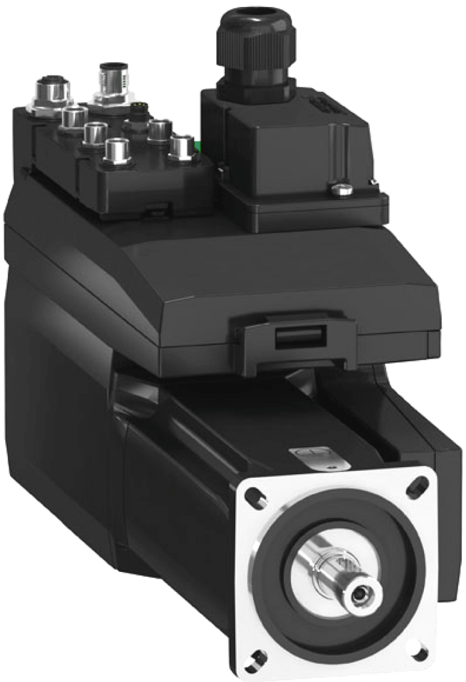
Lexium 32i CAN and BMi
Integrated Servo Drive System
User Guide

10/2018



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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

QUALIFICATION OF PERSONNEL

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by modifying the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment.

The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

INTENDED USE

The products described or affected by this document are, along with software, accessories and options, servo motors with an integrated drive. The products are intended for industrial use according to the instructions, directions, examples and safety information contained in the present user guide and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the products, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the products are used as components in an overall machine or process, you must ensure the safety of persons by means of the design of this overall machine or process.

Operate the products only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted as described herein is prohibited and may result in unanticipated hazards.

About the Book

At a Glance

Document Scope

This manual describes technical characteristics, installation, commissioning, operation and maintenance of the integrated servo drive system Lexium 32i CAN + BMi.

Validity Note

This manual is valid for the standard products listed in the type code, see chapter Type Code *(see page 17)*.

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to *www.schneider-electric.com/green-premium*.

The technical characteristics of the devices described in this document also appear online. To access this information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in this manual should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the manual and online information, use the online information as your reference.

Product Related Information

The use and application of the information contained herein require expertise in the design and programming of automated control systems.

Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, repair and maintenance of the machine or process.

You must also consider any applicable standards and/or regulations with respect to grounding of all equipment. Verify compliance with any safety information, different electrical requirements, and normative standards that apply to your machine or process in the use of this equipment.

Many components of the equipment, including the printed circuit board, operate with mains voltage, or present transformed high currents, and/or high voltages.

The motor itself generates voltage when the motor shaft is rotated.

⚠ DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

Failure to follow these instructions will result in death or serious injury.

If the power stage is disabled unintentionally, for example as a result of power outage, errors or functions, the motor is no longer decelerated in a controlled way. Overload, errors or incorrect use may cause the holding brake to no longer operate properly and may result in premature wear.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that movements without braking effect cannot cause injuries or equipment damage.
- Verify the function of the holding brake at regular intervals.
- Do not use the holding brake as a service brake.
- Do not use the holding brake for safety-related purposes.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Drive systems may perform unanticipated movements because of incorrect wiring, incorrect settings, incorrect data or other errors.

⚠ WARNING

UNINTENDED MOVEMENT OR MACHINE OPERATION

- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with undetermined settings and data.
- Perform comprehensive commissioning tests that include verification of configuration settings and data that determine position and movement.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems” or their equivalent governing your particular location.

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

⚠ WARNING

UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS

- In your hazard and risk analysis, consider all hazards that result from access to and operation on the network/fieldbus and develop an appropriate cyber security concept.
- Verify that the hardware infrastructure and the software infrastructure into which the machine is integrated as well as all organizational measures and rules covering access to this infrastructure consider the results of the hazard and risk analysis and are implemented according to best practices and standards covering IT security and cyber security (such as: ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security).
- Verify the effectiveness of your IT security and cyber security systems using appropriate, proven methods.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
EN 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2008	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 1088:2008 ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2006	Safety of machinery - Emergency stop - Principles for design
EN/IEC 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2008	Digital data communication for measurement and control: Functional safety field buses.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Chapter 1
Introduction

What Is in This Chapter?

This chapter contains the following topics:

Device Overview

General

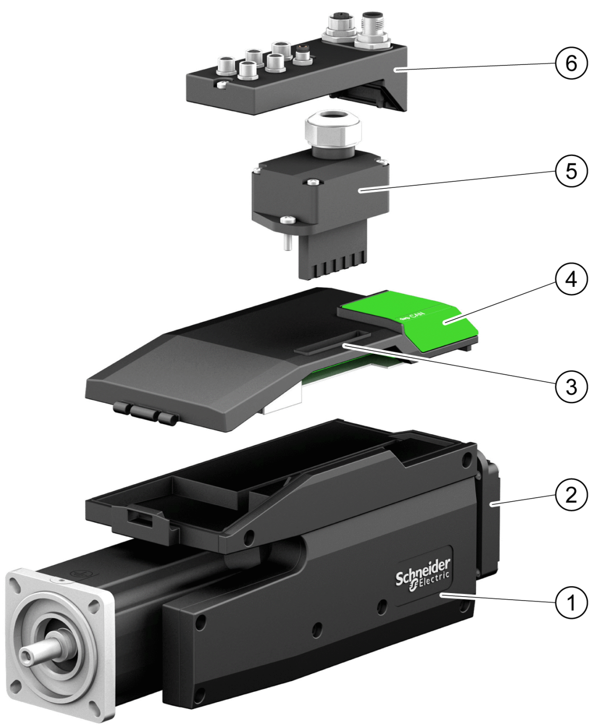
The modular components of the product family Lexium 32i can be combined to meet the requirements of a great variety of applications. Minimum wiring as well as a comprehensive portfolio of options and accessories allow you to implement compact, high-performance drive solutions for a wide range of power requirements.

Overview of some of the features:

- Communication interface for CANopen and CANmotion; the reference values for numerous operating modes are supplied via this interface.
- The product is commissioned via a PC with commissioning software or the fieldbus.
- Memory cards allow for copying of parameters and fast device replacement.
- The safety function "Safe Torque Off" (STO) as per IEC 61800-5-2 is implemented on board.

Servo Drive System

The product can comprise the following components:



1 BMI servo motor with integrated power stage
2 Standard braking resistor
3 LXM32I control unit for CAN fieldbus
4 Cover of commissioning interface
5 Connection module for mains supply
6 Connection module with spring terminals or industrial connector for fieldbus, inputs/outputs and safety function STO

For an overview of the available accessories see chapter Accessories and Spare Parts *(see page 569)*.

Type Code

Type Code LXM32I

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Type code (example)	L	X	M	3	2	I	C	A	N	•	•	•	•	•

Item	Meaning
1 ... 3	**Product family** LXM = Lexium
4 ... 6	**Product type** 32I = Control unit for Lexium 32i
7 ... 9	**Fieldbus interface** CAN = CANopen
10 ... 14	**Customized Version** S•••• = Customized version

If you have questions concerning the type code, contact your Schneider Electric representative.

Designation Customized Version

In the case of a customized version, position 10 of the type code is an "S". The subsequent number defines the customized version. Example: LXM32I•••S1234

Contact your local Schneider Electric service representative if you have questions concerning customized versions.

Type Code BMI

Item	1	2	3	4	5	6	7	8	9	10	11
Type code (example)	B	M	I	0	7	0	2	P	0	6	A

Item	Meaning
1 ... 3	**Product family** BMI = Servo motor for Lexium 32i
4 ... 6	**Size (housing)** 070 = 70 mm flange 100 = 100 mm flange
7	**Length** 2 = 2 stacks 3 = 3 stacks
8	**Winding** P = 3 mains phases (208 V / 400 V / 480 V) T = 1 mains phase (115 V / 230 V)
9	**Shaft and degree of protection**[1)] 0 = Smooth shaft; degree of protection: shaft IP54, housing IP65 1 = Parallel key; degree of protection: shaft IP54, housing IP65 2 = Smooth shaft; degree of protection: shaft and housing IP65 3 = Parallel key; degree of protection: shaft and housing IP65 S = Customized version
10	**Encoder system** 1 = Absolute singleturn 128 Sin/Cos periods per revolution (SKS36) 2 = Absolute multiturn 128 Sin/Cos periods per revolution (SKM36) 6 = Absolute singleturn 16 Sin/Cos periods per revolution (SEK37) 7 = Absolute multiturn 16 Sin/Cos periods per revolution (SEL37)
11	**Holding brake** A = Without holding brake F = With holding brake
1) In the case of mounting position IM V3 (drive shaft vertical, shaft end upward), the motor only has degree of protection IP 50.	

If you have questions concerning the type code, contact your Schneider Electric representative.

Designation Customized Version

In the case of a customized version, position 9 of the type code is an "S". The subsequent number defines the customized version. Example: BMI•••••S123

Contact your local Schneider Electric service representative if you have questions concerning customized versions.

Chapter 2
Technical Data

What Is in This Chapter?

This chapter contains the following topics:

Environmental Conditions

Conditions for Transportation and Storage

The environment during transportation and storage must be dry and free from dust.

Temperature	°C (°F)	-25 ... 70 (-13 ... 158)

The following relative humidity is permissible during transportation and storage:

Relative humidity (non-condensing)	%	5 ... 95

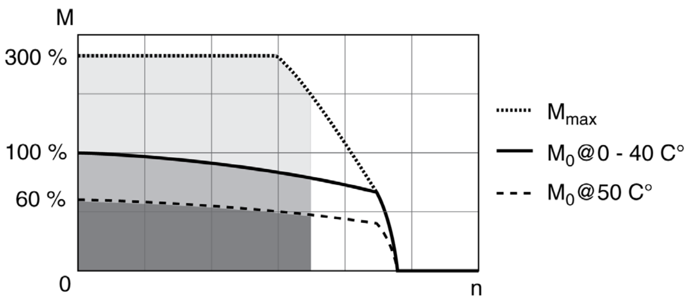
Vibration and shock during transportation and storage		As per IEC 60721-3-2, class 2M2

Conditions for Operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and on the required power. Observe the pertinent instructions in the chapter Installation *(see page 113)*.

Ambient temperature without derating (no icing, non-condensing)	°C (°F)	0 ... 40 (32 ... 104)
Ambient temperature if all of the following conditions are met(1): ● Derating (torque) by 4% per Kelvin ● Maximum installation altitude 1000 m (3281 ft) above m.s.l.	°C (°F)	41 ... 65 (105.8 ... 149)
(1) Usage as per UL 508C requires compliance with the information provided in chapter Conditions for UL 508C *(see page 43)*.		

Example of derating at 50 °C (122 °F):



The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	%	5 ... 95

The installation altitude is defined as altitude above mean sea level.

Installation altitude without derating	m (ft)	<1000 (<3281)
Installation altitude if all of the following conditions are met: ● 45 °C (113 °F) maximum ambient temperature ● Reduction of the continuous power by 1% per 100 m (328 ft) above 1000 m (3281 ft)	m (ft)	1000 ... 2000 (3281 ... 6562)
Installation altitude above mean sea level if all of the following conditions are met: ● 40 °C (104 °F) maximum ambient temperature ● Reduction of the continuous power by 1% per 100 m (328 ft) above 1000 m (3281 ft) ● Overvoltages of the supply mains limited to overvoltage category II as per IEC 60664-1 ● No IT mains	m (ft)	2000 ... 3000 (6562 ... 9843)

Vibration and shock during operation		As per IEC 60721-3-3 Class 3M4

Degree of Protection

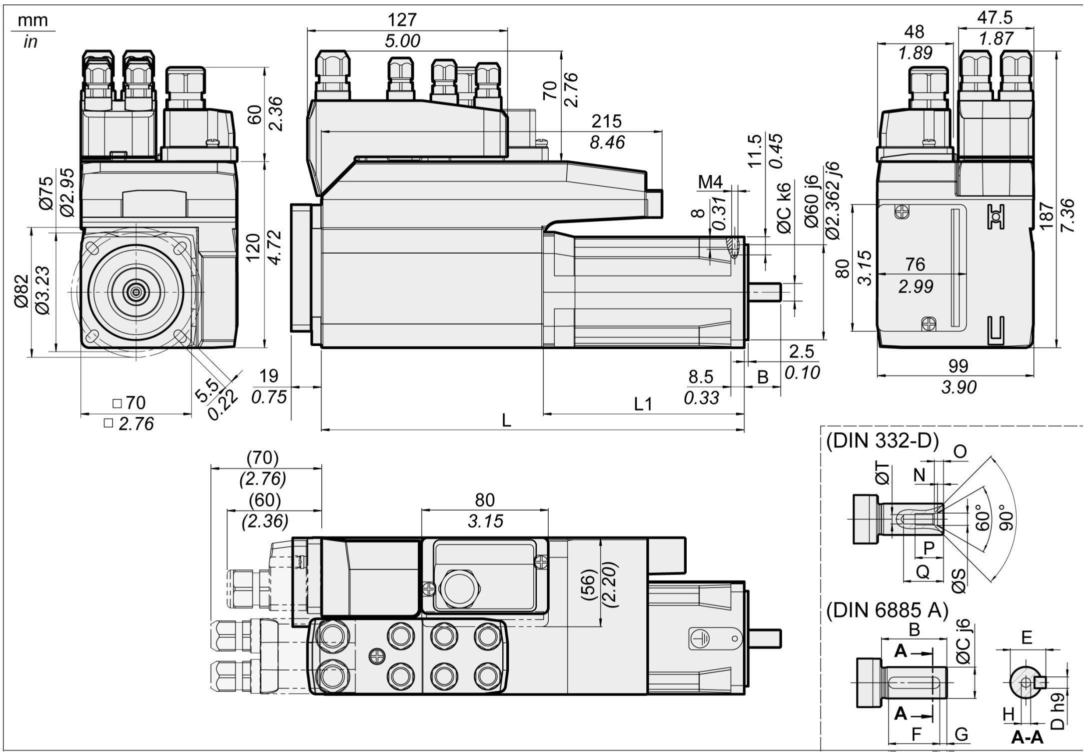
The requires all parts to be correctly mounted, see chapter Installation *(see page 113)*, and the cover of the commissioning interface to be closed (IP as per IEC 60529):

Degree of Protection without shaft sealing ring	IP 54(1)
Degree of protection with shaft sealing ring	IP 65(1)(2)

(1) In the case of mounting position IM V3 (shaft vertical, shaft end upward), the degree of protection is IP 50. The degree of protection does not relate to mounted components such as, for example, a gearbox.
(2) The maximum speed of rotation is limited to 6000 rpm. The shaft sealing ring is factory-pre-lubricated. If the seals run dry, this increases friction and greatly reduces the service life of the sealing rings.

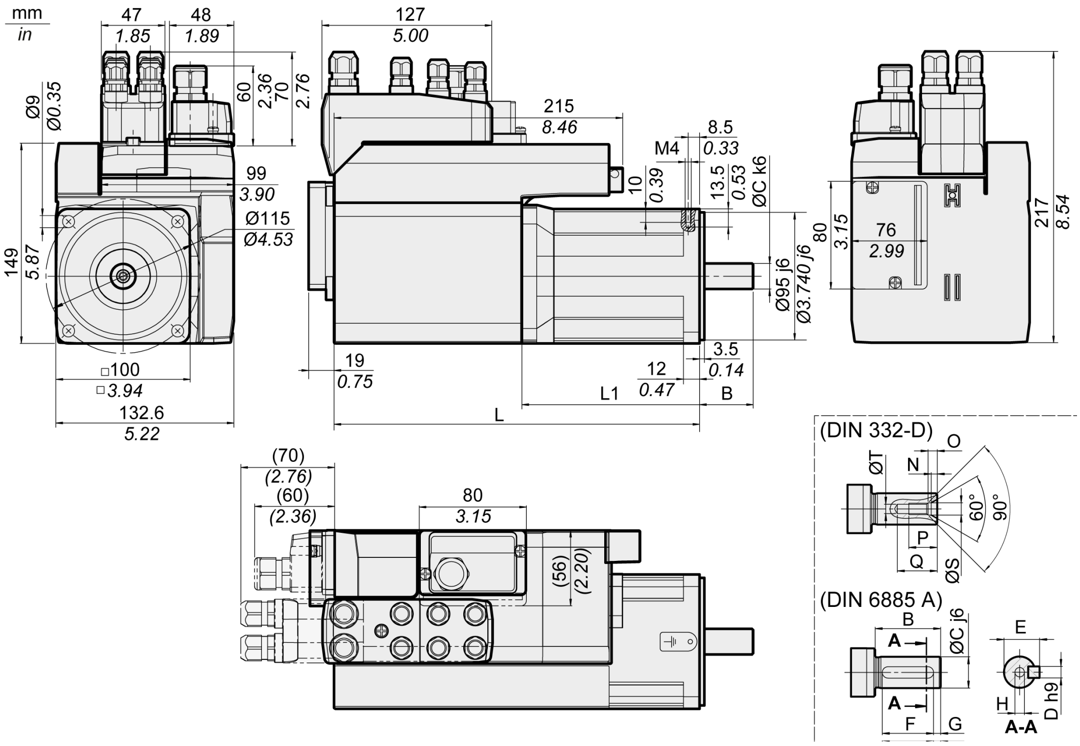
Dimensions

Dimensions BMI070



BMI...		0702	0703
L without holding brake	mm (in)	268 (10.55)	300 (11.81)
L with holding brake	mm (in)	306 (12.05)	339 (13.35)
L1 without holding brake	mm (in)	127 (5)	159 (6.26)
L1 with holding brake	mm (in)	166 (6.54)	198 (7.8)
B	mm (in)	23 (0.91)	30 (1.18)
C	mm (in)	11 (0.43)	14 (0.55)
D	mm (in)	4 (0.16)	5 (0.2)
E	mm (in)	12.5 (0.49)	16 (0.63)
F	mm (in)	18 (0.71)	20 (0.79)
G	mm (in)	2.5 (0.1)	5 (0.2)
H	mm (in)	M4	M5
T	mm (in)	3.3 (0.13)	4.2 (0.17)
S	mm (in)	4.3 (0.17)	5.3 (0.21)
Q	mm (in)	14 (0.55)	17 (0.67)
P	mm (in)	10 (0.39)	12.5 (0.49)
O	mm (in)	3.2 (0.13)	4 (0.16)
N	mm (in)	2.1 (0.08)	2.4 (0.09)

Dimensions BMI100



BMI...		1002	1003
L without holding brake	mm (in)	273 (10.75)	299 (11.77)
L with holding brake	mm (in)	316 (12.44)	346 (13.62)
L1 without holding brake	mm (in)	133 (5.24)	159 (6.26)
L1 with holding brake	mm (in)	176 (6.93)	206 (8.11)
B	mm (in)	40 (1.57)	40 (1.57)
C	mm (in)	19 (0.75)	19 (0.75)
D	mm (in)	6 (0.24)	6 (0.24)
E	mm (in)	21.5 (0.85)	21.5 (0.85)
F	mm (in)	30 (1.18)	30 (1.18)
G	mm (in)	5 (0.2)	5 (0.2)
H	mm (in)	M6	M6
T	mm (in)	5 (0.2)	5 (0.2)
S	mm (in)	6.4 (0.25)	6.4 (0.25)
Q	mm (in)	21 (0.83)	21 (0.83)
P	mm (in)	16 (0.63)	16 (0.63)
O	mm (in)	5 (0.2)	5 (0.2)
N	mm (in)	2.8 (0.11)	2.8 (0.11)

General Characteristics

Number of pairs of poles	5	
Thermal class	F (155 °C)	As per IEC 60034-1
Vibration grade	A	As per IEC 60034-14
Shaft extension run-out / perpendicularity	Class N (normal class)	As per IEC 60072-1, DIN 42955
Housing color	Black RAL 9005	

Mains Voltage: Range and Tolerance

115/230 Vac single-phase	Vac	100 -15% ... 120 +10% 200 -15% ... 240 +10%
208/400/480 Vac three-phase	Vac	200 -15% ... 240 +10% 380 -15% ... 480 +10%
Frequency	Hz	50 -5% ... 60 +5%

Transient overvoltages		Overvoltage category III(1)
Rated voltage to ground	Vac	300
(1) Depends on installation altitude, see chapter Environmental Conditions *(see page 20)*.		

Type of Grounding

TT grounding system, TN grounding system	Permissible
IT mains	Permissible(1)
Mains with corner grounded system	Not permitted
(1) Depending on the installation altitude, see chapter Environmental Conditions *(see page 20)*.	

Leakage Current

Leakage current (as per IEC 60990, figure 3)	mA	<30(1)
(1) Measured on mains with grounded neutral point and without external mains filter. Take into account that a 30 mA RCD can already trigger at 15 mA. In addition, there is a high-frequency leakage current which is not considered in the measurement. The response to this depends on the type of residual current device.		

Harmonic Currents and Impedance

The harmonic currents depend on the impedance of the supply mains. This is expressed in terms of the short-circuit current of the supply mains. If the supply mains has a higher short-circuit current than indicated in the Technical Data for the device, use upstream mains reactors.

Monitoring the Continuous Output Current

The continuous output current is monitored by the device. If the continuous output current is exceeded, the device reduces the output current.

PWM Frequency Power Stage

The PWM frequency of the power stage is set to a fixed value.

PWM frequency power stage	kHz	8

Service Life

Nominal bearing service life L_{10h}(1)	h	20000
(1) Operating hours at a probability of failure of 10%		

The service life of the motors when operated correctly is limited primarily by the service life of the rolling bearing.

The following operating conditions significantly reduce the service life:

- Installation altitude >1000 m (3281 ft) above mean sea level
- Rotary movements exclusively within a fixed angle of <100°
- Operation under vibration load >20 m/s^2
- Allowing sealing rings to run dry
- Contact of the seals with aggressive substances

Shaft Sealing Ring / Degree of Protection

The motors can be equipped with an optional shaft sealing ring. With a shaft sealing ring, they have degree of protection IP65. The shaft sealing ring limits the maximum speed of rotation to 6000 rpm.

Note the following:

- The shaft sealing ring is factory-pre-lubricated.
- If the seals run dry, this increases friction and greatly reduces the service life of the sealing rings.

Signals

Logic Type

Observe the information concerning the logic type in chapter Logic Type *(see page 56)*.

The connection modules can support either positive or negative logic, depending on the module reference. For modules featuring M8/M12 connectors, the logic type is determined by the specific reference of the module. For modules featuring spring connectors, the logic type is determined by the wiring to the connector.

Signal inputs are protected against reverse polarity, outputs are short-circuit protected. The inputs and outputs are functionally isolated.

Internal 24V Signal Power Supply

The internal 24 V signal power supply is short-circuit protected and meets the PELV requirements.

Nominal voltage	Vdc	24
Voltage range	Vdc	23 ... 28
Maximum current `+24VDC`	mA	200
Residual ripple		<5%

The reference potential `0VDC` is grounded internally, see IEC 60204-1 (ground faults).

Do not ground the internal supply voltage by grounding any 0V signal wiring outside the drive to help avoid ground loops.

The short-circuit protection can be reset by removing the short-circuit and by a power cycle of the drive (error with error class 4).

External 24 V Signal Power Supply

Signals can be supplied with voltage either by means of an external power supply unit or the internal signal power supply (see internal 24 V signal power supply). The voltage must meet the requirements of IEC 61131-2 (PELV standard power supply unit):

Voltage	Vdc	24
Voltage tolerance	Vdc	19.2 to 30
Residual ripple		<5%

Digital Input Signals 24 V

When wired as positive logic, the levels of the digital inputs comply with IEC 61131-2, type 1. The electrical characteristics are also valid when wired as negative logic unless otherwise indicated.

Input voltage - positive logic Level 0 Level 1	 Vdc Vdc	 -3 ... 5 15 ... 30
Input voltage - negative logic (at 24 Vdc) Level 0 Level 1	 Vdc Vdc	 >19 <9
Input current (at 24 Vdc)	mA	2.5
Debounce time (software)(1)(2)	ms	1.5 (default value)
Hardware switching time Rising edge (level 0 -> 1) Falling edge (level 1 -> 0)	 µs µs	 15 150
Jitter (capture inputs)	µs	<2
(1) Adjustable via parameter (sampling period 250µs) **(2)** If the capture inputs are used for capture then the debounce time is not applied.		

Digital Output Signals 24 V

When wired as positive logic, the levels of the digital outputs comply with IEC 61131-2. The electrical characteristics are also valid when wired as negative logic unless otherwise indicated.

Nominal supply voltage (for modules with spring terminals)	Vdc	24
Voltage range for supply voltage (for modules with spring terminals)	Vdc	19.2 ... 30
Nominal output voltage - positive logic	Vdc	24
Nominal output voltage - negative logic	Vdc	0
Voltage drop at 50 mA load	Vdc	≤1
Maximum current per output(1)	mA	100
Maximum inductive load	mH	1000
(1) Load resistance between 0.3 ... 50 kΩ.		

The short circuit protection can be reset by switching off the supply voltage.

Input Signals Safety Function STO

The inputs for the safety function STO (inputs `STO_A` and `STO_B`) can only be wired for positive logic. Observe the information provided in chapter Safety function STO ("Safe Torque Off") *(see page 68)*.

Input voltage - positive logic Level 0 Level 1	 Vdc Vdc	 -3 ... 5 15 ... 30
Input current (at 24 Vdc)	mA	2.5
Debounce time `STO_A` and `STO_B`	ms	>1
Detection of signal differences between `STO_A` and `STO_B`	s	>1
Response time of safety function STO	ms	≤10

CAN Bus Signals

The CAN bus signals comply with the CAN standard and are short-circuit protected.

Shaft-Specific Data

Overview

Motor shafts may be subject to premature wear, breakage, or extended damage to the encoder if the maximum force ratings of the motor shaft are exceeded.

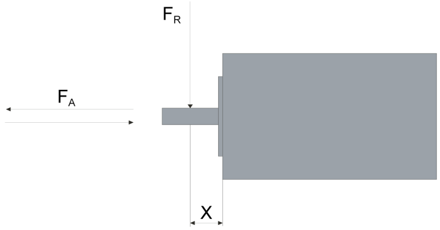
⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION DUE TO MECHANICAL DAMAGE TO THE MOTOR

- Do not exceed the maximum axial and radial forces at the motor shaft.
- Protect the motor shaft from impact.
- Do not exceed the maximum axial force when pressing components onto the motor shaft.

Failure to follow these instructions can result in injury or equipment damage.

Point of application of the forces:



Force for Pressing On

The force applied during pressing on must not exceed the maximum permissible axial force. Applying assembly paste to the shaft and the component to be mounted reduces friction and mechanical impact on the surfaces.

If the shaft has a thread, use it to press on the component to be mounted. This way there is no axial force acting on the rolling bearing.

It is also possible to shrink-fit, clamp or glue the component to be mounted.

The following table shows the maximum permissible axial force F_A at standstill.

BMI...		070	100
Maximum permissible axial force F_A at standstill	N (lbf)	80 (18)	160 (36)

Shaft Load

The following conditions apply:

- The permissible force applied during pressing on must not be exceed.
- Radial and axial limit loads must not be applied simultaneously
- Nominal bearing service life in operating hours at a probability of failure of 10 % (L_{10h} = 20000 hours)
- Mean speed of rotation n = 4000 rpm
- Ambient temperature = 40 °C (104 °F)
- Peak torque = Duty types S3 - S8, 10% duty cycle
- Nominal torque = Duty type S1, 100% duty cycle

The point of application of the forces depends on the motor size:

BMI...		0702	0703	100
Values for "X"	mm (in)	11.5 (0.45)	15 (0.59)	20 (0.79)

The following table shows the maximum radial shaft load F_R.

BMI...		0702	0703	1002	1003
1000 rpm	N (lbf)	710 (160)	730 (164)	990 (223)	1050 (236)
2000 rpm	N (lbf)	560 (126)	580 (130)	790 (178)	830 (187)
3000 rpm	N (lbf)	490 (110)	510 (115)	690 (155)	730 (164)
4000 rpm	N (lbf)	450 (101)	460 (103)	620 (139)	660 (148)
5000 rpm	N (lbf)	410 (92)	430 (97)	580 (130)	610 (137)
6000 rpm	N (lbf)	390 (88)	400 (90)	-	-

The following table shows the maximum axial shaft load F_A during rotation.

BMI...		0702	0703	1002	1003
1000 rpm	N (lbf)	142 (32)	146 (33)	198 (45)	210 (47)
2000 rpm	N (lbf)	112 (25)	116 (26)	158 (36)	166 (37)
3000 rpm	N (lbf)	98 (22)	102 (23)	138 (31)	146 (33)
4000 rpm	N (lbf)	90 (20)	92 (21)	124 (28)	132 (30)
5000 rpm	N (lbf)	82 (18)	86 (19)	116 (26)	122 (27)
6000 rpm	N (lbf)	78 (18)	80 (18)	-	-

Motor-Specific Data

Data for Single-Phase Devices at 115 Vac

BMI...			0702	0703	1002
Winding			T	T	T
Continuous stall torque(1)	M_0(2)	Nm	2.24	2.88	5.07
Peak torque	M_{max}	Nm	4.84	6.3	12.39
Torque constant(3)	k_t	Nm/A	0.67	0.87	0.91
Nominal speed of rotation	n_N	rpm	1900	1400	1400
Nominal torque	M_N	Nm	2.21	2.85	5.01
Nominal power(4)	P_N	kW	0.44	0.418	0.735
Nominal motor current	I_N	A_{rms}	3.55	3.55	5.70
Maximum current motor	I_{max}	A_{rms}	8.00	8.00	15.00
Technical data - electrical					
Input current at nominal power and nominal voltage		A_{rms}	6.99	6.99	12.88
Inrush current limitation		A	7.5	7.5	7.5
Maximum inrush current(5)		A	146	146	209
Time for maximum inrush current		ms	1.12	1.12	1.52
Total harmonic distortion THD of the input current		%	150.58	150.58	134.52
Power factor	λ		0.54	0.54	0.59
Short-circuit current rating (SCCR)		kA	1	1	1
Maximum fuse to be connected upstream(6)		A	25	25	25
Technical data - mechanical					
Maximum permissible speed of rotation	n_{max}	rpm	7000	5500	5000
Rotor inertia without brake	J_M	$kgcm^2$	1.13	1.67	6.28
Rotor inertia with brake	J_M	$kgcm^2$	1.24	1.78	6.77
Mass with standard braking resistor without holding brake	m	kg	4.00	4.75	8.10
Mass with standard braking resistor with holding brake	m	kg	4.50	5.30	8.80
LXM32I control unit	m	kg	0.50	0.50	0.50

(1) Conditions for performance data: Mounted to steel plate $(2.5 \text{ x flange size})^2$ area, 10 mm (0.39 in) thickness, centered hole.
(2) M_0 = Continuous stall torque at 20 rpm and 100% duty cycle; at speeds of rotation less than 20 rpm the continuous stall torque is reduced to 87%
(3) At n = 20 rpm and maximum operating temperature
(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA
(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time
(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C *(see page 43)* for UL. Lower ratings are permissible. The fuse must be rated in such a way that the fuse does not trip at the specified input current.

Data for Single-Phase Devices at 230 Vac

BMI...			0702	0703	1002
Winding			T	T	T
Continuous stall torque[1]	M_0[2]	Nm	2.16	2.78	4.75
Peak torque	M_{max}	Nm	6.18	8.10	14.43
Torque constant[3]	k_t	Nm/A	0.67	0.87	0.91
Nominal speed of rotation	n_N	rpm	4000	3100	3000
Nominal torque	M_N	Nm	1.74	2.25	3.99
Nominal power[4]	P_N	kW	0.73	0.73	1.25
Nominal motor current	I_N	A_{rms}	2.83	2.82	4.59
Maximum current motor	I_{max}	A_{rms}	10.50	10.50	18.00
Technical data - electrical					
Input current at nominal power and nominal voltage		A_{rms}	6.12	6.12	11.19
Inrush current limitation		A	7.5	7.5	7.5
Maximum inrush current[5]		A	201	201	274
Time for maximum inrush current		ms	1.66	1.66	2.24
Total harmonic distortion THD of the input current		%	157.75	157.75	137.82
Power factor	λ		0.53	0.53	0.58
Short-circuit current rating (SCCR)		kA	1	1	1
Maximum fuse to be connected upstream[6]		A	25	25	25
Technical data - mechanical					
Maximum permissible speed of rotation	n_{max}	rpm	7000	5500	5000
Rotor inertia without brake	J_M	$kgcm^2$	1.13	1.67	6.28
Rotor inertia with brake	J_M	$kgcm^2$	1.24	1.78	6.77
Mass with standard braking resistor without holding brake	m	kg	4.00	4.75	8.10
Mass with standard braking resistor with holding brake	m	kg	4.50	5.30	8.80
LXM32I control unit	m	kg	0.50	0.50	0.50

(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)^2 area, 10 mm (0.39 in) thickness, centered hole.
(2) M_0 = Continuous stall torque at 20 rpm and 100% duty cycle; at speeds of rotation less than 20 rpm the continuous stall torque is reduced to 87%
(3) At n = 20 rpm and maximum operating temperature
(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA
(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time
(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C *(see page 43)* for UL. Lower ratings are permissible. The fuse must be rated in such a way that the fuse does not trip at the specified input current.

Data for Three-Phase Devices at 208 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque(1)	M_0(2)	Nm	2.24	2.96	4.99	7.31
Peak torque	M_{max}	Nm	6.42	8.06	13.92	18.87
Torque constant(3)	k_t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n_N	rpm	1800	1600	1900	1500
Nominal torque	M_N	Nm	2.21	2.93	4.91	7.22
Nominal power(4)	P_N	kW	0.42	0.49	0.98	1.13
Nominal motor current	I_N	A_{rms}	1.95	2.1	3.90	4.30
Maximum current motor	I_{max}	A_{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A_{rms}	2.42	2.63	5.35	5.82
Inrush current limitation		A	7.5	7.5	7.5	7.5
Maximum inrush current(5)		A	71	71	111	111
Time for maximum inrush current		ms	0.5	0.50	0.64	0.64
Total harmonic distortion THD of the input current		%	148.31	143.46	148.31	144.98
Power factor	λ		0.55	0.57	0.56	0.56
Short-circuit current rating (SCCR)		kA	5	5	5	5
Maximum fuse to be connected upstream(6)		A	25	25	25	25
Technical data - mechanical						
Maximum permissible speed of rotation	n_{max}	rpm	7000	5500	5000	5000
Rotor inertia without brake	J_M	$kgcm^2$	1.13	1.67	6.28	9.37
Rotor inertia with brake	J_M	$kgcm^2$	1.24	1.78	6.77	10.15
Mass with standard braking resistor without holding brake	m	kg	4.10	4.85	8.10	10.15
Mass with standard braking resistor with holding brake	m	kg	4.60	5.40	8.80	10.60
LXM32I control unit	m	kg	0.50	0.50	0.50	0.50

(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)^2 area, 10 mm (0.39 in) thickness, centered hole.
(2) M_0 = Continuous stall torque at 20 rpm and 100% duty cycle; at speeds of rotation less than 20 rpm the continuous stall torque is reduced to 87%
(3) At n = 20 rpm and maximum operating temperature
(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA
(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time
(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C *(see page 43)* for UL. Lower ratings are permissible. The fuse must be rated in such a way that the fuse does not trip at the specified input current.

Data for Three-Phase Devices at 400 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque(1)	M_0(2)	Nm	2.07	2.82	4.48	6.55
Peak torque	M_{max}	Nm	6.42	8.06	13.92	18.87
Torque constant(3)	k_t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n_N	rpm	3600	3300	3800	3000
Nominal torque	M_N	Nm	2.02	2.58	4.34	6.38
Nominal power(4)	P_N	kW	0.76	0.89	1.73	2.01
Nominal motor current	I_N	A_{rms}	1.80	1.87	3.50	3.85
Maximum current motor	I_{max}	A_{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A_{rms}	2.68	2.94	5.74	6.25
Inrush current limitation		A	1.9	1.9	1.9	1.9
Maximum inrush current(5)		A	126	126	196	196
Time for maximum inrush current		ms	0.68	0.68	0.96	0.96
Total harmonic distortion THD of the input current		%	174.67	170.87	156.79	154.80
Power factor	λ		0.49	0.50	0.53	0.54
Short-circuit current rating (SCCR)		kA	5	5	5	5
Maximum fuse to be connected upstream(6)		A	25	25	25	25
Technical data - mechanical						
Maximum permissible speed of rotation	n_{max}	rpm	7000	5500	5000	5000
Rotor inertia without brake	J_M	$kgcm^2$	1.13	1.67	6.28	9.37
Rotor inertia with brake	J_M	$kgcm^2$	1.24	1.78	6.77	10.30
Mass with standard braking resistor without holding brake	m	kg	4.10	4.85	8.10	10.15
Mass with standard braking resistor with holding brake	m	kg	4.60	5.40	8.80	10.60
LXM32I control unit	m	kg	0.50	0.50	0.50	0.50

(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)^2 area, 10 mm (0.39 in) thickness, centered hole.
(2) M_0 = Continuous stall torque at 20 rpm and 100% duty cycle; at speeds of rotation less than 20 rpm the continuous stall torque is reduced to 87%
(3) At n = 20 rpm and maximum operating temperature
(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA
(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time
(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C *(see page 43)* for UL. Lower ratings are permissible. The fuse must be rated in such a way that the fuse does not trip at the specified input current.

Data for Three-Phase Devices at 480 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque[1]	M_0[2]	Nm	2.07	2.68	4.16	6.04
Peak torque	M_{max}	Nm	6.42	8.06	13.92	18.87
Torque constant[3]	k_t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n_N	rpm	4400	3800	4700	3600
Nominal torque	M_N	Nm	2.01	2.35	4.00	5.57
Nominal power[4]	P_N	kW	0.93	0.94	1.69	2.10
Nominal motor current	I_N	A_{rms}	1.80	1.71	3.25	3.55
Maximum current motor	I_{max}	A_{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A_{rms}	2.23	2.46	4.80	5.23
Inrush current limitation		A	1.9	1.9	1.9	1.9
Maximum inrush current[5]		A	193	193	296	296
Time for maximum inrush current		ms	0.70	0.70	0.96	0.96
Total harmonic distortion THD of the input current		%	177.00	174.33	157.66	156.11
Power factor	λ		0.49	0.49	0.53	0.54
Short-circuit current rating (SCCR)		kA	5	5	5	5
Maximum fuse to be connected upstream[6]		A	25	25	25	25
Technical data - mechanical						
Maximum permissible speed of rotation	n_{max}	rpm	7000	5500	5000	5000
Rotor inertia without brake	J_M	$kgcm^2$	1.13	1.67	6.28	9.37
Rotor inertia with brake	J_M	$kgcm^2$	1.24	1.78	6.77	10.30
Mass with standard braking resistor without holding brake	m	kg	4.10	4.85	8.10	10.15
Mass with standard braking resistor with holding brake	m	kg	4.60	5.40	8.80	10.60
LXM32I control unit	m	kg	0.50	0.50	0.50	0.50

(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)^2 area, 10 mm (0.39 in) thickness, centered hole.
(2) M_0 = Continuous stall torque at 20 rpm and 100% duty cycle; at speeds of rotation less than 20 rpm the continuous stall torque is reduced to 87%
(3) At n = 20 rpm and maximum operating temperature
(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA
(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time
(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C *(see page 43)* for UL. Lower ratings are permissible. The fuse must be rated in such a way that the fuse does not trip at the specified input current.

Holding Brake (Option)

The holding brake in the motor has the task of holding the motor position when the power stage is disabled. The holding brake is not a safety-related function and not a service brake.

⚠ WARNING

UNINTENDED AXIS MOVEMENT

- Do not use the internal holding brake as a safety-related measure.
- Only use certified external brakes as safety-related measures.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

BMI...		070	1002	1003
Holding torque(1)	Nm	3.0	5.5	9
Opening time	ms	80	70	90
Coupling time	ms	17	30	40
Maximum speed of rotation during braking of moving loads	rpm	3000	3000	3000
Maximum number of decelerations during braking of moving loads and 3000 rpm		500	500	500
Maximum number of decelerations during braking of moving loads per hour at even distribution		20	20	20
Maximum kinetic energy that can be transformed into heat per deceleration during braking of moving loads	J	130	150	150

(1) The holding brake is broken-in at the factory. If the holding brake is not used for an extended period of time, parts of the holding brake may corrode. Corrosion reduces the holding torque.

Encoder

SKS36 Singleturn

This motor encoder measures an absolute value within one revolution at start-up and continues to count incrementally from this point.

Resolution per revolution	128 sin/cos periods
Measuring range absolute	1 revolution
Accuracy of digital absolute value	±0.0889°
Accuracy of the incremental position	±0.0222°
Maximum angular acceleration	200000 rad/s^2

SKM36 Multiturn

This motor encoder measures an absolute value within 4096 revolutions at start-up and continues to count incrementally from this point.

Resolution per revolution	128 sin/cos periods
Measuring range absolute	4096 revolutions
Accuracy of digital absolute value	±0.0889°
Accuracy of the incremental position	±0.0222°
Maximum angular acceleration	200000 rad/s^2

SEK37 Singleturn

This motor encoder measures an absolute value within one revolution at start-up and continues to count incrementally from this point.

Resolution per revolution	16 sin/cos periods
Measuring range absolute	1 revolution
Accuracy of position	± 0.08°

SEL37 Multiturn

This motor encoder measures an absolute value within 4096 revolutions at start-up and continues to count incrementally from this point.

Resolution per revolution	16 sin/cos periods
Measuring range absolute	4096 revolutions
Accuracy of position	± 0.08°

Braking Resistor

Data for Calculation of the Braking Resistor

The product is shipped with a standard braking resistor. If the braking resistor is not sufficient for the dynamics requirements of the applications, it must be replaced with an external braking resistor.

The resistance values for external braking resistors must not be below the specified minimum resistance.

BMI...		070 Single-phase	100 Single-phase	070 Three-phase	100 Three-phase
Resistance standard braking resistor	Ω	35	35	70	70
Maximum continuous power standard braking resistor P_{PR}	W	20	20	20	20
Peak energy E_{CR}	Ws	264	264	507	507
External braking resistor minimum	Ω	43	33	70	60
External braking resistor maximum(1)	Ω	73	37	160	77
Maximum continuous power external braking resistor	W	400	700	400	1000
Switch-on voltage of braking resistor at nominal voltage 115 V	V	236	236	-	-
Switch-on voltage of braking resistor at nominal voltage 200 V and 230 V	V	430	430	-	-
Switch-on voltage of braking resistor at nominal voltage 208 V	V	-	-	430	430
Switch-on voltage of braking resistor at nominal voltage 380 V, 400 V and 480 V	V	-	-	780	780
Capacitance	μF	780	1560	195	390
Energy absorption of internal capacitors E_{var} at nominal voltage 115 V +10%	Ws	9	18	-	-
Energy absorption of internal capacitors E_{var} at nominal voltage 200 V +10%	Ws	343	69	-	-
Energy absorption of internal capacitors E_{var} at nominal voltage 230 V +10%	Ws	18	35	-	-
Energy absorption of internal capacitors E_{var} at nominal voltage 208 V +10%	Ws	-	-	4	9
Energy absorption of internal capacitors E_{var} at nominal voltage 380 V +10%	Ws	-	-	25	50
Energy absorption of internal capacitors E_{var} at nominal voltage 400 V +10%	Ws	-	-	22	43
Energy absorption of internal capacitors E_{var} at nominal voltage 480 V +10%	Ws	-	-	5	10

(1) The maximum specified braking resistor can derate the peak power of the device. Depending on the application, it is possible to use a higher ohm resistor.

DC Bus Data for Calculation of the Braking Resistor

Number of phases		Single-phase	Single-phase	Three-phase	Three-phase	Three-phase
Nominal voltage	Vac	115	230	208	400	480
Nominal voltage DC bus	Vdc	163	325	294	566	679
Undervoltage limit	Vdc	55	130	150	350	350
Voltage limit: activation of Quick Stop	Vdc	60	140	160	360	360
Overvoltage limit	Vdc	450	450	820	820	820

External Braking Resistors (Accessories)

VW3A760...		2Rxx	3Rxx	4Rxx(1)	5Rxx	6Rxx	7Rxx(1)
Resistance	Ω	27	27	27	72	72	72
Continuous power	W	100	200	400	100	200	400
Maximum time in braking at 115 V and 230 V	s	0.552	1.08	2.64	1.44	3.72	9.6
Peak power at 115 V	kW	1.8	1.8	1.8	0.7	0.7	0.7
Maximum peak energy at 115 V	kWs	1	1.9	4.8	1	2.6	6.7
Peak power at 230 V	kW	6.8	6.8	6.8	2.6	2.6	2.6
Maximum peak energy at 230 V	kWs	3.8	7.4	18.1	3.7	9.6	24.7
Maximum time in braking at 400 V and 480 V	s	0.084	0.216	0.504	0.3	0.78	1.92
Peak power at 400 V and 480 V	kW	22.5	22.5	22.5	8.5	8.5	8.5
Maximum peak energy at 400 V and 480 V	Ws	1900	4900	11400	2500	6600	16200
Degree of Protection		IP65	IP65	IP65	IP65	IP65	IP65
UL approval (file no.)		E233422	E233422		E233422	E233422	
(1) Resistors with a continuous power of 400 W are not UL/CSA-approved.							

Electromagnetic Emission

Overview

The products described in the present manual meet the EMC requirements as per IEC 61800-3 if the EMC measures described in the present manual are implemented.

⚠ WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

Use proper EMC shielding techniques to help prevent unintended device operation in accordance with the standard IEC 61800-3.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the overall configuration (drive, mains filter, cables, additional accessories as well as all EMC mitigation measures implemented) does not meet the requirements of category C1 as per IEC 61800-3, this may cause radio interference in domestic electrical networks.

⚠ WARNING

RADIO INTERFERENCE

- Verify compliance with all applicable EMC standards, and, in particular, but not limited to, IEC 61800-3.
- Do not operate this equipment with a configuration of category C3 or C4 in a first environment as defined in IEC 61800-3.
- Implement all required radio interference suppression measures, as described in this document, and verify their effectiveness.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The following information as per IEC 61800-3 applies if you operate this equipment with a configuration which does not meet the limits of category C1:

“In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.”

As a machine designer or system integrator, you may need to include this information in the documentation to your customer.

EMC Categories

The following categories for emission as per IEC 61800-3 are reached if the EMC measures described in the present manual are implemented.

Emission type	Category
Conducted emission	Category C2
Radiated emission	Category C2

Tightening Torque for Screws and Cable Glands

Tightening Torque and Property Class for Screws

Tightening torque for the fastening screw for LXM32I control unit to BMI servo motor M5 x 25(1)	Nm (lb•in)	5.0 (44.25)
Tightening torque for the fastening screws for the supply voltage module M4 x 16(1)	Nm (lb•in)	1.4 (12.39)
Tightening torque for the fastening screws for the standard braking resistor M4 x 16(1)	Nm (lb•in)	1.4 (12.39)
Tightening torque for the fastening screws for the connection module of the external braking resistor M4 x 16(1)	Nm (lb•in)	1.4 (12.39)
Tightening torque for the fastening screw for the I/O module M4 x 16(1)	Nm (lb•in)	1.4 (12.39)
Tightening torque for the industrial connectors for the I/O module M8	Nm (lb•in)	0.2 (1.77)
Tightening torque for the industrial connectors for the I/O module M12	Nm (lb•in)	0.4 (3.54)
Property class	H	8.8
(1) Washer required		

Tightening Torque for Cable Glands

The specified tightening torques are maximum values for compression nuts. Keep tightening the compression nut until the tightening torque as per table is reached or until the sealing insert forms a small hump protruding over the compression nut. The cable gland bodies must be tightened with the maximum tightening torque for the appropriate thread size; the threads must be locked to help avoid unintended loosening, if necessary.

Use genuine accessories or cable glands with a degree of protection of at least IP65 (form sealing ring or flat sealing ring required).

Tightening torque for cable gland M12 x 1.5 x 6 (body)	Nm (lb•in)	1.5 (13.28)
Tightening torque for cable gland M12 (compression nut)	Nm (lb•in)	1.0 (8.85)
Tightening torque for cable gland M16 x 1.5 x 6 (cable gland body)	Nm (lb•in)	3.0 (26.55)
Tightening torque for cable gland M16 (compression nut)	Nm (lb•in)	2.0 (17.70)
Tightening torque for cable gland M20 (compression nut)	Nm (lb•in)	4.0 (35.40)

Tightening Torque for Sealing Caps

The specified tightening torques are maximum values for the sealing caps.

NOTE: The sealing caps for the I/O module with industrial connectors seal at the bottom inside the connector.
Due to different depths of the connectors, the distance between the upper edge of the sealing cap and the connector is different from connector to connector.

Tightening torque for the sealing cap for the I/O module with industrial connectors M8 x 1	Nm (lb•in)	0.4 (3.54)
Tightening torque for the sealing cap for the I/O module with industrial connectors M12 x 1	Nm (lb•in)	0.5 (4.43)
Tightening torque for the sealing cap for the I/O module with spring terminals M12 x 1.5	Nm (lb•in)	0.5 (4.43)
Tightening torque for the sealing cap for the I/O module with spring terminals M16 x 1.5	Nm (lb•in)	0.7 (6.20)

Non-Volatile Memory and Memory Card

Non-Volatile Memory

The following table shows characteristics for the non-volatile memory:

Characteristic	Value
Minimum number of writing cycles	100000
Type	EEPROM

Memory Card

The following table shows characteristics for the memory card:

Characteristic	Value
Minimum number of writing cycles	100000
Minimum number of plug-in cycles	1000

Memory Card Holder

The following table shows characteristics for the memory card holder:

Characteristic	Value
Minimum number of plug-in cycles	5000

Certifications

Product certifications:

TÜV Nord	SLA-0046/2010
UL	E363147
CiA (Can in Automation)	CiA201303-301V402/20-0169

Conditions for UL 508C

If the product is used to comply with UL 508C, the following conditions must also be met:

Ambient Temperature During Operation

Surrounding air temperature	°C (°F)	0 ... 40 (32 ... 104)

Fuses

Use fuses as per UL 248.

Maximum fuse rating of fuse to be connected upstream	A	25
Class		CC or J

Wiring

Use at least 60/75 °C (140/167 °F) copper conductors.

400/480 V Three-Phase Devices

400/480 V three-phase devices may only be operated via mains up to 480Y/277 Vac.

Overvoltage Category

"Use only in overvoltage category III or where the maximum available Rated Impulse Withstand Voltage Peak is equal or less than 4000 Volts.", or equivalent.

Motor Overload Protection

This equipment provides Solid State Motor Overload Protection at 200 % of maximum FLA (Full Load Ampacity).

Components

Use only UL-listed components (for example, cable glands).

Chapter 3
Engineering

What Is in This Chapter?

This chapter contains the following sections:

Section 3.1
Electromagnetic Compatibility (EMC)

What Is in This Section?

This section contains the following topics:

General

EMC-Compliant Wiring

This product meets the EMC requirements according to the standard IEC 61800-3 if the measures described in this manual are implemented during installation.

Signal interference can cause unexpected responses of the drive system and of other equipment in the vicinity of the drive system.

⚠ WARNING

SIGNAL AND EQUIPMENT INTERFERENCE

- Install the wiring in accordance with the EMC requirements described in the present document.
- Verify compliance with the EMC requirements described in the present document.
- Verify compliance with all EMC regulations and requirements applicable in the country in which the product is to be operated and with all EMC regulations and requirements applicable at the installation site.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

Use proper EMC shielding techniques to help prevent unintended device operation in accordance with the standard IEC 61800-3.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

See chapter Electromagnetic Emission *(see page 39)* for the EMC categories.

Shielded Cables

EMC measures	Objective
Connect large surface areas of cable shields, use cable clamps and ground straps.	Reduces emissions.
Ground shields of digital signal wires at both ends by connecting them to a large surface area or via conductive connector housings.	Reduces interference affecting the signal wires, reduces emissions.

Cable Installation

EMC measures	Objective
Do not route fieldbus cables and signal wires in a single cable duct together with lines with DC and AC voltages of more than 60 V. (Fieldbus cables, signal lines and analog lines may be in the same cable duct) Recommendation: Use separate cable ducts at least 20 cm apart.	Reduces mutual interference.
Keep cables as short as possible. Do not install unnecessary cable loops, use short cables from the central grounding point in the control cabinet to the external ground connection.	Reduces capacitive and inductive interference.
Use equipotential bonding conductors in the following cases: wide-area installations, different voltage supplies and installation across several buildings.	Reduces current in the cable shield, reduces emissions.
Use fine stranded equipotential bonding conductors.	Diverts high-frequency interference currents.
If motor and machine are not conductively connected, for example by an insulated flange or a connection without surface contact, you must ground the motor with a ground strap or a ground wire. The conductor cross section must be at least 10 mm^2 (AWG 6).	Reduces emissions, increases immunity.

Power Supply

EMC measures	Objective
Operate product on mains with grounded neutral point.	Enables effectiveness of mains filter.
Surge arrester if there is a risk of overvoltage.	Reduces the risk of damage caused by overvoltage.

Additional Measures for EMC Improvement

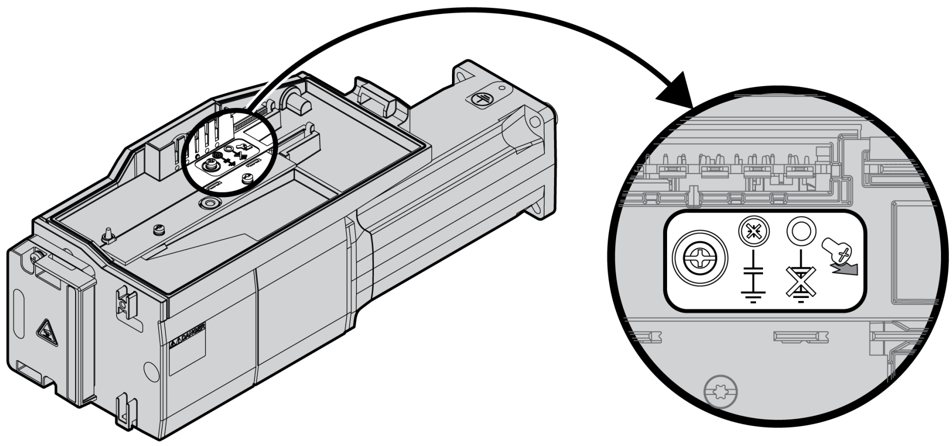
Depending on the application, the following measures can improve the EMC-dependent values:

EMC measures	Objective
Use mains reactors	Reduces mains harmonics, prolongs product service life.

Deactivating the Y Capacitors

Overview

The ground connections of the internal Y capacitors can be disconnected (deactivation).



To deactivate the Y capacitors, remove the screw. Keep this screw so you can re-activate the Y capacitors, if required.

The EMC Categories *(see page 39)* specified no longer apply if the Y capacitors are deactivated.

Section 3.2
Cables and Signals

What Is in This Section?

This section contains the following topics:

Cables - General

Suitability of the Cables

Cables must not be twisted, stretched, crushed or bent. Use only cables that comply with the cable specification. Consider the following in determining suitability of the cables:

- Suitable for drag chain applications
- Temperature range
- Chemical resistance
- Outdoor installation
- Underground installation

Connecting Shields

Shield connection possibilities:

- I/O module with industrial connectors: Connect shield to connector housing
- I/O module with spring terminals: The shields are connected in the housing cover by means of shield clips.

Equipotential Bonding Conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields. The equipotential bonding conductor must be rated for the maximum current.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION ● Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point. 1) ● Route communications and I/O cables separately from power cables. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

1) Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short-circuit currents.

Conductor Cross Sections According to Method of Installation

The following sections describe the conductor cross sections for two methods of installation:

- Method of installation B2:
  Cables in conduits or cable trunking systems
- Method of installation E:
  Cables on open cable trays

Cross section in mm^2 (AWG)	Current-carrying capacity with method of installation B2 in A(1)	Current carrying capacity with method of installation E in A(1)
0.75 (18)	8.5	10.4
1 (16)	10.1	12.4
1.5 (14)	13.1	16.1
2.5 (12)	17.4	22
4 (10)	23	30
6 (8)	30	37
10 (6)	40	52
16 (4)	54	70
25 (2)	70	88
(1) Values as per IEC 60204-1 for continuous operation, copper conductors and ambient air temperature 40 °C (104 °F). See IEC 60204-1 for additional information. The table is an excerpt from this standard and also shows cable cross-sections that are not applicable with regard to the product.		

Note the derating factors for grouping of cables and correction factors for other ambient conditions (IEC 60204-1).

The conductors must have a sufficiently large cross section so that the upstream fuse can trip.

In the case of longer cables, it may be necessary to use a greater conductor cross section to reduce the energy losses.

Overview of the Required Cables

The properties of the required cables are listed in the table below. Use pre-assembled cables to reduce the risk of wiring errors. Pre-assembled cables can be found in chapter Accessories and Spare Parts *(see page 569)*. If the product is used to comply with the requirements as per UL 508C, the conditions specified in chapter Conditions for UL 508C *(see page 43)* must be met.

Moving cables must be fastened (for example, to a drag chain) so that the movement of the cable cannot act on the cable gland.

	Maximum cable length	Minimum cable diameter (1)	Maximum cable diameter(1)	Minimum conductor cross section	Shield	Twisted pair	PELV
Mains voltage	-	8 mm (0.31 in)	15 mm (0.59 in)	-(2)	-	-	-
Digital inputs / outputs	30 m (98.4 ft)	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	0.14 mm^2 (AWG 24)	-	-	Required
Safety function STO(3)	-	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	0.34 mm^2 (AWG 20)	Required, one end grounded	-	Required
PC, commissioning interface	100 m (328 ft)	-	-	0.25 mm^2 (AWG 22)	Required, both ends grounded	Required	Required
Fieldbus CAN For CAN level For reference potential	-(4)	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	0.20 mm^2 (AWG 24) 0.25 mm^2 (AWG 22)	Required, both ends grounded	Required	Required
External braking resistor	3 m (9.84 ft)	6 mm (0.24 in)	10.5 mm (0.41 in)	Same as mains voltage	Required, both ends grounded	-	-

(1) Clamping range of the cable glands.
(2) See chapter Conductor Cross Sections According to Method of Installation *(see page 52)*
(3) See chapter Protected Cable Installation for Safety-Related Signals *(see page 76)*.
(4) Depends on baud rate, see CAN - Maximum bus length *(see page 54)*.

CAN - Galvanic Isolation

The reference potential `CAN_0V` and the shield connection (connector housing) are galvanically isolated.

- Keep the galvanic isolation in order to help avoid ground loops via the CAN bus.
- Use equipotential bonding conductors.
- Use pre-assembled cables to reduce the risk of wiring errors.
- Verify that wiring, cables and connected interfaces meet the PELV requirements.

CAN - Terminating resistors

Both ends of a CAN bus line must be terminated. A 120 Ω terminating resistor between `CAN_L` and `CAN_H` is used for this purpose.

CAN - Maximum bus length

Baud rate [kbit/s]	Maximum bus length in m (ft)
50	1000 (3281)
125	500 (1640)
250	250 (820)
500	100 (328.1)
1000	20 (65.6)[1]

(1) According to the CANopen specification, the maximum bus length is 4 m (13.1 ft). However, in practice, 20 m (65.6 ft) have been possible in most cases. External interference may reduce this length.

At a baud rate of 1 Mbit/s, the drop lines are limited to 0.3 m (0.98 ft).

Wiring Concept

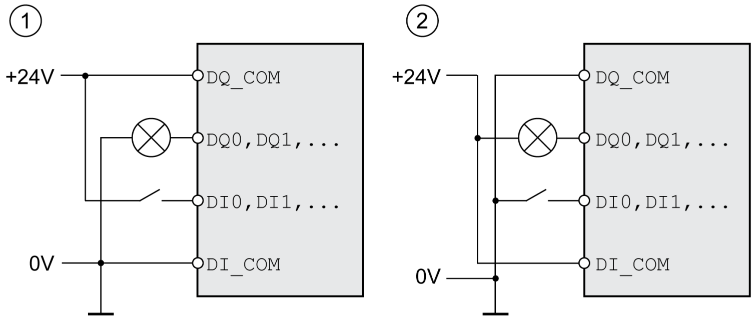
Note the following for wiring the product:

- Use a PLC with galvanically isolated inputs and outputs in the case of internal signal power supply.
- The supply voltage for signals (PELV) may only be grounded at a single point. If the supply voltage is grounded at several points, this will result in ground loops.

Logic Type

Overview

The digital inputs and outputs of this product can be wired for positive logic or negative logic.



Logic type	Active state
(1) Positive logic	Output supplies current (source output) Current flows to the input (sink input)
(2) Negative logic	Output draws current (sink output) Current flows from the input (source input)

Signal inputs are protected against reverse polarity, outputs are short-circuit protected. The inputs and outputs are functionally isolated.

If negative logic is used, a ground fault of a signal is detected as an On state.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Verify that a short-circuit of a signal cannot cause unintended equipment operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connection Module with Industrial Connector

In the case of industrial connectors, the logic type is determined with the selection of the connection module.

Connection Module with Spring Terminals

The logic type is determined by the wiring of `DI_COM` and `DQ_COM`. The logic type affects wiring and control of the sensors; therefore, you must determine the required value in the engineering phase in view of the application.

Special Case: Safety Function STO

The inputs for the safety function STO (inputs `STO_A` and `STO_B`) can only be wired for positive logic.

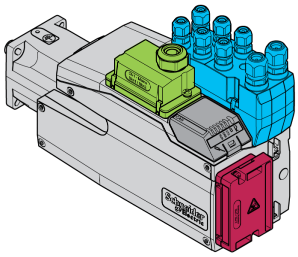
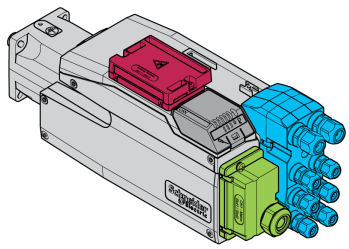
Configurable Inputs and Outputs

This product has digital inputs and outputs that can be configured for specific functional assignments. The inputs and outputs have a defined standard assignment depending on the operating mode. This assignment can be adapted to the requirements of the customer's installation. See chapter Digital Inputs and Outputs *(see page 218)* for additional information.

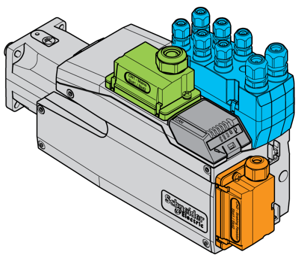
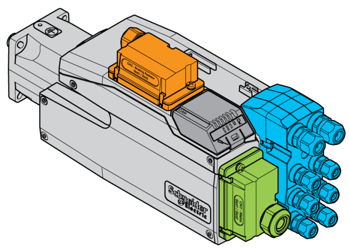
Mounting Types of The Modules

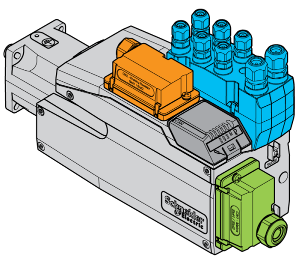
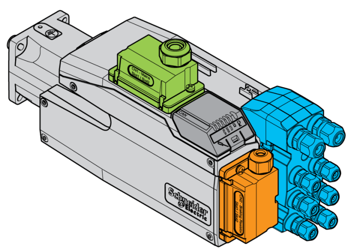
Select the installation of the modules according to the required interfaces and the connection direction. Also note that the modules require space for mounting.

Mounting Type with Standard Braking Resistor

Mounting type A	Mounting type B
	
Module for supply voltage in slot 1 Standard braking resistor slot 2 I/O module in slot 3A	Module for supply voltage in slot 2 Standard braking resistor slot 1 I/O module in slot 3B

Mounting Types with External Braking Resistor

Mounting type C	Mounting type D
	
Module for supply voltage in slot 1 External braking resistor in slot 2 I/O module in slot 3A	Module for supply voltage in slot 2 External braking resistor in slot 1 I/O module in slot 3B

Mounting type E	Mounting type F
	
Module for supply voltage in slot 2 External braking resistor in slot 1 I/O module in slot 3A	Module for supply voltage in slot 1 External braking resistor in slot 2 I/O module in slot 3B

Section 3.3
Mains Supply

What Is in This Section?

This section contains the following topics:

Residual Current Device

Direct current can be introduced in the protective ground conductor of this drive. If a residual current device (RCD / GFCI) or a residual current monitor (RCM) is used for protection against direct or indirect contact, the following specific types must be used:

⚠ WARNING

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

- Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.
- Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters and is sensitive to all types of current for three-phase devices and for single-phase devices not connected to a phase and the neutral conductor.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Further conditions for use of a residual current device:

- The drive has an increased leakage current at the moment power is applied. Use a residual current device (RCD / GFCI) or a residual current monitor (RCM) with a response delay.
- High-frequency currents must be filtered.

Mains Reactor

A mains reactor must be used under the following conditions:

- Operation via supply mains with low impedance (short-circuit current of supply mains greater than specified in chapter Technical Data *(see page 19)*.
- In the case of operation with supply mains with reactive power compensation systems.
- For improvement of the power factor at the mains input and for reduction of mains harmonics.

A single mains reactor can be used for multiple devices. Use a mains reactor with a properly rated current.

Low-impedance supply mains cause high harmonic currents at the mains input. High harmonic currents result in considerable load on the DC bus capacitors. The load on the DC bus capacitors has a decisive impact on the service life of the devices.

Section 3.4
Rating the Braking Resistor

What Is in This Section?

This section contains the following topics:

Standard Braking Resistor

The drive is equipped with a standard braking resistor to absorb braking energy.

Braking resistors are required for dynamic applications. During deceleration, the kinetic energy is transformed into electrical energy in the motor. The electrical energy increases the DC bus voltage. The braking resistor is activated when the defined threshold value is exceeded. The braking resistor transforms electrical energy into heat. If highly dynamic deceleration is required, the braking resistor must be well adapted to the system.

An insufficiently rated braking resistor can cause overvoltage on the DC bus. Overvoltage on the DC bus causes the power stage to be disabled. The motor is no longer actively decelerated.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the braking resistor has a sufficient rating by performing a test run under maximum load conditions.
- Verify that the parameter settings for the braking resistor are correct.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

External Braking Resistor

An external braking resistor is required for applications in which the motor must be decelerated quickly and the standard braking resistor cannot absorb the excess braking energy.

The temperature of the braking resistor may exceed 250 °C (482 °F) during operation.

⚠ WARNING
HOT SURFACES ● Ensure that it is not possible to make any contact with a hot braking resistor. ● Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor. ● Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Monitoring

The device monitors the power of the braking resistor. The load on the braking resistor can be read out.

The output for the external braking resistor is short-circuit protected. The drive does not monitor for ground faults of the braking resistor.

Selection of the External Braking Resistor

The rating of an external braking resistor depends on the required peak power and continuous power.

The resistance R is derived from the required peak power and the DC bus voltage.

$$R = \frac{U^2}{P_{max}}$$

R = Resistance in Ω

U = Switching threshold for braking resistor V

P_{max} = Required peak power in W

If 2 or more braking resistors are connected to one drive, note the following criteria:

- The total resistance of all connected regenerative resistors must comply with the approved resistance.
- The braking resistors can be connected in parallel or in series. Only connect braking resistors with identical resistance in parallel in order to evenly distribute the load to the braking resistors.
- The total continuous power of all connected braking resistors result must be greater than or equal to the required continuous power.

Use only resistors that are specified as braking resistors. For suitable braking resistors, see chapter Accessories and Spare Parts *(see page 569)*.

Mounting and Commissioning of an External Braking Resistor

A parameter is used to switch between the standard braking resistor and an external braking resistor.

The external braking resistors listed in the Accessories chapter are shipped with an information sheet that provides details on installation.

Rating Information

Description

To rate the braking resistor, calculate the proportion contributing to absorbing braking energy.

An external braking resistor is required if the kinetic energy that must be absorbed exceeds the possible total internal energy absorption.

Internal Energy Absorption

Braking energy is absorbed internally by:

- DC bus capacitor E_{var}
- Standard braking resistor E_I
- Electrical losses of the drive E_{el}
- Mechanical losses of the drive E_{mech}

Values for the energy absorption E_{var} can be found in chapter Braking Resistor *(see page 37)*.

Standard Braking Resistor

Two characteristic values determine the energy absorption of the standard braking resistor.

- The continuous power P_{PR} is the amount of energy that can be continuously absorbed without overloading the braking resistor.
- The maximum energy E_{CR} limits the maximum short-term power that can be absorbed.

If the continuous power was exceeded for a specific time, the braking resistor must remain without load for a corresponding period.

The characteristic values P_{PR} and E_{CR} of the standard braking resistor can be found in chapter Braking Resistor *(see page 37)*.

Electrical Losses E_{el}

The electrical losses E_{el} of the drive system can be estimated on the basis of the peak power of the drive. The maximum power dissipation is approximately 10% of the peak power at a typical efficiency of 90%. If the current during deceleration is lower, the power dissipation is reduced accordingly.

Mechanical Losses E_{mech}

The mechanical losses result from friction during operation of the system. Mechanical losses are negligible if the time required by the system to coast to a stop without a driving force is considerably longer than the time required to decelerate the system. The mechanical losses can be calculated from the load torque and the velocity from which the motor is to stop.

Example

Deceleration of a rotary motor with the following data:

- Initial speed of rotation: n = 4000 rpm
- Rotor inertia: J_R = 4 $kgcm^2$
- Load inertia: J_L = 6 $kgcm^2$
- Drive: E_{var} = 23 Ws, E_{CR} = 80 Ws, P_{PR} = 10 W

Calculation of the energy to be absorbed:

$$E_B = \frac{1}{2} J \cdot \left[\frac{2\pi n}{60}\right]^2$$

to E_B = 88 Ws. Electrical and mechanical losses are ignored.

In this example, the DC bus capacitors absorb E_{var} = 23 Ws (the value depends on the device type).

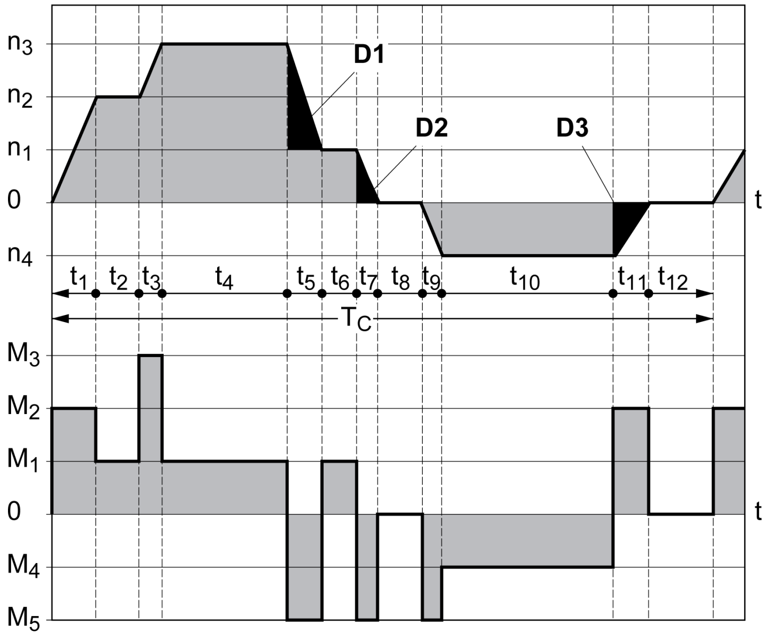
The standard braking resistor must absorb the remaining 65 Ws. It can absorb a pulse of E_{CR} = 80 Ws. If the load is decelerated once, the standard braking resistor is sufficient.

If the deceleration is repeated cyclically, the continuous power must be taken into account. If the cycle time is longer than the ratio of the energy to be absorbed E_B and the continuous power P_{PR}, the standard braking resistor is sufficient. If the system decelerates more frequently, the standard braking resistor is not sufficient.

In this example, the ratio of E_B/P_{PR} is 8.8 s. An external braking resistor is required if the cycle time is shorter.

Rating the External Braking Resistor

Characteristic curves for rating the braking resistor



These two characteristics are also used for the rating the motor. The segments of the characteristic curves to be considered are designated by D_i (D_1 ... D_3).

The total inertia J_t must be known for the calculation of the energy at constant deceleration..

$J_t = J_m + J_c$

J_m: Motor inertia (with holding brake)

J_c: Load inertia

The energy for each deceleration segment is calculated as follows:

$$E_i = \frac{1}{2} J_t \cdot \omega_i^2 = \frac{1}{2} J_t \cdot \left[\frac{2\pi n_i}{60}\right]^2$$

Calculation for the segments (D_1) … (D_3):

$$E_1 = \frac{1}{2} J_t \cdot \left[\frac{2\pi}{60}\right]^2 \cdot \left[n_3^2 - n_1^2\right]$$

$$E_2 = \frac{1}{2} J_t \cdot \left[\frac{2\pi n_1}{60}\right]^2$$

$$E_3 = \frac{1}{2} J_t \cdot \left[\frac{2\pi n_4}{60}\right]^2$$

Units: E_i in Ws (wattseconds), J_t in kgm^2, ω in rad and n_i in rpm.

See the technical data for the energy absorption E_{var} of the devices (without consideration of a braking resistor).

In the next calculation steps, only consider those segments D_i, whose energy E_i exceeds the energy absorption of the device. These excess energies E_{Di} must be diverted by means of the braking resistor.

E_{Di} is calculated using the following formula:

$E_{Di} = E_i - E_{var}$ (in Ws)

The continuous power P_c is calculated for each machine cycle:

$$P_c = \frac{\sum E_{Di}}{\text{Cycletime}}$$

Units: P_c in W, E_{Di} in Ws and cycle time T in s

The selection is made in two steps:

- If the following conditions are met, the standard braking resistor is sufficient.
  - The maximum energy during deceleration must be less than the peak energy that the braking resistor can absorb: $(E_{Di})<(E_{Cr})$.
  - The continuous power of the standard braking resistor must not be exceeded: $(P_C)<(P_{Pr})$.
- If the conditions are not met, you must use an external braking resistor that meets the conditions.

For order data for the external braking resistors, see chapter Accessories and Spare Parts *(see page 569)*.

Section 3.5
Functional Safety

What Is in This Section?

This section contains the following topics:

Basics

Functional Safety

Automation and safety engineering are closely related. Engineering, installation and operation of complex automation solutions are greatly simplified by integrated safety-related functions and modules.

Usually, the safety engineering requirements depend on the application. The level of the requirements results from, among other things, the risk and the hazard potential arising from the specific application and from the applicable standards and regulations.

The goal of designing machines safely is to protect people. The risk associated with machines with electrically controlled drives comes chiefly from moving machine parts and electricity itself.

Only you, the user, machine builder, or system integrator can be aware of all the conditions and factors realized in the design of your application for the machine. Therefore, only you can determine the automation equipment and the related safeties and interlocks which can be properly used, and validate such usage.

⚠ WARNING

NON-CONFORMANCE TO SAFETY FUNCTION REQUIREMENTS

- Specify the requirements and/or measures to be implemented in the risk analysis you perform.
- Verify that your safety-related application complies to applicable safety regulations and standards.
- Make certain that appropriate procedures and measures (according to applicable sector standards) have been established to help avoid hazardous situations when operating the machine.
- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Validate the overall safety-related function and thoroughly test the application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Hazard and Risk Analysis

The standard IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems" defines the safety-related aspects of systems. Instead of a single functional unit of a safety-related system, the standard treats all elements of a function chain as a unit. These elements must meet the requirements of the specific safety integrity level as a whole.

The standard IEC 61800-5-2 "Adjustable speed electrical power drive systems – Safety requirements – Functional" is a product standard that defines the safety-related requirements regarding drives. Among other things, this standard defines the safety-related functions for drives.

Based on the system configuration and utilization, a hazard and risk analysis must be carried out for the system (for example, according to EN ISO 12100 or EN ISO 13849-1). The results of this analysis must be considered when designing the machine, and subsequently applying safety-related equipment and safety-related functions. The results of your analysis may deviate from any application examples contained in the present or related documentation. For example, additional safety components may be required. In principle, the results from the hazard and risk analysis have priority.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Perform a hazard and risk analysis to determine the appropriate safety integrity level, and any other safety requirements, for your specific application based on all the applicable standards.
- Ensure that the hazard and risk analysis is conducted and respected according to EN/ISO 12100 during the design of your machine.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The EN ISO 13849-1 Safety of machinery - Safety-related parts of control systems - Part 1: General Principles for Design describes an iterative process for the selection and design of safety-related parts of controllers to reduce the risk to the machine to a reasonable degree.

To perform risk assessment and risk minimization according to EN ISO 12100, proceed as follows:
1. Defining the boundary of the machine.
2. Identifying risks associated with the machine.
3. Assessing risks.
4. Evaluating risks.
5. Minimizing risks by:
   - Intrinsically safe design
   - Protective devices
   - User information (see EN ISO 12100)
6. Designing safety-related controller parts (SRP/CS, Safety-Related Parts of the Control System) in an interactive process.

To design the safety-related controller parts in an interactive process, proceed as follows:

Step	Action
1	Identify necessary safety functions that are executed via SRP/CS (Safety-Related Parts of the Control System).
2	Determine required properties for each safety function.
3	Determine the required performance level PL_r.
4	Identify safety-related parts executing the safety function.
5	Determine the performance level PL of the afore-mentioned safety-related parts.
6	Verify the performance level PL for the safety function ($PL \geq PL_r$).
7	Verify if all requirements have been met (validation).

Additional information is available on *www.schneider-electric.com*.

Safety Integrity Level (SIL)

The standard IEC 61508 defines 4 safety integrity levels (Safety Integrity Level (SIL)). Safety integrity level SIL1 is the lowest level, safety integrity level SIL4 is the highest level. The safety integrity level required for a given application is determined on the basis of the hazard potential resulting from the hazard and risk analysis. This is used to decide whether the relevant function chain is to be considered as a safety-related function chain and which hazard potential it must cover.

Average Frequency of a Dangerous Failure per Hour (PFH)

To maintain the function of the safety-related system, the IEC 61508 standard requires various levels of measures for avoiding and controlling faults, depending on the required safety integrity level (Safety Integrity Level (SIL)). All components must be subjected to a probability assessment to evaluate the effectiveness of the measures implemented for controlling faults. This assessment determines the probability of a dangerous failure per hour PFH (Average Frequency of a Dangerous Failure per Hour (PFH)) for a safety-related system. This is the frequency per hour with which a safety-related system fails in a hazardous manner so that it can no longer perform its function correctly. Depending on the SIL, the average frequency of a dangerous failure per hour must not exceed certain values for the entire safety-related system. The individual PFH values of a function chain are added. The result must not exceed the maximum value specified in the standard.

SIL	PFH at high demand or continuous demand
4	$\geq 10^{-9}$ ... $<10^{-8}$
3	$\geq 10^{-8}$ ... $<10^{-7}$
2	$\geq 10^{-7}$ ... $<10^{-6}$
1	$\geq 10^{-6}$ ... $<10^{-5}$

Hardware Fault Tolerance (HFT) and Safe Failure Fraction (SFF)

Depending on the safety integrity level (Safety Integrity Level (SIL)) for the safety-related system, the IEC 61508 standard requires a specific hardware fault tolerance (Hardware Fault Tolerance (HFT)) in connection with a specific safe failure fraction (Safe Failure Fraction (SFF)). The hardware fault tolerance is the ability of a safety-related system to execute the required function even if one or more hardware faults are present. The safe failure fraction of a safety-related system is defined as the ratio of the rate of safe failures to the total failure rate of the safety-related system. As per IEC 61508, the maximum achievable safety integrity level of a safety-related system is partly determined by the hardware fault tolerance and the safe failure fraction of the safety-related system.

IEC 61800-5-2 distinguishes two types of subsystems (type A subsystem, type B subsystem). These types are specified on the basis of criteria which the standard defines for the safety-related components.

SFF	HFT type A subsystem			HFT type B subsystem		
	0	1	2	0	1	2
<60 %	SIL1	SIL2	SIL3	---	SIL1	SIL2
60 ... <90 %	SIL2	SIL3	SIL4	SIL1	SIL2	SIL3
90 ... <99 %	SIL3	SIL4	SIL4	SIL2	SIL3	SIL4
≥99 %	SIL3	SIL4	SIL4	SIL3	SIL4	SIL4

Fault Avoidance Measures

Systematic errors in the specifications, in the hardware and the software, incorrect usage and maintenance of the safety-related system must be avoided to the maximum degree possible. To meet these requirements, IEC 61508 specifies a number of measures for fault avoidance that must be implemented depending on the required safety integrity level (Safety Integrity Level (SIL)). These measures for fault avoidance must cover the entire life cycle of the safety-related system, i.e. from design to decommissioning of the system.

Data for Maintenance Plan and the Calculations for Functional Safety

The safety function must be tested at regular intervals. The interval depends on the hazard and risk analysis of the total system. The minimum interval is 1 year (high demand mode as per IEC 61508).

Use the following data of the safety function STO for your maintenance plan and for the calculations for functional safety:

Lifetime of the safety function STO (IEC 61508)(1)	Years	20
SFF (IEC 61508) Safe Failure Fraction	%	90
HFT (IEC 61508) Hardware Fault Tolerance Type A subsystem		1
Safety integrity level IEC 61508 IEC 62061		 SIL3 SILCL3
PFH (IEC 61508) Probability of Dangerous Hardware Failure per Hour	1/h (FIT)	$4*10^{-9}$ (4)
PL (ISO 13849-1) Performance Level		e (category 3)
$MTTF_d$ (ISO 13849-1) Mean Time to Dangerous Failure	Years	100 (nominal 350)
DC (ISO 13849-1) Diagnostic Coverage	%	90
(1) See chapter Lifetime Safety Function STO *(see page 586)*.		

Contact your local Schneider Electric representative for additional data, if required.

Definitions

Integrated Safety Function "Safe Torque Off" STO

The integrated safety function STO (IEC 61800-5-2) allows for a category 0 stop as per IEC 60204-1 without external power contactors. It is not necessary to interrupt the supply voltage for a category 0 stop. This reduces the system costs and the response times.

Category 0 Stop (IEC 60204-1)

In stop category 0 (Safe Torque Off, STO), the drive coasts to a stop (provided there are no external forces operating to the contrary). The STO safety-related function is intended to help prevent an unintended start-up, not stop a motor, and therefore corresponds to an unassisted stop in accordance with IEC 60204-1.

In circumstances where external influences are present, the coast down time depends on physical properties of the components used (such as weight, torque, friction, etc.), and additional measures such as mechanical brakes may be necessary to help prevent any hazard from materializing. That is to say, if this means a hazard to your personnel or equipment, you must take appropriate measures.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Make certain that no hazards can arise for persons or material during the coast down period of the axis/machine.
- Do not enter the zone of operation during the coast down period.
- Ensure that no other persons can access the zone of operation during the coast down period.
- Use appropriate safety interlocks where personnel and/or equipment hazards exist.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Category 1 Stop (IEC 60204-1)

For stops of category 1 (Safe Stop 1, SS1), you can initiate a controlled stop via the control system, or through the use of specific functional safety-related devices. A Category 1 Stop is a controlled stop with power available to the machine actuators to achieve the stop.

The controlled stop by the control/safety-related system is not safety-relevant, nor monitored, and does not perform as defined in the case of a power outage or if an error is detected. This has to be implemented by means of an external safety-related switching device with safety-related delay.

Function

The safety function STO integrated into the product can be used to implement an "EMERGENCY STOP" (IEC 60204-1) for category 0 stops. With an additional, approved EMERGENCY STOP safety relay module, it is also possible to implement category 1 stops.

Function Principle

The safety function STO is triggered via two redundant signal inputs. The wiring of the two signal inputs must be separate.

The safety function STO is triggered if the level at one of the two signal inputs is 0. The power stage is disabled. The motor can no longer generate torque and coasts down without braking. An error of error class 3 is detected.

If, within one second, the level of the other output also becomes 0, the error class remains 3. If, within one second, the level of the other output does not become 0, the error class changes to 4.

Requirements for Using the Safety Function

General

The safety function STO (Safe Torque Off) does not remove power from the DC bus. The safety function STO only removes power to the motor. The DC bus voltage and the mains voltage to the drive are still present.

DANGER

ELECTRIC SHOCK

- Do not use the safety function STO for any other purposes than its intended function.
- Use an appropriate switch, that is not part of the circuit of the safety function STO, to disconnect the drive from the mains power.

Failure to follow these instructions will result in death or serious injury.

After the safety function STO is triggered, the motor can no longer generate torque and coasts down without braking.

WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated service brake if coasting does not meet the deceleration requirements of your application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Logic Type

The inputs for the safety function STO (inputs `STO_A` and `STO_B`) can only be wired for positive logic.

Holding Brake and Safety Function STO

When the safety function STO is triggered, the power stage is immediately disabled. Applying the holding brake requires a certain amount of time. In the case of vertical axes or external forces acting on the load, you may have to take additional measures to bring the load to a standstill and to keep it at a standstill when the safety function STO is used, for example, by using a service brake.

WARNING

FALLING LOAD

Ensure that all loads come to a secure standstill when the safety function STO is used.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the suspension of hanging / pulling loads is a safety objective for the machine, then you can only achieve this objective by using an appropriate external brake as a safety-related measure.

WARNING

UNINTENDED AXIS MOVEMENT

- Do not use the internal holding brake as a safety-related measure.
- Only use certified external brakes as safety-related measures.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The drive does not provide its own safety-related output to connect an external brake to use as a safety-related measure.

Unintended Restart

To help avoid unintended restart of the motor after restoration of power (for example, after power outage), the parameter `IO_AutoEnable` must be set to "off".

Also verify that a master controller will not trigger an unintended restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Set parameter `IO_AutoEnable` to "off" if the automatic enabling of the power stage presents hazards in your application.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Degree of Protection when the Safety Function is Used

You must ensure that conductive substances cannot get into the product (pollution degree 2). Conductive substances may cause the safety function to become inoperative.

⚠ WARNING

INOPERABLE SAFETY FUNCTION

Ensure that conductive substances (water, contaminated or impregnated oils, metal shavings, etc.) cannot get into the drive.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protected Cable Installation

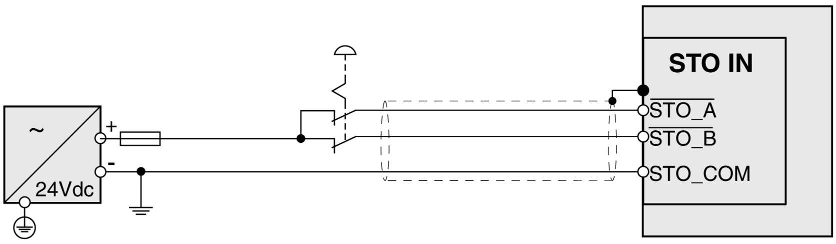
If short circuits and other wiring errors such as a cross fault between the signals of the safety function STO can be expected in connection with safety-related signals, and if these short circuits and cross faults are not detected by upstream devices, protected cable installation as per ISO 13849-2 is required.

In the case of an unprotected cable installation, the two signals (both channels) of a safety function may be connected to external voltage if a cable is damaged. If the two channels are connected to external voltage, the safety function is no longer operative.

Fuse

A fuse for the safety function STO is required.

Type of fuse: 0.5 A (type T)



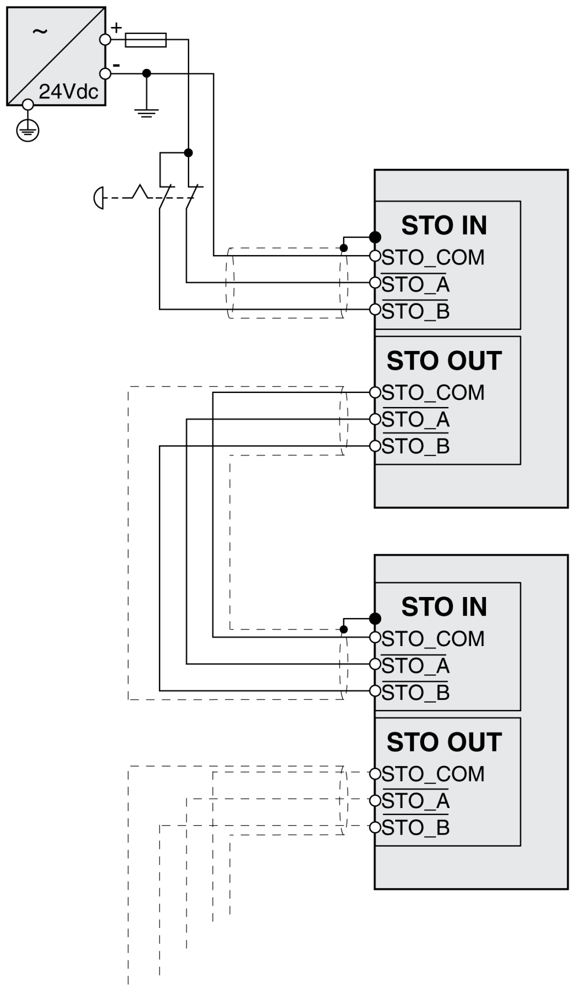
Protected Cable Installation for Safety-Related Signals

ISO 13849-2 describes protected cable installation for cables for safety-related signals. The cables for the safety function STO must be protected against external voltage. A shield with ground connection helps to keep external voltage away from the cables for the signals of the safety function STO.

Ground loops can cause problems in machines. A shield connected at one end only is sufficient for grounding and does not create a ground loop.

- Use shielded cables for the signals of the safety function STO.
- Do not use the cable for the signals of the safety function STO for other signals.
- Connect one end of the shield.
- When daisychaining the signals of the safety function STO, use the shield connection at STO IN.

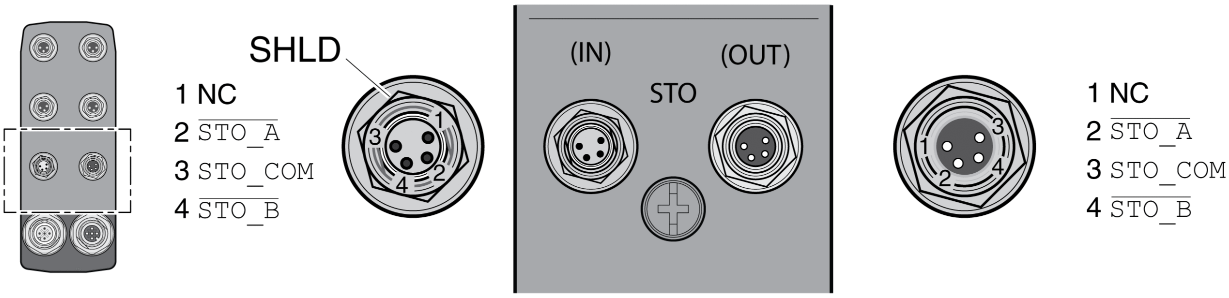
Example of protected cable installation for safety-related signals



Notes on the Connection Modules

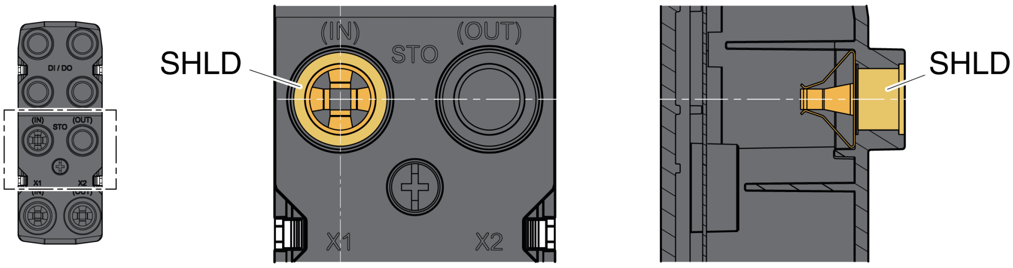
The connection modules are designed for connection of one end of the shield.

Example of connection of one end of shield at the I/O module with industrial connectors



⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not connect any wiring to reserved, unused connections, or to connections designated as No Connection (N.C.).
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Example of connection of one end of shield at the I/O module with spring terminals



Accessories: Cables and Connectors for I/O Module with Industrial Connectors

The accessories are designed for connection of one end of the shield. One end of the cables for the safety function STO is pre-assembled. The pre-assembled connector of the cables for the safety function STO is connected to STO IN. The connector for the safety function STO VW3L50010 is not connected to the shield; it is connected to STO OUT. One end of the shield of the pre-assembled cables VW3M94C is connected.

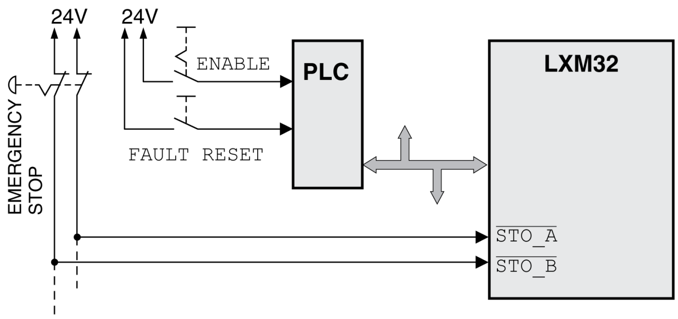
Using pre-assembled cables helps to reduce the possibility of wiring errors. See chapter Accessories and Spare Parts *(see page 569)*.

Application Examples STO

Example of Category 0 stop

Use without EMERGENCY STOP safety relay module, category 0 stop.

Example of category 0 stop



In this example, when an EMERGENCY STOP is activated, it leads to a category 0 stop.

The safety function STO is triggered via a simultaneous 0-level at both inputs (time offset of less than 1 s). The power stage is disabled and an error of error class 3 is detected. The motor can no longer generate torque.

If the motor is not already at a standstill when the STO is triggered, it decelerates under the salient physical forces (gravity, friction, etc.) active at the time until presumably coasting to a standstill.

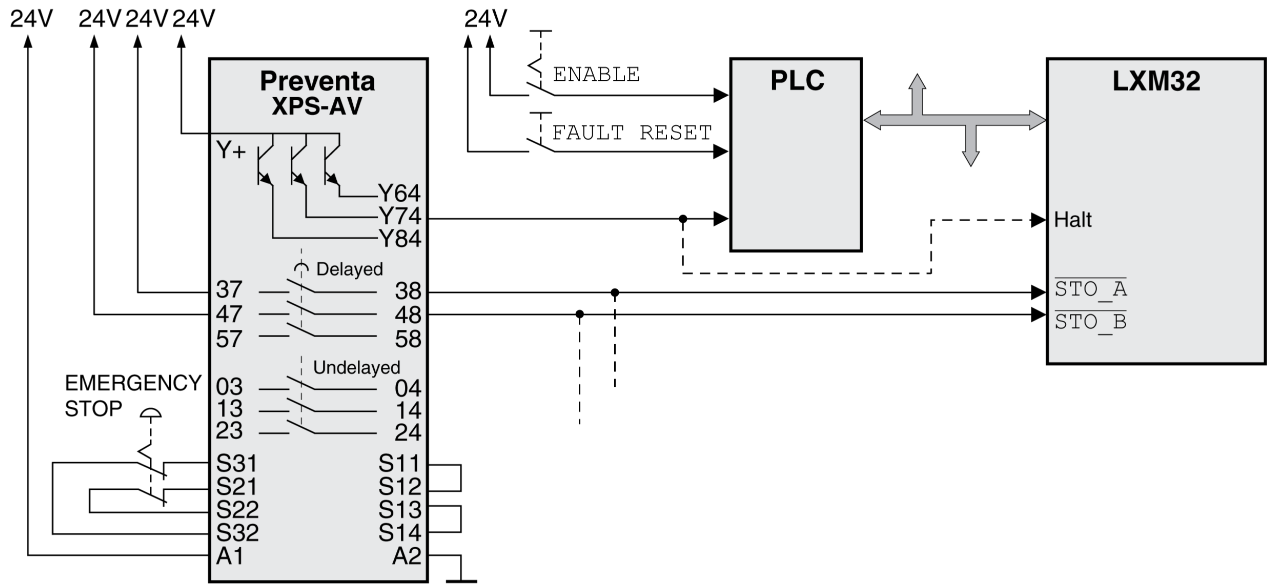
⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Install a dedicated service brake if coasting does not meet the deceleration requirements of your application.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external brake may also be required. See Holding Brake and Safety Function STO *(see page 74)*.

Example of Category 1 stop

Use with EMERGENCY STOP safety relay module, category 1 stop.

Example of category 1 stop with external Preventa XPS-AV EMERGENCY STOP safety relay module



In this example, when an EMERGENCY STOP is activated, it leads to a category 1 stop.

The EMERGENCY STOP safety relay module requests an immediate stop (undelayed) of the drive, for example by means of the function "Halt". After the time delay set in the EMERGENCY STOP safety relay module has elapsed, the EMERGENCY STOP safety relay triggers the safety function STO.

The safety function STO is triggered via a simultaneous 0-level at both inputs (time offset of less than 1 s). The power stage is disabled and an error of error class 3 is detected. The motor can no longer generate torque.

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external brake may also be required. See Holding Brake and Safety Function STO *(see page 74)*.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Install a dedicated service brake if coasting does not meet the deceleration requirements of your application. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Section 3.6
CANopen Fieldbus

What Is in This Section?

This section contains the following topics:

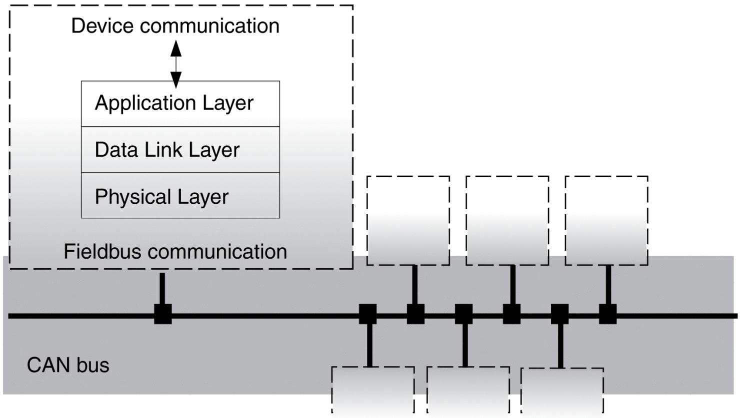
Communication Layers

Overview

CANopen uses the CAN bus technology for data communication.

CANopen is based on the network services for data communication as per the ISO-OSI model.

3 layers enable data communication via the CAN bus:
- Physical Layer
- Data Link Layer
- Application Layer



Physical Layer

The physical layer defines the electrical properties of the CAN bus such as connectors, cable length and cable properties as well as bit assignment and bit timing.

Data Link Layer

The data link layer connects the network devices. It assigns priorities to individual data packets and monitors and detects errors.

Application Layer

The application layer uses communication objects (COB) to exchange data between the various devices. Communication objects are elementary components for creating a CANopen application.

Objects

Overview

Processes under CANopen are executed via objects. Objects carry out different tasks; they act as communication objects for data transport to the fieldbus, control the process of establishing a connection or monitor the network devices. If objects are directly linked to the device (device-specific objects), the device functions can be used and modified via these objects.

The product provides corresponding parameters for CANopen object groups 3000_h and 6000_h.

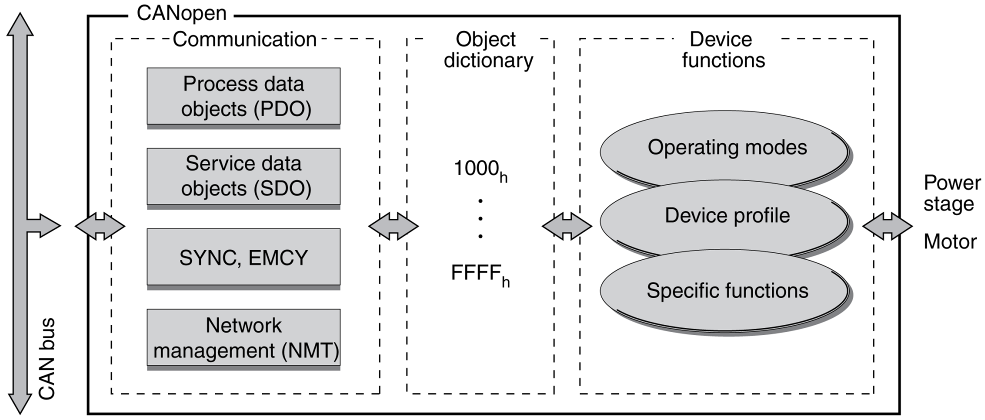
The names of the parameters and the data type of the parameters may be different from the DSP402 definition for object group 6000_h. In this case, enter the data type according to the DS402.

A detailed description of the parameters can be found in the product user guide in the Parameters chapter.

Object Dictionary

The object dictionary of each network device allows for communication between the devices. Other devices find the objects with which they can communicate in this dictionary.

Device model with object dictionary



The object dictionary contains objects for describing the data types and executing the communication tasks and device functions under CANopen.

Object Index

Each object is addressed by means of a 16-bit index, which is represented as a four-digit hexadecimal number. The objects are arranged in groups in the object dictionary. The following table shows an overview of the object dictionary as per the CANopen specifications.

Index range (hex)	Object groups
1000...2FFF hex	Communication profile
3000...5FFF hex	Vendor-specific objects
6000...9FFF hex	Standardized device profiles
A000...FFFF hex	Reserved

See chapter Object Dictionary *(see page 521)* for a list of the CANopen objects.

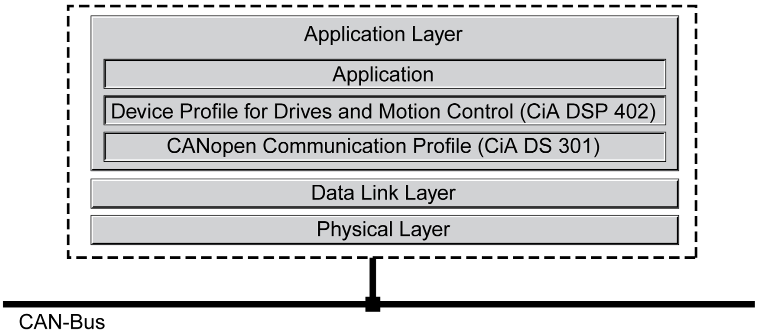
CANopen Profiles

Standardized Profiles

Standardized profiles describe objects that are used with different devices without additional configuration. The international users' and manufacturers' group, CAN in Automation (CiA), has standardized profiles.

These include:
- DS301 communication profile
- DSP402 device profile

CANopen reference model:



DS301 Communication Profile

The DS301 communication profile is the interface between device profiles and CAN bus. It was specified in 1995 under the name DS301 and defines uniform standards for common data exchange between different device types under CANopen.

The objects of the communication profile in the device carry out the tasks of data exchange and parameter exchange with other network devices and initialize, control and monitor the device in the network.

DSP 402 Device Profile

The DSP402 device profile describes standardized objects for positioning, monitoring and settings of drives. The tasks of the objects include:

- Device monitoring and status monitoring (Device Control)
- Standardized parameterization
- Change, monitoring and execution of operating modes

Vendor-Specific Profiles

The core functions of a device can be used with objects of standardized device profiles. Vendor-specific device profiles offer an extended range of functions. The objects with which the special functions of a device can be used under CANopen are defined in these vendor-specific device profiles.

Communication - Object Dictionary

Overview

CANopen manages communication between the network devices with object dictionaries and objects. A network device can use process data objects (PDO) and service data objects (SDO) to send and/or receive object data.

The following can be done by accessing the objects of the network devices:

- Exchange parameter values
- Start movement functions of individual devices
- Request status information

Each CANopen device manages an object dictionary which contains the objects for communication.

Index, Subindex

The objects are addressed in the object dictionary via a 16-bit index. One or more 8-bit subindex entries for each object specify individual data fields in the object. Index and subindex are shown in hexadecimal notation with a subscript "$_h$".

Example

The following table shows index and subindex entries using the example of the object `software position limit (607D`$_h$`)` for specifying the positions of software limit switches.

Index	Subindex	Name	Meaning
$607D_h$	00_h	-	Number of data fields
$607D_h$	01_h	minimum position limit	Negative software limit switch
$607D_h$	02_h	maximum position limit	Positive software limit switch

Object Descriptions in the Manual

For CANopen programming of a device, the objects of the following object groups are described in detail:

- $1xxx_h$ objects: Communication objects in this chapter.
- $3xxx_h$ objects: Vendor-specific objects required to control the device in chapter Operating States and Operating Modes *(see page 247)*.
- $6xxx_h$ objects: Standardized objects of the device profile in chapter Operating States and Operating Modes *(see page 247)*.

Standardized Objects

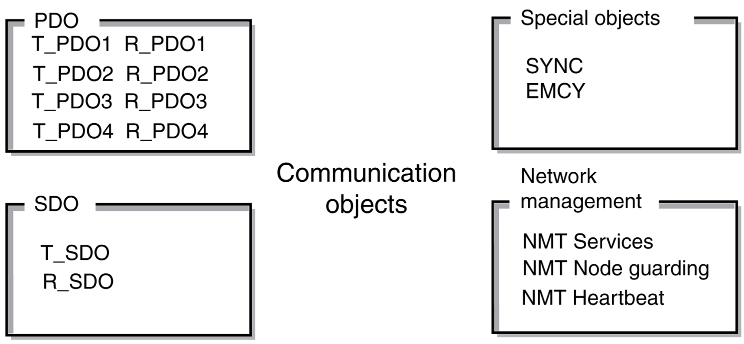
Standardized objects allow you to use the same application program for different network devices of the same device type. This requires these objects to be contained in the object dictionary of the network devices. Standardized objects are defined in the DS301 communication profile and the DSP402 device profile.

Communication - Objects

Overview

The communication objects are standardized with the DS301 CANopen communication profile. The objects can be classified into 4 groups according to their tasks.

Communication objects; the following applies to the perspective of the network device: T_..: "Transmit", R_..: "Receive"

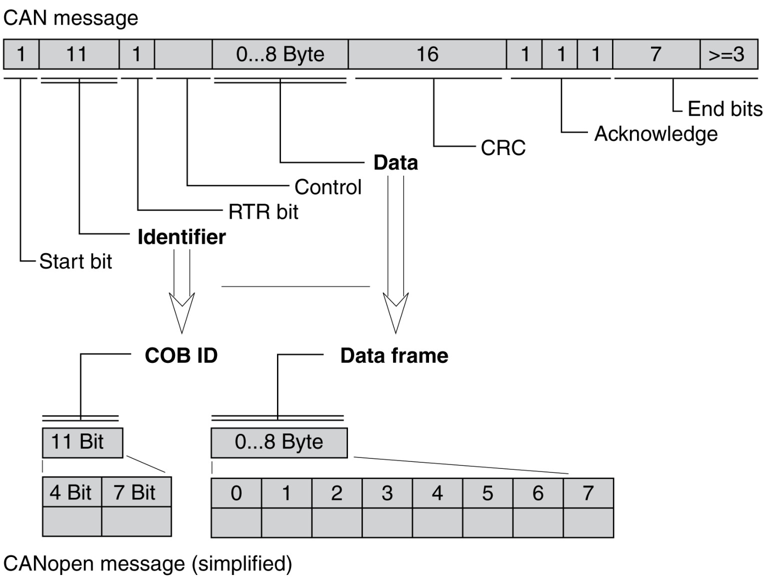


- PDOs (process data objects) for real-time transmission of process data
- SDOs (service data object) for read and write access to the object dictionary
- Objects for controlling CAN messages:
  - SYNC object (synchronization object) for synchronization of network devices
  - EMCY object (emergency object), for signaling errors of a device or its peripherals.
- Network management services:
  - NMT services for initialization and network control (NMT: network management)
  - NMT Node Guarding for monitoring the network devices
  - NMT Heartbeat for monitoring the network devices

CAN Message

Data is exchanged via the CAN bus in the form of CAN messages. A CAN message transmits the communication object as well as numerous administration and control data.

CAN message and simplified representation of CANopen message



CANopen Message

To work with CANopen objects and for data exchange, the CAN message can be represented in simplified form because most of the bits are used for error detection. These bits are automatically removed from the receive message by the data link layer of the OSI model, and added to a message before it is transmitted.

The two bit fields "Identifier" and "Data" form the simplified CANopen message. The "Identifier" corresponds to the "COB ID" and the "Data" field to the data frame (maximum length 8 bytes) of a CANopen message.

COB ID

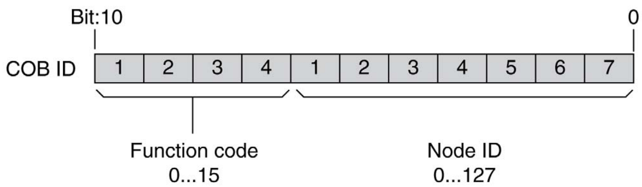
The COB ID (**C**ommunication **OB**ject **Id**entifier) has 2 tasks for controlling communication objects:

- Bus arbitration: Specification of transmission priorities
- Identification of communication objects

An 11-bit COB identifier as per the CAN 3.0A specification is defined for CAN communication; it comprises 2 parts

- Function code, 4 bits
- Node address (node ID), 7 bits.

COB ID with function code and node address:



COB IDs of the Communication Objects

The following table shows the COB IDs of the communication objects with the factory settings. The column "Index of object parameters" shows the index of special objects with which the settings of the communication objects can be read or modified via an SDO.

Communication object	Function code	Node address, node ID [1...127]	COB ID decimal (hexadecimal)	Index of object parameters
NMT Start/Stop Service	0 0 0 0	0 0 0 0 0 0 0	0 (0_h)	-
SYNC object	0 0 0 1	0 0 0 0 0 0 0	128 (80_h)	1005_h ... 1007_h
EMCY object	0 0 0 1	x x x x x x x	128 (80_h) + node ID	1014_h, 1015_h
T_PDO1	0 0 1 1	x x x x x x x	384 (180_h) + node ID	1800_h
R_PDO1	0 1 0 0	x x x x x x x	512 (200_h) + node ID	1400_h
T_PDO2	0 1 0 1	x x x x x x x	640 (280_h) + node ID	1801_h
R_PDO2	0 1 1 0	x x x x x x x	768 (300_h) + node ID	1401_h
T_PDO3	0 1 1 1	x x x x x x x	896 (380_h) + node ID	1802_h
R_PDO3	1 0 0 0	x x x x x x x	1024 (400_h) + node ID	1402_h
T_PDO4	1 0 0 1	x x x x x x x	1152 (480_h) + node ID	1803_h
R_PDO4	1 0 1 0	x x x x x x x	1280 (500_h) + node ID	1403_h
T_SDO	1 0 1 1	x x x x x x x	1408 (580_h) + node ID	-
R_SDO	1 1 0 0	x x x x x x x	1536 (600_h) + node ID	-
NMT error control	1 1 1 0	x x x x x x x	1792 (700_h) + node ID	-

COB IDs of PDOs can be changed if required. The assignment pattern for COB IDs shown corresponds to the factory settings.

Function Code

The function code classifies the communication objects. Since the bits of the function code in the COB ID are more significant, the function code also controls the transmission priorities: Objects with a lower function code are transmitted with higher priority. For example, an object with function code "1" is transmitted prior to an object with function code "3" in the case of simultaneous bus access.

Node Address

Each network device has to be configured before it can be operated on the network. The device is assigned a unique 7-bit node address (node ID) between 1 (01_h) and 127 ($7F_h$). The device address "0" is reserved for "broadcast transmissions" which are used to send messages to the reachable devices simultaneously.

Example

Selection of a COB ID

For a device with the node address 5, the COB ID of the communication object T_PDO1 is:

384+node ID = 384 (180_h) + 5 = 389 (185_h).

Data Frame

The data frame of the CANopen message can hold up to 8 bytes of data. In addition to the data frame for SDOs and PDOs, special frame types are specified in the CANopen profile:

- Error data frame
- Remote data frame for requesting a message

The data frames contain the respective communication objects.

Communication - Relationships

Overview

CANopen uses 3 relationships for communication between network devices:

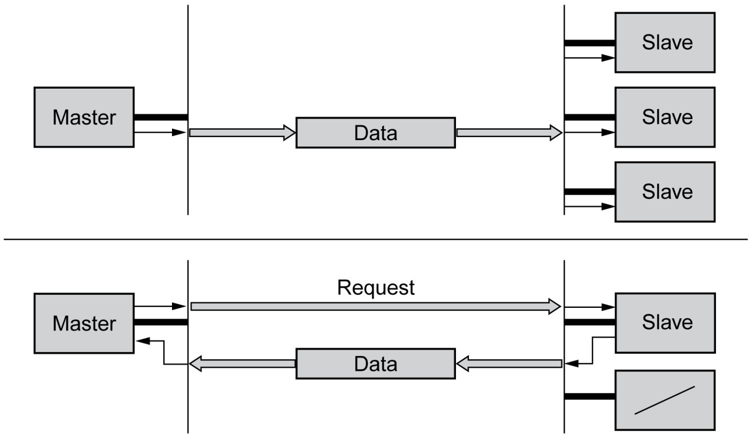
- Master-slave relationship
- Client-server relationship
- Producer-consumer relationship

Master-Slave Relationship

A network master controls the message traffic. A slave can respond only when it is addressed by the master.

The master-slave relationship is used with network management objects for a controlled network start and to monitor the connection of devices.

Master - slave relationships



Messages can be interchanged with and without confirmation. If the master sends an unconfirmed CAN message, it can be received by a single slave or by the reachable slaves or by no slave.

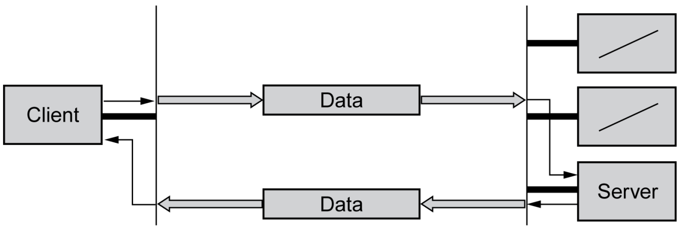
To confirm the message, the master requests a message from a specific slave, which then responds with the required data.

Client-Server Relationship

A client-server relationship is established between 2 devices. The "server" is the device whose object dictionary is used during data exchange. The "client" addresses and starts the exchange of messages and waits for a confirmation from the server.

A client-server relationship with SDOs is used to send configuration data and long messages.

Client-server relationship



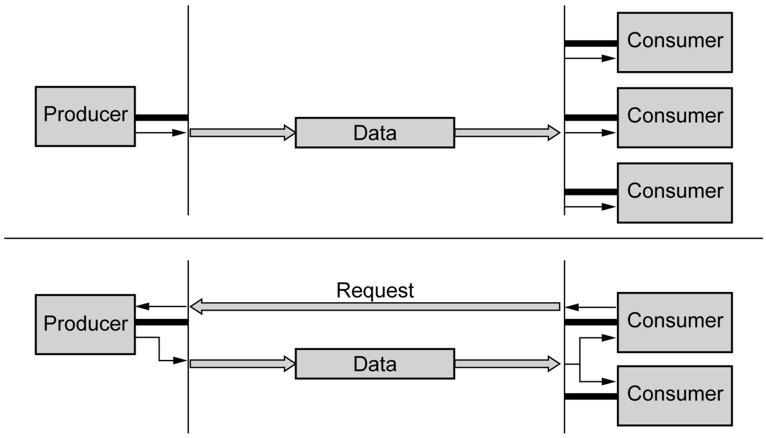
The client addresses and sends a CAN message to a server. The server evaluates the message and sends the response data as an acknowledgement.

Producer-Consumer Relationship

The producer-consumer relationship is used for exchanging messages with process data, because this relationship enables fast data exchange without administration data.

A "Producer" sends data, a "Consumer" receives data.

Producer-consumer relationships



The producer sends a message that can be received by one or more network devices. The producer does not receive an acknowledgement that the message was received.

The message transmission can be triggered by:
- An internal event, for example, "target position reached"
- The synchronization object SYNC
- A request of a consumer

See chapter PDO Data Exchange *(see page 96)* for details on the function of the producer-consumer relationship and on requesting messages.

SDO Data Exchange

Overview

Service Data Objects (SDO: **S**ervice **D**ata **O**bject) can be used to access the entries of an object dictionary via index and subindex. The values of the objects can be read and, if permissible, also be modified.

Every network device has at least one server SDO to be able to respond to read and write requests from a different device. A client SDO is only required to request SDO messages from the object dictionary of a different device or to change them in the dictionary.

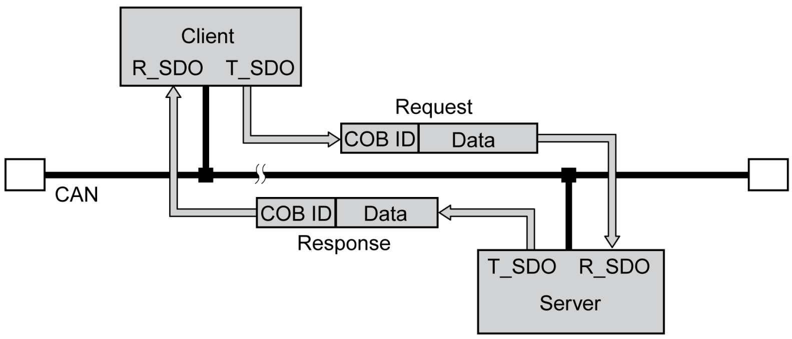
The T_SDO of an SDO client is used to send the request for data exchange; the R_SDO is used to receive. The data frame of an SDO consist of 8 bytes.

SDOs have a higher COB ID than PDOs; therefore, they are transmitted over the CAN bus with a lower priority.

Data Exchange

A service data object (SDO) transmits parameter data between 2 devices. The data exchange conforms to the client-server relationship. The server is the device to whose object dictionary an SDO message refers.

SDO message exchange with request and response:



Message Types

Client-server communication is triggered by the client to send parameter values to the server or to get them from the server. In both cases, the client starts the communication with a request and receives a response from the server.

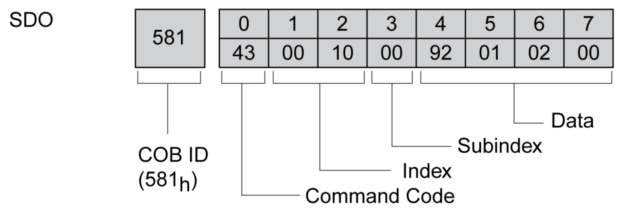
SDO Message

Overview

An SDO message consists of the COB ID and the SDO data frame, in which up to 4 bytes of data can be sent. Longer data sequences are distributed over multiple SDO messages with a special protocol.

The device transmits SDOs with a data length of up to 4 bytes. Greater amounts of data such as 8 byte values of the data type "Visible String 8" can be distributed over multiple SDOs and are transmitted successively in blocks of 7 bytes.

The following illustration shows an example of an SDO message:



COB ID and Data Frame

R_SDO and T_SDO have different COB IDs.

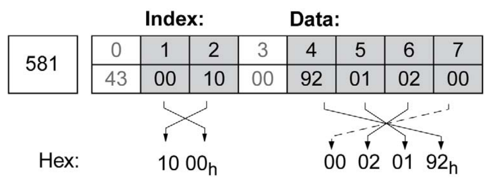
The data frame of an SDO messages consists of:

- Command Code: The command code contains the SDO message type and the data length of the transmitted value.
- Index: Index of the object.
- Subindex: Subindex of the object.
- Data: Data of up to 4 bytes of the object.

Evaluation of Numeric Values

Index and data are transmitted left-aligned in Intel format. If the SDO contains numerical values of more than 1 byte in length, the data must be rearranged byte-by-byte before and after a transmission.

Rearranging numeric values greater than 1 byte:



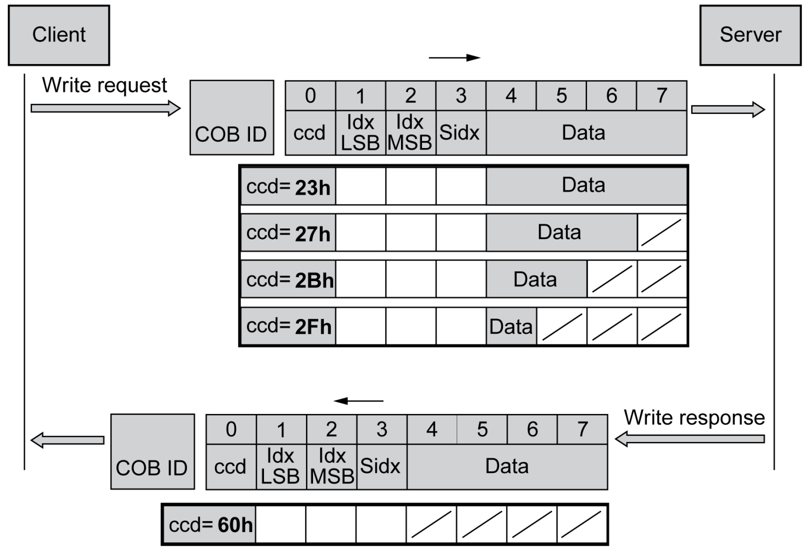
SDO Reading and Writing Data

Writing Data

The client starts a write request by sending index, subindex, data length and value.

The server sends a confirmation indicating whether the data was correctly processed. The confirmation contains the same index and subindex, but no data.

Writing parameter values:



Unused bytes in the data field are shown with a slash in the graphic. The content of these data fields is not defined.

ccd Coding

The table below shows the command code for writing parameter values. It depends on the message type and the transmitted data length.

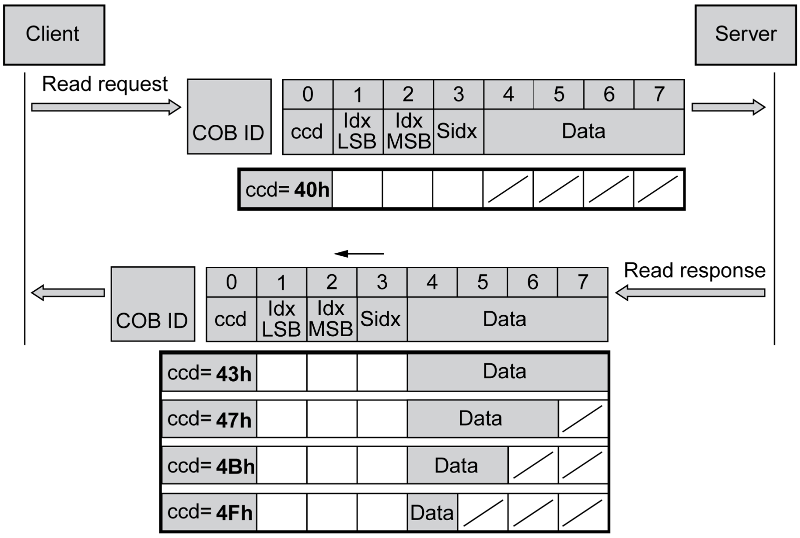
Message type	Data length used				Description
	4 byte	3 byte	2 byte	1 byte	
Write request	23_h	27_h	$2B_h$	$2F_h$	Transmitting parameters
Write response	60_h	60_h	60_h	60_h	Confirmation
Error response	80_h	80_h	80_h	80_h	Error

Reading Data

The client starts a read request by transmitting the index and subindex that point to the object or part of the object to read.

The server confirms the request by sending the required data. The SDO response contains the same index and subindex. The length of the response data is specified in the command code "ccd".

Reading a parameter value:



Unused bytes in the data field are shown with a slash in the graphic. The content of these data fields is not defined.

ccd Coding

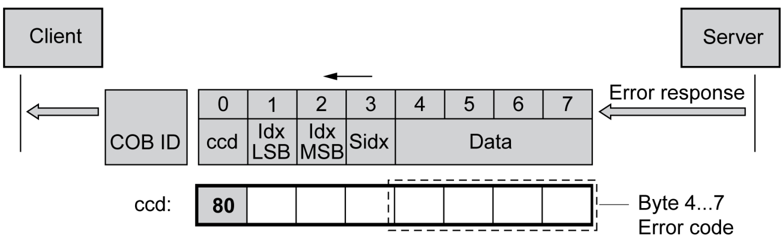
The table below shows the command code for transmitting a read value. It depends on the message type and the transmitted data length.

Message type	Data length used				Description
	4 byte	3 byte	2 byte	1 byte	
Read request	40_h	40_h	40_h	40_h	Request read value
Read response	43_h	47_h	$4B_h$	$4F_h$	Return read value
Error response	80_h	80_h	80_h	80_h	Error

Error Response

If a message could not be evaluated, the server sends an error message. See chapter SDO Error Message ABORT *(see page 410)* for details on the evaluation of the error message.

Response with error message (error response):



SDO Reading Data Longer Than 4 Bytes

Overview

If values of more than 4 bytes are to be transmitted with an SDO message, the message must be divided into several read requests. Each read request consists of 2 parts.

- Request by the SDO client,
- Confirmation by the SDO server.

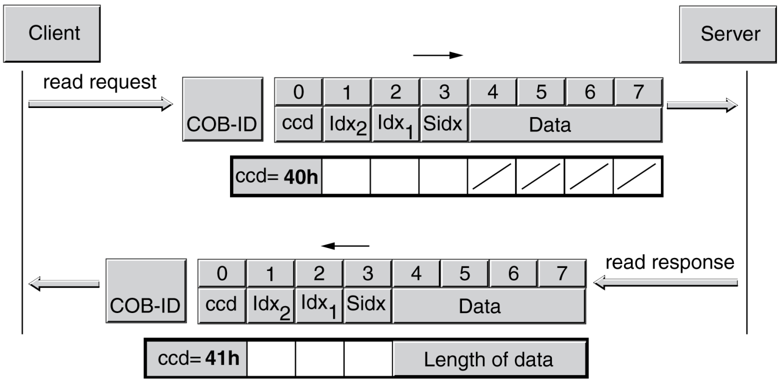
The read request by the SDO client contains the command code "ccd" with the toggle bit and a data segment. The confirmation also contains a toggle bit in the command code "ccd". In the first read request, the toggle bit has the value "0", in the subsequent read requests it toggles between 1 and 0.

Reading Data

The client starts a read request by transmitting the index and subindex that point to the object to read.

The server confirms the read request with the command code 41_h, the index, the subindex and the data length of the object to be read. The command code 41_h indicates that the object has data with a length of more than 4 bytes.

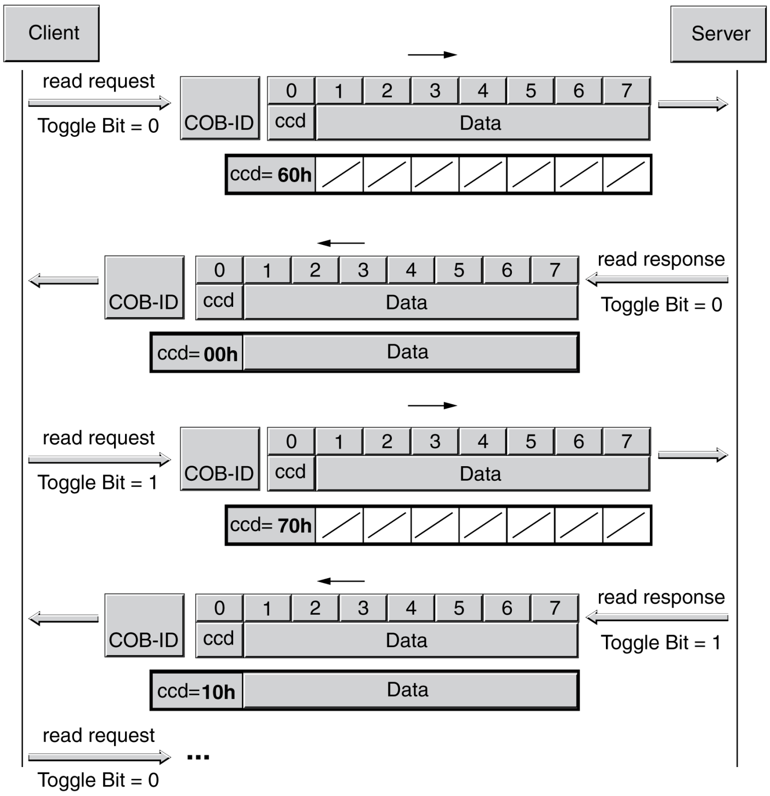
First read request:



The data is requested by means of further read requests. The data is transmitted in messages with 7 bytes each.

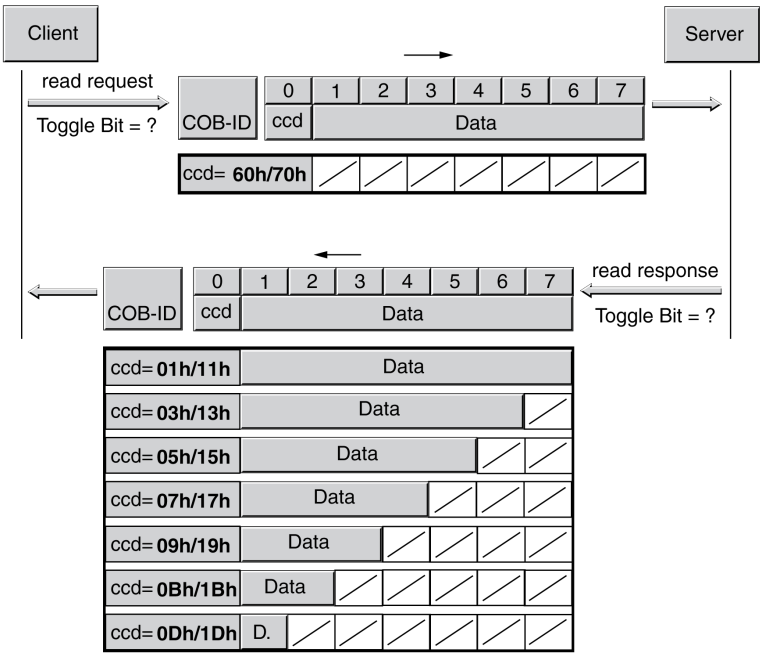
The client must continue to start read requests until the data is transmitted.

Additional read requests:



It is possible to detect whether the data has been transmitted on the basis of the command code of the server. Once the data has been transmitted, the command code of the server indicates the length of the remaining response data and, by the same token, the end of the transmission.

Final read request:



PDO Data Exchange

Overview

Process data objects (PDO: **P**rocess **D**ata **O**bject) are used for realtime data exchange of process data such as actual and reference values or the operating state of the device. Transmission is fast because the data is sent without additional administration data and data transmission acknowledgement from the recipient is not required.

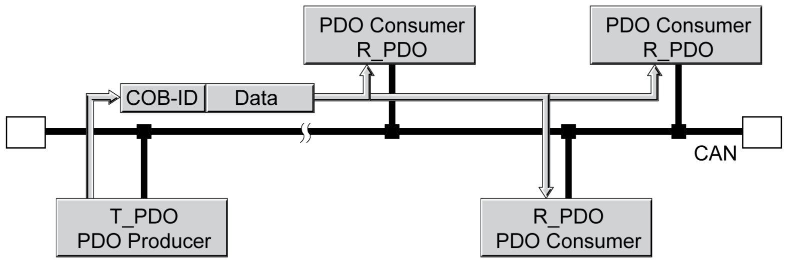
The flexible data length of a PDO message also increases the data throughput. A PDO message can transmit up to 8 bytes of data. If only 2 bytes are assigned, only 2 data bytes are sent.

The length of a PDO message and the assignment of the data fields are specified by PDO mapping. See chapter PDO Mapping *(see page 101)* for additional information.

PDO messages can be exchanged between devices that generate or process data.

Data Exchange

PDO data exchange:



Data exchange with PDOs follows to the producer-consumer relationship and can be triggered in the following ways:

- Synchronized
- Event-driven, asynchronous

The SYNC object controls synchronized data processing. Synchronous PDO messages are transmitted immediately like the other PDO messages, but are only evaluated on the next SYNC transmission. For example, several drives can be started simultaneously via synchronized data exchange.

The device immediately evaluates PDO messages that are called on request or in an event-driven way.

The transmission type can be specified separately for each PDO with subindex 02_h (transmission type) of the PDO communication parameter.

PDO Message

Overview

The device uses 8 PDOs, 4 receive PDOs and 4 transmit PDOs.

- R_PDO to receive PDO messages (R: Receive)
- T_PDO to transmit the PDO message (T: Transmit)

By default, the PDOs are evaluated or transmitted in an event-driven way.

The settings of the PDOs can be read and modified with 8 communication objects:

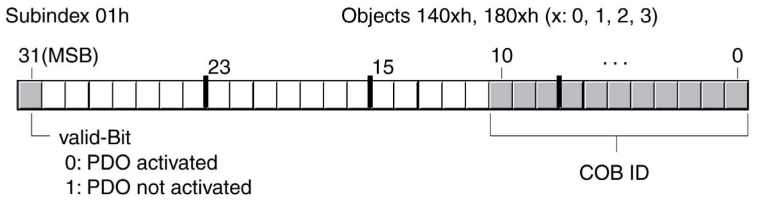
PDO	Object
Settings for R_PDO1	1st receive PDO parameter (1400_h)
Settings for R_PDO2	2nd receive PDO parameter (1401_h)
Settings for R_PDO3	3rd receive PDO parameter (1402_h)
Settings for R_PDO4	4th receive PDO parameter (1403_h)
Settings for T_PDO1	1st transmit PDO parameter (1800_h)
Settings for T_PDO2	2nd transmit PDO parameter (1801_h)
Settings for T_PDO3	3rd transmit PDO parameter (1802_h)
Settings for T_PDO4	4th transmit PDO parameter (1803_h)

Activating PDOs

With the default PDO settings, R_PDO1 and T_PDO1 are activated. The other PDOs must be activated manually in order to be used.

A PDO is activated with bit 31 (valid bit) in subindex 01_h of the respective communication object.

Activating PDOs via subindex 01_h, bit 31:



Example

Setting for R_PDO3 in object 1402_h:

- Subindex 01_h = 8000 $04xx_h$: R_PDO3 not activated
- Subindex 01_h = 0000 $04xx_h$: R_PDO3 activated.

Values for "x" in the example depend on the COB ID setting.

PDO Time Intervals

The time intervals "inhibit time" and "event timer" can be set for each transmit PDO.

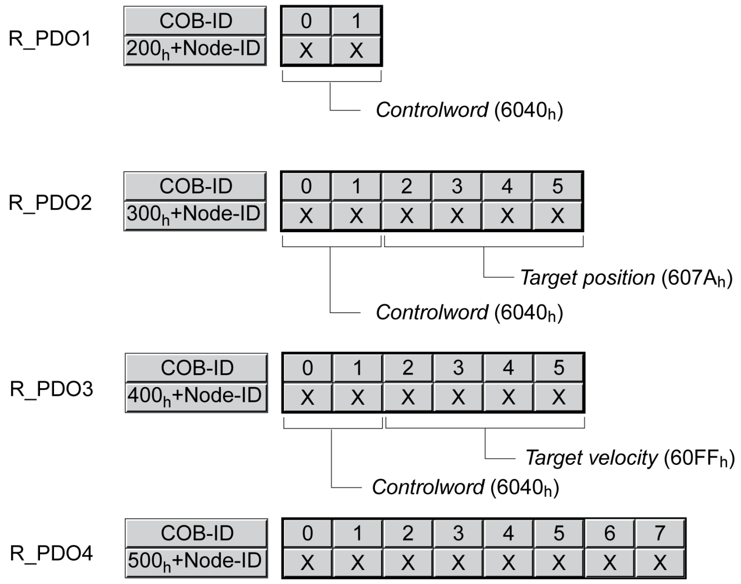
- The time interval "inhibit time" can be used to reduce the CAN bus load, which can be the result of continuous transmission of T_PDOs. If an inhibit time not equal to zero is entered, a transmitted PDO will only be re-transmitted after the inhibit time has elapsed. The time is set with subindex 03_h.
- The time interval "event timer" cyclically triggers an event message. After the time interval has elapsed, the device transmits the event-controlled T_PDO. The value of the time interval is set with subindex 05_h.

Receive PDOs

The R_PDOs can be used to map various vendor-specific objects by means of PDO mapping.

The objects for R_PDO1, R_PDO2, R_PDO3 and R_PDO4 are preset.

Receive PDOs



R_PDO1

R_PDO1 contains the control word, object `controlword` (6040_h), of the state machine which can be used to set the operating state of the device.

R_PDO1 is evaluated asynchronously, i.e. it is event-driven. R_PDO1 is preset.

R_PDO2

With R_PDO2, the control word and the target position are received for a movement in the operating mode "Profile Position" in the object `target position` ($607A_h$).

R_PDO2 is evaluated asynchronously, i.e. it is event-driven. R_PDO2 is preset.

For details on the SYNC object see chapter Synchronization *(see page 103)*.

R_PDO3

R_PDO3 contains the control word and the target velocity, object `Target velocity` ($60FF_h$), for the operating mode "Profile Velocity".

R_PDO3 is evaluated asynchronously, i.e. it is event-driven. R_PDO3 is preset.

R_PDO4

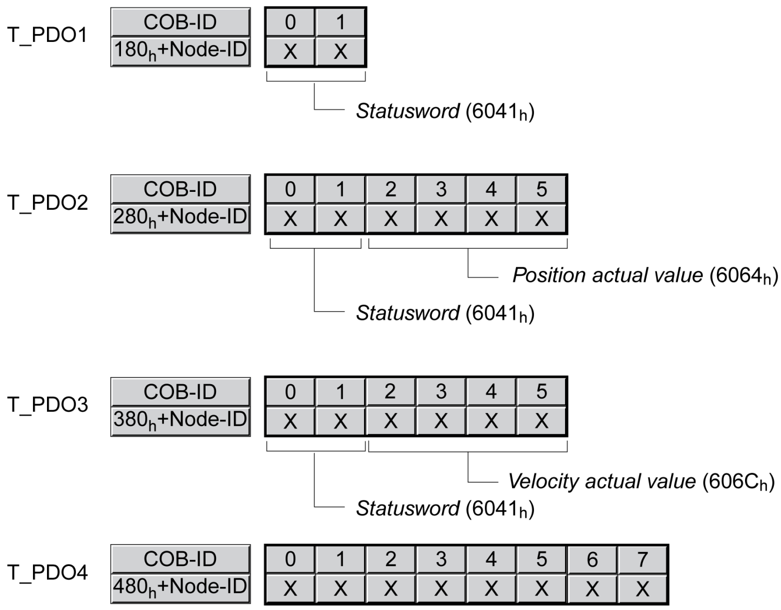
R_PDO4 is used to transmit vendor-specific object values. By default, R_PDO4 is empty.

R_PDO4 is evaluated asynchronously, i.e. it is event-driven.

Transmit PDOs

The objects for T_PDO1, T_PDO2, T_PDO3 and T_PDO4 can be changed by means of PDO mapping.

Transmit PDOs



T_PDO1

T_PDO1 contains the status word, object `statusword (6041h)`, of the state machine.

T_PDO1 is transmitted asynchronously and in an event-driven way whenever the status information changes.

T_PDO2

T_PDO2 contains the status word and the actual position of the motor, object `Position actual value (6064h)`, to monitor movements in the operating mode "Profile Position".

T_PDO2 is transmitted after receipt of a SYNC object and in an event-driven way.

T_PDO3

T_PDO3 contains the status word and the actual velocity, object `Velocity actual value (606Ch)`, for monitoring the actual velocity in the operating mode "Profile Velocity".

T_PDO3 is transmitted asynchronously and in an event-driven way whenever the status information changes.

T_PDO4

Vendor-specific object values (for monitoring) are transmitted with T_PDO4. By default, T_PDO4 is empty.

T_PDO4 is transmitted asynchronously and in an event-driven way whenever the data changes.

The T_PDOs can be used to map various vendor-specific objects via PDO mapping.

PDO Events

Overview

The parameters CANpdo1Event ... CANpdo4Event are used to specify the objects which are to trigger an event.

Example: If CANpdo1Event = 1 only a change to the first PDO object triggers an event. If CANpdo1Event = 15, each change to a PDO object triggers an event.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CANpdo1Event	PDO 1 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:B$_h$ Modbus 16662
CANpdo2Event	PDO 2 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:C$_h$ Modbus 16664
CANpdo3Event	PDO 3 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:D$_h$ Modbus 16666
CANpdo4Event	PDO 4 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 15 15	UINT16 R/W - -	CANopen 3041:E$_h$ Modbus 16668

PDO Mapping

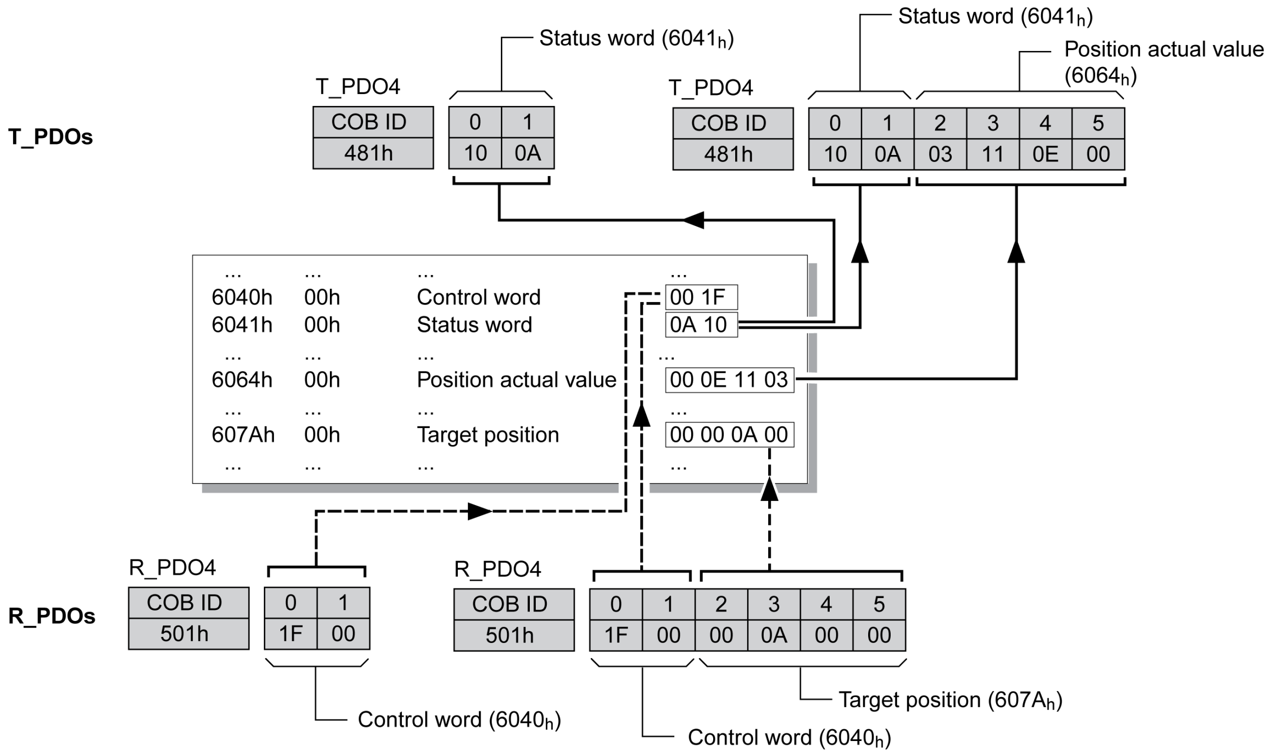
Overview

Up to 8 bytes of data from different areas of the object dictionary can be transmitted with a PDO message. Mapping of data to a PDO message is referred to as PDO mapping.

Chapter Assignment Object Group 3000h (see page 526) and Assignment Object Group 6000h (see page 536) contain lists of vendor-specific objects with the information whether they are available for PDO mapping.

The picture below shows the data exchange between PDOs and object dictionary on the basis of two examples of objects in T_PDO4 and R_PDO4 of the PDOs.

PDO mapping, in this case for a device with node address 1:



Dynamic PDO Mapping

The device uses dynamic PDO mapping. Dynamic PDO mapping means that objects can be mapped to the corresponding PDO using adjustable settings.

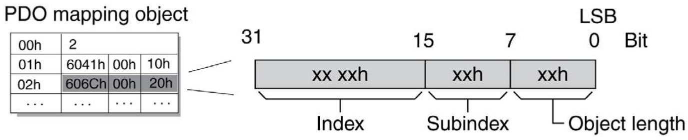
The settings for PDO mapping are defined in an assigned communication object for each PDO.

Object	PDO mapping for	Type
1st receive PDO mapping (1600_h)	R_PDO1	Dynamic
2nd receive PDO mapping (1601_h)	R_PDO2	Dynamic
3rd receive PDO mapping (1602_h)	R_PDO3	Dynamic
4th receive PDO mapping (1603_h)	R_PDO4	Dynamic
1st transmit PDO mapping ($1A00_h$)	T_PDO1	Dynamic
2nd transmit PDO mapping ($1A01_h$)	T_PDO2	Dynamic
3rd transmit PDO mapping ($1A02_h$)	T_PDO3	Dynamic
4th transmit PDO mapping ($1A03_h$)	T_PDO4	Dynamic

Structure of the Entries

Up to 8 bytes of 8 different objects can be mapped in a PDO. Each communication object for setting the PDO mapping provides 4 subindex entries. A subindex entry contains 3 pieces of information on the object: the index, the subindex and the number of bits that the object uses in the PDO.

Structure of entries for PDO mapping:



Subindex 00_h of the communication object contains the number of valid subindex entries.

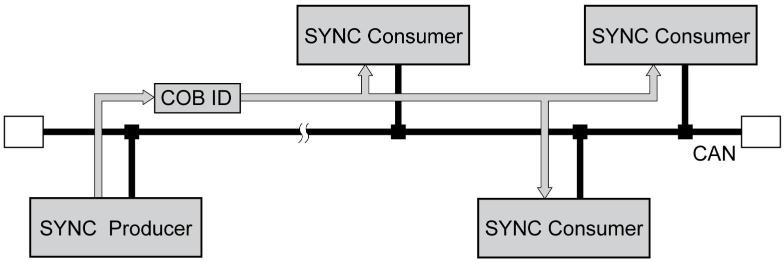
Object length	Bit value
08_h	8 bits
10_h	16 bits
20_h	32 bits

Synchronization

Overview

The synchronization object SYNC controls the synchronous exchange of messages between network devices for purposes such as the simultaneous start of multiple drives.

The data exchange conforms to the producer-consumer relationship. The SYNC object is transmitted to the reachable devices by a network device and can be evaluated by the devices that support synchronous PDOs.

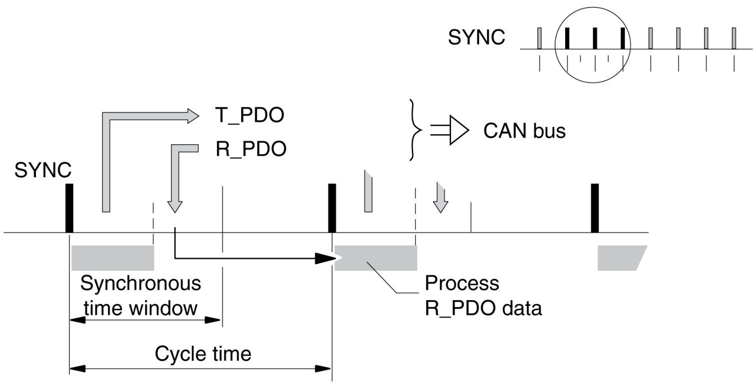


Time Values for Synchronization

Two time values define the behavior of synchronous data transmission:

- The cycle time specifies the time intervals between 2 SYNC messages. It is set with the object `Communication cycle period`(1006_h).
- The synchronous time window specifies the time span during which the synchronous PDO messages must be received and transmitted. The time window is set with the object `Synchronous window length` (1007_h).

Synchronization times:



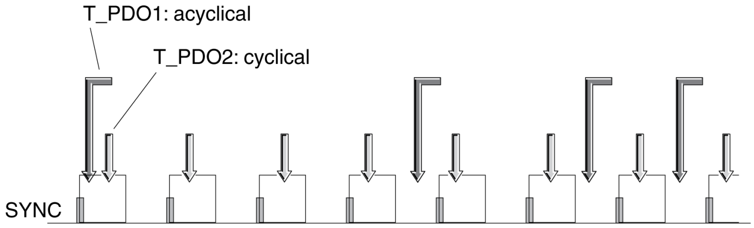
Synchronous Data Transmission

From the perspective of a SYNC recipient, in one time window the status data is transmitted first in a T_PDO, then new control data is received via an R_PDO. However, the control data is only processed when the next SYNC message is received. The SYNC object itself does not transmit data.

Cyclic and Acyclic Data Transmission

Synchronous exchange of messages can be cyclic or acyclic.

Cyclic and acyclic transmission:



In the case of cyclic transmission, PDO messages are exchanged continuously in a specified cycle, for example with each SYNC message.

If a synchronous PDO message is transmitted acyclically, it can be transmitted or received at any time; however, it will not be valid until the next SYNC message.

Cyclic or acyclic behavior of a PDO is specified in the subindex `transmission type` (02_h) of the corresponding PDO parameter, for example, in the object `1st receive PDO parameter` (1400_h:02_h) for R_PDO1.

COB ID, SYNC Object

For fast transmission, the SYNC object is transmitted unconfirmed and with high priority.

The COB ID of the SYNC object is set to the value 128 (80_h) by default. The value can be modified after initialization of the network with the object `COB-ID SYNC Message` (1005_h) .

"Start" PDO

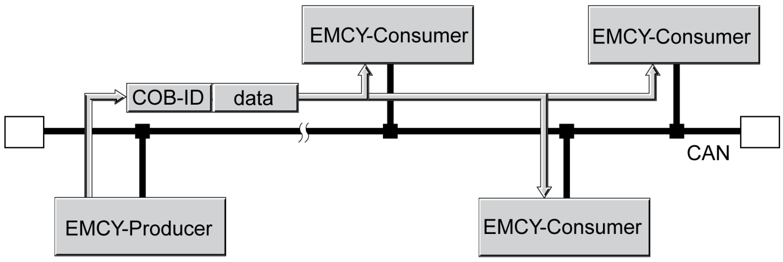
With the default settings of the PDOs, R_PDO1 ... R_PDO4 and T_PDO1 ... T_PDO4 are received and transmitted asynchronously. T_PDO2 ... T_PDO3 are transmitted additionally after the event timer has elapsed. The synchronization allows an operating mode to be started simultaneously on multiple devices so that, for example, the feed of a portal drive with several motors can be synchronized.

Emergency Object Service

Overview

The emergency object service signals internal errors via the CAN bus. The error message is transmitted to the network devices with an EMCY object according to the Consumer-Producer relationship.

Error message via EMCY objects:

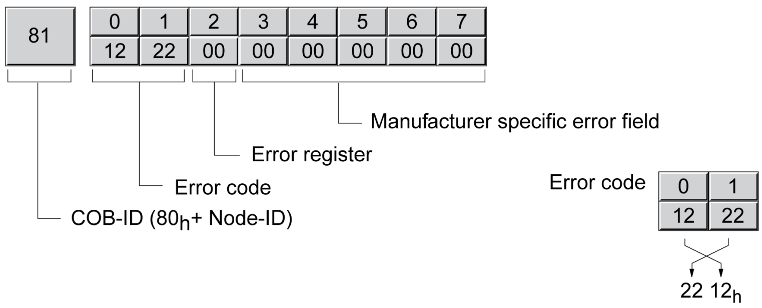


Boot-Up Message

The boot-up message is transmitted with the COB ID 700h + node ID and one data byte (00h).

EMCY Message

If an error occurs, the device switches to the operating state 9 Fault as per the CANopen state machine. At the same time, it transmits an EMCY message with error register and error code.



Bytes 0 ... 1: Error code (as per DS301)

The value is also saved in the object `Predefined error field` (1003:1$_h$).

Byte 2: Error register

The value is also saved in the object `Error register` (1001$_h$).

Bytes 3 ... 4: Reserved

Byte 5: PDO: Number of the PDO

Bytes 6 ... 7: Vendor-specific error number

The value is also saved in the object `Error code` (603F$_h$).

COB ID

The COB ID for each device on the network supporting an EMCY object is determined on the basis of the node address:

COB ID = EMCY object (80$_h$) + node ID

The function code of the COB ID can be modified with the object `COB-ID emergency` (1014$_h$).

Error Register and Error Code

The error register contains bit-coded information on the error. Bit 0 remains set as long as an error is active. The remaining bits identify the error type. The cause of error can be determined using the error code. The error code is transmitted in Intel format as a 2 byte value; the bytes must be reversed for evaluation.

Error Memory

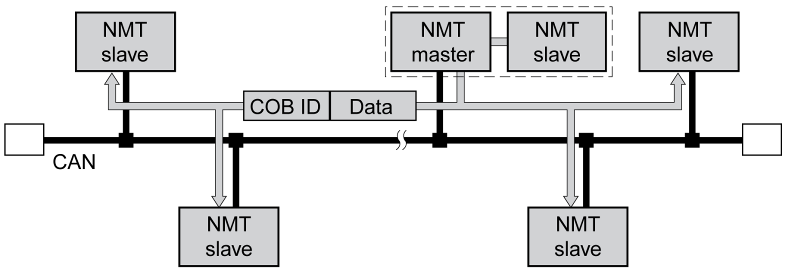
The device saves the error register in the object `Error register (1001`$_h$`)` and the last error that was detected in the object `Error code (603F`$_h$`)`.

Network Management Services - Overview

Description

Network management (NMT) is part of the CANopen communication profile; it is used to initialize the network and the network devices and to start, stop and monitor the network devices during operation on the network.

NMT services are executed in a master-slave relationship. The NMT master addresses individual NMT slaves via their node address. A message with node address "0" is broadcast to all reachable NMT slaves simultaneously.



The device can only take on the function of an NMT slave.

NMT Services

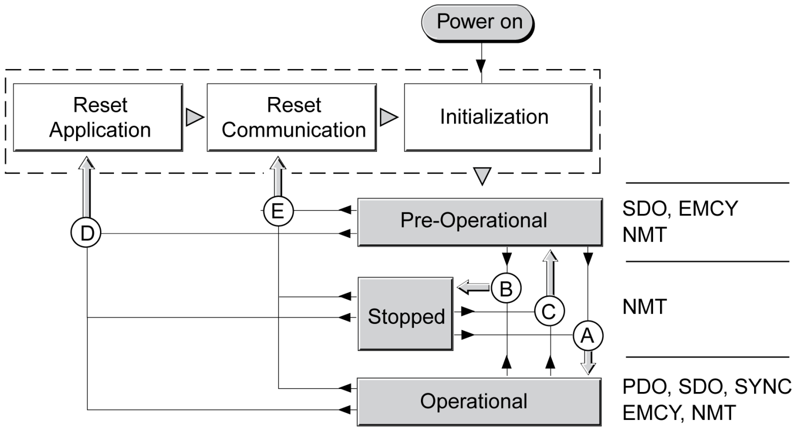
NMT services can be divided into 2 groups:

- Services for device control, to initialize devices for CANopen communication and to control the behavior of devices during operation on the network.
- Services for connection monitoring to monitor the communication status of network devices.
  - "Node guarding" for monitoring the connection of an NMT slave
  - "Life guarding" for monitoring the connection of an NMT master
  - "Heartbeat" for unconfirmed connection messages from network devices.

NMT Services for Device Control

NMT State Machine

The NMT state machine describes the initialization and states of an NMT slave during operation on the network.



To the right, the graphic shows the communication objects that can be used in the specific network state.

Initialization

An NMT slave automatically runs through an initialization phase after the supply voltage is applied (Power on) to prepare it for CAN bus operation. On completion of the initialization, the slave switches to the operating state "Pre Operational" and sends a boot-up message. After this, an NMT master can control the operational behavior of an NMT slave on the network via 5 NMT services, represented in the above illustration by the letters A to E.

NMT service	Transition	Meaning
Start remote node (Start network node)	A	Transition to operating state "Operational" Start operation on the network
Stop remote node (Stop network node)	B	Transition to operating state "Stopped" Stops communication of the network device on the network. If connection monitoring is active, it remains on. **NOTE:** If the power stage is enabled (operating state "Operation Enabled" or "Quick Stop"), an error of error class 2 is triggered. The motor is stopped and the power stage disabled.
Enter Pre-Operational (Transition to "Pre-Operational")	C	Transition to operating state "Pre-Operational" The communication objects except for PDOs can be used. The operating state "Pre-Operational" can be used for configuration via SDOs: - PDO mapping - Start of synchronization - Start of connection monitoring
Reset node (Reset node)	D	Transition to operating state "Reset application" Load stored data of the device profiles and automatically switch via operating state "Reset communication" to "Pre-Operational".
Reset communication (Reset communication data)	E	Transition to operating state "Reset communication" Load stored data of the communication profile and automatically transition to operating state "Pre-Operational". **NOTE:** If the power stage is enabled (operating state "Operation Enabled" or "Quick Stop"), an error of error class 2 is triggered. The motor is stopped and the power stage disabled.

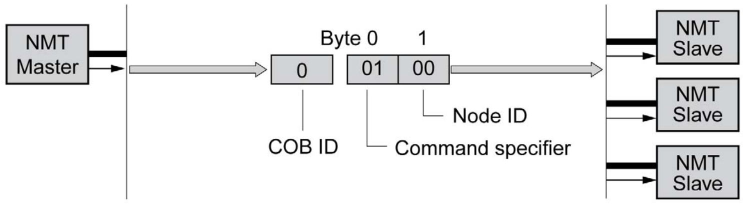
Persistent Data Memory

When the supply voltage is applied (Power on), the device loads the saved object data from the non-volatile memory for persistent data to the RAM.

NMT Message

The NMT services for device control are transmitted as unconfirmed messages with the COB ID = 0 . By default, they have the highest priority on the CAN bus.

The data frame of the NMT device service consists of 2 bytes.



The first byte, the "Command specifier", indicates the NMT service used.

Command Specifier	NMT service	Transition
1 (01_h)	Start remote node	A
2 (02_h)	Stop remote node	B
128 (80_h)	Enter Pre-Operational	C
129 (81_h)	Reset node	D
130 (82_h)	Reset communication	E

The second byte addresses the recipient of an NMT message with a node address between 1 and 127 ($7F_h$). A message with node address "0" is broadcast to the reachable NMT slaves.

NMT Service Node Guarding/Life Guarding

COB ID

The communication object `NMT error control (700`$_h$`+Node-ID)` is used for connection monitoring.

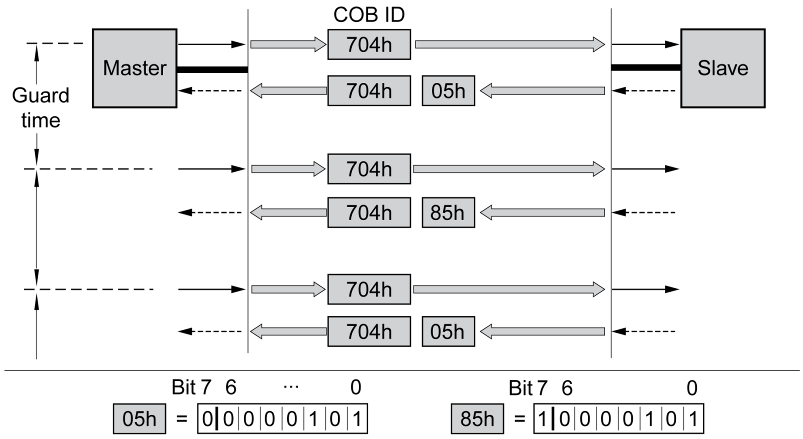
The COB ID for each NMT slave is determined on the basis of the node address:

COB ID = function code `NMT error control (700`$_h$`) + Node-ID`.

Structure of the NMT Message

After a request from the NMT master, the NMT slave responds with one data byte.

Acknowledgement of the NMT slave:



Bits 0 to 6 identify the NMT state of the slave:
- 4 (04_h): "Stopped"
- 5 (05_h): "Operational"
- 127 ($7F_h$): "Pre-Operational"

After each "guard time" interval, bit 7 switches toggles between "0" and "1", so the NMT master can detect and ignore a second response within the "guard time" interval. The first request when connection monitoring is started begins with bit 7 = 0.

Connection monitoring must not be active during the initialization phase of a device. The status of bit 7 is reset as soon as the device runs though the NMT state "Reset communication".

Connection monitoring remains active in the NMT state "Stopped".

Configuration

Node Guarding/Life Guarding is configured via:
- Guard time ($100C_h$)
- Life time factor ($100D_h$)

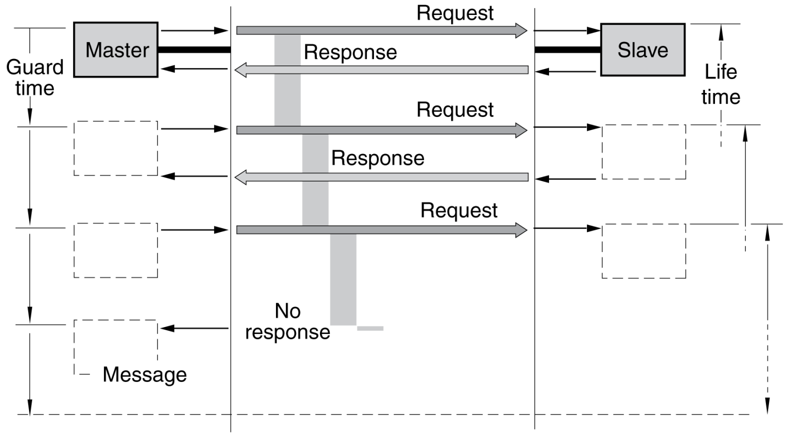
Connection Error

The NMT master signals a connection error to the master program in the following cases:

- The slave does not respond within the "guard time" period.
- The NMT state of the slave has changed without a request by the NMT master.

The illustration below shows an error message after the end of the third cycle because no response was received from an NMT slave.

"Node Guarding" and "Life Guarding" with time intervals:



NMT Service Heartbeat

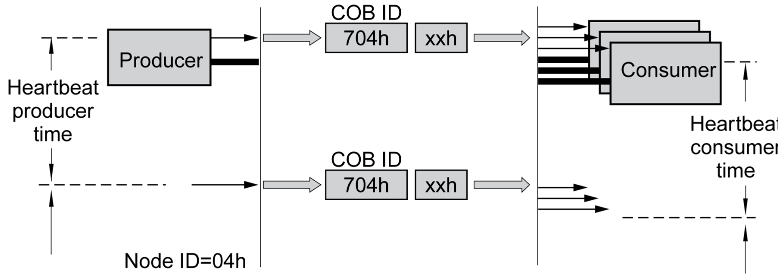
Description

The optional Heartbeat protocol replaces the Node Guarding/Life Guarding protocol.

A Heartbeat producer transmits a Heartbeat message cyclically at the frequency defined in the object `Producer heartbeat time (1017h)`. One or several consumers can receive this message.

`Producer heartbeat time (1017h) = 0` deactivates sending of Heartbeat messages.

The relationship between producer and consumer can be configured with objects. If a consumer does not receive a signal within the period of time set with `Consumer heartbeat time (1016h)`, it generates an error message (Heartbeat event). `Consumer heartbeat time (1016h) = 0` deactivates monitoring by a consumer.



Data byte for NMT state of the "Heartbeat" producer:

- 0 (00_h): "Boot-Up"
- 4 (04_h): "Stopped"
- 5 (05_h): "Operational"
- 127 ($7F_h$): "Pre-Operational"

Time Intervals

The time intervals are specified in increments of 1 ms. The values for the producer must be greater than the values for the consumer. Each time the "Heartbeat" message is received, the time interval of the consumer starts again.

Start of Monitoring

"Heartbeat" monitoring of the producer starts as soon as a time interval is set.

"Heartbeat" monitoring of the consumer starts as soon as the consumer receives the first "Heartbeat" message. A time interval must have been set before.

Devices can monitor each other via "Heartbeat" messages. They assume the function of consumer and producer at the same time.

Chapter 4
Installation

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Mechanical Installation

What Is in This Section?

This section contains the following topics:

Before Mounting

Inspecting the Product

- Verify the product version by means of the type code. See chapter Type Code *(see page 17)*.
- Prior to mounting, inspect the product for visible damage.

Damaged products may cause electric shock or unintended equipment operation.

DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

- Do not use damaged products.
- Keep foreign objects (such as chips, screws or wire clippings) from getting into the product.

Failure to follow these instructions will result in death or serious injury.

Contact your local Schneider Electric representative if you detect any damage whatsoever to the products.

Inspecting the Holding Brake (Option)

See chapter Inspecting/Breaking In the Holding Brake *(see page 585)*.

Cleaning the Shaft

The shaft extensions are factory-treated with an anti-corrosive. If output components are glued to the shaft, the anti-corrosive must be removed and the shaft cleaned. If required, use a grease removal agent as specified by the glue manufacturer. If the glue manufacturer does not provide information on grease removal, acetone may be used.

- Remove the anti-corrosive. Avoid direct contact of the skin and the sealing parts with the anti-corrosive or the cleaning agent.

Mounting Surface for Flange

The mounting surface must be stable, clean, deburred and low-vibration. Ensure that the mounting surface is itself grounded, and that a potential exists between the motor flange and the mounting surface.

DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING

- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of the entire drive system.
- Ground the drive system before applying voltage.
- Do not use conduits as protective ground conductors; use a protective ground conductor inside the conduit.
- The cross section of the protective ground conductor must comply with the applicable standards.
- Do not consider cable shields to be protective ground conductors.

Failure to follow these instructions will result in death or serious injury.

- Verify that the mounting surface meets all requirements in terms of dimensions and tolerances. See chapter Dimensions *(see page 22)*.

Mounting the Motor

DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid contamination such as deposits and humidity.

Failure to follow these instructions will result in death or serious injury.

Motors can generate strong local electrical and magnetic fields. This can cause interference in sensitive devices.

WARNING

ELECTROMAGNETIC FIELDS

- Keep persons with electronic medical implants, such as pacemakers, away from the motor.
- Do not place electromagnetically sensitive devices in the vicinity of the motor.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The metal surfaces of the product may exceed 70 °C (158 °F) during operation.

CAUTION

HOT SURFACES

- Avoid unprotected contact with hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

Failure to follow these instructions can result in injury or equipment damage.

CAUTION

IMPROPER APPLICATION OF FORCES

- Do not use the motor as a step to climb into or onto the machine.
- Do not use the motor as a load-bearing part.
- Use hazard labels and guards on your machine to help prevent the improper application of forces on the motor.

Failure to follow these instructions can result in injury or equipment damage.

Electrostatic discharge to the shaft may cause incorrect operation of the encoder system and result in unanticipated motor movements and damage to the bearing.

WARNING

UNINTENDED MOVEMENT CAUSED BY ELECTROSTATIC DISCHARGE

Use conductive components such as antistatic belts or other suitable measures to avoid static charge by motion.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the permissible ambient conditions are not respected, external substances from the environment may penetrate the product and cause unintended movement or equipment damage.

⚠ WARNING

UNINTENDED MOVEMENT

- Verify that the allowable ambient conditions specified in the present document and in the documentation of any supporting hardware or accessories are respected.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example, in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries of the motor to the direct spray of a pressure washer.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Motors are very heavy relative to their size. The great mass of the motor can cause injuries and damage.

⚠ WARNING

HEAVY AND/OR FALLING PARTS

- Use a suitable crane or other suitable lifting gear for mounting the motor if required by the weight of the motor.
- Use the necessary personal protective equipment (for example, protective shoes, protective glasses and protective gloves).
- Mount the motor so that it cannot come loose (use of securing screws with appropriate tightening torque), especially in cases of fast acceleration or continuous vibration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Mounting Distances, Ventilation

When selecting the position of the device, note the following:

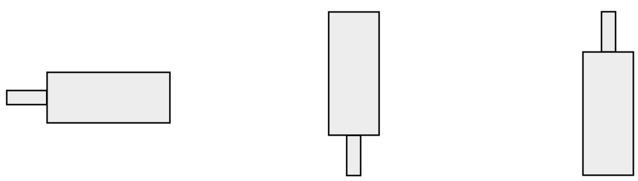
- No minimum distances are required for installation. However, free convection must be possible.
- Avoid heat accumulations.
- Do not obstruct the ventilation slots; keep dirt from reaching the ventilation slots.
- Do not mount the device close to heat sources. Mutual heating of several devices leads to derating.
- Do not mount the device on flammable materials.
- The heated airflow from other devices and components must not heat up the air used for cooling the device.
- If the thermal limits are exceeded during operation, the power stage of the drive is disabled (overtemperature).

Convection Channels

The convection channels featured by size 100 increase the heat dissipation. Do not obstruct the convection channels so that there is no derating.

Mounting Position

The following mounting positions are defined and approved as per IEC 60034-7:



IM B5 IM V1 IM V3

Mounting

When the motor is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. All mounting screws must be tightened with the specified tightening torque. No uneven mechanical load must be applied when the mounting screws are tightened. See chapter Technical Data *(see page 19)* for data, dimensions and degrees of protection (IP).

Mounting Output Components

Output components such as pulleys and couplings must be mounted with suitable equipment and tools. Motor and output component must be accurately aligned both axially and radially. If the motor and the output component are not accurately aligned, this will cause runout and premature wear.

The maximum axial and radial forces acting on the shaft must not exceed the maximum shaft load values specified, see chapter Shaft-Specific Data *(see page 28)*.

Section 4.2
Electrical Installation

What Is in This Section?

This section contains the following topics:

Electrical Installation

General

Many components of the equipment, including the printed circuit board, operate with mains voltage, or present transformed high currents, and/or high voltages.

The motor itself generates voltage when the motor shaft is rotated.

⚠ DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid contamination such as deposits and humidity.

Failure to follow these instructions will result in death or serious injury.

Opening the side wall exposes hazardous voltages and damages the insulation.

⚠ DANGER

ELECTRIC SHOCK

Do not open the side wall.

Failure to follow these instructions will result in death or serious injury.

The `+24VDC` supply voltage is connected with many exposed signal connections in the drive system.

⚠ DANGER

ELECTRIC SHOCK CAUSED BY INCORRECT POWER SUPPLY UNIT

- Use a power supply unit that meets the PELV (Protective Extra Low Voltage) requirements.
- Connect the negative output of the power supply unit to PE (ground).

Failure to follow these instructions will result in death or serious injury.

Ground Connection

This product has a leakage current greater than 3.5 mA. If the protective ground connection is interrupted, a hazardous touch current may flow if the housing is touched.

DANGER

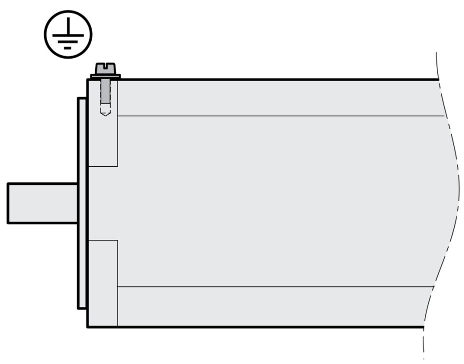
INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 mm^2 (AWG 6) or two protective ground conductors with the cross section of the conductors supplying the power terminals.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Ground the drive system before applying voltage.
- Do not use conduits as protective ground conductors; use a protective ground conductor inside the conduit.
- Do not use cable shields as protective ground conductors.

Failure to follow these instructions will result in death or serious injury.

Connecting to Ground

The ground connection is located at the top of the motor flange.



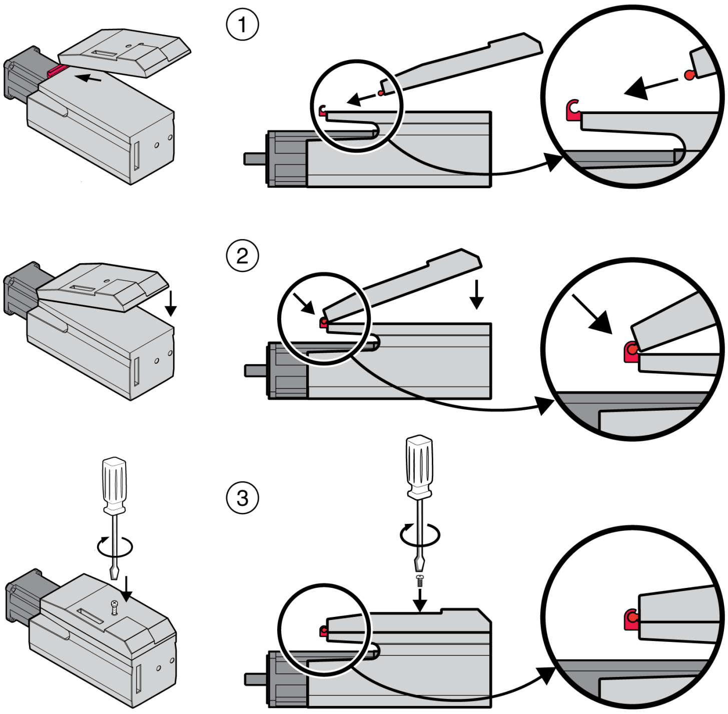
- Connect the ground connection to the central grounding point of the system.

Tightening torque grounding screw M4	Nm (lb•in)	2.9 (25.7)
Property class of grounding screw	H	8.8

Mounting LXM32I Control Unit

Electrostatic discharge (ESD) may permanently damage the module either immediately or over time.

NOTICE
EQUIPMENT DAMAGE DUE TO ESD
● Use suitable ESD measures (for example, ESD gloves) when handling the module. ● Do not touch internal components.
Failure to follow these instructions can result in equipment damage.



- Remove the transport lock.
- Check the seals for damage. You must not use devices with damaged seals.
- (1) Plug the LXM32I control unit onto the BMI servo motor.
- (2) The catch must snap in properly.
- (3) Fasten the LXM32I control unit by tightening the fastening screw.

Note the specified tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

Standard Braking Resistor

The standard braking resistor is factory-mounted in slot 2; it can be used in slot 2 or in slot 1.

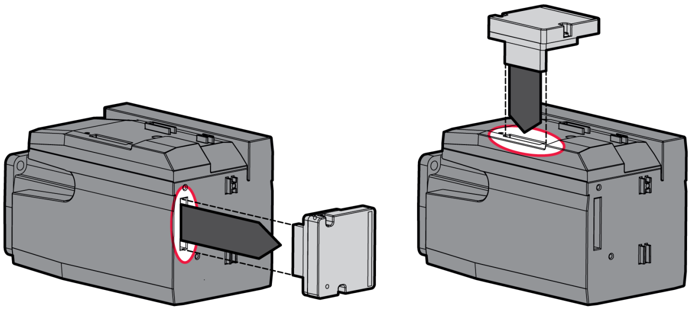
If the standard braking resistor is used, there are several mounting types, see chapter Mounting Types of The Modules *(see page 58)*.

Mounting in Slot 2

The standard braking resistor is factory-mounted in slot 2. No further steps are required.

Mounting in Slot 1

The standard braking resistor can also be mounted in slot 1.



- Loosen the 2 fastening screws and remove the standard braking resistor from slot 2.
- Remove the cover film, plug the standard braking resistor into slot 1 and fasten it by tightening the two fastening screws.

For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

External Braking Resistor (Accessories)

External braking resistors are available as accessories; they are connected via a separate connection module.

Selection and rating of the external braking resistor are described in chapter Rating the Braking Resistor *(see page 62)*. For suitable braking resistors, see chapter Accessories and Spare Parts *(see page 569)*.

Cable Specifications

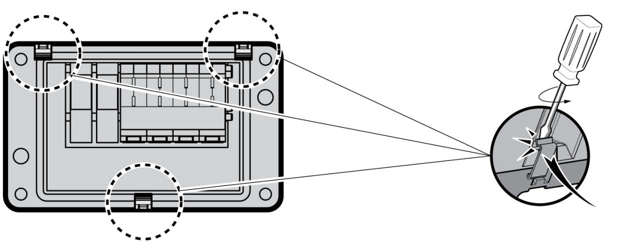
Shield:	Required, both ends grounded
Twisted Pair:	-
PELV:	-
Cable composition:	Minimum conductor cross section: Same cross section as the cross section used for the mains supply. The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Minimum cable diameter:	6 mm (0.24 in)
Maximum cable diameter	10.5 mm (0.41 in)
Maximum cable length:	3 m (9.84 ft)
Special characteristics:	Temperature resistance

Properties of the Connection Terminals

Connection cross section	mm^2	0.75 ... 4 (AWG 18 ... AWG 12)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

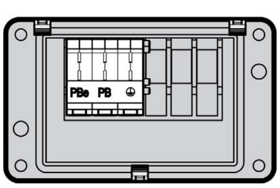
The spring terminals are approved for fine-stranded conductors and solid conductors. Observe the maximum permissible connection cross section. Take into account the fact that wire cable ends (ferrules) increase the conductor cross section.

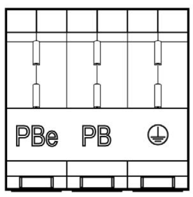
Opening the Connection Module



Wiring Diagram

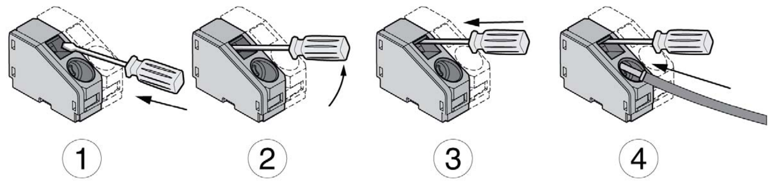
Connection module for external braking resistor





Usage of the Connection Terminals

Use the connection terminals as shown in the illustration below:



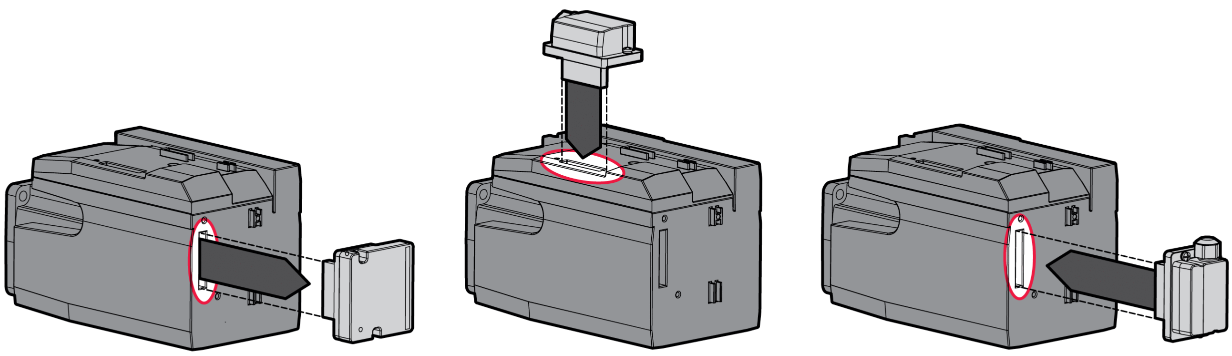
Connecting the External Braking Resistor

The temperature of the braking resistor may exceed 250 °C (482 °F) during operation.

⚠ WARNING
HOT SURFACES • Ensure that it is not possible to make any contact with a hot braking resistor. • Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor. • Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

- Power off all supply voltages. Observe the safety instructions concerning electrical installation.
- Verify that no voltages are present (safety instructions).
- Open the cover.
- Open the cable gland.
- Push the cable through the cable gland.
- Connect the PE connection (ground).
- Connect the connections PBe and PB.
- Connect the cable shield to the shield clamp in the connector (large surface area contact).
- Close the cable gland.
- Close the cover.

Mounting the Connection Module



- Loosen the 2 fastening screws and remove the standard braking resistor from slot 2.
- Remove the cover film, plug the connection module for the external braking resistor into slot 1 or into slot 2 and fasten it by tightening the two fastening screws. Note the information concerning the different mounting types in chapter Mounting Types of The Modules *(see page 58)*.

For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

Mains Supply

General

The products are intended for industrial use and may only be operated with a permanently installed connection.

This product has a leakage current greater than 3.5 mA. If the protective ground connection is interrupted, a hazardous touch current may flow if the housing is touched.

DANGER

INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 mm^2 (AWG 6) or two protective ground conductors with the cross section of the conductors supplying the power terminals.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Ground the drive system before applying voltage.
- Do not use conduits as protective ground conductors; use a protective ground conductor inside the conduit.
- Do not use cable shields as protective ground conductors.

Failure to follow these instructions will result in death or serious injury.

WARNING

INSUFFICIENT PROTECTION AGAINST OVERCURRENT

- Use the external fuses specified in "Technical data".
- Do not connect the product to a supply mains whose short-circuit current rating (SCCR) exceeds the value specified in the chapter "Technical Data".

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Direct current can be introduced in the protective ground conductor of this drive. If a residual current device (RCD / GFCI) or a residual current monitor (RCM) is used for protection against direct or indirect contact, the following specific types must be used:

WARNING

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

- Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.
- Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters and is sensitive to all types of current for three-phase devices and for single-phase devices not connected to a phase and the neutral conductor.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

See chapter Residual Current Device *(see page 60)* for information and conditions concerning the use of a residual current device.

WARNING

INCORRECT MAINS VOLTAGE

Verify that the product is approved for the mains voltage before applying power and configuring the product.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Cable Specifications

Shield:	-
Twisted Pair:	-
PELV:	-
Cable composition:	The conductors of the cable must conform to the current requirements of the drive and motor, and conform to any applicable local regulations.
Minimum cable diameter:	8 mm (0.31 in)
Maximum cable diameter	13 mm (0.51 in)
Maximum cable length:	-
Special characteristics:	-

Properties of the Connection Terminals

Connection cross section	mm^2	0.75 ... 4 (AWG 18 ... AWG 12)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

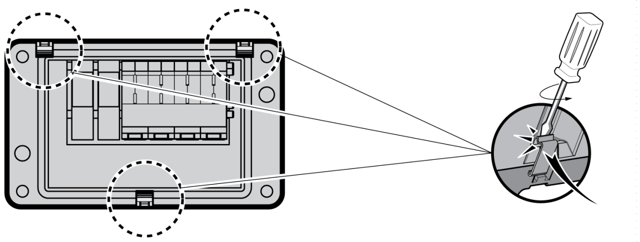
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Prerequisites for Connecting the Power Stage Supply

Note the following information:

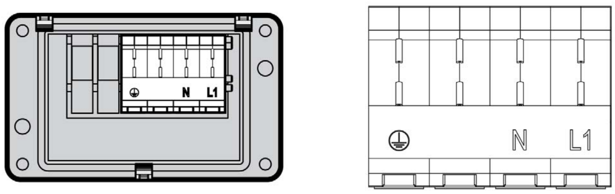
- Three-phase devices may only be connected and operated via three phases.
- Use upstream mains fuses. See chapter Motor-Specific Data *(see page 30)* for information on fuse types and fuse ratings.
- If you use an external mains filter, the mains cable must be shielded and grounded at both ends if the length between the external mains filter and the device exceeds 200 mm (7.87 in).
- See chapter Conditions for UL 508C *(see page 43)* for a UL-compliant design.

Opening the Connection Module

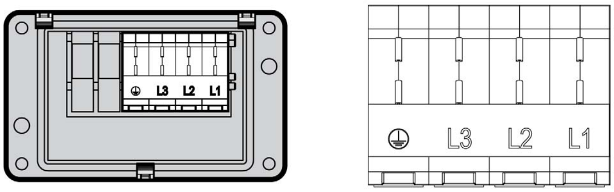


Wiring Diagram

Wiring diagram for single-phase device.

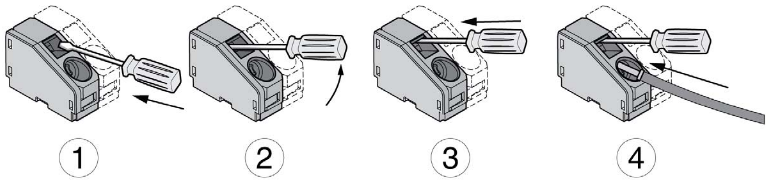


Wiring diagram for three-phase device



Usage of the Connection Terminals

Use the connection terminals as shown in the illustration below:



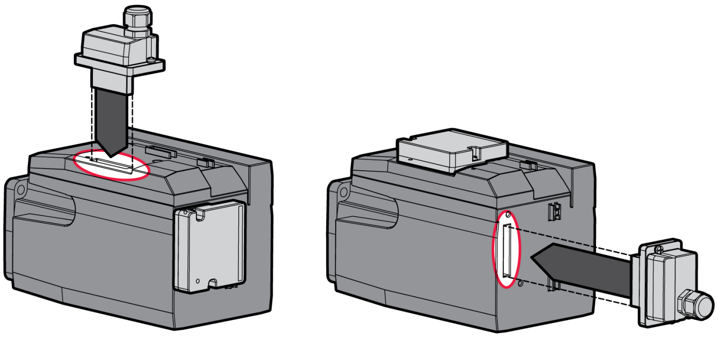
Connecting Mains Supply

- Power off all supply voltages. Observe the safety instructions concerning electrical installation.
- Verify that no voltages are present (safety instructions).
- Open the cover.
- Open the cable gland.
- Push the cable through the cable gland.
- Connect the PE connection (ground).
- Connect the connections L1 and N of single-phase devices.
- Connect the connections L1, L2 and L3 of three-phase devices.
- Close the cable gland.
- Close the cover.

Mounting the Connection Module

The module for the supply voltage can be mounted in slot 1 or in slot 2.

The selection of the slot depends on the slot in which the standard braking resistor or the connection module for the external braking resistor has been mounted.



- Remove the cover film, plug the module for the supply voltage into slot 1 or into slot 2 and fasten it by tightening the two fastening screws.

For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

Commissioning Interface

Cable Specifications

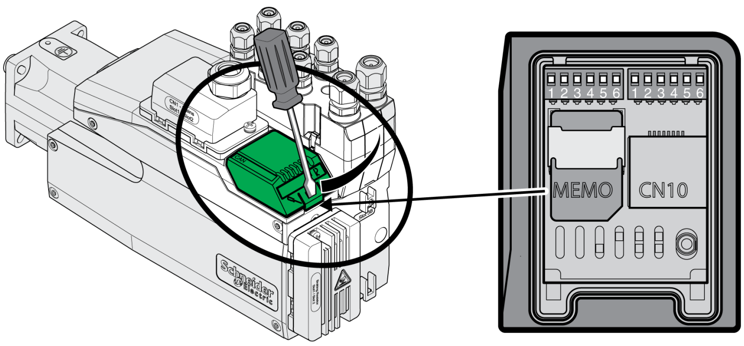
Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	8*0.25 mm^2, (8*AWG 22)
Maximum cable length:	100 m
Special characteristics:	-

Connecting a PC

A PC with commissioning software can be connected for commissioning. The PC is connected via a bidirectional USB/RS485 converter, see chapter Accessories and Spare Parts *(see page 569)*.

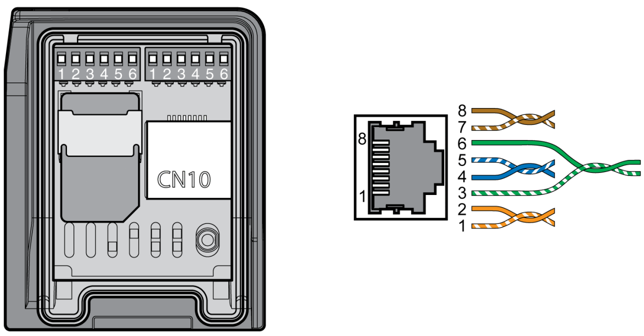
Opening the Cover of the Commissioning Interface

The cover of the commissioning interface can be opened by means of a flat blade screwdriver



Wiring Diagram

Wiring diagram PC with commissioning software



Pin	Signal	Meaning	I/O
1 ... 3	–	Reserved	-
4	`MOD_D1`	Transmit/receive signal	RS 485
5	`MOD_D0`	Transmit/receive signal, inverted	RS 485
6 ... 7	–	Reserved	-
8	`MOD_0V`	Reference potential	-

The cover of the commissioning must be closed after commissioning.

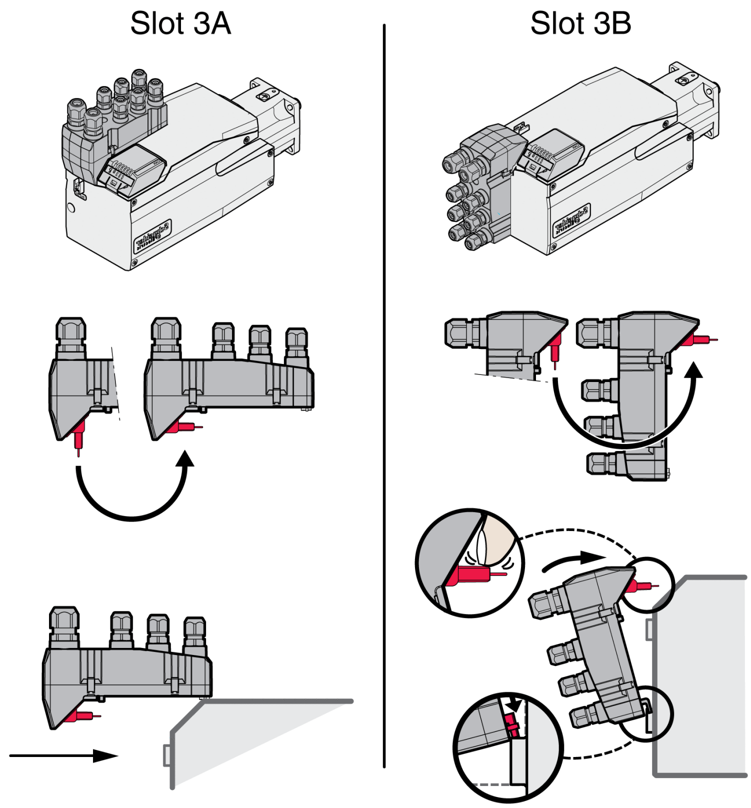
Mounting the I/O Connection Module

The I/O module can be mounted in slot 3A or in slot 3B.

If the standard braking resistor is used, the choice of slot is limited, see chapter Mounting Types of The Modules *(see page 58)*.

- Check the seals for damage. You must not use devices with damaged seals.
- Remove the transport lock from slot 3A or slot 3B. Align the contacts as shown in the illustration below. Only touch the plastic, not the contacts themselves.
- Plug the I/O module into slot 3A or slot 3B. If you use slot 3B, you must first plug in the bottom catch of the module. In a second step, move the contacts towards the device and guide them into the device using your index finger.
- Plug the I/O module into slot 3A or slot 3B and fasten it by tightening the fastening screw.

Mounting the I/O module



For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

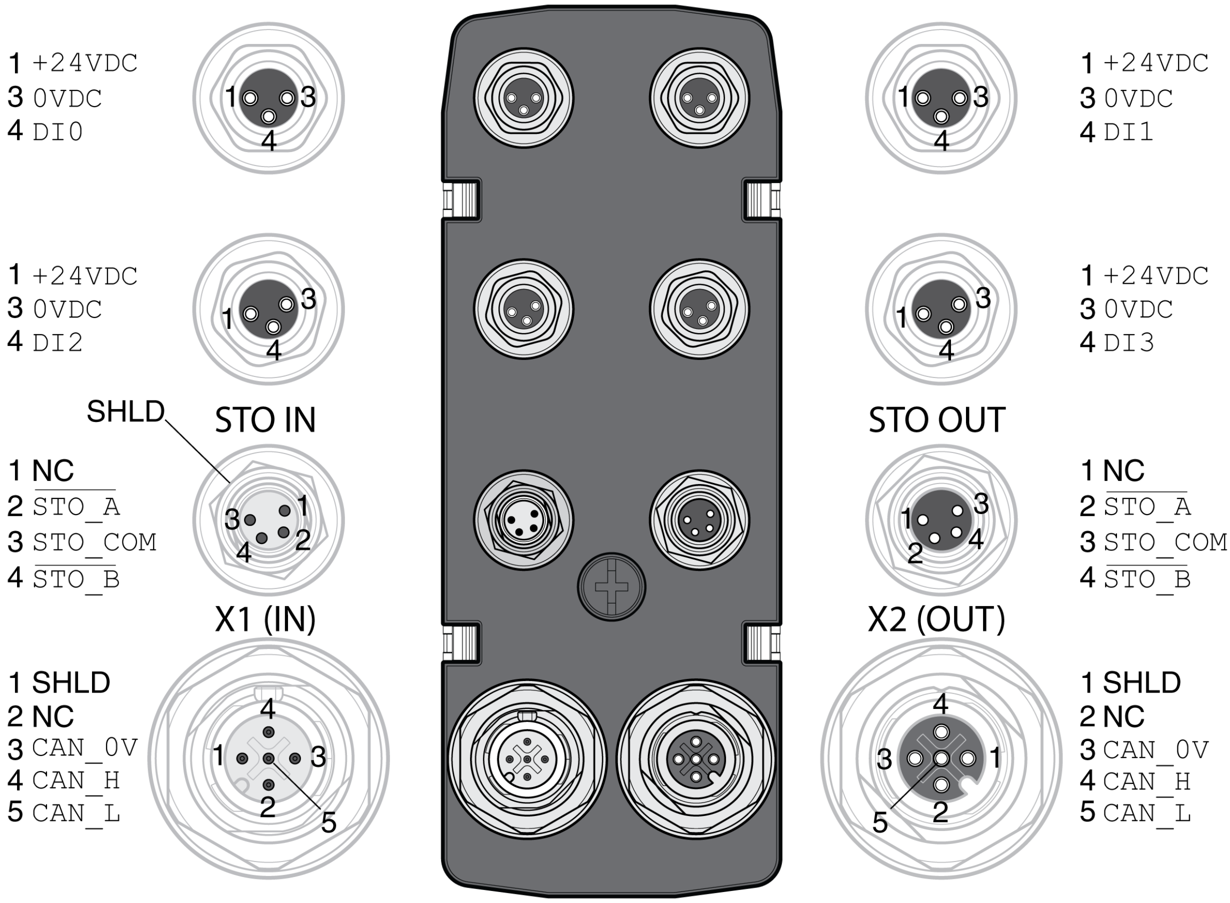
Section 4.3
I/O Module with Industrial Connectors

What Is in This Section?

This section contains the following topics:

Overview I/O Modules with Industrial Connectors

Connection Overview I/O Modules with Industrial Connectors (4 Digital Inputs, STO)



Signal	Meaning	Factory settings(1)	I/O
+24VDC	24 V signal power supply (see chapter Internal 24 V Signal Power Supply *(see page 26)*)	-	O
0VDC	Reference potential to +24VDC	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
STO_A	Safety function STO(2)	-	I
STO_COM	Reference potential for safety function STO(2)	-	I
STO_B	Safety function STO(2)	-	I
SHLD	Shield (grounded internally)	-	-
CAN_0V	Reference potential for CAN	-	-
CAN_H	CAN interface	-	I/O
CAN_L	CAN interface	-	I/O
NC	Not connected	-	-

(1) See chapter Digital Inputs and Outputs *(see page 218)*.
(2) This module requires an external supply for the safety function STO; see the information in chapter Safety function STO ("Safe Torque Off") *(see page 68)*.

Logic Type

The logic type is determined by the specific reference of the module.

The I/O module with industrial connector is available in the following product versions:

- I/O module with positive logic (sinking inputs, sourcing outputs)
- I/O module with negative logic (sourcing inputs, sinking outputs)

See chapters I/O Module with Industrial Connector for Positive Logic *(see page 575)* and I/O Module with Industrial Connector for Negative Logic *(see page 576)* for an overview of the available product versions.

See chapter Logic Type *(see page 56)* for additional information on the logic types.

Connection of the Digital Inputs and Digital Outputs

The number of inputs and outputs depends on the product version of the I/O module.

The I/O module with industrial connector is available in the following product versions:

- I/O module with 2 signal inputs
- I/O module with 4 signal inputs
- I/O module with 4 signal inputs and 2 signal outputs

Cable Specifications

Shield	-
Twisted pair	-
PELV:	Required
Cable composition:	-
Maximum cable length:	30 m (98.4 ft)

Connecting the Digital Inputs

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the digital inputs.
- For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors *(see page 579)*.

Connection of Safety Function STO

General

The I/O module with industrial connector is available in the following product versions:

- I/O module without safety function STO
- I/O module with safety function STO

See chapter Safety function STO ("Safe Torque Off") *(see page 68)* for additional information on the safety function STO.

Cable Specifications

Shield	Required, one end grounded
Twisted pair	-
PELV:	Required
Cable composition:	-
Maximum cable length:	-

Pin Assignment

Signal	Meaning	Wire color
STO_A	Safety function STO: Dual-channel connection, connection A	White
STO_B	Safety function STO: Dual-channel connection, connection B	Brown
STO_COM	Reference potential to STO_A and STO_B	Green

Connecting the Safety Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety function in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") *(see page 68)*.
- For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors *(see page 579)*.

Fieldbus Connection

Cable Specifications

Shield	Required, both ends grounded
Twisted pair	Required
PELV:	Required
Cable composition:	-
Maximum cable length:	-
Connector coding:	D

Connecting the Fieldbus

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors *(see page 579)*.

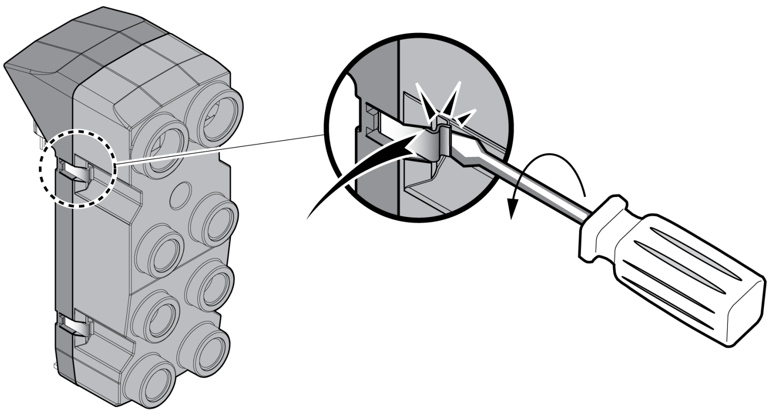
Section 4.4
I/O Module with Spring Terminals

What Is in This Section?

This section contains the following topics:

Opening the I/O Module

- Open the I/O module.

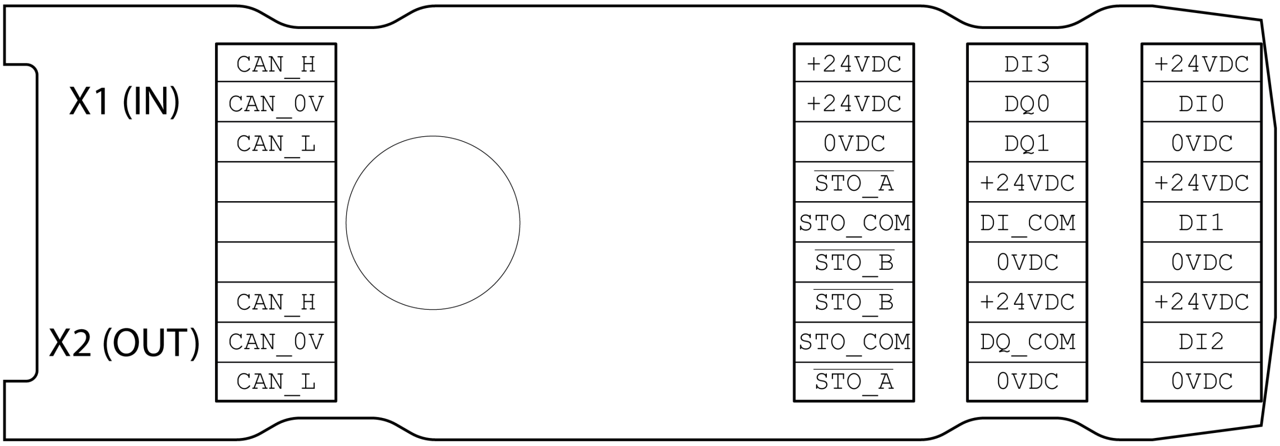


- Screw the required cable glands into the I/O module.
  Cable glands are available as accessories, see chapter Accessories and Spare Parts *(see page 569)*.
- Close unused cable entries with a blind plug,

Use genuine accessories or cable glands with a degree of protection of at least IP65 (form sealing ring or flat sealing ring required).

For the tightening torque see chapter Tightening Torque and Screws *(see page 40)*.

Overview I/O Module with Spring Terminals



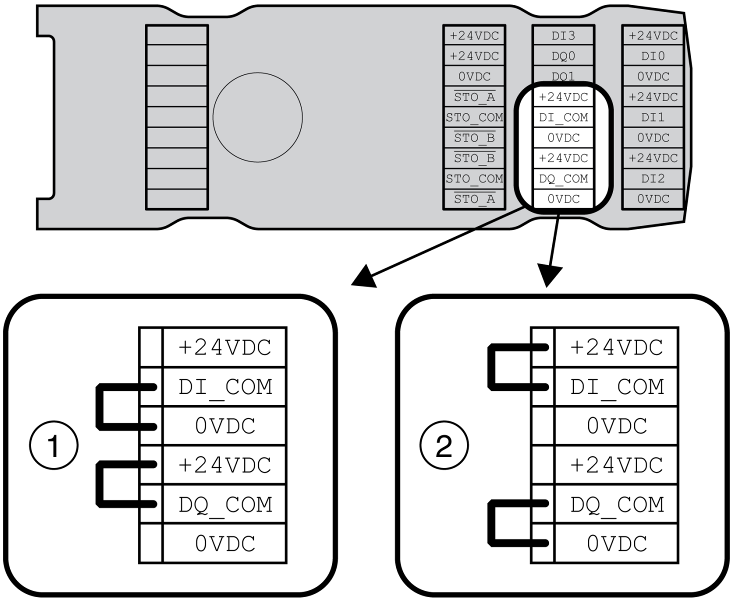
Signal	Meaning	Factory settings(1)	I/O
+24VDC	24 V signal power supply (see chapter Internal 24V Signal Power Supply *(see page 26)*)	-	O
0VDC	Reference potential to +24VDC	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
DQ0	Digital output 0	No Fault	O
DQ1	Digital output 1	Active	O
DI_COM	Reference potential for digital inputs	-	-
DQ_COM	Reference potential for digital outputs	-	-
STO_A	Safety function STO	-	I
STO_COM	Reference potential for STO	-	I
STO_B	Safety function STO	-	I
CAN_0V	Reference potential for CAN	-	-
CAN_H	CAN interface	-	I/O
CAN_L	CAN interface	-	I/O
(1) See chapter Digital Inputs and Outputs *(see page 218)*.			

Setting the Logic Type

The I/O module with spring terminals supports positive logic and negative logic.

See chapter Logic Type (see page 56) for additional information on the logic types.

- In the case of positive logic, the signal `DI_COM` and `0VDC` must be bridged and the signal `DQ_COM` and `+24VDC` must be bridged.
- In the case of negative logic, the signal `DI_COM` and `+24VDC` must be bridged and the signal `DQ_COM` and `0VDC` must be bridged.
- Set the required logic type.



1 Positive logic (sinking inputs, sourcing outputs)
2 Negative logic (sourcing inputs, sinking outputs)

Connection of the Digital Inputs/Outputs

Cable Specifications

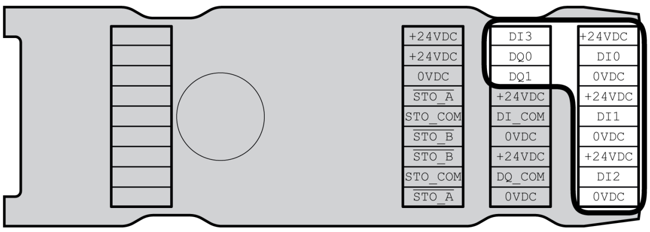
Shield	-
Twisted pair	-
PELV:	Required
Cable composition:	-
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)
Maximum cable length:	30 m (98.4 ft)

Properties of the Connection Terminals

Connection cross section (rigid)	mm^2	0.13 ... 1.3 (AWG 26 ... AWG 16)
Connection cross section (wire)	mm^2	0.2 ... 0.52 (AWG 24 ... AWG 20)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

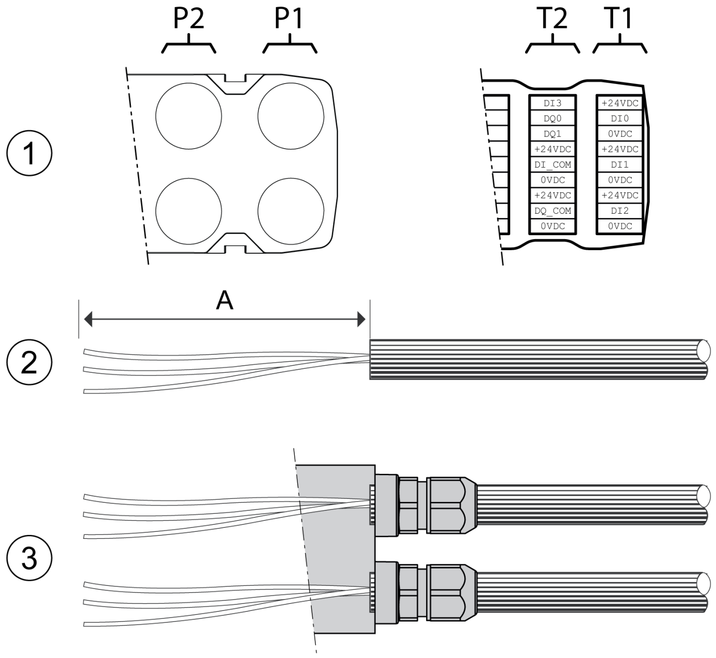
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



Signal	Meaning
DI0	Digital input 0
DI1	Digital input 1
DI2	Digital input 2
DI3	Digital input 3
DQ0	Digital output 0
DQ1	Digital output 1
+24VDC	24 V signal power supply (see chapter Internal 24V Signal Power Supply *(see page 26)*)
0VDC	Reference potential to DI0 ... DI3, DQ0 and DQ1

Assembling Cables



From cable gland ...	... to terminal block	Length A
P1	T1	120 mm (4.72 in)
P1	T2	105 mm (4.13 in)
P2	T1	145 mm (5.71 in)
P2	T2	130 mm (5.12 in)

- (1) Decide which signals are to be routed through which cable gland.
- (2) Strip the cable jackets, length A.
- (3) Push the compression nut of the cable gland over the cable.
  Push the cable through the cable gland and tighten the compression nut.

Connection of Safety Function STO

General

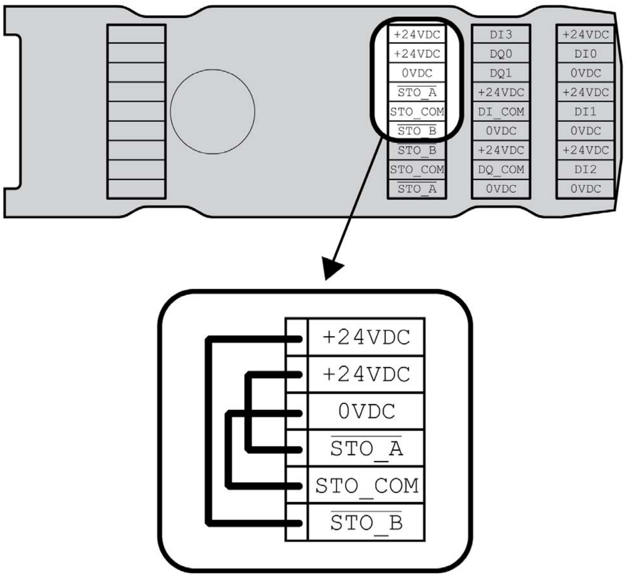
The I/O module with spring terminals supports operation without safety function STO and operation without safety function STO.

See chapter Safety function STO ("Safe Torque Off") (see page 68) for additional information on the safety function STO.

Operation Without STO

If the safety function STO is not to be used, the signal `STO_A` and `+24VDC` must be bridged, the signal `STO_B` and `+24VDC` must be bridged and the signal `STO_COM` and `0VDC` must be bridged.

The safety function STO is deactivated when the signals are bridged.



Operation with Safety Function STO

If the safety function STO is to be used, the safety function STO must be connected in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") (see page 68).

Cable Specifications

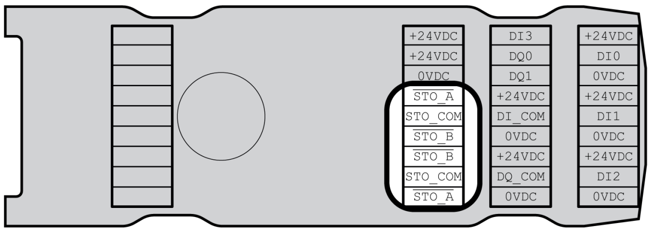
Shield	Required, one end grounded
Twisted pair	-
PELV:	Required
Cable composition:	-
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)
Maximum cable length:	-

Properties of the Connection Terminals

Connection cross section (rigid)	mm^2	0.13 ... 1.3 (AWG 26 ... AWG 16)
Connection cross section (wire)	mm^2	0.2 ... 0.52 (AWG 24 ... AWG 20)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



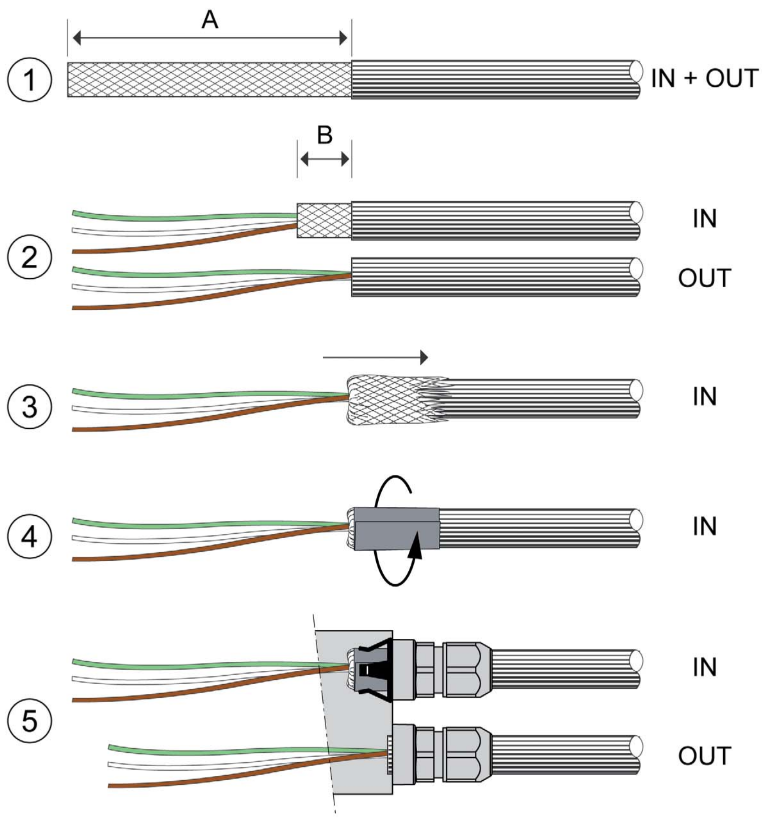
Signal	Meaning	Wire color
STO_A	Safety function STO: Dual-channel connection, connection A	White
STO_B	Safety function STO: Dual-channel connection, connection B	Brown
STO_COM	Reference potential to STO_A and STO_B	Green

Shield Concept

The shield of the cables for the safety function STO must be connected to the connection STO IN (one end). Connecting one end of the shield helps to avoid ground loops.

See chapter Protected Cable Installation for Safety-Related Signals *(see page 76)* for additional information.

Assembling Cables



Length A	mm (in)	150 (5.91 in)
Length B	mm (in)	10 (0.39 in)

- (1) Strip the cable jacket, length A.
- (2) Shorten the shield of the cable for STO_IN to length B.
  Completely shorten the shield of the cable for STO_OUT.

- (3) Slide the shielding braid back over the cable jacket.
- (4) Fasten the shield with a shield foil (50 x 10 mm (1.97 x 0.39 in)).
- (5) Push the compression nut of the cable gland over the cable.
  Push the cable through the cable gland and tighten the compression nut. Verify that the shield is connected to the shield clip.

Connecting the Safety Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety function in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") *(see page 68)*.

Fieldbus Connection

Cable Specifications

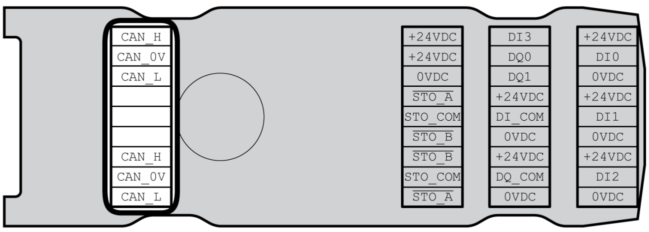
Shield	Required, both ends grounded
Twisted pair	Required
PELV:	Required
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)

Properties of the Connection Terminals

Connection cross section (rigid)	mm^2	0.13 ... 1.3 (AWG 26 ... AWG 16)
Connection cross section (wire)	mm^2	0.2 ... 0.52 (AWG 24 ... AWG 20)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

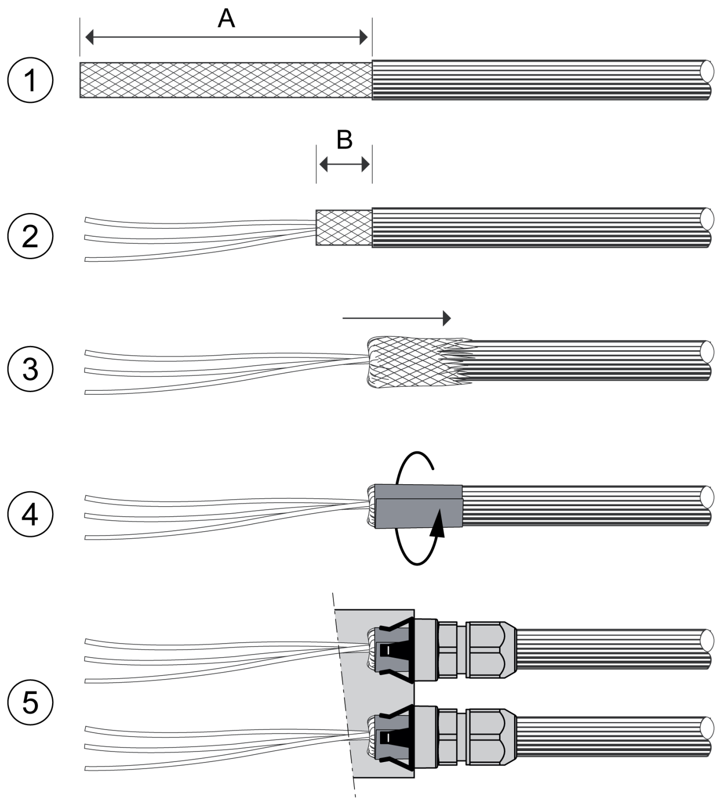
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



Signal	Meaning
CAN_0V	Reference potential for CAN
CAN_H	CAN interface
CAN_L	CAN interface

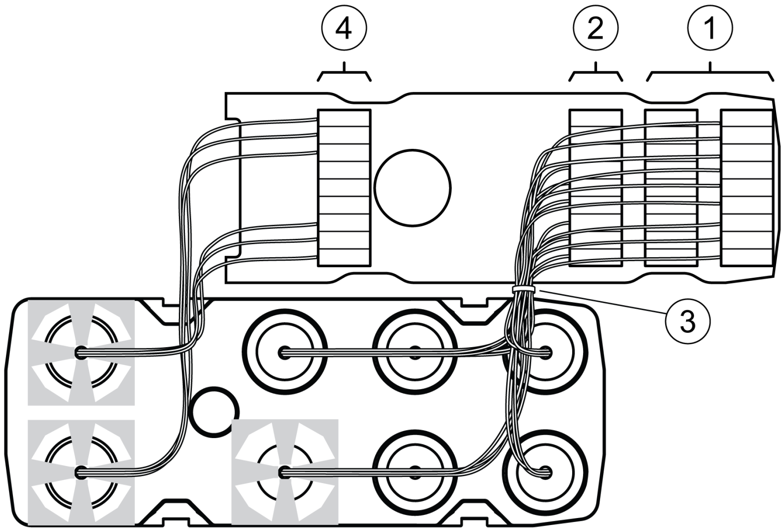
Assembling Cables



Length A	mm (in)	95 (3.74)
Length B	mm (in)	10 (0.39)

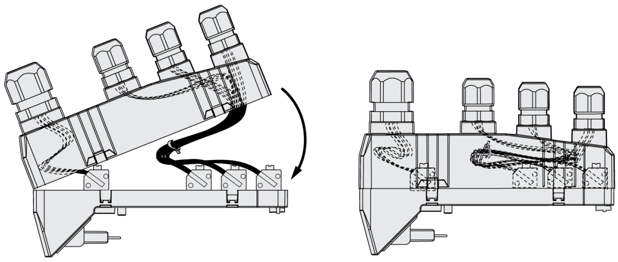
- (1) Strip the cable jacket of the cables for X1 (IN) and X2 (OUT), length A.
- (2) Shorten the shield to length B.
- (3) Slide the shielding braid back over the cable jacket.
- (4) Fasten the shield with a shield foil (50 x 10 mm (1.97 x 0.39 in)).
- (5) Push the compression nut of the cable gland over the cable.
  Push the cable through the cable gland and tighten the compression nut. Verify that the shield is connected to the shield clip.

Connecting the Signals



- Strip the individual wires.
  Use wire cable ends (ferrules).
- (1) Connect the signal wires for the digital inputs and outputs to the terminals.
- (2) If you want to use the safety function STO, connect the signal wires for the safety function STO to the terminals.
- (3) Fasten the signal wires for the digital inputs and outputs and the signal wires for the safety function STO with cable ties.
- (4) Connect the signal wires for the fieldbus to the terminals.
  Twist the wires for the corresponding fieldbus connections by 1 to 2 turns. Twisting improves the signal quality and facilitates inserting the cables into the chambers as well as closing the cover.

Closing the I/O Module



- Place the cables into the cover of the I/O module.
- Close the cover of the I/O module, starting at the fieldbus connection end.
  Verify that no cables are between the clamps in the area of the fieldbus connection.
- Close the 4 clamps of the module.

Section 4.5
Verifying Installation

Verifying Installation

Verify proper installation:

- Verify the mechanical installation of the entire drive system:
- Does the installation meet the specified distance requirements?
- Did you tighten all fastening screws with the specified tightening torque?
- Verify the electrical connections and the cabling:
- Did you connect all protective ground conductors?
- Do all fuses have the correct rating; are the fuses of the specified type?
- Did you connect all wires of the cables or insulate them?
- Did you properly connect and install all cables and connectors?
- Are the mechanical locks of the connectors correct and effective?
- Did you properly connect the signal wires?
- Are the required shield connections EMC-compliant?
- Did you take all measures for EMC compliance?
- Does the drive installation conform to all local, regional, and national electrical safety codes for the eventual placement of the equipment?
- Verify that all covers and seals have been properly installed to achieve the required degree of protection.

If the safety function STO and spring terminals are used:

- Verify conductive connection between cable shield of STO (IN) and ground.

Chapter 5
Commissioning

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Overview

What Is in This Section?

This section contains the following topics:

General

The safety function STO (Safe Torque Off) does not remove power from the DC bus. The safety function STO only removes power to the motor. The DC bus voltage and the mains voltage to the drive are still present.

DANGER

ELECTRIC SHOCK

- Do not use the safety function STO for any other purposes than its intended function.
- Use an appropriate switch, that is not part of the circuit of the safety function STO, to disconnect the drive from the mains power.

Failure to follow these instructions will result in death or serious injury.

External driving forces acting on the motor can cause high currents to be regenerated and supplied back to the drive.

DANGER

FIRE DUE TO EXTERNAL DRIVING FORCES ACTING ON MOTOR

Verify that no external forces can act on the motor in the case of errors of error classes 3 or 4.

Failure to follow these instructions will result in death or serious injury.

Unsuitable parameter values or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameter values or data do not become active until after a restart.

WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not operate the drive system with undetermined parameter values or data.
- Never modify a parameter value unless you fully understand the parameter and all effects of the modification.
- Restart the drive and verify the saved operational data and/or parameter values after modifications.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
- Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the power stage is disabled unintentionally, for example as a result of power outage, errors or functions, the motor is no longer decelerated in a controlled way.

WARNING

UNINTENDED EQUIPMENT OPERATION

Verify that movements without braking effect cannot cause injuries or equipment damage.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Applying the holding brake while the motor is running will cause excessive wear and degradation of the braking torque.

⚠ WARNING

LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE

- Do not use the holding brake as a service brake.
- Do not exceed the maximum number of brake applications and the kinetic energy during braking of moving loads.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

When the product is operated for the first time, there is a risk of unanticipated movements caused by, for example, incorrect wiring or unsuitable parameter settings. Releasing the holding brake can cause an unintended movement, like for example, a falling load in the case of vertical axes.

⚠ WARNING

UNINTENDED MOVEMENT

- Verify that there are no persons or obstructions in the zone of operation when operating the system.
- Take appropriate measures to avoid hazards caused by falling or lowering loads or other unintended movements.
- Run initial tests without coupled loads.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in running tests.
- Anticipate movements in unintended directions or oscillations of the motor.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The metal surfaces of the product may exceed 70 °C (158 °F) during operation.

⚠ CAUTION

HOT SURFACES

- Avoid unprotected contact with hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

Failure to follow these instructions can result in injury or equipment damage.

The product can be accessed via different types of access channels. Simultaneous access via multiple access channels or the use of exclusive access may cause unintended equipment operation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands.
- Verify that the use of exclusive access cannot cause unintended triggering or blocking of commands.
- Verify that the required access channels are available.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the drive was not connected to mains for an extended period of time, the capacitors must be restored to their full performance before the motor is started.

NOTICE
REDUCED CAPACITOR PERFORMANCE ● If the drive has not been connected to mains for a period of more than 24 months, apply mains voltage to the drive for at least one hour before enabling the power stage for the first time. ● If the drive is commissioned for the first time, verify the date of manufacture and run the procedure specified above if the date of manufacture is more than 24 months in the past. **Failure to follow these instructions can result in equipment damage.**

Preparation

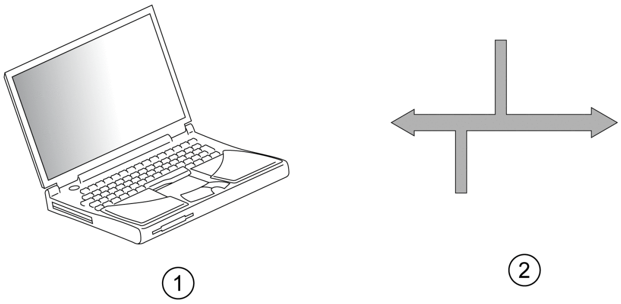
Required Components

The following is required for commissioning:

- Commissioning software “Lexium DTM Library”
  http://www.schneider-electric.com/en/download/document/Lexium_DTM_Library/
- Fieldbus converter for the commissioning software for connection via the commissioning interface
- Electronic Data Sheet file EDS
  http://www.schneider-electric.com

Interfaces

The following interfaces can be used for commissioning, parameterization and diagnostics:



1 PC with commissioning software “Lexium DTM Library”
2 Fieldbus

Device settings can be duplicated. Stored device settings can be transferred to a device of the same type. Duplicating the device settings can be used if multiple devices are to have the same settings, for example, when devices are replaced.

Commissioning Software

The commissioning software “Lexium DTM Library” has a graphic user interface and is used for commissioning, diagnostics and testing settings.

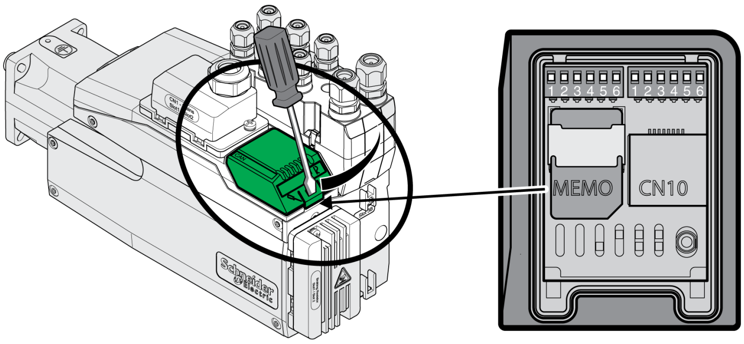
- Tuning of the control loop parameters via a graphical user interface
- Comprehensive set of diagnostics tools for optimization and maintenance
- Long-term trace for evaluation of the performance
- Testing the input and output signals
- Tracking signals on the screen
- Archiving of device settings and recordings with export function for further processing in other applications

Opening the Cover of the Commissioning Interface

The following components can be found below the cover of the commissioning interface:

- DIP switches for address and baud rate for CANopen
- Card holder for the memory card
- Commissioning interface CN10

The cover of the commissioning interface can be opened by means of a flat blade screwdriver



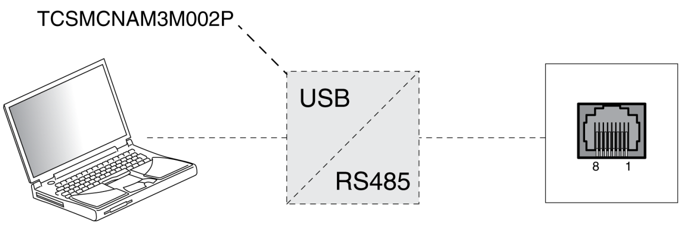
The CN10 interface does not support devices without their own power supply.

Use standard RJ45 patch cables.

The cover of the commissioning must be closed after commissioning.

Connecting a PC

A PC with commissioning software can be connected for commissioning. The PC is connected to a bidirectional USB/RS485 converter, see chapter Accessories and Spare Parts *(see page 569)*.



Section 5.2
Fieldbus Integration

Setting the Baud Rate and Device Address

Overview

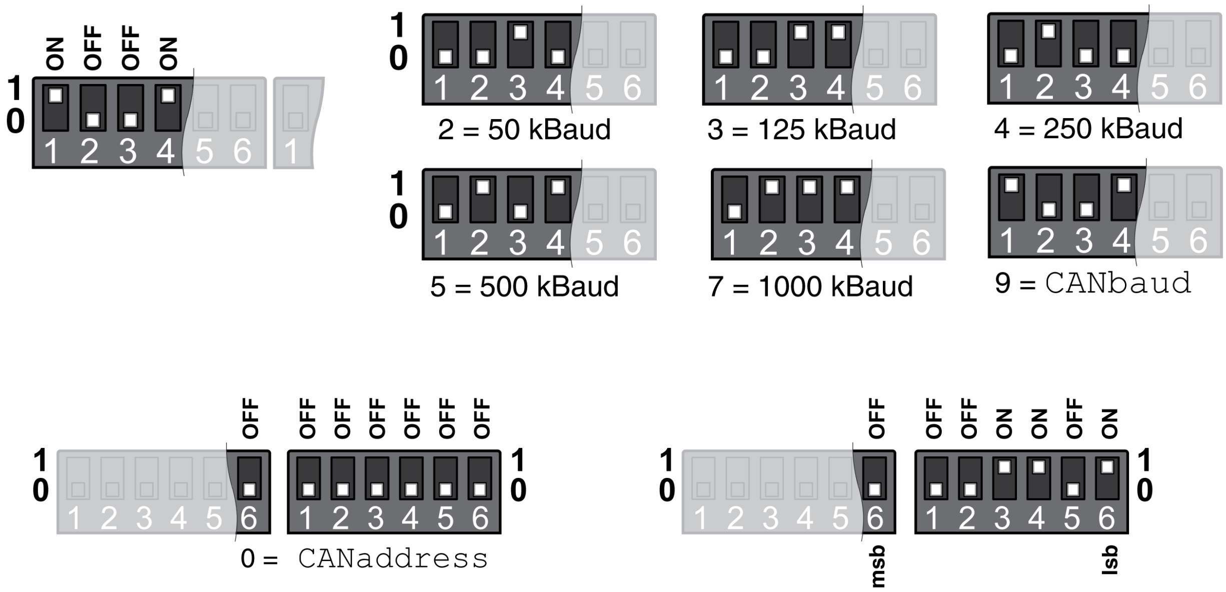
With the factory settings active, the address and the baud rate can be set via the parameters `CANbaud` and `CANaddress`. It is also possible to set the address and the baud rate via the DIP switches located below the cover of the commissioning interface. If the DIP switches are used, the values set via the parameters are ignored.

Up to 64 devices can be addressed in a CAN bus network segment and up to 127 devices in the extended network. Each device is identified by a unique address. The device address factory setting is 0; this setting must be changed. As long as the device address is set to 0, the fieldbus is not initialized. Each device must have its own unique node address, which may only be assigned once in the network. The baud rate factory setting is 250 kBaud. The transmission rate (baud rate) must be the same for all devices in the network.

Depending on the installation conditions, the DIP switches for the address and the baud rate may be hard to access. If the DIP switches are to be used, it is advisable to set them in advance.

Baud Rate and Device Address via DIP Switches

Set the baud rate and the device address via the DIP switches.



Baud Rate and Device Address via Parameters

The DIP switch for the baud rate must be set to 9. The DIP switch for the device address must be set to 0. In the case of other settings, the DIP switch settings for the baud rate and the device address are used, not the parameter settings.

- Set the baud rate via the parameter `CANbaud` to meet the requirements of your network.
- Set the device address via the parameter `CANaddress`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CANbaud`	CANopen baud rate **50 kBaud**: 50 kBaud **125 kBaud**: 125 kBaud **250 kBaud**: 250 kBaud **500 kBaud**: 500 kBaud **1 MBaud**: 1 MBaud Modified settings become active the next time the product is powered on.	- 50 250 1000	UINT16 R/W per. -	-
`CANaddress`	CANopen address (node number) Modified settings become active the next time the product is powered on.	- 1 - 127	UINT16 R/W per. -	-

Reading the DIP Switch Settings via Parameters

The current settings of the DIP switches can be read via the parameters `_DipCANbaud` and `_DipCANaddress`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_DipCANbaud`	CANopen baud rate set via DIP switches **0 / not supported**: Setting is not valid **1 / not supported**: Setting is not valid **2 / 50 kBaud**: 50 kBaud **3 / 125 kBaud**: 125 kBaud **4 / 250 kBaud**: 250 kBaud **5 / 500 kBaud**: 500 kBaud **6 / not supported**: Setting is not valid **7 / 1 MBaud**: 1 MBaud **8 / not supported**: Setting is not valid **9 / CANbaud**: Address is set via parameter CANbaud **10 / not supported**: Setting is not valid **11 / not supported**: Setting is not valid **12 / not supported**: Setting is not valid **13 / not supported**: Setting is not valid **14 / not supported**: Setting is not valid **15 / not supported**: Setting is not valid Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/- - -	CANopen 3041:10$_h$ Modbus 16672
`_DipCANaddress`	CANopen address (node number) set via DIP switches Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/- - -	-

Restarting the Drive

A restart of the drive is required for the changes to become effective. After the restart, the drive is ready for operation.

Further Steps

- Attach a label to the device that contains information for servicing the device such as fieldbus type and device address.
- Make the settings described below for commissioning.

You can additionally save your settings to a memory card. Use only genuine accessory memory cards, see chapter Memory Cards *(see page 571)*.

Section 5.3
Commissioning Procedure

What Is in This Section?

This section contains the following topics:

Setting Limit Values

Setting Limit Values

Suitable limit values must be determined and calculated on the basis of the system and motor data. As long as the motor is operated without loads, the default settings do not need to be changed.

Current Limitation

The maximum motor current can be set with the parameter `CTRL_I_max`.

The maximum current for the "Quick Stop" function can be limited with the parameter `LIM_I_maxQSTP` and for the "Halt" function with the parameter `LIM_I_maxHalt`.

- Use the parameter `CTRL_I_max` to set the maximum motor current.
- Use the parameter `LIM_I_maxQSTP` to set the maximum motor current for the "Quick Stop" function.
- Use the parameter `LIM_I_maxHalt` to set the maximum motor current for the "Halt" function.

The motor can be decelerated via a deceleration ramp or the maximum current for the functions "Quick Stop" and "Halt".

The device limits the maximum permissible current on the basis of the motor data and the device data. Even if the value entered for the maximum current in the parameter `CTRL_I_max` is too high, the value is limited.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL_I_max`	Current limitation During operation, the current limit is one of the following values (whichever is lowest): - CTRL_I_max - _M_I_max - _PS_I_max - Current limitation via digital input Limitations caused by I2t monitoring are also taken into account. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 - 463.00	UINT16 R/W per. -	CANopen 3011:C$_h$ Modbus 4376
`LIM_I_maxQSTP`	Current for Quick Stop This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Quick Stop, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxQSTP - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:D$_h$ Modbus 4378

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_I_maxHalt`	Current for Halt This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Halt, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxHalt - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Halt. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:E_h Modbus 4380

Velocity Limitation

The parameter `CTRL_v_max` can be used to limit the maximum velocity.

- Use the parameter `CTRL_v_max` to set the maximum velocity of the motor.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL_v_max`	Velocity limitation During operation, the velocity limit is one of the following values (whichever is lowest): - CTRL_v_max - M_n_max - Velocity limitation via digital input Modified settings become active immediately.	usr_v 1 13200 2147483647	UINT32 R/W per. -	CANopen 3011:10_h Modbus 4384

Digital Inputs and Outputs

The device has configurable inputs and configurable outputs. See chapter Digital Inputs and Outputs *(see page 218)* for additional information.

The signal states of the digital inputs and digital outputs can be displayed via the fieldbus and the commissioning software.

Fieldbus

The signal states are contained in the parameter `_IO_act` in a bit-coded way. The values "1" and "0" correspond to the signal state of the input or output.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_IO_act`	Physical status of the digital inputs and outputs Low byte: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3 High byte: Bit 8: DQ0 Bit 9: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:1$_h$ Modbus 2050
`_IO_DI_act`	Status of digital inputs Bit assignments: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3	- - - -	UINT16 R/- - -	CANopen 3008:F$_h$ Modbus 2078
`_IO_DQ_act`	Status of digital outputs Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:10$_h$ Modbus 2080
`_IO_STO_act`	Status of the inputs for the safety-related function STO Coding of the individual signals: Bit 0: STO_A Bit 1: STO_B	- - - -	UINT16 R/- - -	CANopen 3008:26$_h$ Modbus 2124

Verifying the Signals of the Limit Switches

The use of limit switches can provide some protection against hazards (for example, collision with mechanical stop caused by incorrect reference values).

⚠ WARNING
LOSS OF CONTROL ● Ensure that limit switches are installed as determined by your risk assessment. ● Verify correct connection of the limit switches. ● Verify that the limit switches are sufficiently distant from the mechanical stop to allow an adequate stopping distance. ● Verify correct parameterization and function of the limit switches. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

- Set up the limit switches in such a way as to keep the motor from overtraveling the limit switches.
- Trigger the limit switches manually.
  If an error message is indicated, the limit switches were triggered.

Parameters can be used to release the limit switches and to set them up as normally closed contacts or normally open contacts, see chapter Limit Switches *(see page 353)*.

Verifying the Safety Function STO

Operation with Safety Function STO

If you want to use the safety function STO, carry out the following steps:

- To help avoid unintended restart after restoration of power, the parameter `IO_AutoEnable` must be set to "off". Verify that the parameter `IO_AutoEnable` is set to "off".

Power off the power supply:

- Verify that the signal wires at the inputs (`STO_A`) and (`STO_B`) are isolated from each other. The two signal wires must not be electrically connected.

Power on the power supply:

- Enable the power stage without starting a motor movement.
- Trigger the safety function STO.
  If the power stage is now disabled and the error message 1300 is indicated, the safety function STO was triggered.
  If a different error message is indicated, the safety function STO was not triggered.
- Document all tests of the safety function in your acceptance protocol.

Operation without Safety Function STO

I/O modules with industrial connectors are available without the safety function STO.

If an I/O module with spring terminals is used:

- Verify that the inputs `STO_A` and `STO_B` are connected to `+24VDC`.
  For details see chapter Connection of Safety Function STO *(see page 143)*.

Holding Brake (Option)

Holding Brake

The holding brake in the motor has the task of holding the motor position when the power stage is disabled. The holding brake is not a safety function and not a service brake.

⚠ WARNING
UNINTENDED AXIS MOVEMENT ● Do not use the internal holding brake as a safety-related measure. ● Only use certified external brakes as safety-related measures. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Releasing the Holding Brake

When the power stage is enabled, current is applied to the motor. When current is applied to the motor, the holding brake is automatically released.

Releasing the holding brake requires a certain amount of time. This time is contained in the electronic nameplate of the motor. Transition to the operating state **6 Operation Enabled** is only possible after this time delay has elapsed.

Applying the Holding Brake

When the power stage is disabled, the holding brake is automatically applied.

However, applying the holding brake requires a certain amount of time. This time is contained in the electronic nameplate of the motor. Current remains to be applied to the motor during this time delay.

See chapter Safety function STO ("Safe Torque Off") *(see page 68)* for additional information on the behavior of the holding brake when the safety function STO is triggered.

Releasing the Holding Brake Manually

Mechanical adjustments may require you to manually rotate the motor shaft.

Manual release of the holding brake is only possible in the operating states **3 Switch On Disabled**, **4 Ready To Switch On** or **9 Fault**.

When the product is operated for the first time, there is a risk of unanticipated movements caused by, for example, incorrect wiring or unsuitable parameter settings. Releasing the holding brake can cause an unintended movement, like for example, a falling load in the case of vertical axes.

⚠ WARNING
UNINTENDED MOVEMENT ● Verify that there are no persons or obstructions in the zone of operation when operating the system. ● Take appropriate measures to avoid hazards caused by falling or lowering loads or other unintended movements. ● Run initial tests without coupled loads. ● Verify that a functioning emergency stop push-button is within reach of all persons involved in running tests. ● Anticipate movements in unintended directions or oscillations of the motor. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Applying the Holding Brake Manually

For testing the holding brake, you may want to manually apply the holding brake.

You can only apply the holding brake manually when the motor is at a standstill.

If you enable the power stage after the holding brake has been applied manually, the holding brake remains applied.

Manual application of the holding brake has priority over automatic and manual release of the holding brake.

If a movement is started after the holding brake has been applied manually, this can cause wear.

NOTICE
BRAKE WEAR AND LOSS OF BRAKING TORQUE • Verify that the generated motor torque is not greater than the holding torque of the holding brake if you have applied the holding brake manually. • Only apply the holding brake manually for the purpose of testing the holding brake. **Failure to follow these instructions can result in equipment damage.**

As of firmware version ≥V01.06, you can manually apply the holding brake.

Releasing the Holding Brake Manually via a Signal Input

In order to release the holding brake via a signal input, you must first parameterize the signal input function "Release Holding Brake", see chapter Digital Inputs and Outputs *(see page 218)*.

Releasing or Applying the Holding Brake Manually via the Fieldbus

The parameter `BRK_release` can be used to release the holding brake via the fieldbus.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`BRK_release`	Manual operation of the holding brake **0 / Automatic**: Automatic processing **1 / Manual Release**: Manual release of holding brake **2 / Manual Application**: Manual applying of holding brake You can apply or release the holding brake manually. The holding brake can only be manually released in the operating states 'Switch On Disabled', 'Ready To Switch On' or 'Fault'. If you have applied the holding brake manually and then want to release it manually, you must first set this parameter to Automatic and then to Manual Release. Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 3008:A$_h$ Modbus 2068

Verifying the Direction of Movement

Definition of Direction of Movement

In the case of a rotary motors, direction of movement is defined in accordance with IEC 61800-7-204: Positive direction is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

It is important to maintain the IEC 61800-7-204 directional standard within your application because many motion-related function blocks, programming conventions, and, safety-related and conventional devices expect this underlying assumption within their logic and operational methodologies.

⚠ WARNING
UNINTENDED MOVEMENT CAUSED BY INTERCHANGED MOTOR PHASES
Do not interchange the motor phases.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

If your application requires an inversion of the direction of movement, you can parameterize the direction of movement.

The direction of movement can be verified by starting a movement.

Verifying the Direction of Movement via the Commissioning Software

Power supply has been powered on.

- Enable the power stage.
- Start the operating mode Jog.
- Use the ">" button to trigger a movement in positive direction.
  A movement is made in positive direction.
- Use the "<" button to trigger a movement in negative direction.
  A movement is made in negative direction.

Verifying the Direction of Movement via Signal Inputs

The signal input functions "Jog Positive With Enable" and "Jog Negative With Enable" enable the power stage, start the operating mode Jog and trigger a movement in positive direction or in negative direction.

The signal input functions "Jog Positive With Enable" and "Jog Negative With Enable" must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

Power supply has been powered on.

- Use the signal input function "Jog Positive With Enable" to trigger a movement in positive direction.
  A movement is made in positive direction.
- Use the signal input function "Jog Negative With Enable" to trigger a movement in negative direction.
  A movement is made in negative direction.

Changing the Direction of Movement

You can invert the direction of movement.

- Inversion of direction of movement is off:
  Movements are made in positive direction with positive target values.
- Inversion of direction of movement is on:
  Movements are made in positive direction with negative target values.

The parameter `InvertDirOfMove` allows you to invert the direction of movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`InvertDirOfMove`	Inversion of direction of movement **0 / Inversion Off**: Inversion of direction of movement is off **1 / Inversion On**: Inversion of direction of movement is on The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:C_h Modbus 1560

Setting Parameters for Encoder

When starting up, the device reads the absolute position of the motor from the encoder. The absolute position can be read with the parameter _p_absENC.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_absENC	Absolute position with reference to the encoder range This value corresponds to the modulo position of the absolute encoder range.	usr_p - - -	UINT32 R/- - -	CANopen 301E:F$_h$ Modbus 7710

Working Range of the Encoder

The working range of the singleturn encoder is 131072 increments per turn.

The working range of the multiturn encoder is 4096 turns with 131072 increments per turn.

Underrun of Absolute Position

If a rotary motor performs a movement from 0 into negative direction, there is an underrun of the absolute position of the encoder. However, the actual position keeps counting forward and delivers a negative position value. After a power cycle, the actual position no longer corresponds to the negative position value, but to the absolute position of the encoder.

The following options are available to adjust the absolute position of the encoder:

- Adjustment of the absolute position
- Shifting the working range

Adjustment of the Absolute Position

When the motor is at a standstill, the new absolute position of the motor can be set to the current mechanical motor position the with the parameter `ENC1_adjustment`.

Adjusting the absolute position also shifts the position of the index pulse.

- Set the absolute position at the negative mechanical limit to a position value greater than 0. This way, the movements remain within the continuous range of the encoder.

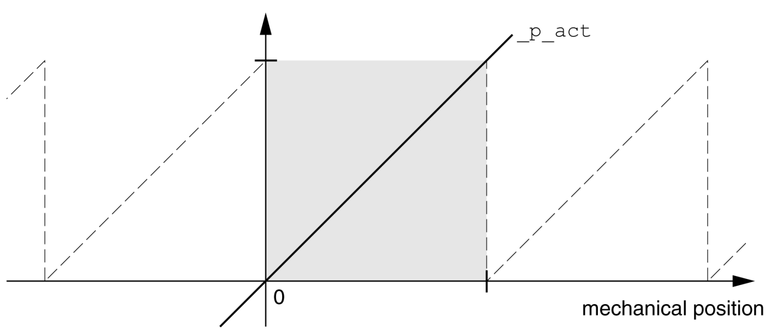
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ENC1_adjustment`	Adjustment of absolute position of encoder 1 The value range depends on the encoder type. Singleturn encoder: 0 ... x-1 Multiturn encoder: 0 ... (4096*x)-1 Singleturn encoder (shifted with parameter ShiftEncWorkRang): -(x/2) ... (x/2)-1 Multiturn encoder (shifted with parameter ShiftEncWorkRang): -(2048*x) ... (2048*x)-1 Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling. If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted. After the write access, a wait time of at least 1 second is required before the drive can be powered off. Modified settings become active the next time the product is powered on.	usr_p - - -	INT32 R/W - -	CANopen 3005:16$_h$ Modbus 1324

Shifting the Working Range

The parameter `ShiftEncWorkRang` lets you shift the working range.

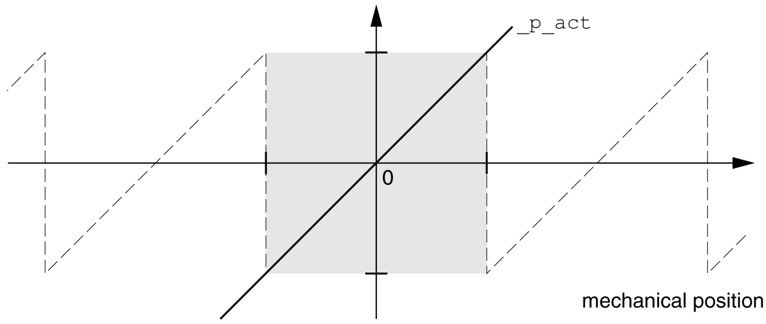
The working range without shift comprises:

Singleturn encoder	0 ... 131071 increments
Multiturn encoder	0 ... 4095 revolutions



The working range with shift comprises:

Singleturn encoder	-65536 ... 65535 increments
Multiturn encoder	-2048 ... 2047 revolutions



Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ShiftEncWorkRang	Shifting of the encoder working range **0 / Off**: Shifting off **1 / On**: Shifting on After activating the shifting function, the position range of a multiturn encoder is shifted by one half of the range. Example for the position range of a multiturn encoder with 4096 revolutions: Value 0: Position values are between 0 … 4096 revolutions. Value 1: Position values are between -2048 … 2048 revolutions. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	CANopen 3005:21$_h$ Modbus 1346

Setting the Braking Resistor Parameters

An insufficiently rated braking resistor can cause overvoltage on the DC bus. Overvoltage on the DC bus causes the power stage to be disabled. The motor is no longer actively decelerated.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the braking resistor has a sufficient rating by performing a test run under maximum load conditions.
- Verify that the parameter settings for the braking resistor are correct.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The temperature of the braking resistor may exceed 250 °C (482 °F) during operation.

⚠ WARNING

HOT SURFACES

- Ensure that it is not possible to make any contact with a hot braking resistor.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If you use an external braking resistor, perform the following steps:

- Set the parameter `RESint_ext` to "External Braking Resistor".
- Set the parameters `RESext_P`, `RESext_R` and `RESext_ton`.

See chapter Rating the Braking Resistor *(see page 62)* for additional information.

If the regenerated power becomes greater than the power that can be absorbed by the braking resistor, an error message is generated and the power stage is disabled.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RESint_ext`	Selection of type of braking resistor **0 / Standard Braking Resistor**: Standard braking resistor **1 / External Braking Resistor**: External braking resistor **2 / Reserved**: Reserved Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:9$_h$ Modbus 1298
`RESext_P`	Nominal power of external braking resistor Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	W 1 10 32767	UINT16 R/W per. -	CANopen 3005:12$_h$ Modbus 1316
`RESext_R`	Resistance value of external braking resistor The minimum value depends on the power stage. In increments of 0.01 Ω. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	Ω 0.00 100.00 327.67	UINT16 R/W per. -	CANopen 3005:13$_h$ Modbus 1318
`RESext_ton`	Maximum permissible switch-on time of external braking resistor Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 1 1 30000	UINT16 R/W per. -	CANopen 3005:11$_h$ Modbus 1314

Autotuning

Autotuning moves the motor in order to tune the control loops. Incorrect parameters may cause unintended movements or the loss of monitoring functions.

⚠ WARNING
UNINTENDED MOVEMENT ● Only start the system if there are no persons or obstructions in the zone of operation. ● Verify that the values for the parameters `AT_dir` and `AT_dis_usr` (`AT_dis`) do not exceed the available movement range. ● Verify that the parameterized movement ranges are available, free and clear for the mechanical movement defined by your application logic. ● Include in your calculations when determining the available movement range, the additional distance for the deceleration ramp in the case of an emergency stop. ● Verify that the parameter settings for a Quick Stop are correct. ● Verify correct operation of the limit switches. ● Verify that a functioning emergency stop push-button is within reach of all persons involved in all phases of machine operation and maintenance involving this equipment. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Autotuning

Autotuning determines the friction torque as a constantly acting load torque and considers it in the calculation of the moment of inertia of the entire system.

External factors such as a load at the motor are considered. Autotuning optimizes the settings of the control loop parameters; see chapter Controller Optimization with Step Response *(see page 179)*.

Autotuning also supports vertical axes.

Methods

There are three ways of tuning the drive control loops:

- Easy Tuning: Automatic - autotuning without user intervention. For most applications, autotuning yields good, highly dynamic results.
- Comfort Tuning: Semi-automatic - autotuning with user intervention. Parameters for direction and parameters for damping can be set by the user.
- Manual: The user can set and tune the control loop parameters manually. Expert mode.

Function

During autotuning, the motor is activated and small movements are made. Noise development and mechanical oscillations of the system are normal.

If you want to perform Easy Tuning, no additional parameters need to be adjusted. To perform Comfort Tuning, the parameters `AT_dir`, `AT_dis_usr` (`AT_dis`) and `AT_mechanics` are available to be adjusted to meet the requirements of your application.

The parameter `AT_Start` is used to start Easy Tuning or Comfort Tuning.

- Start autotuning via the commissioning software.
- Save the new settings to the EEPROM via the commissioning software.
  The product features 2 control loop parameter sets that can be parameterized separately. The values for the control loop parameters determined during autotuning are stored in control loop parameter set 1.

If autotuning cancels with an error message, the default values are used. Change the mechanical position and restart autotuning. If you want to verify the plausibility of the calculated values, you can have them displayed; see chapter Enhanced Settings for Autotuning *(see page 177)*.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AT_dir	Direction of movement for Autotuning **1 / Positive Negative Home**: Positive direction first, then negative direction with return to initial position **2 / Negative Positive Home**: Negative direction first, then positive direction with return to initial position **3 / Positive Home**: Positive direction only with return to initial position **4 / Positive**: Positive direction only without return to initial position **5 / Negative Home**: Negative direction only with return to initial position **6 / Negative**: Negative direction only without return to initial position Modified settings become active the next time the motor moves.	- 1 1 6	UINT16 R/W - -	CANopen 302F:4$_h$ Modbus 12040
AT_dis_usr	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active the next time the motor moves.	usr_p 1 32768 2147483647	INT32 R/W - -	CANopen 302F:12$_h$ Modbus 12068
AT_dis	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified movement range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The parameter AT_dis_usr allows you to enter the value in user-defined units. In increments of 0.1 revolution. Modified settings become active the next time the motor moves.	revolution 1.0 2.0 999.9	UINT32 R/W - -	CANopen 302F:3$_h$ Modbus 12038
AT_mechanical	Type of coupling of the system **1 / Direct Coupling**: Direct coupling **2 / Belt Axis**: Belt axis **3 / Spindle Axis**: Spindle axis Modified settings become active the next time the motor moves.	- 1 2 3	UINT16 R/W - -	CANopen 302F:E$_h$ Modbus 12060
AT_start	Autotuning start Value 0: Terminate Value 1: Activate EasyTuning Value 2: Activate ComfortTuning Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	CANopen 302F:1$_h$ Modbus 12034

Enhanced Settings for Autotuning

The following parameters allow you to monitor and influence autotuning.

The parameters `AT_state` and `AT_progress` allow you to monitor the progress and status of autotuning.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_AT_state`	Autotuning status Bit assignments: Bits 0 ... 10: Last processing step Bit 13: auto_tune_process Bit 14: auto_tune_end Bit 15: auto_tune_err	- - - -	UINT16 R/- - -	CANopen 302F:2$_h$ Modbus 12036
`_AT_progress`	Progress of Autotuning	% 0 0 100	UINT16 R/- - -	CANopen 302F:B$_h$ Modbus 12054

If, in a test run, you want to determine the effects of harder or softer settings of the control loop parameters on your system, you can write the parameter `CTRL_GlobGain` to modify the settings determined during autotuning. The parameter `_AT_J` allows you to read the moment of inertia of the entire system calculated during autotuning.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL_GlobGain`	Global gain factor (affects control loop parameter set 1) The global gain factor affects the following parameters of control loop parameter set 1: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref The global gain factor is set to 100% - if the control loop parameters are set to default - at the end of the Autotuning process - if control loop parameter set 2 is copied to set 1 via the parameter CTRL_ParSetCopy If a full configuration is transmitted via the fieldbus, the value for CTRL_GlobGain must be transmitted prior to the values of the control loop parameters CTRL_KPn, CTRL_TNn, CTRL_KPp and CTRL_TAUnref. If CTRL_GlobGain is changed during a configuration transmission, CTRL_KPn, CTRL_TNn, CTRL_KPp and CTRL_TAUnref must also be part of the configuration. In increments of 0.1 %. Modified settings become active immediately.	% 5.0 100.0 1000.0	UINT16 R/W per. -	CANopen 3011:15$_h$ Modbus 4394
`_AT_M_friction`	Friction torque of the system Is determined during Autotuning. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 302F:7$_h$ Modbus 12046

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_AT_M_load	Constant load torque Is determined during Autotuning. In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 302F:8_h Modbus 12048
_AT_J	Moment of inertia of the system Is automatically calculated during Autotuning. In increments of 0.1 kg cm^2.	kg cm^2 0.1 0.1 6553.5	UINT16 R/- per. -	CANopen 302F:C_h Modbus 12056

The parameter AT_wait lets you set a waiting time between the individual autotuning steps. Setting a waiting time is only useful in the case of a low-rigidity coupling, in particular so if the next autotuning step (changing the hardness) is already performed while the system is still settling.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AT_wait	Waiting time between Autotuning steps Modified settings become active the next time the motor moves.	ms 300 500 10000	UINT16 R/W - -	CANopen 302F:9_h Modbus 12050

Section 5.4
Controller Optimization with Step Response

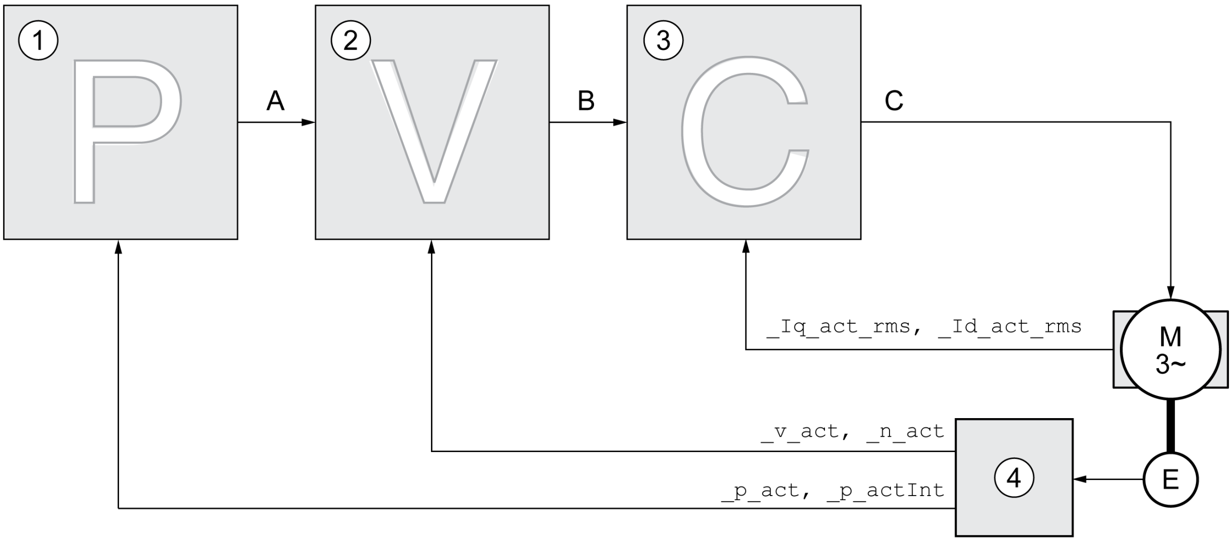
What Is in This Section?

This section contains the following topics:

Controller Structure

The controller structure corresponds to the classical cascaded closed loop with current controller, velocity controller and position controller. In addition, the reference value of the velocity controller can be smoothed via a filter.

The controllers are tuned one after the other from the "inside" to the "outside" in the following sequence: current control, velocity control, position control. The superimposed control loop remains off.



1 Position controller
2 Velocity Loop Controller
3 Current controller
4 Encoder evaluation

See chapter Overview of the Controller Structure *(see page 232)* for a detailed description of the controller structure.

Current Controller

The current controller determines the torque of the motor. The current controller is automatically optimally tuned with the stored motor data.

Velocity Controller

The velocity controller controls the motor velocity by varying the motor current depending on the load situation. The velocity controller has a decisive influence on the dynamic response of the drive. The dynamics of the velocity controller depend on:

- Moment of inertia of the drive and the controlled system
- Power of the motor
- Stiffness and elasticity of the elements in the flow of forces
- Backlash of the drive elements
- Friction

Position Controller

The position controller reduces the difference between the reference position and the actual position of the motor (position deviation) to a minimum. When the motor is at a standstill, the position deviation is close to zero in the case of a well-tuned position controller.

An optimized velocity control loop is a prerequisite for good amplification of the position controller.

Control Loop Parameters

This device allows you to use two control loop parameter sets. It is possible to switch form one set of control loop parameter sets to the other during operation. The active control loop parameter set is selected with the parameter `CTRL_SelParSet`.

The corresponding parameters are `CTRL1_xx` for the first control loop parameter set and `CTRL2_xx` for the second control loop parameter set. The following descriptions use the notation `CTRL1_xx` (`CTRL2_xx`) if there are no functional differences between the two control loop parameter sets.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL_SelParSet`	Selection of control loop parameter set (non-persistent) Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen 3011:19$_h$ Modbus 4402
`_CTRL_ActParSet`	Active control loop parameter set Value 1: Control loop parameter set 1 is active Value 2: Control loop parameter set 2 is active A control loop parameter set is active after the time for the parameter switching (CTRL_ParChgTime) has elapsed.	- - - -	UINT16 R/- - -	CANopen 3011:17$_h$ Modbus 4398
`CTRL_ParChgTime`	Period of time for control loop parameter set switching In the case of control loop parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Such a switching can be caused by - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen 3011:14$_h$ Modbus 4392

Optimization

The drive optimization function matches the device to the application conditions. The following options are available:

- Selecting control loops. Upstream control loops are automatically deactivated.
- Defining reference value signals: signal type, amplitude, frequency and starting point
- Testing control performance with the signal generator.
- Recording the control performance on screen and evaluating it with the commissioning software.

Setting Reference Value Signals

Start controller optimization with the commissioning software.

Set the following values for the reference value signal:

- Signal type: Step "positive"
- Amplitude: 100 min^{-1}
- Cycle duration: 100 ms
- Number of repetitions: 1

- Start the trace.

Only the signal types "Step" and "Square" allow you to determine the entire dynamic behavior of a control loop. The manual shows signal paths for the signal type "Step".

Entering Values for Optimization

The optimization steps described on the following pages require you to enter control loop parameters and test their effect by triggering a step function.

A step function is triggered as soon as you start a trace in the commissioning software.

Control Loop Parameters

This device allows you to use two control loop parameter sets. It is possible to switch form one set of control loop parameter sets to the other during operation. The active control loop parameter set is selected with the parameter `CTRL_SelParSet`.

The corresponding parameters are `CTRL1_xx` for the first control loop parameter set and `CTRL2_xx` for the second control loop parameter set. The following descriptions use the notation `CTRL1_xx` (`CTRL2_xx`) if there are no functional differences between the two control loop parameter sets.

For details see chapter Switching Between Control Loop Parameter Sets *(see page 231)*.

Optimizing the Velocity Controller

Optimizing complex mechanical control systems require hands-on experience with controller tuning. This includes the ability to calculate control loop parameters and to apply identification procedures.

Less complex mechanical systems can often be optimized by means of experimental adjustment using the aperiodic limit method. The following parameters are used for this:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL1_KPn`	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen 3012:1_h Modbus 4610
`CTRL2_KPn`	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen 3013:1_h Modbus 4866
`CTRL1_TNn`	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3012:2_h Modbus 4612
`CTRL2_TNn`	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3013:2_h Modbus 4868

Verify and optimize the calculated values in a second step, see chapter Verifying and Optimizing the P Gain *(see page 187)*.

Reference Value Filter of the Velocity Controller

The reference value filter of the velocity controller allows you to improve the transient response at optimized velocity control. The reference value filter must be deactivated for the first setup of the velocity controller.

- Deactivate the reference value filter of the velocity controller. Set the parameter `CTRL1_TAUnref` (`CTRL2_TAUnref`) to the lower limit value "0".

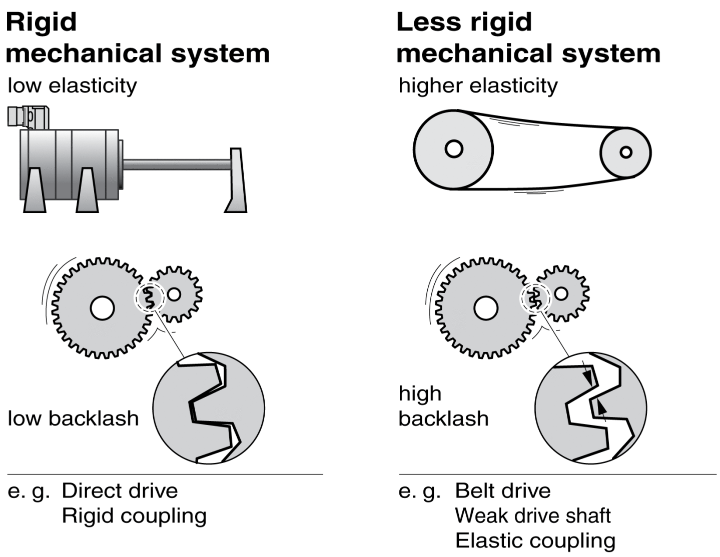
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL1_TAUnref`	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen $3012:4_h$ Modbus 4616
`CTRL2_TAUnref`	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen $3013:4_h$ Modbus 4872

Determining the Type of Mechanical System

To assess and optimize the transient response behavior of your system, group its mechanical system into one of the following two categories.

- System with rigid mechanical system
- System with a less rigid mechanical system

Rigid and less rigid mechanical systems



Determining Values for Rigid Mechanical Systems

In the case of a rigid mechanical system, adjusting the control performance on the basis of the table is possible if:

- the moment of inertia of the load and of the motor are known and
- the moment of inertia of the load and of the motor are constant

The P gain `CTRL_KPn` and the integral action time `CTRL_TNn` depend on:

- J_L: Moment of inertia of the load
- J_M: Moment of inertia of the motor

- Determine the values on the basis of the following table:

	$J_L = J_M$		$J_L = 5 * J_M$		$J_L = 10 * J_M$	
J_L	KPn	TNn	KPn	TNn	KPn	TNn
1 kgcm^2	0.0125	8	0.008	12	0.007	16
2 kgcm^2	0.0250	8	0.015	12	0.014	16
5 kgcm^2	0.0625	8	0.038	12	0.034	16
10 kgcm^2	0.125	8	0.075	12	0.069	16
20 kgcm^2	0.250	8	0.150	12	0.138	16

Determining Values for Less Rigid Mechanical Systems

For optimization purposes, determine the P gain of the velocity controller at which the controller adjusts velocity `_v_act` as quickly as possible without overshooting.

- Set the integral action time `CTRL1_TNn` (`CTRL2_TNn`) to infinite (= 327.67 ms).

If a load torque acts on the motor when the motor is at a standstill, the integral action time must not exceed a value that causes unwanted changes of the motor position.

If the motor is subject to loads when it is at a standstill, setting the integral action time to "infinite" may cause position deviations (for example, in the case of vertical axes). Reduce the integral action time if the position deviation is unacceptable in your application. However, reducing the integral action time can adversely affect optimization results.

⚠ WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the velocity and the time do not exceed the available movement range.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

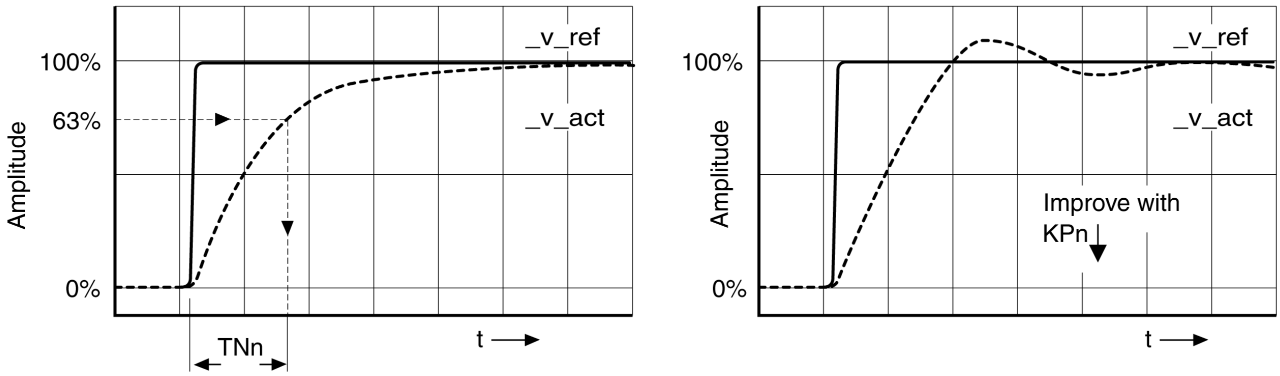
- Trigger a step function.
- After the first test, verify the maximum amplitude for the reference value for the current `_Iq_ref`.

Set the amplitude of the reference value just high enough so the reference value for the current `_Iq_ref` remains below the maximum value `CTRL_I_max`. On the other hand, the value selected should not be too low, otherwise friction effects of the mechanical system will determine the performance of the control loop.

- Trigger another step function if you had to modify `_v_ref` and verify the amplitude of `_Iq_ref`.
- Increase or decrease the P gain in small increments until `_v_act` is obtained as fast as possible. The following diagram shows the required transient response on the left. Overshooting - as shown on the right - is reduced by reducing `CTRL1_KPn` (`CTRL2_KPn`).

Differences between `_v_ref` and `_v_act` result from setting `CTRL1_TNn` (`CTRL2_TNn`) to "Infinite".

Determining "TNn" for the aperiodic limit



In the case of drive systems in which oscillations occur before the aperiodic limit is reached, the P gain "KPn" must be reduced until oscillations can no longer be detected. This occurs frequently in the case of linear axes with a toothed belt drive.

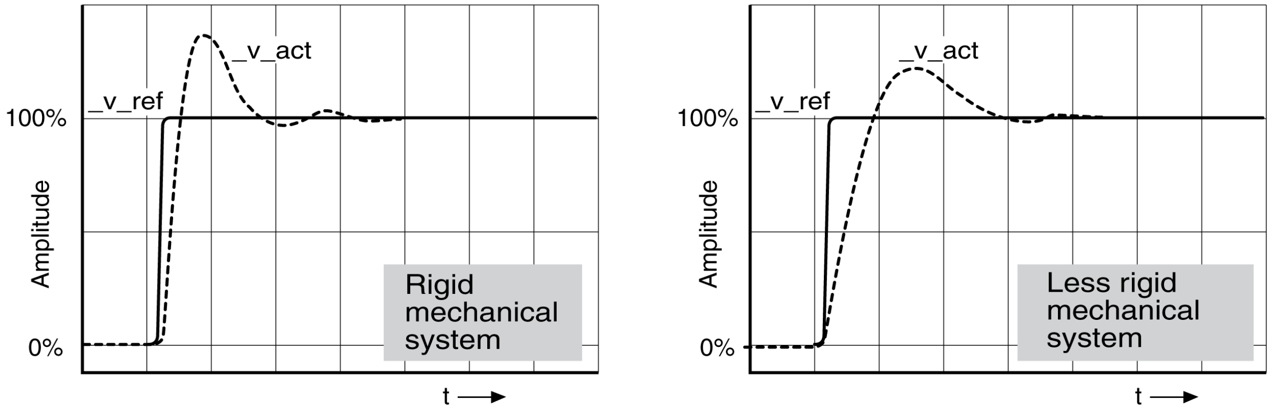
Graphic Determination of the 63% Value

Graphically determine the point at which the actual velocity `_v_act` reaches 63% of the final value. The integral action time `CTRL1_TNn` (`CTRL2_TNn`) then results as a value on the time axis. The commissioning software supports you with the evaluation:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL1_TNn`	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3012:2$_h$ Modbus 4612
`CTRL2_TNn`	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3013:2$_h$ Modbus 4868

Verifying and Optimizing the P Gain

Step responses with good control performance



The controller is properly set when the step response is approximately identical to the signal shown. Good control performance is characterized by

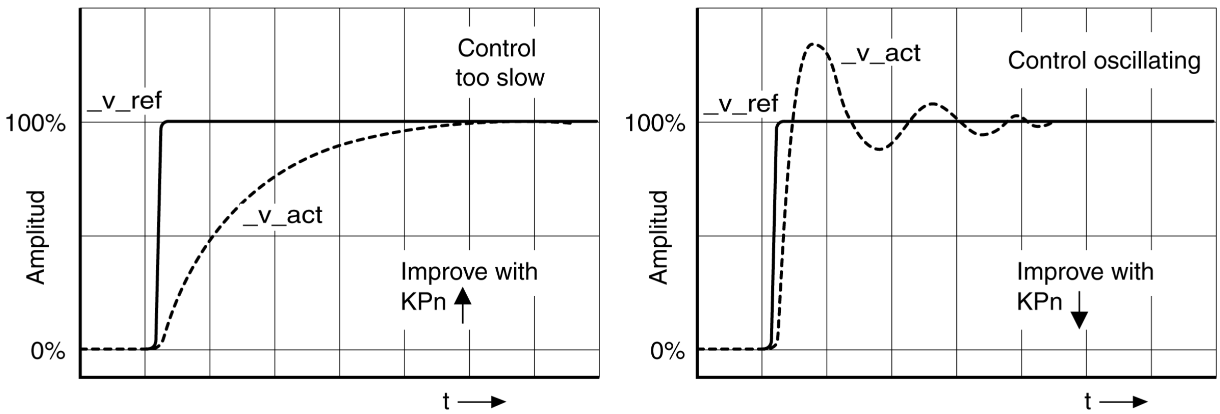
- Fast transient response
- Overshooting up to a maximum of 40%, 20%.

If the control performance does not correspond to the curve shown, change `CTRL_KPn` in increments of about 10% and then trigger another step function:

- If the control is too slow: Use a higher `CTRL1_KPn` (`CTRL2_KPn`) value.
- If the control tends to oscillate: Use a lower `CTRL1_KPn` (`CTRL2_KPn`) value.

Oscillation ringing is characterized by continuous acceleration and deceleration of the motor.

Optimizing insufficient velocity controller settings



Optimizing the Position Controller

General

An optimized velocity controller is a prerequisite for optimization of the position controller.

When tuning the position controller, you must optimize the P gain CTRL1_KPp (CTRL2_KPp):

- CTRL1_KPp (CTRL2_KPp) too high: Overshooting, instability
- CTRL1_KPp (CTRL2_KPp) too low: High position deviation

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen 3012:3$_h$ Modbus 4614
CTRL2_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen 3013:3$_h$ Modbus 4870

The step function moves the motor at constant velocity until the specified time has expired.

⚠ WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the velocity and the time do not exceed the available movement range.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Setting the Reference Value Signal

- Select Position Controller as the reference value in the commissioning software.
- Set the reference value signal:

- Signal type: "Step"
- Set the amplitude to approx. 1/10 motor revolution.

The amplitude is entered in user-defined units. With the default scaling, the resolution is 16384 user-defined units per motor revolution.

Selecting the Trace Signals

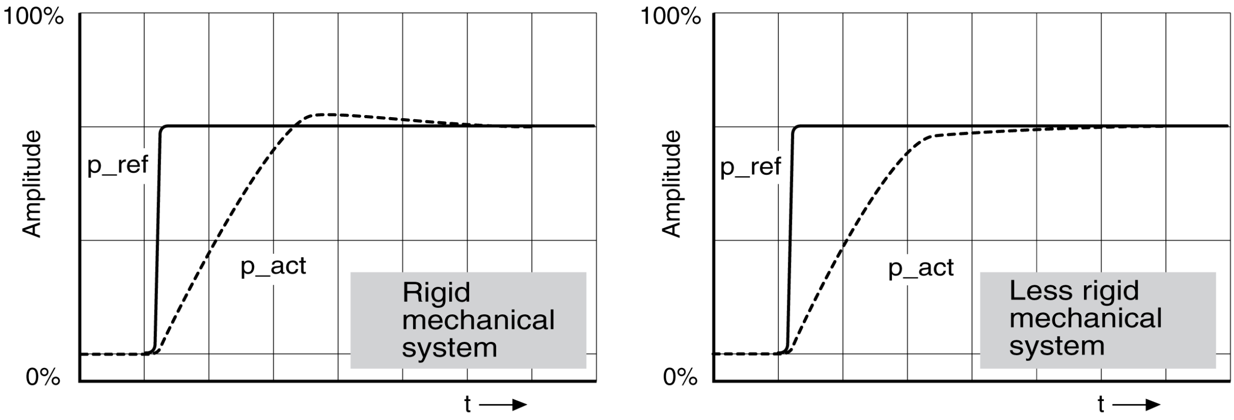
- Select the values in the box General Trace Parameters:

- Reference position of position controller _p_refusr (_p_ref)
- Actual position of position controller _p_actusr (_p_act)
- Actual velocity _v_act
- Reference value current _Iq_ref

Optimizing the Position Controller Value

- Trigger a step function with the default controller values.
- After the first test, verify the values achieved for `_v_act` and `_Iq_ref` for current control and velocity control. The values must not reach the current and velocity limitation range.

Step responses of a position controller with good control performance

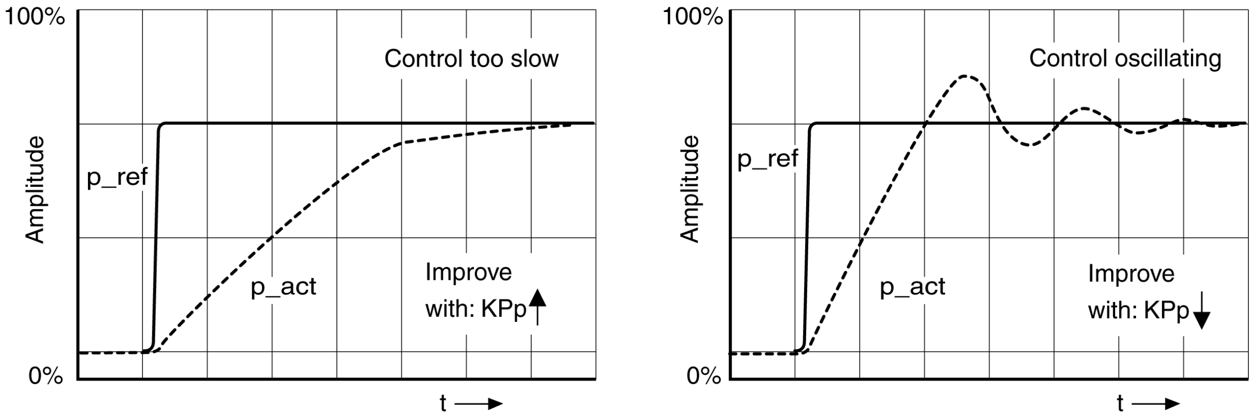


The p gain setting `CTRL1_KPp` (`CTRL2_KPp`) is optimal if the reference value is reached rapidly and with little or no overshooting.

If the control performance does not correspond to the curve shown, change the P gain `CTRL1_KPp` (`CTRL2_KPp`) in increments of approximately 10% and trigger another step function.

- If the control tends to oscillate: Use a lower KPp value.
- If the actual value is too slow reaching the reference value: Use a higher KPp value.

Optimizing inadequate position controller settings



Section 5.5
Parameter Management

What Is in This Section?

This section contains the following topics:

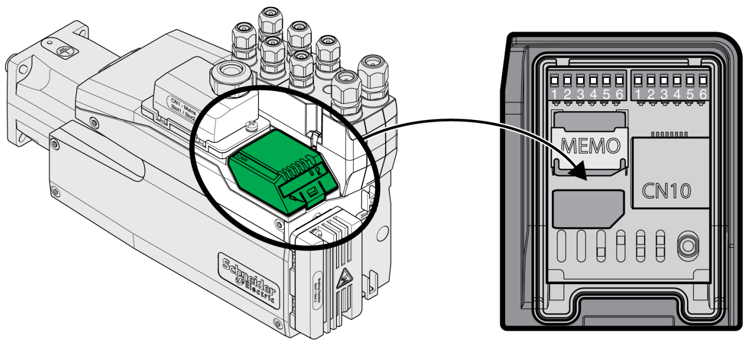
Memory Card

General

The devices features a card holder for a memory card. The parameters stored on the memory card can be transferred to other devices. If a device is replaced, a new device of the same type can be operated with identical parameters.

The content of the memory card is compared to the parameters stored in the device when the device is powered on.

When the parameters are written to the EEPROM, they are also saved to the memory card.



Note the following:

- Use only genuine accessory memory cards.
- Do not touch the gold contacts.
- The insert/remove cycles of the memory card are limited.
- The memory card can remain in the device.
- The memory card can only be removed from the device by pulling (not by pushing).

Inserting a Memory Card

- Power supply has been powered off.
- Place the memory card in front of the card holder. The slanted corner must be aligned as shown on the printed circuit board. Push the memory card into the device.
- Switch on the power supply.

Observe the memory card LED during the initialization of the device. See chapter Memory card LEDs *(see page 400)* for information on the meaning of the LED signals.

Writing Data to the Memory Card

The memory card is empty. Power supply has been powered off.

- Insert the memory card. The slanted corner must be aligned as shown on the printed circuit board.
- Switch on the power supply.

The device data is transferred to the memory card. Observe the memory card LED and the error memory of the device.

Transferring Data From the Memory Card to the Device

The memory card contains a parameter set of a device with the same fieldbus and of the same size. Power supply has been powered off.

- Insert the memory card. The slanted corner must be aligned as shown on the printed circuit board.
- Switch on the power supply.

The data on the memory card is transferred to the device. Observe the memory card LED and the error memory of the device.

- Check the fieldbus address settings.
- Switch the power supply off and on again to apply the new configuration.

Memory Card Has Been Removed

If there is no memory card in the device (or if the memory card has not been detected), the memory card LED is off.

Write Protection for Memory Card

It is possible to write-protect the memory card. For example, you may want to write-protect memory cards used for regular duplication of device data.

Memory cards are write-protected via the commissioning software.

Duplicating Existing Parameter Values

Application

Multiple devices are to have the same settings, for example, when devices are replaced.

Prerequisites

- Device type, motor type and firmware version must be identical.
- Tools for duplication:
  - Memory card
  - Commissioning software
- The controller supply must be powered on.

Duplication Using a Memory Card

Device settings can be stored on a memory card (accessories).

The stored device settings can be copied to a device of the same type. Note that the fieldbus address and the settings for the monitoring functions are copied along with this information.

Duplication Using the Commissioning Software

The commissioning software can save the settings of a device in the form of a configuration file. The stored device settings can be copied to a device of the same type. Note that the fieldbus address and the settings for the monitoring functions are copied along with this information.

See the manual for the commissioning software for additional information.

Resetting the User Parameters

The user parameters are reset by means of the parameter `PARuserReset`.

- Disconnect the drive from the fieldbus.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PARuserReset`	Reset user parameters **0 / No**: No **65535 / Yes**: Yes Bit 0: Set persistent user and control loop parameters to default values Bit 1: Reset Motion Sequence parameters to default values Bits 2 ... 15: Reserved The parameters are reset with the exception of: - Communication parameters - Inversion of direction of movement - Functions of digital inputs and outputs The new settings are not saved to the EEPROM. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 - 65535	UINT16 R/W - -	CANopen 3004:8$_h$ Modbus 1040

Resetting via the Commissioning Software

Use the menu items "Device -> User Functions -> Reset User Parameters" in the commissioning software to reset the user parameters.

If the device transitions to the operating state "**2** Not Ready To Switch On" after the user parameters are reset, the new settings only become active until after the device is powered off and on again.

Restoring Factory Settings

Description

The parameter values, both active and those saved in non-volatile memory, are lost in this process.

NOTICE
LOSS OF DATA Perform a backup of the drive parameters prior to restoring factory settings (factory established parameter values). **Failure to follow these instructions can result in equipment damage.**

The commissioning software allows you to save the parameter values set for a device as a configuration file. For information on saving the existing parameters in the drive, see chapter Parameter Management *(see page 190)*.

The factory settings can be restored via the commissioning software.

Factory Settings via Commissioning Software

Use the menu items **Device → User Functions → Restore Factory Settings** in the commissioning software to restore the factory settings.

The new settings only become active until after the device is powered off and on again.

Chapter 6
Operation

What Is in This Chapter?

This chapter contains the following sections:

Section 6.1
Access Channels

Access Channels

The product can be accessed via different types of access channels. Simultaneous access via multiple access channels or the use of exclusive access may cause unintended equipment operation.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION ● Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands. ● Verify that the use of exclusive access cannot cause unintended triggering or blocking of commands. ● Verify that the required access channels are available. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The product can be addressed via different access channels. Access channels are:

- Fieldbus
- Commissioning software
- Digital signal inputs

Only one access channel can have exclusive access to the product. An exclusive access can be provided via different access channels:

- Via a fieldbus:
  Exclusive access is provided to a fieldbus by blocking the other access channels with the parameter `AccessLock`.
- Via the commissioning software:
  The commissioning software receives exclusive access via the switch "Exclusive access" in position "On".

When the product is powered on, there is no exclusive access via an access channel.

The signal input functions "Halt", "Fault Reset", "Enable", "Positive Limit Switch (LIMP)", "Negative Limit Switch (LIMN)" and "Reference Switch (REF)" as well as the signals of the safety function STO (`STO_A` and `STO_B`) are always effective during exclusive access.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`AccessLock`	Locking other access channels Value 0: Allow control via other access channels Value 1: Lock control via other access channels Example: The access channel is used by the fieldbus. In this case, control via the commissioning software, for example, is not possible. The access channel can only be locked after the currently active operating mode has terminated. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3001:E$_h$ Modbus 284

Section 6.2
Control Mode

Control Mode

Overview

The control mode determines whether the operating states are changed and the operating modes started and changed via the signal inputs or via the fieldbus.

In local control mode, the operating states are changed and the operating modes started and changed via the digital signal inputs.

In fieldbus control mode, the operating states are changed and the operating modes started and changed via the fieldbus.

Availability

Available with firmware version ≥V01.06.

The following table provides an overview of the operating modes available in the different control modes.

Operating Mode	Local control mode	Fieldbus control mode
Jog	Available(1)	Available
Profile Torque	Not available	Available
Profile Velocity	Not available	Available
Profile Position	Not available	Available
Interpolated Position	Not available	Available
Homing	Not available	Available
Motion Sequence	Available(2)	Available(2)
(1) With firmware version ≥V01.06 (2) With firmware version ≥V01.08		

Setting the Control Mode

The parameter `DEVcmdinterf` lets you set the control mode.

- Set the desired control mode with the parameter `DEVcmdinterf`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DEVcmdinterf`	Control mode **1 / Local Control Mode**: Local control mode **2 / Fieldbus Control Mode**: Fieldbus control mode Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.06.	- - - -	UINT16 R/W per. -	CANopen 3005:1$_h$ Modbus 1282

Section 6.3
Movement Range

What Is in This Section?

This section contains the following topics:

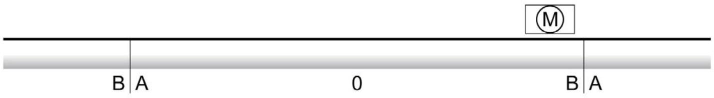
Size of the Movement Range

Description

The movement range is the maximum possible range within which a movement can be made to any position.

The actual position of the motor is the position in the movement range.

The figure below shows the movement range in user-defined units with the factory scaling.



A -268435456 user-defined units (usr_p)
B 268435455 user-defined units (usr_p)

Availability

The movement range is relevant in the following operating modes:
- Jog
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Zero Point of the Movement Range

The zero point is the point of reference for absolute movements in the operating modes Profile Position and Motion Sequence.

Valid Zero Point

The zero point of the movement range is set by means of a reference movement or by position setting.

A reference movement and position setting can be performed in the operating modes Homing and Motion Sequence.

In the case of a movement beyond the movement range (for example, a relative movement), the zero point becomes invalid.

Movement Beyond the Movement Range

Description

The behavior in the case of a movement beyond the movement range depends on the operating mode and the type of movement.

The following behavior is possible:

- In the case of a movement beyond the movement range, the movement range restarts.
- In the case of a movement with a target position outside of the movement range, position setting to 0 is performed before the movement is started.

The behavior can be set by means of the parameter `PP_ModeRangeLim`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PP_ModeRangeLim`	Absolute movement beyond movement range **0 / NoAbsMoveAllowed**: Absolute movement beyond movement range is not possible **1 / AbsMoveAllowed**: Absolute movement beyond movement range is possible Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	CANopen 3023:7_h Modbus 8974

Behavior for Operating Mode Jog (Continuous Movement)

Behavior for continuous movement beyond the movement range:

- The movement range restarts.

Behavior for Operating Mode Jog (Step Movement)

Behavior for step movement beyond the movement range:

- Parameter `PP_ModeRangeLim` = 1:
  The movement range restarts.
- Parameter `PP_ModeRangeLim` = 0:
  Internal position setting to 0.

Behavior for Operating Mode Profile Position (Relative Movement)

Behavior for relative movement beyond the movement range:

- Parameter `PP_ModeRangeLim` = 1:
  The movement range restarts.
  A relative movement is possible when the motor is at a standstill and during movements
- Parameter `PP_ModeRangeLim` = 0:
  Internal position setting to 0.
  A relative movement is only possible when the motor is at a standstill.

Behavior for Operating Mode Profile Position (Absolute Movement)

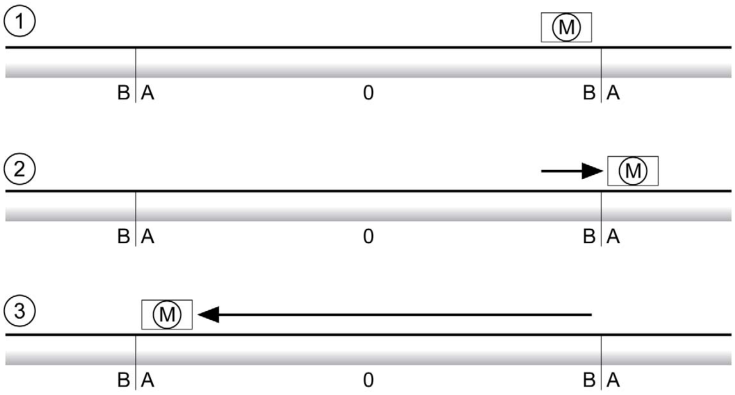
Behavior for absolute movement:

- Parameter `PP_ModeRangeLim` = 1:
  A absolute movement beyond the movement range is possible.
- Parameter `PP_ModeRangeLim` = 0:
  An absolute movement is made within the movement range. A absolute movement beyond the movement range is not possible.

Example:

Actual position: 268435000 user-defined units (usr_p)

Target position absolute: -268435000 user-defined units (usr_p)



A -268435456 user-defined units (usr_p)
B 268435455 user-defined units (usr_p)
1 Actual position: 268435000 user-defined units
2 Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 1
3 Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 0

Behavior for Operating Mode Motion Sequence (Move Relative and Move Additive)

Behavior for movement with Move Relative and Move Additive beyond the movement range:

- Parameter PP_ModeRangeLim = 1:
  The movement range restarts.
- Parameter PP_ModeRangeLim = 0:
  Internal position setting to 0.

Behavior for Operating Mode Motion Sequence (Move Absolute)

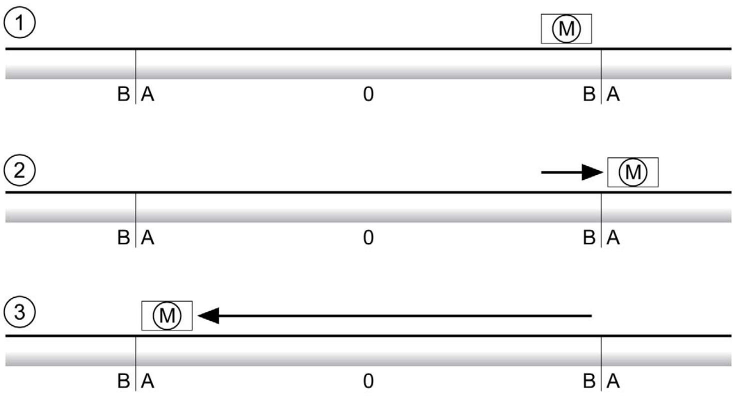
Behavior for a movement with Move Absolute:

- Parameter PP_ModeRangeLim = 1:
  A absolute movement beyond the movement range is possible.
- Parameter PP_ModeRangeLim = 0:
  An absolute movement is made within the movement range. A absolute movement beyond the movement range is not possible.

Example:

Actual position: 268435000 user-defined units (usr_p)

Target position absolute: -268435000 user-defined units (usr_p)



A -268435456 user-defined units (usr_p)
B 268435455 user-defined units (usr_p)
1 Actual position: 268435000 user-defined units
2 Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 1
3 Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 0

Setting a Modulo Range

Description

The modulo range supports applications with repeating arrangements of target positions (such as rotary indexing tables). The target positions are mapped to a parameterizable movement range.

For details see chapter Setting a Modulo Range *(see page 206)*.

Section 6.4
Modulo Range

What Is in This Section?

This section contains the following topics:

Setting a Modulo Range

Description

The modulo range supports applications with repeating arrangements of target positions (such as rotary indexing tables). The target positions are mapped to a parameterizable movement range.

Direction of Movement

The direction of movement for absolute target positions can be adjusted to meet the requirements of the application.

- Shortest distance
- Positive direction of movement only
- Negative direction of movement only

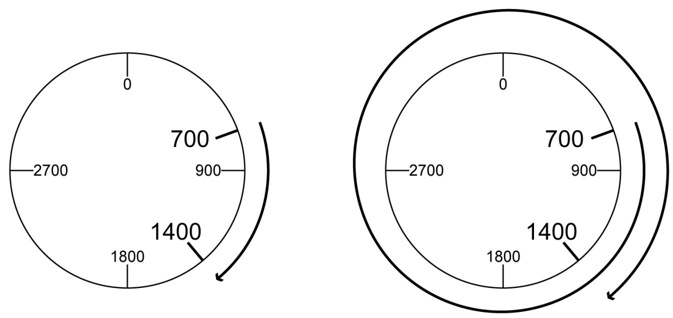
Multiple Modulo Range

In addition, it is possible to set a multiple modulo range for absolute target positions. A movement with an absolute target position beyond the modulo range is performed in a way as if several modulo ranges had been arranged one after the other.

Example:

- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p
- Target positions absolute: 5000 usr_p
- Left: Without multiple modulo range
  Right: With multiple modulo range

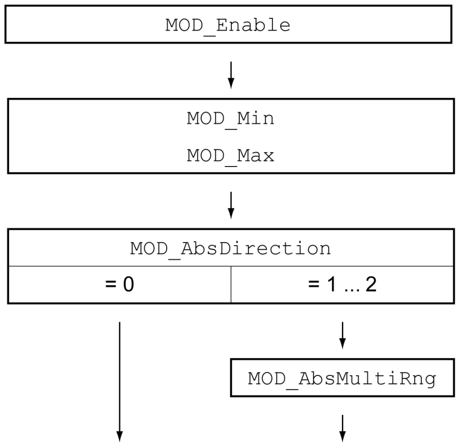
Multiple modulo range



Parameterization

Overview

Overview of parameters



Scaling

Using a modulo range requires the scaling to be adapted. The scaling of the motor must be adapted to the requirements of the application, see chapter Scaling *(see page 213)*.

Activation

The modulo range is activated with the parameter `MOD_Enable`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MOD_Enable`	Activation of Modulo function **0 / Modulo Off**: Modulo is off **1 / Modulo On**: Modulo is on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen $3006{:}38_h$ Modbus 1648

Modulo Range

The parameters `MOD_Min` and `MOD_Max` can be used to set the modulo range.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MOD_Min`	Minimum position of modulo range The minimum position value of the modulo range must be less than the maximum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	usr_p - 0 -	INT32 R/W per. -	CANopen $3006{:}39_h$ Modbus 1650

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MOD_Max`	Maximum position of modulo range The maximum position value of the modulo range must be greater than the minimum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	usr_p - 3600 -	INT32 R/W per. -	CANopen 3006:3A$_h$ Modbus 1652

Direction for Absolute Movements

The parameter `MOD_AbsDirection` lets you set the direction of movement for absolute movements.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MOD_AbsDirection`	Direction of absolute movement with Modulo **0 / Shortest Distance**: Movement with shortest distance **1 / Positive Direction**: Movement only in positive direction **2 / Negative Direction**: Movement only in negative direction If the parameter is set to 0, the drive calculates the shortest way to the new target position and starts the movement in the corresponding direction. If the distance to the target position is identical in positive and negative directions, the movement takes place in positive direction. Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3006:3B$_h$ Modbus 1654

Multiple Modulo Range for Absolute Movements

The parameter `MOD_AbsMultiRng` lets you set a multiple modulo range for absolute movements.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MOD_AbsMultiRng`	Multiple ranges for absolute movement with Modulo **0 / Multiple Ranges Off**: Absolute movement in one modulo range **1 / Multiple Ranges On**: Absolute movement in multiple modulo ranges Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:3C$_h$ Modbus 1656

Examples with Relative Movements

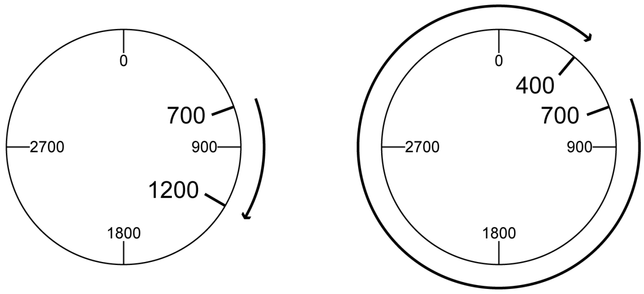
Assumptions

The settings below are assumed for the examples.

- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

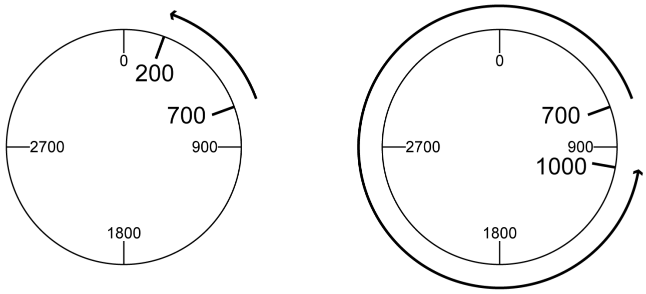
Example 1

Target positions relative: 500 usr_p and 3300 usr_p



Example 2

Target positions relative: -500 usr_p and -3300 usr_p



Examples with Absolute Movements and "Shortest Distance"

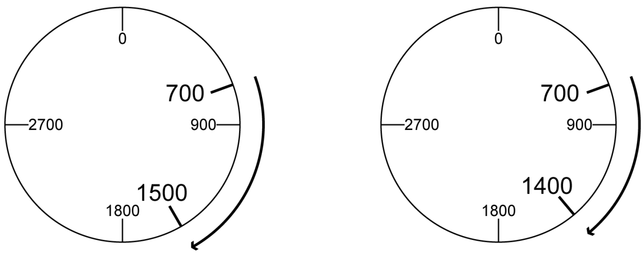
Assumptions

The settings below are assumed for the examples.

- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

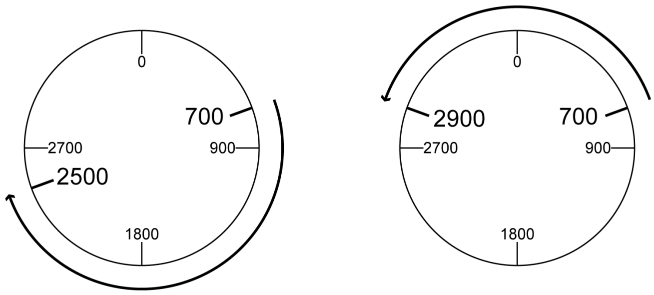
Example 1

Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Target positions absolute: 2500 usr_p and 2900 usr_p



Examples with Absolute Movements and "Positive Direction"

Assumptions

The settings below are assumed for the examples.

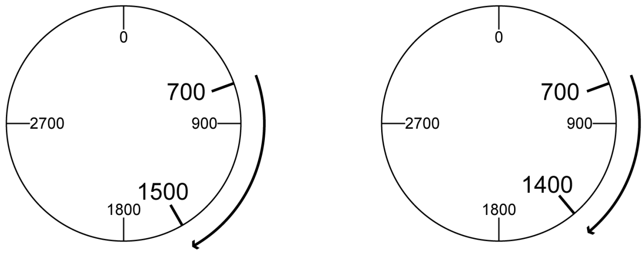
- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter `MOD_AbsDirection`: Positive Direction

Example 1

Parameter `MOD_AbsMultiRng`: Off

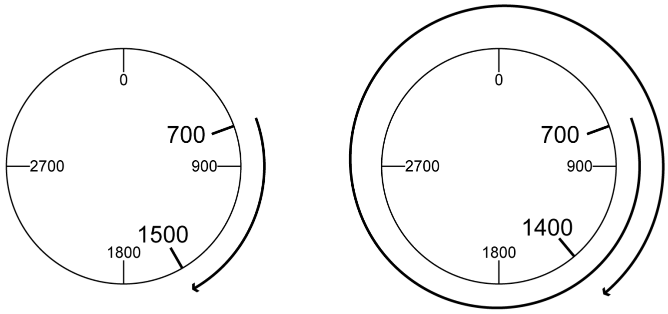
Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Parameter `MOD_AbsMultiRng`: On

Target positions absolute: 1500 usr_p and 5000 usr_p



Examples with Absolute Movements and "Negative Direction"

Assumptions

The settings below are assumed for the examples.

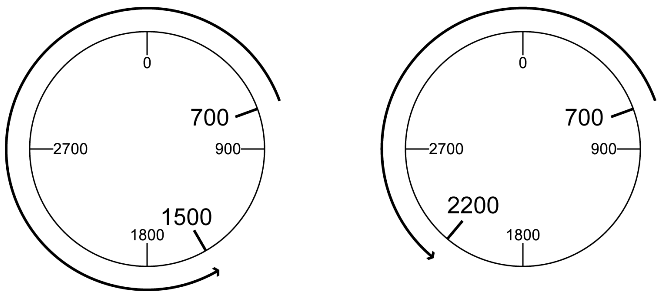
- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter `MOD_AbsDirection`: Negative Direction

Example 1

Parameter `MOD_AbsMultiRng`: Off

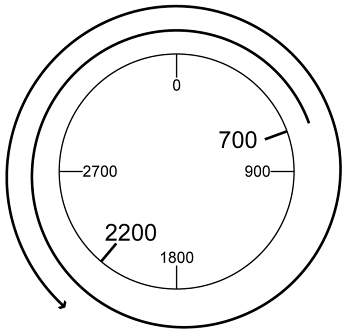
Target positions absolute: 1500 usr_p and -5000 usr_p



Example 2

Parameter `MOD_AbsMultiRng`: On

Target positions absolute: 1500 usr_p and -5000 usr_p



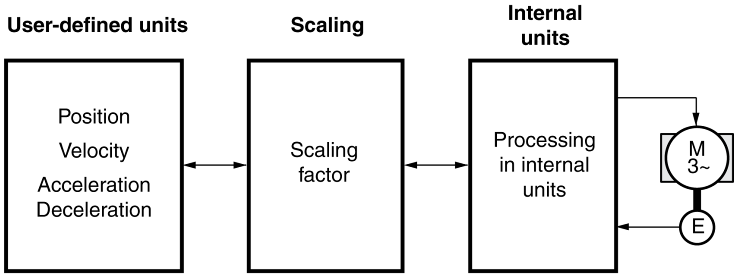
Section 6.5
Scaling

What Is in This Section?

This section contains the following topics:

General

Scaling converts user-defined units into internal units of the device, and vice versa.



User-Defined Units

Values for positions, velocities, acceleration and deceleration are specified in the following user-defined unit:

- usr_p for positions
- usr_v for velocities
- usr_a for acceleration and deceleration

Modifying the scaling modifies the ratio between user-defined units and internal units. After a modification to the scaling, one and the same value of a parameter specified in a user-defined unit causes a different movement than before the modification. A modification of the scaling affects all parameters whose values are specified in user-defined units.

⚠ WARNING
UNINTENDED MOVEMENT • Verify all parameters with user-defined units before modifying the scaling factor. • Verify that a modification of the scaling factor cannot cause unintended movements. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Scaling Factor

The scaling factor is the relationship between the motor movement and the required user-defined units.

Commissioning Software

You can adjust the scaling via the commissioning software. The parameters with user-defined units are automatically checked and adjusted.

Configuration of position scaling

Position scaling is the relationship between the number of motor revolutions and the required user-defined units (usr_p).

Scaling Factor

Position scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr\_p]}}$$

A new scaling factor is activated when you specify the numerator value.

With a scaling factor of < 1 / 131072, it is not possible to perform a movement outside of the movement range.

Factory Setting

The following factory settings are used:

- 1 motor revolution corresponds to 16384 user-defined units

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ScalePOSnum`	Position scaling: Numerator Specification of the scaling factor: Motor revolutions -- User-defined units [usr_p] A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	CANopen 3006:8$_h$ Modbus 1552
`ScalePOSdenom`	Position scaling: Denominator Refer to numerator (ScalePOSnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_p 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:7$_h$ Modbus 1550

Configuration of Velocity Scaling

Velocity scaling is the relationship between the number of motor revolutions per minute and the required user-defined units (usr_v).

Scaling Factor

Velocity scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolutions of the motor per minute}}{\text{Number of user-defined units [usr\_v]}}$$

Factory Setting

The following factory settings are used:

- 1 motor revolution per minute corresponds to 1 user-defined unit

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ScaleVELnum`	Velocity scaling: Numerator Specification of the scaling factor: Speed of rotation of motor [min-1] -- User-defined units [usr_v] A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	rpm 1 1 2147483647	INT32 R/W per. -	CANopen $3006:22_h$ Modbus 1604
`ScaleVELdenom`	Velocity scaling: Denominator See numerator (ScaleVELnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_v 1 1 2147483647	INT32 R/W per. -	CANopen $3006:21_h$ Modbus 1602

Configuration of Ramp Scaling

Ramp scaling is the relationship between the change in velocity and the required user-defined units (usr_a).

Scaling Factor

Ramp scaling is specified by means of scaling factor:

$$\frac{\text{Velocity change per second}}{\text{Number of user-defined units [usr\_a]}}$$

Factory Setting

The following factory settings are used:

- A change of 1 motor revolution per minute per second corresponds to 1 user-defined unit.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ScaleRAMPnum`	Ramp scaling: Numerator Setting can only be modified if power stage is disabled. Modified settings become active immediately.	rpm/s 1 1 2147483647	INT32 R/W per. -	CANopen 3006:31$_h$ Modbus 1634
`ScaleRAMPdenom`	Ramp scaling: Denominator See numerator (ScaleRAMPnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_a 1 1 2147483647	INT32 R/W per. -	CANopen 3006:30$_h$ Modbus 1632

Section 6.6
Digital Inputs and Outputs

What Is in This Section?

This section contains the following topics:

Parameterization of the Signal Input Functions

Signal Input Function

Various signal input functions can be assigned to the digital signal inputs.

Depending on the selected control mode and the selected operating mode, different signal input functions are assigned to the digital signal inputs.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the wiring is appropriate for the settings.
- Only start the system if there are no persons or obstructions in the zone of operation.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Factory Settings

The table below shows the factory settings of the digital signal inputs depending on the selected operating mode in local control mode:

Signal	Jog	Motion Sequence
DI0	Enable	Positive Limit Switch (LIMP)
DI1	Fault Reset	Negative Limit Switch (LIMN)
DI2	Jog negative	Enable
DI3	Jog positive	Start Motion Sequence

The table below shows the factory settings of the digital signal inputs in fieldbus control mode:

Signal	Signal input function
DI0	Positive Limit Switch (LIMP)
DI1	Negative Limit Switch (LIMN)
DI2	Reference Switch (REF)
DI3	Freely Available

Parameterization

The table below provides an overview of the possible signal input functions depending on the selected operating mode in local control mode:

Signal input function	Jog	Motion Sequence	Description in chapter
Freely Available	•	•	Setting a Signal Output via Parameter *(see page 339)*
Fault Reset	•	•	Changing the Operating State via Signal Inputs *(see page 255)*
Enable	•	•	Changing the Operating State via Signal Inputs *(see page 255)*
Halt	•	•	Stop Movement with Halt *(see page 332)*
Current Limitation	•	•	Limitation of the Current via Signal Inputs *(see page 337)*
Zero Clamp	•	•	Zero Clamp *(see page 338)*
Velocity Limitation	•	•	Limitation of the Velocity via Signal Inputs *(see page 336)*
Jog Positive	•		Operating Mode Jog *(see page 261)*
Jog Negative	•		Operating Mode Jog *(see page 261)*
Jog Fast/Slow	•		Operating Mode Jog *(see page 261)*
Start Single Data Set		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Select		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 0		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 1		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 2		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 3		•	Operating Mode Motion Sequence *(see page 306)*
Reference Switch (REF)		•	Reference Switch *(see page 354)*
Positive Limit Switch (LIMP)	•	•	Limit Switches *(see page 353)*
Negative Limit Switch (LIMN)	•	•	Limit Switches *(see page 353)*
Switch Controller Parameter Set	•	•	Switching Between Control Loop Parameter Sets *(see page 231)*
Velocity Controller Integral Off	•	•	Switching Between Control Loop Parameter Sets *(see page 231)*
Start Motion Sequence		•	Operating Mode Motion Sequence *(see page 306)*
Start Signal Of RMAC	•	•	Relative Movement After Capture (RMAC) *(see page 347)*
Activate RMAC	•	•	Relative Movement After Capture (RMAC) *(see page 347)*
Activate Operating Mode	•	•	Relative Movement After Capture (RMAC) *(see page 347)*
Data Set Bit 4		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 5		•	Operating Mode Motion Sequence *(see page 306)*
Data Set Bit 6		•	Operating Mode Motion Sequence *(see page 306)*
Release Holding Brake	•	•	Releasing the Holding Brake Manually *(see page 167)*

The table below provides an overview of the possible signal input functions in fieldbus control mode:

Signal input function	Description in chapter
Freely Available	Setting a Signal Output via Parameter *(see page 339)*
Fault Reset	Changing the Operating State via Signal Inputs *(see page 255)*
Enable	Changing the Operating State via Signal Inputs *(see page 255)*
Halt	Stop Movement with Halt *(see page 332)*
Start Profile Positioning	Starting a Movement via a Signal Input *(see page 340)*
Current Limitation	Limitation of the Current via Signal Inputs *(see page 337)*
Zero Clamp	Zero Clamp *(see page 338)*
Velocity Limitation	Limitation of the Velocity via Signal Inputs *(see page 336)*
Reference Switch (REF)	Reference Switch *(see page 354)*
Positive Limit Switch (LIMP)	Limit Switches *(see page 353)*
Negative Limit Switch (LIMN)	Limit Switches *(see page 353)*
Switch Controller Parameter Set	Switching Between Control Loop Parameter Sets *(see page 231)*
Velocity Controller Integral Off	Switching Between Control Loop Parameter Sets *(see page 231)*
Start Signal Of RMAC	Relative Movement After Capture (RMAC) *(see page 347)*
Activate RMAC	Relative Movement After Capture (RMAC) *(see page 347)*
Jog Positive With Enable	Operating Mode Jog *(see page 261)*
Jog Negative With Enable	Operating Mode Jog *(see page 261)*
Release Holding Brake	Releasing the Holding Brake Manually *(see page 167)*

The following parameters can be used to parameterize the digital signal inputs:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DI0`	Function Input DI0 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:1$_h$ Modbus 1794

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI1	Function Input DI1 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:2$_h$ Modbus 1796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DI2`	Function Input DI2 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:3$_h$ Modbus 1798

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DI3`	Function Input DI3 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:4$_h$ Modbus 1800

Parameterization of the Signal Output Functions

Signal Output Function

Various signal output functions can be assigned to the digital signal outputs.

Depending on the selected control mode and the selected operating mode, different signal output functions are assigned to the digital signal outputs.

In the case of a detected error the state of the signal outputs remains active according to assigned signal output function.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
• Verify that the wiring is appropriate for the settings. • Only start the system if there are no persons or obstructions in the zone of operation. • Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Factory Settings

The table below shows the factory settings of the digital signal outputs depending on the selected operating mode in local control mode:

Signal	Jog	Motion Sequence
`DQ0`	No Fault	Motion Sequence: Start Acknowledge
`DQ1`	Active	Active

The table below shows the factory settings of the digital signal outputs in fieldbus control mode:

Signal	Signal output function
`DQ0`	No Fault
`DQ1`	Active

Parameterization

The table below provides an overview of the possible signal output functions depending on the selected operating mode in local control mode:

Signal output function	Jog	Motion Sequence	Description in chapter
Freely Available	•	•	Setting a Signal Output via Parameter *(see page 339)*
No Fault	•	•	Indication of the Operating State via Signal Inputs *(see page 252)*
Active	•	•	Indication of the Operating State via Signal Inputs *(see page 252)*
RMAC Active Or Finished	•	•	Relative Movement After Capture (RMAC) *(see page 347)*
In Position Deviation Window	•	•	Position Deviation Window *(see page 372)*
In Velocity Deviation Window	•	•	Velocity Deviation Window *(see page 374)*
Velocity Below Threshold	•	•	Velocity Threshold Value *(see page 376)*
Current Below Threshold	•	•	Current Threshold Value *(see page 377)*
Halt Acknowledge	•	•	Stop Movement with Halt *(see page 332)*
Motion Sequence: Start Acknowledge		•	Operating Mode Motion Sequence *(see page 306)*

Signal output function	Jog	Motion Sequence	Description in chapter
Motor Standstill	•	•	Motor Standstill and Direction of Movement *(see page 362)*
Selected Error	•	•	Indicating Error Messages *(see page 404)*
Drive Referenced (ref_ok)		•	Operating Mode Homing *(see page 292)*
Selected Warning	•	•	Indicating Error Messages *(see page 404)*
Motion Sequence: Done		•	Operating Mode Motion Sequence *(see page 306)*
Position Register Channel 1		•	Position Register *(see page 367)*
Position Register Channel 2		•	Position Register *(see page 367)*
Position Register Channel 3		•	Position Register *(see page 367)*
Position Register Channel 4		•	Position Register *(see page 367)*
Motor Moves Positive	•	•	Motor Standstill and Direction of Movement *(see page 362)*
Motor Moves Negative	•	•	Motor Standstill and Direction of Movement *(see page 362)*

The table below provides an overview of the possible signal output functions in fieldbus control mode:

Signal output function	Description in chapter
Freely Available	Setting a Signal Output via Parameter *(see page 339)*
No Fault	Indication of the Operating State via Signal Inputs *(see page 252)*
Active	Indication of the Operating State via Signal Inputs *(see page 252)*
RMAC Active Or Finished	Relative Movement After Capture (RMAC) *(see page 347)*
In Position Deviation Window	Position Deviation Window *(see page 372)*
In Velocity Deviation Window	Velocity Deviation Window *(see page 374)*
Velocity Below Threshold	Velocity Threshold Value *(see page 376)*
Current Below Threshold	Current Threshold Value *(see page 377)*
Halt Acknowledge	Stop Movement with Halt *(see page 332)*
Motor Standstill	Motor Standstill and Direction of Movement *(see page 362)*
Selected Error	Indicating Error Messages *(see page 404)*
Drive Referenced (ref_ok)	Operating Mode Homing *(see page 292)*
Selected Warning	Indicating Error Messages *(see page 404)*
Position Register Channel 1	Position Register *(see page 367)*
Position Register Channel 2	Position Register *(see page 367)*
Position Register Channel 3	Position Register *(see page 367)*
Position Register Channel 4	Position Register *(see page 367)*
Motor Moves Positive	Motor Standstill and Direction of Movement *(see page 362)*
Motor Moves Negative	Motor Standstill and Direction of Movement *(see page 362)*

The following parameters can be used to parameterize the digital signal outputs:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DQ0`	Function Output DQ0 **1 / Freely Available**: Available as required **2 / No Fault**: Signals operating states Ready To Switch On, Switched On and Operation Enabled **3 / Active**: Signals operating state Operation Enabled **4 / RMAC Active Or Finished**: Relative movement after capture active or finished (RMAC) **5 / In Position Deviation Window**: Position deviation is within window **6 / In Velocity Deviation Window**: Velocity deviation is within window **7 / Velocity Below Threshold**: Motor velocity below threshold **8 / Current Below Threshold**: Motor current below threshold **9 / Halt Acknowledge**: Halt acknowledgement **11 / Motion Sequence: Start Acknowledge**: Motion Sequence: Acknowledgement of start request **13 / Motor Standstill**: Motor at a standstill **14 / Selected Error**: One of the specified errors of error classes 1 … 4 is active **15 / Valid Reference (ref_ok)**: Zero point is valid (ref_ok) **16 / Selected Warning**: One of the specified errors of error class 0 is active **17 / Motion Sequence: Done**: Motion Sequence: Sequence done **18 / Position Register Channel 1**: Position register channel 1 **19 / Position Register Channel 2**: Position register channel 2 **20 / Position Register Channel 3**: Position register channel 3 **21 / Position Register Channel 4**: Position register channel 4 **22 / Motor Moves Positive**: Motor moves in positive direction **23 / Motor Moves Negative**: Motor moves in negative direction Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:9$_h$ Modbus 1810

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DQ1	Function Output DQ1 **1 / Freely Available**: Available as required **2 / No Fault**: Signals operating states Ready To Switch On, Switched On and Operation Enabled **3 / Active**: Signals operating state Operation Enabled **4 / RMAC Active Or Finished**: Relative movement after capture active or finished (RMAC) **5 / In Position Deviation Window**: Position deviation is within window **6 / In Velocity Deviation Window**: Velocity deviation is within window **7 / Velocity Below Threshold**: Motor velocity below threshold **8 / Current Below Threshold**: Motor current below threshold **9 / Halt Acknowledge**: Halt acknowledgement **11 / Motion Sequence: Start Acknowledge**: Motion Sequence: Acknowledgement of start request **13 / Motor Standstill**: Motor at a standstill **14 / Selected Error**: One of the specified errors of error classes 1 … 4 is active **15 / Valid Reference (ref_ok)**: Zero point is valid (ref_ok) **16 / Selected Warning**: One of the specified errors of error class 0 is active **17 / Motion Sequence: Done**: Motion Sequence: Sequence done **18 / Position Register Channel 1**: Position register channel 1 **19 / Position Register Channel 2**: Position register channel 2 **20 / Position Register Channel 3**: Position register channel 3 **21 / Position Register Channel 4**: Position register channel 4 **22 / Motor Moves Positive**: Motor moves in positive direction **23 / Motor Moves Negative**: Motor moves in negative direction Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:A$_h$ Modbus 1812

Parameterization of Software Debouncing

Debounce Time

Signal input debouncing comprises hardware debouncing and software debouncing.

Hardware debounce time is permanently set, see Signals *(see page 26)*.

When a set signal function is changed and when the product is powered off and on again, software debouncing is reset to the factory setting.

The software debounce time can be set via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DI_0_Debounce`	Debounce time of DI0 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen $3008:20_h$ Modbus 2112
`DI_1_Debounce`	Debounce time of DI1 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen $3008:21_h$ Modbus 2114
`DI_2_Debounce`	Debounce time of DI2 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen $3008:22_h$ Modbus 2116
`DI_3_Debounce`	Debounce time of DI3 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen $3008:23_h$ Modbus 2118

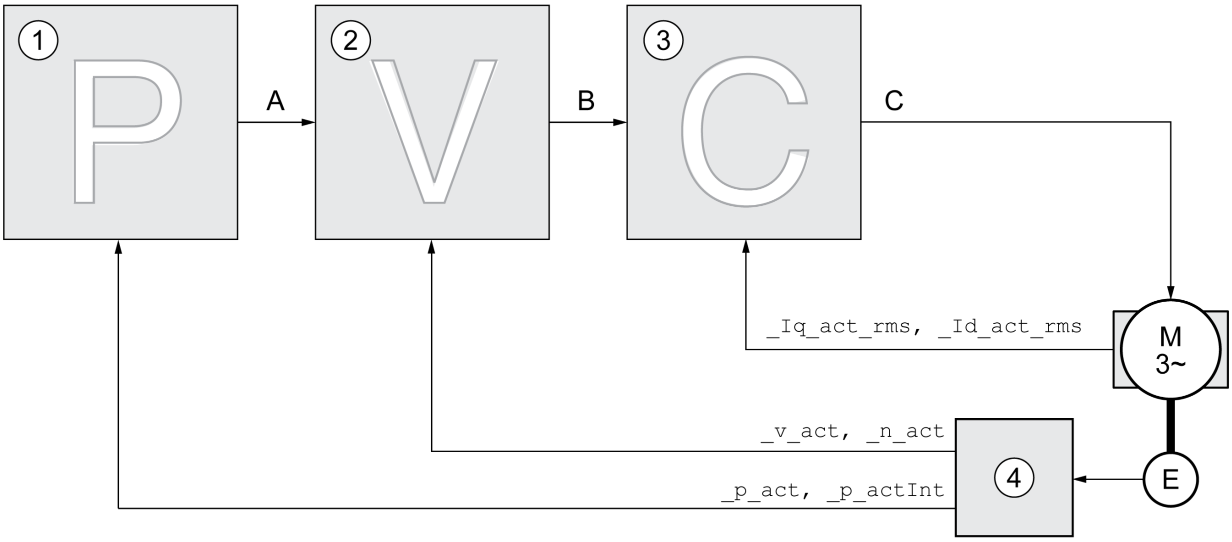
Section 6.7
Switching Between Control Loop Parameter Sets

What Is in This Section?

This section contains the following topics:

Overview of the Controller Structure

The illustration below provides an overview of the controller structure.



1 Position controller
2 Velocity controller
3 Current controller
4 Encoder evaluation

Position Controller

The position controller reduces the difference between the reference position and the actual position of the motor (position deviation) to a minimum. When the motor is at a standstill, the position deviation is close to zero in the case of a well-tuned position controller.

An optimized velocity control loop is a prerequisite for good amplification of the position controller.

Velocity Controller

The velocity controller controls the motor velocity by varying the motor current depending on the load situation. The velocity controller has a decisive influence on the dynamic response of the drive. The dynamics of the velocity controller depend on:

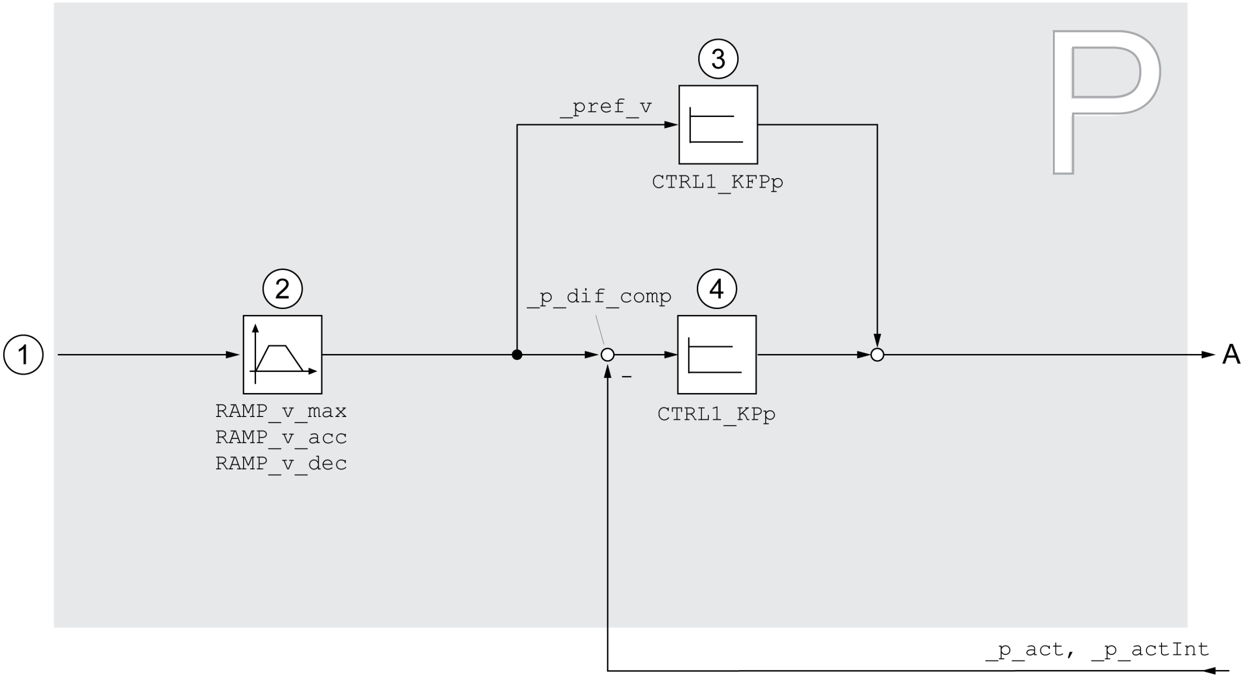
- Moment of inertia of the drive and the controlled system
- Power of the motor
- Stiffness and elasticity of the elements in the flow of forces
- Backlash of the drive elements
- Friction

Current Controller

The current controller determines the torque of the motor. The current controller is automatically optimally tuned with the stored motor data.

Overview of Position Controller

The illustration below provides an overview of the position controller.



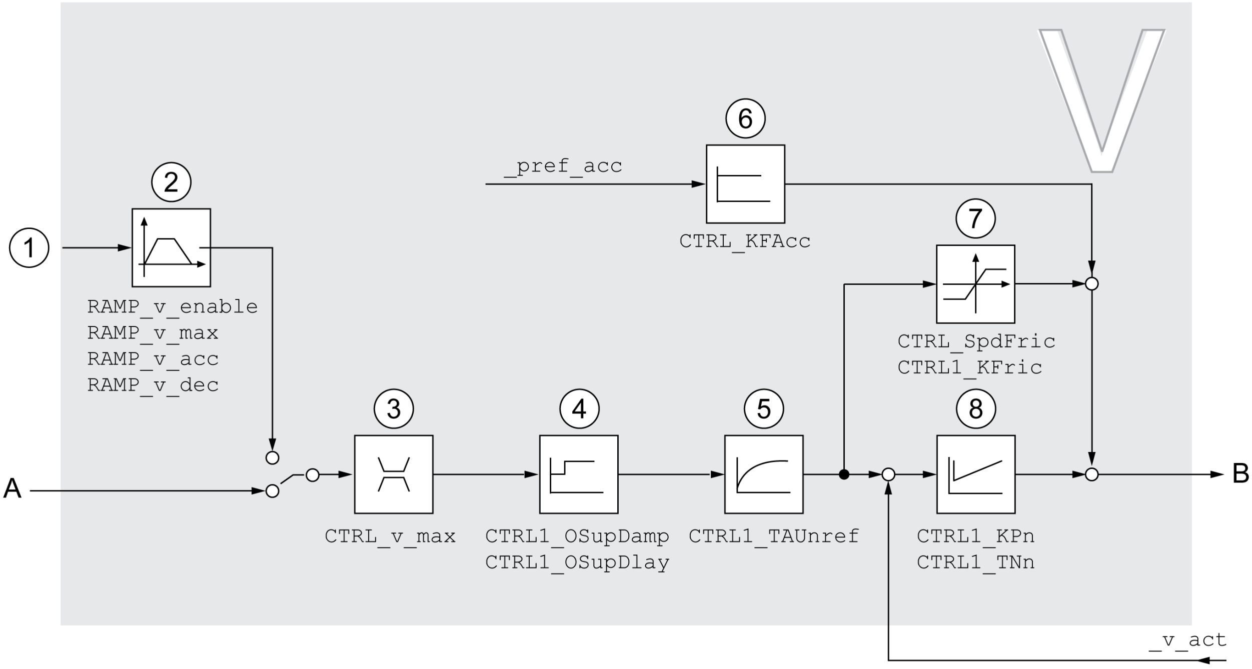
1 Target values for the operating modes Jog, Profile Position, Homing and Motion Sequence
2 Motion profile for the velocity
3 Velocity feed-forward control
4 Position controller

Sampling Period

The sampling period of the position controller is 250 µs.

Overview of Velocity Controller

The illustration below provides an overview of the velocity controller.



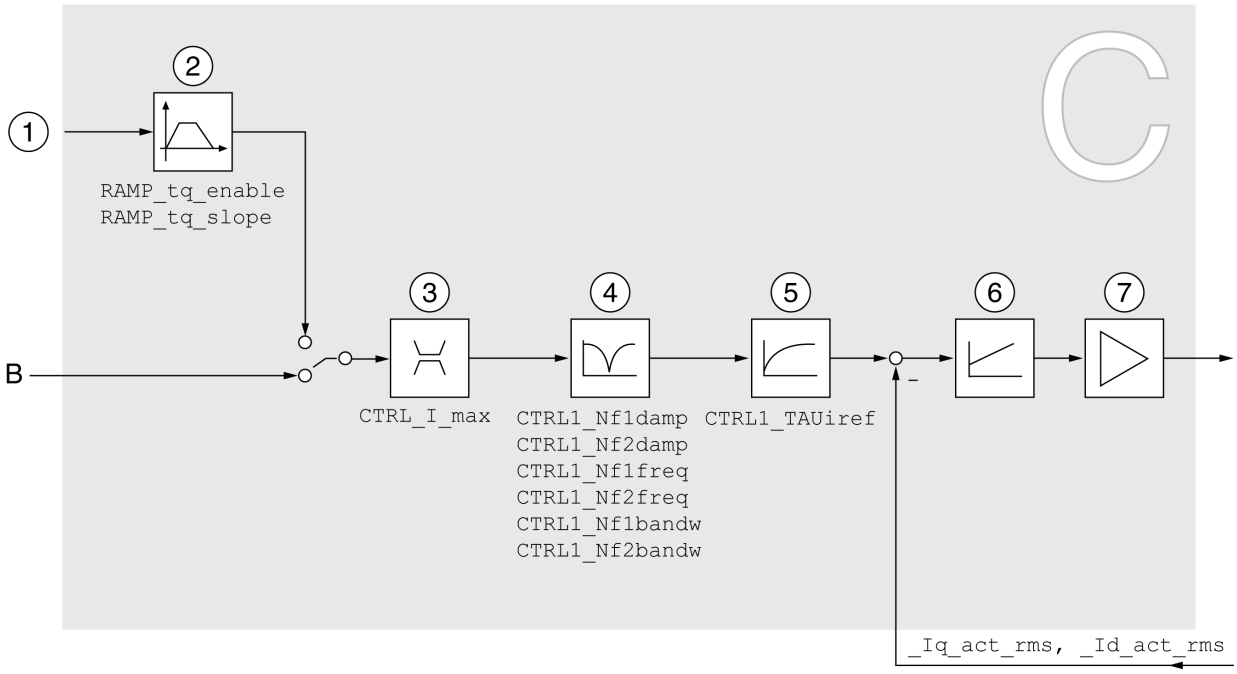
1 Target values for the operating mode Profile Velocity
2 Motion profile for the velocity
3 Velocity limitation
4 Overshoot suppression filter (parameter accessible in Expert mode)
5 Filter time constant of the reference velocity value filter
6 Acceleration feed forward control (parameter accessible in Expert mode)
7 Friction compensation (parameter accessible in Expert mode)
8 Velocity Loop Controller

Sampling Period

The sampling period of the velocity controller is 62.5 μs.

Overview of Current Controller

The illustration below provides an overview of the current controller.



1 Target values for the operating mode Profile Torque
2 Motion profile for the torque
3 Current limitation
4 Notch filter (parameter accessible in Expert mode)
5 Filter time constant of the reference current value filter
6 Current controller
7 Power stage

Sampling Period

The sampling period of the current controller is 62.5 µs.

Parameterizable Control Loop Parameters

Control Loop Parameter Set

The product features 2 control loop parameter sets that can be parameterized separately. The values for the control loop parameters determined during autotuning are stored in control loop parameter set 1.

A control loop parameter set consists of freely accessible parameters and parameters which are only accessible in Expert mode.

Control loop parameter set 1	Control loop parameter set 2
Freely accessible parameters: CTRL1_KPn CTRL1_TNn CTRL1_KPp CTRL1_TAUiref CTRL1_TAUnref CTRL1_KFPp Parameters only accessible in expert mode: CTRL1_Nf1damp CTRL1_Nf1freq CTRL1_Nf1bandw CTRL1_Nf2damp CTRL1_Nf2freq CTRL1_Nf2bandw CTRL1_Osupdamp CTRL1_Osupdelay CTRL1_Kfric	Freely accessible parameters: CTRL2_KPn CTRL2_TNn CTRL2_KPp CTRL2_TAUiref CTRL2_TAUnref CTRL2_KFPp Parameters only accessible in expert mode: CTRL2_Nf1damp CTRL2_Nf1freq CTRL2_Nf1bandw CTRL2_Nf2damp CTRL2_Nf2freq CTRL2_Nf2bandw CTRL2_Osupdamp CTRL2_Osupdelay CTRL2_Kfric

See chapters Control Loop Parameter Set 1 *(see page 243)* and Control Loop Parameter Set 2 *(see page 245)*.

Parameterization

- Selecting a control loop parameter set
  Select a control loop parameter set after switching on.
  See chapter Selecting a Control Loop Parameter Set *(see page 237)*.
- Automatically switching between control loop parameter sets
  It is possible to switch between the two control loop parameter sets.
  See chapter Automatically Switching Between Control Loop Parameter Sets *(see page 238)*.
- Copying a control loop parameter set
  The values of control loop parameter set 1 can be copied to control loop parameter set 2.
  See chapter Copying a Control Loop Parameter Set *(see page 241)*.
- Deactivating the integral term
  The integral term and, by implication, the integral action time, can be deactivated via a digital signal input.
  See chapter Deactivating the Integral Term *(see page 242)*.

Selecting a Control Loop Parameter Set

The active control loop parameter set is indicated via the parameter `_CTRL_ActParSet`.

The parameter `CTRL_PwrUpParSet` allows you to set the control loop parameter set to be activated after powering on. Alternatively, you can set whether or not the product is to switch automatically between the two control loop parameter sets.

The parameter `CTRL_SelParSet` allows you to switch between the two control loop parameter sets during operation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_CTRL_ActParSet`	Active control loop parameter set Value 1: Control loop parameter set 1 is active Value 2: Control loop parameter set 2 is active A control loop parameter set is active after the time for the parameter switching (CTRL_ParChgTime) has elapsed.	- - - -	UINT16 R/- - -	CANopen 3011:17$_h$ Modbus 4398
`CTRL_PwrUpParSet`	Selection of control loop parameter set at power up **0 / Switching Condition**: The switching condition is used for control loop parameter set switching **1 / Parameter Set 1**: Control loop parameter set 1 is used **2 / Parameter Set 2**: Control loop parameter set 2 is used The selected value is also written to CTRL_SelParSet (non-persistent). Modified settings become active immediately.	- 0 1 2	UINT16 R/W per. -	CANopen 3011:18$_h$ Modbus 4400
`CTRL_SelParSet`	Selection of control loop parameter set (non-persistent) Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen 3011:19$_h$ Modbus 4402

Automatically Switching Between Control Loop Parameter Sets

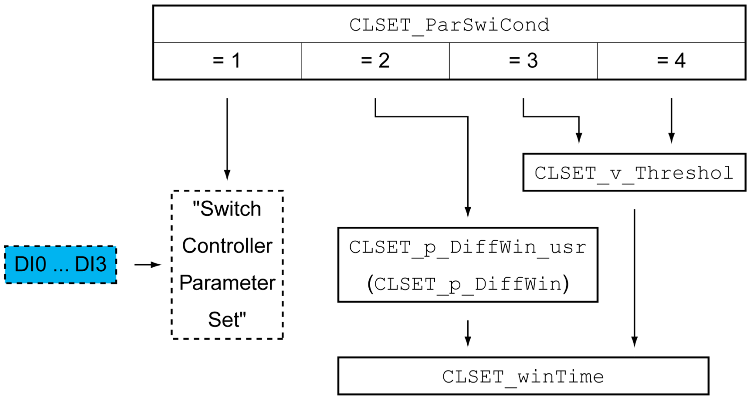
It is possible to automatically switch between the two control loop parameter sets.

The following criteria can be set for switching between the control loop parameter sets:

- Digital signal input
- Position deviation window
- Target velocity below parameterizable value
- Actual velocity below parameterizable value

Settings

The illustration below provides an overview of switching between the parameter sets.



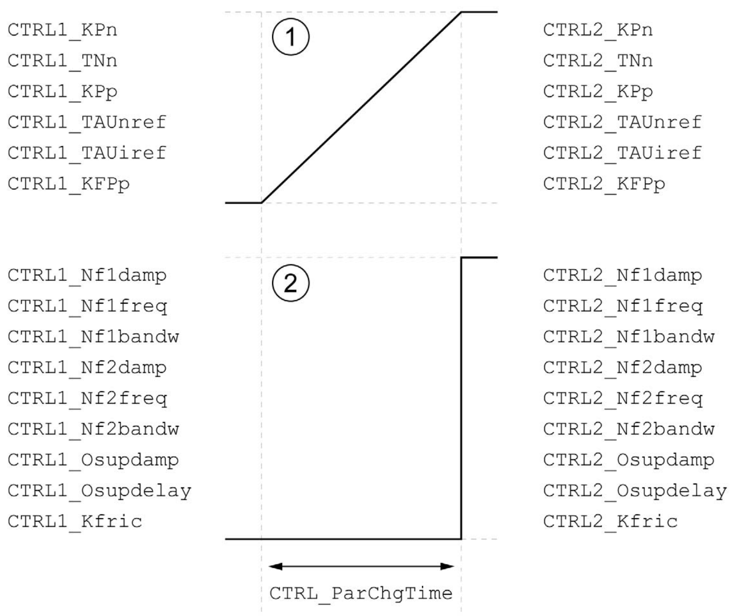
Time Chart

The freely accessible parameters are changed linearly. This linear change of the values of control loop parameter set 1 to the values of control loop parameter set 2 takes place during the parameterizable time `CTRL_ParChgTime`.

The parameters only accessible in Expert mode are directly changed to the values of the other control loop parameter set after the parameterizable time `CTRL_ParChgTime` has passed.

The figure below shows the time chart for switching the control loop parameters.

Time chart for switching the control loop parameter sets



1 Freely accessible parameters are changed linearly over time
2 Parameters which are only accessible in Expert mode are switched over directly

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_ParSwiCond	Condition for parameter set switching **0 / None Or Digital Input**: None or digital input function selected **1 / Inside Position Deviation**: Inside position deviation (value definition in parameter CLSET_p_DiffWin) **2 / Below Reference Velocity**: Below reference velocity (value definition in parameter CLSET_v_Threshol) **3 / Below Actual Velocity**: Below actual velocity (value definition in parameter CLSET_v_Threshol) **4 / Reserved**: Reserved In the case of parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp The following parameters are changed immediately after the time for parameter set switching (CTRL_ParChgTime): - CTRL_Nf1damp - CTRL_Nf1freq - CTRL_Nf1bandw - CTRL_Nf2damp - CTRL_Nf2freq - CTRL_Nf2bandw - CTRL_Osupdamp - CTRL_Osupdelay - CTRL_Kfric Modified settings become active immediately.	- 0 0 4	UINT16 R/W per. -	CANopen 3011:1A$_h$ Modbus 4404

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_p_DiffWin_usr	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 164 2147483647	INT32 R/W per. -	CANopen 3011:25$_h$ Modbus 4426
CLSET_p_DiffWin	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The parameter CLSET_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0100 2.0000	UINT16 R/W per. -	CANopen 3011:1C$_h$ Modbus 4408
CLSET_v_Threshol	Velocity threshold for control loop parameter set switching If the reference velocity or the actual velocity are less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. Modified settings become active immediately.	usr_v 0 50 2147483647	UINT32 R/W per. -	CANopen 3011:1D$_h$ Modbus 4410
CLSET_winTime	Time window for parameter set switching Value 0: Window monitoring deactivated. Value >0: Window time for the parameters CLSET_v_Threshol and CLSET_p_DiffWin. Modified settings become active immediately.	ms 0 0 1000	UINT16 R/W per. -	CANopen 3011:1B$_h$ Modbus 4406
CTRL_ParChgTime	Period of time for control loop parameter set switching In the case of control loop parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Such a switching can be caused by - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen 3011:14$_h$ Modbus 4392

Copying a Control Loop Parameter Set

The parameter CTRL_ParSetCopy allows you to copy the values of control loop parameter set 1 to control loop parameter set 2 or the values of control loop parameter set 2 to control loop parameter set 1.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_ParSetCopy	Control loop parameter set copying Value 1: Copy control loop parameter set 1 to set 2 Value 2: Copy control loop parameter set 2 to set 1 If control loop parameter set 2 is copied to control loop parameter set 1, the parameter CTRL_GlobGain is set to 100%. Modified settings become active immediately.	- 0.0 - 0.2	UINT16 R/W - -	CANopen 3011:16$_h$ Modbus 4396

Deactivating the Integral Term

The integral term of the velocity controller can be deactivated via the signal input function "Velocity Controller Integral Off". If the integral term is deactivated, the integral action time of the velocity controller (CTRL1_TNn and CTRL2_TNn) is implicitly and gradually reduced to zero. The time it takes to reduce the value to zero depends on the parameter CTRL_ParChgTime. In the case of vertical axes, the integral term is needed to reduce position deviations during standstill.

Control Loop Parameter Set 1

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen 3012:1$_h$ Modbus 4610
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3012:2$_h$ Modbus 4612
CTRL1_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen 3012:3$_h$ Modbus 4614
CTRL1_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	CANopen 3012:5$_h$ Modbus 4618
CTRL1_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen 3012:4$_h$ Modbus 4616
CTRL1_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	CANopen 3012:6$_h$ Modbus 4620

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen 3012:8$_h$ Modbus 4624
CTRL1_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen 3012:9$_h$ Modbus 4626
CTRL1_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen 3012:A$_h$ Modbus 4628
CTRL1_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen 3012:B$_h$ Modbus 4630
CTRL1_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen 3012:C$_h$ Modbus 4632
CTRL1_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen 3012:D$_h$ Modbus 4634
CTRL1_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	CANopen 3012:E$_h$ Modbus 4636
CTRL1_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	CANopen 3012:F$_h$ Modbus 4638
CTRL1_Kfric	Friction compensation: Gain In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	CANopen 3012:10$_h$ Modbus 4640

Control Loop Parameter Set 2

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen 3013:1$_h$ Modbus 4866
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3013:2$_h$ Modbus 4868
CTRL2_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen 3013:3$_h$ Modbus 4870
CTRL2_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	CANopen 3013:5$_h$ Modbus 4874
CTRL2_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen 3013:4$_h$ Modbus 4872
CTRL2_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	CANopen 3013:6$_h$ Modbus 4876

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen 3013:8$_h$ Modbus 4880
CTRL2_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen 3013:9$_h$ Modbus 4882
CTRL2_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen 3013:A$_h$ Modbus 4884
CTRL2_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen 3013:B$_h$ Modbus 4886
CTRL2_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen 3013:C$_h$ Modbus 4888
CTRL2_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen 3013:D$_h$ Modbus 4890
CTRL2_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	CANopen 3013:E$_h$ Modbus 4892
CTRL2_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	CANopen 3013:F$_h$ Modbus 4894
CTRL2_Kfric	Friction compensation: Gain In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	CANopen 3013:10$_h$ Modbus 4896

Chapter 7
Operating States and Operating Modes

What Is in This Chapter?

This chapter contains the following sections:

Section 7.1
Operating States

What Is in This Section?

This section contains the following topics:

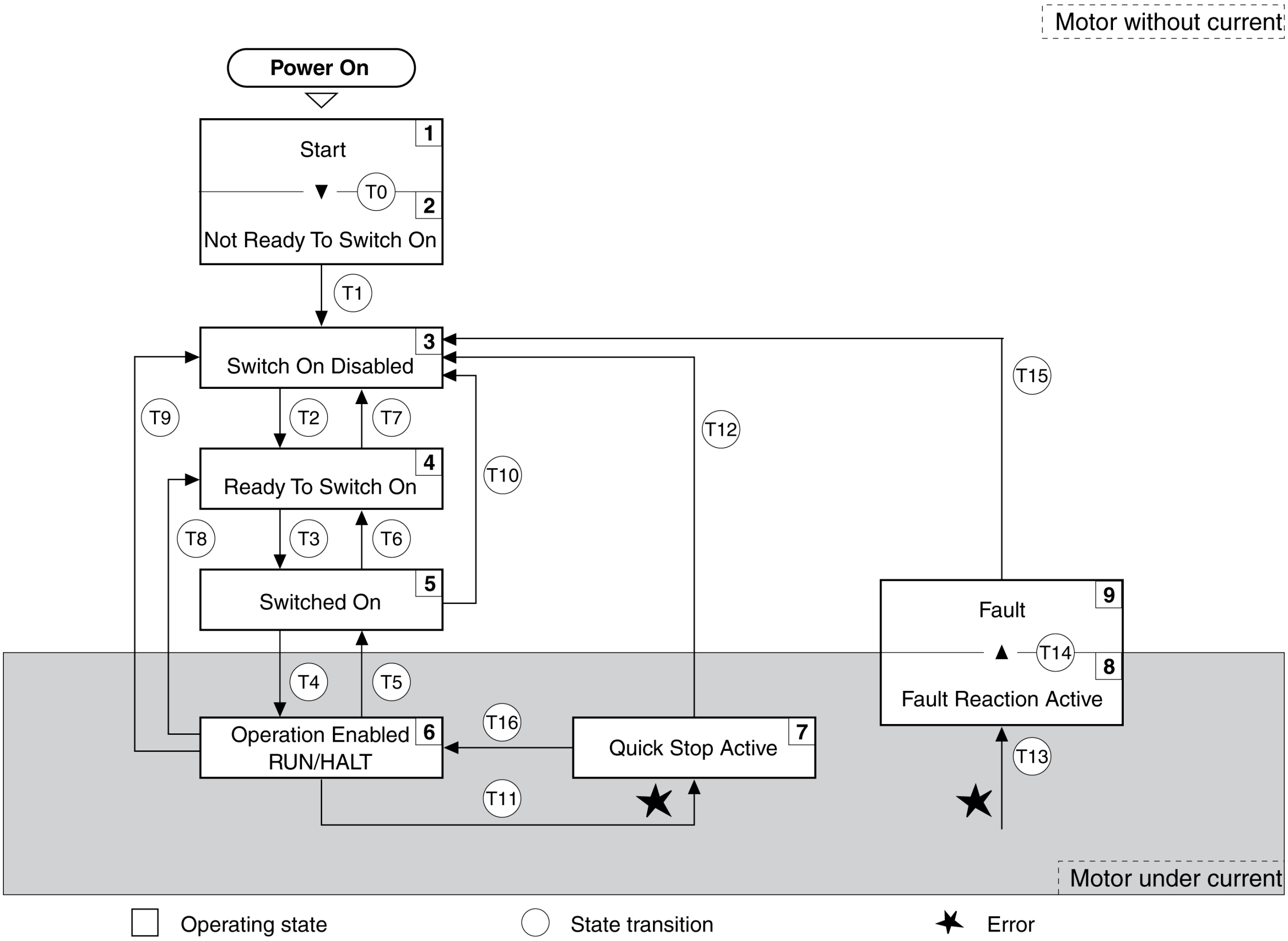
State Diagram and State Transitions

State Diagram

When the product is powered on and when an operating mode is started, the product goes through a number of operating states.

The state diagram (state machine) shows the relationships between the operating states and the state transitions.

The operating states are internally monitored and influenced by monitoring functions.



Operating States

Operating state	Description
1 Start	Electronics are initialized
2 Not Ready To Switch On	The power stage is not ready to switch on
3 Switch On Disabled	Impossible to enable the power stage
4 Ready To Switch On	The power stage is ready to switch on.
5 Switched On	Power stage is switched on
6 Operation Enabled	Power stage is enabled Selected operating mode is active
7 Quick Stop Active	"Quick Stop" is being executed
8 Fault Reaction Active	Error response is active
9 Fault	Error response terminated Power stage is disabled

Error Class

The errors are classified according to the following error classes:

Error class	State transition	Error response	Resetting an error message
0	-	No interruption of the movement	Function "Fault Reset"
1	T11	Stop movement with "Quick Stop"	Function "Fault Reset"
2	T13, T14	Stop movement with "Quick Stop" and disable the power stage when the motor has come to a standstill	Function "Fault Reset"
3	T13, T14	Disable the power stage immediately without stopping the movement first	Function "Fault Reset"
4	T13, T14	Disable the power stage immediately without stopping the movement first	Power cycle

Error Response

The state transition T13 (error class 2, 3 or 4) initiates an error response as soon as an internal occurrence signals an error to which the device must react.

Error class	Response
2	Movement is stopped with "Quick Stop" Holding brake is applied Power stage is disabled
3, 4 or Safety function STO	Power stage is immediately disabled

An error can be triggered by a temperature sensor, for example. The product cancels the current movement and triggers an error response. Subsequently, the operating state changes to **9** Fault.

Resetting an Error Message

A "Fault Reset" resets an error message.

In the event of a "Quick Stop" triggered by a detected error of class 1 (operating state **7** Quick Stop Active), a "Fault Reset" causes a direct transition to operating state **6** Operation Enabled.

State Transitions

State transitions are triggered by an input signal, a fieldbus command or as a response to a monitoring function.

State transition	Operating state	Condition / event(1)	Response
T0	1-> 2	• Device electronics successfully initialized	
T1	2-> 3	• Parameter successfully initialized	
T2	3 -> 4	• No undervoltage Encoder successfully checked Actual velocity: <1000 rpm STO signals = +24V Fieldbus command: Shutdown(2)	
T3	4 -> 5	• Request for enabling the power stage • Fieldbus command: Switch On or Enable Operation	
T4	5 -> 6	• Automatic transition • Fieldbus command: Enable Operation	Power stage is enabled. User parameters are checked. Holding brake is released (if available).
T5	6 -> 5	• Fieldbus command: Disable Operation	Movement is canceled with "Halt". Holding brake is applied (if available). Power stage is disabled.
T6	5 -> 4	• Fieldbus command: Shutdown	
(1) In order to trigger a state transition it is sufficient if one condition is met (2) Only required with fieldbus control mode and parameter `DS402compatib` = 1 (3) Possible only if operating state was triggered via the fieldbus			

State transition	Operating state	Condition / event[1]	Response
T7	**4** -> **3**	● Undervoltage ● STO signals = 0V ● Actual velocity: >1000 rpm (for example by external driving force) ● Fieldbus command: Disable Voltage	-
T8	**6** -> **4**	● Fieldbus command: Shutdown	Movement is canceled with "Halt" or power stage is immediately disabled. Can be set via parameter `DSM_ShutDownOption`.
T9	**6** -> **3**	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	For “Request for disabling the power stage”: Movement is canceled with "Halt" or power stage is immediately disabled. Can be set via parameter `DSM_ShutDownOption`. For “Fieldbus command: Disable Voltage”: Power stage is disabled immediately.
T10	**5** -> **3**	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	
T11	**6** -> **7**	● Error of error class 1 ● Fieldbus command: Quick Stop	Movement is canceled with "Quick Stop".
T12	**7** -> **3**	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	Power stage is disabled immediately, even if "Quick Stop" is still active.
T13	**x** -> **8**	● Error of error classes 2, 3 or 4	Error response is carried out, see "Error Response".
T14	**8** -> **9**	● Error response terminated (error class 2) ● Error of error classes 3 or 4	
T15	**9** -> **3**	● Function: "Fault Reset"	Error is reset (cause of error must have been corrected).
T16	**7** -> **6**	● Function: "Fault Reset" ● Fieldbus command: Enable Operation[3]	In the event of a "Quick Stop" triggered by a detected error of class 1, a "Fault Reset" causes a direct transition to the operating state **6** Operation Enabled.

(1) In order to trigger a state transition it is sufficient if one condition is met
(2) Only required with fieldbus control mode and parameter `DS402compatib` = 1
(3) Possible only if operating state was triggered via the fieldbus

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DSM_ShutDownOption`	Behavior for disabling the power stage during movement **0 / Disable Immediately**: Disable power stage immediately **1 / Disable After Halt**: Disable power stage after deceleration to standstill This parameter specifies the response to a power stage disable request. Halt is used for deceleration to standstill. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	INT16 R/W per. -	CANopen 605B:0_h Modbus 1684

Indication of the Operating State via Signal Outputs

Information on the operating state is available via the signal outputs. The table below provides an overview:

Operating state	Signal output function "No fault"(1)	Signal output function "Active"(2)
1 Start	0	0
2 Not Ready To Switch On	0	0
3 Switch On Disabled	0	0
4 Ready To Switch On	1	0
5 Switched On	1	0
6 Operation Enabled	1	1
7 Quick Stop Active	0	0
8 Fault Reaction Active	0	0
9 Fault	0	0
(1) The signal output function is factory setting for `DQ0` (2) The signal output function is the factory setting for `DQ1`		

Indication of the Operating State

Status Word

The parameter DCOMstatus provides information on the operating state of the device and the processing status of the operating mode.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DCOMstatus	DriveCom status word Bit assignments: Bit 0: Operating state Ready To Switch On Bit 1: Operating state Switched On Bit 2: Operating state Operation Enabled Bit 3: Operating state Fault Bit 4: Voltage Enabled Bit 5: Operating state Quick Stop Bit 6: Operating state Switch On Disabled Bit 7: Error of error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Target Reached Bit 11: Internal Limit Active Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	CANopen 6041:0$_h$ Modbus 6916

Bits 0, 1, 2, 3, 5 and 6

Bits 0, 1, 2, 3, 5 and 6 of the DCOMstatus parameter provide information on the operating state.

Operating state	Bit 6 Switch On Disabled	Bit 5 Quick Stop	Bit 3 Fault	Bit 2 Operation Enabled	Bit 1 Switch On	Bit 0 Ready To Switch On
2 Not Ready To Switch On	0	X	0	0	0	0
3 Switch On Disabled	1	X	0	0	0	0
4 Ready To Switch On	0	1	0	0	0	1
5 Switched On	0	1	0	0	1	1
6 Operation Enabled	0	1	0	1	1	1
7 Quick Stop Active	0	0	0	1	1	1
8 Fault Reaction Active	0	X	1	1	1	1
9 Fault	0	X	1	0	0	0

Bit 4

Bit 4=1 indicates whether the DC bus voltage is correct. If the voltage is insufficient, the device does not transition from operating state 3 to operating state 4.

Bit 7

Bit 7 is 1 if parameter _WarnActive contains an error message of error class 0. The movement is not interrupted. The bit remains set to 1 as long as the message is contained in parameter _WarnActive. The bit remains set to 1 for at least 100 ms, even if an error message of error class 0 is active for a shorter time. The bit is immediately reset to 0 in the case of a "Fault Reset".

Bit 8

Bit 8=1 indicates that a "Halt" is active.

Bit 9

If bit 9 is set to 1, the device carries out commands via the fieldbus. If Bit 9 is reset to 0, the device is controlled via a different access channel. In such a case, it is still possible to read or write parameters via the fieldbus.

Bit 10

Bit 10 is used for monitoring the operating mode. Details can be found in the chapters on the individual operating modes.

Bit 11

The meaning of bit 11 can be set via the parameter `DS402intLim`.

Bit 12

Bit 12 is used for monitoring the operating mode. Details can be found in the chapters on the individual operating modes.

Bit 13

Bit 13 is only set to 1 in the case of an error which needs to be corrected prior to further processing. The device responds corresponding to the error class.

Bit 14

Bit 14 changes to "0" if an operating mode is started. When processing is terminated or interrupted, for example by a "Halt", bit 14 toggles back to "1" once the motor has come to a standstill. The signal change of bit 14 to "1" is suppressed if one process is followed immediately by a new process in a different operating mode.

Bit 15

Bit 15 is set to 1 if the motor has a valid zero point, for example as a result of a reference movement. A valid zero point remains valid even if the power stage is disabled.

Changing the Operating State via Signal Inputs

Overview

It is possible to switch between operating states via the signal inputs.

- Signal input function "Enable"
- Signal input function "Fault Reset"
- Signal input functions "Jog Positive With Enable"
- Signal input functions "Jog Negative With Enable"

Signal Input Function "Enable"

The power stage is enabled by means of the signal input function "Enable".

"Enable"	State transition
Rising edge	Enable power stage (T3)
Falling edge	Disabling the power stage (T9 and T12)

In local control mode, the signal input function "Enable" is the factory setting for `DI0`.

In order to enable the power stage via the signal input in fieldbus control mode, you must first parameterize the signal input function "Enable", see chapter Digital Inputs and Outputs *(see page 218)*.

With the parameter `IO_FaultResOnEnaInp`, it is possible to also reset an error message with a rising or a falling edge at the signal input.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_FaultResOnEnaInp`	Additional 'Fault Reset' for the signal input function 'Enable' **0 / Off**: No additional 'Fault Reset' **1 / OnFallingEdge**: Additional 'Fault Reset' with falling edge **2 / OnRisingEdge**: Additional 'Fault Reset' with rising edge Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:34$_h$ Modbus 1384

Signal Input Function "Fault Reset"

The signal input function "Fault Reset" is used to reset an error message.

"Fault Reset"	State transition
Rising edge	Resetting an error message (T15 and T16)

In local control mode, the signal input function "Fault Reset" is the factory setting for `DI1`.

In order to reset an error message via the signal input in fieldbus control mode, you must first parameterize the signal input function "Fault Reset", see chapter Digital Inputs and Outputs *(see page 218)*.

Signal Input Function "Jog Positive With Enable"

The signal input function "Jog Positive With Enable" enables the power stage, starts the operating mode Jog and triggers a movement in positive direction.

"Jog Positive With Enable"	State transition
Rising edge	Enable power stage (T3) Automatic change to the operating mode Jog and start of a movement in positive direction. See chapter Operating Mode Jog *(see page 261)* for details and parameterization.
Falling edge	Stopping the movement. Disabling the power stage (T9 and T12)

Signal Input Function "Jog Negative With Enable"

The signal input function "Jog Negative With Enable" enables the power stage, starts the operating mode Jog and triggers a movement in negative direction.

"Jog Negative With Enable"	State transition
Rising edge	Enable power stage (T3) Automatic change to the operating mode Jog and start of a movement in negative direction. See chapter Operating Mode Jog *(see page 261)* for details and parameterization.
Falling edge	Stopping the movement. Disabling the power stage (T9 and T12)

Changing the Operating State

Control Word

It is possible to switch between operating states via the parameter `DCOMcontrol`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DCOMcontrol`	DriveCom control word See chapter Operation, Operating States, for bit assignment information. Bit 0: Operating state Switch On Bit 1: Enable Voltage Bit 2: Operating state Quick Stop Bit 3: Enable Operation Bits 4 … 6: Operating mode-specific Bit 7: Fault Reset Bit 8: Halt Bit 9: Operating mode-specific Bits 10 … 15: Reserved (must be 0) Modified settings become active immediately.	- - - -	UINT16 R/W - -	CANopen 6040:0$_h$ Modbus 6914

Bits 0, 1, 2, 3 and 7

Bits 0, 1, 2, 3 and 7 of the parameter `DCOMcontrol` allow you to switch between the operating states.

Fieldbus command	State transitions	State transition to	Bit 7 Fault Reset	Bit 3 Enable Operation	Bit 2 Quick Stop	Bit 1 Enable Voltage	Bit 0 Switch On
Shutdown	T2, T6, T8	**4** Ready To Switch On	0	X	1	1	0
Switch On	T3	**5** Switched On	0	0	1	1	1
Disable Voltage	T7, T9, T10, T12	**3** Switch On Disabled	0	X	X	0	X
Quick Stop	T7, T10 T11	**3** Switch On Disabled **7** Quick Stop Active	0	X	0	1	X
Disable Operation	T5	**5** Switched On	0	0	1	1	1
Enable Operation	T4, T16	**6** Operation Enabled	0	1	1	1	1
Fault Reset	T15	**3** Switch On Disabled	0->1	X	X	X	X

Bits 4 ... 6

Bits 4 to 6 are used for the operating mode-specific settings. Details can be found in the descriptions of the individual operating modes in this chapter.

Bit 8

Bit 8 is used to trigger a "Halt". Set bit 8 to 1 to stop a movement with "Halt".

Bit 9

Bit 9 is used for the operating mode-specific settings. Details can be found in the descriptions of the individual operating modes in this chapter.

Bits 10 ... 15

Reserved.

Section 7.2
Indicating, Starting and Changing an Operating Mode

Starting and Changing an Operating Mode

Starting the Operating Mode

In local control mode, the parameter `IOdefaultMode` is used to set the desired operating mode.

The set operating mode is automatically started by enabling the power stage.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOdefaultMode`	Operating mode **0 / None**: None **5 / Jog**: Jog **6 / Motion Sequence**: Motion Sequence Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.06.	- 0 5 6	UINT16 R/W per. -	CANopen 3005:3$_h$ Modbus 1286

In fieldbus control mode, the desired operating mode is set via the fieldbus.

The parameter `DCOMopmode` is used to set the operating mode for fieldbus control mode:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DCOMopmode`	Operating mode **-6 / Manual Tuning / Autotuning**: Manual Tuning or Autotuning **-3 / Motion Sequence**: Motion Sequence **-1 / Jog**: Jog **0 / Reserved**: Reserved **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **4 / Profile Torque**: Profile Torque **6 / Homing**: Homing **7 / Interpolated Position**: Interpolated Position **8 / Cyclic Synchronous Position**: Cyclic Synchronous Position **9 / Cyclic Synchronous Velocity**: Cyclic Synchronous Velocity **10 / Cyclic Synchronous Torque**: Cyclic Synchronous Torque Modified settings become active immediately. * Datatype for CANopen: INT8	- -6 - 10	INT16* R/W - -	CANopen 6060:0$_h$ Modbus 6918

The parameter _DCOMopmode_act can be used to read the operating mode:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DCOMopmd_act	Active operating mode **-6 / Manual Tuning / Autotuning**: Manual Tuning / Autotuning **-3 / Motion Sequence**: Motion Sequence **-1 / Jog**: Jog **0 / Reserved**: Reserved **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **4 / Profile Torque**: Profile Torque **6 / Homing**: Homing **7 / Interpolated Position**: Interpolated Position **8 / Cyclic Synchronous Position**: Cyclic Synchronous Position **9 / Cyclic Synchronous Velocity**: Cyclic Synchronous Velocity **10 / Cyclic Synchronous Torque**: Cyclic Synchronous Torque * Datatype for CANopen: INT8	- -6 - 10	INT16* R/- - -	CANopen 6061:0_h Modbus 6920

Starting the Operating Mode via Signal Input

As of firmware version ≥V01.06, the signal input function "Activate Operating Mode" is available in local control mode.

This means that you can start the set operating mode via a signal input.

If the signal input function "Activate Operating Mode" has been set, the operating mode is not started automatically when the power stage is enabled. The operating mode is only started when a rising edge is available at the edge.

In order to start the set operating mode via a signal input, you must first parameterize the signal input function "Activate Operating Mode", see chapter Digital Inputs and Outputs *(see page 218)*.

Changing the Operating Mode

The operating mode can be changed after the active operating mode has been terminated.

In addition, it is also possible to change the operating mode during a running movement; however, this is only possible in certain operating modes.

Changing the Operating Mode During a Movement

You can switch between the following operating modes during a running movement.

- Jog
- Profile Torque
- Profile Velocity
- Profile Position

The operating mode can be changed while the motor is at a standstill or while the motor is not at a standstill, depending on the new operating mode.

Operating mode to be changed to	Motor standstill
Jog	With motor standstill
Profile Torque	Without motor standstill
Profile Velocity	Without motor standstill
Profile Position	Drive profile Drive Profile Lexium: Adjustable via parameter `PP_OpmChgType` Drive profile DS402: With motor standstill(1)
(1) Parameter `PP_OpmChgType` must be set to the value 0.	

The motor is decelerated to a standstill via the ramp set in the parameter `LIM_HaltReaction`, see chapter Stop Movement with Halt *(see page 332)*.

Section 7.3
Operating Mode Jog

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode *(see page 199)*.

Description

In the operating mode Jog, a movement is made from the actual motor position in the specified direction.

A movement can be made using one of 2 methods:

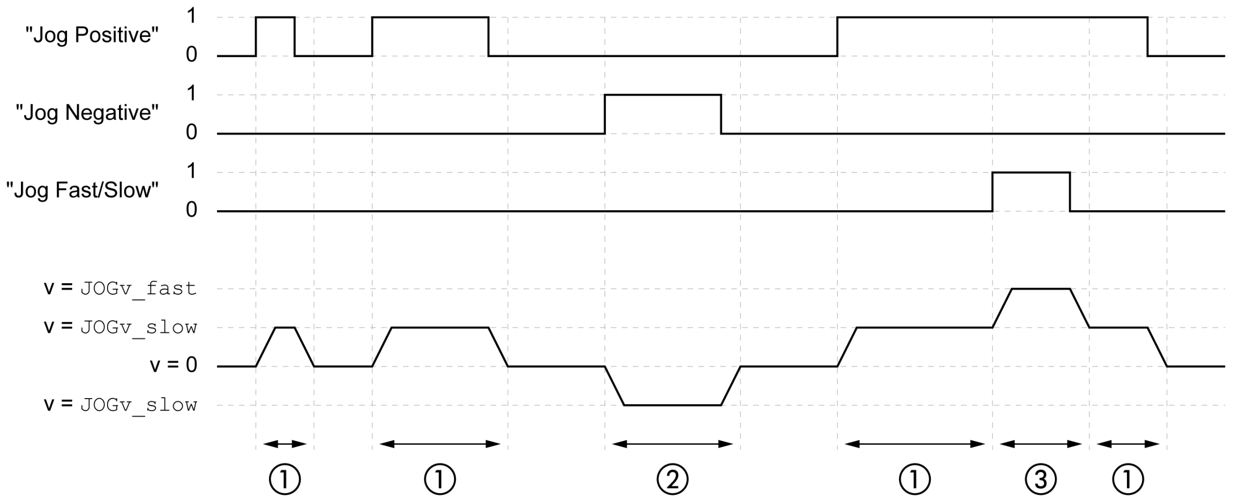
- Continuous movement
- Step movement

In addition, the product features 2 parameterizable velocities.

Continuous Movement

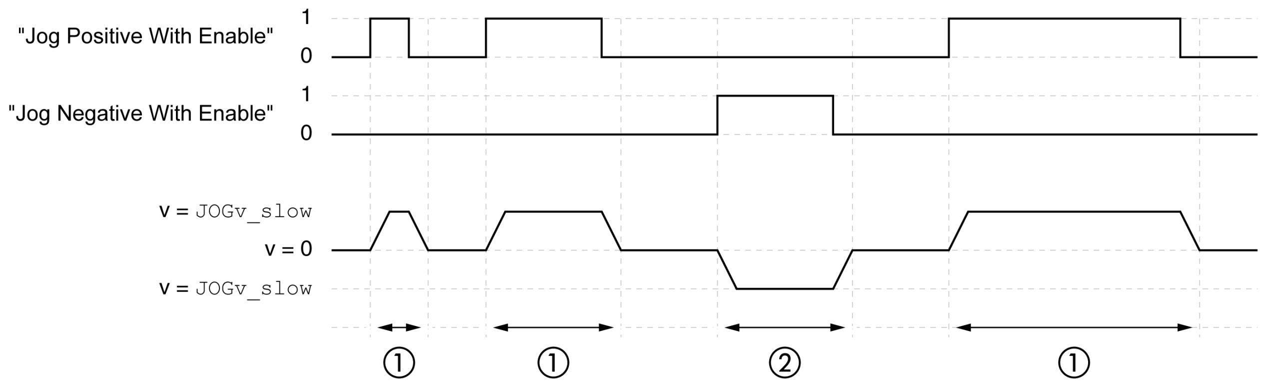
As long as the signal for the direction is available, a continuous movement is made in the desired direction.

The illustration below provides an overview of continuous movement via the signal inputs in local control mode:



1 Slow movement in positive direction
2 Slow movement in negative direction
3 Fast movement in positive direction

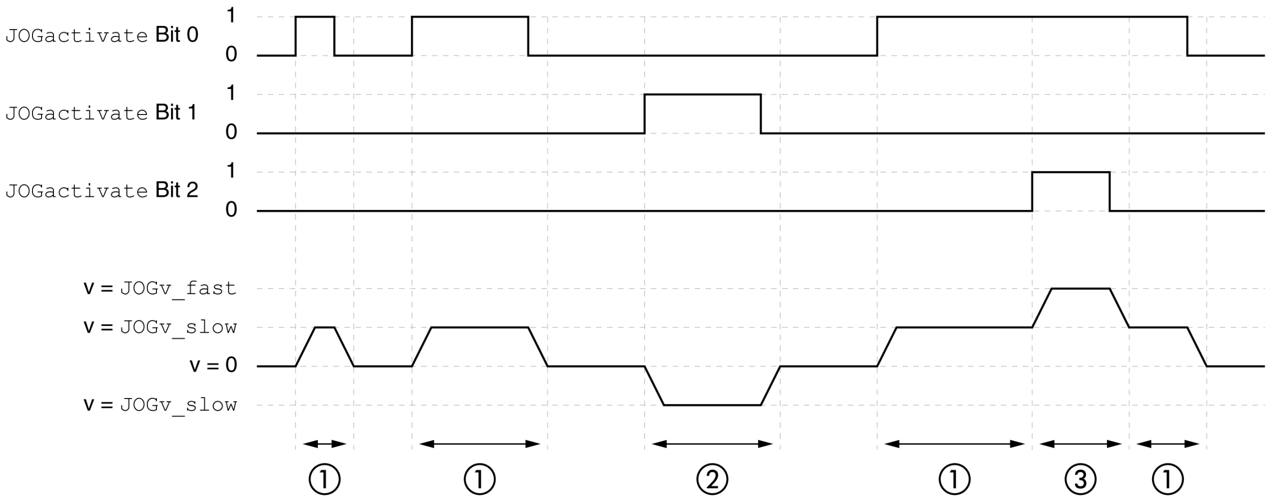
The illustration below provides an overview of continuous movement via the signal inputs in fieldbus control mode:



1 Slow movement in positive direction
2 Slow movement in negative direction

The signal input functions “Jog Positive With Enable” and/or “Jog Negative With Enable” must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

The illustration below provides an overview of continuous movement via the fieldbus in fieldbus control mode:



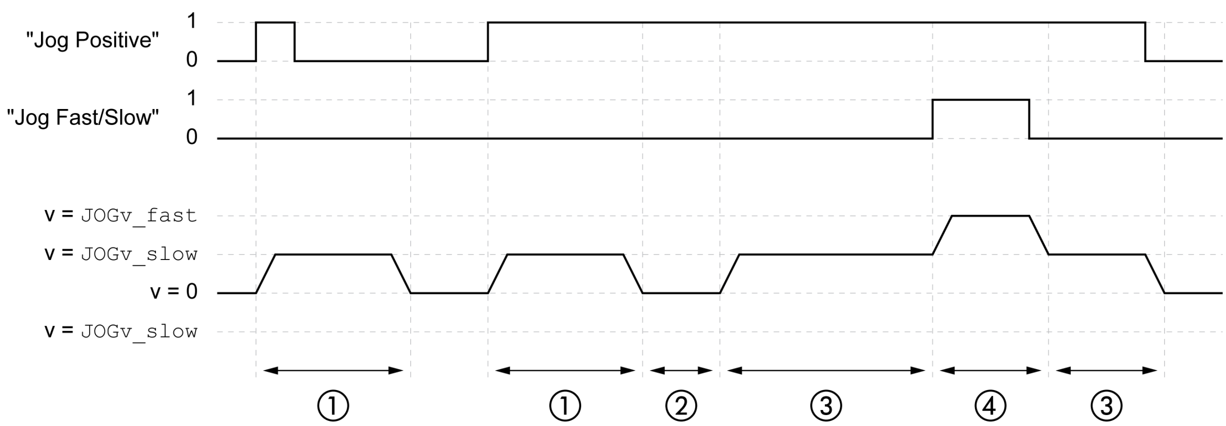
1 Slow movement in positive direction
2 Slow movement in negative direction
3 Fast movement in positive direction

Step Movement

If the signal for the direction is available for a short period of time, a movement with a parameterizable number of user-defined units is made in the desired direction.

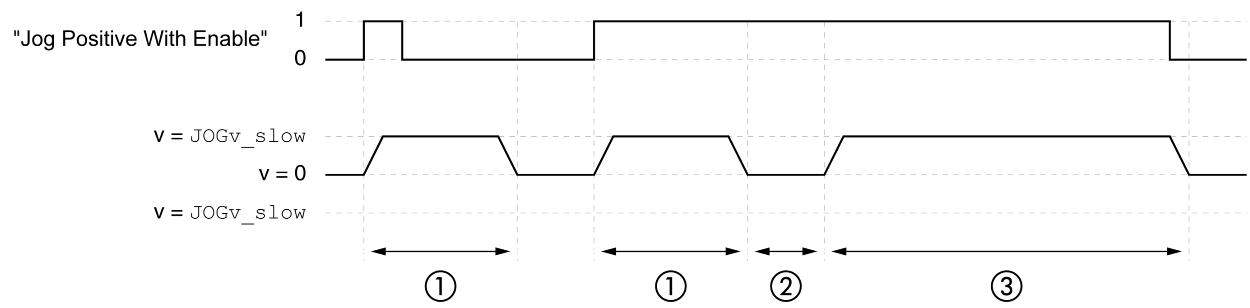
If the signal for the direction is available continuously, a movement with a parameterizable number of user-defined units is made in the desired direction. After this movement, the motor stops for a defined period of time. Then a continuous movement is made in the desired direction.

The illustration below provides an overview of step movement via the signal inputs in local control mode:



1 Slow movement in positive direction with a parameterizable number of user-defined units JOGstep
2 Waiting time JOGtime
3 Slow continuous movement in positive direction
4 Fast continuous movement in positive direction

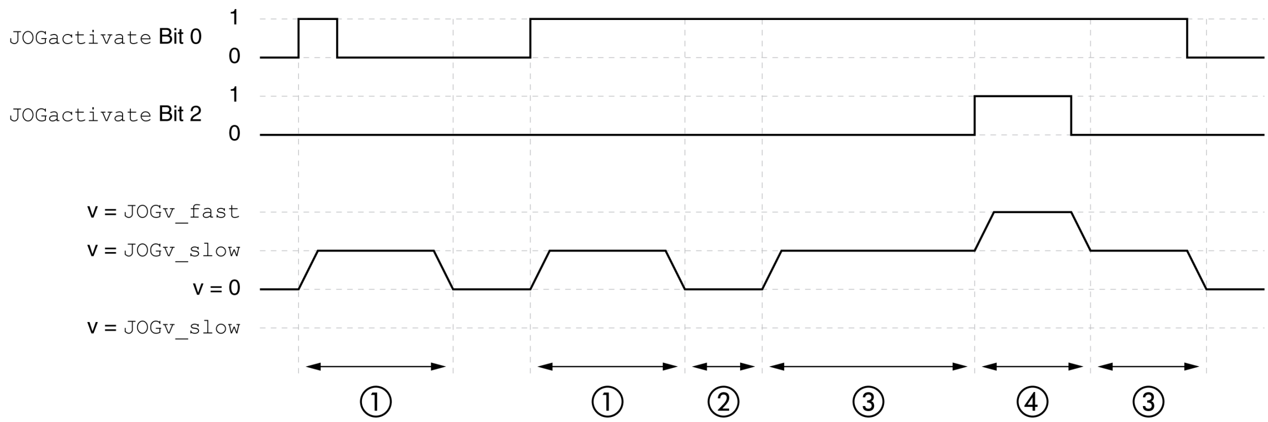
The illustration below provides an overview of step movement via the signal inputs in fieldbus control mode:



1 Slow movement in positive direction with a parameterizable number of user-defined units `JOGstep`
2 Waiting time `JOGtime`
3 Slow continuous movement in positive direction

The signal input functions “Jog Positive With Enable” and/or “Jog Negative With Enable” must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

The illustration below provides an overview of step movement via the fieldbus in fieldbus control mode:



1 Slow movement in positive direction with a parameterizable number of user-defined units `JOGstep`
2 Waiting time `JOGtime`
3 Slow continuous movement in positive direction
4 Fast continuous movement in positive direction

Starting the Operating Mode

In local control mode, the operating mode must first have been selected, see chapter Starting and Changing an Operating Mode *(see page 258)*. After the power stage is enabled, the operating mode is started automatically.

The power stage is enabled via the signal inputs. The table below provides an overview of the factory settings of the signal inputs:

Signal input	Signal input function
`DI0`	"Enable" Enable and disable the power stage
`DI1`	"Fault Reset" Resetting an error message
`DI2`	"Jog Negative" Operating mode Jog: Movement in negative direction
`DI3`	"Jog Positive" Operating mode Jog: Movement in positive direction

The factory settings of the signal inputs depend on the selected operating mode; they can be adapted, see chapter Digital Inputs and Outputs *(see page 218)*.

In fieldbus control mode, the operating mode can be started via the signal inputs or via the fieldbus.

If the operating mode is started via the signal inputs, the signal input functions “Jog Positive With Enable” and “Jog Negative With Enable” must have been parameterized, see chapter Digital Inputs and Outputs (see page 218).

Signal input function	Meaning
“Jog Positive With Enable”	The signal input function “Jog Positive With Enable” enables the power stage, starts the operating mode Jog and triggers a movement in positive direction.
“Jog Negative With Enable”	The signal input function “Jog Negative With Enable” enables the power stage, starts the operating mode Jog and triggers a movement in negative direction.

If the operating mode is started via the fieldbus, the operating mode must have been set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The parameter `JOGactivate` starts the movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`JOGactivate`	Activation of operating mode Jog Bit 0: Positive direction of movement Bit 1: Negative direction of movement Bit 2: 0=slow 1=fast Modified settings become active immediately.	- 0 0 7	UINT16 R/W - -	CANopen 301B:9$_h$ Modbus 6930

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State (see page 257).

Status Word

The operating mode-specific bits 10 and 12 are reserved in this operating mode.

For the common bits of the Control Word see chapter Indication of the Operating State (see page 253).

Terminating the Operating Mode

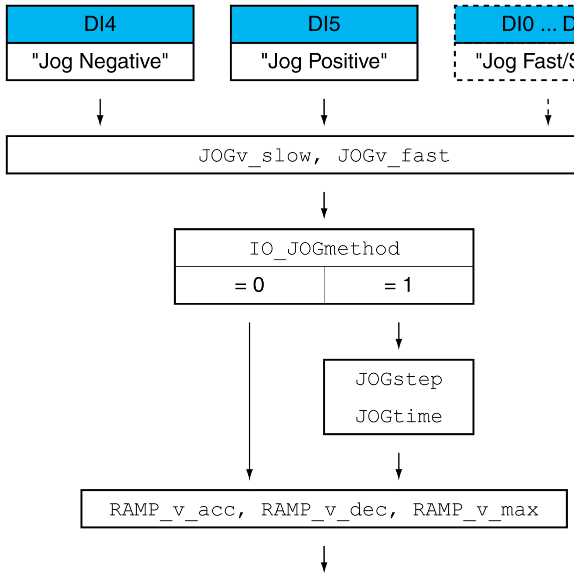
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Signal inputs “Jog Positive” and “Jog Negative” are set to 0 (local control mode)
- Signal inputs “Jog Positive With Enable” and “Jog Negative With Enable” are set to 0 (fieldbus control mode)
- Value of the parameter `JOGactivate` is 0 (fieldbus control mode)
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

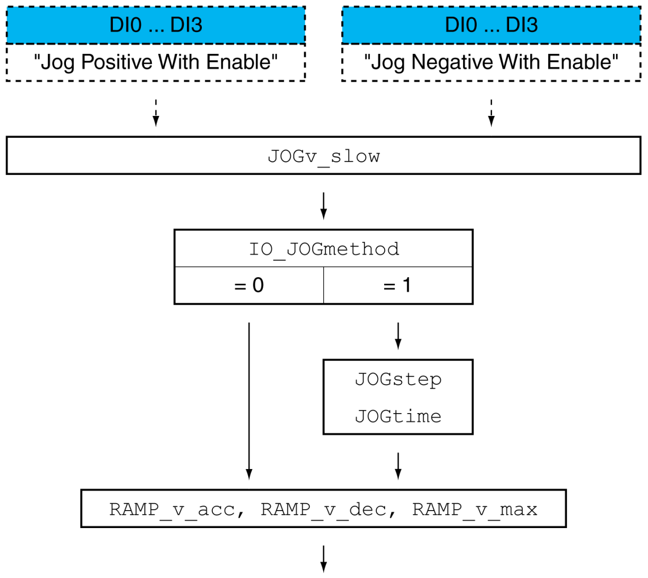
Parameterization

Overview

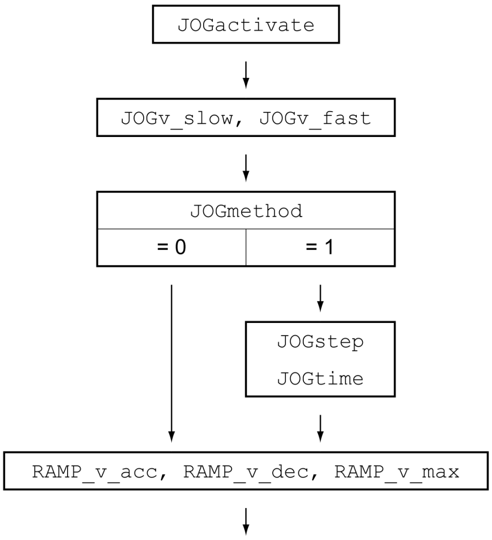
The illustration below provides an overview of the parameters that can be adjusted in local control mode.



The illustration below provides an overview of the adjustable parameters for movements via the signal inputs in fieldbus control mode:



The illustration below provides an overview of the adjustable parameters for movements via the fieldbus in fieldbus control mode:



Velocities

Two parameterizable velocities are available.

● Set the desired values with the parameters JOGv_slow and JOGv_fast.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGv_slow	Velocity for slow movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active immediately.	usr_v 1 60 2147483647	UINT32 R/W per. -	CANopen 3029:4$_h$ Modbus 10504
JOGv_fast	Velocity for fast movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active immediately.	usr_v 1 180 2147483647	UINT32 R/W per. -	CANopen 3029:5$_h$ Modbus 10506

Switching Between Velocities

In local control mode, the signal input function "Jog Fast/Slow" is available. It allows you to switch between the two velocities via a signal input.

In order to switch between the two velocities, you must first parameterize the signal input function "Jog Fast/Slow", see chapter Digital Inputs and Outputs *(see page 218)*.

Selection of the Method

The parameter `IO_JOGmethod` is used to set the method for movements via the signal inputs.

- Set the desired method with the parameter `IO_JOGmethod`.

The parameter `JOGmethod` is used to set the method for movements via the fieldbus.

- Set the desired method with the parameter `JOGmethod`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_JOGmethod`	Selection of jog method **0 / Continuous Movement**: Jog with continuous movement **1 / Step Movement**: Jog with step movement Modified settings become active the next time the motor moves.	- 0 1 1	UINT16 R/W per. -	CANopen 3005:18$_h$ Modbus 1328
`JOGmethod`	Selection of jog method **0 / Continuous Movement**: Jog with continuous movement **1 / Step Movement**: Jog with step movement Modified settings become active immediately.	- 0 1 1	UINT16 R/W - -	CANopen 3029:3$_h$ Modbus 10502

Setting the Step Movement

The parameters `JOGstep` and `JOGtime` are used to set the parameterizable number of user-defined units and the time for which the motor is stopped.

- Set the desired values with the parameters `JOGstep` and `JOGtime`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`JOGstep`	Distance for step movement Modified settings become active the next time the motor moves.	usr_p 1 20 2147483647	INT32 R/W per. -	CANopen 3029:7$_h$ Modbus 10510
`JOGtime`	Wait time for step movement Modified settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	CANopen 3029:8$_h$ Modbus 10512

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity *(see page 329)*.

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation *(see page 331)*
- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Stop Movement with Quick Stop *(see page 334)*
- Chapter Limitation of the Velocity via Signal Inputs *(see page 336)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*
- Chapter Relative Movement After Capture (RMAC) *(see page 347)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Software Limit Switches *(see page 355)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 357)*
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Standstill Window *(see page 365)*
  This function is only available for a step movement.
- Chapter Position Register *(see page 367)*
- Chapter Position Deviation Window *(see page 372)*
- Chapter Velocity Deviation Window *(see page 374)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.4
Operating Mode Profile Torque

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode (see page 199).

Description

In the operating mode Profile Torque, a movement is made with a specified target torque.

Without a proper limit value, the motor can reach an unintentionally high velocity in this operating mode.

⚠ WARNING
UNINTENTIONALLY HIGH VELOCITY Verify that the parameterized velocity limitation is appropriate for the motor. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Starting the Operating Mode

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The parameter `PTtq_target` starts the movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PTtq_target`	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %. Modified settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	CANopen 6071:0_h Modbus 6944

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State (see page 257).

Status Word

Parameter **`DCOMstatus`**	Meaning
Bit 10	0: Target torque not reached 1: Target torque reached
Bit 12	Reserved

For the common bits of the Control Word see chapter Indication of the Operating State (see page 253).

Terminating the Operating Mode

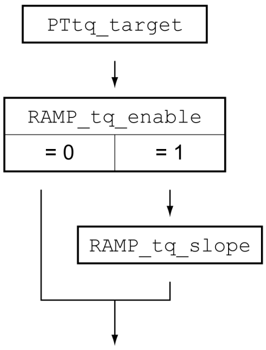
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.



Setting the Target Torque

The target torque is set by means of the parameter `PTtq_target`.

- Set the desired target torque with the parameter `PTtq_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PTtq_target`	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %. Modified settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	CANopen 6071:0_h Modbus 6944

Changing the Motion Profile for the Torque

It is possible to change the parameterization of the motion profile for the torque.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_tq_enable	Activation of the motion profile for torque **0 / Profile Off**: Profile off **1 / Profile On**: Profile on In the operating mode Profile Torque, the motion profile for torque can be activated or deactivated. In the other operating modes, the motion profile for torque is inactive. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:2C$_h$ Modbus 1624
RAMP_tq_slope	Slope setting of the motion profile for torque 100.00 % of the torque setting correspond to the continuous stall torque _M_M_0. Example: A ramp setting of 10000.00 %/s results in a torque change of 100.0% of _M_M_0 in 0.01s. In increments of 0.1 %/s. Modified settings become active immediately.	%/s 0.1 10000.0 3000000.0	UINT32 R/W per. -	CANopen 6087:0$_h$ Modbus 1620

Additional Settings

The following functions can be used for target value processing:

- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Stop Movement with Quick Stop *(see page 334)*
- Chapter Limitation of the Velocity via Signal Inputs *(see page 336)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*
- Chapter Relative Movement After Capture (RMAC) *(see page 347)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Software Limit Switches *(see page 355)*
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Torque Window *(see page 363)*
- Chapter Position Register *(see page 367)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.5
Operating Mode Profile Velocity

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode *(see page 199)*.

Description

In the operating mode Profile Velocity, a movement is made with a specified target velocity.

Starting the Operating Mode

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The parameter `PVv_target` starts the movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PVv_target`	Target velocity for operating mode Profile Velocity The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active immediately.	usr_v - 0 -	INT32 R/W - -	CANopen 60FF:0_h Modbus 6938

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter **`DCOMstatus`**	Meaning
Bit 10	0: Target velocity not reached 1: Target velocity reached
Bit 12	0: Velocity = >0 1: Velocity = 0

For the common bits of the Control Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

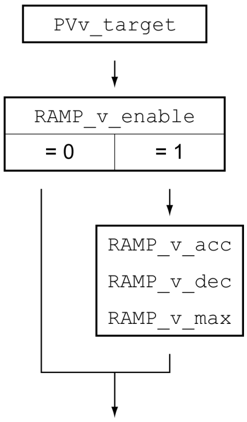
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.



Setting the Target Velocity

The parameter PVv_target allows you to set the target velocity.

- Set the target velocity with the parameter PVv_target.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PVv_target	Target velocity for operating mode Profile Velocity The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active immediately.	usr_v - 0 -	INT32 R/W - -	CANopen 60FF:0$_h$ Modbus 6938

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity *(see page 329)*.

Additional Settings

The following functions can be used for target value processing:

- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Stop Movement with Quick Stop *(see page 334)*
- Chapter Limitation of the Velocity via Signal Inputs *(see page 336)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Zero Clamp *(see page 338)*
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*
- Chapter Relative Movement After Capture (RMAC) *(see page 347)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Software Limit Switches *(see page 355)*
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Velocity Window *(see page 364)*
- Chapter Position Register *(see page 367)*
- Chapter Velocity Deviation Window *(see page 374)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.6
Operating Mode Profile Position

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode (see page 199).

Description

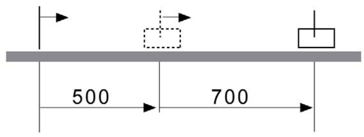
In the operating mode Profile Position, a movement to a desired target position is performed.

A movement can be made using one of 2 methods:

- Relative movement
- Absolute movement

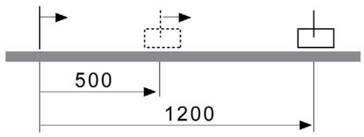
Relative Movement

In the case of a relative movement, the movement is relative with reference to the previous target position or the actual position of the motor.



Absolute Movement

In the case of an absolute movement, the movement is absolute with reference to the zero point.



A zero point must be defined with the operating mode Homing prior to the first absolute movement.

Starting the Operating Mode

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The movement is started via the control word.

Control Word

Bit 9: Change on setpoint	Bit 5: Change setpoint immediately	Bit 4: New setpoint	Meaning
0	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is stopped at the target position.
1	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is not stopped at the target position.
x	1	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are immediately executed.

Parameter value	Meaning
Bit 6: Absolute / relative	0: Absolute movement 1: Relative movement

Target values include target position, target velocity, acceleration and deceleration.

For the common bits of the Control Word see chapter Changing the Operating State (see page 257).

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Halt = 0: Target position not reached Halt = 1: Motor decelerates 1: Halt = 0: Target position reached Halt = 1: Motor standstill
Bit 12	0: New position possible 1: New target position accepted

For the common bits of the Control Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

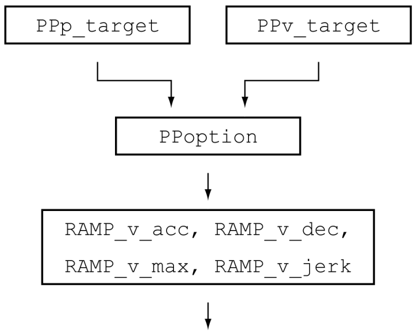
- Target position reached
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.

Overview of adjustable parameters



Target Position

The parameter `PPp_target` allows you to enter the target position.

- Set the desired target position with the parameter `PPp_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PPp_target`	Target position for operating mode Profile Position Minimum/maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Modified settings become active immediately.	usr_p - - -	INT32 R/W - -	CANopen 607A:0_h Modbus 6940

Target Velocity

The parameter `PPv_target` allows you to set the target velocity.

- Set the target velocity with the parameter `PPv_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PPv_target`	Target velocity for operating mode Profile Position The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 60 4294967295	UINT32 R/W - -	CANopen 6081:0_h Modbus 6942

Selection of the Method

The parameter `PPoption` allows you to set the method for a relative movement.

- Set the desired method for a relative movement with the parameter `PPoption`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PPoption`	Options for operating mode Profile Position Determines the reference position for relative positioning: 0: Relative with reference to the previous target position of the profile generator 1: Not supported 2: Relative with reference to the actual position of the motor Modified settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	CANopen 60F2:0$_h$ Modbus 6960

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity *(see page 329)*.

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation *(see page 331)*
- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Stop Movement with Quick Stop *(see page 334)*
- Chapter Limitation of the Velocity via Signal Inputs *(see page 336)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Starting a Movement via a Signal Input *(see page 340)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*
- Chapter Relative Movement After Capture (RMAC) *(see page 347)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Software Limit Switches *(see page 355)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 357)*
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Standstill Window *(see page 365)*
- Chapter Position Register *(see page 367)*
- Chapter Position Deviation Window *(see page 372)*
- Chapter Velocity Deviation Window *(see page 374)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.7
Operating Mode Interpolated Position

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode (see page 199).

Description

In the operating mode Interpolated Position, movements are made to cyclically set reference positions.

The monitoring functions Heartbeat and Node Guarding cannot be used in this operating mode.

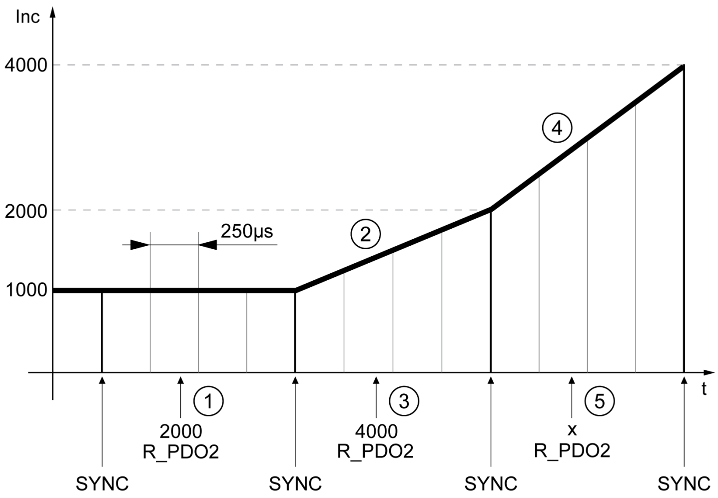
- Check cyclical reception of PDOs at the PLC in order to detect an interruption of the connection.

The reference positions are transmitted synchronously with each cycle. The cycle time of a cycle can be set from 1 ... 20 ms.

The movement to the reference positions starts with the SYNC signal.

The drive performs an internal fine interpolation with a raster of 250 μs.

The illustration below provides an overview:



1 Transmission of first reference position (example)
2 Movement to first reference position
3 Transmission of second reference position (example)
4 Movement to second reference position
5 Transmission of next reference position (example)

Starting the Operating Mode

An initialization sequence must be written to start the operating mode. After the initialization sequence, the operating mode can be started via the control word.

In the operating mode Interpolated Position, the scaling factor of the user-defined unit usr_p must be set to 1 rpm/131072. Among other things, this scaling factor is written by means of the initialization sequence.

Index	Subindex	Length in bytes	Value	Meaning
1400_h	1_h	4	80000200_h + node id	Deactivate R_PDO1
1800_h	1_h	4	80000180_h + node id	Deactivate T_PDO1
1401_h	1_h	4	00000300_h + node id	Activate R_PDO2
1801_h	1_h	4	00000280_h + node id	Activate T_PDO2
1402_h	1_h	4	80000400_h + node id	Deactivate R_PDO3
1802_h	1_h	4	80000380_h + node id	Deactivate T_PDO3
1403_h	1_h	4	80000500_h + node id	Deactivate R_PDO4
1803_h	1_h	4	80000480_h + node id	Deactivate T_PDO4
1401_h	2_h	1	1_h	Activate cyclic transmission of R_PDO2

Index	Subindex	Length in bytes	Value	Meaning
1801_h	2_h	1	1_h	Activate cyclic transmission of T_PDO2
6040_h	0_h	2	0_h	Control word = 0
6040_h	0_h	2	80_h	Perform Fault Reset
1601_h	0_h	1	0_h	Change PDO mapping for R_PDO2
1601_h	1_h	4	60400010_h	Map control word
1601_h	2_h	4	$60C10120_h$	Map reference position for Interpolated Position
1601_h	0_h	1	2_h	Finalize mapping for R_PDO2
$1a01_h$	0_h	1	0_h	Change PDO mapping for T_PDO2
$1a01_h$	1_h	4	60410010_h	Map status word
$1a01_h$	2_h	4	60640020_h	Map Position actual Value
$1a01_h$	0_h	1	2_h	Finalize mapping for T_PDO2
3006_h	7_h	4	20000_h	Position scaling: denominator
3006_h	8_h	4	1_h	Position scaling: numerator
6060_h	0_h	1	7_h	Select operating mode Interpolated Position
3006_h	$3D_h$	2	1_h	Must be written for reasons of compatibility
$60C2_h$	1_h	1	2_h	Cycle time 2 ms (example)
3012_h	6_h	2	$3E8_h$	Velocity feed-forward control 100% CTRL1
3013_h	6_h	2	$3E8_h$	Velocity feed-forward control 100% CTRL2
3006_h	6_h	2	1_h	Suppress error message for LIMP or LIMN when the power stage is enabled
3022_h	4_h	2	1_h	Tolerance for synchronization mechanism (example)
3022_h	5_h	2	2_h	Activate synchronization mechanism

Control Word

Parameter `DCOMcontrol`	Meaning
Bit 4	0: Terminate operating mode 1: Start operating mode **NOTE:** If the control word is transmitted via SDO, the power stage must be enabled first. After that, the operating mode can be started with a rising edge.
Bits 5, 6 and 9	Reserved (must be set to 0)

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Halt = 0: Position not (yet) reached Halt = 1: Motor decelerates 1: Halt = 0: Position reached Halt = 1: Motor standstill
Bit 12	0: Operating mode terminated 1: Operating mode started

For the common bits of the Control Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated under the following conditions is met:

- Bit 4 of the control word = 0
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by a detected error

Parameterization

Synchronization Mechanism

The synchronization mechanism must be activated for the operating mode Interpolated Position.

The synchronization mechanism is activated via the parameter `SyncMechStart` = 2.

The parameter `SyncMechTol` is used to set a synchronization tolerance. The value of the parameter `SyncMechTol` is internally multiplied by 250 μs. For example, a value of 4 corresponds to a tolerance of 1 ms.

The status of the synchronizations mechanism can be read by means of the parameter `SyncMechStatus`.

- Activate the synchronization mechanism by means of the parameter `SyncMechStart`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`SyncMechStart`	Activation of synchronization mechanism Value 0: Deactivate synchronization mechanism Value 1: Activate synchronization mechanism (CANmotion). Value 2: Activate synchronization mechanism, standard CANopen mechanism. The cycle time of the synchronization signal is derived from the parameters intTimPerVal and intTimInd. Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 3022:5$_h$ Modbus 8714
`SyncMechTol`	Synchronization tolerance The value is applied when the synchronization mechanism is activated via the parameter SyncMechStart. Modified settings become active immediately.	- 1 1 20	UINT16 R/W - -	CANopen 3022:4$_h$ Modbus 8712
`SyncMechStatus`	Status of synchronization mechanism Status of synchronization mechanism: Value 1: Synchronization mechanism of drive is inactive. Value 32: Drive is synchronizing with external sync signal. Value 64: Drive is synchronized with external sync signal.	- - - -	UINT16 R/- - -	CANopen 3022:6$_h$ Modbus 8716

Cycle Time

The cycle time is set via the parameters `IP_IntTimPerVal` and `IP_IntTimInd`.

The cycle time depends on the following factors:

- Number of drives
- Baud rate
- Time of the minimum data packets per cycle:
  - SYNC
  - R_PDO2, T_PDO2
  - EMCY (This time must be reserved.)
- Optionally the time of the additional data packets per cycle:
  - R_SDO and T_SDO
    The PLC must make sure that the number of requests (R_SDO) and the cycle time match. The response (T_SDO) is transmitted with the next cycle.
  - n_{PDO} - additional R_PDO and T_PDO:
    R_PDO1, T_PDO1, R_PDO3, T_PDO3, R_PDO4 and T_PDO4

The table below shows the typical values for the individual data packets, depending on the baud rate:

Data packets	Size in bytes	1 Mbit	500 kbit	250 kbit
R_PDO2	6	0.114 ms	0.228 ms	0.456 ms
T_PDO2	6	0.114 ms	0.228 ms	0.456 ms
SYNC	0	0.067 ms	0.134 ms	0.268 ms
EMCY	8	0.130 ms	0.260 ms	0.520 ms
R_PDOx	8	0.130 ms	0.260 ms	0.520 ms
T_PDOx	8	0.130 ms	0.260 ms	0.520 ms
R_SDO and T_SDO	16	0.260 ms	0.520 ms	1.040 ms

In the case of one drive, the minimum cycle time is calculated as follows: t_{cycle}= SYNC + R_PDO2+ T_PDO2 + EMCY + SDO +n_{PDO}

The following table shows t_{cycle} depending on the baud rate and the number of additional PDOs n_{PDO}, based on one drive:

Number of additional PDOs (n_{PDO})	Minimum cycle time at 1 Mbit	Minimum cycle time at 500 kbit	Minimum cycle time at 250 kbit
0	1 ms	2 ms	3 ms
1	1 ms	2 ms	3 ms
2	1 ms	2 ms	4 ms
3	2 ms	2 ms	4 ms
4	2 ms	3 ms	5 ms
5	2 ms	3 ms	5 ms
6	2 ms	3 ms	6 ms

Cycle time in seconds: `IP_IntTimPerVal` * 10 $^{\text{IP\_IntTimInd}}$

- Set the desired cycle time with the parameters `IP_IntTimPerVal` and `IP_IntTimInd`.
  Valid cycle times are 1 ... 20 ms in increments of 1 ms.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IP_IntTimPerVal`	Interpolation time period value * Datatype for CANopen: UINT8	s 0 1 255	UINT16* R/W - -	CANopen 60C2:1$_h$ Modbus 7000
`IP_IntTimInd`	Interpolation time index * Datatype for CANopen: INT8	- -128 -3 63	INT16* R/W - -	CANopen 60C2:2$_h$ Modbus 7002

Position Comparison

The drive cyclically processes the reference position as soon as bit 4 of the control word is set to 1. If the difference between reference position and actual position is too great, this results in a following error. To help avoid such an error, the actual position must be read via the parameter `_p_act` before the operating mode is activated or continued. New reference positions must correspond to the actual position in the first cycle.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_p_act`	Actual position	usr_p - - -	INT32 R/- - -	CANopen 6064:0_h Modbus 7706

Reference Position

The parameter `IPp_target` cyclically transmits a reference value.

- Set the desired reference value with the parameter `IPp_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IPp_target`	Position reference value for operating mode Interpolated Position	- -2147483648 - 2147483647	INT32 R/W - -	CANopen 60C1:1_h Modbus 7004

Section 7.8
Operating Mode Homing

What Is in This Section?

This section contains the following topics:

Overview

Availability

See chapter Control Mode (see page 199).

Description

Description In the operating mode Homing, a reference is generated between a mechanical position and the actual position of the motor.

A reference between a mechanical position and the actual position of the motor is generated by means of a reference movement or by means of position setting.

A successful reference movement or position setting homes the motor and the zero point becomes valid.

The zero point is the point of reference for absolute movements in the operating modes Profile Position and Motion Sequence.

Methods

A movement can be made using different methods:

- Reference movement to a limit switch
  In the case of a reference movement to a limit switch, a movement to the negative limit switch or the positive limit switch is performed.
  When the limit switch is reached, the motor is stopped and a movement is made back to the switching point of the limit switch.
  From the switching point of the limit switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.
  The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.
- Reference movement to the reference switch
  In the case of a reference movement to the reference switch, a movement to the reference switch is performed.
  When the reference switch is reached, the motor is stopped and a movement is made back to the switching point of the reference switch.
  From the switching point of the reference switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.
  The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.
- Reference movement to the index pulse
  In the case of a reference movement to the index pulse, a movement is made from the actual position to the next index pulse. The position of the index pulse is the reference point.
- Position setting
  In the case of position setting, the actual position of the motor is set to a desired position value.

A reference movement must be terminated without interruption for the new zero point to be valid. If the reference movement is interrupted, it must be started again.

Motors with multiturn encoder deliver a valid zero point after they are powered on.

Starting the Operating Mode

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The movement is started via the control word.

Control Word

Parameter `DCOMcontrol`	Meaning
Bit 4	Start Homing
Bits 5, 6 and 9	Reserved (must be set to 0)

For the common bits of the Control Word see chapter Changing the Operating State (see page 257).

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Homing not completed 1: Homing completed
Bit 12	1: Homing successfully completed

For the common bits of the Control Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

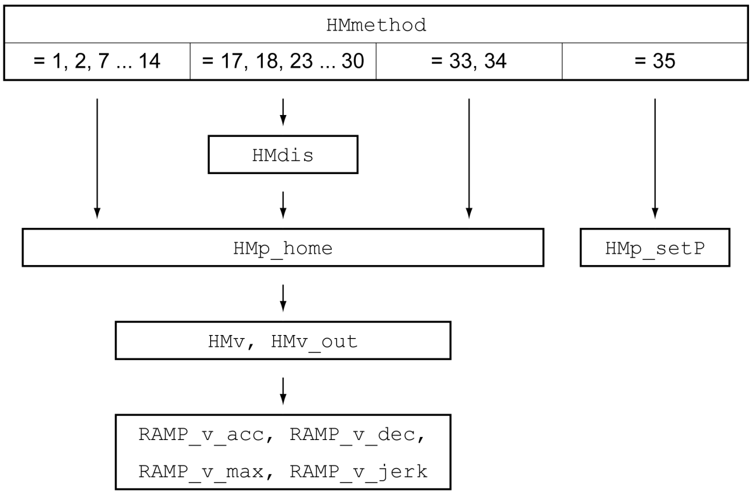
- Homing successful
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.

Overview of adjustable parameters



Setting Limit Switches and Reference Switches

The limit switches and reference switches must be set to meet the requirements, see chapter Limit Switches *(see page 353)* and chapter Reference Switch *(see page 354)*.

Selection of the Method

The operating mode Homing establishes an absolute position reference between the motor position and a defined axis position. There are various Homing methods which can be selected via the parameter `HMmethod`.

The `HMprefmethod` parameter is used to save the preferred method to the EEPROM (persistent). When the preferred method has been set in this parameter, the method is performed during homing even after the device is powered off and on. The value to be entered corresponds to the value in the `HMmethod` parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMmethod`	Homing method 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting Abbreviations: REF+: Search movement in pos. direction REF-: Search movement in neg. direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Modified settings become active immediately. * Datatype for CANopen: INT8	- 1 18 35	INT16* R/W - -	CANopen 6098:0_h Modbus 6936
`HMprefmethod`	Preferred homing method Modified settings become active immediately.	- 1 18 35	INT16 R/W per. -	CANopen 3028:A_h Modbus 10260

Setting the Distance From the Switching Point

A distance to the switching point of the limit switch or the reference switch must be parameterized for a reference movement with index pulse. The parameter `HMdis` lets you set the distance to the switching limit switch or the reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMdis`	Distance from switching point The distance from the switching point is defined as the reference point. The parameter is only effective during a reference movement without index pulse. Modified settings become active the next time the motor moves.	usr_p 1 200 2147483647	INT32 R/W per. -	CANopen 3028:7$_h$ Modbus 10254

Defining the Zero Point

The parameter `HMp_home` is used to specify a desired position value, which is set at the reference point after a successful reference movement. The desired position value at the reference point defines the zero point.

If the value 0 is used, the zero point corresponds to the reference point.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMp_home`	Position at reference point After a successful reference movement, this position is automatically set at the reference point. Modified settings become active the next time the motor moves.	usr_p -2147483648 0 2147483647	INT32 R/W per. -	CANopen 3028:B$_h$ Modbus 10262

Setting Monitoring

The parameters `HMoutdis` and `HMsrchdis` allow you to activate monitoring of the limit switches and the reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMoutdis`	Maximum distance for search for switching point 0: Monitoring of distance inactive >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Modified settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen 3028:6$_h$ Modbus 10252
`HMsrchdis`	Maximum search distance after overtravel of switch 0: Search distance monitoring disabled >0: Search distance The switch must be activated again within this search distance, otherwise the reference movement is canceled. Modified settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen 3028:D$_h$ Modbus 10266

Reading out the Position Distance

The position distance between the switching point and index pulse can be read out with the following parameters.

The distance between the switching point and the index pulse must be >0.05 revolutions for reproducible reference movements with index pulse.

If the index pulse is too close to the switching point, the limit switch or reference switch can be moved mechanically.

Otherwise the position of the index pulse can be moved with the parameter `ENC_pabsusr`, see Chapter Setting Parameters for Encoder *(see page 171)*.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_HMdisREFtoIDX_usr`	Distance from switching point to index pulse Allows you to verify the distance between the index pulse and the switching point and serves as a criterion for determining whether the reference movement with index pulse can be reproduced.	usr_p -2147483648 - 2147483647	INT32 R/- - -	CANopen 3028:F$_h$ Modbus 10270
`_HMdisREFtoIDX`	Distance from switching point to index pulse Allows you to verify the distance between the index pulse and the switching point and serves as a criterion for determining whether the reference movement with index pulse can be reproduced. The parameter _HMdisREFtoIDX_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution - - -	INT32 R/- - -	CANopen 3028:C$_h$ Modbus 10264

Setting Velocities

The parameters HMv and HMv_out are used to set the velocities for searching the switch and for moving away from the switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMv	Target velocity for searching the switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 60 2147483647	UINT32 R/W per. -	CANopen 6099:1$_h$ Modbus 10248
HMv_out	Target velocity for moving away from switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 6 2147483647	UINT32 R/W per. -	CANopen 6099:2$_h$ Modbus 10250

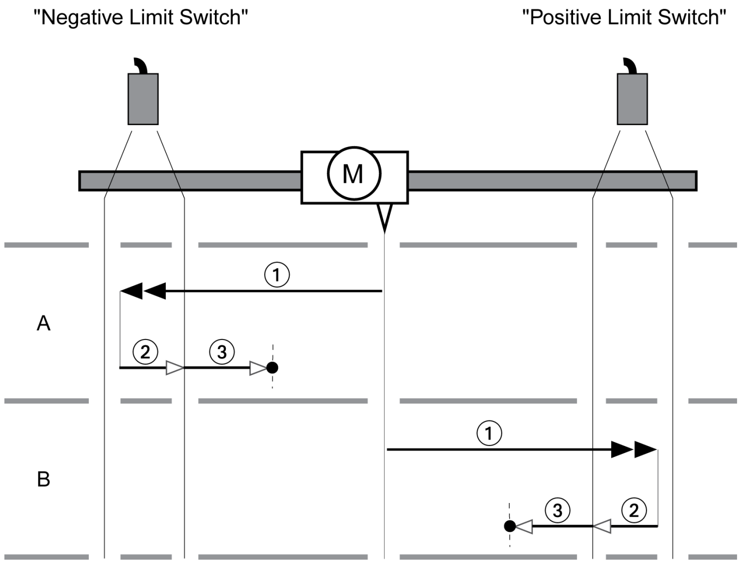
Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity *(see page 329)*.

Reference Movement to a Limit Switch

The illustration below shows a reference movement to a limit switch

Reference movement to a limit switch



1 Movement to limit switch at velocity `HMv`
2 Movement to the switching point of the limit switch at velocity `HMv_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMv_out`

Type A

Method 1: Movement to the index pulse.

Method 17: Movement to distance from switching point.

Type B

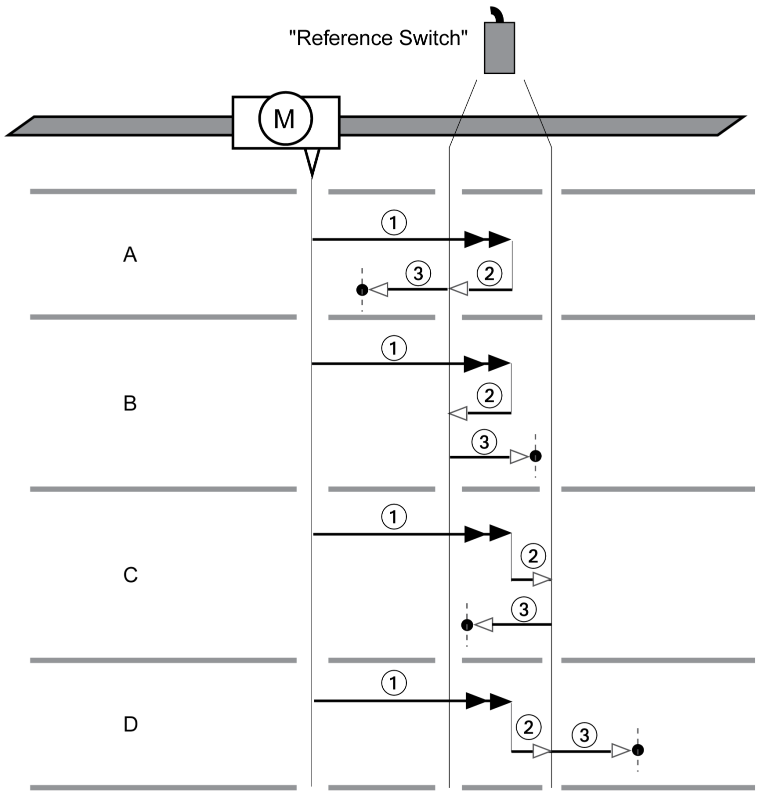
Method 2: Movement to the index pulse.

Method 18: Movement to distance from switching point.

Reference Movement to the Reference Switch in Positive Direction

The illustration below shows a reference movement to the reference switch in positive direction

Reference movement to the reference switch in positive direction



1 Movement to reference switch at velocity `HMv`
2 Movement to the switching point of the reference switch at velocity `HMv_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMv_out`

Type A

Method 7: Movement to the index pulse.

Method 23: Movement to distance from switching point.

Type B

Method 8: Movement to the index pulse.

Method 24: Movement to distance from switching point.

Type C

Method 9: Movement to the index pulse.

Method 25: Movement to distance from switching point.

Type D

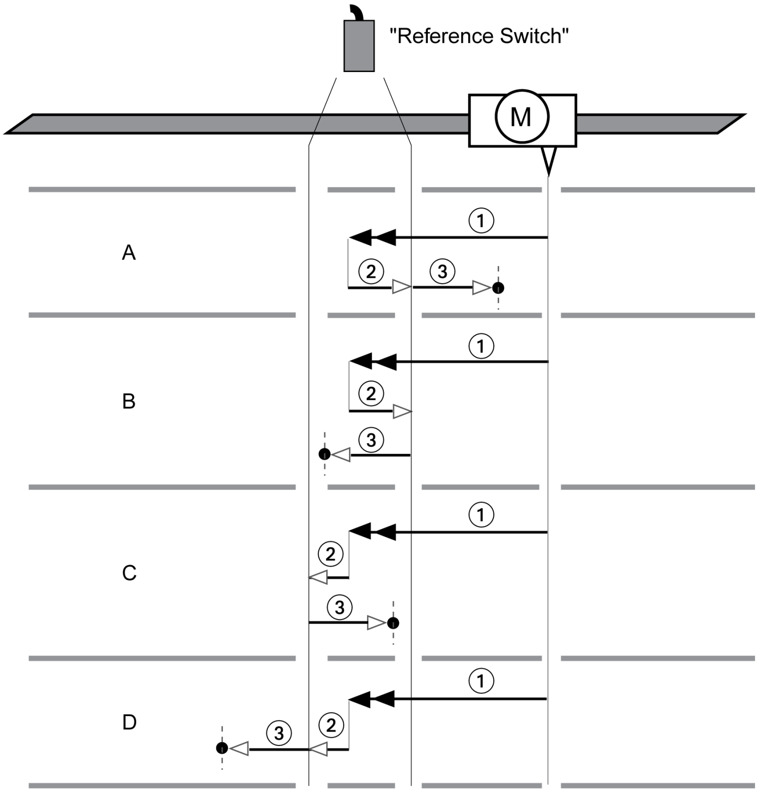
Method 10: Movement to the index pulse.

Method 26: Movement to distance from switching point.

Reference Movement to the Reference Switch in Negative Direction

The illustration below shows a reference movement to the reference switch in negative direction

Reference movement to the reference switch in negative direction



1 Movement to reference switch at velocity `HMv`
2 Movement to the switching point of the reference switch at velocity `HMv_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMv_out`

Type A

Method 11: Movement to the index pulse.

Method 27: Movement to distance from switching point.

Type B

Method 12: Movement to the index pulse.

Method 28: Movement to distance from switching point.

Type C

Method 13: Movement to the index pulse.

Method 29: Movement to distance from switching point.

Type D

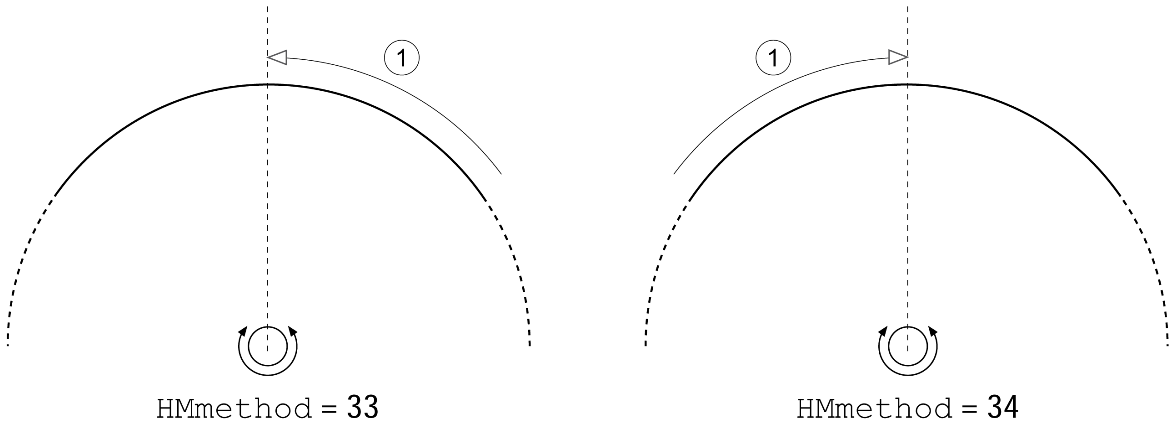
Method 14: Movement to the index pulse.

Method 30: Movement to distance from switching point.

Reference Movement to the Index Pulse

The illustration below shows a reference movement to the index pulse

Reference movement to the index pulse



1 Movement to index pulse at velocity `HMv_out`

Position Setting

Description

By means of position setting, the actual position of the motor is set to the position value in parameter `HMp_setP`. This also defines the zero point.

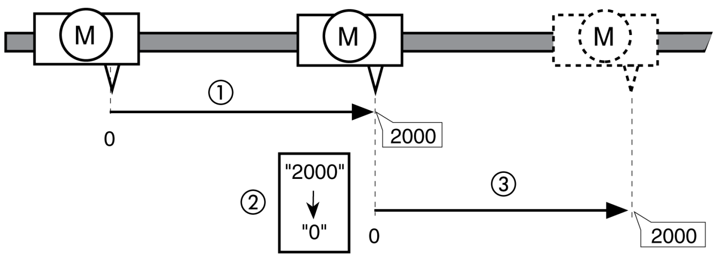
Position setting is only possible when the motor is at a standstill. Any active position deviation remains active and can still be compensated for by the position controller after position setting.

Setting the Position for Position Setting

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMp_setP`	Position for Position Setting Position for operating mode Homing, method 35. Modified settings become active immediately.	usr_p - 0 -	INT32 R/W - -	CANopen 301B:16$_h$ Modbus 6956

Example

Movement by 4000 user-defined units with position setting



1 The motor is positioned by 2000 user-defined units.
2 By means of position setting to 0, the actual position of the motor is set to position value 0 which, at the same time, defines a new zero point.
3 When a new movement by 2000 user-defined units is triggered, the new target position is 2000 user-defined units.

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation *(see page 331)*
- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Reference Switch *(see page 354)*
- Chapter Software Limit Switches *(see page 355)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 357)*
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Position Deviation Window *(see page 372)*
- Chapter Velocity Deviation Window *(see page 374)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.9
Operating Mode Motion Sequence

What Is in This Section?

This section contains the following topics:

Overview

Availability

Available with firmware version ≥V01.08.

Description

In the operating mode Motion Sequence, movements are started via parameterizable data sets.

A parameterizable data set contains settings on the type of movement (data set type) and the appropriate target values (such as the target velocity and target position).

In addition, you can specify in a data set that a subsequent data set is to be started once the movement has been terminated. You can also define a transition condition for starting the subsequent data set.

The data sets are parameterized via the commissioning software.

Sequence

A data set can be started in two different ways:

- Start of a data set with sequence:
  The set data set is started.
  If a subsequent data set has been defined in the data set, the subsequent data set is started once the movement has been terminated.
  If a transition condition has been defined, the subsequent data set is started once the transition condition is met.
- Start of a data set without sequence:
  The set data set is started.
  If a subsequent data set has been defined in the data set, the subsequent data set is not started when the movement has been terminated.

Data Set Types

The following data set types are available:
- Movement to a specific position value (absolute movement, additive movement or relative movement)
- Movement at a specific velocity
- Homing the motor (reference movement or position setting)
- Repetition of a given sequence (1 ... 65535)
- Write parameter with desired value

Number of Data Sets

The product features 128 data sets.

Control Mode

In local control mode, a movement is started via the digital signal inputs.

In fieldbus control mode, a movement is started via the fieldbus.

See chapter Control Mode *(see page 199)* for information on setting the control mode.

Starting the Operating Mode

In local control mode, the operating mode must first have been selected, see chapter Starting and Changing an Operating Mode *(see page 258)*. After the power stage is enabled, the operating mode is started automatically.

The power stage is enabled via the signal inputs. The table below provides an overview of the factory settings of the signal inputs:

Signal input	Signal input function
DI0	"Positive Limit Switch (LIMP)" See chapter Limit Switches *(see page 353)*
DI1	"Negative Limit Switch (LIMN)" See chapter Limit Switches *(see page 353)*
DI2	"Enable" Enable and disable the power stage
DI3	"Start Motion Sequence" Start sequence

The factory settings of the signal inputs depend on the selected operating mode; they can be adapted, see chapter Digital Inputs and Outputs *(see page 218)*.

In fieldbus control mode, the operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value causes the operating mode to start.

The movement is started via the control word.

The parameter `MSM_start_ds` allows you to set the data set to be started.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MSM_start_ds	Selection of a data set to be started for operating mode Motion Sequence Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 127	UINT16 R/W - -	CANopen 301B:A_h Modbus 6932

Control Word

Parameter **DCOMcontrol**	Meaning
Bit 4	0 -> 1: Start data set
Bit 5	0: Start individual data set 1: Start sequence
Bit 6	1: Use data set from parameter MSM_start_ds for starting a sequence
Bit 9	Reserved (must be set to 0)

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter **DCOMstatus**	Meaning
Bit 10	1: End of a sequence
Bit 12	Reserved

For the common bits of the Status Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

In local control mode, the operating mode is automatically terminated by disabling the power stage.

In fieldbus control mode, the operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Individual data set terminated
- Data set of a sequence terminated (waiting for transition condition to be fulfilled)
- Sequence terminated
- Stop caused by "Halt" or "Quick Stop"
- Stop caused by a detected error

Status Messages

In local control mode, information on the operating state and the ongoing movement is available via signal outputs.

In fieldbus control mode, information on the operating state and the ongoing movement is available via the fieldbus and the signal outputs.

The table below provides an overview of the signal outputs:

Signal output	Signal output function
`DQ0`	With local control mode: "Motion Sequence: Start Acknowledge" Signals that the system is waiting for a transition condition to be met. With fieldbus control mode: "No Fault" Signals the operating states **4** Ready To Switch On, **5** Switched On and **6** Operation Enabled
`DQ1`	"Active" Signals the operating state **6** Operation Enabled

The factory settings of the signal outputs depend on the selected control mode and the selected operating mode; they can be adapted, see chapter Digital Inputs and Outputs *(see page 218)*.

Start of a Data Set with Sequence

Description

The set data set is started.

If a subsequent data set has been defined in the data set, the subsequent data set is started once the movement has been terminated.

If a transition condition has been defined, the subsequent data set is started once the transition condition is met.

Signal Input Functions

In local control mode, the following signal input functions are required to start a data set with sequence:

Signal input function	Description
"Start Motion Sequence" Factory setting for DI3	Start of a data set with sequence. A data set is set via the signal input functions "Data Set Bit 0" to "Data Set Bit x" and confirmed with the signal input function "Data Set Select".
"Data Set Select" Adjustable for signal inputs DI0 ... DI3	The signal input function "Data Set Select" is used to confirmed the set data set. If the signal input functions "Data Set Bit 0" to "Data Set Bit x" are not set to any of the signal inputs, data set 0 is confirmed with the signal input function "Data Set Select".
"Data Set Bit 0" to "Data Set Bit x" Adjustable for signal inputs DI0 ... DI3	The signal input functions "Data Set Bit 0" to "Data Set Bit x" are used to set a data set in a bit-coded way. The set data set must be confirmed with the signal input function "Data Set Select".

Start Condition

A start condition is defined for starting a data set with sequence. The start conditions can be set with the parameter MSM_CondSequ.

- Set the desired start condition for the start of a data set with sequence with the parameter MSM_CondSequ.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MSM_CondSequ	Start condition for the start of a sequence via a signal input **0 / Rising Edge**: Rising edge **1 / Falling Edge**: Falling edge **2 / 1-level**: 1 level **3 / 0-level**: 0 level The start condition defines the way the start request is to be processed. This setting is used for the first start after activation of the operating mode. Modified settings become active the next time the motor moves. Available with firmware version ≥V01.08.	- 0 0 3	UINT16 R/W per. -	CANopen 302D:8$_h$ Modbus 11536

End of a Sequence

You can parameterize whether the set data set is to be confirmed at the end of a sequence.

- Set the type of confirmation with the `MSMendNumSequence` parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSMendNumSequence`	Selection of the data set number after the end of a sequence **0 / DataSetSelect**: Data set is set via the signal input function "Data Set Select" **1 / Automatic**: Data set is set automatically Value 0: After the end of a sequence, the selected data set must be set via the signal input function "Data Set Select". Value 1: After the end of a sequence, the selected data set is set automatically. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W per. -	CANopen 302D:9$_h$ Modbus 11538

Start of a Data Set without Sequence

Description

The set data set is started.

If a subsequent data set has been defined in the data set, the subsequent data set is not started when the movement has been terminated.

Signal Input Functions

In local control mode, the following signal input functions are required to start a data set without sequence:

Signal input function	Description
"Start Single Data Set" The signal input function must be set.	The set data set is started without a sequence via a rising edge. A data set is set via the signal input functions "Data Set Bit 0" to "Data Set Bit x".
"Data Set Bit 0" to "Data Set Bit x" Adjustable for signal inputs `DI0` ... `DI3`	The signal input functions "Data Set Bit 0" to "Data Set Bit x" are used to set a data set in a bit-coded way. The set data set is immediately confirmed; it does not need to be confirmed with the signal input function "Data Set Select".

Setting the Start Signal

You can parameterize whether a movement can be aborted via a rising edge at the signal input.

The parameter `MSMstartSignal` lets you set the behavior of the start signal.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSMstartSignal`	Response to falling edge at signal input for 'Start Signal Data Set' **0 / No Reaction**: No response **1 / Cancel Movement**: Cancel active movement Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W per. -	CANopen 302D:C$_h$ Modbus 11544

Structure of a Data Set

Data Set Type, Settings and Type of Transition

Structure of a data set

Data set type	Setting A	Setting B	Setting C	Setting D	Transition type

Data set type	Setting A	Setting B	Setting C	Setting D	Transition type
"Move Absolute" Movement to an absolute position value	Acceleration Unit: usr_a	Velocity Unit: usr_v	Absolute target position Unit: usr_p	Deceleration Unit: usr_a	• No Transition • Abort And Go Next • Buffer And Start Next • Blending Previous • Blending Next
"Move Additive" Movement that is added to target position	Acceleration Unit: usr_a	Velocity Unit: usr_v	Added target position Unit: usr_p	Deceleration Unit: usr_a	• No Transition • Abort And Go Next • Buffer And Start Next
"Reference Movement" Reference movement(1)	Homing method Like parameter `HMmethod`	Desired position value at reference point Unit: usr_p	-	-	• No Transition • Buffer And Start Next
"Position Setting" Position setting	Position for Position Setting Unit: usr_p	-	-	-	• No Transition • Buffer And Start Next
"Repeat" Repeat part of a sequence	Number of repetitions (1 ... 65535)	Number of the data set at which the repetition is to be started	-	-	• No Transition • Buffer And Start Next
"Move Relative" Movement relative with reference to actual position	Acceleration Unit: usr_a	Velocity Unit: usr_v	Relative target position Unit: usr_p	Deceleration Unit: usr_a	• No Transition • Abort And Go Next • Buffer And Start Next
"Move Velocity" Movement at a specific velocity	Acceleration(2) Unit: usr_a	Velocity Unit: usr_v	Direction of movement Value 0: Positive Value 1: Negative Value 2: From previous data set	Deceleration(2) Unit: usr_a	• Abort And Go Next

(1) Function principle like operating mode Homing.
(2) The motion profile for velocity must have been activated see parameter `RAMP_v_enable` in chapter Motion Profile for the Velocity *(see page 329)*.

Data set type	Setting A	Setting B	Setting C	Setting D	Transition type
"Write Parameter" Write parameter directly	Modbus address of the parameter The parameters of the safety module eSM and the following parameters cannot be written directly: AccessLock AT_start DCOMopmode GEARreference JOGactivate OFSp_rel PAR_CTRLreset PAR_ScalingStart PAReeprSave PARuserReset PTtq_reference PTtq_target PVv_reference PVv_target	Value of the parameter (Values greater than 2147483647 must be entered as negative values.)	-	-	• No Transition • Buffer And Start Next

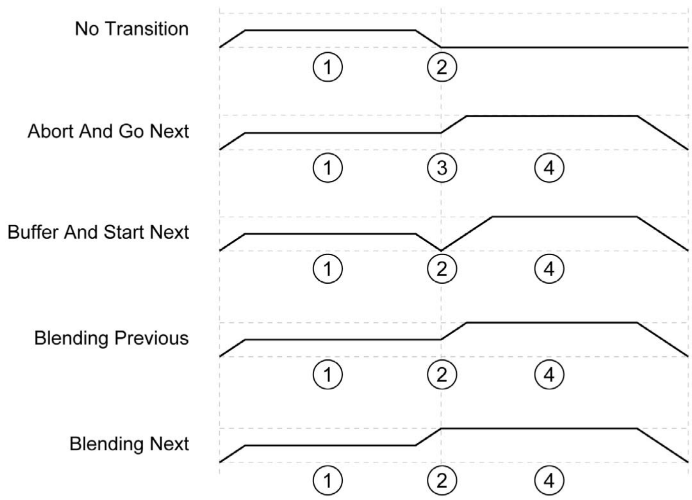
(1) Function principle like operating mode Homing.
(2) The motion profile for velocity must have been activated see parameter RAMP_v_enable in chapter Motion Profile for the Velocity *(see page 329)*.

Transition Type

Transition type is used to set the type of transition to the subsequent data set. The following types of transitions are possible:

- No Transition
  No further data set is started upon successful completion of the movement (end of sequence).
- Abort And Go Next
  If the transition condition is met, the current movement is aborted and the subsequent data set started. The transition conditions are considered for the transition.
- Buffer And Start Next
  Upon successful completion of the movement and if the transition condition is met, the subsequent data set is started.
  The transition conditions are considered for the transition.
- Blending Previous / Blending Next (data set type Move Absolute only)
  The velocity is adapted to the velocity of the subsequent data set until the target position is reached or when it has been reached.
  The transition is performed without consideration of the transition conditions.

Transition type



1 First data set.
2 Target position of first data set reached.
3 Transition condition met, the first data set is terminated and the next data set is started.
4 Next data set.

Subsequent Data Set and Transition Conditions

Structure of a data set

Subsequent data set	Transition condition 1	Transition value 1	Logical operator	Transition condition 2	Transition value 2

Subsequent Data Set

Subsequent data set defines the data set to be started next.

Transition Condition 1

Transition condition 1 is used to set the first transition condition. The following transition conditions are possible:

- Continue Without Condition
  No condition for a transition. The subsequent data set is started directly. Any second transition condition is without effect.
- Wait Time
  The condition for a transition is a waiting time.
- Start Request Edge
  The condition for a transition is an edge at the signal input.
- Start Request Level
  The condition for a transition is a level at the signal input.

Transition Value 1

Transition value 1 is used to set the value for the first transition condition. The meaning depends on the selected transition condition.

- In the case of transition condition Continue Without Condition
  - No meaning
- In the case of transition condition Waiting Time
  - Value 0 ... 30000: Waiting time of 0 ... 30000 ms
- In the case of transition condition Start Request Edge
  - 0: CCLR is triggered by rising-edge
  - Value 1: Falling edge
  - Value 4: Rising or falling edge
- In the case of transition condition Start Request Level
  - Value 2: 1 level
  - Value 3: 0 level

Logical Operator

Logical operator is used to logically link transition condition 1 and transition condition 2. The following logical operators are available:

- None
  No operator (transition condition 2 has no effect)
- AND
  Logical AND
- OR
  Logical OR

Transition Condition 2

Transition condition 2 is used to set the second transition condition. The following transition conditions are possible:

- Continue Without Condition
  No condition for a transition. The subsequent data set is started directly.
- Start Request Edge
  The condition for a transition is an edge at the signal input.
  If an And is used to logically link an edge and a waiting time, the edge is not evaluated until the waiting time has elapsed.
- Start Request Level
  The condition for a transition is a level at the signal input.

Transition Value 2

Transition value 2 is used to set the value for the second transition condition. The meaning depends on the selected transition condition.

- In the case of transition condition Continue Without Condition
  - No meaning
- In the case of transition condition Start Request Edge
  - 0: CCLR is triggered by rising-edge
  - Value 1: Falling edge
  - Value 4: Rising or falling edge
- In the case of transition condition Start Request Level
  - Value 2: 1 level
  - Value 3: 0 level

Error Diagnostics

Plausibility Check

The fields of a data set are verified for plausibility when the data set is started. If an error is detected in a data set, the parameters _MSM_error_num and _MSM_error_field provide information on the data set number and the data set field containing the error.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_MSM_error_num	Number of the data set in which an error has been detected Value -1: No error Values 0 ... 127: Number of the data set in which an error has been detected. Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:D_h Modbus 11546
_MSM_error_field	Field of the data set in which an error has been detected Value -1: No error Value 0: Data set type Value 1: Setting A Value 2: Setting B Value 3: Setting C Value 4: Setting D Value 5: Transition type Value 6: Subsequent data set Value 7: Transition condition 1 Value 8: Transition value 1 Value 9: Logical operator Value 10: Transition condition 2 Value 11: Transition value 2 Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 11	INT16 R/- - -	CANopen 302D:E_h Modbus 11548

Diagnostics via Parameter

The parameter _MSMnumFinish lets you read the number of the data set that was being executed at the point in time the movement was canceled.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_MSMNumFinish	Number of data set that was active when a movement was interrupted When a movement is interrupted, the number of the data set that was being processed at the point in time of the interruption is contained in this parameter. Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:B_h Modbus 11542

Additional Settings

The following functions can be used for target value processing:

- Chapter Stop Movement with Halt *(see page 332)*
- Chapter Stop Movement with Quick Stop *(see page 334)*
- Chapter Limitation of the Velocity via Signal Inputs *(see page 336)*
- Chapter Limitation of the Current via Signal Inputs *(see page 337)*
- Chapter Jerk Limitation *(see page 331)*
  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Chapter Zero Clamp *(see page 338)*
  This function is only available for data set type Move Velocity.
- Chapter Setting a Signal Output via Parameter *(see page 339)*
- Chapter Position Capture via Signal Input (Vendor-Specific Profile) *(see page 341)*
  Chapter Position Capture via Signal Input (DS402 Profile) *(see page 344)*
- Chapter Relative Movement After Capture (RMAC) *(see page 347)*
  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Move Velocity.

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 353)*
- Chapter Reference Switch *(see page 354)*
  This function is only available for data set type Reference Movement.
- Chapter Software Limit Switches *(see page 355)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 357)*
  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Chapter Motor Standstill and Direction of Movement *(see page 362)*
- Chapter Standstill Window *(see page 365)*
  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Chapter Position Register *(see page 367)*
- Chapter Position Deviation Window *(see page 372)*
  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Chapter Velocity Deviation Window *(see page 374)*
- Chapter Velocity Threshold Value *(see page 376)*
- Chapter Current Threshold Value *(see page 377)*

Section 7.10
Operating Mode Cyclic Synchronous Torque

Operating Mode Cyclic Synchronous Torque

Overview

The drive synchronously follows the torque values transmitted on a cyclic basis. The transmitted values are linearly interpolated (internally).

The possible applications for this operating mode are described in the manual of the master controller.

Starting the Operating Mode

The operating mode is set in the parameter `DCOMopmode`.

A transition to the operating state **6** Operation Enabled starts the set operating mode.

The parameter `PTtq_target` provides the target value.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PTtq_target`	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %. Modified settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	CANopen 6071:0$_h$ Modbus 6944

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter **`DCOMstatus`**	Meaning
Bit 10	Reserved
Bit 12	0: Target torque ignored 1: Target torque shall be used as input to torque control loop

For the common bits of the Status Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state **6** Operation Enabled is left.

Section 7.11
Operating Mode Cyclic Synchronous Velocity

Operating Mode Cyclic Synchronous Velocity

Overview

The drive synchronously follows the velocity values transmitted on a cyclic basis. The transmitted values are linearly interpolated (internally).

The possible applications for this operating mode are described in the manual of the master controller.

Starting the Operating Mode

The operating mode is set in the parameter `DCOMopmode`.

A transition to the operating state **6** Operation Enabled starts the set operating mode.

The parameter `PVv_target` provides the target value.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PVv_target`	Target velocity for operating mode Profile Velocity The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active immediately.	usr_v - 0 -	INT32 R/W - -	CANopen 60FF:0_h Modbus 6938

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	Reserved
Bit 12	0: Target velocity ignored 1: Target velocity shall be used as input to velocity control loop

For the common bits of the Status Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state **6** Operation Enabled is left.

Section 7.12
Operating Mode Cyclic Synchronous Position

Operating Mode Cyclic Synchronous Position

Overview

The drive synchronously follows the position values transmitted on a cyclic basis. The transmitted values are linearly interpolated (internally).

The possible applications for this operating mode are described in the manual of the master controller.

Starting the Operating Mode

The operating mode is set in the parameter `DCOMopmode`.

A transition to the operating state **6** Operation Enabled starts the set operating mode.

The parameter `PPp_target` provides the target value.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PPp_target`	Target position for operating mode Profile Position Minimum/maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Modified settings become active immediately.	usr_p - - -	INT32 R/W - -	CANopen 607A:0$_h$ Modbus 6940

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

For the common bits of the Control Word see chapter Changing the Operating State *(see page 257)*.

Status Word

Parameter **`DCOMstatus`**	Meaning
Bit 10	Reserved
Bit 12	0: Target position ignored 1: Target position shall be used as input to position control loop

For the common bits of the Status Word see chapter Indication of the Operating State *(see page 253)*.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state **6** Operation Enabled is left.

Section 7.13
Examples for Node Address 1

Examples for Node Address 1

Operating Mode Jog

Work step COB ID / data	Object Value

Slow velocity to 100
`→601 / 23 29 30 04 64 00 00 00`
`←581 / 60 29 30 04 00 00 00 00`
	$3029{:}4_h$
	0064_h

Fast velocity to 250
`→601 / 23 29 30 05 FA 00 00 00`
`←581 / 60 29 30 05 00 00 00 00`
	$3029{:}5_h$
	$00FA_h$

NMT Start remote node
`→  0 / 01 00`
T_PDO1 with status word
`←181 / 31 62`	

Enable power stage with R_PDO1
`→201 / 00 00`
`→201 / 06 00`
`→201 / 0F 00`
T_PDO1 (operating state: **6** Operation Enabled)
`←181 / 37 42`	

Starting the operating mode
`→601 / 2F 60 60 00 FF 00 00 00`
`←581 / 60 60 60 00 00 00 00 00`
	6060_h
	FF_h

Check operating mode(1)
`→601 / 40 61 60 00 00 00 00 00`
Operating mode active
`←581 / 4F 61 60 00 FF 61 01 00`
	6061_h
	
	FF_h

Start movement (positive direction, slow)
`→601 / 2B 1B 30 09 01 00 00 00`
`←581 / 60 1B 30 09 00 00 00 00`
T_PDO1 with status word
`←181 / 37 02`
	$301B{:}9_h$
	01_h

Start movement (positive direction, fast)
`→601 / 2B 1B 30 09 05 00 00 00`
`←581 / 60 1B 30 09 00 00 00 00`
T_PDO1 with status word
`←181 / 37 02`
	$301B{:}9_h$
	05_h

Terminate movement
`→601 / 2B 1B 30 09 00 00 00 00`
`←581 / 60 1B 30 09 00 00 00 00`
T_PDO1 with status word
`←181 / 37 42`
	$301B{:}9_h$
	00_h

(1) The operating mode must be checked until the device has activated the specified operating mode.	

Operating Mode Profile Torque

Work step COB ID / data	Object Value

NMT Start remote node
`→  0 / 01 00`
T_PDO1 with status word
`←181 / 31 62`	

Enable power stage with R_PDO1
`→201 / 00 00`
`→201 / 06 00`
`→201 / 0F 00`
T_PDO1 (operating state: **6** Operation Enabled)
`←181 / 31 62`	

Starting the operating mode
`→601 / 2F 60 60 00 04 00 00 00`
`←581 / 60 60 60 00 00 00 00 00`
	6060_h
	04_h

Check operating mode[(1)]
`→601 / 40 61 60 00 00 00 00 00`
Operating mode active
`←581 / 4F 61 60 00 04 61 01 00`
	6061_h
	
	04_h

Target torque set to 100 (10.0%)
`→601 / 2B 71 60 00 64 00 00 00`
`←581 / 60 71 60 00 00 00 00 00`
Target torque reached
`←181 / 37 06`
	6071_h
	64_h

Terminate operating mode with "Quick Stop" with R_PDO1
`→201 / 0B 00`
T_PDO1 with status word
`←181 / 17 66`	

Clear "Quick Stop" with R_PDO1
`→201 / 0F 00`
T_PDO1 with status word
`←181 / 37 46`	

(1) The operating mode must be checked until the device has activated the specified operating mode.	

Operating Mode Profile Velocity

Work step COB ID / data	Object Value

Activate R_PDO3
`→601 / 23 02 14 01 01 04 00 04`
`←581 / 60 02 14 01 00 00 00 00`
	$1402:1_h$
	$0400\ 0401_h$

Activate T_PDO3
`→601 / 23 02 18 01 81 03 00 04`
`←581 / 60 02 18 01 00 00 00 00`
	$1802:1_h$
	$0400\ 0381_h$

Set acceleration to 2000
`→601 / 23 83 60 00 D0 07 00 00`
`←581 / 60 83 60 00 00 00 00 00`
	6083_h
	$0000\ 07D0_h$

NMT Start remote node
`→  0 / 01 00`
T_PDO3 with status word
`←381 / 31 66 00 00 00 00`	

Enable power stage with R_PDO3
`→401 / 00 00 00 00 00 00`
`→401 / 06 00 00 00 00 00`
`→401 / 0F 00 00 00 00 00`
T_PDO3 (operating state: **6** Operation Enabled)
`←381 / 37 46 00 00 00 00`	

Starting the operating mode
`→601 / 2F 60 60 00 03 00 00 00`
`←581 / 60 60 60 00 00 00 00 00`
	6060_h
	03_h

Check operating mode(1)
`→601 / 40 61 60 00 00 00 00 00`
Operating mode active
`←581 / 4F 61 60 00 03 61 01 00`
	6061_h
	
	03_h

R_PDO3: Specification of target velocity 1000
`→401 / 0F 00 E8 03 00 00`
T_PDO2 with status word and velocity actual value
`←381 / 37 02 00 00 00 00`
Target velocity reached
`←381 / 37 06 E8 03 00 00`	

Terminate operating mode with "Quick Stop" with R_PDO3
`→401 / 0B 00 00 00 00 00`
T_PDO3 with status word
`←381 / 17 66 00 00 00 00`	

Clear "Quick Stop" with R_PDO3
`→401 / 0F 00 00 00 00 00`
T_PDO3 with status word
`←381 / 37 46 00 00 00 00`	

(1) The operating mode must be checked until the device has activated the specified operating mode.	

Operating Mode Profile Position

Work step COB ID / data	Object Value
Activate R_PDO2 →601 / 23 01 14 01 01 03 00 04 ←581 / 60 01 14 01 00 00 00 00	$1401{:}1_h$ $0400\ 0301_h$
Activate T_PDO2 →601 / 23 01 18 01 81 02 00 04 ←581 / 60 01 18 01 00 00 00 00	$1801{:}1_h$ $0400\ 0281_h$
Set acceleration to 2000 →601 / 23 83 60 00 D0 07 00 00 ←581 / 60 83 60 00 00 00 00 00	6083_h $0000\ 07D0_h$
Set deceleration to 4000 →601 / 23 84 60 00 A0 0F 00 00 ←581 / 60 84 60 00 00 00 00 00	6084_h $0000\ 0FA0_h$
Set target velocity to 4000 →601 / 23 81 60 00 A0 0F 00 00 ←581 / 60 81 60 00 00 00 00 00	6081_h $0000\ 0FA0_h$
NMT Start remote node → 0 / 01 00 T_PDO2 with status word ←281 / 31 66 00 00 00 00	
Enable power stage with R_PDO2 →301 / 00 00 00 00 00 00 →301 / 06 00 00 00 00 00 →301 / 0F 00 00 00 00 00 T_PDO2 (operating state: **6** Operation Enabled) ←281 / 37 42 00 00 00 00	
Starting the operating mode →601 / 2F 60 60 00 01 00 00 00 ←581 / 60 60 60 00 00 00 00 00	6060_h 01_h
Check operating mode(1) →601 / 40 61 60 00 00 00 00 00 Operating mode active ←581 / 4F 61 60 00 01 61 01 00	6061_h 01_h
R_PDO2: Start relative movement with NewSetpoint=1 →301 / 5F 00 30 75 00 00 T_PDO2 with status word and position actual value ←281 / 37 12 00 00 00 00 Target position reached ←281 / 37 56 30 75 00 00	
R_PDO2: NewSetpoint=0 →301 / 4F 00 30 75 00 00	
(1) The operating mode must be checked until the device has activated the specified operating mode.	

Operating Mode Homing

Work step COB ID / data	Object Value
Velocity for searching the limit switch to 100 →601 / 23 99 60 01 64 00 00 00 ←581 / 60 99 60 01 00 00 00 00	$6099:1_h$ $0000\ 0064_h$
Velocity for moving away from switch to 10 →601 / 23 99 60 02 0A 00 00 00 ←581 / 60 99 60 02 00 00 00 00	$6099:2_h$ $0000\ 000A_h$
NMT Start remote node → 0 / 01 00 T_PDO1 with status word ←181 / 31 62	
Enable power stage with R_PDO1 →201 / 00 00 →201 / 06 00 →201 / 0F 00 T_PDO1 (operating state: **6** Operation Enabled) ←181 / 37 42	
Starting the operating mode →601 / 2F 60 60 00 06 00 00 00 ←581 / 60 60 60 00 00 00 00 00	6060_h 06_h
Check operating mode(1) →601 / 40 61 60 00 00 00 00 00 Operating mode active ←581 / 4F 61 60 00 06 61 01 00	6061_h 06_h
Select method 17 →601 / 2F 98 60 00 11 00 00 00 ←581 / 60 98 60 00 00 00 00 00	6098_h 11_h
Start reference movement (Homing operation start) →201 / 1F 00 T_PDO1 reference movement active ←181 / 37 02 T_PDO1 reference movement terminated ←181 / 37 D6	
(1) The operating mode must be checked until the device has activated the specified operating mode.	

Chapter 8
Functions for Operation

What Is in This Chapter?

This chapter contains the following sections:

Section 8.1
Functions for Target Value Processing

What Is in This Section?

This section contains the following topics:

Motion Profile for the Velocity

Description

Target position and target velocity are input values specified by the user. A motion profile for the velocity is calculated on the basis of these input values.

The motion profile for the velocity consists of an acceleration, a deceleration and a maximum velocity.

A linear ramp for both directions of movement is available.

Availability

The availability of the motion profile for the velocity depends on the operating mode.

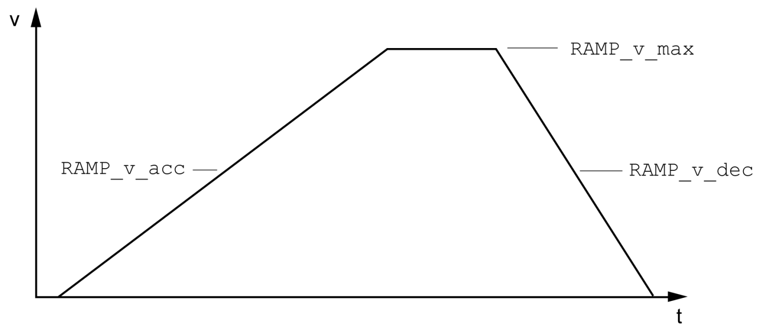
In the following operating modes, the motion profile for the velocity is permanently active:
- Jog
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

In the following operating modes, the motion profile for the velocity can be activated and deactivated:
- Profile Velocity
- Motion Sequence (Move Velocity)

In the following operating modes, the motion profile for the velocity is unavailable:
- Profile Torque
- Interpolated Position

Ramp Slope

The ramp slope determines the velocity changes of the motor per time unit. The ramp slope can be set for acceleration and deceleration.



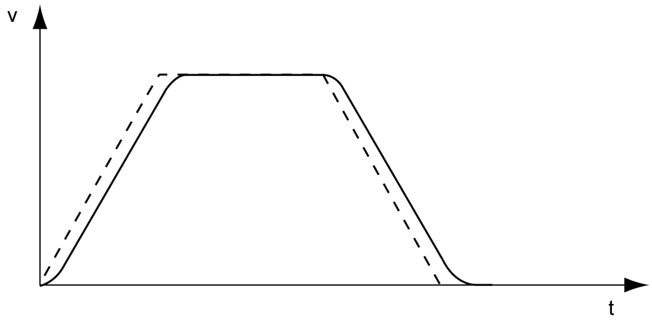
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_enable	Activation of the motion profile for velocity **0 / Profile Off**: Profile off **1 / Profile On**: Profile on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:2B$_h$ Modbus 1622
RAMP_v_max	Maximum velocity of the motion profile for velocity If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMP_v_max. This way, commissioning at limited velocity is easier to perform. Setting can only be modified if power stage is disabled. Modified settings become active the next time the motor moves.	usr_v 1 13200 2147483647	UINT32 R/W per. -	CANopen 607F:0$_h$ Modbus 1554

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RAMP_v_acc`	Acceleration of the motion profile for velocity Writing the value 0 has no effect on the parameter. Modified settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	CANopen 6083:0$_h$ Modbus 1556
`RAMP_v_dec`	Deceleration of the motion profile for velocity The minimum value depends on the operating mode: Operating modes with minimum value 1: Profile Velocity Motion Sequence (Move Velocity) Operating modes with minimum value 120: Jog Profile Position Homing Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement) Writing the value 0 has no effect on the parameter. Modified settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	CANopen 6084:0$_h$ Modbus 1558

Jerk Limitation

Description

Jerk limitation smoothes sudden acceleration changes to allow for smooth transitions with almost no jerking.



Availability

Jerk limitation is available in the following operating modes.

- Jog
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Settings

Jerk limitation is activated and set via the parameter `RAMP_v_jerk`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RAMP_v_jerk`	Jerk limitation of the motion profile for velocity **0 / Off**: Off **1 / 1**: 1 ms **2 / 2**: 2 ms **4 / 4**: 4 ms **8 / 8**: 8 ms **16 / 16**: 16 ms **32 / 32**: 32 ms **64 / 64**: 64 ms **128 / 128**: 128 ms Adjustments can only be made if the operating mode is inactive (x_end=1). Modified settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	CANopen 3006:D_h Modbus 1562

Stop Movement with Halt

With a Halt, the ongoing movement is interrupted; it can be resumed.

A Halt can be triggered via a digital signal input or a fieldbus command.

In order to interrupt a movement via a signal input, you must first parameterize the signal input function “Halt”, see chapter Digital Inputs and Outputs *(see page 218)*.

The movement can be interrupted with 2 different deceleration types.

- Deceleration via deceleration ramp
- Deceleration via torque ramp

Setting the Type of Deceleration

The parameter `LIM_HaltReaction` lets you set the type of deceleration.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_HaltReaction`	Halt option code **1 / Deceleration Ramp**: Deceleration ramp **3 / Torque Ramp**: Torque ramp Type of deceleration for Halt. Setting of deceleration ramp with parameter RAMP_v_dec. Setting of torque ramp with parameter LIM_I_maxHalt. If a deceleration ramp is already active, the parameter cannot be written. Modified settings become active immediately.	- 1 1 3	INT16 R/W per. -	CANopen 605D:0_h Modbus 1582

Setting the Deceleration Ramp

The deceleration ramp is set with the parameter `Ramp_v_dec` via the Motion Profile for the Velocity *(see page 329)*.

Setting the Torque Ramp

The parameter `LIM_I_maxHalt` lets you set the torque ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_I_maxHalt`	Current for Halt This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Halt, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxHalt - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Halt. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:E_h Modbus 4380

Stop Movement with Quick Stop

With a Quick Stop, the ongoing movement is stopped.

A Quick Stop can be triggered by a detected error of error classes 1 or 2 or via a fieldbus command.

The movement can be stopped with 2 different deceleration types.

- Deceleration via deceleration ramp
- Deceleration via torque ramp

In addition, you can set the operating state to switch to after the deceleration.

- Transition to operating state **9** Fault
- Transition to operating state **7** Quick Stop Active

Setting the Type of Deceleration

The parameter `LIM_QStopReact` lets you set the type of deceleration.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_QStopReact`	Quick Stop option code **-2 / Torque ramp (Fault)**: Use torque ramp and transit to operating state 9 Fault **-1 / Deceleration Ramp (Fault)**: Use deceleration ramp and transit to operating state 9 Fault **6 / Deceleration ramp (Quick Stop)**: Use deceleration ramp and remain in operating state 7 Quick Stop **7 / Torque ramp (Quick Stop)**: Use torque ramp and remain in operating state 7 Quick Stop Type of deceleration for Quick Stop. Setting of deceleration ramp with parameter RAMPquickstop. Setting of torque ramp with parameter LIM_I_maxQSTP. If a deceleration ramp is already active, the parameter cannot be written. Modified settings become active immediately.	- -2 6 7	INT16 R/W per. -	CANopen 3006:18$_h$ Modbus 1584

Setting the Deceleration Ramp

The parameter `RAMPquickstop` lets you set the deceleration ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RAMPquickstop`	Deceleration ramp for Quick Stop Deceleration ramp for a software stop or an error with error class 1 or 2. Modified settings become active the next time the motor moves.	usr_a 1 6000 2147483647	UINT32 R/W per. -	CANopen 3006:12$_h$ Modbus 1572

Setting the Torque Ramp

The parameter LIM_I_maxQSTP lets you set the torque ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxQSTP	Current for Quick Stop This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Quick Stop, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxQSTP - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:D_h Modbus 4378

Limitation of the Velocity via Signal Inputs

Limitation via Digital Signal Input

The velocity can be limited to a specific value via a digital signal input.

The parameter `IO_v_limit` lets you set the velocity limitation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_v_limit`	Velocity limitation via input A velocity limitation can be activated via a digital input. In operating mode Profile Torque, the minimum velocity is internally limited to 100 min-1. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:1E$_h$ Modbus 1596

In order to limit the velocity via a digital signal input, you must first parameterize the signal input function “Velocity Limitation”, see chapter Digital Inputs and Outputs *(see page 218)*.

As of firmware version ≥V01.06 you can configure the signal evaluation of the signal input function via the parameter `IOsigVelLim`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOsigVelLim`	Signal evaluation for signal input function Velocity Limitation **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.06.	- 1 2 2	UINT16 R/W per. -	CANopen 3008:27$_h$ Modbus 2126

Limitation of the Current via Signal Inputs

Limitation via Digital Signal Input

The current can be limited to a specific value via a digital signal input.

The parameter `IO_I_limit` lets you set the current limitation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_I_limit`	Current limitation via input A current limit can be activated via a digital input. In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	CANopen 3006:27$_h$ Modbus 1614

In order to limit the current via a digital signal input, you must first parameterize the signal input function “Current Limitation”, see chapter Digital Inputs and Outputs *(see page 218)*.

As of firmware version ≥V01.06 you can configure the signal evaluation of the signal input function via the parameter `IOsigCurrLim`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOsigCurrLim`	Signal evaluation for signal input function Current Limitation **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.06.	- 1 2 2	UINT16 R/W per. -	CANopen 3008:28$_h$ Modbus 2128

Zero Clamp

Description

The motor can be stopped via a digital signal input. The velocity of the motor must be below a parameterizable velocity value.

Availability

The signal input function “Zero Clamp” is available in the following operating mode:

- Profile Velocity
- Motion Sequence (Move Velocity)

Settings

Target velocities below the parameterized velocity value are interpreted as "zero".

The signal input function “Zero Clamp” has a hysteresis of 20 %.

The parameter `MON_v_zeroclamp` lets you set the velocity value.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_v_zeroclamp`	Velocity limit for Zero Clamp A Zero Clamp operation is only possible if the reference velocity is below the Zero Clamp velocity limit. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:28$_h$ Modbus 1616

In order to stop the motor via a digital signal input, you must first parameterize the signal input function “Zero Clamp”, see chapter Digital Inputs and Outputs *(see page 218)*.

Setting a Signal Output via Parameter

Description

The digital signal outputs can be set as required via the fieldbus.

In order to set a digital signal output via the parameter, you must first parameterize the signal output function “Freely Available”, see chapter Parameterization of the Signal Output Functions *(see page 226)*.

The parameter `IO_DQ_set` lets you set the digital signal outputs.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_DQ_set`	Setting the digital outputs directly Digital outputs can only be set directly if the signal output function has been set to 'Available as required'. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/W - -	CANopen $3008{:}11_h$ Modbus 2082

Starting a Movement via a Signal Input

The signal input function “Start Profile Positioning” sets the start signal for the movement in the operating mode Profile Position. The positioning movement is then executed when the edge at the digital input rises.

Position Capture via Signal Input (Vendor-Specific Profile)

Description

The motor position can be captured when a signal is detected at a Capture input.

Number of Capture Inputs

2 Capture inputs are available.

- Capture input: `DI0/CAP1`
- Capture input: `DI1/CAP2`

Selection of the Method

The motor position can be captured in 2 different ways:

- One-time position capture
  One-time capture means that the position is captured at the first edge.
- Continuous motor position capture
  Continuous capture means that the motor position is captured anew at every edge. The previously captured value is lost.

The motor position can be captured when the edge at the Capture input rises or falls.

Accuracy

A jitter of 2 µs results in an inaccuracy of the captured position of approximately 1.6 user-defined units at a velocity of 3000 rpm.

(3000 rpm = (3000*16384)/(60*10^6) = 0.8 usr_p/µs)

If the factory settings for scaling are used, 1.6 user-defined units correspond to 0.035 °.

The captured motor position is less accurate during the acceleration phase and the deceleration phase.

Setting the Edge

The following parameters let you set the edge for position capture.

- Set the desired edge with the parameters `Cap1Config` and `Cap2Config`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`Cap1Config`	Capture input 1 configuration **0 / Falling Edge**: Position capture at falling edge **1 / Rising Edge**: Position capture at rising edge **2 / Both Edges**: Position capture at both edges Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 300A:2_h Modbus 2564
`Cap2Config`	Capture input 2 configuration **0 / Falling Edge**: Position capture at falling edge **1 / Rising Edge**: Position capture at rising edge **2 / Both Edges**: Position capture at both edges Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 300A:3_h Modbus 2566

Starting Position Capture

The following parameters let you start position capture.

- Set the desired method with the parameters Cap1Activate and Cap2Activate.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
Cap1Activate	Capture input 1 start/stop **0 / Capture Stop**: Cancel capture function **1 / Capture Once**: Start one-time capture **2 / Capture Continuous**: Start continuous capture **3 / Reserved**: Reserved **4 / Reserved**: Reserved In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 4	UINT16 R/W - -	CANopen 300A:4$_h$ Modbus 2568
Cap2Activate	Capture input 2 start/stop **0 / Capture Stop**: Cancel capture function **1 / Capture Once**: Start one-time capture **2 / Capture Continuous**: Start continuous capture **3 / Reserved**: Reserved **4 / Reserved**: Reserved In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 4	UINT16 R/W - -	CANopen 300A:5$_h$ Modbus 2570

Status Messages

The parameter _CapStatus indicates the capture status.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_CapStatus	Status of the capture inputs Read access: Bit 0: Position captured via input CAP1 Bit 1: Position captured via input CAP2	- - - -	UINT16 R/- - -	CANopen 300A:1$_h$ Modbus 2562

Captured Position

The captured position can be read via the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_Cap1PosCons`	Capture input 1 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap1CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	CANopen 300A:18$_h$ Modbus 2608
`_Cap1CountCons`	Capture input 1 event counter (consistent) Counts the capture events. The event counter is reset when capture input 1 is activated. By reading this parameter, the parameter "_Cap1PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	CANopen 300A:17$_h$ Modbus 2606
`_Cap2PosCons`	Capture input 2 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap2CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	CANopen 300A:1A$_h$ Modbus 2612
`_Cap2CountCons`	Capture input 2 event counter (consistent) Counts the capture events. The event counter is reset when capture input 2 is activated. By reading this parameter, the parameter "_Cap2PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	CANopen 300A:19$_h$ Modbus 2610

Position Capture via Signal Input (DS402 Profile)

Description

The motor position can be captured when a signal is detected at a Capture input.

Availability

Available with firmware version ≥V01.04.

Number of Capture Inputs

2 Capture inputs are available.

- Capture input: `DI0/CAP1`
- Capture input: `DI1/CAP2`

Selection of the Method

The motor position can be captured in 2 different ways:

- One-time position capture
  One-time capture means that the position is captured at the first edge.
- Continuous motor position capture
  Continuous capture means that the motor position is captured anew at every edge. The previously captured value is lost.

The motor position can be captured when the edge at the Capture input rises or falls.

Accuracy

A jitter of 2 μs results in an inaccuracy of the captured position of approximately 1.6 user-defined units at a velocity of 3000 rpm.

(3000 rpm = (3000*16384)/(60*10^6) = 0.8 usr_p/μs)

If the factory settings for scaling are used, 1.6 user-defined units correspond to 0.035 °.

The captured motor position is less accurate during the acceleration phase and the deceleration phase.

Adjusting and Starting Position Capture

The following parameter let you adjust and start position capture.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`TouchProbeFct`	Touch Probe function Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/W - -	CANopen 60B8:0_h Modbus 7028

Bit	Value 0	Value 1
0	Deactivate Capture input 1	Activate Capture input 1
1	One-time capture	Continuous capture
2 ... 3	Reserved (must be 0)	-
4	Disabling capture with rising edge	Enabling capture with rising edge
5	Disabling capture with falling edge	Enabling capture with falling edge
6 ... 7	Reserved (must be 0)	-
8	Deactivate Capture input 2	Activate Capture input 2
9	One-time capture	Continuous capture
10 ... 11	Reserved (must be 0)	-
12	Disabling capture with rising edge	Enabling capture with rising edge
13	Disabling capture with falling edge	Enabling capture with falling edge
14 ... 15	Reserved (must be 0)	-

Status Messages

The following parameter lets you indicate the capture status.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_TouchProbeStat`	Touch Probe status Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 60B9:0$_h$ Modbus 7030

Bit	Value 0	Value 1
0	Capture input 1 deactivated	Capture input 1 activated
1	Capture input 1 no value captured for rising edge	Capture input 1 value captured for rising edge
2	Capture input 1 no value captured for falling edge	Capture input 1 value captured for falling edge
3 ... 7	Reserved	-
8	Capture input 2 deactivated	Capture input 2 activated
9	Capture input 2 no value captured for rising edge	Capture input 2 value captured for rising edge
10	Capture input 2 no value captured for falling edge	Capture input 2 value captured for falling edge
11 ... 15	Reserved	-

Captured Position

The captured position can be read via the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_Cap1PosRisEdge`	Capture input 1 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BA:0$_h$ Modbus 2634
`_Cap1CntRise`	Capture input 1 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 1 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2B$_h$ Modbus 2646
`_Cap1PosFallEdge`	Capture input 1 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BB:0$_h$ Modbus 2636
`_Cap1CntFall`	Capture input 1 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 1 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2C$_h$ Modbus 2648

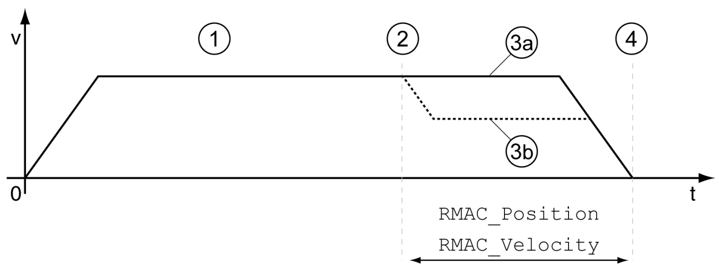
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_Cap2PosRisEdge`	Capture input 2 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BC:0$_h$ Modbus 2638
`_Cap2CntRise`	Capture input 2 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 2 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2D$_h$ Modbus 2650
`_Cap2PosFallEdge`	Capture input 2 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BD:0$_h$ Modbus 2640
`_Cap2CntFall`	Capture input 2 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 2 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2E$_h$ Modbus 2652
`_CapEventCounters`	Capture inputs 1 and 2 summary of event counters This parameter contains the counted capture events. Bits 0 ... 3: _Cap1CntRise (lowest 4 bits) Bits 4 ... 7: _Cap1CntFall (lowest 4 bits) Bits 8 ... 11: _Cap2CntRise (lowest 4 bits) Bits 12 ... 15: _Cap2CntFall (lowest 4 bits) Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2F$_h$ Modbus 2654

Relative Movement After Capture (RMAC)

Description

Relative Movement After Capture (RMAC) starts a relative movement via a signal input while another movement is running.

The target position and the velocity can be parameterized.



1 Movement with set operating mode (for example operating mode Profile Velocity)
2 Start of the relative movement after capture with the signal input function Start Signal Of RMAC
3a Relative movement after capture is performed with unchanged velocity
3b Relative movement after capture is performed with parameterized velocity
4 Target position reached

Availability

A Relative Movement After Capture (RMAC) can be started in the following operating modes:

- Jog
- Profile Torque
- Profile Velocity
- Profile Position

Signal Input Functions

In local control mode, the following signal input functions are required to start the relative movement:

Signal input function	Meaning	Activation
Activate RMAC	Activation of relative movement after capture	1 level
Start Signal Of RMAC	Start signal for relative movement	Adjustable via parameter RMAC_Edge
Activate Operating Mode	When the relative movement has terminated, the operating mode is resumed.	Rising edge

In fieldbus control mode, the signal input function "Start Signal Of RMAC" is required to start the relative movement.

The signal input functions must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function “RMAC Active Or Finished”, see chapter Digital Inputs and Outputs *(see page 218)*.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters *(see page 379)*.

In addition, the status is available via the parameters `_RMAC_Status` and `_RMAC_DetailStatus`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_RMAC_Status`	Status of relative movement after capture **0 / Not Active**: Not active **1 / Active Or Finished**: Relative movement after capture is active or finished	- 0 - 1	UINT16 R/- - -	CANopen 3023:11$_h$ Modbus 8994
`_RMAC_DetailStatus`	Detailed status of relative movement after capture (RMAC) **0 / Not Activated**: Not activated **1 / Waiting**: Waiting for capture signal **2 / Moving**: Relative movement after capture running **3 / Interrupted**: Relative movement after capture interrupted **4 / Finished**: Relative movement after capture terminated Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 3023:12$_h$ Modbus 8996

Activates Relative Movement After Capture

Relative Movement After Capture (RMAC) must be activated before it can be started.

In local control mode, Relative Movement After Capture is activated via the signal input function "Activate RMAC".

In fieldbus control mode, Relative Movement After Capture (RMAC) is activated via the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RMAC_Activate`	Activation of relative movement after capture **0 / Off**: Off **1 / On**: On Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3023:C$_h$ Modbus 8984

In fieldbus control mode, it is also possible to activate relative Movement After Capture (RMAC) via the signal input function "Activate RMAC".

Target Values

The target position and the velocity for the relative movement are set via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RMAC_Position`	Target position of relative movement after capture Minimum/maximum values depend on: - Scaling factor Modified settings become active the next time the motor moves.	usr_p - 0 -	INT32 R/W per. -	CANopen 3023:D$_h$ Modbus 8986
`RMAC_Velocity`	Velocity of relative movement after capture Value 0: Use actual motor velocity Value >0: Value is the target velocity The adjustable value is internally limited to the setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 0 0 2147483647	UINT32 R/W per. -	CANopen 3023:E$_h$ Modbus 8988

Edge for the Start Signal

The edge which is to trigger the relative movement is set via the following parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RMAC_Edge`	Edge of capture signal for relative movement after capture **0 / Falling edge**: Falling edge **1 / Rising edge**: Rising edge	- 0 0 1	UINT16 R/W per. -	CANopen 3023:10$_h$ Modbus 8992

Response to Overtravelling of the Target Position

Depending on the set velocity, target position and deceleration ramp, the target position may be overtravelled.

The response to overtravelling of the target position is set via the following parameter.

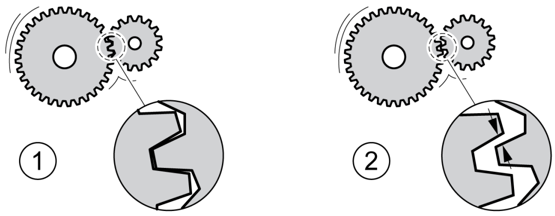
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`RMAC_Response`	Response if target position is overtraveld **0 / Error Class 1**: Error class 1 **1 / No Movement To Target Position**: No movement to target position **2 / Movement To Target Position**: Movement to target position Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3023:F$_h$ Modbus 8990

Backlash Compensation

Description

By setting backlash compensation, you can compensate for mechanical backlash.

Example of mechanical backlash



1 Example of low mechanical backlash
2 Example of high mechanical backlash

When backlash compensation is activated, the drive automatically compensates for the mechanical backlash during each movement.

Availability

Backlash compensation is possible in the following operating modes:

- Jog
- Profile Position
- Interpolated Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Parameterization

To use backlash compensation, you must set the amount of backlash.

The parameter `BLSH_Position` lets you set the amount of backlash in user-defined units.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`BLSH_Position`	Position value for backlash compensation Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen 3006:42$_h$ Modbus 1668

In addition, you can set a processing time. The processing time specifies the period of time during which the mechanical backlash is to be compensated for.

The parameter `BLSH_Time` lets you set the processing time in ms.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`BLSH_Time`	Processing time for backlash compensation Value 0: Immediate backlash compensation Value >0: Processing time for backlash compensation Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 0 0 16383	UINT16 R/W per. -	CANopen 3006:44$_h$ Modbus 1672

Activating Backlash Compensation

Before you can activate backlash compensation, there must be a movement in positive or negative direction. Backlash compensation is activated with the parameter `BLSH_Mode`.

- Start a movement in positive direction or in negative direction. This movement must last as long as it takes to move the mechanical system connected to the motor.
- If the movement was in positive direction (positive target values), activate backlash compensation with the value "OnAfterPositiveMovement".
- If the movement was in negative direction (negative target values), activate backlash compensation with the value "OnAfterNegativeMovement".

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`BLSH_Mode`	Processing mode of backlash compensation **0 / Off**: Backlash compensation is off **1 / OnAfterPositiveMovement**: Backlash compensation is on, last movement was in positive direction **2 / OnAfterNegativeMovement**: Backlash compensation is on, last movement was in negative direction Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3006:41$_h$ Modbus 1666

Section 8.2
Functions for Monitoring Movements

What Is in This Section?

This section contains the following topics:

Limit Switches

The use of limit switches can provide some protection against hazards (for example, collision with mechanical stop caused by incorrect reference values).

⚠ WARNING
LOSS OF CONTROL
● Ensure that limit switches are installed as determined by your risk assessment. ● Verify correct connection of the limit switches. ● Verify that the limit switches are sufficiently distant from the mechanical stop to allow an adequate stopping distance. ● Verify correct parameterization and function of the limit switches.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Limit Switches

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring.

If the positive or negative limit switch are tripped, the movement stops. An error message is generated and the operating state switches to **7** Quick Stop Active.

The error message can be reset by means of a “Fault Reset”. The operating state switches back to **6** Operation Enabled.

The movement can continue, however, only in the opposite direction. For example, if the positive limit switch was triggered, further movement is only possible in negative direction. In the case of further movement in positive direction, a new error message is generated and the operating state switches back to **7** Quick Stop Active.

The parameters `IOsigLIMP` and `IOsigLIMN` are used to set the type of limit switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOsigLIMP`	Signal evaluation for positive limit switch **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3006:10$_h$ Modbus 1568
`IOsigLIMN`	Signal evaluation for negative limit switch **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3006:F$_h$ Modbus 1566

The signal input functions “Positive Limit Switch (LIMP)” and “Negative Limit Switch (LIMN)” must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

Reference Switch

Description

The reference switch is only active in the operating mode Homing and in the operating mode Motion Sequence (Reference Movement).

The parameter `IOsigREF` lets you set the type of reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOsigREF`	Signal evaluation for reference switch **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO The reference switch is only active while a reference movement to the reference switch is processed. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	CANopen 3006:E$_h$ Modbus 1564

The signal input function “Reference Switch (REF)” must have been parameterized, see chapter Digital Inputs and Outputs *(see page 218)*.

Software Limit Switches

Description

Movements can be monitored using software limit switches. A positive position limit and a negative position limit can be set for monitoring.

If the positive or negative position limit switch are reached, the movement stops. An error message is generated and the operating state switches to **7** Quick Stop Active.

The error message can be reset by means of a “Fault Reset”. The operating state switches back to **6** Operation Enabled.

The movement can continue, however, only in the opposite direction of the position limit. For example, if the positive position limit was reached, further movement is only possible in negative direction. In the case of further movement in positive direction, a new error message is generated and the operating state switches back to **7** Quick Stop Active.

Prerequisite

Software limit switch monitoring only works with a valid zero point, see chapter Size of the Movement Range *(see page 201)*.

Behavior in Operating Modes with Target Positions

In the case of operating modes with target positions, the target position is compared to the position limits before the movement is started. The movement is started normally, even if the target position is greater than the positive position limit or less than the negative position limit. However, the movement is stopped before the position limit is exceeded.

In the following operating modes, the target position is verified prior to the start of a movement.

- Jog (step movement)
- Profile Position
- Motion Sequence (Move Absolute, Move Additive and Move Relative)

Behavior in Operating Modes Without Target Positions

In operating modes without target position, a Quick Stop is triggered at the position limit.

In the following operating modes, a Quick Stop is triggered at the position limit.

- Jog (continuous movement)
- Profile Torque
- Profile Velocity
- Motion Sequence (Move Velocity)

As of firmware version ≥V01.04, you can use the parameter `MON_SWLimMode` to set the behavior for reaching a position limit.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_SWLimMode`	Behavior when position limit is reached **0 / Standstill Behind Position Limit**: Quick Stop is triggered at position limit and standstill is reached behind position limit **1 / Standstill At Position Limit**: Quick Stop is triggered in front of position limit and standstill is reached at position limit Modified settings become active immediately. Available with firmware version ≥V01.04.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:47$_h$ Modbus 1678

Standstill at the position limit in operating modes without target position requires the parameter `LIM_QStopReact` to be set to "Deceleration ramp (Quick Stop)", see chapter Stop Movement with Quick Stop *(see page 334)*. If the parameter `LIM_QStopReact` is set to "Torque ramp (Quick Stop)", the movement may come to a standstill in front of or behind the position limit due to different loads.

Activation

The software limit switches are activated via the parameter MON_SW_Limits.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_SW_Limits	Activation of software limit switches **0 / None**: Deactivated **1 / SWLIMP**: Activation of software limit switches positive direction **2 / SWLIMN**: Activation of software limit switches negative direction **3 / SWLIMP+SWLIMN**: Activation of software limit switches both directions Software limit switches can only be activated if the zero point is valid. Modified settings become active immediately.	- 0 0 3	UINT16 R/W per. -	CANopen 3006:3$_h$ Modbus 1542

Setting Position Limits

The software limit switches are set via the parameters MON_swLimP and MON_swLimN.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_swLimP	Positive position limit for software limit switch If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p - 2147483647 -	INT32 R/W per. -	CANopen 607D:2$_h$ Modbus 1544
MON_swLimN	Negative position limit for software limit switch See description 'MON_swLimP'. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p - -2147483648 -	INT32 R/W per. -	CANopen 607D:1$_h$ Modbus 1546

Load-Dependent Position Deviation (Following Error)

Description

The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.

Parameters are available to read the load-dependent position deviation during operation and the maximum position deviation reached so far.

The maximum permissible load-dependent position deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent position deviation is available in the following operating modes:

- Jog
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Reading the Position Deviation

The following parameters let you read the load-dependent position deviation in user-defined units or revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_dif_load_usr	Load-dependent position deviation between reference and actual positions The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. This value is used for following error monitoring.	usr_p -2147483648 - 2147483647	INT32 R/- - -	CANopen 301E:16$_h$ Modbus 7724
_p_dif_load	Load-dependent position deviation between reference and actual positions The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. This value is used for following error monitoring. The parameter _p_dif_load_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	CANopen 301E:1C$_h$ Modbus 7736

The following parameters let you read the maximum value of the load-dependent position deviation reached so far in user-defined units or revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_p_dif_load_peak_usr`	Maximum value of the load-dependent position deviation This parameter contains the maximum load-dependent position deviation reached so far. A write access resets this value. Modified settings become active immediately.	usr_p 0 - 2147483647	INT32 R/W - -	CANopen 301E:15$_h$ Modbus 7722
`_p_dif_load_peak`	Maximum value of the load-dependent position deviation This parameter contains the maximum load-dependent position deviation reached so far. A write access resets this value. The parameter _p_dif_load_peak_usr allows you to enter the value in user-defined units.. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 - 429496.7295	UINT32 R/W - -	CANopen 301E:1B$_h$ Modbus 7734

Setting the Position Deviation

The following parameter lets you set the threshold for the maximum load-dependent position deviation that is to trigger an error of error class 0.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_p_dif_warn`	Maximum load-dependent position deviation (error class 0) 100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter MON_p_dif_load. Modified settings become active immediately.	% 0 75 100	UINT16 R/W per. -	CANopen 3006:29$_h$ Modbus 1618

The following parameters let you set the maximum load-dependent position deviation at which a movement is canceled with an error of error classes 1, 2, or 3.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_p_dif_load_usr`	Maximum load-dependent position deviation The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:3E$_h$ Modbus 1660
`MON_p_dif_load`	Maximum load-dependent position deviation The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. The parameter MON_p_dif_load_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0001 1.0000 200.0000	UINT32 R/W per. -	CANopen 6065:0$_h$ Modbus 1606

Setting the Error Class

The following parameter lets you set the error class for an excessively high load-dependent position deviation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ErrorResp_p_dif`	Error response to excessively high load-dependent position deviation **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	CANopen 3005:B$_h$ Modbus 1302

Load-Dependent Velocity Deviation

Description

The load-dependent velocity deviation is the difference between the reference velocity and the actual velocity caused by the load.

The maximum permissible load-dependent velocity deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent velocity deviation is available in the following operating modes:

- Profile Velocity

Reading the Velocity Deviation

The following parameters let you read the load-dependent velocity deviation in user-defined units.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_v_dif_usr`	Current load-dependent velocity deviation The load-dependent velocity deviation is the difference between reference velocity and actual velocity. Available with firmware version ≥V01.08.	usr_v -2147483648 - 2147483647	INT32 R/- - -	CANopen 301E:2C$_h$ Modbus 7768

Setting the Velocity Deviation

The following parameters let you specify the size of the window for the maximum load-dependent velocity deviation at which a movement is canceled.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_VelDiff`	Maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Maximum value Modified settings become active immediately. Available with firmware version ≥V01.08.	usr_v 0 0 2147483647	UINT32 R/W per. -	CANopen 3006:4B$_h$ Modbus 1686
`MON_VelDiff_Time`	Time window for maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Time window for maximum value Modified settings become active immediately. Available with firmware version ≥V01.08.	ms 0 10 -	UINT16 R/W per. -	CANopen 3006:4C$_h$ Modbus 1688

Setting the Error Class

The following parameter lets you set the error class for an excessively high load-dependent velocity deviation.

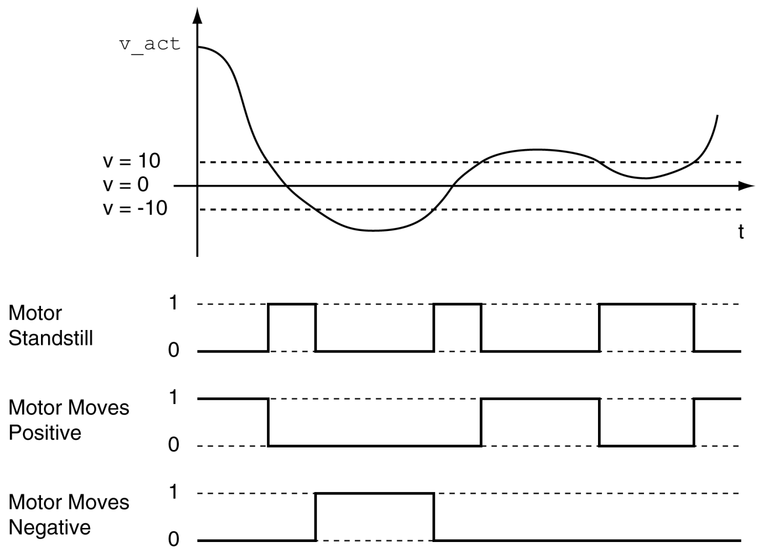
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ErrorResp_v_dif`	Error response to excessively high load-dependent velocity deviation **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.08.	- 1 3 3	UINT16 R/W per. -	CANopen 3005:3C$_h$ Modbus 1400

Motor Standstill and Direction of Movement

Description

The status of a movement can be monitored. You can read out whether the motor is at a standstill or whether it moves in a specific direction.

A velocity of <10 rpm is interpreted as standstill.



The status is available via signal outputs. In order to read the status, you must first parameterize the signal output functions “Motor Standstill”, “Motor Moves Positive” or “Motor Moves Negative”, see chapter Digital Inputs and Outputs *(see page 218)*.

Torque Window

Description

The torque window allows you to monitor whether the motor has reached the target torque.

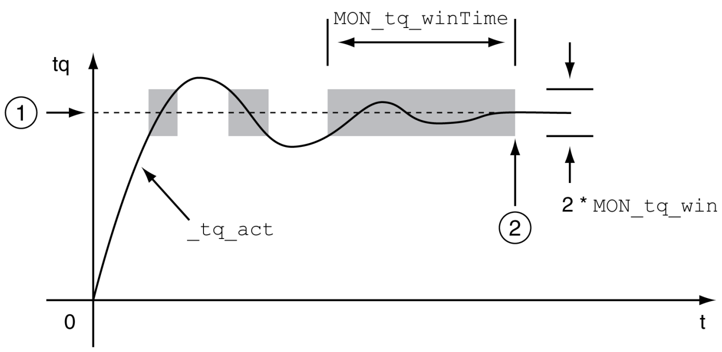
If the difference between the target torque and the actual torque remains in the torque window for the time MON_tq_winTime, the target torque is considered to have been reached.

Availability

The torque window is available in the following operating modes.

- Profile Torque

Setings



1 Target torque
2 Target torque reached (the actual torque did not exceed the permissible deviation MON_tq_win during time MON_tq_winTime).

The parameters MON_tq_win and MON_tq_winTime specify the size of the window.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_tq_win	Torque window, permissible deviation The torque window can only be activated in operating mode Profile Torque. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 3.0 3000.0	UINT16 R/W per. -	CANopen 3006:2D$_h$ Modbus 1626
MON_tq_winTime	Torque window, time Value 0: Torque window monitoring deactivated Changing the value causes a restart of torque monitoring. Torque window is only used in operating mode Profile Torque. Modified settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	CANopen 3006:2E$_h$ Modbus 1628

Velocity Window

Description

The velocity window allows you to monitor whether the motor has reached the target velocity.

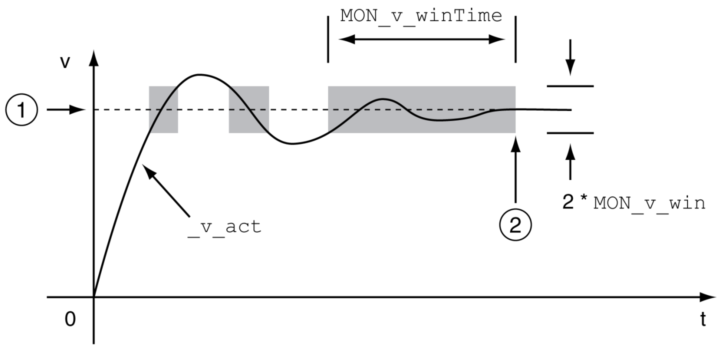
If the difference between the target velocity and the actual velocity remains in the velocity window for the time MON_v_winTime, the target velocity is considered to have been reached.

Availability

The velocity window is available in the following operating modes.

- Profile Velocity

Settings



1 Target velocity
2 Target velocity reached (the target velocity did not exceed the permissible deviation MON_v_win during time MON_v_winTime).

The parameters MON_v_win and MON_v_winTime specify the size of the window.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_v_win	Velocity window, permissible deviation Modified settings become active immediately. * Datatype for CANopen: UINT16	usr_v 1 10 2147483647	UINT32* R/W per. -	CANopen 606D:0$_h$ Modbus 1576
MON_v_winTime	Velocity window, time Value 0: Velocity window monitoring deactivated Changing the value causes a restart of velocity monitoring. Modified settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	CANopen 606E:0$_h$ Modbus 1578

Standstill Window

Description

The standstill window allows you to monitor whether the motor has reached the target position.

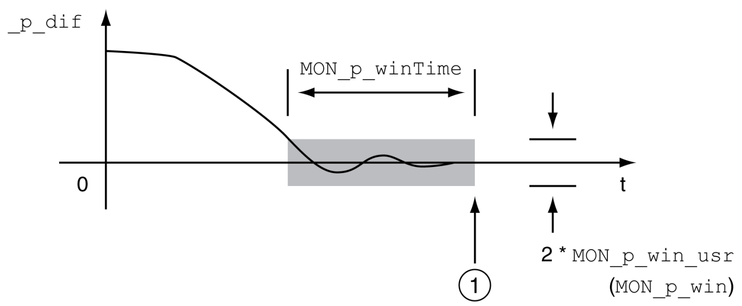
If the difference between the target position and the actual position remains in the standstill window for the time `MON_p_winTime`, the target position is considered to have been reached.

Availability

The standstill window is available in the following operating modes.

- Jog (step movement)
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Settings



1 Target position reached (the actual position did not exceed the permissible deviation `MON_p_win_usr` during time `MON_p_winTime`).

The parameters `MON_p_win_usr` (`MON_p_win`) and `MON_p_winTime` specify the size of the window.

The parameter `MON_p_winTout` can be used to set the period of time after which a detected error is signaled if the standstill window was not reached.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_p_win_usr`	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 16 2147483647	INT32 R/W per. -	CANopen 3006:40$_h$ Modbus 1664

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_win	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The parameter MON_p_win_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately. * Datatype for CANopen: UINT32	revolution 0.0000 0.0010 3.2767	UINT16* R/W per. -	CANopen 6067:0$_h$ Modbus 1608
MON_p_winTime	Standstill window, time Value 0: Monitoring of standstill window deactivated Value >0: Time in ms during which the control deviation must be in the standstill window Modified settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	CANopen 6068:0$_h$ Modbus 1610
MON_p_winTout	Timeout time for standstill window monitoring Value 0: Timeout monitoring deactivated Value >0: Timeout time in ms Standstill window processing values are set via MON_p_win and MON_p_winTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Modified settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	CANopen 3006:26$_h$ Modbus 1612

Position Register

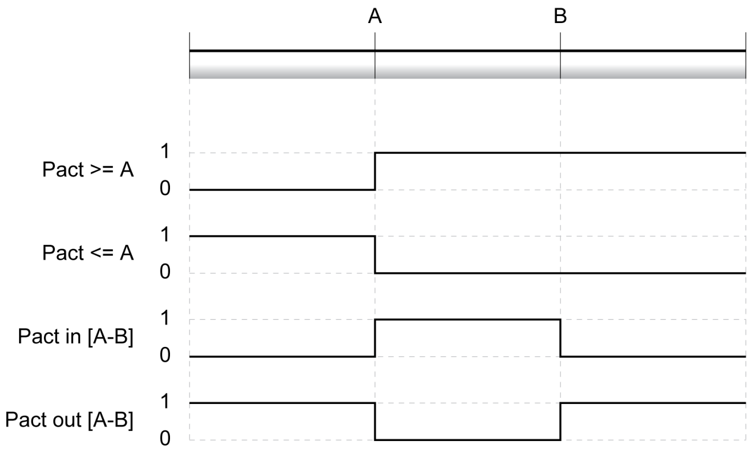
Description

The position register allows you to monitor whether the motor is within a parameterizable position range.

A movement can be monitored using one of 4 methods:

- The motor position is greater than or equal to comparison value A.
- The motor position is less than or equal to comparison value A.
- The motor position is within the range between comparison value A and comparison value B.
- The motor position is outside the range between comparison value A and comparison value B.

Separate channels are available for monitoring.



Number of Channels

4 channels are available.

Status Messages

The status of the position register is available via the parameter `_PosRegStatus`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_PosRegStatus`	Status of the position register channels Signal state: 0: Comparison criterion not met 1: Comparison criterion met Bit assignments: Bit 0: State of position register channel 1 Bit 1: State of position register channel 2 Bit 2: State of position register channel 3 Bit 3: State of position register channel 4	- - - -	UINT16 R/- - -	CANopen 300B:1$_h$ Modbus 2818

In addition, the status is available via signal outputs. In order to read the status via the signal outputs, you must first parameterize the signal output function “Position Register Channel 1”,“Position Register Channel 2”, “Position Register Channel 3” and “Position Register Channel 4”, see chapter Digital Inputs and Outputs *(see page 218)*.

Starting the Position Registers

The channels of the position registers are started via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosReg1Start`	Start/stop of position register channel 1 **0 / Off (keep last state)**: Position Register channel 1 is off and status bit keeps last state **1 / On**: Position Register channel 1 is on **2 / Off (set state 0)**: Position Register channel 1 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 1 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:2_h Modbus 2820
`PosReg2Start`	Start/stop of position register channel 2 **0 / Off (keep last state)**: Position Register channel 2 is off and status bit keeps last state **1 / On**: Position Register channel 2 is on **2 / Off (set state 0)**: Position Register channel 2 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 2 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:3_h Modbus 2822
`PosReg3Start`	Start/stop of position register channel 3 **0 / Off (keep last state)**: Position Register channel 3 is off and status bit keeps last state **1 / On**: Position Register channel 3 is on **2 / Off (set state 0)**: Position Register channel 3 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 3 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:C_h Modbus 2840
`PosReg4Start`	Start/stop of position register channel 4 **0 / Off (keep last state)**: Position Register channel 4 is off and status bit keeps last state **1 / On**: Position Register channel 4 is on **2 / Off (set state 0)**: Position Register channel 4 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 4 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:D_h Modbus 2842

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosRegGroupStart`	Start/stop of position register channels **0 / No Channel**: No channel activated **1 / Channel 1**: Channel 1 activated **2 / Channel 2**: Channel 2 activated **3 / Channel 1 & 2**: Channels 1 and 2 activated **4 / Channel 3**: Channel 3 activated **5 / Channel 1 & 3**: Channels 1 and 3 activated **6 / Channel 2 & 3**: Channels 2 and 3 activated **7 / Channel 1 & 2 & 3**: Channels 1, 2 and 3 activated **8 / Channel 4**: Channel 4 activated **9 / Channel 1 & 4**: Channels 1 and 4 activated **10 / Channel 2 & 4**: Channels 2 and 4 activated **11 / Channel 1 & 2 & 4**: Channels 1, 2 and 4 activated **12 / Channel 3 & 4**: Channels 3 and 4 activated **13 / Channel 1 & 3 & 4**: Channels 1, 3 and 4 activated **14 / Channel 2 & 3 & 4**: Channels 2, 3 and 4 activated **15 / Channel 1 & 2 & 3 & 4**: Channels 1, 2, 3 and 4 activated Modified settings become active immediately.	- 0 0 15	UINT16 R/W per. -	CANopen 300B:16$_h$ Modbus 2860

Setting the Comparison Criterion

The comparison criterion is set via the following parameters.

In the case of the comparison criteria “Pact in” and “Pact out”, there is a difference between “basic” and “extended”.

- Basic: The movement to be performed remains within the movement range.
- Extended: The movement to be performed can extend beyond the movement range.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosReg1Mode`	Selection of comparison criterion for position register channel 1 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 1 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 1 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:4$_h$ Modbus 2824

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg2Mode	Selection of comparison criterion for position register channel 2 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 2 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 2 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:5$_h$ Modbus 2826
PosReg3Mode	Selection of comparison criterion for position register channel 3 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 3 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 3 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:E$_h$ Modbus 2844
PosReg4Mode	Selection of comparison criterion for position register channel 4 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 4 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 4 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:F$_h$ Modbus 2846

Setting Comparison Values

The comparison values are set via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg1ValueA	Comparison value A for position register channel 1	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:8$_h$ Modbus 2832
PosReg1ValueB	Comparison value B for position register channel 1	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:9$_h$ Modbus 2834
PosReg2ValueA	Comparison value A for position register channel 2	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:A$_h$ Modbus 2836
PosReg2ValueB	Comparison value B for position register channel 2	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:B$_h$ Modbus 2838
PosReg3ValueA	Comparison value A for position register channel 3	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:12$_h$ Modbus 2852
PosReg3ValueB	Comparison value B for position register channel 3	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:13$_h$ Modbus 2854
PosReg4ValueA	Comparison value A for position register channel 4	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:14$_h$ Modbus 2856
PosReg4ValueB	Comparison value B for position register channel 4	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:15$_h$ Modbus 2858

Position Deviation Window

Description

The position deviation window allows you to monitor whether the motor is within a parameterizable position deviation.

The position deviation is the difference between reference position and actual position.

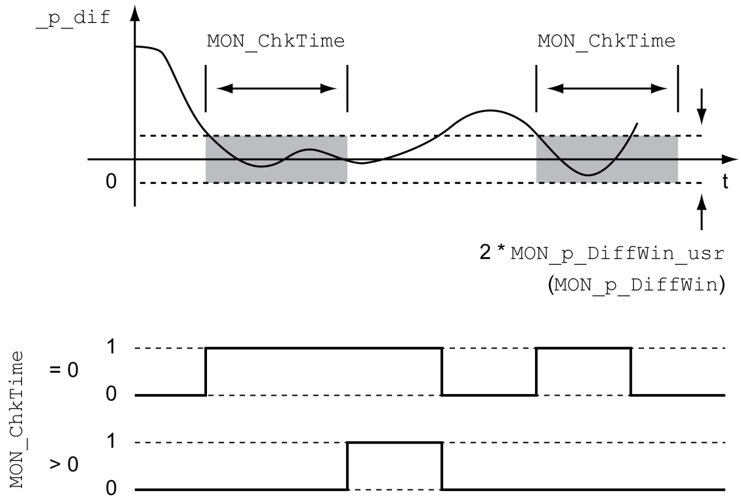
The position deviation window comprises position deviation and monitoring time.

Availability

The position deviation window is available in the following operating modes.

- Jog
- Profile Position
- Homing
- Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement)

Settings



The parameters MON_p_DiffWin_usr (MON_p_DiffWin) and MON_ChkTime specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function “In Position Deviation Window”, see chapter Digital Inputs and Outputs (see page 218).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters (see page 379).

The parameter `MON_ChkTime` acts on the parameters `MON_p_DiffWin_usr` (`MON_p_DiffWin`), `MON_v_DiffWin`, `MON_v_Threshold` and `MON_I_Threshold`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_p_DiffWin_usr`	Monitoring of position deviation The system checks whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 16 2147483647	INT32 R/W per. -	CANopen 3006:3F$_h$ Modbus 1662
`MON_p_DiffWin`	Monitoring of position deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. The parameter MON_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0010 0.9999	UINT16 R/W per. -	CANopen 3006:19$_h$ Modbus 1586
`MON_ChkTime`	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Modified settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	CANopen 3006:1D$_h$ Modbus 1594

Velocity Deviation Window

Description

The velocity deviation window allows you to monitor whether the motor is within a parameterizable velocity deviation.

The velocity deviation is the difference between the reference velocity and the actual velocity.

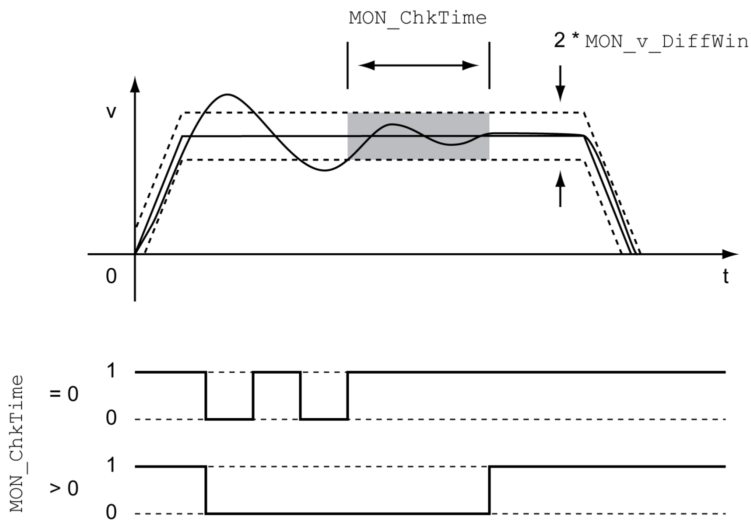
The velocity deviation window comprises velocity deviation and monitoring time.

Availability

The velocity deviation window is available in the following operating modes.

- Jog
- Profile Velocity
- Profile Position
- Homing
- Motion Sequence

Settings



The parameters MON_v_DiffWin and MON_ChkTime specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "In Velocity Deviation Window", see chapter Digital Inputs and Outputs *(see page 218)*.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters *(see page 379)*.

The parameter `MON_ChkTime` acts on the parameters `MON_p_DiffWin_usr` (`MON_p_DiffWin`), `MON_v_DiffWin`, `MON_v_Threshold` and `MON_I_Threshold`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_v_DiffWin`	Monitoring of velocity deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. Modified settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	CANopen 3006:1A$_h$ Modbus 1588
`MON_ChkTime`	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Modified settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	CANopen 3006:1D$_h$ Modbus 1594

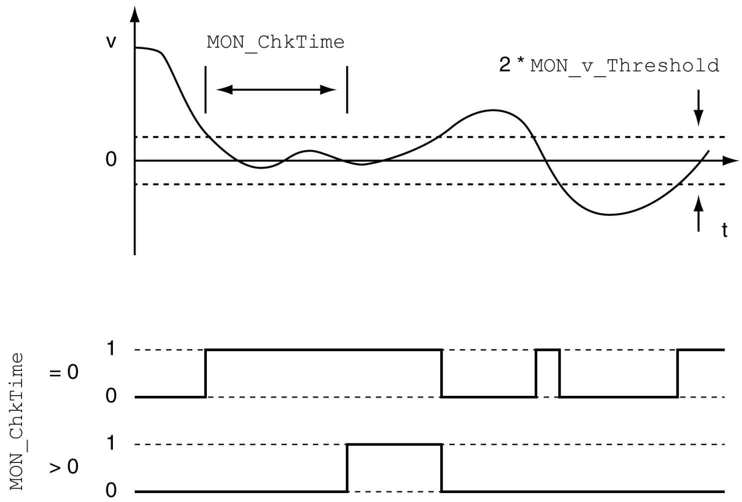
Velocity Threshold Value

Description

The velocity threshold value allows you to monitor whether the actual velocity is below a parameterizable velocity value.

The velocity threshold value comprises the velocity and the monitoring time.

Settings



The parameters MON_v_Threshold and MON_ChkTime specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "Velocity Below Threshold", see chapter Digital Inputs and Outputs *(see page 218)*.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters *(see page 379)*.

The parameter MON_ChkTime acts on the parameters MON_p_DiffWin_usr (MON_p_DiffWin), MON_v_DiffWin, MON_v_Threshold and MON_I_Threshold.

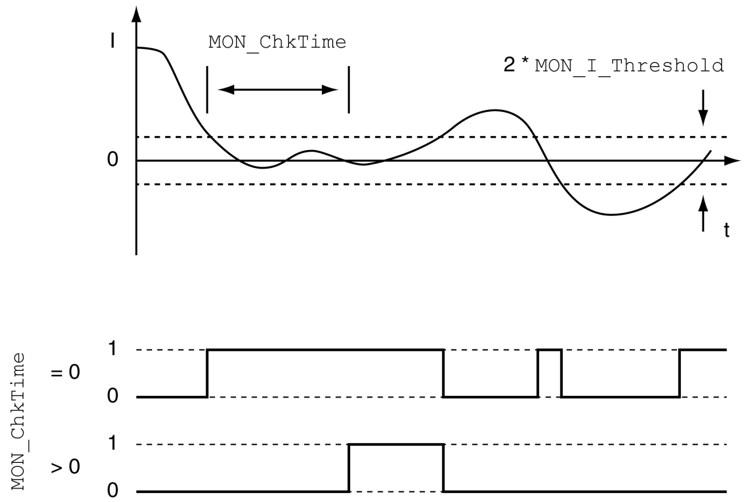
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_v_Threshold	Monitoring of velocity threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime. The status can be output via a parameterizable output. Modified settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	CANopen 3006:1B$_h$ Modbus 1590
MON_ChkTime	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Modified settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	CANopen 3006:1D$_h$ Modbus 1594

Current Threshold Value

The current threshold value allows you to monitor whether the actual current is below a parameterizable current value.

The current threshold value comprises the current value and the monitoring time.

Settings



The parameters MON_I_Threshold and MON_ChkTime specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "Current Below Threshold", see chapter Digital Inputs and Outputs *(see page 218)*.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters *(see page 379)*.

The parameter `MON_ChkTime` acts on the parameters `MON_p_DiffWin_usr` (`MON_p_DiffWin`), `MON_v_DiffWin`, `MON_v_Threshold` and `MON_I_Threshold`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_I_Threshold`	Monitoring of current threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime. The status can be output via a parameterizable output. The parameter _Iq_act_rms is used as comparison value. In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	CANopen 3006:1C$_h$ Modbus 1592
`MON_ChkTime`	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Modified settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	CANopen 3006:1D$_h$ Modbus 1594

Adjustable Bits of the Status Parameters

Overview

The status bits of the following parameters can be adjusted:

- Parameter `_actionStatus`
  - Setting of bit 9 via parameter `DPL_intLim`
  - Setting of bit 10 via parameter `DS402intLim`
- Parameter `_DPL_motionStat`
  - Setting of bit 9 via parameter `DPL_intLim`
  - Setting of bit 10 via parameter `DS402intLim`
- Parameter `_DCOMstatus`
  - Setting of bit 11 via parameter `DS402intLim`

Status Parameter

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_actionStatus`	Action word Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: Error class 0 Bit 1: Error class 1 Bit 2: Error class 2 Bit 3: Error class 3 Bit 4: Error class 4 Bit 5: Reserved Bit 6: Motor is at a standstill (_n_act < 9 rpm) Bit 7: Motor movement in positive direction Bit 8: Motor movement in negative direction Bit 9: Assignment can be set via parameter DPL_intLim Bit 10: Assignment can be set via parameter DS402intLim Bit 11: Profile generator idle (reference velocity is 0) Bit 12: Profile generator decelerates Bit 13: Profile generator accelerates Bit 14: Profile generator moves at constant speed Bit 15: Reserved	- - - -	UINT16 R/- - -	CANopen 301C:4$_h$ Modbus 7176
`_DCOMstatus`	DriveCom status word Bit assignments: Bit 0: Operating state Ready To Switch On Bit 1: Operating state Switched On Bit 2: Operating state Operation Enabled Bit 3: Operating state Fault Bit 4: Voltage Enabled Bit 5: Operating state Quick Stop Bit 6: Operating state Switch On Disabled Bit 7: Error of error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Target Reached Bit 11: Internal Limit Active Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	CANopen 6041:0$_h$ Modbus 6916
`_DPL_motionStat`	Drive Profile Lexium motionStat	- - - -	UINT16 R/- - -	CANopen 301B:27$_h$ Modbus 6990

Parameter for Setting the Status Bits

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DPL_intLim`	Setting for bit 9 of _DPL_motionStat and _actionStatus **0 / None**: Not used (reserved) **1 / Current Below Threshold**: Current threshold value **2 / Velocity Below Threshold**: Velocity threshold value **3 / In Position Deviation Window**: Position deviation window **4 / In Velocity Deviation Window**: Velocity deviation window **5 / Position Register Channel 1**: Position register channel 1 **6 / Position Register Channel 2**: Position register channel 2 **7 / Position Register Channel 3**: Position register channel 3 **8 / Position Register Channel 4**: Position register channel 4 **9 / Hardware Limit Switch**: Hardware limit switch **10 / RMAC active or finished**: Relative movement after capture is active or finished **11 / Position Window**: Position window Setting for: Bit 9 of the parameter _actionStatus Bit 9 of the parameter _DPL_motionStat Modified settings become active immediately.	- 0 11 11	UINT16 R/W per. -	CANopen 301B:35$_h$ Modbus 7018
`DS402intLim`	DS402 status word: Setting for bit 11 (internal limit) **0 / None**: Not used (reserved) **1 / Current Below Threshold**: Current threshold value **2 / Velocity Below Threshold**: Velocity threshold value **3 / In Position Deviation Window**: Position deviation window **4 / In Velocity Deviation Window**: Velocity deviation window **5 / Position Register Channel 1**: Position register channel 1 **6 / Position Register Channel 2**: Position register channel 2 **7 / Position Register Channel 3**: Position register channel 3 **8 / Position Register Channel 4**: Position register channel 4 **9 / Hardware Limit Switch**: Hardware limit switch **10 / RMAC active or finished**: Relative movement after capture is active or finished **11 / Position Window**: Position window Setting for: Bit 11 of the parameter _DCOMstatus Bit 10 of the parameter _actionStatus Bit 10 of the parameter _DPL_motionStat Modified settings become active immediately.	- 0 0 11	UINT16 R/W per. -	CANopen 301B:1E$_h$ Modbus 6972

Section 8.3
Functions for Monitoring Internal Device Signals

What Is in This Section?

This section contains the following topics:

Temperature Monitoring

Temperature of Power Stage

The parameter _PS_T_current indicates the temperature of the power stage.

The parameter _PS_T_warn contains the threshold value for an error of error class 0. The parameter _PS_T_max indicates the maximum power stage temperature.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_PS_T_current	Temperature of power stage	°C - - -	INT16 R/- - -	CANopen 301C:10$_h$ Modbus 7200
_PS_T_warn	Maximum temperature of power stage (error class 0)	°C - - -	INT16 R/- per. -	CANopen 3010:6$_h$ Modbus 4108
_PS_T_max	Maximum temperature of power stage	°C - - -	INT16 R/- per. -	CANopen 3010:7$_h$ Modbus 4110

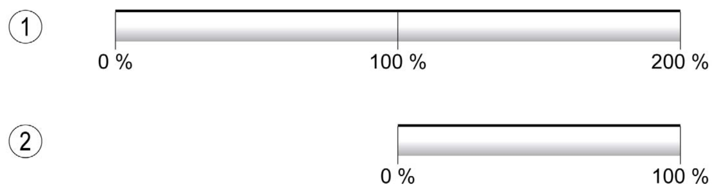
Monitoring Load and Overload (I^{2}T Monitoring)

Description

The load is the thermal load on the power stage, the motor and the braking resistor.

Load and overload on the individual components are monitored internally; the values can be read by means of parameters.

Overload starts at a load value of 100 %.



1 Load
2 Overload

Load Monitoring

The load can be read using the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_PS_load`	Load of power stage	% - - -	INT16 R/- - -	CANopen 301C:17$_h$ Modbus 7214
`_M_load`	Load of motor	% - - -	INT16 R/- - -	CANopen 301C:1A$_h$ Modbus 7220
`_RES_load`	Load of braking resistor The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208

Overload Monitoring

In the case of 100 % overload of the power stage or the motor, the current is limited internally. In the case of 100 % overload of the braking resistor, the braking resistor is deactivated.

The overload and the peak value can be read using the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_PS_overload`	Overload of power stage	% - - -	INT16 R/- - -	CANopen 301C:24$_h$ Modbus 7240
`_PS_maxoverload`	Maximum value of overload of power stage Maximum overload of power stage during the last 10 seconds.	% - - -	INT16 R/- - -	CANopen 301C:18$_h$ Modbus 7216
`_M_overload`	Overload of motor (I2t)	% - - -	INT16 R/- - -	CANopen 301C:19$_h$ Modbus 7218

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_M_maxoverload`	Maximum value of overload of motor Maximum overload of motor during the last 10 seconds.	% - - -	INT16 R/- - -	CANopen 301C:1B$_h$ Modbus 7222
`_RES_overload`	Overload of braking resistor (I2t) The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:13$_h$ Modbus 7206
`_RES_maxoverload`	Maximum value of overload of braking resistor Maximum overload of braking resistor during the last 10 seconds. The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:15$_h$ Modbus 7210

Commutation Monitoring

Commutation monitoring verifies the plausibility of acceleration and effective motor torque.

If the motor accelerates though the drive control decelerates the motor with the maximum current, an error is detected.

Deactivating commutation monitoring can cause unintended movements.

⚠ WARNING
UNINTENDED MOVEMENT
• Only deactivate commutation monitoring during commissioning and only for test purposes. • Verify that the commutation monitoring is active prior to putting the equipment into service.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The parameter `MON_commutat` lets you deactivate commutation monitoring.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_commutat`	Commutation monitoring **0 / Off**: Commutation monitoring off **1 / On (OpState6)**: Commutation monitoring on in operating state 6 **2 / On (OpState6+7)**: Commutation monitoring on in operating states 6 and 7 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3005:5$_h$ Modbus 1290

Monitoring of Mains Phases

If a three-phase drive is missing a mains phase and mains phase monitoring is not correctly set, this can cause overload of the product.

NOTICE
INOPERABLE EQUIPMENT DUE TO MISSING MAINS PHASE
● Verify that mains phase monitoring is set to "Automatic Mains Detection" or to "Mains ..." with the correct voltage value if the drive is supplied via the mains phases. ● Verify that mains phase monitoring is set to "DC bus only ..." with the correct voltage value if the drive is supplied via the DC bus.
Failure to follow these instructions can result in equipment damage.

The parameter `ErrorResp_Flt_AC` lets you set the error response to a missing mains phase for three-phase devices.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ErrorResp_Flt_AC`	Error response to missing mains phase **0 / Error Class 0**: Error class 0 **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 2 3	UINT16 R/W per. -	CANopen 3005:A_h Modbus 1300

Mains phase monitoring is set by means of the parameter `MON_MainsVolt`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_MainsVolt`	Detection and monitoring of mains phases **0 / Automatic Mains Detection**: Automatic detection and monitoring of mains voltage **3 / Mains 1~230 V / 3~480 V**: Mains voltage 230 V (single-phase) or 480 V (three phases) **4 / Mains 1~115 V / 3~208 V**: Mains voltage 115 V (single-phase) or 208 V (three phases) Value 0: As soon as mains voltage detected, the device automatically verifies whether the mains voltage is 115 V or 230 V in the case of single-phase devices or 208 V or 400/480 V in the case of three-phase devices. Values 3 … 4: If the mains voltage is not detected properly during start-up, the mains voltage to be used can be selected manually. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 4	UINT16 R/W per. expert	CANopen 3005:F_h Modbus 1310

Ground Fault Monitoring

When the power stage is enabled, the device monitors the motor phases for ground faults. A ground fault occurs when one or more motor phases are short-circuited to the ground (earth) of the application.

A ground fault of one or more motor phases is detected. A ground fault of the DC bus or the braking resistor is not detected.

If the ground fault monitoring is deactivated, the drive may be rendered inoperable by a ground fault.

NOTICE

INOPERABLE EQUIPMENT DUE TO GROUND FAULTS

- Only deactivate ground fault monitoring during commissioning and only for test purposes.
- Verify that the ground fault monitoring is active prior to putting the equipment into service.

Failure to follow these instructions can result in equipment damage.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_GroundFault`	Ground fault monitoring **0 / Off**: Ground fault monitoring off **1 / On**: Ground fault monitoring on Modified settings become active the next time the product is powered on.	- 0 1 1	UINT16 R/W per. expert	CANopen 3005:10$_h$ Modbus 1312

Chapter 9
Examples

Examples

General Information

The examples show some typical applications of the product. The examples are intended to provide an overview; they are not exhaustive wiring plans.

The examples described here are intended for learning purposes only. In general, they are intended to help you understand how to develop, test, commission, and integrate application logic and/or the device wiring of the equipment associated with your own design in your control systems. The examples are not intended to be used directly on products that are part of a machine or process.

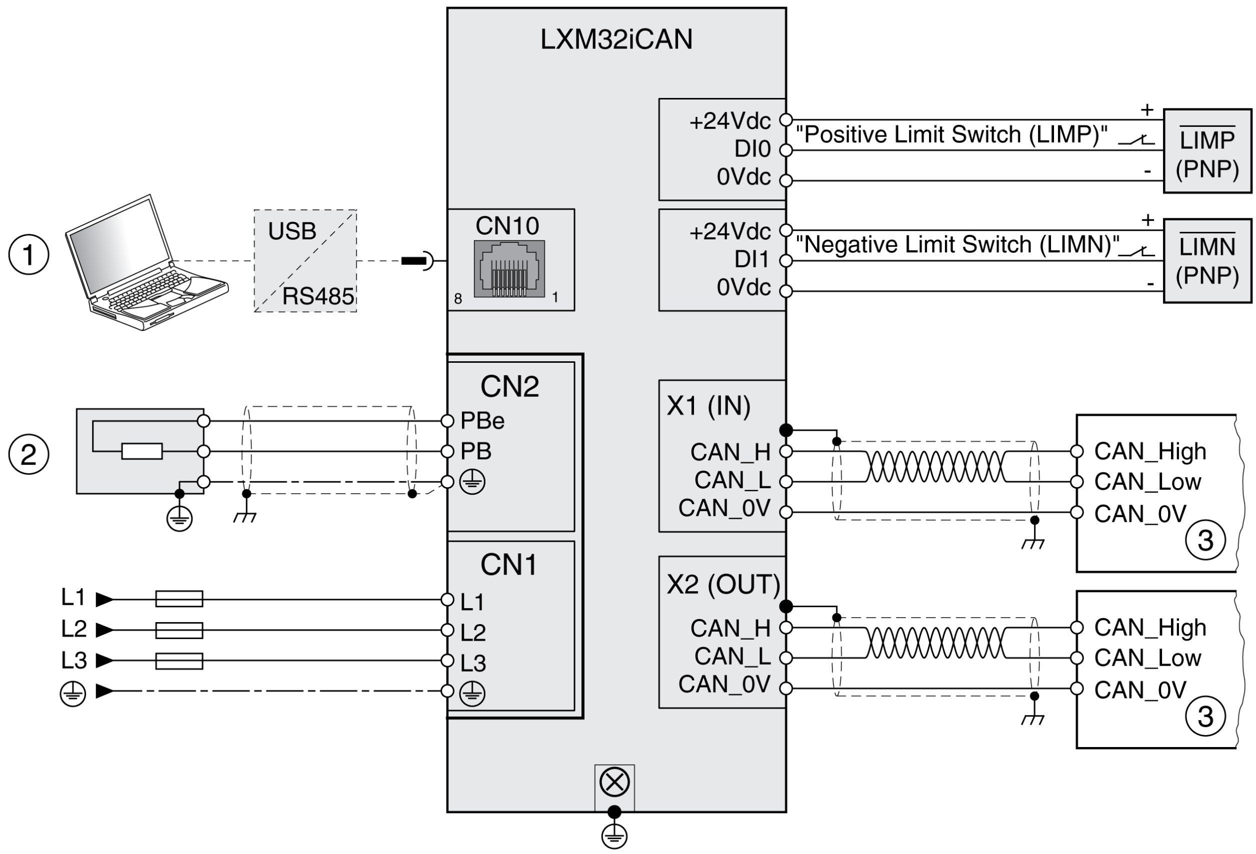
⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not include any wiring information, programming or configuration logic, or parameterization values from the Examples in your machine or process without thoroughly testing your entire application.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Using the safety function STO integrated in this product requires careful planning. See chapter Safety function STO ("Safe Torque Off") *(see page 68)* for additional information.

Wiring Example 1

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety function STO	Miscellaneous
Positive logic(1)	Internal	-	I/O module with industrial connectors without safety function STO
(1) See chapter Logic Type *(see page 56)*.			

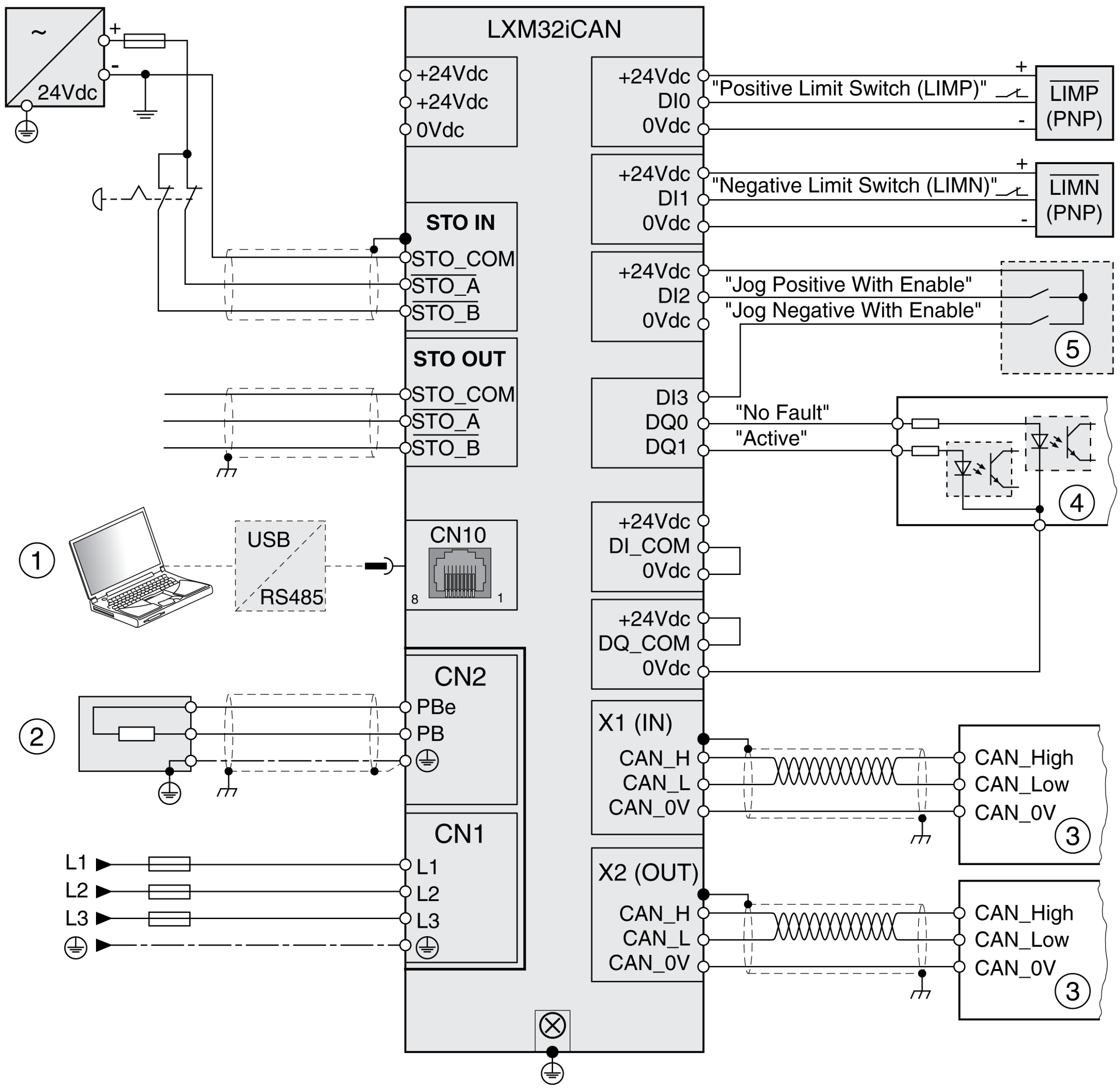


1 Commissioning accessories
2 Standard braking resistor or external braking resistor
3 Fieldbus device

Wiring Example 2

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety function STO	Miscellaneous
Positive logic[1]	Internal	Required	I/O module with spring terminals
(1) See chapter Logic Type *(see page 56)*.			

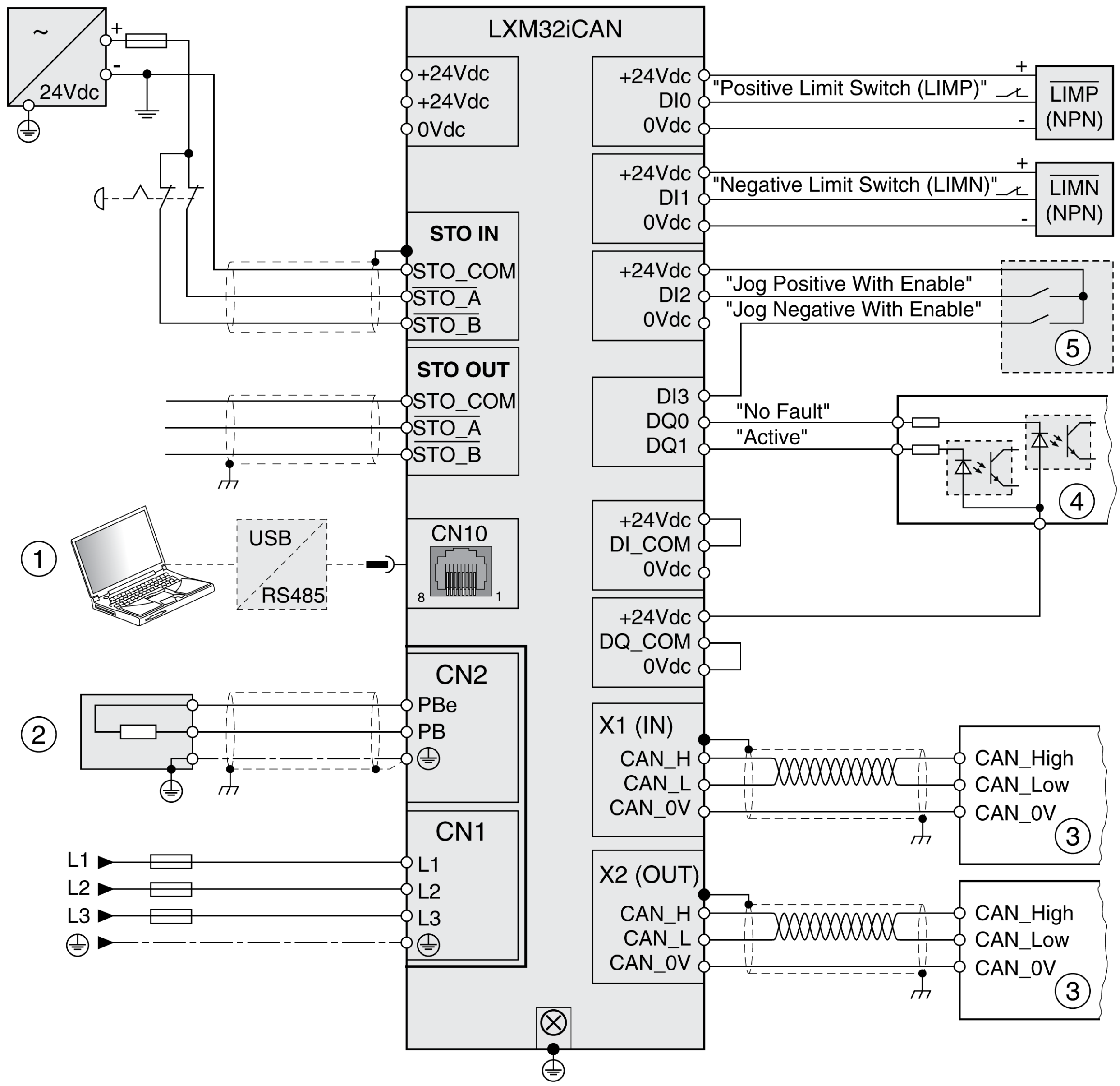


1 Commissioning accessories
2 Standard braking resistor or external braking resistor
3 Fieldbus device
4 Signal lights or inputs of the PLC
5 "Test box" for commissioning

Wiring Example 3

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety function STO	Miscellaneous
Negative logic(1)	Internal	Required	I/O module with spring terminals
(1) See chapter Logic Type *(see page 56)*.			

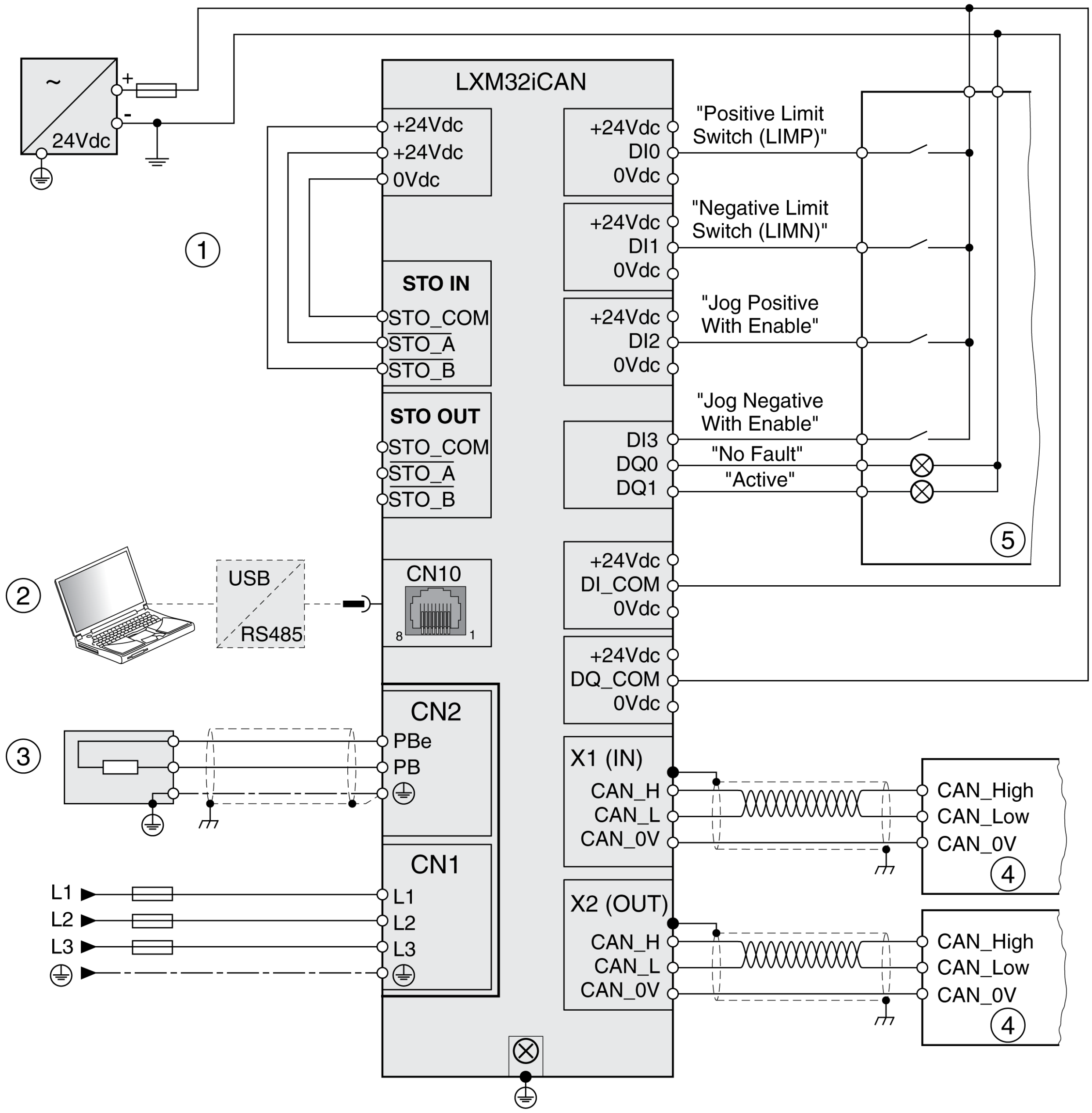


1 Commissioning accessories
2 Standard braking resistor or external braking resistor
3 Fieldbus device
4 Signal lights or inputs of the PLC
5 "Test box" for commissioning

Wiring Example 4

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety function STO	Miscellaneous
Positive logic(1)	External	Deactivated	I/O module with spring terminals Digital inputs and digital outputs via PLC
(1) See chapter Logic Type *(see page 56)*.			

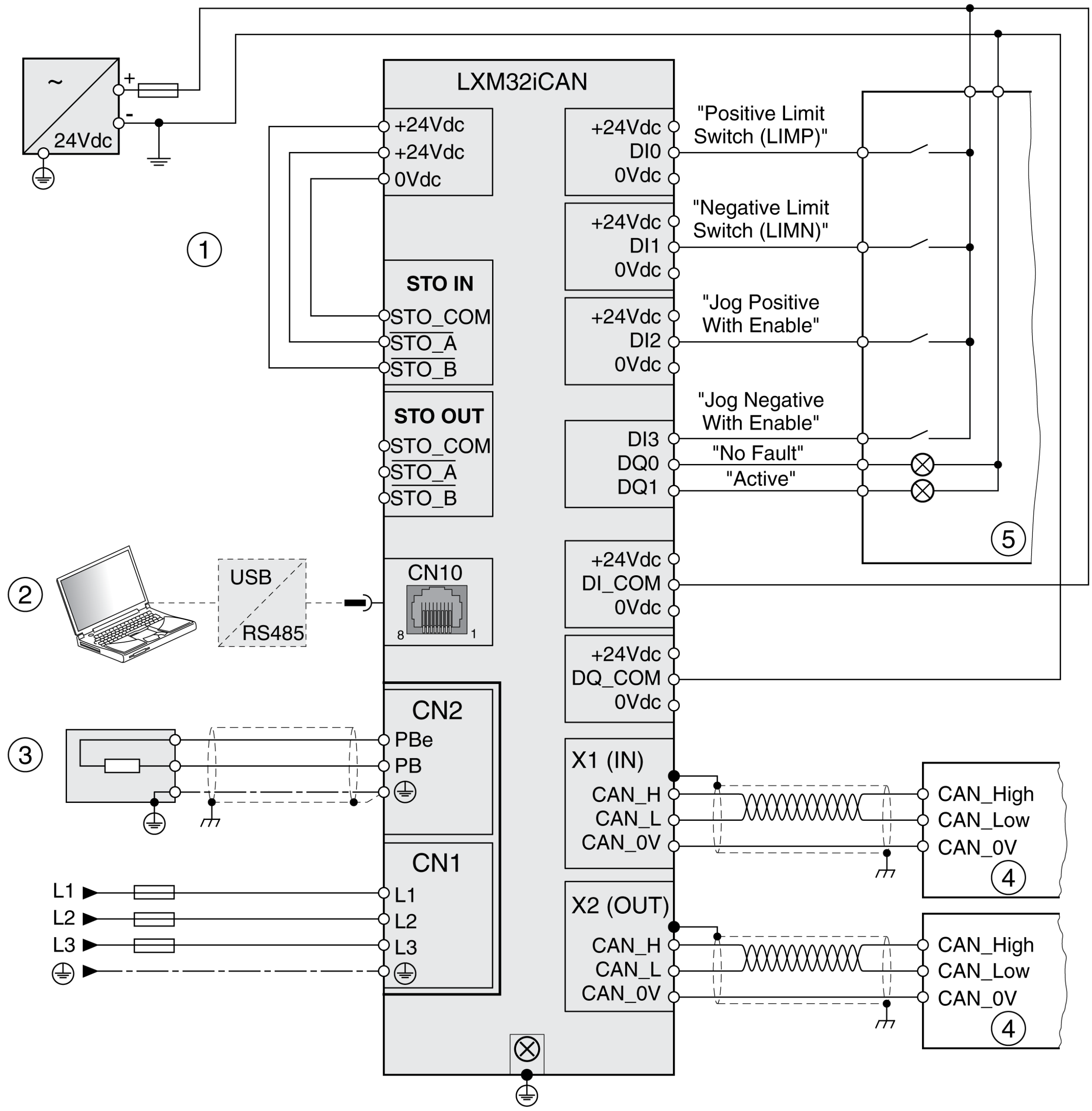


1 Safety function STO deactivated
2 Commissioning accessories
3 Standard braking resistor or external braking resistor
4 Fieldbus device
5 Signal lights / PLC

Wiring Example 5

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety function STO	Miscellaneous
Negative logic(1)	External	Deactivated	I/O module with spring terminals Digital inputs and digital outputs via PLC
(1) See chapter Logic Type *(see page 56)*.			



1 Safety function STO deactivated
2 Commissioning accessories
3 Standard braking resistor or external braking resistor
4 Fieldbus device
5 Signal lights / PLC

Chapter 10
Diagnostics and Troubleshooting

What Is in This Chapter?

This chapter contains the following sections:

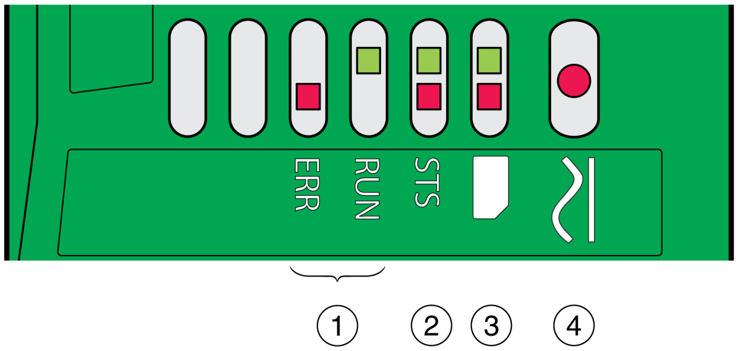
Section 10.1
Diagnostics via LEDs

What Is in This Section?

This section contains the following topics:

Overview Diagnostics LEDs

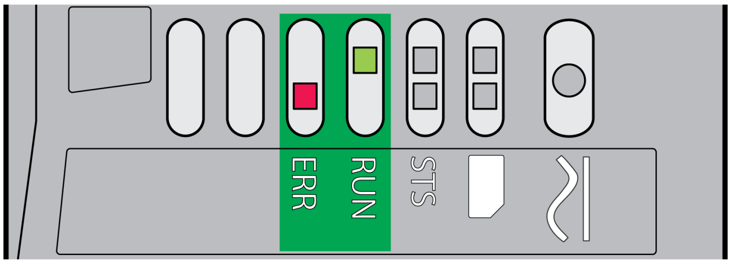
The following illustration provides an overview of the diagnostics LEDs.



1 Fieldbus status LEDs
2 Operating state LEDs
3 Memory card LEDs
4 DC bus LED

Fieldbus Status LEDs

The fieldbus status LEDs visualize the status of the fieldbus.



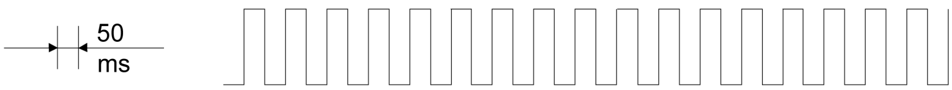
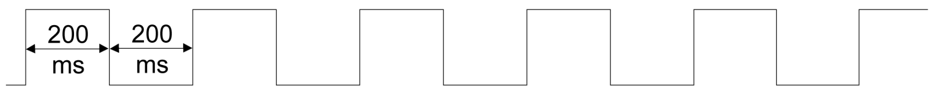
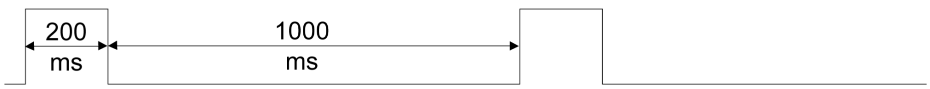
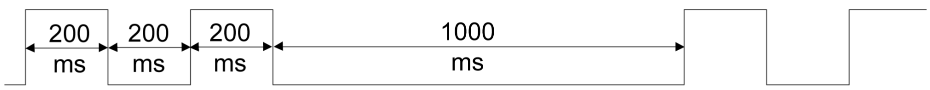
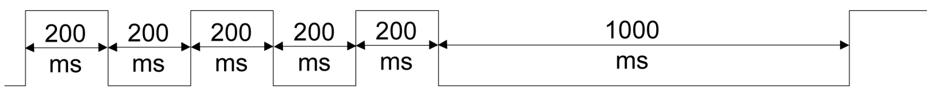
LED **ERR**

Status	Meaning
Blinking	Incorrect settings, for example, invalid node address.
Single flash	Warning limit reached, for example after 16 incorrect transmission attempts.
Double flash	Monitoring event (Node Guarding) has occurred.
On	CAN is BUS-OFF, for example after 32 incorrect transmission attempts.
Off	Fieldbus communication without error message.

LED **RUN**

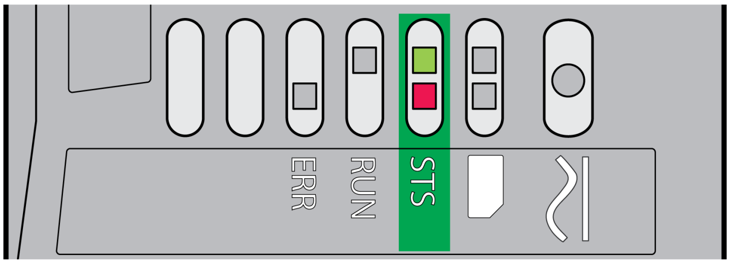
Status	Meaning
Blinking	NMT state PRE-OPERATIONAL
Single flash	NMT state STOPPED
On	NMT state OPERATIONAL
Off	CAN not initialized, for example, invalid node address.

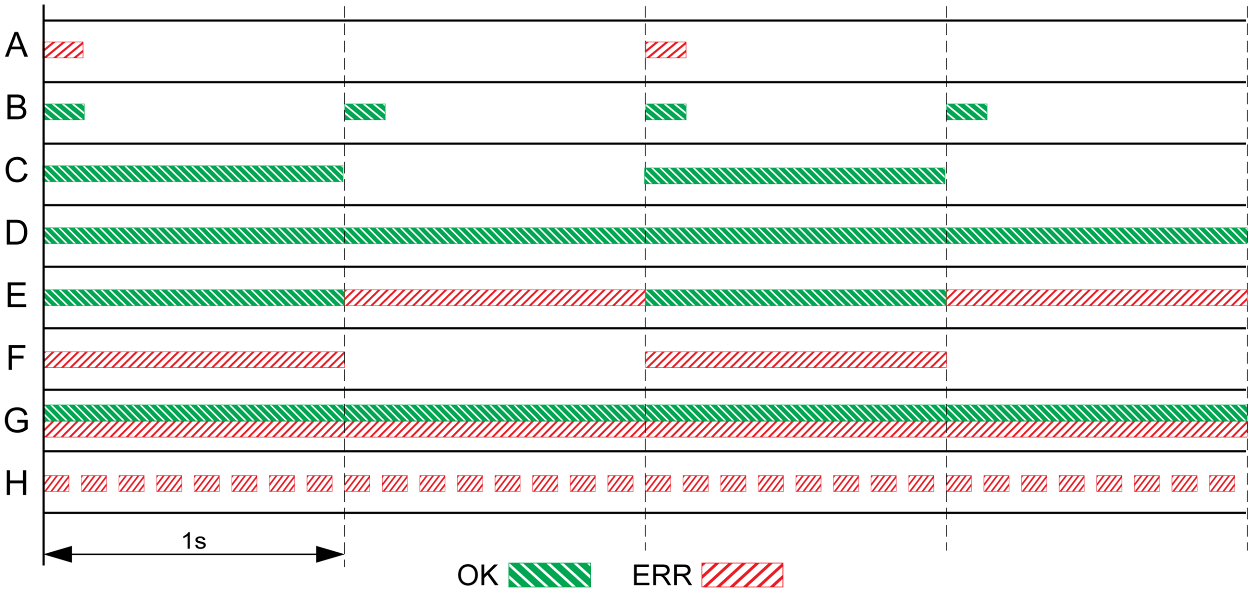
Meaning of the LED status

Status	Meaning
Flickering	
Blinking	
Single flash	
Double flash	
Triple flash	

Operating State LEDs

The operating state LEDs show the current operating state.

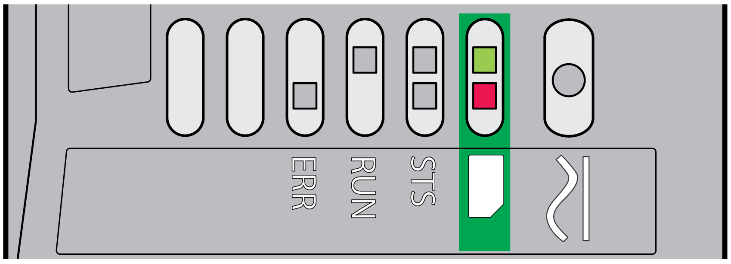


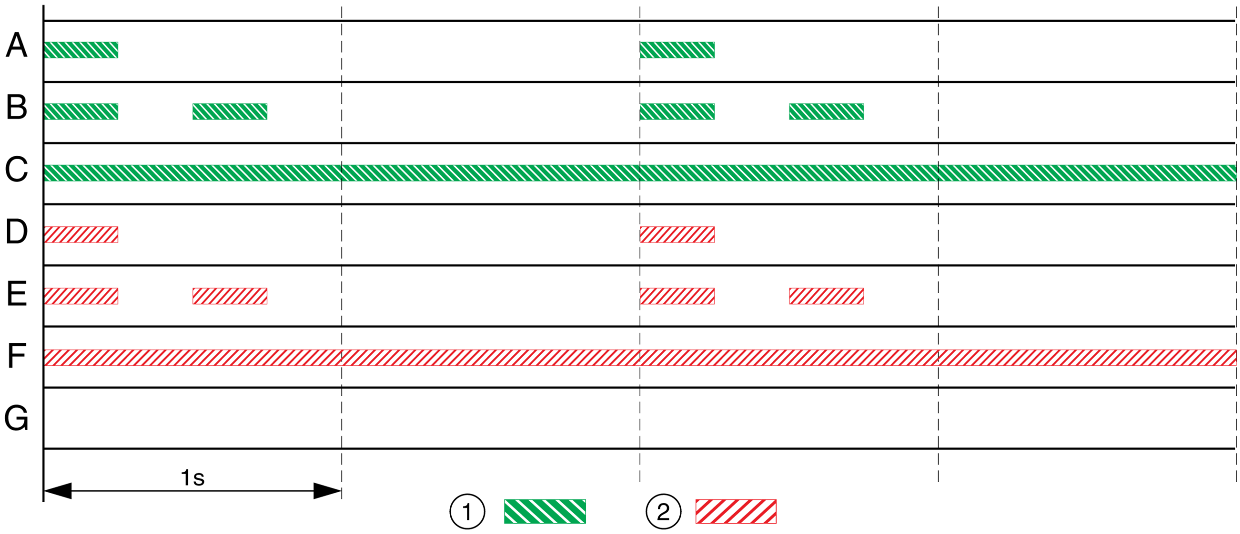


A Operating state **1 Start** and **2 Not Ready To Switch On**
B Operating state **3 Switch On Disabled**
C Operating state **4 Ready To Switch On** and **5 Switched On**
D Operating state **6 Operation Enabled**
E Operating state **7 Quick Stop Active** and **8 Fault Reaction Active**
F Operating state **9 Fault**
G Firmware not available
H Internal error

Memory Card LEDs

The memory card LEDs show the status of the memory card.

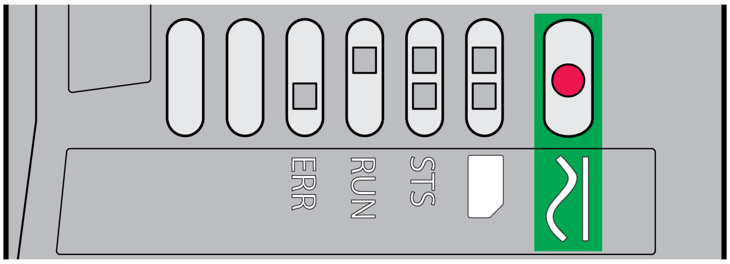




1 LED green
2 LED red
A The parameter values stored in the device and the contents of the memory card are different. The contents of the memory card is transferred to the device.
B The memory card is empty. The configuration of the device is transferred to the memory card.
C The parameter values stored in the device and the contents of the memory card are identical.
D The memory card is write-protected.
E An error was detected during data transfer. Check the error memory of the device.
F Data on the memory card does not match the device or is damaged.
G No memory card detected. Power off the supply. Verify that the memory card has been properly inserted (contacts, slanted corner).

DC Bus LED

The DC bus LED shows the status of the DC bus.



Status	Meaning
On	Voltage at DC bus.
Off	Undervoltage. The DC bus LED is not an indicator of the absence of DC bus voltage.

Observe the information provided in chapter Product Related Information (see page 12).

Section 10.2
Diagnostics via Signal Outputs

What Is in This Section?

This section contains the following topics:

Indicating the Operating State

Information on the operating state is available via the signal outputs.

The table below provides an overview.

	Signal output function	
Operating state	“No fault”(1)	“Active”(2)
1 Start	0	0
2 Not Ready To Switch On	0	0
3 Switch On Disabled	0	0
4 Ready To Switch On	1	0
5 Switched On	1	0
6 Operation Enabled	1	1
7 Quick Stop Active	0	0
8 Fault Reaction Active	0	0
9 Fault	0	0
(1) The signal output function is factory setting for signal output DQ0 **(2)** The signal output function is the factory setting for signal output DQ1		

Indicating Error Messages

Selected error messages can be output via the signal outputs.

In order to output an error message via a signal output, you must first parameterizes the signal output functions “Selected Warning” or “Selected Error”, see chapter Digital Inputs and Outputs *(see page 218)*.

The parameters `MON_IO_SelWar1` and `MON_IO_SelWar2` are used to specify error codes with the error class 0.

The parameters `MON_IO_SelErr1` and `MON_IO_SelErr2` are used to specify error codes with the error classes 1 ... 4.

If an error specified in one of these parameters is detected, the corresponding signal output is to be set.

The list of the error messages sorted by error code can be found in the chapter Error Messages *(see page 415)*.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_IO_SelWar1`	Signal output function Selected Warning (error class 0): First error code This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:8$_h$ Modbus 15120
`MON_IO_SelWar2`	Signal output function Selected Warning (error class 0): Second error code This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:9$_h$ Modbus 15122
`MON_IO_SelErr1`	Signal output function Selected Error (error classes 1 to 4): First error code This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:6$_h$ Modbus 15116
`MON_IO_SelErr2`	Signal output function Selected Error (error classes 1 to 4): Second error code This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:7$_h$ Modbus 15118

Section 10.3
Diagnostics via the Fieldbus

What Is in This Section?

This section contains the following topics:

Fieldbus Communication Error Diagnostics

Checking Connections

A properly operating fieldbus is essential for evaluating status and error messages.

If the product cannot be addressed via the fieldbus, first verify the connections.

Verify the following connections:
- System power supply
- Supply connections
- Fieldbus cables and wiring
- Fieldbus connection

Fieldbus Function Test

If the connections are correct, verify that you can address the product on the fieldbus.

Most Recent Detected Error - Status Bits

Parameter DCOMstatus

The parameter DCOMstatus is a part of the process data communication. The parameter DCOMstatus is transmitted asynchronously and in an event-driven way whenever the status information changes.

In the case of an error of error class 0, bit 7 is set in the parameter DCOMstatus.

In the case of an error of error class 1, 2, 3 or 4, bit 13 is set in the parameter DCOMstatus.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DCOMstatus	DriveCom status word Bit assignments: Bit 0: Operating state Ready To Switch On Bit 1: Operating state Switched On Bit 2: Operating state Operation Enabled Bit 3: Operating state Fault Bit 4: Voltage Enabled Bit 5: Operating state Quick Stop Bit 6: Operating state Switch On Disabled Bit 7: Error of error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Target Reached Bit 11: Internal Limit Active Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	CANopen 6041:0$_h$ Modbus 6916

Error Bits

The parameters `_WarnLatched` and `_SigLatched` contain information on errors of error class 0 and errors of error classes 1 ... 4.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_WarnLatched`	Saved errors of error class 0, bit-coded The bits are set to 0 in the case of a Fault Reset. Bits 10 and 13 are set to 0 automatically. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General Bit 1: Reserved Bit 2: Out of range (software limit switches, tuning) Bit 3: Reserved Bit 4: Active operating mode Bit 5: Commissioning interface (RS485) Bit 6: Integrated fieldbus Bit 7: Reserved Bit 8: Following error Bit 9: Reserved Bit 10: Inputs STO_A and/or STO_B Bits 11 ... 12: Reserved Bit 13: Low voltage DC bus or mains phase missing Bits 14 ... 15: Reserved Bit 16: Integrated encoder interface Bit 17: Temperature of motor high Bit 18: Temperature of power stage high Bit 19: Reserved Bit 20: Memory card Bit 21: Fieldbus module Bit 22: Encoder module Bit 23: Safety module eSM or module IOM1 Bits 24 … 27: Reserved Bit 28: Transistor for braking resistor overload (I^2t) Bit 29: Braking resistor overload (I^2t) Bit 30: Power stage overload (I^2t) Bit 31: Motor overload (I^2t) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	CANopen 301C:C$_h$ Modbus 7192

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_SigLatched`	Saved status of monitoring signals Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General error Bit 1: Hardware limit switches (LIMP/LIMN/REF) Bit 2: Out of range (software limit switches, tuning) Bit 3: Quick Stop via fieldbus Bit 4: Error in active operating mode Bit 5: Commissioning interface (RS485) Bit 6: Integrated fieldbus Bit 7: Reserved Bit 8: Following error Bit 9: Reserved Bit 10: Inputs STO are 0 Bit 11: Inputs STO different Bit 12: Reserved Bit 13: DC bus voltage low Bit 14: DC bus voltage high Bit 15: Mains phase missing Bit 16: Integrated encoder interface Bit 17: Overtemperature motor Bit 18: Overtemperature power stage Bit 19: Reserved Bit 20: Memory card Bit 21: Fieldbus module Bit 22: Encoder module Bit 23: Safety module eSM or module IOM1 Bit 24: Reserved Bit 25: Reserved Bit 26: Motor connection Bit 27: Motor overcurrent/short circuit Bit 28: Frequency of reference signal too high Bit 29: EEPROM error detected Bit 30: System start-up (hardware or parameter) Bit 31: System error detected (for example, watchdog, internal hardware interface) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	CANopen 301C:8$_h$ Modbus 7184

CANopen Error Messages

Description

CANopen error messages are signaled in the form of EMCY messages. They are evaluated via the objects `Error register (1001h)` and `Error code (603Fh)`. For information on the object `EMCY` see chapter Emergency Object Service *(see page 105)*.

CANopen signals errors that occur during data exchange via SDO with the special SDO error message ABORT.

Error Register

The object `Error register (1001h)` indicates the error of a device in bit-coded form. The cause of error can be determined with the error code table. Bit 0 is set to 1 as soon as an error is detected.

bit	Message	Meaning
0	Generic Error	An error has been detected
1	-	Reserved
2	-	Reserved
3	-	Reserved
4	Communication	Network communication error
5	Device Profile Specific	Error during execution as per device profile
6	-	Reserved
7	Manufacturer Specific	Vendor-specific error number

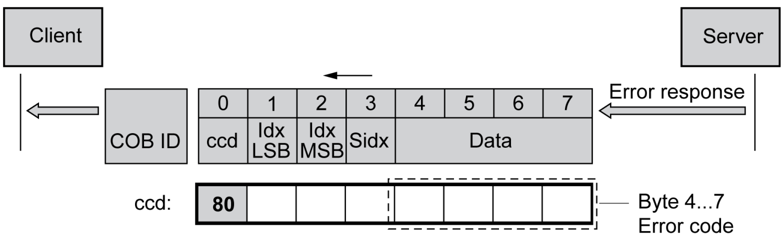
Error Code Table

The error code is evaluated with the object `error code (603Fh)`, an object of the DSP402 device profile, and output as a four-digit hexadecimal value. The error code indicates the cause of the last interruption of movement. See the Troubleshooting chapter of the product user guide for the meaning of the error code.

SDO Error Message ABORT

An SDO error message is generated as a response to an SDO transmission error. The cause of error is contained in `error code`, byte 4 to byte 7.

SDO error message as a response to an SDO message



The table below lists the error messages that may be detected during data exchange with the product.

Error code	Meaning
0503 0000_h	Toggle bit not toggled
0504 0000_h	Time-out during SDO transfer
0504 0001_h	Command specifier CS incorrect or indeterminable
0504 0005_h	No memory available
0601 0000_h	Access to object not possible
0601 0001_h	No read access, because write-only object (wo)
0601 0002_h	No write access, because read object (ro)
0602 0000_h	Object does not exist in object dictionary
0604 0041_h	Object does not support PDO mapping

Error code	Meaning
0604 0042_h	PDO mapping: Number or length of objects exceed the byte length of the PDO
0604 0043_h	Parameters are incompatible
0604 0047_h	Device detects internal incompatibility
0606 0000_h	Hardware error, access denied
0607 0010_h	Data type and parameter length do not match
0607 0012_h	Data type does not match, parameter too long
0607 0013_h	Data type does not match, parameter too short
0609 0011_h	Subindex not supported
0609 0030_h	Value range of parameter too large (relevant only for write access)
0609 0031_h	Parameter values above maximum value
0609 0032_h	Parameter values below minimum value
0609 0036_h	Upper value is less than lower value
0800 0000_h	General error. See parameter `_ManuSdoAbort` after this table. This parameter contains the drive specific error code.
0800 0020_h	Data can neither be transmitted to the application nor saved.
0800 0021_h	Local control mode, data can neither be transmitted nor saved.
0800 0022_h	Data can neither be transmitted nor saved in this device state.
0800 0023_h	Object dictionary does not exist or cannot be generated (for example, if data error occurs during generation from file)
0800 0024_h	Data not available.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_ManuSdoAbort`	CANopen manufacturer-specific SDO abort code Provides more detailed information on a general SDO abort code (0800 0000).	- - - -	UINT16 R/- - -	CANopen 3041:A_h Modbus 16660

Most Recent Detected Error - Error Code

If the master controller receives information concerning a detected error via the process data communication, the following parameters can be used to read the error code.

The list of the error messages sorted by error code can be found in the chapter Error Messages *(see page 415)*.

Most Recent Detected Error with Error Class 0

The parameter `_LastWarning` allows you to read the error number of the last detected error with error class 0.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_LastWarning`	Code of most recent error of error class 0 If the error is no longer active, the code is stored until the next Fault Reset. Value 0: No error of error class 0	- - - -	UINT16 R/- - -	CANopen 301C:9$_h$ Modbus 7186

Most Recent Detected Error with Error Class 1 ... 4

The parameter `_LastError` allows you to read the error number of the last detected error with error class 1 ... 4.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_LastError`	Detected error causing a stop (error classes 1 to 4) Error code of the most recent detected error. Consecutive detected errors do not overwrite this error code. Example: If an error response to a detected limit switch error causes overvoltage, this parameter contains the code of the detected limit switch error. Exception: Detected errors of error class 4 overwrite existing entries.	- - - -	UINT16 R/- - -	CANopen 603F:0$_h$ Modbus 7178

Error Memory

General

The error memory is an error history of the last 10 error messages. It is not cleared even if the product is powered off. The error memory allows you to read and evaluate past events.

The following information on the events is stored:

- Error class
- Error code
- Motor current
- Number of power on cycles
- Additional error information (for example, parameter numbers)
- Product temperature
- Power stage temperature
- Time the error was detected (with reference to operating hours counter)
- DC Bus Voltage
- Velocity
- Number of Enable cycles after powering on
- Time from Enable until detection of the error

The stored information relates to the situation at the point in time the error was detected.

The list of the error messages sorted by error code can be found in the chapter Error Messages *(see page 415)*.

Reading the Error Memory

The error memory can only be read sequentially. The parameter `ERR_reset` must be used to reset the read pointer. Then the first error entry can be read. The read pointer is automatically set to the next entry. A new read access delivers the next error entry. If the error code 0 is returned, there is no additional error entry.

Position of the entry	Meaning
1	First error message (oldest message).
2	Second error message (later message).
...	...
10	Tenth error message. In the case of ten error messages, the most recent error message is contained here.

An error entry consists of several pieces of information which can be read using different parameters. When you read an error entry, the error code must be read first with the parameter `_ERR_number`.

The following parameters allow you to manage the error memory:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_ERR_class`	Error class Value 0: Error class 0 Value 1: Error class 1 Value 2: Error class 2 Value 3: Error class 3 Value 4: Error class 4	- 0 - 4	UINT16 R/- - -	CANopen 303C:2$_h$ Modbus 15364
`_ERR_number`	Error code Reading this parameter copies the entire entry for the detected error (error class, time of detection of error, …) to an intermediate memory from which the elements of the detected error can then be read. In addition, the read pointer of the error memory is automatically set to the next error entry.	- 0 - 65535	UINT16 R/- - -	CANopen 303C:1$_h$ Modbus 15362

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_ERR_motor_I`	Motor current at the time the error was detected In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 303C:9$_h$ Modbus 15378
`_ERR_powerOn`	Number of power on cycles	- 0 - 4294967295	UINT32 R/- - -	CANopen 303B:2$_h$ Modbus 15108
`_ERR_qual`	Additional information on detected error This entry contains additional information on the detected error, depending on the error number. Example: a parameter address	- 0 - 65535	UINT16 R/- - -	CANopen 303C:4$_h$ Modbus 15368
`_ERR_temp_dev`	Temperature of device at the time the error was detected	°C - - -	INT16 R/- - -	CANopen 303C:B$_h$ Modbus 15382
`_ERR_temp_ps`	Temperature of power stage at the time the error was detected	°C - - -	INT16 R/- - -	CANopen 303C:A$_h$ Modbus 15380
`_ERR_time`	Time of detection of error With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	CANopen 303C:3$_h$ Modbus 15366
`_ERR_DCbus`	DC bus voltage at the time the error was detected In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 303C:7$_h$ Modbus 15374
`_ERR_motor_v`	Motor velocity at the time the error was detected	usr_v - - -	INT32 R/- - -	CANopen 303C:8$_h$ Modbus 15376
`_ERR_enable_cycl`	Number of cycles of enabling the power stage at error time Number of cycles of enabling the power stage from the time the control voltage was applied to the time the error was detected.	- - - -	UINT16 R/- - -	CANopen 303C:5$_h$ Modbus 15370
`_ERR_enable_time`	Time between enabling of power stage and detection of the error	s - - -	UINT16 R/- - -	CANopen 303C:6$_h$ Modbus 15372
`ERR_reset`	Reset error memory read pointer Value 1: Set error memory read pointer to oldest error entry. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	CANopen 303B:5$_h$ Modbus 15114
`ERR_clear`	Clear error memory Value 1: Delete entries in the error memory The clearing process is completed if a 0 is returned after a read access. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	CANopen 303B:4$_h$ Modbus 15112

Section 10.4
Error Messages

What Is in This Section?

This section contains the following topics:

Description of Error Messages

Description

If monitoring functions of the drive detect an error, the drive generates an error message. Each error message is identified by an error code.

The following information is available for each error message:

- Error code
- Error class
- Description of error
- Possible causes
- Possible remedies

Range of Error Messages

The table below summarizes the error codes classified by range.

Error code	Range
E 1xxx	General
E 2xxx	Overcurrent
E 3xxx	Voltage
E 4xxx	Temperature
E 5xxx	Hardware
E 6xxx	Software
E 7xxx	Interface, wiring
E 8xxx	Fieldbus
E Axxx	Motor movement
E Bxxx	Communication

Error Class of Error Messages

The error messages are classified according to the following error classes:

Error class	State transition[1)]	Error response	Resetting the error message
0	-	No interruption of the movement	Function “Fault Reset”
1	T11	Stop movement with “Quick Stop”	Function “Fault Reset”
2	T13, T14	Stop movement with “Quick Stop” and disable the power stage when the motor has come to a standstill	Function “Fault Reset”
3	T13, T14	Disable the power stage immediately without stopping the movement first	Function “Fault Reset”
4	T13, T14	Disable the power stage immediately without stopping the movement first	Power cycle
(1) See chapter Operating State *(see page 248)*			

Table of Error Messages

List of the Error Messages Sorted by Error Code

Error code	Error class	Description	Cause	Correctives
E 1100	0	Parameter out of permissible value range	The value entered was outside of the permissible value range for this parameter.	The entered value must be within the permissible value range.
E 1101	0	Parameter does not exist	Error detected by parameter management: Parameter (index) does not exist.	Select a different parameter (index).
E 1102	0	Parameter does not exist	Error detected by parameter management: Parameter (subindex) does not exist.	Select a different parameter (subindex).
E 1103	0	Parameter write not permissible (READ only)	Write access to read only parameter.	Write only to parameters that are not read-only.
E 1104	0	Write access denied (no access authorization)	Parameter only accessible at expert level.	The write access level expert is required.
E 1105	0	Block Upload/Download not initialized		
E 1106	0	Command not permissible while power stage is active	Command not permissible while the power stage is enabled (operating state Operation Enabled or Quick Stop Active).	Disable the power stage and repeat the command.
E 1107	0	Access via other interface blocked	Access occupied by another channel (for example: Commissioning software is active and fieldbus access was tried at the same time).	Verify the channel that blocks access.
E 1108	0	File cannot be uploaded: Incorrect file ID		
E 1109	1	Data stored after a power outage is invalid		
E 110A	0	System error detected: No bootloader available		
E 110B	3	Configuration error detected (additional info=Modbus register address) Parameter `_SigLatched` Bit 30	Error detected during parameter check (for example, reference velocity value for operating mode Profile Position is greater than maximum permissible velocity of drive).	Value in additional error information shows the Modbus register address of the parameter where the initialization error was detected.
E 110D	1	Basic configuration of drive required after factory setting	The "First Setup" (FSU) was not run at all or not completed.	Perform a First Setup.
E 110E	0	Parameter changed that requires a restart of the drive	Only displayed by the commissioning software. A parameter modification requires the drive to be powered off and on.	Restart the drive to activate the parameter functionality. See the chapter Parameters for the parameter that requires a restart of the drive.
E 110F	0	Function not available in this type of device	The specific type of device does not support this function or this parameter value.	Verify that you have the correct device type, in particular type of motor, type of encoder, holding brake.
E 1110	0	Incorrect file ID for upload or download	The specific type of device does not support this kind of file.	Verify that you have the correct device type or the correct configuration file.
E 1111	0	File transfer not correctly initialized	A previous file transfer has been aborted.	

Error code	Error class	Description	Cause	Correctives
E 1112	0	Locking of configuration denied	An external tool has tried to lock the configuration of the drive for upload or download. This may not work because another tool had already locked the configuration of the drive or the drive is in an operating state that does not allow locking.	
E 1113	0	System not locked for configuration transfer	An external tool has tried to transfer the configuration without locking the drive.	
E 1114	4	Configuration download aborted Parameter `_SigLatched` Bit 5	During a configuration download, a communication error or an error in the external tool was detected. The configuration was only partially transferred to the drive and might be inconsistent now.	Power the drive off/on and retry to download the configuration or restore the factory settings.
E 1115	0	Incorrect configuration file format Parameter `_WarnLatched` Bit 5	An external tool has downloaded a configuration which has an incorrect format.	
E 1116	0	Request is processed asynchronously		
E 1117	0	Asynchronous request blocked	Request to a module is blocked because the module is currently processing another request.	
E 1118	0	Configuration data incompatible with device	The configuration data contains data from a different device.	Verify device type including type of power stage.
E 1119	0	Incorrect data length, too many bytes		
E 111A	0	Incorrect data length, insufficient number of bytes		
E 111B	4	Configuration download error detected (additional info=Modbus register address)	During a configuration download, one or more configuration values were not accepted by the drive.	Verify that the configuration file is valid and matches the type and version of the drive. The value in the additional error info shows the Modbus register address of the parameter where the initialization error was detected.
E 111C	1	Not possible to initialize recalculation for scaling	A parameter could not be initialized.	The address of the parameter that caused the detected error can be read via the parameter _PAR_ScalingError.
E 111D	3	Original state of a parameter cannot be restored after an error was detected during recalculation of parameters with user-defined units.	The drive contained an invalid configuration before the recalculation was started. An error was detected during the recalculation.	Power the drive off and on again. This may help you to identify the affected parameter(s). Change the parameters as required. Verify that the parameter configuration is valid before starting the recalculation procedure.

Error code	Error class	Description	Cause	Correctives
E 111E	1	Not possible to recalculate data set	A data set of the operating mode Motion Sequence could not be recalculated.	The address of the parameter and the number of the data set that caused this condition can be read via the parameter _PAR_ScalingError.
E 111F	1	Recalculation not possible.	Invalid scaling factor.	Verify that you really want the selected scaling factor. Try a different scaling factor. Before triggering scaling, reset the parameters with user-defined units.
E 1120	1	Recalculation for scaling not possible	A parameter could not be recalculated.	The address of the parameter that caused this condition can be read via the parameter _PAR_ScalingError.
E 1121	0	Incorrect sequence of steps for scaling (fieldbus)	The recalculation has been started prior to the initialization.	The recalculation must be started after the initialization.
E 1122	0	Recalculation for scaling not possible	Recalculation for scaling is already running.	Wait for the running recalculation for scaling to finish.
E 1123	0	Parameter cannot be changed	Recalculation for scaling is running.	Wait for the running recalculation for scaling to finish.
E 1124	1	Timeout during recalculation for scaling	The time between the initialization of the recalculation and the start of the recalculation has been exceeded (30 seconds).	Recalculation must be started within 30 seconds after initialization.
E 1125	1	Scaling not possible	The scaling factors for position, velocity or acceleration/deceleration are beyond internal calculation limits.	Retry with different scaling factors.
E 1126	0	Configuration is blocked by another access channel		Close other access channel (for example, other instance of commissioning software).
E 1127	0	Invalid key received		
E 1128	0	Special login is required for Manufacturing Test Firmware		
E 1129	0	Test step not yet started		
E 112D	0	Configuration of edges is not supported	The selected capture input does not support rising and falling edge at the same time.	Set the edge to either "rising" or "falling".
E 112F	0	Time filter settings cannot be changed	Position capture is already active with a time filter. The filter settings cannot be changed.	Deactivate position capture.
E 1300	3	Safety function STO activated (STO_A, STO_B) Parameter `_SigLatched` Bit 10	The safety function STO was activated in the operating state Operation Enabled.	Verify correct wiring of the inputs of the safety function STO and perform a Fault Reset.
E 1301	4	STO_A and STO_B different level Parameter `_SigLatched` Bit 11	The levels of the inputs STO_A and STO_B were different for more than 1 second.	Verify correct wiring of the inputs of the safety function STO.
E 1302	0	Safety function STO activated (STO_A, STO_B) Parameter `_WarnLatched` Bit 10	Safety function STO was activated while the power stage was disabled.	Verify correct wiring of the inputs of the safety function STO.

Error code	Error class	Description	Cause	Correctives
E 1311	0	The selected signal input function or signal output function cannot be configured	The selected signal input function or signal output function cannot be used in the selected operating mode.	Select another function or change the operating mode.
E 1312	0	Limit switch or reference switch signal not defined for signal input function	Reference movements require limit switches. These limit switches are not assigned to inputs.	Assign the signal input functions Positive Limit Switch, Negative Limit Switch and Reference Switch.
E 1313	0	Configured debounce time not possible for this signal input function	The signal input function does not support the selected debounce time.	Set the debounce time to a valid value.
E 1314	4	At least two inputs have the same signal input function.	The same signal input function has been assigned to at least two inputs.	Reconfigure the inputs.
E 1316	1	Position capture via signal input currently not possible Parameter `_SigLatched` Bit 28	Position capture is already being used.	
E 1501	4	System error detected: DriveCom state machine indeterminable state		
E 1502	4	System error detected: HWL low-level state machine indeterminable state		
E 1503	1	Quick Stop triggered via fieldbus	A Quick Stop has been triggered via the fieldbus. The Quick Stop option code has been set to -1 or -2 which causes the drive to transition to the operating state 9 Fault instead of the operating state 7 Quick Stop Active.	
E 1600	0	Oscilloscope: No additional data available		
E 1601	0	Oscilloscope: Parameterization incomplete		
E 1602	0	Oscilloscope: Trigger variable not defined		
E 1606	0	Logging still active		
E 1607	0	Logging: No trigger defined		
E 1608	0	Logging: Invalid trigger option		
E 1609	0	Logging: No channel selected		
E 160A	0	Logging: No data available		
E 160B	0	Parameter cannot be logged		
E 160C	1	Autotuning: Moment of inertia outside permissible range	The load inertia is too high.	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
E 160E	1	Autotuning: Test movement could not be started		
E 160F	1	Autotuning: Power stage cannot be enabled	Autotuning was not started in the operating state Ready To Switch On.	Start Autotuning when the drive is in the operating state Ready To Switch On.
E 1610	1	Autotuning: Processing stopped	Autotuning stopped by user command or by detected error (see additional error message in error memory, for example, DC bus undervoltage, limit switches triggered)	Remove the cause of the stop and restart Autotuning.

Error code	Error class	Description	Cause	Correctives
E 1611	1	System error detected: Parameter could not be written during Autotuning (additional info=Modbus register address)		
E 1612	1	System error detected: Parameter could not be read during Autotuning		
E 1613	1	Autotuning: Maximum permissible movement range exceeded Parameter `_SigLatched` Bit 2	The movement exceeded the adjusted movement range during Autotuning.	Increase the movement range value or disable movement range monitoring by setting AT_DIS = 0.
E 1614	0	Autotuning: Already active	Autotuning has been started twice simultaneously or an Autotuning parameter is modified during Autotuning (parameter AT_dis and AT_dir).	Wait for Autotuning to finish before restarting Autotuning.
E 1615	0	Autotuning: This parameter cannot be changed while Autotuning is active	Parameter AT_gain or AT_J are written during Autotuning.	Wait for Autotuning to finish before changing the parameter.
E 1617	1	Autotuning: Friction torque or load torque too great	The current limit has been reached (parameter CTRL_I_max).	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
E 1618	1	Autotuning: Optimization aborted	The internal Autotuning sequence has not been finished, there may have been a following error.	See the additional information provided in the error memory.
E 1619	0	Autotuning: Velocity jump in parameter AT_n_ref is not sufficient	Parameter AT_n_ref < 2 * AT_n_tolerance. The drive only checks this for the first velocity jump.	Modify the parameter AT_n_ref or AT_n_tolerance to meet the required condition.
E 1620	1	Autotuning: Load torque too high	Product rating is not suitable for the machine load. Detected machine inertia is too high compared to the inertia of the motor.	Reduce load, verify rating.
E 1621	1	System error detected: Calculation error		
E 1622	0	Autotuning: Not possible to perform Autotuning	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
E 1623	1	Autotuning: HALT request has stopped the autotuning process	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
E 1A00	0	System error detected: FIFO memory overflow		
E 1A01	3	Motor has been changed (different type of motor) Parameter `_SigLatched` Bit 16	Detected motor type is different from previously detected motor.	Confirm the change.
E 1A03	4	System error detected: Hardware and firmware do not match		
E 1B00	3	System error detected: Incorrect parameters for motor and power stage Parameter `_SigLatched` Bit 30	Incorrect manufacturer parameter value (data) non-volatile memory of device.	Replace device.
E 1B02	3	Target value too high. Parameter `_SigLatched` Bit 30		
E 1B05	2	Error detected during parameter switching Parameter `_SigLatched` Bit 30		

Error code	Error class	Description	Cause	Correctives
E 1B0B	1	The operating state at the beginning of the commutation offset identification must be Ready To Switch On.		Set the operating state to Ready To Switch On and restart commutation offset identification.
E 1B0C	3	Motor velocity too high.		
E 1B0D	3	Velocity value determined by velocity observer is incorrect	Incorrect system inertia for velocity observer calculations. Incorrect velocity observer dynamics. System inertia changes during operation. In this case, operation with velocity observer is not possible and the velocity observer must be deactivated.	Change the velocity observer dynamics via the parameter CTRL_SpdObsDyn. Change the system inertia used for velocity observer calculations via the parameter CTRL_SpdObsInert. If the detected error persists, deactivate the velocity observer.
E 1B0F	3	Velocity deviation too high		
E 2201	2	System error: DC bus relay error Parameter `_SigLatched` Bit 30	Inoperative DC bus relay.	Contact Technical Support.
E 2300	3	Power stage overcurrent Parameter `_SigLatched` Bit 27	Motor short circuit and disabling of the power stage. Motor phases are inverted.	Verify the motor power connection.
E 2301	3	Braking resistor overcurrent Parameter `_SigLatched` Bit 27	Braking resistor short circuit.	If you use the internal braking resistor, contact Technical Support. If you use an external braking resistor, verify correct wiring and rating of the braking resistor.
E 3100	par.	Missing mains supply, undervoltage mains supply or overvoltage mains supply Parameter `_SigLatched` Bit 15	Missing phase(s) for more than 50 ms. Mains voltage is out of range. Mains frequency is out of range.	Verify that the values of the mains power supply network comply with the technical data.
E 3200	3	DC bus overvoltage Parameter `_SigLatched` Bit 14	Excessive regeneration during deceleration.	Verify correct deceleration ramp, rating of drive and braking resistor.
E 3201	3	DC bus undervoltage (shutdown threshold) Parameter `_SigLatched` Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
E 3202	2	DC bus undervoltage (Quick Stop threshold) Parameter `_SigLatched` Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
E 3206	0	Undervoltage DC bus, missing mains supply, undervoltage mains supply or overvoltage mains supply Parameter `_WarnLatched` Bit 13	Missing phase(s) for more than 50 ms. Mains voltage is out of range. Mains frequency is out of range. Mains voltage and setting of parameter MON_MainsVolt do not match (for example, mains voltage is 230 V and MON_MainsVolt is set to 115 V).	Verify that the values of the mains power supply network comply with the technical data. Verify the settings of the parameter for reduced mains voltage.
E 3300	0	The winding voltage of the motor is lower than the nominal supply voltage of the drive	If the winding voltage of the motor is lower than the nominal supply voltage of the drive, this may result in motor overtemperature due to high current ripple.	Verify the motor temperature. In the case of overtemperature, use a motor with a higher winding voltage or use a drive with a lower nominal supply voltage.

Error code	Error class	Description	Cause	Correctives
E 4100	3	Power stage overtemperature Parameter _SigLatched Bit 18	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation. If a fan is installed, verify correct operation of the fan.
E 4101	0	Power stage overtemperature Parameter _WarnLatched Bit 18	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation. If a fan is installed, verify correct operation of the fan.
E 4102	0	Power stage overload (I2t) Parameter _WarnLatched Bit 30	The current has exceeded the nominal value for an extended period of time.	Verify rating, reduce cycle time.
E 4200	3	Device overtemperature Parameter _SigLatched Bit 18	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation. If a fan is installed, verify correct operation of the fan.
E 4201	0	Device overtemperature	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation. If a fan is installed, verify correct operation of the fan.
E 4300	2	Motor overtemperature Parameter _SigLatched Bit 17	Ambient temperature is too high. Duty cycle is too high. Motor not properly mounted (thermal isolation). Motor overload.	Verify motor installation: The heat must be dissipated via the mounting surface. Reduce ambient temperature. Provide ventilation.
E 4301	0	Motor overtemperature Parameter _WarnLatched Bit 17	Ambient temperature is too high. Duty cycle is too high. Motor not properly mounted (thermal isolation). Motor overload.	Verify motor installation: The heat must be dissipated via the mounting surface. Reduce ambient temperature. Provide ventilation.
E 4302	0	Motor overload (I2t) Parameter _WarnLatched Bit 31	The current has exceeded the nominal value for an extended period of time.	Verify that the system can easily be moved. Verify the load. Use a differently sized motor, if necessary.
E 4303	0	No motor temperature monitoring	The temperature parameters (in electronic nameplate of motor, non-volatile memory of encoder) are unavailable or invalid; parameter A12 is equal to 0.	Contact Technical Support. Replace motor.
E 4304	0	The encoder does not support motor temperature monitoring.		
E 4402	0	Braking resistor overload (I2t > 75%) Parameter _WarnLatched Bit 29	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating.
E 4403	par.	Braking resistor overload (I2t > 100%)	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating.
E 4404	0	Overload of transistor for braking resistor Parameter _WarnLatched Bit 28	Regeneration energy too high. External loads too high. Deceleration too fast.	Reduce load and/or deceleration.
E 5101	0	Modbus power supply missing		
E 5102	4	Motor encoder supply voltage Parameter _SigLatched Bit 16	Encoder power supply is not within permissible range of 8 V to 12 V.	Replace the device. Contact Technical Support.
E 5200	4	Error detected at connection to motor encoder Parameter _SigLatched Bit 16	Encoder not properly connected, EMC	

Error code	Error class	Description	Cause	Correctives
E 5201	4	Error detected in motor encoder communication Parameter `_SigLatched` Bit 16	Encoder not properly connected, EMC	
E 5203	4	Error detected in connection motor encoder Parameter `_SigLatched` Bit 16	Encoder not properly connected	
E 5204	3	Connection to motor encoder lost Parameter `_SigLatched` Bit 16	Encoder not properly connected	
E 5206	0	Communication error detected in encoder Parameter `_WarnLatched` Bit 16	Communication channel to encoder is subject to interference.	Verify EMC measures.
E 5207	1	Function is not supported	The hardware revision does not support the function.	
E 5302	4	The motor requires a PWM frequency (16kHz) which the power stage does not support.	The motor only works with a PWM frequency of 16 kHz (motor nameplate entry). However, the power stage does not support this PWM frequency.	Use a motor that works with a PWM frequency of 8 kHz. Contact Technical Support.
E 5430	4	System error detected: EEPROM read error Parameter `_SigLatched` Bit 29		
E 5431	3	System error: EEPROM write error Parameter `_SigLatched` Bit 29		
E 5432	3	System error: EEPROM state machine Parameter `_SigLatched` Bit 29		
E 5433	3	System error: EEPROM address error Parameter `_SigLatched` Bit 29		
E 5434	3	System error: EEPROM incorrect data length Parameter `_SigLatched` Bit 29		
E 5435	4	System error: EEPROM not formatted Parameter `_SigLatched` Bit 29		
E 5436	4	System error: EEPROM incompatible structure Parameter `_SigLatched` Bit 29		
E 5437	4	System error detected: EEPROM checksum error (manufacturer data) Parameter `_SigLatched` Bit 29		
E 5438	3	System error detected: EEPROM checksum error (user parameters) Parameter `_SigLatched` Bit 29		
E 5439	3	System error detected: EEPROM checksum error (fieldbus parameters) Parameter `_SigLatched` Bit 29		
E 543B	4	System error detected: No valid manufacturer data Parameter `_SigLatched` Bit 29		
E 543E	3	System error detected: EEPROM checksum error (NoInit parameter) Parameter `_SigLatched` Bit 29		
E 543F	3	System error detected: EEPROM checksum error (motor parameters) Parameter `_SigLatched` Bit 29		
E 5441	4	System error detected: EEPROM checksum error (global control loop parameter set) Parameter `_SigLatched` Bit 29		

Error code	Error class	Description	Cause	Correctives
E 5442	4	System error detected: EEPROM checksum error (control loop parameter set 1) Parameter _SigLatched Bit 29		
E 5443	4	System error detected: EEPROM checksum error (control loop parameter set 2) Parameter _SigLatched Bit 29		
E 5444	4	System error detected: EEPROM checksum error (NoReset parameter) Parameter _SigLatched Bit 29		
E 5445	4	System error detected: EEPROM checksum error (hardware information) Parameter _SigLatched Bit 29		
E 5446	4	System error detected: EEPROM checksum error (for power outage data) Parameter _SigLatched Bit 29	Internal EEPROM not operative.	Restart the drive. If the detected error persists, contact Technical Support.
E 5447	3	System error detected: EEPROM checksum error (data sets operating mode Motion Sequence) Parameter _SigLatched Bit 29		
E 5448	2	System error detected: Communication with memory card Parameter _SigLatched Bit 20		
E 5449	2	System error detected: Memory card bus is busy Parameter _SigLatched Bit 20		
E 544A	4	System error detected: EEPROM checksum error (administration data) Parameter _SigLatched Bit 29		
E 544C	4	System error detected: EEPROM is write-protected Parameter _SigLatched Bit 29		
E 544D	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.
E 544E	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.
E 544F	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.
E 5451	0	System error detected: No memory card available Parameter _WarnLatched Bit 20		
E 5452	2	System error detected: Data on memory card and device do not match Parameter _SigLatched Bit 20	Different type of device. Different type of power stage. Data on memory card does not match firmware version of device.	
E 5453	2	System error detected: Incompatible data on the memory card Parameter _SigLatched Bit 20		

Error code	Error class	Description	Cause	Correctives
E 5454	2	System error detected: Capacity of detected memory card insufficient Parameter _SigLatched Bit 20		
E 5455	2	System error detected: Memory card not formatted Parameter _SigLatched Bit 20		Update memory card (drive to card).
E 5456	1	System error detected: Memory card is write-protected Parameter _SigLatched Bit 20	The memory card has been write-protected.	Remove memory card or disable write protection.
E 5457	2	System error detected: Incompatible memory card Parameter _SigLatched Bit 20	Memory card capacity is insufficient.	Replace memory card
E 5458	4	System error detected: Flash programming sequence		
E 5459	1	System error detected: Parameter only available during flashing (flash request)		
E 545A	4	System error detected: Firmware update FiFo overrun		
E 545B	4	System error detected: Incompatible firmware file header information		
E 545C	4	System error detected: Firmware file and device not compatible		
E 545D	4	System error detected: Firmware file checksum incorrect		
E 545E	4	System error detected: Firmware file header information has an odd number of bytes		
E 545F	4	System error detected: Size of firmware file exceeds memory capacity		
E 5460	4	System error detected: Loader for firmware file not available	Incorrect loader.	Contact Technical Support.
E 5461	4	System error detected: Firmware version in device and firmware version to be updated are identical		
E 5462	0	Memory card implicitly written by the device Parameter _WarnLatched Bit 20	The content of the memory card and the content of the EEPROM are not identical.	
E 5463	1	Error detected in firmware file	Transfer of firmware file incomplete.	
E 5464	1	Firmware update in progress	Update of firmware file is still running.	
E 5465	4	System error detected: File header too large		
E 5466	4	System error detected: Bootloader does not match the bootloader required for the firmware file		
E 5467	4	System error detected: Loader does not match the loader required for the firmware file		
E 546C	0	EEPROM file not available		
E 5600	3	Motor connection phase error detected Parameter _SigLatched Bit 26	Missing motor phase.	

Error code	Error class	Description	Cause	Correctives
E 5603	3	Commutation error detected (additional info=Internal_DeltaQuep) Parameter `_SigLatched` Bit 26	Incorrect wiring of motor cable. Encoder signals are lost or subject to interference. The load torque is greater than the motor torque. The encoder EEPROM contains incorrect data (encoder phase offset is incorrect). Motor is not adjusted.	Verify motor phases, verify encoder wiring. Improve EMC, verify grounding and shield connection. Use a differently sized motor that can withstand the load torque. Verify the motor data. Contact Technical Support.
E 6102	4	System error detected: Internal software error Parameter `_SigLatched` Bit 30		
E 6103	4	System error detected: System stack overflow Parameter `_SigLatched` Bit 31		
E 6104	0	System error detected: Division by zero (internal)		
E 6105	0	System error detected: Overflow during 32 bit calculation (internal)		
E 6106	4	System error detected: Size of data interface does not match Parameter `_SigLatched` Bit 30		
E 6107	0	Parameter outside of value range (calculation error detected)		
E 6108	0	Function not available		
E 6109	0	System error detected: Internal range exceeded		
E 610A	2	System error detected: Calculated value cannot be represented as a 32 bit value		
E 610D	0	Error detected in selection parameter	Incorrect parameter value selected.	Verify the value to be written.
E 610E	4	System error detected: 24 VDC below undervoltage threshold for shutdown		
E 610F	4	System error detected: Internal timer basis missing (Timer0) Parameter `_SigLatched` Bit 30		
E 6111	2	System error detected: Memory area locked Parameter `_SigLatched` Bit 30		
E 6112	2	System error detected: Out of memory Parameter `_SigLatched` Bit 30		
E 6113	1	System error detected: Calculated value cannot be represented as a 16 bit value		
E 6114	4	System error detected: Impermissible function call from interrupt service routine	Incorrect programming	
E 6117	0	Holding brake cannot be released manually.	The holding brake cannot be relased manually because it is still applied manually.	First, switch from applying the holding brake manually to Automatic, then to releasing the holding brake manually.
E 7100	4	System error detected: Invalid power stage data Parameter `_SigLatched` Bit 30	Error detected in power stage data stored in device (incorrect CRC), error detected in internal memory data.	Contact Technical Support or replace the device.

Error code	Error class	Description	Cause	Correctives
E 7111	0	Parameter cannot be changed because the external braking resistor is active.	An attempt is made to change one of the parameters RESext_ton, RESext_P or RESext_R even though the external braking resistor is active.	Verify that the external braking resistor is not active if one of the parameters RESext_ton, RESext_P or RESext_R has to be changed.
E 7112	2	No external braking resistor connected	External braking resistor activated (Parameter RESint_ext), but no external resistor is detected.	Verify wiring of the external braking resistor. Verify correct resistance.
E 7113	0	Control voltage for holding brake too low	The DC bus voltage is too low (temporarily or permanently). The ripple is too high.	Increase the supply voltage. Stabilize the mains supply.
E 7114	2	No braking resistor connected	Connection to braking resistor lost	Verify wiring of the braking resistor. Verify correct resistance.
E 7120	4	Invalid motor data Parameter `_SigLatched` Bit 16	Motor data is incorrect (incorrect CRC).	Contact Technical Support or replace the motor.
E 7121	2	System error detected: Error in motor encoder communication Parameter `_SigLatched` Bit 16	EMC, detailed information can be found in the error memory that contains the error code of the encoder.	Contact Technical Support.
E 7122	4	Invalid motor data Parameter `_SigLatched` Bit 30	Error detected in motor data stored in motor encoder, error detected in internal memory data.	Contact Technical Support or replace the motor.
E 7124	4	System error detected: Motor encoder inoperative Parameter `_SigLatched` Bit 16		Contact Technical Support or replace the motor.
E 7125	4	System error detected: Length specification for user data too great Parameter `_SigLatched` Bit 16		
E 7129	0	System error detected: Motor encoder Parameter `_WarnLatched` Bit 16		
E 712C	0	System error detected: Communication with encoder not possible Parameter `_WarnLatched` Bit 16		
E 712D	4	Electronic motor nameplate not found Parameter `_SigLatched` Bit 16	Incorrect motor data (incorrect CRC). Motor without electronic motor nameplate (for example, SER motor)	Contact Technical Support or replace the motor.
E 712F	0	No data segment of the electronic motor nameplate		
E 7132	0	System error detected: Motor configuration cannot be written		
E 7134	4	Incomplete motor configuration Parameter `_SigLatched` Bit 16		
E 7135	4	Format is not supported Parameter `_SigLatched` Bit 16		
E 7136	4	Incorrect encoder type selected with parameter MotEnctype Parameter `_SigLatched` Bit 16		
E 7137	4	Error detected during the internal conversion of the motor configuration Parameter `_SigLatched` Bit 16		

Error code	Error class	Description	Cause	Correctives
E 7138	4	Parameter of the motor configuration out of permissible range Parameter `_SigLatched` Bit 16		
E 7139	0	Encoder offset: Data segment in encoder is incorrect.		
E 713A	3	Adjustment value of the encoder of the third party motor has not yet been determined. Parameter `_SigLatched` Bit 16		
E 7200	4	System error detected: Calibration analog/digital converter during manufacturing / incorrect BLE file Parameter `_SigLatched` Bit 30		
E 7320	4	System error detected: Invalid encoder parameter Parameter `_SigLatched` Bit 16	Communication channel (Hiperface) to encoder is subject to interference, motor encoder has not been factory-parameterized.	Contact Technical Support.
E 7321	3	Timeout reading the absolute position from the encoder Parameter `_SigLatched` Bit 16	Communication channel (Hiperface) to encoder is subject to interference or motor encoder is inoperative.	Verify EMC measures.
E 7327	0	Error bit set in Hiperface answer Parameter `_WarnLatched` Bit 16	Insufficient EMC.	Verify wiring (shield).
E 7328	4	Motor encoder: Position evaluation error detected Parameter `_SigLatched` Bit 16	Encoder has detected incorrect position evaluation.	Contact Technical Support or replace the motor.
E 7329	0	Motor encoder Warn signal Parameter `_WarnLatched` Bit 16	EMC.	Contact Technical Support or replace the motor.
E 7330	4	System error detected: Motor encoder (Hiperface) Parameter `_SigLatched` Bit 16		Verify EMC measures. Contact Technical Support.
E 7331	4	System error detected: Motor encoder initialization Parameter `_SigLatched` Bit 30		Verify EMC measures. Contact Technical Support.
E 7335	0	Communication with motor encoder active Parameter `_WarnLatched` Bit 16	Command is being processed or communication may be disturbed (EMC).	Verify EMC measures. Contact Technical Support.
E 733F	4	Amplitude of encoder analog signals too low Parameter `_SigLatched` Bit 16	Incorrect encoder wiring. Encoder not connected. Encoder signals subject to EMC interference (shield connection, cabling, etc.).	Verify EMC measures. Contact Technical Support.
E 7340	3	Reading of absolute position aborted Parameter `_SigLatched` Bit 16	Communication channel (Hiperface) to encoder is subject to interference. Encoder (in motor) is inoperative.	Verify EMC measures. Contact Technical Support.
E 7341	0	Encoder overtemperature Parameter `_WarnLatched` Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor.

Error code	Error class	Description	Cause	Correctives
E 7342	2	Encoder overtemperature Parameter `_SigLatched` Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor.
E 7343	0	Absolute position is different from incremental position Parameter `_WarnLatched` Bit 16	Encoder is subject to EMC interference. Motor encoder is inoperative.	Verify EMC measures. Contact Technical Support.
E 7344	3	Absolute position is different from incremental position Parameter `_SigLatched` Bit 16	Encoder is subject to EMC interference. Motor encoder is inoperative.	Verify EMC measures. Contact Technical Support.
E 7345	0	Amplitude of analog signals too high, limit of AD conversion exceeded	Encoder signals subject to EMC interference (shield connection, wiring, etc.). Encoder inoperative.	Verify EMC measures. Contact Technical Support.
E 7346	4	System error detected: Encoder not ready Parameter `_SigLatched` Bit 16		Verify EMC measures. Contact Technical Support.
E 7347	0	System error detected: Position initialization not possible	Analog and digital encoder signals subject to massive interference.	Verify EMC measures. Contact Technical Support.
E 7348	3	Timeout reading encoder temperature Parameter `_SigLatched` Bit 16	Encoder without temperature sensor, incorrect encoder connection.	Verify EMC measures. Contact Technical Support.
E 7349	0	Discrepancy between absolute and analog encoder phases	Analog encoder signals are subject to interference. Encoder inoperative.	Verify EMC measures. Contact Technical Support.
E 734A	3	Amplitude of analog signals from encoder too high, signals are clipped Parameter `_SigLatched` Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734B	0	Signal position evaluation of analog encoder inoperative Parameter `_WarnLatched` Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734C	par.	Error detected with quasi absolute position Parameter `_SigLatched` Bit 16	The motor shaft may have been moved while the drive was powered down. A quasi absolute position has been detected that is not within the permissible motor shaft deviation range.	If the quasi absolute function is active, only power down the drive if the motor is at a standstill and do not move the motor shaft when the drive is off.
E 734D	0	Index pulse is not available for the encoder Parameter `_WarnLatched` Bit 16		
E 734E	4	Error in analog signals from encoder detected (additional info=Internal_DeltaQuep) Parameter `_SigLatched` Bit 16	Encoder cable not properly connected. Encoder signals subject to EMC interference (shield connection, wiring, etc.). Mechanical issue.	Verify EMC measures. Contact Technical Support.
E 7500	0	RS485/Modbus: Overrun error detected Parameter `_WarnLatched` Bit 5	EMC; incorrect cabling.	Verify cables.

Error code	Error class	Description	Cause	Correctives
E 7501	0	RS485/Modbus: Framing error detected Parameter `_WarnLatched` Bit 5	EMC; incorrect cabling.	Verify cables.
E 7502	0	RS485/Modbus: Parity error detected Parameter `_WarnLatched` Bit 5	EMC; incorrect cabling.	Verify cables.
E 7503	0	RS485/Modbus: Receive error detected Parameter `_WarnLatched` Bit 5	EMC; incorrect cabling.	Verify cables.
E 7623	0	Absolute encoder signal is not available Parameter `_WarnLatched` Bit 22	There is no encoder available at the input specified via the parameter ENC_abs_source.	Verify wiring, verify encoder. Change the value of the parameter ENC_abs_source.
E 7625	0	Not possible to set the absolute position for encoder 1. Parameter `_WarnLatched` Bit 22	There is no encoder connected to the input for encoder 1.	Connect an encoder to the input for encoder 1 before trying to set the absolute position directly via ENC1_abs_pos.
E 7701	4	System error detected: Timeout during connection to power stage Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7702	4	System error detected: Invalid data received from power stage Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7703	4	System error detected: Data exchange with power stage lost Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7704	4	System error detected: Exchange of identification data from power stage not successful Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7705	4	System error detected: Checksum identification data from power stage incorrect Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7706	4	System error detected: No identification frame received from power stage Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7707	4	System error detected: Type of power stage and manufacture data do not match		Contact Technical Support.
E 7708	4	PIC voltage supply too low Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 7709	4	System error detected: Invalid numbers of data received Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 770A	2	PIC received data with incorrect parity Parameter `_SigLatched` Bit 31		Contact Technical Support.
E 770B	2	Motor has been changed (different type of power stage) Parameter `_SigLatched` Bit 31	Detected power stage type is different from previously detected power stage.	Confirm the change.
E 8110	0	CANopen: Overflow internal receive queue (message lost) Parameter `_WarnLatched` Bit 21	Two short CAN messages have been sent too fast (at 1 Mbits only).	
E 8120	0	CANopen: CAN Controller in state Error Passive Parameter `_WarnLatched` Bit 21	Too many error frames have been detected.	Verify CAN bus installation.

Error code	Error class	Description	Cause	Correctives
E 8130	2	CANopen: Detected Heartbeat or Life Guard error Parameter _SigLatched Bit 21	The bus cycle time of the CANopen master is longer than the programmed heartbeat or node guarding time.	Verify the CANopen configuration, increase the heartbeat or node guarding time.
E 8131	0	CANopen: Detected Heartbeat or Life Guard error Parameter _WarnLatched Bit 21		
E 8140	0	CANopen: CAN controller was in state 'bus-off', communication is possible again Parameter _WarnLatched Bit 21		
E 8141	2	CANopen: CAN controller is in state 'bus-off' Parameter _SigLatched Bit 21	Too many error frames have been detected, CAN devices with different baud rates.	Verify CAN bus installation.
E 8142	0	CANopen: CAN controller is in state 'bus-off' Parameter _WarnLatched Bit 21	Too many error frames have been detected, CAN devices with different baud rates.	Verify CAN bus installation.
E 8281	0	CANopen: RxPDO1 could not be processed Parameter _WarnLatched Bit 21	Error detected while processing Receive PDO1: PDO1 contains invalid value.	Verify RxPDO1 content (application).
E 8282	0	CANopen: RxPDO2 could not be processed Parameter _WarnLatched Bit 21	Error detected while processing Receive PDO2: PDO2 contains invalid value.	Verify RxPDO2 content (application).
E 8283	0	CANopen: RxPDO3 could not be processed Parameter _WarnLatched Bit 21	Error detected while processing Receive PDO3: PDO3 contains invalid value.	Verify RxPDO3 content (application).
E 8284	0	CANopen: RxPDO4 could not be processed Parameter _WarnLatched Bit 21	Error detected while processing Receive PDO4: PDO4 contains invalid value.	Verify RxPDO4 content (application)
E 8291	0	CANopen: TxPdo could not be processed Parameter _WarnLatched Bit 21		
E 8292	0	CANopen: TxPdo could not be processed Parameter _WarnLatched Bit 21		
E 8293	0	CANopen: TxPdo could not be processed Parameter _WarnLatched Bit 21		
E 8294	0	CANopen: TxPdo could not be processed Parameter _WarnLatched Bit 21		
E 82A0	0	CANopen: Initialization CANopen stack Parameter _WarnLatched Bit 21		
E 82A1	0	CANopen: Overflow internal transmit queue (message lost) Parameter _WarnLatched Bit 21		
E 82B1	0	CANopen: The data tunneling protocol is not Modbus RTU Parameter _WarnLatched Bit 21		
E 82B2	0	CANopen: Data frame is still being processed Parameter _WarnLatched Bit 21	A new data frame was written but the previous data frame is still being processed.	Write the data frame again later on.
E A065	0	Parameters cannot be written Parameter _WarnLatched Bit 4	A data set is still active.	Wait until the currently active data set has been terminated.
E A066	0	Teach-in position cannot be accepted Parameter _WarnLatched Bit 4	Data set type is not 'MoveAbsolute'	Set the data set type to 'MoveAbsolute'

Error code	Error class	Description	Cause	Correctives
E A067	1	Invalid value in data set (additional info = data set number (low byte) and entry (high byte)) Parameter `_SigLatched` Bit 4	Value not possible in data set.	See also parameters _MSM_error_num and _MSM_error_entry for additional information.
E A300	0	Deceleration after HALT request still running	HALT was removed too soon. New command was sent before motor standstill was reached after a HALT request.	Wait for complete stop before removing HALT signal. Wait until motor has come to a complete standstill.
E A301	0	Drive in operating state Quick Stop Active	Error with error class 1 detected. Drive stopped with Quick Stop.	
E A302	1	Stop by positive limit switch Parameter `_SigLatched` Bit 1	The positive limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
E A303	1	Stop by negative limit switch Parameter `_SigLatched` Bit 1	The negative limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
E A304	1	Stop by reference switch Parameter `_SigLatched` Bit 1		
E A305	0	Power stage cannot be enabled in the operating state Not Ready To Switch On	Fieldbus: An attempt was made to enable the power stage in the operating state Not Ready To Switch On.	Refer to the state diagram.
E A306	1	Stop by user-initiated software stop Parameter `_SigLatched` Bit 3	Drive is in operating state Quick Stop Active due to a software stop request. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Clear break condition with command Fault Reset.
E A307	0	Interruption by internal software stop	In the operating modes Homing and Jog, the movement is internally interrupted by an internal software stop. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Perform a Fault Reset.
E A308	0	Drive is in operating state Fault or Fault Reaction Active	Error with error class 2 or higher detected.	Verify the error code, remove the cause and perform a Fault Reset.
E A309	0	Drive not in operating state Operation Enabled	A command was sent that requires the drive to be in the operating state Operation Enabled (for example, a command to change the operating mode).	Set drive to operating state Operation Enabled and repeat the command.
E A310	0	Power stage not enabled	Command cannot be used because the power stage is not enabled (operating state Operation Enabled or Quick Stop Active).	Set drive to an operating state in which the power stage is enabled, see state diagram.

Error code	Error class	Description	Cause	Correctives
E A311	0	Operating mode change active	A start request for an operating mode has been received while a change of the operating mode was active.	Wait until the operating mode change has terminated before triggering a start request for another operating mode.
E A312	0	Profile generation interrupted		
E A313	0	Position overflow, zero point is therefore no longer valid (ref_ok=0)	The movement range limits were exceeded and the zero point is no longer valid. An absolute movement requires a valid zero point.	Define a valid zero point by means of the operating mode Homing.
E A314	0	No valid zero point	Command needs a valid zero point (ref_ok=1).	Define a valid zero point by means of the operating mode Homing.
E A315	0	Homing active	Command cannot be used while the operating mode Homing is active.	Wait until reference movement is finished.
E A316	0	Overflow during calculation of acceleration		
E A317	0	Motor is not at a standstill	Command sent which is not permissible when the motor is not at a standstill. For example: - Change of software limit switches - Change of handling of monitoring signals - Setting of reference point - Teach in of data set	Wait until the motor has come to a standstill (x_end = 1).
E A318	0	Operating mode active (x_end=0)	Activation of a new operating mode is not possible while another operating mode is still active.	Wait until the command in the operating mode has finished (x_end=1) or terminate active operating mode with HALT command.
E A319	1	Manual tuning/Autotuning: Movement out of range Parameter `_SigLatched` Bit 2	The movement exceeds the parameterized maximum movement range.	Verify permissible movement range value and time interval.
E A31A	0	Manual tuning/Autotuning: Amplitude/offset too high	Amplitude plus offset for tuning exceed internal velocity or current limitation.	Choose lower amplitude and offset values.
E A31B	0	Halt requested	Command not permissible while Halt is requested.	Clear Halt request and repeat command.
E A31C	0	Invalid position setting with software limit switch	Value for negative (positive) software limit switch is greater (less) than value for positive (negative) software limit switch.	Set correct position values.
E A31D	0	Velocity range exceeded (parameter CTRL_v_max, M_n_max)	The velocity was set to a value greater than the maximum permissible velocity in parameter CTRL_v_max or M_n_max, whichever is lower.	If the value of parameter M_n_max is greater than the value of parameter CTRL_v_max, increase the value of parameter CTRL_v_max or reduce the velocity value.
E A31E	1	Stop by positive software limit switch Parameter `_SigLatched` Bit 2	Not possible to execute command because positive software limit switch was triggered.	Return to the permissible movement range.
E A31F	1	Stop by negative software limit switch Parameter `_SigLatched` Bit 2	Not possible to execute command because negative software limit switch was triggered.	Return to the permissible movement range.

Error code	Error class	Description	Cause	Correctives
E A320	par.	Permissible position deviation exceeded Parameter _SigLatched Bit 8	External load or acceleration are too high.	Reduce external load or acceleration. Use a differently rated drive, if necessary. Error response can be adjusted via parameter ErrorResp_p_dif.
E A322	0	Error detected in ramp calculation		
E A323	3	System error detected: Processing error detected during generation of profile		
E A324	1	Error detected during homing (additional info = detailed error code) Parameter _SigLatched Bit 4	Homing movement was stopped in response to a detected error, the detailed reason is indicated by the additional info in the error memory.	Possible sub-error codes: E A325, E A326, E A327, E A328 or E A329.
E A325	1	Limit switch to be approached not enabled Parameter _SigLatched Bit 4	Homing to positive limit switch or negative limit switch is disabled.	Enable limit switch via 'IOsigLimP' or 'IOsigLimN'.
E A326	1	Reference switch not found between positive limit switch and negative limit switch Parameter _SigLatched Bit 4	Reference switch inoperative or not correctly connected.	Verify the function and wiring of the reference switch.
E A329	1	More than one signal positive limit switch/negative limit switch/reference switch active Parameter _SigLatched Bit 4	Reference switch or limit switch not connected correctly or supply voltage for switches too low.	Verify the wiring and 24 VDC supply voltage.
E A32A	1	Positive limit switch triggered with negative direction of movement Parameter _SigLatched Bit 4	Start reference movement with negative direction (for example, reference movement to negative limit switch) and activate the positive limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with negative direction of movement (target limit switch must be connected to the negative limit switch).
E A32B	1	Negative limit switch triggered with positive direction of movement Parameter _SigLatched Bit 4	Start reference movement with positive direction (for example, reference movement to positive limit switch) and activate the negative limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with positive direction of movement (target limit switch must be connected to the positive limit switch).
E A32C	1	Reference switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
E A32D	1	Positive limit switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
E A32E	1	Negative limit switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.

Error code	Error class	Description	Cause	Correctives
E A32F	1	Index pulse not found Parameter `_SigLatched` Bit 4	Index pulse signal not connected or not working properly.	Verify index pulse signal and connection.
E A330	0	Reference movement to index pulse cannot be reproduced. Index pulse is too close to the switch Parameter `_WarnLatched` Bit 4	The position difference between the index pulse and the switching point is insufficient.	Increase the distance between the index pulse and the switching point. If possible, the distance between the index pulse and the switching point should be a half motor revolution.
E A332	1	Jog error detected (additional info = detailed error code) Parameter `_SigLatched` Bit 4	Jog movement was stopped in response to a detected error.	For additional info, verify the detailed error code in the error memory.
E A333	3	System error detected: Invalid internal selection		
E A334	2	Timeout Standstill Window monitoring	Position deviation after movement greater than standstill window. This may have been caused by an external load.	Verify load. Verify settings for standstill window (parameter MON_p_win, MON_p_winTime and MON_p_winTout). Optimize control loop settings.
E A336	1	System error detected: Jerk limitation with position offset after end of movement (additional info = offset in Inc.)		
E A337	0	Operating mode cannot be continued Parameter `_WarnLatched` Bit 4	Continuation of interrupted movement in operating mode Profile Position is not possible because another operating mode had been active in the meantime. In the operating mode Motion Sequence, continuation is not possible if a motion blend was interrupted.	Restart the operating mode.
E A338	0	Operating mode unavailable Parameter `_WarnLatched` Bit 4	The selected operating mode is not available.	
E A33A	0	No valid zero point (ref_ok=0) Parameter `_WarnLatched` Bit 4	No zero point defined by means of operating mode Homing. Zero point no longer valid due to movement beyond permissible movement range. Motor does not have an absolute encoder.	Use operating mode Homing to define a valid zero point. Use a motor with an absolute encoder.
E A33C	0	Function not available in this operating mode Parameter `_WarnLatched` Bit 4	Activation of a function which is not available in the active operating mode. Example: Start of backlash compensation while autotuning/manual tuning is active.	
E A33D	0	Motion blend is already active Parameter `_WarnLatched` Bit 4	Change of motion blend during the ongoing motion blend (end position of motion blend not yet reached)	Wait for the motion blend to complete before setting the next position.
E A33E	0	No movement activated Parameter `_WarnLatched` Bit 4	Activation of a motion blend without movement.	Start a movement before the motion blend is activated.

Error code	Error class	Description	Cause	Correctives
E A33F	0	Position of motion blend movement not in the range of the ongoing movement Parameter `_WarnLatched` Bit 4	The position of the motion blend is outside of the movement range.	Verify the position of the motion blend and the movement range.
E A340	1	Error detected in operating mode Motion Sequence (additional info = detailed error code) Parameter `_SigLatched` Bit 4	The operating mode Motion Sequence was stopped in response to a detected error. Verify the error memory for details on the detected error.	See the additional error information.
E A341	0	Position of motion blend has already been passed Parameter `_WarnLatched` Bit 4	The movement has passed beyond the position of the motion blend.	
E A342	1	Target velocity was not reached at motion blend position. Parameter `_SigLatched` Bit 4	The position of the motion blend was overtraveled, the target velocity was not reached.	Reduce the ramp velocity so that the target velocity is reached at the position of the motion blend.
E A343	0	Processing only possible with linear ramp Parameter `_WarnLatched` Bit 4	Motion blend position was set with a non-linear ramp.	Set a linear ramp.
E A347	0	Permissible position deviation exceeded Parameter `_WarnLatched` Bit 8	External load or acceleration are too high.	Reduce external load or acceleration. Threshold value can be adjusted via the parameter MON_p_dif_warn.
E A349	0	Position setting exceeds system limits	Position scaling of POSscaleDenom and POSscaleNum results in a scaling factor that is too small.	Change POSscaleDenom and POSscaleNum in such a way as to increase the resulting scaling factor.
E A34A	0	Velocity setting exceeds system limits	The velocity scaling of 'VELscaleDenom' and 'VELscaleNum' results in a scaling factor that is too small. The velocity has been set to a value greater than the maximum possible velocity (the maximum velocity is 13200 rpm).	Change 'VELscaleDenom' and 'VELscaleNum' in such a way as to increase the resulting scaling factor.
E A34B	0	Ramp setting exceeds system limits	The ramp scaling of 'RAMPscaleDenom' and 'RAMPscaleNum' results in a scaling factor that is too small.	Change of 'RAMPscaleDenom' and 'RAMPscaleNum' in such a way as to increase the resulting scaling factor.
E A34C	0	Resolution of scaling too high (range exceeded)		
E A34D	0	Function not available when Modulo is active	The function cannot be executed when Modulo is active.	Deactivate Modulo to use the function.
E A34E	0	Target value for absolute movement not possible with defined modulo range and modulo handling.	If parameter 'MOD_Absolute' is set to: Shortest Distance: Target value is not in defined modulo range. Positive Direction: Target value is less than parameter 'MOD_Min'. Negative Direction: Target value is greater than parameter 'MOD_Max'.	Set a correct target value for absolute movement.
E A34F	0	Target position outside of modulo range. Corresponding movement within range performed instead.	The setting of parameter 'MOD_AbsMultiRng' only allows for a movement within the modulo range.	Change the parameter 'MOD_AbsMultiRng' to allow for movements beyond the modulo range.

Error code	Error class	Description	Cause	Correctives
E A351	1	Function cannot be executed with this position scaling factor Parameter `_SigLatched` Bit 4	The positions scaling factor is set to a value less than 1rev/131072usr_p, which is less than the internal resolution. In the operating mode Cyclic Synchronous Position, the resolution is not set to 1rev/131072usr_p.	Use a different position scaling factor or deactivate the selected function.
E A352	0	Position list active		
E A353	0	Position list not sorted		
E A354	0	Position list does not match the configuration of the Modulo range		
E A355	1	Error detected during relative movement after capture (additional info = detailed error code) Parameter `_SigLatched` Bit 4	Movement was stopped by error.	Verify the error memory.
E A356	0	Function Relative Movement After Capture not assigned to a digital input		Assign the function Relative Movement After Capture to a digital input.
E A357	0	Deceleration still running	Command is not permissible during deceleration.	Wait until motor has come to a complete standstill.
E A358	1	Target position overtraveled with function Relative Movement After Capture Parameter `_SigLatched` Bit 4	Stopping distance too small or velocity too high at the point in time of the capture event.	Reduce the velocity.
E A359	0	Request cannot be processed since the relative movement after capture is still active		
E A35A	1	Selected data set cannot be started Parameter `_SigLatched` Bit 4	The data set with the selected number is not available.	Verify the number of the data set.
E A35B	0	Modulo cannot be activated Parameter `_WarnLatched` Bit 4	The set operating mode does not support Modulo.	
E A35D	par.	Permissible velocity deviation exceeded Parameter `_SigLatched` Bit 8	Load or acceleration too high.	Reduce load or acceleration.
E B100	0	RS485/Modbus: Indeterminable service Parameter `_WarnLatched` Bit 5	Unsupported Modbus service was received.	Verify application on the Modbus master.
E B200	0	RS485/Modbus: Protocol error detected Parameter `_WarnLatched` Bit 5	Logical protocol error detected: Incorrect length or unsupported subfunction.	Verify application on the Modbus master.
E B201	2	RS485/Modbus: Interruption of the connection Parameter `_SigLatched` Bit 5	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
E B202	0	RS485/Modbus: Interruption of the connection Parameter `_WarnLatched` Bit 5	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
E B203	0	RS485/Modbus: Incorrect number of monitor objects Parameter `_WarnLatched` Bit 5		
E B400	2	CANopen: NMT reset with power stage enabled Parameter `_SigLatched` Bit 21	NMT Reset command is received while drive is in operating state Operation Enabled.	Disable the power stage before sending a NMT reset command.

Error code	Error class	Description	Cause	Correctives
E B401	2	CANopen: NMT stop with power stage enabled Parameter `_SigLatched` Bit 21	NMT Stop command is received while drive is in operating state Operation Enabled.	Disable the power stage before sending a NMT Stop command.
E B402	0	CAN PLL active Parameter `_WarnLatched` Bit 21	An attempt has been made to start the synchronization mechanism, but the synchronization mechanism was already active.	Deactivate the synchronization mechanism.
E B403	2	Excessive Sync period deviation Parameter `_SigLatched` Bit 21	The period time of the SYNC signals is not stable. The deviation is more than 100 usec.	The SYNC signals of the motion controller must be more accurate.
E B404	2	Sync signal error detected Parameter `_SigLatched` Bit 21	SYNC signal missed more than twice.	Verify CAN connection, verify motion controller.
E B405	2	Drive could not be adapted to master cycle Parameter `_SigLatched` Bit 21	The jitter of the SYNC object is too great or the motion bus requirements are not taken into account.	Verify the timing requirements regarding interpolation time period and number of devices.
E B406	0	Baud rate is not supported Parameter `_WarnLatched` Bit 21	The configured baud rate is not supported.	Choose one of the following baud rates: 250 kB, 500 kB, 1000 kB.
E B407	0	Drive is not synchronous with master cycle Parameter `_WarnLatched` Bit 21	The operating mode 'Cyclic Synchronous Mode' cannot be activated as long as the drive is not synchronized.	Verify motion controller. To be synchronized, the motion controller must cyclically send SYNC signals.
E B700	0	Drive Profile Lexium: On activation of the profile, no dmControl, refA or refB has been mapped.	dmControl, refA or refB have not been mapped.	Map dmControl, refA or refB.
E B702	1	Insufficient velocity resolution due to velocity scaling	Due to the configured velocity scaling, the velocity resolution in REFA16 is insufficient.	Change the velocity scaling.
E B703	0	Drive Profile Lexium: Write request with incorrect data type.		

Chapter 11
Parameters

What Is in This Chapter?

This chapter contains the following topics:

Representation of the Parameters

Description

This chapter provides an overview of the parameters which can be used for operating the product.

Unsuitable parameter values or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameter values or data do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not operate the drive system with undetermined parameter values or data.
- Never modify a parameter value unless you fully understand the parameter and all effects of the modification.
- Restart the drive and verify the saved operational data and/or parameter values after modifications.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
- Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Overview

The way parameters are shown provides information required for unique identification, the default values and the properties of a parameter.

Structure of the parameter representation:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ABCDE`	Short description Selection values **1 / Abc1**: Explanation 1 **2 / Abc2**: Explanation 2 Description and details	A_{pk} 0.00 3.00 300.00	UINT32 R/W per. -	Fieldbus 1234

Field “Parameter Name”

The parameter name uniquely identifies a parameter.

Field “Description”

Short description:

The short description contains information on the parameter and a cross reference to the page that describes the use of the parameter.

Selection values:

In the case of parameters which offer a selection of settings, the value to be entered via the fieldbus and the designation of the value for entry via the commissioning software are specified.

1 = Value for input via fieldbus

Abc1 = Designation for entry via the commissioning software

Description and details:

Provides further information on the parameter.

Field “Unit”

The unit of the value.

Field “Minimum Value”

The minimum value which can be entered.

Field “Factory Settings”

Settings when the product is shipped.

Field “Maximum Value”

The maximum value which can be entered.

Field “Data Type”

If the minimum and the maximum values are not explicitly indicated, the valid range of values is determined by the data type.

Data type	Minumum value	Maximum value
INT8	-128	127
UINT8	0	255
INT16	-32768	32767
UINT16	0	65535
INT32	-2147483648	2147483647
UINT32	0	4294967295

Field “R/W”

Indicates read and/or write values

"R/" values can only be read

"R/W" values can be read and written.

Field “Persistent”

“per.” indicates whether the value of the parameter is persistent, i.e. whether it remains in the memory after the device is powered off.

When a value of a persistent parameter is modified via the commissioning software or the fieldbus, the user must explicitly store the modified value in the persistent memory.

Field “Parameter Address”

Each parameter has a unique parameter address. The parameter address is used to access the parameter via the fieldbus.

Decimal Numbers Entered via the Fieldbus

Please note that parameter values are entered via the fieldbus without a decimal point. All decimal places must be entered.

Input examples:

Value	Commissioning software	Fieldbus
20	20	20
5.0	5.0	50
23.57	23.57	2357
1.000	1.000	1000

List of Parameters

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_AccessInfo	Access channel information Low byte: Exclusive access Value 0: No Value 1: Yes High byte: Access channel Value 0: Reserved Value 1: I/O Value 2: Reserved Value 3: Modbus RS485 Value 4: Fieldbus main channel Value 5: CANopen second SDO	- - - -	UINT16 R/- - -	CANopen $3001{:}C_h$ Modbus 280
_actionStatus	Action word Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: Error class 0 Bit 1: Error class 1 Bit 2: Error class 2 Bit 3: Error class 3 Bit 4: Error class 4 Bit 5: Reserved Bit 6: Motor is at a standstill (_n_act < 9 rpm) Bit 7: Motor movement in positive direction Bit 8: Motor movement in negative direction Bit 9: Assignment can be set via parameter DPL_intLim Bit 10: Assignment can be set via parameter DS402intLim Bit 11: Profile generator idle (reference velocity is 0) Bit 12: Profile generator decelerates Bit 13: Profile generator accelerates Bit 14: Profile generator moves at constant speed Bit 15: Reserved	- - - -	UINT16 R/- - -	CANopen $301C{:}4_h$ Modbus 7176
_AT_J	Moment of inertia of the system Is automatically calculated during Autotuning. In increments of 0.1 kg cm^2.	kg cm^2 0.1 0.1 6553.5	UINT16 R/- per. -	CANopen $302F{:}C_h$ Modbus 12056
_AT_M_friction	Friction torque of the system Is determined during Autotuning. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen $302F{:}7_h$ Modbus 12046
_AT_M_load	Constant load torque Is determined during Autotuning. In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen $302F{:}8_h$ Modbus 12048
_AT_progress	Progress of Autotuning	% 0 0 100	UINT16 R/- - -	CANopen $302F{:}B_h$ Modbus 12054

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_AT_state`	Autotuning status Bit assignments: Bits 0 ... 10: Last processing step Bit 13: auto_tune_process Bit 14: auto_tune_end Bit 15: auto_tune_err	- - - -	UINT16 R/- - -	CANopen 302F:2_h Modbus 12036
`_CanDiag`	CANopen diagnostics word 0001h: pms read error for TxPdo 0002h: pms write error for RxPdo1 0004h: pms write error for RxPdo2 0008h: pms write error for RxPdo3 0010h: pms write error for RxPdo4 0020h: heartbeat or lifeguard error (timer expired) 0040h: heartbeat msg with incorrect state received 0080h: CAN error counter >96 0100h: CAN message lost 0200h: CAN error counter = 256 (bus-off) 0400h: software queue rx/tx overrun 0800h: error indication from last detected error	- - - -	UINT16 R/- - -	CANopen 3041:6_h Modbus 16652
`_Cap1CntFall`	Capture input 1 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 1 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:$2C_h$ Modbus 2648
`_Cap1CntRise`	Capture input 1 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 1 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:$2B_h$ Modbus 2646
`_Cap1Count`	Capture input 1 event counter Counts the capture events. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	CANopen 300A:8_h Modbus 2576
`_Cap1CountCons`	Capture input 1 event counter (consistent) Counts the capture events. The event counter is reset when capture input 1 is activated. By reading this parameter, the parameter "_Cap1PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	CANopen 300A:17_h Modbus 2606
`_Cap1Pos`	Capture input 1 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	CANopen 300A:6_h Modbus 2572
`_Cap1PosCons`	Capture input 1 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap1CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	CANopen 300A:18_h Modbus 2608

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap1PosFallEdge	Capture input 1 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BB:0$_h$ Modbus 2636
_Cap1PosRisEdge	Capture input 1 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BA:0$_h$ Modbus 2634
_Cap2CntFall	Capture input 2 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 2 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2E$_h$ Modbus 2652
_Cap2CntRise	Capture input 2 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 2 is activated. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2D$_h$ Modbus 2650
_Cap2Count	Capture input 2 event counter Counts the capture events. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	CANopen 300A:9$_h$ Modbus 2578
_Cap2CountCons	Capture input 2 event counter (consistent) Counts the capture events. The event counter is reset when capture input 2 is activated. By reading this parameter, the parameter "_Cap2PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	CANopen 300A:19$_h$ Modbus 2610
_Cap2Pos	Capture input 2 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	CANopen 300A:7$_h$ Modbus 2574
_Cap2PosCons	Capture input 2 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap2CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	CANopen 300A:1A$_h$ Modbus 2612
_Cap2PosFallEdge	Capture input 2 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BD:0$_h$ Modbus 2640

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap2PosRisEdge	Capture input 2 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement". Available with firmware version ≥V01.04.	usr_p - - -	INT32 R/- - -	CANopen 60BC:0$_h$ Modbus 2638
_CapEventCounters	Capture inputs 1 and 2 summary of event counters This parameter contains the counted capture events. Bits 0 ... 3: _Cap1CntRise (lowest 4 bits) Bits 4 ... 7: _Cap1CntFall (lowest 4 bits) Bits 8 ... 11: _Cap2CntRise (lowest 4 bits) Bits 12 ... 15: _Cap2CntFall (lowest 4 bits) Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 300A:2F$_h$ Modbus 2654
_CapStatus	Status of the capture inputs Read access: Bit 0: Position captured via input CAP1 Bit 1: Position captured via input CAP2	- - - -	UINT16 R/- - -	CANopen 300A:1$_h$ Modbus 2562
_Cond_State4	Conditions for transition to operating state Ready To Switch On Signal state: 0: Condition not met 1: Condition met Bit 0: DC bus or mains voltage Bit 1: Inputs for safety function Bit 2: No configuration download ongoing Bit 3: Velocity greater than limit value Bit 4: Absolute position has been set Bit 5: Holding brake not manually released	- - - -	UINT16 R/- - -	CANopen 301C:26$_h$ Modbus 7244
_CTRL_ActParSet	Active control loop parameter set Value 1: Control loop parameter set 1 is active Value 2: Control loop parameter set 2 is active A control loop parameter set is active after the time for the parameter switching (CTRL_ParChgTime) has elapsed.	- - - -	UINT16 R/- - -	CANopen 3011:17$_h$ Modbus 4398
_CTRL_KPid	Current controller d component P gain This value is calculated on the basis of the motor parameters. In increments of 0.1 V/A. Modified settings become active immediately.	V/A 0.5 - 1270.0	UINT16 R/- per. -	CANopen 3011:1$_h$ Modbus 4354
_CTRL_KPiq	Current controller q component P gain This value is calculated on the basis of the motor parameters. In increments of 0.1 V/A. Modified settings become active immediately.	V/A 0.5 - 1270.0	UINT16 R/- per. -	CANopen 3011:3$_h$ Modbus 4358
_CTRL_TNid	Current controller d component integral action time This value is calculated on the basis of the motor parameters. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.13 - 327.67	UINT16 R/- per. -	CANopen 3011:2$_h$ Modbus 4356

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_CTRL_TNiq`	Current controller q component integral action time This value is calculated on the basis of the motor parameters. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.13 - 327.67	UINT16 R/- per. -	CANopen 3011:4$_h$ Modbus 4360
`_DataError`	Error code for detected synchronous errors (DE bit) Drive Profile Lexium: Manufacturer-specific error code that caused the DataError bit to be set. Usually, this is an error that was detected as a result to changing of a data value within the process data. The DataError bit relates to MT-independent parameters.	- - - -	UINT16 R/- - -	CANopen 301B:1B$_h$ Modbus 6966
`_DataErrorInfo`	Additional error information of a detected DataError (DE bit) Drive Profile Lexium: Indicates the parameter of the mapping that caused the DE bit to be set. The DE bit is set if MT-independent parameters of the active mapping cause an error in connection with a write command. Example: 1 = First mapped parameter 2 = Second mapped parameter etc.	- - - -	UINT16 R/- - -	CANopen 301B:1D$_h$ Modbus 6970
`_DCOMopmd_act`	Active operating mode **-6 / Manual Tuning / Autotuning**: Manual Tuning / Autotuning **-3 / Motion Sequence**: Motion Sequence **-1 / Jog**: Jog **0 / Reserved**: Reserved **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **4 / Profile Torque**: Profile Torque **6 / Homing**: Homing **7 / Interpolated Position**: Interpolated Position **8 / Cyclic Synchronous Position**: Cyclic Synchronous Position **9 / Cyclic Synchronous Velocity**: Cyclic Synchronous Velocity **10 / Cyclic Synchronous Torque**: Cyclic Synchronous Torque * Datatype for CANopen: INT8	- -6 - 10	INT16* R/- - -	CANopen 6061:0$_h$ Modbus 6920

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DCOMstatus	DriveCom status word Bit assignments: Bit 0: Operating state Ready To Switch On Bit 1: Operating state Switched On Bit 2: Operating state Operation Enabled Bit 3: Operating state Fault Bit 4: Voltage Enabled Bit 5: Operating state Quick Stop Bit 6: Operating state Switch On Disabled Bit 7: Error of error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Target Reached Bit 11: Internal Limit Active Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	CANopen 6041:0$_h$ Modbus 6916
_DEV_T_current	Temperature of device	°C - - -	INT16 R/- - -	CANopen 301C:12$_h$ Modbus 7204
_DipCANaddress	CANopen address (node number) set via DIP switches Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/- - -	-
_DipCANbaud	CANopen baud rate set via DIP switches **0 / not supported**: Setting is not valid **1 / not supported**: Setting is not valid **2 / 50 kBaud**: 50 kBaud **3 / 125 kBaud**: 125 kBaud **4 / 250 kBaud**: 250 kBaud **5 / 500 kBaud**: 500 kBaud **6 / not supported**: Setting is not valid **7 / 1 MBaud**: 1 MBaud **8 / not supported**: Setting is not valid **9 / CANbaud**: Address is set via parameter CANbaud **10 / not supported**: Setting is not valid **11 / not supported**: Setting is not valid **12 / not supported**: Setting is not valid **13 / not supported**: Setting is not valid **14 / not supported**: Setting is not valid **15 / not supported**: Setting is not valid Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/- - -	CANopen 3041:10$_h$ Modbus 16672
_DipSwitches	Settings of the DIP switches Bits 0 … 11: Settings of the DIP switches Bits 12 … 14: Reserved Bit 15: Bit is set to 1 if the settings have been modified since power on. Available with firmware version ≥V01.08.	- - - -	UINT16 R/- - -	CANopen 3002:2D$_h$ Modbus 602

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DPL_BitShiftRefA16	Bit shift for RefA16 for Drive Profile Lexium Velocity scaling may lead to values that cannot be represented as 16 bit values. If RefA16 is used, this parameter indicates the number of bits by which the value is shifted so that transmission is possible. The master must take into account this value prior to transmission and shift the bits to the right accordingly. The number of bits is recalculated each time the power stage is enabled. Modified settings become active immediately.	- 0 0 12	UINT16 R/- - -	CANopen 301B:5$_h$ Modbus 6922
_DPL_driveInput	Drive Profile Lexium driveInput	- - - -	UINT16 R/- - -	CANopen 301B:28$_h$ Modbus 6992
_DPL_driveStat	Drive Profile Lexium driveStat	- - - -	UINT16 R/- - -	CANopen 301B:25$_h$ Modbus 6986
_DPL_mfStat	Drive Profile Lexium mfStat	- - - -	UINT16 R/- - -	CANopen 301B:26$_h$ Modbus 6988
_DPL_motionStat	Drive Profile Lexium motionStat	- - - -	UINT16 R/- - -	CANopen 301B:27$_h$ Modbus 6990
_ENC_AmplMax	Maximum value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated. Available with firmware version ≥V01.08.	mV - - -	UINT16 R/- - -	CANopen 303F:60$_h$ Modbus 16320
_ENC_AmplMean	Mean value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated. Available with firmware version ≥V01.08.	mV - - -	UINT16 R/- - -	CANopen 303F:5E$_h$ Modbus 16316
_ENC_AmplMin	Minimum value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated. Available with firmware version ≥V01.08.	mV - - -	UINT16 R/- - -	CANopen 303F:5F$_h$ Modbus 16318
_ENC_AmplVal	Value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated. Available with firmware version ≥V01.08.	mV - - -	UINT16 R/- - -	CANopen 303F:5D$_h$ Modbus 16314
_ERR_class	Error class Value 0: Error class 0 Value 1: Error class 1 Value 2: Error class 2 Value 3: Error class 3 Value 4: Error class 4	- 0 - 4	UINT16 R/- - -	CANopen 303C:2$_h$ Modbus 15364
_ERR_DCbus	DC bus voltage at the time the error was detected In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 303C:7$_h$ Modbus 15374
_ERR_enable_cycl	Number of cycles of enabling the power stage at error time Number of cycles of enabling the power stage from the time the control voltage was applied to the time the error was detected.	- - - -	UINT16 R/- - -	CANopen 303C:5$_h$ Modbus 15370

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ERR_enable_time	Time between enabling of power stage and detection of the error	s - - -	UINT16 R/- - -	CANopen 303C:6$_h$ Modbus 15372
_ERR_motor_I	Motor current at the time the error was detected In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 303C:9$_h$ Modbus 15378
_ERR_motor_v	Motor velocity at the time the error was detected	usr_v - - -	INT32 R/- - -	CANopen 303C:8$_h$ Modbus 15376
_ERR_number	Error code Reading this parameter copies the entire entry for the detected error (error class, time of detection of error, …) to an intermediate memory from which the elements of the detected error can then be read. In addition, the read pointer of the error memory is automatically set to the next error entry.	- 0 - 65535	UINT16 R/- - -	CANopen 303C:1$_h$ Modbus 15362
_ERR_powerOn	Number of power on cycles	- 0 - 4294967295	UINT32 R/- - -	CANopen 303B:2$_h$ Modbus 15108
_ERR_qual	Additional information on detected error This entry contains additional information on the detected error, depending on the error number. Example: a parameter address	- 0 - 65535	UINT16 R/- - -	CANopen 303C:4$_h$ Modbus 15368
_ERR_temp_dev	Temperature of device at the time the error was detected	°C - - -	INT16 R/- - -	CANopen 303C:B$_h$ Modbus 15382
_ERR_temp_ps	Temperature of power stage at the time the error was detected	°C - - -	INT16 R/- - -	CANopen 303C:A$_h$ Modbus 15380
_ERR_time	Time of detection of error With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	CANopen 303C:3$_h$ Modbus 15366
_ErrNumFbParSvc	Last error code of fieldbus parameter services Some fieldbusses only provide general error codes if a request for a parameter service is not successful. This parameter returns the vendor-specific error code of the last unsuccessful service.	- - - -	UINT16 R/- - -	CANopen 3040:43$_h$ Modbus 16518
_HMdisREFtoIDX	Distance from switching point to index pulse Allows you to verify the distance between the index pulse and the switching point and serves as a criterion for determining whether the reference movement with index pulse can be reproduced. The parameter _HMdisREFtoIDX_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution - - -	INT32 R/- - -	CANopen 3028:C$_h$ Modbus 10264

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_HMdisREFtoIDX_usr`	Distance from switching point to index pulse Allows you to verify the distance between the index pulse and the switching point and serves as a criterion for determining whether the reference movement with index pulse can be reproduced.	usr_p -2147483648 - 2147483647	INT32 R/- - -	CANopen 3028:F_h Modbus 10270
`_hwVersCPU`	Hardware version of control board	- - - -	UINT16 R/- - -	CANopen 3002:12_h Modbus 548
`_hwVersPS`	Hardware version of power stage	- - - -	UINT16 R/- - -	CANopen 3002:14_h Modbus 552
`_I_act`	Total motor current In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:3_h Modbus 7686
`_Id_act_rms`	Actual motor current (d component, field weakening) In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:2_h Modbus 7684
`_Id_ref_rms`	Reference motor current (d component, field weakening) In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:11_h Modbus 7714
`_Imax_act`	Currently effective current limitation Value of the currently effective current limitation. This is one of the following values (whichever is lowest): - CTRL_I_max (only during normal operation) - LIM_I_maxQSTP (only during Quick Stop) - LIM_I_maxHalt (only during Halt) - Current limitation via digital input - _M_I_max (only if motor is connected) - _PS_I_max Limitations caused by I2t monitoring are also taken into account. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 301C:28_h Modbus 7248
`_Imax_system`	Current limitation of the system This parameter specifies the maximum system current. This is the lower value of the maximum motor current and the maximum power stage current. If no motor is connected, only the maximum power stage current is taken into account in this parameter. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 301C:27_h Modbus 7246
`_InvalidParam`	Modbus address of parameter with invalid value If a configuration error is detected, the Modbus address of the parameter with an invalid value is indicated here.	- - 0 -	UINT16 R/- - -	CANopen 301C:6_h Modbus 7180

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_IO_act	Physical status of the digital inputs and outputs Low byte: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3 High byte: Bit 8: DQ0 Bit 9: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:1$_h$ Modbus 2050
_IO_DI_act	Status of digital inputs Bit assignments: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3	- - - -	UINT16 R/- - -	CANopen 3008:F$_h$ Modbus 2078
_IO_DQ_act	Status of digital outputs Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:10$_h$ Modbus 2080
_IO_STO_act	Status of the inputs for the safety-related function STO Coding of the individual signals: Bit 0: STO_A Bit 1: STO_B	- - - -	UINT16 R/- - -	CANopen 3008:26$_h$ Modbus 2124
_Iq_act_rms	Actual motor current (q component, generating torque) In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:1$_h$ Modbus 7682
_Iq_ref_rms	Reference motor current (q component, generating torque) In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:10$_h$ Modbus 7712
_LastError	Detected error causing a stop (error classes 1 to 4) Error code of the most recent detected error. Consecutive detected errors do not overwrite this error code. Example: If an error response to a detected limit switch error causes overvoltage, this parameter contains the code of the detected limit switch error. Exception: Detected errors of error class 4 overwrite existing entries.	- - - -	UINT16 R/- - -	CANopen 603F:0$_h$ Modbus 7178
_LastError_Qual	Additional info on most recent error This parameter contains additional information on the most recent detected error, depending on the error code. For example: a parameter address.	- - 0 -	UINT16 R/- - -	CANopen 301C:1F$_h$ Modbus 7230
_LastWarning	Code of most recent error of error class 0 If the error is no longer active, the code is stored until the next Fault Reset. Value 0: No error of error class 0	- - - -	UINT16 R/- - -	CANopen 301C:9$_h$ Modbus 7186
_M_BRK_T_apply	Holding brake application time	ms - - -	UINT16 R/- - -	CANopen 300D:21$_h$ Modbus 3394

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_M_BRK_T_release	Holding brake release time	ms - - -	UINT16 R/- - -	CANopen 300D:22$_h$ Modbus 3396
_M_Enc_Cosine	Voltage of cosine signal of encoder In increments of 0.001 V. Available with firmware version ≥V01.08.	V - - -	INT16 R/- - -	CANopen 301C:2B$_h$ Modbus 7254
_M_Enc_Sine	Voltage of sine signal of encoder In increments of 0.001 V. Available with firmware version ≥V01.08.	V - - -	INT16 R/- - -	CANopen 301C:2C$_h$ Modbus 7256
_M_Encoder	Type of motor encoder **1 / SinCos With HiFa**: SinCos with Hiperface **2 / SinCos Without HiFa**: SinCos without Hiperface **3 / SinCos With Hall**: SinCos with Hall **4 / SinCos With EnDat**: SinCos with EnDat **5 / EnDat Without SinCos**: EnDat without SinCos **6 / Resolver**: Resolver **7 / Hall**: Hall (not supported yet) **8 / BISS**: BISS High byte: Value 0: Rotary encoder Value 1: Linear encoder	- - - -	UINT16 R/- - -	CANopen 300D:3$_h$ Modbus 3334
_M_HoldingBrake	Holding brake identification Value 0: Motor without holding brake Value 1: Motor with holding brake	- - - -	UINT16 R/- - -	CANopen 300D:20$_h$ Modbus 3392
_M_I_0	Continuous stall current of motor In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 300D:13$_h$ Modbus 3366
_M_I_max	Maximum current of motor In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 300D:6$_h$ Modbus 3340
_M_I_nom	Nominal current of motor In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 300D:7$_h$ Modbus 3342
_M_I2t	Maximum permissible time for maximum current of motor	ms - - -	UINT16 R/- - -	CANopen 300D:11$_h$ Modbus 3362
_M_Jrot	Moment of inertia of motor Units: Rotary motors: $kgcm^2$ Linear motors: kg In increments of 0.001 motor_f.	motor_f - - -	UINT32 R/- - -	CANopen 300D:C$_h$ Modbus 3352
_M_kE	Voltage constant kE of motor Voltage constant in Vrms at 1000 min-1. Units: Rotary motors: Vrms/min-1 Linear motors: Vrms/(m/s) In increments of 0.1 motor_u.	motor_u - - -	UINT32 R/- - -	CANopen 300D:B$_h$ Modbus 3350

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_M_L_d`	Inductance d component of motor In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	CANopen 300D:F_h Modbus 3358
`_M_L_q`	Inductance q component of motor In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	CANopen 300D:E_h Modbus 3356
`_M_load`	Load of motor	% - - -	INT16 R/- - -	CANopen 301C:$1A_h$ Modbus 7220
`_M_M_0`	Continuous stall torque of motor A value of 100 % in operating mode Profile Torque corresponds to this parameter. Units: Rotary motors: Ncm Linear motors: N	motor_m - - -	UINT16 R/- - -	CANopen 300D:16_h Modbus 3372
`_M_M_max`	Maximum torque of motor In increments of 0.1 Nm.	Nm - - -	UINT16 R/- - -	CANopen 300D:9_h Modbus 3346
`_M_M_nom`	Nominal torque/force of motor Units: Rotary motors: Ncm Linear motors: N	motor_m - - -	UINT16 R/- - -	CANopen 300D:8_h Modbus 3344
`_M_maxoverload`	Maximum value of overload of motor Maximum overload of motor during the last 10 seconds.	% - - -	INT16 R/- - -	CANopen 301C:$1B_h$ Modbus 7222
`_M_n_max`	Maximum permissible speed of rotation/velocity of motor Units: Rotary motors: min-1 Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	CANopen 300D:4_h Modbus 3336
`_M_n_nom`	Nominal speed of rotation/velocity of motor Units: Rotary motors: min-1 Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	CANopen 300D:5_h Modbus 3338
`_M_overload`	Overload of motor (I2t)	% - - -	INT16 R/- - -	CANopen 301C:19_h Modbus 7218
`_M_Polepair`	Number of pole pairs of motor	- - - -	UINT16 R/- - -	CANopen 300D:14_h Modbus 3368
`_M_PolePairPitch`	Pole pair pitch of motor In increments of 0.01 mm.	mm - - -	UINT16 R/- - -	CANopen 300D:23_h Modbus 3398
`_M_R_UV`	Winding resistance of motor In increments of 0.01 Ω.	Ω - - -	UINT16 R/- - -	CANopen 300D:D_h Modbus 3354

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_M_T_max`	Maximum temperature of motor	°C - - -	INT16 R/- - -	CANopen 300D:10$_h$ Modbus 3360
`_M_Type`	Motor type Value 0: No motor selected Value >0: Connected motor type	- - - -	UINT32 R/- - -	CANopen 300D:2$_h$ Modbus 3332
`_M_U_max`	Maximum voltage of motor In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 300D:19$_h$ Modbus 3378
`_M_U_nom`	Nominal voltage of motor In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 300D:A$_h$ Modbus 3348
`_ManuSdoAbort`	CANopen manufacturer-specific SDO abort code Provides more detailed information on a general SDO abort code (0800 0000).	- - - -	UINT16 R/- - -	CANopen 3041:A$_h$ Modbus 16660
`_ModeError`	Error code for detected synchronous errors (ME bit) Drive Profile Lexium: Manufacturer-specific error code that caused the ModeError bit to be set. Usually, this is an error that was detected as a result of the activation of an operating mode. The ModeError bit relates to MT-dependent parameters.	- - - -	UINT16 R/- - -	CANopen 301B:19$_h$ Modbus 6962
`_ModeErrorInfo`	Additional error information of a detected ModeError (ME bit) Drive Profile Lexium: Indicates the parameter of the mapping that caused the ME bit to be set. The ME bit is set if MT-dependent parameters of the active mapping cause an error in connection with a write command. Example: 1 = First mapped parameter 2 = Second mapped parameter etc.	- - - -	UINT16 R/- - -	CANopen 301B:1C$_h$ Modbus 6968
`_MSM_avail_ds`	Number of available data sets Number of data sets that are available. Modified settings become active immediately. Available with firmware version ≥V01.08.	- - - -	UINT16 R/- - -	CANopen 302D:F$_h$ Modbus 11550

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_MSM_error_field	Field of the data set in which an error has been detected Value -1: No error Value 0: Data set type Value 1: Setting A Value 2: Setting B Value 3: Setting C Value 4: Setting D Value 5: Transition type Value 6: Subsequent data set Value 7: Transition condition 1 Value 8: Transition value 1 Value 9: Logical operator Value 10: Transition condition 2 Value 11: Transition value 2 Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 11	INT16 R/- - -	CANopen 302D:E_h Modbus 11548
_MSM_error_num	Number of the data set in which an error has been detected Value -1: No error Values 0 … 127: Number of the data set in which an error has been detected. Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:D_h Modbus 11546
_MSM_used_data_sets	Number of data sets used Any data set whose data set type is not equal to 'None' is counted as a used data set. Modified settings become active immediately. Available with firmware version ≥V01.08.	- - - -	UINT16 R/- - -	CANopen 302D:$1F_h$ Modbus 11582
_MSMactNum	Number of data set being processed Value -1: Operating mode is inactive or no data set has been triggered Value >0: Number of the data set being processed Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:6_h Modbus 11532
_MSMnextNum	Next data set to be triggered Value -1: Operating mode is inactive or no data set is selected Value >0: Number of the next data set Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:7_h Modbus 11534
_MSMNumFinish	Number of data set that was active when a movement was interrupted When a movement is interrupted, the number of the data set that was being processed at the point in time of the interruption is contained in this parameter. Modified settings become active immediately. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:B_h Modbus 11542
_n_act	Actual speed of rotation	rpm - - -	INT16 R/- - -	CANopen 301E:8_h Modbus 7696

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_n_act_ENC1`	Actual speed of rotation of encoder 1	rpm - - -	INT16 R/- - -	CANopen 301E:28$_h$ Modbus 7760
`_n_ref`	Reference speed of rotation	rpm - - -	INT16 R/- - -	CANopen 301E:7$_h$ Modbus 7694
`_OpHours`	Operating hours counter	s - - -	UINT32 R/- - -	CANopen 301C:A$_h$ Modbus 7188
`_p_absENC`	Absolute position with reference to the encoder range This value corresponds to the modulo position of the absolute encoder range.	usr_p - - -	UINT32 R/- - -	CANopen 301E:F$_h$ Modbus 7710
`_p_absmodulo`	Absolute position with reference to internal resolution in internal units This value is based on encoder raw position with reference to internal resolution (131072 Inc).	Inc - - -	UINT32 R/- - -	CANopen 301E:E$_h$ Modbus 7708
`_p_act`	Actual position	usr_p - - -	INT32 R/- - -	CANopen 6064:0$_h$ Modbus 7706
`_p_act_ENC1`	Actual position of encoder 1	usr_p - - -	INT32 R/- - -	CANopen 301E:27$_h$ Modbus 7758
`_p_act_ENC1_int`	Actual position of encoder 1 in internal units	Inc - - -	INT32 R/- - -	CANopen 301E:26$_h$ Modbus 7756
`_p_act_int`	Actual position in internal units	Inc - - -	INT32 R/- - -	CANopen 6063:0$_h$ Modbus 7700
`_p_dif`	Position deviation including dynamic position deviation Position deviation is the difference between reference position and actual position. The position deviation consists of the load-dependent position deviation and the dynamic position deviation. The parameter _p_dif_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	CANopen 60F4:0$_h$ Modbus 7716
`_p_dif_load`	Load-dependent position deviation between reference and actual positions The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. This value is used for following error monitoring. The parameter _p_dif_load_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	CANopen 301E:1C$_h$ Modbus 7736

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_p_dif_load_peak`	Maximum value of the load-dependent position deviation This parameter contains the maximum load-dependent position deviation reached so far. A write access resets this value. The parameter _p_dif_load_peak_usr allows you to enter the value in user-defined units.. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 - 429496.7295	UINT32 R/W - -	CANopen 301E:1B$_h$ Modbus 7734
`_p_dif_load_peak_usr`	Maximum value of the load-dependent position deviation This parameter contains the maximum load-dependent position deviation reached so far. A write access resets this value. Modified settings become active immediately.	usr_p 0 - 2147483647	INT32 R/W - -	CANopen 301E:15$_h$ Modbus 7722
`_p_dif_load_usr`	Load-dependent position deviation between reference and actual positions The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. This value is used for following error monitoring.	usr_p -2147483648 - 2147483647	INT32 R/- - -	CANopen 301E:16$_h$ Modbus 7724
`_p_dif_usr`	Position deviation including dynamic position deviation Position deviation is the difference between reference position and actual position. The position deviation consists of the load-dependent position deviation and the dynamic position deviation.	usr_p -2147483648 - 2147483647	INT32 R/- - -	CANopen 301E:14$_h$ Modbus 7720
`_p_ref`	Reference position Value corresponds to the reference position of the position controller.	usr_p - - -	INT32 R/- - -	CANopen 301E:C$_h$ Modbus 7704
`_p_ref_int`	Reference position in internal units Value corresponds to the reference position of the position controller.	Inc - - -	INT32 R/- - -	CANopen 301E:9$_h$ Modbus 7698
`_PAR_ScalingError`	Additional information on error detected during recalculation Coding: Bits 0 ... 15: Address of the parameter that caused the error Bits 16 ... 31: Number of the data set in the operating mode Motion Sequence that caused the error Modified settings become active immediately.	- - - -	UINT32 R/- - -	CANopen 3004:16$_h$ Modbus 1068

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_PAR_ScalingState`	Status of recalculation of the parameters with user-defined units **0 / Recalculation Active**: Recalculation active **1 / Reserved (1)**: Reserved **2 / Recalculation Finished - No Error**: Recalculation finished, no error **3 / Error During Recalculation**: Error during recalculation **4 / Initialization Successful**: Initialization successful **5 / Reserved (5)**: Reserved **6 / Reserved (6)**: Reserved **7 / Reserved (7)**: Reserved Status of recalculation of the parameters with user-defined units which are recalculated with a changed scaling factor. Modified settings become active immediately.	- 0 2 7	UINT16 R/- - -	CANopen 3004:15$_h$ Modbus 1066
`_PosRegStatus`	Status of the position register channels Signal state: 0: Comparison criterion not met 1: Comparison criterion met Bit assignments: Bit 0: State of position register channel 1 Bit 1: State of position register channel 2 Bit 2: State of position register channel 3 Bit 3: State of position register channel 4	- - - -	UINT16 R/- - -	CANopen 300B:1$_h$ Modbus 2818
`_Power_act`	Output power	W - - -	INT32 R/- - -	CANopen 301C:D$_h$ Modbus 7194
`_Power_mean`	Mean output power	W - - -	UINT16 R/- - -	CANopen 301C:E$_h$ Modbus 7196
`_pref_acc`	Acceleration of reference value for acceleration feed-forward control Sign according to the changed velocity value: Increased velocity: Positive sign Reduced velocity: Negative sign	usr_a - - -	INT32 R/- - -	CANopen 301F:9$_h$ Modbus 7954
`_pref_v`	Velocity of reference value for velocity feed-forward control	usr_v - - -	INT32 R/- - -	CANopen 301F:7$_h$ Modbus 7950
`_prgNoDEV`	Firmware number of device Example: PR0912.00 The value is provided as a decimal value: 91200	- - - -	UINT32 R/- - -	CANopen 3001:1$_h$ Modbus 258
`_prgNoLOD`	Firmware number of update loader Example: PR0912.00 The value is provided as a decimal value: 91200	- - - -	UINT32 R/- - -	CANopen 3001:33$_h$ Modbus 358

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_prgRevDEV`	Firmware revision of device The version format is XX.YY.ZZ. Part XX.YY is contained in parameter _prgVerDEV. Part ZZ is used for quality evolution and contained in this parameter. Example: V01.23.45 The value is provided as a decimal value: 45	- - - -	UINT16 R/- - -	CANopen 3001:4$_h$ Modbus 264
`_prgRevLOD`	Firmware revision of update loader The version format is XX.YY.ZZ. Part XX.YY is contained in parameter _prgVerLOD. Part ZZ is used for quality evolution and contained in this parameter. Example: V01.23.45 The value is provided as a decimal value: 45	- - - -	UINT16 R/- - -	CANopen 3001:36$_h$ Modbus 364
`_prgVerDEV`	Firmware version of device The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter _prgRevDEV. Example: V01.23.45 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	CANopen 3001:2$_h$ Modbus 260
`_prgVerLOD`	Firmware version of update loader The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter _prgRevLOD. Example: V01.23.45 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	CANopen 3001:34$_h$ Modbus 360
`_PS_I_max`	Maximum current of power stage In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- per. -	CANopen 3010:2$_h$ Modbus 4100
`_PS_I_nom`	Nominal current of power stage In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- per. -	CANopen 3010:1$_h$ Modbus 4098
`_PS_load`	Load of power stage	% - - -	INT16 R/- - -	CANopen 301C:17$_h$ Modbus 7214
`_PS_maxoverload`	Maximum value of overload of power stage Maximum overload of power stage during the last 10 seconds.	% - - -	INT16 R/- - -	CANopen 301C:18$_h$ Modbus 7216
`_PS_overload`	Overload of power stage	% - - -	INT16 R/- - -	CANopen 301C:24$_h$ Modbus 7240
`_PS_overload_cte`	Overload of power stage (chip temperature)	% - - -	INT16 R/- - -	CANopen 301C:22$_h$ Modbus 7236

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_PS_overload_I2t	Overload of power stage (I2t)	% - - -	INT16 R/- - -	CANopen 301C:16$_h$ Modbus 7212
_PS_overload_psq	Overload of power stage (power squared)	% - - -	INT16 R/- - -	CANopen 301C:23$_h$ Modbus 7238
_PS_T_current	Temperature of power stage	°C - - -	INT16 R/- - -	CANopen 301C:10$_h$ Modbus 7200
_PS_T_max	Maximum temperature of power stage	°C - - -	INT16 R/- per. -	CANopen 3010:7$_h$ Modbus 4110
_PS_T_warn	Maximum temperature of power stage (error class 0)	°C - - -	INT16 R/- per. -	CANopen 3010:6$_h$ Modbus 4108
_PS_U_maxDC	Maximum permissible DC bus voltage In increments of 0.1 V.	V - - -	UINT16 R/- per. -	CANopen 3010:3$_h$ Modbus 4102
_PS_U_minDC	Minimum permissible DC bus voltage In increments of 0.1 V.	V - - -	UINT16 R/- per. -	CANopen 3010:4$_h$ Modbus 4104
_PS_U_minStopDC	DC bus voltage low threshold for Quick Stop If the threshold is reached, the drive performs a Quick Stop. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	CANopen 3010:A$_h$ Modbus 4116
_PT_max_val	Maximum possible value for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %.	% - - -	INT16 R/- - -	CANopen 301C:1E$_h$ Modbus 7228
_RAMP_p_act	Actual position of profile generator	usr_p - - -	INT32 R/- - -	CANopen 301F:2$_h$ Modbus 7940
_RAMP_p_target	Target position of profile generator Absolute position value of the profile generator, calculated on the basis of the relative and absolute position values received.	usr_p - - -	INT32 R/- - -	CANopen 301F:1$_h$ Modbus 7938
_RAMP_v_act	Actual velocity of profile generator	usr_v - - -	INT32 R/- - -	CANopen 606B:0$_h$ Modbus 7948
_RAMP_v_target	Target velocity of profile generator	usr_v - - -	INT32 R/- - -	CANopen 301F:5$_h$ Modbus 7946
_RES_load	Load of braking resistor The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_RES_maxoverload`	Maximum value of overload of braking resistor Maximum overload of braking resistor during the last 10 seconds. The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:15$_h$ Modbus 7210
`_RES_overload`	Overload of braking resistor (I2t) The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:13$_h$ Modbus 7206
`_RESint_P`	Nominal power of internal braking resistor	W - - -	UINT16 R/- per. -	CANopen 3010:9$_h$ Modbus 4114
`_RESint_R`	Resistance value of internal braking resistor In increments of 0.01 Ω.	Ω - - -	UINT16 R/- per. -	CANopen 3010:8$_h$ Modbus 4112
`_RMAC_DetailStatus`	Detailed status of relative movement after capture (RMAC) **0 / Not Activated**: Not activated **1 / Waiting**: Waiting for capture signal **2 / Moving**: Relative movement after capture running **3 / Interrupted**: Relative movement after capture interrupted **4 / Finished**: Relative movement after capture terminated Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 3023:12$_h$ Modbus 8996
`_RMAC_Status`	Status of relative movement after capture **0 / Not Active**: Not active **1 / Active Or Finished**: Relative movement after capture is active or finished	- 0 - 1	UINT16 R/- - -	CANopen 3023:11$_h$ Modbus 8994
`_ScalePOSmax`	Maximum user-defined value for positions This value depends on ScalePOSdenom and ScalePOSnum.	usr_p - - -	INT32 R/- - -	CANopen 301F:A$_h$ Modbus 7956
`_ScaleRAMPmax`	Maximum user-defined value for acceleration and deceleration This value depends on ScaleRAMPdenom and ScaleRAMPnum.	usr_a - - -	INT32 R/- - -	CANopen 301F:C$_h$ Modbus 7960
`_ScaleVELmax`	Maximum user-defined value for velocity This value depends on ScaleVELdenom and ScaleVELnum.	usr_v - - -	INT32 R/- - -	CANopen 301F:B$_h$ Modbus 7958
`_SigActive`	Status of monitoring signals See _SigLatched for more details on the bit codes.	- - - -	UINT32 R/- - -	CANopen 301C:7$_h$ Modbus 7182

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_SigLatched	Saved status of monitoring signals Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General error Bit 1: Hardware limit switches (LIMP/LIMN/REF) Bit 2: Out of range (software limit switches, tuning) Bit 3: Quick Stop via fieldbus Bit 4: Error in active operating mode Bit 5: Commissioning interface (RS485) Bit 6: Integrated fieldbus Bit 7: Reserved Bit 8: Following error Bit 9: Reserved Bit 10: Inputs STO are 0 Bit 11: Inputs STO different Bit 12: Reserved Bit 13: DC bus voltage low Bit 14: DC bus voltage high Bit 15: Mains phase missing Bit 16: Integrated encoder interface Bit 17: Overtemperature motor Bit 18: Overtemperature power stage Bit 19: Reserved Bit 20: Memory card Bit 21: Fieldbus module Bit 22: Encoder module Bit 23: Safety module eSM or module IOM1 Bit 24: Reserved Bit 25: Reserved Bit 26: Motor connection Bit 27: Motor overcurrent/short circuit Bit 28: Frequency of reference signal too high Bit 29: EEPROM error detected Bit 30: System start-up (hardware or parameter) Bit 31: System error detected (for example, watchdog, internal hardware interface) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	CANopen 301C:8$_h$ Modbus 7184
_SuppDriveModes	Supported operating modes as per DSP402 Bit 0: Profile Position Bit 2: Profile Velocity Bit 3: Profile Torque Bit 5: Homing Bit 16: Jog Bit 21: Manual Tuning Bit 23: Motion Sequence	- - - -	UINT32 R/- - -	CANopen 6502:0$_h$ Modbus 6952
_TouchProbeStat	Touch Probe status Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 60B9:0$_h$ Modbus 7030
_tq_act	Actual torque Positive value: Actual torque in positive direction of movement Negative value: Actual torque in negative direction of movement 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %.	% - - -	INT16 R/- - -	CANopen 6077:0$_h$ Modbus 7752

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_Ud_ref`	Reference motor voltage d component In increments of 0.1 V.	V - - -	INT16 R/- - -	CANopen 301E:5$_h$ Modbus 7690
`_UDC_act`	Voltage at DC bus In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 301C:F$_h$ Modbus 7198
`_Udq_ref`	Total motor voltage (vector sum d components and q components) Square root of ($\_Uq\_ref^2$ + $\_Ud\_ref^2$) In increments of 0.1 V.	V - - -	INT16 R/- - -	CANopen 301E:6$_h$ Modbus 7692
`_Uq_ref`	Reference motor voltage q component In increments of 0.1 V.	V - - -	INT16 R/- - -	CANopen 301E:4$_h$ Modbus 7688
`_v_act`	Actual velocity	usr_v - - -	INT32 R/- - -	CANopen 606C:0$_h$ Modbus 7744
`_v_act_ENC1`	Actual velocity of encoder 1	usr_v - - -	INT32 R/- - -	CANopen 301E:29$_h$ Modbus 7762
`_v_dif_usr`	Current load-dependent velocity deviation The load-dependent velocity deviation is the difference between reference velocity and actual velocity. Available with firmware version ≥V01.08.	usr_v -2147483648 - 2147483647	INT32 R/- - -	CANopen 301E:2C$_h$ Modbus 7768
`_v_ref`	Reference velocity	usr_v - - -	INT32 R/- - -	CANopen 301E:1F$_h$ Modbus 7742
`_Vmax_act`	Currently effective velocity limitation Value of the currently effective velocity limitation. This is one of the following values (whichever is lowest): - CTRL_v_max - M_n_max (only if motor is connected) - Velocity limitation via digital input	usr_v - - -	UINT32 R/- - -	CANopen 301C:29$_h$ Modbus 7250
`_VoltUtil`	Degree of utilization of DC bus voltage With a value of 100%, the drive operates at the voltage limit.	% - - -	INT16 R/- - -	CANopen 301E:13$_h$ Modbus 7718
`_WarnActive`	Active errors of error class 0, bit-coded See parameter _WarnLatched for more details on the bits.	- - - -	UINT32 R/- - -	CANopen 301C:B$_h$ Modbus 7190

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_WarnLatched`	Saved errors of error class 0, bit-coded The bits are set to 0 in the case of a Fault Reset. Bits 10 and 13 are set to 0 automatically. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General Bit 1: Reserved Bit 2: Out of range (software limit switches, tuning) Bit 3: Reserved Bit 4: Active operating mode Bit 5: Commissioning interface (RS485) Bit 6: Integrated fieldbus Bit 7: Reserved Bit 8: Following error Bit 9: Reserved Bit 10: Inputs STO_A and/or STO_B Bits 11 ... 12: Reserved Bit 13: Low voltage DC bus or mains phase missing Bits 14 ... 15: Reserved Bit 16: Integrated encoder interface Bit 17: Temperature of motor high Bit 18: Temperature of power stage high Bit 19: Reserved Bit 20: Memory card Bit 21: Fieldbus module Bit 22: Encoder module Bit 23: Safety module eSM or module IOM1 Bits 24 … 27: Reserved Bit 28: Transistor for braking resistor overload (I^2t) Bit 29: Braking resistor overload (I^2t) Bit 30: Power stage overload (I^2t) Bit 31: Motor overload (I^2t) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	CANopen 301C:C_h Modbus 7192
`AbsHomeRequest`	Absolute positioning only after homing **0 / No**: No **1 / Yes**: Yes This parameter has no function if the parameter 'PP_ModeRangeLim' is set to '1' which allows overtraveling of the movement range (ref_ok is set to 0 when the range is overtraveled). Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:16_h Modbus 1580

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AccessLock	Locking other access channels Value 0: Allow control via other access channels Value 1: Lock control via other access channels Example: The access channel is used by the fieldbus. In this case, control via the commissioning software, for example, is not possible. The access channel can only be locked after the currently active operating mode has terminated. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3001:E$_h$ Modbus 284
AT_dir	Direction of movement for Autotuning **1 / Positive Negative Home**: Positive direction first, then negative direction with return to initial position **2 / Negative Positive Home**: Negative direction first, then positive direction with return to initial position **3 / Positive Home**: Positive direction only with return to initial position **4 / Positive**: Positive direction only without return to initial position **5 / Negative Home**: Negative direction only with return to initial position **6 / Negative**: Negative direction only without return to initial position Modified settings become active the next time the motor moves.	- 1 1 6	UINT16 R/W - -	CANopen 302F:4$_h$ Modbus 12040
AT_dis	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified movement range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The parameter AT_dis_usr allows you to enter the value in user-defined units. In increments of 0.1 revolution. Modified settings become active the next time the motor moves.	revolution 1.0 2.0 999.9	UINT32 R/W - -	CANopen 302F:3$_h$ Modbus 12038

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AT_dis_usr	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active the next time the motor moves.	usr_p 1 32768 2147483647	INT32 R/W - -	CANopen 302F:12_h Modbus 12068
AT_mechanical	Type of coupling of the system **1 / Direct Coupling**: Direct coupling **2 / Belt Axis**: Belt axis **3 / Spindle Axis**: Spindle axis Modified settings become active the next time the motor moves.	- 1 2 3	UINT16 R/W - -	CANopen 302F:E_h Modbus 12060
AT_n_ref	Velocity jump for Autotuning The parameter AT_v_ref allows you to enter the value in user-defined units. Modified settings become active the next time the motor moves.	rpm 10 100 1000	UINT32 R/W - -	CANopen 302F:6_h Modbus 12044
AT_start	Autotuning start Value 0: Terminate Value 1: Activate EasyTuning Value 2: Activate ComfortTuning Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	CANopen 302F:1_h Modbus 12034
AT_v_ref	Velocity jump for Autotuning The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active the next time the motor moves.	usr_v 1 100 2147483647	INT32 R/W - -	CANopen 302F:13_h Modbus 12070
AT_wait	Waiting time between Autotuning steps Modified settings become active the next time the motor moves.	ms 300 500 10000	UINT16 R/W - -	CANopen 302F:9_h Modbus 12050
BLSH_Mode	Processing mode of backlash compensation **0 / Off**: Backlash compensation is off **1 / OnAfterPositiveMovement**: Backlash compensation is on, last movement was in positive direction **2 / OnAfterNegativeMovement**: Backlash compensation is on, last movement was in negative direction Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3006:41_h Modbus 1666
BLSH_Position	Position value for backlash compensation Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen 3006:42_h Modbus 1668

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`BLSH_Time`	Processing time for backlash compensation Value 0: Immediate backlash compensation Value >0: Processing time for backlash compensation Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 0 0 16383	UINT16 R/W per. -	CANopen 3006:44$_h$ Modbus 1672
`BRK_AddT_apply`	Additional time delay for applying the holding brake The overall time delay for applying the holding brake is the time delay from the electronic nameplate of the motor and the additional time delay in this parameter. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 0 0 1000	INT16 R/W per. -	CANopen 3005:8$_h$ Modbus 1296
`BRK_AddT_release`	Additional time delay for releasing the holding brake The overall time delay for releasing the holding brake is the time delay from the electronic nameplate of the motor and the additional time delay in this parameter. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 0 0 400	INT16 R/W per. -	CANopen 3005:7$_h$ Modbus 1294
`BRK_release`	Manual operation of the holding brake **0 / Automatic**: Automatic processing **1 / Manual Release**: Manual release of holding brake **2 / Manual Application**: Manual applying of holding brake You can apply or release the holding brake manually. The holding brake can only be manually released in the operating states 'Switch On Disabled', 'Ready To Switch On' or 'Fault'. If you have applied the holding brake manually and then want to release it manually, you must first set this parameter to Automatic and then to Manual Release. Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 3008:A$_h$ Modbus 2068
`CANaddress`	CANopen address (node number) Modified settings become active the next time the product is powered on.	- 1 - 127	UINT16 R/W per. -	-
`CANbaud`	CANopen baud rate **50 kBaud**: 50 kBaud **125 kBaud**: 125 kBaud **250 kBaud**: 250 kBaud **500 kBaud**: 500 kBaud **1 MBaud**: 1 MBaud Modified settings become active the next time the product is powered on.	- 50 250 1000	UINT16 R/W per. -	-

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CANpdo1Event`	PDO 1 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:B_h Modbus 16662
`CANpdo2Event`	PDO 2 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:C_h Modbus 16664
`CANpdo3Event`	PDO 3 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 1 15	UINT16 R/W - -	CANopen 3041:D_h Modbus 16666
`CANpdo4Event`	PDO 4 event mask Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object Modified settings become active immediately.	- 0 15 15	UINT16 R/W - -	CANopen 3041:E_h Modbus 16668
`Cap1Activate`	Capture input 1 start/stop **0 / Capture Stop**: Cancel capture function **1 / Capture Once**: Start one-time capture **2 / Capture Continuous**: Start continuous capture **3 / Reserved**: Reserved **4 / Reserved**: Reserved In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 4	UINT16 R/W - -	CANopen 300A:4_h Modbus 2568
`Cap1Config`	Capture input 1 configuration **0 / Falling Edge**: Position capture at falling edge **1 / Rising Edge**: Position capture at rising edge **2 / Both Edges**: Position capture at both edges Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 300A:2_h Modbus 2564
`Cap1Source`	Capture input 1 encoder source **0 / Pact Encoder 1**: Source for capture input 1 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W - -	CANopen 300A:A_h Modbus 2580

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`Cap2Activate`	Capture input 2 start/stop **0 / Capture Stop**: Cancel capture function **1 / Capture Once**: Start one-time capture **2 / Capture Continuous**: Start continuous capture **3 / Reserved**: Reserved **4 / Reserved**: Reserved In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 4	UINT16 R/W - -	CANopen 300A:5$_h$ Modbus 2570
`Cap2Config`	Capture input 2 configuration **0 / Falling Edge**: Position capture at falling edge **1 / Rising Edge**: Position capture at rising edge **2 / Both Edges**: Position capture at both edges Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 300A:3$_h$ Modbus 2566
`Cap2Source`	Capture input 2 encoder source **0 / Pact Encoder 1**: Source for capture input 2 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W - -	CANopen 300A:B$_h$ Modbus 2582
`CLSET_p_DiffWin`	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The parameter CLSET_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0100 2.0000	UINT16 R/W per. -	CANopen 3011:1C$_h$ Modbus 4408
`CLSET_p_DiffWin_usr`	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 164 2147483647	INT32 R/W per. -	CANopen 3011:25$_h$ Modbus 4426

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_ParSwiCond	Condition for parameter set switching **0 / None Or Digital Input**: None or digital input function selected **1 / Inside Position Deviation**: Inside position deviation (value definition in parameter CLSET_p_DiffWin) **2 / Below Reference Velocity**: Below reference velocity (value definition in parameter CLSET_v_Threshol) **3 / Below Actual Velocity**: Below actual velocity (value definition in parameter CLSET_v_Threshol) **4 / Reserved**: Reserved In the case of parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp The following parameters are changed immediately after the time for parameter set switching (CTRL_ParChgTime): - CTRL_Nf1damp - CTRL_Nf1freq - CTRL_Nf1bandw - CTRL_Nf2damp - CTRL_Nf2freq - CTRL_Nf2bandw - CTRL_Osupdamp - CTRL_Osupdelay - CTRL_Kfric Modified settings become active immediately.	- 0 0 4	UINT16 R/W per. -	CANopen 3011:1A$_h$ Modbus 4404
CLSET_v_Threshol	Velocity threshold for control loop parameter set switching If the reference velocity or the actual velocity are less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. Modified settings become active immediately.	usr_v 0 50 2147483647	UINT32 R/W per. -	CANopen 3011:1D$_h$ Modbus 4410
CLSET_winTime	Time window for parameter set switching Value 0: Window monitoring deactivated. Value >0: Window time for the parameters CLSET_v_Threshol and CLSET_p_DiffWin. Modified settings become active immediately.	ms 0 0 1000	UINT16 R/W per. -	CANopen 3011:1B$_h$ Modbus 4406

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_GlobGain	Global gain factor (affects control loop parameter set 1) The global gain factor affects the following parameters of control loop parameter set 1: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref The global gain factor is set to 100% - if the control loop parameters are set to default - at the end of the Autotuning process - if control loop parameter set 2 is copied to set 1 via the parameter CTRL_ParSetCopy If a full configuration is transmitted via the fieldbus, the value for CTRL_GlobGain must be transmitted prior to the values of the control loop parameters CTRL_KPn, CTRL_TNn, CTRL_KPp and CTRL_TAUnref. If CTRL_GlobGain is changed during a configuration transmission, CTRL_KPn, CTRL_TNn, CTRL_KPp and CTRL_TAUnref must also be part of the configuration. In increments of 0.1 %. Modified settings become active immediately.	% 5.0 100.0 1000.0	UINT16 R/W per. -	CANopen $3011:15_h$ Modbus 4394
CTRL_I_max	Current limitation During operation, the current limit is one of the following values (whichever is lowest): - CTRL_I_max - _M_I_max - _PS_I_max - Current limitation via digital input Limitations caused by I2t monitoring are also taken into account. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 - 463.00	UINT16 R/W per. -	CANopen $3011:C_h$ Modbus 4376
CTRL_I_max_fw	Maximum current for field weakening (d component) This value is only limited by the minimum/maximum parameter range (no limitation of this value by motor/power stage). The actually effective field weakening current is the minimum of CTRL_I_max_fw and one half of the lower value of the nominal current of the power stage and the motor. In increments of 0.01 A_{rms}. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	A_{rms} 0.00 0.00 300.00	UINT16 R/W per. expert	CANopen $3011:F_h$ Modbus 4382
CTRL_KFAcc	Acceleration feed-forward control In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 3000.0	UINT16 R/W per. expert	CANopen $3011:A_h$ Modbus 4372

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`CTRL_ParChgTime`	Period of time for control loop parameter set switching In the case of control loop parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Such a switching can be caused by - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen $3011{:}14_h$ Modbus 4392
`CTRL_ParSetCopy`	Control loop parameter set copying Value 1: Copy control loop parameter set 1 to set 2 Value 2: Copy control loop parameter set 2 to set 1 If control loop parameter set 2 is copied to control loop parameter set 1, the parameter CTRL_GlobGain is set to 100%. Modified settings become active immediately.	- 0.0 - 0.2	UINT16 R/W - -	CANopen $3011{:}16_h$ Modbus 4396
`CTRL_PwrUpParSet`	Selection of control loop parameter set at power up **0 / Switching Condition**: The switching condition is used for control loop parameter set switching **1 / Parameter Set 1**: Control loop parameter set 1 is used **2 / Parameter Set 2**: Control loop parameter set 2 is used The selected value is also written to CTRL_SelParSet (non-persistent). Modified settings become active immediately.	- 0 1 2	UINT16 R/W per. -	CANopen $3011{:}18_h$ Modbus 4400
`CTRL_SelParSet`	Selection of control loop parameter set (non-persistent) Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen $3011{:}19_h$ Modbus 4402
`CTRL_SmoothCurr`	Smoothing factor for current controller This parameter decreases the dynamics of the current control loop. Modified settings become active immediately. Available with firmware version ≥V01.08.	% 50 100 100	UINT16 R/W per. -	CANopen $3011{:}26_h$ Modbus 4428
`CTRL_SpdFric`	Speed of rotation up to which the friction compensation is linear Modified settings become active immediately.	rpm 0 5 20	UINT32 R/W per. expert	CANopen $3011{:}9_h$ Modbus 4370

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_TAUnact	Filter time constant to smooth velocity of motor The default value is calculated on the basis of the motor data. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 30.00	UINT16 R/W per. expert	CANopen 3011:8$_h$ Modbus 4368
CTRL_v_max	Velocity limitation During operation, the velocity limit is one of the following values (whichever is lowest): - CTRL_v_max - M_n_max - Velocity limitation via digital input Modified settings become active immediately.	usr_v 1 13200 2147483647	UINT32 R/W per. -	CANopen 3011:10$_h$ Modbus 4384
CTRL_VelObsActiv	Activation of velocity observer **0 / Velocity Observer Off**: Velocity observer is off **1 / Velocity Observer Passive**: Velocity observer is on, but not used for motor control **2 / Velocity Observer Active**: Velocity observer is on and used for motor control Velocity observer control reduces velocity ripple and enhances controller bandwidth. Set the correct dynamics and inertia values before activation. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. expert	CANopen 3011:22$_h$ Modbus 4420
CTRL_VelObsDyn	Dynamics of velocity observer The value of this parameter must be less than (for example, between 5 % and 20 %) the integral action time of the velocity controller (parameter CTRL1_TNn und CTRL2_TNn). In increments of 0.01 ms. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	ms 0.03 0.25 200.00	UINT16 R/W per. expert	CANopen 3011:23$_h$ Modbus 4422
CTRL_VelObsInert	Inertia value for velocity observer System inertia that is used for velocity observer calculations. The default value is the inertia of the mounted motor. In the case of autotuning, the value of this parameter can be set equal to that of _AT_J. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	g cm^2 1 - 2147483648	UINT32 R/W per. expert	CANopen 3011:24$_h$ Modbus 4424
CTRL_vPIDDPart	PID velocity controller: D gain In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 400.0	UINT16 R/W per. expert	CANopen 3011:6$_h$ Modbus 4364
CTRL_vPIDDTime	PID velocity controller: Time constant of D term smoothing filter In increments of 0.01 ms. Modified settings become active immediately.	ms 0.01 0.25 10.00	UINT16 R/W per. expert	CANopen 3011:5$_h$ Modbus 4362

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	CANopen $3012:6_h$ Modbus 4620
CTRL1_Kfric	Friction compensation: Gain In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	CANopen $3012:10_h$ Modbus 4640
CTRL1_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen $3012:1_h$ Modbus 4610
CTRL1_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen $3012:3_h$ Modbus 4614
CTRL1_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen $3012:A_h$ Modbus 4628
CTRL1_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen $3012:8_h$ Modbus 4624
CTRL1_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen $3012:9_h$ Modbus 4626
CTRL1_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen $3012:D_h$ Modbus 4634
CTRL1_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen $3012:B_h$ Modbus 4630
CTRL1_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen $3012:C_h$ Modbus 4632

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	CANopen 3012:E$_h$ Modbus 4636
CTRL1_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	CANopen 3012:F$_h$ Modbus 4638
CTRL1_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	CANopen 3012:5$_h$ Modbus 4618
CTRL1_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen 3012:4$_h$ Modbus 4616
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3012:2$_h$ Modbus 4612
CTRL2_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	CANopen 3013:6$_h$ Modbus 4876
CTRL2_Kfric	Friction compensation: Gain In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	CANopen 3013:10$_h$ Modbus 4896
CTRL2_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Modified settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	CANopen 3013:1$_h$ Modbus 4866

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	CANopen $3013{:}3_h$ Modbus 4870
CTRL2_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen $3013{:}A_h$ Modbus 4884
CTRL2_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen $3013{:}8_h$ Modbus 4880
CTRL2_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen $3013{:}9_h$ Modbus 4882
CTRL2_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Modified settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	CANopen $3013{:}D_h$ Modbus 4890
CTRL2_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Modified settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	CANopen $3013{:}B_h$ Modbus 4886
CTRL2_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Modified settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	CANopen $3013{:}C_h$ Modbus 4888
CTRL2_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	CANopen $3013{:}E_h$ Modbus 4892
CTRL2_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	CANopen $3013{:}F_h$ Modbus 4894
CTRL2_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	CANopen $3013{:}5_h$ Modbus 4874

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	CANopen 3013:4$_h$ Modbus 4872
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	CANopen 3013:2$_h$ Modbus 4868
DCOMcontrol	DriveCom control word See chapter Operation, Operating States, for bit assignment information. Bit 0: Operating state Switch On Bit 1: Enable Voltage Bit 2: Operating state Quick Stop Bit 3: Enable Operation Bits 4 … 6: Operating mode-specific Bit 7: Fault Reset Bit 8: Halt Bit 9: Operating mode-specific Bits 10 … 15: Reserved (must be 0) Modified settings become active immediately.	- - - -	UINT16 R/W - -	CANopen 6040:0$_h$ Modbus 6914
DCOMopmode	Operating mode **-6 / Manual Tuning / Autotuning**: Manual Tuning or Autotuning **-3 / Motion Sequence**: Motion Sequence **-1 / Jog**: Jog **0 / Reserved**: Reserved **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **4 / Profile Torque**: Profile Torque **6 / Homing**: Homing **7 / Interpolated Position**: Interpolated Position **8 / Cyclic Synchronous Position**: Cyclic Synchronous Position **9 / Cyclic Synchronous Velocity**: Cyclic Synchronous Velocity **10 / Cyclic Synchronous Torque**: Cyclic Synchronous Torque Modified settings become active immediately. * Datatype for CANopen: INT8	- -6 - 10	INT16* R/W - -	CANopen 6060:0$_h$ Modbus 6918
DEVcmdinterf	Control mode **1 / Local Control Mode**: Local control mode **2 / Fieldbus Control Mode**: Fieldbus control mode Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.06.	- - - -	UINT16 R/W per. -	CANopen 3005:1$_h$ Modbus 1282

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DI_0_Debounce	Debounce time of DI0 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen 3008:20$_h$ Modbus 2112
DI_1_Debounce	Debounce time of DI1 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen 3008:21$_h$ Modbus 2114
DI_2_Debounce	Debounce time of DI2 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen 3008:22$_h$ Modbus 2116
DI_3_Debounce	Debounce time of DI3 **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 1.00 ms **5 / 1.25 ms**: 1.25 ms **6 / 1.50 ms**: 1.50 ms Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 6 6	UINT16 R/W per. -	CANopen 3008:23$_h$ Modbus 2118
DPL_Activate	Activation of Drive Profile Lexium Value 0: Deactivate Drive Profile Lexium Value 1: Activate Drive Profile Lexium The access channel via which the drive profile has been activated is the only access channel that can use the drive profile. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 301B:8$_h$ Modbus 6928
DPL_dmControl	Drive Profile Lexium dmControl	- - - -	UINT16 R/W - -	CANopen 301B:1F$_h$ Modbus 6974

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DPL_intLim	Setting for bit 9 of _DPL_motionStat and _actionStatus **0 / None**: Not used (reserved) **1 / Current Below Threshold**: Current threshold value **2 / Velocity Below Threshold**: Velocity threshold value **3 / In Position Deviation Window**: Position deviation window **4 / In Velocity Deviation Window**: Velocity deviation window **5 / Position Register Channel 1**: Position register channel 1 **6 / Position Register Channel 2**: Position register channel 2 **7 / Position Register Channel 3**: Position register channel 3 **8 / Position Register Channel 4**: Position register channel 4 **9 / Hardware Limit Switch**: Hardware limit switch **10 / RMAC active or finished**: Relative movement after capture is active or finished **11 / Position Window**: Position window Setting for: Bit 9 of the parameter _actionStatus Bit 9 of the parameter _DPL_motionStat Modified settings become active immediately.	- 0 11 11	UINT16 R/W per. -	CANopen 301B:35$_h$ Modbus 7018
DPL_RefA16	Drive Profile Lexium RefA16	- - - -	INT16 R/W - -	CANopen 301B:22$_h$ Modbus 6980
DPL_RefB32	Drive Profile Lexium RefB32	- - - -	INT32 R/W - -	CANopen 301B:21$_h$ Modbus 6978
DS402compatib	DS402 state machine: State transition from 3 to 4 **0 / Automatic**: Automatic (state transition is performed automatically) **1 / DS402-compliant**: DS402-compliant (state transition must be controlled via the fieldbus) Determines the state transition between the states SwitchOnDisabled (3) and ReadyToSwitchOn (4). Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 301B:13$_h$ Modbus 6950

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DS402intLim	DS402 status word: Setting for bit 11 (internal limit) **0 / None**: Not used (reserved) **1 / Current Below Threshold**: Current threshold value **2 / Velocity Below Threshold**: Velocity threshold value **3 / In Position Deviation Window**: Position deviation window **4 / In Velocity Deviation Window**: Velocity deviation window **5 / Position Register Channel 1**: Position register channel 1 **6 / Position Register Channel 2**: Position register channel 2 **7 / Position Register Channel 3**: Position register channel 3 **8 / Position Register Channel 4**: Position register channel 4 **9 / Hardware Limit Switch**: Hardware limit switch **10 / RMAC active or finished**: Relative movement after capture is active or finished **11 / Position Window**: Position window Setting for: Bit 11 of the parameter _DCOMstatus Bit 10 of the parameter _actionStatus Bit 10 of the parameter _DPL_motionStat Modified settings become active immediately.	- 0 0 11	UINT16 R/W per. -	CANopen 301B:1E$_h$ Modbus 6972
DSM_ShutDownOption	Behavior for disabling the power stage during movement **0 / Disable Immediately**: Disable power stage immediately **1 / Disable After Halt**: Disable power stage after deceleration to standstill This parameter specifies the response to a power stage disable request. Halt is used for deceleration to standstill. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	INT16 R/W per. -	CANopen 605B:0$_h$ Modbus 1684

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC1_adjustment	Adjustment of absolute position of encoder 1 The value range depends on the encoder type. Singleturn encoder: 0 ... x-1 Multiturn encoder: 0 ... (4096*x)-1 Singleturn encoder (shifted with parameter ShiftEncWorkRang): -(x/2) ... (x/2)-1 Multiturn encoder (shifted with parameter ShiftEncWorkRang): -(2048*x) ... (2048*x)-1 Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling. If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted. After the write access, a wait time of at least 1 second is required before the drive can be powered off. Modified settings become active the next time the product is powered on.	usr_p - - -	INT32 R/W - -	CANopen 3005:16$_h$ Modbus 1324
ERR_clear	Clear error memory Value 1: Delete entries in the error memory The clearing process is completed if a 0 is returned after a read access. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	CANopen 303B:4$_h$ Modbus 15112
ERR_reset	Reset error memory read pointer Value 1: Set error memory read pointer to oldest error entry. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	CANopen 303B:5$_h$ Modbus 15114
ErrorResp_bit_DE	Error response to detected data error (DE bit) **-1 / No Error Response**: No error response **0 / Error Class 0**: Error class 0 **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 For the Drive Profile Lexium, the error response to a detected data error (DE bit) can be parameterized. For EtherCAT RxPDO data error handling, this parameter is also used to classify the error response.	- -1 -1 3	INT16 R/W per. -	CANopen 301B:6$_h$ Modbus 6924

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ErrorResp_bit_ME`	Error response to detected mode error (ME bit) **-1 / No Error Response**: No error response **0 / Error Class 0**: Error class 0 **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 For the Drive Profile Lexium, the error response to a detected mode error (ME bit) can be parameterized.	- -1 -1 3	INT16 R/W per. -	CANopen 301B:7$_h$ Modbus 6926
`ErrorResp_Flt_AC`	Error response to missing mains phase **0 / Error Class 0**: Error class 0 **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 2 3	UINT16 R/W per. -	CANopen 3005:A$_h$ Modbus 1300
`ErrorResp_I2tRES`	Error response to 100% I2t braking resistor **0 / Error Class 0**: Error class 0 **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:22$_h$ Modbus 1348
`ErrorResp_p_dif`	Error response to excessively high load-dependent position deviation **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	CANopen 3005:B$_h$ Modbus 1302
`ErrorResp_QuasiAbs`	Error response to detected error with quasi absolute position **3 / Error Class 3**: Error class 3 **4 / Error Class 4**: Error class 4 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.08.	- 3 3 4	UINT16 R/W per. -	CANopen 3005:3A$_h$ Modbus 1396
`ErrorResp_v_dif`	Error response to excessively high load-dependent velocity deviation **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.08.	- 1 3 3	UINT16 R/W per. -	CANopen 3005:3C$_h$ Modbus 1400
`HMdis`	Distance from switching point The distance from the switching point is defined as the reference point. The parameter is only effective during a reference movement without index pulse. Modified settings become active the next time the motor moves.	usr_p 1 200 2147483647	INT32 R/W per. -	CANopen 3028:7$_h$ Modbus 10254

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMmethod	Homing method 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting Abbreviations: REF+: Search movement in pos. direction REF-: Search movement in neg. direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Modified settings become active immediately. * Datatype for CANopen: INT8	- 1 18 35	INT16* R/W - -	CANopen $6098:0_h$ Modbus 6936
HMoutdis	Maximum distance for search for switching point 0: Monitoring of distance inactive >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Modified settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen $3028:6_h$ Modbus 10252
HMp_home	Position at reference point After a successful reference movement, this position is automatically set at the reference point. Modified settings become active the next time the motor moves.	usr_p -2147483648 0 2147483647	INT32 R/W per. -	CANopen $3028:B_h$ Modbus 10262
HMp_setP	Position for Position Setting Position for operating mode Homing, method 35. Modified settings become active immediately.	usr_p - 0 -	INT32 R/W - -	CANopen $301B:16_h$ Modbus 6956
HMprefmethod	Preferred homing method Modified settings become active immediately.	- 1 18 35	INT16 R/W per. -	CANopen $3028:A_h$ Modbus 10260

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMsrchdis	Maximum search distance after overtravel of switch 0: Search distance monitoring disabled >0: Search distance The switch must be activated again within this search distance, otherwise the reference movement is canceled. Modified settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	CANopen 3028:D$_h$ Modbus 10266
HMv	Target velocity for searching the switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 60 2147483647	UINT32 R/W per. -	CANopen 6099:1$_h$ Modbus 10248
HMv_out	Target velocity for moving away from switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 6 2147483647	UINT32 R/W per. -	CANopen 6099:2$_h$ Modbus 10250
InvertDirOfMove	Inversion of direction of movement **0 / Inversion Off**: Inversion of direction of movement is off **1 / Inversion On**: Inversion of direction of movement is on The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:C$_h$ Modbus 1560
IO_AutoEnable	Enabling the power stage at PowerOn **0 / RisingEdge**: A rising edge with the signal input function "Enable" enables the power stage **1 / HighLevel**: An active signal input with signal input function "Enable" enables the power stage **2 / AutoOn**: The power stage is automatically enabled Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:6$_h$ Modbus 1292
IO_AutoEnaConfig	Enabling the power stage as set via IO_AutoEnable even after error **0 / Off**: Setting in parameter IO_AutoEnable is only used after start-up **1 / On**: Setting in parameter IO_AutoEnable is used after start-up and after detected error Modified settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	CANopen 3005:4$_h$ Modbus 1288
IO_DQ_set	Setting the digital outputs directly Digital outputs can only be set directly if the signal output function has been set to 'Available as required'. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/W - -	CANopen 3008:11$_h$ Modbus 2082

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IO_FaultResOnEnaInp`	Additional 'Fault Reset' for the signal input function 'Enable' **0 / Off**: No additional 'Fault Reset' **1 / OnFallingEdge**: Additional 'Fault Reset' with falling edge **2 / OnRisingEdge**: Additional 'Fault Reset' with rising edge Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:34$_h$ Modbus 1384
`IO_I_limit`	Current limitation via input A current limit can be activated via a digital input. In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	CANopen 3006:27$_h$ Modbus 1614
`IO_JOGmethod`	Selection of jog method **0 / Continuous Movement**: Jog with continuous movement **1 / Step Movement**: Jog with step movement Modified settings become active the next time the motor moves.	- 0 1 1	UINT16 R/W per. -	CANopen 3005:18$_h$ Modbus 1328
`IO_v_limit`	Velocity limitation via input A velocity limitation can be activated via a digital input. In operating mode Profile Torque, the minimum velocity is internally limited to 100 min-1. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:1E$_h$ Modbus 1596
`IOdefaultMode`	Operating mode **0 / None**: None **5 / Jog**: Jog **6 / Motion Sequence**: Motion Sequence Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.06.	- 0 5 6	UINT16 R/W per. -	CANopen 3005:3$_h$ Modbus 1286

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DI0`	Function Input DI0 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:1$_h$ Modbus 1794

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI1	Function Input DI1 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:2$_h$ Modbus 1796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI2	Function Input DI2 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:3$_h$ Modbus 1798

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI3	Function Input DI3 **1 / Freely Available**: Available as required **2 / Fault Reset**: Fault reset after error **3 / Enable**: Enables the power stage **4 / Halt**: Halt **5 / Start Profile Positioning**: Start request for movement **6 / Current Limitation**: Limits the current to parameter value **7 / Zero Clamp**: Zero clamping **8 / Velocity Limitation**: Limits the velocity to parameter value **9 / Jog Positive**: Jog: Moves in positive direction **10 / Jog Negative**: Jog: Moves in negative direction **11 / Jog Fast/Slow**: Jog: Switches between slow and fast movement **13 / Start Single Data Set**: Motion Sequence: Starts a single data set **14 / Data Set Select**: Motion Sequence: Data set selection **15 / Data Set Bit 0**: Motion Sequence: Data set bit 0 **16 / Data Set Bit 1**: Motion Sequence: Data set bit 1 **17 / Data Set Bit 2**: Motion Sequence: Data set bit 2 **18 / Data Set Bit 3**: Motion Sequence: Data set bit 3 **21 / Reference Switch (REF)**: Reference switch **22 / Positive Limit Switch (LIMP)**: Positive limit switch **23 / Negative Limit Switch (LIMN)**: Negative limit switch **24 / Switch Controller Parameter Set**: Switches control loop parameter set **28 / Velocity Controller Integral Off**: Switches off velocity controller integral term **29 / Start Motion Sequence**: Motion Sequence: Starts a motion sequence **30 / Start Signal Of RMAC**: Start signal of relative movement after capture (RMAC) **31 / Activate RMAC**: Activates the relative movement after capture (RMAC) **32 / Activate Operating Mode**: Activates operating mode **33 / Jog Positive With Enable**: Jog: Enables power stage and moves in positive direction **34 / Jog Negative With Enable**: Jog: Enables power stage and moves in negative direction **35 / Data Set Bit 4**: Motion Sequence: Data set bit 4 **36 / Data Set Bit 5**: Motion Sequence: Data set bit 5 **37 / Data Set Bit 6**: Motion Sequence: Data set bit 6 **40 / Release Holding Brake**: Releases the holding brake Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:4$_h$ Modbus 1800

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DQ0	Function Output DQ0 **1 / Freely Available**: Available as required **2 / No Fault**: Signals operating states Ready To Switch On, Switched On and Operation Enabled **3 / Active**: Signals operating state Operation Enabled **4 / RMAC Active Or Finished**: Relative movement after capture active or finished (RMAC) **5 / In Position Deviation Window**: Position deviation is within window **6 / In Velocity Deviation Window**: Velocity deviation is within window **7 / Velocity Below Threshold**: Motor velocity below threshold **8 / Current Below Threshold**: Motor current below threshold **9 / Halt Acknowledge**: Halt acknowledgement **11 / Motion Sequence: Start Acknowledge**: Motion Sequence: Acknowledgement of start request **13 / Motor Standstill**: Motor at a standstill **14 / Selected Error**: One of the specified errors of error classes 1 … 4 is active **15 / Valid Reference (ref_ok)**: Zero point is valid (ref_ok) **16 / Selected Warning**: One of the specified errors of error class 0 is active **17 / Motion Sequence: Done**: Motion Sequence: Sequence done **18 / Position Register Channel 1**: Position register channel 1 **19 / Position Register Channel 2**: Position register channel 2 **20 / Position Register Channel 3**: Position register channel 3 **21 / Position Register Channel 4**: Position register channel 4 **22 / Motor Moves Positive**: Motor moves in positive direction **23 / Motor Moves Negative**: Motor moves in negative direction Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:9$_h$ Modbus 1810

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOfunct_DQ1`	Function Output DQ1 **1 / Freely Available**: Available as required **2 / No Fault**: Signals operating states Ready To Switch On, Switched On and Operation Enabled **3 / Active**: Signals operating state Operation Enabled **4 / RMAC Active Or Finished**: Relative movement after capture active or finished (RMAC) **5 / In Position Deviation Window**: Position deviation is within window **6 / In Velocity Deviation Window**: Velocity deviation is within window **7 / Velocity Below Threshold**: Motor velocity below threshold **8 / Current Below Threshold**: Motor current below threshold **9 / Halt Acknowledge**: Halt acknowledgement **11 / Motion Sequence: Start Acknowledge**: Motion Sequence: Acknowledgement of start request **13 / Motor Standstill**: Motor at a standstill **14 / Selected Error**: One of the specified errors of error classes 1 … 4 is active **15 / Valid Reference (ref_ok)**: Zero point is valid (ref_ok) **16 / Selected Warning**: One of the specified errors of error class 0 is active **17 / Motion Sequence: Done**: Motion Sequence: Sequence done **18 / Position Register Channel 1**: Position register channel 1 **19 / Position Register Channel 2**: Position register channel 2 **20 / Position Register Channel 3**: Position register channel 3 **21 / Position Register Channel 4**: Position register channel 4 **22 / Motor Moves Positive**: Motor moves in positive direction **23 / Motor Moves Negative**: Motor moves in negative direction Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	CANopen 3007:A$_h$ Modbus 1812
`IOsigCurrLim`	Signal evaluation for signal input function Current Limitation **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.06.	- 1 2 2	UINT16 R/W per. -	CANopen 3008:28$_h$ Modbus 2128
`IOsigLIMN`	Signal evaluation for negative limit switch **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3006:F$_h$ Modbus 1566

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`IOsigLIMP`	Signal evaluation for positive limit switch **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3006:10$_h$ Modbus 1568
`IOsigREF`	Signal evaluation for reference switch **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO The reference switch is only active while a reference movement to the reference switch is processed. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	CANopen 3006:E$_h$ Modbus 1564
`IOsigRespOfPS`	Response to active limit switch during enabling of power stage **0 / Error**: Active limit switch triggers an error. **1 / No Error**: Active limit switch does not trigger an error. Defines the response when the power stage is enabled while a hardware limit switch is active. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:6$_h$ Modbus 1548
`IOsigVelLim`	Signal evaluation for signal input function Velocity Limitation **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.06.	- 1 2 2	UINT16 R/W per. -	CANopen 3008:27$_h$ Modbus 2126
`IP_IntTimInd`	Interpolation time index * Datatype for CANopen: INT8	- -128 -3 63	INT16* R/W - -	CANopen 60C2:2$_h$ Modbus 7002
`IP_IntTimPerVal`	Interpolation time period value * Datatype for CANopen: UINT8	s 0 1 255	UINT16* R/W - -	CANopen 60C2:1$_h$ Modbus 7000
`IPp_target`	Position reference value for operating mode Interpolated Position	- -2147483648 - 2147483647	INT32 R/W - -	CANopen 60C1:1$_h$ Modbus 7004
`JOGactivate`	Activation of operating mode Jog Bit 0: Positive direction of movement Bit 1: Negative direction of movement Bit 2: 0=slow 1=fast Modified settings become active immediately.	- 0 0 7	UINT16 R/W - -	CANopen 301B:9$_h$ Modbus 6930
`JOGmethod`	Selection of jog method **0 / Continuous Movement**: Jog with continuous movement **1 / Step Movement**: Jog with step movement Modified settings become active immediately.	- 0 1 1	UINT16 R/W - -	CANopen 3029:3$_h$ Modbus 10502

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGstep	Distance for step movement Modified settings become active the next time the motor moves.	usr_p 1 20 2147483647	INT32 R/W per. -	CANopen 3029:7$_h$ Modbus 10510
JOGtime	Wait time for step movement Modified settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	CANopen 3029:8$_h$ Modbus 10512
JOGv_fast	Velocity for fast movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active immediately.	usr_v 1 180 2147483647	UINT32 R/W per. -	CANopen 3029:5$_h$ Modbus 10506
JOGv_slow	Velocity for slow movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Modified settings become active immediately.	usr_v 1 60 2147483647	UINT32 R/W per. -	CANopen 3029:4$_h$ Modbus 10504
LIM_HaltReaction	Halt option code **1 / Deceleration Ramp**: Deceleration ramp **3 / Torque Ramp**: Torque ramp Type of deceleration for Halt. Setting of deceleration ramp with parameter RAMP_v_dec. Setting of torque ramp with parameter LIM_I_maxHalt. If a deceleration ramp is already active, the parameter cannot be written. Modified settings become active immediately.	- 1 1 3	INT16 R/W per. -	CANopen 605D:0$_h$ Modbus 1582
LIM_I_maxHalt	Current for Halt This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Halt, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxHalt - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Halt. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:E$_h$ Modbus 4380

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxQSTP	Current for Quick Stop This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Quick Stop, the current limit (_Imax_act) is one of the following values (whichever is lowest): - LIM_I_maxQSTP - _M_I_max - _PS_I_max Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop. Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	CANopen 3011:D_h Modbus 4378
LIM_QStopReact	Quick Stop option code **-2 / Torque ramp (Fault)**: Use torque ramp and transit to operating state 9 Fault **-1 / Deceleration Ramp (Fault)**: Use deceleration ramp and transit to operating state 9 Fault **6 / Deceleration ramp (Quick Stop)**: Use deceleration ramp and remain in operating state 7 Quick Stop **7 / Torque ramp (Quick Stop)**: Use torque ramp and remain in operating state 7 Quick Stop Type of deceleration for Quick Stop. Setting of deceleration ramp with parameter RAMPquickstop. Setting of torque ramp with parameter LIM_I_maxQSTP. If a deceleration ramp is already active, the parameter cannot be written. Modified settings become active immediately.	- -2 6 7	INT16 R/W per. -	CANopen 3006:18_h Modbus 1584
MBaddress	Modbus address Valid addresses: 1 to 247 Modified settings become active the next time the product is powered on.	- 1 1 247	UINT16 R/W per. -	CANopen 3016:4_h Modbus 5640
MBbaud	Modbus baud rate **9600 / 9600 Baud**: 9600 Baud **19200 / 19200 Baud**: 19200 Baud **38400 / 38400 Baud**: 38400 Baud **115200 / 115200 Baud**: 115200 Baud Modified settings become active the next time the product is powered on.	- 9600 19200 115200	UINT32 R/W per. -	CANopen 3016:3_h Modbus 5638

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MOD_AbsDirection	Direction of absolute movement with Modulo **0 / Shortest Distance**: Movement with shortest distance **1 / Positive Direction**: Movement only in positive direction **2 / Negative Direction**: Movement only in negative direction If the parameter is set to 0, the drive calculates the shortest way to the new target position and starts the movement in the corresponding direction. If the distance to the target position is identical in positive and negative directions, the movement takes place in positive direction. Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3006:3B$_h$ Modbus 1654
MOD_AbsMultiRng	Multiple ranges for absolute movement with Modulo **0 / Multiple Ranges Off**: Absolute movement in one modulo range **1 / Multiple Ranges On**: Absolute movement in multiple modulo ranges Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:3C$_h$ Modbus 1656
MOD_Enable	Activation of Modulo function **0 / Modulo Off**: Modulo is off **1 / Modulo On**: Modulo is on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:38$_h$ Modbus 1648
MOD_Max	Maximum position of modulo range The maximum position value of the modulo range must be greater than the minimum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	usr_p - 3600 -	INT32 R/W per. -	CANopen 3006:3A$_h$ Modbus 1652
MOD_Min	Minimum position of modulo range The minimum position value of the modulo range must be less than the maximum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	usr_p - 0 -	INT32 R/W per. -	CANopen 3006:39$_h$ Modbus 1650
MON_ChkTime	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Modified settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	CANopen 3006:1D$_h$ Modbus 1594

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_commutat	Commutation monitoring **0 / Off**: Commutation monitoring off **1 / On (OpState6)**: Commutation monitoring on in operating state 6 **2 / On (OpState6+7)**: Commutation monitoring on in operating states 6 and 7 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3005:5$_h$ Modbus 1290
MON_ConfModification	Configuration modification monitoring Value 0: Modification detected for each write access. Value 1: Modification detected for each write access which modifies a value. Value 2: Identical to value 0 if commissioning software is not connected. Identical to value 1 if commissioning software is connected. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 2 2	UINT16 R/W per. -	CANopen 3004:1D$_h$ Modbus 1082
MON_ENC_Ampl	Activation of monitoring of SinCos amplitude Value 0: Deactivate monitoring Value 1: Activate monitoring Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W - -	CANopen 303F:61$_h$ Modbus 16322
MON_GroundFault	Ground fault monitoring **0 / Off**: Ground fault monitoring off **1 / On**: Ground fault monitoring on Modified settings become active the next time the product is powered on.	- 0 1 1	UINT16 R/W per. expert	CANopen 3005:10$_h$ Modbus 1312
MON_I_Threshold	Monitoring of current threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime. The status can be output via a parameterizable output. The parameter _Iq_act_rms is used as comparison value. In increments of 0.01 A_{rms}. Modified settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	CANopen 3006:1C$_h$ Modbus 1592
MON_IO_SelErr1	Signal output function Selected Error (error classes 1 to 4): First error code This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:6$_h$ Modbus 15116
MON_IO_SelErr2	Signal output function Selected Error (error classes 1 to 4): Second error code This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:7$_h$ Modbus 15118

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_IO_SelWar1	Signal output function Selected Warning (error class 0): First error code This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:8$_h$ Modbus 15120
MON_IO_SelWar2	Signal output function Selected Warning (error class 0): Second error code This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Modified settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	CANopen 303B:9$_h$ Modbus 15122
MON_MainsVolt	Detection and monitoring of mains phases **0 / Automatic Mains Detection**: Automatic detection and monitoring of mains voltage **3 / Mains 1~230 V / 3~480 V**: Mains voltage 230 V (single-phase) or 480 V (three phases) **4 / Mains 1~115 V / 3~208 V**: Mains voltage 115 V (single-phase) or 208 V (three phases) Value 0: As soon as mains voltage detected, the device automatically verifies whether the mains voltage is 115 V or 230 V in the case of single-phase devices or 208 V or 400/480 V in the case of three-phase devices. Values 3 … 4: If the mains voltage is not detected properly during start-up, the mains voltage to be used can be selected manually. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 4	UINT16 R/W per. expert	CANopen 3005:F$_h$ Modbus 1310
MON_p_dif_load	Maximum load-dependent position deviation The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. The parameter MON_p_dif_load_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0001 1.0000 200.0000	UINT32 R/W per. -	CANopen 6065:0$_h$ Modbus 1606
MON_p_dif_load_usr	Maximum load-dependent position deviation The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:3E$_h$ Modbus 1660

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_dif_warn	Maximum load-dependent position deviation (error class 0) 100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter MON_p_dif_load. Modified settings become active immediately.	% 0 75 100	UINT16 R/W per. -	CANopen 3006:29$_h$ Modbus 1618
MON_p_DiffWin	Monitoring of position deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. The parameter MON_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0010 0.9999	UINT16 R/W per. -	CANopen 3006:19$_h$ Modbus 1586
MON_p_DiffWin_usr	Monitoring of position deviation The system checks whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 16 2147483647	INT32 R/W per. -	CANopen 3006:3F$_h$ Modbus 1662
MON_p_win	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The parameter MON_p_win_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Modified settings become active immediately. * Datatype for CANopen: UINT32	revolution 0.0000 0.0010 3.2767	UINT16* R/W per. -	CANopen 6067:0$_h$ Modbus 1608
MON_p_win_usr	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active immediately.	usr_p 0 16 2147483647	INT32 R/W per. -	CANopen 3006:40$_h$ Modbus 1664

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MON_p_winTime`	Standstill window, time Value 0: Monitoring of standstill window deactivated Value >0: Time in ms during which the control deviation must be in the standstill window Modified settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	CANopen 6068:0$_h$ Modbus 1610
`MON_p_winTout`	Timeout time for standstill window monitoring Value 0: Timeout monitoring deactivated Value >0: Timeout time in ms Standstill window processing values are set via MON_p_win and MON_p_winTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Modified settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	CANopen 3006:26$_h$ Modbus 1612
`MON_SW_Limits`	Activation of software limit switches **0 / None**: Deactivated **1 / SWLIMP**: Activation of software limit switches positive direction **2 / SWLIMN**: Activation of software limit switches negative direction **3 / SWLIMP+SWLIMN**: Activation of software limit switches both directions Software limit switches can only be activated if the zero point is valid. Modified settings become active immediately.	- 0 0 3	UINT16 R/W per. -	CANopen 3006:3$_h$ Modbus 1542
`MON_SWLimMode`	Behavior when position limit is reached **0 / Standstill Behind Position Limit**: Quick Stop is triggered at position limit and standstill is reached behind position limit **1 / Standstill At Position Limit**: Quick Stop is triggered in front of position limit and standstill is reached at position limit Modified settings become active immediately. Available with firmware version ≥V01.04.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:47$_h$ Modbus 1678
`MON_swLimN`	Negative position limit for software limit switch See description 'MON_swLimP'. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p - -2147483648 -	INT32 R/W per. -	CANopen 607D:1$_h$ Modbus 1546
`MON_swLimP`	Positive position limit for software limit switch If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr_p - 2147483647 -	INT32 R/W per. -	CANopen 607D:2$_h$ Modbus 1544

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_tq_win	Torque window, permissible deviation The torque window can only be activated in operating mode Profile Torque. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 3.0 3000.0	UINT16 R/W per. -	CANopen 3006:2D$_h$ Modbus 1626
MON_tq_winTime	Torque window, time Value 0: Torque window monitoring deactivated Changing the value causes a restart of torque monitoring. Torque window is only used in operating mode Profile Torque. Modified settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	CANopen 3006:2E$_h$ Modbus 1628
MON_v_DiffWin	Monitoring of velocity deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. Modified settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	CANopen 3006:1A$_h$ Modbus 1588
MON_v_Threshold	Monitoring of velocity threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime. The status can be output via a parameterizable output. Modified settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	CANopen 3006:1B$_h$ Modbus 1590
MON_v_win	Velocity window, permissible deviation Modified settings become active immediately. * Datatype for CANopen: UINT16	usr_v 1 10 2147483647	UINT32* R/W per. -	CANopen 606D:0$_h$ Modbus 1576
MON_v_winTime	Velocity window, time Value 0: Velocity window monitoring deactivated Changing the value causes a restart of velocity monitoring. Modified settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	CANopen 606E:0$_h$ Modbus 1578
MON_v_zeroclamp	Velocity limit for Zero Clamp A Zero Clamp operation is only possible if the reference velocity is below the Zero Clamp velocity limit. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:28$_h$ Modbus 1616
MON_VelDiff	Maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Maximum value Modified settings become active immediately. Available with firmware version ≥V01.08.	usr_v 0 0 2147483647	UINT32 R/W per. -	CANopen 3006:4B$_h$ Modbus 1686

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_VelDiff_Time	Time window for maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Time window for maximum value Modified settings become active immediately. Available with firmware version ≥V01.08.	ms 0 10 -	UINT16 R/W per. -	CANopen 3006:4C$_h$ Modbus 1688
MSM_AddtlSettings	Additional settings for operating mode Motion Sequence Bit 0 = 0: After Relative Movement After Capture (RMAC), the operating mode Motion Sequence is resumed without a rising edge or a falling edge of the signal input function Start Motion Sequence. Bit 0 = 1: After Relative Movement After Capture (RMAC), the operating mode Motion Sequence is resumed with a rising edge or a falling edge of the signal input function Start Motion Sequence. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 65535	UINT16 R/W per. -	CANopen 302D:21$_h$ Modbus 11586
MSM_CondSequ	Start condition for the start of a sequence via a signal input **0 / Rising Edge**: Rising edge **1 / Falling Edge**: Falling edge **2 / 1-level**: 1 level **3 / 0-level**: 0 level The start condition defines the way the start request is to be processed. This setting is used for the first start after activation of the operating mode. Modified settings become active the next time the motor moves. Available with firmware version ≥V01.08.	- 0 0 3	UINT16 R/W per. -	CANopen 302D:8$_h$ Modbus 11536
MSM_datasetnum	Selection of data set number in data set table Before an entry in the data set table can be read or written, the corresponding data set number must be selected. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 127	UINT16 R/W - -	CANopen 302D:10$_h$ Modbus 11552
MSM_DebDigInNum	Debounce time for data set selection Debounce time for which the signal at the digital input must be stable before the data set is considered to be valid. The debounce time is the value of this parameter multiplied by 250 µs. The value 0 deactivates debouncing. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 32767	UINT16 R/W per. -	CANopen 302D:20$_h$ Modbus 11584
MSM_ds_logopera	Logical operator **0 / None**: None **1 / Logical AND**: Logical AND **2 / Logical OR**: Logical OR Transition condition 1 and transition condition 2 can be logically combined. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 2	UINT16 R/W per. -	CANopen 302D:1A$_h$ Modbus 11572

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSM_ds_setA`	Setting A The value depends on the type of data set as selected with parameter MSM_ds_type: - Move Absolute: Acceleration - Move Relative: Acceleration - Reference Movement: Homing method (except method 35) - Position Setting: Position for Position Setting - Repeat: Loop counter (1 ... 65535) - Move Additive: Acceleration - Move Velocity: Acceleration - Gear: Synchronization method - Write Parameter: Modbus address of the parameter Modified settings become active immediately. Available with firmware version ≥V01.08.	- -2147483648 0 2147483647	INT32 R/W per. -	CANopen 302D:12$_h$ Modbus 11556
`MSM_ds_setB`	Setting B The value depends on the type of data set as selected with parameter MSM_ds_type: - Move Absolute: Velocity - Move Relative: Velocity - Reference Movement: Position at reference point after a successful reference movement - Position Setting: - - Repeat: Number of data set to be executed - Move Additive: Velocity - Move Velocity: Velocity - Write Parameter: Value of the parameter Modified settings become active immediately. Available with firmware version ≥V01.08.	- -2147483648 0 2147483647	INT32 R/W per. -	CANopen 302D:13$_h$ Modbus 11558
`MSM_ds_setC`	Setting C The value depends on the type of data set as selected with parameter MSM_ds_type: - Move Absolute: Absolute position - Move Relative: Relative position - Reference Movement: - - Position Setting: - - Repeat: - - Move Additive: Relative position - Move Velocity: Selection of direction Value 0: Positive Value 1: Negative Value 2: Active direction - Write Parameter: - Modified settings become active immediately. Available with firmware version ≥V01.08.	- -2147483648 0 2147483647	INT32 R/W per. -	CANopen 302D:14$_h$ Modbus 11560

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSM_ds_setD`	Setting D The value depends on the type of data set as selected with parameter MSM_ds_type: - Move Absolute: Decelaration - Move Relative: Decelaration - Reference Movement: - - Position Setting: - - Repeat: - - Move Additive: Decelaration - Move Velocity: Deceleration - Write Parameter: - Modified settings become active immediately. Available with firmware version ≥V01.08.	- -2147483648 0 2147483647	INT32 R/W per. -	CANopen 302D:15$_h$ Modbus 11562
`MSM_ds_sub_ds`	Subsequent data set Number of the next data set to be started. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 127	UINT16 R/W per. -	CANopen 302D:17$_h$ Modbus 11566
`MSM_ds_trancon1`	Transition condition 1 **0 / Continue Without Condition**: Continue without condition **1 / Wait Time**: Wait time **2 / Start Request Edge**: Start request edge **3 / Start Request Level**: Start request level Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 3	UINT16 R/W per. -	CANopen 302D:18$_h$ Modbus 11568
`MSM_ds_trancon2`	Transition condition 2 **0 / Continue Without Condition**: Continue without condition **2 / Start Request Edge**: Start request edge **3 / Start Request Level**: Start request level Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 3	UINT16 R/W per. -	CANopen 302D:1C$_h$ Modbus 11576
`MSM_ds_transiti`	Transition type **0 / No Transition**: No transition **1 / Abort And Go Next**: Abort and go next **2 / Buffer And Start Next**: Buffer and start next **3 / Blending Previous**: Blending previous **4 / Blending Next**: Blending next Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 4	UINT16 R/W per. -	CANopen 302D:16$_h$ Modbus 11564

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSM_ds_tranval1`	Value for transition condition 1 The value depends on the type of data set as selected with parameter MSM_ds_trancon1: - Continue Without Condition: No transition condition value - Waiting Time: Wait time in ms Values: 0 ... 30000 - Start Request Edge: Start request edge Value 0: Rising edge Value 1: Falling edge Value 4: Rising or falling edge - Start Request Level: Start request level Value 2: 1 level Value 3: 0 level Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 30000	INT32 R/W per. -	CANopen 302D:19$_h$ Modbus 11570
`MSM_ds_tranval2`	Value for transition condition 2 The value depends on the type of data set as selected with parameter MSM_ds_trancon2: - Continue Without Condition: No transition condition value - Start Request Edge: Start request edge Value 0: Rising edge Value 1: Falling edge Value 4: Rising or falling edge - Start Request Level: Start request level Value 2: 1 level Value 3: 0 level Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 4	INT32 R/W per. -	CANopen 302D:1D$_h$ Modbus 11578
`MSM_ds_type`	Data set type **0 / None**: None **1 / Move Absolute**: Absolute movement **2 / Move Additive**: Additive movement **3 / Reference Movement**: Reference movement **4 / Position Setting**: Position setting **5 / Repeat**: Repeat **6 / Move Relative**: Relative movement **7 / Move Velocity**: Movement with a defined velocity **9 / Write Parameter**: Write a parameter The values for the selected data set type are specified by means of the parameters MSM_ds_set1 to MSM_ds_set4. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 9	UINT16 R/W per. -	CANopen 302D:11$_h$ Modbus 11554
`MSM_start_ds`	Selection of a data set to be started for operating mode Motion Sequence Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 127	UINT16 R/W - -	CANopen 301B:A$_h$ Modbus 6932

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MSMendNumSequence`	Selection of the data set number after the end of a sequence **0 / DataSetSelect**: Data set is set via the signal input function "Data Set Select" **1 / Automatic**: Data set is set automatically Value 0: After the end of a sequence, the selected data set must be set via the signal input function "Data Set Select". Value 1: After the end of a sequence, the selected data set is set automatically. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W per. -	CANopen 302D:9$_h$ Modbus 11538
`MSMstartSignal`	Response to falling edge at signal input for 'Start Signal Data Set' **0 / No Reaction**: No response **1 / Cancel Movement**: Cancel active movement Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W per. -	CANopen 302D:C$_h$ Modbus 11544
`MT_dismax`	Maximum permissible distance If the reference value is active and the maximum permissible distance is exceeded, an error of error class 1 is detected. The value 0 switches off monitoring. The parameter MT_dismax_usr allows you to enter the value in user-defined units. In increments of 0.1 revolution. Modified settings become active the next time the motor moves.	revolution 0.0 1.0 999.9	UINT16 R/W - -	CANopen 302E:3$_h$ Modbus 11782
`MT_dismax_usr`	Maximum permissible distance If the reference value is active and the maximum permissible distance is exceeded, an error of error class 1 is detected. The value 0 switches off monitoring. The minimum value, the factory setting and the maximum value depend on the scaling factor. Modified settings become active the next time the motor moves.	usr_p 0 16384 2147483647	INT32 R/W - -	CANopen 302E:A$_h$ Modbus 11796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PAR_CTRLreset`	Reset control loop parameters **0 / No**: No **1 / Yes**: Yes Reset of the control loop parameters. The control loop parameters are recalculated on the basis of the motor data of the connected motor. Current and velocity limitations are not reset. Therefore, a user parameter reset is required. The new settings are not saved to the EEPROM. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3004:7$_h$ Modbus 1038
`PAR_ScalingStart`	Recalculation of parameters with user-defined units The parameters with user-defined units can be recalculated with a changed scaling factor. Value 0: Inactive Value 1: Initialize recalculation Value 2: Start recalculation Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen 3004:14$_h$ Modbus 1064
`PAReeprSave`	Save parameter values to the non-volatile memory Value 1: Save persistent parameters The currently set parameters are saved to the non-volatile memory (EEPROM). The saving process is complete when the parameter is read and 0 is returned. Modified settings become active immediately.	- - - -	UINT16 R/W - -	CANopen 3004:1$_h$ Modbus 1026
`PARuserReset`	Reset user parameters **0 / No**: No **65535 / Yes**: Yes Bit 0: Set persistent user and control loop parameters to default values Bit 1: Reset Motion Sequence parameters to default values Bits 2 … 15: Reserved The parameters are reset with the exception of: - Communication parameters - Inversion of direction of movement - Functions of digital inputs and outputs The new settings are not saved to the EEPROM. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 - 65535	UINT16 R/W - -	CANopen 3004:8$_h$ Modbus 1040

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosReg1Mode`	Selection of comparison criterion for position register channel 1 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 1 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 1 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:4_h Modbus 2824
`PosReg1Source`	Selection of source for position register channel 1 **0 / Pact Encoder 1**: Source for position register channel 1 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W per. -	CANopen 300B:6_h Modbus 2828
`PosReg1Start`	Start/stop of position register channel 1 **0 / Off (keep last state)**: Position Register channel 1 is off and status bit keeps last state **1 / On**: Position Register channel 1 is on **2 / Off (set state 0)**: Position Register channel 1 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 1 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:2_h Modbus 2820
`PosReg1ValueA`	Comparison value A for position register channel 1	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:8_h Modbus 2832
`PosReg1ValueB`	Comparison value B for position register channel 1	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:9_h Modbus 2834

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosReg2Mode`	Selection of comparison criterion for position register channel 2 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 2 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 2 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:5$_h$ Modbus 2826
`PosReg2Source`	Selection of source for position register channel 2 **0 / Pact Encoder 1**: Source for position register channel 2 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W per. -	CANopen 300B:7$_h$ Modbus 2830
`PosReg2Start`	Start/stop of position register channel 2 **0 / Off (keep last state)**: Position Register channel 2 is off and status bit keeps last state **1 / On**: Position Register channel 2 is on **2 / Off (set state 0)**: Position Register channel 2 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 2 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:3$_h$ Modbus 2822
`PosReg2ValueA`	Comparison value A for position register channel 2	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:A$_h$ Modbus 2836
`PosReg2ValueB`	Comparison value B for position register channel 2	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:B$_h$ Modbus 2838

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg3Mode	Selection of comparison criterion for position register channel 3 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 3 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 3 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:E_h Modbus 2844
PosReg3Source	Selection of source for position register channel 3 **0 / Pact Encoder 1**: Source for position register channel 3 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W per. -	CANopen 300B:10_h Modbus 2848
PosReg3Start	Start/stop of position register channel 3 **0 / Off (keep last state)**: Position Register channel 3 is off and status bit keeps last state **1 / On**: Position Register channel 3 is on **2 / Off (set state 0)**: Position Register channel 3 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 3 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:C_h Modbus 2840
PosReg3ValueA	Comparison value A for position register channel 3	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:12_h Modbus 2852
PosReg3ValueB	Comparison value B for position register channel 3	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:13_h Modbus 2854

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosReg4Mode`	Selection of comparison criterion for position register channel 4 **0 / Pact greater equal A**: Actual position is greater than or equal to comparison value A for position register channel 4 **1 / Pact less equal A**: Actual position is less than or equal to comparison value A for position register channel 4 **2 / Pact in [A-B] (basic)**: Actual position is in the range A-B including limits (basic) **3 / Pact out [A-B] (basic)**: Actual position is out of the range A-B excluding limits (basic) **4 / Pact in [A-B] (extended)**: Actual position is in the range A-B including limits (extended) **5 / Pact out [A-B] (extended)**: Actual position is out of the range A-B excluding limits (extended) Modified settings become active immediately.	- 0 0 5	UINT16 R/W per. -	CANopen 300B:F$_h$ Modbus 2846
`PosReg4Source`	Selection of source for position register channel 4 **0 / Pact Encoder 1**: Source for position register channel 4 is Pact of encoder 1 Modified settings become active immediately.	- 0 0 0	UINT16 R/W per. -	CANopen 300B:11$_h$ Modbus 2850
`PosReg4Start`	Start/stop of position register channel 4 **0 / Off (keep last state)**: Position Register channel 4 is off and status bit keeps last state **1 / On**: Position Register channel 4 is on **2 / Off (set state 0)**: Position Register channel 4 is off and status bit is set to 0 **3 / Off (set state 1)**: Position Register channel 4 is off and status bit is set to 1 Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 300B:D$_h$ Modbus 2842
`PosReg4ValueA`	Comparison value A for position register channel 4	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:14$_h$ Modbus 2856
`PosReg4ValueB`	Comparison value B for position register channel 4	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:15$_h$ Modbus 2858

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PosRegGroupStart`	Start/stop of position register channels **0 / No Channel**: No channel activated **1 / Channel 1**: Channel 1 activated **2 / Channel 2**: Channel 2 activated **3 / Channel 1 & 2**: Channels 1 and 2 activated **4 / Channel 3**: Channel 3 activated **5 / Channel 1 & 3**: Channels 1 and 3 activated **6 / Channel 2 & 3**: Channels 2 and 3 activated **7 / Channel 1 & 2 & 3**: Channels 1, 2 and 3 activated **8 / Channel 4**: Channel 4 activated **9 / Channel 1 & 4**: Channels 1 and 4 activated **10 / Channel 2 & 4**: Channels 2 and 4 activated **11 / Channel 1 & 2 & 4**: Channels 1, 2 and 4 activated **12 / Channel 3 & 4**: Channels 3 and 4 activated **13 / Channel 1 & 3 & 4**: Channels 1, 3 and 4 activated **14 / Channel 2 & 3 & 4**: Channels 2, 3 and 4 activated **15 / Channel 1 & 2 & 3 & 4**: Channels 1, 2, 3 and 4 activated Modified settings become active immediately.	- 0 0 15	UINT16 R/W per. -	CANopen 300B:16$_h$ Modbus 2860
`PP_ModeRangeLim`	Absolute movement beyond movement range **0 / NoAbsMoveAllowed**: Absolute movement beyond movement range is not possible **1 / AbsMoveAllowed**: Absolute movement beyond movement range is possible Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	CANopen 3023:7$_h$ Modbus 8974
`PP_OpmChgType`	Change to operating mode Profile Position during movements **0 / WithStandStill**: Change with standstill **1 / OnTheFly**: Change without standstill Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	CANopen 3023:9$_h$ Modbus 8978
`PPoption`	Options for operating mode Profile Position Determines the reference position for relative positioning: 0: Relative with reference to the previous target position of the profile generator 1: Not supported 2: Relative with reference to the actual position of the motor Modified settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	CANopen 60F2:0$_h$ Modbus 6960

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PPp_target	Target position for operating mode Profile Position Minimum/maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Modified settings become active immediately.	usr_p - - -	INT32 R/W - -	CANopen 607A:0$_h$ Modbus 6940
PPv_target	Target velocity for operating mode Profile Position The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 1 60 4294967295	UINT32 R/W - -	CANopen 6081:0$_h$ Modbus 6942
PTtq_target	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %. Modified settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	CANopen 6071:0$_h$ Modbus 6944
PVv_target	Target velocity for operating mode Profile Velocity The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Modified settings become active immediately.	usr_v - 0 -	INT32 R/W - -	CANopen 60FF:0$_h$ Modbus 6938
RAMP_tq_enable	Activation of the motion profile for torque **0 / Profile Off**: Profile off **1 / Profile On**: Profile on In the operating mode Profile Torque, the motion profile for torque can be activated or deactivated. In the other operating modes, the motion profile for torque is inactive. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:2C$_h$ Modbus 1624
RAMP_tq_slope	Slope setting of the motion profile for torque 100.00 % of the torque setting correspond to the continuous stall torque _M_M_0. Example: A ramp setting of 10000.00 %/s results in a torque change of 100.0% of _M_M_0 in 0.01s. In increments of 0.1 %/s. Modified settings become active immediately.	%/s 0.1 10000.0 3000000.0	UINT32 R/W per. -	CANopen 6087:0$_h$ Modbus 1620
RAMP_v_acc	Acceleration of the motion profile for velocity Writing the value 0 has no effect on the parameter. Modified settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	CANopen 6083:0$_h$ Modbus 1556

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_dec	Deceleration of the motion profile for velocity The minimum value depends on the operating mode: Operating modes with minimum value 1: Profile Velocity Motion Sequence (Move Velocity) Operating modes with minimum value 120: Jog Profile Position Homing Motion Sequence (Move Absolute, Move Additive, Move Relative and Reference Movement) Writing the value 0 has no effect on the parameter. Modified settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	CANopen 6084:0$_h$ Modbus 1558
RAMP_v_enable	Activation of the motion profile for velocity **0 / Profile Off**: Profile off **1 / Profile On**: Profile on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:2B$_h$ Modbus 1622
RAMP_v_jerk	Jerk limitation of the motion profile for velocity **0 / Off**: Off **1 / 1**: 1 ms **2 / 2**: 2 ms **4 / 4**: 4 ms **8 / 8**: 8 ms **16 / 16**: 16 ms **32 / 32**: 32 ms **64 / 64**: 64 ms **128 / 128**: 128 ms Adjustments can only be made if the operating mode is inactive (x_end=1). Modified settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	CANopen 3006:D$_h$ Modbus 1562
RAMP_v_max	Maximum velocity of the motion profile for velocity If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMP_v_max. This way, commissioning at limited velocity is easier to perform. Setting can only be modified if power stage is disabled. Modified settings become active the next time the motor moves.	usr_v 1 13200 2147483647	UINT32 R/W per. -	CANopen 607F:0$_h$ Modbus 1554

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_sym	Acceleration and deceleration of the motion profile for velocity The values are internally multiplied by 10 (example: 1 = 10 min-1/s). Write access changes the values of RAMP_v_acc and RAMP_v_dec. The limit values are verified on the basis of the values indicated for these parameters. Read access returns the greater value from RAMP_v_acc/RAMP_v_dec. If the value cannot be represented as a 16 bit value, the value is set to 65535 (maximum UINT16 value) Modified settings become active the next time the motor moves.	- - - -	UINT16 R/W - -	CANopen 3006:1$_h$ Modbus 1538
RAMPaccdec	Acceleration and deceleration for the Drive Profile Lexium High word: Acceleration Low word: Deceleration The values are internally multiplied by 10 (example: 1 = 10 min-1/s). Write access changes the values of RAMP_v_acc and RAMP_v_dec. The limit values are verified on the basis of the values indicated for these parameters. If the value cannot be represented as a 16 bit value, the value is set to 65535 (maximum UINT16 value). Modified settings become active the next time the motor moves.	- - - -	UINT32 R/W - -	CANopen 3006:2$_h$ Modbus 1540
RAMPquickstop	Deceleration ramp for Quick Stop Deceleration ramp for a software stop or an error with error class 1 or 2. Modified settings become active the next time the motor moves.	usr_a 1 6000 2147483647	UINT32 R/W per. -	CANopen 3006:12$_h$ Modbus 1572
RESext_P	Nominal power of external braking resistor Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	W 1 10 32767	UINT16 R/W per. -	CANopen 3005:12$_h$ Modbus 1316
RESext_R	Resistance value of external braking resistor The minimum value depends on the power stage. In increments of 0.01 Ω. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	Ω 0.00 100.00 327.67	UINT16 R/W per. -	CANopen 3005:13$_h$ Modbus 1318
RESext_ton	Maximum permissible switch-on time of external braking resistor Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	ms 1 1 30000	UINT16 R/W per. -	CANopen 3005:11$_h$ Modbus 1314

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RESint_ext	Selection of type of braking resistor **0 / Standard Braking Resistor**: Standard braking resistor **1 / External Braking Resistor**: External braking resistor **2 / Reserved**: Reserved Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	CANopen 3005:9$_h$ Modbus 1298
ResWriComNotOpEn	Response to write command (operating state is not Operation Enabled) **0 / Emergency Message**: An Emergency message is sent **1 / Error class 0**: An error with error class 0 is sent This parameter specifies the response of the drive to a write command that cannot be executed because the operating state is not Operation Enabled. Modified settings become active immediately. Available with firmware version ≥V01.08.	- 0 0 1	UINT16 R/W per. -	CANopen 3006:49$_h$ Modbus 1682
RMAC_Activate	Activation of relative movement after capture **0 / Off**: Off **1 / On**: On Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3023:C$_h$ Modbus 8984
RMAC_Edge	Edge of capture signal for relative movement after capture **0 / Falling edge**: Falling edge **1 / Rising edge**: Rising edge	- 0 0 1	UINT16 R/W per. -	CANopen 3023:10$_h$ Modbus 8992
RMAC_Position	Target position of relative movement after capture Minimum/maximum values depend on: - Scaling factor Modified settings become active the next time the motor moves.	usr_p - 0 -	INT32 R/W per. -	CANopen 3023:D$_h$ Modbus 8986
RMAC_Response	Response if target position is overtraveld **0 / Error Class 1**: Error class 1 **1 / No Movement To Target Position**: No movement to target position **2 / Movement To Target Position**: Movement to target position Modified settings become active immediately.	- 0 0 2	UINT16 R/W per. -	CANopen 3023:F$_h$ Modbus 8990
RMAC_Velocity	Velocity of relative movement after capture Value 0: Use actual motor velocity Value >0: Value is the target velocity The adjustable value is internally limited to the setting in RAMP_v_max. Modified settings become active the next time the motor moves.	usr_v 0 0 2147483647	UINT32 R/W per. -	CANopen 3023:E$_h$ Modbus 8988
ScalePOSdenom	Position scaling: Denominator Refer to numerator (ScalePOSnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_p 1 16384 2147483647	INT32 R/W per. -	CANopen 3006:7$_h$ Modbus 1550

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ScalePOSnum	Position scaling: Numerator Specification of the scaling factor: Motor revolutions -- User-defined units [usr_p] A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	CANopen $3006:8_h$ Modbus 1552
ScaleRAMPdenom	Ramp scaling: Denominator See numerator (ScaleRAMPnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_a 1 1 2147483647	INT32 R/W per. -	CANopen $3006:30_h$ Modbus 1632
ScaleRAMPnum	Ramp scaling: Numerator Setting can only be modified if power stage is disabled. Modified settings become active immediately.	rpm/s 1 1 2147483647	INT32 R/W per. -	CANopen $3006:31_h$ Modbus 1634
ScaleVELdenom	Velocity scaling: Denominator See numerator (ScaleVELnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled.	usr_v 1 1 2147483647	INT32 R/W per. -	CANopen $3006:21_h$ Modbus 1602
ScaleVELnum	Velocity scaling: Numerator Specification of the scaling factor: Speed of rotation of motor [min-1] -- User-defined units [usr_v] A new scaling is activated when the numerator value is supplied. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	rpm 1 1 2147483647	INT32 R/W per. -	CANopen $3006:22_h$ Modbus 1604
ShiftEncWorkRang	Shifting of the encoder working range **0 / Off**: Shifting off **1 / On**: Shifting on After activating the shifting function, the position range of a multiturn encoder is shifted by one half of the range. Example for the position range of a multiturn encoder with 4096 revolutions: Value 0: Position values are between 0 … 4096 revolutions. Value 1: Position values are between -2048 … 2048 revolutions. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	CANopen $3005:21_h$ Modbus 1346

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`SimAbsolutePos`	Simulation of absolute position at power cycling **0 / Simulation Off**: Do not use the last mechanical position after power cycling **1 / Simulation On**: Use last mechanical position after power cycling This parameter specifies the way position values are handled over a power cycle and allows for the simulation of an absolute position encoder using singleturn encoders. If this function is activated, the drive saves the pertinent position data prior to a power removal so that the drive can restore the mechanical position the next time it is powered on. In the case of singleturn encoders, the position can be restored if the motor shaft has not been moved by more than 0.25 revolutions while the drive was powered off. In the case of multiturn encoders, the permissible shaft movement while the drive is off can be much greater, depending on the type of multiturn encoder. For this function to work, the drive may only be powered off while the motor is at a standstill and the motor shaft must not be moved outside of the permissible range (for example, use a holding brake). Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen $3005:23_h$ Modbus 1350
`SyncMechStart`	Activation of synchronization mechanism Value 0: Deactivate synchronization mechanism Value 1: Activate synchronization mechanism (CANmotion). Value 2: Activate synchronization mechanism, standard CANopen mechanism. The cycle time of the synchronization signal is derived from the parameters intTimPerVal and intTimInd. Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	CANopen $3022:5_h$ Modbus 8714
`SyncMechStatus`	Status of synchronization mechanism Status of synchronization mechanism: Value 1: Synchronization mechanism of drive is inactive. Value 32: Drive is synchronizing with external sync signal. Value 64: Drive is synchronized with external sync signal.	- - - -	UINT16 R/- - -	CANopen $3022:6_h$ Modbus 8716
`SyncMechTol`	Synchronization tolerance The value is applied when the synchronization mechanism is activated via the parameter SyncMechStart. Modified settings become active immediately.	- 1 1 20	UINT16 R/W - -	CANopen $3022:4_h$ Modbus 8712

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
TouchProbeFct	Touch Probe function Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/W - -	CANopen 60B8:0$_h$ Modbus 7028
UsrAppDataMem1	User-specific data 1 This parameter can be used to store user-specific data. Modified settings become active immediately. Available with firmware version ≥V01.06.	- - - -	UINT32 R/W per. -	CANopen 3001:43$_h$ Modbus 390
UsrAppDataMem2	User-specific data 2 This parameter can be used to store user-specific data. Modified settings become active immediately. Available with firmware version ≥V01.06.	- - 0 -	UINT32 R/W per. -	CANopen 3001:44$_h$ Modbus 392

Chapter 12
Object Dictionary

What Is in This Chapter?

This chapter contains the following topics:

Specifications for the Objects

Index

The index specifies the position of the object in the object dictionary. The index value is specified as a hexadecimal value.

Object Code

The object code specifies the data structure of the object.

Object code	Meaning	Coding
VAR	A simple value, for example of the type Integer8, Unsigned32 or Visible String8.	7
ARR (ARRAY)	A data field in which the entries have the same data type.	8
REC (RECORD)	A data field that contains entries that are a combination of simple data types.	9

Data type	Value range	Data length	DS301 coding
Boolean	0 = false, 1 = true	1 byte	0001
Integer8	-128 ... +127	1 byte	0002
Integer16	-32768 ... +32767	2 byte	0003
Integer32	-2147483648 ... 2147483647	4 byte	0004
Unsigned8	0 ... 255	1 byte	0005
Unsigned16	0 ... 65535	2 byte	0006
Unsigned32	0 ... 4294967295	4 byte	0007
Visible String8	ASCII characters	8 byte	0009
Visible String16	ASCII characters	16 byte	0010

RO/RW

Indicates read and/or write values

RO: values can only be read

RW: values can be read and written.

PDO

R_PDO: Mapping for R_PDO possible

T_PDO: Mapping for T_PDO possible

No specification: PDO mapping not possible with the object

Factory Setting

Settings when the product is shipped.

Persistent

"per." indicates whether the value of the parameter is persistent, i.e. whether it remains in the memory after the device is powered off.

Overview of object group 1000_h

Overview

Index	Subindex	Name	Object code	Data type	Access	Description
1000_h		Device type	VAR	Unsigned32	RO	Device type and profile
1001_h		Error register	VAR	Unsigned8	RO	Error register
1003_h		Predefined error field	ARR		RW	Error history, memory for error messages
1003_h	00_h	Number of errors	VAR	Unsigned8	RW	Number of error entries
1003_h	01_h	Error field	VAR	Unsigned32	RO	Error number
1005_h		COB-ID SYNC	VAR	Unsigned32	RW	Identifier of the synchronization object
1008_h		Manufacturer device name	VAR	Visible String8	RO	Manufacturer's designation
1009_h		Manufacturer hardware version	VAR	Visible String8	RO	Hardware version
$100A_h$		Manufacturer software version	VAR	Visible String8	RO	Software version
$100C_h$		Guard time	VAR	Unsigned16	RW	Time span for Node Guarding [ms]
$100D_h$		Life time factor	VAR	Unsigned8	RW	Repeat factor for the Node Guarding protocol
1014_h		COB-ID EMCY	VAR	Unsigned32	RW	Unsigned16
1015_h		Inhibit time EMCY	VAR	Unsigned16	RW	Unsigned16
1016_h		Consumer Heartbeat Time	ARR	Unsigned32	RW	Unsigned16
1016_h	01_h	Consumer Heartbeat Time	VAR	Unsigned32	RW	Time interval and node ID of the "Heartbeat" recipient
1017_h		Producer Heartbeat Time	VAR	Unsigned16	RW	Time interval for producer "Heartbeat"
1018_h		Identity Object	REC	Identity	RO	Identification object:
1018_h	01_h	Vendor ID	VAR	Unsigned32	RO	Vendor ID
1018_h	02_h	Product code	VAR	Unsigned32	RO	Product code
1018_h	03_h	Revision number	VAR	Unsigned32	RO	Revision number
1029_h		Number of elements	ARR	Unsigned8	RO	Number of values for the object
1029_h	01_h	Communication error	ARR	Unsigned8	RW	Communication error
1200_h		1st server SDO parameter	REC	SDO server param.	RO	First server SDO, settings
1200_h	01_h	COB-ID Client -> Server	VAR	Unsigned32	RO	Identifier client -> server
1200_h	02_h	COB-ID Server -> Client	VAR	Unsigned32	RO	Identifier server -> client
1201_h		2nd server SDO parameter	REC	SDO server param.	RW	Second server SDO, settings
1201_h	01_h	COB-ID Client -> Server	VAR	Unsigned32	RW	Identifier client -> server
1201_h	02_h	COB-ID Server -> Client	VAR	Unsigned32	RW	Identifier server -> client
1201_h	03_h	Node-ID SDO Client	VAR	Unsigned32	RW	Node ID SDO client
1400_h		1st receive PDO parameter	REC	PDO comm. param.	RW	First receive PDO (R_PDO1), settings
1400_h	01_h	COB-ID R_PDO1	VAR	Unsigned32	RW	Identifier of the R_PDO1
1400_h	02_h	Transmission type R_PDO1	VAR	Unsigned8	RW	Transmission type

Index	Subindex	Name	Object code	Data type	Access	Description
1401_h		2nd receive PDO parameter	REC	PDO comm. param.	RW	Second receive PDO (R_PDO2), settings
1401_h	01_h	COB-ID R_PDO2	VAR	Unsigned32	RW	Identifier of the R_PDO2
1401_h	02_h	Transmission type R_PDO2	VAR	Unsigned8	RW	Transmission type
1402_h		3rd receive PDO parameter	REC	PDO comm. param.	RW	Third receive PDO (R_PDO3), settings
1402_h	01_h	COB-ID R_PDO3	VAR	Unsigned32	RW	Identifier of the R_PDO3
1402_h	02_h	Transmission type R_PDO3	VAR	Unsigned8	RW	Transmission type
1403_h		4th receive PDO parameter	REC	PDO comm. param.	RW	Fourth receive PDO (R_PDO4), settings
1403_h	01_h	COB-ID R_PDO4	VAR	Unsigned32	RW	Identifier of the R_PDO4
1403_h	02_h	Transmission type R_PDO4	VAR	Unsigned8	RW	Transmission type
1600_h		1st receive PDO mapping	REC	PDO mapping	RO	PDO mapping for R_PDO1, settings
1600_h	01_h	1st mapped object R_PDO1	VAR	Unsigned32	RO	First object for the mapping in R_PDO1
1601_h		2nd receive PDO mapping	REC	PDO mapping	RO	PDO mapping for R_PDO2, settings
1601_h	01_h	1st mapped object R_PDO2	VAR	Unsigned32	RO	First object for the mapping in R_PDO2
1601_h	02_h	2nd mapped object R_PDO2	VAR	Unsigned32	RO	Second object for the mapping in R_PDO2
1602_h		3rd receive PDO mapping	REC	PDO mapping	RO	PDO mapping for R_PDO3, settings
1602_h	01_h	1st mapped object R_PDO3	VAR	Unsigned32	RO	First object for the mapping in R_PDO3
1602_h	02_h	2nd mapped object R_PDO3	VAR	Unsigned32	RO	Second object for the mapping in R_PDO3
1603_h		4th receive PDO mapping	REC	PDO mapping	RW	PDO mapping for R_PDO3, settings
1603_h	01_h	1st mapped object R_PDO4	VAR	Unsigned32	RW	First object for the mapping in R_PDO4
1603_h	02_h	2nd mapped object R_PDO4	VAR	Unsigned32	RW	Second object for the mapping in R_PDO4
1603_h	03_h	3rd mapped object R_PDO4	VAR	Unsigned32	RW	Third object for mapping in R_PDO4
1800_h		1st transmit PDO parameter	REC	PDO comm. param.	RW	First transmit PDO (T_PDO1), settings
1800_h	01_h	COB-ID T_PDO1	VAR	Unsigned32	RW	Identifier of the T_PDO1
1800_h	02_h	Transmission type T_PDO1	VAR	Unsigned8	RW	Transmission type
1800_h	03_h	Inhibit time T_PDO1	VAR	Unsigned16	RW	Inhibit time for locking bus access (1=100μs)
1800_h	04_h	Reserved T_PDO1	VAR	Unsigned8	RW	Priority for CAN bus arbitration ([0-7]).
1800_h	05_h	Event timer T_PDO1	VAR	Unsigned16	RW	Time span for event triggering (1=1 ms)
1801_h		2nd transmit PDO parameter	REC	PDO comm. param.	RW	Second transmit PDO (T_PDO2), settings
1801_h	01_h	COB-ID T_PDO2	VAR	Unsigned32	RW	Identifier of the T_PDO2
1801_h	02_h	Transmission type T_PDO2	VAR	Unsigned8	RW	Transmission type
1801_h	03_h	Inhibit time T_PDO2	VAR	Unsigned16	RW	Inhibit time for locking bus access (1=100μs)

Index	Subindex	Name	Object code	Data type	Access	Description
1801_h	04_h	Reserved T_PDO2	VAR	Unsigned8	RW	Reserved
1801_h	05_h	Event timer T_PDO2	VAR	Unsigned16	RW	Time span for event triggering (1=1 ms)
1802_h		3rd transmit PDO parameter	REC	PDO comm. param.	RW	Third transmit PDO (T_PDO3), settings
1802_h	01_h	COB-ID T_PDO3	VAR	Unsigned32	RW	Identifier of the T_PDO3
1802_h	02_h	Transmission type T_PDO3	VAR	Unsigned8	RW	Transmission type
1802_h	03_h	Inhibit time T_PDO3	VAR	Unsigned16	RW	Inhibit time for locking bus access (1=100µs)
1802_h	04_h	Reserved T_PDO3	VAR	Unsigned8	RW	Reserved
1802_h	05_h	Event timer T_PDO3	VAR	Unsigned16	RW	Time span for event triggering (1=1 ms)
1803_h		4th transmit PDO parameter	REC	PDO comm. param.	RW	Fourth transmit PDO (T_PDO4), settings
1803_h	01_h	COB-ID T_PDO4	VAR	Unsigned32	RW	Identifier of the T_PDO4
1803_h	02_h	Transmission type T_PDO4	VAR	Unsigned8	RW	Transmission type
1803_h	03_h	Inhibit time T_PDO4	VAR	Unsigned16	RW	Inhibit time for locking bus access (1=100µs)
1803_h	04_h	Reserved T_PDO4	VAR	Unsigned8	RO	Reserved
1803_h	05_h	Event timer T_PDO4	VAR	Unsigned16	RW	Time span for event triggering (1=1 ms)
$1A00_h$		1st transmit PDO mapping	REC	PDO mapping	RW	PDO mapping for T_PDO1, settings
$1A00_h$	01_h	1st mapped object T_PDO1	VAR	Unsigned32	RO	First object for the mapping in T_PDO1
$1A01_h$		2nd transmit PDO mapping	REC	PDO mapping	RW	PDO mapping for T_PDO2, settings
$1A01_h$	01_h	1st mapped object T_PDO2	VAR	Unsigned32	RO	First object for the mapping in T_PDO2
$1A01_h$	02_h	2nd mapped object T_PDO2	VAR	Unsigned32	RO	Second object for the mapping in T_PDO2
$1A02_h$		3rd transmit PDO mapping	REC	PDO mapping	RW	PDO mapping for T_PDO3, settings
$1A02_h$	01_h	1st mapped object T_PDO3	VAR	Unsigned32	RO	First object for the mapping in T_PDO3
$1A02_h$	02_h	2nd mapped object T_PDO3	VAR	Unsigned32	RO	Second object for the mapping in T_PDO3
$1A03_h$		4th transmit PDO mapping	REC	PDO mapping	RW	PDO mapping for T_PDO4, settings
$1A03_h$	01_h	1st mapped object T_PDO4	VAR	Unsigned32	RW	First object for the mapping in T_PDO4
$1A03_h$	02_h	2nd mapped object T_PDO4	VAR	Unsigned32	RW	Second object for the mapping in T_PDO4
$1A03_h$	03_h	3rd mapped object T_PDO4	VAR	Unsigned32	RW	Third object for the mapping in T_PDO4
$1A03_h$	04_h	4th mapped object T_PDO4	VAR	Unsigned32	RW	Fourth object for the mapping in T_PDO4

Assignment Object Group 3000_h

Overview

The product provides corresponding parameters for the CANopen object group 3000_h.

Address	Object	PDO	Data type	Parameter name
$3001:1_h$	Firmware number of device	-	UINT32	_prgNoDEV
$3001:2_h$	Firmware version of device	-	UINT16	_prgVerDEV
$3001:4_h$	Firmware revision of device	-	UINT16	_prgRevDEV
$3001:C_h$	Access channel information	T_PDO	UINT16	_AccessInfo
$3001:E_h$	Locking other access channels	-	UINT16	AccessLock
$3001:33_h$	Firmware number of update loader	-	UINT32	_prgNoLOD
$3001:34_h$	Firmware version of update loader	-	UINT16	_prgVerLOD
$3001:36_h$	Firmware revision of update loader	-	UINT16	_prgRevLOD
$3001:43_h$	User-specific data 1	-	UINT32	UsrAppDataMem1
$3001:44_h$	User-specific data 2	-	UINT32	UsrAppDataMem2
$3002:12_h$	Hardware version of control board	T_PDO	UINT16	_hwVersCPU
$3002:14_h$	Hardware version of power stage	T_PDO	UINT16	_hwVersPS
$3002:2D_h$	Settings of the DIP switches	-	UINT16	_DipSwitches
$3004:1_h$	Save parameter values to the non-volatile memory	-	UINT16	PAReeprSave
$3004:2_h$	Restore factory settings (default values)	-	UINT16	PARfactorySet
$3004:7_h$	Reset control loop parameters	-	UINT16	PAR_CTRLreset
$3004:8_h$	Reset user parameters	-	UINT16	PARuserReset
$3004:14_h$	Recalculation of parameters with user-defined units	-	UINT16	PAR_ScalingStart
$3004:15_h$	Status of recalculation of the parameters with user-defined units	T_PDO	UINT16	_PAR_ScalingState
$3004:16_h$	Additional information on error detected during recalculation	T_PDO	UINT32	_PAR_ScalingError
$3004:1D_h$	Configuration modification monitoring	-	UINT16	MON_ConfModification
$3005:1_h$	Control mode	-	UINT16	DEVcmdinterf
$3005:3_h$	Operating mode	-	UINT16	IOdefaultMode
$3005:4_h$	Enabling the power stage as set via IO_AutoEnable even after error	-	UINT16	IO_AutoEnaConfig
$3005:5_h$	Commutation monitoring	-	UINT16	MON_commutat
$3005:6_h$	Enabling the power stage at PowerOn	-	UINT16	IO_AutoEnable
$3005:7_h$	Additional time delay for releasing the holding brake	-	INT16	BRK_AddT_release
$3005:8_h$	Additional time delay for applying the holding brake	-	INT16	BRK_AddT_apply
$3005:9_h$	Selection of type of braking resistor	-	UINT16	RESint_ext
$3005:A_h$	Error response to missing mains phase	-	UINT16	ErrorResp_Flt_AC
$3005:B_h$	Error response to excessively high load-dependent position deviation	-	UINT16	ErrorResp_p_dif
$3005:F_h$	Detection and monitoring of mains phases	-	UINT16	MON_MainsVolt
$3005:10_h$	Ground fault monitoring	-	UINT16	MON_GroundFault
$3005:11_h$	Maximum permissible switch-on time of external braking resistor	-	UINT16	RESext_ton
$3005:12_h$	Nominal power of external braking resistor	-	UINT16	RESext_P
$3005:13_h$	Resistance value of external braking resistor	-	UINT16	RESext_R
$3005:16_h$	Adjustment of absolute position of encoder 1	-	INT32	ENC1_adjustment
$3005:18_h$	Selection of jog method	-	UINT16	IO_JOGmethod
$3005:21_h$	Shifting of the encoder working range	-	UINT16	ShiftEncWorkRang
$3005:22_h$	Error response to 100% I2t braking resistor	-	UINT16	ErrorResp_I2tRES

Address	Object	PDO	Data type	Parameter name
3005:23$_h$	Simulation of absolute position at power cycling	-	UINT16	SimAbsolutePos
3005:34$_h$	Additional 'Fault Reset' for the signal input function 'Enable'	-	UINT16	IO_FaultResOnEnaInp
3005:3A$_h$	Error response to detected error with quasi absolute position	-	UINT16	ErrorResp_QuasiAbs
3005:3C$_h$	Error response to excessively high load-dependent velocity deviation	-	UINT16	ErrorResp_v_dif
3006:1$_h$	Acceleration and deceleration of the motion profile for velocity	R_PDO	UINT16	RAMP_v_sym
3006:2$_h$	Acceleration and deceleration for the Drive Profile Lexium	-	UINT32	RAMPaccdec
3006:3$_h$	Activation of software limit switches	-	UINT16	MON_SW_Limits
3006:6$_h$	Response to active limit switch during enabling of power stage	-	UINT16	IOsigRespOfPS
3006:7$_h$	Position scaling: Denominator	-	INT32	ScalePOSdenom
3006:8$_h$	Position scaling: Numerator	-	INT32	ScalePOSnum
3006:C$_h$	Inversion of direction of movement	-	UINT16	InvertDirOfMove
3006:D$_h$	Jerk limitation of the motion profile for velocity	-	UINT16	RAMP_v_jerk
3006:E$_h$	Signal evaluation for reference switch	-	UINT16	IOsigREF
3006:F$_h$	Signal evaluation for negative limit switch	-	UINT16	IOsigLIMN
3006:10$_h$	Signal evaluation for positive limit switch	-	UINT16	IOsigLIMP
3006:12$_h$	Deceleration ramp for Quick Stop	-	UINT32	RAMPquickstop
3006:16$_h$	Absolute positioning only after homing	-	UINT16	AbsHomeRequest
3006:18$_h$	Quick Stop option code	-	INT16	LIM_QStopReact
3006:19$_h$	Monitoring of position deviation	-	UINT16	MON_p_DiffWin
3006:1A$_h$	Monitoring of velocity deviation	-	UINT32	MON_v_DiffWin
3006:1B$_h$	Monitoring of velocity threshold	R_PDO	UINT32	MON_v_Threshold
3006:1C$_h$	Monitoring of current threshold	R_PDO	UINT16	MON_I_Threshold
3006:1D$_h$	Monitoring of time window	-	UINT16	MON_ChkTime
3006:1E$_h$	Velocity limitation via input	-	UINT32	IO_v_limit
3006:21$_h$	Velocity scaling: Denominator	-	INT32	ScaleVELdenom
3006:22$_h$	Velocity scaling: Numerator	-	INT32	ScaleVELnum
3006:26$_h$	Timeout time for standstill window monitoring	-	UINT16	MON_p_winTout
3006:27$_h$	Current limitation via input	-	UINT16	IO_I_limit
3006:28$_h$	Velocity limit for Zero Clamp	-	UINT32	MON_v_zeroclamp
3006:29$_h$	Maximum load-dependent position deviation (error class 0)	-	UINT16	MON_p_dif_warn
3006:2B$_h$	Activation of the motion profile for velocity	-	UINT16	RAMP_v_enable
3006:2C$_h$	Activation of the motion profile for torque	-	UINT16	RAMP_tq_enable
3006:2D$_h$	Torque window, permissible deviation	-	UINT16	MON_tq_win
3006:2E$_h$	Torque window, time	-	UINT16	MON_tq_winTime
3006:30$_h$	Ramp scaling: Denominator	-	INT32	ScaleRAMPdenom
3006:31$_h$	Ramp scaling: Numerator	-	INT32	ScaleRAMPnum
3006:38$_h$	Activation of Modulo function	-	UINT16	MOD_Enable
3006:39$_h$	Minimum position of modulo range	-	INT32	MOD_Min
3006:3A$_h$	Maximum position of modulo range	-	INT32	MOD_Max
3006:3B$_h$	Direction of absolute movement with Modulo	-	UINT16	MOD_AbsDirection
3006:3C$_h$	Multiple ranges for absolute movement with Modulo	-	UINT16	MOD_AbsMultiRng
3006:3E$_h$	Maximum load-dependent position deviation	-	INT32	MON_p_dif_load_usr
3006:3F$_h$	Monitoring of position deviation	-	INT32	MON_p_DiffWin_usr
3006:40$_h$	Standstill window, permissible control deviation	-	INT32	MON_p_win_usr
3006:41$_h$	Processing mode of backlash compensation	-	UINT16	BLSH_Mode

Address	Object	PDO	Data type	Parameter name
3006:42$_h$	Position value for backlash compensation	-	INT32	BLSH_Position
3006:44$_h$	Processing time for backlash compensation	-	UINT16	BLSH_Time
3006:47$_h$	Behavior when position limit is reached	-	UINT16	MON_SWLimMode
3006:49$_h$	Response to write command (operating state is not Operation Enabled)	-	UINT16	ResWriComNotOpEn
3006:4B$_h$	Maximum load-dependent velocity deviation	-	UINT32	MON_VelDiff
3006:4C$_h$	Time window for maximum load-dependent velocity deviation	-	UINT16	MON_VelDiff_Time
3007:1$_h$	Function Input DI0	-	UINT16	IOfunct_DI0
3007:2$_h$	Function Input DI1	-	UINT16	IOfunct_DI1
3007:3$_h$	Function Input DI2	-	UINT16	IOfunct_DI2
3007:4$_h$	Function Input DI3	-	UINT16	IOfunct_DI3
3007:9$_h$	Function Output DQ0	-	UINT16	IOfunct_DQ0
3007:A$_h$	Function Output DQ1	-	UINT16	IOfunct_DQ1
3008:1$_h$	Physical status of the digital inputs and outputs	T_PDO	UINT16	_IO_act
3008:A$_h$	Manual operation of the holding brake	-	UINT16	BRK_release
3008:F$_h$	Status of digital inputs	T_PDO	UINT16	_IO_DI_act
3008:10$_h$	Status of digital outputs	T_PDO	UINT16	_IO_DQ_act
3008:11$_h$	Setting the digital outputs directly	R_PDO	UINT16	IO_DQ_set
3008:20$_h$	Debounce time of DI0	-	UINT16	DI_0_Debounce
3008:21$_h$	Debounce time of DI1	-	UINT16	DI_1_Debounce
3008:22$_h$	Debounce time of DI2	-	UINT16	DI_2_Debounce
3008:23$_h$	Debounce time of DI3	-	UINT16	DI_3_Debounce
3008:26$_h$	Status of the inputs for the safety-related function STO	T_PDO	UINT16	_IO_STO_act
3008:27$_h$	Signal evaluation for signal input function Velocity Limitation	-	UINT16	IOsigVelLim
3008:28$_h$	Signal evaluation for signal input function Current Limitation	-	UINT16	IOsigCurrLim
300A:1$_h$	Status of the capture inputs	T_PDO	UINT16	_CapStatus
300A:2$_h$	Capture input 1 configuration	-	UINT16	Cap1Config
300A:3$_h$	Capture input 2 configuration	-	UINT16	Cap2Config
300A:4$_h$	Capture input 1 start/stop	-	UINT16	Cap1Activate
300A:5$_h$	Capture input 2 start/stop	-	UINT16	Cap2Activate
300A:6$_h$	Capture input 1 captured position	T_PDO	INT32	_Cap1Pos
300A:7$_h$	Capture input 2 captured position	T_PDO	INT32	_Cap2Pos
300A:8$_h$	Capture input 1 event counter	T_PDO	UINT16	_Cap1Count
300A:9$_h$	Capture input 2 event counter	T_PDO	UINT16	_Cap2Count
300A:A$_h$	Capture input 1 encoder source	-	UINT16	Cap1Source
300A:B$_h$	Capture input 2 encoder source	-	UINT16	Cap2Source
300A:17$_h$	Capture input 1 event counter (consistent)	T_PDO	UINT16	_Cap1CountCons
300A:18$_h$	Capture input 1 captured position (consistent)	T_PDO	INT32	_Cap1PosCons
300A:19$_h$	Capture input 2 event counter (consistent)	T_PDO	UINT16	_Cap2CountCons
300A:1A$_h$	Capture input 2 captured position (consistent)	T_PDO	INT32	_Cap2PosCons
300A:2B$_h$	Capture input 1 event counter at rising edges	T_PDO	UINT16	_Cap1CntRise
300A:2C$_h$	Capture input 1 event counter at falling edges	T_PDO	UINT16	_Cap1CntFall
300A:2D$_h$	Capture input 2 event counter at rising edges	T_PDO	UINT16	_Cap2CntRise
300A:2E$_h$	Capture input 2 event counter at falling edges	T_PDO	UINT16	_Cap2CntFall
300A:2F$_h$	Capture inputs 1 and 2 summary of event counters	T_PDO	UINT16	_CapEventCounters
300B:1$_h$	Status of the position register channels	T_PDO	UINT16	_PosRegStatus

Address	Object	PDO	Data type	Parameter name
300B:2$_h$	Start/stop of position register channel 1	R_PDO	UINT16	PosReg1Start
300B:3$_h$	Start/stop of position register channel 2	R_PDO	UINT16	PosReg2Start
300B:4$_h$	Selection of comparison criterion for position register channel 1	-	UINT16	PosReg1Mode
300B:5$_h$	Selection of comparison criterion for position register channel 2	-	UINT16	PosReg2Mode
300B:6$_h$	Selection of source for position register channel 1	-	UINT16	PosReg1Source
300B:7$_h$	Selection of source for position register channel 2	-	UINT16	PosReg2Source
300B:8$_h$	Comparison value A for position register channel 1	R_PDO	INT32	PosReg1ValueA
300B:9$_h$	Comparison value B for position register channel 1	R_PDO	INT32	PosReg1ValueB
300B:A$_h$	Comparison value A for position register channel 2	R_PDO	INT32	PosReg2ValueA
300B:B$_h$	Comparison value B for position register channel 2	R_PDO	INT32	PosReg2ValueB
300B:C$_h$	Start/stop of position register channel 3	R_PDO	UINT16	PosReg3Start
300B:D$_h$	Start/stop of position register channel 4	R_PDO	UINT16	PosReg4Start
300B:E$_h$	Selection of comparison criterion for position register channel 3	-	UINT16	PosReg3Mode
300B:F$_h$	Selection of comparison criterion for position register channel 4	-	UINT16	PosReg4Mode
300B:10$_h$	Selection of source for position register channel 3	-	UINT16	PosReg3Source
300B:11$_h$	Selection of source for position register channel 4	-	UINT16	PosReg4Source
300B:12$_h$	Comparison value A for position register channel 3	R_PDO	INT32	PosReg3ValueA
300B:13$_h$	Comparison value B for position register channel 3	R_PDO	INT32	PosReg3ValueB
300B:14$_h$	Comparison value A for position register channel 4	R_PDO	INT32	PosReg4ValueA
300B:15$_h$	Comparison value B for position register channel 4	R_PDO	INT32	PosReg4ValueB
300B:16$_h$	Start/stop of position register channels	-	UINT16	PosRegGroupStart
300D:2$_h$	Motor type	T_PDO	UINT32	_M_Type
300D:3$_h$	Type of motor encoder	T_PDO	UINT16	_M_Encoder
300D:4$_h$	Maximum permissible speed of rotation/velocity of motor	T_PDO	UINT16	_M_n_max
300D:5$_h$	Nominal speed of rotation/velocity of motor	T_PDO	UINT16	_M_n_nom
300D:6$_h$	Maximum current of motor	T_PDO	UINT16	_M_I_max
300D:7$_h$	Nominal current of motor	T_PDO	UINT16	_M_I_nom
300D:8$_h$	Nominal torque/force of motor	T_PDO	UINT16	_M_M_nom
300D:9$_h$	Maximum torque of motor	T_PDO	UINT16	_M_M_max
300D:A$_h$	Nominal voltage of motor	T_PDO	UINT16	_M_U_nom
300D:B$_h$	Voltage constant kE of motor	T_PDO	UINT32	_M_kE
300D:C$_h$	Moment of inertia of motor	T_PDO	UINT32	_M_Jrot
300D:D$_h$	Winding resistance of motor	T_PDO	UINT16	_M_R_UV
300D:E$_h$	Inductance q component of motor	T_PDO	UINT16	_M_L_q
300D:F$_h$	Inductance d component of motor	T_PDO	UINT16	_M_L_d
300D:10$_h$	Maximum temperature of motor	T_PDO	INT16	_M_T_max
300D:11$_h$	Maximum permissible time for maximum current of motor	T_PDO	UINT16	_M_I2t
300D:13$_h$	Continuous stall current of motor	T_PDO	UINT16	_M_I_0
300D:14$_h$	Number of pole pairs of motor	T_PDO	UINT16	_M_Polepair
300D:16$_h$	Continuous stall torque of motor	T_PDO	UINT16	_M_M_0
300D:19$_h$	Maximum voltage of motor	T_PDO	UINT16	_M_U_max
300D:20$_h$	Holding brake identification	T_PDO	UINT16	_M_HoldingBrake
300D:21$_h$	Holding brake application time	T_PDO	UINT16	_M_BRK_T_apply
300D:22$_h$	Holding brake release time	T_PDO	UINT16	_M_BRK_T_release
300D:23$_h$	Pole pair pitch of motor	T_PDO	UINT16	_M_PolePairPitch

Address	Object	PDO	Data type	Parameter name
3010:1$_h$	Nominal current of power stage	T_PDO	UINT16	_PS_I_nom
3010:2$_h$	Maximum current of power stage	T_PDO	UINT16	_PS_I_max
3010:3$_h$	Maximum permissible DC bus voltage	T_PDO	UINT16	_PS_U_maxDC
3010:4$_h$	Minimum permissible DC bus voltage	T_PDO	UINT16	_PS_U_minDC
3010:6$_h$	Maximum temperature of power stage (error class 0)	T_PDO	INT16	_PS_T_warn
3010:7$_h$	Maximum temperature of power stage	T_PDO	INT16	_PS_T_max
3010:8$_h$	Resistance value of internal braking resistor	T_PDO	UINT16	_RESint_R
3010:9$_h$	Nominal power of internal braking resistor	T_PDO	UINT16	_RESint_P
3010:A$_h$	DC bus voltage low threshold for Quick Stop	T_PDO	UINT16	_PS_U_minStopDC
3011:1$_h$	Current controller d component P gain	-	UINT16	_CTRL_KPid
3011:2$_h$	Current controller d component integral action time	-	UINT16	_CTRL_TNid
3011:3$_h$	Current controller q component P gain	-	UINT16	_CTRL_KPiq
3011:4$_h$	Current controller q component integral action time	-	UINT16	_CTRL_TNiq
3011:5$_h$	PID velocity controller: Time constant of D term smoothing filter	-	UINT16	CTRL_vPIDDTime
3011:6$_h$	PID velocity controller: D gain	-	UINT16	CTRL_vPIDDPart
3011:8$_h$	Filter time constant to smooth velocity of motor	-	UINT16	CTRL_TAUnact
3011:9$_h$	Speed of rotation up to which the friction compensation is linear	-	UINT32	CTRL_SpdFric
3011:A$_h$	Acceleration feed-forward control	-	UINT16	CTRL_KFAcc
3011:C$_h$	Current limitation	R_PDO	UINT16	CTRL_I_max
3011:D$_h$	Current for Quick Stop	-	UINT16	LIM_I_maxQSTP
3011:E$_h$	Current for Halt	-	UINT16	LIM_I_maxHalt
3011:F$_h$	Maximum current for field weakening (d component)	-	UINT16	CTRL_I_max_fw
3011:10$_h$	Velocity limitation	R_PDO	UINT32	CTRL_v_max
3011:14$_h$	Period of time for control loop parameter set switching	-	UINT16	CTRL_ParChgTime
3011:15$_h$	Global gain factor (affects control loop parameter set 1)	-	UINT16	CTRL_GlobGain
3011:16$_h$	Control loop parameter set copying	-	UINT16	CTRL_ParSetCopy
3011:17$_h$	Active control loop parameter set	T_PDO	UINT16	_CTRL_ActParSet
3011:18$_h$	Selection of control loop parameter set at power up	-	UINT16	CTRL_PwrUpParSet
3011:19$_h$	Selection of control loop parameter set (non-persistent)	-	UINT16	CTRL_SelParSet
3011:1A$_h$	Condition for parameter set switching	-	UINT16	CLSET_ParSwiCond
3011:1B$_h$	Time window for parameter set switching	-	UINT16	CLSET_winTime
3011:1C$_h$	Position deviation for control loop parameter set switching	-	UINT16	CLSET_p_DiffWin
3011:1D$_h$	Velocity threshold for control loop parameter set switching	-	UINT32	CLSET_v_Threshol
3011:22$_h$	Activation of velocity observer	-	UINT16	CTRL_VelObsActiv
3011:23$_h$	Dynamics of velocity observer	-	UINT16	CTRL_VelObsDyn
3011:24$_h$	Inertia value for velocity observer	-	UINT32	CTRL_VelObsInert
3011:25$_h$	Position deviation for control loop parameter set switching	-	INT32	CLSET_p_DiffWin_usr
3011:26$_h$	Smoothing factor for current controller	-	UINT16	CTRL_SmoothCurr
3012:1$_h$	Velocity controller P gain	-	UINT16	CTRL1_KPn
3012:2$_h$	Velocity controller integral action time	-	UINT16	CTRL1_TNn
3012:3$_h$	Position controller P gain	-	UINT16	CTRL1_KPp
3012:4$_h$	Filter time constant of the reference velocity value filter	-	UINT16	CTRL1_TAUnref
3012:5$_h$	Filter time constant of the reference current value filter	-	UINT16	CTRL1_TAUiref
3012:6$_h$	Velocity feed-forward control	-	UINT16	CTRL1_KFPp
3012:8$_h$	Notch filter 1: Damping	-	UINT16	CTRL1_Nf1damp

Address	Object	PDO	Data type	Parameter name
$3012:9_h$	Notch filter 1: Frequency	-	UINT16	CTRL1_Nf1freq
$3012:A_h$	Notch filter 1: Bandwidth	-	UINT16	CTRL1_Nf1bandw
$3012:B_h$	Notch filter 2: Damping	-	UINT16	CTRL1_Nf2damp
$3012:C_h$	Notch filter 2: Frequency	-	UINT16	CTRL1_Nf2freq
$3012:D_h$	Notch filter 2: Bandwidth	-	UINT16	CTRL1_Nf2bandw
$3012:E_h$	Overshoot suppression filter: Damping	-	UINT16	CTRL1_Osupdamp
$3012:F_h$	Overshoot suppression filter: Time delay	-	UINT16	CTRL1_Osupdelay
$3012:10_h$	Friction compensation: Gain	-	UINT16	CTRL1_Kfric
$3013:1_h$	Velocity controller P gain	-	UINT16	CTRL2_KPn
$3013:2_h$	Velocity controller integral action time	-	UINT16	CTRL2_TNn
$3013:3_h$	Position controller P gain	-	UINT16	CTRL2_KPp
$3013:4_h$	Filter time constant of the reference velocity value filter	-	UINT16	CTRL2_TAUnref
$3013:5_h$	Filter time constant of the reference current value filter	-	UINT16	CTRL2_TAUiref
$3013:6_h$	Velocity feed-forward control	-	UINT16	CTRL2_KFPp
$3013:8_h$	Notch filter 1: Damping	-	UINT16	CTRL2_Nf1damp
$3013:9_h$	Notch filter 1: Frequency	-	UINT16	CTRL2_Nf1freq
$3013:A_h$	Notch filter 1: Bandwidth	-	UINT16	CTRL2_Nf1bandw
$3013:B_h$	Notch filter 2: Damping	-	UINT16	CTRL2_Nf2damp
$3013:C_h$	Notch filter 2: Frequency	-	UINT16	CTRL2_Nf2freq
$3013:D_h$	Notch filter 2: Bandwidth	-	UINT16	CTRL2_Nf2bandw
$3013:E_h$	Overshoot suppression filter: Damping	-	UINT16	CTRL2_Osupdamp
$3013:F_h$	Overshoot suppression filter: Time delay	-	UINT16	CTRL2_Osupdelay
$3013:10_h$	Friction compensation: Gain	-	UINT16	CTRL2_Kfric
$3016:3_h$	Modbus baud rate	-	UINT32	MBbaud
$3016:4_h$	Modbus address	-	UINT16	MBaddress
$301B:5_h$	Bit shift for RefA16 for Drive Profile Lexium	T_PDO	UINT16	_DPL_BitShiftRefA16
$301B:6_h$	Error response to detected data error (DE bit)	-	INT16	ErrorResp_bit_DE
$301B:7_h$	Error response to detected mode error (ME bit)	-	INT16	ErrorResp_bit_ME
$301B:8_h$	Activation of Drive Profile Lexium	-	UINT16	DPL_Activate
$301B:9_h$	Activation of operating mode Jog	R_PDO	UINT16	JOGactivate
$301B:A_h$	Selection of a data set to be started for operating mode Motion Sequence	R_PDO	UINT16	MSM_start_ds
$301B:13_h$	DS402 state machine: State transition from 3 to 4	-	UINT16	DS402compatib
$301B:16_h$	Position for Position Setting	-	INT32	HMp_setP
$301B:19_h$	Error code for detected synchronous errors (ME bit)	T_PDO	UINT16	_ModeError
$301B:1B_h$	Error code for detected synchronous errors (DE bit)	T_PDO	UINT16	_DataError
$301B:1C_h$	Additional error information of a detected ModeError (ME bit)	T_PDO	UINT16	_ModeErrorInfo
$301B:1D_h$	Additional error information of a detected DataError (DE bit)	T_PDO	UINT16	_DataErrorInfo
$301B:1E_h$	DS402 status word: Setting for bit 11 (internal limit)	-	UINT16	DS402intLim
$301B:1F_h$	Drive Profile Lexium dmControl	R_PDO	UINT16	DPL_dmControl
$301B:21_h$	Drive Profile Lexium RefB32	R_PDO	INT32	DPL_RefB32
$301B:22_h$	Drive Profile Lexium RefA16	R_PDO	INT16	DPL_RefA16
$301B:25_h$	Drive Profile Lexium driveStat	T_PDO	UINT16	_DPL_driveStat
$301B:26_h$	Drive Profile Lexium mfStat	T_PDO	UINT16	_DPL_mfStat
$301B:27_h$	Drive Profile Lexium motionStat	T_PDO	UINT16	_DPL_motionStat

Address	Object	PDO	Data type	Parameter name
301B:28$_h$	Drive Profile Lexium driveInput	T_PDO	UINT16	_DPL_driveInput
301B:35$_h$	Setting for bit 9 of _DPL_motionStat and _actionStatus	-	UINT16	DPL_intLim
301C:4$_h$	Action word	T_PDO	UINT16	_actionStatus
301C:6$_h$	Modbus address of parameter with invalid value	T_PDO	UINT16	_InvalidParam
301C:7$_h$	Status of monitoring signals	T_PDO	UINT32	_SigActive
301C:8$_h$	Saved status of monitoring signals	T_PDO	UINT32	_SigLatched
301C:9$_h$	Code of most recent error of error class 0	T_PDO	UINT16	_LastWarning
301C:A$_h$	Operating hours counter	T_PDO	UINT32	_OpHours
301C:B$_h$	Active errors of error class 0, bit-coded	T_PDO	UINT32	_WarnActive
301C:C$_h$	Saved errors of error class 0, bit-coded	T_PDO	UINT32	_WarnLatched
301C:D$_h$	Output power	T_PDO	INT32	_Power_act
301C:E$_h$	Mean output power	T_PDO	UINT16	_Power_mean
301C:F$_h$	Voltage at DC bus	T_PDO	UINT16	_UDC_act
301C:10$_h$	Temperature of power stage	T_PDO	INT16	_PS_T_current
301C:12$_h$	Temperature of device	T_PDO	INT16	_DEV_T_current
301C:13$_h$	Overload of braking resistor (I2t)	T_PDO	INT16	_RES_overload
301C:14$_h$	Load of braking resistor	T_PDO	INT16	_RES_load
301C:15$_h$	Maximum value of overload of braking resistor	T_PDO	INT16	_RES_maxoverload
301C:16$_h$	Overload of power stage (I2t)	T_PDO	INT16	_PS_overload_I2t
301C:17$_h$	Load of power stage	T_PDO	INT16	_PS_load
301C:18$_h$	Maximum value of overload of power stage	T_PDO	INT16	_PS_maxoverload
301C:19$_h$	Overload of motor (I2t)	T_PDO	INT16	_M_overload
301C:1A$_h$	Load of motor	T_PDO	INT16	_M_load
301C:1B$_h$	Maximum value of overload of motor	T_PDO	INT16	_M_maxoverload
301C:1E$_h$	Maximum possible value for operating mode Profile Torque	T_PDO	INT16	_PT_max_val
301C:1F$_h$	Additional info on most recent error	T_PDO	UINT16	_LastError_Qual
301C:22$_h$	Overload of power stage (chip temperature)	T_PDO	INT16	_PS_overload_cte
301C:23$_h$	Overload of power stage (power squared)	T_PDO	INT16	_PS_overload_psq
301C:24$_h$	Overload of power stage	T_PDO	INT16	_PS_overload
301C:26$_h$	Conditions for transition to operating state Ready To Switch On	T_PDO	UINT16	_Cond_State4
301C:27$_h$	Current limitation of the system	T_PDO	UINT16	_Imax_system
301C:28$_h$	Currently effective current limitation	T_PDO	UINT16	_Imax_act
301C:29$_h$	Currently effective velocity limitation	T_PDO	UINT32	_Vmax_act
301C:2B$_h$	Voltage of cosine signal of encoder	-	INT16	_M_Enc_Cosine
301C:2C$_h$	Voltage of sine signal of encoder	-	INT16	_M_Enc_Sine
301E:1$_h$	Actual motor current (q component, generating torque)	T_PDO	INT16	_Iq_act_rms
301E:2$_h$	Actual motor current (d component, field weakening)	T_PDO	INT16	_Id_act_rms
301E:3$_h$	Total motor current	T_PDO	INT16	_I_act
301E:4$_h$	Reference motor voltage q component	T_PDO	INT16	_Uq_ref
301E:5$_h$	Reference motor voltage d component	T_PDO	INT16	_Ud_ref
301E:6$_h$	Total motor voltage (vector sum d components and q components)	T_PDO	INT16	_Udq_ref
301E:7$_h$	Reference speed of rotation	T_PDO	INT16	_n_ref
301E:8$_h$	Actual speed of rotation	T_PDO	INT16	_n_act
301E:9$_h$	Reference position in internal units	T_PDO	INT32	_p_ref_int
301E:C$_h$	Reference position	T_PDO	INT32	_p_ref

Address	Object	PDO	Data type	Parameter name
301E:E$_h$	Absolute position with reference to internal resolution in internal units	T_PDO	UINT32	_p_absmodulo
301E:F$_h$	Absolute position with reference to the encoder range	T_PDO	UINT32	_p_absENC
301E:10$_h$	Reference motor current (q component, generating torque)	T_PDO	INT16	_Iq_ref_rms
301E:11$_h$	Reference motor current (d component, field weakening)	T_PDO	INT16	_Id_ref_rms
301E:13$_h$	Degree of utilization of DC bus voltage	T_PDO	INT16	_VoltUtil
301E:14$_h$	Position deviation including dynamic position deviation	T_PDO	INT32	_p_dif_usr
301E:15$_h$	Maximum value of the load-dependent position deviation	-	INT32	_p_dif_load_peak_usr
301E:16$_h$	Load-dependent position deviation between reference and actual positions	T_PDO	INT32	_p_dif_load_usr
301E:1B$_h$	Maximum value of the load-dependent position deviation	-	UINT32	_p_dif_load_peak
301E:1C$_h$	Load-dependent position deviation between reference and actual positions	T_PDO	INT32	_p_dif_load
301E:1F$_h$	Reference velocity	T_PDO	INT32	_v_ref
301E:26$_h$	Actual position of encoder 1 in internal units	T_PDO	INT32	_p_act_ENC1_int
301E:27$_h$	Actual position of encoder 1	T_PDO	INT32	_p_act_ENC1
301E:28$_h$	Actual speed of rotation of encoder 1	T_PDO	INT16	_n_act_ENC1
301E:29$_h$	Actual velocity of encoder 1	T_PDO	INT32	_v_act_ENC1
301E:2C$_h$	Current load-dependent velocity deviation	T_PDO	INT32	_v_dif_usr
301F:1$_h$	Target position of profile generator	T_PDO	INT32	_RAMP_p_target
301F:2$_h$	Actual position of profile generator	T_PDO	INT32	_RAMP_p_act
301F:5$_h$	Target velocity of profile generator	T_PDO	INT32	_RAMP_v_target
301F:7$_h$	Velocity of reference value for velocity feed-forward control	T_PDO	INT32	_pref_v
301F:9$_h$	Acceleration of reference value for acceleration feed-forward control	T_PDO	INT32	_pref_acc
301F:A$_h$	Maximum user-defined value for positions	T_PDO	INT32	_ScalePOSmax
301F:B$_h$	Maximum user-defined value for velocity	T_PDO	INT32	_ScaleVELmax
301F:C$_h$	Maximum user-defined value for acceleration and deceleration	T_PDO	INT32	_ScaleRAMPmax
3022:4$_h$	Synchronization tolerance	-	UINT16	SyncMechTol
3022:5$_h$	Activation of synchronization mechanism	-	UINT16	SyncMechStart
3022:6$_h$	Status of synchronization mechanism	T_PDO	UINT16	SyncMechStatus
3023:7$_h$	Absolute movement beyond movement range	-	UINT16	PP_ModeRangeLim
3023:9$_h$	Change to operating mode Profile Position during movements	-	UINT16	PP_OpmChgType
3023:C$_h$	Activation of relative movement after capture	-	UINT16	RMAC_Activate
3023:D$_h$	Target position of relative movement after capture	-	INT32	RMAC_Position
3023:E$_h$	Velocity of relative movement after capture	-	UINT32	RMAC_Velocity
3023:F$_h$	Response if target position is overtraveld	-	UINT16	RMAC_Response
3023:10$_h$	Edge of capture signal for relative movement after capture	-	UINT16	RMAC_Edge
3023:11$_h$	Status of relative movement after capture	T_PDO	UINT16	_RMAC_Status
3023:12$_h$	Detailed status of relative movement after capture (RMAC)	T_PDO	UINT16	_RMAC_DetailStatus
3028:6$_h$	Maximum distance for search for switching point	-	INT32	HMoutdis
3028:7$_h$	Distance from switching point	-	INT32	HMdis
3028:A$_h$	Preferred homing method	-	INT16	HMprefmethod
3028:B$_h$	Position at reference point	R_PDO	INT32	HMp_home
3028:C$_h$	Distance from switching point to index pulse	T_PDO	INT32	_HMdisREFtoIDX
3028:D$_h$	Maximum search distance after overtravel of switch	-	INT32	HMsrchdis
3028:F$_h$	Distance from switching point to index pulse	T_PDO	INT32	_HMdisREFtoIDX_usr

Address	Object	PDO	Data type	Parameter name
3029:3$_h$	Selection of jog method	R_PDO	UINT16	JOGmethod
3029:4$_h$	Velocity for slow movement	R_PDO	UINT32	JOGv_slow
3029:5$_h$	Velocity for fast movement	R_PDO	UINT32	JOGv_fast
3029:7$_h$	Distance for step movement	-	INT32	JOGstep
3029:8$_h$	Wait time for step movement	-	UINT16	JOGtime
302D:6$_h$	Number of data set being processed	T_PDO	INT16	_MSMactNum
302D:7$_h$	Next data set to be triggered	T_PDO	INT16	_MSMnextNum
302D:8$_h$	Start condition for the start of a sequence via a signal input	-	UINT16	MSM_CondSequ
302D:9$_h$	Selection of the data set number after the end of a sequence	-	UINT16	MSMendNumSequence
302D:B$_h$	Number of data set that was active when a movement was interrupted	T_PDO	INT16	_MSMNumFinish
302D:C$_h$	Response to falling edge at signal input for 'Start Signal Data Set'	-	UINT16	MSMstartSignal
302D:D$_h$	Number of the data set in which an error has been detected	T_PDO	INT16	_MSM_error_num
302D:E$_h$	Field of the data set in which an error has been detected	T_PDO	INT16	_MSM_error_field
302D:F$_h$	Number of available data sets	T_PDO	UINT16	_MSM_avail_ds
302D:10$_h$	Selection of data set number in data set table	-	UINT16	MSM_datasetnum
302D:11$_h$	Data set type	-	UINT16	MSM_ds_type
302D:12$_h$	Setting A	-	INT32	MSM_ds_setA
302D:13$_h$	Setting B	-	INT32	MSM_ds_setB
302D:14$_h$	Setting C	-	INT32	MSM_ds_setC
302D:15$_h$	Setting D	-	INT32	MSM_ds_setD
302D:16$_h$	Transition type	-	UINT16	MSM_ds_transiti
302D:17$_h$	Subsequent data set	-	UINT16	MSM_ds_sub_ds
302D:18$_h$	Transition condition 1	-	UINT16	MSM_ds_trancon1
302D:19$_h$	Value for transition condition 1	-	INT32	MSM_ds_tranval1
302D:1A$_h$	Logical operator	-	UINT16	MSM_ds_logopera
302D:1C$_h$	Transition condition 2	-	UINT16	MSM_ds_trancon2
302D:1D$_h$	Value for transition condition 2	-	INT32	MSM_ds_tranval2
302D:1F$_h$	Number of data sets used	T_PDO	UINT16	_MSM_used_data_sets
302D:20$_h$	Debounce time for data set selection	-	UINT16	MSM_DebDigInNum
302D:21$_h$	Additional settings for operating mode Motion Sequence	-	UINT16	MSM_AddtlSettings
302E:3$_h$	Maximum permissible distance	-	UINT16	MT_dismax
302E:A$_h$	Maximum permissible distance	-	INT32	MT_dismax_usr
302F:1$_h$	Autotuning start	-	UINT16	AT_start
302F:2$_h$	Autotuning status	T_PDO	UINT16	_AT_state
302F:3$_h$	Movement range for Autotuning	-	UINT32	AT_dis
302F:4$_h$	Direction of movement for Autotuning	-	UINT16	AT_dir
302F:6$_h$	Velocity jump for Autotuning	-	UINT32	AT_n_ref
302F:7$_h$	Friction torque of the system	T_PDO	UINT16	_AT_M_friction
302F:8$_h$	Constant load torque	T_PDO	INT16	_AT_M_load
302F:9$_h$	Waiting time between Autotuning steps	-	UINT16	AT_wait
302F:B$_h$	Progress of Autotuning	T_PDO	UINT16	_AT_progress
302F:C$_h$	Moment of inertia of the system	T_PDO	UINT16	_AT_J
302F:E$_h$	Type of coupling of the system	-	UINT16	AT_mechanical
302F:12$_h$	Movement range for Autotuning	-	INT32	AT_dis_usr
302F:13$_h$	Velocity jump for Autotuning	-	INT32	AT_v_ref

Address	Object	PDO	Data type	Parameter name
303B:2$_h$	Number of power on cycles	T_PDO	UINT32	_ERR_powerOn
303B:4$_h$	Clear error memory	-	UINT16	ERR_clear
303B:5$_h$	Reset error memory read pointer	-	UINT16	ERR_reset
303B:6$_h$	Signal output function Selected Error (error classes 1 to 4): First error code	-	UINT16	MON_IO_SelErr1
303B:7$_h$	Signal output function Selected Error (error classes 1 to 4): Second error code	-	UINT16	MON_IO_SelErr2
303B:8$_h$	Signal output function Selected Warning (error class 0): First error code	-	UINT16	MON_IO_SelWar1
303B:9$_h$	Signal output function Selected Warning (error class 0): Second error code	-	UINT16	MON_IO_SelWar2
303C:1$_h$	Error code	-	UINT16	_ERR_number
303C:2$_h$	Error class	-	UINT16	_ERR_class
303C:3$_h$	Time of detection of error	-	UINT32	_ERR_time
303C:4$_h$	Additional information on detected error	-	UINT16	_ERR_qual
303C:5$_h$	Number of cycles of enabling the power stage at error time	-	UINT16	_ERR_enable_cycl
303C:6$_h$	Time between enabling of power stage and detection of the error	-	UINT16	_ERR_enable_time
303C:7$_h$	DC bus voltage at the time the error was detected	-	UINT16	_ERR_DCbus
303C:8$_h$	Motor velocity at the time the error was detected	-	INT32	_ERR_motor_v
303C:9$_h$	Motor current at the time the error was detected	-	UINT16	_ERR_motor_I
303C:A$_h$	Temperature of power stage at the time the error was detected	-	INT16	_ERR_temp_ps
303C:B$_h$	Temperature of device at the time the error was detected	-	INT16	_ERR_temp_dev
303F:5D$_h$	Value of the SinCos amplitude	-	UINT16	_ENC_AmplVal
303F:5E$_h$	Mean value of the SinCos amplitude	-	UINT16	_ENC_AmplMean
303F:5F$_h$	Minimum value of the SinCos amplitude	-	UINT16	_ENC_AmplMin
303F:60$_h$	Maximum value of the SinCos amplitude	-	UINT16	_ENC_AmplMax
303F:61$_h$	Activation of monitoring of SinCos amplitude	-	UINT16	MON_ENC_Ampl
3040:43$_h$	Last error code of fieldbus parameter services	-	UINT16	_ErrNumFbParSvc
3041:2$_h$	CANopen address (node number)	-	UINT16	CANaddress
3041:3$_h$	CANopen baud rate	-	UINT16	CANbaud
3041:6$_h$	CANopen diagnostics word	-	UINT16	_CanDiag
3041:A$_h$	CANopen manufacturer-specific SDO abort code	-	UINT16	_ManuSdoAbort
3041:B$_h$	PDO 1 event mask	-	UINT16	CANpdo1Event
3041:C$_h$	PDO 2 event mask	-	UINT16	CANpdo2Event
3041:D$_h$	PDO 3 event mask	-	UINT16	CANpdo3Event
3041:E$_h$	PDO 4 event mask	-	UINT16	CANpdo4Event
3041:F$_h$	CANopen address (node number) set via DIP switches	-	UINT16	_DipCANaddress
3041:10$_h$	CANopen baud rate set via DIP switches	-	UINT16	_DipCANbaud

Assignment Object Group 6000_h

Overview

The product provides corresponding parameters for the CANopen object group 6000_h.

Address	Object	PDO	Data type	Parameter name
$603F:0_h$	Detected error causing a stop (error classes 1 to 4)	T_PDO	UINT16	_LastError
$6040:0_h$	DriveCom control word	R_PDO	UINT16	DCOMcontrol
$6041:0_h$	DriveCom status word	T_PDO	UINT16	_DCOMstatus
$605B:0_h$	Behavior for disabling the power stage during movement	-	INT16	DSM_ShutDownOption
$605D:0_h$	Halt option code	-	INT16	LIM_HaltReaction
$6060:0_h$	Operating mode	R_PDO	INT8	DCOMopmode
$6061:0_h$	Active operating mode	T_PDO	INT8	_DCOMopmd_act
$6063:0_h$	Actual position in internal units	T_PDO	INT32	_p_act_int
$6064:0_h$	Actual position	T_PDO	INT32	_p_act
$6065:0_h$	Maximum load-dependent position deviation	R_PDO	UINT32	MON_p_dif_load
$6067:0_h$	Standstill window, permissible control deviation	R_PDO	UINT32	MON_p_win
$6068:0_h$	Standstill window, time	-	UINT16	MON_p_winTime
$606B:0_h$	Actual velocity of profile generator	T_PDO	INT32	_RAMP_v_act
$606C:0_h$	Actual velocity	T_PDO	INT32	_v_act
$606D:0_h$	Velocity window, permissible deviation	-	UINT16	MON_v_win
$606E:0_h$	Velocity window, time	-	UINT16	MON_v_winTime
$6071:0_h$	Target torque for operating mode Profile Torque	R_PDO	INT16	PTtq_target
$6077:0_h$	Actual torque	T_PDO	INT16	_tq_act
$607A:0_h$	Target position for operating mode Profile Position	R_PDO	INT32	PPp_target
$607D:1_h$	Negative position limit for software limit switch	-	INT32	MON_swLimN
$607D:2_h$	Positive position limit for software limit switch	-	INT32	MON_swLimP
$607F:0_h$	Maximum velocity of the motion profile for velocity	-	UINT32	RAMP_v_max
$6081:0_h$	Target velocity for operating mode Profile Position	R_PDO	UINT32	PPv_target
$6083:0_h$	Acceleration of the motion profile for velocity	R_PDO	UINT32	RAMP_v_acc
$6084:0_h$	Deceleration of the motion profile for velocity	R_PDO	UINT32	RAMP_v_dec
$6087:0_h$	Slope setting of the motion profile for torque	R_PDO	UINT32	RAMP_tq_slope
$6098:0_h$	Homing method	R_PDO	INT8	HMmethod
$6099:1_h$	Target velocity for searching the switch	-	UINT32	HMv
$6099:2_h$	Target velocity for moving away from switch	-	UINT32	HMv_out
$60B8:0_h$	Touch Probe function	R_PDO	UINT16	TouchProbeFct
$60B9:0_h$	Touch Probe status	T_PDO	UINT16	_TouchProbeStat
$60BA:0_h$	Capture input 1 captured position at rising edge	T_PDO	INT32	_Cap1PosRisEdge
$60BB:0_h$	Capture input 1 captured position at falling edge	T_PDO	INT32	_Cap1PosFallEdge
$60BC:0_h$	Capture input 2 captured position at rising edge	T_PDO	INT32	_Cap2PosRisEdge
$60BD:0_h$	Capture input 2 captured position at falling edge	T_PDO	INT32	_Cap2PosFallEdge
$60C1:1_h$	Position reference value for operating mode Interpolated Position	R_PDO	INT32	IPp_target
$60C2:1_h$	Interpolation time period value	-	UINT8	IP_IntTimPerVal
$60C2:2_h$	Interpolation time index	-	INT8	IP_IntTimInd
$60F2:0_h$	Options for operating mode Profile Position	-	UINT16	PPoption

Address	Object	PDO	Data type	Parameter name
60F4:0_h	Position deviation including dynamic position deviation	T_PDO	INT32	_p_dif
60FF:0_h	Target velocity for operating mode Profile Velocity	R_PDO	INT32	PVv_target
6502:0_h	Supported operating modes as per DSP402	T_PDO	UINT32	_SuppDriveModes

Details of Object Group 1000_h

1000_h Device Type

The object specifies the device profile used as well as the device type.

Object description

Index	1000_h
Object name	Device type
Object code	VAR
Data type	Unsigned32

Value description

Subindex	00_h, device type
Meaning	Device type and device profile
Access	RO
PDO mapping	–
Value range	–
Default value	0042 0192_h
Can be saved	–

Bit assignment, subindex 00h

bit	Access	Value	Meaning
0 ... 15	RO	0192_h	Device profile DS-402 (192_h)
16 ... 23	RO	42_h	Bit 17 = 1: AC servo drive
24 ... 31	RO	00_h	Not used

1001_h Error Register

The object specifies the error of the device. The detailed cause of error can be determined with the object `Predefined error field (1003h)` and - for reasons of compatibility with devices with other fieldbus profiles - with the object `Error code (603Fh)`.

Errors are signaled by an EMCY message as soon as they are detected.

Object description

Index	1001_h
Object name	Error register
Object code	VAR
Data type	Unsigned8

Value description

Subindex	00_h, error register
Meaning	Error register
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

Bit assignment, subindex 00h

bit	Access	Value	Meaning
0	RO	–	Error (generic error)
1	RO	–	Reserved
2	RO	–	Reserved
3	RO	–	Reserved
4	RO	–	Communication profile (communication error)
5	RO	–	Device profile (device profile error)
6	RO	–	Reserved
7	RO	–	Manufacturer-specific

1003_h Predefined Error Field

The object contains the latest error messages that were shown as EMCY messages.

- The subindex 00_h entry contains the number of saved error messages.
- The most recent error message is stored at subindex 01_h, older messages are moved to higher subindex entries.
- Writing '0' to subindex 00_h resets the error list.

Object description

Index	1003_h
Object name	Predefined error field
Object code	ARRAY
Data type	Unsigned32

Value description

Subindex	00_h, number of errors
Meaning	Number of error entries
Access	RW
PDO mapping	–
Value range	0...1
Default value	1
Can be saved	–

Subindex	01_h, error field
Meaning	Error number
Access	RO
PDO mapping	–
Value range	–
Default value	0
Can be saved	–

Bit assignment, subindex 00_h ... 05_h

Bits 0 ... 15: Error code (as per DS301).

Bits 16 ... 31: Error code 1000_h: Vendor-specific error number.

1005_h COB ID SYNC Message

The object specifies the COB ID of the SYNC object and determines whether a device sends or receives SYNC messages.

The device can only receive SYNC messages.

For synchronization, a device in the network must send SYNC objects.

The COB ID can be changed in the NMT state "Pre-Operational"

Object description

Index	1005_h
Object name	COB ID SYNC
Object code	VAR
Data type	Unsigned32

Value description

Subindex	00_h, COB ID SYNC
Meaning	Identifier of the synchronization object
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	8000 0080_h
Can be saved	–

Bit assignment, subindex 00_h

bit	Access	Value	Meaning
31	RO	0_b	1: Device can receive SYNC messages (SYNC consumer)
30	RO	1_b	1: Device can send SYNC messages (SYNC producer)
29	RO	0_b	0: 11 bit identifier (CAN 3.0A) 1: 29 bit identifier (CAN 3.0B)
28-11	RO	0000_h	Only relevant if bit 29=1 is not used by the device.
10-7	RW	0001_b	Function code, bits 10 ... 7 of COB ID
6-0	RO	$7F_h$	Node address, bit 6 ... 0 of COB ID

1008_h Manufacturer Device Name

The object specifies the device name of the manufacturer.

Object description

Index	1008_h
Object name	Manufacturer device name
Object code	VAR
Data type	Visible String8

Value description

Subindex	00_h, manufacturer device name
Meaning	Manufacturer's designation
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

The following objects contain additional information on the device:- Objects 6404_h, 6410_h: Motor data

1009_h Manufacturer Hardware Version

The object specifies the version of the device hardware.

Object description

Index	1009_h
Object name	Manufacturer hardware version
Object code	VAR
Data type	Visible String8

Value description

Subindex	00_h, manufacturer hardware version
Meaning	Hardware version
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

$100A_h$ Manufacturer Software Version

The object specifies the version of the device software.

Object description

Index	$100A_h$
Object name	Manufacturer software version
Object code	VAR
Data type	Visible String8

Value description

Subindex	00_h, manufacturer software version
Meaning	Software version
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

$100C_h$ Guard Time

The object specifies the time span for connection monitoring (Node Guarding) of an NMT slave.

The time span for connection monitoring of an NMT master results from the time span "Guard Time" multiplied by the factor "Life Time", object `Life time factor` ($100D_h$).

The time span can be changed in the NMT state "Pre-Operational".

Object description

Index	$100C_h$
Object name	Guard Time
Object code	VAR
Data type	Unsigned16

Value description

Subindex	00_h, Guard Time
Meaning	Time span for Node Guarding [ms]

Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

$100D_h$ Life Time Factor

The object specifies the factor that, together with the time span "Guard Time", results in the time interval for connection monitoring of an NMT master. Within this period, the NMT slave device expects a monitoring request via Node Guarding from the NMT master.

Life Time = Guard Time * Life Time Factor

The value "0" deactivates monitoring of the NMT master.

If there is no connection monitoring through the NMT master during the time interval "Life Time", the device signals an error and switches to the operating state Fault.

The time factor can be changed in the NMT state "Pre-Operational".

The time span "Guard Time" is set with the object `Guard time` ($100C_h$).

Object description

Index	$100D_h$
Object name	Life Time Factor
Object code	VAR
Data type	Unsigned8

Value description

Subindex	00_h, Life Time Factor
Meaning	Repeat factor for the Node Guarding protocol.
Access	RW
PDO mapping	–
Value range	0...255
Default value	0
Can be saved	–

1014_h COB ID Emergency Object Message

The object specifies the COB ID of the emergency object "EMCY".

Object description

Index	1014_h
Object name	COB ID EMCY
Object code	VAR
Data type	Unsigned32

Value description

Subindex	00_h, COB ID EMCY
Meaning	Identifier of the emergency object
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	4000 0080_h + node ID
Can be saved	–

Bit assignment, subindex 00h

bit	Access	Value	Meaning
31, 30	RO	0_b	Reserved
29	RO	0_b	0: 11 bit identifier (CAN 3.0A) 1: 29 bit identifier (CAN 3.0B)
28-11	RO	0000_h	Only relevant if bit 29=1 is not used by the device.
10-7	RW	0001_b	Function code, bits 10-7 of the COB ID
6-0	RO	–	Node address, bits 6-0, of the COB ID

The COB ID can be changed in the NMT state "Pre-Operational"

1015_h Inhibit Time Emergency Object Message

The object specifies the waiting time for the repeated transmission of EMCY messages as a multiple of 100µs.

Object description

Index	1015_h
Object name	Inhibit time EMCY
Object code	VAR
Data type	Unsigned16

Value description

Subindex	00_h, inhibit time EMCY
Meaning	Waiting time for repeated transmission of an EMCY
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

1016_h Consumer Heartbeat Time

The object contains the settings of the "Heartbeat Consumers" for NMT monitoring by mans of "Heartbeat" connection message.

Object description

Index	1016_h
Object name	Consumer Heartbeat Time
Object code	ARRAY
Data type	Unsigned32

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	3
Can be saved	–

Subindex	01_h, Consumer Heartbeat Time
Meaning	Time interval and node ID of the "Heartbeat" recipient

Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	0
Can be saved	–

Bit assignment, subindex 01_h ... 03_h

bit	Meaning
31 ... 24	Reserved
23 ... 16	Node ID
15 ... 0	Time interval for "Heartbeat" message

The time interval is specified as a multiple of 1 ms and must be greater than the producer "Heartbeat" time, object `Producer Heartbeat Time (1017`$_h$`)`. If the time interval is zero, the device specified via the node ID is not monitored.

1017_h Producer Heartbeat Time

The object contains the time interval of the "Heartbeat" producer for NMT monitoring by means of "Heartbeat" connection message as a multiple of 1 ms.

The producer "Heartbeat" time must be less than the time interval of the "Heartbeat" consumer, object `Consumer Heartbeat Time (1016`$_h$`)`. A time interval of zero deactivates monitoring.

Object description

Index	1017_h
Object name	Producer Heartbeat Time
Object code	VAR
Data type	Unsigned16

Value description

Subindex	00_h, Producer Heartbeat Time
Meaning	Time interval for producer "Heartbeat"
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

1018_h Identity Object

The object provides information on the product.

- Subindex 01_h (vendor ID) contains the manufacturer ID
- Subindex 02_h (product ID) contains the manufacturer-specific product code
- Subindex 03_h (revision number) identifies special CANopen properties for the device

Object description

Index	1018_h
Object name	Identity Object
Object code	RECORD
Data type	Identity

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	3
Can be saved	–

Subindex	01_h, vendor ID
Meaning	Vendor ID
Access	RO
PDO mapping	–
Value range	–
Default value	0800 $005A_h$
Can be saved	–

Subindex	02_h, product code
Meaning	Product code
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

Subindex	03_h, revision number
Meaning	Revision number
Access	RO
PDO mapping	–
Value range	–
Default value	–
Can be saved	–

1029_h Error Behavior

The object specifies the behavior of the NMT state machine in the event of a communication error.

Object description

Index	1029_h
Object name	Error behavior
Object code	ARRAY
Data type	Unsigned8

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RO
PDO mapping	–

Value range	–
Default value	1
Can be saved	–

Subindex	01_h, Communication Error
Meaning	Communication errors
Access	RW
PDO mapping	–
Value range	0...2
Default value	0
Can be saved	–

Settings, subindex 01_h

Value	Meaning
0	Pre-operational (with state Operational only)
1	No state transition
2	Stopped

1200_h 1st Server SDO Parameter

The object contains the settings for the first server SDO.

Object description

Index	1200_h
Object name	1st server SDO parameter
Object code	RECORD
Data type	SDO server parameter

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	2
Can be saved	–

Subindex	01_h, COB ID client -> server
Meaning	Identifier client -> server
Access	RO
PDO mapping	–
Value range	0...4294967295
Default value	1536 + node ID
Can be saved	–

Subindex	02_h, COB ID server -> client
Meaning	Identifier server -> client
Access	RO
PDO mapping	–
Value range	0...4294967295

Default value	1408 + node ID
Can be saved	–

1201_h 2nd Server SDO Parameter

The object contains the settings for the second server SDO.

Object description

Index	1201_h
Object name	2nd server SDO parameter
Object code	RECORD
Data type	SDO server parameter

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	3
Can be saved	–

Subindex	01_h, COB ID client -> server
Meaning	Identifier client -> server
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	8000 0000_h
Can be saved	–

Subindex	02_h, COB ID server -> client
Meaning	Identifier server -> client
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	8000 0000_h
Can be saved	–

Subindex	03_h, node ID SDO client
Meaning	Node ID SDO client
Access	RW
PDO mapping	–
Value range	1...127
Default value	–
Can be saved	–

1400_h 1st Receive PDO Parameter

The object contains the settings for the first receive PDO R_PDO1.

Object description

Index	1400_h
Object name	1st receive PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, number of entries
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	2
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the R_PDO1
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	0200_h + node ID
Can be saved	–

Subindex	02_h, transmission type = asynchronous
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0...255
Default value	255
Can be saved	–

Bit assignment, subindex 01_h

bit	Access	Value	Meaning
31	RW	0_b	0: PDO is active 1: PDO is inactive
30	RO	0_b	0: RTR (see below) is possible 1: RTR not permitted
29	RO	0_b	0: 11-bit identifier (CAN 3.0A) 1: 29 bit identifier (CAN 3.0B)
28-11	RO	0000_h	Only relevant if bit 29=1 is not used by the device.
10-7	RW	0100_b	Function code, bits 10-7 of the COB ID
6-0	RO	–	Node address, bits 6-0, of the COB ID

A R_PDO can only be used if bit 31="0".

Bit assignment, subindex 02_h

Transmission type	cyclic	acyclic	synchronous	asynchronous	RTR-controlled
0	–	X	X	–	–
1-240	X	–	X	–	–
252	–	–	X	–	X
253	–	–	–	X	X
254	–	–	–	X	–
255	–	–	–	X	–

The type of control for evaluating R_PDO data is specified via subindex 02_h. The values 241 ... 251 are reserved.

If an R_PDO is transmitted synchronously (transmission type=0 ... 252), the device evaluates the received data depending on the SYNC object.

- In the case of acyclic transmission (transmission type=0), the evaluation depends on the SYNC object, but not the transmission of the PDO. A received PDO message is evaluated with the following SYNC. A value between 1 and 240 specifies the number of SYNC cycles after which a received PDO is evaluated.

The values 252 to 254 are relevant for updating T_PDOs, but not for sending them.

- 252: Updating of transmit data with receipt of the next SYNC
- 253: Updating of transmit data with receipt of a request from a PDO consumer
- 254: Updating of data in an event-driven way, the triggering event is specified in a manufacturer-specific way

R_PDOs with the value 255 are updated immediately upon receipt of the PDOs. The triggering event is the data that is transmitted corresponding to the definition of the DSP402 device profile in the PDO.

Settings:

R_PDO1 is processed asynchronously and in an event-driven way.

The byte assignment of the R_PDO1 is specified via PDO mapping with the object `1st receive PDO mapping (1600`$_h$`)`. The following default assignment is used for R_PDO1:

- Bytes 0 ... 1: Control word `controlword (6040`$_h$`)`.

The COB ID of the object can be changed in the NMT state "Pre-Operational".

1401_h 2nd Receive PDO Parameter

The object contains settings for the second receive PDO R_PDO2.

Object description

Index	1401_h
Object name	2nd receive PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–
Default value	2
Can be saved	–

Subindex	01_h, COB ID R_PDO2
Meaning	Identifier of the R_PDO2
Access	RW
PDO mapping	–
Value range	0 ... .4294967295
Default value	8000 0300_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0 ... .255
Default value	255
Can be saved	–

The meaning of the bit states and subindex values is described with the object 1st receive PDO parameters (1400_h).

Settings:

R_PDO2 is processed synchronously, acyclically and in an event-driven way and must be activated with bit 31=1 in subindex 01_h before it can be used.

The byte assignment of R_PDO2 is specified via PDO mapping with the object 2nd Receive PDO mapping (1601_h). The following default assignment is set for the operating mode "Profile Position":

- Bytes 0 ... 1: Control word `controlword` (6040_h)
- Bytes 2 ... 5: Target position of the motion command `target position` ($607A_h$)

The COB ID of the object can be changed in the NMT state "Pre-Operational".

The transmission type for the receive PDO can have 3 value ranges:

0	For an asynchronous cycle
1 to 240	Instructs the receive PDO to become active only if a SYNC object is received
255	Specifies that the PDO is executed when it is received

1402_h 3rd Receive PDO Parameter

The object contains settings for the third receive PDO R_PDO3.

Object description

Index	1402_h
Object name	3rd receive PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–
Default value	2
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the R_PDO3
Access	RW
PDO mapping	–
Value range	0 ... 4294967295
Default value	8000 0400_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0...255
Default value	255
Can be saved	–

The meaning of the bit states and subindex values is described with the object `1st receive PDO-parameters (1400h)`.

Settings:

R_PDO3 is processed synchronously, acyclically and in an event-driven way and must be activated with bit 31=1 in subindex 01_h before it can be used.

The byte assignment of the R_PDO3 is specified via PDO mapping with the object `3rd Receive PDO mapping (1602h)`. The following default assignment is set for the operating mode "Profile Velocity":

- Bytes 0 ... 1: Control word `controlword (6040h)`
- Bytes 2 ... 5: Reference velocity of motion command `Target velocity (60FFh)`

The COB ID of the object can be changed in the NMT state "Pre-Operational".

The transmission type for the receive PDO can have 3 value ranges:

0	For an asynchronous cycle
1 to 240	Instructs the receive PDO to become active only if a SYNC object is received
255	Specifies that the PDO is executed when it is received

1403_h 4th Receive PDO Parameter

The object stores settings for the fourth receive PDO R_PDO4.

Object description

Index	1403_h
Object name	4th receive PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–
Default value	2
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the R_PDO4
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	8000 0500_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RO
PDO mapping	–
Value range	–
Default value	254
Can be saved	–

The meaning of the bit states and subindex values is described under object `1st receive PDO-parameters` (1400_h).

Settings:

R_PDO4 is processed asynchronously and in an event-driven way and must be activated with bit 31=1 in subindex 01_h before it can be used.

The COB ID of the object can be changed in the NMT state "Pre-Operational".

1600_h 1st Receive PDO Mapping

The object specifies the objects mapped in R_PDO1 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	1600_h
Object name	1st receive PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped objects
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	1
Can be saved	–

Subindex	01_h, CMD: Control word
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	6040 0010_h
Can be saved	–

Subindex	02_h
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Bit assignment, starting at subindex 01h

bit	Meaning
0 ... 7	Object length in bits
8 ... 15	Subindex
16 ... 31	Index

Each subindex entry from subindex 01_h on specifies the object and the bit length of the object. The object is identified via the index and the subindex, which refer to the object dictionary of the device.

Settings:

The following default assignment is used:

- Subindex 01_h: `controlword` (6040_h)

1601_h 2nd Receive PDO Mapping

The object specifies the objects mapped in R_PDO2 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	1601_h
Object name	2nd receive PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped application objects in PDO
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	2
Can be saved	–

Subindex	01_h, PDO mapping for the first application object to be mapped (control word)
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	6040 0010_h
Can be saved	–

Subindex	02_h, PDO mapping for the second application object to be mapped (target position)
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	607A 0020_h
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO-mapping (1600`$_h$`)`.

Settings:

The following default assignment is set for the operating mode Profile Position:

- Subindex 01_h: `controlword (6040`$_h$`)`
- Subindex 02_h: `target position (607A`$_h$`)`

1602_h 3rd Receive PDO Mapping

The object specifies the objects mapped in R_PDO3 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	1602_h
Object name	3rd receive PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped application objects in PDO
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	2
Can be saved	–

Subindex	01_h, PDO mapping for the first application object to be mapped (control word)
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	6040 0010_h
Can be saved	–

Subindex	02_h, PDO mapping for the second application object to be mapped (target velocity)
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	60FF 0020_h
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO-mapping (1600h)`.

Settings:

The following default assignment is set for the operating mode Profile Position:

- Subindex 01_h: `controlword (6040h)`
- Subindex 02_h: `target velocity (60FFh)`

1603_h 4th Receive PDO Mapping

The object specifies the objects mapped in R_PDO4 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	1603_h
Object name	4th receive PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	0
Can be saved	–

Subindex	01_h
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	02_h
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO mapping (1600`$_h$`)`.

Settings:

The PDO assignment for R_PDO4 can be modified.

1800_h 1st Transmit PDO Parameter

The object contains settings for the first transmit PDO T_PDO1.

Object description

Index	1800_h
Object name	1st transmit PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, number of entries
Meaning	Number of values for the object
Access	RO
PDO mapping	–
Value range	–
Default value	5
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the T_PDO1
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	4000 0180_h + node ID
Can be saved	–

Subindex	02_h, transmission type = asynchronous
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0...255
Default value	255
Can be saved	–

Subindex	03_h, inhibit time
Meaning	Inhibit time for locking bus access (1=100µs)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

Subindex	04_h, reserved
Meaning	Reserved
Access	–
PDO mapping	–
Value range	0...255
Default value	–
Can be saved	–

Subindex	05_h, event timer
Meaning	Time span for event triggering (1=1 ms)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

The meaning of the bit states and subindex values is described with the object `1st receive PDO-parameters (1400h)`.

Settings:

T_PDO1 is transmitted asynchronously and in an event-driven way whenever the PDO data changes.

The byte assignment of the T_PDO1 is specified via PDO mapping with the object `1st transmit PDO mapping (1A00h)`. The following default assignment is used:

- Bytes 0 ... 1: Status word `statusword (6041h)`.

The COB ID of the object can be changed in the NMT state "Pre-Operational".

1801_h 2nd Transmit PDO Parameter

The object contains settings for the second transmit PDO T_PDO2.

Object description

Index	1801_h
Object name	2nd transmit PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–

Default value	5
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the T_PDO2
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	C000 0280_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0...255
Default value	255
Can be saved	–

Subindex	03_h, inhibit time
Meaning	Inhibit time for locking bus access (1=100µs)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

Subindex	04_h, reserved
Meaning	Reserved
Access	–
PDO mapping	–
Value range	0...255
Default value	–
Can be saved	–

Subindex	05_h, event timer
Meaning	Time span for event triggering (1=1 ms)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	100
Can be saved	–

The meaning of the bit states and subindex values is described with the object `1st receive PDO-parameters` (1400_h).

Settings:

T_PDO2 is transmitted synchronously and acyclically.

The byte assignment of the T_PDO2 is specified via PDO mapping with the object `2nd transmit PDO mapping` ($1A01_h$). The following default assignment is set for the operating mode "Profile Position":

- Bytes 0 ... 1: Status word `statusword` (6041_h)
- Bytes 2 ... 5: Actual position `position actual value` (6064_h).

The COB ID of the object can be changed in the NMT state "Pre-Operational".

1802_h 3rd Transmit PDO Parameter

The object contains settings for the third transmit PDO T_PDO3.

Object description

Index	1802_h
Object name	3rd transmit PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–
Default value	5
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the T_PDO3
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	C000 0380_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RW
PDO mapping	–
Value range	0...255
Default value	255
Can be saved	–

Subindex	03_h, inhibit time
Meaning	Inhibit time for locking bus access (1=100µs)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

Subindex	04_h, reserved
Meaning	Reserved
Access	–
PDO mapping	–
Value range	0...255
Default value	–
Can be saved	–

Subindex	05_h, event timer
Meaning	Time span for event triggering (1=1 ms)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	100
Can be saved	–

The meaning of the bit states and subindex values is described with the object `1st receive PDO-parameters (1400h)`.

Settings:

T_PDO3 is transmitted synchronously and acyclically.

The byte assignment of the T_PDO3 is specified via PDO mapping with the object `3rd transmit PDO mapping (1A02h)`. The following default assignment is set for the operating mode "Profile Position":

- Bytes 0 ... 1: Status word `statusword (6041h)`
- Bytes 2 ... 5: Actual velocity `velocity actual value (606Ch)`.

The COB ID of the object can be changed in the NMT state "Pre-Operational".

1803_h 4th Transmit PDO Parameter

The object contains settings for the fourth transmit PDO T_PDO4.

Object description

Index	1803_h
Object name	4th transmit PDO parameter
Object code	RECORD
Data type	PDO Communication Parameter

Value description

Subindex	00_h, largest subindex supported
Meaning	Largest subindex supported
Access	RO
PDO mapping	–
Value range	–
Default value	5
Can be saved	–

Subindex	01_h, COB ID used by PDO
Meaning	Identifier of the T_PDO4
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	C000 0480_h + node ID
Can be saved	–

Subindex	02_h, transmission type
Meaning	Transmission type
Access	RO
PDO mapping	–
Value range	0...255
Default value	254
Can be saved	–

Subindex	03_h, inhibit time
Meaning	Inhibit time for locking bus access (1=100µs)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

Subindex	04_h, reserved
Meaning	Reserved
Access	–
PDO mapping	–
Value range	0...255
Default value	–
Can be saved	–

Subindex	05_h, event timer
Meaning	Time span for event triggering (1=1 ms)
Access	RW
PDO mapping	–
Value range	0...65535
Default value	0
Can be saved	–

The meaning of the bit states and subindex values is described with the object `1st receive PDO-parameters (1400h)`.

Settings:

R_PDO4 is transmitted asynchronously and in an event-driven way.

The COB ID of the object can be changed in the NMT state "Pre-Operational".

$1A00_h$ 1st Transmit PDO Mapping

The object specifies the objects mapped in T_PDO1 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	$1A00_h$
Object name	1st transmit PDO mapping

Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped objects
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	1
Can be saved	–

Subindex	01_h, ETA: status word
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	6041 0010_h
Can be saved	–

Subindex	02_h
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO mapping` (1600_h).

Settings:

The following default assignment is used:

- Subindex 01_h: `statusword` (6041_h)

$1A01_h$ 2nd Transmit PDO Mapping

The object specifies the objects mapped in T_PDO2 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	$1A01_h$
Object name	2nd transmit PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped application objects in PDO
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	2
Can be saved	–

Subindex	01_h, PDO mapping for the first application object to be mapped (status word)
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	$6041\ 0010_h$
Can be saved	–

Subindex	02_h, PDO mapping for the second application object to be mapped (actual position)
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	$6064\ 0020_h$
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO-mapping (1600h)`.

Settings:

The following default assignment is set for the operating mode Profile Position:

- Subindex 01_h: `statusword (6041h)`
- Subindex 02_h: `position actual value (6064h)`

$1A02_h$ 3rd Transmit PDO Mapping

The object specifies the objects mapped in T_PDO3 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	$1A02_h$
Object name	3rd transmit PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of mapped application objects in PDO
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	2
Can be saved	–

Subindex	01_h, PDO mapping for the first application object to be mapped (status word)
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	6041 0010_h
Can be saved	–

Subindex	02_h, PDO mapping for the second application object to be mapped (actual velocity)
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	606C 0020_h
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO-mapping (1600`$_h$`).`

Settings:

The following default assignment is set for the operating mode Profile Position:

- Subindex 01_h: `statusword (6041`$_h$`)`
- Subindex 02_h: `velocity actual value (606C`$_h$`)`

$1A03_h$ 4th Transmit PDO Mapping

The object specifies the objects mapped in T_PDO4 and transmitted with the PDO. When the object is read, subindex 00_h, the number of mapped objects is read.

Object description

Index	$1A03_h$
Object name	4th transmit PDO mapping
Object code	RECORD
Data type	PDO mapping

Value description

Subindex	00_h, number of elements
Meaning	Number of values for the object
Access	RW
PDO mapping	–
Value range	0 ... 4
Default value	0
Can be saved	–

Subindex	01_h
Meaning	First object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	02_h
Meaning	Second object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295

Default value	–
Can be saved	–

Subindex	03_h
Meaning	Third object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

Subindex	04_h
Meaning	Fourth object for mapping
Access	RW
PDO mapping	–
Value range	0...4294967295
Default value	–
Can be saved	–

The meaning of the bit states is described with the object `1st receive PDO mapping` (1600_h).

Settings:

The PDO assignment for T_PDO4 can be modified.

Chapter 13
Accessories and Spare Parts

What Is in This Chapter?

This chapter contains the following topics:

Commissioning Tools

Description	Reference
PC connection kit, serial connection between drive and PC, USB-A to RJ45	TCSMCNAM3M002P
Multi-Loader, device for copying the parameter settings to a PC or to another drive	VW3A8121
Modbus cable, 1 m (3.28 ft), 2 x RJ45	VW3A8306R10

Memory Cards

Description	Reference
Memory card for copying parameter settings	VW3M8705
25 memory cards for copying parameter settings	VW3M8704

Mains Supply for Slot 1 or Slot 2

Description	Reference
LXM32I connection module mains supply, single-phase	VW3M9001
LXM32I connection module mains supply, three-phase	VW3M9002

Braking Resistors for Slot 1 or Slot 2

Description	Reference
LXM32I module standard braking resistor, single-phase 35 Ω, 20 W	VW3M9021
LXM32I module standard braking resistor, three-phase, 70 Ω, 20 W	VW3M9022
LXM32I connection module external braking resistor	VW3M9010

External Braking Resistors

Description	Reference
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7602R07
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7602R20
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7602R30
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7603R07
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7603R20
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7603R30
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7604R07
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7604R20
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7604R30
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7605R07
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7605R20
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7605R30
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7606R07
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7606R20
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14), UL	VW3A7606R30
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7607R07
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7607R20
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm^2 (AWG 14)	VW3A7607R30

I/O Module with Industrial Connector for Positive Logic

Description	Reference
LXM32I CAN connection module with industrial connector, 4 digital inputs M8 (source), fieldbus M12, safety function STO	VW3M9101
LXM32I CAN connection module with industrial connector, 4 digital inputs M8 (source), fieldbus M12	VW3M9102
LXM32I CAN connection module with industrial connector, 2 digital inputs M8 (source), fieldbus M12, safety function STO	VW3M9103
LXM32I CAN connection module with industrial connector, 2 digital inputs M8 (source), fieldbus M12	VW3M9104

I/O Module with Industrial Connector for Negative Logic

Description	Reference
LXM32I CAN connection module with industrial connector, 4 digital inputs M8 (sink), fieldbus M12, safety function STO	VW3M9201
LXM32I CAN connection module with industrial connector, 4 digital inputs M8 (sink), fieldbus M12	VW3M9202
LXM32I CAN connection module with industrial connector, 2 digital inputs M8 (sink), fieldbus M12, safety function STO	VW3M9203
LXM32I CAN connection module with industrial connector, 2 digital inputs M8 (sink), fieldbus M12	VW3M9204

I/O Module with Spring Terminals

Description	Reference
LXM32I CAN connection module with spring terminals (sink/source), 4 digital inputs, 2 digital outputs, safety function STO, CANopen terminating resistor and 7 blind plugs	VW3M9105
Cable glands M8 for signals and STO, 12 pieces	VW3M9508
Cable glands M12 for fieldbus, 10 pieces	VW3M9512

Cables for Safety Function STO

Description	Reference
Pre-assembled cable for the safety function STO, 3 m (9.84 ft), 3 x 0.34 mm^2, industrial connector M8, other cable end open	VW3M9403
Pre-assembled cable for the safety function STO, 5 m (16.4 ft), 3 x 0.34 mm^2, industrial connector M8, other cable end open	VW3M9405
Pre-assembled cable for the safety function STO, 10 m (32.8 ft), 3 x 0.34 mm^2, industrial connector M8, other cable end open	VW3M9410
Pre-assembled cable for the safety function STO, 15 m (49.2 ft), 3 x 0.34 mm^2, industrial connector M8, other cable end open	VW3M9415
Pre-assembled cable for the safety function STO, 20 m (65.6 ft), 3 x 0.34 mm^2, industrial connector M8, other cable end open	VW3M9420
Connector for STO output, 1 x industrial connector M8	VW3L50010
Pre-assembled cable for the safety function STO, 3 m (9.84 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR03
Pre-assembled cable for the safety function STO, 5 m (16.4 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR05
Pre-assembled cable for the safety function STO, 10 m (32.8 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR10
Pre-assembled cable for the safety function STO, 15 m (49.2 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR15
Pre-assembled cable for the safety function STO, 20 m (65.6 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR20

Industrial Plug Connectors

Description	Reference
Connector kit for CANopen/RS485, 1 x male industrial connector M12, 1 x female industrial connector M12, 1 x sealing cap M12	VW3L5F000
Connector kit for I/O, 2 x industrial connector M8	VW3L50200
Connector kit for I/O, 3 x industrial connector M8	VW3L50300
Connector for STO output, 1 x industrial connector M8	VW3L50010
Sealing caps for I/O module with industrial connectors, 5 x M8, 1 x M12	VW3M9530

CANopen Cable With Connectors

Description	Reference
CANopen cable, 0.3 m (0.98 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F03
CANopen cable, 1 m (3.28 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F1
CANopen cable, 2 m (6.56 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F2
CANopen cable, 5 m (16.4 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F5
CANopen cable, 10 m (32.8 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F10
CANopen cable, 15 m (49.2 ft), M12 connector, M12 female connector, straight	TCSCCN1M1F15
CANopen cable, 0.3 m (0.98 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F03
CANopen cable, 1 m (3.28 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F1
CANopen cable, 2 m (6.56 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F2
CANopen cable, 5 m (16.4 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F5
CANopen cable, 10 m (32.8 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F10
CANopen cable, 15 m (49.2 ft), M12 connector, M12 female connector, 90° angled	TCSCCN2M2F15
CANopen cable, 1 m (3.28 ft), M12 connector, straight, other cable end open	TCSCCN1FNX1SA
CANopen cable, 3 m (9.84 ft), M12 connector, straight, other cable end open	TCSCCN1FNX3SA
CANopen cable, 10 m (32.8 ft), M12 connector, straight, other cable end open	TCSCCN1FNX10SA
CANopen cable, 25 m (82 ft), M12 connector, straight, other cable end open	TCSCCN1FNX25SA
CANopen cable, 1 m (3.28 ft), M12 connector, 90° angled, other cable end open	TCSCCN2FNX1SA
CANopen cable, 3 m (9.84 ft), M12 connector, 90° angled, other cable end open	TCSCCN2FNX3SA
CANopen cable, 10 m (32.8 ft), M12 connector, 90° angled, other cable end open	TCSCCN2FNX10SA
CANopen cable, 25 m (82 ft), M12 connector, 90° angled, other cable end open	TCSCCN2FNX25SA
CANopen cable, 3 m (9.84 ft), M12 female connector, RJ45 connector	VW3M94CAN45R03
CANopen cable, 5 m (16.4 ft), M12 female connector, RJ45 connector	VW3M94CAN45R05
CANopen cable, 10 m (32.8 ft), M12 female connector, RJ45 connector	VW3M94CAN45R10
CANopen cable, 15 m (49.2 ft), M12 female connector, RJ45 connector	VW3M94CAN45R15
CANopen cable, 20 m (65.6 ft), M12 female connector, RJ45 connector	VW3M94CAN45R20
CANopen cable, 3 m (9.84 ft), M12 female connector, D9-SUB female connector	VW3M94CANS9R03
CANopen cable, 5 m (16.4 ft), M12 female connector, D9-SUB female connector	VW3M94CANS9R05
CANopen cable, 10 m (32.8 ft), M12 female connector, D9-SUB female connector	VW3M94CANS9R10
CANopen cable, 15 m (49.2 ft), M12 female connector, D9-SUB female connector	VW3M94CANS9R15
CANopen cable, 20 m (65.6 ft), M12 female connector, D9-SUB female connector	VW3M94CANS9R20

CANopen Connectors, Distributors, Terminating Resistors

Description	Reference
CANopen terminating resistor M12	TM7ACTLA
CANopen terminating resistor D9-SUB (female)	VW3M3802
CANopen connector with PC interface, D9-SUB (female), with switchable terminating resistor and additional D9-SUB (male) to connect a PC to the bus, PC interface straight, bus cable angled 90°	TSXCANKCDF90TP

CANopen Cables With Open Cable Ends

Cables with open cable ends are suitable for connection of D-SUB connectors. Observe the cable cross section and the connection cross section of the required connector.

Description	Reference
CANopen cable, 50 m (164 ft), [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA50
CANopen cable, 100 m (328 ft), [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA100
CANopen cable, 300 m (984 ft), [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA300
CANopen cable, 50 m (164 ft), [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB50
CANopen cable, 100 m (328 ft), [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB100
CANopen cable, 300 m (984 ft), [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB300
CANopen cable, 50 m (164 ft), [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD50
CANopen cable, 100 m (328 ft), [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD100
CANopen cable, 300 m (984 ft), [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD300

Chapter 14
Service, Maintenance, and Disposal

What Is in This Chapter?

This chapter contains the following topics:

Service Addresses

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97828 Marktheidenfeld, Germany

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Phone: +49 (0) 9391 / 606 - 3265

Fax: +49 (0) 9391 / 606 - 3340

Email: automation.support.de@schneider-electric.com

Internet: *http://www.schneider-electric.com*

Additional Contact Addresses

See the homepage for additional contact addresses:

http://www.schneider-electric.com

Maintenance

Maintenance Plan

Inspect the product for pollution or damage at regular intervals.

Repairs may only be made by the manufacturer. No warranty or liability is accepted for repairs made by unauthorized persons.

Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information on the precautions and processes to be observed.

Include the following points in the maintenance plan of your machine.

Connections and Fastening

- Inspect all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Verify that all output elements are firmly seated.
- Tighten all mechanical and electrical threaded connections to the specified torque.

Lubricating the Shaft Sealing Ring

In the case of motors with shaft sealing ring, lubricant must be applied to the space between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the shaft sealing rings will be significantly reduced.

Cleaning

If the permissible ambient conditions are not respected, external substances from the environment may penetrate the product and cause unintended movement or equipment damage.

⚠ WARNING

UNINTENDED MOVEMENT

- Verify that the allowable ambient conditions specified in the present document and in the documentation of any supporting hardware or accessories are respected.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example, in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries of the motor to the direct spray of a pressure washer.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a pressure washer. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the cables, cable entry seals, O-rings and motor paint are not damaged.

Inspecting/Breaking In the Holding Brake

The holding brake is broken-in at the factory. If the holding brake is not used for an extended period of time, parts of the holding brake may corrode. Corrosion reduces the holding torque.

If the holding brake does not have the holding torque indicated in the technical data, it must be broken in again.

- If the motor is mounted, dismount the motor.
- Measure the holding torque of the holding brake using a torque wrench.
- If the holding torque of the holding brake considerably differs from the specified values, manually rotate the motor shaft by 25 rotations in both directions. See chapter Holding Brake (Option) *(see page 35)* for the values.
- Repeat the process up to 3 times, until you can restore the original holding torque.
  Contact your Schneider Electric representative if the original holding torque is not restored.

Replacing the Rolling Bearing

When the rolling bearing is replaced, the motor is partially demagnetized and loses power.

NOTICE
INOPERABLE EQUIPMENT
Do not replace the rolling bearing.
Failure to follow these instructions can result in equipment damage.

For all service matters, contact your Schneider Electric representative.

Lifetime Safety Function STO

The STO safety function is designed for a lifetime of 20 years. After this period, the data of the safety function are no longer valid. The expiry date is determined by adding 20 years to the DOM shown on the nameplate of the product.

- This date must be included in the maintenance plan of the system.
  Do not use the safety function after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.16. (31 December 2016). This means: Do not use the safety function after December 31, 2036.

Replacing the Product

Opening the side wall exposes hazardous voltages and damages the insulation.

DANGER

ELECTRIC SHOCK

Do not open the side wall.

Failure to follow these instructions will result in death or serious injury.

Unsuitable parameter values or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameter values or data do not become active until after a restart.

WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not operate the drive system with undetermined parameter values or data.
- Never modify a parameter value unless you fully understand the parameter and all effects of the modification.
- Restart the drive and verify the saved operational data and/or parameter values after modifications.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
- Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Only replace LXM32I control unit and BMI servo motor together. Do not replace one of the two individually.

Follow the procedure below for replacing devices.

- Save all parameter settings. To do so, use a memory card or save the data to a PC using the commissioning software, see chapter Parameter Management *(see page 190)*.
- Power off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and remove all connection cables (unlock connector locks).
- Uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per chapter Installation *(see page 113)*.
- If the product to be installed has previously been used in a different system or application, you must restore the factory settings before commissioning the product.
- Commission the product as per chapter Commissioning *(see page 151)*.

Shipping, Storage, Disposal

Shipping

The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage

The product may only be stored in spaces where the specified permissible ambient conditions are met.

Protect the product from dust and dirt.

Disposal

The product consists of various materials that can be recycled. Dispose of the product in accordance with local regulations.

Visit *http://www.schneider-electric.com/green-premium* for information and documents on environmental protection as per ISO 14025 such as:

- EoLi (Product End-of-Life Instructions)
- PEP (Product Environmental Profile)

Glossary

A

Actual value

In control engineering, the actual value is the value of the controlled variable at a given instant (for example, actual velocity, actual torque, actual position). The actual value is an input value (measured value) used by the control loops to reach the reference value.

C

CAN

(**C**ontroller **A**rea **N**etwork), standardized open fieldbus as per ISO 11898, allows drives and other devices from different manufacturers to communicate.

CANopen

Device- and manufacturer-independent description language for communication via the CAN bus

CiA

CAN **i**n **A**utomation, CAN interest group, standardization group for CAN and CANopen.

COB

Communication **OB**ject, transport unit in a CAN network.

COB ID

Communication **OB**ject **ID**entifier; uniquely identifies each communication object in a CAN network

D

DC bus

Circuit that supplies the power stage with energy (direct voltage).

Degree of protection

The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).

Direction of movement

In the case of a rotary motors, direction of movement is defined in accordance with IEC 61800-7-204: Positive direction is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

DOM

Date **o**f **m**anufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. For example:

31.12.11 corresponds to December 31, 2011

31.12.2011 corresponds to December 31, 2011

DriveCom

Specification of the DSP402 state machine was created in accordance with the DriveCom specification.

DS301

Standardizes the CANopen communication profile

DSP402

Standardizes the CANopen device profile for drives

E

EDS

(**E**lectronic **D**ata **S**heet); contains the specific properties of a product.

EMC

Electromagnetic compatibility

Encoder

Sensor that converts a measured distance or angle into an electrical signal. This signal is evaluated by the drive to determine the actual position of a shaft (rotor) or a driving unit.

Error

Discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.

Error class

Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.

F

Factory settings

Settings when the product is shipped.

Fault

Fault is an operating state. If the monitoring functions detect an error, a transition to this operating state is triggered, depending on the error class. A "Fault Reset" or a power cycle are required to exit this operating state. Prior to this, the cause of the detected error must be removed. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).

Fault Reset

Function used to exit the operating state Fault. Before the function is used, the cause of the detected error must be removed.

H

Heartbeat

Used for unconfirmed connection acknowledgement messages from network devices.

Holding brake

The holding brake in the motor has the task of holding the motor position when the power stage is disabled. The holding brake is not a safety function and not a service brake.

I

Inc

Increments

Index pulse

Signal of an encoder to reference the rotor position in the motor. The encoder returns one index pulse per revolution.

Internal units

Resolution of the power stage at which the motor can be positioned. Internal units are specified in increments.

IT mains

Mains in which all active components are isolated from ground or are grounded by a high impedance. IT: isolé terre (French), isolated ground.

Opposite: Grounded mains, see TT/TN mains

L

Life guarding

For monitoring the connection of an NMT master

Limit switch

Switches that signal overtravel of the permissible range of travel.

M

Mapping

Assignment of object dictionary entries to PDOs

N

NMT

Network Management (NMT), part of the CANopen communication profile; tasks include initialization of the network and devices, starting, stopping and monitoring of devices

Node guarding

Monitoring of the connection to the slave at an interface for cyclic data traffic.

Node ID

Node address assigned to a device on the network.

P

Parameter

Device data and values that can be read and set (to a certain extent) by the user.

PELV

Protective Extra Low Voltage, low voltage with isolation. For more information: IEC 60364-4-41

Persistent

Indicates whether the value of the parameter remains in the memory after the device is switched off.

Power stage

The power stage controls the motor. The power stage generates current for controlling the motor on the basis of the motion signals from the controller.

Q

Quick Stop

The function can be used for fast deceleration of a movement as a response to a detected error or via a command.

R

RCD

RCD residual current device.

rms

"Root Mean Square" value of a voltage (V_{rms}) or a current (A_{rms})

RS485

Fieldbus interface as per EIA-485 which enables serial data transmission with multiple devices.

S

Scaling factor

This factor is the ratio between an internal unit and a user-defined unit.

T

TT mains, TN mains

Grounded mains, differ in terms of the ground connection (PE conductor connection). Opposite: Ungrounded mains, see IT mains.

U

User-defined unit

Unit whose reference to motor movement can be determined by the user via parameters.

Index

Q

R

S

T

U