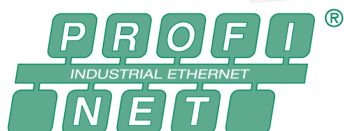
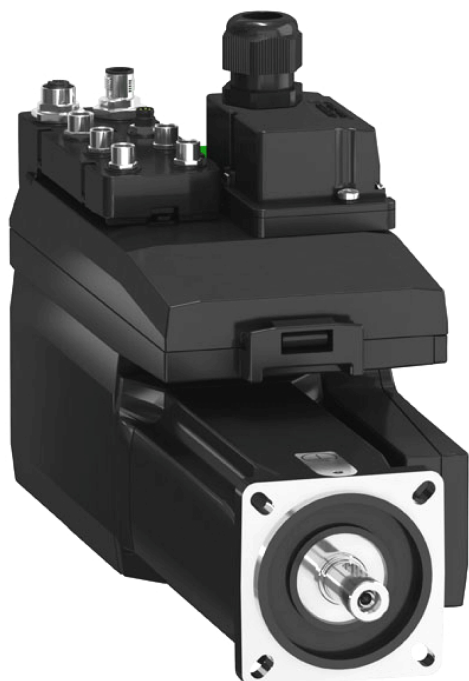


Lexium 32i ETH and BMi

Integrated Servo Drive System

User Guide

03/2020



The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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

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

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

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

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Important Information

NOTICE

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



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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

QUALIFICATION OF PERSONNEL

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

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

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

INTENDED USE

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

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

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


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

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

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

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 <ul style="list-style-type: none">• 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 be 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 (English version prevails):

- 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 actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.



At a Glance

Document Scope

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

Validity Note

This manual is valid for the standard products listed in the type code, see chapter Type Code (*see page 19*).

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

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

Step	Action
1	Go to the Schneider Electric home page www.schneider-electric.com .
2	In the Search box type the reference of a product or the name of a product range. <ul style="list-style-type: none">• Do not include blank spaces in the reference or product range.• To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the Product Datasheets search results and click on the reference that interests you. If you entered the name of a product range, go to the Product Ranges search results and click on the product range that interests you.
4	If more than one reference appears in the Products search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click Download XXX product datasheet .

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.

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.

Standard	Description
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.

Chapter 1

Introduction

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Device Overview	18
Type Code	19

Device Overview

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.

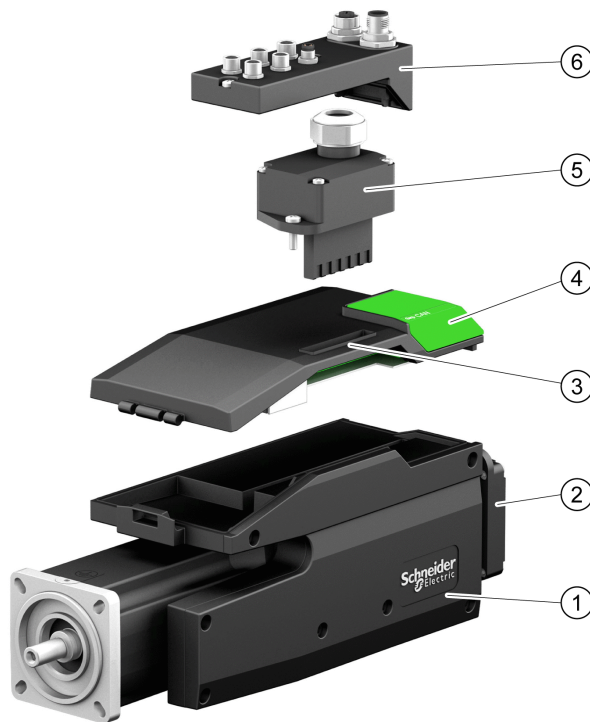
Overview of some of the features:

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

PROFINET is an Ethernet-based fieldbus which allows you to network products from different manufacturers without the need for special interface adaptation.

Servo Drive System

The product can comprise the following components:



- 1 BMi servomotor with integrated power stage
- 2 Standard braking resistor
- 3 LXM32i control unit for PROFINET fieldbus
- 4 Cover of commissioning interface
- 5 Connection module for mains supply
- 6 Connection module with spring terminals or industrial connector for fieldbus, inputs/outputs and safety function STO

For an overview of the available accessories see chapter Accessories and Spare Parts ([see page 467](#)).

Type Code

Type Code LXM32I

Item	1	2	3	4	5	6	7	8	9	10
Type code (example)	L	X	M	3	2	I	E	T	H	•

Item	Meaning
1 ... 3	Product family LXM = Lexium
4 ... 6	Product type 32I = Control unit for Lexium 32i
7 ... 9	Fieldbus interface ETH = Multi-Ethernet (PROFINET)
10	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 protection¹⁾ 0 = Smooth shaft; degree of protection: shaft IP54, housing IP65 1 = Parallel key; degree of protection: shaft IP54, housing IP65 2 = Smooth shaft; degree of protection: shaft and housing IP65 3 = Parallel key; degree of protection: shaft and housing IP65 S = Customized version
10	Encoder system 1 = Absolute singleturn 128 Sin/Cos periods per revolution (SKS36) 2 = Absolute multiturn 128 Sin/Cos periods per revolution (SKM36) 6 = Absolute singleturn 16 Sin/Cos periods per revolution (SEK37) 7 = Absolute multiturn 16 Sin/Cos periods per revolution (SEL37)
11	Holding brake A = Without holding brake F = With holding brake
1) In the case of mounting position IM V3 (drive shaft vertical, shaft end upward), the motor only has degree of protection IP 50.	

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

Designation Customized Version

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

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

Chapter 2

Technical Data

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Environmental Conditions	22
Dimensions	24
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Signals	28
Shaft-Specific Data	30
Motor-Specific Data	32
Holding Brake (Option)	37
Encoder	38
Braking Resistor	39
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Tightening Torque of Screws and Cable Glands	42
Non-Volatile Memory and Memory Card	43
Certifications	44
Conditions for UL 508C	45

Environmental Conditions

Conditions for Transportation and Storage

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

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

The following relative humidity is permissible during transportation and storage:

Relative humidity (non-condensing)	%	5 ... 80
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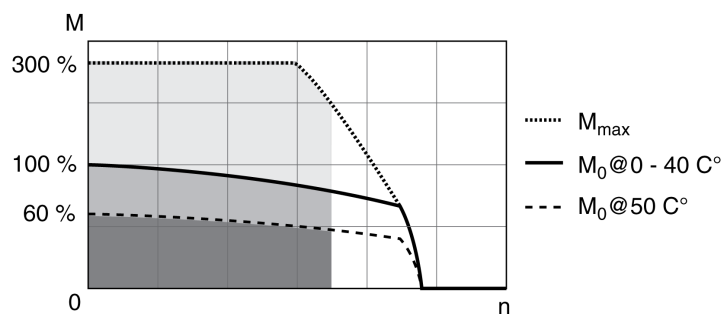
Vibration and shock during transportation and storage		As per IEC 60721-3-2, class 2M2
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Conditions for Operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and on the required power. Observe the pertinent instructions in the chapter Installation (*see page 95*).

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⁾ : <ul style="list-style-type: none"> Derating (torque) by 4% per Kelvin Maximum installation altitude 1000 m (3281 ft) above m.s.l. 	°C (°F)	41 ... 65 (105.8 ... 149)
(1) Usage as per UL 508C requires compliance with the information provided in chapter Conditions for UL 508C (<i>see page 45</i>).		

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



The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	%	5 ... 80
------------------------------------	---	----------

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

Installation altitude without derating	m (ft)	<1000 (<3281)
Installation altitude if all of the following conditions are met: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> ● 40 °C (104 °F) maximum ambient temperature ● Reduction of the continuous power by 1% per 100 m (328 ft) above 1000 m (3281 ft) ● Overvoltages of the supply mains limited to overvoltage category II as per IEC 60664-1 ● No IT mains 	m (ft)	2000 ... 3000 (6562 ... 9843)
Vibration and shock during operation		As per IEC 60721-3-3 Class 3M4

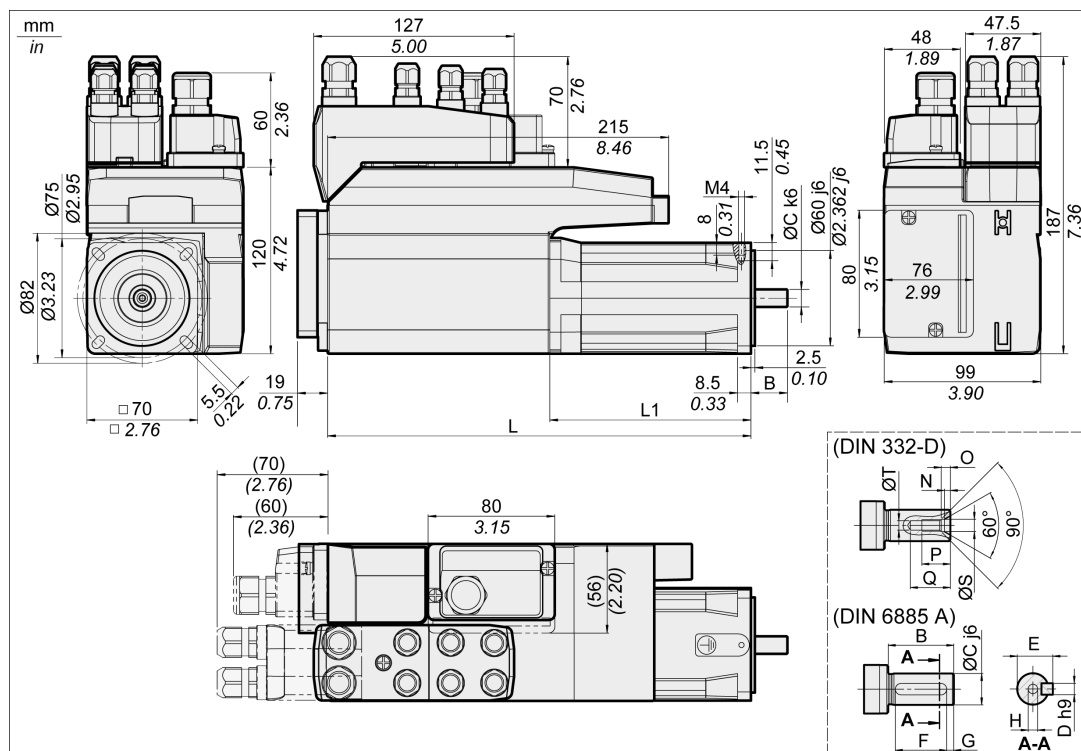
Degree of Protection

The requires all parts to be correctly mounted, see chapter Installation (*see page 95*), and the cover of the commissioning interface to be closed (IP as per IEC 60529):

Degree of Protection without shaft sealing ring	IP 54 ⁽¹⁾
Degree of protection with shaft sealing ring	IP 65 ⁽¹⁾⁽²⁾
<p>(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.</p> <p>(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.</p>	

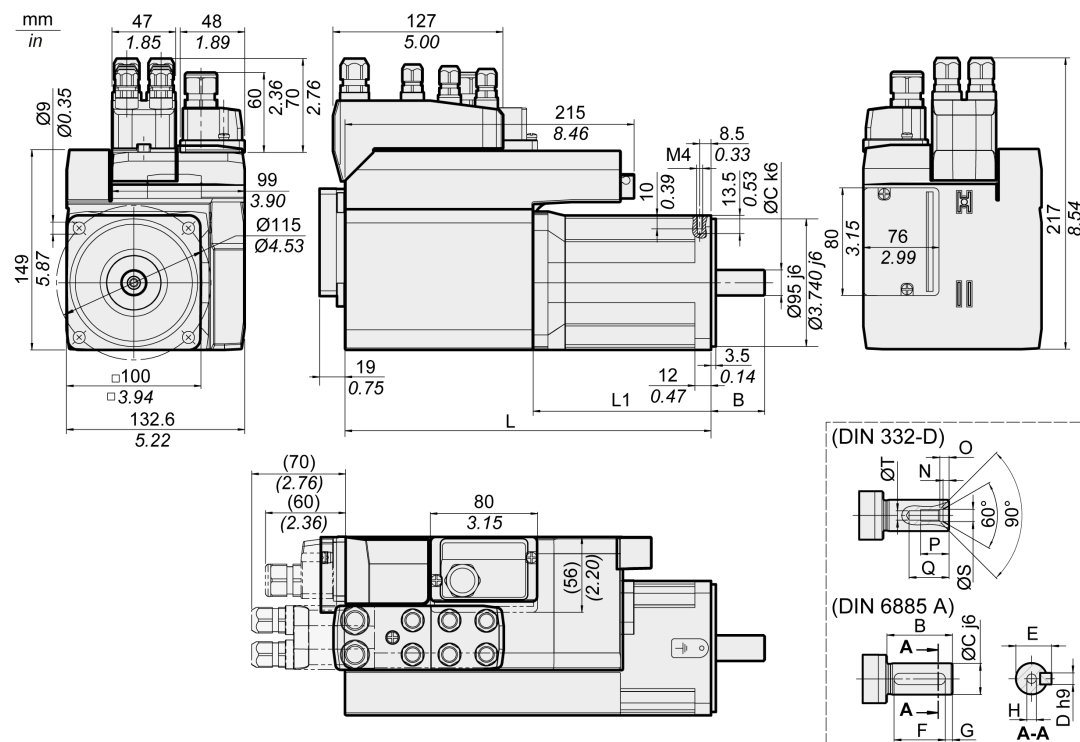
Dimensions

Dimensions BMI070



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

Dimensions BMI100



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

General Characteristics

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

Mains Voltage: Range and Tolerance

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

Transient overvoltages		Overvoltage category III ⁽¹⁾
Rated voltage to ground	Vac	300
(1) Depends on installation altitude, see chapter Environmental Conditions (see page 22).		

Type of Grounding

TT grounding system, TN grounding system	Permissible
IT mains	Permissible ⁽¹⁾
Mains with corner grounded system	Not permitted
(1) Depending on the installation altitude, see chapter Environmental Conditions (see page 22).	

Leakage Current

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

Harmonic Currents and Impedance

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

Monitoring the Continuous Output Current

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

PWM Frequency Power Stage

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

PWM frequency power stage	kHz	8
---------------------------	-----	---

Service Life

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

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

The following operating conditions significantly reduce the service life:

- Installation altitude >1000 m (3281 ft) above mean sea level
- Rotary movements exclusively within a fixed angle of <100°
- Operation under vibration load >20 m/s²
- Allowing sealing rings to run dry
- Contact of the seals with aggressive substances

Shaft Sealing Ring / Degree of Protection

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

Note the following:

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

Signals

Logic Type

Observe the information concerning the logic type in chapter Logic Type (*see page 57*).

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

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

Internal 24V Signal Power Supply

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

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

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

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

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

External 24 V Signal Power Supply

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

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

Digital Input Signals 24 V

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

Input voltage - positive logic	Vdc	-3 ... 5
Level 0	Vdc	15 ... 30
Level 1		
Input voltage - negative logic (at 24 Vdc)	Vdc	>19
Level 0	Vdc	<9
Level 1		
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)	µs	15
Falling edge (level 1 → 0)	µs	150
Jitter (capture inputs)	µs	<2
(1) Adjustable via parameter (sampling period 250µs)		
(2) If the capture inputs are used for capture then the debounce time is not applied.		

Digital Output Signals 24 V

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

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

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

Input Signals Safety Function STO

The inputs for the safety function STO (inputs `STO_A` and `STO_B`) can only be wired for positive logic. Observe the information provided in chapter Safety function STO ("Safe Torque Off") ([see page 69](#)).

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

Shaft-Specific Data

Overview

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

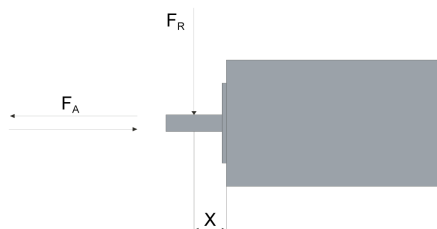
⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION DUE TO MECHANICAL DAMAGE TO THE MOTOR

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

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

Point of application of the forces:



Force for Pressing On

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

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

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

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

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

Shaft Load

The following conditions apply:

- The permissible force applied during pressing on must not be exceeded.
- 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 = $40\text{ }^{\circ}\text{C}$ ($104\text{ }^{\circ}\text{F}$)
- Peak torque = Duty types S3 - S8, 10% duty cycle
- Nominal torque = Duty type S1, 100% duty cycle

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

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

The following table shows the maximum radial shaft load F_R .

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

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

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

Motor-Specific Data

Data for Single-Phase Devices at 115 Vac

BMI...			0702	0703	1002
Winding			T	T	T
Continuous stall torque ⁽¹⁾	$M_0^{(2)}$	Nm	2.24	2.88	5.07
Peak torque	M_{\max}	Nm	4.84	6.3	12.39
Torque constant ⁽³⁾	k_t	Nm/A	0.67	0.87	0.91
Nominal speed of rotation	n_N	rpm	1900	1400	1400
Nominal torque	M_N	Nm	2.21	2.85	5.01
Nominal power ⁽⁴⁾	P_N	kW	0.44	0.418	0.735
Nominal motor current	I_N	A_{rms}	3.55	3.55	5.70
Maximum current motor	I_{\max}	A_{rms}	8.00	8.00	15.00
Technical data - electrical					
Input current at nominal power and nominal voltage		A_{rms}	6.99	6.99	12.88
Inrush current limitation		A	7.5	7.5	7.5
Maximum inrush current ⁽⁵⁾		A	146	146	209
Time for maximum inrush current		ms	1.12	1.12	1.52
Total harmonic distortion THD of the input current		%	150.58	150.58	134.52
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
<p>(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)² area, 10 mm (0.39 in) thickness, centered hole.</p> <p>(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%</p> <p>(3) At $n = 20$ rpm and maximum operating temperature</p> <p>(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA</p> <p>(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time</p> <p>(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C (see page 45) 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.</p>					

Data for Single-Phase Devices at 230 Vac

BMI...			0702	0703	1002
Winding			T	T	T
Continuous stall torque ⁽¹⁾	M ₀ ⁽²⁾	Nm	2.16	2.78	4.75
Peak torque	M _{max}	Nm	6.18	8.10	14.43
Torque constant ⁽³⁾	k _t	Nm/A	0.67	0.87	0.91
Nominal speed of rotation	n _N	rpm	4000	3100	3000
Nominal torque	M _N	Nm	1.74	2.25	3.99
Nominal power ⁽⁴⁾	P _N	kW	0.73	0.73	1.25
Nominal motor current	I _N	A _{rms}	2.83	2.82	4.59
Maximum current motor	I _{max}	A _{rms}	10.50	10.50	18.00
Technical data - electrical					
Input current at nominal power and nominal voltage		A _{rms}	6.12	6.12	11.19
Inrush current limitation		A	7.5	7.5	7.5
Maximum inrush current ⁽⁵⁾		A	201	201	274
Time for maximum inrush current		ms	1.66	1.66	2.24
Total harmonic distortion THD of the input current		%	157.75	157.75	137.82
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
<p>(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)² area, 10 mm (0.39 in) thickness, centered hole.</p> <p>(2) M₀ = 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%</p> <p>(3) At n = 20 rpm and maximum operating temperature</p> <p>(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA</p> <p>(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time</p> <p>(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C (see page 45) 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.</p>					

Data for Three-Phase Devices at 208 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque ⁽¹⁾	M ₀ ⁽²⁾	Nm	2.24	2.96	4.99	7.31
Peak torque	M _{max}	Nm	6.42	8.06	13.92	18.87
Torque constant ⁽³⁾	k _t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n _N	rpm	1800	1600	1900	1500
Nominal torque	M _N	Nm	2.21	2.93	4.91	7.22
Nominal power ⁽⁴⁾	P _N	kW	0.42	0.49	0.98	1.13
Nominal motor current	I _N	A _{rms}	1.95	2.1	3.90	4.30
Maximum current motor	I _{max}	A _{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A _{rms}	2.42	2.63	5.35	5.82
Inrush current limitation		A	7.5	7.5	7.5	7.5
Maximum inrush current ⁽⁵⁾		A	71	71	111	111
Time for maximum inrush current		ms	0.5	0.50	0.64	0.64
Total harmonic distortion THD of the input current		%	148.31	143.46	148.31	144.98
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
<p>(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)² area, 10 mm (0.39 in) thickness, centered hole.</p> <p>(2) M₀ = 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%</p> <p>(3) At n = 20 rpm and maximum operating temperature</p> <p>(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA</p> <p>(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time</p> <p>(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C (see page 45) 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.</p>						

Data for Three-Phase Devices at 400 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque ⁽¹⁾	M ₀ ⁽²⁾	Nm	2.07	2.82	4.48	6.55
Peak torque	M _{max}	Nm	6.42	8.06	13.92	18.87
Torque constant ⁽³⁾	k _t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n _N	rpm	3600	3300	3800	3000
Nominal torque	M _N	Nm	2.02	2.58	4.34	6.38
Nominal power ⁽⁴⁾	P _N	kW	0.76	0.89	1.73	2.01
Nominal motor current	I _N	A _{rms}	1.80	1.87	3.50	3.85
Maximum current motor	I _{max}	A _{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A _{rms}	2.68	2.94	5.74	6.25
Inrush current limitation		A	1.9	1.9	1.9	1.9
Maximum inrush current ⁽⁵⁾		A	126	126	196	196
Time for maximum inrush current		ms	0.68	0.68	0.96	0.96
Total harmonic distortion THD of the input current		%	174.67	170.87	156.79	154.80
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
<p>(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)² area, 10 mm (0.39 in) thickness, centered hole.</p> <p>(2) M₀ = 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%</p> <p>(3) At n = 20 rpm and maximum operating temperature</p> <p>(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA</p> <p>(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time</p> <p>(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C (see page 45) 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.</p>						

Data for Three-Phase Devices at 480 Vac

BMI...			0702	0703	1002	1003
Winding			P	P	P	P
Continuous stall torque ⁽¹⁾	M ₀ ⁽²⁾	Nm	2.07	2.68	4.16	6.04
Peak torque	M _{max}	Nm	6.42	8.06	13.92	18.87
Torque constant ⁽³⁾	k _t	Nm/A	1.24	1.52	1.32	1.79
Nominal speed of rotation	n _N	rpm	4400	3800	4700	3600
Nominal torque	M _N	Nm	2.01	2.35	4.00	5.57
Nominal power ⁽⁴⁾	P _N	kW	0.93	0.94	1.69	2.10
Nominal motor current	I _N	A _{rms}	1.80	1.71	3.25	3.55
Maximum current motor	I _{max}	A _{rms}	6.00	6.00	12.00	12.00
Technical data - electrical						
Input current at nominal power and nominal voltage		A _{rms}	2.23	2.46	4.80	5.23
Inrush current limitation		A	1.9	1.9	1.9	1.9
Maximum inrush current ⁽⁵⁾		A	193	193	296	296
Time for maximum inrush current		ms	0.70	0.70	0.96	0.96
Total harmonic distortion THD of the input current		%	177.00	174.33	157.66	156.11
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
<p>(1) Conditions for performance data: Mounted to steel plate (2.5 x flange size)² area, 10 mm (0.39 in) thickness, centered hole.</p> <p>(2) M₀ = 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%</p> <p>(3) At n = 20 rpm and maximum operating temperature</p> <p>(4) At a mains impedance corresponding to a short-circuit current of the supply mains of 1 kA</p> <p>(5) Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time</p> <p>(6) Fuses: Circuit breakers with B or C characteristic; see chapter Conditions for UL 508C (see page 45) 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.</p>						

Holding Brake (Option)

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

WARNING

UNINTENDED AXIS MOVEMENT

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

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

BMI...		070	1002	1003
Holding torque ⁽¹⁾	Nm	3.0	5.5	9
Opening time	ms	80	70	90
Coupling time	ms	17	30	40
Maximum speed of rotation during braking of moving loads	rpm	3000	3000	3000
Maximum number of decelerations during braking of moving loads and 3000 rpm		500	500	500
Maximum number of decelerations during braking of moving loads per hour at even distribution		20	20	20
Maximum kinetic energy that can be transformed into heat per deceleration during braking of moving loads	J	130	150	150
(1) The holding brake is broken-in at the factory. If the holding brake is not used for an extended period of time, parts of the holding brake may corrode. Corrosion reduces the holding torque.				

Encoder

SKS36 Singleturn

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

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measuring range absolute	1 revolution
Accuracy of digital absolute value	$\pm 0.0889^\circ$
Accuracy of the incremental position	$\pm 0.0222^\circ$
Maximum angular acceleration	200000 rad/s ²

SKM36 Multiturn

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

Resolution in increments	Depending on evaluation
Resolution per revolution	128 sin/cos periods
Measuring range absolute	4096 revolutions
Accuracy of digital absolute value	$\pm 0.0889^\circ$
Accuracy of the incremental position	$\pm 0.0222^\circ$
Maximum angular acceleration	200000 rad/s ²

SEK37 Singleturn

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

Resolution in increments	Depending on evaluation
Resolution per revolution	16 sin/cos periods
Measuring range absolute	1 revolution
Accuracy of position	$\pm 0.08^\circ$

SEL37 Multiturn

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

Resolution in increments	Depending on evaluation
Resolution per revolution	16 sin/cos periods
Measuring range absolute	4096 revolutions
Accuracy of position	$\pm 0.08^\circ$

Braking Resistor

Data for Calculation of the Braking Resistor

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

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

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

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

DC Bus Data for Calculation of the Braking Resistor

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

External Braking Resistors (Accessories)

VW3A760...		2Rxx	3Rxx	4Rxx ⁽¹⁾	5Rxx	6Rxx	7Rxx ⁽¹⁾
Resistance	Ω	27	27	27	72	72	72
Continuous power	W	100	200	400	100	200	400
Maximum time in braking at 115 V and 230 V	s	0.552	1.08	2.64	1.44	3.72	9.6
Peak power at 115 V	kW	1.8	1.8	1.8	0.7	0.7	0.7
Maximum peak energy at 115 V	kWs	1	1.9	4.8	1	2.6	6.7
Peak power at 230 V	kW	6.8	6.8	6.8	2.6	2.6	2.6
Maximum peak energy at 230 V	kWs	3.8	7.4	18.1	3.7	9.6	24.7
Maximum time in braking at 400 V and 480 V	s	0.084	0.216	0.504	0.3	0.78	1.92
Peak power at 400 V and 480 V	kW	22.5	22.5	22.5	8.5	8.5	8.5
Maximum peak energy at 400 V and 480 V	Ws	1900	4900	11400	2500	6600	16200
Degree of Protection		IP65	IP65	IP65	IP65	IP65	IP65
UL approval (file no.)		E23342 2	E23342 2		E23342 2	E23342 2	
(1) Resistors with a continuous power of 400 W are not UL/CSA-approved.							

Electromagnetic Emission

Overview

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

WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

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

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

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

WARNING

RADIO INTERFERENCE

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

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

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

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

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

EMC Categories

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

Emission type	Category
Conducted emission	Category C2
Radiated emission	Category C2

Tightening Torque of Screws and Cable Glands

Tightening Torque and Property Class of Screws

Tightening torque of the fastening screw for LXM32i to BMi M5 x 25 ⁽¹⁾	Nm (lb•in)	5.0 (44.25)
Tightening torque of the fastening screws for the supply voltage module M4 x 16 ⁽¹⁾	Nm (lb•in)	1.4 (12.39)
Tightening torque of the fastening screws for the standard braking resistor M4 x 16 ⁽¹⁾	Nm (lb•in)	1.4 (12.39)
Tightening torque of 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 of the fastening screw for the I/O module M4 x 16 ⁽¹⁾	Nm (lb•in)	1.4 (12.39)
Tightening torque of the industrial connectors for the I/O module M8	Nm (lb•in)	0.2 (1.77)
Tightening torque of 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 of Cable Glands

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

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

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

Non-Volatile Memory and Memory Card

Non-Volatile Memory

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

Characteristic	Value
Minimum number of writing cycles	100000
Type	EEPROM

Memory Card

The following table shows characteristics for the memory card:

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

Memory Card Holder

The following table shows characteristics for the memory card holder:

Characteristic	Value
Minimum number of plug-in cycles	5000

Certifications

Product certifications:

TÜV Nord	SLA-0046/2010
UL	E363147

Conditions for UL 508C

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

Ambient Temperature During Operation

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

Fuses

Use fuses as per UL 248.

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

Wiring

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

400/480 V Three-Phase Devices

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

Overvoltage Category

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

Motor Overload Protection

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

Components

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

Chapter 3

Engineering

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
3.1	Electromagnetic Compatibility (EMC)	48
3.2	Cables and Signals	52
3.3	Mains Supply	60
3.4	Rating the Braking Resistor	63
3.5	Functional Safety	69
3.6	PROFINET Fieldbus	81

Section 3.1

Electromagnetic Compatibility (EMC)

What Is in This Section?

This section contains the following topics:


Topic	Page
General	49
Deactivating the Y Capacitors	51


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 <ul style="list-style-type: none"> • 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. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

 WARNING
ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES <p>Use proper EMC shielding techniques to help prevent unintended device operation in accordance with the standard IEC 61800-3.</p> <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

See chapter Electromagnetic Emission (*see page 41*) 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.

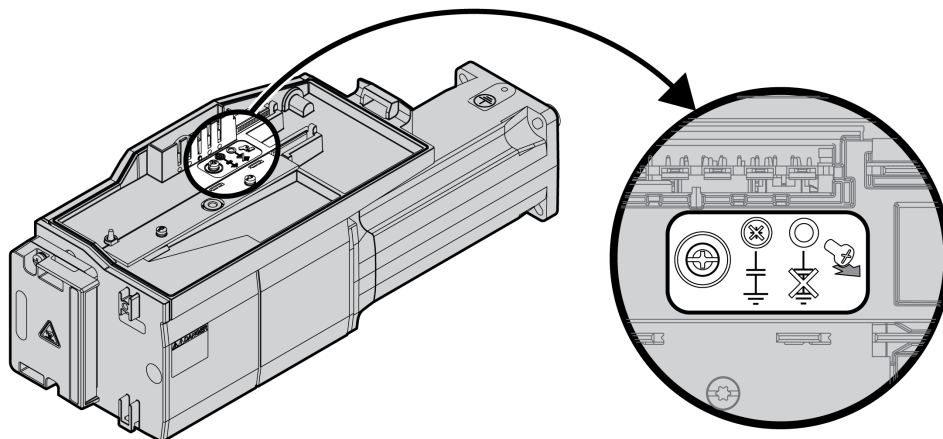
Additional Measures for EMC Improvement

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

The ground connections of the internal Y capacitors can be disconnected (deactivation). Usually, it is not required to deactivate the ground connection of the Y capacitors.



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

The EMC limit values specified no longer apply if the Y capacitors are deactivated.

Section 3.2

Cables and Signals

What Is in This Section?

This section contains the following topics:

Topic	Page
Cables - General	53
Overview of the Required Cables	55
Wiring Concept	56
Logic Type	57
Configurable Inputs and Outputs	58
Mounting Types of The Modules	59

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.

<div style="text-align: center;"> WARNING</div>		
UNINTENDED EQUIPMENT OPERATION		
<ul style="list-style-type: none"> • Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point. ¹⁾ • Route communications and I/O cables separately from power cables. 		
Failure to follow these instructions can result in death, serious injury, or equipment damage.		

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

Conductor Cross Sections According to Method of Installation

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

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

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

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

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

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

Overview of the Required Cables

The properties of the required cables are listed in the table below. Use pre-assembled cables to reduce the risk of wiring errors. Pre-assembled cables can be found in chapter Accessories and Spare Parts ([see page 467](#)). If the product is used to comply with the requirements as per UL 508C, the conditions specified in chapter Conditions for UL 508C ([see page 45](#)) must be met.

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

	Maximum cable length	Minimum cable diameter ⁽¹⁾	Maximum cable diameter ⁽¹⁾	Minimum conductor cross section	Shield	Twisted pair	PELV
Mains voltage	-	8 mm (0.31 in)	15 mm (0.59 in)	_(2)	-	-	-
Digital inputs / outputs	30 m (98.4 ft)	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	0.14 mm ² (AWG 24)	-	-	Required
Safety function STO ⁽³⁾	-	2.5 mm (0.1 in) (for UL: 5 mm (0.2 in))	6.5 mm (0.26 in)	0.34 mm ² (AWG 20)	Required, one end grounded	-	Required
PC, commissioning interface	100 m (328 ft)	-	-	0.25 mm ² (AWG 22)	Required, both ends grounded	Required	Required
External braking resistor	3 m (9.84 ft)	6 mm (0.24 in)	10.5 mm (0.41 in)	Same as mains voltage	Required, both ends grounded	-	-
(1) Clamping range of the cable glands. (2) See chapter Conductor Cross Sections According to Method of Installation (see page 53) (3) See chapter Protected Cable Installation for Safety-Related Signals (see page 77).							

Wiring Concept

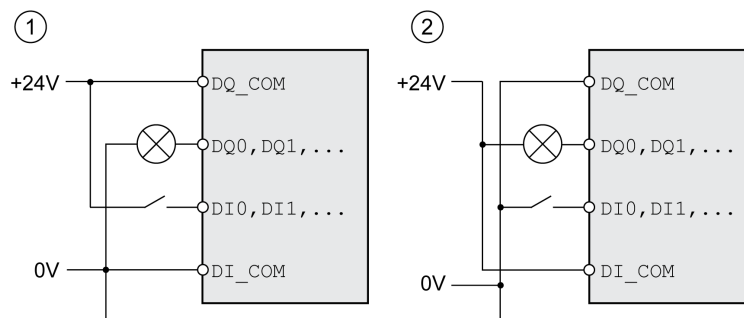
Note the following for wiring the product:

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

Logic Type

Overview

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



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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Connection Module with Industrial Connector

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

Connection Module with Spring Terminals

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

Special Case: Safety Function STO

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

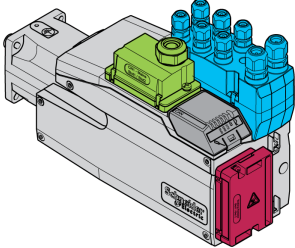
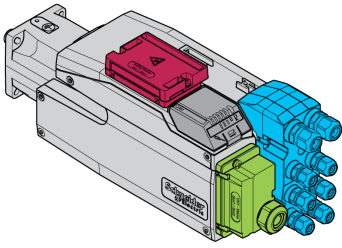
Configurable Inputs and Outputs

This product has digital inputs and outputs that can be configured for specific functional assignments. The inputs and outputs have a defined standard assignment depending on the operating mode. This assignment can be adapted to the requirements of the customer's installation. See chapter Digital Inputs and Outputs ([see page 207](#)) for additional information.

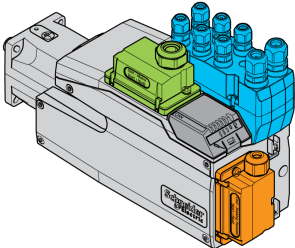
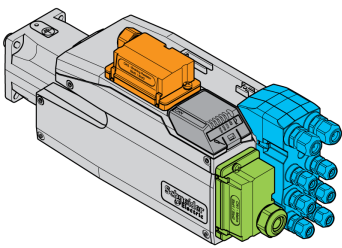
Mounting Types of The Modules

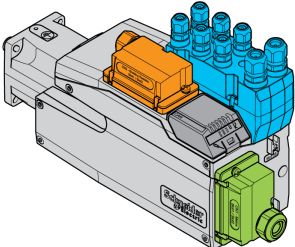
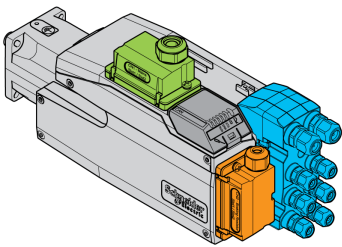
Select the installation of the modules according to the required interfaces and the connection direction. Also note that the modules require space for mounting.

Mounting Type with Standard Braking Resistor

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

Mounting Types with External Braking Resistor

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

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

Section 3.3

Mains Supply

What Is in This Section?

This section contains the following topics:

Topic	Page
Residual Current Device	61
Mains Reactor	62

Residual Current Device

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

WARNING

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

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

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

Further conditions for use of a residual current device:

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

Mains Reactor

A mains reactor must be used under the following conditions:

- Operation via supply mains with low impedance (short-circuit current of supply mains greater than specified in chapter Technical Data ([see page 21](#)).
- In the case of operation with supply mains with reactive power compensation systems.
- For improvement of the power factor at the mains input and for reduction of mains harmonics.

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

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

Section 3.4

Rating the Braking Resistor

What Is in This Section?

This section contains the following topics:

Topic	Page
Standard Braking Resistor	64
External Braking Resistor	65
Rating Information	66

Standard Braking Resistor

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

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

External Braking Resistor

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

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

WARNING

HOT SURFACES

- Ensure that it is not possible to make any contact with a hot braking resistor.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

Monitoring

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

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

Selection of the External Braking Resistor

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

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

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

R = Resistance in Ω

U = Switching threshold for braking resistor V

P_{max} = Required peak power in W

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

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

Use only resistors that are specified as braking resistors. For suitable braking resistors, see chapter Accessories and Spare Parts ([see page 467](#)).

Mounting and Commissioning of an External Braking Resistor

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

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

Rating Information

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

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

Internal Energy Absorption

Braking energy is absorbed internally by:

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

Values for the energy absorption E_{var} can be found in chapter Braking Resistor (*see page 39*).

Standard Braking Resistor

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

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

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

The characteristic values P_{PR} and E_{CR} of the standard braking resistor can be found in chapter Braking Resistor (*see page 39*).

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: $n = 4000 \text{ min}^{-1}$
- Rotor inertia: $J_R = 4 \text{ kgcm}^2$
- Load inertia: $J_L = 6 \text{ kgcm}^2$
- Drive: $E_{var} = 23 \text{ Ws}$, $E_{CR} = 80 \text{ Ws}$, $P_{PR} = 10 \text{ W}$

Calculation of the energy to be absorbed:

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

to $E_B = 88 \text{ Ws}$. Electrical and mechanical losses are ignored.

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

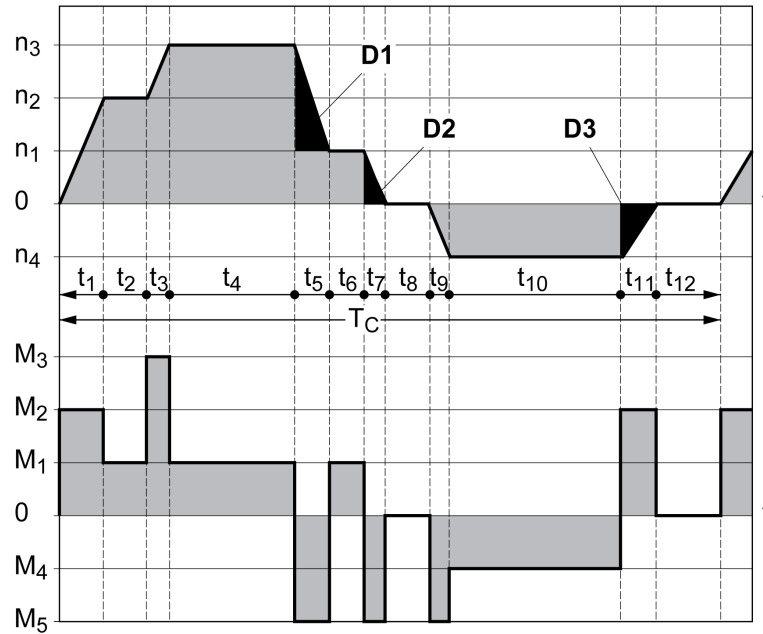
The standard braking resistor must absorb the remaining 65 Ws. It can absorb a pulse of $E_{CR} = 80 \text{ Ws}$. If the load is decelerated once, the standard braking resistor is sufficient.

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 ($D_1 \dots D_3$).

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

$$J_t = J_m + J_c$$

J_m : Motor inertia (with holding brake)

J_c : Load inertia

The energy for each deceleration segment is calculated as follows:

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

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

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

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

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

Units: E_i in Ws (wattseconds), J_t in kgm^2 , ω in rad and n_i in min^{-1} .

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

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

E_{Di} is calculated using the following formula:

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

The continuous power P_c is calculated for each machine cycle:

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

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

The selection is made in two steps:

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

For order data for the external braking resistors, see chapter Accessories and Spare Parts ([see page 467](#)).

Section 3.5

Functional Safety

What Is in This Section?

This section contains the following topics:

Topic	Page
Basics	70
Definitions	73
Function	74
Requirements for Using the Safety Function	75
Protected Cable Installation for Safety-Related Signals	77
Application Examples STO	79

Basics

Functional Safety

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

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

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

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

WARNING

NON-CONFORMANCE TO SAFETY FUNCTION REQUIREMENTS

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

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

Hazard and Risk Analysis

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

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

To perform risk assessment and risk minimization according to EN ISO 12100, proceed as follows:

1. Defining the boundary of the machine.
2. Identifying risks associated with the machine.
3. Assessing risks.
4. Evaluating risks.
5. Minimizing risks by:

- Intrinsically safe design
- Protective devices
- User information (see EN ISO 12100)

6. Designing safety-related controller parts (SRP/CS, Safety-Related Parts of the Control System) in an interactive process.

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

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

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

Safety Integrity Level (SIL)

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

Average Frequency of a Dangerous Failure per Hour (PFH)

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

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

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

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

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

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

Fault Avoidance Measures

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

Data for Maintenance Plan and the Calculations for Functional Safety

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

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

Lifetime of the safety function STO (IEC 61508) ⁽¹⁾	Years	20
SFF (IEC 61508) Safe Failure Fraction	%	90
HFT (IEC 61508) Hardware Fault Tolerance Type A subsystem		1
Safety integrity level IEC 61508 IEC 62061		SIL3 SILCL3
PFH (IEC 61508) Probability of Dangerous Hardware Failure per Hour	1/h (FIT)	$4 \cdot 10^{-9}$ (4)
PL (ISO 13849-1) Performance Level		e (category 3)
MTTF _d (ISO 13849-1) Mean Time to Dangerous Failure	Years	100 (nominal 350)
DC (ISO 13849-1) Diagnostic Coverage	%	90
(1) See chapter Lifetime Safety Function STO (<i>see page 482</i>).		

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

Definitions

Integrated Safety Function "Safe Torque Off" STO

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

Category 0 Stop (IEC 60204-1)

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Category 1 Stop (IEC 60204-1)

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

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

Function

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

Function Principle


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

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


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

Requirements for Using the Safety Function

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

 DANGER
ELECTRIC SHOCK <ul style="list-style-type: none"> Do not use the safety function STO for any other purposes than its intended function. Use an appropriate switch, that is not part of the circuit of the safety function STO, to disconnect the drive from the mains power. Failure to follow these instructions will result in death or serious injury.

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


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

Logic Type


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

Holding Brake and Safety Function STO

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

 WARNING
FALLING LOAD <p>Ensure that all loads come to a secure standstill when the safety function STO is used.</p> 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 <ul style="list-style-type: none"> Do not use the internal holding brake as a safety-related measure. Only use certified external brakes as safety-related measures. Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

Unintended Restart

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

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

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

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

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

Degree of Protection when the Safety Function is Used

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

⚠ WARNING**INOPERABLE SAFETY FUNCTION**

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

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

Protected Cable Installation

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

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

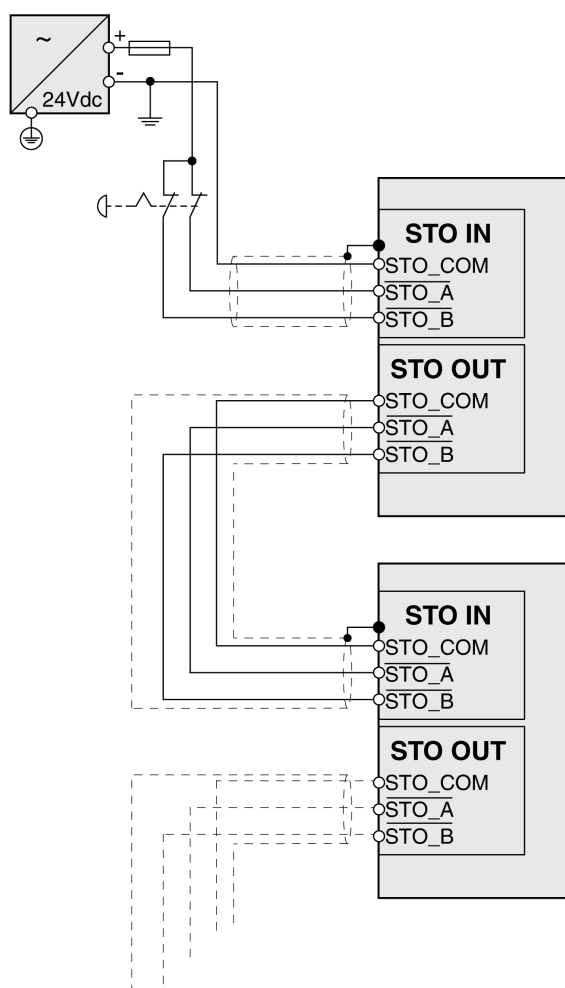
Protected Cable Installation for Safety-Related Signals

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

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

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

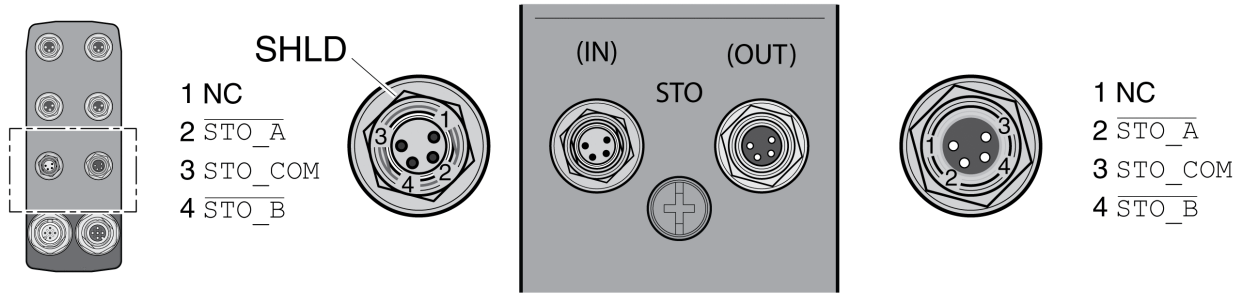
Example of protected cable installation for safety-related signals



Notes on the Connection Modules

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

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



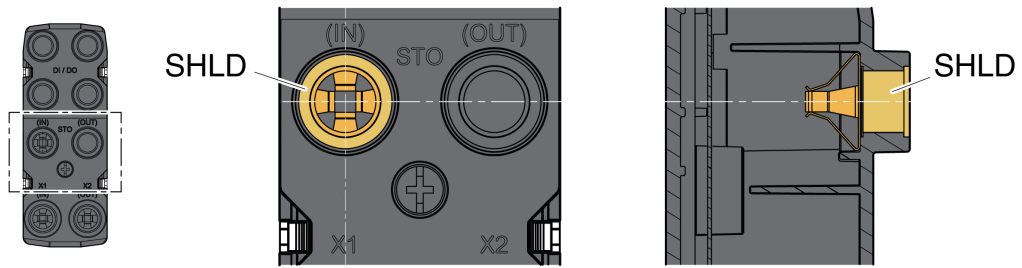
⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not connect any wiring to reserved, unused connections, or to connections designated as No Connection (N.C.).

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

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



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

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

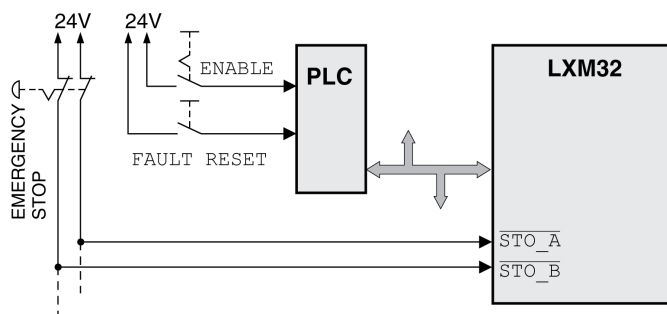
Using pre-assembled cables helps to reduce the possibility of wiring errors. See chapter Accessories and Spare Parts ([see page 467](#)).

Application Examples STO

Example of Category 0 stop

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

Example of category 0 stop



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

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

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

! WARNING

UNINTENDED EQUIPMENT OPERATION

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

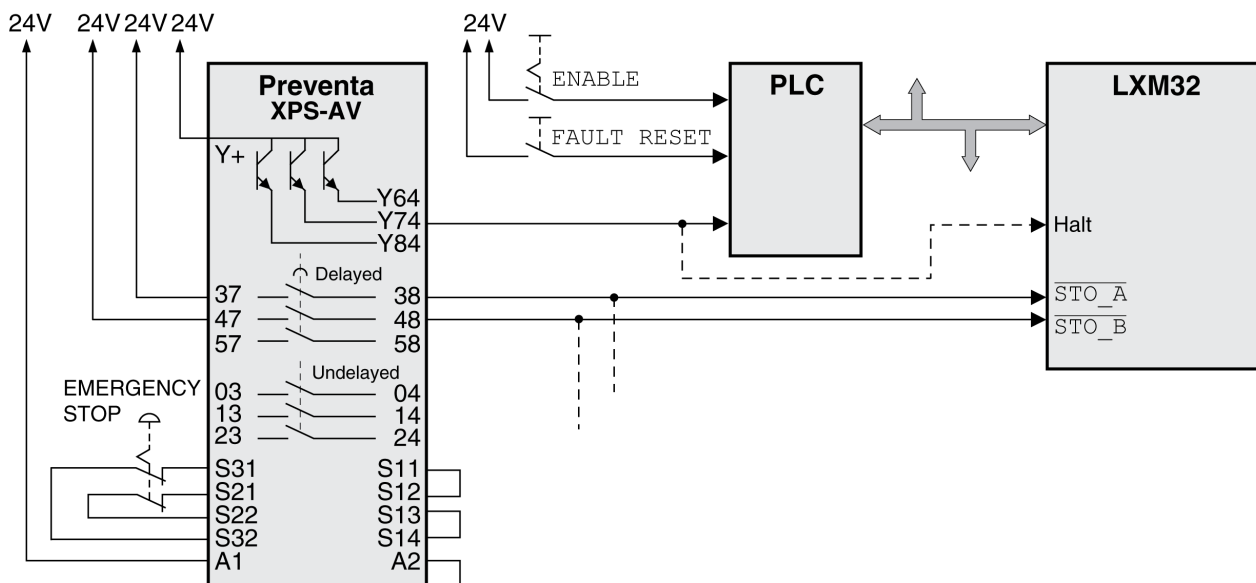
Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external brake may also be required. See Holding Brake and Safety Function STO ([see page 75](#)).

Example of Category 1 stop

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

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



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

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

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

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external brake may also be required. See Holding Brake and Safety Function STO ([see page 75](#)).

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Section 3.6

PROFINET Fieldbus

What Is in This Section?

This section contains the following topics:

Topic	Page
Conformance Classes	82
Network Topology	83
Data Structure	84
Cyclic Communication - Overview	85
Cyclic Communication - Structure of the Output Data	86
Cyclic Communication - Structure of the Input Data	87
Cyclic Communication - Parameter Channel	89
Cyclic Communication - Handshake via the "Mode Toggle" Bit	91
Acyclic Communication - Overview	92
Acyclic Communication - Example: Reading a Parameter (with Configuration Tool STEP 7)	93

Conformance Classes

PROFINET is a communication protocol based on Industrial Ethernet.

Depending on the application area, PROFINET functionality is subdivided into 3 classes:

- Conformance class A (CC-A)
- Conformance class B (CC-B)
- Conformance class C (CC-C)

Conformance Class A (CC-A)

Conformance class A provides basic functions for cyclic real-time communication and acyclic TCP/IP communication. Typical applications include building automation.

Conformance Class B (CC-B)

Conformance class B adds network diagnostics, SNMP and topology information to conformance class A. Typical applications include process automation.

Conformance Class C (CC-C)

Conformance class C adds bandwidth reservation and synchronization to conformance class B. Typical applications include positioning systems.

Supported Conformance Class

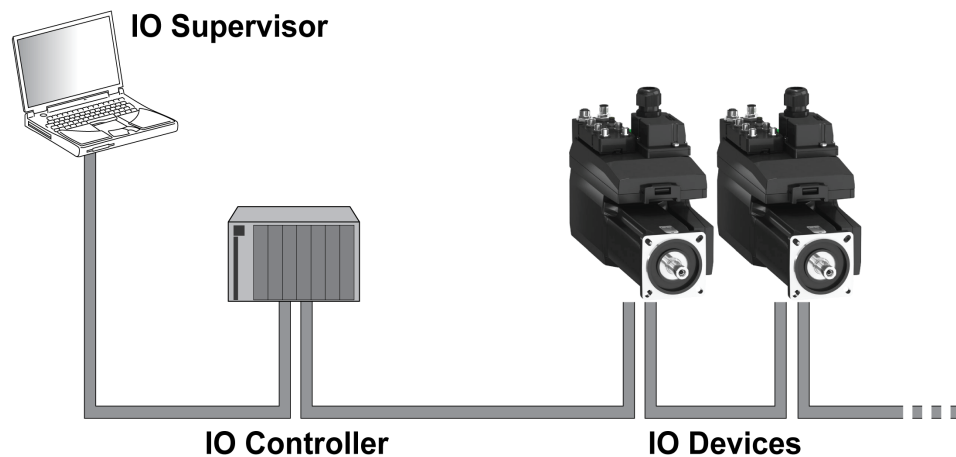
The device supports conformance class B (CC-B).

Network Topology

A PROFINET network consists of the following components:

- PROFINET IO supervisor
(corresponds to the definition of a PROFIBUS master class 2)
- One or several PROFINET IO controllers
(corresponds to the definition of a PROFIBUS master class 1)
- One or several PROFINET IO devices
(corresponds to the definition of a PROFIBUS slave)

The PROFINET network uses CAT5e Ethernet cable.



IO Supervisor

The IO supervisor allows for commissioning and network diagnostics. Examples of IO supervisors:

- PCs
- HMIs
- Programming devices

IO Controller

The IO controller sends the output data to the IO device and receives the input data from the IO device. Examples of IO controllers:

- Automation devices, for example, logic controllers

IO Devices

The IO device receives commands from the IO controller and sends status information to the IO controller. Examples of IO devices:

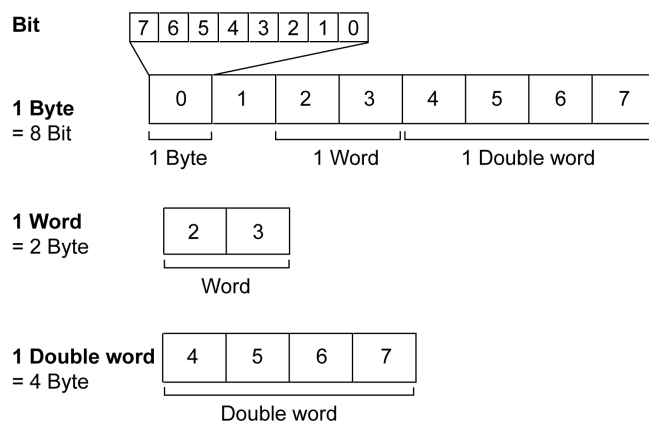
- Input/output modules
- Drive systems
- Sensors and actuators

Data Structure

Overview

Byte, word and double word values are shown in hexadecimal notation. Hexadecimal values are indicated as such by means of an "h" behind the numerical value, for example, "31_h". Decimal values have no special identification. Note the different counting format of bits (right to left) and bytes (left to right).

General data structure from bit to double word



Used Byte Sequence: Big Endian Format

The bytes are transmitted in Big Endian format.

Cyclic Communication - Overview

PROFINET provides functionality for cyclic communication, station-specific, module-specific and channel-specific diagnostics, as well as various alarm types for diagnostics.

Input Data and Output Data

With the output data, the IO controller sends a command to the IO device, for example, in order to start an operating mode, trigger a function, perform a movement or request status information. The IO device executes the command and acknowledges it with a confirmation.

The exchange of data follows a fixed pattern:

- Output data to the IO device: The IO controller places a command in the output data memory. From there, it is transmitted to the IO device and executed.
- Input data from IO device: The IO device acknowledges the command in the input data. If the command was successfully executed, the IO controller receives an acknowledgement without an error message.

The IO controller cannot send a new command unless it has received acknowledgement concerning the ongoing command. Acknowledgement information and error messages are included in the transmitted data in bit-coded form.

The IO controller receives up-to-date input data from the IO device during each cycle. The input data contains acknowledgement information concerning a transmitted command and status information.

The data of the cyclic communication comprise 2 parts:

- Process data channel
- Parameter channel (optional)

The selection of the drive profile determines whether or not the parameter channel is to be used.

Process Data Channel

The process data channel is used for realtime data exchange, for example the actual position or the actual velocity. Transmission is fast because the data is sent without additional administration data and data transmission acknowledgement from the recipient is not required.

The IO controller can control the operating states of the IO device via the process data channel, for example:

- Enabling and disabling the power stage
- Starting and terminating operating modes
- Starting and terminating movements
- Triggering a "Quick Stop" / resetting a "Quick Stop"
- Resetting an error message

Changing operating states and activating operating modes must be done separately. An operating mode can only be started if the operating state of the drive is 6 Operation Enabled.

Parameter Channel

The IO controller can request a parameter value from the IO device or change a parameter value via the parameter channel. Each parameter can be uniquely addressed via the index and subindex.

Drive Profile

The product supports the following drive profiles:

- Profile 104: "Drive Profile Lexium 1" (vendor-specific)
- Profile 105: "Drive Profile Lexium 2" (vendor-specific)

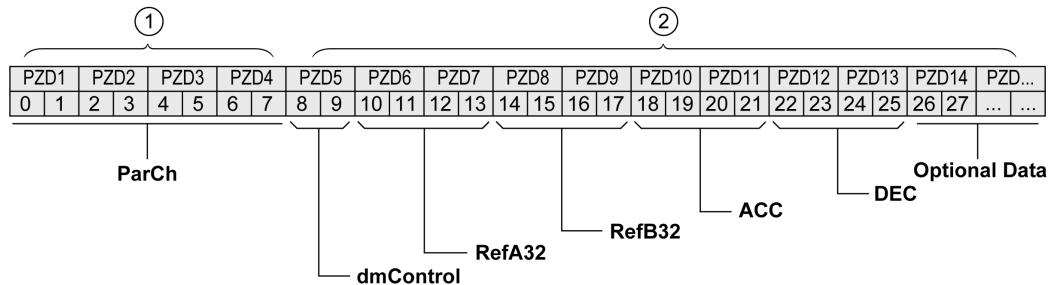
Profile 104 "Drive Profile Lexium 1"	Profile 105: "Drive Profile Lexium 2"
Profile with 26 bytes	Profile with 10 bytes
Advanced functionality	Core functionality
With parameter channel (8 bytes)	Without parameter channel

Cyclic Communication - Structure of the Output Data

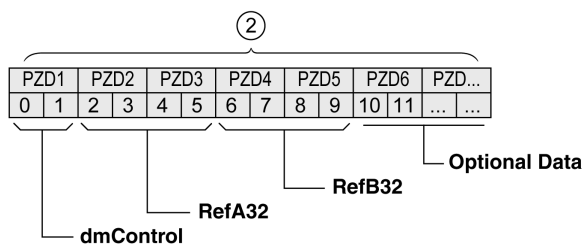
Overview

The output data is used to transmit requests from the IO controller to the IO device.

Output data "Drive Profile Lexium 1", profile 104



Output data "Drive Profile Lexium 2", profile 105



- 1 Parameter channel
- 2 Process data channel

Parameter Channel "ParCh"

Parameters can be read or written via "ParCh", see chapter Cyclic Communication - Parameter Channel ([see page 89](#)).

Word "dmControl"

The word "dmControl" is used to set the operating state and the operating mode.

See chapters Changing the Operating State via Fieldbus ([see page 244](#)) and Starting and Changing an Operating Mode ([see page 247](#)) for a detailed description of the bits.

Double Words "RefA32" and "RefB32"

The two double words "RefA32" and "RefB32" are used to set two values for the operating mode. The meaning depends on the operating mode; it is described in the chapters on the individual operating modes.

Double Words "ACC" and "DEC"

The two double words "ACC" and "DEC" are used to set the values for the acceleration ramp and the deceleration ramp. The acceleration ramp corresponds to the parameter `RAMP_v_acc`, the deceleration ramp corresponds to the parameter `RAMP_v_dec`.

Bytes "Optional Data"

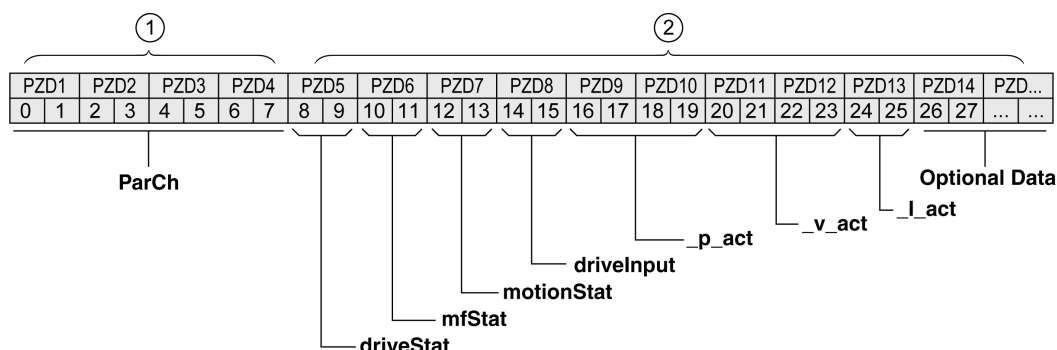
"Optional Data" is used to append additional parameters to the profile that can be selected by the user (mapping). See chapter Settings with the Configuration Tool STEP7 - V13 (TIA Portal) ([see page 147](#)) for additional information on mapping.

Cyclic Communication - Structure of the Input Data

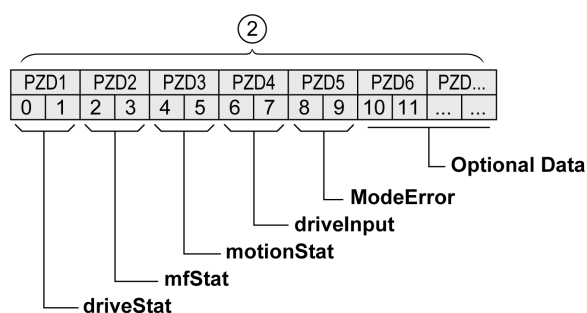
Overview

The input data is used to transmit information from the IO device to the IO controller.

Input data "Drive Profile Lexium 1", profile 104



Input data "Drive Profile Lexium 2", profile 105



- 1 Parameter channel
- 2 Process data channel

Parameter Channel "ParCh"

Parameters can be read or written via "ParCh", see chapter Cyclic Communication - Parameter Channel ([see page 89](#)).

Word "driveStat"

The current operating state is indicated with the "driveStat" word.

For a detailed description of the bits, see chapter Indication of the Operating State via Fieldbus ([see page 241](#)).

Word "mfStat"

The word "mfStat" is used to indicate the current operating mode.

For a detailed description of the bits, see chapter Indicating an Operating Mode ([see page 246](#)).

Word "motionStat"

The word "motionStat" is used to provide information on the motor and profile generator.

Bit	Meaning
1	Positive limit switch triggered
2	Negative limit switch triggered
3 ... 5	Reserved
6	MOTZ: Motor at a standstill
7	MOTP: Motor movement in positive direction
8	MOTN: Motor movement in negative direction

Bit	Meaning
9	Setting via parameter DS402intLim
10	Setting via parameter DPL_intLim
11	TAR0: Profile generator at standstill
12	DEC: Profile generator decelerates
13	ACC: Profile generator accelerates
14	CNST: Profile generator moves at constant velocity
15	Reserved

Word "driveInput"

The word "driveInput" is used to indicate the status of the digital signal inputs.

Bit	Signal	Factory setting
0	DI0	Signal input function Freely Available
1	DI1	Signal input function Reference Switch (REF)
2	DI2	Signal input function Positive Limit Switch (LIMP)
3	DI3	Signal input function Negative Limit Switch (LIMN)
4 ... 15	-	Reserved

Double Word "_p_act"

The double word "_p_act" indicates the actual position. The value corresponds to the parameter `_p_act`.

Double Word "_v_act"

The double word "_v_act" can be parameterized. You can select the parameter `_v_act` (actual velocity) or the parameter `_n_act` (actual speed of rotation), see chapter Mapping for "_v_act" ([see page 148](#)).

Word "_I_act"

The word "_I_act" is used to provide information on the total motor current. The value corresponds to the parameter `_I_act`.

Word "ModeError"

The word "ModeError" is used to provide the vendor-specific error code that caused the ModeError to be set. The ModeError bit relates to MT-dependent parameters. The value corresponds to the parameter `_ModeError`.

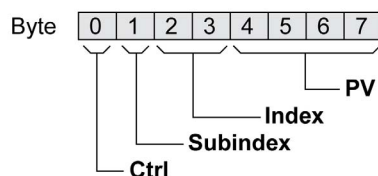
Bytes "Optional Data"

"Optional Data" is used to append additional parameters to the profile that can be selected by the user (mapping). See chapter Settings with the Configuration Tool STEP7 - V13 (TIA Portal) ([see page 147](#)) for additional information on mapping.

Cyclic Communication - Parameter Channel

Overview

The IO controller can request a parameter value from the IO device or change a parameter value via the parameter channel. Each parameter can be uniquely addressed via the index and subindex.



Byte "Ctrl"

Byte "Ctrl" contains the request to read or write a parameter.

The output data contains the information whether a parameter is to be read or written. The input data contains the information whether the read request or the write request were successful.

Output data:

Ctrl	Function
00 _h	No request
10 _h	Read request
20 _h	Write request (word)
30 _h	Write request (double word)

Input data:

Ctrl	Function
00 _h	Request not yet completed
10 _h	Read request or write request successfully completed (word)
20 _h	Read request or write request successfully completed (double word)
70 _h	Error message

Only one request can be processed at a time. The IO device provides the response until the IO controller sends a new request. If a response includes parameter values, the IO device responds with the current value in the case of a repetition.

Read requests are only executed by the IO device if the value changes from 00_h to 10_h. Write requests are only executed by the IO device if the value changes from 00_h to 20_h or to 30_h.

Byte "Subindex"

The byte "Subindex" must be set to the value 00_h.

Word "Index"

The word "Index" contains the parameter address.

Double Word "PV"

The double word "PV" contains the parameter value.

In the case of a read request, the value in the output data has no significance. The input data contains the parameter value.

In the case of a write request, the output data contains the value to be written to the parameter. The input data contains the parameter value.

If a read request or a write request were not successful, the double word "PV" contains the error number of the error.

Example: Reading a Parameter

In the example, the program number of the product is read from the parameter `_prgNoDEV`. The parameter `_prgNoDEV` has the parameter address 258 (01_h 02_h).

The parameter value read has the decimal value 91200 which corresponds to 01_h 64_h 40_h.

Output data:

Ctrl	Subindex	Index	PV
10 _h	00 _h	01 _h 02 _h	00 _h 00 _h 00 _h 00 _h

Input data:

Ctrl	Subindex	Index	PV
20 _h	00 _h	01 _h 02 _h	00 _h 01 _h 64 _h 40 _h

Example: Writing of an Invalid Parameter

In this example, the value of a non-existent parameter is to be changed. The parameter has the parameter address 101 (00_h 65_h). The value of the parameters is to be changed to 222 (DE_h).

Before the IO device can accept a new request, the value 00_h must first be transmitted in byte "Ctrl".

Since the IO device cannot address the parameter, a synchronous error message is transmitted with the input data. Byte "Ctrl" is set to 70_h. Double word "PV" is set to the error number (error number 1101_h: Parameter does not exist).

Output data:

Ctrl	Subindex	Index	PV
30 _h	00 _h	00 _h 65 _h	00 _h 00 _h 00 _h DE _h

Input data:

Ctrl	Subindex	Index	PV
70 _h	00 _h	00 _h 65 _h	00 _h 00 _h 11 _h 01 _h

Cyclic Communication - Handshake via the "Mode Toggle" Bit

Mode Toggle

The "Drive Profile Lexium" uses synchronous communication. In the case of synchronous communication, the IO controller waits for a response from the IO device prior to new actions.

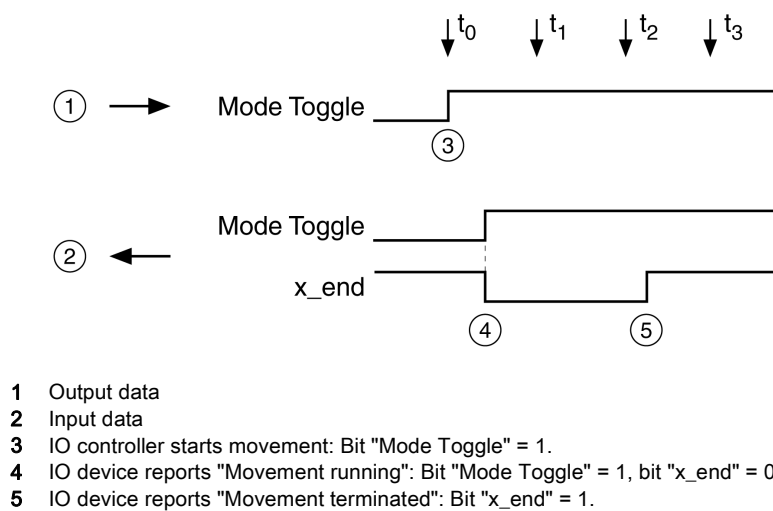
Synchronous communication is controlled by means of the appropriate bits in the output data and the input data:

- Output data: In the word "dmControl" by means of the bit "Mode Toggle"
- Input data: In the byte "mfStat" by means of the bit "ModeError" and the bit "Mode Toggle"

The bit "Mode Toggle" is effective with a rising edge and a falling edge.

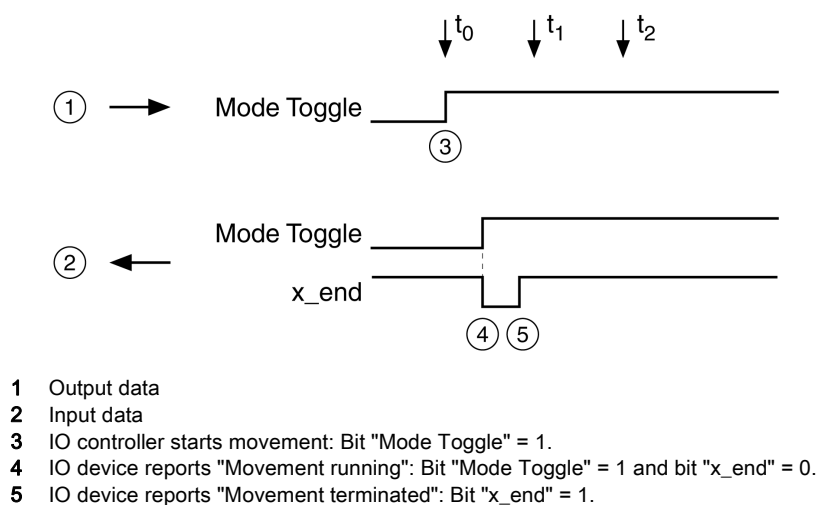
Example 1: Positioning

The IO controller starts a movement at point in time t_0 . At points in time t_1, t_2, \dots , the IO controller verifies the responses from the IO device. It waits for the end of the movement. The end of the movement is detected when bit "x_end" = 1.



Example 2: Short-Distance Movement

The IO controller starts a short-distance movement at point in time t_0 . The duration is shorter than the request cycle of the IO controller. At point in time t_1 the movement is terminated. Bit "x_end" does not allow the IO controller to detect whether the movement is already terminated or has not yet been started. However, it can identify the current state with the "Mode Toggle" bit.



Acyclic Communication - Overview

Overview

In addition to cyclic communication, the IO controller and the IO device can also communicate acyclically. Acyclic communication enables the change of parameters during operation, but it is slower than the cyclic communication. Additionally, an acyclic communication is used for error messages via "Diagnostics Alarm" (*see page 359*).

Acyclic Communication - Parameter Channel

The IO device supports acyclic data exchange with an IO controller and an IO supervisor.

Structure of acyclic communication:

- IO controller sends WRITE Request with data (read parameter or write parameter).
- IO device confirms write request with WRITE Response.
- IO controller sends READ Request.
- IO device confirms read request with READ Response. Depending on the request, several READ Request / READ Response cycles without data transmission may be required before the IO device can provide the data with a READ Response.

Acyclic Communication: Elements

The following items are defined for acyclic communication:

	Data type	Value
REQUEST REFERENCE	Unsigned 8	00 _h : Reserved 01 _h ... FF _h
REQUEST ID	Unsigned 8	01 _h : Request Parameter 02 _h : Change Parameter
RESPONSE ID	Unsigned 8	Response (+) 00 _h : Reserved 01 _h : Request Parameter (+) 02 _h : Change Parameter (+) Response (-) 81 _h : Request Parameter (-) 82 _h : Change Parameter (-)
AXIS	Unsigned 8	01 _h
NO. OF PARAMETERS	Unsigned 8	01 _h ... 17 _h : 1 ... 23 DWORD (240 data bytes)
ATTRIBUTE	Unsigned 8	00 _h : Reserved 01 _h : Value
NO. OF ELEMENTS	Unsigned 8	00 _h : Special Function 01 _h ... EA _h : Quantity 1 ... 234
PARAMETER NUMBER	Unsigned 16	00 _h : Reserved 0001 _h ... FFFF _h : Parameter Index
SUBINDEX	Unsigned 16	0000 _h (Drive Profile Lexium)
FORMAT	Unsigned 8	42 _h : WORD 43 _h : DWORD 44 _h : ERROR
NO. OF VALUES	Unsigned 8	00 _h ... EA _h : Quantity 0 ... 234
ERROR NUMBER	Unsigned 16	0000 _h ... 0064 _h Error codes

Acyclic Communication - Example: Reading a Parameter (with Configuration Tool STEP 7)

Sending WRITE Request

Administration data:

WRITE Request		Description
Index	47	Index (Drive Profile Lexium: 47)
Length	10	10 bytes payload

Payload data:

Byte	Name	Value	Description
0	REQUEST REFERENCE	01 _h	Reference number for parameter request
1	REQUEST ID	01 _h	Request Parameter
2	AXIS	01 _h	Axis 1
3	NO. OF PARAMETERS	01 _h	1 parameter is transmitted
4	ATTRIBUTE	10 _h	Parameter value (access)
5	NO. OF ELEMENTS	00 _h	Access to direct value (>0: sub-elements)
6, 7	PARAMETER NUMBER	0104 _h	Firmware version (1.2)
8, 9	SUBINDEX	0000 _h	Subindex: In drive profile Lexium 0

Sending READ Request

Administration data:

READ Request		Description
Index	47	Index (Drive Profile Lexium: 47)
Length	10	10 bytes receive buffer

Receiving READ Response

Administration data:

READ Response		Description
Index	47	Index (Drive Profile Lexium: 47)
Length	8	8 bytes payload

Payload data:

Byte	Name	Value	Description
0	RESPONSE REFERENCE	01 _h	Mirrored reference number of parameter request
1	RESPONSE ID	01 _h	Positive response for requested parameter
2	AXIS	01 _h	Mirrored axis number (axis 1)
3	NO. OF PARAMETERS	01 _h	1 parameter is transmitted.
4	FORMAT	42 _h	Parameter format (WORD)
5	NO. OF VALUES	01 _h	Access to 1 value
6, 7	VALUE	xxxx _h	Value of the parameter

Chapter 4

Installation

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
4.1	Mechanical Installation	96
4.2	Electrical Installation	101
4.3	I/O Module with Industrial Connectors	113
4.4	I/O Module with Spring Terminals	121
4.5	Verifying Installation	134

Section 4.1

Mechanical Installation

What Is in This Section?

This section contains the following topics:

Topic	Page
Before Mounting	97
Mounting the Motor	98

Before Mounting

Inspecting the Product

- Verify the product version by means of the type code. See chapter Type Code (*see page 19*).
- Prior to mounting, inspect the product for visible damage.

Damaged products may cause electric shock or unintended equipment operation.

⚡ ⚠ DANGER
<p>ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION</p> <ul style="list-style-type: none"> • Do not use damaged products. • Keep foreign objects (such as chips, screws or wire clippings) from getting into the product. <p>Failure to follow these instructions will result in death or serious injury.</p>

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

Inspecting the Holding Brake (Option)

See chapter Inspecting/Breaking In the Holding Brake (*see page 481*).

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
<p>ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING</p> <ul style="list-style-type: none"> • 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. <p>Failure to follow these instructions will result in death or serious injury.</p>

- Verify that the mounting surface meets all requirements in terms of dimensions and tolerances. See chapter Dimensions (*see page 24*).

Mounting the Motor

DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

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

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

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

WARNING

ELECTROMAGNETIC FIELDS

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

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

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

CAUTION

HOT SURFACES

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

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

CAUTION

IMPROPER APPLICATION OF FORCES

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

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

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

WARNING

UNINTENDED MOVEMENT CAUSED BY ELECTROSTATIC DISCHARGE

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

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

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

⚠ WARNING

UNINTENDED MOVEMENT

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

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

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

⚠ WARNING

HEAVY AND/OR FALLING PARTS

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

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

Mounting Distances, Ventilation

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

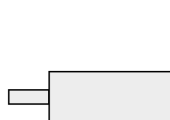
- No minimum distances are required for installation. However, free convection must be possible.
- Avoid heat accumulations.
- Do not obstruct the ventilation slots; keep dirt from reaching the ventilation slots.
- Do not mount the device close to heat sources. Mutual heating of several devices leads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

Convection Channels

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

Mounting Position

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



IM B5



IM V1



IM V3

Mounting

When the motor is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. All mounting screws must be tightened with the specified tightening torque. No uneven mechanical load must be applied when the mounting screws are tightened. See chapter Technical Data ([see page 21](#)) for data, dimensions and degrees of protection (IP).

Mounting Output Components

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

The maximum axial and radial forces acting on the shaft must not exceed the maximum shaft load values specified, see chapter Shaft-Specific Data ([see page 30](#)).

Section 4.2

Electrical Installation

What Is in This Section?

This section contains the following topics:

Topic	Page
General	102
Ground Connection	103
Mounting LXM32i	104
Standard Braking Resistor	105
External Braking Resistor (Accessories)	106
Mains Supply	108
Commissioning Interface	111
Mounting the I/O Connection Module	112

General

  **DANGER****ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION**

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

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

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

  **DANGER****ELECTRIC SHOCK**

Do not open the side wall.

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

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

  **DANGER****ELECTRIC SHOCK CAUSED BY INCORRECT POWER SUPPLY UNIT**

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

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

Ground Connection

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

DANGER

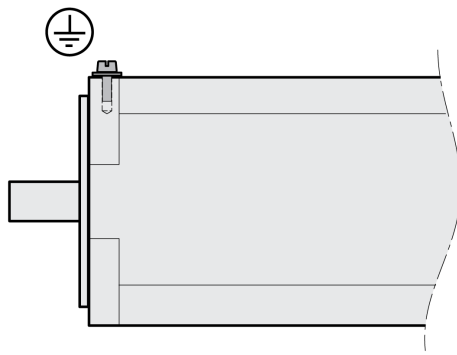
INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 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.

Connecting to Ground

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



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

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

Mounting LXM32i

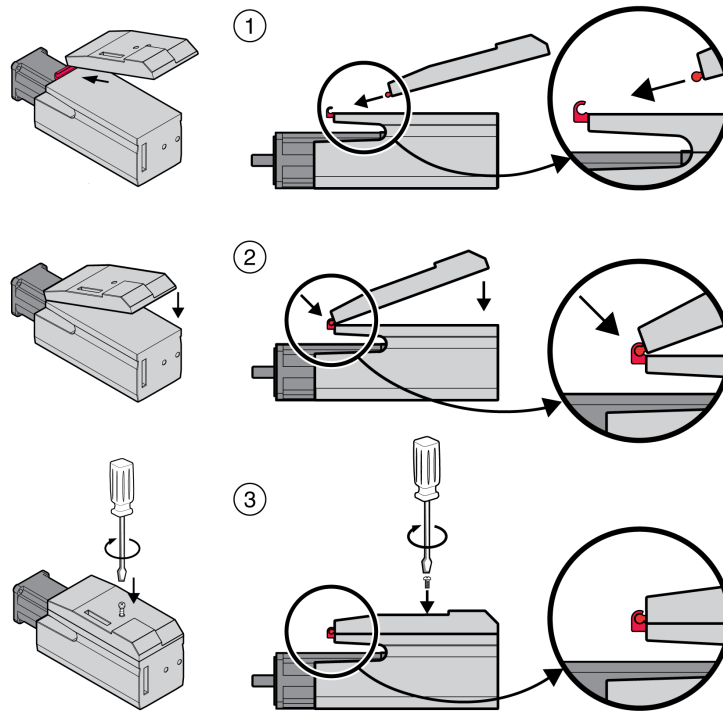
Electrostatic discharge (ESD) may permanently damage the module either immediately or over time.

NOTICE

EQUIPMENT DAMAGE DUE TO ESD

- Use suitable ESD measures (for example, ESD gloves) when handling the module.
- Do not touch internal components.

Failure to follow these instructions can result in equipment damage.



- Remove the transport lock.
- Check the seals for damage. You must not use devices with damaged seals.
- (1) Plug the LXM32i onto the BMi.
- (2) The catch must snap in properly.
- (3) Fasten the LXM32i by tightening the fastening screw.

Note the specified tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

Standard Braking Resistor

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

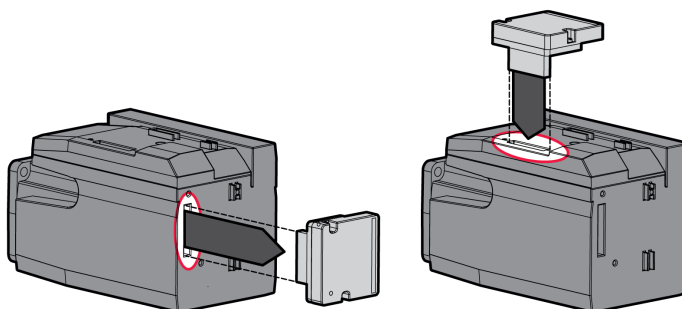
If the standard braking resistor is used, there are several mounting types, see chapter Mounting Types of The Modules ([see page 59](#)).

Mounting in Slot 2

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

Mounting in Slot 1

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



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

For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

External Braking Resistor (Accessories)

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

Selection and rating of the external braking resistor are described in chapter Rating the Braking Resistor (see page 63). For suitable braking resistors, see chapter Accessories and Spare Parts (see page 467).

Cable Specifications

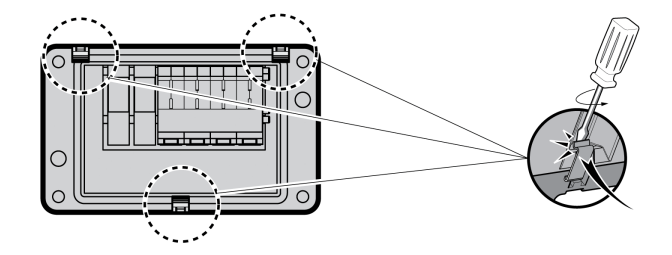
Shield:	Required, both ends grounded
Twisted Pair:	-
PELV:	-
Cable composition:	Minimum conductor cross section: Same cross section as the cross section used for the mains supply. The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.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

Properties of the Connection Terminals

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

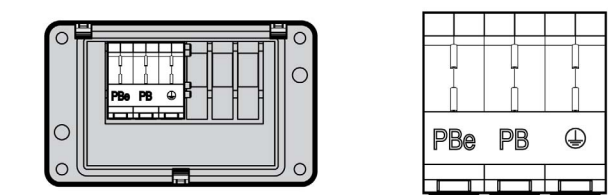
The spring terminals are approved for fine-stranded conductors and solid conductors. Observe the maximum permissible connection cross section. Take into account the fact that wire cable ends (ferrules) increase the conductor cross section.

Opening the Connection Module



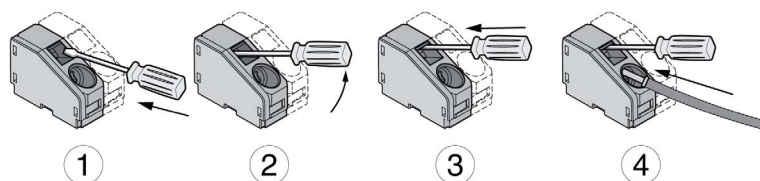
Wiring Diagram

Connection module for external braking resistor



Usage of the Connection Terminals

Use the connection terminals as shown in the illustration below:



Connecting the External Braking Resistor

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

⚠ WARNING

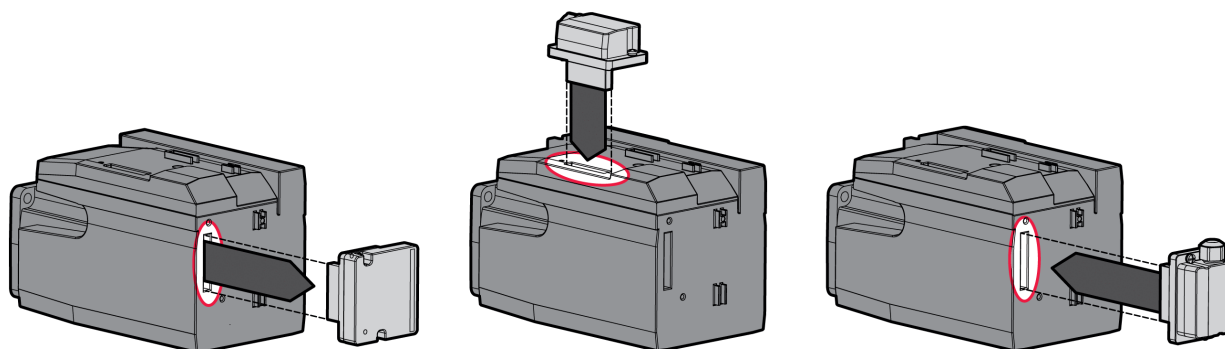
HOT SURFACES

- Ensure that it is not possible to make any contact with a hot braking resistor.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

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

Mounting the Connection Module



- Loosen the 2 fastening screws and remove the standard braking resistor from slot 2.
- Remove the cover film, plug the connection module for the external braking resistor into slot 1 or into slot 2 and fasten it by tightening the two fastening screws. Note the information concerning the different mounting types in chapter Mounting Types of The Modules ([see page 59](#)).

For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

Mains Supply

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

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

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

WARNING

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

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

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

See chapter Residual Current Device ([see page 61](#)) for information and conditions concerning the use of a residual current device.

WARNING

INCORRECT MAINS VOLTAGE

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

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

Cable Specifications

Shield:	-
Twisted Pair:	-

PELV:	-
Cable composition:	The conductors of the cable must conform to the current requirements of the drive and motor, and conform to any applicable local regulations.
Minimum cable diameter:	8 mm (0.31 in)
Maximum cable diameter	15 mm (0.59 in)
Maximum cable length:	-
Special characteristics:	-

Properties of the Connection Terminals

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

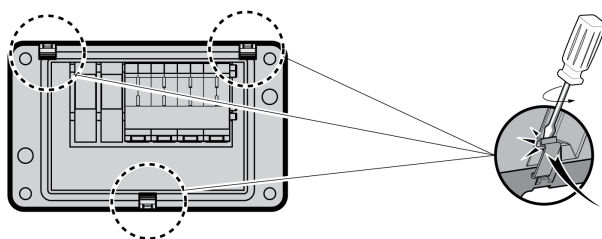
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Prerequisites for Connecting the Power Stage Supply

Note the following information:

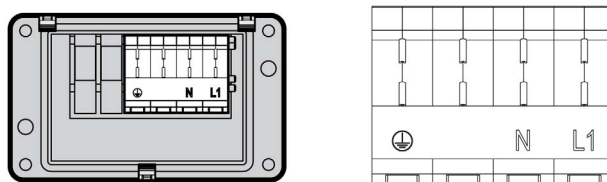
- Three-phase devices may only be connected and operated via three phases.
- Use upstream mains fuses. See chapter Motor-Specific Data ([see page 32](#)) for information on fuse types and fuse ratings.
- If you use an external mains filter, the mains cable must be shielded and grounded at both ends if the length between the external mains filter and the device exceeds 200 mm (7.87 in).
- See chapter Conditions for UL 508C ([see page 45](#)) for a UL-compliant design.

Opening the Connection Module

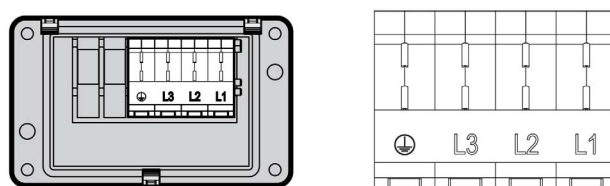


Wiring Diagram

Wiring diagram for single-phase device.

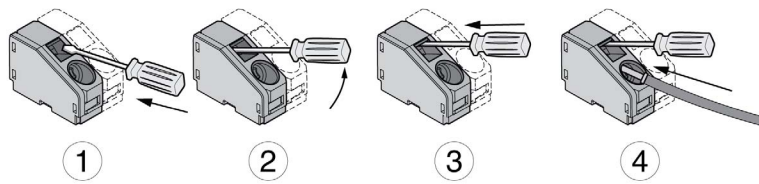


Wiring diagram for three-phase device



Usage of the Connection Terminals

Use the connection terminals as shown in the illustration below:



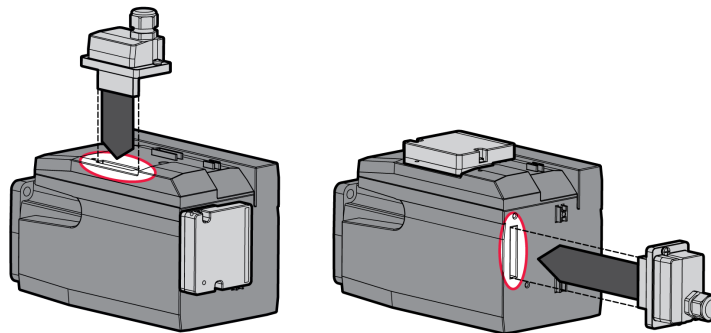
Connecting Mains Supply

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

Mounting the Connection Module

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

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



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

For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

Commissioning Interface

Cable Specifications

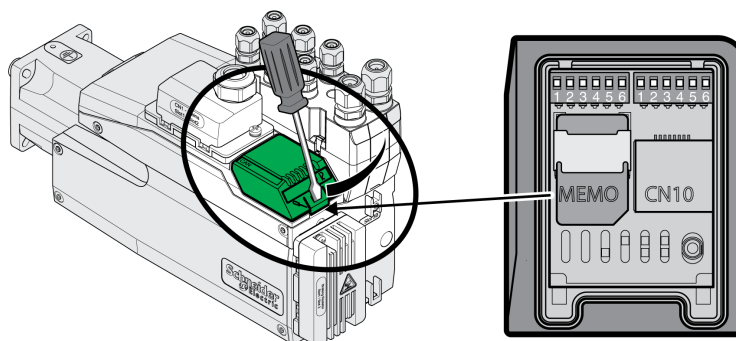
Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	8*0.25 mm ² , (8*AWG 22)
Maximum cable length:	100 m
Special characteristics:	-

Connecting a PC

A PC with commissioning software can be connected for commissioning. The PC is connected via a bidirectional USB/RS485 converter, see chapter Accessories and Spare Parts (*see page 467*).

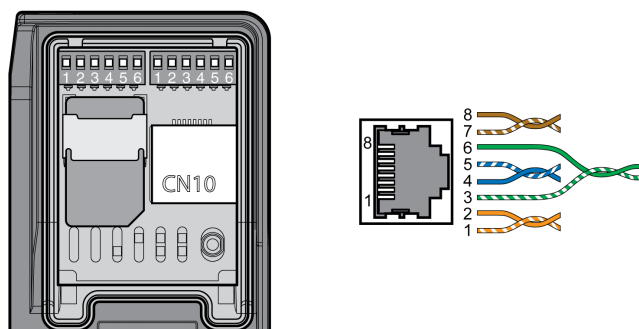
Opening the Cover of the Commissioning Interface

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



Wiring Diagram

Wiring diagram PC with commissioning software



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

The cover of the commissioning must be closed after commissioning.

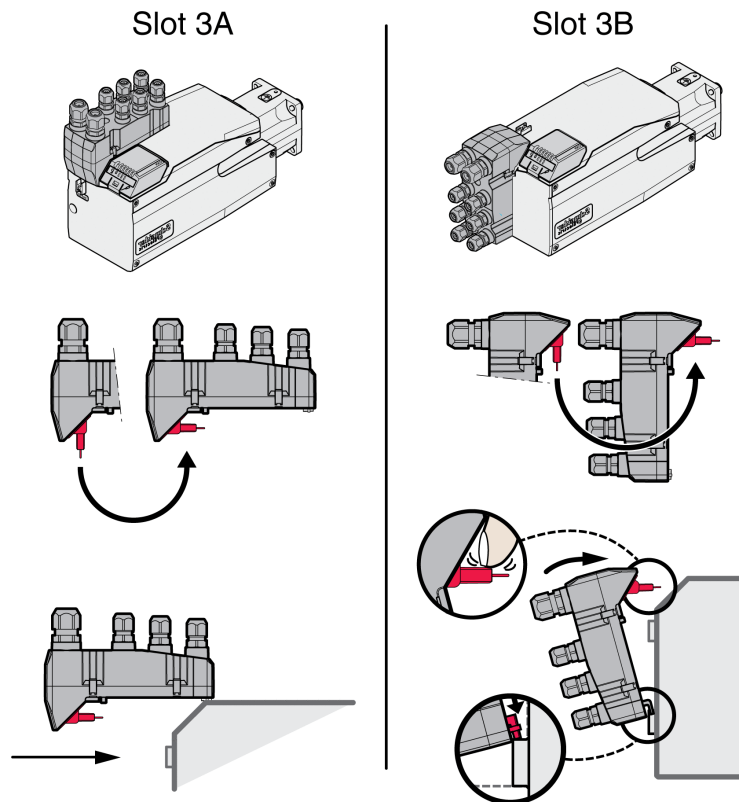
Mounting the I/O Connection Module

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

If the standard braking resistor is used, the choice of slot is limited, see chapter Mounting Types of The Modules ([see page 59](#)).

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

Mounting the I/O module



For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

Section 4.3

I/O Module with Industrial Connectors

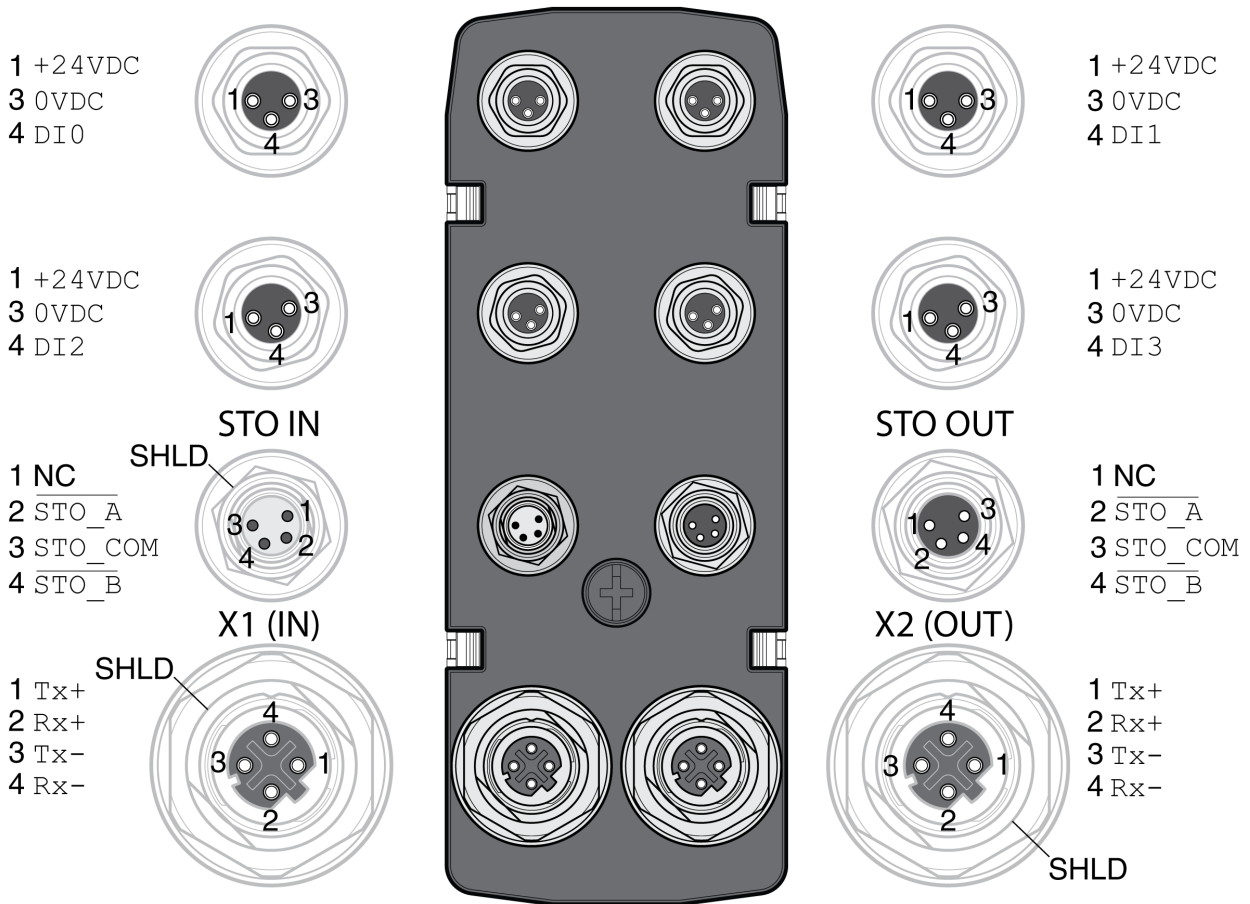
What Is in This Section?

This section contains the following topics:

Topic	Page
Overview I/O Modules with Industrial Connectors	114
Logic Type	117
Connection of the Digital Inputs and Digital Outputs	118
Connection of Safety Function STO	119
Fieldbus Connection	120

Overview I/O Modules with Industrial Connectors

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

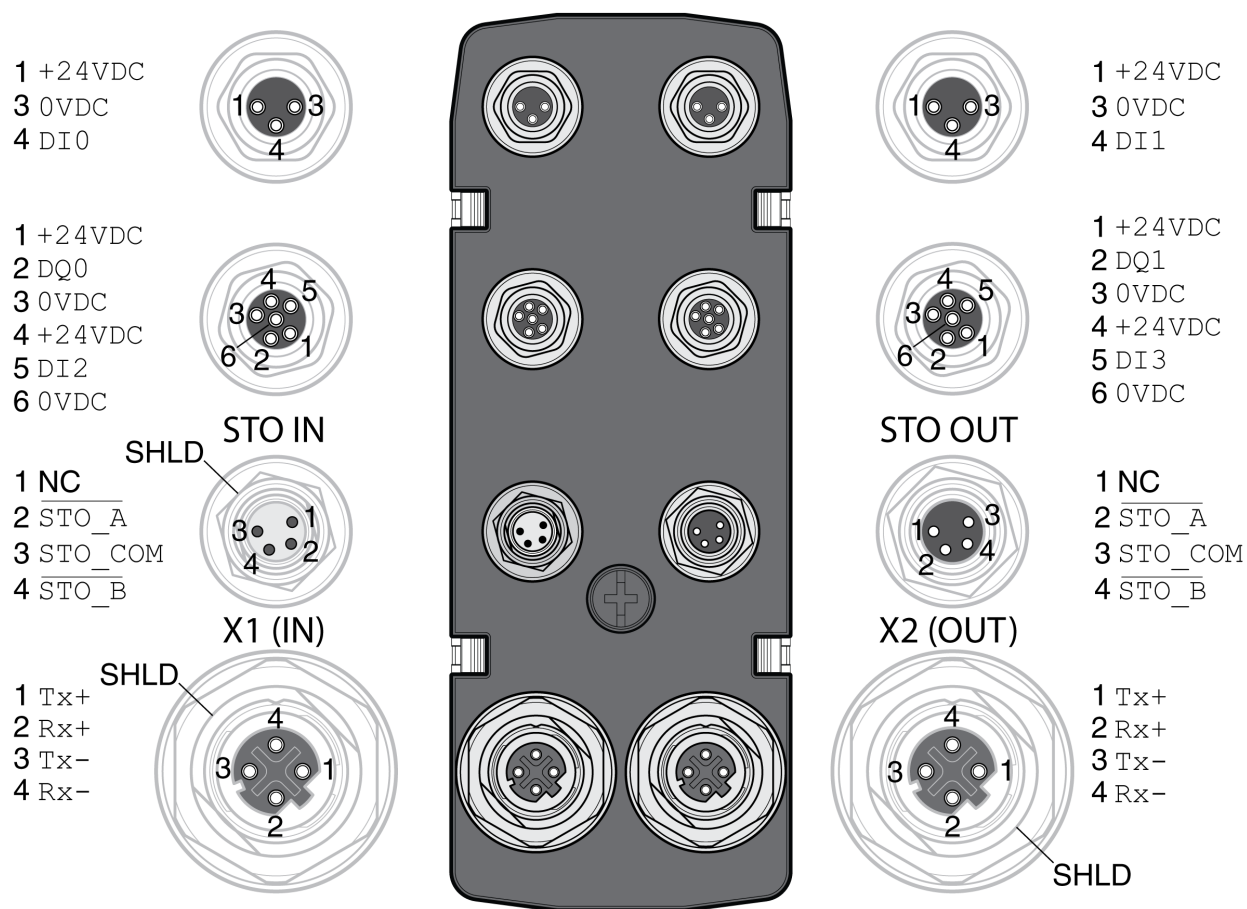


Signal	Meaning	Factory settings ⁽¹⁾	I/O
+24VDC	24 V signal power supply (see chapter Internal 24 V Signal Power Supply (see page 28))	-	O
0VDC	Reference potential to +24VDC	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
STO_A	Safety function STO ⁽²⁾	-	I
STO_COM	Reference potential for safety function STO ⁽²⁾	-	I
STO_B	Safety function STO ⁽²⁾	-	I
SHLD	Shield (grounded internally)	-	-
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 chapter Digital Inputs and Outputs ([see page 207](#)).

(2) This module requires an external supply for the safety function STO; see the information in chapter Safety function STO ("Safe Torque Off") ([see page 69](#)).

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

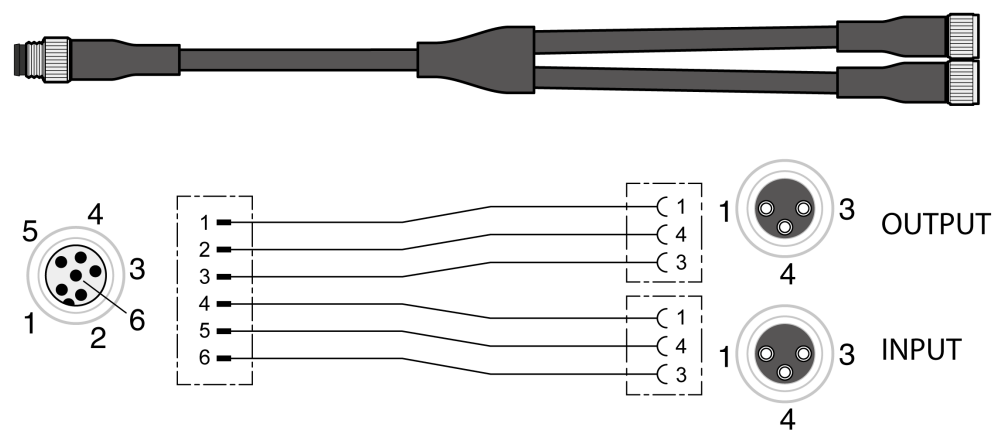


Signal	Meaning	Factory settings ⁽¹⁾	I/O
+24VDC	24 V signal power supply (see chapter Internal 24 V Signal Power Supply (see page 28))	-	O
0VDC	Reference potential to +24VDC	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
DQ0	Digital output 0	No Fault	O
DQ1	Digital output 1	Active	O
STO_A	Safety function STO ⁽²⁾	-	I
STO_COM	Reference potential for safety function STO ⁽²⁾	-	I
STO_B	Safety function STO ⁽²⁾	-	I
SHLD	Shield (grounded internally)	-	-
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 chapter Digital Inputs and Outputs ([see page 207](#)).

(2) This module requires an external supply for the safety function STO; see the information in chapter Safety function STO ("Safe Torque Off") ([see page 69](#)).

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



Signal	6-pin	3-pin	Connector	Meaning
+24VDC	1	1	Output	24 V signal power supply (see chapter Internal 24 V Signal Power Supply (see page 28))
DQ •	2	4		Digital output
0VDC	3	3		Reference potential to +24VDC
+24VDC	4	1	Input	24 V signal power supply (see chapter Internal 24 V Signal Power Supply (see page 28))
DI •	5	4		Digital input
0VDC	6	3		Reference potential to +24VDC

Logic Type

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

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

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

See chapters I/O Module with Industrial Connector for Positive Logic ([see page 473](#)) and I/O Module with Industrial Connector for Negative Logic ([see page 474](#)) for an overview of the available product versions.

See chapter Logic Type ([see page 57](#)) for additional information on the logic types.

Connection of the Digital Inputs and Digital Outputs

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

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

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

Cable Specifications

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

Connecting the Digital Inputs

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the digital inputs.
- For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors ([see page 477](#)).

Connection of Safety Function STO

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

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

See chapter Safety function STO ("Safe Torque Off") ([see page 69](#)) for additional information on the safety function STO.

Cable Specifications

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

Connecting the Safety Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety function in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") ([see page 69](#)).
- For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors ([see page 477](#)).

Fieldbus Connection

Cable Specifications

Shield	Required, both ends grounded
Twisted pair	Required
PELV:	Required
Cable composition:	8 * 0.25 mm ² (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 chapter Tightening Torque and Screws ([see page 42](#)).
- Close unused industrial connectors with a sealing cap, see chapter Industrial Plug Connectors ([see page 477](#)).

Section 4.4

I/O Module with Spring Terminals

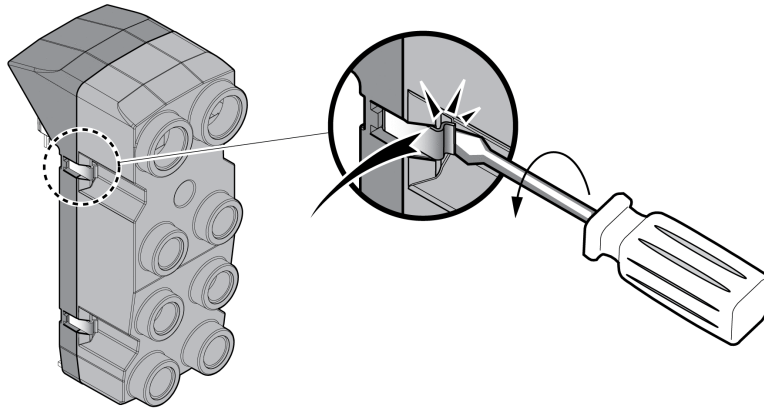
What Is in This Section?

This section contains the following topics:

Topic	Page
Opening the I/O Module	122
Overview I/O Module with Spring Terminals	123
Setting the Logic Type	124
Connection of the Digital Inputs/Outputs	125
Connection of Safety Function STO	127
Fieldbus Connection	130
Connecting the Signals	132
Closing the I/O Module	133

Opening the I/O Module

- Open the I/O module.

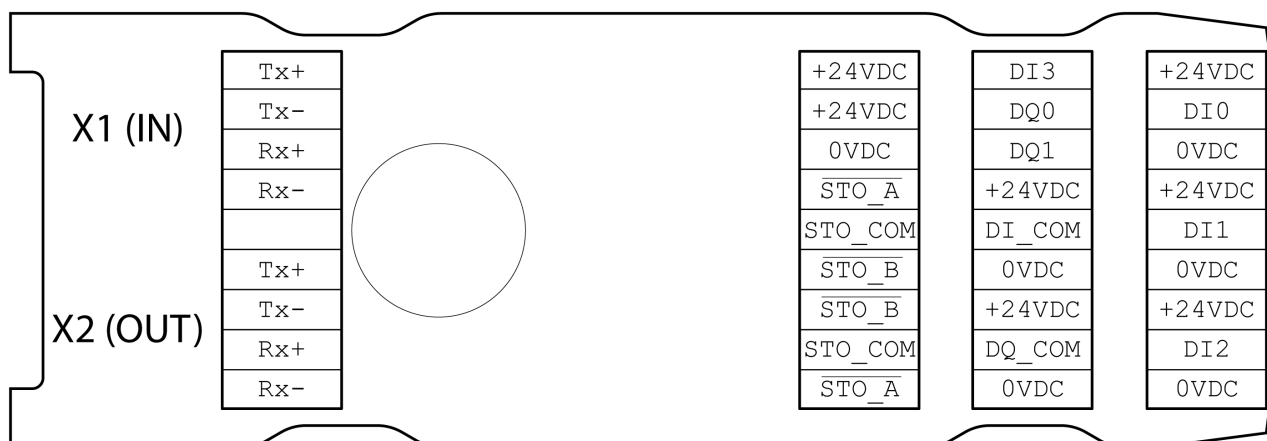


- Screw the required cable glands into the I/O module.
Cable glands are available as accessories, see chapter Accessories and Spare Parts ([see page 467](#)).
- Close unused cable entries with a blind plug,

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

For the tightening torque see chapter Tightening Torque and Screws ([see page 42](#)).

Overview I/O Module with Spring Terminals



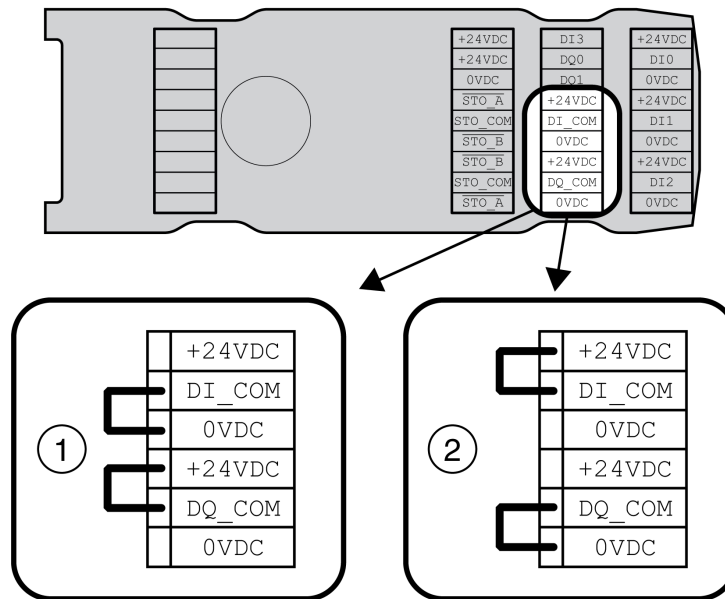
Signal	Meaning	Factory settings ⁽¹⁾	I/O
+24VDC	24 V signal power supply (see chapter Internal 24V Signal Power Supply (see page 28))	-	O
0VDC	Reference potential to +24VDC	-	-
DI0	Digital input 0	Positive Limit Switch (LIMP)	I
DI1	Digital input 1	Negative Limit Switch (LIMN)	I
DI2	Digital input 2	Reference Switch (REF)	I
DI3	Digital input 3	Freely Available	I
DQ0	Digital output 0	No Fault	O
DQ1	Digital output 1	Active	O
DI_COM	Reference potential for digital inputs	-	-
DQ_COM	Reference potential for digital outputs	-	-
STO_A	Safety function STO	-	I
STO_COM	Reference potential for STO	-	I
STO_B	Safety function STO	-	I
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 chapter Digital Inputs and Outputs (see page 207).			

Setting the Logic Type

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

See chapter Logic Type ([see page 57](#)) for additional information on the logic types.

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



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

Connection of the Digital Inputs/Outputs

Cable Specifications

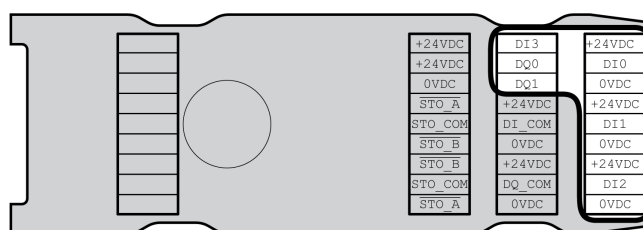
Shield	-
Twisted pair	-
PELV:	Required
Cable composition:	-
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)
Maximum cable length:	30 m (98.4 ft)

Properties of the Connection Terminals

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

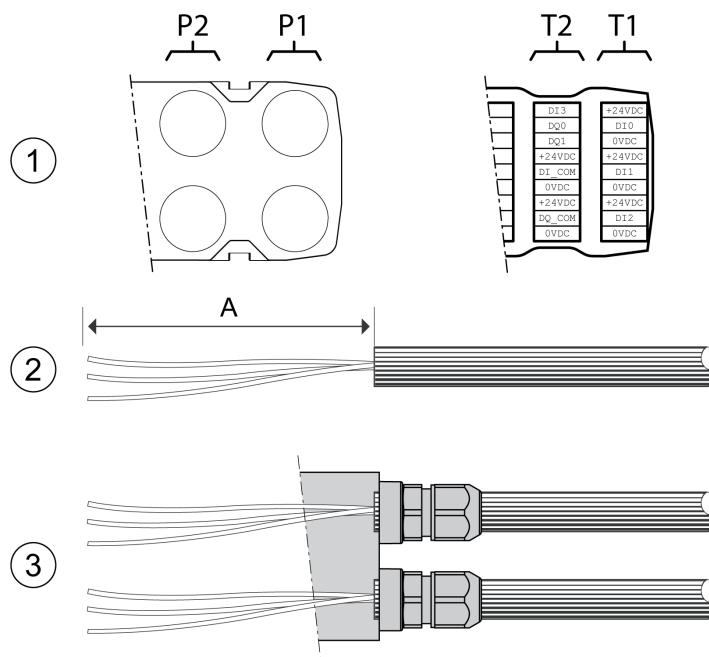
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



Signal	Meaning
DI0	Digital input 0
DI1	Digital input 1
DI2	Digital input 2
DI3	Digital input 3
DQ0	Digital output 0
DQ1	Digital output 1
+24VDC	24 V signal power supply (see chapter Internal 24V Signal Power Supply (see page 28))
0VDC	Reference potential to DI0 ... DI3, DQ0 and DQ1

Assembling Cables



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

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

Connection of Safety Function STO

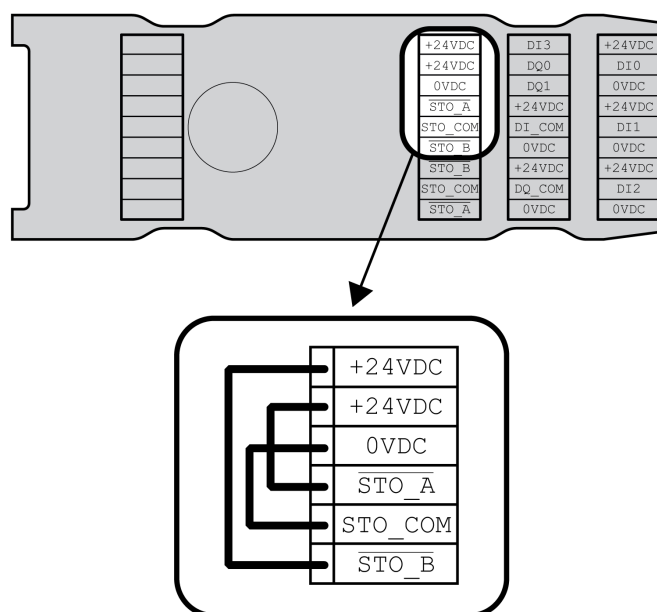
The I/O module with spring terminals supports operation without safety function STO and operation without safety function STO.

See chapter Safety function STO ("Safe Torque Off") ([see page 69](#)) for additional information on the safety function STO.

Operation Without STO

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

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



Operation with Safety Function STO

If the safety function STO is to be used, the safety function STO must be connected in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") ([see page 69](#)).

Cable Specifications

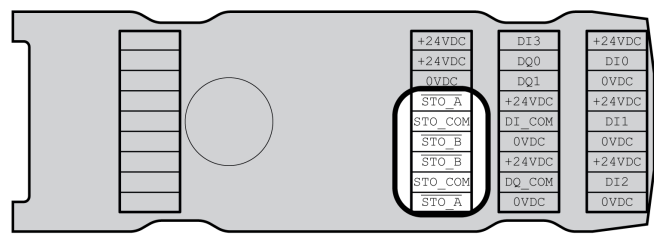
Shield	Required, one end grounded
Twisted pair	-
PELV:	Required
Cable composition:	-
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)
Maximum cable length:	-

Properties of the Connection Terminals

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

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

Pin Assignment



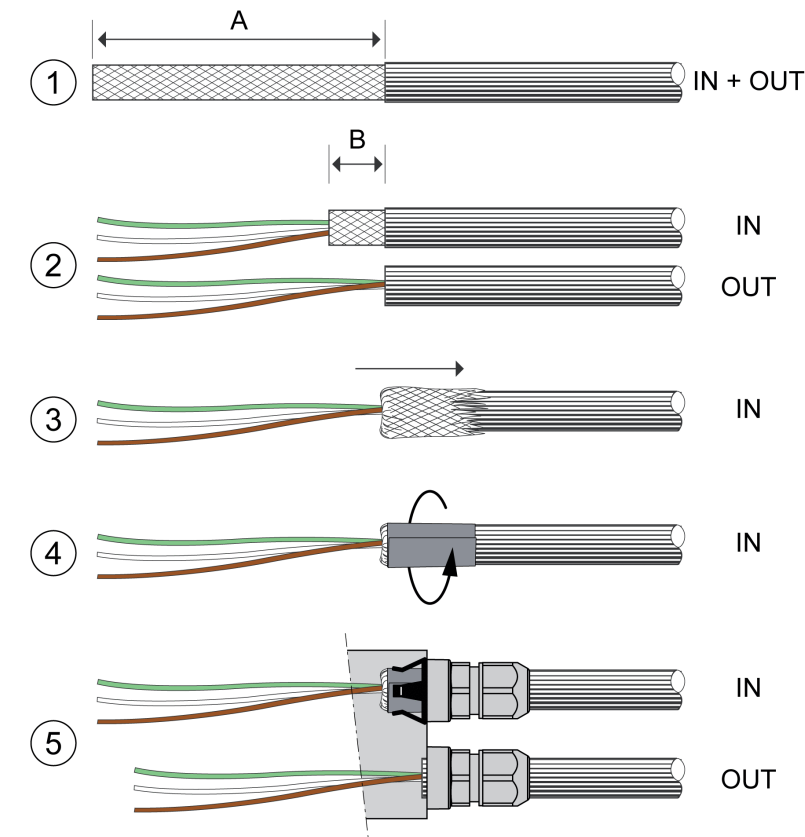
Signal	Meaning
STO_A	Safety function STO: Dual-channel connection, connection A
STO_B	Safety function STO: Dual-channel connection, connection B
STO_COM	Reference potential to STO_A and STO_B

Shield Concept

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

See chapter Protected Cable Installation for Safety-Related Signals ([see page 77](#)) for additional information.

Assembling Cables



Length A	mm (in)	150 (5.91 in)
----------	---------	---------------

Length B	mm (in)	10 (0.39 in)
----------	---------	--------------

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

Connecting the Safety Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety function in accordance with the specifications in chapter Safety function STO ("Safe Torque Off") (*see page 69*).

Fieldbus Connection

Cable Specifications

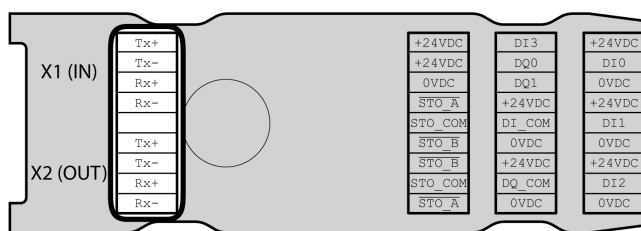
Shield	Required, both ends grounded
Twisted pair	Required
PELV:	Required
Cable composition:	8 * 0.25 mm ² (8 * AWG 22) Cat 5e, no crossover cable
Minimum cable diameter: For UL:	2.5 mm (0.1 in) 5 mm (0.2 in)
Maximum cable diameter	6.5 mm (0.26 in)
Maximum cable length:	100 m (328 ft)

Properties of the Connection Terminals

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)

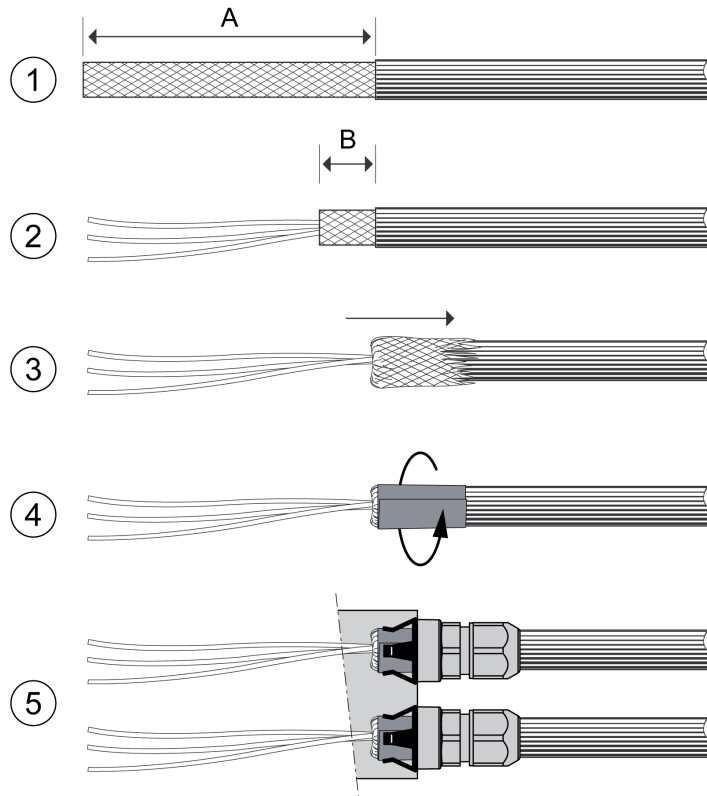
The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Pin Assignment



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

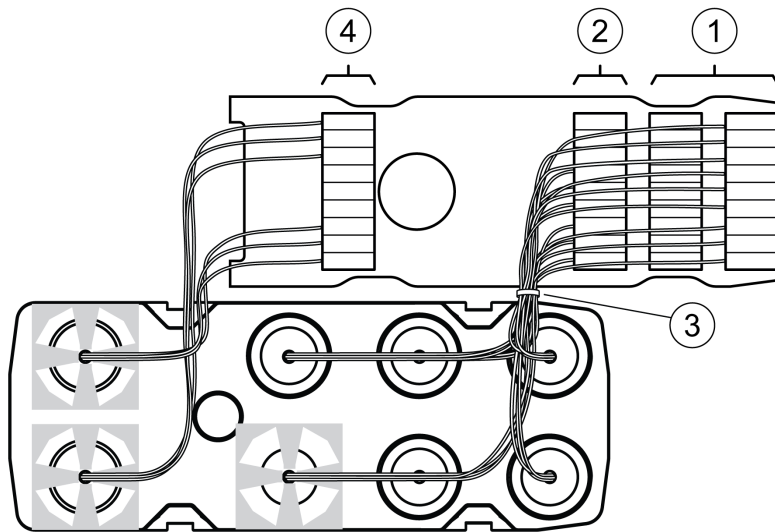
Assembling Cables



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

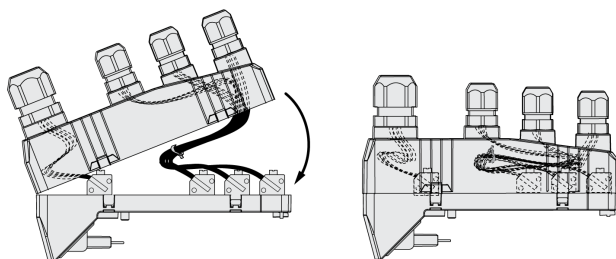
- (1) Strip the cable jacket of the cables for X1 (IN) and X2 (OUT), length A.
- (2) Shorten the shield to length B.
- (3) Slide the shielding braid back over the cable jacket.
- (4) Fasten the shield with a shield foil (50 x 10 mm (1.97 x 0.39 in)).
- (5) Push the compression nut of the cable gland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

Connecting the Signals



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

Closing the I/O Module



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

Section 4.5

Verifying Installation

Verifying Installation

Verify proper installation:

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

If the safety function STO and spring terminals are used:

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

Chapter 5

Commissioning

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
5.1	Overview	136
5.2	Fieldbus Integration	141
5.3	Commissioning Procedure	151
5.4	Controller Optimization with Step Response	170
5.5	Parameter Management	181

Section 5.1

Overview

What Is in This Section?

This section contains the following topics:

Topic	Page
General	137
Preparation	139

General

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

DANGER

ELECTRIC SHOCK

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

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

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

DANGER

FIRE DUE TO EXTERNAL DRIVING FORCES ACTING ON MOTOR

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

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

⚠ WARNING**LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE**

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

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

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

⚠ WARNING**UNINTENDED MOVEMENT**

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

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

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

⚠ CAUTION**HOT SURFACES**

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

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

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

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

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

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

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

NOTICE**REDUCED CAPACITOR PERFORMANCE**

- If the drive has not been connected to mains for a period of more than 24 months, apply mains voltage to the drive for at least one hour before enabling the power stage for the first time.
- If the drive is commissioned for the first time, verify the date of manufacture and run the procedure specified above if the date of manufacture is more than 24 months in the past.

Failure to follow these instructions can result in equipment damage.

Preparation

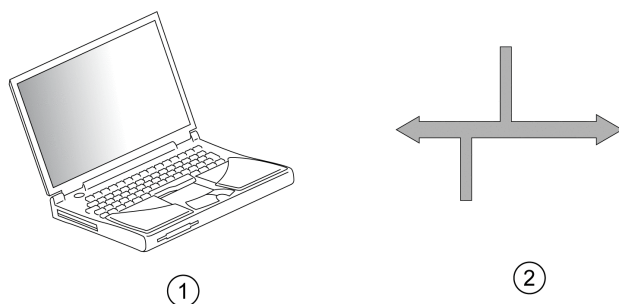
Required Components

The following is required for commissioning:

- Commissioning software “Lexium DTM Library”
http://www.schneider-electric.com/en/download/document/Lexium_DTM_Library/
- Fieldbus converter for the commissioning software for connection via the commissioning interface
- GSD file
<http://www.schneider-electric.com>
- PROFINET IO controller

Interfaces

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



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

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

Commissioning Software

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

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

GSD File

The properties of an IO device are described in a GSD file (General Station Description). The GSD file is provided by the manufacturer of the product and must be read using the configuration tool of the IO controller.

The GSD file contains information on the operation of the IO device on the PROFINET network.

- Manufacturer information
- Profile class (IO device)
- Device identification
- Time intervals
- Settings of inputs and outputs

The GSD file for this product can be downloaded from the Internet at:

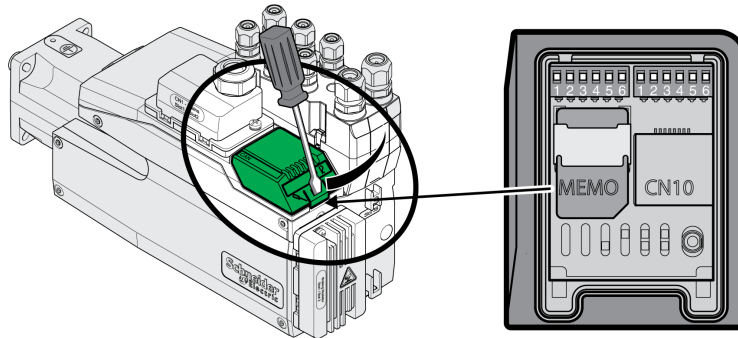
<http://www.schneider-electric.com>

Opening the Cover of the Commissioning Interface

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

- DIP switches for fieldbus, IP-address and device name
- Card holder for the memory card
- Commissioning interface CN10

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



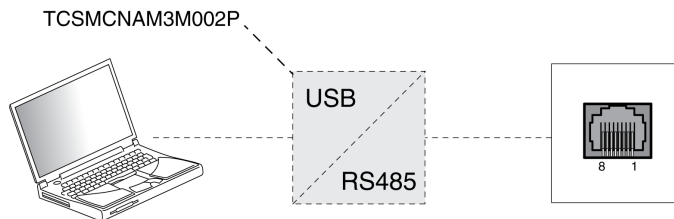
The CN10 interface does not support devices without their own power supply.

Use standard RJ45 patch cables.

The cover of the commissioning must be closed after commissioning.

Connecting a PC

A PC with commissioning software can be connected for commissioning. The PC is connected to a bidirectional USB/RS485 converter, see chapter Accessories and Spare Parts ([see page 467](#)).



Section 5.2

Fieldbus Integration

What Is in This Section?

This section contains the following topics:

Topic	Page
Selecting the Fieldbus	142
Setting the IP Address	143
Setting the Device Name	146
Settings with the Configuration Tool STEP7 - V13 (TIA Portal)	147
Settings with the Configuration Tool STEP7 - V5	149

Selecting the Fieldbus

Overview

The fieldbus to be used with the device has to be set.

Factory Setting

The factory setting for the fieldbus is **Reserved**.

Settings

Set the fieldbus of the device to **PROFINET**.
The fieldbus can be set via the DIP switches or via the parameter `FieldbusSelection`.
Setting the fieldbus via DIP switches:



Changed settings become active the next time the product is powered on.

Value decimal	Value bit-coded	Meaning
0	0 0 0	Fieldbus can be set via parameter <code>FieldbusSelection</code> .
2	0 1 0	Fieldbus PROFINET

Setting the fieldbus via parameter (only if the DIP switches are set to value 0):

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>FieldbusSelection</code>	Fieldbus selection 1 / Reserved: Reserved 2 / PROFINET: PROFINET The fieldbus can be selected with this parameter if the DIP switches are set to 0. Changed settings become active the next time the product is powered on. 3...7 / Reserved: Reserved	- 1 1 7	UINT16 R/W per. -	Modbus 15912 PROFINET 15912

Setting the IP Address

Overview

The IP address of the device can be set by means of the following methods:

- DCP (Discovery Configuration Protocol)
- Manual setting

Factory Setting

The factory setting for the IP address is **DCP**.

This setting does not have to be changed if the DCP sever of the IO controller (logic or motion controller) is used.

Settings

If a connection is to be established without the configuration tool of the IO controller, the IP address can also be set manually.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the devices have unique IP addresses.
- Verify that you use the correct IP address to address the intended device.

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

The method of obtaining the IP address can be set via the DIP switches or via the parameter `PntIpMode`.

Setting the method via DIP switches:



Changed settings become active the next time the product is powered on.

Value decimal	Value bit-coded	Meaning
0	0 0	Method can be set via parameter <code>PntIpMode</code> .
3	1 1	IP address via DCP

Setting the method via parameter (only if the DIP switches are set to value 0):

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>PntIpMode</code>	Type of obtaining IP address 0 / Manual: Manual 3 / DCP: DCP	- 0 3 3	UINT16 R/W per. -	Modbus 18436 PROFINET 18436

Set the parameter to the value “Manual” if you want to set the IP address manually.

The IP address can be set manually via the commissioning software Lexium DTM Library.

The parameters `PntIPAddress1` ... `PntIPAddress4` let you set the IP address.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PntIPAddress1	IP address, byte 1 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18446 PROFINET 18446
PntIPAddress2	IP address, byte 2 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18448 PROFINET 18448
PntIPAddress3	IP address, byte 3 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18450 PROFINET 18450
PntIPAddress4	IP address, byte 4 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18452 PROFINET 18452

The parameters PntIPmask1 ... PntIPmask4 let you set the subnet mask.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PntIPmask1	IP address subnet mask, byte 1 Changed settings become active the next time the product is powered on.	- 0 255 255	UINT16 R/W per. -	Modbus 18454 PROFINET 18454
PntIPmask2	IP address subnet mask, byte 2 Changed settings become active the next time the product is powered on.	- 0 255 255	UINT16 R/W per. -	Modbus 18456 PROFINET 18456
PntIPmask3	IP address subnet mask, byte 3 Changed settings become active the next time the product is powered on.	- 0 255 255	UINT16 R/W per. -	Modbus 18458 PROFINET 18458
PntIPmask4	IP address subnet mask, byte 4 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18460 PROFINET 18460

The parameters PntIPgate1 ... PntIPgate4 let you set the gateway.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PntIPgate1	IP address gateway, byte 1 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18462 PROFINET 18462
PntIPgate2	IP address gateway, byte 2 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18464 PROFINET 18464
PntIPgate3	IP address gateway, byte 3 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18466 PROFINET 18466

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PntIPgate4	IP address gateway, byte 4 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18468 PROFINET 18468

Setting the Device Name

Overview

The device name consists of two parts:

- Device name text
- Device name extension (additional numbers appended with a "-")

Example: UserDefinedName-123

Each device must have a unique device name on the network.

Factory Setting

The device name is "empty" (no device name text is set and the device name extension is set to 0).

Setting the Device Name Text

The device name text can be set via the PROFINET commissioning software "PRONETA" or via the configuration tool of the IO controller.

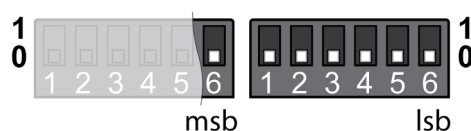
If no user-defined device name text is set, but if a device name extension is set, then the device name text is set automatically to **lxm32i**.

Setting the Device Name Extension

The value set via the device name extension is appended to the device name text with a "-". The additional number is appended either to the user-defined device name text or to the automatic device name text.

The device name extension can be set via the DIP switches or via the parameter `DevNameExtAddr`.

Setting the device name extension via DIP switches:



Modified settings become active the next time the product is powered on.

Value bit-coded	Value decimal	Meaning
0 0 0 0 0 0	0	Device name extension can be set via parameter <code>DevNameExtAddr</code> .
0 0 0 0 0 1 ... 1 1 1 1 1 1	1 ... 127	Value of the device name extension

Setting the device name extension via parameter (only if the DIP switches are set to value 0):

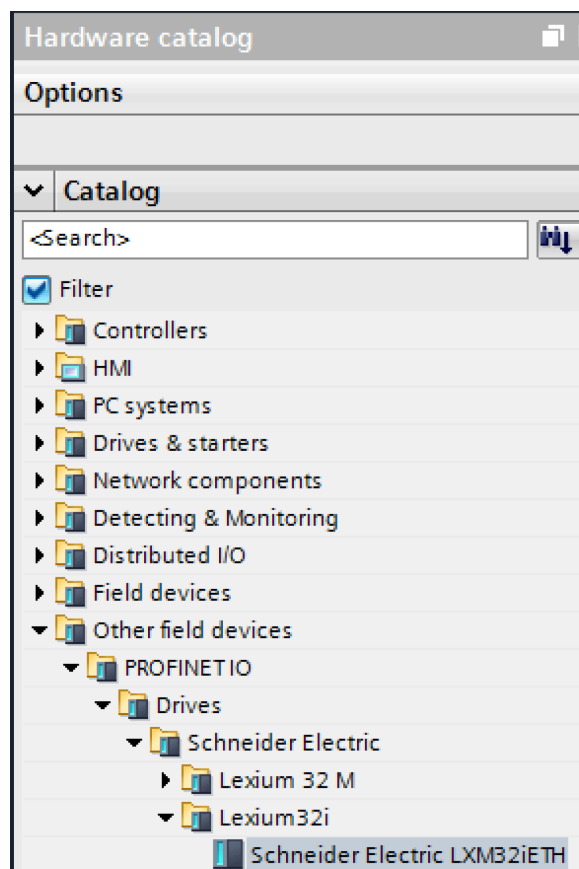
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>DevNameExtAddr</code>	Value for device name extension (PROFINET) PROFINET: The device name extension can be set with this parameter if the DIP switches are set to 0. Changed settings become active the next time the product is powered on.	- 0 0 65535	UINT16 R/W per. -	Modbus 15906 PROFINET 15906

Settings with the Configuration Tool STEP7 - V13 (TIA Portal)

GSD File

The GSD file must be read with the configuration tool of the IO controller. The device is then known to the network.

In the Hardware catalog, select the device "Schneider Electric LXM32iETH" from the list.



Selecting the Drive Profile

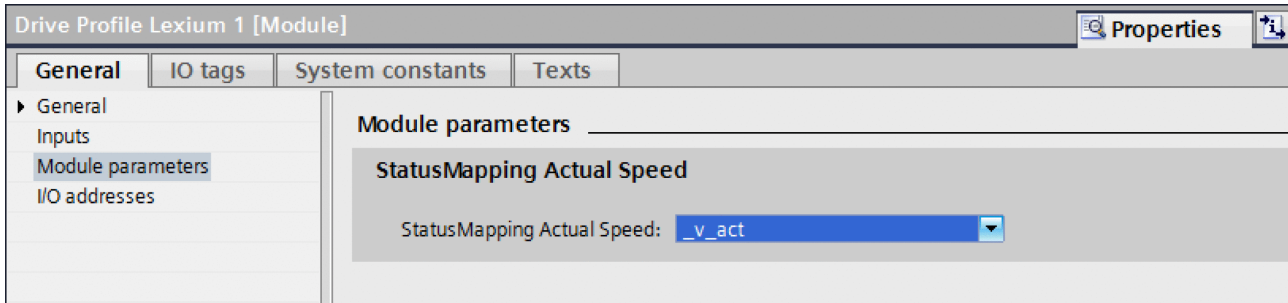
The configuration tool of the IO controller lets you select the drive profile to be used.

In the Device overview, select the required drive profile ("Drive Profile Lexium 1" or "Drive Profile Lexium 2") in slot 1. See chapter Cyclic Communication - Overview ([see page 85](#)) for additional information on the drive profiles.

Device overview									
...	Module	Rack	Slot	I address	Q address	Type	Article no.	Firmware	Comment
	▼ LXM32i_1	0	0			Schneider Electric LXM32iETH	LXM32iETH		
	▶ X1	0	0 X1			LXM32i			
	Drive Profile Lexium 1_1	0	1	256...281	256...281	Drive Profile Lexium 1			
		0	2						
		0	3						
		0	4						
		0	5						
		0	6						
		0	7						
		0	8						
		0	9						

Mapping for "_v_act"

In the drive profile "Drive Profile Lexium 1", the double word "_v_act" can be parameterized. In the properties of the drive profile "Drive Profile Lexium 1", you can select the parameter `_v_act` (actual velocity) or `_n_act` (actual speed of rotation).



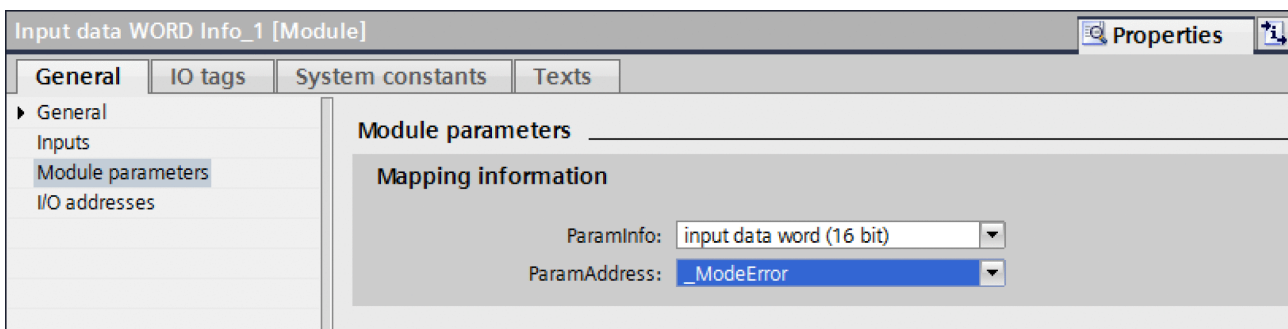
Additional Parameters in "Optional Data"

The configuration tool of the IO controller lets you set the additional parameters to be transmitted in the output data and the input data in the range "Optional Data".

There are up to 8 slots in which 8 additional parameters can be set. The total length of the data frame of the output data and the input data must not exceed 40 bytes.

Set the required additional parameters in slots 2 ... 9 in the Device overview.

Device overview										
	Module	Rack	Slot	I address	Q address	Type	Article no.	Firmware	Comment	
	▼ LXM32i_1	0	0			Schneider Electric LXM32iETH	LXM32iETH			
	▶ X1	0	0 X1			LXM32i				
	Drive Profile Lexium 1_1	0	1	256...281	256...281	Drive Profile Lexium 1				
	Input data WORD Info_1	0	2	2...3		Input data WORD Info				
	Input data DWORD Info_1	0	3	4...7		Input data DWORD Info				
	Output data WORD Info_1	0	4		2...3	Output data WORD Info				
	Output data DWORD Info_1	0	5		4...7	Output data DWORD Info				
		0	6							
		0	7							
		0	8							
		0	9							

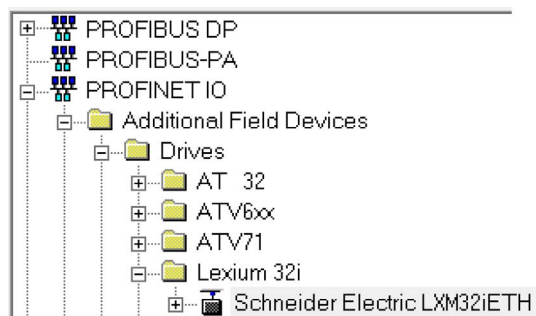


Settings with the Configuration Tool STEP7 - V5

GSD File

The GSD file must be read with the configuration tool of the IO controller. The device is then known to the network.

In the Hardware catalog, select the device "Schneider Electric LXM32iETH" from the list.



Selecting the Drive Profile

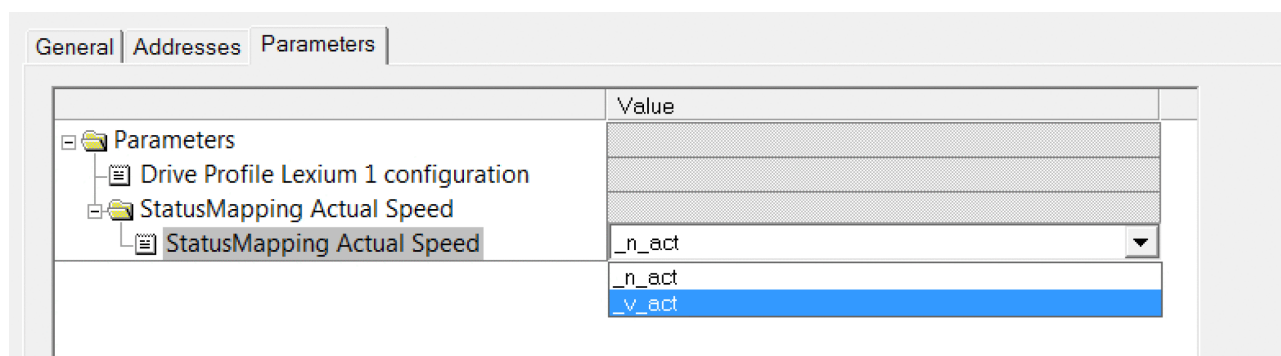
The configuration tool of the IO controller lets you select the drive profile to be used.

In the Device overview, select the required drive profile ("Drive Profile Lexium 1" or "Drive Profile Lexium 2") in slot 1. See chapter Cyclic Communication - Overview ([see page 85](#)) for additional information on the drive profiles.

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment
0	LXM32i	LXM32iETH			2042"	
X1	X1				2041"	
X1 F1	Port 1				2040"	
X1 F2	Port 2				2039"	
1	Drive Profile Lexium 1		256...281	256...281		
2						
3						
4						
5						
6						
7						
8						
9						

Mapping for "_v_act"

In the drive profile "Drive Profile Lexium 1", the double word "_v_act" can be parameterized. In the properties of the drive profile "Drive Profile Lexium 1", you can select the parameter `_v_act` (actual velocity) or `_n_act` (actual speed of rotation).












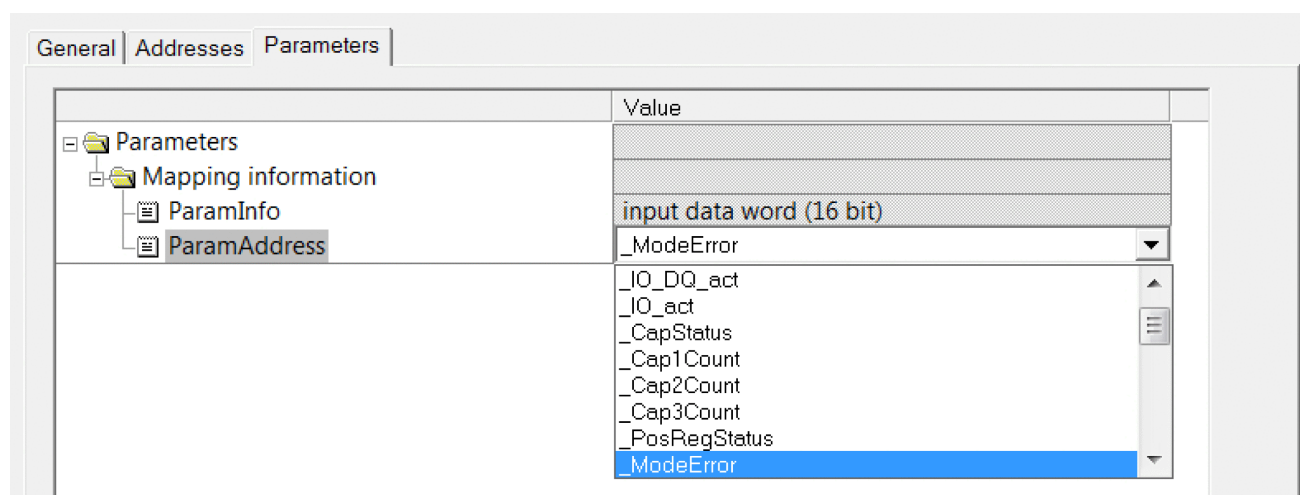
Additional Parameters in "Optional Data"

The configuration tool of the IO controller lets you set the additional parameters to be transmitted in the output data and the input data in the range "Optional Data".

There are up to 8 slots in which 8 additional parameters can be set. The total length of the data frame of the output data and the input data must not exceed 40 bytes.

Set the required additional parameters in slots 2 ... 9 in the Device overview.

Slot	Module	Order number	I Address	Q address	Diagnostic Address	Comment
0	 LXM32i	LXM32iETH			2042*	
X1	 X1				2041*	
X1 F1	 Part 1				2040*	
X1 F2	 Part 2				2039*	
1	 Drive Profile Lexium 1		256...281	256...281		
2	 Input data DWORD Info		282...285			
3	 Input data WORD Info		286...287			
4	 Output data DWORD Info			282...285		
5	 Output data WORD Info			286...287		
6						
7						
8						
9						



Section 5.3

Commissioning Procedure

What Is in This Section?

This section contains the following topics:

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Verifying the Signals of the Limit Switches	155
Verifying the Safety Function STO	156
Holding Brake (Option)	157
Verifying the Direction of Movement	159
Setting Parameters for Encoder	161
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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
<code>CTRL_I_max</code>	<p>Current limitation</p> <p>During operation, the current limit is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - <code>CTRL_I_max</code> - <code>_M_I_max</code> - <code>_PS_I_max</code> - Current limitation via digital input <p>Limitations caused by I2t monitoring are also taken into account.</p> <p>Default: <code>_PS_I_max</code> at 8 kHz PWM frequency and 230/480 V mains voltage</p> <p>In increments of 0.01 A_{rms}.</p> <p>Changed settings become active immediately.</p>	A_{rms} 0.00 - 463.00	UINT16 R/W per. -	Modbus 4376 PROFINET 4376
<code>LIM_I_maxQSTP</code>	<p>Current for Quick Stop</p> <p>This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).</p> <p>In the case of a Quick Stop, the current limit (<code>_Imax_act</code>) is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - <code>LIM_I_maxQSTP</code> - <code>_M_I_max</code> - <code>_PS_I_max</code> <p>Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop.</p> <p>Default: <code>_PS_I_max</code> at 8 kHz PWM frequency and 230/480 V mains voltage</p> <p>In increments of 0.01 A_{rms}.</p> <p>Changed settings become active immediately.</p>	A_{rms} - - -	UINT16 R/W per. -	Modbus 4378 PROFINET 4378

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxHalt	<p>Current for Halt</p> <p>This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).</p> <p>In the case of a Halt, the current limit (I_{max_act}) is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - LIM_I_maxHalt - M_I_max - PS_I_max <p>Further current limitations caused by I2t monitoring are also taken into account during a Halt.</p> <p>Default: PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of $0.01 A_{rms}$.</p> <p>Changed settings become active immediately.</p>	A_{rms} - - -	UINT16 R/W per. -	Modbus 4380 PROFINET 4380

Velocity Limitation

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

- Use the parameter `CTRL_v_max` to set the maximum velocity of the motor.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_v_max	<p>Velocity limitation</p> <p>During operation, the velocity limit is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - CTRL_v_max - M_n_max - Velocity limitation via digital input <p>Changed settings become active immediately.</p>	usr_v 1 13200 2147483647	UINT32 R/W per. -	Modbus 4384 PROFINET 4384

Digital Inputs and Outputs

The device has configurable inputs and configurable outputs. See chapter Digital Inputs and Outputs (*see page 207*) 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
<code>_IO_act</code>	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/- - -	Modbus 2050 PROFINET 2050
<code>_IO_DI_act</code>	Status of digital inputs Bit assignments: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3	- - - -	UINT16 R/- - -	Modbus 2078 PROFINET 2078
<code>_IO_DQ_act</code>	Status of digital outputs Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	Modbus 2080 PROFINET 2080
<code>_IO_STO_act</code>	Status of the inputs for the safety function STO Coding of the individual signals: Bit 0: STO_A Bit 1: STO_B	- - - -	UINT16 R/- - -	Modbus 2124 PROFINET 2124

Verifying the Signals of the Limit Switches

The use of limit switches can provide some protection against hazards (for example, collision with mechanical stop caused by incorrect reference values).

WARNING

LOSS OF CONTROL

- Ensure that limit switches are installed as determined by your risk assessment.
- Verify correct connection of the limit switches.
- Verify that the limit switches are sufficiently distant from the mechanical stop to allow an adequate stopping distance.
- Verify correct parameterization and function of the limit switches.

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

- Set up the limit switches in such a way as to keep the motor from overtraveling the limit switches.
- Trigger the limit switches manually.

If an error message is indicated, the limit switches were triggered.

Parameters can be used to release the limit switches and to set them up as normally closed contacts or normally open contacts, see chapter Limit Switches ([see page 306](#)).

Verifying the Safety Function STO

Operation with Safety Function STO

If you want to use the safety function STO, carry out the following steps:

- To help avoid unintended restart after restoration of power, the parameter `IO_AutoEnable` must be set to "off". Verify that the parameter `IO_AutoEnable` is set to "off".

Power off the power supply:

- Verify that the signal wires at the inputs (`STO_A`) and (`STO_B`) are isolated from each other. The two signal wires must not be electrically connected.

Power on the power supply:

- Enable the power stage without starting a motor movement.
- Trigger the safety function STO.
 - If the power stage is now disabled and the error message 1300 is indicated, the safety function STO was triggered.
 - If a different error message is indicated, the safety function STO was not triggered.
- Document all tests of the safety function in your acceptance protocol.

Operation without Safety Function STO

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


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

- Verify that the inputs `STO_A` and `STO_B` are connected to +24VDC.
For details see chapter Connection of Safety Function STO ([see page 127](#)).

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
<p>UNINTENDED AXIS MOVEMENT</p> <ul style="list-style-type: none"> Do not use the internal holding brake as a safety-related measure. Only use certified external brakes as safety-related measures. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

Releasing the Holding Brake

When the power stage is enabled, current is applied to the motor. When current is applied to the motor, the holding brake is automatically released.

Releasing the holding brake requires a certain amount of time. This time is contained in the electronic nameplate of the motor. Transition to the operating state **6 Operation Enabled** is only possible after this time delay has elapsed.

Applying the Holding Brake

When the power stage is disabled, the holding brake is automatically applied.

However, applying the holding brake requires a certain amount of time. This time is contained in the electronic nameplate of the motor. Current remains to be applied to the motor during this time delay.


See chapter Safety function STO ("Safe Torque Off") ([see page 69](#)) for additional information on the behavior of the holding brake when the safety function STO is triggered.

Releasing the Holding Brake Manually

Mechanical adjustments may require you to manually rotate the motor shaft.

Manual release of the holding brake is only possible in the operating states **3 Switch On Disabled**, **4 Ready To Switch On** or **9 Fault**.

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

 WARNING
<p>UNINTENDED MOVEMENT</p> <ul style="list-style-type: none"> 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. <p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p>

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.

Releasing the Holding Brake Manually via a Signal Input

In order to release the holding brake via a signal input, you must first parameterize the signal input function "Release Holding Brake", see chapter Digital Inputs and Outputs (*see page 207*).

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
<code>BRK_release</code>	<p>Manual operation of the holding brake</p> <p>0 / Automatic: Automatic processing</p> <p>1 / Manual Release: Manual release of holding brake</p> <p>2 / Manual Application: Manual applying of holding brake</p> <p>You can apply or release the holding brake manually.</p> <p>The holding brake can only be manually released in the operating states 'Switch On Disabled', 'Ready To Switch On' or 'Fault'.</p> <p>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. Changed settings become active immediately.</p>	- 0 0 2	UINT16 R/W - -	Modbus 2068 PROFINET 2068

Verifying the Direction of Movement

Definition of Direction of Movement

In the case of a rotary motors, direction of movement is defined in accordance with IEC 61800-7-204: Positive direction is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

It is important to maintain the IEC 61800-7-204 directional standard within your application because many motion-related function blocks, programming conventions, and, safety-related and conventional devices expect this underlying assumption within their logic and operational methodologies.

WARNING

UNINTENDED MOVEMENT CAUSED BY INTERCHANGED MOTOR PHASES

Do not interchange the motor phases.

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

If your application requires an inversion of the direction of movement, you can parameterize the direction of movement.

The direction of movement can be verified by starting a movement.

Verifying the Direction of Movement via the Commissioning Software

Power supply has been powered on.

- Enable the power stage.
- Start the operating mode Jog.
- Use the ">" button to trigger a movement in positive direction.
A movement is made in positive direction.
- Use the "<" button to trigger a movement in negative direction.
A movement is made in negative direction.

Verifying the Direction of Movement via Signal Inputs

The signal input functions "Jog Positive With Enable" and "Jog Negative With Enable" enable the power stage, start the operating mode Jog and trigger a movement in positive direction or in negative direction.

The signal input functions "Jog Positive With Enable" and "Jog Negative With Enable" must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

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	<p>Inversion of direction of movement</p> <p>0 / Inversion Off: Inversion of direction of movement is off</p> <p>1 / Inversion On: Inversion of direction of movement is on</p> <p>The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa.</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- 0 0 1	UINT16 R/W per. -	Modbus 1560 PROFINET 1560

Setting Parameters for Encoder

When starting up, the device reads the absolute position of the motor from the encoder. The absolute position can be read with the parameter `_p_absENC`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_p_absENC</code>	Absolute position with reference to the encoder range This value corresponds to the modulo position of the absolute encoder range. The value is no longer valid if the gear ratio of machine encoder and motor encoder is changed. A restart is required in such a case.	usr_p - - -	UINT32 R/- - -	Modbus 7710 PROFINET 7710

Working Range of the Encoder

The working range of the singleturn encoder is 131072 increments per turn.

The working range of the multiturn encoder is 4096 turns with 131072 increments per turn.

Underrun of Absolute Position

If a rotary motor performs a movement from 0 into negative direction, there is an underrun of the absolute position of the encoder. However, the actual position keeps counting forward and delivers a negative position value. After a power cycle, the actual position no longer corresponds to the negative position value, but to the absolute position of the encoder.

The following options are available to adjust the absolute position of the encoder:

- Adjustment of the absolute position
- Shifting the working range

Adjustment of the Absolute Position

When the motor is at a standstill, the new absolute position of the motor can be set to the current mechanical motor position with the parameter `ENC1_adjustment`.

Adjusting the absolute position also shifts the position of the index pulse.

- Set the absolute position at the negative mechanical limit to a position value greater than 0. This way, the movements remain within the continuous range of the encoder.

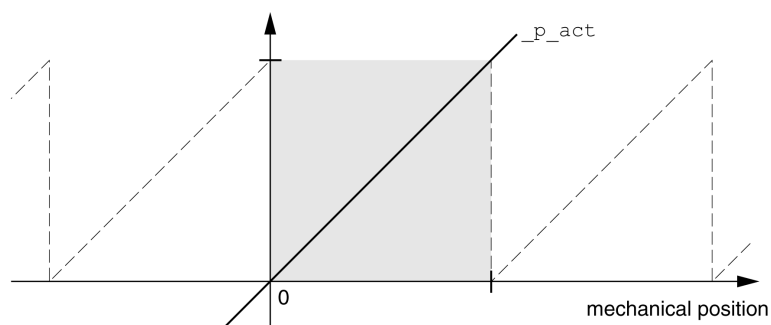
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC1_adjustment	<p>Adjustment of absolute position of encoder 1</p> <p>The value range depends on the encoder type.</p> <p>Singleturn encoder: 0 ... x-1</p> <p>Multiturn encoder: 0 ... (4096*x)-1</p> <p>Singleturn encoder (shifted with parameter ShiftEncWorkRang): -(x/2) ... (x/2)-1</p> <p>Multiturn encoder (shifted with parameter ShiftEncWorkRang): -(2048*x) ... (2048*x)-1</p> <p>Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling.</p> <p>If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted.</p> <p>After the write access, a wait time of at least 1 second is required before the drive can be powered off.</p> <p>Changed settings become active the next time the product is powered on.</p>	usr_p - - -	INT32 R/W - -	Modbus 1324 PROFINET 1324

Shifting the Working Range

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

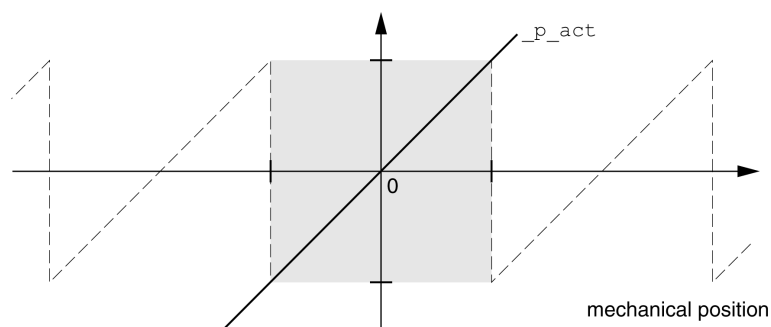
The working range without shift comprises:

Singleturn encoder	0 ... 131071 increments
Multiturn encoder	0 ... 4095 revolutions



The working range with shift comprises:


Singleturn encoder	-65536 ... 65535 increments
Multiturn encoder	-2048 ... 2047 revolutions




Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ShiftEncWorking	<p>Shifting of the encoder working range</p> <p>0 / Off: Shifting off</p> <p>1 / On: Shifting on</p> <p>After activating the shifting function, the position range of a multiturn encoder is shifted by one half of the range.</p> <p>Example for the position range of a multiturn encoder with 4096 revolutions:</p> <p>Value 0: Position values are between 0 ... 4096 revolutions.</p> <p>Value 1: Position values are between -2048 ... 2048 revolutions.</p> <p>Changed settings become active the next time the product is powered on.</p>	- 0 0 1	UINT16 R/W per. -	Modbus 1346 PROFINET 1346

Setting the Braking Resistor Parameters

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

 WARNING	
UNINTENDED EQUIPMENT OPERATION	
<ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • Ensure that it is not possible to make any contact with a hot braking resistor. • Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor. • Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions. 	
Failure to follow these instructions can result in death, serious injury, or equipment damage.	

If you use an external braking resistor, perform the following steps:

- Set the parameter `RESint_ext` to "External Braking Resistor".
- Set the parameters `REsExt_P`, `REsExt_R` and `REsExt_ton`.

See chapter Rating the Braking Resistor ([see page 63](#)) 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
<code>RESint_ext</code>	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1298 PROFINET 1298
<code>REsExt_P</code>	Nominal power of external braking resistor Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	W 1 10 32767	UINT16 R/W per. -	Modbus 1316 PROFINET 1316
<code>REsExt_R</code>	Resistance value of external braking resistor The minimum value depends on the power stage. In increments of 0.01 Ω. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	Ω 0.00 100.00 327.67	UINT16 R/W per. -	Modbus 1318 PROFINET 1318

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
REsExt_ton	Maximum permissible switch-on time of external braking resistor Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 1 1 30000	UINT16 R/W per. -	Modbus 1314 PROFINET 1314

Autotuning

Autotuning moves the motor in order to tune the control loops. Incorrect parameters may cause unintended movements or the loss of monitoring functions.

WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the parameters `AT_dir` and `AT_dis_usr` (`AT_dis`) do not exceed the available movement range.
- Verify that the parameterized movement ranges are available, free and clear for the mechanical movement defined by your application logic.
- Include in your calculations when determining the available movement range, the additional distance for the deceleration ramp in the case of an emergency stop.
- Verify that the parameter settings for a Quick Stop are correct.
- Verify correct operation of the limit switches.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in all phases of machine operation and maintenance involving this equipment.

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

Autotuning

Autotuning determines the friction torque as a constantly acting load torque and considers it in the calculation of the moment of inertia of the entire system.

External factors such as a load at the motor are considered. Autotuning optimizes the settings of the control loop parameters; see chapter Controller Optimization with Step Response ([see page 170](#)).

Autotuning also supports vertical axes.

Methods

There are three ways of tuning the drive control loops:

- Easy Tuning: Automatic - autotuning without user intervention. For most applications, autotuning yields good, highly dynamic results.
- Comfort Tuning: Semi-automatic - autotuning with user intervention. Parameters for direction and parameters for damping can be set by the user.
- Manual: The user can set and tune the control loop parameters manually. Expert mode.

Function

During autotuning, the motor is activated and small movements are made. Noise development and mechanical oscillations of the system are normal.

If you want to perform Easy Tuning, no additional parameters need to be adjusted. To perform Comfort Tuning, the parameters `AT_dir`, `AT_dis_usr` (`AT_dis`) and `AT_mechanics` are available to be adjusted to meet the requirements of your application.

The parameter `AT_Start` is used to start Easy Tuning or Comfort Tuning.

- Start autotuning via the commissioning software.
- Save the new settings to the EEPROM via the commissioning software.
The product features 2 control loop parameter sets that can be parameterized separately. The values for the control loop parameters determined during autotuning are stored in control loop parameter set 1.

If autotuning cancels with an error message, the default values are used. Change the mechanical position and restart autotuning. If you want to verify the plausibility of the calculated values, you can have them displayed; see chapter Enhanced Settings for Autotuning ([see page 168](#)).

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 Changed settings become active the next time the motor moves.	- 1 1 6	UINT16 R/W - -	Modbus 12040 PROFINET 12040
AT_dis_usr	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active the next time the motor moves.	usr_p 1 32768 2147483647	INT32 R/W - -	Modbus 12068 PROFINET 12068
AT_dis	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified movement range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The parameter AT_dis_usr allows you to enter the value in user-defined units. In increments of 0.1 revolution. Changed settings become active the next time the motor moves.	revolution 1.0 2.0 999.9	UINT32 R/W - -	Modbus 12038 PROFINET 12038
AT_mechanical	Type of coupling of the system 1 / Direct Coupling: Direct coupling 2 / Belt Axis: Belt axis 3 / Spindle Axis: Spindle axis Changed settings become active the next time the motor moves.	- 1 2 3	UINT16 R/W - -	Modbus 12060 PROFINET 12060
AT_start	Autotuning start Value 0: Terminate Value 1: Activate EasyTuning Value 2: Activate ComfortTuning Changed settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 12034 PROFINET 12034

Enhanced Settings for Autotuning

The following parameters allow you to monitor and influence autotuning.

The parameters `AT_state` and `AT_progress` allow you to monitor the progress and status of autotuning.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_AT_state</code>	Autotuning status Bit assignments: Bits 0 ... 10: Last processing step Bit 13: <code>auto_tune_process</code> Bit 14: <code>auto_tune_end</code> Bit 15: <code>auto_tune_err</code>	- - - -	UINT16 R/- - -	Modbus 12036 PROFINET 12036
<code>_AT_progress</code>	Progress of Autotuning	% 0 0 100	UINT16 R/- - -	Modbus 12054 PROFINET 12054

If, in a test run, you want to determine the effects of harder or softer settings of the control loop parameters on your system, you can write the parameter `CTRL_GlobGain` to modify the settings determined during autotuning. The parameter `_AT_J` allows you to read the moment of inertia of the entire system calculated during autotuning.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>CTRL_GlobGain</code>	Global gain factor (affects control loop parameter set 1) The global gain factor affects the following parameters of control loop parameter set 1: - <code>CTRL_KPn</code> - <code>CTRL_TNn</code> - <code>CTRL_KPp</code> - <code>CTRL_TAUref</code> 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 <code>CTRL_ParSetCopy</code> If a full configuration is transmitted via the fieldbus, the value for <code>CTRL_GlobGain</code> must be transmitted prior to the values of the control loop parameters <code>CTRL_KPn</code> , <code>CTRL_TNn</code> , <code>CTRL_KPp</code> and <code>CTRL_TAUref</code> . If <code>CTRL_GlobGain</code> is changed during a configuration transmission, <code>CTRL_KPn</code> , <code>CTRL_TNn</code> , <code>CTRL_KPp</code> and <code>CTRL_TAUref</code> must also be part of the configuration. In increments of 0.1 %. Changed settings become active immediately.	% 5.0 100.0 1000.0	UINT16 R/W per. -	Modbus 4394 PROFINET 4394
<code>_AT_M_friction</code>	Friction torque of the system Is determined during Autotuning. In increments of 0.01 A_{rms} .	A_{rms} - - -	UINT16 R/- - -	Modbus 12046 PROFINET 12046

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_AT_M_load	Constant load torque Is determined during Autotuning. In increments of 0.01 A_{rms} .	A_{rms} - - -	INT16 R/- - -	Modbus 12048 PROFINET 12048
_AT_J	Moment of inertia of the entire 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. -	Modbus 12056 PROFINET 12056

The parameter `AT_wait` lets you set a waiting time between the individual autotuning steps. Setting a waiting time is only useful in the case of a low-rigidity coupling, in particular so if the next autotuning step (changing the hardness) is already performed while the system is still settling.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AT_wait	Waiting time between Autotuning steps Changed settings become active the next time the motor moves.	ms 300 500 10000	UINT16 R/W - -	Modbus 12050 PROFINET 12050

Section 5.4

Controller Optimization with Step Response

What Is in This Section?

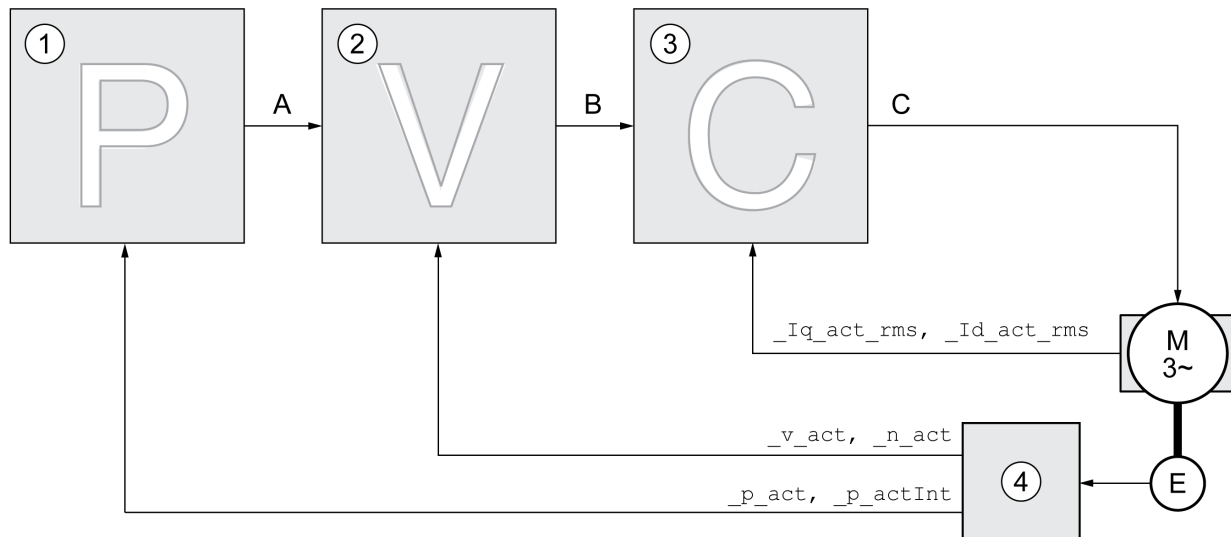
This section contains the following topics:

Topic	Page
Controller Structure	171
Optimization	173
Optimizing the Velocity Controller	174
Verifying and Optimizing the P Gain	178
Optimizing the Position Controller	179

Controller Structure

The controller structure corresponds to the classical cascaded closed loop with current controller, velocity controller and position controller. In addition, the reference value of the velocity controller can be smoothed via a filter.

The controllers are tuned one after the other from the "inside" to the "outside" in the following sequence: current control, velocity control, position control. The superimposed control loop remains off.



- 1 Position controller
- 2 Velocity Loop Controller
- 3 Current controller
- 4 Encoder evaluation

See chapter Overview of the Controller Structure ([see page 218](#)) 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 from 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
<code>CTRL_SelParSet</code>	Selection of control loop parameter set (non-persistent) Coding see parameter: <code>CTRL_PwrUpParSet</code> Changed settings become active immediately.	- 0 1 2	UINT16 R/W - -	Modbus 4402 PROFINET 4402
<code>_CTRL_ActParSet</code>	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 (<code>CTRL_ParChgTime</code>) has elapsed.	- - - -	UINT16 R/- - -	Modbus 4398 PROFINET 4398
<code>CTRL_ParChgTime</code>	Period of time for control loop parameter set switching In the case of control loop parameter set switching, the values of the following parameters are changed gradually: - <code>CTRL_KPn</code> - <code>CTRL_TNn</code> - <code>CTRL_KPp</code> - <code>CTRL_TAUref</code> - <code>CTRL_TAUiref</code> - <code>CTRL_KFPP</code> Such a switching can be caused by - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller Changed settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	Modbus 4392 PROFINET 4392

Optimization

The drive optimization function matches the device to the application conditions. The following options are available:

- Selecting control loops. Upstream control loops are automatically deactivated.
- Defining reference value signals: signal type, amplitude, frequency and starting point
- Testing control performance with the signal generator.
- Recording the control performance on screen and evaluating it with the commissioning software.

Setting Reference Value Signals

Start controller optimization with the commissioning software.

Set the following values for the reference value signal:

- Signal type: Step "positive"
- Amplitude: 100 min⁻¹
- Cycle duration: 100 ms
- Number of repetitions: 1
- Start the trace.

Only the signal types "Step" and "Square" allow you to determine the entire dynamic behavior of a control loop. The manual shows signal paths for the signal type "Step".

Entering Values for Optimization

The optimization steps described on the following pages require you to enter control loop parameters and test their effect by triggering a step function.

A step function is triggered as soon as you start a trace in the commissioning software.

Control Loop Parameters

This device allows you to use two control loop parameter sets. It is possible to switch from one set of control loop parameter sets to the other during operation. The active control loop parameter set is selected with the parameter `CTRL_SelParSet`.

The corresponding parameters are `CTRL1_xx` for the first control loop parameter set and `CTRL2_xx` for the second control loop parameter set. The following descriptions use the notation `CTRL1_xx` (`CTRL2_xx`) if there are no functional differences between the two control loop parameter sets.

For details see chapter Switching Between Control Loop Parameter Sets ([see page 217](#)).

Optimizing the Velocity Controller

Optimizing complex mechanical control systems require hands-on experience with controller tuning. This includes the ability to calculate control loop parameters and to apply identification procedures.

Less complex mechanical systems can often be optimized by means of experimental adjustment using the aperiodic limit method. The following parameters are used for this:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4610 PROFINET 4610
CTRL2_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4866 PROFINET 4866
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4612 PROFINET 4612
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4868 PROFINET 4868

Verify and optimize the calculated values in a second step, see chapter Verifying and Optimizing the P Gain ([see page 178](#)).

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. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4616 PROFINET 4616
CTRL2_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4872 PROFINET 4872

Determining the Type of Mechanical System

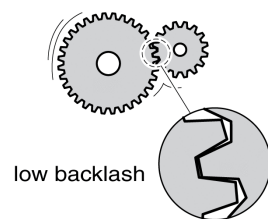
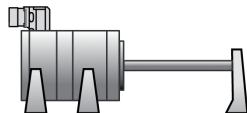
To assess and optimize the transient response behavior of your system, group its mechanical system into one of the following two categories.

- System with rigid mechanical system
- System with a less rigid mechanical system

Rigid and less rigid mechanical systems

Rigid mechanical system

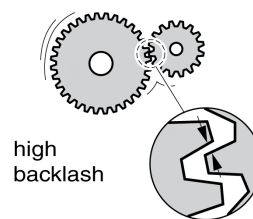
low elasticity



e. g. Direct drive
Rigid coupling

Less rigid mechanical system

higher elasticity



e. g. Belt drive
Weak drive shaft
Elastic coupling

Determining Values for Rigid Mechanical Systems

In the case of a rigid mechanical system, adjusting the control performance on the basis of the table is possible if:

- the moment of inertia of the load and of the motor are known and
- the moment of inertia of the load and of the motor are constant

The P gain CTRL_KPn and the integral action time CTRL_TNn depend on:

- J_L : Moment of inertia of the load
- J_M : Moment of inertia of the motor
- Determine the values on the basis of the following table:

	$J_L = J_M$		$J_L = 5 * J_M$		$J_L = 10 * J_M$	
J_L	KPn	TNn	KPn	TNn	KPn	TNn
1 kgcm ²	0.0125	8	0.008	12	0.007	16
2 kgcm ²	0.0250	8	0.015	12	0.014	16
5 kgcm ²	0.0625	8	0.038	12	0.034	16
10 kgcm ²	0.125	8	0.075	12	0.069	16
20 kgcm ²	0.250	8	0.150	12	0.138	16

Determining Values for Less Rigid Mechanical Systems

For optimization purposes, determine the P gain of the velocity controller at which the controller adjusts velocity $_v_act$ as quickly as possible without overshooting.

- Set the integral action time CTRL1_TNn (CTRL2_TNn) to infinite (= 327.67 ms).

If a load torque acts on the motor when the motor is at a standstill, the integral action time must not exceed a value that causes unwanted changes of the motor position.

If the motor is subject to loads when it is at a standstill, setting the integral action time to "infinite" may cause position deviations (for example, in the case of vertical axes). Reduce the integral action time if the position deviation is unacceptable in your application. However, reducing the integral action time can adversely affect optimization results.

! WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the velocity and the time do not exceed the available movement range.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.

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

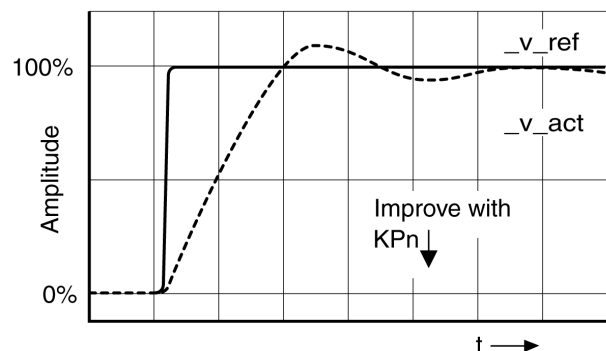
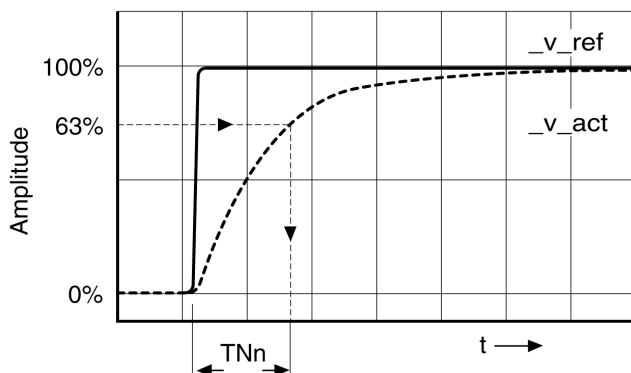
- Trigger a step function.
- After the first test, verify the maximum amplitude for the reference value for the current $_Iq_ref$.

Set the amplitude of the reference value just high enough so the reference value for the current $_Iq_ref$ remains below the maximum value CTRL_I_max. On the other hand, the value selected should not be too low, otherwise friction effects of the mechanical system will determine the performance of the control loop.

- Trigger another step function if you had to modify $_v_ref$ and verify the amplitude of $_Iq_ref$.
- Increase or decrease the P gain in small increments until $_v_act$ is obtained as fast as possible. The following diagram shows the required transient response on the left. Overshooting - as shown on the right - is reduced by reducing CTRL1_KPn (CTRL2_KPn).

Differences between $_v_ref$ and $_v_act$ result from setting CTRL1_TNn (CTRL2_TNn) to "Infinite".

Determining "TNn" for the aperiodic limit



In the case of drive systems in which oscillations occur before the aperiodic limit is reached, the P gain "KPn" must be reduced until oscillations can no longer be detected. This occurs frequently in the case of linear axes with a toothed belt drive.

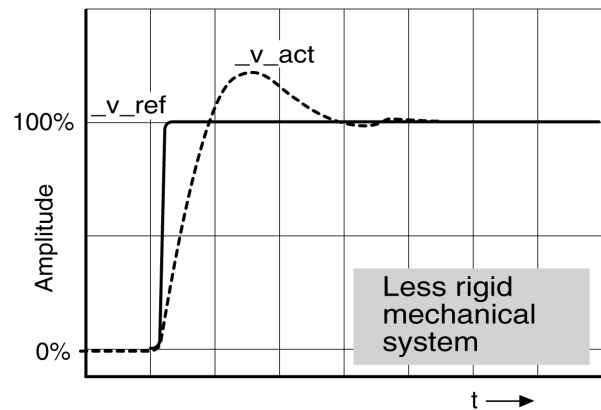
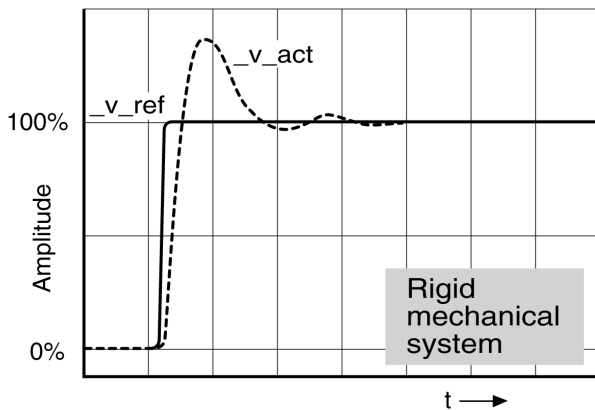
Graphic Determination of the 63% Value

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4612 PROFINET 4612
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4868 PROFINET 4868

Verifying and Optimizing the P Gain

Step responses with good control performance



The controller is properly set when the step response is approximately identical to the signal shown. Good control performance is characterized by

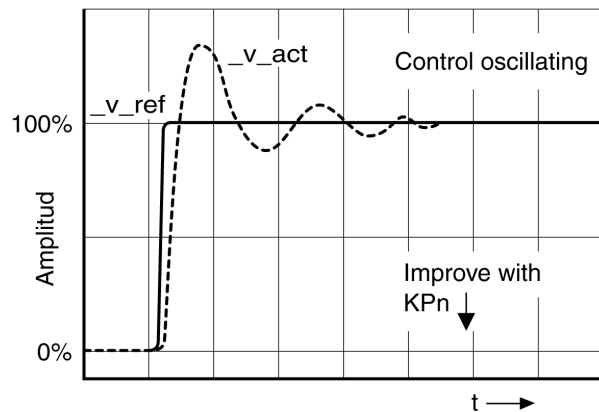
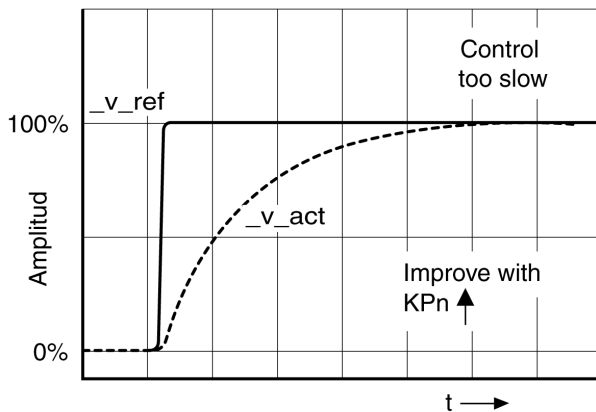
- Fast transient response
- Overshooting up to a maximum of 40%, 20%.

If the control performance does not correspond to the curve shown, change $_CTRL_KPn$ in increments of about 10% and then trigger another step function:

- If the control is too slow: Use a higher $_CTRL1_KPn$ ($_CTRL2_KPn$) value.
- If the control tends to oscillate: Use a lower $_CTRL1_KPn$ ($_CTRL2_KPn$) value.

Oscillation ringing is characterized by continuous acceleration and deceleration of the motor.

Optimizing insufficient velocity controller settings



Optimizing the Position Controller


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
<code>CTRL1_KPp</code>	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 <code>CTRL_ParChgTime</code> . In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4614 PROFINET 4614
<code>CTRL2_KPp</code>	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 <code>CTRL_ParChgTime</code> . In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4870 PROFINET 4870

The step function moves the motor at constant velocity until the specified time has expired.

 WARNING	
UNINTENDED MOVEMENT	
<ul style="list-style-type: none"> • 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"
- For rotary motors: Set the amplitude to approx. 1/10 motor revolution.

The amplitude is entered in user-defined units. With the default scaling, the resolution is 16384 user-defined units per motor revolution.

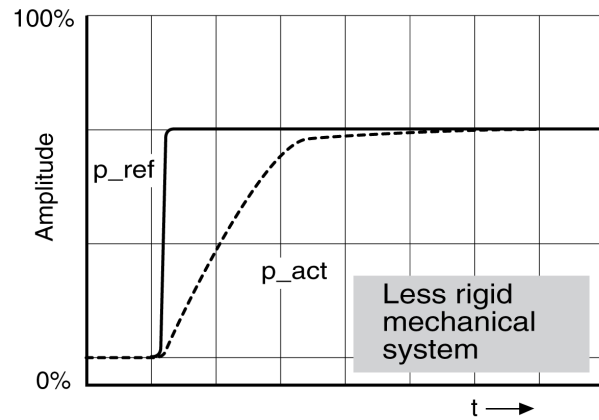
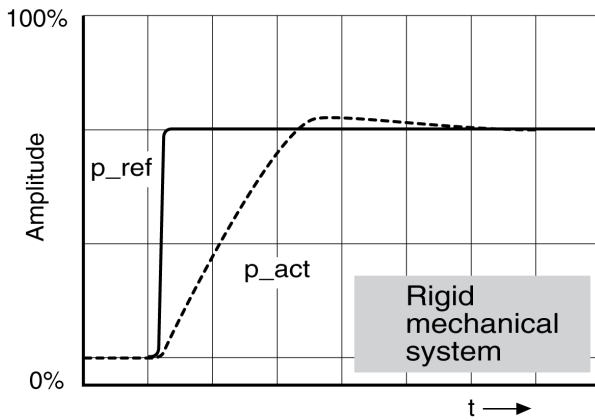
Selecting the Trace Signals

- Select the values in the box General Trace Parameters:
- Reference position of position controller `_p_refusr` (`_p_ref`)
- Actual position of position controller `_p_actusr` (`_p_act`)
- Actual velocity `_v_act`
- Reference value current `_Iq_ref`

Optimizing the Position Controller Value

- Trigger a step function with the default controller values.
- After the first test, verify the values achieved for `_v_act` and `_Iq_ref` for current control and velocity control. The values must not reach the current and velocity limitation range.

Step responses of a position controller with good control performance

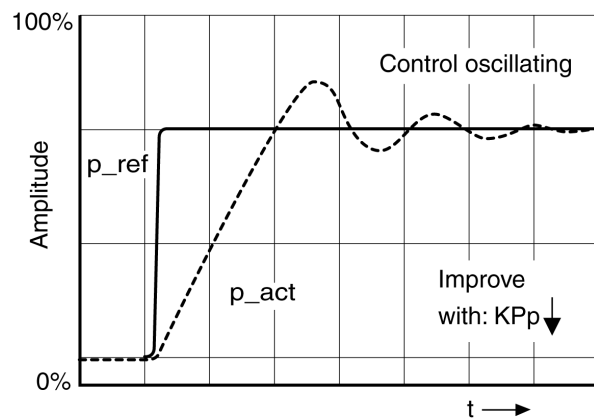
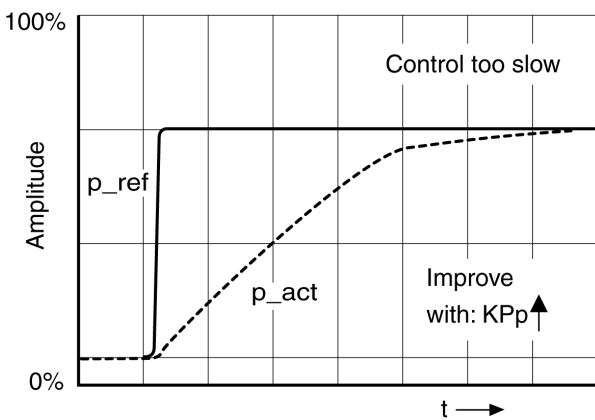


The p gain setting `CTRL1_KPp` (`CTRL2_KPp`) is optimal if the reference value is reached rapidly and with little or no overshooting.

If the control performance does not correspond to the curve shown, change the P gain `CTRL1_KPp` (`CTRL2_KPp`) in increments of approximately 10% and trigger another step function.

- If the control tends to oscillate: Use a lower KPp value.
- If the actual value is too slow reaching the reference value: Use a higher KPp value.

Optimizing inadequate position controller settings



Section 5.5

Parameter Management

What Is in This Section?

This section contains the following topics:

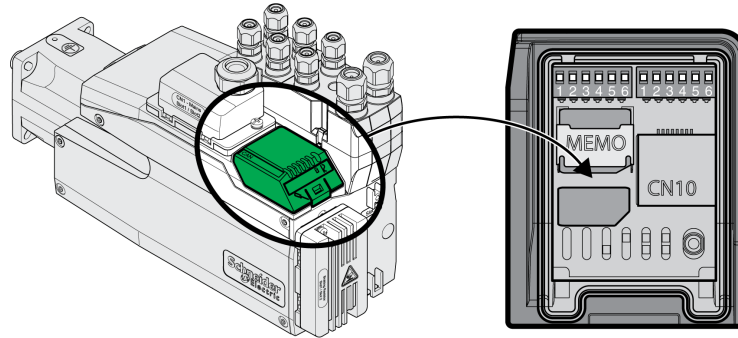
Topic	Page
Memory Card	182
Duplicating Existing Parameter Values	184
Resetting the User Parameters	185
Restoring Factory Settings	186

Memory Card

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

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

When the parameters are written to the EEPROM, they are also saved to the memory card.



Note the following:

- Use only genuine accessory memory cards.
- Do not touch the gold contacts.
- The insert/remove cycles of the memory card are limited.
- The memory card can remain in the device.
- The memory card can only be removed from the device by pulling (not by pushing).

Inserting a Memory Card

- Power supply has been powered off.
- Place the memory card in front of the the card holder. The slanted corner must be aligned as shown on the printed circuit board. Push the memory card into the device.
- Switch on the power supply.

Observe the memory card LED during the initialization of the device. See chapter Memory card LEDs ([see page 349](#)) for information on the meaning of the LED signals.

Writing Data to the Memory Card

The memory card is empty. Power supply has been powered off.

- Insert the memory card. The slanted corner must be aligned as shown on the printed circuit board.
- Switch on the power supply.

The device data is transferred to the memory card. Observe the memory card LED and the error memory of the device.

Transferring Data From the Memory Card to the Device

The memory card contains a parameter set of a device with the same fieldbus and of the same size. Power supply has been powered off.

- Insert the memory card. The slanted corner must be aligned as shown on the printed circuit board.
- Switch on the power supply.

The data on the memory card is transferred to the device. Observe the memory card LED and the error memory of the device.

- Check the fieldbus address settings.
- Switch the power supply off and on again to apply the new configuration.

Memory Card Has Been Removed

If there is no memory card in the device (or if the memory card has not been detected), the memory card LED is off.

Write Protection for Memory Card

It is possible to write-protect the memory card. For example, you may want to write-protect memory cards used for regular duplication of device data.

Memory cards are write-protected via the commissioning software.

Duplicating Existing Parameter Values

Application

Multiple devices are to have the same settings, for example, when devices are replaced.

Prerequisites

- Device type, motor type and firmware version must be identical.
- The DIP switches for the fieldbus must be set identical, see chapter Selecting the Fieldbus (*see page 142*).
- Tools for duplication:
 - Memory card
 - Commissioning software
- The controller supply must be powered on.

Duplication Using a Memory Card

Device settings can be stored on a memory card (accessories).

The stored device settings can be copied to a device of the same type. Note that the fieldbus address and the settings for the monitoring functions are copied along with this information.

Duplication Using the Commissioning Software

The commissioning software can save the settings of a device in the form of a configuration file. The stored device settings can be copied to a device of the same type. Note that the fieldbus address and the settings for the monitoring functions are copied along with this information.

See the manual for the commissioning software for additional information.

Resetting the User Parameters

The user parameters are reset by means of the parameter `PARuserReset`.

- Disconnect the drive from the fieldbus.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>PARuserReset</code>	<p>Reset user parameters 0 / No: No 65535 / Yes: Yes Bit 0: Set persistent user and control loop parameters to default values Bits 1 ... 15: Reserved</p> <p>The parameters are reset with the exception of:</p> <ul style="list-style-type: none"> - Communication parameters - Inversion of direction of movement - Functions of digital inputs and outputs <p>The new settings are not saved to the EEPROM. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.</p>	- 0 - 65535	UINT16 R/W - -	Modbus 1040 PROFINET 1040

Resetting via the Commissioning Software

Use the menu items "Device -> User Functions -> Reset User Parameters" in the commissioning software to reset the user parameters.

If the device transitions to the operating state "2 Not Ready To Switch On" after the user parameters are reset, the new settings only become active until after the device is powered off and on again.

Restoring Factory Settings

The parameter values, both active and those saved in non-volatile memory, are lost in this process.

NOTICE

LOSS OF DATA

Perform a backup of the drive parameters prior to restoring factory settings (factory established parameter values).

Failure to follow these instructions can result in equipment damage.

The commissioning software allows you to save the parameter values set for a device as a configuration file. For information on saving the existing parameters in the drive, see chapter Parameter Management ([see page 181](#)).

The factory settings are restored by means of the parameter `PARfactorySet`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>PARfactorySet</code>	<p>Restore factory settings (default values)</p> <p>No: No</p> <p>Yes: Yes</p> <p>The parameters are reset to the factory settings and subsequently saved to the EEPROM.</p> <p>The factory settings can be restored via the HMI or the commissioning software.</p> <p>The saving process is complete when the parameter is read and 0 is returned.</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	<p>-</p> <p>0</p> <p>-</p> <p>1</p>	<p>UINT16</p> <p>R/W</p> <p>-</p> <p>-</p>	<p>Modbus 1028</p> <p>PROFINET 1028</p>

Factory Settings via Commissioning Software

Use the menu items "Device -> User Functions -> Restore factory Settings" in the commissioning software to restore the factory settings.

The new settings only become active until after the device is powered off and on again.

Chapter 6

Operation

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
6.1	Access Channels	188
6.2	Movement Range	189
6.3	Modulo Range	194
6.4	Scaling	202
6.5	Digital Inputs and Outputs	207
6.6	Switching Between Control Loop Parameter Sets	217

Section 6.1

Access Channels

Access Channels

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

The product can be addressed via different access channels. Access channels are:

- Fieldbus
- Commissioning software
- Digital signal inputs

Only one access channel can have exclusive access to the product. An exclusive access can be provided via different access channels:

- Via a fieldbus:
Exclusive access is provided to a fieldbus by blocking the other access channels with the parameter `AccessLock`.
- Via the commissioning software:
The commissioning software receives exclusive access via the switch "Exclusive access" in position "On".

When the product is powered on, there is no exclusive access via an access channel.

The signal input functions "Halt", "Fault Reset", "Enable", "Positive Limit Switch (LIMP)", "Negative Limit Switch (LIMN)" and "Reference Switch (REF)" as well as the signals of the safety function STO (`STO_A` and `STO_B`) are always effective during exclusive access.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>AccessLock</code>	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 or the HMI is not possible. The access channel can only be locked after the currently active operating mode has terminated. Changed settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 284 PROFINET 284

Section 6.2

Movement Range

What Is in This Section?

This section contains the following topics:

Topic	Page
Size of the Movement Range	190
Movement Beyond the Movement Range	191
Setting a Modulo Range	193

Size of the Movement Range

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

Zero Point of the Movement Range

The zero point is the point of reference for absolute movements in the operating mode Profile Position.

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 mode Homing.

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

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
<code>PP_ModeRangeLim</code>	<p>Absolute movement beyond movement range</p> <p>0 / NoAbsMoveAllowed: Absolute movement beyond movement range is not possible</p> <p>1 / AbsMoveAllowed: Absolute movement beyond movement range is possible</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the power stage is enabled.</p>	- 0 0 1	UINT16 R/W per. -	Modbus 8974 PROFINET 8974

Behavior for Operating Mode Jog (Continuous Movement)

Behavior for continuous movement beyond the movement range:

- The movement range restarts.

Behavior for Operating Mode Jog (Step Movement)

Behavior for step movement beyond the movement range:

- Parameter `PP_ModeRangeLim` = 1:
The movement range restarts.
- Parameter `PP_ModeRangeLim` = 0:
Internal position setting to 0.

Behavior for Operating Mode Profile Position (Relative Movement)

Behavior for relative movement beyond the movement range:

- Parameter `PP_ModeRangeLim` = 1:
The movement range restarts.
A relative movement is possible when the motor is at a standstill and during movements
- Parameter `PP_ModeRangeLim` = 0:
Internal position setting to 0.
A relative movement is only possible when the motor is at a standstill.

Behavior for Operating Mode Profile Position (Absolute Movement)

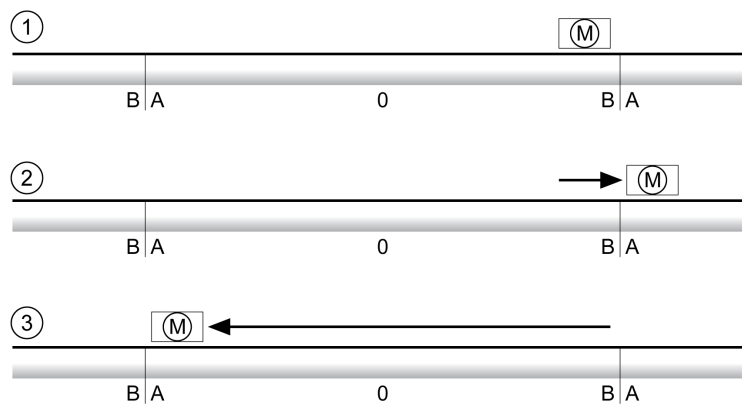
Behavior for absolute movement:

- Parameter `PP_ModeRangeLim` = 1:
A relative movement beyond the movement range is possible.
- Parameter `PP_ModeRangeLim` = 0:
An absolute movement is made within the movement range. A relative movement beyond the movement range is not possible.

Example:

Actual position: 268435000 user-defined units (usr_p)

Target position absolute: -268435000 user-defined units (usr_p)



- A** -268435456 user-defined units (usr_p)
- B** 268435455 user-defined units (usr_p)
- 1** Actual position: 268435000 user-defined units
- 2** Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 1
- 3** Absolute movement to -268435000 user-defined units with parameter PP_ModeRangeLim = 0

Setting a Modulo Range

Description

The modulo range supports applications with repeating arrangements of target positions (such as rotary indexing tables). The target positions are mapped to a parameterizable movement range.

For details see chapter Setting a Modulo Range ([see page 195](#)).

Section 6.3

Modulo Range

What Is in This Section?

This section contains the following topics:

Topic	Page
Setting a Modulo Range	195
Parameterization	196
Examples with Relative Movements	198
Examples with Absolute Movements and "Shortest Distance"	199
Examples with Absolute Movements and "Positive Direction"	200
Examples with Absolute Movements and "Negative Direction"	201

Setting a Modulo Range

Description

The modulo range supports applications with repeating arrangements of target positions (such as rotary indexing tables). The target positions are mapped to a parameterizable movement range.

Direction of Movement

The direction of movement for absolute target positions can be adjusted to meet the requirements of the application.

- Shortest distance
- Positive direction of movement only
- Negative direction of movement only

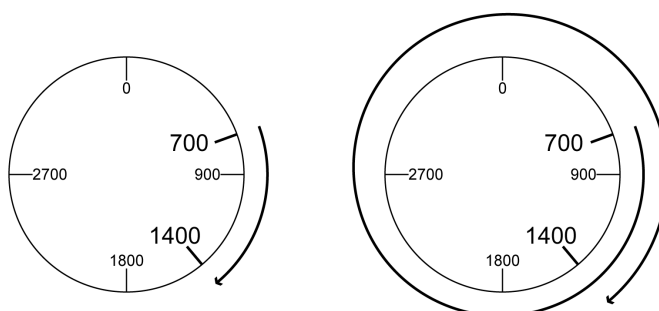
Multiple Modulo Range

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

Example:

- Modulo range
 - Minimum position: 0 usr_p
 - Maximum position: 3600 usr_p
- Actual position: 700 usr_p
- Target positions absolute: 5000 usr_p
- Left: Without multiple modulo range
- Right: With multiple modulo range

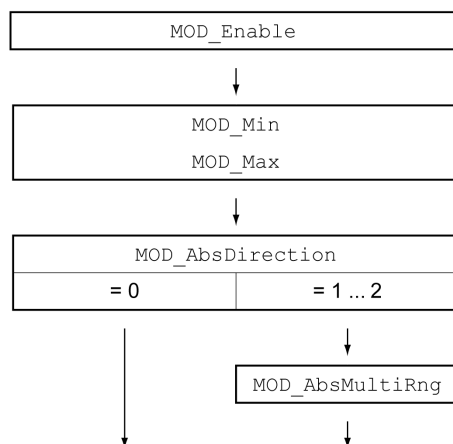
Multiple modulo range



Parameterization

Overview

Overview of parameters



Scaling

Using a modulo range requires the scaling to be adapted. The scaling of the motor must be adapted to the requirements of the application, see chapter Scaling ([see page 202](#)).

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
<code>MOD_Enable</code>	Activation of Modulo 0 / Modulo Off: Modulo is off 1 / Modulo On: Modulo is on Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1648 PROFINET 1648

Modulo Range

The parameters `MOD_Min` and `MOD_Max` can be used to set the modulo range.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MOD_Min</code>	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 <code>_ScalePOSmax</code> . Setting can only be changed if power stage is disabled. Changed settings become active immediately.	<code>usr_p</code> - 0 -	INT32 R/W per. -	Modbus 1650 PROFINET 1650

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MOD_Max	Maximum position of modulo range The maximum position value of the modulo range must be greater than the minimum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	usr_p - 3600 -	INT32 R/W per. -	Modbus 1652 PROFINET 1652

Direction for Absolute Movements

The parameter MOD_AbsDirection lets you set the direction of movement for absolute movements.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MOD_AbsDirection	Direction of absolute movement with Modulo 0 / Shortest Distance: Movement with shortest distance 1 / Positive Direction: Movement only in positive direction 2 / Negative Direction: Movement only in negative direction If the parameter is set to 0, the drive calculates the shortest way to the new target position and starts the movement in the corresponding direction. If the distance to the target position is identical in positive and negative directions, the movement takes place in positive direction. Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 1654 PROFINET 1654

Multiple Modulo Range for Absolute Movements

The parameter MOD_AbsMultiRng lets you set a multiple modulo range for absolute movements.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MOD_AbsMultiRng	Multiple ranges for absolute movement with Modulo 0 / Multiple Ranges Off: Absolute movement in one modulo range 1 / Multiple Ranges On: Absolute movement in multiple modulo ranges Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1656 PROFINET 1656

Examples with Relative Movements

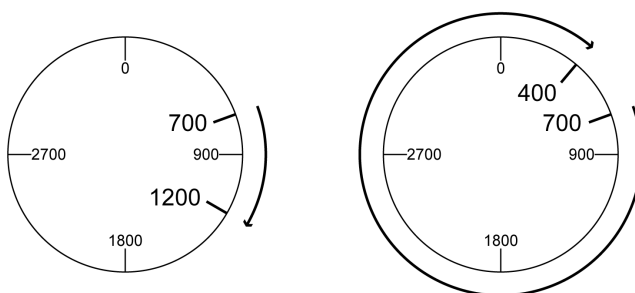
Assumptions

The settings below are assumed for the examples.

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

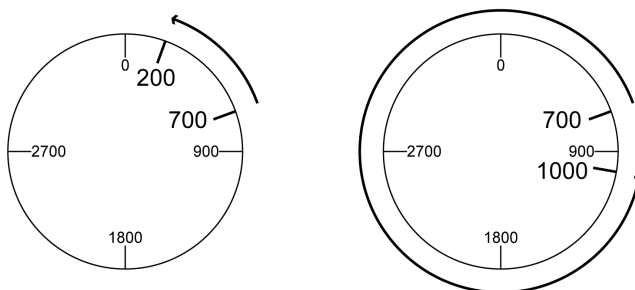
Example 1

Target positions relative: 500 usr_p and 3300 usr_p



Example 2

Target positions relative: -500 usr_p and -3300 usr_p



Examples with Absolute Movements and "Shortest Distance"

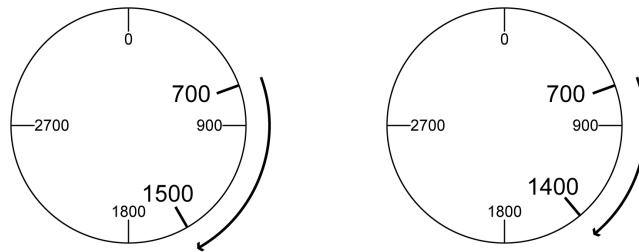
Assumptions

The settings below are assumed for the examples.

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

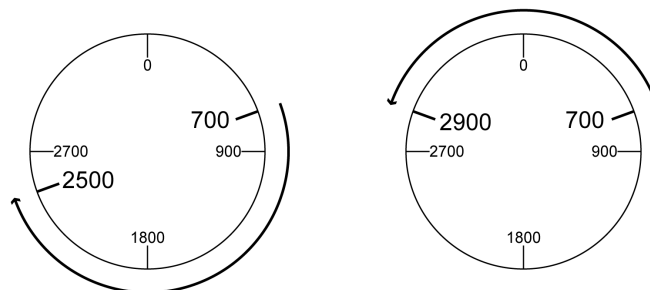
Example 1

Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Target positions absolute: 2500 usr_p and 2900 usr_p



Examples with Absolute Movements and "Positive Direction"

Assumptions

The settings below are assumed for the examples.

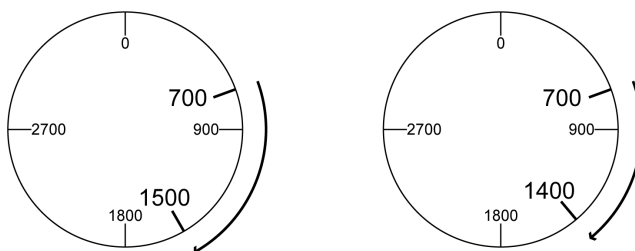
- Rotary motor
- Position scaling
 - Numerator: 1
 - Denominator: 3600
- Modulo range
 - Minimum position: 0 usr_p
 - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter MOD_AbsDirection: Positive Direction

Example 1

Parameter MOD_AbsMultiRng: Off

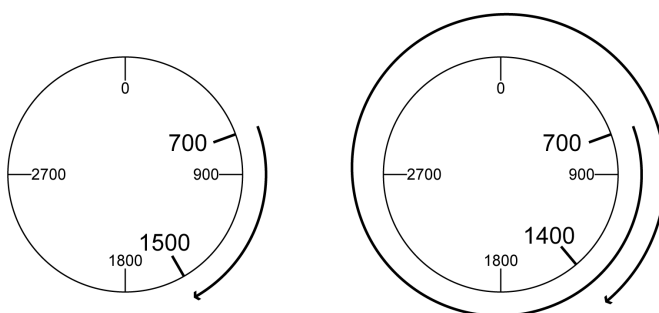
Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Parameter MOD_AbsMultiRng: On

Target positions absolute: 1500 usr_p and 5000 usr_p



Examples with Absolute Movements and "Negative Direction"

Assumptions

The settings below are assumed for the examples.

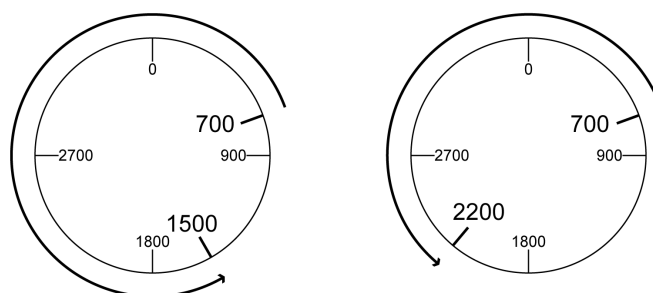
- Rotary motor
- Position scaling
 - Numerator: 1
 - Denominator: 3600
- Modulo range
 - Minimum position: 0 usr_p
 - Maximum position: 3600 usr_p
- Actual position: 700 usr_p

Parameter MOD_AbsDirection: Negative Direction

Example 1

Parameter MOD_AbsMultiRng: Off

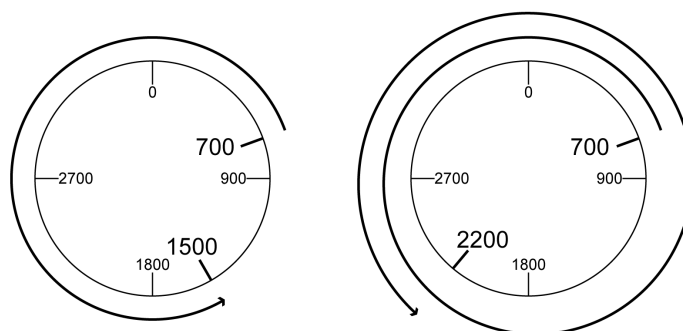
Target positions absolute: 1500 usr_p and -5000 usr_p



Example 2

Parameter MOD_AbsMultiRng: On

Target positions absolute: 1500 usr_p and -5000 usr_p



Section 6.4

Scaling

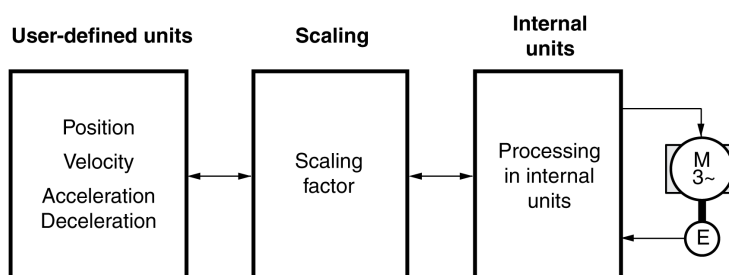
What Is in This Section?

This section contains the following topics:

Topic	Page
General	203
Configuration of position scaling	204
Configuration of Velocity Scaling	205
Configuration of Ramp Scaling	206

General

Scaling converts user-defined units into internal units of the device, and vice versa.



User-Defined Units

Values for positions, velocities, acceleration and deceleration are specified in the following user-defined unit:

- usr_p for positions
- usr_v for velocities
- usr_a for acceleration and deceleration

Modifying the scaling modifies the ratio between user-defined units and internal units. After a modification to the scaling, one and the same value of a parameter specified in a user-defined unit causes a different movement than before the modification. A modification of the scaling affects all parameters whose values are specified in user-defined units.

! WARNING

UNINTENDED MOVEMENT

- Verify all parameters with user-defined units before modifying the scaling factor.
- Verify that a modification of the scaling factor cannot cause unintended movements.

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

Scaling Factor

The scaling factor is the relationship between the motor movement and the required user-defined units.

Commissioning Software

You can adjust the scaling via the commissioning software. The parameters with user-defined units are automatically checked and adjusted.

Configuration of position scaling

Position scaling is the relationship between the number of motor revolutions and the required user-defined units (usr_p).

Scaling Factor

Position scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr_p]}}$$

A new scaling factor is activated when you specify the numerator value.

With a scaling factor of $< 1 / 131072$, it is not possible to perform a movement outside of the movement range.

Factory Setting

The following factory settings are used:

- 1 motor revolution corresponds to 16384 user-defined units

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ScalePOSnum	Position scaling: Numerator Specification of the scaling factor: Motor revolutions ----- User-defined units [usr_p] A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	Modbus 1552 PROFINET 1552
ScalePOSdenom	Position scaling: Denominator Refer to numerator (ScalePOSnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled.	usr_p 1 16384 2147483647	INT32 R/W per. -	Modbus 1550 PROFINET 1550

Configuration of Velocity Scaling

Velocity scaling is the relationship between the number of motor revolutions per minute and the required user-defined units (usr_v).

Scaling Factor

Velocity scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolutions of the motor per minute}}{\text{Number of user-defined units [usr_v]}}$$

Factory Setting

The following factory settings are used:

- 1 motor revolution per minute corresponds to 1 user-defined unit

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ScaleVELnum	Velocity scaling: Numerator Specification of the scaling factor: Speed of rotation of motor [min-1] ----- User-defined units [usr_v] A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	rpm 1 1 2147483647	INT32 R/W per. -	Modbus 1604 PROFINET 1604
ScaleVELdenom	Velocity scaling: Denominator See numerator (ScaleVELnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled.	usr_v 1 1 2147483647	INT32 R/W per. -	Modbus 1602 PROFINET 1602

Configuration of Ramp Scaling

Ramp scaling is the relationship between the change in velocity and the required user-defined units (usr_a).

Scaling Factor

Ramp scaling is specified by means of scaling factor:

$$\frac{\text{Velocity change per second}}{\text{Number of user-defined units [usr_a]}}$$

Factory Setting

The following factory settings are used:

- A change of 1 motor revolution per minute per second corresponds to 1 user-defined unit.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ScaleRAMPnum	Ramp scaling: Numerator Setting can only be changed if power stage is disabled. Changed settings become active immediately.	rpm/s 1 1 2147483647	INT32 R/W per. -	Modbus 1634 PROFINET 1634
ScaleRAMPdenom	Ramp scaling: Denominator See numerator (ScaleRAMPnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled.	usr_a 1 1 2147483647	INT32 R/W per. -	Modbus 1632 PROFINET 1632

Section 6.5

Digital Inputs and Outputs

What Is in This Section?

This section contains the following topics:

Topic	Page
Parameterization of the Signal Input Functions	208
Parameterization of the Signal Output Functions	213
Parameterization of Software Debouncing	216

Parameterization of the Signal Input Functions

Signal Input Function

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

WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the wiring is appropriate for the settings.
- Only start the system if there are no persons or obstructions in the zone of operation.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.

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

Factory Settings

The table below shows the factory settings of the digital signal inputs:

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:

Signal input function	Description in chapter
Freely Available	Setting a Signal Output via Parameter (see page 295)
Fault Reset	Changing the Operating State via Signal Inputs (see page 242)
Enable	Changing the Operating State via Signal Inputs (see page 242)
Halt	Stop Movement with Halt (see page 288)
Start Profile Positioning	Starting a Movement via a Signal Input (see page 296)
Current Limitation	Limitation of the Current via Signal Inputs (see page 293)
Zero Clamp	Zero Clamp (see page 294)
Velocity Limitation	Limitation of the Velocity via Signal Inputs (see page 292)
Reference Switch (REF)	Reference Switch (see page 307)
Positive Limit Switch (LIMP)	Limit Switches (see page 306)
Negative Limit Switch (LIMN)	Limit Switches (see page 306)
Switch Controller Parameter Set	Switching Between Control Loop Parameter Sets (see page 217)
Velocity Controller Integral Off	Switching Between Control Loop Parameter Sets (see page 217)
Start Signal Of RMAC	Relative Movement After Capture (RMAC) (see page 300)
Activate RMAC	Relative Movement After Capture (RMAC) (see page 300)
Jog Positive With Enable	Operating Mode Jog (see page 248)

Signal input function	Description in chapter
Jog Negative With Enable	Operating Mode Jog (see page 248)
Release Holding Brake	Releasing the Holding Brake Manually (see page 157)

The following parameters can be used to parameterize the digital signal inputs:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI0	Function Input DI0 1 / Freely Available: Available as required 2 / Fault Reset: 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 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 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 40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.	- 1 22 40	UINT16 R/W per. -	Modbus 1794 PROFINET 1794

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI1	<p>Function Input DI1</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 23 40	UINT16 R/W per. -	Modbus 1796 PROFINET 1796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI2	<p>Function Input DI2</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 21 40	UINT16 R/W per. -	Modbus 1798 PROFINET 1798

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI3	<p>Function Input DI3</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 1 40	UINT16 R/W per. -	Modbus 1800 PROFINET 1800

Parameterization of the Signal Output Functions

Signal Output Function

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the wiring is appropriate for the settings.
- Only start the system if there are no persons or obstructions in the zone of operation.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.

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

Factory Settings

The table below shows the factory settings of the digital signal outputs:

Signal	Signal output function
DQ0	No Fault
DQ1	Active

Parameterization

The table below provides an overview of the possible signal output functions:

Signal output function	Description in chapter
Freely Available	Setting a Signal Output via Parameter (see page 295)
No Fault	Indication of the Operating State via Signal Inputs (see page 240)
Active	Indication of the Operating State via Signal Inputs (see page 240)
RMAC Active Or Finished	Relative Movement After Capture (RMAC) (see page 300)
In Position Deviation Window	Position Deviation Window (see page 325)
In Velocity Deviation Window	Velocity Deviation Window (see page 327)
Velocity Below Threshold	Velocity Threshold Value (see page 329)
Current Below Threshold	Current Threshold Value (see page 331)
Halt Acknowledge	Stop Movement with Halt (see page 288)
Motor Standstill	Motor Standstill and Direction of Movement (see page 315)
Selected Error	Indicating Error Messages (see page 353)
Drive Referenced (ref_ok)	Operating Mode Homing (see page 270)
Selected Warning	Indicating Error Messages (see page 353)
Position Register Channel 1	Position Register (see page 320)
Position Register Channel 2	Position Register (see page 320)
Position Register Channel 3	Position Register (see page 320)
Position Register Channel 4	Position Register (see page 320)

Signal output function	Description in chapter
Motor Moves Positive	Motor Standstill and Direction of Movement (<i>see page 315</i>)
Motor Moves Negative	Motor Standstill and Direction of Movement (<i>see page 315</i>)

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	<p>Function Output DQ0</p> <p>1 / Freely Available: Available as required</p> <p>2 / No Fault: Signals operating states Ready To Switch On, Switched On and Operation Enabled</p> <p>3 / Active: Signals operating state Operation Enabled</p> <p>4 / RMAC Active Or Finished: Relative movement after capture active or finished (RMAC)</p> <p>5 / In Position Deviation Window: Position deviation is within window</p> <p>6 / In Velocity Deviation Window: Velocity deviation is within window</p> <p>7 / Velocity Below Threshold: Motor velocity below threshold</p> <p>8 / Current Below Threshold: Motor current below threshold</p> <p>9 / Halt Acknowledge: Halt acknowledgement</p> <p>13 / Motor Standstill: Motor at a standstill</p> <p>14 / Selected Error: One of the specified errors of error classes 1 ... 4 is active</p> <p>15 / Valid Reference (ref_ok): Zero point is valid (ref_ok)</p> <p>16 / Selected Warning: One of the specified errors of error class 0 is active</p> <p>18 / Position Register Channel 1: Position register channel 1</p> <p>19 / Position Register Channel 2: Position register channel 2</p> <p>20 / Position Register Channel 3: Position register channel 3</p> <p>21 / Position Register Channel 4: Position register channel 4</p> <p>22 / Motor Moves Positive: Motor moves in positive direction</p> <p>23 / Motor Moves Negative: Motor moves in negative direction</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- - - -	UINT16 R/W per. -	Modbus 1810 PROFINET 1810

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DQ1	<p>Function Output DQ1</p> <p>1 / Freely Available: Available as required</p> <p>2 / No Fault: Signals operating states Ready To Switch On, Switched On and Operation Enabled</p> <p>3 / Active: Signals operating state Operation Enabled</p> <p>4 / RMAC Active Or Finished: Relative movement after capture active or finished (RMAC)</p> <p>5 / In Position Deviation Window: Position deviation is within window</p> <p>6 / In Velocity Deviation Window: Velocity deviation is within window</p> <p>7 / Velocity Below Threshold: Motor velocity below threshold</p> <p>8 / Current Below Threshold: Motor current below threshold</p> <p>9 / Halt Acknowledge: Halt acknowledgement</p> <p>13 / Motor Standstill: Motor at a standstill</p> <p>14 / Selected Error: One of the specified errors of error classes 1 ... 4 is active</p> <p>15 / Valid Reference (ref_ok): Zero point is valid (ref_ok)</p> <p>16 / Selected Warning: One of the specified errors of error class 0 is active</p> <p>18 / Position Register Channel 1: Position register channel 1</p> <p>19 / Position Register Channel 2: Position register channel 2</p> <p>20 / Position Register Channel 3: Position register channel 3</p> <p>21 / Position Register Channel 4: Position register channel 4</p> <p>22 / Motor Moves Positive: Motor moves in positive direction</p> <p>23 / Motor Moves Negative: Motor moves in negative direction</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- - - -	UINT16 R/W per. -	Modbus 1812 PROFINET 1812

Parameterization of Software Debouncing

Debounce Time

Signal input debouncing comprises hardware debouncing and software debouncing.

Hardware debounce time is permanently set, see Signals ([see page 28](#)).

When a set signal function is changed and when the product is powered off and on again, software debouncing is reset to the factory setting.

The software debounce time can be set via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DI_0_Debounce	Debounce time of DI0 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2112 PROFINET 2112
DI_1_Debounce	Debounce time of DI1 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2114 PROFINET 2114
DI_2_Debounce	Debounce time of DI2 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2116 PROFINET 2116
DI_3_Debounce	Debounce time of DI3 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2118 PROFINET 2118

Section 6.6

Switching Between Control Loop Parameter Sets

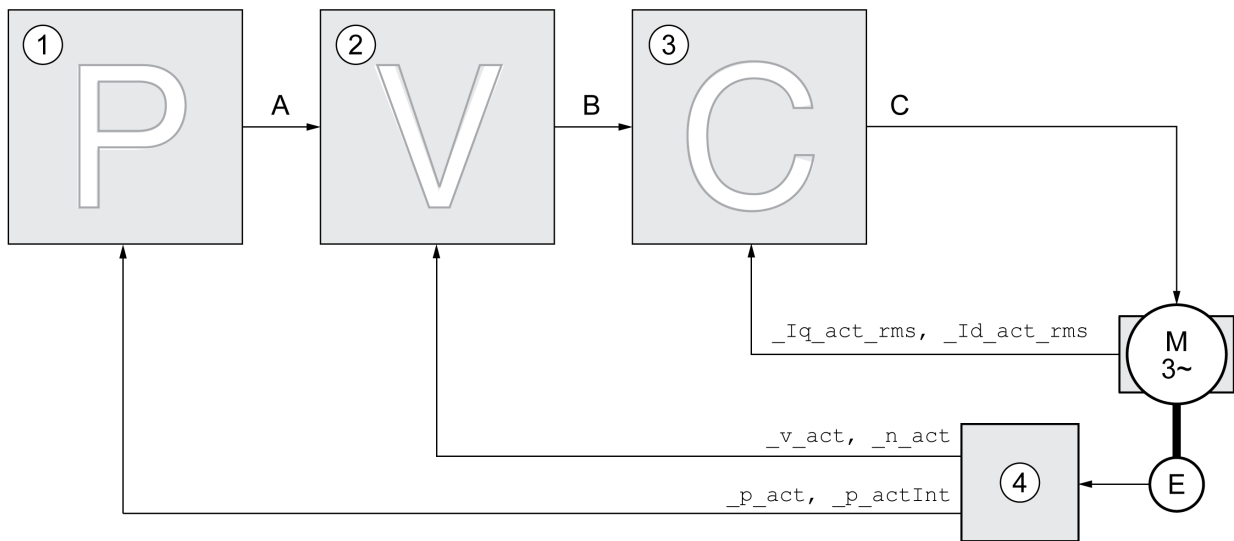
What Is in This Section?

This section contains the following topics:

Topic	Page
Overview of the Controller Structure	218
Overview of Position Controller	219
Overview of Velocity Controller	220
Overview of Current Controller	221
Parameterizable Control Loop Parameters	222
Selecting a Control Loop Parameter Set	223
Automatically Switching Between Control Loop Parameter Sets	224
Copying a Control Loop Parameter Set	228
Deactivating the Integral Term	229
Control Loop Parameter Set 1	230
Control Loop Parameter Set 2	232

Overview of the Controller Structure

The illustration below provides an overview of the controller structure.



- 1 Position controller
- 2 Velocity controller
- 3 Current controller
- 4 Encoder evaluation

Position Controller

The position controller reduces the difference between the reference position and the actual position of the motor (position deviation) to a minimum. When the motor is at a standstill, the position deviation is close to zero in the case of a well-tuned position controller.

An optimized velocity control loop is a prerequisite for good amplification of the position controller.

Velocity Controller

The velocity controller controls the motor velocity by varying the motor current depending on the load situation. The velocity controller has a decisive influence on the dynamic response of the drive. The dynamics of the velocity controller depend on:

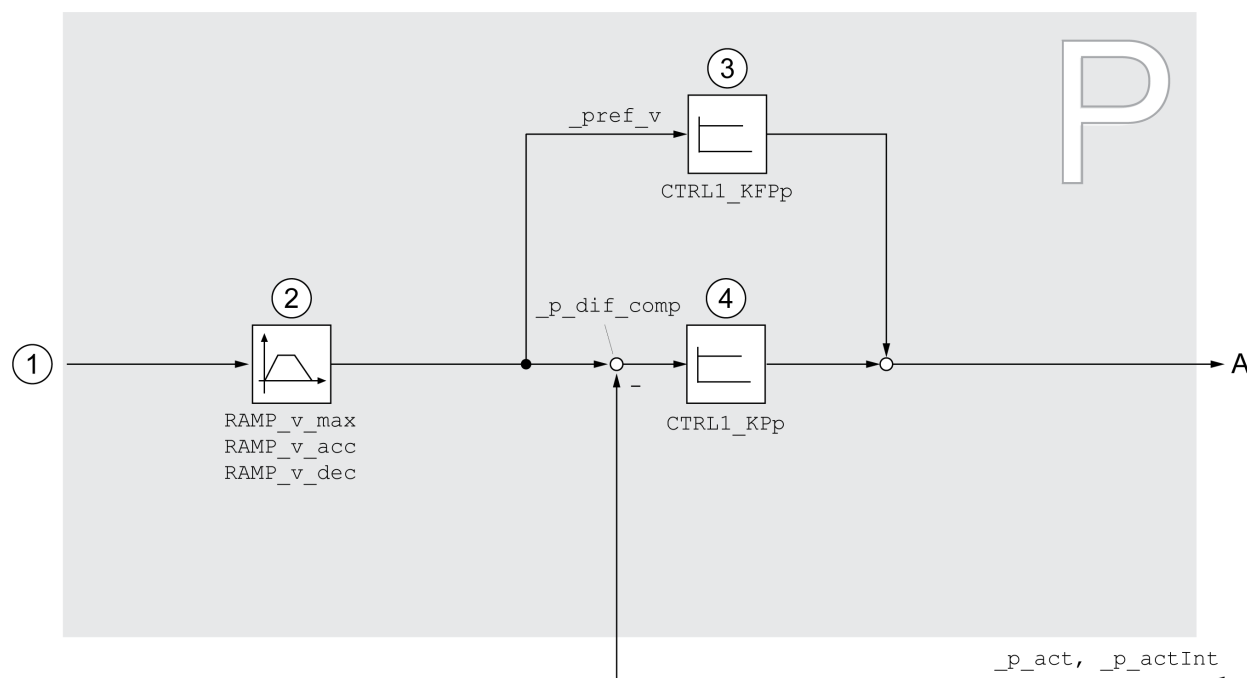
- Moment of inertia of the drive and the controlled system
- Power of the motor
- Stiffness and elasticity of the elements in the flow of forces
- Backlash of the drive elements
- Friction

Current Controller

The current controller determines the torque of the motor. The current controller is automatically optimally tuned with the stored motor data.

Overview of Position Controller

The illustration below provides an overview of the position controller.



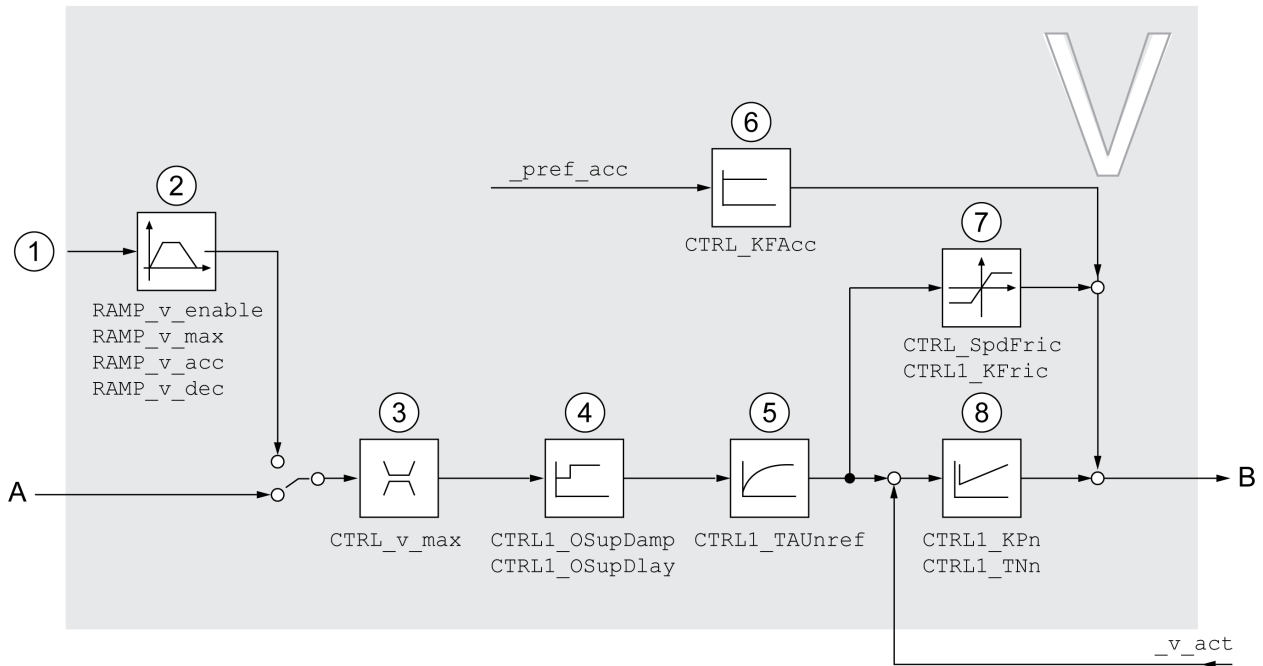
- 1 Target values for the operating modes Jog, Profile Position and Homing
- 2 Motion profile for the velocity
- 3 Velocity feed-forward control
- 4 Position controller

Sampling Period

The sampling period of the position controller is 250 μ s.

Overview of Velocity Controller

The illustration below provides an overview of the velocity controller.



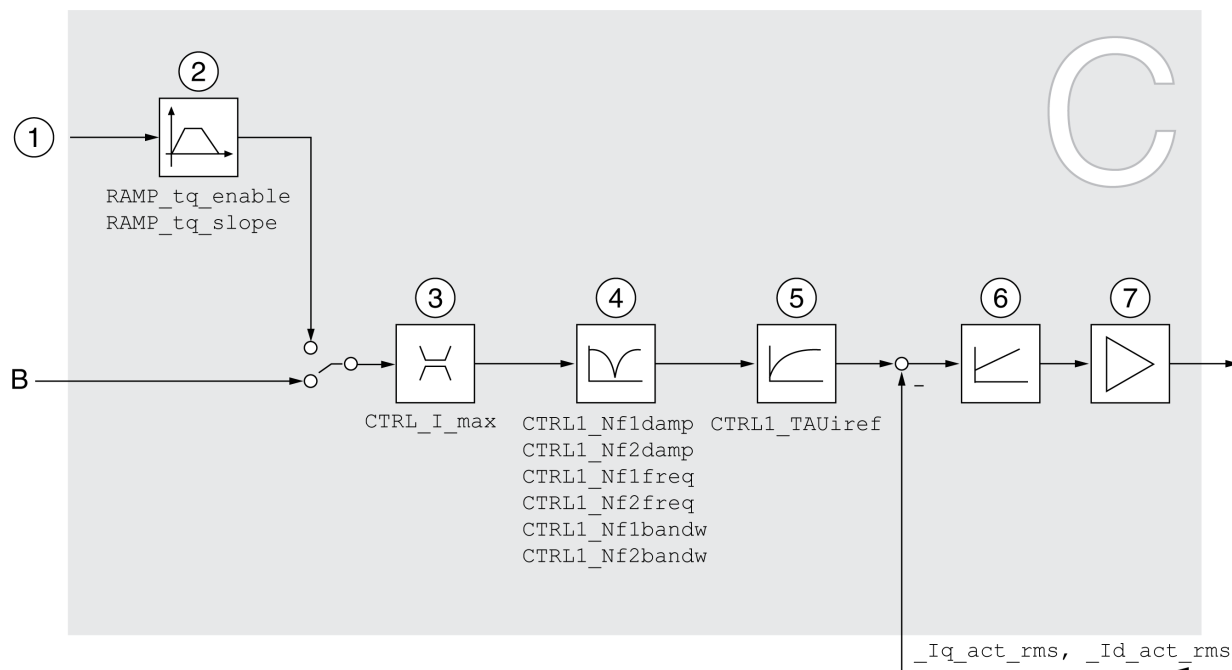
- 1 Target values for the operating mode Profile Velocity
- 2 Motion profile for the velocity
- 3 Velocity limitation
- 4 Overshoot suppression filter (parameter accessible in Expert mode)
- 5 Filter time constant of the reference velocity value filter
- 6 Acceleration feed forward control (parameter accessible in Expert mode)
- 7 Friction compensation (parameter accessible in Expert mode)
- 8 Velocity Loop Controller

Sampling Period

The sampling period of the velocity controller is 62.5 μ s.

Overview of Current Controller

The illustration below provides an overview of the current controller.



- 1 Target values for the operating mode Profile Torque
- 2 Motion profile for the torque
- 3 Current limitation
- 4 Notch filter (parameter accessible in Expert mode)
- 5 Filter time constant of the reference current value filter
- 6 Current controller
- 7 Power stage

Sampling Period

The sampling period of the current controller is 62.5 μ s.

Parameterizable Control Loop Parameters

Control Loop Parameter Set

The product features 2 control loop parameter sets that can be parameterized separately. The values for the control loop parameters determined during autotuning are stored in control loop parameter set 1.

A control loop parameter set consists of freely accessible parameters and parameters which are only accessible in Expert mode.

Control loop parameter set 1	Control loop parameter set 2
Freely accessible parameters: CTRL1_KPn CTRL1_TNn CTRL1_KPp CTRL1_TAUiref CTRL1_TAUUnref CTRL1_KFPp Parameters only accessible in expert mode: CTRL1_Nf1damp CTRL1_Nf1freq CTRL1_Nf1bandw CTRL1_Nf2damp CTRL1_Nf2freq CTRL1_Nf2bandw CTRL1_Osupdamp CTRL1_Osupdelay CTRL1_Kfric	Freely accessible parameters: CTRL2_KPn CTRL2_TNn CTRL2_KPp CTRL2_TAUiref CTRL2_TAUUnref CTRL2_KFPp Parameters only accessible in expert mode: CTRL2_Nf1damp CTRL2_Nf1freq CTRL2_Nf1bandw CTRL2_Nf2damp CTRL2_Nf2freq CTRL2_Nf2bandw CTRL2_Osupdamp CTRL2_Osupdelay CTRL2_Kfric

See chapters Control Loop Parameter Set 1 ([see page 230](#)) and Control Loop Parameter Set 2 ([see page 232](#)).

Parameterization

- Selecting a control loop parameter set
Select a control loop parameter set after switching on.
See chapter Selecting a Control Loop Parameter Set ([see page 223](#)).
- Automatically switching between control loop parameter sets
It is possible to switch between the two control loop parameter sets.
See chapter Automatically Switching Between Control Loop Parameter Sets ([see page 224](#)).
- Copying a control loop parameter set
The values of control loop parameter set 1 can be copied to control loop parameter set 2.
See chapter Copying a Control Loop Parameter Set ([see page 228](#)).
- Deactivating the integral term
The integral term and, by implication, the integral action time, can be deactivated via a digital signal input.
See chapter Deactivating the Integral Term ([see page 229](#)).

Selecting a Control Loop Parameter Set

The active control loop parameter set is indicated via the parameter `_CTRL_ActParSet`.

The parameter `CTRL_PwrUpParSet` allows you to set the control loop parameter set to be activated after powering on. Alternatively, you can set whether or not the product is to switch automatically between the two control loop parameter sets.

The parameter `CTRL_SelParSet` allows you to switch between the two control loop parameter sets during operation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_CTRL_ActParSet</code>	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 (<code>CTRL_ParChgTime</code>) has elapsed.	- - - -	UINT16 R/- - -	Modbus 4398 PROFINET 4398
<code>CTRL_PwrUpParSet</code>	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 <code>CTRL_SelParSet</code> (non-persistent). Changed settings become active immediately.	- 0 1 2	UINT16 R/W per. -	Modbus 4400 PROFINET 4400
<code>CTRL_SelParSet</code>	Selection of control loop parameter set (non-persistent) Coding see parameter: <code>CTRL_PwrUpParSet</code> Changed settings become active immediately.	- 0 1 2	UINT16 R/W - -	Modbus 4402 PROFINET 4402

Automatically Switching Between Control Loop Parameter Sets

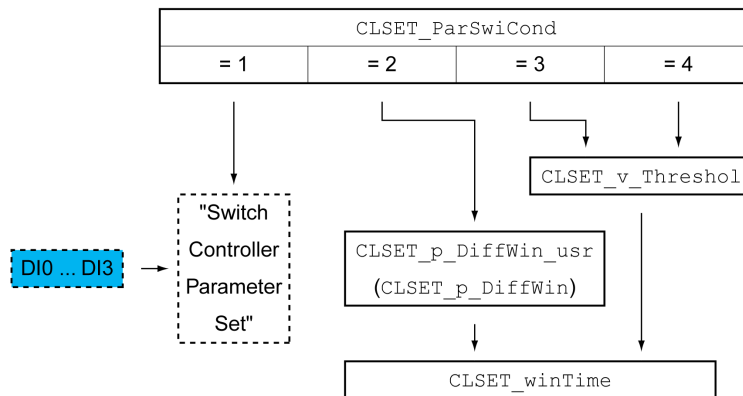
It is possible to automatically switch between the two control loop parameter sets.

The following criteria can be set for switching between the control loop parameter sets:

- Digital signal input
- Position deviation window
- Target velocity below parameterizable value
- Actual velocity below parameterizable value

Settings

The illustration below provides an overview of switching between the parameter sets.



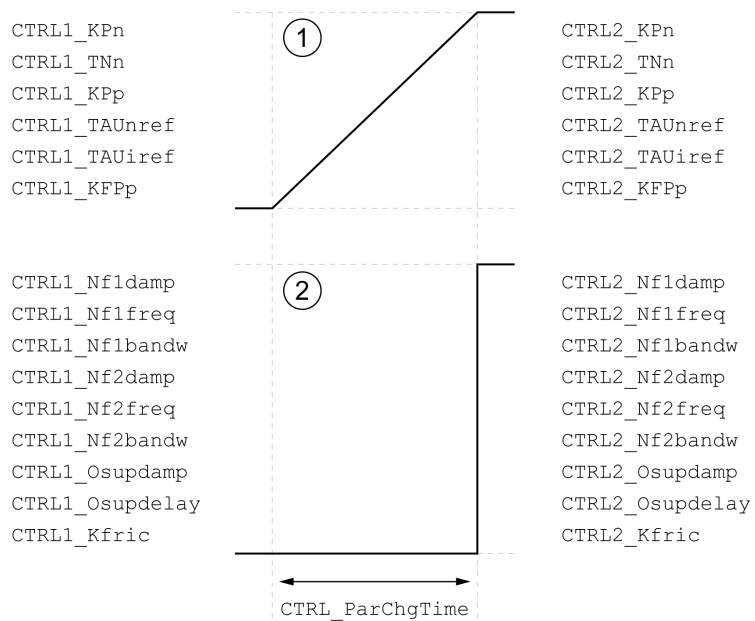
Time Chart

The freely accessible parameters are changed linearly. This linear change of the values of control loop parameter set 1 to the values of control loop parameter set 2 takes place during the parameterizable time `CTRL_ParChgTime`.

The parameters only accessible in Expert mode are directly changed to the values of the other control loop parameter set after the parameterizable time `CTRL_ParChgTime` has passed.

The figure below shows the time chart for switching the control loop parameters.

Time chart for switching the control loop parameter sets



- 1 Freely accessible parameters are changed linearly over time
- 2 Parameters which are only accessible in Expert mode are switched over directly

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_ParSwiCond	<p>Condition for parameter set switching</p> <p>0 / None Or Digital Input: None or digital input function selected</p> <p>1 / Inside Position Deviation: Inside position deviation (value definition in parameter CLSET_p_DiffWin)</p> <p>2 / Below Reference Velocity: Below reference velocity (value definition in parameter CLSET_v_Threshold)</p> <p>3 / Below Actual Velocity: Below actual velocity (value definition in parameter CLSET_v_Threshold)</p> <p>4 / Reserved: Reserved</p> <p>In the case of parameter set switching, the values of the following parameters are changed gradually:</p> <ul style="list-style-type: none"> - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUref - CTRL_TAUiref - CTRL_KFPp <p>The following parameters are changed immediately after the time for parameter set switching (CTRL_ParChgTime):</p> <ul style="list-style-type: none"> - CTRL_Nf1damp - CTRL_Nf1freq - CTRL_Nf1bandw - CTRL_Nf2damp - CTRL_Nf2freq - CTRL_Nf2bandw - CTRL_Osupdamp - CTRL_Osupdelay - CTRL_Kfric <p>Changed settings become active immediately.</p>	- 0 0 4	UINT16 R/W per. -	Modbus 4404 PROFINET 4404
CLSET_p_DiffWin_usr	<p>Position deviation for control loop parameter set switching</p> <p>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.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor.</p> <p>Changed settings become active immediately.</p>	usr_p 0 164 2147483647	INT32 R/W per. -	Modbus 4426 PROFINET 4426
CLSET_p_DiffWin	<p>Position deviation for control loop parameter set switching</p> <p>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.</p> <p>The parameter CLSET_p_DiffWin_usr allows you to enter the value in user-defined units.</p> <p>In increments of 0.0001 revolution.</p> <p>Changed settings become active immediately.</p>	revolution 0.0000 0.0100 2.0000	UINT16 R/W per. -	Modbus 4408 PROFINET 4408

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_v_Threshold	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. Changed settings become active immediately.	usr_v 0 50 2147483647	UINT32 R/W per. -	Modbus 4410 PROFINET 4410
CLSET_winTime	Time window for parameter set switching Value 0: Window monitoring deactivated. Value >0: Window time for the parameters CLSET_v_Threshold and CLSET_p_DiffWin. Changed settings become active immediately.	ms 0 0 1000	UINT16 R/W per. -	Modbus 4406 PROFINET 4406
CTRL_ParChgTime	Period of time for control loop parameter set switching In the case of control loop parameter set switching, the values of the following parameters are changed gradually: - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUref - CTRL_TAUiref - CTRL_KFPp Such a switching can be caused by - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller Changed settings become active immediately.	ms 0 0 2000	UINT16 R/W per. -	Modbus 4392 PROFINET 4392

Copying a Control Loop Parameter Set

The parameter `CTRL_ParSetCopy` allows you to copy the values of control loop parameter set 1 to control loop parameter set 2 or the values of control loop parameter set 2 to control loop parameter set 1.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>CTRL_ParSetCopy</code>	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 <code>CTRL_GlobGain</code> is set to 100%. Changed settings become active immediately.	- 0.0 - 0.2	UINT16 R/W - -	Modbus 4396 PROFINET 4396

Deactivating the Integral Term

The integral term of the velocity controller can be deactivated via the signal input function "Velocity Controller Integral Off". If the integral term is deactivated, the integral action time of the velocity controller (`CTRL1_TNn` and `CTRL2_TNn`) is implicitly and gradually reduced to zero. The time it takes to reduce the value to zero depends on the parameter `CTRL_ParChgTime`. In the case of vertical axes, the integral term is needed to reduce position deviations during standstill.

Control Loop Parameter Set 1

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4610 PROFINET 4610
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4612 PROFINET 4612
CTRL1_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4614 PROFINET 4614
CTRL1_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	Modbus 4618 PROFINET 4618
CTRL1_TAUunref	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. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4616 PROFINET 4616
CTRL1_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	Modbus 4620 PROFINET 4620

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4624 PROFINET 4624
CTRL1_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4626 PROFINET 4626
CTRL1_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4628 PROFINET 4628
CTRL1_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4630 PROFINET 4630
CTRL1_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4632 PROFINET 4632
CTRL1_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4634 PROFINET 4634
CTRL1_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	Modbus 4636 PROFINET 4636
CTRL1_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	Modbus 4638 PROFINET 4638
CTRL1_Kfric	Friction compensation: Gain In increments of $0.01 A_{rms}$. Changed settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	Modbus 4640 PROFINET 4640

Control Loop Parameter Set 2

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4866 PROFINET 4866
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4868 PROFINET 4868
CTRL2_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4870 PROFINET 4870
CTRL2_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	Modbus 4874 PROFINET 4874
CTRL2_TAUunref	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. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4872 PROFINET 4872
CTRL2_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	Modbus 4876 PROFINET 4876

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4880 PROFINET 4880
CTRL2_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4882 PROFINET 4882
CTRL2_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4884 PROFINET 4884
CTRL2_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4886 PROFINET 4886
CTRL2_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4888 PROFINET 4888
CTRL2_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4890 PROFINET 4890
CTRL2_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	Modbus 4892 PROFINET 4892
CTRL2_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	Modbus 4894 PROFINET 4894
CTRL2_Kfric	Friction compensation: Gain In increments of $0.01 A_{rms}$. Changed settings become active immediately.	A_{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	Modbus 4896 PROFINET 4896

Chapter 7

Operating States and Operating Modes

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
7.1	Operating States	236
7.2	Indicating, Starting and Changing an Operating Mode	245
7.3	Operating Mode Jog	248
7.4	Operating Mode Profile Torque	255
7.5	Operating Mode Profile Velocity	260
7.6	Operating Mode Profile Position	264
7.7	Operating Mode Homing	270

Section 7.1

Operating States

What Is in This Section?

This section contains the following topics:

Topic	Page
State Diagram and State Transitions	237
Indication of the Operating State via Signal Outputs	240
Indication of the Operating State via Fieldbus	241
Changing the Operating State via Signal Inputs	242
Changing the Operating State via Fieldbus	244

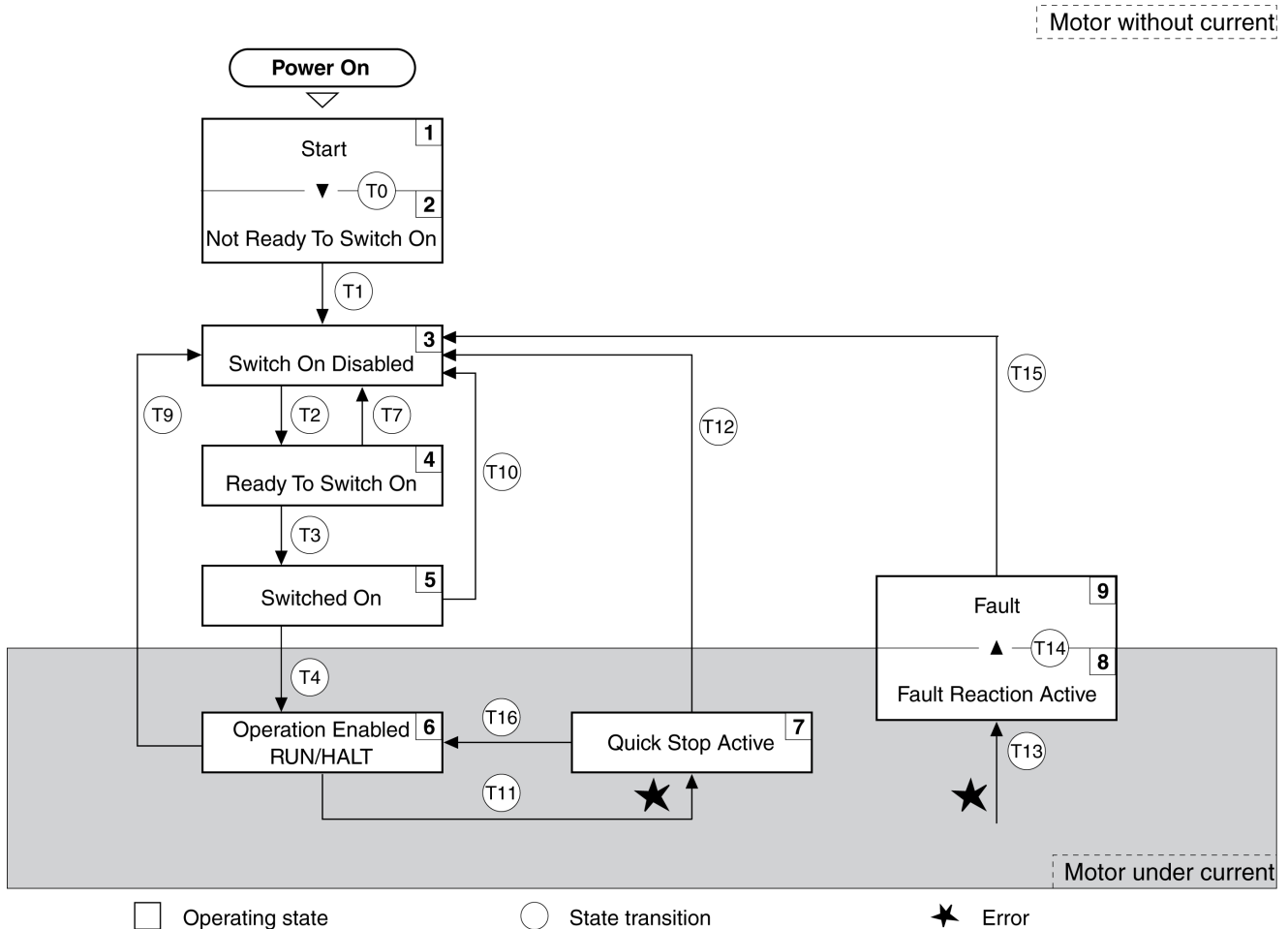
State Diagram and State Transitions

State Diagram

When the product is powered on and when an operating mode is started, the product goes through a number of operating states.

The state diagram (state machine) shows the relationships between the operating states and the state transitions.

The operating states are internally monitored and influenced by monitoring functions.



Operating States

Operating state	Description
1 Start	Electronics are initialized
2 Not Ready To Switch On	The power stage is not ready to switch on
3 Switch On Disabled	Impossible to enable the power stage
4 Ready To Switch On	The power stage is ready to switch on.
5 Switched On	Power stage is switched on
6 Operation Enabled	Power stage is enabled Selected operating mode is active
7 Quick Stop Active	"Quick Stop" is being executed
8 Fault Reaction Active	Error response is active
9 Fault	Error response terminated Power stage is disabled

Error Class

The errors are classified according to the following error classes:

Error class	State transition	Error response	Resetting an error message
0	-	No interruption of the movement	Function "Fault Reset"
1	T11	Stop movement with "Quick Stop"	Function "Fault Reset"
2	T13, T14	Stop movement with "Quick Stop" and disable the power stage when the motor has come to a standstill	Function "Fault Reset"
3	T13, T14	Disable the power stage immediately without stopping the movement first	Function "Fault Reset"
4	T13, T14	Disable the power stage immediately without stopping the movement first	Power cycle

Error Response

The state transition T13 (error class 2, 3 or 4) initiates an error response as soon as an internal occurrence signals an error to which the device must react.

Error class	Response
2	Movement is stopped with "Quick Stop" Holding brake is applied Power stage is disabled
3, 4 or Safety function STO	Power stage is immediately disabled

An error can be triggered by a temperature sensor, for example. The product cancels the current movement and triggers an error response. Subsequently, the operating state changes to **9 Fault**.

Resetting an Error Message

A "Fault Reset" resets an error message.

In the event of a "Quick Stop" triggered by a detected error of class 1 (operating state **7 Quick Stop Active**), a "Fault Reset" causes a direct transition to operating state **6 Operation Enabled**.

State Transitions

State transitions are triggered by an input signal, a fieldbus command or as a response to a monitoring function.

State transition	Operating state	Condition / event ⁽¹⁾	Response
T0	1 -> 2	<ul style="list-style-type: none"> Device electronics successfully initialized 	
T1	2 -> 3	<ul style="list-style-type: none"> Parameter successfully initialized 	
T2	3 -> 4	<ul style="list-style-type: none"> No undervoltage Encoder successfully checked Actual velocity: <1000 rpm STO signals = +24V 	
T3	4 -> 5	<ul style="list-style-type: none"> Request for enabling the power stage 	
T4	5 -> 6	<ul style="list-style-type: none"> Automatic transition 	Power stage is enabled. User parameters are checked. Holding brake is released (if available).
T7	4 -> 3	<ul style="list-style-type: none"> Undervoltage STO signals = 0V Actual velocity: >1000 rpm (for example by external driving force) 	-
T9	6 -> 3	<ul style="list-style-type: none"> Request for disabling the power stage 	Movement is canceled with "Halt" or power stage is immediately disabled. Can be set via parameter DSM_ShutDownOption.
(1) In order to trigger a state transition it is sufficient if one condition is met			

State transition	Operating state	Condition / event ⁽¹⁾	Response
T10	5 -> 3	<ul style="list-style-type: none"> Request for disabling the power stage 	
T11	6 -> 7	<ul style="list-style-type: none"> Error of error class 1 	Movement is canceled with "Quick Stop".
T12	7 -> 3	<ul style="list-style-type: none"> Request for disabling the power stage 	Power stage is disabled immediately, even if "Quick Stop" is still active.
T13	x -> 8	<ul style="list-style-type: none"> Error of error classes 2, 3 or 4 	Error response is carried out, see "Error Response".
T14	8 -> 9	<ul style="list-style-type: none"> Error response terminated (error class 2) Error of error classes 3 or 4 	
T15	9 -> 3	<ul style="list-style-type: none"> Function: "Fault Reset" 	Error is reset (cause of error must have been corrected).
T16	7 -> 6	<ul style="list-style-type: none"> Function: "Fault Reset" 	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

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. Changed settings become active immediately.	- 0 0 1	INT16 R/W per. -	Modbus 1684 PROFINET 1684

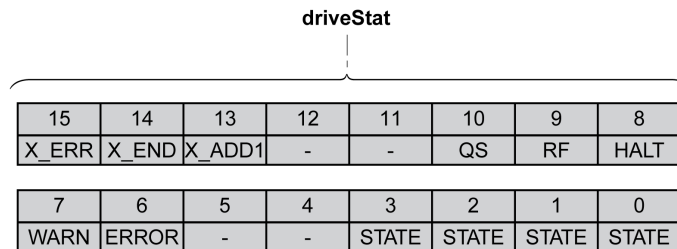
Indication of the Operating State via Signal Outputs

Information on the operating state is available via the signal outputs. The table below provides an overview:

Operating state	Signal output function "No fault" ⁽¹⁾	Signal output function "Active" ⁽²⁾
1 Start	0	0
2 Not Ready To Switch On	0	0
3 Switch On Disabled	0	0
4 Ready To Switch On	1	0
5 Switched On	1	0
6 Operation Enabled	1	1
7 Quick Stop Active	0	0
8 Fault Reaction Active	0	0
9 Fault	0	0
(1) The signal output function is factory setting for DQ0		
(2) The signal output function is the factory setting for DQ1		

Indication of the Operating State via Fieldbus

In the process data channel, status information is transmitted via the input data of the IO device.
The operating state is indicated with the word "driveStat".



bit	Name	Meaning
0 ... 3	STATE	Operating state (binary coded) 1 Start 2 Not Ready To Switch On 3 Switch On Disabled 4 Ready To Switch On 5 Switched On 6 Operation Enabled 7 Quick Stop Active 8 Fault Reaction Active 9 Fault
4 ... 5	-	Reserved
6	ERROR	Error detected (error classes 1 ... 3)
7	WARN	Error detected (error class 0)
8	HALT	"Halt" is active
9	RF	Homing valid
10	QS	"Quick Stop" is active
11 ... 12	-	Reserved
13	X_ADD1	Operating mode-specific information
14	X_END	Operating mode terminated
15	X_ERR	Operating mode terminated with error

Changing the Operating State via Signal Inputs

It is possible to switch between operating states via the signal inputs.

- Signal input function "Enable"
- Signal input function "Fault Reset"
- Signal input functions "Jog Positive With Enable"
- Signal input functions "Jog Negative With Enable"

Signal Input Function "Enable"

The power stage is enabled by means of the signal input function "Enable".

"Enable"	State transition
Rising edge	Enable power stage (T3)
Falling edge	Disabling the power stage (T9 and T12)

In order to enable the power stage via the signal input, you must first parameterize the signal input function "Enable", see chapter Digital Inputs and Outputs ([see page 207](#)).

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
<code>IO_FaultResOnEnaInp</code>	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 Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1384 PROFINET 1384

Signal Input Function "Fault Reset"

The signal input function "Fault Reset" is used to reset an error message.

"Fault Reset"	State transition
Rising edge	Resetting an error message (T15 and T16)

In order to reset an error message via the signal input, you must first parameterize the signal input function "Fault Reset", see chapter Digital Inputs and Outputs ([see page 207](#)).

Signal Input Function "Jog Positive With Enable"

The signal input function "Jog Positive With Enable" enables the power stage, starts the operating mode Jog and triggers a movement in positive direction.

"Jog Positive With Enable"	State transition
Rising edge	Enable power stage (T3) Automatic change to the operating mode Jog and start of a movement in positive direction. See chapter Operating Mode Jog (see page 248) for details and parameterization.
Falling edge	Stopping the movement. Disabling the power stage (T9 and T12)

Signal Input Function "Jog Negative With Enable"

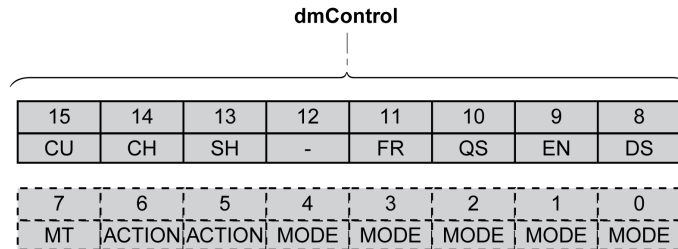
The signal input function "Jog Negative With Enable" enables the power stage, starts the operating mode Jog and triggers a movement in negative direction.

"Jog Negative With Enable"	State transition
Rising edge	Enable power stage (T3) Automatic change to the operating mode Jog and start of a movement in negative direction. See chapter Operating Mode Jog (see page 248) for details and parameterization.
Falling edge	Stopping the movement. Disabling the power stage (T9 and T12)

Changing the Operating State via Fieldbus

In the process data channel, output data is used to make settings to the IO device.

Bits 8 ... 15 of the word "dmControl" are used to set the operating state.



bit	Name	Meaning	Operating state
8	DS	Disabling the power stage	6 Operation Enabled -> 4 Ready To Switch On
9	EN	Enabling the power stage	4 Ready To Switch On -> 6 Operation Enabled
10	QA	Perform "Quick Stop"	6 Operation Enabled -> 7 Quick Stop Active
11	FR	Perform "Fault Reset"	7 Quick Stop Active -> 6 Operation Enabled 9 Fault -> 4 Ready To Switch On
12	-	Reserved	Reserved
13	SH	Execute "Halt"	6 Operation Enabled
14	CH	Clear "Halt"	6 Operation Enabled
15	CU	Resume operating mode interrupted by "Halt"	6 Operation Enabled

In the case of an access, the bits respond to a 0->1 change to trigger the corresponding function.

If a request for changing the operating state is not successful, this request is ignored. There is no error response.

Ambivalent bit combinations are treated in accordance with the following priority list (highest priority bit 8, lowest priority bit 14 and bit 15):

- Bit 8 (disable power stage) prior to bit 9 (enable power stage)
- Bit 10 ("Quick Stop") prior to bit 11 ("Fault Reset")
- Bit 13 (execute "Halt") prior to bit 14 (clear "Halt") and bit 15 (resume operating mode interrupted by "Halt")

In the case of an error of error class 2 or error class 3, a "Fault Reset" can only be performed when bit 9 (enable power stage) is no longer set.

Section 7.2

Indicating, Starting and Changing an Operating Mode

What Is in This Section?

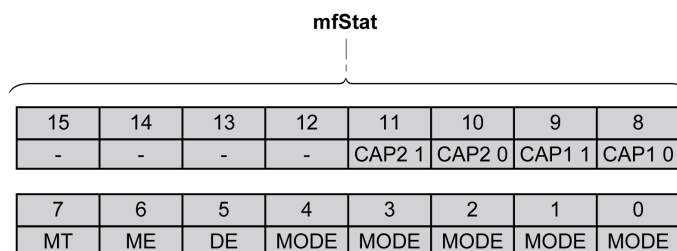
This section contains the following topics:

Topic	Page
Indicating an Operating Mode	246
Starting and Changing an Operating Mode	247

Indicating an Operating Mode

In the process data channel, status information is transmitted via the input data of the IO device.

The word “mfStat” is used to indicate the set operating mode.

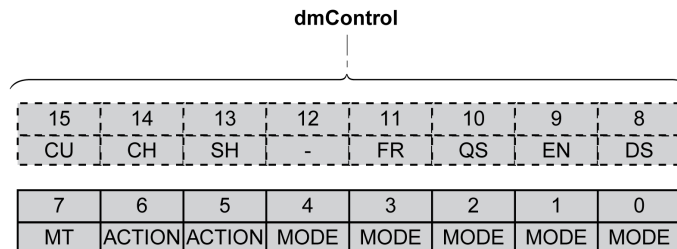


bit	Name	Description
0 ... 4	MODE	Indicates the set operating mode Value 01 _h : Profile Position Value 03 _h : Profile Velocity Value 04 _h : Profile Torque Value 06 _h : Homing Value 1F _h : Jog
5	DE	The “DE” bit relates to parameters that are independent of “Mode Toggle” (MT). The “DE” bit is set if a data value in the process data channel is invalid.
6	ME	The “ME” bit relates to parameters that are dependent on “Mode Toggle” (MT). The “ME” bit is set if a request (for example, starting an operating mode) was rejected.
7	MT	Handshake via “Mode Toggle”
8 ... 9	CAP1	Bit 0 and bit 1 of parameter <code>_Cap1Count</code>
10 ... 11	CAP2	Bit 0 and bit 1 of parameter <code>_Cap2Count</code>
12 ... 15	-	Reserved

Starting and Changing an Operating Mode

In the process data channel, output data is used to make settings to the IO device.

Bits 0 ... 7 in the word "dmControl" are used to set the operating mode.



bit	Name	Description
0 ... 4	MODE	Operating Mode Value 01 _h : Profile Position Value 03 _h : Profile Velocity Value 04 _h : Profile Torque Value 06 _h : Homing Value 1F _h : Jog
5 ... 6	ACTION	Operating mode-dependent
7	MT	Handshake via Mode Toggle

The operating modes can be changed during operation. For this purpose, the current movement must be completed or explicitly canceled. The motor must be at a standstill.

The IO controller must enter the following values to activate an operating mode or to change target values:

- Target values, depending on required operating mode
- Operating mode in "dmControl", bits 0 ... 4 (MODE).
- Action for this operating mode in bit 5 and bit 6 (ACTION)
- Toggle bit 7 (MT)

The following chapters describe the possible operating modes, functions and the corresponding target values.

Section 7.3

Operating Mode Jog

What Is in This Section?

This section contains the following topics:

Topic	Page
Overview	249
Parameterization	252
Additional Settings	254

Overview

Description

In the operating mode Jog, a movement is made from the actual motor position in the specified direction.

A movement can be made using one of 2 methods:

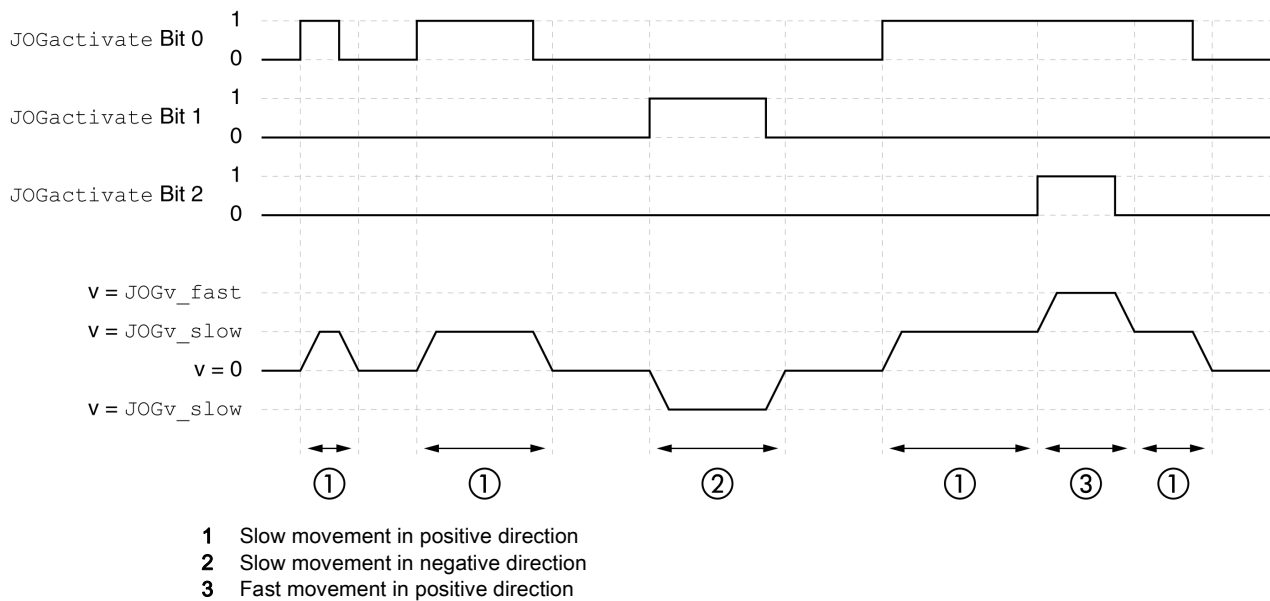
- Continuous movement
- Step movement

In addition, the product features 2 parameterizable velocities.

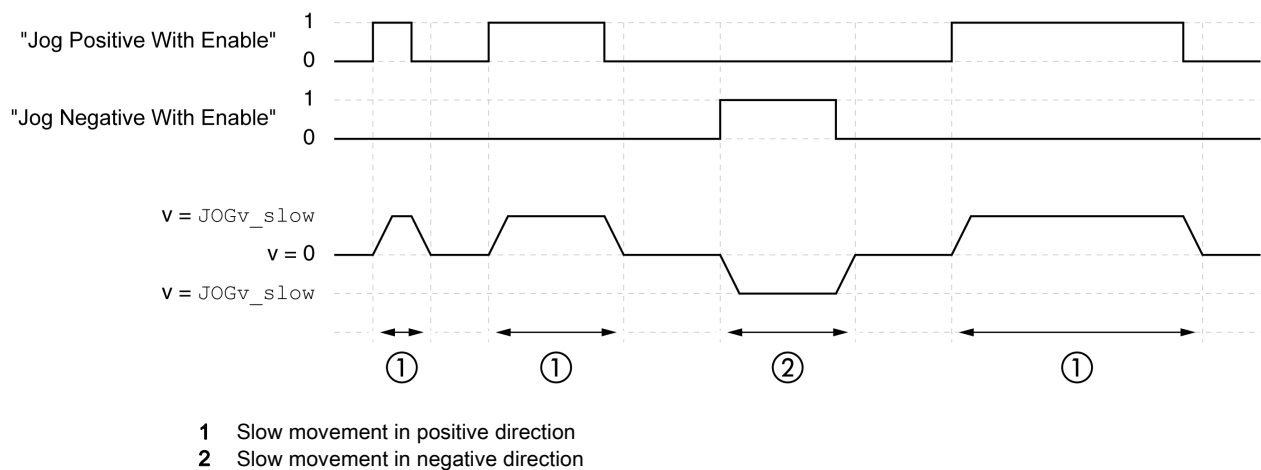
Continuous Movement

As long as the signal for the direction is available, a continuous movement is made in the desired direction.

The illustration below provides an overview of continuous movement via the fieldbus:



The illustration below provides an overview of continuous movement via the signal inputs:



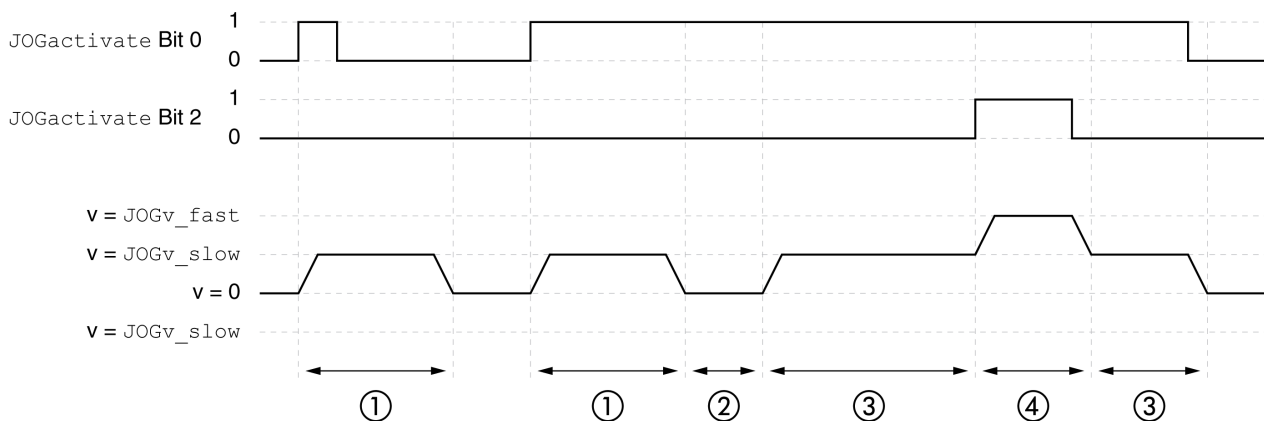
The signal input functions "Jog Positive With Enable" and/or "Jog Negative With Enable" must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

Step Movement

If the signal for the direction is available for a short period of time, a movement with a parameterizable number of user-defined units is made in the desired direction.

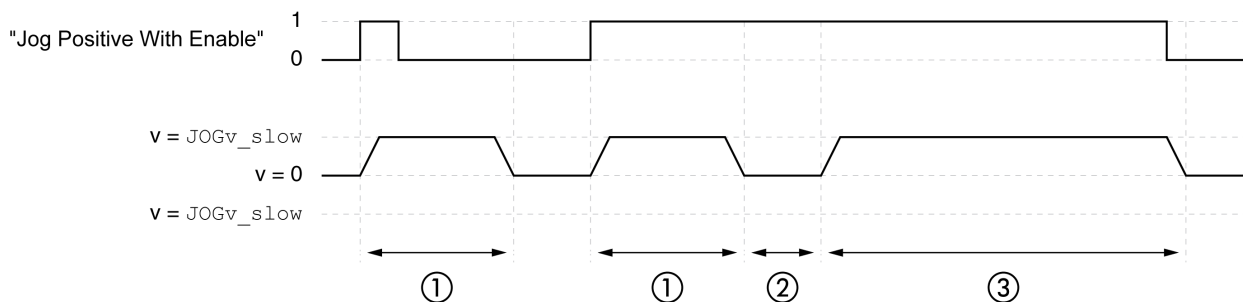
If the signal for the direction is available continuously, a movement with a parameterizable number of user-defined units is made in the desired direction. After this movement, the motor stops for a defined period of time. Then a continuous movement is made in the desired direction.

The illustration below provides an overview of step movement via the fieldbus:



- 1 Slow movement in positive direction with a parameterizable number of user-defined units JOGstep
- 2 Waiting time JOGtime
- 3 Slow continuous movement in positive direction
- 4 Fast continuous movement in positive direction

The illustration below provides an overview of step movement via the signal inputs:



- 1 Slow movement in positive direction with a parameterizable number of user-defined units JOGstep
- 2 Waiting time JOGtime
- 3 Slow continuous movement in positive direction

The signal input functions "Jog Positive With Enable" and/or "Jog Negative With Enable" must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

Starting the Operating Mode

The operating mode can be started via the fieldbus or via the signal inputs.

The operating mode is set and started in the process data channel with the output data.

dmControl Bits 0 ... 6 MODE+ACTION	RefA32	RefB32
1F _h	Value 0: No movement Value 1: Slow movement in positive direction Value 2: Slow movement in negative direction Value 5: Fast movement in positive direction Value 6: Fast movement in negative direction	-

If the operating mode is started via the signal inputs, the signal input functions “Jog Positive With Enable” and “Jog Negative With Enable” must have been parameterized, see chapter Digital Inputs and Outputs (*see page 207*).

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.

Status Information

The word “driveStat” provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	Reserved
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

Terminating the Operating Mode

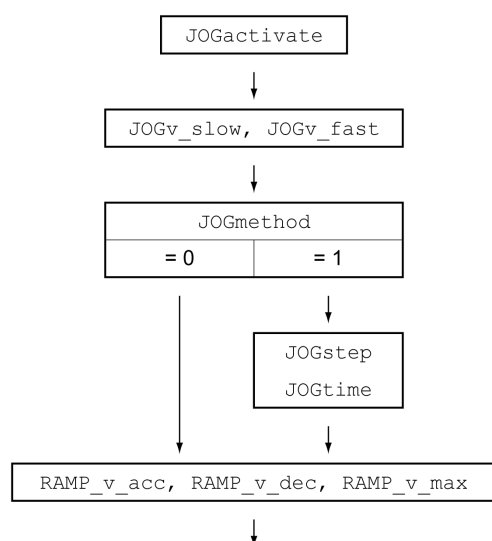
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Value 0 RefA
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

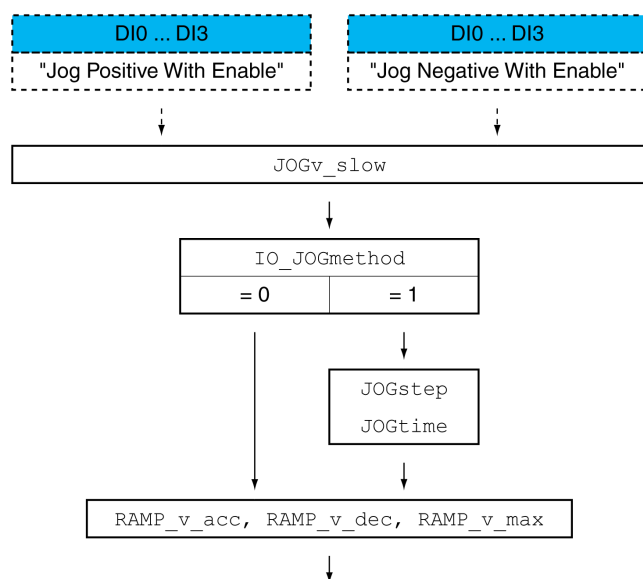
Parameterization

Overview

The illustration below provides an overview of the adjustable parameters for movements via the fieldbus:



The illustration below provides an overview of the adjustable parameters for movements via the signal inputs:



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. Changed settings become active immediately.	usr_v 1 60 2147483647	UINT32 R/W per. -	Modbus 10504 PROFINET 10504
JOGv_fast	Velocity for fast movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active immediately.	usr_v 1 180 2147483647	UINT32 R/W per. -	Modbus 10506 PROFINET 10506

Selection of the Method

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

- Set the desired method with the parameter JOGmethod.

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

- Set the desired method with the parameter IO_JOGmethod.

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 Changed settings become active the next time the motor moves.	- 0 1 1	UINT16 R/W per. -	Modbus 1328 PROFINET 1328
JOGmethod	Selection of jog method 0 / Continuous Movement: Jog with continuous movement 1 / Step Movement: Jog with step movement Changed settings become active immediately.	- 0 1 1	UINT16 R/W - -	Modbus 10502 PROFINET 10502

Setting the Step Movement

The parameters JOGstep and JOGtime are used to set the parameterizable number of user-defined units and the time for which the motor is stopped.

- Set the desired values with the parameters JOGstep and JOGtime.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGstep	Distance for step movement Changed settings become active the next time the motor moves.	usr_p 1 20 2147483647	INT32 R/W per. -	Modbus 10510 PROFINET 10510
JOGtime	Wait time for step movement Changed settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	Modbus 10512 PROFINET 10512

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity (*see page 285*).

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation ([see page 287](#))
- Chapter Stop Movement with Halt ([see page 288](#))
- Chapter Stop Movement with Quick Stop ([see page 290](#))
- Chapter Limitation of the Velocity via Signal Inputs ([see page 292](#))
- Chapter Limitation of the Current via Signal Inputs ([see page 293](#))
- Chapter Setting a Signal Output via Parameter ([see page 295](#))
- Chapter Position Capture via Signal Input ([see page 297](#))
- Chapter Relative Movement After Capture (RMAC) ([see page 300](#))

The following functions can be used for monitoring the movement:

- Chapter Limit Switches ([see page 306](#))
- Chapter Software Limit Switches ([see page 308](#))
- Chapter Load-Dependent Position Deviation (Following Error) ([see page 310](#))
- Chapter Motor Standstill and Direction of Movement ([see page 315](#))
- Chapter Standstill Window ([see page 318](#))
This function is only available for a step movement.
- Chapter Position Register ([see page 320](#))
- Chapter Position Deviation Window ([see page 325](#))
- Chapter Velocity Deviation Window ([see page 327](#))
- Chapter Velocity Threshold Value ([see page 329](#))
- Chapter Current Threshold Value ([see page 331](#))

Section 7.4

Operating Mode Profile Torque

What Is in This Section?

This section contains the following topics:

Topic	Page
Overview	256
Parameterization	257
Additional Settings	259

Overview

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 is set and started in the process data channel with the output data.

dmControl Bits 0 ... 6 MODE+ACTION	RefA32	RefB32
24 _h	As PTtq_target	As RAMP_tq_slope

Status Information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target torque not reached 1: Target torque reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

Status Messages

The table below provides an overview of the signal outputs:

Signal output	Signal output function
DQ0	"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

Terminating the Operating Mode

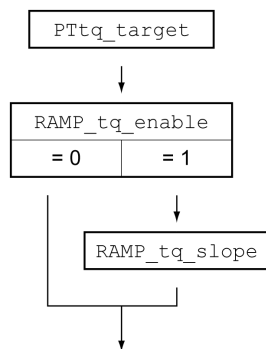
The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by "Halt" or "Quick Stop"
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.



Setting the Target Torque

The target torque is set by means of the parameter `PTtq_target`.

- Set the desired target torque with the parameter `PTtq_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>PTtq_target</code>	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque <code>_M_M_0</code> . In increments of 0.1 %. Changed settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	Modbus 6944 PROFINET 6944

Changing the Motion Profile for the Torque

It is possible to change the parameterization of the motion profile for the torque.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>RAMP_tq_enable</code>	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 changed if power stage is disabled. Changed settings become active immediately.	- 0 1 1	UINT16 R/W per. -	Modbus 1624 PROFINET 1624

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_tq_slope	<p>Slope setting of the motion profile for torque 100.00 % of the torque setting correspond to the continuous stall torque _M_M_0.</p> <p>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. Changed settings become active immediately.</p>	%/s 0.1 10000.0 3000000.0	UINT32 R/W per. -	Modbus 1620 PROFINET 1620

Additional Settings

The following functions can be used for target value processing:

- Chapter Stop Movement with Halt ([see page 288](#))
- Chapter Stop Movement with Quick Stop ([see page 290](#))
- Chapter Limitation of the Velocity via Signal Inputs ([see page 292](#))
- Chapter Limitation of the Current via Signal Inputs ([see page 293](#))
- Chapter Setting a Signal Output via Parameter ([see page 295](#))
- Chapter Position Capture via Signal Input ([see page 297](#))
- Chapter Relative Movement After Capture (RMAC) ([see page 300](#))

The following functions can be used for monitoring the movement:

- Chapter Limit Switches ([see page 306](#))
- Chapter Software Limit Switches ([see page 308](#))
- Chapter Motor Standstill and Direction of Movement ([see page 315](#))
- Chapter Torque Window ([see page 316](#))
- Chapter Position Register ([see page 320](#))
- Chapter Velocity Threshold Value ([see page 329](#))
- Chapter Current Threshold Value ([see page 331](#))

Section 7.5

Operating Mode Profile Velocity

What Is in This Section?

This section contains the following topics:

Topic	Page
Overview	261
Parameterization	262
Additional Settings	263

Overview

Description

In the operating mode Profile Velocity, a movement is made with a specified target velocity.

Starting the Operating Mode

The operating mode is set and started in the process data channel with the output data.

dmControl Bits 0 ... 6 MODE+ACTION	RefA32	RefB32
23 _h	As PVv_target	-

Status Information

The word “driveStat” provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target velocity not reached 1: Target velocity reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

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

Additional Settings

The following functions can be used for target value processing:

- Chapter Stop Movement with Halt ([see page 288](#))
- Chapter Stop Movement with Quick Stop ([see page 290](#))
- Chapter Limitation of the Velocity via Signal Inputs ([see page 292](#))
- Chapter Limitation of the Current via Signal Inputs ([see page 293](#))
- Chapter Zero Clamp ([see page 294](#))
- Chapter Setting a Signal Output via Parameter ([see page 295](#))
- Chapter Position Capture via Signal Input ([see page 297](#))
- Chapter Relative Movement After Capture (RMAC) ([see page 300](#))

The following functions can be used for monitoring the movement:

- Chapter Limit Switches ([see page 306](#))
- Chapter Software Limit Switches ([see page 308](#))
- Chapter Motor Standstill and Direction of Movement ([see page 315](#))
- Chapter Velocity Window ([see page 317](#))
- Chapter Position Register ([see page 320](#))
- Chapter Velocity Deviation Window ([see page 327](#))
- Chapter Velocity Threshold Value ([see page 329](#))
- Chapter Current Threshold Value ([see page 331](#))

Section 7.6

Operating Mode Profile Position

What Is in This Section?

This section contains the following topics:

Topic	Page
Overview	265
Parameterization	267
Additional Settings	269

Overview

Description

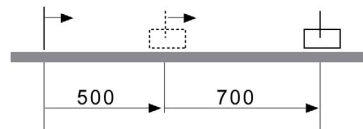
In the operating mode Profile Position, a movement to a desired target position is performed.

A movement can be made using one of 2 methods:

- Relative movement
- Absolute movement

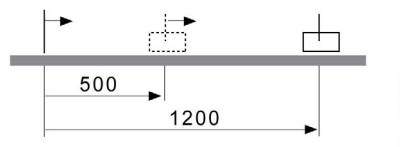
Relative Movement

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 is set and started in the process data channel with the output data.

Method	dmControl Bits 0 ... 6 MODE+ACTION	RefA32	RefB32
Absolute	01 _h	As PPv_target	As PPp_target
Relative with reference to the currently set target position	21 _h	As PPv_target	As PPp_target
Relative with reference to the current motor position	41 _h	As PPv_target	As PPp_target

Status Information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	0: Target position not reached 1: Target position reached
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

Terminating the Operating Mode

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

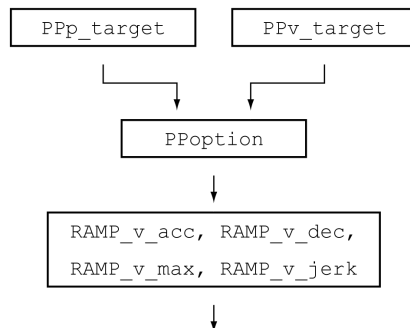
- Target position reached
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.

Overview of adjustable parameters



Target Position

The parameter `PPp_target` allows you to enter the target position.

- Set the desired target position with the parameter `PPp_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PPp_target	Target position for operating mode Profile Position Minimum/maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Changed settings become active immediately.	usr_p - - -	INT32 R/W - -	Modbus 6940 PROFINET 6940

Target Velocity

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

- Set the target velocity with the parameter `PPv_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PPv_target	Target velocity for operating mode Profile Position The target velocity is limited to the setting in <code>CTRL_v_max</code> and <code>RAMP_v_max</code> . Changed settings become active the next time the motor moves.	usr_v 1 60 4294967295	UINT32 R/W - -	Modbus 6942 PROFINET 6942

Selection of the Method

The parameter `PPOption` allows you to set the method for a relative movement.

- Set the desired method for a relative movement with the parameter `PPOption`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PPoption	Options for operating mode Profile Position Determines the reference position for relative positioning: 0: Relative with reference to the previous target position of the profile generator 1: Not supported 2: Relative with reference to the actual position of the motor Changed settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	Modbus 6960 PROFINET 6960

Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity ([see page 285](#)).

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation ([see page 287](#))
- Chapter Stop Movement with Halt ([see page 288](#))
- Chapter Stop Movement with Quick Stop ([see page 290](#))
- Chapter Limitation of the Velocity via Signal Inputs ([see page 292](#))
- Chapter Limitation of the Current via Signal Inputs ([see page 293](#))
- Chapter Setting a Signal Output via Parameter ([see page 295](#))
- Chapter Starting a Movement via a Signal Input ([see page 296](#))
- Chapter Position Capture via Signal Input ([see page 297](#))
- Chapter Relative Movement After Capture (RMAC) ([see page 300](#))

The following functions can be used for monitoring the movement:

- Chapter Limit Switches ([see page 306](#))
- Chapter Software Limit Switches ([see page 308](#))
- Chapter Load-Dependent Position Deviation (Following Error) ([see page 310](#))
- Chapter Motor Standstill and Direction of Movement ([see page 315](#))
- Chapter Standstill Window ([see page 318](#))
- Chapter Position Register ([see page 320](#))
- Chapter Position Deviation Window ([see page 325](#))
- Chapter Velocity Deviation Window ([see page 327](#))
- Chapter Velocity Threshold Value ([see page 329](#))
- Chapter Current Threshold Value ([see page 331](#))

Section 7.7

Operating Mode Homing

What Is in This Section?

This section contains the following topics:

Topic	Page
Overview	271
Parameterization	273
Reference Movement to a Limit Switch	277
Reference Movement to the Reference Switch in Positive Direction	278
Reference Movement to the Reference Switch in Negative Direction	279
Reference Movement to the Index Pulse	280
Position Setting	281
Additional Settings	282

Overview

Description

Description In the operating mode Homing, a reference is generated between a mechanical position and the actual position of the motor.

A reference between a mechanical position and the actual position of the motor is generated by means of a reference movement or by means of position setting.

A successful reference movement or position setting homes the motor and the zero point becomes valid.

The zero point is the point of reference for absolute movements in the operating mode Profile Position.

Methods

A movement can be made using different methods:

- Reference movement to a limit switch
In the case of a reference movement to a limit switch, a movement to the negative limit switch or the positive limit switch is performed.
When the limit switch is reached, the motor is stopped and a movement is made back to the switching point of the limit switch.
From the switching point of the limit switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.
The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.
- Reference movement to the reference switch
In the case of a reference movement to the reference switch, a movement to the reference switch is performed.
When the reference switch is reached, the motor is stopped and a movement is made back to the switching point of the reference switch.
From the switching point of the reference switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.
The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.
- Reference movement to the index pulse
In the case of a reference movement to the index pulse, a movement is made from the actual position to the next index pulse. The position of the index pulse is the reference point.
- Position setting
In the case of position setting, the actual position of the motor is set to a desired position value.

A reference movement must be terminated without interruption for the new zero point to be valid. If the reference movement is interrupted, it must be started again.

Motors with multiturn encoder deliver a valid zero point after they are powered on.

Starting the Operating Mode

The operating mode is set and started in the process data channel with the output data.

Method	dmControl Bits 0 ... 6 MODE+ACTION	RefA32	RefB32
Position setting	06 _h	-	As HMp_setP
Reference movement	26 _h	As HMmethod	-

Status Information

The word "driveStat" provides information on the operating mode.

bit	Name	Meaning
13	X_ADD1	Reserved
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

Terminating the Operating Mode

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

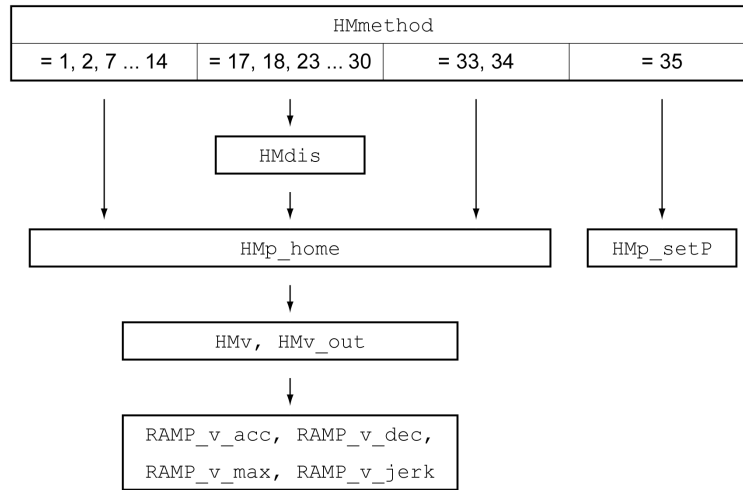
- Homing successful
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

Overview

The illustration below provides an overview of the adjustable parameters.

Overview of adjustable parameters



Setting Limit Switches and Reference Switches

The limit switches and reference switches must be set to meet the requirements, see chapter Limit Switches ([see page 306](#)) and chapter Reference Switch ([see page 307](#)).

Selection of the Method

The operating mode Homing establishes an absolute position reference between the motor position and a defined axis position. There are various Homing methods which can be selected via the parameter **HMmethod**.

The **HMPrefmethod** parameter is used to save the preferred method to the EEPROM (persistent). When the preferred method has been set in this parameter, the method is performed during homing even after the device is powered off and on. The value to be entered corresponds to the value in the **HMmethod** parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMmethod	<p>Homing method</p> <p>1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting</p> <p>Abbreviations: REF+: Search movement in pos. direction REF-: Search movement in neg. direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Changed settings become active immediately.</p>	- 1 18 35	INT16 R/W - -	Modbus 6936 PROFINET 6936
HMprefmethod	<p>Preferred homing method</p> <p>Changed settings become active immediately.</p>	- 1 18 35	INT16 R/W per. -	Modbus 10260 PROFINET 10260

Setting the Distance From the Switching Point

A distance to the switching point of the limit switch or the reference switch must be parameterized for a reference movement with index pulse. The parameter **HMdis** lets you set the distance to the switching limit switch or the reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMdis	<p>Distance from switching point</p> <p>The distance from the switching point is defined as the reference point.</p> <p>The parameter is only effective during a reference movement without index pulse. Changed settings become active the next time the motor moves.</p>	usr_p 1 200 2147483647	INT32 R/W per. -	Modbus 10254 PROFINET 10254

Defining the Zero Point

The parameter `HMp_home` is used to specify a desired position value, which is set at the reference point after a successful reference movement. The desired position value at the reference point defines the zero point.

If the value 0 is used, the zero point corresponds to the reference point.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMp_home	Position at reference point After a successful reference movement, this position is automatically set at the reference point. Changed settings become active the next time the motor moves.	usr_p -2147483648 0 2147483647	INT32 R/W per. -	Modbus 10262 PROFINET 10262

Setting Monitoring

The parameters `HMoutdis` and `HMsrchdis` allow you to activate monitoring of the limit switches and the reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMoutdis	Maximum distance for search for switching point 0: Monitoring of distance inactive >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Changed settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 10252 PROFINET 10252
HMsrchdis	Maximum search distance after overtravel of switch 0: Search distance monitoring disabled >0: Search distance The switch must be activated again within this search distance, otherwise the reference movement is canceled. Changed settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 10266 PROFINET 10266

Reading out the Position Distance

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

The distance between the switching point and the index pulse must be >0.05 revolutions for reproducible reference movements with index pulse.

If the index pulse is too close to the switching point, the limit switch or reference switch can be moved mechanically.

Otherwise the position of the index pulse can be moved with the parameter `ENC_pabsusr`, see Chapter Setting Parameters for Encoder (*see page 161*).

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/- - -	Modbus 10270 PROFINET 10270
_HMdisREFtoIDX	Distance from switching point to index pulse Allows you to verify the distance between the index pulse and the switching point and serves as a criterion for determining whether the reference movement with index pulse can be reproduced. The parameter _HMdisREFtoIDX_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution - - -	INT32 R/- - -	Modbus 10264 PROFINET 10264

Setting Velocities

The parameters **HMv** and **HMv_out** are used to set the velocities for searching the switch and for moving away from the switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMv	Target velocity for searching the switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 1 60 2147483647	UINT32 R/W per. -	Modbus 10248 PROFINET 10248
HMv_out	Target velocity for moving away from switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 1 6 2147483647	UINT32 R/W per. -	Modbus 10250 PROFINET 10250

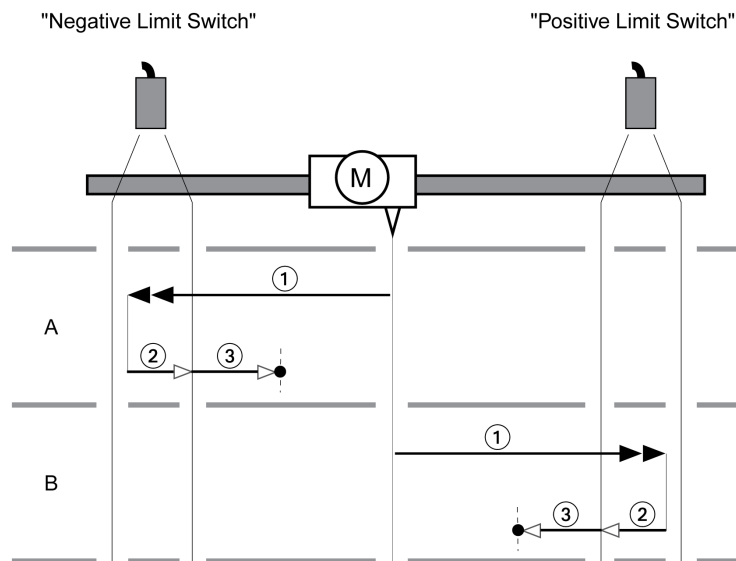
Changing the Motion Profile for the Velocity

It is possible to change the parameterization of the Motion Profile for the Velocity ([see page 285](#)).

Reference Movement to a Limit Switch

The illustration below shows a reference movement to a limit switch

Reference movement to a limit switch



- 1 Movement to limit switch at velocity HMv
- 2 Movement to the switching point of the limit switch at velocity HMv_{out}
- 3 Movement to index pulse or movement to a distance from the switching point at velocity HMv_{out}

Type A

Method 1: Movement to the index pulse.

Method 17: Movement to distance from switching point.

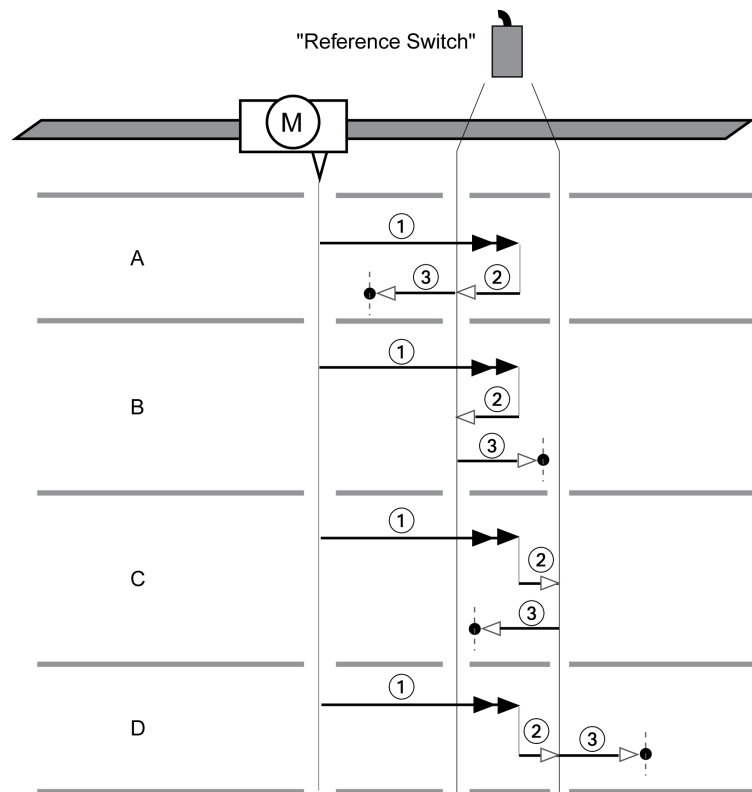
Type B

Method 2: Movement to the index pulse.

Method 18: Movement to distance from switching point.

Reference Movement to the Reference Switch in Positive Direction

The illustration below shows a reference movement to the reference switch in positive direction
Reference movement to the reference switch in positive direction



- 1 Movement to reference switch at velocity HMv
- 2 Movement to the switching point of the reference switch at velocity HMv_{out}
- 3 Movement to index pulse or movement to a distance from the switching point at velocity HMv_{out}

Type A

Method 7: Movement to the index pulse.

Method 23: Movement to distance from switching point.

Type B

Method 8: Movement to the index pulse.

Method 24: Movement to distance from switching point.

Type C

Method 9: Movement to the index pulse.

Method 25: Movement to distance from switching point.

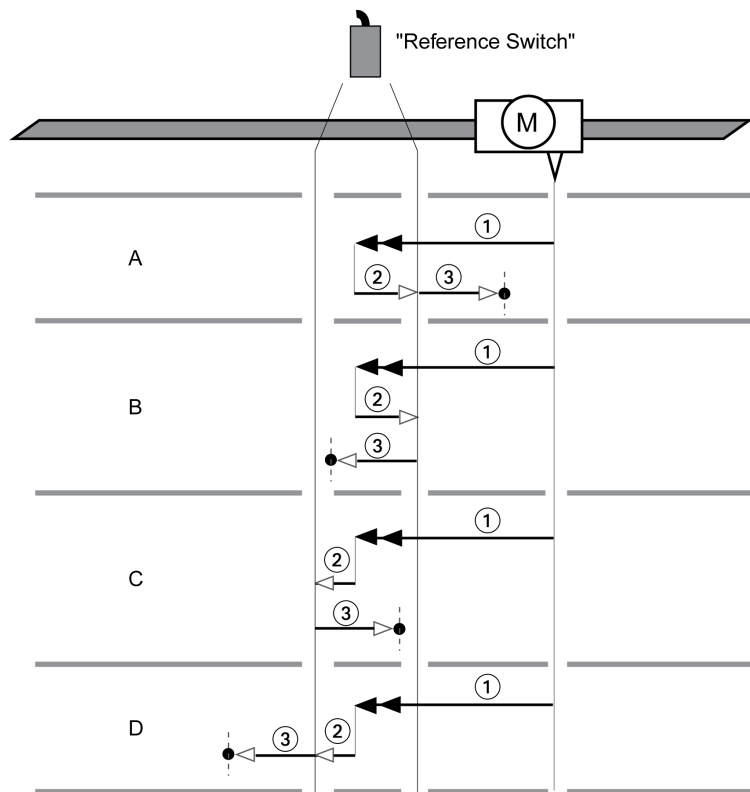
Type D

Method 10: Movement to the index pulse.

Method 26: Movement to distance from switching point.

Reference Movement to the Reference Switch in Negative Direction

The illustration below shows a reference movement to the reference switch in negative direction
Reference movement to the reference switch in negative direction



- 1 Movement to reference switch at velocity HMv
- 2 Movement to the switching point of the reference switch at velocity HMv_{out}
- 3 Movement to index pulse or movement to a distance from the switching point at velocity HMv_{out}

Type A

Method 11: Movement to the index pulse.

Method 27: Movement to distance from switching point.

Type B

Method 12: Movement to the index pulse.

Method 28: Movement to distance from switching point.

Type C

Method 13: Movement to the index pulse.

Method 29: Movement to distance from switching point.

Type D

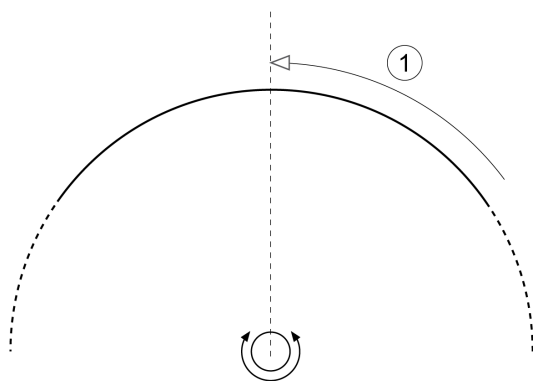
Method 14: Movement to the index pulse.

Method 30: Movement to distance from switching point.

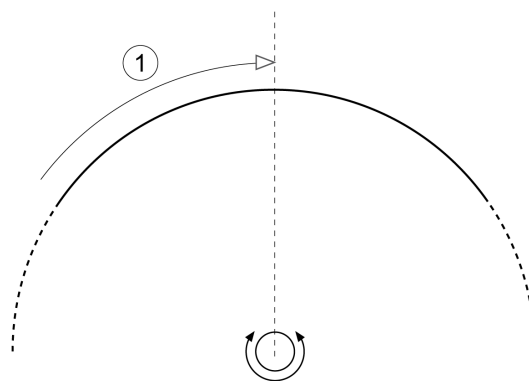
Reference Movement to the Index Pulse

The illustration below shows a reference movement to the index pulse

Reference movement to the index pulse



HMmethod = 33



HMmethod = 34

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.

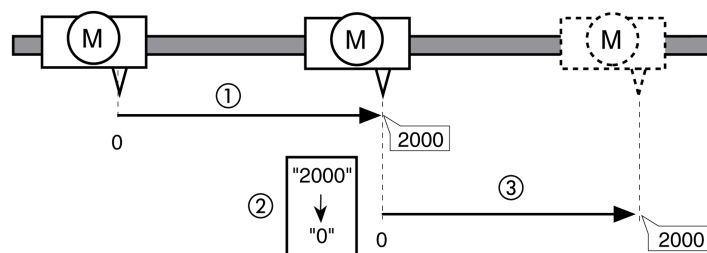
Position setting is only possible when the motor is at a standstill. Any active position deviation remains active and can still be compensated for by the position controller after position setting.

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
<code>HMp_setP</code>	Position for Position Setting Position for operating mode Homing, method 35. Changed settings become active immediately.	<code>usr_p</code> - 0 -	INT32 R/W - -	Modbus 6956 PROFINET 6956

Example

Movement by 4000 user-defined units with position setting



- 1 The motor is positioned by 2000 user-defined units.
- 2 By means of position setting to 0, the actual position of the motor is set to position value 0 which, at the same time, defines a new zero point.
- 3 When a new movement by 2000 user-defined units is triggered, the new target position is 2000 user-defined units.

Additional Settings

The following functions can be used for target value processing:

- Chapter Jerk Limitation ([see page 287](#))
- Chapter Stop Movement with Halt ([see page 288](#))
- Chapter Limitation of the Current via Signal Inputs ([see page 293](#))
- Chapter Setting a Signal Output via Parameter ([see page 295](#))
- Chapter Position Capture via Signal Input ([see page 297](#))

The following functions can be used for monitoring the movement:

- Chapter Limit Switches ([see page 306](#))
- Chapter Reference Switch ([see page 307](#))
- Chapter Software Limit Switches ([see page 308](#))
- Chapter Load-Dependent Position Deviation (Following Error) ([see page 310](#))
- Chapter Motor Standstill and Direction of Movement ([see page 315](#))
- Chapter Position Deviation Window ([see page 325](#))
- Chapter Velocity Deviation Window ([see page 327](#))
- Chapter Velocity Threshold Value ([see page 329](#))
- Chapter Current Threshold Value ([see page 331](#))

Chapter 8

Functions for Operation

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
8.1	Functions for Target Value Processing	284
8.2	Functions for Monitoring Movements	305
8.3	Functions for Monitoring Internal Device Signals	336

Section 8.1

Functions for Target Value Processing

What Is in This Section?

This section contains the following topics:

Topic	Page
Motion Profile for the Velocity	285
Jerk Limitation	287
Stop Movement with Halt	288
Stop Movement with Quick Stop	290
Limitation of the Velocity via Signal Inputs	292
Limitation of the Current via Signal Inputs	293
Zero Clamp	294
Setting a Signal Output via Parameter	295
Starting a Movement via a Signal Input	296
Position Capture via Signal Input	297
Relative Movement After Capture (RMAC)	300
Backlash Compensation	303

Motion Profile for the Velocity

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

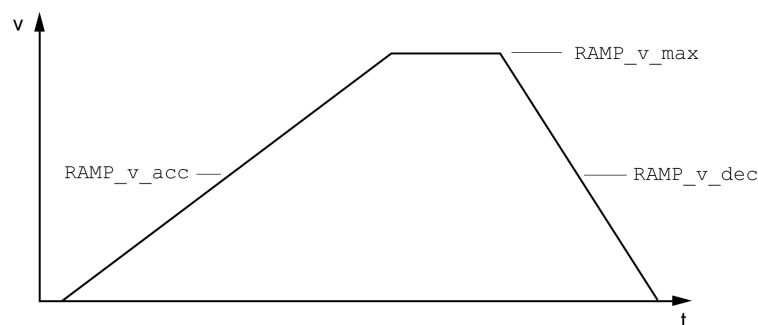
The availability of the motion profile for the velocity depends on the operating mode.

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

- Jog
- Profile Position
- Homing

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.



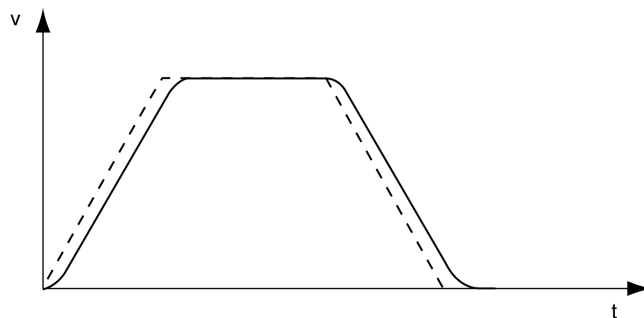
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_enable	Activation of the motion profile for velocity 0 / Profile Off: Profile off 1 / Profile On: Profile on Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 1 1	UINT16 R/W per. -	Modbus 1622 PROFINET 1622
RAMP_v_max	Maximum velocity of the motion profile for velocity If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMP_v_max. This way, commissioning at limited velocity is easier to perform. Setting can only be changed if power stage is disabled. Changed settings become active the next time the motor moves.	usr_v 1 13200 2147483647	UINT32 R/W per. -	Modbus 1554 PROFINET 1554
RAMP_v_acc	Acceleration of the motion profile for velocity Writing the value 0 has no effect on the parameter. Changed settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	Modbus 1556 PROFINET 1556

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_dec	<p>Deceleration of the motion profile for velocity</p> <p>The minimum value depends on the operating mode:</p> <p>Operating modes with minimum value 1: Profile Velocity</p> <p>Operating modes with minimum value 120: Jog Profile Position Homing</p> <p>Writing the value 0 has no effect on the parameter. Changed settings become active the next time the motor moves.</p>	usr_a 1 600 2147483647	UINT32 R/W per. -	Modbus 1558 PROFINET 1558

Jerk Limitation

Description

Jerk limitation smoothes sudden acceleration changes to allow for smooth transitions with almost no jerking.



Availability

Jerk limitation is available in the following operating modes.

- Jog
- Profile Position
- Homing

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
<code>RAMP_v_jerk</code>	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 (<code>x_end=1</code>). Changed settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	Modbus 1562 PROFINET 1562

Stop Movement with Halt

With a Halt, the ongoing movement is interrupted; it can be resumed.

A Halt can be triggered via a digital signal input or a fieldbus command.

In order to interrupt a movement via a signal input, you must first parameterize the signal input function "Halt", see chapter Digital Inputs and Outputs (*see page 207*).

The movement can be interrupted with 2 different deceleration types.

- Deceleration via deceleration ramp
- Deceleration via torque ramp

Setting the Type of Deceleration

The parameter `LIM_HaltReaction` lets you set the type of deceleration.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>LIM_HaltReaction</code>	<p>Halt option code</p> <p>1 / Deceleration Ramp: Deceleration ramp</p> <p>3 / Torque Ramp: Torque ramp</p> <p>Type of deceleration for Halt.</p> <p>Setting of deceleration ramp with parameter <code>RAMP_v_dec</code>.</p> <p>Setting of torque ramp with parameter <code>LIM_I_maxHalt</code>.</p> <p>If a deceleration ramp is already active, the parameter cannot be written.</p> <p>Changed settings become active immediately.</p>	- 1 1 3	INT16 R/W per. -	Modbus 1582 PROFINET 1582

Setting the Deceleration Ramp

The deceleration ramp is set with the parameter `Ramp_v_dec` via the Motion Profile for the Velocity (*see page 285*).

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	<p>Current for Halt</p> <p>This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).</p> <p>In the case of a Halt, the current limit (I_{max_act}) is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - LIM_I_maxHalt - M_I_max - PS_I_max <p>Further current limitations caused by I_{2t} monitoring are also taken into account during a Halt.</p> <p>Default: PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}.</p> <p>Changed settings become active immediately.</p>	A_{rms} - - -	UINT16 R/W per. -	Modbus 4380 PROFINET 4380

Stop Movement with Quick Stop

With a Quick Stop, the ongoing movement is stopped.

A Quick Stop can be triggered by a detected error of error classes 1 or 2 or via a fieldbus command.

The movement can be stopped with 2 different deceleration types.

- Deceleration via deceleration ramp
- Deceleration via torque ramp

In addition, you can set the operating state to switch to after the deceleration.

- Transition to operating state **9** Fault
- Transition to operating state **7** Quick Stop Active

Setting the Type of Deceleration

The parameter `LIM_QStopReact` lets you set the type of deceleration.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>LIM_QStopReact</code>	<p>Quick Stop option code</p> <p>-2 / Torque ramp (Fault): Use torque ramp and transit to operating state 9 Fault</p> <p>-1 / Deceleration Ramp (Fault): Use deceleration ramp and transit to operating state 9 Fault</p> <p>6 / Deceleration ramp (Quick Stop): Use deceleration ramp and remain in operating state 7 Quick Stop</p> <p>7 / Torque ramp (Quick Stop): Use torque ramp and remain in operating state 7 Quick Stop</p> <p>Type of deceleration for Quick Stop.</p> <p>Setting of deceleration ramp with parameter <code>RAMPquickstop</code>.</p> <p>Setting of torque ramp with parameter <code>LIM_I_maxQSTP</code>.</p> <p>If a deceleration ramp is already active, the parameter cannot be written. Changed settings become active immediately.</p>	- -2 6 7	INT16 R/W per. -	Modbus 1584 PROFINET 1584

Setting the Deceleration Ramp

The parameter `RAMPquickstop` lets you set the deceleration ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>RAMPquickstop</code>	<p>Deceleration ramp for Quick Stop</p> <p>Deceleration ramp for a software stop or an error with error class 1 or 2.</p> <p>Changed settings become active the next time the motor moves.</p>	usr_a 1 6000 2147483647	UINT32 R/W per. -	Modbus 1572 PROFINET 1572

Setting the Torque Ramp

The parameter `LIM_I_maxQSTP` lets you set the torque ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxQSTP	<p>Current for Quick Stop</p> <p>This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).</p> <p>In the case of a Quick Stop, the current limit (I_{max_act}) is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - LIM_I_maxQSTP - M_I_max - PS_I_max <p>Further current limitations caused by I_{2t} monitoring are also taken into account during a Quick Stop.</p> <p>Default: PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}.</p> <p>Changed settings become active immediately.</p>	A_{rms} - - -	UINT16 R/W per. -	Modbus 4378 PROFINET 4378

Limitation of the Velocity via Signal Inputs

Limitation via Digital Signal Input

The velocity can be limited to a specific value via a digital signal input.

The parameter `IO_v_limit` lets you set the velocity limitation.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>IO_v_limit</code>	Velocity limitation via input A velocity limitation can be activated via a digital input. In operating mode Profile Torque, the minimum velocity is internally limited to 100 min-1. Changed settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	Modbus 1596 PROFINET 1596

In order to limit the velocity via a digital signal input, you must first parameterize the signal input function "Velocity Limitation", see chapter Digital Inputs and Outputs ([see page 207](#)).

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
<code>IO_I_limit</code>	Current limitation via input A current limit can be activated via a digital input. In increments of 0.01 A _{rms} . Changed settings become active immediately.	A _{rms} 0.00 0.20 300.00	UINT16 R/W per. -	Modbus 1614 PROFINET 1614

In order to limit the current via a digital signal input, you must first parameterize the signal input function "Current Limitation", see chapter Digital Inputs and Outputs ([see page 207](#)).

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

Settings

Target velocities below the parameterized velocity value are interpreted as "zero".

The signal input function "Zero Clamp" has a hysteresis of 20 %.

The parameter `MON_v_zeroclamp` lets you set the velocity value.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_v_zeroclamp</code>	Velocity limit for Zero Clamp A Zero Clamp operation is only possible if the reference velocity is below the Zero Clamp velocity limit. Changed settings become active immediately.	<code>usr_v</code> 0 10 2147483647	UINT32 R/W per. -	Modbus 1616 PROFINET 1616

In order to stop the motor via a digital signal input, you must first parameterize the signal input function "Zero Clamp", see chapter Digital Inputs and Outputs ([see page 207](#)).

Setting a Signal Output via Parameter

Description

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

In order to set a digital signal output via the parameter, you must first parameterize the signal output function "Freely Available", see chapter Parameterization of the Signal Output Functions ([see page 213](#)).

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
<code>IO_DQ_set</code>	<p>Setting the digital outputs directly Digital outputs can only be set directly if the signal output function has been set to 'Available as required'.</p> <p>Bit assignments: Bit 0: DQ0 Bit 1: DQ1</p>	- - - -	UINT16 R/W - -	Modbus 2082 PROFINET 2082

If the IO controller is in the state STOP or in the case of a communication interruption between the IO controller and the drive, the states of the signal outputs of the drive remain as they have been set. The states of the signal outputs of the drive cannot be modified as long as the IO controller is in the state STOP.

Starting a Movement via a Signal Input

The signal input function “Start Profile Positioning” sets the start signal for the movement in the operating mode Profile Position. The positioning movement is then executed when the edge at the digital input rises.

Position Capture via Signal Input

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.

- DI0/CAP1 and 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 min⁻¹.

$$(3000 \text{ min}^{-1} = (3000 \cdot 16384) / (60 \cdot 10^6) = 0.8 \text{ usr}_p / \mu\text{s})$$

If the factory settings for scaling are used, 1.6 user-defined units correspond to 0.036 °.

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

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
<code>_CapStatus</code>	Status of the capture inputs Read access: Bit 0: Position captured via input CAP1 Bit 1: Position captured via input CAP2	- - - -	UINT16 R/- - -	Modbus 2562 PROFINET 2562

Captured Position

The captured position can be read via the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_Cap1Pos</code>	Capture input 1 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2572 PROFINET 2572
<code>_Cap2Pos</code>	Capture input 2 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2574 PROFINET 2574

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap1Count	Capture input 1 event counter Counts the capture events. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	Modbus 2576 PROFINET 2576
_Cap2Count	Capture input 2 event counter Counts the capture events. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2578 PROFINET 2578

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. Changed settings become active immediately.	- 0 - 4	UINT16 R/W - -	Modbus 2568 PROFINET 2568
Cap2Activate	Capture input 2 start/stop 0 / Capture Stop: Cancel capture function 1 / Capture Once: Start one-time capture 2 / Capture Continuous: Start continuous capture 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. Changed settings become active immediately.	- 0 - 4	UINT16 R/W - -	Modbus 2570 PROFINET 2570

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 Changed settings become active immediately.	- 0 0 2	UINT16 R/W - -	Modbus 2564 PROFINET 2564

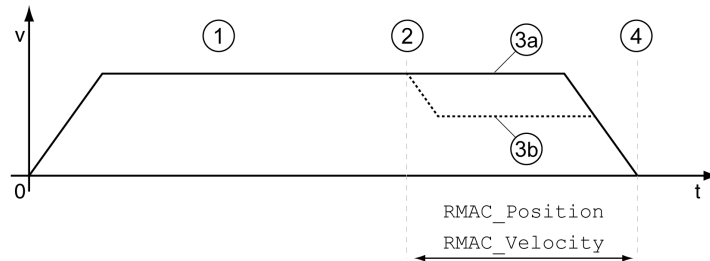
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
Cap2Config	Capture input 2 configuration 0 / Falling Edge: Position capture at falling edge 1 / Rising Edge: Position capture at rising edge 2 / Both Edges: Position capture at both edges Changed settings become active immediately.	- 0 0 2	UINT16 R/W - -	Modbus 2566 PROFINET 2566

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

The signal input function "Start Signal Of RMAC" is required to start the relative movement.

The signal input function must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "RMAC Active Or Finished", see chapter Digital Inputs and Outputs ([see page 207](#)).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters ([see page 333](#)).

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
<code>_RMAC_Status</code>	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/- - -	Modbus 8994 PROFINET 8994

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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	- - - -	UINT16 R/- - -	Modbus 8996 PROFINET 8996

Activates Relative Movement After Capture

Relative Movement After Capture (RMAC) must be activated before it can be started.

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 Changed settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 8984 PROFINET 8984

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 Changed settings become active the next time the motor moves.	usr_p - 0 -	INT32 R/W per. -	Modbus 8986 PROFINET 8986
RMAC_Velocity	Velocity of relative movement after capture Value 0: Use actual motor velocity Value >0: Value is the target velocity The adjustable value is internally limited to the setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 0 0 2147483647	UINT32 R/W per. -	Modbus 8988 PROFINET 8988

Edge for the Start Signal

The edge which is to trigger the relative movement is set via the following parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RMAC_Edge	Edge of capture signal for relative movement after capture 0 / Falling edge: Falling edge 1 / Rising edge: Rising edge	- 0 0 1	UINT16 R/W per. -	Modbus 8992 PROFINET 8992

Response to Overtravelling of the Target Position

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

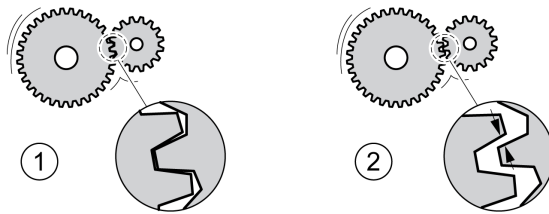
The response to overtravelling of the target position is set via the following parameter.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RMAC_Response	Response if target position is overtravelled 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 Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 8990 PROFINET 8990

Backlash Compensation

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

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
<code>BLSH_Position</code>	Position value for backlash compensation Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 1668 PROFINET 1668

In addition, you can set a processing time. The processing time specifies the period of time during which the mechanical backlash is to be compensated for.

The parameter `BLSH_Time` lets you set the processing time in ms.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>BLSH_Time</code>	Processing time for backlash compensation Value 0: Immediate backlash compensation Value >0: Processing time for backlash compensation Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1672 PROFINET 1672

Activating Backlash Compensation

Before you can activate backlash compensation, there must be a movement in positive or negative direction. Backlash compensation is activated with the parameter `BLSH_Mode`.

- Start a movement in positive direction or in negative direction. This movement must last as long as it takes to move the mechanical system connected to the motor.
- If the movement was in positive direction (positive target values), activate backlash compensation with the value "OnAfterPositiveMovement".
- If the movement was in negative direction (negative target values), activate backlash compensation with the value "OnAfterNegativeMovement".

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>BLSH_Mode</code>	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 Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 1666 PROFINET 1666

Section 8.2

Functions for Monitoring Movements

What Is in This Section?

This section contains the following topics:

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Software Limit Switches	308
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Motor Standstill and Direction of Movement	315
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Limit Switches

The use of limit switches can provide some protection against hazards (for example, collision with mechanical stop caused by incorrect reference values).

WARNING

LOSS OF CONTROL

- Ensure that limit switches are installed as determined by your risk assessment.
- Verify correct connection of the limit switches.
- Verify that the limit switches are sufficiently distant from the mechanical stop to allow an adequate stopping distance.
- Verify correct parameterization and function of the limit switches.

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

Limit Switches

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring.

If the positive or negative limit switch are tripped, the movement stops. An error message is generated and the operating state switches to **7 Quick Stop Active**.

The error message can be reset by means of a "Fault Reset". The operating state switches back to **6 Operation Enabled**.

The movement can continue, however, only in the opposite direction. For example, if the positive limit switch was triggered, further movement is only possible in negative direction. In the case of further movement in positive direction, a new error message is generated and the operating state switches back to **7 Quick Stop Active**.

The parameters `IOsigLIMP` and `IOsigLIMN` are used to set the type of limit switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>IOsigLIMP</code>	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1568 PROFINET 1568
<code>IOsigLIMN</code>	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1566 PROFINET 1566

The signal input functions "Positive Limit Switch (LIMP)" and "Negative Limit Switch (LIMN)" must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

Reference Switch

The reference switch is only active in the operating mode Homing.

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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	Modbus 1564 PROFINET 1564

The signal input function "Reference Switch (REF)" must have been parameterized, see chapter Digital Inputs and Outputs ([see page 207](#)).

Software Limit Switches

Description

Movements can be monitored using software limit switches. A positive position limit and a negative position limit can be set for monitoring.

If the positive or negative position limit switch are reached, the movement stops. An error message is generated and the operating state switches to **7 Quick Stop Active**.

The error message can be reset by means of a "Fault Reset". The operating state switches back to **6 Operation Enabled**.

The movement can continue, however, only in the opposite direction of the position limit. For example, if the positive position limit was reached, further movement is only possible in negative direction. In the case of further movement in positive direction, a new error message is generated and the operating state switches back to **7 Quick Stop Active**.

Prerequisite

Software limit switch monitoring only works with a valid zero point, see chapter Size of the Movement Range (*see page 190*).

Behavior in Operating Modes with Target Positions

In the case of operating modes with target positions, the target position is compared to the position limits before the movement is started. The movement is started normally, even if the target position is greater than the positive position limit or less than the negative position limit. However, the movement is stopped before the position limit is exceeded.

In the following operating modes, the target position is verified prior to the start of a movement.

- Jog (step movement)
- Profile Position

Behavior in Operating Modes Without Target Positions

In operating modes without target position, a Quick Stop is triggered at the position limit.

In the following operating modes, a Quick Stop is triggered at the position limit.

- Jog (continuous movement)
- Profile Torque
- Profile Velocity

The parameter `MON_SWLimMode` allows you to set the behavior when a position limit is reached.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_SWLimMode</code>	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 Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1678 PROFINET 1678

Standstill at the position limit in operating modes without target position requires the parameter `LIM_QStopReact` to be set to "Deceleration ramp (Quick Stop)", see chapter Stop Movement with Quick Stop (*see page 290*). 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. Changed settings become active immediately.	- 0 0 3	UINT16 R/W per. -	Modbus 1542 PROFINET 1542

Setting Position Limits

The software limit switches are set via the parameters `MON_swLimP` and `MON_swLimN`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_swLimP	Positive position limit for software limit switch If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p - 2147483647 -	INT32 R/W per. -	Modbus 1544 PROFINET 1544
MON_swLimN	Negative position limit for software limit switch See description 'MON_swLimP'. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p - -2147483648 -	INT32 R/W per. -	Modbus 1546 PROFINET 1546

Load-Dependent Position Deviation (Following Error)

Description

The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.

Parameters are available to read the load-dependent position deviation during operation and the maximum position deviation reached so far.

The maximum permissible load-dependent position deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent position deviation is available in the following operating modes:

- Jog
- Profile Position
- Homing

Reading the Position Deviation

The following parameters let you read the load-dependent position deviation in user-defined units or revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_p_dif_load_usr</code>	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/- - -	Modbus 7724 PROFINET 7724
<code>_p_dif_load</code>	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 <code>_p_dif_load_usr</code> allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	Modbus 7736 PROFINET 7736

The following parameters let you read the maximum value of the load-dependent position deviation reached so far in user-defined units or revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_p_dif_load_peak_usr</code>	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. Changed settings become active immediately.	usr_p 0 - 2147483647	INT32 R/W - -	Modbus 7722 PROFINET 7722

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_dif_load_peak	<p>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.</p> <p>The parameter _p_dif_load_peak_usr allows you to enter the value in user-defined units.. In increments of 0.0001 revolution. Changed settings become active immediately.</p>	revolution 0.0000 - 429496.7295	UINT32 R/W - -	Modbus 7734 PROFINET 7734

Setting the Position Deviation

The following parameter lets you set the threshold for the maximum load-dependent position deviation that is to trigger an error of error class 0.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_dif_warn	<p>Maximum load-dependent position deviation (error class 0) 100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter MON_p_dif_load. Changed settings become active immediately.</p>	% 0 75 100	UINT16 R/W per. -	Modbus 1618 PROFINET 1618

The following parameters let you set the maximum load-dependent position deviation at which a movement is canceled with an error of error classes 1, 2, or 3.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_dif_load_usr	<p>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.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active immediately.</p>	usr_p 1 16384 2147483647	INT32 R/W per. -	Modbus 1660 PROFINET 1660
MON_p_dif_load	<p>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.</p> <p>The parameter MON_p_dif_load_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Changed settings become active immediately.</p>	revolution 0.0001 1.0000 200.0000	UINT32 R/W per. -	Modbus 1606 PROFINET 1606

Setting the Error Class

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ErrorResp_p_dif	Error response to excessively high load-dependent position deviation 1 / Error Class 1: Error class 1 2 / Error Class 2: Error class 2 3 / Error Class 3: Error class 3 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	Modbus 1302 PROFINET 1302

Load-Dependent Velocity Deviation

Description

The load-dependent velocity deviation is the difference between the reference velocity and the actual velocity caused by the load.

The maximum permissible load-dependent velocity deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent velocity deviation is available in the following operating modes:

- Profile Velocity

Reading the Velocity Deviation

The following parameters let you read the load-dependent velocity deviation in user-defined units.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_v_dif_usr	Current load-dependent velocity deviation The load-dependent velocity deviation is the difference between reference velocity and actual velocity.	usr_v -2147483648 - 2147483647	INT32 R/- - -	Modbus 7768 PROFINET 7768

Setting the Velocity Deviation

The following parameters let you specify the size of the window for the maximum load-dependent velocity deviation at which a movement is canceled.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_VelDiff	Maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Maximum value Changed settings become active immediately.	usr_v 0 0 2147483647	UINT32 R/W per. -	Modbus 1686 PROFINET 1686
MON_VelDiff_Time	Time window for maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Time window for maximum value Changed settings become active immediately.	ms 0 10 -	UINT16 R/W per. -	Modbus 1688 PROFINET 1688

Setting the Error Class

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

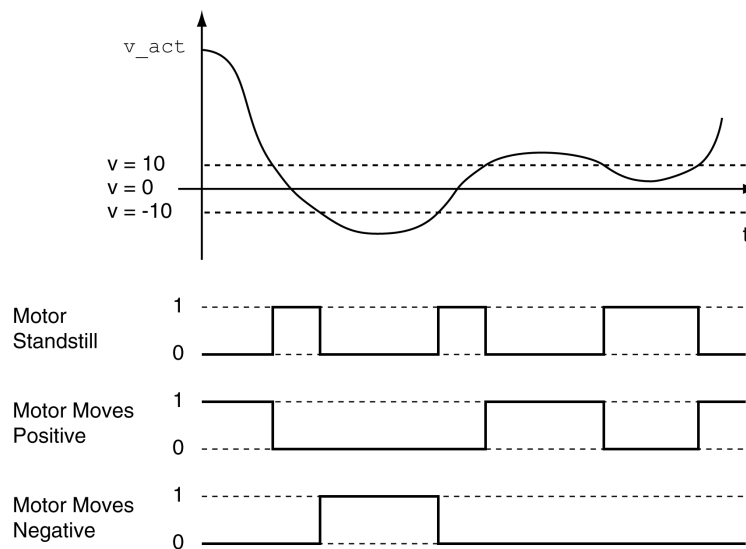
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ErrorResp_v_dif	<p>Error response to excessively high load-dependent velocity deviation</p> <p>1 / Error Class 1: Error class 1</p> <p>2 / Error Class 2: Error class 2</p> <p>3 / Error Class 3: Error class 3</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the power stage is enabled.</p>	<p>-</p> <p>1</p> <p>3</p> <p>3</p>	<p>UINT16</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1400</p> <p>PROFINET 1400</p>

Motor Standstill and Direction of Movement

Description

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

A velocity of <10 rpm is interpreted as standstill.



The status is available via signal outputs. In order to read the status, you must first parameterize the signal output functions "Motor Standstill", "Motor Moves Positive" or "Motor Moves Negative", see chapter Digital Inputs and Outputs ([see page 207](#)).

Torque Window

Description

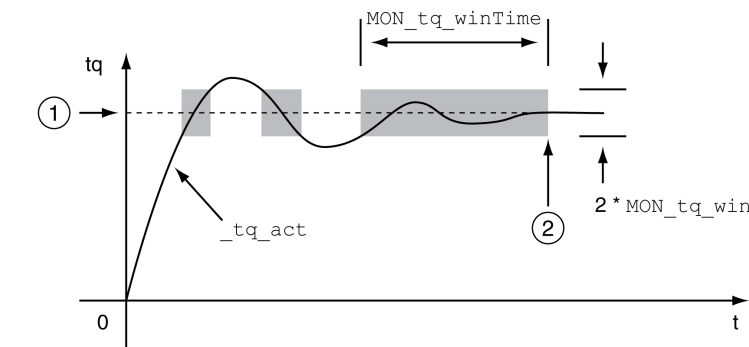
The torque window allows you to monitor whether the motor has reached the target torque.
If the difference between the target torque and the actual torque remains in the torque window for the time `MON_tq_winTime`, the target torque is considered to have been reached.

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
<code>MON_tq_win</code>	Torque window, permissible deviation The torque window can only be activated in operating mode Profile Torque. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 3.0 3000.0	UINT16 R/W per. -	Modbus 1626 PROFINET 1626
<code>MON_tq_winTime</code>	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. Changed settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1628 PROFINET 1628

Velocity Window

Description

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

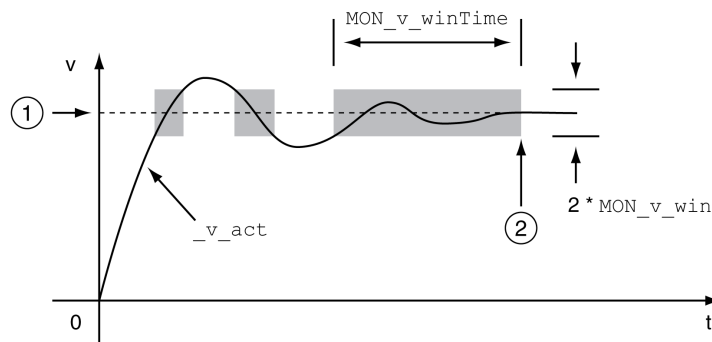
If the difference between the target velocity and the actual velocity remains in the velocity window for the time `MON_v_winTime`, the target velocity is considered to have been reached.

Availability

The velocity window is available in the following operating modes.

- Profile Velocity

Settings



- 1 Target velocity
- 2 Target velocity reached (the target velocity did not exceed the permissible deviation `MON_v_win` during time `MON_v_winTime`).

The parameters `MON_v_win` and `MON_v_winTime` specify the size of the window.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_v_win</code>	Velocity window, permissible deviation Changed settings become active immediately.	<code>usr_v</code> 1 10 2147483647	UINT32 R/W per. -	Modbus 1576 PROFINET 1576
<code>MON_v_winTime</code>	Velocity window, time Value 0: Velocity window monitoring deactivated Changing the value causes a restart of velocity monitoring. Changed settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1578 PROFINET 1578

Standstill Window

Description

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

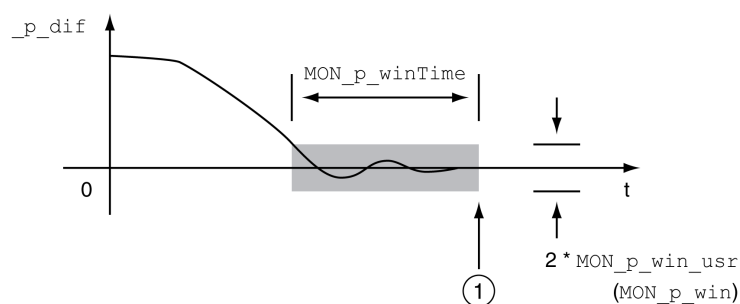
If the difference between the target position and the actual position remains in the standstill window for the time `MON_p_winTime`, the target position is considered to have been reached.

Availability

The standstill window is available in the following operating modes.

- Jog (step movement)
- Profile Position
- Homing

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
<code>MON_p_win_usr</code>	<p>Standstill window, permissible control deviation</p> <p>The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected.</p> <p>Processing of the standstill window must be activated via the parameter <code>MON_p_winTime</code>.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor.</p> <p>Changed settings become active immediately.</p>	<code>usr_p</code> 0 16 2147483647	INT32 R/W per. -	Modbus 1664 PROFINET 1664

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_win	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The parameter MON_p_win_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Changed settings become active immediately.	revolution 0.0000 0.0010 3.2767	UINT16 R/W per. -	Modbus 1608 PROFINET 1608
MON_p_winTime	Standstill window, time Value 0: Monitoring of standstill window deactivated Value >0: Time in ms during which the control deviation must be in the standstill window Changed settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	Modbus 1610 PROFINET 1610
MON_p_winTout	Timeout time for standstill window monitoring Value 0: Timeout monitoring deactivated Value >0: Timeout time in ms Standstill window processing values are set via MON_p_win and MON_p_winTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Changed settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	Modbus 1612 PROFINET 1612

Position Register

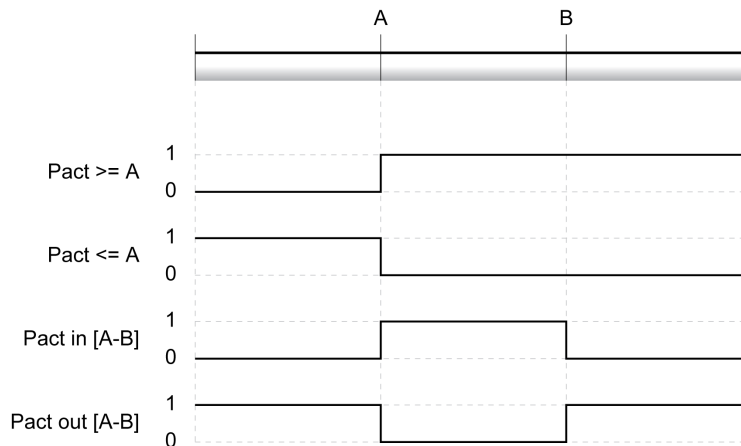
Description

The position register allows you to monitor whether the motor is within a parameterizable position range.

A movement can be monitored using one of 4 methods:

- The motor position is greater than or equal to comparison value A.
- The motor position is less than or equal to comparison value A.
- The motor position is within the range between comparison value A and comparison value B.
- The motor position is outside the range between comparison value A and comparison value B.

Separate channels are available for monitoring.



Number of Channels

4 channels are available.

Status Messages

The status of the position register is available via the parameter `_PosRegStatus`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_PosRegStatus</code>	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/- - -	Modbus 2818 PROFINET 2818

In addition, the status is available via signal outputs. In order to read the status via the signal outputs, you must first parameterize the signal output function "Position Register Channel 1", "Position Register Channel 2", "Position Register Channel 3" and "Position Register Channel 4", see chapter Digital Inputs and Outputs ([see page 207](#)).

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 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2820 PROFINET 2820
PosReg2Start	Start/stop of position register channel 2 0 / Off (keep last state): Position Register channel 2 is off and status bit keeps last state 1 / On: Position Register channel 2 is on 2 / Off (set state 0): Position Register channel 2 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 2 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2822 PROFINET 2822
PosReg3Start	Start/stop of position register channel 3 0 / Off (keep last state): Position Register channel 3 is off and status bit keeps last state 1 / On: Position Register channel 3 is on 2 / Off (set state 0): Position Register channel 3 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 3 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2840 PROFINET 2840
PosReg4Start	Start/stop of position register channel 4 0 / Off (keep last state): Position Register channel 4 is off and status bit keeps last state 1 / On: Position Register channel 4 is on 2 / Off (set state 0): Position Register channel 4 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 4 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2842 PROFINET 2842

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosRegGroupStart	Start/stop of position register channels 0 / No Channel: No channel activated 1 / Channel 1: Channel 1 activated 2 / Channel 2: Channel 2 activated 3 / Channel 1 & 2: Channels 1 and 2 activated 4 / Channel 3: Channel 3 activated 5 / Channel 1 & 3: Channels 1 and 3 activated 6 / Channel 2 & 3: Channels 2 and 3 activated 7 / Channel 1 & 2 & 3: Channels 1, 2 and 3 activated 8 / Channel 4: Channel 4 activated 9 / Channel 1 & 4: Channels 1 and 4 activated 10 / Channel 2 & 4: Channels 2 and 4 activated 11 / Channel 1 & 2 & 4: Channels 1, 2 and 4 activated 12 / Channel 3 & 4: Channels 3 and 4 activated 13 / Channel 1 & 3 & 4: Channels 1, 3 and 4 activated 14 / Channel 2 & 3 & 4: Channels 2, 3 and 4 activated 15 / Channel 1 & 2 & 3 & 4: Channels 1, 2, 3 and 4 activated Changed settings become active immediately.	- 0 0 15	UINT16 R/W per. -	Modbus 2860 PROFINET 2860

Setting the Comparison Criterion

The comparison criterion is set via the following parameters.

In the case of the comparison criteria “Pact in” and “Pact out”, there is a difference between “basic” and “extended”.

- Basic: The movement to be performed remains within the movement range.
- Extended: The movement to be performed can extend beyond the movement range.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg1Mode	Selection of comparison criterion for position register channel 1 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 1 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 1 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2824 PROFINET 2824

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg2Mode	Selection of comparison criterion for position register channel 2 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 2 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 2 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2826 PROFINET 2826
PosReg3Mode	Selection of comparison criterion for position register channel 3 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 3 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 3 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2844 PROFINET 2844
PosReg4Mode	Selection of comparison criterion for position register channel 4 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 4 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 4 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2846 PROFINET 2846

Setting Comparison Values

The comparison values are set via the following parameters.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg1ValueA	Comparison value A for position register channel 1	usr_p - 0 -	INT32 R/W per. -	Modbus 2832 PROFINET 2832
PosReg1ValueB	Comparison value B for position register channel 1	usr_p - 0 -	INT32 R/W per. -	Modbus 2834 PROFINET 2834
PosReg2ValueA	Comparison value A for position register channel 2	usr_p - 0 -	INT32 R/W per. -	Modbus 2836 PROFINET 2836
PosReg2ValueB	Comparison value B for position register channel 2	usr_p - 0 -	INT32 R/W per. -	Modbus 2838 PROFINET 2838
PosReg3ValueA	Comparison value A for position register channel 3	usr_p - 0 -	INT32 R/W per. -	Modbus 2852 PROFINET 2852
PosReg3ValueB	Comparison value B for position register channel 3	usr_p - 0 -	INT32 R/W per. -	Modbus 2854 PROFINET 2854
PosReg4ValueA	Comparison value A for position register channel 4	usr_p - 0 -	INT32 R/W per. -	Modbus 2856 PROFINET 2856
PosReg4ValueB	Comparison value B for position register channel 4	usr_p - 0 -	INT32 R/W per. -	Modbus 2858 PROFINET 2858

Position Deviation Window

Description

The position deviation window allows you to monitor whether the motor is within a parameterizable position deviation.

The position deviation is the difference between reference position and actual position.

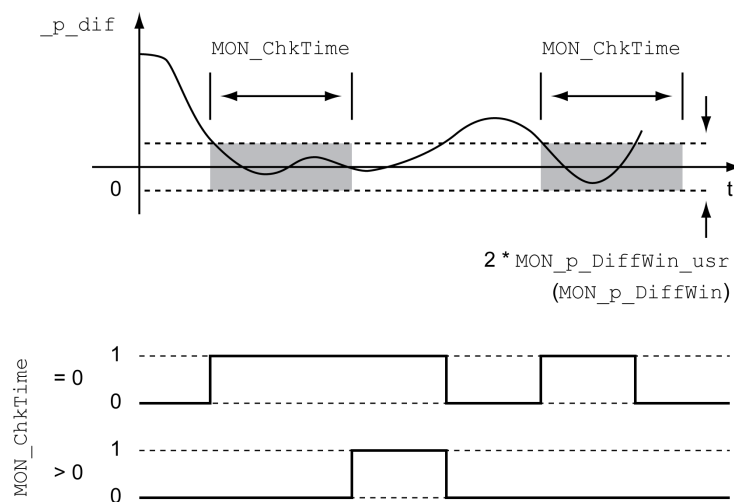
The position deviation window comprises position deviation and monitoring time.

Availability

The position deviation window is available in the following operating modes.

- Jog
- Profile Position
- Homing

Settings



The parameters `MON_p_DiffWin_usr` (`MON_p_DiffWin`) and `MON_ChkTime` specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function “In Position Deviation Window”, see chapter Digital Inputs and Outputs ([see page 207](#)).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters ([see page 333](#)).

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	<p>Monitoring of position deviation The system checks whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active immediately.</p>	usr_p 0 16 2147483647	INT32 R/W per. -	Modbus 1662 PROFINET 1662
MON_p_DiffWin	<p>Monitoring of position deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output.</p> <p>The parameter MON_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Changed settings become active immediately.</p>	revolution 0.0000 0.0010 0.9999	UINT16 R/W per. -	Modbus 1586 PROFINET 1586
MON_ChkTime	<p>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. Changed settings become active immediately.</p>	ms 0 0 9999	UINT16 R/W per. -	Modbus 1594 PROFINET 1594

Velocity Deviation Window

Description

The velocity deviation window allows you to monitor whether the motor is within a parameterizable velocity deviation.

The velocity deviation is the difference between the reference velocity and the actual velocity.

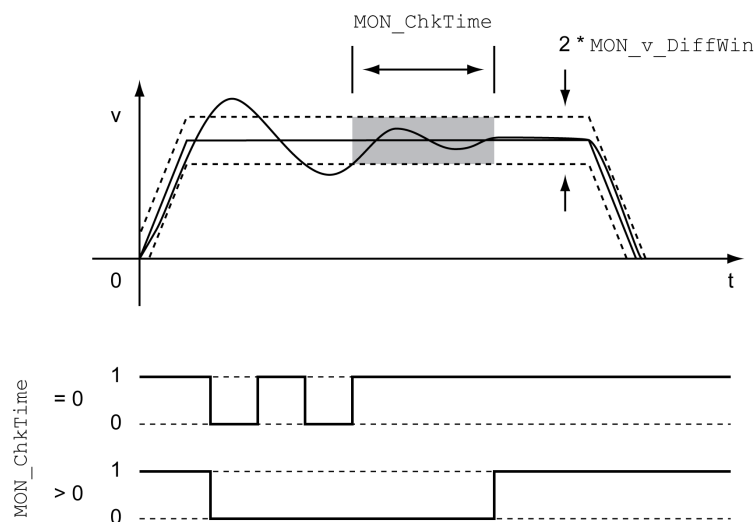
The velocity deviation window comprises velocity deviation and monitoring time.

Availability

The velocity deviation window is available in the following operating modes.

- Jog
- Profile Velocity
- Profile Position
- Homing

Settings



The parameters `MON_v_DiffWin` and `MON_ChkTime` specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "In Velocity Deviation Window", see chapter Digital Inputs and Outputs ([see page 207](#)).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters ([see page 333](#)).

The parameter `MON_ChkTime` acts on the parameters `MON_p_DiffWin_usr` (`MON_p_DiffWin`), `MON_v_DiffWin`, `MON_v_Threshold` and `MON_I_Threshold`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_v_DiffWin	Monitoring of velocity deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. Changed settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	Modbus 1588 PROFINET 1588
MON_ChkTime	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result. The status can be output via a parameterizable output. Changed settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	Modbus 1594 PROFINET 1594

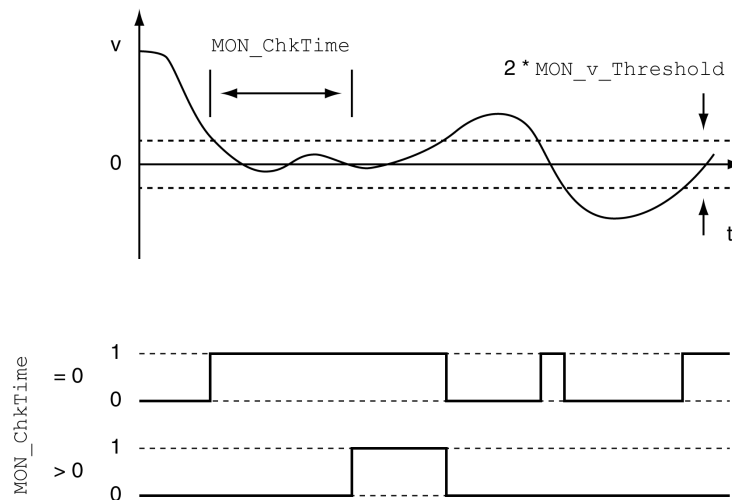
Velocity Threshold Value

Description

The velocity threshold value allows you to monitor whether the actual velocity is below a parameterizable velocity value.

The velocity threshold value comprises the velocity and the monitoring time.

Settings



The parameters MON_v_Threshold and MON_ChkTime specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "Velocity Below Threshold", see chapter Digital Inputs and Outputs ([see page 207](#)).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters ([see page 333](#)).

The parameter MON_ChkTime acts on the parameters MON_p_DiffWin_usr (MON_p_DiffWin), MON_v_DiffWin , MON_v_Threshold and MON_I_Threshold .

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_v_Threshold	Monitoring of velocity threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime . The status can be output via a parameterizable output. Changed settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	Modbus 1590 PROFINET 1590

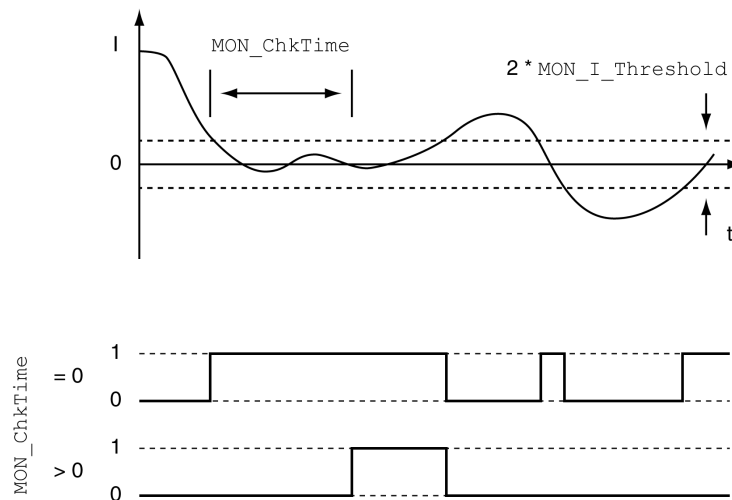
Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_ChkTime	Monitoring of time window Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored 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. Changed settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	Modbus 1594 PROFINET 1594

Current Threshold Value

The current threshold value allows you to monitor whether the actual current is below a parameterizable current value.

The current threshold value comprises the current value and the monitoring time.

Settings



The parameters `MON_I_Threshold` and `MON_ChkTime` specify the size of the window.

Status Indication

The status is available via a signal output or via the fieldbus.

In order to read the status via a signal output, you must first parameterize the signal output function "Current Below Threshold", see chapter Digital Inputs and Outputs ([see page 207](#)).

In order to read the status via the fieldbus, you must set the status bits of the status parameters, see chapter Adjustable Bits of the Status Parameters ([see page 333](#)).

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
<code>MON_I_Threshold</code>	Monitoring of current threshold The system monitors whether the drive is below the defined value during the period set with <code>MON_ChkTime</code> . The status can be output via a parameterizable output. The parameter <code>_Iq_act_rms</code> is used as comparison value. In increments of $0.01 A_{rms}$. Changed settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	Modbus 1592 PROFINET 1592

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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. Changed settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	Modbus 1594 PROFINET 1594

Adjustable Bits of the Status Parameters

Overview

The status bits of the following parameters can be adjusted:

- Parameter `_actionStatus`
 - Setting of bit 9 via parameter `DPL_intLim`
 - Setting of bit 10 via parameter `DS402intLim`
- Parameter `_DPL_motionStat`
 - Setting of bit 9 via parameter `DPL_intLim`
 - Setting of bit 10 via parameter `DS402intLim`
- Parameter `_DCOMstatus`
 - Setting of bit 11 via parameter `DS402intLim`

Status Parameter

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_actionStatus</code>	<p>Action word</p> <p>Signal state:</p> <p>0: Not activated</p> <p>1: Activated</p> <p>Bit assignments:</p> <p>Bit 0: Error class 0</p> <p>Bit 1: Error class 1</p> <p>Bit 2: Error class 2</p> <p>Bit 3: Error class 3</p> <p>Bit 4: Error class 4</p> <p>Bit 5: Reserved</p> <p>Bit 6: Motor is at a standstill (<code>_n_act < 9</code>)</p> <p>Bit 7: Motor movement in positive direction</p> <p>Bit 8: Motor movement in negative direction</p> <p>Bit 9: Assignment can be set via parameter <code>DPL_intLim</code></p> <p>Bit 10: Assignment can be set via parameter <code>DS402intLim</code></p> <p>Bit 11: Profile generator idle (reference velocity is 0)</p> <p>Bit 12: Profile generator decelerates</p> <p>Bit 13: Profile generator accelerates</p> <p>Bit 14: Profile generator moves at constant speed</p> <p>Bit 15: Reserved</p>	- - - -	UINT16 R/- - -	Modbus 7176 PROFINET 7176
<code>_DCOMstatus</code>	<p>DriveCom status word</p> <p>Bit assignments:</p> <p>Bit 0: Operating state Ready To Switch On</p> <p>Bit 1: Operating state Switched On</p> <p>Bit 2: Operating state Operation Enabled</p> <p>Bit 3: Operating state Fault</p> <p>Bit 4: Voltage Enabled</p> <p>Bit 5: Operating state Quick Stop</p> <p>Bit 6: Operating state Switch On Disabled</p> <p>Bit 7: Error of error class 0</p> <p>Bit 8: HALT request active</p> <p>Bit 9: Remote</p> <p>Bit 10: Target Reached</p> <p>Bit 11: Internal Limit Active</p> <p>Bit 12: Operating mode-specific</p> <p>Bit 13: <code>x_err</code></p> <p>Bit 14: <code>x_end</code></p> <p>Bit 15: <code>ref_ok</code></p>	- - - -	UINT16 R/- - -	Modbus 6916 PROFINET 6916

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DPL_motionStat	Drive Profile Lexium motionStat	- - - -	UINT16 R/- - -	Modbus 6990 PROFINET 6990

Parameter for Setting the Status Bits

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DPL_intLim	Setting for bit 9 of _DPL_motionStat and _actionStatus 0 / None: None 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 Changed settings become active immediately.	- 0 11 11	UINT16 R/W per. -	Modbus 7018 PROFINET 7018

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DS402intLim	<p>DS402 status word: Setting for bit 11 (internal limit)</p> <p>0 / None: None</p> <p>1 / Current Below Threshold: Current threshold value</p> <p>2 / Velocity Below Threshold: Velocity threshold value</p> <p>3 / In Position Deviation Window: Position deviation window</p> <p>4 / In Velocity Deviation Window: Velocity deviation window</p> <p>5 / Position Register Channel 1: Position register channel 1</p> <p>6 / Position Register Channel 2: Position register channel 2</p> <p>7 / Position Register Channel 3: Position register channel 3</p> <p>8 / Position Register Channel 4: Position register channel 4</p> <p>9 / Hardware Limit Switch: Hardware limit switch</p> <p>10 / RMAC active or finished: Relative movement after capture is active or finished</p> <p>11 / Position Window: Position window</p> <p>Setting for: Bit 11 of the parameter _DCOMstatus Bit 10 of the parameter _actionStatus Bit 10 of the parameter _DPL_motionStat Changed settings become active immediately.</p>	- 0 0 11	UINT16 R/W per. -	Modbus 6972 PROFINET 6972

Section 8.3

Functions for Monitoring Internal Device Signals

What Is in This Section?

This section contains the following topics:

Topic	Page
Temperature Monitoring	337
Monitoring Load and Overload (I^2T Monitoring)	338
Commutation Monitoring	340
Monitoring of Mains Phases	341
Ground Fault Monitoring	342

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
<code>_PS_T_current</code>	Temperature of power stage	°C - - -	INT16 R/- - -	Modbus 7200 PROFINET 7200
<code>_PS_T_warn</code>	Maximum temperature of power stage (error class 0)	°C - - -	INT16 R/- per. -	Modbus 4108 PROFINET 4108
<code>_PS_T_max</code>	Maximum temperature of power stage	°C - - -	INT16 R/- per. -	Modbus 4110 PROFINET 4110

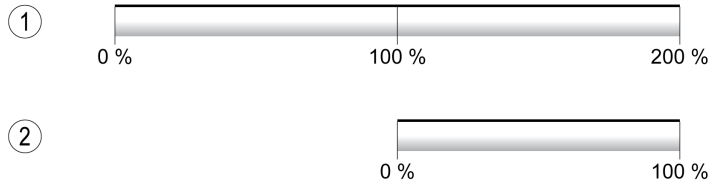
Monitoring Load and Overload (I²T Monitoring)

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/- -	Modbus 7214 PROFINET 7214
_M_load	Load of motor	% - -	INT16 R/- -	Modbus 7220 PROFINET 7220
_RES_load	Load of braking resistor The braking resistor set via parameter RESint_ext is monitored.	% - -	INT16 R/- -	Modbus 7208 PROFINET 7208

Overload Monitoring

In the case of 100 % overload of the power stage or the motor), the current is limited internally. In the case of 100 % overload of the braking resistor, the braking resistor is deactivated.

The overload and the peak value can be read using the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_PS_overload	Overload of power stage	% - -	INT16 R/- -	Modbus 7240 PROFINET 7240
_PS_maxoverload	Maximum value of overload of power stage Maximum overload of power stage during the last 10 seconds.	% - -	INT16 R/- -	Modbus 7216 PROFINET 7216
_M_overload	Overload of motor (I ² t)	% - -	INT16 R/- -	Modbus 7218 PROFINET 7218

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_M_maxoverload	Maximum value of overload of motor Maximum overload of motor during the last 10 seconds.	% - - -	INT16 R/- - -	Modbus 7222 PROFINET 7222
_RES_overload	Overload of braking resistor (I2t) The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	Modbus 7206 PROFINET 7206
_RES_maxoverload	Maximum value of overload of braking resistor Maximum overload of braking resistor during the last 10 seconds. The braking resistor set via parameter RESint_ext is monitored.	% - - -	INT16 R/- - -	Modbus 7210 PROFINET 7210

Commutation Monitoring

Commutation monitoring verifies the plausibility of acceleration and effective motor torque.

If the motor accelerates though the drive control decelerates the motor with the maximum current, an error is detected.

Deactivating commutation monitoring can cause unintended movements.

WARNING

UNINTENDED MOVEMENT

- Only deactivate commutation monitoring during commissioning and only for test purposes.
- Verify that the commutation monitoring is active prior to putting the equipment into service.

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

The parameter `MON_commutat` lets you deactivate commutation monitoring.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_commutat</code>	Commutation monitoring 0 / Off: Commutation monitoring off 1 / On (OpState6): Commutation monitoring on in operating state 6 2 / On (OpState6+7): Commutation monitoring on in operating states 6 and 7 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1290 PROFINET 1290

Monitoring of Mains Phases

If a three-phase drive is missing a mains phase and mains phase monitoring is not correctly set, this can cause overload of the product.

NOTICE

INOPERABLE EQUIPMENT DUE TO MISSING MAINS PHASE

- Verify that mains phase monitoring is set to "Automatic Mains Detection" or to "Mains ..." with the correct voltage value if the drive is supplied via the mains phases.
- Verify that mains phase monitoring is set to "DC bus only ..." with the correct voltage value if the drive is supplied via the DC bus.

Failure to follow these instructions can result in equipment damage.

The parameter `ErrorResp_Flt_AC` lets you set the error response to a missing mains phase for three-phase devices.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>ErrorResp_Flt_AC</code>	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 2 3	UINT16 R/W per. -	Modbus 1300 PROFINET 1300

Mains phase monitoring is set by means of the parameter `MON_MainsVolt`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_MainsVolt</code>	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 4	UINT16 R/W per. expert	Modbus 1310 PROFINET 1310

Ground Fault Monitoring

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

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

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

NOTICE

INOPERABLE EQUIPMENT DUE TO GROUND FAULTS

- Only deactivate ground fault monitoring during commissioning and only for test purposes.
- Verify that the ground fault monitoring is active prior to putting the equipment into service.

Failure to follow these instructions can result in equipment damage.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_GroundFault	Ground fault monitoring 0 / Off: Ground fault monitoring off 1 / On: Ground fault monitoring on Changed settings become active the next time the product is powered on.	- 0 1 1	UINT16 R/W per. expert	Modbus 1312 PROFINET 1312

Chapter 9

Diagnostics and Troubleshooting

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
9.1	Diagnostics via LEDs	344
9.2	Diagnostics via Signal Outputs	351
9.3	Diagnostics via the Fieldbus	354
9.4	Error Messages	363

Section 9.1

Diagnostics via LEDs

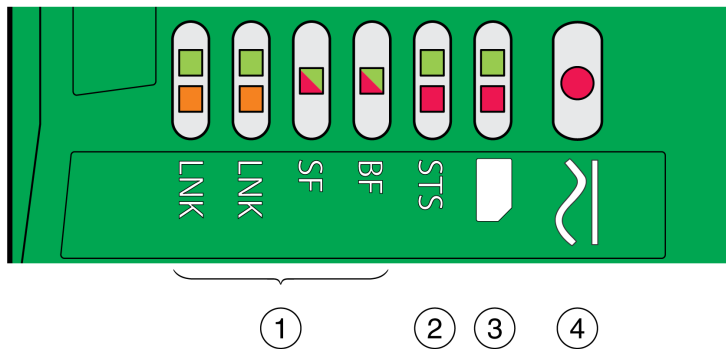
What Is in This Section?

This section contains the following topics:

Topic	Page
Overview Diagnostics LEDs	345
Fieldbus Status LEDs	346
Operating State LEDs	348
Memory Card LEDs	349
DC Bus LED	350

Overview Diagnostics LEDs

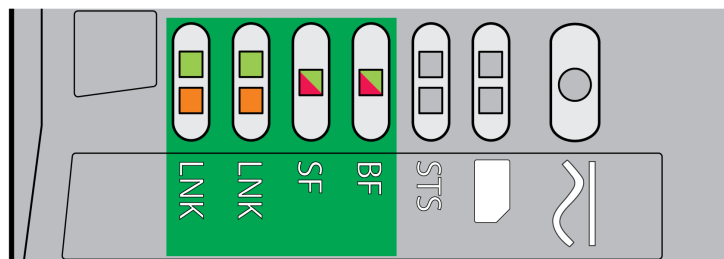
The following illustration provides an overview of the diagnostics LEDs.









- 1 Fieldbus status LEDs
- 2 Operating state LEDs
- 3 Memory card LEDs
- 4 DC bus LED

Fieldbus Status LEDs

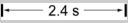







The fieldbus status LEDs visualize the status of the fieldbus.



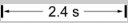

LED LNK

	Meaning
	No link
	Link, 100 MBit, no activity
	Link, 100 MBit, activity
	Link, 10 MBit, no activity
	Link, 10 MBit, activity

LED SF

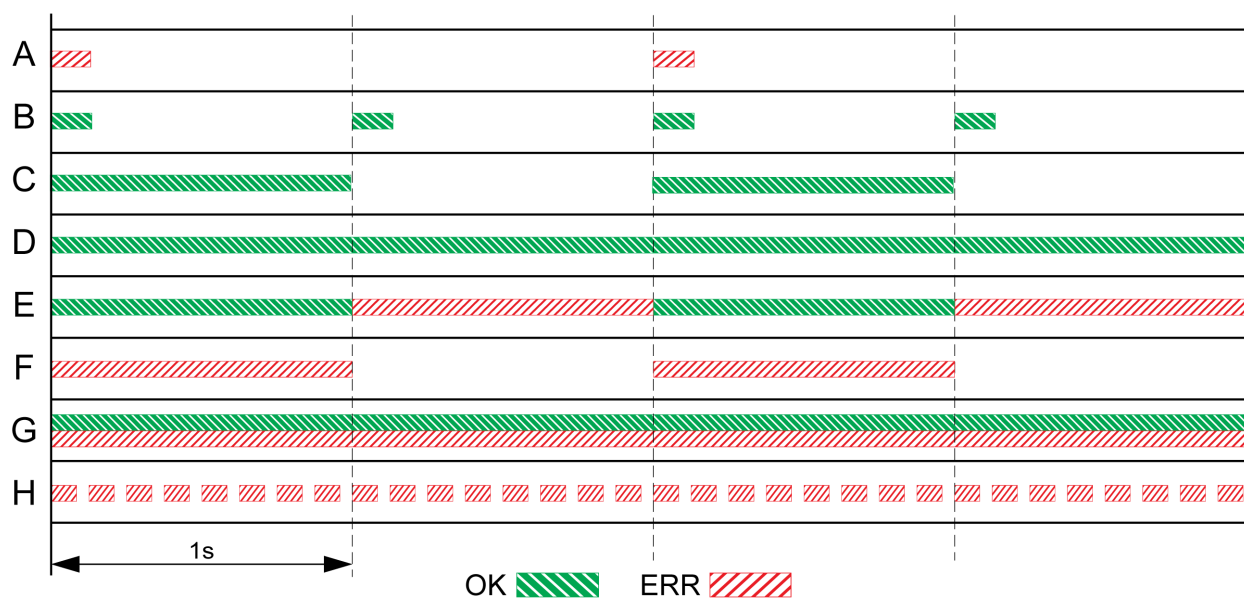
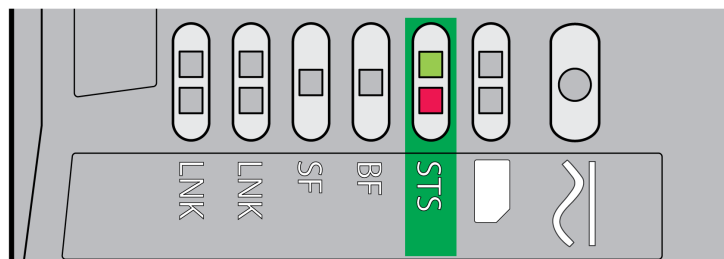
	Meaning
	Device is powered off
	Internal error detected
	Ready for operation
	IO controller in state "Stop", communication interrupted or invalid configuration
	Startup test (after successful initialization)
	No communication with IO controller (waiting for IO controller)
	Device detection (DCP), synchron blinking with LED BF

LED BF

	Meaning
	No IP address or the device is powered off

Operating State LEDs

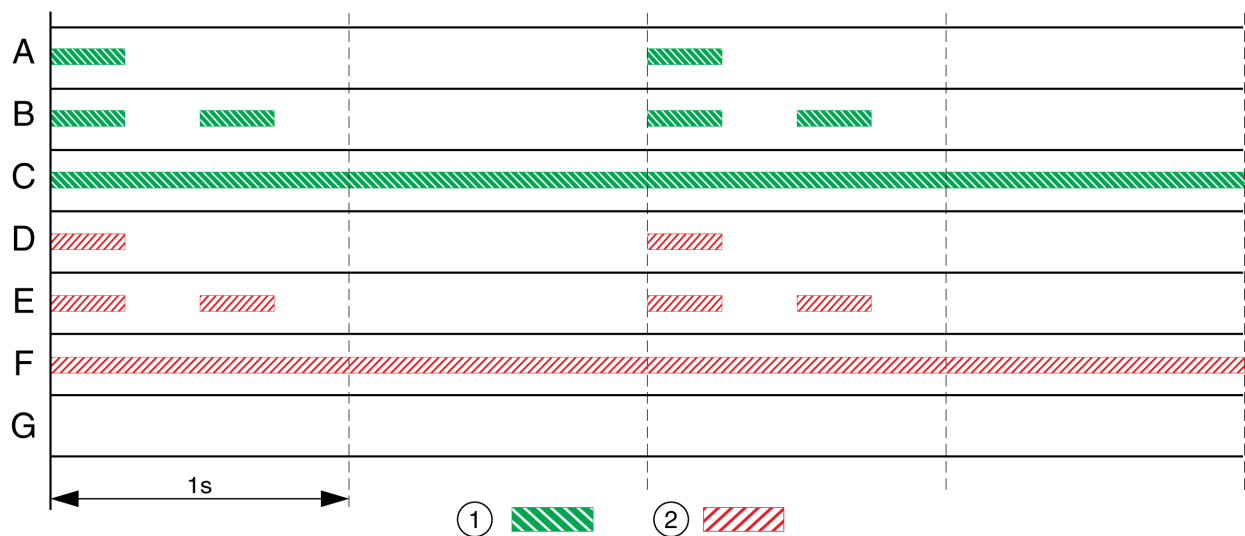
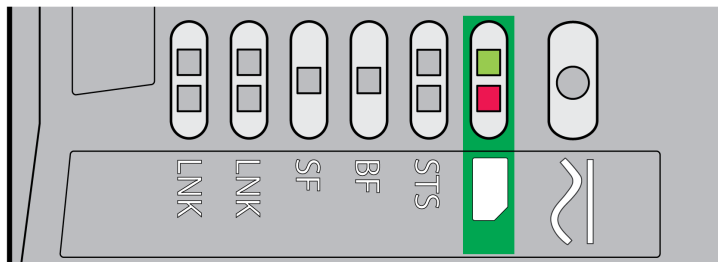
The operating state LEDs show the current operating state.



- A Operating state 1 **Start** and 2 **Not Ready To Switch On**
- B Operating state 3 **Switch On Disabled**
- C Operating state 4 **Ready To Switch On** and 5 **Switched On**
- D Operating state 6 **Operation Enabled**
- E Operating state 7 **Quick Stop Active** and 8 **Fault Reaction Active**
- F Operating state 9 **Fault**
- G Firmware not available
- H Internal error

Memory Card LEDs

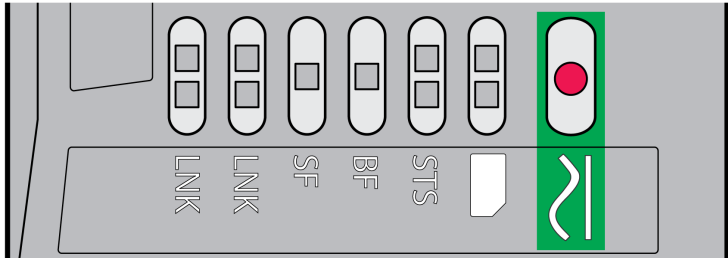
The memory card LEDs show the status of the memory card.



- 1 LED green
- 2 LED red
- A** The parameter values stored in the device and the contents of the memory card are different. The contents of the memory card is transferred to the device.
- B** The memory card is empty. The configuration of the device is transferred to the memory card.
- C** The parameter values stored in the device and the contents of the memory card are identical.
- D** The memory card is write-protected.
- E** An error was detected during data transfer. Check the error memory of the device.
- F** Data on the memory card does not match the device or is damaged.
- G** No memory card detected. Power off the supply. Verify that the memory card has been properly inserted (contacts, slanted corner).

DC Bus LED

The DC bus LED shows the status of the DC bus.



Status	Meaning
On	Voltage at DC bus.
Off	Undervoltage. The DC bus LED is not an indicator of the absence of DC bus voltage.

Observe the information provided in chapter Product Related Information ([see page 13](#)).

Section 9.2

Diagnostics via Signal Outputs

What Is in This Section?

This section contains the following topics:

Topic	Page
Indicating the Operating State	352
Indicating Error Messages	353

Indicating the Operating State

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⁾	"Active" ⁽²⁾
1 Start	0	0
2 Not Ready To Switch On	0	0
3 Switch On Disabled	0	0
4 Ready To Switch On	1	0
5 Switched On	1	0
6 Operation Enabled	1	1
7 Quick Stop Active	0	0
8 Fault Reaction Active	0	0
9 Fault	0	0
(1) The signal output function is factory setting for signal output DQ0		
(2) The signal output function is the factory setting for signal output DQ1		

Indicating Error Messages

Selected error messages can be output via the signal outputs.

In order to output an error message via a signal output, you must first parameterizes the signal output functions "Selected Warning" or "Selected Error", see chapter Digital Inputs and Outputs ([see page 207](#)).

The parameters `MON_IO_SelWar1` and `MON_IO_SelWar2` are used to specify error codes with the error class 0.

The parameters `MON_IO_SelErr1` and `MON_IO_SelErr2` are used to specify error codes with the error classes 1 ... 4.

If an error specified in one of these parameters is detected, the corresponding signal output is to be set.

The list of the error messages sorted by error code can be found in the chapter Error Messages ([see page 363](#)).

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>MON_IO_SelWar1</code>	First error code for the signal output function Selected Warning This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15120 PROFINET 15120
<code>MON_IO_SelWar2</code>	Second error code for the signal output function Selected Warning This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15122 PROFINET 15122
<code>MON_IO_SelErr1</code>	First error code for the signal output function Selected Error This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15116 PROFINET 15116
<code>MON_IO_SelErr2</code>	Second error code for the signal output function Selected Error This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15118 PROFINET 15118

Section 9.3

Diagnostics via the Fieldbus

What Is in This Section?

This section contains the following topics:

Topic	Page
Fieldbus Communication Error Diagnostics	355
Most Recent Detected Error - Status Bits	356
Error Messages	358
Most Recent Detected Error - Error Code	360
Error Memory	361

Fieldbus Communication Error Diagnostics

Checking Connections

A properly operating fieldbus is essential for evaluating status and error messages.

If the product cannot be addressed via the fieldbus, first verify the connections.

Verify the following connections:

- System power supply
- Supply connections
- Fieldbus cables and wiring
- Fieldbus connection

Fieldbus Function Test

If the connections are correct, verify that you can address the product on the fieldbus.

This can be done, for example, with the software "Primary Setup Tool (PST)".

If you can address the product, verify the settings for the IP address and the device name.

Most Recent Detected Error - Status Bits

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
<code>_WarnLatched</code>	<p>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.</p> <p>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 Bit 24 ... 28: Reserved Bit 29: Braking resistor overload (I^2t) Bit 30: Power stage overload (I^2t) Bit 31: Motor overload (I^2t)</p> <p>Monitoring functions are product-dependent.</p>	- - - -	UINT32 R/- - -	Modbus 7192 PROFINET 7192

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_SigLatched	<p>Saved status of monitoring signals</p> <p>Bit assignments:</p> <p>Bit 0: General error</p> <p>Bit 1: Hardware limit switches (LIMP/LIMN/REF)</p> <p>Bit 2: Out of range (software limit switches, tuning)</p> <p>Bit 3: Quick Stop via fieldbus</p> <p>Bit 4: Error in active operating mode</p> <p>Bit 5: Commissioning interface (RS485)</p> <p>Bit 6: Integrated fieldbus</p> <p>Bit 7: Reserved</p> <p>Bit 8: Following error</p> <p>Bit 9: Reserved</p> <p>Bit 10: Inputs STO are 0</p> <p>Bit 11: Inputs STO different</p> <p>Bit 12: Reserved</p> <p>Bit 13: DC bus voltage low</p> <p>Bit 14: DC bus voltage high</p> <p>Bit 15: Mains phase missing</p> <p>Bit 16: Integrated encoder interface</p> <p>Bit 17: Overtemperature motor</p> <p>Bit 18: Overtemperature power stage</p> <p>Bit 19: Reserved</p> <p>Bit 20: Memory card</p> <p>Bit 21: Fieldbus module</p> <p>Bit 22: Encoder module</p> <p>Bit 23: Safety module eSM or module IOM1</p> <p>Bit 24: Reserved</p> <p>Bit 25: Reserved</p> <p>Bit 26: Motor connection</p> <p>Bit 27: Motor overcurrent/short circuit</p> <p>Bit 28: Frequency of reference signal too high</p> <p>Bit 29: EEPROM error detected</p> <p>Bit 30: System start-up (hardware or parameter)</p> <p>Bit 31: System error detected (for example, watchdog, internal hardware interface)</p> <p>Monitoring functions are product-dependent.</p>	- - - -	<p>UINT32</p> <p>R/-</p> <p>-</p> <p>-</p>	<p>Modbus 7184</p> <p>PROFINET 7184</p>

Error Messages

Overview

Error messages generated during operation on network are received by the IO controller via the fieldbus.

The following error messages are possible:

- Synchronous errors
- Asynchronous errors

Error Message in Parameter Channel

If a command cannot be processed in the parameter channel, the IO controller receives a synchronous error message from the IO device.

In the case of a synchronous error message, the input data contains the following information:

Ctrl	Subindex	Index	PV
70 _h	00 _h	Contains the address of the parameter	Contains the error number

Error Message in Process Data Channel

If a command cannot be processed in the process data channel, bit 6 (ModeError, ME) in the word "mfStat" is set in the input data.

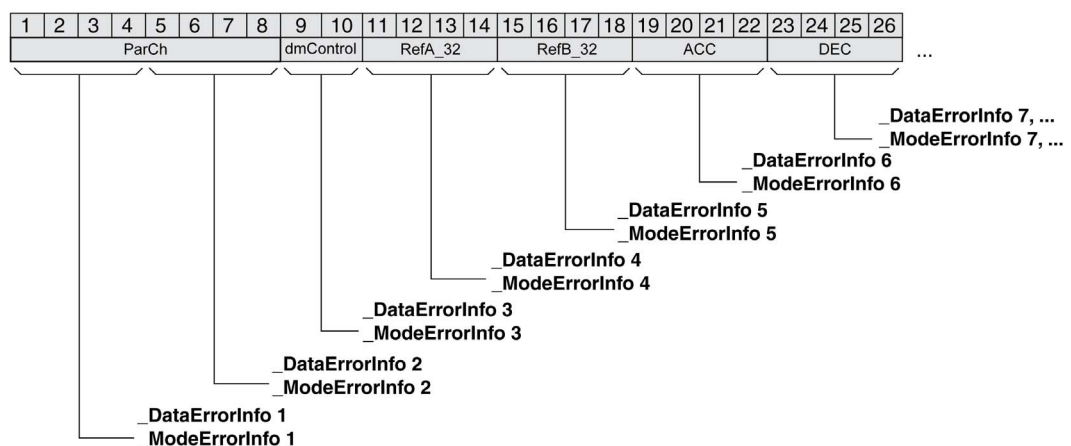
Data such as position and velocity is transmitted via the process data channel. If the data is not accepted (for example, if the value is outside of the permissible range), bit 5 (DataError, DE) is set in the input data in the word "mfStat".

Bit	Name	Description
5	DE	The DataError bit relates to parameters that are independent of "Mode Toggle" (MT). It is set if a data value in the process data channel is invalid.
6	ME	The ModeError bit relates to parameters that are dependent on "Mode Toggle" (MT). Is set if a request from a IO controller (starting an operating mode) was rejected

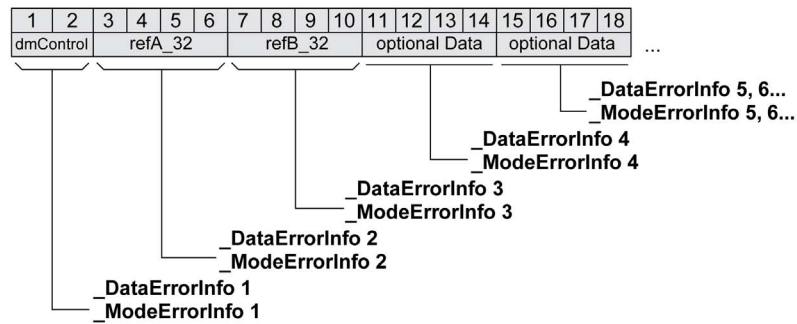
If DE or ME are set, this does not interrupt the ongoing movement. To determine the cause of the error, the IO controller can read the error number from the parameters `_DataError`, 6966:00 and `_ModeError`, 6962:00.

In order to identify the parameter that has caused the DE bit or the ME bit to be set, the position of the parameter can be read from the parameters `_DataErrorInfo`, 6970:00 and `_ModeErrorInfo`, 6968:00.

Overview for "Drive Profile Lexium 1"



Overview for "Drive Profile Lexium 2"



The error message is reset when the next valid data frame is transmitted.

Asynchronous Errors

Asynchronous errors are triggered by internal monitoring functions (for example, temperature) or by external monitoring functions (for example, limit switch).

Asynchronous errors are indicated in the following way:

- Transition to operating state **7** Quick Stop Active or to operating state **9** Fault (see "driveStat", bits 0 ... 3)
- Setting of:
 - "driveStat" bit 6 (error of error classes 1 ... 4)
 - "driveStat" bit 7 (error of error class 0)
 - "driveStat", bit 15 (operating mode terminated with detected error).

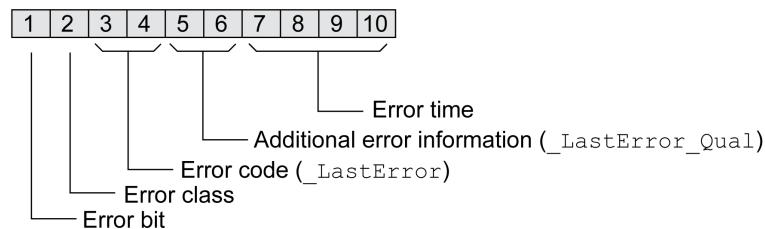
The error bits have the following meaning:

- Bit 6
 - Error of error classes 1 ... 4
 - The cause is contained in parameter `_LastError` in a bit-coded way.
- Bit 7
 - Error of error class 0
 - The error information is contained in parameter `_LastWarning` in a bit-coded way.
- Bit 15
 - Indicates whether the operating mode was terminated by an error.

Error Message via "Diagnostics Alarm"

If an error of error classes 1 ... 4 is detected, the IO device sends a "Diagnostics Alarm" to the IO controller.

Error message via "Diagnostics Alarm"



Most Recent Detected Error - Error Code

If the master controller receives information concerning a detected error via the process data communication, the following parameters can be used to read the error code.

The list of the error messages sorted by error code can be found in the chapter Error Messages (*see page 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
<code>_LastWarning</code>	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/- - -	Modbus 7186 PROFINET 7186

Most Recent Detected Error with Error Class 1 ... 4

The parameter `_LastError` allows you to read the error number of the last detected error with error class 1 ... 4.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
<code>_LastError</code>	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/- - -	Modbus 7178 PROFINET 7178

Error Memory

General

The error memory is an error history of the last 10 error messages. It is not cleared even if the product is powered off. The error memory allows you to read and evaluate past events.

The following information on the events is stored:

- Error class
- Error code
- Motor current
- Number of power on cycles
- Additional error information (for example, parameter numbers)
- Product temperature
- Power stage temperature
- Time the error was detected (with reference to operating hours counter)
- DC Bus Voltage
- Velocity
- Number of Enable cycles after powering on
- Time from Enable until detection of the error

The stored information relates to the situation at the point in time the error was detected.

The list of the error messages sorted by error code can be found in the chapter Error Messages (*see page 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).
...	...
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
<code>_ERR_class</code>	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/- - -	Modbus 15364 PROFINET 15364
<code>_ERR_number</code>	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/- - -	Modbus 15362 PROFINET 15362

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ERR_motor_I	Motor current at the time the error was detected In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 15378 PROFINET 15378
_ERR_powerOn	Number of power on cycles	- 0 4294967295	UINT32 R/- - -	Modbus 15108 PROFINET 15108
_ERR_qual	Additional information on detected error This entry contains additional information on the detected error, depending on the error number. Example: a parameter address	- 0 - 65535	UINT16 R/- - -	Modbus 15368 PROFINET 15368
_ERR_temp_dev	Temperature of device at the time the error was detected	°C - - -	INT16 R/- - -	Modbus 15382 PROFINET 15382
_ERR_temp_ps	Temperature of power stage at the time the error was detected	°C - - -	INT16 R/- - -	Modbus 15380 PROFINET 15380
_ERR_time	Time of detection of error With reference to operating hours counter	s 0 536870911	UINT32 R/- - -	Modbus 15366 PROFINET 15366
_ERR_DCbus	DC bus voltage at the time the error was detected In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 15374 PROFINET 15374
_ERR_motor_v	Motor velocity at the time the error was detected	usr_v - - -	INT32 R/- - -	Modbus 15376 PROFINET 15376
_ERR_enable_cycles	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/- - -	Modbus 15370 PROFINET 15370
_ERR_enable_time	Time between enabling of power stage and detection of the error	s - - -	UINT16 R/- - -	Modbus 15372 PROFINET 15372
ERR_reset	Reset error memory read pointer Value 1: Set error memory read pointer to oldest error entry. Changed settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15114 PROFINET 15114
ERR_clear	Clear error memory Value 1: Delete entries in the error memory The clearing process is completed if a 0 is returned after a read access. Changed settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15112 PROFINET 15112

Section 9.4

Error Messages

What Is in This Section?

This section contains the following topics:

Topic	Page
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Description of Error Messages

Description

If monitoring functions of the drive detect an error, the drive generates an error message. Each error message is identified by an error code.

The following information is available for each error message:

- Error code
- Error class
- Description of error
- Possible causes
- Possible remedies

Range of Error Messages

The table below summarizes the error codes classified by range.

Error code	Range
E 1xxx	General
E 2xxx	Overcurrent
E 3xxx	Voltage
E 4xxx	Temperature
E 5xxx	Hardware
E 6xxx	Software
E 7xxx	Interface, wiring
E 8xxx	Fieldbus
E Axxx	Motor movement
E Bxxx	Communication

Error Class of Error Messages

The error messages are classified according to the following error classes:

Error class	State transition ¹⁾	Error response	Resetting the error message
0	-	No interruption of the movement	Function "Fault Reset"
1	T11	Stop movement with "Quick Stop"	Function "Fault Reset"
2	T13, T14	Stop movement with "Quick Stop" and disable the power stage when the motor has come to a standstill	Function "Fault Reset"
3	T13, T14	Disable the power stage immediately without stopping the movement first	Function "Fault Reset"
4	T13, T14	Disable the power stage immediately without stopping the movement first	Power cycle
(1) See chapter Operating State (see page 236)			

Table of Error Messages

List of the Error Messages Sorted by Error Code

Error code	Error class	Description	Cause	Correctives
E 1100	0	Parameter out of permissible value range	The value entered was outside of the permissible value range for this parameter.	The entered value must be within the permissible value range.
E 1101	0	Parameter does not exist	Error detected by parameter management: Parameter (index) does not exist.	Select a different parameter (index).
E 1102	0	Parameter does not exist	Error detected by parameter management: Parameter (subindex) does not exist.	Select a different parameter (subindex).
E 1103	0	Parameter write not permissible (READ only)	Write access to read only parameter.	Write only to parameters that are not read-only.
E 1104	0	Write access denied (no access authorization)	Parameter only accessible at expert level.	The write access level expert is required.
E 1105	0	Block Upload/Download not initialized		
E 1106	0	Command not permissible while power stage is active	Command not permissible while the power stage is enabled (operating state Operation Enabled or Quick Stop Active).	Disable the power stage and repeat the command.
E 1107	0	Access via other interface blocked	Access occupied by another channel (for example: Commissioning software is active and fieldbus access was tried at the same time).	Verify the channel that blocks access.
E 1108	0	File cannot be uploaded: Incorrect file ID		
E 1109	1	Data stored after a power outage is invalid		
E 110A	0	System error detected: No bootloader available		
E 110B	3	Configuration error detected (additional info=Modbus register address) Parameter_SigLatched Bit 30	Error detected during parameter check (for example, reference velocity value for operating mode Profile Position is greater than maximum permissible velocity of drive).	Value in additional error information shows the Modbus register address of the parameter where the initialization error was detected.
E 110D	1	Basic configuration of drive required after factory setting	The "First Setup" (FSU) was not run at all or not completed.	Perform a First Setup.
E 110E	0	Parameter changed that requires a restart of the drive	Only displayed by the commissioning software. A parameter modification requires the drive to be powered off and on.	Restart the drive to activate the parameter functionality. See the chapter Parameters for the parameter that requires a restart of the drive.
E 110F	0	Function not available in this type of device	The specific type of device does not support this function or this parameter value.	Verify that you have the correct device type, in particular type of motor, type of encoder, holding brake.
E 1110	0	Incorrect file ID for upload or download	The specific type of device does not support this kind of file.	Verify that you have the correct device type or the correct configuration file.
E 1111	0	File transfer not correctly initialized	A previous file transfer has been aborted.	

Error code	Error class	Description	Cause	Correctives
E 1112	0	Locking of configuration denied	An external tool has tried to lock the configuration of the drive for upload or download. This may not work because another tool had already locked the configuration of the drive or the drive is in an operating state that does not allow locking.	
E 1113	0	System not locked for configuration transfer	An external tool has tried to transfer the configuration without locking the drive.	
E 1114	4	Configuration download aborted Parameter _SigLatched Bit 5	During a configuration download, a communication error or an error in the external tool was detected. The configuration was only partially transferred to the drive and might be inconsistent now.	Power the drive off/on and retry to download the configuration or restore the factory settings.
E 1115	0	Incorrect configuration file format Parameter _WarnLatched Bit 5	An external tool has downloaded a configuration which has an incorrect format.	
E 1116	0	Request is processed asynchronously		
E 1117	0	Asynchronous request blocked	Request to a module is blocked because the module is currently processing another request.	
E 1118	0	Configuration data incompatible with device	The configuration data contains data from a different device.	Verify device type including type of power stage.
E 1119	0	Incorrect data length, too many bytes		
E 111A	0	Incorrect data length, insufficient number of bytes		
E 111B	4	Configuration download error detected (additional info=Modbus register address)	During a configuration download, one or more configuration values were not accepted by the drive.	Verify that the configuration file is valid and matches the type and version of the drive. The value in the additional error info shows the Modbus register address of the parameter where the initialization error was detected.
E 111C	1	Not possible to initialize recalculation for scaling	A parameter could not be initialized.	The address of the parameter that caused the detected error can be read via the parameter _PAR_ScalingError.
E 111D	3	Original state of a parameter cannot be restored after an error was detected during recalculation of parameters with user-defined units.	The drive contained an invalid configuration before the recalculation was started. An error was detected during the recalculation.	Power the drive off and on again. This may help you to identify the affected parameter(s). Change the parameters as required. Verify that the parameter configuration is valid before starting the recalculation procedure.

Error code	Error class	Description	Cause	Correctives
E 111F	1	Recalculation not possible.	Invalid scaling factor.	Verify that you really want the selected scaling factor. Try a different scaling factor. Before triggering scaling, reset the parameters with user-defined units.
E 1120	1	Recalculation for scaling not possible	A parameter could not be recalculated.	The address of the parameter that caused this condition can be read via the parameter <code>_PAR_ScalingError</code> .
E 1121	0	Incorrect sequence of steps for scaling (fieldbus)	The recalculation has been started prior to the initialization.	The recalculation must be started after the initialization.
E 1122	0	Recalculation for scaling not possible	Recalculation for scaling is already running.	Wait for the running recalculation for scaling to finish.
E 1123	0	Parameter cannot be changed	Recalculation for scaling is running.	Wait for the running recalculation for scaling to finish.
E 1124	1	Timeout during recalculation for scaling	The time between the initialization of the recalculation and the start of the recalculation has been exceeded (30 seconds).	Recalculation must be started within 30 seconds after initialization.
E 1125	1	Scaling not possible	The scaling factors for position, velocity or acceleration/deceleration are beyond internal calculation limits.	Retry with different scaling factors.
E 1126	0	Configuration is blocked by another access channel		Close other access channel (for example, other instance of commissioning software).
E 1127	0	Invalid key received		
E 1128	0	Special login is required for Manufacturing Test Firmware		
E 1129	0	Test step not yet started		
E 112D	0	Configuration of edges is not supported	The selected capture input does not support rising and falling edge at the same time.	Set the edge to either "rising" or "falling".
E 112F	0	Time filter settings cannot be changed	Position capture is already active with a time filter. The filter settings cannot be changed.	Deactivate position capture.
E 1300	3	Safety function STO activated (STO_A, STO_B) Parameter <code>_SigLatched</code> Bit 10	The safety function STO was activated in the operating state Operation Enabled.	Verify correct wiring of the inputs of the safety function STO and perform a Fault Reset.
E 1301	4	STO_A and STO_B different level Parameter <code>_SigLatched</code> Bit 11	The levels of the inputs STO_A and STO_B were different for more than 1 second.	Verify correct wiring of the inputs of the safety function STO.
E 1302	0	Safety function STO activated (STO_A, STO_B) Parameter <code>_WarnLatched</code> Bit 10	Safety function STO was activated while the power stage was disabled.	Verify correct wiring of the inputs of the safety function STO.
E 1311	0	The selected signal input function or signal output function cannot be configured	The selected signal input function or signal output function cannot be used in the selected operating mode.	Select another function or change the operating mode.

Error code	Error class	Description	Cause	Correctives
E 1312	0	Limit switch or reference switch signal not defined for signal input function	Reference movements require limit switches. These limit switches are not assigned to inputs.	Assign the signal input functions Positive Limit Switch, Negative Limit Switch and Reference Switch.
E 1313	0	Configured debounce time not possible for this signal input function	The signal input function does not support the selected debounce time.	Set the debounce time to a valid value.
E 1314	4	At least two inputs have the same signal input function.	The same signal input function has been assigned to at least two inputs.	Reconfigure the inputs.
E 1316	1	Position capture via signal input currently not possible Parameter <code>_SigLatched</code> Bit 28	Position capture is already being used.	
E 1501	4	System error detected: DriveCom state machine indeterminable state		
E 1502	4	System error detected: HWL low-level state machine indeterminable state		
E 1503	1	Quick Stop triggered via fieldbus	A Quick Stop has been triggered via the fieldbus. The Quick Stop option code has been set to -1 or -2 which causes the drive to transition to the operating state 9 Fault instead of the operating state 7 Quick Stop Active.	
E 1600	0	Oscilloscope: No additional data available		
E 1601	0	Oscilloscope: Parameterization incomplete		
E 1602	0	Oscilloscope: Trigger variable not defined		
E 1606	0	Logging still active		
E 1607	0	Logging: No trigger defined		
E 1608	0	Logging: Invalid trigger option		
E 1609	0	Logging: No channel selected		
E 160A	0	Logging: No data available		
E 160B	0	Parameter cannot be logged		
E 160C	1	Autotuning: Moment of inertia outside permissible range	The load inertia is too high.	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
E 160E	1	Autotuning: Test movement could not be started		
E 160F	1	Autotuning: Power stage cannot be enabled	Autotuning was not started in the operating state Ready To Switch On.	Start Autotuning when the drive is in the operating state Ready To Switch On.
E 1610	1	Autotuning: Processing stopped	Autotuning stopped by user command or by detected error (see additional error message in error memory, for example, DC bus undervoltage, limit switches triggered)	Remove the cause of the stop and restart Autotuning.
E 1611	1	System error detected: Parameter could not be written during Autotuning (additional info=Modbus register address)		

Error code	Error class	Description	Cause	Correctives
E 1612	1	System error detected: Parameter could not be read during Autotuning		
E 1613	1	Autotuning: Maximum permissible movement range exceeded Parameter _SigLatched Bit 2	The movement exceeded the adjusted movement range during Autotuning.	Increase the movement range value or disable movement range monitoring by setting AT_DIS = 0.
E 1614	0	Autotuning: Already active	Autotuning has been started twice simultaneously or an Autotuning parameter is modified during Autotuning (parameter AT_dis and AT_dir).	Wait for Autotuning to finish before restarting Autotuning.
E 1615	0	Autotuning: This parameter cannot be changed while Autotuning is active	Parameter AT_gain or AT_J are written during Autotuning.	Wait for Autotuning to finish before changing the parameter.
E 1617	1	Autotuning: Friction torque or load torque too great	The current limit has been reached (parameter CTRL_I_max).	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
E 1618	1	Autotuning: Optimization aborted	The internal Autotuning sequence has not been finished, there may have been a following error.	See the additional information provided in the error memory.
E 1619	0	Autotuning: Velocity jump in parameter AT_n_ref is not sufficient	Parameter AT_n_ref < 2 * AT_n_tolerance. The drive only checks this for the first velocity jump.	Modify the parameter AT_n_ref or AT_n_tolerance to meet the required condition.
E 1620	1	Autotuning: Load torque too high	Product rating is not suitable for the machine load. Detected machine inertia is too high compared to the inertia of the motor.	Reduce load, verify rating.
E 1621	1	System error detected: Calculation error		
E 1622	0	Autotuning: Not possible to perform Autotuning	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
E 1623	1	Autotuning: HALT request has stopped the autotuning process	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
E 1A00	0	System error detected: FIFO memory overflow		
E 1A01	3	Motor has been changed (different type of motor) Parameter _SigLatched Bit 16	Detected motor type is different from previously detected motor.	Confirm the change.
E 1A03	4	System error detected: Hardware and firmware do not match		
E 1A04	4	Invalid dip switch settings (additional info: 1 = Fieldbus selection, 2 = IP address, 3 = Device name) Parameter _SigLatched Bit 30		
E 1B00	3	System error detected: Incorrect parameters for motor and power stage Parameter _SigLatched Bit 30	Incorrect manufacturer parameter value (data) non-volatile memory of device.	Replace device.
E 1B02	3	Target value too high. Parameter _SigLatched Bit 30		

Error code	Error class	Description	Cause	Correctives
E 1B05	2	Error detected during parameter switching Parameter _SigLatched Bit 30		
E 1B0B	1	The operating state at the beginning of the commutation offset identification must be Ready To Switch On.		Set the operating state to Ready To Switch On and restart commutation offset identification.
E 1B0C	3	Motor velocity too high.		
E 1B0D	3	Velocity value determined by velocity observer is incorrect	Incorrect system inertia for velocity observer calculations. Incorrect velocity observer dynamics. System inertia changes during operation. In this case, operation with velocity observer is not possible and the velocity observer must be deactivated.	Change the velocity observer dynamics via the parameter CTRL_SpdObsDyn. Change the system inertia used for velocity observer calculations via the parameter CTRL_SpdObsInert. If the detected error persists, deactivate the velocity observer.
E 1B0F	3	Velocity deviation too high		
E 2201	2	System error: DC bus relay error Parameter _SigLatched Bit 30	Inoperative DC bus relay.	Contact Technical Support.
E 2300	3	Power stage overcurrent Parameter _SigLatched Bit 27	Motor short circuit and disabling of the power stage. Motor phases are inverted.	Verify the motor power connection.
E 2301	3	Braking resistor overcurrent Parameter _SigLatched Bit 27	Braking resistor short circuit.	If you use the internal braking resistor, contact Technical Support. If you use an external braking resistor, verify correct wiring and rating of the braking resistor.
E 3100	par.	Missing mains supply, undervoltage mains supply or overvoltage mains supply Parameter _SigLatched Bit 15	Missing phase(s) for more than 50 ms. Mains voltage is out of range. Mains frequency is out of range.	Verify that the values of the mains power supply network comply with the technical data.
E 3200	3	DC bus overvoltage Parameter _SigLatched Bit 14	Excessive regeneration during deceleration.	Verify correct deceleration ramp, rating of drive and braking resistor.
E 3201	3	DC bus undervoltage (shutdown threshold) Parameter _SigLatched Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
E 3202	2	DC bus undervoltage (Quick Stop threshold) Parameter _SigLatched Bit 13	Power supply outage, insufficient power supply.	Verify mains supply.
E 3206	0	Undervoltage DC bus, missing mains supply, undervoltage mains supply or overvoltage mains supply Parameter _WarnLatched Bit 13	Missing phase(s) for more than 50 ms. Mains voltage is out of range. Mains frequency is out of range. Mains voltage and setting of parameter MON_MainsVolt do not match (for example, mains voltage is 230 V and MON_MainsVolt is set to 115 V).	Verify that the values of the mains power supply network comply with the technical data. Verify the settings of the parameter for reduced mains voltage.
E 3300	0	The winding voltage of the motor is lower than the nominal supply voltage of the drive	If the winding voltage of the motor is lower than the nominal supply voltage of the drive, this may result in motor overtemperature due to high current ripple.	Verify the motor temperature. In the case of overtemperature, use a motor with a higher winding voltage or use a drive with a lower nominal supply voltage.

Error code	Error class	Description	Cause	Correctives
E 4100	3	Power stage overtemperature Parameter _SigLatched Bit 18	Transistors overtemperature: Ambient temperature is too high, fan is inoperative, dust.	Verify the fan, improve the heat dissipation in the cabinet.
E 4101	0	Power stage overtemperature Parameter _WarnLatched Bit 18	Transistors overtemperature: Ambient temperature is too high, fan is inoperative, dust.	Verify the fan, improve the heat dissipation in the cabinet.
E 4102	0	Power stage overload (I2t) Parameter _WarnLatched Bit 30	The current has exceeded the nominal value for an extended period of time.	Verify rating, reduce cycle time.
E 4200	3	Device overtemperature Parameter _SigLatched Bit 18	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation in the control cabinet. If a fan is installed, verify correct operation of the fan. Install a fan in the control cabinet. Improve heat transfer from the rear wall of the device to the control cabinet.
E 4201	0	Device overtemperature	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation in the control cabinet. If a fan is installed, verify correct operation of the fan. Install a fan in the control cabinet. Improve heat transfer from the rear wall of the device to the control cabinet.
E 4300	2	Motor overtemperature Parameter _SigLatched Bit 17	Ambient temperature is too high. Duty cycle is too high. Motor not properly mounted (thermal isolation). Motor overload.	Verify motor installation: The heat must be dissipated via the mounting surface. Reduce ambient temperature. Provide ventilation.
E 4301	0	Motor overtemperature Parameter _WarnLatched Bit 17	Ambient temperature is too high. Duty cycle is too high. Motor not properly mounted (thermal isolation). Motor overload.	Verify motor installation: The heat must be dissipated via the mounting surface. Reduce ambient temperature. Provide ventilation.
E 4302	0	Motor overload (I2t) Parameter _WarnLatched Bit 31	The current has exceeded the nominal value for an extended period of time.	Verify that the system can easily be moved. Verify the load. Use a differently sized motor, if necessary.
E 4303	0	No motor temperature monitoring	The temperature parameters (in electronic nameplate of motor, non-volatile memory of encoder) are unavailable or invalid; parameter A12 is equal to 0.	Contact Technical Support. Replace motor.
E 4304	0	The encoder does not support motor temperature monitoring.		
E 4402	0	Braking resistor overload (I2t > 75%) Parameter _WarnLatched Bit 29	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating.
E 4403	par.	Braking resistor overload (I2t > 100%)	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating.

Error code	Error class	Description	Cause	Correctives
E 4404	0	Overload of transistor for braking resistor Parameter _WarnLatched Bit 28	Regeneration energy too high. External loads too high. Deceleration too fast.	Reduce load and/or deceleration.
E 5101	0	Modbus power supply missing		
E 5102	4	Motor encoder supply voltage Parameter _SigLatched Bit 16	Encoder power supply is not within permissible range of 8 V to 12 V.	Replace the device. Contact Technical Support.
E 5200	4	Error detected at connection to motor encoder Parameter _SigLatched Bit 16	Incorrect encoder cable or cable not connected, EMC.	Verify the cable connection and the cable shield.
E 5201	4	Error detected in motor encoder communication Parameter _SigLatched Bit 16		Verify the cable connection and the cable shield.
E 5202	4	Motor encoder is not supported Parameter _SigLatched Bit 16	Incompatible encoder connected.	Verify that a correct encoder is used.
E 5203	4	Error detected in connection motor encoder Parameter _SigLatched Bit 16		
E 5204	3	Connection to motor encoder lost Parameter _SigLatched Bit 16	Encoder cable (communication has been interrupted).	Verify the cable connection.
E 5206	0	Communication error detected in encoder Parameter _WarnLatched Bit 16	Communication disturbed, EMC.	Verify cable specifications, cable shield connection and EMC.
E 5207	1	Function is not supported	The hardware revision does not support the function.	
E 5302	4	The motor requires a PWM frequency (16kHz) which the power stage does not support.	The connected 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.
E 5430	4	System error detected: EEPROM read error Parameter _SigLatched Bit 29		
E 5431	3	System error: EEPROM write error Parameter _SigLatched Bit 29		
E 5432	3	System error: EEPROM state machine Parameter _SigLatched Bit 29		
E 5433	3	System error: EEPROM address error Parameter _SigLatched Bit 29		
E 5434	3	System error: EEPROM incorrect data length Parameter _SigLatched Bit 29		
E 5435	4	System error: EEPROM not formatted Parameter _SigLatched Bit 29		
E 5436	4	System error: EEPROM incompatible structure Parameter _SigLatched Bit 29		
E 5437	4	System error detected: EEPROM checksum error (manufacturer data) Parameter _SigLatched Bit 29		

Error code	Error class	Description	Cause	Correctives
E 5438	3	System error detected: EEPROM checksum error (user parameters) Parameter _SigLatched Bit 29		
E 5439	3	System error detected: EEPROM checksum error (fieldbus parameters) Parameter _SigLatched Bit 29		
E 543B	4	System error detected: No valid manufacturer data Parameter _SigLatched Bit 29		
E 543E	3	System error detected: EEPROM checksum error (Nolnit parameter) Parameter _SigLatched Bit 29		
E 543F	3	System error detected: EEPROM checksum error (motor parameters) Parameter _SigLatched Bit 29		
E 5441	4	System error detected: EEPROM checksum error (global control loop parameter set) Parameter _SigLatched Bit 29		
E 5442	4	System error detected: EEPROM checksum error (control loop parameter set 1) Parameter _SigLatched Bit 29		
E 5443	4	System error detected: EEPROM checksum error (control loop parameter set 2) Parameter _SigLatched Bit 29		
E 5444	4	System error detected: EEPROM checksum error (NoReset parameter) Parameter _SigLatched Bit 29		
E 5445	4	System error detected: EEPROM checksum error (hardware information) Parameter _SigLatched Bit 29		
E 5446	4	System error detected: EEPROM checksum error (for power outage data) Parameter _SigLatched Bit 29	Internal EEPROM not operative.	Restart the drive. If the detected error persists, contact Technical Support.
E 5448	2	System error detected: Communication with memory card Parameter _SigLatched Bit 20		
E 5449	2	System error detected: Memory card bus is busy Parameter _SigLatched Bit 20		
E 544A	4	System error detected: EEPROM checksum error (administration data) Parameter _SigLatched Bit 29		
E 544C	4	System error detected: EEPROM is write-protected Parameter _SigLatched Bit 29		
E 544D	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.

Error code	Error class	Description	Cause	Correctives
E 544E	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.
E 544F	2	System error detected: Memory card Parameter _SigLatched Bit 20	The last saving procedure may not have been successful; the memory card may be inoperative.	Retry saving the data. Replace the memory card.
E 5451	0	System error detected: No memory card available Parameter _WarnLatched Bit 20		
E 5452	2	System error detected: Data on memory card and device do not match Parameter _SigLatched Bit 20	Different type of device. Different type of power stage. Data on memory card does not match firmware version of device.	
E 5453	2	System error detected: Incompatible data on the memory card Parameter _SigLatched Bit 20		
E 5454	2	System error detected: Capacity of detected memory card insufficient Parameter _SigLatched Bit 20		
E 5455	2	System error detected: Memory card not formatted Parameter _SigLatched Bit 20		Update memory card via HMI command "dtoc" (drive-to-card).
E 5456	1	System error detected: Memory card is write-protected Parameter _SigLatched Bit 20	The memory card has been write-protected.	Remove memory card or disable write protection via HMI.
E 5457	2	System error detected: Incompatible memory card Parameter _SigLatched Bit 20	Memory card capacity is insufficient.	Replace memory card
E 5458	4	System error detected: Flash programming sequence		
E 5459	1	System error detected: Parameter only available during flashing (flash request)		
E 545A	4	System error detected: Firmware update FiFo overrun		
E 545B	4	System error detected: Incompatible firmware file header information		
E 545C	4	System error detected: Firmware file and device not compatible		
E 545D	4	System error detected: Firmware file checksum incorrect		
E 545E	4	System error detected: Firmware file header information has an odd number of bytes		
E 545F	4	System error detected: Size of firmware file exceeds memory capacity		
E 5460	4	System error detected: Loader for firmware file not available	Incorrect loader.	Contact Technical Support.
E 5461	4	System error detected: Firmware version in device and firmware version to be updated are identical		

Error code	Error class	Description	Cause	Correctives
E 5462	0	Memory card implicitly written by the device Parameter <code>_WarnLatched</code> Bit 20	The content of the memory card and the content of the EEPROM are not identical.	
E 5463	1	Error detected in firmware file	Transfer of firmware file incomplete.	
E 5464	1	Firmware update in progress	Update of firmware file is still running.	
E 5465	4	System error detected: File header too large		
E 5466	4	System error detected: Bootloader does not match the bootloader required for the firmware file		
E 5467	4	System error detected: Loader does not match the loader required for the firmware file		
E 5468	3	System error detected: EEPROM checksum error (device name) Parameter <code>_SigLatched</code> Bit 29		
E 5469	3	System error detected: EEPROM checksum error (SNMP information) Parameter <code>_SigLatched</code> Bit 29		
E 546A	3	System error detected: EEPROM checksum error Parameter <code>_SigLatched</code> Bit 29		
E 546B	3	System error detected: EEPROM checksum error (LLDP MIB data) Parameter <code>_SigLatched</code> Bit 29		
E 546C	0	EEPROM file not available		
E 5600	3	Motor connection phase error detected Parameter <code>_SigLatched</code> Bit 26	Missing motor phase.	Verify connection of motor phases.
E 5603	3	Commutation error detected Parameter <code>_SigLatched</code> Bit 26	Incorrect wiring of motor cable. Encoder signals are lost or subject to interference. The load torque is greater than the motor torque. The encoder EEPROM contains incorrect data (encoder phase offset is incorrect). Motor is not adjusted.	Verify motor phases, verify encoder wiring. Improve EMC, verify grounding and shield connection. Use a differently sized motor that can withstand the load torque. Verify the motor data. Contact Technical Support.
E 6102	4	System error detected: Internal software error Parameter <code>_SigLatched</code> Bit 30		
E 6103	4	System error detected: System stack overflow Parameter <code>_SigLatched</code> Bit 31		
E 6104	0	System error detected: Division by zero (internal)		
E 6105	0	System error detected: Overflow during 32 bit calculation (internal)		
E 6106	4	System error detected: Size of data interface does not match Parameter <code>_SigLatched</code> Bit 30		
E 6107	0	Parameter outside of value range (calculation error detected)		

Error code	Error class	Description	Cause	Correctives
E 6108	0	Function not available		
E 6109	0	System error detected: Internal range exceeded		
E 610A	2	System error detected: Calculated value cannot be represented as a 32 bit value		
E 610D	0	Error detected in selection parameter	Incorrect parameter value selected.	Verify the value to be written.
E 610E	4	System error detected: 24 VDC below undervoltage threshold for shutdown		
E 610F	4	System error detected: Internal timer basis missing (Timer0) Parameter _SigLatched Bit 30		
E 6111	2	System error detected: Memory area locked Parameter _SigLatched Bit 30		
E 6112	2	System error detected: Out of memory Parameter _SigLatched Bit 30		
E 6113	1	System error detected: Calculated value cannot be represented as a 16 bit value		
E 6114	4	System error detected: Impermissible function call from interrupt service routine	Incorrect programming	
E 6117	0	Holding brake cannot be released manually.	The holding brake cannot be 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.
E 7100	4	System error detected: Invalid power stage data Parameter _SigLatched Bit 30	Error detected in power stage data stored in device (incorrect CRC), error detected in internal memory data.	Contact Technical Support or replace the device.
E 7111	0	Parameter cannot be changed because the external braking resistor is active.	An attempt is made to change one of the parameters RESext_ton, RESext_P or RESext_R even though the external braking resistor is active.	Verify that the external braking resistor is not active if one of the parameters RESext_ton, RESext_P or RESext_R has to be changed.
E 7112	2	No external braking resistor connected	External braking resistor activated (Parameter RESint_ext), but no external resistor is detected.	Verify wiring of the external braking resistor. Verify correct resistance.
E 7113	0	Control voltage for holding brake too low	The DC bus voltage is too low (temporarily or permanently). The ripple is too high.	Increase the supply voltage. Stabilize the mains supply.
E 7114	2	No braking resistor connected	Connection to braking resistor lost	Verify wiring of the braking resistor. Verify correct resistance.
E 7120	4	Invalid motor data Parameter _SigLatched Bit 16	Motor data is incorrect (incorrect CRC).	Contact Technical Support or replace the motor.
E 7121	2	System error detected: Error in motor encoder communication Parameter _SigLatched Bit 16	EMC, detailed information can be found in the error memory that contains the error code of the encoder.	Contact Technical Support.
E 7122	4	Invalid motor data Parameter _SigLatched Bit 30	Error detected in motor data stored in motor encoder, error detected in internal memory data.	Contact Technical Support or replace the motor.

Error code	Error class	Description	Cause	Correctives
E 7124	4	System error detected: Motor encoder inoperative Parameter _SigLatched Bit 16		Contact Technical Support or replace the motor.
E 7125	4	System error detected: Length specification for user data too great Parameter _SigLatched Bit 16		
E 7129	0	System error detected: Motor encoder Parameter _WarnLatched Bit 16		
E 712C	0	System error detected: Communication with encoder not possible Parameter _WarnLatched Bit 16		
E 712D	4	Electronic motor nameplate not found Parameter _SigLatched Bit 16	Incorrect motor data (incorrect CRC). Motor without electronic motor nameplate (for example, SER motor)	Contact Technical Support or replace the motor.
E 712F	0	No data segment of the electronic motor nameplate		
E 7132	0	System error detected: Motor configuration cannot be written		
E 7134	4	Incomplete motor configuration Parameter _SigLatched Bit 16		
E 7135	4	Format is not supported Parameter _SigLatched Bit 16		
E 7136	4	Incorrect encoder type selected with parameter MotEnctype Parameter _SigLatched Bit 16		
E 7137	4	Error detected during the internal conversion of the motor configuration Parameter _SigLatched Bit 16		
E 7138	4	Parameter of the motor configuration out of permissible range Parameter _SigLatched Bit 16		
E 7139	0	Encoder offset: Data segment in encoder is incorrect.		
E 713A	3	Adjustment value of the encoder of the third party motor has not yet been determined. Parameter _SigLatched Bit 16		
E 7200	4	System error detected: Calibration analog/digital converter during manufacturing / incorrect BLE file Parameter _SigLatched Bit 30		
E 7320	4	System error detected: Invalid encoder parameter Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference, motor encoder has not been factory-parameterized.	Contact Technical Support.
E 7321	3	Timeout reading the absolute position from the encoder Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference or motor encoder is inoperative.	Verify wiring and shield connection of encoder cable or replace motor.

Error code	Error class	Description	Cause	Correctives
E 7327	0	Error bit set in Hiperface answer Parameter _WarnLatched Bit 16	Insufficient EMC.	Verify wiring (shield).
E 7328	4	Motor encoder: Position evaluation error detected Parameter _SigLatched Bit 16	Encoder has detected incorrect position evaluation.	Contact Technical Support or replace the motor.
E 7329	0	Motor encoder Warn signal Parameter _WarnLatched Bit 16	EMC.	Contact Technical Support or replace the motor.
E 7330	4	System error detected: Motor encoder (Hiperface) Parameter _SigLatched Bit 16		Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 7331	4	System error detected: Motor encoder initialization Parameter _SigLatched Bit 30		Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 7335	0	Communication with motor encoder active Parameter _WarnLatched Bit 16	Command is being processed or communication may be disturbed (EMC).	Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 733F	4	Amplitude of encoder analog signals too low Parameter _SigLatched Bit 16	Incorrect encoder wiring. Encoder not connected. Encoder signals subject to EMC interference (shield connection, cabling, etc.).	
E 7340	3	Reading of absolute position aborted Parameter _SigLatched Bit 16	Communication channel (Hiperface) to encoder is subject to interference. Encoder (in motor) is inoperative.	Verify wiring and shield connection of encoder cable, replace motor.
E 7341	0	Encoder overtemperature Parameter _WarnLatched Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor.
E 7342	2	Encoder overtemperature Parameter _SigLatched Bit 16	The maximum permissible duty cycle is exceeded. The motor was not mounted properly, for example, it is thermally isolated. The motor is blocked so that more current is used than under normal conditions. The ambient temperature is too high.	Reduce the duty cycle, for example, reduce acceleration. Supply additional cooling, for example, use a fan. Mount the motor in such a way as to increase thermal conductivity. Use a differently rated drive or motor. Replace the motor.
E 7343	0	Absolute position is different from incremental position Parameter _WarnLatched Bit 16	- Encoder is subject to EMC interference. - Motor encoder is inoperative.	Verify wiring and shield connection of encoder cable, replace motor.
E 7344	3	Absolute position is different from incremental position Parameter _SigLatched Bit 16	- Encoder is subject to EMC interference. - Motor encoder is inoperative.	Verify wiring and shield connection of encoder cable, replace motor.
E 7345	0	Amplitude of analog signals too high, limit of AD conversion exceeded	Encoder signals subject to EMC interference (shield connection, wiring, etc.). Encoder inoperative.	Verify wiring and shield connection. Replace encoder.

Error code	Error class	Description	Cause	Correctives
E 7346	4	System error detected: Encoder not ready Parameter _SigLatched Bit 16		Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 7347	0	System error detected: Position initialization not possible	Analog and digital encoder signals subject to massive interference.	Reduce encoder signal interference, verify shield connection. Contact Technical Support.
E 7348	3	Timeout reading encoder temperature Parameter _SigLatched Bit 16	Encoder without temperature sensor, incorrect encoder connection.	Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 7349	0	Discrepancy between absolute and analog encoder phases	Analog encoder signals are subject to interference. Encoder inoperative.	Verify wiring and shield connection of encoder cable. Replace motor. Contact Technical Support.
E 734A	3	Amplitude of analog signals from encoder too high, signals are clipped Parameter _SigLatched Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734B	0	Signal position evaluation of analog encoder inoperative Parameter _WarnLatched Bit 16	Incorrect encoder wiring. Encoder hardware interface inoperative.	
E 734C	par.	Error detected with quasi absolute position Parameter _SigLatched Bit 16	The motor shaft may have been moved while the drive was powered down. A quasi absolute position has been detected that is not within the permissible motor shaft deviation range.	If the quasi absolute function is active, only power down the drive if the motor is at a standstill and do not move the motor shaft when the drive is off.
E 734D	0	Index pulse is not available for the encoder Parameter _WarnLatched Bit 16		
E 734E	4	Error in analog signals from encoder detected Parameter _SigLatched Bit 16	Encoder cable not properly connected. Encoder signals subject to EMC interference (shield connection, wiring, etc.). Mechanical issue.	Verify wiring and shield connection of encoder cable. Contact Technical Support.
E 7500	0	RS485/Modbus: Overrun error detected Parameter _WarnLatched Bit 5	EMC; incorrect cabling.	Verify cables.
E 7501	0	RS485/Modbus: Framing error detected Parameter _WarnLatched Bit 5	EMC; incorrect cabling.	Verify cables.
E 7502	0	RS485/Modbus: Parity error detected Parameter _WarnLatched Bit 5	EMC; incorrect cabling.	Verify cables.
E 7503	0	RS485/Modbus: Receive error detected Parameter _WarnLatched Bit 5	EMC; incorrect cabling.	Verify cables.
E 7623	0	Absolute encoder signal is not available Parameter _WarnLatched Bit 22	There is no encoder available at the input specified via the parameter ENC_abs_source.	Verify wiring, verify encoder. Change the value of the parameter ENC_abs_source.
E 7625	0	Not possible to set the absolute position for encoder 1. Parameter _WarnLatched Bit 22	There is no encoder connected to the input for encoder 1.	Connect an encoder to the input for encoder 1 before trying to set the absolute position directly via ENC1_abs_pos.

Error code	Error class	Description	Cause	Correctives
E 7701	4	System error detected: Timeout during connection to power stage Parameter _SigLatched Bit 31		Contact Technical Support.
E 7702	4	System error detected: Invalid data received from power stage Parameter _SigLatched Bit 31		Contact Technical Support.
E 7703	4	System error detected: Data exchange with power stage lost Parameter _SigLatched Bit 31		Contact Technical Support.
E 7704	4	System error detected: Exchange of identification data from power stage not successful Parameter _SigLatched Bit 31		Contact Technical Support.
E 7705	4	System error detected: Checksum identification data from power stage incorrect Parameter _SigLatched Bit 31		Contact Technical Support.
E 7706	4	System error detected: No identification frame received from power stage Parameter _SigLatched Bit 31		Contact Technical Support.
E 7707	4	System error detected: Type of power stage and manufacture data do not match		Contact Technical Support.
E 7708	4	PIC voltage supply too low Parameter _SigLatched Bit 31		Contact Technical Support.
E 7709	4	System error detected: Invalid numbers of data received Parameter _SigLatched Bit 31		Contact Technical Support.
E 770A	2	PIC received data with incorrect parity Parameter _SigLatched Bit 31		Contact Technical Support.
E 770B	2	Motor has been changed (different type of power stage) Parameter _SigLatched Bit 31	Detected power stage type is different from previously detected power stage.	Confirm the change.
E A065	0	Parameters cannot be written Parameter _WarnLatched Bit 4	A data set is still active.	Wait until the currently active data set has been terminated.
E A300	0	Deceleration after HALT request still running	HALT was removed too soon. New command was sent before motor standstill was reached after a HALT request.	Wait for complete stop before removing HALT signal. Wait until motor has come to a complete standstill.
E A301	0	Drive in operating state Quick Stop Active	Error with error class 1 detected. Drive stopped with Quick Stop.	
E A302	1	Stop by positive limit switch Parameter _SigLatched Bit 1	The positive limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
E A303	1	Stop by negative limit switch Parameter _SigLatched Bit 1	The negative limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
E A304	1	Stop by reference switch Parameter _SigLatched Bit 1		

Error code	Error class	Description	Cause	Correctives
E A305	0	Power stage cannot be enabled in the operating state Not Ready To Switch On	Fieldbus: An attempt was made to enable the power stage in the operating state Not Ready To Switch On.	Refer to the state diagram.
E A306	1	Stop by user-initiated software stop Parameter _SigLatched Bit 3	Drive is in operating state Quick Stop Active due to a software stop request. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Clear break condition with command Fault Reset.
E A307	0	Interruption by internal software stop	In the operating modes Homing and Jog, the movement is internally interrupted by an internal software stop. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Perform a Fault Reset.
E A308	0	Drive is in operating state Fault or Fault Reaction Active	Error with error class 2 or higher detected.	Verify the error code (HMI or commissioning software), remove the cause and perform a Fault Reset.
E A309	0	Drive not in operating state Operation Enabled	A command was sent that requires the drive to be in the operating state Operation Enabled (for example, a command to change the operating mode).	Set drive to operating state Operation Enabled and repeat the command.
E A310	0	Power stage not enabled	Command cannot be used because the power stage is not enabled (operating state Operation Enabled or Quick Stop Active).	Set drive to an operating state in which the power stage is enabled, see state diagram.
E A311	0	Operating mode change active	A start request for an operating mode has been received while a change of the operating mode was active.	Wait until the operating mode change has terminated before triggering a start request for another operating mode.
E A312	0	Profile generation interrupted		
E A313	0	Position overflow, zero point is therefore no longer valid (ref_ok=0)	The movement range limits were exceeded and the zero point is no longer valid. An absolute movement requires a valid zero point.	Define a valid zero point by means of the operating mode Homing.
E A314	0	No valid zero point	Command needs a valid zero point (ref_ok=1).	Define a valid zero point by means of the operating mode Homing.
E A315	0	Homing active	Command cannot be used while the operating mode Homing is active.	Wait until reference movement is finished.
E A316	0	Overflow during calculation of acceleration		

Error code	Error class	Description	Cause	Correctives
E A317	0	Motor is not at a standstill	Command sent which is not permissible when the motor is not at a standstill. For example: - Change of software limit switches - Change of handling of monitoring signals - Setting of reference point - Teach in of data set	Wait until the motor has come to a standstill (x_end = 1).
E A318	0	Operating mode active (x_end=0)	Activation of a new operating mode is not possible while another operating mode is still active.	Wait until the command in the operating mode has finished (x_end=1) or terminate active operating mode with HALT command.
E A319	1	Manual tuning/Autotuning: Movement out of range Parameter _SigLatched Bit 2	The movement exceeds the parameterized maximum movement range.	Verify permissible movement range value and time interval.
E A31A	0	Manual tuning/Autotuning: Amplitude/offset too high	Amplitude plus offset for tuning exceed internal velocity or current limitation.	Choose lower amplitude and offset values.
E A31B	0	Halt requested	Command not permissible while Halt is requested.	Clear Halt request and repeat command.
E A31C	0	Invalid position setting with software limit switch	Value for negative (positive) software limit switch is greater (less) than value for positive (negative) software limit switch.	Set correct position values.
E A31D	0	Velocity range exceeded (parameter CTRL_v_max, M_n_max)	The velocity was set to a value greater than the maximum permissible velocity in parameter CTRL_v_max or M_n_max, whichever is lower.	If the value of parameter M_n_max is greater than the value of parameter CTRL_v_max, increase the value of parameter CTRL_v_max or reduce the velocity value.
E A31E	1	Stop by positive software limit switch Parameter _SigLatched Bit 2	Not possible to execute command because positive software limit switch was triggered.	Return to the permissible movement range.
E A31F	1	Stop by negative software limit switch Parameter _SigLatched Bit 2	Not possible to execute command because negative software limit switch was triggered.	Return to the permissible movement range.
E A320	par.	Permissible position deviation exceeded Parameter _SigLatched Bit 8	External load or acceleration are too high.	Reduce external load or acceleration. Use a differently rated drive, if necessary. Error response can be adjusted via parameter ErrorResp_p_dif.
E A322	0	Error detected in ramp calculation		
E A323	3	System error detected: Processing error detected during generation of profile		
E A324	1	Error detected during homing (additional info = detailed error code) Parameter _SigLatched Bit 4	Homing movement was stopped in response to a detected error, the detailed reason is indicated by the additional info in the error memory.	Possible sub-error codes: E A325, E A326, E A327, E A328 or E A329.

Error code	Error class	Description	Cause	Correctives
E A325	1	Limit switch to be approached not enabled Parameter _SigLatched Bit 4	Homing to positive limit switch or negative limit switch is disabled.	Enable limit switch via 'IOsigLimP' or 'IOsigLimN'.
E A326	1	Reference switch not found between positive limit switch and negative limit switch Parameter _SigLatched Bit 4	Reference switch inoperative or not correctly connected.	Verify the function and wiring of the reference switch.
E A329	1	More than one signal positive limit switch/negative limit switch/reference switch active Parameter _SigLatched Bit 4	Reference switch or limit switch not connected correctly or supply voltage for switches too low.	Verify the wiring and 24 VDC supply voltage.
E A32A	1	Positive limit switch triggered with negative direction of movement Parameter _SigLatched Bit 4	Start reference movement with negative direction (for example, reference movement to negative limit switch) and activate the positive limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with negative direction of movement (target limit switch must be connected to the negative limit switch).
E A32B	1	Negative limit switch triggered with positive direction of movement Parameter _SigLatched Bit 4	Start reference movement with positive direction (for example, reference movement to positive limit switch) and activate the negative limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with positive direction of movement (target limit switch must be connected to the positive limit switch).
E A32C	1	Reference switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
E A32D	1	Positive limit switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
E A32E	1	Negative limit switch error detected (switch signal briefly enabled or switch overtraveled) Parameter _SigLatched Bit 4	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
E A32F	1	Index pulse not found Parameter _SigLatched Bit 4	Index pulse signal not connected or not working properly.	Verify index pulse signal and connection.
E A330	0	Reference movement to index pulse cannot be reproduced. Index pulse is too close to the switch Parameter _WarnLatched Bit 4	The position difference between the index pulse and the switching point is insufficient.	Increase the distance between the index pulse and the switching point. If possible, the distance between the index pulse and the switching point should be a half motor revolution.
E A332	1	Jog error detected (additional info = detailed error code) Parameter _SigLatched Bit 4	Jog movement was stopped in response to a detected error.	For additional info, verify the detailed error code in the error memory.
E A333	3	System error detected: Invalid internal selection		

Error code	Error class	Description	Cause	Correctives
E A334	2	Timeout Standstill Window monitoring	Position deviation after movement greater than standstill window. This may have been caused by an external load.	Verify load. Verify settings for standstill window (parameter MON_p_win, MON_p_winTime and MON_p_winTout). Optimize control loop settings.
E A336	1	System error detected: Jerk limitation with position offset after end of movement (additional info = offset in Inc.)		
E A337	0	Operating mode cannot be continued Parameter _WarnLatched Bit 4	Continuation of interrupted movement in operating mode Profile Position is not possible because another operating mode had been active in the meantime. In the operating mode Motion Sequence, continuation is not possible if a motion blend was interrupted.	Restart the operating mode.
E A338	0	Operating mode unavailable Parameter _WarnLatched Bit 4	The selected operating mode is not available.	
E A33A	0	No valid zero point (ref_ok=0) Parameter _WarnLatched Bit 4	No zero point defined by means of operating mode Homing. Zero point no longer valid due to movement beyond permissible movement range. Motor does not have an absolute encoder.	Use operating mode Homing to define a valid zero point. Use a motor with an absolute encoder.
E A33C	0	Function not available in this operating mode Parameter _WarnLatched Bit 4	Activation of a function which is not available in the active operating mode. Example: Start of backlash compensation while autotuning/manual tuning is active.	
E A33D	0	Motion blend is already active Parameter _WarnLatched Bit 4	Change of motion blend during the ongoing motion blend (end position of motion blend not yet reached)	Wait for the motion blend to complete before setting the next position.
E A33E	0	No movement activated Parameter _WarnLatched Bit 4	Activation of a motion blend without movement.	Start a movement before the motion blend is activated.
E A33F	0	Position of motion blend movement not in the range of the ongoing movement Parameter _WarnLatched Bit 4	The position of the motion blend is outside of the movement range.	Verify the position of the motion blend and the movement range.
E A341	0	Position of motion blend has already been passed Parameter _WarnLatched Bit 4	The movement has passed beyond the position of the motion blend.	
E A342	1	Target velocity was not reached at motion blend position. Parameter _SigLatched Bit 4	The position of the motion blend was overtraveled, the target velocity was not reached.	Reduce the ramp velocity so that the target velocity is reached at the position of the motion blend.
E A343	0	Processing only possible with linear ramp Parameter _WarnLatched Bit 4	Motion blend position was set with a non-linear ramp.	Set a linear ramp.

Error code	Error class	Description	Cause	Correctives
E A347	0	Permissible position deviation exceeded Parameter <code>_WarnLatched</code> Bit 8	External load or acceleration are too high.	Reduce external load or acceleration. Threshold value can be adjusted via the parameter <code>MON_p_dif_warn</code> .
E A349	0	Position setting exceeds system limits	Position scaling of <code>POSScaleDenom</code> and <code>POSScaleNum</code> results in a scaling factor that is too small.	Change <code>POSScaleDenom</code> and <code>POSScaleNum</code> in such a way as to increase the resulting scaling factor.
E A34A	0	Velocity setting exceeds system limits	The velocity scaling of <code>'VELScaleDenom'</code> and <code>'VELScaleNum'</code> 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 <code>'VELScaleDenom'</code> and <code>'VELScaleNum'</code> in such a way as to increase the resulting scaling factor.
E A34B	0	Ramp setting exceeds system limits	The ramp scaling of <code>'RAMPScaleDenom'</code> and <code>'RAMPScaleNum'</code> results in a scaling factor that is too small.	Change of <code>'RAMPScaleDenom'</code> and <code>'RAMPScaleNum'</code> in such a way as to increase the resulting scaling factor.
E A34C	0	Resolution of scaling too high (range exceeded)		
E A34D	0	Function not available when Modulo is active	The function cannot be executed when Modulo is active.	Deactivate Modulo to use the function.
E A34E	0	Target value for absolute movement not possible with defined modulo range and modulo handling.	If parameter <code>'MOD_Absolute'</code> is set to: Shortest Distance: Target value is not in defined modulo range. Positive Direction: Target value is less than parameter <code>'MOD_Min'</code> . Negative Direction: Target value is greater than parameter <code>'MOD_Max'</code> .	Set a correct target value for absolute movement.
E A34F	0	Target position outside of modulo range. Corresponding movement within range performed instead.	The setting of parameter <code>'MOD_AbsMultiRng'</code> only allows for a movement within the modulo range.	Change the parameter <code>'MOD_AbsMultiRng'</code> to allow for movements beyond the modulo range.
E A351	1	Function cannot be executed with this position scaling factor Parameter <code>_SigLatched</code> Bit 4	The positions scaling factor is set to a value less than <code>1rev/131072usr_p</code> , which is less than the internal resolution. In the operating mode Cyclic Synchronous Position, the resolution is not set to <code>1rev/131072usr_p</code> .	Use a different position scaling factor or deactivate the selected function.
E A355	1	Error detected during relative movement after capture (additional info = detailed error code) Parameter <code>_SigLatched</code> Bit 4	Movement was stopped by error.	Verify the error memory.
E A356	0	Function Relative Movement After Capture not assigned to a digital input		Assign the function Relative Movement After Capture to a digital input.
E A357	0	Deceleration still running	Command is not permissible during deceleration.	Wait until motor has come to a complete standstill.

Error code	Error class	Description	Cause	Correctives
E A358	1	Target position overtraveled with function Relative Movement After Capture Parameter <code>_SigLatched</code> Bit 4	Stopping distance too small or velocity too high at the point in time of the capture event.	Reduce the velocity.
E A359	0	Request cannot be processed since the relative movement after capture is still active		
E A35B	0	Modulo cannot be activated Parameter <code>_WarnLatched</code> Bit 4	The set operating mode does not support Modulo.	
E A35D	par.	Permissible velocity deviation exceeded Parameter <code>_SigLatched</code> Bit 8	Load or acceleration too high.	Reduce load or acceleration.
E B100	0	RS485/Modbus: Indeterminable service Parameter <code>_WarnLatched</code> Bit 5	Unsupported Modbus service was received.	Verify application on the Modbus master.
E B101	1	Incorrect I/O data configuration (additional info = Modbus register address) Parameter <code>_SigLatched</code> 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.
E B102	1	Fieldbus module: General error detected Parameter <code>_SigLatched</code> Bit 21		
E B103	2	Fieldbus module: Controlling communication channel has been closed Parameter <code>_SigLatched</code> Bit 21		
E B104	2	Fieldbus module: Internal communication error detected Parameter <code>_SigLatched</code> Bit 21		
E B105	2	Fieldbus module: I/O data timeout Parameter <code>_SigLatched</code> Bit 21		
E B106	2	Fieldbus module: I/O data mapping error detected Parameter <code>_SigLatched</code> Bit 21		
E B109	4	Fieldbus module: Synchronization heartbeat lost between module and drive Parameter <code>_SigLatched</code> Bit 21		
E B10A	4	Fieldbus module: Selected fieldbus not available Parameter <code>_SigLatched</code> Bit 21		
E B120	2	Cyclic communication: Incorrect cycle time Parameter <code>_SigLatched</code> 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.
E B121	2	Cyclic communication: Synchronization signal missing Parameter <code>_SigLatched</code> Bit 21	Two cycles have passed without a synchronization signal having been received.	Analyze the communication.
E B122	2	Cyclic communication: Incorrect synchronization Parameter <code>_SigLatched</code> 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.

Error code	Error class	Description	Cause	Correctives
E 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.
E 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.
E B200	0	RS485/Modbus: Protocol error detected Parameter _WarnLatched Bit 5	Logical protocol error detected: Incorrect length or unsupported subfunction.	Verify application on the Modbus master.
E B201	2	RS485/Modbus: Interruption of the connection Parameter _SigLatched Bit 5	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
E B202	0	RS485/Modbus: Interruption of the connection Parameter _WarnLatched Bit 5	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
E B203	0	RS485/Modbus: Incorrect number of monitor objects Parameter _WarnLatched Bit 5		
E B314	2	Watchdog error with error response Parameter _SigLatched Bit 21	The bus cycle time is greater than the programmed watchdog time.	Increase watchdog time.
E B316	2	Communication error detected with error response Parameter _SigLatched Bit 21	Detected system or bus error, EMC.	Verify fieldbus connection, shield connection.
E B600	2	Ethernet: Network overload Parameter _SigLatched Bit 21		
E B601	2	Ethernet: Loss of Ethernet carrier Parameter _SigLatched Bit 21		
E B602	2	Ethernet: Duplicate IP address Parameter _SigLatched Bit 21		
E B603	2	Ethernet: No valid IP address Parameter _SigLatched Bit 21		
E B604	0	Ethernet: DHCP/BOOTP Parameter _WarnLatched Bit 21	IP assignment via DHCP/BOOTP unsuccessful. Effort was given up after 2 minutes.	Set up a properly working DHCP or BOOTP server or assign the IP address manually.
E B605	2	Ethernet FDR: Unconfigured error detected Parameter _SigLatched Bit 21		
E B606	2	Ethernet FDR: Irrecoverable error detected Parameter _SigLatched Bit 21		
E B607	2	Ethernet: I/O data idle Parameter _SigLatched Bit 21	PLC has been stopped, but I/O data keeps being transmitted.	Disable power stage of connected drives before stopping the PLC.
E B610	2	EtherCAT: Fieldbus watchdog (additional info = 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.
E B611	2	EtherCAT: Invalid I/O data (additional info = 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.).

Error code	Error class	Description	Cause	Correctives
E 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.
E B613	2	Ethernet: Ethernet carrier port 2 not available Parameter _SigLatched Bit 21		
E B700	0	Drive Profile Lexium: On activation of the profile, no dmControl, refA or refB has been mapped.	dmControl, refA or refB have not been mapped.	Map dmControl, refA or refB.
E B702	1	Insufficient velocity resolution due to velocity scaling	Due to the configured velocity scaling, the velocity resolution in REFA16 is insufficient.	Change the velocity scaling.
E B703	0	Drive Profile Lexium: Write request with incorrect data type.		

Chapter 10

Parameters

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Representation of the Parameters	390
List of Parameters	392

Representation of the Parameters

This chapter provides an overview of the parameters which can be used for operating the product.

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Overview

The way parameters are shown provides information required for unique identification, the default values and the properties of a parameter.

Structure of the parameter representation:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ABCDE	Short description Selection values 1 / Abc1: Explanation 1 2 / Abc2: Explanation 2 Description and details	A _{pk} 0.00 3.00 300.00	UINT32 R/W per. -	Fieldbus 1234

Field "Parameter Name"

The parameter name uniquely identifies a parameter.

Field "Description"

Short description:

The short description contains information on the parameter and a cross reference to the page that describes the use of the parameter.

Selection values:

In the case of parameters which offer a selection of settings, the value to be entered via the fieldbus and the designation of the value for entry via the commissioning software are specified.

1 = Value for input via fieldbus

Abc1 = Designation for entry via the commissioning software

A B c 1 = Designation for entry via the HMI

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	Minimum value	Maximum value
INT8	-128	127
UINT8	0	255
INT16	-32768	32767
UINT16	0	65535
INT32	-2147483648	2147483647
UINT32	0	4294967295

Field "R/W"

Indicates read and/or write values

"R/" values can only be read

"R/W" values can be read and written.

Field "Persistent"

"per." indicates whether the value of the parameter is persistent, i.e. whether it remains in the memory after the device is powered off.

When a value of a persistent parameter is modified via the commissioning software or the fieldbus, the user must explicitly store the modified value in the persistent memory.

Field "Parameter Address"

Each parameter has a unique parameter address. The parameter address is used to access the parameter via the fieldbus.

Decimal Numbers Entered via the Fieldbus

Please note that parameter values are entered via the fieldbus without a decimal point. All decimal places must be entered.

Input examples:

Value	Commissioning software	Fieldbus
20	20	20
5.0	5.0	50
23.57	23.57	2357
1.000	1.000	1000

List of Parameters

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_AccessInfo	Access channel information Low byte: Exclusive access Value 0: No Value 1: Yes High byte: Access channel Value 0: Reserved Value 1: I/O Value 2: HMI Value 3: Modbus RS485 Value 4: Fieldbus main channel Values 5 ... 12: Modbus TCP, CANopen second SDO or Profibus master class 2 Values 13 ... 28: Ethernet/IP explicit channels	- - - -	UINT16 R/- - -	Modbus 280 PROFINET 280
_actionStatus	Action word Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: Error class 0 Bit 1: Error class 1 Bit 2: Error class 2 Bit 3: Error class 3 Bit 4: Error class 4 Bit 5: Reserved Bit 6: Motor is at a standstill ($_n_act < 9$) 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/- - -	Modbus 7176 PROFINET 7176
_AT_J	Moment of inertia of the entire 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. -	Modbus 12056 PROFINET 12056
_AT_M_friction	Friction torque of the system Is determined during Autotuning. In increments of $0.01 A_{rms}$.	A_{rms} - - -	UINT16 R/- - -	Modbus 12046 PROFINET 12046
_AT_M_load	Constant load torque Is determined during Autotuning. In increments of $0.01 A_{rms}$.	A_{rms} - - -	INT16 R/- - -	Modbus 12048 PROFINET 12048
_AT_progress	Progress of Autotuning	% 0 0 100	UINT16 R/- - -	Modbus 12054 PROFINET 12054

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_AT_state	Autotuning status Bit assignments: Bits 0 ... 10: Last processing step Bit 13: auto_tune_process Bit 14: auto_tune_end Bit 15: auto_tune_err	- - - -	UINT16 R/- - -	Modbus 12036 PROFINET 12036
_Cap1CntFall	Capture input 1 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	Modbus 2648 PROFINET 2648
_Cap1CntRise	Capture input 1 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	Modbus 2646 PROFINET 2646
_Cap1Count	Capture input 1 event counter Counts the capture events. The event counter is reset when capture input 1 is activated.	- - - -	UINT16 R/- - -	Modbus 2576 PROFINET 2576
_Cap1CountCons	Capture input 1 event counter (consistent) Counts the capture events. The event counter is reset when capture input 1 is activated. By reading this parameter, the parameter "_Cap1PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	Modbus 2606 PROFINET 2606
_Cap1Pos	Capture input 1 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2572 PROFINET 2572
_Cap1PosCons	Capture input 1 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap1CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	Modbus 2608 PROFINET 2608
_Cap1PosFallEdge	Capture input 1 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2636 PROFINET 2636
_Cap1PosRiseEdge	Capture input 1 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2634 PROFINET 2634

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Cap2CntFall	Capture input 2 event counter at falling edges Counts the capture events at falling edges. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2652 PROFINET 2652
_Cap2CntRise	Capture input 2 event counter at rising edges Counts the capture events at rising edges. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2650 PROFINET 2650
_Cap2Count	Capture input 2 event counter Counts the capture events. The event counter is reset when capture input 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2578 PROFINET 2578
_Cap2CountCons	Capture input 2 event counter (consistent) Counts the capture events. The event counter is reset when capture input 2 is activated. By reading this parameter, the parameter "_Cap2PosCons" is updated and locked so it cannot be changed. Both parameter values remain consistent.	- - - -	UINT16 R/- - -	Modbus 2610 PROFINET 2610
_Cap2Pos	Capture input 2 captured position Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2574 PROFINET 2574
_Cap2PosCons	Capture input 2 captured position (consistent) Captured position at the time of the "capture signal". The captured position is re-calculated after "Position Setting" or "Reference Movement". By reading the parameter "_Cap2CountCons", this parameter is updated and locked so it cannot be changed. Both parameter values remain consistent.	usr_p - - -	INT32 R/- - -	Modbus 2612 PROFINET 2612
_Cap2PosFallEdge	Capture input 2 captured position at falling edge This parameter contains the position captured at the point in time a falling edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2640 PROFINET 2640
_Cap2PosRiseEdge	Capture input 2 captured position at rising edge This parameter contains the position captured at the point in time a rising edge was detected. The captured position is recalculated after "Position Setting" or "Reference Movement".	usr_p - - -	INT32 R/- - -	Modbus 2638 PROFINET 2638

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_CapEventCounters	Capture inputs 1 and 2 summary of event counters This parameter contains the counted capture events. Bits 0 ... 3: _Cap1CntRise (lowest 4 bits) Bits 4 ... 7: _Cap1CntFall (lowest 4 bits) Bits 8 ... 11: _Cap2CntRise (lowest 4 bits) Bits 12 ... 15: _Cap2CntFall (lowest 4 bits)	- - - -	UINT16 R/- - -	Modbus 2654 PROFINET 2654
_CapStatus	Status of the capture inputs Read access: Bit 0: Position captured via input CAP1 Bit 1: Position captured via input CAP2	- - - -	UINT16 R/- - -	Modbus 2562 PROFINET 2562
_Cond_State4	Conditions for transition to operating state Ready To Switch On Signal state: 0: Condition not met 1: Condition met Bit 0: DC bus or mains voltage Bit 1: Inputs for safety function Bit 2: No configuration download ongoing Bit 3: Velocity greater than limit value Bit 4: Absolute position has been set Bit 5: Holding brake not manually released	- - - -	UINT16 R/- - -	Modbus 7244 PROFINET 7244
_CTRL_ActParSet	Active control loop parameter set Value 1: Control loop parameter set 1 is active Value 2: Control loop parameter set 2 is active A control loop parameter set is active after the time for the parameter switching (CTRL_ParChgTime) has elapsed.	- - - -	UINT16 R/- - -	Modbus 4398 PROFINET 4398
_CTRL_KPId	Current controller d component P gain This value is calculated on the basis of the motor parameters. In increments of 0.1 V/A. Changed settings become active immediately.	V/A 0.5 - 1270.0	UINT16 R/- per. -	Modbus 4354 PROFINET 4354
_CTRL_KPiq	Current controller q component P gain This value is calculated on the basis of the motor parameters. In increments of 0.1 V/A. Changed settings become active immediately.	V/A 0.5 - 1270.0	UINT16 R/- per. -	Modbus 4358 PROFINET 4358
_CTRL_TNiId	Current controller d component integral action time This value is calculated on the basis of the motor parameters. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.13 - 327.67	UINT16 R/- per. -	Modbus 4356 PROFINET 4356
_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. Changed settings become active immediately.	ms 0.13 - 327.67	UINT16 R/- per. -	Modbus 4360 PROFINET 4360

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/- - -	Modbus 6966 PROFINET 6966
_DataErrorInfo	Additional error information of a detected DataError (DE bit) Drive Profile Lexium: Indicates the parameter of the mapping that caused the DE bit to be set. The DE bit is set if MT-independent parameters of the active mapping cause an error in connection with a write command. Example: 1 = First mapped parameter 2 = Second mapped parameter etc.	- - - -	UINT16 R/- - -	Modbus 6970 PROFINET 6970
_DCOMopmd_act	Active operating mode -6 / Manual Tuning / Autotuning: Manual Tuning / Autotuning -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	- -6 - 10	INT16 R/- - -	Modbus 6920 PROFINET 6920
_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/- - -	Modbus 6916 PROFINET 6916
_DEV_T_current	Temperature of device	°C - - -	INT16 R/- - -	Modbus 7204 PROFINET 7204

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_DevNameExtAddr	Value of device name extension (PROFINET) PROFINET: Device name extension set via DIP switches or parameter DevNameExtAddr.	- - 0 -	UINT16 R/- - -	Modbus 15904 PROFINET 15904
_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.	- - - -	UINT16 R/- - -	Modbus 602 PROFINET 602
_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. Changed settings become active immediately.	- 0 0 12	UINT16 R/- - -	Modbus 6922 PROFINET 6922
_DPL_driveInput	Drive Profile Lexium driveInput	- - - -	UINT16 R/- - -	Modbus 6992 PROFINET 6992
_DPL_driveStat	Drive Profile Lexium driveStat	- - - -	UINT16 R/- - -	Modbus 6986 PROFINET 6986
_DPL_mfStat	Drive Profile Lexium mfStat	- - - -	UINT16 R/- - -	Modbus 6988 PROFINET 6988
_DPL_motionStat	Drive Profile Lexium motionStat	- - - -	UINT16 R/- - -	Modbus 6990 PROFINET 6990
_ENC_AmplMax	Maximum value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated.	mV - - -	UINT16 R/- - -	Modbus 16320 PROFINET 16320
_ENC_AmplMean	Mean value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated.	mV - - -	UINT16 R/- - -	Modbus 16316 PROFINET 16316
_ENC_AmplMean	Value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated.	mV - - -	UINT16 R/- - -	Modbus 16314 PROFINET 16314
_ENC_AmplMin	Minimum value of the SinCos amplitude This value is only available if monitoring of the SinCos amplitude has been activated.	mV - - -	UINT16 R/- - -	Modbus 16318 PROFINET 16318
_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/- - -	Modbus 15364 PROFINET 15364

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ERR_DCbus	DC bus voltage at the time the error was detected In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 15374 PROFINET 15374
_ERR_enable_cycles	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/- - -	Modbus 15370 PROFINET 15370
_ERR_enable_time	Time between enabling of power stage and detection of the error	s - - -	UINT16 R/- - -	Modbus 15372 PROFINET 15372
_ERR_motor_I	Motor current at the time the error was detected In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 15378 PROFINET 15378
_ERR_motor_v	Motor velocity at the time the error was detected	usr_v - - -	INT32 R/- - -	Modbus 15376 PROFINET 15376
_ERR_number	Error code Reading this parameter copies the entire entry for the detected error (error class, time of detection of error, ...) to an intermediate memory from which the elements of the detected error can then be read. In addition, the read pointer of the error memory is automatically set to the next error entry.	- 0 - 65535	UINT16 R/- - -	Modbus 15362 PROFINET 15362
_ERR_powerOn	Number of power on cycles	- 0 - 4294967295	UINT32 R/- - -	Modbus 15108 PROFINET 15108
_ERR_qual	Additional information on detected error This entry contains additional information on the detected error, depending on the error number. Example: a parameter address	- 0 - 65535	UINT16 R/- - -	Modbus 15368 PROFINET 15368
_ERR_temp_dev	Temperature of device at the time the error was detected	°C - - -	INT16 R/- - -	Modbus 15382 PROFINET 15382
_ERR_temp_ps	Temperature of power stage at the time the error was detected	°C - - -	INT16 R/- - -	Modbus 15380 PROFINET 15380
_ERR_time	Time of detection of error With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	Modbus 15366 PROFINET 15366
_ErrNumFbParSvc	Last error code of fieldbus parameter services Some fieldbusses only provide general error codes if a request for a parameter service is not successful. This parameter returns the vendor-specific error code of the last unsuccessful service.	- - - -	UINT16 R/- - -	Modbus 16518 PROFINET 16518

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_FieldbusSelection	Selected fieldbus 1 / Reserved: Reserved 2 / PROFINET: PROFINET Fieldbus selected via DIP switches or parameter FieldbusSelection.	- - 0 -	UINT16 R/- - -	Modbus 15910 PROFINET 15910
_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/- - -	Modbus 578 PROFINET 578
_fwNoSlot3Boot	Firmware number of slot 3 (Bootloader) Example: PR0912.00 The value is provided as a decimal value: 91200. If no module is installed, the value 0 is returned.	- - - -	UINT32 R/- - -	Modbus 590 PROFINET 590
_fwNoSlot3FPGA	Firmware number of slot 3 (FPGA) Example: PR0912.00 The value is provided as a decimal value: 91200. If no module is installed, the value 0 is returned.	- - - -	UINT32 R/- - -	Modbus 584 PROFINET 584
_fwNoSlot3PRU	Firmware number of slot 3 (PRU) Example: PR0912.00 The value is provided as a decimal value: 91200. If no module is installed, the value 0 is returned.	- - - -	UINT32 R/- - -	Modbus 596 PROFINET 596
_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/- - -	Modbus 582 PROFINET 582
_fwRevSlot3Boot	Firmware revision of slot 3 (Bootloader) The version format is XX.YY.ZZ.BB. Part XX.YY is contained in parameter _fwVerSlot3Boot. Part ZZ.BB is used for quality evolution and contained in this parameter. If no module is installed, the value 0 is returned. Example: V01.23.45.67 The value is provided as a decimal value: 4567	- - - -	UINT16 R/- - -	Modbus 594 PROFINET 594

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_fwRevSlot3FPGA	Firmware revision of slot 3 (FPGA) The version format is XX.YY.ZZ. Part XX.YY is contained in parameter _fwVerSlot3FPGA. 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/- - -	Modbus 588 PROFINET 588
_fwRevSlot3PRU	Firmware revision of slot 3 (PRU) The version format is XX.YY.ZZ.B. Part XX.YY is contained in parameter _fwVerSlot3PRU. Part ZZ.B is used for quality evolution and contained in this parameter. If no module is installed, the value 0 is returned. Example: V01.23.45.6 The value is provided as a decimal value: 456	- - - -	UINT16 R/- - -	Modbus 600 PROFINET 600
_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/- - -	Modbus 580 PROFINET 580
_fwVersSlot3Boot	Firmware version of slot 3 (Bootloader) The version format is XX.YY.ZZ.BB. Part XX.YY is contained in this parameter. Part ZZ.BB is contained in parameter _fwRevSlot3Boot. If no module is installed, the value 0 is returned. Example: V01.23.45.67 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	Modbus 592 PROFINET 592
_fwVersSlot3FPGA	Firmware version of slot 3 (FPGA) The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter _fwRevSlot3FPGA. 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/- - -	Modbus 586 PROFINET 586

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_fwVersSlot3PRU	Firmware version of slot 3 (PRU) The version format is XX.YY.ZZ.B. Part XX.YY is contained in this parameter. Part ZZ.B is contained in parameter _fwRevSlot3PRU. If no module is installed, the value 0 is returned. Example: V01.23.45.6 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	Modbus 598 PROFINET 598
_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/- - -	Modbus 10264 PROFINET 10264
_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/- - -	Modbus 10270 PROFINET 10270
_hwVersCPU	Hardware version of control board	- - - -	UINT16 R/- - -	Modbus 548 PROFINET 548
_hwVersPS	Hardware version of power stage	- - - -	UINT16 R/- - -	Modbus 552 PROFINET 552
_hwVersSlot3	Hardware version of module in slot 3	- - - -	UINT16 R/- - -	Modbus 576 PROFINET 576
_I_act	Total motor current In increments of 0.01 A _{rms} .	A _{rms} - - -	INT16 R/- - -	Modbus 7686 PROFINET 7686
_Id_act_rms	Actual motor current (d component, field weakening) In increments of 0.01 A _{rms} .	A _{rms} - - -	INT16 R/- - -	Modbus 7684 PROFINET 7684
_Id_ref_rms	Reference motor current (d component, field weakening) In increments of 0.01 A _{rms} .	A _{rms} - - -	INT16 R/- - -	Modbus 7714 PROFINET 7714

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/- - -	Modbus 7248 PROFINET 7248
_Imax_system	Current limitation of the system This parameter specifies the maximum system current. This is the lower value of the maximum motor current and the maximum power stage current. If no motor is connected, only the maximum power stage current is taken into account in this parameter. In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 7246 PROFINET 7246
_InvalidParam	Modbus address of parameter with invalid value If a configuration error is detected, the Modbus address of the parameter with an invalid value is indicated here.	- - 0 -	UINT16 R/- - -	Modbus 7180 PROFINET 7180
_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/- - -	Modbus 2050 PROFINET 2050
_IO_DI_act	Status of digital inputs Bit assignments: Bit 0: DI0 Bit 1: DI1 Bit 2: DI2 Bit 3: DI3	- - - -	UINT16 R/- - -	Modbus 2078 PROFINET 2078
_IO_DQ_act	Status of digital outputs Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/- - -	Modbus 2080 PROFINET 2080
_IO_STO_act	Status of the inputs for the safety function STO Coding of the individual signals: Bit 0: STO_A Bit 1: STO_B	- - - -	UINT16 R/- - -	Modbus 2124 PROFINET 2124

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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 FFFFFFFFh 4294967295	UINT32 R/- - -	Modbus 16386 PROFINET 16386
_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 FFFFFFFFh 4294967295	UINT32 R/- - -	Modbus 16450 PROFINET 16450
_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 FFFFh 65535	UINT16 R/- - -	Modbus 16418 PROFINET 16418
_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 FFFFh 65535	UINT16 R/- - -	Modbus 16482 PROFINET 16482
_IPAddressAct1	Currently used IP address, byte 1 Byte 1 (x.0.0.0) of the IP address.	- 0 0 255	UINT16 R/- - -	Modbus 15880 PROFINET 15880
_IPAddressAct2	Currently used IP address, byte 2 Byte 2 (0.x.0.0) of the IP address.	- 0 0 255	UINT16 R/- - -	Modbus 15882 PROFINET 15882
_IPAddressAct3	Currently used IP address, byte 3 Byte 3 (0.0.x.0) of the IP address.	- 0 0 255	UINT16 R/- - -	Modbus 15884 PROFINET 15884
_IPAddressAct4	Currently used IP address, byte 4 Byte 4 (0.0.0.x) of the IP address.	- 0 0 255	UINT16 R/- - -	Modbus 15886 PROFINET 15886
_IPgateAct1	Currently used IP address gateway, byte 1 Byte 1 (x.0.0.0) of the IP address of the gateway.	- 0 0 255	UINT16 R/- - -	Modbus 15896 PROFINET 15896

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_IPgateAct2	Currently used IP address gateway, byte 2 Byte 2 (0.x.0.0) of the IP address of the gateway.	- 0 0 255	UINT16 R/- - -	Modbus 15898 PROFINET 15898
_IPgateAct3	Currently used IP address gateway, byte 3 Byte 3 (0.0.x.0) of the IP address of the gateway.	- 0 0 255	UINT16 R/- - -	Modbus 15900 PROFINET 15900
_IPgateAct4	Currently used IP address gateway, byte 4 Byte 4 (0.0.0.x) of the IP address of the gateway.	- 0 0 255	UINT16 R/- - -	Modbus 15902 PROFINET 15902
_IPmaskAct1	Currently used IP address subnet mask, byte 1 Byte 1 (x.0.0.0) of the IP address of the subnet mask.	- 0 0 255	UINT16 R/- - -	Modbus 15888 PROFINET 15888
_IPmaskAct2	Currently used IP address subnet mask, byte 2 Byte 2 (0.x.0.0) of the IP address of the subnet mask.	- 0 0 255	UINT16 R/- - -	Modbus 15890 PROFINET 15890
_IPmaskAct3	Currently used IP address subnet mask, byte 3 Byte 3 (0.0.x.0) of the IP address of the subnet mask.	- 0 0 255	UINT16 R/- - -	Modbus 15892 PROFINET 15892
_IPmaskAct4	Currently used IP address subnet mask, byte 4 Byte 4 (0.0.0.x) of the IP address of the subnet mask.	- 0 0 255	UINT16 R/- - -	Modbus 15894 PROFINET 15894
_IPmode	Type of obtaining the IP address 0 / Manual: Manual 1 / BOOTP: BOOTP 2 / DHCP: DHCP 3 / DCP: DCP Type of obtaining the IP address set via DIP switches or parameter PntIpMode.	- - 0 -	UINT16 R/- - -	Modbus 15908 PROFINET 15908
_Iq_act_rms	Actual motor current (q component, generating torque) In increments of 0.01 A _{rms} .	A _{rms} - - -	INT16 R/- - -	Modbus 7682 PROFINET 7682
_Iq_ref_rms	Reference motor current (q component, generating torque) In increments of 0.01 A _{rms} .	A _{rms} - - -	INT16 R/- - -	Modbus 7712 PROFINET 7712
_LastError	Detected error causing a stop (error classes 1 to 4) Error code of the most recent detected error. Consecutive detected errors do not overwrite this error code. Example: If an error response to a detected limit switch error causes overvoltage, this parameter contains the code of the detected limit switch error. Exception: Detected errors of error class 4 overwrite existing entries.	- - - -	UINT16 R/- - -	Modbus 7178 PROFINET 7178
_LastError_Qual	Additional info on most recent error This parameter contains additional information on the most recent detected error, depending on the error code. For example: a parameter address.	- - 0 -	UINT16 R/- - -	Modbus 7230 PROFINET 7230

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/- - -	Modbus 7186 PROFINET 7186
_M_BRK_T_apply	Holding brake application time	ms - - -	UINT16 R/- - -	Modbus 3394 PROFINET 3394
_M_BRK_T_release	Holding brake release time	ms - - -	UINT16 R/- - -	Modbus 3396 PROFINET 3396
_M_Enc_Cosine	Voltage of cosine signal of encoder In increments of 0.001 V.	V - - -	INT16 R/- - -	Modbus 7254 PROFINET 7254
_M_Enc_Sine	Voltage of sine signal of encoder In increments of 0.001 V.	V - - -	INT16 R/- - -	Modbus 7256 PROFINET 7256
_M_Encoder	Type of motor encoder 1 / SinCos With HiFa: SinCos with Hiperface 2 / SinCos Without HiFa: SinCos without Hiperface 3 / SinCos With Hall: SinCos with Hall 4 / SinCos With EnDat: SinCos with EnDat 5 / EnDat Without SinCos: EnDat without SinCos 6 / Resolver: Resolver 7 / Hall: Hall (not supported yet) 8 / BISS: BISS High byte: Value 0: Rotary encoder Value 1: Linear encoder	- - - -	UINT16 R/- - -	Modbus 3334 PROFINET 3334
_M_HoldingBrake	Holding brake identification Value 0: Motor without holding brake Value 1: Motor with holding brake	- - - -	UINT16 R/- - -	Modbus 3392 PROFINET 3392
_M_I_0	Continuous stall current of motor In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 3366 PROFINET 3366
_M_I_max	Maximum current of motor In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 3340 PROFINET 3340
_M_I_nom	Nominal current of motor In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- - -	Modbus 3342 PROFINET 3342
_M_I2t	Maximum permissible time for maximum current of motor	ms - - -	UINT16 R/- - -	Modbus 3362 PROFINET 3362
_M_Jrot	Moment of inertia of motor Units: Rotary motors: kgcm ² Linear motors: kg In increments of 0.001 motor_f.	motor_f - - -	UINT32 R/- - -	Modbus 3352 PROFINET 3352

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 min-1. Units: Rotary motors: Vrms/min-1 Linear motors: Vrms/(m/s) In increments of 0.1 motor_u.	motor_u - - -	UINT32 R/- - -	Modbus 3350 PROFINET 3350
_M_L_d	Inductance d component of motor In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	Modbus 3358 PROFINET 3358
_M_L_q	Inductance q component of motor In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	Modbus 3356 PROFINET 3356
_M_load	Load of motor	% - - -	INT16 R/- - -	Modbus 7220 PROFINET 7220
_M_M_0	Continuous stall torque of motor A value of 100 % in operating mode Profile Torque corresponds to this parameter. Units: Rotary motors: Ncm Linear motors: N	motor_m - - -	UINT16 R/- - -	Modbus 3372 PROFINET 3372
_M_M_max	Maximum torque of motor In increments of 0.1 Nm.	Nm - - -	UINT16 R/- - -	Modbus 3346 PROFINET 3346
_M_M_nom	Nominal torque/force of motor Units: Rotary motors: Ncm Linear motors: N	motor_m - - -	UINT16 R/- - -	Modbus 3344 PROFINET 3344
_M_maxoverload	Maximum value of overload of motor Maximum overload of motor during the last 10 seconds.	% - - -	INT16 R/- - -	Modbus 7222 PROFINET 7222
_M_n_max	Maximum permissible speed of rotation/velocity of motor Units: Rotary motors: min-1 Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	Modbus 3336 PROFINET 3336
_M_n_nom	Nominal speed of rotation/velocity of motor Units: Rotary motors: min-1 Linear motors: mm/s	motor_v - - -	UINT16 R/- - -	Modbus 3338 PROFINET 3338
_M_overload	Overload of motor (I2t)	% - - -	INT16 R/- - -	Modbus 7218 PROFINET 7218
_M_Polepair	Number of pole pairs of motor	- - - -	UINT16 R/- - -	Modbus 3368 PROFINET 3368
_M_PolePairPitch	Pole pair pitch of motor In increments of 0.01 mm.	mm - - -	UINT16 R/- - -	Modbus 3398 PROFINET 3398

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_M_R_UV	Winding resistance of motor In increments of 0.01 Ω .	Ω - - -	UINT16 R/- - -	Modbus 3354 PROFINET 3354
_M_T_max	Maximum temperature of motor	$^{\circ}\text{C}$ - - -	INT16 R/- - -	Modbus 3360 PROFINET 3360
_M_Type	Motor type Value 0: No motor selected Value >0: Connected motor type	- - - -	UINT32 R/- - -	Modbus 3332 PROFINET 3332
_M_U_max	Maximum voltage of motor In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 3378 PROFINET 3378
_M_U_nom	Nominal voltage of motor In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 3348 PROFINET 3348
_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/- - -	Modbus 6962 PROFINET 6962
_ModeErrorInfo	Additional error information of a detected ModeError (ME bit) Drive Profile Lexium: Indicates the parameter of the mapping that caused the ME bit to be set. The ME bit is set if MT-dependent parameters of the active mapping cause an error in connection with a write command. Example: 1 = First mapped parameter 2 = Second mapped parameter etc.	- - - -	UINT16 R/- - -	Modbus 6968 PROFINET 6968
_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 / EtherNet/IP: Fieldbus EtherNet/IP 530 / EtherCAT: Fieldbus EtherCAT 531 / SercosII: Fieldbus Sercos II 532 / PROFINET: Fieldbus PROFINET 533 / SercosIII: Fieldbus Sercos III	- - - -	UINT16 R/- - -	Modbus 574 PROFINET 574
_n_act	Actual speed of rotation	rpm - - -	INT16 R/- - -	Modbus 7696 PROFINET 7696

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_n_act_ENC1	Actual speed of rotation of encoder 1	rpm - - -	INT16 R/- - -	Modbus 7760 PROFINET 7760
_n_ref	Reference speed of rotation	rpm - - -	INT16 R/- - -	Modbus 7694 PROFINET 7694
_OpHours	Operating hours counter	s - - -	UINT32 R/- - -	Modbus 7188 PROFINET 7188
_p_absENC	Absolute position with reference to the encoder range This value corresponds to the modulo position of the absolute encoder range. The value is no longer valid if the gear ratio of machine encoder and motor encoder is changed. A restart is required in such a case.	usr_p - - -	UINT32 R/- - -	Modbus 7710 PROFINET 7710
_p_absmodulo	Absolute position with reference to internal resolution in internal units This value is based on encoder raw position with reference to internal resolution (131072 Inc).	Inc - - -	UINT32 R/- - -	Modbus 7708 PROFINET 7708
_p_act	Actual position	usr_p - - -	INT32 R/- - -	Modbus 7706 PROFINET 7706
_p_act_ENC1	Actual position of encoder 1	usr_p - - -	INT32 R/- - -	Modbus 7758 PROFINET 7758
_p_act_ENC1_int	Actual position of encoder 1 in internal units	Inc - - -	INT32 R/- - -	Modbus 7756 PROFINET 7756
_p_act_int	Actual position in internal units	Inc - - -	INT32 R/- - -	Modbus 7700 PROFINET 7700
_p_dif	Position deviation including dynamic position deviation Position deviation is the difference between reference position and actual position. The position deviation consists of the load-dependent position deviation and the dynamic position deviation. The parameter _p_dif_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	Modbus 7716 PROFINET 7716

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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/- - -	Modbus 7736 PROFINET 7736
_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. Changed settings become active immediately.	revolution 0.0000 - 429496.7295	UINT32 R/W - -	Modbus 7734 PROFINET 7734
_p_dif_load_peak_usr	Maximum value of the load-dependent position deviation This parameter contains the maximum load-dependent position deviation reached so far. A write access resets this value. Changed settings become active immediately.	usr_p 0 - 2147483647	INT32 R/W - -	Modbus 7722 PROFINET 7722
_p_dif_load_usr	Load-dependent position deviation between reference and actual positions The load-dependent position deviation is the difference between the reference position and the actual position caused by the load. This value is used for following error monitoring.	usr_p -2147483648 - 2147483647	INT32 R/- - -	Modbus 7724 PROFINET 7724
_p_dif_usr	Position deviation including dynamic position deviation Position deviation is the difference between reference position and actual position. The position deviation consists of the load-dependent position deviation and the dynamic position deviation.	usr_p -2147483648 - 2147483647	INT32 R/- - -	Modbus 7720 PROFINET 7720
_p_ref	Reference position Value corresponds to the reference position of the position controller.	usr_p - - -	INT32 R/- - -	Modbus 7704 PROFINET 7704
_p_ref_int	Reference position in internal units Value corresponds to the reference position of the position controller.	Inc - - -	INT32 R/- - -	Modbus 7698 PROFINET 7698
_PAR_ScalingError	Additional information on error detected during recalculation Coding: Bits 0 ... 15: Address of the parameter that caused the error Bits 16 ... 31: Reserved Changed settings become active immediately.	- - - -	UINT32 R/- - -	Modbus 1068 PROFINET 1068

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_PAR_ScalingState	Status of recalculation of the parameters with user-defined units 0 / Recalculation Active: Recalculation active 1 / Reserved (1): Reserved 2 / Recalculation Finished - No Error: Recalculation finished, no error 3 / Error During Recalculation: Error during recalculation 4 / Initialization Successful: Initialization successful 5 / Reserved (5): Reserved 6 / Reserved (6): Reserved 7 / Reserved (7): Reserved Status of recalculation of the parameters with user-defined units which are recalculated with a changed scaling factor. Changed settings become active immediately.	- 0 2 7	UINT16 R/- - -	Modbus 1066 PROFINET 1066
_PntMAC1	MAC address PROFINET module, byte 1	- - - -	UINT16 R/- - -	Modbus 18506 PROFINET 18506
_PntMAC2	MAC address PROFINET module, byte 2	- - - -	UINT16 R/- - -	Modbus 18508 PROFINET 18508
_PntMAC3	MAC address PROFINET module, byte 3	- - - -	UINT16 R/- - -	Modbus 18510 PROFINET 18510
_PntMAC4	MAC address PROFINET module, byte 4	- - - -	UINT16 R/- - -	Modbus 18512 PROFINET 18512
_PntMAC5	MAC address PROFINET module, byte 5	- - - -	UINT16 R/- - -	Modbus 18514 PROFINET 18514
_PntMAC6	MAC address PROFINET module, byte 6	- - - -	UINT16 R/- - -	Modbus 18516 PROFINET 18516
_PntProfile	PROFINET drive profile 0 / None: No connection 104 / Drive Profile Lexium 1: Drive Profile Lexium telegram 1 (library) 105 / Drive Profile Lexium 2: Drive Profile Lexium telegram 2	- - - -	UINT16 R/- - -	Modbus 18438 PROFINET 18438
_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/- - -	Modbus 2818 PROFINET 2818
_Power_act	Output power	W - - -	INT32 R/- - -	Modbus 7194 PROFINET 7194

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Power_mean	Mean output power	W - - -	UINT16 R/- - -	Modbus 7196 PROFINET 7196
_pref_acc	Acceleration of reference value for acceleration feed-forward control Sign according to the changed velocity value: Increased velocity: Positive sign Reduced velocity: Negative sign	usr_a - - -	INT32 R/- - -	Modbus 7954 PROFINET 7954
_pref_v	Velocity of reference value for velocity feed-forward control	usr_v - - -	INT32 R/- - -	Modbus 7950 PROFINET 7950
_prgNoDEV	Firmware number of device Example: PR0912.00 The value is provided as a decimal value: 91200	- - - -	UINT32 R/- - -	Modbus 258 PROFINET 258
_prgNoLOD	Firmware number of update loader Example: PR0912.00 The value is provided as a decimal value: 91200	- - - -	UINT32 R/- - -	Modbus 358 PROFINET 358
_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/- - -	Modbus 264 PROFINET 264
_prgRevLOD	Firmware revision of update loader The version format is XX.YY.ZZ. Part XX.YY is contained in parameter _prgVerLOD. Part ZZ is used for quality evolution and contained in this parameter. Example: V01.23.45 The value is provided as a decimal value: 45	- - - -	UINT16 R/- - -	Modbus 364 PROFINET 364
_prgVerDEV	Firmware version of device The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter _prgRevDEV. Example: V01.23.45 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	Modbus 260 PROFINET 260
_prgVerLOD	Firmware version of update loader The version format is XX.YY.ZZ. Part XX.YY is contained in this parameter. Part ZZ is contained in parameter _prgRevLOD. Example: V01.23.45 The value is provided as a decimal value: 123	- - - -	UINT16 R/- - -	Modbus 360 PROFINET 360

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_PS_I_max	Maximum current of power stage In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- per. -	Modbus 4100 PROFINET 4100
_PS_I_nom	Nominal current of power stage In increments of 0.01 A _{rms} .	A _{rms} - - -	UINT16 R/- per. -	Modbus 4098 PROFINET 4098
_PS_load	Load of power stage	% - - -	INT16 R/- - -	Modbus 7214 PROFINET 7214
_PS_maxoverload	Maximum value of overload of power stage Maximum overload of power stage during the last 10 seconds.	% - - -	INT16 R/- - -	Modbus 7216 PROFINET 7216
_PS_overload	Overload of power stage	% - - -	INT16 R/- - -	Modbus 7240 PROFINET 7240
_PS_overload_cte	Overload of power stage (chip temperature)	% - - -	INT16 R/- - -	Modbus 7236 PROFINET 7236
_PS_overload_I2t	Overload of power stage (I2t)	% - - -	INT16 R/- - -	Modbus 7212 PROFINET 7212
_PS_overload_psq	Overload of power stage (power squared)	% - - -	INT16 R/- - -	Modbus 7238 PROFINET 7238
_PS_T_current	Temperature of power stage	°C - - -	INT16 R/- - -	Modbus 7200 PROFINET 7200
_PS_T_max	Maximum temperature of power stage	°C - - -	INT16 R/- per. -	Modbus 4110 PROFINET 4110
_PS_T_warn	Maximum temperature of power stage (error class 0)	°C - - -	INT16 R/- per. -	Modbus 4108 PROFINET 4108
_PS_U_maxDC	Maximum permissible DC bus voltage In increments of 0.1 V.	V - - -	UINT16 R/- per. -	Modbus 4102 PROFINET 4102
_PS_U_minDC	Minimum permissible DC bus voltage In increments of 0.1 V.	V - - -	UINT16 R/- per. -	Modbus 4104 PROFINET 4104
_PS_U_minStopDC	DC bus voltage low threshold for Quick Stop If the threshold is reached, the drive performs a Quick Stop. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	Modbus 4116 PROFINET 4116

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_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/- - -	Modbus 7228 PROFINET 7228
_RAMP_p_act	Actual position of profile generator	usr_p - - -	INT32 R/- - -	Modbus 7940 PROFINET 7940
_RAMP_p_target	Target position of profile generator Absolute position value of the profile generator, calculated on the basis of the relative and absolute position values received.	usr_p - - -	INT32 R/- - -	Modbus 7938 PROFINET 7938
_RAMP_v_act	Actual velocity of profile generator	usr_v - - -	INT32 R/- - -	Modbus 7948 PROFINET 7948
_RAMP_v_target	Target velocity of profile generator	usr_v - - -	INT32 R/- - -	Modbus 7946 PROFINET 7946
_RES_load	Load of braking resistor The braking resistor set via parameter RESInt_ext is monitored.	% - - -	INT16 R/- - -	Modbus 7208 PROFINET 7208
_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/- - -	Modbus 7210 PROFINET 7210
_RES_overload	Overload of braking resistor (I2t) The braking resistor set via parameter RESInt_ext is monitored.	% - - -	INT16 R/- - -	Modbus 7206 PROFINET 7206
_RESInt_P	Nominal power of internal braking resistor	W - - -	UINT16 R/- per. -	Modbus 4114 PROFINET 4114
_RESInt_R	Resistance value of internal braking resistor In increments of 0.01 Ω.	Ω - - -	UINT16 R/- per. -	Modbus 4112 PROFINET 4112
_RMAC_DetailStatus	Detailed status of relative movement after capture (RMAC) 0 / Not Activated: Not activated 1 / Waiting: Waiting for capture signal 2 / Moving: Relative movement after capture running 3 / Interrupted: Relative movement after capture interrupted 4 / Finished: Relative movement after capture terminated	- - - -	UINT16 R/- - -	Modbus 8996 PROFINET 8996
_RMAC_Status	Status of relative movement after capture 0 / Not Active: Not active 1 / Active Or Finished: Relative movement after capture is active or finished	- 0 - 1	UINT16 R/- - -	Modbus 8994 PROFINET 8994
_ScalePOSmax	Maximum user-defined value for positions This value depends on ScalePOSdenom and ScalePOSnum.	usr_p - - -	INT32 R/- - -	Modbus 7956 PROFINET 7956

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/- - -	Modbus 7960 PROFINET 7960
_ScaleVELmax	Maximum user-defined value for velocity This value depends on ScaleVELdenom and ScaleVELnum.	usr_v - - -	INT32 R/- - -	Modbus 7958 PROFINET 7958
_SigActive	Status of monitoring signals See _SigLatched for more details on the bit codes.	- - - -	UINT32 R/- - -	Modbus 7182 PROFINET 7182
_SigLatched	Saved status of monitoring signals Bit assignments: Bit 0: General error Bit 1: Hardware limit switches (LIMP/LIMN/REF) Bit 2: Out of range (software limit switches, tuning) Bit 3: Quick Stop via fieldbus Bit 4: Error in active operating mode Bit 5: Commissioning interface (RS485) Bit 6: Integrated fieldbus Bit 7: Reserved Bit 8: Following error Bit 9: Reserved Bit 10: Inputs STO are 0 Bit 11: Inputs STO different Bit 12: Reserved Bit 13: DC bus voltage low Bit 14: DC bus voltage high Bit 15: Mains phase missing Bit 16: Integrated encoder interface Bit 17: Overtemperature motor Bit 18: Overtemperature power stage Bit 19: Reserved Bit 20: Memory card Bit 21: Fieldbus module Bit 22: Encoder module Bit 23: Safety module eSM or module IOM1 Bit 24: Reserved Bit 25: Reserved Bit 26: Motor connection Bit 27: Motor overcurrent/short circuit Bit 28: Frequency of reference signal too high Bit 29: EEPROM error detected Bit 30: System start-up (hardware or parameter) Bit 31: System error detected (for example, watchdog, internal hardware interface) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	Modbus 7184 PROFINET 7184
_SuppDriveModes	Supported operating modes as per DSP402 Bit 0: Profile Position Bit 2: Profile Velocity Bit 3: Profile Torque Bit 5: Homing Bit 16: Jog Bit 21: Manual Tuning	- - - -	UINT32 R/- - -	Modbus 6952 PROFINET 6952

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_TouchProbeStat	Touch Probe status Changed settings become active immediately.	- - - -	UINT16 R/- - -	Modbus 7030 PROFINET 7030
_tq_act	Actual torque Positive value: Actual torque in positive direction of movement Negative value: Actual torque in negative direction of movement 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %.	% - - -	INT16 R/- - -	Modbus 7752 PROFINET 7752
_Ud_ref	Reference motor voltage d component In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7690 PROFINET 7690
_UDC_act	Voltage at DC bus In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 7198 PROFINET 7198
_Udq_ref	Total motor voltage (vector sum d components and q components) Square root of ($_{Uq_ref}^2 + _{Ud_ref}^2$) In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7692 PROFINET 7692
_Uq_ref	Reference motor voltage q component In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7688 PROFINET 7688
_v_act	Actual velocity	usr_v - - -	INT32 R/- - -	Modbus 7744 PROFINET 7744
_v_act_ENC1	Actual velocity of encoder 1	usr_v - - -	INT32 R/- - -	Modbus 7762 PROFINET 7762
_v_dif_usr	Current load-dependent velocity deviation The load-dependent velocity deviation is the difference between reference velocity and actual velocity.	usr_v -2147483648 - 2147483647	INT32 R/- - -	Modbus 7768 PROFINET 7768
_v_ref	Reference velocity	usr_v - - -	INT32 R/- - -	Modbus 7742 PROFINET 7742
_Vmax_act	Currently effective velocity limitation Value of the currently effective velocity limitation. This is one of the following values (whichever is lowest): - CTRL_v_max - M_n_max (only if motor is connected) - Velocity limitation via digital input	usr_v - - -	UINT32 R/- - -	Modbus 7250 PROFINET 7250
_VoltUtil	Degree of utilization of DC bus voltage With a value of 100%, the drive operates at the voltage limit.	% - - -	INT16 R/- - -	Modbus 7718 PROFINET 7718
_WarnActive	Active errors of error class 0, bit-coded See parameter _WarnLatched for more details on the bits.	- - - -	UINT32 R/- - -	Modbus 7190 PROFINET 7190

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_WarnLatched	<p>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.</p> <p>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 Bit 24 ... 28: Reserved Bit 29: Braking resistor overload (I^2t) Bit 30: Power stage overload (I^2t) Bit 31: Motor overload (I^2t)</p> <p>Monitoring functions are product-dependent.</p>	- - - -	UINT32 R/- - -	Modbus 7192 PROFINET 7192
AbsHomeRequest	<p>Absolute positioning only after homing 0 / No: No 1 / Yes: Yes This parameter has no function if the parameter 'PP_ModeRangeLim' is set to '1' which allows overtraveling of the movement range (ref_ok is set to 0 when the range is overtraveled). Changed settings become active immediately.</p>	- 0 1 1	UINT16 R/W per. -	Modbus 1580 PROFINET 1580
AccessLock	<p>Locking other access channels Value 0: Allow control via other access channels Value 1: Lock control via other access channels</p> <p>Example: The access channel is used by the fieldbus. In this case, control via the commissioning software or the HMI is not possible.</p> <p>The access channel can only be locked after the currently active operating mode has terminated. Changed settings become active immediately.</p>	- 0 0 1	UINT16 R/W - -	Modbus 284 PROFINET 284

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 Changed settings become active the next time the motor moves.	- 1 1 6	UINT16 R/W - -	Modbus 12040 PROFINET 12040
AT_dis	Movement range for Autotuning Movement range within which the control parameters are automatically optimized. The movement range is entered with reference to the actual position. In the case of "Movement in one direction only" (Parameter AT_dir), the specified movement range is used for each optimization step. The movement typically corresponds to 20 times the value, but it is not limited. The parameter AT_dis_usr allows you to enter the value in user-defined units. In increments of 0.1 revolution. Changed settings become active the next time the motor moves.	revolution 1.0 2.0 999.9	UINT32 R/W - -	Modbus 12038 PROFINET 12038
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. Changed settings become active the next time the motor moves.	usr_p 1 32768 2147483647	INT32 R/W - -	Modbus 12068 PROFINET 12068
AT_mechanical	Type of coupling of the system 1 / Direct Coupling: Direct coupling 2 / Belt Axis: Belt axis 3 / Spindle Axis: Spindle axis Changed settings become active the next time the motor moves.	- 1 2 3	UINT16 R/W - -	Modbus 12060 PROFINET 12060
AT_n_ref	Velocity jump for Autotuning The parameter AT_v_ref allows you to enter the value in user-defined units. Changed settings become active the next time the motor moves.	rpm 10 100 1000	UINT32 R/W - -	Modbus 12044 PROFINET 12044

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AT_start	Autotuning start Value 0: Terminate Value 1: Activate EasyTuning Value 2: Activate ComfortTuning Changed settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 12034 PROFINET 12034
AT_v_ref	Velocity jump for Autotuning The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active the next time the motor moves.	usr_v 1 100 2147483647	INT32 R/W - -	Modbus 12070 PROFINET 12070
AT_wait	Waiting time between Autotuning steps Changed settings become active the next time the motor moves.	ms 300 500 10000	UINT16 R/W - -	Modbus 12050 PROFINET 12050
BLSH_Mode	Processing mode of backlash compensation 0 / Off: Backlash compensation is off 1 / OnAfterPositiveMovement: Backlash compensation is on, last movement was in positive direction 2 / OnAfterNegativeMovement: Backlash compensation is on, last movement was in negative direction Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 1666 PROFINET 1666
BLSH_Position	Position value for backlash compensation Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 1668 PROFINET 1668
BLSH_Time	Processing time for backlash compensation Value 0: Immediate backlash compensation Value >0: Processing time for backlash compensation Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1672 PROFINET 1672
BRK_AddT_apply	Additional time delay for applying the holding brake The overall time delay for applying the holding brake is the time delay from the electronic nameplate of the motor and the additional time delay in this parameter. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 0 0 1000	INT16 R/W per. -	Modbus 1296 PROFINET 1296
BRK_AddT_release	Additional time delay for releasing the holding brake The overall time delay for releasing the holding brake is the time delay from the electronic nameplate of the motor and the additional time delay in this parameter. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 0 0 400	INT16 R/W per. -	Modbus 1294 PROFINET 1294

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
BRK_release	<p>Manual operation of the holding brake</p> <p>0 / Automatic: Automatic processing</p> <p>1 / Manual Release: Manual release of holding brake</p> <p>2 / Manual Application: Manual applying of holding brake</p> <p>You can apply or release the holding brake manually.</p> <p>The holding brake can only be manually released in the operating states 'Switch On Disabled', 'Ready To Switch On' or 'Fault'.</p> <p>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. Changed settings become active immediately.</p>	- 0 0 2	UINT16 R/W - -	Modbus 2068 PROFINET 2068
Cap1Activate	<p>Capture input 1 start/stop</p> <p>0 / Capture Stop: Cancel capture function</p> <p>1 / Capture Once: Start one-time capture</p> <p>2 / Capture Continuous: Start continuous capture</p> <p>In the case of one-time capture, the function is terminated when the first value is captured.</p> <p>In the case of continuous capture, the function continues to run.</p> <p>Changed settings become active immediately.</p>	- 0 - 4	UINT16 R/W - -	Modbus 2568 PROFINET 2568
Cap1Config	<p>Capture input 1 configuration</p> <p>0 / Falling Edge: Position capture at falling edge</p> <p>1 / Rising Edge: Position capture at rising edge</p> <p>2 / Both Edges: Position capture at both edges</p> <p>Changed settings become active immediately.</p>	- 0 0 2	UINT16 R/W - -	Modbus 2564 PROFINET 2564
Cap1Source	<p>Capture input 1 encoder source</p> <p>0 / Pact Encoder 1: Source for capture input 1 is Pact of encoder 1</p> <p>Changed settings become active immediately.</p>	- 0 0 0	UINT16 R/W - -	Modbus 2580 PROFINET 2580
Cap2Activate	<p>Capture input 2 start/stop</p> <p>0 / Capture Stop: Cancel capture function</p> <p>1 / Capture Once: Start one-time capture</p> <p>2 / Capture Continuous: Start continuous capture</p> <p>In the case of one-time capture, the function is terminated when the first value is captured.</p> <p>In the case of continuous capture, the function continues to run.</p> <p>Changed settings become active immediately.</p>	- 0 - 4	UINT16 R/W - -	Modbus 2570 PROFINET 2570

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 Changed settings become active immediately.	- 0 0 2	UINT16 R/W - -	Modbus 2566 PROFINET 2566
Cap2Source	Capture input 2 encoder source 0 / Pact Encoder 1: Source for capture input 2 is Pact of encoder 1 Changed settings become active immediately.	- 0 0 0	UINT16 R/W - -	Modbus 2582 PROFINET 2582
CLSET_p_DiffWin	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The parameter CLSET_p_DiffWin_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Changed settings become active immediately.	revolution 0.0000 0.0100 2.0000	UINT16 R/W per. -	Modbus 4408 PROFINET 4408
CLSET_p_DiffWin_usr	Position deviation for control loop parameter set switching If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used. The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active immediately.	usr_p 0 164 2147483647	INT32 R/W per. -	Modbus 4426 PROFINET 4426

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CLSET_ParSwiCond	<p>Condition for parameter set switching</p> <p>0 / None Or Digital Input: None or digital input function selected</p> <p>1 / Inside Position Deviation: Inside position deviation (value definition in parameter CLSET_p_DiffWin)</p> <p>2 / Below Reference Velocity: Below reference velocity (value definition in parameter CLSET_v_Threshol)</p> <p>3 / Below Actual Velocity: Below actual velocity (value definition in parameter CLSET_v_Threshol)</p> <p>4 / Reserved: Reserved</p> <p>In the case of parameter set switching, the values of the following parameters are changed gradually:</p> <ul style="list-style-type: none"> - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUref - CTRL_TAUiref - CTRL_KFPp <p>The following parameters are changed immediately after the time for parameter set switching (CTRL_ParChgTime):</p> <ul style="list-style-type: none"> - CTRL_Nf1damp - CTRL_Nf1freq - CTRL_Nf1bandw - CTRL_Nf2damp - CTRL_Nf2freq - CTRL_Nf2bandw - CTRL_Osupdamp - CTRL_Osupdelay - CTRL_Kfric <p>Changed settings become active immediately.</p>	- 0 0 4	UINT16 R/W per. -	Modbus 4404 PROFINET 4404
CLSET_v_Threshol	<p>Velocity threshold for control loop parameter set switching</p> <p>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.</p> <p>Changed settings become active immediately.</p>	usr_v 0 50 2147483647	UINT32 R/W per. -	Modbus 4410 PROFINET 4410
CLSET_winTime	<p>Time window for parameter set switching</p> <p>Value 0: Window monitoring deactivated.</p> <p>Value >0: Window time for the parameters CLSET_v_Threshol and CLSET_p_DiffWin.</p> <p>Changed settings become active immediately.</p>	ms 0 0 1000	UINT16 R/W per. -	Modbus 4406 PROFINET 4406

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_GlobGain	<p>Global gain factor (affects control loop parameter set 1) The global gain factor affects the following parameters of control loop parameter set 1:</p> <ul style="list-style-type: none"> - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUref <p>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</p> <p>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_TAUref. If CTRL_GlobGain is changed during a configuration transmission, CTRL_KPn, CTRL_TNn, CTRL_KPp and CTRL_TAUref must also be part of the configuration. In increments of 0.1 %. Changed settings become active immediately.</p>	% 5.0 100.0 1000.0	UINT16 R/W per. -	Modbus 4394 PROFINET 4394
CTRL_I_max	<p>Current limitation During operation, the current limit is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - CTRL_I_max - _M_I_max - _PS_I_max - Current limitation via digital input <p>Limitations caused by I2t monitoring are also taken into account.</p> <p>Default: _PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of 0.01 A_{rms}. Changed settings become active immediately.</p>	A _{rms} 0.00 - 463.00	UINT16 R/W per. -	Modbus 4376 PROFINET 4376
CTRL_I_max_fw	<p>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).</p> <p>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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.</p>	A _{rms} 0.00 0.00 300.00	UINT16 R/W per. expert	Modbus 4382 PROFINET 4382
CTRL_KFAcc	<p>Acceleration feed-forward control In increments of 0.1 %. Changed settings become active immediately.</p>	% 0.0 0.0 3000.0	UINT16 R/W per. expert	Modbus 4372 PROFINET 4372

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_ParChgTime	<p>Period of time for control loop parameter set switching</p> <p>In the case of control loop parameter set switching, the values of the following parameters are changed gradually:</p> <ul style="list-style-type: none"> - CTRL_KPn - CTRL_TNn - CTRL_KPp - CTRL_TAUref - CTRL_TAUiref - CTRL_KFPp <p>Such a switching can be caused by</p> <ul style="list-style-type: none"> - change of the active control loop parameter set - change of the global gain - change of any of the parameters listed above - deactivating the integral term of the velocity controller <p>Changed settings become active immediately.</p>	ms 0 0 2000	UINT16 R/W per. -	Modbus 4392 PROFINET 4392
CTRL_ParSetCopy	<p>Control loop parameter set copying</p> <p>Value 1: Copy control loop parameter set 1 to set 2</p> <p>Value 2: Copy control loop parameter set 2 to set 1</p> <p>If control loop parameter set 2 is copied to control loop parameter set 1, the parameter CTRL_GlobGain is set to 100%. Changed settings become active immediately.</p>	- 0.0 - 0.2	UINT16 R/W - -	Modbus 4396 PROFINET 4396
CTRL_PwrUpParSet	<p>Selection of control loop parameter set at power up</p> <p>0 / Switching Condition: The switching condition is used for control loop parameter set switching</p> <p>1 / Parameter Set 1: Control loop parameter set 1 is used</p> <p>2 / Parameter Set 2: Control loop parameter set 2 is used</p> <p>The selected value is also written to CTRL_SelParSet (non-persistent). Changed settings become active immediately.</p>	- 0 1 2	UINT16 R/W per. -	Modbus 4400 PROFINET 4400
CTRL_SelParSet	<p>Selection of control loop parameter set (non-persistent)</p> <p>Coding see parameter: CTRL_PwrUpParSet</p> <p>Changed settings become active immediately.</p>	- 0 1 2	UINT16 R/W - -	Modbus 4402 PROFINET 4402
CTRL_SmoothCurrent	<p>Smoothing factor for current controller</p> <p>This parameter decreases the dynamics of the current control loop.</p> <p>Changed settings become active immediately.</p>	% 50 100 100	UINT16 R/W per. -	Modbus 4428 PROFINET 4428
CTRL_SpdFric	<p>Speed of rotation up to which the friction compensation is linear</p> <p>Changed settings become active immediately.</p>	rpm 0 5 20	UINT32 R/W per. expert	Modbus 4370 PROFINET 4370

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_TAUact	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. Changed settings become active immediately.	ms 0.00 - 30.00	UINT16 R/W per. expert	Modbus 4368 PROFINET 4368
CTRL_v_max	Velocity limitation During operation, the velocity limit is one of the following values (whichever is lowest): - CTRL_v_max - M_n_max - Velocity limitation via digital input Changed settings become active immediately.	usr_v 1 13200 2147483647	UINT32 R/W per. -	Modbus 4384 PROFINET 4384
CTRL_VelObsActiv	Activation of velocity observer 0 / Velocity Observer Off: Velocity observer is off 1 / Velocity Observer Passive: Velocity observer is on, but not used for motor control 2 / Velocity Observer Active: Velocity observer is on and used for motor control Velocity observer control reduces velocity ripple and enhances controller bandwidth. Set the correct dynamics and inertia values before activation. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. expert	Modbus 4420 PROFINET 4420
CTRL_VelObsDyn	Dynamics of velocity observer The value of this parameter must be less than (for example, between 5 % and 20 %) the integral action time of the velocity controller (parameter CTRL1_TNn und CTRL2_TNn). In increments of 0.01 ms. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	ms 0.03 0.25 200.00	UINT16 R/W per. expert	Modbus 4422 PROFINET 4422
CTRL_VelObsInert	Inertia value for velocity observer System inertia that is used for velocity observer calculations. The default value is the inertia of the mounted motor. In the case of autotuning, the value of this parameter can be set equal to that of _AT_J. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	g cm ² 1 - 2147483648	UINT32 R/W per. expert	Modbus 4424 PROFINET 4424
CTRL_vPIDDPart	PID velocity controller: D gain In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 400.0	UINT16 R/W per. expert	Modbus 4364 PROFINET 4364
CTRL_vPIDDTime	PID velocity controller: Time constant of D term smoothing filter In increments of 0.01 ms. Changed settings become active immediately.	ms 0.01 0.25 10.00	UINT16 R/W per. expert	Modbus 4362 PROFINET 4362

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	Modbus 4620 PROFINET 4620
CTRL1_Kfric	Friction compensation: Gain In increments of 0.01 A _{rms} . Changed settings become active immediately.	A _{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	Modbus 4640 PROFINET 4640
CTRL1_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4610 PROFINET 4610
CTRL1_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4614 PROFINET 4614
CTRL1_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4628 PROFINET 4628
CTRL1_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4624 PROFINET 4624
CTRL1_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4626 PROFINET 4626
CTRL1_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: 1 - Fb/F0 In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4634 PROFINET 4634
CTRL1_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4630 PROFINET 4630
CTRL1_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4632 PROFINET 4632

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL1_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	Modbus 4636 PROFINET 4636
CTRL1_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	Modbus 4638 PROFINET 4638
CTRL1_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	Modbus 4618 PROFINET 4618
CTRL1_TAUvref	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. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4616 PROFINET 4616
CTRL1_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4612 PROFINET 4612
CTRL2_KFPp	Velocity feed-forward control In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 200.0	UINT16 R/W per. -	Modbus 4876 PROFINET 4876
CTRL2_Kfrie	Friction compensation: Gain In increments of 0.01 A _{rms} . Changed settings become active immediately.	A _{rms} 0.00 0.00 10.00	UINT16 R/W per. expert	Modbus 4896 PROFINET 4896
CTRL2_KPn	Velocity controller P gain The default value is calculated on the basis of the motor parameters. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.0001 A/rpm. Changed settings become active immediately.	A/rpm 0.0001 - 2.5400	UINT16 R/W per. -	Modbus 4866 PROFINET 4866

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_KPp	Position controller P gain The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.1 1/s. Changed settings become active immediately.	1/s 2.0 - 900.0	UINT16 R/W per. -	Modbus 4870 PROFINET 4870
CTRL2_Nf1bandw	Notch filter 1: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4884 PROFINET 4884
CTRL2_Nf1damp	Notch filter 1: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4880 PROFINET 4880
CTRL2_Nf1freq	Notch filter 1: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4882 PROFINET 4882
CTRL2_Nf2bandw	Notch filter 2: Bandwidth Definition of bandwidth: $1 - F_b/F_0$ In increments of 0.1 %. Changed settings become active immediately.	% 1.0 70.0 90.0	UINT16 R/W per. expert	Modbus 4890 PROFINET 4890
CTRL2_Nf2damp	Notch filter 2: Damping In increments of 0.1 %. Changed settings become active immediately.	% 55.0 90.0 99.0	UINT16 R/W per. expert	Modbus 4886 PROFINET 4886
CTRL2_Nf2freq	Notch filter 2: Frequency The filter is deactivated at a value of 15000. In increments of 0.1 Hz. Changed settings become active immediately.	Hz 50.0 1500.0 1500.0	UINT16 R/W per. expert	Modbus 4888 PROFINET 4888
CTRL2_Osupdamp	Overshoot suppression filter: Damping The filter is deactivated at a value of 0. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 0.0 50.0	UINT16 R/W per. expert	Modbus 4892 PROFINET 4892
CTRL2_Osupdelay	Overshoot suppression filter: Time delay The filter is deactivated at a value of 0. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.00 75.00	UINT16 R/W per. expert	Modbus 4894 PROFINET 4894
CTRL2_TAUiref	Filter time constant of the reference current value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 0.50 4.00	UINT16 R/W per. -	Modbus 4874 PROFINET 4874

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL2_TAUnref	Filter time constant of the reference velocity value filter In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 1.81 327.67	UINT16 R/W per. -	Modbus 4872 PROFINET 4872
CTRL2_TNn	Velocity controller integral action time The default value is calculated. In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter CTRL_ParChgTime. In increments of 0.01 ms. Changed settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4868 PROFINET 4868
DCOMcontrol	DriveCom control word See chapter Operation, Operating States, for bit assignment information. Bit 0: Operating state Switch On Bit 1: Enable Voltage Bit 2: Operating state Quick Stop Bit 3: Enable Operation Bits 4 ... 6: Operating mode-specific Bit 7: Fault Reset Bit 8: Halt Bit 9: Operating mode-specific Bits 10 ... 15: Reserved (must be 0) Changed settings become active immediately.	- - - -	UINT16 R/W - -	Modbus 6914 PROFINET 6914
DCOMopmode	Operating mode -6 / Manual Tuning / Autotuning: Manual Tuning or Autotuning -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 Changed settings become active immediately.	- -6 - 10	INT16 R/W - -	Modbus 6918 PROFINET 6918
DevNameExtAddr	Value for device name extension (PROFINET) PROFINET: The device name extension can be set with this parameter if the DIP switches are set to 0. Changed settings become active the next time the product is powered on.	- 0 0 65535	UINT16 R/W per. -	Modbus 15906 PROFINET 15906

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 changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2112 PROFINET 2112
DI_1_Debounce	Debounce time of DI1 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2114 PROFINET 2114
DI_2_Debounce	Debounce time of DI2 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2116 PROFINET 2116
DI_3_Debounce	Debounce time of DI3 0 / No: No software debouncing 1 / 0.25 ms: 0.25 ms 2 / 0.50 ms: 0.50 ms 3 / 0.75 ms: 0.75 ms 4 / 1.00 ms: 1.00 ms 5 / 1.25 ms: 1.25 ms 6 / 1.50 ms: 1.50 ms Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 6 6	UINT16 R/W per. -	Modbus 2118 PROFINET 2118
DPL_Activate	Activation of Drive Profile Lexium Value 0: Deactivate Drive Profile Lexium Value 1: Activate Drive Profile Lexium The access channel via which the drive profile has been activated is the only access channel that can use the drive profile. Changed settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 6928 PROFINET 6928
DPL_dmControl	Drive Profile Lexium dmControl	- - - -	UINT16 R/W - -	Modbus 6974 PROFINET 6974

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DPL_intLim	Setting for bit 9 of _DPL_motionStat and _actionStatus 0 / None: None 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 Changed settings become active immediately.	- 0 11 11	UINT16 R/W per. -	Modbus 7018 PROFINET 7018
DPL_RefA16	Drive Profile Lexium RefA16	- - - -	INT16 R/W - -	Modbus 6980 PROFINET 6980
DPL_RefB32	Drive Profile Lexium RefB32	- - - -	INT32 R/W - -	Modbus 6978 PROFINET 6978
DplParChCheckDataTyp	Drive Profile Lexium: Data type verification for write access 0 / Data Type Verification Off: Data type verification for write access is off 1 / Data Type Verification On: Data type verification for write access is on Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1394 PROFINET 1394
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 changed if power stage is disabled. Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 6950 PROFINET 6950

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DS402intLim	DS402 status word: Setting for bit 11 (internal limit) 0 / None: None 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 Changed settings become active immediately.	- 0 0 11	UINT16 R/W per. -	Modbus 6972 PROFINET 6972
DSM_ShutDownOption	Behavior for disabling the power stage during movement 0 / Disable Immediately: Disable power stage immediately 1 / Disable After Halt: Disable power stage after deceleration to standstill This parameter specifies the response to a power stage disable request. Halt is used for deceleration to standstill. Changed settings become active immediately.	- 0 0 1	INT16 R/W per. -	Modbus 1684 PROFINET 1684

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC1_adjustment	<p>Adjustment of absolute position of encoder 1</p> <p>The value range depends on the encoder type.</p> <p>Singleturn encoder: 0 ... x-1</p> <p>Multiturn encoder: 0 ... (4096*x)-1</p> <p>Singleturn encoder (shifted with parameter ShiftEncWorkRang): -(x/2) ... (x/2)-1</p> <p>Multiturn encoder (shifted with parameter ShiftEncWorkRang): -(2048*x) ... (2048*x)-1</p> <p>Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling.</p> <p>If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted.</p> <p>After the write access, a wait time of at least 1 second is required before the drive can be powered off.</p> <p>Changed settings become active the next time the product is powered on.</p>	usr_p - - -	INT32 R/W - -	Modbus 1324 PROFINET 1324
ERR_clear	<p>Clear error memory</p> <p>Value 1: Delete entries in the error memory</p> <p>The clearing process is completed if a 0 is returned after a read access.</p> <p>Changed settings become active immediately.</p>	- 0 - 1	UINT16 R/W - -	Modbus 15112 PROFINET 15112
ERR_reset	<p>Reset error memory read pointer</p> <p>Value 1: Set error memory read pointer to oldest error entry.</p> <p>Changed settings become active immediately.</p>	- 0 - 1	UINT16 R/W - -	Modbus 15114 PROFINET 15114
ErrorResp_bit_DE	<p>Error response to detected data error (DE bit)</p> <p>-1 / No Error Response: No error response</p> <p>0 / Error Class 0: Error class 0</p> <p>1 / Error Class 1: Error class 1</p> <p>2 / Error Class 2: Error class 2</p> <p>3 / Error Class 3: Error class 3</p> <p>For the Drive Profile Lexium, the error response to a detected data error (DE bit) can be parameterized.</p> <p>For EtherCAT RxPDO data error handling, this parameter is also used to classify the error response.</p>	- -1 -1 3	INT16 R/W per. -	Modbus 6924 PROFINET 6924

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ErrorResp_bit_ME	Error response to detected mode error (ME bit) -1 / No Error Response: No error response 0 / Error Class 0: Error class 0 1 / Error Class 1: Error class 1 2 / Error Class 2: Error class 2 3 / Error Class 3: Error class 3 For the Drive Profile Lexium, the error response to a detected mode error (ME bit) can be parameterized.	- -1 -1 3	INT16 R/W per. -	Modbus 6926 PROFINET 6926
ErrorResp_Flt_AC	Error response to missing mains phase 0 / Error Class 0: Error Class 0 1 / Error Class 1: Error class 1 2 / Error Class 2: Error class 2 3 / Error Class 3: Error class 3 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 2 3	UINT16 R/W per. -	Modbus 1300 PROFINET 1300
ErrorResp_I2tRES	Error response to 100% I2t braking resistor 0 / Error Class 0: Error class 0 1 / Error Class 1: Error class 1 2 / Error Class 2: Error class 2 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1348 PROFINET 1348
ErrorResp_p_diff	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	Modbus 1302 PROFINET 1302
ErrorResp_QuasiAbs	Error response to detected error with quasi absolute position 3 / Error Class 3: Error class 3 4 / Error Class 4: Error class 4 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 3 3 4	UINT16 R/W per. -	Modbus 1396 PROFINET 1396
ErrorResp_v_diff	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 changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	Modbus 1400 PROFINET 1400
FieldbusSelection	Fieldbus selection 1 / Reserved: Reserved 2 / PROFINET: PROFINET The fieldbus can be selected with this parameter if the DIP switches are set to 0. Changed settings become active the next time the product is powered on. 3...7 / Reserved: Reserved	- 1 1 7	UINT16 R/W per. -	Modbus 15912 PROFINET 15912

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. Changed settings become active the next time the motor moves.	usr_p 1 200 2147483647	INT32 R/W per. -	Modbus 10254 PROFINET 10254
HMmethod	Homing method 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting Abbreviations: REF+: Search movement in pos. direction REF-: Search movement in neg. direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Changed settings become active immediately.	- 1 18 35	INT16 R/W - -	Modbus 6936 PROFINET 6936
HMoutdis	Maximum distance for search for switching point 0: Monitoring of distance inactive >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Changed settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 10252 PROFINET 10252
HMp_home	Position at reference point After a successful reference movement, this position is automatically set at the reference point. Changed settings become active the next time the motor moves.	usr_p -2147483648 0 2147483647	INT32 R/W per. -	Modbus 10262 PROFINET 10262

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. Changed settings become active immediately.	usr_p - 0 -	INT32 R/W - -	Modbus 6956 PROFINET 6956
HMprefmethod	Preferred homing method Changed settings become active immediately.	- 1 18 35	INT16 R/W per. -	Modbus 10260 PROFINET 10260
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. Changed settings become active the next time the motor moves.	usr_p 0 0 2147483647	INT32 R/W per. -	Modbus 10266 PROFINET 10266
HMv	Target velocity for searching the switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 1 60 2147483647	UINT32 R/W per. -	Modbus 10248 PROFINET 10248
HMv_out	Target velocity for moving away from switch The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 1 6 2147483647	UINT32 R/W per. -	Modbus 10250 PROFINET 10250
InvertDirOfMove	Inversion of direction of movement 0 / Inversion Off: Inversion of direction of movement is off 1 / Inversion On: Inversion of direction of movement is on The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa. Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	Modbus 1560 PROFINET 1560
IO_AutoEnable	Enabling the power stage at PowerOn 0 / RisingEdge: A rising edge with the signal input function "Enable" enables the power stage 1 / HighLevel: An active signal input with signal input function "Enable" enables the power stage 2 / AutoOn: The power stage is automatically enabled Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1292 PROFINET 1292
IO_AutoEnaConfig	Enabling the power stage as set via IO_AutoEnable even after error 0 / Off: Setting in parameter IO_AutoEnable is only used after start-up 1 / On: Setting in parameter IO_AutoEnable is used after start-up and after detected error Changed settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	Modbus 1288 PROFINET 1288

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IO_DQ_set	Setting the digital outputs directly Digital outputs can only be set directly if the signal output function has been set to 'Available as required'. Bit assignments: Bit 0: DQ0 Bit 1: DQ1	- - - -	UINT16 R/W - -	Modbus 2082 PROFINET 2082
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 Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1384 PROFINET 1384
IO_I_limit	Current limitation via input A current limit can be activated via a digital input. In increments of 0.01 A _{rms} . Changed settings become active immediately.	A _{rms} 0.00 0.20 300.00	UINT16 R/W per. -	Modbus 1614 PROFINET 1614
IO_JOGmethod	Selection of jog method 0 / Continuous Movement: Jog with continuous movement 1 / Step Movement: Jog with step movement Changed settings become active the next time the motor moves.	- 0 1 1	UINT16 R/W per. -	Modbus 1328 PROFINET 1328
IO_v_limit	Velocity limitation via input A velocity limitation can be activated via a digital input. In operating mode Profile Torque, the minimum velocity is internally limited to 100 min ⁻¹ . Changed settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	Modbus 1596 PROFINET 1596
IOdefaultMode	Operating mode 0 / None: None 5 / Jog: Jog Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.	- 0 5 5	UINT16 R/W per. -	Modbus 1286 PROFINET 1286

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI0	<p>Function Input DI0</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 22 40	UINT16 R/W per. -	Modbus 1794 PROFINET 1794

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI1	<p>Function Input DI1</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 23 40	UINT16 R/W per. -	Modbus 1796 PROFINET 1796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI2	<p>Function Input DI2</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 21 40	UINT16 R/W per. -	Modbus 1798 PROFINET 1798

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DI3	<p>Function Input DI3</p> <p>1 / Freely Available: Available as required</p> <p>2 / Fault Reset: Reset after error</p> <p>3 / Enable: Enables the power stage</p> <p>4 / Halt: Halt</p> <p>5 / Start Profile Positioning: Start request for movement</p> <p>6 / Current Limitation: Limits the current to parameter value</p> <p>7 / Zero Clamp: Zero clamping</p> <p>8 / Velocity Limitation: Limits the velocity to parameter value</p> <p>9 / Jog Positive: Jog: Moves in positive direction</p> <p>10 / Jog Negative: Jog: Moves in negative direction</p> <p>11 / Jog Fast/Slow: Jog: Switches between slow and fast movement</p> <p>21 / Reference Switch (REF): Reference switch</p> <p>22 / Positive Limit Switch (LIMP): Positive limit switch</p> <p>23 / Negative Limit Switch (LIMN): Negative limit switch</p> <p>24 / Switch Controller Parameter Set: Switches control loop parameter set</p> <p>28 / Velocity Controller Integral Off: Switches off velocity controller integral term</p> <p>30 / Start Signal Of RMAC: Start signal of relative movement after capture (RMAC)</p> <p>31 / Activate RMAC: Activates the relative movement after capture (RMAC)</p> <p>32 / Activate Operating Mode: Activates operating mode</p> <p>33 / Jog Positive With Enable: Jog: Enables power stage and moves in positive direction</p> <p>34 / Jog Negative With Enable: Jog: Enables power stage and moves in negative direction</p> <p>40 / Release Holding Brake: Releases the holding brake Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 1 1 40	UINT16 R/W per. -	Modbus 1800 PROFINET 1800

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DQ0	<p>Function Output DQ0</p> <p>1 / Freely Available: Available as required</p> <p>2 / No Fault: Signals operating states Ready To Switch On, Switched On and Operation Enabled</p> <p>3 / Active: Signals operating state Operation Enabled</p> <p>4 / RMAC Active Or Finished: Relative movement after capture active or finished (RMAC)</p> <p>5 / In Position Deviation Window: Position deviation is within window</p> <p>6 / In Velocity Deviation Window: Velocity deviation is within window</p> <p>7 / Velocity Below Threshold: Motor velocity below threshold</p> <p>8 / Current Below Threshold: Motor current below threshold</p> <p>9 / Halt Acknowledge: Halt acknowledgement</p> <p>13 / Motor Standstill: Motor at a standstill</p> <p>14 / Selected Error: One of the specified errors of error classes 1 ... 4 is active</p> <p>15 / Valid Reference (ref_ok): Zero point is valid (ref_ok)</p> <p>16 / Selected Warning: One of the specified errors of error class 0 is active</p> <p>18 / Position Register Channel 1: Position register channel 1</p> <p>19 / Position Register Channel 2: Position register channel 2</p> <p>20 / Position Register Channel 3: Position register channel 3</p> <p>21 / Position Register Channel 4: Position register channel 4</p> <p>22 / Motor Moves Positive: Motor moves in positive direction</p> <p>23 / Motor Moves Negative: Motor moves in negative direction</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- - - -	UINT16 R/W per. -	Modbus 1810 PROFINET 1810

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_DQ1	<p>Function Output DQ1</p> <p>1 / Freely Available: Available as required</p> <p>2 / No Fault: Signals operating states Ready To Switch On, Switched On and Operation Enabled</p> <p>3 / Active: Signals operating state Operation Enabled</p> <p>4 / RMAC Active Or Finished: Relative movement after capture active or finished (RMAC)</p> <p>5 / In Position Deviation Window: Position deviation is within window</p> <p>6 / In Velocity Deviation Window: Velocity deviation is within window</p> <p>7 / Velocity Below Threshold: Motor velocity below threshold</p> <p>8 / Current Below Threshold: Motor current below threshold</p> <p>9 / Halt Acknowledge: Halt acknowledgement</p> <p>13 / Motor Standstill: Motor at a standstill</p> <p>14 / Selected Error: One of the specified errors of error classes 1 ... 4 is active</p> <p>15 / Valid Reference (ref_ok): Zero point is valid (ref_ok)</p> <p>16 / Selected Warning: One of the specified errors of error class 0 is active</p> <p>18 / Position Register Channel 1: Position register channel 1</p> <p>19 / Position Register Channel 2: Position register channel 2</p> <p>20 / Position Register Channel 3: Position register channel 3</p> <p>21 / Position Register Channel 4: Position register channel 4</p> <p>22 / Motor Moves Positive: Motor moves in positive direction</p> <p>23 / Motor Moves Negative: Motor moves in negative direction</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- - - -	UINT16 R/W per. -	Modbus 1812 PROFINET 1812
IOsigCurrLim	<p>Signal evaluation for signal input function Current Limitation</p> <p>1 / Normally Closed: Normally closed NC</p> <p>2 / Normally Open: Normally open NO</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the power stage is enabled.</p>	- 1 2 2	UINT16 R/W per. -	Modbus 2128 PROFINET 2128
IOsigLIMN	<p>Signal evaluation for negative limit switch</p> <p>0 / Inactive: Inactive</p> <p>1 / Normally Closed: Normally closed NC</p> <p>2 / Normally Open: Normally open NO</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the power stage is enabled.</p>	- 0 1 2	UINT16 R/W per. -	Modbus 1566 PROFINET 1566

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOsigLIMP	Signal evaluation for positive limit switch 0 / Inactive: Inactive 1 / Normally Closed: Normally closed NC 2 / Normally Open: Normally open NO Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1568 PROFINET 1568
IOsigREF	Signal evaluation for reference switch 1 / Normally Closed: Normally closed NC 2 / Normally Open: Normally open NO The reference switch is only active while a reference movement to the reference switch is processed. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	Modbus 1564 PROFINET 1564
IOsigRespOfPS	Response to active limit switch during enabling of power stage 0 / Error: Active limit switch triggers an error. 1 / No Error: Active limit switch does not trigger an error. Defines the response when the power stage is enabled while a hardware limit switch is active. Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1548 PROFINET 1548
IOsigVelLim	Signal evaluation for signal input function Velocity Limitation 1 / Normally Closed: Normally closed NC 2 / Normally Open: Normally open NO Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 1 2 2	UINT16 R/W per. -	Modbus 2126 PROFINET 2126
IP_IntTimInd	Interpolation time index	- -128 -3 63	INT16 R/W - -	Modbus 7002 PROFINET 7002
IP_IntTimPerVal	Interpolation time period value	s 0 1 255	UINT16 R/W - -	Modbus 7000 PROFINET 7000
IPp_target	Position reference value for operating mode Interpolated Position	- -2147483648 - 2147483647	INT32 R/W - -	Modbus 7004 PROFINET 7004
JOGactivate	Activation of operating mode Jog Bit 0: Positive direction of movement Bit 1: Negative direction of movement Bit 2: 0=slow 1=fast Changed settings become active immediately.	- 0 0 7	UINT16 R/W - -	Modbus 6930 PROFINET 6930
JOGmethod	Selection of jog method 0 / Continuous Movement: Jog with continuous movement 1 / Step Movement: Jog with step movement Changed settings become active immediately.	- 0 1 1	UINT16 R/W - -	Modbus 10502 PROFINET 10502

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGstep	Distance for step movement Changed settings become active the next time the motor moves.	usr_p 1 20 2147483647	INT32 R/W per. -	Modbus 10510 PROFINET 10510
JOGtime	Wait time for step movement Changed settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	Modbus 10512 PROFINET 10512
JOGv_fast	Velocity for fast movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active immediately.	usr_v 1 180 2147483647	UINT32 R/W per. -	Modbus 10506 PROFINET 10506
JOGv_slow	Velocity for slow movement The adjustable value is internally limited to the parameter setting in RAMP_v_max. Changed settings become active immediately.	usr_v 1 60 2147483647	UINT32 R/W per. -	Modbus 10504 PROFINET 10504
LIM_HaltReaction	Halt option code 1 / Deceleration Ramp: Deceleration ramp 3 / Torque Ramp: Torque ramp Type of deceleration for Halt. Setting of deceleration ramp with parameter RAMP_v_dec. Setting of torque ramp with parameter LIM_I_maxHalt. If a deceleration ramp is already active, the parameter cannot be written. Changed settings become active immediately.	- 1 1 3	INT16 R/W per. -	Modbus 1582 PROFINET 1582
LIM_I_maxHalt	Current for Halt This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage). In the case of a Halt, the current limit (I_{max_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 $0.01 A_{rms}$. Changed settings become active immediately.	A_{rms} - - -	UINT16 R/W per. -	Modbus 4380 PROFINET 4380

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxQSTP	<p>Current for Quick Stop</p> <p>This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).</p> <p>In the case of a Quick Stop, the current limit (I_{max_act}) is one of the following values (whichever is lowest):</p> <ul style="list-style-type: none"> - LIM_I_maxQSTP - M_I_max - PS_I_max <p>Further current limitations caused by I_{2t} monitoring are also taken into account during a Quick Stop.</p> <p>Default: PS_I_max at 8 kHz PWM frequency and 230/480 V mains voltage In increments of $0.01 A_{rms}$.</p> <p>Changed settings become active immediately.</p>	A_{rms} - - -	UINT16 R/W per. -	Modbus 4378 PROFINET 4378
LIM_QStopReact	<p>Quick Stop option code</p> <p>-2 / Torque ramp (Fault): Use torque ramp and transit to operating state 9 Fault</p> <p>-1 / Deceleration Ramp (Fault): Use deceleration ramp and transit to operating state 9 Fault</p> <p>6 / Deceleration ramp (Quick Stop): Use deceleration ramp and remain in operating state 7 Quick Stop</p> <p>7 / Torque ramp (Quick Stop): Use torque ramp and remain in operating state 7 Quick Stop</p> <p>Type of deceleration for Quick Stop.</p> <p>Setting of deceleration ramp with parameter RAMPquickstop. Setting of torque ramp with parameter LIM_I_maxQSTP.</p> <p>If a deceleration ramp is already active, the parameter cannot be written. Changed settings become active immediately.</p>	- -2 6 7	INT16 R/W per. -	Modbus 1584 PROFINET 1584
Mbaddress	<p>Modbus address</p> <p>Valid addresses: 1 to 247</p> <p>Changed settings become active the next time the product is powered on.</p>	- 1 1 247	UINT16 R/W per. -	Modbus 5640 PROFINET 5640
Mbbaud	<p>Modbus baud rate</p> <p>9600 / 9600 Baud: 9600 Baud 19200 / 19200 Baud: 19200 Baud 38400 / 38400 Baud: 38400 Baud 115200 / 115200 Baud: 115200 Baud</p> <p>Changed settings become active the next time the product is powered on.</p>	- 9600 19200 115200	UINT32 R/W per. -	Modbus 5638 PROFINET 5638
Mfb_ResRatio	<p>Transformation ratio</p> <p>Setting can only be changed if power stage is disabled.</p> <p>Changed settings become active the next time the product is powered on.</p>	- 0.3 - 1.0	UINT16 R/W - -	Modbus 23598 PROFINET 23598

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. Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 1654 PROFINET 1654
MOD_AbsMultiRange	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 Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1656 PROFINET 1656
MOD_Enable	Activation of Modulo 0 / Modulo Off: Modulo is off 1 / Modulo On: Modulo is on Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1648 PROFINET 1648
MOD_Max	Maximum position of modulo range The maximum position value of the modulo range must be greater than the minimum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	usr_p - 3600 -	INT32 R/W per. -	Modbus 1652 PROFINET 1652
MOD_Min	Minimum position of modulo range The minimum position value of the modulo range must be less than the maximum position value of the modulo range. The value must not exceed the maximum possible value of position scaling _ScalePOSmax. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	usr_p - 0 -	INT32 R/W per. -	Modbus 1650 PROFINET 1650

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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. Changed settings become active immediately.	ms 0 0 9999	UINT16 R/W per. -	Modbus 1594 PROFINET 1594
MON_commutat	Commutation monitoring 0 / Off: Commutation monitoring off 1 / On (OpState6): Commutation monitoring on in operating state 6 2 / On (OpState6+7): Commutation monitoring on in operating states 6 and 7 Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1290 PROFINET 1290
MON_ConfModifi cation	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. Changed settings become active immediately.	- 0 2 2	UINT16 R/W per. -	Modbus 1082 PROFINET 1082
MON_ENC_Ampl	Activation of monitoring of SinCos amplitude Value 0: Deactivate monitoring Value 1: Activate monitoring Changed settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 16322 PROFINET 16322
MON_GroundFaul t	Ground fault monitoring 0 / Off: Ground fault monitoring off 1 / On: Ground fault monitoring on Changed settings become active the next time the product is powered on.	- 0 1 1	UINT16 R/W per. expert	Modbus 1312 PROFINET 1312
MON_HW_Limits	Temporary deactivation of hardware limit switches 0: No limit switch deactivated 1: Deactivate positive limit switch 2: Deactivate negative limit switch 3: Deactivate both limit switches With this parameter, a PLC can temporarily deactivate hardware limit switches. This is useful if a homing procedure controlled by a PLC is to use a limit switch as a reference switch without an error response of the drive. Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 1570 PROFINET 1570

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 $I_{q_act_rms}$ is used as comparison value. In increments of $0.01 A_{rms}$. Changed settings become active immediately.	A_{rms} 0.00 0.20 300.00	UINT16 R/W per. -	Modbus 1592 PROFINET 1592
MON_IO_SelErr1	First error code for the signal output function Selected Error This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15116 PROFINET 15116
MON_IO_SelErr2	Second error code for the signal output function Selected Error This parameter specifies the error code of an error of error classes 1 ... 4 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15118 PROFINET 15118
MON_IO_SelWar1	First error code for the signal output function Selected Warning This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15120 PROFINET 15120
MON_IO_SelWar2	Second error code for the signal output function Selected Warning This parameter specifies the error code of an error of error class 0 which is to activate the signal output function. Changed settings become active immediately.	- 0 0 65535	UINT16 R/W per. -	Modbus 15122 PROFINET 15122
MON_MainsVolt	Detection and monitoring of mains phases 0 / Automatic Mains Detection: Automatic detection and monitoring of mains voltage 3 / Mains 1~230 V / 3~480 V: Mains voltage 230 V (single-phase) or 480 V (three phases) 4 / Mains 1~115 V / 3~208 V: Mains voltage 115 V (single-phase) or 208 V (three phases) Value 0: As soon as mains voltage detected, the device automatically verifies whether the mains voltage is 115 V or 230 V in the case of single-phase devices or 208 V or 400/480 V in the case of three-phase devices. Values 3 ... 4: If the mains voltage is not detected properly during start-up, the mains voltage to be used can be selected manually. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 0 4	UINT16 R/W per. expert	Modbus 1310 PROFINET 1310

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_dif_load	<p>Maximum load-dependent position deviation</p> <p>The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.</p> <p>The parameter MON_p_dif_load_usr allows you to enter the value in user-defined units.</p> <p>In increments of 0.0001 revolution.</p> <p>Changed settings become active immediately.</p>	<p>revolution</p> <p>0.0001</p> <p>1.0000</p> <p>200.0000</p>	<p>UINT32</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1606</p> <p>PROFINET 1606</p>
MON_p_dif_load_usr	<p>Maximum load-dependent position deviation</p> <p>The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor.</p> <p>Changed settings become active immediately.</p>	<p>usr_p</p> <p>1</p> <p>16384</p> <p>2147483647</p>	<p>INT32</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1660</p> <p>PROFINET 1660</p>
MON_p_dif_warn	<p>Maximum load-dependent position deviation (error class 0)</p> <p>100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter MON_p_dif_load.</p> <p>Changed settings become active immediately.</p>	<p>%</p> <p>0</p> <p>75</p> <p>100</p>	<p>UINT16</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1618</p> <p>PROFINET 1618</p>
MON_p_DiffWin	<p>Monitoring of position deviation</p> <p>The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime.</p> <p>The status can be output via a parameterizable output.</p> <p>The parameter MON_p_DiffWin_usr allows you to enter the value in user-defined units.</p> <p>In increments of 0.0001 revolution.</p> <p>Changed settings become active immediately.</p>	<p>revolution</p> <p>0.0000</p> <p>0.0010</p> <p>0.9999</p>	<p>UINT16</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1586</p> <p>PROFINET 1586</p>
MON_p_DiffWin_usr	<p>Monitoring of position deviation</p> <p>The system checks whether the drive is within the defined deviation during the period set with MON_ChkTime.</p> <p>The status can be output via a parameterizable output.</p> <p>The minimum value, the factory setting and the maximum value depend on the scaling factor.</p> <p>Changed settings become active immediately.</p>	<p>usr_p</p> <p>0</p> <p>16</p> <p>2147483647</p>	<p>INT32</p> <p>R/W</p> <p>per.</p> <p>-</p>	<p>Modbus 1662</p> <p>PROFINET 1662</p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_p_win	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The parameter MON_p_win_usr allows you to enter the value in user-defined units. In increments of 0.0001 revolution. Changed settings become active immediately.	revolution 0.0000 0.0010 3.2767	UINT16 R/W per. -	Modbus 1608 PROFINET 1608
MON_p_win_usr	Standstill window, permissible control deviation The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected. Processing of the standstill window must be activated via the parameter MON_p_winTime. The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active immediately.	usr_p 0 16 2147483647	INT32 R/W per. -	Modbus 1664 PROFINET 1664
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 Changed settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	Modbus 1610 PROFINET 1610
MON_p_winTout	Timeout time for standstill window monitoring Value 0: Timeout monitoring deactivated Value >0: Timeout time in ms Standstill window processing values are set via MON_p_win and MON_p_winTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Changed settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	Modbus 1612 PROFINET 1612
MON_SW_Limits	Activation of software limit switches 0 / None: Deactivated 1 / SWLIMP: Activation of software limit switches positive direction 2 / SWLIMN: Activation of software limit switches negative direction 3 / SWLIMP+SWLIMN: Activation of software limit switches both directions Software limit switches can only be activated if the zero point is valid. Changed settings become active immediately.	- 0 0 3	UINT16 R/W per. -	Modbus 1542 PROFINET 1542

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 Changed settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1678 PROFINET 1678
MON_swLimN	Negative position limit for software limit switch See description 'MON_swLimP'. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p - -2147483648 -	INT32 R/W per. -	Modbus 1546 PROFINET 1546
MON_swLimP	Positive position limit for software limit switch If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	usr_p - 2147483647 -	INT32 R/W per. -	Modbus 1544 PROFINET 1544
MON_tq_win	Torque window, permissible deviation The torque window can only be activated in operating mode Profile Torque. In increments of 0.1 %. Changed settings become active immediately.	% 0.0 3.0 3000.0	UINT16 R/W per. -	Modbus 1626 PROFINET 1626
MON_tq_winTime	Torque window, time Value 0: Torque window monitoring deactivated Changing the value causes a restart of torque monitoring. Torque window is only used in operating mode Profile Torque. Changed settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1628 PROFINET 1628
MON_v_DiffWin	Monitoring of velocity deviation The system monitors whether the drive is within the defined deviation during the period set with MON_ChkTime. The status can be output via a parameterizable output. Changed settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	Modbus 1588 PROFINET 1588
MON_v_Threshold	Monitoring of velocity threshold The system monitors whether the drive is below the defined value during the period set with MON_ChkTime. The status can be output via a parameterizable output. Changed settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	Modbus 1590 PROFINET 1590
MON_v_win	Velocity window, permissible deviation Changed settings become active immediately.	usr_v 1 10 2147483647	UINT32 R/W per. -	Modbus 1576 PROFINET 1576

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MON_v_winTime	Velocity window, time Value 0: Velocity window monitoring deactivated Changing the value causes a restart of velocity monitoring. Changed settings become active immediately.	ms 0 0 16383	UINT16 R/W per. -	Modbus 1578 PROFINET 1578
MON_v_zeroclamp	Velocity limit for Zero Clamp A Zero Clamp operation is only possible if the reference velocity is below the Zero Clamp velocity limit. Changed settings become active immediately.	usr_v 0 10 2147483647	UINT32 R/W per. -	Modbus 1616 PROFINET 1616
MON_VelDiff	Maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Maximum value Changed settings become active immediately.	usr_v 0 0 2147483647	UINT32 R/W per. -	Modbus 1686 PROFINET 1686
MON_VelDiff_Time	Time window for maximum load-dependent velocity deviation Value 0: Monitoring deactivated. Value >0: Time window for maximum value Changed settings become active immediately.	ms 0 10 -	UINT16 R/W per. -	Modbus 1688 PROFINET 1688
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. Changed settings become active the next time the motor moves.	revolution 0.0 1.0 999.9	UINT16 R/W - -	Modbus 11782 PROFINET 11782
MT_dismax_usr	Maximum permissible distance If the reference value is active and the maximum permissible distance is exceeded, an error of error class 1 is detected. The value 0 switches off monitoring. The minimum value, the factory setting and the maximum value depend on the scaling factor. Changed settings become active the next time the motor moves.	usr_p 0 16384 2147483647	INT32 R/W - -	Modbus 11796 PROFINET 11796

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PAR_CTRLreset	<p>Reset control loop parameters</p> <p>0 / No: No 1 / Yes: Yes</p> <p>Reset of the control loop parameters. The control loop parameters are recalculated on the basis of the motor data of the connected motor.</p> <p>Current and velocity limitations are not reset. Therefore, a user parameter reset is required.</p> <p>The new settings are not saved to the EEPROM. Setting can only be changed if power stage is disabled. Changed settings become active immediately.</p>	- 0 0 1	UINT16 R/W - -	Modbus 1038 PROFINET 1038
PAR_ScalingStart	<p>Recalculation of parameters with user-defined units</p> <p>The parameters with user-defined units can be recalculated with a changed scaling factor.</p> <p>Value 0: Inactive Value 1: Initialize recalculation Value 2: Start recalculation</p> <p>Setting can only be changed if power stage is disabled. Changed settings become active immediately.</p>	- 0 0 2	UINT16 R/W - -	Modbus 1064 PROFINET 1064
PAReeprSave	<p>Save parameter values to EEPROM</p> <p>Value 1: Save persistent parameters</p> <p>The currently set parameters are saved to the non-volatile memory (EEPROM). The saving process is complete when the parameter is read and 0 is returned. Changed settings become active immediately.</p>	- - - -	UINT16 R/W - -	Modbus 1026 PROFINET 1026
PARfactorySet	<p>Restore factory settings (default values)</p> <p>No: No Yes: Yes</p> <p>The parameters are reset to the factory settings and subsequently saved to the EEPROM.</p> <p>The factory settings can be restored via the HMI or the commissioning software.</p> <p>The saving process is complete when the parameter is read and 0 is returned. Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.</p>	- 0 - 1	UINT16 R/W - -	Modbus 1028 PROFINET 1028

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PARuserReset	<p>Reset user parameters 0 / No: No 65535 / Yes: Yes Bit 0: Set persistent user and control loop parameters to default values Bits 1 ... 15: Reserved</p> <p>The parameters are reset with the exception of: - Communication parameters - Inversion of direction of movement - Functions of digital inputs and outputs</p> <p>The new settings are not saved to the EEPROM. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.</p>	- 0 - 65535	UINT16 R/W - -	Modbus 1040 PROFINET 1040
PDOmask	<p>Deactivate receive PDO Value 0: Activate receive PDO Value 1: Deactivate receive PDO Changed settings become active immediately.</p>	- 0 0 1	UINT16 R/W - -	Modbus 16516 PROFINET 16516
PntIPAddress1	<p>IP address, byte 1 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18446 PROFINET 18446
PntIPAddress2	<p>IP address, byte 2 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18448 PROFINET 18448
PntIPAddress3	<p>IP address, byte 3 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18450 PROFINET 18450
PntIPAddress4	<p>IP address, byte 4 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18452 PROFINET 18452
PntIPgate1	<p>IP address gateway, byte 1 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18462 PROFINET 18462
PntIPgate2	<p>IP address gateway, byte 2 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18464 PROFINET 18464
PntIPgate3	<p>IP address gateway, byte 3 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18466 PROFINET 18466
PntIPgate4	<p>IP address gateway, byte 4 Changed settings become active the next time the product is powered on.</p>	- 0 0 255	UINT16 R/W per. -	Modbus 18468 PROFINET 18468
PntIPmask1	<p>IP address subnet mask, byte 1 Changed settings become active the next time the product is powered on.</p>	- 0 255 255	UINT16 R/W per. -	Modbus 18454 PROFINET 18454

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PntIPmask2	IP address subnet mask, byte 2 Changed settings become active the next time the product is powered on.	- 0 255 255	UINT16 R/W per. -	Modbus 18456 PROFINET 18456
PntIPmask3	IP address subnet mask, byte 3 Changed settings become active the next time the product is powered on.	- 0 255 255	UINT16 R/W per. -	Modbus 18458 PROFINET 18458
PntIPmask4	IP address subnet mask, byte 4 Changed settings become active the next time the product is powered on.	- 0 0 255	UINT16 R/W per. -	Modbus 18460 PROFINET 18460
PntIpMode	Type of obtaining IP address 0 / Manual: Manual 3 / DCP: DCP	- 0 3 3	UINT16 R/W per. -	Modbus 18436 PROFINET 18436
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) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2824 PROFINET 2824
PosReg1Source	Selection of source for position register channel 1 0 / Pact Encoder 1: Source for position register channel 1 is Pact of encoder 1 Changed settings become active immediately.	- 0 0 0	UINT16 R/W per. -	Modbus 2828 PROFINET 2828
PosReg1Start	Start/stop of position register channel 1 0 / Off (keep last state): Position Register channel 1 is off and status bit keeps last state 1 / On: Position Register channel 1 is on 2 / Off (set state 0): Position Register channel 1 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 1 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2820 PROFINET 2820
PosReg1ValueA	Comparison value A for position register channel 1	usr_p - 0 -	INT32 R/W per. -	Modbus 2832 PROFINET 2832
PosReg1ValueB	Comparison value B for position register channel 1	usr_p - 0 -	INT32 R/W per. -	Modbus 2834 PROFINET 2834

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg2Mode	Selection of comparison criterion for position register channel 2 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 2 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 2 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2826 PROFINET 2826
PosReg2Source	Selection of source for position register channel 2 0 / Pact Encoder 1: Source for position register channel 2 is Pact of encoder 1 Changed settings become active immediately.	- 0 0 0	UINT16 R/W per. -	Modbus 2830 PROFINET 2830
PosReg2Start	Start/stop of position register channel 2 0 / Off (keep last state): Position Register channel 2 is off and status bit keeps last state 1 / On: Position Register channel 2 is on 2 / Off (set state 0): Position Register channel 2 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 2 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2822 PROFINET 2822
PosReg2ValueA	Comparison value A for position register channel 2	usr_p - 0 -	INT32 R/W per. -	Modbus 2836 PROFINET 2836
PosReg2ValueB	Comparison value B for position register channel 2	usr_p - 0 -	INT32 R/W per. -	Modbus 2838 PROFINET 2838

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg3Mode	Selection of comparison criterion for position register channel 3 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 3 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 3 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2844 PROFINET 2844
PosReg3Source	Selection of source for position register channel 3 0 / Pact Encoder 1: Source for position register channel 3 is Pact of encoder 1 Changed settings become active immediately.	- 0 0 0	UINT16 R/W per. -	Modbus 2848 PROFINET 2848
PosReg3Start	Start/stop of position register channel 3 0 / Off (keep last state): Position Register channel 3 is off and status bit keeps last state 1 / On: Position Register channel 3 is on 2 / Off (set state 0): Position Register channel 3 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 3 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2840 PROFINET 2840
PosReg3ValueA	Comparison value A for position register channel 3	usr_p - 0 -	INT32 R/W per. -	Modbus 2852 PROFINET 2852
PosReg3ValueB	Comparison value B for position register channel 3	usr_p - 0 -	INT32 R/W per. -	Modbus 2854 PROFINET 2854

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosReg4Mode	Selection of comparison criterion for position register channel 4 0 / Pact greater equal A: Actual position is greater than or equal to comparison value A for position register channel 4 1 / Pact less equal A: Actual position is less than or equal to comparison value A for position register channel 4 2 / Pact in [A-B] (basic): Actual position is in the range A-B including limits (basic) 3 / Pact out [A-B] (basic): Actual position is out of the range A-B excluding limits (basic) 4 / Pact in [A-B] (extended): Actual position is in the range A-B including limits (extended) 5 / Pact out [A-B] (extended): Actual position is out of the range A-B excluding limits (extended) Changed settings become active immediately.	- 0 0 5	UINT16 R/W per. -	Modbus 2846 PROFINET 2846
PosReg4Source	Selection of source for position register channel 4 0 / Pact Encoder 1: Source for position register channel 4 is Pact of encoder 1 Changed settings become active immediately.	- 0 0 0	UINT16 R/W per. -	Modbus 2850 PROFINET 2850
PosReg4Start	Start/stop of position register channel 4 0 / Off (keep last state): Position Register channel 4 is off and status bit keeps last state 1 / On: Position Register channel 4 is on 2 / Off (set state 0): Position Register channel 4 is off and status bit is set to 0 3 / Off (set state 1): Position Register channel 4 is off and status bit is set to 1 Changed settings become active immediately.	- 0 0 3	UINT16 R/W - -	Modbus 2842 PROFINET 2842
PosReg4ValueA	Comparison value A for position register channel 4	usr_p - 0 -	INT32 R/W per. -	Modbus 2856 PROFINET 2856
PosReg4ValueB	Comparison value B for position register channel 4	usr_p - 0 -	INT32 R/W per. -	Modbus 2858 PROFINET 2858

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PosRegGroupStart	Start/stop of position register channels 0 / No Channel: No channel activated 1 / Channel 1: Channel 1 activated 2 / Channel 2: Channel 2 activated 3 / Channel 1 & 2: Channels 1 and 2 activated 4 / Channel 3: Channel 3 activated 5 / Channel 1 & 3: Channels 1 and 3 activated 6 / Channel 2 & 3: Channels 2 and 3 activated 7 / Channel 1 & 2 & 3: Channels 1, 2 and 3 activated 8 / Channel 4: Channel 4 activated 9 / Channel 1 & 4: Channels 1 and 4 activated 10 / Channel 2 & 4: Channels 2 and 4 activated 11 / Channel 1 & 2 & 4: Channels 1, 2 and 4 activated 12 / Channel 3 & 4: Channels 3 and 4 activated 13 / Channel 1 & 3 & 4: Channels 1, 3 and 4 activated 14 / Channel 2 & 3 & 4: Channels 2, 3 and 4 activated 15 / Channel 1 & 2 & 3 & 4: Channels 1, 2, 3 and 4 activated Changed settings become active immediately.	- 0 0 15	UINT16 R/W per. -	Modbus 2860 PROFINET 2860
PP_ModeRangeLim	Absolute movement beyond movement range 0 / NoAbsMoveAllowed: Absolute movement beyond movement range is not possible 1 / AbsMoveAllowed: Absolute movement beyond movement range is possible Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	Modbus 8974 PROFINET 8974
PP_OpmChgType	Change to operating mode Profile Position during movements 0 / WithStandStill: Change with standstill 1 / OnTheFly: Change without standstill Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 1	UINT16 R/W per. -	Modbus 8978 PROFINET 8978
PPoption	Options for operating mode Profile Position Determines the reference position for relative positioning: 0: Relative with reference to the previous target position of the profile generator 1: Not supported 2: Relative with reference to the actual position of the motor Changed settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	Modbus 6960 PROFINET 6960

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PPp_target	Target position for operating mode Profile Position Minimum/maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Changed settings become active immediately.	usr_p - - -	INT32 R/W - -	Modbus 6940 PROFINET 6940
PPv_target	Target velocity for operating mode Profile Position The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 1 60 4294967295	UINT32 R/W - -	Modbus 6942 PROFINET 6942
PTtq_target	Target torque for operating mode Profile Torque 100.0 % correspond to the continuous stall torque _M_M_0. In increments of 0.1 %. Changed settings become active immediately.	% -3000.0 0.0 3000.0	INT16 R/W - -	Modbus 6944 PROFINET 6944
PVv_target	Target velocity for operating mode Profile Velocity The target velocity is limited to the setting in CTRL_v_max and RAMP_v_max. Changed settings become active immediately.	usr_v - 0 -	INT32 R/W - -	Modbus 6938 PROFINET 6938
RAMP_tq_enable	Activation of the motion profile for torque 0 / Profile Off: Profile off 1 / Profile On: Profile on In the operating mode Profile Torque, the motion profile for torque can be activated or deactivated. In the other operating modes, the motion profile for torque is inactive. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 1 1	UINT16 R/W per. -	Modbus 1624 PROFINET 1624
RAMP_tq_slope	Slope setting of the motion profile for torque 100.00 % of the torque setting correspond to the continuous stall torque _M_M_0. Example: A ramp setting of 10000.00 %/s results in a torque change of 100.0% of _M_M_0 in 0.01s. In increments of 0.1 %/s. Changed settings become active immediately.	%/s 0.1 10000.0 3000000.0	UINT32 R/W per. -	Modbus 1620 PROFINET 1620
RAMP_v_acc	Acceleration of the motion profile for velocity Writing the value 0 has no effect on the parameter. Changed settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	Modbus 1556 PROFINET 1556

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_dec	Deceleration of the motion profile for velocity The minimum value depends on the operating mode: Operating modes with minimum value 1: Profile Velocity Operating modes with minimum value 120: Jog Profile Position Homing Writing the value 0 has no effect on the parameter. Changed settings become active the next time the motor moves.	usr_a 1 600 2147483647	UINT32 R/W per. -	Modbus 1558 PROFINET 1558
RAMP_v_enable	Activation of the motion profile for velocity 0 / Profile Off: Profile off 1 / Profile On: Profile on Setting can only be changed if power stage is disabled. Changed settings become active immediately.	- 0 1 1	UINT16 R/W per. -	Modbus 1622 PROFINET 1622
RAMP_v_jerk	Jerk limitation of the motion profile for velocity 0 / Off: Off 1 / 1: 1 ms 2 / 2: 2 ms 4 / 4: 4 ms 8 / 8: 8 ms 16 / 16: 16 ms 32 / 32: 32 ms 64 / 64: 64 ms 128 / 128: 128 ms Adjustments can only be made if the operating mode is inactive (x_end=1). Changed settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	Modbus 1562 PROFINET 1562
RAMP_v_max	Maximum velocity of the motion profile for velocity If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMP_v_max. This way, commissioning at limited velocity is easier to perform. Setting can only be changed if power stage is disabled. Changed settings become active the next time the motor moves.	usr_v 1 13200 2147483647	UINT32 R/W per. -	Modbus 1554 PROFINET 1554

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_v_sym	Acceleration and deceleration of the motion profile for velocity The values are internally multiplied by 10 (example: 1 = 10 min-1/s). Write access changes the values of RAMP_v_acc and RAMP_v_dec. The limit values are verified on the basis of the values indicated for these parameters. Read access returns the greater value from RAMP_v_acc/RAMP_v_dec. If the value cannot be represented as a 16 bit value, the value is set to 65535 (maximum UINT16 value) Changed settings become active the next time the motor moves.	- - - -	UINT16 R/W - -	Modbus 1538 PROFINET 1538
RAMPaccdec	Acceleration and deceleration for the Drive Profile Lexium High word: Acceleration Low word: Deceleration The values are internally multiplied by 10 (example: 1 = 10 min-1/s). Write access changes the values of RAMP_v_acc and RAMP_v_dec. The limit values are verified on the basis of the values indicated for these parameters. If the value cannot be represented as a 16 bit value, the value is set to 65535 (maximum UINT16 value). Changed settings become active the next time the motor moves.	- - - -	UINT32 R/W - -	Modbus 1540 PROFINET 1540
RAMPquickstop	Deceleration ramp for Quick Stop Deceleration ramp for a software stop or an error with error class 1 or 2. Changed settings become active the next time the motor moves.	usr_a 1 6000 2147483647	UINT32 R/W per. -	Modbus 1572 PROFINET 1572
REsExt_P	Nominal power of external braking resistor Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	W 1 10 32767	UINT16 R/W per. -	Modbus 1316 PROFINET 1316
REsExt_R	Resistance value of external braking resistor The minimum value depends on the power stage. In increments of 0.01 Ω. Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	Ω 0.00 100.00 327.67	UINT16 R/W per. -	Modbus 1318 PROFINET 1318
REsExt_ton	Maximum permissible switch-on time of external braking resistor Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	ms 1 1 30000	UINT16 R/W per. -	Modbus 1314 PROFINET 1314

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RESint_ext	Selection of type of braking resistor 0 / Standard Braking Resistor: Standard braking resistor 1 / External Braking Resistor: External braking resistor 2 / Reserved: Reserved Setting can only be changed if power stage is disabled. Changed settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1298 PROFINET 1298
RMAC_Activate	Activation of relative movement after capture 0 / Off: Off 1 / On: On Changed settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 8984 PROFINET 8984
RMAC_Edge	Edge of capture signal for relative movement after capture 0 / Falling edge: Falling edge 1 / Rising edge: Rising edge	- 0 0 1	UINT16 R/W per. -	Modbus 8992 PROFINET 8992
RMAC_Position	Target position of relative movement after capture Minimum/maximum values depend on: - Scaling factor Changed settings become active the next time the motor moves.	usr_p - 0 -	INT32 R/W per. -	Modbus 8986 PROFINET 8986
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 Changed settings become active immediately.	- 0 0 2	UINT16 R/W per. -	Modbus 8990 PROFINET 8990
RMAC_Velocity	Velocity of relative movement after capture Value 0: Use actual motor velocity Value >0: Value is the target velocity The adjustable value is internally limited to the setting in RAMP_v_max. Changed settings become active the next time the motor moves.	usr_v 0 0 2147483647	UINT32 R/W per. -	Modbus 8988 PROFINET 8988
ScalePOSdenom	Position scaling: Denominator Refer to numerator (ScalePOSnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled.	usr_p 1 16384 2147483647	INT32 R/W per. -	Modbus 1550 PROFINET 1550
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 changed if power stage is disabled. Changed settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	Modbus 1552 PROFINET 1552

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 changed if power stage is disabled.	usr_a 1 1 2147483647	INT32 R/W per. -	Modbus 1632 PROFINET 1632
ScaleRAMPnum	Ramp scaling: Numerator Setting can only be changed if power stage is disabled. Changed settings become active immediately.	rpm/s 1 1 2147483647	INT32 R/W per. -	Modbus 1634 PROFINET 1634
ScaleVELdenom	Velocity scaling: Denominator See numerator (ScaleVELnum) for a description. A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled.	usr_v 1 1 2147483647	INT32 R/W per. -	Modbus 1602 PROFINET 1602
ScaleVELnum	Velocity scaling: Numerator Specification of the scaling factor: Speed of rotation of motor [min-1] ----- User-defined units [usr_v] A new scaling is activated when the numerator value is supplied. Setting can only be changed if power stage is disabled. Changed settings become active immediately.	rpm 1 1 2147483647	INT32 R/W per. -	Modbus 1604 PROFINET 1604
ShiftEncWorkRange	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. Changed settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	Modbus 1346 PROFINET 1346

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
SimAbsolutePos	<p>Simulation of absolute position at power cycling</p> <p>0 / Simulation Off: Do not use the last mechanical position after power cycling</p> <p>1 / Simulation On: Use last mechanical position after power cycling</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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). Changed settings become active immediately.</p>	- 0 0 1	UINT16 R/W per. -	Modbus 1350 PROFINET 1350
SyncMechStart	<p>Activation of synchronization mechanism</p> <p>Value 0: Deactivate synchronization mechanism</p> <p>Value 1: Activate synchronization mechanism (CANmotion).</p> <p>Value 2: Activate synchronization mechanism, standard CANopen mechanism.</p> <p>The cycle time of the synchronization signal is derived from the parameters intTimPerVal and intTimInd. Changed settings become active immediately.</p>	- 0 0 2	UINT16 R/W - -	Modbus 8714 PROFINET 8714
SyncMechStatus	<p>Status of synchronization mechanism</p> <p>Status of synchronization mechanism:</p> <p>Value 1: Synchronization mechanism of drive is inactive.</p> <p>Value 32: Drive is synchronizing with external sync signal.</p> <p>Value 64: Drive is synchronized with external sync signal.</p>	- - - -	UINT16 R/- - -	Modbus 8716 PROFINET 8716
SyncMechTol	<p>Synchronization tolerance</p> <p>The value is applied when the synchronization mechanism is activated via the parameter SyncMechStart. Changed settings become active immediately.</p>	- 1 1 20	UINT16 R/W - -	Modbus 8712 PROFINET 8712

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
TouchProbeFct	Touch Probe function Changed settings become active immediately.	- - - -	UINT16 R/W - -	Modbus 7028 PROFINET 7028
UsrAppDataMem1	User-specific data 1 This parameter can be used to store user-specific data. Changed settings become active immediately.	- - - -	UINT32 R/W per. -	Modbus 390 PROFINET 390
UsrAppDataMem2	User-specific data 2 This parameter can be used to store user-specific data. Changed settings become active immediately.	- - 0 -	UINT32 R/W per. -	Modbus 392 PROFINET 392

Chapter 11

Accessories and Spare Parts

What Is in This Chapter?

This chapter contains the following topics:

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Commissioning Tools

Description	Reference
PC connection kit, serial connection between drive and PC, USB-A to RJ45	TCSMCNAM3M002P
Multi-Loader, device for copying the parameter settings to a PC or to another drive	VW3A8121
Modbus cable, 1 m (3.28 ft), 2 x RJ45	VW3A8306R10

Memory Cards

Description	Reference
Memory card for copying parameter settings	VW3M8705
25 memory cards for copying parameter settings	VW3M8704

Mains Supply for Slot 1 or Slot 2

Description	Reference
LXM32I connection module mains supply, single-phase	VW3M9001
LXM32I connection module mains supply, three-phase	VW3M9002

Braking Resistors for Slot 1 or Slot 2

Description	Reference
LXM32I module standard braking resistor, single-phase 35 Ω , 20 W	VW3M9021
LXM32I module standard braking resistor, three-phase, 70 Ω , 20 W	VW3M9022
LXM32I connection module external braking resistor	VW3M9010

External Braking Resistors

Description	Reference
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7602R07
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7602R20
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7602R30
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7603R07
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7603R20
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7603R30
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7604R07
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7604R20
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7604R30
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7605R07
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7605R20
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7605R30
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7606R07
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7606R20
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14), UL	VW3A7606R30
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 0.75 m (2.46 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7607R07
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 2 m (6.56 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7607R20
Braking resistor IP65; 72 Ω; maximum continuous power 400 W; 3 m (9.84 ft) connection cable, 2.1 mm ² (AWG 14)	VW3A7607R30

I/O Module with Industrial Connector for Positive Logic

Description	Reference
LXM32I Ethernet connection module with industrial connector, 4 digital inputs M8 (source), fieldbus M12, safety 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 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 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 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 function STO	VW3M9208
LXM32I Ethernet connection module with industrial connector, 2 digital inputs M8 (sink), fieldbus M12	VW3M9209
LXM32I Ethernet connection module with industrial connector, 4 digital inputs and 2 digital outputs M8 (sink), fieldbus M12, safety 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 function STO, 7 blind plugs	VW3M9110
Cable glands M8 for signals and STO, 12 pieces	VW3M9508
Cable glands M12 for fieldbus, 10 pieces	VW3M9512

Cables for Safety Function STO

Description	Reference
Pre-assembled cable for the safety function STO, 3 m (9.84 ft), 3 x 0.34 mm ² , industrial connector M8, other cable end open	VW3M9403
Pre-assembled cable for the safety function STO, 5 m (16.4 ft), 3 x 0.34 mm ² , industrial connector M8, other cable end open	VW3M9405
Pre-assembled cable for the safety function STO, 10 m (32.8 ft), 3 x 0.34 mm ² , industrial connector M8, other cable end open	VW3M9410
Pre-assembled cable for the safety function STO, 15 m (49.2 ft), 3 x 0.34 mm ² , industrial connector M8, other cable end open	VW3M9415
Pre-assembled cable for the safety function STO, 20 m (65.6 ft), 3 x 0.34 mm ² , industrial connector M8, other cable end open	VW3M9420
Connector for STO output, 1 x industrial connector M8	VW3L50010
Pre-assembled cable for the safety function STO, 3 m (9.84 ft), 3 x 0.34 mm ² , industrial connector M8, female connector M8, shielded	VW3M94CR03
Pre-assembled cable for the safety function STO, 5 m (16.4 ft), 3 x 0.34 mm ² , industrial connector M8, female connector M8, shielded	VW3M94CR05
Pre-assembled cable for the safety function STO, 10 m (32.8 ft), 3 x 0.34 mm ² , industrial connector M8, female connector M8, shielded	VW3M94CR10
Pre-assembled cable for the safety function STO, 15 m (49.2 ft), 3 x 0.34 mm ² , industrial connector M8, female connector M8, shielded	VW3M94CR15
Pre-assembled cable for the safety function STO, 20 m (65.6 ft), 3 x 0.34 mm ² , industrial connector M8, female connector M8, shielded	VW3M94CR20

Industrial Plug Connectors

Description	Reference
Connector kit for 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
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

Chapter 12

Service, Maintenance, and Disposal

What Is in This Chapter?

This chapter contains the following topics:

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Maintenance	481
Replacing the Product	483
Shipping, Storage, Disposal	484

Service Addresses

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Phone: +49 (0) 9391 / 606 - 0
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Email: automation.support.de@schneider-electric.com
Internet: <http://www.schneider-electric.com>

Additional Contact Addresses

See the homepage for additional contact addresses:
<http://www.schneider-electric.com>

Maintenance

Maintenance Plan

Inspect the product for pollution or damage at regular intervals.

Repairs may only be made by the manufacturer. No warranty or liability is accepted for repairs made by unauthorized persons.

Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information on the precautions and processes to be observed.

Include the following points in the maintenance plan of your machine.

Connections and Fastening

- Inspect all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Verify that all output elements are firmly seated.
- Tighten all mechanical and electrical threaded connections to the specified torque.

Lubricating the Shaft Sealing Ring

In the case of motors with shaft sealing ring, lubricant must be applied to the space between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the shaft sealing rings will be significantly reduced.

Cleaning

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

WARNING

UNINTENDED MOVEMENT

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

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

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a pressure washer. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the cables, cable entry seals, O-rings and motor paint are not damaged.

Inspecting/Breaking In the Holding Brake

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

If the holding brake does not have the holding torque indicated in the technical data, it must be broken in again.

- If the motor is mounted, dismount the motor.
- Measure the holding torque of the holding brake using a torque wrench.
- If the holding torque of the holding brake considerably differs from the specified values, manually rotate the motor shaft by 25 rotations in both directions. See chapter Holding Brake (Option) (*see page 37*) for the values.
- Repeat the process up to 3 times, until you can restore the original holding torque.
Contact your Schneider Electric representative if the original holding torque is not restored.

Replacing the Rolling Bearing

When the rolling bearing is replaced, the motor is partially demagnetized and loses power.

<i>NOTICE</i>

INOPERABLE EQUIPMENT

Do not replace the rolling bearing.

Failure to follow these instructions can result in equipment damage.

For all service matters, contact your Schneider Electric representative.

Lifetime Safety Function STO

The STO safety function is designed for a lifetime of 20 years. After this period, the data of the safety function are no longer valid. The expiry date is determined by adding 20 years to the DOM shown on the nameplate of the product.

- This date must be included in the maintenance plan of the system.
Do not use the safety function after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.16. (31 December 2016). This means: Do not use the safety function after December 31, 2036.

Replacing the Product

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

DANGER

ELECTRIC SHOCK

Do not open the side wall.

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

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

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Only replace BMi and Lexium 32i together. Do not replace one of the two individually.

Follow the procedure below for replacing devices.

- Save all parameter settings. To do so, use a memory card or save the data to a PC using the commissioning software, see chapter Parameter Management ([see page 181](#)).
- Power off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and remove all connection cables (unlock connector locks).
- Uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per chapter Installation ([see page 95](#)).
- If the product to be installed has previously been used in a different system or application, you must restore the factory settings before commissioning the product.
- Commission the product as per chapter Commissioning ([see page 135](#)).

Shipping, Storage, Disposal

Shipping

The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage

The product may only be stored in spaces where the specified permissible ambient conditions are met. Protect the product from dust and dirt.

Disposal

The product consists of various materials that can be recycled. Dispose of the product in accordance with local regulations.

Visit <http://www.schneider-electric.com/green-premium> for information and documents on environmental protection as per ISO 14025 such as:

- EoLi (Product End-of-Life Instructions)
- PEP (Product Environmental Profile)



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 of manufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. For example:

31.12.11 corresponds to December 31, 2011

31.12.2011 corresponds to December 31, 2011

DriveCom

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

E

EDS

(Electronic Data Sheet); contains the specific properties of a product.

EMC

Electromagnetic compatibility

Encoder

Sensor that converts a measured distance or angle into an electrical signal. This signal is evaluated by the drive to determine the actual position of a shaft (rotor) or a driving unit.

Error

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

Error class

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

F

Factory settings

Settings when the product is shipped.

Fault

Fault is an operating state. If the monitoring functions detect an error, a transition to this operating state is triggered, depending on the error class. A "Fault Reset" or a power cycle are required to exit this operating state. Prior to this, the cause of the detected error must be removed. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).

Fault Reset

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

H**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: isol   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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