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Lexium 32i ECT and BMi

Integrated Servo Drive System

User Guide

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Safety Information

Important Information

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 in or affected by the present 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.

Before You Begin

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National

Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

Start-up and Test

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check are made and that enough time is allowed to perform complete and satisfactory testing.

⚠WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer’s instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer’s instructions and the machinery used with the electrical equipment.
- Only those operational adjustments required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

Document Scope

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

Validity Note

This manual is valid for the standard products listed in the Type Code, page 21.

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.se.com/ww/en/work/support/green-premium/.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document 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 document 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.

Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

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

For more information on organizational measures and rules covering access to infrastructures, refer to 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, and refer to Cybersecurity Guidelines for EcoStruxure Machine Expert, Modicon and PacDrive Controllers and Associated Equipment.

For reasons of Internet security, for those devices that have a native Ethernet connection, TCP/IP forwarding is disabled by default. Therefore, you must manually enable TCP/IP forwarding. However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

⚠WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION

- Observe and respect any and all pertinent national, regional and local cybersecurity and/or personal data laws and regulations when enabling TCP/IP forwarding on an industrial network.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.

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

Consult the Schneider Electric Cybersecurity Best Practices for additional information.

Firmware

Use the latest firmware version. Visit https://www.se.com or contact your Schneider Electric representative for information on firmware updates.

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
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	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
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	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 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
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.

Introduction

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 EtherCAT; 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-related function "Safe Torque Off" (STO) as per IEC 61800-5-2 is implemented on board.

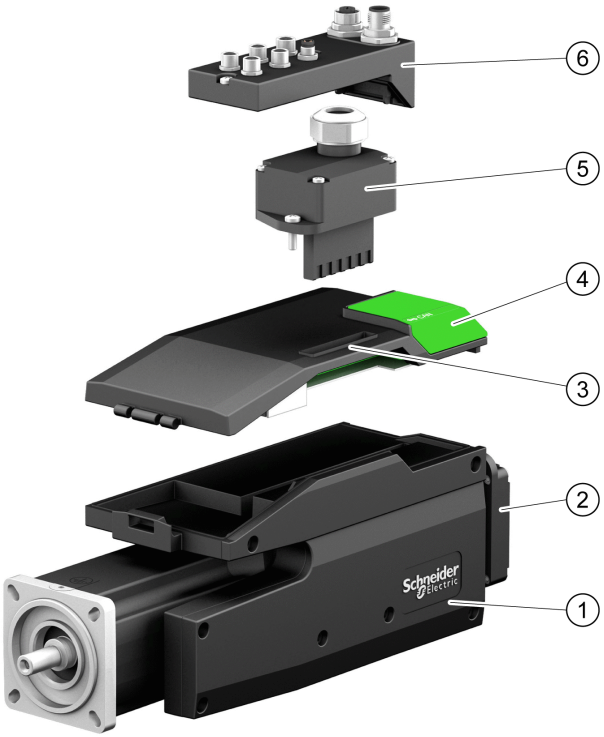
EtherCAT is an Ethernet-based fieldbus system. The technology is standardized as per the international standards IEC 61158 and IEC 61784 as well as ISO 15745-4.

EtherCAT is a real-time Ethernet system that lends itself for use in cycle-synchronous motion control applications.

EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany.

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 EtherCAT 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-related function STO

For an overview of the available accessories see Accessories and Spare Parts, page 483.

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	E	C	T	•	•	•	•	•

Item	Meaning
1 ... 3	**Product family** LXM = Lexium
4 ... 6	**Product type** 32I = Control unit for Lexium 32i
7 ... 9	**Fieldbus interface** ECT = EtherCAT
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.

Technical Data

Environmental Conditions

Conditions for Transportation and Storage

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

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

The following relative humidity is permissible during transportation and storage:

Characteristic	Unit	Value
Relative humidity (non-condensing)	%	5 ... 80

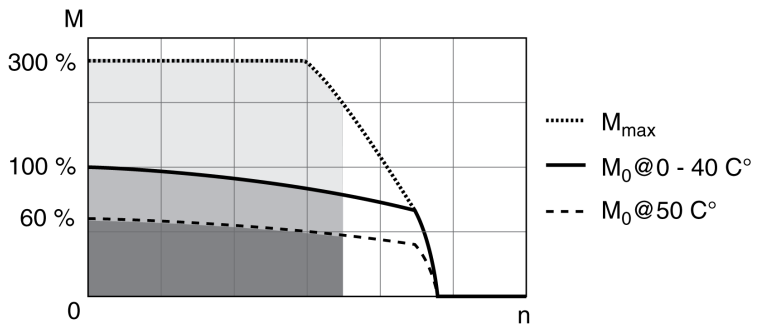
Characteristic	Unit	Value
Vibration and shock during transportation and storage	-	As per IEC 60721-3-2, class 2M2

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 section Installation, page 78.

Characteristic	Unit	Value
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 section Conditions for UL 508C, page 48.		

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



The following relative humidity is permissible during operation:

Characteristic	Unit	Value
Relative humidity (non-condensing)	%	5 ... 80

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

Characteristic	Unit	Value
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)

Characteristic	Unit	Value
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 Installation, page 78, and the cover of the commissioning interface to be closed (IP as per IEC 60529):

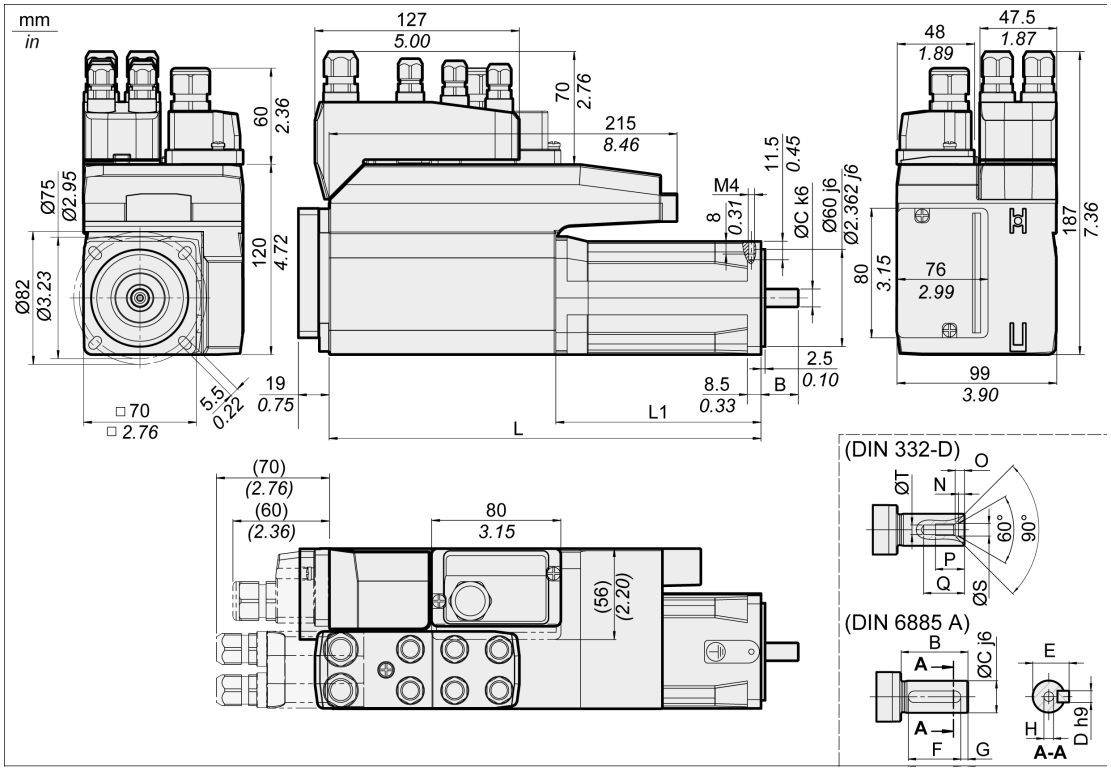
Characteristic	Value
Degree of Protection without shaft sealing ring	IP 54(1)
Degree of protection with shaft sealing ring	IP 65(1)(2)

(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.

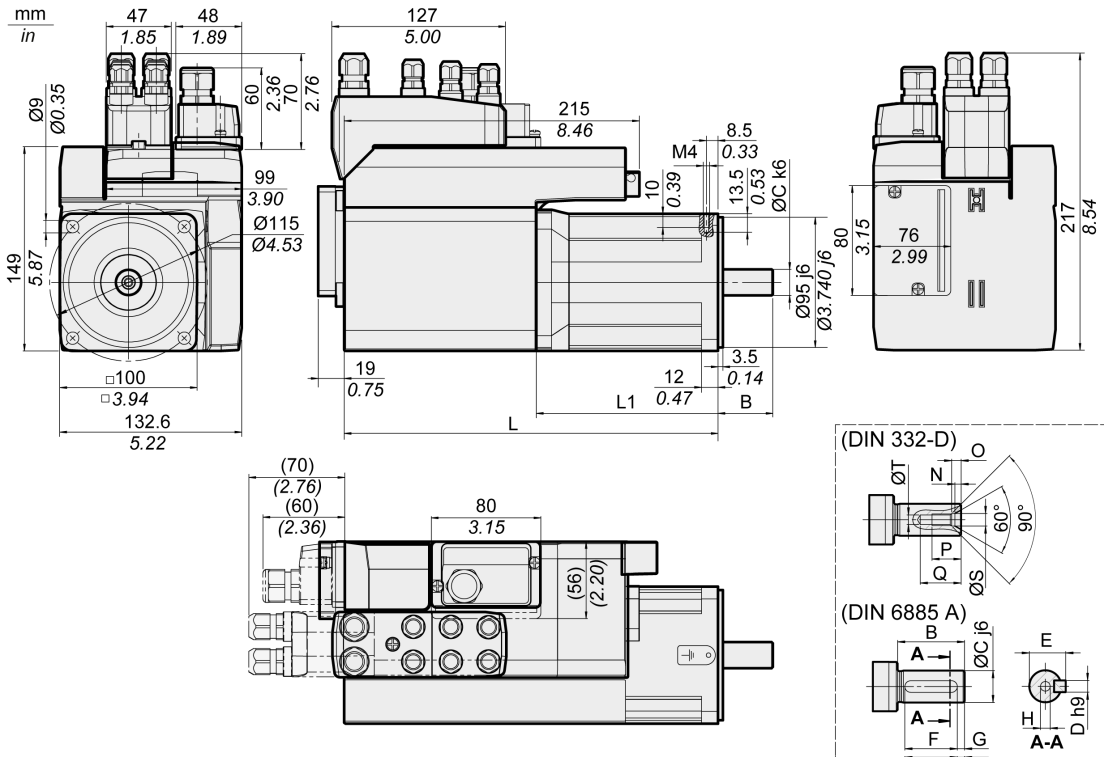
Dimensions

Dimensions BMI070



Characteristic	Unit	Value	
		BMI0702	BMI0703
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



Characteristic	Unit	Value	
		BMI1002	**BMI1003**
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

Overview

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

Mains Voltage: Range and Tolerance

Characteristic	Unit	Value
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%

Characteristic	Unit	Value
Transient overvoltages	-	Overvoltage category III(1)
Rated voltage to ground	Vac	300
(1) Depends on installation altitude, see Environmental Conditions, page 23.		

Type of Grounding

Characteristic	Value
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 Environmental Conditions, page 23.	

Leakage Current

Characteristic	Unit	Value
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.

Characteristic	Unit	Value
PWM frequency power stage	kHz	8

Service Life

Characteristic	Unit	Value
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 section Logic Type, 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.

Characteristic	Unit	Value
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):

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

Digital Input Signals 24 V

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

Characteristic	Unit	Value
Input voltage - sinking inputs Level 0 Level 1	Vdc	 -3 ... 5 15 ... 30
Input voltage - sourcing inputs (at 24 Vdc) Level 0 Level 1	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	 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 sourcing outputs, the levels of the digital outputs comply with IEC 61131-2. The electrical characteristics are also valid when wired as sinking outputs unless otherwise indicated.

Characteristic	Unit	Value
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 - sourcing outputs	Vdc	24
Nominal output voltage - sinking outputs	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-Related Function STO

The inputs for the safety-related function STO (inputs $\overline{STO_A}$ and $\overline{STO_B}$) can only be wired for sinking inputs. Observe the information provided in section Functional Safety, page 67.

Characteristic	Unit	Value
Input voltage - sinking inputs Level 0 Level 1	Vdc	 -3 ... 5 15 ... 30
Input current (at 24 Vdc)	mA	2.5
Debounce time $\overline{STO_A}$ and $\overline{STO_B}$	ms	>1

Characteristic	Unit	Value
Detection of signal differences between *STO_A* and *STO_B*	s	>1
Response time of safety-related function STO	ms	≤10

EtherCAT Signals

The EtherCAT signals comply with the IEEE 802.3 standard.

Characteristic	Value
Fieldbus protocol	EtherCAT
Transmission Rate	100 Mbit/s
Status indication	2 x LED Link/Activity 1 x LED Network RUN 1 x LED Network ERROR
Addressing methods	Position addressing Node addressing Logical addressing Second address
Communication profile	CoE (CANopen over EtherCAT) EoE (Ethernet over EtherCAT)
Synchronization methods	DC synchronous (Distributed Clock, Jitter <1 µs) SM synchronous (SyncManager)
Communication cycle time	0.25 ms ... 20 ms (0.25 ms increments)

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.

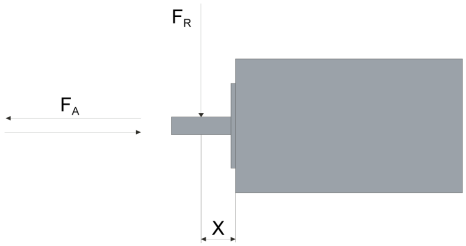
⚠CAUTION

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.

Characteristic	Unit	Value	
		BMI070	BMI100
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:

Characteristic	Unit	Value		
		BMI0702	BMI0703	BMI100
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.

Character-istic	Unit	Value			
		BMI0702	BMI0703	BMI1002	BMI1003
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.

Character-istic	Unit	Value			
		BMI0702	BMI0703	BMI1002	BMI1003
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

Characteristic		Unit	Value		
			BMI0702	BMI0703	BMI1002
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	1.5	1.5	1.5
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 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 Conditions for UL 508C, page 48 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

Characteristic		Unit	Value		
			BMI0702	BMI0703	BMI1002
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	3.0	3.0	3.0
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 Conditions for UL 508C, page 48 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

Characteristic		Unit	Value			
			BMI0702	BMI0703	BMI1002	BMI1003
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	0.7	0.7	0.7	0.7
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 Conditions for UL 508C, page 48 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

Characteristic		Unit	Value			
			BMI0702	BMI0703	BMI1002	BMI1003
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	1.4	1.4	1.4	1.4
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 Conditions for UL 508C, page 48 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

Characteristic		Unit	Value			
			BMI0702	BMI0703	BMI1002	BMI1003
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	1.7	1.7	1.7	1.7
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 Conditions for UL 508C, page 48 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)

Description

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.

Characteristic	Unit	Value		
		BMI070	BMI1002	BMI1003
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.

Characteristic	Value
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/s²

SKM36 Multiturn

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

Characteristic	Value
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/s²

SEK37 Singleturn

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

Characteristic	Value
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.

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

Capacitor and Braking Resistor

Description

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.

Data of Internal Capacitor

Characteristic	Unit	Value			
		BMI070 Single-phase	BMI100 Single-phase	BMI070 Three-phase	BMI100 Three-phase
Capacitance of internal capacitor	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

Data of Standard Braking Resistor

Characteristic	Unit	Value			
		BMI070 Single-phase	BMI100 Single-phase	BMI070 Three-phase	BMI100 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
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

Data for External Braking Resistor

Characteristic	Unit	Value			
		BMI070 Single-phase	BMI100 Single-phase	BMI070 Three-phase	BMI100 Three-phase
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

(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

Characteristic	Unit	Value				
		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

Data of External Braking Resistors (Accessories)

Characteristic	Unit	Value					
		VW3A7602-Rxx	VW3A7603-Rxx	VW3A7604-Rxx(1)	VW3A7605-Rxx	VW3A7606-Rxx	VW3A7607-Rxx(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

Characteristic	Unit	Value					
		VW3A7602-Rxx	**VW3A7603-Rxx**	**VW3A7604-Rxx(1)**	**VW3A7605-Rxx**	**VW3A7606-Rxx**	**VW3A7607-Rxx(1)**
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 EMI shielding techniques to help prevent unintended device operation.

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

Specifications Screws, Cable Glands, and Sealing Caps

Tightening Torque and Property Class for Screws

Characteristic	Unit	Value
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).

Characteristic	Unit	Value
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.

Characteristic	Unit	Value
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)

Nonvolatile Memory and Memory Card

Nonvolatile Memory

The following table shows characteristics for the nonvolatile 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 insertion cycles	1000

Memory Card Holder

The following table shows characteristics for the memory card holder:

Characteristic	Value
Minimum number of insertion cycles	5000

Conditions for UL 508C

General

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

Ambient Temperature During Operation

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

Fuses

Use fuses as per UL 248.

Characteristic	Unit	Value
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).

Engineering

Electromagnetic Compatibility (EMC)

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 EMI shielding techniques to help prevent unintended device operation.

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

See Electromagnetic Emission, page 44 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

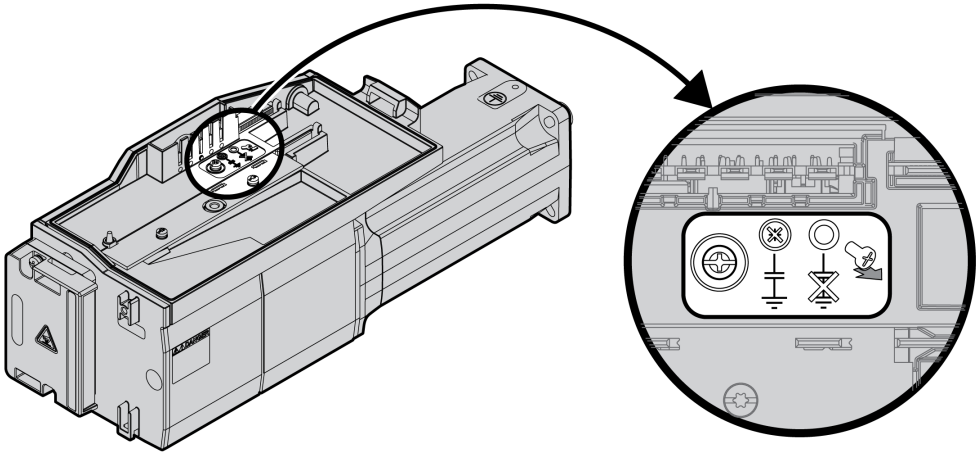
Depending on the application, the following measures can improve the EMC-dependent values:

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, page 44 specified no longer apply if the Y capacitors are deactivated.

Cables and Signals

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 mm² (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

Overview

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 section Accessories and Spare Parts, page 483. If the product is used to comply with the requirements as per UL 508C, the conditions specified in section Conditions for UL 508C, page 48 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-related 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 EtherCAT	100 m (328 ft)	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	8 * 0.25 mm^2 (8 * 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 Conductor Cross Sections According to Method of Installation, page 52.

(3) See Protected Cable Installation for Safety-Related Signals, page 74.

Wiring Concept

Description

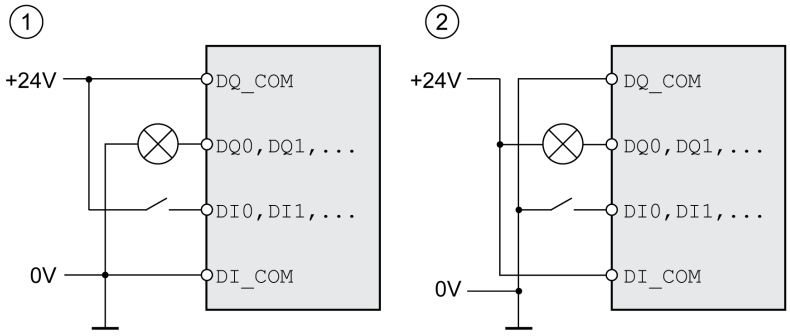
Note the following for wiring the product:

- 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 to enable 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-Related Function STO

The inputs for the safety-related function STO (inputs $\overline{STO_A}$ and $\overline{STO_B}$) can only be wired for sinking inputs.

Configurable Inputs and Outputs

Description

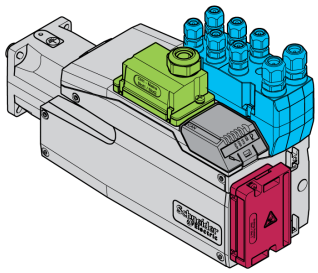
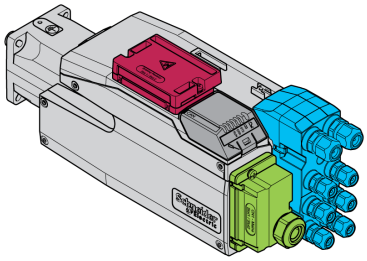
This product has digital inputs and outputs that can be configured for specific functional assignments. The inputs and outputs have a defined standard assignment depending on the operating mode. This assignment can be adapted to the requirements of the customer's installation. See Digital Signal Inputs and Digital Signal Outputs, page 184 for additional information.

Mounting Types of The Modules

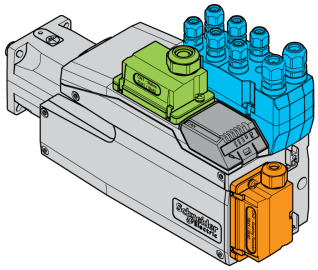
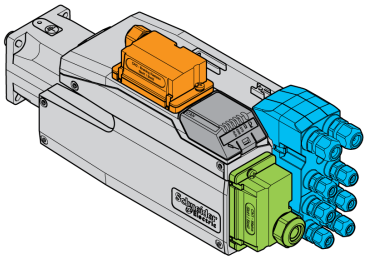
Description

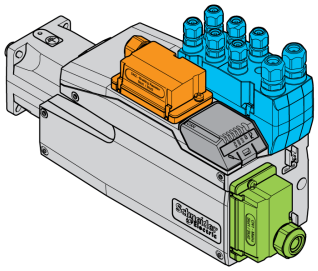
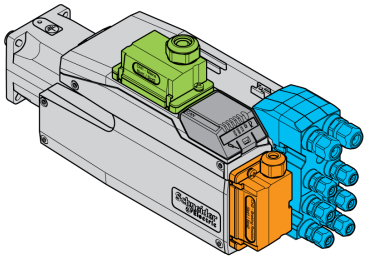
Select the installation of the modules according to the required interfaces and the connection direction. Also note that the modules require space for mounting.

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

Mains Supply

Residual Current Device

Description

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

Description

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 section Technical Data, page 23.
- 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.

You can use the following combinations:

Integrated drive	Mains reactor
BMI070•T (single-phase)	VZ1L007UM50
BMI100•T (single-phase)	VZ1L018UM20

Integrated drive	Mains reactor
BMI070•P (three-phase)	VW3A4551
BMI100•P (three-phase)	VW3A4552

Rating the Braking Resistor

Standard Braking Resistor

Description

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

Description

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

- The total resistance of the connected braking 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 the connected braking resistors 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 Accessories and Spare Parts, page 483.

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 and Spare Parts, page 483 section are shipped with an information sheet that provides details on their 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_l
- 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 section Capacitor and Braking Resistor, page 41.

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 section Capacitor and Braking Resistor, page 41.

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 drive type).

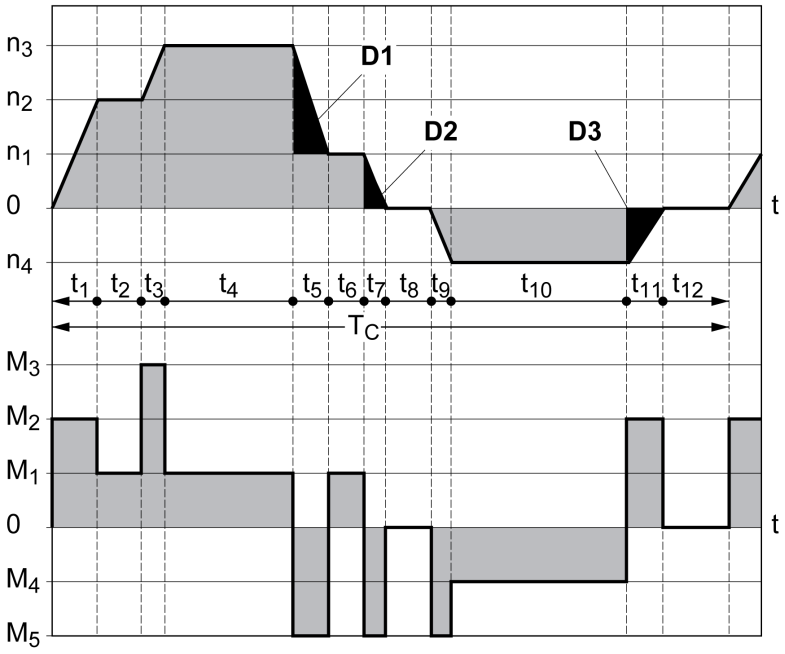
The standard braking resistor must absorb the remaining 65 Ws. It can absorb a pulse of $E_{CR} = 80\ Ws$. If the load is decelerated once, the standard braking resistor is sufficient.

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 kgm², ω in rad and n_i in RPM.

See the technical data for the energy absorption E_{var} of the drives (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 drive. 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 Accessories and Spare Parts, page 483.

Functional Safety

Basics

Functional Safety

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

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:
   - The 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 that all requirements have been met (validation).

Additional information is available on https://www.se.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-related function STO 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-related function STO for your maintenance plan and for the calculations for functional safety:

Characteristic	Unit	Value
Lifetime of the safety-related function STO (IEC 61508)	Years	20 See also Lifetime Safety-Related Function STO, page 488.
SFF (IEC 61508) Safe Failure Fraction	%	90
HFT (IEC 61508) Hardware Fault Tolerance Type A subsystem	-	1
Safety integrity level IEC 61508	-	SIL3
Safety integrity level IEC 62061	-	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	-	High (350 years)
DC (ISO 13849-1) Diagnostic Coverage	%	90

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

Definitions

Integrated Safety-Related Function "Safe Torque Off" STO

The integrated safety-related 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 safety-related function STO 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 external safety-related 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

General

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

The safety-related 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-Related Function STO

General

The safety-related function STO (Safe Torque Off) does not remove power from the DC bus. The safety-related 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-related function STO for any other purposes than its intended function.
- Use an appropriate switch, that is not part of the circuit of the safety-related 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-related function STO is triggered, the motor can no longer generate torque and coasts down without braking.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated, external safety-related 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-related function STO (inputs $\overline{STO_A}$ and $\overline{STO_B}$) can only be wired for sinking inputs.

Holding Brake and Safety-Related Function STO

When the safety-related 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-related 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-related 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

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that your risk assessment covers all potential effects of automatic or unintended enabling of the power stage, for example, after power outage.
- Implement all measures such as control functions, guards, or other safety-related functions, required to reliably protect against all hazards that may result from automatic or unintended enabling of the power stage.
- Verify that a master controller cannot enable the power stage in an unintended way.

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

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Set the 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-Related Function STO is Used

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

⚠WARNING

INOPERABLE SAFETY-RELATED 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

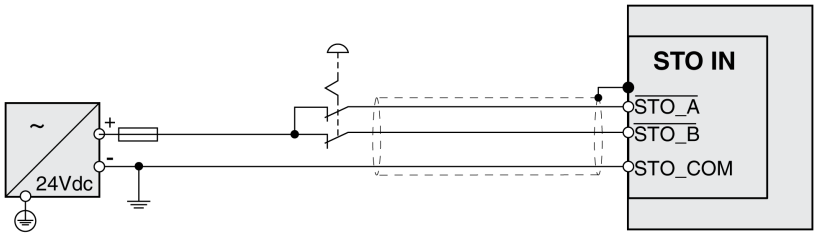
If short circuits and other wiring errors such as a cross circuit between the signals of the safety-related function STO can be expected in connection with safety-related signals, and if these short circuits and cross circuits are not detected by upstream devices, protected cable installation as per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

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

Fuse

A fuse for the safety-related function STO is required.

Type of fuse: 0.5 A (type T)



Protected Cable Installation for Safety-Related Signals

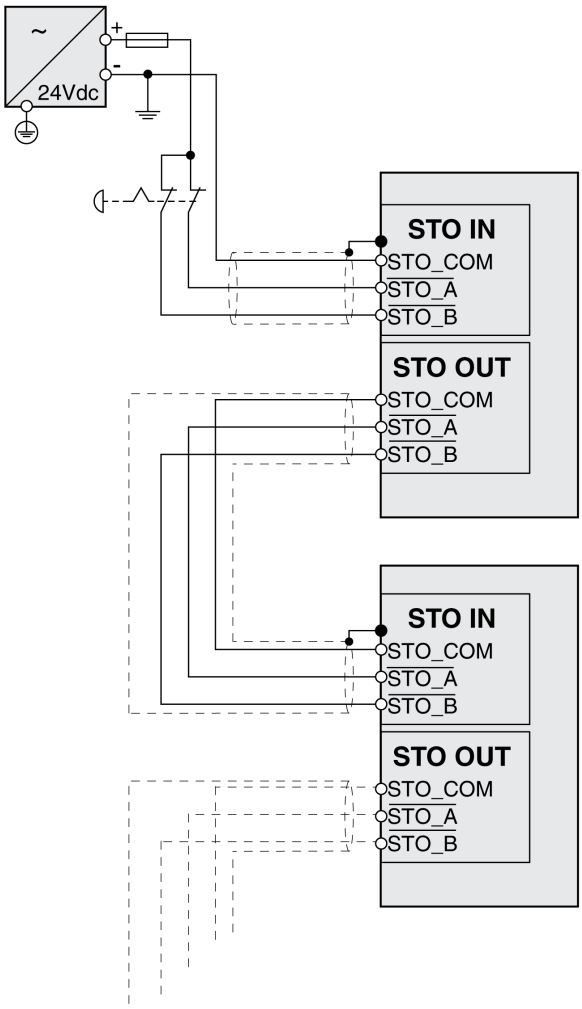
Description

ISO 13849-2 describes protected cable installation for cables for safety-related signals. The cables for the safety-related 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-related 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-related function STO.
- Do not use the cable for the signals of the safety-related function STO for other signals.
- Connect one end of the shield.
- When daisychaining the signals of the safety-related function STO, use the shield connection at STO IN.

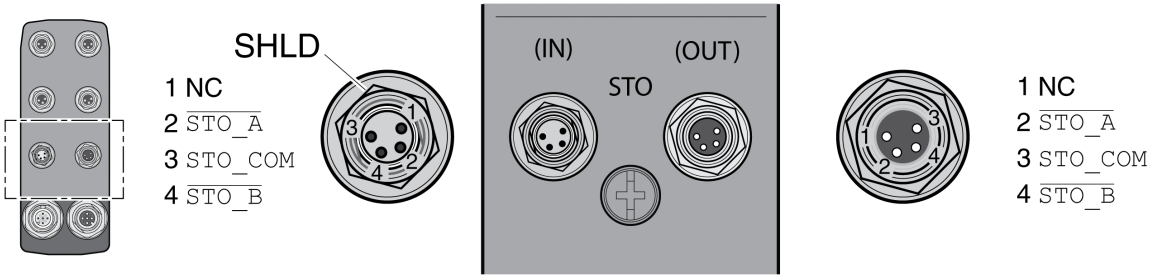
Example of protected cable installation for safety-related signals:



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:



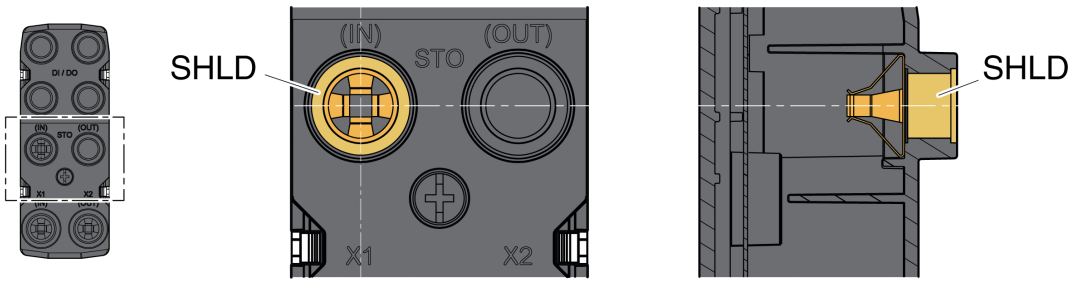
⚠WARNING

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-related function STO is pre-assembled. The pre-assembled connector of the cables for the safety-related function STO is connected to STO IN. The connector for the safety-related 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.

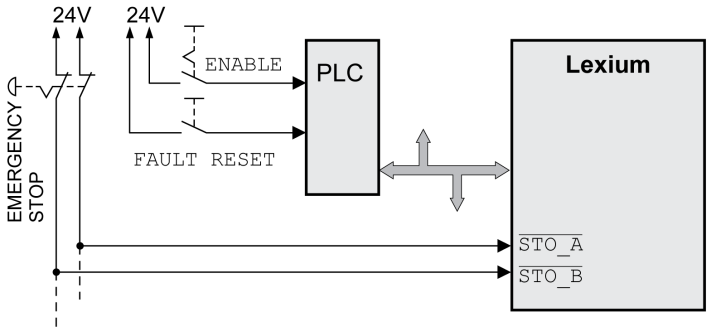
Using pre-assembled cables helps to reduce the possibility of wiring errors, see Accessories and Spare Parts, page 483.

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-related 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 safety-related function STO is triggered, it decelerates under the salient physical forces (gravity, friction, etc.) active at the time until presumably coasting to a standstill.

If coasting of the motor and its potential load is unsatisfactory as determined by your risk assessment, an external safety-related brake may also be required.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated, external safety-related brake if coasting does not meet the deceleration requirements of your application.

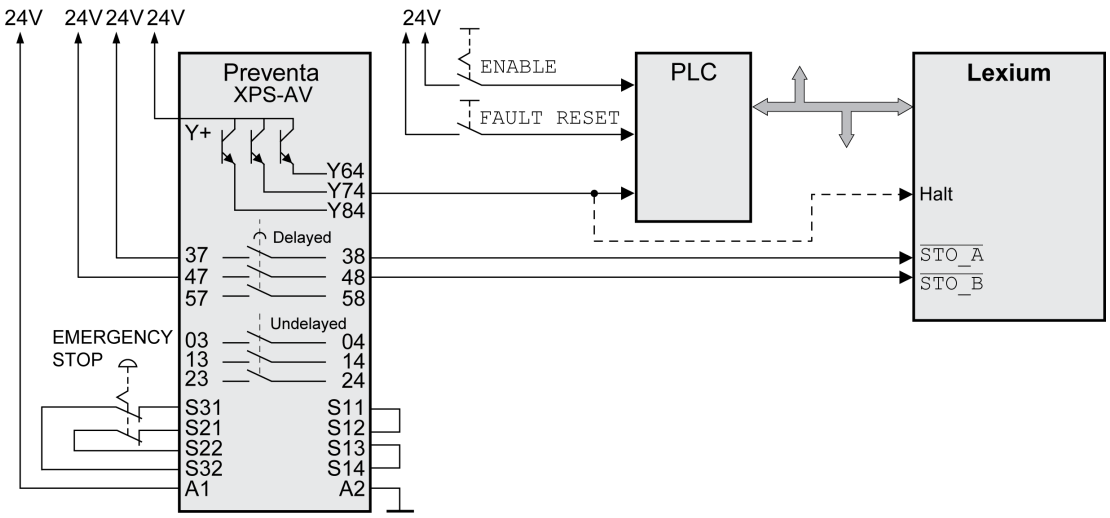
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Refer to section Holding Brake and Safety-Related Function STO, page 72.

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. After the time delay set in the EMERGENCY STOP safety relay module has elapsed, the EMERGENCY STOP safety relay triggers the safety-related function STO.

The safety-related 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 coasting of the motor and its potential load is unsatisfactory as determined by your risk assessment, an external safety-related brake may also be required.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated, external safety-related 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.

Refer to section Holding Brake and Safety-Related Function STO, page 72.

Installation

Mechanical Installation

Before Mounting

Inspecting the Product

- Verify the product version by means of the Type Code, page 21.
- 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 section Inspecting/Breaking In the Holding Brake, page 488.

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 section Dimensions, page 25.

Mounting the Motor

Overview

⚠⚠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.

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.

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.

Mounting Distances, Ventilation

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

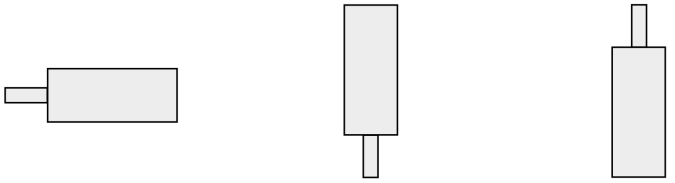
- No minimum distances are required for installation. However, free convection must be possible.
- Avoid heat accumulations.
- Do not obstruct the ventilation slots; keep dirt from reaching the ventilation slots.
- Do not mount the device close to heat sources. Mutual heating of several devices leads 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 section Technical Data, page 23 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 Shaft-Specific Data, page 32.

Electrical Installation

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 24 Vdc supply voltage is connected with many exposed signal connections in the drive system.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Use power supply units that meet the PELV (Protective Extra Low Voltage) requirements.
- Connect the 0 Vdc outputs of all power supply units to FE (functional earth/ functional ground), for example, for the VDC supply voltage and for the 24 Vdc voltage for the safety-related function STO.
- Interconnect all 0 Vdc outputs (reference potentials) of all power supply units used for the drive.

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

Ground Connection

General

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

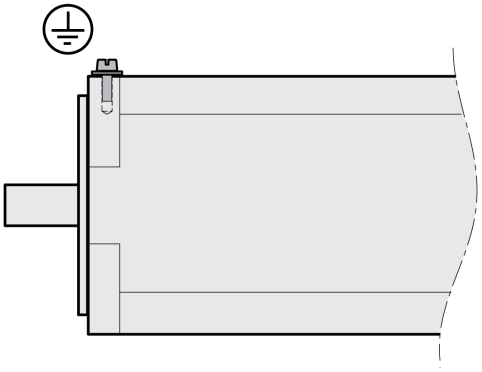
INSUFFICIENT GROUNDING

- 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.

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

Mounting LXM32I Control Unit

Description

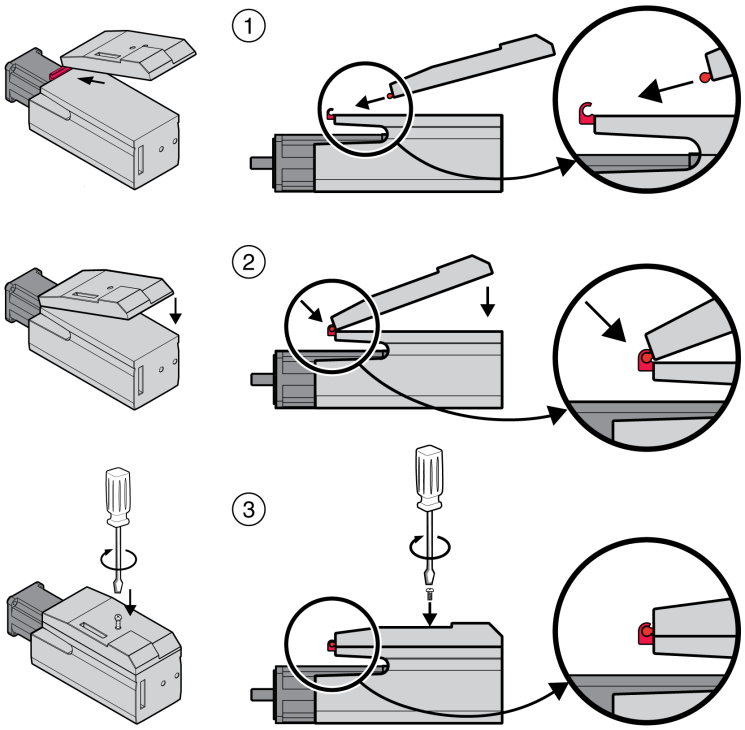
Electrostatic discharge (ESD) may permanently damage the module either immediately or over time.

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.
- Verify that the seals are not damaged.
- (1) Mount 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.

For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.

Standard Braking Resistor

Description

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

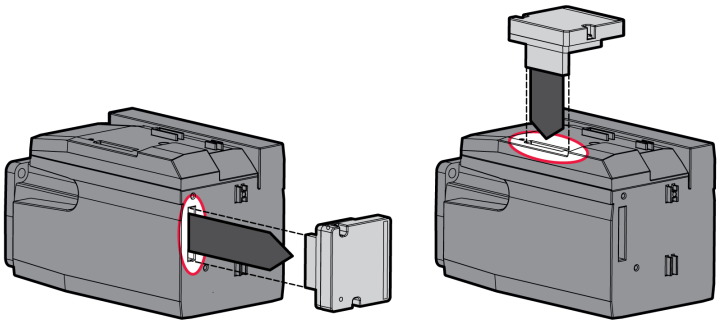
If the standard braking resistor is used, there are several mounting types, see Mounting Types of The Modules, page 58.

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, insert the standard braking resistor into slot 1 and fasten it by tightening the two fastening screws.

For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.

External Braking Resistor (Accessories)

Description

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 section Rating the Braking Resistor, page 62. For suitable braking resistors see Accessories and Spare Parts, page 483.

Cable Specifications

Characteristic	Value
Shield:	Required, both ends grounded
Twisted Pair:	-
PELV:	-

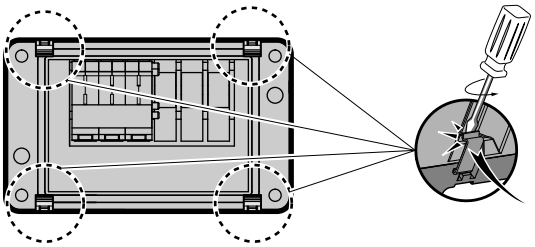
Characteristic	Value
Cable composition:	Minimum conductor cross section: Same cross section as the cross section used for the mains supply. The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Minimum cable diameter:	6 mm (0.24 in)
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

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

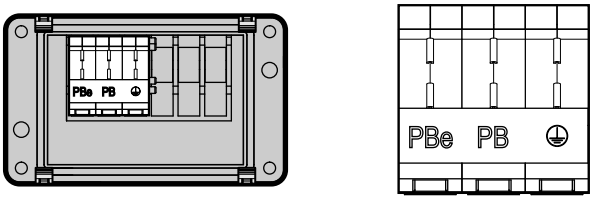
The spring terminals are approved for fine-stranded conductors and solid conductors. Observe the maximum permissible connection cross section. Take into account the fact that wire cable ends (ferrules) increase the conductor cross section.

Opening the Connection Module



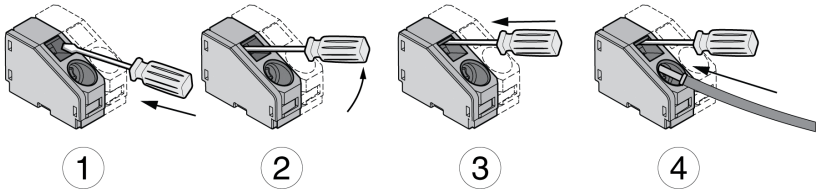
Wiring Diagram

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

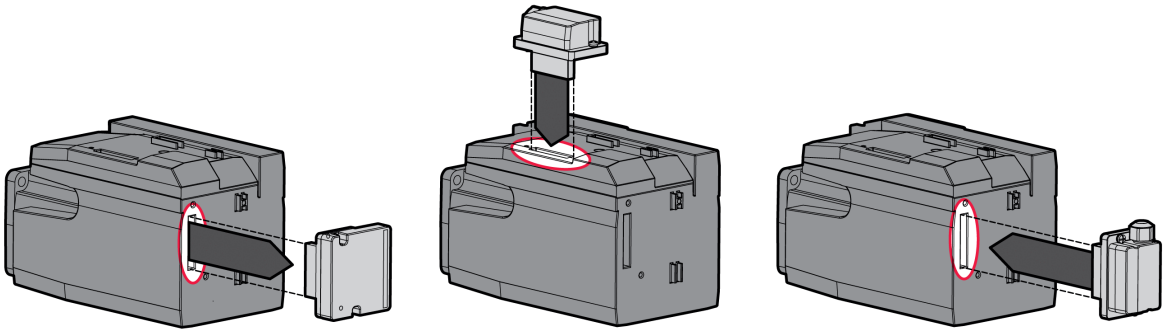
HOT SURFACES

- 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, insert 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 section Mounting Types of The Modules, page 58.

For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.

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 mm² (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 section "Technical data".
- Do not connect the product to a supply mains whose short-circuit current rating (SCCR) exceeds the value specified in the section "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 section Residual Current Device, 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

Characteristic	Value
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

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

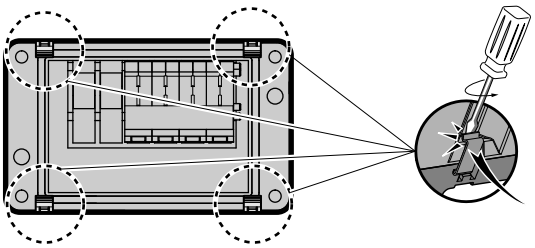
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Prerequisites for Connecting the Power Stage Supply

Note the following information:

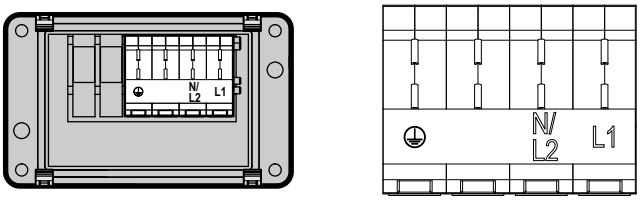
- Three-phase devices may only be connected and operated via three phases.
- Use upstream mains fuses. See section Motor-Specific Data, page 34 for information on fuse types and fuse ratings.
- If you use an external mains filter, the mains cable must be shielded and grounded at both ends if the length between the external mains filter and the device exceeds 200 mm (7.87 in).
- See section Conditions for UL 508C, page 48 for a UL-compliant design.

Opening the Connection Module



Mains Supply Single-Phase Drive

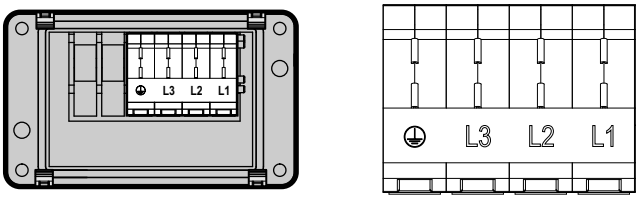
Wiring diagram for single-phase drive (115/230 Vac)



Verify the type of mains. See section Mains Voltage: Range and Tolerance, page 27 for the approved types of mains.

Mains Supply Three-Phase Drive

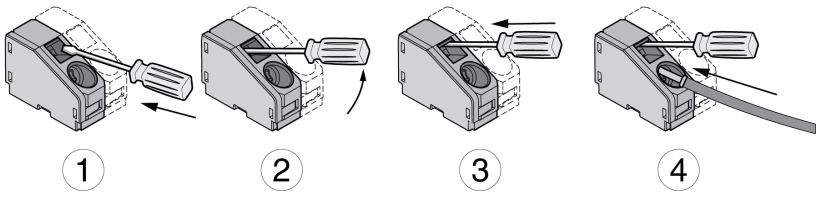
Wiring diagram for three-phase drive (208/400/480 Vac)



Verify the type of mains. See section Mains Voltage: Range and Tolerance, page 27 for the approved types of mains.

Usage of the Connection Terminals

Use the connection terminals as shown in the illustration below:



Connecting Mains Supply

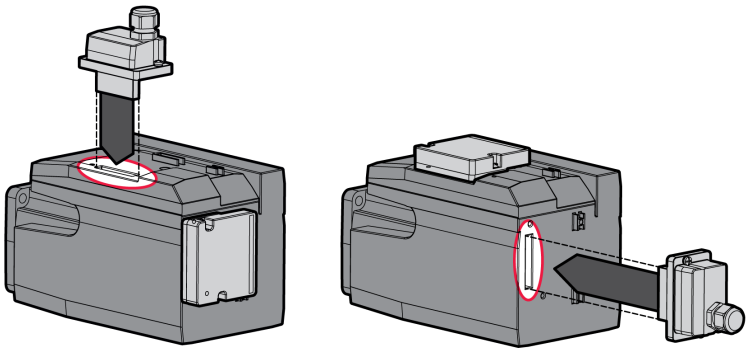
- Power off all supply voltages. Observe the safety instructions concerning electrical installation.
- Verify that no voltages are present (safety instructions).
- Open the cover.
- Open the cable gland.

- Push the cable through the cable gland.
- Connect the PE connection (ground).
- Connect the connections L1 and N/L2 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, insert 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 Specifications Screws, Cable Glands, and Sealing Caps, page 45.

Commissioning Interface

Cable Specifications

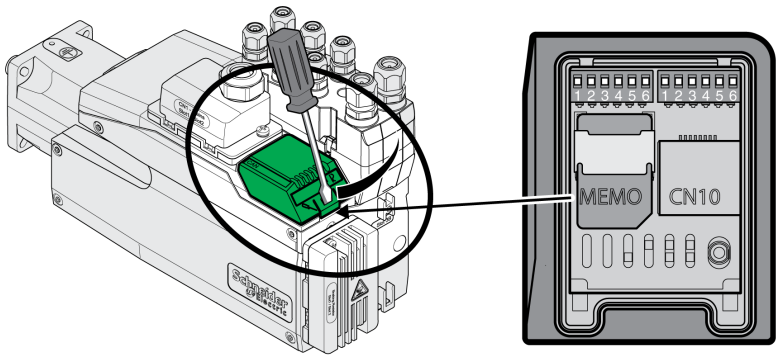
Characteristic	Value
Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	8*0.25 mm^2, (8*AWG 22)
Maximum cable length:	100 m
Special characteristics:	-

Connecting a PC

A PC with commissioning software can be connected for commissioning. The PC is connected via a bidirectional USB/RS485 converter, see Accessories and Spare Parts, page 483.

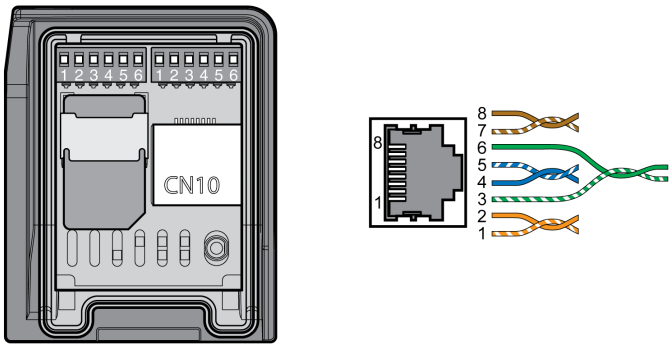
Opening the Cover of the Commissioning Interface

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

Description

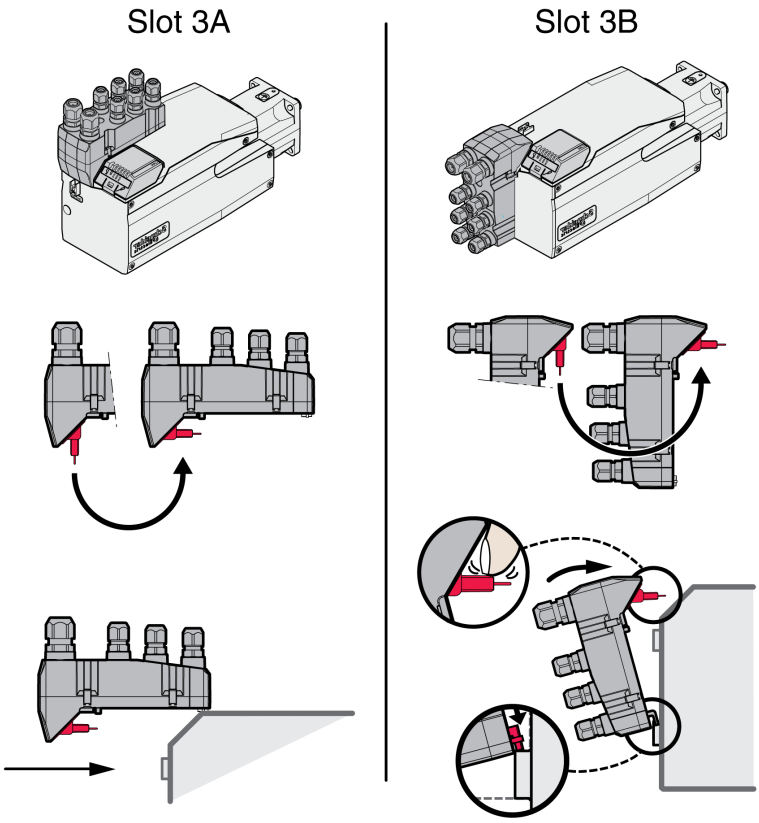
The I/O module can be mounted in slot 3A or in slot 3B.

If the standard braking resistor is used, the choice of slot is limited, see Mounting Types of The Modules, 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.

- Insert the I/O module into slot 3A or slot 3B. If you use slot 3B, you must first insert the bottom catch of the module. In a second step, move the contacts towards the drive and guide them into the drive using your index finger.
- Insert the I/O module into slot 3A or slot 3B and fasten it by tightening the fastening screw.

Mounting the I/O module

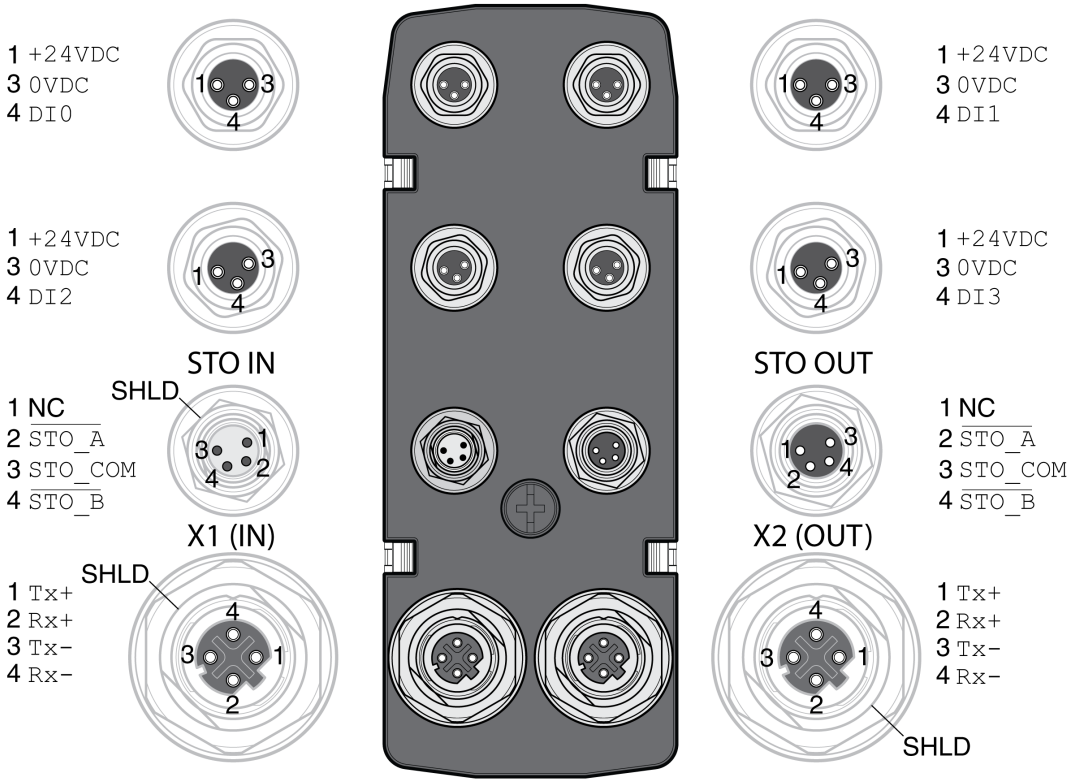


For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.

I/O Module with Industrial Connectors

Overview I/O Modules with Industrial Connectors

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

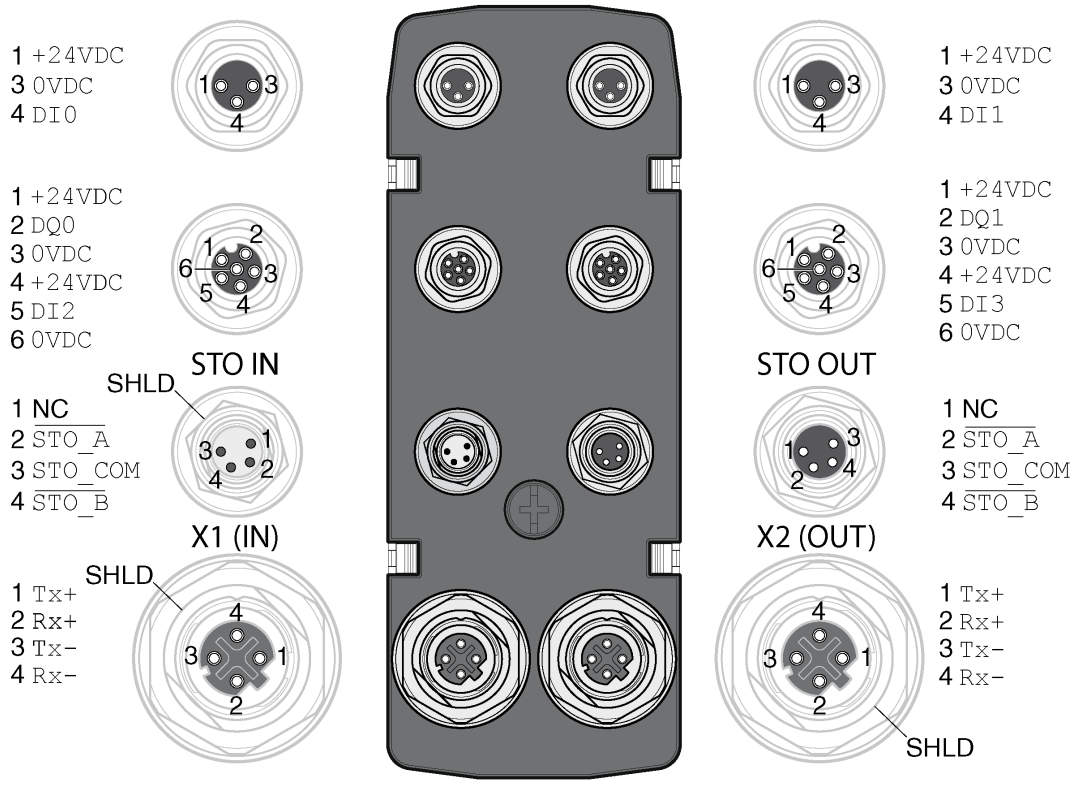


Signal	Meaning	Factory settings(1)	I/O
+24VDC	Internal 24 V Signal Power Supply, page 29	-	O
0VDC	Reference potential to *+24VDC*	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
$\overline{STO_A}$	Safety-related function STO(2)	-	I
STO_COM	Reference potential for safety-related function STO(2)	-	I
$\overline{STO_B}$	Safety-related function STO(2)	-	I
SHLD	Shield (grounded internally)	-	-
Tx+	Ethernet transmit signal +	-	I/O
Tx-	Ethernet transmit signal -	-	I/O
Rx+	Ethernet receive signal +	-	I/O
Rx-	Ethernet receive signal -	-	I/O
NC	Not connected	-	-

(1) See section Digital Signal Inputs and Digital Signal Outputs, page 184.

(2) This module requires an external supply for the safety-related function STO; see the information in section Functional Safety, page 67.

Connection Overview I/O Modules with Industrial Connectors (4 Digital Inputs, 2 Digital Outputs, STO)

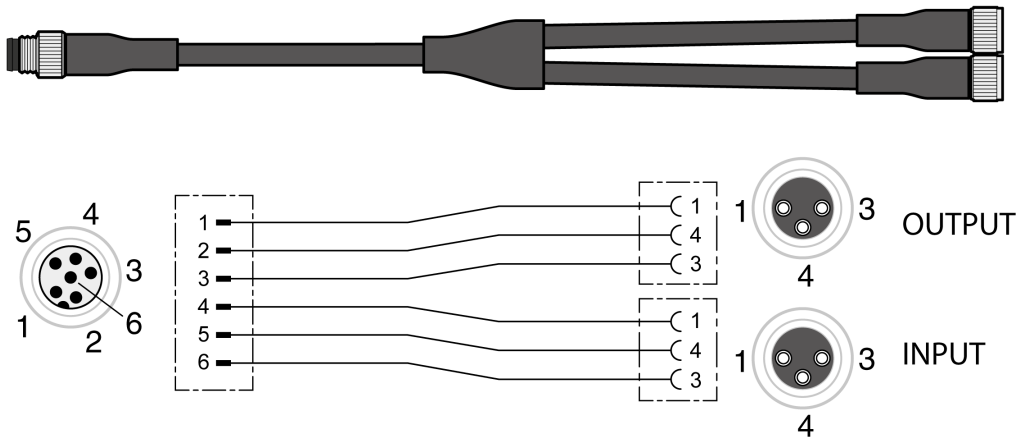


Signal	Meaning	Factory settings[1]	I/O
+24VDC	Internal 24 V Signal Power Supply, page 29	-	O
0VDC	Reference potential to *+24VDC*	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
DQ0	Digital output 0	No Fault	O
DQ1	Digital output 1	Active	O
$\overline{STO_A}$	Safety-related function STO[2]	-	I
STO_COM	Reference potential for safety-related function STO[2]	-	I
$\overline{STO_B}$	Safety-related function STO[2]	-	I
SHLD	Shield (grounded internally)	-	-
Tx+	Ethernet transmit signal +	-	I/O
Tx-	Ethernet transmit signal -	-	I/O
Rx+	Ethernet receive signal +	-	I/O
Rx-	Ethernet receive signal -	-	I/O
NC	Not connected	-	-

(1) See section Digital Signal Inputs and Digital Signal Outputs, page 184.

(2) This module requires an external supply for the safety-related function STO; see the information in section Functional Safety, page 67.

Connection Overview Y-Cable (DI/DO Splitter Cable - VW3M9601)



Signal	6-pin	3-pin	Connector	Meaning
+24VDC	1	1	Output	Internal 24 V Signal Power Supply, page 29
DQ•	2	4		Digital output
0VDC	3	3		Reference potential to *+24VDC*
+24VDC	4	1	Input	Internal 24 V Signal Power Supply, page 29
DI•	5	4		Digital input
0VDC	6	3		Reference potential to *+24VDC*

Logic Type

Description

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 sections I/O Module with Industrial Connector for Positive Logic, page 484 and I/O Module with Industrial Connector for Negative Logic, page 484 for an overview of the available product versions.

See section Logic Type, page 56 for additional information on the logic types.

Connection of the Digital Inputs and Digital Outputs

Description

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

Characteristic	Value
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 Specifications Screws, Cable Glands, and Sealing Caps, page 45.
- Close unused industrial connectors with a sealing cap, see Industrial Connectors, page 485.

Connection of Safety-Related Function STO

General

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

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

See section Functional Safety, page 67 for additional information on the safety-related function STO.

Cable Specifications

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

Pin Assignment

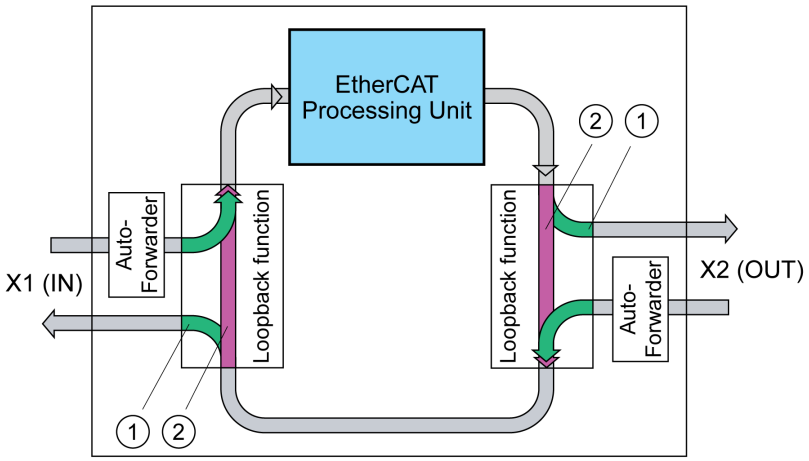
Signal	Meaning	Wire color
$\overline{STO_A}$	Dual-channel connection, connection A	White
$\overline{STO_B}$	Dual-channel connection, connection B	Brown
STO_COM	Reference potential to $\overline{STO_A}$ and $\overline{STO_B}$	Green

Connecting the Safety-Related Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety-related function STO in accordance with the specifications in section Functional Safety, page 67.
- For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.
- Close unused industrial connectors with a sealing cap, see Industrial Connectors, page 485.

Fieldbus Connection

Topology



1 Port open

2 Port closed

Cable Specifications

Characteristic	Value
Shield:	Required, both ends grounded
Twisted pair:	Required
PELV:	Required
Cable composition:	8 * 0.25 mm² (8 * AWG 22) Cat 5e, no crossover cable
Maximum cable length:	100 m (328 ft)
Connector coding:	D

Connecting the Fieldbus

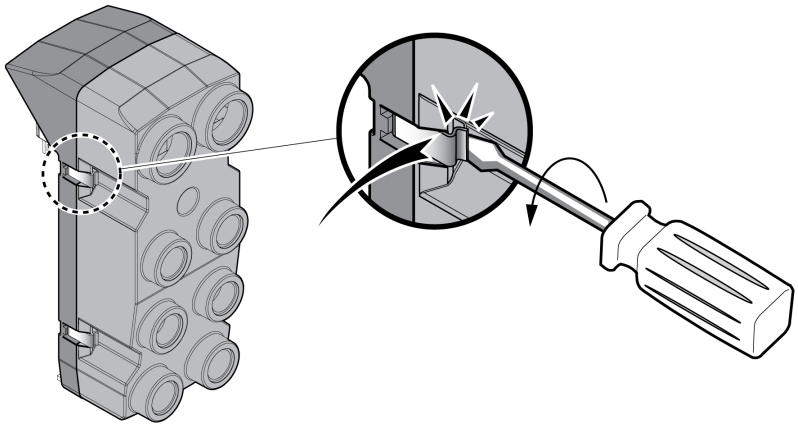
- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- For the tightening torque see Specifications Screws, Cable Glands, and Sealing Caps, page 45.
- Close unused industrial connectors with a sealing cap, see Industrial Connectors, page 485.

I/O Module with Spring Terminals

Opening the I/O Module

Description

- Open the I/O module.



- Screw the required cable glands into the I/O module.

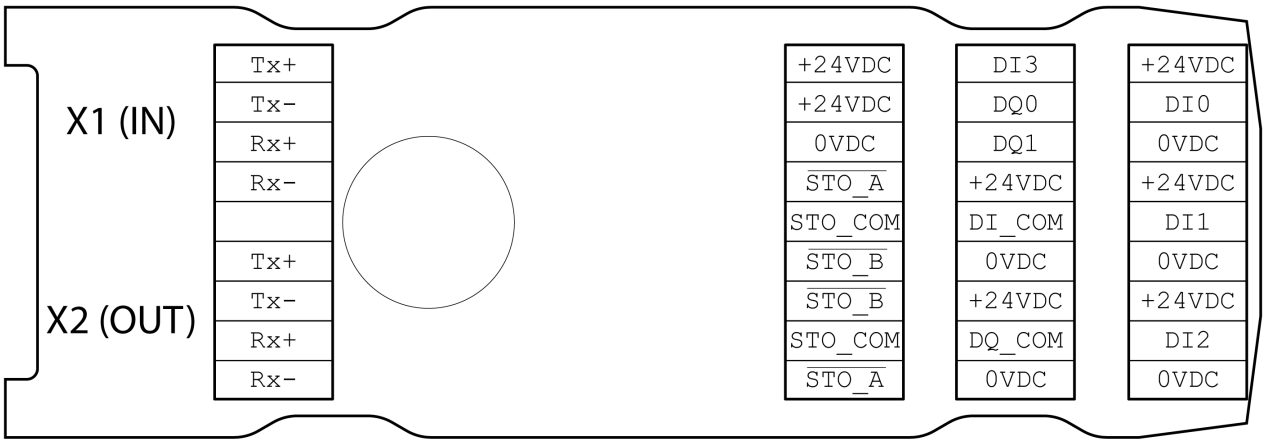
  Cable glands are available as accessories, see Accessories and Spare Parts, page 483.
- Close unused cable entries with a sealing cap.

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 Specifications Screws, Cable Glands, and Sealing Caps, page 45.

Overview I/O Module with Spring Terminals

Overview



Signal	Meaning	Factory settings(1)	I/O
+24VDC	Internal 24 V Signal Power Supply, page 29	-	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	-	-
$\overline{STO_A}$	Safety-related function STO	-	I
STO_COM	Reference potential for safety-related function STO	-	I
$\overline{STO_B}$	Safety-related function STO	-	I
Tx+	Ethernet transmit signal +	-	I/O
Tx-	Ethernet transmit signal -	-	I/O
Rx+	Ethernet receive signal +	-	I/O
Rx-	Ethernet receive signal -	-	I/O

(1) See section Digital Signal Inputs and Digital Signal Outputs, page 184.

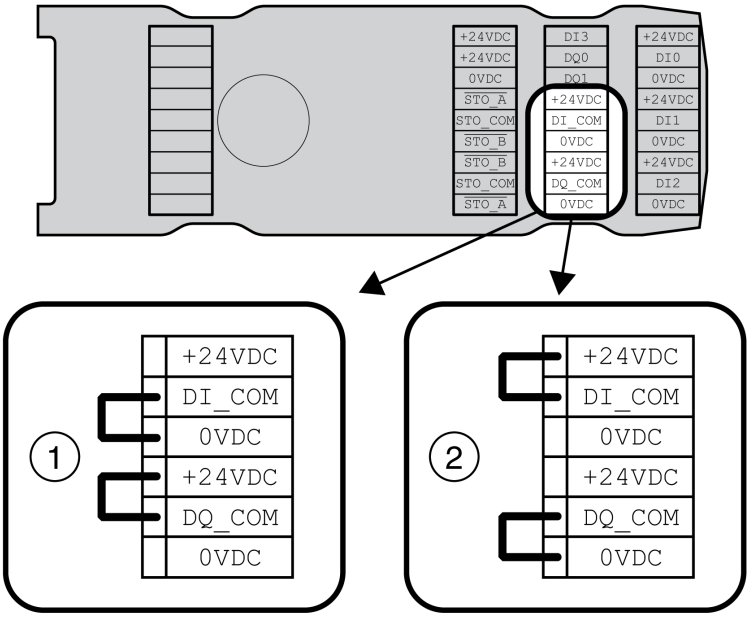
Setting the Logic Type

Description

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

See section Logic Type, 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

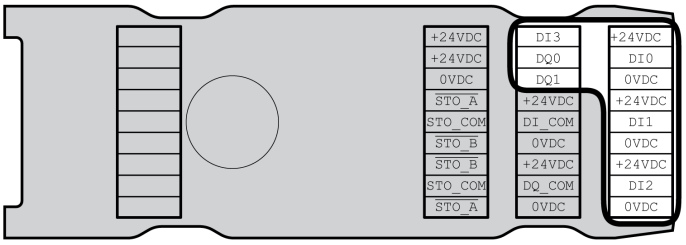
Characteristic	Value
Shield:	-
Twisted pair:	-
PELV:	Required
Cable composition:	-
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter:	6.5 mm (0.26 in)
Maximum cable length:	30 m (98.4 ft)

Properties of the Connection Terminals

Characteristic	Unit	Value
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)

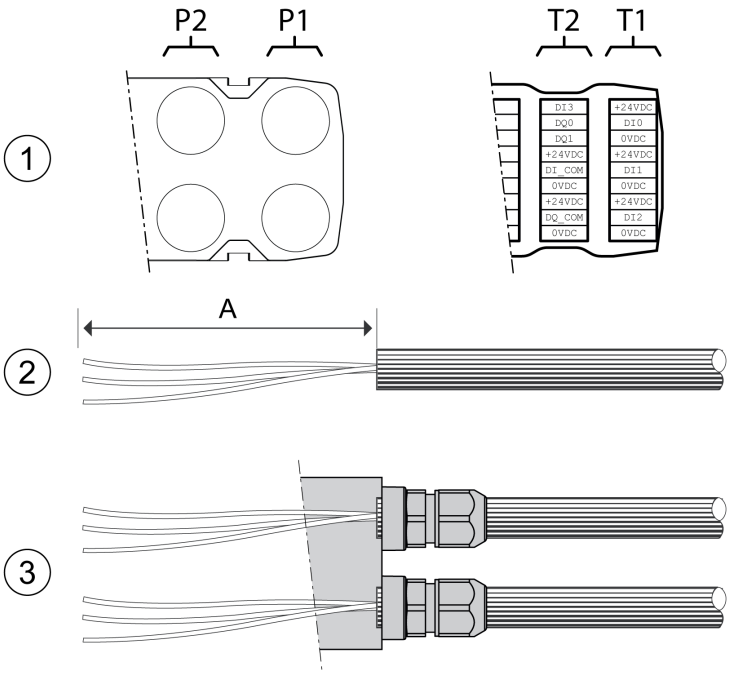
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

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	Internal 24 V Signal Power Supply, page 29
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-Related Function STO

General

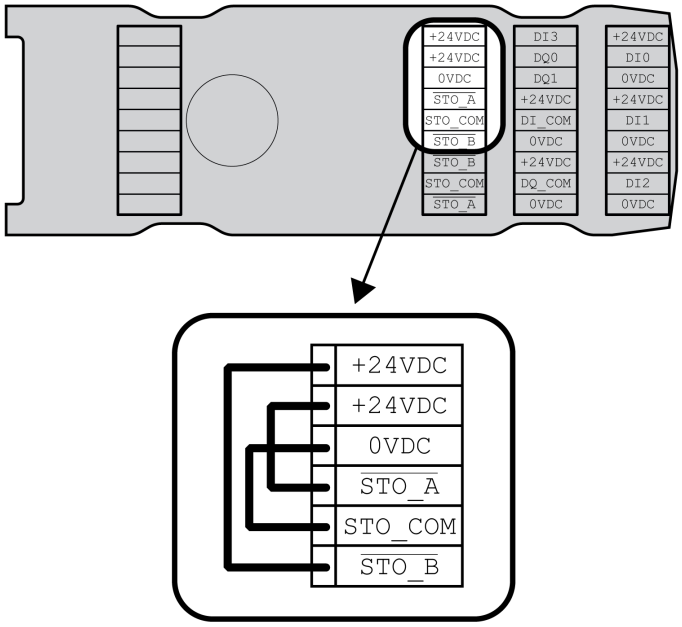
The I/O module with spring terminals supports operation without safety-related function STO and operation with safety-related function STO.

See section Functional Safety, page 67 for additional information on the safety-related function STO.

Operation without Safety-Related Function STO

If the safety-related function STO is not to be used, the signal *$\overline{STO_A}$* and *+24VDC* must be bridged, the signal *$\overline{STO_B}$* and *+24VDC* must be bridged and the signal *STO_COM* and *0VDC* must be bridged.

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



Operation with Safety-Related Function STO

If the safety-related function STO is to be used, the safety-related function STO must be connected in accordance with the specifications in section Functional Safety, page 67.

Cable Specifications

Characteristic	Value
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)

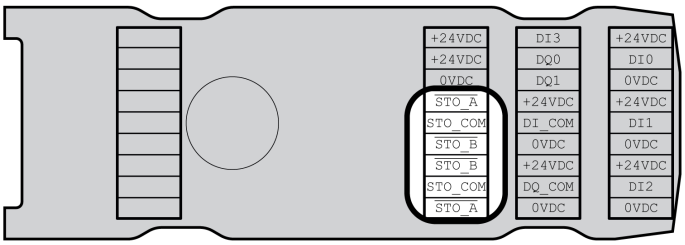
Characteristic	Value
Maximum cable diameter:	6.5 mm (0.26 in)
Maximum cable length:	-

Properties of the Connection Terminals

Characteristic	Unit	Value
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



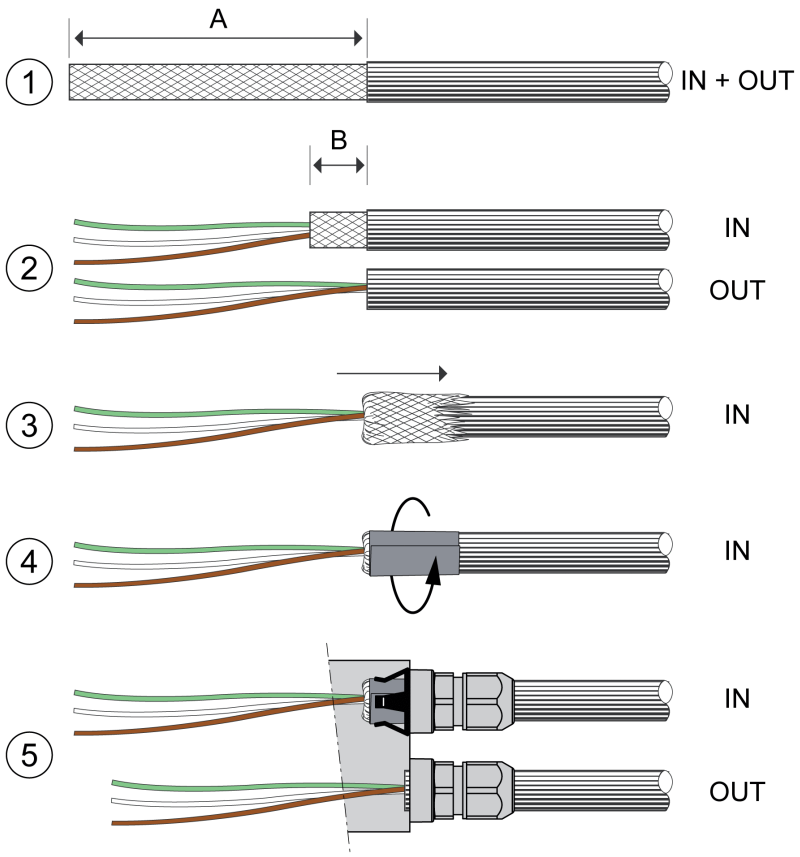
Signal	Meaning	Wire color
$\overline{STO_A}$	Dual-channel connection, connection A	White
$\overline{STO_B}$	Dual-channel connection, connection B	Brown
STO_COM	Reference potential to $\overline{STO_A}$ and $\overline{STO_B}$	Green

Shield Concept

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

See section Protected Cable Installation for Safety-Related Signals, page 74 for additional information.

Assembling Cables



Characteristic	Unit	Value
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-Related Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety-related function STO in accordance with the specifications in section Functional Safety, page 67.

Fieldbus Connection

Cable Specifications

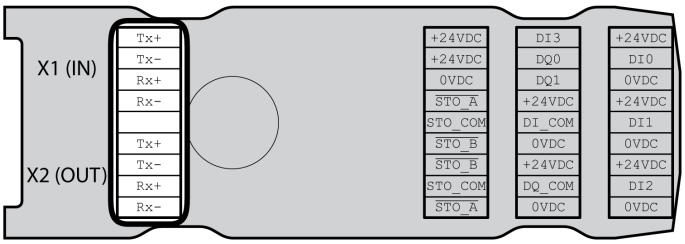
Characteristic	Value
Shield:	Required, both ends grounded
Twisted pair:	Required
PELV:	Required
Cable composition:	8 * 0.25 mm² (8 * AWG 22) Cat 5e, no crossover cable
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter:	6.5 mm (0.26 in)
Maximum cable length:	100 m (328 ft)

Properties of the Connection Terminals

Characteristic	Unit	Value
Connection cross section (rigid)	mm²	0.13 ... 1.3 (AWG 26 ... AWG 16)
Connection cross section (wire)	mm²	0.2 ... 0.52 (AWG 24 ... AWG 20)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)

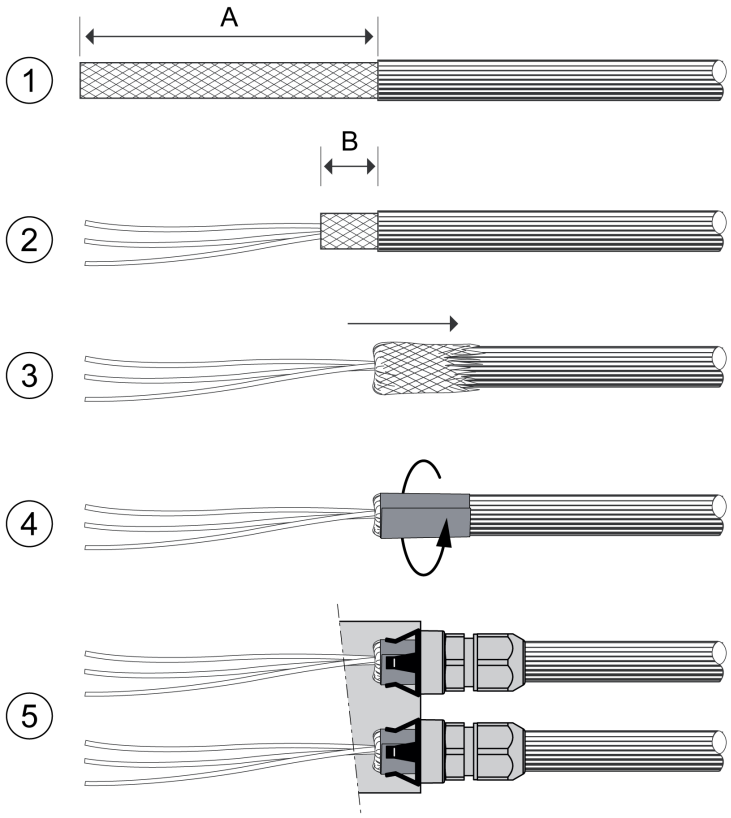
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



Signal	Meaning
Tx+	Ethernet transmit signal +
Tx-	Ethernet transmit signal -
Rx+	Ethernet receive signal +
Rx-	Ethernet receive signal -

Assembling Cables



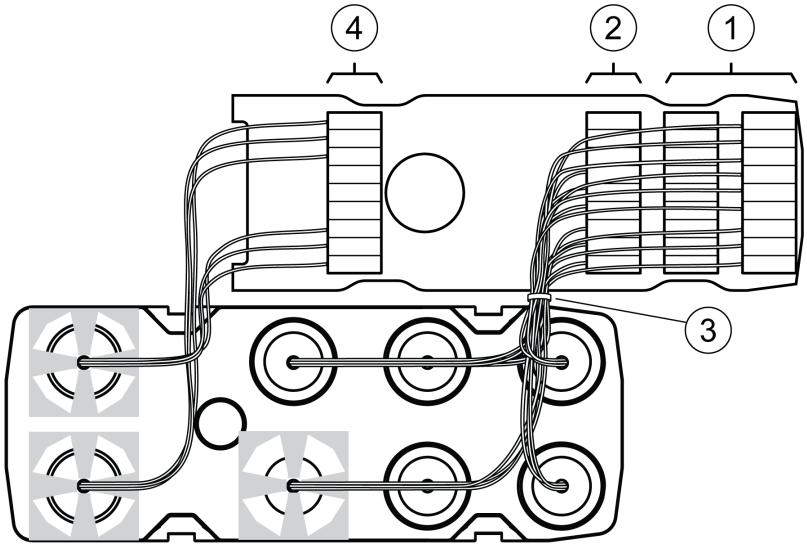
Characteristic	Unit	Value
Length A	mm (in)	95 (3.74)
Length B	mm (in)	10 (0.39)

- (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

Description



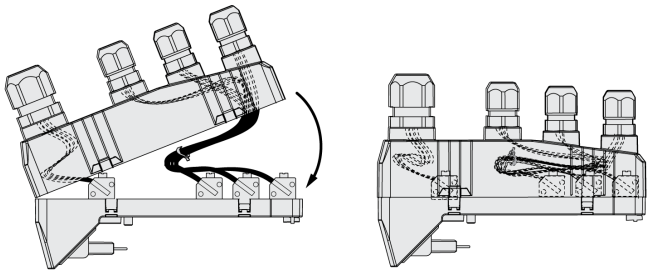
- Strip the individual wires.

  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-related function STO, connect the signal wires for the safety-related function STO to the terminals.
- (3) Fasten the signal wires for the digital inputs and outputs and the signal wires for the safety-related 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

Description



- 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.

Verifying Installation

Description

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-related function STO and spring terminals are used:

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

Commissioning

Overview

General

The safety-related function STO (Safe Torque Off) does not remove power from the DC bus. The safety-related 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-related function STO for any other purposes than its intended function.
- Use an appropriate switch, that is not part of the circuit of the safety-related 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, 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 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 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.

If the drive was not connected to mains for more than 24 months, the capacitors must be restored to their full performance before the motor is started.

NOTICE

REDUCED CAPACITOR PERFORMANCE

Apply mains voltage to the drive for at least one hour before enabling the power stage for the first time in case that the drive has not been under power for a period of 24 months or greater.

Failure to follow these instructions can result in equipment damage.

If the drive is being 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.

Preparation

Required Components

The following is required for commissioning:

- Commissioning software “Lexium DTM Library”

  https://www.se.com/ww/en/download/document/Lexium_DTM_Library/
- Fieldbus converter for the commissioning software for connection via the commissioning interface
- ESI file (EtherCAT Slave Information, file format XML)

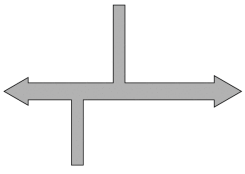
  https://www.se.com

Interfaces

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



①



②

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.

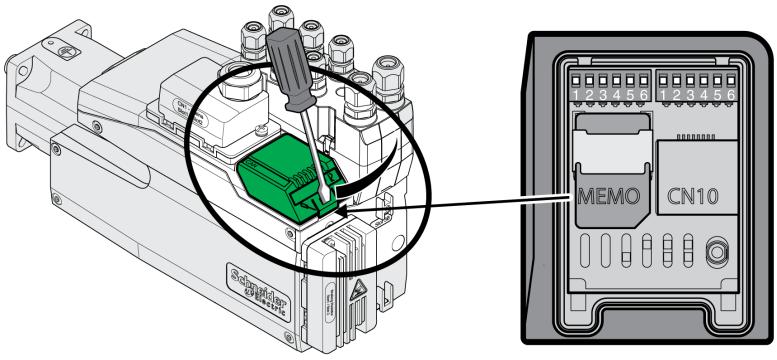
- Tuning of the control loop parameters via a graphical user interface
- Comprehensive set of diagnostics tools for optimization and maintenance
- Long-term trace for evaluation of the performance
- Testing the input and output signals
- Tracking signals on the screen
- Archiving of device settings and 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 switch for “Identification”
- 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



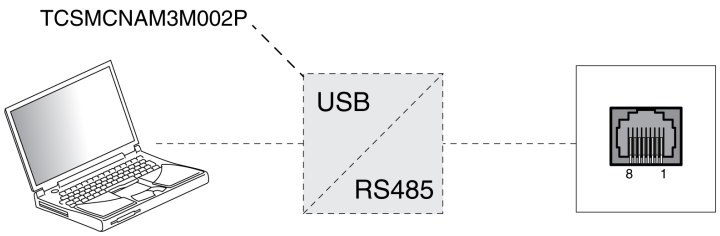
The CN10 interface does not support devices without their own power supply.

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 Accessories and Spare Parts, page 483.


TCSMCNAM3M002P
USB
RS485
8
1

Fieldbus Integration

Add the Product as an NC Axis in the Beckhoff TwinCAT Software

TwinCAT

The product is added to the fieldbus using the Beckhoff TwinCAT software.

The following TwinCAT functions are supported:

- TwinCAT-Systeme PLC, NC PTP, NC I and CNC
- TwinCAT libraries using TcMc.lib or TcMc2.lib
- TwinCAT homing methods Plc CAM and Software Sync

Adding the Product to TwinCAT

Add the XML file to TwinCAT.

Scan the EtherCAT network to automatically add the product to TwinCAT.



Add the product to the NC configuration.

Settings

Setting the Process Data

4 predefined RxPDOs and 4 predefined TxPDOs are available.

Depending on the selected operating mode, one of the predefined RxPDOs and one of the predefined TxPDOs can be used:

Operating mode	Suitable PDO
Cyclic Synchronous Position	First Predefined PDO
Cyclic Synchronous Velocity	Second Predefined PDO
Cyclic Synchronous Torque	Third Predefined PDO
Any type of switch between: Cyclic Synchronous Position Cyclic Synchronous Velocity Cyclic Synchronous Torque	Fourth Predefined PDO

Only a single predefined RxPDO and only a single predefined TxPDO can be used simultaneously.

The PDOs can be adapted as required. A maximum of 10 parameters are possible per RxPDO and TxPDO.

Setting the Process Data of the First Predefined PDO

The first PDO is suitable for the operating mode Cyclic Synchronous Position.

Structure RxPDO 1600_h

Index	Parameter name (DS402 name)
$6040:0_h$	*DCOMcontrol* (Control word)
$607A:0_h$	*PPp_target* (Target position)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A00_h$

Index	Parameter name (DS402 name)
$6041:0_h$	*_DCOMstatus* (Status word)
$6064:0_h$	*_p_act* (Position actual value)
$603F:0_h$	*_LastError* (Error code)
$3008:1_h$	*_IO_act*

Setting the Process Data of the Second Predefined PDO

The second PDO is suitable for the operating mode Cyclic Synchronous Velocity.

Structure RxPDO 1601_h

Index	Parameter name (DS402 name)
$6040:0_h$	*DCOMcontrol* (Control word)
$60FF:0_h$	*PVv_target* (Target velocity)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A01_h$

Index	Parameter name (DS402 name)
$6041:0_h$	*_DCOMstatus* (Status word)
$6064:0_h$	*_p_act* (Position actual value)
$603F:0_h$	*_LastError* (Error code)
$3008:1_h$	*_IO_act*

Setting the Process Data of the Third Predefined PDO

The third PDO is suitable for the operating mode Cyclic Synchronous Torque.

Structure RxPDO 1602_h

Index	Parameter name (DS402 name)
$6040:0_h$	*DCOMcontrol* (Control word)
$6071:0_h$	*PTtq_target* (Target torque)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A02_h$

Index	Parameter name (DS402 name)
6041:0$_h$	*_DCOMstatus* (Status word)
6064:0$_h$	*_p_act* (Position actual value)
6077:0$_h$	*_tq_act* (Torque actual value)
603F:0$_h$	*_LastError* (Error code)
3008:1$_h$	*_IO_act*

Setting the Process Data of the Fourth Predefined PDO

The fourth predefined PDO is suitable for the operating modes Cyclic Synchronous Position, Cyclic Synchronous Velocity and Cyclic Synchronous Torque. You can switch between the operating modes as required.

Structure RxPDO 1603$_h$

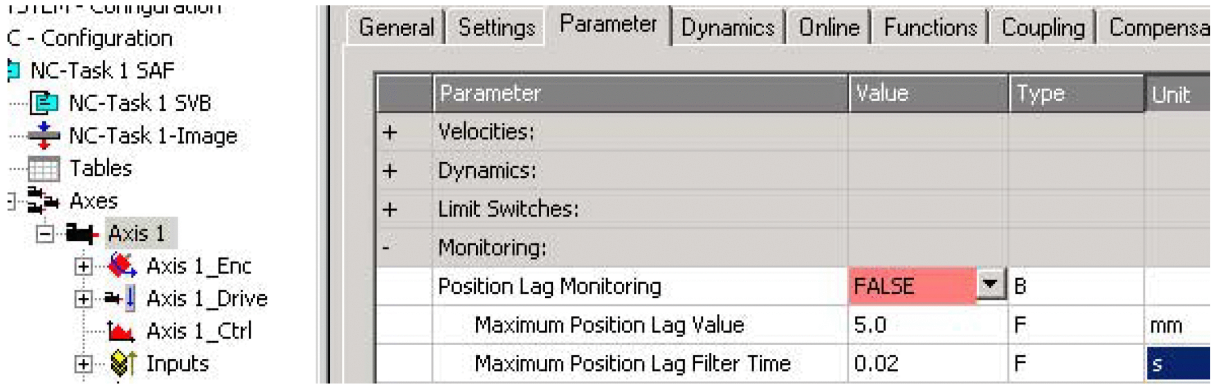
Index	Parameter name (DS402 name)
6040:0$_h$	*DCOMcontrol* (Control word)
6060:0$_h$	*DCOMopmode* (Mode of operation)
607A:0$_h$	*PPp_target* (Target position)
60FF:0$_h$	*PVv_target* (Target velocity)
6071:0$_h$	*PTtq_target* (Target torque)
3008:11$_h$	*IO_DQ_set*

Structure TxPDO 1A03$_h$

Index	Parameter name (DS402 name)
6041:0$_h$	*_DCOMstatus* (Status word)
6061:0$_h$	*_DCOMopmd_act* (Mode of operation display)
6064:0$_h$	*_p_act* (Position actual value)
60F4:0$_h$	*_p_dif* (Following error actual value)
6077:0$_h$	*_tq_act* (Torque actual value)
603F:0$_h$	*_LastError* (Error code)
3008:1$_h$	*_IO_act*

Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Position

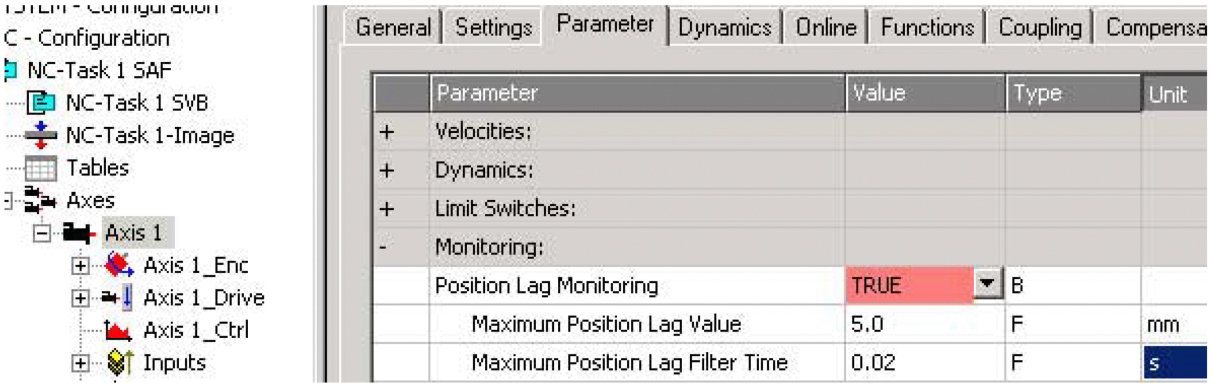
Monitoring of the position deviation must be deactivated for the operating mode Cyclic Synchronous Position since the position deviation is monitored in the drive.



If you use the operating mode Cyclic Synchronous Position, set "Position Lag Monitoring" to "FALSE".

Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Velocity

Monitoring of the position deviation must be activated for the operating mode Cyclic Synchronous Velocity.



If you use the operating mode Cyclic Synchronous Velocity, set "Position Lag Monitoring" to "TRUE".

Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Torque

Monitoring of the position deviation depends on the application for the operating mode Cyclic Synchronous Torque.

Setting the Scaling Factor

The scaling factor must be set.

Formula: Scaling factor = 1 / (position scaling in the product / mechanical system)

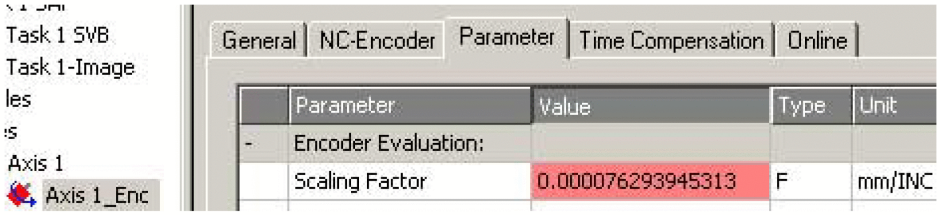
Example:

Mechanical system: 1 revolution corresponds to 10 mm

Position scaling in the product: 1 revolution corresponds to 131072 INC

Calculation: 1 / (131072 INC / 10 mm) = 0.000076293945313 mm/INC

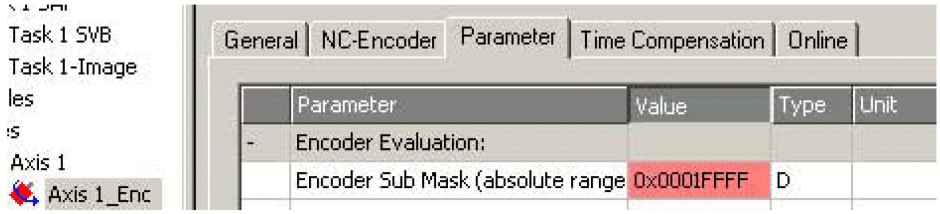
Position scaling in the product is adapted by the list of startup parameters, see List of the Startup Parameters, page 124.



Set "Scaling Factor" to 0.000076293945313 (example).

Setting Homing

For the TwinCAT homing method Software Sync, you must adjust the setting "Encoder Sub Mask (absolute range maximum value)".



Set "Encoder Sub Mask (absolute range maximum value)" to 0x0001FFFF.

Setting the Output Scaling

The output scaling must be set for the operating mode Cyclic Synchronous Velocity.

Formula:

Output scaling = (*ScaleVELdenom* / *ScaleVELnum*) x 0.007153

Example:

Velocity scaling in the product

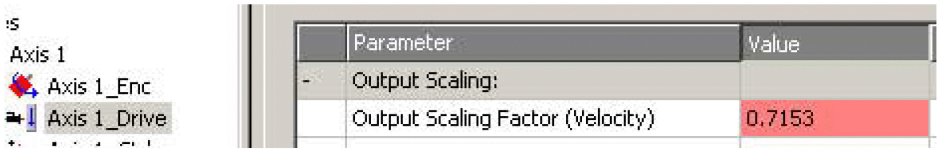
ScaleVELdenom = 100

ScaleVELnum = 1

Calculation:

(100 / 1) x 0.007153 = 0.7153

NOTE: The velocity scaling in the product must be adapted via additional parameters in the list of the startup parameters, see List of the Startup Parameters, page 124.



Set "Output Scaling Factor (Velocity)" to 0.7153 (example).

Setting the Velocity Gain Kv of the Position Controller

The velocity gain kV or the position controller must be adapted for the operating mode Cyclic Synchronous Velocity.

Set the velocity gain (Kv factor) of the position controller as described in the TwinCAT manual under "TwinCAT Axis Commissioning".

List of the Startup Parameters

Overview

The list of the startup parameters comprises parameters of the product. These parameters are adjusted so that the product can be added to "TwinCAT" as an NC axis.

The following parameters are contained in the list of start-up parameters:

- *CompParSyncMot*
- *MOD_Enable*
- *LIM_QStopReact*
- *IOsigRespOfPS*
- *ScalePOSdenom*
- *ScalePOSnum*
- *CTRL1_KFPp*
- *CTRL2_KFPp*
- *DCOMopmode*
- *ECATinpshifttime*

The following parameters must be added to the list of startup parameters if you want to use the operating mode Cyclic Synchronous Velocity:

- *ScaleVELdenom*
- *ScaleVELnum*
- *RAMP_v_max*
- *CTRL_v_max*
- *MON_v_zeroclamp*

Setting the Compatibility for Synchronous Operating Modes

The parameter for the compatibility setting for the Synchronous operating modes is set to the following value:

Parameter name	Value that is written
CompParSyncMot	1 The value must not be changed.

Setting the Modulo Range

The parameter for the modulo range is set to the following value:

Parameter name	Value that is written
MOD_Enable	0 The value must not be changed.

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 EtherCAT 3006:38$_h$

Setting the Response to "Quick Stop"

The parameter for the response to a "Quick Stop" is set to the following value:

Parameter name	Value that is written
LIM_QStopReact	-1

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 EtherCAT 3006:18$_h$

Setting the Response to a Limit Switch Error

The parameter for the response to a limit switch error is set to the following value:

Parameter name	Value that is written
IOsigRespOfPS	1 The value must not be changed.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3006:6$_h$

Setting Position Scaling

The parameter for position scaling is set to the following value:

Parameter name	Value that is written
ScalePOSdenom	131072 The value must not be changed.
ScalePOSnum	1 The value must not be changed.

These values are required for the operating modes Cyclic Synchronous Position, Cyclic Synchronous Velocity and Cyclic Synchronous Torque; they must not be changed.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3006:7$_h$
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 EtherCAT 3006:8$_h$

Setting the Velocity Feed-Forward Control

The parameter for the velocity feed-forward control is set to the following value:

Parameter name	Value that is written
CTRL1_KFPp	1000
CTRL2_KFPp	1000

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 EtherCAT 3012:6$_h$
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 EtherCAT 3013:6$_h$

Setting the Operating Mode

The parameter for the operating mode is set to the following value:

Parameter name	Value that is written
DCOMopmode	8

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 EtherCAT 6060:0$_h$

Setting the Input Shift Time

The parameter for the input shift time is set to the following value:

Parameter name	Value that is written
ECATinpshifttime	250000 The value must not be changed.

Adapting the Velocity Scaling for the Operating Mode Cyclic Synchronous Velocity

The parameters for velocity scaling must be set in the product:

Parameter name	Example
ScaleVELdenom	100
ScaleVELnum	1

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3006:21$_h$
ScaleVELnum	Velocity scaling: Numerator. Specification of the scaling factor: Speed of rotation of motor [RPM] ---------- 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 EtherCAT 3006:22$_h$

Adapting the Velocity Limitations for the Operating Mode Cyclic Synchronous Velocity

Due to the changed velocity scaling, the following parameters must be adapted:

Formula: (*ScaleVELdenom*/*ScaleVELnum*) x value of the parameter

Parameter name	Example(1)
RAMP_v_max	1320000 ((100/1) x 13200)
CTRL_v_max	1320000 ((100/1) x 13200)
MON_v_zeroclamp	1000 ((100/1) x 10)
(1) The sample values relate to the factory settings.	

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 607F:0$_h$
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 EtherCAT 3011:10$_h$
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 EtherCAT 3006:28$_h$

Adapting the Additional Velocity Limitations for the Operating Mode Cyclic Synchronous Velocity

Due to the changed velocity scaling, the following parameters must be verified.

If a parameter is used in the application, it must be adapted.

- Velocities of the operating mode Jog
  - *JOGv_slow*
  - *JOGv_fast*
- Velocities of the operating mode Homing
  - *HMv*
  - *HMv_out*
- Automatically switching between control parameter sets
  - *CLSET_v_Threshol*
- Limitation of the velocity via digital signal input
  - *IO_v_limit*
- Velocity deviation window
  - *MON_v_DiffWin*
- Velocity threshold value
  - *MON_v_Threshold*
- Velocity window
  - *MON_v_win*

- Velocity for autotuning
  - *AT_v_ref*
- Relative movement after capture
  - *RMAC_Velocity*

Setting EtherCAT "Identification"

Overview

The following possibilities are available for an EtherCAT "Identification":

- Selection of a value via DIP switch
- Selection of a value via a parameter
- Selection of a value via the TwinCAT system manager

In the TwinCAT system manager, the setting Slave-Register (ADO): 12_h is required (also known as Station Alias).

The parameter *_ECAT_Identification* allows you to read the current setting of the EtherCAT "Identification".

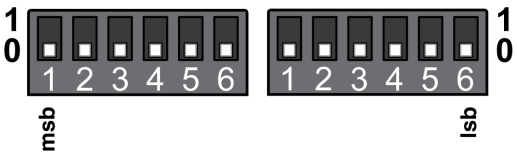
Parameter name	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
_ECAT_Identification	Set value of the EtherCAT Identification.	- 0 0 65535	UINT16 R/- - -	CANopen 3045:C_h Modbus 17688 EtherCAT 3045:C_h

Setting via DIP Switch

A value for an EtherCAT "Identification" (Device ID) can be set via the DIP switches.

The DIP switches can be set to values of 1 ... 4095.

If a value >0 has been set via the DIP switches, it is no longer possible to assign a value via the parameter *ECAT2ndaddress* or via the TwinCAT system manager.



The current settings of the DIP switches can be read via the parameter *_ECAT_DIPswitches*.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ECAT_DIPswitches	EtherCAT Identification value set via DIP switches.	- 0 0 65535	UINT16 R/- - -	CANopen 3045:B_h Modbus 17686 EtherCAT 3045:B_h

Setting via Parameter

A value for an EtherCAT "Identification" can be set via the parameter *ECAT2ndaddress*.

The value set via the parameter *ECAT2ndaddress* becomes effective when the DIP switches are set to the value 0 (factory setting).

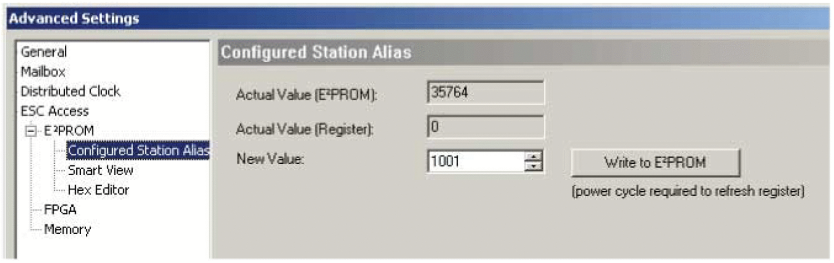
If a value >0 has been set via the parameter *ECAT2ndaddress*, it is no longer possible to assign a value via the TwinCAT system manager.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ECAT2ndaddress	Value for an EtherCAT Identification. Value for an EtherCAT "Identification" (also known as "Station Alias"), for example, for the EtherCAT function Hot Connect. Modified settings become active the next time the product is powered on.	- 0 0 65535	UINT16 R/W per. -	CANopen 3045:6_h Modbus 17676 EtherCAT 3045:6_h

Setting via TwinCAT System Manager

A value for an EtherCAT "Identification" can be set via the TwinCAT system manager.

The value is set by means of the menu item Configured Station Alias.



The value set via the TwinCAT system manager becomes effective when the parameter *ECAT2ndaddress* is set to the value 0 (factory setting).

Commissioning Procedure

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 EtherCAT 3011:C_h
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 EtherCAT 3011:D_h
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 EtherCAT 3011:E_h

Velocity Limitation

The parameter *CTRL_v_max* can be used to limit the maximum velocity.

NOTE: 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

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 EtherCAT 3011:10_h

Digital Inputs and Outputs

General

The device has configurable inputs and configurable outputs. See section Digital Signal Inputs and Digital Signal Outputs, page 184 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 EtherCAT 3008:1_h
_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 EtherCAT 3008:F_h
_IO_DQ_act	Status of digital outputs. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:10_h Modbus 2080 EtherCAT 3008:10_h
_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 EtherCAT 3008:26_h

Verifying the Signals of the Limit Switches

General

The use of limit switches can help protect against some 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 end 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.

- Install and configure the limit switches in such a way that no movements are made beyond the range defined by 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 Limit Switches, page 304.

Verifying the Safety-Related Function STO

Operation with Safety-Related Function STO

If you want to use the safety-related 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 ($\overline{STO_A}$) and ($\overline{STO_B}$) 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-related function STO.

  If the power stage is now disabled and the error message 1300 is indicated, the safety-related function STO was triggered.

  If a different error message is indicated, the safety-related function STO was not triggered.
- Document all tests of the safety-related function STO in your acceptance protocol.

Operation without Safety-Related Function STO

I/O modules with industrial connectors are available without the safety-related function STO.

If an I/O module with spring terminals is used:

- Verify that the inputs $\overline{STO_A}$ and $\overline{STO_B}$ are connected to *+24VDC*.

  For details see section Connection of Safety-Related Function STO, page 106.

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 section Functional Safety, page 67 for additional information on the behavior of the holding brake when the safety-related 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, 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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3008:A_h

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3006:C_h

Setting Parameters for Encoder

General

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*.

NOTE: 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

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 EtherCAT 301E:F_h

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 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.

Procedure:

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.

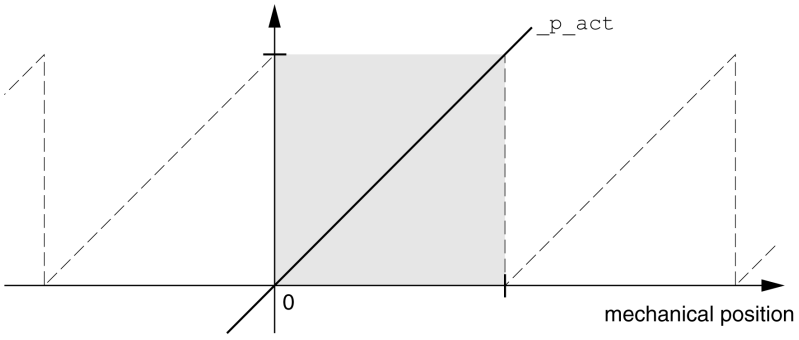
Parameter name	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENC1_adjustment	Adjustment of absolute position of encoder 1. The value range depends on the encoder type. Singleturn encoder: 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 EtherCAT 3005:16$_h$

Shifting the Working Range

The parameter *ShiftEncWorkRang* lets you shift the working range.

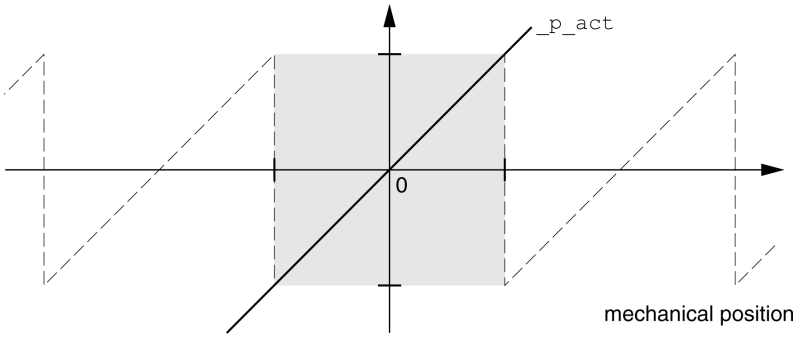
The working range without shift comprises:

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 EtherCAT 3005:21$_h$

Setting the Braking Resistor Parameters

Description

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*.

The maximum value of *RESext_P* and the minimum value of *RESext_R* depend on the power stage, see Data for External Braking Resistor, page 42.

See section Rating the Braking Resistor, 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 EtherCAT 3005:9$_h$
RESext_P	Nominal power of external braking resistor. The maximum value depends on the power stage. 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 -	UINT16 R/W per. -	CANopen 3005:12$_h$ Modbus 1316 EtherCAT 3005:12$_h$
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 - 100.00 327.67	UINT16 R/W per. -	CANopen 3005:13$_h$ Modbus 1318 EtherCAT 3005:13$_h$
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 EtherCAT 3005:11$_h$

Autotuning

General

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 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 Controller Optimization with Step Response, page 151.

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 Tuning: The user can set and tune the control loop parameters manually. Manual Tuning is available in the Expert Mode of the commissioning software.

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* 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 nonvolatile memory 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 Enhanced Settings for Autotuning, page 148.

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 EtherCAT 302F:4_h
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 EtherCAT 302F:12_h
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 EtherCAT 302F:E_h
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 EtherCAT 302F:1_h

Enhanced Settings for Autotuning

Description

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 EtherCAT 302F:2_h
_AT_progress	Progress of Autotuning.	% 0 0 100	UINT16 R/- - -	CANopen 302F:B_h Modbus 12054 EtherCAT 302F:B_h

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 EtherCAT 3011:15$_h$
_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 EtherCAT 302F:7$_h$
_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 EtherCAT 302F:8$_h$
_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 EtherCAT 302F:C$_h$

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 EtherCAT 302F:9_h

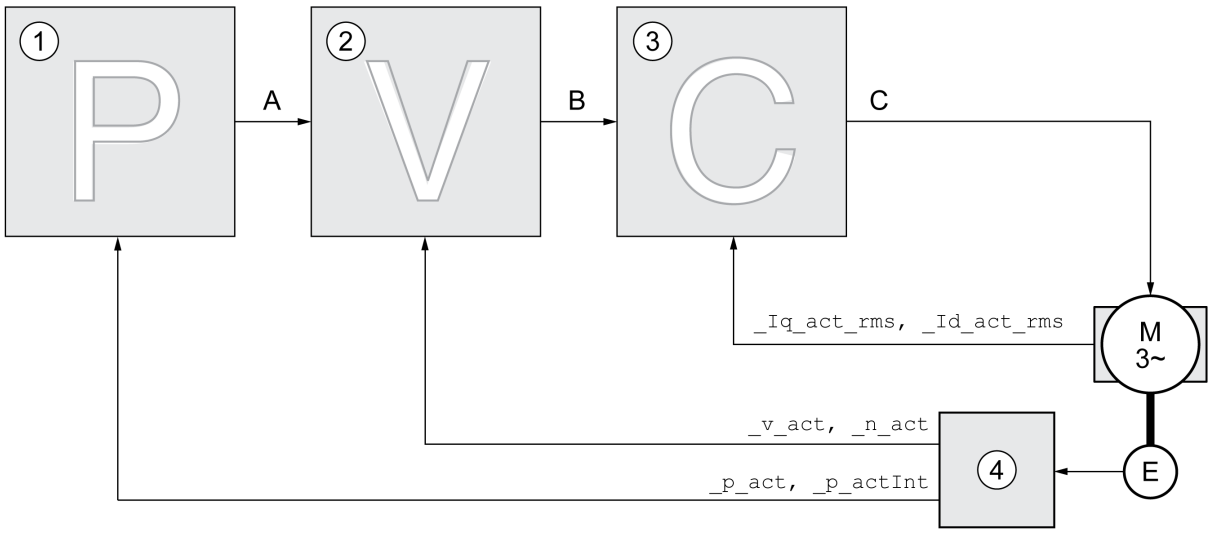
Controller Optimization with Step Response

Controller Structure

Overview

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.



1 Position controller

2 Velocity controller

3 Current controller

4 Encoder evaluation

See section Overview of the Controller Structure, page 198 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. Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen 3011:19$_h$ Modbus 4402 EtherCAT 3011:19$_h$
_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 EtherCAT 3011:17$_h$
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 linearly: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen 3011:14$_h$ Modbus 4392 EtherCAT 3011:14$_h$

Optimization

General

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 RPM
- 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 section Switching Between Control Loop Parameter Sets, page 198.

Optimizing the Velocity Controller

General

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 EtherCAT 3012:1_h
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 EtherCAT 3013:1_h
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 EtherCAT 3012:2_h
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 EtherCAT 3013:2_h

Verify and optimize the calculated values in a second step, see Verifying and Optimizing the P Gain, page 158.

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".

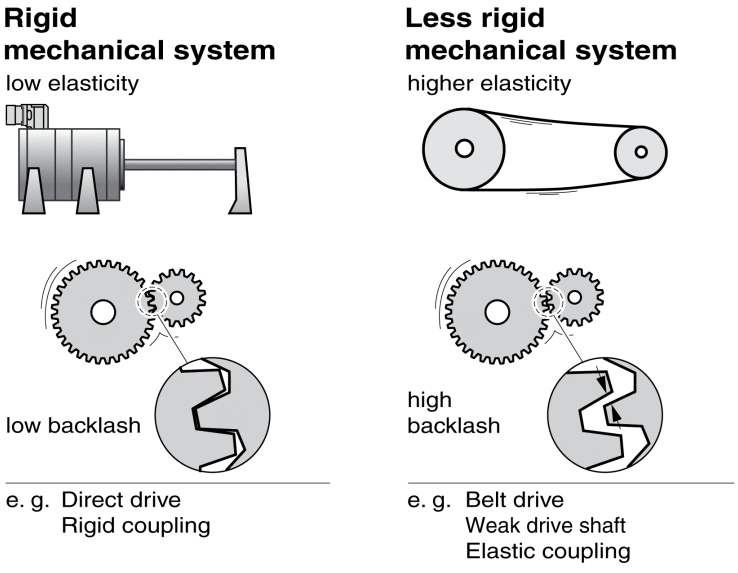
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_TAUnref	Filter time constant of the reference velocity value filter. In the case of switching between the two control loop parameter sets, the values are changed 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 EtherCAT 3012:4$_h$
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 EtherCAT 3013:4$_h$

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 kgcm²	0.0125	8	0.008	12	0.007	16
2 kgcm²	0.0250	8	0.015	12	0.014	16
5 kgcm²	0.0625	8	0.038	12	0.034	16
10 kgcm²	0.125	8	0.075	12	0.069	16
20 kgcm²	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.

The step function moves the motor 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.

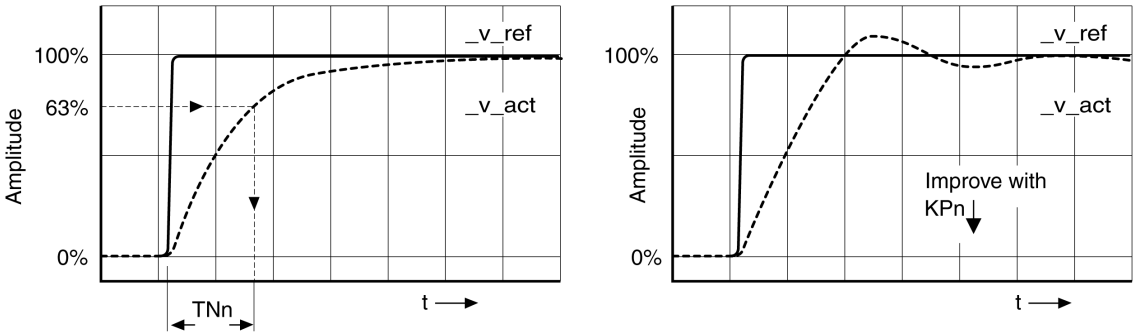
- Trigger a step function.
- After the first test, verify the maximum amplitude for the reference value for the current *_Iq_ref*.

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

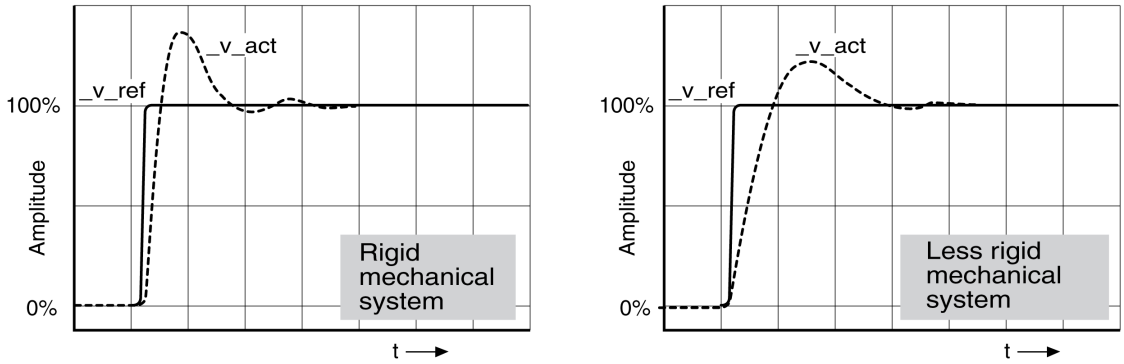
Graphically determine the point at which the actual velocity *_v_act* reaches 63% of the final value. The integral action time *CTRL1_TNn* (*CTRL2_TNn*) then results as a value on the time axis. The commissioning software supports you with the evaluation:

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 EtherCAT 3012:2$_h$
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 EtherCAT 3013:2$_h$

Verifying and Optimizing the P Gain

General

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

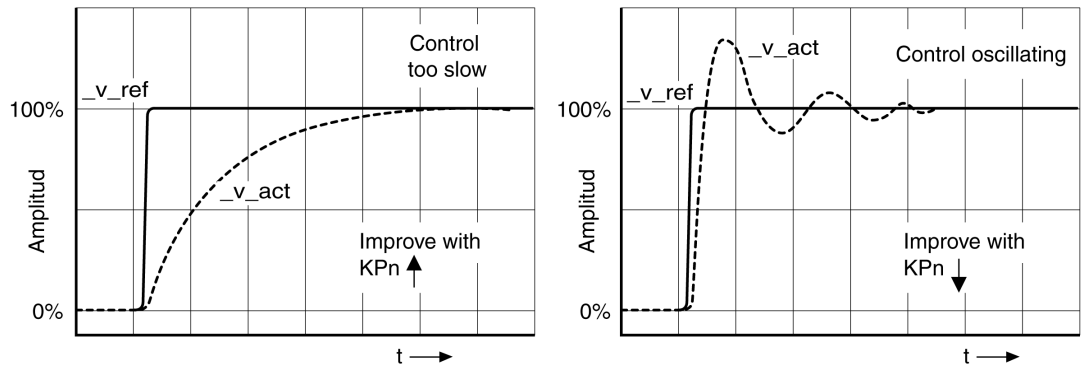
- Fast transient response
- Overshooting with 20%, up to a maximum of 40%.

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 EtherCAT 3012:3$_h$
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 EtherCAT 3013:3$_h$

The step function moves the motor 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 approximately 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.

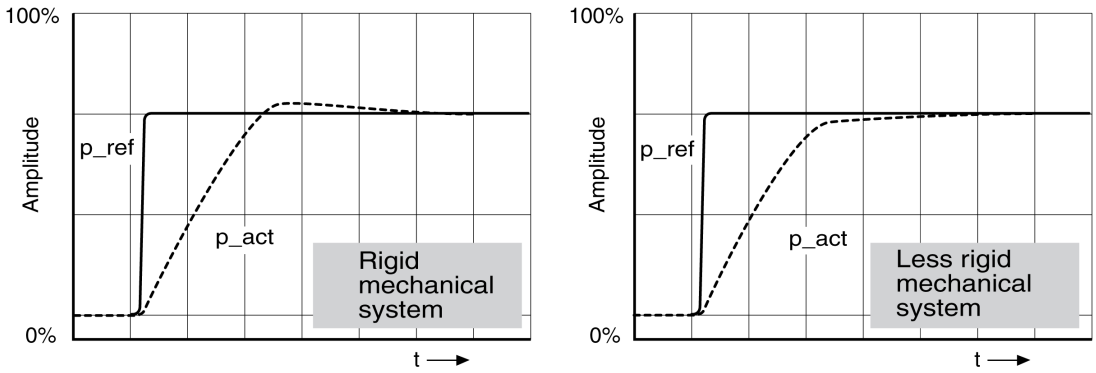
Selecting the Trace Signals

- 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

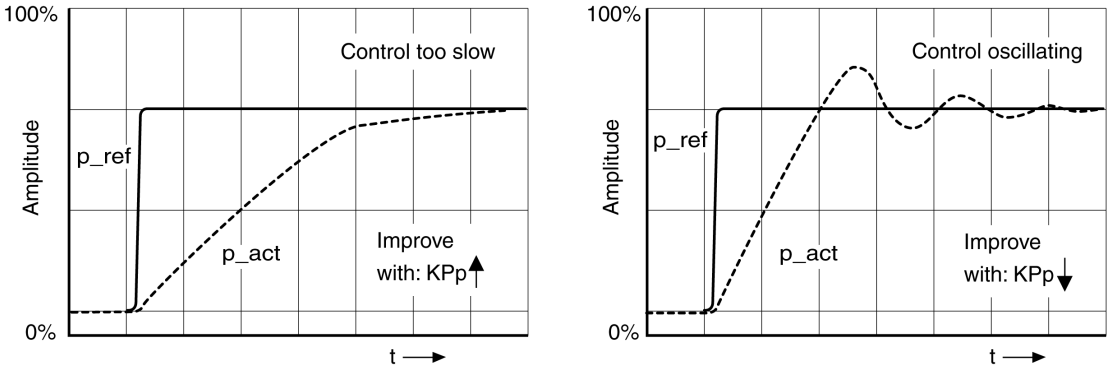


The p gain setting *CTRL1_KPp* (*CTRL2_KPp*) is optimal if the reference value is reached rapidly and with little or no overshooting.

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



Parameter Management

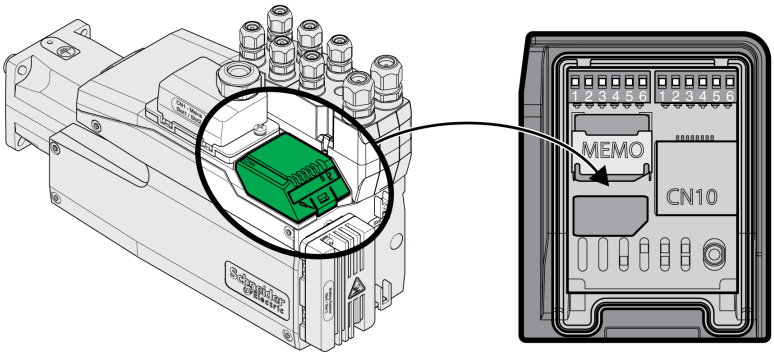
Memory Card

Description

The drives features a card holder for a memory card. The parameters stored on the memory card can be transferred to other drives. If a drive is replaced, a new drive of the same type can be operated with identical parameters.

The contents of the memory card is compared to the parameters stored in the drive when the drive is powered on.

When the parameters are written to the nonvolatile memory, 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 drive.
- The memory card can only be removed from the drive by pulling (not by pushing).

NOTICE
ELECTROSTATIC DISCHARGE OR INTERMITTENT CONTACT AND LOSS OF DATA Do not touch the contacts of the memory card. **Failure to follow these instructions can result in equipment damage.**

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 drive.
- Switch on the power supply.

Observe the memory card LED during the initialization of the drive. See section Memory card LEDs, page 350 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 drive data is transferred to the memory card. Observe the memory card LED and the error memory of the drive.

Transferring Data From the Memory Card to the Drive

The memory card contains a parameter set of a drive 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 drive. Observe the memory card LED and the error memory of the drive.

- 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 drive (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 drive 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 24 Vdc control 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

Description

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: Reset persistent user parameters 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 nonvolatile memory. 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 EtherCAT 3004:8_h

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 drive transitions to the operating state "**2** Not Ready To Switch On" after the user parameters are reset, the new settings only become active after the 24 Vdc control supply of the drive is power cycled.

Restoring Factory Settings

Description

The parameter values, both active and those saved in nonvolatile 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 drive as a configuration file. For information on saving the existing parameters in the drive, see Parameter Management, page 161.

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 24 Vdc control supply of the drive is power cycled.

Operation

Access Channels

Description

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 drive 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-related function STO (*STO_A* and *STO_B*) are available during exclusive access.

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: Modbus TCP	- - - -	UINT16 R/- - -	CANopen 3001:C_h Modbus 280 EtherCAT 3001:C_h
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 EtherCAT 3001:E_h

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
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.

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 EtherCAT 3005:1$_h$

Movement Range

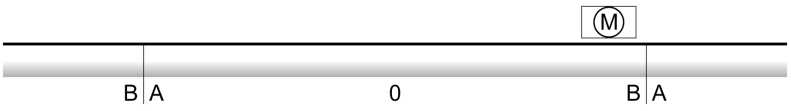
Size of the Movement Range

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 EtherCAT 3023:7$_h$

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:
  An absolute movement beyond the movement range is possible.

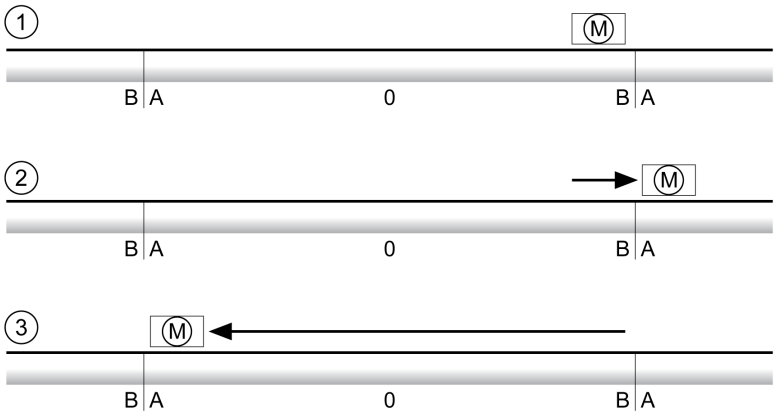
- Parameter *PP_ModeRangeLim* = 0:

  An absolute movement is made within the movement range. An 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:

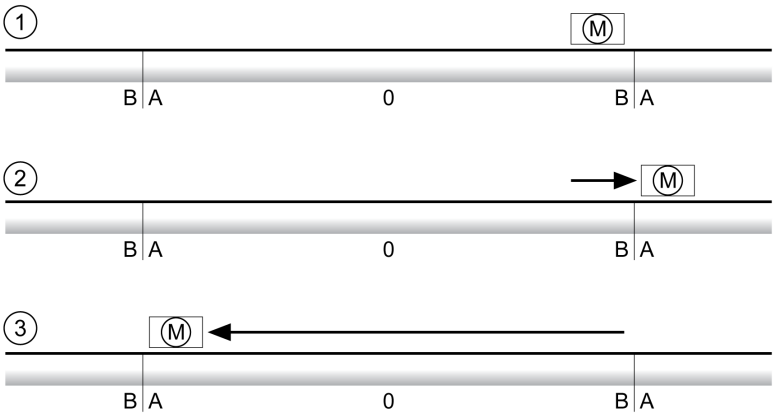
  An absolute movement beyond the movement range is possible.
- Parameter *PP_ModeRangeLim* = 0:

  An absolute movement is made within the movement range. An 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 section Modulo Range, page 172.

Modulo Range

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

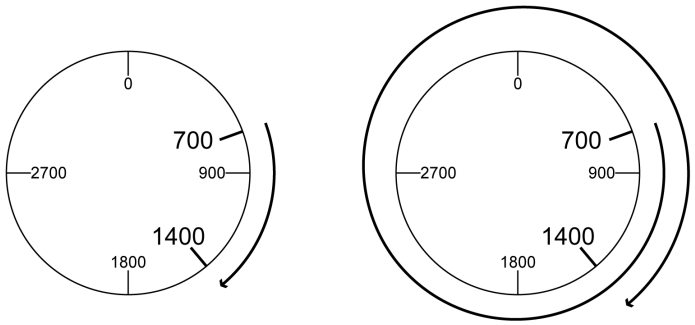
In addition, it is possible to set a multiple modulo range for absolute target positions. A movement with an absolute target position beyond the modulo range is performed in a way as if several modulo ranges had been arranged one after the other.

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

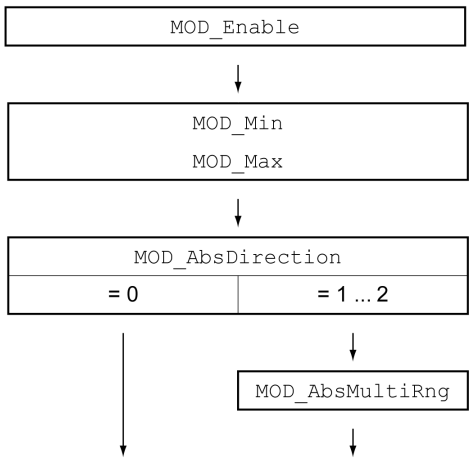
Multiple modulo range



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 Scaling, page 180.

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 EtherCAT 3006:38$_h$

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 EtherCAT 3006:39$_h$
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 EtherCAT 3006:3A$_h$

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 EtherCAT 3006:3B$_h$

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 EtherCAT 3006:3C$_h$

Examples with Relative Movements

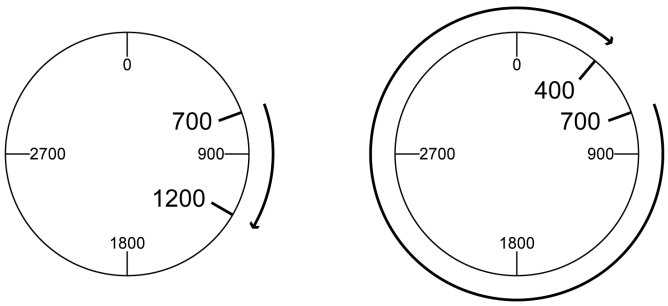
Assumptions

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

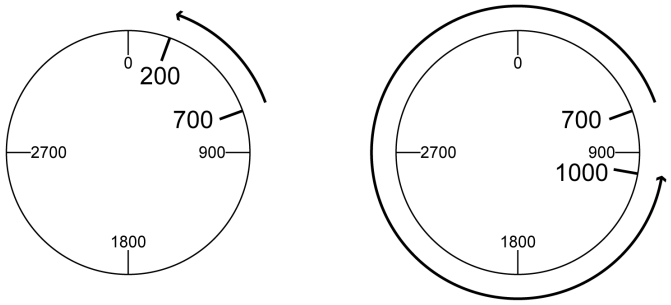
Example 1

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"

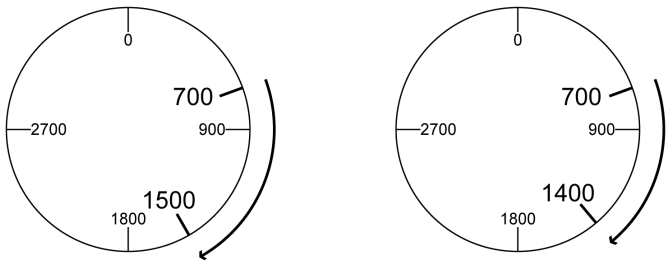
Assumptions

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

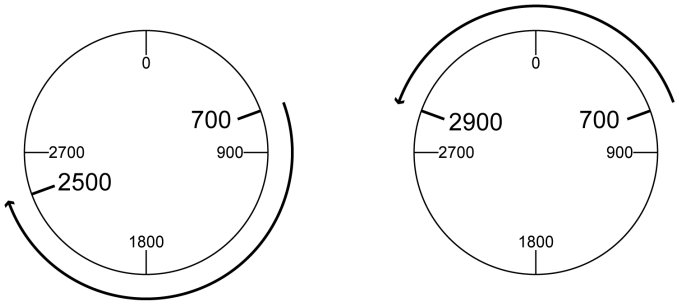
Example 1

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.

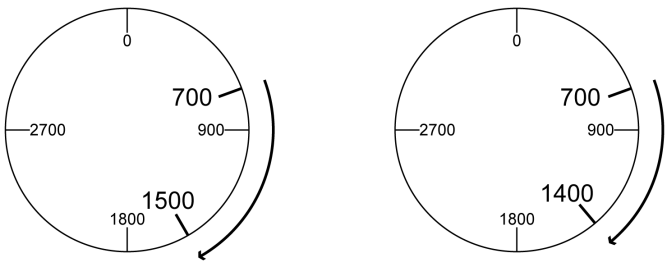
- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter *MOD_AbsDirection*: Positive Direction

Example 1

Parameter *MOD_AbsMultiRng*: Off

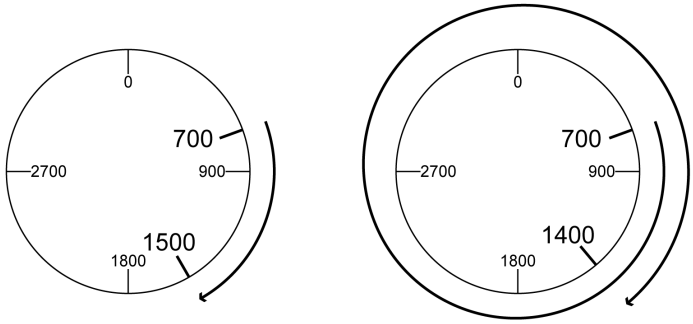
Target positions absolute: 1500 usr_p and 5000 usr_p



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.

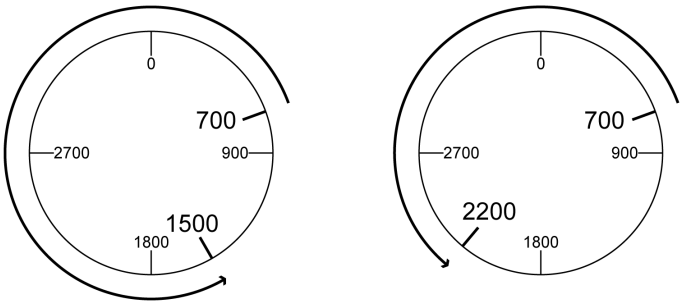
- Rotary motor
- Position scaling
  - Numerator: 1
  - Denominator: 3600
- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter *MOD_AbsDirection*: Negative Direction

Example 1

Parameter *MOD_AbsMultiRng*: Off

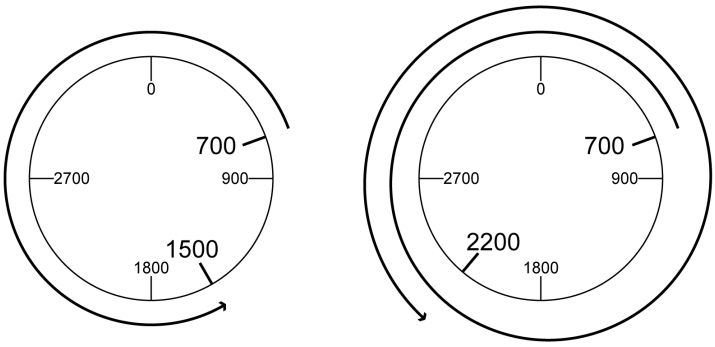
Target positions absolute: 1500 usr_p and -5000 usr_p



Example 2

Parameter *MOD_AbsMultiRng*: On

Target positions absolute: 1500 usr_p and -5000 usr_p

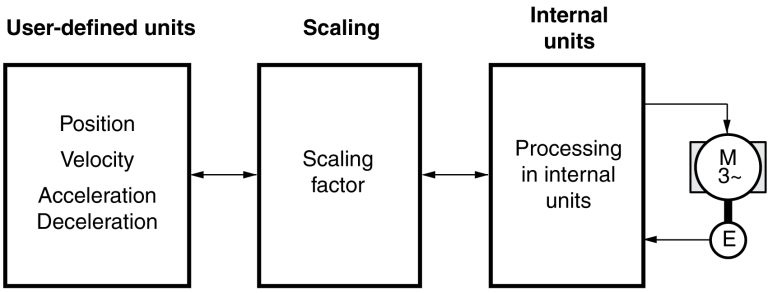

0
700
2700
900
1500
1800
0
700
2700
900
2200
1800

Scaling

General

Overview

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, 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 adjusted.

Configuration of Position Scaling

Description

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 EtherCAT 3006:8_h
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 EtherCAT 3006:7_h

Configuration of Velocity Scaling

Description

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 [RPM] ---------- 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 EtherCAT 3006:22$_h$
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 EtherCAT 3006:21$_h$

Configuration of Ramp Scaling

Description

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 EtherCAT 3006:31$_h$
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 EtherCAT 3006:30$_h$

Digital Signal Inputs and Digital Signal Outputs

Parameterization of the Signal Input Functions

Signal Input Function

Various signal input functions can be assigned to the digital signal inputs.

The functions of the inputs and outputs depend on the selected operating mode and the settings of the corresponding parameters.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the wiring is appropriate for the factory settings and any subsequent parameterizations.
- 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 section
Freely Available	•	•	Setting a Signal Output via Parameter, page 289
Fault Reset	•	•	Changing the Operating State via Signal Inputs, page 218
Enable	•	•	Changing the Operating State via Signal Inputs, page 218
Halt	•	•	Stopping Movement with Halt, page 283
Current Limitation	•	•	Limitation of the Current via Signal Inputs, page 288
Zero Clamp	•	•	Zero Clamp, page 289
Velocity Limitation	•	•	Limitation of the Velocity via Signal Inputs, page 287
Jog Positive	•		Operating Mode Jog, page 225
Jog Negative	•		Operating Mode Jog, page 225
Jog Fast/Slow	•		Operating Mode Jog, page 225
Start Single Data Set		•	Operating Mode Motion Sequence, page 257
Data Set Select		•	Operating Mode Motion Sequence, page 257
Data Set Bit 0		•	Operating Mode Motion Sequence, page 257
Data Set Bit 1		•	Operating Mode Motion Sequence, page 257
Data Set Bit 2		•	Operating Mode Motion Sequence, page 257
Data Set Bit 3		•	Operating Mode Motion Sequence, page 257
Reference Switch (REF)		•	Reference Switch, page 305
Positive Limit Switch (LIMP)	•	•	Limit Switches, page 304
Negative Limit Switch (LIMN)	•	•	Limit Switches, page 304
Switch Controller Parameter Set	•	•	Switching Between Control Loop Parameter Sets, page 198
Velocity Controller Integral Off	•	•	Switching Between Control Loop Parameter Sets, page 198
Start Motion Sequence		•	Operating Mode Motion Sequence, page 257
Start Signal Of RMAC	•	•	Relative Movement After Capture (RMAC), page 297
Activate RMAC	•	•	Relative Movement After Capture (RMAC), page 297
Activate Operating Mode	•	•	Relative Movement After Capture (RMAC), page 297
Data Set Bit 4		•	Operating Mode Motion Sequence, page 257

Signal input function	Jog	Motion Sequence	Description in section
Data Set Bit 5		•	Operating Mode Motion Sequence, page 257
Data Set Bit 6		•	Operating Mode Motion Sequence, page 257
Release Holding Brake	•	•	Releasing the Holding Brake Manually, page 138

The table below provides an overview of the possible signal input functions in fieldbus control mode:

Signal input function	Description in section
Freely Available	Setting a Signal Output via Parameter, page 289
Fault Reset	Changing the Operating State via Signal Inputs, page 218
Enable	Changing the Operating State via Signal Inputs, page 218
Halt	Stopping Movement with Halt, page 283
Start Profile Positioning	Starting a Movement via a Signal Input, page 290
Current Limitation	Limitation of the Current via Signal Inputs, page 288
Zero Clamp	Zero Clamp, page 289
Velocity Limitation	Limitation of the Velocity via Signal Inputs, page 287
Reference Switch (REF)	Reference Switch, page 305
Positive Limit Switch (LIMP)	Limit Switches, page 304
Negative Limit Switch (LIMN)	Limit Switches, page 304
Switch Controller Parameter Set	Switching Between Control Loop Parameter Sets, page 198
Velocity Controller Integral Off	Switching Between Control Loop Parameter Sets, page 198
Start Signal Of RMAC	Relative Movement After Capture (RMAC), page 297
Activate RMAC	Relative Movement After Capture (RMAC), page 297
Jog Positive With Enable	Operating Mode Jog, page 225
Jog Negative With Enable	Operating Mode Jog, page 225
Release Holding Brake	Releasing the Holding Brake Manually, page 138

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 Persis-tent 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.	- - - -	UINT16 R/W per. -	CANopen 3007:1$_h$ Modbus 1794 EtherCAT 3007:1$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persis-tent Expert	Parameter address via fieldbus
	Modified settings become active the next time the product is powered on.			
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	- - - -	UINT16 R/W per. -	CANopen 3007:2_h Modbus 1796 EtherCAT 3007:2_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persis-tent Expert	Parameter address via fieldbus
	Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.			
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	- - - -	UINT16 R/W per. -	CANopen $3007:3_h$ Modbus 1798 EtherCAT $3007:3_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persis-tent Expert	Parameter address via fieldbus
	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.			
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	- - - -	UINT16 R/W per. -	CANopen 3007:4$_h$ Modbus 1800 EtherCAT 3007:4$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persis-tent Expert	Parameter address via fieldbus
	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.			

Parameterization of the Signal Output Functions

Signal Output Function

Various signal output functions can be assigned to the digital signal outputs.

The functions of the inputs and outputs depend on the selected operating mode and the settings of the corresponding parameters.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the wiring is appropriate for the factory settings and any subsequent parameterizations.
- 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.

In the case of a detected error the state of the signal outputs remains active according to assigned signal output function.

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 section
Freely Available	•	•	Setting a Signal Output via Parameter, page 289
No Fault	•	•	Indication of the Operating State via Signal Inputs, page 215
Active	•	•	Indication of the Operating State via Signal Inputs, page 215
RMAC Active Or Finished	•	•	Relative Movement After Capture (RMAC), page 297
In Position Deviation Window	•	•	Position Deviation Window, page 322
In Velocity Deviation Window	•	•	Velocity Deviation Window, page 324
Velocity Below Threshold	•	•	Velocity Threshold Value, page 326
Current Below Threshold	•	•	Current Threshold Value, page 327
Halt Acknowledge	•	•	Stopping Movement with Halt, page 283
Motion Sequence: Start Acknowledge		•	Operating Mode Motion Sequence, page 257
Motor Standstill	•	•	Motor Standstill and Direction of Movement, page 312
Selected Error	•	•	Indicating Error Messages, page 352
Drive Referenced (ref_ok)		•	Operating Mode Homing, page 245
Selected Warning	•	•	Indicating Error Messages, page 352
Motion Sequence: Done		•	Operating Mode Motion Sequence, page 257
Position Register Channel 1		•	Position Register, page 316
Position Register Channel 2		•	Position Register, page 316
Position Register Channel 3		•	Position Register, page 316
Position Register Channel 4		•	Position Register, page 316
Motor Moves Positive	•	•	Motor Standstill and Direction of Movement, page 312
Motor Moves Negative	•	•	Motor Standstill and Direction of Movement, page 312

The table below provides an overview of the possible signal output functions in fieldbus control mode:

Signal output function	Description in section
Freely Available	Setting a Signal Output via Parameter, page 289
No Fault	Indication of the Operating State via Signal Inputs, page 215
Active	Indication of the Operating State via Signal Inputs, page 215
RMAC Active Or Finished	Relative Movement After Capture (RMAC), page 297
In Position Deviation Window	Position Deviation Window, page 322
In Velocity Deviation Window	Velocity Deviation Window, page 324
Velocity Below Threshold	Velocity Threshold Value, page 326
Current Below Threshold	Current Threshold Value, page 327
Halt Acknowledge	Stopping Movement with Halt, page 283
Motor Standstill	Motor Standstill and Direction of Movement, page 312
Selected Error	Indicating Error Messages, page 352
Drive Referenced (ref_ok)	Operating Mode Homing, page 245
Selected Warning	Indicating Error Messages, page 352
Position Register Channel 1	Position Register, page 316
Position Register Channel 2	Position Register, page 316
Position Register Channel 3	Position Register, page 316
Position Register Channel 4	Position Register, page 316
Motor Moves Positive	Motor Standstill and Direction of Movement, page 312
Motor Moves Negative	Motor Standstill and Direction of Movement, page 312

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 EtherCAT 3007:9_h
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	- - - -	UINT16 R/W per. -	CANopen 3007:A_h Modbus 1812 EtherCAT 3007:A_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			

Parameterization of Software Debouncing

Debounce Time

Signal input debouncing comprises hardware debouncing and software debouncing.

Hardware debounce time is permanently set, see Digital Input Signals 24 V (Hardware switching time), page 29.

When a set signal function is modified, software debouncing is reset to the factory setting on the next power cycle.

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 EtherCAT 3008:20$_h$
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 EtherCAT 3008:21$_h$

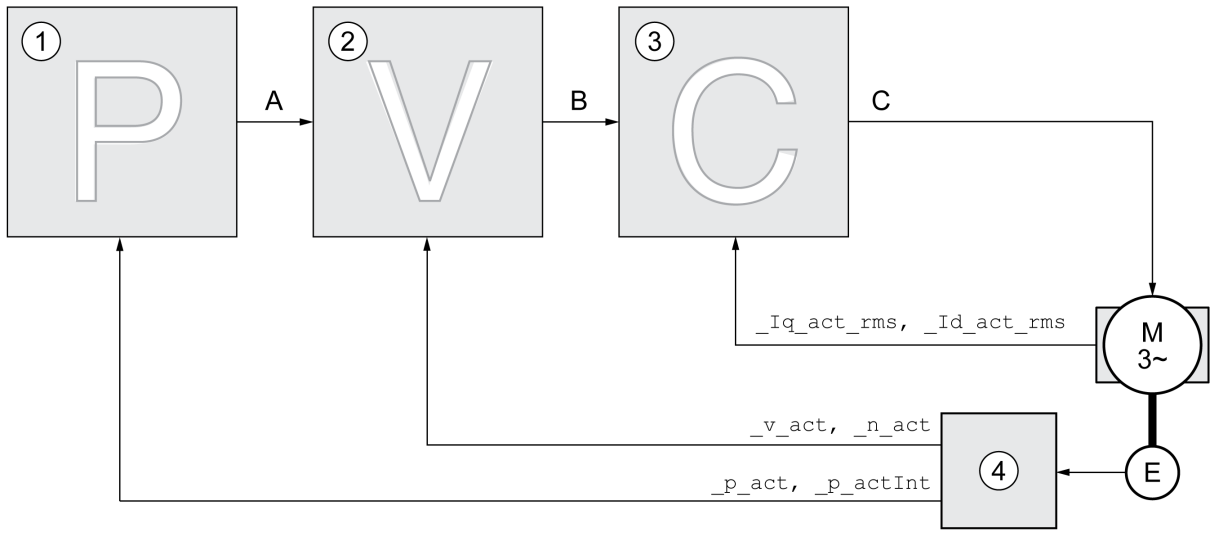
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DI_2_Debounce	Debounce time of DI2. **0 / No**: No software debouncing **1 / 0.25 ms**: 0.25 ms **2 / 0.50 ms**: 0.50 ms **3 / 0.75 ms**: 0.75 ms **4 / 1.00 ms**: 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 EtherCAT 3008:22$_h$
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 EtherCAT 3008:23$_h$

Switching Between Control Loop Parameter Sets

Overview of the Controller Structure

General

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

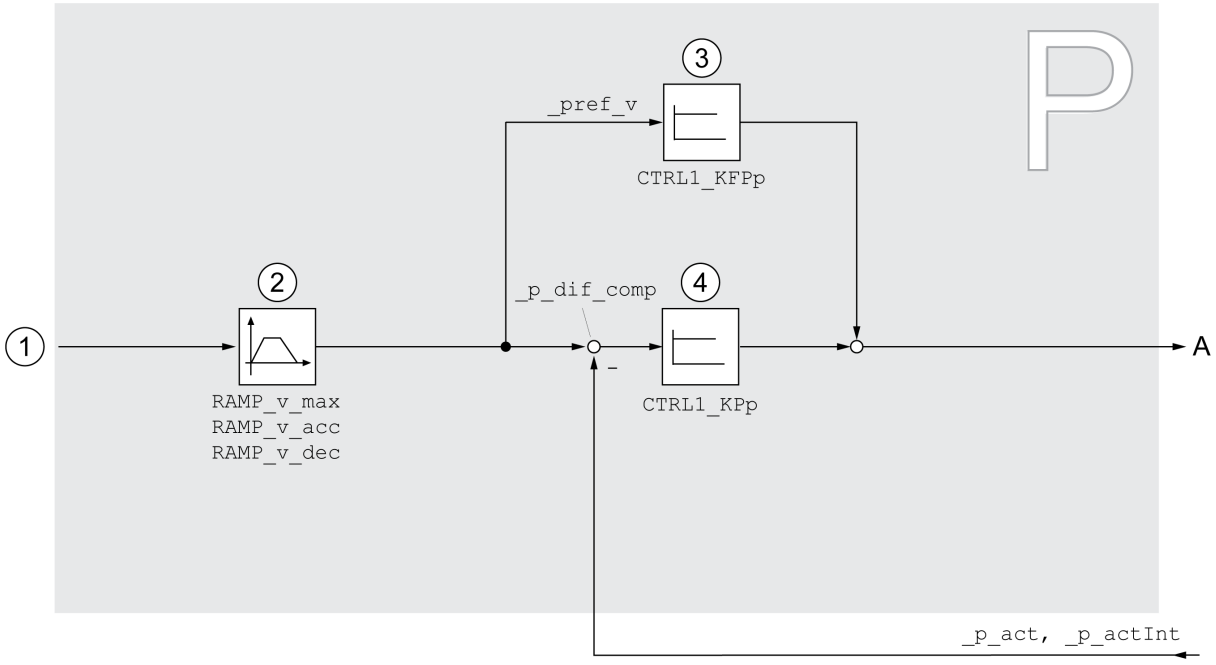
Current Controller

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

Overview

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

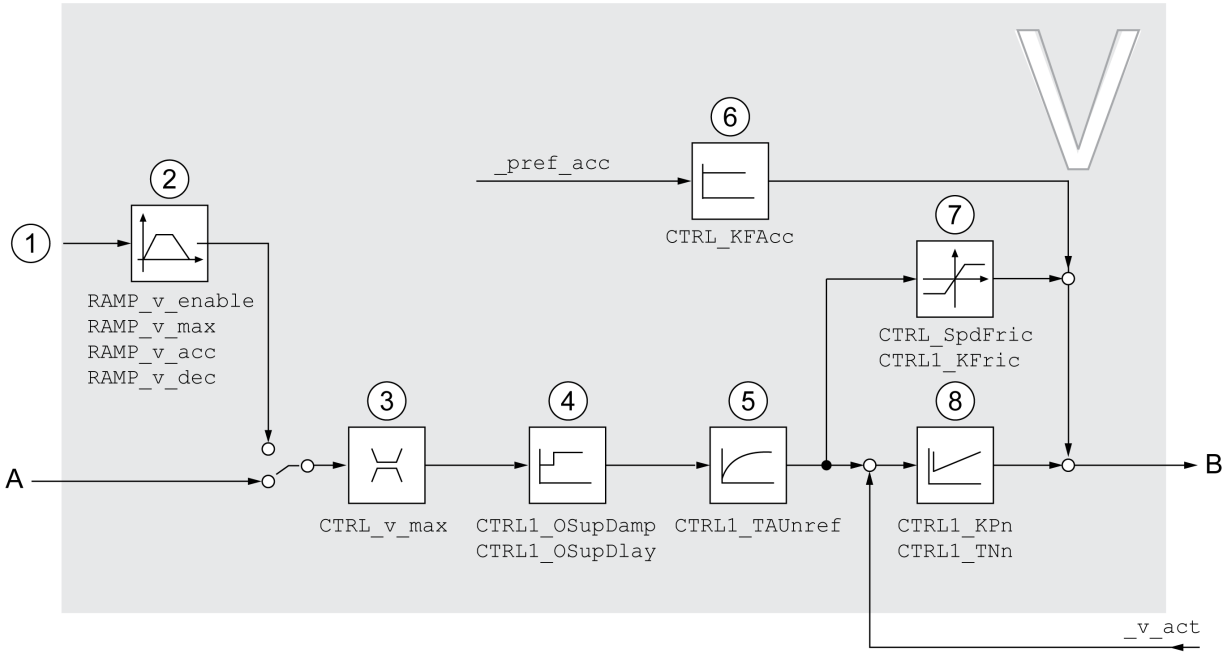
Sampling Period

The sampling period of the position controller is 250 µs.

Overview of Velocity Controller

Overview

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

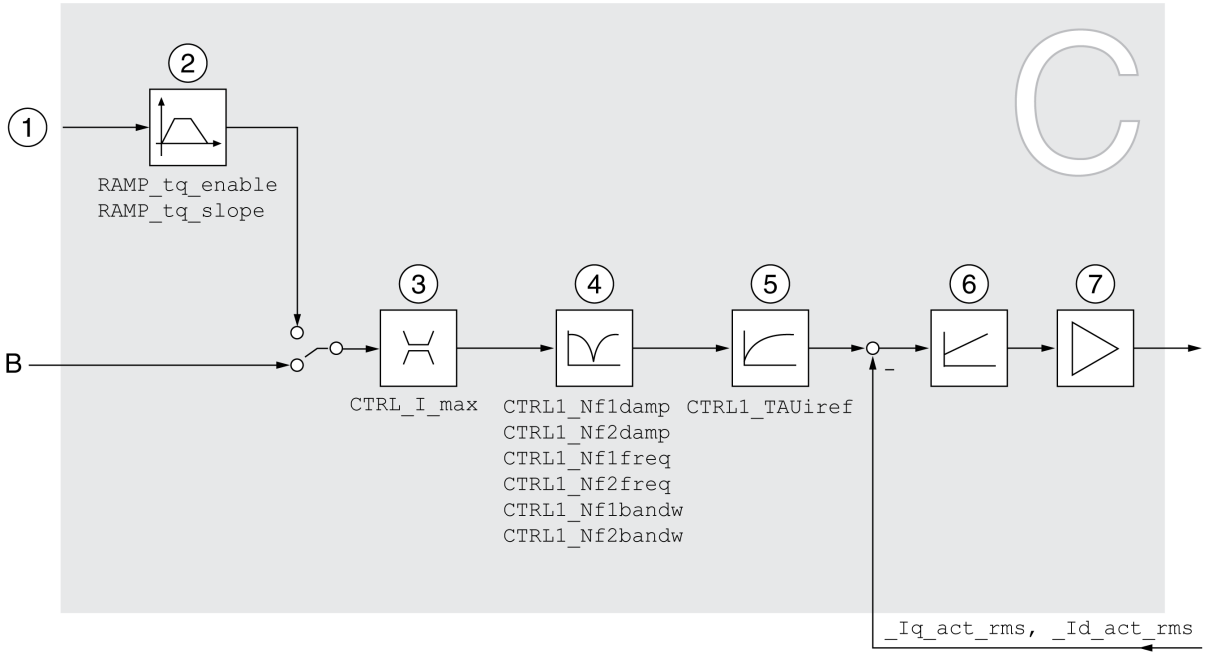
Sampling Period

The sampling period of the velocity controller is 62.5 µs.

Overview of Current Controller

Overview

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:	Freely accessible parameters:
CTRL1_KPn	*CTRL2_KPn*
CTRL1_TNn	*CTRL2_TNn*
CTRL1_KPp	*CTRL2_KPp*
CTRL1_TAUiref	*CTRL2_TAUiref*
CTRL1_TAUnref	*CTRL2_TAUnref*
CTRL1_KFPp	*CTRL2_KFPp*
Parameters only accessible in expert mode:	Parameters only accessible in expert mode:
CTRL1_Nf1damp	*CTRL2_Nf1damp*
CTRL1_Nf1freq	*CTRL2_Nf1freq*
CTRL1_Nf1bandw	*CTRL2_Nf1bandw*
CTRL1_Nf2damp	*CTRL2_Nf2damp*
CTRL1_Nf2freq	*CTRL2_Nf2freq*
CTRL1_Nf2bandw	*CTRL2_Nf2bandw*
CTRL1_Osupdamp	*CTRL2_Osupdamp*
CTRL1_Osupdelay	*CTRL2_Osupdelay*
CTRL1_Kfric	*CTRL2_Kfric*

See sections Control Loop Parameter Set 1, page 207 and Control Loop Parameter Set 2, page 209.

Parameterization

- Selecting a control loop parameter set

  Select a control loop parameter set after switching on.

  See Selecting a Control Loop Parameter Set, page 202.
- Automatically switching between control loop parameter sets

  It is possible to switch between the two control loop parameter sets.

  See Automatically Switching Between Control Loop Parameter Sets, page 203.
- Copying a control loop parameter set

  The values of control loop parameter set 1 can be copied to control loop parameter set 2.

  See Copying a Control Loop Parameter Set, page 206.
- Deactivating the integral term

  The integral term and, by implication, the integral action time, can be deactivated via a digital signal input.

  See Deactivating the Integral Term, page 206.

Selecting a Control Loop Parameter Set

Description

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 EtherCAT 3011:17$_h$
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 EtherCAT 3011:18$_h$
CTRL_SelParSet	Selection of control loop parameter set. Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen 3011:19$_h$ Modbus 4402 EtherCAT 3011:19$_h$

Automatically Switching Between Control Loop Parameter Sets

Description

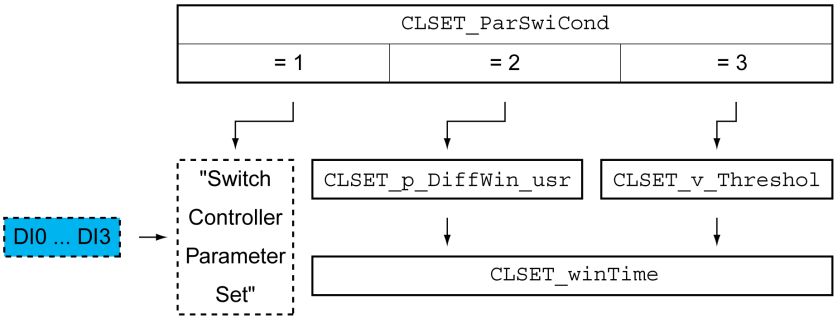
It is possible to automatically switch between the two control loop parameter sets.

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.



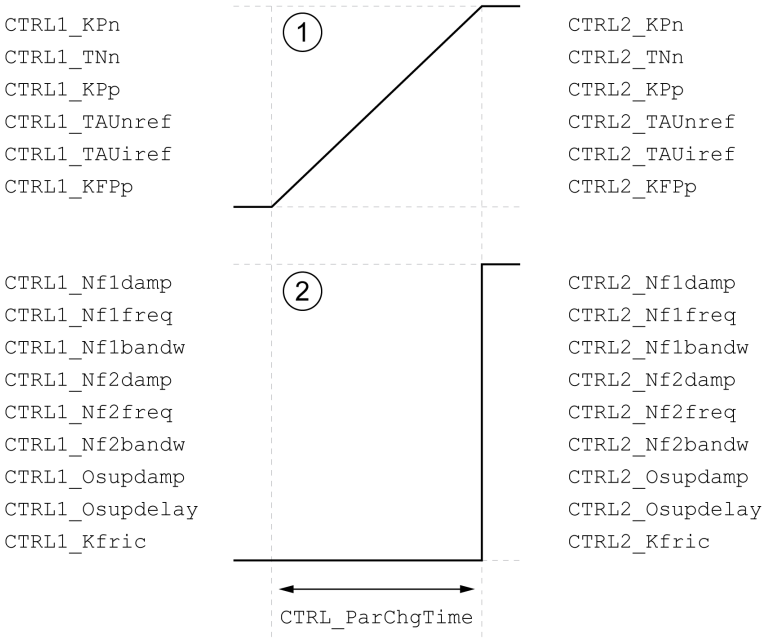
Time Chart

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 EtherCAT 3011:1A$_h$
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 EtherCAT 3011:25$_h$
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 EtherCAT 3011:1D$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3011:1B$_h$
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 linearly: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen 3011:14$_h$ Modbus 4392 EtherCAT 3011:14$_h$

Copying a Control Loop Parameter Set

Description

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 EtherCAT 3011:16$_h$

Deactivating the Integral Term

Description

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

Overview

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 EtherCAT 3012:1$_h$
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 EtherCAT 3012:2$_h$
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 EtherCAT 3012:3$_h$
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 EtherCAT 3012:5$_h$
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 EtherCAT 3012:4$_h$

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 EtherCAT 3012:6_h
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 EtherCAT 3012:8_h
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 EtherCAT 3012:9_h
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 EtherCAT 3012:A_h
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 EtherCAT 3012:B_h
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 EtherCAT 3012:C_h
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 EtherCAT 3012:D_h
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 EtherCAT 3012:E_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3012:F_h
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 EtherCAT 3012:10_h

Control Loop Parameter Set 2

Overview

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 EtherCAT 3013:1_h
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 EtherCAT 3013:2_h
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 EtherCAT 3013:3_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3013:5$_h$
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 EtherCAT 3013:4$_h$
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 EtherCAT 3013:6$_h$
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 EtherCAT 3013:8$_h$
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 EtherCAT 3013:9$_h$
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 EtherCAT 3013:A$_h$
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 EtherCAT 3013:B$_h$
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 EtherCAT 3013:C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3013:D_h
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 EtherCAT 3013:E_h
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 EtherCAT 3013:F_h
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 EtherCAT 3013:10_h

Operating States and Operating Modes

Operating States

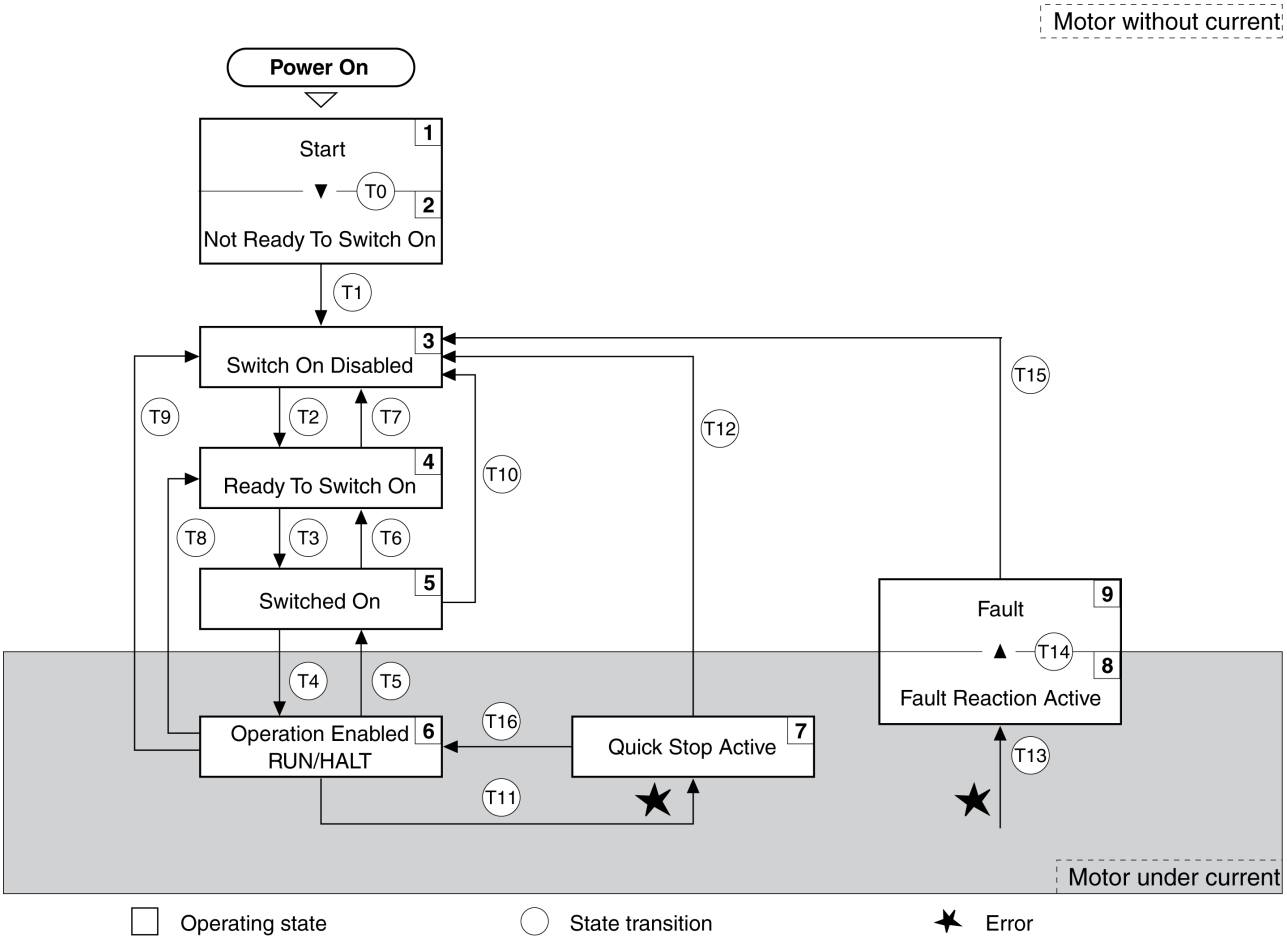
State Diagram and State Transitions

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

Operating state	Description
	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-related function STO	Power stage is immediately disabled

An error can be triggered by a temperature sensor, for example. The drive cancels the 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 and Encoder successfully checked and Actual velocity: <1000 RPM and STO signals = +24V and 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	
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 EtherCAT 605B:0_h

Indication of the Operating State via Signal Outputs

Description

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 via Fieldbus

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 EtherCAT 6041:0$_h$

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 sections 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 sections 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 function "Jog Positive With Enable"
- Signal input function "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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3005:34$_h$

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 Operating Mode Jog, page 225 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 Operating Mode Jog, page 225 for details and parameterization.
Falling edge	Stopping the movement. Disabling the power stage (T9 and T12)

Changing the Operating State via Fieldbus

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 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 EtherCAT 6040:0$_h$

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 section.

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 section.

Bits 10 ... 15

Reserved.

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 EtherCAT 3005:3$_h$

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 EtherCAT 6060:0_h

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 0 10	INT16* R/- - -	CANopen 6061:0_h Modbus 6920 EtherCAT 6061:0_h

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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.

- 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 Stopping Movement with Halt, page 283.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PP_OpmChgType	Change to operating mode Profile Position during movements. **0 / WithStandStill**: Change with standstill **1 / OnTheFly**: Change without standstill If Modulo is active, a transition to the operating mode Profile Position is performed with the setting WithStandStill, regardless of the setting of this parameter. 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 EtherCAT 3023:9$_h$

Operating Mode Jog

Overview

Availability

See Control Mode, page 167.

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 two methods:

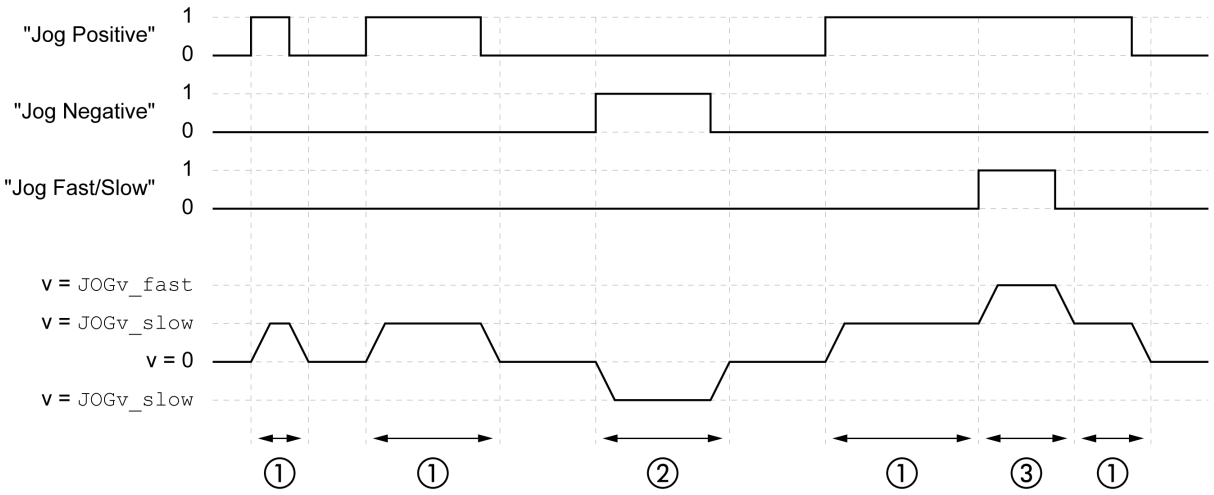
- Continuous movement
- Step movement

In addition, the product features two 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 example of continuous movement via the signal inputs in local control mode:

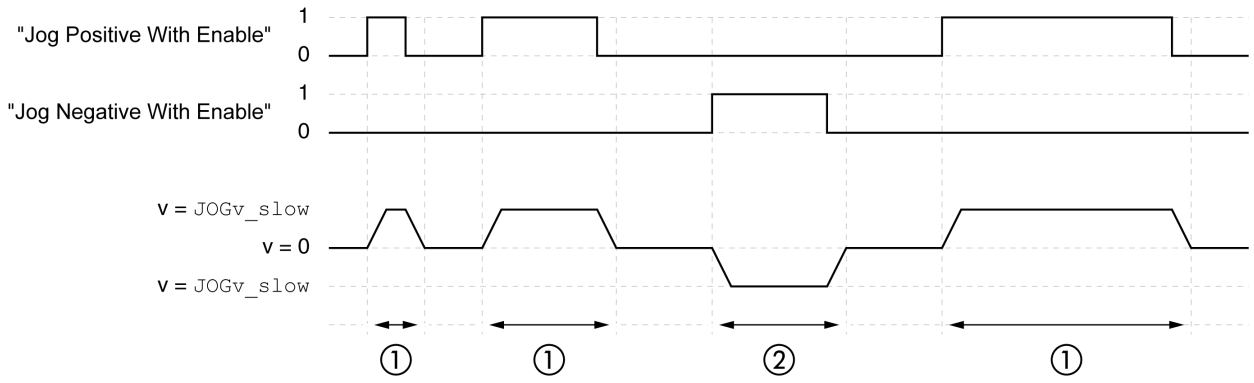


1 Slow movement in positive direction

2 Slow movement in negative direction

3 Fast movement in positive direction

The illustration below provides an example of continuous movement via the signal inputs in fieldbus control mode:

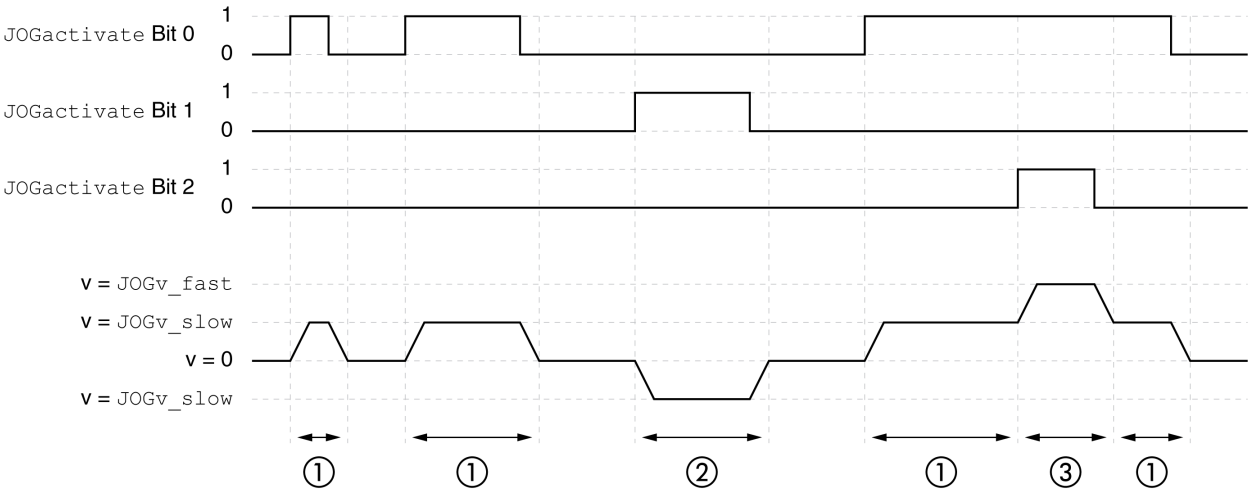


1 Slow movement in positive direction

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

The illustration below provides an example of continuous movement via the fieldbus in fieldbus control mode:



1 Slow movement in positive direction

2 Slow movement in negative direction

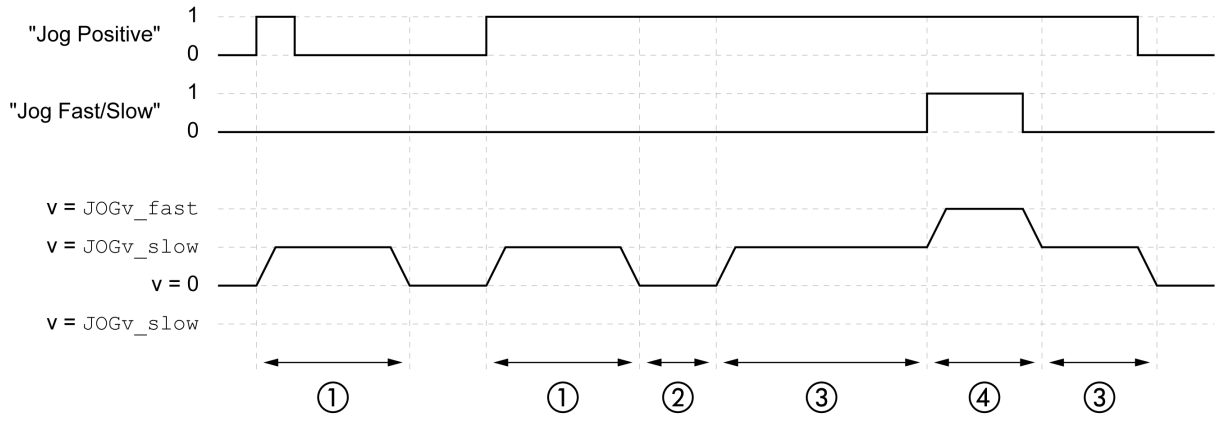
3 Fast movement in positive direction

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 example of step movement via the signal inputs in local control mode:



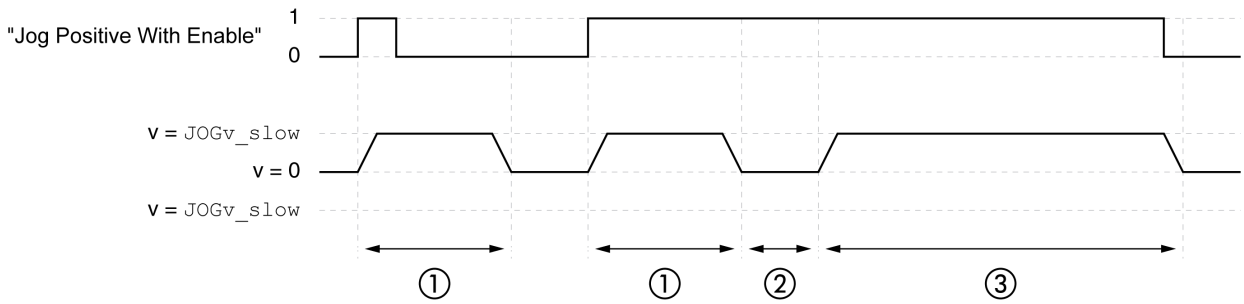
1 Slow movement in positive direction with a parameterizable number of user-defined units *JOGstep*

2 Waiting time *JOGtime*

3 Slow continuous movement in positive direction

4 Fast continuous movement in positive direction

The illustration below provides an example of step movement via the signal inputs in fieldbus control mode:



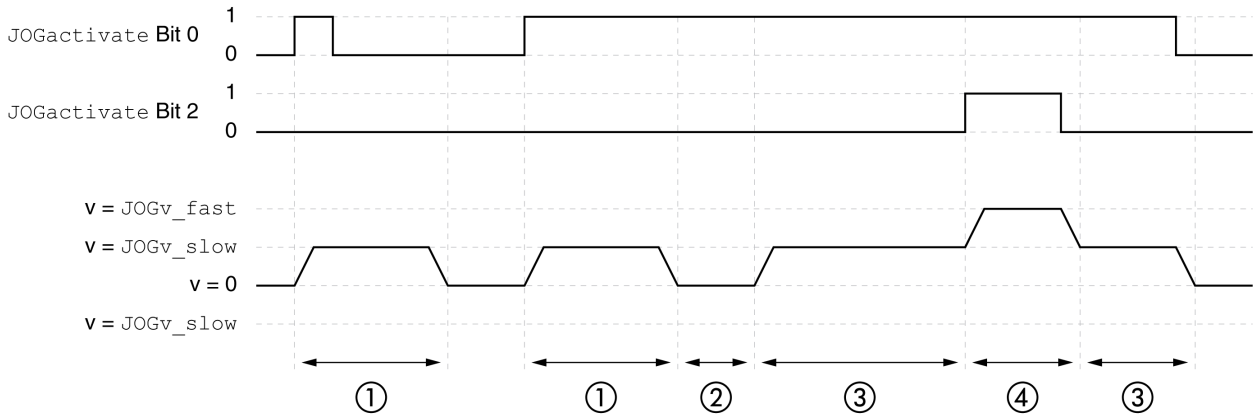
1 Slow movement in positive direction with a parameterizable number of user-defined units *JOGstep*

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

The illustration below provides an example 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 Starting and Changing an Operating Mode, page 221.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 301B:9$_h$

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

Terminating the Operating Mode

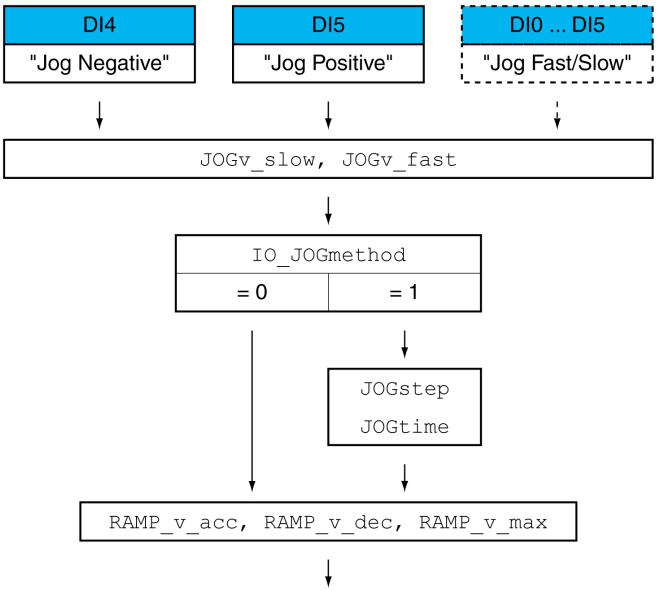
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- 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

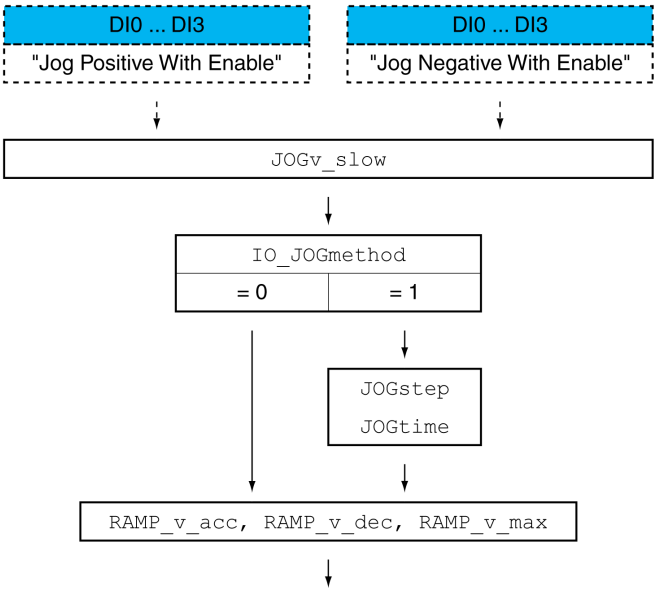
Parameterization

Overview

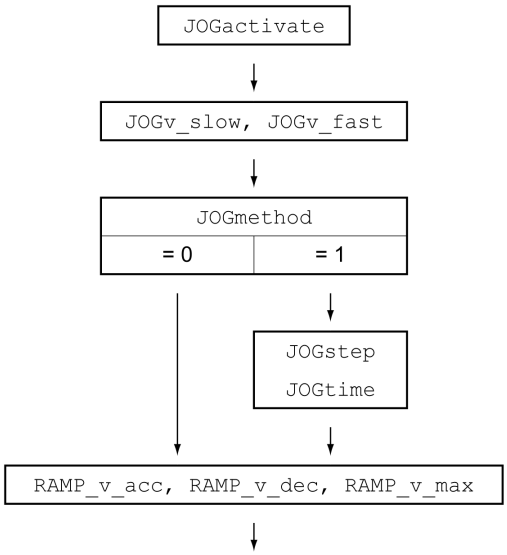
The illustration below provides an overview of the parameters that can be adjusted in local control mode.



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 3029:4h Modbus 10504 EtherCAT 3029:4h
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 3029:5h Modbus 10506 EtherCAT 3029:5h

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

Selection of the Method

The parameter *IO_JOGmethod* is used to set the method for movements via the signal inputs.

The parameter *JOGmethod* is used to set the method for movements via the fieldbus.

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 EtherCAT 3005:18$_h$
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 EtherCAT 3029:3$_h$

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.

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 EtherCAT 3029:7$_h$
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 EtherCAT 3029:8$_h$

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity, page 281.

Additional Settings

Overview

The following functions can be used for target value processing:

- Jerk Limitation, page 282
- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287

- Limitation of the Current via Signal Inputs, page 288
- Setting a Signal Output via Parameter, page 289
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294
- Relative Movement After Capture (RMAC), page 297

The following functions can be used for monitoring the movement:

- Limit Switches, page 304
- Software Limit Switches, page 306
- Load-Dependent Position Deviation (Following Error), page 308
- Motor Standstill and Direction of Movement, page 312
- Standstill Window, page 314
  This function is only available for a step movement.
- Position Register, page 316
- Position Deviation Window, page 322
- Velocity Deviation Window, page 324
- Velocity Threshold Value, page 326
- Current Threshold Value, page 327

Operating Mode Profile Torque

Overview

Availability

See Control Mode, page 167.

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. 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 EtherCAT 6071:0$_h$

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

Terminating the Operating Mode

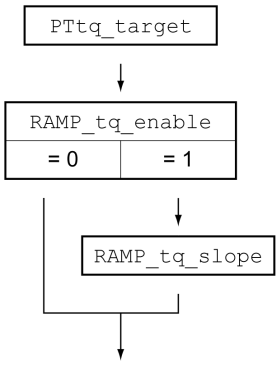
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- 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*.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PTtq_target	Target 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 EtherCAT 6071:0$_h$

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 EtherCAT 3006:2C$_h$
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 EtherCAT 6087:0$_h$

Additional Settings

Overview

The following functions can be used for target value processing:

- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287
- Limitation of the Current via Signal Inputs, page 288
- Setting a Signal Output via Parameter, page 289
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294
- Relative Movement After Capture (RMAC), page 297

The following functions can be used for monitoring the movement:

- Limit Switches, page 304
- Software Limit Switches, page 306
- Motor Standstill and Direction of Movement, page 312
- Torque Window, page 312
- Position Register, page 316
- Velocity Threshold Value, page 326
- Current Threshold Value, page 327

Operating Mode Profile Velocity

Overview

Availability

See Control Mode, page 167.

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. 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 EtherCAT 60FF:0_h

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

Terminating the Operating Mode

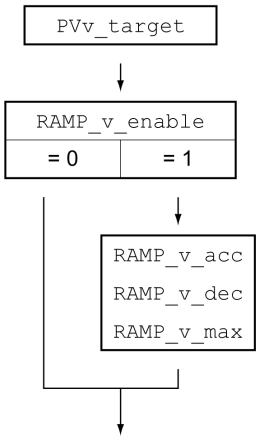
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- 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.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PVv_target	Target 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 EtherCAT 60FF:0$_h$

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity, page 281.

Additional Settings

Overview

The following functions can be used for target value processing:

- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287

- Limitation of the Current via Signal Inputs, page 288
- Zero Clamp, page 289
- Setting a Signal Output via Parameter, page 289
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294
- Relative Movement After Capture (RMAC), page 297

The following functions can be used for monitoring the movement:

- Limit Switches, page 304
- Software Limit Switches, page 306
- Motor Standstill and Direction of Movement, page 312
- Velocity Window, page 313
- Position Register, page 316
- Velocity Deviation Window, page 324
- Velocity Threshold Value, page 326
- Current Threshold Value, page 327

Operating Mode Profile Position

Overview

Availability

See Control Mode, page 167.

Description

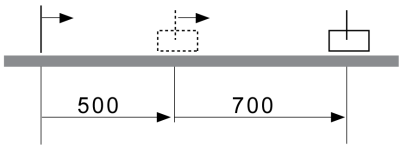
In the operating mode Profile Position, a movement to a desired target position is performed.

A movement can be made using one of 2 methods:

- Relative movement
- Absolute movement

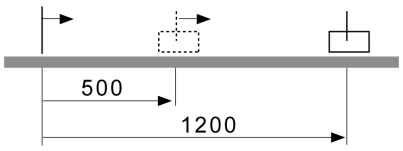
Relative Movement

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

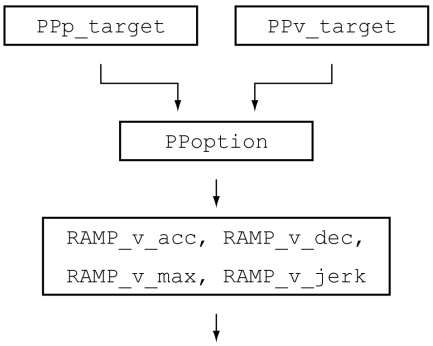
- Target position reached
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

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 set the target position.

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 EtherCAT 607A:0$_h$

Target Velocity

The parameter *PPv_target* allows you to set the target velocity.

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 EtherCAT 6081:0$_h$

Selection of the Method

The parameter *PPoption* allows you to set the method for a relative movement.

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 EtherCAT 60F2:0$_h$

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity, page 281.

Additional Settings

Overview

The following functions can be used for target value processing:

- Jerk Limitation, page 282
- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287
- Limitation of the Current via Signal Inputs, page 288
- Setting a Signal Output via Parameter, page 289
- Starting a Movement via a Signal Input, page 290
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294
- Relative Movement After Capture (RMAC), page 297

The following functions can be used for monitoring the movement:

- Limit Switches, page 304
- Software Limit Switches, page 306
- Load-Dependent Position Deviation (Following Error), page 308
- Motor Standstill and Direction of Movement, page 312
- Standstill Window, page 314
- Position Register, page 316
- Position Deviation Window, page 322
- Velocity Deviation Window, page 324
- Velocity Threshold Value, page 326

- Current Threshold Value, page 327

Operating Mode Homing

Overview

Availability

See Control Mode, page 167.

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 of the movement range is the point of reference for absolute movements in the operating modes Profile Position and Motion Sequence.

Methods

Different methods are available:

- 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 movement is stopped and then 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 movement is stopped and then a movement is made 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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

Terminating the Operating Mode

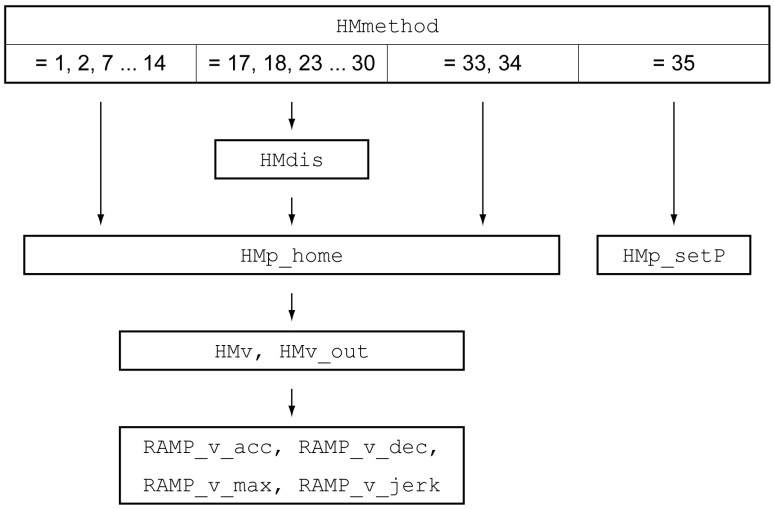
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- 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.



Setting Limit Switches and Reference Switches

The limit switches and reference switches must be set to meet the requirements, see Limit Switches, page 304 and Reference Switch, page 305.

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 nonvolatile memory (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 negative direction 34: Index pulse positive direction 35: Position setting Abbreviations: REF+: Search movement in positive direction REF-: Search movement in negative 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 EtherCAT 6098:0_h
HMprefmethod	Preferred homing method. Modified settings become active immediately.	- 1 18 35	INT16 R/W per. -	CANopen 3028:A_h Modbus 10260 EtherCAT 3028:A_h

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 EtherCAT 3028:7_h

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 EtherCAT 3028:B_h

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 EtherCAT 3028:6_h
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 EtherCAT 3028:D_h

Reading out the Position Distance

The position distance between the switching point and index pulse can be read out with the following parameter.

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 Setting Parameters for Encoder, page 141.

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 EtherCAT 3028:F_h

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 EtherCAT 6099:1$_h$
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 EtherCAT 6099:2$_h$

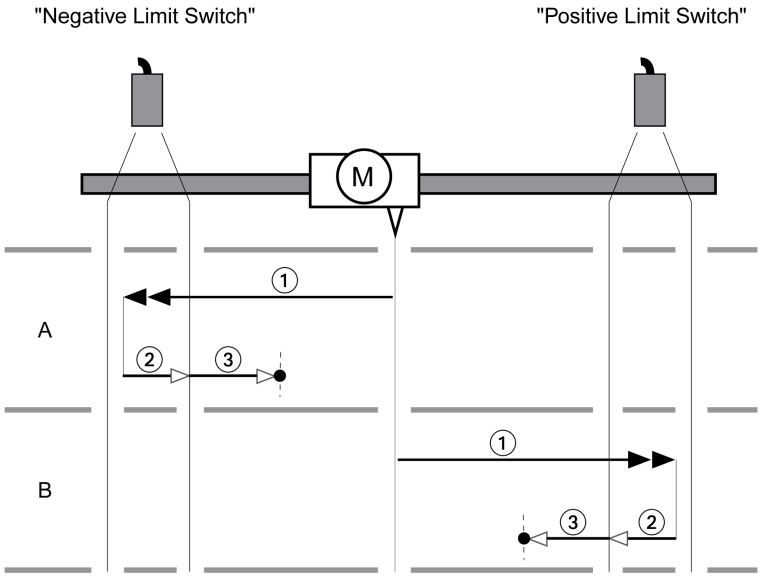
Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity, page 281.

Reference Movement to a Limit Switch

Overview

The illustration below shows a 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

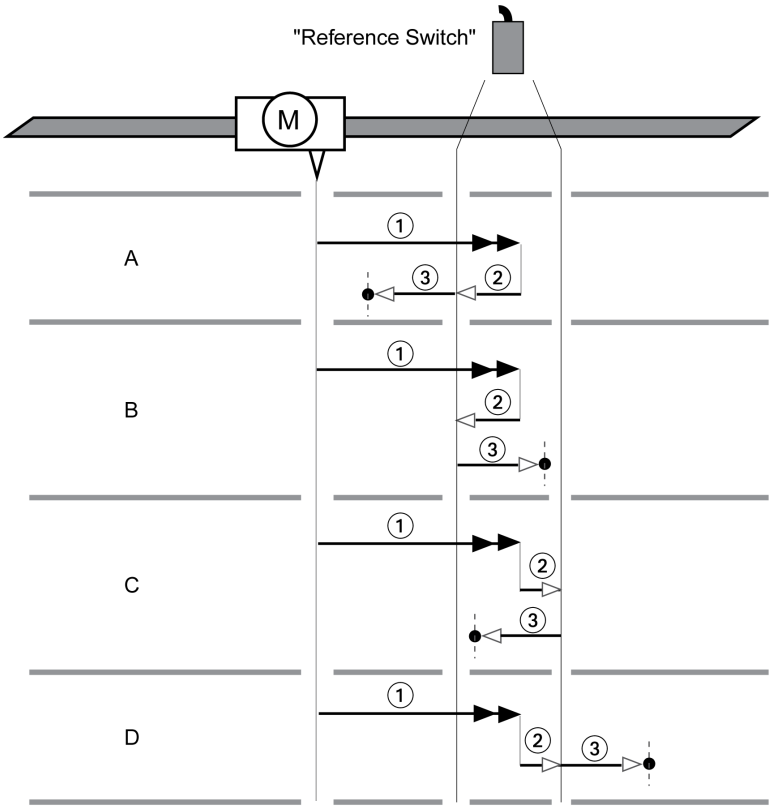
Method 2: Movement to the index pulse.

Method 18: Movement to distance from switching point.

Reference Movement to the Reference Switch in Positive Direction

Overview

The illustration below shows a 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

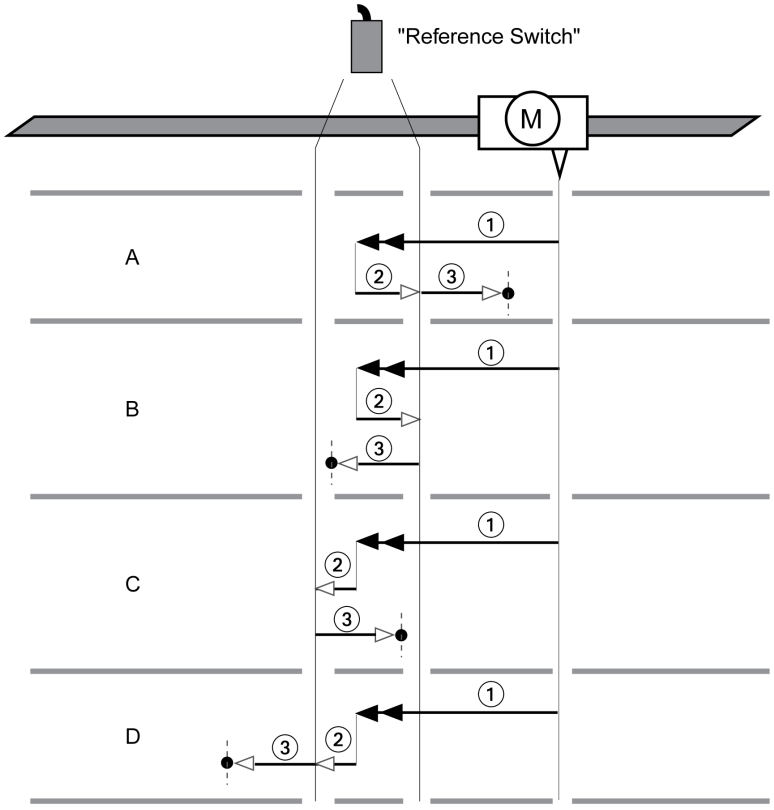
Method 10: Movement to the index pulse.

Method 26: Movement to distance from switching point.

Reference Movement to the Reference Switch in Negative Direction

Overview

The illustration below shows a 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

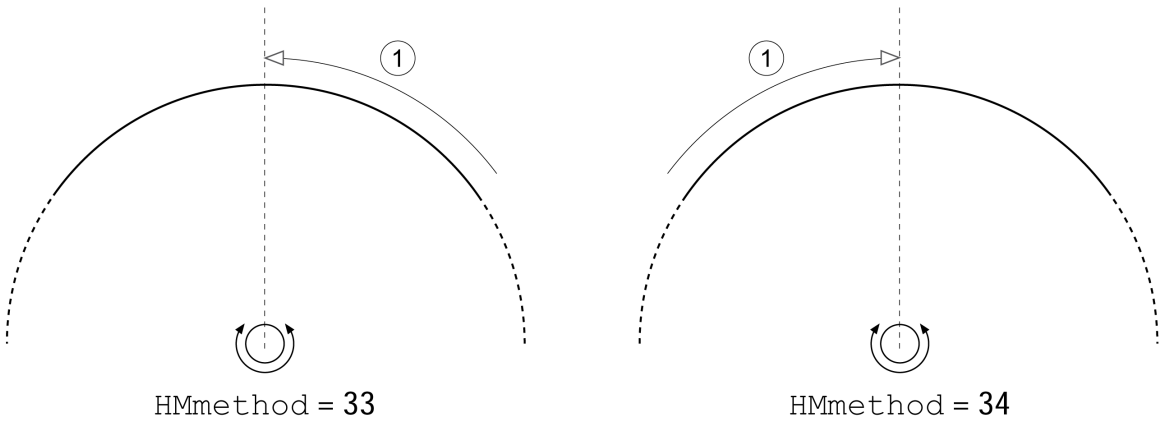
Method 14: Movement to the index pulse.

Method 30: Movement to distance from switching point.

Reference Movement to the Index Pulse

Overview

The illustration below shows a 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.

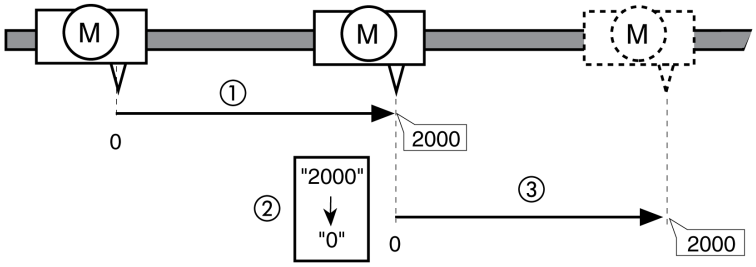
Position setting is only possible when the motor is at a standstill. Any active position deviation remains active and can still be compensated for by the position controller after position setting.

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 EtherCAT 301B:16$_h$

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

Overview

The following functions can be used for target value processing:

- Jerk Limitation, page 282
- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287
- Limitation of the Current via Signal Inputs, page 288
- Setting a Signal Output via Parameter, page 289
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294

The following functions can be used for monitoring the movement:

- Limit Switches, page 304
- Reference Switch, page 305
- Software Limit Switches, page 306
- Load-Dependent Position Deviation (Following Error), page 308
- Motor Standstill and Direction of Movement, page 312

- Standstill Window, page 314
- Position Register, page 316
- Position Deviation Window, page 322
- Velocity Deviation Window, page 324
- Velocity Threshold Value, page 326
- Current Threshold Value, page 327

Operating Mode Motion Sequence

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 Control Mode, page 167 for information on setting the control mode.

Starting the Operating Mode

In local control mode, the operating mode must first have been selected, see Starting and Changing an Operating Mode, page 221. 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 Limit Switches, page 304
DI1	"Negative Limit Switch (LIMN)" See Limit Switches, page 304
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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 301B:A_h

Control Word

Parameter *DCOMcontrol*	Meaning
Bit 4	0 -> 1: Start data set
Bit 5	0: Start individual data set 1: Start sequence

Parameter *DCOMcontrol*	Meaning
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 section Changing the Operating State via Fieldbus, page 219.

Status Word

Parameter *DCOMstatus*	Meaning
Bit 10	1: End of a sequence
Bit 12	Reserved

For the common bits of the Status Word see section Indication of the Operating State via Fieldbus, page 215.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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

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*.

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 EtherCAT 302D:8_h

End of a Sequence

You can parameterize whether the set data set is to be confirmed at the end of a sequence.

The confirmation can be set with the parameter *MSMendNumSequence*.

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 EtherCAT 302D:9_h

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.

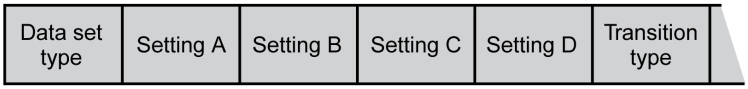
The parameter *MSMstartSignal* lets you set the behavior of the start signal.

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 EtherCAT 302D:C_h

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
"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

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 section Motion Profile for the Velocity, page 281.

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

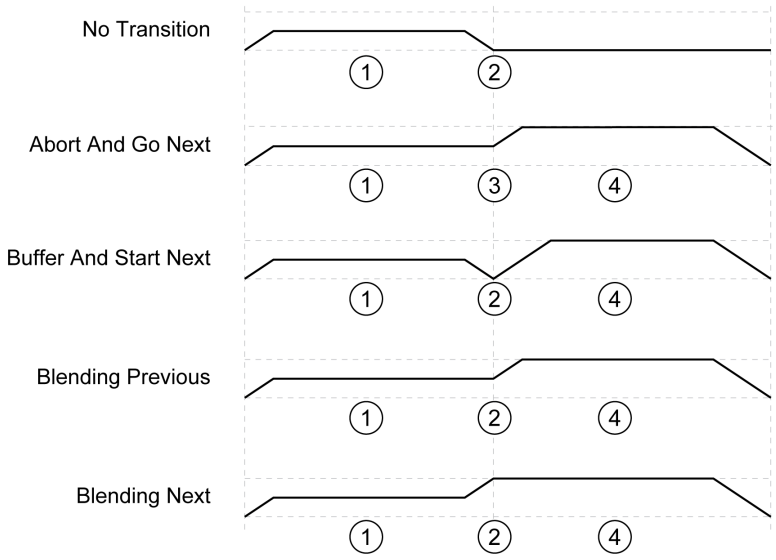
  Upon successful completion of the movement and if the transition condition is met, the subsequent data set is started.

  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
  - Value 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
  - Value 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 Verification

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. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:D_h Modbus 11546 EtherCAT 302D:D_h
_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 Available with firmware version ≥V01.08.	- -1 -1 11	INT16 R/- - -	CANopen 302D:E_h Modbus 11548 EtherCAT 302D:E_h

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. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:B_h Modbus 11542 EtherCAT 302D:B_h

Additional Settings

Overview

The following functions can be used for target value processing:

- Jerk Limitation, page 282

  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Stopping Movement with Halt, page 283
- Stopping Movement with Quick Stop, page 285
- Limitation of the Velocity via Signal Inputs, page 287
- Limitation of the Current via Signal Inputs, page 288
- Zero Clamp, page 289

  This function is only available for data set type Move Velocity.
- Setting a Signal Output via Parameter, page 289
- Position Capture via Signal Input (Vendor-Specific Profile), page 290
- Position Capture via Signal Input (DS402 Profile), page 294
- Relative Movement After Capture (RMAC), page 297

  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:

- Limit Switches, page 304
- Reference Switch, page 305

  This function is only available for data set type Reference Movement.
- Software Limit Switches, page 306
- Load-Dependent Position Deviation (Following Error), page 308

  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Motor Standstill and Direction of Movement, page 312
- Standstill Window, page 314

  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Position Register, page 316
- Position Deviation Window, page 322

  This function is only available for the data set types Move Absolute, Move Additive, Move Relative and Reference Movement.
- Velocity Deviation Window, page 324

- Velocity Threshold Value, page 326
- Current Threshold Value, page 327

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. 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 EtherCAT 6071:0$_h$

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

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.

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. 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 EtherCAT 60FF:0_h

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

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.

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 EtherCAT 607A:0_h

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 section Changing the Operating State via Fieldbus, page 219.

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 section Indication of the Operating State via Fieldbus, page 215.

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.

Examples of a Movement via DS402 Objects

Operating Mode Jog

Adapting the list of the startup parameters

Address (hex)	Parameter name (DS402 name)	Value
3006:3D	*CompParSyncMot*	0
3006:38	*MOD_Enable*	0
3006:18	*LIM_QStopReact*	6
3006:6	*IOsigRespOfPS*	0
3006:7	*ScalePOSdenom*	16384
3006:8	*ScalePOSnum*	1
3012:6	*CTRL1_KFPp*	1000
3013:6	*CTRL2_KFPp*	1000
6060:0	*DCOMopmode* (Mode of operation)	-1
1C33:3	*ECATinpshifttime*	250000

Adapting the mapping for RxPDO

Address (hex)	Parameter name (DS402 name)
6040:0	*DCOMcontrol* (Control word)
301B:9	*JOGactivate*
6060:0	*DCOMopmode* (Mode of operation)

Adapting the mapping for TxPDO

Address (hex)	Parameter name (DS402 name)
6041:0	*_DCOMstatus* (Status word)
6060:0	*_DCOMopmd_act* (Mode of operation display)

Example

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
SDO: Set the velocity for slow movement (for example, 100 RPM)	3029:4	*JOGv_slow*	64
SDO: Set the velocity for fast movement (for example, 300 RPM)	3029:5	*JOGv_fast*	012C
RxPDO: Enable power stage	6040:0	*DCOMcontrol* (Control word)	00
	6040:0	*DCOMcontrol* (Control word)	06
	6040:0	*DCOMcontrol* (Control word)	0F
TxPDO: Verify whether power stage has been enabled	6041:0	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	6060:0	*DCOMopmode* (Mode of operation)	FF
TxPDO: Verify whether operating mode has been set	6061:0	*_DCOMopmd_act* (Mode of operation display)	FF
RxPDO: Start movement (for example, slow movement in positive direction)	301B:9	*JOGactivate*	01
TxPDO: Get the state via status parameters	6041:0	*_DCOMstatus* (Status word)	0237

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
RxPDO: Terminate movement	301B:9	*JOGactivate*	00
TxPDO: Get the state via status parameters (wait for end of movement)	6041:0	*_DCOMstatus* (Status word)	4237

Operating Mode Profile Torque

Adapting the list of the startup parameters

Address (hex)	Parameter name (DS402 name)	Value
3006:3D	*CompParSyncMot*	0
3006:38	*MOD_Enable*	0
3006:18	*LIM_QStopReact*	6
3006:6	*IOsigRespOfPS*	0
3006:7	*ScalePOSdenom*	16384
3006:8	*ScalePOSnum*	1
3012:6	*CTRL1_KFPp*	1000
3013:6	*CTRL2_KFPp*	1000
6060:0	*DCOMopmode* (Mode of operation)	4
1C33:3	*ECATinpshifttime*	250000

Adapting the mapping for RxPDO

Address (hex)	Parameter name (DS402 name)
6040:0	*DCOMcontrol* (Control word)
6071:0	*PTtq_target* (Target torque)
6060:0	*DCOMopmode* (Mode of operation)

Adapting the mapping for TxPDO

Address (hex)	Parameter name (DS402 name)
6041:0	*_DCOMstatus* (Status word)
6060:0	*_DCOMopmd_act* (Mode of operation display)

Example

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
SDO: Slope setting of the motion profile for torque (example 10.0 %/s)	3029:4	*RAMP_tq_slope* (Torque slope)	64
RxPDO: Enable power stage	6040:0	*DCOMcontrol* (Control word)	00
	6040:0	*DCOMcontrol* (Control word)	06
	6040:0	*DCOMcontrol* (Control word)	0F
TxPDO: Verify whether power stage has been enabled	6041:0	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	6060:0	*DCOMopmode* (Mode of operation)	04
TxPDO: Verify whether operating mode has been set	6061:0	*_DCOMopmd_act* (Mode of operation display)	04
RxPDO: Start movement by transmitting a target torque (example 1.0 %)	60FF:0	*PTtq_target* (Target torque)	0A

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
TxPDO: Verify whether target torque has been reached	6041:0	*_DCOMstatus* (Status word)	0637
RxPDO: Terminate movement (with Quick Stop)	6040:0	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	6040:0	*DCOMcontrol* (Control word)	0F

Operating Mode Profile Velocity

Adapting the list of the startup parameters

Address (hex)	Parameter name (DS402 name)	Value
3006:3D	*CompParSyncMot*	0
3006:38	*MOD_Enable*	0
3006:18	*LIM_QStopReact*	6
3006:6	*IOsigRespOfPS*	0
3006:7	*ScalePOSdenom*	16384
3006:8	*ScalePOSnum*	1
3012:6	*CTRL1_KFPp*	1000
3013:6	*CTRL2_KFPp*	1000
6060:0	*DCOMopmode* (Mode of operation)	3
1C33:3	*ECATinpshifttime*	250000

Adapting the mapping for RxPDO

Address (hex)	Parameter name (DS402 name)
6040:0	*DCOMcontrol* (Control word)
60FF:0	*PVv_target* (Target velocity)
6083:0	*RAMP_v_acc* (Profile acceleration)
6084:0	*RAMP_v_dec* (Profile deceleration)
6060:0	*DCOMopmode* (Mode of operation)

Adapting the mapping for TxPDO

Address (hex)	Parameter name (DS402 name)
6041:0	*_DCOMstatus* (Status word)
6060:0	*_DCOMopmd_act* (Mode of operation display)

Example

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
RxPDO: Set acceleration (for example, 100 RPM/s)	6083:0	*RAMP_v_acc* (Profile acceleration)	64
RxPDO: Set deceleration (for example, 300 RPM/s)	6084:0	*RAMP_v_dec* (Profile deceleration)	012C
RxPDO: Enable power stage	6040:0	*DCOMcontrol* (Control word)	00
	6040:0	*DCOMcontrol* (Control word)	06
	6040:0	*DCOMcontrol* (Control word)	0F

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
TxPDO: Verify whether power stage has been enabled	6041:0	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	6060:0	*DCOMopmode* (Mode of operation)	03
TxPDO: Verify whether operating mode has been set	6061:0	*_DCOMopmd_act* (Mode of operation display)	03
RxPDO: Start movement by setting a target velocity (for example, 600 RPM)	60FF:0	*PVv_target* (Target velocity)	0258
TxPDO: Verify whether target velocity has been reached	6041:0	*_DCOMstatus* (Status word)	0637
RxPDO: Terminate movement (with Quick Stop)	6040:0	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	6040:0	*DCOMcontrol* (Control word)	0F

Operating Mode Profile Position

Adapting the list of the startup parameters

Address (hex)	Parameter name (DS402 name)	Value
3006:3D	*CompParSyncMot*	0
3006:38	*MOD_Enable*	0
3006:18	*LIM_QStopReact*	6
3006:6	*IOsigRespOfPS*	0
3006:7	*ScalePOSdenom*	16384
3006:8	*ScalePOSnum*	1
3012:6	*CTRL1_KFPp*	1000
3013:6	*CTRL2_KFPp*	1000
6060:0	*DCOMopmode* (Mode of operation)	1
1C33:3	*ECATinpshifttime*	250000

Adapting the mapping for RxPDO

Address (hex)	Parameter name (DS402 name)
6040:0	*DCOMcontrol* (Control word)
607A:0	*PPp_target* (Target position)
6081:0	*PPv_target* (Profile velocity)
6083:0	*RAMP_v_acc* (Profile acceleration)
6084:0	*RAMP_v_dec* (Profile deceleration)
6060:0	*DCOMopmode* (Mode of operation)

Adapting the mapping for TxPDO

Address (hex)	Parameter name (DS402 name)
6041:0	*_DCOMstatus* (Status word)
6060:0	*_DCOMopmd_act* (Mode of operation display)

Example

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
RxPDO: Set acceleration (for example, 100 RPM/s)	6083:0	*RAMP_v_acc* (Profile acceleration)	64
RxPDO: Set deceleration (for example, 300 RPM/s)	6084:0	*RAMP_v_dec* (Profile deceleration)	012C
RxPDO: Set target velocity (for example, 60 RPM)	6081:0	*PPv_target* (Profile velocity)	3C
RxPDO: Enable power stage	6040:0	*DCOMcontrol* (Control word)	00
	6040:0	*DCOMcontrol* (Control word)	06
	6040:0	*DCOMcontrol* (Control word)	0F
TxPDO: Verify whether power stage has been enabled	6041:0	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	6060:0	*DCOMopmode* (Mode of operation)	01
TxPDO: Verify whether operating mode has been set	6061:0	*_DCOMopmd_act* (Mode of operation display)	01
RxPDO: Set target position (for example, 10000_usr)	607A:0	*PPp_target* (Target position)	2710
RxPDO: Start relative movement	6040:0	*DCOMcontrol* (Control word)	5F
TxPDO: Verify whether target position has been reached	6041:0	*_DCOMstatus* (Status word)	5637
RxPDO: Reset bit "New setpoint"	6040:0	*DCOMcontrol* (Control word)	4F
TxPDO: Verify whether new target position has been accepted	6041:0	*_DCOMstatus* (Status word)	4637

Operating Mode Homing

Adapting the list of the startup parameters

Address (hex)	Parameter name (DS402 name)	Value
3006:3D	*CompParSyncMot*	0
3006:38	*MOD_Enable*	0
3006:18	*LIM_QStopReact*	6
3006:6	*IOsigRespOfPS*	0
3006:7	*ScalePOSdenom*	16384
3006:8	*ScalePOSnum*	1
3012:6	*CTRL1_KFPp*	1000
3013:6	*CTRL2_KFPp*	1000
6060:0	*DCOMopmode* (Mode of operation)	6
1C33:3	*ECATinpshifttime*	250000

Adapting the mapping for RxPDO

Address (hex)	Parameter name (DS402 name)
6040:0	*DCOMcontrol* (Control word)
6060:0	*DCOMopmode* (Mode of operation)

Adapting the mapping for TxPDO

Address (hex)	Parameter name (DS402 name)
6041:0	*_DCOMstatus* (Status word)
6060:0	*_DCOMopmd_act* (Mode of operation display)

Example

Meaning	Address (hex)	Parameter name (DS402 name)	Value (hex)
SDO: Set homing method (for example 17)	6098:0	*HMmethod* (Homing method)	11
SDO: Set target velocity for searching the switch (for example, 100 RPM)	6099:1	*HMv* (Homing speed during search for switch)	64
SDO: Target velocity for moving away from switch (for example 6 RPM)	6099:2	*HMv_out* (Speed during search for zero)	6
RxPDO: Enable power stage	6040:0	*DCOMcontrol* (Control word)	00
	6040:0	*DCOMcontrol* (Control word)	06
	6040:0	*DCOMcontrol* (Control word)	0F
TxPDO: Verify whether power stage has been enabled	6041:0	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	6060:0	*DCOMopmode* (Mode of operation)	06
TxPDO: Verify whether operating mode has been set	6061:0	*_DCOMopmd_act* (Mode of operation display)	06
RxPDO: Start Homing	6040:0	*DCOMcontrol* (Control word)	1F
TxPDO: Verify whether Homing has been successful	6041:0	*_DCOMstatus* (Status word)	D637

Functions for Operation

Functions for Target Value Processing

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:

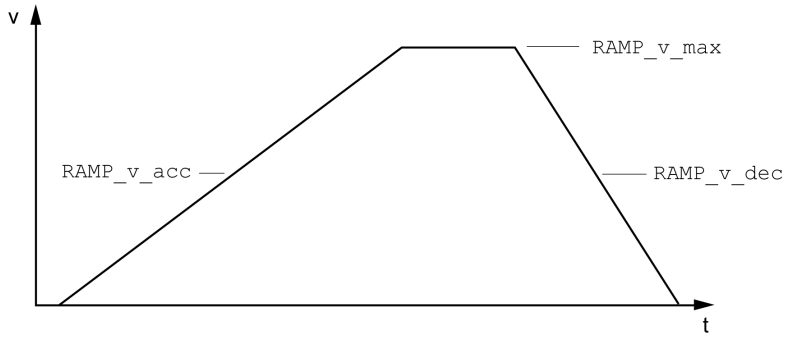
- Profile Velocity
- Motion Sequence (Move Velocity)

In the following operating modes, the motion profile for the velocity is unavailable:

- Profile Torque

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.

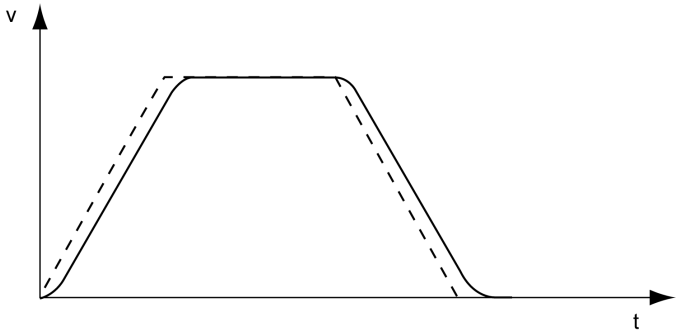


Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_enable	Activation of the motion profile for velocity. **0 / Profile Off**: Profile off **1 / Profile On**: Profile on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 1 1	UINT16 R/W per. -	CANopen 3006:2B$_h$ Modbus 1622 EtherCAT 3006:2B$_h$
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 EtherCAT 607F:0$_h$
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 EtherCAT 6083:0$_h$
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 EtherCAT 6084:0$_h$

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 EtherCAT 3006:D_h

Stopping Movement with Halt

Description

With a Halt, the ongoing movement is interrupted. The movement can be resumed when the Halt is cleared.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

The following deceleration types are available:

- 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 Set the deceleration ramp with parameter RAMP_v_dec. Set the 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 EtherCAT 605D:0_h

Setting the Deceleration Ramp

The deceleration ramp is set with the parameter *Ramp_v_dec* via the Motion Profile for the Velocity, page 281.

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 EtherCAT 3011:E_h

Stopping Movement with Quick Stop

Description

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 EtherCAT 3006:18$_h$

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 EtherCAT 3006:12$_h$

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 EtherCAT 3011:D_h

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 RPM. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:1E_h Modbus 1596 EtherCAT 3006:1E_h

In order to limit the velocity via a digital signal input, you must first parameterize the signal input function “Velocity Limitation”, see Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3008:27$_h$

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 EtherCAT 3006:27$_h$

In order to limit the current via a digital signal input, you must first parameterize the signal input function “Current Limitation”, see Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3008:28$_h$

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 parameterizable 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 EtherCAT 3006:28$_h$

In order to stop the motor via a digital signal input, you must first parameterize the signal input function “Zero Clamp”, see Digital Signal Inputs and Digital Signal Outputs, page 184.

Setting a Signal Output via Parameter

Description

The digital signal outputs can be set as required via the fieldbus.

In order to set the digital signal outputs via the parameter, you must first parameterize the signal output function “Freely Available”, see Digital Signal Inputs and Digital Signal Outputs, page 184.

If one or more of the outputs are not set to "Freely Available", writing to that or those outputs is ignored.

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 'Freely Available'. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/W - -	CANopen 3008:11$_h$ Modbus 2082 EtherCAT 3008:11$_h$

Starting a Movement via a Signal Input

Description

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.

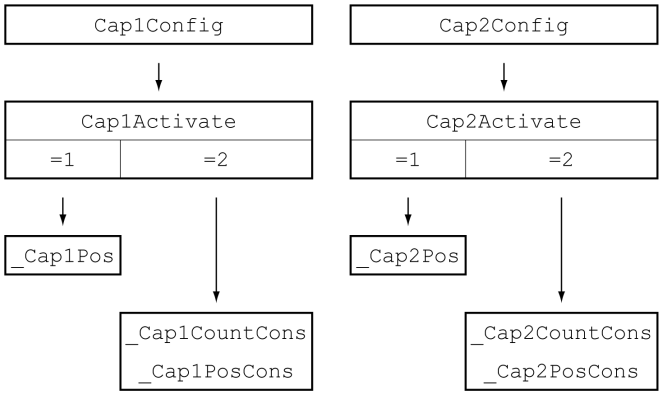
(3000 RPM = (3000*16384)/(60*10^6) = 0.8 usr_p/µs)

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.

Overview of the Parameters

The following graphics provide an overview of the parameters:



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 EtherCAT 300A:2_h
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 EtherCAT 300A:3_h

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 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 EtherCAT 300A:4_h
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 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 EtherCAT 300A:5_h

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 EtherCAT 300A:1_h

Captured Position

The captured positions for one-time capture 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
_Cap1Pos	Capture input 1 captured position (one-time). 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 EtherCAT 300A:6$_h$
_Cap2Pos	Capture input 2 captured position (one-time). 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 EtherCAT 300A:7$_h$

The captured positions for continuous capture 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
_Cap1CountCons	Capture input 1 event counter (continuous). 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 EtherCAT 300A:17$_h$
_Cap1PosCons	Capture input 1 captured position (continuous). 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 EtherCAT 300A:18$_h$
_Cap2CountCons	Capture input 2 event counter (continuous). 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 EtherCAT 300A:19$_h$
_Cap2PosCons	Capture input 2 captured position (continuous). 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 EtherCAT 300A:1A$_h$

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

Two Capture inputs are available under DS402 profile.

- 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)

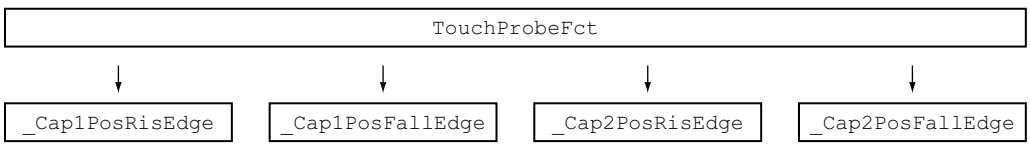
If the factory settings for scaling are used, 1.6 user-defined units correspond to 0.035 °.

The captured motor position is less accurate during the acceleration phase and the deceleration phase.

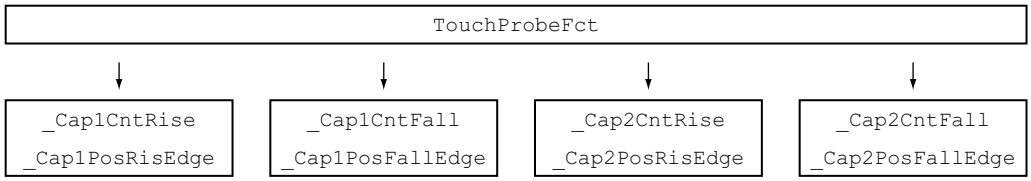
Overview of the Parameters

The following graphics provide an overview of the parameters.

Parameters for one-time capture:



Parameters for continuous capture:



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 (DS402). Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/W - -	CANopen 60B8:0$_h$ Modbus 7028 EtherCAT 60B8:0$_h$

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 (DS402). Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 60B9:0$_h$ Modbus 7030 EtherCAT 60B9:0$_h$

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 (DS402). 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 EtherCAT 60BA:0_h
_Cap1CntRise	Capture input 1 event counter at rising edges (DS402). 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 EtherCAT 300A:$2B_h$
_Cap1PosFallEdge	Capture input 1 captured position at falling edge (DS402). 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 EtherCAT 60BB:0_h
_Cap1CntFall	Capture input 1 event counter at falling edges (DS402). 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 EtherCAT 300A:$2C_h$

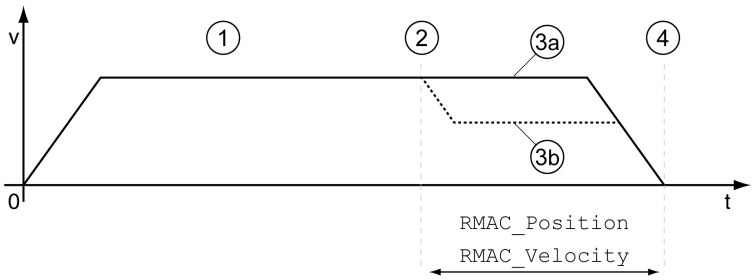
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap2PosRisEdge	Capture input 2 captured position at rising edge (DS402). This parameter contains the position captured at the point in time a rising edge was detected. 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 EtherCAT 60BC:0$_h$
_Cap2CntRise	Capture input 2 event counter at rising edges (DS402). 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 EtherCAT 300A:2D$_h$
_Cap2PosFallEdge	Capture input 2 captured position at falling edge (DS402). 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 EtherCAT 60BD:0$_h$
_Cap2CntFall	Capture input 2 event counter at falling edges (DS402). 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 EtherCAT 300A:2E$_h$
_CapEventCounters	Capture inputs 1 and 2 summary of event counters (DS402). 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 EtherCAT 300A:2F$_h$

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 328.

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 EtherCAT 3023:11$_h$
_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 EtherCAT 3023:12$_h$

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 parameter:

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 EtherCAT 3023:C$_h$

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 EtherCAT 3023:D_h
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 EtherCAT 3023:E_h

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 EtherCAT 3023:10_h

Response to Overtravelling of the Target Position

Depending on the set velocity, target position and deceleration ramp, the target position may be overtraveled.

The response to overtravelling of the target position is set via the following parameter.

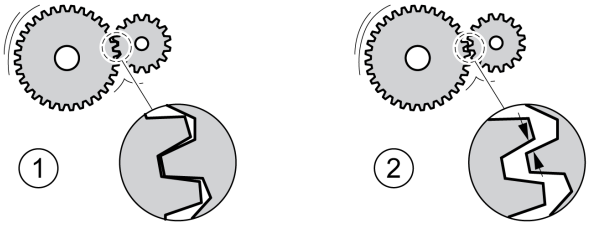
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RMAC_Response	Response if target position is overtraveled. **0 / Error Class 1**: Error class 1 **1 / No Movement To Target Position**: No movement to target position **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 EtherCAT 3023:F_h

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
- 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 EtherCAT 3006:42$_h$

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 EtherCAT 3006:44$_h$

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 EtherCAT 3006:41$_h$

Functions for Monitoring Movements

Limit Switches

Description

The use of limit switches can help protect against some 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 end 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.

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 EtherCAT 3006:10_h
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 EtherCAT 3006:F_h

The signal input functions “Positive Limit Switch (LIMP)” and “Negative Limit Switch (LIMN)” must have been parameterized, see Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 3006:E_h

The signal input function “Reference Switch (REF)” must have been parameterized, see Digital Signal Inputs and Digital Signal Outputs, page 184.

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 Size of the Movement Range, page 168.

Behavior in Operating Modes with Target Positions

In operating modes with target positions, the movement is started even if the target position is beyond the positive position limit or the negative position limit. The movement is stopped so that the motor comes to a standstill at the position limit. After standstill, the drive transitions to the operating state Quick Stop Active.

In the following operating modes, the target position is verified prior to the start of a movement so that the position limit is not exceeded regardless of the target position.

- Jog (step movement)
- Profile Position
- Motion Sequence (Move Absolute, Move Additive and Move Relative)

Behavior in Operating Modes Without Target Positions

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 approaching 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 EtherCAT 3006:47$_h$

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 Stopping Movement with Quick Stop, page 285. 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 EtherCAT 3006:3$_h$

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 EtherCAT 607D:2_h
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 EtherCAT 607D:1_h

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 inertia.

Parameters are available to read the load-dependent position deviation during operation and the maximum position deviation reached since the last power cycle.

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.

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 EtherCAT 301E:16$_h$

The following parameters let you read the maximum value of the load-dependent position deviation reached since the last power cycle.

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 EtherCAT 301E:15$_h$

Setting the Maximum Values for 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	Advisory limit of the 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 EtherCAT 3006:29$_h$

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 EtherCAT 3006:3E$_h$

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 EtherCAT 3005:B$_h$

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.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_v_dif_usr	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 EtherCAT 301E:2C$_h$

Setting the Maximum Values for 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 EtherCAT 3006:4B$_h$
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 EtherCAT 3006:4C$_h$

Setting the Error Class

The following parameter lets you set the error class for an excessively high load-dependent velocity deviation.

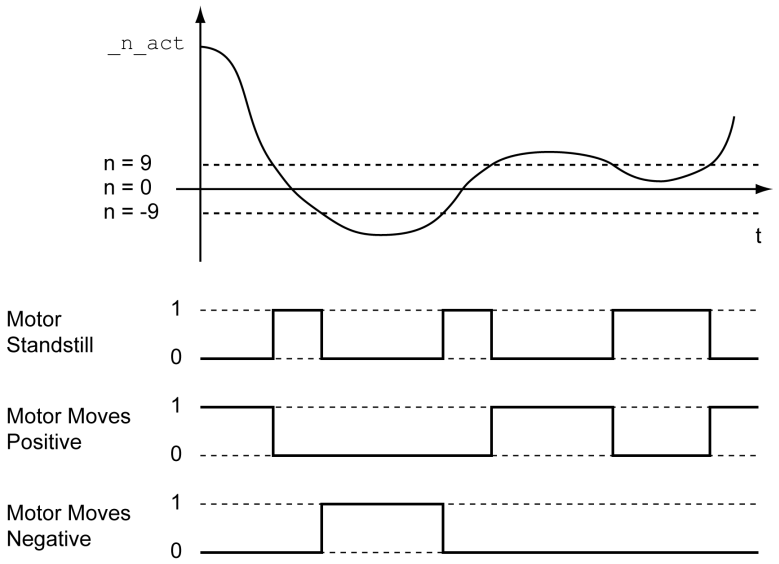
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ErrorResp_v_dif	Error response to excessively high load-dependent velocity deviation. **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / 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 EtherCAT 3005:3C$_h$

Motor Standstill and Direction of Movement

Description

The status of a movement can be monitored. You can determine whether the motor is at a standstill or whether it moves in a specific direction.

A velocity of <9 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 Digital Signal Inputs and Digital Signal Outputs, page 184.

Torque Window

Description

The torque window allows you to monitor whether the motor has reached the target torque.

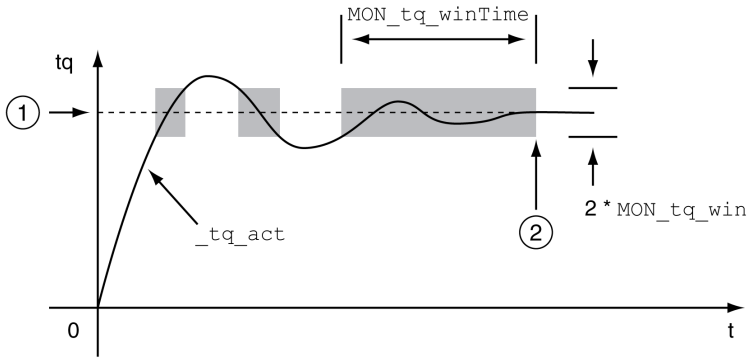
If the difference between the target torque and the actual torque remains in the torque window for the time *MON_tq_winTime*, the target torque is considered to have been reached.

Availability

The torque window is available in the following operating modes.

- Profile Torque

Settings



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 EtherCAT 3006:2D$_h$
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 EtherCAT 3006:2E$_h$

Velocity Window

Description

The velocity window allows you to monitor whether the motor has reached the target velocity.

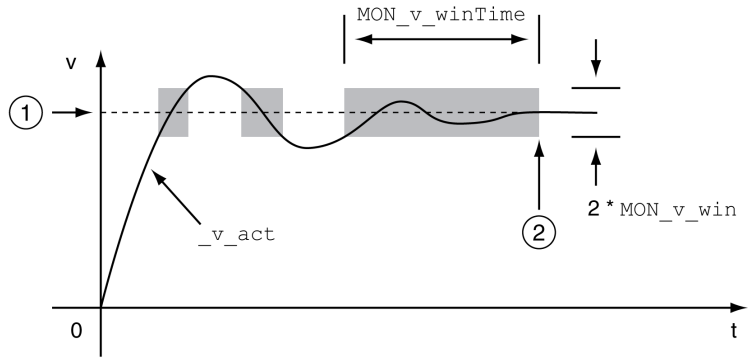
If the difference between the target velocity and the actual velocity remains in the velocity window for the time *MON_v_winTime*, the target velocity is considered to have been reached.

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 EtherCAT 606D:0$_h$
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 EtherCAT 606E:0$_h$

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.

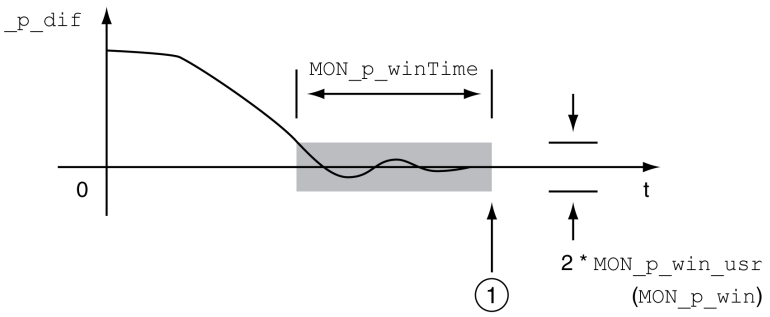
Availability

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 EtherCAT 3006:40$_h$
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 EtherCAT 6067:0$_h$

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 EtherCAT 6068:0$_h$
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 EtherCAT 3006:26$_h$

Position Register

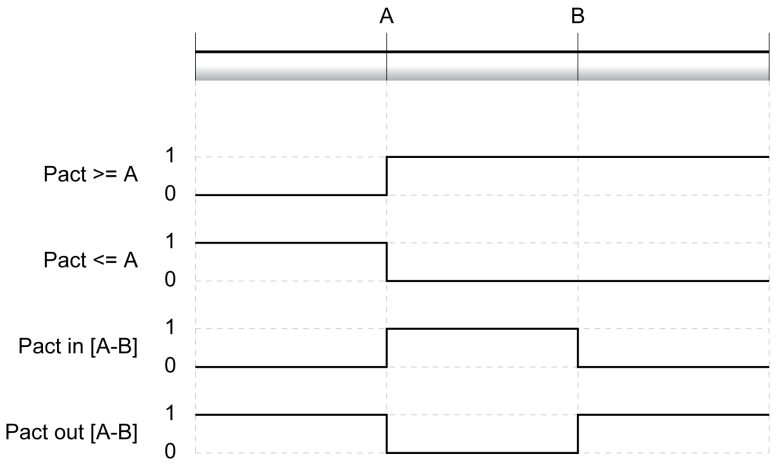
Description

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 EtherCAT 300B:1_h

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 EtherCAT 300B:2_h
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 EtherCAT 300B:3_h
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 EtherCAT 300B:C_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 300B:D_h
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 EtherCAT 300B:16_h

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 EtherCAT 300B:4_h
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 EtherCAT 300B:5_h

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 EtherCAT 300B:E_h
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 EtherCAT 300B:F_h

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 EtherCAT 300B:8_h
PosReg1ValueB	Comparison value B for position register channel 1.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:9_h Modbus 2834 EtherCAT 300B:9_h
PosReg2ValueA	Comparison value A for position register channel 2.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:A_h Modbus 2836 EtherCAT 300B:A_h
PosReg2ValueB	Comparison value B for position register channel 2.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:B_h Modbus 2838 EtherCAT 300B:B_h
PosReg3ValueA	Comparison value A for position register channel 3.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:12_h Modbus 2852 EtherCAT 300B:12_h
PosReg3ValueB	Comparison value B for position register channel 3.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:13_h Modbus 2854 EtherCAT 300B:13_h
PosReg4ValueA	Comparison value A for position register channel 4.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:14_h Modbus 2856 EtherCAT 300B:14_h
PosReg4ValueB	Comparison value B for position register channel 4.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:15_h Modbus 2858 EtherCAT 300B:15_h

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.

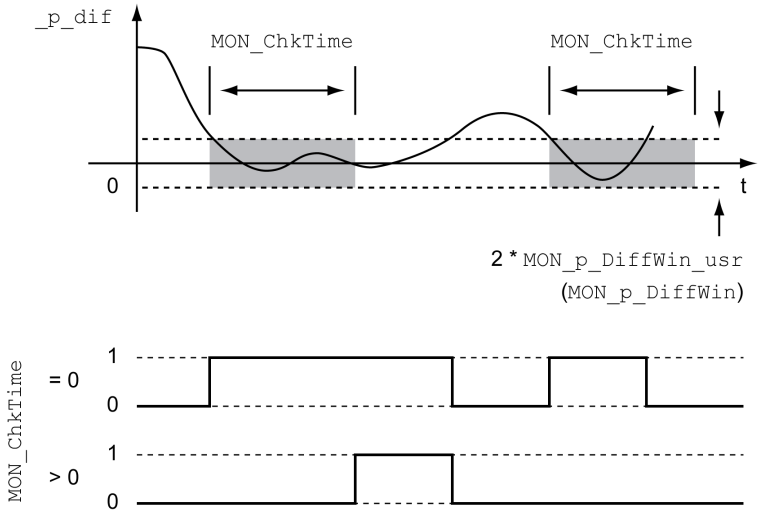
The position deviation window comprises position deviation and monitoring time.

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* 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 Digital Signal Inputs and Digital Signal Outputs, page 184.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 328.

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 verifies 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 EtherCAT 3006:3F$_h$
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 EtherCAT 3006:1D$_h$

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.

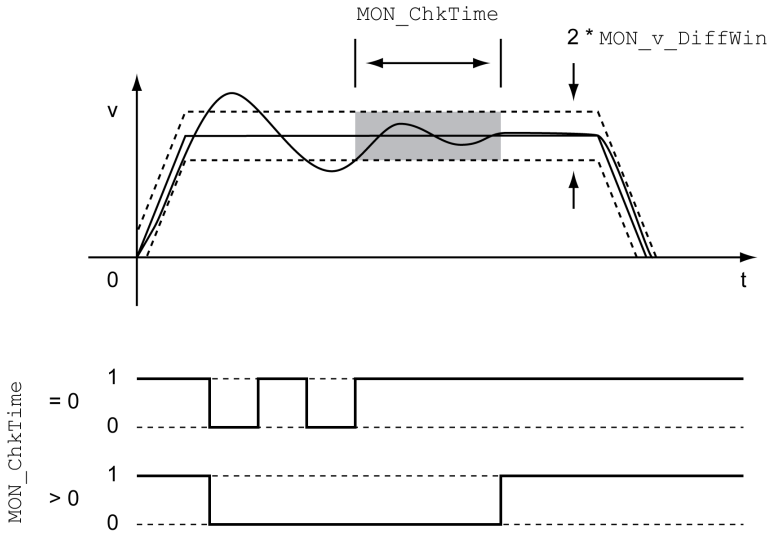
The velocity deviation window comprises velocity deviation and monitoring time.

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 328.

The parameter *MON_ChkTime* acts on the parameters *MON_p_DiffWin_usr*, *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 EtherCAT 3006:1A$_h$
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 EtherCAT 3006:1D$_h$

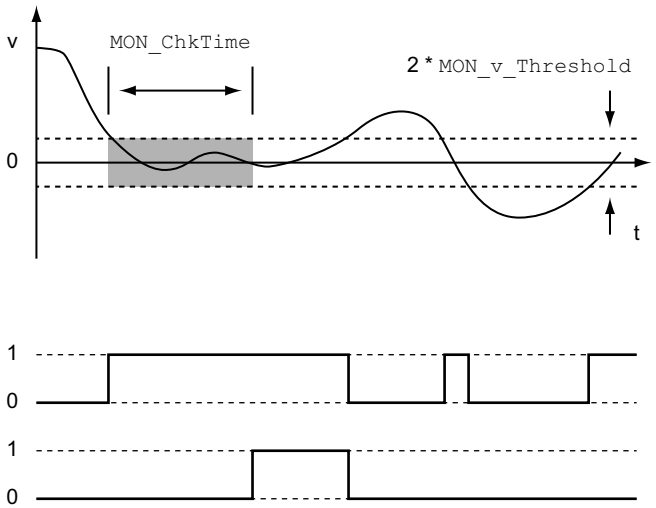
Velocity Threshold Value

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 328.

The parameter *MON_ChkTime* acts on the parameters *MON_p_DiffWin_usr*, *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 EtherCAT 3006:1B$_h$
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 EtherCAT 3006:1D$_h$

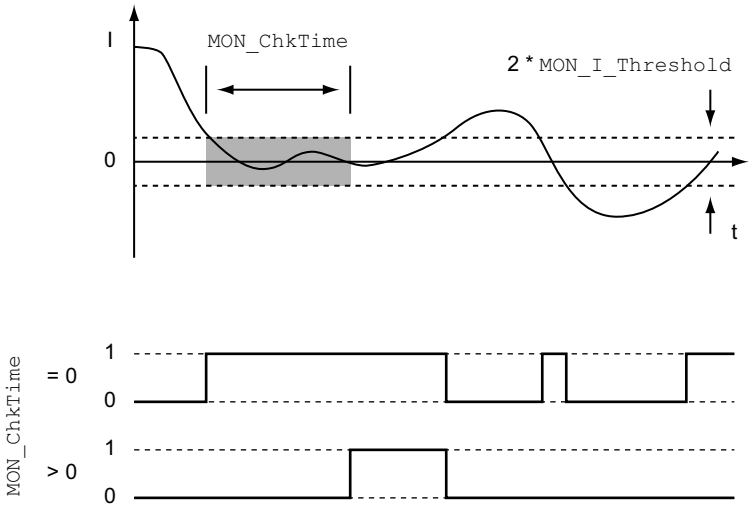
Current Threshold Value

Description

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 328.

The parameter *MON_ChkTime* acts on the parameters *MON_p_DiffWin_usr*, *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 EtherCAT 3006:1C_h
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 EtherCAT 3006:1D_h

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 EtherCAT 301C:4_h

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 EtherCAT 6041:0$_h$
_DPL_motionStat	Drive Profile Lexium motionStat.	- - - -	UINT16 R/- - -	CANopen 301B:27$_h$ Modbus 6990 EtherCAT 301B:27$_h$

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 EtherCAT 301B:35$_h$
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	- 0 0 11	UINT16 R/W per. -	CANopen 301B:1E$_h$ Modbus 6972 EtherCAT 301B:1E$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			

Functions for Monitoring Internal Device Signals

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:10h Modbus 7200 EtherCAT 301C:10h
_PS_T_warn	Advisory temperature limit of power stage (error class 0).	°C - - -	INT16 R/- per. -	CANopen 3010:6h Modbus 4108 EtherCAT 3010:6h
_PS_T_max	Maximum temperature of power stage.	°C - - -	INT16 R/- per. -	CANopen 3010:7h Modbus 4110 EtherCAT 3010:7h

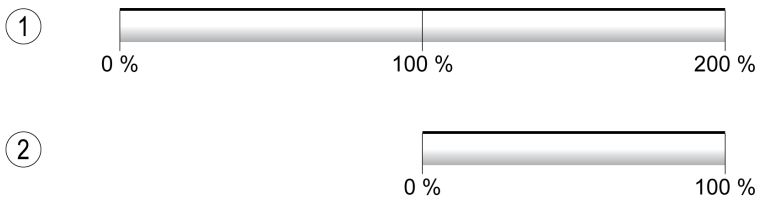
Monitoring Load and Overload (I^2T Monitoring)

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 EtherCAT 301C:17$_h$
_M_load	Load of motor.	% - - -	INT16 R/- - -	CANopen 301C:1A$_h$ Modbus 7220 EtherCAT 301C:1A$_h$
_RES_load	Load of braking resistor. The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208 EtherCAT 301C:14$_h$

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 EtherCAT 301C:24$_h$
_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 EtherCAT 301C:18$_h$
_M_overload	Overload of motor (I2t).	% - - -	INT16 R/- - -	CANopen 301C:19$_h$ Modbus 7218 EtherCAT 301C:19$_h$

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 EtherCAT 301C:1B$_h$
_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 EtherCAT 301C:13$_h$
_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 EtherCAT 301C:15$_h$

Commutation Monitoring

Description

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**: Commutation monitoring on in operating states 6, 7 and 8 **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 EtherCAT 3005:5_h

Monitoring of Mains Phases

Description

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.

NOTE: The mains phases are only monitored in the operating states **5** Switched On, **6** Operation Enabled, **7** Quick Stop Active, and **8** Fault Reaction Active.

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 EtherCAT 3005:A_h

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 EtherCAT 3005:F_h

Ground Monitoring

Description

When the power stage is enabled, the device monitors the motor phases for ground errors. A ground error occurs when one or more motor phases are short-circuited to the ground (earth) of the application.

A ground error of one or more motor phases is detected. A ground error of the DC bus or the braking resistor is not monitored.

If the ground error monitoring is deactivated, the drive may be rendered inoperable by a ground error.

NOTICE

INOPERABLE EQUIPMENT DUE TO GROUND ERRORS

- Only deactivate ground monitoring during commissioning and only for test purposes.
- Verify that the ground 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 monitoring. **0 / Off**: Ground monitoring off **1 / On**: Ground 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 EtherCAT 3005:10_h

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.

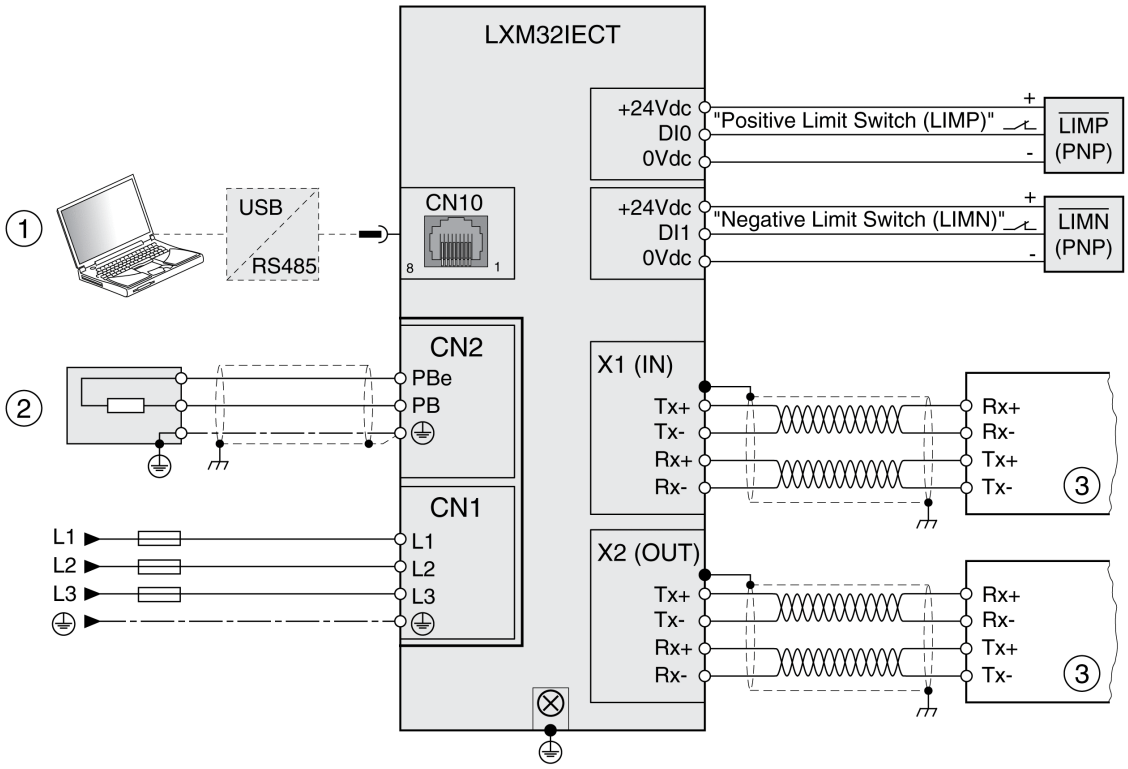
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Using the safety-related function STO integrated in this product requires careful planning. See section Functional Safety, page 67 for additional information.

Wiring Example 1

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety-related function STO	Miscellaneous
Positive logic(1)	Internal	-	I/O module with industrial connectors without safety-related function STO
(1) See Logic Type, page 56.			



(1) Commissioning accessories

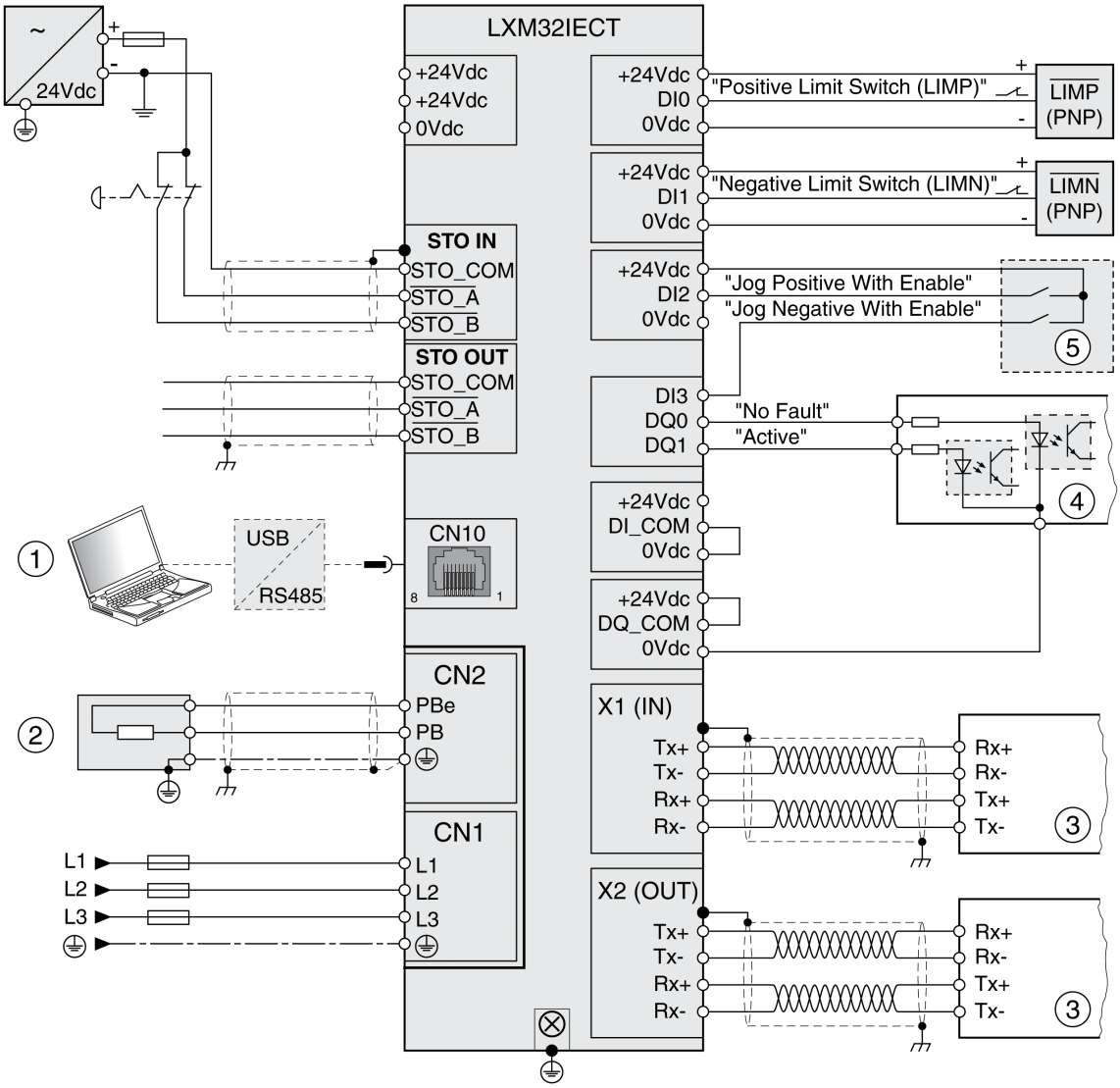
(2) Standard braking resistor or external braking resistor

(3) Fieldbus device

Wiring Example 2

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety-related function STO	Miscellaneous
Positive logic(1)	Internal	Required	I/O module with spring terminals
(1) See Logic Type, page 56.			



(1) Commissioning accessories

(2) Standard braking resistor or external braking resistor

(3) Fieldbus device

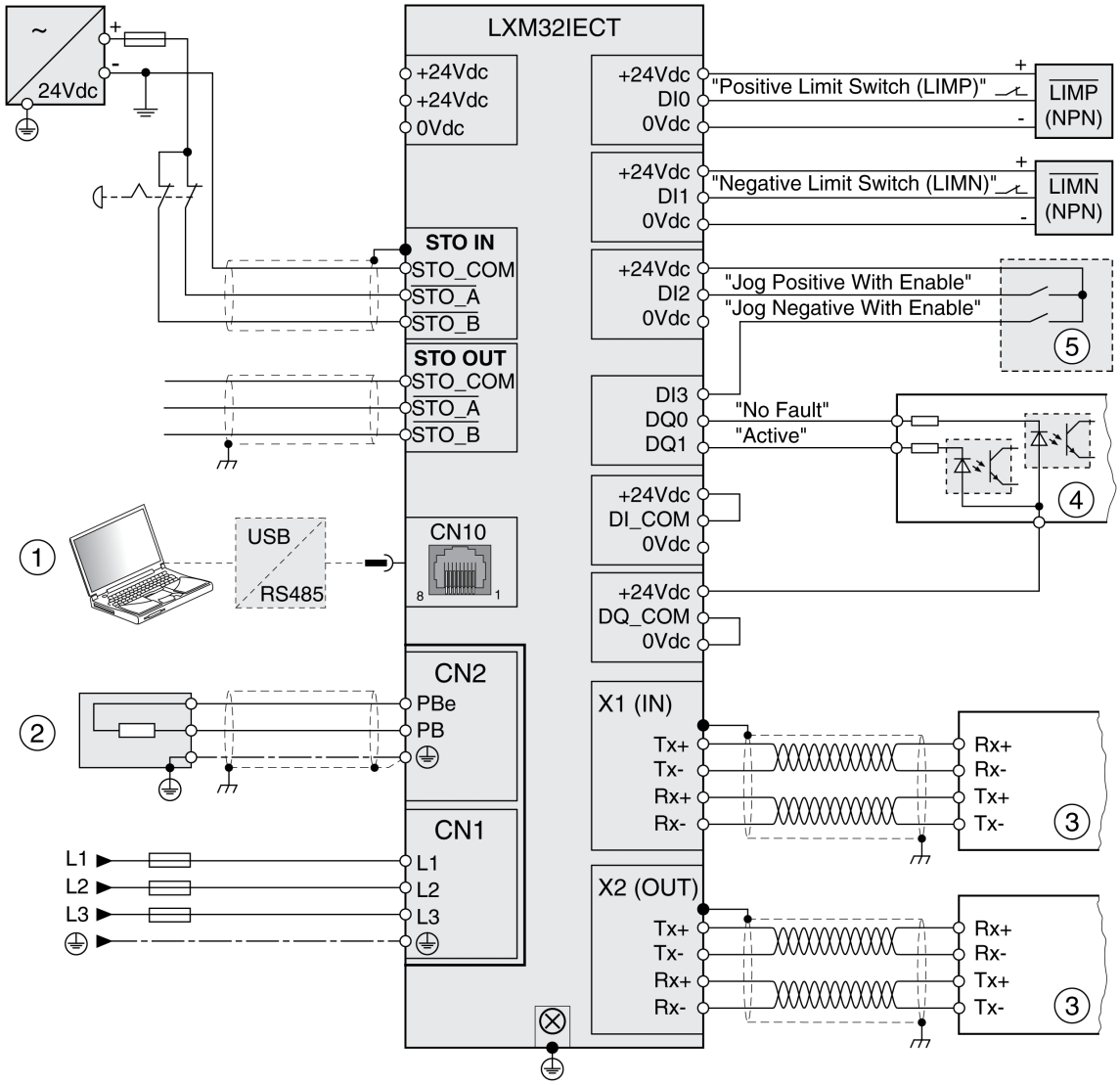
(4) Signal lights or inputs of the controller

(5) "Test box" for commissioning

Wiring Example 3

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety-related function STO	Miscellaneous
Negative logic(1)	Internal	Required	I/O module with spring terminals
(1) See Logic Type, page 56.			



(1) Commissioning accessories

(2) Standard braking resistor or external braking resistor

(3) Fieldbus device

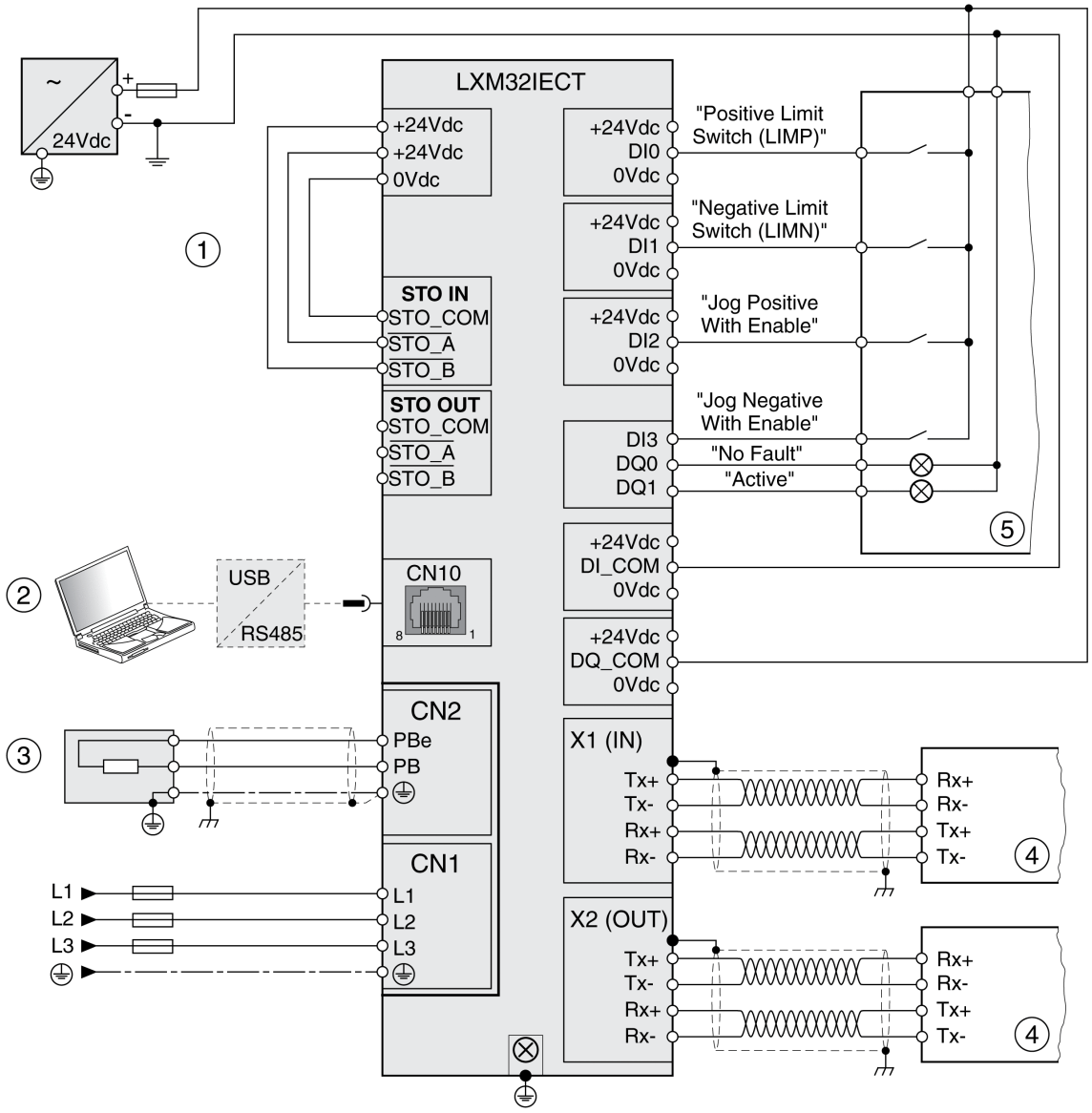
(4) Signal lights or inputs of the controller

(5) "Test box" for commissioning

Wiring Example 4

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety-related function STO	Miscellaneous
Positive logic(1)	External	Deactivated	I/O module with spring terminals Digital inputs and digital outputs via the controller
(1) See Logic Type, page 56.			



(1) Safety-related function STO deactivated

(2) Commissioning accessories

(3) Standard braking resistor or external braking resistor

(4) Fieldbus device

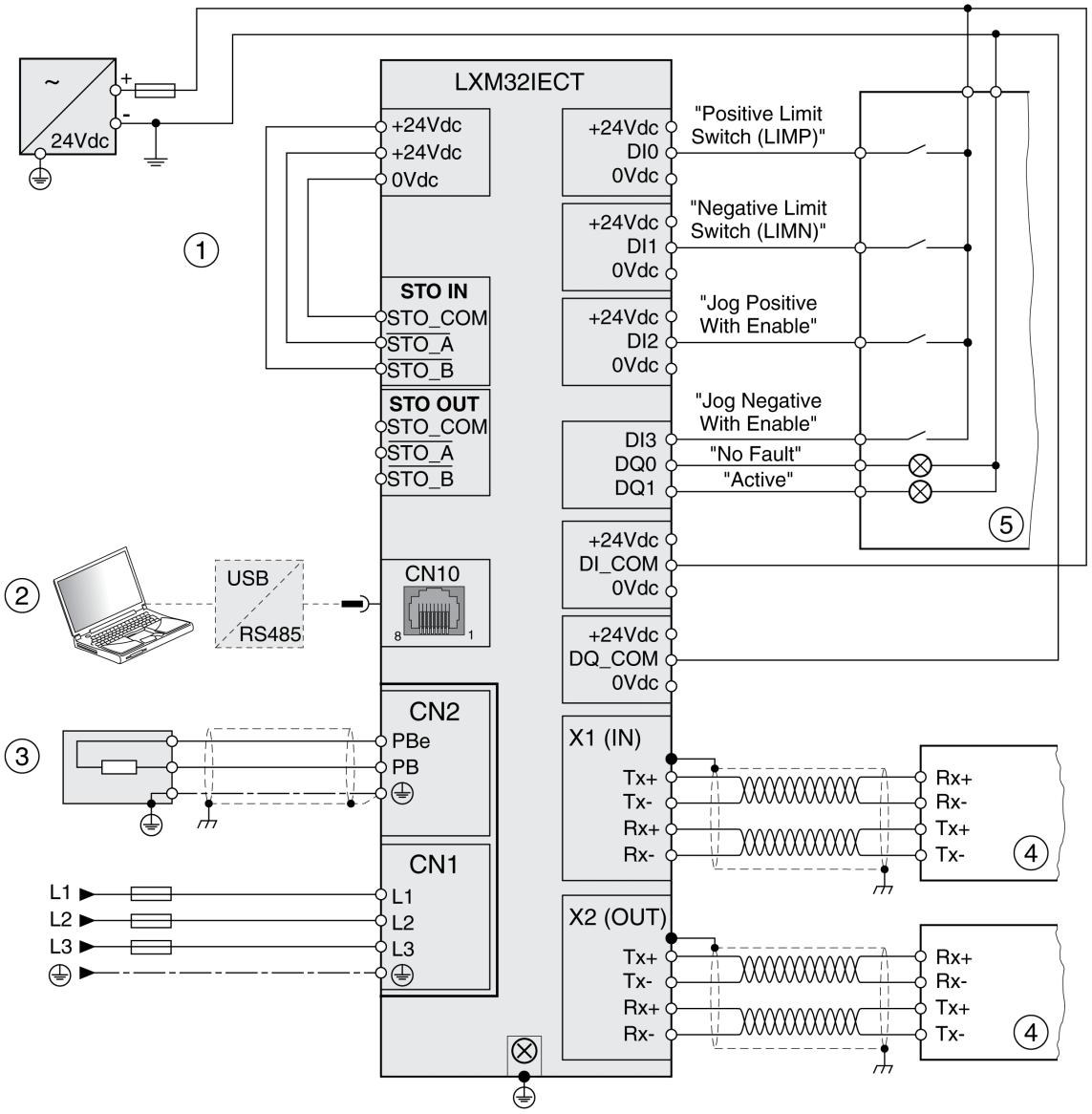
(5) Signal lights / controller

Wiring Example 5

The following illustration shows a wiring example with:

Logic type	Signal power supply	Safety-related function STO	Miscellaneous
Negative logic(1)	External	Deactivated	I/O module with spring terminals Digital inputs and digital outputs via the controller

(1) See Logic Type, page 56.



(1) Safety-related function STO deactivated

(2) Commissioning accessories

(3) Standard braking resistor or external braking resistor

(4) Fieldbus device

(5) Signal lights / controller

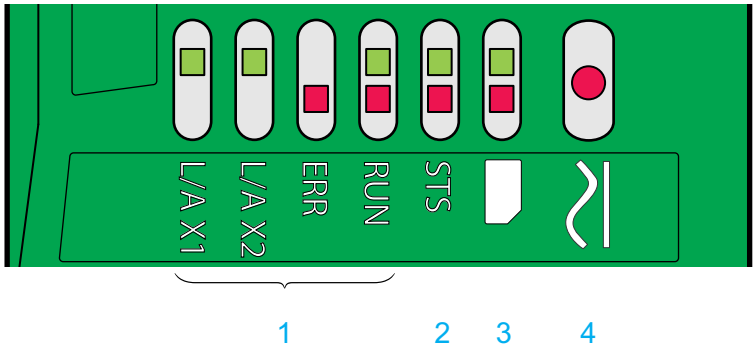
Diagnostics and Troubleshooting

Diagnostics via LEDs

Overview Diagnostics LEDs

Overview

The following illustration provides an overview of the diagnostics LEDs.



1 Fieldbus status LEDs

2 Operating state LEDs

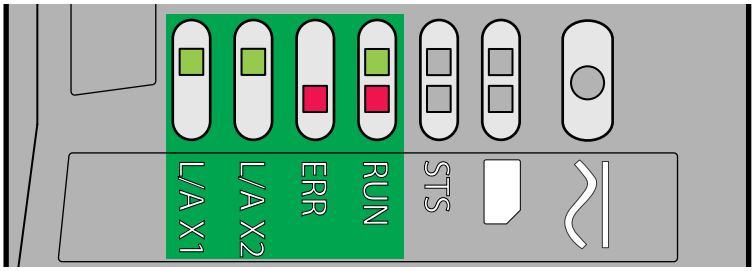
3 Memory card LEDs

4 DC bus LED

Fieldbus Status LEDs

Overview

The fieldbus status LEDs visualize the status of the fieldbus.



LED **L/A X1** and **L/A X2**

Status	Meaning
Off	No link
On	Link, no activity
Flickering	Link, activity

LED **ERR**

Status	Meaning
Double flash	Watchdog timeout
Single flash	Local error (such as synchronization error)
Blinking	Invalid configuration
On	Irrecoverable or internal error detected if LED RUN (red) is also on.
Off	No error

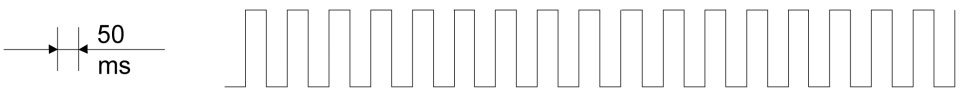
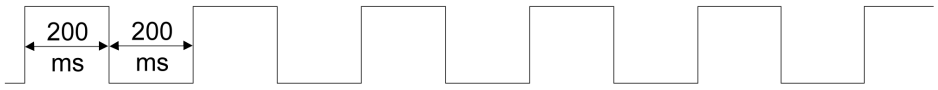
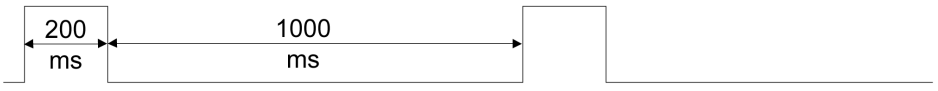
LED **RUN** (green)

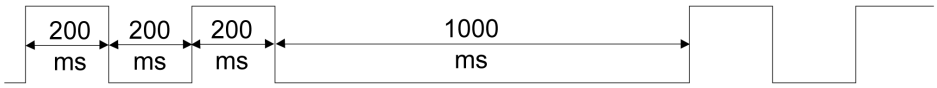
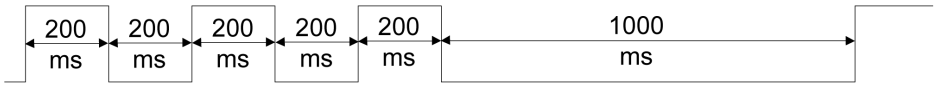
Status	Meaning
Off	EtherCAT state INIT
Blinking	EtherCAT state PRE-OPERATIONAL
Single flash	EtherCAT state SAFE-OPERATIONAL
On	EtherCAT state OPERATIONAL

LED **RUN** (red)

Status	Meaning
On	Irrecoverable or internal error detected if LED ERR is also on.

Meaning of the LED status

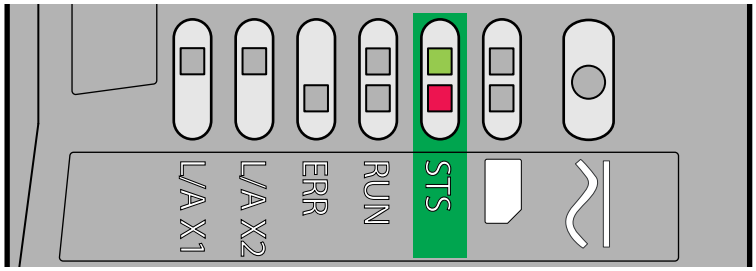
Status	Meaning
Flickering	
Blinking	
Single flash	

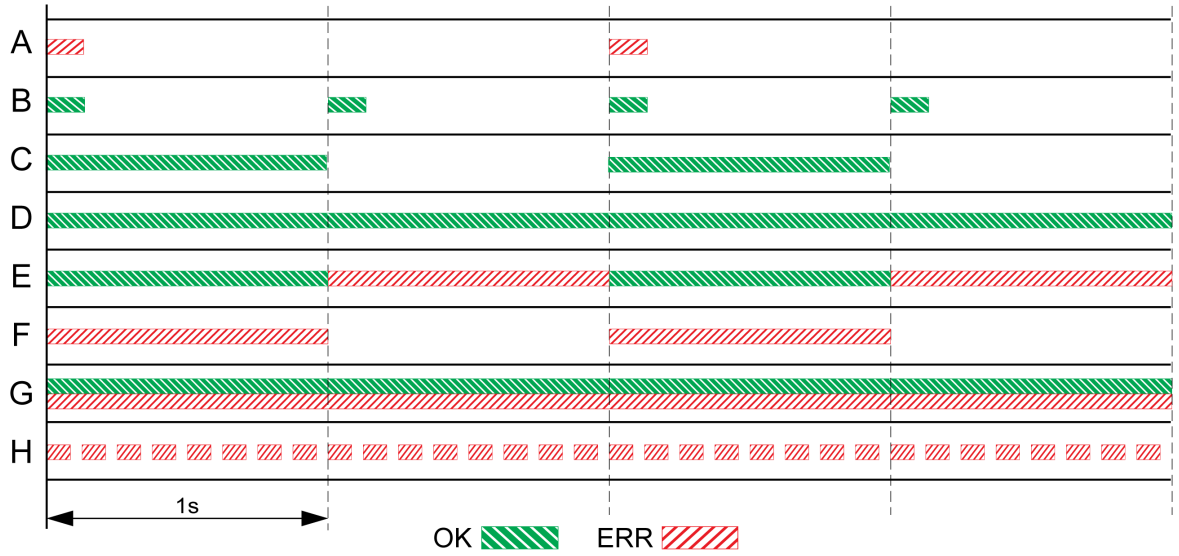
Status	Meaning
Double flash	
Triple flash	

Operating State LEDs

Overview

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**

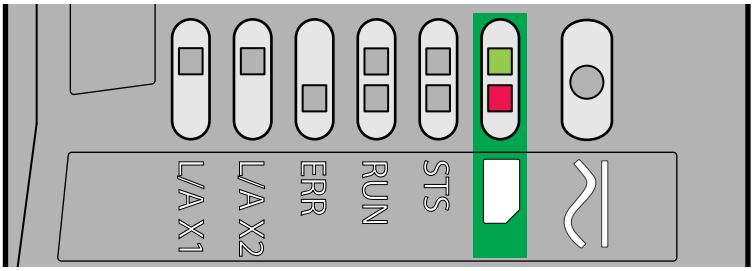
G Firmware not available

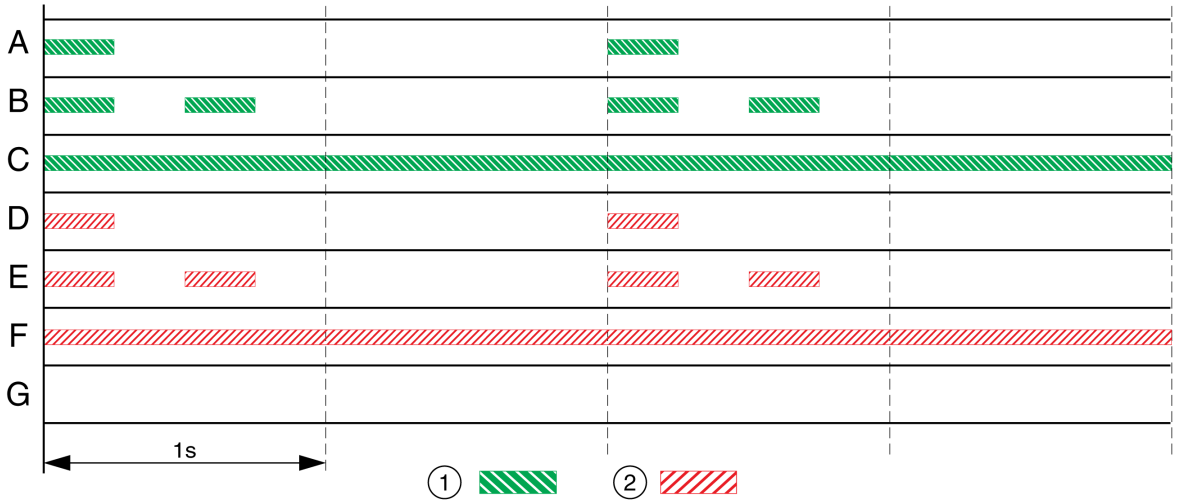
H Internal error

Memory Card LEDs

Overview

The memory card LEDs show the status of the memory card.





1 LED green

2 LED red

A The parameter values stored in the drive and the contents of the memory card are different. The contents of the memory card is transferred to the drive.

B The memory card is empty. The configuration of the drive is transferred to the memory card.

C The parameter values stored in the drive 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 drive.

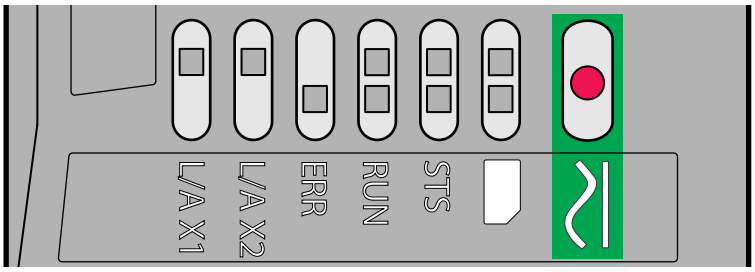
F Data on the memory card does not match the drive or is damaged.

G No memory card detected. Power off the supply. Verify that the memory card has been properly inserted (contacts, slanted corner).

DC Bus LED

Overview

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 section Product Related Information, page 13.

Diagnostics via Signal Outputs

Indicating the Operating State

Description

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

Description

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 Digital Signal Inputs and Digital Signal Outputs, page 184.

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 section Error Messages, page 363.

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 EtherCAT 303B:8_h
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 EtherCAT 303B:9_h
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 EtherCAT 303B:6_h
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 EtherCAT 303B:7_h

Diagnostics via the Fieldbus

Fieldbus Communication Error Diagnostics

Verifying 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 EtherCAT 6041:0$_h$

Error Bits

The parameters *_WarnLatched* and *_SigLatched* contain information on errors of error class 0 and errors of error classes 1 ... 4.

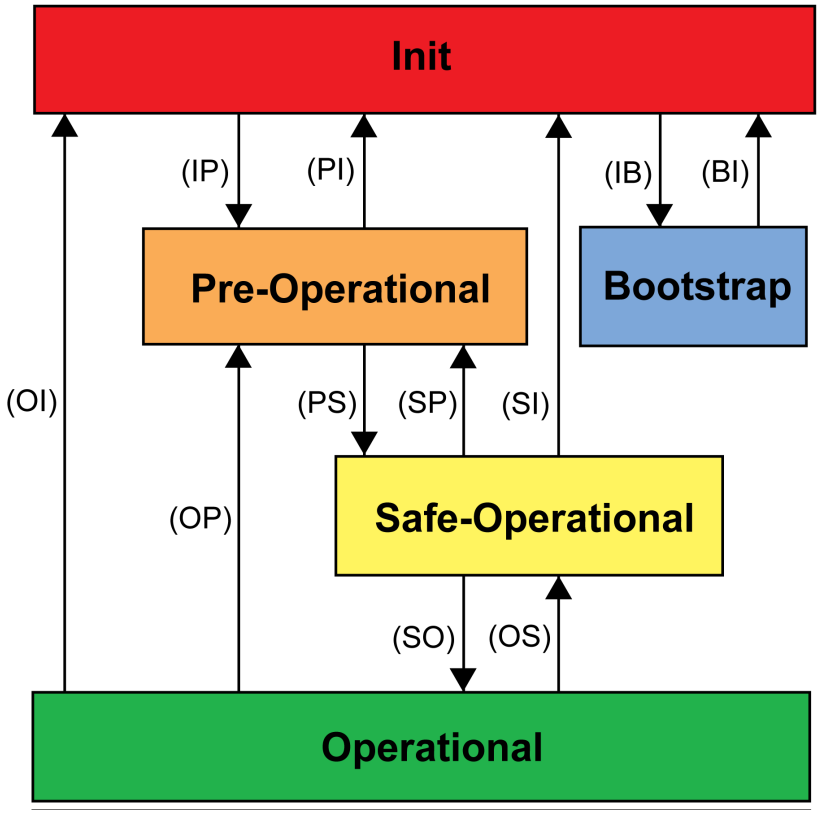
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_WarnLatched	Saved errors of error class 0, bit-coded. The bits are set to 0 in the case of a Fault Reset. Bits 10 and 13 are set to 0 automatically. Signal state: 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 EtherCAT 301C:C$_h$
_SigLatched	Saved status of monitoring signals. Signal state: 0: Not activated 1: Activated Bit assignments:	- - - -	UINT32 R/- - -	CANopen 301C:8$_h$ Modbus 7184 EtherCAT 301C:8$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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: Nonvolatile memory 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.			

EtherCAT State Machine

Overview

According to IEC 61800-7-304, the following EtherCAT operating states have been defined for an EtherCAT network:



States

The operating state **Init** defines the foundation of the communication relationship between the master and the slaves at the application layer. Direct communication between the master and the slave is impossible at the application layer. The master uses the Init state to initialize a set of configuration registers of the EtherCAT slave controllers. If the slaves support mailbox services, the Sync Manager is also configured in this state.

In the operating state **Pre-Operational**, the mailbox is active. Both master and slave use the mailbox and the corresponding protocol to interchange application-specific initialization data and parameters. In this operating state, process data communication is not possible.

If the drive does not receive a valid mapping for the process data from the EtherCAT master, it remains in this operating state.

In the operating state **Safe-Operational**, the slave application provides input data such as limit switch data. Output data of the master are ignored in this operating state. This operating state is not a safety-related function.

In the operating state **Operational**, the slave applications deliver input data and the drive processes the output data from the master, such as target positions.

State Transitions

The following state transitions are defined:

State transition	Local management service
IP	Start Mailbox Communication
PI	Stop Mailbox Communication
PS	Start Input Update
SP	Stop Input Update
SO	Start Output Update
OS	Stop Output Update
OP	Stop Output Update and Stop Input Update
SI	Stop Input Update, Stop Mailbox Communication
OI	Stop Input Update, Stop Input Update, Stop Mailbox Communication
IB	Start Bootstrap Mode
BI	Restart Device

Most Recent Detected Error - Error Code

Description

If the 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 section Error Messages, page 363.

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 EtherCAT 301C:9_h

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 EtherCAT 603F:0_h

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 section Error Messages, page 363.

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).

Position of the entry	Meaning
...	...
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 EtherCAT 303C:2_h
_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 EtherCAT 303C:1_h
_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 EtherCAT 303C:9_h
_ERR_powerOn	Number of power on cycles.	- 0 - 4294967295	UINT32 R/- - -	CANopen 303B:2_h Modbus 15108 EtherCAT 303B:2_h
_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 EtherCAT 303C:4_h
_ERR_temp_dev	Temperature of device at the time the error was detected.	°C - - -	INT16 R/- - -	CANopen 303C:B_h Modbus 15382 EtherCAT 303C:B_h
_ERR_temp_ps	Temperature of power stage at the time the error was detected.	°C - - -	INT16 R/- - -	CANopen 303C:A_h Modbus 15380 EtherCAT 303C:A_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ERR_time	Time of detection of error. With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	CANopen 303C:3$_h$ Modbus 15366 EtherCAT 303C:3$_h$
_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 EtherCAT 303C:7$_h$
_ERR_motor_v	Motor velocity at the time the error was detected.	usr_v - - -	INT32 R/- - -	CANopen 303C:8$_h$ Modbus 15376 EtherCAT 303C:8$_h$
_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 EtherCAT 303C:5$_h$
_ERR_enable_time	Time between enabling of power stage and detection of the error.	s - - -	UINT16 R/- - -	CANopen 303C:6$_h$ Modbus 15372 EtherCAT 303C:6$_h$
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 EtherCAT 303B:5$_h$
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 EtherCAT 303B:4$_h$

Error Messages

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 (hex)	Range
1xxx	General
2xxx	Overcurrent
3xxx	Voltage
4xxx	Temperature
5xxx	Hardware
6xxx	Software
7xxx	Interface, wiring
8xxx	Fieldbus
Axxx	Motor movement
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 section Operating States, page 212.			

Table of Error Messages

List of the Error Messages Sorted by Error Code

Error code (hex)	Error class	Description	Cause	Correctives
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.
1101	0	Parameter does not exist	Error detected by parameter management: Parameter (index) does not exist.	Select a different parameter (index).
1102	0	Parameter does not exist	Error detected by parameter management: Parameter (subindex) does not exist.	Select a different parameter (subindex).
1103	0	Parameter write not permissible (READ only)	Write access to read only parameter.	Write only to parameters that are not read-only.
1104	0	Write access denied (no access authorization)	Parameter only accessible at expert level.	The write access level expert is required.
1105	0	Block Upload/Download not initialized	-	-
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.
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.
1108	0	File cannot be uploaded: Incorrect file ID	-	-
1109	1	Data stored after a power outage is invalid	-	-
110A	0	System error detected: No bootloader available	-	-
110B	3	Configuration error detected. Additional information in the error memory indicates the 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.
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.
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 section Parameters for the parameter that requires a restart of the drive.
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.
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.
1111	0	File transfer not correctly initialized	A previous file transfer has been aborted.	-
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.	-

Error code (hex)	Error class	Description	Cause	Correctives
1113	0	System not locked for configuration transfer	An external tool has tried to transfer the configuration without locking the drive.	-
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.
1115	0	Incorrect configuration file format Parameter *_WarnLatched* Bit 5	An external tool has downloaded a configuration which has an incorrect format.	-
1116	0	Request is processed asynchronously	-	-
1117	0	Asynchronous request blocked	Request to a module is blocked because the module is currently processing another request.	-
1118	0	Configuration data incompatible with device	The configuration data contains data from a different device.	Verify device type including type of power stage.
1119	0	Incorrect data length, too many bytes	-	-
111A	0	Incorrect data length, insufficient number of bytes	-	-
111B	4	Configuration download error detected. Additional information in the error memory indicates the 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.
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.
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.
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.
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.
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.
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.
1122	0	Recalculation for scaling not possible	Recalculation for scaling is already running.	Wait for the running recalculation for scaling to finish.
1123	0	Parameter cannot be changed	Recalculation for scaling is running.	Wait for the running recalculation for scaling to finish.
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.

Error code (hex)	Error class	Description	Cause	Correctives
1125	1	Scaling not possible	The scaling factors for position, velocity or acceleration/deceleration are beyond internal calculation limits.	Retry with different scaling factors.
1126	0	Configuration is blocked by another access channel	-	Close other access channel (for example, other instance of commissioning software).
1127	0	Invalid key received	-	-
1128	0	Special login is required for Manufacturing Test Firmware	-	-
1129	0	Test step not yet started	-	-
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".
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.
1132	0	Incorrect size of configuration file (odd number of bytes)	Incorrect number of bytes.	Retry. If the condition persists, contact your Schneider Electric service representative.
1300	3	Safety-related function STO activated (STO_A, STO_B) Parameter *_SigLatched* Bit 10	The safety-related function STO was activated in the operating state Operation Enabled.	Verify correct wiring of the inputs of the safety-related function STO and perform a Fault Reset.
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-related function STO.
1302	0	Safety-related function STO activated (STO_A, STO_B) Parameter *_WarnLatched* Bit 10	Safety-related function STO was activated while the power stage was disabled.	Verify correct wiring of the inputs of the safety-related function STO.
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.
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.
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.
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.
1316	1	Position capture via signal input currently not possible Parameter *_SigLatched* Bit 28	Position capture is already being used.	-
1501	4	System error detected: DriveCom state machine indeterminable state	-	-
1502	4	System error detected: HWL low-level state machine indeterminable state	-	-
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.	-
1600	0	Oscilloscope: No additional data available	-	-
1601	0	Oscilloscope: Parameterization incomplete	-	-
1602	0	Oscilloscope: Trigger variable not defined	-	-

Error code (hex)	Error class	Description	Cause	Correctives
1606	0	Logging still active	-	-
1607	0	Logging: No trigger defined	-	-
1608	0	Logging: Invalid trigger option	-	-
1609	0	Logging: No channel selected	-	-
160A	0	Logging: No data available	-	-
160B	0	Parameter cannot be logged	-	-
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.
160E	1	Autotuning: Test movement could not be started	-	-
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.
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.
1611	1	System error detected: Parameter could not be written during Autotuning. Additional information in the error memory indicates the Modbus register address.	-	-
1612	1	System error detected: Parameter could not be read during Autotuning	-	-
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.
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.
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.
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.
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.
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.
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.
1621	1	System error detected: Calculation error	-	-

Error code (hex)	Error class	Description	Cause	Correctives
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.
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.
1A00	0	System error detected: FIFO memory overflow	-	-
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.
1A03	4	System error detected: Hardware and firmware do not match	-	-
1B00	3	System error detected: Incorrect parameters for motor and power stage Parameter *_SigLatched* Bit 30	Incorrect manufacturer parameter value (data) nonvolatile memory of device.	Replace device.
1B02	3	Target value too high. Parameter *_SigLatched* Bit 30	-	-
1B05	2	Error detected during parameter switching Parameter *_SigLatched* Bit 30	-	-
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.
1B0C	3	Motor velocity too high.	-	-
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.
1B0F	3	Velocity deviation too high	-	-
2201	2	System error: DC bus relay error Parameter *_SigLatched* Bit 30	Inoperative DC bus relay.	Contact your Schneider Electric service representative.
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.
2301	3	Braking resistor overcurrent Parameter *_SigLatched* Bit 27	Braking resistor short circuit.	If you use the internal braking resistor, contact your Schneider Electric service representative. If you use an external braking resistor, verify correct wiring and rating of the braking resistor.
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.
3200	3	DC bus overvoltage Parameter *_SigLatched* Bit 14	Excessive regeneration during deceleration.	Verify correct deceleration ramp, rating of drive and braking resistor.

Error code (hex)	Error class	Description	Cause	Correctives
3201	3	DC bus undervoltage (shutdown threshold) Parameter *_SigLatched* Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
3202	2	DC bus undervoltage (Quick Stop threshold) Parameter *_SigLatched* Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.

Error code (hex)	Error class	Description	Cause	Correctives
4303	0	No motor temperature monitoring	The temperature parameters (in electronic nameplate of motor, nonvolatile memory of encoder) are unavailable or invalid; parameter A12 is equal to 0.	Contact your Schneider Electric service representative. Replace motor.
4304	0	The encoder does not support motor temperature monitoring.	-	-
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.
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.
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.
5101	0	Modbus power supply missing	-	-
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 your Schneider Electric service representative.
5200	4	Error detected at connection to motor encoder Parameter *_SigLatched* Bit 16	Encoder not properly connected, EMI	-
5201	4	Error detected in motor encoder communication Parameter *_SigLatched* Bit 16	Encoder not properly connected, EMI	-
5203	4	Error detected in connection motor encoder Parameter *_SigLatched* Bit 16	Encoder not properly connected	-
5204	3	Connection to motor encoder lost Parameter *_SigLatched* Bit 16	Encoder not properly connected	-
5206	0	Communication error detected in encoder Parameter *_WarnLatched* Bit 16	Communication channel to encoder is subject to interference.	Verify EMC measures.
5207	1	Function is not supported	The hardware revision does not support the function.	-
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 your Schneider Electric service representative.
5430	4	System error detected: Nonvolatile memory read error Parameter *_SigLatched* Bit 29	-	-

Error code (hex)	Error class	Description	Cause	Correctives
5431	3	System error: Nonvolatile memory write error Parameter *_SigLatched* Bit 29	-	-
5432	3	System error: Nonvolatile memory state machine Parameter *_SigLatched* Bit 29	-	-
5433	3	System error: Nonvolatile memory address error Parameter *_SigLatched* Bit 29	-	-
5434	3	System error: Nonvolatile memory incorrect data length Parameter *_SigLatched* Bit 29	-	-
5435	4	System error: Nonvolatile memory not formatted Parameter *_SigLatched* Bit 29	-	-
5436	4	System error: Nonvolatile memory incompatible structure Parameter *_SigLatched* Bit 29	-	-
5437	4	System error detected: Nonvolatile memory checksum error (manufacturer data) Parameter *_SigLatched* Bit 29	-	-
5438	3	System error detected: Nonvolatile memory checksum error (user parameters) Parameter *_SigLatched* Bit 29	-	-
5439	3	System error detected: Nonvolatile memory checksum error (fieldbus parameters) Parameter *_SigLatched* Bit 29	-	-
543B	4	System error detected: No valid manufacturer data Parameter *_SigLatched* Bit 29	-	-
543E	3	System error detected: Nonvolatile memory checksum error (NoInit parameter) Parameter *_SigLatched* Bit 29	-	-
543F	3	System error detected: Nonvolatile memory checksum error (motor parameters) Parameter *_SigLatched* Bit 29	-	-
5441	4	System error detected: Nonvolatile memory checksum error (global control loop parameter set) Parameter *_SigLatched* Bit 29	-	-
5442	4	System error detected: Nonvolatile memory checksum error (control loop parameter set 1) Parameter *_SigLatched* Bit 29	-	-
5443	4	System error detected: Nonvolatile memory checksum error (control loop parameter set 2) Parameter *_SigLatched* Bit 29	-	-

Error code (hex)	Error class	Description	Cause	Correctives
5444	4	System error detected: Nonvolatile memory checksum error (NoReset parameter) Parameter *_SigLatched* Bit 29	-	-
5445	4	System error detected: Nonvolatile memory checksum error (hardware information) Parameter *_SigLatched* Bit 29	-	-
5446	4	System error detected: Nonvolatile memory checksum error (for power outage data) Parameter *_SigLatched* Bit 29	Internal nonvolatile memory not operative.	Restart the drive. If the detected error persists, contact your Schneider Electric service representative.
5447	3	System error detected: Nonvolatile memory checksum error (data sets operating mode Motion Sequence) Parameter *_SigLatched* Bit 29	-	-
5448	2	System error detected: Communication with memory card Parameter *_SigLatched* Bit 20	-	-
5449	2	System error detected: Memory card bus is busy Parameter *_SigLatched* Bit 20	-	-
544A	4	System error detected: Nonvolatile memory checksum error (administration data) Parameter *_SigLatched* Bit 29	-	-
544C	4	System error detected: Nonvolatile memory is write-protected Parameter *_SigLatched* Bit 29	-	-
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.
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.
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.
5451	0	System error detected: No memory card available Parameter *_WarnLatched* Bit 20	-	-
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.	-
5453	2	System error detected: Incompatible data on the memory card Parameter *_SigLatched* Bit 20	-	-
5454	2	System error detected: Capacity of detected memory card insufficient Parameter *_SigLatched* Bit 20	-	-

Error code (hex)	Error class	Description	Cause	Correctives
5455	2	System error detected: Memory card not formatted properly Parameter *_SigLatched* Bit 20	-	Format memory card or copy data from drive to memory card.
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.
5457	2	System error detected: Incompatible memory card Parameter *_SigLatched* Bit 20	Memory card capacity is insufficient.	Replace memory card
5458	4	System error detected: Flash programming sequence	-	-
5459	1	System error detected: Parameter only available during flashing (flash request)	-	-
545A	4	System error detected: Firmware update FiFo overrun	-	-
545B	4	System error detected: Incompatible firmware file header information	-	-
545C	4	System error detected: Firmware file and device not compatible	-	-
545D	4	System error detected: Firmware file checksum incorrect	-	-
545E	4	System error detected: Firmware file header information has an odd number of bytes	-	-
545F	4	System error detected: Size of firmware file exceeds memory capacity	-	-
5460	4	System error detected: Loader for firmware file not available	Incorrect loader.	Contact your Schneider Electric service representative.
5461	4	System error detected: Firmware version in device and firmware version to be updated are identical	-	-
5462	0	Memory card implicitly written by the device Parameter *_WarnLatched* Bit 20	The content of the memory card and the content of the nonvolatile memory are not identical.	-
5463	1	Error detected in firmware file	Transfer of firmware file incomplete.	-
5464	1	Firmware update in progress	Update of firmware file is still running.	-
5465	4	System error detected: File header too large	-	-
5466	4	System error detected: Bootloader does not match the bootloader required for the firmware file	-	-
5467	4	System error detected: Loader does not match the loader required for the firmware file	-	-
546C	0	Nonvolatile memory file not available	-	-
5600	3	Motor connection phase error detected Parameter *_SigLatched* Bit 26	Missing motor phase.	-

Error code (hex)	Error class	Description	Cause	Correctives
5603	3	Commutation error detected. Additional information in the error memory indicates 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 nonvolatile memory 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 your Schneider Electric service representative.
6102	4	System error detected: Internal software error Parameter *_SigLatched* Bit 30	-	-
6103	4	System error detected: System stack overflow Parameter *_SigLatched* Bit 31	-	-
6104	0	System error detected: Division by zero (internal)	-	-
6105	0	System error detected: Overflow during 32 bit calculation (internal)	-	-
6106	4	System error detected: Size of data interface does not match Parameter *_SigLatched* Bit 30	-	-
6107	0	Parameter outside of value range (calculation error detected)	-	-
6108	0	Function not available	-	-
6109	0	System error detected: Internal range exceeded	-	-
610A	2	System error detected: Calculated value cannot be represented as a 32 bit value	-	-
610D	0	Error detected in selection parameter	Incorrect parameter value selected.	Verify the value to be written.
610E	4	System error detected: 24 VDC below undervoltage threshold for shutdown	-	-
610F	4	System error detected: Internal timer basis missing (Timer0) Parameter *_SigLatched* Bit 30	-	-
6111	2	System error detected: Memory area locked Parameter *_SigLatched* Bit 30	-	-
6112	2	System error detected: Out of memory Parameter *_SigLatched* Bit 30	-	-
6113	1	System error detected: Calculated value cannot be represented as a 16 bit value	-	-
6114	4	System error detected: Impermissible function call from interrupt service routine	Incorrect programming	-
6117	0	Holding brake cannot be released manually.	The holding brake cannot be released manually because it is still applied manually.	First, switch from applying the holding brake manually to Automatic, then to releasing the holding brake manually.

Error code (hex)	Error class	Description	Cause	Correctives
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 your Schneider Electric service representative or replace the device.
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.
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.
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.
7114	2	No braking resistor connected	Connection to braking resistor lost	Verify wiring of the braking resistor. Verify correct resistance.
7120	4	Invalid motor data Parameter *_SigLatched* Bit 16	Motor data is incorrect (incorrect CRC).	Contact your Schneider Electric service representative or replace the motor.
7121	2	System error detected: Error in motor encoder communication Parameter *_SigLatched* Bit 16	EMI, detailed information can be found in the error memory that contains the error code of the encoder.	Contact your Schneider Electric service representative.
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 your Schneider Electric service representative or replace the motor.
7124	4	System error detected: Motor encoder inoperative Parameter *_SigLatched* Bit 16	-	Contact your Schneider Electric service representative or replace the motor.
7125	4	System error detected: Length specification for user data too great Parameter *_SigLatched* Bit 16	-	-
7129	0	System error detected: Motor encoder Parameter *_WarnLatched* Bit 16	-	-
712C	0	System error detected: Communication with encoder not possible Parameter *_WarnLatched* Bit 16	-	-
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 your Schneider Electric service representative or replace the motor.
712F	0	No data segment of the electronic motor nameplate	-	-
7132	0	System error detected: Motor configuration cannot be written	-	-
7134	4	Incomplete motor configuration Parameter *_SigLatched* Bit 16	-	-
7135	4	Format is not supported Parameter *_SigLatched* Bit 16	-	-
7136	4	Incorrect encoder type selected with parameter MotEnctype Parameter *_SigLatched* Bit 16	-	-

Error code (hex)	Error class	Description	Cause	Correctives
7137	4	Error detected during the internal conversion of the motor configuration Parameter *_SigLatched* Bit 16	-	-
7138	4	Parameter of the motor configuration out of permissible range Parameter *_SigLatched* Bit 16	-	-
7139	0	Encoder offset: Data segment in encoder is incorrect.	-	-
713A	3	Adjustment value of the encoder of the third party motor has not yet been determined. Parameter *_SigLatched* Bit 16	-	-
7200	4	System error detected: Calibration analog/digital converter during manufacturing / incorrect BLE file Parameter *_SigLatched* Bit 30	-	-
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 your Schneider Electric service representative.
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.
7327	0	Error bit set in Hiperface answer Parameter *_WarnLatched* Bit 16	EMI.	Verify wiring (shield).
7328	4	Motor encoder: Position evaluation error detected Parameter *_SigLatched* Bit 16	Encoder has detected incorrect position evaluation.	Contact your Schneider Electric service representative or replace the motor.
7329	0	Motor encoder Warn signal Parameter *_WarnLatched* Bit 16	EMI.	Contact your Schneider Electric service representative or replace the motor.
7330	4	System error detected: Motor encoder (Hiperface) Parameter *_SigLatched* Bit 16	-	Verify EMC measures. Contact your Schneider Electric service representative.
7331	4	System error detected: Motor encoder initialization Parameter *_SigLatched* Bit 30	-	Verify EMC measures. Contact your Schneider Electric service representative.
7335	0	Communication with motor encoder active Parameter *_WarnLatched* Bit 16	Command is being processed or communication may be disturbed (EMI).	Verify EMC measures. Contact your Schneider Electric service representative.
733F	4	Amplitude of encoder analog signals too low Parameter *_SigLatched* Bit 16	Incorrect encoder wiring. Encoder not connected. Encoder signals subject to EMI (shield connection, cabling, etc.).	Verify EMC measures. Contact your Schneider Electric service representative.
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 your Schneider Electric service representative.

Error code (hex)	Error class	Description	Cause	Correctives
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.
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.
7343	0	Absolute position is different from incremental position Parameter *_WarnLatched* Bit 16	Encoder is subject to EMI. Motor encoder is inoperative.	Verify EMC measures. Contact your Schneider Electric service representative.
7344	3	Absolute position is different from incremental position Parameter *_SigLatched* Bit 16	Encoder is subject to EMI. Motor encoder is inoperative.	Verify EMC measures. Contact your Schneider Electric service representative.
7345	0	Amplitude of analog signals too high, limit of AD conversion exceeded	Encoder signals subject to EMI (shield connection, wiring, etc.). Encoder inoperative.	Verify EMC measures. Contact your Schneider Electric service representative.
7346	4	System error detected: Encoder not ready Parameter *_SigLatched* Bit 16	-	Verify EMC measures. Contact your Schneider Electric service representative.
7347	0	System error detected: Position initialization not possible	Analog and digital encoder signals subject to massive interference.	Verify EMC measures. Contact your Schneider Electric service representative.
7348	3	Timeout reading encoder temperature Parameter *_SigLatched* Bit 16	Encoder without temperature sensor, incorrect encoder connection.	Verify EMC measures. Contact your Schneider Electric service representative.
7349	0	Discrepancy between absolute and analog encoder phases	Analog encoder signals are subject to interference. Encoder inoperative.	Verify EMC measures. Contact your Schneider Electric service representative.
734A	3	Amplitude of analog signals from encoder too high, signals are clipped Parameter *_SigLatched* Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	-
734B	0	Signal position evaluation of analog encoder inoperative Parameter *_WarnLatched* Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	-
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.
734D	0	Index pulse is not available for the encoder Parameter *_WarnLatched* Bit 16	-	-

Error code (hex)	Error class	Description	Cause	Correctives
734E	4	Error in analog signals from encoder detected. Additional information in the error memory indicates Internal_ DeltaQuep. Parameter *_SigLatched* Bit 16	Encoder cable not properly connected. Encoder signals subject to EMI (shield connection, wiring, etc.). Mechanical issue.	Verify EMC measures. Contact your Schneider Electric service representative.
7500	0	RS485/Modbus: Overrun error detected Parameter *_WarnLatched* Bit 5	EMI; incorrect cabling.	Verify cables.
7501	0	RS485/Modbus: Framing error detected Parameter *_WarnLatched* Bit 5	EMI; incorrect cabling.	Verify cables.
7502	0	RS485/Modbus: Parity error detected Parameter *_WarnLatched* Bit 5	EMI; incorrect cabling.	Verify cables.
7503	0	RS485/Modbus: Receive error detected Parameter *_WarnLatched* Bit 5	EMI; incorrect cabling.	Verify cables.
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.
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.
7701	4	System error detected: Timeout during connection to power stage Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7702	4	System error detected: Invalid data received from power stage Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7703	4	System error detected: Data exchange with power stage lost Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7704	4	System error detected: Exchange of identification data from power stage not successful Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7705	4	System error detected: Checksum identification data from power stage incorrect Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7706	4	System error detected: No identification frame received from power stage Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7707	4	System error detected: Type of power stage and manufacture data do not match	-	Contact your Schneider Electric service representative.
7708	4	PIC voltage supply too low Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
7709	4	System error detected: Invalid numbers of data received Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.

Error code (hex)	Error class	Description	Cause	Correctives
770A	2	PIC received data with incorrect parity Parameter *_SigLatched* Bit 31	-	Contact your Schneider Electric service representative.
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.
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.
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'
A067	1	Invalid value in data set. Additional information in the error memory indicates the 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.
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.
A301	0	Drive in operating state Quick Stop Active	Error with error class 1 detected. Drive stopped with Quick Stop.	-
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.
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.
A304	1	Stop by reference switch Parameter *_SigLatched* Bit 1	-	-
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.
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.
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.
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.
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.
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 (hex)	Error class	Description	Cause	Correctives
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.
A312	0	Profile generation interrupted	-	-
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.
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.
A315	0	Homing active	Command cannot be used while the operating mode Homing is active.	Wait until reference movement is finished.
A316	0	Overflow during calculation of acceleration	-	-
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).
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.
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.
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.
A31B	0	Halt requested	Command not permissible while Halt is requested.	Clear Halt request and repeat command.
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.
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.
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.
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.
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.
A322	0	Error detected in ramp calculation	-	-

Error code (hex)	Error class	Description	Cause	Correctives
A323	3	System error detected: Processing error detected during generation of profile	-	-
A324	1	Error detected during homing. Additional information in the error memory indicates the 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: A325, A326, A327, A328 or A329.
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'.
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.
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.
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).
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).
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.
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.
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.
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.
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.
A332	1	Jog error detected. Additional information in the error memory indicates the 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.
A333	3	System error detected: Invalid internal selection	-	-

Error code (hex)	Error class	Description	Cause	Correctives
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.
A336	1	System error detected: Jerk limitation with position offset after end of movement. Additional information in the error memory indicates the offset in Increments.	-	-
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.
A338	0	Operating mode unavailable Parameter *_WarnLatched* Bit 4	The selected operating mode is not available.	-
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.
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.	-
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.
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.
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.
A340	1	Error detected in operating mode Motion Sequence. Additional information in the error memory indicates the 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.
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.	-
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.
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.

Error code (hex)	Error class	Description	Cause	Correctives
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.
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.
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.
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.
A34C	0	Resolution of scaling too high (range exceeded)	-	-
A34D	0	Function not available when Modulo is active	The function cannot be executed when Modulo is active.	Deactivate Modulo to use the function.
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.
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.
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.
A355	1	Error detected during relative movement after capture. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 4	Movement was stopped by error.	Verify the error memory.
A356	0	Function Relative Movement After Capture not assigned to a digital input	-	Assign the function Relative Movement After Capture to a digital input.
A357	0	Deceleration still running	Command is not permissible during deceleration.	Wait until motor has come to a complete standstill.
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.
A359	0	Request cannot be processed since the relative movement after capture is still active	-	-
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.

Error code (hex)	Error class	Description	Cause	Correctives
A35B	0	Modulo cannot be activated Parameter *_WarnLatched* Bit 4	The set operating mode does not support Modulo.	-
A35D	par.	Permissible velocity deviation exceeded Parameter *_SigLatched* Bit 8	Load or acceleration too high.	Reduce load or acceleration.
A35E	0	The selected velocity scaling factor reduces the accuracy of the velocity scaling.	-	Increase or decrease the value of the numerator and/or denominator of the scaling factor. If the condition persists, contact your Schneider Electric service representative.
A35F	0	The selected ramp scaling factor reduces the accuracy of the ramp scaling.	-	Increase or decrease the value of the numerator and/or denominator of the scaling factor. If the condition persists, contact your Schneider Electric service representative.
B100	0	RS485/Modbus: Indeterminable service Parameter *_WarnLatched* Bit 5	Unsupported Modbus service was received.	Verify application on the Modbus master.
B101	1	Incorrect I/O data configuration. Additional information in the error memory indicates the Modbus register address. Parameter *_SigLatched* Bit 21	The I/O data configuration or the Modbus I/O scanning configuration contains an invalid parameter.	Verify the configuration of the I/O data.
B102	1	Fieldbus module: General error detected Parameter *_SigLatched* Bit 21	-	-
B103	2	Fieldbus module: Controlling communication channel has been closed Parameter *_SigLatched* Bit 21	-	-
B104	2	Fieldbus module: Internal communication error detected Parameter *_SigLatched* Bit 21	-	-
B105	2	Fieldbus module: I/O data timeout Parameter *_SigLatched* Bit 21	-	-
B106	2	Fieldbus module: I/O data mapping error detected Parameter *_SigLatched* Bit 21	-	-
B120	2	Cyclic communication: Incorrect cycle time Parameter *_SigLatched* Bit 21	The drive does not support the configured cycle time or the difference between the measured cycle time and the configured cycle time is too great.	Change the cycle time in the master controller to a cycle time supported by the drive or verify synchronization requirements.
B121	2	Cyclic communication: Synchronization signal missing Parameter *_SigLatched* Bit 21	Two cycles have passed without a synchronization signal having been received.	Analyze the communication.
B122	2	Cyclic communication: Incorrect synchronization Parameter *_SigLatched* Bit 21	One signal was missing and the expected second signal was received at an incorrect point in time. The master controller may be unable to provide the required synchronization signals at the set cycle time, for example, due to insufficient computing power.	Analyze the communication or increase the cycle time.
B123	2	Cyclic communication: The selected cycle time tolerance is too high Parameter *_SigLatched* Bit 21	The cycle time tolerance may not exceed one quarter of the set cycle time.	Enter a correct value.

Error code (hex)	Error class	Description	Cause	Correctives
B124	0	Cyclic Communication: Drive is not synchronous with master cycle Parameter *_WarnLatched* Bit 21	Operating mode has been activated but drive is not synchronized to external synchronization signal.	After having started the synchronization mechanism, wait for 120 cycles before activating the operating mode.
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.
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.
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.
B203	0	RS485/Modbus: Incorrect number of monitor objects Parameter *_WarnLatched* Bit 5	-	-
B600	2	Ethernet: Network overload Parameter *_SigLatched* Bit 21	-	-
B601	2	Ethernet: Loss of Ethernet carrier Parameter *_SigLatched* Bit 21	-	-
B602	2	Ethernet: Duplicate IP address Parameter *_SigLatched* Bit 21	-	-
B603	2	Ethernet: No valid IP address Parameter *_SigLatched* Bit 21	-	-
B604	0	Ethernet: DHCP/BOOTP Parameter *_WarnLatched* Bit 21	IP assignment via DHCP/BOOTP unsuccessfull. Effort was given up after 2 minutes.	Set up a properly working DHCP or BOOTP server or assign the IP address manually.
B605	2	Ethernet FDR: Unconfigured error detected Parameter *_SigLatched* Bit 21	-	-
B606	2	Ethernet FDR: Irrecoverable error detected Parameter *_SigLatched* Bit 21	-	-
B607	2	Ethernet: I/O data idle Parameter *_SigLatched* Bit 21	Controller has been stopped, but I/O data keeps being transmitted.	Disable power stage of connected drives before stopping the controller.
B610	2	EtherCAT: Fieldbus watchdog. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 21	EtherCAT frames are lost, for example, due to inoperative cables or errors caused by the master.	Verify correct cabling and shield connection. Verify diagnostics info of EtherCAT master.
B611	2	EtherCAT: Invalid I/O data. Additional information in the error memory indicates the Modbus address. Parameter *_SigLatched* Bit 21	Incorrect input data or output data (such as object length, object type)	Verify correct PDO configuration (length, objects, etc.).
B612	2	EtherCAT: Link lost at input and output port Parameter *_SigLatched* Bit 21	EtherCAT cable. Link to connected devices lost.	Verify link LEDs. Verify cables and that the devices connected to input port and output port operate. Use EtherCAT master diagnostics for further troubleshooting.
B613	2	Ethernet: Ethernet carrier port 2 not available Parameter *_SigLatched* Bit 21	-	-

Error code (hex)	Error class	Description	Cause	Correctives
B614	1	EtherCAT: General error detected. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 21	-	-
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.
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.
B703	0	Drive Profile Lexium: Write request with incorrect data type.	-	-

Parameters

Representation of the Parameters

Description

This section provides an overview of the parameters which can be used for operating the drive.

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.

Decimal Numbers Entered via the Fieldbus

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

List of the Parameters Sorted by Parameter Name

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: Modbus TCP	- - - -	UINT16 R/- - -	CANopen 3001:C_h Modbus 280 EtherCAT 3001:C_h
_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 EtherCAT 301C:4_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 302F:C_h
_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 EtherCAT 302F:7_h
_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 EtherCAT 302F:8_h
_AT_progress	Progress of Autotuning.	% 0 0 100	UINT16 R/- - -	CANopen 302F:B_h Modbus 12054 EtherCAT 302F:B_h
_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 EtherCAT 302F:2_h
_Cap1CntFall	Capture input 1 event counter at falling edges (DS402). 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 EtherCAT 300A:$2C_h$
_Cap1CntRise	Capture input 1 event counter at rising edges (DS402). 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 EtherCAT 300A:$2B_h$
_Cap1Count	Capture input 1 event counter (one-time). Counts the capture events. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	CANopen 300A:8_h Modbus 2576 EtherCAT 300A:8_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap1CountCons	Capture input 1 event counter (continuous). 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 EtherCAT 300A:17$_h$
_Cap1Pos	Capture input 1 captured position (one-time). 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 EtherCAT 300A:6$_h$
_Cap1PosCons	Capture input 1 captured position (continuous). 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 EtherCAT 300A:18$_h$
_Cap1PosFallEdge	Capture input 1 captured position at falling edge (DS402). 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 EtherCAT 60BB:0$_h$
_Cap1PosRisEdge	Capture input 1 captured position at rising edge (DS402). 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 EtherCAT 60BA:0$_h$
_Cap2CntFall	Capture input 2 event counter at falling edges (DS402). 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 EtherCAT 300A:2E$_h$
_Cap2CntRise	Capture input 2 event counter at rising edges (DS402). 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 EtherCAT 300A:2D$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap2Count	Capture input 2 event counter (one-time). Counts the capture events. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	CANopen 300A:9h Modbus 2578 EtherCAT 300A:9h
_Cap2CountCons	Capture input 2 event counter (continuous). 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:19h Modbus 2610 EtherCAT 300A:19h
_Cap2Pos	Capture input 2 captured position (one-time). 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:7h Modbus 2574 EtherCAT 300A:7h
_Cap2PosCons	Capture input 2 captured position (continuous). 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:1Ah Modbus 2612 EtherCAT 300A:1Ah
_Cap2PosFallEdge	Capture input 2 captured position at falling edge (DS402). 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:0h Modbus 2640 EtherCAT 60BD:0h
_Cap2PosRisEdge	Capture input 2 captured position at rising edge (DS402). 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:0h Modbus 2638 EtherCAT 60BC:0h
_CapEventCounters	Capture inputs 1 and 2 summary of event counters (DS402). 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:2Fh Modbus 2654 EtherCAT 300A:2Fh

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 EtherCAT 300A:1$_h$
_CommutCntAct	Actual value of commutation monitoring counter.	- - - -	INT16 R/- - -	CANopen 303F:62$_h$ Modbus 16324 EtherCAT 303F:62$_h$
_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 EtherCAT 301C:26$_h$
_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 EtherCAT 3011:17$_h$
_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.	V/A 0.5 - 1270.0	UINT16 R/- per. -	CANopen 3011:1$_h$ Modbus 4354 EtherCAT 3011:1$_h$
_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.	V/A 0.5 - 1270.0	UINT16 R/- per. -	CANopen 3011:3$_h$ Modbus 4358 EtherCAT 3011:3$_h$
_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.	ms 0.13 - 327.67	UINT16 R/- per. -	CANopen 3011:2$_h$ Modbus 4356 EtherCAT 3011:2$_h$
_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.	ms 0.13 - 327.67	UINT16 R/- per. -	CANopen 3011:4$_h$ Modbus 4360 EtherCAT 3011:4$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301B:1B$_h$
_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 EtherCAT 301B:1D$_h$
_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 0 10	INT16* R/- - -	CANopen 6061:0$_h$ Modbus 6920 EtherCAT 6061:0$_h$

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 EtherCAT 6041:0$_h$
_DEV_T_current	Temperature of device.	°C - - -	INT16 R/- - -	CANopen 301C:12$_h$ Modbus 7204 EtherCAT 301C:12$_h$
_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 EtherCAT 3002:2D$_h$
_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.	- 0 0 12	UINT16 R/- - -	CANopen 301B:5$_h$ Modbus 6922 EtherCAT 301B:5$_h$
_DPL_driveInput	Drive Profile Lexium driveInput.	- - - -	UINT16 R/- - -	CANopen 301B:28$_h$ Modbus 6992 EtherCAT 301B:28$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DPL_driveStat	Drive Profile Lexium driveStat.	- - - -	UINT16 R/- - -	CANopen 301B:25$_h$ Modbus 6986 EtherCAT 301B:25$_h$
_DPL_mfStat	Drive Profile Lexium mfStat.	- - - -	UINT16 R/- - -	CANopen 301B:26$_h$ Modbus 6988 EtherCAT 301B:26$_h$
_DPL_motionStat	Drive Profile Lexium motionStat.	- - - -	UINT16 R/- - -	CANopen 301B:27$_h$ Modbus 6990 EtherCAT 301B:27$_h$
_ECAT_DIPswitches	EtherCAT Identification value set via DIP switches.	- 0 0 65535	UINT16 R/- - -	CANopen 3045:B$_h$ Modbus 17686 EtherCAT 3045:B$_h$
_ECAT_Identification	Set value of the EtherCAT Identification.	- 0 0 65535	UINT16 R/- - -	CANopen 3045:C$_h$ Modbus 17688 EtherCAT 3045:C$_h$
_ECATaddress	EtherCAT address used. EtherCAT slave address set by the master.	- - 1 -	UINT16 R/- - -	CANopen 3045:7$_h$ Modbus 17678 EtherCAT 3045:7$_h$
_ECATslavestate	EtherCAT slave state. **1 / Init**: Init **2 / PreOp**: Pre-Operational **3 / Boot**: Bootstrap **4 / SafeOp**: Safe-Operational **8 / Op**: Operational	- - 1 -	UINT16 R/- - -	CANopen 3045:2$_h$ Modbus 17668 EtherCAT 3045:2$_h$
_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 EtherCAT 303F:60$_h$
_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 EtherCAT 303F:5E$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 303F:5F$_h$
_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 EtherCAT 303F:5D$_h$
_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 EtherCAT 303C:2$_h$
_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 EtherCAT 303C:7$_h$
_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 EtherCAT 303C:5$_h$
_ERR_enable_time	Time between enabling of power stage and detection of the error.	s - - -	UINT16 R/- - -	CANopen 303C:6$_h$ Modbus 15372 EtherCAT 303C:6$_h$
_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 EtherCAT 303C:9$_h$
_ERR_motor_v	Motor velocity at the time the error was detected.	usr_v - - -	INT32 R/- - -	CANopen 303C:8$_h$ Modbus 15376 EtherCAT 303C:8$_h$
_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 EtherCAT 303C:1$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ERR_powerOn	Number of power on cycles.	- 0 - 4294967295	UINT32 R/- - -	CANopen 303B:2_h Modbus 15108 EtherCAT 303B:2_h
_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 EtherCAT 303C:4_h
_ERR_temp_dev	Temperature of device at the time the error was detected.	°C - - -	INT16 R/- - -	CANopen 303C:B_h Modbus 15382 EtherCAT 303C:B_h
_ERR_temp_ps	Temperature of power stage at the time the error was detected.	°C - - -	INT16 R/- - -	CANopen 303C:A_h Modbus 15380 EtherCAT 303C:A_h
_ERR_time	Time of detection of error. With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	CANopen 303C:3_h Modbus 15366 EtherCAT 303C:3_h
_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 EtherCAT 3040:43_h
_fwNoSlot3	Firmware number of slot 3. Example: PR0912.00 The value is provided as a decimal value: 91200. If no module is installed, the value 0 is returned.	- - - -	UINT32 R/- - -	CANopen 3002:21_h Modbus 578 EtherCAT 3002:21_h
_fwRevSlot3	Firmware revision of slot 3. The version format is XX.YY.ZZ. Part XX.YY is contained in parameter *_fwVerSlot3*. Part ZZ is used for quality evolution and contained in this parameter. If no module is installed, the value 0 is returned. Example: V01.23.45 The value is provided as a decimal value: 45	- - - -	UINT16 R/- - -	CANopen 3002:23_h Modbus 582 EtherCAT 3002:23_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_fwVersSlot3	Firmware version of slot 3. The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter *_fwRevSlot3*. If no module is installed, the value 0 is returned. Example: V01.23.45 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	CANopen 3002:22$_h$ Modbus 580 EtherCAT 3002:22$_h$
_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 EtherCAT 3028:C$_h$
_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 EtherCAT 3028:F$_h$
_hwVersCPU	Hardware version of control board.	- - - -	UINT16 R/- - -	CANopen 3002:12$_h$ Modbus 548 EtherCAT 3002:12$_h$
_hwVersPS	Hardware version of power stage.	- - - -	UINT16 R/- - -	CANopen 3002:14$_h$ Modbus 552 EtherCAT 3002:14$_h$
_hwVersSlot3	Hardware version of module in slot 3.	- - - -	UINT16 R/- - -	CANopen 3002:20$_h$ Modbus 576 EtherCAT 3002:20$_h$
_I_act	Total motor current. In increments of 0.01 A_{rms}.	A_{rms} - - -	INT16 R/- - -	CANopen 301E:3$_h$ Modbus 7686 EtherCAT 301E:3$_h$
_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 EtherCAT 301E:2$_h$
_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 EtherCAT 301E:11$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301C:28_h
_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 EtherCAT 301C:27_h
_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 EtherCAT 301C:6_h
_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 EtherCAT 3008:1_h
_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 EtherCAT 3008:F_h
_IO_DQ_act	Status of digital outputs. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	CANopen 3008:10_h Modbus 2080 EtherCAT 3008:10_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 3008:26$_h$
_IOdataMtoS01	I/O parameter data Master to Slave - parameter 01. Data of the cyclic communication between the master and slave. This parameter contains the data of the first parameter mapped from the master to the slave. The parameters _IOdataMtoS02 to _IOdataMtoS16 contain the data of the remaining mapped parameters.	- 0 FFFFFFFFhex 4294967295	UINT32 R/- - -	CANopen 3040:1$_h$ Modbus 16386 EtherCAT 3040:1$_h$
_IOdataStoM01	I/O parameter data Slave to Master - parameter 01. Data of the cyclic communication between the master and slave. This parameter contains the data of the first parameter mapped from the slave to the master. The parameters _IOdataStoM02 to _IOdataStoM16 contain the data of the remaining mapped parameters.	- 0 FFFFFFFFhex 4294967295	UINT32 R/- - -	CANopen 3040:21$_h$ Modbus 16450 EtherCAT 3040:21$_h$
_IOmappingMtoS01	I/O parameter mapping Master to Slave - parameter 01. Mapping of the cyclic communication between the master and slave. This parameter contains the mapping of the first parameter mapped from the master to the slave. The parameters _IOmappingMtoS02 to _IOmappingMtoS16 contain the mapping of the remaining mapped parameters.	- 0 FFFFhex 65535	UINT16 R/- - -	CANopen 3040:11$_h$ Modbus 16418 EtherCAT 3040:11$_h$
_IOmappingStoM01	I/O parameter mapping Slave to Master - parameter 01. Mapping of the cyclic communication between the master and slave. This parameter contains the mapping of the first parameter mapped from the slave to the master. The parameters _IOmappingStoM02 to _IOmappingStoM16 contain the mapping of the remaining mapped parameters.	- 0 FFFFhex 65535	UINT16 R/- - -	CANopen 3040:31$_h$ Modbus 16482 EtherCAT 3040:31$_h$
_IPAddressAct1	Currently used IP address, byte 1. Byte 1 (x.0.0.0) of the IP address. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:4$_h$ Modbus 15880 EtherCAT 303E:4$_h$
_IPAddressAct2	Currently used IP address, byte 2. Byte 2 (0.x.0.0) of the IP address. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:5$_h$ Modbus 15882 EtherCAT 303E:5$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_IPAddressAct3	Currently used IP address, byte 3. Byte 3 (0.0.x.0) of the IP address. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:6_h Modbus 15884 EtherCAT 303E:6_h
_IPAddressAct4	Currently used IP address, byte 4. Byte 4 (0.0.0.x) of the IP address. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:7_h Modbus 15886 EtherCAT 303E:7_h
_IPgateAct1	Currently used IP address gateway, byte 1. Byte 1 (x.0.0.0) of the IP address of the gateway. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:C_h Modbus 15896 EtherCAT 303E:C_h
_IPgateAct2	Currently used IP address gateway, byte 2. Byte 2 (0.x.0.0) of the IP address of the gateway. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:D_h Modbus 15898 EtherCAT 303E:D_h
_IPgateAct3	Currently used IP address gateway, byte 3. Byte 3 (0.0.x.0) of the IP address of the gateway. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:E_h Modbus 15900 EtherCAT 303E:E_h
_IPgateAct4	Currently used IP address gateway, byte 4. Byte 4 (0.0.0.x) of the IP address of the gateway. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:F_h Modbus 15902 EtherCAT 303E:F_h
_IPmaskAct1	Currently used IP address subnet mask, byte 1. Byte 1 (x.0.0.0) of the IP address of the subnet mask. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:8_h Modbus 15888 EtherCAT 303E:8_h
_IPmaskAct2	Currently used IP address subnet mask, byte 2. Byte 2 (0.x.0.0) of the IP address of the subnet mask. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:9_h Modbus 15890 EtherCAT 303E:9_h
_IPmaskAct3	Currently used IP address subnet mask, byte 3. Byte 3 (0.0.x.0) of the IP address of the subnet mask. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:A_h Modbus 15892 EtherCAT 303E:A_h
_IPmaskAct4	Currently used IP address subnet mask, byte 4. Byte 4 (0.0.0.x) of the IP address of the subnet mask. Available with firmware version ≥V01.08.	- 0 0 255	UINT16 R/- - -	CANopen 303E:B_h Modbus 15894 EtherCAT 303E:B_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301E:1_h
_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 EtherCAT 301E:10_h
_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 EtherCAT 603F:0_h
_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 EtherCAT 301C:$1F_h$
_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 EtherCAT 301C:9_h
_M_BRK_T_apply	Holding brake application time.	ms - - -	UINT16 R/- - -	CANopen 300D:21_h Modbus 3394 EtherCAT 300D:21_h
_M_BRK_T_release	Holding brake release time.	ms - - -	UINT16 R/- - -	CANopen 300D:22_h Modbus 3396 EtherCAT 300D:22_h
_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 EtherCAT 301C:$2B_h$
_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 EtherCAT 301C:$2C_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 300D:3_h
_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 EtherCAT 300D:20_h
_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 EtherCAT 300D:13_h
_M_I_max	Maximum current of motor. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 300D:6_h Modbus 3340 EtherCAT 300D:6_h
_M_I_nom	Nominal current of motor. In increments of 0.01 A_{rms}.	A_{rms} - - -	UINT16 R/- - -	CANopen 300D:7_h Modbus 3342 EtherCAT 300D:7_h
_M_I2t	Maximum permissible time for maximum current of motor.	ms - - -	UINT16 R/- - -	CANopen 300D:11_h Modbus 3362 EtherCAT 300D:11_h
_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 EtherCAT 300D:C_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_M_kE	Voltage constant kE of motor. Voltage constant in Vrms at 1000 RPM. Units: Rotary motors: Vrms/RPM Linear motors: Vrms/(m/s) In increments of 0.1 motor_u.	motor_u - - -	UINT32 R/- - -	CANopen 300D:B_h Modbus 3350 EtherCAT 300D:B_h
_M_L_d	Inductance d component of motor. In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	CANopen 300D:F_h Modbus 3358 EtherCAT 300D:F_h
_M_L_q	Inductance q component of motor. In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	CANopen 300D:E_h Modbus 3356 EtherCAT 300D:E_h
_M_load	Load of motor.	% - - -	INT16 R/- - -	CANopen 301C:$1A_h$ Modbus 7220 EtherCAT 301C:$1A_h$
_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 EtherCAT 300D:16_h
_M_M_max	Maximum torque of motor. In increments of 0.1 Nm.	Nm - - -	UINT16 R/- - -	CANopen 300D:9_h Modbus 3346 EtherCAT 300D:9_h
_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 EtherCAT 300D:8_h
_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 EtherCAT 301C:$1B_h$
_M_n_max	Maximum permissible speed of rotation/velocity of motor. Units: Rotary motors: RPM Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	CANopen 300D:4_h Modbus 3336 EtherCAT 300D:4_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_M_n_nom	Nominal speed of rotation/velocity of motor. Units: Rotary motors: RPM Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	CANopen 300D:5_h Modbus 3338 EtherCAT 300D:5_h
_M_overload	Overload of motor (I2t).	% - - -	INT16 R/- - -	CANopen 301C:19_h Modbus 7218 EtherCAT 301C:19_h
_M_Polepair	Number of pole pairs of motor.	- - - -	UINT16 R/- - -	CANopen 300D:14_h Modbus 3368 EtherCAT 300D:14_h
_M_PolePairPitch	Pole pair pitch of motor. In increments of 0.01 mm.	mm - - -	UINT16 R/- - -	CANopen 300D:23_h Modbus 3398 EtherCAT 300D:23_h
_M_R_UV	Winding resistance of motor. In increments of 0.01 Ω.	Ω - - -	UINT16 R/- - -	CANopen 300D:D_h Modbus 3354 EtherCAT 300D:D_h
_M_T_max	Maximum temperature of motor.	°C - - -	INT16 R/- - -	CANopen 300D:10_h Modbus 3360 EtherCAT 300D:10_h
_M_Type	Motor type. Value 0: No motor selected Value >0: Connected motor type	- - - -	UINT32 R/- - -	CANopen 300D:2_h Modbus 3332 EtherCAT 300D:2_h
_M_U_max	Maximum voltage of motor. In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 300D:19_h Modbus 3378 EtherCAT 300D:19_h
_M_U_nom	Nominal voltage of motor. In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 300D:A_h Modbus 3348 EtherCAT 300D:A_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301B:19$_h$
_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 EtherCAT 301B:1C$_h$
_ModuleSlot3	Module in slot 3. **0 / None**: No module **513 / CANopen (D-SUB)**: Fieldbus CANopen (D-SUB) **514 / CANopen (RJ45)**: Fieldbus CANopen (RJ45) **515 / DeviceNet (Open-Style)**: Fieldbus DeviceNet (Open-Style) **517 / CANopen (Open-Style)**: Fieldbus CANopen (Open-Style) **528 / ProfibusDP**: Fieldbus Profibus DP **529 / EtherNetIP**: Fieldbus EtherNetIP **530 / EtherCAT**: Fieldbus EtherCAT **531 / SercosII**: Fieldbus Sercos II **533 / SercosIII**: Fieldbus Sercos III	- - - -	UINT16 R/- - -	CANopen 3002:1F$_h$ Modbus 574 EtherCAT 3002:1F$_h$
_MSM_avail_ds	Number of available data sets. Number of data sets that are available. Available with firmware version ≥V01.08.	- - - -	UINT16 R/- - -	CANopen 302D:F$_h$ Modbus 11550 EtherCAT 302D:F$_h$

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 Available with firmware version ≥V01.08.	- -1 -1 11	INT16 R/- - -	CANopen 302D:E_h Modbus 11548 EtherCAT 302D:E_h
_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. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:D_h Modbus 11546 EtherCAT 302D:D_h
_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. Available with firmware version ≥V01.08.	- - - -	UINT16 R/- - -	CANopen 302D:$1F_h$ Modbus 11582 EtherCAT 302D:$1F_h$
_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 Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:6_h Modbus 11532 EtherCAT 302D:6_h
_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 Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:7_h Modbus 11534 EtherCAT 302D:7_h
_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. Available with firmware version ≥V01.08.	- -1 -1 127	INT16 R/- - -	CANopen 302D:B_h Modbus 11542 EtherCAT 302D:B_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_n_act	Actual speed of rotation.	RPM - - -	INT16 R/- - -	CANopen 301E:8_h Modbus 7696 EtherCAT 301E:8_h
_n_act_ENC1	Actual speed of rotation of encoder 1.	RPM - - -	INT16 R/- - -	CANopen 301E:28_h Modbus 7760 EtherCAT 301E:28_h
_n_ref	Reference speed of rotation.	RPM - - -	INT16 R/- - -	CANopen 301E:7_h Modbus 7694 EtherCAT 301E:7_h
_OpHours	Operating hours counter.	s - - -	UINT32 R/- - -	CANopen 301C:A_h Modbus 7188 EtherCAT 301C:A_h
_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 EtherCAT 301E:F_h
_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 EtherCAT 301E:E_h
_p_act	Actual position.	usr_p - - -	INT32 R/- - -	CANopen 6064:0_h Modbus 7706 EtherCAT 6064:0_h
_p_act_ENC1	Actual position of encoder 1.	usr_p - - -	INT32 R/- - -	CANopen 301E:27_h Modbus 7758 EtherCAT 301E:27_h
_p_act_ENC1_int	Actual position of encoder 1 in internal units.	Inc - - -	INT32 R/- - -	CANopen 301E:26_h Modbus 7756 EtherCAT 301E:26_h
_p_act_int	Actual position in internal units.	Inc - - -	INT32 R/- - -	CANopen 6063:0_h Modbus 7700 EtherCAT 6063:0_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 60F4:0$_h$
_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 EtherCAT 301E:1C$_h$
_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 EtherCAT 301E:1B$_h$
_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 EtherCAT 301E:15$_h$
_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 EtherCAT 301E:16$_h$
_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 EtherCAT 301E:14$_h$
_p_ref	Reference position. Value corresponds to the reference position of the position controller.	usr_p - - -	INT32 R/- - -	CANopen 301E:C$_h$ Modbus 7704 EtherCAT 301E:C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301E:9_h
_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	- - - -	UINT32 R/- - -	CANopen 3004:16_h Modbus 1068 EtherCAT 3004:16_h
_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.	- 0 2 7	UINT16 R/- - -	CANopen 3004:15_h Modbus 1066 EtherCAT 3004:15_h
_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 EtherCAT 300B:1_h
_Power_act	Output power.	W - - -	INT32 R/- - -	CANopen 301C:D_h Modbus 7194 EtherCAT 301C:D_h
_Power_mean	Mean output power.	W - - -	UINT16 R/- - -	CANopen 301C:E_h Modbus 7196 EtherCAT 301C:E_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301F:9$_h$
_pref_v	Velocity of reference value for velocity feed-forward control.	usr_v - - -	INT32 R/- - -	CANopen 301F:7$_h$ Modbus 7950 EtherCAT 301F:7$_h$
_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 EtherCAT 3001:1$_h$
_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 EtherCAT 3001:33$_h$
_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 EtherCAT 3001:4$_h$
_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 EtherCAT 3001:36$_h$
_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 EtherCAT 3001:2$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 3001:34$_h$
_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 EtherCAT 3010:2$_h$
_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 EtherCAT 3010:1$_h$
_PS_load	Load of power stage.	% - - -	INT16 R/- - -	CANopen 301C:17$_h$ Modbus 7214 EtherCAT 301C:17$_h$
_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 EtherCAT 301C:18$_h$
_PS_overload	Overload of power stage.	% - - -	INT16 R/- - -	CANopen 301C:24$_h$ Modbus 7240 EtherCAT 301C:24$_h$
_PS_overload_cte	Overload of power stage (chip temperature).	% - - -	INT16 R/- - -	CANopen 301C:22$_h$ Modbus 7236 EtherCAT 301C:22$_h$
_PS_overload_I2t	Overload of power stage (I2t).	% - - -	INT16 R/- - -	CANopen 301C:16$_h$ Modbus 7212 EtherCAT 301C:16$_h$
_PS_overload_psq	Overload of power stage (power squared).	% - - -	INT16 R/- - -	CANopen 301C:23$_h$ Modbus 7238 EtherCAT 301C:23$_h$

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 EtherCAT 301C:10$_h$
_PS_T_max	Maximum temperature of power stage.	°C - - -	INT16 R/- per. -	CANopen 3010:7$_h$ Modbus 4110 EtherCAT 3010:7$_h$
_PS_T_warn	Advisory temperature limit of power stage (error class 0).	°C - - -	INT16 R/- per. -	CANopen 3010:6$_h$ Modbus 4108 EtherCAT 3010:6$_h$
_PS_U_maxDC	Maximum permissible DC bus voltage. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	CANopen 3010:3$_h$ Modbus 4102 EtherCAT 3010:3$_h$
_PS_U_minDC	Minimum permissible DC bus voltage. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	CANopen 3010:4$_h$ Modbus 4104 EtherCAT 3010:4$_h$
_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 EtherCAT 3010:A$_h$
_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 EtherCAT 301C:1E$_h$
_RAMP_p_act	Actual position of profile generator.	usr_p - - -	INT32 R/- - -	CANopen 301F:2$_h$ Modbus 7940 EtherCAT 301F:2$_h$
_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 EtherCAT 301F:1$_h$
_RAMP_v_act	Actual velocity of profile generator.	usr_v - - -	INT32 R/- - -	CANopen 606B:0$_h$ Modbus 7948 EtherCAT 606B:0$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_RAMP_v_target	Target velocity of profile generator.	usr_v - - -	INT32 R/- - -	CANopen 301F:5$_h$ Modbus 7946 EtherCAT 301F:5$_h$
_RES_load	Load of braking resistor. The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	CANopen 301C:14$_h$ Modbus 7208 EtherCAT 301C:14$_h$
_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 EtherCAT 301C:15$_h$
_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 EtherCAT 301C:13$_h$
_RESint_P	Nominal power of internal braking resistor.	W - - -	UINT16 R/- per. -	CANopen 3010:9$_h$ Modbus 4114 EtherCAT 3010:9$_h$
_RESint_R	Resistance value of internal braking resistor. In increments of 0.01 Ω.	Ω - - -	UINT16 R/- per. -	CANopen 3010:8$_h$ Modbus 4112 EtherCAT 3010:8$_h$
_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 EtherCAT 3023:12$_h$
_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 EtherCAT 3023:11$_h$
_ScalePOSmax	Maximum user-defined value for positions. This value depends on ScalePOSdenom and ScalePOSnum.	usr_p - - -	INT32 R/- - -	CANopen 301F:A$_h$ Modbus 7956 EtherCAT 301F:A$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 EtherCAT 301F:C_h
_ScaleVELmax	Maximum user-defined value for velocity. This value depends on ScaleVELdenom and ScaleVELnum.	usr_v - - -	INT32 R/- - -	CANopen 301F:B_h Modbus 7958 EtherCAT 301F:B_h
_SigActive	Status of monitoring signals. See _SigLatched for more details on the bit codes.	- - - -	UINT32 R/- - -	CANopen 301C:7_h Modbus 7182 EtherCAT 301C:7_h

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: Nonvolatile memory 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 EtherCAT 301C:8$_h$
_SuppDriveModes	Supported operating modes as per DSP402. Bit 0: Profile Position	- -	UINT32 R/-	CANopen 6502:0$_h$ Modbus 6952

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	Bit 2: Profile Velocity Bit 3: Profile Torque Bit 5: Homing Bit 16: Jog Bit 21: Manual Tuning Bit 23: Motion Sequence	- -	- -	EtherCAT 6502:0_h
_TouchProbeStat	Touch Probe status (DS402). Available with firmware version ≥V01.04.	- - - -	UINT16 R/- - -	CANopen 60B9:0_h Modbus 7030 EtherCAT 60B9:0_h
_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 EtherCAT 6077:0_h
_Ud_ref	Reference motor voltage d component. In increments of 0.1 V.	V - - -	INT16 R/- - -	CANopen 301E:5_h Modbus 7690 EtherCAT 301E:5_h
_UDC_act	Voltage at DC bus. In increments of 0.1 V.	V - - -	UINT16 R/- - -	CANopen 301C:F_h Modbus 7198 EtherCAT 301C:F_h
_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 EtherCAT 301E:6_h
_Uq_ref	Reference motor voltage q component. In increments of 0.1 V.	V - - -	INT16 R/- - -	CANopen 301E:4_h Modbus 7688 EtherCAT 301E:4_h
_v_act	Actual velocity.	usr_v - - -	INT32 R/- - -	CANopen 606C:0_h Modbus 7744 EtherCAT 606C:0_h
_v_act_ENC1	Actual velocity of encoder 1.	usr_v - - -	INT32 R/- - -	CANopen 301E:29_h Modbus 7762 EtherCAT 301E:29_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_v_dif_usr	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 EtherCAT 301E:2C$_h$
_v_ref	Reference velocity.	usr_v - - -	INT32 R/- - -	CANopen 301E:1F$_h$ Modbus 7742 EtherCAT 301E:1F$_h$
_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 EtherCAT 301C:29$_h$
_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 EtherCAT 301E:13$_h$
_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 EtherCAT 301C:B$_h$

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 EtherCAT 301C:C_h
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	- 0 1 1	UINT16 R/W per. -	CANopen 3006:16_h Modbus 1580 EtherCAT 3006:16_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	overtraveling of the movement range (ref_ok is set to 0 when the range is overtraveled). Modified settings become active immediately.			
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 EtherCAT 3001:E_h
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 EtherCAT 302F:4_h
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 EtherCAT 302F:3_h

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 EtherCAT 302F:12$_h$
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 EtherCAT 302F:E$_h$
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 EtherCAT 302F:6$_h$
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 EtherCAT 302F:1$_h$
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 EtherCAT 302F:13$_h$
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 EtherCAT 302F:9$_h$
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 EtherCAT 3006:41$_h$

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 EtherCAT 3006:42$_h$
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 EtherCAT 3006:44$_h$
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 EtherCAT 3005:8$_h$
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 EtherCAT 3005:7$_h$
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 EtherCAT 3008:A$_h$

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 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 EtherCAT 300A:4_h
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 EtherCAT 300A:2_h
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 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 EtherCAT 300A:5_h
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 EtherCAT 300A:3_h
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 EtherCAT 3011:$1C_h$

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 EtherCAT 3011:25$_h$
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 EtherCAT 3011:1A$_h$
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 EtherCAT 3011:1D$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3011:1B$_h$
CommutCntCred	Value for increased threshold for commutation monitoring. This parameter contains the value which is added to the threshold value for commutation monitoring. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.10.	- 0 0 1000	INT16 R/W per. expert	CANopen 3005:3E$_h$ Modbus 1404 EtherCAT 3005:3E$_h$
CommutCntMax	Maximum value the commutation monitoring counter has reached. This parameter contains the maximum value the commutation monitoring counter has reached since power on or reset. The maximum value can be reset by writing the value 0.	- - - -	INT16 R/W - expert	CANopen 303F:63$_h$ Modbus 16326 EtherCAT 303F:63$_h$
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 EtherCAT 3011:15$_h$

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 EtherCAT 3011:C_h
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 EtherCAT 3011:F_h
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 EtherCAT 3011:A_h
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 linearly: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUnref - CTRL_TAUiref - CTRL_KFPp Modified settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	CANopen 3011:14_h Modbus 4392 EtherCAT 3011:14_h

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 EtherCAT 3011:16$_h$
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 EtherCAT 3011:18$_h$
CTRL_SelParSet	Selection of control loop parameter set. Coding see parameter: CTRL_PwrUpParSet Modified settings become active immediately.	- 0 1 2	UINT16 R/W - -	CANopen 3011:19$_h$ Modbus 4402 EtherCAT 3011:19$_h$
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 EtherCAT 3011:26$_h$
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 EtherCAT 3011:9$_h$
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 EtherCAT 3011:8$_h$
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 EtherCAT 3011:10$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3011:22$_h$
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 EtherCAT 3011:23$_h$
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 EtherCAT 3011:24$_h$
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 EtherCAT 3011:6$_h$
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 EtherCAT 3011:5$_h$
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 EtherCAT 3012:6$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3012:10_h
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 EtherCAT 3012:1_h
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 EtherCAT 3012:3_h
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 EtherCAT 3012:A_h
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 EtherCAT 3012:8_h
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 EtherCAT 3012:9_h
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 EtherCAT 3012:D_h
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 EtherCAT 3012:B_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3012:C_h
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 EtherCAT 3012:E_h
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 EtherCAT 3012:F_h
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 EtherCAT 3012:5_h
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 EtherCAT 3012:4_h
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 EtherCAT 3012:2_h
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 EtherCAT 3013:6_h
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 EtherCAT 3013:10_h

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 EtherCAT 3013:1$_h$
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 EtherCAT 3013:3$_h$
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 EtherCAT 3013:A$_h$
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 EtherCAT 3013:8$_h$
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 EtherCAT 3013:9$_h$
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 EtherCAT 3013:D$_h$
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 EtherCAT 3013:B$_h$
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 EtherCAT 3013:C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3013:E_h
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 EtherCAT 3013:F_h
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 EtherCAT 3013:5_h
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 EtherCAT 3013:4_h
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 EtherCAT 3013:2_h
DCOMcontrol	DriveCom control word. See 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 EtherCAT 6040:0_h

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 EtherCAT 6060:0$_h$
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 EtherCAT 3005:1$_h$
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 EtherCAT 3008:20$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3008:21$_h$
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 EtherCAT 3008:22$_h$
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 EtherCAT 3008:23$_h$
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 EtherCAT 301B:8$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DPL_dmControl	Drive Profile Lexium dmControl.	- - - -	UINT16 R/W - -	CANopen 301B:1F$_h$ Modbus 6974 EtherCAT 301B:1F$_h$
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 EtherCAT 301B:35$_h$
DPL_RefA16	Drive Profile Lexium RefA16.	- - - -	INT16 R/W - -	CANopen 301B:22$_h$ Modbus 6980 EtherCAT 301B:22$_h$
DPL_RefB32	Drive Profile Lexium RefB32.	- - - -	INT32 R/W - -	CANopen 301B:21$_h$ Modbus 6978 EtherCAT 301B:21$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 301B:13_h
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 EtherCAT 301B:$1E_h$
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 EtherCAT 605B:0_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ECAT2ndaddress	Value for an EtherCAT Identification. Value for an EtherCAT "Identification" (also known as "Station Alias"), for example, for the EtherCAT function Hot Connect. Modified settings become active the next time the product is powered on.	- 0 0 65535	UINT16 R/W per. -	CANopen 3045:6$_h$ Modbus 17676 EtherCAT 3045:6$_h$
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 EtherCAT 3005:16$_h$
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 EtherCAT 303B:4$_h$
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 EtherCAT 303B:5$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 301B:6_h
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 EtherCAT 301B:7_h
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 EtherCAT 3005:A_h
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 EtherCAT 3005:22_h
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 EtherCAT 3005:B_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3005:3A$_h$
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 EtherCAT 3005:3C$_h$
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 EtherCAT 3028:7$_h$

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 negative direction 34: Index pulse positive direction 35: Position setting Abbreviations: REF+: Search movement in positive direction REF-: Search movement in negative 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 EtherCAT 6098:0$_h$
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 EtherCAT 3028:6$_h$

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 EtherCAT 3028:B_h
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 EtherCAT 301B:16_h
HMprefmethod	Preferred homing method. Modified settings become active immediately.	- 1 18 35	INT16 R/W per. -	CANopen 3028:A_h Modbus 10260 EtherCAT 3028:A_h
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 EtherCAT 3028:D_h
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 EtherCAT 6099:1_h
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 EtherCAT 6099:2_h
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 EtherCAT 3006:C_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3005:6$_h$
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 EtherCAT 3005:4$_h$
IO_DQ_set	Setting the digital outputs directly. Digital outputs can only be set directly if the signal output function has been set to 'Freely Available'. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/W - -	CANopen 3008:11$_h$ Modbus 2082 EtherCAT 3008:11$_h$
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 EtherCAT 3005:34$_h$
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 EtherCAT 3006:27$_h$
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 EtherCAT 3005:18$_h$
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 RPM. Modified settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	CANopen 3006:1E$_h$ Modbus 1596 EtherCAT 3006:1E$_h$

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 EtherCAT 3005:3$_h$
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	- - - -	UINT16 R/W per. -	CANopen 3007:1$_h$ Modbus 1794 EtherCAT 3007:1$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			
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	- - - -	UINT16 R/W per. -	CANopen 3007:2_h Modbus 1796 EtherCAT 3007:2_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			
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	- - - -	UINT16 R/W per. -	CANopen 3007:3_h Modbus 1798 EtherCAT 3007:3_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			
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	- - - -	UINT16 R/W per. -	CANopen 3007:4$_h$ Modbus 1800 EtherCAT 3007:4$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	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.			

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	Modified settings become active the next time the product is powered on.			
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 EtherCAT 3007:9_h

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 EtherCAT 3007:A_h
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.	- 1 2 2	UINT16 R/W per. -	CANopen 3008:28_h Modbus 2128 EtherCAT 3008:28_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
	Modified settings become active the next time the power stage is enabled. Available with firmware version ≥V01.06.			
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 EtherCAT 3006:F_h
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 EtherCAT 3006:10_h
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 EtherCAT 3006:E_h
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 EtherCAT 3006:6_h
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 EtherCAT 3008:27_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IP_IntTimInd	Interpolation time index. * Datatype for CANopen: INT8	- -128 -3 63	INT16* R/W - -	CANopen 60C2:2$_h$ Modbus 7002 EtherCAT 60C2:2$_h$
IP_IntTimPerVal	Interpolation time period value. * Datatype for CANopen: UINT8	s 0 1 255	UINT16* R/W - -	CANopen 60C2:1$_h$ Modbus 7000 EtherCAT 60C2:1$_h$
IPp_target	Position reference value for operating mode Interpolated Position.	- -2147483648 - 2147483647	INT32 R/W - -	CANopen 60C1:1$_h$ Modbus 7004 EtherCAT 60C1:1$_h$
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 EtherCAT 301B:9$_h$
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 EtherCAT 3029:3$_h$
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 EtherCAT 3029:7$_h$
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 EtherCAT 3029:8$_h$
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 EtherCAT 3029:5$_h$
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 EtherCAT 3029:4$_h$

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 Set the deceleration ramp with parameter RAMP_v_dec. Set the 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 EtherCAT 605D:0_h
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 EtherCAT 3011:E_h
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 EtherCAT 3011:D_h

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 EtherCAT 3006:18$_h$
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 EtherCAT 3016:4$_h$
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 EtherCAT 3016:3$_h$
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 EtherCAT 3006:3B$_h$
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 EtherCAT 3006:3C$_h$

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 EtherCAT 3006:38$_h$
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 EtherCAT 3006:3A$_h$
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 EtherCAT 3006:39$_h$
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 EtherCAT 3006:1D$_h$
MON_commutat	Commutation monitoring. **0 / Off**: Commutation monitoring off **1 / On**: Commutation monitoring on in operating states 6, 7 and 8 **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 EtherCAT 3005:5$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3004:1D$_h$
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 EtherCAT 303F:61$_h$
MON_GroundFault	Ground monitoring. **0 / Off**: Ground monitoring off **1 / On**: Ground 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 EtherCAT 3005:10$_h$
MON_HW_Limits	Temporary deactivation of hardware limit switches. **0 / None**: No limit switch deactivated **1 / Positive Limit Switch**: Deactivate positive limit switch **2 / Negative Limit Switch**: Deactivate negative limit switch **3 / Both Limit Switches**: Deactivate both limit switches With this parameter, a controller can temporarily deactivate hardware limit switches. This is useful if a homing procedure controlled by a controller is to use a limit switch as a reference switch without an error response of the drive. Modified settings become active immediately.	- 0 0 3	UINT16 R/W - -	CANopen 3006:11$_h$ Modbus 1570 EtherCAT 3006:11$_h$
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 EtherCAT 3006:1C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 303B:6_h
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 EtherCAT 303B:7_h
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 EtherCAT 303B:8_h
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 EtherCAT 303B:9_h
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 EtherCAT 3005:F_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_ MotOvLoadOvTemp	Motor overload and overtemperature monitoring. Value 0: Motor overload and overtemperature monitoring using thermal retention and speed sensitivity (as per IEC 61800-5-1:2007/ AMD1:2016) Value 1: Motor overload and overtemperature monitoring using the nominal stall torque of the motor, without thermal retention and speed sensitivity. Additional external measures may have to be implemented. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.10.	- 0 0 1	UINT16 R/W per. expert	CANopen 303F:68_h Modbus 16336 EtherCAT 303F:68_h
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 EtherCAT 6065:0_h
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 EtherCAT 3006:$3E_h$
MON_p_dif_warn	Advisory limit of the 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 EtherCAT 3006:29_h
MON_p_DiffWin	Monitoring of position deviation. The system verifies 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 EtherCAT 3006:19_h

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 verifies 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 EtherCAT 3006:3F$_h$
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 EtherCAT 6067:0$_h$
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 EtherCAT 3006:40$_h$
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 EtherCAT 6068:0$_h$
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 EtherCAT 3006:26$_h$

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 EtherCAT 3006:3$_h$
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 EtherCAT 3006:47$_h$
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 EtherCAT 607D:1$_h$
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 EtherCAT 607D:2$_h$
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 EtherCAT 3006:2D$_h$
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 EtherCAT 3006:2E$_h$

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 EtherCAT 3006:1A$_h$
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 EtherCAT 3006:1B$_h$
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 EtherCAT 606D:0$_h$
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 EtherCAT 606E:0$_h$
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 EtherCAT 3006:28$_h$
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 EtherCAT 3006:4B$_h$
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 EtherCAT 3006:4C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_ VelDiffOpSt578	Maximum load-dependent velocity deviation for operating states 5, 7 and 8. Maximum load-dependent velocity deviation for operating states 5 Switch On, 7 Quick Stop Active and 8 Fault Reaction Active. Value 0: Monitoring deactivated. Value >0: Maximum value. Monitoring is active if parameter *LIM_QStopReact* is set to "Deceleration Ramp (Fault)" or to "Deceleration ramp (Quick Stop)". 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 ≥V01.10.	usr_v 0 0 2147483647	UINT32 R/W per. -	CANopen 3006:48$_h$ Modbus 1680 EtherCAT 3006:48$_h$
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 EtherCAT 302D:21$_h$
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 EtherCAT 302D:8$_h$
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 EtherCAT 302D:10$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 302D:20_h
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 EtherCAT 302D:$1A_h$
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 EtherCAT 302D:12_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 302D:13_h
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 EtherCAT 302D:14_h
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 EtherCAT 302D:15_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 302D:17_h
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 EtherCAT 302D:18_h
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 EtherCAT 302D:$1C_h$
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 EtherCAT 302D:16_h
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 EtherCAT 302D:19_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 302D:1D$_h$
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 EtherCAT 302D:11$_h$
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 EtherCAT 301B:A$_h$

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 EtherCAT 302D:9_h
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 EtherCAT 302D:C_h
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 EtherCAT 302E:3_h
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 EtherCAT 302E:A_h

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 nonvolatile memory. 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 EtherCAT 3004:7$_h$
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 EtherCAT 3004:14$_h$
PAReeprSave	Save parameter values to the nonvolatile memory. Value 1: Save persistent parameters The currently set parameters are saved to the nonvolatile memory. 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 EtherCAT 3004:1$_h$
PARuserReset	Reset user parameters. **0 / No**: No **65535 / Yes**: Yes Bit 0: Reset persistent user parameters 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 nonvolatile memory. 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 EtherCAT 3004:8$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PDOmask	Deactivate receive PDO. Value 0: Activate receive PDO Value 1: Deactivate receive PDO Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	CANopen 3040:42$_h$ Modbus 16516 EtherCAT 3040:42$_h$
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 EtherCAT 300B:4$_h$
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 EtherCAT 300B:6$_h$
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 EtherCAT 300B:2$_h$
PosReg1ValueA	Comparison value A for position register channel 1.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:8$_h$ Modbus 2832 EtherCAT 300B:8$_h$
PosReg1ValueB	Comparison value B for position register channel 1.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:9$_h$ Modbus 2834 EtherCAT 300B:9$_h$

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 EtherCAT 300B:5_h
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 EtherCAT 300B:7_h
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 EtherCAT 300B:3_h
PosReg2ValueA	Comparison value A for position register channel 2.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:A_h Modbus 2836 EtherCAT 300B:A_h
PosReg2ValueB	Comparison value B for position register channel 2.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:B_h Modbus 2838 EtherCAT 300B:B_h

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 EtherCAT 300B:E_h
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 EtherCAT 300B:10_h
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 EtherCAT 300B:C_h
PosReg3ValueA	Comparison value A for position register channel 3.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:12_h Modbus 2852 EtherCAT 300B:12_h
PosReg3ValueB	Comparison value B for position register channel 3.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:13_h Modbus 2854 EtherCAT 300B:13_h

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 EtherCAT 300B:F_h
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 EtherCAT 300B:11_h
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 EtherCAT 300B:D_h
PosReg4ValueA	Comparison value A for position register channel 4.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:14_h Modbus 2856 EtherCAT 300B:14_h
PosReg4ValueB	Comparison value B for position register channel 4.	usr_p - 0 -	INT32 R/W per. -	CANopen 300B:15_h Modbus 2858 EtherCAT 300B:15_h

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 EtherCAT 300B:16_h
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 EtherCAT 3023:7_h
PP_OpmChgType	Change to operating mode Profile Position during movements. **0 / WithStandStill**: Change with standstill **1 / OnTheFly**: Change without standstill If Modulo is active, a transition to the operating mode Profile Position is performed with the setting WithStandStill, regardless of the setting of this parameter. 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 EtherCAT 3023:9_h

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 EtherCAT 60F2:0_h
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 EtherCAT 607A:0_h
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 EtherCAT 6081:0_h
PTtq_target	Target 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 EtherCAT 6071:0_h
PVv_target	Target 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 EtherCAT 60FF:0_h
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 EtherCAT 3006:2C$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 6087:0$_h$
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 EtherCAT 6083:0$_h$
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 EtherCAT 6084:0$_h$
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 EtherCAT 3006:2B$_h$

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 EtherCAT 3006:D_h
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 EtherCAT 607F:0_h
RAMP_v_sym	Acceleration and deceleration of the motion profile for velocity. The values are internally multiplied by 10 (example: 1 = 10 RPM/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 EtherCAT 3006:1_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 RPM/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 EtherCAT 3006:2_h
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 EtherCAT 3006:12_h
RESext_P	Nominal power of external braking resistor. The maximum value depends on the power stage. 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 -	UINT16 R/W per. -	CANopen 3005:12_h Modbus 1316 EtherCAT 3005:12_h
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 - 100.00 327.67	UINT16 R/W per. -	CANopen 3005:13_h Modbus 1318 EtherCAT 3005:13_h
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 EtherCAT 3005:11_h
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 EtherCAT 3005:9_h

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3006:49$_h$
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 EtherCAT 3023:C$_h$
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 EtherCAT 3023:10$_h$
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 EtherCAT 3023:D$_h$
RMAC_Response	Response if target position is overtraveled. **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 EtherCAT 3023:F$_h$
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 EtherCAT 3023:E$_h$
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 EtherCAT 3006:7$_h$

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 EtherCAT 3006:8$_h$
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 EtherCAT 3006:30$_h$
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 EtherCAT 3006:31$_h$
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 EtherCAT 3006:21$_h$
ScaleVELnum	Velocity scaling: Numerator. Specification of the scaling factor: Speed of rotation of motor [RPM] ---------- 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 EtherCAT 3006:22$_h$

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 EtherCAT 3005:21$_h$
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 EtherCAT 3005:23$_h$
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 EtherCAT 3022:5$_h$

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 EtherCAT 3022:6$_h$
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 EtherCAT 3022:4$_h$
TouchProbeFct	Touch Probe function (DS402). Modified settings become active immediately. Available with firmware version ≥V01.04.	- - - -	UINT16 R/W - -	CANopen 60B8:0$_h$ Modbus 7028 EtherCAT 60B8:0$_h$
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 EtherCAT 3001:43$_h$
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 EtherCAT 3001:44$_h$

Accessories and Spare Parts

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

Description	Reference
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7603R30
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7604R07
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7604R20
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7604R30
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 0.75 m (2.46 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7605R07
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 2 m (6.56 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7605R20
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 3 m (9.84 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7605R30
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 0.75 m (2.46 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7606R07
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 2 m (6.56 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7606R20
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm² (AWG 14), UL	VW3A7606R30
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7607R07
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7607R20
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm² (AWG 14)	VW3A7607R30

I/O Module with Industrial Connector for Positive Logic

Description	Reference
LXM32I Ethernet connection module with industrial connector, 4 digital inputs M8 (source), fieldbus M12, safety-related function STO	VW3M9106
LXM32I Ethernet connection module with industrial connector, 4 digital inputs M8 (source), fieldbus M12	VW3M9107
LXM32I Ethernet connection module with industrial connector, 2 digital inputs M8 (source), fieldbus M12, safety-related function STO	VW3M9108
LXM32I Ethernet connection module with industrial connector, 2 digital inputs M8 (source), fieldbus M12	VW3M9109
LXM32I Ethernet connection module with industrial connector, 4 digital inputs and 2 digital outputs M8 (source), fieldbus M12, safety-related function STO	VW3M9116
LXM32I Ethernet connection module with industrial connector, 4 digital inputs and 2 digital outputs M8 (source), fieldbus M12	VW3M9117

I/O Module with Industrial Connector for Negative Logic

Description	Reference
LXM32I Ethernet connection module with industrial connector, 4 digital inputs M8 (sink), fieldbus M12, safety-related function STO	VW3M9206
LXM32I Ethernet connection module with industrial connector, 4 digital inputs M8 (sink), fieldbus M12	VW3M9207
LXM32I Ethernet connection module with industrial connector, 2 digital inputs M8 (sink), fieldbus M12, safety-related function STO	VW3M9208
LXM32I Ethernet connection module with industrial connector, 2 digital inputs M8 (sink), fieldbus M12	VW3M9209

Description	Reference
LXM32I Ethernet connection module with industrial connector, 4 digital inputs and 2 digital outputs M8 (sink), fieldbus M12, safety-related function STO	VW3M9216
LXM32I Ethernet connection module with industrial connector, 4 digital inputs and 2 digital outputs M8 (sink), fieldbus M12	VW3M9217

I/O Module with Spring Terminals

Description	Reference
LXM32I Ethernet connection module with spring terminals (sink/source), 4 digital inputs, 2 digital outputs, safety-related function STO, 7 sealing caps	VW3M9110
Cable glands M8 for signals and safety-related function STO, 12 pieces	VW3M9508
Cable glands M12 for fieldbus, 10 pieces	VW3M9512

Cables for Safety-Related Function STO

Description	Reference
Pre-assembled cable for the safety-related 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-related 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-related 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-related 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-related 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-related 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-related 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-related 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-related 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-related function STO, 20 m (65.6 ft), 3 x 0.34 mm^2, industrial connector M8, female connector M8, shielded	VW3M94CR20

Industrial Connectors

Description	Reference
Connector kit for Ethernet, 2 x male industrial connector M12, 1 x sealing cap M12	VW3L5E000
Connector kit for I/O, 2 x industrial connector M8	VW3L50200
Connector kit for I/O, 3 x industrial connector M8	VW3L50300
Y-cable, DI/DO splitter cable, industrial connector M8, 1 x 6-pin to 2 x 3-pin, 2 pieces	VW3M9601

Description	Reference
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

Ethernet Cables with Connectors

Description	Reference
Ethernet ConneXium cable, 1 m (3.28 ft), M12 connector, M12 connector, straight	TCSECL1M1M1S2
Ethernet ConneXium cable, 10 m (32.8 ft), M12 connector, M12 connector, straight	TCSECL1M1M10S2
Ethernet ConneXium cable, 1 m (3.28 ft), M12 connector, RJ45 connector, straight	TCSECL1M3M1S2
Ethernet ConneXium cable, 3 m (9.84 ft), M12 connector, RJ45 connector, straight	TCSECL1M3M3S2
Ethernet ConneXium cable, 10 m (32.8 ft), M12 connector, RJ45 connector, straight	TCSECL1M3M10S2
Ethernet ConneXium cable, 25 m (82 ft), M12 connector, RJ45 connector, straight	TCSECL1M3M25S2
Ethernet ConneXium cable, 40 m (131 ft), M12 connector, RJ45 connector, straight	TCSECL1M3M40S2

Mains Reactors

Description	Reference
Mains reactor single-phase; 50-60 Hz; 7 A; 5 mH; IP00	VZ1L007UM50
Mains reactor single-phase; 50-60 Hz; 18 A; 2 mH; IP00	VZ1L018UM20
Mains reactor three-phase; 50-60 Hz; 4 A; 10 mH; IP00	VW3A4551
Mains reactor three-phase; 50-60 Hz; 10 A; 4 mH; IP00	VW3A4552

Service, Maintenance, and Disposal

Maintenance

Maintenance Plan

Inspect the product for pollution or damage at regular intervals.

Repairs may only be made by the manufacturer.

Prior to any type of work on the drive system, consult the sections 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 Holding Brake (Option), page 39 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 Bearing

When the 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-Related Function STO

The safety-related function STO is designed for a lifetime of 20 years. After this period, the data of the safety-related function STO 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-related function STO after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.20. (31 December 2020). This means: Do not use the safety-related function STO after December 31, 2040.

Replacing the Product

Description

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 Parameter Management, page 161.
- Power off all supply voltages. Verify that no voltages are present (safety instructions), see Product Related Information, page 13.
- 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 section Installation, page 78.
- 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 section Commissioning, page 114.

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 https://www.se.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.

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:

31.12.19 corresponds to December 31, 2019

31.12.2019 corresponds to December 31, 2019

DriveCom:

Specification of the DSP402 state machine was created in accordance with the DriveCom specification.

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 class :

Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.

Error:

Discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.

F

Factory settings:

Settings when the product is shipped.

Fault Reset:

Function used to exit the operating state Fault. Before the function is used, the cause of the detected error must be removed.

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).

H

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

Limit switch:

Switches that signal overtravel of the permissible range of travel.

M

Mapping:

Assignment of object dictionary entries to PDOs

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.

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