ILA2T Modbus TCP
Integrated Drive
User Guide

Original instructions

08/2020

Schneider Electric

The information provided in this documentation contains general descriptions and/or technical character-istics 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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Safety Information

Important Information

NOTICE

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

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

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

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

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

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

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

PLEASE NOTE

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

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

QUALIFICATION OF PERSONNEL

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

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

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

INTENDED USE

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

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

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

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

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

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

About the Book

At a Glance

Document Scope

This manual describes technical characteristics, installation, commissioning, operation, and maintenance of the integrated drive ILA2T.

Validity Note

This manual is valid for the standard products listed in the type code, see chapter Type Code .

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

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

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

Product Related Information

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

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

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

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.
- 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.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

⚠ WARNING

UNINTENDED MOVEMENT OR MACHINE OPERATION

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

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

⚠ WARNING

LOSS OF CONTROL

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

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

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

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

⚠ WARNING

UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS

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

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

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.

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

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION

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

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

Consult the *Schneider Electric Cybersecurity Best Practices* for additional information.

Use the latest firmware version. Visit *https://www.se.com* or contact your Schneider Electric representative for information on firmware updates that may involve Ethernet connections.

Terminology Derived from Standards

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

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

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

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

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

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

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

Chapter 1
Introduction

What Is in This Chapter?

This chapter contains the following topics:

Overview of Integrated Drive

Lexium Integrated Drive
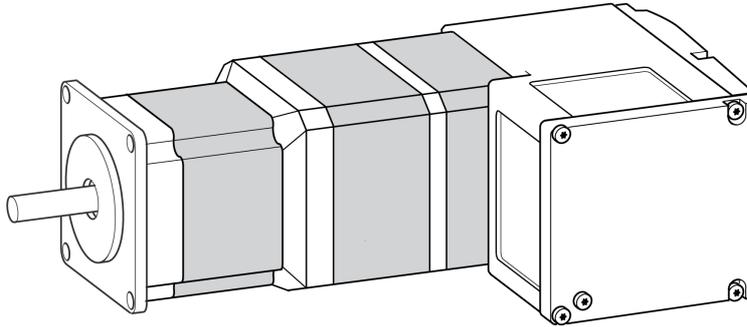
The Lexium integrated drive consists of a servo motor and an integrated drive. The product integrates interfaces, control electronics, a holding brake (optional) and the power stage.

Minimum wiring as well as a comprehensive portfolio of options and accessories allows you to implement compact, high-performance drive solutions for a wide range of power requirements.

Features

Overview of some of the features:

● Fieldbus interface for Modbus TCP.
● The drive is commissioned via a PC with the commissioning software "Lexium CT" or the fieldbus.
● Four digital 24 V signals. Each of these signals can be used as an input or output.
● The integrated safety-related function Safe Torque Off (STO) as per IEC 61800-5-2 allows for a stop with stop category 0 as per IEC 60204-1 without external power contactors.

Components and Interfaces

Overview
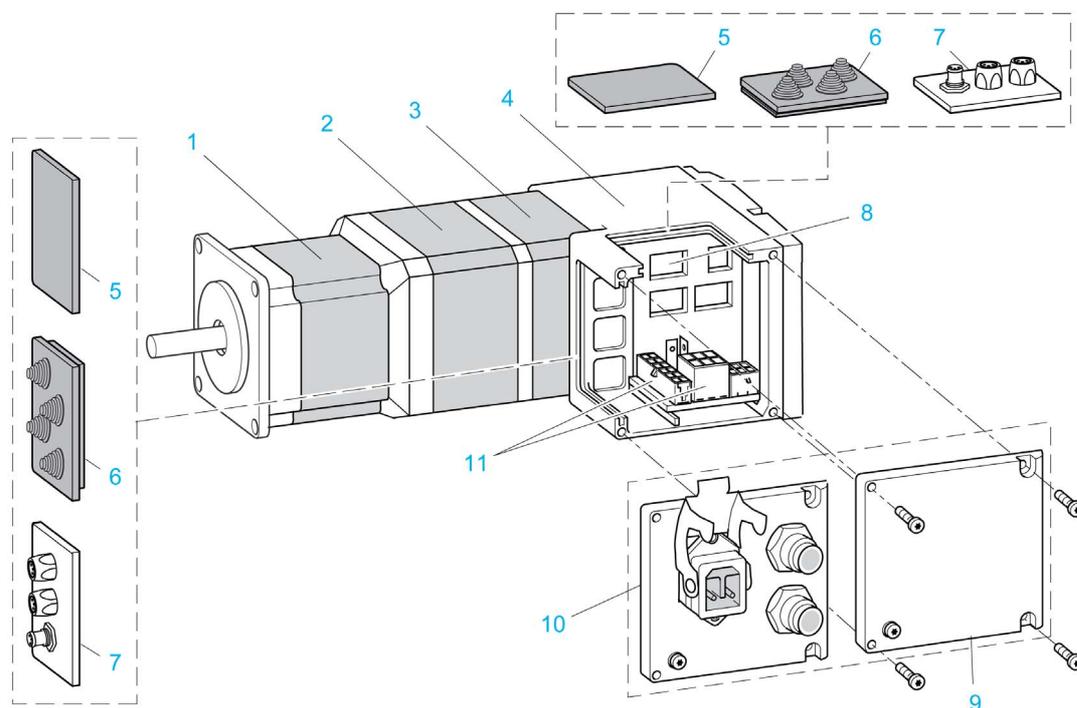
1 AC synchronous servo motor
2 Holding brake (optional)
3 Encoder
4 Electronics housing
5 Insert for sealing (accessory)
6 Insert with cable entry (accessory)
7 I/O insert with industrial connectors (accessory)
8 Switches for settings
9 Cover with connector for functional ground, to be removed for installation
10 Cover with industrial connector for Vdc supply voltage and IN/OUT fieldbus connection and with connector for functional ground (optional)
11 Electrical interfaces

Motor

The motor is a brushless AC synchronous servo motor.

Electronics

The electronic system comprises control electronics and power stage.

The drive can be parameterized and controlled via the fieldbus interface.

Four digital 24 V signals are also available. Each of these signals can be used as an input or output.

Encoder

The integrated drive features a singleturn or a multiturn encoder, depending on the drive version.

The singleturn encoder has an internal resolution of 32768 increments per revolution.

The scaling of the integrated drive is set to 16384 user-defined units per revolution.

The multiturn encoder covers a range of 4096 motor revolutions.

Holding Brake

The integrated drive is available with an optional integrated holding brake. The holding brake is controlled automatically.

Vdc Supply Voltage

The Vdc supply voltage supplies the control electronics and the power stage.

Fieldbus Interface

The integrated drive features a Modbus TCP fieldbus interface.

The fieldbus interface is used for parameterizing and controlling the drive. The fieldbus interface allows the integrated drive to be operated on a fieldbus via a master controller, for example, a logic controller.

Communication Interface RS-485

The RS-485 interface is used for commissioning the drive by means of the commissioning software.

The firmware can be updated via the RS-485 interface. Contact your Schneider Electric service representative for any firmware update.

24 Vdc Signal Interface

Four digital 24 Vdc signals are available. Each of these signals can be used as an input or output.

The 24 Vdc signals are available to the master controller.

Nameplate

Overview

The nameplate contains the following data:

1	Type code
2	Type code (previous)
3	Nominal voltage
4	Nominal torque
5	Maximum input current
6	Nominal speed of rotation
7	Date of manufacture
8	Thermal class
9	Maximum surrounding air temperature
10	Firmware version
11	Hardware version
12	Firmware number
13	Commercial reference
14	Serial number

Type Code

Overview

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Type code (example)	I	L	A	2	T	5	7	1	P	B	1	A	0	•	•

Item	Meaning
1 ... 3	**Product family** ILA = Servo motor
4	**Supply voltage** 2 = 24 ... 48 Vdc
5	**Fieldbus interface** T = Modbus TCP
6 ... 7	**Size** 57 = 57 mm
8	**Length** 1 = 1 stack 2 = 2 stacks
9	**Winding** P = Medium speed of rotation/medium torque T = High speed of rotation/medium torque
10	**Connection version** B = Printed circuit board connector C = Industrial connector
11	**Encoder** 1 = Servo Singleturn 2 = Servo Multiturn
12	**Holding brake** A = Without holding brake F = With holding brake
13	**Gearbox** 0 = Without gearbox
14 ... 15	**Reserved**

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: IL••••••S1234--

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

Chapter 2
Technical Data

What Is in This Chapter?

This chapter contains the following topics:

Environmental Conditions

Environmental Conditions for Operation

Characteristic	Unit	Value
Chemically active substances as per IEC 60721-3-3, operation		3C1
Ambient temperature (no icing, non-condensing)[1]	°C (°F)	0 ... 40 (32 ... 104)
Ambient temperature with current derating of 2 % per one degree Celsius (per 1.8 degrees Fahrenheit)[1]	°C (°F)	40 ... 55 (104 ... 131)
Relative humidity	%	15 ... 85
Installation altitude[2]	m (ft)	< 1000 (< 3281)
Installation altitude[2] if all of the following conditions are met: • 45 °C (113 °F) maximum ambient temperature • Reduction of the continuous power by 1% per 100 m (328 ft) above 1000 m (3281 ft)	m (ft)	1000 ... 2000 (3281 ... 6562)
Installation altitude[2] above mean sea level if all of the following conditions are met: • 40 °C (104 °F) maximum ambient temperature • Reduction of the continuous power by 1% per 100 m (328 ft) above 1000 m (3281 ft)	m (ft)	2000 ... 3000 (6562 ... 9843)
(1) Limit values with flanged motor (for example, steel plate 300 x 300x10 mm). **(2)** The installation altitude is defined in terms of altitude above mean sea level.		

Environmental Conditions for Transportation and Storage

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

Characteristic	Unit	Value
Chemically active substances as per IEC 60721-3-2, transportation		3C1
Chemically active substances as per IEC 60721-3-1, storage		3C1
Ambient temperature (no icing, non-condensing)	°C (°F)	-25 ... 70 (-13 ... 158)
Relative humidity (non-condensing)	%	5 ... 80

Vibration and Shock

Characteristic	Value
Vibration, sinusoidal	Type test with 10 runs as per IEC 60068-2-6 0.15 mm (10 Hz ... 60 Hz) 20 m/s^2 (60 Hz 500 Hz)
Shock, semi-sinusoidal	Type test with 3 shocks in each direction as per IEC 60068-2-27 150 m/s^2 (11 ms)

IP Degree of Protection

The integrated drive has the following IP degree of protection as per IEC 60529:
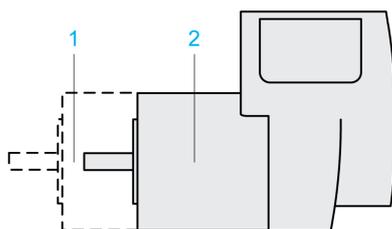
Item	Component	Degree of protection
1	Shaft bushing Shaft bushing with GBX gearbox (accessory)	IP41[(1)] IP54
2	Housing, except shaft bushing	IP54
(1) In the case of mounting position IM V3 (shaft vertical, shaft end upward), the degree of protection is IP 40. The degree of protection does not relate to mounted components such as, for example, a gearbox.		

The total degree of protection is determined by the component with the lowest degree of protection.

Pollution Degree

Characteristic	Value
Pollution degree	2

Mechanical Data

Dimensions

1 Insert with cable entry (accessory)
2 Insert kit (accessory)
3 Industrial connector (option)

Dimension	Unit	ILA••57...					
		1••1A0	1••2A0	1••1F0	2••1A0	2••2A0	2••2F0
Total length L	mm (in)	145.3 (5.72)	179.3 (7.06)	190.8 (7.51)	163.8 (6.45)	197.8 (7.79)	209.3 (8.24)

Electrical Data

Overview of Connectors
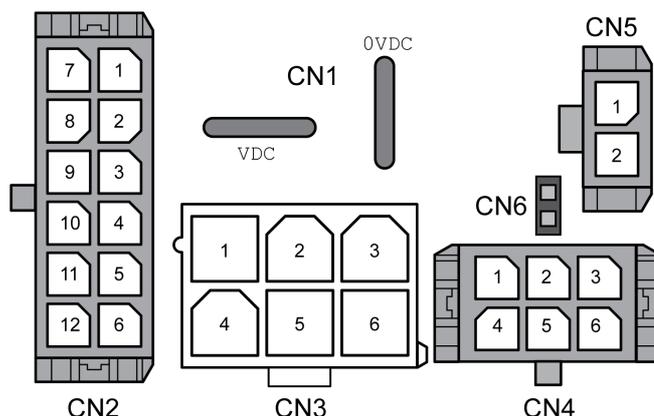
Connection	Assignment
CN1	Connectors for Vdc supply voltage
CN2	Fieldbus interface for Modbus TCP
CN3	Commissioning interface
CN4	24 V signal interface
CN5	Connector for the safety-related function STO
CN6	Jumper for activating and deactivating the safety-related function STO

CN1: Vdc Supply Voltage

Characteristic	Unit	ILA••571	ILA••572
Nominal voltage Minimum voltage Maximum voltage	Vdc	24 / 48 18 55.2	24 / 48 18 55.2
Ripple at nominal voltage	Vpp	≤3.6	≤3.6
Maximum input current Winding type P Winding type T	A	 5 7.5	 7 7.5
Peak input current Winding type P Winding type T	A	 7 11	 8.5 9
Overvoltage category	-	III at input of power supply unit, II at output of power supply unit (as per IEC 61800-5-1)	
Capacitance at VDC to 0VDC (for inrush current)	µF	1500	1500
Fuse rating of fuse to be connected upstream	A	≤15	≤15
Type of fuse or circuit breaker to be connected upstream	-	● Circuit-breaker (type Multi 9 - C60BP, M9F42115 by Schneider Electric, 15 A, tripping characteristic C), or ● Blade fuse (FKS, 15 A maximum), or ● Fuse (5 x 20 mm, 10 A, slow-blow)	
PELV	-	Required	
Galvanic isolation	-	No	

CN2: Fieldbus Interface

The Modbus TCP signals comply with the IEEE 802.3 standard.

Characteristic	Unit	Value
Transmission rate	MBit	10 / 100

Characteristic	Unit	Value
Transmission protocol	-	Modbus TCP
Galvanic isolation	-	Yes

CN3: Commissioning Interface

The RS485 signals comply with the RS485 standard.

Characteristic	Unit	Value
Transmission rate	kBaud	9.6 / 19.2 / 38.4
Transmission protocol	-	Modbus RTU
Galvanic isolation	-	No

CN4: 24 V Signals

The signal inputs are not protected against reverse polarity.

Characteristic	Unit	Value
Logic 0 (U_{low})	V	-3 ... 4.5
Logic 1 (U_{high})	V	15 ... 30
Input current at 24 Vdc	mA	2
Debounce time `LIO1` ... `LIO4`	ms	1.25 ... 1.5
Debounce time `LIO1` and `LIO2`[1]	ms	0.01
Jitter `LIO1` and `LIO2`	ms	<2
Galvanic isolation	-	No
(1) When the function "Fast Position Capture" is used		

The internal 24 V power supply and the signal outputs are short-circuit protected.

Characteristic	Unit	Value
Nominal voltage	V	24
Voltage range	V	23 ... 25
Maximum current `+24VDC_OUT`	mA	200
Maximum current per output	mA	100
Maximum total current	mA	200
Suitable for inductive loads	mH	1000
Voltage drop at 50 mA load	V	≤1
Galvanic isolation	-	No

CN5 and CN6: Safety-Related Function STO

Jumper CN6 to deactivate the safety-related function STO.

Characteristic	Unit	Value
Voltage for logic level 0	V	-3 ...4.5
Voltage for logic level 1	V	15 ... 30
Input current $\overline{STO\_A}$ at 24 Vdc	mA	≤10
Input current $\overline{STO\_B}$ at 24 Vdc	mA	≤3
Debounce time	ms	1
Detection of difference between level of $\overline{STO\_A}$ and level of $\overline{STO\_B}$	s	>1
Response time of safety-related function STO	ms	<50
Permissible duration of test pulses from upstream devices	ms	<1
PELV	-	Required

Characteristic	Unit	Value
Galvanic isolation	-	No

Electromagnetic Compatibility

Electromagnetic Compatibility (EMC)

Characteristic	Value
Emission	Category C2 as per IEC 61800-3 Compliant with IEC 61000-6-4
Immunity	Use permissible in second environment as per EN 61800-3

NOTE: The emission category is independent of immunity. For example, if a power drive system has emission category 2, this does not imply that it is only suitable for the first environment.

The equipment described in the present document is not intended for use in domestic, residential environments and may not provide adequate protection to radio reception in such environments.

⚠ WARNING

INSUFFICIENT ELECTROMAGNETIC COMPATIBILITY

- Verify compliance with all EMC regulations and requirements applicable in the country in which the device is to be operated and with all EMC regulations and requirements applicable at the installation site.
- Do not install and operate the devices described in the present document in residential environments.
- Implement all required radio interference suppression measures and verify their effectiveness.

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

NOTE: Compliance of the product described in the present manual with Directive 2014/30/EU of the European Parliament and the Council (EMC Directive) is declared with reference to the harmonized standard EN 61800-3 "Adjustable speed power drive systems - Part 3: EMC requirements and specific test methods". With regard to equipment of category 2, this harmonized standard and the Directive itself oblige manufacturers to include the following statement in their product documentation: "In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required."

Shaft-Specific Data

Overview

If the maximum permissible forces at the motor shaft are exceeded, this will result in premature wear of the bearing or shaft breakage.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION DUE TO MECHANICAL DAMAGE TO THE MOTOR
● Do not exceed the maximum permissible axial and radial forces at the motor shaft. ● Protect the motor shaft from impact. ● Do press output components onto the shaft unless the shaft has a thread that can be used for pressing on.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Mounting Output Components

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.

Shaft Load

The following conditions apply:
● The permissible force applied during pressing on must not be exceeded.
● The maximum permissible radial force and the maximum permissible axial force must not be applied simultaneously.
● Nominal bearing service life in operating hours at a probability of failure of 10% (L_{10h} = 20000 hours)
● Mean speed of rotation n = 4000 RPM
● Ambient temperature = 40 °C (104 °F)
● Nominal torque = Duty type S1, 100% duty cycle

The following figure shows the points of application of forces:
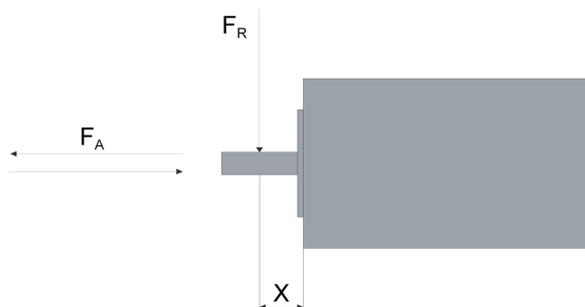
The following table shows the maximum radial and axial forces:

Characteristic	Unit	Value	
		ILA2•571	ILA2•572
Maximum radial force F_R at 100% duty cycle and X = 10 mm (0.39 in)	N (lbf)	89 (20.01)	107 (24.05)
Maximum axial force F_A at 100% duty cycle, tension	N (lbf)	104 (23.38)	104 (23.38)
Maximum axial force F_A at 100% duty cycle, compression	N (lbf)	104 (23.38)	104 (23.38)

Data for Safety-Related Function STO

Data for Safety-Related Calculations and Maintenance Plan

The safety-related function must be triggered at regular intervals. The interval depends on, among other things, the risk assessment for the overall system. The minimum interval is one year (high demand mode as per IEC 61508).

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

Lifetime of the safety-related function STO (IEC 61508)[1]	Years	20
SFF (IEC 61508) Safe Failure Fraction	%	47
HFT (IEC 61508) Hardware Fault Tolerance Type A subsystem	-	1
Safety Integrity Level (IEC 61508) Safety Integrity Level Claim Limit (IEC 62061)	-	SIL2 SILCL2
PFH (IEC 61508) Probability of Dangerous Hardware Failure per Hour	1/h	$5.223*10^{-9}$
PL (ISO 13849-1) Performance Level	-	d (category 3)
$MTTF_d$ (ISO 13849-1) Mean Time to Dangerous Failure	Years	1995
DC (ISO 13849-1) Diagnostic Coverage	%	90
Demand Mode (IEC 61508)	-	High Demand Mode (safety-related function must be triggered at least once per year)
(1) Refer to the chapter Lifetime Safety-Related Function STO *(see page 258)*.		

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

Conditions for UL 508C and CSA

Description

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

PELV Power Supply

Use only power supply units that are approved for overvoltage category III.

Motor Overload Protection

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

Fuses

The product was tested with a UL-listed 15 A circuit breaker. The product must be fused either with a UL-listed circuit breaker or a fuse for "Branch Circuit Protection" as per UL 248 with a maximum current of 15 A and DC rating.

Wiring

Use at least 60/75 °C copper conductors.

Chapter 3
Engineering

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
3.1	Electromagnetic Compatibility (EMC)	32
3.2	Power Supply	34
3.3	Functional Safety	37
3.4	Modbus TCP Fieldbus	44
3.5	Modbus TCP Communication	47
3.6	Modbus Services - "Function Code"	58

Section 3.1
Electromagnetic Compatibility (EMC)

Electromagnetic Compatibility (EMC)

EMC-Compliant Wiring

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

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

⚠ WARNING

SIGNAL AND EQUIPMENT INTERFERENCE

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

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

⚠ WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

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

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

Refer to the chapter Electromagnetic Compatibility *(see page 26)* for technical data on EMC.

NOTE: The emission category is independent of immunity. For example, if a power drive system has emission category 2, this does not imply that it is only suitable for the first environment.

The equipment described in the present document is not intended for use in domestic, residential environments and may not provide adequate protection to radio reception in such environments.

⚠ WARNING

INSUFFICIENT ELECTROMAGNETIC COMPATIBILITY

- Verify compliance with all EMC regulations and requirements applicable in the country in which the device is to be operated and with all EMC regulations and requirements applicable at the installation site.
- Do not install and operate the devices described in the present document in residential environments.
- Implement all required radio interference suppression measures and verify their effectiveness.

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

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) Use separate cable ducts at least 20 cm (7.87 in) 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.

Section 3.2
Power Supply

What Is in This Section?

This section contains the following topics:

External Power Supply Units

General Information

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
• Use power supply units that meet the PELV (Protective Extra Low Voltage) requirements. • Connect the 0 Vdc outputs of all power supply units to FE (functional earth/functional ground), for example, for the VDC supply voltage and for the 24 Vdc voltage for the safety-related function STO. • Interconnect all 0 Vdc outputs (reference potentials) of all power supply units used for the drive.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The motor regenerates energy during deceleration and when external driving forces act on the motor shaft. This can increase the `VDC` voltage up to 60 Vdc. The DC bus can absorb a limited amount of energy via the capacitors. If the capacity of the capacitors is exceeded, this results in 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
LOSS OF CONTROL DUE TO REGENERATION CONDITION
• Verify that the integrated drive can absorb the entire energy generated during deceleration by performing test runs under maximum load conditions. • Install an external Braking Resistor Controller (UBC60) if the integrated drive cannot absorb the entire energy generated under maximum load conditions. • Verify that all equipment is properly isolated from high Vdc voltage for which it is not rated, or use properly rated equipment. • Only use power supply units that can withstand the voltage that may be present during regeneration conditions.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Refer to the chapter Accessories *(see page 253)* for a braking resistor controller. Refer to the user guide of the braking resistor controller for additional details.

Reverse polarity of the `Vdc` supply voltage leads to a short-circuit.

NOTICE
INCORRECT POLARITY
Verify correct polarity of the Vdc supply voltage before applying power.
Failure to follow these instructions can result in equipment damage.

The external power supply unit must be rated for the power requirements of the drive. Refer to the chapter Electrical Data *(see page 23)* for the input current.

Fusing

Install the fusing specified in the chapter Electrical Data *(see page 23)*.

Wiring Information

Description

The reference potential of interfaces without galvanic isolation is internally connected via 0VDC. If the negative connection (0VDC) between the power supply and the drive is interrupted, the current of the power stage flows via the negative connection of the interfaces without galvanic isolation.

⚠ WARNING

LOSS OF CONTROL

● Do not interrupt the negative connection between the power supply unit and the drive, for example, by means of a switch or a fuse.
● Connect the reference potential of interfaces with galvanic isolation to 0VDC.
● Do not connect the reference potential of interfaces without galvanic isolation to 0VDC.

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

Wiring the product:

● Keep the voltage drop on the supply cables for the Vdc supply voltage to less than 1 V. The reference potential of some interfaces are connected to $0VDC$. At higher potential differences, the communication and control signals can be disturbed.
Decentralized power supply units for VDC close to the drives are advisable if the drives are installed at greater distances from each other. Connect $0VDC$ of the individual power supply units with the largest possible conductor cross section.
● Do not connect any other power supply in parallel with the internal 24 V power supply ($+24VDC\_OUT$). This may cause overloads of the internal 24 V power supply.

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.

Section 3.3
Functional Safety

What Is in This Section?

This section contains the following topics:

Definitions

Integrated Safety-Related Function "Safe Torque Off" STO

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

Category 0 Stop (IEC 60204-1)

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Category 1 Stop (IEC 60204-1)

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

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

Function

General

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

Function Principle

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

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

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

Requirements for Using the Safety-Related Function STO

General

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

⚡ ⚠ DANGER

ELECTRIC SHOCK

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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Logic Type

The inputs for the safety-related function STO (inputs $\overline{STO\_A}$ and $\overline{STO\_B}$) can only be wired for positive logic.

Holding Brake and Safety-Related Function STO

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

⚠ WARNING

FALLING LOAD

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

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

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

⚠ WARNING

UNINTENDED AXIS MOVEMENT

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

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

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

Unintended Restart

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Verify that your risk assessment covers all potential effects of automatic or unintended enabling of the power stage, for example, after power outage. ● Implement all measures such as control functions, guards, or other safety-related functions, required to reliably protect against all hazards that may result from automatic or unintended enabling of the power stage. ● Verify that a master controller cannot enable the power stage in an unintended way.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
Set the parameter `IO_AutoEnable` to "off" if the automatic enabling of the power stage presents hazards in your application.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Degree of Protection when the Safety-Related Function STO is Used

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

⚠ **WARNING**
INOPERABLE SAFETY-RELATED FUNCTION
Ensure that conductive substances (water, contaminated or impregnated oils, metal shavings, etc.) cannot get into the drive.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protected Cable Installation

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

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

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

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

● Use shielded cables for the signals of the safety-related function STO.
● Do not use the cable for the signals of the safety-related function STO for other signals.
● Connect one end of the shield.

Application Examples STO

Example of Category 0 stop

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

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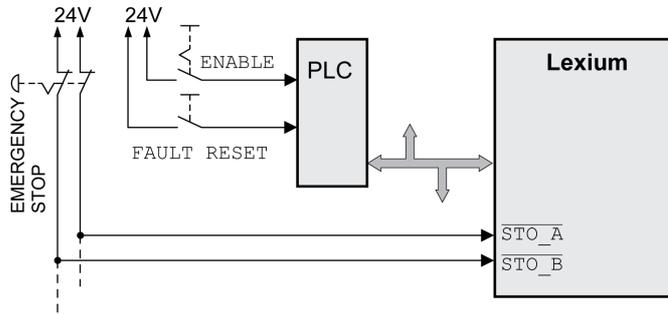
In this example, when an EMERGENCY STOP is activated, it leads to a category 0 stop.

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

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

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

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

Refer to the chapter Holding Brake and Safety-Related Function STO .

Example of Category 1 stop

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

Example of category 1 stop with external Preventa XPS-AV EMERGENCY STOP safety relay module:
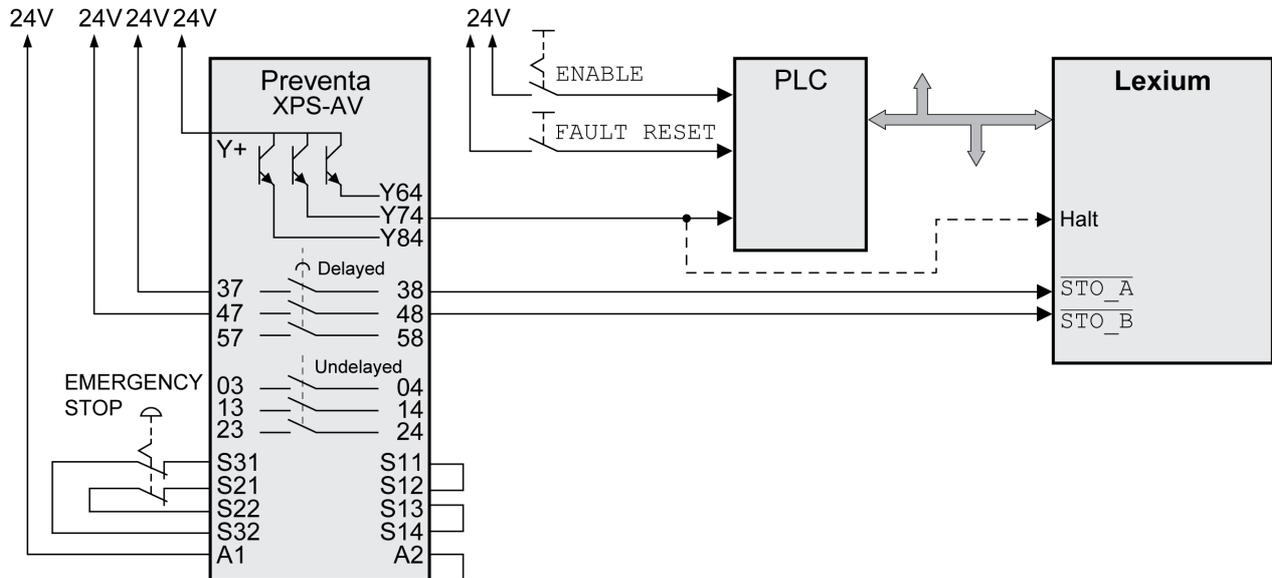
In this example, when an EMERGENCY STOP is activated, it leads to a category 1 stop.

The EMERGENCY STOP safety relay module requests an immediate stop (undelayed) of the drive. After the time delay set in the EMERGENCY STOP safety relay module has elapsed, the EMERGENCY STOP safety relay triggers the safety-related function STO.

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Refer to the chapter Holding Brake and Safety-Related Function STO *(see page 40)*.

Section 3.4
Modbus TCP Fieldbus

What Is in This Section?

This section contains the following topics:

Modbus TCP Technology

Function Principle

Modbus TCP is an Ethernet fieldbus. Modbus TCP describes the transmission of the Modbus protocol via the Ethernet interface and the TCP/IP transport and network layers.

The Modbus TCP client (master) connects to the Modbus TCP server (slave). Once the connection is established, the client sends Modbus requests to the server. These requests are processed by the server. The result is returned to the client as a Modbus response.

The Modbus TCP services are identical to the Modbus RTU services.

Bus Topology

Modbus TCP allows for the use of hubs or switches. Use switches in the case of high bus loads with many devices.

The maximum length of a segment is 100 m (328 ft). A segment consists of devices and hubs. A network can be subdivided into several segments by means of gateways or switches. For a fast bus cycle, keep the cables short and use a star topology.

The transmission rate is 10 or 100 MBit/s in half-duplex mode. If switches are used, transmission is also possible in full duplex mode.

Client-Server Model
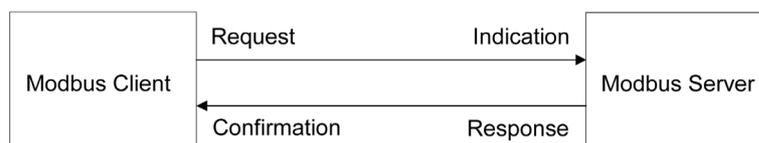
The Modbus messaging service implements client-server communication between devices connected by means of a TCP/IP network. Modbus TCP does not use an object dictionary.

The client-server model is based on four types of messages:

- **Request**: Message sent by the client to initiate a transaction.
- **Indication**: Request as received by the server.
- **Response**: Response message to the request sent by the server.
- **Confirmation**: Response as received by the client.

A communication cycle consists of the request from the client (request from the fieldbus master) and a response from the server (response from the fieldbus slave). Modbus request and Modbus response have the same structure. If an error is detected on receipt of the Modbus request or if the slave cannot execute the action, the slave sends an error message in the Modbus response.

The drive analyzes the Modus requests received. Depending on the Modbus request, the drive triggers actions or provides requested data.

Network Service SNMP

The Network Management System can exchange data with SNMP devices. The tasks of the network management system comprise monitoring, control, and configuration of network components as well as error detection and error messaging.

The product supports SNMP version 1.0. An SNMP agent must be used to monitor a network with SNMP.

Modbus TCP Protocol

Overview

The Modbus protocol defines a Modbus PDU (Protocol Data Unit) which is independent of the underlying communication layers. This Modbus PDU consists of the fields "Function Code" and "Data". Depending on the mapping to the different network protocols, the Modbus PDU is extended by additional fields in the Modbus ADU (Application Data Unit). The Modbus PDU and the Modbus ADU constitute the Modbus message, also referred to as "Frame".

Structure of a Modbus message
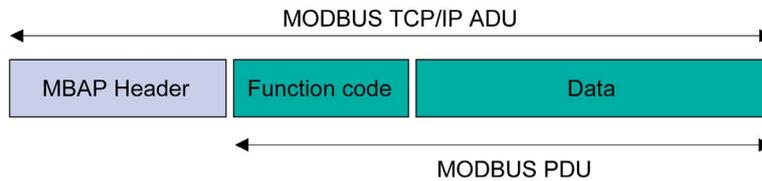
The "Function Code" of a message specifies the Modbus service to be triggered. The "Data" field can contain additional information, depending on the "Function Code".

Due to the encapsulation of "Function Code" and "Data" in the Modbus PDU, different Modbus versions can use same Modbus services and object model.

The maximum size of a Modbus ADU is 260 bytes. The size of an embedded Modbus PDU is 253 bytes.

MBAP Header

The MBAP header contains the information allowing the recipient to uniquely identify a message.

The MBAP header has a length of seven bytes and contains the following fields:

Field	Length	Description
Transaction Identifier	2 bytes	Identification of a Modbus request or Modbus response.
Protocol Identifier	2 bytes	Value 0 means Modbus protocol.
Length	2 bytes	Byte counter for the subsequent fields ("Unit Identifier", "Function Code" and "Data").
Unit Identifier	1 byte	Identification of a slave connected to another bus via a serial line.

Section 3.5
Modbus TCP Communication

What Is in This Section?

This section contains the following topics:

Connection management

Establishing of a Connection

The Modbus TCP server allows for TCP connections via the default port 502. A client can establish a new connection via this port. If the client is to exchange data with a remote server, a new client connection via remote port 502 must be established.

Closing a Connection

After the Modbus communication between the client and a server is finished, the client causes the connection used to be closed.

The server does not close the connection under normal circumstances.

However, when errors are detected, the server closes the connection, for example:

● Communication error detected
● Communication inactivity
● Maximum number of connections reached

The product can manage up to 8 TCP connections. If an attempt is made to establish a further connection beyond this maximum, the oldest unused connection is closed. If it is impossible to close the oldest unused connection, a new connection cannot be established.

Modbus Response to a Modbus Request

Overview

The Modus server generates a Modbus response after having processed a Modbus request.

Two types of Modbus responses are possible:
● Positive Modbus response
  ○ The "Function Code" in the Modbus response corresponds to the "Function Code" in the Modbus request.

● Negative Modbus response
  ○ The client receives pertinent information on error detection during processing;
  ○ The "Function Code" in the Modbus response corresponds to the "Function Code" in the Modbus request + 80_h.
  ○ The "Exception Code" indicates the cause of the error.

If a syntactically incorrect Modbus PDU (Protocol Data Unit) is transmitted, the connection is terminated. In the case of other errors, a negative Modbus response is sent.

Exception Code	Modbus name (as per Modbus specifications)	Description
01	Illegal Function	The "Function Code" cannot be processed by the server.
02	Illegal Data Address	Depends on the Modbus request
03	Illegal Data Value	Depends on the Modbus request
04	Server Failure	The server was unable to properly process the request. You can use Function Code 8 to read the vendor-specific error code.
05	Acknowledge	The server has accepted the Modbus request. However, the execution takes a relatively long time. The server therefore only returns an acknowledgement confirming receipt of the service request.
06	Server Busy	The server was unable to accept the Modbus request. It is the responsibility of the application on the client to determine whether and when to re-send the request.
0A	Gateway Problem	The gateway path is unavailable.
0B	Gateway Problem	The targeted device does not respond. This condition is detected by the gateway.

Reading and Writing Parameters

Overview

Parameters are processed as 32 bit values. 16 bit values must also be processed as 32 bit values. Two consecutive 16 bit parameters must be read or written to process a 16 bit parameter. The Modbus address of the first 16-bit parameter must be used.

If several consecutive parameters are to be processed, a single Modbus command with the corresponding Modbus address and the length indication is sufficient.

NOTE: This does not apply to reading and writing parameters with addresses in the range from 6656 (1A00 hex) to 6911 (1AFF hex).
In this range, only a single parameter can be addressed with one Modbus command.

Example

Reading the parameter `RAMPn_max`.

Modbus address: 1554

When the parameter `RAMPn_max` with the address 1554 and length 2 is read, the two parameter addresses 1554 and 1555 are read. Result:

Address	Value
1554	3390 hex
1555	0000 hex

The sequence of the words can be changed via the parameter 6410 (190A hex) for the corresponding Modbus TCP connection.

I/O Scanning to "Drive Profile Lexium"

Overview

I/O scanning is used for cyclic interchange of data between master and slave.

I/O scanning must be configured on the master. The master can use 2 different approaches for I/O scanning:

- "Function Code" 23 (17 hex), Read-Write Multiple Registers
- "Function Code" 3 (03 hex), Read Multiple Registers and "Function Code" 16 (10 hex), Write Multiple Registers
  The read value is 0 until the first write command is executed.

Settings

The following setting must be made on the master before you can use I/O scanning:

- The "Unit Identifier" is 255.
- The data length is 8 bytes.

The Modbus addresses for I/O scanning do not differ from the addresses for normal Modbus access.

Output - Input

Output and input refer to the direction of data transmission from the perspective of the master.

- Output: Commands from the master to the slave
- Input: Status messages from the slave to the master

I/O Scanning - Output

Overview

The table below shows the structure of the cyclic data for the commands from the master to the product.

Address	Byte	Name
6922	0	driveControl
	1	modeControl
	2 ... 3	Ref_16
6924	0 ... 3	Ref_32

Byte "driveControl"

The byte "driveControl" is used to set the operating state.

driveControl

7	6	5	4	3	2	1	0
CU	CH	SH	-	FR	QS	EN	DS
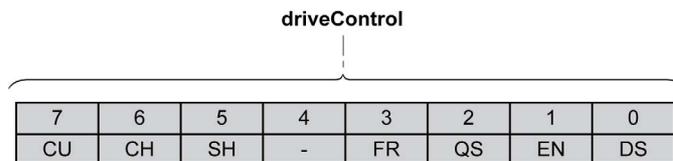
Bit	Name	Meaning	Operating state
0	DS	Disable the power stage	**6** Operation Enabled -> **4** Ready To Switch On
1	EN	Enable the power stage	**4** Ready To Switch On -> **6** Operation Enabled
2	QS	Perform "Quick Stop"	**6** Operation Enabled -> **7** Quick Stop Active
3	FR	Perform "Fault Reset"	**7** Quick Stop Active -> **6** Operation Enabled **9** Fault -> **4** Ready To Switch On
4	-	Reserved	-
5	SH	Perform "Halt"	**6** Operation Enabled
6	CH	Clear "Halt"	**6** Operation Enabled
7	CU	Resume operating mode interrupted by "Halt"	**6** Operation Enabled

In the case of a write access, the bits respond to a transition from 0 to 1 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.

If the bits 0 ... 7 are set to 0, the power stage is disabled.

Ambivalent bit combinations are treated in accordance with the following priority list (highest priority bit 0, lowest priority bit 6 and bit 7):

- Bit 0 (disable power stage) takes precedence over bit 1 (enable power stage)
- Bit 2 (perform "Quick Stop") takes precedence over bit 3 (perform "Fault Reset")
- Bit 5 (perform "Halt") takes precedence over bit 6 (clear "Halt") and bit 7 (resume operating mode interrupted by "Halt")

If an error of error class 2 or error class 3 is detected, a "Fault Reset" can only be performed if the value of bit 1 (enable power stage) is 0.

Byte "modeControl", Word "Ref_16" and Double Word "Ref_32"

The byte "modeControl" is used to set the operating mode.

modeControl

7	6	5	4	3	2	1	0
MT	ACTION			MODE			
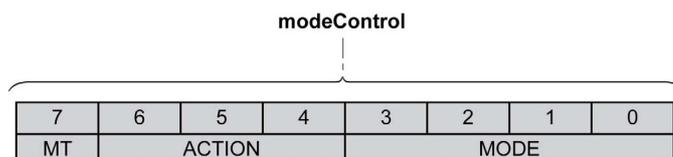
Bit	Name	Description
0 ... 3	MODE	Operating Mode Value 1: Jog Value 2: Homing Value 3: Profile Position Value 4: Profile Velocity Value 7: Speed Control
4 ... 6	ACTION	Operating mode-dependent
7	MT	Bit "MT" (Mode Toggle)

The operating mode can be activated or target values can be modified by supplying or setting the following values:

● Target values, depending on required operating mode
● Operating mode in "modeControl", bits 0 ... 3 (MODE).
● Action for this operating mode, bits 4 ... 6 (ACTION)
● Toggle bit 7 (MT)

MODE	ACTION	Description	Byte "modeControl"	Word "Ref_16"	Double Word "Ref_32"
1	0	Jog	01 hex	Corresponds to parameter `JOGactivate`	-
2	0	Homing: Position Setting	02 hex	-	Position for position setting Corresponds to parameter `HMp_homeusr`
	1	Homing: Reference movement	12 hex	Homing method Corresponds to parameter `HMmethod`	-
3	0	Profile Position Absolute movement	03 hex	Target velocity Corresponds to parameter `PPn_target`	Target position Corresponds to parameter `PPp_absusr`
	1	Profile Position Relative movement with reference to the target position	13 hex	Target velocity Corresponds to parameter `PPn_target`	Target position Corresponds to parameter `PPp_relprefusr`
	2	Profile Position Relative movement with reference to the actual position	23 hex	Target velocity Corresponds to parameter `PPn_target`	Target position Corresponds to parameter `PPp_relprefusr`
4	0	Profile Velocity	04 hex	Target velocity Corresponds to parameter `PVn_target`	-
7	1	Speed Control	17 hex	Reference velocity Corresponds to parameter `SPEEDn_target`	-

If the values of bit 0 to bit 7 in "modeControl" are zero during transmission, the transmitted additional data is not processed and no error message is detected.

Operating mode data (operating mode, reference position and reference velocity) that is transmitted simultaneously with a single access is only processed if bit 7 (MT) was toggled.

Toggling means that a change of edge of this bit from 0 to 1 or from 1 to 0 has been detected since the last transmission.

Procedure for activating an operating mode or for modifying reference values:

1. Reference values in the fields "Ref_16" and "Ref_32" (0 must be entered in unused fields)

2. Operating mode with "modeControl" bits 0 ... 3 (MODE)

3. Action for this operating mode with "modeControl" bits 4 ... 6 (ACTION)

4. Toggle "modeControl", bit 7 (MT)

I/O Scanning - Input

Overview

The table below shows the structure of the cyclic data for the status messages from the product to the master.

Address	Byte	Name
6926	0 ... 1	driveStat
	2	modeStat
	3	Digital IO
6928	0 ... 1	ActionWord
	2 ... 3	Special Functions

Word "driveStat"

The operating state is indicated with the "driveStat" word.
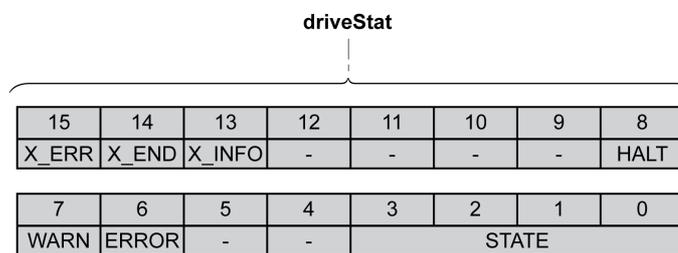
Bit	Name	Meaning
0 ... 3	STATE	Operating state (binary coded) **1** Start **2** Not Ready To Switch On **3** Switch On Disabled **4** Ready To Switch On **5** Switched On **6** Operation Enabled **7** Quick Stop Active **8** Fault Reaction Active **9** Fault
4 ... 5	-	Reserved
6	ERROR	Error detected (error classes 1 ... 3)
7	WARN	Error detected (error class 0)
8	HALT	"Halt" is active
9 ... 12	-	Reserved
13	X_INFO	Operating mode-specific information
14	X_END	0: Operating mode started 1: Operating mode terminated
15	X_ERR	0: No error detected 1: Error detected

Byte "modeStat"

The byte "modeStat" is used to indicate the set operating mode.

modeStat

7	6	5	4	3	2	1	0
MT	ME	ref_ok	-	MODE			
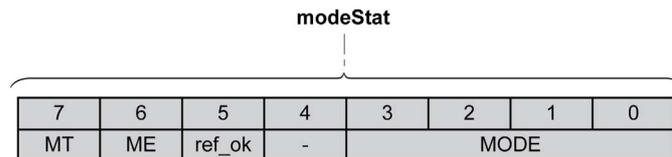
Bit	Name	Description
0 ... 3	MODE	Indicates the set operating mode Value 1: Jog Value 2: Homing Value 3: Profile Position Value 4: Profile Velocity Value 7: Speed Control
4	-	Reserved
5	ref_ok	Zero point is valid.
6	ME	The bit "ME" (Mode Error) relates to parameters that depend on the bit "MT" (Mode Toggle). The bit "ME" (Mode Error) is set to 1 if a request (for example, starting an operating mode) was rejected.
7	MT	Bit "MT" (Mode Toggle)

Byte "Digital IO"

The byte "Digital IO" is used to indicate the state of the digital signal inputs.

Bit	Signal	Factory setting
0	LIO1	Signal input function Positive Limit Switch (LIMP)
1	LIO2	Signal input function Negative Limit Switch (LIMN)
2	LIO3	Signal input function Freely Available
3	LIO4	Signal input function Reference Switch (REF)
4	$\overline{STO\_A}$	Signal $\overline{STO\_A}$ of safety-related function STO
5	$\overline{STO\_B}$	Signal $\overline{STO\_B}$ of safety-related function STO
6 ... 7	–	Reserved

Word "ActionWord"

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

Bit	Meaning
0 ... 5	Reserved
6	MOTZ: Motor at a standstill
7	MOTP: Motor movement in positive direction
8	MOTN: Motor movement in negative direction
9	PWIN: Inside position deviation window
10	Reserved
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 "Special Functions"

The word "Special Functions" is used to indicate the state of the counter of the capture inputs.

Bit	Meaning
0	Bit 0 of the counter of the capture input 1.
1	Bit 1 of the counter of the capture input 1.
2	Bit 0 of the counter of the capture input 2.
3	Bit 1 of the counter of the capture input 2.
4 ... 15	Reserved

Section 3.6
Modbus Services - "Function Code"

What Is in This Section?

This section contains the following topics:

"Function Code" 3 (Read Multiple Registers)

Description

The "Function Code" 3 (Read Multiple Registers) allows you to read several consecutive parameters, starting at any address.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	3 = 03 hex	Read Multiple Registers
Starting Address	2	(various)	Address of the first parameter to be read
Quantity Of Registers	2	2 * n	Number of 16 bit values to be read (1 parameter has the value 2 since a parameter consists of a 32 bit value)

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	3 = 03 hex	Read Multiple Registers
Byte Count	1	4 * n	Number of data bytes
Registers Value	4 * n	(various)	Parameter values

Structure of the negative Modbus response

Field	Bytes	Value	Meaning
Function Code	1	03 hex + 80 hex = 83 hex	Read Multiple Registers
Exception Code	1	01 hex ... 04 hex	See chapter Modbus Response to a Modbus Request (see page 49)

"Function Code" 8 (Diagnostics)

Description

The "Function Code" 8 (Diagnostics) allows you to read diagnostics data of the slave.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	8 = 08 hex	Diagnostics
Sub-function Code	2	(various)	Diagnostics function
Data	2	(various)	Data (depending on diagnostics function)

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	8 = 08 hex	Diagnostics
Sub-function Code	2	(various)	Diagnostics function
Data	2	(various)	Diagnostics data

Structure of the negative Modbus response

Field	Bytes	Value	Meaning
Function Code	1	08 hex + 80 hex = 88 hex	Diagnostics
Exception Code	1	01 hex ... 04 hex	See chapter Modbus Response to a Modbus Request *(see page 49)*

Sub-Function Code

The following diagnostics functions are available:

Sub-function Code		Diagnostics function
00	Return Query Data	Return request as a response
01	Restart Communication Option	Re-initialize the communication port
02	Return Diagnostic Register	Return the error code *(see page 216)* in the case of synchronous errors
03	(reserved)	–
04	Force Listen Only Mode	Force "Listen Only" mode of slave
05 ... 09	(reserved)	–
10	Clear Counters and Diagnostic Register	Clear the statistical counters
11	Return Bus Message Count	Return number of detected "Bus Message"s
12	Return Bus Communication Error Count	Return number of detected "Bus Communication Error"s
13	Return Bus Exception Error Count	Return number of detected "Bus Exception Error"s
14 ... 15	(reserved)	–
16	Return Slave NAK Count	Return number of detected "Slave Not-Acknowledged"s
17	Return Slave Busy Count	Return number of detected "Slave Busy"s
18	Return Bus Char Overrun Count	Return number of detected "Bus Char Overrun"s
>18	(reserved)	–

"Function Code" 16 (Write Multiple Registers)

Description

The "Function Code" 16 (Write Multiple Registers) allows you to write several consecutive parameters, starting at any address.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	16 = 10 hex	Write Multiple Registers
Starting Address	2	(various)	Address of the first parameter to be written
Quantity Of Registers	2	2 * m	Number of 16 bit values to be written (1 parameter has the value 2 since a parameter consists of a 32 bit value)
Byte Count	1	4 * m	Number of data bytes
Registers Value	2 * m	(various)	Parameter values

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	16 = 10 hex	Write Multiple Registers
Starting Address	2	(various)	Corresponds to the Modbus request
Quantity Of Registers	2	2 * m	Corresponds to the Modbus request

Structure of the negative Modbus response

Field	Bytes	Value	Meaning
Function Code	1	10 hex + 80 hex = 90 hex	Write Multiple Registers
Exception Code	1	01 hex ... 04 hex	See chapter Modbus Response to a Modbus Request (see page 49)

"Function Code" 23 (ReadWrite Multiple Registers)

Description

The "Function Code" 23 (ReadWrite Multiple Registers) allows you to read and write several consecutive parameters, starting at any address.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	23 = 17 hex	Read/Write Multiple Registers
Read Starting Address	2	(various)	Address of the first parameter to be read
Quantity To Read	2	2 * n	Number of 16 bit values to be read (1 parameter has the value 2 since a parameter consists of a 32 bit value)
Write Starting Address	2	(various)	Address of the first parameter to be written
Quantity To Write	2	2 * m	Number of 16 bit values to be written (1 parameter has the value 2 since a parameter consists of a 32 bit value)
Write Byte Count	1	4 * m	Number of data bytes
Write Registers Value	4 * m	(various)	Parameter values

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	23 = 17 hex	Read/Write Multiple Registers
Byte Count	1	2 * n	Number of data bytes
Read Registers Value	2 * n	(various)	Parameter values

Structure of the negative Modbus response

Field	Bytes	Value	Meaning
Function Code	1	17 hex + 80 hex = 97 hex	Read/Write Multiple Registers
Exception Code	1	01 hex ... 04 hex	See chapter Modbus Response to a Modbus Request *(see page 49)*

"Function Code" 43 (Encapsulated Interface Transport)

Description

The "Function Code" 43 / 14 (Read Device Identification) allows you to read device-specific data.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	43 = 2B hex	Encapsulated Interface Transport
Modbus Encapsulated Interface Type	1	14 = 0E hex	Fixed value 14 (Read Device Identification)
Read Device ID Code	1	01	Read the objects
Object ID	1	0 x 00	Object ID

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	43 = 2B hex	Encapsulated Interface Transport
Modbus Encapsulated Interface Type	1	14 = 0E hex	Fixed value 14 (Read Device Identification)
Read Device ID Code	1	01	Corresponds to the Modbus request
Conformity Level	1	02	Fixed value
More Follows	1	00	Fixed value
Next Object ID	1	00	Fixed value
Number Of Objects	1	03	Number of objects
Object ID	1		Object ID *(see page 63)*
Object Length	1		Object length
Object Value		(various)	Object data (various)

Structure of the negative Modbus response

Field	Bytes	Value	Meaning
Function Code	1	2B hex + 80 hex = AB hex	Encapsulated Interface Transport
Exception Code	1	01 hex ... 04 hex	See chapter Modbus Response to a Modbus Request *(see page 49)*

Object ID

The following object IDs are available:

Object ID	Object name	Value
00 hex	vendor name	Manufacturer name
01 hex	product code	„xxxxxxxxxxx" (see type code of the drive)
03 hex	revision	"Vxx.yyy" (for example "V02.001")

Example of "Function Code" 3

Description

Reading an error memory entry. Since the Modbus addresses of the parameters of an error memory entry are contiguous (ascending order), a single Modbus request is sufficient.

Parameters `_FLT_number (15362)`, `_FLT_class (15364)`, `_FLT_time (15366)` and `_FLT_qual (15368)`.

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	3	Read Multiple Registers
Starting Address	2	15362 (3C02 hex)	Address of the first parameter to be read
Quantity Of Registers	2	8	Number of the 16 bit values to be read = 8

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	3	Read Multiple Registers
Byte Count	1	16	Number of bytes: 8 bytes of data
Registers Value	16	32 bit value 32 bit value 32 bit value 32 bit value	`_FLT_number`, 15362 (error number) `_FLT_class`, 15364 (error class) `_FLT_time`, 15366 (error time) `_FLT_qual`, 15368 (error qualifier)

Example of "Function Code" 16

Description

Writing of the software limit switches. Since these parameters have consecutive addresses, a single Modbus request is sufficient:

Parameters `SPVswLimPusr` (1544) and `SPVswLimNusr` (1546).

Modbus Request

Structure of the Modbus request:

Field	Bytes	Value	Meaning
Function Code	1	16	Write Multiple Registers
Starting Address	2	1544 (608 hex)	Address of the first parameter to be written
Quantity Of Registers	2	4	Number of parameters = 4 (8 bytes of data)
Byte Count	1	8	Number of bytes: 8 bytes of data
Registers Value	8	32 bit value 32 bit value	`SPVswLimPusr`, 1544 `SPVswLimNusr`, 1546

Modbus Response

Structure of the positive Modbus response:

Field	Bytes	Value	Meaning
Function Code	1	16	Write Multiple Registers
Starting Address	2	1544 (608 hex)	Address of the parameter
Quantity Of Registers	2	4	Number of parameters = 4 (8 bytes of data)

Chapter 4
Installation

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Mechanical Installation

What Is in This Section?

This section contains the following topics:

Topic	Page
Before Mounting	69
Mounting the Integrated Drive	70

Before Mounting

General

An engineering phase is mandatory prior to mechanical and electrical installation. See chapter Engineering *(see page 31)* for basic information.

⚠ ⚠ 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.

Conductive foreign objects, dust or liquids may cause safety-related functions to become inoperative.

⚠ WARNING

LOSS OF SAFETY-RELATED FUNCTION CAUSED BY FOREIGN OBJECTS

Protect the system against contamination by conductive substances.

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.

Inspecting the Product

- Verify the product version by means of the Type Code *(see page 18)* on the Nameplate *(see page 17)*.
- Prior to mounting, inspect the product for visible damage.

Damaged products may cause electric shock or unintended equipment operation.

⚠ ⚠ DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

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

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

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

Mounting Surface for Flange

The integrated drive features four holes for mounting it to a flange.

The mounting surface must be plane, stable, clean, deburred, low-vibration, and grounded. Functional grounding must be established either via the mounting flange or via the functional ground connection.

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

Painted surfaces have an insulating effect. Verify that the motor flange is mounted in such a way as to allow for good electrical and thermal conductivity.

Mounting the Integrated Drive

General

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

⚠ **WARNING**
ELECTROMAGNETIC FIELDS
● Keep persons with electronic medical implants, such as pacemakers, away from the motor.
● Do not place electromagnetically sensitive devices in the vicinity of the motor.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

⚠ **WARNING**
UNINTENDED MOVEMENT CAUSED BY ELECTROSTATIC DISCHARGE
Use conductive components such as antistatic belts or other suitable measures to avoid static charge by motion.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Verify that the environmental conditions are respected.
● Keep liquids from getting to the shaft bushing.
● Do not clean the product with 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.

| ⚠ **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.** |

Clearances and Ventilation

When selecting the position of the device, take into account the following:

● No minimum clearances are required for installation. However, free convection must be possible.
● Avoid heat accumulations.
● Do not mount the device close to heat sources.
● 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).

Mounting Positions

The following mounting positions defined by IEC 60034-7 are permissible:

IM B5   IM V1   IM V3
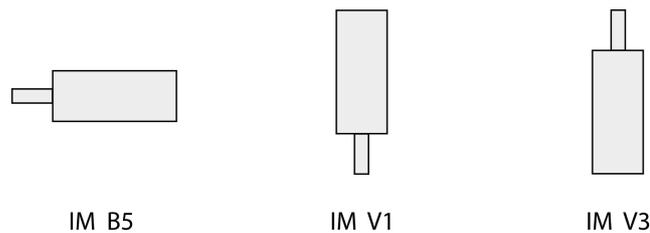
● IM B5: Motor shaft horizontal
● IM V1: Motor shaft vertical, shaft end to the bottom
● IM V3: Motor shaft vertical, shaft end to the top

Mounting

When the integrated drive is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. No uneven mechanical forces must be applied when the mounting screws are tightened.

See chapter Technical Data *(see page 19)* for data, dimensions and degrees of protection (IP).

Mounting Output Components

If the maximum permissible forces at the motor shaft are exceeded, this will result in premature wear of the bearing or shaft breakage.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO MECHANICAL DAMAGE TO THE MOTOR

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

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

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 causes runout and premature wear.

The maximum axial and radial forces acting on the shaft must not exceed the maximum shaft load values specified *(see page 27)*.

Section 4.2
Electrical Installation

What Is in This Section?

This section contains the following topics:

Overview of Procedure

General Information

⚡ ⚠ DANGER
ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION
Keep foreign objects (such as chips, screws or wire clippings) from getting into the product.
Failure to follow these instructions will result in death or serious injury.

⚡ ⚠ DANGER
ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING
● Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of the entire drive system.   ● Ground the drive system before applying voltage.   ● Do not use conduits as functional ground conductors; use a functional ground conductor inside the conduit.   ● The cross section of the functional ground conductor must comply with the applicable standards.   ● Do not consider cable shields to be functional ground conductors.
Failure to follow these instructions will result in death or serious injury.

⚡ ⚠ DANGER
ELECTRIC SHOCK CAUSED BY INCORRECT POWER SUPPLY UNIT
● Use power supply units that meet the PELV (Protective Extra Low Voltage) requirements.   ● Connect the negative outputs of all power supply units to PE (protective earth/protective ground), for example, for the VDC supply voltage and for the 24 Vdc voltage for the safety-related function STO.   ● Interconnect all negative outputs (reference potentials) of all power supply units used for the integrated drive.
Failure to follow these instructions will result in death or serious injury.

⚠ 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.

The `VDC` connection of the product does not have an inrush current limitation. If the voltage is applied by means of switching of contacts, damage to the contacts or contact welding may result.

NOTICE
PERMANENT DAMAGE TO CONTACTS
● Switch the power input (primary side) of the power supply unit.   ● Do not switch the output voltage (secondary side) of the power supply unit.
Failure to follow these instructions can result in equipment damage.

The installation procedure must be performed without voltage present.

Overview of the Procedure for Electrical Installation

Depending on the space conditions in your machine and other factors, you can first perform the mechanical installation *(see page 68)* of the integrated drive and then the electrical installation. However, it is also possible to first perform the electrical installation, then commission the integrated drive and finally mount the integrated drive in the machine.

Connection Overview

Overview of Printed Circuit Board Connectors
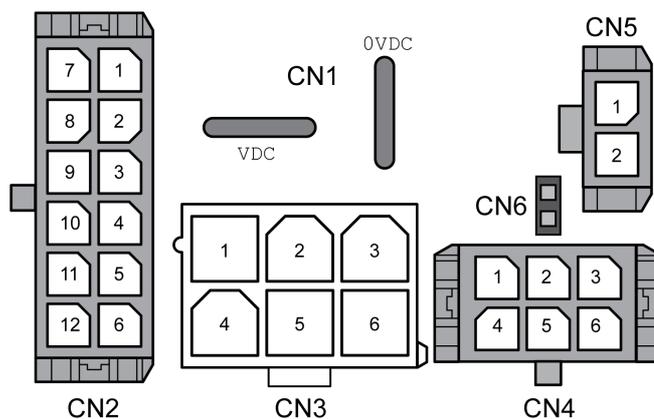
Connection	Assignment
CN1	Connector for Vdc supply voltage
CN2	Connector for fieldbus Modbus TCP
CN3	Connector for commissioning interface (RS-485)
CN4	Connector for 24 Vdc signals
CN5	Connector for the safety-related function STO
CN6	Jumper for activating and deactivating the safety-related function STO

The integrated drive can be connected via cable entries or industrial connectors.

Refer to the chapter Connection Via Cable Entry *(see page 76)* or to the chapter Connection Via Industrial Connectors *(see page 79)* for details.

Connection Via Cable Entry

Mounting Cables to Cable Entries

Mounting cables to the cable entry:

1 Unshielded cables
2 Shielded cables

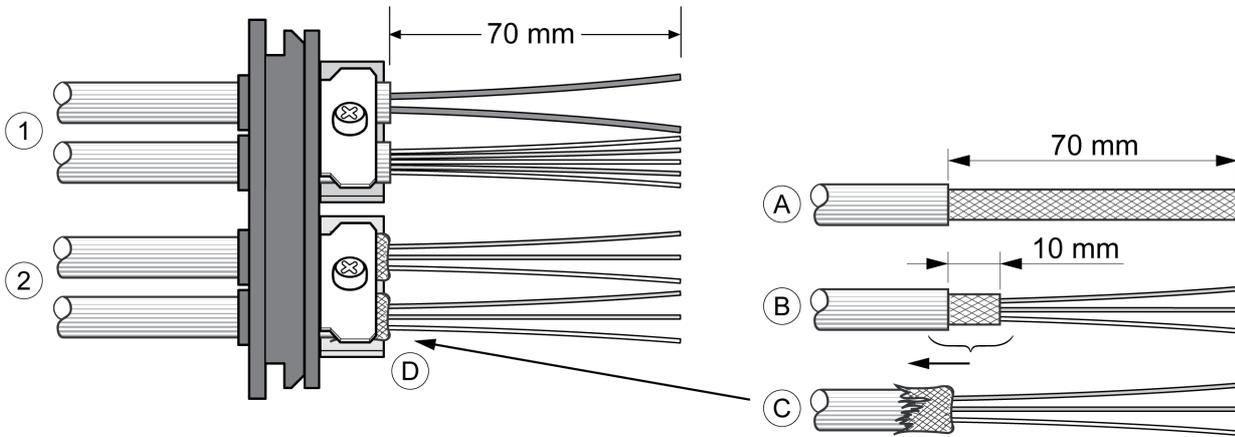| Step	Action
1	Trim the cable bushings so that the diameter of the opening matches the diameter of the cable. The specified degree of protection IP54 can only be achieved with properly trimmed cable bushings.
2	(A) Strip the jacket of the cables by a length of 70 mm (2.76 in).
3	(B) Shorten the shield to a length of 10 mm (0.4 in).
4	(C) Slide the shielding braid back over the cable jacket.
5	(D) Loosen the strain relief.
6	Push the cables though the strain relief.
7	Glue EMC shielding film around the shield.
8	Pull the cable back to the strain relief.
9	Fasten the strain relief.

Mounting Connectors

The following table lists the parts and data required for mounting connectors. Connector housings and crimp contacts are included in the accessories kits. Refer to the chapter Accessories and Spare Parts ().

Connection	Conductor cross section [mm²]	Stripping length [mm]	Manufacturer's crimp contact no.	Crimping tool	Connector manufacturer	Connector type
CN1	0.75 ... 1.5 (AWG 18 ... 16) 2.5 ... 4.0 (AWG 12)	5 ... 6	160773-6 341001-6	654174-1	Tyco Electronics	Positive Lock 1-926522-1
CN2	0.2 ... 0.6 (AWG 24 ... 20)	2.5 ... 3.0	43030-0007	63819-0000	Molex	Micro-Fit 3.0 43025-1200
CN3	0.2 ... 1.0 (AWG 24 ... 18)	3.0 ... 3.5	39-00-0060	63819-0901	Molex	Mini-Fit Jr. 39-01-2065
CN4	0.2 ... 0.6 (AWG 24 ... 20)	2.5 ... 3.0	43030-0007	63819-0000	Molex	Micro-Fit 3.0 43025-0600
CN5	0.34 ... 0.6 (AWG 20)	2.5 ... 3.0	43030-0007	63819-0000	Molex	Micro-Fit 3.0 43645-0200

Assembling the Cables

Procedure:

Step	Action
1	Strip the ends of the wires.
2	Attach cable lugs and crimp contacts. Verify that you use the correct crimp contacts and the matching crimping tool.
3	Slide the cable lugs and crimp contacts straight into the connector until they snap in place.
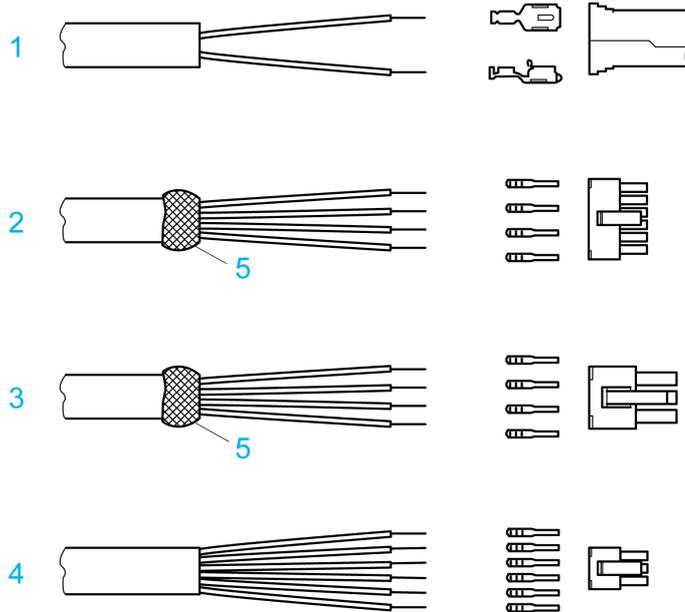
1 CN1 Supply voltage `Vdc`
2 CN2 Fieldbus
3 CN3 Commissioning
4 CN4 24 V signal interface
5 Shield wire with EMC shield film

Mounting the Cable Entry
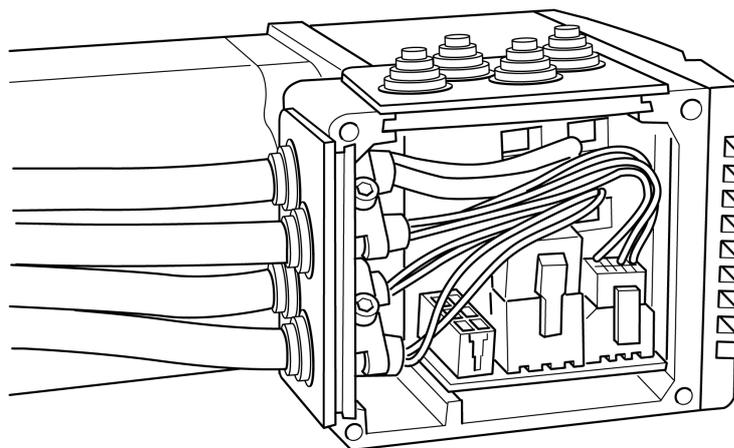
Step	Action
1	Unscrew the cover of the connector housing.
2	Remove the shipping locks made of cardboard.

Step	Action
3	Set the parameter switches as they are difficult to access once the cables have been connected. For a description of the parameter switches, see chapter Fieldbus Integration *(see page 98)*.
4	Connect the connectors of the assembled cables to the matching sockets. The connectors must snap in. Only pull the connector housing (not the cable).
5	Plug the cable entry into one of the two cutouts provided. The side to be used for the cable entry depends on the space available in your system. The pointed corners of the cable entry must point in the direction of the cover of the connector housing. Degree of protection IP54 is not reached if the cable entry is mounted the other way around.
6	Close the cutout that is not used with a sealing insert for cutouts.
7	Finally, screw the cover of connector housing cover back into place with a tightening torque of 1.1 Nm (9.74 lbin). If screws are lost, use M3 x 12 as a replacement.
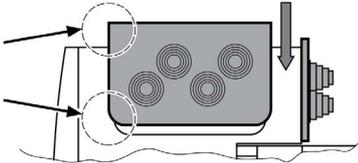
Connection Via Industrial Connectors

Overview

Interface	Connector used
Supply voltage VDC	Hirschmann STASEI 200
Connector for fieldbus Modbus TCP	Circular connector M12, 4 poles, D-coded
24 V signal inputs and outputs	Circular connector M8, 3-pin
Safety-related function STO	Circular connector M8, 4-pin

Refer to the chapter Accessories and Spare Parts *(see page 253)* for information on pre-assembled cables and connector kits.

Connection of CN1 - `Vdc` Supply Voltage

Description

The Vdc supply voltage is connected by means of printed circuit board connectors or industrial connectors.

Use pre-assembled cables to reduce the risk of wiring errors.

Verify that wiring, cables, and connected interfaces meet the PELV circuit requirements.

Cable Specifications CN1 (Vdc Supply Voltage)

Characteristic	Unit	Value
Shield	-	Not required
Twisted pair	-	Not required
PELV	-	Required
Minimum conductor cross section	mm^2 (AWG)	0.75 (18)
Maximum connection cross section	mm^2 (AWG)	4.0 (12)

Connector Specifications CN1 (Vdc Supply Voltage)

Two different crimp terminals are available for different conductor cross sections. It is possible to connect two wires via a single crimp terminal to daisy-chain multiple drives.

Characteristic	Value/Description
Connector housing	Tyco Electronics, Positive Lock 1-926522-1
Crimp terminal for conductor cross section 0.75 ... 1.5 (AWG 18 ... 16)	Tyco Electronics, Positive Lock 160773-6
Crimp terminal for conductor cross section 2.5 ... 4.0 (AWG 12)	Tyco Electronics, Positive Lock 341001-6
Stripping length	5 ... 6 mm (0.20 ... 0.24 in)
Crimping tool	Tyco Electronics, 654174-1

Pin Assignments Printed Circuit Board Connector CN1 (Vdc Supply Voltage)
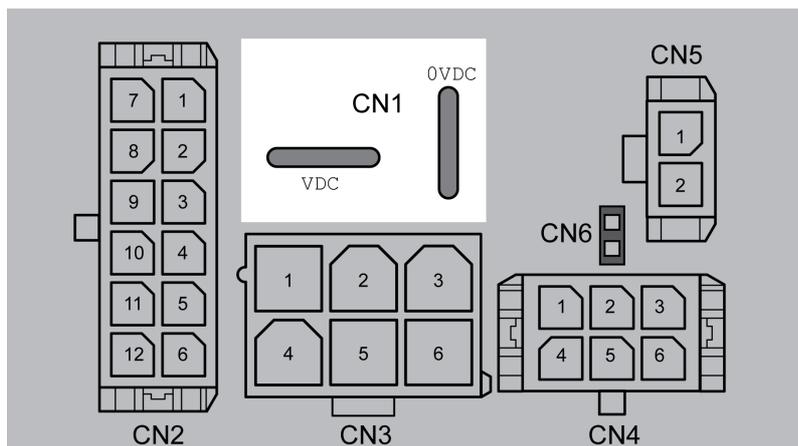
Designation	Description	Number[1]
`VDC`	Supply Voltage	1
`OVDC`	Reference potential `VDC`	2
(1) Number relates to pre-assembled cables		

Pin Assignments Industrial Connector CN1 (Vdc Supply Voltage)
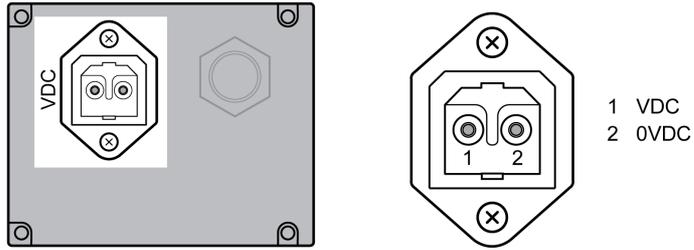
1 VDC
2 0VDC

Pin	Signal	Description	Number[1]
1	VDC	Supply Voltage	1
2	OVDC	Reference potential Vdc	2
(1) Number relates to pre-assembled cables			

Connection of CN2 - Fieldbus

Description

The fieldbus interface allows you to network the drive as a slave in a Modbus TCP network.

The fieldbus is connected by means of printed circuit board connectors or industrial connectors.

Use pre-assembled cables to reduce the risk of wiring errors.

Verify that wiring, cables, and connected interfaces meet the PELV requirements.

Cable Specifications CN2 (Fieldbus)

| Characteristic	Unit	Value
Shield	-	Required
Shield grounded at both ends	-	Required
Twisted pair	-	Required
PELV	-	Required
Maximum cable length	m (ft)	100 (328)
Minimum conductor cross section	mm^2 (AWG)	0.25 (22)
Maximum connection cross section	mm^2 (AWG)	0.6 (20)

Connector Specifications CN2 (Fieldbus)

Characteristic	Value/Description
Connector housing	Molex, Micro-Fit 3.0, 43025-1200
Crimp terminal	Molex, Micro-Fit 3.0, 43030-0007
Stripping length	2.5 ... 3.0 mm (0.10 ... 0.12 in)
Crimping tool	Molex, 63819-0000
Extraction tool	Molex, 11-03-0043

Pin Assignments Printed Circuit Board Connector CN2 (Fieldbus)
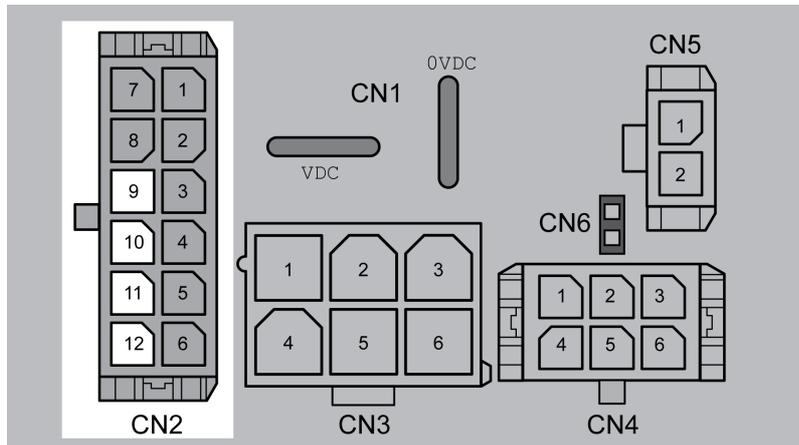
Pin assignment port IN:

Pin	Signal	Description (drive end)
9	`Tx+`	Fieldbus Tx+
10	`Tx-`	Fieldbus Tx-
11	`Rx+`	Fieldbus Rx+
12	`Rx-`	Fieldbus Rx-

Pin Assignments Industrial Connector CN2 (Fieldbus)
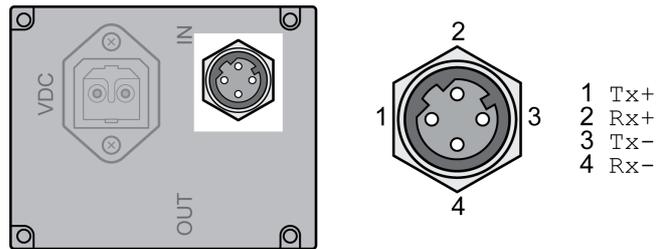
Pin assignment port IN:

Pin	Signal	Description (drive end)
1	Tx+	Fieldbus Tx+ (internally connected to pin CN2.9)
2	Tx-	Fieldbus Tx- (internally connected to pin CN2.10)
3	Rx+	Fieldbus Rx+ (internally connected to pin CN2.11)
4	Rx-	Fieldbus Rx- (internally connected to pin CN2.12)

Connection of CN3 - RS485

Function

An RS485 interface is provided in addition to the fieldbus interface. The RS485 interface is also used to commission the drive.

You can also use the RS485 interface and the commissioning software to monitor the drive during operation. It is possible to establish simultaneous connections via the commissioning interface and the fieldbus.

Use pre-assembled cables to reduce the risk of wiring errors.

Verify that wiring, cables, and connected interfaces meet the PELV requirements.

### Cable Specifications CN3 (RS485)

Characteristic	Unit	Value
Shield	-	Required
Shield grounded at both ends	-	Required
Twisted pair	-	Required
PELV	-	Required
Maximum cable length	m (ft)	400 (1312)
Minimum conductor cross section	mm^2 (AWG)	0.25 (22)
Maximum connection cross section	mm^2 (AWG)	1.0 (18)

Connector Specifications CN3 (RS485)

Characteristic	Value/Description
Connector housing	Molex, Mini-Fit Jr, 39-01-2065
Crimp terminal	Molex, Mini-Fit, 39-00-0060
Stripping length	3.0 ... 3.5 mm (0.12 ... 0.14 in)
Crimping tool	Molex, 63819-0901
Extraction tool	Molex, 11-03-0044

Address and Baud Rate Setting

Each device on the network is identified by a unique, adjustable node address.

Factory setting:
● Address: 1
● Baud rate: 19200
● Data format: 8 bits
   Even Parity
   1 stop bit

The address and the baud rate of the RS485 interface can be set via the commissioning software.

Pin Assignments CN3 (RS485)
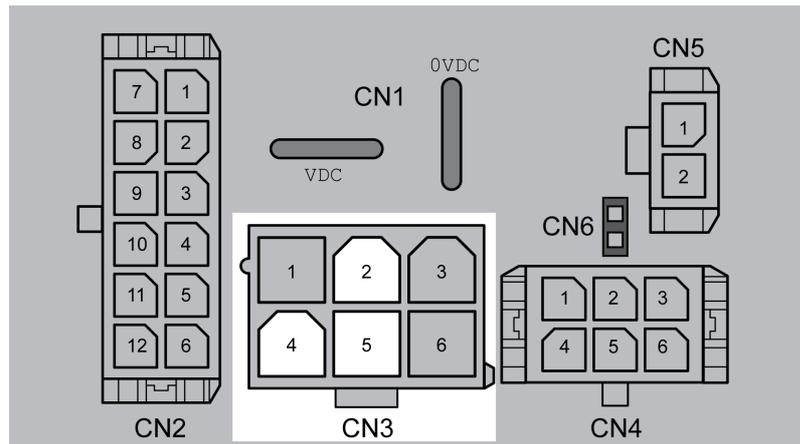
Pin	Signal	Description	SUB-D[1]
2	+RS485	RS485 interface	7
5	-RS485	RS485 interface	2
4	RS485_0V	Internally connected to CN1.0VDC	3
(1) Information relates to pre-assembled cables			

Connection of CN4 - 24 V Signal Interface

Description

The drive has four configurable inputs and outputs.

An internal 24 V power supply for the sensor system is integrated. Do not connect the internal 24 V power supply to another power supply.

Use pre-assembled cables to reduce the risk of wiring errors.

Verify that wiring, cables, and connected interfaces meet the PELV requirements.

Factory Settings

Factory settings of the digital inputs and digital outputs:

Signal	Signal input function
LIO1	Input Positive Limit Switch (LIMP)
LIO2	Input Negative Limit Switch (LIMN)
LIO3	Input Free Available
LIO4	Input Reference Switch (REF)

The assignments can be parameterized. Refer to the chapter Parameterization of the Signal Input Functions and the Signal Output Functions for details.

Cable Specifications CN4 (24 V Signal Interface)

Characteristic	Unit	Value
Shield	-	Not required
Twisted pair	-	Not required
PELV	-	Required
Minimum conductor cross section	mm^2 (AWG)	0.2 (24)
Maximum connection cross section	mm^2 (AWG)	0.6 (20)

Connector Specifications CN4 (24 V Signal Interface)

Characteristic	Value/Description
Connector housing	Molex, Micro-Fit 3.0, 43025-0600
Crimp terminal	Molex, Micro-Fit 3.0, 43030-0007
Stripping length	2.5 ... 3.0 mm (0.10 ... 0.12 in)
Crimping tool	Molex, 63819-0000
Extraction tool	Molex, 11-03-0043

Pin Assignments CN4 (24 V Signal Interface)
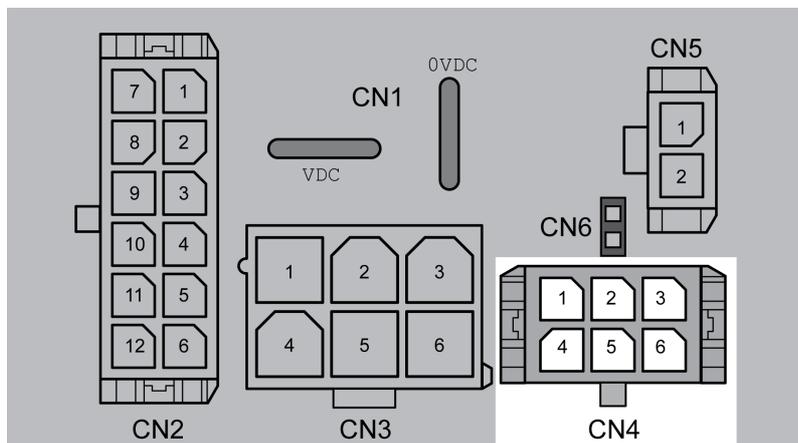
Pin	Signal	Description
1	+24VDC_OUT	The 24 V power supply can be used to supply the sensor system (for example the limit switches)
2	LIO3	Input or output for use as required
3	LIO1	Input or output for use as required
4	0VDC	Internally connected to CN1.0VDC
5	LIO4	Input or output for use as required
6	LIO2	Input or output for use as required

Pin	Signal	Description
1	+24VDC_OUT	The 24 V power supply can be used to supply the sensor system (for example the limit switches)

Connection of CN5 - Safety-Related Function STO

Requirements

Incorrect usage may cause a hazard due to the loss of the safety-related function.

⚠ WARNING
LOSS OF SAFETY-RELATED FUNCTION
Observe the requirements for using the safety-related function.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Refer to chapter Functional Safety *(see page 37)* for information and requirements relating to the safety-related function STO.

The wiring of the safety-related function STO must meet all applicable requirements as per ISO 13849-1 and ISO 13849-2.

Verify that wiring, cables, and connected interfaces meet the PELV requirements.

Use pre-assembled cables to reduce the risk of wiring errors.

Cable Specifications CN5 (STO)

Characteristic	Unit	Value
Shield	-	Required
Shield connected at one end	-	Required
Protected cable installation *(see page 41)* as per ISO 13849-2	-	Required
Minimum conductor cross section	mm^2 (AWG)	0.34 (20)
Maximum connection cross section	mm^2 (AWG)	0.6 (20)

The cable available as an accessory is a special cable that is only available with a connector. The shield of the cable is connected to the grounded housing of the drive via the metal connector. It is sufficient to connect one end of the cable to the grounded housing.

Connector Specifications CN5 (STO)

Characteristic	Value/Description
Connector housing	Molex, Micro-Fit 3.0, 43645-0200
Crimp terminal	Molex, Micro-Fit 3.0, 43030-0007
Stripping length	2.5 ... 3.0 mm (0.10 ... 0.12 in)
Crimping tool	Molex, 63819-0000
Extraction tool	Molex, 11-03-0043

Pin Assignments CN5 (STO)
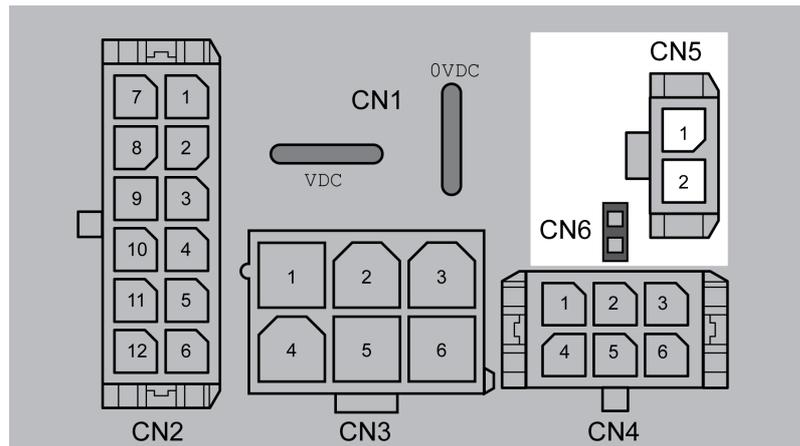
Pin	Signal	Description
CN5.1	$\overline{\text{STO\_A}}$	Safety-related function STO
CN5.2	$\overline{\text{STO\_B}}$	Safety-related function STO
CN6	-	Jumper connected: STO disabled (default) Jumper removed: STO enabled

Remove jumper CN6 before connecting in the connector for CN5 (mechanical lock).
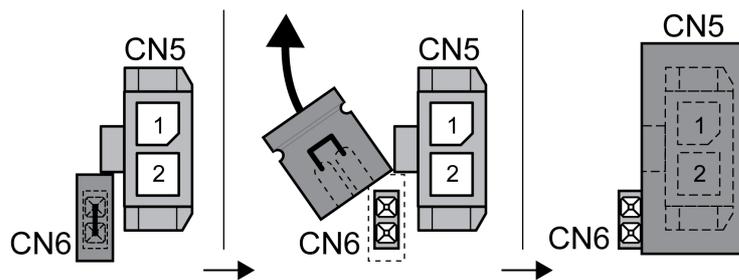
Connection of Accessories for 24 V Signals and Safety-Related Function STO

Accessory "Insert kit, 3 x I/O"

The accessory makes the signals `LIO1`, `LIO2` and `LIO4` available outside of the drive via industrial connectors.
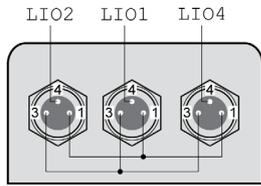
Pin 1 is internally connected to CN4.1 (`+24VDC_OUT`).

Pin 3 is internally connected to CN4.4 (`0VDC`).

Accessory "Insert kit, 2 x I/O, 1x STO in"

The accessory makes the signals `LIO1`, `LIO2` and the signals of the safety-related function STO available outside of the drive via industrial connectors.
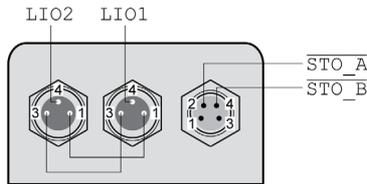
Pin 1 is internally connected to CN4.1 (`+24VDC_OUT`).

Pin 3 is internally connected to CN4.4 (`0VDC`).

Accessory "Insert kit, 1 x STO in, 1 x STO out"

The accessory makes the signals of the safety-related function STO available outside of the drive via industrial connectors.

Accessory "Insert kit, 4 x I/O, 1x STO in, 1 x STO out"

The accessory makes the signals `LIO1`, `LIO2`, `LIO3`, `LIO4` and the signals of the safety-related function STO available outside of the drive via industrial connectors.

Pin 1 is internally connected to CN4.1 (`+24VDC_OUT`).

Pin 3 is internally connected to CN4.4 (`0VDC`).

Section 4.3
Verifying Installation

Verifying Installation

Overview

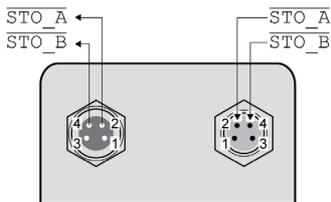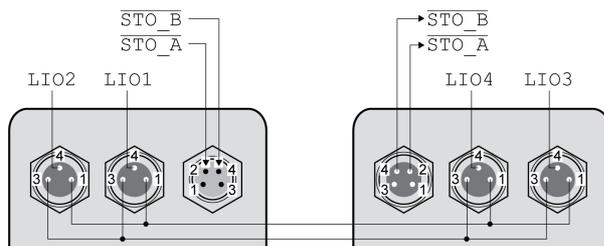After you have completed the mechanical and electrical installation, verify correct installation of the overall drive system. The following table is not exhaustive. The points you need to consider in addition depend on, among other things, your application, your process definitions, and the standards and regulatory requirements applicable in the country of manufacture and at the installation site.

Verification of Correct Installation

Mechanical installation:
● Correct tightening torque of screw connections
● Correct mounting of output components
● Correct installation of the covers and seals to achieve the required degree of protection.

Electrical installation:
● Protective ground of power supply unit
● Functional ground of integrated drive
● Correct type and fuse rating of fuses
● Correct assembly of cables and connectors
● Correct routing and fastening of cables
● Correct installation and connection of cables
● Correct insulation of unused wires
● Effectiveness of mechanical locks of connectors
● Compliance of the overall installation with all local, regional, and national electrical safety codes and requirements at the eventual installation site of the equipment

Electromagnetic compatibility:
● Correct connection of shields
● Correct equipotential bonding
● Compliance of the overall installation with all local, regional, and national regulations and requirements concerning EMC at the eventual installation site of the equipment

Overall installation:
● Compliance with all specifications in the present document
● All items identified in risk assessment covered

Chapter 5
Commissioning

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Overview

What Is in This Section?

This section contains the following topics:

Topic	Page
General	95
Preparation	97

General

Overview

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

⚠ ⚠ DANGER

ELECTRIC SHOCK

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

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

⚠ WARNING

INEFFECTIVE SAFETY-RELATED FUNCTION AND/OR UNINTENDED EQUIPMENT OPERATION

- Commission the integrated drive before it is used for the first time and after each modification to parameter values, settings, and wiring.
- Commission or recommission the machine/process pursuant to all regulations, standards, and process definitions applicable to your machine/process.
- Verify that the commissioning procedure covers all items identified in your risk assessment.
- Verify correct operation and effectiveness of all functions by performing comprehensive tests for all operating states, the defined safe state, and all potential error situations.
- Document all modifications and the results of the commissioning procedure in compliance with all regulations, standards, and process definitions applicable to your machine/process.

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

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.

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

⚠ WARNING

UNINTENDED MOVEMENT

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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are out of balance may be ejected.

⚠ WARNING

MOVING, UNGUARDED EQUIPMENT

Verify that rotating parts cannot cause injuries or equipment damage.

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

⚠ WARNING

FALLING PARTS

Verify correct mounting of the drive with the specified tightening torque before taking up commissioning.

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.

Preparation

Required Components

The following is required for commissioning:

● Commissioning software "Lexium CT"
   https://www.se.com/ww/en/download/document/LexiumCTInstall/
● Fieldbus converter for the commissioning software for connection via the commissioning interface

Interfaces

The following interfaces can be used for commissioning, parameterization and diagnostics:
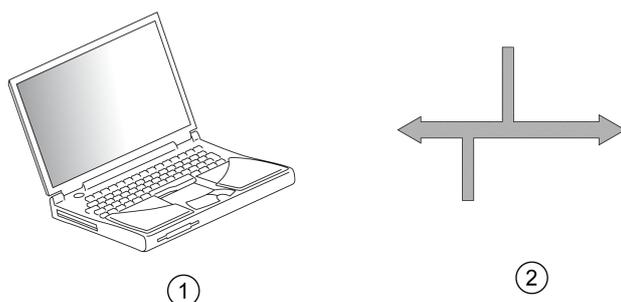
1 PC with commissioning software "Lexium CT"
2 Fieldbus

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 CT" 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

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 253)*.

TCSMCNAM3M002P   VW3L1T000R30
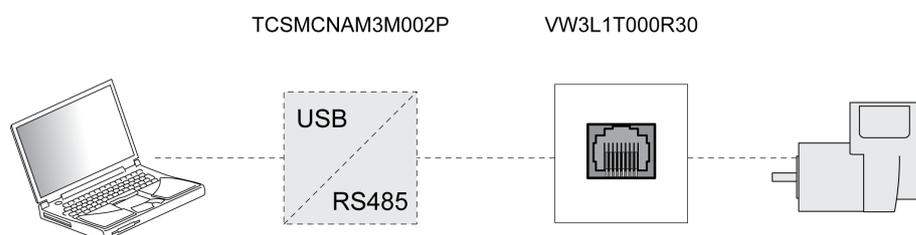
Section 5.2
Fieldbus Integration

What Is in This Section?

This section contains the following topics:

Setting the IP Address

Overview

Carefully manage the IP addresses because each device on the network requires a unique address. Having multiple devices with the same IP address can cause unintended operation of your network and associated equipment. Although some equipment, such as the present device, may detect duplicate IP addresses, other equipment may not.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Ensure that there is only one "master" on the network controlling this equipment when using IO Scanning.
- Verify that all devices have unique addresses.
- Obtain your IP address from your system administrator.
- Confirm that the IP address of the drive is unique before placing the system into service.
- Do not assign the same IP address to any other equipment on the network.
- Update the IP address after resetting the drive to factory settings.

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

NOTE: Verify that your system administrator maintains a record of all assigned IP addresses on the network and subnetwork, and inform the system administrator of all configuration changes performed.
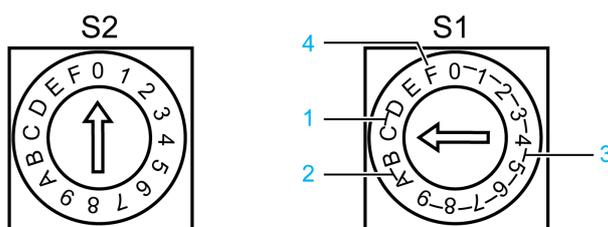
The IP address of the drive can be set in the following ways:

1 Using the IP address stored in the nonvolatile memory (factory setting) *(see page 99)*
2 IP address assignment via a DHCP/BOOTP server based on the MAC address *(see page 100)*
3 IP address assignment via a DHCP server based on a "DeviceName" *(see page 100)*
4 Deriving the IP address from the MAC address *(see page 100)*

Using the IP Address Stored in the Nonvolatile Memory (Factory Setting)

The IP address stored in the nonvolatile memory is used.

The IP address can be adjusted via the commissioning software or via the web server.

The default IP address of the drive is **192.168.100.10**.

The last byte of the IP address can be adjusted via the rotary switches.

Procedure for adjusting the last byte of the IP address via the rotary switches:

Step	Action
1	Power off the drive.
2	Set the rotary switch S1 to the position E (Clear IP). The setting of the rotary switch S2 is not relevant in this case.
3	Power on the drive.
4	Wait until the status LED indicates "No valid IP parameters after a Clear IP" (two flashes).
5	The IP address is set in the following way **xxx.xxx.xxx.yyy**. **xxx.xxx.xxx** is used from the IP address stored in the nonvolatile memory. **yyy** is the result of ten times the value of S2 plus the value of S1 (**yyy** = 10 * S2 + S1). Set the rotary switch S2 to a position from 0 to F. Set the rotary switch S1 to a position from 0 to 9. Valid values are from **1** to **159**.

Step	Action
6	After having set the desired IP address, wait until the status LED indicates "Ready without error" (Steady ON). If, after that, you modify the settings of the rotary switches to select a different IP address, the status LED indicates "No valid IP parameters after a Clear IP" (two flashes) again.
7	Power off the product when the status LED indicates "Ready without error" (Steady ON).
8	Set the rotary switch S1 to the position D (Stored). The setting of the rotary switch S2 is not relevant in this case.
9	Power on the drive.

IP Address Assignment via a DHCP/BOOTP Server Based on the MAC Address

The IP address is obtained from a DHCP server or a BOOTP server based on the MAC address of the drive.

The MAC address is shown in the drive housing next to the connectors.

Procedure:

Step	Action
1	Power off the drive.
2	Set the rotary switch S1 to the position A or B. The setting of the rotary switch S2 is not relevant in this case.
3	Power on the drive.

The DHCP/BOOTP server must manage a list that associates each MAC address with an IP address so each device has unique IP address.

IP Address Assignment via a DHCP Server Based on a "DeviceName"

The IP address is obtained from a DHCP server based on the "DeviceName" of the drive.

The DHCP server must support the "DeviceName" configuration.

The "DeviceName" of the drive can only be adjusted via the rotary switches.

Procedure:

Step	Action
1	Power off the drive.
2	The Device Name is the string "Lexium-ILx-" and a three-digit number. This number results from the setting of the two rotary switches: Ten times the value of S2 plus the value of S1. Device Name = "Lexium-ILx-" + (10 * S2 + S1) Set the rotary switch S2 to a position from 0 to F. Set the rotary switch S1 to a position from 0 to 9. Valid values are from **1** to **159**. For values from 1 to 9 two leading zeros "00" will be added. For values from 10 to 99 one leading zero "0" will be added.
3	Power on the drive.

Deriving the IP Address from the MAC Address

The IP address is set in the following way **xxx.xxx.xxx.yyy**.

xxx.xxx.xxx is used from the IP address stored in the nonvolatile memory.

yyy is set depending on the last byte of the MAC address.

The MAC address is shown in the drive housing next to the connectors.

Procedure:

Step	Action
1	Power off the drive.
2	Set the rotary switch S1 to the position F. The setting of the rotary switch S2 is not relevant in this case.
3	Power on the drive.

Step	Action
4	Example 1: MAC address xx:xx:xx:xx:xx:06, the resulting IP address is xxx.xxx.xxx.6.
	Example 2: MAC address xx:xx:xx:xx:xx:A7, the resulting IP address is xxx.xxx.xxx.167.
	Exception 1: MAC address xx:xx:xx:xx:xx:00, the resulting IP address is xxx.xxx.xxx.1
	Exception 2: MAC address xx:xx:xx:xx:xx:FF, the resulting IP address is xxx.xxx.xxx.254
	The subnet mask is set to the default value 255.255.255.0.
	The gateway is set to the default value 192.168.100.254.

NOTE: With this setting, the same IP address may be assigned to different devices. For important safety information, see the Overview *(see page 99)* of this section.

Settings for Communication with I/O Scanning

Overview

I/O scanning is used for cyclic interchange of data between master and slave.

The following settings must be made to establish communication with I/O scanning:

- Usage of the Unit ID 255 on the master (refer to I/O Scanning to "Drive Profile Lexium" *(see page 51)*)
- Activation of communication monitoring

Setting Communication Monitoring for I/O Scanning

⚠ WARNING
LOSS OF CONTROL
- Ensure that connection monitoring is enabled.   - Set the shortest, practical monitoring time cycles to detect communication interruptions as quickly as possible.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Set communication monitoring for I/O scanning with the parameter `MBscan_guard`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`MBscan_guard`	Modbus TCP Node Guarding for I/O scanning. Value 0: Node Guarding inactive Value >0: Monitoring time in ms The drive starts monitoring when it receives the first I/O scanning message. After a Node Guarding error the drive starts monitoring again when it receives the next I/O scanning message. Modified settings become active immediately.	ms 0 0 10000	UINT16 R/W - -	Modbus 6414

NOTE: Additionally, the drive monitors the Ethernet connection link for interruption. The drive can detect an interruption of the Ethernet connection link only if there is no Ethernet switch between the master and the drive.

Settings for Communication without I/O Scanning

Overview

It is also possible to establish communication without I/O scanning.

The following settings must be made to establish communication without I/O scanning:

● Usage of a Unit ID from 1 to 255 on the master
● Activation of communication monitoring
● Exclusive use of access channel (for changing operating states and starting operating modes)

Setting Communication Monitoring

⚠ **WARNING**
LOSS OF CONTROL
● Ensure that connection monitoring is enabled. ● Set the shortest, practical monitoring time cycles to detect communication interruptions as quickly as possible.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

In order to monitor an individual Modbus TCP channel, the parameter `MBnode_guard` must be set via this channel. The device then monitors whether communication is active via this channel.

If the device no longer receives Modbus messages via this channel, the drive responds with an error of error class 2.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MBnode_guard	Modbus Node Guarding. Value 0: Node Guarding inactive Value >0: Monitoring time Modified settings become active immediately.	ms 0 0 10000	UINT16 R/W - -	Modbus 5644

NOTE: Additionally, the drive monitors the Ethernet connection link for interruption. The drive can detect an interruption of the Ethernet connection link only if there is no Ethernet switch between the master and the drive.

Exclusive Use of Access Channel

In addition, the access channel must be used exclusively. Only after this it is possible to change operating states and start operating modes.

Once the access channel is used exclusively, it is no longer possible to change operating states and start operating modes via another access channel.

Writing the parameter `AccessExcl` sets the access channel to exclusive access.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AccessExcl	Get exclusive access to access channel. Write parameter: Value 0: Release access channel Value 1: Use exclusive access for access channel Read parameter: Value 0: Access channel is not used exclusively Value 1: Access channel is used exclusively (access channel used for reading) Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 282

Web Server

Overview

The drive features an integrated web server. The web server allows for configuration of the drive without the commissioning software.

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Define a secure password for the Web server, and do not allow unauthorized or otherwise unqualified personnel to use this feature.   ● Ensure that there is a local, competent, and qualified observer present when operating on the controller from a remote location.   ● You must have a complete understanding of the application and the machine/process it is controlling before attempting to adjust data, stopping an application that is operating, or starting the controller remotely.   ● Take the precautions necessary to assure that you are operating on the intended controller by having clear, identifying documentation within the controller application and its remote connection.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: The web server must only be used by authorized and qualified personnel. A qualified person is one who has the skills and knowledge related to the construction and operation of the machine and the process controlled by the application and its installation, and has received safety training to recognize and avoid the hazards involved. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this feature.

Connecting

The drive must have a valid IP address.

To connect, enter the IP address of the drive in the address bar of the browser.

When connecting to the web server for the first time, you need to specify a new password for the web server. To do so, enter the default password and your new password.

● Default password of the web server: **USER**

After you have set your new password, the web server displays the main page.

⚠ **WARNING**
UNAUTHORIZED DATA ACCESS
● Do not expose the device or device network to public networks and the Internet as much as possible.   ● Immediately change the default password to a new secure password.   ● Do not distribute passwords to unauthorized or otherwise unqualified personnel.   ● Restrict access to unauthorized personnel.   ● Use additional security layers like VPN for remote access and install firewall mechanisms.   ● Validate the effectiveness of these measurements regularly and frequently.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: Choose a password that complies with all password requirements of your company and that follows best practices with regard to password strength.

This includes, but is not limited to:
● The password does not contain any personal or otherwise obvious information.
● The password consists of a mix of uppercase and lowercase letters, numbers, and special characters.
● The password length is at least ten characters.
● Follow all rules for keeping the password confidential.
● Do not disclose the password to any unauthorized persons.

Parameter Values

Before you can read and write parameters, you have to sign in.

Use the following user name and your new password:
- User name: **USER**

Parameter values are entered in a way similar to the commissioning software.

- Click the **Write** button to send the settings to the drive.
- After that, click the **Save** button to save the settings to the nonvolatile memory of the drive.

Web Server Functions

Menu	Function
Home	Start page.
Maintenance	Edit motor and communication parameters.
Diagnostics	View drive status and communication statistics.
Setup	Modify the password of the web server. The password of the web server can only be reset to the default value via the parameter `ResetWebPass`. Modify the setting for Fast Device Replacement.
Documentation	Link to the *Schneider Electric* website.

Resetting the Password Via Parameter

The password of the web server can be reset via the parameter `ResetWebPass`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ResetWebPass`	Reset password of web server. Value 1: The password of the web server is reset to the default value. A new password must be set when a new connection is established. The parameter can only be written via Modbus RTU. Modified settings become active immediately. Available with firmware version ≥V1.102.	- 0 - 1	UINT16 R/W - -	Modbus 6704

Fast Device Replacement (FDR)

Description

The FDR service uses standard DHCP and TFTP (Trivial File Transfer Protocol) technologies to simplify maintenance of Ethernet devices.

For example, the FDR service is used to replace a device by a new device. The service allows for detection, configuration, and automatic start of the new device without complex manual user interaction.

The main steps comprise:
● A device configured for the FDR service is removed.
● The new device that is pre-configured with the "DeviceName" of the device to be installed is installed in the network.
● The FDR server detects the new device, configures it with its IP address and transmits the configuration parameters to the new device.
● The new device verifies compatibility of the parameters and parameter values and then activates the original operating mode.

Obtaining the IP Address

The IP address can only be obtained via the "DeviceName". Refer to the chapter Setting the IP Address .

Configuration File

Information on the configuration file can be found in the manual of the FDR server used.

Settings

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
EthFdrAutosave	Fast Device Replacement (FDR) Autosave. **0 / Disabled**: Disabled **1 / 1 minute**: 1 minute **2 / 5 minutes**: 5 minutes **3 / 15 minutes**: 15 minutes **4 / 30 minutes**: 30 minutes **5 / 60 minutes**: 60 minutes If FDR is enabled, the drive cyclically saves the configuration to the server in Autosave mode.	- 0 0 5	UINT16 R/W per. -	Modbus 6698
EthFdrEnable	Fast Device Replacement (FDR) Enable. **0 / Disabled**: Disabled **1 / Enabled**: Enabled Global setting to enable the FDR. If the device name is configured and this parameter is enabled, the drive gets the configuration from the FDR server.	- 0 0 1	UINT16 R/W per. -	Modbus 6696

Section 5.3
Commissioning Procedure

What Is in This Section?

This section contains the following topics:

Setting Limit Values

Current Limitation

The maximum motor current, the maximum current for Quick Stop, and the maximum current for Halt can be parameterized.

● 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 Quick Stop.
● Use the parameter LIM_I_maxHalt to set the maximum motor current for Halt.

The motor can be decelerated via a deceleration ramp or with the maximum current for Quick Stop and Halt.

The drive limits the maximum permissible current on the basis of the motor data and the drive data. If the value entered for the maximum current in the parameter CTRL_I_max is too great, the value is internally limited by the drive.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_I_max	Current limitation. The value must not exceed the maximum permissible current of the motor or the power stage. Default: M_I_max In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} 0.00 - 299.99	UINT16 R/W per. -	Modbus 4610
LIM_I_maxQSTP	Current for Quick Stop via torque ramp. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4362
LIM_I_maxHalt	Current for Halt. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4364

Velocity Limitation

The maximum velocity can be parameterized.

● Use the parameter CTRL_n_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_n_max	Limitation of speed of rotation. The set value must not exceed the maximum speed of rotation of the motor. Default: Maximum permissible speed of rotation of the motor (see M_n_max) Modified settings become active immediately.	RPM 0 - 13200	UINT16 R/W per. -	Modbus 4612

Digital Inputs and Digital Outputs

Overview

The drive provides configurable digital inputs and digital outputs.

Signal input functions and signal output functions can be assigned to the digital inputs and digital outputs.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
● Verify that the wiring is appropriate for the factory settings and any subsequent parameterizations. ● Only start the system if there are no persons or obstructions in the zone of operation. ● Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The signal states of the digital inputs and digital outputs can be indicated via the fieldbus and the commissioning software.

Factory Settings

Factory settings of the digital signal inputs/outputs:

Signal	Signal input function
LIO1	Input Positive Limit Switch (LIMP)
LIO2	Input Negative Limit Switch (LIMN)
LIO3	Input Free Available
LIO4	Input Reference Switch (REF)

Refer to the chapter Parameterization of the Signal Input Functions and the Signal Output Functions for information on assigning the digital input functions and the digital output functions you have wired during installation of the drive.

Reading Signal States via the Fieldbus

The signal states are contained in the parameter `_IO_act` in a bit-coded way. The values "1" and "0" correspond to the signal state of the input or output.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_IO_LIO_act`	Status of digital inputs/outputs. Coding of the individual signals: Bit 0: LIO1 Bit 1: LIO2 ...	- - - -	UINT16 R/- - -	Modbus 2090

Verifying the Signals of the Limit Switches

Description

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

⚠ WARNING
LOSS OF CONTROL
● Ensure that limit switches are installed as determined by your risk assessment. ● Verify correct connection of the limit switches. ● Verify that the limit switches are sufficiently distant from the mechanical end to allow an adequate stopping distance. ● Verify correct parameterization and function of the limit switches.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

● 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. Refer to the chapter Limit Switches *(see page 190)* for details.

Verifying the Safety-Related Function STO

Operation with Safety-Related Function STO

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

Step	Action
1	To help avoid unanticipated restart after restoration of power, the parameter `IO_AutoEnable` must be set to "off". Verify that the parameter `IO_AutoEnable` is set to "off".
2	Power off the power supply:
3	Verify that the signal wires connected to the inputs (STO_A) and (STO_B) are electrically isolated from each other.
4	Apply power to the drive.
5	Enable the power stage without starting a motor movement.
6	Trigger the safety-related function STO. If the power stage is disabled and the error message 1300 is indicated, the safety-related function STO was triggered. If a different error message is indicated, the safety-related function STO was not triggered.
7	Document the tests of and settings for the safety-related function STO in compliance with all applicable standards, regulations, and process definitions.

Operation with Safety-Related Function STO

Operation without the safety-related function STO:

Step	Action
1	Verify that the jumper CN6 is connected.

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-related function. The holding brake is not a service brake.

⚠ **WARNING**
UNINTENDED AXIS MOVEMENT
● Do not use the internal holding brake as a safety-related measure.
● Only use certified external brakes as safety-related measures.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Releasing the Holding Brake

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

Releasing the holding brake requires a certain amount of time. This time value is contained in the electronic nameplate of the motor. Transition to the operating state **6 Operation Enabled** is only possible after this time 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 value is contained in the electronic nameplate of the motor. Current remains to be applied to the motor during this time.

Refer to the chapter Functional Safety *(see page 37)* for additional information on the behavior of the holding brake when the safety-related function STO is triggered.

Releasing the Holding Brake Manually

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

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

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

⚠ **WARNING**
UNINTENDED MOVEMENT
● Verify that there are no persons or obstructions in the zone of operation when operating the system.
● Take appropriate measures to avoid hazards caused by falling or lowering loads or other unintended movements.
● Run initial tests without coupled loads.
● Verify that a functioning emergency stop push-button is within reach of all persons involved in running tests.
● Anticipate movements in unintended directions or oscillations of the motor.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The parameter `BRK_release` can be used to release the holding brake via the fieldbus.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
BRK_release	Manual operation of the holding brake. **0 / Close**: Automatic processing **1 / Open**: Manual release of holding brake The holding brake can only be manually released in the operating states Switch On Disabled or Ready To Switch On. If the power stage is enabled, the value is automatically set to 0. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2068

Direction of Movement

Definition of Direction of Movement

In the case of a rotary motor, direction of movement is defined as follows: Positive direction is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

Verifying the Direction of Movement Via the Commissioning Software

The direction of movement can be verified by starting a movement in the commissioning software.

Procedure:

Step	Action
1	Apply power to the drive.
2	Enable the power stage.
3	Start the operating mode Jog.
4	Use the ">" button to trigger a movement in positive direction. Observe the movement.
5	Use the "<" button to trigger a movement in negative direction. Observe the movement.

Inverting the Direction of Movement

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

● If inversion of direction of movement is not activated (parameter value "Clockwise"):
  Positive target values result in movements in positive direction.
● If inversion of direction of movement is activated (parameter value "Counter Clockwise"):
  Positive target values result in movements in negative direction.

The parameter `POSdirOfRotat` 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
POSdirOfRotat	Definition of direction of rotation. **0 / Clockwise**: Clockwise **1 / Counter Clockwise**: Counter-clockwise With positive reference values, the motor rotates clockwise (as you look at the end of the motor shaft at the flange). The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	Modbus 1560

Setting Parameters for Encoder

Overview

After power-on, the drive reads the position value from the encoder. The value can be read with the parameter `_p_absENCusr`.

Depending on your application, you may have to set a new absolute position of the encoder.

Examples:
● Shifting the position of the index pulse (typically for singleturn encoders)
● Adjusting the working range of the encoder to the working range of the application (typically for multiturn encoders)

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_p_absENCusr`	Motor position with reference to encoder range. The value range is determined by the encoder type. In the case of singleturn encoders, the value refers to one motor revolution, in the case of multiturn encoders to the entire encoder range (for example 4096 revolutions). The position is not valid until the absolute motor position has been determined. In the case of invalid absolute motor position: _WarnLatched _WarnActive Bit 13=1: Absolute motor position not yet captured	usr - - -	UINT32 R/- - -	Modbus 7710

Working Range of the Encoder and Index Pulse Position

The working range of the singleturn encoder is 32768 increments per turn.

The working range of the multiturn encoder is 4096 turns with 32768 increments per turn.

The index pulse is at position value 0.

Singleturn Encoder

In the case of a singleturn encoder, you can shift the position of the index pulse of the encoder by setting a new absolute position.

Multiturn Encoder

In the case of a multiturn encoder, the working range of the application must be within the working range of the multiturn encoder. This means that the range defined by the position value at the negative mechanical limit and at the positive mechanical limit must be within the working range of the multiturn encoder.

In the case of a movement beyond the working range of the encoder, the position continues to be processed properly. However, a power cycle in such a condition results in an incorrect absolute position.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Set the absolute position in such a way that no movement in your application can result in an absolute position outside of the working range of the encoder.

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

Perform a movement to the position in the working range between the mechanical limits of the application where you want to set the absolute position.

If you want to set the absolute position close to the negative mechanical limit, use a value greater than 0, for example, 10000.

Setting the Absolute Position

Use the parameter `ENC_pabsusr` to set the absolute position of the encoder.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ENC_pabsusr`	Adjustment of absolute position of encoder. The value range depends on the encoder type. Singleturn encoder: 0 ... x - 1 Multiturn encoder: 0 ... (4096 * x) -1 Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling. If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted. After the write access, a wait time of at least 1 second is required before the drive can be powered off. Modified settings become active the next time the product is powered on.	usr -2147483648 - 2147483647	INT32 R/W - -	Modbus 1324

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

Section 5.4
Controller Optimization with Step Response

**What Is in This Section?**

This section contains the following topics:

Controller Structure

Overview

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

The control loops are tuned one after the other from the "inside" to the "outside" in the following sequence: current control, velocity control, position control.
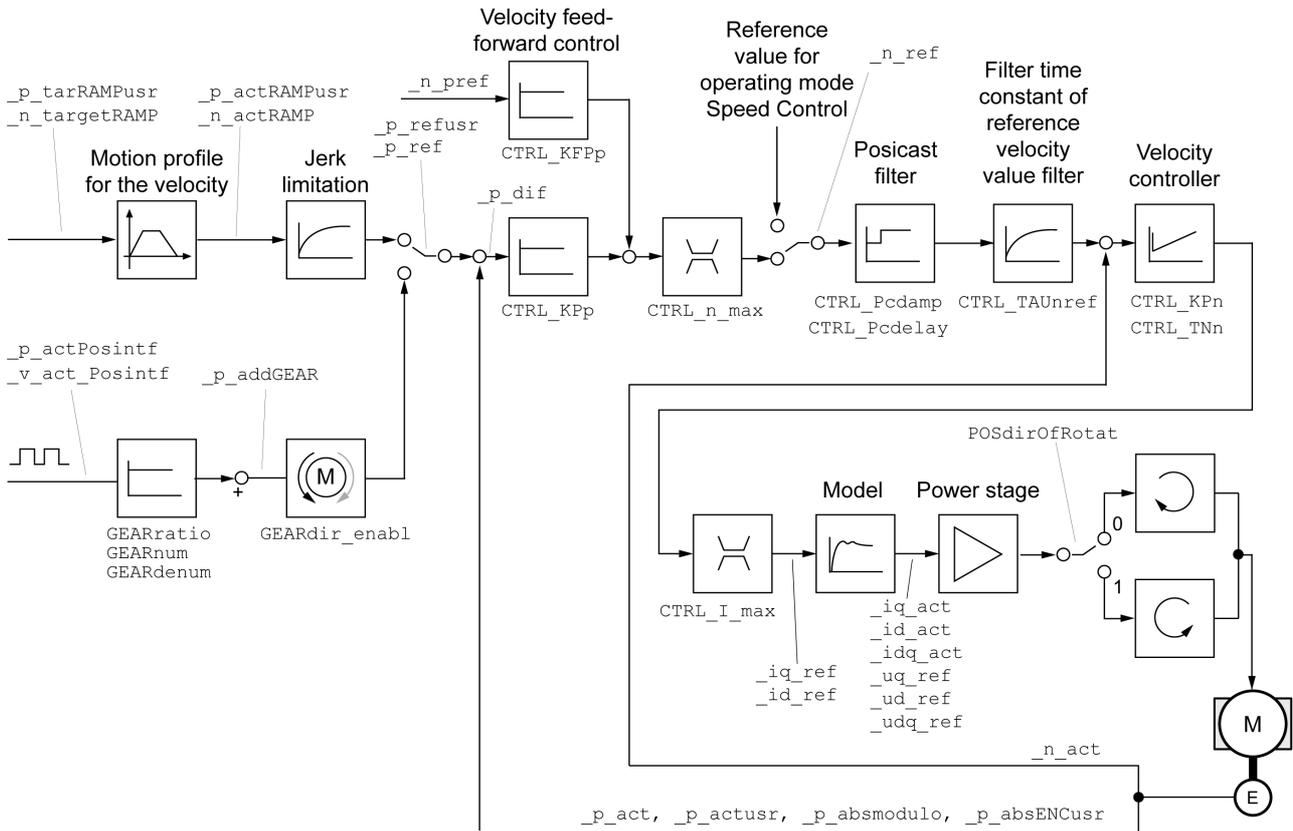
Position Controller

The position controller reduces the difference between the reference position and the encoder 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 effective gain 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 tuned on the basis of the motor data.

Preparation of Optimization

Overview

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

- Selecting control loops. Superimposed control loops are automatically deactivated.
- Setting reference value signals: signal type, amplitude, frequency, and starting point
- Verifying control performance with the signal generator.
- Tracing the control performance on screen and evaluating it with the commissioning software.

Setting Reference Value Signals

Start controller optimization with the commissioning software.

Set the following values for the reference value signal:

- Signal type: Step "positive"
- Amplitude: 100 RPM
- Cycle duration: 100 ms
- Number of repetitions: 1

- Start the trace.

Only the signal types "Step" and "Square" allow you to determine the entire dynamic behavior of a control loop. The present user guide shows signal traces of the signal type "Step".

Entering Values for Optimization

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

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

Optimizing the Velocity Controller

Overview

Optimizing complex mechanical control systems requires 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
CTRL_KPn	Velocity controller P gain. The default value is calculated on the basis of the motor parameters. In increments of 0.0001 A/RPM. Modified settings become active immediately.	A/RPM 0.0001 - 1.2700	UINT16 R/W per. -	Modbus 4614
CTRL_TNn	Velocity controller integral action time. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4616

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

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 initial setup of the velocity controller.

● Deactivate the reference value filter of the velocity controller. Set the parameter CTRL_TAUnref to 0.

| Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_TAUnref	Filter time constant of reference velocity value filter. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 327.67	UINT16 R/W per. -	Modbus 4626

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:

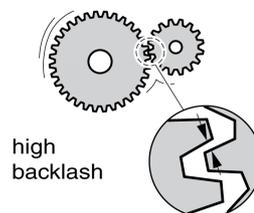**Rigid mechanical system**
low elasticity

Less rigid mechanical system
higher elasticity
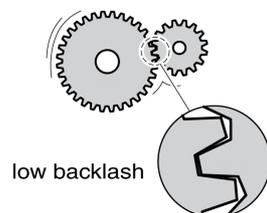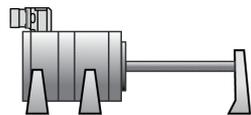
low backlash

high backlash

e. g. Direct drive
Rigid coupling

e. g. Belt drive
Weak drive shaft
Elastic coupling

Determining Values for Rigid Mechanical Systems

In the case of a rigid mechanical system, you can adjust the control performance on the basis of the following table subject to the following conditions:

● The moment of inertia of the load and of the motor are known.
● 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	$J_L = J_M$		$J_L = 5 * J_M$		$J_L = 10 * J_M$	
	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 reaches velocity `_n_act` as quickly as possible without overshooting.

● Set the integral action time `CTRL_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 determine the performance of the control loop.

- Trigger another step function if you had to modify `_n_ref` and verify the amplitude of `_Iq_ref`.
- Increase or decrease the P gain in small increments until `_n_act` is reached 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 `CTRL_KPn`.

Differences between `_n_ref` and `_n_act` result from setting `CTRL_TNn` to "Infinite".

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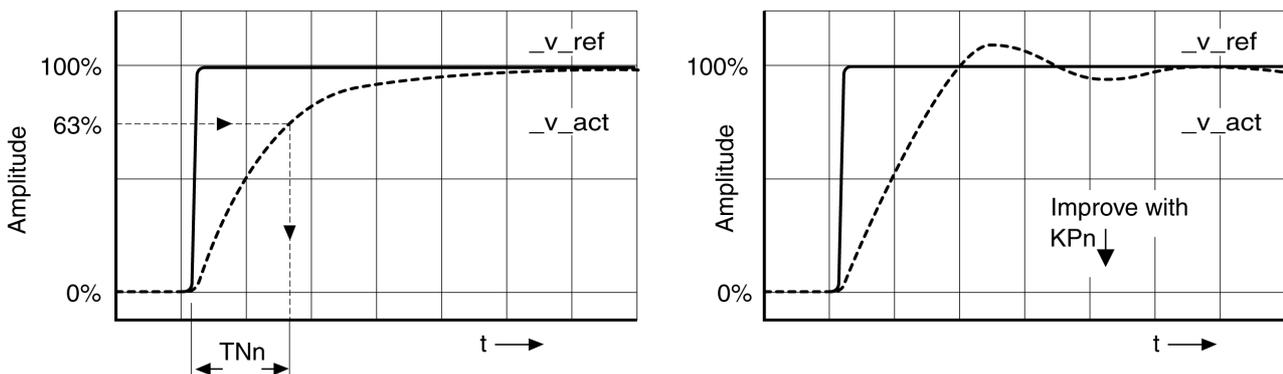
In the case of drive systems in which oscillations occur before the aperiodic limit is reached, the P gain "KPn" must be reduced until oscillations can no longer be detected. This occurs frequently in the case of linear axes with a toothed belt drive.

Graphic Determination of the 63% Value

Graphically determine the point at which the actual velocity `_n_act` reaches 63% of the final value. The integral action time `CTRL_TNn` then results as a value on the time axis. The commissioning software supports you with the evaluation.

Verifying and Optimizing the P Gain of the Velocity Controller

Description

Step responses with good control performance:
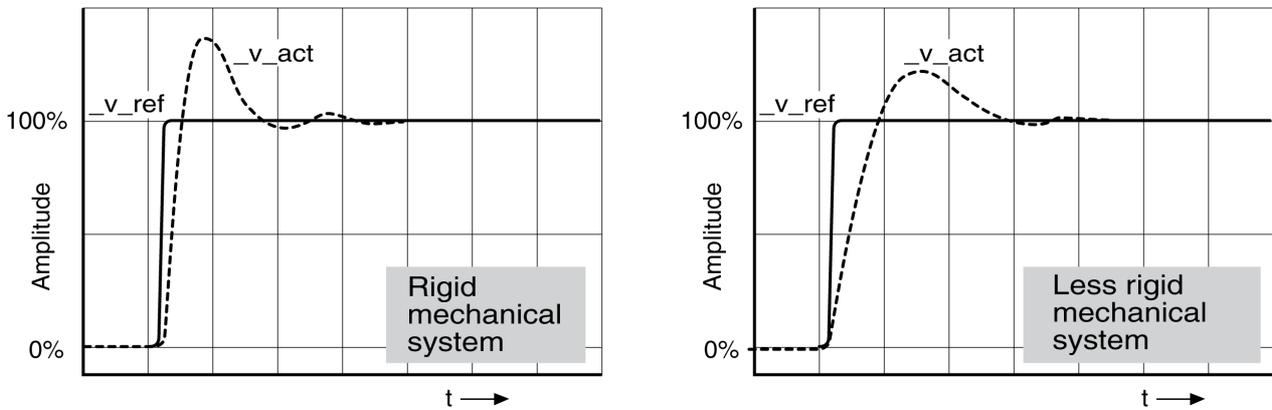
The velocity controller is properly set if the step response is closely resembles the signal illustrated. Good control performance is characterized by

- Fast transient response
- Overshooting up to a maximum of 40 %; a value of 20 % is advisable.

If the control performance does not correspond to the curve illustrated, modify `CTRL_KPn` in increments of about 10 % and then trigger another step function:

- If the velocity controller is too slow: Use a higher `CTRL_KPn` value.
- If the velocity controller tends to oscillate: Use a lower `CTRL_KPn` value.

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

Optimizing insufficient velocity controller settings
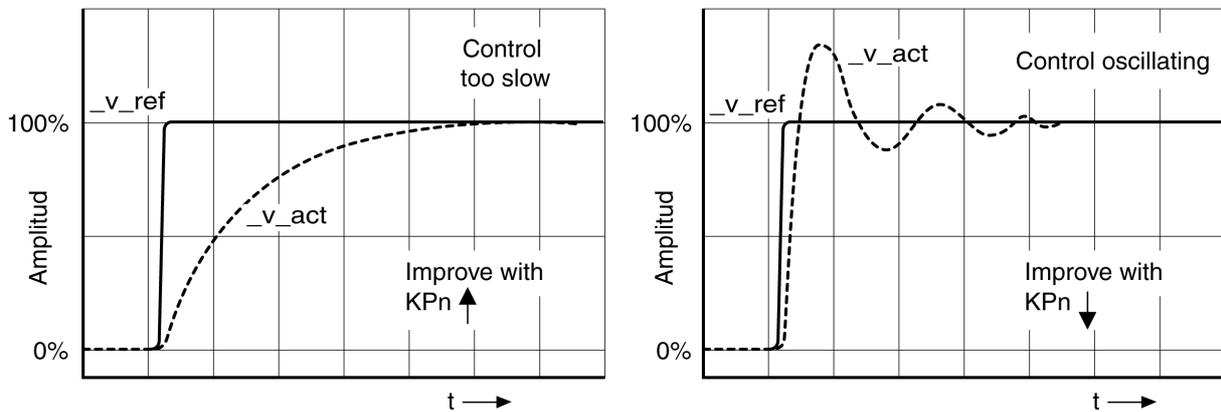
Optimizing the Position Controller

Description

An optimized velocity controller is a prerequisite for optimization of the position controller.

When tuning the position controller, you must optimize the P gain `CTRL_KPp`:

- `CTRL_KPp` too high: Overshooting, instability
- `CTRL_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
`CTRL_KPp`	Position controller P gain. The default value is calculated. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 114.3	UINT16 R/W per. -	Modbus 4620

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

⚠ WARNING

UNINTENDED MOVEMENT

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

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

Setting the Reference Value Signal

- Select Position Controller as the reference value in the commissioning software.
- Set the reference value signal:

- Signal type: "Step"
- Set the amplitude to approximately 1/10 motor revolution.

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

Selecting the Trace Signals

- Select the values in the box General Trace Parameters:

- Reference position of position controller `_p_refusr` (`_p_ref`)
- Actual position of position controller `_p_actusr` (`_p_act`)
- Actual velocity `_n_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 `_n_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:
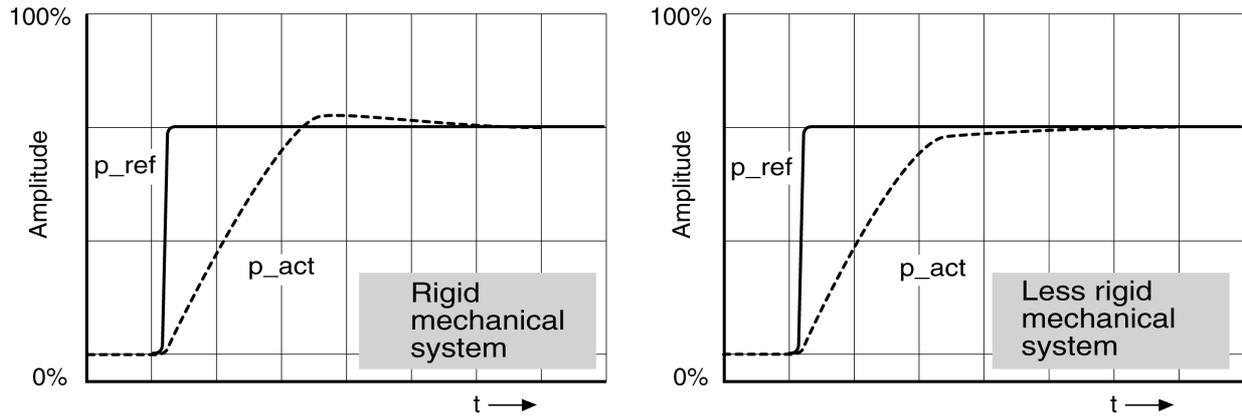
The p gain setting `CTRL_KPp` is optimal if the reference value is reached rapidly and with little or no overshooting.

If the control performance does not correspond to the curve illustrated, modify the P gain `CTRL_KPp` in increments of approximately 10 % and trigger another step function.

● If the position controller 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:
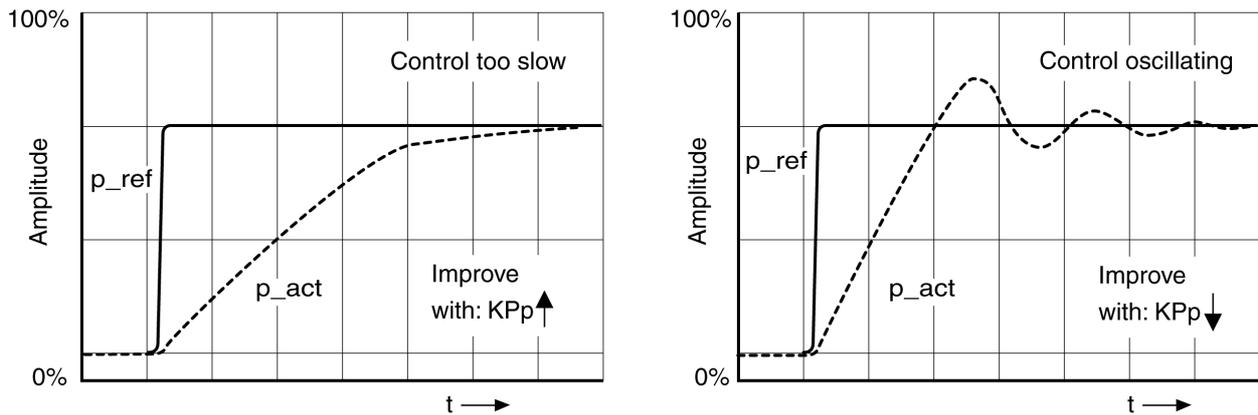
Section 5.5
Parameter Management

What Is in This Section?

This section contains the following topics:

Topic	Page
Resetting the User Parameters	127
Restoring Factory Settings	128

Resetting the User Parameters

Description

The user parameters are reset by means of the parameter `PARuserReset`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PARuserReset`	Reset user parameters. Bit 0: Reset persistent user parameters to default values. The parameters are reset with the exception of: - Communication parameters - Definition of the direction of rotation - Signal selection position interface - I/O functions Bits 1 and 2: Reserved The new settings are not saved to the nonvolatile memory. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 - 7	UINT16 R/W - -	Modbus 1040

Restoring Factory Settings

Description

The parameter values, both active and those saved in nonvolatile memory, are lost in this process.

NOTICE
LOSS OF DATA
Perform a backup of the drive parameters prior to restoring factory settings (factory established parameter values).
Failure to follow these instructions can result in equipment damage.

The commissioning software allows you to save the parameter values set for a drive as a configuration file.

The factory settings can be restored via the commissioning software.

Disconnect the drive from the fieldbus before you restore the factory settings.

Carefully manage the IP addresses because each device on the network requires a unique address. Having multiple devices with the same IP address can cause unintended operation of your network and associated equipment. Although some equipment, such as the present device, may detect duplicate IP addresses, other equipment may not.

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Ensure that there is only one "master" on the network controlling this equipment when using IO Scanning. ● Verify that all devices have unique addresses. ● Obtain your IP address from your system administrator. ● Confirm that the IP address of the drive is unique before placing the system into service. ● Do not assign the same IP address to any other equipment on the network. ● Update the IP address after resetting the drive to factory settings.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTE: Verify that your system administrator maintains a record of all assigned IP addresses on the network and subnetwork, and inform the system administrator of all configuration changes performed.

Factory Settings via Commissioning Software

Use the menu items **Configuration → Factory Settings** in the commissioning software to restore the factory settings.

The new settings become active after a power cycle of the drive.

Chapter 6
Operation

What Is in This Chapter?

This chapter contains the following topics:

Access Channels

Description

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

The product can be addressed via different access channels. Access channels are:

- Fieldbus
- Commissioning software
- Digital signal inputs
- Web server

Only one access channel can have exclusive access to the product. An exclusive access can be provided via different access channels:

- Via a fieldbus:
  Exclusive access is provided to a fieldbus by blocking the other access channels with the parameter `AccessLock`.
- Via the commissioning software:
  The commissioning software receives exclusive access via the switch "Exclusive access" in position "On".

When the drive is powered on, there is no exclusive access via an access channel.

The signal input functions "Halt", "Fault Reset", "Enable", "Positive Limit Switch (LIMP)", "Negative Limit Switch (LIMN)" and "Reference Switch (REF)" as well as the signals of the safety-related function STO ($\overline{\text{STO\_A}}$ and $\overline{\text{STO\_B}}$) are available during exclusive access.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AccessLock	Locking other access channels. Value 0: Allow control via other access channels Value 1: Lock control via other access channels With this parameter, the fieldbus can lock active access to the device via the following access channels: - Input signals - Commissioning software Processing of the input signal HALT cannot be locked. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 316

A separate access channel is assigned for each connection via Modbus TCP. The drive can be controlled via a single access channel only.

Special case I/O scanning:

The Modbus Unit ID 255 is used for I/O scanning. The connections of a Modbus client that address the Modbus Unit ID 255 are combined to a single channel in the drive.

Only one Modbus client can use this access channel. If messages from other Modbus clients are received with the Modbus Unit ID 255, the response to these requests is a detected error.

This access channel has access control by default. As long as a movement is ongoing, access control cannot be revoked.

Movement Range

Size of the Movement Range

The movement range is the maximum possible range within which a movement can be made to a position.

Movement range in user-defined units with the factory scaling:
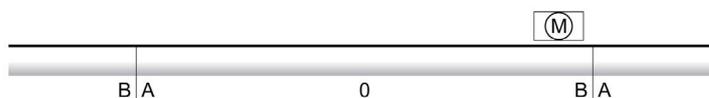
A -1073741824 user-defined units (usr)
B 1073741823 user-defined units (usr)

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 response to a movement beyond the movement range depends on the operating mode and the type of movement.

The following responses are 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.

Responses in operating mode Jog:
- Continuous movement: The movement range restarts.
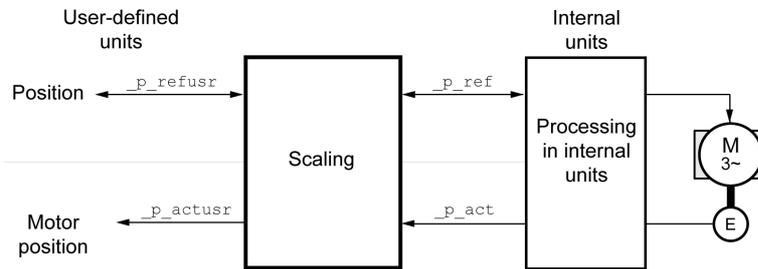- Step movement: Internal position setting to 0.

Responses in operating mode Profile Position:
- Relative movement: Internal position setting to 0.
- Absolute movement: An absolute movement beyond the movement range is not possible.

Scaling

Overview

Scaling converts user-defined units into internal units of the drive, and vice versa.

User-Defined Units

Values for positions are specified in user-defined unit **usr**.

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 number of motor revolutions and the required user-defined units (usr).

Calculation of the scaling factor:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr]}}$$

A new scaling factor is activated when you specify the numerator value.

With a scaling factor of < 1 / 32768, a movement outside of the movement range cannot be performed.

The internal resolution used by the drive is 32768 increments per revolution.

The following parameter values must be adapted in addition to the user-defined values to obtain the same movement of the motor after modifying the scaling factor: HMoutdisusr, HMdisusr, HMp_homeusr, HMsrchdisusr, JOGstepusr, SPVswLimPusr and SPVswLimNusr.

The following factory settings are used:
- One 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
POSscaleNum	Position scaling: Numerator. Scaling factor is defined as: Motor revolutions --- User-defined units [usr] A new scaling is activated when the numerator value is set. User-defined limit values may be reduced due to the calculation of an internal factor. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	Modbus 1552
POSscaleDenom	Position scaling: Denominator. Refer to numerator (POSscaleNum) for a description. A new scaling is activated when the numerator value is set. Setting can only be modified if power stage is disabled.	usr 1 16384 2147483647	INT32 R/W per. -	Modbus 1550

Parameterization of the Signal Input Functions and the Signal Output Functions

Description

Signal input functions and signal output functions can be assigned to the digital inputs and digital outputs.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
● Verify that the wiring is appropriate for the factory settings and any subsequent parameterizations.
● Only start the system if there are no persons or obstructions in the zone of operation.
● Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Factory Settings

Factory settings of the digital inputs and digital outputs:

Signal	Signal input function
`LIO1`	Input Positive Limit Switch (LIMP)
`LIO2`	Input Negative Limit Switch (LIMN)
`LIO3`	Input Free Available
`LIO4`	Input Reference Switch (REF)

Parameterization

Available signal input functions:

Signal input function	Description in chapter
Input Free Available	Available as required. Via parameter `_IO_LIO_act`, the signal input can be read.
Input Fault Reset	Changing the Operating State via Signal Inputs *(see page 145)*
Input Enable	Changing the Operating State via Signal Inputs *(see page 145)*
Input Halt	Stopping Movement with Halt *(see page 183)*
Input Jog Positive	Operating Mode Jog *(see page 148)*
Input Jog Negative	Operating Mode Jog *(see page 148)*
Input Jog Fast/Slow	Operating Mode Jog *(see page 148)*
Input Reference Switch (REF)	Reference Switch *(see page 192)*
Input Positive Limit Switch (LIMP)[1]	Limit Switches *(see page 190)*
Input Negative Limit Switch (LIMN)[2]	Limit Switches *(see page 190)*
(1) Only available with `LIO1` **(2)** Only available with `LIO2`	

Available signal output functions:

Signal output function	Description in chapter
Output Free Available	Setting a Signal Output via Parameter *(see page 186)*
Output No Fault	Indicating the Operating State via Signal Inputs *(see page 142)*
Output Active	Indicating the Operating State via Signal Inputs *(see page 142)*

The following parameters can be used to parameterize the digital inputs and digital outputs:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_LIO1	Function Input/Output LIO1. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **21 / Input Positive limit switch (LIMP)**: Positive limit switch (LIMP) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1826
IOfunct_LIO2	Function Input/Output LIO2. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **22 / Input Negative limit switch (LIMN)**: Negative limit switch (LIMN) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1828
IOfunct_LIO3	Function Input/Output LIO3. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1830

Operation

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_LIO4	Function Input/Output LIO4. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1832

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Chapter 7
Operating States and Operating Modes

What Is in This Chapter?

This chapter contains the following sections:

Section 7.1
Operating States

What Is in This Section?

This section contains the following topics:

State Diagram and State Transitions

State Diagram

When the product is powered on and when an operating mode is started, the product goes through a number of operating states.

The state diagram (state machine) shows the relationships between the operating states and the state transitions.

The operating states are internally monitored and influenced by monitoring functions.
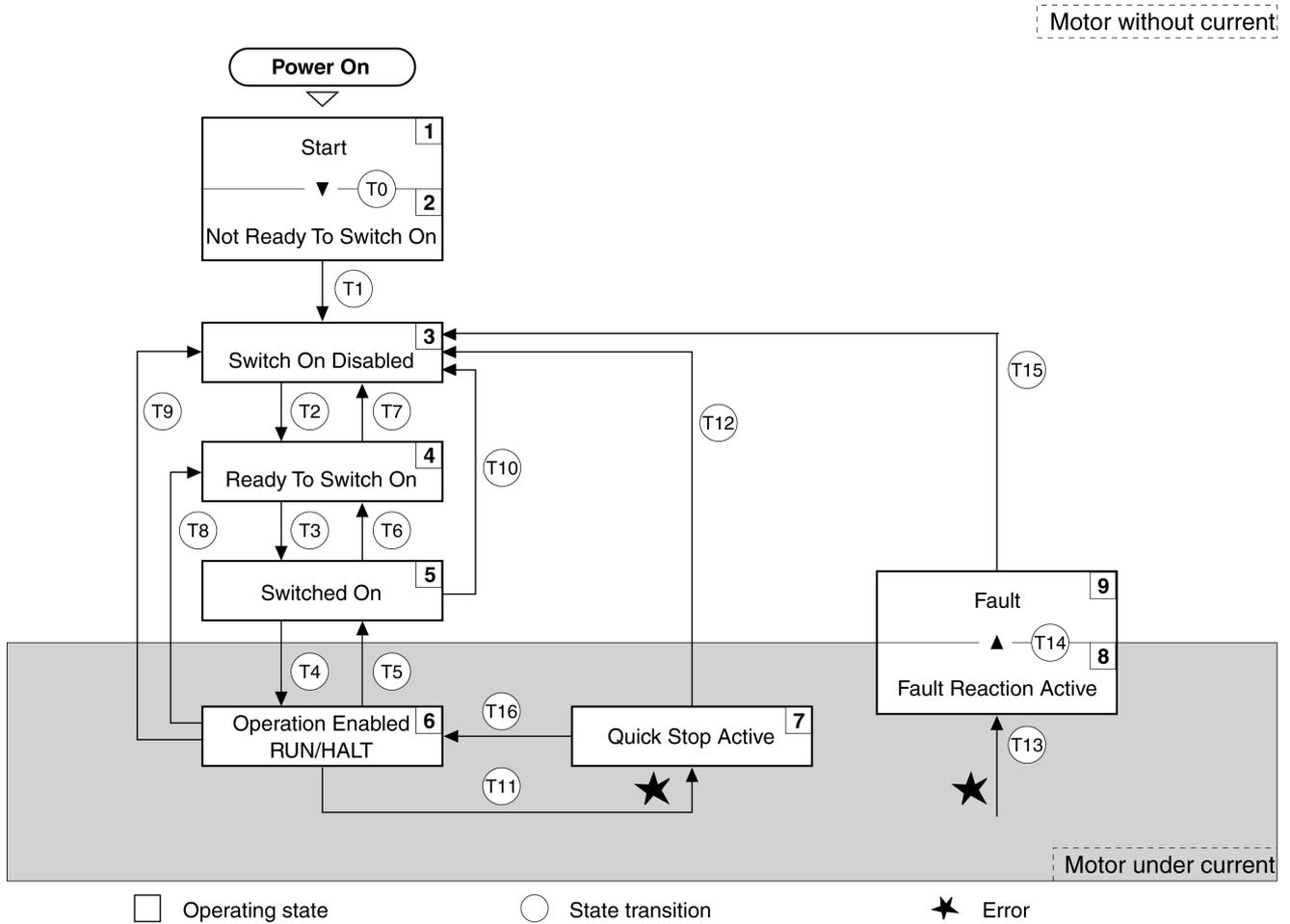
Operating States

Operating state	Description
1 Start	Electronics are initialized
2 Not Ready To Switch On	The power stage is not ready to switch on
3 Switch On Disabled	Not possible 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 the error message
0	-	No interruption of the movement	Function "Fault Reset"
1	T11	Stop the movement with "Quick Stop"	Function "Fault Reset"
2	T13, T14	Stop the 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 error is detected to which the device must respond.

Error class	Response
2	Movement is stopped with "Quick Stop". After standstill the holding brake is applied (if available). After the holding brake is applied the power stage is disabled.
3, 4 or safety-related function STO	Power stage is immediately disabled

An error can be detected by a temperature sensor, for example. The drive stops the movement and triggers an error response. Subsequently, the drive transitions to the operating state **9** Fault.

Resetting an Error

The function "Fault Reset" resets an error.

In the event of a "Quick Stop" triggered by a detected error of class 1 (operating state **7** Quick Stop Active), a "Fault Reset" causes a direct transition to operating state **6** Operation Enabled.

State Transitions

State transitions are triggered by an input signal, a fieldbus command or as a response to a monitoring function.

State transition	Operating state	Condition / event[1]	Response
T0	1-> **2**	● Device electronics successfully initialized	
T1	2-> **3**	● Parameter successfully initialized	
T2	3 -> **4**	● No undervoltage and Encoder successfully tested and Actual velocity: <1000 RPM and $\overline{STO\_A}$ and $\overline{STO\_B}$ = +24 V and fieldbus command: Shutdown[2]	
T3	4 -> **5**	● Request for enabling the power stage ● Fieldbus command: Switch On or Enable Operation	
T4	5 -> **6**	● Automatic transition ● Fieldbus command: Enable Operation	Power stage is enabled. User parameters are verified. Holding brake is released (if available).
(1) In order to trigger a state transition it is sufficient if one condition is met **(2)** Only required with parameter `DS402compatib` = 1 **(3)** Possible only if operating state was triggered via the fieldbus			

State transition	Operating state	Condition / event[1]	Response
T5	6 -> 5	● Fieldbus command: Disable Operation	Movement is stopped with "Halt". After standstill the holding brake is applied (if available). After the holding brake is applied the power stage is disabled.
T6	5 -> 4	● Fieldbus command: Shutdown	
T7	4 -> 3	● Undervoltage ● STO signals = 0 V ● Actual velocity: >1000 RPM (for example by external driving force) ● Fieldbus command: Disable Voltage	-
T8	6 -> 4	● Fieldbus command: Shutdown	Power stage is immediately disabled.
T9	6 -> 3	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	Power stage is immediately disabled.
T10	5 -> 3	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	
T11	6 -> 7	● Error of error class 1 ● Fieldbus command: Quick Stop	Movement is stopped with "Quick Stop".
T12	7 -> 3	● Request for disabling the power stage ● Fieldbus command: Disable Voltage	Power stage is immediately disabled, even if "Quick Stop" is still active.
T13	x -> 8	● Error of error classes 2, 3 or 4	Error response is carried out (see page 140).
T14	8 -> 9	● Error response terminated (error class 2) ● Error of error classes 3 or 4	
T15	9 -> 3	● Function: "Fault Reset"	Error is reset (cause of error must have been corrected).
T16	7 -> 6	● Function: "Fault Reset" ● Fieldbus command: Enable Operation[3]	In the event of a "Quick Stop" triggered by a detected error of class 1, a "Fault Reset" causes a direct transition to the operating state 6 Operation Enabled.
(1) In order to trigger a state transition it is sufficient if one condition is met (2) Only required with parameter DS402compatib = 1 (3) Possible only if operating state was triggered via the fieldbus			

Indicating the Operating State via Signal Outputs

Overview

Information on the operating state is available via the signal outputs.

The table below provides an overview.

	Signal output function	
Operating state	"Output No Fault"	"Output Active"
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

Indication of the Operating State via Fieldbus

Status Word

The parameter `DCOMstatus` provides information on the operating state of the device and the processing status of the operating mode.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DCOMstatus`	DriveCom status word. Bit assignments: Bits 0...3,5,6: Status bits Bit 4: Voltage enabled Bit 7: Error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Operating mode-specific Bit 11: Reserved Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	Modbus 6916

Bits 0, 1, 2, 3, 5, and 6

Bits 0, 1, 2, 3, 5, and 6 of the parameter `DCOMstatus` provide information on the operating state.

Operating state	Bit 6 Switch On Disabled	Bit 5 Quick Stop	Bit 3 Fault	Bit 2 Operation Enabled	Bit 1 Switch On	Bit 0 Ready To Switch On
2 Not Ready To Switch On	0	X	0	0	0	0
3 Switch On Disabled	1	X	0	0	0	0
4 Ready To Switch On	0	1	0	0	0	1
5 Switched On	0	1	0	0	1	1
6 Operation Enabled	0	1	0	1	1	1
7 Quick Stop Active	0	0	0	1	1	1
8 Fault Reaction Active	0	X	1	1	1	1
9 Fault	0	X	1	0	0	0

Bit 4

Bit 4=1 indicates whether the DC bus voltage is correct. If the voltage is insufficient, the drive does not transition from operating state 3 to operating state 4.

Bit 7

Bit 7 is 1 if parameter `_WarnActive` contains an error message of error class 0. The movement is not interrupted. The bit remains set to 1 as long as the message is contained in parameter `_WarnActive`. The bit remains set to 1 for at least 100 ms, even if an error message of error class 0 is active for a shorter time. The bit is immediately reset to 0 in the case of a "Fault Reset".

Bit 8

Bit 8=1 indicates that a "Halt" is active.

Bit 9

If bit 9 is set to 1, the drive executes commands via the fieldbus. If Bit 9 is reset to 0, the drive is controlled via a different access channel. In such a case, it is still possible to read or write parameters via the fieldbus.

Bit 10

Bit 10 is used for monitoring the operating mode. Details can be found in the chapters on the individual operating modes.

Bit 11

Reserved.

Bit 12

Bit 12 is used for monitoring the operating mode. Details can be found in the chapters on the individual operating modes.

Bit 13

Bit 13 is only set to 1 if an error is detected whose cause required to be removed prior to further processing. The device responds corresponding to the error class.

Bit 14

Bit 14 changes to "0" if an operating mode is started. When processing is terminated or interrupted, for example by a "Halt", bit 14 toggles back to "1" once the motor has come to a standstill. Bit 14 does not change to "1" if a new operating mode is started immediately after completion of a different operating mode.

Bit 15

Bit 15 is set to 1 if the motor has a valid zero point, for example, as a result of a reference movement. A valid zero point remains valid even if the power stage is disabled.

Changing the Operating State via Signal Inputs

Overview

It is possible to switch between operating states via the signal inputs.

- Signal input function "Input Enable"
- Signal input function "Input Fault Reset"

Signal Input Function "Input Enable"

The power stage is enabled by means of the signal input function "Input Enable".

"Input Enable"	State transition
Rising edge	Enable power stage (T3)
Falling edge	Disabling the power stage (T9 and T12)

If you want to enable the power stage via the signal input, you must first parameterize the signal input function "Enable", refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

Signal Input Function "Input Fault Reset"

The signal input function "Input Fault Reset" is used to reset an error.

"Input Fault Reset"	State transition
Rising edge	Resetting an error (T15 and T16)

If you want to reset an error via the signal input, you must first parameterize the signal input function "Input Fault Reset", refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

Changing the Operating State via Fieldbus

Control Word

It is possible to switch between operating states via the parameter `DCOMcontrol`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DCOMcontrol`	DriveCom control word. Refer to chapter Operation, Operating States, for bit coding information. Bit 0: Switch on Bit 1: Enable Voltage Bit 2: Quick Stop Bit 3: Enable Operation Bit 4..6: Operating mode specific Bit 7: Fault Reset Bit 8: Halt Bit 9..15: Reserved (must be 0) Modified settings become active immediately.	- - - -	UINT16 R/W - -	Modbus 6914

Bits 0, 1, 2, 3 and 7

Bits 0, 1, 2, 3 and 7 of the parameter `DCOMcontrol` allow you to switch between the operating states.

Fieldbus command	State transitions	State transition to	Bit 7 Fault Reset	Bit 3 Enable Operation	Bit 2 Quick Stop	Bit 1 Enable Voltage	Bit 0 Switch On
Shutdown	T2, T6, T8	**4** Ready To Switch On	0	X	1	1	0
Switch On	T3	**5** Switched On	0	0	1	1	1
Disable Voltage	T7, T9, T10, T12	**3** Switch On Disabled	0	X	X	0	X
Quick Stop	T7, T10 T11	**3** Switch On Disabled **7** Quick Stop Active	0	X	0	1	X
Disable Operation	T5	**5** Switched On	0	0	1	1	1
Enable Operation	T4, T16	**6** Operation Enabled	0	1	1	1	1
Fault Reset	T15	**3** Switch On Disabled	0->1	X	X	X	X

Bits 4 ... 6

Bits 4 to 6 are used for the operating mode-specific settings. Details can be found in the descriptions of the individual operating modes in this chapter.

Bit 8

Bit 8 is used to trigger a "Halt". Set bit 8 to 1 to stop a movement with "Halt".

Bits 9 ... 15

Reserved.

Section 7.2
Indicating, Starting and Changing an Operating Mode

Starting and Changing an Operating Mode

Starting the Operating Mode

The set operating mode is automatically started by enabling the power stage.

The parameter `DCOMopmode` is used to set the operating mode.

The parameter `_DCOMopmode_act` can be used to read the operating mode.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DCOMopmode	Operating mode. **0 / Reserved**: Reserved **-4 / Speed Control**: Speed Control **-1 / Jog**: Jog **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **6 / Homing**: Homing Modified settings become active immediately.	- -4 - 6	INT16 R/W - -	Modbus 6918
_DCOMopmd_act	Active operating mode. **0 / Reserved**: Reserved **-4 / Speed Control**: Speed Control **-1 / Jog**: Jog **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **6 / Homing**: Homing	- -4 - 6	INT16 R/- - -	Modbus 6920

Changing the Operating Mode

The operating mode can be changed after the active operating mode has been terminated.

The drive must be at a standstill.

Section 7.3
Operating Mode Jog

What Is in This Section?

This section contains the following topics:

Overview

Description

In the operating mode Jog, a movement is made from the actual motor in the specified direction.

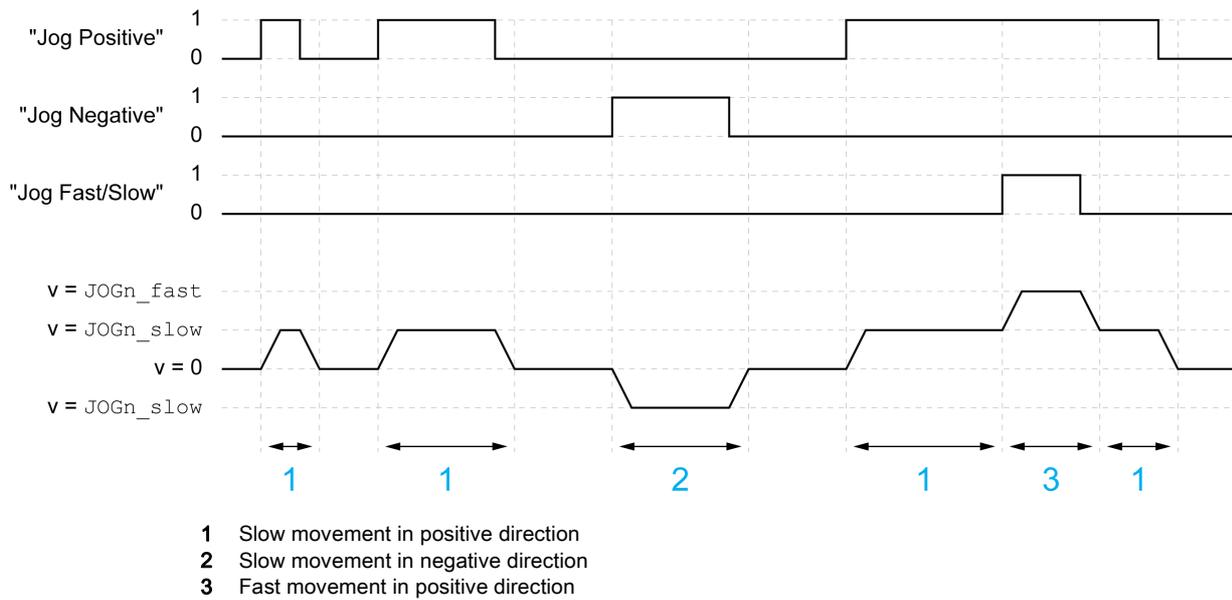A movement can be made using one of two methods:

- Continuous movement
- Step movement

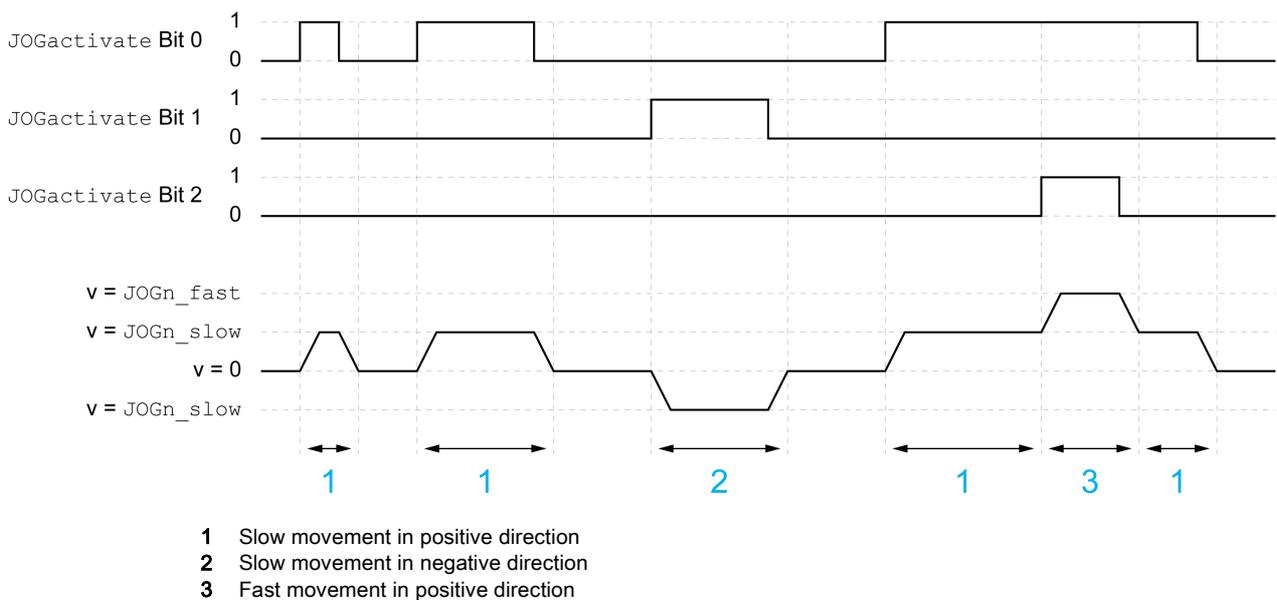In addition, the drive provides two parameterizable velocities.

Continuous Movement

As long as the signal for the direction is available, a continuous movement is made in the required direction.

The illustration below provides an example of continuous movement via the signal inputs:

"Jog Positive"
"Jog Negative"
"Jog Fast/Slow"

v = JOGn_fast
v = JOGn_slow
v = 0
v = JOGn_slow

1 1 2 1 3 1

1 Slow movement in positive direction
2 Slow movement in negative direction
3 Fast movement in positive direction

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

JOGactivate Bit 0
JOGactivate Bit 1
JOGactivate Bit 2

v = JOGn_fast
v = JOGn_slow
v = 0
v = JOGn_slow

1 1 2 1 3 1

1 Slow movement in positive direction
2 Slow movement in negative direction
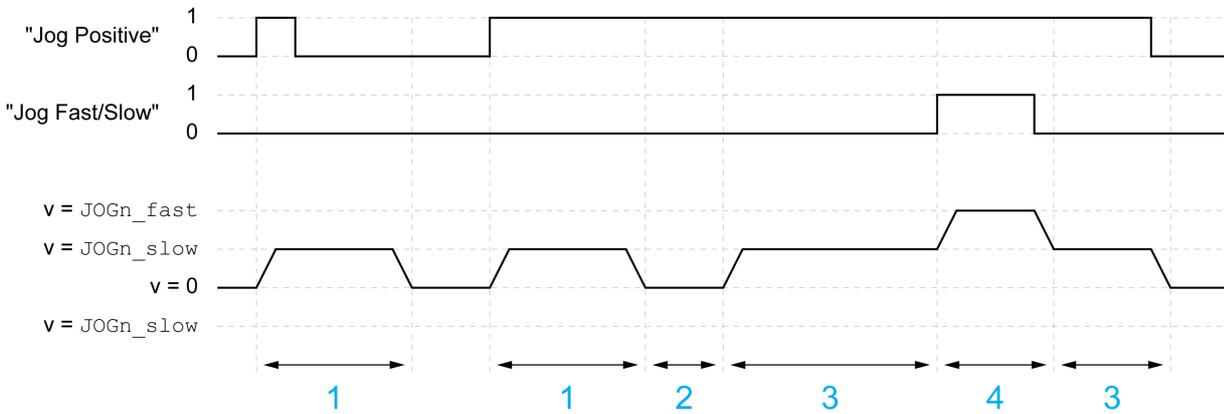**3** Fast movement in positive direction

Step Movement

If the signal for the direction is available for a short period of time, a movement with a parameterizable number of user-defined units is made in the required direction.

If the signal for the direction is available continuously, a movement with a parameterizable number of user-defined units is made in the required direction. After this movement, the motor stops for a defined period of time. Then a continuous movement is made in the required direction.

The illustration below provides an example of step movement via the signal inputs:

1 Slow movement in positive direction with a parameterizable number of user-defined units `JOGstepusr`
2 Waiting time `JOGtime`
3 Slow continuous movement in positive direction
4 Fast continuous movement in positive direction

The illustration below provides an example of step movement via the fieldbus:
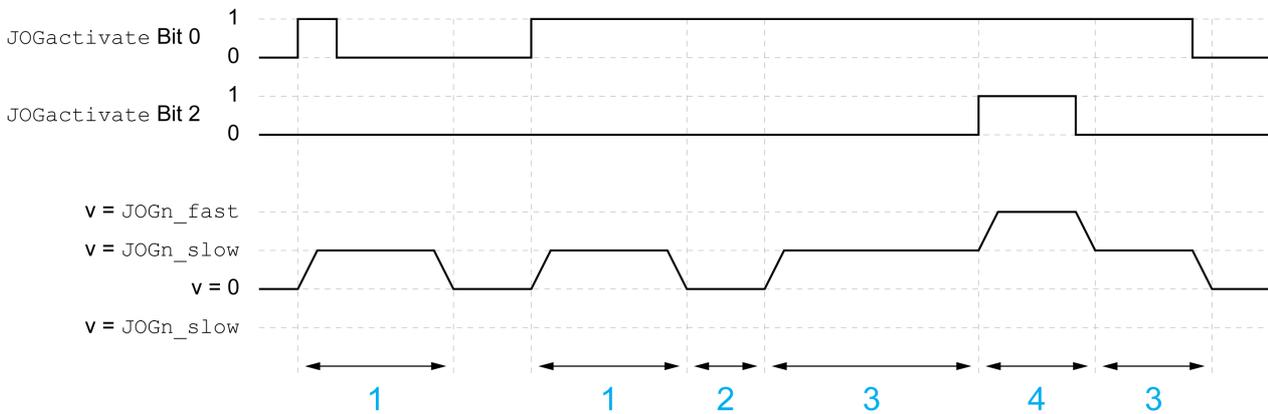
1 Slow movement in positive direction with a parameterizable number of user-defined units `JOGstepusr`
2 Waiting time `JOGtime`
3 Slow continuous movement in positive direction
4 Fast continuous movement in positive direction

Starting the Operating Mode

The operating mode can be started via the signal inputs or via the fieldbus.

If you want to start the operating mode via the signal inputs, you must first parameterize the signal input functions "Input Enable", "Input Fault Reset", "Input Jog Negative" and "Input Jog Positive", refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

Signal input	Signal input function
`DI0`	"Input Enable" Enable and disable the power stage
`DI1`	"Input Fault Reset" Resetting an error message

Signal input	Signal input function
DI2	"Input Jog Negative" Operating mode Jog: Movement in negative direction
DI3	"Input Jog Positive" Operating mode Jog: Movement in positive direction

If you want to start the operating mode via the fieldbus, you must first set the operating mode in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The parameter `JOGactivate` starts the movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGactivate	Activation of operating mode Jog. Bit 0 = 1: Positive direction of rotation Bit 1 = 1: Negative direction of rotation Bit 2 = 0: Slow velocity Bit 2 = 1: Fast velocity If both bits for the direction of rotation are activated at the same time, no movement is started. If a jog movement is running, the simultaneous activation of the bits for the direction of rotation has no effect. Modified settings become active immediately.	- 0 0 7	UINT16 R/W - -	Modbus 6930

Control Word

The operating mode-specific bits 4, 5, and 6 are reserved in this operating mode and must be set to 0.

Refer to the chapter Changing the Operating State for the common bits of the Control Word.

Status Word

The operating mode-specific bits 10 and 12 are reserved in this operating mode.

Refer to the chapter Indication of the Operating State for the common bits of the Control Word.

Terminating the Operating Mode

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

● Signal inputs "Input Jog Positive" and "Input Jog Negative" are set to 0
● Value 0 in parameter `JOGactivate`
● Stop caused by "Halt" or "Quick Stop"
● Stop caused by a detected error

Parameterization

Switching Between Velocities Via a Signal Input

The drive provides the signal input function "Input Jog Fast/Slow". This signal input function allows you to switch between two velocities via a signal input.

If you want to switch between the two velocities, you must first parameterize the signal input function "Input Jog Fast/Slow", refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

Setting the Velocities

Two parameterizable velocities are available.

● Set the values with the parameters `JOGn_slow` and `JOGn_fast`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGn_slow	Velocity for slow movement. The adjustable value is internally limited to the parameter setting in RAMPn_max. Modified settings become active immediately.	RPM 1 60 13200	UINT16 R/W per. -	Modbus 10504
JOGn_fast	Velocity for fast movement. The adjustable value is internally limited to the parameter setting in RAMPn_max. Modified settings become active immediately.	RPM 1 180 13200	UINT16 R/W per. -	Modbus 10506

Setting the Step Movement

The parameters `JOGstepusr` and `JOGtime` are used to set the number of user-defined units and the time for which the motor is stopped.

● Set the values with the parameters `JOGstepusr` and `JOGtime`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGstepusr	Distance for step movement. Modified settings become active the next time the motor moves.	usr 0 20 2147483647	INT32 R/W per. -	Modbus 10510
JOGtime	Wait time for step movement. Modified settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	Modbus 10512

Changing the Motion Profile for the Velocity

It is possible to modify the parameterization of the Motion Profile for the Velocity *(see page 181)*.

Additional Settings

Overview

The following functions can be used for target value processing:

- Chapter Stopping Movement with Halt *(see page 183)*
- Chapter Stopping Movement with Quick Stop *(see page 184)*
- Chapter Setting a Signal Output via Parameter *(see page 186)*
- Chapter Position Capture via Signal Input *(see page 187)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 190)*
- Chapter Software Limit Switches *(see page 193)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 195)*
- Chapter Standstill Window *(see page 197)*
  This function is only available for a step movement.

Section 7.4
Operating Mode Speed Control

What Is in This Section?

This section contains the following topics:

Overview

Description

In the operating mode Speed Control, a movement is made with a specified reference velocity.

The motion profile for velocity is not active in this operating mode.

Starting the Operating Mode

The operating mode can be started via the fieldbus.

The operating mode must be set in the parameter `DCOMopmode`. The parameter `SPEEDreference` must be set to value 2. Writing the parameter value activates the operating mode. Writing the value in parameter `SPEEDn_target` starts the movement.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`SPEEDreference`	Reference value source for operating mode Speed Control. **0 / None**: None **2 / Parameter 'SPEEDn_target'**: Reference value via parameter SPEEDn_target Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	Modbus 6946

Control Word

The operating mode-specific bits 4, 5, and 6 are reserved in this operating mode and must be set to 0.

Refer to the chapter Changing the Operating State *(see page 146)* for the common bits of the Control Word.

Status Word

The operating mode-specific bits 10 and 12 are reserved in this operating mode.

Refer to chapter Indication of the Operating State *(see page 143)* for the common bits of the Control Word.

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

Reference Velocity

The parameter `SPEEDn_target` allows you to set the reference velocity.

● Set the reference velocity with the parameter `SPEEDn_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`SPEEDn_target`	Reference velocity in operating mode Speed Control. The internal maximum speed is limited to the setting in CTRL_n_max. Modified settings become active immediately.	RPM -30000 0 30000	INT16 R/W - -	Modbus 8456

Setting the Limit Values

The current and the velocity can be limited via parameters. Refer to the chapter Setting Limit Values for details.

Additional Settings

Overview

The following functions can be used for target value processing:

● Chapter Stopping Movement with Halt *(see page 183)*
● Chapter Stopping Movement with Quick Stop *(see page 184)*
● Chapter Setting a Signal Output via Parameter *(see page 186)*
● Chapter Position Capture via Signal Input *(see page 187)*

The following functions can be used for monitoring the movement:

● Chapter Limit Switches *(see page 190)*
● Chapter Software Limit Switches *(see page 193)*

Section 7.5
Operating Mode Profile Velocity

What Is in This Section?

This section contains the following topics:

Overview

Description

In the operating mode Profile Velocity, a movement is made with a specified target velocity.

The motion profile for velocity is active in this operating mode.

Starting the Operating Mode

The operating mode can be started via the fieldbus.

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The parameter `PVn_target` starts the movement.

Control Word

The operating mode-specific bits 4, 5, and 6 are reserved in this operating mode and must be set to 0.

Refer to the chapter Changing the Operating State *(see page 146)* for the common bits of the Control Word.

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Target velocity not reached 1: Target velocity reached
Bit 12	0: Velocity = >0 1: Velocity = 0

Refer to the chapter Indication of the Operating State *(see page 143)* for the common bits of the Control Word.

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

Target Velocity

The parameter `PVn_target` allows you to set the target velocity.

- Set the target velocity with the parameter `PVn_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PVn_target`	Target velocity for operating mode Profile Velocity. The maximum value is limited to the setting in CTRL_n_max. The adjusted value is internally limited to the parameter value in RAMPn_max. Modified settings become active immediately.	RPM - 0 -	INT32 R/W - -	Modbus 6938

Modifying the Motion Profile for the Velocity

It is possible to modify the parameterization of the Motion Profile for the Velocity .

Additional Settings

Overview

The following functions can be used for target value processing:

● Chapter Stopping Movement with Halt *(see page 183)*
● Chapter Stopping Movement with Quick Stop *(see page 184)*
● Chapter Setting a Signal Output via Parameter *(see page 186)*
● Chapter Position Capture via Signal Input *(see page 187)*

The following functions can be used for monitoring the movement:

● Chapter Limit Switches *(see page 190)*
● Chapter Software Limit Switches *(see page 193)*

Section 7.6
Operating Mode Profile Position

What Is in This Section?

This section contains the following topics:
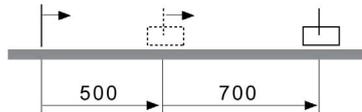
Overview

Description

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

Twp types of movements are available:

● Relative movement
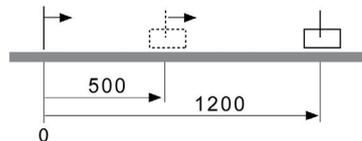● Absolute movement

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 can be started via the fieldbus.

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The movement is started via the control word.

Control Word

Parameter value	Meaning
Bit 4: New setpoint	0->1: Starts a movement to a target position.
Bit 5: Change setpoint immediately	0: Target values transmitted during a movement become immediately effective and are executed at the target. The movement is stopped at the target position. 1: Target values transmitted during a movement become immediately effective and are immediately executed.
Bit 6: Absolute / relative	0: Absolute movement 1: Relative movement

Target values include target position, target velocity, acceleration and deceleration.

Refer to the chapter Changing the Operating State for the common bits of the Control Word.

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Target position not reached 1: Target position reached If "Halt" is active: 0: Motor decelerates 1: Motor standstill

Parameter DCOMstatus	Meaning
Bit 12	0: New position possible 1: New target position accepted

Refer to the chapter Indication of the Operating State *(see page 143)* for the common bits of the Control Word.

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

Target Velocity

The parameter `PPn_target` allows you to set the target velocity.

● Set the target velocity with the parameter `PPn_target`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`PPn_target`	Target velocity for operating mode Profile Position. The maximum value is limited to the setting in CTRL_n_max. The adjusted value is internally limited to the parameter value in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 60 -	UINT32 R/W - -	Modbus 6942

Target Position

The parameter `PPp_targetusr` allows you to enter the target position.

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

● Set the required target position with the parameter `PPp_targetusr`.
● Set the required 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
`PPp_targetusr`	Target position for operating mode Profile Position. Minimum and maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Modified settings become active immediately.	usr - - -	INT32 R/W - -	Modbus 6940
`PPoption`	Options for operating mode profile position. Determines the reference position for relative positioning: Value 0: Relative with reference to the previous target position of the motion profile generator Value 1: Reserved Value 2: Relative with reference to the actual position of the motor Modified settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	Modbus 6960

Modifying the Motion Profile for the Velocity

It is possible to modify the parameterization of the Motion Profile for the Velocity .

Additional Settings

Overview

The following functions can be used for target value processing:

● Chapter Stopping Movement with Halt *(see page 183)*
● Chapter Stopping Movement with Quick Stop *(see page 184)*
● Chapter Setting a Signal Output via Parameter *(see page 186)*
● Chapter Position Capture via Signal Input *(see page 187)*

The following functions can be used for monitoring the movement:

● Chapter Limit Switches *(see page 190)*
● Chapter Software Limit Switches *(see page 193)*
● Chapter Load-Dependent Position Deviation (Following Error) *(see page 195)*
● Chapter Standstill Window *(see page 197)*

Section 7.7
Operating Mode Homing

What Is in This Section?

This section contains the following topics:

Overview

Description

In the operating mode Homing, a reference is generated between a mechanical position and the position of the motor as determined by the encoder.

A reference between a mechanical position and the encoder 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 specific 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.

Starting the Operating Mode

The operating mode can be started via the fieldbus.

The operating mode must be set in the parameter `DCOMopmode`. Writing the parameter value activates the operating mode. The movement is started via the control word.

Control Word

Parameter `DCOMcontrol`	Meaning
Bit 4	Start Homing
Bits 5 and 6	Reserved (must be set to 0)

Refer to the chapter Changing the Operating State for the common bits of the Control Word.

Status Word

Parameter `DCOMstatus`	Meaning
Bit 10	0: Homing not completed 1: Homing completed
Bit 12	1: Homing successfully completed

Refer to the chapter Indication of the Operating State *(see page 143)* for the common bits of the Control Word.

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

Setting Limit Switches and Reference Switches

The limit switches and reference switches must be set to meet the application requirements. Refer to the chapter Limit Switches *(see page 190)* and to the chapter Reference Switch *(see page 192)* for details.

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`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMmethod	Homing method. 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting Abbreviations: REF+: Search movement in positive direction REF-: Search movement in negative direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Modified settings become active immediately.	- 1 18 35	INT16 R/W - -	Modbus 6936

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 without index pulse. The parameter `HMdisusr` lets you set the distance to the switching point of the limit switch or of the reference switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMdisusr	Distance from switching point. The distance from the switching point is defined as the reference point. The parameter is only effective during a reference movement without index pulse. Modified settings become active the next time the motor moves.	usr 1 200 2147483647	INT32 R/W per. -	Modbus 10254

Defining the Zero Point

The parameter `HMp_homeusr` is used to specify a position value which is set at the reference point after a successful reference movement. The 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_homeusr	Position at reference point. After a successful reference movement, this position is automatically set at the reference point. Modified settings become active the next time the motor moves.	usr -2147483648 0 2147483647	INT32 R/W per. -	Modbus 10262

Setting Monitoring

The parameters `HMoutdisusr` and `HMsrchdisusr` 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
HMoutdisusr	Maximum distance for search for switching point. Value 0: Monitoring of distance inactive Value >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Modified settings become active the next time the motor moves.	usr 0 0 2147483647	INT32 R/W per. -	Modbus 10252
HMsrchdisusr	Maximum search distance after overtravel of switch. Value 0: Search distance monitoring disabled Value >0: Search distance The switch must be activated again within this search distance, otherwise the reference movement is canceled. Modified settings become active the next time the motor moves.	usr 0 0 2147483647	INT32 R/W per. -	Modbus 10266

Reading the Position Distance

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

The distance between the switching point and the index pulse must be greater than 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.

The position of the index pulse can also be moved with the parameter `ENC_pabsusr`, Refer to the chapter Setting Parameters for Encoder *(see page 115)* for details.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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. In increments of 0.0001 revolution.	revolution - - -	INT32 R/- - -	Modbus 10264

Setting Velocities

The parameters `HMn` and `HMn_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
HMn	Target velocity for searching the switch. The adjustable value is internally limited to the setting in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 60 13200	UINT16 R/W per. -	Modbus 10248
HMn_out	Target velocity for moving away from switch. The adjustable value is internally limited to the setting in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 6 3000	UINT16 R/W per. -	Modbus 10250

Modifying the Motion Profile for the Velocity

It is possible to modify the parameterization of the Motion Profile for the Velocity *(see page 181)*.

Reference Movement to a Limit Switch

Overview

The following figure illustrates a reference movement to a limit switch

Reference movement to a limit switch:
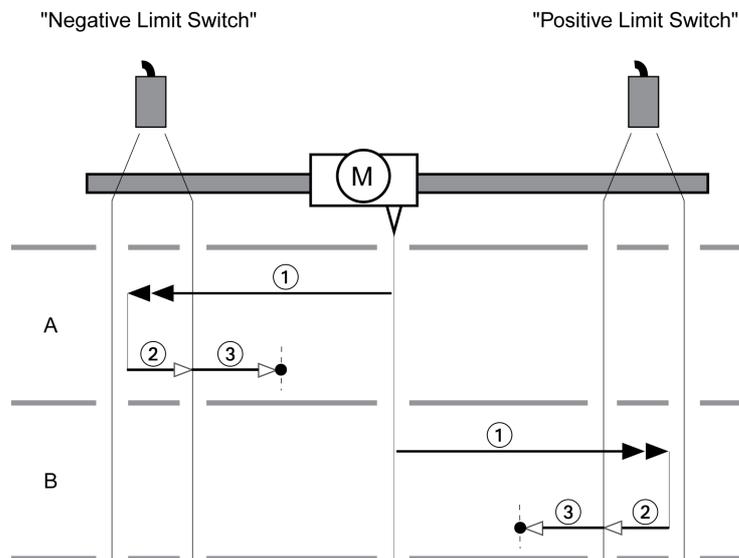
1 Movement to limit switch at velocity `HMn`
2 Movement to the switching point of the limit switch at velocity `HMn_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMn_out`

Type A

Method 1: Movement to the index pulse.

Method 17: Movement to distance from switching point.

Type B

Method 2: Movement to the index pulse.

Method 18: Movement to distance from switching point.

Reference Movement to the Reference Switch in Positive Direction

Overview

The following figure illustrates a reference movement to the reference switch in positive direction

Reference movement to the reference switch in positive direction:
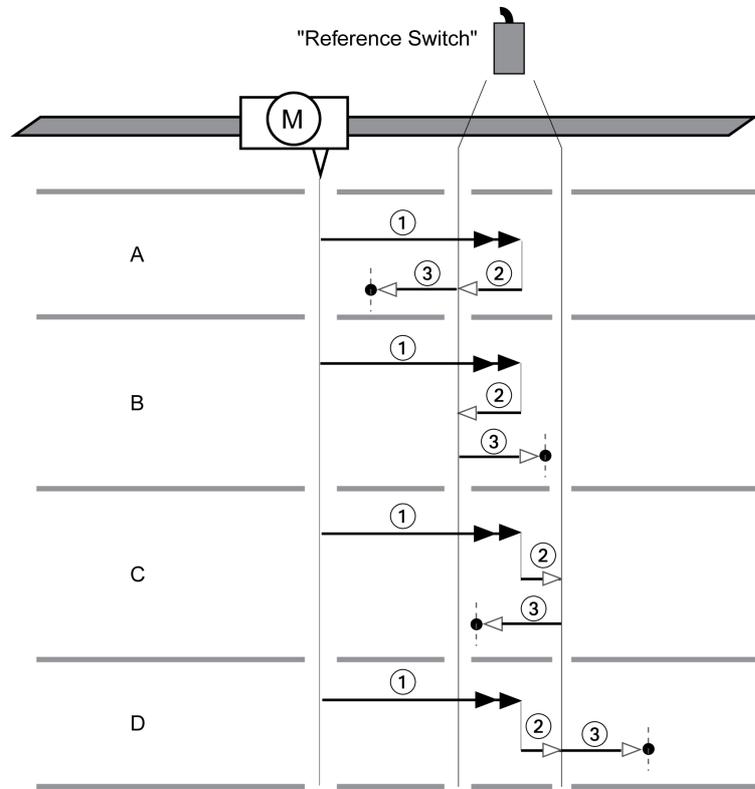
1 Movement to reference switch at velocity `HMn`
2 Movement to the switching point of the reference switch at velocity `HMn_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMn_out`

Type A

Method 7: Movement to the index pulse.

Method 23: Movement to distance from switching point.

Type B

Method 8: Movement to the index pulse.

Method 24: Movement to distance from switching point.

Type C

Method 9: Movement to the index pulse.

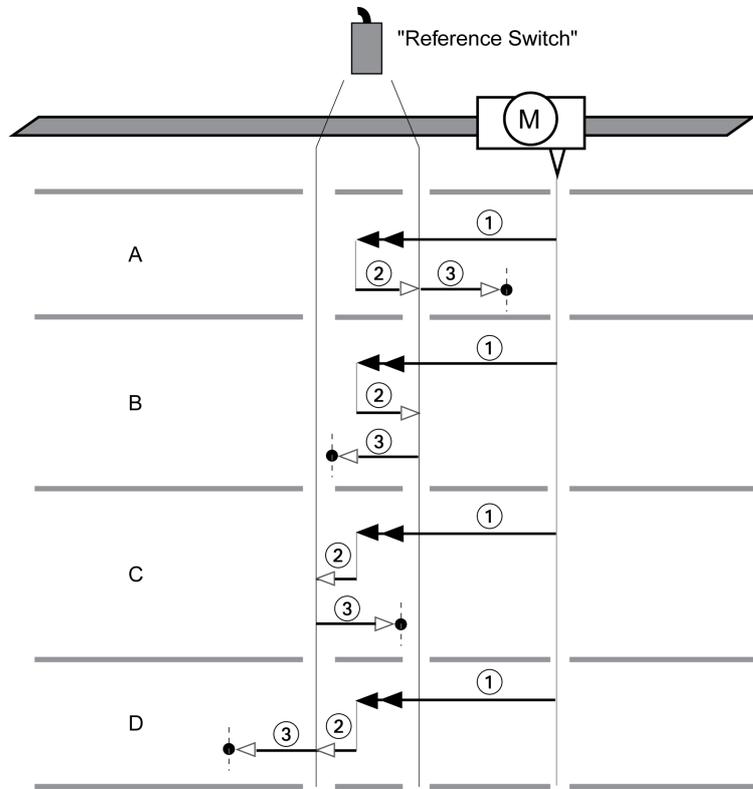Method 25: Movement to distance from switching point.

Type D

Method 10: Movement to the index pulse.

Method 26: Movement to distance from switching point.

Reference Movement to the Reference Switch in Negative Direction

Overview

The following figure illustrates 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 `HMn`
2 Movement to the switching point of the reference switch at velocity `HMn_out`
3 Movement to index pulse or movement to a distance from the switching point at velocity `HMn_out`

Type A

Method 11: Movement to the index pulse.

Method 27: Movement to distance from switching point.

Type B

Method 12: Movement to the index pulse.

Method 28: Movement to distance from switching point.

Type C

Method 13: Movement to the index pulse.
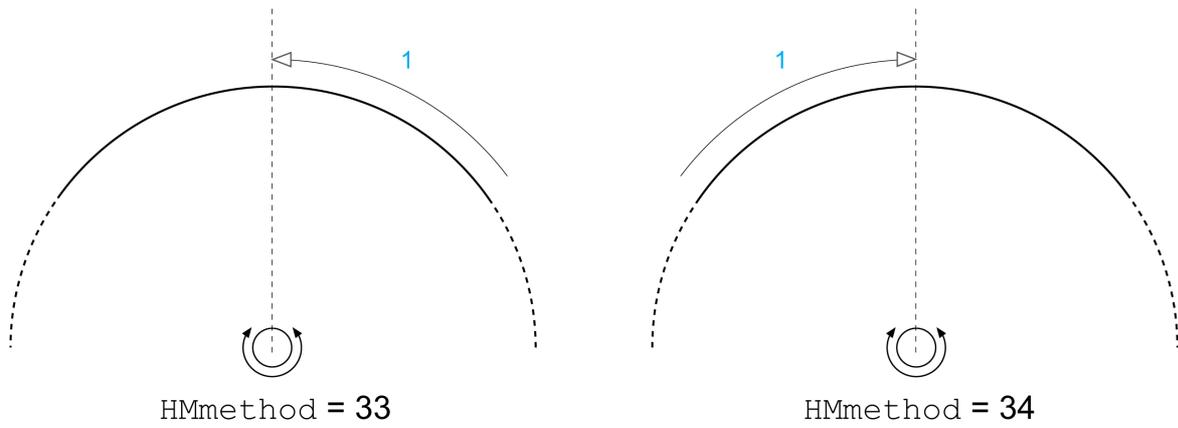
Method 29: Movement to distance from switching point.

Type D

Method 14: Movement to the index pulse.

Method 30: Movement to distance from switching point.

Reference Movement to the Index Pulse

Overview

The following figure illustrates a reference movement to the index pulse

Reference movement to the index pulse:

`HMmethod` = 33

`HMmethod` = 34

1 Movement to index pulse at velocity `HMn_out`

Position Setting

Description

By means of position setting, the actual position is set to the position value in parameter `HMp_setpusr`. 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 be compensated for by the position controller after position setting.

Setting the Position for Position Setting

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`HMp_setpusr`	Position for Position Setting. Position for operating mode Homing, method 35 (Position Setting). Modified settings become active immediately.	usr - 0 -	INT32 R/W - -	Modbus 6956

Example

Movement by 4000 user-defined units with position setting:
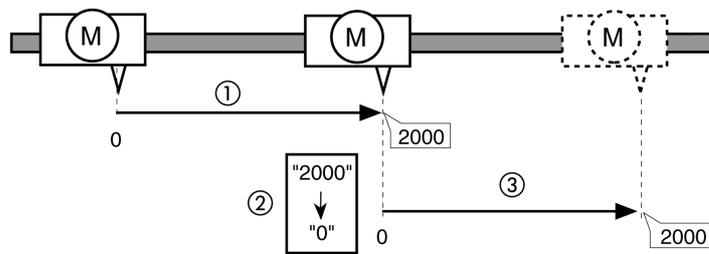
1   The motor is positioned by 2000 user-defined units.
2   By means of position setting to 0, the actual position is set to position value 0 which, at the same time, defines a new zero point.
3   When a new movement by 2000 user-defined units is triggered, the new target position is 2000 user-defined units.

Additional Settings

Overview

The following functions can be used for target value processing:

- Chapter Stopping Movement with Halt *(see page 183)*
- Chapter Stopping Movement with Quick Stop *(see page 184)*
- Chapter Setting a Signal Output via Parameter *(see page 186)*
- Chapter Position Capture via Signal Input *(see page 187)*

The following functions can be used for monitoring the movement:

- Chapter Limit Switches *(see page 190)*
- Chapter Software Limit Switches *(see page 193)*
- Chapter Load-Dependent Position Deviation (Following Error) *(see page 195)*
- Chapter Standstill Window *(see page 197)*

Chapter 8
Functions for Operation

This chapter contains the following sections:

Section 8.1
Functions for Target Value Processing

What Is in This Section?

This section contains the following topics:

Motion Profile for the Velocity

Description

Target position and target velocity are input values you specify. A motion profile for the velocity is calculated on the basis of these values.

The motion profile for the velocity consists of an acceleration, a deceleration, and a maximum velocity.

The settings for the motion profile for the velocity are valid for both directions of movement.

Acceleration Ramp and Deceleration Ramp

The integrated drive uses a linear ramp for acceleration and deceleration.
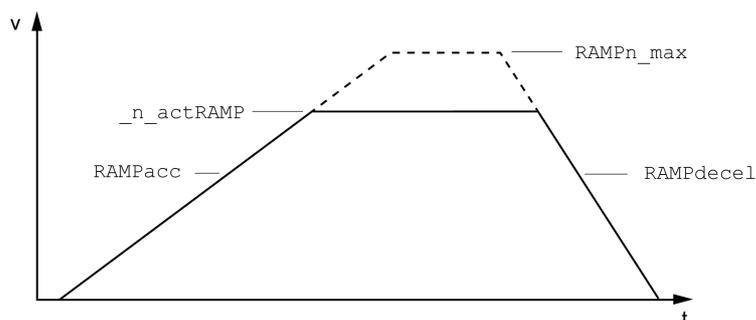
Availability

The availability of the motion profile for the velocity depends on the operating mode.

The motion profile for the velocity is available in the following operating modes:
- Jog
- Profile Position
- Profile Velocity
- 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.
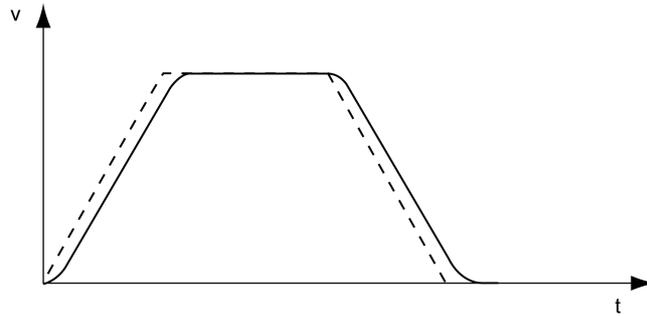

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMPn_max	Maximum velocity of the motion profile for velocity. The parameter is active in the following operating modes: - Profile Position - Profile Velocity - Homing - Jog If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMPn_max. This way, commissioning at limited velocity is easier to perform. Setting can only be modified if power stage is disabled. Modified settings become active the next time the motor moves.	RPM 60 13200 13200	UINT16 R/W per. -	Modbus 1554
RAMPacc	Acceleration of the motion profile for velocity. Modified settings become active the next time the motor moves.	RPM/s 1 600 3000000	UINT32 R/W per. -	Modbus 1556

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMPdecel	Deceleration of the motion profile for velocity. Modified settings become active the next time the motor moves.	RPM/s 750 750 3000000	UINT32 R/W per. -	Modbus 1558

Jerk Limitation

Jerk limitation smoothes sudden acceleration changes to allow for smooth transitions.

The following figure illustrates the profile without jerk limitation (dashed line) and with jerk limitation (solid line):

Jerk limitation is activated and set via the parameter RAMP_TAUjerk.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMP_TAUjerk	Jerk limitation of the motion profile for velocity. **0 / Off**: Off **1 / 1**: 1 ms **2 / 2**: 2 ms **4 / 4**: 4 ms **8 / 8**: 8 ms **16 / 16**: 16 ms **32 / 32**: 32 ms **64 / 64**: 64 ms **128 / 128**: 128 ms Adjustments can only be made if the operating mode is inactive (x_end=1). Modified settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	Modbus 1562

Stopping a Movement with Halt

Description

You can stop a movement with a Halt. The movement is resumed when the Halt is cleared.

A Halt can be triggered via a digital signal input or a fieldbus command.

In order to interrupt a movement with a Halt via a signal input, you must first parameterize the signal input function "Input Halt", see chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

The following deceleration types are available:
● Deceleration via deceleration ramp
● Deceleration via torque ramp

If the Halt request is cleared while the deceleration is still being performed, the deceleration is continued until the motor has reached a standstill. After that, the motor accelerates to the original velocity.

Setting the Type of Deceleration

The parameter `LIM_HaltReaction` lets you set the type of deceleration.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_HaltReaction`	Halt option code. **1 / Deceleration ramp**: Deceleration ramp **3 / Torque ramp**: Torque ramp Setting of deceleration ramp with parameter RAMPdecel. Setting of torque ramp with parameter LIM_I_maxHalt. The deceleration ramp is only available for operating modes with motion profile for velocity. The torque ramp is used in the operating modes without motion profile for velocity. Modified settings become active immediately.	- 1 3 3	INT16 R/W per. -	Modbus 1582

Setting the Deceleration Ramp

The deceleration ramp set with the parameter `RAMPdecel` for the Motion Profile for the Velocity *(see page 181)* is used for a Halt.

Setting the Torque Ramp

The parameter `LIM_I_maxHalt` lets you set the torque ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`LIM_I_maxHalt`	Current for Halt. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4364

Stopping a Movement with Quick Stop

Description

You can stop a movement with a Quick Stop.

A Quick Stop can be triggered via a fieldbus command or in response to a detected error of error classes 1 or 2.

The following deceleration types are available:
- Deceleration via deceleration ramp
- Deceleration via torque ramp

You can set the operating state to transition to after standstill has been reached:
- Remain in operating state **7** Quick Stop Active
- Transition to operating state **9** Fault

Setting the Type of Deceleration And the Type of Operating State Transition

The parameter `LIM_QStopReact` lets you set the type of deceleration ant the type of operating state transition.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_QStopReact	Quick Stop option code. **-2 / Torque ramp (Fault)**: Use torque ramp and transition to operating state 9 Fault **-1 / Deceleration ramp (Fault)**: Use deceleration ramp and transition to operating state 9 Fault **6 / Deceleration ramp (Quick Stop)**: Use deceleration ramp and remain in operating state 7 Quick Stop Active **7 / Torque ramp (Quick Stop)**: Use torque ramp and remain in operating state 7 Quick Stop Active Setting of deceleration ramp with parameter RAMPquickstop. Setting of torque ramp with parameter LIM_I_maxQSTP. The deceleration ramp is only available for operating modes with motion profile for velocity. The torque ramp is used in the operating modes without motion profile for velocity. Modified settings become active immediately.	- -2 7 7	INT16 R/W per. -	Modbus 1584

Setting the Deceleration Ramp

The parameter `RAMPquickstop` lets you set the deceleration ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMPquickstop	Deceleration ramp for Quick Stop. Deceleration ramp for a software stop or an error with error class 1 or 2. Modified settings become active the next time the motor moves.	RPM/s 200 6000 3000000	UINT32 R/W per. -	Modbus 1572

Setting the Torque Ramp

The parameter `LIM_I_maxQSTP` lets you set the torque ramp.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_I_maxQSTP	Current for Quick Stop via torque ramp. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4362

Setting a Signal Output via Parameter

Description

The digital signal outputs can be set via the fieldbus.

In order to set the digital signal outputs via the parameter, you must first parameterize the signal output function "Output Free Available", see chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)*.

If one or more of the outputs are not set to "Output Free Available", write access to that or those outputs is ignored.

The parameter `IO_LO_set` lets you set the digital signal outputs.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IO_LO_set	Setting the digital outputs directly. Bit 0 corresponds to the first output, bit 1 corresponds to the second output, and so on.	- - - -	UINT16 R/W - -	Modbus 2082

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

Two Capture inputs are available.

- `LIO1` (CAP1)
- `LIO2` (CAP2)

Method

The motor position can be captured in two 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 motor position can be captured when the edge at the Capture input rises or falls.

Setting the Edge

The following parameters let you set the edge for position capture.

- Set the required 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 / 1->0**: Position capture at falling edge **1 / 0->1**: Position capture at rising edge Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2564
`Cap2Config`	Capture input 2 configuration. **0 / 1->0**: Position capture at falling edge **1 / 0->1**: Position capture at rising edge Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2566

Starting Position Capture

The following parameters let you start position capture.

- Set the method with the parameters `Cap1Activate` and `Cap2Activate`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`Cap1Activate`	Capture input 1 start/stop. **0 / Capture stop**: Cancel capture function **1 / Capture once**: Start one-time capture **2 / Capture continuous**: Start continuous capture In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 2568

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
Cap2Activate	Capture input 2 start/stop. **0 / Capture stop**: Cancel capture function **1 / Capture once**: Start one-time capture **2 / Capture continuous**: Start continuous capture In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 2570

Status Messages

The parameter `CapStatus` indicates the capture status.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CapStatus	Status of the capture inputs. Read access: Bit 0: Position captured via input CAP1 Bit 1: Position captured via input CAP2	- - - -	UINT16 R/- - -	Modbus 2562

Captured Position

The captured position can be read via the following parameters:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
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 - - -	INT32 R/- - -	Modbus 2572
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 - - -	INT32 R/- - -	Modbus 2574
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
Cap2Count	Capture input 2 event counter. Counts the capture events. The event counter is reset when capture unit 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2578

Section 8.2
Functions for Monitoring Movements

What Is in This Section?

This section contains the following topics:

Hardware Limit Switches

Description

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

⚠ WARNING

LOSS OF CONTROL

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

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

Movements can be monitored with hardware limit switches. A positive hardware limit switch and a negative hardware limit switch can be used for monitoring.

If the positive or negative hardware limit switch is triggered, the movement is stopped with a Quick Stop. The drive responds with a detected error of error class 1. The error message can be reset by means of a "Fault Reset".

The response of the drive to a Quick Stop can be adjusted via the parameter `LIM_QStopReact`. Refer to the chapter Stopping a Movement with Quick Stop *(see page 184)* for additional information.

The movement can continue, however, only in the opposite direction. For example, if the positive hardware limit switch was triggered, further movement is only possible in negative direction. In the case of further movement in positive direction, the drive responds with a new detected error of error class 1.

The parameters `IOsigLimP` and `IOsigLimN` are used to set the type of hardware limit switch.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOsigLimP	Signal evaluation for positive limit switch. **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1568
IOsigLimN	Signal evaluation for negative limit switch. **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1566

If you want to use hardware limit switches, you must first parameterize the signal input functions "Input Positive Limit Switch (LIMP)" and/or "Input Negative Limit Switch (LIMN)". Refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)* for details.

Temporary Deactivation of Hardware Limit Switches

The parameter `SPV_HW_Deactiv` can be used to temporarily deactivate the hardware limit switches, for example, for commissioning, or machine setup.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Implement all measures identified in your risk assessment to avoid hazardous conditions that could result from temporary deactivation of limit switches.

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
SPV_HW_Deactiv	Temporary deactivation of hardware limit switches. **0 / None**: No limit switch deactivated **1 / Deactivate LIMP**: Deactivate positive limit switch **2 / Deactivate LIMN**: Deactivate negative limit switch **3 / Deact. LIMP+LIMN**: 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 any error response of the drive. Modified settings become active immediately. Available with firmware version ≥V1.010.	- 0 0 3	UINT16 R/W - -	Modbus 1610

Reference Switch

Description

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 modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	Modbus 1564

If you want to use the reference switch, you must first parameterize the signal input function "Input Reference Switch (REF)". Refer to chapter Parameterization of the Signal Input Functions and the Signal Output Functions *(see page 134)* for details.

Software Limit Switches

Description

Movements can be monitored with software limit switches. A positive position limit and a negative position limit can be set for monitoring.

If the positive or negative software limit switch is triggered, the movement is stopped with a Quick Stop. The integrated drive responds with a detected error of error class 1. The error message can be reset by means of a "Fault Reset".

The response of the drive to a Quick Stop can be adjusted via the parameter `LIM_QStopReact`. Refer to the chapter Stopping a Movement with Quick Stop *(see page 184)* for additional information.

The movement can continue, however, only in the opposite direction. 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, the drive responds with a new detected error of error class 1.

Position monitoring with software limit switches uses the reference position. Therefore, depending on the control loop settings, the motor may stop before the limit switch position is reached.

Prerequisite

Software limit switch monitoring only works with a valid zero point, refer to chapter Size of the Movement Range *(see page 131)*.

Behavior in Operating Modes with Target Positions

In operating modes with target positions, the movement is started even if the target position is beyond the positive position limit or the negative position limit. A Quick Stop is triggered so that the motor comes to a standstill at the position limit.

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

- Jog (step movement)
- Profile Position

Behavior in Operating Modes Without Target Positions

In operating modes without target positions, a Quick Stop is triggered at the position limit.

- Jog (continuous movement)
- Speed Control
- Profile Velocity

Activation

The software limit switches are activated via the parameter `SPV_SW_Limits`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
SPV_SW_Limits	Activation of software limit switches. **0 / None**: Deactivated **1 / SWLIMP**: Activation of software limit switch positive direction **2 / SWLIMN**: Activation of software limit switch negative direction **3 / SWLIMP+SWLIMN**: Activation of software limit switches both directions Software limit switches can only be activated if the zero point is valid. Modified settings become active immediately.	- 0 0 3	UINT16 R/W per. -	Modbus 1542

Setting Position Limits

The position limits of the software limit switches are set via the parameters `SPV_swLimP` and `SPV_swLimN`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
SPVswLimPusr	Positive position limit for software limit switch. If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr - 2147483647 -	INT32 R/W per. -	Modbus 1544
SPVswLimNusr	Negative position limit for software limit switch. Refer to description of parameter SPVswLimPusr. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr - -2147483648 -	INT32 R/W per. -	Modbus 1546

Load-Dependent Position Deviation (Following Error)

Description

The load-dependent position deviation is the difference between the reference position and the actual position caused by the load inertia.

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 parameter lets you read the load-dependent position deviation in revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_dif	Deviation between reference position and actual position. Corresponds to the position deviation of the position controller. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	Modbus 7716

The following parameter lets you read the maximum value of the load-dependent position deviation reached so far in revolutions.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_DifPeak	Maximum value of the position deviation. See SPV_p_maxDiff for more information. A write access resets this value. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 - 429496.7295	UINT32 R/W - -	Modbus 4382

Setting the Maximum Position Deviation

The following parameter lets you set the maximum load-dependent position deviation at which a movement is stopped 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
SPV_p_maxDiff	Maximum position deviation. The position deviation is the difference between the reference position and the actual position caused by the load. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0001 1.0000 200.0000	UINT32 R/W per. -	Modbus 4636

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
SPV_Flt_pDiff	Error response to excessively high position deviation. **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	Modbus 1302

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 STANDpwinTime, 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
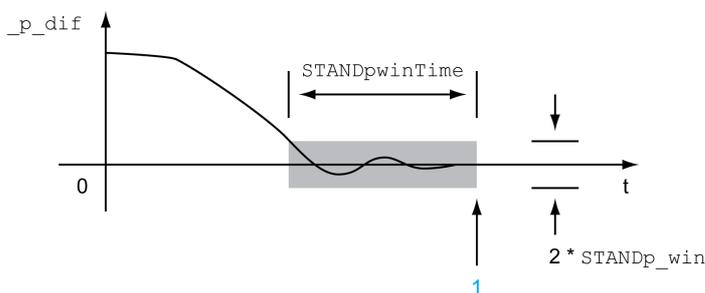
1   Target position reached (the actual position did not exceed the permissible deviation STANDp_win during time STANDpwinTime).

The parameters STANDp_win and STANDpwinTime specify the size of the window.

The parameter STANDpwinTout can be used to set the period of time after which the drive responds with a detected error 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
STANDp_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 'STANDpwinTime. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0010 3.2767	UINT16 R/W per. -	Modbus 4370
STANDpwinTime	Standstill window, time. Value 0: Monitoring of standstill window deactivated Value >0: Time in ms during which the control deviation must be in the standstill window Modified settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	Modbus 4372

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
STANDpwinTout	Timeout time for standstill window monitoring. Value 0 : Timeout monitoring deactivated Value >0 : Timeout time in ms Standstill window processing values are set via STANDp_win and STANDpwinTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Modified settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	Modbus 4374

Section 8.3
Functions for Monitoring Internal Device Signals

What Is in This Section?

This section contains the following topics:

Temperature Monitoring

Temperature of Power Stage

The parameter `_Temp_act_PA` contains the temperature value of the power stage.

The parameter `PA_T_warn` contains the threshold value for an error of error class 0.

The parameter `PA_T_max` contains the maximum temperature value of the power stage . If the temperature exceeds the limit value for more than five seconds, an error of error class 3 is detected.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Temp_act_PA	Temperature of power stage.	°C - - -	INT16 R/- - -	Modbus 7200
PA_T_warn	Temperature limit of power stage for error class 0.	°C - - -	INT16 R/- per. -	Modbus 4108
PA_T_max	Maximum permissible temperature of power stage.	°C - - -	INT16 R/- per. -	Modbus 4110

Load Monitoring (I^{2}t Monitoring)

Description

I^{2}t monitoring monitors the load. It allows the integrated drive to anticipate a rise in temperature and to reduce the current to the nominal value when the I^{2}t limit value is exceeded.

When the value falls below the limit value, the device can be operated with maximum performance again.

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
_I2t_act_M	Overload of motor.	% - - -	INT16 R/- - -	Modbus 7218
_I2t_mean_M	Load of motor.	% - - -	INT16 R/- - -	Modbus 7220

Chapter 9
Examples

Wiring Example

Overview

In the following wiring example, the limit switches and the reference switch are supplied via the internal 24 V power supply.
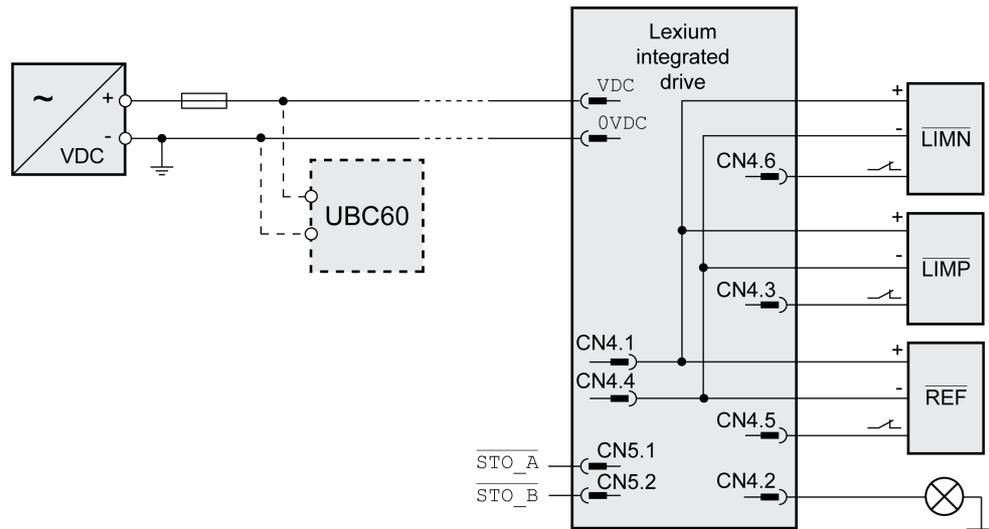
The UBC60 braking resistor controller is available as an accessory, refer to the chapter Accessories and Spare Parts *(see page 253)*.

Chapter 10
Diagnostics and Troubleshooting

0198441113652 08/2020

What Is in This Chapter?

This chapter contains the following sections:

Section 10.1
Diagnostics via LEDs

What Is in This Section?

This section contains the following topics:

Operating State LEDs

Overview

The integrated drive has a green and a red LED on the printed circuit board. The two LEDs indicate the operating states and detected errors.
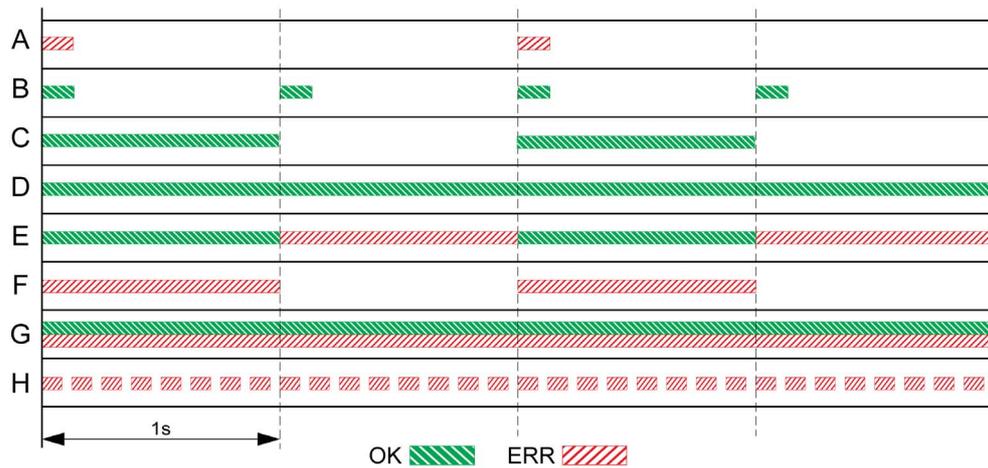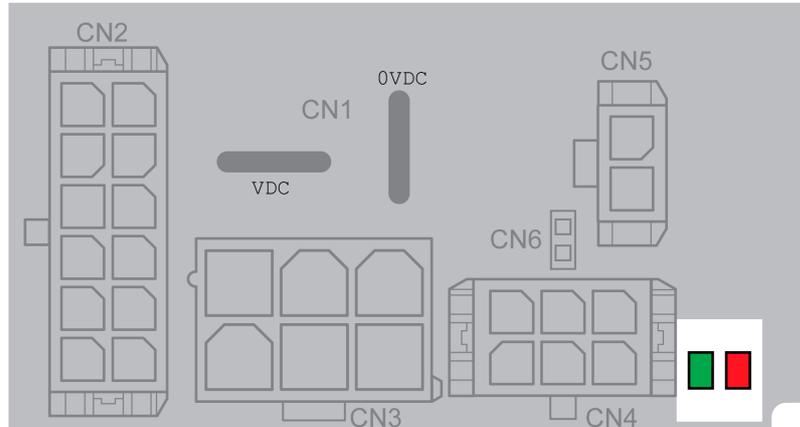
A	Operating states **1 Start** and **2 Not Ready To Switch On**
B	Operating state **3 Switch On Disabled**
C	Operating states **4 Ready To Switch On** and **5 Switched On**
D	Operating state **6 Operation Enabled**
E	Operating states **7 Quick Stop Active** and **8 Fault Reaction Active**
F	Operating state **9 Fault**
G	Firmware not available
H	Internal error

Fieldbus Status LEDs

Overview

The fieldbus status LED visualizes the status of the fieldbus.
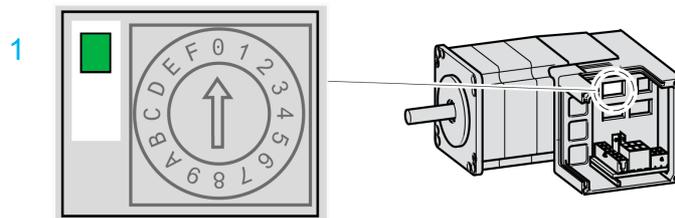
LED	Description
1	Communication status of the fieldbus

LED communication status of the drive:

LED code	Description
Flashes	The drive is booting.
Steady on	The drive is ready.
Flashing twice per cycle	The drive has no connection.
Flashing 3 times per cycle	The drive has no valid IP parameters after Clear IP.
Flashing 4 times per cycle	The drive has detected that its IP address is already in use.
Flashing 5 times per cycle	The drive is waiting for Bootsstrap Protocol/address from DHCP server.
Flashing 6 times per cycle	The drive is in 'default IP address mode' for various reasons.

Section 10.2
Diagnostics via the Fieldbus

What Is in This Section?

This section contains the following topics:

Fieldbus Communication Error Diagnostics

Verifying Connections

A properly operating fieldbus is essential for evaluating status and error messages.

If the product cannot be addressed via the fieldbus, first verify the connections.

Verify the following connections:
- System power supply
- Supply connections
- Fieldbus cables and wiring
- Fieldbus connection

Fieldbus Function Test

If the connections are correct, verify that you can address the product on the fieldbus.

Most Recent Detected Error - Status Bits

Parameter `DCOMstatus`

The parameter `DCOMstatus` is a part of the process data communication. The parameter `DCOMstatus` is transmitted asynchronously and in an event-driven way whenever the status information changes.

In the case of an error of error class 0, bit 7 is set in the parameter `DCOMstatus`.

In the case of an error of error class 1, 2, 3 or 4, bit 13 is set in the parameter `DCOMstatus`.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`DCOMstatus`	DriveCom status word. Bit assignments: Bits 0...3,5,6: Status bits Bit 4: Voltage enabled Bit 7: Error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Operating mode-specific Bit 11: Reserved Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	Modbus 6916

Error Bits

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_WarnLatched`	Saved errors of error class 0, bit-coded. The bits are set to 0 in the case of a Fault Reset. Bits 10, 11, and 13 are set to 0 automatically. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General (see _LastWarning) Bit 1: Temperature of power stage high Bit 2: Temperature of motor high Bit 3: Reserved Bit 4: Power stage overload (I^2t) Bit 5: Motor overload (I^2t) Bit 6: Braking resistor overload (I^2t) Bit 7: CAN Bit 8: Motor encoder Bit 9: RS485 protocol Bit 10: Inputs STO Bit 11: DC bus undervoltage/mains phase not present Bit 12: Profibus Bit 13: Position not yet valid (position capture still running) Bit 14: Ethernet Bit 15: Reserved Monitoring functions are product-dependent.	- - - -	UINT16 R/- - -	Modbus 7192

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_SigLatched	Saved status of monitoring signals. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General error detected 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: Inputs STO are 0 Bit 5: Reserved Bit 6: RS485 Bit 7: CAN Bit 8: Ethernet Bit 9: Frequency of reference signal too high Bit 10: Operating mode Bit 11: Reserved Bit 12: Profibus Bit 13: Reserved Bit 14: Undervoltage DC bus Bit 15: Overvoltage DC bus Bit 16: Mains phase Bit 17: Motor connection Bit 18: Motor overcurrent/short circuit Bit 19: Motor encoder Bit 20: Undervoltage 24VDC Bit 21: Overtemperature (power stage, motor) Bit 22: Position deviation exceeded Bit 23: Maximum velocity exceeded Bit 24: Inputs STO different Bit 25: Reserved Bit 26: Reserved Bit 27: Reserved Bit 28: Reserved Bit 29: Nonvolatile memory error Bit 30: System booting (hardware or parameter) Bit 31: System (for example, Watchdog) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	Modbus 7184

Most Recent Detected Error - Error Code

Description

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 216)*.

Most Recent Detected Error with Error Class 0

The parameter `_LastWarning` allows you to read the error number of the last detected error with error class 0.

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`_LastWarning`	Code of most recent error of error class 0. If the error is no longer active, the code is stored until the next Fault Reset. Value 0: No error of error class 0	- - - -	UINT16 R/- - -	Modbus 7186

Most Recent Detected Error with Error Class 1 ... 4

The parameter `_StopFault` 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
`_StopFault`	Detected error causing a stop (error classes 1 to 4). Error code of the most recent detected error.	- - 0 -	UINT16 R/- - -	Modbus 7178

Error Memory

General

The error memory is an error history of the last 10 error messages. It is not cleared even if the product is powered off. The error memory allows you to read and evaluate past events.

The following information on the events is stored:

- Error class
- Error code
- Motor current
- Number of power on cycles
- Additional error information (for example, parameter numbers)
- Product temperature
- Power stage temperature
- Time the error was detected (with reference to operating hours counter)
- DC Bus Voltage
- Velocity
- Number of Enable cycles after powering on
- Time from Enable until detection of the error

The stored information relates to the situation at the point in time the error was detected.

The list of the error messages sorted by error code can be found in the chapter Error Messages .

Reading the Error Memory

The error memory can only be read sequentially. The parameter `FLT_MemReset` 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 `_FLT_err_num`.

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
FLT_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
FLT_err_num	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

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
FLT_Idq	Motor current at the time the error was detected. In increments of 0.01 A.	A - - -	UINT16 R/- - -	Modbus 15378
FLT_powerOn	Number of power on cycles.	- 0 - 4294967295	UINT32 R/- - -	Modbus 15108
FLT_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
FLT_Temp_DEV	Temperature of device at the time the error was detected.	°C - - -	INT16 R/- - -	Modbus 15382
FLT_Temp_PA	Temperature of power stage at the time the error was detected.	°C - - -	INT16 R/- - -	Modbus 15380
FLT_Time	Error time. With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	Modbus 15366
FLT_UDC	DC bus voltage at the time the error was detected. In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 15374
FLT_n	Motor velocity at the time the error was detected.	RPM - - -	INT16 R/- - -	Modbus 15376
FLTAmpOnCyc	Number of cycles of enabling the power stage at error time. Number of cycles of enabling the power stage from the time the power supply (control voltage) was switched on to the time the error occurred.	- - - -	UINT16 R/- - -	Modbus 15370
FLTAmpOnTime	Time between enabling of power stage and detection of the error.	s - - -	UINT16 R/- - -	Modbus 15372
FLT_MemReset	Reset error memory read pointer. Value 1: Set error memory read pointer to oldest error entry. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15114
FLT_del_err	Clear error memory. Value 1: Delete entries in the error memory The clearing process is completed if a 0 is returned after a read access. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15112

Section 10.3
Error Messages

What Is in This Section?

This section contains the following topics:

Topic	Page
Description of Error Messages	217
Table of Error Messages	218

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 138)*			

Table of Error Messages

List of the Error Messages Sorted by Error Code

Error code (hex)	Error class	Description	Cause	Correctives
E 1100	0	Parameter out of permissible 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.	Write access level expert is required.
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 the access.
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 110E	0	Parameter value modified 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 for this type of device	The function or parameter value is not supported.	Verify whether you have the correct device (type of motor, type of encoder, holding brake).
E 1110	0	Function not available	-	-
E 1300	3	Safety-related function STO activated (STO_A, STO_B) Parameter _SigLatched Bit 4	The safety function STO was activated in the operating state Operation Enabled.	Verify correct wiring of the inputs of the safety-related function STO and reset the error.
E 1301	4	STO_A and STO_B different level Parameter _SigLatched Bit 24	The levels of the inputs STO_A and STO_B were different for more than 1 second.	Verify correct wiring of the inputs of the safety-related function STO.
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 2300	3	Power stage overcurrent Parameter _SigLatched Bit 18	Motor short circuit and disabling of the power stage. Motor phases are inverted.	Verify correct motor power connection.
E 3200	3	DC bus overvoltage Parameter _SigLatched Bit 15	Excessive regeneration during braking.	Verify correct deceleration ramp, rating of drive and braking resistor.
E 3201	3	DC bus undervoltage (shutdown threshold) Parameter _SigLatched Bit 14	Power outage, insufficient power supply.	Verify mains supply.
E 3202	2	DC bus undervoltage (Quick Stop threshold) Parameter _SigLatched Bit 14	Power outage, insufficient power supply.	Verify mains supply.

Error code (hex)	Error class	Description	Cause	Correctives
E 4100	3	Power stage overtemperature Parameter _SigLatched Bit 21	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 (error class 0) Parameter _WarnLatched Bit 1	Transistors overtemperature: Ambient temperature is too high, fan is inoperative, dust.	Verify the fan, improve the heat dissipation in the cabinet.
E 4302	0	Motor overload (I2t) (error class 0) Parameter _WarnLatched Bit 5	The current has exceeded the nominal value for an extended period of time.	-
E 610D	0	Error detected in selection parameter	Incorrect parameter value selected.	Verify the value to be written.
E 7328	4	Motor encoder: Position evaluation error detected Parameter _SigLatched Bit 19	-	Contact your Schneider Electric representative or replace the motor.
E 7329	0	Motor encoder error detected (error class 0) Parameter _WarnLatched Bit 8	EMI, encoder signals internal error detected.	Contact your Schneider Electric representative or replace the motor.
E 7338	0	No valid motor absolute position Parameter _WarnLatched Bit 13	Absolute position has not yet been determined.	Depending on application, verify correct absolute position.
E 7500	0	RS485/Modbus: Overflow error detected Parameter _WarnLatched Bit 9	EMI; incorrect wiring.	Verify cables.
E 7501	0	RS485/Modbus: Framing error detected Parameter _WarnLatched Bit 9	EMI; incorrect wiring.	Verify cables.
E 7502	0	RS485/Modbus: Parity error detected Parameter _WarnLatched Bit 9	EMI; incorrect wiring.	Verify cables.
E 7503	0	RS485/Modbus: Receive error detected Parameter _WarnLatched Bit 9	EMI; incorrect wiring.	Verify cables.
E A069	3	Configuration error detection: The function Halt has been assigned to a digital input. Parameter _SigLatched Bit 10	When any of the Cyclic operating modes is used, the function Halt must not be assigned to a digital input.	Verify the configuration of the digital inputs.
E A06A	3	Configuration error detected: Software limit switches are activated Parameter _SigLatched Bit 10	When any of the Cyclic operating modes is used, the software limit switches must not be activated.	Verify correct setting of the parameter SPV_SW_Limits.
E A300	0	Deceleration after HALT request still active	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 was detected. Drive stopped with Quick Stop command.	-
E A302	1	Stop by positive limit switch Parameter _SigLatched Bit 1	The positive limit switch was activated because movement range was exceeded, incorrect of limit switch or signal disturbance.	Verify application. Verify correct 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 correct limit switch function and connection.
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.

Error code (hex)	Error class	Description	Cause	Correctives
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.	Perform a Fault Reset.
E A307	0	Stop 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.	Read the error code (HMI or commissioning software), remove error condition 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 activate a different 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, refer to the state diagram.
E A313	0	Movement range limits were exceeded, zero point is 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 new zero point by means of the operating mode Homing.
E A314	0	No valid zero point	Command needs a defined zero point (ref_ok=1).	Define a new 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 A317	0	Motor is not at a standstill	Command sent which is not permissible when the motor is not at a standstill. For example: - Modification to software limit switches - Modification to handling of monitoring signals - Setting of zero 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 the current 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 permissible 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 a 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 (CTRL_n_max)	The velocity was set to a value greater than the maximum permissible velocity in parameter CTRL_n_max.	Increase the value of parameter CTRL_n_max or reduce the velocity value.

Error code (hex)	Error class	Description	Cause	Correctives
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 22	External load or acceleration are too high.	Reduce external load or acceleration. Use a differently rated drive. Error response can be adjusted via parameter Flt_pDiff.
E A324	1	Error detected during homing (additional info = detailed error number) Parameter _SigLatched Bit 10	Homing movement was stopped in response to a detected error, the detailed reason is indicated by the additional info in the error memory.	Possible sub-error codes: E A325, E A326, E A327, E A328 or E A329.
E A325	1	Limit switch to be approached not enabled Parameter _SigLatched Bit 10	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 10	Reference switch inoperative or not correctly connected.	Verify correct operation and wiring of the reference switch.
E A327	1	Reference movement to reference switch without reversal of direction results in triggering of limit switch Parameter _SigLatched Bit 10	Search for reference switch without reversal of direction in positive (negative) direction with positive limit switch (negative limit switch) triggered.	Verify correct operation and wiring of the positive limit switch (negative limit switch).
E A328	1	Reference movement to reference switch without reversal of direction results in triggering of limit switch Parameter _SigLatched Bit 10	Search of reference switch without reversal of direction with limit switch or reference switch triggered.	Reduce velocity for reference movement (parameter HMn) or increase deceleration (parameter RAMPdecel). Verify correction operation and wiring of positive limit switch, negative limit switch and reference switch.
E A329	1	More than one signal positive limit switch/negative limit switch/reference switch signal active Parameter _SigLatched Bit 10	Reference switch or limit switch not connected correctly or supply voltage for switches too low.	Verify correct wiring and 24 VDC supply voltage.
E A32A	1	Positive limit switch triggered with negative direction of movement Parameter _SigLatched Bit 10	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 operation of limit switch. Activate a jog movement with negative 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 10	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 operation of limit switch. Activate a jog movement with positive 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 10	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify correct supply voltage, wiring and operation 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 10	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify correct supply voltage, wiring and operation 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 10	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify correct supply voltage, wiring and operation of switch. Verify motor response after stopping and optimize control loop settings.

Error code (hex)	Error class	Description	Cause	Correctives
E A330	0	Reference movement to index pulse cannot be reproduced. Index pulse is too close to the switch	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	Error detected in operating mode Jog (additional info = detailed error number) Parameter _SigLatched Bit 10	Jog movement was stopped in response to a detected error.	For additional info, see the detailed error number in the error memory.
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 (parameters STANDp_win, STANDpwinTime and STANDpwinTout). Optimize control loop settings.
E A337	0	Operating mode cannot be continued Parameter _WarnLatched Bit 10	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 A33A	0	No valid zero point (ref_ok=0)	No zero point defined by means of operating mode Homing. Zero point no longer valid due to movement beyond permissible movement range.	Use operating mode Homing to define a valid zero point. Use motor with multiturn encoder (does not require homing).
E B100	0	RS485/Modbus: Indeterminable service Parameter _WarnLatched Bit 9	Unsupported Modbus service was received.	Verify application on the Modbus master.
E B101	2	Cyclic communication: No synchronization signal Parameter _SigLatched Bit 8	Two cycles have passed without a synchronization signal having been received.	Verify correct communication.
E B102	2	Cyclic communication: Incorrect cycle time Parameter _SigLatched Bit 8	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 B103	2	Cyclic communication: One signal was not received, the next signal received was incorrect. Parameter _SigLatched Bit 8	One synchronization signal was not received and one of the following synchronization signals was incorrect.	Analyze the communication.
E B104	2	Cyclic communication: No synchronization signal Parameter _SigLatched Bit 8	100 ms have passed without a synchronization signal having been received.	Verify correct communication.
E B200	0	RS485/Modbus: Protocol error detected Parameter _WarnLatched Bit 9	Logical protocol error detected: Incorrect length or unsupported subfunction.	Verify application on the Modbus master.
E B201	2	RS485/Modbus: Nodeguard error detected Parameter _SigLatched Bit 6	Connection monitoring (parameter MBnode_guard) is <> 0 ms and a nodeguard event was detected.	Verify application on the Modbus master or modify value (set to 0 ms or increase the value of the parameter MBnode_guard monitoring time).
E B202	0	RS485/Modbus: Nodeguard alert Parameter _WarnLatched Bit 9	Connection monitoring (parameter MBnode_guard) is <> 0 ms and a nodeguard event was detected.	Verify application on the Modbus master or modify value (set to 0 ms or increase the value of the parameter MBnode_guard monitoring time).
E B600	4	Ethernet: Initialization error detected Parameter _SigLatched Bit 8	-	-
E B601	1	Ethernet: Realtime data error detected Parameter _SigLatched Bit 8	-	-

Error code (hex)	Error class	Description	Cause	Correctives
E B602	0	Ethernet: Realtime data alert Parameter _WarnLatched Bit 14	-	-
E B603	2	Ethernet: Protocol error detected Parameter _SigLatched Bit 8	Can be caused by a connection timeout or an interruption of the Ethernet link.	Verify wiring, network devices and master controller connection.
E B604	0	Ethernet: Protocol-related alert Parameter _WarnLatched Bit 14	-	-
E B605	2	Indeterminable Ethernet error detected Parameter _SigLatched Bit 8	-	-
E B607	0	Ethernet: Another request is currently being processed Parameter _WarnLatched Bit 14	-	-
E B608	2	Ethernet: Realtime Hot-Reset Parameter _SigLatched Bit 8	An NMT Reset was sent while the power stage was enabled. A Modbus TCP channel was reset while the power stage was enabled.	-
E B609	2	Ethernet: Realtime Hot-Stop Parameter _SigLatched Bit 8	-	-
E B60A	0	Ethernet: Timeout in internal communication Parameter _WarnLatched Bit 14	-	-
E B60B	0	Ethernet: Error detected in internal communication Parameter _WarnLatched Bit 14	-	-
E B60C	4	Ethernet Module Incompatible Parameter _SigLatched Bit 8	The firmware of the drive is not compatible with the communication firmware of the Ethernet module.	-

Chapter 11
Parameters

What Is in This Chapter?

This chapter contains the following topics:

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Representation of the Parameters

Description

This chapter provides an overview of the parameters which can be used for operating the product.

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

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
● Only start the system if there are no persons or obstructions in the zone of operation. ● Do not operate the drive system with undetermined parameter values or data. ● Never modify a parameter value unless you fully understand the parameter and all effects of the modification. ● Restart the drive and verify the saved operational data and/or parameter values after modifications. ● Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive. ● Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Overview

The way parameters are shown provides information required for unique identification, the default values and the properties of a parameter.

Structure of the parameter representation:

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
`ABCDE`	Short description Selection values **1 / Abc1**: Explanation 1 **2 / Abc2**: Explanation 2 Description and details	A 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:

Provides a short description 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 = Entry in the drop-down menu of the commissioning software

Description and details:

Provides further information on the parameter.

Field "Unit"

The unit of the value.

Field "Minimum Value"

The minimum value which can be entered.

Field "Factory Settings"

Settings when the product is shipped.

Field "Maximum Value"

The maximum value which can be entered.

Field "Data Type"

If the minimum and the maximum values are not explicitly indicated, the valid range of values is determined by the data type.

Data type	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 remains in the nonvolatile memory after the drive is powered off.

When a value of a persistent parameter is modified via the commissioning software or the fieldbus, you must explicitly store the modified value in the nonvolatile memory.

Field "Expert"

The value of parameters with "expert" can only be modified in Expert mode of the commissioning software. Expert mode requires access to the commissioning software via a password.

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

List of the Parameters Sorted by Parameter Name

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_acc_pref	Acceleration of reference value for profile generator. Sign according to the changed velocity value: Increased velocity: Positive sign Reduced velocity: Negative sign	RPM/s - - -	INT32 R/- - -	Modbus 7954
_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: CANopen Value 5: CANopen via second SDO channel Value 6: Profibus Value 7: DeviceNet Value 8: Reserved Value 9: Ethernet Values 10 ... 15: Modbus TCP	- - - -	UINT16 R/- - -	Modbus 280
_actionStatus	Action word. Signal state: 0: Not activated 1: Activated 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 standstill (_n_act < 9 RPM) Bit 7: Motor movement in positive direction Bit 8: Motor movement in negative direction Bit 9: Reserved Bit 10: Reserved 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
_DCOMopmd_act	Active operating mode. **0 / Reserved**: Reserved **-4 / Speed Control**: Speed Control **-1 / Jog**: Jog **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **6 / Homing**: Homing	- -4 - 6	INT16 R/- - -	Modbus 6920
_ethMacAdr1	Ethernet MAC address part 1. Bytes 1 ... 2 of the MAC address (XX-XX-__-__-__-__) XX are the bytes used. Example: MAC address: 11-22-33-44-55-66 The value stored in this case is 00001122h.	- - 0 -	UINT32 R/- - -	Modbus 6672

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_ethMacAdr2	Ethernet MAC address part 2. Bytes 3 ... 6 of the MAC address (__-__-XX-XX-XX-XX) XX are the bytes used. Example: MAC address: 11-22-33-44-55-66 The value stored in this case is 33445566h.	- - - -	UINT32 R/- - -	Modbus 6674
_I2t_act_M	Overload of motor.	% - - -	INT16 R/- - -	Modbus 7218
_I2t_mean_M	Load of motor.	% - - -	INT16 R/- - -	Modbus 7220
_Id_act	Actual motor current d-component. In increments of 0.01 A_{pk}.	A_{pk} - - -	INT16 R/- - -	Modbus 7684
_Id_ref	Reference motor current (d component, field weakening). In increments of 0.01 A_{pk}.	A_{pk} - - -	INT16 R/- - -	Modbus 7714
_Idq_act	Total motor current (vector sum d-components and q-components). In increments of 0.01 A_{pk}.	A_{pk} - - -	INT16 R/- - -	Modbus 7686
_IO_LIO_act	Status of digital inputs/outputs. Coding of the individual signals: Bit 0: LIO1 Bit 1: LIO2 ...	- - - -	UINT16 R/- - -	Modbus 2090
_IO_STO_con	Status of the inputs for the safety-related function STO. **0 / Not Available**: Inputs not available **1 / Not Connected**: Inputs available, but not connected (jumpered) **3 / Connected**: Inputs available and connected (safety-related function STO active)	- 0 - 3	UINT16 R/- - -	Modbus 2088
_Iq_act	Actual motor current q-component. In increments of 0.01 A_{pk}.	A_{pk} - - -	INT16 R/- - -	Modbus 7682
_Iq_ref	Reference motor current (q component, generating torque). In increments of 0.01 A_{pk}.	A_{pk} - - -	INT16 R/- - -	Modbus 7712
_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
_n_act	Actual velocity of motor.	RPM - - -	INT16 R/- - -	Modbus 7696
_n_actRAMP	Actual velocity of profile generator.	RPM - - -	INT32 R/- - -	Modbus 7948

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_n_pref	Velocity of reference value for profile generator.	RPM - - -	INT32 R/- - -	Modbus 7950
_n_ref	Reference speed of rotation.	RPM - - -	INT16 R/- - -	Modbus 7694
_n_targetRAMP	Target velocity of profile generator.	RPM - - -	INT32 R/- - -	Modbus 7946
_OpHours	Operating hours counter.	s - - -	UINT32 R/- - -	Modbus 7188
_p_absENCusr	Motor position with reference to encoder range. The value range is determined by the encoder type. In the case of singleturn encoders, the value refers to one motor revolution, in the case of multiturn encoders to the entire encoder range (for example 4096 revolutions). The position is not valid until the absolute motor position has been determined. In the case of invalid absolute motor position: _WarnLatched _WarnActive Bit 13=1: Absolute motor position not yet captured	usr - - -	UINT32 R/- - -	Modbus 7710
_p_absmodulo	Absolute position with reference to 1 motor revolution. The position is not valid until the absolute motor position has been determined. In the case of invalid absolute motor position: _WarnLatched _WarnActive Bit 13=1: Absolute motor position not yet captured	Inc - - -	UINT32 R/- - -	Modbus 7708
_p_act	Actual position in internal units.	Inc - - -	INT32 R/- - -	Modbus 7700
_p_actRAMPusr	Actual position of profile generator.	usr - - -	INT32 R/- - -	Modbus 7940
_p_actusr	Actual position in user-defined units.	usr - - -	INT32 R/- - -	Modbus 7706
_p_dif	Deviation between reference position and actual position. Corresponds to the position deviation of the position controller. In increments of 0.0001 revolution.	revolution -214748.3648 - 214748.3647	INT32 R/- - -	Modbus 7716
_p_DifPeak	Maximum value of the position deviation. See SPV_p_maxDiff for more information. A write access resets this value. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 - 429496.7295	UINT32 R/W - -	Modbus 4382

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_ref	Reference position in internal units. Value corresponds to the reference position of the position controller.	Inc - - -	INT32 R/- - -	Modbus 7698
_p_refusr	Reference position in user-defined units. Value corresponds to the reference position of the position controller.	usr - - -	INT32 R/- - -	Modbus 7704
_p_tarRAMPusr	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 - - -	INT32 R/- - -	Modbus 7938
_prgNoCOM	Program number of communication module. Example: PR840.1 The value is provided as a decimal value: 8401	- - - -	UINT16 R/- - -	Modbus 6676
_prgNoDEV	Firmware number of device. Example: PR840.1 The value is provided as a decimal value: 8401	- - - -	UINT16 R/- - -	Modbus 258
_prgVerCOM	Firmware version of communication module. Example: V4.201 The value is provided as a decimal value: 4201	- - - -	UINT16 R/- - -	Modbus 6678
_prgVerDEV	Firmware version of device. Example: V4.201 The value is provided as a decimal value: 4201	- - - -	UINT16 R/- - -	Modbus 260
_serialNoDEV	Device serial number. Unique number for identification of the product Setting can only be modified if power stage is disabled.	- 0 - 4294967295	UINT32 R/- per. -	Modbus 302
_SigActive	Status of monitoring signals. See parameter _SigLatched for more details on the bit codes.	- - - -	UINT32 R/- - -	Modbus 7182

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_SigLatched	Saved status of monitoring signals. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General error detected 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: Inputs STO are 0 Bit 5: Reserved Bit 6: RS485 Bit 7: CAN Bit 8: Ethernet Bit 9: Frequency of reference signal too high Bit 10: Operating mode Bit 11: Reserved Bit 12: Profibus Bit 13: Reserved Bit 14: Undervoltage DC bus Bit 15: Overvoltage DC bus Bit 16: Mains phase Bit 17: Motor connection Bit 18: Motor overcurrent/short circuit Bit 19: Motor encoder Bit 20: Undervoltage 24VDC Bit 21: Overtemperature (power stage, motor) Bit 22: Position deviation exceeded Bit 23: Maximum velocity exceeded Bit 24: Inputs STO different Bit 25: Reserved Bit 26: Reserved Bit 27: Reserved Bit 28: Reserved Bit 29: Nonvolatile memory error Bit 30: System booting (hardware or parameter) Bit 31: System (for example, Watchdog) Monitoring functions are product-dependent.	- - - -	UINT32 R/- - -	Modbus 7184
_StopFault	Detected error causing a stop (error classes 1 to 4). Error code of the most recent detected error.	- - 0 -	UINT16 R/- - -	Modbus 7178
_Temp_act_PA	Temperature of power stage.	°C - - -	INT16 R/- - -	Modbus 7200
_Ud_ref	Reference motor voltage d-component. In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7690
_UDC_act	Voltage at DC bus. Supply voltage VDC. In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 7198
_Udq_ref	Total motor voltage (vector sum d-components and q-components). Square root of ($\_Uq\_ref^2 + \_Ud\_ref^2$). In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7692
_Uq_ref	Reference motor voltage q-component. In increments of 0.1 V.	V - - -	INT16 R/- - -	Modbus 7688

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_UserAppMem1	User-specific data 1. This parameter can be used to store user-specific data.	- - 0 -	UINT32 R/W per. -	Modbus 318
_UserAppMem2	User-specific data 2. This parameter can be used to store user-specific data.	- - 0 -	UINT32 R/W per. -	Modbus 320
_UserAppMem3	User-specific data 3. This parameter can be used to store user-specific data.	- - 0 -	UINT32 R/W per. -	Modbus 322
_UserAppMem4	User-specific data 4. This parameter can be used to store user-specific data.	- - 0 -	UINT32 R/W per. -	Modbus 324
_VoltUtil	Degree of utilization of DC bus voltage. With a value of 100 %, the drive operates at the voltage limit.	% - - -	INT16 R/- - -	Modbus 7718
_WarnActive	Active errors of error class 0, bit-coded. See parameter _WarnLatched for more details on the bits.	- - - -	UINT16 R/- - -	Modbus 7190
_WarnLatched	Saved errors of error class 0, bit-coded. The bits are set to 0 in the case of a Fault Reset. Bits 10, 11, and 13 are set to 0 automatically. Signal state: 0: Not activated 1: Activated Bit assignments: Bit 0: General (see _LastWarning) Bit 1: Temperature of power stage high Bit 2: Temperature of motor high Bit 3: Reserved Bit 4: Power stage overload (I^2t) Bit 5: Motor overload (I^2t) Bit 6: Braking resistor overload (I^2t) Bit 7: CAN Bit 8: Motor encoder Bit 9: RS485 protocol Bit 10: Inputs STO Bit 11: DC bus undervoltage/mains phase not present Bit 12: Profibus Bit 13: Position not yet valid (position capture still running) Bit 14: Ethernet Bit 15: Reserved Monitoring functions are product-dependent.	- - - -	UINT16 R/- - -	Modbus 7192
AbsHomeRequest	Absolute positioning only after homing. **0 / No**: No **1 / Yes**: Yes Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 1580

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
AccessExcl	Get exclusive access to access channel. Write parameter: Value 0: Release access channel Value 1: Use exclusive access for access channel Read parameter: Value 0: Access channel is not used exclusively Value 1: Access channel is used exclusively (access channel used for reading) Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 282
AccessLock	Locking other access channels. Value 0: Allow control via other access channels Value 1: Lock control via other access channels With this parameter, the fieldbus can lock active access to the device via the following access channels: - Input signals - Commissioning software Processing of the input signal HALT cannot be locked. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 316
BRK_release	Manual operation of the holding brake. 0 / Close: Automatic processing 1 / Open: Manual release of holding brake The holding brake can only be manually released in the operating states Switch On Disabled or Ready To Switch On. If the power stage is enabled, the value is automatically set to 0. Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2068
BRK_status	Status of holding brake. Value 0: Applied Value 1: Released Value 2: Not available Modified settings become active immediately.	- 0 0 2	UINT16 R/- - -	Modbus 2070
Cap1Activate	Capture input 1 start/stop. 0 / Capture stop: Cancel capture function 1 / Capture once: Start one-time capture 2 / Capture continuous: Start continuous capture In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 2568
Cap1Config	Capture input 1 configuration. 0 / 1->0: Position capture at falling edge 1 / 0->1: Position capture at rising edge Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2564
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
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 - - -	INT32 R/- - -	Modbus 2572

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
Cap2Activate	Capture input 2 start/stop. **0 / Capture stop**: Cancel capture function **1 / Capture once**: Start one-time capture **2 / Capture continuous**: Start continuous capture In the case of one-time capture, the function is terminated when the first value is captured. In the case of continuous capture, the function continues to run. Modified settings become active immediately.	- 0 - 2	UINT16 R/W - -	Modbus 2570
Cap2Config	Capture input 2 configuration. **0 / 1->0**: Position capture at falling edge **1 / 0->1**: Position capture at rising edge Modified settings become active immediately.	- 0 0 1	UINT16 R/W - -	Modbus 2566
Cap2Count	Capture input 2 event counter. Counts the capture events. The event counter is reset when capture unit 2 is activated.	- - - -	UINT16 R/- - -	Modbus 2578
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 - - -	INT32 R/- - -	Modbus 2574
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
CTRL_I_max	Current limitation. The value must not exceed the maximum permissible current of the motor or the power stage. Default: M_I_max In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} 0.00 - 299.99	UINT16 R/W per. -	Modbus 4610
CTRL_KFPp	Velocity feed-forward control. Overshoot of up to 110 % is possible. In increments of 0.1 %. Modified settings become active immediately.	% 0.0 100.0 110.0	UINT16 R/W per. -	Modbus 4624
CTRL_KPn	Velocity controller P gain. The default value is calculated on the basis of the motor parameters. In increments of 0.0001 A/RPM. Modified settings become active immediately.	A/RPM 0.0001 - 1.2700	UINT16 R/W per. -	Modbus 4614
CTRL_KPp	Position controller P gain. The default value is calculated. In increments of 0.1 1/s. Modified settings become active immediately.	1/s 2.0 - 114.3	UINT16 R/W per. -	Modbus 4620
CTRL_n_max	Limitation of speed of rotation. The set value must not exceed the maximum speed of rotation of the motor. Default: Maximum permissible speed of rotation of the motor (see M_n_max) Modified settings become active immediately.	RPM 0 - 13200	UINT16 R/W per. -	Modbus 4612
CTRL_Pcdamp	Posicast filter: Damping. The filter is deactivated at a value of 1000. In increments of 0.1 %. Modified settings become active immediately.	% 50.0 100.0 100.0	UINT16 R/W per. expert	Modbus 4648
CTRL_Pcdelay	Posicast filter: Time delay. The filter is deactivated at a value of 0. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 25.00	UINT16 R/W per. expert	Modbus 4650

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
CTRL_TAUnref	Filter time constant of reference velocity value filter. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 0.00 327.67	UINT16 R/W per. -	Modbus 4626
CTRL_TNn	Velocity controller integral action time. In increments of 0.01 ms. Modified settings become active immediately.	ms 0.00 - 327.67	UINT16 R/W per. -	Modbus 4616
DCOMcompatib	DriveCom state machine: state transition from 3 to 4. **0 / Automatic**: Automatic (state transition is performed automatically) **1 / Drivecom-conform**: Standard-compliant (state transition must be controlled via the fieldbus) Determines the state transition between the states Switch On Disabled (3) and Ready To Switch On (4) for CANopen devices. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 6950
DCOMcontrol	DriveCom control word. Refer to chapter Operation, Operating States, for bit coding information. Bit 0: Switch on Bit 1: Enable Voltage Bit 2: Quick Stop Bit 3: Enable Operation Bit 4..6: Operating mode specific Bit 7: Fault Reset Bit 8: Halt Bit 9..15: Reserved (must be 0) Modified settings become active immediately.	- - - -	UINT16 R/W - -	Modbus 6914
DCOMopmode	Operating mode. **0 / Reserved**: Reserved **-4 / Speed Control**: Speed Control **-1 / Jog**: Jog **1 / Profile Position**: Profile Position **3 / Profile Velocity**: Profile Velocity **6 / Homing**: Homing Modified settings become active immediately.	- -4 - 6	INT16 R/W - -	Modbus 6918
DCOMstatus	DriveCom status word. Bit assignments: Bits 0...3,5,6: Status bits Bit 4: Voltage enabled Bit 7: Error class 0 Bit 8: HALT request active Bit 9: Remote Bit 10: Operating mode-specific Bit 11: Reserved Bit 12: Operating mode-specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - - -	UINT16 R/- - -	Modbus 6916

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC_pabsusr	Adjustment of absolute position of encoder. The value range depends on the encoder type. Singleturn encoder: 0 ... x - 1 Multiturn encoder: 0 ... (4096 * x) -1 Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling. If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted. After the write access, a wait time of at least 1 second is required before the drive can be powered off. Modified settings become active the next time the product is powered on.	usr -2147483648 - 2147483647	INT32 R/W - -	Modbus 1324
EthErrBehv	Error class for incorrect realtime Ethernet data. **0 / Warning**: Error class 0 **1 / ErrorClass1**: Error class 1 (Quick Stop) Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 6412
EthFdrAutosave	Fast Device Replacement (FDR) Autosave. **0 / Disabled**: Disabled **1 / 1 minute**: 1 minute **2 / 5 minutes**: 5 minutes **3 / 15 minutes**: 15 minutes **4 / 30 minutes**: 30 minutes **5 / 60 minutes**: 60 minutes If FDR is enabled, the drive cyclically saves the configuration to the server in Autosave mode.	- 0 0 5	UINT16 R/W per. -	Modbus 6698
EthFdrEnable	Fast Device Replacement (FDR) Enable. **0 / Disabled**: Disabled **1 / Enabled**: Enabled Global setting to enable the FDR. If the device name is configured and this parameter is enabled, the drive gets the configuration from the FDR server.	- 0 0 1	UINT16 R/W per. -	Modbus 6696
EthGateway	Stored Ethernet network gateway. Default is 192.168.100.254 Modified settings become active the next time the product is powered on.	- - - -	UINT32 R/W per. -	Modbus 6662
EthGatewayAct	Ethernet network gateway used. Default is 192.168.100.254	- - - -	UINT32 R/- - -	Modbus 6668
EthIpAddr	Stored IP address. Default is 192.168.100.10 Modified settings become active the next time the product is powered on.	- - - -	UINT32 R/W per. -	Modbus 6658
EthIpAddrAct	IP address used.	- - - -	UINT32 R/- - -	Modbus 6664

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
EthIPConfInfo	IP configuration information. **2000 / Device Name**: Device Name **2001 / Bootp**: Bootp **2002 / Stored**: Stored in nonvolatile memory **2003 / Build from MAC**: Build from MAC **2004 / EtherNet/IP default**: EtherNet/IP default **2005 / Powerlink**: Powerlink **2006 / EtherCAT**: EtherCAT The IP configuration can be set with the switches in the connector housing.	- 0 - 65535	UINT16 R/- - -	Modbus 6694
EthSubMask	Stored subnet mask. Default is 255.255.255.0 Modified settings become active the next time the product is powered on.	- - - -	UINT32 R/W per. -	Modbus 6660
EthSubMaskAct	Subnet mask used. Default is 255.255.255.0	- - - -	UINT32 R/- - -	Modbus 6666
FLT_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
FLT_del_err	Clear error memory. Value 1: Delete entries in the error memory The clearing process is completed if a 0 is returned after a read access. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15112
FLT_err_num	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
FLT_Idq	Motor current at the time the error was detected. In increments of 0.01 A.	A - - -	UINT16 R/- - -	Modbus 15378
FLT_MemReset	Reset error memory read pointer. Value 1: Set error memory read pointer to oldest error entry. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 15114
FLT_n	Motor velocity at the time the error was detected.	RPM - - -	INT16 R/- - -	Modbus 15376
FLT_powerOn	Number of power on cycles.	- 0 - 4294967295	UINT32 R/- - -	Modbus 15108
FLT_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
FLT_Temp_DEV	Temperature of device at the time the error was detected.	°C - - -	INT16 R/- - -	Modbus 15382

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
FLT_Temp_PA	Temperature of power stage at the time the error was detected.	°C - - -	INT16 R/- - -	Modbus 15380
FLT_Time	Error time. With reference to operating hours counter	s 0 - 536870911	UINT32 R/- - -	Modbus 15366
FLT_UDC	DC bus voltage at the time the error was detected. In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 15374
FLTAmpOnCyc	Number of cycles of enabling the power stage at error time. Number of cycles of enabling the power stage from the time the power supply (control voltage) was switched on to the time the error occurred.	- - - -	UINT16 R/- - -	Modbus 15370
FLTAmpOnTime	Time between enabling of power stage and detection of the error.	s - - -	UINT16 R/- - -	Modbus 15372
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. In increments of 0.0001 revolution.	revolution - - -	INT32 R/- - -	Modbus 10264
HMdisusr	Distance from switching point. The distance from the switching point is defined as the reference point. The parameter is only effective during a reference movement without index pulse. Modified settings become active the next time the motor moves.	usr 1 200 2147483647	INT32 R/W per. -	Modbus 10254

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMmethod	Homing method. 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting Abbreviations: REF+: Search movement in positive direction REF-: Search movement in negative direction inv.: Invert direction in switch not inv.: Direction not inverted in switch outside: Index pulse / distance outside switch inside: Index pulse / distance inside switch Modified settings become active immediately.	- 1 18 35	INT16 R/W - -	Modbus 6936
HMn	Target velocity for searching the switch. The adjustable value is internally limited to the setting in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 60 13200	UINT16 R/W per. -	Modbus 10248
HMn_out	Target velocity for moving away from switch. The adjustable value is internally limited to the setting in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 6 3000	UINT16 R/W per. -	Modbus 10250
HMoutdisusr	Maximum distance for search for switching point. Value 0: Monitoring of distance inactive Value >0: Maximum distance After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected. Modified settings become active the next time the motor moves.	usr 0 0 2147483647	INT32 R/W per. -	Modbus 10252
HMp_homeusr	Position at reference point. After a successful reference movement, this position is automatically set at the reference point. Modified settings become active the next time the motor moves.	usr -2147483648 0 2147483647	INT32 R/W per. -	Modbus 10262
HMp_setpusr	Position for Position Setting. Position for operating mode Homing, method 35 (Position Setting). Modified settings become active immediately.	usr - 0 -	INT32 R/W - -	Modbus 6956

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
HMsrchdisusr	Maximum search distance after overtravel of switch. Value 0: Search distance monitoring disabled Value >0: Search distance The switch must be activated again within this search distance, otherwise the reference movement is canceled. Modified settings become active the next time the motor moves.	usr 0 0 2147483647	INT32 R/W per. -	Modbus 10266
IO_AutoEnable	Enabling the power stage at PowerOn. 0 / Off: A rising edge with the signal input function "Enable" enables the power stage 1 / On: An active signal input with the signal input function "Enable" enables the power stage 2 / AutoOn: The power stage is automatically enabled Modified settings become active the next time the power stage is enabled.	- 0 0 2	UINT16 R/W per. -	Modbus 1292
IO_LO_set	Setting the digital outputs directly. Bit 0 corresponds to the first output, bit 1 corresponds to the second output, and so on.	- - - -	UINT16 R/W - -	Modbus 2082
IOfunct_LIO1	Function Input/Output LIO1. 1 / Input Free available: Available as required 2 / Input Fault reset: Reset fault (local control mode only) 3 / Input Enable: Enable (local control mode only) 4 / Input Halt: Halt 9 / Input Jog positive: Jog positive 10 / Input Jog negative: Jog negative 11 / Input Jog fast/slow: Jog fast/slow 20 / Input Reference switch (REF): Reference switch (REF) 21 / Input Positive limit switch (LIMP): Positive limit switch (LIMP) 101 / Output Free available: Available as required 102 / Output No fault: No fault 103 / Output Active: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1826
IOfunct_LIO2	Function Input/Output LIO2. 1 / Input Free available: Available as required 2 / Input Fault reset: Reset fault (local control mode only) 3 / Input Enable: Enable (local control mode only) 4 / Input Halt: Halt 9 / Input Jog positive: Jog positive 10 / Input Jog negative: Jog negative 11 / Input Jog fast/slow: Jog fast/slow 20 / Input Reference switch (REF): Reference switch (REF) 22 / Input Negative limit switch (LIMN): Negative limit switch (LIMN) 101 / Output Free available: Available as required 102 / Output No fault: No fault 103 / Output Active: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1828

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
IOfunct_LIO3	Function Input/Output LIO3. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1830
IOfunct_LIO4	Function Input/Output LIO4. **1 / Input Free available**: Available as required **2 / Input Fault reset**: Reset fault (local control mode only) **3 / Input Enable**: Enable (local control mode only) **4 / Input Halt**: Halt **9 / Input Jog positive**: Jog positive **10 / Input Jog negative**: Jog negative **11 / Input Jog fast/slow**: Jog fast/slow **20 / Input Reference switch (REF)**: Reference switch (REF) **101 / Output Free available**: Available as required **102 / Output No fault**: No fault **103 / Output Active**: Ready Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- - - -	UINT16 R/W per. -	Modbus 1832
IOsigLimN	Signal evaluation for negative limit switch. **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1566
IOsigLimP	Signal evaluation for positive limit switch. **0 / Inactive**: Inactive **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	Modbus 1568
IOsigRef	Signal evaluation for reference switch. **1 / Normally Closed**: Normally closed NC **2 / Normally Open**: Normally open NO The reference switch is only active while a reference movement to the reference switch is processed. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 1 2	UINT16 R/W per. -	Modbus 1564

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
JOGactivate	Activation of operating mode Jog. Bit 0 = 1: Positive direction of rotation Bit 1 = 1: Negative direction of rotation Bit 2 = 0: Slow velocity Bit 2 = 1: Fast velocity If both bits for the direction of rotation are activated at the same time, no movement is started. If a jog movement is running, the simultaneous activation of the bits for the direction of rotation has no effect. Modified settings become active immediately.	- 0 0 7	UINT16 R/W - -	Modbus 6930
JOGn_fast	Velocity for fast movement. The adjustable value is internally limited to the parameter setting in RAMPn_max. Modified settings become active immediately.	RPM 1 180 13200	UINT16 R/W per. -	Modbus 10506
JOGn_slow	Velocity for slow movement. The adjustable value is internally limited to the parameter setting in RAMPn_max. Modified settings become active immediately.	RPM 1 60 13200	UINT16 R/W per. -	Modbus 10504
JOGstepusr	Distance for step movement. Modified settings become active the next time the motor moves.	usr 0 20 2147483647	INT32 R/W per. -	Modbus 10510
JOGtime	Wait time for step movement. Modified settings become active the next time the motor moves.	ms 1 500 32767	UINT16 R/W per. -	Modbus 10512
LIM_HaltReaction	Halt option code. 1 / Deceleration ramp: Deceleration ramp 3 / Torque ramp: Torque ramp Setting of deceleration ramp with parameter RAMPdecel. Setting of torque ramp with parameter LIM_I_maxHalt. The deceleration ramp is only available for operating modes with motion profile for velocity. The torque ramp is used in the operating modes without motion profile for velocity. Modified settings become active immediately.	- 1 3 3	INT16 R/W per. -	Modbus 1582
LIM_I_maxHalt	Current for Halt. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4364
LIM_I_maxQSTP	Current for Quick Stop via torque ramp. Maximum value and default value depend on the motor and the power stage (settings M_I_max and PA_I_max). In increments of 0.01 A_{pk}. Modified settings become active immediately.	A_{pk} - - -	UINT16 R/W per. -	Modbus 4362

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
LIM_QStopReact	Quick Stop option code. **-2 / Torque ramp (Fault)**: Use torque ramp and transition to operating state 9 Fault **-1 / Deceleration ramp (Fault)**: Use deceleration ramp and transition to operating state 9 Fault **6 / Deceleration ramp (Quick Stop)**: Use deceleration ramp and remain in operating state 7 Quick Stop Active **7 / Torque ramp (Quick Stop)**: Use torque ramp and remain in operating state 7 Quick Stop Active Setting of deceleration ramp with parameter RAMPquickstop. Setting of torque ramp with parameter LIM_I_maxQSTP. The deceleration ramp is only available for operating modes with motion profile for velocity. The torque ramp is used in the operating modes without motion profile for velocity. Modified settings become active immediately.	- -2 7 7	INT16 R/W per. -	Modbus 1584
M_I_0	Continuous stall current of motor. In increments of 0.01 A_{pk}.	A_{pk} - - -	UINT16 R/- - -	Modbus 3366
M_I_max	Maximum current of motor. In increments of 0.01 A_{pk}.	A_{pk} - - -	UINT16 R/- - -	Modbus 3340
M_I_nom	Nominal current of motor. In increments of 0.01 A_{pk}.	A_{pk} - - -	UINT16 R/- - -	Modbus 3342
M_I2t	Maximum permissible time for maximum current of motor.	ms - - -	UINT16 R/- - -	Modbus 3362
M_Jrot	Moment of inertia of motor. In increments of 0.1 kg cm^2.	kg cm^2 - - -	UINT16 R/- - -	Modbus 3352
M_kE	Voltage constant kE of motor. Voltage constant in Vpk at 1000 RPM	- - - -	UINT16 R/- - -	Modbus 3350
M_L_d	Inductance d component of motor. In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	Modbus 3358
M_L_q	Inductance q component of motor. In increments of 0.01 mH.	mH - - -	UINT16 R/- - -	Modbus 3356
M_M_max	Maximum torque of motor.	N cm - - -	UINT16 R/- - -	Modbus 3346
M_M_nom	Nominal torque of motor.	N cm - - -	UINT16 R/- - -	Modbus 3344

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
M_n_max	Maximum permissible speed of rotation of motor.	RPM - - -	UINT16 R/- - -	Modbus 3336
M_n_nom	Nominal speed of rotation of motor.	RPM - - -	UINT16 R/- - -	Modbus 3338
M_Polepair	Number of pole pairs of motor.	- - - -	UINT16 R/- - -	Modbus 3368
M_R_UV	Winding resistance of motor. In increments of 0.01 Ω.	Ω - - -	UINT16 R/- - -	Modbus 3354
M_U_nom	Nominal voltage of motor. In increments of 0.1 V.	V - - -	UINT16 R/- - -	Modbus 3348
MBadr	Modbus address. Valid addresses: 1 to 247 Modified settings become active immediately.	- 1 1 247	UINT16 R/W per. -	Modbus 5640
MBbaud	Modbus Baud rate. **9600 / 9600**: 9600 Baud **19200 / 19200**: 19200 Baud **38400 / 38400**: 38400 Baud Modified settings become active the next time the product is powered on.	- 9600 19200 38400	UINT16 R/W per. -	Modbus 5638
MBdword_order	Modbus word order for double words (32 bit values). **0 / HighLow**: HighWord-LowWord **1 / LowHigh**: LowWord-HighWord High word first or low word first High word first -> Modicon Quantum Low word first -> Premium, HMI (Schneider Electric) Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	Modbus 5646
MBformat	Modbus data format. **1 / 8Bit NoParity 1Stop**: 8 bits, no parity bit, 1 stop bit **2 / 8Bit EvenParity 1Stop**: 8 bits, even parity bit, 1 stop bit **3 / 8Bit OddParity 1Stop**: 8 bits, odd parity bit, 1 stop bit **4 / 8Bit NoParity 2Stop**: 8 bits, no parity bit, 2 stop bits Modified settings become active the next time the product is powered on.	- 1 2 4	UINT16 R/W per. -	Modbus 5642
MBnode_guard	Modbus Node Guarding. Value 0: Node Guarding inactive Value >0: Monitoring time Modified settings become active immediately.	ms 0 0 10000	UINT16 R/W - -	Modbus 5644
MBscan_guard	Modbus TCP Node Guarding for I/O scanning. Value 0: Node Guarding inactive Value >0: Monitoring time in ms The drive starts monitoring when it receives the first I/O scanning message. After a Node Guarding error the drive starts monitoring again when it receives the next I/O scanning message. Modified settings become active immediately.	ms 0 0 10000	UINT16 R/W - -	Modbus 6414

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
MBTCP_FWupdate	Firmware update via Modbus TCP. 0 / Off: Disable firmware update via Modbus TCP 1 / On: Enable firmware update via Modbus TCP The parameter can only be set via Modbus RTU. After a firmware update the parameter has to be set to 0. Modified settings become active immediately. Available with firmware version ≥V1.102.	- 0 0 1	UINT16 R/W per. expert	Modbus 5656
MBTCPdword_order	Modbus TCP word order for double words (32 bit values). 0 / HighLow: HighWord-LowWord 1 / LowHigh: LowWord-HighWord High word first or low word first High word first -> Modicon Quantum Low word first -> Premium, HMI (Schneider Electric) Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	Modbus 6410
MinTimeAckBitLow	Minimum time for acknowledgement bit movement active. Value 0: Disabled. Acknowledgement is generated by movement time itself. Value >0: Minimum time for acknowledgement bit movement active. If the movement time is less than the set time value, the time for the acknowledgement of active movement is increased. If the movement time is greater than the set time value, the acknowledgment bit for active movement is processed based on the movement time only. Example: Movement time = 5 ms Value for minimum time = 20 ms Acknowledgement bit for active movement is set to LOW for 20 ms. This setting is also used for reference movements and position setting (bits 'ref_ok' and 'homing_attained'). Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V1.010.	- 0 0 16383	UINT16 R/W per. -	Modbus 1608
ModeError	Error code for synchronous errors (ME flag). Manufacturer-specific error code that caused the ModeError flag to be set. Usually, this is an error that was caused by the activation of an operating mode.	- - - -	UINT16 R/- - -	Modbus 6962
MT_dismax	Maximum permissible distance. If the reference value is active and the maximum permissible distance is exceeded, an error of class 1 is detected. The value 0 switches off monitoring. In increments of 0.1 revolution. Modified settings become active the next time the motor moves.	revolution 0.0 1.0 999.9	UINT16 R/W - -	Modbus 11782
PA_T_max	Maximum permissible temperature of power stage.	°C - - -	INT16 R/- per. -	Modbus 4110

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PA_T_warn	Temperature limit of power stage for error class 0.	°C - - -	INT16 R/- per. -	Modbus 4108
PA_U_maxDC	Maximum permissible DC bus voltage. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	Modbus 4102
PA_U_minDC	Minimum permissible DC bus voltage. In increments of 0.1 V.	V - - -	UINT16 R/- per. -	Modbus 4104
PA_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
PAR_CTRLreset	Reset control loop parameters. **0 / No**: No **1 / Yes**: Yes The control loop parameters of the velocity controller and the position controller are reset. The current controller is automatically adjusted for the connected motor. Modified settings become active immediately.	- 0 - 1	UINT16 R/W - -	Modbus 1038
PAReeprSave	Save parameter values to the nonvolatile memory. Value 1: Save persistent parameters The currently set parameters are saved to the nonvolatile memory. The saving process is complete when the parameter is read and 0 is returned. Modified settings become active immediately.	- - - -	UINT16 R/W - -	Modbus 1026
PARfactorySet	Restore factory settings (default values). **No**: No **Yes**: Yes The parameters are reset to the factory settings and subsequently saved to the nonvolatile memory. A reset to the factory settings is only possible via the commissioning software. The saving process is complete when the parameter is read and 0 is returned. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 - 3	UINT16 R/W - -	-
PARuserReset	Reset user parameters. Bit 0: Reset persistent user parameters to default values. The parameters are reset with the exception of: - Communication parameters - Definition of the direction of rotation - Signal selection position interface - I/O functions Bits 1 and 2: Reserved The new settings are not saved to the nonvolatile memory. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 - 7	UINT16 R/W - -	Modbus 1040

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
PLCopenRxPro1	PLCopen receive process data part 1.	- - - -	UINT32 R/W - -	Modbus 6922
PLCopenRxPro2	PLCopen receive process data part 2. Modified settings become active immediately.	- - - -	UINT32 R/W - -	Modbus 6924
PLCopenTxPro1	PLCopen transmit process data part 1. Modified settings become active immediately.	- - - -	UINT32 R/- - -	Modbus 6926
PLCopenTxPro2	PLCopen transmit process data part 2. Modified settings become active immediately.	- - - -	UINT32 R/- - -	Modbus 6928
POSdirOfRotat	Definition of direction of rotation. **0 / Clockwise**: Clockwise **1 / Counter Clockwise**: Counter-clockwise With positive reference values, the motor rotates clockwise (as you look at the end of the motor shaft at the flange). The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	Modbus 1560
POSscaleDenom	Position scaling: Denominator. Refer to numerator (POSscaleNum) for a description. A new scaling is activated when the numerator value is set. Setting can only be modified if power stage is disabled.	usr 1 16384 2147483647	INT32 R/W per. -	Modbus 1550
POSscaleNum	Position scaling: Numerator. Scaling factor is defined as: Motor revolutions --- User-defined units [usr] A new scaling is activated when the numerator value is set. User-defined limit values may be reduced due to the calculation of an internal factor. Setting can only be modified if power stage is disabled. Modified settings become active immediately.	revolution 1 1 2147483647	INT32 R/W per. -	Modbus 1552
PPn_target	Target velocity for operating mode Profile Position. The maximum value is limited to the setting in CTRL_n_max. The adjusted value is internally limited to the parameter value in RAMPn_max. Modified settings become active the next time the motor moves.	RPM 1 60 -	UINT32 R/W - -	Modbus 6942

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: Value 0: Relative with reference to the previous target position of the motion profile generator Value 1: Reserved Value 2: Relative with reference to the actual position of the motor Modified settings become active the next time the motor moves.	- 0 0 2	UINT16 R/W - -	Modbus 6960
PPp_targetusr	Target position for operating mode Profile Position. Minimum and maximum values depend on: - Scaling factor - Software limit switches (if they are activated) Modified settings become active immediately.	usr - - -	INT32 R/W - -	Modbus 6940
ProfileType	Motion profile. Value 0: Linear	- 0 0 0	INT16 R/W - -	Modbus 6954
PVn_target	Target velocity for operating mode Profile Velocity. The maximum value is limited to the setting in CTRL_n_max. The adjusted value is internally limited to the parameter value in RAMPn_max. Modified settings become active immediately.	RPM - 0 -	INT32 R/W - -	Modbus 6938
RAMP_TAUjerk	Jerk limitation of the motion profile for velocity. **0 / Off**: Off **1 / 1**: 1 ms **2 / 2**: 2 ms **4 / 4**: 4 ms **8 / 8**: 8 ms **16 / 16**: 16 ms **32 / 32**: 32 ms **64 / 64**: 64 ms **128 / 128**: 128 ms Adjustments can only be made if the operating mode is inactive (x_end=1). Modified settings become active the next time the motor moves.	ms 0 0 128	UINT16 R/W per. -	Modbus 1562
RAMPacc	Acceleration of the motion profile for velocity. Modified settings become active the next time the motor moves.	RPM/s 1 600 3000000	UINT32 R/W per. -	Modbus 1556
RAMPdecel	Deceleration of the motion profile for velocity. Modified settings become active the next time the motor moves.	RPM/s 750 750 3000000	UINT32 R/W per. -	Modbus 1558

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
RAMPn_max	Maximum velocity of the motion profile for velocity. The parameter is active in the following operating modes: - Profile Position - Profile Velocity - Homing - Jog If a greater reference velocity is set in one of these operating modes, it is automatically limited to RAMPn_max. This way, commissioning at limited velocity is easier to perform. Setting can only be modified if power stage is disabled. Modified settings become active the next time the motor moves.	RPM 60 13200 13200	UINT16 R/W per. -	Modbus 1554
RAMPquickstop	Deceleration ramp for Quick Stop. Deceleration ramp for a software stop or an error with error class 1 or 2. Modified settings become active the next time the motor moves.	RPM/s 200 6000 3000000	UINT32 R/W per. -	Modbus 1572
RAMPsym	Acceleration/deceleration of the motion profile for velocity. The values are internally multiplied by 10 (example: 1 = 10 RPM/s). Write access modifies the values of RAMPacc and RAMPdecel. The limit values are verified on the basis of the values indicated for these parameters. Read access returns the value of RAMPacc or RAMPdecel, whichever is greater. If the value cannot be represented as a 16 bit value, the value is set to 65535 (maximum UINT16 value). Modified settings become active the next time the motor moves.	usr - - -	UINT16 R/W - -	Modbus 1538
ResetWebPass	Reset password of web server. Value 1: The password of the web server is reset to the default value. A new password must be set when a new connection is established. The parameter can only be written via Modbus RTU. Modified settings become active immediately. Available with firmware version ≥V1.102.	- 0 - 1	UINT16 R/W - -	Modbus 6704
SPEEDn_target	Reference velocity in operating mode Speed Control. The internal maximum speed is limited to the setting in CTRL_n_max. Modified settings become active immediately.	RPM -30000 0 30000	INT16 R/W - -	Modbus 8456
SPEEDreference	Reference value source for operating mode Speed Control. **0 / None**: None **2 / Parameter 'SPEEDn_target'**: Reference value via parameter SPEEDn_target Modified settings become active immediately.	- 0 0 2	UINT16 R/W - -	Modbus 6946
SPV_Flt_pDiff	Error response to excessively high position deviation. **1 / Error Class 1**: Error class 1 **2 / Error Class 2**: Error class 2 **3 / Error Class 3**: Error class 3 Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 1 3 3	UINT16 R/W per. -	Modbus 1302

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
SPV_HW_Deactiv	Temporary deactivation of hardware limit switches. **0 / None**: No limit switch deactivated **1 / Deactivate LIMP**: Deactivate positive limit switch **2 / Deactivate LIMN**: Deactivate negative limit switch **3 / Deact. LIMP+LIMN**: 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 any error response of the drive. Modified settings become active immediately. Available with firmware version ≥V1.010.	- 0 0 3	UINT16 R/W - -	Modbus 1610
SPV_p_maxDiff	Maximum position deviation. The position deviation is the difference between the reference position and the actual position caused by the load. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0001 1.0000 200.0000	UINT32 R/W per. -	Modbus 4636
SPV_SW_Limits	Activation of software limit switches. **0 / None**: Deactivated **1 / SWLIMP**: Activation of software limit switch positive direction **2 / SWLIMN**: Activation of software limit switch negative direction **3 / SWLIMP+SWLIMN**: Activation of software limit switches both directions Software limit switches can only be activated if the zero point is valid. Modified settings become active immediately.	- 0 0 3	UINT16 R/W per. -	Modbus 1542
SPVswLimNusr	Negative position limit for software limit switch. Refer to description of parameter SPVswLimPusr. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr - -2147483648 -	INT32 R/W per. -	Modbus 1546
SPVswLimPusr	Positive position limit for software limit switch. If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum user-defined value. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	usr - 2147483647 -	INT32 R/W per. -	Modbus 1544
STANDp_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 'STANDpwinTime. In increments of 0.0001 revolution. Modified settings become active immediately.	revolution 0.0000 0.0010 3.2767	UINT16 R/W per. -	Modbus 4370
STANDpwinTime	Standstill window, time. Value 0: Monitoring of standstill window deactivated Value >0: Time in ms during which the control deviation must be in the standstill window Modified settings become active immediately.	ms 0 0 32767	UINT16 R/W per. -	Modbus 4372

Parameter name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
STANDpwinTout	Timeout time for standstill window monitoring. Value 0 : Timeout monitoring deactivated Value >0 : Timeout time in ms Standstill window processing values are set via STANDp_win and STANDpwinTime. Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing. Modified settings become active immediately.	ms 0 0 16000	UINT16 R/W per. -	Modbus 4374
SuppDriveModes	Supported operating modes as per DSP402. Coding: Bit 0: Profile position Bit 2: Profile velocity Bit 5: Homing Bit 16: Jog Bit 17: Electronic gear Bit 18: Current control Bit 19: Speed control Bit 20: Position control Bit 21: Manual tuning Bit 22: Oscillator The availability of the individual bits is product-dependent.	- - - -	UINT32 R/- - -	Modbus 6952

Chapter 12
Accessories and Spare Parts

Accessories and Spare Parts

Accessories

Description	Reference
Braking Resistor Controller UBC60	ACC3EA001
Installation kit	VW3L10111
Insert with cable entry (2 pieces)	VW3L10100N2
Insert with cable entry (10 pieces)	VW3L10100N10
Cable entry for commissioning	VW3L10222
Insert for sealing (10 pieces)	VW3L10000N10
Insert for sealing (20 pieces)	VW3L10000N20
Insert for sealing (50 pieces)	VW3L10000N50
Cable for commissioning interface, other cable end open 3 m	VW3L1R000R30
Cable for commissioning interface, other cable end RJ45 3 m	VW3L1T000R30
PC connection kit, serial connection between drive and PC, USB-A to RJ45	TCSMCNAM3M002P
Insert kit for commissioning	VW3L1R000
Cable kit, power supply, Modbus TCP, 3m	VW3L2T001R30
Cable kit, STO, 3 m	VW3L20010R30
Cable kit, STO, 5 m	VW3L20010R50
Cable kit, STO, 10 m	VW3L20010R100
Cable kit, STO, 15 m	VW3L20010R150
Cable kit, STO, 20 m	VW3L20010R200
Cable, power supply, 3 m	VW3L30001R30
Cable, power supply, 5 m	VW3L30001R50
Cable, power supply, 10 m	VW3L30001R100
Cable, power supply, 15 m	VW3L30001R150
Cable, power supply, 20 m	VW3L30001R200
Cable, STO, 3 m	VW3L30010R30
Cable, STO, 5 m	VW3L30010R50
Cable, STO, 10 m	VW3L30010R100
Cable, STO, 15 m	VW3L30010R150
Cable, STO, 20 m	VW3L30010R200
Connector kit for Modbus TCP, 1 x female industrial connector M12	VW3L5T000
Connector kit for I/O, 2 x industrial connector M8	VW3L50200
Connector kit for I/O, 3 x industrial connector M8	VW3L50300
Connector for STO output, 1 x industrial connector M8	VW3L50010
Insert kit, 3 x I/O	VW3L40300
Insert kit, 2 x I/O, 1 x STO input	VW3L40210
Insert kit, 1 x STO input, 1 x STO output	VW3L40020
Insert kit, 4 x I/O, 1 x STO input, 1 x STO output	VW3L40420

Gearbox

Description	Reference
Planetary gear for Lexium Integrated Drive ILAxx571, ratio 3:1	GBX060003A571L

Description	Reference
Planetary gear for Lexium Integrated Drive ILAxx571, ratio 5:1	GBX060005A571L
Planetary gear for Lexium Integrated Drive ILAxx571, ratio 8:1	GBX060008A571L
Planetary gear for Lexium Integrated Drive ILAxx571, ratio 16:1	GBX060016A571L
Planetary gear for Lexium Integrated Drive ILAxx571, ratio 40:1	GBX060040A571L
Planetary gear for Lexium Integrated Drive ILAxx572, ratio 3:1	GBX060003A572L
Planetary gear for Lexium Integrated Drive ILAxx572, ratio 5:1	GBX060005A572L
Planetary gear for Lexium Integrated Drive ILAxx572, ratio 8:1	GBX060008A572L
Planetary gear for Lexium Integrated Drive ILAxx572, ratio 16:1	GBX060016A572L
Planetary gear for Lexium Integrated Drive ILAxx572, ratio 40:1	GBX060040A572L

Chapter 13
Service, Maintenance, and Disposal

What Is in This Chapter?

This chapter contains the following topics:

Service Addresses

Schneider Electric Automation GmbH

Schneiderplatz 1

97828 Marktheidenfeld, Germany

Phone: +49 (0) 9391 / 606 - 0

Fax: +49 (0) 9391 / 606 - 4000

Email: info-marktheidenfeld@se.com

Additional Contact Addresses

See the homepage for additional contact addresses:

https://www.se.com

Maintenance

Overview

There are no user-serviceable parts within the product.

Either replace the product, or contact your Schneider Electric service representative.

The product may only be repaired by a Schneider Electric service center.

For all service matters, contact your Schneider Electric service representative.

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Only use software and hardware components approved by Schneider Electric for use with this equipment. ● Do not attempt to service this equipment outside of authorized Schneider Electric service centers. ● Update your application program every time you change the physical hardware configuration.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Use only the accessories and mounting parts specified in the present document and no third-party devices or components that have not been expressly approved by Schneider Electric. Do not modify the equipment.

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 regularly that all output elements are firmly seated.
● Verify regularly that all mechanical and electrical threaded connections are tightened to the specified torque.

Cleaning

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

⚠ **WARNING**
UNINTENDED EQUIPMENT OPERATION
● Verify that the environmental conditions are respected. ● Keep liquids from getting to the shaft bushing. ● Do not clean the product with 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.

Care must be taken with cleaning products as some active agents may have deleterious effects on plastics and welds. When using solvents or cleaning agents, verify that the cables, cable entry seals, O-rings and motor paint are not damaged.

NOTICE
CORROSION CAUSED BY CLEANING AGENTS
● Before using a cleaning agent, carry out a compatibility test in relation to the cleaning agent and the component affected. ● Do not use alkaline cleaning agents. ● Do not use cleaning agents containing chloride. ● Do not use cleaning agents containing sulfuric acid.
Failure to follow these instructions can result in equipment damage.

Lifetime Safety-Related Function STO

The safety-related function STO is designed for a lifetime of 20 years. The expiration date is determined by adding 20 years to the DOM (date of manufacture) shown on the nameplate of the product.

● This date must be included in the maintenance plan of your application.
   Do not use the safety-related function STO after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.19. (31 December 2019). This means: Do not use the safety-related function STO after December 31, 2039.

Replacing the Product

Overview

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.

Follow the procedure below for replacing devices.

● Save all parameter settings. To do so, save the data to a PC using the commissioning software.
● Power off all supply voltages. Verify that no voltages are present.
● 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 67)*.
● 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 93)*.

Shipping, Storage, Disposal

Shipping

The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage

The product may only be stored in spaces where the specified permissible ambient conditions are met.

Protect the product from dust and dirt.

Disposal

The product consists of various materials that can be recycled. Dispose of the product in accordance with local regulations.

Visit *https://www.se.com/green-premium* for information and documents on environmental protection as per ISO 14025 such as:

- EoLi (Product End-of-Life Instructions)
- PEP (Product Environmental Profile)

Glossary

A

Actual value

In control engineering, the actual value is the value of the controlled variable at a given instant (for example, actual velocity, actual torque, actual position, actual current, and so on). An actual value can be a measured value (for example, the actual position can be a value measured by an encoder) or a derived value (for example, the actual torque can be a value derived from the actual current). The actual value is an input value used by the control loops of the drive to reach the reference value. Definition as per IEC 61800-7 series and IEC 60050.

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 motor, direction of movement is defined as follows: 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:

31.12.19 corresponds to December 31, 2019

31.12.2019 corresponds to December 31, 2019

E

EDS

Electronic Data Sheet

EMC

Electromagnetic compatibility

EMI

Electromagnetic interference

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 and to derive other actual values such as actual velocity.

Error

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

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.

I

I^2t monitoring

Anticipatory temperature monitoring. The expected temperature rise of components is calculated in advance on the basis of the motor current. If a limit value is exceeded, the drive reduces the motor current.

Inc

Increments

Index pulse

Signal of an encoder identifying the rotor position. The encoder returns one index pulse per revolution.

Internal units

Resolution at which the motor can be positioned. Internal units are specified in increments.

P

Parameter

Device data and values that can be read and set (to a certain extent) by the user.

PDU

Protocol Data Unit

PELV

Protective Extra Low Voltage, low voltage with isolation. For more information, refer to IEC 60364-4-41

Persistent

Indicates whether the value of the parameter remains in the memory after a power cycle.

Power stage

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

RS-485

Fieldbus interface as per EIA-485 which enables serial data transmission with multiple devices.

S

Safety-related function

Safety-related functions are defined in the standard IEC 61800-5-2 (for example, Safe Torque Off (STO), Safe Operating Stop (SOS) or Safe Stop 1 (SS1)).

Scaling factor

This factor is the ratio between an internal unit and a user-defined unit.

U

User-defined unit

Unit whose relationship to movements can be determined by the user via parameters.

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