

# Lexium 28A and BCH2 Servo Drive System

## User Guide

Original instructions

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# Safety Information

## Important Information

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



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



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

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **NOTICE**

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

## Please Note

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

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

## QUALIFICATION OF PERSONNEL

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

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

## INTENDED USE

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

The products 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 entire system, you must ensure the safety of persons by means of the design of this entire system.

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 is prohibited and can result in hazards.

# About the Book

## Document Scope

This document describes the functions of the Servo Drive LXM28A and the BCH2 motor.

## Validity Note

This document has been updated with the firmware release of the Lexium 28A V1.78.

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

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

## Related Documents

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on [www.se.com](http://www.se.com).

The internet site provides the information you need for products and solutions:

- The whole catalog for detailed characteristics and selection guides,
- The CAD files to help design your installation,
- All software and firmware to maintain your installation up to date,
- And finally all the User Guides related to your drive, listed below:

Title of documentation	Reference number
Lexium 28A and BCH2 Servo Drive System - User Guide (This document)	EIO0000002305 (English)
	EIO0000002310 (Chinese)
Lexium 28A DTM Commissioning software - User Guide	EIO0000002317 (English)
LXM28 - Common DC bus - Application note	0198441114085-EN (English)
	0198441114084-DE (German)
	0198441114086-FR (French)
	0198441114087-IT (Italian)
	0198441114088-ES (Spanish)
	0198441114089-ZH (Chinese)
HBC Holding Brake Controller -Product Manual	0198441113316 (English)
Multi-loader - User Manual	BBV48778 (English)
	BBV48777 (French)

You can download these technical publications, the present document and other technical information from our website [www.se.com/en/download/](http://www.se.com/en/download/).

## Product Related Information

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

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

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

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

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

### DANGER

#### ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Measure the voltage on the DC bus with a properly rated voltage sensing device and verify that the voltage is less than 42.4 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

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

### DANGER

#### POTENTIAL FOR EXPLOSION

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

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

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



**▲ WARNING****UNINTENDED EQUIPMENT OPERATION**

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

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

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

**▲ WARNING****UNINTENDED MOVEMENT OR MACHINE OPERATION**

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

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

**▲ WARNING****LOSS OF CONTROL**

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.<sup>1</sup>
- 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.**

<sup>1</sup> 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.

## DC Bus Voltage Measurement

The DC bus voltage can exceed 400 Vdc. The DC bus LED is not an indicator of the absence of DC bus voltage.

## ⚡⚠ DANGER

### ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect the voltage supply to all connections.
- Wait 15 minutes to allow the DC bus capacitors to discharge.
- Use a properly rated voltage-sensing device for measuring (greater than 400 Vdc).
- Measure the DC bus voltage between the DC bus terminals (PA/+ and PC/-) to verify that the voltage is less than 42 Vdc
- Contact your local Schneider Electric representative if the DC bus capacitors do not discharge to less than 42 Vdc within a period of 15 minutes.
- Do not operate the product if the DC bus capacitors do not discharge properly.
- Do not attempt any repairs involving opening the drive case.
- Do not attempt to replace cables, connectors or the drive itself if the DC bus capacitors are not discharged to a voltage level less than 42 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.

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

## 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.

Standard	Description
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.



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# Servo Drive System Planning

## What's in This Part

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# General Overview

## What's in This Chapter

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Drive / Motor References .....	19

## Servo Drive Device Overview

### Presentation

The servo drive system includes:

- the drive, page 29 and the motor, page 45:



- the accessories and spare parts, page 71:



Item	Description
1	Commissioning tools, page 71
2	Connectors and adapters, page 71
3	External mains filters, page 72
4	DC Bus accessories, page 72 (1)
5	Application nameplate, page 72
6	Fieldbus accessories, page 72
7	Motor cables, page 73
8	Encoder cables, page 74
9	Signal cables, page 74
10	Signal cables for safety function STO, page 74
11	External braking resistors, page 74
12	Circuit breakers, page 75
13	Motor protection switches and power contractors, page 75
(1) Not available for LXM28A•••M1X drives.	

## Drive / Motor References

### Introduction

The present user guide provides information about the following Drives and Motors reference tables.

The Lexium 28A range is defined by AC-servo drives Lexium 28A for combination with AC-servo motors BCH2.

- The combinations of servo motors with servo drives are based on the power class: both servo motor and servo drive must have the same power class.
- The bundle of a servo drive with its related servo motor is designed to cover a nominal power from:
  - 0.05 kW up to 4.5 kW (0.067 up to 6.03 hp) with 200...240 V mains supply voltage.
  - 0.05 kW up to 0.75 kW (0.067 up to 1.005 hp) with 100...120 V mains supply voltage.

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

## Lexium 28A Drive References List

Drive references	Nominal power	Supply mains
LXM28AUA5M1X	50 W	single phase, 110 Vac
LXM28AU01M1X	100 W	single phase, 110 Vac
LXM28AU02M1X	200 W	single phase, 110 Vac
LXM28AU04M1X	400 W	single phase, 110 Vac
LXM28AU07M1X	750 W	single phase, 110 Vac
LXM28AUA5M3X	50 W	single phase or 3-phase, 230 Vac
LXM28AU01M3X	100 W	single phase or 3-phase, 230 Vac
LXM28AU02M3X	200 W	single phase or 3-phase, 230 Vac
LXM28AU04M3X	400 W	single phase or 3-phase, 230 Vac
LXM28AU07M3X	750 W	single phase or 3-phase, 230 Vac
LXM28AU10M3X	1000 W	single phase or 3-phase, 230 Vac
LXM28AU15M3X	1500 W	single phase or 3-phase, 230 Vac
LXM28AU20M3X	2000 W	3-phase, 230 Vac
LXM28AU30M3X	3000 W	3-phase, 230 Vac
LXM28AU45M3X	4500 W	3-phase, 230 Vac

For further information, refer to the servo drive general overview, page 29.

## BCH2 Motor References List

Motor references	Nominal power
BCH2MBA53...5C	50 W
BCH2MB013...5C	100 W
BCH2LD023...5C	200 W
BCH2MM031...6C	300 W
BCH2LD043...5C	400 W
BCH2LF043...5C	400 W
BCH2MM052...6C	500 W
BCH2MM061...6C	600 W
BCH2HF073...5C	750 W
BCH2LF073...5C	750 W
BCH2MM081...6C	850 W
BCH2MM091...6C	900 W
BCH2MM102...6C	1000 W
BCH2HM102...6C	1000 W
BCH2LH103...6C	1000 W
BCH2MM152...6C	1500 W
BCH2MM202...6C	2000 W
BCH2MR202...6C	2000 W
BCH2HR202...6C	2000 W
BCH2LH203...6C	2000 W
BCH2MR301...6C	3000 W
BCH2MR302...6C	3000 W



Motor references	Nominal power
BCH2MR352...6C	3500 W
BCH2MR451...6C	4500 W

For further information, refer to Servo Motor Type Code, page 47.

## Drive / Motor Combinations

The permissible Drive / Motor Combinations are detailed in the following table:

Drive	Motor	Nominal power	Nominal speed of rotation	Nominal torque	Peak torque	Rotor inertia without holding brake	Moment of inertia
		W	rpm	Nm	Nm	kg. cm <sup>2</sup>	-
Devices 110 Vac that can be connected via a single phase							
LXM28AUA5M1X	BCH2MBA53...5-C	50	3000	0.16	0.48	0.054	Medium
LXM28AU01M1X	BCH2MB013...5C	100	3000	0.32	0.96	0.075	Medium
LXM28AU02M1X	BCH2LD023...5C	200	3000	0.64	1.92	0.16	Low
LXM28AU04M1X	BCH2LD043...5C	400	3000	1.27	3.81	0.27	Low
	BCH2LF043...5C	400	3000	1.27	3.81	0.67	Low
LXM28AU07M1X	BCH2LF073...5C	750	3000	2.39	7.16	1.19	Low
	BCH2HF073...5C	750	3000	2.39	7.16	1.54	High
Devices 220 Vac that can be connected via a single phase or three phases							
LXM28AUA5M3X	BCH2MBA53...5-C	50	3000	0.16	0.48	0.054	Medium
	Hardware version RS 01 or RS 02					0.044	
LXM28AU01M3X	BCH2MB013...5C	100	3000	0.32	0.96	0.075	Medium
	Hardware version RS 01 or RS 02					0.065	
LXM28AU02M3X	BCH2MB013...5C	200	3000	0.64	1.92	0.16	Low
	Hardware version RS 03						
LXM28AU04M3X	BCH2MM031...6-C	300	1000	2.86	8.59	6.63	Medium
	BCH2LD043...5C	400	3000	1.27	3.81	0.27	Low
	BCH2LF043...5C	400	3000	1.27	3.81	0.67	Low
LXM28AU07M3X	BCH2MM052...6-C	500	2000	2.39	7.16	6.63	Medium
	BCH2MM061...6-C	600	1000	5.73	17.19	6.63	Medium
	BCH2LF073...5C	750	3000	2.39	7.16	1.19	Low
	BCH2HF073...5C	750	3000	2.39	7.16	1.54	High

Drive	Motor	Nomi- nal power	Nomi- nal speed of rota- tion	Nomi- nal torque	Peak torque	Rotor inertia with- out hold- ing brake	Mo- ment of inertia
		W	rpm	Nm	Nm	kg. cm <sup>2</sup>	-
LXM28AU10M3X	BCH2MM081...6-C	850	1500	5.39	13.8	13.5	Medi- um
	BCH2MM091...6-C	900	1000	8.59	25.77	9.7	Medi- um
	BCH2LH103...6C	1000	3000	3.18	9.54	2.4	Low
	BCH2MM102...6-C	1000	2000	4.77	14.3	6.63	Medi- um
	BCH2HM102...6C	1000	2000	4.77	14.3	8.41	High
LXM28AU15M3X	BCH2MM152...6-C	1500	2000	7.16	21.48	9.7	Medi- um
Devices 220 Vac that can be connected via three phases							
LXM28AU20M3X	BCH2LH203...6C	2000	3000	6.37	19.11	4.28	Low
	BCH2MM202...6-C	2000	2000	9.55	28.65	13.5	Medi- um
	BCH2MR202...6C	2000	2000	9.55	28.65	26.5	Medi- um
	BCH2HR202...6C	2000	2000	9.55	28.65	34.68	High
LXM28AU30M3X	BCH2MR301...6C	3000	1500	19.1	57.29	53.56	Medi- um
	BCH2MR302...6C	3000	2000	14.32	42.97	53.56	Medi- um
LXM28AU45M3X	BCH2MR352...6C	3500	2000	16.7	50.3	53.56	Medi- um
	BCH2MR451...6C	4500	1500	28.65	71.62	73.32	Medi- um

# Document Navigator

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## Document Navigator

### Document Content

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  - Conditions for UL 508C and CSA, page 25
  - Drive, page 29
  - Motor, page 45
  - Accessories and spare parts, page 71
- Engineering, page 76
- Installation, page 101
  - Before mounting, page 103
  - Drive installation, page 104
  - Motor installation, page 139
  - Verifying installation, page 148
- Commissioning, page 149
  - Overview, page 150
  - Integrated HMI, page 153
  - Commissioning procedure, page 158
  - Tuning the control loop, page 165
- Parameters, page 186
- Operation, page 268
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- Diagnostics and troubleshooting, page 364
- Service, maintenance and disposal, page 378
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# Servo Drive System Technical Data

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# Certifications

## What's in This Chapter

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## Download links

Item	Link
UL certification status	UL_InfoBY01
CSA certificate	CSA_70022260 CSA_2869159
EU Declaration of conformity	NHA3487100
TÜV certificate	TUEV_0120554010014
KC certificate - Reference group 1	KC_1333-B797-B43E-FC6C
KC certificate - Reference group 2	KC_8812-6AC0-ECBC-1757
KC certificate - Reference group 3	KC_AE96-6B40-C214-7A18
KC certificate - Reference group 4	KC_A1BB-480B-E156-0EF1

# Conditions for UL 508C

## Introduction

The UL certification status can be downloaded on the Schneider Electric website.  
 If the product is used to comply with UL 508C, the following conditions must also be met.

## Wiring

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

## Fuses

Use fuses as per UL 248 or circuit breaker as per UL 489.

LXM28A	UA5, U01, U02, U04, U07, U10, U15	U20, U30, U45
Maximum fuse rating of fuse to be connected upstream	25 A	32 A
Class if fuses are used	J	J
Class if circuit breakers are used	D	D

## Overvoltage Category

Use only in overvoltage category III or where the maximum available Rated Impulse Withstand Voltage Peak is equal or less than 4000 Volts, or equivalent as defined in UL 840 and its equivalent defined in IEC 60664-1.

## Conditions for CSA

The CSA certificate can be downloaded on the [Schneider Electric website](#).

If the product is used to comply with CSA, the following conditions must also be met.

Integral solid-state short circuit protection in these drives does not provide branch circuit protection.

### DANGER

#### ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Provide branch circuit protection in accordance with the manual instructions, National Electrical Code and any additional local codes of the type and size specified in the present document.

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

For reference groups 1, 2, 3, and 4 (see Fuse Types table), this product is suitable for use on a circuit capable of delivering not more than 200 kA RMS symmetrical amperes and 230 Vac (LXM28A•••M3X) or 120 Vac (LXM28A•••M1X) maximum, when protected by Listed Class J, CC or RK5 fuses as indicated in this instruction manual and the Fuse Types table. Instead of fuses, protection may be provided by circuit breakers of type C60 by Schneider Electric with the maximum current ratings specified in the Fuse Types table.

For reference group 1 only, this product is suitable for motor group installation on a circuit capable of delivering not more than 5 kA RMS symmetrical amperes and 230 Vac (LXM28A•••M3X) or 120 Vac (LXM28A•••M1X) maximum, when protected by Listed Class J or CC fuses as indicated in the instruction manual and the Fuse Types table. Instead of fuses, protection may be provided by circuit breakers of type C60 by Schneider Electric with the maximum current ratings specified in the Fuse Types table.

The opening of the branch-circuit protective device may be an indication that an electrical interruption has been detected.

### DANGER

#### ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Examine all current carrying parts and other components of the drive controller for damage and replace if necessary before replacing fuses or engaging circuit breakers.
- Completely replace overload relays if burnout of the current element occurs.

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

Capacitive voltages above 42.4 V may remain for up to 15 minutes after power is removed from the drive.

**⚠️⚠️ DANGER**

**ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Measure the voltage on the DC bus with a properly rated voltage sensing device and verify that the voltage is less than 42.4 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- 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.**

These drives are provided with load and speed adjustable motor overload and short circuit protection. Adjust the parameter P1-78 'User-Defined maximal current' in the drive which protects the motor by limiting the maximum current according to the required degree of protection of the motors as indicated on the name plate.

## Other Characteristics

Maximum surrounding Air Temperature: 40...55 °C (104...131 °F) with current derating of 1% per °C (per 1.8 °F).

Tightening torque for the connectors labelled CN5, CN7 and CN8 for drive reference group:

- 3 and 4: 0.7 ... 0.8 Nm (6.2 ... 7 lb.in)

## Fuse Types

Reference Group	Reference	Class	Maximum Current
1	LXM28AUA5M3X	CC or J	25 A
	LXM28AU01M3X		
	LXM28AU02M3X		
	LXM28AU04M3X		
	LXM28AU07M3X		
2	LXM28AUA5M1X	RK5 or CC or J	25 A
	LXM28AU01M1X		
	LXM28AU02M1X		
	LXM28AU04M1X		
	LXM28AU07M1X		
	LXM28AU10M3X	RK5 or CC or J	25 A

Reference Group	Reference	Class	Maximum Current
	LXM28AU15M3X		
3	LXM28AU20M3X	RK5 or J	45 A
4	LXM28AU30M3X	RK5 or J	50 A
	LXM28AU45M3X		



# Drive

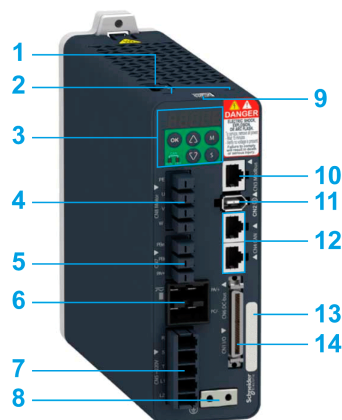
## What's in This Chapter

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 Drive Technical Data.....31

## General Overview

### Servo Drive Description

#### Presentation



Item	Description	Connector
1	Connector for safety function STO	CN9, page 136
2	Slot for application name plate (VW3M2501)	-
3	HMI: 7-segment display, 5 buttons, and 2 status LED	-
4	Terminal for motor connection	CN8, page 132
5	Terminal for braking resistor connection	CN7, page 129
6	DC-bus connector <sup>(1)</sup> with status LED	CN6, page 129
7	Terminal for connecting the power supply	CN5, page 126
8	Screw terminal for protective ground (protective earth)	-
9	QR code for access to technical data	-
10	RJ45 connector for Modbus serial link (commissioning interface)	CN3, page 121
11	Connector for the encoder of the motor	CN2, page 120
12	2 x RJ45 connectors for integrated CANopen connection	CN4, page 123
13	Device Reference	-
14	Input/output connector	CN1, page 109

**(1)** Not available for LXM28A\*\*\*M1X drives.

## Integrated Fieldbus

The Lexium 28A Servo Drive embeds a dual port CANopen adapter that can be used in a CANopen industrial fieldbus.

## Parameters Access

Servo drive parameters, page 187 may be accessed using:

- The integrated HMI
- The Device Type Manager (DTM)
- Directly using the fieldbus address of the device to read and write to parameters using the object dictionary

## Object Dictionary

The CANopen objects may be accessed through the fieldbus, using their address.

The objects Drive Parameters are identified by their name in the **Parameter** column in the object dictionary table.

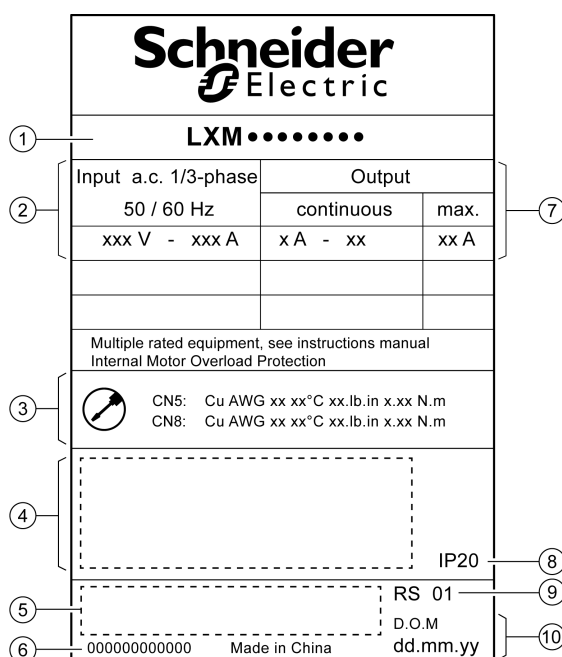
Three groups of objects are available in the object dictionary.

- 1000<sub>h</sub> - 1FFF<sub>h</sub>: Standard communication Object Group, page 398
- 4000<sub>h</sub> - 4FFF<sub>h</sub>: Vendor-specific Object Group, page 409
- 6000<sub>h</sub> - 6FFF<sub>h</sub>: Device profile Object Group, page 450

## Servo Drive Nameplate

### Presentation

The nameplate contains the following data:



Item	Description
1	Drive reference, page 31
2	Logic supply
3	Cable specifications
4	Certifications
5	Barcode
6	Serial number
7	Output power

Item	Description
8	Degree of protection
9	Hardware version
10	Date of manufacture

## Servo Drive Type Code

### Servo Drive Type Code

Item	1	2	3	4	5
Type code (example)	LXM	28	A	U07	M3X

Item	Meaning
1	<b>Product designation</b> LXM = Lexium
2	<b>Product type</b> 28 = AC servo drive for one axis
3	<b>Interfaces</b> A = CAN, PTI, I/O interface, commissioning via Modbus RTU
4	<b>Continuous power</b> UA5 = 0.05 kW U01 = 0.1 kW U02 = 0.2 kW U04 = 0.4 kW U07 = 0.75 kW U10 = 1 kW U15 = 1.5 kW U20 = 2 kW U30 = 3 kW U45 = 4.5 kW
5	<b>Power stage supply [Vac]</b> M1X = single phase, 100/120 Vac M3X = single phase or 3-phase, 200/230 Vac

## Drive Technical Data

### Environmental Conditions

#### Ambient Conditions During Operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and on the required power. Observe the instructions in the chapter Installation, page 104.

Description	Unit	Value
Ambient temperature without current derating (no icing, non-condensing)	°C (°F)	0...40 (32...104)
Ambient temperature with current derating of 1% per 1 °C (1.8 °F)	°C (°F)	40...55 (104...131)

The following relative humidity is permissible during operation:

Description	Unit	Value
Relative humidity (non-condensing)	%	<95

Description	Unit	Value
Installation altitude above mean sea level without current derating	m (ft)	<2000 (<6561)

## Ambient Conditions During Transportation and Storage

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


Description	Unit	Value
Temperature	°C (°F)	-25...65 (-4...149)

The following relative humidity is permissible during transportation and storage:

Description	Unit	Value
Relative humidity (non-condensing)	%	<95

## Installation Site and Connection

For operation, the device must be mounted in a closed control cabinet with a degree of protection of at least IP 54. The device may only be operated with a permanently installed connection.

 <b>DANGER</b>	
<b>ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH</b>	
Install the drive in a control cabinet or housing with a minimum IP 54 rating.	
<b>Failure to follow these instructions will result in death or serious injury.</b>	

## Pollution Degree and Degree of Protection

Description	Value
Pollution degree	2
Degree of protection	IP20

## Degree of Protection When the Safety Function Is Used

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

## ⚠ WARNING

### INOPERABLE SAFETY FUNCTION

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

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

## Vibration and Shock During Operation

Description	Value
Class as per IEC 60721-3-3	3M4 3 mm from 9...200 Hz
Maximum shock	98.1 m/s <sup>2</sup> (10 g) Type I

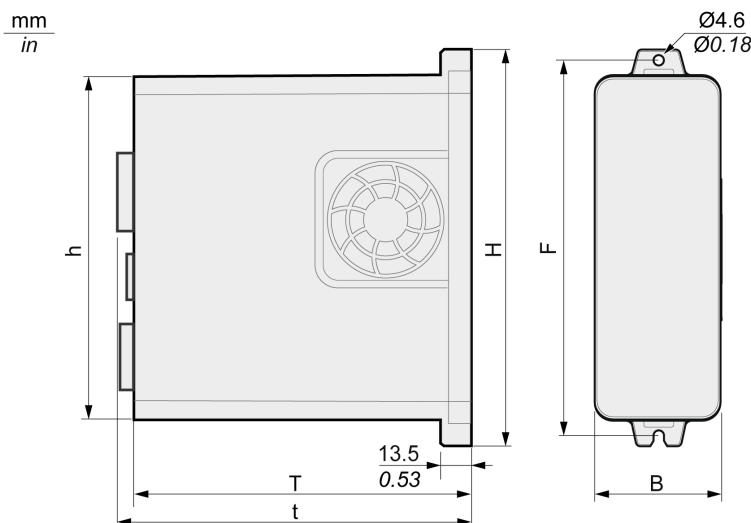
## Vibration and Shock During Transportation and Storage

Description	Value
Class as per IEC 60721-3-2	2M2 3.5 mm (2...9 Hz) 9.81 m/s <sup>2</sup> (1 g) from 9...200 Hz 14.715 m/s <sup>2</sup> (1.5 g) from 200...500 Hz 34.335 m/s <sup>2</sup> (3.5 g) from 2...9 Hz
Maximum shock	294.3 m/s <sup>2</sup> (30 g) Type II

## Dimensions

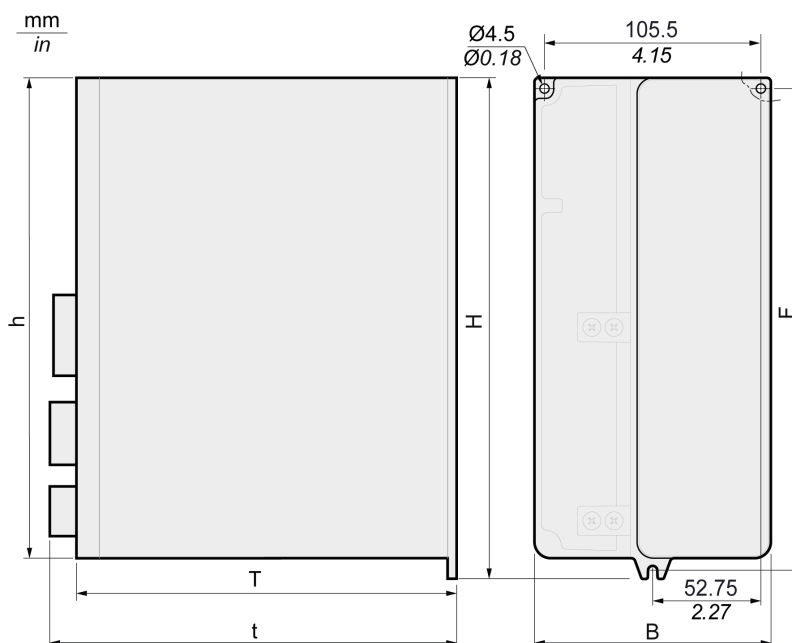
### Lexium 28A Dimensions

LXM28AUA5, LXM28AU01, LXM28AU02, LXM28AU04, LXM28AU07, LXM28AU10, LXM28AU15, LXM28AU20



LXM28A	Unit	UA5M3X, U01M3X, U02M3X, U04M3X, U07M3X	U10M3X, U15M3X UA5M1X, U01M1X, U02M1X, U04M1X, U07M1X	U20M3X
B	mm (in)	55 (2.17)	55 (2.17)	62 (2.44)
H	mm (in)	173.2 (6.82)	173.5 (6.83)	194.5 (7.66)
h	mm (in)	150 (5.91)	150 (5.91)	170 (6.69)
F	mm (in)	164 (6.46)	164 (6.46)	185 (7.28)
T	mm (in)	146 (5.75)	170 (6.69)	184 (7.24)
t	mm (in)	152.7 (6.01)	176.3 (6.94)	197 (7.76)

LXM28AU30, LXM28AU45



LXM28A	Unit	U30M3X, U45M3X
B	mm (in)	116 (4.57)
H	mm (in)	245 (9.65)
h	mm (in)	234 (9.21)
F	mm (in)	235 (9.25)
T	mm (in)	186 (7.32)
t	mm (in)	199 (7.83)

## Electrical Data

### Introduction

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

### 110 Vac Mains Voltage: Range and Tolerance

LXM28A•••M1X

Description	Unit	Value
110 Vac single-phase (LXM28A***M1X)	Vac	120 -10 % ... 120 +10 %
Frequency	Hz	50 -5 % ... 60 +5 %
Transient overvoltages	–	Overvoltage category III <sup>(1)</sup>
Rated voltage to ground	Vac	120
(1)	Depends on installation altitude, see Environmental Conditions, page 31	

## 220 Vac Mains Voltage: Range and Tolerance

### LXM28A\*\*\*M3X

Description	Unit	Value
220 Vac single-phase/three-phase (LXM28A***M3X)	Vac	200 -15 % ... 230 +10 %
Frequency	Hz	50 -5 % ... 60 +5 %
Transient overvoltages	–	Overvoltage category III <sup>(1)</sup>
Rated voltage to ground	Vac	230
(1)	Depends on installation altitude, see Environmental Conditions, page 31	

## Type of Grounding

Description	Value
TT grounding system, TN grounding system	Approved
IT mains	Not approved
Mains with grounded line conductor	Not approved

## Leakage Current

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

## Monitoring of the Continuous Output Power

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

## PWM Frequency Power Stage

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

<b>LXM28A</b>	<b>UA5, U01, U02, U04, U07, U10, U15</b>	<b>U20, U30, U45</b>
PWM frequency power stage	16 kHz	8 kHz

## Type of Cooling

<b>LXM28A</b>	<b>UA5, U01, U02</b>	<b>U04, U07, U10, U15, U20, U30, U45</b>
Type of cooling	Convection	Fan

## Permissible Drive / Motor Combinations

The BCH2 motors can be connected to the Lexium 28A drive range.

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

## Single-Phase Connection

### Electrical Data for LXM28A...M1X Drive Connected Via a Single-Phase 110 Vac

<b>LXM28A...M1X</b>	<b>Unit</b>	<b>UA5</b>	<b>U01</b>	<b>U02</b>	<b>U04</b>	<b>U07</b>
Nominal voltage	V	120 (single-phase)				
Inrush current limitation	A	8				
Maximum fuse to be connected upstream <sup>(1)</sup>	A	25				
Short-circuit current rating (SCCR)	kA	5				
Continuous output current	A <sub>rms</sub>	0.64	0.9	1.5	2.6	4.5
Peak output current	A <sub>rms</sub>	2	2.7	4.5	7.8	13.5
Nominal power <sup>(2)</sup>	W	50	100	200	400	750
Input current <sup>(2)(3)</sup>	A <sub>rms</sub>	1.2	1.8	3.6	5.7	13.5
THD (total harmonic distortion) <sup>(2)(4)</sup>	%	262.8	239.2	226.8	211.6	181.8
Power dissipation <sup>(5)</sup>	W	8	10	14	22	38
Maximum inrush current <sup>(6)</sup>	A	175				
Time for maximum inrush current	ms	0.5				

(1)	As per IEC 60269; Circuit breakers with C characteristic; See Conditions for UL 508C, page 25 for UL and CSA; Lower ratings are permissible; The fuse must be rated in such a way that the fuse does not trip at the specified input current.
(2)	At a mains impedance corresponding to the short-circuit current rating (SCCR)
(3)	At nominal power and nominal voltage
(4)	With reference to the input current
(5)	Condition: internal braking resistor not active; value at nominal current, nominal voltage, and nominal power; value approximately proportional with output current
(6)	Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time



## DC bus data for drives connected via a single-phase 110 Vac

LXM28A...M1X	Unit	UA5	U01	U02	U04	U07
Nominal voltage (single-phase)	Vac	120				
Nominal voltage DC bus	Vdc	322				
Undervoltage limit	Vdc	100				
Overvoltage limit	Vdc	420				
Maximum continuous power via DC bus	W	50	100	200	400	750
Maximum continuous power via DC bus	A	0.2	0.3	0.6	1.2	2.3

## Electrical Data for LXM28A...M3X Drive Connected Via a Single-Phase 220 Vac

LXM28A...M3X	Unit	UA5	U01	U02	U04	U07	U10	U15
Nominal voltage	V	230 (single-phase)						
Inrush current limitation	A	8						
Maximum fuse to be connected upstream <sup>(1)</sup>	A	25						
Short-circuit current rating (SCCR)	kA	5						
Continuous output current	A <sub>rms</sub>	0.64	0.9	1.5	2.6	4.5	7	7
Peak output current	A <sub>rms</sub>	2	2.7	4.5	7.8	13.5	21	21
Nominal power <sup>(2)</sup>	W	50	100	200	400	750	1000	1500
Input current <sup>(2)(3)</sup>	A <sub>rms</sub>	0.8	1.2	2.4	3.8	6	8.5	10
THD (total harmonic distortion) <sup>(2)(4)</sup>	%	262.8	239.2	226.8	211.6	181.8	176.3	166.6
Power dissipation <sup>(5)</sup>	W	8	10	14	22	38	36	41
Maximum inrush current <sup>(6)</sup>	A	175					235	
Time for maximum inrush current	ms	0.5					0.6	

(1)	As per IEC 60269; Circuit breakers with C characteristic; See Conditions for UL 508C, page 25 for UL and CSA; Lower ratings are permissible; The fuse must be rated in such a way that the fuse does not trip at the specified input current.
(2)	At a mains impedance corresponding to the short-circuit current rating (SCCR)
(3)	At nominal power and nominal voltage
(4)	With reference to the input current
(5)	Condition: internal braking resistor not active; value at nominal current, nominal voltage, and nominal power; value approximately proportional with output current
(6)	Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time

## DC bus data for drives connected via a single-phase 220 Vac

LXM28A...M3X	Unit	UA5	U01	U02	U04	U07	U10	U15
Nominal voltage (single-phase)	Vac	230						
Nominal voltage DC bus	Vdc	322						
Undervoltage limit	Vdc	160						
Overvoltage limit	Vdc	420						
Maximum continuous power via DC bus	W	50	100	200	400	750	1000	1500
Maximum continuous power via DC bus	A	0.2	0.3	0.6	1.2	2.3	3.1	4.6

## Three-Phase Connection

### Electrical Data for LXM28A··M3X Drive Connected Via Three-Phase 220 Vac

LXM28A··M3X	Unit	UA5	U01	U02	U04	U07	U10
Nominal voltage	V	230 (3-phase)					
Inrush current limitation	A	8					
Maximum fuse to be connected upstream <sup>(1)</sup>	A	25					
Short-circuit current rating (SCCR)	kA	5					
Continuous output current	A <sub>rms</sub>	0.64	0.9	1.5	2.6	4.5	7
Peak output current	A <sub>rms</sub>	2	2.7	4.5	7.8	13.5	21
Nominal power <sup>(2)</sup>	W	50	100	200	400	750	1000
Input current <sup>(2)(3)</sup>	A <sub>rms</sub>	0.42	0.74	1.25	2.2	3.9	5
THD (total harmonic distortion) <sup>(2)(4)</sup>	%	227.8	212.7	200.7	183.7	160.8	155.5
Power dissipation <sup>(5)</sup>	W	8	10	14	22	38	36
Maximum inrush current <sup>(6)</sup>	A	175					235
Time for maximum inrush current	ms	0.5					0.6
(1)	As per IEC 60269; Circuit breakers with C characteristic; See Conditions for UL 508C, page 25 for UL and CSA; Lower ratings are permissible; The fuse must be rated in such a way that the fuse does not trip at the specified input current.						
(2)	At a mains impedance corresponding to the short-circuit current rating (SCCR)						
(3)	At nominal power and nominal voltage						
(4)	With reference to the input current						
(5)	Condition: internal braking resistor not active; value at nominal current, nominal voltage, and nominal power; value approximately proportional with output current						
(6)	Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time						

LXM28A··M3X	Unit	U15	U20	U30	U45
Nominal voltage	V	230 (3-phase)			
Inrush current limitation	A	8	19.2	17	
Maximum fuse to be connected upstream <sup>(1)</sup>	A	25	32		
Short-circuit current rating (SCCR)	kA	5		22	
Continuous output current	A <sub>rms</sub>	7	12	19.8	22.8
Peak output current	A <sub>rms</sub>	21	36	60	61
Nominal power <sup>(2)</sup>	W	1500	2000	3000	4500
Input current <sup>(2)(3)</sup>	A <sub>rms</sub>	5.9	8.7	12.9	18
THD (total harmonic distortion) <sup>(2)(4)</sup>	%	144.8	137.1	155.8	147.1
Power dissipation <sup>(5)</sup>	W	41		97	
Maximum inrush current <sup>(6)</sup>	A	235	295	300	

LXM28A...M3X	Unit	U15	U20	U30	U45
Time for maximum inrush current	ms	0.6	1.0		
(1)	As per IEC 60269; Circuit breakers with C characteristic; See Conditions for UL 508C, page 25 for UL and CSA; Lower ratings are permissible; The fuse must be rated in such a way that the fuse does not trip at the specified input current.				
(2)	At a mains impedance corresponding to the short-circuit current rating (SCCR)				
(3)	At nominal power and nominal voltage				
(4)	With reference to the input current				
(5)	Condition: internal braking resistor not active; value at nominal current, nominal voltage, and nominal power; value approximately proportional with output current				
(6)	Extreme case, off/on pulse before the inrush current limitation responds, see next line for maximum time				

#### DC bus data for drives connected via three-phase 220 Vac

LXM28A...M3X	Unit	UA5	U01	U02	U04	U07	U10
Nominal voltage (three phases)	Vac	230					
Nominal voltage DC bus	Vdc	322					
Undervoltage limit	Vdc	160					
Overvoltage limit	Vdc	420					
Maximum continuous power via DC bus	W	50	100	200	400	750	1000
Maximum continuous power via DC bus	A	0.2	0.3	0.6	1.2	2.3	3.1

LXM28A...M3X	Unit	U15	U20	U30	U45
Nominal voltage (three phases)	Vac	230			
Nominal voltage DC bus	Vdc	322			
Undervoltage limit	Vdc	160			
Overvoltage limit	Vdc	420			
Maximum continuous power via DC bus	W	1500	2000	3000	4500
Maximum continuous power via DC bus	A	4.6	6.2	9.2	13.8

## Inputs / Outputs Characteristics

### Logic Type

The outputs are short-circuit protected. The inputs and outputs are galvanically isolated.

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

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

## Digital Input Signals 24 V

When wired as positive logic, the levels of the opto-isolated inputs DI1...DI5 and DI8 comply with IEC 61131-2, type 1. The electrical characteristics are also valid when wired as negative logic.

Description	Unit	Value		
"0" signal voltage	Vdc	≤5		
"1" signal voltage	Vdc	≥11		
Input current (typical)	mA	6		
Debounce time <sup>(1)</sup>	mA	0...20		
<table border="1" style="width: 100%;"> <tr> <td style="width: 15%;">(1)</td> <td>Adjustable via parameter P2-09 in increments of 1 ms.</td> </tr> </table>			(1)	Adjustable via parameter P2-09 in increments of 1 ms.
(1)	Adjustable via parameter P2-09 in increments of 1 ms.			

## Digital Output Signals 24 V

The levels of the digital 24 V output signals DO· comply with IEC 61131-2.

Description	Unit	Value
Switching voltage	Vdc	24
Maximum switching current	mA	100
Voltage drop at 100 mA load	Vdc	< 3

## Analog Input Signals

Description	Unit	Value
Voltage range	Vdc	-10...10
Input resistance, typical	kΩ	10
Resolution	Bit	12
Sampling period	μs	32.25

## Analog Output Signals

Description	Unit	Value
Voltage range	Vdc	-8...8
Output current	mA	10
Minimum load resistance (voltage source)	kΩ	1
Resolution	Bit	12
Sampling period	ms	1
Time constant	μs	10

## Touch Probe Input Signals 24 V

When wired as positive logic, the levels of the opto-isolated inputs DI6 and DI7 comply with IEC 61131-2, type 1. The electrical characteristics are also valid when wired as negative logic.

Description	Unit	Value
"0" signal voltage	Vdc	≤5
"1" signal voltage	Vdc	≥11
Input current (typical)	mA	7
Debounce time <sup>(1)</sup>	μs	0...20000
Jitter Capture	μs	1

(1)	Adjustable via parameter P2-24 in increments of 1 μs.
-----	---

## Safety Function STO

The signal inputs **STO\_0V** and **STO\_24V** (CN9) are protected against reverse polarity.

Description	Unit	Value
Nominal voltage	Vdc	24
PELV power supply unit	–	Required
"0" signal voltage <sup>(1)</sup>	Vdc	< 5
"1" signal voltage <sup>(1)</sup>	Vdc	15...30
Input current (typical)	mA	190
LXM28AUA5M3X, U01M3X, U02M3X, U04M3X, U07M3X		190
LXM28AUA5M1X, U01M1X, U02M1X, U04M1X, U07M1X		190
LXM28AU10M3X, U15M3X		190
LXM28AU20		240
LXM28AU30, U45		240
Maximum peak current	A	18
Maximum frequency for OSSD (Output Signal Switching Device) test pulses	Hz	475
Debounce time	ms	< 1
Response time of safety function STO	ms	< 40

(1)	Voltage level according to IEC 61131-2 type 2 with the exception of the operation with 15 Vdc instead of 11 Vdc. The condition between 5 Vdc and 15 Vdc is undefined and not permissible.
-----	---

For further information, refer to data for maintenance plan and the calculation for the safety function, page 85.

## 24 Vdc Power Supply (Pin 17):

24 Vdc power supply (pin 17):

Description	Unit	Value
Output voltage	Vdc	24
Maximum output current	mA	200

### CAN Bus Signals:

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

### ESIM Output Signals

The ESIM output signals comply with the RS422 interface specification.

Description	Unit	Value
Logic level	–	As per RS422 <sup>(1)</sup>
Output frequency per signal	kHz	800
Maximum output frequency (quadruple evaluation)	kHz	3200

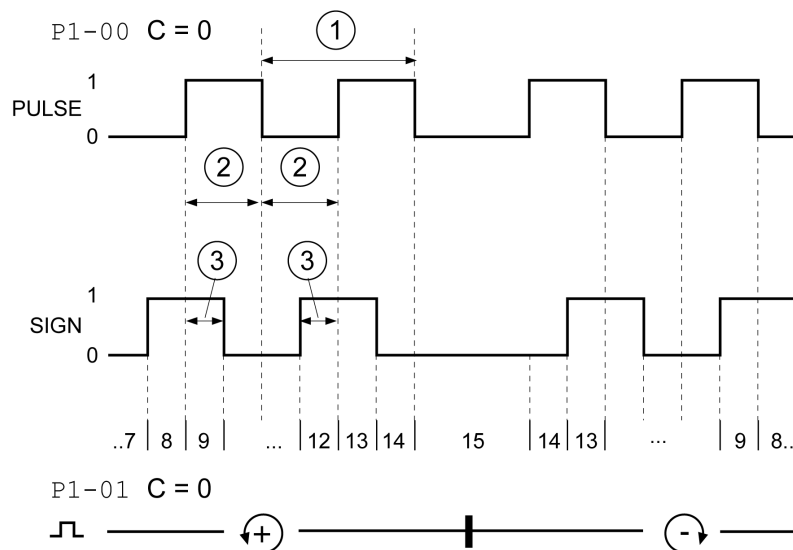
(1)	Due to the input current of the optocoupler in the input circuit, a parallel connection of a driver output to several devices is not permitted.
-----	---

### Function A/B Signals

External A/B signals can be supplied via the PTI input as reference values in operating mode Pulse Train (Pt).

Signal	Function
Signal SIGN before signal PULSE	Movement in positive direction
Signal PULSE before signal SIGN	Movement in negative direction

Time chart with A/B signal, counting forwards and backwards



The signal shape shown relates to the factory setting (P1-00 C=0). The direction of movement shown relates to the factory setting (P1-01 C=0).

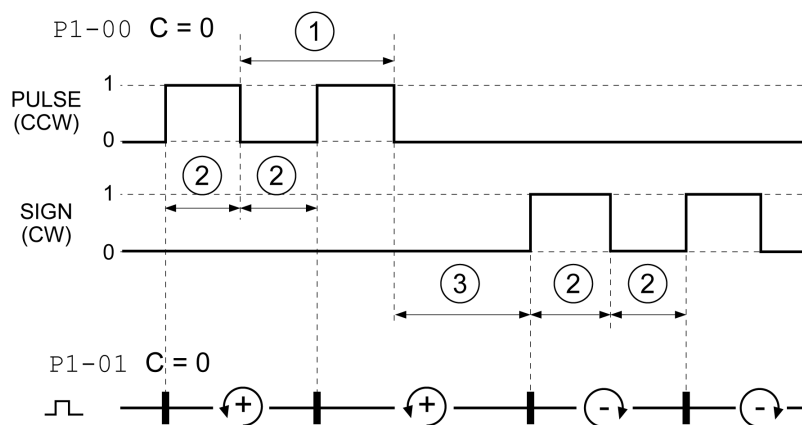
Intervals (minimum)	HPULSE / HSIGN with RS422	PULSE / SIGN with RS422	PULSE / SIGN with Open Collector
1	4 MHz	500 kHz	200 kHz
2	0.125 µs	0.1 µs	2.5 µs
3	0.0625 µs	0.5 µs	1.25 µs

## Function CW/CCW

External CW/CCW signals can be supplied via the PTI input as reference values.

Signal	Function
Signal PULSE (CCW)	Movement in positive direction
Signal SIGN (CW)	Movement in negative direction

Time chart with "CW/CCW"



The signal shape shown relates to the factory setting (P1-00 C=0). The direction of movement shown relates to the factory setting (P1-01 C=0).

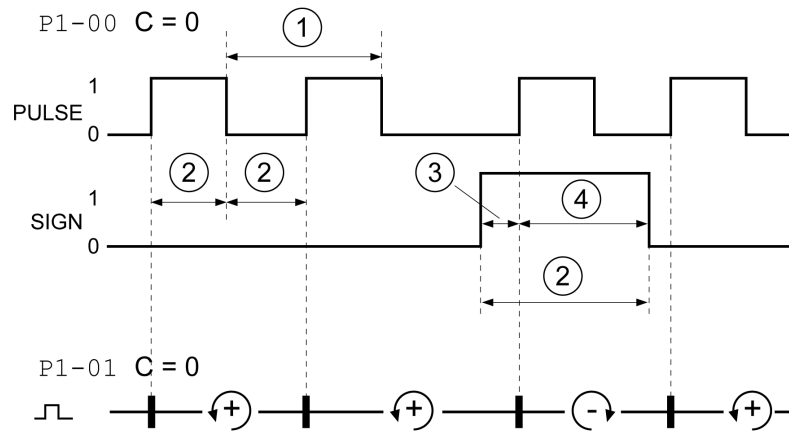
Intervals (minimum)	HPULSE / HSIGN with RS422	PULSE / SIGN with RS422	PULSE / SIGN with Open Collector
1	4 MHz	500 kHz	200 kHz
2	0.125 µs	0.1 µs	2.5 µs
3	0.0625 µs	0.5 µs	1.25 µs

## Function P/D

External P/D signals can be supplied via the PTI input as reference values.

Signal	Function
Signal PULSE	Motor movement
Signal SIGN	Direction of movement

Time chart with pulse/direction signal



The signal shape shown relates to the factory setting (P1-00 C=0). The direction of movement shown relates to the factory setting (P1-01 C=0).

Intervals (minimum)	HPULSE / HSIGN with RS422	PULSE / SIGN with RS422	PULSE / SIGN with Open Collector
1	4 MHz	500 kHz	200 kHz
2	0.125 $\mu$ s	0.1 $\mu$ s	2.5 $\mu$ s
3	0.0625 $\mu$ s	0.5 $\mu$ s	1.25 $\mu$ s
4	0.0625 $\mu$ s	0.5 $\mu$ s	1.25 $\mu$ s



# Motor

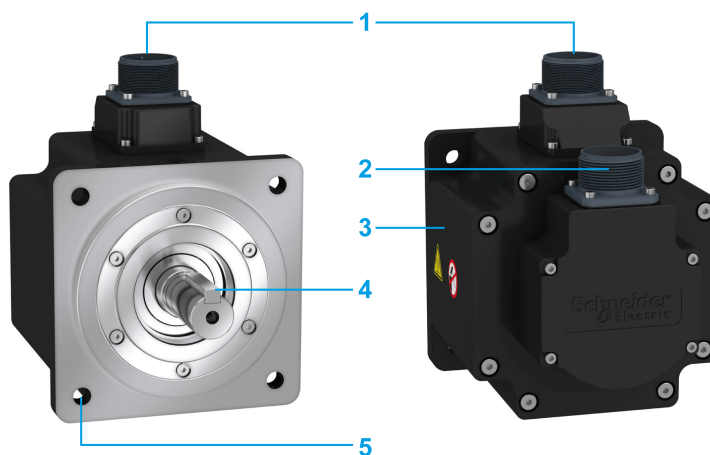
## What's in This Chapter

General Overview .....45  
 Motor Technical Data .....49  
 BCH2MB Motor .....52  
 BCH2LD Motor .....55  
 BCH2-F Motor .....57  
 BCH2LH Motor .....60  
 BCH2-M Motor .....62  
 BCH2-R Motor .....66

## General Overview

### Components and Interfaces

#### Presentation



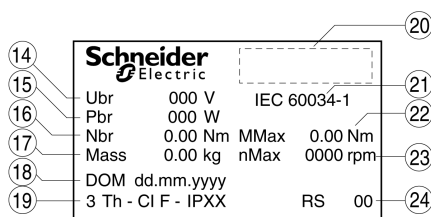
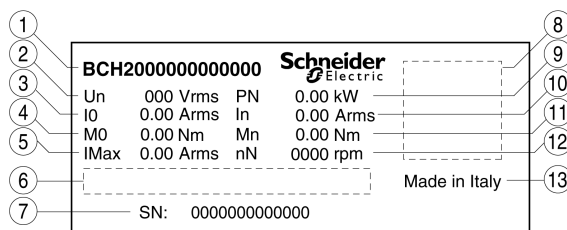
BCH2 servo motors, with a 3-phase stator and rotor with rare earth-based permanent magnets, consist of:

Item	Description
1	Connector of the motor cable, page 73
2	Connector of the encoder cable, page 74
3	Housing
4	Smooth or keyed shaft end, depending on the motor reference
5	4-point axial mounting flange

# Servo Motor Nameplate

## BCH2-B

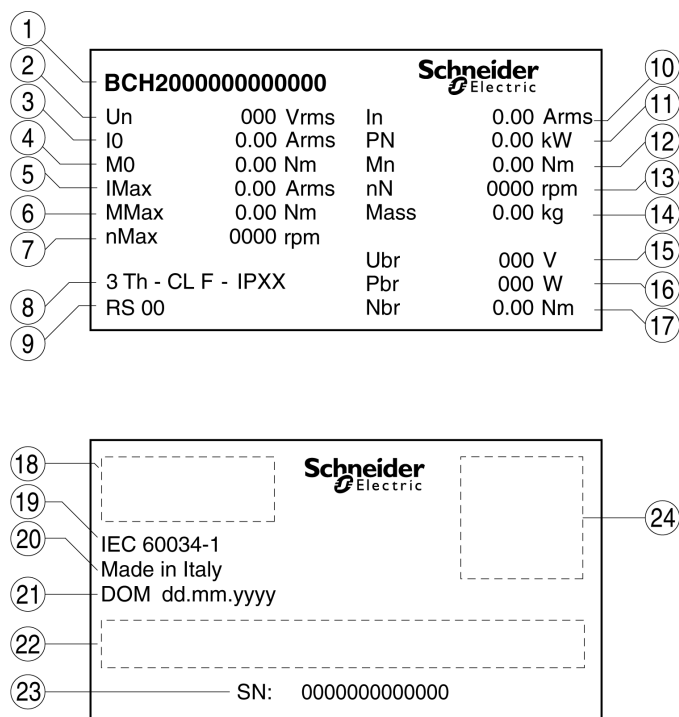
The nameplate contains the following data:



Item	Description	Item	Description
1	Motor reference, page 47	13	Country of manufacture
2	Nominal voltage	14	Nominal voltage of the holding brake (optional)
3	Continuous stall current	15	Nominal power of the holding brake (optional)
4	Continuous stall torque	16	Nominal torque of the holding brake (optional)
5	Maximum current	17	Mass
6	Barcode	18	Date of manufacture DOM
7	Serial number	19	Number of motor phases, temperature class, degree of protection
8	QR code	20	Certifications
9	Nominal power	21	Applied standard
10	Nominal current	22	Peak torque
11	Nominal torque	23	Maximum permissible speed of rotation
12	Nominal speed of rotation	24	Hardware version

## BCH2-D, BCH2-F, BCH2-H, BCH2-M, and BCH2-R

The nameplate contains the following data:



Item	Description	Item	Description
1	Motor reference, page 47	13	Nominal speed of rotation
2	Nominal voltage	14	Mass
3	Continuous stall current	15	Nominal voltage of the holding brake (optional)
4	Continuous stall torque	16	Nominal power of the holding brake (optional)
5	Maximum current	17	Nominal torque of the holding brake (optional)
6	Peak torque	18	Certifications
7	Maximum permissible speed of rotation	19	Applied standard
8	Number of motor phases, temperature class, degree of protection	20	Country of manufacture
9	Hardware version	21	Date of manufacture DOM
10	Nominal current	22	Barcode
11	Nominal power	23	Serial number
12	Nominal torque	24	QR code

## Servo Motor Type Code

### Servo Motor Type Code

Item	1	2	3	4	5	6	7	8	9	10
Type code (example)	BC-H2	M	B	01	3	3	C	A	5	C

Item	Meaning	
1	<b>Product family</b> BCH2 = Brushless servo motors - second generation	
2	<b>Moment of inertia</b> L = Low M = Medium H = High	
3	<b>Size (housing)</b> B = 40 mm flange D = 60 mm flange F = 80 mm flange H = 100 mm flange M = 130 mm flange R = 180 mm flange	
4	<b>Nominal power</b> A5 = 50 W 01 = 100 W 02 = 200 W 03 = 300 W 04 = 400 W 05 = 500 W 06 = 600 W 07 = 750 W 08 = 850 W 09 = 900 W	10 = 1.0 kW 13 = 1.3 kW 15 = 1.5 kW 20 = 2.0 kW 30 = 3.0 kW 35 = 3.5 kW 45 = 4.5 kW
5	<b>Winding</b> 1 = Optimized in terms of torque (1000 rpm/1500 rpm) 2 = Optimized in terms of torque and speed of rotation (2000 rpm) 3 = Optimized in terms of speed of rotation (3000 rpm)	
6	<b>Shaft and degree of protection<sup>(1)</sup></b> 0 = Smooth shaft; degree of protection: shaft IP 54, housing IP 65 <sup>(2)</sup> 1 = Parallel key; degree of protection: shaft IP 54, housing IP 65 <sup>(2)</sup> 2 = Smooth shaft; degree of protection: shaft and housing IP 65 3 = Parallel key; degree of protection: shaft and housing IP 65	
7	<b>Encoder system</b> C = High-resolution encoder single-turn M = High-resolution encoder multi-turn	
8	<b>Holding brake</b> A = Without holding brake F = With holding brake	
9	<b>Connection version</b> 5 = Flying leads (for BCH2-B, BCH2-D, BCH2-F) 6 = MIL connector (for BCH2-H, BCH2-M, BCH2-R)	

Item	Meaning
10	<b>Mechanical interface - mounting</b> C = Asian style
<p>(1) In the case of mounting position IM V3 (drive shaft vertical, shaft end up), the motor has degree of protection IP 50.</p> <p>(2) Only available with single-turn encoder, up to 4.5 kW.</p>	

## Motor Technical Data

### Environmental Conditions

#### Ambient Conditions During Operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and on the required power. Observe the instructions in the chapter Installation, page 139.

Description	Unit	Value
Ambient temperature <sup>(1)</sup> for motors without holding brake (no icing, non-condensing).	°C (°F)	-20...40 (-4...104)
Ambient temperature for motors with holding brake (no icing, non-condensing).	°C (°F)	0...40 (32...104)
Ambient temperature with current derating of 1% per °C (per 1.8 °F)	°C (°F)	40...60 (104...140)
Relative humidity (non-condensing)	%	5...85
Class as per IEC 60721-3-3	-	3K3, 3Z12, 3Z2, 3B2, 3C1, 3M6 <sup>(2)</sup>
Installation altitude above mean sea level without current derating	m (ft)	<1000 (<3281)
Installation altitude above mean sea level with current derating of 1% per 100 m at altitudes higher than 1000 m	m (ft)	1000...3000 (3281...9843)
(1)	Limit values with flanged motor, see Flange Sizes for Limit Values, page 49	
(2)	Tested as per IEC 60068-2-6 and IEC 60068-2-27	

#### Ambient Conditions During Transportation and Storage

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

Description	Unit	Value
Temperature	°C (°F)	-40...70 (-40...158)
Relative humidity (non-condensing)	%	≤75
Set of class combinations as per IEC 60721-3-2	-	IE 21

### Flange Sizes for Limit Values

Limit values referring to this table relate to flanged motors with the following flange sizes:

Motor	Flange material	Flange size in [mm (in)]
BCH2MB	Aluminum	185 x 185 x 8 (7.28 x 7.28 x 0.31)
BCH2LD	Aluminum	250 x 250 x 12 (9.84 x 9.84 x 0.47)
BCH2-F	Aluminum	250 x 250 x 12 (9.84 x 9.84 x 0.47)
BCH2LH	Steel	300 x 300 x 20 (11.8 x 11.8 x 0.79)
BCH2-M	Steel	400 x 400 x 20 (15.7 x 15.7 x 0.79)
BCH2-R	Steel	550 x 550 x 20 (21.7 x 21.7 x 0.79)

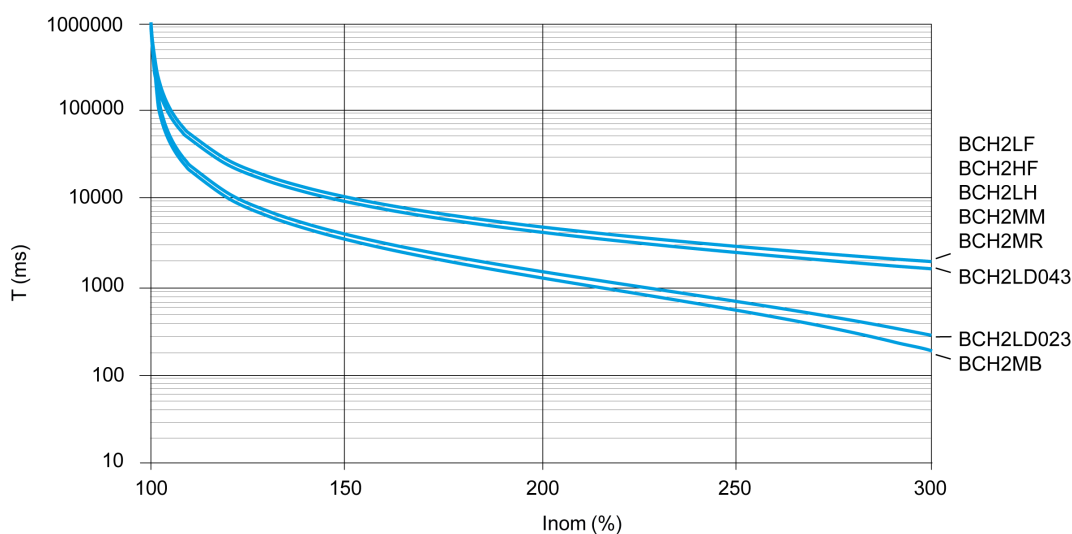
## Compatibility with Foreign Substances

The motor has been tested for compatibility with many known substances and with the latest available knowledge at the moment of the design. Nonetheless, you must perform a compatibility test before using a foreign substance.

## Tightening Torque and Property Class of Screws

Housing screws	Unit	Tightening torque
M3 x 0.50	Nm (lb.in)	1 (8.85)
M4 x 0.70	Nm (lb.in)	2.9 (25.67)
M5 x 0.80	Nm (lb.in)	5.9 (52.22)
M6 x 1.00	Nm (lb.in)	9.9 (87.62)
M7 x 1.25	Nm (lb.in)	24 (212.40)
M8 x 1.50	Nm (lb.in)	49 (433.65)
Property class of the screws	H	8.8

## Overload Characteristics Curves



In order to make old MFOLD and new MFOLD be compatible, add new P parameter *P2-71* to active new fold back algorithm. If you want to increase the

overload capacity, you can set MFOLD level by new parameter *P2-73* (1~4), default value is 1. The corresponding MFOLDT value is displayed in *P2-72* (see New Motor Fold Back Characteristics and Parameter Setting, page 376).

## Encoder Technical Data

### Overview

The drive can access the electronic nameplate via the electronic interface of the encoder for easy commissioning.

The signals meet the PELV requirements.

Depending on the motor reference, the motor are delivered with a single-turn encoder or a multi-turn encoder.

### Single-Turn Encoder

#### Technical data

Description	Value
Measuring range absolute	1 revolution
Resolution in increments	Depending on evaluation
Accuracy of position	$\pm 0.044^\circ$
Supply voltage	4.1...5.25 Vdc
Maximum supply current	100 mA
Maximum permissible speed of rotation	6000 rpm
Maximum angular acceleration	100,000 rad/s <sup>2</sup>

### Multi-Turn Encoder

#### Technical data

Description	Value
Measuring range absolute	1 revolution
Resolution in increments	Depending on evaluation
Accuracy of position	$\pm 0.044^\circ$
Supply voltage	4.1...5.25 Vdc
Maximum supply current	40 $\mu$ A
Maximum permissible speed of rotation	6000 rpm
Maximum angular acceleration	100,000 rad/s <sup>2</sup>
Battery nominal voltage	3.6 Vdc
Battery nominal current consumption while the encoder is not powered by the drive	20 $\mu$ A at standstill 40 $\mu$ A with rotating shaft
Battery life time (at 25 °C)	3 years

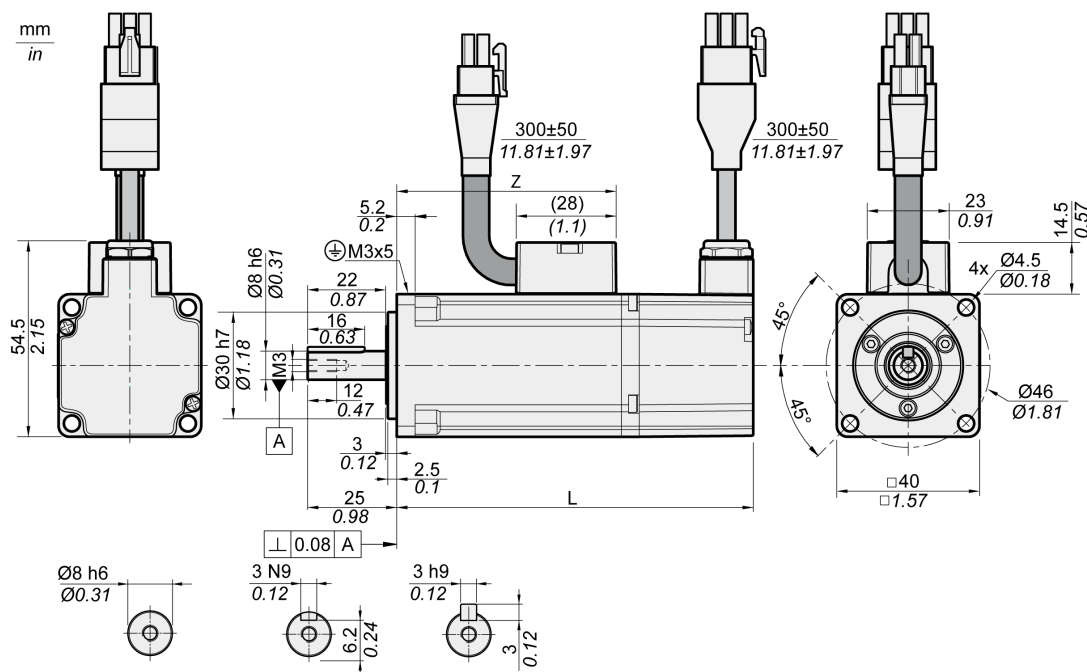
The multi-turn counting is preserved through power down by an external battery.

- For further information on the battery compartment connection, refer to the motor encoder connection, page 121.

- For further information on the battery replacement, refer to the maintenance of the motor, page 382.

## BCH2MB Motor

### BCH2MB Dimensions



BCH2MB	Unit	A5	01
L (without holding brake)	mm (in)	82 (3.23)	100 (3.94)
L (with holding brake)	mm (in)	112 (4.41)	130 (5.12)
Z	mm (in)	43.5 (1.71)	61.5 (2.42)

### BCH2MB Characteristics Table

BCH2MB <sup>(1)</sup>			A53	013
<b>Technical data - general</b>				
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	0.16	0.32
Peak torque	M <sub>max</sub>	Nm	0.48	0.96
With supply voltage U <sub>n</sub> = 230 Vac				
Nominal speed of rotation	n <sub>N</sub>	rpm	3000	3000
Nominal torque	M <sub>N</sub>	Nm	0.16	0.32
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	0.59	0.89
Nominal power	P <sub>N</sub>	kW	0.05	0.10
<b>Technical data - electrical</b>				
Maximum winding voltage	U <sub>max</sub>	Vac	255	255
Maximum winding voltage	U <sub>max</sub>	Vdc	360	360
Maximum voltage to ground	–	Vac	255	255
Maximum Current	I <sub>max</sub>	A <sub>rms</sub>	1.8	2.7

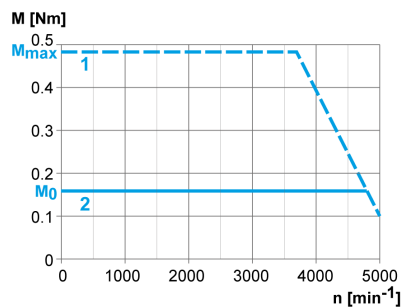


BCH2MB <sup>(1)</sup>			A53	013	
Continuous stall current	$I_0$	$A_{rms}$	0.54	0.81	
Voltage constant <sup>(3)</sup>	$k_{E\text{U-V}}$	$V_{rms}$	18	24	
Torque constant <sup>(4)</sup>	$k_t$	Nm/A	0.30	0.40	
Winding resistance	$R_{20\text{U-V}}$	$\Omega$	31.0	23.4	
Winding inductance	$L_{\text{qU-V}}$	mH	26.4	21.5	
Winding inductance	$L_{\text{dU-V}}$	mH	24.7	20.6	
<b>Technical data - mechanical</b>					
Maximum permissible speed of rotation	$n_{max}$	rpm	5000	5000	
Rotor inertia without brake	Hardware version RS 01 or RS 2	$J_M$	kgcm <sup>2</sup>	0.054	0.075
	Hardware version RS 03			0.044	0.065
Rotor inertia with brake	Hardware version RS 01 or RS 2	$J_M$	kgcm <sup>2</sup>	0.055	0.076
	Hardware version RS 03			0.045	0.066
Mass without brake	$m$	kg	0.40	0.56	
Mass with brake	$m$	kg	0.60	0.77	
Degree of protection of the shaft	–	–	IP 65	IP 65	
Degree of protection of the housing	–	–	IP 65	IP 65	
<b>Technical data - holding brake</b>					
Holding torque	–	Nm	0.32	0.32	
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%	
Nominal power (electrical pull-in power)	–	W	4.4	4.4	
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>• Flange material: Aluminum</li> <li>• Flange size in mm (in): 185 x 185 x 8 (7.28 x 7.28 x 0.31)</li> </ul>				
(2)	$M_0$ = Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %.				
(3)	RMS value at 1000 rpm and 20 °C (68 °F).				
(4)	At $n = 20$ rpm and 20 °C (68 °F).				

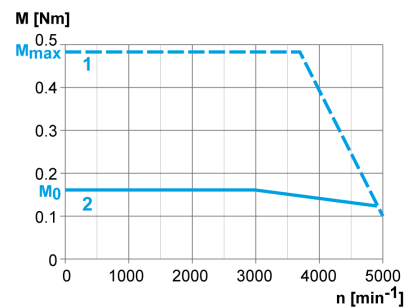
# BCH2MB Curves

## BCH2MBA53 + LXM28AU5

Without shaft sealing ring



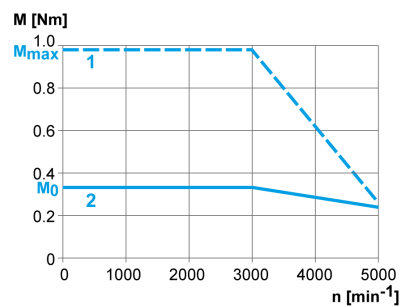
With shaft sealing ring



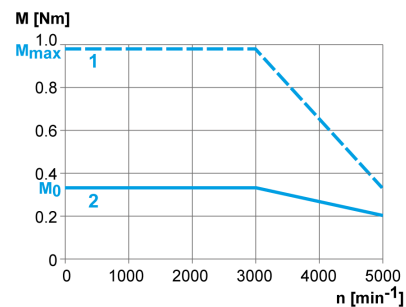
(1)	Peak torque
(2)	Continuous torque

## BCH2MB013 + LXM28AU01

Without shaft sealing ring



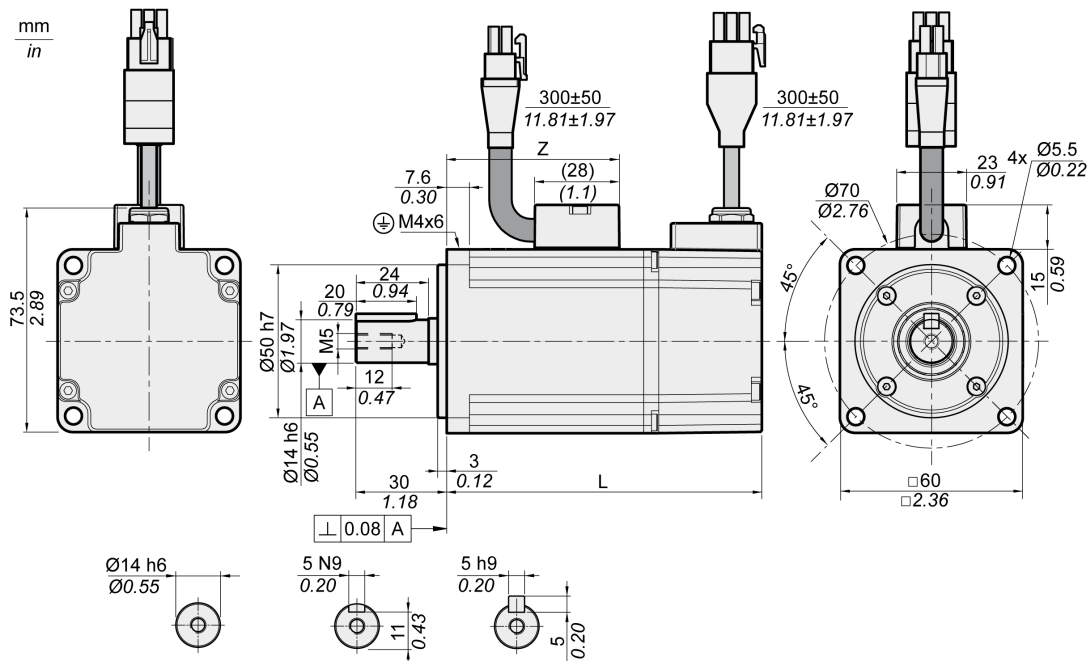
With shaft sealing ring



(1)	Peak torque
(2)	Continuous torque

# BCH2LD Motor

## BCH2LD Dimensions



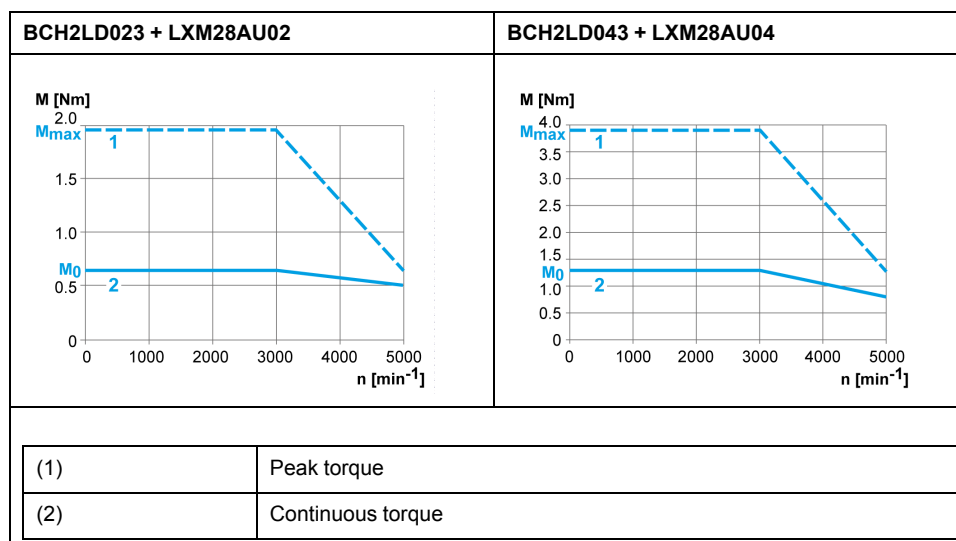
BCH2LD	Unit	02	04
L (without holding brake)	mm (in)	104 (4.09)	129 (5.08)
L (with holding brake)	mm (in)	140 (5.51)	165 (6.5)
Z	mm (in)	57 (2.24)	82 (3.23)

## BCH2LD Characteristics Table

BCH2LD <sup>(1)</sup>			023	043
<b>Technical data - general</b>				
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	0.64	1.27
Peak torque	M <sub>max</sub>	Nm	1.92	3.81
With supply voltage U <sub>n</sub> = 230 Vac				
Nominal speed of rotation	n <sub>N</sub>	rpm	3000	3000
Nominal torque	M <sub>N</sub>	Nm	0.64	1.27
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	1.30	2.50
Nominal power	P <sub>N</sub>	kW	0.20	0.40
<b>Technical data - electrical</b>				
Maximum winding voltage	U <sub>max</sub>	Vac	255	255
Maximum winding voltage	U <sub>max</sub>	Vdc	360	360
Maximum voltage to ground	–	Vac	255	255
Maximum Current	I <sub>max</sub>	A <sub>rms</sub>	4.5	7.8
Continuous stall current	I <sub>0</sub>	A <sub>rms</sub>	1.11	2.19

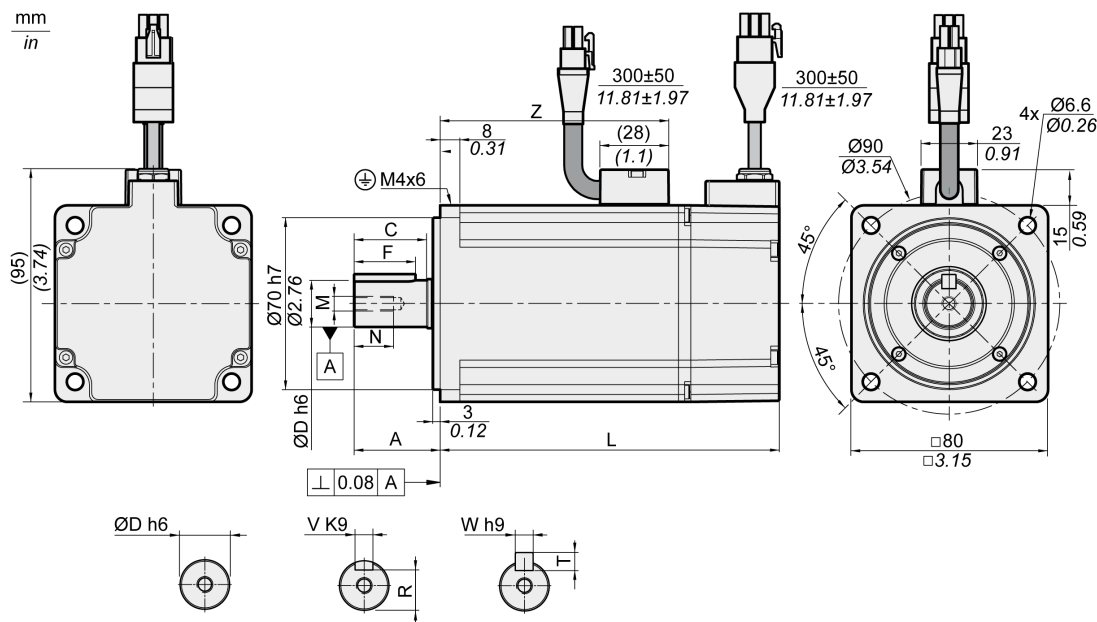
BCH2LD <sup>(1)</sup>			023	043
Voltage constant <sup>(3)</sup>	$k_{EU-V}$	$V_{rms}$	35	35
Torque constant <sup>(4)</sup>	$k_t$	Nm/A	0.58	0.58
Winding resistance	$R_{20U-V}$	$\Omega$	12.2	5.2
Winding inductance	$L_{qU-V}$	mH	24.8	12.5
Winding inductance	$L_{dU-V}$	mH	22.7	12.0
<b>Technical data - mechanical</b>				
Maximum permissible speed of rotation	$n_{max}$	rpm	5000	5000
Rotor inertia without brake	$J_M$	kgcm <sup>2</sup>	0.15	0.26
Rotor inertia with brake	$J_M$	kgcm <sup>2</sup>	0.16	0.27
Mass without brake	m	kg	1.02	1.45
Mass with brake	m	kg	1.50	2.00
Degree of protection of the shaft	–	–	IP 65	IP 65
Degree of protection of the housing	–	–	IP 65	IP 65
<b>Technical data - holding brake</b>				
Holding torque	–	Nm	1.3	1.3
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%
Nominal power (electrical pull-in power)	–	W	11.2	11.2
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>Flange material: Aluminum</li> <li>Flange size in mm (in): 250 x 250 x 12 (9.84 x 9.84 x 0.47)</li> </ul>			
(2)	$M_0$ =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %			
(3)	RMS value at 1000 rpm and 20 °C (68 °F).			
(4)	At $n = 20$ rpm and 20 °C (68 °F).			

## BCH2LD Curves



# BCH2-F Motor

## BCH2-F Dimensions



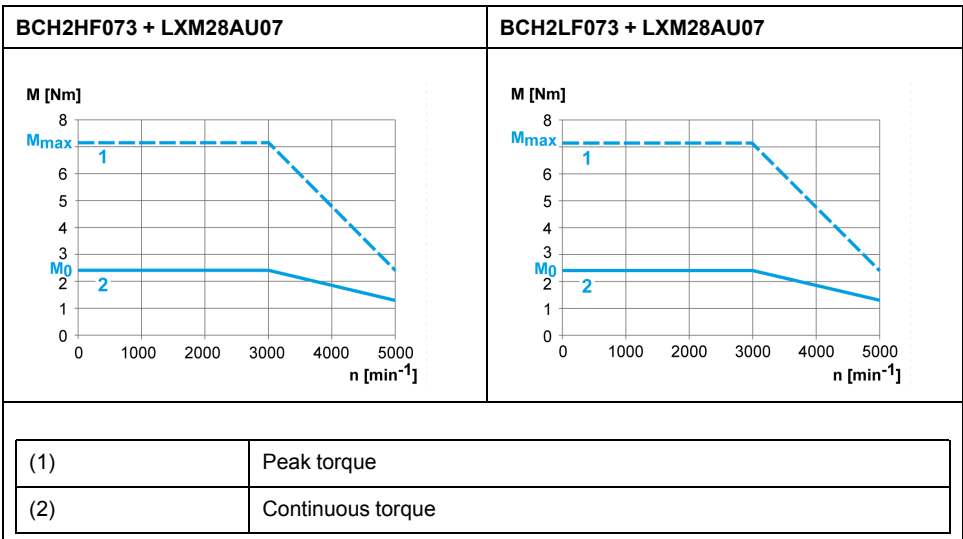
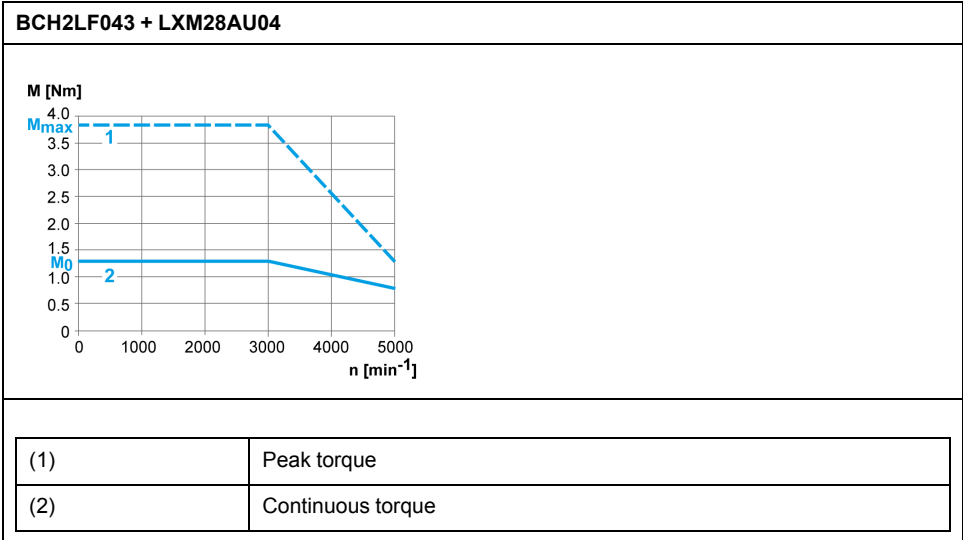
BCH2	Unit	LF04	HF07	LF07
L (without holding brake)	mm (in)	112 (4.41)	138 (5.43)	138 (5.43)
L (with holding brake)	mm (in)	152 (5.98)	178 (7.01)	178 (7.01)
A	mm (in)	30 (1.18)	35 (1.38)	35 (1.38)
C	mm (in)	24.5 (0.96)	29.5 (1.16)	29.5 (1.16)
D	mm (in)	14 (0.55)	19 (0.75)	19 (0.75)
F	mm (in)	20 (0.79)	25 (0.98)	25 (0.98)
M	-	M5	M6	M6
N	mm (in)	12 (0.47)	16 (0.63)	16 (0.63)
R	mm (in)	11 (0.43)	15.5 (0.61)	15.5 (0.61)
T	mm (in)	5 (0.2)	6 (0.24)	6 (0.24)
V	mm (in)	5 (0.2)	6 (0.24)	6 (0.24)
W	mm (in)	5 (0.2)	6 (0.24)	6 (0.24)
Z	mm (in)	68 (2.68)	93 (3.66)	93 (3.66)

## BCH2-F Characteristics Table

BCH2 <sup>(1)</sup>			LF043	HF073	LF073
<b>Technical data - general</b>					
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	1.27	2.39	2.39
Peak torque	M <sub>max</sub>	Nm	3.81	7.16	7.16
With supply voltage U <sub>n</sub> = 230 Vac					
Nominal speed of rotation	n <sub>N</sub>	rpm	3000	3000	3000

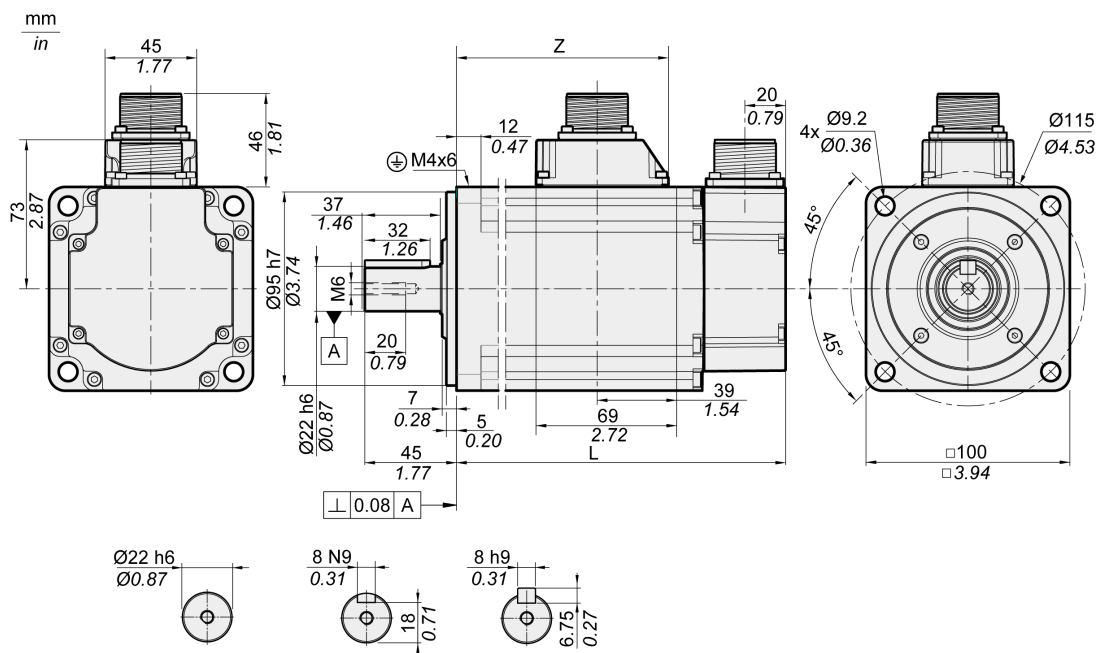
BCH2 <sup>(1)</sup>			LF043	HF073	LF073
Nominal torque	M <sub>N</sub>	Nm	1.27	2.39	2.39
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	2.52	4.29	4.29
Nominal power	P <sub>N</sub>	kW	0.40	0.75	0.75
<b>Technical data - electrical</b>					
Maximum winding voltage	U <sub>max</sub>	Vac	255	255	255
Maximum winding voltage	U <sub>max</sub>	Vdc	360	360	360
Maximum voltage to ground	–	Vac	255	255	255
Maximum Current	I <sub>max</sub>	A <sub>rms</sub>	7.8	13.5	13.5
Continuous stall current	I <sub>0</sub>	A <sub>rms</sub>	2.29	4.01	4.01
Voltage constant <sup>(3)</sup>	k <sub>E</sub> U-V	V <sub>rms</sub>	33.5	36	36
Torque constant <sup>(4)</sup>	k <sub>t</sub>	Nm/A	0.55	0.60	0.60
Winding resistance	R <sub>20U-V</sub>	Ω	3.20	1.50	1.50
Winding inductance	L <sub>qu-v</sub>	mH	12.0	6.6	6.6
Winding inductance	L <sub>dU-v</sub>	mH	11.3	6.1	6.1
<b>Technical data - mechanical</b>					
Maximum permissible speed of rotation	n <sub>max</sub>	rpm	5000	5000	5000
Rotor inertia without brake	J <sub>M</sub>	kgcm <sup>2</sup>	0.66	1.53	1.18
Rotor inertia with brake	J <sub>M</sub>	kgcm <sup>2</sup>	0.71	1.58	1.23
Mass without brake	m	kg	2.00	2.90	2.80
Mass with brake	m	kg	2.80	3.70	3.60
Degree of protection of the shaft	–	–	IP 65	IP 65	IP 65
Degree of protection of the housing	–	–	IP 65	IP 65	IP 65
<b>Technical data - holding brake</b>					
Holding torque	–	Nm	2.5	2.5	2.5
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%	24 +/-10%
Nominal power (electrical pull-in power)	–	W	10.2	10.2	10.2
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>• Flange material: Aluminum</li> <li>• Flange size in mm (in): 250 x 250 x 12 (9.84 x 9.84 x 0.47)</li> </ul>				
(2)	M <sub>0</sub> =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %				
(3)	RMS value at 1000 rpm and 20 °C (68 °F).				
(4)	At n = 20 rpm and 20 °C (68 °F).				

# BCH2-F Curves



# BCH2LH Motor

## BCH2LH Dimensions



BCH2LH	Unit	103	203
L (without holding brake)	mm (in)	153.5 (6.04)	198.5 (7.81)
L (with holding brake)	mm (in)	180.5 (7.11)	225.5 (8.88)
Z	mm (in)	96 (3.78)	141 (5.55)

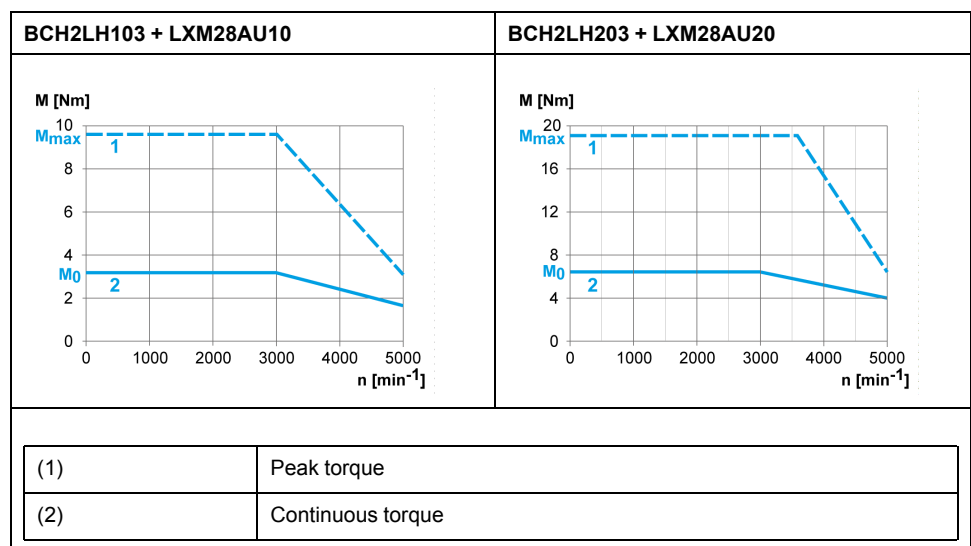
## BCH2LH Characteristics Table

BCH2LH <sup>(1)</sup>			103	203
<b>Technical data - general</b>				
Continuous stall torque <sup>(2)</sup>	$M_0$	Nm	3.18	6.37
Peak torque	$M_{max}$	Nm	9.54	19.11
With supply voltage $U_n = 230$ Vac				
Nominal speed of rotation	$n_N$	rpm	3000	3000
Nominal torque	$M_N$	Nm	3.18	6.37
Nominal Current	$I_N$	$A_{rms}$	6.64	10.27
Nominal power	$P_N$	kW	1.00	2.00
<b>Technical data - electrical</b>				
Maximum winding voltage	$U_{max}$	Vac	255	255
Maximum winding voltage	$U_{max}$	Vdc	360	360
Maximum voltage to ground	–	Vac	255	255
Maximum Current	$I_{max}$	$A_{rms}$	20.0	35.0
Continuous stall current	$I_0$	$A_{rms}$	5.83	9.87



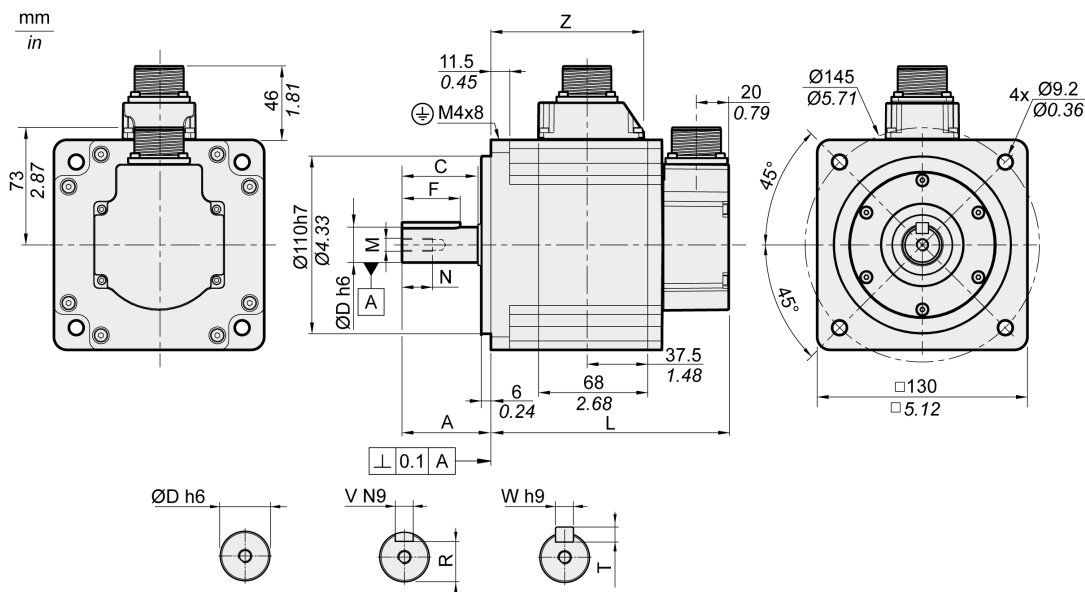
BCH2LH <sup>(1)</sup>			103	203
Voltage constant <sup>(3)</sup>	$k_E$ U-V	$V_{rms}$	33	39
Torque constant <sup>(4)</sup>	$k_t$	Nm/A	0.55	0.65
Winding resistance	$R_{20U-V}$	$\Omega$	0.67	0.36
Winding inductance	$L_{qu-v}$	mH	4.3	2.6
Winding inductance	$L_d$ U-V	mH	4.20	2.59
<b>Technical data - mechanical</b>				
Maximum permissible speed of rotation	$n_{max}$	rpm	5000	5000
Rotor inertia without brake	$J_M$	kgcm <sup>2</sup>	2.39	4.27
Rotor inertia with brake	$J_M$	kgcm <sup>2</sup>	2.44	4.34
Mass without brake	m	kg	4.60	6.70
Mass with brake	m	kg	5.10	7.20
Degree of protection of the shaft	-	-	IP 65	IP 65
Degree of protection of the housing	-	-	IP 65	IP 65
<b>Technical data - holding brake</b>				
Holding torque	-	Nm	6.5	6.5
Nominal voltage	-	Vdc	24 +/-10%	24 +/-10%
Nominal power (electrical pull-in power)	-	W	10.4	10.4
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>Flange material: Steel</li> <li>Flange size in mm (in): 300 x 300 x 20 (11.8 x 11.8 x 0.79)</li> </ul>			
(2)	$M_0$ =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %			
(3)	RMS value at 1000 rpm and 20 °C (68 °F).			
(4)	At $n = 20$ rpm and 20 °C (68 °F).			

## BCH2LH Curves



# BCH2-M Motor

## BCH2-M Dimensions



BCH2-M	Unit	08	03, 05, 06, 10	09, 15	20
L (without holding brake)	mm (in)	187 (7.36)	147 (5.79)	163 (6.42)	187 (7.36)
L (with holding brake)	mm (in)	216 (8.5)	176 (6.93)	192 (7.56)	216 (8.5)
A	mm (in)	48 (1.89)	55 (2.17)	55 (2.17)	55 (2.17)
C	mm (in)	40 (1.57)	47 (1.85)	47 (1.85)	47 (1.85)
D	mm (in)	19 (0.75)	22 (0.87)	22 (0.87)	22 (0.87)
F	mm (in)	25 (0.98)	36 (1.42)	36 (1.42)	36 (1.42)
M	-	M6	M8	M8	M8
N	mm (in)	16 (0.63)	19 (0.75)	19 (0.75)	19 (0.75)
R	mm (in)	15.5 (0.61)	18 (0.71)	18 (0.71)	18 (0.71)
T	mm (in)	6 (0.24)	7 (0.28)	7 (0.28)	7 (0.28)
V	mm (in)	6 (0.24)	8 (0.31)	8 (0.31)	8 (0.31)
W	mm (in)	6 (0.24)	8 (0.31)	8 (0.31)	8 (0.31)
Z	mm (in)	134.5 (5.30)	94.5 (3.72)	110.5 (4.35)	134.5 (5.30)

## BCH2-M Characteristics Table

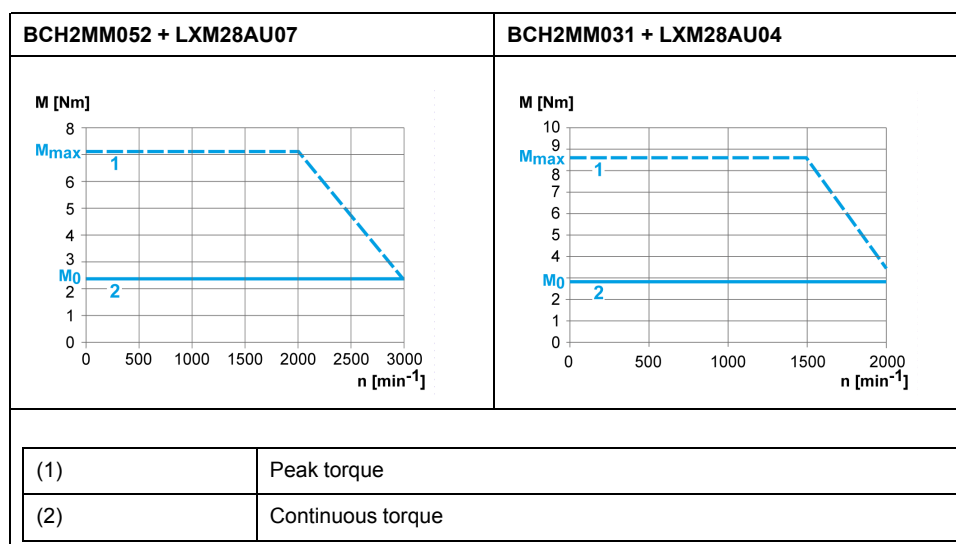
BCH2 <sup>(1)</sup>			MM052	MM031	MM102	HM102	MM081
<b>Technical data - general</b>							
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	2.39	2.86	4.77	4.77	5.39
Peak torque	M <sub>max</sub>	Nm	7.16	8.59	14.30	14.30	13.80
With supply voltage U <sub>n</sub> = 230 Vac							
Nominal speed of rotation	n <sub>N</sub>	rpm	2000	1000	2000	2000	1500
Nominal torque	M <sub>N</sub>	Nm	2.39	2.86	4.77	4.77	5.39
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	3.24	2.09	6.29	6.29	6.29

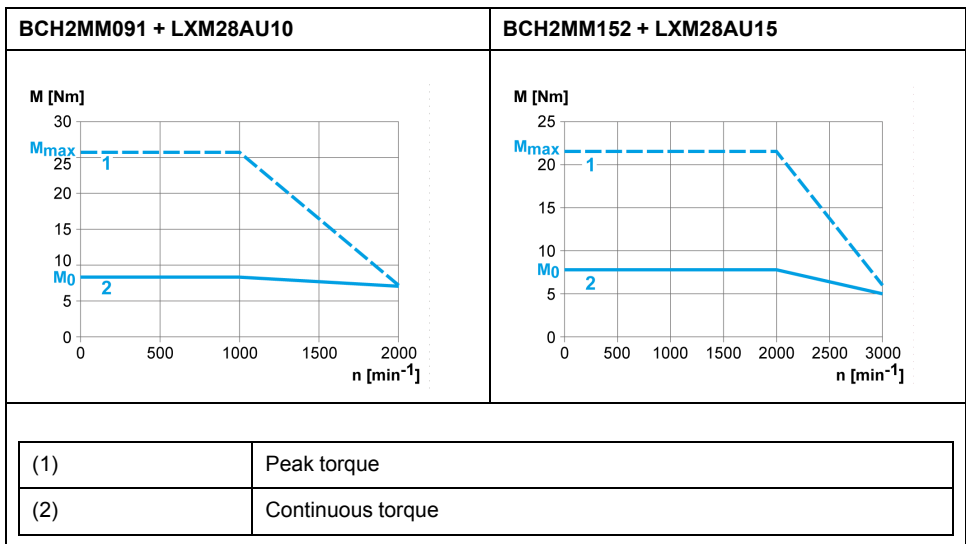
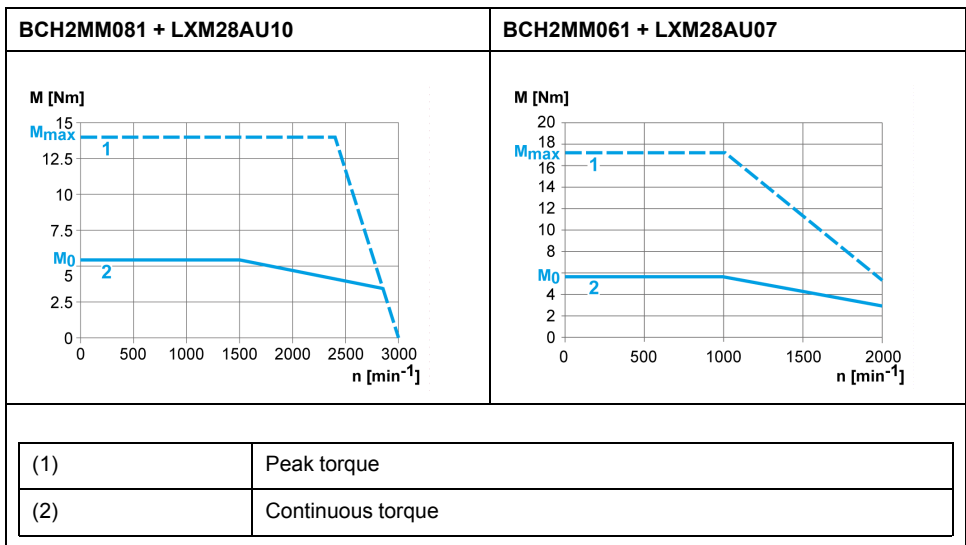
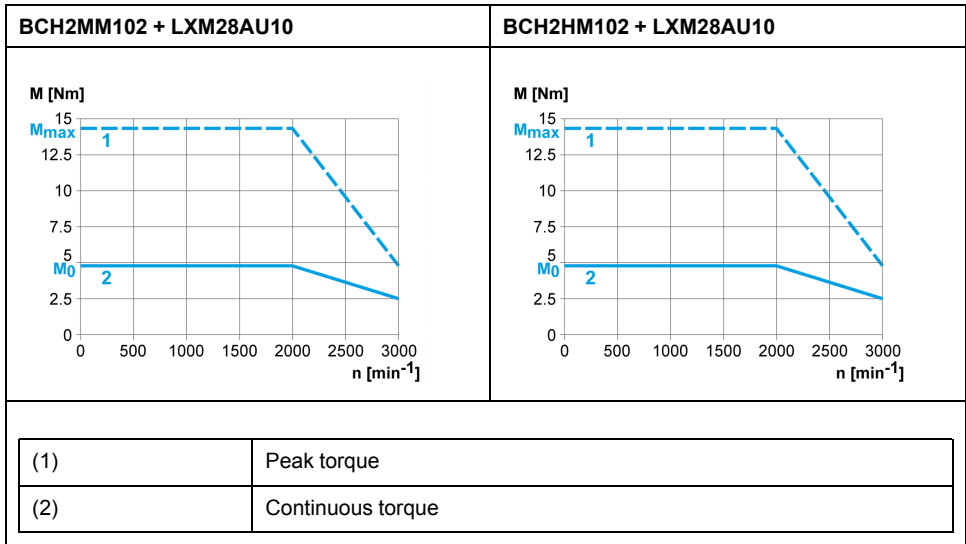
BCH2 <sup>(1)</sup>			MM052	MM031	MM102	HM102	MM081
Nominal power	P <sub>N</sub>	kW	0.50	0.30	1.00	1.00	0.85
<b>Technical data - electrical</b>							
Maximum winding voltage	U <sub>max</sub>	Vac	255	255	255	255	255
Maximum winding voltage	U <sub>max</sub>	Vdc	360	360	360	360	360
Maximum voltage to ground	–	Vac	255	255	255	255	255
Maximum Current	I <sub>max</sub>	A <sub>rms</sub>	9.5	6.0	20.0	20.0	15.0
Continuous stall current	I <sub>0</sub>	A <sub>rms</sub>	2.89	1.88	5.77	5.77	5.62
Voltage constant <sup>(3)</sup>	k <sub>EU-V</sub>	V <sub>rms</sub>	50	92	50	50	58
Torque constant <sup>(4)</sup>	k <sub>t</sub>	Nm/A	0.83	1.52	0.83	0.83	0.96
Winding resistance	R <sub>20U-V</sub>	Ω	0.74	2.08	0.74	0.74	0.42
Winding inductance	L <sub>qU-V</sub>	mH	7.84	26.25	7.84	7.84	4.70
Winding inductance	L <sub>dU-V</sub>	mH	7.14	23.91	7.14	7.14	4.30
<b>Technical data - mechanical</b>							
Maximum permissible speed of rotation	n <sub>max</sub>	rpm	3000	2000	3000	3000	3000
Rotor inertia without brake	J <sub>M</sub>	kgcm <sup>2</sup>	6.62	6.62	6.62	8.40	13.49
Rotor inertia with brake	J <sub>M</sub>	kgcm <sup>2</sup>	6.90	6.90	6.90	8.79	14.09
Mass without brake	m	kg	7.00	7.00	7.00	7.10	9.60
Mass with brake	m	kg	8.20	8.20	8.20	8.30	10.90
Degree of protection of the shaft	–	–	IP 65	IP 54	IP 65	IP 65	IP 54
Degree of protection of the housing	–	–	IP 65	IP 65	IP 65	IP 65	IP 65
<b>Technical data - holding brake</b>							
Holding torque	–	Nm	9.6	9.6	9.6	9.6	9.6
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%	24 +/-10%	24 +/-10%	24 +/-10%
Nominal power (electrical pull-in power)	–	W	19.7	19.7	19.7	19.7	19.7
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>• Flange material: Steel</li> <li>• Flange size in mm (in): 400 x 400 x 20 (15.7 x 15.7 x 0.79)</li> </ul>						
(2)	M <sub>0</sub> =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %						
(3)	RMS value at 1000 rpm and 20 °C (68 °F).						
(4)	At n = 20 rpm and 20 °C (68 °F).						

BCH2 <sup>(1)</sup>			MM061	MM091	MM152	MM202
<b>Technical data - general</b>						
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	5.73	8.59	7.16	9.55
Peak torque	M <sub>max</sub>	Nm	17.19	25.77	21.48	28.65
With supply voltage U <sub>n</sub> = 230 Vac						
Nominal speed of rotation	n <sub>N</sub>	rpm	1000	1000	2000	2000
Nominal torque	M <sub>N</sub>	Nm	5.73	8.59	7.16	9.55
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	4.10	6.15	6.74	11.25
Nominal power	P <sub>N</sub>	kW	0.60	0.90	1.50	2.00
<b>Technical data - electrical</b>						

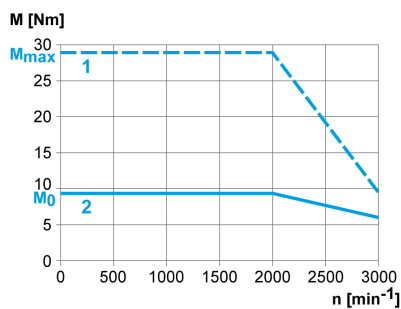
BCH2 <sup>(1)</sup>			MM061	MM091	MM152	MM202
Maximum winding voltage	$U_{\max}$	Vac	255	255	255	255
Maximum winding voltage	$U_{\max}$	Vdc	360	360	360	360
Maximum voltage to ground	–	Vac	255	255	255	255
Maximum Current	$I_{\max}$	$A_{\text{rms}}$	13.5	20.0	21.0	33.0
Continuous stall current	$I_0$	$A_{\text{rms}}$	3.77	5.64	6.18	9.95
Voltage constant <sup>(3)</sup>	$k_{E\text{U-V}}$	$V_{\text{rms}}$	92	92	70	58
Torque constant <sup>(4)</sup>	$k_t$	Nm/A	1.52	1.52	1.16	0.96
Winding resistance	$R_{20\text{U-V}}$	$\Omega$	2.08	1.22	0.64	0.42
Winding inductance	$L_{q\text{U-V}}$	mH	26.25	16.40	7.20	4.70
Winding inductance	$L_{d\text{U-V}}$	mH	23.91	14.90	6.40	4.30
<b>Technical data - mechanical</b>						
Maximum permissible speed of rotation	$n_{\max}$	rpm	2000	2000	3000	3000
Rotor inertia without brake	$J_M$	kgcm <sup>2</sup>	6.62	9.69	9.69	13.49
Rotor inertia with brake	$J_M$	kgcm <sup>2</sup>	6.90	9.99	9.99	14.09
Mass without brake	m	kg	7.00	7.60	7.60	9.70
Mass with brake	m	kg	8.20	8.80	8.80	11.00
<b>Technical data - holding brake</b>						
Holding torque	–	Nm	9.6	9.6	9.6	9.6
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%	24 +/-10%	24 +/-10%
Nominal power (electrical pull-in power)	–	W	19.7	19.7	19.7	19.7
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>Flange material: Steel</li> <li>Flange size in mm (in): 400 x 400 x 20 (15.7 x 15.7 x 0.79)</li> </ul>					
(2)	$M_0$ =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %					
(3)	RMS value at 1000 rpm and 20 °C (68 °F).					
(4)	At n = 20 rpm and 20 °C (68 °F).					

## BCH2-M Curves





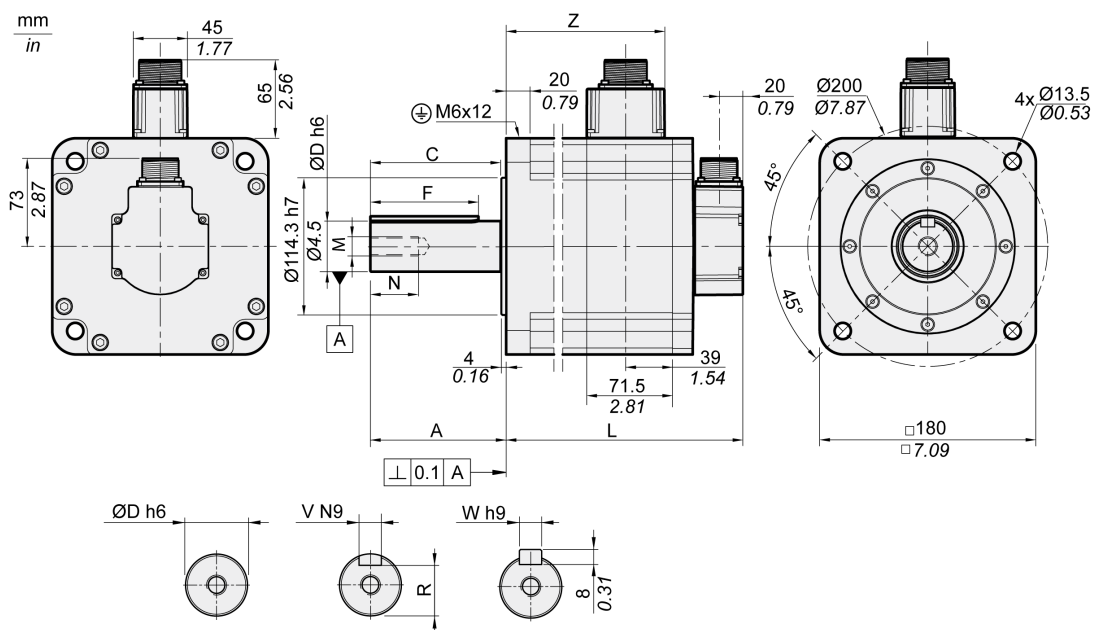
**BCH2MM202 + LXM28AU20**



(1)	Peak torque
(2)	Continuous torque

## BCH2-R Motor

### BCH2-R Dimensions



BCH2-R	Unit	20	30, 35	45
L (without holding brake)	mm (in)	168 (6.61)	201 (7.91)	234 (9.21)
L (with holding brake)	mm (in)	203 (7.99)	236 (9.29)	269 (10.59)
A	mm (in)	79 (3.11)		
C	mm (in)	73 (2.87)		
D	mm (in)	35 (1.38)		
F	mm (in)	63 (2.48)		
M	-	M12		
N	mm (in)	28 (1.10)		
R	mm (in)	30 (1.18)		
V	mm (in)	10 (0.39)		

BCH2-R	Unit	20	30, 35	45
W	mm (in)	10 (0.39)		
Z	mm (in)	103 (4.06)	136 (5.35)	169 (6.65)

## BCH2-R Characteristics Table

BCH2MR202/301/302, BCH2HR202 technical data

BCH2 <sup>(1)</sup>			MR202	HR202	MR302	MR301
<b>Technical data - general</b>						
Continuous stall torque <sup>(2)</sup>	M <sub>0</sub>	Nm	9.55	9.55	14.32	19.10
Peak torque	M <sub>max</sub>	Nm	28.65	28.65	42.97	57.29
With supply voltage U <sub>n</sub> = 230 Vac						
Nominal speed of rotation	n <sub>N</sub>	rpm	2000	2000	2000	1500
Nominal torque	M <sub>N</sub>	Nm	9.55	9.55	14.32	19.10
Nominal Current	I <sub>N</sub>	A <sub>rms</sub>	9.6	9.6	18.8	18.8
Nominal power	P <sub>N</sub>	kW	2.00	2.00	3.00	3.00
<b>Technical data - electrical</b>						
Maximum winding voltage	U <sub>max</sub>	Vac	255	255	255	255
Maximum winding voltage	U <sub>max</sub>	Vdc	360	360	360	360
Maximum voltage to ground	–	Vac	255	255	255	255
Maximum Current	I <sub>max</sub>	A <sub>rms</sub>	35.5	35.5	56.0	61.0
Continuous stall current	I <sub>0</sub>	A <sub>rms</sub>	8.75	8.75	16.33	16.49
Voltage constant <sup>(3)</sup>	k <sub>E</sub> U-V	V <sub>rms</sub>	66	66	53	70
Torque constant <sup>(4)</sup>	k <sub>t</sub>	Nm/A	1.09	1.09	0.88	1.16
Winding resistance	R <sub>20U-V</sub>	Ω	0.572	0.572	0.168	0.234
Winding inductance	L <sub>qU-V</sub>	mH	6.70	6.70	2.88	3.78
Winding inductance	L <sub>dU-V</sub>	mH	6.10	6.10	2.71	3.45
<b>Technical data - mechanical</b>						
Maximum permissible speed of rotation	n <sub>max</sub>	rpm	3000	3000	3000	3000
Rotor inertia without brake	J <sub>M</sub>	kgcm <sup>2</sup>	26.49	34.67	53.55	53.55
Rotor inertia with brake	J <sub>M</sub>	kgcm <sup>2</sup>	26.99	36.17	54.09	54.09
Mass without brake	m	kg	13.00	14.30	18.50	18.50
Mass with brake	m	kg	18.00	19.30	23.00	23.00
Degree of protection of the shaft	–	–	IP 65	IP 65	IP 65	IP 54
Degree of protection of the housing	–	–	IP 65	IP 65	IP 65	IP 65
<b>Technical data - holding brake</b>						
Holding torque	–	Nm	48	48	48	48
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%	24 +/-10%	24 +/-10%

BCH2 <sup>(1)</sup>			MR202	HR202	MR302	MR301
Nominal power (electrical pull-in power)	–	W	49.6	49.6	49.6	49.6
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>Flange material: Steel</li> <li>Flange size in mm (in): 550 x 550 x 20 (21.7 x 21.7 x 0.79)</li> </ul>					
(2)	$M_0$ =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %					
(3)	RMS value at 1000 rpm and 20 °C (68 °F).					
(4)	At n = 20 rpm and 20 °C (68 °F).					

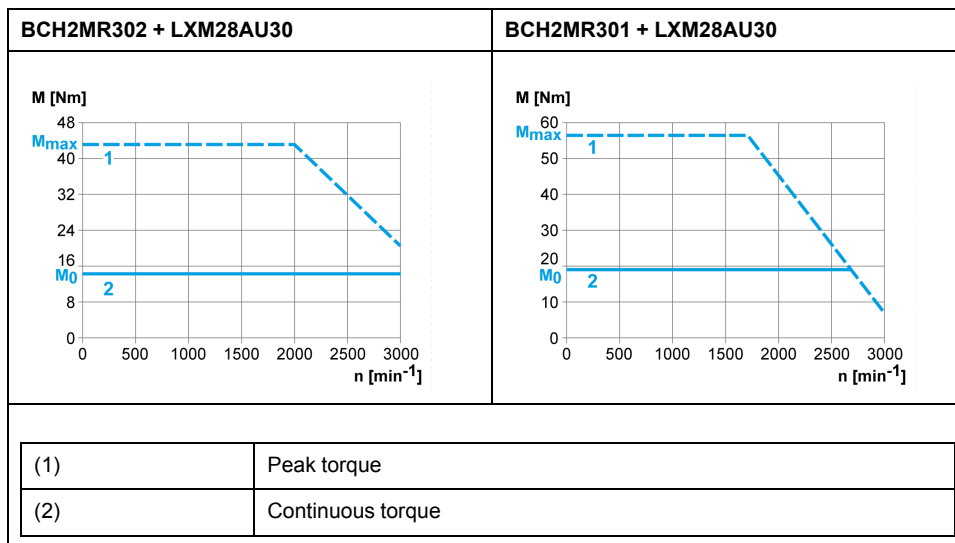
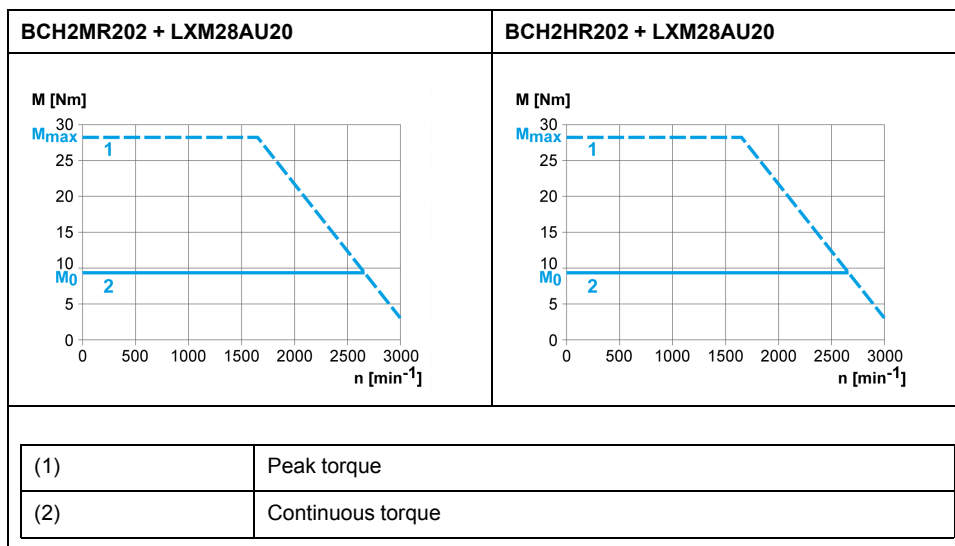
## BCH2MR352/451 technical data

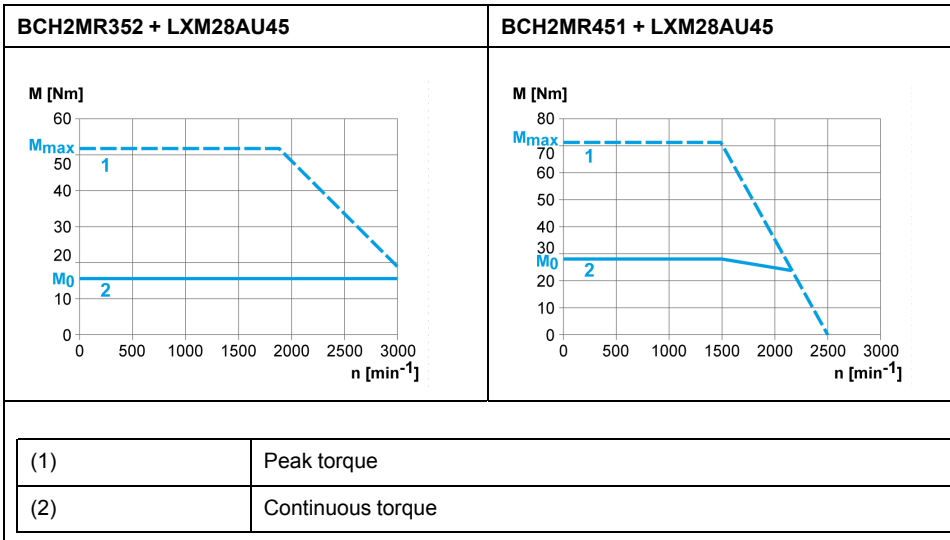
BCH2 <sup>(1)</sup>			MR352	MR451
<b>Technical data - general</b>				
Continuous stall torque <sup>(2)</sup>	$M_0$	Nm	16.70	28.65
Peak torque	$M_{max}$	Nm	50.30	71.62
With supply voltage $U_n = 230$ Vac				
Nominal speed of rotation	$n_N$	rpm	2000	1500
Nominal torque	$M_N$	Nm	16.70	28.65
Nominal Current	$I_N$	$A_{rms}$	19.3	22.8
Nominal power	$P_N$	kW	3.50	4.50
<b>Technical data - electrical</b>				
Maximum winding voltage	$U_{max}$	Vac	255	255
Maximum winding voltage	$U_{max}$	Vdc	360	360
Maximum voltage to ground	–	Vac	255	255
Maximum Current	$I_{max}$	$A_{rms}$	61.0	61.0
Continuous stall current	$I_0$	$A_{rms}$	16.83	19.68
Voltage constant <sup>(3)</sup>	$k_E U-V$	$V_{rms}$	60	88
Torque constant <sup>(4)</sup>	$k_t$	Nm/A	0.99	1.46
Winding resistance	$R_{20U-V}$	$\Omega$	0.168	0.199
Winding inductance	$L_q U-V$	mH	2.80	4.00
Winding inductance	$L_d U-V$	mH	2.57	3.80
<b>Technical data - mechanical</b>				
Maximum permissible speed of rotation	$n_{max}$	rpm	3000	3000
Rotor inertia without brake	$J_M$	kgc- m <sup>2</sup>	53.55	73.31
Rotor inertia with brake	$J_M$	kgc- m <sup>2</sup>	54.09	72.99
Mass without brake	m	kg	18.50	23.64
Mass with brake	m	kg	23.00	28.00
<b>Technical data - holding brake</b>				
Holding torque	–	Nm	48	48
Nominal voltage	–	Vdc	24 +/-10%	24 +/-10%



BCH2 <sup>(1)</sup>			MR352	MR451
Nominal power (electrical pull-in power)	–	W	49.6	49.6
(1)	Limit values with flanged motor: <ul style="list-style-type: none"> <li>Flange material: Steel</li> <li>Flange size in mm (in): 550 x 550 x 20 (21.7 x 21.7 x 0.79)</li> </ul>			
(2)	$M_0$ =Continuous stall torque at 20 rpm and 100 % duty cycle; at speeds of rotation of <20 rpm the continuous stall torque is reduced to 87 %			
(3)	RMS value at 1000 rpm and 20 °C (68 °F).			
(4)	At n = 20 rpm and 20 °C (68 °F).			

## BCH2-R Curves





# Accessories and Spare Parts

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## Commissioning Tools

Description	Reference
Commissioning software LXM28 DTM Library, can be downloaded at: <a href="http://www.se.com">www.se.com</a>	-
PC connection kit, serial connection between drive and PC, USB-A to RJ45	TCSMCNAM3M002P
Multi-Loader, device for copying the parameter settings to a PC or to another drive	VW3A8121
Connection cable for Multi-Loader	VW3A8126
Modbus cable, 1 m (3.28 ft), 2 x RJ45	VW3A8306R10

## Connectors and Adapters

Description	Reference
Connector kit for controller supply and power stage supply (CN5), braking resistor (CN7) and motor (CN8); suitable for LXM28-UA5, U01, U02, U04, U07, U10 and U15	VW3M4C21
Connector kit for controller supply and power stage supply (CN5), braking resistor (CN7) and motor (CN8); suitable for LXM28-U2219U20, U30 and U45	VW3M4C22
Interface connector for CN1, 50-pin, 3 pieces	VW3M1C12
Interface adapter for CN1, connector with 0.5 m (1.64 ft) cable and connection module with screw terminals for DIN rail mounting	VW3M1C13
Connector kit for motor; motor end plastic connector without holding brake	VW3M5D1A
Connector kit for motor; motor end plastic connector with holding brake	VW3M5D1F
Connector kit for motor; motor end MIL connector with holding brake, size 100 ... 130	VW3M5D2A
Connector kit for motor; motor end MIL connector with holding brake, size 180	VW3M5D2B
Connector kit for encoder; motor end flying leads; device end IEEE1394 connector	VW3M8D1A
Connector kit for encoder; motor end MIL connector; device end IEEE1394 connector	VW3M8D2A

## External Mains Filters

Description		Reference
Mains filter single-phase; 115/230 Vac	9 A	VW3A4420
	16 A	VW3A4421
	23 A	VW3A4426
Mains filter three-phase; 208/400/480 Vac	15 A	VW3A4422
	25 A	VW3A4423
	47 A	VW3A4424

## DC Bus Accessories

Description		Reference
DC bus connection cable, 2 x 6 mm <sup>2</sup> (2 x AWG 10)	Pre-assembled, 0.1 m (0.33 ft), 5 pieces	VW3M7101R01
	Twisted Pair, shielded, 15 m (49.2 ft)	VW3M7102R150
DC bus connector kit, connector housing, and crimp contacts for 3 ... 6 mm <sup>2</sup> (AWG 12 ... 10), 10 pieces		VW3M2207

A crimping tool is required for the crimp contacts of the connector kit.

Manufacturer: Tyco Electronics, Heavy Head Hand Tool, Tool Pt. No 180250

## Application Nameplate

Description	Reference
Application nameplate to be clipped onto the top of the drive, size 38.5 mm (1.52 in) x 13 mm (0.51 in), 50 pieces	VW3M2501

## CANopen Connectors, Distributors, Terminating Resistors

Description		Reference	
CANopen terminating resistor, 120 Ohm, integrated in RJ45 connector		TCSCAR013M120	
CANopen cable	2 x RJ45	0.3 m (0.98 ft)	VW3CANCARR03
		1 m (3.28 ft)	VW3CANCARR1
	D9-SUB (female) with integrated terminating resistor to RJ45	1 m (3.28 ft)	VW3M3805R010
		3 m (9.84 ft)	VW3M3805R030

## CANopen Cables with Open Cable Ends

Cables with open cable ends are suitable for connection of D-SUB connectors. Observe the cable cross section and the connection cross section of the required connector.

Description		Reference	
CANopen cable, [(2 x AWG 22) + (2 x AWG 24)], both cable ends open	LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1)	50 m (164 ft)	TSXCANCA50
		100 m (328 ft)	TSXCANCA100
		300 m (984 ft)	TSXCANCA300
	flame-retardant, tested as per IEC 60332-2, UL certification	50 m (164 ft)	TSXCANCB50
		100 m (328 ft)	TSXCANCB100
		300 m (984 ft)	TSXCANCB300
	flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant	50 m (164 ft)	TSXCANCD50
		100 m (328 ft)	TSXCANCD100
		300 m (984 ft)	TSXCANCD300

## Motor Cables

Description	Reference
Motor cable without holding brake 1.5 m (4.92 ft), 4 x 0.82 mm <sup>2</sup> (AWG 18) shielded; motor end plastic connector, other cable end flying leads	VW3M5D1AR15
Motor cable without holding brake 3 m (9.84 ft), 4 x 0.82 mm <sup>2</sup> (AWG 18) shielded; motor end plastic connector, other cable end flying leads	VW3M5D1AR30
Motor cable without holding brake 5 m (16.4 ft), 4 x 0.82 mm <sup>2</sup> (AWG 18) shielded; motor end plastic connector, other cable end flying leads	VW3M5D1AR50
Motor cable with holding brake 3 m (9.84 ft), 6 x 0.82 mm <sup>2</sup> (AWG 18) shielded; motor end plastic connector, other cable end flying leads	VW3M5D1FR30
Motor cable with holding brake 5 m (16.4 ft), 6 x 0.82 mm <sup>2</sup> (AWG 18) shielded; motor end plastic connector, other cable end flying leads	VW3M5D1FR50
Motor cable without holding brake 3 m (9.84 ft), 4 x 1.3 mm <sup>2</sup> (AWG 16) shielded; motor end MIL connector, other cable end flying leads	VW3M5D2AR30
Motor cable without holding brake 5 m (16.4 ft), 4 x 1.3 mm <sup>2</sup> (AWG 16) shielded; motor end MIL connector, other cable end flying leads	VW3M5D2AR50
Motor cable with holding brake 3 m (9.84 ft), 6 x 1.3 mm <sup>2</sup> (AWG 16) shielded; motor end MIL connector, other cable end flying leads	VW3M5D2FR30
Motor cable with holding brake 5 m (16.4 ft), 6 x 1.3 mm <sup>2</sup> (AWG 16) shielded; motor end MIL connector, other cable end flying leads	VW3M5D2FR50
Motor cable without holding brake 3 m (9.84 ft), 4 x 3.3 mm <sup>2</sup> (AWG 12) shielded; motor end MIL connector, other cable end flying leads	VW3M5D4AR30
Motor cable without holding brake 5 m (16.4 ft), 4 x 3.3 mm <sup>2</sup> (AWG 12) shielded; motor end MIL connector, other cable end flying leads	VW3M5D4AR50
Motor cable with holding brake 3 m (9.84 ft), 6 x 3.3 mm <sup>2</sup> (AWG 12) shielded; motor end MIL connector, other cable end flying leads	VW3M5D4FR30
Motor cable with holding brake 5 m (16.4 ft), 6 x 3.3 mm <sup>2</sup> (AWG 12) shielded; motor end MIL connector, other cable end flying leads	VW3M5D4FR50
Motor cable without holding brake 3 m (9.84 ft), 4 x 6 mm <sup>2</sup> (AWG 10) shielded; motor end MIL connector, other cable end flying leads	VW3M5D6AR30
Motor cable without holding brake 5 m (16.4 ft), 4 x 6 mm <sup>2</sup> (AWG 10) shielded; motor end MIL connector, other cable end flying leads	VW3M5D6AR50
Motor cable with holding brake 3 m (9.84 ft), 6 x 6 mm <sup>2</sup> (AWG 10) shielded; motor end MIL connector, other cable end flying leads	VW3M5D6FR30
Motor cable with holding brake 5 m (16.4 ft), 6 x 6 mm <sup>2</sup> (AWG 10) shielded; motor end MIL connector, other cable end flying leads	VW3M5D6FR50

## Encoder Cables and Accessories

Description			Reference
Encoder cable, 10 x 0.13 mm <sup>2</sup> (AWG 26) shielded	Motor end and device end plastic connector	1.5 m (4.92 ft)	VW3M8D1AR15
		3 m (9.84 ft)	VW3M8D1AR30
		5 m (16.4 ft)	VW3M8D1AR50
	Motor end MIL connector, other cable end plastic connector	3 m (9.84 ft)	VW3M8D2AR30
		5 m (16.4 ft)	VW3M8D2AR50
Battery compartment for multi-turn encoder, cable 0.45 m (1.47 ft)			VW3M8BATC
Battery 3.6 Vdc for multi-turn encoder			VW3M9BATT

**NOTE:** The battery compartment and the battery are not provided with motor equipped with a multi-turn encoder and must be ordered separately.

## Signal Cables

Description		Reference
Signal cable for signal interface CN1, device end 50-pin connector, other cable end flying leads	1 m (3.28 ft)	VW3M1C10R10
	2 m (6.56 ft)	VW3M1C10R20
	3 m (9.84 ft)	VW3M1C10R30

## Signal Cable for Safety Function STO

Description		Reference
Signal cable for safety function STO CN9	1 m (3.28 ft)	VW3M1C20R10
	2 m (6.56 ft)	VW3M1C20R20
	3 m (9.84 ft)	VW3M1C20R30

## External Braking Resistors and Holding Brake Controller

Description				Reference
Holding brake controller HBC with automatic voltage reduction; 24 V - 1.6 A				VW3M3103
Braking resistor IP 65 connection cable 2.1 mm <sup>2</sup> (AWG 14)	10 Ω	Maximum continuous power 400 W	0.75 m (2.46 ft)	VW3A7601R07
			2 m (6.56 ft)	VW3A7601R20
			3 m (9.84 ft)	VW3A7601R30
Braking resistor IP 65, UL connection cable 2.1 mm <sup>2</sup> (AWG 14)	27 Ω	Maximum continuous power 100 W	0.75 m (2.46 ft)	VW3A7602R07
			2 m (6.56 ft)	VW3A7602R20
			3 m (9.84 ft)	VW3A7602R30
		Maximum continuous power 200 W	0.75 m (2.46 ft)	VW3A7603R07
			2 m (6.56 ft)	VW3A7603R20
			3 m (9.84 ft)	VW3A7603R30

Description				Reference
		Maximum continuous power 400 W	0.75 m (2.46 ft)	VW3A7604R07
			2 m (6.56 ft)	VW3A7604R20
			3 m (9.84 ft)	VW3A7604R30
	72 Ω	Maximum continuous power 200 W	0.75 m (2.46 ft)	VW3A7606R07
			2 m (6.56 ft)	VW3A7606R20
			3 m (9.84 ft)	VW3A7606R30
		Maximum continuous power 400 W	0.75 m (2.46 ft)	VW3A7607R07
			2 m (6.56 ft)	VW3A7607R20
			3 m (9.84 ft)	VW3A7607R30
Braking resistor IP20, UL screw terminals M6	16 Ω	Maximum continuous power 956 W	-	VW3A7733
	10 Ω		-	VW3A7734

## Circuit Breakers

Description	Reference
Circuit breaker - thermal magnetic - 4 ... 6.3 A - screw terminals	GV2P10
Circuit breaker - thermal magnetic - 6 ... 10 A - screw terminals	GV2P14
Circuit breaker - thermal magnetic - 9 ... 14 A - screw terminals	GV2P16
Circuit breaker - thermal magnetic - 13 ... 18 A - screw terminals	GV2P20
Circuit breaker - thermal magnetic - 17 ... 23 A - screw terminals	GV2P21
Circuit breaker - thermal magnetic - 20 ... 25 A - screw terminals	GV2P22
Circuit breaker - thermal magnetic - 24 ... 32 A - screw terminals	GV2P32

## Motor Protection Switches and Power Contactors

Drive	Nominal power	Order no. motor protection switch	Rated continuous current motor protection switch	Order no. power contactor
LXM28AUA5	50 W	GV2L10	6.3 A	LC1K0610**
LXM28AU01	100 W	GV2L10	6.3 A	LC1K0610**
LXM28AU02	200 W	GV2L14	10 A	LC1D09**
LXM28AU04	400 W	GV2L14	10 A	LC1D09**
LXM28AU07	750 W	GV2L16	14 A	LC1D12**
LXM28AU15	1500 W	GV2L22	25 A	LC1D18**
LXM28AU20	2000 W	GV2L32	30 A	LC1D32**
LXM28AU30	3000 W	GV2L32	30 A	LC1D32**

Control voltage power contactor		24 V	48 V	110 V	220 V	230 V	240 V
LC1K****	50/60 Hz	B7	E7	F7	M7	P7	U7

Control voltage power contactor		24 V	48 V	110 V	220/230 V	230	230/240 V
LC1D****	50 Hz	B5	E5	F5	M5	P5	U5
	60 Hz	B6	E&	F6	M6	-	U6
	50/60 Hz	B7	E7	F7	M7	P7	U7

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# Engineering

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# Engineering

## What's in This Chapter

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This chapter contains information on the application of the Servo Drive system for the engineering phase.

## Electromagnetic Compatibility (EMC)

### Electromagnetic Compatibility (EMC)

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

<b>▲ WARNING</b>
<b>SIGNAL AND EQUIPMENT INTERFERENCE</b> <ul style="list-style-type: none"><li>• Only operate the drive with the specified external mains filter.</li><li>• Install the wiring in accordance with the EMC requirements described in the present document.</li><li>• Verify compliance with the EMC requirements described in the present document.</li><li>• 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.</li></ul> <b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

### Limit Values

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

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

These types of devices are not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if used in such a network.

<b>⚠ WARNING</b>
<b>RADIO INTERFERENCE</b>
Do not use these products in domestic electrical networks.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

As a system provider, you may have to include this information in the documentation to your customer.

## 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.

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

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

The equipotential bonding conductors must be rated for the maximum current. The following conductors cross sections can be used:

- 16 mm<sup>2</sup> (AWG 4) for equipotential bonding conductors up to a length of 200 m (656 ft)
- 20 mm<sup>2</sup> (AWG 4) for equipotential bonding conductors with a length of more than 200 m (656 ft)

## EMC Requirements for the Control Cabinet

EMC measures	Objective
Use mounting plates with good electrical conductivity, connect large surface areas of metal parts, remove paint from contact areas.	Good conductivity due to large surface contact.
Ground the control cabinet, the control cabinet door, and the mounting plate with ground straps or ground wires. The conductor cross section must be at least 10 mm <sup>2</sup> (AWG 6).	Reduces emissions.
Install switching devices such as power contactors, relays, or solenoid valves with interference suppression units or arc suppressors (for example, diodes, varistors, RC circuits).	Reduces mutual interference
Do not install power components and control components adjacent to one another.	Reduces mutual interference

## Additional Measures for EMC Improvement

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

EMC measures	Objective
Use mains reactors.	Reduces mains harmonics, prolongs product service life.
Mount in a closed control cabinet with shielded attenuation of radiated interference	Improves the EMC limit values.

## External Mains Filters

### Filter/Drive Combinations

You can obtain EMC conformance by following the wiring standards and practices in the present document and installing, for each drive, the following filter/drive combination:

For further information, refer to Electromagnetic compatibility (EMC), page 77.

LXM28A	Mains filter for single-phase connection	Mains filter for three-phase connection
UA5 = 0.05 kW U01 = 0.1 kW U02 = 0.2 kW U04 = 0.4 kW U07 = 0.75 kW U10 = 1 kW	VW3A4420	VW3A4422
U15 = 1.5 kW	VW3A4421	VW3A4422
U20 = 2 kW	-	VW3A4422
U30 = 3 kW	-	VW3A4422
U45 = 4.5 kW	-	VW3A4423

If you use mains filters of other manufacturers, these mains filters must have the same technical data as specified mains filters.

## Emission

The specified limit values are complied with if the external mains filters available as accessories are used.

The following limit values for emission are complied with if the installation is EMC-compliant and if the cables offered as accessories are used.

Lexium 28A	Category
Conducted interference	C3
Radiated emission	C3

## Cables

### Cables

#### Suitability of the Cables

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

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

#### 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

### **▲ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

- Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point. <sup>1)</sup>
- Route communications and I/O cables separately from power cables.

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

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

The equipotential bonding conductor must be rated for the maximum current. The following conductor cross sections can be used:

- 16 mm<sup>2</sup> (AWG 4) for equipotential bonding conductors up to a length of 200 m (656 ft)
- 20 mm<sup>2</sup> (AWG 4) for equipotential bonding conductors with a length of more than 200 m (656 ft)

#### Conductor Cross Sections According to Method of Installation

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

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

Gross section in mm <sup>2</sup> (AWG) <sup>(1)</sup>	Current-carrying capacity with method of installation B2 in A <sup>(2)</sup>	Current carrying capacity with method of installation E in A <sup>(2)</sup>
0.75 (18)	8.5	10.4
1 (16)	10.1	12.4

Cross section in mm <sup>2</sup> (AWG) (1)	Current-carrying capacity with method of installation B2 in A(2)	Current carrying capacity with method of installation E in A(2)
1.5 (14)	13.1	16.1
2.5 (12)	17.4	22
4 (10)	23	30
6 (8)	30	37
10 (6)	40	52
16 (4)	54	70
25 (2)	70	88
(1)	See chapter "Accessories and spare parts", page 71 for available cables.	
(2)	Values as per IEC 60204-1 for continuous operation, copper conductors, and ambient air temperature 40 °C (104 °F); see IEC 60204-1 for additional information.	

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

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

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

For conformance to UL requirements, use 75 °C (167 °F) copper conductors.

## Residual Current Device

### Residual Current Device

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

<b>⚠ WARNING</b>
<p><b>DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR</b></p> <ul style="list-style-type: none"> <li>• Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.</li> <li>• Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters and is sensitive to all types of current for three-phase drives and for single-phase drives not connected to a phase and the neutral conductor.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Conditions for Use of Residual Current Device

- The drive has an increased leakage current at the moment power is applied. Use residual current devices with a response delay.
- High-frequency currents must be filtered.

## Common DC Bus

### Common DC Bus

#### Function Principle

The DC buses of several devices can be connected so that energy can be used efficiently. If one device decelerates, a different device connected to the common DC bus can use the generated braking energy. Without a common DC bus, the braking energy would be converted to heat by the braking resistor while the other device would have to be supplied with energy from mains.

Another advantage of having a common DC bus is that several devices can share one external braking resistor. The number of the individual external braking resistors can be reduced to a single braking resistor if the braking resistor is properly rated.

This and other important information can be found in the Common DC bus Application Note for the drive. If you wish to take advantage of DC bus sharing, you must first consult the Common DC bus Application Note for important safety-related information.

#### Requirements for Use

The requirements and limit values for parallel connection of multiple devices via the DC bus are described in the Common DC bus Application Note for the drive that can be found on [www.se.com](http://www.se.com). If there are any issues or questions related to obtaining the Common DC bus Application Note, consult your local Schneider-Electric representative.

## Safety Function STO (“Safe Torque Off”)

For information on using the IEC 61508 standard, refer to Functional Safety, page 84.

## Process Minimizing Risks Associated with the Machine

### General

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

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

## Hazard and Risk Analysis

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

<b>▲ WARNING</b>
<p><b>NON-CONFORMANCE TO SAFETY FUNCTION REQUIREMENTS</b></p> <ul style="list-style-type: none"> <li>• Specify the requirements and/or measures to be implemented in the risk analysis you perform.</li> <li>• Verify that your safety-related application complies to applicable safety regulations and standards.</li> <li>• Make certain that appropriate procedures and measures (according to applicable sector standards) have been established to help avoid hazardous situations when operating the machine.</li> <li>• Use appropriate safety interlocks where personnel and/or equipment hazards exist.</li> <li>• Validate the overall safety-related function and thoroughly test the application.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

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

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

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

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

Step	Action
1	Identify necessary safety functions that are executed via SRP/CS (Safety-Related Parts of the Control System).
2	Determine required properties for each safety function.
3	Determine the required performance level PL <sub>r</sub> .
4	Identify safety-related parts executing the safety function.
5	Determine the performance level PL of the afore-mentioned safety-related parts.

Step	Action
6	Verify the performance level PL for the safety function ( $PL \geq PL_r$ ).
7	Verify if all requirements have been met (validation).

Additional information is available on [www.se.com](http://www.se.com).

## Functional Safety

### Overview

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

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

### IEC 61508 and IEC 61800-5-2

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

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

### Safety Integrity Level (SIL)

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

### Average Frequency of a Dangerous Failure Per Hour (PFH)

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



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

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

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

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

SFF	HFT type A subsystem			HFT type B subsystem		
	0	1	2	0	1	2
<60 %	SIL1	SIL2	SIL3	—	SIL1	SIL2
60 ... <90 %	SIL2	SIL3	SIL4	SIL1	SIL2	SIL3
90 ... <99 %	SIL3	SIL4	SIL4	SIL2	SIL3	SIL4
$\geq 99$ %	SIL3	SIL4	SIL4	SIL3	SIL4	SIL4

## Fault Avoidance Measures

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

## Data for Maintenance Plan and the Calculations for the Safety Function

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

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

Description	Unit	Value
Lifetime of the safety function STO (IEC 61508) <sup>(1)</sup>	Years	20
SFF (IEC 61508) Safe Failure Fraction	%	98.9
Safety integrity level	—	SIL CL 2

Description	Unit	Value						
IEC 61508 IEC 62061 IEC 61800-5-2								
PFH (IEC 61508) Probability of Dangerous Hardware Failure per Hour	1/h	STO_A <sup>(2)</sup> : $1.7 \times 10^{-9}$ STO_B <sup>(3)</sup> : $1.5 \times 10^{-9}$						
PFD <sub>avg</sub> (IEC 61508) Probability of Failure on Demand, calculated as one demand per year	–	STO_A <sup>(2)</sup> : $1.5 \times 10^{-4}$ STO_B <sup>(3)</sup> : $1.3 \times 10^{-4}$						
PL (ISO 13849-1) Performance Level	–	d (category 3)						
MTTF <sub>d</sub> (ISO 13849-1) Mean Time to Dangerous Failure	Years	STO_A <sup>(2)</sup> : 66757 STO_B <sup>(3)</sup> : 78457						
DC <sub>avg</sub> (ISO 13849-1) Diagnostic Coverage	%	≥90						
<table border="1"> <tbody> <tr> <td>(1)</td> <td>See chapter Lifetime Safety Function STO, page 380</td> </tr> <tr> <td>(2)</td> <td>STO_A: LXM28AU5, LXM28AU01, LXM28AU02, LXM28AU04, LXM28AU07, LXM28AU10, LXM28AU15, LXM28AU20</td> </tr> <tr> <td>(3)</td> <td>STO_B: LXM28AU30, LXM28AU45</td> </tr> </tbody> </table>			(1)	See chapter Lifetime Safety Function STO, page 380	(2)	STO_A: LXM28AU5, LXM28AU01, LXM28AU02, LXM28AU04, LXM28AU07, LXM28AU10, LXM28AU15, LXM28AU20	(3)	STO_B: LXM28AU30, LXM28AU45
(1)	See chapter Lifetime Safety Function STO, page 380							
(2)	STO_A: LXM28AU5, LXM28AU01, LXM28AU02, LXM28AU04, LXM28AU07, LXM28AU10, LXM28AU15, LXM28AU20							
(3)	STO_B: LXM28AU30, LXM28AU45							

If two non-adjacent IGBTs have a short circuit, a movement of a maximum of 120 degrees (electrical) can occur even if the safety function STO is active. Include in your risk analysis the probability of IGBT short circuits, and make a determination whether it is acceptable as it relates to your application.

## ⚠ WARNING

### UNINTENTIONAL MOVEMENT DURING STO FUNCTION

Use appropriate safety interlocks (such as a service brake) where personnel and/or equipment hazards exist.

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

The probability of such a condition is  $1.5 \times 10^{-15}$  per hour (without common cause error). Include this in your calculations for the safety function.

Contact your local sales office for additional data, if required.

## Definitions

### Integrated Safety-Related Function "Safe Torque Off" STO

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

### Category 0 Stop (IEC 60204-1)

In stop category 0 (Safe Torque Off, STO), the drive coasts to a stop (provided there are no external forces operating to the contrary). The safety-related function

STO is intended to help prevent an unintended start-up, not stop a motor, and therefore corresponds to an unassisted stop in accordance with IEC 60204-1.

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

## **▲WARNING**

### **UNINTENDED EQUIPMENT OPERATION**

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

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

## **Category 1 Stop (IEC 60204-1)**

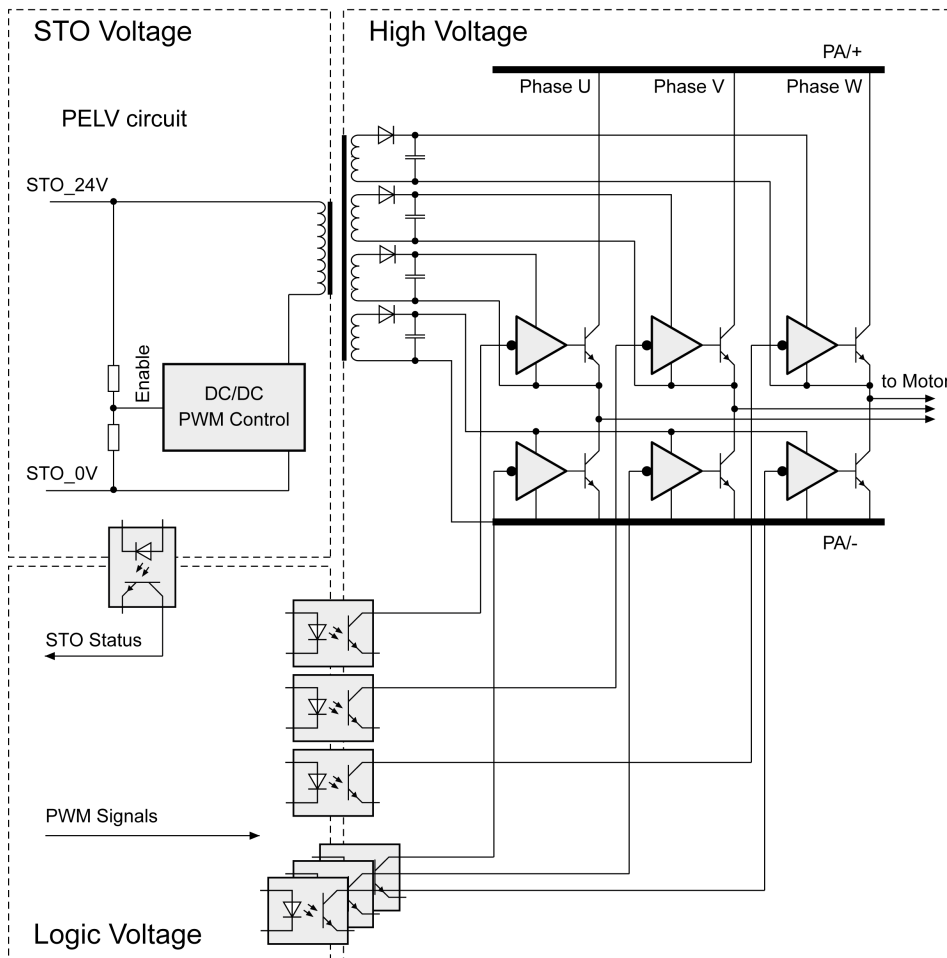
For stops of category 1 (Safe Stop 1, SS1), you can initiate a controlled stop via the control system, or through the use of specific functional safety-related devices. A Category 1 Stop is a controlled stop with power available to the machine actuators to achieve the stop.

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

## **Function**

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

The safety function STO switches the supply voltage of the IGBT drivers so that PWM signals cannot switch the IGBTs. The following diagram illustrates the concept:



## Requirements for Using the Safety Function

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

**⚡ ⚠ DANGER**

**ELECTRIC SHOCK**

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

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

After the safety function STO is triggered, the motor can no longer generate torque and coasts down without braking in the case of motors without a holding brake. In the case of motors with holding brake, the holding brake is not a safety-related function, and may not be sufficient to hold the axis at a standstill.

**▲ WARNING****UNINTENDED EQUIPMENT OPERATION**

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

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

The safety function STO is factory-deactivated by means of the jumper for CN9. If you want to use the safety function STO, you must remove the jumper for CN9. You may only use the safety function STO with an external PELV 24 Vdc power supply unit.

**▲ WARNING****UNINTENDED EQUIPMENT OPERATION**

- Remove the jumpers connected to the STO power connector (CN9) only if you intend to use the STO safety-related function for your application.
- Use only an external PELV 24 Vdc power supply unit when applying the safety-related STO function.

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

For additional information on deactivating the safety function STO, refer to Connection STO (CN9), page 136.

## Holding Brake and Safety Function STO

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

**▲ WARNING****FALLING LOAD**

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

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

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

**▲ WARNING****UNINTENDED AXIS MOVEMENT**

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

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

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

## Unintended Restart

To help avoid unintended restart of the motor after restoration of power (for example, after power outage), the parameter P2-68 must be set to "X=0". A controlled restart must be managed externally from the drive, note that the external management itself must not trigger an unintended restart.

### **▲ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

Set parameter P2-68 setting X to 0 (zero) if the automatic enabling of the power stage presents hazards in your application.

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

## Degree of Protection When the Safety Function Is Used

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

### **▲ WARNING**

#### **INOPERABLE SAFETY FUNCTION**

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

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

## Protected Cable Installation

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

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

- Use shielded cables for the signals of the safety function STO.
- Do not use the cable for the signals of the safety function STO for other signals.
- Connect one end of the shield.
- When daisy chaining the signals of the safety function STO, connect the shield to the equipotential grounding plane associated to the drives.

## Hazard and Risk Analysis

You must conduct, or ensure that your OEM, system integrator, or anyone responsible for the development of the application containing the equipment indicated in the present document conducts a hazard and risk analysis of the entire system. The results of the analysis must be taken into account in the application of the safety function.

The type of circuit resulting from the analysis may differ from any application examples provided in the present document or any supplementary documents

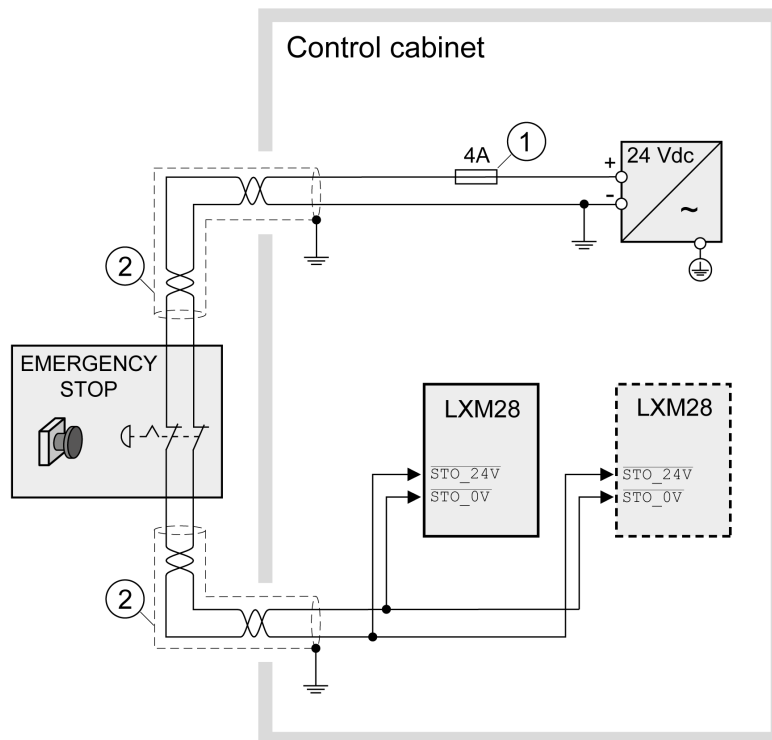
concerning this equipment. Additional safety components may be required. The results of the hazard and risk analysis have priority over any other design considerations. Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your system.

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
<ul style="list-style-type: none"> <li>• Perform a hazard and risk analysis to determine the appropriate safety integrity level, and any other safety requirements, for your specific application based on all the applicable standards.</li> <li>• Ensure that the hazard and risk analysis is conducted and respected according to EN/ISO 12100 during the design of your machine.</li> </ul>
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

## Application Examples STO

### Example of Category 0 Stop

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



**1** If the maximum output current of the 24 V power supply exceeds 4 A, a 4 A slow-blow fuse is required.

**2** Grounded shielded cable for wiring out of the control cabinet.

For further information on STO wiring, refer to [Connection of STO \(CN9\)](#), page 136

**NOTE:** The internal DC power supply of the drive is only to be used to deactivate the safety function STO via the jumper supplied with the drive.

**▲ WARNING****UNINTENDED EQUIPMENT OPERATION**

- Remove the jumpers connected to the STO power connector (CN9) only if you intend to use the STO safety-related function for your application.
- Use only an external PELV 24 Vdc power supply unit when applying the safety-related STO function.

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

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

The power stage is immediately disabled via the inputs STO\_24V and STO\_0V of the safety function STO. Power can no longer be supplied to the motor. If the motor is not already at a standstill when the STO is triggered, it decelerates under the salient physical forces (gravity, friction, etc.) active at the time until presumably coasting to a standstill.

**▲ WARNING****UNINTENDED EQUIPMENT OPERATION**

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

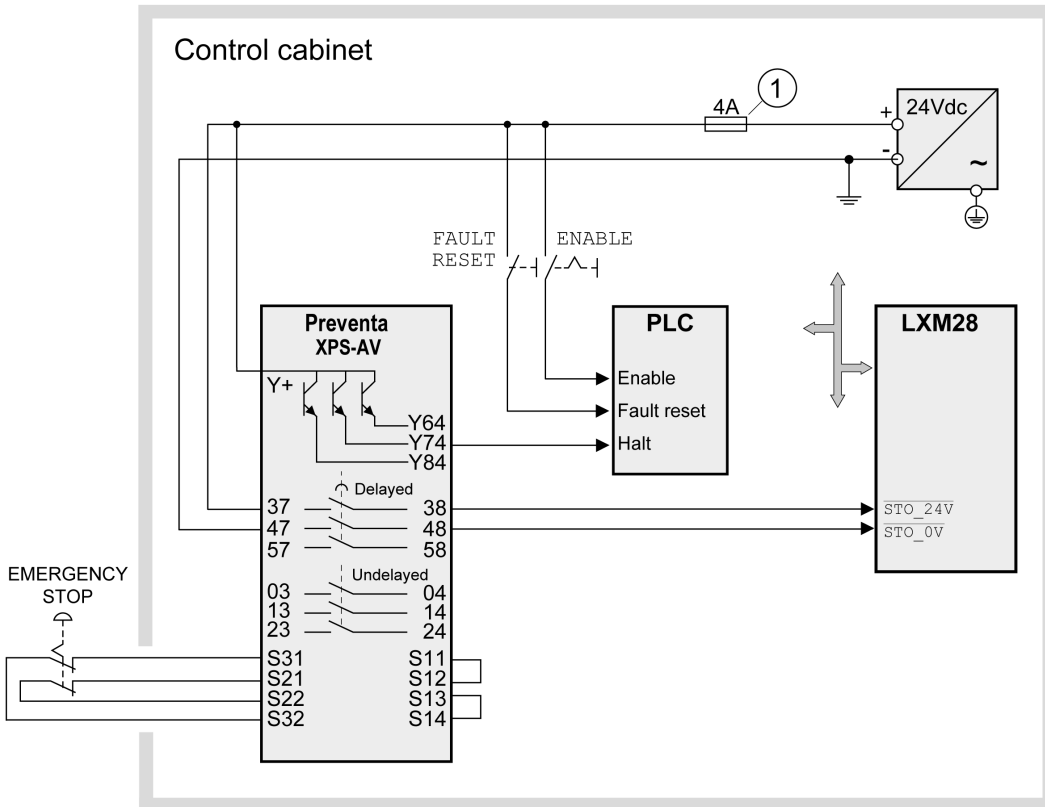
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external service brake may also be required. Refer to Holding Brake and Safety Function STO, page 89.



## 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.



1 If the maximum output current of the 24 V power supply exceeds 4 A, a 4 A slow-blow fuse is required.

For more information on STO wiring, see chapter Connection of STO (CN9), page 136

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

- The safety relay module requests an immediate stop (undelayed) of the drive via the logic controller (Halt). The logic controller takes the configured or programmed action to instruct the drive to make a decelerated stop.
- The power stage is disabled via the inputs STO\_24V and STO\_0V of the safety function STO after the delay time set in the EMERGENCY STOP safety relay module has elapsed. Power can no longer be supplied to the motor. If the motor is not already at a standstill when safety function STO is triggered when the delay time has elapsed, it decelerates under the salient physical forces (gravity, friction, etc.) active at the time until presumably coasting to a standstill.

If the coasting of the motor and its potential load is unsatisfactory as determined by your risk and hazard analysis, an external service brake may also be required. Refer to Holding Brake and Safety Function STO, page 89.

### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

**NOTE:** The specified minimum current and the permissible maximum current of the relay outputs of the EMERGENCY STOP safety relay module must be respected.

## Rating the Braking Resistor

### Rating the Braking Resistor

Braking resistors are required for dynamic applications. During deceleration, the kinetic energy is transformed into electrical energy in the motor. The electrical energy increases the DC bus voltage. The braking resistor is activated when the defined threshold value is exceeded. The braking resistor transforms electrical energy into heat. If highly dynamic deceleration is required, the braking resistor must be well adapted to the system. External driving forces acting on the motor can cause high currents to be regenerated and supplied back to the drive.

#### **⚠ DANGER**

##### **FIRE DUE TO EXTERNAL DRIVING FORCES ACTING ON MOTOR**

Verify that no external forces can act on the motor that will exceed the capacity of the braking resistor.

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

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

#### **⚠ WARNING**

##### **UNINTENDED EQUIPMENT OPERATION**

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

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

If multiple drives are connected via a common DC bus, this affects all motors. For further information, refer to [Common DC bus](#), page 82.

An [external braking resistor](#), page 74 is required for applications in which the motor must be decelerated quickly and the internal braking resistor cannot absorb the excess braking energy.

## Internal Braking Resistor

### Introduction

The drive has an internal braking resistor. If the internal braking resistor is insufficient for the dynamics of the application, one or more external braking resistors must be used.

The resistance values for external braking resistors must not be below the specified minimum resistance. If an external braking resistor is activated by using the appropriate parameter, the internal braking resistor is deactivated.

<b>LXM28A***M1X</b>		<b>Unit</b>	<b>UA5, U01, U02, U04</b>	<b>U07</b>
Resistance value of internal braking resistor		Ω	100	40
Continuous power internal braking resistor P <sub>PR</sub>		W	60	
Peak energy E <sub>CR</sub> <sup>(1)</sup>		Ws	152	380
External braking resistor minimum		Ω	25	
External braking resistor maximum <sup>(2)</sup>		Ω	50	
Maximum continuous power external braking resistor		W	640	
Switch-on voltage braking resistor		V	390	
Capacitance of the internal capacitors		μF	1640	
Energy absorption of internal capacitors E <sub>var</sub> at nominal voltage 120 V +10%		Ws	8.87	
(1)	Parameter P1-71 is set to 100 ms.			
(2)	The maximum specified braking resistor can derate the peak power of the device. Depending on the application, it is possible to use a greater ohm resistor.			

<b>LXM28A***M3X</b>		<b>Unit</b>	<b>UA5, U01, U02, U04</b>	<b>U07</b>	<b>U10, U15</b>	<b>U20</b>	<b>U30, U45</b>
Resistance value of internal braking resistor		Ω	100	40		22	
Continuous power internal braking resistor P <sub>PR</sub>		W	60	60		100	
Peak energy E <sub>CR</sub> <sup>(1)</sup>		Ws	152	380		691	
External braking resistor minimum		Ω	25		15	8	
External braking resistor maximum <sup>(2)</sup>		Ω	50		25		
Maximum continuous power external braking resistor		W	640		1000	1500	2500
Switch-on voltage braking resistor		V	390				
Capacitance of the internal capacitors		μF	820	1640	2110	3280	
Energy absorption of internal capacitors E <sub>var</sub> at nominal voltage 230 V +10%		Ws	8.87	17.76	22.82	35.51	
(1)	Parameter P1-71 is set to 100 ms.						
(2)	The maximum specified braking resistor can derate the peak power of the device. Depending on the application, it is possible to use a greater ohm resistor.						

## External Braking Resistors

### Introduction

An external braking resistor is required for applications in which the motor must be decelerated quickly and the internal braking resistor cannot absorb the excess braking energy. The temperature of the braking resistor may exceed 250 °C (482 °F) during operation.

## ⚠ WARNING

### HOT SURFACES

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

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

VW3A760•	Unit	1R•• <sup>(1)</sup>	2R••	3R••	4R•• <sup>(1)</sup>	5R••	6R••	7R•• <sup>(1)</sup>
Resistance	Ω	10	27			72		
Continuous power	W	400	100	200	400	100	200	400
Maximum time in braking at 115 V / 230 V	s	0.72	0.552	1.08	2.64	1.44	3.72	9.6
Peak power at 115 V / 230 V	kW	18.5	6.8			2.6		
Maximum peak energy at 115 V / 230 V	Ws	13300	3800	7400	18100	3700	9600	24700
Degree of protection	-	IP 65						
(1)		Resistors with a continuous power of 400 W are not UL/CSA-approved.						

VW3A77•	Unit	04	05
Resistance	Ω	15	10
Continuous power	W	1000	
Maximum time in braking at 115 V / 230 V	s	3.5	1.98
Peak power at 115 V / 230 V	kW	12.3	18.5
Maximum peak energy at 115 V / 230 V	Ws	43100	36500
Degree of protection	-	IP20	

## Monitoring Functions

### Monitoring Functions

#### Overview

The monitoring functions of the drive can be used to monitor movements and to monitor internal signals. These monitoring functions are not safety-related functions.

The following monitoring functions are available:

Monitoring function	Task
Data connection	Monitors data connection for interruption
Limit switch signals	Monitors for permissible movement range

Monitoring function	Task
Position deviation	Monitors for difference between actual position and reference position
Motor overload	Monitors for excessively high current in the motor phases
Oversvoltage and undervoltage	Monitors for oversvoltage and undervoltage of the power stage supply and the DC bus
Overtemperature	Monitors the drive for overtemperature
Encoder overtemperature	Monitors the encoder for overtemperature
Oversvoltage and undervoltage	Monitors the logic supply and power stage supply for permissible voltage range
Oversvoltage at digital inputs	Monitors the digital inputs for oversvoltage
Wire break HPULSE inputs	Monitors the HPULSE inputs for wire break
Power supply encoder	Monitors the encoder supply for short circuit and permissible voltage range
Current limitation (Foldback)	Power limitation in the case of overloads for the motor, the output current, the output power, and the braking resistor.

## Configurable Inputs and Outputs

### Configurable Inputs and Outputs

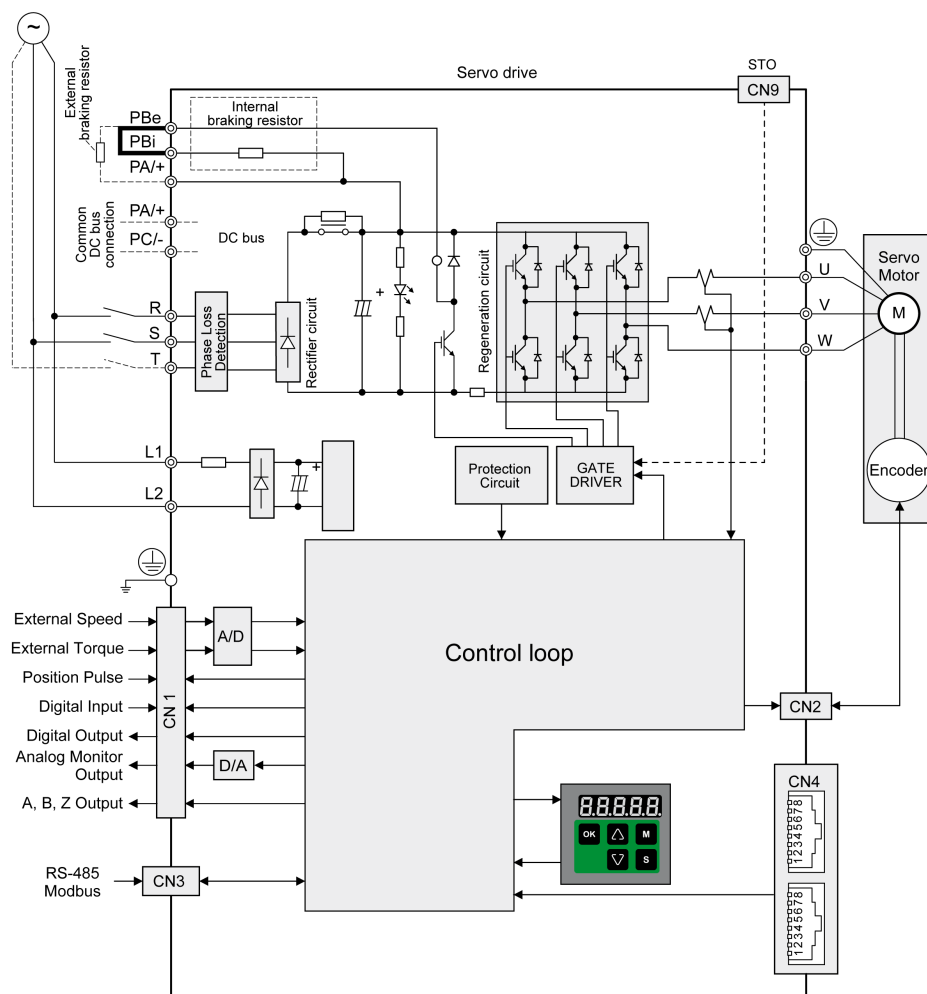
#### Presentation

This drive has digital inputs and outputs that can be configured. The inputs and outputs have a defined default assignment depending on the operating mode. This assignment can be adapted to the requirements of the customer's installation.

For further details, refer to chapter Operation, page 269.

# Wiring

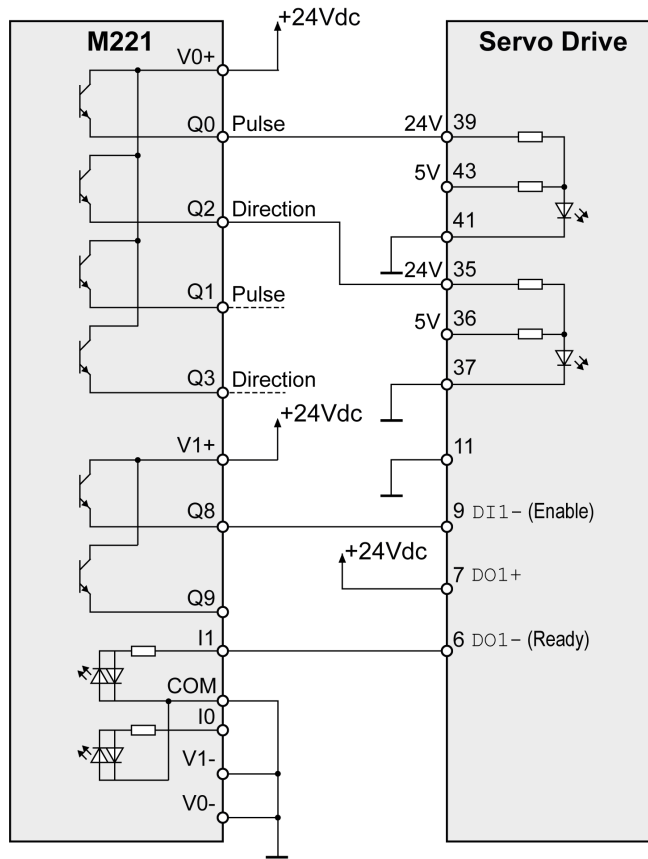
## General Wiring



## I/O Wiring Example With Modicon M221 Logic Controller

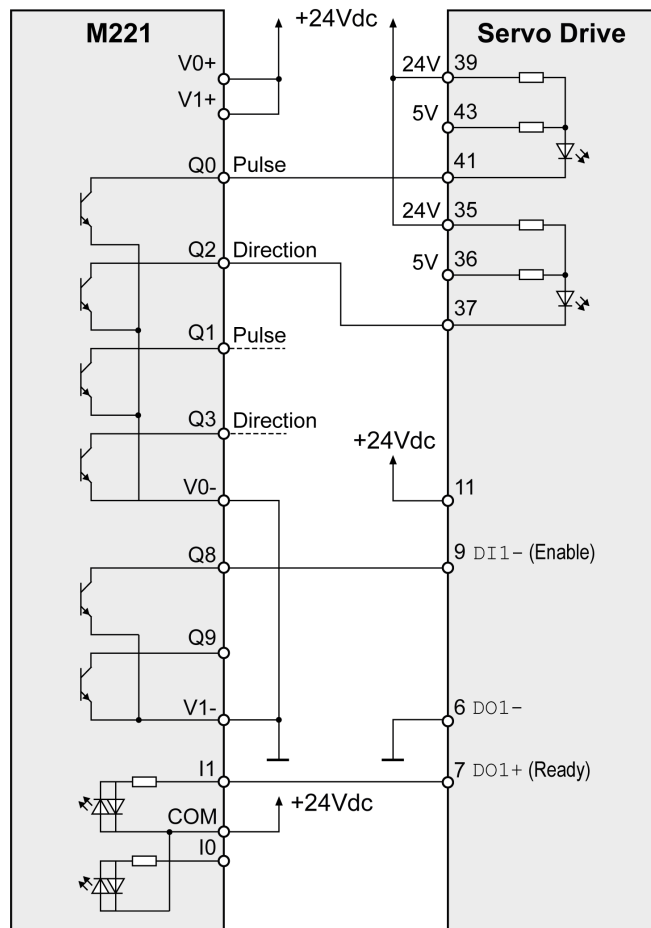
### Positive Logic

Wiring example with Modicon M221 Logic Controller (positive logic).



## Negative Logic

Wiring example with Modicon M221 Logic Controller (negative logic).





# Installation

## What's in This Part

Before Mounting.....	103
Drive Installation .....	104
Motor Installation.....	139
Verifying Installation .....	148

## Introduction

An engineering phase is mandatory prior to mechanical and electrical installation. For basic information, refer to *Engineering*, page 77.

### **DANGER**

#### **INSUFFICIENT GROUNDING**

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

In the case of a ground error, the maximum permissible current in the motor phases may be exceeded.

### **DANGER**

#### **FIRE CAUSED BY INCORRECT INSTALLATION**

Use upstream, external ground error detection equipment (Residual Current Device / Ground Fault Circuit Interrupter).

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

## **⚠ 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.<sup>1</sup>
- 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.**

<sup>1</sup> 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.

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

## **⚠ WARNING**

### **LOSS OF SAFETY 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 65 °C (149 °F) (for bare metal) during operation.

## **⚠ WARNING**

### **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 death, serious injury, or equipment damage.**

## **⚠ CAUTION**

### **INOPERABLE EQUIPMENT DUE TO INCORRECT MAINS VOLTAGE CONNECTION**

- Verify that you use the correct mains voltage; install a transformer, if necessary.
- Do not connect mains voltage to the output terminals (U, V, W).

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

# Before Mounting

## What's in This Chapter

Inspecting the Product .....	103
Scope of Supply .....	103

## Inspecting the Product

### Inspecting the Product

- Verify the product version by means of the type code on the nameplate. Refer to chapter Nameplate, page 30 and chapter Type Code, page 31.
- 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.

## Scope of Supply

### Drive

- Drive Lexium 28A
- Connector kit with 3 connectors for:
  - Power stage supply and logic supply
  - Braking resistor  
Including jumper between **PBi** and **PBe**
  - Motor
- Plastic tool for opening the spring terminals (available for devices from 50 W to 1.5 kW)
- 4-pin connector for deactivating the safety function STO (CN9)
- Adhesive hazard labels in 5 languages (German, French, Italian, Spanish, Chinese)
- Instruction sheet for the product

### Motor

- BCH2 servo motor
- BCH2•R: 2 eyebolts
- Information sheet for the product

# Drive Installation

## What's in This Chapter

Mechanical Installation Drive .....	104
Electrical Installation Drive .....	106
Connection Grounding Screw .....	108
Connection I/O Interface (CN1) .....	109
Connecting the Motor Encoder (CN2) .....	120
Connection PC (CN3) .....	121
Connection CAN (CN4) .....	123
Connection Logic Supply and Power Stage Supply (CN5) .....	126
Connection DC Bus (CN6) .....	129
Connection Braking Resistor (CN7) .....	129
Connecting the Motor Phases (CN8) .....	132
Holding Brake Connection .....	135
Connection STO (CN9) .....	136

## Mechanical Installation Drive

### 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 functions to become inoperative.

### WARNING

#### LOSS OF SAFETY 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.

### WARNING

#### 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 death, serious injury, or equipment damage.**

## Attaching a Hazard Label with Safety Instructions

Included in the packaging of the drive are adhesive hazard labels in German, French, Italian, Spanish, and Chinese languages. The English version is affixed to

the drive by the factory. If the country to which your final machine or process is to be delivered is other than English speaking:

- Select the hazard label suitable for the target country.  
Respect the safety regulations in the target country.
- Attach the hazard label to the front of the device so that it is clearly visible.

## Control Cabinet

The control cabinet (enclosure) must have a sufficient size so that all devices and components can be permanently installed and wired in compliance with the EMC requirements.

The ventilation of the control cabinet must be sufficient to comply with the specified ambient conditions for the devices and components operated in the control cabinet.

Install and operate this equipment in a control cabinet rated for its intended environment and secured by a keyed or tooled locking mechanism.

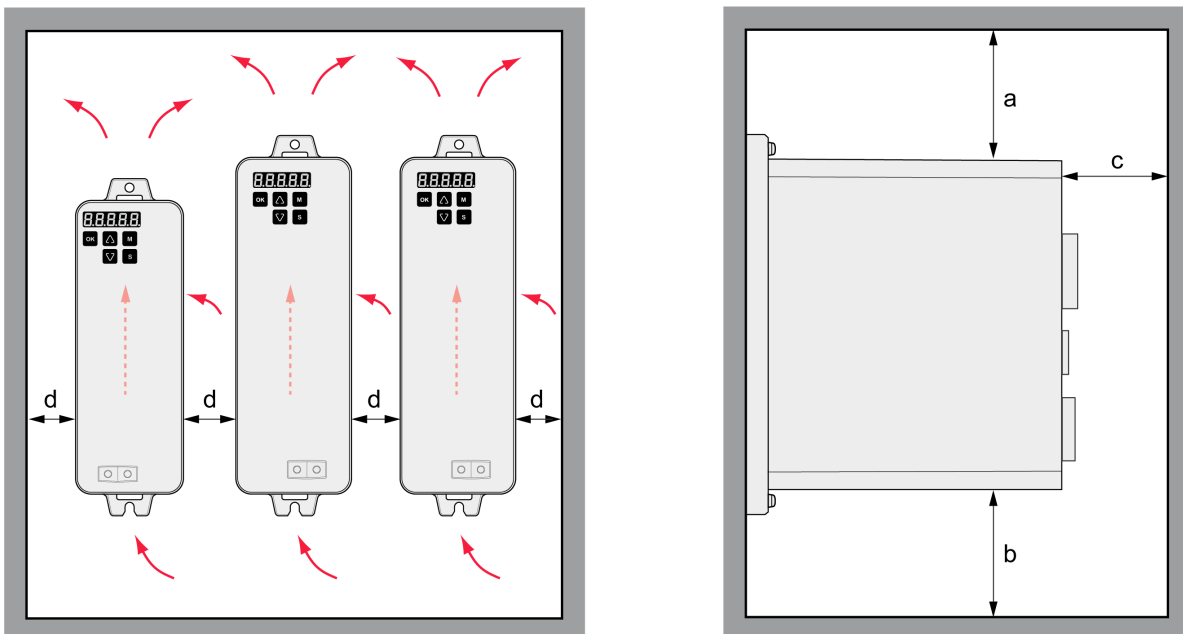
## Mounting Distances, Ventilation

When selecting the position of the device in the control cabinet, note the following:

- Mount the device in a vertical position ( $\pm 10^\circ$ ). This is required for cooling the device.
- Adhere to the minimum installation distances for required cooling. Avoid heat accumulations.
- Do not mount the device close to heat sources.
- Do not mount the device on or near flammable materials.
- The heated airflow from other devices and components must not heat up the air used for cooling the device.

The connection cables of the devices are routed to the top and to the bottom. The minimum distances must be adhered to for air circulation and cable installation.

Mounting distances and air circulation



LXM28AUA5, U01, U02, U04, U07, U10, U15, U20, U30, U45

Distance	Unit	Value
Free space a above the device	mm (in)	≥50 (≥1.97)
Free space b below the device	mm (in)	≥50 (≥1.97)
Free space c in front of the device <sup>(1)</sup>	mm (in)	≥60 (≥2.36)
Free space d between devices	mm (in)	≥15 (≥0.59)

(1)	The free space is strictly for observing proper ventilation and may not be sufficient for your wiring requirements.
-----	---

## Mounting the Drive


For further information on the dimensions of the mounting holes, refer to chapter Dimensions, page 33.

Painted surfaces may create electrical resistance or isolation. Before mounting the device to a painted mounting plate, remove all paint across a large area of the mounting points.

- Respect the ambient conditions in chapter Environmental Conditions, page 31.
- Mount the device in a vertical position ( $\pm 10^\circ$ ).

## Electrical Installation Drive

### Introduction


**DANGER**

**INSUFFICIENT GROUNDING**

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

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

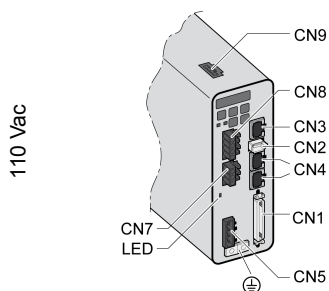
## ⚠ WARNING

### DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

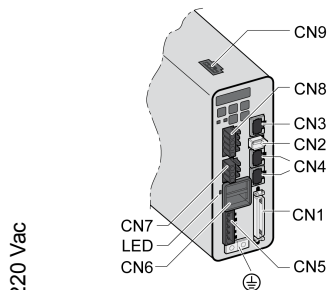
- Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.
- Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters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

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

The entire installation procedure must be performed without voltage present.

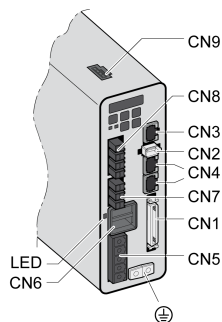


110 Vac

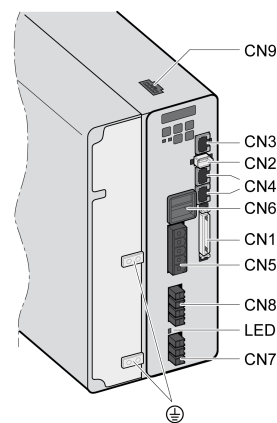


220 Vac

LXM28AU5 ... U15



LXM28AU20



LXM28AU30, U45

Item	Description	Refer to
CN1	Signal interface For connecting master controller or I/O signals.	Connection I/O Interface (CN1), page 109
CN2	Connection for motor encoder	Connecting the Motor Encoder (CN2), page 120
CN3	Modbus (commissioning interface) For connecting PC via converter TCSMCNAM3M002P	Connection PC (CN3), page 121
CN4	2 connections for fieldbus CANopen For connecting master controller or I/O signals.	Connection CAN (CN4), page 123
CN5	Power stage supply (R,S,T) and logic supply (L1, L2)	Connection Logic Supply and Power Stage Supply (CN5), page 126
CN6	DC bus connection <sup>(1)</sup>	Connection DC bus (CN6), page 129
LED	DC bus LED	-

Item	Description	Refer to
	The LED is illuminated when mains voltage or internal charge are present. The DC bus LED is not an indicator of the absence of DC bus voltage.	
CN7	Connection for external braking resistor	Connection braking resistor (CN7), page 129
CN8	Motor phases connection (U, V, W, PE)	Connecting the motor phases (CN8), page 132
CN9	Connection for safety function STO	Connection STO (CN9), page 136
(1) Not available for LXM28A... M1X drives.		

## Connection Grounding Screw

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

### **⚡⚠ DANGER**

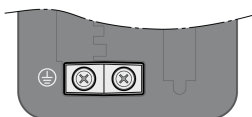
#### **INSUFFICIENT GROUNDING**

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

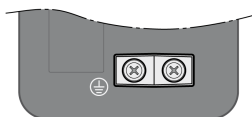
**Failure to follow these instructions will result in death or serious injury.**

The central grounding screws of the product are located at the front side.

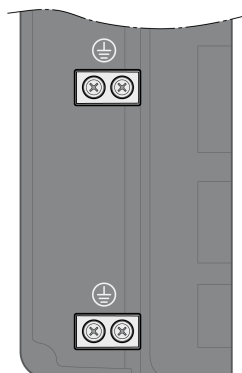
LXM28AU5...U15



LXM28AU20



LXM28AU30, U45



- Use ring-type cable lugs or fork-type cable lugs.
- Connect the ground connection of the device to the equipotential ground plane of your system.



<b>LXM28A</b>	<b>Unit</b>	<b>UA5, U01, U02, U04, U07, U10, U15, U20, U30, U45</b>
Tightening torque of grounding screw	Nm (lb.in)	1.3 (11.5)
Screw type	-	M4 x 8 socket button head screw

## Connection I/O Interface (CN1)

The I/O Interface (CN1) is a D-Sub 50-pin female connector. The following table describes the contacts of the connector:

Pin	Signal	Meaning	Pin	Signal	Meaning
1	DO4+	Digital output 4	2	DO3-	Digital output 3
3	DO3+	Digital output 3	4	DO2-	Digital output 2
5	DO2+	Digital output 2	6	DO1-	Digital output 1
7	DO1+	Digital output 1	8	DI4-	Digital input 4
9	DI1-	Digital input 1	10	DI2-	Digital input 2
11	COM+	Reference potential to DI1 ... DI8	12	GND	Reference potential analog input
13	GND	Reference potential for analog input	14	-	Reserved
15	MON2	Analog output 2	16	MON1	Analog output 1
17	VDD	24 Vdc power supply (for external I/O)	18	T_REF	Analog input for reference torque
19	GND	Analog input signal ground	20	VCC	Output power supply 12 Vdc (for analog reference values)
21	OA	ESIM channel A	22	/OA	ESIM channel A, inverted
23	/OB	ESIM channel B, inverted	24	/OZ	ESIM index pulse, inverted
25	OB	ESIM channel B	26	DO4-	Digital output 4
27	DO5-	Digital output 5	28	DO5+	Digital output 5
29	/HPULSE	High-speed pulses, inverted	30	DI8-	Digital input 8
31	DI7-	Digital input 7	32	DI6-	Digital input 6
33	DI5-	Digital input 5	34	DI3-	Digital input 3
35	PULL HI_S (SIGN)	Pulse applied Power (SIGN)	36	/SIGN	Direction signal, inverted
37	SIGN	Direction signal	38	HPULSE	High-speed pulses
39	PULL HI_P (PULSE)	Pulse applied Power (PULSE)	40	/HSIGN	Direction signal for high-speed pulses, inverted
41	PULSE	Pulse input	42	V_REF	Analog input for reference velocity
43	/PULSE	Pulse input	44	GND	Analog input signal ground
45	COM-	Reference potential to VDD and DO6 (OCZ)	46	HSIGN	Direction signal for high-speed pulses
47	COM-	Reference potential to VDD and DO6 (OCZ)	48	DO6(OCZ)	ESIM index pulse Open collector output
49	COM-	Reference potential to VDD and DO6 (OCZ)	50	OZ	ESIM index pulse Line driver output

**⚠ WARNING**

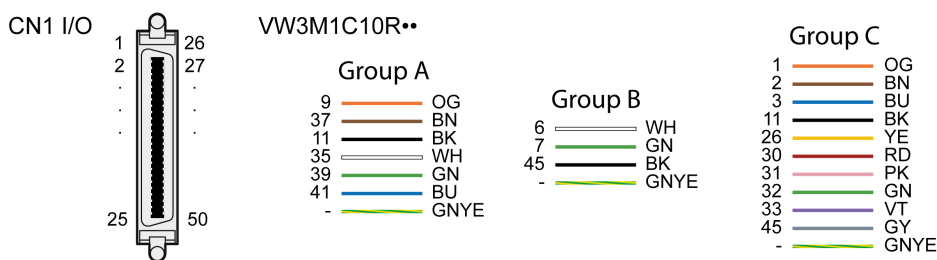
**UNINTENDED EQUIPMENT OPERATION**

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.**

## Prefabricated Cable VW3M1C10R••

Color assignments of the prefabricated cable connected to the I/O interface (CN1):



VW3M1C10R•• Pinout

Group A			Group B			Group C		
Pin	Signal	Color	Pin	Signal	Color	Pin	Signal	Color
9	DI1-	OG	6	DO1-	WH	1	DO4+	OG
37	SIGN	BN	7	DO1+	GN	2	DO3-	BN
11	COM	BK	45	COM-	BK	3	DO3+	BU
35	PULL HI_S (SIGN)	WH	-			11	COM	BK
39	PULL HI_P (PULSE)	GN		26	DO4-	YE		
41	PULSE	BU		30	DI8-	RD		
				31	DI7-	PK		
				32	DI6-	GN		
				33	DI5-	VT		
				45	COM-	BY		

**NOTE:** For the CN1 mating connector, use a clip-on (latching) type, such as Schneider Electric reference VW3M1C12 CN1 Connector Kit.

## Inputs and Outputs Signals

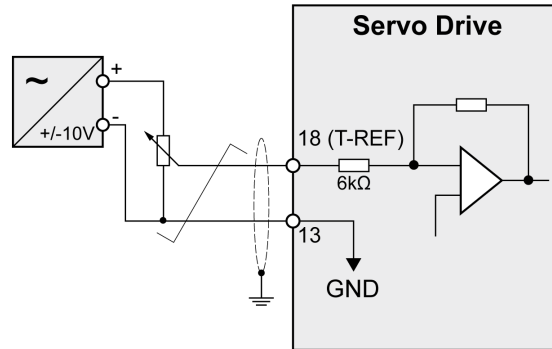
The following inputs and outputs signals are available:

- Analog inputs and outputs, page 111
- Pulse input (open collector, negative logic), page 111
- Pulse input (open collector, positive logic), page 112
- Pulse input (line driver), page 113
- High-speed pulse input (line driver), page 114
- Digital outputs (negative logic), page 114
- Digital outputs (positive logic), page 116

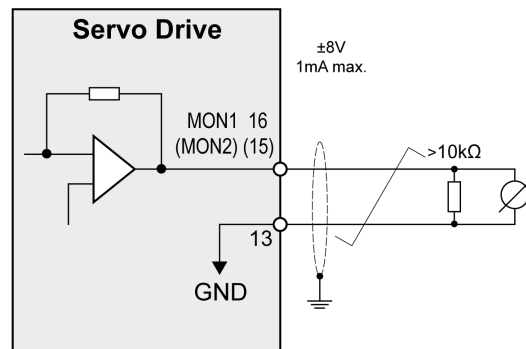
- Digital inputs (negative logic), page 117
- Digital inputs (positive logic), page 118
- Encoder output signal), page 119

## Analog Inputs and Outputs

Example of reference value via analog input:



Example of analog output:



## Pulse Input (Open Collector, Negative Logic)

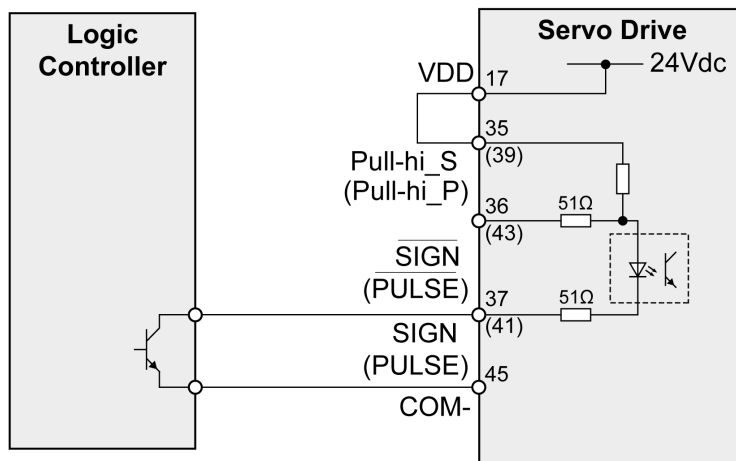
### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

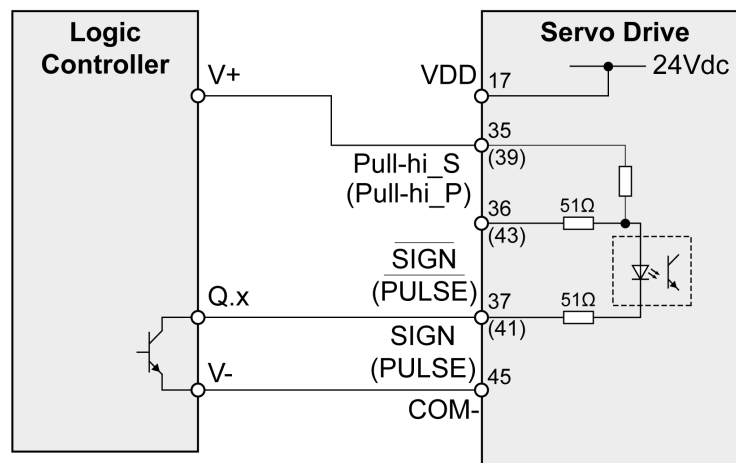
Do not connect an external, 24 Vdc power supply to the VDD connection of the I/O interface (CN1) connector.

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

Example of pulse input (open collector) with internal power supply (negative logic).



Example of pulse input (open collector) with external power supply (negative logic).



## Pulse Input (Open Collector, Positive Logic)

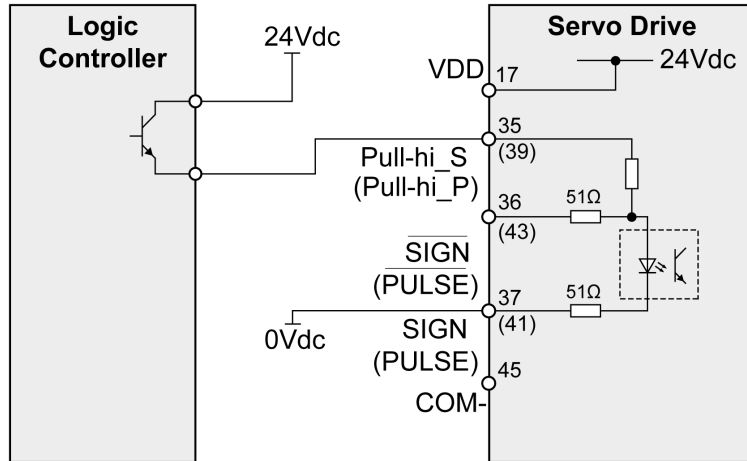
### ⚠ WARNING

#### UNINTENDED EQUIPMENT OPERATION

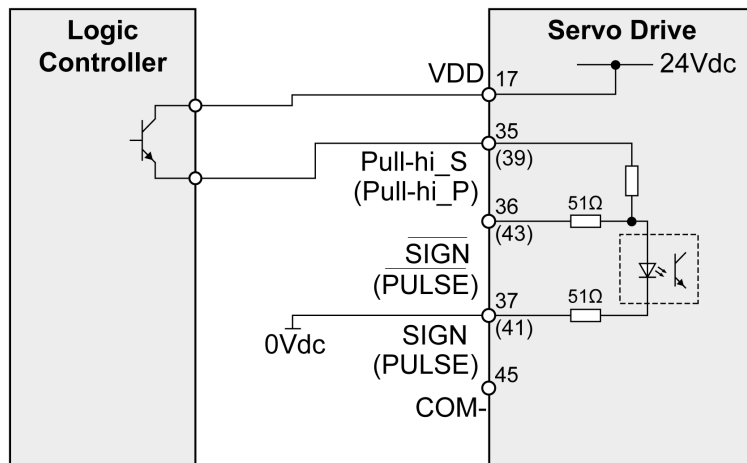
Do not connect an external, 24 Vdc power supply to the VDD connection of the I/O interface (CN1) connector.

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

Example of pulse input (open collector) with internal power supply (positive logic).

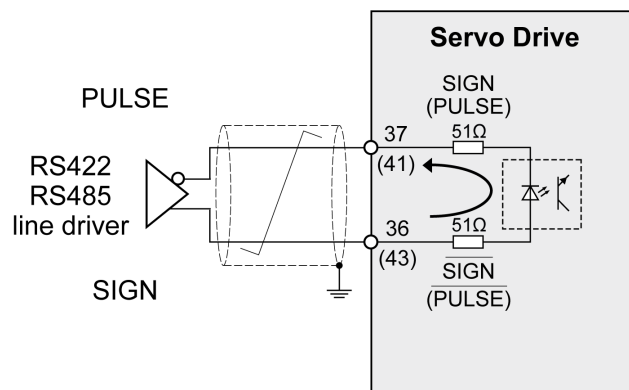


Example of pulse input (open collector) with external power supply (positive logic).



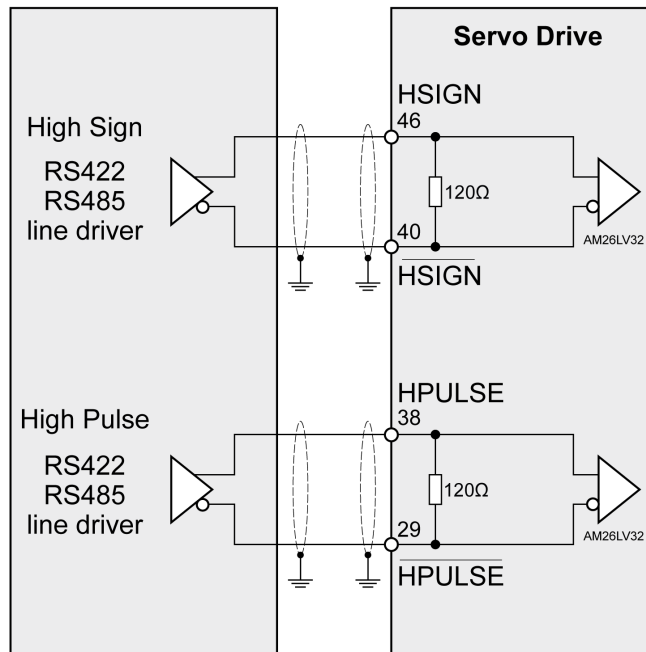
## Pulse Input (Line Driver)

Example of pulse input (line driver).



## High-Speed Pulses

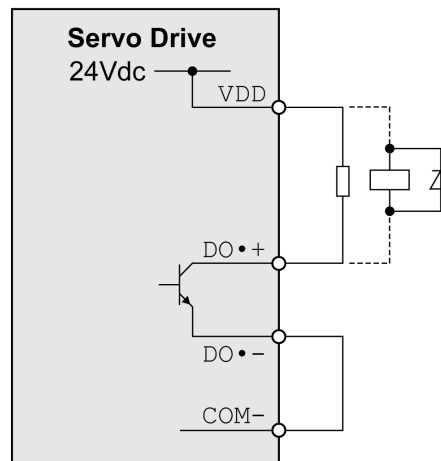
Example of high-speed pulse input (line driver).



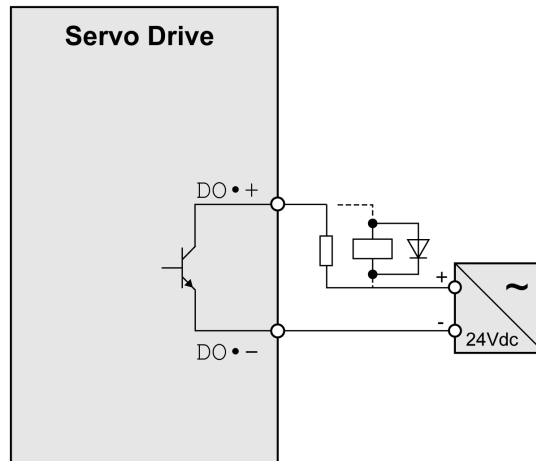
Connect the cable shield to the equipotential ground of your controller/drive electrical system.

## Wiring of the Digital Outputs (Negative Logic)

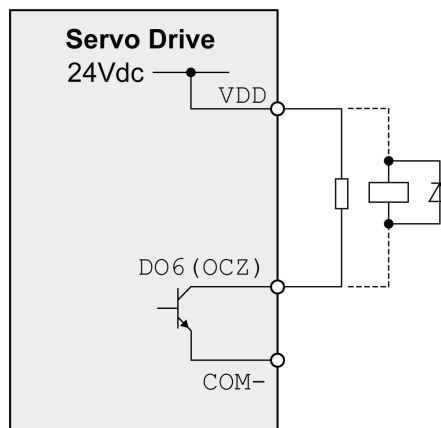
Example of digital outputs DO1 ... DO5 with internal power supply (negative logic):



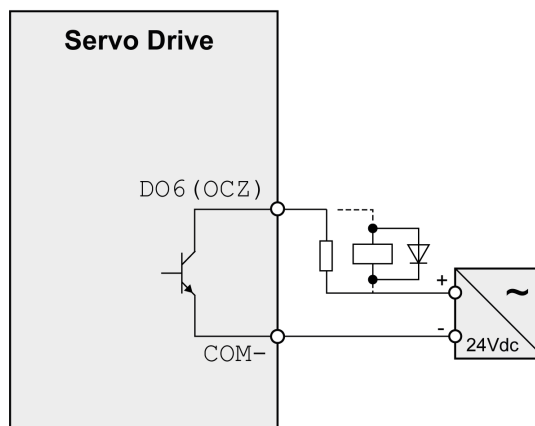
Example of digital outputs DO1 ... DO5 with external power supply (negative logic):



Example of digital output DO6 (OCZ) with internal power supply (negative logic):



Example of digital output DO6 (OCZ) with external power supply (negative logic):



Inductive loads using DC voltages may damage the signal outputs. A protection circuit is required to protect the signal outputs against inductive loads.

## ▲ CAUTION

### OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the inductive direct current load damage.

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

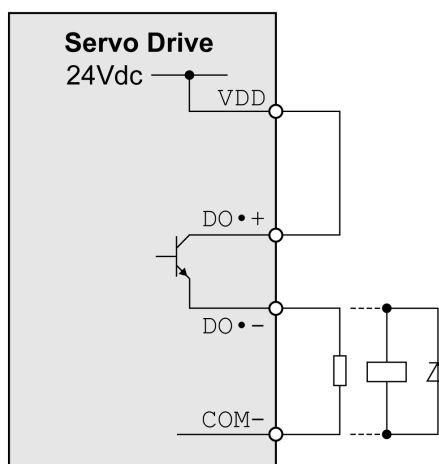
A diode can be used to protect the signal outputs against inductive loads.

Use a diode with the following ratings:

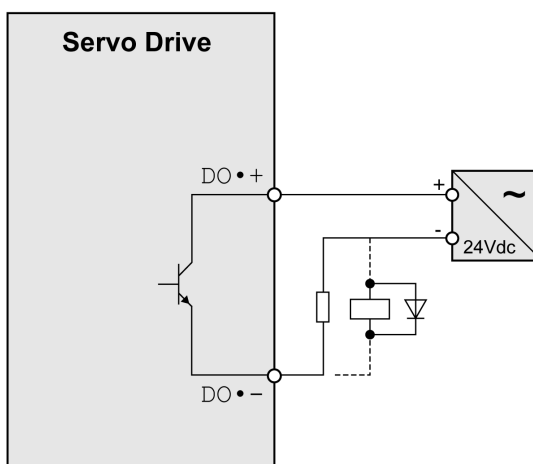
- Reverse withstand voltage: voltage of signal output times 10
- Forward current: greater than the load current

## Wiring of the Digital Outputs (Positive Logic)

Example of digital outputs DO1 ... DO5 with internal power supply (positive logic):



Example of digital outputs DO1 ... DO5 with external power supply (positive logic):



Inductive loads using DC voltages may damage the signal outputs. A protection circuit is required to protect the signal outputs against inductive loads.



### ⚠ CAUTION

#### OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the inductive direct current load damage.

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

A diode can be used to protect the signal outputs against inductive loads. Use a diode with the following ratings:

Reverse withstand voltage: voltage of signal output times 10

Forward current: greater than the load current

## Wiring of the Digital Inputs (Negative Logic)

### ⚠ WARNING

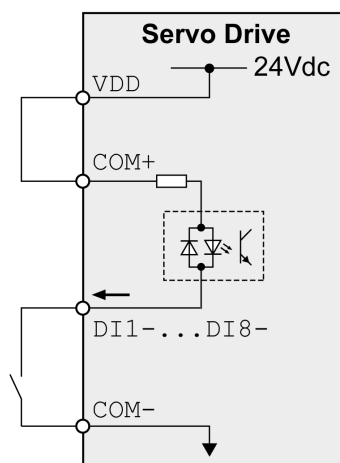
#### UNINTENDED EQUIPMENT OPERATION

Do not connect an external, 24 Vdc power supply to the VDD connection of the I/O interface (CN1) connector.

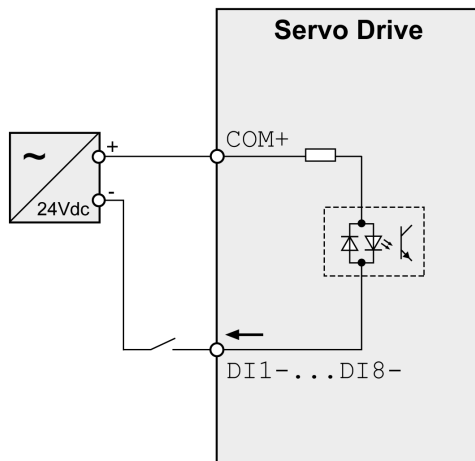
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Use a relay or an open collector output (NPN transistor) for the input signal.

Example of digital input (negative logic) with internal power supply:



Example of digital input (negative logic) with external power supply:



## Wiring of the Digital Inputs (Positive Logic)

**⚠ WARNING**

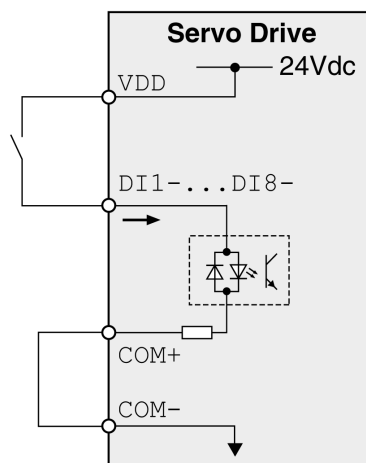
**UNINTENDED EQUIPMENT OPERATION**

Do not connect an external, 24 Vdc power supply to the VDD connection of the I/O interface (CN1) connector.

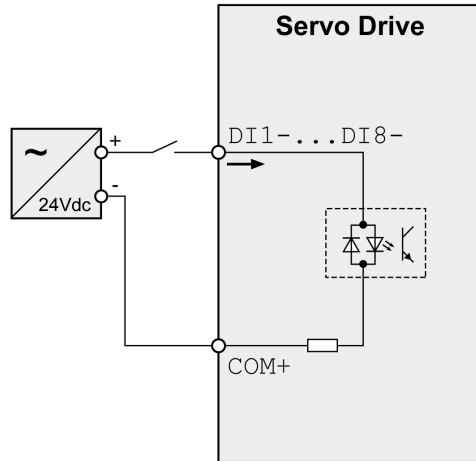
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Use a relay or an open collector output (PNP transistor) for the input signal.

Example of digital input with internal power supply (positive logic):

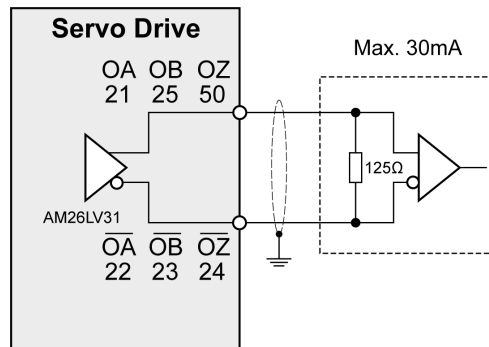


Example of digital input with external power supply (positive logic):

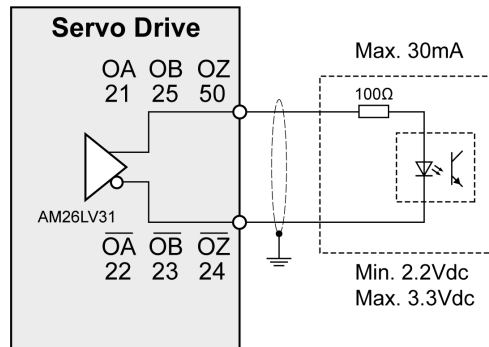


## Encoder Output Signal

Example of encoder output signal Line Driver.



Example of encoder output signal, high-speed optocoupler.



## Connecting the Motor Encoder (CN2)

### Function and Encoder Type

The motor encoder is an integrated, high-resolution absolute encoder. It provides the device with information on the motor position (analog and digital).

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

### Cable Specifications

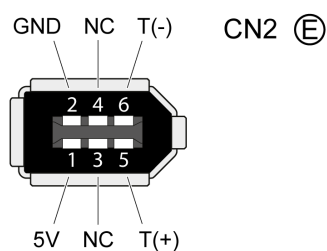
For further information, refer to chapter Cables, page 80.

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	10 x 0.13 mm <sup>2</sup> (10 x AWG 24)
Maximum cable length:	20 m (65.6 ft)
Special characteristics:	Fieldbus cables are not suitable for connecting encoders.

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

### Wiring Diagram

Connection assignment motor encoder (CN2)



The motor encoder interface (CN2) is a 6-pin connector. The following table describes the contacts of the connector:

Pin	Signal	Color <sup>(1)</sup>	Meaning	Motor military connector	Motor plastic connector	I/O
5	T+	Blue (BU)	Serial communication	A	1	I/O
6	T-	Blue/Black (BU/BK)		B	4	
1	+5 V	Red, red/white (RD, RD/WH)	5 V encoder supply	S	7	I
2	GND	Black, black/white (BK, BK/WH)	Reference potential for encoder supply	R	8	O
3, 4	N.C.	Reserved	-	-	-	-

(1) Color information relates to the cables available as accessories.

## ⚠ 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.**

## Connecting the Motor Encoder

- Verify that wiring, cables, and connected interface meet the PELV requirements.
- Note the information on EMC, see chapter [Electromagnetic Compatibility \(EMC\)](#), page 77. Use equipotential bonding conductors for equipotential bonding.
- Connect the connector to
  - CN2 Encoder if using a motor equipped with a single-turn encoder.
  - the battery compartment if using a motor equipped with a multi-turn encoder.
- Verify that the connector locks snap in properly at the housing.

Route the cables from the motor and the encoder to the device (starting from the motor). Due to the pre-assembled connectors, this direction is often faster and easier.

## Connecting the Battery Compartment When Using a Motor Equipped With a Multi-Turn Encoder

The battery compartment is connected to CN2 Encoder, between the drive and the motor encoder cable.

**NOTE:** The multi-turn counting is preserved through power down by the external battery located into the battery compartment.

For further information on the battery replacement, refer to the [maintenance of the motor](#), page 382.

For LXM28A...UA5 ...U45, the battery compartment should be installed on a baseplate near the drive

## Connection PC (CN3)

### Function

The commissioning interface (CN3) is an RS-485 connection, supported on an RJ45 connector. If the PC used to connect to the commissioning interface has an RS-485 port, typically supported on a DB9 connector, you can connect it to this connector (RJ45 / DB9 cable). Otherwise, you can use the USB port of the PC with a USB to RS-485 converter.

The commissioning interface may only be used for a point-to-point connection, but not for a point-to-multipoint connection (RS-485 network).

If the commissioning interface at the product is directly connected to an Ethernet interface at the PC, the PC interface may be damaged and rendered inoperable.

## **NOTICE**

### **INOPERABLE EQUIPMENT**

Do not directly connect an Ethernet interface to the commissioning interface of this product.

**Failure to follow these instructions can result in equipment damage.**

## Connecting a PC

A PC with the commissioning software LXM28 DTM Library can be connected for commissioning. The PC is connected via a bidirectional USB/RS485 converter, refer to *Accessories and Spare Parts*, page 71.

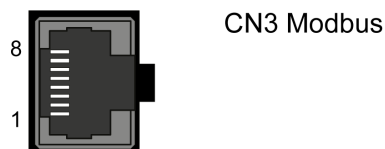
## Cable Specifications

For further information, refer to chapter *Cables*, page 80.

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	8 x 0.25 mm <sup>2</sup> (8 x AWG 22)
Maximum cable length:	100 m (328 ft)
Special characteristics:	-

## Wiring Diagram

Wiring diagram PC with commissioning software



The commissioning interface (CN3) is an RJ45 connector. The following table describes the contacts of the connector:

Pin	Signal	Meaning	I/O		
1 ... 3	-	Reserved	-		
4	MOD_D1 <sup>(1)</sup>	Bidirectional transmit/receive signal	RS-485 level		
5	MOD_D0 <sup>(1)</sup>	Bidirectional transmit/receive signal, inverted			
6 ... 7	-	Reserved	-		
8 and connector housing	SHLD	Functional ground / shield - internally connected to ground potential of the drive	-		
<table border="1" style="width: 100%;"> <tr> <td style="width: 20%;">(1)</td> <td>No polarization.</td> </tr> </table>				(1)	No polarization.
(1)	No polarization.				

**▲ 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.**

**NOTE:** Verify that the connector locks snap in properly at the housing.

## Connection CAN (CN4)

### Function

The device is suitable for connection to CANopen and CANmotion.

A CAN bus connects multiple devices via a bus cable. Each network device can transmit and receive messages. Data between network devices is transmitted serially.

Each network device must be configured before it can be operated on the network. The device is assigned a unique 7-bit node address (node ID) between 1 (01<sub>h</sub>) and 127 (7F<sub>h</sub>). The address is set during commissioning.

The baud rate must be the same for all devices in the fieldbus.

### Cable Specifications

For further information, refer to chapter [Cables](#), page 80.

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition for cables with RJ45 connectors <sup>(1)</sup> :	8 x 0.14 mm <sup>2</sup> (AWG 24)
Cable composition with D-SUB connectors:	2 x 0.25 mm <sup>2</sup> , 2 x 0.20 mm <sup>2</sup> (2 x AWG 22, 2 x AWG 24)  Cross section 0.20 mm <sup>2</sup> (AWG 24) for CAN level, cross section 0.25 mm <sup>2</sup> (AWG 22) for reference potential.
(1)	Cables with RJ45 connectors may only be used inside of control cabinets.

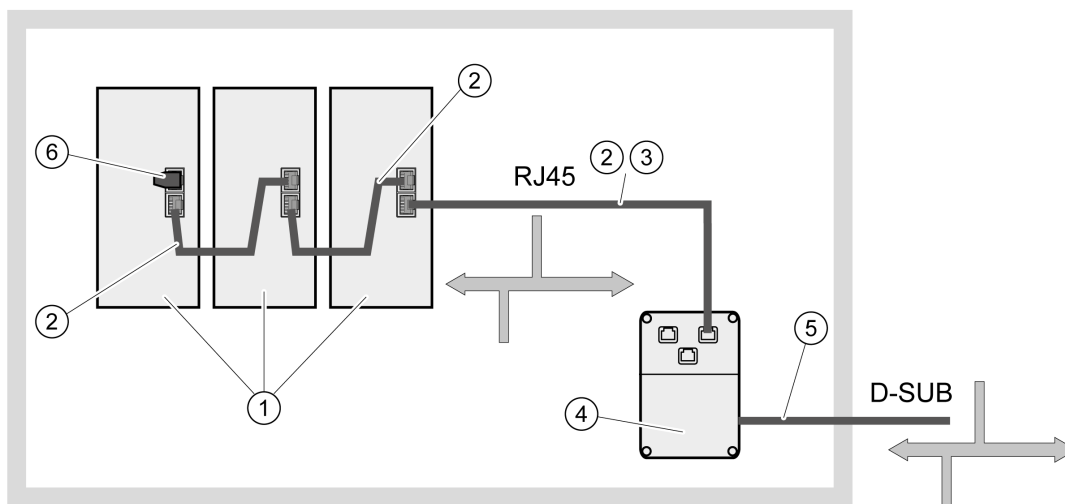
- Use equipotential bonding conductors.
- Use pre-assembled cables to reduce the risk of wiring errors.

### Connectors D-SUB and RJ45

Usually, a cable with D-Sub connectors is used for CAN fieldbus connection in the field. Inside control cabinets, connections with RJ45 cables have the benefit of easier and faster wiring. In the case of CAN cables with RJ45 connectors, the maximum permissible bus length is reduced by 50%.

Multiple-port taps can be used to connect an RJ45 system inside the control cabinet to a D-Sub system in the field, see the figure below. The trunk line is connected to the multiple-port tap by means of screw terminals; the devices are connected by means of pre-assembled cables. See chapter CANopen Connectors, Distributors, Terminating Resistors, page 72.

Connection of RJ45 CAN in the control cabinet to the field



Item	Description
1	Devices with RJ45 CAN connection in the control cabinet
2	CANopen cables with RJ45 connectors
3	Connection cables between device and tap, for example TCSCCN4F3M3T for tap TSXCANTDM4
4	Tap in the control cabinet, for example TSXCANTDM4 as D-SUB four-port tap or VW3CANTAP2 as RJ45 tap
5	Fieldbus cable (trunk line) to the bus devices outside of the control cabinet, connected to the tap by means of screw terminals. Cross section 0.20 mm <sup>2</sup> (AWG 24) for CAN level, cross section 0.25 mm <sup>2</sup> (AWG 22) for reference potential
6	Terminating resistor 120 Ω RJ45 (TCSCAR013M120)

## Maximum Bus Length CAN

The maximum bus length depends on the selected baud rate. The following table shows the maximum overall length of the CAN bus in the case of cables with D-SUB connectors.

Baud rate	Maximum bus length
125 kbit/s	500 m (1640 ft)
250 kbit/s	250 m (820 ft)
500 kbit/s	100 m (328 ft)
1000 kbit/s	20 m (65.6 ft) <sup>(1)</sup>
(1)	According to the CANopen specification, the maximum bus length is 40 m. However, in practice, limiting the length to 20 m reduces communication errors caused by external interference.

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



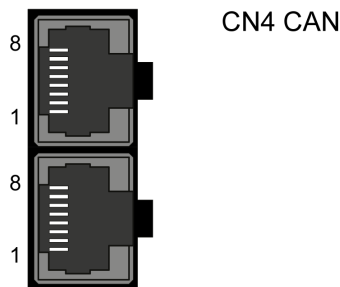
## Terminating Resistors

Both ends of a CAN bus line must be terminated. A 120 Ω terminating resistor between **CAN\_L** and **CAN\_H** is used for this purpose.

Connectors with integrated terminating resistors are available as accessories, refer to chapter CANopen Connectors, Distributors, Terminating Resistors, page 72.

## Wiring Diagram

Wiring diagram CN4 CANopen



The CAN interface (CN4) consists of 2 RJ45 connectors. The following table describes the contacts of the connectors:

Pin	Signal	Meaning	I/O
1	CAN_H	CAN interface	CAN level
2	CAN_L		
3	CAN_0V	Reference potential CAN	-
4...5	-	Reserved	-
6 and connector housing	SHLD	Functional ground / shield - internally connected to ground potential of the drive	-
7	CAN_0V	Reference potential CAN	-
8	-	Reserved	-

### **⚠ 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.**

## Connecting CANopen

- Connect the CANopen cable to CN4 (pins 1, 2, and 3) with an RJ45 connector. Note the information on using cables with RJ45 connectors.
- Verify that the connector locks snap in properly at the housing.

## 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.

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

- Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point. <sup>1)</sup>
- Route communications and I/O cables separately from power cables.

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

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

## Terminating Resistors

Both ends of a CAN bus line must be terminated. A 120 Ω terminating resistor between **CAN\_L** and **CAN\_H** is used for this purpose.

## Connection Logic Supply and Power Stage Supply (CN5)

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

### **DANGER**

#### **INSUFFICIENT GROUNDING**

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

**⚠ WARNING****INSUFFICIENT PROTECTION AGAINST OVERCURRENT**

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

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

**⚠ WARNING****INCORRECT MAINS VOLTAGE**

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

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

The equipment, drives and motors, are intended for industrial use and may only be operated with a permanently installed connection.

Prior to connecting the equipment, verify the approved mains types, see chapter Electrical Data Drive, page 34.

## Cable Specifications

Respect the required cable properties in chapter Cables, page 80 and in chapter Electromagnetic Compatibility (EMC), page 77.

Shield:	-
Twisted Pair:	-
PELV:	-
Cable composition:	The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Maximum cable length:	3 m (9.84 ft)
Special characteristics:	-

## Properties of the Terminals

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

LXM28A	Unit	UA5, U01, U02, U04, U07, U10, U15	U20, U30, U45
Connection cross section	mm <sup>2</sup> (AWG)	0.75 ... 2.5 (20 ... 14)	0.75 ... 6 (20 ... 10)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)	15 (0.59)

## Prerequisites for Connecting the Logic Supply

Note the following information:

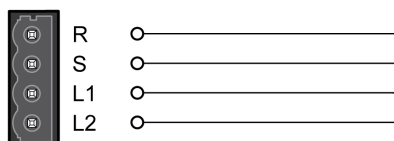
- Use upstream mains fuses. For further information about fuse types and fuse ratings, refer to chapter *Electrical Data Drive*, page 34.
- Note the EMC requirements. Where required, use surge arresters and mains reactors.
- If the length of the mains cable between the external mains filter and the drive exceeds 200 mm (7.87 in), it must be shielded and grounded at both ends.
- For a UL-compliant design, refer to chapter *Conditions for UL 508C*, page 25.

## Connection Logic Supply

Wiring diagram logic supply LXM28A•••M1X

UA5, U01, U02, U04, U07, U10, U15

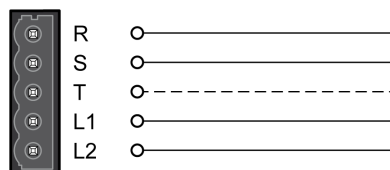
~110V



Wiring diagram logic supply LXM28A•••M3X

UA5, U01, U02, U04, U07, U10, U15, U20, U30, U45

~220V



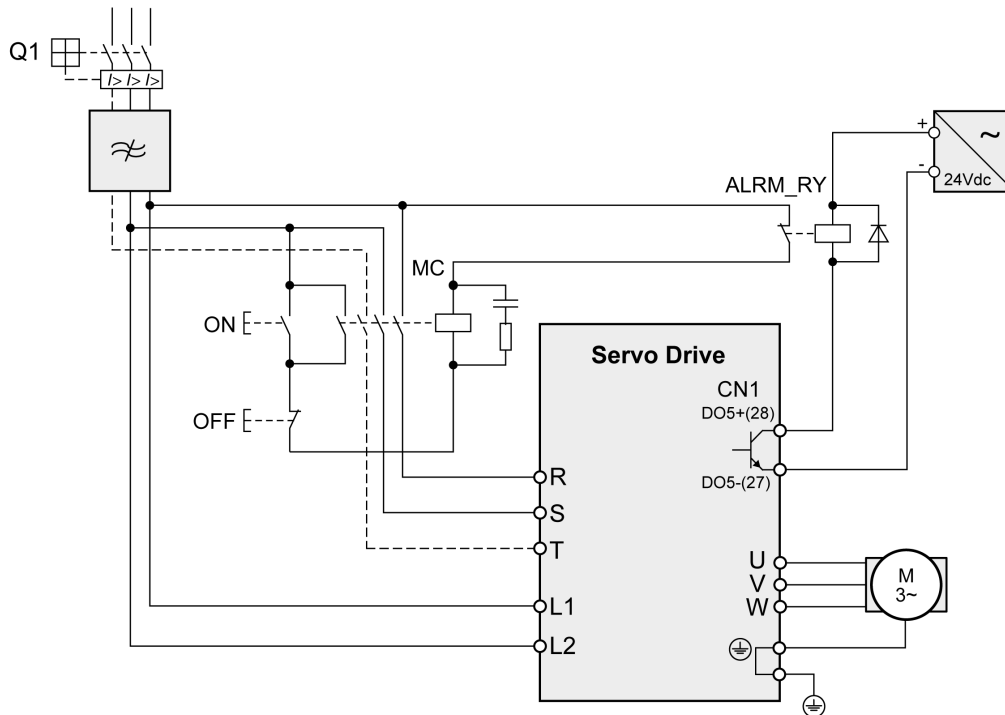
Connection	Meaning
R, S, (T)	Power stage supply
L1, L2	Logic supply

- Verify the type of mains. For the approved types of mains, refer to chapter *Electrical Data Drive*, page 34.
- Connect the mains cable.
- Verify that the connector locks snap in properly at the housing.

## Wiring Diagram for Devices That Can Be Connected Via a Single-Phase or Three Phases

Drives with a continuous power from 50 W to 1500 W can be connected via a single-phase or via three phases. Drives with a continuous power of more than 1500 W must be connected via three phases.

Wiring diagram for devices that can be connected via a single-phase or three-phases



## Connection DC Bus (CN6)

Incorrect use of the DC bus may permanently damage the drives either immediately or over time.

<b>⚠ WARNING</b>
<b>INOPERABLE SYSTEM COMPONENTS AND LOSS OF CONTROL</b>
Verify that all requirements for using the DC bus are met.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

This and other important information can be found in the "LXM28 - Common DC bus - Application note", page 11. If you wish to take advantage of DC bus sharing, you must first consult the LXM28 - Common DC bus - Application note for important safety-related information.

## Requirements for Use

The requirements and limit values for parallel connection of multiple devices via the DC bus can be found on [www.se.com](http://www.se.com) in the form of an application note (refer to chapter Related Documents, page 11).

## Connection Braking Resistor (CN7)

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

**⚠ WARNING****UNINTENDED EQUIPMENT OPERATION**

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

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

## Internal Braking Resistor

A braking resistor is integrated in the device to absorb braking energy. The drive is shipped with the internal braking resistor active.

## External Braking Resistor

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

Selection and rating of the external braking resistor are described in chapter *Rating the Braking Resistor*, page 94. For suitable braking resistors, refer to chapter *Accessories and Spare Parts*, page 74.

## Cable Specifications

For further information, refer to chapter *Cables*, page 80.

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

The braking resistors listed in chapter *Accessories and Spare Parts*, page 74 have a 3-wire, temperature-resistant cable with a length of 0.75 m (2.46 ft) to 3 m (9.84 ft).

## Properties of the Terminals (CN7) LXM28AUA5, U01, U02, U04, U07, U10, U15, U20, U30, U45

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

LXM28A	Unit	UA5, U01, U02, U04, U07, U10, U15	U20, U30, U45
Connection cross section	mm <sup>2</sup> (AWG)	0.75 ... 2.5 (20 ... 14)	0.75 ... 6 (20 ... 10)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)	15 (0.59)

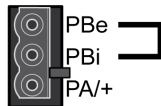
The removable terminals are approved for fine-stranded conductors and solid conductors. Respect the maximum permissible connection cross section. Take into account the fact that cable ends (ferrules) increase the conductor cross section.

**NOTE:** If you use cable ends (ferrules), use only cable ends (ferrules) with collars for these terminals.

## Wiring Diagram

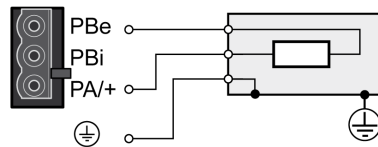
Wiring diagram internal braking resistor activated

LXM28AUA5...U45



Wiring diagram external braking resistor

LXM28AUA5...U45



## Connecting the External Braking Resistor

- Remove power from all supply voltages. Respect the safety instructions concerning electrical installation.
- Verify that no voltages are present.
- Ground the ground connection (PE) of the braking resistor.
- Connect the external braking resistor to the device.
- Connect a large surface area of the cable shield to the central grounding point of your system.

**⚡⚠ DANGER****ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Measure the voltage on the DC bus with a properly rated voltage sensing device and verify that the voltage is less than 42.4 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- 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.**

## Connecting the Motor Phases (CN8)

High voltages may be present at the motor connection. The motor itself generates voltage when the motor shaft is rotated. AC voltage can couple voltage to unused conductors in the motor cable.

**⚡⚠ DANGER****ELECTRIC SHOCK**

- Verify that no voltage is present prior to performing any type of work on the drive system.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Insulate both ends of unused conductors of the motor cable.
- Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

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

Incorrect wiring of the motor connection may cause live wires to be exposed outside of the motor connector below the HMI.



**⚠ ⚠ DANGER**

**ELECTRIC SHOCK CAUSED BY INCORRECT WIRING**

- Verify that the protective ground connection (PE) of the device is connected to ground.
- Do not remove the cable end (ferrule) from the protective ground terminal (PE) of the motor connector until you are prepared to wire the protective ground conductor of the motor to the protective ground terminal (PE) of the motor connector.
- Verify that no bare metal of the wires is exposed outside of the motor connector housing when wiring the motor connector.
- Regularly, as part of a maintenance plan, assure that the motor wires are secured in the terminals of the motor connector due to vibration or other influences.

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

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used. Even if motors are similar, different adjustment of the encoder system may be a source of hazards. Even if the connectors for motor connection and encoder connection match mechanically, this does not imply that the motor is approved for use.

**⚠ WARNING**

**UNINTENDED MOVEMENT**

Only use approved combinations of drive and motor.

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

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

Route the cables from the motor and the encoder to the device (starting from the motor). Due to the pre-assembled connectors, this direction is often faster and easier.

## Cable Specifications

For further information, refer to chapter Cables, page 80.

Shield:	Required, both ends grounded
Twisted Pair:	-
PELV:	The wires for the holding brake must be PELV-compliant.
Cable composition:	3 wires for motor phases The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Maximum cable length:	Depends on the required limit values for conducted interference. Category C3: 20 m (65.6 ft)
Special characteristics:	Contains wires for the temperature sensor

Note the following information:

- You may only connect the original motor cable.
- If you do not connect the wires at the motor end, you must isolate each wire individually (inductive voltages).

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

## Properties of the Terminals (CN8)

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

LXM28A	Unit	UA5, U01, U02, U04, U07, U10, U15	U20, U30, U45
Connection cross section	mm <sup>2</sup> (AWG)	0.75 ... 2.5 (20 ... 14)	0.75 ... 6 (20 ... 10)
Stripping length	mm (in)	8 ... 9 (0.31 ... 0.35)	15 (0.59)

## Monitoring

The drive monitors the motor phases for:

- Short circuit between the motor phases
- Short circuit between the motor phases and ground (Not applicable for LXM28AUA5 ... U07 M3X.)

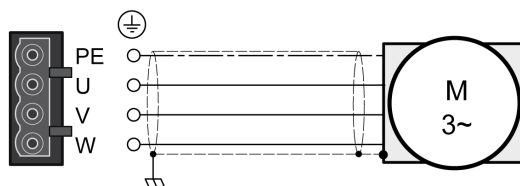
Short circuits between the motor phases and the DC bus, the braking resistor, or the holding brake wires are not detected.

When a short-circuit is detected, power is removed by disabling the power stage. The firmware reports error AL001. Once you have resolved the issue of the over-current, you can re-enable the power stage of the drive.

**NOTE:** After three successive unsuccessful retries of resetting the power stage, the reset will be blocked for a minimum of one minute.

## Wiring Diagram Motor

LXM28AUA5...U45



Connection	Meaning	Color <sup>(1)</sup> (IEC 757)		
U	Motor phase	Red (RD)		
V		White (WH)		
W		Black (BK)		
PE	Protective ground conductor	Green/Yellow (GN/YE)		
<table border="1"> <tr> <td>(1)</td> <td>Color information relates to the cables available as accessories.</td> </tr> </table>			(1)	Color information relates to the cables available as accessories.
(1)	Color information relates to the cables available as accessories.			

## Connecting the Motor Cable

- Note the information on EMC, refer to chapter Electromagnetic Compatibility (EMC), page 77.
- Connect the motor phases and protective ground conductor to CN8. Verify that the connections U, V, W, and PE (ground) match at the motor and the device.
- If the product is equipped with removable connectors, Verify that the connector locks snap in properly at the housing.

## Holding Brake Connection

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

A motor with a holding brake requires a suitable holding brake controller which releases the brake when the power stage is enabled and locks the motor shaft when the power stage is disabled.

The holding brake is connected to one of the digital outputs **DO1...DO5**. The signal output function BRKR must be assigned to the digital output to which the holding brake is connected. The signal output function BRKR releases the holding brake when the power stage is enabled. When the power stage is disabled, the holding brake is reapplied.

The factory settings for the signal outputs depend on the operating mode, see chapter Setting the Digital Signal Outputs, page 276. Depending on the operating mode, the signal output function is either assigned to the digital output DO4 or not assigned at all. When you reset the drive to the factory settings with P2-08 = 10, the assignments of the signal output functions are also reset to the factory settings.

When you switch the operating mode using the parameter P1-01 or the signal input functions V-Px and V-T, the signal output functions may also be reset to the factory settings for the new operating mode. If you use the setting D = 0 of parameter P1-01, the assignment of the signal output functions remains the same in the new operating mode.

Resetting the drive to the factory settings or switching the operating mode can modify the assignment of the signal output functions in such a way that the holding brake is released unintentionally.

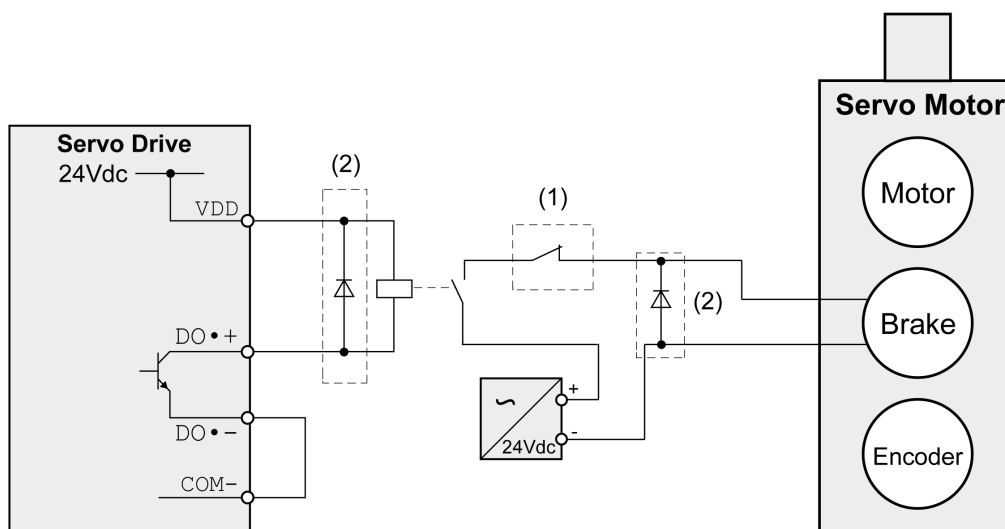
### **▲ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

- Verify that the digital output to which you have assigned the signal output function BRKR has been properly wired and configured.
- Before switching to a different operating mode, verify that the signal output function BRKR for the holding brake will not be assigned to an incorrect digital output in the new operating mode.
- Before resetting the drive to the factory settings, verify that the signal output function BRKR for the holding brake will be assigned to the correct digital output or reassign the signal output function BRKR after the factory reset according to the requirements of your application prior to starting the system.
- In all cases, take all necessary measures to prevent unintended movements of the load caused by a release of the holding brake.

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

Example (negative logic) of wiring the holding brake



Item	Description
1	Triggering an EMERGENCY STOP should apply the holding brake
2	Flyback diode

## Connection STO (CN9)

For important safety information, refer to the chapter Safety Function STO (Safe Torque Off), page 82 for the requirements for using the safety function STO.

## Cable Specifications - Cables Outside of Control Cabinet

Shield:	Yes
Twisted Pair:	Yes
PELV:	Required
Minimum conductor cross section:	2 x 0.34 mm <sup>2</sup> (AWG 22)
Maximum cable length:	30 m (98.4 ft)
Fuse:	4 A

## Cable Specifications - Cables Inside Control Cabinet

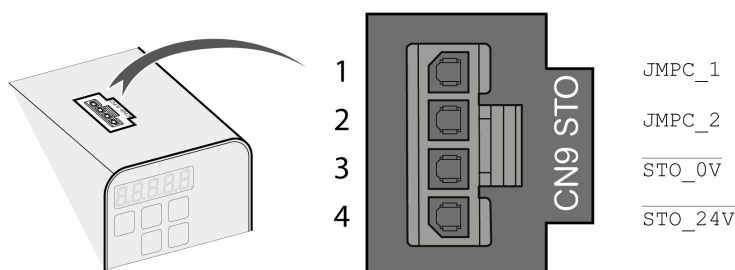
Shield:	No
Twisted Pair:	No
PELV:	Required
Minimum conductor cross section:	2 x 0.25 mm <sup>2</sup> (AWG 24)
Maximum cable length:	3 m (9.84 ft)
Fuse:	4 A

## Properties of the Connection

Connectors housing	Molex 436450400 <sup>(1)</sup>	
Connectors crimp contact	Molex 430300001 <sup>(1)</sup>	
Connection cross section	mm <sup>2</sup>	0.25 ... 0.34
	(AWG)	(24 ... 22)
(1)	Or corresponding equivalent.	

## Wiring Diagram

Wiring diagram safety function STO



The STO interface (CN9) is a 4-pin female connector. The following table describes the contacts of the connector:

Pin	Signal	Meaning
1	JMPC_1	Jumper connector 1 to be connected to STO_24V if the safety function STO is not used in your application
2	JMPC_2	Jumper connector 2 to be connected to STO_0V if the safety function STO is not used in your application
3	STO_0V	Safety function STO 0 Vdc input <sup>(1)</sup>
4	STO_24V	Safety function STO 24 Vdc input <sup>(1)</sup>
(1)	PELV power supply is required.	

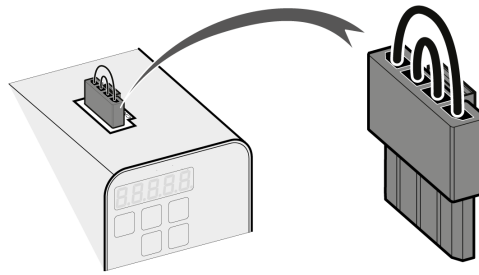
## Connecting the Safety Function STO

- Verify that wiring, cables, and connected interfaces meet the PELV requirements.
- Connect the safety function STO in accordance with the specifications in chapter Safety Function STO (Safe Torque Off), page 82.

## Deactivating the Safety Function STO

If the safety function STO is not to be used, it must be deactivated. Plug in the jumper for CN9 to bridge pin 1 and pin 4 as well as pin 2 and pin 3 to deactivate the safety function STO. The jumper for CN9 is factory-fitted.

## Deactivating the safety function STO

**⚠ WARNING****UNINTENDED EQUIPMENT OPERATION**

- Remove the jumpers connected to the STO power connector (CN9) only if you intend to use the STO safety-related function for your application.
- Use only an external PELV 24 Vdc power supply unit when applying the safety-related STO function.

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

# Motor Installation

## What's in This Chapter

Mechanical Installation Motor .....	139
Connections and Pin Assignments.....	142
Connection of Motor and Encoder.....	144
Holding Brake Connection .....	146

## Mechanical Installation Motor

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

<b>▲ WARNING</b>
<p><b>HEAVY AND/OR FALLING PARTS</b></p> <ul style="list-style-type: none"> <li>• Use a suitable crane or other suitable lifting gear for mounting the motor if this is required by the weight of the motor.</li> <li>• Use the necessary personal protective equipment (for example, protective shoes, protective glasses and protective gloves).</li> <li>• 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.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

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

<b>▲ WARNING</b>
<p><b>ELECTROMAGNETIC FIELDS</b></p> <ul style="list-style-type: none"> <li>• Keep persons with electronic medical implants, such as pacemakers, away from the motor.</li> <li>• Do not place electromagnetically sensitive devices in the vicinity of the motor.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

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

<b>▲ WARNING</b>
<p><b>HOT SURFACES</b></p> <ul style="list-style-type: none"> <li>• Avoid unprotected contact with hot surfaces.</li> <li>• Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces.</li> <li>• Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

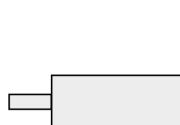
**▲ CAUTION****IMPROPER APPLICATION OF FORCES**

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

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

## Mounting Position

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



IM B5



IM V1



IM V3

## Mounting

When the motor is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. All mounting screws must be tightened with the specified tightening torque. No uneven mechanical load may be applied while the mounting screws are tightened. For data, dimensions, and degrees of protection (IP), refer to chapter *Motor*, page 45.

## Mounting Situation

**NOTICE****FORCES APPLIED TO THE REAR SIDE OF THE MOTOR**

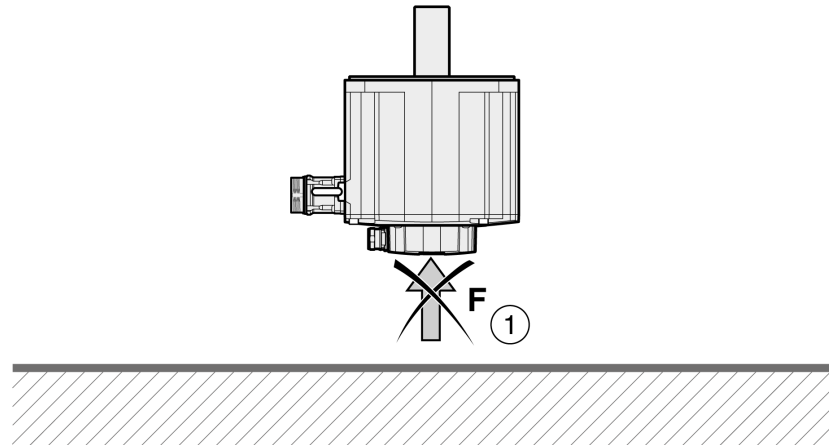
- Do not place the motor on the rear side.
- Protect the rear side of the motor from impact.
- Do not lift motors via the rear side.
- Only lift motors equipped with eyebolts via the eyebolts.

**Failure to follow these instructions can result in equipment damage.**



## Special Characteristics BCH2•H, BCH2•M, BCH2•R

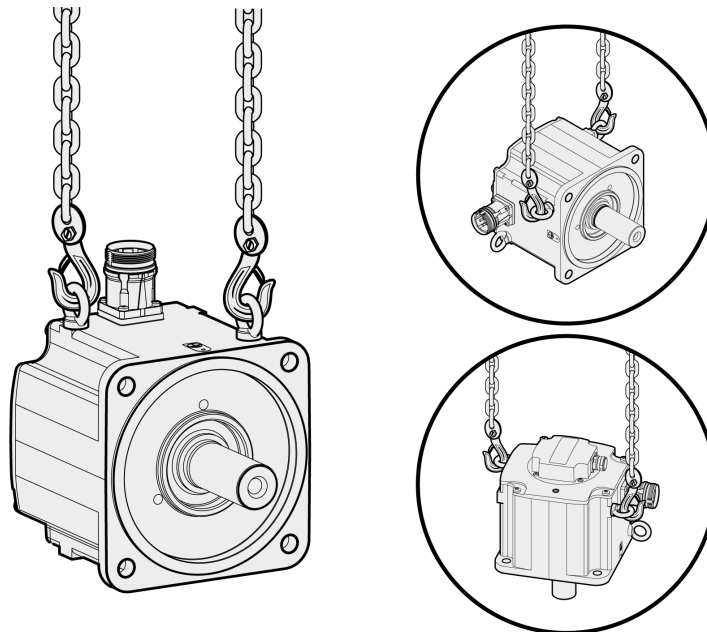
Rear side of motor



Item	Description
1	Protect the rear side of the motor from application of forces.

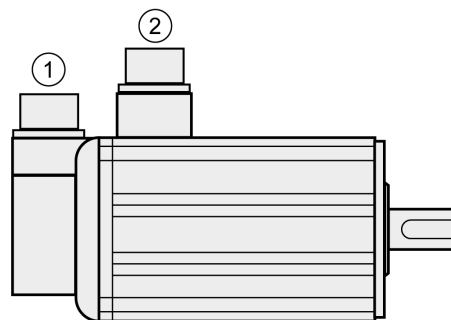
## Eyebolts BCH2•R

Consider the mass of the product when mounting the motor. It may be necessary to use suitable lifting gear.



# Connections and Pin Assignments

Connection overview



Item	Description
1	Encoder connection
2	Motor connection

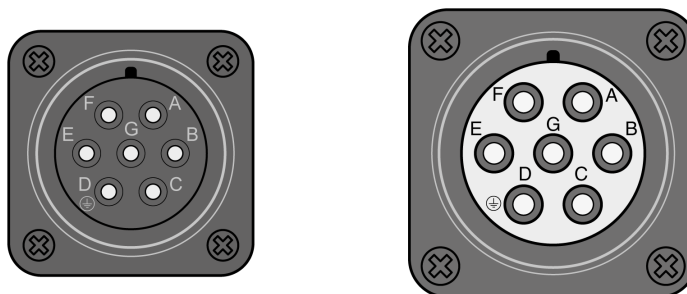
## Pin Assignment Motor Connection

Pin assignments of motor phases and holding brake

Motor connection plastic connector (type A and type B), drive side:



Motor connection MIL connector (type C and type D), motor side:



Pin Type A	Pin Type B	Pin Type C and D	Signal	Meaning	Color <sup>(1)</sup> (IEC 757)	
					Plastic connector	ML connector
1	1	E	U	Motor phase U	Grey (GY)	White (WH)
2	2	G	V	Motor phase V	Black (BK)	Black (BK)
3	4	B	W	Motor phase W	Brown (BN)	Red (RD)
4	5	D	PE	Protective ground (protective earth)	Green/Yellow (GN/YE)	Green/Yellow (GN/YE)

–	3	F	BRAKE_24V	Supply voltage holding brake 24 Vdc	Brown (BN)	Red (RD)
–	6	A	BRAKE_0V	Reference potential holding brake 0 Vdc	White (WH)	Black (BK)
–	–	C	–	Reserved	–	–

<sup>(1)</sup> Color information relates to the cables available as accessories.

**⚠ WARNING**

**UNINTENDED EQUIPMENT OPERATION**

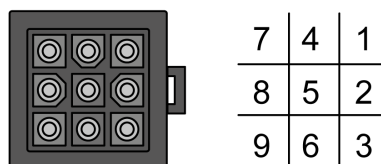
Do not connect any wiring to reserved, unused connections, or to connections designated as No Connection (N.C.).

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

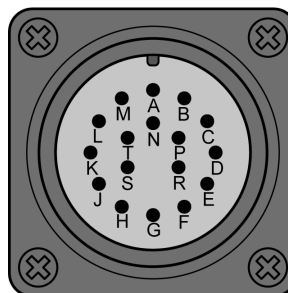
## Pin Assignment Encoder Connection

Pin assignment of the encoder.

Encoder connection plastic connector (Type A), drive side:



Encoder connection MIL connector (Type B), motor side:



Pin Type A	Pin Type B	Signal	Meaning	Color <sup>(1)</sup> (IEC 757)
1	A	T+	Data	Blue (BU)
2	C	–	Reserved	–
3	D	–	Reserved	–
4	B	T-	Data	Blue/Black (BU/BK)
5	F	Battery +	Battery + <sup>(2)</sup>	Red (RD)
6	G	Battery -	Battery - <sup>(2)</sup>	Black (BK)
7	S	DC+5 V	Supply voltage	Red/White (RD/WH)
8	R	GND	Reference potential	Black/White (BK/WH)
9	L	Shield	Shield	Black (BK)
–	E	–	Reserved	–

Pin Type A	Pin Type B	Signal	Meaning	Color <sup>(1)</sup> (IEC 757)
–	H	–	Reserved	–
–	J	–	Reserved	–
–	K	–	Reserved	–
–	M	–	Reserved	–
–	N	–	Reserved	–
–	P	–	Reserved	–
–	T	–	Reserved	–

(1) Color information relates to the cables available as accessories.  
(2) Used with multi-turn encoders.

## ⚠ 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.**

## Mating Connector

For suitable mating connectors, refer to chapter Connectors and Adapters, page 71.

## Connection of Motor and Encoder

The motor is designed for operation via a drive. Connecting the motor directly to line voltage will damage the motor and can cause fires.

## ⚠ DANGER

### FIRE HAZARD DUE TO INCORRECT CONNECTION

Only connect the motor to a matching, approved drive.

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

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

High voltages may be present at the motor connection. The motor itself generates voltage when the motor shaft is rotated. AC voltage can couple voltage to unused conductors in the motor cable.

**⚠ ⚠ DANGER****ELECTRIC SHOCK**

- Verify that no voltage is present prior to performing any type of work on the drive system.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Insulate both ends of unused conductors of the motor cable.
- Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

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

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used. Even if motors are similar, different adjustment of the encoder system may be a source of hazards. Even if the connectors for motor connection and encoder connection match mechanically, this does not imply that the motor is approved for use.

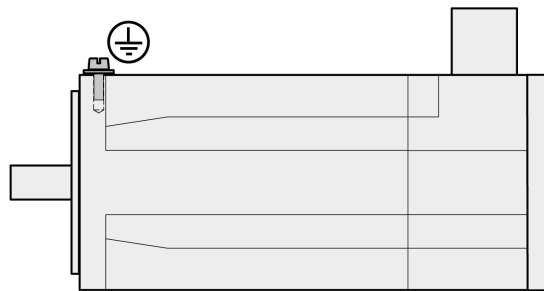
**⚠ WARNING****UNINTENDED MOVEMENT**

Only use approved combinations of drive and motor.

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

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

## Protective Ground Conductor Connection



- Ground the motor via a grounding screw if grounding via the flange and the protective ground conductor of the motor cable is not sufficient.
- Use parts with suitable corrosion protection.

## Connecting the Cables

Incorrect installation of the cable may destroy the insulation. Broken conductors in the cable or improperly connected connectors may be melted by arcs.

**⚡⚠ DANGER****ELECTRIC SHOCK, ARC FLASH AND FIRE CAUSED BY INCORRECT INSTALLATION OF THE CABLE**

- Disconnect all power before plugging in or unplugging the connectors.
- Verify correct pin assignment of the connectors according to the specifications in this chapter before connecting the cables.
- Verify that the connectors are properly inserted and locked before applying power.
- Avoid forces or movements of the cable at the cable entries.

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

- Connect the motor cable and the encoder cable to the drive according to the wiring diagram of the drive.
- If your motor is equipped with a holding brake, follow the instructions in chapter Holding Brake Connection, page 146.

## Holding Brake Connection

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

A motor with a holding brake requires a suitable holding brake controller which releases the brake when the power stage is enabled and locks the motor shaft when the power stage is disabled.

See chapter Holding Brake Connection, page 135 for additional information.

As a result of damage to the insulation of the motor cable, mains voltage may get to the wires for the holding brake.

**⚡⚠ DANGER****ELECTRIC SHOCK CAUSED BY DAMAGE TO THE MOTOR CABLE**

- Use a PELV power supply for the holding brake.
- Insulate both ends of unused conductors of the motor cable.

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

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, lowering of the load in the case of vertical axes.

**⚠ WARNING****UNINTENDED MOVEMENT**

- Verify that there are no persons or obstacles in the zone of operation when performing a test of the holding brake.
- Take appropriate measures to avoid damage 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.**

## Cable Specifications

For further information on cable specifications, refer to chapter Cables, page 80.

---

# Verifying Installation

## What's in This Chapter

Verifying Installation .....	148
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## Verifying Installation

Verify the mechanical installation of the entire drive system:

- Does the installation meet the specified distance requirements?
- Did you tighten all fastening screws with the specified tightening torque?

Verify the electrical connections and the wiring:

- Did you connect all protective ground conductors?
- Do all fuses have the correct rating; are the fuses of the specified type?
- Did you connect all wires of the cables or insulate them?
- Did you properly connect and install all cables and connectors?
- Are the mechanical locks of the connectors correct and effective?
- Did you properly connect the signal wires?
- Are the required shield connections EMC-compliant?
- Did you take all measures for EMC compliance?
- Does the drive installation conform to all local, regional, and national electrical safety codes for the eventual placement of the equipment?

Verify that all covers and seals of the control cabinet are properly installed to meet the required degree of protection.



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# Commissioning

## What's in This Part

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Integrated HMI .....	153
Commissioning Procedure .....	158
Tuning the Control Loops .....	165

# Overview

## What's in This Chapter

General .....	150
Commissioning Tools.....	152

## General

You must recommission an already configured device if you want to use it under different operating conditions.

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

### DANGER

#### ELECTRIC SHOCK

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

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

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameters and other operational 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.
- 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 modification.
- 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 a power outage, errors or functions, the motor is no longer decelerated in a controlled way.

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

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

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

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

## **▲ WARNING**

### **LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE**

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

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

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

## **▲ WARNING**

### **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 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.**

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, lowering of the load in the case of vertical axes.

## **▲ WARNING**

### **UNINTENDED MOVEMENT**

- Verify that there are no persons or obstacles in the zone of operation when performing a test of the holding brake.
- Take appropriate measures to avoid damage 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.**

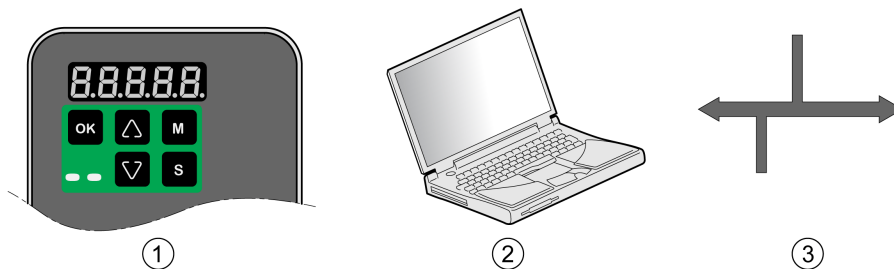
The product can be accessed via different types of access channels. Simultaneous access via multiple access channels or the use of exclusive access may cause unintended equipment operation.

<b>⚠ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands.</li> <li>• Verify that the use of exclusive access cannot cause unintended triggering or blocking of commands.</li> <li>• Verify that the required access channels are available.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Commissioning Tools

### Overview

The following tools, page 71 can be used for commissioning, parameterization, and diagnostics:



Item	Description
1	Integrated HMI
2	PC with commissioning software LXM28 DTM Library
3	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.

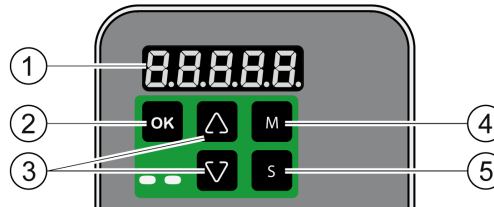
# Integrated HMI

## What's in This Chapter

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 Integrated HMI Structure ..... 154  
 7-Segment Display ..... 154  
 Status Information Via the HMI ..... 156

## Overview

The integrated HMI allows you to edit parameters, start the operating mode Jog or perform autotuning via the integrated Human-Machine Interface (HMI). Diagnostics information (such as parameter values or error codes) can also be displayed. The individual sections on commissioning and operation include information on whether a function can be carried out via the integrated HMI or whether the commissioning software must be used.



Item	Description
1	5-digit 7-segment display
2	OK key
3	Arrow keys
4	M key
5	S key

Incorrect wiring of the motor connection may cause live wires to be exposed outside of the motor connector below the HMI.

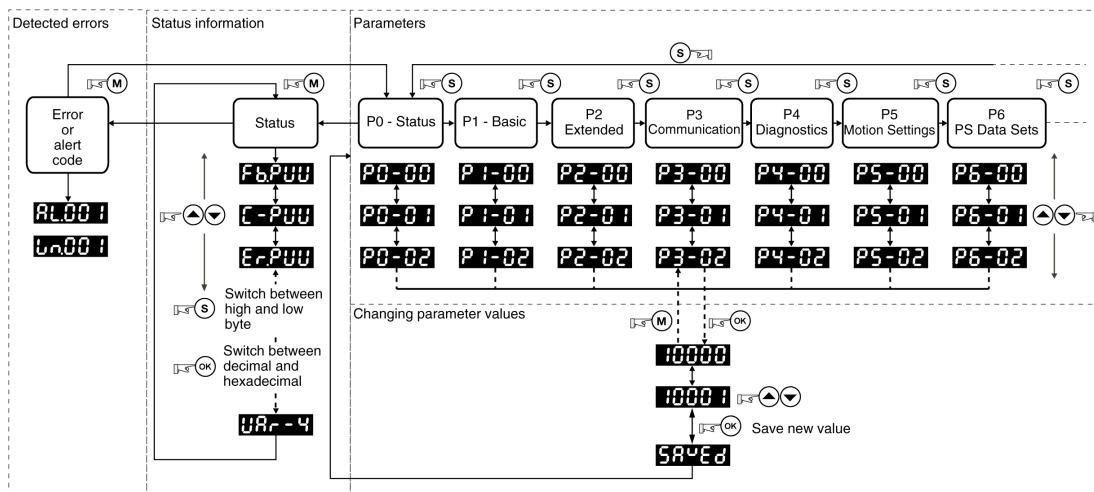
### ⚠️ ⚠️ DANGER

**ELECTRIC SHOCK CAUSED BY INCORRECT WIRING**

- Verify that the protective ground connection (PE) of the device is connected to ground.
- Do not remove the cable end (ferrule) from the protective ground terminal (PE) of the motor connector until you are prepared to wire the protective ground conductor of the motor to the protective ground terminal (PE) of the motor connector.
- Verify that no bare metal of the wires is exposed outside of the motor connector housing when wiring the motor connector.
- Regularly, as part of a maintenance plan, assure that the motor wires are secured in the terminals of the motor connector due to vibration or other influences.

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

# Integrated HMI Structure



When the drive is powered on, the display shows the name of the selected status information function for approximately one second; after that, it displays the corresponding actual value or status value.

Element	Function
HMI display	The 5-digit 7-segment display shows actual values, parameter settings, status information, and error codes.
M key	The M key lets you switch between the type of information displayed: status information/actual values, error codes, and parameters.  If an error is detected, the display shows the error code. If you press the M while the error is active, you can display other information; however, after approximately 20 seconds without interaction, the error code is displayed again.
S key	The S lets you scroll through the parameter groups.  After you have selected a parameter and its value is displayed, you can use the S key to move the cursor to the left. The digit at the current cursor position flashes. The arrow keys let you change the value at the current cursor position.
Arrow keys	The arrow keys let you scroll through the actual values/status information and the parameters within a parameter group. Use the arrow keys to increase or decrease values.
OK key	After you have selected a parameter, press the OK key to display the current parameter value. The arrow keys let you change the displayed value. Pressing the OK key again saves the value.

## 7-Segment Display

### Saving Settings

If you set a new parameter value and press the OK key, a message is displayed for approximately one second to provide feedback.

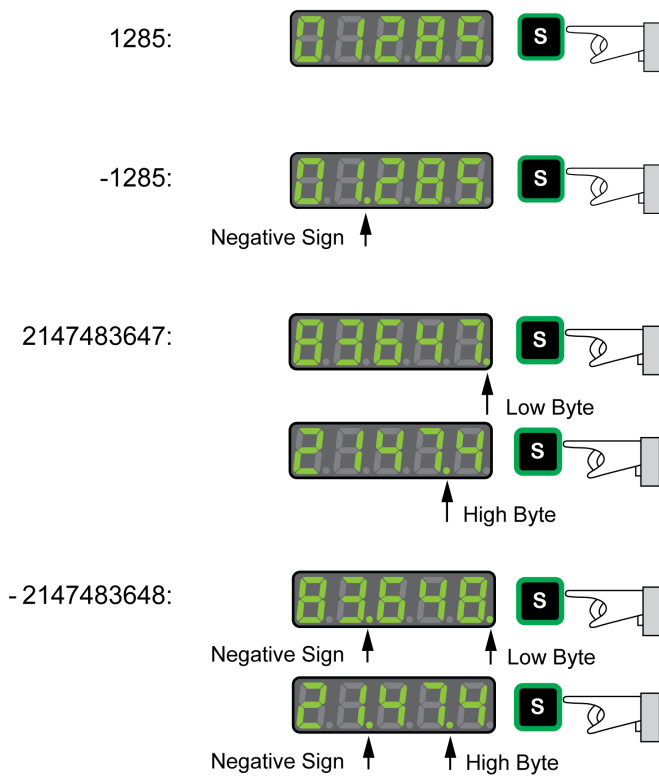
7-segment display	Description
5R4Ed	The new parameter value was successfully saved.
r - o L Y	The parameter value is a read-only value and cannot be saved (Read-Only).
P r o t	Changing a parameter value requires exclusive access. See chapter Access Channels, page 269.
o u t - r	The new parameter value is outside the permissible value range (Out of range).

7-segment display	Description
<i>S r v o n</i>	The new parameter value can only be saved when the power stage is disabled (Servo On).
<i>P o - O n</i>	The new parameter value becomes active the next time the product is powered on (Power On).
<i>E r r o r</i>	Displayed whenever a value you have entered for a parameter is, for various reasons, rejected by the drive.

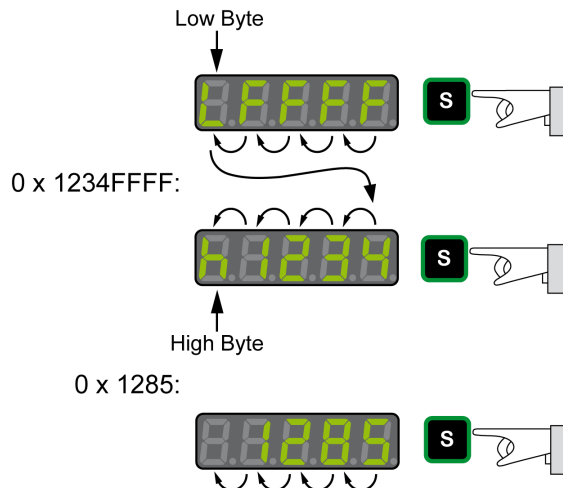
## Representation of Numerical Values on the 7-Segment Display

The illustration below shows the decimal representation of a 16-bit value and a 32-bit value as a positive value and as a negative value each.

Example of representation of decimal values



Example of representation of hexadecimal values



## Changing the Sign Via the 7-Segment Display

7-segment display	Description
2 4 6 8 0 2 4 . 6 8 0 X 3 4 3 E X C b C 2	You can change the sign of a value by holding down the <b>S</b> key for a period of more than 2 seconds.  Negative decimal values are represented with a dot between the second and the third position. Negative hexadecimal values are represented as a two's complement.

## Alert Messages and Error Messages on the 7-Segment Display

7-segment display	Description
W n n n n	If an alert condition is detected, <b>Wnnnn</b> is displayed. <b>Win</b> identifies the code as an alert. The subsequent 3 digit <b>nnn</b> represent the number of the alert. For a list of alert codes, refer to Alert Codes and Error Codes, page 370.
AL n n n	If an error is detected <b>ALnnn</b> is displayed. <b>AL</b> identifies the code as a detected error. The subsequent 3 digit <b>nnn</b> represent the error number. For a list of error codes, refer to Alert Codes and Error Codes, page 370.
S t o p	The display shows <b>STOP</b> if exclusive access is enabled while the power stage is still enabled. For further information on access channels, refer to Access Channels, page 269.
- - - - -	The display shows - - - - if the drive boot was unsuccessful. It may be caused by corrupted or missing firmware, or because the hardware is inoperable. Contact your local Schneider Electric service representative.

## Status Information Via the HMI

After you have powered on the drive, status information is displayed via the HMI. Use the parameter *P0-02* to select the type of status information to be displayed. For example, if you set the parameter *P0-02* to the value 7, the speed of rotation of the motor after is displayed after you have powered on the drive.

Setting <i>P0-02</i>	Description
0	Actual position (with gear ratio applied) in the unit PUU
1	Target position (with gear ratio applied) in the unit PUU
2	Deviation between actual position and target position (with gear ratio applied) in the unit PUU
3	Actual position in motor increments (1280000 pulses/revolution)
4	Target position in motor increments (1280000 pulses/revolution)
5	Deviation between actual position and target position in motor increments (1280000 pulses/revolution)
6	Reference value in kilopulses per second (kpps)
7	Actual velocity in rpm
8	Voltage for target velocity in V
9	Target velocity in rpm
10	Voltage for target torque in V
11	Target torque in percent of continuous motor current
12	Average load of the motor in percent of continuous motor current (The sampling window duration is specified via parameter <i>P4-29</i> )



Setting P0-02	Description
13	Peak load of the motor since the last power cycle of the drive in percent of continuous motor current (maximum value of occurring in setting 12 since last power cycle)
14	Mains voltage in V
15	Ratio of load inertia and motor inertia (divided by 10)
16	Power stage temperature in degrees Celsius (°C)
17	Resonance frequency in Hz
18	Absolute pulse number relative to encoder
19	Mapping parameter 1: Content of parameter P0-25 (mapping target is specified via parameter P0-35)
20	Mapping parameter 2: Content of parameter P0-26 (mapping target is specified via parameter P0-36)
21	Mapping parameter 3: Content of parameter P0-27 (mapping target is specified via parameter P0-37)
22	Mapping parameter 4: Content of parameter P0-28 (mapping target is specified via parameter P0-38)
23	Status indication 1: Content of parameter P0-09 (the status information to be displayed is specified by parameter P0-17)
24	Status indication 2: Content of parameter P0-10 (the status information to be displayed is specified by parameter P0-18)
25	Status indication 3: Content of parameter P0-11 (the status information to be displayed is specified by parameter P0-19)
26	Status indication 4: Content of parameter P0-12 (the status information to be displayed is specified by parameter P0-20)
27	Reserved
39	Status of digital inputs (content of P4-07)
40	Status of digital outputs (content of P4-09)
41	Drive status (content of P0-46)
42	Operating mode (content of P1-01)
49	Actual position encoder (content of P5-18)
50	Target velocity in rpm
53	Target torque in 0.1 percent of the nominal torque
54	Actual torque in 0.1 percent of the nominal torque
55	Actual torque in 0.01 A
77	Target velocity in rpm in operating modes PT and PS
96	Firmware version and firmware revision of drive (P0-00 and P5-00)
111	Number of detected errors

# Commissioning Procedure

## What's in This Chapter

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## Commissioning Software

The commissioning software LXM28 DTM Library has a graphic user interface and is used for commissioning, diagnostics, and testing settings.

## Online Help

The commissioning software offers help functions, which can be accessed via help menu or by pressing the F1 key.

## Source of Commissioning Software

The latest version of the commissioning software LXM28 DTM Library is available for download from the Internet.

[www.se.com](http://www.se.com)

## Setting the Device Address, Baud Rate and Connection Settings

Each device is identified by a unique address. Each device must have its own unique node address, which may only be assigned once in the network. The transmission rate (baud rate) must be the same for all devices in the network.

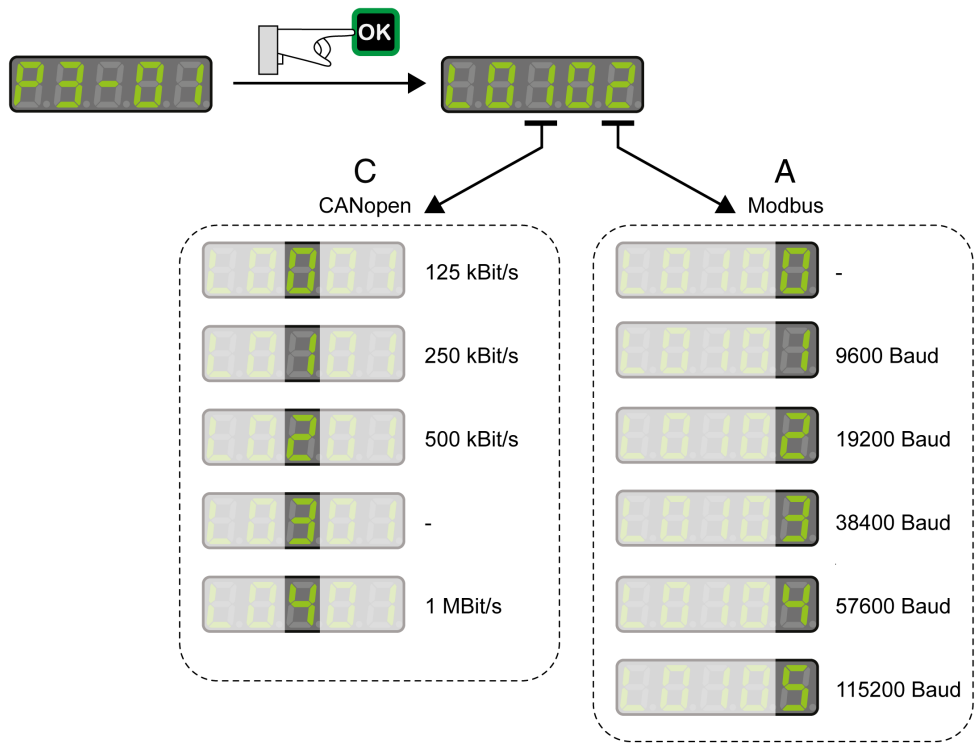
Use the parameter *P3-00* to set the Modbus device address.

Use the parameter *P3-05* to set the CANopen device address.

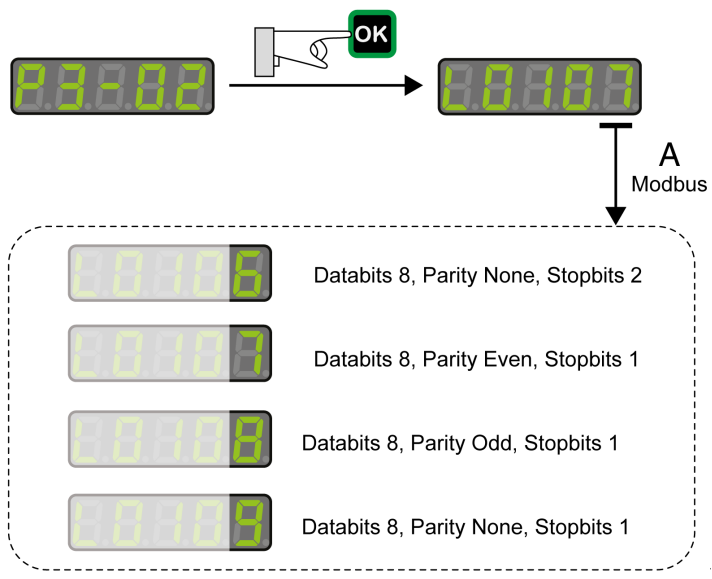
Use the parameter *P3-01* to set the baud rate.

Use the parameter *P3-02* to set the connection settings.

Setting the baud rate:



Modbus Connection Settings



**⚠ WARNING**

**UNINTENDED EQUIPMENT OPERATION**

- Verify that there is only one master controller configured on the network or remote link.
- Verify that all devices have unique addresses.
- Confirm that the device address is unique before placing the system into service.

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-00 ADR	Device Address Modbus Applicable operating mode: PT, PS, V, T The device address must be unique. Modified settings become active the next time the product is powered on.	- 1 127 247 Decimal	u16 RW per.	Modbus 400 <sub>h</sub> CANopen 4300 <sub>h</sub>
P3-01 BRT	Transmission Rate Applicable operating mode: PT, PS, V, T This parameter is used to set the data transmission rate. If this parameter is set via CANopen, only the CANopen transmission rate can be set. Modified settings become active the next time the product is powered on.	- 0 <sub>h</sub> 102 <sub>h</sub> 405 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 402 <sub>h</sub> CANopen 4301 <sub>h</sub>
P3-02 PTL	Modbus Connection Settings Applicable operating mode: PT, PS, V, T This parameter specifies the Modbus connection settings. Modified settings become active the next time the product is powered on.	- 6 <sub>h</sub> 7 <sub>h</sub> 9 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 404 <sub>h</sub> CANopen 4302 <sub>h</sub>
P3-03 FLT	Detected Modbus Communication Errors - Handling Applicable operating mode: PT, PS, V, T This parameter specifies the response of the drive to a detected communication error. Value 0: Detected alert Value 1: Detected error	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 406 <sub>h</sub> CANopen 4303 <sub>h</sub>
P3-04 CWD	Modbus Connection Monitoring Applicable operating mode: PT, PS, V, T This parameter specifies the maximum permissible duration for communication timeout. When this time has elapsed, the communication timeout is treated as a detected error. Setting this parameter to 0 to disables connection monitoring.	ms 0 0 20000 Decimal	u16 RW per.	Modbus 408 <sub>h</sub> CANopen 4304 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-05 CMM	Device Address CANopen Applicable operating mode: PT, PS, V, T This parameter specifies the CANopen address of the drive in decimal format. The device address must be unique. Change to this parameter becomes effective only after a restart of the drive. Modified settings become active the next time the product is powered on.	- 0 0 127 Decimal	u16 RW per.	Modbus 40A <sub>h</sub> CANopen 4305 <sub>n</sub>
P3-07 CDT	Modbus Response Delay Time Applicable operating mode: PT, PS, V, T This parameter specifies the time delay with which the drive responds to the Modbus master.	0.5 ms 0 0 1000 Decimal	u16 RW per.	Modbus 40E <sub>h</sub> CANopen 4307 <sub>n</sub>

## Verifying the Direction of Movement

### Direction of Movement

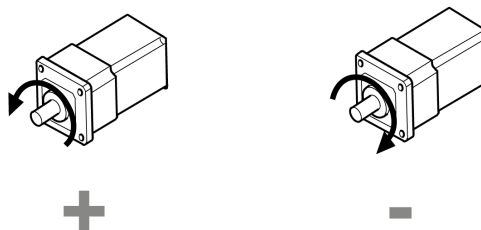
<b>⚠ WARNING</b>
<b>UNINTENDED MOVEMENT CAUSED BY INTERCHANGED MOTOR PHASES</b>
Do not interchange the motor phases.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

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

Movements are made in positive or in negative directions.

Definition of the direction of movement: Positive direction of movement is when the motor shaft rotates counterclockwise as you look at the end of the protruding motor shaft.

Direction of movement with factory settings



## Verifying the Direction of Movement

- Start the operating mode Jog. (HMI: *P 4 - 0 5*)  
The HMI displays the velocity in the unit rpm for the operating mode JOG.
- Set a velocity suitable for your application and conform with the OK key.  
The HMI displays *J 0 0*.

Movement in positive direction:

- Press the **Up Arrow** key.  
A movement is made in positive direction.

Movement in negative direction:

- Press the **Down Arrow** key.  
A movement is made in negative direction.

Press the M key to terminate the operating mode Jog.

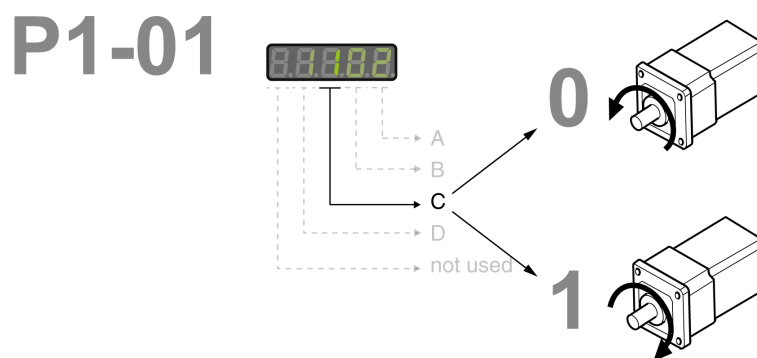
## Changing the Direction of Movement

If the expected direction of movement and the actual direction of movement are not identical, you can invert the direction of movement.

- Inversion of direction of movement is not activated:  
Movements are made in positive direction with positive target values.
- Inversion of direction of movement is activated:  
Movements are made in positive direction with negative target values.

The parameter *P1-01 C = 1* allows you to invert the direction of movement.

Changing the direction of movement



## Test Operation in Operating Mode Velocity (V)

- Select the operating mode Velocity (V) via the parameter *P1-01: = 2*. Refer to Setting the Operating Mode, page 286.
- Set the parameter *P1-01* to D=1. This assigns defaults to the signal input functions for the operating mode Velocity (V), DI6...DI8 presets must be modified for this test.  
New settings for the parameter *P1-01* do not become active until the drive is powered on the next time.
- Restart the drive.
- Select the following signal input functions via the parameters P2-10 to P2-17:

Digital input	Parameter	Setting	Signal	Function	Pin at CN1
DI1	P2-10	0101 <sub>h</sub>	SON	Enable power stage	9
DI2	P2-11	0109 <sub>h</sub>	TRQLM	Activate Torque Limitation	10
DI3	P2-12	0114 <sub>h</sub>	SPD0	Velocity Reference Value Bit 0	34
DI4	P2-13	0115 <sub>h</sub>	SPD1	Velocity Reference Value Bit 1	8
DI5	P2-14	0102 <sub>h</sub>	FAULT_RESET	Fault Reset	33
DI6	P2-15	0 <sub>h</sub>	-	-	32
DI7	P2-16	0 <sub>h</sub>	-	-	31
DI8	P2-17	0 <sub>h</sub>	-	-	30

For further information on the settings, refer to Setting the Digital Signal Inputs, page 271.

## Error Messages HMI

If the default presets of the signal inputs OPST, CWL(NL), and CCWL(PL/LIMP) are still present, the following error codes can be displayed:

- AL013: Parameter P2-17 not set to 0 (deactivated).
- AL014: Parameter P2-15 not set to 0 (deactivated).
- AL015: Parameter P2-16 not set to 0 (deactivated).

For further information on error messages, refer to Diagnostics and Troubleshooting, page 370.

## Target Velocity

The target velocity is selected via the signal input functions SPD0 (least significant bit) and SPD1 (most significant bit):

-	Signal state of the digital signal inputs		Target velocity via:		Range
	SPD1	SPD0			
S1	0	0	External analog signal	Voltage between V_REF (pin 42) and GND (pin 44)	-10 ... 10 Vdc
S2	0	1	Internal parameters	P1-09	-60000 ... 60000 x 0.1 rpm
S3	1	0		P1-10	
S4	1	1		P1-11	

- Enable the power stage via DI1 (SON).  
If DI3 (SPD0) and DI4 (SPD1) are deactivated, the target velocity is supplied via the analog input V\_REF.
- Activate DI3 (SPD0).  
The target velocity is supplied via the parameter P1-09. The factory setting for the target velocity is 1000 rpm.

## Verifying the Safety Function STO

The safety function STO must be tested at least once per year.

Procedure:

- 
- Operate the system with the nominal voltage at the STO inputs as described in the chapter Inputs / Outputs Characteristics, page 39.
  - Enable the power stage (operating state 6 Operation Enabled).
  - Trigger the safety function STO by switching off the voltage (for example, via an emergency stop push-button).  
The power stage is disabled and the error message AL501 is displayed.
  - Verify that drive is in the operating state Fault.
  - Check whether the drive can be set to the operating state 6 Operation Enabled.  
The drive remains in the operating state Fault.
  - Restore the STO voltage at the signal inputs of the safety function STO and trigger a Fault Reset.
  - Verify that the drive can be set to the operating state 6 Operation Enabled.  
The drive is set to the operating state 6 Operation Enabled. Movements are possible again.



# Tuning the Control Loops

## What's in This Chapter

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Easy Tuning .....	165
Comfort Tuning .....	166
Manual Tuning .....	172

## Tuning the Control Loops

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

<b>▲ WARNING</b>
<p><b>UNINTENDED MOVEMENT</b></p> <ul style="list-style-type: none"> <li>• Only start the system if there are no persons or obstructions in the zone of operation.</li> <li>• Verify that the values for the parameters <i>P9-26</i> and <i>P9-27</i> do not exceed the available movement range.</li> <li>• Verify that the parameterized movement ranges are available.</li> <li>• In determining the available movement range, consider the additional distance for the deceleration ramp in the case of an EMERGENCY STOP.</li> <li>• Verify that the parameter settings for a Quick Stop are correct.</li> <li>• Verify correct operation of the limit switches.</li> <li>• Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

Autotuning adapts the control performance of the drive to the mechanical system used and optimizes the control loop settings appropriately. External factors such as a load at the motor are considered. The control loop settings can also be optimized by using manual tuning.

Two autotuning methods and manual tuning are provided for control loop optimization:

- **Easy Tuning:** This type of autotuning is performed without user intervention. For most applications, Easy Tuning yields good, highly dynamic results.
- **Comfort Tuning:** This type of autotuning is performed with user intervention. You can select optimization criteria and set parameters for movement, direction, and velocity.
- **Manual Tuning:** This type of tuning allows you to perform test movements and optimize the control loop settings using the Scope function.

## Easy Tuning

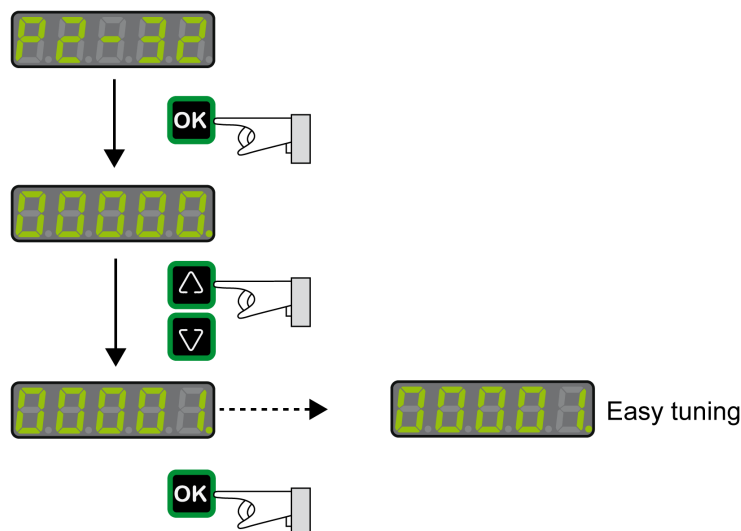
Easy Tuning is started via the HMI or the commissioning software LXM28 DTM Library.

Easy Tuning requires an available movement range of 5 revolutions. During Easy Tuning, movements of 2.5 revolutions are performed in positive direction of movement and 2.5 revolutions in negative direction of movement. If this movement range is not available, you must use Comfort Tuning.

Easy Tuning can be used for a ratio of motor inertia to load inertia of up to 1:50.

## Performing Easy Tuning

Set the parameter P2-32 to 1 to perform Easy Tuning.



After you have started Easy Tuning via P2-32, the display of the HMI shows the progress as a percentage from `tn000` to `tn100`.

Press the **M** button of the HMI to cancel autotuning.

If autotuning completes successfully, the display of the HMI shows the message `done`.

Press the **OK** key of the HMI to save the control loop parameters. The display of the HMI briefly shows the message `saved`.

Press the **M** key of the HMI to discard the autotuning results.

If autotuning does not complete successfully, the display of the HMI shows the message `ERROR`. The cause can be read with the parameter P9-30.

The parameter P9-37 provides additional information on the last event that occurred during autotuning.

## Comfort Tuning

Comfort Tuning allows you to select optimization criteria and set values for the movement.

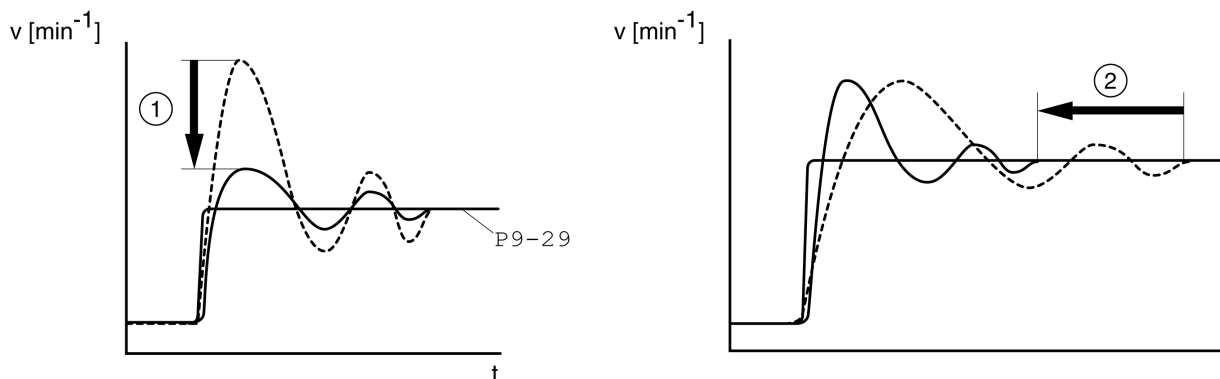
### Optimization Criteria for Comfort Tuning

Comfort Tuning allows you to select an optimization criterion for autotuning. The following optimization criteria are available:

- Optimization of the control loop parameters for minimum settling time with vibration suppression
- Optimization of the control loop parameters for minimum overshoot with vibration suppression
- Optimization of the control loop parameters for minimum settling time without vibration suppression

- Optimization of the control loop parameters for minimum overshoot without vibration suppression

The illustration below shows optimization for minimum overshoot and optimization for minimum settling time.



Item	Description
1	Optimization for minimum overshoot
2	Optimization for minimum settling time

Vibration suppression compensates resonance frequencies of the mechanical system. The option Vibration Suppression is available for both optimization criteria.

## Parameters for the Movement for Comfort Tuning

The following settings must be made for Comfort Tuning:

- Direction of movement
- Velocity
- Acceleration and deceleration
- Movement range
- Smoothing

These values must be as close as possible to the values used in the actual application. If you enter implausible values, Comfort Tuning is canceled.

## Setting the Direction of Movement

Set the direction of movement via the parameter P9-20.

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		<b>Minimum value</b>	<b>R/W</b>	
		<b>Factory setting</b>	<b>Persistent</b>	
		<b>Maximum value</b>		
		<b>HMI Format</b>		
P9-20	Autotuning - Direction of Movement	-	s16	Modbus A28 <sub>h</sub>
LTNCYCLE	Applicable operating mode: PT, PS, V	0	RW	CANopen 4914 <sub>n</sub>
	This parameter sets the direction of movement for autotuning.	0	-	
	Value 0: Both directions of movement	3		
	Value 2: One direction of movement	Decimal		

## Setting the Velocity

Set the velocity via the parameter P9-29.

The velocity must be between 10 ... 100 % of the nominal velocity  $n_N$ .

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-29 LTNVCRUISE	Autotuning - Velocity Applicable operating mode: PT, PS, V Bits 0 ... 15: Velocity for positive direction of movement Bits 16 ... 31: Velocity for negative direction of movement	0.1rpm 0.1rpm - - - Decimal	u32 RW -	Modbus A3A <sub>n</sub> CANopen 491D <sub>n</sub>

## Setting Acceleration and Deceleration

Set the acceleration and the deceleration with the P9-31 parameter.

The value for the acceleration and the value for the deceleration must be between  $t_{\min}$  and  $t_{\max}$ :

$$t_{\min} = \frac{100}{90} 20\pi \frac{J_M + J_{\text{load}}}{M_{\max}} \quad t_{\max} = \frac{100}{33} 20\pi \frac{J_M + J_{\text{load}}}{M_N}$$

$J_M$  = Moment of inertia of the motor in kg cm<sup>2</sup>

$J_{\text{load}}$  = Moment of inertia of the load in kg cm<sup>2</sup>

$M_{\max}$  = Peak torque in Nm

$M_N$  = Nominal torque in Nm

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-31 PTACCDEC	Autotuning - Acceleration and Deceleration Applicable operating mode: PT, PS, V Bits 0 ... 15: Acceleration for Autotuning Bits 16 ... 31: Deceleration for Autotuning	ms ms 6  6 6000  6000 65500  65500 Decimal	u32 RW -	Modbus A3E <sub>n</sub> CANopen 491F <sub>n</sub>

## Setting the Movement Range

Set the movement range via parameters P9-26 and P9-27.

The movement range must be sufficiently large to allow for a constant movement at the set speed in addition to the acceleration phase and the deceleration phase.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-26 PTPOS	<p>Autotuning - Movement Range in Direction 1</p> <p>Applicable operating mode: PS</p> <p>This parameter specifies the movement range for autotuning in direction of movement 1.</p> <p>The sign of the value determines the direction of movement:</p> <p>Positive value: Positive direction of movement as set via parameter P1-01</p> <p>Negative value: Negative direction of movement as set via parameter P1-01</p> <p>See parameter P9-20 to select one direction of movement or both directions of movement for Comfort Tuning.</p>	PUU -2147483647 0 2147483647 Decimal	s32 RW -	Modbus A34 <sub>h</sub> CANopen 491A <sub>h</sub>
P9-27 PTNEG	<p>Autotuning - Movement Range in Direction 2</p> <p>Applicable operating mode: PS</p> <p>This parameter specifies the movement range for autotuning in direction of movement 2.</p> <p>The sign of the value determines the direction of movement:</p> <p>Positive value: Positive direction of movement as set via parameter P1-01</p> <p>Negative value: Negative direction of movement as set via parameter P1-01</p> <p>See parameter P9-20 for Comfort Tuning in a single or in both directions of movement.</p> <p>See parameter P9-20 to select one direction of movement or both directions of movement for Comfort Tuning.</p>	PUU -2147483647 0 2147483647 Decimal	s32 RW -	Modbus A36 <sub>h</sub> CANopen 491B <sub>h</sub>

## Setting Smoothing

Comfort Tuning uses S-curve smoothing by default. The value for smoothing via the S-curve is optimized during Comfort Tunings.

The parameter P9-23 allows you to change from automatic smoothing to manual smoothing.

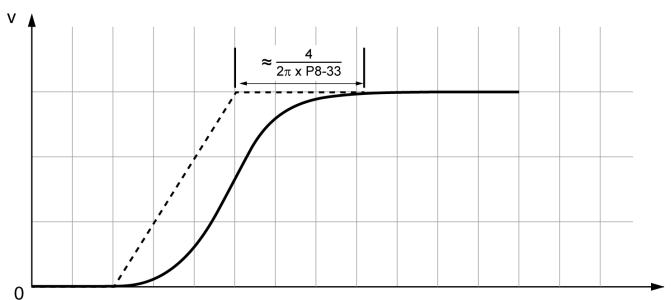
The following options are available for manual smoothing:

- No smoothing
- Smoothing via low-pass filter with a fixed value
- Smoothing via S-curve with a fixed value

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-23 LTNSTIFF	Defines which values are used for the position command filters. Applicable operating mode: PT, PS, V Value 0: Automatic smoothing via S-curve optimization of the value Value 1: Manual smoothing	- 0 0 1 Decimal	u16 RW -	Modbus A2E <sub>h</sub> CANopen 4917 <sub>h</sub>
P8-34 MOVESMOOTH-MODE	Smoothing Filter for Operating modes PT and PS - Type Applicable operating mode: PT, PS Value 0: No smoothing Value 1: LPF smoothing Value 2: S-curve smoothing Setting can only be modified if power stage is disabled.	- 0 2 2 Decimal	u16 RW per.	Modbus 944 <sub>h</sub> CANopen 4822 <sub>h</sub>

The illustration below shows the movement during Comfort Tuning if smoothing via the low-pass filter is used:

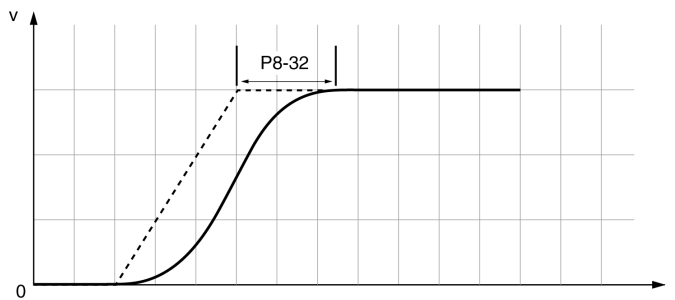
Comfort Tuning with smoothing via low-pass filter



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P8-33 MOVE-SMOOTHLPFHZ	Low Pass Filter Setting Applicable operating mode: PT, PS	Hz 1 5000 500000 Decimal	u32 RW per.	Modbus 942 <sub>h</sub> CANopen 4821 <sub>h</sub>

The illustration below shows the movement during Comfort Tuning if smoothing via an S-curve is used:

Comfort Tuning with smoothing via S-curve



Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
		Factory setting	Persistent	
		Maximum value		
		HMI Format		
P8-32	S-Curve Setting	0.01 ms	u32	Modbus 940 <sub>h</sub>
MOVESMOOTHAVG	Applicable operating mode: PT, PS	25	RW	CANopen 4820 <sub>h</sub>
	Setting can only be modified if power stage is disabled.	400	per.	
	The maximum value is reduced to 12800 if P8-35 CONTROLMODE (high byte) is set to 5.	25600		
		Decimal		

## Performing Comfort Tuning

Start Comfort Tuning by selecting the required method via the parameter P2-32.

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
		Factory setting	Persistent	
		Maximum value		
		HMI Format		
P2-32	Autotuning	-	u16	Modbus 340 <sub>h</sub>
ATMODE	Applicable operating mode: PT, PS, V	0	RW	CANopen 4220 <sub>h</sub>
	This parameter is used to start autotuning with the selected autotuning method.	0	-	
	Value 0: Stop Autotuning	56		
	Value 1: Easy Tuning	Decimal		
	Value 2: Comfort Tuning [minimum settling time, vibration suppression]			
	Value 3: Comfort Tuning [minimum overshoot, vibration suppression]			
	Value 52: Comfort Tuning [minimum settling time, no vibration suppression]			
	Value 53: Comfort Tuning [minimum overshoot, no vibration suppression]			

If you want Comfort Tuning in both directions, set parameter P9-20 to 0. Then set the parameters P9-26 and P9-27 to the same values, but with different signs (for example, P9-26 = -20000 and P9-27 = +20000). The value determines the movement range in both directions.

If you want Comfort Tuning in a single direction, set parameter P9-20 to 2. Then set the parameters P9-26 and P9-27 to the same values. The sign of the value determines the direction for Comfort Tuning. For example, if you set P9-26 = -20000 and P9-27 = -20000, Comfort Tuning is performed in negative direction of movement with a movement range of 20000 PUU.

NOTE: If you do not enter consistent values for parameters P9-26 and P9-27, the autotuning is unsuccessful. Parameter P9-30 contains the information on the unsuccessful autotuning attempt.

After you have started the required Comfort Tuning method via P2-32, the display of the HMI shows the progress as a percentage from *E n 0 0 0* to *E n 1 0 0*.

Press the **M** button of the HMI to cancel autotuning.

If autotuning completes successfully, the display of the HMI shows the message *d o n E*.

Press the **OK** key of the HMI to save the control loop parameters. The display of the HMI briefly shows the message *S A V E d*.

Press the **M** key of the HMI to discard the autotuning results.

If autotuning does not complete successfully, the display of the HMI shows the message *E r r o r*. The cause can be read with the parameter P9-30.

The parameter P9-37 provides additional information on the last event that occurred during autotuning.

## Manual Tuning

Manual tuning is performed in the operating mode Internal Profile. Manual tuning allows you to perform test movements and optimize the control loop settings using the Scope function.

NOTE: Manual tuning should only be attempted by trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation. These persons must have sufficient technical training, knowledge, and experience and be able to foresee and detect potential hazards and issues that may be caused by manual tuning, by changing the settings and by the mechanical, electrical, and electronic equipment of the entire system in which the product is used. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of manual tuning.

In addition to the low-pass filter, electronic gear filter function can be used in the following cases:

- Pulse and direction command has a low resolution
- Low rigidity of the coupling between motor and load
- Movement is too short
- Motor is noisy after tuning
- Current is unstable during tuning
- Motor temperature is unusually high

## Procedure for Manual Tuning

The control loop parameters are tuned in the following sequence:

Step	Item	Parameters
1	Derivative gain, page 173	P8-00 (LTND)
2	Low-pass filter, page 175	P8-14 (NLFILTDAMPING) P8-15 (NLFILTT1)



Step	Item	Parameters
3	Retuning of the derivative gain, page 177	<i>P8-00</i> (LTND)
4	Proportional gain, page 177	<i>P8-03</i> (LTNP)
5	Derivative-integral gain, page 180	<i>P8-02</i> (LTNIV)
6	Integral gain, page 182	<i>P8-01</i> (LTNI)
7	Compensation of the flexibility of the mechanical system, page 183	<i>P8-05</i> (NLAFFLPFHZ) <i>P8-20</i> (NLPEAFF)

Depending on the requirements concerning the control performance, steps 2 and 3 can be omitted. Perform a movement in both directions after each of the steps below to check the recorded parameter values on the Scope tab of the commissioning software LXM28 DTM Library.

## Step 1: Setting the Derivative Gain

The objective of tuning the derivative gain is to achieve a current ripple that is as low as possible. The optimum value primarily depends on the load.

Criteria for a well-tuned derivative gain include:

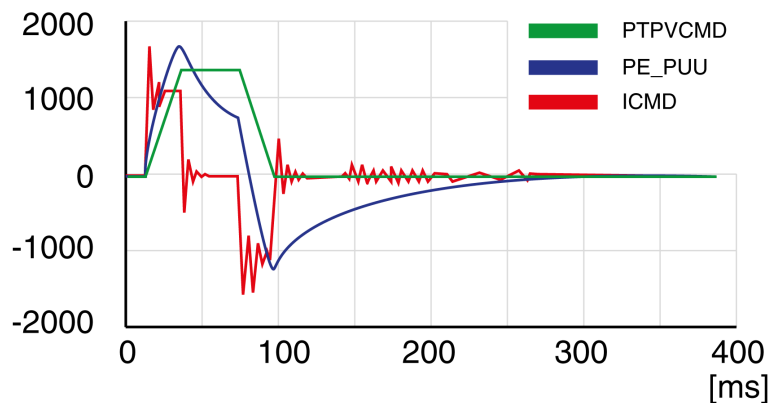
- For loads less than twice the rotor inertia: 5 % of the nominal current may be acceptable
- For greater loads: 10 % of the nominal current may be acceptable

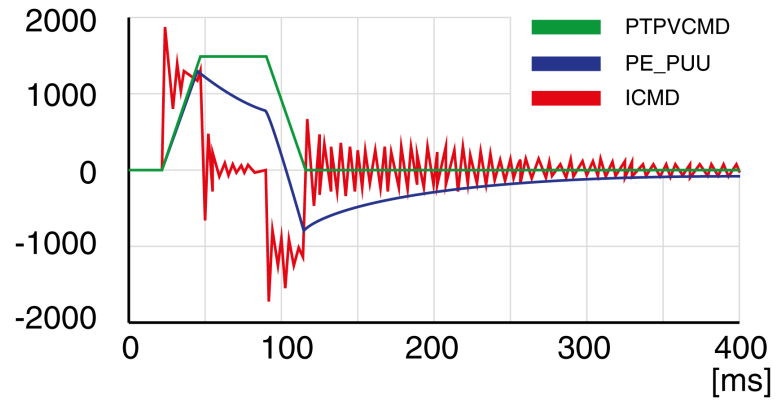
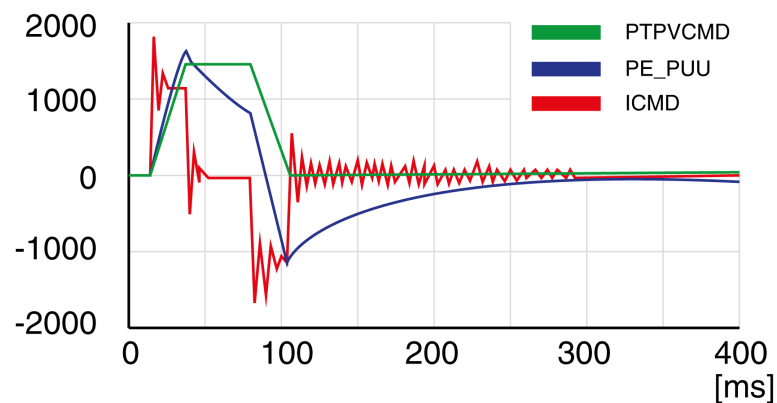
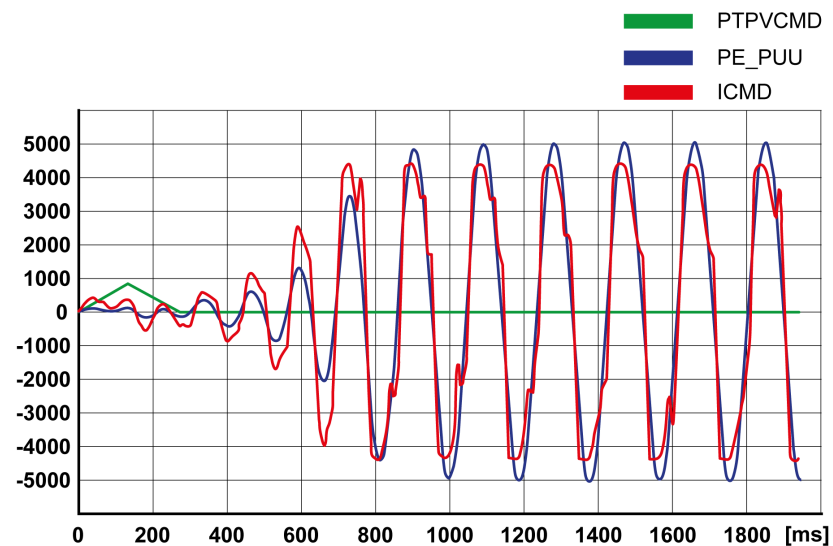
The derivative gain is set via parameter *P8-00* (LTND).

Procedure:

- Set the value of parameter *P8-03* (LTNP) to 150 (corresponds to 15 Hz).
- Set the value of parameter *P8-01* (LTNI) to 0.
- Set the value of parameter *P8-02* (LTNIV) to 0.
- Progressively increase the value of parameter *P8-00* (LTND) until the oscilloscope shows oscillation of the reference current, *P11-11* (TCMD).

Example *P8-00* (LTND) set to 1340 (134 Hz)



Example *P8-00* (LTND) set too high at 2000 (200 Hz)Example *P8-00* (LTND) OK at 1500 (150 Hz)Example *P8-00* (LTND) set too low at 100 (10 Hz)

**NOTE:** The process of tuning requires trials of successive approximations. Values that are too high or too low relative to the other relevant values might cause instability. If it is necessary to have a low or high value of the parameter in the preceding example, you may need to adjust the values of the other relevant parameters to compensate and achieve a stable system.

## Step 2: Setting the Low-Pass Filter

Setting the low-pass filter is an optional step in manual tuning of the control loop parameters. The low-pass filter parameters are optimized after you have tuned the derivative gain. The objective of tuning the low-pass filter parameters is to suppress high-frequency resonance and reduce the response time of the control loops to a minimum.

The low-pass filter is set via parameters *P8-14* (NLFILTDAMPING) and *P8-15* (NLFILTT1).

The parameter *P8-14* (NLFILTDAMPING) maintains the bandwidth of the low-pass filter up to the cutoff frequency. The parameter value is expressed as a percentage. The parameter *P8-15* (NLFILTT1) sets the inverse frequency of the cutoff frequency. The parameter *P8-14* (NLFILTDAMPING) can also be used independently to allow for a certain degree of compensation of system-related bandwidth limits.

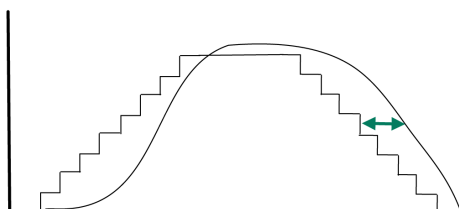
Criteria for a well-tuned low-pass filter include:

- The value of parameter *P8-14* (NLFILTDAMPING) is as high as possible.
- The value of parameter *P8-15* (NLFILTT1) is as low as possible.

When *P8-35* (CONTROLMODE) (high byte) is set to 5, the following table presents the values for 10 % overshoot. Set the filter parameter values *P8-14* (NLFILTDAMPING) and *P8-15* (NLFILTT1) accordingly:

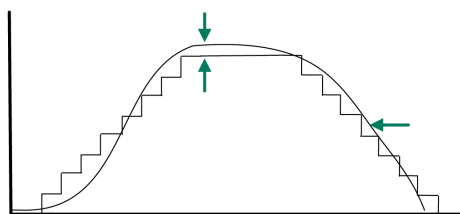
Frequency (Hz)	<i>P8-14</i> (NLFILTDAMPING) (%)	<i>P8-15</i> (NLFILTT1) (ms)
100	98.27	122.86
200	29.3	96.5
300	14.3	95
400	7.9	93.32
500	5.05	91.677
600	3.5	90.03
700	2.566	88.4
800	2	86.934
900	1.6056	85.457
1000	1.31	83.98
1100	1.09	82.45
1200	0.928694	81.1
1300	0.815	79.9
1400	0.7	78.4
1500	0.62	77
1600	0.555	75.97
1700	0.496	74.6
1800	0.439	73
1900	0.406	72.19
2000	0.365	70.5

Electronic gear filter example 1:



Increasing  $P8-27$  (GEARFILTT1) smooths the input command, but adds a delay.

Electronic gear filter example 2:



Increasing  $P8-28$  (GEARFILTT2) and  $P8-29$  (GEARFILTVELFF) compensate the delay, but adds overshoots.

If  $P8-29$  (GEARFILTVELFF) has the same value as  $P8-28$  (GEARFILTT2), there is no delay.

Usual values:

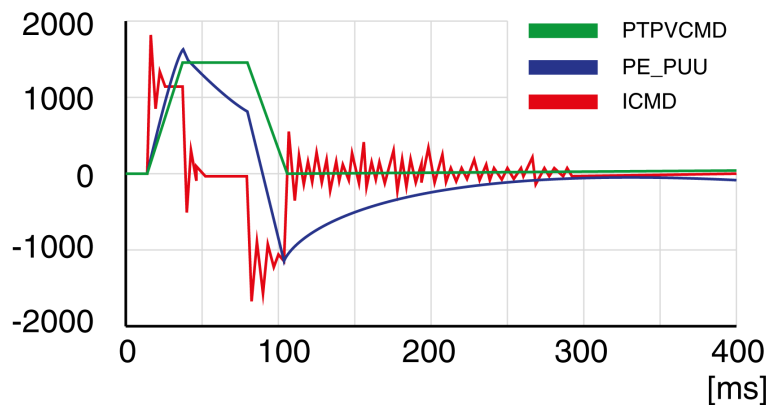
- $P8-27$  (GEARFILTT1) is usually around 2 times the input step width
- $P8-28$  (GEARFILTT2) is usually 2 times  $P8-27$  (GEARFILTT1)

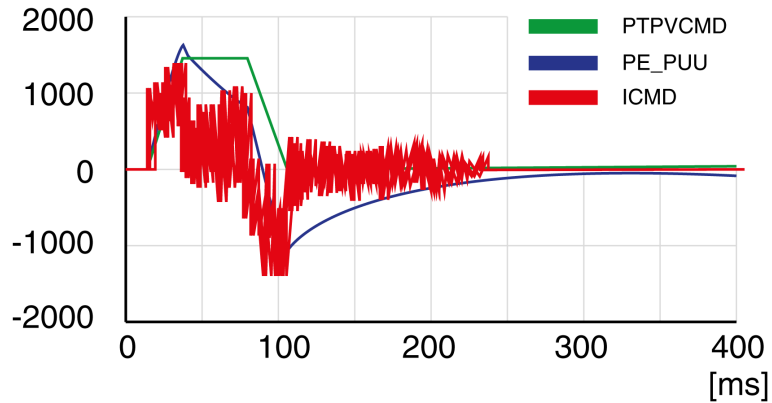
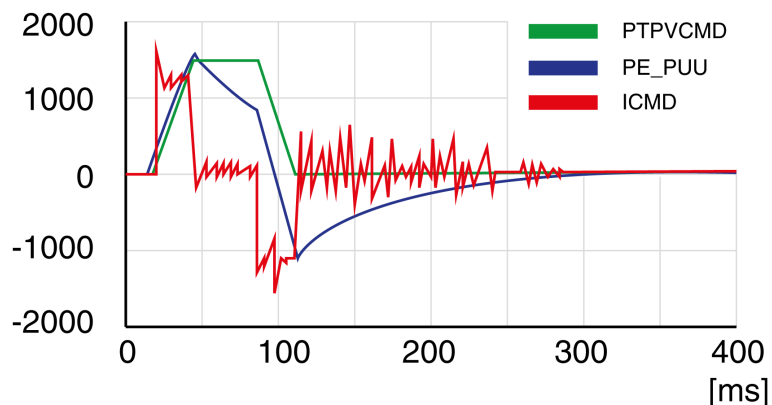
**NOTE:** When a system has multiple axes, gear filter values must be the same for all axes.

Procedure:

- Progressively increase the value of parameter  $P8-14$  (NLFILTDAMPING) until the oscilloscope shows noise and/or oscillation of the reference current,  $P11-11$  (TCMD).
- Progressively decrease the value of parameter  $P8-15$  (NLFILTT1) until the oscilloscope shows noise and/or oscillation of the reference current  $P11-11$  (TCMD).
- Increase the value of parameter  $P8-15$  (NLFILTT1) by 20 %, however, by at least 0.05 ms.

Example  $P8-14$  (NLFILTDAMPING) OK (75 %)



Example *P8-15* (NLFILTT1) too low (0.5 ms)Example *P8-15* (NLFILTT1) OK (1.2 ms)

### Step 3: Re-Tuning of the Derivative Gain

If you have modified the low-pass filter values in parameters *P8-14* (NLFILTDAMPING) and *P8-15* (NLFILTT1), the derivative gain can be set to a greater value via parameter *P8-00* (LTND). Follow the procedure described in step 1.

The objective of tuning the proportional gain is to get a constant and low position deviation in the acceleration phase, the constant velocity phase, and the deceleration phase and to have no oscillations during the transitions between these phases. In the oscilloscope, this is indicated by a shape that is as square and as flat as possible.

Criteria for a well-tuned proportional gain include:

- No or minimum overshoot of position deviation
- No or minimum current ripple
- No or minimum oscillations at standstill

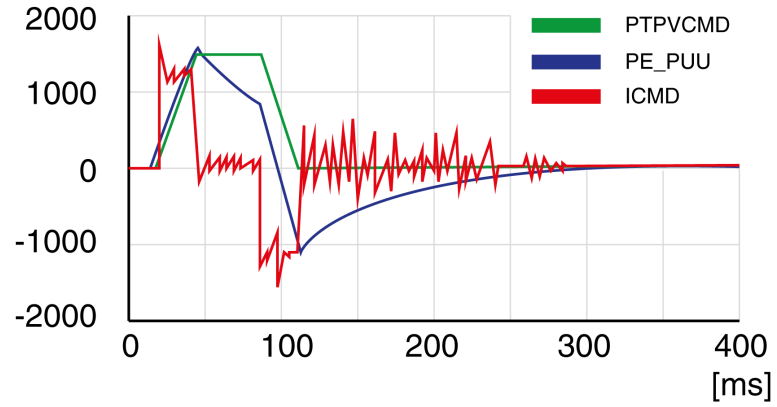
### Step 4: Setting the Proportional Gain

The proportional gain is set via parameter *P8-03* (LTNP).

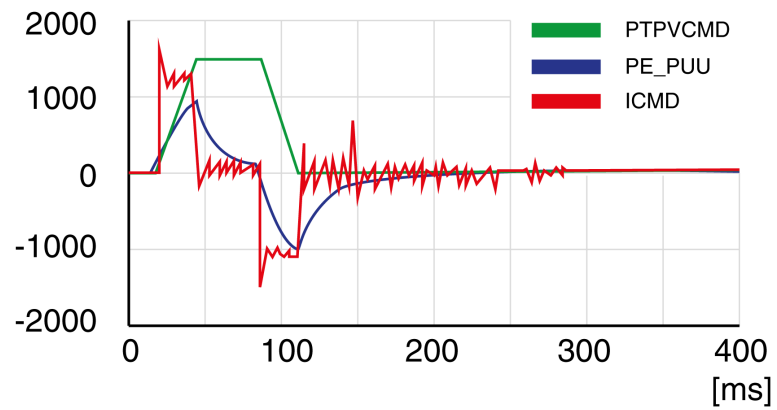
Procedure:

- Progressively increase the value of parameter *P8-03* (LTNP) to find the optimum value. The figures below show examples of the plot as the value approaches the optimum value.

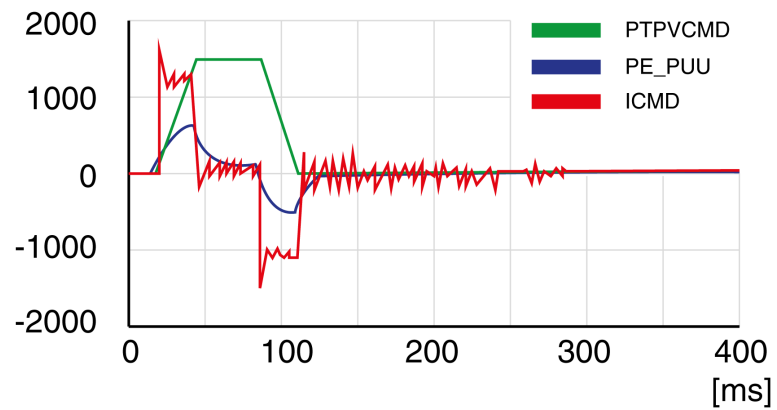
Example P8-03 (LTNP) starting value (13 Hz)



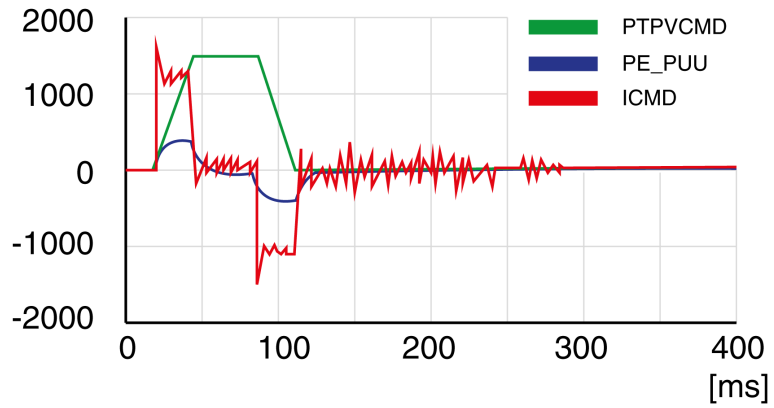
Example P8-03 (LTNP) position deviation decreased (25 Hz)



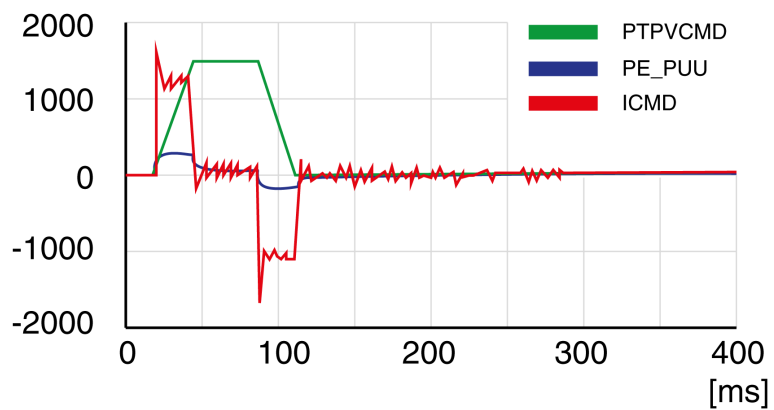
Example P8-03 (LTNP) position deviation further decreased (35 Hz)



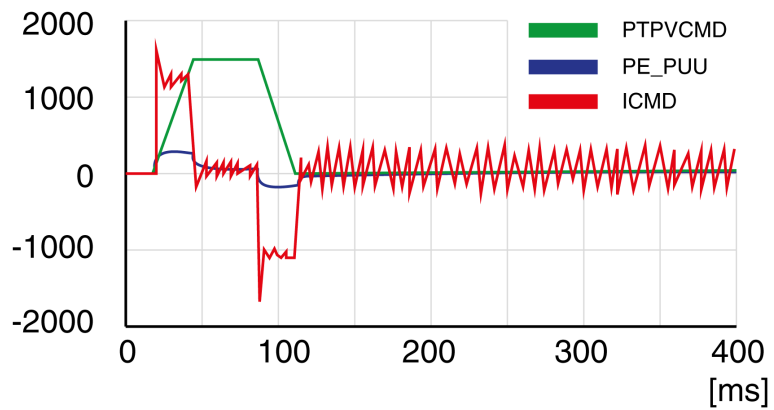
Example P8-03 (LTNP) position deviation further decreased (45 Hz)



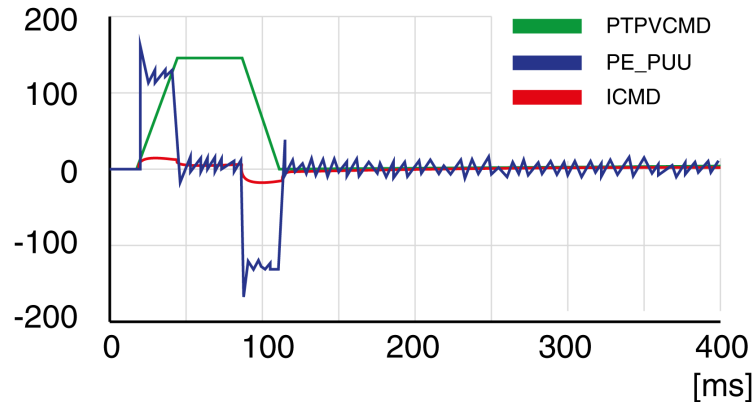
Example P8-03 (LTNP) value too high - oscillation at standstill (65 Hz)



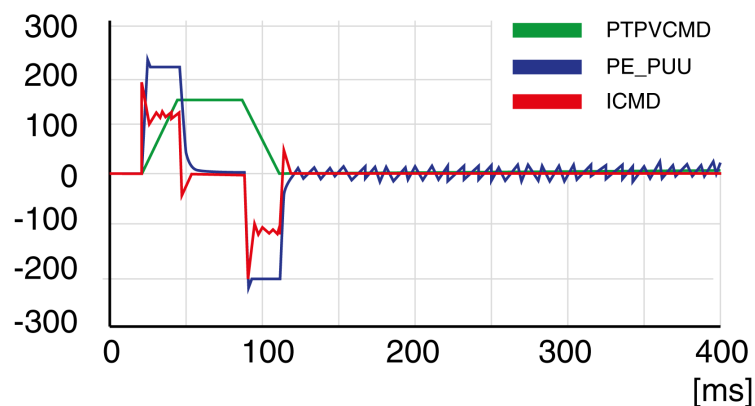
Example P8-03 (LTNP) value too high - oscillation at standstill (75 Hz)



Example *P8-03* (LTNP) value too high - oscillation at standstill, overshoot of position deviation (100 Hz)



Example *P8-03* (LTNP) OK (65 Hz)



## Step 5: Setting the Derivative-Integral Gain

The objective of tuning the derivative-integral gain is to reduce the position deviation. As a general rule, the value for the derivative-integral gain (*P8-02*LTNIV) is within the following range:

$$P8-03 \text{ (LTNP)} / 2 < P8-02 \text{ (LTNIV)} < 2 \times P8-03 \text{ (LTNP)}$$

Progressively increasing the value of the derivative-integral gain progressively decreases the position deviation during the acceleration phase, the constant velocity phase, and the deceleration phase.

Criteria for a well-tuned derivative-integral gain include:

- Position deviation decreases rapidly after each transition of the movement phases (jerk)
- No or minimum overshoot of position deviation
- No or minimum oscillations during transitions between the movement phases
- Oscillations at standstill as low as possible (+/- 1 encoder increment)

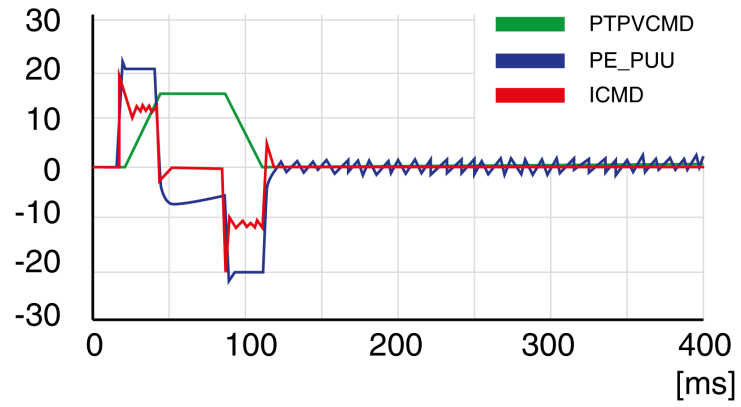
The derivative-integral gain is set via parameter *P8-02* (LTNIV).

Procedure:

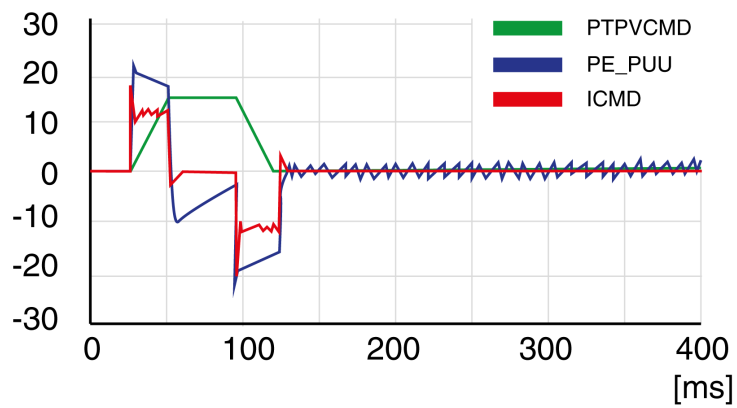
- Progressively increase the value of parameter *P8-02* (LTNIV) to find the optimum value. The figures below show examples of the plot as the value approaches the optimum value.



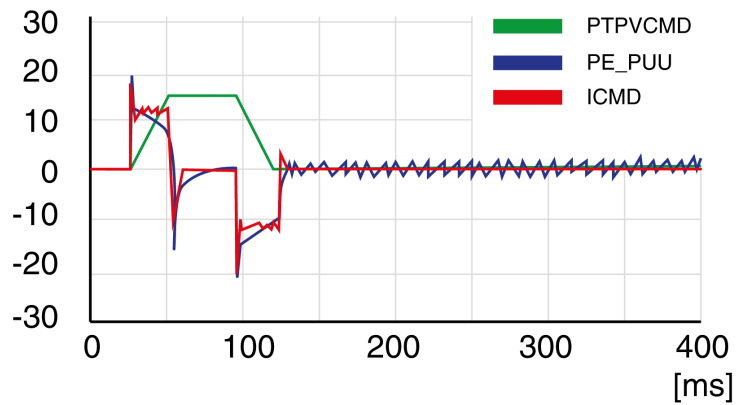
Example P8-02 (LTNIV) starting value (30 Hz)



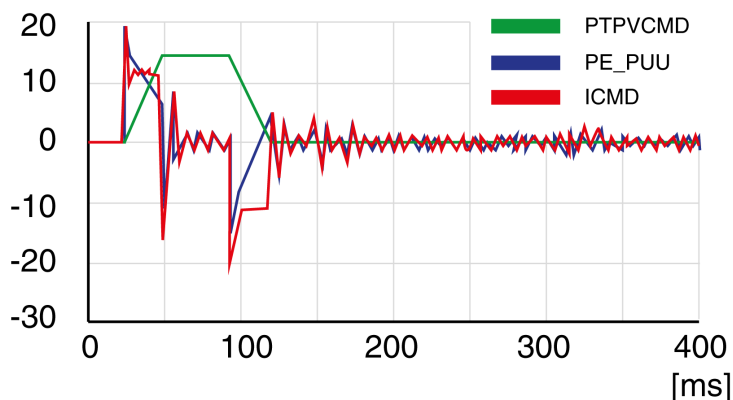
Example P8-02 (LTNIV) position deviation decreased (60 Hz)



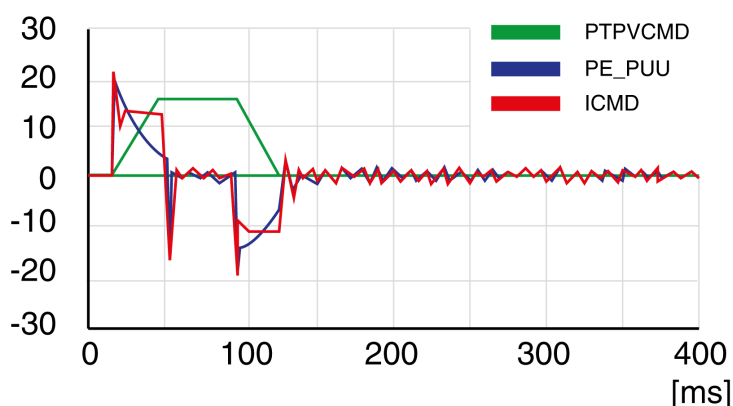
Example P8-02 (LTNIV) position deviation decreases rapidly when target velocity is reached (90 Hz)



Example *P8-02* (LTNIV) value too high - oscillation at standstill, overshoot of position deviation (120 Hz)



Example *P8-02* (LTNIV) OK (90 Hz)



## Step 6: Setting the Integral Gain

The objective of tuning the integral gain is to reduce the position deviation during movements and at standstill.

Criteria for a well-tuned integral gain include:

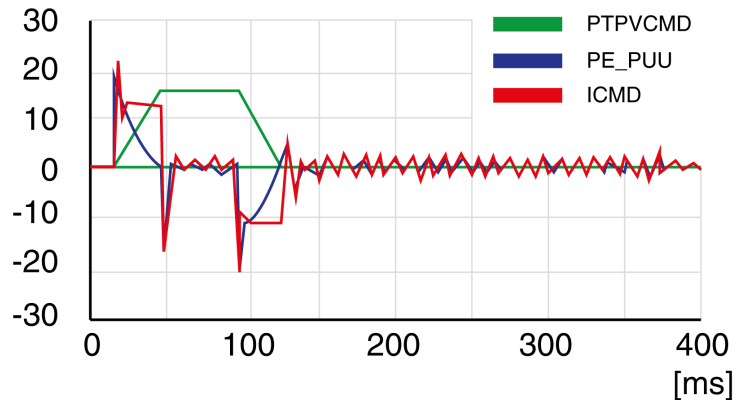
- Position deviation further reduced
- No or minimum overshoot of position deviation at the end of the deceleration phase
- Oscillations at standstill as low as possible (+/- 1 encoder increment)

The integral gain is set via parameter *P8-01* (LTNI).

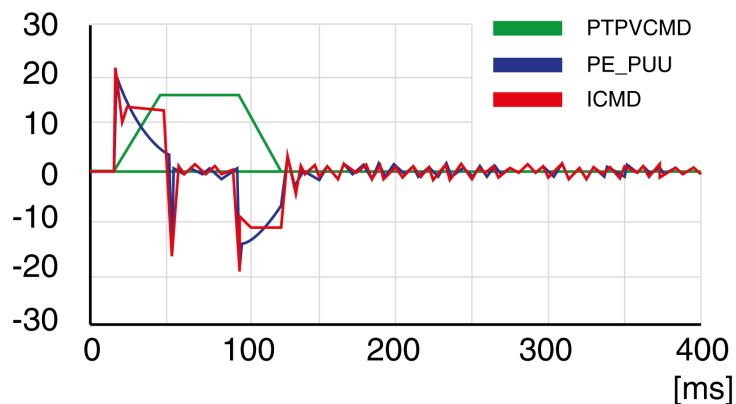
Procedure:

- Progressively increase the value of parameter *P8-01* (LTNI) until the oscilloscope shows overshoot or oscillations. The figures below show examples of the plot as the value approaches the optimum value.

Example *P8-01* (LTNI) value too high - oscillation at standstill, overshoot of position deviation (50 Hz)



Example *P8-01* (LTNI) OK (25 Hz)



## Step 7: Compensation of the Flexibility of the Mechanical System

The parameters for compensation of the system flexibility reduce the vibrations caused by abrupt changes in the acceleration (jerk). The parameters can also be used to further minimize overshoot or settling time.

The value of parameter *P8-20* (NLPEAFF) reflects the oscillation frequency of the mechanical system, i.e. the coupling between the motor and the load. The coupling can be very rigid (for example, a direct drive or a low-backlash coupling) and less rigid (for example, a belt drive or an elastic coupling). Systems with a high rigidity require a high value. Systems with high load inertia and less rigid couplings require lower values. The less rigid the coupling, the lower this frequency. Depending on the application, the typical value range is 400 ... 30 Hz.

The parameter *P8-05* (NLAFFLPFHZ) sets a low-pass filter for the acceleration profile. If the target value has a relatively low resolution as, for example, in the case of a pulse train input, the calculated acceleration may be subject to noise. The low-pass filter set via this parameter can be used to smooth the acceleration profile. The parameter can be used if the flexibility compensation set via parameter *P8-20* (NLPEAFF) results in noise.

The compensation of the flexibility of the mechanical system is set via parameters *P8-05* (NLAFFLPFHZ) and *P8-20* (NLPEAFF).

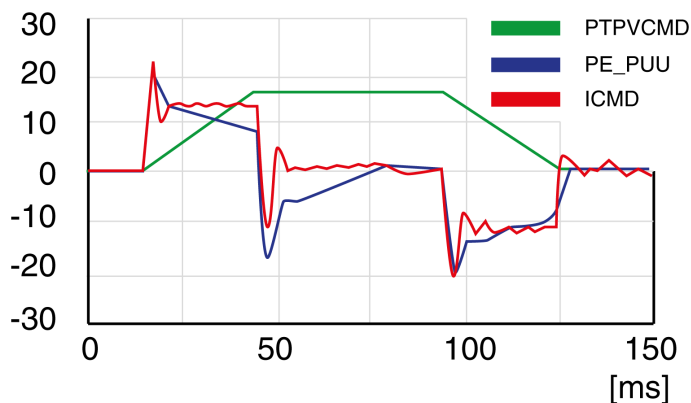
Procedure:

- Set the value of parameter *P8-05* (NLAFFLPFHZ) to a value three times as high as that of parameter *P8-20* (NLPEAFF). With this value, the bandwidth of this low-pass filter is sufficiently higher than the response time of the system.

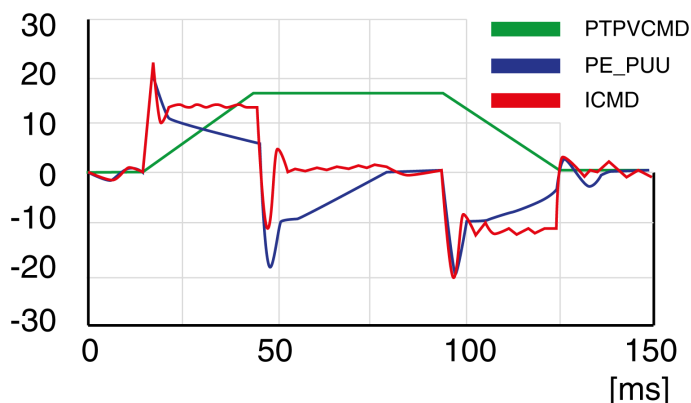
- Progressively decrease the value of parameter *P8-20* (NLPEAFF) to find the optimum value. The optimum value depends on your optimization criterion: either short settling time or low position deviation.

Start with a high frequency of 400 Hz. Decrease the value and compare the amplitudes for the position deviation and the settling time. Select the most suitable value according to your optimization criterion. The figures below show examples of the plot as the value approaches the optimum value.

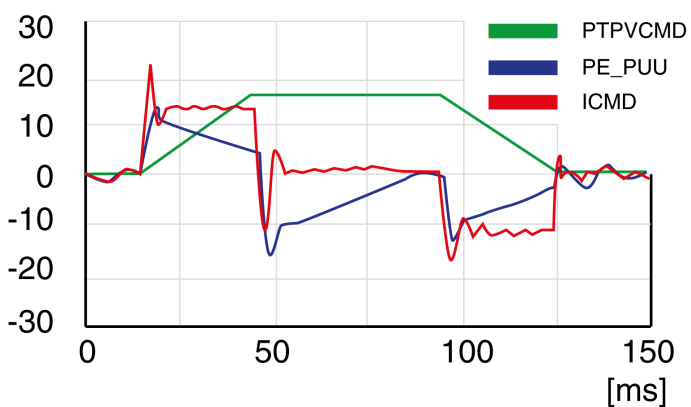
Example *P8-20* (NLPEAFF) without compensation of the flexibility (5000 Hz)



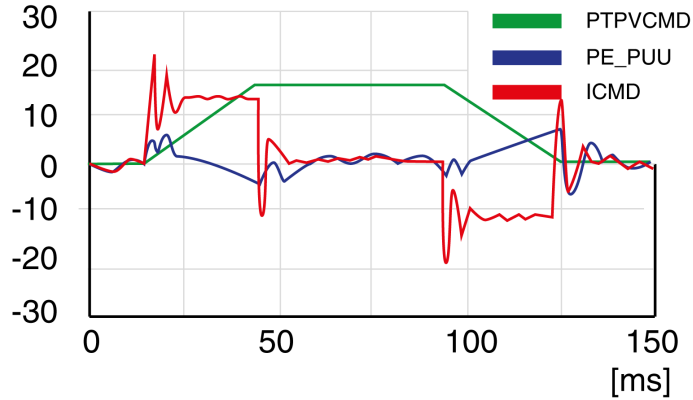
Example *P8-20* (NLPEAFF) maximum position deviation decreased (300 Hz)



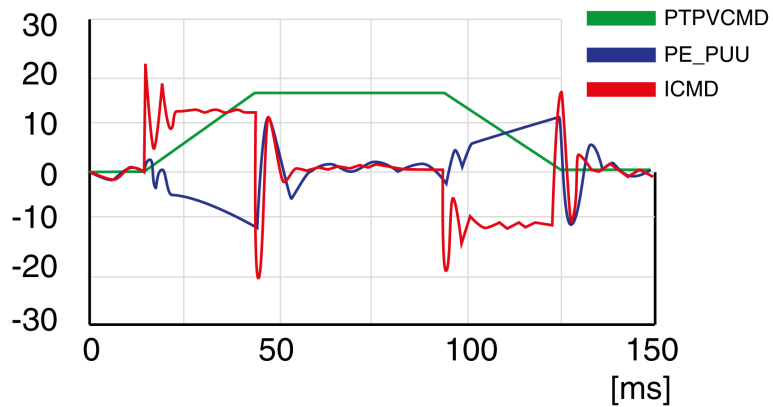
Example *P8-20* (NLPEAFF) maximum position deviation further decreased (220 Hz)



Example *P8-20* (NLPEAFF) minimum position deviation, short settling time, oscillation at standstill (120 Hz)



Example *P8-20* (NLPEAFF) negative position deviation during acceleration phase (100 Hz)



## Manual turning steps within cascade mode

Step	Action
1	<p>Increase the speed loop gain <i>P8-57</i> to decrease the speed deviation. After increasing the gain value each time, the motor moves in a positive and negative direction at high and low speed respectively. If the motor does not vibrate or scream, the gain can be increased continuously.</p> <p>If the motor vibrates or screams, reduce the current value by 20%.</p>
2	<p>Increase the gain of position loop <i>P8-53</i> decrease the position deviation. After increasing the gain value each time, the motor moves in a positive and negative direction at high and low speed respectively. If the motor does not vibrate or scream, the gain can be increased continuously.</p> <p>Slow to reach target position, increase the gain. Shaking near the target position, reduce the gain. If the motor vibrates or screams, reduce the current value by 20%.</p>
3	To further reduce the steady-state error, increase the speed integral <i>P8-58</i> .
4	To further reduce the dynamic position error, feed-forward <i>P8-54</i> is used.
5	Set the S-curve smoothing time constant <i>P8-32</i> appropriately.
6	Use low-pass filtering and notch filter <i>P8-60</i> , <i>P8-61</i> , <i>P8-62</i> as appropriate.

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# Parameters

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# Parameters

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## Representation of the Parameters

This chapter provides an overview of the parameters which can be used for operating the product.

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameters and other operational 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.
- 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 modification.
- 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.**

**NOTE:** Possible values of a parameter that are not described are considered as reserved and must not be used.

## Parameter Name

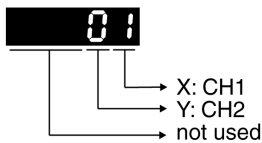
The parameter name uniquely identifies a parameter.

## Unit

The unit of the value.

## P0 - Status Parameters

### P0 - Status Parameters

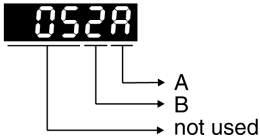
Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P0-00 VER	Firmware Version Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 100 <sub>h</sub> CANopen 4000 <sub>h</sub>
P0-01 ALE	Error code of detected error Applicable operating mode: PT, PS, V, T  This parameter contains the error number of the most recently detected error.  For a list of the detected error codes, refer to Error Codes, page 370.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 102 <sub>h</sub> CANopen 4001 <sub>h</sub>
P0-02 STS	Drive Status Displayed by HMI Applicable operating mode: PT, PS, V, T  This parameter selects the type of status information to be displayed on the HMI.  Example: If the setting is 7, the HMI displays the speed of rotation of the motor.  For further information, refer to chapter Status Information via the HMI, page 156.	- 0 0 123 Decimal	u16 RW per.	Modbus 104 <sub>h</sub> CANopen 4002 <sub>h</sub>
P0-03 MON	Function of Analog Outputs Applicable operating mode: PT, PS, V, T  This parameter specifies the functions of the analog outputs.    XY: (X: MON1; Y: MON2)  0: Actual velocity (+/-8 V correspond to maximum velocity)  1: Actual torque (+/-8 V correspond to maximum torque)  2: Reference value in kilopulses per second (+8 V correspond to 4.5 Mpps)  3: Target velocity (+/-8 V correspond to maximum target velocity)  4: Target torque (+/-8 V correspond to maximum target torque)  5: DC bus voltage (+/-8 V correspond to 450 V)  6: Reserved  7: Reserved	- 0 <sub>h</sub> 0 <sub>h</sub> 77 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 106 <sub>h</sub> CANopen 4003 <sub>h</sub>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P1-04 and P1-05 for setting a voltage percentage (scaling). Example: P0-03 = 01: Voltage value at analog output indicates the actual velocity. $Velocity = (maximum\ velocity \times V1 / 8) \times P1-04 / 100$ if the output voltage value of MON2 is V1.			
P0-04 FPGAVER	FPGA Version Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> - <sub>h</sub> 0000FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 108 <sub>h</sub> CANopen 4004 <sub>h</sub>
P0-08 TSON	Operating Hour Meter in Seconds Applicable operating mode: PT, PS, V, T	s 0 - 4294967295 Decimal	u32 RO -	Modbus 110 <sub>h</sub> CANopen 4008 <sub>h</sub>
P0-09 CM1	Status Value 1 Applicable operating mode: PT, PS, V, T  This parameter is used to provide the value of one of the status indications in P0-02. The value of this parameter is determined via P0-17.  Examples:  If the status of the drive is read via the HMI and if P0-02 is set to 23, VAR-1 is displayed for approximately two seconds by the HMI, followed by the value of this parameter.  If the setting of P0-17 is 3, reading this parameter displays the actual position in pulses.  For reading the status via Modbus, read two 16-bit data stored in the addresses of 0012H and 0013H to generate 32-bit data.  (0013H : 0012H) = (high byte : low byte)	- -2147483647 - 2147483647 Decimal	s32 RO -	Modbus 112 <sub>h</sub> CANopen 4009 <sub>h</sub>
P0-10 CM2	Status Value 2 Applicable operating mode: PT, PS, V, T  This parameter is used to provide the value of one of the status indications in P0-02. The value of this parameter is determined via P0-18.  See P0-09 for details.	- -2147483647 - 2147483647 Decimal	s32 RO -	Modbus 114 <sub>h</sub> CANopen 400A <sub>h</sub>
P0-11 CM3	Status Value 3 Applicable operating mode: PT, PS, V, T  This parameter is used to provide the value of one of the status indications in P0-02. The value of this parameter is determined via P0-19.  See P0-09 for details.	- -2147483647 - 2147483647 Decimal	s32 RO -	Modbus 116 <sub>h</sub> CANopen 400B <sub>h</sub>
P0-12 CM4	Status Value 4 Applicable operating mode: PT, PS, V, T	- -2147483647	s32 RO	Modbus 118 <sub>h</sub> CANopen 400C <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	This parameter is used to provide the value of one of the status indications in P0-02. The value of this parameter is determined via P0-20. See P0-09 for details.	- 2147483647 Decimal	-	
P0-13 CM5	Status Value 5 Applicable operating mode: PT, PS, V, T This parameter is used to provide the value of one of the status indications in P0-02. The value of this parameter is determined via P0-21. See P0-09 for details.	- -2147483647 - 2147483647 Decimal	s32 RO -	Modbus 11A <sub>h</sub> CANopen 400D <sub>h</sub>
P0-17 CMA1	Indicate status value 1 Applicable operating mode: PT, PS, V, T This parameter is used to select a drive status provided in P0-02. The selected status is indicated via P0-09. Example: If the setting of P0-17 is 7, reading P0-09 returns the speed of rotation of the motor in rpm.	- 0 0 123 Decimal	u16 RW per.	Modbus 122 <sub>h</sub> CANopen 4011 <sub>h</sub>
P0-18 CMA2	Indicate status value 2 Applicable operating mode: PT, PS, V, T This parameter is used to select a drive status provided in P0-02. The selected status is indicated via P0-10. See P0-17 for details.	- 0 0 123 Decimal	u16 RW per.	Modbus 124 <sub>h</sub> CANopen 4012 <sub>h</sub>
P0-19 CMA3	Indicate status value 3 Applicable operating mode: PT, PS, V, T This parameter is used to select a drive status provided in P0-02. The selected status is indicated via P0-11. See P0-17 for details.	- 0 0 123 Decimal	u16 RW per.	Modbus 126 <sub>h</sub> CANopen 4013 <sub>h</sub>
P0-20 CMA4	Indicate status value 4 Applicable operating mode: PT, PS, V, T This parameter is used to select a drive status provided in P0-02. The selected status is indicated via P0-12. See P0-17 for details.	- 0 0 123 Decimal	u16 RW per.	Modbus 128 <sub>h</sub> CANopen 4014 <sub>h</sub>
P0-21 CMA5	Indicate status value 5 Applicable operating mode: PT, PS, V, T This parameter is used to select a drive status provided in P0-02. The selected status is indicated via P0-13. See P0-17 for details.	- 0 0 123 Decimal	u16 RW per.	Modbus 12A <sub>h</sub> CANopen 4015 <sub>h</sub>
P0-25 MAP1	Parameter Mapping 1 Applicable operating mode: PT, PS, V, T The parameters from P0-25 ... P0-32 are used to read and write the values of parameters with non-consecutive communication addresses. You can set P0-35 ... P0-42 as the required read and write mapping parameter numbers. When P0-25 ... P0-	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 132 <sub>h</sub> CANopen 4019 <sub>h</sub>

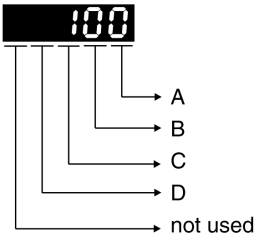
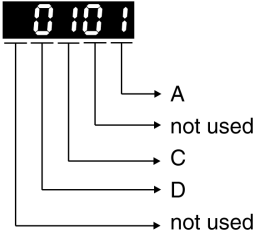
Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
	32 are read, the read or write values are equivalent to the values of the parameters specified via P0-35 ... P0-42, and vice versa. See P0-35 for details.			
P0-26 MAP2	Parameter Mapping 2 Applicable operating mode: PT, PS, V, T See P0-25 and P0-36 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 134 <sub>h</sub> CANopen 401A <sub>h</sub>
P0-27 MAP3	Parameter Mapping 3 Applicable operating mode: PT, PS, V, T See P0-25 and P0-37 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 136 <sub>h</sub> CANopen 401B <sub>h</sub>
P0-28 MAP4	Parameter Mapping 4 Applicable operating mode: PT, PS, V, T See P0-25 and P0-38 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 138 <sub>h</sub> CANopen 401C <sub>h</sub>
P0-29 MAP5	Parameter Mapping 5 Applicable operating mode: PT, PS, V, T See P0-25 and P0-39 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 13A <sub>h</sub> CANopen 401D <sub>h</sub>
P0-30 MAP6	Parameter Mapping 6 Applicable operating mode: PT, PS, V, T See P0-25 and P0-40 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 13C <sub>h</sub> CANopen 401E <sub>h</sub>
P0-31 MAP7	Parameter Mapping 7 Applicable operating mode: PT, PS, V, T See P0-25 and P0-41 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 13E <sub>h</sub> CANopen 401F <sub>h</sub>
P0-32 MAP8	Parameter Mapping 8 Applicable operating mode: PT, PS, V, T See P0-25 and P0-42 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW -	Modbus 140 <sub>h</sub> CANopen 4020 <sub>h</sub>
P0-35 MAPA1	Block Data Read/Write P0-35...P0-42 1 Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub>	u32 RW per.	Modbus 146 <sub>h</sub> CANopen 4023 <sub>h</sub>

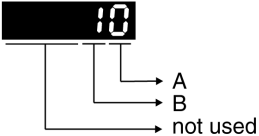
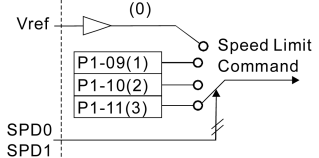
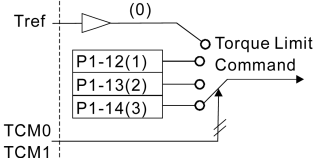
Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>The parameters P0-35 ... P0-42 specify the required read and write parameter numbers for P0-25 ... P0-32. They read and write the values of the parameters whose communication addresses are not consecutive.</p> <p>The read/write parameter can be a single 32-bit parameter or two 16-bit parameters.</p>  <p>A: Parameter group code in hexadecimal format B: Parameter number in hexadecimal format</p> <p>Example:</p> <p>If you want to read and write the value of P1-44 (32-bit parameter) via P0-25, set P0-35 to 012C012C<sub>h</sub>.</p> <p>If you want to read and write the values of P2-02 (16-bit parameter) and P2-04 (16-bit parameter) via P0-25, set P0-35 to 02040202<sub>h</sub>.</p>	FFFFFFFF <sub>h</sub> Hexadecimal		
P0-36 MAPA2	Block Data Read/Write P0-35...P0-42 2 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 148 <sub>h</sub> CANopen 4024 <sub>h</sub>
P0-37 MAPA3	Block Data Read/Write P0-35...P0-42 3 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 14A <sub>h</sub> CANopen 4025 <sub>h</sub>
P0-38 MAPA4	Block Data Read/Write P0-35...P0-42 4 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 14C <sub>h</sub> CANopen 4026 <sub>h</sub>
P0-39 MAPA5	Block Data Read/Write P0-35...P0-42 5 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 14E <sub>h</sub> CANopen 4027 <sub>h</sub>
P0-40 MAPA6	Block Data Read/Write P0-35...P0-42 6 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFF <sub>h</sub>	u32 RW per.	Modbus 150 <sub>h</sub> CANopen 4028 <sub>h</sub>

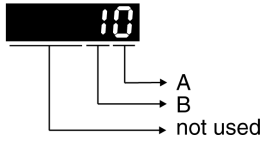
Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
		Hexadecimal		
P0-41 MAPA7	Block Data Read/Write P0-35...P0-42 7 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 152 <sub>h</sub> CANopen 4029 <sub>h</sub>
P0-42 MAPA8	Block Data Read/Write P0-35...P0-42 8 Applicable operating mode: PT, PS, V, T See P0-35 for details.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 154 <sub>h</sub> CANopen 402A <sub>h</sub>
P0-46 SVSTS	State of Signal Output Functions Applicable operating mode: PT, PS, V, T  This parameter is used to indicate the state of the signal output function of the drive in hexadecimal format. If the function is assigned to a digital output, it would represent the state of the output given no forcing on the output.  Bit 0: SRDY (Servo ready) Bit 1: SON (Servo On) Bit 2: ZSPD (Zero speed) Bit 3: TSPD (Speed reached) Bit 4: TPOS (Movement completed) Bit 5: TQL (Torque Limit Reached) Bit 6: ERR (Error Detected) Bit 7: BRKR (Holding brake control) Bit 8: HOMED_OK (Homing completed) Bit 9: OLW (Motor Overload Alert)  Bit 10: WARN (indicates that one of the following conditions has been detected: Hardware limit switch triggered, undervoltage, Nodeguard alert, Operational Stop (OPST))  Bits 11 ... 15: Reserved  The parameter can also be read via the fieldbus.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 15C <sub>h</sub> CANopen 402E <sub>h</sub>
P0-47 LAST_WRN	Number of Last Alert Applicable operating mode: PT, PS, V, T  This parameter contains the number of the last detected alert. After a Fault Reset, the number is cleared.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 15E <sub>h</sub> CANopen 402F <sub>h</sub>

# P1 - Basic Parameters

## P1 - Basic Parameters

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P1-00 PTT	<p>Reference Value Signal - Pulse Settings</p> <p>Applicable operating mode: PT</p>  <p>This parameter is used to configure the reference value signals for the operating mode PT.</p> <p>A: Type of reference value signals B: Signal frequency C: Input polarity D: Source of reference value signals</p> <p>Setting can only be modified if power stage is disabled.</p>	- 0 <sub>h</sub> 2 <sub>h</sub> 1132 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 200 <sub>h</sub> CANopen 4100 <sub>h</sub>
P1-01 CTL	<p>Operating Mode and Direction of Rotation</p> <p>Applicable operating mode: PT, PS, V, T</p>  <p>A: Operating mode</p> <p>Refer to chapter <a href="#">Setting the Operating Mode</a>, page 286.</p> <p>C: Direction of movement</p> <p>Refer to chapter <a href="#">Verifying the Direction of Movement</a>, page 161.</p> <p>D: Signal input functions and signal output functions after operating mode switching</p> <p>Value 0: The assignments of the signal input functions and the signal output functions (P2-10 ... P2-22) remain identical for the new operating mode.</p> <p>Value 1: The assignments of the signal input functions and the signal output functions (P2-10 ... P2-22) are set to the default presets of the new operating mode. Refer to chapters <a href="#">Default Presets</a></p>	- 0 <sub>h</sub> B <sub>h</sub> 110B <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 202 <sub>h</sub> CANopen 4101 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>of the Signal Inputs, page 271 and Default Presets of the Signal Outputs, page 276.</p> <p>Modified settings become active the next time the product is powered on.</p>			
<p>P1-02 PSTL</p>	<p>Velocity and Torque Limitations Activation/ Deactivation</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter activates/deactivates velocity limitation and torque limitation.</p> <p>It can also be activated via the signal input functions SPDLM and TRQLM.</p> <p>The signal input functions SPD0 and SPD1 are used to select velocity values set via P1-09 to P1-11.</p> <p>The signal input functions TCM0 and TCM1 are used to select torque values set via P1-12 to P1-14.</p>  <p>A: Velocity limitation</p> <p>0: Deactivate</p> <p>1: Activate (in operating mode T, and CANopen T (refer to P1-82))</p>  <p>B: Torque limitation</p> <p>0: Deactivate</p> <p>1: Activate (operating modes PT, PS, CANopen V (refer to P1-85) and V)</p> 	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>11<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 204<sub>h</sub></p> <p>CANopen 4102<sub>h</sub></p>
<p>P1-03 AOUT</p>	<p>Polarity of Analog Outputs / Polarity of Pulse Outputs</p> <p>Applicable operating mode: PT, PS, V, T</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>13<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 206<sub>h</sub></p> <p>CANopen 4103<sub>h</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	 <p>This parameter is used to specify the polarity of analog outputs MON1 and MON2 and the polarity of pulse outputs.</p> <p>A: Polarity of analog outputs MON1 and MON2</p> <p>0: MON1(+), MON2(+)</p> <p>1: MON1(+), MON2(-)</p> <p>2: MON1(-), MON2(+)</p> <p>3: MON1(-), MON2(-)</p> <p>B: Polarity of pulse outputs</p> <p>0: Not inverted</p> <p>1: Inverted</p>			
P1-04 MON1	Scaling Factor Analog Output 1 Applicable operating mode: PT, PS, V, T	% 1 100 100 Decimal	u16 RW per.	Modbus 208 <sub>h</sub> CANopen 4104 <sub>h</sub>
P1-05 MON2	Scaling Factor Analog Output 2 Applicable operating mode: PT, PS, V, T	% 1 100 100 Decimal	u16 RW per.	Modbus 20A <sub>h</sub> CANopen 4105 <sub>h</sub>
P1-06 DCOMopmod	CAN Opmode	% -32768 0 32767 Decimal	s16 RO -	Modbus 20C <sub>h</sub> CANopen 4106 <sub>h</sub>
P1-07 ReactLimSw	Limit Switch Fault Reaction Applicable operating mode: PT, PS, V, T Error reaction selection after a limit switch is at active state while the power stage is disabled. 1: The drive does not trigger an error 0: The drive triggers an error	- 0 0 1 Decimal	u16 RW per.	Modbus 20E <sub>h</sub> CANopen 4107 <sub>h</sub>
P1-09 SP1	Target Velocity/Velocity Limitation 1 Applicable operating mode: V, T Target velocity 1 In the operating mode V, this parameter specifies the first target velocity.	0.1rpm -60000 10000 60000 Decimal	s32 RW per.	Modbus 212 <sub>h</sub> CANopen 4109 <sub>h</sub>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Velocity limitation 1 In the operating mode T, this parameter specifies the first velocity limitation.			
P1-10 SP2	Target Velocity/Velocity Limitation 2 Applicable operating mode: V, T Target velocity 2 In the operating mode V, this parameter specifies the second target velocity. Velocity limitation 2 In the operating mode T, this parameter specifies the second velocity limitation.	0.1rpm -60000 20000 60000 Decimal	s32 RW per.	Modbus 214 <sub>h</sub> CANopen 410A <sub>h</sub>
P1-11 SP3	Target Velocity/Velocity Limitation 3 Applicable operating mode: V, T Target velocity 3 In the operating mode V, this parameter specifies the third target velocity. Velocity limitation 3 In the operating mode T, this parameter specifies the third velocity limitation.	0.1rpm -60000 30000 60000 Decimal	s32 RW per.	Modbus 216 <sub>h</sub> CANopen 410B <sub>h</sub>
P1-12 TQ1	Target Torque/Torque Limitation 1 Applicable operating mode: PT, PS, V, T Target torque 1 in percent of nominal current In the operating mode T, this parameter specifies the first target torque. Torque limitation 1 in percent of nominal current In the operating modes PT, PS and V, this parameter specifies the first torque limitation. The signal output function TQL is activated if the torque reaches the torque limitations set via the parameters P1-12 ... P1-14 or via an analog input.	% -300 100 300 Decimal	s16 RW per.	Modbus 218 <sub>h</sub> CANopen 410C <sub>h</sub>
P1-13 TQ2	Target Torque/Torque Limitation 2 Applicable operating mode: PT, PS, V, T Target torque 2 in percent of nominal current In the operating mode T, this parameter specifies the second target torque. Torque limitation 2 in percent of nominal current In the operating modes PT, PS and V, this parameter specifies the second torque limitation. The signal output function TQL is activated if the torque reaches the torque limitations set via the parameters P1-12 ... P1-14 or via an analog input.	% -300 100 300 Decimal	s16 RW per.	Modbus 21A <sub>h</sub> CANopen 410D <sub>h</sub>
P1-14 TQ3	Target Torque/Torque Limitation 3 Applicable operating mode: PT, PS, V, T Target torque 3 in percent of nominal current In the operating mode T, this parameter specifies the third target torque.	% -300 100 300	s16 RW per.	Modbus 21C <sub>h</sub> CANopen 410E <sub>h</sub>

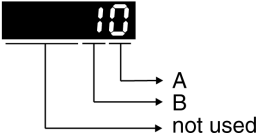
Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Torque limitation 3 in percent of nominal current  In the operating modes PT, PS and V, this parameter specifies the third torque limitation.  The signal output function TQL is activated if the torque reaches the torque limitations set via the parameters P1-12 ... P1-14 or via an analog input.	Decimal		
P1-15 LINELOSSMODE	Mains Phase Monitoring - Response to Missing Mains Phase  Applicable operating mode: PT, PS, V, T  This parameter specifies the response of the drive if the mains phase monitoring function detects an error.  Value 0: Detected error if power stage is enabled or disabled  Value 1: Detected error if power stage is enabled, alert if power stage is disabled  Value 2: Alert if power stage is enabled or disabled	- 0 0 2 Decimal	u16  RW per.	Modbus 21E <sub>h</sub> CANopen 410F <sub>h</sub>
P1-16 LINELOSSRECOVER	Mains Phase Monitoring - Fault Reset  Applicable operating mode: PT, PS, V, T  This parameter specifies the type of Fault Reset after a detected mains phase error has been removed.  Value 0: No automatic Fault Reset  Value 1: Automatic Fault Reset	- 0 0 1 Decimal	u16  RW per.	Modbus 220 <sub>h</sub> CANopen 4110 <sub>h</sub>
P1-17 LINELOSSTYPE	Mains Phase Monitoring - Type  Applicable operating mode: PT, PS, V, T  This parameter specifies the type of mains phase monitoring  Value 0: No mains phase monitoring  Value 1: Mains phase monitoring single-phase connection  Value 2: Mains phase monitoring three-phase connection	- 0 0 2 Decimal	u16  RW per.	Modbus 222 <sub>h</sub> CANopen 4111 <sub>h</sub>
P1-18	Reserved	-	-	-
P1-19 DISTIME	Active Disable - Delay Time Power Stage  Applicable operating mode: PT, PS, V, T  This parameter specifies the delay time between standstill of the motor and disabling the power stage.	ms 0 0 6500 Decimal	u16  RW per.	Modbus 226 <sub>h</sub> CANopen 4113 <sub>h</sub>
P1-20 ESTOPI LIM	Current Limit During Quick Stop  Applicable operating mode: PT, PS, V  This parameter specifies the maximum current during a Quick Stop (expressed as factor of P1-78).	0.001 1 1000 1000 Decimal	s16  RW per.	Modbus 228 <sub>h</sub> CANopen 4114 <sub>h</sub>
P1-21	Status of Foldback Current Drive	-	u16	Modbus 22A <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
FOLD	Applicable operating mode: PT, PS, V, T  This parameter indicates whether the foldback current limit is greater than or less than the maximum current of the drive (see P1-78).  Value 0: Foldback current limit greater than P1-78 Value 1: Foldback current limit is less than P1-78	0 - 1  Decimal	RO  -	CANopen 4115 <sub>h</sub>
P1-22 IFOLD	Foldback Current Limit - Drive  Applicable operating mode: PT, PS, V, T  Drive foldback current limit	0.01A 0 - 30000 Decimal	u32 RO -	Modbus 22C <sub>h</sub> CANopen 4116 <sub>h</sub>
P1-23 IFOLDFTHRESH	Current Monitoring Drive - Detected Error Threshold Foldback Current  Applicable operating mode: PT, PS, V, T  This parameter specifies the threshold value used by the drive current monitoring function to detect a drive foldback current error.	0.01A 0 - 30000 Decimal	u32 RW per.	Modbus 22E <sub>h</sub> CANopen 4117 <sub>h</sub>
P1-24 IFOLDWTHRESH	Current Monitoring Drive - Alert Threshold Foldback Current  Applicable operating mode: PT, PS, V, T  This parameter specifies the threshold value used by the drive current monitoring function to trigger a drive foldback current alert.	0.01A 0 - 30000 Decimal	u32 RW per.	Modbus 230 <sub>h</sub> CANopen 4118 <sub>h</sub>
P1-25	Reserved	-	-	-
P1-26 MIFOLD	Foldback Current Limit - Motor  Applicable operating mode: PT, PS, V, T  Motor foldback current limit	0.01A 0 - 30000 Decimal	u32 RO -	Modbus 234 <sub>h</sub> CANopen 411A <sub>h</sub>
P1-27 MIFOLDFTHRESH	Motor Current Monitoring - Detected Error Threshold Foldback Current  Applicable operating mode: PT, PS, V, T  This parameter specifies the threshold value used by the motor current monitoring function to detect a motor foldback current error.	0.01A 0 - 30000 Decimal	u32 RW per.	Modbus 236 <sub>h</sub> CANopen 411B <sub>h</sub>
P1-28 MIFOLDWTHRESH	Motor Current Monitoring - Alert Threshold Foldback Current  Applicable operating mode: PT, PS, V, T  This parameter specifies the threshold value used by the motor current monitoring function to trigger a motor foldback current alert.	0.01A 0 - 30000 Decimal	u32 RW per.	Modbus 238 <sub>h</sub> CANopen 411C <sub>h</sub>
P1-29 OVTHRESH	DC Bus Overvoltage Monitoring - Threshold  Applicable operating mode: PT, PS, V, T  This parameter specifies the threshold value used by the DC bus overvoltage monitoring function.	V - - -	u16 RO -	Modbus 23A <sub>h</sub> CANopen 411D <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Decimal		
P1-30 COMMERRMAXCNT	Commutation Monitoring - Maximum Counter Value Applicable operating mode: PT, PS, V, T	ms 0 0 0 Decimal	u16 RW -	Modbus 23C <sub>h</sub> CANopen 411E <sub>h</sub>
P1-32 LSTP	Stop Method Applicable operating mode: PT, PS, V This parameter specifies how the motor is stopped if the power stage is to be disabled (includes signal input function OPST) or if an error is detected. Value 0 <sub>h</sub> : Deceleration ramp Value 10 <sub>h</sub> : Coast to stop Value 20 <sub>h</sub> : Deceleration ramp to velocity P1-38, then coast to stop (actual velocity must be less than the value of P1-38 for 50 ms before coasting to stop starts) In the operating mode Torque (T), the deceleration ramp is not used. Instead, the current is set to zero. Depending on the event that triggered the stop, the following deceleration ramps are used: - Signal input function STOP: P5-20 - Transmission error detected: P5-21 - Position overflow: P5-22 - Triggering of negative software limit switch: P5-23 - Triggering of positive software limit switch: P5-24 - Triggering of negative hardware limit switch: P5-25 - Triggering of positive hardware limit switch: P5-26 - Any other event: P1-68 The delay time between standstill of the motor and disabling the power stage is set via P1-19.	- 0 <sub>h</sub> 0 <sub>h</sub> 20 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 240 <sub>h</sub> CANopen 4120 <sub>h</sub>
P1-34 TACC	Acceleration Period Applicable operating mode: PT, V The acceleration period is the time in milliseconds required to accelerate from motor standstill to 6000 rpm. For operating mode V, this parameter specifies the acceleration. For operating mode PT, this parameter specifies an acceleration limitation for the pulses at the PTI interface.	ms 6 30 65500 Decimal	u16 RW per.	Modbus 244 <sub>h</sub> CANopen 4122 <sub>h</sub>
P1-35 TDEC	Deceleration Period Applicable operating mode: PT, V	ms 6	u16 RW	Modbus 246 <sub>h</sub> CANopen 4123 <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
	<p>The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill.</p> <p>For operating mode V, this parameter specifies the deceleration.</p> <p>For operating mode PT, this parameter specifies a deceleration limitation for the pulses at the PTI interface.</p>	30 65500 Decimal	per.	
P1-37 LMJR	<p>Ratio of Load Inertia to Motor Inertia</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the ratio of load inertia to motor inertia (<math>J_{load} / J_{motor}</math>).</p> <p>J_load: Total moment of inertia of external mechanical load</p> <p>J_motor: Moment of inertia of motor</p>	0.1 0 10 20000 Decimal	u32 RW per.	Modbus 24A <sub>h</sub> CANopen 4125 <sub>h</sub>
P1-38 ZSPD	<p>Signal Output Function ZSPD / Signal Input Function ZCLAMP - Velocity</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the velocity for the signal output function ZSPD. The signal output function ZSPD indicates that the velocity of the motor is less than the velocity value set via this parameter.</p> <p>This parameter specifies the velocity for the signal input function ZCLAMP. The signal input function ZCLAMP stops the motor. The velocity of the motor must be below the velocity value set via this parameter.</p>	0.1rpm 0 100 2000 Decimal	s32 RW per.	Modbus 24C <sub>h</sub> CANopen 4126 <sub>h</sub>
P1-39 SSPD	<p>Signal Output Function TSPD - Velocity</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the velocity for the signal output function TSPD. The signal output function TSPD indicates that the velocity of the motor is greater than the velocity value set via this parameter.</p>	rpm 0 3000 5000 Decimal	u32 RW per.	Modbus 24E <sub>h</sub> CANopen 4127 <sub>h</sub>
P1-40 VCM	<p>Velocity Target Value and Velocity Limitation 10 V</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>In the operating mode V, this parameter specifies the target velocity that corresponds to the maximum input voltage of 10 V.</p> <p>In the operating mode T, this parameter specifies the velocity limitation that corresponds to the maximum input voltage of 10 V.</p> <p>Example: If the value of this parameter is 3000 in the operating mode V and if the input voltage is 10 V, the target velocity is 3000 rpm.</p>	rpm 0 - 10001 Decimal	s32 RW per.	Modbus 250 <sub>h</sub> CANopen 4128 <sub>h</sub>
P1-41 TCM	<p>Torque Target Value and Torque Limitation 10 V</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>In the operating mode T, this parameter specifies the target torque that corresponds to the maximum input voltage of 10 V.</p> <p>In the operating modes PT, PS and V, this parameter specifies the torque limitation that corresponds to the maximum input voltage of 10 V.</p>	% 0 100 1000 Decimal	u16 RW per.	Modbus 252 <sub>h</sub> CANopen 4129 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>Example: If the value of this parameter is 100 in the operating mode T and if the input voltage is 10 V, the target torque is 100 % of the nominal torque.</p> <p>Setting can only be modified if power stage is disabled.</p>			
P1-42 MBT1	<p>ON Delay Time of Holding Brake</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the time between enabling the power stage and starting a movement (opening time for the holding brake).</p>	<p>ms</p> <p>0</p> <p>0</p> <p>1000</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 254<sub>h</sub></p> <p>CANopen 412A<sub>h</sub></p>
P1-44 GR1	<p>Electronic Gear Ratio - Numerator 1</p> <p>Applicable operating mode: PT, PS</p> <p>This parameter is used to set the numerator of the gear ratio. The denominator of the gear ratio is set via P1-45.</p> <p>In the operating mode PS, the value of this parameter can only be modified when the power stage is disabled.</p>	<p>-</p> <p>1</p> <p>128</p> <p>536870911</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 258<sub>h</sub></p> <p>CANopen 412C<sub>h</sub></p>
P1-45 GR2	<p>Electronic Gear Ratio - Denominator</p> <p>Applicable operating mode: PT, PS</p> <p>This parameter is used to set the denominator of the gear ratio. The numerator of the gear ratio is set via P1-44.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>-</p> <p>1</p> <p>10</p> <p>2147483647</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 25A<sub>h</sub></p> <p>CANopen 412D<sub>h</sub></p>
P1-46 ENCOUTRES	<p>Number of encoder simulation increments (AB signal) per revolution</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>The calculation of the range of this parameter depends on the value of P1-55.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>LPR</p> <p>-</p> <p>2048</p> <p>-</p> <p>Decimal</p>	<p>s32</p> <p>RW</p> <p>per.</p>	<p>Modbus 25C<sub>h</sub></p> <p>CANopen 412E<sub>h</sub></p>
P1-47 SPOK	<p>Signal Output Function SP_OK - Velocity</p> <p>Applicable operating mode: V</p> <p>This parameter specifies the velocity deviation window for the signal output function SP_OK. The signal output function SP_OK indicates that actual velocity is within the velocity deviation window.</p>	<p>rpm</p> <p>0</p> <p>10</p> <p>300</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 25E<sub>h</sub></p> <p>CANopen 412F<sub>h</sub></p>
P1-48 MCOK	<p>Signal Output Function MC_OK - Settings</p> <p>Applicable operating mode: PS</p> <p>This parameter specifies the behavior of the signal output function MC_OK after it has been activated. The signal output function MC_OK indicates that both the signal output functions CMD_OK and TPOS have been activated. In addition, you can specify whether a detected position deviation is to trigger a detected error.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>21<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 260<sub>h</sub></p> <p>CANopen 4130<sub>h</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	 <p>A: Behavior of MC_OK after deactivation of TPOS Value 0: When TPOS is deactivated, MC_OK is deactivated. Value 1: When TPOS is deactivated, MC_OK remains activated.</p> <p>B: Response to detected position deviation via TPOS if A is set to 0 Value 0: No response Value 1: Detected alert Value 2: Detected error</p>			
P1-52 REGENRES	Braking Resistor - Resistance Applicable operating mode: PT, PS, V, T This parameter is used to set the resistance of the braking resistor. Value -1: No braking resistor	Ohm -1 - 32767 Decimal	s16 RW per.	Modbus 268 <sub>h</sub> CANopen 4134 <sub>h</sub>
P1-53 REGENPOW	Braking Resistor - Power Applicable operating mode: PT, PS, V, T This parameter is used to set the power of the braking resistor. Value -1: No braking resistor	W -1 - 32767 Decimal	s16 RW per.	Modbus 26A <sub>h</sub> CANopen 4135 <sub>h</sub>
P1-54 PER	Signal Output Function TPOS - Trigger Value Applicable operating mode: PT, PS This parameter specifies the position deviation value used to activate the signal output function TPOS. Operating mode PT: The signal output function TPOS indicates that the position deviation is within the tolerance set via this parameter. Operating mode PS: The signal output function TPOS indicates that the position deviation at the target position is within the tolerance set via this parameter.	PUU 0 1311 1280000 Decimal	u32 RW per.	Modbus 26C <sub>h</sub> CANopen 4136 <sub>h</sub>
P1-55 VLIM	Maximum Velocity - User-Defined Applicable operating mode: PT, PS, V, T This parameter specifies the maximum velocity. Factory setting: maximum motor speed. Setting can only be modified if power stage is disabled.	rpm 10 - 6000 Decimal	u32 RW per.	Modbus 26E <sub>h</sub> CANopen 4137 <sub>h</sub>
P1-57 CRSHA	Torque Monitoring - Torque Value Applicable operating mode: PT, PS, V, T	% 0 0	u16 RW per.	Modbus 272 <sub>h</sub> CANopen 4139 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	This parameter is used to configure the torque monitoring function. The torque monitoring function detects an error (AL030) if the torque value set via this parameter is exceeded for a period of time set via P1-58.	300 Decimal		
P1-58 CRSHT	Torque Monitoring - Time Value Applicable operating mode: PT, PS, V, T  This parameter is used to configure the torque monitoring function. The torque monitoring function detects an error (AL030) if the torque value set via P1-57 is exceeded for a period of time set via this parameter.	ms 1 1 1000 Decimal	u16 RW per.	Modbus 274 <sub>h</sub> CANopen 413A <sub>h</sub>
P1-59 VELCMDMOVEAVG	S Curve Filter for Operating Mode Velocity Applicable operating mode: V  This parameter specifies the moving average time in [us] for the S curve filter in the operating mode Velocity. The value of this parameter must be a multiple of 125. This filter changes a linear acceleration into an S curve.  Setting can only be modified if power stage is disabled.	us 0 0 255875 Decimal	u32 RW per.	Modbus 276 <sub>h</sub> CANopen 413B <sub>h</sub>
P1-60 COMMERRT-THRESH	Commutation Monitoring - Time Threshold Applicable operating mode: PT, PS, V, T	ms 0 0 3000 Decimal	u16 RW per.	Modbus 278 <sub>h</sub> CANopen 413C <sub>h</sub>
P1-61 COMMERRV-THRESH	Commutation Monitoring - Velocity Threshold Applicable operating mode: PT, PS, V, T	0.1rpm 0 600 60000 Decimal	u32 RW per.	Modbus 27A <sub>h</sub> CANopen 413D <sub>h</sub>
P1-62 THERMODE	Motor Overtemperature Monitoring - Response Applicable operating mode: PT, PS, V, T  This parameter specifies the response of the drive if the temperature monitoring function detects motor overtemperature.  Value 0: Disable power stage immediately  Value 3: Ignore overtemperature  Value 4: Alert  Value 5: Alert first, then detected error if condition persists after P1-63	- 0 0 5 Decimal	u16 RW per.	Modbus 27C <sub>h</sub> CANopen 413E <sub>h</sub>
P1-63 THERMTIME	Motor Overtemperature Monitoring - Delay Time Applicable operating mode: PT, PS, V, T  This parameter specifies the delay time between the detection of motor overtemperature and the transition to the operating state Fault (see P1-62).	s 0 30 300 Decimal	u16 RW per.	Modbus 27E <sub>h</sub> CANopen 413F <sub>h</sub>
P1-64	Undervoltage Monitoring - Response	-	u16	Modbus 280 <sub>h</sub>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
UVMODE	Applicable operating mode: PT, PS, V, T  This parameter specifies the response of the drive if the undervoltage monitoring function detects undervoltage.  Value 0: Detected error  Value 1: Alert (if power stage is enabled)  Value 2: Alert first, then detected error if condition persists after P1-67 (if power stage is enabled)  Value 3: Detected error (if power stage is enabled)	0  0  3  Decimal	RW  per.	CANopen 4140 <sub>h</sub>
P1-65	Reserved	–	–	–
P1-66 MFOLD	Status of Foldback Current Motor  Applicable operating mode: PT, PS, V, T  This parameter indicates whether the foldback current limit is greater than or less than the maximum current of the motor (see P1-78).  Value 0: Foldback current limit greater than P1-78  Value 1: Foldback current limit is less than P1-78	-  0  -  1  Decimal	u16  RO  -	Modbus 284 <sub>h</sub>  CANopen 4142 <sub>h</sub>
P1-67 UVTIME	Undervoltage Monitoring - Delay Time  Applicable operating mode: PT, PS, V, T  This parameter specifies the delay time between the detection of an undervoltage condition (displayed as "u") and the response of the drive to this condition as specified in P1-64.	s  0  30  300  Decimal	u16  RW  per.	Modbus 286 <sub>h</sub>  CANopen 4143 <sub>h</sub>
P1-68 DECSTOP	Active Disable - Deceleration Ramp  Applicable operating mode: PT, PS, V  This parameter specifies the deceleration ramp for a power stage Disable request, see P1-32.	ms  6  30  65500  Decimal	u16  RW  per.	Modbus 288 <sub>h</sub>  CANopen 4144 <sub>h</sub>
P1-69 DECSTOPTIME	Disable - Deceleration Time  Applicable operating mode: PT, PS, V  This parameter specifies the deceleration ramp for a power stage Disable request, see P1-32. If the value of this parameter is not 0, this parameter overrides P1-68.  Setting can only be modified if power stage is disabled.	ms  0  0  6500  Decimal	u16  RW  per.	Modbus 28A <sub>h</sub>  CANopen 4145 <sub>h</sub>
P1-70 IMAXHALT	Signal Input Function HALT - Maximum Current  Applicable operating mode: T  This parameter specifies the maximum current for the signal input function Halt. The maximum value for this parameter is the value of P1-79.	0.01A  -  0  -  Decimal	u32  RW  per.	Modbus 28C <sub>h</sub>  CANopen 4146 <sub>h</sub>
P1-71 REGENMAXONTIME	Braking Resistor - Maximum Time in Braking  Applicable operating mode: PT, PS, V, T  This parameter specifies the maximum time in braking for the braking resistor. The maximum time in braking is the maximum period of time	ms  10  40  100	u16  RW  per.	Modbus 28E <sub>h</sub>  CANopen 4147 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	during which the braking resistor may be activated.	Decimal		
P1-72 REGENFLTMODE	Braking Resistor Overload Monitoring - Response Applicable operating mode: PT, PS, V, T  This parameter specifies the response of the drive if the braking resistor overload monitoring function detects braking resistor overload.  Value 0: Alert Value 1: Detected error	- 0 0 1 Decimal	u16 RW per.	Modbus 290 <sub>h</sub> CANopen 4148 <sub>h</sub>
P1-78 ILIM	User-Defined Maximum Current Applicable operating mode: PT, PS, V, T  This parameter is specifies a user-defined maximum current for the drive. The maximum value of this parameter is the value of P1-79.	0.01A - - - Decimal	u32 RW per.	Modbus 29C <sub>h</sub> CANopen 414E <sub>h</sub>
P1-79 IMAX	Maximum Current Applicable operating mode: PT, PS, V, T  This parameter indicates the maximum current for a drive / motor combination.	0.01A - - - Decimal	u32 RO -	Modbus 29E <sub>h</sub> CANopen 414F <sub>h</sub>
P1-80 DIPEAK	Maximum Peak Current Applicable operating mode: PT, PS, V, T  This parameter indicates the maximum peak current of the drive.	0.01A - - - Decimal	u32 RO -	Modbus 2A0 <sub>h</sub> CANopen 4150 <sub>h</sub>
P1-81 DICONT	Nominal Current Applicable operating mode: PT, PS, V, T  This parameter indicates the nominal current of the drive.	0.01A - - - Decimal	u32 RO -	Modbus 2A2 <sub>h</sub> CANopen 4151 <sub>h</sub>
P1-82 CANOPEN_VEL_LIMIT	Velocity limitation for CANopen operating mode Profile Torque Applicable operating mode: Fieldbus mode  The limitation is effective only if P1-02 is set to 0x0001.  Value 0: Limitation via analog input Value 1: Limitation via P1-09 Value 2: Limitation via P1-10 Value 3: Limitation via P1-11	- 0 0 3 Decimal	u16 RW per.	Modbus 2A4 <sub>h</sub> CANopen 4152 <sub>h</sub>
P1-84 CFG_MOTOR	Configured motor type Applicable operating mode: PT, PS, V, T	- 0 - 2147483647 Decimal	u32 RW per.	Modbus 2A8 <sub>h</sub> CANopen 4154 <sub>h</sub>

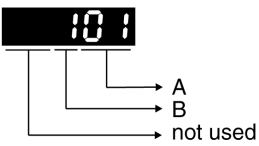
Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
P1-85 CANOPEN_TRQ_LIMIT	Torque Limit For CANopen Modes Applicable operating mode: Fieldbus mode The limitation is effective only if P1-02 is set to 0x0010. Value 0: Limitation via analog input Value 1: Limitation via P1-12 Value 2: Limitation via P1-13 Value 3: Limitation via P1-14	- 0 0 3 Decimal	u16 RW per.	Modbus 2AA <sub>h</sub> CANopen 4155 <sub>h</sub>
P1-87 I_MAX_QUICK_STOP	Quick Stop - Maximum Current Applicable operating mode: Fieldbus mode This parameter specifies the maximum current at Quick Stop for CANopen modes. The limitation is effective only if P3-31 is set to -2 or 7.	0.01A - P1-79 0 Decimal	u32 RW per.	Modbus 2AE <sub>h</sub> CANopen 4157 <sub>h</sub>
P1-88 INDEXDURATE	Simulated Enc Index Pulse Duration	- 0 0 100 Decimal	u16 RW per.	Modbus 2B0 <sub>h</sub> CANopen 4158 <sub>h</sub>

## P2 - Extended Parameters

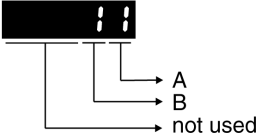
### P2 - Extended Parameters

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
P2-01 PPR	Gain Switching - Rate for Position Loop Applicable operating mode: PT, PS This parameter specifies the gain switching rate for the position loop. The gain switching function is configured via this parameter and parameters P2-05, P2-27 and P2-29.	% 10 100 500 Decimal	u16 RW per.	Modbus 302 <sub>h</sub> CANopen 4201 <sub>h</sub>
P2-05 SPR	Gain Switching - Rate for Velocity Loop Applicable operating mode: PT, PS, V, T This parameter specifies the gain switching rate for the velocity loop. The gain switching function is configured via this parameter and parameters P2-01, P2-27 and P2-29.	% 10 100 500 Decimal	u16 RW per.	Modbus 30A <sub>h</sub> CANopen 4205 <sub>h</sub>
P2-08 PCTL	Factory Reset / Save Parameters Applicable operating mode: PT, PS, V, T	- 0	u16 RW	Modbus 310 <sub>h</sub> CANopen 4208 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>This parameter provides the following functions:</p> <ul style="list-style-type: none"> <li>- Reset the parameters to the factory settings</li> <li>- Save the current parameter values</li> </ul> <p>The factory settings do not become effective until after you have powered the drive off and on again.</p> <p>Value 10: Reset the parameter values to the factory settings</p> <p>Value 11: Save the parameter values</p> <p>Value 400: Normal digital output control operation mode</p> <p>Value 406: Force output control operation mode</p> <p><b>NOTE:</b> Value 999 is displayed when the parameter values are successfully saved.</p>	<p>0</p> <p>406</p> <p>Decimal</p>	-	
P2-09 DRT	<p>Debounce Time - Inputs</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the debounce time for the digital inputs DI1 ... DI5 and DI8. See P2-24 for the debounce time for the fast digital inputs DI6 and DI7.</p>	<p>ms</p> <p>0</p> <p>2</p> <p>20</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 312<sub>h</sub></p> <p>CANopen 4209<sub>h</sub></p>
P2-10 DITF1	<p>Signal Input Function for DI1</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>The parameters P2-10 ... P2-17 are used to assign signal input functions to the digital inputs DI1 ... DI8 and to configure the type of digital input (normally closed, normally open).</p> <p>A: Signal input functions:</p> <p>For the values, refer to chapter Setting the Digital Signal Inputs, page 271.</p> <p>B: Type:</p> <p>0: Normally closed (contact b)</p> <p>1: Normally open (contact a)</p> <p>Example: If the setting of P2-10 is 101, the signal input function assigned to digital input 1 is SON (0x01) and the type of contact is a normally open contact.</p> <p>The drive must be restarted after the parameters have been modified.</p> <p>Forcing of digital inputs is configured via P3-06 and activated via P4-07.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>146<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 314<sub>h</sub></p> <p>CANopen 420A<sub>h</sub></p>
P2-11 DITF2	<p>Signal Input Function for DI2</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>See P2-10 for details.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>100<sub>h</sub></p> <p>146<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 316<sub>h</sub></p> <p>CANopen 420B<sub>h</sub></p>
P2-12	Signal Input Function for DI3	-	u16	Modbus 318 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
DITF3	Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	0 <sub>h</sub> 100 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	RW per.	CANopen 420C <sub>h</sub>
P2-13 DITF4	Signal Input Function for DI4 Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 100 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 31A <sub>h</sub> CANopen 420D <sub>h</sub>
P2-14 DITF5	Signal Input Function for DI5 Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 24 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 31C <sub>h</sub> CANopen 420E <sub>h</sub>
P2-15 DITF6	Signal Input Function for DI6 Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 22 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 31E <sub>h</sub> CANopen 420F <sub>h</sub>
P2-16 DITF7	Signal Input Function for DI7 Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 23 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 320 <sub>h</sub> CANopen 4210 <sub>h</sub>
P2-17 DITF8	Signal Input Function for DI8 Applicable operating mode: PT, PS, V, T See P2-10 for details. Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 21 <sub>h</sub> 146 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 322 <sub>h</sub> CANopen 4211 <sub>h</sub>
P2-18 DOTF1	Signal Output Function for DO1 Applicable operating mode: PT, PS, V, T The parameters P2-18 ... P2-22 are used to assign signal output functions to the digital outputs DO1 ... DO5 and to configure the type of digital output (normally closed, normally open).  A: Signal output functions:	- 0 <sub>h</sub> 101 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 324 <sub>h</sub> CANopen 4212 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>For the values, refer to chapter Setting the Digital Signal Outputs, page 276.</p> <p>B: Type:</p> <p>0: Normally closed (contact b)</p> <p>1: Normally open (contact a)</p> <p>Example: If the setting of P2-18 is 101, the signal output function assigned to digital output 1 is SRDY (0x01) and the type of contact is a normally open contact.</p>			
P2-19 DOTF2	<p>Signal Output Function for DO2</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>See P2-18 for details.</p>	- 0 <sub>h</sub> 100 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 326 <sub>h</sub> CANopen 4213 <sub>h</sub>
P2-20 DOTF3	<p>Signal Output Function for DO3</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>See P2-18 for details.</p>	- 0 <sub>h</sub> 100 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 328 <sub>h</sub> CANopen 4214 <sub>h</sub>
P2-21 DOTF4	<p>Signal Output Function for DO4</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>See P2-18 for details.</p>	- 0 <sub>h</sub> 100 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 32A <sub>h</sub> CANopen 4215 <sub>h</sub>
P2-22 DOTF5	<p>Signal Output Function for DO5</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>See P2-18 for details.</p>	- 0 <sub>h</sub> 7 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 32C <sub>h</sub> CANopen 4216 <sub>h</sub>
P2-23 DOTF6	<p>Signal Output Function for DO6(OCZ)</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>Only the signal output function ESIM can be assigned to the digital output DO6(OCZ).</p> <p>Value 0: Encoder simulation function disabled</p> <p>Value 40<sub>h</sub>: Encoder simulation function enabled</p> <p>Use P2-18 ... P2-22 for assigning other signal output functions to the other digital outputs DO1 ... DO5.</p> <p>See P2-18 for details.</p>	- 0 <sub>h</sub> 40 <sub>h</sub> 137 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 32E <sub>h</sub> CANopen 4217 <sub>h</sub>
P2-24 FDRT	<p>Debounce Time - Fast Inputs</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the debounce time for the digital inputs DI6 and DI7. See P2-09 for the</p>	us 0 50 20000	u16 RW per.	Modbus 330 <sub>h</sub> CANopen 4218 <sub>h</sub>

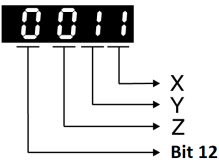
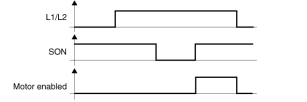
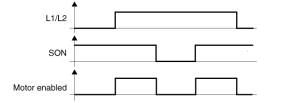
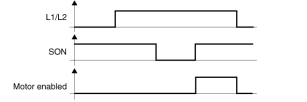
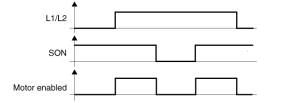
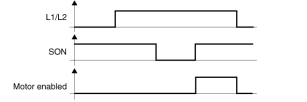
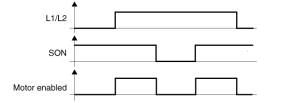
Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	debounce time for the digital inputs DI1 ... DI5 and DI8.	Decimal		
<i>P2-27</i> GCC	<p>Gain Switching - Conditions and Type</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the conditions for and the type of gain switching. The gain switching function is configured via this parameter and parameters P2-01, P2-05 and P2-29.</p>  <p>A: Conditions for gain switching:</p> <p>0: Disabled</p> <p>1: Signal input function GAINUP is active</p> <p>2: In operating modes PT and PS, the position deviation is greater than the value of P2-29</p> <p>3: Pulse frequency is greater than the value of P2-29</p> <p>4: Velocity is greater than the value of P2-29</p> <p>5: Signal input function GAINUP is not active</p> <p>6: In operating modes PT and PS, the position deviation is less than the value of P2-29</p> <p>7: Pulse frequency is less than the value of P2-29</p> <p>8: Velocity is less than the value of P2-29</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 18 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 336 <sub>h</sub> CANopen 421B <sub>h</sub>
<i>P2-29</i> GPE	<p>Gain Switching - Comparison Value</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the comparison value used for the conditions for gain switching. Depending on the selected condition, the value entered represents the number of pulses (position deviation), the pulse frequency or the velocity. The gain switching function is configured via this parameter and parameters P2-01, P2-05 and P2-27.</p>	- 0 <sub>h</sub> 138800 <sub>h</sub> 3A9800 <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 33A <sub>h</sub> CANopen 421D <sub>h</sub>
<i>P2-30</i> INH	<p>Auxiliary Functions</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>Value 0: Disabled</p> <p>Value 1: Enable the power stage</p>	- -8 0 8 Decimal	s16 RW -	Modbus 33C <sub>h</sub> CANopen 421E <sub>h</sub>
<i>P2-31</i> LTNEFFORT	<p>Autotuning Optimization Value Threshold</p> <p>Applicable operating mode: PT, PS, V</p> <p>This parameter is used to modify the gain.</p>	0.001 100 1000 10000 Decimal	u32 RW -	Modbus 33E <sub>h</sub> CANopen 421F <sub>h</sub>
<i>P2-32</i> ATMODE	Autotuning	- 0	u16 RW	Modbus 340 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>Applicable operating mode: PT, PS, V</p> <p>This parameter is used to start autotuning with the selected autotuning method.</p> <p>Value 0: Stop Autotuning</p> <p>Value 1: Easy Tuning</p> <p>Value 2: Comfort Tuning [minimum settling time, vibration suppression]</p> <p>Value 3: Comfort Tuning [minimum overshoot, vibration suppression]</p> <p>Value 52: Comfort Tuning [minimum settling time, no vibration suppression]</p> <p>Value 53: Comfort Tuning [minimum overshoot, no vibration suppression]</p>	<p>0</p> <p>56</p> <p>Decimal</p>	-	CANopen 4220 <sub>h</sub>
P2-34 VEMAX	<p>Velocity Monitoring - Threshold Value</p> <p>Applicable operating mode: V</p> <p>This parameter specifies the velocity threshold for the velocity monitoring function. If this value is exceeded, error AL555 is detected.</p>	<p>0.1rpm</p> <p>0</p> <p>50000</p> <p>60000</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 344<sub>h</sub></p> <p>CANopen 4222<sub>h</sub></p>
P2-35 PDEV	<p>Position Deviation Monitoring - Threshold Value</p> <p>Applicable operating mode: PT, PS</p> <p>This parameter specifies the position deviation threshold for the position deviation monitoring function. If this value is exceeded, error AL009 is detected.</p>	<p>10*pulse</p> <p>1</p> <p>384000</p> <p>12800000</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 346<sub>h</sub></p> <p>CANopen 4223<sub>h</sub></p>
P2-36 PT_PULSE_FLTR	<p>PTI Interface Debounce Time - Pulse</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the debounce time of the pulse input of the PTI interface.</p>	<p>16.6666*ns</p> <p>0</p> <p>30</p> <p>511</p> <p>Decimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 348<sub>h</sub></p> <p>CANopen 4224<sub>h</sub></p>
P2-37 PT_DIRECT_FLTR	<p>PTI Interface Debounce Time - Direction</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the debounce time of the direction input of the PTI interface.</p>	<p>16.6666*ns</p> <p>0</p> <p>30</p> <p>511</p> <p>Decimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 34A<sub>h</sub></p> <p>CANopen 4225<sub>h</sub></p>
P2-44 AUTOR_DOMS	<p>Set the AUTOR feature digital out mode</p> <p>Applicable operating mode: PS</p> <p>This parameter provides information on the status of the sequence of data sets processed with the signal input functions.</p> <p>Value 0: General output mode. The functions assigned to the digital outputs DO1 ... DO6 via the parameters P2-18 ... P2-23 are active.</p> <p>Value 1: Combination output mode. The digital outputs provide information on the status of the sequence of data sets.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>1<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 358<sub>h</sub></p> <p>CANopen 422C<sub>h</sub></p>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	When this parameter is reset to 0, the previous assignments and configurations of the digital outputs as set via the parameters P2-18 ... P2-23 are restored.  See Status of Data Set Sequences, page 299 for details.			
P2-50 DCLR	Signal Input Function CLRPOS - Trigger  Applicable operating mode: PT  This function is only supported in linear control mode (P8-35=0x4001)  This parameter specifies how the signal input function CLRPOSDEV is triggered. The signal input function CLRPOSDEV resets the position deviation to zero.  Value 0: Rising edge Value 1: Level	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16  RW  per.	Modbus 364 <sub>h</sub>  CANopen 4232 <sub>h</sub>
P2-60 GR2	Electronic Gear Ratio - Numerator 2  Applicable operating mode: PT, PS  This parameter can be used to set an additional gear ratio. The additional gear ratio can be selected via the signal input functions GNUM0 and GNUM1.  See P1-44 for details.	- 1 128 536870911 Decimal	u32  RW  per.	Modbus 378 <sub>h</sub>  CANopen 423C <sub>h</sub>
P2-61 GR3	Electronic Gear Ratio - Numerator 3  Applicable operating mode: PT, PS  See P2-60 for details.	- 1 128 536870911 Decimal	u32  RW  per.	Modbus 37A <sub>h</sub>  CANopen 423D <sub>h</sub>
P2-62 GR4	Electronic Gear Ratio - Numerator 4  Applicable operating mode: PT, PS  See P2-60 for details.	- 1 128 536870911 Decimal	u32  RW  per.	Modbus 37C <sub>h</sub>  CANopen 423E <sub>h</sub>
P2-65 GBIT	Special Function 1  Applicable operating mode: PT, PS, V  Bits 0 ... 1: Reserved (must be set to 0).  Bit 2: Activate/deactivate the error AL560 <ul style="list-style-type: none"> <li>• 0: The alarm can be triggered</li> <li>• 1: The alarm cannot be triggered</li> </ul> Bit 3: Reserved (must be set to 0).  Bit 4: Target position rejected monitoring <ul style="list-style-type: none"> <li>• 0: Function Activated (AL520)</li> <li>• 1: Function deactivated</li> </ul> Bit 5: Current limitation in torque mode <ul style="list-style-type: none"> <li>• 0: Function activated</li> <li>• 1: Function deactivated</li> </ul> Bit 6: Reference pulse monitoring	- 0 <sub>h</sub> 200 <sub>h</sub> FFFC <sub>h</sub> Hexadecimal	u16  RW  per.	Modbus 382 <sub>h</sub>  CANopen 4241 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<ul style="list-style-type: none"> <li>• 0: Function activated</li> <li>• 1: Function deactivated</li> </ul> Bit 7: Pulse signal monitoring <ul style="list-style-type: none"> <li>• 0: Function activated (AL534)</li> <li>• 1: Function deactivated</li> </ul> Bit 8: Motor overload monitoring <ul style="list-style-type: none"> <li>• 0: Function activated (AL006)</li> <li>• 1: Function deactivated</li> </ul> Bit 9: Motor phase monitoring <ul style="list-style-type: none"> <li>• 0: Function deactivated</li> <li>• 1: Function activated</li> </ul> Bit 10: Acceleration and deceleration for ZCLAMP: <ul style="list-style-type: none"> <li>• 0: Immediate stop. Motor is locked at the position where it was when ZCLAMP became active.</li> <li>• 1: Motor is decelerated with deceleration ramp setting. Motor is locked at the position where standstill is reached.</li> </ul> Bit 11: NL(CWL)/PL(CCWL) pulse input inhibit function <ul style="list-style-type: none"> <li>• 0: Function activated</li> <li>• 1: Function deactivated</li> </ul> If P8-31 is set to 1 or 3 and if a hardware limit switch is triggered, a Fault Reset clears the missing master pulses. Only use the pulse inhibit function with settings 1 or 3 of P8-31 if you do not need a Fault Reset after a detected hardware limit switch error. To achieve this, set the Automatic Fault Reset function of P2-68 to 1. Bit 12: Mains phase monitoring <ul style="list-style-type: none"> <li>• 0: Function activated (AL022)</li> <li>• 1: Function deactivated</li> </ul> Bit 13: Encoder simulation output monitoring <ul style="list-style-type: none"> <li>• 0: Function activated (AL018)</li> <li>• 1: Function deactivated</li> </ul> Bit 14: Unit of P8-23, P8-24 and P8-33 <ul style="list-style-type: none"> <li>• 0: Unit is in Hz</li> <li>• 1: Unit is in 0.01Hz</li> </ul> Bit 15: Verify whether phases are connected by current injection <ul style="list-style-type: none"> <li>• 0: Function activated</li> <li>• 1: Function deactivated</li> </ul>			
P2-66 GBIT2	Special Function 2 Applicable operating mode: PT, PS, V, T Bits 0 ... 1: Reserved (must be set to 0). Bit 2: This bit specifies the type of Fault Reset after a detected undervoltage error has been removed. 0: No automatic Fault Reset 1: Automatic Fault Reset Bits 3 ... 7: Reserved (must be set to 0).	- 0 0 4 Decimal	u16 RW per.	Modbus 384 <sub>h</sub> CANopen 4242 <sub>h</sub>
P2-68 AEAL	Auto-Enable and Automatic Hardware Limit Switch Fault Reset	- 0 <sub>h</sub>	u16 RW	Modbus 388 <sub>h</sub> CANopen 4244 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus						
	<p>Bit12 of P2-68 to switch Error or Alert when trigger limit switch for IO output function:</p> <ul style="list-style-type: none"> <li>0: Digital Output (0x11) Alert Signal Activated = TRUE</li> <li>1: Digital Output (0x07) ERROR Detected = TRUE</li> </ul> <p>Applicable operating mode: PT, PS, V, T</p>  <p>X: Automatic power stage enabling</p> <p>0: Trigger SON to enable power stage</p> <p>1: Enable power stage automatically if SON is active after drive has been powered on</p> <table border="1" data-bbox="391 952 794 1211"> <thead> <tr> <th>X</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>  </td> </tr> <tr> <td>1</td> <td>  </td> </tr> </tbody> </table> <p>Y: Automatic Fault Reset for limit switches</p> <p>0: Detected hardware limit switch error (AL014 and AL015) requires Fault Reset</p> <p>1: Detected hardware limit switch error (AL014 and AL015) can be reset without Fault Reset (only valid in I/O mode)</p> <p>Z: Repeated attempt to overtravel limit switch (CANopen only)</p> <p>0: No detected error</p> <p>1: Detected error, Fault Reset required</p> <p>Modified settings become active the next time the product is powered on.</p>	X	FUNCTION	0		1		<p>0<sub>h</sub></p> <p>1111<sub>h</sub></p> <p>Hexadecimal</p>	<p>per.</p>	
X	FUNCTION									
0										
1										
<p>P2-69 ANIN1</p>	<p>Analog Input 1 Value</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter Indicates the value of analog input 1.</p>	<p>mV</p> <p>-12500</p> <p>-</p> <p>12500</p> <p>Decimal</p>	<p>s16</p> <p>RO</p> <p>per.</p>	<p>Modbus 38A<sub>h</sub></p> <p>CANopen 4245<sub>h</sub></p>						
<p>P2-70 ANIN2</p>	<p>Analog Input 2 Value</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter Indicates the value of analog input 2.</p>	<p>mV</p> <p>-12500</p> <p>-</p> <p>12500</p> <p>Decimal</p>	<p>s16</p> <p>RO</p> <p>per.</p>	<p>Modbus 38C<sub>h</sub></p> <p>CANopen 4246<sub>h</sub></p>						

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P2-71 FOLDBACK_FAULT_TRIG_IMM	FOLDBACK_FAULT_TRIG_IMM Applicable operating mode: PT, PS, V, T This parameter activates the error detecting that the fold back limit is equal to current.	- 0 1 1 Decimal	u16 RW per	Modbus 38E <sub>h</sub> CANopen 4247 <sub>h</sub>
P2-72 MFOLDT_DISPLY	Motor Foldback Time Constant Applicable operating mode: PT, PS, V, T This parameter Indicates the value of MFOLDT_INDEX according to P2-73 (see Overload Characteristics Curves, page 50).	- 0 0 4294967295 Decimal	u32 RO per	Modbus 390 <sub>h</sub> CANopen 4248 <sub>h</sub>
P2-73 MFOLDT_INDEX	Motor Foldback level Applicable operating mode: PT, PS, V, T This parameter define the level of MFOLDT. The corresponding MFOLDT value is displayed in P2-72.	- 1 1 4 Decimal	u16 RW per	Modbus 392 <sub>h</sub> CANopen 4249 <sub>h</sub>

## P3 - Communication Parameters

### P3 - Communication Parameters

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-00 ADR	Device Address Modbus Applicable operating mode: PT, PS, V, T The device address must be unique. Modified settings become active the next time the product is powered on.	- 1 127 247 Decimal	u16 RW per.	Modbus 400 <sub>h</sub> CANopen 4300 <sub>h</sub>
P3-01 BRT	Transmission Rate Applicable operating mode: PT, PS, V, T This parameter is used to set the data transmission rate. For further information, refer to chapter Setting the Device Address, Baud Rate and Connection Settings, page 158. If this parameter is set via CANopen, only the CANopen transmission rate can be set. Modified settings become active the next time the product is powered on.	- 0 <sub>h</sub> 102 <sub>h</sub> 405 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 402 <sub>h</sub> CANopen 4301 <sub>h</sub>
P3-02	Modbus Connection Settings	-	u16	Modbus 404 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
PTL	Applicable operating mode: PT, PS, V, T  This parameter specifies the Modbus connection settings.  For further information, refer to chapter Setting the Device Address, Baud Rate and Connection Settings, page 158.  Modified settings become active the next time the product is powered on.	6 <sub>h</sub> 7 <sub>h</sub> 9 <sub>h</sub> Hexadecimal	RW per.	CANopen 4302 <sub>h</sub>
P3-03 FLT	Detected Modbus Communication Errors - Handling  Applicable operating mode: PT, PS, V, T  This parameter specifies the response of the drive to a detected communication error.  Value 0: Detected alert Value 1: Detected error	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 406 <sub>h</sub> CANopen 4303 <sub>h</sub>
P3-04 CWD	Modbus Connection Monitoring  Applicable operating mode: PT, PS, V, T  This parameter specifies the maximum permissible duration for communication timeout. When this time has elapsed, the communication timeout is treated as a detected error.  Setting this parameter to 0 to disables connection monitoring.	ms 0 0 20000 Decimal	u16 RW per.	Modbus 408 <sub>h</sub> CANopen 4304 <sub>h</sub>
P3-05 CMM	Device Address CANopen  Applicable operating mode: PT, PS, V, T  This parameter specifies the CANopen address of the drive in decimal format.  The device address must be unique.  Modified settings become active the next time the product is powered on.	- 0 0 127 Decimal	u16 RW per.	Modbus 40A <sub>h</sub> CANopen 4305 <sub>h</sub>
P3-06 SDI	Digital Inputs - Forcing Settings  Applicable operating mode: PT, PS, V, T  This parameter determines whether or not a digital input can be forced.  Bits 0 ... 7: Digital input DI1 ... digital input DI8 Bit settings: Value 0: Digital input cannot be forced Value 1: Digital input can be forced  To actually start forcing, you must write P4-07.  See P2-10 ... P2-17 for the assignment of signal input functions to the digital inputs.	- 0 <sub>h</sub> 0 <sub>h</sub> 7FF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 40C <sub>h</sub> CANopen 4306 <sub>h</sub>
P3-07 CDT	Modbus Response Delay Time  Applicable operating mode: PT, PS, V, T  This parameter specifies the time delay with which the drive responds to the Modbus master.	0.5ms 0 0 1000 Decimal	u16 RW per.	Modbus 40E <sub>h</sub> CANopen 4307 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-09 SYC	CANopen Master/Slave Synchronization Applicable operating mode: Fieldbus mode This parameter specifies synchronization settings of the CANopen slave and the CANopen master via the synchronization signal. Setting can only be modified if power stage is disabled.	- 1001 <sub>h</sub> 5055 <sub>h</sub> 9FFF <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 412 <sub>h</sub> CANopen 4309 <sub>h</sub>
P3-10 LXM_PLC_EN	Drive Profile Lexium - Activation Applicable operating mode: Fieldbus mode 0: Deactivate Drive Profile Lexium 1: Activate Drive Profile Lexium	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 414 <sub>h</sub> CANopen 430A <sub>h</sub>
P3-11 DRIVE_INPUT	Drive Profile Lexium - State of Digital Inputs Applicable operating mode: Fieldbus mode	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 416 <sub>h</sub> CANopen 430B <sub>h</sub>
P3-12 DRIVE_MODE_CTRL	Drive Profile Lexium - Control Word Applicable operating mode: Fieldbus mode	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 418 <sub>h</sub> CANopen 430C <sub>h</sub>
P3-13 REFA16	Drive Profile Lexium - RefA 16 Bit Parameter Applicable operating mode: Fieldbus mode	- 8000 <sub>h</sub> 0 <sub>h</sub> 7FFF <sub>h</sub> Hexadecimal	s16 RW -	Modbus 41A <sub>h</sub> CANopen 430D <sub>h</sub>
P3-14 REFB32	Drive Profile Lexium - RefB 32 Bit Parameter Applicable operating mode: Fieldbus mode	- 80000000 <sub>h</sub> 0 <sub>h</sub> 7FFFFFFF <sub>h</sub> Hexadecimal	s32 RW -	Modbus 41C <sub>h</sub> CANopen 430E <sub>h</sub>
P3-15 DRIVE_STAT	Drive Profile Lexium - Drive Status Applicable operating mode: Fieldbus mode	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 41E <sub>h</sub> CANopen 430F <sub>h</sub>
P3-16 MF_STAT	Drive Profile Lexium - Operating Mode Status Applicable operating mode: Fieldbus mode	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 420 <sub>h</sub> CANopen 4310 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-17 MOTION_STAT	Drive Profile Lexium - Motion Status Applicable operating mode: Fieldbus mode	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 422 <sub>h</sub> CANopen 4311 <sub>h</sub>
P3-18 PEVM1	PDO Event Mask 1 Applicable operating mode: Fieldbus mode Changes of values in the object trigger an event: Bit 0: First PDO object Bit 1: Second PDO object Bit 2: Third PDO object Bit 3: Fourth PDO object	- 0 <sub>h</sub> 1 <sub>h</sub> F <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 424 <sub>h</sub> CANopen 4312 <sub>h</sub>
P3-19 PEVM2	PDO Event Mask 2 Applicable operating mode: Fieldbus mode See P3-18 for details.	- 0 <sub>h</sub> 1 <sub>h</sub> F <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 426 <sub>h</sub> CANopen 4313 <sub>h</sub>
P3-20 PEVM3	PDO Event Mask 3 Applicable operating mode: Fieldbus mode See P3-18 for details.	- 0 <sub>h</sub> 1 <sub>h</sub> F <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 428 <sub>h</sub> CANopen 4314 <sub>h</sub>
P3-21 PEVM4	PDO Event Mask 4 Applicable operating mode: Fieldbus mode See P3-18 for details.	- 0 <sub>h</sub> F <sub>h</sub> F <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 42A <sub>h</sub> CANopen 4315 <sub>h</sub>
P3-30 INTRN_LIM_SRC	Internal Limit for Bit 11 <i>DriveCom Status Word</i> 6041 <sub>h</sub> Applicable operating mode: PT, PS, V, T This parameter assigns a status information to bit 11 (internal limit active) of the parameter <i>DriveCom Status Word</i> 6041 <sub>h</sub> . Value 0: None: Not used (reserved) Value 1: Current Below Threshold: Current threshold value Value 2: Velocity Below Threshold: Velocity threshold value Value 3: In Position Deviation Window: Position deviation window Value 4: In Velocity Deviation Window: Velocity deviation window Value 9: Hardware Limit Switch: Hardware limit switch	- 0 0 11 Decimal	u16 RW per.	Modbus 43C <sub>h</sub> CANopen 431E <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Value 11: Position Window: Position window			
P3-31 QSOC	Settings for NMT operating state Quick Stop Applicable operating mode: Fieldbus mode Value -2: Slow down on torque ramp and switch to Operating State Fault Value -1: Slow down on Quick Stop ramp and switch to Operating State Fault Value 6: Slow down on Quick Stop ramp and stay in Quick stop Active Value 7: Slow down on current limit and stay in Quick stop Active	- -2 6 7 Decimal	s16 RW per.	Modbus 43E <sub>h</sub> CANopen 431F <sub>h</sub>
P3-32 SOD2RTSO	Automatic operating state transition from Switch On Disabled to Ready To Switch On Applicable operating mode: PT, PS, V, T Value 0: Automatic transition Value 1: Transition according to value of CANopen control word	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 440 <sub>h</sub> CANopen 4320 <sub>h</sub>

## P4 - Diagnostics Parameters

### P4 - Diagnostics Parameters

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P4-00 ASH1	Error History - Error Code of Most Recent Detected Error n Applicable operating mode: PT, PS, V, T This parameter indicates the error code of the most recent detected error. Writing 0 to this parameter clears the error history.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 500 <sub>h</sub> CANopen 4400 <sub>h</sub>
P4-01 ASH2	Error History - Error Code of Most Recent Detected Error n - 1 Applicable operating mode: PT, PS, V, T This parameter indicates the error code of the detected error n-1, n being the most recent detected error.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 502 <sub>h</sub> CANopen 4401 <sub>h</sub>
P4-02 ASH3	Error History - Error Code of Most Recent Detected Error n - 2 Applicable operating mode: PT, PS, V, T This parameter indicates the error code of the detected error n-2, n being the most recent detected error.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub>	u16 RO -	Modbus 504 <sub>h</sub> CANopen 4402 <sub>h</sub>



Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
		Factory setting	Persistent	
		Maximum value		
		HMI Format		
		Hexadecimal		
P4-03 ASH4	<p>Error History - Error Code of Most Recent Detected Error n - 3</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter indicates the error code of the detected error n-3, n being the most recent detected error.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>FFFF<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 506<sub>h</sub></p> <p>CANopen 4403<sub>h</sub></p>
P4-04 ASH5	<p>Error History - Error Code of Most Recent Detected Error n - 4</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter indicates the error code of the detected error n-4, n being the most recent detected error.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>FFFF<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 508<sub>h</sub></p> <p>CANopen 4404<sub>h</sub></p>
P4-05 JOG	<p>Jog Velocity</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>For further information, refer to chapter Jog Operation, page 289.</p>	<p>rpm</p> <p>0</p> <p>20</p> <p>5000</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 50A<sub>h</sub></p> <p>CANopen 4405<sub>h</sub></p>
P4-06 FOT	<p>Forcing Matrix of Digital Outputs</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter lets you set those signal outputs whose signal output functions have been set to SDO_0 ... SDO_5.</p> <p>Bit 0 = 1 sets those signal outputs whose signal output function has been set to SDO_0.</p> <p>Bit 1 = 1 sets those signal outputs whose signal output function has been set to SDO_1.</p> <p>Bit 2 = 1 sets those signal outputs whose signal output function has been set to SDO_2.</p> <p>Bit 3 = 1 sets those signal outputs whose signal output function has been set to SDO_3.</p> <p>Bit 4 = 1 sets those signal outputs whose signal output function has been set to SDO_4.</p> <p>Bit 5 = 1 sets those signal outputs whose signal output function has been set to SDO_5.</p> <p>Bit 6 = 1 sets those signal outputs whose signal output function has been set to SDO_6.</p> <p>Bit 7 = 1 sets those signal outputs whose signal output function has been set to SDO_7.</p> <p>See P2-18 ... P2-22 for assigning the functions to the digital outputs.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>FF<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>-</p>	<p>Modbus 50C<sub>h</sub></p> <p>CANopen 4406<sub>h</sub></p>
P4-07 ITST	<p>State of Digital Inputs / Activate Forcing</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>A read access to this parameter indicates the state of the digital inputs in the form of a bit pattern.</p> <p>Example:</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>FF<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>-</p>	<p>Modbus 50E<sub>h</sub></p> <p>CANopen 4407<sub>h</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>Read value 0x0011: Digital inputs 1 and 5 are logical 1</p> <p>By writing this parameter, you can modify the state of the inputs provided that the setting for the corresponding input in P3-06 allows for forcing (value 1 for the bit corresponding to the input).</p> <p>Example:</p> <p>Write value 0x0011: Digital inputs 1 and 5 are set to logical 1, regardless of the previous state</p> <p>See P3-06 for permitting forcing of individual digital inputs.</p> <p>See P2-10 ... P2-17 for the assignment of signal input functions to the digital inputs.</p>			
P4-08 PKEY	<p>Status of HMI Keypad</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter is used to verify proper operation of the keys on the HMI keypad of the drive</p> <p>As a bitwise:</p> <ul style="list-style-type: none"> <li>"1" - key is pressed,</li> <li>"0" - key is released.</li> </ul> <p>When:</p> <ul style="list-style-type: none"> <li><b>S</b> key is indicated by bit0</li> <li><b>M</b> key is indicated by bit1</li> <li><b>UP</b> key is indicated by bit2</li> <li><b>DOWN</b> key is indicated by bit3</li> <li><b>ENT</b> key is indicated by bit4</li> </ul>	- 0 <sub>h</sub> 0 <sub>h</sub> FF <sub>h</sub> Hexadecimal	u16 RO -	Modbus 510 <sub>h</sub> CANopen 4408 <sub>h</sub>
P4-09 MOT	<p>State of Digital Outputs</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter indicates the state of the digital outputs DO1...DO6.</p> <p>Bit 0 = 1: DO1 is activated</p> <p>Bit 1 = 1: DO2 is activated</p> <p>Bit 2 = 1: DO3 is activated</p> <p>Bit 3 = 1: DO4 is activated</p> <p>Bit 4 = 1: DO5 is activated</p> <p>Bit 5 = 1: DO6 is activated</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 3F <sub>h</sub> Hexadecimal	u16 RO -	Modbus 512 <sub>h</sub> CANopen 4409 <sub>h</sub>
P4-10 FLTHISTCLR	<p>Clear Error History</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>Writing 0 to this parameter clears the error history.</p>	- 0 0 0 Decimal	u16 RW -	Modbus 514 <sub>h</sub> CANopen 440A <sub>h</sub>
P4-20 ANIN1DB	<p>Analog Input 1 Dead Band</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter gets/sets the dead band of analog input 1.</p>	mV 0 0 10000 Decimal	s16 RW per.	Modbus 528 <sub>h</sub> CANopen 4414 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>If the absolute value of the analog input signal is less than this value, no analog command signal is generated.</p> <p>This function helps to prevent the drive from responding to voltage noise near the zero point of the analog input.</p>			
P4-21 ANIN2DB	<p>Analog Input 2 Dead Band</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter gets/sets the dead band of analog input 2.</p> <p>If the absolute value of the analog input signal is less than this value, no analog command signal is generated.</p> <p>This function helps to prevent the drive from responding to voltage noise near the zero point of the analog input.</p>	<p>mV</p> <p>0</p> <p>0</p> <p>10000</p> <p>Decimal</p>	<p>s16</p> <p>RW</p> <p>per.</p>	<p>Modbus 52A<sub>h</sub></p> <p>CANopen 4415<sub>n</sub></p>
P4-22 ANIN1OFFSET	<p>Analog Input 1 Offset</p> <p>Applicable operating mode: V</p> <p>This parameter specifies an offset for the analog input used in operating mode V.</p>	<p>mV</p> <p>-10000</p> <p>0</p> <p>10000</p> <p>Decimal</p>	<p>s16</p> <p>RW</p> <p>per.</p>	<p>Modbus 52C<sub>h</sub></p> <p>CANopen 4416<sub>n</sub></p>
P4-23 ANIN2OFFSET	<p>Analog Input 2 Offset</p> <p>Applicable operating mode: T</p> <p>This parameter specifies an offset for the analog input used in operating mode T.</p>	<p>mV</p> <p>-10000</p> <p>0</p> <p>10000</p> <p>Decimal</p>	<p>s16</p> <p>RW</p> <p>per.</p>	<p>Modbus 52E<sub>h</sub></p> <p>CANopen 4417<sub>n</sub></p>
P4-24 LVL	<p>Undervoltage Monitoring - Threshold Value</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter specifies the threshold value for DC bus undervoltage monitoring. If the DC Bus voltage is less than the value of P4-24 x <math>\sqrt{2}</math>, the error AL003 is detected.</p>	<p>V</p> <p>140</p> <p>160</p> <p>190</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 530<sub>h</sub></p> <p>CANopen 4418<sub>n</sub></p>
P4-25 STO	<p>Safety Function STO - Status</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter indicates the status of the safety function STO.</p> <p>Bit 0 = 0: Safety function STO triggered</p> <p>Bit 0 = 1: Safety function STO not triggered or deactivated via jumper at CN9</p>	<p>-</p> <p>0</p> <p>-</p> <p>1</p> <p>Decimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 532<sub>h</sub></p> <p>CANopen 4419<sub>n</sub></p>
P4-26 DO_FORCEABLE	<p>Forceable digital outputs</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter shows whether or not a digital output can be forced.</p> <p>Bits 0 ... 4: Digital output DO1 ... digital output DO5</p> <p>Bit settings:</p>	<p>-</p> <p>1F<sub>h</sub></p> <p>1F<sub>h</sub></p> <p>1F<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RO</p> <p>-</p>	<p>Modbus 534<sub>h</sub></p> <p>CANopen 441A<sub>n</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Value 0: Digital output cannot be forced Value 1: Digital output can be forced			
<i>P4-27</i> DO_FORCE_MASK	Digital output force mask Applicable operating mode: PT, PS, V, T  This parameter contains a mask that determines whether or not a digital output can be forced.  Bits 0 ... 4: Digital output DO1 ... digital output DO5  Bit settings:  Value 0: Digital output cannot be forced  Value 1: Digital output can be forced  To actually start forcing, you must write P4-28.  See P2-18 ... P2-22 for the assignment of signal output functions to the digital outputs.	- 0 <sub>h</sub> 0 <sub>h</sub> 1F <sub>h</sub> Hexadecimal	u16 RW -	Modbus 536 <sub>h</sub> CANopen 441B <sub>h</sub>
<i>P4-28</i> DO_FORCE_VALUE	Digital output force value Applicable operating mode: PT, PS, V, T  A read access to this parameter indicates the state of the digital outputs in the form of a bit pattern.  Example:  Read value 0x0011: Digital outputs 1 and 5 are logical 1  By writing this parameter, you can modify the state of the outputs provided that the setting for the corresponding output in P4-27 allows for forcing (value 1 for the bit corresponding to the output).  Example:  Write value 0x0011: Digital outputs 1 and 5 are set to logical 1, regardless of the previous state  See P4-27 for permitting forcing of individual digital outputs.  See P2-18 ... P2-22 for the assignment of signal output functions to the digital outputs.	- 0 <sub>h</sub> 0 <sub>h</sub> 1F <sub>h</sub> Hexadecimal	u16 RW -	Modbus 538 <sub>h</sub> CANopen 441C <sub>h</sub>
<i>P4-29</i> LOAD_PERIOD_TIME	Motor Load Period Time Applicable operating mode: PT, PS, V, T  This parameter specifies the time period in which the average load will be calculated.  Modified settings become active the next time the product is powered on.	ms 1 5000 100000 Decimal	u32 RW per.	Modbus 53A <sub>h</sub> CANopen 441D <sub>h</sub>

## P5 - Motion Settings

### P5- Motion Settings

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P5-00 REV	Firmware Revision  Applicable operating mode: PT, PS, V, T  This parameter contains the revision number of the firmware.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFF <sub>h</sub> Hexadecimal	u16  RO  -	Modbus 600 <sub>h</sub>  CANopen 4500 <sub>h</sub>
P5-04 HMOV	Homing - Homing Method Selection  Applicable operating mode: PS  This parameter is used to select the homing method and configure the behavior of the index pulse and the limit switches.  For further information, refer to chapter Operating Mode Position Sequence (PS), page 294.  Setting can only be modified if power stage is disabled.	- 0 <sub>h</sub> 0 <sub>h</sub> 128 <sub>h</sub> Hexadecimal	u16  RW  per.	Modbus 608 <sub>h</sub>  CANopen 4504 <sub>h</sub>
P5-05 HOMESPEED1	Homing - Fast Velocity for Reference Movement  Applicable operating mode: PS	0.1rpm 10 1000 60000 Decimal	u32  RW  per.	Modbus 60A <sub>h</sub>  CANopen 4505 <sub>h</sub>
P5-06 HOMESPEED2	Homing - Slow Velocity for Reference Movement  Applicable operating mode: PS	0.1rpm 10 200 60000 Decimal	u32  RW  per.	Modbus 60C <sub>h</sub>  CANopen 4506 <sub>h</sub>
P5-07 PRCM	LXM28 is controlled by Modbus, and it needs to activate the access P10-32 = 1 (Modbus address 0xb40) before it can be operated by P5-07.  Operating Mode PS via Parameter  Applicable operating mode: PS  The power stage must be enabled by using the parameter P2-30 prior to use this function.  The power stage must be disabled by using the parameter P2-30 after using this function.  The operating mode Position Sequence (PS) provides 32 data sets that can be executed via the signal input functions POS0 ... POS4 and CTRG or via of this parameter.  0: Start operating mode Homing (Homing data set)  1 ... 32: Trigger data set (equivalent to the signal input functions CTRG and POSn).  33 ... 9999: Not permitted	- 0 0 20032 Decimal	u16  RW  -	Modbus 60E <sub>h</sub>  CANopen 4507 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>10000: Stop movement (equivalent to the signal input function STOP)</p> <p>Values displayed via this parameter:</p> <p>If a data set is active, but not yet completed, the value displayed is the value of this parameter plus 10000.</p> <p>If a data set has been completed, the value displayed is the value of this parameter plus 20000.</p> <p>Example:</p> <p>Displayed value 10003: Data set 3 has been started, but is not yet completed.</p> <p>Displayed value 20003: Data set 3 has been completed.</p> <p>Refer to chapter Operating Mode Position Sequence (PS), page 294.</p>			
P5-08 POSLIMPOS	<p>Positive Software Limit Switch - Position</p> <p>Applicable operating mode: PS</p> <p>Prerequisite: Software limit switches only work with a valid zero point.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>PUU</p> <p>-2147483647</p> <p>134217727</p> <p>2147483647</p> <p>Decimal</p>	<p>s32</p> <p>RW</p> <p>per.</p>	<p>Modbus 610<sub>h</sub></p> <p>CANopen 4508<sub>h</sub></p>
P5-09 POSLIMNEG	<p>Negative Software Limit Switch - Position</p> <p>Applicable operating mode: PS</p> <p>Prerequisite: Software limit switches only work with a valid zero point.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>PUU</p> <p>-2147483647</p> <p>-134217727</p> <p>2147483647</p> <p>Decimal</p>	<p>s32</p> <p>RW</p> <p>per.</p>	<p>Modbus 612<sub>h</sub></p> <p>CANopen 4509<sub>h</sub></p>
P5-10 GEARACCTHRESH	<p>Operating mode Pulse Train - Maximum Acceleration</p> <p>Applicable operating mode: PT</p> <p>This parameter is used to reduce the acceleration noise.</p>	<p>ms</p> <p>6</p> <p>6</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 614<sub>h</sub></p> <p>CANopen 450A<sub>h</sub></p>
P5-11 POSLIMHYST	<p>Software Limit Switches - Hysteresis Value</p> <p>Applicable operating mode: PS</p> <p>This parameter specifies a hysteresis value for the software limit switches.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>PULSE</p> <p>0</p> <p>3556</p> <p>35555</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 616<sub>h</sub></p> <p>CANopen 450B<sub>h</sub></p>
P5-12 PROBE_1_LVL_PRD	<p>Touch Probe Input 1 - Stable Level Duration</p> <p>Applicable operating mode: PT, PS</p> <p>This parameter specifies the period of time for which the level at Touch Probe input 1 must be stable.</p>	<p>31.25 <math>\mu</math>s</p> <p>2</p> <p>5</p> <p>32</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 618<sub>h</sub></p> <p>CANopen 450C<sub>h</sub></p>
P5-13 POSLIMMODE	<p>Position Limiting Mode</p> <p>Applicable operating mode: PS</p>	<p>-</p> <p>0</p>	<p>u16</p> <p>RW</p>	<p>Modbus 61A<sub>h</sub></p> <p>CANopen 450D<sub>h</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<p>This parameter activates/deactivates the software limit switches and the homing transient limits.</p> <p>Value 0:</p> <ul style="list-style-type: none"> <li>Deactivate software limit switches.</li> <li>Activate homing transient limits.</li> </ul> <p>Value 1:</p> <ul style="list-style-type: none"> <li>Activate software limit switches.</li> <li>Activate homing transient limits.</li> </ul> <p>Value 2:</p> <ul style="list-style-type: none"> <li>Deactivate software limit switches.</li> <li>Deactivate homing transient limits.</li> </ul> <p>Value 3:</p> <ul style="list-style-type: none"> <li>Activate software limit switches.</li> <li>Deactivate homing transient limits.</li> </ul> <p><b>NOTE:</b> Software limit switches only work with a valid zero point.</p>	2 3 Decimal	per.	
<i>P5-14</i> ICMDSLOPE	<p>Motion Profile for Torque - Slope</p> <p>Applicable operating mode: T</p> <p>This parameter specifies the slope of the motion profile for torque.</p>	<p>mA/s</p> <p>1</p> <p>100000</p> <p>30000000</p> <p>Decimal</p>	<p>u32</p> <p>RW</p> <p>per.</p>	<p>Modbus 61C<sub>h</sub></p> <p>CANopen 450E<sub>h</sub></p>
<i>P5-15</i> ICMDSLOPEEN	<p>Motion Profile for Torque - Activation</p> <p>Applicable operating mode: T</p> <p>This parameter activates the motion profile for torque.</p> <p>Value 0: Deactivate</p> <p>Value 1: Activate</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>-</p> <p>0</p> <p>0</p> <p>1</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 61E<sub>h</sub></p> <p>CANopen 450F<sub>h</sub></p>
<i>P5-16</i> AXEN	<p>Encoder Increments in PUU</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>Setting can only be modified if power stage is disabled.</p> <p>This parameter specifies an offset to the encoder position.</p>	<p>PUU</p> <p>-2147483647</p> <p>0</p> <p>2147483647</p> <p>Decimal</p>	<p>s32</p> <p>RW</p> <p>-</p>	<p>Modbus 620<sub>h</sub></p> <p>CANopen 4510<sub>h</sub></p>
<i>P5-18</i> AXPC	<p>External Encoder (Pulses)</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter contains the cumulated pluses counted at the PTI input multiplied by 16 since the drive has been switched on.</p>	<p>-</p> <p>-2147483648</p> <p>-</p> <p>2147483647</p> <p>Decimal</p>	<p>s32</p> <p>RO</p> <p>-</p>	<p>Modbus 624<sub>h</sub></p> <p>CANopen 4512<sub>h</sub></p>
<i>P5-20</i> STP	<p>Deceleration Ramp - Signal Input Function STOP</p> <p>Applicable operating mode: PT, PS, V</p> <p>This parameter specifies the deceleration ramp for a stop triggered via the signal input function STOP.</p>	<p>ms</p> <p>6</p> <p>50</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 628<sub>h</sub></p> <p>CANopen 4514<sub>h</sub></p>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.			
P5-21 CTO	Deceleration Ramp - Detected Transmission Error Applicable operating mode: PT, PS, V This parameter specifies the deceleration ramp for a stop triggered if a transmission error is detected. The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.	ms 6 50 65500 Decimal	u16 RW per.	Modbus 62A <sub>h</sub> CANopen 4515 <sub>h</sub>
P5-22 OVF	Deceleration Ramp - Position Overflow Applicable operating mode: PT, PS, V This parameter specifies the deceleration ramp for a stop triggered if a position overflow is detected. The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.	ms 6 30 65500 Decimal	u16 RW per.	Modbus 62C <sub>h</sub> CANopen 4516 <sub>h</sub>
P5-23 SNL	Deceleration Ramp - Triggering of Negative Software Limit Switch Applicable operating mode: PS This parameter specifies the deceleration ramp for a stop triggered if the negative software limit switch is activated. The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.	ms 6 50 65500 Decimal	u16 RW per.	Modbus 62E <sub>h</sub> CANopen 4517 <sub>h</sub>
P5-24 SPL	Deceleration Ramp - Triggering of Positive Software Limit Switch Applicable operating mode: PS This parameter specifies the deceleration ramp for a stop triggered if the positive software limit switch is activated. The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.	ms 6 50 65500 Decimal	u16 RW per.	Modbus 630 <sub>h</sub> CANopen 4518 <sub>h</sub>
P5-25 NL	Deceleration Ramp - Triggering of Negative Hardware Limit Switch Applicable operating mode: PT, PS, V This parameter specifies the deceleration ramp for a stop triggered if the negative hardware limit switch is activated. The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.	ms 6 30 65500 Decimal	u16 RW per.	Modbus 632 <sub>h</sub> CANopen 4519 <sub>h</sub>
P5-26 PL	Deceleration Ramp - Triggering of Positive Hardware Limit Switch Applicable operating mode: PT, PS, V This parameter specifies the deceleration ramp for a stop triggered if the positive hardware limit switch is activated.	ms 6 30 65500 Decimal	u16 RW per.	Modbus 634 <sub>h</sub> CANopen 451A <sub>h</sub>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.			
<i>P5-35</i> PROBES_POLARITY	Touch Probes Polarity Applicable operating mode: PT, PS, V, T This parameter specifies the touch probes polarity.	- 0 - 3 Decimal	u16 RO per.	Modbus 646 <sub>h</sub> CANopen 4523 <sub>h</sub>
<i>P5-36</i> CAAX_CANOPEN	Touch Probe Input 1 - Captured Position CANopen Units Applicable operating mode: PT, PS, V, T This parameter contains the position captured at Touch Probe input 1.	CANopen PU -2147483647 - 2147483647 Decimal	s32 RO per.	Modbus 648 <sub>h</sub> CANopen 4524 <sub>h</sub>
<i>P5-37</i> CAAX	Touch Probe Input 1 - Captured Position Applicable operating mode: PT, PS, V, T This parameter contains the position captured at Touch Probe input 1.	PUU -2147483647 0 2147483647 Decimal	s32 RO -	Modbus 64A <sub>h</sub> CANopen 4525 <sub>h</sub>
<i>P5-38</i> PROBE1_CNTR	Touch Probe Input 1 - Event Counter Applicable operating mode: PT, PS, V, T The value is increased by 1 each time a position has been captured at Touch Probe input 1.	- 0 0 65535 Decimal	u16 RO -	Modbus 64C <sub>h</sub> CANopen 4526 <sub>h</sub>
<i>P5-39</i> CACT	Touch Probe Input 1 - Configuration Applicable operating mode: PT, PS, V, T X: Activate/deactivate position capture 0: Deactivate 1: Activate (is reset to 0 when the counter in P5-38 is incremented) Y: Reserved U: Reserved Z: Polarity of Touch Probe input 0: Normally open 1: Normally closed Where X is the least significant half-byte and U is the most significant half-byte of the X/Y/U/Z Integer.	- 0 <sub>h</sub> 0 <sub>h</sub> 101 <sub>h</sub> Hexadecimal	u16 RW -	Modbus 64E <sub>h</sub> CANopen 4527 <sub>h</sub>
<i>P5-56</i> CAAX2_CANOPEN	Touch Probe Input 2 - Captured Position CANopen Units Applicable operating mode: PT, PS, V, T This parameter contains the position captured at Touch Probe input 2.	CANopen PU -2147483647 - 2147483647 Decimal	s32 RO per.	Modbus 670 <sub>h</sub> CANopen 4538 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P5-57 CAAX2	Touch Probe Input 2 - Captured Position Applicable operating mode: PT, PS, V, T This parameter contains the position captured at Touch Probe input 2.	PUU -2147483647 0 2147483647 Decimal	s32 RO -	Modbus 672 <sub>h</sub> CANopen 4539 <sub>h</sub>
P5-58 PROBE2_CNTR	Touch Probe Input 2 - Event Counter Applicable operating mode: PT, PS, V, T The value is increased by 1 each time a position has been captured at Touch Probe input 2.	- 0 0 65535 Decimal	u16 RO -	Modbus 674 <sub>h</sub> CANopen 453A <sub>h</sub>
P5-59 CACT2	Touch Probe Input 2 - Configuration Applicable operating mode: PT, PS, V, T X: Activate/deactivate position capture 0: Deactivate 1: Activate (is reset to 0 when the counter in P5-58 is incremented) Y: Reserved Z: Polarity of Touch Probe input 0: Normally open 1: Normally closed U: Reserved	- 0 <sub>h</sub> 0 <sub>h</sub> 101 <sub>h</sub> Hexadecimal	u16 RW -	Modbus 676 <sub>h</sub> CANopen 453B <sub>h</sub>
P5-76 HOME_OFFSET_MOVE	Move Home Offset When Homing Applicable operating mode: Fieldbus mode This parameter activate/deactivate a movement to a configured home offset position when the homing position is reached.	- 0 0 1 Decimal	u16 RW per.	Modbus 698 <sub>h</sub> CANopen 454C <sub>h</sub>
P5-77 PROBE_2_LVL_PRD	Touch Probe Input 2 - Stable Level Duration Applicable operating mode: PT, PS This parameter specifies the period of time for which the level at Touch Probe input 2 must be stable.	31.25 μs 2 5 32 Decimal	u16 RW per.	Modbus 69A <sub>h</sub> CANopen 454D <sub>h</sub>
P5-78 MT_Ref_P	MULTI_TURN_REF_POSITION After a successful reference set (P8-44=2), this P5-78 position is automatically set at the reference point.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 69C <sub>h</sub> CANopen 454E <sub>h</sub>
P5-79 IGNORE_BATTERY_FAULTS	Defines whether the drive is to ignore the multi-turn error AL576. • 0: The masking of the multi-turn error AL576 is inactive. • 1: The masking of the multi-turn error AL576 is active.	- 0 0 1 Decimal	u16 RW per.	Modbus 69E <sub>h</sub> CANopen 454F <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	When set P5-79=1, multi-turn encoder can be used as single-turn (even with single-turn cable).			
P5-80 IGNORE_ENCODER_WARNINGS	Defines whether the drive is to ignore the multi-turn alert Wn750. <ul style="list-style-type: none"> <li>0: The masking of the Wn750 is inactive.</li> <li>1: The masking of the Wn750 is active.</li> </ul> For some applications which will rotate motor in one direction, the alert Wn750 for checking turns number within -32767 ... 32768 can be turned off by parameter P5-80=1.	- 0 0 1 Decimal	u16 RW per.	Modbus 6A0 <sub>h</sub> CANopen 4550 <sub>h</sub>
P5-81 IgnorHome	Defines whether absolute positioning is allowed without homing/Reference Position Set. <ul style="list-style-type: none"> <li>0: Not allowed</li> <li>1: Allowed</li> </ul> When set P5-81=1, absolute positioning is allowed without homing/set Reference Point.	- 0 0 1 Decimal	u16 RW per.	Modbus 6A2 <sub>h</sub> CANopen 4551 <sub>h</sub>
P5-82 MT_C_P	Current position in revolutions of multi-turn. This parameter is used to monitor the revolutions of multi-turn.	Rev -32767 0 32768 Decimal	s32 RO per.	Modbus 6A4 <sub>h</sub> CANopen 4552 <sub>h</sub>

## P6 - Position Sequence Data Sets Group 1

### P6 - PS Data Sets Group 1

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P6-00 ODAT	Position of Homing Data Set Applicable operating mode: PS After a successful reference movement, this position is automatically set at the reference point. Bits 0...31: Position	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 700 <sub>h</sub> CANopen 4600 <sub>h</sub>
P6-01 ODEF	Subsequent Data Set and Auto-start of Homing Data Set Applicable operating mode: PS Bit 0: 0 = Do not start Homing after first power stage enable 1 = Start Homing after first power stage enable Bits 1...7: Reserved	- 0 <sub>h</sub> 0 <sub>h</sub> 2001 <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 702 <sub>h</sub> CANopen 4601 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Bits 8...15: Number of the subsequent data set			
P6-02 PATHPOS1	Target Position of Data Set 1 Applicable operating mode: PS Bits 0...31: Target position	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 704 <sub>h</sub> CANopen 4602 <sub>h</sub>
P6-03 PATHCTRL1	Configuration of Data Set 1 Applicable operating mode: PS Bits 0...3: Reserved Bit 4: 0 = Wait for preceding data set to complete, then start this data set 1 = Start this data set immediately Bit 5: Reserved Bit 6: • 0 = Path Overlap • 1 = Path interrupt (start this data set immediately from actual trigger position) Bit 7: 0 = Absolute position 1 = Relative (incremental) position Bits 8...15: Reserved	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 706 <sub>h</sub> CANopen 4603 <sub>h</sub>
P6-04 PATHPOS2	Target Position of Data Set 2 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 708 <sub>h</sub> CANopen 4604 <sub>h</sub>
P6-05 PATHCTRL2	Configuration of Data Set 2 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 70A <sub>h</sub> CANopen 4605 <sub>h</sub>
P6-06 PATHPOS3	Target Position of Data Set 3 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 70C <sub>h</sub> CANopen 4606 <sub>h</sub>
P6-07 PATHCTRL3	Configuration of Data Set 3 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 70E <sub>h</sub> CANopen 4607 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Hexadecimal		
P6-08 PATHPOS4	Target Position of Data Set 4 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 710 <sub>h</sub> CANopen 4608 <sub>h</sub>
P6-09 PATHCTRL4	Configuration of Data Set 4 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 712 <sub>h</sub> CANopen 4609 <sub>h</sub>
P6-10 PATHPOS5	Target Position of Data Set 5 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 714 <sub>h</sub> CANopen 460A <sub>h</sub>
P6-11 PATHCTRL5	Configuration of Data Set 5 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 716 <sub>h</sub> CANopen 460B <sub>h</sub>
P6-12 PATHPOS6	Target Position of Data Set 6 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 718 <sub>h</sub> CANopen 460C <sub>h</sub>
P6-13 PATHCTRL6	Configuration of Data Set 6 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 71A <sub>h</sub> CANopen 460D <sub>h</sub>
P6-14 PATHPOS7	Target Position of Data Set 7 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 71C <sub>h</sub> CANopen 460E <sub>h</sub>
P6-15 PATHCTRL7	Configuration of Data Set 7 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 71E <sub>h</sub> CANopen 460F <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Hexadecimal		
P6-16 PATHPOS8	Target Position of Data Set 8 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 720 <sub>h</sub> CANopen 4610 <sub>h</sub>
P6-17 PATHCTRL8	Configuration of Data Set 8 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 722 <sub>h</sub> CANopen 4611 <sub>h</sub>
P6-18 PATHPOS9	Target Position of Data Set 9 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 724 <sub>h</sub> CANopen 4612 <sub>h</sub>
P6-19 PATHCTRL9	Configuration of Data Set 9 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 726 <sub>h</sub> CANopen 4613 <sub>h</sub>
P6-20 PATHPOS10	Target Position of Data Set 10 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 728 <sub>h</sub> CANopen 4614 <sub>h</sub>
P6-21 PATHCTRL10	Configuration of Data Set 10 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 72A <sub>h</sub> CANopen 4615 <sub>h</sub>
P6-22 PATHPOS11	Target Position of Data Set 11 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 72C <sub>h</sub> CANopen 4616 <sub>h</sub>
P6-23 PATHCTRL11	Configuration of Data Set 11 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 72E <sub>h</sub> CANopen 4617 <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
		Hexadecimal		
P6-24 PATHPOS12	Target Position of Data Set 12 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 730 <sub>h</sub> CANopen 4618 <sub>h</sub>
P6-25 PATHCTRL12	Configuration of Data Set 12 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 732 <sub>h</sub> CANopen 4619 <sub>h</sub>
P6-26 PATHPOS13	Target Position of Data Set 13 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 734 <sub>h</sub> CANopen 461A <sub>h</sub>
P6-27 PATHCTRL13	Configuration of Data Set 13 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 736 <sub>h</sub> CANopen 461B <sub>h</sub>
P6-28 PATHPOS14	Target Position of Data Set 14 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 738 <sub>h</sub> CANopen 461C <sub>h</sub>
P6-29 PATHCTRL14	Configuration of Data Set 14 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 73A <sub>h</sub> CANopen 461D <sub>h</sub>
P6-30 PATHPOS15	Target Position of Data Set 15 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 73C <sub>h</sub> CANopen 461E <sub>h</sub>
P6-31 PATHCTRL15	Configuration of Data Set 15 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 73E <sub>h</sub> CANopen 461F <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Hexadecimal		
P6-32 PATHPOS16	Target Position of Data Set 16 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 740 <sub>h</sub> CANopen 4620 <sub>h</sub>
P6-33 PATHCTRL16	Configuration of Data Set 16 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 742 <sub>h</sub> CANopen 4621 <sub>h</sub>
P6-34 PATHPOS17	Target Position of Data Set 17 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 744 <sub>h</sub> CANopen 4622 <sub>h</sub>
P6-35 PATHCTRL17	Configuration of Data Set 17 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 746 <sub>h</sub> CANopen 4623 <sub>h</sub>
P6-36 PATHPOS18	Target Position of Data Set 18 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 748 <sub>h</sub> CANopen 4624 <sub>h</sub>
P6-37 PATHCTRL18	Configuration of Data Set 18 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 74A <sub>h</sub> CANopen 4625 <sub>h</sub>
P6-38 PATHPOS19	Target Position of Data Set 19 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 74C <sub>h</sub> CANopen 4626 <sub>h</sub>
P6-39 PATHCTRL19	Configuration of Data Set 19 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 74E <sub>h</sub> CANopen 4627 <sub>h</sub>



Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
		Hexadecimal		
P6-40 PATHPOS20	Target Position of Data Set 20 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 750 <sub>h</sub> CANopen 4628 <sub>h</sub>
P6-41 PATHCTRL20	Configuration of Data Set 20 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 752 <sub>h</sub> CANopen 4629 <sub>h</sub>
P6-42 PATHPOS21	Target Position of Data Set 21 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 754 <sub>h</sub> CANopen 462A <sub>h</sub>
P6-43 PATHCTRL21	Configuration of Data Set 21 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 756 <sub>h</sub> CANopen 462B <sub>h</sub>
P6-44 PATHPOS22	Target Position of Data Set 22 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 758 <sub>h</sub> CANopen 462C <sub>h</sub>
P6-45 PATHCTRL22	Configuration of Data Set 22 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 75A <sub>h</sub> CANopen 462D <sub>h</sub>
P6-46 PATHPOS23	Target Position of Data Set 23 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 75C <sub>h</sub> CANopen 462E <sub>h</sub>
P6-47 PATHCTRL23	Configuration of Data Set 23 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 75E <sub>h</sub> CANopen 462F <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Hexadecimal		
P6-48 PATHPOS24	Target Position of Data Set 24 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 760 <sub>h</sub> CANopen 4630 <sub>h</sub>
P6-49 PATHCTRL24	Configuration of Data Set 24 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 762 <sub>h</sub> CANopen 4631 <sub>h</sub>
P6-50 PATHPOS25	Target Position of Data Set 25 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 764 <sub>h</sub> CANopen 4632 <sub>h</sub>
P6-51 PATHCTRL25	Configuration of Data Set 25 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 766 <sub>h</sub> CANopen 4633 <sub>h</sub>
P6-52 PATHPOS26	Target Position of Data Set 26 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 768 <sub>h</sub> CANopen 4634 <sub>h</sub>
P6-53 PATHCTRL26	Configuration of Data Set 26 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 76A <sub>h</sub> CANopen 4635 <sub>h</sub>
P6-54 PATHPOS27	Target Position of Data Set 27 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 76C <sub>h</sub> CANopen 4636 <sub>h</sub>
P6-55 PATHCTRL27	Configuration of Data Set 27 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 76E <sub>h</sub> CANopen 4637 <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
		Hexadecimal		
P6-56 PATHPOS28	Target Position of Data Set 28 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 770 <sub>h</sub> CANopen 4638 <sub>h</sub>
P6-57 PATHCTRL28	Configuration of Data Set 28 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 772 <sub>h</sub> CANopen 4639 <sub>h</sub>
P6-58 PATHPOS29	Target Position of Data Set 29 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 774 <sub>h</sub> CANopen 463A <sub>h</sub>
P6-59 PATHCTRL29	Configuration of Data Set 29 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 776 <sub>h</sub> CANopen 463B <sub>h</sub>
P6-60 PATHPOS30	Target Position of Data Set 30 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 778 <sub>h</sub> CANopen 463C <sub>h</sub>
P6-61 PATHCTRL30	Configuration of Data Set 30 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 77A <sub>h</sub> CANopen 463D <sub>h</sub>
P6-62 PATHPOS31	Target Position of Data Set 31 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 77C <sub>h</sub> CANopen 463E <sub>h</sub>
P6-63 PATHCTRL31	Configuration of Data Set 31 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub>	u16 RW per.	Modbus 77E <sub>h</sub> CANopen 463F <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Hexadecimal		
P6-64 PATHPOS32	Target Position of Data Set 32 Applicable operating mode: PS See P6-02 for details.	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 780 <sub>h</sub> CANopen 4640 <sub>h</sub>
P6-65 PATHCTRL32	Configuration of Data Set 32 Applicable operating mode: PS See P6-03 for details.	- 0 <sub>h</sub> 80 <sub>h</sub> D0 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 782 <sub>h</sub> CANopen 4641 <sub>h</sub>

## P7 - Position Sequence Data Sets Group 2

### P7 - PS Data Sets Group 2

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P7-00 HOME_ACC_DEC	Deceleration and Acceleration of Homing Data Set Applicable operating mode: PS Bits 0 ... 15: Deceleration Bits 16 ... 31: Acceleration	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 800 <sub>h</sub> CANopen 4700 <sub>h</sub>
P7-01 HOME_DLY	Waiting Time of Homing Data Set Applicable operating mode: PS Bits 0 ... 15: Waiting time until next dataset is started Bits 16 ... 31: Reserved	ms 0 0 32767 Decimal	u32 RW per.	Modbus 802 <sub>h</sub> CANopen 4701 <sub>h</sub>
P7-02 ACC_DEC1	Deceleration and Acceleration of Data Set 1 Applicable operating mode: PS Bits 0 ... 15: Deceleration Bits 16 ... 31: Acceleration	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 804 <sub>h</sub> CANopen 4702 <sub>h</sub>
P7-03 SPD_DLY1	Waiting Time and Target Velocity of Data Set 1 Applicable operating mode: PS	0.1rpm ms 0  0 200  0	u32 RW per.	Modbus 806 <sub>h</sub> CANopen 4703 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Bits 0 ... 15: Waiting time until next dataset is started (in ms) Bits 16 ... 31: Target velocity (in rpm)	60000  32767 Decimal		
<i>P7-04</i> ACC_DEC2	Deceleration and Acceleration of Data Set 2 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 808 <sub>h</sub> CANopen 4704 <sub>h</sub>
<i>P7-05</i> SPD_DLY2	Waiting Time and Target Velocity of Data Set 2 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 80A <sub>h</sub> CANopen 4705 <sub>h</sub>
<i>P7-06</i> ACC_DEC3	Deceleration and Acceleration of Data Set 3 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 80C <sub>h</sub> CANopen 4706 <sub>h</sub>
<i>P7-07</i> SPD_DLY3	Waiting Time and Target Velocity of Data Set 3 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 80E <sub>h</sub> CANopen 4707 <sub>h</sub>
<i>P7-08</i> ACC_DEC4	Deceleration and Acceleration of Data Set 4 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 810 <sub>h</sub> CANopen 4708 <sub>h</sub>
<i>P7-09</i> SPD_DLY4	Waiting Time and Target Velocity of Data Set 4 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 812 <sub>h</sub> CANopen 4709 <sub>h</sub>
<i>P7-10</i> ACC_DEC5	Deceleration and Acceleration of Data Set 5 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 814 <sub>h</sub> CANopen 470A <sub>h</sub>
<i>P7-11</i> SPD_DLY5	Waiting Time and Target Velocity of Data Set 5 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 816 <sub>h</sub> CANopen 470B <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-12 ACC_DEC6	Deceleration and Acceleration of Data Set 6 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 818 <sub>h</sub> CANopen 470C <sub>h</sub>
P7-13 SPD_DLY6	Waiting Time and Target Velocity of Data Set 6 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 81A <sub>h</sub> CANopen 470D <sub>h</sub>
P7-14 ACC_DEC7	Deceleration and Acceleration of Data Set 7 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 81C <sub>h</sub> CANopen 470E <sub>h</sub>
P7-15 SPD_DLY7	Waiting Time and Target Velocity of Data Set 7 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 81E <sub>h</sub> CANopen 470F <sub>h</sub>
P7-16 ACC_DEC8	Deceleration and Acceleration of Data Set 8 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 820 <sub>h</sub> CANopen 4710 <sub>h</sub>
P7-17 SPD_DLY8	Waiting Time and Target Velocity of Data Set 8 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 822 <sub>h</sub> CANopen 4711 <sub>h</sub>
P7-18 ACC_DEC9	Deceleration and Acceleration of Data Set 9 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 824 <sub>h</sub> CANopen 4712 <sub>h</sub>
P7-19 SPD_DLY9	Waiting Time and Target Velocity of Data Set 9 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 826 <sub>h</sub> CANopen 4713 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-20 ACC_DEC10	Deceleration and Acceleration of Data Set 10 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 828 <sub>h</sub> CANopen 4714 <sub>h</sub>
P7-21 SPD_DLY10	Waiting Time and Target Velocity of Data Set 10 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 82A <sub>h</sub> CANopen 4715 <sub>h</sub>
P7-22 ACC_DEC11	Deceleration and Acceleration of Data Set 11 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 82C <sub>h</sub> CANopen 4716 <sub>h</sub>
P7-23 SPD_DLY11	Waiting Time and Target Velocity of Data Set 11 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 82E <sub>h</sub> CANopen 4717 <sub>h</sub>
P7-24 ACC_DEC12	Deceleration and Acceleration of Data Set 12 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 830 <sub>h</sub> CANopen 4718 <sub>h</sub>
P7-25 SPD_DLY12	Waiting Time and Target Velocity of Data Set 12 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 832 <sub>h</sub> CANopen 4719 <sub>h</sub>
P7-26 ACC_DEC13	Deceleration and Acceleration of Data Set 13 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 834 <sub>h</sub> CANopen 471A <sub>h</sub>
P7-27 SPD_DLY13	Waiting Time and Target Velocity of Data Set 13 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 836 <sub>h</sub> CANopen 471B <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-28 ACC_DEC14	Deceleration and Acceleration of Data Set 14 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 838 <sub>h</sub> CANopen 471C <sub>h</sub>
P7-29 SPD_DLY14	Waiting Time and Target Velocity of Data Set 14 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 83A <sub>h</sub> CANopen 471D <sub>h</sub>
P7-30 ACC_DEC15	Deceleration and Acceleration of Data Set 15 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 83C <sub>h</sub> CANopen 471E <sub>h</sub>
P7-31 SPD_DLY15	Waiting Time and Target Velocity of Data Set 15 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 83E <sub>h</sub> CANopen 471F <sub>h</sub>
P7-32 ACC_DEC16	Deceleration and Acceleration of Data Set 16 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 840 <sub>h</sub> CANopen 4720 <sub>h</sub>
P7-33 SPD_DLY16	Waiting Time and Target Velocity of Data Set 16 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 842 <sub>h</sub> CANopen 4721 <sub>h</sub>
P7-34 ACC_DEC17	Deceleration and Acceleration of Data Set 17 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 844 <sub>h</sub> CANopen 4722 <sub>h</sub>
P7-35 SPD_DLY17	Waiting Time and Target Velocity of Data Set 17 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 846 <sub>h</sub> CANopen 4723 <sub>h</sub>



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-36 ACC_DEC18	Deceleration and Acceleration of Data Set 18 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 848 <sub>h</sub> CANopen 4724 <sub>h</sub>
P7-37 SPD_DLY18	Waiting Time and Target Velocity of Data Set 18 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 84A <sub>h</sub> CANopen 4725 <sub>h</sub>
P7-38 ACC_DEC19	Deceleration and Acceleration of Data Set 19 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 84C <sub>h</sub> CANopen 4726 <sub>h</sub>
P7-39 SPD_DLY19	Waiting Time and Target Velocity of Data Set 19 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 84E <sub>h</sub> CANopen 4727 <sub>h</sub>
P7-40 ACC_DEC20	Deceleration and Acceleration of Data Set 20 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 850 <sub>h</sub> CANopen 4728 <sub>h</sub>
P7-41 SPD_DLY20	Waiting Time and Target Velocity of Data Set 20 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 852 <sub>h</sub> CANopen 4729 <sub>h</sub>
P7-42 ACC_DEC21	Deceleration and Acceleration of Data Set 21 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 854 <sub>h</sub> CANopen 472A <sub>h</sub>
P7-43 SPD_DLY21	Waiting Time and Target Velocity of Data Set 21 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 856 <sub>h</sub> CANopen 472B <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-44 ACC_DEC22	Deceleration and Acceleration of Data Set 22 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 858 <sub>h</sub> CANopen 472C <sub>h</sub>
P7-45 SPD_DLY22	Waiting Time and Target Velocity of Data Set 22 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 85A <sub>h</sub> CANopen 472D <sub>h</sub>
P7-46 ACC_DEC23	Deceleration and Acceleration of Data Set 23 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 85C <sub>h</sub> CANopen 472E <sub>h</sub>
P7-47 SPD_DLY23	Waiting Time and Target Velocity of Data Set 23 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 85E <sub>h</sub> CANopen 472F <sub>h</sub>
P7-48 ACC_DEC24	Deceleration and Acceleration of Data Set 24 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 860 <sub>h</sub> CANopen 4730 <sub>h</sub>
P7-49 SPD_DLY24	Waiting Time and Target Velocity of Data Set 24 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 862 <sub>h</sub> CANopen 4731 <sub>h</sub>
P7-50 ACC_DEC25	Deceleration and Acceleration of Data Set 25 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 864 <sub>h</sub> CANopen 4732 <sub>h</sub>
P7-51 SPD_DLY25	Waiting Time and Target Velocity of Data Set 25 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 866 <sub>h</sub> CANopen 4733 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-52 ACC_DEC26	Deceleration and Acceleration of Data Set 26 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 868 <sub>h</sub> CANopen 4734 <sub>h</sub>
P7-53 SPD_DLY26	Waiting Time and Target Velocity of Data Set 26 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 86A <sub>h</sub> CANopen 4735 <sub>h</sub>
P7-54 ACC_DEC27	Deceleration and Acceleration of Data Set 27 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 86C <sub>h</sub> CANopen 4736 <sub>h</sub>
P7-55 SPD_DLY27	Waiting Time and Target Velocity of Data Set 27 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 86E <sub>h</sub> CANopen 4737 <sub>h</sub>
P7-56 ACC_DEC28	Deceleration and Acceleration of Data Set 28 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 870 <sub>h</sub> CANopen 4738 <sub>h</sub>
P7-57 SPD_DLY28	Waiting Time and Target Velocity of Data Set 28 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 872 <sub>h</sub> CANopen 4739 <sub>h</sub>
P7-58 ACC_DEC29	Deceleration and Acceleration of Data Set 29 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 874 <sub>h</sub> CANopen 473A <sub>h</sub>
P7-59 SPD_DLY29	Waiting Time and Target Velocity of Data Set 29 Applicable operating mode: PS	0.1rpm ms 0  0	u32 RW	Modbus 876 <sub>h</sub> CANopen 473B <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	See P7-03 for details.	200  0 60000  32767 Decimal	per.	
P7-60 ACC_DEC30	Deceleration and Acceleration of Data Set 30 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 878 <sub>h</sub> CANopen 473C <sub>h</sub>
P7-61 SPD_DLY30	Waiting Time and Target Velocity of Data Set 30 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 87A <sub>h</sub> CANopen 473D <sub>h</sub>
P7-62 ACC_DEC31	Deceleration and Acceleration of Data Set 31 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 87C <sub>h</sub> CANopen 473E <sub>h</sub>
P7-63 SPD_DLY31	Waiting Time and Target Velocity of Data Set 31 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 87E <sub>h</sub> CANopen 473F <sub>h</sub>
P7-64 ACC_DEC32	Deceleration and Acceleration of Data Set 32 Applicable operating mode: PS See P7-02 for details.	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 880 <sub>h</sub> CANopen 4740 <sub>h</sub>
P7-65 SPD_DLY32	Waiting Time and Target Velocity of Data Set 32 Applicable operating mode: PS See P7-03 for details.	0.1rpm ms 0  0 200  0 60000  32767 Decimal	u32 RW per.	Modbus 882 <sub>h</sub> CANopen 4741 <sub>h</sub>

## P8 - Control Loops

### P8 - Control Loops

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
<i>P8-00</i> LTND	Derivative Gain Applicable operating mode: PT, PS, V  This parameter is used to adjust the derivative gain. Refer to chapter <i>Manual Tuning</i> , page 172.	0.1Hz 0 800 20000 Decimal	u32 RW per.	Modbus 900 <sub>h</sub> CANopen 4800 <sub>h</sub>
<i>P8-01</i> LTNI	Integral Gain Applicable operating mode: PT, PS, V  This parameter is used to adjust the integral gain. Refer to chapter <i>Manual Tuning</i> , page 172.	0.1Hz 0 100 2000 Decimal	u32 RW per.	Modbus 902 <sub>h</sub> CANopen 4801 <sub>h</sub>
<i>P8-02</i> LTNIV	Derivative-Integral Gain Applicable operating mode: PT, PS, V  This parameter is used to adjust the derivative-integral gain. Refer to chapter <i>Manual Tuning</i> , page 172.	0.1Hz 0 400 4000 Decimal	u32 RW per.	Modbus 904 <sub>h</sub> CANopen 4802 <sub>h</sub>
<i>P8-03</i> LTNP	Proportional Gain Applicable operating mode: PT, PS, V  This parameter is used to adjust the proportional gain. Refer to chapter <i>Manual Tuning</i> , page 172.	0.1Hz 0 300 4000 Decimal	u32 RW per.	Modbus 906 <sub>h</sub> CANopen 4803 <sub>h</sub>
<i>P8-04</i> LTNUSERGAIN	Global Gain Applicable operating mode: PT, PS, V	0.001 100 500 3000 Decimal	u32 RW per.	Modbus 908 <sub>h</sub> CANopen 4804 <sub>h</sub>
<i>P8-05</i> NLAFFLPPHZ	LTN Spring Filter Applicable operating mode: PT, PS, V  This parameter is used to set a low-pass filter for the acceleration profile during tuning. Refer to chapter <i>Manual Tuning</i> , page 172.	Hz 10 7000 7000 Decimal	u16 RW per.	Modbus 90A <sub>h</sub> CANopen 4805 <sub>h</sub>
<i>P8-06</i> NLANTIVBGAIN	Anti-Vibration Gain Applicable operating mode: PT, PS, V	Rad*10-3/N 0 0 10000 Decimal	u32 RW per.	Modbus 90C <sub>h</sub> CANopen 4806 <sub>h</sub>
<i>P8-07</i>	Pe filter	0.001	u32	Modbus 90E <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
NLANTIVIBGAIN2	Applicable operating mode: PT, PS, V This parameter is used to set the gain of the Pe filter.	0 0 99000 Decimal	RW per.	CANopen 4807 <sub>h</sub>
<i>P8-08</i> NLANTIVIBHZ	Anti-Vibration Filter Applicable operating mode: PT, PS, V This parameter is used to set the frequency to remove while using the anti-vibration filter.	0.1Hz 50 4000 4000 Decimal	u32 RW per.	Modbus 910 <sub>h</sub> CANopen 4808 <sub>h</sub>
<i>P8-09</i> NLANTIVIBHZ2	Pe filter Applicable operating mode: PT, PS, V This parameter is used to set the frequency to remove with the Pe filter.	0.1Hz 50 4000 8000 Decimal	u32 RW per.	Modbus 912 <sub>h</sub> CANopen 4809 <sub>h</sub>
<i>P8-10</i> NLANTIVIBLMJR	Ratio of Load Inertia to Motor Inertia for Anti-Vibration Applicable operating mode: PT, PS, V Expert parameter for the internal control loop.	0.1 0 0 6000 Decimal	u32 RW per.	Modbus 914 <sub>h</sub> CANopen 480A <sub>h</sub>
<i>P8-11</i> NLANTIVIBN	NL Anti-Resonance Filter Divider Applicable operating mode: PT, PS, V Expert parameter for the internal control loop.	0.01 1 200 10000 Decimal	u32 RW per.	Modbus 916 <sub>h</sub> CANopen 480B <sub>h</sub>
<i>P8-12</i> NLANTIVIBSHARP	Anti-Resonance Sharpness Applicable operating mode: PT, PS, V Expert parameter for the internal control loop.	0.001 10 500 10000 Decimal	u16 RW per.	Modbus 918 <sub>h</sub> CANopen 480C <sub>h</sub>
<i>P8-13</i> NLANTIVIBSHARP2	Pe Sharpness Applicable operating mode: PT, PS, V This parameter is used to optimize the Pe filter action.	0.001 10 500 10000 Decimal	u16 RW per.	Modbus 91A <sub>h</sub> CANopen 480D <sub>h</sub>
<i>P8-14</i> NLFILTDAMPING	Current Filter Damping Applicable operating mode: PT, PS, V For further details, refer to Manual Tuning, page 172.	% 0 0 100 Decimal	u16 RW per.	Modbus 91C <sub>h</sub> CANopen 480E <sub>h</sub>
<i>P8-15</i>	Current Filter Low Pass Filter Rise Time	0.01ms	u16	Modbus 91E <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
NLFILTT1	Applicable operating mode: PT, PS, V  For further details, refer to Manual Tuning, page 172.	0 10 3000 Decimal	RW per.	CANopen 480F <sub>h</sub>
<i>P8-16</i> NLNOTCH2BW	Current Filter - Second Notch Filter Bandwidth Applicable operating mode: PT, PS, V	Hz 0 0 500 Decimal	u16 RW per.	Modbus 920 <sub>h</sub> CANopen 4810 <sub>h</sub>
<i>P8-17</i> NLNOTCH2CENTER	Current Filter - Second Notch Filter Center Applicable operating mode: PT, PS, V	Hz 5 100 1800 Decimal	u16 RW per.	Modbus 922 <sub>h</sub> CANopen 4811 <sub>h</sub>
<i>P8-18</i> NLNOTCHBW	Current Filter - Notch Filter Bandwidth Applicable operating mode: PT, PS, V	Hz 0 0 500 Decimal	u16 RW per.	Modbus 924 <sub>h</sub> CANopen 4812 <sub>h</sub>
<i>P8-19</i> NLNOTCHCENTER	Current Filter - Notch Filter Center Applicable operating mode: PT, PS, V  For further details, refer to Manual Tuning, page 172.	Hz 5 100 1800 Decimal	u16 RW per.	Modbus 926 <sub>h</sub> CANopen 4813 <sub>h</sub>
<i>P8-20</i> NLPEAFF	Elasticity Compensation Applicable operating mode: PT, PS, V  This parameter is used in the compensation of the elasticity of the mechanical system.  For further details, refer to Manual Tuning, page 172.	0.1Hz 0 50000 50000 Decimal	u32 RW per.	Modbus 928 <sub>h</sub> CANopen 4814 <sub>h</sub>
<i>P8-21</i> NLPEDFFRATIO	Spring Deceleration Ratio Applicable operating mode: PT, PS, V  This parameter is used in the compensation of the elasticity of the mechanical system.  For further details, refer to Manual Tuning, page 172.	0.001 0 1000 2000 Decimal	u16 RW per.	Modbus 92A <sub>h</sub> CANopen 4815 <sub>h</sub>
<i>P8-22</i> NLVELLIM	Analog NCT standstill Applicable operating mode: PT, PS, V  If the target value is supplied as an analog voltage signal, this parameter can be used to improve the standstill stability. If the voltage drops below the value specified via this parameter, the integral gain set via parameter P8-01 and the derivative-	mV -3815 0 3815 Decimal	s16 RW per.	Modbus 92C <sub>h</sub> CANopen 4816 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	integral gain set via parameter P8-02 are reduced by one half.			
P8-23 ANIN1LPFHZ	Analog Input 1 - Filter Applicable operating mode: PT, PS, V, T This parameter specifies the cut-off frequency for the first order low-pass filter of analog input 1. The unit is modified to 0.01 Hz if P2-65 GBIT Bit 14 is set to 1.	0.01 HZ   HZ 100   1 100000   1000 1000000   10000 Decimal	u32 RW per.	Modbus 92E <sub>h</sub> CANopen 4817 <sub>h</sub>
P8-24 ANIN2LPFHZ	Analog Input 2 - Filter Applicable operating mode: PT, PS, V, T This parameter specifies the cut-off frequency for the first order low-pass filter of analog input 2. The unit is modified to 0.01 Hz if P2-65 GBIT Bit 14 is set to 1.	0.01 HZ   HZ 100   1 100000   1000 1000000   10000 Decimal	u32 RW per.	Modbus 930 <sub>h</sub> CANopen 4818 <sub>h</sub>
P8-25 GEARFILTAFF	Electronic Gear Filter - Acceleration Feedforward Applicable operating mode: PT This parameter specifies the acceleration feed-forward for the electronic gear filter. Setting can only be modified if power stage is disabled.	0.001 -2000 0 2000 Decimal	s16 RW per.	Modbus 932 <sub>h</sub> CANopen 4819 <sub>h</sub>
P8-26 GEARFILTMODE	Electronic Gear Filter - Activation Applicable operating mode: PT This parameter activates/deactivates the electronic gear filter. Value 0: Deactivate electronic gear filter Value 1: Activate electronic gear filter Value 2: Activate enhanced electronic gear filter Setting can only be modified if power stage is disabled.	- 0 0 2 Decimal	u16 RW per.	Modbus 934 <sub>h</sub> CANopen 481A <sub>h</sub>
P8-27 GEARFILTT1	Electronic Gear Filter - Depth Applicable operating mode: PT	0.01ms 75 200 3200 Decimal	u32 RW per.	Modbus 936 <sub>h</sub> CANopen 481B <sub>h</sub>
P8-28 GEARFILTT2	Electronic Gear Filter - Velocity and Acceleration Depth Applicable operating mode: PT	0.01ms 0 400 6000 Decimal	u16 RW per.	Modbus 938 <sub>h</sub> CANopen 481C <sub>h</sub>
P8-29 GEARFILTVELFF	Electronic Gear Filter - Velocity Feedforward Applicable operating mode: PT This parameter specifies the velocity feed-forward for the electronic gear filter. Setting can only be modified if power stage is disabled.	0.01ms -20000 0 20000 Decimal	s32 RW per.	Modbus 93A <sub>h</sub> CANopen 481D <sub>h</sub>



Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
<i>P8-30</i> GEARINMODE	Interpolation of Input Signal for Electronic Gear - Activation  Applicable operating mode: PT  This parameter allows for interpolation of the input signal for electronic gear and increases the resolution by a factor of 16.  Value 0: Deactivate interpolation of input signal for electronic gear  Value 1: Activate interpolation of input signal for electronic gear  Setting can only be modified if power stage is disabled.	-  0  1  1  Decimal	u16  RW  per.	Modbus 93C <sub>h</sub>  CANopen 481E <sub>h</sub>
<i>P8-31</i> GEARING_MODE	Method for Operating Mode Pulse Train (PT)  Applicable operating mode: PT  Value 0: Synchronization deactivated  Value 1: Position synchronization without compensation movement  Value 2: Position synchronization with compensation movement  Value 3: Velocity synchronization  The parameters for acceleration (P1-34), deceleration (P1-35) and velocity (P1-55) act as limitations for the synchronization.	-  0  1  3  Decimal	u16  RW  per.	Modbus 93E <sub>h</sub>  CANopen 481F <sub>h</sub>
<i>P8-32</i> MOVESMOOTHAVG	S-Curve Setting  Applicable operating mode: PT, PS  Setting can only be modified if power stage is disabled.  The maximum value is reduced to 12800 if <i>P8-35</i> CONTROLMODE (high byte) is set to 5.	0.01ms  25  400  25600  Decimal	u32  RW  per.	Modbus 940 <sub>h</sub>  CANopen 4820 <sub>h</sub>
<i>P8-33</i> MOVE-SMOOTHLPFHZ	Low Pass Filter Setting  Applicable operating mode: PT, PS  The unit is modified to 0.01Hz if <i>P2-65</i> GBIT Bit 14 is set to 1.	0.01 HZ   HZ  100   1  500000   5000  500000   5000  Decimal	u32  RW  per.	Modbus 942 <sub>h</sub>  CANopen 4821 <sub>h</sub>
<i>P8-34</i> MOVESMOOTH-MODE	Smoothing Filter for Operating modes PT and PS - Type  Applicable operating mode: PT, PS  Value 0: No smoothing  Value 1: LPF smoothing  Value 2: S-curve smoothing  Setting can only be modified if power stage is disabled.	-  0  2  2  Decimal	u16  RW  per.	Modbus 944 <sub>h</sub>  CANopen 4822 <sub>h</sub>
<i>P8-35</i> CONTROLMODE	Type of Velocity Control Type of Position Control  Applicable operating mode: PT, PS, V  This parameter specifies:	-  5 <sub>h</sub>  207 <sub>h</sub>  4001 <sub>h</sub>  Hexadecimal	u16  RW  per.	Modbus 946 <sub>h</sub>  CANopen 4823 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<ul style="list-style-type: none"> <li>• the position control mode (high byte) <ul style="list-style-type: none"> <li>◦ value 2: Position control mode 2 (Sample rate 4 kHz)</li> <li>◦ value 5: Position control mode 5 (Sample rate 8 kHz)</li> <li>◦ value 40: Linear position control</li> </ul> </li> <li>• the type of velocity (low byte) <ul style="list-style-type: none"> <li>◦ value 1: Linear velocity control</li> <li>◦ value 5: Velocity control with integral gain (P8-01, P8-02)</li> <li>◦ value 6: Velocity control without integral gain</li> <li>◦ value 7: Velocity control with P8-00 = P8-01, P8-02 = 0, P8-03 = 0</li> </ul> </li> </ul> <p>Setting can only be modified if power stage is disabled.</p>			
P8-36 NLANTIVIBGAIN3	Pe filter 3 Applicable operating mode: PT, PS, V  This parameter is used to set the gain of the Pe filter 3	0.001 0 0 6000 Decimal	u32 RW per.	Modbus 948 <sub>h</sub> CANopen 4824 <sub>h</sub>
P8-37 NLANTIVIBHZ3	Pe filter 3 Applicable operating mode: PT, PS, V  This parameter is used to set the frequency to remove with the Pe filter 3.	0.1Hz 50 4000 8000 Decimal	u32 RW per.	Modbus 94A <sub>h</sub> CANopen 4825 <sub>h</sub>
P8-38 NLANTIVIBQ3	Pe filter 3 Applicable operating mode: PT, PS, V  This parameter is used to set the zero-pole alignment with the Pe filter 3.	0.001 200 1000 10000 Decimal	u32 RW per.	Modbus 94C <sub>h</sub> CANopen 4826 <sub>h</sub>
P8-39 IGRAV	Gravity Compensation Applicable operating mode: PT, PS, V, T  This parameter is used to set the gravity compensation current for unbalanced systems.	0.01A - 0 - Decimal	s16 RW per.	Modbus 94E <sub>h</sub> CANopen 4827 <sub>h</sub>
P8-40 LTNAFRC	LTN AFF Applicable operating mode: PT, PS, V  This parameter is used to set the feed-forward term for the current command.	- 0 0 200 Decimal	u16 RW per.	Modbus 950 <sub>h</sub> CANopen 4828 <sub>h</sub>
P8-41 NLANTIVIBSHARP3	Pe Sharpness Applicable operating mode: PT, PS, V  This parameter is used to optimize the Pe filter 3 action.	- 10 200 10000	u16 RW per.	Modbus 952 <sub>h</sub> CANopen 4829 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
		Decimal		
P8-42 HOME_FAILURE_IND	Homing Error Information Applicable operating mode: PT, PS, V, T This parameter provides information in case of the homing is not successful.	- 0 - FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus 954 <sub>h</sub> CANopen 482A <sub>h</sub>
P8-43 ZSPDLPFHZ	ZSPD Low Pass Filter Value Applicable operating mode: PT, PS, V, T This parameter sets the low pass filter value for ZSPD output in order to reduce jitters when the motor speed is around the Zero speed Threshold (P1-38) value.	Hz 10 1000 1000 Decimal	u16 RW per.	Modbus 956 <sub>h</sub> CANopen 482B <sub>h</sub>
P8-44 MT_COMMANDS	Send commands to multi-turn encoder Applicable operating mode: PT, PS, V, T Value 0: No command to send. Value 1: Clear the battery detected error AL576 on the encoder. Value 2: To set an encoder reference position. Clear Wn753. This command can be performed in both (enable and disable) drive states, excluding CSP mode. Value 3: Reset the number of accumulated revolutions of the encoder to zero. Clear Wn750. The drive must be disabled.	- 0 - 3 Decimal	u16 RW -	Modbus 958 <sub>h</sub> CANopen 482C <sub>h</sub>
P8-45 FEEDBACKTYPE	Feedback type Applicable operating mode: PT, PS, V, T Value 0: No feedback connected or undetermined feedback connected. Value 1: Single-turn encoder. Value 2: Multi-turn encoder.	- 0 - 2 Decimal	u16 RO -	Modbus 95A <sub>h</sub> CANopen 482D <sub>h</sub>
P8-46 SRVSNS_TEMPERATURE	Encoder temperature Applicable operating mode: PT, PS, V, T	Deg. - - - Decimal	s16 RO -	Modbus 95C <sub>h</sub> CANopen 482E <sub>h</sub>
P8-47 SRVSNS_VER	Encoder firmware and hardware versions Applicable operating mode: PT, PS, V, T The format is: ZZaabbcc • aa.bb.cc: firmware version. • ZZ: hardware version.	- - - 4294967295 Decimal	u32 RO -	Modbus 95E <sub>h</sub> CANopen 482F <sub>h</sub>
P8-48 SRVSNS_FLTS	Encoder errors Applicable operating mode: PT, PS, V, T • Bit 0: The returned position values are no longer considered as reliable. • Bit 1: The device temperature is too high.	- - - 4294967295	u32 RO -	Modbus 960 <sub>h</sub> CANopen 4830 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	<ul style="list-style-type: none"> <li>Bit 2: The device temperature is too low.</li> <li>Bit 3: The device is not calibrated or the calibration data is corrupted. The device is not able to decode the position.</li> <li>Bit 4: The device supply voltage has dropped under operational value.</li> <li>Bit 5: The multi-turn encoder battery voltage has dropped under 3 Vdc.</li> <li>Bit 6: The multi-turn encoder requires an explicit configuration command.</li> <li>Bit 7: Internal position synchronization error detected between the multi-turn and the single-turn modules.</li> <li>Bit 8: Generic error code of the multi-turn module is detected.</li> <li>Bit 16...23: Internal Error detected.</li> <li>Bit 24: The encoder firmware cannot operate on the provided hardware.</li> <li>Bit 25...31: Reserved.</li> </ul>	Hexadecimal		
<i>P8-49</i> SRVSNS_WRNS	<p>Encoder alerts</p> <p>Applicable operating mode: PT, PS, V, T</p> <ul style="list-style-type: none"> <li>Bit 0: The device temperature is too high.</li> <li>Bit 1: The device temperature is too low.</li> <li>Bit 2: Over speed.</li> <li>Bit 3: Over acceleration.</li> <li>Bit 4: Invalid checksum value detected on non-volatile memory initialization.</li> <li>Bit 5: non-volatile memory is empty.</li> <li>Bit 6: Internal Parameters area detected as invalid, default values are used.</li> <li>Bit 7: Invalid decoding sequence detected.</li> <li>Bit 8: Encoder internal flash error detected.</li> <li>Bit 9: The device has detected unusual high shaft displacement. Position error might be greater than usual.</li> <li>Bit 10: The multi-turn encoder battery voltage is in the range 3000 ... 3150 mVdc.</li> <li>Bit 11: Reserved.</li> <li>Bit 12: The multi-turn encoder counter exceeded the range of signed 16 bit value (-32767 ... 32768). The alert remains active until MT_COMMANDS (P8-44) is set to 2. The multi-turn encoder counter continues to count in the range 0 ... 65535.</li> <li>Bit 13...31: Reserved.</li> </ul>	- - - 4294967295 Hexadecimal	u32 RO -	Modbus 962 <sub>h</sub> CANopen 4831 <sub>h</sub>
<i>P8-51</i> SPDOBSRVRMODE	<p>Speed Observer Mode</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>Value 0: Speed feedback value is computed by the drive.</p> <p>Value 3: Speed feedback value is measured by the encoder.</p>	- 0 0 3 Decimal	u16 RW per.	Modbus 966 <sub>h</sub> CANopen 4833 <sub>h</sub>
<i>P8-52</i> GEARFILTDEPTH	<p>Electronic Gear Filter - Depth</p> <p>Applicable operating mode: PT</p> <p>This parameter sets the value of the depth for the enhanced electronic gear filter (P8-26 set to the value 2).</p>	0.01 ms 75 200 3200	u32 RW per.	Modbus 968 <sub>h</sub> CANopen 4834 <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value Factory setting Maximum value HMI Format	R/W Persistent	
		Decimal		
P8-53 KPP	Position Linear Controller Proportional Gain  Applicable operating mode: PT, PS  This parameter sets the value of the proportional gain for the linear position controller.  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	0.1 rps/rev  0  300  12000  Decimal	u16  RW  per.	Modbus 96A <sub>h</sub>  CANopen 4835 <sub>h</sub>
P8-54 KPVFR	Position Velocity Feedforward  This parameter sets the value of the position velocity feedforward to velocity command gain for the linear position controller. This is used to reduce the position following error at constant speed.  <b>NOTE:</b> Value of 1000 is the nominal design for zero position following error.	0.001  -2000  500  2000  Decimal	s32  RW  per.	Modbus 96C <sub>h</sub>  CANopen 4836 <sub>h</sub>
P8-55 KPAFVRV	Position Acceleration Feedforward  This parameter sets the value of the position acceleration feedforward to velocity command gain for the linear position controller. This is used to reduce the position following error at constant acceleration.  <b>NOTE:</b> Value of 1000 is the nominal design for zero position following error.	0.001  -20000  0  20000  Decimal	s32  RW  per.	Modbus 96E <sub>h</sub>  CANopen 4837 <sub>h</sub>
P8-56 KPAFRC	Position Acceleration Feedforward to Current Loop  This parameter sets the value of the position acceleration feedforward to current command gain for the linear position controller. This is used to reduce the position following error at constant acceleration.  <b>NOTE:</b> Value of 100 is the nominal design for zero position following error. P1-37 value must be correctly set.	0.001  -20000  0  20000  Decimal	s32  RW  per.	Modbus 970 <sub>h</sub>  CANopen 4838 <sub>h</sub>
P8-57 KVP	Velocity Proportional Gain  This parameter sets the value of the proportional gain for the linear velocity controller.  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	0.001  0  100  1000000000  Decimal	u32  RW  per.	Modbus 972 <sub>h</sub>  CANopen 4839 <sub>h</sub>
P8-58 KVI	Velocity Integral Gain  This parameter sets the value of the integral gain for the linear velocity controller.  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	0.001  0  30000  200000000  Decimal	u32  RW  per.	Modbus 974 <sub>h</sub>  CANopen 483A <sub>h</sub>
P8-59 KVFR	Velocity Feedforward Ratio  This parameter sets the value of the feedforward ratio for the linear velocity controller.  <b>NOTE:</b> Value of 1000 makes the control close to a PI control. Higher values reduces the following error but introduces an overshoot.	0.001  0  900  1000  Decimal	u16  RW  per.	Modbus 976 <sub>h</sub>  CANopen 483B <sub>h</sub>
P8-60	Velocity Loop Output Filter Mode	-	u16	Modbus 978 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
FILTMODE	This parameter sets the value of the velocity loop output filter for the linear velocity controller.  Value 0: No filtering.  Value 1: First order low pass filter; sets P8-61 as corner frequency.  Value 2: Double first order low pass filter (sets P8-61 and P8-62 as corner frequencies).  Value 3: Notch filter (sets P8-62 as notch center frequency and P8-61 as notch frequency width).  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	0 2 3 Decimal	RW per.	CANopen 483C <sub>h</sub>
P8-61 FILTHZ1	Velocity Loop Output Filter Parameter 1  The function of this parameter depends on the velocity loop output filter mode (see P8-60).  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	- 1 500 10000 Decimal	u16 RW per.	Modbus 97A <sub>h</sub> CANopen 483D <sub>h</sub>
P8-62 FILTHZ2	Velocity Loop Output Filter Parameter 2  The function of this parameter depends on the velocity loop output filter mode (see P8-60).  <b>NOTE:</b> After motor connection, the drive automatically sets the optimized value, page 260.	- 1 500 10000 Decimal	u16 RW per.	Modbus 97C <sub>h</sub> CANopen 483E <sub>h</sub>
P8-63 VELFILTMODE	Velocity Filter Mode  This parameter sets the value of the type of filter that is used for extraction of a velocity signal from the position feedback.  Value 0: No filtering. Use derivative of feedback position.  Value 1: First order low pass filter; sets P8-64 as corner frequency.  Value 2: Use of the velocity feedback provided by the encoder.  Setting can only be modified if power stage is disabled.	- 0 1 2 Decimal	u32 RW per.	Modbus 97E <sub>h</sub> CANopen 483F <sub>h</sub>
P8-64 VELFILTRFQ	Velocity Filter Pole Frequency  This parameter sets the value of the first order filter, which is applied to the velocity feedback signal before applying the velocity controller.  <b>NOTE:</b> This parameter value is used only if P8-63 is set to 1.  Setting can only be modified if power stage is disabled.	- 20 440 2000 Decimal	u16 RW per.	Modbus 980 <sub>h</sub> CANopen 4840 <sub>h</sub>
P8-65 IFFLPPHZ	Current Feedforward Low Pass Filter  Applicable operating mode: PT, PS  This parameter sets the value of the first order filter of the linear controller which is applied to the current feedforward before it is added to current command.	- 10 1000 1000 Decimal	u16 RW per.	Modbus 982 <sub>h</sub> CANopen 4841 <sub>h</sub>
P8-66	LTN Torque Filter Mode	-	u16	Modbus 984 <sub>h</sub>

Parameter name	Description	Unit	Data type	Parameter address via fieldbus	
		Minimum value	R/W		
		Factory setting	Persistent		
		Maximum value			
		HMI Format			
NLTFDESIGNMODE	Applicable operating mode: PT, PS, V  This parameter sets the value of the torque filter mode used in the LTN control loop.  Value 0: Manual set of P8-15 and P8-14 values.  Value 1: P8-15 and P8-14 values are computed based on P8-67 value.	0  0  1  Decimal	RW  per.	CANopen 4842 <sub>h</sub>	
<i>P8-67</i> NLTFBW	LTN Torque Filter Bandwidth  Applicable operating mode: PT, PS, V  This parameter sets the value of the filter bandwidth used in LTN control loop to define P8-15 and P8-14 values with 10% overshoot.	Hz  50  1000  2000  Decimal	u16  RW  per.	Modbus 986 <sub>h</sub>  CANopen 4843 <sub>h</sub>	
<i>P8-68</i> NLNOTCHMODE	Current Filter - Notch Filter Mode  Applicable operating mode: PT, PS, V  This parameter sets the value of the notch filter mode used in the LTN control loop.  Value 0: Original notch filter.  Value 1: Advanced notch filter.	-  0  0  1  Decimal	u16  RW  per.	Modbus 988 <sub>h</sub>  CANopen 4844 <sub>h</sub>	
<i>P8-69</i> STANDSTILLMODE	Standstill Mode  Applicable operating mode: PT, PS, V  This parameter sets the value of the standstill mode used for variable gain.  The drive latches the variable gain when the motor is at standstill.  Value 0: The drive revert to the original gain when the motor is not at standstill.  Value 1: The drive revert to the original gain when a new motion command is applied.  <b>NOTE:</b> The motor is at standstill when: <ul style="list-style-type: none"> <li>the velocity command is less than the velocity value set via the parameter P1-38</li> <li>and the position deviation is within the tolerance sets via the parameter P1-54.</li> </ul>	-  0  0  1  Decimal	u16  RW  per.	Modbus 98A <sub>h</sub>  CANopen 4845 <sub>h</sub>	
<i>P8-70</i> STANDSTILLGAIN	Standstill Gain  Applicable operating mode: PT, PS, V  This parameter sets the value of the variable gain used for the linear position controller.  When the motor is at standstill, the velocity proportional gain (P8-57 KVP) and the position proportional gain (P8-53 KPP) are multiplied by (P8-70/1024).When the motor is not at standstill, the velocity proportional gain and the position proportional gain revert to their original values.	-  128  1024  1024  Decimal	u16  RW  per.	Modbus 98C <sub>h</sub>  CANopen 4846 <sub>h</sub>	
<i>P8-71</i> SFILTMODE	Encoder Filter Mode  Applicable operating mode: PT, PS, V  This parameter activates/deactivates the encoder filter.  Value 0: Deactivate the encoder filter.	-  0  0  1  Decimal	s16  RW  per.	Modbus 98E <sub>h</sub>  CANopen 4847 <sub>h</sub>	

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Value 1: Activate the encoder filter. The encoder filter helps to reduce the feedback jitter.			
P8-72 HWTEMPHRESH	HW Temperature failure threshold. If HWTEMPHRESH = 0, AL561 will be disabled.	- 0 2000 32767 Decimal	u16 RW per.	Modbus 990 <sub>h</sub> CANopen 4848 <sub>h</sub>
P8-99 LTNUSERVCMGDG-AIN	Adaptive Velocity Reference Value Gain Applicable operating mode: PT, PS	0.001 0 1000 3000 Decimal	u32 RW per.	Modbus 9C6 <sub>h</sub> CANopen 4863 <sub>h</sub>

## Linear Default Gains Values

The following table displays the optimized values set according to the connected motor:

Motor references	P8-53 KPP	P8-57 KVP	P8-58 KVI	P8-60 FILTMODE	P8-61 FILTHZ1	P8-62 FILTHZ2
BCH2MBA53...5C	55	0.4	50	0	0	0
BCH2MB013...5C	25	0.25	50	1	500	0
BCH2LD023...5C	35	0.5	30	1	800	0
BCH2MM031...6C	19	4.5	20	2	400	500
BCH2LD043...5C	30	1.1	25	1	1000	0
BCH2LF043...5C	35	2	50	1	700	0
BCH2MM052...6C	18	8	30	2	500	500
BCH2MM061...6C	20	5	30	1	400	0
BCH2HF073...5C	25	4	30	1	400	0
BCH2LF073...5C	30	3	50	1	500	0
BCH2MM081...6C	23	12	35	2	400	400
BCH2MM091...6C	25	7	35	1	300	0
BCH2MM102...6C	16	8.5	50	1	200	0
BCH2HM102...6C	16	8.5	50	1	200	0
BCH2LH103...6C	23	7	40	1	700	0
BCH2MM152...6C	25	8	50	2	500	500
BCH2MM202...6C	17	11	15	2	400	400
BCH2MR202...6C	13	21	25	1	200	0
BCH2HR202...6C	13	21	25	1	200	0
BCH2LH203...6C	21	9	40	1	700	0
BCH2MR301...6C	20	30	25	2	400	400



Motor references	P8-53 KPP	P8-57 KVP	P8-58 KVI	P8-60 FILTMODE	P8-61 FILTHZ1	P8-62 FILTHZ2
BCH2MR302***6C	15	33	30	2	300	300
BCH2MR352***6C	22	50	30	1	300	0
BCH2MR451***6C	22	35	30	2	300	400

## P9 - DTM Data

### P9 - DTM Data

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-00 PRGNR	Lexium program number Applicable operating mode: PT, PS, V, T Reads the program number	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A00 <sub>h</sub> CANopen 4900 <sub>h</sub>
P9-01 DATE	Firmware Version Date Applicable operating mode: PT, PS, V, T This parameter contains the date of the firmware version.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A02 <sub>h</sub> CANopen 4901 <sub>h</sub>
P9-02 MTP_ID	MTP Identification Code Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> - FFFFFFFF <sub>h</sub> Hexadecimal	u16 RO -	Modbus A04 <sub>h</sub> CANopen 4902 <sub>h</sub>
P9-06 UNAME1	User-Defined Application Name 1 Applicable operating mode: PT, PS, V, T This parameter is provided for a user-defined application name.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus A0C <sub>h</sub> CANopen 4906 <sub>h</sub>
P9-07 UNAME2	User-Defined Application Name 2 Applicable operating mode: PT, PS, V, T This parameter is provided for a user-defined application name.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus A0E <sub>h</sub> CANopen 4907 <sub>h</sub>
P9-08 UNAME3	User-Defined Application Name 3 Applicable operating mode: PT, PS, V, T This parameter is provided for a user-defined application name.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus A10 <sub>h</sub> CANopen 4908 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-09 UNAME4	User-Defined Application Name 4 Applicable operating mode: PT, PS, V, T This parameter is provided for a user-defined application name.	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RW per.	Modbus A12 <sub>h</sub> CANopen 4909 <sub>h</sub>
P9-10 MBWORD	Modbus Word Order Applicable operating mode: PT, PS, V, T This parameter sets the word order for Modbus. Value 0: Order of the bytes: 0 1 2 3 Value 1: Order of the bytes: 2 3 0 1	- 0 0 1 Decimal	u16 RW per.	Modbus A14 <sub>h</sub> CANopen 490A <sub>h</sub>
P9-11 SERNUM1	Serial Number Part 1 Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A16 <sub>h</sub> CANopen 490B <sub>h</sub>
P9-12 SERNUM2	Serial Number Part 2 Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A18 <sub>h</sub> CANopen 490C <sub>h</sub>
P9-13 SERNUM3	Serial Number Part 3 Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A1A <sub>h</sub> CANopen 490D <sub>h</sub>
P9-14 SERNUM4	Serial Number Part 4 Applicable operating mode: PT, PS, V, T	- 0 <sub>h</sub> 0 <sub>h</sub> FFFFFFFF <sub>h</sub> Hexadecimal	u32 RO -	Modbus A1C <sub>h</sub> CANopen 490E <sub>h</sub>
P9-15 LTN	Autotuning Method Applicable operating mode: PT, PS, V, T	- 0 0 6 Decimal	u16 RW -	Modbus A1E <sub>h</sub> CANopen 490F <sub>h</sub>
P9-16 LTNREFERENCE	Autotuning Motion Profile - Type Applicable operating mode: PT, PS, V	- 0 0 2 Decimal	u16 RW -	Modbus A20 <sub>h</sub> CANopen 4910 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-17 LTNAVMODE	Anti-vibration tuning mode. Applicable operating mode: PT, PS, V	- 0 0 6 Decimal	u16 RW -	Modbus A22 <sub>h</sub> CANopen 4911 <sub>h</sub>
P9-18 LTNSAVEMODE	Autotuning Results - Save/Discard Applicable operating mode: PT, PS, V	- 0 0 3 Decimal	u16 RW -	Modbus A24 <sub>h</sub> CANopen 4912 <sub>h</sub>
P9-19 LTNNLPEAFF	Autotuning - Elasticity Compensation Filters Applicable operating mode: PT, PS, V	- 0 1 1 Decimal	s16 RW -	Modbus A26 <sub>h</sub> CANopen 4913 <sub>h</sub>
P9-20 LTNCYCLE	Autotuning - Direction of Movement Applicable operating mode: PT, PS, V  This parameter sets the direction of movement for autotuning. Value 0: Both directions of movement Value 2: One direction of movement	- 0 0 3 Decimal	s16 RW -	Modbus A28 <sub>h</sub> CANopen 4914 <sub>h</sub>
P9-21 LTNDWELLTIME	Minimum Dwell Time for Detection of Movement Cycle Applicable operating mode: PT, PS, V	- 100 200 1000 Decimal	u16 RW -	Modbus A2A <sub>h</sub> CANopen 4915 <sub>h</sub>
P9-22 LTNLMJR	Autotuning - Automatic Estimation of Ratio of Load Inertia and Motor Inertia Applicable operating mode: PT, PS, V	- 0 0 1 Decimal	u16 RW -	Modbus A2C <sub>h</sub> CANopen 4916 <sub>h</sub>
P9-23 LTNSTIFF	Defines which values will be used for the position command filters. Applicable operating mode: PT, PS, V  Value 0: Automatic smoothing via S-curve optimization of the value Value 1: Manual smoothing	- 0 0 1 Decimal	u16 RW -	Modbus A2E <sub>h</sub> CANopen 4917 <sub>h</sub>
P9-25 LTNREFEN	Autotuning Motion Profile - Activation Applicable operating mode: PT, PS, V	- 0 0 1 Decimal	u16 RW -	Modbus A32 <sub>h</sub> CANopen 4919 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-26 PTPOS	Autotuning - Movement Range in Direction 1  Applicable operating mode: PS  This parameter specifies the movement range for autotuning in direction of movement 1.  The sign of the value determines the direction of movement:  Positive value: Positive direction of movement as set via parameter P1-01  Negative value: Negative direction of movement as set via parameter P1-01  See parameter P9-20 to select one direction of movement or both directions of movement for Comfort Tuning.	PUU -2147483647 0 2147483647 Decimal	s32 RW -	Modbus A34 <sub>h</sub> CANopen 491A <sub>h</sub>
P9-27 PTNEG	Autotuning - Movement Range in Direction 2  Applicable operating mode: PS  This parameter specifies the movement range for autotuning in direction of movement 2.  The sign of the value determines the direction of movement:  Positive value: Positive direction of movement as set via parameter P1-01  Negative value: Negative direction of movement as set via parameter P1-01  See parameter P9-20 to select one direction of movement or both directions of movement for Comfort Tuning.	PUU -2147483647 0 2147483647 Decimal	s32 RW -	Modbus A36 <sub>h</sub> CANopen 491B <sub>h</sub>
P9-28 LTNACTIVE	Autotuning Active  Applicable operating mode: PT, PS, V  This parameter indicates whether autotuning is active.  Value 0: Autotuning inactive Value 1: Autotuning active	- 0 - 1 Decimal	s16 RO -	Modbus A38 <sub>h</sub> CANopen 491C <sub>h</sub>
P9-29 LTNVCRUISE	Autotuning - Velocity  Applicable operating mode: PT, PS, V  Bits 0 ... 15: Velocity for positive direction of movement  Bits 16 ... 31: Velocity for negative direction of movement	0.1rpm 0.1rpm - - - Decimal	u32 RW -	Modbus A3A <sub>h</sub> CANopen 491D <sub>h</sub>
P9-30 LTNST	Autotuning - Status  Applicable operating mode: PT, PS, V  Value 0: Inactive Value 1: Active Value 2: Successfully completed Values 3 ... 9: Reserved Value 10: Impossible to set P9-15 Value 11: Impossible to set P9-16 Value 12: Impossible to set P9-17	- 0 - 65535 Decimal	u32 RO -	Modbus A3C <sub>h</sub> CANopen 491E <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Value 13: Impossible to set P9-18 Value 14: Impossible to set P9-19 Value 15: Impossible to set P9-21 Value 16: Impossible to set P9-22 Value 17: Impossible to set P9-23 Value 18: Impossible to set P9-24 Value 19: Impossible to set P9-25 Value 20: Impossible to set P9-32 Value 21: Impossible to enable the power stage Value 22: Hold is active Value 23: Undetermined motor Values 24 ... 26: Reserved Value 27: Impossible to activate autotuning Value 28: Autotuning did not run successfully Value 29: Reserved Value 30: Low Effort Value 31: AVG Zero Init Value Value 32: Cost factor error detected Value 33: Pos tune user gain modified Value 34: Motor Was Not Recognized Value 35: LTNP Step Updated Value 36: Movement too small Value 37: ICMD Sat. Value 38: Insufficient load estimation time. Value 39: Insufficient acceleration/deceleration (less than 33 % of nominal acc/dec) Value 40: Excessive acceleration/deceleration (more than 90 % of nominal acc/dec)			
P9-30 Continued	Value 41: Need for gravity compensation (see P9-35) Value 42: Insufficient velocity (less than 10 % of nominal velocity) Value 43: Insufficient deceleration (less than deceleration ramp DECSTOP) Value 44: Autotuning timeout Value 45: Invalid default values Value 46: Ratio of load inertia to motor inertia is too high (>30) Values 47 ... 49: Reserved Value 50: P9-15 set to 0 Value 51: Power stage disabled during autotuning Value 52: Current saturation			

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
	Value 53: Reserved Value 54: Insufficient excitation for autotuning (poor motion profile: short distance, low acceleration/deceleration, etc.) Value 55: Insufficient tuning effort Value 56: Halt during autotuning Value 57: Undetermined motor Value 58: Motion profile exceeds limits Value 59: Invalid gains during autotuning Value 60: Insufficient movement Value 61: Current limitation during autotuning Value 62: Detected alert during autotuning Values 63 ... 69: Reserved Value 70: Positive distance and negative distance are not equal Value 71: Velocity is too low Value 72: Motion profile is not trapezoidal Value 73: Same sign used for positive and negative movement in bidirectional mode Value 74: Different signs used for positive and negative movement in unidirectional mode Values 75 ... 89: Reserved			
P9-31 PTACCDEC	Autotuning - Acceleration and Deceleration Applicable operating mode: PT, PS, V Bits 0 ... 15: Acceleration for Autotuning Bits 16 ... 31: Deceleration for Autotuning	ms ms 6  6 6000  6000 65500  65500 Decimal	u32 RW -	Modbus A3E <sub>h</sub> CANopen 491F <sub>h</sub>
P9-32 LTNADVMODE	Autotune advance mode. Applicable operating mode: PT, PS, V	- 0 1 2 Decimal	u16 RW -	Modbus A40 <sub>h</sub> CANopen 4920 <sub>h</sub>
P9-33 LTNEFFORTMAX	Maximum Autotuning Optimization Value Applicable operating mode: PT, PS, V Setting can only be modified if power stage is disabled.	0.001 0 - 1000 Decimal	u32 RO -	Modbus A42 <sub>h</sub> CANopen 4921 <sub>h</sub>
P9-34 LTNBAR	Autotuning Progress Bar Applicable operating mode: PT, PS, V	- 0 0 100 Decimal	u16 RO -	Modbus A44 <sub>h</sub> CANopen 4922 <sub>h</sub>

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P9-35 LTNIGRAV	Autotuning - Gravity Estimation Applicable operating mode: PT, PS, V	- 0 0 1 Decimal	u16 RW -	Modbus A46 <sub>h</sub> CANopen 4923 <sub>n</sub>
P9-36 LTNLAFRC	Set LTNAFRC in Autotune Applicable operating mode: PT, PS, V	- 0 0 2 Decimal	s16 RW -	Modbus A48 <sub>h</sub> CANopen 4924 <sub>n</sub>
P9-37 LTNWARNING	Autotuning - Last Stored Event Applicable operating mode: PT, PS, V	- 0 0 65535 Decimal	u32 RO -	Modbus A4A <sub>h</sub> CANopen 4925 <sub>n</sub>
P9-38 LTNIMPROVEMENT	Mode 2 AT improvement Applicable operating mode: PT, PS, V, T	- 0 0 100 Decimal	u16 RO -	Modbus A4C <sub>h</sub> CANopen 4926 <sub>n</sub>
P9-39 LTNCYCLEIDENT	Cycle Identification status Applicable operating mode: PT, PS, V, T	- 0 0 9 Decimal	u16 RO -	Modbus A4E <sub>h</sub> CANopen 4927 <sub>n</sub>
P9-40 LTNDEFAULTS	LTN Autotuning Using Defaults Applicable operating mode: PT, PS, V	- 0 0 1 Decimal	u16 RW -	Modbus A50 <sub>h</sub> CANopen 4928 <sub>n</sub>

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# Operation

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# Operation

## What's in This Chapter

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## Access Channels

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

<b>⚠ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands.</li> <li>• Verify that the use of exclusive access cannot cause unintended triggering or blocking of commands.</li> <li>• Verify that the required access channels are available.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

The product can be addressed via different access channels.

Access channels are:

- Integrated HMI
- Digital and analog input signals
- Fieldbus
- Commissioning software LXM28 DTM Library

The product allows you to work with exclusive access which limits access to the product via a single access channel.

Only one access channel can have exclusive access to the product.

Exclusive access can be provided via different access channels:

- Via the integrated HMI:  
The operating mode Jog or Autotuning can be started via the HMI.
- Via a fieldbus:  
Exclusive access is provided to a fieldbus by blocking the other access channels with the parameter *AccessLock*.
- Via the commissioning software LXM28 DTM Library:  
The commissioning software receives exclusive access via the switch *Exclusive access* in position *On*.

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

The reference values are effective at the analog inputs and at the pulse inputs when the product is powered on. If exclusive access has been assigned to an access channel, signal at the pulse inputs are ignored.

The signal inputs of the safety function STO and the signal input functions **HALT**, **FAULT\_RESET**, **SON** (falling edge), **CWL(NL)** and **CCWL(PL)** are always effective during exclusive access.

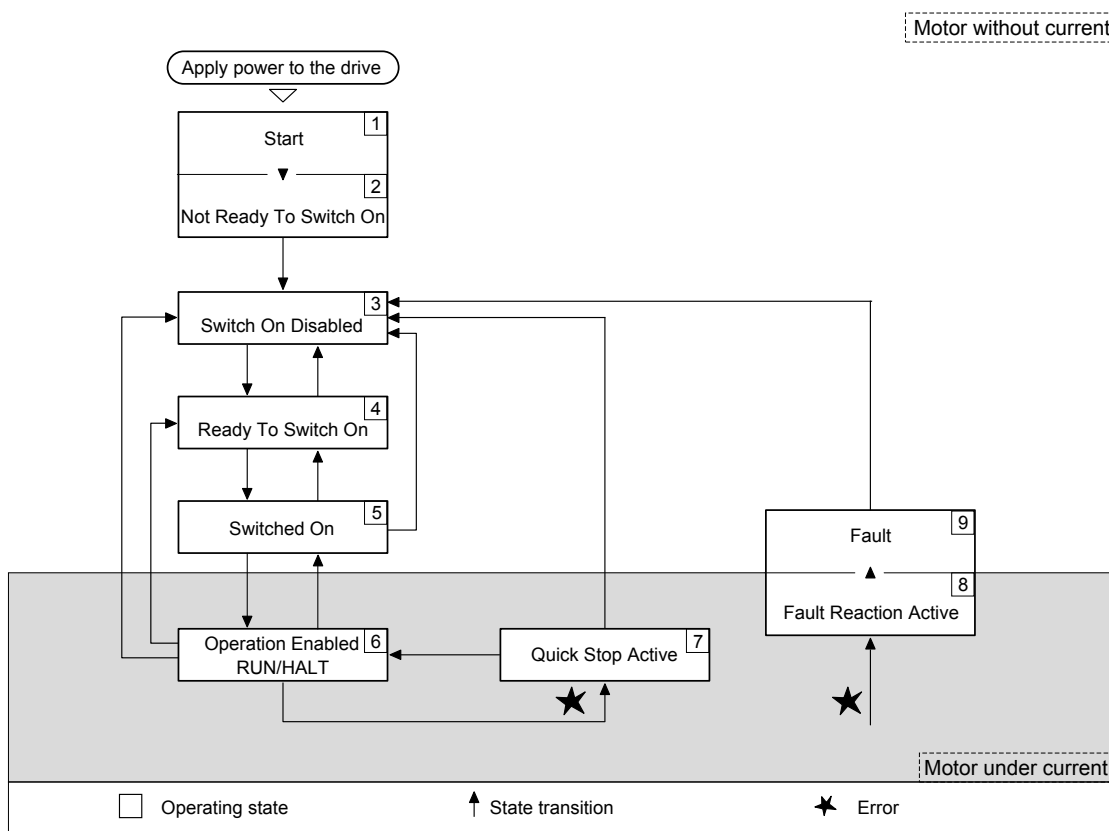
## Operating States

### State Diagram

When the product is powered on and when an operating mode is started, page 286, the product goes through a number of operating states.

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

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



## Operating States

Operating state	Description
1 Start	Electronics are initialized
2 Not Ready To Switch On	The power stage is not ready to switch on
3 Switch On Disabled	Impossible to enable the power stage
4 Ready To Switch On	The power stage is ready to switch on.
5 Switched On	Power stage is switched on
6 Operation Enabled	Power stage is enabled Selected operating mode is active
7 Quick Stop Active	Quick Stop is being executed

Operating state	Description
8 Fault Reaction Active	Error response is active
9 Fault	Error response terminated Power stage is disabled

## Resetting an Error Message

After you have removed the cause of the error, you can reset the error message in one of the following ways:

- With a rising edge of the signal input function **FAULT\_RESET**
- With a rising edge of the signal input function **SON**
- By using the **Fault Reset** button in the SoMove commissioning software.

## Setting the Digital Signal Inputs

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

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

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
<ul style="list-style-type: none"> <li>• Only start the system if there are no persons or obstructions in the zone of operation.</li> <li>• Verify that the wiring is appropriate for the settings.</li> <li>• Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.</li> </ul>
Failure to follow these instructions can result in death, serious injury, or equipment damage.

## Default Presets of the Signal Inputs

The following table shows the default presets of the digital signal inputs depending on the selected operating mode:

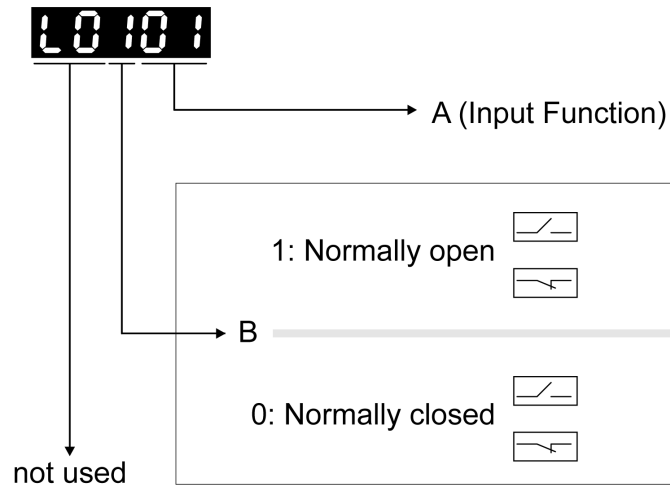
Setting A for P2-10 ... P2-17	Short name	Name	PT	PS	V	T	Vz	Tz	PT V	PT T	PS V	PS T	V T	CANopen
01 <sub>h</sub>	SON	Servo ON	D11											-
02 <sub>h</sub>	FAULT_RESET	Fault Reset	D15						-					
03 <sub>h</sub>	GAINUP	Increase Gain	-											
04 <sub>h</sub>	CLRPO-SDEV	Clear Position Deviation	D12	-				D12		-				
05 <sub>h</sub>	ZCLAMP	Zero Clamp	-											
06 <sub>h</sub>	INVDIR-ROT	Inverse Direction Of Rotation	-											
07 <sub>h</sub>	HALT	Halt	-											
08 <sub>h</sub>	CTRG	Start Data Set	-	D12	-						D12		-	

Setting A for P2-10 ... P2- 17	Short name	Name	PT	PS	V	T	Vz	Tz	PT V	PT T	PS V	PS T	V T	CANopen	
09 <sub>h</sub>	TRQLM	Activate Torque Limit	-	-	DI2	-	DI2	-							
10 <sub>h</sub>	SPDLM	Activate Speed Limit	-			DI2	-	DI2	-						
11 <sub>h</sub>	POS0	Data Set Bit 0	-	DI3	-						DI3	-			
12 <sub>h</sub>	POS1	Data Set Bit 1	-	DI4	-						DI4	-			
13 <sub>h</sub>	POS2	Data Set Bit 2	-												
14 <sub>h</sub>	SPD0	Speed Reference Value Bit 0	-	-	DI3	-	DI3	-	DI3	-	DI5	-	DI3	-	
15 <sub>h</sub>	SPD1	Speed Reference Value Bit 1	-	-	DI4	-	DI4	-	DI4	-	DI6	-	DI4	-	
16 <sub>h</sub>	TCM0	Torque Reference Value Bit 0	DI3	-	-	DI3	-	DI3	-	DI3	-	DI5		-	
17 <sub>h</sub>	TCM1	Torque Reference Value Bit 1	DI4	-	-	DI4	-	DI4	-	DI4	-	DI6		-	
18 <sub>h</sub>	V-Px	Velocity - Position	-						DI7	-	DI7	-			
19 <sub>h</sub>	V-T	Velocity - Torque	-										DI7	-	
1A <sub>h</sub>	POS3	Data Set Bit 3	-												
1B <sub>h</sub>	POS4	Data Set Bit 4	-												
1C <sub>h</sub>	TPROB1	Touch Probe 1	-												
1D <sub>h</sub>	TPROB2	Touch Probe 2	-												
20 <sub>h</sub>	T-Px	Torque - Position	-							DI7	-	DI7	-	-	
21 <sub>h</sub>	OPST	Stop and Disable Power Stage	DI8												
22 <sub>h</sub>	CWL(NL)	Negative Limit Switch (NL/LIMN)	DI6						-						DI6
23 <sub>h</sub>	CCWL (PL)	Positive Limit Switch (PL/LIMP)	DI7						-						DI7
24 <sub>h</sub>	ORGP	Reference Switch	-										DI5		
27 <sub>h</sub>	GOTO-HOME	Move To Home Position	-												
2C <sub>h</sub>	PTCMS	Type of pulses for operating mode Pulse Train (PT) (OFF: Low-speed pulses, ON: High-Speed pulses)	-												
37 <sub>h</sub>	JOGP	Jog Positive	-												
38 <sub>h</sub>	JOBN	Jog Negative	-												
39 <sub>h</sub>	STEPU	Next Data Set	-												
40 <sub>h</sub>	STEPD	Previous Data Set	-												
41 <sub>h</sub>	STEPB	First Data Set	-												
42 <sub>h</sub>	AUTOR	Automatic Position Sequence: Start with first data set, repeat sequence	-												
43 <sub>h</sub>	GNUM0	Numerator Bit 0 Electronic Gear Ratio	-												
44 <sub>h</sub>	GNUM1	Numerator Bit 1 Electronic Gear Ratio	-												
45 <sub>h</sub>	INHPP	Pulse Inhibit	-												
46 <sub>h</sub>	STOP	Stop Motor (operating mode PS only)	-												

## Parameterization of the Signal Input Functions

The signal input functions for the inputs DI1 ... DI8 are configured via the parameters *P2-10* ... *P2-17*.

A signal input function can only be assigned to one of the signal inputs.



The operating modes Torque (T) and Torque (Tz) and the dual operating modes with Torque (T) and Torque (Tz) do not provide deceleration functionality in response to a power stage disable request. In these operating modes, the motor coasts down to a standstill in response to a power stage disable request. You must install additional equipment such as a dedicated service brake if your application requires faster deceleration of the load.

<b>⚠ WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
<ul style="list-style-type: none"> <li>• During commissioning, trigger all signals and simulate all conditions that cause a power stage disable request in order to verify that all loads come to a secure standstill when the power stage is disabled under maximum load conditions.</li> <li>• Install a dedicated service brake if removal of power to the motor does not meet the requirements of your application.</li> </ul>
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

The following table provides an overview of the possible signal input functions:

Setting A for <i>P2-10</i> ... <i>P2-17</i>	Short name	Name	Description	Signal inputs
01 <sub>h</sub>	SON	Servo ON	The signal input function SON enables the power stage (operating state Operation Enabled). The signal input function SON is only available if no detected errors are present.	DI1 ... DI8
02 <sub>h</sub>	FAULT_RESET	Fault Reset	The signal input function FAULT_RESET performs a Fault Reset. The cause of the error must have been removed before a Fault Reset is performed.	DI1 ... DI8
03 <sub>h</sub>	GAINUP	Increase Gain	The signal input function GAINUP increases the control gain according to the values and conditions set via parameter <i>P2-27</i> .	DI1 ... DI8
04 <sub>h</sub>	CLRPOS-DEV	Clear Position Deviation	The signal input function CLRPOSDEV resets the position deviation to zero as set via parameter <i>P2-50</i> .  This function is only supported in linear control mode ( <i>P8-35=4001<sub>h</sub></i> )	DI1 ... DI8
05 <sub>h</sub>	ZCLAMP	Zero Clamp	In the operating mode V, the signal input function ZCLAMP can be used to stop the motor if the velocity of the motor is below the velocity value set via the parameter <i>P1-38</i> . The behavior of the signal input function ZCLAMP is set via the parameter <i>P2-65</i> , bit 10.	DI1 ... DI8

Setting A for P2-10 ... P2-17	Short name	Name	Description	Signal inputs
06 <sub>h</sub>	INVDIRROT	Inverse Direction Of Rotation	The signal input function INVDIRROT inverts the direction of rotation of the motor. The signal input function INVDIRROT is available in the operating modes Velocity (V) and Torque (T).	D11 ... D18
07 <sub>h</sub>	HALT	Halt	The signal input function HALT interrupts the movement with the deceleration ramp set via the parameter P1-68. The movement is resumed when the signal input function is no longer active.	D11 ... D18
08 <sub>h</sub>	CTRG	Start Data Set	The signal input function CTRG starts the selected data set in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
09 <sub>h</sub>	TRQLM	Activate Torque Limit	The signal input function TRQLM activates the torque limitations set via parameters P1-12 ... P1-14. You can also use the parameter P1-02 to activate the torque limitations set via parameters P1-12 ... P1-14.	D11 ... D18
10 <sub>h</sub>	SPDLM	Activate Speed Limit	The signal input function SPDLM activates the velocity limitations set via parameters P1-09 ... P1-11. You can also use the parameter P1-02 to activate the velocity limitations set via parameters P1-09 ... P1-11.	D11 ... D18
11 <sub>h</sub>	POS0	Data Set Bit 0	The signal input functions POS0 ... POS4 represent bits 0 ... 4 required to select one of the 32 data sets available in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
12 <sub>h</sub>	POS1	Data Set Bit 1	The signal input functions POS0 ... POS4 represent bits 0 ... 4 required to select one of the 32 data sets available in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
13 <sub>h</sub>	POS2	Data Set Bit 2	The signal input functions POS0 ... POS4 represent bits 0 ... 4 required to select one of the 32 data sets available in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
14 <sub>h</sub>	SPD0	Speed Reference Value Bit 0	The signal input functions SPD0 and SPD1 represent bits 0 and 1 to select one of the three velocity reference values available in the operating mode Velocity (V). For further information, refer to Operating Modes Velocity (V) and Velocity Zero (Vz), page 330.	D11 ... D18
15 <sub>h</sub>	SPD1	Speed Reference Value Bit 1	The signal input functions SPD0 and SPD1 represent bits 0 and 1 to select one of the three velocity reference values available in the operating mode Velocity (V). For further information, refer to Operating Modes Velocity (V) and Velocity Zero (Vz), page 330.	D11 ... D18
16 <sub>h</sub>	TCM0	Torque Reference Value Bit 0	The signal input functions TCM0 and TCM1 represent bits 0 and 1 to select one of the three torque reference values available in the operating mode Torque (T). For further information, refer to Operating Modes Torque (T) and Torque Zero (Tz), page 333.	D11 ... D18
17 <sub>h</sub>	TCM1	Torque Reference Value Bit 1	The signal input functions TCM0 and TCM1 represent bits 0 and 1 to select one of the three torque reference values available in the operating mode Torque (T). For further information, refer to Operating Modes Torque (T) and Torque Zero (Tz), page 333.	D11 ... D18
18 <sub>h</sub>	V-Px	Velocity - Position	Operating mode switching between Velocity (V) and Pulse Train (PT) or between Velocity (V) and Position Sequence (PS). For further information, refer to Setting the Operating Mode, page 286.  (OFF: Velocity (V), ON: Pulse Train (PT) or Position Sequence (PS), depending on P1-01)	D11 ... D18
19 <sub>h</sub>	V-T	Velocity - Torque	Operating mode switching between Velocity (V) and Torque (T). For further information, refer to Setting the Operating Mode, page 286.  (OFF: Velocity (V), ON: Pulse Torque (T))	D11 ... D18
1A <sub>h</sub>	POS3	Data Set Bit 3	The signal input functions POS0 ... POS4 represent bits 0 ... 4 required to select one of the 32 data sets available in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
1B <sub>h</sub>	POS4	Data Set Bit 4	The signal input functions POS0 ... POS4 represent bits 0 ... 4 required to select one of the 32 data sets available in the operating mode Position Sequence (PS). For further information, refer to Operating Mode Position Sequence (PS), page 294.	D11 ... D18
1C <sub>h</sub>	TPROB1	Touch Probe 1	The signal input function TPROB1 is used to trigger the Position Capture function. See the sections on the parameters P5-37 ... P5-39 for additional information.	D17

Setting A for P2-10 ... P2-17	Short name	Name	Description	Signal inputs
1D <sub>h</sub>	TPROB2	Touch Probe 2	The signal input function TPROB2 is used to trigger the Position Capture function. See the sections on the parameters P5-57 ... P5-59 for additional information.	D16
20 <sub>h</sub>	T-Px	Torque - Position	Operating mode switching between Torque (T) and Pulse Train (PT) or between Torque (T) and Position Sequence (PS) . For further information, refer to <i>Setting the Operating Mode</i> , page 286.  (OFF: Torque (T), ON: Pulse Train (PT) or Position Sequence (PS), depending on P1-01)	D11 ... D18
21 <sub>h</sub>	OPST	Stop and Disable Power Stage	The signal input function OPST stops the motor with the deceleration ramp set via the parameter P1-68 and then disables the power stage.	D11 ... D18
22 <sub>h</sub>	CWL(NL)	Negative Limit Switch (NL/LIMN)	Negative limit switch (NL/LIMN). When the signal input is activated, an alert is triggered. The deceleration ramp is specified via parameter P5-25.	D11 ... D18
23 <sub>h</sub>	CCWL(PL)	Positive Limit Switch (PL/LIMP)	Positive limit switch (PL/LIMP). When the signal input is activated, an alert is triggered. The deceleration ramp is specified via parameter P5-26.	D11 ... D18
24 <sub>h</sub>	ORGP	Reference Switch	The signal input function ORGP is used for the reference switch. For further information, refer to <i>Operating Mode Position Sequence (PS)</i> , page 294.	D11 ... D18
27 <sub>h</sub>	GOTOHOME	Move To Home Position	The signal input function GOTOHOME triggers a movement to the Home position set via the parameter P5-04.	D11 ... D18
2C <sub>h</sub>	PTCMS	Type of pulses for operating mode Pulse Train (PT) (OFF: Low-speed pulses, ON: High-Speed pulses)	The signal input function PTCMS selects the type of pulses for the operating mode Pulse Train PT (OFF: Low-speed pulses, ON: High-speed pulses). You can also use the parameter P1-00 to select the type of pulses.	D11 ... D18
37 <sub>h</sub>	JOGP	Jog Positive	The signal input function JOGP triggers a Jog movement in positive direction if the value determining the direction of movement in the parameter P1-01 is set to the default value.	D11 ... D18
38 <sub>h</sub>	JOGN	Jog Negative	The signal input function JOGN triggers a Jog movement in negative direction if the value determining the direction of movement in the parameter P1-01 is set to the default value.	D11 ... D18
39 <sub>h</sub>	STEPU	Next Data Set	The signal input function STEPUP starts the next data set in the operating mode Position Sequence (PS).	D11 ... D18
40 <sub>h</sub>	STEPD	Previous Data Set	The signal input function STEPDP starts the previous data set in the operating mode Position Sequence (PS).	D11 ... D18
41 <sub>h</sub>	STEPB	First Data Set	The signal input function STEPBP starts the first data set in the operating mode Position Sequence (PS).	D11 ... D18
42 <sub>h</sub>	AUTOR	Automatic Position Sequence: Start with first data set, repeat sequence	The signal input function AUTOR starts a sequence of data sets from the first data set in the operating mode Position Sequence (PS). The sequence is repeated as long as the signal input function AUTOR is active.	D11 ... D18
43 <sub>h</sub>	GNUM0	Numerator Bit 0 Electronic Gear Ratio	The signal input functions GNUM0 and GNUM1 represent bits 0 and 1 to select one of the four numerators set via the parameters P1-44, P2-60 ... P2-62. The denominator is set via the parameter P1-45 . The ratios are used as gear factors in the operating mode Pulse Train (PT) and as scaling factors. For further information, refer to <i>Gear Ratio</i> , page 292 and <i>Scaling</i> , page 301.	D11 ... D18
44 <sub>h</sub>	GNUM1	Numerator Bit 1 Electronic Gear Ratio	The signal input functions GNUM0 and GNUM1 represent bits 0 and 1 to select one of the four numerators set via the parameters P1-44, P2-60 ... P2-62. The denominator is set via the parameter P1-45. The ratios are used as gear factors in the operating mode Pulse Train (PT) and as scaling factors. For further information, refer to <i>Gear Ratio</i> , page 292 and <i>Scaling</i> , page 301.	D11 ... D18
45 <sub>h</sub>	INHP	Pulse Inhibit	The signal input function INHP is used in the operating mode Pulse Train (PT) to block pulses received as reference signals. If the signal input function is active, the pulses are no longer evaluated and the motor coasts down.	D11 ... D18
46 <sub>h</sub>	STOP	Stop Motor (operating mode PS only)	The signal input function STOP stops the motor with the deceleration ramp set via the parameter P5-20. The power stage remains enabled. The signal input function STOP is available in the operating mode Position Sequence (PS).	D11 ... D18

## Setting the Digital Signal Outputs

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

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

### **▲ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the wiring is appropriate for the settings.
- 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.**

## Default Presets of the Signal Outputs

The following table shows the default presets of the digital signal outputs depending on the selected operating mode:

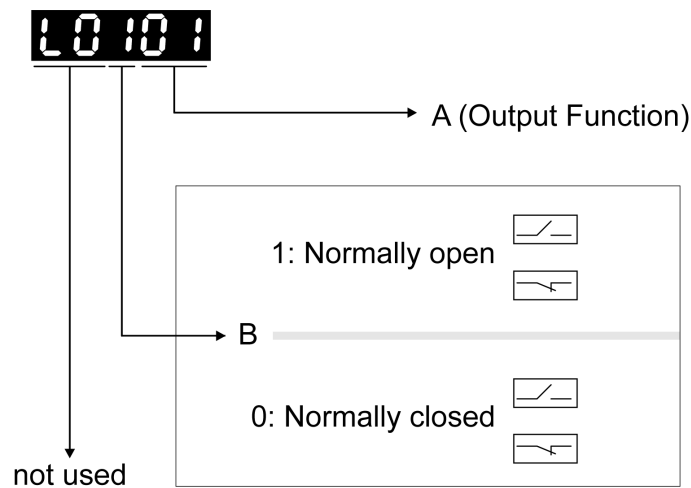
Setting A for P2-18 ... P2-22	Short name	Name	PT	PS	V	T	Vz	Tz	PT V	PT T	PS V	PS T	V T	CANopen		
01 <sub>h</sub>	SRDY	Servo Ready	DO1													
02 <sub>h</sub>	SON	Servo On	-													
03 <sub>h</sub>	ZSPD	Zero Speed	DO2													-
04 <sub>h</sub>	TSPD	Speed Reached	-	DO3											-	
05 <sub>h</sub>	TPOS	Movement Completed	DO4	-					DO4				-			
06 <sub>h</sub>	TQL	Torque Limit Reached	-													
07 <sub>h</sub>	ERROR	Error Detected	DO5													
08 <sub>h</sub>	BRKR	Holding Brake Control	-	DO4				-								
09 <sub>h</sub>	HOME-D_OK	Homing Completed	DO3	-												
10 <sub>h</sub>	OLW	Motor Overload Alert	-													
11 <sub>h</sub>	WARN	Alert Signal activated	-													
12 <sub>h</sub>	OVF	Position command overflow	-													
13 <sub>h</sub>	SCWL (SNL)	Negative Software Limit Switch Reached	-													
14 <sub>h</sub>	SCCWL (SPL)	Positive Software Limit Switch Reached	-													
15 <sub>h</sub>	CMD_OK	Data set completed	-													



Setting A for P2-18 ... P2-22	Short name	Name	PT	PS	V	T	Vz	Tz	PT	PT	PS	PS	V	CANopen
									V	T	V	T	T	
16h	CAP1_OK	Capture 1 completed												
17h	MC_OK	Motion control completed output												
18h	-	-												
19h	SP_OK	Speed reached output												
1Ah...2Fh	-	-												
30h	SDO_0	Output the status of bit 0 of P4-06.												
31h	SDO_1	Output the status of bit 1 of P4-06.												
32h	SDO_2	Output the status of bit 2 of P4-06.												
33h	SDO_3	Output the status of bit 3 of P4-06.												
34h	SDO_4	Output the status of bit 4 of P4-06.												
35h	SDO_5	Output the status of bit 5 of P4-06.												
36h	SDO_6	Output the status of bit 6 of P4-06.												
37h	SDO_7	Output the status of bit 7 of P4-06.												
38h...3Fh	-	-												

## Parameterization of the Signal Output Functions

The signal output functions for the outputs DO1 ... DO5 are configured via the parameters P2-18 ... P2-22.



The following table provides an overview of the possible signal output functions:

Setting A for P2-18 ... P2-22	Short name	Name	Description
01 <sub>h</sub>	SRDY	Servo Ready	The signal output function SRDY indicates that no errors are detected, i.e., the drive is not in the operating state Fault.
02 <sub>h</sub>	SON	Servo On	The signal output function SON indicates that the drive is in the operating state Operation Enabled .
03 <sub>h</sub>	ZSPD	Zero Speed	The signal output function ZSPD indicates that the velocity of the motor is less than the velocity value set via parameter P1-38 .
04 <sub>h</sub>	TSPD	Speed Reached	The signal output function TSPD indicates that the velocity of the motor is greater than the velocity value set via parameter P1-39 .
05 <sub>h</sub>	TPOS	Movement Completed	Operating mode Pulse Train (PT): The signal output function TPOS indicates that the position deviation is within the tolerance set via the parameter P1-54 and the motor has come to a standstill.  Operating mode Position Sequence (PS): The signal output function TPOS indicates that the position deviation at the target position is within the tolerance set via the parameter P1-54 and the reference velocity is below the value set via the parameter P1-38.
06 <sub>h</sub>	TQL	Torque Limit Reached	The signal output function TQL indicates that the torque of the motor has reached the value set via parameters P1-12 ... P1-14 or an analog input.
07 <sub>h</sub>	ERROR	Error Detected	The signal output function ERROR indicates that an error has been detected and that the drive has switched to the operating state Fault. For further information, refer to Diagnostics and Troubleshooting, page 365.
08 <sub>h</sub>	BRKR	Holding Brake Control	The signal output function BRKR is used to control the holding brake with the settings made via parameters P1-42 and P1-19. The holding brake must be connected to the output to which the signal output function BRKR is assigned. For further information, refer to Holding Brake Connection, page 135.
09 <sub>h</sub>	HOMED_OK	Homing Completed	The signal output function HOMED_OK indicates that the homing procedure has been successfully completed. The settings for Homing are specified via parameters P5-04 ... P5-06. For further information, refer to Operating Mode Position Sequence (PS), page 294.
10 <sub>h</sub>	OLW	Motor Overload Alert	The signal output function OLW indicates a motor overload condition. A threshold for the signal output function OLW can be set via parameter P1-28.
11 <sub>h</sub>	WARN	Alert Signal activated	The signal output function indicates that one of the following conditions has been detected: Hardware limit switch triggered, undervoltage, Nodeguard alert, Operational Stop (OPST). For further information, refer to Diagnostics and Troubleshooting, page 365.
12 <sub>h</sub>	-	-	Reserved
13 <sub>h</sub>	SCWL(SNL)	Negative Software Limit Switch Reached	The signal output function SCWL(SNL) indicates that the negative software limit switch set via parameter P5-09 has been reached. When the software limit switch is reached, an alert is triggered. The deceleration ramp is specified via parameter P5-23.
14 <sub>h</sub>	SCCWL (SPL)	Positive Software Limit Switch Reached	The signal output function SCCWL(SPL) indicates that the positive software limit switch set via parameter P5-08 has been reached. When the software limit switch is reached, an alert is triggered. The deceleration ramp is specified via parameter P5-24.
15 <sub>h</sub>	CMD_OK	Data set completed	The signal output function CMD_OK indicates that the data set including the waiting time has been successfully completed.
16 <sub>h</sub>	CAP1_OK	Capture 1 completed	The signal output function CAP1_OK indicates that a position capture (Touch Probe) has been successfully completed. The settings for position capture (Touch Probe) are specified via parameters P5-37 ... P5-39.
17 <sub>h</sub>	MC_OK	Motion control completed output	The signal output function MC_OK indicates that both the signal output functions CMD_OK and TPOS have been activated.
18 <sub>h</sub>	-	-	Reserved
19 <sub>h</sub>	SP_OK	Speed reached output	The signal output function SP_OK indicates that the target velocity has been reached. The velocity range for activating this signal output function is set via parameter P1-47.
1A <sub>h</sub> ...2F <sub>h</sub>	-	-	Reserved
30 <sub>h</sub>	SDO_0	Output the status of bit 0 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.

Setting A for P2-18 ... P2-22	Short name	Name	Description
31 <sub>h</sub>	SDO_1	Output the status of bit 1 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
32 <sub>h</sub>	SDO_2	Output the status of bit 2 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
33 <sub>h</sub>	SDO_3	Output the status of bit 3 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
34 <sub>h</sub>	SDO_4	Output the status of bit 4 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
35 <sub>h</sub>	SDO_5	Output the status of bit 5 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
36 <sub>h</sub>	SDO_6	Output the status of bit 6 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
37 <sub>h</sub>	SDO_7	Output the status of bit 7 of P4-06.	The signal output functions SDO_0 ... SDO_7 provide the bit pattern (bits 0 ... 7) required to determine the setting of the parameter P4-06.
38 <sub>h</sub> ...3F <sub>h</sub>	-	-	Reserved

## Functions for Target Value Processing

### Interrupting a Movement with HALT

The HALT signal input function is available in the operating mode PT only.

With the signal input function HALT, the ongoing movement is interrupted. When the signal input function HALT is no longer active, the movement is resumed from the point where it was interrupted.

The movement is interrupted via a deceleration ramp. The deceleration ramp is specified via parameter *P1-68*.

In order to interrupt a movement via a signal input, you must first parameterize the signal input function HALT, refer to *Setting the Digital Signal Inputs*, page 271.

NOTE: The pulses received while the HALT function is active are ignored. When the HALT is no longer active, the drive accepts any on-going pulse stream and start movement according to that stream.

<b>▲ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• Do not deactivate the HALT function prior to the deceleration of the motor.</li> <li>• If the deactivation of the HALT function prior to the deceleration of the motor is unavoidable, be sure to include these circumstances in your hazard and risk analysis of your application.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

If there is uncertainty of the effect of the movement generated by an ongoing pulse stream at the time of HALT deactivation, you must rehome the application.

### Stopping a Movement with OPST

With the signal input function OPST (Operational Stop), the ongoing movement is stopped.

In order to stop a movement via a signal input, you must first parameterize the signal input function OPST, refer to *Setting the Digital Signal Inputs*, page 271.

The movement is interrupted via a deceleration ramp to the point of the defined standstill. After that, the power stage is disabled once the drive has determined that the motor is at standstill, and if so configured, the holding brake is applied.

## **▲ WARNING**

### **UNINTENDED EQUIPMENT OPERATION**

- During commissioning, trigger all signals and simulate all conditions that cause a power stage disable request in order to verify that all loads come to a secure standstill when the power stage is disabled under maximum load conditions.
- Install a dedicated service brake if removal of power to the motor does not meet the requirements of your application.

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

An error, AL013, is detected and presented.

The deceleration ramp is specified via parameter *P1-68*.

After the OPST function is enabled, you must disable it and re-enable the power stage for continued operation.

## **Setting a Signal Output Via Parameter**

The digital signal outputs can be set via a parameter.

In order to set a digital signal output via the parameter, you must first parameterize the signal output functions SDO\_0 ... SDO\_7, refer to *Setting the Digital Signal Outputs*, page 276.

The parameter *P4-06* lets you set the digital signal outputs.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
<p>P4-06</p> <p>FOT</p>	<p>Setting a signal output via parameter</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter lets you set those signal outputs whose signal output functions have been defined by SDO_0 ... SDO_7.</p> <p>Bit 0 = 1 sets those signal outputs whose signal output function has been set to SDO_0.</p> <p>Bit 1 = 1 sets those signal outputs whose signal output function has been set to SDO_1.</p> <p>Bit 2 = 1 sets those signal outputs whose signal output function has been set to SDO_2.</p> <p>Bit 3 = 1 sets those signal outputs whose signal output function has been set to SDO_3.</p> <p>Bit 4 = 1 sets those signal outputs whose signal output function has been set to SDO_4.</p> <p>Bit 5 = 1 sets those signal outputs whose signal output function has been set to SDO_5.</p> <p>Bit 6 = 1 sets those signal outputs whose signal output function has been set to SDO_6.</p> <p>Bit 7 = 1 sets those signal outputs whose signal output function has been set to SDO_7.</p> <p>See P2-18 ... P2-22 for assigning the functions to the digital outputs.</p>	<p>-</p> <p>0<sub>h</sub></p> <p>0<sub>h</sub></p> <p>FF<sub>h</sub></p> <p>Hexadecimal</p>	<p>u16</p> <p>RW</p> <p>-</p>	<p>Modbus 50C<sub>h</sub></p> <p>CANopen 4406<sub>h</sub></p>

## Forcing the Digital Signal Inputs and Signal Outputs

Forcing of signals means that the digital inputs and outputs are set manually. Forcing input and output values can have serious consequences on the operation of a machine or process.

<b>⚠ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION CAUSED BY FORCING</b></p> <ul style="list-style-type: none"> <li>• Only force I/O if there are no persons or obstructions in the zone of operation.</li> <li>• Only force I/O if you are fully familiar with the effects of the signals.</li> <li>• Only force I/O for test purposes, maintenance or other short-term tasks.</li> <li>• Do not use forcing for regular, long-term or in-service operation.</li> <li>• Always remove forcing when the task (testing, maintenance or other short-term operation) is completed.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Forcing the Digital Inputs

Forcing of the digital inputs is set via the parameters P3-06 and P4-07.

The parameter P3-06 lets you specify which digital signal inputs are allowed to be forced.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P3-06 SDI	<p>Digital Inputs - Forcing Settings</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter determines whether a digital input can be forced.</p> <p>Bits 0 ... 7: Digital input DI1 ... Digital input DI8</p> <p>Bit settings:</p> <p>Value 0: Digital input cannot be forced</p> <p>Value 1: Digital input can be forced</p> <p>To start forcing, you must write P4-07.</p> <p>See P2-10 ... P2-17 for the assignment of signal input functions to the digital inputs.</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 7FF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 40C <sub>h</sub> CANopen 4306 <sub>h</sub>

Use parameter P4-07 to activate forcing of the digital signal inputs.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P4-07 ITST	<p>State of Digital Inputs / Activate Forcing</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>A read access to this parameter indicates the state of the digital inputs in the form of a bit pattern.</p> <p>Example:</p> <p>Read value 0x0011: Digital inputs 1 and 5 are activated</p> <p>By writing this parameter, you can change the state of the inputs provided that the setting for the corresponding input in P3-06 allows for forcing (value 1 for the bit corresponding to the input).</p> <p>Example:</p> <p>Write value 0x0011: Digital inputs 1 and 5 are activated</p> <p>Read value 0x0011: Digital inputs 1 and 5 are activated</p> <p>See P3-06 for permitting forcing of individual digital inputs.</p> <p>See P2-10 ... P2-17 for the assignment of signal input functions to the digital inputs.</p>	- 0 <sub>h</sub> 0 <sub>h</sub> FF <sub>h</sub> Hexadecimal	u16 RW -	Modbus 50E <sub>h</sub> CANopen 4407 <sub>h</sub>

## Forcing the Digital Outputs

Forcing of the digital outputs is set via the parameters P4-27 and P4-28.

The parameter P4-27 lets you specify which digital signal outputs are allowed to be forced.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P4-27 DO_FORCE_MASK	<p>Digital Outputs - Forcing Settings</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>This parameter determines whether a digital output can be forced.</p> <p>Bits 0 ... 4: Digital output DO1 ... Digital output DO5</p> <p>Bit settings:</p> <p>Value 0: Digital output cannot be forced</p> <p>Value 1: Digital output can be forced</p> <p>To start forcing, you must write P4-28.</p> <p>See P2-18 ... P2-22 for the assignment of signal output functions to the digital outputs.</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 1F <sub>h</sub> Hexadecimal	u16 RW -	Modbus 536 <sub>h</sub> CANopen 441B <sub>h</sub>

Use parameter P4-28 to activate forcing of the digital signal outputs.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P4-28 DO_FORCE_VALUE	<p>State of Digital Outputs / Activate Forcing</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>A read access to this parameter indicates the state of the digital outputs in the form of a bit pattern.</p> <p>Example:</p> <p>Read value 0x0011: Digital outputs 1 and 5 are activated</p> <p>By writing this parameter, you can change the state of the outputs provided that the setting for the corresponding output in P4-27 allows for forcing (value 1 for the bit corresponding to the output).</p> <p>Example:</p> <p>Write value 0x0011: Digital outputs 1 and 5 are activated</p> <p>Read value 0x0011: Digital outputs 1 and 5 are activated</p> <p>See P4-27 for permitting forcing of individual digital outputs.</p> <p>See P2-18 ... P2-22 for the assignment of signal output functions to the digital outputs.</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 1F <sub>h</sub> Hexadecimal	u16 RW -	Modbus 538 <sub>h</sub> CANopen 441C <sub>h</sub>

# Position Capture via DS402 Profile

## Description

The motor position can be captured when a signal is detected at a Touch Probe Input.

## Adjusting and Starting Position Capture

*Touch Probe Function 60B8<sub>h</sub>* object is used to adjust and start position capture.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
60B8 <sub>h</sub>	Touch Probe Function	VAR UINT16 rww	Yes	0 - 65535

Bit	Meaning
Bit 0	0: Deactivate Touch Probe Input 1 1: Activate Touch Probe Input 1
Bit 1	0: One time capture 1: Continuous capture
Bit 2	0: Trigger Touch Probe Input 1 1: Trigger with zero pulse signal or position encoder
Bit 3	Reserved
Bit 4	0: Disabling capture with rising edge 1: Enabling capture with rising edge
Bit 5	0: Disabling capture with falling edge 1: Enabling capture with falling edge
Bit 6 ... 7	Reserved
Bit 8	0: Deactivate Touch Probe Input 2 1: Activate Touch Probe Input 2
Bit 9	0: One time capture 1: Continuous capture
Bit 10	0: Trigger Touch Probe Input 2 1: Trigger with zero pulse signal or position encoder
Bit 11	Reserved
Bit 12	0: Disabling capture with rising edge 1: Enabling capture with rising edge
Bit 13	0: Disabling capture with falling edge 1: Enabling capture with falling edge
Bit 14 ... 15	Reserved



## Indicating the Position Capture Status

*Touch Probe Status 60B9<sub>h</sub>* object is used to indicate the position capture status.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
60B9 <sub>h</sub>	Touch Probe Status	VAR UINT16 ro	Yes	0 0 65535

Bit	Meaning
Bit 0	0: Touch Probe Input 1 deactivated 1: Touch Probe Input 1 activated
Bit 1	0: Touch Probe Input 1: no value captured for rising edge 1: Touch Probe Input 1: value captured for rising edge
Bit 2	0: Touch Probe Input 1: no value captured for falling edge 1: Touch Probe Input 1: value captured for falling edge
Bit 3 ... 7	Reserved
Bit 8	0: Touch Probe Input 2 deactivated 1: Touch Probe Input 2 activated
Bit 9	0: Touch Probe Input 2: no value captured for rising edge 1: Touch Probe Input 2: value captured for rising edge
Bit 10	0: Touch Probe Input 2: no value captured for falling edge 1: Touch Probe Input 2: value captured for falling edge
Bit 11 ... 15	Reserved

# Operating Modes

## What's in This Chapter

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 Operating Modes Velocity (V) and Velocity Zero (Vz)..... 330  
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## Setting the Operating Mode

### Setting the Operating Mode

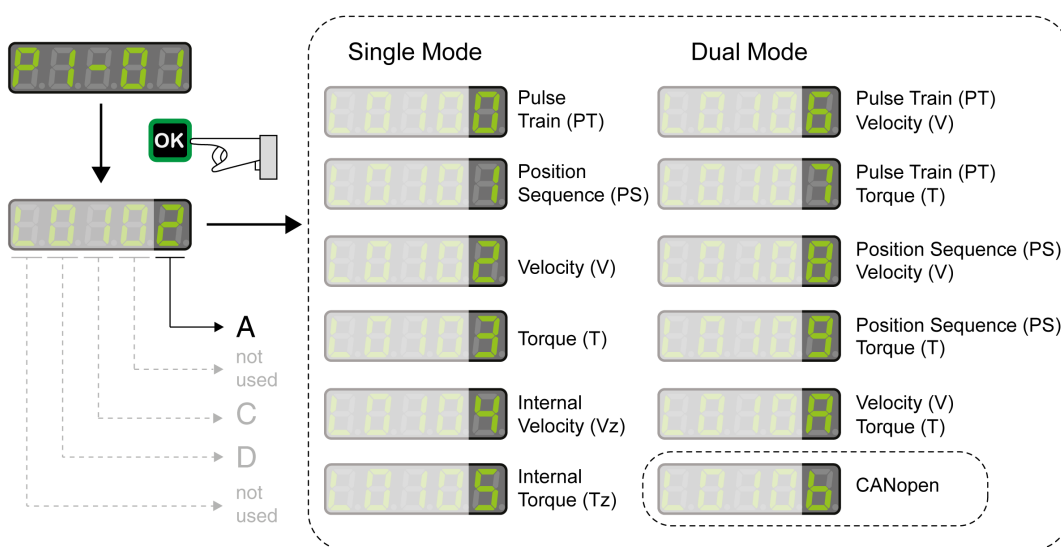
Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some parameters and other operational data do not become active until after a restart.

**⚠ 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.
- 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 modification.
- 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.**



The drive has the following types of operating modes:

- *Single Mode* operating modes
  - The drive operates in a single operating mode.
- *Dual Mode* operating modes
  - The drive operates using 2 operating modes alternately. The signal input functions are used to switch between the operating modes.
- *CANopen Mode* operating mode
  - The drive operates in the operating mode CANopen.

The operating modes Torque (T) and Torque (Tz) and the dual operating modes with Torque (T) and Torque (Tz) do not provide deceleration functionality in response to a power stage disable request. In these operating modes, the motor coasts down to a standstill in response to a power stage disable request. You must install additional equipment such as a dedicated service brake if your application requires faster deceleration of the load.

**⚠ WARNING**

**UNINTENDED EQUIPMENT OPERATION**

- During commissioning, trigger all signals and simulate all conditions that cause a power stage disable request in order to verify that all loads come to a secure standstill when the power stage is disabled under maximum load conditions.
- Install a dedicated service brake if removal of power to the motor does not meet the requirements of your application.

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

## Object units

### Overview

Two objects are used to set the gear ratio and the feed constant conversion factors, each of which has two subindex.

These objects have four equivalent variables:

Item	Object		Description
Feed constant	6092:1 <sub>h</sub>	Feed Unit conversion numerator	Conversion factors of the user-defined position unit.  Used to multiply the motor revolution (rotary motors) or the motor pitch (linear motors), according to the configured motor type.
	6092:2 <sub>h</sub>	Shaft revolutions Unit conversion denominator	
Gear ratio	6091:1 <sub>h</sub>	Motor revolutions Motor shaft scaling for the fieldbus gear ratio	Conversion factor of the motor shaft revolution.
	6091:2 <sub>h</sub>	Shaft revolutions Drive shaft scaling for the fieldbus gear ratio	Conversion factor of the drive shaft revolution.

It is possible to modify the subindex of both objects, but it is usually sufficient to modify only the feed constant value, as shown in the following example:

$$\text{Resolution} = (6092:1_h / 6092:2_h) \times (6091:1_h / 6091:2_h)$$

Example by unit dimensions:

Unit dimension	Examples
Position units	<p>Assuming:</p> <ul style="list-style-type: none"> <li>• 6092:1<sub>h</sub> = 360000</li> <li>• 6092:2<sub>h</sub> = 1</li> <li>• 6091:1<sub>h</sub> = 1</li> <li>• 6091:2<sub>h</sub> = 1</li> <li>• The actual position reading = 720000</li> </ul> <p>Then:</p> $720000 / [(360000 / 1) \times (1 / 1)] = 2 \text{ revolutions}$
Velocity units	<p>Assuming:</p> <ul style="list-style-type: none"> <li>• 6092:1<sub>h</sub> = 360000</li> <li>• 6092:2<sub>h</sub> = 1</li> <li>• 6091:1<sub>h</sub> = 1</li> <li>• 6091:2<sub>h</sub> = 1</li> <li>• The actual velocity reading = 720000</li> </ul> <p>Then:</p> $720000 / [(360000 / 1) \times (1 / 1)] = 2 \text{ revolutions per second}$
Acceleration units	<p>Assuming:</p> <ul style="list-style-type: none"> <li>• 6092:1<sub>h</sub> = 360000</li> <li>• 6092:2<sub>h</sub> = 1</li> <li>• 6091:1<sub>h</sub> = 1</li> <li>• 6091:2<sub>h</sub> = 1</li> <li>• The actual acceleration reading = 720000</li> </ul> <p>Then:</p> $720000 / [(360000 / 1) \times (1 / 1)] = 2 \text{ revolutions per second}^2$
Current units	<p>The units are derived from object 6075<sub>h</sub> (Motor Rated Current)</p> <p>The value of this object is user-defined, in mA.</p> <p>After setting a value for 6075<sub>h</sub>, all other current objects must receive values defined in 1/1000 (one-thousandth) of 6075<sub>h</sub>.</p> <p>For example:</p> <p>Assuming 6075<sub>h</sub> has a value of 20000 mA, then to set a value of 15000 mA for 6073<sub>h</sub> (Maximum Current), write 750 for 6073<sub>h</sub>.</p> <p>The calculation is:</p> $(750 / 1000) \times 20000 = 15000 \text{ mA}$

## Examples of Rotary Motor with Gear or Rotary to Linear Motion Translation Device

When using a gear or rotary-to-linear motion translation device, set values for the translation ratio of the gear in order to define the unit variables.

Using a ball screw that converts	Object values to set
1 motor revolution to 155 mm	6092:1 <sub>h</sub> = 1550 6092:2 <sub>h</sub> = 1 6091:1 <sub>h</sub> = 1 6091:2 <sub>h</sub> = 1

This units will be as follows:

- Position in 0.1 mm
- Velocity in 0.1 mm/sec
- Acceleration in 0.1 mm.sec<sup>2</sup>

# Jog Operation

## Jog Operation

### Description

In the Jog operation, a movement is made from the actual motor position in the specified direction.

The parameter *P4-05* is used to set the velocity for the movement in the unit rpm.

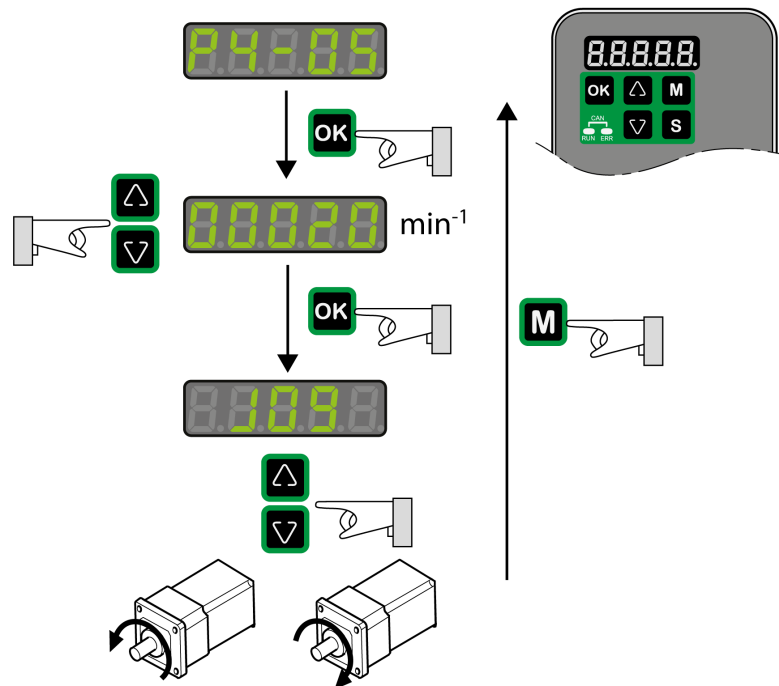
The movement can be performed via the arrow keys at the HMI or via the signal input functions JOGP and JOGN.

For further information on the parameterizable signal input functions, refer to *Setting the Digital Signal Inputs*, page 271.

### Jog Via HMI

If the HMI is used, the movements are performed via the arrow keys. The operating mode is terminated via the **M** key.

If the HMI is used, the movements are performed via the arrow keys. The operating mode is terminated via the **M** key.



## Operating Mode Pulse Train (PT)

### Operating mode Pulse Train (PT)

#### Description

In the operating mode Pulse Train (PT), movements are carried out according to externally supplied reference value signals. A position reference value is calculated on the basis of these external reference values plus an adjustable gear

ratio. The reference value signals can be A/B signals, P/D signals or CW/CCW signals.

## Method

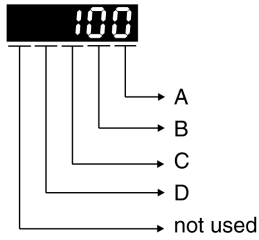
A movement can be made using one of 3 methods:

- Position synchronization without compensation movement  
 In the case of position synchronization without compensation movement, the movement is made synchronously (position synchronicity) with the supplied reference value signals. Reference value signals supplied during an interruption are not taken into account.
- Position synchronization with compensation movement  
 In the case of position synchronization with compensation movement, the movement is made synchronously (position synchronicity) with the supplied reference value signals. Reference value signals supplied during an interruption are taken into account and compensated for.
- Velocity synchronization  
 In the case of velocity synchronization, the movement is made synchronously (velocity synchronicity) with the supplied reference value signals.

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
P8-31 GEARING_MODE	Method for Operating Mode Pulse Train (PT)	-	u16	Modbus 93E <sub>h</sub>
	Applicable operating mode: PT	0	RW	CANopen 481F <sub>h</sub>
	Value 0: Synchronization deactivated	1	per.	
	Value 1: Position synchronization without compensation movement	3		
	Value 2: Position synchronization with compensation movement	Decimal		
	Value 3: Velocity synchronization			
	The parameters for acceleration (P1-34), deceleration (P1-35) and velocity (P1-55) act as limitations for the synchronization.			

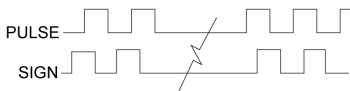

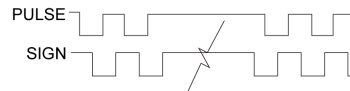
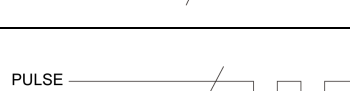


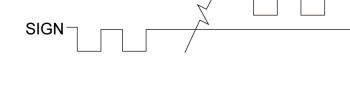
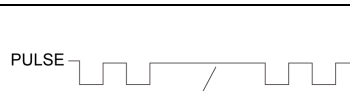




## Pulse Settings

The parameter *P1-00* lets you specify the type of reference value signals, the input polarity, the maximum signal frequency and the source of the pulses.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P1-00 PTT	<p>Reference Value Signal - Pulse Settings</p> <p>Applicable operating mode: PT</p>  <p>This parameter is used to configure the reference value signals for the operating mode PT.</p> <p>A: Type of reference value signals B: Signal frequency C: Input polarity D: Source of reference value signals</p> <p>Setting can only be modified if power stage is disabled.</p>	- 0 <sub>h</sub> 2 <sub>h</sub> 1132 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 200 <sub>h</sub> CANopen 4100 <sub>h</sub>

## Settings A and C

Type of reference value signals and input polarity

-	<b>C = 0</b> Positive input polarity		<b>C = 1</b> Negative input polarity	
	Positive direction of movement	Negative direction of movement	Positive direction of movement	Negative direction of movement
<b>A = 0</b> A/B signals				
<b>A = 1</b> CW/CCW signals				
<b>A = 2</b> P/D signals				

## Setting B

Maximum signal frequency:

-	Low-speed pulses PULSE, SIGN	High-speed pulses HPULSE, HSIGN		
<b>B = 0</b>	500 Kpps <sup>(1)</sup>	4 Mpps		
<b>B = 1</b>	200 Kpps	2 Mpps		
<b>B = 2</b>	100 Kpps	1 Mpps		
<b>B = 3</b>	50 Kpps	500 Kpps		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 2px;">(1)</td> <td style="padding: 2px;">Only possible with RS422.</td> </tr> </table>			(1)	Only possible with RS422.
(1)	Only possible with RS422.			

Parameter *P2-65* bit 6 allows you to set an error response for frequencies exceeding the maximum signal frequency by more than 10 %.

## Setting D

Source of the pulses:

<b>D = 0</b>	Low-speed pulses	CN1 Terminal: PULSE, SIGN
<b>D = 1</b>	High-speed pulses	CN1 Terminal: HPULSE, HSIGN

The source of the pulses can also be set via the signal input function PTCMS. The settings of the signal input function take priority over the settings of the parameter *P1-00*.

## Gear Ratio

The gear ratio is the ratio of the number of motor increments and the number of reference increments.

The reference increments are supplied as reference value signals via the signal inputs.

$$\text{Gear factor} = \frac{\text{Motor increments}}{\text{Reference increments}} = \frac{\text{Gear factor numerator}}{\text{Gear factor denominator}}$$

With the factory setting for the gear ratio, 100000 reference increments correspond to one revolution.

There are 1280000 motor increments per revolution.

## Parameterization

You can set up 4 gear ratios. It is possible to switch between these gear ratios via the signal inputs.

The gear ratios are set via parameters *P1-44*, *P1-45*, *P2-60*, *P2-61*, and *P2-62*.

You can switch between the gear ratios with the signal input functions *GNUM0* and *GNUM1*.



GNUM1	GNUM0	=
0	0	$\frac{P1-44}{P1-45}$
0	1	$\frac{P2-60}{P1-45}$
1	0	$\frac{P2-61}{P1-45}$
1	1	$\frac{P2-62}{P1-45}$

In order to switch between the gear ratios via the signal inputs, you must first parameterize the signal input functions GNUM0 and GNUM1, refer to [Setting the Digital Signal Inputs](#), page 271.

### Example 1

Calculation of number of motor revolutions corresponding to 30000 PUU:

$$30000 \text{ PUU} \times \frac{P1-44 = 128}{P1-45 = 10} = 384000 \rightarrow \frac{384000}{1280000} = 0,3 \text{ (M)}$$

### Example 2

Calculation of gear ratio if 10000 PUU are to effect 500 revolutions of the motor shaft:

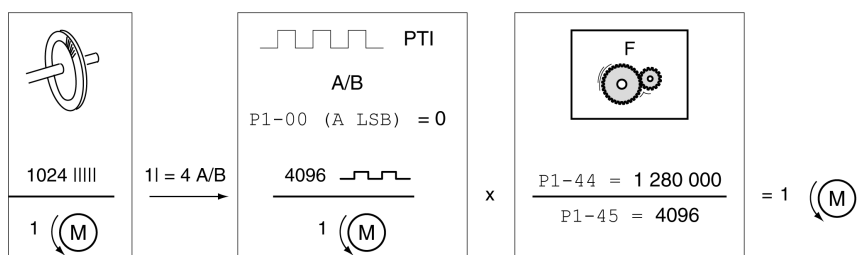
$$10000 \text{ PUU} = 500 \text{ (M)} \rightarrow \frac{P1-44 = ?}{P1-45 = ?}$$

$$\frac{1280000}{1 \text{ (M)}} \rightarrow \frac{1280000 \times 500}{1 \text{ (M)} \times 10000} = \frac{128 \times 500}{\text{(M)} \times 1}$$

$$\rightarrow \frac{P1-44 = 128 \times 500}{P1-45 = 1}$$

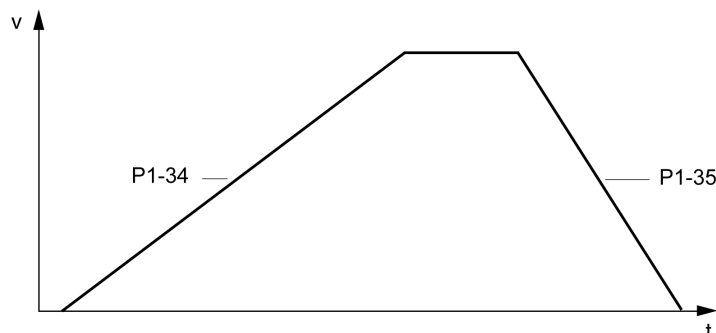
### Example 3

A machine encoder with 1024 lines per revolution is to effect one revolution of the motor shaft with one revolution.



## Acceleration and Deceleration Limitation

The parameters P1-34 and P1-35 allow you to set a limitation for the acceleration and deceleration.



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P1-34 TACC	<p>Acceleration Period</p> <p>Applicable operating mode: PT, V</p> <p>The acceleration period is the time in milliseconds required to accelerate from motor standstill to 6000 rpm.</p> <p>For operating mode V, this parameter specifies the acceleration.</p> <p>For operating mode PT, this parameter specifies an acceleration limitation for the pulses at the PTI interface.</p>	<p>ms</p> <p>6</p> <p>30</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 244<sub>h</sub></p> <p>CANopen 4122<sub>h</sub></p>
P1-35 TDEC	<p>Deceleration Period</p> <p>Applicable operating mode: PT, V</p> <p>The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill.</p> <p>For operating mode V, this parameter specifies the deceleration.</p> <p>For operating mode PT, this parameter specifies a deceleration limitation for the pulses at the PTI interface.</p>	<p>ms</p> <p>6</p> <p>30</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 246<sub>h</sub></p> <p>CANopen 4123<sub>h</sub></p>

## Operating Mode Position Sequence (PS)

### Operating mode Position Sequence (PS)

#### Description

The operating mode Position Sequence (PS) allows you to set and execute 32 motion profiles in any sequence. The motion profiles are defined via 32 data sets.

The following values can be set for each data set:

- Target position
- Type of movement: Absolute or relative

- Type of transition between data sets
- Acceleration
- Target velocity
- Deceleration
- Waiting time after completion of the data set

In addition, a Homing data set is provided. This Homing data set is used to set a reference point for absolute movements.

## Configuration

The data sets are configured by means of the commissioning software LXM28 DTM Library.

## Structure of a Data Set

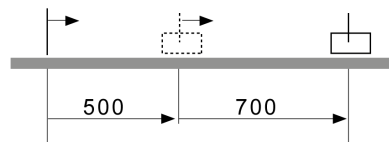
### Target Position

The target position is set in the user-defined unit. With the factory scaling, the resolution is 100000 user-defined units per revolution.

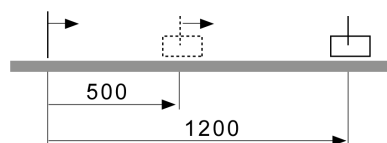
For further information on scaling, refer to chapter [Scaling](#), page 301.

### Type of Movement

In the case of a relative movement, the movement is relative with reference to the previous target position or the current motor position.



In the case of an absolute movement, the movement is absolute with reference to the zero point.



Homing or position setting is required before the first absolute movement can be performed.

## Transition Between Data Sets

There are two types of transitions:

- The subsequent data set is only started after the preceding data set has been completed.
- The subsequent data set is started as soon as it is triggered via the signal input function CTRG or the parameter P5-07.

## Acceleration Period

The acceleration period is the time in milliseconds required to accelerate from motor standstill to 6000 rpm. It is used to set the acceleration ramp.

## Target Velocity

The target velocity is reached after the time required for acceleration has passed.

## Deceleration Period

The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill. It is used to set the deceleration ramp.

## Waiting Time

The waiting time is the period of time that must pass after the target position has been reached for the data set to be considered completed.

## Parameters for the Data Sets

The data set are configured via parameters P6-02 ... P6-65 and P7-02 ... P7-65. The following table provides an overview:

Data set	Target position	Type / transition	Acceleration / deceleration	Waiting time / target velocity
1	P6-02	P6-03	P7-02	P7-03
2	P6-04	P6-05	P7-04	P7-05
3	P6-06	P6-07	P7-06	P7-07
4	P6-08	P6-09	P7-08	P7-09
5	P6-10	P6-11	P7-10	P7-11
6	P6-12	P6-13	P7-12	P7-13
7	P6-14	P6-15	P7-14	P7-15
8	P6-16	P6-17	P7-16	P7-17
9	P6-18	P6-19	P7-18	P7-19
10	P6-20	P6-21	P7-20	P7-21
11	P6-22	P6-23	P7-22	P7-23
12	P6-24	P6-25	P7-24	P7-25
13	P6-26	P6-27	P7-26	P7-27
14	P6-28	P6-29	P7-28	P7-29
15	P6-30	P6-31	P7-30	P7-31
16	P6-32	P6-33	P7-32	P7-33
17	P6-34	P6-35	P7-34	P7-35
18	P6-36	P6-37	P7-36	P7-37
19	P6-38	P6-39	P7-38	P7-39
20	P6-40	P6-41	P7-40	P7-41
21	P6-42	P6-43	P7-42	P7-43
22	P6-44	P6-45	P7-44	P7-45
23	P6-46	P6-47	P7-46	P7-47
24	P6-48	P6-49	P7-48	P7-49
25	P6-50	P6-51	P7-50	P7-51

Data set	Target position	Type / transition	Acceleration / deceleration	Waiting time / target velocity
26	P6-52	P6-53	P7-52	P7-53
27	P6-54	P6-55	P7-54	P7-55
28	P6-56	P6-57	P7-56	P7-57
29	P6-58	P6-59	P7-58	P7-59
30	P6-60	P6-61	P7-60	P7-61
31	P6-62	P6-63	P7-62	P7-63
32	P6-64	P6-65	P7-64	P7-65

## Running Data Sets

### Running Individual Data Sets

Individual data sets are selected via the signal input functions POS0 ... POS4.

The following table shows the bit pattern used to select the data sets.

Data set	POS4	POS3	POS2	POS1	POS0
1	0	0	0	0	0
2	0	0	0	0	1
3	0	0	0	1	0
4	0	0	0	1	1
5	0	0	1	0	0
...	...	...	...	...	...
31	1	1	1	1	0
32	1	1	1	1	1

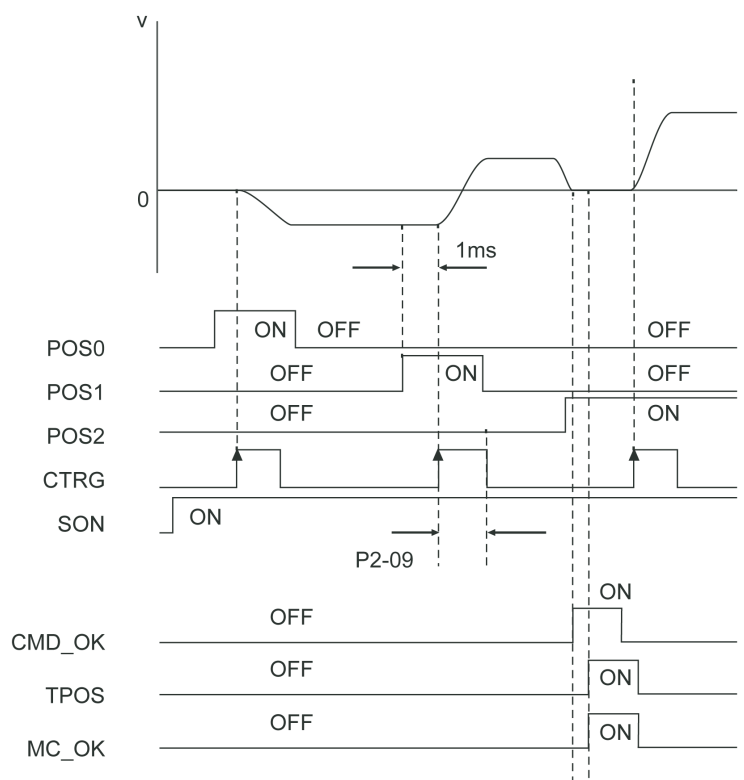
The selected data set is executed and the movement started via the signal input function CTRG, rising edge, or via the parameter *P5-07*.

For further information on parameterizing the signal input functions, refer to *Setting the Digital Signal Inputs*, page 271.

### Example of Running Individual Data Sets

The illustration below shows how the data sets are started and terminated via the signal input functions and the signal output functions CMD\_OK, TPOS and MC\_OK:

## Operating mode Position Sequence (PS)



For further information, refer to [Setting the Digital Signal Inputs](#), page 271.

## Running Sequences of Data Sets via the Signal Input Functions AUTOR and STEPB

The signal input function AUTOR allows you to automatically execute a sequence of the 32 available data sets. When this signal input function is activated, data sets 1 to 32 are executed one after the other with the values set via the appropriate parameters for each data set (*P6-02 ... P6-65* and *P7-02 ... P7-65*).

After the last data is completed, the sequence restarts with the first data set. This loop continues as long as the signal input function AUTOR is active.

If any of the 32 data sets contains an absolute movement, successful homing is required before the signal input function AUTOR can be used.

The signal input function AUTOR is level-triggered.

If the execution of a data set is interrupted and AUTOR is active again, the data set is resumed where it was interrupted.

If the signal input function AUTOR is deactivated, the currently active data set is completed. You can use the signal input function STEPB to return to the first of the 32 data sets.

The parameter *P2-44* can be used to provide information on the running sequence of data sets via the digital outputs. For further information, refer to [Status of Data Set Sequences - Parameter P2-44](#), page 299.

For further information on assigning signal input functions to the digital inputs, refer to [Setting the Digital Signal Inputs](#), page 271.

## Running Sequences of Data Sets via the Signal Input Functions STEPUP, STEPD, and STEPB

The signal input functions STEPUP and STEPD allow you to run data sets in ascending or descending order.

Successful homing is required before the signal input function STEPUP and STEPD can be used.

When the signal input function STEPUP is activated via a rising edge at the digital input to which the signal input function STEPUP is assigned, the first of the 32 data sets is executed with the values set via the parameters (*P6-02 ... P6-03* and *P7-02 ... P7-03*).

Each subsequent rising edge at the digital input to which the signal input function STEPUP is assigned starts the next data set in the sequence. A falling edge at the digital input has no effect. If a rising edge is detected at the digital input, the next data set is started immediately if the target position has been reached, even if the waiting time set for the data set currently being executed has not yet elapsed.

When the last data set (data set 32) is reached with the signal input function STEPUP, a further rising edge at the corresponding input has no effect. Use the signal input functions STEPB to return to the first data set (data set 1).

The signal input function STEPD works like the signal input function STEPUP, but instead of the next data set, it starts the preceding data set.

You can use the signal input function STEPB to return to the first of the 32 data sets.

The parameter *P2-44* can be used to provide information on the running sequence of data sets via the digital outputs. For further information, refer to *Status of Data Set Sequences - Parameter P2-44*, page 299.

For further information on assigning signal input functions to the digital inputs, refer to *Setting the Digital Signal Inputs*, page 271.

## Status of Data Set Sequences

Parameter *P2-44* allows you to output information on the status of the sequence of data sets processed with the signal input functions AUTOR, STEPB, STEPUP, and STEPD.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
<i>P2-44</i> AUTOR_DOMS	<p>Status of Data Set Sequences in Operating Mode PS</p> <p>Applicable operating mode: PS</p> <p>This parameter provides information on the status of the sequence of data sets.</p> <p>Value 0: The functions assigned to the digital outputs DO1 ... DO6 via the parameters <i>P2-18 ... P2-23</i> are active.</p> <p>Value 1: The digital outputs provide information on the status of the sequence of data sets.</p> <p>When this parameter is reset to 0, the previous assignments and configurations of the digital outputs as set via the parameters <i>P2-18 ... P2-23</i> are restored.</p>	- 0 <sub>h</sub> 0 <sub>h</sub> 1 <sub>h</sub> Hexadecimal	u16 RW per.	Modbus 358 <sub>h</sub> CANopen 422C <sub>h</sub>

The following table shows the meanings of the bit patterns available via the digital outputs when the parameter *P2-44* is set to 1:

Item	DO6	DO5	DO4	DO3	DO2	DO1	Meaning
1	0	0	0	0	0	0	Error detected
2	0	0	0	0	0	1	Operating state Operation Enabled
3	0	0	0	0	1	0	Homing in progress
4	0	0	0	0	1	1	Homing completed
5	0	0	0	1	0	0	Data set transition in progress
6	0	0	0	1	0	1	Data set 1 target position reached
7	0	0	0	1	1	0	Data set 2 target position reached
8	0	0	0	1	1	1	Data set 3 target position reached
9	0	0	1	0	0	0	Data set 4 target position reached
10	0	0	1	0	0	1	Data set 5 target position reached
11	0	0	1	0	1	0	Data set 6 target position reached
12	0	0	1	0	1	1	Data set 7 target position reached
13	0	0	1	1	0	0	Data set 8 target position reached
14	0	0	1	1	0	1	Data set 9 target position reached
15	0	0	1	1	1	0	Data set 10 target position reached
16	0	0	1	1	1	1	Data set 11 target position reached
17	0	1	0	0	0	0	Data set 12 target position reached
18	0	1	0	0	0	1	Data set 13 target position reached
19	0	1	0	0	1	0	Data set 14 target position reached
20	0	1	0	0	1	1	Data set 15 target position reached
21	0	1	0	1	0	0	Data set 16 target position reached
22	0	1	0	1	0	1	Data set 17 target position reached
23	0	1	0	1	1	0	Data set 18 target position reached
24	0	1	0	1	1	1	Data set 18 target position reached
25	0	1	1	0	0	0	Data set 20 target position reached
26	0	1	1	0	0	1	Data set 21 target position reached
27	0	1	1	0	1	0	Data set 22 target position reached
28	0	1	1	0	1	1	Data set 23 target position reached
29	0	1	1	1	0	0	Data set 24 target position reached
30	0	1	1	1	0	1	Data set 25 target position reached
31	0	1	1	1	1	0	Data set 26 target position reached
32	0	1	1	1	1	1	Data set 27 target position reached
33	1	0	0	0	0	0	Data set 28 target position reached
34	1	0	0	0	0	1	Data set 29 target position reached
35	1	0	0	0	1	0	Data set 30 target position reached
36	1	0	0	0	1	1	Data set 31 target position reached
37	1	0	0	1	0	0	Data set 32 target position reached



## Scaling

Scaling is the ratio of the number of user-defined units and the number of internal units.

The user-defined units are supplied as parameter values in the unit PUU.

$$\text{Scaling factor} = \frac{\text{Internal units}}{\text{User-defined units}} = \frac{\text{Gear factor numerator}}{\text{Gear factor denominator}}$$

With the factory setting for the scaling factor, 100000 user-defined units correspond to one revolution.

The internal units are 1280000 increments per revolution.

## Parameterization

The scaling factor is set using the parameters P1-44 and P1-45.

$$\frac{P1-44}{P1-45}$$

### Example 1

Calculation of number of motor revolutions corresponding to 30000 PUU:

$$30000 \text{ PUU} \times \frac{P1-44 = 128}{P1-45 = 10} = 384000 \rightarrow \frac{384000}{1280000} = 0,3 \text{ (M)}$$

### Example 2

Calculation of the scaling factor if 10000 PUU are to effect 500 revolutions of the motor shaft:

$$10000 \text{ PUU} = 500 \text{ (M)} \rightarrow \frac{P1-44 = ?}{P1-45 = ?}$$

$$\frac{1280000}{1 \text{ (M)}} \rightarrow \frac{\cancel{1280000} \times 500}{1 \text{ (M)} \times \cancel{10000}} = \frac{128 \times 500}{\text{(M)} \times 1}$$

$$\rightarrow \frac{P1-44 = 128 \times 500}{P1-45 = 1}$$

## Homing Data Set for Absolute Movements

The Homing data set is used to establish a reference between a mechanical position and the actual position of the motor.

A reference between a mechanical position and the actual position of the motor is generated by means of a reference movement or by means of position setting.

A successful reference movement, or position setting, homes the motor.

Homing establishes the zero point for absolute movements.

## Methods

The following methods are available:

- Reference movement to a limit switch
 

In the case of a reference movement to a limit switch, a movement to the negative limit switch or the positive limit switch is performed.

When the limit switch is reached, the 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, an additional movement can be made to the next index pulse of the motor.

The switching point of the limit switch or the position of the index pulse 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, an additional movement can be made to the next index pulse of the motor.

The switching point of the reference switch or the position of the index pulse 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 current motor position is set to a desired position value.

A reference movement must be terminated without interruption for the new zero point to be valid. If the reference movement is interrupted, it must be started again.

## Starting the Homing Data Set

The Homing data set can be started in the following ways:

- Automatic start when the power stage is enabled for the first time
 

The automatic start can be set with the parameter P6-01.
- Start via the signal input function GOTOHOME
 

The signal input function must have been parameterized, refer to *Setting the Digital Signal Inputs*, page 271.

## Setting Automatic Start and the Subsequent Data Set

The parameter P6-01 is used to set the automatic start and select a data set to be executed after completion of the Homing data set.

The parameter P7-01 is used to set a waiting time for the subsequent data set. The subsequent data set is started after the waiting time has elapsed.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P6-01 ODEF	Subsequent Data Set and Auto-start of Homing Data Set Applicable operating mode: PS Bit 0: 0 = Do not start Homing after first power stage enable 1 = Start Homing after first power stage enable Bits 1 ... 7: Reserved Bits 8 ... 15: Subsequent data set	- 0 <sub>h</sub> 0 <sub>h</sub> 2001 <sub>h</sub> Hexadecimal	u32 RW per.	Modbus 702 <sub>h</sub> CANopen 4601 <sub>h</sub>
P7-01 HOME_DLY	Waiting Time of Homing Data Set Applicable operating mode: PS Bits 0 ... 15: Waiting time until next dataset is started Bits 16 ... 31: Reserved	ms 0 0 32767 Decimal	u32 RW per.	Modbus 802 <sub>h</sub> CANopen 4701 <sub>h</sub>

## Setting Acceleration and Deceleration

The acceleration and deceleration for the Homing data set are set via the parameter P7-00.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P7-00 HOME_ACC_DEC	Deceleration and Acceleration of Homing Data Set Applicable operating mode: PS Bits 0 ... 15: Deceleration Bits 16 ... 31: Acceleration	ms ms 6  6 200  200 65500  65500 Decimal	u32 RW per.	Modbus 800 <sub>h</sub> CANopen 4700 <sub>h</sub>

## Setting Velocities

The parameters P5-05 and P5-06 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 HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P5-05 HOMESPEED1	Homing - Fast Velocity for Reference Movement Applicable operating mode: PS	0.1rpm 10 1000 60000 Decimal	u32 RW per.	Modbus 60A <sub>h</sub> CANopen 4505 <sub>h</sub>
P5-06 HOMESPEED2	Homing - Slow Velocity for Reference Movement Applicable operating mode: PS	0.1rpm 10 200 60000 Decimal	u32 RW per.	Modbus 60C <sub>h</sub> CANopen 4506 <sub>h</sub>

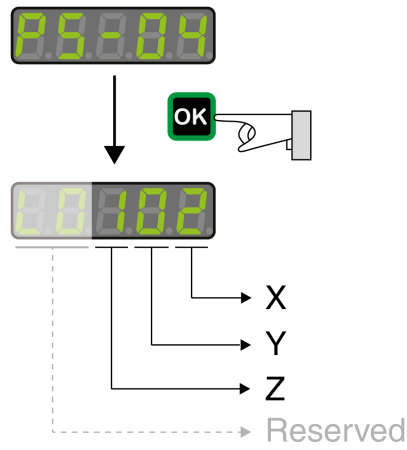
## Defining the Zero Point

The parameter P6-00 is used to specify a position value, which is set at the reference point after a successful reference movement or after position setting. This position value defines the zero point.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P6-00 ODAT	Position of Homing Data Set Applicable operating mode: PS  After a successful reference movement, this position is automatically set at the reference point. Bits 0 ... 31: Position	PUU -2147483647 0 2147483647 Decimal	s32 RW per.	Modbus 700 <sub>h</sub> CANopen 4600 <sub>h</sub>

## Selecting the Homing Method

The parameter P5-04 is used to set the Homing method.



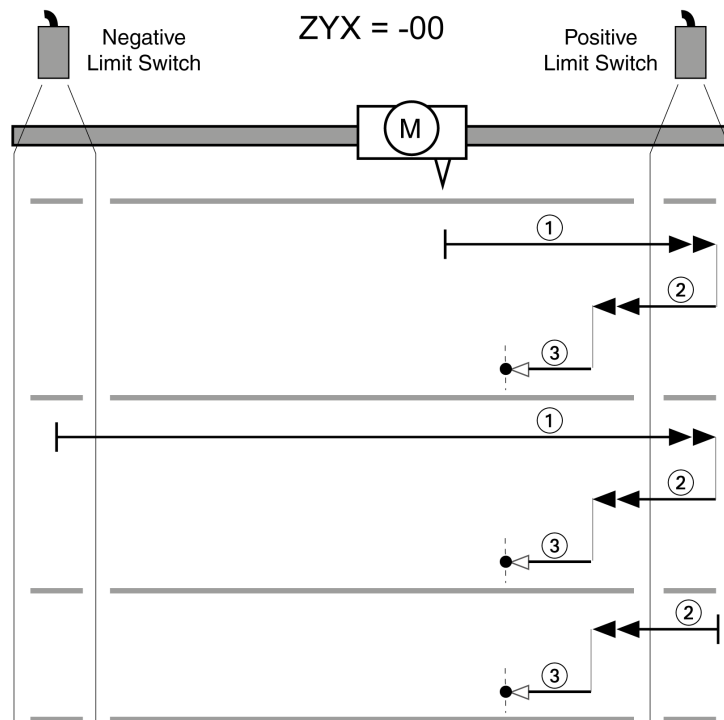
Setting Z - limit switch	Setting Y - index pulse	Settings X - Homing method	
-	Y=0: Movement back to the last index pulse	0	Movement in positive direction to the positive limit switch
-	Y=2: No movement to the index pulse	1	Movement in negative direction to the negative limit switch
Z=0: Stop after limit switch is reached and trigger alert AL014 or AL015 Z=1: Move in opposite direction after having reached the limit switch, no alert	Y=0: Movement back to the last index pulse	2	Movement in positive direction to the rising edge of the reference switch
	Y=1: Movement to the next index pulse	3	Movement in negative direction to the rising edge of the reference switch
	Y=2: No movement to the index pulse	4	Movement in positive direction to the next index pulse
	-	5	Movement in negative direction to the next index pulse
	Y=0: Movement back to the last index pulse	6	Movement in positive direction to the falling edge of the reference switch
Y=1: Movement to the next index pulse	7	Movement in negative direction to the falling edge of the reference switch	
Y=2: No movement to the index pulse	-	8	Position setting

The illustrations below show the Homing methods.

## Reference Movement to the Positive Limit Switch

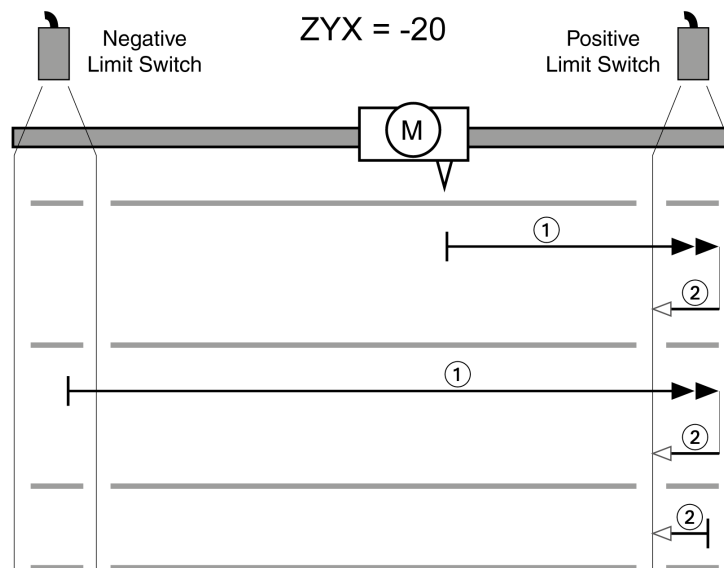
The following illustrations show reference movements to the positive limit switch from different starting positions.

Reference movement (ZYX = -00)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06

Reference movement (ZYX = -20)

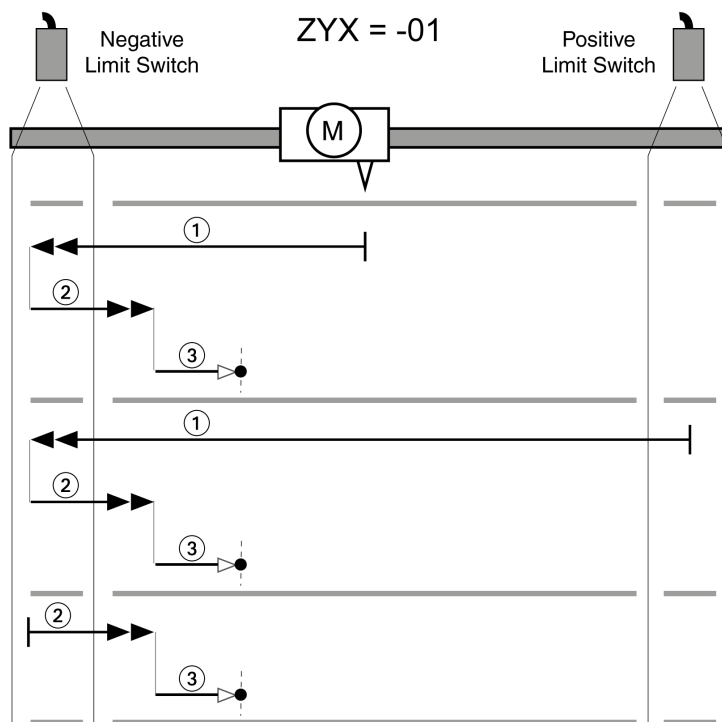


Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06

## Reference Movement to the Negative Limit Switch

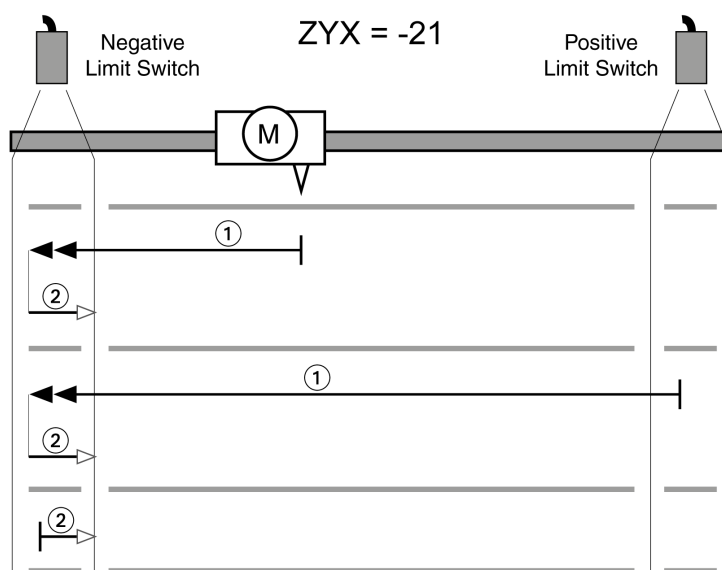
The following illustrations show reference movements to the negative limit switch from different starting positions.

Reference movement (ZYX = -01)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06

Reference movement (ZYX = -21)

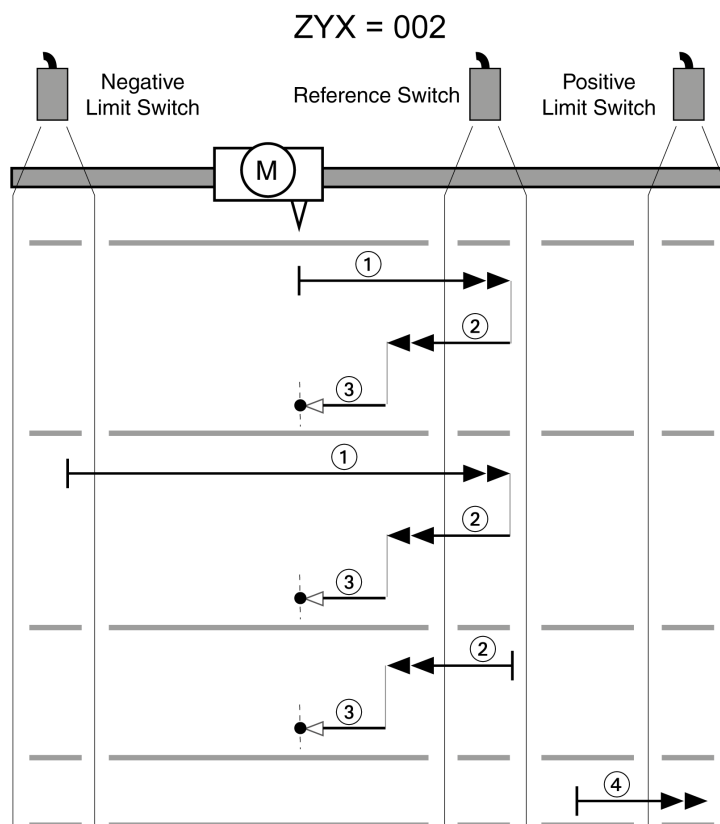


Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06

## Reference Movement in Positive Direction to the Rising Edge of the Reference Switch

The following illustrations show reference movements to the rising edge of the reference switch in positive direction from different starting positions.

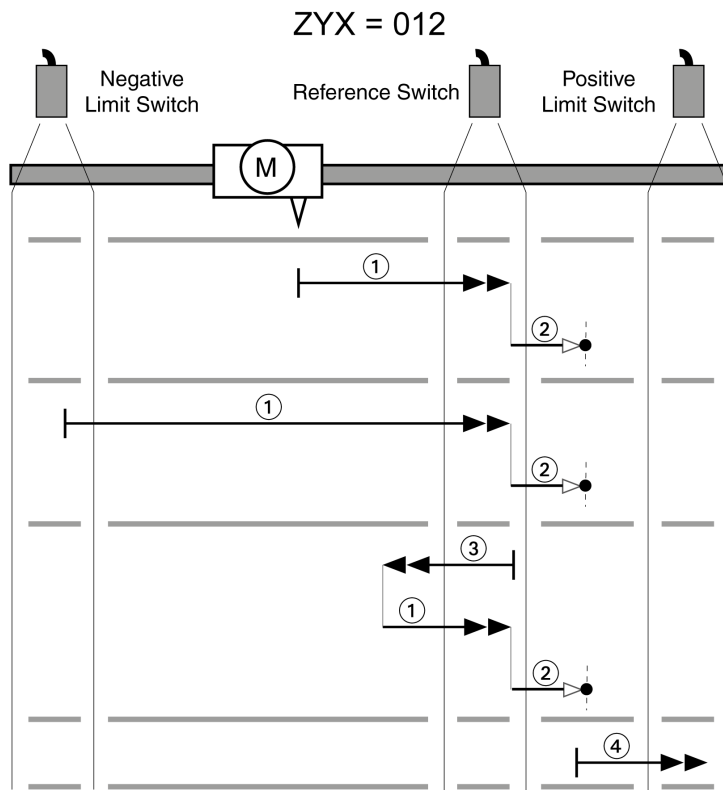
Reference movement (ZYX = 002)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

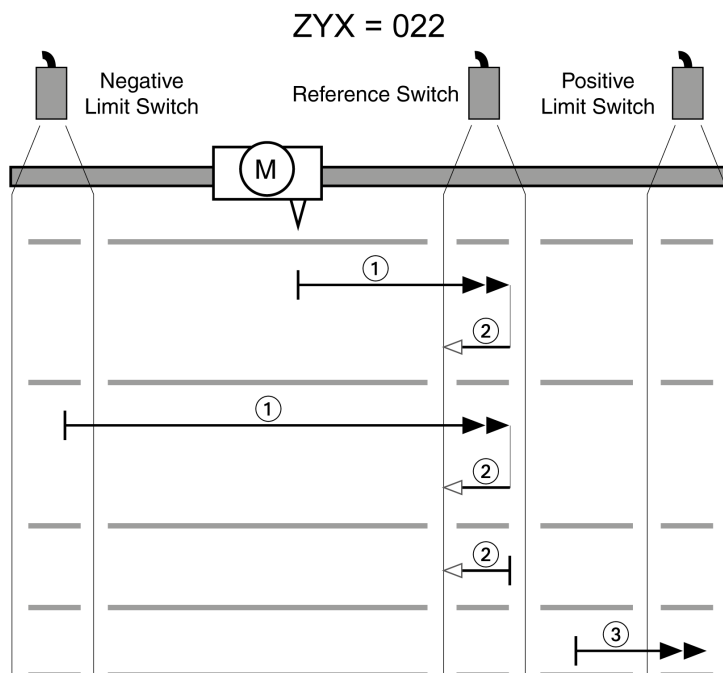


Reference movement (ZYX = 012)



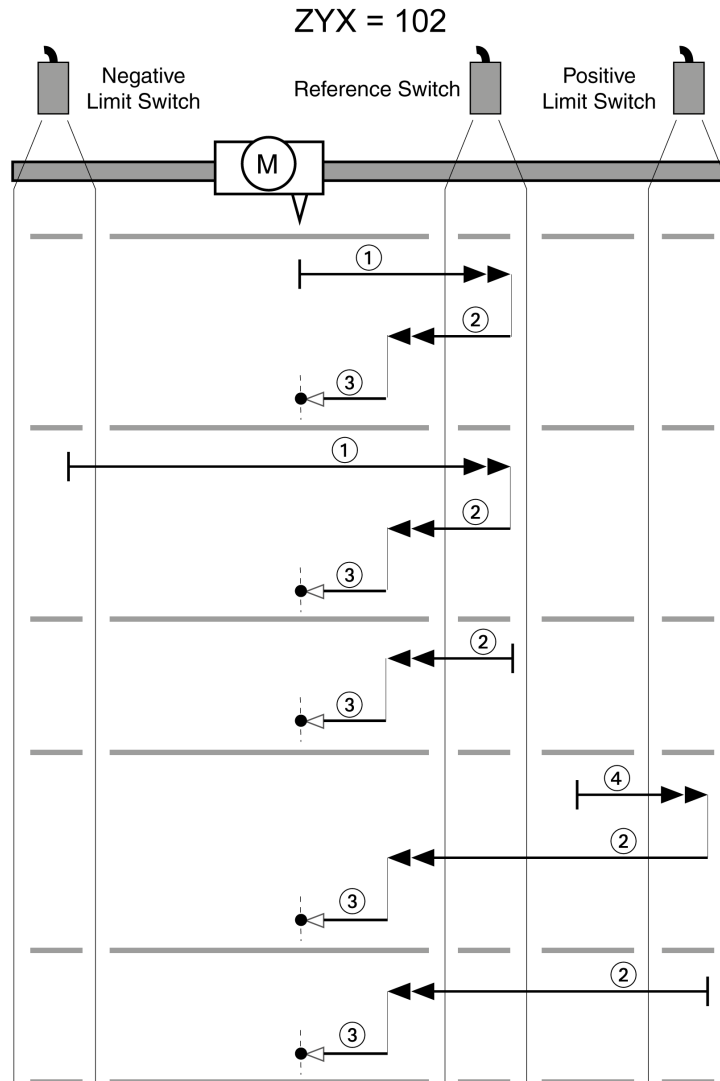
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to falling edge at velocity P5-05
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 022)



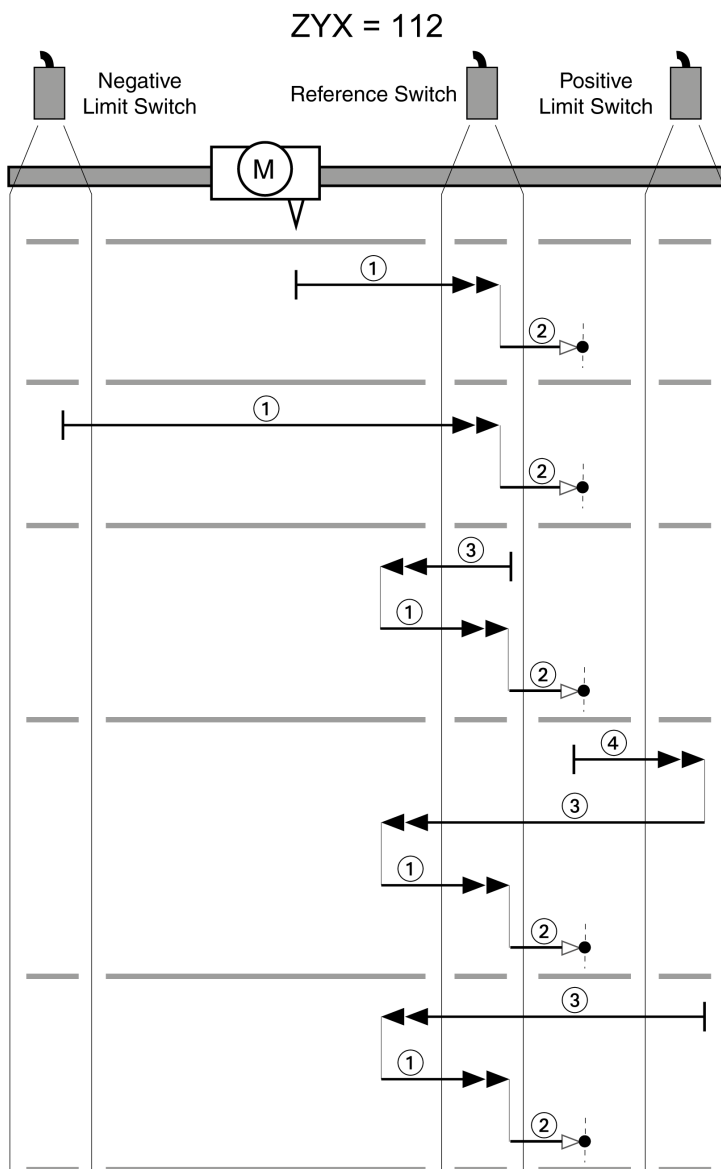
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 102)



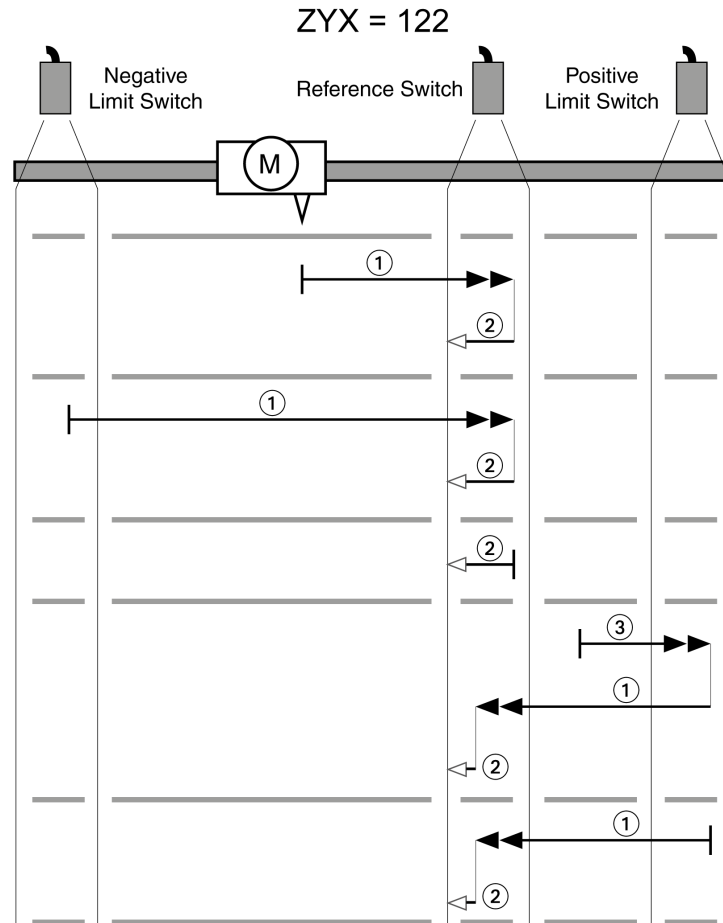
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 112)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to falling edge at velocity P5-05
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 122)

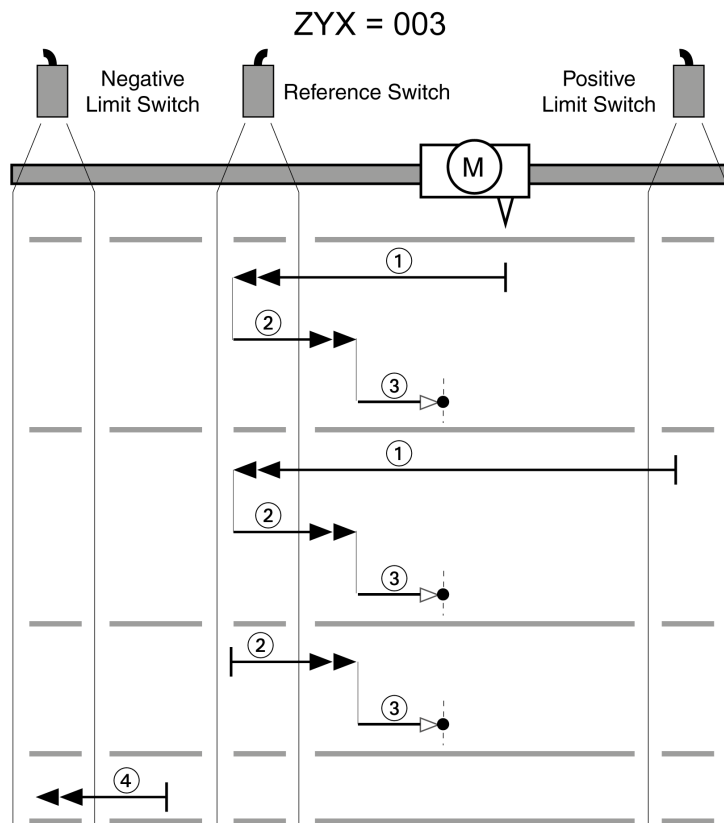


Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

## Reference Movement in Negative Direction to the Rising Edge of the Reference Switch

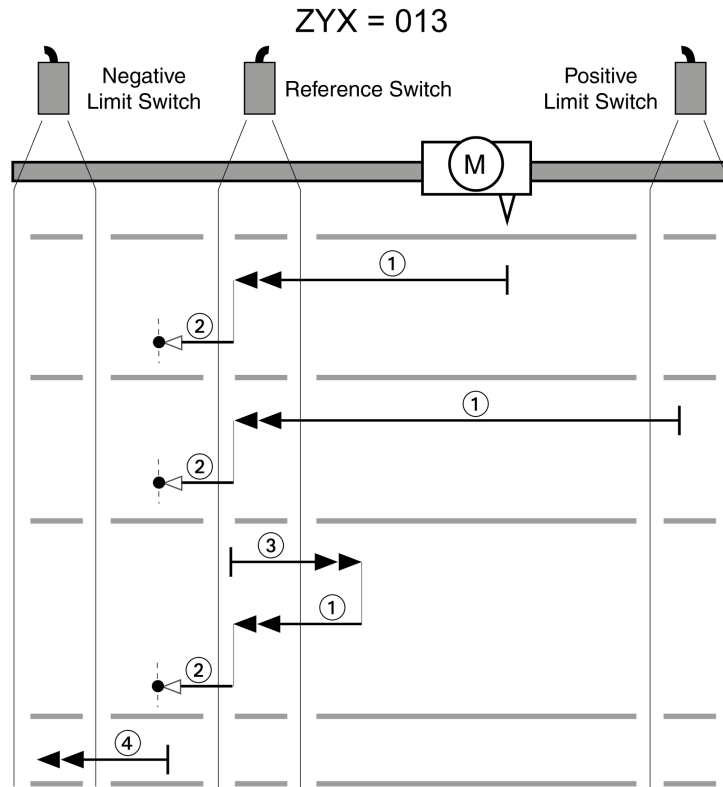
The following illustrations show reference movements to the rising edge of the reference switch in negative direction from different starting positions.

Reference movement (ZYX = 003)



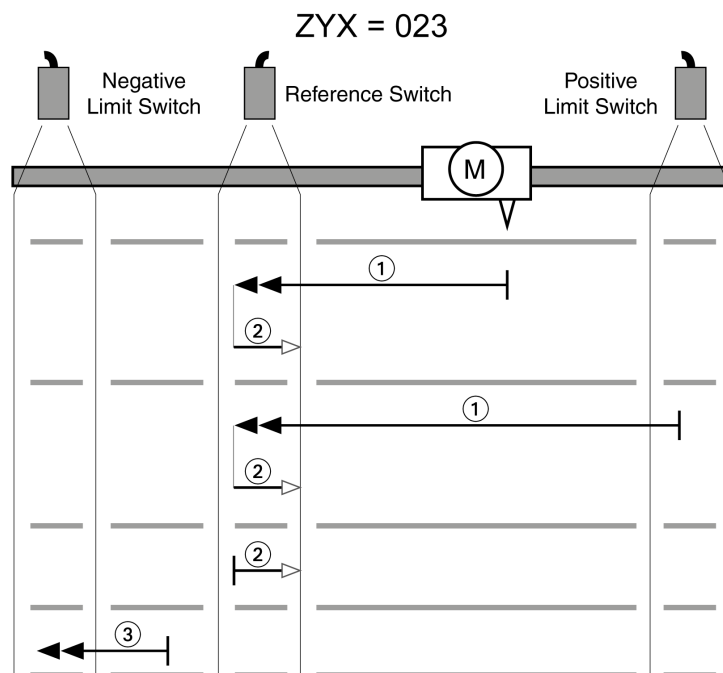
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 013)



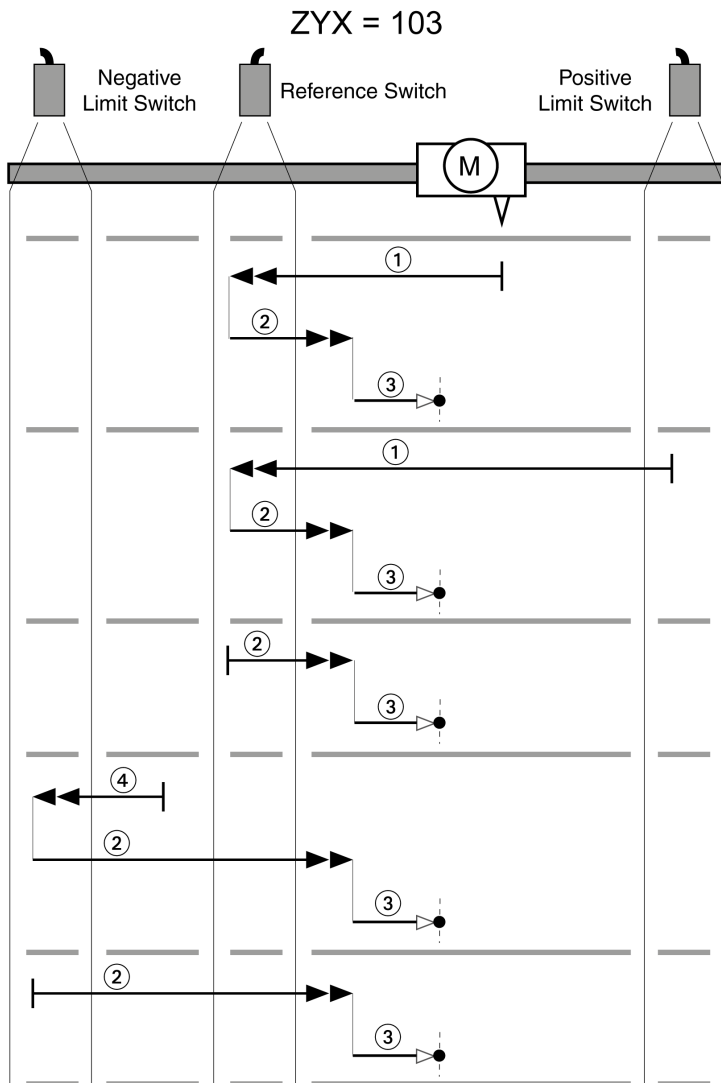
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to falling edge at velocity P5-05
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 023)



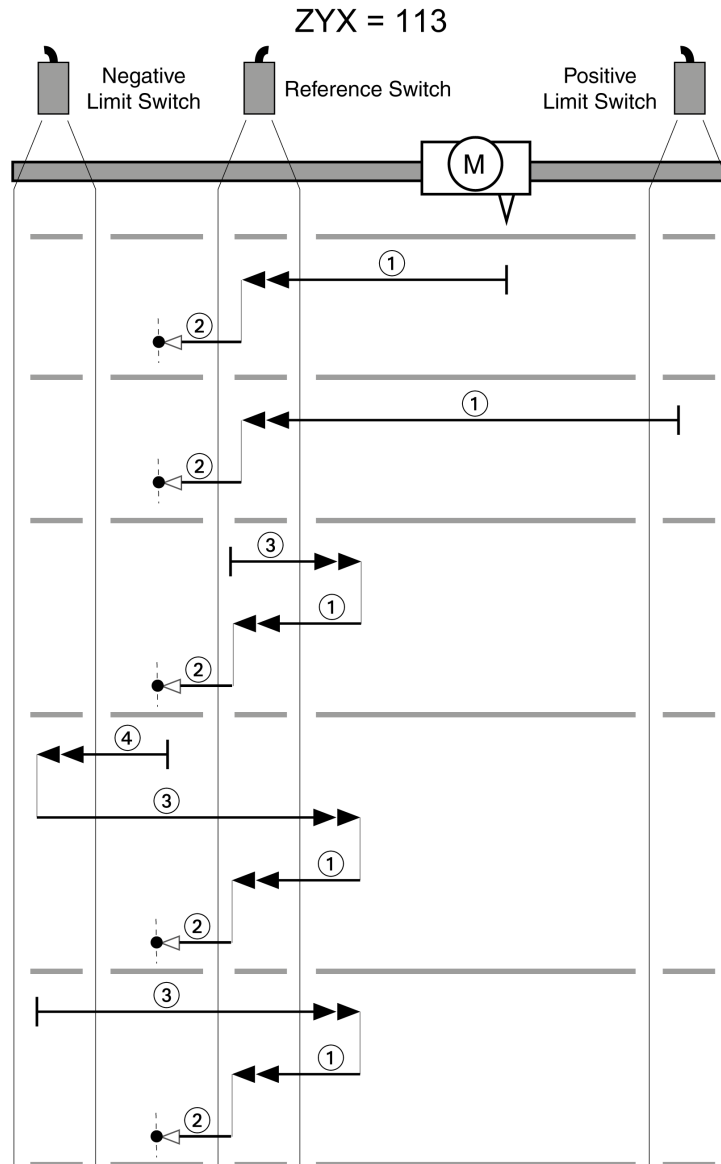
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 103)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

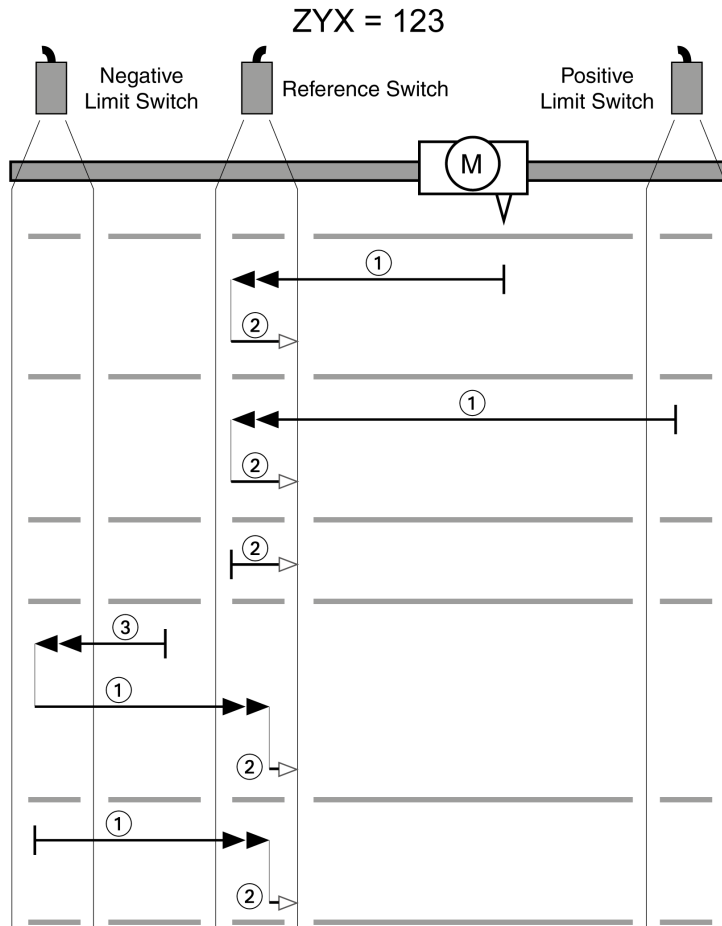
Reference movement (ZYX = 113)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to falling edge at velocity P5-05
4	Movement to the limit switch at velocity P5-05



Reference movement (ZYX = 123)

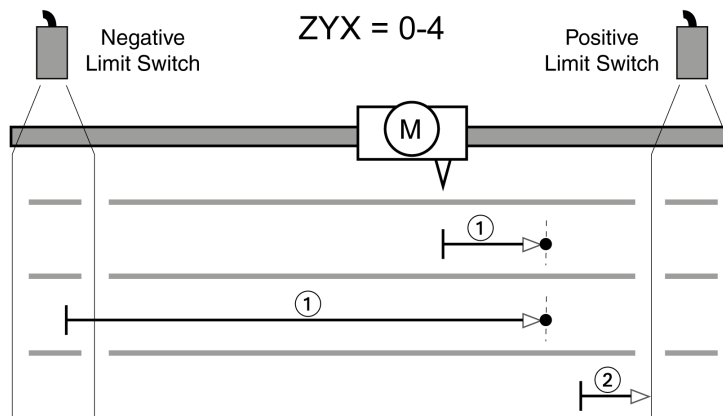


Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

## Reference Movement to the Index Pulse in Positive Direction

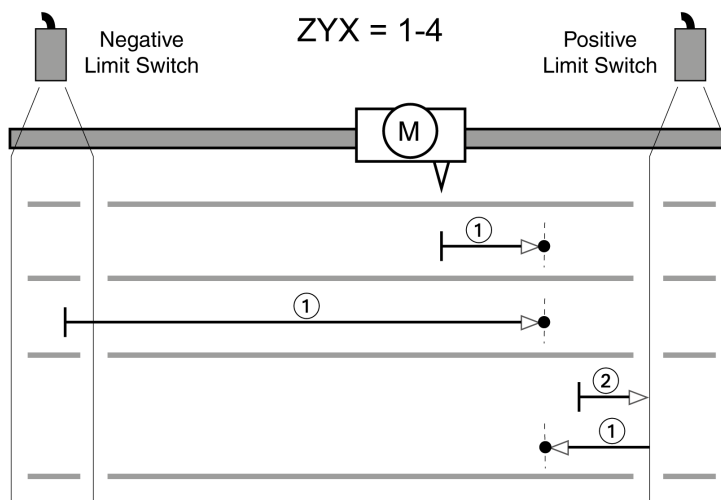
The following illustrations show reference movements to the index pulse in positive direction from different starting positions.

Reference movement (ZYX = 0-4)



Item	Description
1	Movement to the next index pulse at velocity P5-06
2	Movement to the limit switch at velocity P5-06

Reference movement (ZYX = 1-4)

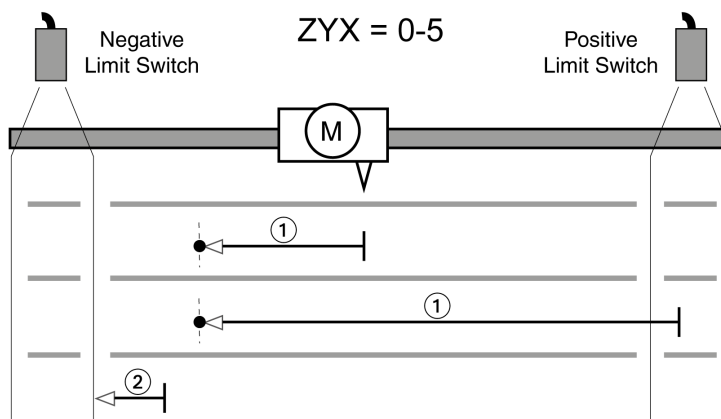


Item	Description
1	Movement to the next index pulse at velocity P5-06
2	Movement to the limit switch at velocity P5-06

## Reference Movement to the Index Pulse in Negative Direction

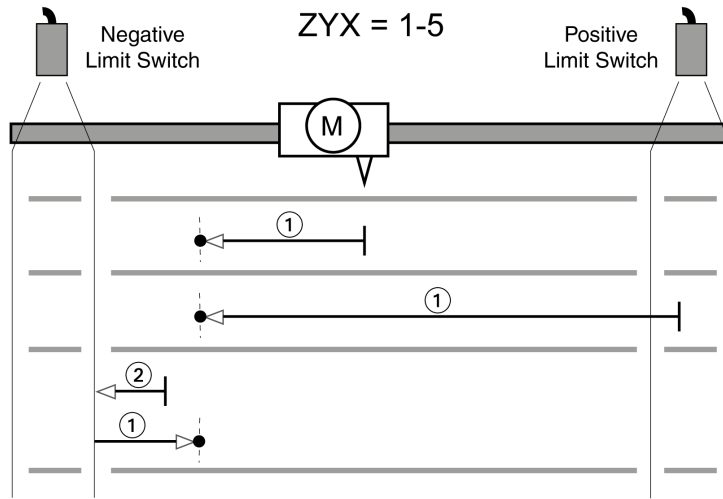
The following illustrations show reference movements to the index pulse in negative direction from different starting positions.

Reference movement (ZYX = 0-5)



Item	Description
1	Movement to the next index pulse at velocity P5-06
2	Movement to the limit switch at velocity P5-06

Reference movement (ZYX = 1-5)

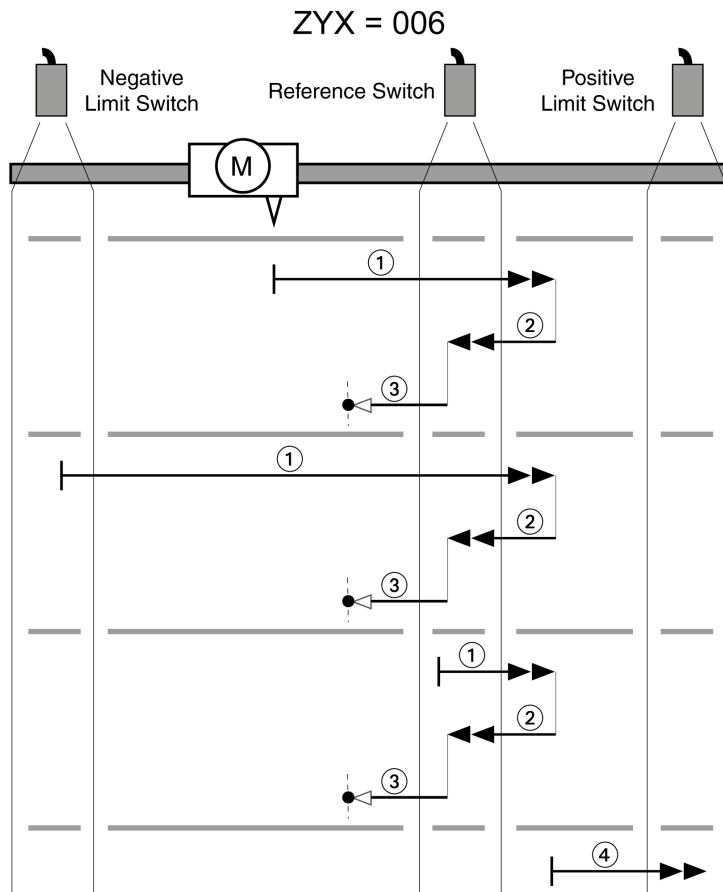


Item	Description
1	Movement to the next index pulse at velocity P5-06
2	Movement to the limit switch at velocity P5-06

**Reference Movement in Positive Direction to the Falling Edge of the Reference Switch**

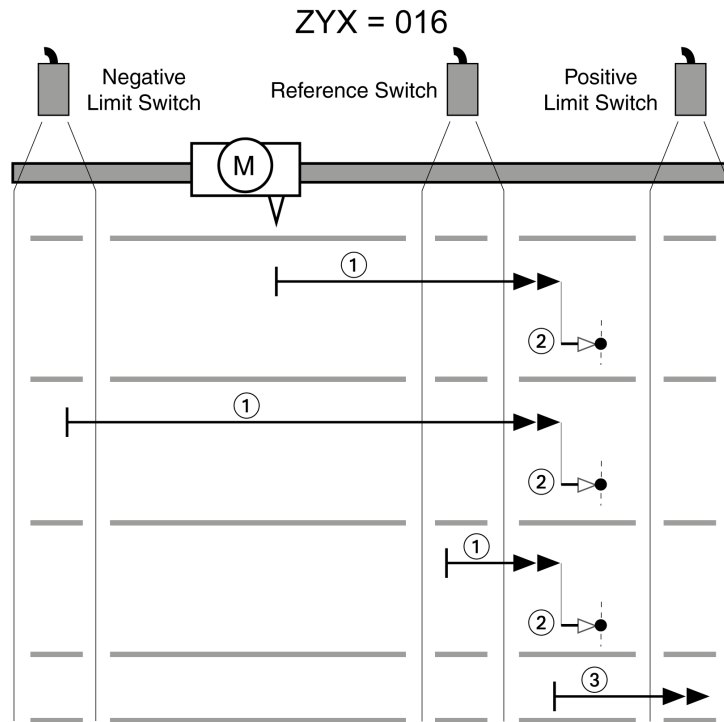
The following illustrations show reference movements to the falling edge of the reference switch in positive direction from different starting positions.

Reference movement (ZYX = 006)



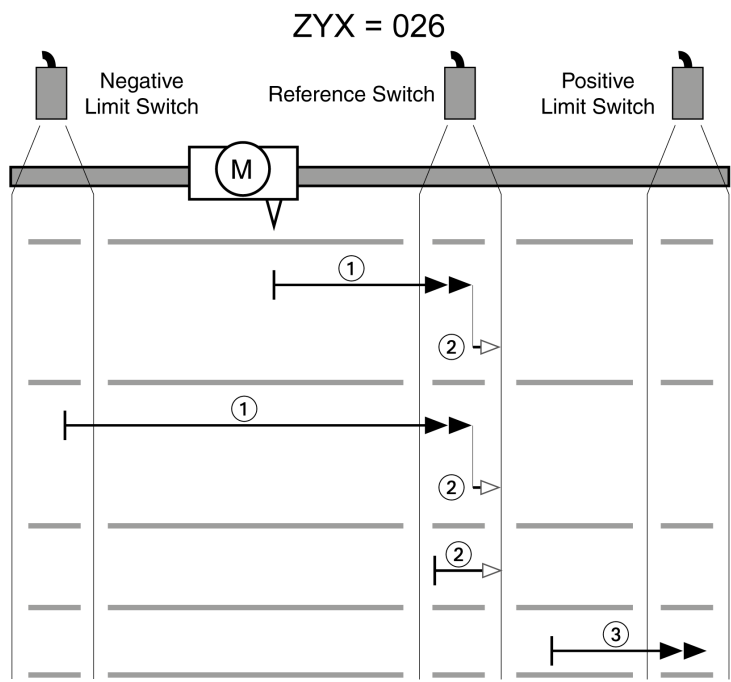
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to rising edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 016)



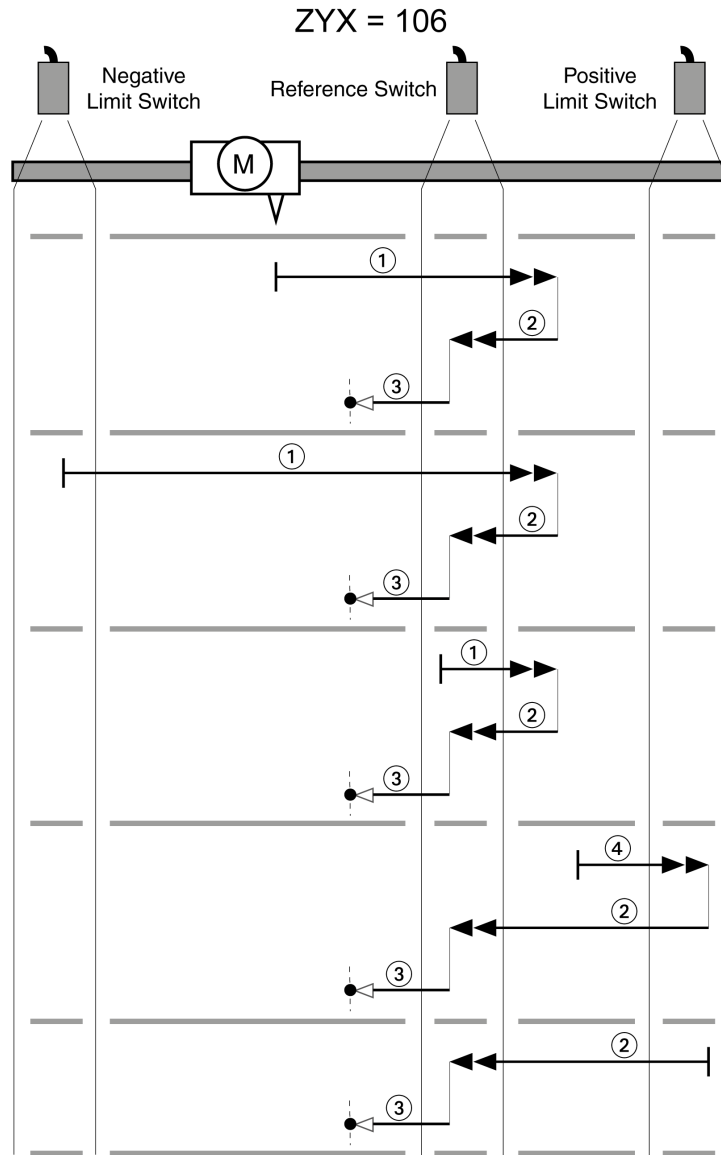
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 026)



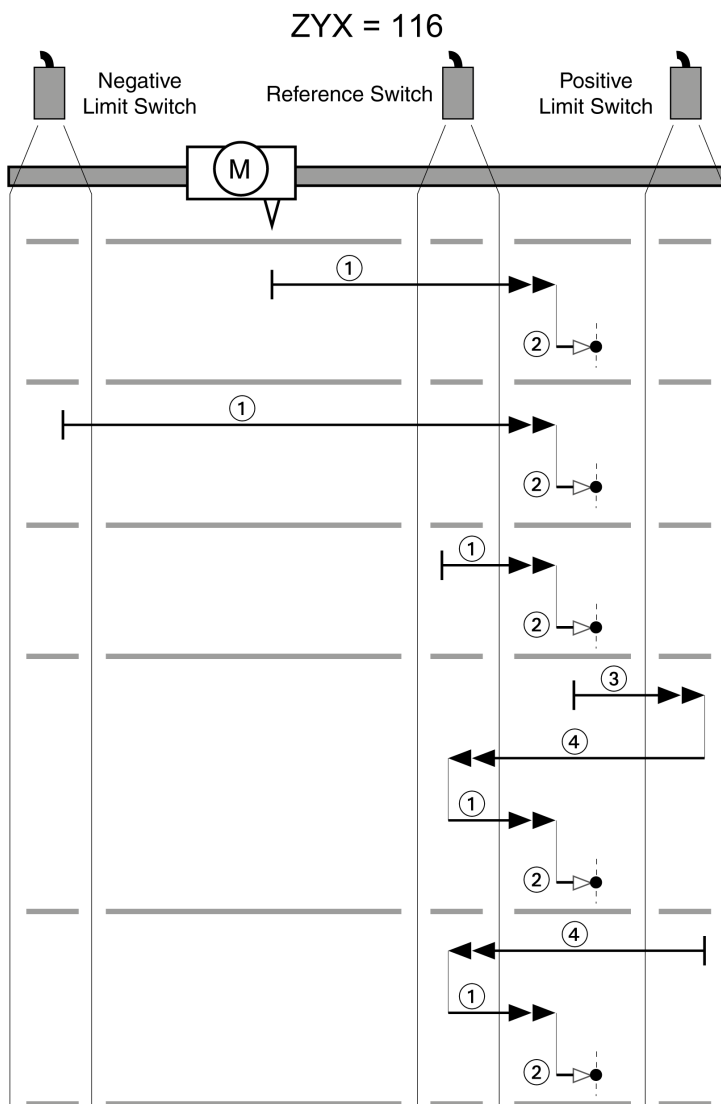
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 106)



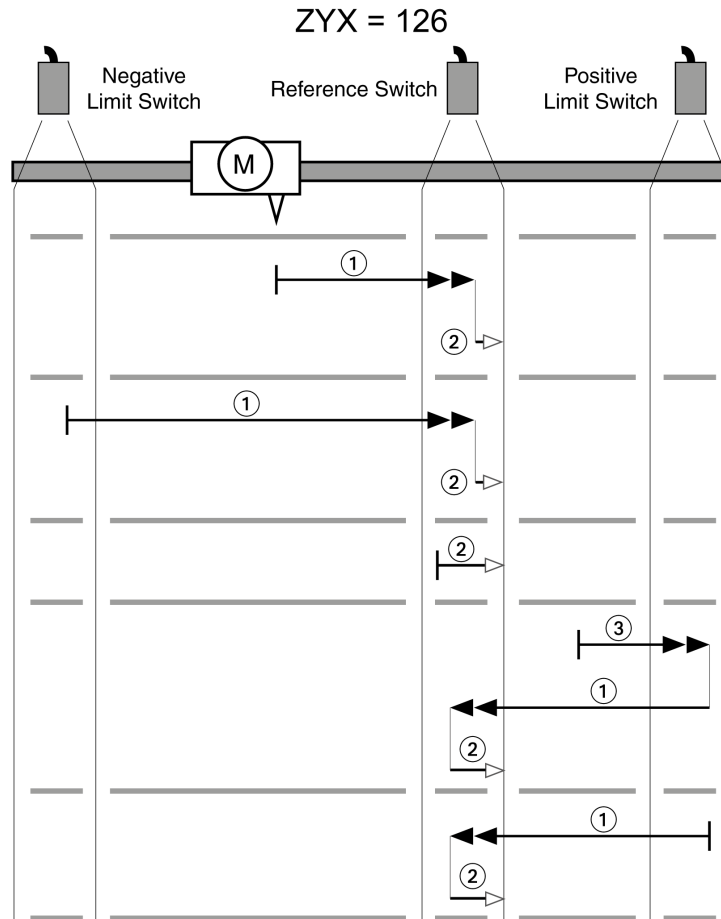
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to rising edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 116)



Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to the limit switch at velocity P5-05
4	Movement to rising edge at velocity P5-05

Reference movement (ZYX = 126)



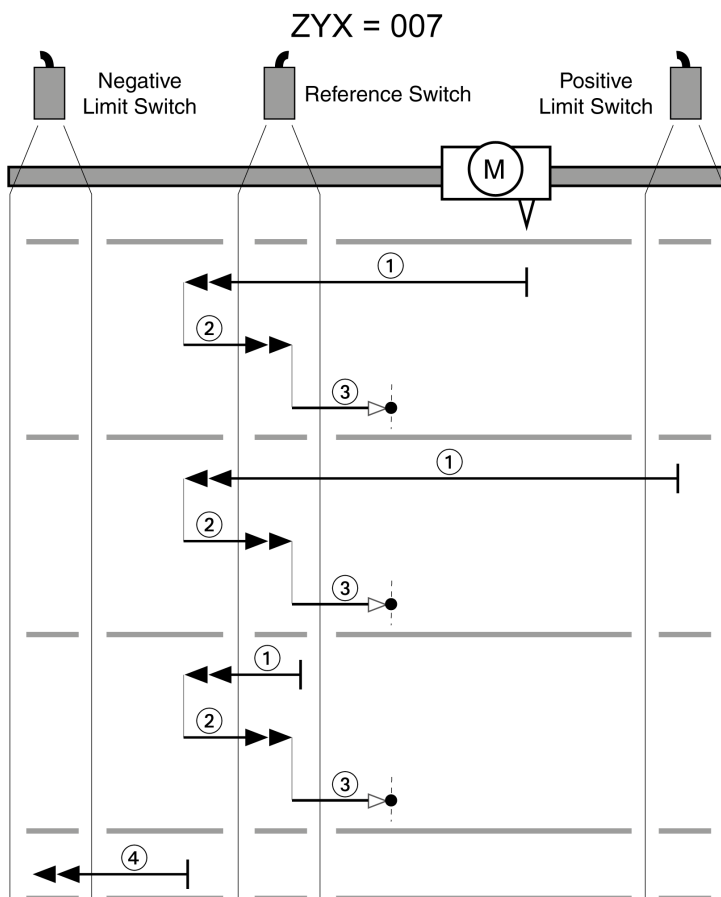
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

## Reference Movement in Negative Direction to the Falling Edge of the Reference Switch

The following illustrations show reference movements to the falling edge of the reference switch in negative direction from different starting positions.

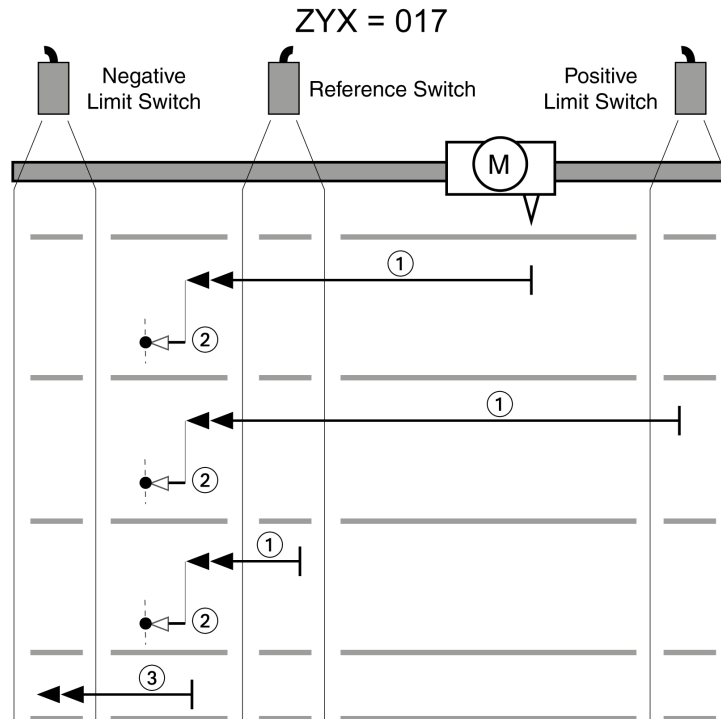


Reference movement (ZYX = 007)



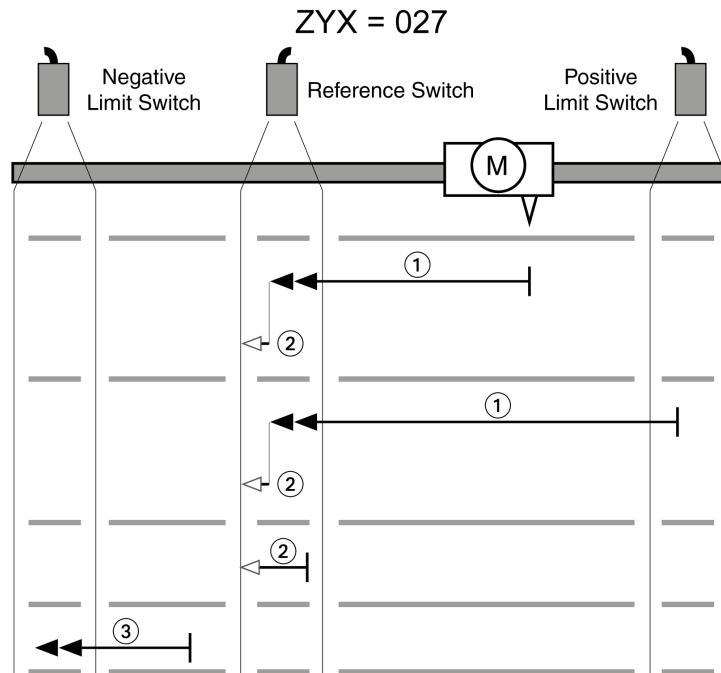
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to rising edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 017)



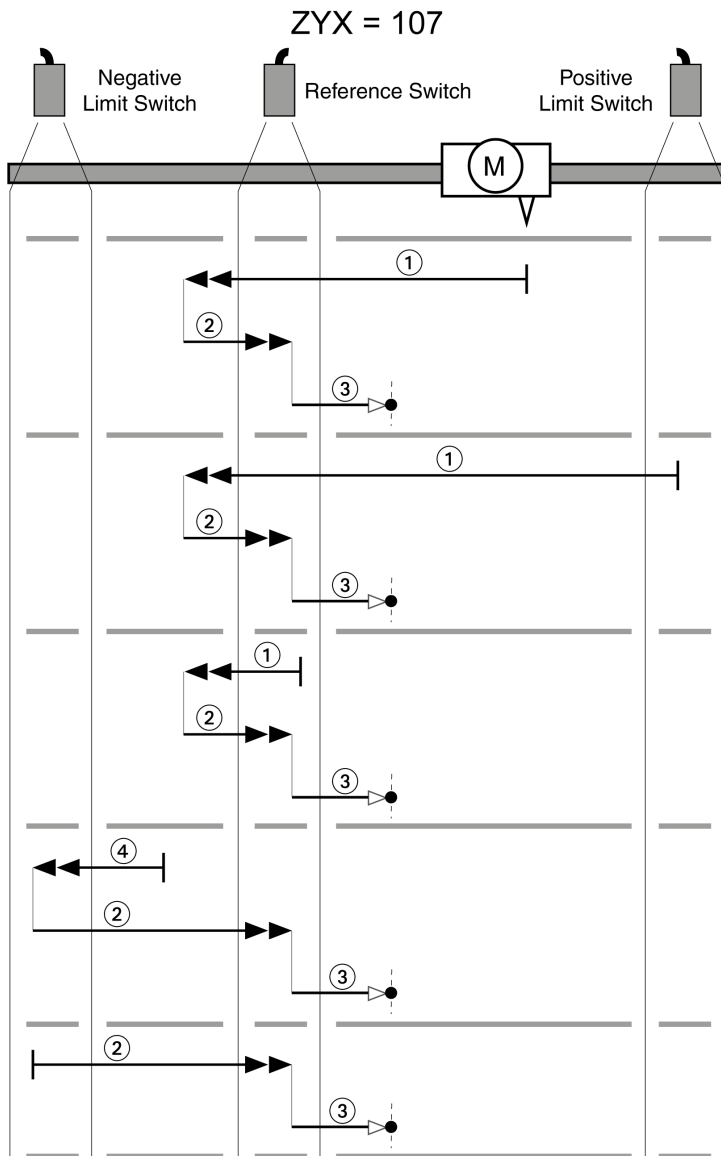
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 027)



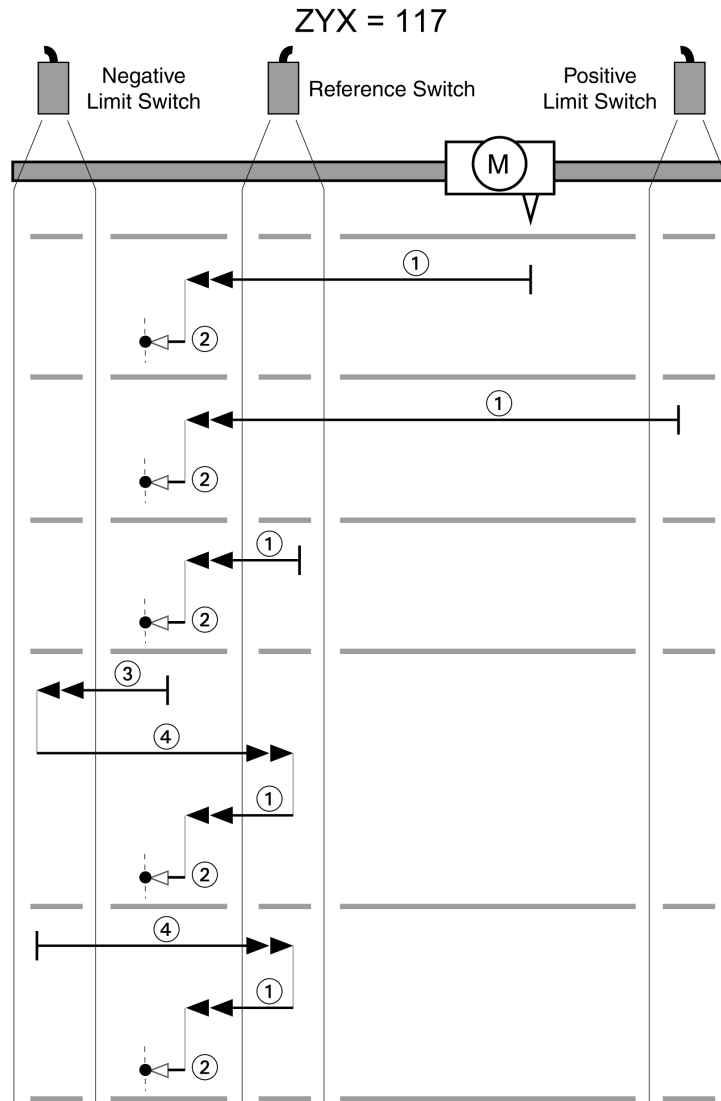
Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 107)



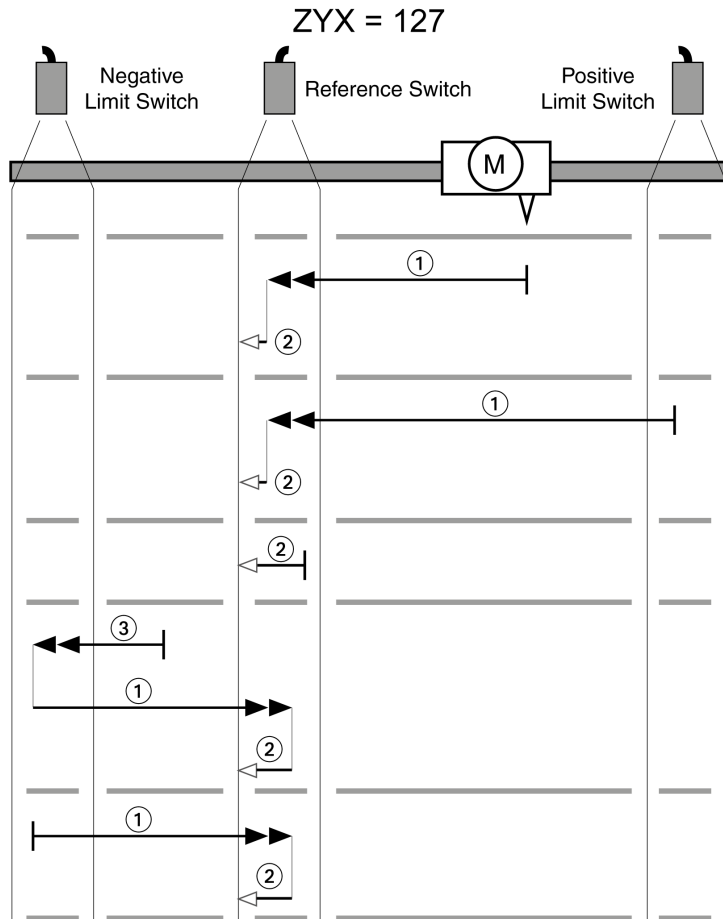
Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to rising edge at velocity P5-05
3	Movement to the index pulse at velocity P5-06
4	Movement to the limit switch at velocity P5-05

Reference movement (ZYX = 117)



Item	Description
1	Movement to falling edge at velocity P5-05
2	Movement to the index pulse at velocity P5-06
3	Movement to the limit switch at velocity P5-05
4	Movement to rising edge at velocity P5-05

Reference movement (ZYX = 127)



Item	Description
1	Movement to rising edge at velocity P5-05
2	Movement to falling edge at velocity P5-06
3	Movement to the limit switch at velocity P5-05

## Position Setting

By means of position setting, the current motor position is set to the position value in parameter P6-00. This also defines the zero point.

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

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P6-00	Position of Homing Data Set	PUU	s32	Modbus 700 <sub>h</sub>
ODAT	Applicable operating mode: PS  After a successful reference movement, this position is automatically set at the reference point. Bits 0 ... 31: Position	-2147483647 0 2147483647 Decimal	RW  per.	CANopen 4600 <sub>h</sub>

# Operating Modes Velocity (V) and Velocity Zero (Vz)

## Operating Modes Velocity (V) and Velocity Zero (Vz)

### Description

In the operating mode Velocity (V), a movement is made with a specified target velocity.

### Source of Reference Value Signals

In the operating mode Velocity (V), the source of the reference value signals is one of the three values set via the parameters *P1-09* to *P1-11*.

In the operating mode Velocity Zero (Vz), the source of the reference value signals is either one of the three values set via the parameters *P1-09* to *P1-11* or the fixed target velocity 0.

The values of the parameters *P1-09* to *P1-11* can be selected via the signal input functions SPD0 and SPD1.

The signal input functions SPD0 and SPD1 take priority over the reference value signal at the analog input *V\_REF*.

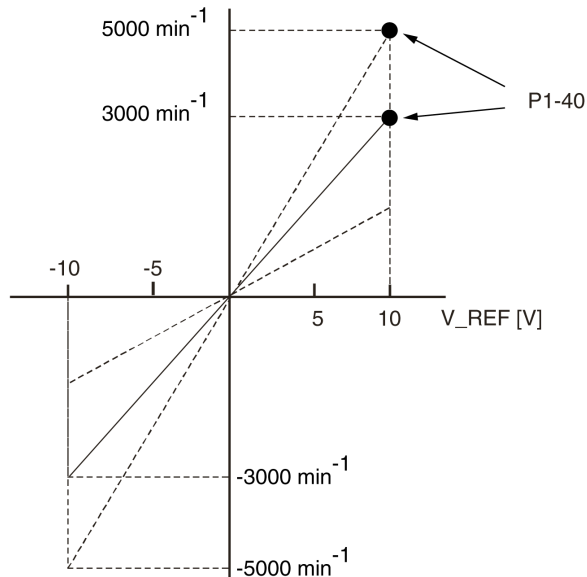
The target velocity is selected via the signal input functions SPD0 (LSB) and SPD1 (MSB) (bit-coded):

For additional information on the parameterizable signal input functions, refer to Setting the Digital Signal Inputs, page 271.

-	Signal state of the digital signal inputs		Target velocity via:		Range
	SPD1	SPD0			
S1	0	0	Operating mode Velocity (Vz)	Voltage between <i>V_REF</i> (Pin42) and GND (pin 44)	-10V ... 10V
			Operating mode Velocity Zero (Vz)	0 rpm	
S2	0	1	Internal parameters	<i>P1-09</i>	-
S3	1	0		<i>P1-10</i>	
S4	1	1		<i>P1-11</i>	

### Scaling of the Analog Input *V\_REF*

The parameter *P1-40* lets you set the velocity corresponding to 10 V. This results in a linear scaling for the analog input *V\_REF*.

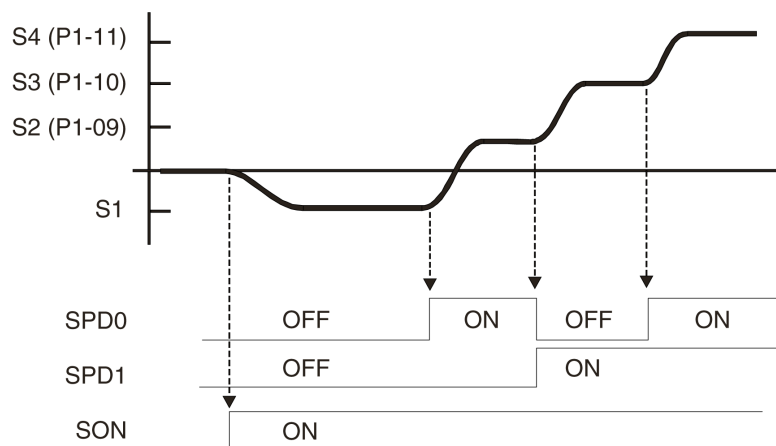


Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
P1-40 VCM	Velocity Target Value and Velocity Limitation 10 V Applicable operating mode: PT, PS, V, T  In the operating mode V, this parameter specifies the target velocity that corresponds to the maximum input voltage of 10 V.  In the operating mode T, this parameter specifies the velocity limitation that corresponds to the maximum input voltage of 10 V.  Example: If the value of this parameter is 3000 in the operating mode V and if the input voltage is 10 V, the target velocity is 3000 rpm.	rpm	s32	Modbus 250 <sub>n</sub>
		0	RW	CANopen 4128 <sub>n</sub>
		-	per.	
		10001		
		Decimal		

## Example

The illustration below shows how the target velocities are switched by means of the signal input functions SPD0, SPD1 and SON.

Operating modes Velocity (V) and Velocity Zero (Vz)



For further information, refer to Setting the Digital Signal Inputs, page 271.

### Stopping the Movement via Signal Input Function ZCLAMP

The movement can be stopped via the digital signal input function ZCLAMP.

Conditions for stopping the movement:

- The reference velocity must be below the velocity value defined in parameter P1-38.
- The signal input function ZCLAMP must be assigned and the signal input must be triggered.

For assigning the signal input function, refer to Setting the Digital Signal Inputs, page 271.

Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P1-38 ZSPD	Signal Output Function ZSPD / Signal Input Function ZCLAMP - Velocity  Applicable operating mode: PT, PS, V, T  This parameter specifies the velocity for the signal output function ZSPD. The signal output function ZSPD indicates that the velocity of the motor is less than the velocity value set via this parameter.  This parameter specifies the velocity for the signal input function ZCLAMP. The signal input function ZCLAMP stops the motor. The velocity of the motor must be below the velocity value set via this parameter.	0.1rpm 0 100 2000 Decimal	s32 RW per.	Modbus 24C <sub>n</sub> CANopen 4126 <sub>n</sub>

Additionally the behavior for ZCLAMP can be set via parameter P2-65 bit 10.

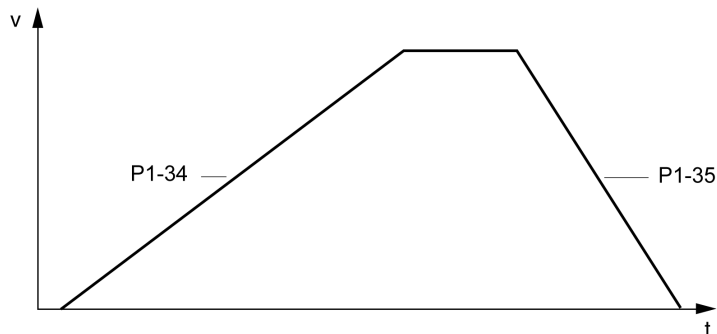
Setting of parameter P2-65 bit 10:

- Bit 10 = 0: Immediate stop. Motor is locked at the position where it was when ZCLAMP became active.
- Bit 10 = 1: Motor is decelerated with deceleration ramp setting. Motor is locked at the position where standstill is reached.



## Acceleration and Deceleration

The parameters *P1-34* and *P1-35* allow you to set the acceleration and deceleration.



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
<i>P1-34</i> TACC	<p>Acceleration Period</p> <p>Applicable operating mode: PT, V</p> <p>The acceleration period is the time in milliseconds required to accelerate from motor standstill to 6000 rpm.</p> <p>For operating mode V, this parameter specifies the acceleration.</p> <p>For operating mode PT, this parameter specifies an acceleration limitation for the pulses at the PTI interface.</p>	<p>ms</p> <p>6</p> <p>30</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 244<sub>h</sub></p> <p>CANopen 4122<sub>h</sub></p>
<i>P1-35</i> TDEC	<p>Deceleration Period</p> <p>Applicable operating mode: PT, V</p> <p>The deceleration period is the time in milliseconds required to decelerate from 6000 rpm to motor standstill.</p> <p>For operating mode V, this parameter specifies the deceleration.</p> <p>For operating mode PT, this parameter specifies a deceleration limitation for the pulses at the PTI interface.</p>	<p>ms</p> <p>6</p> <p>30</p> <p>65500</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 246<sub>h</sub></p> <p>CANopen 4123<sub>h</sub></p>

## Operating Modes Torque (T) and Torque Zero (Tz)

### Operating Modes Torque (T) and Torque Zero (Tz)

#### Description

In the operating mode Torque (T), a movement is made with a specified target torque. The target torque is specified in percent of the nominal torque of the motor.

The operating modes Torque (T) and Torque (Tz) and the dual operating modes with Torque (T) and Torque (Tz) do not provide deceleration functionality in response to a power stage disable request. In these operating modes, the motor coasts down to a standstill in response to a power stage disable request. You

must install additional equipment such as a dedicated service brake if your application requires faster deceleration of the load.

<b>⚠ WARNING</b>
<p><b>UNINTENDED EQUIPMENT OPERATION</b></p> <ul style="list-style-type: none"> <li>• During commissioning, trigger all signals and simulate all conditions that cause a power stage disable request in order to verify that all loads come to a secure standstill when the power stage is disabled under maximum load conditions.</li> <li>• Install a dedicated service brake if removal of power to the motor does not meet the requirements of your application.</li> </ul> <p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p>

## Source of Reference Value Signals

In the operating mode Torque (T), the source of the reference value signals is either the analog input *T\_REF* or one of the three values set via the parameters *P1-12* to *P1-14*.

In the operating mode Torque Zero (Tz), the source of the reference value signals is either one of the three values set via the parameters *P1-12* to *P1-14* or the fixed target torque 0 %.

The values of the parameters *P1-12* to *P1-14* can be selected via the signal input functions TCM0 and TCM1.

The signal input functions TCM0 and TCM1 take priority over the reference value signal of the analog input *T\_REF*.

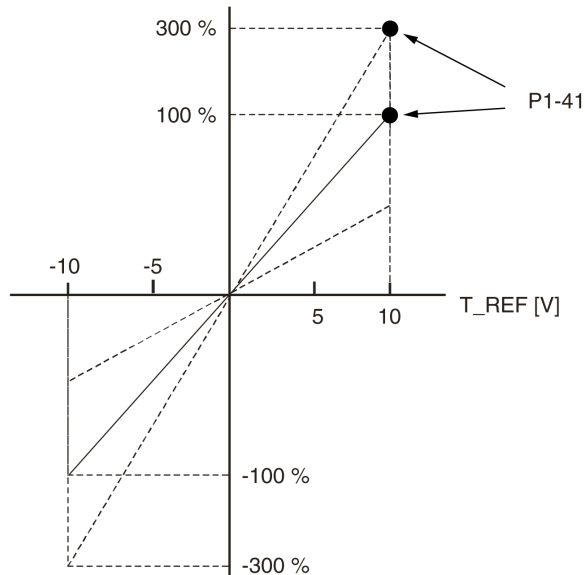
The target torque is selected via the signal input functions TCM0 (LSB) and TCM1 (MSB) (bit-coded):

For further information on the parameterizable signal input functions, refer to Setting the Digital Signal Inputs, page 271.

-	Signal state of the digital signal inputs		Target torque is provided via:		Range
	TCM1	TCM0			
T1	0	0	Operating mode Torque (T)	Voltage between T_REF (pin 18) and GND (pin 19)	-10V ... 10V
			Operating mode Torque Zero (Tz)	0 %	-
T2	0	1	Internal parameters	<i>P1-12</i>	-300 ... 300%
T3	1	0		<i>P1-13</i>	
T4	1	1		<i>P1-14</i>	

## Scaling of the Analog Input T\_REF

The parameter *P1-41* lets you set the torque corresponding to 10 V. This results in a linear scaling for the analog input *T\_REF*.

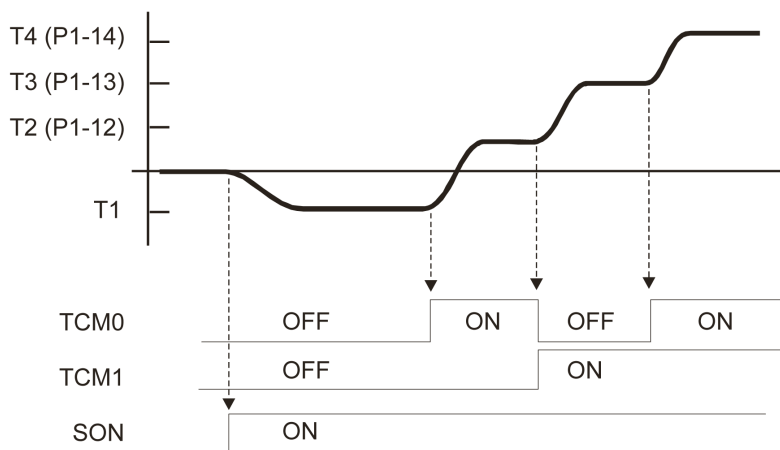


Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
P1-41 TCM	Torque Target Value and Torque Limitation 10 V Applicable operating mode: PT, PS, V, T In the operating mode T, this parameter specifies the target torque that corresponds to the maximum input voltage of 10 V. In the operating modes PT, PS and V, this parameter specifies the torque limitation that corresponds to the maximum input voltage of 10 V. Example: If the value of this parameter is 100 in the operating mode T and if the input voltage is 10 V, the target torque is 100 % of the nominal torque. Setting can only be modified if power stage is disabled.	%	u16	Modbus 252 <sub>n</sub>
		0 100 1000 Decimal	RW per.	CANopen 4129 <sub>n</sub>

## Example

The illustration below shows how the target torque is switched by means of the signal input functions TCM0, TCM1 and SON.

Operating modes Torque (T) and Torque Zero (Tz)



For further information, refer to Setting the Digital Signal Inputs, page 271.

## Operating Mode CANopen

### Indication of the Operating State

The parameter *Statusword* 6041<sub>h</sub> provides information on the operating state of the device and the processing status of the operating mode.

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory settings Maximum value
6041 <sub>h</sub>	Statusword Bit assignments: <ul style="list-style-type: none"> <li>• Bits 0 ... 3: Status bits</li> <li>• Bit 4: Voltage Enabled</li> <li>• Bits 5 ... 6: Status bits</li> <li>• Bit 7: Error detected</li> <li>• Bit 8: Halt request active</li> <li>• Bit 9: Remote</li> <li>• Bit 10: Target Reached</li> <li>• Bit 11: Internal Limit Active</li> <li>• Bit 12: Operating mode-specific</li> <li>• Bit 13: x_err</li> <li>• Bit 14: x_end</li> <li>• Bit 15: ref_ok</li> </ul>	VAR UINT16 ro	Yes	0 - 65535

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

Bits 0, 1, 2, 3, 5 and 6 of the parameter *Statusword* 6041<sub>h</sub> 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

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
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 missing or is too low, the device does not transition from operating state 3 to operating state 4.

### Bit 7

Bit 7=1 indicates that an error has been detected.

### Bit 8

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

### Bit 9

If bit 9 is set, the device carries out commands via the fieldbus. If Bit 9 is reset, the device is controlled via a different interface. 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 current operating mode. Details can be found in the chapters on the individual operating modes.

### Bit 11

The assignment of bit 11 can be set via the parameter *P3-30*.

### Bit 12

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

### Bit 13

Bit 13 only becomes "1" in the case of an error which needs to be remedied prior to further processing.

## Bit 14

Bit 14 changes to "0" if an operating mode is started. When processing is terminated or interrupted, for example by a "Halt", bit 14 toggles back to "1" once the motor has come to a standstill. The signal change of bit 14 to "1" is suppressed if one process is followed immediately by a new process in a different operating mode.

## Bit 15

Bit 15 is "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

The parameter *Controlword* 6040<sub>h</sub> can be used to switch between the operating states.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6040 <sub>h</sub>	Controlword Bit assignments: <ul style="list-style-type: none"> <li>• Bit 0: Switch On</li> <li>• Bit 1: Enable Voltage</li> <li>• Bit 2: Quick Stop</li> <li>• Bit 3: Enable Operation</li> <li>• Bits 4 ... 6: Operating mode-specific</li> <li>• Bit 7: Fault Reset</li> <li>• Bit 8: Halt</li> <li>• Bit 9: Operating mode-specific</li> <li>• Bits 10 ... 15: Reserved</li> </ul>	VAR UINT16 rww	Yes	0 - 65535

## Bits 0 ... 3 and 7

Bits 0 ... 3 and bit 7 of the parameter *Controlword* 6040<sub>h</sub> 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	T5	3 Switch On Disabled	0->1	X	X	X	X

## Bits 4 ... 6 and 9

Bits 4 to 6 and bit 9 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

A "Halt" can be triggered with bit 8=1.

## Bits 10 ... 15

Reserved.

# Starting and Changing a CANopen Operating Mode

## Overview of the CANopen Operating Modes

The following CANopen operating modes are available:

- CANopen operating modes as per CiA 402
  - Profile Position
  - Profile Velocity
  - Profile Torque
  - Homing
  - Interpolated Position
  - Cyclic Synchronous Position
  - Cyclic Synchronous Velocity
  - Cyclic Synchronous Torque
- CANopen vendor-specific operating modes
  - Jog
  - Electronic Gear
  - Analog Velocity
  - Analog Torque

## Starting and Changing an Operating Mode

The parameter *Modes of Operation* 6060<sub>h</sub> is used to set the operating mode.

The parameter *Modes of Operation Display* 6061<sub>h</sub> can be used to read the current operating mode.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6060 <sub>h</sub>	Modes of Operation	VAR	Yes	-128
		INT8		0
		rww		10
6061 <sub>h</sub>	Modes of Operation Display	VAR	Yes	-128
		INT8		-
		ro		10

Values for the parameters *Modes of Operation* 6060<sub>n</sub> and *Modes of Operation Display* (6061<sub>n</sub>):

- Value 1: Profile Position
- Value 3: Profile Velocity
- Value 4: Profile Torque
- Value 6: Homing
- Value 7: Interpolated Position
- Value 8: Cyclic Synchronous Position
- Value 9: Cyclic Synchronous Velocity
- Value 10: Cyclic Synchronous Torque
- Value -1: Jog
- Value -2: Electronic Gear
- Value -3: Analog Velocity
- Value -4: Analog Torque

## CANopen Operating Mode Profile Position

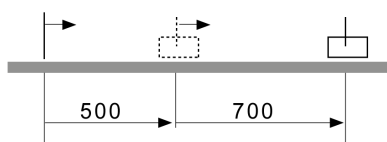
### Description

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

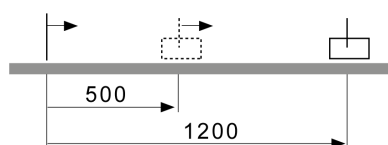
A movement can be made using one of 2 methods:

- Relative movement
- Absolute movement

In the case of a relative movement, the movement is relative with reference to the previous target position or the current motor position.



In the case of an absolute movement, the movement is absolute with reference to the zero point.



### Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>n</sub>. Writing the parameter value causes the operating mode to start.

The target position is set via the parameter *Controlword* 607A<sub>n</sub> and the target velocity is set via the parameter *Controlword* 6081<sub>n</sub>.



Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
607A <sub>h</sub>	Target Position Unit: User-defined position unit	VAR	Yes	-2147483648
		INT32		0
		rww		2147483647
6081 <sub>h</sub>	Profile Velocity in profile position mode Unit: User-defined position unit/s	VAR	Yes	0
		UINT32		0
		rww		4294967295

The acceleration is set via the parameter *Profile Acceleration* 6083<sub>h</sub> and the deceleration is set via the parameter *Profile Deceleration* 6084<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6083 <sub>h</sub>	Profile Acceleration Unit: User-defined position unit/s <sup>2</sup>	VAR	Yes	1
		UINT32		4266666667
		rww		4294967295
6084 <sub>h</sub>	Profile Deceleration Unit: User-defined position unit/s <sup>2</sup>	VAR	Yes	1
		UINT32		4266666667
		rww		4294967295

The movement is started via the parameter *Controlword* 6040<sub>h</sub>.

## Controlword

Bit 9	Bit 5	Bit 4	Meaning
Change on setpoint	Change setpoint immediately	New setpoint	
0	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is stopped at the current target position. <sup>(1)</sup>
1	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is not stopped at the current target position. <sup>(1)</sup>
X	1	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are immediately executed. <sup>(1)</sup>
(1)		Target values include target position, target velocity, acceleration and deceleration.	

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bit 6: Absolute / relative	0: Absolute movement

Controlword	Meaning
	1: Relative movement
Bit 7: Fault Reset	Triggers a Fault Reset
Bit 8: Halt	Triggers a Halt

## Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request 1: A Halt request is active
Bit 10: Target Reached	0: Target position not reached 1: Target position reached
Bit 12: Target value acknowledge	0: New position possible 1: New target position accepted
Bit 13: x_err	0: No error detected 1: An error has been detected
Bit 14: x_end	0: Operating mode started 1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid 1: Zero point is valid

## 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

The maximum velocity can be adjusted via the parameter *Max profile velocity* 607F<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
607F <sub>h</sub>	Max Profile Velocity Unit: User-defined position unit/s	VAR UINT32 rw	No	1 - 4294967295

The reference for a relative movement can be set via the parameter *Position option code* 60F2<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
60F2 <sub>h</sub>	Position option code	VAR	No	0
	Value 0: Relative with reference to the previous target position	UINT16		0
	Value 2: Relative with reference to the actual position of the motor	rw		65535

## CANopen Operating Mode Profile Velocity

### Description

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

### Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

The parameter *Target velocity* 60FF<sub>h</sub> starts the movement.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
60FF <sub>h</sub>	Target Velocity	VAR	Yes	-2147483648
	Unit: User-defined position unit/s	INT32		0
		rww		2147483647

The acceleration is set via the parameter *Profile Acceleration* 6083<sub>h</sub> and the deceleration is set via the parameter *Profile Deceleration* 6084<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6083 <sub>h</sub>	Profile Acceleration	VAR	Yes	1
	Unit: User-defined position unit/s <sup>2</sup>	UINT32		4266666667
		rww		4294967295
6084 <sub>h</sub>	Profile Deceleration	VAR	Yes	1
	Unit: User-defined position unit/s <sup>2</sup>	UINT32		4266666667
		rww		4294967295

### Controlword

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bits 4 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 7: Fault Reset	Triggers a Fault Reset

Controlword	Meaning
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

## Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request 1: A Halt request is active
Bit 10: Target Reached	0: Target velocity not reached 1: Target velocity reached
Bit 12: Operating mode-specific	0: Velocity = >0 1: Velocity = 0
Bit 13: x_err	0: No error detected 1: An error has been detected
Bit 14: x_end	0: Operating mode started 1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid 1: Zero point is valid

## 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

The maximum velocity can be adjusted via the parameter *Max profile velocity* 607F<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
607F <sub>h</sub>	Max Profile Velocity Unit: User-defined position unit/s	VAR UINT32 rw	No	1 - 4294967295

## CANopen Operating Mode Profile Torque

### Description

In the operating mode Profile Torque, a movement is made with a specified target torque.

## Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

The parameter *Target torque* 6071<sub>h</sub> starts the movement.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6071 <sub>h</sub>	Target Torque Unit: 1/1000 of nominal torque	VAR	Yes	-32768
		INT16		0
		rww		32767

## Controlword

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bits 4 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 7: Fault Reset	Triggers a Fault Reset
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

## Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request
	1: A Halt request is active
Bit 10: Target Reached	0: Target torque not reached
	1: Target torque reached
Bit 12: Operating mode-specific	Not relevant for this operating mode
Bit 13: x_err	0: No error detected
	1: An error has been detected
Bit 14: x_end	0: Operating mode started
	1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid
	1: Zero point is valid

## 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

In the operating mode Profile Torque, the motion profile for torque can be adjusted via the parameter *Torque slope* 6087<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
6087 <sub>h</sub>	Torque Slope 100% of the torque setting correspond to the nominal torque. Unit: 1/1000 of nominal torque/s Example: A ramp setting of 10000%/s results in a torque change of 100% of the nominal torque in 0.01s.	VAR UINT32 rww	Yes	1 - 30000000

## CANopen Operating Mode Homing

### Description

In the operating mode Homing, a reference is generated between a mechanical position and the actual position of the motor.

A reference between a mechanical position and the actual position of the motor is generated by means of a reference movement or by means of position setting.

A successful reference movement or position setting homes the motor and the zero point becomes valid.

The zero point is the point of reference for absolute movements in the CANopen operating mode Profile Position.

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 specified 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.

#### Procedure

- Set *Mode of operation* 6060<sub>h</sub> to operating mode Homing (6).
- Set *Home offset* 607C<sub>h</sub>.
- Set *Home method* 6098<sub>h</sub>, the value range is 1 to 35 and specifies the different homing methods.
- Set *Home speeds* 6099:1<sub>h</sub> to the value for velocity to search for the limit switches (unit = puu).
- Set *Home speeds* 6099:2<sub>h</sub> to the value for velocity to search for the index pulse (unit = puu).
- Set *Home acceleration* 609A<sub>h</sub> to the value for the acceleration ramp (unit = ms from 0 to 3000 rpm).

## Supported Homing Methods

### Method 1: Homing on the negative limit switch and index pulse

The initial movement is in the negative direction if the negative limit switch is inactive.

The initial movement is in the positive direction if the negative limit switch is active.

The home position is at the first index pulse in the positive direction where the negative limit switch becomes inactive.

### Method 2: Homing on the positive limit switch and index pulse

The initial movement is in the positive direction if the positive limit switch is inactive.

The initial movement is in the negative direction if the positive limit switch is active.

The home position is at the first index pulse in the negative direction where the positive limit switch becomes inactive.

### Methods 3 and 4: Homing on the positive reference switch and index pulse

The initial movement is in the negative direction if the positive reference switch is active.

The initial movement is in the positive direction if the positive reference switch is inactive.

- Method 3: The home position is at the first index pulse in the negative direction where the reference switch becomes inactive.
- Method 4: The home position is at the first index pulse in the positive direction where the reference switch becomes active.

### Methods 5 and 6: Homing on the negative reference switch and index pulse

The initial movement is in the positive direction if the negative reference switch is active.

The initial movement is in the negative direction if the negative reference switch is inactive.

- Method 5: The home position is at the first index pulse in the positive direction where the reference switch becomes inactive.
- Method 6: The home position is at the first index pulse in the negative direction where the reference switch becomes active.

### Methods 7 to 10: Homing on the reference switch and index pulse (Positive)

These methods use a reference switch which is active over only a portion of the travel.

The initial movement is in the positive direction if the reference switch is inactive.

The initial movement is in the negative direction if the reference switch is active.

If the initial movement leads away from the reference switch, the drive reverses on encountering the positive limit switch.

- Method 7: The home position is at the first index pulse in the negative direction where the reference switch becomes inactive.
- Method 8: The home position is at the first index pulse in the positive direction where the reference switch becomes active.
- Method 9: The home position is at the first index pulse in the negative direction where the reference switch becomes active.
- Method 10: The home position is at the first index pulse in the positive direction where the reference switch becomes inactive.

#### **Methods 11 to 14: Homing on the reference switch and index pulse (Negative)**

The initial movement is in the negative direction if the reference switch is inactive.

The initial movement is in the positive direction if the reference switch is active.

If the initial movement leads away from the reference switch, the drive reverses on encountering the negative limit switch.

- Method 11: The home position is at the first index pulse in the positive direction where the reference switch becomes inactive.
- Method 12: The home position is at the first index pulse in the negative direction where the reference switch becomes active.
- Method 13: The home position is at the first index pulse in the positive direction where the reference switch becomes active.
- Method 14: The home position is at the first index pulse in the negative direction where the reference switch becomes inactive.

#### **Methods 15 and 16: Reserved**

#### **Method 17: Homing on the negative limit switch**

The initial movement is in the negative direction if the negative limit switch is inactive.

The initial movement is in the positive direction if the negative limit switch is active.

The home position is in the positive direction where the negative limit switch becomes inactive.

#### **Method 18: Homing on the positive limit switch**

The initial movement is in the positive direction if the positive limit switch is inactive.

The initial movement is in the negative direction if the positive limit switch is active.

The home position is in the negative direction where the positive limit switch becomes inactive.

#### **Methods 19 and 20: Homing on the positive reference switch**

The initial movement is in the negative direction if the positive reference switch is active.

The initial movement is in the positive direction if the positive reference switch is inactive.

- Method 19: The home position is in the negative direction where the reference switch becomes inactive.
- Method 20: The home position is in the positive direction where the reference switch becomes active.

#### **Methods 21 and 22: Homing on the negative reference switch**

The initial movement is in the positive direction if the negative reference switch is active.



The initial movement is in the negative direction if the negative reference switch is inactive.

- Method 21: The home position is in the positive direction where the reference switch becomes inactive.
- Method 22: The home position is in the negative direction where the reference switch becomes active.

#### **Methods 23 to 26: Homing on the reference switch (Positive)**

These methods use a reference switch which is active over only a portion of the travel.

The initial movement is in the positive direction if the reference switch is inactive.

The initial movement is in the negative direction if the reference switch is active.

If the initial movement leads away from the reference switch, the drive reverses on encountering the positive limit switch.

- Method 23: The home position is in the negative direction where the reference switch becomes inactive.
- Method 24: The home position is in the positive direction where the reference switch becomes active.
- Method 25: The home position is in the negative direction where the reference switch becomes active.
- Method 26: The home position is in the positive direction where the reference switch becomes inactive.

#### **Methods 27 to 30: Homing on the reference switch (Negative)**

These methods use a reference switch which is active over only a portion of the travel.

The initial movement is in the negative direction if the reference switch is inactive.

The initial movement is in the positive direction if the reference switch is active.

If the initial movement leads away from the reference switch, the drive reverses on encountering the negative limit switch.

- Method 27: The home position is in the positive direction where the reference switch becomes inactive.
- Method 28: The home position is in the negative direction where the reference switch becomes active.
- Method 29: The home position is in the positive direction where the reference switch becomes active.
- Method 30: The home position is in the negative direction where the reference switch becomes inactive.

#### **Methods 31 and 32: Reserved**

#### **Methods 33 and 34: Homing on the index pulse**

- Method 33: The home position is at the first index pulse in the negative direction.
- Method 34: The home position is at the first index pulse in the positive direction.

#### **Methods 35: Homing on the current position**

The current position is considered as the home position.

## **Starting the Operating Mode**

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

The movement is started via the *Controlword* 6040<sub>h</sub>.

## Controlword

Bit 4 in the parameter *Controlword 6040<sub>h</sub>* starts a movement, bit 8 terminates the movement.

Controlword	Meaning
Bit 4: Homing operation start	Start homing
Bits 5 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

## Statusword

Statusword	Meaning
Bit 10: Target Reached	0: Homing not completed 1: Homing completed
Bit 12: Homing attained	Homing successfully completed
Bit 13: x_err	0: No error detected 1: An error has been detected
Bit 14: Operating mode-specific	Not relevant for this operating mode
Bit 15: Operating mode-specific	Not relevant for this operating mode

## 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

## CANopen Operating Mode Interpolated Position

### Description

In the operating mode Interpolated Position, the drive follows the position values transmitted on a cyclic basis. The transmitted values are linearly interpolated within the drive.

This mode uses a buffer of position commands. The buffer size is always 1, thus it is not possible to give a list of target position commands in advance

The monitoring functions Heartbeat and Node Guarding cannot be used in this operating mode.

Check cyclical reception of PDOs at the PLC in order to detect an interruption of the connection.

The reference positions are transmitted synchronously with each cycle. The cycle time of a cycle can be set from 1 ... 20 ms.

The movement to the reference positions starts with the SYNC signal.

The drive performs an internal fine interpolation with a raster of 250 µs.

The operating mode is selected by writing 7 in the object *Mode of operation 6060<sub>h</sub>*.

## Starting and Terminating the Operating Mode

The movement is started via the *Controlword 6040<sub>h</sub>*.

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

- Target position reached
- Stop caused by Halt or Quick Stop
- Stop caused by a detected error
- Switch to another operating mode

## Source of Reference Value Signals

The object *Target position 60C1<sub>h</sub>* provides the target position value.

The target position minimum and maximum values depends on

- Scaling factor
- Software limit switches if they are activated

The object *Target velocity 6081<sub>h</sub>* provides the target velocity value.

The object *Profile acceleration 6083<sub>h</sub>* provides the acceleration value.

The object *Profile deceleration 6084<sub>h</sub>* provides the deceleration value.

The target velocity is limited to the setting in *Max Profile Velocity 607F<sub>h</sub>*.

The object *Interpolation time period 60C2<sub>h</sub>* consist of:

- *Interpolation time units 60C2:01<sub>h</sub>* which specifies the interpolation time.
- *Interpolation time index 60C2:02<sub>h</sub>* which specifies the time basis. The value of -3 corresponds to a time basis in milliseconds.

The object *Interpolation sub mode select 60C0<sub>h</sub>* allows to select the interpolation mode:

- 0: Linear interpolation.
- 1: Cubic interpolation with position only. This forces the interpolated path to pass via the original position commands sent by the controller.

**NOTE:** This may cause an abrupt velocity profile when velocity changes.

The value of this object cannot be modified when NMT operating state is **Operationnal**.

Modified settings become active immediately.

## Control Word

In the operating mode, the bit 4 and the bit 8 in the *Controlword 6040<sub>h</sub>* start a movement.

Bit	Name	Meaning
Bit 4	Enable IP mode	0: Interpolated position mode not active 1: Interpolated position mode active
Bit 8	Halt	0: No Halt command 1: Stop movement with Halt

## Status Word

Information on the current movement is available via bits 10 and 12 ... 15 in the *Statusword 6041<sub>h</sub>*.

Bit	Name	Meaning
Bit 10	Target reached	0: Target position not reached 1: Target position reached
Bit 12	-	0: New position possible 1: New target position accepted
Bit 13	x_err	0: No error detected 1: A following error has been detected
Bit 14	x_end	0: Operating mode started 1: Operating mode terminated
Bit 15	ref_ok	1: Drive has valid reference point

## CANopen Operating Mode Cyclic Synchronous Position

### Description

In the operating mode Cyclic Synchronous Position (CSP), the drive synchronously follows the position values transmitted on a cyclic basis. The transmitted values are linearly interpolated within the drive.

The motion profile is generated by the master controller.

The possible applications for this operating mode are described in the manual of the master controller.

The operating mode is selected by writing 8 in the object *Mode of operation 6060<sub>h</sub>*.

### Starting and Terminating the Operating Mode

A transition to the operating state 6 Operation Enabled starts the set operating mode.

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is exited.

### Source of Reference Value Signals

The object *Target Position 607A<sub>h</sub>* provides the target value.

Target values are in pulses.

The object *Interpolation time period 60C2<sub>h</sub>* consist of:

- *Interpolation time units 60C2:01<sub>h</sub>* which specifies the interpolation time.
- *Interpolation time index 60C2:02<sub>h</sub>* which specifies the time basis. The value of -3 corresponds to a time basis in milliseconds.

Modified settings become active immediately.

### Control Word

In the operating mode, the operating mode-specific bits in the *Controlword 6040<sub>h</sub>* have no significance.

## Status Word

Information on the current movement is available via bits 10 and 12 ... 15 in the *Statusword 6041<sub>h</sub>*.

Bit	Name	Meaning
Bit 10	Reserved	Not relevant for this operating mode
Bit 12	-	0: Target position ignored 1: Target position used as input to position control loop
Bit 13	Reserved	Not relevant for this operating mode
Bit 14	x_end	0: Operating mode started 1: Operating mode terminated
Bit 15	ref_ok	1: Drive has valid reference point

## CANopen Operating Mode Cyclic Synchronous Torque

### Operating Mode Cyclic Synchronous Torque

#### Description

In the operating mode Cyclic Synchronous Torque (CST), the drive synchronously follows the torque values transmitted on a cyclic basis. The transmitted values are linearly interpolated within the drive.

The motion profile is generated by the master controller. The possible applications for this operating mode are described in the manual of the master controller.

The operating mode is selected by writing 10 in the object Mode of operation 6060h.

#### Starting and Terminating the Operating Mode

A transition to the operating state 6 Operation Enabled starts the set operating mode.

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is exited.

#### Source of Reference Value Signals

The object *Target torque 6071h* provides the target value.

100.0% correspond to the continuous stall torque.

Target values are in increments of 0.1%.

Modified settings become active immediately.

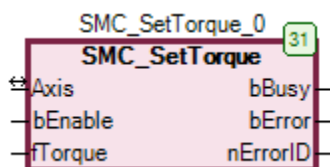
#### Control Word

In the operating mode, the operating mode-specific bits in the *Controlword 6040h* have no significance.

## Status Word

Information on the current movement is available via bits 10 and 12 ... 15 in the *Statusword 6041h*.

Bit	Name	Meaning
Bit 10	Reserved	Not relevant for this operating mode
Bit 12	-	0: Target torque ignored 1: Target torque shall be used as input to torque control loop
Bit 13	Reserved	Not relevant for this operating mode
Bit 14	x_end	0: Operating mode started 1: Operating mode terminated
Bit 15	ref_ok	1: Drive has valid reference point



This function block is part of the library `SM3_Basic`. It can be used to create a torque, if the drive is in controller mode "torque".

Function block `SMC_SetTorque`:

Name	Type	Initialization	Description
VAR_IN_OUT	—	—	—
Axis	AXIS_REF	—	—
VAR_INPUT	—	—	—
bEnable	BOOL	FALSE	Have to be set to TRUE to enable execution of function block.
fTorque	LREAL	—	Torque in Nm.
VAR_OUTPUT	—	—	—
bBusy	BOOL	FALSE	TRUE, if execution of function block is not finished.
bError	BOOL	FALSE	Signal, that an error has occurred within the function block.
nErrorID	SMC_ERROR	—	Error identification

## CANopen Operating Mode Cyclic Synchronous Velocity

### Operating Mode Cyclic Synchronous Velocity

#### Description

In the operating mode Cyclic Synchronous Velocity (CSV), the drive synchronously follows the velocity values transmitted on a cyclic basis. The transmitted values are linearly interpolated within the drive.

The motion profile is generated by the master controller. The possible applications for this operating mode are described in the manual of the master controller.

The operating mode is selected by writing 9 in the object *Mode of operation 6060h*.

## Starting and Terminating the Operating Mode

A transition to the operating state 6 Operation Enabled starts the set operating mode.

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is exited.

## Source of Reference Value Signals

The object *Target velocity 60FFh* provides the target value.

The target velocity is limited to the setting in *Max Profile Velocity 607Fh*.

Modified settings become active immediately.

## Control Word

In the operating mode, the operating mode-specific bits in the *Controlword 6040h* have no significance.

## Status Word

Information on the current movement is available via bits 10 and 12 ... 15 in the *Statusword 6041h*.

Bit	Name	Meaning
Bit 10	Reserved	Not relevant for this operating mode
Bit 12	—	0: Target velocity ignored 1: Target velocity shall be used as input to torque control loop
Bit 13	Reserved	Not relevant for this operating mode
Bit 14	x_end	0: Operating mode started 1: Operating mode terminated
Bit 15	ref_ok	1: Drive has valid reference point

## CANopen Operating Mode Jog

### Description

In the operating mode Jog, the drive performs a movement with the transmitted jog target value.

The motion profile is generated by the drive, taking into account the target values received from the master controller.

The operating mode is selected by writing -1 in the object *Mode of operation 6060h*.

## Starting and Terminating the Operating Mode

The movement is started via the *Controlword 6040<sub>h</sub>*.

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

- Stop caused by Halt or Quick Stop
- Stop caused by a detected error
- Switch to another operating mode

## Source of Reference Value Signals

The jog method is set with the object *Jog Method 4453<sub>h</sub>*.

- 0: jog operation at constant speed
- 1: Move a distance during a time, and start a jog operation at constant speed

The fast speed is set with the object *Jog Speed Fast 4450<sub>h</sub>*.

The slow speed is set with the object *Jog Speed Slow 4454<sub>h</sub>*.

The distance is set with the object *Jog Step 4452<sub>h</sub>*.

The time is set with the object *Jog Time 4451<sub>h</sub>*.

The target velocity is limited to the setting in *Max Profile Velocity 607F<sub>h</sub>*.

The object *Profile acceleration 6083<sub>h</sub>* provides the acceleration value.

The object *Profile deceleration 6084<sub>h</sub>* provides the deceleration value.

Modified settings become active immediately.

## Control Word

In the operating mode, the bits 4 ... 6 in the *Controlword 6040<sub>h</sub>* start a movement

Bit	Name	Meaning
Bit 4	Forward	Movement in positive direction
Bit 5	Reverse	Movement in negative direction
Bit 6	Speed	0: Slow speed 1: Fast speed

**NOTE:** If bit 4 and bit 5 are both at active state, it stops the movement.

## Status Word

Information on the current movement is available via bits 10 and 12 ... 15 in the *Statusword 6041<sub>h</sub>*.

Bit	Name	Meaning
Bit 10	Reserved	Not relevant for this operating mode
Bit 12	-	Not relevant for this operating mode
Bit 13	x_err	0: No error detected 1: An error has been detected
Bit 14	x_end	0: Operating mode started 1: Operating mode terminated
Bit 15	ref_ok	1: Drive has valid reference point



# CANopen Operating Mode Electronic Gear

## Description

In the operating mode Electronic Gear, movements are carried out according to externally supplied reference value signals. A position reference value is calculated on the basis of these external reference values plus an adjustable gear ratio. The reference value signals can be A/B signals, P/D signals or CW/CCW signals.

## Method

A movement can be made using one of 3 methods:

- Position synchronization without compensation movement

In the case of position synchronization without compensation movement, the movement is made synchronously (position synchronicity) with the supplied reference value signals. Reference value signals supplied during an interruption caused by Halt or by a detected error which cancelled the movement with a Quick Stop are not taken into account.

- Position synchronization with compensation movement

In the case of position synchronization with compensation movement, the movement is made synchronously (position synchronicity) with the supplied reference value signals. Reference value signals supplied during an interruption caused by Halt or by a detected error which cancelled the movement with a Quick Stop are taken into account and compensated for.

- Velocity synchronization

In the case of velocity synchronization, the movement is made synchronously (velocity synchronicity) with the supplied reference value signals.

Parameter name	Description	Unit	Data type	Parameter address via fieldbus
		Minimum value	R/W	
		Factory setting	Persistent	
		Maximum value		
		HMI Format		
P8-31	Method for Operating Mode Pulse Train (PT)	-	u16	Modbus 93E <sub>h</sub>
GEARING_MODE	Applicable operating mode: PT	0	RW	CANopen 481F <sub>h</sub>
	Value 0: Synchronization deactivated	1	per.	
	Value 1: Position synchronization without compensation movement	3		
	Value 2: Position synchronization with compensation movement			
	Value 3: Velocity synchronization	Decimal		
	The parameters for acceleration (P1-34), deceleration (P1-35) and velocity (P1-55) act as limitations for the synchronization.			

## Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

## Controlword

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bits 4 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 7: Fault Reset	Triggers a Fault Reset
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

## Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request 1: A Halt request is active
Bit 12: Operating mode-specific	Not relevant for this operating mode
Bit 13: x_err	0: No error detected 1: An error has been detected
Bit 14: x_end	0: Operating mode started 1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid 1: Zero point is valid

## 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

## Pulse Settings

The parameter *P1-00* lets you specify the type of reference value signals, the input polarity, the maximum signal frequency and the source of the pulses.

For further information on the settings of the reference value signal, refer to chapter *Pulse Setting*, page 290.

## Gear Ratio

The gear ratio is the ratio of the number of motor increments and the number of reference increments.

The reference increments are supplied as reference value signals via the signal inputs.

$$\text{Gear factor} = \frac{\text{Motor increments}}{\text{Reference increments}} = \frac{\text{Gear factor numerator}}{\text{Gear factor denominator}}$$

With the factory setting for the gear ratio, 100000 reference increments correspond to one revolution.

There are 1280000 motor increments per revolution.

The gear ratio can be adjusted via the objects 4FA5:1<sub>h</sub> and 4FA5:2<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
4FA5:1 <sub>h</sub>	Electronic Gear Ratio (Numerator)	VAR	Yes	1
		INT32		128
		rww		536870911
4FA5:2 <sub>h</sub>	Electronic Gear Ratio (Denominator)	VAR	Yes	1
		INT32		10
		rww		2147483647

The velocity window in gearing mode can be adjusted via the objects 4328<sub>h</sub> and 606E<sub>h</sub>.

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory settings
		Access	Maximum value	
4328 <sub>h</sub>	Velocity Gearing Window	VAR	No	0
		UINT32		2100000
		rw		4294967295
606E <sub>h</sub>	Velocity Window Time Unit: ms	VAR	No	0
		UINT16		0
		rw		65535

## CANopen Operating Mode Analog Velocity

### Description

In the operating mode Analog Velocity, a movement is made with a specified target velocity. The source of the reference value signals is the analog input *V<sub>REF</sub>*.

### Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

### Controlword

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bits 4 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 7: Fault Reset	Triggers a Fault Reset
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

## Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request 1: A Halt request is active
Bit 10: Target Reached	0: Target velocity not reached 1: Target velocity reached
Bit 12: Operating mode-specific	Not relevant for this operating mode
Bit 13: x_err	0: No error detected 1: An error has been detected
Bit 14: x_end	0: Operating mode started 1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid 1: Zero point is valid

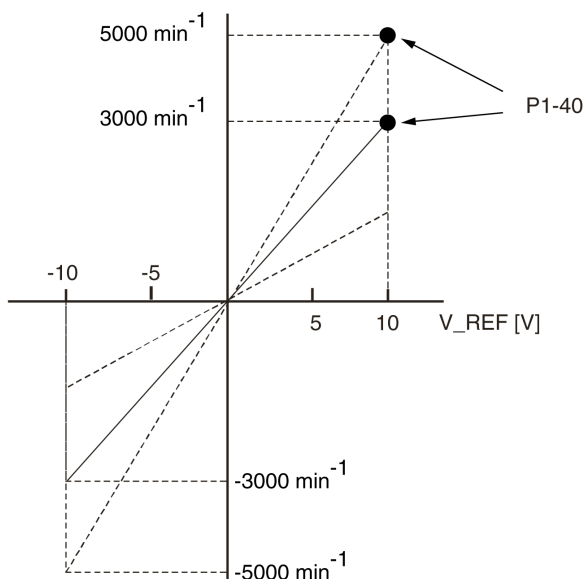
## Terminating the Operating Mode

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

## Scaling of the Analog Input V\_REF

The parameter P1-40 lets you set the velocity corresponding to 10 V. This results in a linear scaling for the analog input V\_REF.



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
P1-40 VCM	Velocity Target Value and Velocity Limitation 10 V Applicable operating mode: PT, PS, V, T In the operating mode V, this parameter specifies the target velocity that corresponds to the maximum input voltage of 10 V. In the operating mode T, this parameter specifies the velocity limitation that corresponds to the maximum input voltage of 10 V. Example: If the value of this parameter is 3000 in the operating mode V and if the input voltage is 10 V, the target velocity is 3000 rpm.	rpm 0 - 10001 Decimal	s32 RW per.	Modbus 250 <sub>h</sub> CANopen 4128 <sub>h</sub>

## CANopen Operating Mode Analog Torque

### Description

In the operating mode Analog Torque, a movement is made with a specified target torque. The target torque is specified in percent of the nominal torque of the motor. The source of the reference value signals is the analog input *T\_REF*.

### Starting the Operating Mode

The operating mode must be set in the parameter *Modes of Operation* 6060<sub>h</sub>. Writing the parameter value causes the operating mode to start.

### Controlword

Controlword	Meaning
Bit 2: Quick Stop	Triggers a Quick Stop
Bits 4 ... 6: Operating mode-specific	Not relevant for this operating mode
Bit 7: Fault Reset	Triggers a Fault Reset
Bit 8: Halt	Triggers a Halt
Bit 9: Operating mode-specific	Not relevant for this operating mode

### Statusword

Statusword	Meaning
Bit 8: Halt request active	0: No Halt request 1: A Halt request is active
Bit 10: Target Reached	0: Target torque not reached 1: Target torque reached
Bit 12: Operating mode-specific	Not relevant for this operating mode
Bit 13: x_err	0: No error detected 1: An error has been detected

Statusword	Meaning
Bit 14: x_end	0: Operating mode started 1: Operating mode terminated
Bit 15: ref_ok	0: Zero point is not valid 1: Zero point is valid

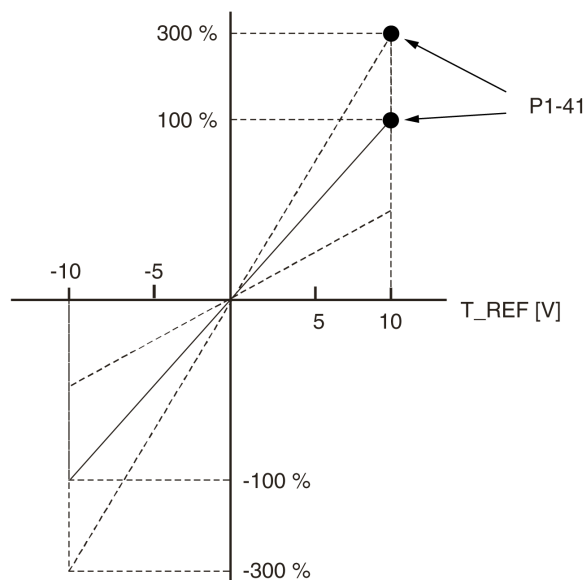
## Terminating the Operating Mode

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

## Scaling of the Analog Input T\_REF

The parameter *P1-41* lets you set the torque corresponding to 10 V. This results in a linear scaling for the analog input T\_REF.



Parameter name	Description	Unit Minimum value Factory setting Maximum value HMI Format	Data type R/W Persistent	Parameter address via fieldbus
<p><i>P1-41</i> TCM</p>	<p>Torque Target Value and Torque Limitation 10 V</p> <p>Applicable operating mode: PT, PS, V, T</p> <p>In the operating mode T, this parameter specifies the target torque that corresponds to the maximum input voltage of 10 V.</p> <p>In the operating modes PT, PS and V, this parameter specifies the torque limitation that corresponds to the maximum input voltage of 10 V.</p> <p>Example: If the value of this parameter is 100 in the operating mode T and if the input voltage is 10 V, the target torque is 100 % of the nominal torque.</p> <p>Setting can only be modified if power stage is disabled.</p>	<p>%</p> <p>0</p> <p>100</p> <p>1000</p> <p>Decimal</p>	<p>u16</p> <p>RW</p> <p>per.</p>	<p>Modbus 252<sub>h</sub></p> <p>CANopen 4129<sub>h</sub></p>

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# Diagnostics and Troubleshooting

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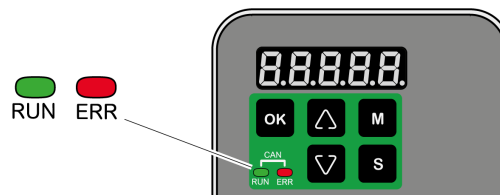
# Diagnostics and Troubleshooting

## What's in This Chapter

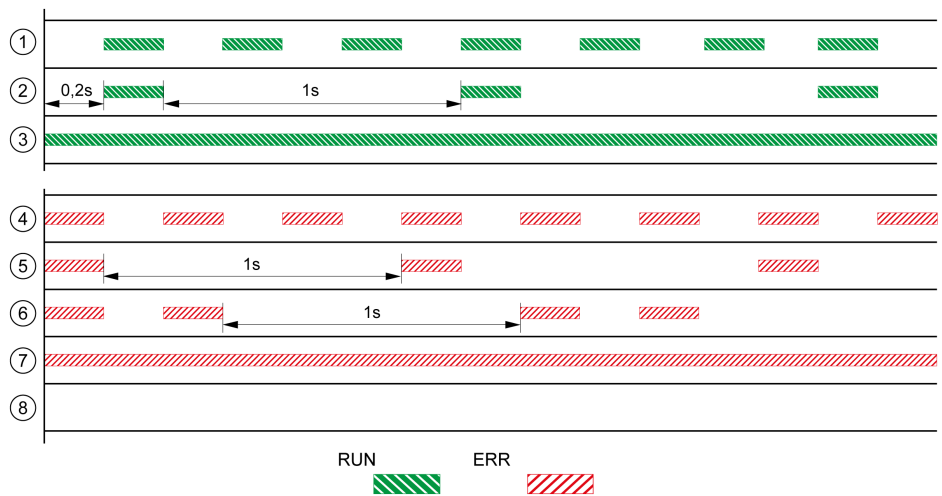
Diagnostics Via the Fieldbus Status LEDs ..... 365  
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## Diagnostics Via the Fieldbus Status LEDs

The fieldbus status LEDs visualize the status of the fieldbus.



The illustration below shows the signals of the CAN bus status LEDs (Run=GN; Err=RD).



Item	Description
1	NMT state PRE-OPERATIONAL
2	NMT state STOPPED
3	NMT state OPERATIONAL
4	Incorrect settings, for example, invalid node address
5	Alert limit reached, for example after 16 incorrect transmission attempts
6	Node Guarding
7	CAN is BUS-OFF, for example after 32 incorrect transmission attempts.
8	Fieldbus communication without error message

## Diagnostics Via the Integrated HMI

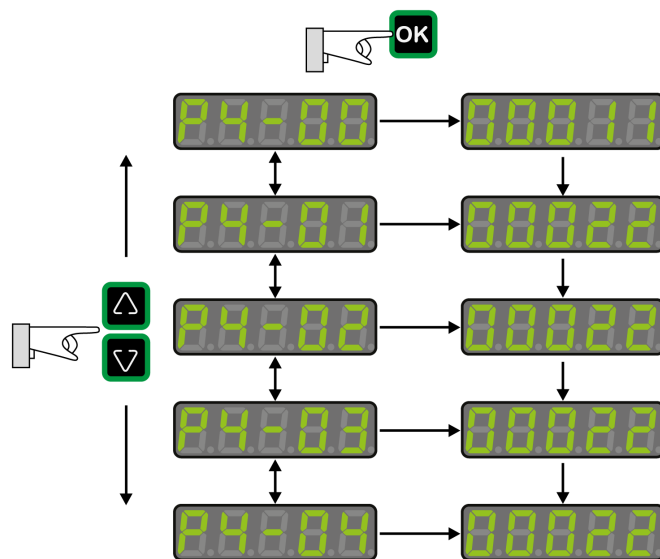
### Modbus Activity

The left most decimal point in the integrated HMI indicates Modbus activity by flashing.

### Error Memory

Parameters *P4-00* to *P4-04* allow you to read the error memory.

The error memory also contains a history of the last 5 detected errors.



Parameter	Description
P4-00	Error number of the most recently detected error
...	...
P4-04	Error number of the oldest detected error

The parameter *P0-47* allows you to read the last detected alert.

## Diagnostics Via the Signal Outputs

The signal outputs allow you to indicate, among other things, operating states and detected errors. The following list is an excerpt of the parameterizable signal output functions. For additional signal output functions, refer to *Setting the Digital Signal Outputs*, page 276.

Setting A for P2-18 ... P2-22	Short name	Name of the output function	Description
1	SRDY	Servo Ready	The signal output function SRDY indicates that no errors are presently detected, i.e. the drive is not in the operating state Fault.
2	SON	Servo On	The signal output function SON indicates that the drive is in the operating state Operation Enabled.

Setting A for P2-18 ... P2-22	Short name	Name of the output function	Description
7	ERROR	Error Detected	The signal output function ERROR indicates that an error has been detected and that the drive has switched to the operating state Fault. For further information, refer to <i>Diagnostics and Troubleshooting</i> , page 365.
11	WARN	Advisory or Alert Signal activated	The signal output function indicates that one of the following conditions has been detected: Hardware limit switch triggered, undervoltage, Nodeguard alert, Operational Stop (OPST).

## Diagnostics Via the Commissioning Software

See the information provided with the commissioning software for details on how to display the device state via the commissioning software LXM28 DTM Library.

## Diagnostics Via the Fieldbus

### Reading Error Numbers

The object 603F<sub>h</sub> contains the most recently detected error.

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory settings Maximum value
603F <sub>h</sub>	Error Code	VAR UINT16 ro	Yes	0 - 65535

The following table is sorted by CANopen error numbers and shows the corresponding Error Code, page 372 (ALnnn).

Value (hex)	Value (dec)	Error Code
2214 <sub>h</sub>	8724	AL001
2310 <sub>h</sub>	8976	AL006
2311 <sub>h</sub>	8977	AL508
2380 <sub>h</sub>	9088	AL532
2381 <sub>h</sub>	9089	AL539
2382 <sub>h</sub>	9090	AL570
3110 <sub>h</sub>	12560	AL002
3120 <sub>h</sub>	12576	AL003
3180 <sub>h</sub>	12672	AL005
3181 <sub>h</sub>	12673	AL501
3182 <sub>h</sub>	12674	AL505
3183 <sub>h</sub>	12675	AL022
3184 <sub>h</sub>	12676	AL575
3185 <sub>h</sub>	12677	AL576
3186 <sub>h</sub>	12678	AL578
3187 <sub>h</sub>	12679	AL579
3199 <sub>h</sub>	12697	AL568
4080 <sub>h</sub>	16512	AL528

Value (hex)	Value (dec)	Error Code
4081 <sub>h</sub>	16513	AL529
4096 <sub>h</sub>	16534	AL561
4310 <sub>h</sub>	17168	AL016
4380 <sub>h</sub>	17280	AL574
4410 <sub>h</sub>	17424	AL514
5111 <sub>h</sub>	20753	AL525 AL526
5530 <sub>h</sub>	21808	AL504
5581 <sub>h</sub>	21889	AL503
5582 <sub>h</sub>	21890	AL522
5583 <sub>h</sub>	21891	AL523
5585 <sub>h</sub>	21893	AL017
5586 <sub>h</sub>	21894	AL507
6380 <sub>h</sub>	25472	AL520
6581 <sub>h</sub>	25985	AL502
7081 <sub>h</sub>	28801	AL533
7090 <sub>h</sub>	28816	AL535
7091 <sub>h</sub>	28817	AL013
7095 <sub>h</sub>	28821	AL595
7121 <sub>h</sub>	28961	AL547
7182 <sub>h</sub>	29058	AL534
7198 <sub>h</sub>	29080	AL563
7380 <sub>h</sub>	29568	AL026
7386 <sub>h</sub>	29574	AL3E1
7387 <sub>h</sub>	29575	AL018
738D <sub>h</sub>	29581	AL567
7393 <sub>h</sub>	29587	AL517
7398 <sub>h</sub>	29592	AL573
7399 <sub>h</sub>	29593	AL577
7580 <sub>h</sub>	30080	AL553
7581 <sub>h</sub>	30081	AL554
7582 <sub>h</sub>	30082	AL557
7583 <sub>h</sub>	30083	AL020
7584 <sub>h</sub>	30084	AL569
8130 <sub>h</sub>	33072	AL180
8210 <sub>h</sub>	33296	AL597
8311 <sub>h</sub>	33553	AL030
8380 <sub>h</sub>	33664	AL596
8481 <sub>h</sub>	33921	AL007
8482 <sub>h</sub>	33922	AL555
8611 <sub>h</sub>	34321	AL009
8680 <sub>h</sub>	34432	AL564
8689 <sub>h</sub>	34441	AL572
F080 <sub>h</sub>	61568	AL401
FF01 <sub>h</sub>	65281	AL558
FF02 <sub>h</sub>	65282	AL025

Value (hex)	Value (dec)	Error Code
FF04 <sub>h</sub>	65284	AL588
FF10 <sub>h</sub>	65296	AL015
FF11 <sub>h</sub>	65297	AL014
FF12 <sub>h</sub>	65298	AL283
FF13 <sub>h</sub>	65299	AL285
FF15 <sub>h</sub>	65301	AL580
FF97 <sub>h</sub>	65431	AL008

## SDO Abort Codes

SDO Abort Code	Meaning
05040001 <sub>h</sub>	Client/server command specifier not valid or undetermined
06010002 <sub>h</sub>	Attempt to write a read-only object
06020000 <sub>h</sub>	Object does not exist in the object dictionary
06040041 <sub>h</sub>	Object cannot be mapped to the PDO
06040042 <sub>h</sub>	The number and length of the objects to be mapped would exceed PDO length
06060000 <sub>h</sub>	Access impossible due to a hardware error (store or restore error)
06070010 <sub>h</sub>	Data type does not match, length of service parameter does not match
06090011 <sub>h</sub>	Subindex does not exist
06090030 <sub>h</sub>	Value range of parameter exceeded (only for write access)
08000000 <sub>h</sub>	General error
080000a1 <sub>h</sub>	Object error reading from non-volatile memory
080000a2 <sub>h</sub>	Object error writing to non-volatile memory
080000a3 <sub>h</sub>	Invalid Range accessing non-volatile memory
080000a4 <sub>h</sub>	Checksum error accessing non-volatile memory
080000a5 <sub>h</sub>	Password error writing encryption zone
08000020 <sub>h</sub>	Data cannot be transferred to or stored in the application (store or restore signature error)
08000021 <sub>h</sub>	Data cannot be transferred to or stored in the application because of the local control (incorrect state)

## Connection for Fieldbus Mode

### Description

If the product cannot be addressed via the fieldbus, check the following connections:

- Power connections to the device.
- Network cable and network wiring.
- Network connection to the device.

# Alert Codes and Error Codes

## Meaning of an Alert

An alert indicates a potential issue that was detected by a monitoring function. An alert does not trigger a transition of the operating state.

Number	Description	Cause	Remedy
AL014	Negative hardware limit switch triggered	-	-
AL015	Positive hardware limit switch triggered	-	-
AL283	Positive software limit switch triggered	-	-
AL285	Negative software limit switch triggered	-	-
Wn023	Alert threshold reached: Motor overload (foldback)	The foldback current of the motor has dropped below the alert threshold specified via the parameter P1-28.	Verify correct settings of the parameter P1-28 for the foldback current of the motor.
Wn124	Data in PDO out of range	-	Verify that the minimum and maximum limit values are not exceeded.
Wn127	R_PDO data cannot be written while the power stage is enabled	-	-
Wn185	CANopen: A communication error was detected.	-	-
Wn380	Position deviation via signal output function MC_OK	After a movement has been successfully completed, MC_OK was active. Then TPOS became inactive which caused MC_OK to become inactive as well.	If you want this condition to cause a detected error instead of an alert, set the parameter P1-48 accordingly.
Wn700	Safety function Safe Torque Off (STO) triggered while the power stage was disabled	The safety function STO has been triggered or the signal for the safety function STO is not properly connected. If this condition is detected while the power stage is enabled, the drive detects an error. If this condition is detected while the power stage is disabled, the drive detects an alert.	Check whether the safety function STO was triggered intentionally. If not, verify correct connection of the signal of the safety function STO.
Wn701	Alert threshold reached: Drive overload (foldback)	The foldback current of the drive has dropped below the alert threshold specified via the parameter P1-24.	Verify correct settings of the parameter P1-24 for the foldback current of the drive.
Wn702	The DC bus voltage has dropped below the alert threshold.	Power supply loss, poor power supply.	Verify correct mains supply. Verify that the undervoltage limit is set correctly via the parameter P4-24.
Wn703	Alert threshold reached: Power stage overtemperature	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
Wn704	Alert threshold reached: Motor overtemperature	The motor temperature is excessively high.	Verify correct settings of the parameters for temperature monitoring. Verify proper ventilation and heat dissipation of the motor. Clean off pollutants such as dust. Verify that the motor is evenly mounted to the flange plate. Increase the size of the flange plate to which the motor is mounted to improve heat dissipation. Verify that the motor is properly sized for the application.
Wn707	Alert threshold reached: Drive overtemperature (controller)	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
Wn709	PLL not synchronized	-	-
Wn713	Positive hardware limit switch and negative hardware limit triggered	-	-

Number	Description	Cause	Remedy
Wn716	Positive software limit switch and negative software limit triggered	-	-
Wn728	Alert: Missing mains supply, undervoltage mains supply	At least one mains phase is missing. Mains voltage is out of range. Mains frequency is out of range.	Verify correct connection of mains supply. Verify that the values of the mains power supply network comply with the technical data.
Wn729	Modbus: Node Guarding error detected	Incorrect Modbus connection, incorrect data from Modbus master.	Verify correct Modbus connection. Verify correct operation of Modbus master.
Wn730	Alert threshold reached: Braking resistor overload	The permissible braking resistor power has been exceeded.	Verify correct rating of the braking resistor used. Verify your application.
Wn731	Encoder error detected	Refer to parameter P8-49 for details.	-
Wn732	Alert threshold reached: Processing time too long	-	-
Wn734	Alert threshold reached: Drive overtemperature (IPM)	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
Wn736	PDO packet too long	-	Verify correct PDO mapping.
Wn737	Parameters have been reset to the factory settings, but are not yet saved to the non-volatile memory.	-	Use parameter P2-08 = 11 to save parameters reset to the factory settings to the non-volatile memory and restart the drive.
Wn738	No target values received via the fieldbus	No target values have been received via the fieldbus three times in succession.	Verify that target values are transmitted via the fieldbus. Verify that the fieldbus has exclusive access.
Wn739	Temperature value for monitoring function not available	-	-
Wn740	Target value will cause movement to positive software limit switch	-	Verify correct target positions.
Wn741	Target value will cause movement to negative software limit switch	-	Verify correct target positions.
Wn742	Motor type has changed	The type of motor connected is different from the previously connected type of motor.	Reset the drive to the factory settings.
Wn743	Fan circuit alert	The fan circuit is either overloaded or disconnected.	Check for fan short circuit or disconnection.
Wn744	Excessive electronic noise	-	Check proper grounding and shielding. Use line filter.
Wn745	Configured feedbacktype and actual connected encoder mismatch	The connected encoder does not correspond to configured feedback type.	Check that configured feedback type and connected encoder match.
Wn746	Encoder overtemperature	-	-
Wn747	Encoder internal flash memory error detected	-	-
Wn748	Encoderfeedback error detected	The device has detected unusually high shaft displacement. The device can still operate correctly; but position error might be higher than usual.	-
Wn749	The multi-turn battery voltage is within the following range: $3\text{ V} < \text{VBAT} < 3.15\text{ V}$ .  Battery voltage has started to drop; but the multi-turn information is still reliable.	-	Replace encoder battery.
Wn750	The multi-turn counter exceeded the range of 16 bit signed value.  Multi-turn Counter $< -32768$  Or multi-turn Counter $> 32767$	-	Execute multi-turn Config/Reset (Set Reference Point) by command P8-44=3/2.  For some applications which will rotate motor in one direction, the alert Wn750 for checking turns number within $-32768\dots32767$ can be turned off by parameter P5-80=1.

Number	Description	Cause	Remedy
Wn751	The last save operation was interrupted.	The last save operation was interrupted by power cycle. The former set of parameters are active.	Set the new parameter configuration and perform save command.
Wn752	Stop filter command cannot be set	SensAR Encoder Filter Mode is not supported on the connected Motor.	Set P8-71 to 0 ignore the alert. Or Upgrade Motor Hardware version.
Wn753	Reference position reset	AL576 or homing procedure error or the multi-turn roll over will cause this alert.	Execute multi-turn Config/Reset (Set Reference Point) by command P8-44=2 Or Execute a homing procedure. Or set P5-80 to 1.

## Meaning of an Error

An error is a discrepancy between a computed, measured, or signaled value or condition and the specified or theoretically correct value or condition detected by a monitoring function. An error triggers a transition of the operating state.

Number	Short description	Cause	Remedy
AL001	Power stage overcurrent	An overcurrent has been detected at the power stage which may be caused by a short circuit or by incorrect settings of the current loop parameters. This condition may occur up to three times in succession. After the third time, a time delay of one minute must pass before the power stage can be enabled again.	Verify correct connection of the motor. Verify correct settings of the parameters for the current loop.
AL002	DC bus overvoltage	The DC bus voltage exceeded the maximum value.	Verify your application. Reduce the external load, the motor velocity, or the deceleration. Use an appropriately rated braking resistor, if necessary.
AL003	DC bus undervoltage	Power supply loss, poor power supply.	Verify correct mains supply. Verify that the undervoltage limitation is set correctly via the parameter P4-24.
AL005	Braking resistor overload	The braking resistor has been on for such a long period of time that its overload capability has been exceeded.	Verify your application. Reduce the external load, the motor velocity, or the deceleration. Use a braking resistor with a greater rating, if necessary.
AL006	Motor overload (foldback)	The foldback current of the motor has dropped below the value specified via the parameter P1-27.	Verify correct settings for the parameter P1-27.
AL007	Actual motor velocity too high.	The actual motor velocity exceeded the velocity limitation by more than 20% (P1-55). The analog input signal is not stable.	Verify that the velocity limitation set via the parameter P1-55 matches the requirements of the application. Verify that the values for the tuning parameters are suitable. Verify that the frequency of the analog input signal is stable using a signal detector. Use a filter function.
AL008	Frequency of reference value signal is too high	The frequency of the pulse signal (A/B, Pulse/Direction, CW/CCW) exceeds the specified range. Received pulses may be lost.	Adapt the output pulse frequency of the external source to fit the input specification of the drive. Adapt the gear ratios to the application requirements (parameters P1-44, P1-45, P2-60, P2-61 and P2-62).
AL009	Position deviation too high (following error)	The position deviation has exceeded the maximum permissible position deviation specified via the parameter P2-35 and the drive has detected a following error.	Verify your application. Reduce the external load. Increase the permissible position deviation via the parameter P2-35. Reduce the motor velocity via the parameters P1-09 ... P1-11 or the analog input V_REF. Increase the torque limitation via the parameters P1-12 ... P1-14 or the analog input T_REF.
AL013	The input to which the signal input function OPST is assigned has been activated.	-	Identify the cause which has triggered the signal input function OPST. Remove the cause. If your application does not require the signal input function OPST, disable this signal input function.



Number	Short description	Cause	Remedy
AL016	Power stage overtemperature	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
AL017	Error detected in non-volatile memory	The drive was reset to the factory settings via parameter P2-08.	Use parameter P2-08 = 11 to save parameters reset to the factory settings to the non-volatile memory and restart the drive.  Contact technical support.
AL018	Encoder simulation frequency exceeded 4 MHz	The computed equivalent encoder output frequency exceeds the maximum limit of 4 MHz for this signal.	Reduce the resolution of the encoder simulation via the parameter P1-46 or reduce the maximum velocity.
AL020	Modbus: Node Guarding error detected	Incorrect Modbus connection, incorrect data from Modbus master.	Verify correct Modbus connection. Verify correct operation of Modbus master.
AL022	Missing mains supply, undervoltage mains supply	At least one mains phase is missing. Mains voltage is out of range. Mains frequency is out of range.	Verify correct connection of mains supply. Verify that the values of the mains power supply network comply with the technical data.
AL025	Not possible to read data of electronic motor nameplate	Incorrect or missing motor data. Motor without electronic motor nameplate has been connected.	Verify that the drive and the connected motor are a permissible product combination. Verify correct connection of the encoder. Contact Technical Support or replace the motor.
AL026	Error detected in communication with motor encoder	Communication with the encoder was not initialized correctly.	Verify correct connection of the encoder. Contact Technical Support or replace the motor.
AL030	Motor torque too high for an excessive period of time	The motor torque has exceeded the value specified via the parameter P1-57 for a period of time exceeding the value specified via the parameter P1-58.	Verify your application. Verify that no movements are made up to a mechanical stop (for example, use limit switches). Verify that the values for the parameters P1-57 and P1-58 are suitable.
AL180	CANopen: Heartbeat error detected	The bus cycle time of the CANopen master is greater than the programmed heartbeat or node guard time. The connection between the CANopen master and the drive is lost.	Verify correct CANopen connection. Check the CANopen master. Verify correct CANopen configuration, increase the Heartbeat or Node Guarding time.
AL3E1	Drive is not synchronous with master cycle	Operating mode has been activated but drive is not synchronized to external synchronization signal.	Verify correct CANopen connection. After having started the synchronization mechanism, wait for 120 cycles before activating the operating mode.
AL401	Fieldbus: Communication error detected	While the power stage was enabled, a command was received requesting a different communication state.	Verify that the master does not try to change the communication state while the power stage of the drive is enabled.
AL501	Safety function Safe Torque Off (STO) triggered	The safety function STO has been triggered or the signal for the safety function STO is not properly connected. If this condition is detected while the power stage is enabled, the drive detects an error. If this condition is detected while the power stage is disabled, the drive detects an alert.	Check whether the safety function STO was triggered intentionally. If not, verify correct connection of the signal of the safety function STO.
AL502	System error detected (FPGA)	-	Contact technical support.
AL503	System error detected (non-volatile memory)	-	Contact technical support.
AL504	System error detected (non-volatile memory)	-	Contact technical support.
AL505	DC bus voltage measurement	An error was detected in the circuit that measures the DC bus voltage.	Perform a Fault Reset. Restart the drive. If the error persists, contact Technical Support.
AL507	System error detected (NV access)	-	Contact technical support.
AL508	Drive overload (foldback)	The foldback current of the drive has dropped below the value specified via the parameter P1-23.	Verify correct settings for the parameter P1-23.

Number	Short description	Cause	Remedy
AL514	Motor overtemperature	The motor temperature is excessively high.	Verify correct settings of the parameters P1-62 and P1-63 for temperature monitoring. Verify proper ventilation and heat dissipation of the motor. Clean off pollutants such as dust. Verify that the motor is evenly mounted to the flange plate. Increase the size of the flange plate to which the motor is mounted to improve heat dissipation. Verify that the motor is properly sized for the application.
AL517	Encoder overvoltage or overcurrent	The current supplied by the drive for the 5 V encoder supply has exceeded the limit. This condition may occur up to three times in succession. After the third time, a time delay of one second must pass before the power stage can be enabled again.	Verify correct connection of the encoder (short circuits). Verify the current consumption of the encoder.
AL520	Target position rejected	A target position was rejected because it would have caused the motor to exceed the maximum velocity.	Verify that target positions do not lead to excessive motor velocities.
AL522	System error detected (CAN power supply)	The internal supply voltage for the CAN bus is not correct.	Contact technical support.
AL523	System error detected (self-test)	The self-test has detected an error.	Contact technical support.
AL525	Reserved	–	–
AL526	Reserved	–	–
AL527	System error detected (Watchdog)	The Watchdog function has detected a system error.	Restart the drive. If the error persists, contact Technical Support.
AL528	Drive overtemperature (IPM)	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
AL529	Drive overtemperature (controller)	Ambient temperature is too high, fan is inoperative, dust.	Verify correct operation of the fan. Improve the heat dissipation in the control cabinet. Remove pollution and verify that dust cannot get into the control cabinet or into the drive.
AL532	Calculated offsets for current sensors out of range	The calculated offsets for the current sensors are out of range.	Perform a Fault Reset. Restart the drive. If the error persists, contact Technical Support.
AL533	Reserved	–	–
AL534	Pulse signal missing	One of the pulse signals is not connected.	Verify correct connection of the pulse inputs.
AL535	System error detected (FPGA does not match firmware)	The firmware version is not suitable for the drive.	Update the firmware of the drive. Contact technical support.
AL539	Motor phase missing	One of the motor phases is not connected.	Verify correct connection of the motor phases. Contact technical support.
AL547	Motor blocked	The motor was blocked mechanically, for example, by a mechanical stop or by the load.	Remove condition causing the mechanical blocking. Verify your application.
AL553	No connection between master and drive	-	Connect master and drive.
AL554	Target position rejected	A target position was rejected because it would have caused the motor to exceed the maximum acceleration/deceleration.	Verify that target positions do not lead to excessive acceleration/deceleration.
AL555	Velocity deviation too high	The deviation between actual velocity and reference velocity has exceeded the maximum velocity deviation specified via the parameter P2-34.	Verify your application. Verify that the values for the tuning parameters are suitable. Increase the value for the maximum velocity deviation in the parameter P2-34.
AL557	No target values received via the fieldbus	No target values have been received via the fieldbus three times in succession.	Perform a Fault Reset. Verify that target values are transmitted via the fieldbus.
AL558	System error detected	-	Contact technical support.
AL560	Power stage supply off	-	Power on the power stage supply.

Number	Short description	Cause	Remedy
AL561	Temperature sensor inoperative	-	Restart the drive. If the error persists, contact Technical Support.
AL563	Commutation error detected	Motor phases have been interchanged.	Verify correct connection of the motor phases.
AL564	Position deviation via signal output function MC_OK	After a movement has been successfully completed, MC_OK was active. Then TPOS became inactive which caused MC_OK to become inactive as well.	Use the signal input function FAULT_RESET to perform a Fault Reset and set the parameter P0-01 to 0. If you want this condition to cause an alert instead of a detected error, set the parameter P1-48 accordingly.
AL567	System error detected (encoder)	Refer to parameter P8-48 for details.	Contact technical support.
AL568	Braking resistor overload	The permissible braking resistor power has been exceeded.	Verify correct rating of the braking resistor used. Verify your application.
AL569	Configuration not correctly transferred via Modbus	-	Verify correct connection. Verify that configuration file and drive are compatible.
AL570	Overcurrent detected at one of the digital outputs	-	Verify correct wiring of the digital outputs. Verify that there are no short circuits.
AL571	Reference position operation rejected.	If you directly perform Homing, or P8-44 = 2, after modifying P1-01 C (byte 2) without power-cycling the drive, then error AL571 is reported.	Power-cycle the drive and then perform Homing or set P8-44 to 2.
AL572	Position deviation too high (following error)	The position deviation has exceeded the maximum permissible position deviation specified via the parameter P2-35 and the drive has detected a following error.	Verify your application. Reduce the external load. Increase the permissible position deviation via the parameter P2-35. Reduce the motor velocity via the parameters P1-09 ... P1-11 or the analog input V_REF. Increase the torque limitation via the parameters P1-12 ... P1-14 or the analog input T_REF.
AL573	The returned position values are no longer considered valid	Usually caused by inoperable encoder hardware or incorrect encoder assembly, for example: damaged hall sensors, damaged encoder rotor, displacement between motor shaft and encoder is too great, corrupted encoder FLASH memory - corrupts calibration tables.	Replace new motor.
AL574	The encoder temperature is too high	Caused when temperature on encoder is too high relative to what was configured.	Reduce temperature applied on encoder replace new motor.
AL575	The encoder supply voltage has dropped under operational value	The device supply voltage has dropped under operational value.	Make sure power supplied to encoder is according to specifications.  Replace new driver.
AL576	The multi-turn encoder battery voltage has dropped under 3 Vdc	The multi-turn encoder battery voltage has dropped under 3 Vdc; battery box cable disconnect from motor encoder side.	Check battery box cable.  Check battery voltage.  Replace encoder battery.  Clear AL576 by command P8-44=1.
AL577	The multi-turn encoder requires an explicit configuration command	-	Execute multi-turn Config/Reset (Set Reference Point) by command P8-44=3/2.
AL578	Internal position synchronization error detected between the multi-turn and the single-turn modules	Possible likely reasons: incorrect multi-turn calibration, corrupted multi-turn calibration data on FLASH, internal multi-turn chip error, or incorrect multi-turn chip magnetic screw.	Replace by a new motor.
AL579	Generic error code of the multi-turn module is detected	Encoder is damaged or that a magnetic screw is missing or multi-turn calibration is either missing or corrupt or battery disconnect form encoder for a long time or the FW version of encoder is below 13020023.	Reconnect battery to encoder and Execute multi-turn Config /Reset (Set Reference Point) by command P8-44=3/2, then power cycle the drive. If this error happens again, contact your local Schneider Electric service representative.
AL580	The encoder firmware cannot operate on the provided hardware	-	-
AL581	The drive firmware cannot operate with the provided encoder version	-	-

Number	Short description	Cause	Remedy
AL582	Unsupported HW (110V/Multi-Turn Encoder/Size 5 power stage)	-	-
AL585	CANopen device in state bus-off	Too many error frames have been detected. CANopen devices have different baud rates.	Verify correct baud rates. Verify CANopen bus installation.
AL588	RT Overload error	Real time execution time is more than 31.25us. Mapping large amount of PDO.	Too much load on the real time loop - such as: too many PDO (rx/tx) are mapped/ sync-position/record/ touch probe are tasks with large impact to the CPU.
AL595	Impermissible combination of drive and motor	-	Use an approved drive/motor combination.
AL596	Unstable current loop	Excessive overshoot in current loop.	Verify correct settings of the parameters for the current loop.
AL597	R_PDO is too short	-	Verify correct PDO settings for drive and master.
AL598	Invalid Quick Stop active state	A Quick Stop has been triggered via the fieldbus or by releasing access right. The Quick Stop option code (P3-31) has been set to -1 or -2 which causes the drive to transition to the operating state 9 Fault instead of the operating state 7 Quick Stop Active.	Verify correct setting of the parameter P3-31.
AL5A0	Drive Locked	Hardware issue causing problems accessing nonvolatile memory.	Return drive to factory check HW.
AL5A1	Drive is not configured	-	Implement factory restore.

## New Motor Fold Back Characteristics and Parameter Setting

	P2-72: value BCH2 LB - LD	P2-72: value BCH2 LF - HF - LH	P2-72: value BCH2 MM - MR
P2-73: value 1 (default)	MFOLDT=450	MFOLDT=2450	MFOLDT=3400
P2-73: value 2	MFOLDT=750	MFOLDT=7700	MFOLDT=4500
P2-73: value 3	MFOLDT=980	MFOLDT=7700	MFOLDT=5640
P2-73: value 4	MFOLDT=1670	MFOLDT=27340	MFOLDT=6840

Current [%]	BCH2 LB - LD BQ 04 - 06	MFOLDT=1670		MFOLDT=980		MFOLDT=750		MFOLDT=450	
		Deviation	Deviation	Deviation	Deviation	Deviation	Deviation	Deviation	Deviation
		Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]
120	21	21	0.00	14.8	-29.52	12.7	-39.52	10	-52.38
140	6.9	9.6	39.13	6.9	0.00	6	-13.04	4.8	-30.43
160	4	5.8	45.00	4.2	5.00	3.7	-7.50	3	-25.00
180	2.6	4	53.85	2.9	11.54	2.6	0.00	2.1	-19.23
200	1.8	2.8	55.56	2.1	16.67	1.95	8.33	1.65	-8.33
220	1.3	2.16	1.54	1.65	26.92	1.5	15.38	1.3	0.00
240	1	1.57	57.00	1.27	27.00	1.17	17.00	1.05	5.00
260	0.8	1.16	45.00	0.99	23.75	0.93	16.25	0.86	7.50
280	0.7	0.85	21.43	0.77	10.00	0.75	7.14	0.71	1.43
300	0.6	0.6	0.00	0.6	0.00	0.6	0.00	0.6	0.00

Current [%]	BCH2 LF - HF - LH	MFOLDT=27340	MFOLDT=19500	MFOLDT=7700	MFOLDT=2450
		Deviation	Deviation	Deviation	Deviation

	BQ 08 - 10	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]
120	270	270	0.00	199.5	-26.11	93.3	-65.44	46	-82.96
140	90	121.3	34.78	90	0.00	42.8	-52.44	21.8	-75.78
160	36	71.7	99.17	53.5	48.61	25.9	-28.06	13.7	-61.94
180	17.5	47	168.57	35.2	101.14	17.5	0.00	9.6	-45.14
200	8.4	32.1	282.14	24.3	189.29	12.5	48.81	7.2	-14.29
220	5.6	22.2	296.43	17	203.57	9.1	62.50	5.6	0.00
240	4.2	15.1	259.52	11.7	178.57	6.7	59.52	4.4	4.76
260	3.3	9.8	196.97	7.8	136.36	4.9	48.48	3.6	9.09
280	2.5	5.7	128.00	4.8	92.00	3.5	40.00	2.9	16.00
300	2.4	2.4	0.00	2.4	0.00	2.4	0.00	2.4	0.00

Current [%]	BCH2 MM - MR	MFOLDT=6840		MFOLDT=5640		MFOLDT=4500		MFOLDT=3400	
	BQ 13 - 18	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]	Overload time [s]	from MPC [%]
120	82.5	82.5	0.00	71.7	-13.09	61.5	-25.45	51.6	-37.45
140	33	37.8	14.55	33	0.00	28.5	-13.64	24.1	-26.97
160	18.6	22.9	23.12	20.1	8.06	17.5	-5.91	14.9	-19.89
180	12	15.5	29.17	13.7	14.17	12	0.00	10.3	-14.17
200	8.1	11	35.80	9.8	20.99	8.7	7.41	7.6	-6.17
220	5.7	8	40.35	7.2	26.32	6.5	14.04	5.7	0.00
240	4.2	5.9	40.48	5.4	28.57	4.9	16.67	4.4	4.76
260	3.3	4.3	30.30	4	21.21	3.7	12.12	3.4	3.03
280	2.7	3	11.11	2.9	7.41	2.8	3.70	2.7	0.00
300	2.1	2.1	0.00	2.1	0.00	2.1	0.00	2.1	0.00

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# Service, Maintenance and Disposal

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# Service, Maintenance, and Disposal

## What's in This Chapter

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## General

There are no user-serviceable parts within the product. If you perceive difficulties with the operation of the product, contact your local Schneider Electric service representative.


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

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

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

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

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


**DANGER**

**ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Measure the voltage on the DC bus with a properly rated voltage sensing device and verify that the voltage is less than 42.4 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- 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.**

## Service Address

If you cannot resolve an error yourself, contact your sales office.

Have the following data available:

- Nameplate (type, identification number, serial number, DOM, ...)
- Type of error (with LED flash code or error code)
- Previous and concomitant circumstances
- Your own assumptions concerning the cause of the error

Also include this information if you return the product for inspection or repair.

If you have any questions, contact your sales office. Your sales office staff will provide you the name of a customer service office in your area.

[www.se.com](http://www.se.com)

## Maintenance of the Drive

Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information to be observed.

Repairs cannot be made with the device installed.

Include the following points in the maintenance plan of your machine.

## Connections and Fastening

- Check all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Tighten all mechanical and electrical threaded connections to the specified torque.

## Cleaning

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

## Lifetime of the Safety Function STO

The STO safety function is designed for a lifetime of 20 years. After this period, the data of the safety function are no longer valid. The expiry date is determined by adding 20 years to the DOM shown on the nameplate of the product.

- This date must be included in the maintenance plan of the system.
- Do not use the safety function after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.08. (31 December 2008). This means: Do not use the safety function after December 31, 2028.



## Replacement of Drive

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

<b>▲ WARNING</b>	
<b>UNINTENDED EQUIPMENT OPERATION</b>	
<ul style="list-style-type: none"> <li>• Only start the system if there are no persons or obstructions in the zone of operation.</li> <li>• Do not operate the drive system with undetermined parameter values.</li> <li>• Never modify a parameter value unless you fully understand the parameter and all effects of the modification.</li> <li>• Restart the drive and verify the saved operational data and/or parameter values after modification.</li> <li>• Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.</li> <li>• Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.</li> </ul>	
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>	

Prepare a list with the parameters required for the functions used.

Observe the following procedure when replacing devices:

Step	Action
1	Save all parameter settings. Save the data to your PC using the commissioning software, refer to chapter <a href="#">Commissioning Software</a> , page 158.
2	Power off all supply voltages. Verify that no voltages are present.
3	Label all connections and remove all connection cables (unlock connector locks).
4	Uninstall the product.
5	Note the identification number and the serial number shown on the product nameplate for later identification.
6	Install the new product as per chapter <a href="#">Installation</a> , page 104.
7	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.
8	Commission the product as per chapter <a href="#">Commissioning</a> , page 149.

## Maintenance of the Motor

Prior to any type of work on the drive system, consult the chapters on [Installation](#) and [Commissioning](#) for information to be observed.

Repairs cannot be made with the device installed.

Include the following points in the maintenance plan of your machine.

## Connections and Fastening

- Inspect all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Verify that all output elements are firmly seated.

- Tighten all mechanical and electrical threaded connections to the specified torque.

## Lubricating the Shaft Sealing Ring

In the case of motors with shaft sealing ring, lubricant must be applied to the space between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the shaft sealing rings will be significantly reduced.

## Cleaning

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

### **▲ WARNING**

#### **UNINTENDED MOVEMENT**

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

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

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a pressure washer. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the cables, cable entry seals, O-rings, and motor paint are not damaged.

## Replacing the Rolling Bearing

When the rolling bearing is replaced, the motor is partially demagnetized and loses power.

### **NOTICE**

#### **INOPERABLE EQUIPMENT**

Do not replace the rolling bearing.

**Failure to follow these instructions can result in equipment damage.**

## Replacing the Battery for the Multi-Turn Encoder

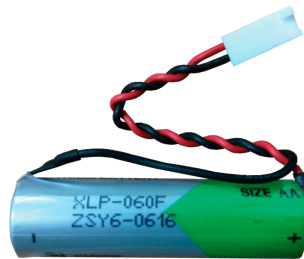
The multi-turn counting is preserved through power down by the external battery located into the battery compartment.

- Do not disconnect the encoder cable from the battery compartment or the multi-turn information is discarded.

- Replace the battery while the encoder is powered by the drive or the multi-turn information is discarded.

The battery has its manufacturing date printing on it in MMY format. The expiration date for the battery is 3 years after the manufacturing date.

On the following example, the manufacturing date of the battery is June 2016 (0616). The expiration date is June 2019.



The battery voltage is monitored by the encoder at each power on of the drive.

- An alert Wn749 related to P8-49 Bit 10 is triggered when the measured voltage is in the range 3 ... 3.15 Vdc.
- An error AL576 related to P8-48 Bit 5 is triggered when the measured voltage is under 3 Vdc.

**NOTE:** After replacing the battery, the detected error is cleared the next time the drive is powered on (next battery voltage measurement), or when an explicit command is sent to the encoder by setting P8-44 to the value 1.

## Lexium 26/28 Multi-Turn Encoder

The purpose of this part is to help you understand the interface between the multi-turn encoder and Lexium 26/28 servo drives in order to be able to operate the system with multi-turn encoder.

### Introduction

#### Overview

An absolute system is used in an application which must preserve the motor position even when the power to the servo system is interrupted.

Lexium 26/28 absolute system includes a Lexium 26/28 series servo drive, an absolute type BCH2 series servo motor, a battery compartment VW3M8BATC, and a battery VW3M9BATT. An absolute encoder in an BCH2 series servo motor will constantly record the actual positions at all times.

When power is removed from the system, the encoder will keep operating because the power will be supplied from battery. Therefore, when the motor shaft is rotated during main power off, the system can still calculate its position to its data memory inside encoder.

Lexium 26/28 multi-turn encoder is a digital, single-turn or multi-turn absolute feedback device. Its major output is the absolute position of the motor shaft in a turn, represented digitally as a 22-bit word, and number of total revolutions in a 16-bit word, for the multi-turn one.

## Single-Turn versus Multi-Turn

A single-turn absolute encoder is capable of encoding a shaft position of the motor within one revolution (or turn). After each power up of the servo system with a single-turn encoder, the absolute position of the shaft in a turn can be obtained.

During run-time, both the drive and the single-turn encoder are capable of counting the number of motor revolutions (the multi-turn counter). However, after power cycle, the revolutions counter is reset for a single-turn system. For example, the multi-turn counter is volatile in a single-turn system.

Single-turn systems are used in machines that do not have a requirement for maintaining position data after a power cycle. In terms of application, it means that homing of the machine after power cycle is acceptable or the system is not required to be homed during operation.

Contrary to single-turn, the multi-turn system has full absolute position information, including the revolutions counter, even if the power is removed. This is used in machines where positioning of the load in a multi-dimensional space is required. In those systems, the homing (or motion calibration) is only acceptable during initial machine calibration and not acceptable after each power cycle. For such systems, the multi-turn encoder is typically used.

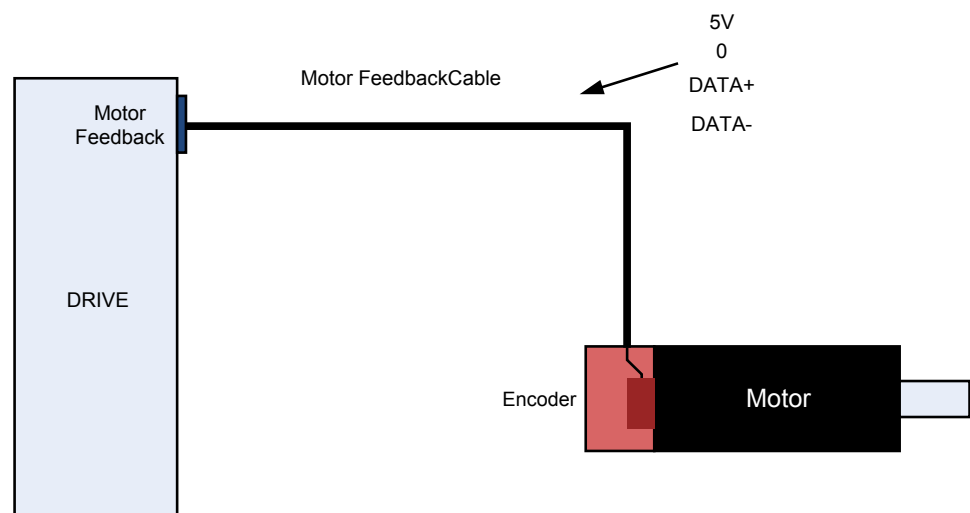
In conclusion, the advantage of the multi-turn over a single-turn system is the absence of the need for homing procedure after each system power cycle. The multi-turn system has the absolute position information including the number of revolutions at any time, even after power cycle.

There are two major types of multi-turn encoders: battery backed up and battery-less.

Lexium 26/28 multi-turn encoder is battery backed, meaning the battery is used to maintain the non-volatility of the revolutions counter. As long as the battery is connected and has enough voltage (> 3 V), the multi-turn counter and revolutions counter will remain during the absence of mains power.

## Architecture Single-Turn

Motor with a single-turn encoder is connected to the drive according to the following diagram:

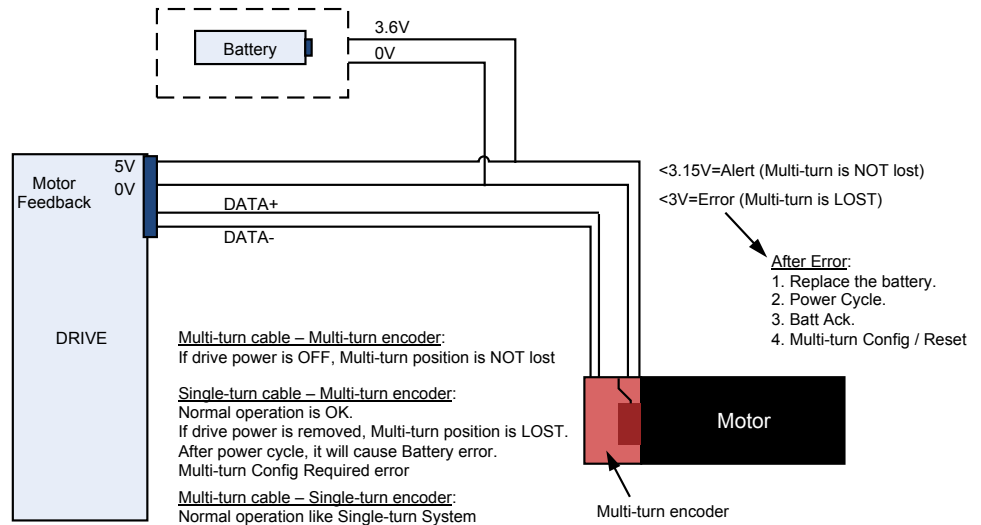


Single-turn encoder is connected to the servo drive over a motor feedback cable. The power to the encoder is supplied over the 5V output of the servo drive. As long as the servo drive is powered, the encoder is powered too, responding with an absolute position in a single revolution.

The servo drive can move the motor and count the number of revolutions. However, right after the 5V output is removed, the multi-turn information is reset. After the power is back again, the encoder will return the information inside one revolution, but the multi-turn counter will be zero.

## Architecture Multi-Turn with Battery

Motor with a multi-turn encoder is connected to the drive according to the following diagram:



The multi-turn encoder is connected to the servo drive over a battery compartment, which is responsible to supply battery to the multi-turn subsystem in the encoder while power (5V) is off. The battery compartment contains circuitry which controls the switching between the power (5V) and the battery supply automatically.

Since both the battery and the power supply are connected to the same wires in the cable, Lexium 26/28 multi-turn encoder can measure the battery only during power up.

The battery backup is designed to work for at least 3 years. After this period, the battery voltage is expected to drop exponentially. The drop period might take less than a month or maybe more, depending on how much of battery charge has been consumed.

The battery is consumed only when the power supply of 5V is removed, meaning when the servo system mains power is removed. If the motor is at standstill, the power consumption off the battery is relatively low. It grows, however, with rotation velocity. Typically, the motor is not rotated when the servo system is without power. However, the multi-turn system is capable to count the revolutions when powered by battery, while consuming more charge from the battery.

## Operation

### Functionalities

### Reference Position Set

The **Reference Position Set** command is performed in multi-turn motor, only while in the multi-turn mode.

This command can be performed in both (enable and disable) drive states by command (P8-44=2).

The **Reference Position Set** command configures multi-turn encoder and sets new reference position according to the value of P5-78 parameter.

If you implement P8-44=2, then the position equals the reference position as determined by P5-78.

If you implement Homing, then the position equals the home-offset as determined by HOMEOFFSET- (P-0-4020.0.7, usually equals 0).

While a drive is in enable state, this command is performed for all operational modes, excluding **CYCLIC SYNCHRONOUS POSITION** mode.

During the execution of this command, the encoder serial number is read. This serial number is used to check the replacement of the motor or encoder, when a power cycle is performed.

Such as P8-47 ServoSense firmware and hardware versions, P8-45 encoder Feedback type.

When the **Reference Position Set** command is successful, the alert - **reference position not established** (WN753) is cleared, and bit 5 of S-0-0135 in the Statusword is set to 1.

## Multi-Turn Battery Acknowledge

The battery error (AL576) is set in the drive, when battery disconnection from the multi-turn encoder is detected after power cycle.

This error automatically produces the **reference position not established** (WN753) alert.

Multi-turn battery Acknowledge command is used to clear **battery voltage is below allowed threshold** error in the multi-turn encoder after battery replacement, and to reset battery error (AL576) in the drive.

This command can be performed by command P8-44=1.

## Ignore Multi-Turn Encoder Errors

This feature allows multi-turn encoder work in multi-turn or single-turn mode.

When P5-79 is set to 0, encoder works as multi-turn, when the parameter is set to 1 – as single-turn.

This feature performs the following procedure:

- Get multi-turn encoder error mask by reading special error mask address from the encoder.
- Set new error mask according to the entered value and send command to write updated mask into error mask address in the encoder.

When encoder is set to the single-turn mode, multi-turn errors and alerts are cleared.

## Ignore Multi-Turn Encoder Alerts

When encoder is in multi-turn mode, this feature allows to enable or disable multi-turn encoder alerts. Parameter P5-80=1 disables multi-turn encoder alerts.

The alert **MT Encoder rollover** (WN750) is disabled even if the encoder exceeds the counting range. Multi-turn Counter  $\leq -32768$  or multi-turn Counter  $\geq 32767$ .

This feature performs the following procedure:

- Get multi-turn encoder alert mask by reading special alert mask address from encoder.
- Set new alert mask according to the parameter value and send command to write updated mask into alert mask address in encoder.

## Ignore Homing and Reference Position

This feature allows absolute moving with or without homing for both single-turn and multi-turn encoder and without **Reference Position Set** command for multi-turn encoder. Parameter P5-81=1 blocks the multi-turn encoder alerts and sets the

Bit 15 Statusword to 1, when the reference position is not set. The 'isHomed' signal automatic set to on if parameter P5-81=1

## Multi-Turn Encoder Position Counter

This feature is used to indicate multi-turn encoder current revolutions.

Special command is sent in the init feedback communication procedure to get encoder's position. An encoder revolutions value can be received by reading the P5-82.

When the encoder is single-turn or is in single-turn mode, the value of position counter always is 0.

## Homing Procedure For Multi-Turn Encoder

To set position, drive with multi-turn encoder can independently perform ether homing or reference position set command.

Two main differences for multi-turn encoder:

- Write position to the multi-turn encoder.
- Save homing parameters in NVRAM to reproduce after power cycle.

The homing procedure for multi-turn encoder needs more execution time than for single-turn encoder.

## Commands and Parameters

Multi-turn encoder has several commands, which allows managing the errors, multi-turn functionality and battery issues. These commands are encapsulated on the drive side as Parameters. The following table gives a short description of the commands:

Name	Parameters	Description	Use Cases
Battery Acknowledge	P8 – 44 → 1	Acknowledges the battery event: <ul style="list-style-type: none"> <li>• Battery Down error - AL576.</li> <li>• Low Battery alert - Wn749.</li> </ul>	This command is used to clear the following events: <ul style="list-style-type: none"> <li>• Battery Down error - AL576</li> <li>• Low Battery alert - Wn749</li> </ul>
MT Set Reference Point	P8 – 44 → 2	This command performs the following: <ul style="list-style-type: none"> <li>• Set reference point.</li> </ul>	This command can be performed in both (enable and disable) drive states, excluding <b>CSP</b> mode When alert Wn753 is indicated.
MT Config /Reset	P8 – 44 → 3	This command performs the following: <ul style="list-style-type: none"> <li>• Initialize the multi-turn system.</li> <li>• Reset multi-turn revolution counter to 0.</li> </ul>	This command only can be performed in disable drive states.  When the multi-turn Config/Reset required error AL577 or Wn750 is indicated.
MULTI_TURN_REF_POSITION	P5-78	Multi-turn reference position in PUU.	After a successful reference set (P8-44=2), this P5-78 position is automatically set at the reference point.
IGNORE_BATTERY_FAULTS	P5-79	Defines whether the drive is to ignore the multi-turn error AL576: <ul style="list-style-type: none"> <li>• Value 0: The masking of the multi-turn error AL576 is inactive.</li> <li>• Value 1: The masking of the multi-turn error AL576 is active.</li> </ul>	When set P5-79=1, multi-turn encoder can be used as single-turn (even with single-turn cable).
IGNORE_ENCODER_WARNINGS	P5-80	Defines whether the drive is to ignore the multi-turn alert Wn750.  Multi-turn counter exceeded the range of 16-bit signed value:	For some applications which will rotate motor in one direction, the alert Wn750 for checking turns number within -32768 ... 32767

Name	Parameters	Description	Use Cases
		<ul style="list-style-type: none"> <li>Multi-turn Counter <math>\leq -32768</math> or;</li> <li>Multi-turn Counter <math>\geq 32767</math></li> <li>Value 0: The masking of Wn750 is inactive.</li> <li>Value 1: The masking of Wn750 is active.</li> </ul>	can be turned off by parameter P5-80=1.
IGNORE_HOMING_REF_POS	P5-81	Ignore homing and reference position set. Defines whether absolute positioning is allowed without homing/Reference Position Set. <ul style="list-style-type: none"> <li>Value 0: Not allowed.</li> <li>Value 1: Allowed.</li> </ul>	When set P5-81=1, absolute positioning is allowed without homing/ set Reference Point.
MT_ENCODER_POSITION	P5-82	Current position in revolutions.	This parameter is used to monitor the current revolutions of multi-turn.

## Errors and Alerts

Error Codes	Description	Remedy
AL571	Reference position operation rejected.	Power-cycle the drive and then perform Homing/ P8-44 = 2.
AL576	The multi-turn encoder battery voltage has dropped under 3 Vdc.	Replace encoder battery. Clear AL576 by command P8-44=1.
AL577	The multi-turn encoder requires an Config/Reset command.	Execute multi-turn Config /Reset (Set Reference Point) by command P8-44=3/2.
AL578	Internal position synchronization error detected between the multi-turn and the single-turn modules.	Restart Drive.
AL579	Encoder is damaged or that a magnetic screw is missing.	Implement factory restore if error happen again replace motor.
Wn749	The multi-turn battery voltage is within the following range: $3\text{ V} < \text{VBAT} < 3.15\text{V}$ . Battery voltage has started to drop; but the multi-turn information is still reliable.	Replace encoder battery. Clear Wn749 by command P8-44=1.
Wn750	The multi-turn counter exceeded the range of 16bit signed value. Multi-turn Counter $< -32768$ Or multi-turn Counter $> 32767$ .	Execute multi-turn Config /Reset (Set Reference Point) by command P8-44=3/2.  For some applications which will rotate motor in one direction, the alert Wn750 for checking turns number within $-32768 \dots 32767$ can be turned off by parameter P5-80=1.
Wn753	Reference position reset.	Execute multi-turn Config /Reset (Set Reference Point) by command P8-44=2  Or Execute a homing procedure.

## Initialization Procedure

At the very first time to operate absolute system, there will be an error code AL576 and an alert code Wn753 shown when power on because the initialization procedure has not been done yet. The error and alert will be kept until the initialization procedure is finished. Besides, the AL576 and Wn753 will be displayed when the power from the servo and battery cell box is discontinued that will lead to the coordinate system being reset.

Parameter Settings for first operation:

1. P8-44=1, the AL576 will be cleared.
2. P8-44=3, initialize the multi-turn system.
3. P8-44=2, or execute a homing procedure, the Wn753 will be cleared.



## Multi-Turn Methods

### LXM28A + Multi-Turn

LXM28A with multi-turn encoder motor lose position while motor rollover (multi-turn counter < -32767 or multi-turn counter > 32768) after power cycle if the gear ratio cannot be divided into an integer by 2.

Follow the workaround:

1. Set P1-44 and P1-45 to values which result to wanted ratio in PT or PS mode (P1-01 set to 0 or 1).  
For example, for values to convert to ratio of 13072: P1-44 = 10000, and P1-45 = 1024. The gear ration must be divided into an integer by 2.
2. Change drive work mode back to CAN mode (P1-01 set to B).
3. Set 16#6092 to 131072 in program SDO configuration.
4. Set to 131072 in canmotion incremental configuration.
5. Add `SMC3_PersistPositionSingleturn` function block in the PLC program.  
`usiNumberOfAbsoluteBits` pin is set to 32, `bEnable` pin is set to 1.
6. Put the variable `stPerdat` into a persistent variable.
7. Add `MC_SetPosition` function block when do reference point operation.

#### Homing35 Limitation

If motor is always running toward the same direction, the Homing 35 mode does not reset the position to 0 when the rollover value +/-2147483647 (PUU) is reached.

Follow the workaround:

1. Set P8-44 = 3 / CAN 0x482C = 3 (initial multi-turn encoder while servo disable).
2. Set P8-44 = 2 / CAN 0x482C = 2 (set encoder position to 0).
3. Execute `MC_SetPosition` function block.

## Changing the Motor

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used. Even if motors are similar, different adjustment of the encoder system may be a source of hazards. Even if the connectors for motor connection and encoder connection match mechanically, this does not imply that the motor is approved for use.

<b>▲ WARNING</b>
<b>UNINTENDED MOVEMENT</b>
Only use approved combinations of drive and motor.
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

Compatibility between Drive and Motor is defined in the Drive / Motor combinations table, page 21.

Observe the following procedure when changing motors:

Step	Action
1	Switch off all supply voltages. Verify that no voltages are present.
2	Label all connections and uninstall the product.

Step	Action
3	Note the identification number and the serial number shown on the product nameplate for later identification.
4	Install the new product as per chapter Installation, page 139.
5	Commission the product as per chapter Commissioning, page 149.

If the connected motor is replaced by another approved motor, the new motor is automatically recognized by the drive.

## 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 [www.se.com/green-premium](http://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)

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# CANopen Basics

## What's in This Chapter

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## Communication Objects

### Overview

CANopen manages communication between the network devices with object dictionaries and objects. A network device can use process data objects (PDO) and service data objects (SDO) to request the object data from the object dictionary of another device and, if permissible, write back modified values.

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

## Service Data Communication

### SDO Description

Service Data Objects (SDO) can be used to access the entries of an object dictionary using index and subindex. The values of the objects can be read and, if permissible, also written.

Every network device has at least one SDO server to be able to respond to read and write requests from a different device.

The TxSDO of a SDO client is used to send the request for data exchange; the RxSDO is used to receive.

## Process Data Communication

### PDO Mapping

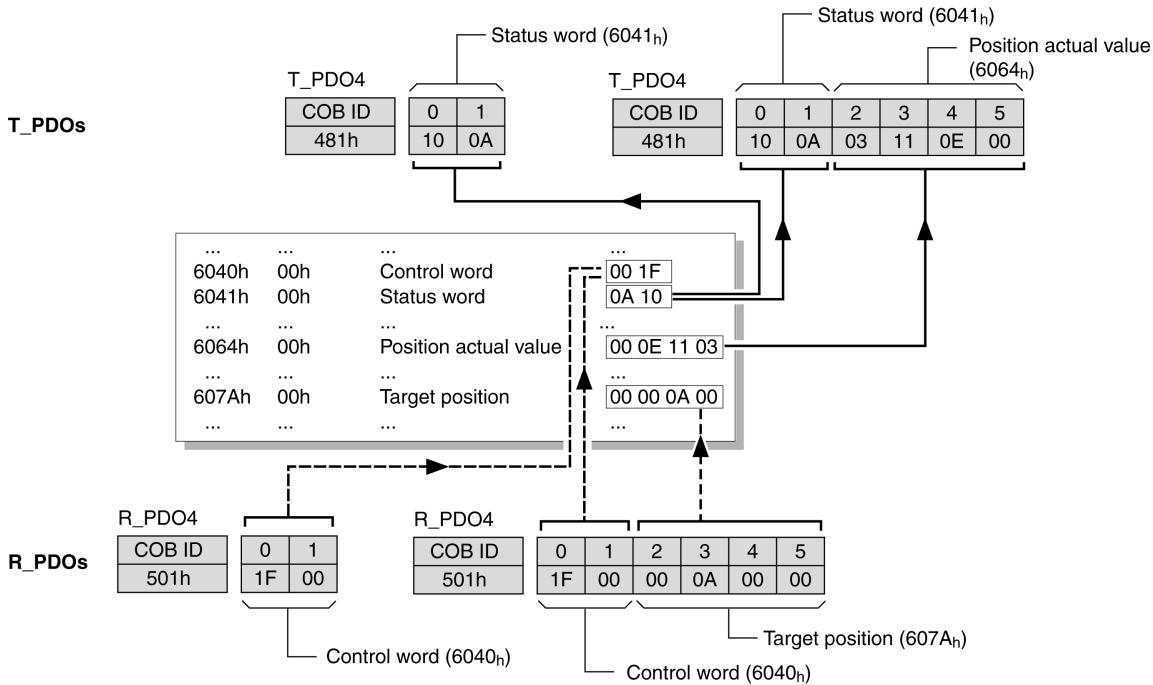
Up to 8 bytes of data from different areas of the object dictionary can be transmitted with a PDO message. Mapping of data to a PDO message is referred to as PDO mapping.

Objects that can be used in PDO mapping are identified in the **PDO mapping object** column in the object dictionary table.

The groups of objects that are involved in PDO mapping are:

- Vendor-specific Object Group 4000h, page 409
- Device Profile Object Group 6000h, page 450

The picture below shows the data exchange between PDOs and object dictionary based on two examples of objects in TxPDO4 and RxPDO4 of the PDOs.



## Dynamic PDO Mapping

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

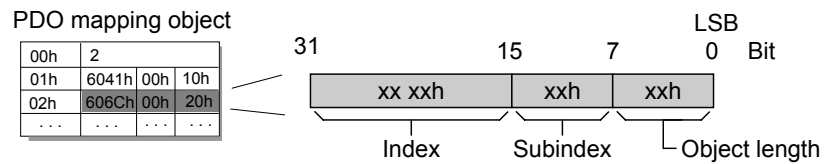
The settings for PDO mapping are defined in an assigned communication object for each PDO.

Object	PDO mapping for	Type
1st receive PDO mapping (1600h)	RxPDO1	Dynamic
2nd receive PDO mapping (1601h)	RxPDO2	Dynamic
3rd receive PDO mapping (1602h)	RxPDO3	Dynamic
4th receive PDO mapping (1603h)	RxPDO4	Dynamic
1st transmit PDO mapping (1A00h)	TxPDO1	Dynamic
2nd transmit PDO mapping (1A01h)	TxPDO2	Dynamic
3rd transmit PDO mapping (1A02h)	TxPDO3	Dynamic
4th transmit PDO mapping (1A03h)	TxPDO4	Dynamic

## Structure of the Entries

Up to 8 bytes of 8 different objects can be mapped in a PDO. Each communication object for setting the PDO mapping provides four subindex entries. A subindex

entry contains three pieces of information on the object: the index, the subindex, and the number of bits that the object uses in the PDO.



Subindex 00<sub>n</sub> of the communication object contains the number of valid subindex entries.

Object length	Bit value
08 <sub>n</sub>	8 bits
10 <sub>n</sub>	16 bits
20 <sub>n</sub>	32 bits

# CANopen Object Dictionary

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 6000<sub>h</sub> ... 6FFF<sub>h</sub> Device-Specific Object Group ..... 450

## Overview

### Specifications for the Objects

#### Overview

The object dictionary table contains the following information:

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access		Maximum value

The symbol (-) means that the value is not significant.

#### Index

The index specifies the position of the object in the object dictionary. The index value is specified as a hexadecimal value. The subindex is also available in this cell if it is relevant

#### Name

Name of the object.

#### Object Type

The object type specifies the data structure of the object:

Object type	Description	DS306 Coding
VAR	A simple value, for example of the type Integer8, Unsigned32 or Visible String8.	7 <sub>h</sub>
ARRAY	A data field in which the entries have the same data type.	8 <sub>h</sub>
RECORD	A data field that contains entries that are a combination of simple data types.	9 <sub>h</sub>

#### Data Type

The data type specifies the type of the object:

Data type	Description	Value range	Data length	DS301 coding
BOOL	Boolean	0 = false, 1 = true	1 byte	0001 <sub>h</sub>
INT8	Integer 8 bits	-128 ... +127	1 byte	0002 <sub>h</sub>
INT16	Integer 16 bits	-32768 ... +32767	2 bytes	0003 <sub>h</sub>
INT32	Integer 32 bits	-2147483648 ... 2147483647	4 bytes	0004 <sub>h</sub>
UINT8	Unsigned Integer 8 bits	0 ... 255	1 byte	0005 <sub>h</sub>
UINT16	Unsigned Integer 16 bits	0 ... 65535	2 bytes	0006 <sub>h</sub>
UINT32	Unsigned Integer 32 bits	0 ... 4294967295	4 bytes	0007 <sub>h</sub>
VISIBLE_STRING	Visible String 8 bytes	ASCII characters	8 bytes	0009 <sub>h</sub>

## Access

Indicates the access type for the object:

Access type	Description
ro	Read only
rw	Read and write
rww	Read and write on process output
const	Constant value

## PDO Mapping Object

Indicates if the object can be mapped in a PDO:

PDO mapping object	Description
No	The object cannot be mapped in a PDO
Yes	The object can be mapped in a PDO

## Minimum Value

The minimum value which can be set.

## Factory Setting

The value of the object when the product is shipped from the factory.

## Maximum Value

The maximum value which can be set.



## Object Dictionary Overview

### Description

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

### Index and Subindex

The objects are addressed in the object dictionary via a 16 bits index.

One or more 8 bits subindex entries for each object specify individual data fields in the object. Index and subindex are shown in hexadecimal notation.

### Description Object Dictionary

The description object dictionary is made of several object groups:

Index (hex)	Object
0000	Unused
0001...001F	Static data types
0020...003F	Complex data types
0040...005F	Unused (Manufacturer-specific complex data types)
0060...007F	Device profile-specific static data types
0080...009F	Device profile-specific complex data types
00A0...0FFF	Reserved
1000...1FFF	Communication profile area
2000...5FFF	Vendor-specific profile area
6000...9FFF	Standardized device profile area
A000...FFFF	Reserved

### Object Groups Implemented

Three groups of objects are available in the object dictionary.

- 1000<sub>h</sub> - 1FFF<sub>h</sub>: Standard communication Object Group, page 398
- 4000<sub>h</sub> - 4FFF<sub>h</sub>: Vendor-specific Object Group, page 409
- 6000<sub>h</sub> - 6FFF<sub>h</sub>: Device profile Object Group, page 450

# 1000<sub>h</sub>...1FFF<sub>h</sub> Standard Communication Object Group

## 10xx<sub>h</sub> Object Group

### 10xx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1000 <sub>h</sub>	Device Type	VAR UINT32 ro	No	- 4325778 -
1001 <sub>h</sub>	Error Register	VAR UINT8 ro	No	- - -
1002 <sub>h</sub>	Manufacturer Status Register	VAR UINT32 ro	No	- - -
1003 <sub>h</sub>	Pre-defined Error Field History of the errors detected by the drive and notified via the Emergency Object.	ARRAY - -	No	- - -
1003:0 <sub>h</sub>	Number of Errors The history of error codes can be cleared by writing value 0 to this sub index.	VAR UINT8 rw	No	- 0 -
1003:1 <sub>h</sub>	Standard Error Field Error code of most recent detected error n	VAR UINT32 ro	No	- - -
1003:2 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-1	VAR UINT32 ro	No	- - -
1003:3 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-2	VAR UINT32 ro	No	- - -
1003:4 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-3	VAR UINT32 ro	No	- - -
1003:5 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-4	VAR UINT32 ro	No	- - -
1003:6 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-5	VAR UINT32 ro	No	- - -
1003:7 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-6	VAR UINT32 ro	No	- - -
1003:8 <sub>h</sub>	Standard Error Field	VAR	No	-

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
	Error code of most recent detected error n-7	UINT32 ro		- -
1003:9 <sub>h</sub>	Standard Error Field Error code of most recent detected error n-8	VAR UINT32 ro	No	- - -
1003:A <sub>h</sub>	Standard Error Field Error code of most recent detected error n-9	VAR UINT32 ro	No	- - -
1005 <sub>h</sub>	COB-ID SYNC	VAR UINT32 rw	No	- 128 -
1006 <sub>h</sub>	Communication Cycle Period	VAR UINT32 rw	No	- 0 -
1007 <sub>h</sub>	Synchronous Window Length	VAR UINT32 rw	No	- 0 -
1008 <sub>h</sub>	Manufacturer Device Name	VAR VISIBLE_STRING const	No	- - -
1009 <sub>h</sub>	Manufacturer Hardware Version	VAR VISIBLE_STRING const	No	- - -
100A <sub>h</sub>	Manufacturer Software Version	VAR VISIBLE_STRING const	No	- - -
100C <sub>h</sub>	Guard Time	VAR UINT16 rw	No	- 0 -
100D <sub>h</sub>	Life Time Factor	VAR UINT8 rw	No	- 0 -
1014 <sub>h</sub>	COB-ID EMCY	VAR UINT32 rw	No	- \$NODEID+0x80 -
1015 <sub>h</sub>	Inhibit Time Emergency	VAR UINT16 rw	No	- 0 -
1016 <sub>h</sub>	Heartbeat Consumer Entries	ARRAY - -	No	- - -
1016:0 <sub>h</sub>	Number of Entries	VAR	No	-

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		UINT8 ro		3 -
1016:1 <sub>h</sub>	Consumer Heartbeat Time 1	VAR UINT32 rw	No	0 0 8388607
1016:2 <sub>h</sub>	Consumer Heartbeat Time 2	VAR UINT32 rw	No	0 0 8388607
1016:3 <sub>h</sub>	Consumer Heartbeat Time 3	VAR UINT32 rw	No	0 0 8388607
1017 <sub>h</sub>	Producer Heartbeat Time	VAR UINT16 rw	No	- 0 -
1018 <sub>h</sub>	Identity Object	RECORD - -	No	- - -
1018:0 <sub>h</sub>	number of entries	VAR UINT8 ro	No	1 4 4
1018:1 <sub>h</sub>	Vendor ID	VAR UINT32 ro	No	- 134217818 -
1018:2 <sub>h</sub>	Product Code	VAR UINT32 ro	No	- 614416 -
1018:3 <sub>h</sub>	Revision number	VAR UINT32 ro	No	- - -
1018:4 <sub>h</sub>	Serial number	VAR UINT32 ro	No	- - -
1019 <sub>h</sub>	Synchronous counter overflow value	VAR UINT8 rw	No	- 0 -
1029 <sub>h</sub>	Error Behavior	ARRAY - -	No	- - -

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1029:0 <sub>h</sub>	Number of Entries	VAR	No	1
		UINT8		1
		ro		254
1029:1 <sub>h</sub>	Communication Error	VAR	No	0
		UINT8		0
		rw		-

## 12xx<sub>h</sub> Object Group

### 12xx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1200 <sub>h</sub>	Server SDO Parameter 1	RECORD	No	-
		-		-
		-		-
1200:0 <sub>h</sub>	Number of Entries	VAR	No	2
		UINT8		2
		ro		2
1200:1 <sub>h</sub>	COB-ID Client -> Server	VAR	No	\$NODEID+0x600
		UINT32		\$NODEID+0x600
		ro		\$NODEID +0xBFFFFFFF
1200:2 <sub>h</sub>	COB-ID Server -> Client	VAR	No	\$NODEID+0x580
		UINT32		\$NODEID+0x580
		ro		\$NODEID +0xBFFFFFFF
1201 <sub>h</sub>	Server SDO Parameter 2	RECORD	No	-
		-		-
		-		-
1201:0 <sub>h</sub>	Number of Entries	VAR	No	2
		UINT8		3
		ro		3
1201:1 <sub>h</sub>	COB-ID Client -> Server	VAR	No	-
		UINT32		-
		rw		4294967295
1201:2 <sub>h</sub>	COB-ID Server -> Client	VAR	No	-
		UINT32		-
		rw		4294967295
1201:3 <sub>h</sub>	Node ID of the SDO Client	VAR	No	-
		UINT8		-
		rw		127

## 14xx<sub>h</sub> Object Group

### Objects 14xx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1400 <sub>h</sub>	Receive PDO Communication Parameter 1	RECORD - -	No	- - -
1400:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 3 5
1400:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID+0x200 \$NODEID +0xFFFFFFFF
1400:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0 255 255
1400:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1401 <sub>h</sub>	Receive PDO Communication Parameter 2	RECORD - -	No	- - -
1401:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 3 5
1401:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID +0x80000300 \$NODEID +0xFFFFFFFF
1401:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0 255 255
1401:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1402 <sub>h</sub>	Receive PDO Communication Parameter 3	RECORD - -	No	- - -
1402:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 3 5
1402:1 <sub>h</sub>	COB-ID	VAR	No	-

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		UINT32 rw		\$NODEID +0x80000400  \$NODEID +0xFFFFFFFF
1402:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0  255 255
1402:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0  0 65535
1403 <sub>h</sub>	Receive PDO Communication Parameter 4	RECORD - -	No	- - -
1403:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2  3 5
1403:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	-  \$NODEID +0x80000500  \$NODEID +0xFFFFFFFF
1403:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0  255 255
1403:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0  0 65535

## 16xx<sub>h</sub> Object Group

### 16xx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1600 <sub>h</sub>	Receive PDO Mapping Parameter 1	RECORD - -	No	- - -
1600:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0  1 64
1600:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32	No	0  1614807056

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		rw		4294967295
1600:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 0 4294967295
1600:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1600:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1601 <sub>h</sub>	Receive PDO Mapping Parameter 2	RECORD - -	No	- - -
1601:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0 2 64
1601:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32 rw	No	0 1614807056 4294967295
1601:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 1618608160 4294967295
1601:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1601:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1602 <sub>h</sub>	Receive PDO Mapping Parameter 3	RECORD - -	No	- - -
1602:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0 2 64
1602:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32 rw	No	0 1614807056 4294967295
1602:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 1627324448 4294967295
1602:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32	No	0 0



Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		rw		4294967295
1602:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1603 <sub>h</sub>	Receive PDO Mapping Parameter 4	RECORD - -	No	- - -
1603:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0 0 64
1603:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32 rw	No	0 0 4294967295
1603:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 0 4294967295
1603:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1603:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295

## 18xx<sub>h</sub> Object Group

### 18xx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1800 <sub>h</sub>	Transmit PDO Communication Parameter 1	RECORD - -	No	- - -
1800:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 5 6
1800:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID +0x40000180 \$NODEID +0xFFFFFFFF
1800:2 <sub>h</sub>	Transmission Type	VAR UINT8	No	0 255

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
		rw		255
1800:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1800:4 <sub>h</sub>	Compatibility Entry	VAR UINT8 rw	No	0 0 255
1800:5 <sub>h</sub>	Event Timer	VAR UINT16 rw	No	0 0 65535
1801 <sub>h</sub>	Transmit PDO Communication Parameter 2	RECORD - -	No	- - -
1801:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 5 6
1801:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID +0xC0000280 \$NODEID +0xFFFFFFFF
1801:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0 255 255
1801:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1801:4 <sub>h</sub>	Compatibility Entry	VAR UINT8 rw	No	0 0 255
1801:5 <sub>h</sub>	Event Timer	VAR UINT16 rw	No	0 100 65535
1802 <sub>h</sub>	Transmit PDO Communication Parameter 3	RECORD - -	No	- - -
1802:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 5 6
1802:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID +0xC0000380 \$NODEID +0xFFFFFFFF

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
1802:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0 255 255
1802:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1802:4 <sub>h</sub>	Compatibility Entry	VAR UINT8 rw	No	0 0 255
1802:5 <sub>h</sub>	Event Timer	VAR UINT16 rw	No	0 100 65535
1803 <sub>h</sub>	Transmit PDO Communication Parameter 4	RECORD - -	No	- - -
1803:0 <sub>h</sub>	Number of Entries	VAR UINT8 ro	No	2 5 6
1803:1 <sub>h</sub>	COB-ID	VAR UINT32 rw	No	- \$NODEID +0xC0000480 \$NODEID +0xFFFFFFFF
1803:2 <sub>h</sub>	Transmission Type	VAR UINT8 rw	No	0 254 255
1803:3 <sub>h</sub>	Inhibit Time	VAR UINT16 rw	No	0 0 65535
1803:4 <sub>h</sub>	Reserved	VAR UINT8 -	No	0 0 255
1803:5 <sub>h</sub>	Event Timer	VAR UINT16 rw	No	0 0 65535

## 1Axx<sub>h</sub> Object Group

### 1Axx<sub>h</sub> Standard Communication Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1A00 <sub>h</sub>	Transmit PDO Mapping Parameter 1	RECORD - -	No	- - -
1A00:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0 1 255
1A00:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32 rw	No	0 1614872592 4294967295
1A00:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 0 4294967295
1A00:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1A00:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1A01 <sub>h</sub>	Transmit PDO Mapping Parameter 2	RECORD - -	No	- - -
1A01:0 <sub>h</sub>	Number of Entries	VAR UINT8 rw	No	0 2 255
1A01:1 <sub>h</sub>	Mapping Entry 1	VAR UINT32 rw	No	0 1614872592 4294967295
1A01:2 <sub>h</sub>	Mapping Entry 2	VAR UINT32 rw	No	0 1617166368 4294967295
1A01:3 <sub>h</sub>	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1A01:4 <sub>h</sub>	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1A02 <sub>h</sub>	Transmit PDO Mapping Parameter 3	RECORD - -	No	- - -

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
1A02:0h	Number of Entries	VAR UINT8 rw	No	0 2 255
1A02:1h	Mapping Entry 1	VAR UINT32 rw	No	0 1614872592 4294967295
1A02:2h	Mapping Entry 2	VAR UINT32 rw	No	0 1617690656 4294967295
1A02:3h	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1A02:4h	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295
1A03h	Transmit PDO Mapping Parameter 4	RECORD - -	No	- - -
1A03:0h	Number of Entries	VAR UINT8 rw	No	0 0 255
1A03:1h	Mapping Entry 1	VAR UINT32 rw	No	0 0 4294967295
1A03:2h	Mapping Entry 2	VAR UINT32 rw	No	0 0 4294967295
1A03:3h	Mapping Entry 3	VAR UINT32 rw	No	0 0 4294967295
1A03:4h	Mapping Entry 4	VAR UINT32 rw	No	0 0 4294967295

## 4000<sub>h</sub> ... 4FFF<sub>h</sub> Vendor-specific Object Group

### 40xx<sub>h</sub> Object Group

### 40xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P0 - Status parameters, page 188

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4000 <sub>h</sub>	Firmware Version	P0-00	VAR UINT16 ro	No	0 - 65535
4001 <sub>h</sub>	Error code of detected error	P0-01	VAR UINT16 rw	No	0 - 65535
4002 <sub>h</sub>	Drive Status Displayed by HMI	P0-02	VAR UINT16 rw	No	0 0 123
4003 <sub>h</sub>	Function of Analog Outputs	P0-03	VAR UINT16 rw	No	0 0 119
4004 <sub>h</sub>	FPGA Version	P0-04	VAR UINT16 ro	No	0 - 65535
4008 <sub>h</sub>	Operating Hour Meter in Seconds	P0-08	VAR UINT32 ro	No	0 - 4294967295
4009 <sub>h</sub>	Status Value 1	P0-09	VAR INT32 ro	No	-2147483647 - 2147483647
400A <sub>h</sub>	Status Value 2	P0-10	VAR INT32 ro	No	-2147483647 - 2147483647
400B <sub>h</sub>	Status Value 3	P0-11	VAR INT32 ro	No	-2147483647 - 2147483647
400C <sub>h</sub>	Status Value 4	P0-12	VAR INT32 ro	No	-2147483647 - 2147483647
400D <sub>h</sub>	Status Value 5	P0-13	VAR INT32 ro	No	-2147483647 - 2147483647
4011 <sub>h</sub>	Indicate status value 1	P0-17	VAR UINT16 rw	No	0 0 123
4012 <sub>h</sub>	Indicate status value 2	P0-18	VAR UINT16 rw	No	0 0 123
4013 <sub>h</sub>	Indicate status value 3	P0-19	VAR UINT16 rw	No	0 0 123
4014 <sub>h</sub>	Indicate status value 4	P0-20	VAR	No	0

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			UINT16 rw		0 123
4015 <sub>h</sub>	Indicate status value 5	P0-21	VAR UINT16 rw	No	0 0 123
4019 <sub>h</sub>	Parameter Mapping 1	P0-25	VAR UINT32 rw	No	0 - 4294967295
401A <sub>h</sub>	Parameter Mapping 2	P0-26	VAR UINT32 rw	No	0 - 4294967295
401B <sub>h</sub>	Parameter Mapping 3	P0-27	VAR UINT32 rw	No	0 - 4294967295
401C <sub>h</sub>	Parameter Mapping 4	P0-28	VAR UINT32 rw	No	0 - 4294967295
401D <sub>h</sub>	Parameter Mapping 5	P0-29	VAR UINT32 rw	No	0 - 4294967295
401E <sub>h</sub>	Parameter Mapping 6	P0-30	VAR UINT32 rw	No	0 - 4294967295
401F <sub>h</sub>	Parameter Mapping 7	P0-31	VAR UINT32 rw	No	0 - 4294967295
4020 <sub>h</sub>	Parameter Mapping 8	P0-32	VAR UINT32 rw	No	0 - 4294967295
4023 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 1	P0-35	VAR UINT32 rw	No	0 0 4294967295
4024 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 2	P0-36	VAR UINT32 rw	No	0 0 4294967295
4025 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 3	P0-37	VAR UINT32 rw	No	0 0 4294967295
4026 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 4	P0-38	VAR UINT32 rw	No	0 0 4294967295
4027 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 5	P0-39	VAR	No	0

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT32 rw		0 4294967295
4028 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 6	P0-40	VAR UINT32 rw	No	0 0 4294967295
4029 <sub>h</sub>	Block Data Read/Write P0-35... P0-42 7	P0-41	VAR UINT32 rw	No	0 0 4294967295
402A <sub>h</sub>	Block Data Read/Write P0-35... P0-42 8	P0-42	VAR UINT32 rw	No	0 0 4294967295
402E <sub>h</sub>	State of Signal Output Functions	P0-46	VAR UINT16 ro	No	0 - 65535
402F <sub>h</sub>	Number of Last Alert	P0-47	VAR UINT16 ro	No	0 - 65535

## 41xx<sub>h</sub> Object Group

### 41xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P1 - Basic parameters, page 194

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4100 <sub>h</sub>	Reference Value Signal - Pulse Settings	P1-00	VAR UINT16 rw	No	0 2 4402
4101 <sub>h</sub>	Operating Mode and Direction of Rotation	P1-01	VAR UINT16 rw	No	0 11 4363
4102 <sub>h</sub>	Velocity and Torque Limitations Activation/Deactivation	P1-02	VAR UINT16 rw	No	0 0 17
4103 <sub>h</sub>	Polarity of Analog Outputs / Polarity of Pulse Outputs	P1-03	VAR UINT16 rw	No	0 0 19
4104 <sub>h</sub>	Scaling Factor Analog Output 1	P1-04	VAR UINT16 rw	No	1 100 100



Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4105 <sub>h</sub>	Scaling Factor Analog Output 2	P1-05	VAR UINT16 rw	No	1 100 100
4106 <sub>h</sub>	CAN Opmode	P1-06	VAR INT16 ro	No	-32768 0 32767
4107 <sub>h</sub>	Limit Switch Fault Reaction	P1-07	VAR UINT16 rw	No	0 0 1
4109 <sub>h</sub>	Target Velocity/Velocity Limitation 1	P1-09	VAR INT32 rww	Yes	-60000 10000 60000
410A <sub>h</sub>	Target Velocity/Velocity Limitation 2	P1-10	VAR INT32 rww	Yes	-60000 20000 60000
410B <sub>h</sub>	Target Velocity/Velocity Limitation 3	P1-11	VAR INT32 rww	Yes	-60000 30000 60000
410C <sub>h</sub>	Target Torque/Torque Limitation 1	P1-12	VAR INT16 rww	Yes	-300 100 300
410D <sub>h</sub>	Target Torque/Torque Limitation 2	P1-13	VAR INT16 rww	Yes	-300 100 300
410E <sub>h</sub>	Target Torque/Torque Limitation 3	P1-14	VAR INT16 rww	Yes	-300 100 300
410F <sub>h</sub>	Mains Phase Monitoring - Response to Missing Mains Phase	P1-15	VAR UINT16 rw	No	0 0 2
4110 <sub>h</sub>	Mains Phase Monitoring - Fault Reset	P1-16	VAR UINT16 rw	No	0 0 1
4111 <sub>h</sub>	Mains Phase Monitoring - Type	P1-17	VAR UINT16 rw	No	0 0 2
4112 <sub>h</sub>	Reserved	P1-18	VAR UINT16 rw	No	0 3 5
4113 <sub>h</sub>	Active Disable - Delay Time Power Stage	P1-19	VAR UINT16 rw	No	0 0 6500
4114 <sub>h</sub>	Current Limit During Quick Stop	P1-20	VAR	No	1

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			INT16 rw		1000 1000
4115 <sub>h</sub>	Status of Foldback Current Drive	P1-21	VAR UINT16 ro	No	0 - 1
4116 <sub>h</sub>	Foldback Current Limit - Drive	P1-22	VAR UINT32 ro	No	0 - 30000
4117 <sub>h</sub>	Current Monitoring Drive - Detected Error Threshold Foldback Current	P1-23	VAR UINT32 rw	No	0 - 30000
4118 <sub>h</sub>	Current Monitoring Drive - Alert Threshold Foldback Current	P1-24	VAR UINT32 rw	No	0 - 30000
4119 <sub>h</sub>	Reserved	P1-25	VAR UINT32 rw	No	- - -
411A <sub>h</sub>	Foldback Current Limit - Motor	P1-26	VAR UINT32 ro	No	0 - 30000
411B <sub>h</sub>	Motor Current Monitoring - Detected Error Threshold Foldback Current	P1-27	VAR UINT32 rw	No	0 - 30000
411C <sub>h</sub>	Motor Current Monitoring - Alert Threshold Foldback Current	P1-28	VAR UINT32 rw	No	0 - 30000
411D <sub>h</sub>	DC Bus Overvoltage Monitoring - Threshold	P1-29	VAR UINT16 ro	No	- - -
411E <sub>h</sub>	Commutation Monitoring - Maximum Counter Value	P1-30	VAR UINT16 rw	No	0 0 0
4120 <sub>h</sub>	Stop Method	P1-32	VAR UINT16 rw	No	0 0 32
4122 <sub>h</sub>	Acceleration Period	P1-34	VAR UINT16 rw	No	6 30 65500
4123 <sub>h</sub>	Deceleration Period	P1-35	VAR UINT16 rw	No	6 30 65500
4125 <sub>h</sub>	Ratio of Load Inertia to Motor Inertia	P1-37	VAR	Yes	0

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT32 rww		10 20000
4126 <sub>h</sub>	Signal Output Function ZSPD / Signal Input Function ZCLAMP - Velocity	P1-38	VAR INT32 rw	No	0 100 2000
4127 <sub>h</sub>	Signal Output Function TSPD - Velocity	P1-39	VAR UINT32 rw	No	0 3000 5000
4128 <sub>h</sub>	Velocity Target Value and Velocity Limitation 10 V	P1-40	VAR INT32 rw	No	0 - 10001
4129 <sub>h</sub>	Torque Target Value and Torque Limitation 10 V	P1-41	VAR UINT16 rw	No	0 100 1000
412A <sub>h</sub>	ON Delay Time of Holding Brake	P1-42	VAR UINT16 rw	No	0 0 1000
412C <sub>h</sub>	Electronic Gear Ratio - Numerator 1	P1-44	VAR UINT32 rw	No	1 128 536870911
412D <sub>h</sub>	Electronic Gear Ratio - Denominator	P1-45	VAR UINT32 rw	No	1 10 2147483647
412E <sub>h</sub>	Encoder Simulation Resolution	P1-46	VAR INT32 rw	No	- 2048 -
412F <sub>h</sub>	Signal Output Function SP_OK - Velocity	P1-47	VAR UINT32 rw	No	0 10 300
4130 <sub>h</sub>	Signal Output Function MC_OK - Settings	P1-48	VAR UINT16 rw	No	0 0 33
4134 <sub>h</sub>	Braking Resistor - Resistance	P1-52	VAR INT16 rw	No	-1 - 32767
4135 <sub>h</sub>	Braking Resistor - Power	P1-53	VAR INT16 rw	No	-1 - 32767
4136 <sub>h</sub>	Signal Output Function TPOS - Trigger Value	P1-54	VAR UINT32 rw	No	0 1311 1280000
4137 <sub>h</sub>	Maximum Velocity - User-Defined	P1-55	VAR	Yes	10

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT32 rww		- 6000
4139 <sub>h</sub>	Torque Monitoring - Torque Value	P1-57	VAR UINT16 rw	No	0 0 300
413A <sub>h</sub>	Torque Monitoring - Time Value	P1-58	VAR UINT16 rw	No	1 1 1000
413B <sub>h</sub>	S Curve Filter for Operating Mode Velocity	P1-59	VAR UINT32 rww	Yes	0 0 255875
413C <sub>h</sub>	Commutation Monitoring - Time Threshold	P1-60	VAR UINT16 rw	No	0 0 3000
413D <sub>h</sub>	Commutation Monitoring - Velocity Threshold	P1-61	VAR UINT32 rw	No	0 600 60000
413E <sub>h</sub>	Motor Overtemperature Monitoring - Response	P1-62	VAR UINT16 rw	No	0 0 5
413F <sub>h</sub>	Motor Overtemperature Monitoring - Delay Time	P1-63	VAR UINT16 rw	No	0 30 300
4140 <sub>h</sub>	Undervoltage Monitoring - Response	P1-64	VAR UINT16 rw	No	0 0 3
4141 <sub>h</sub>	Reserved	P1-65	VAR UINT16 rw	No	0 0 1
4142 <sub>h</sub>	Status of Foldback Current Motor	P1-66	VAR UINT16 ro	No	0 - 1
4143 <sub>h</sub>	Undervoltage Monitoring - Delay Time	P1-67	VAR UINT16 rw	No	0 30 300
4144 <sub>h</sub>	Active Disable - Deceleration Ramp	P1-68	VAR UINT16 rw	No	6 30 65500
4145 <sub>h</sub>	Disable - Deceleration Time	P1-69	VAR UINT16 rw	No	0 0 6500
4146 <sub>h</sub>	Signal Input Function HALT - Maximum Current	P1-70	VAR	No	-

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT32 rw		0 -
4147 <sub>h</sub>	Braking Resistor - Maximum Time in Braking	P1-71	VAR UINT16 rw	No	10 40 100
4148 <sub>h</sub>	Braking Resistor Overload Monitoring - Response	P1-72	VAR UINT16 rw	No	0 0 1
414E <sub>h</sub>	User-Defined Maximum Current	P1-78	VAR UINT32 rww	Yes	- - -
414F <sub>h</sub>	Maximum Current	P1-79	VAR UINT32 ro	No	- - -
4150 <sub>h</sub>	Maximum Peak Current	P1-80	VAR UINT32 ro	No	- - -
4151 <sub>h</sub>	Nominal Current	P1-81	VAR UINT32 ro	No	- - -
4152 <sub>h</sub>	Velocity limitation for CANopen operating mode Profile Torque	P1-82	VAR UINT16 rww	Yes	0 0 3
4154 <sub>h</sub>	Configured motor type	P1-84	VAR UINT32 rw	No	0 - 2147483647
4155 <sub>h</sub>	Torque Limit For CANopen Modes	P1-85	VAR UINT16 rww	Yes	0 0 3
4157 <sub>h</sub>	Quick Stop - Maximum Current	P1-87	VAR UINT32 rw	No	- 0 P1-79
4158 <sub>h</sub>	Simulated Enc Index Pulse Duration	P1-88	VAR UINT16 rw	No	0 0 100

## 42xx<sub>h</sub> Object Group

### 42xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P2 - Extended parameters, page 207

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4201 <sub>h</sub>	Gain Switching - Rate for Position Loop	P2-01	VAR UINT16 rw	No	10 100 500
4205 <sub>h</sub>	Gain Switching - Rate for Velocity Loop	P2-05	VAR UINT16 rw	No	10 100 500
4208 <sub>h</sub>	Factory Reset / Save Parameters / Activation of Forcing of Outputs	P2-08	VAR UINT16 rw	No	0 0 406
4209 <sub>h</sub>	Debounce Time - Inputs	P2-09	VAR UINT16 rw	No	0 2 20
420A <sub>h</sub>	Signal Input Function for DI1	P2-10	VAR UINT16 rw	No	0 256 326
420B <sub>h</sub>	Signal Input Function for DI2	P2-11	VAR UINT16 rw	No	0 256 326
420C <sub>h</sub>	Signal Input Function for DI3	P2-12	VAR UINT16 rw	No	0 256 326
420D <sub>h</sub>	Signal Input Function for DI4	P2-13	VAR UINT16 rw	No	0 256 326
420E <sub>h</sub>	Signal Input Function for DI5	P2-14	VAR UINT16 rw	No	0 36 326
420F <sub>h</sub>	Signal Input Function for DI6	P2-15	VAR UINT16 rw	No	0 34 326
4210 <sub>h</sub>	Signal Input Function for DI7	P2-16	VAR UINT16 rw	No	0 35 326
4211 <sub>h</sub>	Signal Input Function for DI8	P2-17	VAR UINT16 rw	No	0 33 326
4212 <sub>h</sub>	Signal Output Function for DO1	P2-18	VAR UINT16 rw	No	0 257 311
4213 <sub>h</sub>	Signal Output Function for DO2	P2-19	VAR UINT16 rw	No	0 256 311

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4214 <sub>h</sub>	Signal Output Function for DO3	P2-20	VAR UINT16 rw	No	0 256 311
4215 <sub>h</sub>	Signal Output Function for DO4	P2-21	VAR UINT16 rw	No	0 256 311
4216 <sub>h</sub>	Signal Output Function for DO5	P2-22	VAR UINT16 rw	No	0 7 311
4217 <sub>h</sub>	Signal Output Function for DO6 (OCZ)	P2-23	VAR UINT16 rw	No	0 64 319
4218 <sub>h</sub>	Debounce Time - Fast Inputs	P2-24	VAR UINT16 rw	No	0 50 20000
421B <sub>h</sub>	Gain Switching - Conditions and Type	P2-27	VAR UINT16 rw	No	0 0 24
421D <sub>h</sub>	Gain Switching - Comparison Value	P2-29	VAR UINT32 rw	No	0 1280000 3840000
421E <sub>h</sub>	Auxiliary Functions	P2-30	VAR INT16 rw	No	-8 0 8
421F <sub>h</sub>	Autotuning Optimization Value Threshold	P2-31	VAR UINT32 rw	No	100 1000 10000
4220 <sub>h</sub>	Autotuning	P2-32	VAR UINT16 rww	Yes	0 0 56
4222 <sub>h</sub>	Velocity Monitoring - Threshold Value	P2-34	VAR UINT32 rw	No	0 50000 60000
4223 <sub>h</sub>	Position Deviation Monitoring - Threshold Value	P2-35	VAR UINT32 rw	No	1 384000 12800000
4224 <sub>h</sub>	PTI Interface Debounce Time - Pulse	P2-36	VAR UINT16 ro	No	0 30 511
4225 <sub>h</sub>	PTI Interface Debounce Time - Direction	P2-37	VAR UINT16 ro	No	0 30 511

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
422C <sub>h</sub>	Set the AUTOR feature digital out mode	P2-44	VAR UINT16 rw	No	0 0 1
4232 <sub>h</sub>	Signal Input Function CLRPOS - Trigger	P2-50	VAR UINT16 rw	No	0 0 1
423C <sub>h</sub>	Electronic Gear Ratio - Numerator 2	P2-60	VAR UINT32 rw	No	1 128 536870911
423D <sub>h</sub>	Electronic Gear Ratio - Numerator 3	P2-61	VAR UINT32 rw	No	1 128 536870911
423E <sub>h</sub>	Electronic Gear Ratio - Numerator 4	P2-62	VAR UINT32 rw	No	1 128 536870911
4241 <sub>h</sub>	Special Function 1	P2-65	VAR UINT16 rw	No	0 512 65020
4242 <sub>h</sub>	Special Function 2	P2-66	VAR UINT16 rw	No	0 0 4
4244 <sub>h</sub>	Auto-Enable and Automatic Hardware Limit Switch Fault Reset	P2-68	VAR UINT16 rw	No	0 0 4369
4245 <sub>h</sub>	Analog Input 1 Value	P2-69	VAR INT16 ro	No	-12500 - 12500
4246 <sub>h</sub>	Analog Input 2 Value	P2-70	VAR INT16 ro	No	-12500 - 12500

## 43xx<sub>h</sub> Object Group

### 43xx<sub>h</sub> Vendor-specific Object Group

Part of this objects list is also available in P3 - Communication parameters, page 216



Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4300 <sub>h</sub>	Device Address Modbus	P3-00	VAR UINT16 rw	No	1 127 247
4301 <sub>h</sub>	Transmission Rate for Integrated Fieldbus and Modbus	P3-01	VAR UINT16 rw	No	0 258 1029
4302 <sub>h</sub>	Modbus Connection Settings	P3-02	VAR UINT16 rw	No	6 7 9
4303 <sub>h</sub>	Detected Modbus Communication Errors - Handling	P3-03	VAR UINT16 rw	No	0 0 1
4304 <sub>h</sub>	Modbus Connection Monitoring	P3-04	VAR UINT16 rw	No	0 0 20000
4305 <sub>h</sub>	Device Address Integrated Fieldbus	P3-05	VAR UINT16 rw	No	0 0 127
4306 <sub>h</sub>	Digital Inputs - Forcing Settings	P3-06	VAR UINT16 rw	No	0 0 2047
4307 <sub>h</sub>	Modbus Response Delay Time	P3-07	VAR UINT16 rw	No	0 0 1000
4309 <sub>h</sub>	CANopen Master/Slave Synchronization	P3-09	VAR UINT16 rw	No	4097 20565 40959
430A <sub>h</sub>	Drive Profile Lexium - Activation	P3-10	VAR UINT16 rw	No	0 0 1
430B <sub>h</sub>	Drive Profile Lexium - State of Digital Inputs	P3-11	VAR UINT16 ro	Yes	0 - 65535
430C <sub>h</sub>	Drive Profile Lexium - Control Word	P3-12	VAR UINT16 rww	Yes	0 0 65535
430D <sub>h</sub>	Drive Profile Lexium - RefA 16 Bit Parameter	P3-13	VAR INT16 rww	Yes	-32768 0 32767
430E <sub>h</sub>	Drive Profile Lexium - RefB 32 Bit Parameter	P3-14	VAR INT32 rww	Yes	-2147483648 0 2147483647
430F <sub>h</sub>	Drive Profile Lexium - Drive Status	P3-15	VAR	Yes	0

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT16 ro		- 65535
4310 <sub>h</sub>	Drive Profile Lexium - Operating Mode Status	P3-16	VAR UINT16 ro	Yes	0 - 65535
4311 <sub>h</sub>	Drive Profile Lexium - Motion Status	P3-17	VAR UINT16 ro	Yes	0 - 65535
4312 <sub>h</sub>	PDO Event Mask 1	P3-18	VAR UINT16 rw	No	0 1 15
4313 <sub>h</sub>	PDO Event Mask 2	P3-19	VAR UINT16 rw	No	0 1 15
4314 <sub>h</sub>	PDO Event Mask 3	P3-20	VAR UINT16 rw	No	0 1 15
4315 <sub>h</sub>	PDO Event Mask 4	P3-21	VAR UINT16 rw	No	0 15 15
431E <sub>h</sub>	Internal Limit for Bit 11 <i>DriveCom Status Word</i> 6041 <sub>h</sub>	P3-30	VAR UINT16 rw	No	0 0 11
431F <sub>h</sub>	Settings for NMT operating state Quick Stop	P3-31	VAR INT16 rw	No	-2 6 7
4320 <sub>h</sub>	Automatic operating state transition from Switch On Disabled to Ready To Switch On	P3-32	VAR UINT16 rw	No	0 0 1
4328 <sub>h</sub>	Velocity Gearing Window	-	VAR UINT32 rw	No	0 2100000 4294967295

## 44xx<sub>h</sub> Object Group

### 44xx<sub>h</sub> Vendor-specific Object Group

Part of this objects list is also available in P4 - Diagnostics parameters, page 220

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4400 <sub>h</sub>	Error History - Error Number of the Most Recently Detected Error n	P4-00	VAR UINT16 rw	No	0 - 65535
4401 <sub>h</sub>	Error History - Error Number of the Most Recently Detected Error n - 1	P4-01	VAR UINT16 ro	No	0 - 65535
4402 <sub>h</sub>	Error History -Error Number of the Most Recently Detected Error n - 2	P4-02	VAR UINT16 ro	No	0 - 65535
4403 <sub>h</sub>	Error History - Error Number of the Most Recently Detected Error n - 3	P4-03	VAR UINT16 ro	No	0 - 65535
4404 <sub>h</sub>	Error History - Error Number of the Most Recently Detected Error n - 4	P4-04	VAR UINT16 ro	No	0 - 65535
4405 <sub>h</sub>	Jog Velocity	P4-05	VAR UINT32 rw	No	0 20 5000
4406 <sub>h</sub>	Forcing Matrix of Digital Outputs	P4-06	VAR UINT16 rw	No	0 0 255
4407 <sub>h</sub>	State of Digital Inputs / Activate Forcing	P4-07	VAR UINT16 rw	No	0 - 255
4408 <sub>h</sub>	Status of HMI Keypad	P4-08	VAR UINT16 ro	No	0 0 255
4409 <sub>h</sub>	State of Digital Outputs	P4-09	VAR UINT16 ro	No	0 - 63
440A <sub>h</sub>	Clear Error History	P4-10	VAR UINT16 rw	No	0 0 0
4414 <sub>h</sub>	Analog Input 1 Dead Band	P4-20	VAR UINT16 rw	No	0 0 10000
4415 <sub>h</sub>	Analog Input 2 Dead Band	P4-21	VAR UINT16 rw	No	0 0 10000
4416 <sub>h</sub>	Analog Input 1 Offset	P4-22	VAR INT16 rw	No	-10000 0 10000

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4417 <sub>h</sub>	Analog Input 2 Offset	P4-23	VAR INT16 rw	No	-10000 0 10000
4418 <sub>h</sub>	Undervoltage Monitoring - Threshold Value	P4-24	VAR UINT16 rw	No	140 160 190
4419 <sub>h</sub>	Safety Function STO - Status	P4-25	VAR UINT16 ro	Yes	0 - 1
441A <sub>h</sub>	Forceable digital outputs	P4-26	VAR UINT16 ro	No	31 31 31
441B <sub>h</sub>	Digital output force mask	P4-27	VAR UINT16 rw	No	0 0 31
441C <sub>h</sub>	Digital output force value	P4-28	VAR UINT16 rw	No	0 0 31
441D <sub>h</sub>	Motor Load Period Time	P4-29	VAR UINT32 rw	No	1 5000 100000
4450 <sub>h</sub>	Jog Speed Fast	-	VAR UINT32 rw	No	0 426674 4294967295
4451 <sub>h</sub>	Jog Time	-	VAR UINT32 rw	No	0 0 4294967295
4452 <sub>h</sub>	Jog Step	-	VAR UINT32 rw	No	0 0 2147483647
4453 <sub>h</sub>	Jog Method	-	VAR UINT16 rw	No	0 0 1
4454 <sub>h</sub>	Jog Speed Slow	-	VAR UINT32 rw	No	0 426674 4294967295

## 45xx<sub>h</sub> Object Group

### 45xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P5 - Motion settings parameters, page 225

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4500 <sub>h</sub>	Firmware Revision	P5-00	VAR UINT16 ro	No	0 - 65535
4504 <sub>h</sub>	Homing - Homing Method Selection	P5-04	VAR UINT16 rw	No	0 0 296
4505 <sub>h</sub>	Homing - Fast Velocity for Reference Movement	P5-05	VAR UINT32 rw	No	10 1000 60000
4506 <sub>h</sub>	Homing - Slow Velocity for Reference Movement	P5-06	VAR UINT32 rw	No	10 200 60000
4507 <sub>h</sub>	Operating Mode PS via Parameter	P5-07	VAR UINT16 rw	No	0 0 20032
4508 <sub>h</sub>	Positive Software Limit Switch - Position	P5-08	VAR INT32 rw	No	-2147483647 134217727 2147483647
4509 <sub>h</sub>	Negative Software Limit Switch - Position	P5-09	VAR INT32 rw	No	-2147483647 -134217727 2147483647
450A <sub>h</sub>	Operating mode Pulse Train - Maximum Acceleration	P5-10	VAR UINT16 rw	No	6 6 65500
450B <sub>h</sub>	Software Limit Switches - Hysteresis Value	P5-11	VAR UINT16 rw	No	0 3556 35555
450C <sub>h</sub>	Touch Probe Input 1 - Stable Level Duration	P5-12	VAR UINT16 rw	No	2 5 32
450D <sub>h</sub>	Position Limiting Mode	P5-13	VAR UINT16 rw	No	0 0 3
450E <sub>h</sub>	Motion Profile for Torque - Slope	P5-14	VAR UINT32 rw	No	1 100000 30000000
450F <sub>h</sub>	Motion Profile for Torque - Activation	P5-15	VAR UINT16 rw	No	0 0 1
4510 <sub>h</sub>	Encoder Increments in PUU	P5-16	VAR INT32 rw	No	-2147483647 0 2147483647

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4512 <sub>h</sub>	External Encoder (Pulses)	P5-18	VAR INT32 ro	No	-2147483648 - 2147483647
4514 <sub>h</sub>	Deceleration Ramp - Signal Input Function STOP	P5-20	VAR UINT16 rw	No	6 50 65500
4515 <sub>h</sub>	Deceleration Ramp - Detected Transmission Error	P5-21	VAR UINT16 rw	No	6 50 65500
4516 <sub>h</sub>	Deceleration Ramp - Position Overflow	P5-22	VAR UINT16 rw	No	6 30 65500
4517 <sub>h</sub>	Deceleration Ramp - Triggering of Negative Software Limit Switch	P5-23	VAR UINT16 rw	No	6 50 65500
4518 <sub>h</sub>	Deceleration Ramp - Triggering of Positive Software Limit Switch	P5-24	VAR UINT16 rw	No	6 50 65500
4519 <sub>h</sub>	Deceleration Ramp - Triggering of Negative Hardware Limit Switch	P5-25	VAR UINT16 rw	No	6 30 65500
451A <sub>h</sub>	Deceleration Ramp - Triggering of Positive Hardware Limit Switch	P5-26	VAR UINT16 rw	No	6 30 65500
4523 <sub>h</sub>	Touch Probes Polarity	P5-35	VAR UINT16 ro	Yes	0 - 3
4524 <sub>h</sub>	Touch Probe Input 1 - Captured Position CANopen Units	P5-36	VAR INT32 ro	No	-2147483647 0 2147483647
4525 <sub>h</sub>	Touch Probe Input 1 - Captured Position	P5-37	VAR INT32 ro	No	-2147483647 0 2147483647
4526 <sub>h</sub>	Touch Probe Input 1 - Event Counter	P5-38	VAR UINT16 ro	Yes	0 0 65535
4527 <sub>h</sub>	Touch Probe Input 1 - Configuration	P5-39	VAR UINT16 rw	No	0 0 257
4538 <sub>h</sub>	Touch Probe Input 2 - Captured Position CANopen Units	P5-56	VAR INT32 ro	No	-2147483647 0 2147483647

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4539 <sub>h</sub>	Touch Probe Input 2 - Captured Position	P5-57	VAR INT32 ro	No	-2147483647 0 2147483647
453A <sub>h</sub>	Touch Probe Input 2 - Event Counter	P5-58	VAR UINT16 ro	Yes	0 0 65535
453B <sub>h</sub>	Touch Probe Input 2 - Configuration	P5-59	VAR UINT16 rw	No	0 0 257
454C <sub>h</sub>	Move Offset When Homing	P5-76	VAR UINT16 rww	Yes	0 0 1
454D <sub>h</sub>	Touch Probe Input 2 - Stable Level Duration	P5-77	VAR UINT16 rw	No	2 5 32

## 46xx<sub>h</sub> Object Group

### 46xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P6 - Data sets group 1 parameters, page 231

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4600 <sub>h</sub>	Position of Homing Data Set	P6-00	VAR INT32 rw	No	-2147483647 0 2147483647
4601 <sub>h</sub>	Subsequent Data Set and Auto-start of Homing Data Set	P6-01	VAR UINT32 rw	No	0 0 8193
4602 <sub>h</sub>	Target Position of Data Set 1	P6-02	VAR INT32 rw	No	-2147483647 0 2147483647
4603 <sub>h</sub>	Configuration of Data Set 1	P6-03	VAR UINT16 rw	No	0 0 208
4604 <sub>h</sub>	Target Position of Data Set 2	P6-04	VAR INT32 rw	No	-2147483647 0 2147483647
4605 <sub>h</sub>	Configuration of Data Set 2	P6-05	VAR UINT16 rw	No	0 0 208

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4606 <sub>h</sub>	Target Position of Data Set 3	P6-06	VAR INT32 rw	No	-2147483647 0 2147483647
4607 <sub>h</sub>	Configuration of Data Set 3	P6-07	VAR UINT16 rw	No	0 0 208
4608 <sub>h</sub>	Target Position of Data Set 4	P6-08	VAR INT32 rw	No	-2147483647 0 2147483647
4609 <sub>h</sub>	Configuration of Data Set 4	P6-09	VAR UINT16 rw	No	0 0 208
460A <sub>h</sub>	Target Position of Data Set 5	P6-10	VAR INT32 rw	No	-2147483647 0 2147483647
460B <sub>h</sub>	Configuration of Data Set 5	P6-11	VAR UINT16 rw	No	0 0 208
460C <sub>h</sub>	Target Position of Data Set 6	P6-12	VAR INT32 rw	No	-2147483647 0 2147483647
460D <sub>h</sub>	Configuration of Data Set 6	P6-13	VAR UINT16 rw	No	0 0 208
460E <sub>h</sub>	Target Position of Data Set 7	P6-14	VAR INT32 rw	No	-2147483647 0 2147483647
460F <sub>h</sub>	Configuration of Data Set 7	P6-15	VAR UINT16 rw	No	0 0 208
4610 <sub>h</sub>	Target Position of Data Set 8	P6-16	VAR INT32 rw	No	-2147483647 0 2147483647
4611 <sub>h</sub>	Configuration of Data Set 8	P6-17	VAR UINT16 rw	No	0 0 208
4612 <sub>h</sub>	Target Position of Data Set 9	P6-18	VAR INT32 rw	No	-2147483647 0 2147483647
4613 <sub>h</sub>	Configuration of Data Set 9	P6-19	VAR UINT16 rw	No	0 0 208



Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4614 <sub>h</sub>	Target Position of Data Set 10	P6-20	VAR INT32 rw	No	-2147483647 0 2147483647
4615 <sub>h</sub>	Configuration of Data Set 10	P6-21	VAR UINT16 rw	No	0 0 208
4616 <sub>h</sub>	Target Position of Data Set 11	P6-22	VAR INT32 rw	No	-2147483647 0 2147483647
4617 <sub>h</sub>	Configuration of Data Set 11	P6-23	VAR UINT16 rw	No	0 0 208
4618 <sub>h</sub>	Target Position of Data Set 12	P6-24	VAR INT32 rw	No	-2147483647 0 2147483647
4619 <sub>h</sub>	Configuration of Data Set 12	P6-25	VAR UINT16 rw	No	0 0 208
461A <sub>h</sub>	Target Position of Data Set 13	P6-26	VAR INT32 rw	No	-2147483647 0 2147483647
461B <sub>h</sub>	Configuration of Data Set 13	P6-27	VAR UINT16 rw	No	0 0 208
461C <sub>h</sub>	Target Position of Data Set 14	P6-28	VAR INT32 rw	No	-2147483647 0 2147483647
461D <sub>h</sub>	Configuration of Data Set 14	P6-29	VAR UINT16 rw	No	0 0 208
461E <sub>h</sub>	Target Position of Data Set 15	P6-30	VAR INT32 rw	No	-2147483647 0 2147483647
461F <sub>h</sub>	Configuration of Data Set 15	P6-31	VAR UINT16 rw	No	0 0 208
4620 <sub>h</sub>	Target Position of Data Set 16	P6-32	VAR INT32 rw	No	-2147483647 0 2147483647
4621 <sub>h</sub>	Configuration of Data Set 16	P6-33	VAR UINT16 rw	No	0 0 208

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4622 <sub>h</sub>	Target Position of Data Set 17	P6-34	VAR INT32 rw	No	-2147483647 0 2147483647
4623 <sub>h</sub>	Configuration of Data Set 17	P6-35	VAR UINT16 rw	No	0 0 208
4624 <sub>h</sub>	Target Position of Data Set 18	P6-36	VAR INT32 rw	No	-2147483647 0 2147483647
4625 <sub>h</sub>	Configuration of Data Set 18	P6-37	VAR UINT16 rw	No	0 0 208
4626 <sub>h</sub>	Target Position of Data Set 19	P6-38	VAR INT32 rw	No	-2147483647 0 2147483647
4627 <sub>h</sub>	Configuration of Data Set 19	P6-39	VAR UINT16 rw	No	0 0 208
4628 <sub>h</sub>	Target Position of Data Set 20	P6-40	VAR INT32 rw	No	-2147483647 0 2147483647
4629 <sub>h</sub>	Configuration of Data Set 20	P6-41	VAR UINT16 rw	No	0 0 208
462A <sub>h</sub>	Target Position of Data Set 21	P6-42	VAR INT32 rw	No	-2147483647 0 2147483647
462B <sub>h</sub>	Configuration of Data Set 21	P6-43	VAR UINT16 rw	No	0 0 208
462C <sub>h</sub>	Target Position of Data Set 22	P6-44	VAR INT32 rw	No	-2147483647 0 2147483647
462D <sub>h</sub>	Configuration of Data Set 22	P6-45	VAR UINT16 rw	No	0 0 208
462E <sub>h</sub>	Target Position of Data Set 23	P6-46	VAR INT32 rw	No	-2147483647 0 2147483647
462F <sub>h</sub>	Configuration of Data Set 23	P6-47	VAR UINT16 rw	No	0 0 208

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4630 <sub>h</sub>	Target Position of Data Set 24	P6-48	VAR INT32 rw	No	-2147483647 0 2147483647
4631 <sub>h</sub>	Configuration of Data Set 24	P6-49	VAR UINT16 rw	No	0 0 208
4632 <sub>h</sub>	Target Position of Data Set 25	P6-50	VAR INT32 rw	No	-2147483647 0 2147483647
4633 <sub>h</sub>	Configuration of Data Set 25	P6-51	VAR UINT16 rw	No	0 0 208
4634 <sub>h</sub>	Target Position of Data Set 26	P6-52	VAR INT32 rw	No	-2147483647 0 2147483647
4635 <sub>h</sub>	Configuration of Data Set 26	P6-53	VAR UINT16 rw	No	0 0 208
4636 <sub>h</sub>	Target Position of Data Set 27	P6-54	VAR INT32 rw	No	-2147483647 0 2147483647
4637 <sub>h</sub>	Configuration of Data Set 27	P6-55	VAR UINT16 rw	No	0 0 208
4638 <sub>h</sub>	Target Position of Data Set 28	P6-56	VAR INT32 rw	No	-2147483647 0 2147483647
4639 <sub>h</sub>	Configuration of Data Set 28	P6-57	VAR UINT16 rw	No	0 0 208
463A <sub>h</sub>	Target Position of Data Set 29	P6-58	VAR INT32 rw	No	-2147483647 0 2147483647
463B <sub>h</sub>	Configuration of Data Set 29	P6-59	VAR UINT16 rw	No	0 0 208
463C <sub>h</sub>	Target Position of Data Set 30	P6-60	VAR INT32 rw	No	-2147483647 0 2147483647
463D <sub>h</sub>	Configuration of Data Set 30	P6-61	VAR UINT16 rw	No	0 0 208

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
463E <sub>h</sub>	Target Position of Data Set 31	P6-62	VAR INT32 rw	No	-2147483647 0 2147483647
463F <sub>h</sub>	Configuration of Data Set 31	P6-63	VAR UINT16 rw	No	0 0 208
4640 <sub>h</sub>	Target Position of Data Set 32	P6-64	VAR INT32 rw	No	-2147483647 0 2147483647
4641 <sub>h</sub>	Configuration of Data Set 32	P6-65	VAR UINT16 rw	No	0 0 208

## 47xx<sub>h</sub> Object Group

### 47xx<sub>h</sub> Vendor-specific Object Group

Part of this objects list is also available in P7 - Data sets group 2 parameters, page 240

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4700 <sub>h</sub>	Deceleration and Acceleration of Homing Data Set	P7-00	VAR UINT32 rw	No	393222 13107400 4292673500
4701 <sub>h</sub>	Waiting Time of Homing Data Set	P7-01	VAR UINT32 rw	No	0 0 32767
4702 <sub>h</sub>	Deceleration and Acceleration of Data Set 1	P7-02	VAR UINT32 rw	No	393222 13107400 4292673500
4703 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 1	P7-03	VAR UINT32 rw	No	0 13107200 3932192767
4704 <sub>h</sub>	Deceleration and Acceleration of Data Set 2	P7-04	VAR UINT32 rw	No	393222 13107400 4292673500
4705 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 2	P7-05	VAR UINT32 rw	No	0 13107200 3932192767
4706 <sub>h</sub>	Deceleration and Acceleration of Data Set 3	P7-06	VAR UINT32	No	393222 13107400

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			rw		4292673500
4707 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 3	P7-07	VAR UINT32 rw	No	0 13107200 3932192767
4708 <sub>h</sub>	Deceleration and Acceleration of Data Set 4	P7-08	VAR UINT32 rw	No	393222 13107400 4292673500
4709 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 4	P7-09	VAR UINT32 rw	No	0 13107200 3932192767
470A <sub>h</sub>	Deceleration and Acceleration of Data Set 5	P7-10	VAR UINT32 rw	No	393222 13107400 4292673500
470B <sub>h</sub>	Waiting Time and Target Velocity of Data Set 5	P7-11	VAR UINT32 rw	No	0 13107200 3932192767
470C <sub>h</sub>	Deceleration and Acceleration of Data Set 6	P7-12	VAR UINT32 rw	No	393222 13107400 4292673500
470D <sub>h</sub>	Waiting Time and Target Velocity of Data Set 6	P7-13	VAR UINT32 rw	No	0 13107200 3932192767
470E <sub>h</sub>	Deceleration and Acceleration of Data Set 7	P7-14	VAR UINT32 rw	No	393222 13107400 4292673500
470F <sub>h</sub>	Waiting Time and Target Velocity of Data Set 7	P7-15	VAR UINT32 rw	No	0 13107200 3932192767
4710 <sub>h</sub>	Deceleration and Acceleration of Data Set 8	P7-16	VAR UINT32 rw	No	393222 13107400 4292673500
4711 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 8	P7-17	VAR UINT32 rw	No	0 13107200 3932192767
4712 <sub>h</sub>	Deceleration and Acceleration of Data Set 9	P7-18	VAR UINT32 rw	No	393222 13107400 4292673500
4713 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 9	P7-19	VAR UINT32 rw	No	0 13107200 3932192767
4714 <sub>h</sub>	Deceleration and Acceleration of Data Set 10	P7-20	VAR UINT32	No	393222 13107400

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			rw		4292673500
4715 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 10	P7-21	VAR UINT32 rw	No	0 13107200 3932192767
4716 <sub>h</sub>	Deceleration and Acceleration of Data Set 11	P7-22	VAR UINT32 rw	No	393222 13107400 4292673500
4717 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 11	P7-23	VAR UINT32 rw	No	0 13107200 3932192767
4718 <sub>h</sub>	Deceleration and Acceleration of Data Set 12	P7-24	VAR UINT32 rw	No	393222 13107400 4292673500
4719 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 12	P7-25	VAR UINT32 rw	No	0 13107200 3932192767
471A <sub>h</sub>	Deceleration and Acceleration of Data Set 13	P7-26	VAR UINT32 rw	No	393222 13107400 4292673500
471B <sub>h</sub>	Waiting Time and Target Velocity of Data Set 13	P7-27	VAR UINT32 rw	No	0 13107200 3932192767
471C <sub>h</sub>	Deceleration and Acceleration of Data Set 14	P7-28	VAR UINT32 rw	No	393222 13107400 4292673500
471D <sub>h</sub>	Waiting Time and Target Velocity of Data Set 14	P7-29	VAR UINT32 rw	No	0 13107200 3932192767
471E <sub>h</sub>	Deceleration and Acceleration of Data Set 15	P7-30	VAR UINT32 rw	No	393222 13107400 4292673500
471F <sub>h</sub>	Waiting Time and Target Velocity of Data Set 15	P7-31	VAR UINT32 rw	No	0 13107200 3932192767
4720 <sub>h</sub>	Deceleration and Acceleration of Data Set 16	P7-32	VAR UINT32 rw	No	393222 13107400 4292673500
4721 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 16	P7-33	VAR UINT32 rw	No	0 13107200 3932192767
4722 <sub>h</sub>	Deceleration and Acceleration of Data Set 17	P7-34	VAR UINT32	No	393222 13107400

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			rw		4292673500
4723 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 17	P7-35	VAR UINT32 rw	No	0 13107200 3932192767
4724 <sub>h</sub>	Deceleration and Acceleration of Data Set 18	P7-36	VAR UINT32 rw	No	393222 13107400 4292673500
4725 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 18	P7-37	VAR UINT32 rw	No	0 13107200 3932192767
4726 <sub>h</sub>	Deceleration and Acceleration of Data Set 19	P7-38	VAR UINT32 rw	No	393222 13107400 4292673500
4727 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 19	P7-39	VAR UINT32 rw	No	0 13107200 3932192767
4728 <sub>h</sub>	Deceleration and Acceleration of Data Set 20	P7-40	VAR UINT32 rw	No	393222 13107400 4292673500
4729 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 20	P7-41	VAR UINT32 rw	No	0 13107200 3932192767
472A <sub>h</sub>	Deceleration and Acceleration of Data Set 21	P7-42	VAR UINT32 rw	No	393222 13107400 4292673500
472B <sub>h</sub>	Waiting Time and Target Velocity of Data Set 21	P7-43	VAR UINT32 rw	No	0 13107200 3932192767
472C <sub>h</sub>	Deceleration and Acceleration of Data Set 22	P7-44	VAR UINT32 rw	No	393222 13107400 4292673500
472D <sub>h</sub>	Waiting Time and Target Velocity of Data Set 22	P7-45	VAR UINT32 rw	No	0 13107200 3932192767
472E <sub>h</sub>	Deceleration and Acceleration of Data Set 23	P7-46	VAR UINT32 rw	No	393222 13107400 4292673500
472F <sub>h</sub>	Waiting Time and Target Velocity of Data Set 23	P7-47	VAR UINT32 rw	No	0 13107200 3932192767
4730 <sub>h</sub>	Deceleration and Acceleration of Data Set 24	P7-48	VAR UINT32	No	393222 13107400

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			rw		4292673500
4731 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 24	P7-49	VAR UINT32 rw	No	0 13107200 3932192767
4732 <sub>h</sub>	Deceleration and Acceleration of Data Set 25	P7-50	VAR UINT32 rw	No	393222 13107400 4292673500
4733 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 25	P7-51	VAR UINT32 rw	No	0 13107200 3932192767
4734 <sub>h</sub>	Deceleration and Acceleration of Data Set 26	P7-52	VAR UINT32 rw	No	393222 13107400 4292673500
4735 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 26	P7-53	VAR UINT32 rw	No	0 13107200 3932192767
4736 <sub>h</sub>	Deceleration and Acceleration of Data Set 27	P7-54	VAR UINT32 rw	No	393222 13107400 4292673500
4737 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 27	P7-55	VAR UINT32 rw	No	0 13107200 3932192767
4738 <sub>h</sub>	Deceleration and Acceleration of Data Set 28	P7-56	VAR UINT32 rw	No	393222 13107400 4292673500
4739 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 28	P7-57	VAR UINT32 rw	No	0 13107200 3932192767
473A <sub>h</sub>	Deceleration and Acceleration of Data Set 29	P7-58	VAR UINT32 rw	No	393222 13107400 4292673500
473B <sub>h</sub>	Waiting Time and Target Velocity of Data Set 29	P7-59	VAR UINT32 rw	No	0 13107200 3932192767
473C <sub>h</sub>	Deceleration and Acceleration of Data Set 30	P7-60	VAR UINT32 rw	No	393222 13107400 4292673500
473D <sub>h</sub>	Waiting Time and Target Velocity of Data Set 30	P7-61	VAR UINT32 rw	No	0 13107200 3932192767
473E <sub>h</sub>	Deceleration and Acceleration of Data Set 31	P7-62	VAR UINT32	No	393222 13107400



Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			rw		4292673500
473F <sub>h</sub>	Waiting Time and Target Velocity of Data Set 31	P7-63	VAR UINT32 rw	No	0 13107200 3932192767
4740 <sub>h</sub>	Deceleration and Acceleration of Data Set 32	P7-64	VAR UINT32 rw	No	393222 13107400 4292673500
4741 <sub>h</sub>	Waiting Time and Target Velocity of Data Set 32	P7-65	VAR UINT32 rw	No	0 13107200 3932192767

## 48xx<sub>h</sub> Object Group

### 48xx<sub>h</sub> Vendor-specific Object Group

This objects list is also available in P8 - Control loops parameters, page 249

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4800 <sub>h</sub>	Derivative Gain	P8-00	VAR UINT32 rww	Yes	0 800 20000
4801 <sub>h</sub>	Integral Gain	P8-01	VAR UINT32 rww	Yes	0 100 2000
4802 <sub>h</sub>	Derivative-Integral Gain	P8-02	VAR UINT32 rww	Yes	0 400 4000
4803 <sub>h</sub>	Proportional Gain	P8-03	VAR UINT32 rww	Yes	0 300 4000
4804 <sub>h</sub>	Global Gain	P8-04	VAR UINT32 rww	Yes	100 500 3000
4805 <sub>h</sub>	LTN Spring Filter	P8-05	VAR UINT16 rww	Yes	10 7000 7000
4806 <sub>h</sub>	Anti-Vibration Gain	P8-06	VAR UINT32 rww	Yes	0 0 10000
4807 <sub>h</sub>	Pe filter	P8-07	VAR	Yes	0

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT32 rww		0 99000
4808 <sub>h</sub>	Anti-Vibration Filter	P8-08	VAR UINT32 rww	Yes	50 4000 4000
4809 <sub>h</sub>	Pe filter	P8-09	VAR UINT32 rww	Yes	50 4000 8000
480A <sub>h</sub>	Ratio of Load Inertia to Motor Inertia for Anti-Vibration	P8-10	VAR UINT32 rww	Yes	0 0 6000
480B <sub>h</sub>	NL Anti-Resonance Filter Divider	P8-11	VAR UINT32 rww	Yes	1 200 10000
480C <sub>h</sub>	Anti-Resonance Sharpness	P8-12	VAR UINT16 rww	Yes	10 500 10000
480D <sub>h</sub>	Pe Sharpness	P8-13	VAR UINT16 rww	Yes	10 500 10000
480E <sub>h</sub>	Current Filter Damping	P8-14	VAR UINT16 rww	Yes	0 0 100
480F <sub>h</sub>	Current Filter Low Pass Filter Rise Time	P8-15	VAR UINT16 rww	Yes	0 10 3000
4810 <sub>h</sub>	Current Filter - Second Notch Filter Bandwidth	P8-16	VAR UINT16 rww	Yes	0 0 500
4811 <sub>h</sub>	Current Filter - Second Notch Filter Center	P8-17	VAR UINT16 rww	Yes	5 100 1800
4812 <sub>h</sub>	Current Filter - Notch Filter Bandwidth	P8-18	VAR UINT16 rww	Yes	0 0 500
4813 <sub>h</sub>	Current Filter - Notch Filter Center	P8-19	VAR UINT16 rww	Yes	5 100 1800
4814 <sub>h</sub>	Elasticity Compensation	P8-20	VAR UINT32 rww	Yes	0 50000 50000
4815 <sub>h</sub>	Spring Deceleration Ratio	P8-21	VAR	Yes	0

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			UINT16 rww		1000 2000
4816 <sub>h</sub>	Analog NCT standstill	P8-22	VAR INT16 rww	Yes	-3815 0 3815
4817 <sub>h</sub>	Analog Input 1 Filter	P8-23	VAR UINT32 rww	Yes	1 1000 1000000
4818 <sub>h</sub>	Analog Input 2 - Filter	P8-24	VAR UINT32 rww	Yes	1 1000 1000000
4819 <sub>h</sub>	Electronic Gear Filter - Acceleration Feedforward	P8-25	VAR INT16 rww	Yes	-2000 0 2000
481A <sub>h</sub>	Electronic Gear Filter - Activation	P8-26	VAR UINT16 rww	Yes	0 0 2
481B <sub>h</sub>	Electronic Gear Filter - Depth	P8-27	VAR UINT32 rww	Yes	75 200 3200
481C <sub>h</sub>	Electronic Gear Filter - Velocity and Acceleration Depth	P8-28	VAR UINT16 rww	Yes	0 400 6000
481D <sub>h</sub>	Electronic Gear Filter - Velocity Feedforward	P8-29	VAR INT32 rww	Yes	-20000 0 20000
481E <sub>h</sub>	Interpolation of Input Signal for Electronic Gear - Activation	P8-30	VAR UINT16 rww	Yes	0 1 1
481F <sub>h</sub>	Method for Operating Mode Pulse Train (PT)	P8-31	VAR UINT16 rww	Yes	0 1 3
4820 <sub>h</sub>	S-Curve Setting	P8-32	VAR UINT32 rww	Yes	25 400 25600
4821 <sub>h</sub>	Low Pass Filter Setting	P8-33	VAR UINT32 rww	Yes	1 5000 500000
4822 <sub>h</sub>	Smoothing Filter for Operating modes PT and PS - Type	P8-34	VAR UINT16 rww	Yes	0 2 2
4823 <sub>h</sub>	Type of Velocity Control and Type of position Control	P8-35	VAR	Yes	5

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			UINT16 rww		519 16385
4824 <sub>h</sub>	Pe filter 3	P8-36	VAR UINT32 rww	Yes	0 0 6000
4825 <sub>h</sub>	Pe filter 3	P8-37	VAR UINT32 rww	Yes	50 4000 8000
4826 <sub>h</sub>	Pe filter 3	P8-38	VAR UINT32 rww	Yes	200 1000 10000
4827 <sub>h</sub>	Gravity Compensation	P8-39	VAR INT16 rww	Yes	- 0 -
4828 <sub>h</sub>	LTN AFF	P8-40	VAR UINT16 rww	Yes	0 0 200
4829 <sub>h</sub>	Pe Sharpness	P8-41	VAR UINT16 rww	Yes	10 200 10000
482A <sub>h</sub>	Homing Incorrect Information	P8-42	VAR UINT32 ro	Yes	0 - 4294967295
482B <sub>h</sub>	ZSPD Low Pass Filter Value	P8-43	VAR UINT16 rww	Yes	10 1000 1000
482C <sub>h</sub>	Send commands to multi-turn encoder	P8-44	VAR UINT16 rww	Yes	0 - 2
482D <sub>h</sub>	Feedback type	P8-45	VAR UINT16 ro	No	0 - 2
482E <sub>h</sub>	Encoder temperature	P8-46	VAR INT16 ro	No	- - -
482F <sub>h</sub>	Encoder firmware and hardware versions	P8-47	VAR UINT32 ro	Yes	0 - 4294967295
4830 <sub>h</sub>	Encoder active errors	P8-48	VAR UINT32 ro	Yes	0 - 4294967295
4831 <sub>h</sub>	Encoder active alerts	P8-49	VAR	Yes	0

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			UINT32 ro		- 4294967295
4833 <sub>h</sub>	Speed Observer Mode	P8-51	VAR UINT16 rww	Yes	0 0 3
4834 <sub>h</sub>	Electronic Gear Filter Depth	P8-52	VAR UINT32 rww	Yes	0 200 3200
4835 <sub>h</sub>	Position Linear Controller Proportional Gain, page 260	P8-53	VAR UINT16 rww	Yes	0 300 12000
4836 <sub>h</sub>	Position Velocity Feedforward	P8-54	VAR INT32 rww	Yes	-2000 500 2000
4837 <sub>h</sub>	Position Acceleration Feedforward	P8-55	VAR INT32 rww	Yes	-20000 0 20000
4838 <sub>h</sub>	Position Acceleration Feedforward to Current Loop	P8-56	VAR INT32 rww	Yes	-20000 0 20000
4839 <sub>h</sub>	Velocity Proportional Gain, page 260	P8-57	VAR UINT32 rww	Yes	0 300 1000000000
483A <sub>h</sub>	Velocity Integral Gain, page 260	P8-58	VAR UINT32 rww	Yes	0 30000 200000000
483B <sub>h</sub>	Velocity Feedforward Ratio	P8-59	VAR UINT16 rww	Yes	0 900 1000
483C <sub>h</sub>	Velocity Loop Output Filter Mode, page 260	P8-60	VAR UINT16 rww	Yes	0 2 3
483D <sub>h</sub>	Velocity Loop Output Filter Parameter 1, page 260	P8-61	VAR UINT16 rww	Yes	1 500 10000
483E <sub>h</sub>	Velocity Loop Output Filter Parameter 2, page 260	P8-62	VAR UINT16 rww	Yes	1 500 10000
483F <sub>h</sub>	Velocity Filter Mode	P8-63	VAR UINT16 rww	Yes	0 1 2
4840 <sub>h</sub>	Velocity Filter Pole Frequency	P8-64	VAR	Yes	20

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT16 rww		440 2000
4841 <sub>h</sub>	Current Feedforward Low Pass Filter	P8-65	VAR UINT16 rww	Yes	10 1000 1000
4842 <sub>h</sub>	LTN Torque Filter Mode	P8-66	VAR UINT16 rww	Yes	0 0 1
4843 <sub>h</sub>	LTN Torque Filter Bandwidth	P8-67	VAR UINT16 rww	Yes	50 1000 2000
4844 <sub>h</sub>	Current Filter - Notch Filter Mode	P8-68	VAR UINT16 rww	Yes	0 0 1
4845 <sub>h</sub>	Standstill Mode	P8-69	VAR UINT16 rww	Yes	0 0 1
4846 <sub>h</sub>	Standstill Gain	P8-70	VAR UINT16 rww	Yes	128 1024 1024
4847 <sub>h</sub>	Encoder Filter Mode	P8-71	VAR INT16 rww	Yes	0 0 1
4848 <sub>h</sub>	HW Temperature failure threshold	P8-72	VAR INT16 RW	No	0 2000 32767
4863 <sub>h</sub>	Adaptive Velocity Reference Value Gain	P8-99	VAR UINT32 rww	Yes	0 1000 3000

## 49xx<sub>h</sub> Object Group

### 49xx<sub>h</sub> Vendor-specific Object Group

Part of this objects list is also available in P9 - DTM data parameters, page 261

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4900 <sub>h</sub>	Lexium program number	P9-00	VAR UINT32 ro	No	0 - 4294967295
4901 <sub>h</sub>	Firmware Version Date	P9-01	VAR UINT32 ro	No	0 - 4294967295
4902 <sub>h</sub>	MTP Identification Code	P9-02	VAR UINT16 ro	No	0 - 65535
4906 <sub>h</sub>	User-Defined Application Name 1	P9-06	VAR UINT32 rw	No	0 0 4294967295
4907 <sub>h</sub>	User-Defined Application Name 2	P9-07	VAR UINT32 rw	No	0 0 4294967295
4908 <sub>h</sub>	User-Defined Application Name 3	P9-08	VAR UINT32 rw	No	0 0 4294967295
4909 <sub>h</sub>	User-Defined Application Name 4	P9-09	VAR UINT32 rw	No	0 0 4294967295
490A <sub>h</sub>	Modbus Word Order	P9-10	VAR UINT16 rw	No	0 0 1
490B <sub>h</sub>	Serial Number Part 1	P9-11	VAR UINT32 ro	No	0 - 4294967295
490C <sub>h</sub>	Serial Number Part 2	P9-12	VAR UINT32 ro	No	0 - 4294967295
490D <sub>h</sub>	Serial Number Part 3	P9-13	VAR UINT32 ro	No	0 - 4294967295
490E <sub>h</sub>	Serial Number Part 4	P9-14	VAR UINT32 ro	No	0 - 4294967295
490F <sub>h</sub>	Autotuning Method	P9-15	VAR UINT16 rw	No	0 0 6
4910 <sub>h</sub>	Autotuning Motion Profile - Type	P9-16	VAR UINT16 rw	No	0 0 2
4911 <sub>h</sub>	Anti-vibration tuning mode.	P9-17	VAR	No	0

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT16 rw		0 6
4912 <sub>h</sub>	Autotuning Results - Save/Discard	P9-18	VAR UINT16 rw	No	0 0 3
4913 <sub>h</sub>	Autotuning - Elasticity Compensation Filters	P9-19	VAR INT16 rw	No	0 1 1
4914 <sub>h</sub>	Autotuning - Direction of Movement	P9-20	VAR INT16 rw	No	0 0 3
4915 <sub>h</sub>	Minimum Dwell Time for Detection of Movement Cycle	P9-21	VAR UINT16 rw	No	100 200 1000
4916 <sub>h</sub>	Autotuning - Automatic Estimation of Ratio of Load Inertia and Motor Inertia	P9-22	VAR UINT16 rw	No	0 0 1
4917 <sub>h</sub>	Defines which values will be used for the position command filters.	P9-23	VAR UINT16 rw	No	0 0 1
4919 <sub>h</sub>	Autotuning Motion Profile - Activation	P9-25	VAR UINT16 rw	No	0 0 1
491A <sub>h</sub>	Autotuning - Movement Range in Direction1	P9-26	VAR INT32 rw	No	-2147483647 0 2147483647
491B <sub>h</sub>	Autotuning - Movement Range in Direction2	P9-27	VAR INT32 rw	No	-2147483647 0 2147483647
491C <sub>h</sub>	Autotuning Active	P9-28	VAR INT16 ro	No	0 - 1
491D <sub>h</sub>	Autotuning - Velocity	P9-29	VAR UINT32 rw	No	- - -
491E <sub>h</sub>	Autotuning - Status	P9-30	VAR UINT32 ro	No	0 - 65535
491F <sub>h</sub>	Autotuning - Acceleration and Deceleration	P9-31	VAR UINT32 rw	No	6  6 6000  6000 65500  65500
4920 <sub>h</sub>	Autotune advance mode.	P9-32	VAR	No	0



Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			UINT16 rw		1 2
4921 <sub>h</sub>	Maximum Autotuning Optimization Value	P9-33	VAR UINT32 ro	No	0 - 1000
4922 <sub>h</sub>	Autotuning Progress Bar	P9-34	VAR UINT16 ro	No	0 0 100
4923 <sub>h</sub>	Autotuning - Gravity Estimation	P9-35	VAR UINT16 rw	No	0 0 1
4924 <sub>h</sub>	Set LTNAFRC in Autotune	P9-36	VAR INT16 rw	No	0 0 2
4925 <sub>h</sub>	Autotuning - Last Stored Event	P9-37	VAR UINT32 ro	No	0 0 65535
4926 <sub>h</sub>	Mode 2 AT improvment	P9-38	VAR UINT16 ro	No	0 0 100
4927 <sub>h</sub>	Cycle Identification status	P9-39	VAR UINT16 ro	No	0 0 9
4928 <sub>h</sub>	LTN Autotuning Using Defaults	P9-40	VAR UINT16 rw	No	0 0 1

## 4Bxx<sub>h</sub> Object Group

### 4Bxx<sub>h</sub> Vendor-specific Object Group

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4B00 <sub>h</sub>	Position	-	VAR INT32 ro	No	- - -
4B01 <sub>h</sub>	Target Position in PUU	-	VAR INT32 ro	No	- - -
4B02 <sub>h</sub>	Position Deviation in PUU	-	VAR INT32	No	- -

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			ro		-
4B03 <sub>h</sub>	Actual Position in Pulses	-	VAR INT32 ro	No	- - -
4B04 <sub>h</sub>	Target Position in Pulses	-	VAR INT32 ro	No	- - -
4B05 <sub>h</sub>	Position Deviation in Pulses	-	VAR INT32 ro	No	- - -
4B06 <sub>h</sub>	Input Frequency	-	VAR INT32 ro	Yes	- - -
4B07 <sub>h</sub>	Actual Velocity in rpm	-	VAR INT32 ro	No	- - -
4B08 <sub>h</sub>	Target Velocity in V	-	VAR INT32 ro	Yes	- - -
4B09 <sub>h</sub>	Target Velocity in rpm	-	VAR INT32 ro	No	- - -
4B0A <sub>h</sub>	Target Torque in V	-	VAR INT32 ro	Yes	- - -
4B0B <sub>h</sub>	Target Torque in Percent of Nominal Current	-	VAR INT32 ro	No	- - -
4B0E <sub>h</sub>	DC Bus Voltage	-	VAR INT32 ro	Yes	- - -
4B0F <sub>h</sub>	Ratio of Load Inertia and Motor Inertia	-	VAR INT32 ro	No	- - -
4B10 <sub>h</sub>	Drive Temperature - Power Stage	-	VAR INT32 ro	Yes	- - -
4B13 <sub>h</sub>	Map P0-25	-	VAR INT32 ro	No	- - -
4B14 <sub>h</sub>	Map P0-26	-	VAR INT32	No	- -

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
			ro		-
4B15 <sub>h</sub>	Map P0-27	-	VAR INT32 ro	No	- - -
4B16 <sub>h</sub>	Map P0-28	-	VAR INT32 ro	No	- - -
4B17 <sub>h</sub>	Indicate P0-09	-	VAR INT32 ro	No	- - -
4B18 <sub>h</sub>	Indicate P0-10	-	VAR INT32 ro	No	- - -
4B19 <sub>h</sub>	Indicate P0-11	-	VAR INT32 ro	No	- - -
4B1A <sub>h</sub>	Indicate P0-12	-	VAR INT32 ro	No	- - -
4B1B <sub>h</sub>	Drive Temperature - Controller	-	VAR INT32 ro	Yes	- - -
4B27 <sub>h</sub>	Digital Inputs	-	VAR INT32 ro	No	- - -
4B28 <sub>h</sub>	Digital Outputs	-	VAR INT32 ro	No	- - -
4B29 <sub>h</sub>	Drive Status	-	VAR INT32 ro	Yes	- - -
4B2A <sub>h</sub>	Operating Mode	-	VAR INT32 ro	No	- - -
4B31 <sub>h</sub>	External Encoder	-	VAR INT32 ro	No	- - -
4B32 <sub>h</sub>	Target Velocity in rpm	-	VAR INT32 ro	No	- - -
4B35 <sub>h</sub>	Target Torque	-	VAR INT32	No	- -

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
			ro		-
4B36 <sub>h</sub>	Actual Torque in Percent	-	VAR INT32 ro	No	- - -
4B37 <sub>h</sub>	Actual Torque in A	-	VAR INT32 ro	No	- - -
4B3C <sub>h</sub>	Target Position Raw	-	VAR INT32 ro	No	- - -
4B3D <sub>h</sub>	Position Deviation Raw in PUU	-	VAR INT32 ro	No	- - -
4B3E <sub>h</sub>	Target Position Raw in Pulses	-	VAR INT32 ro	No	- - -
4B3F <sub>h</sub>	Position Deviation Raw in Pulses	-	VAR INT32 ro	No	- - -
4B4D <sub>h</sub>	Target Velocity in Operating Modes PT / PS	-	VAR INT32 ro	Yes	- - -

## 4Fxx<sub>h</sub> Object Group

### 4Fxx<sub>h</sub> Vendor-specific Object Group

Index	Name	Parameter	Object type	PDO mapping object	Minimum value
			Data type		Factory setting
			Access	Maximum value	
4FA0 <sub>h</sub>	Drive Profile Lexium Control	-	RECORD - -	No	- - -
4FA0:0 <sub>h</sub>	NumOfEntries	-	VAR UINT8 ro	No	0 9 9
4FA0:1 <sub>h</sub>	ShiftRefA	-	VAR UINT16 ro	No	0 0 65535
4FA0:2 <sub>h</sub>	ModeError	-	VAR UINT16 ro	No	0 0 65535

Index	Name	Parameter	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
4FA0:3h	ModeErrorInfo	-	VAR UINT16 ro	No	0 0 65535
4FA0:4h	Dpl_int_Lim	-	VAR UINT16 rw	No	0 0 65535
4FA0:5h	Ds402intLim	-	VAR UINT16 rw	No	0 0 65535
4FA0:6h	MON_V_Threshold	-	VAR UINT32 rw	No	0 0 4294967295
4FA0:7h	MON_I_Threshold	-	VAR UINT16 rw	No	- - -
4FA0:8h	DataError	-	VAR UINT16 ro	No	- - -
4FA0:9h	DataErrorInfo	-	VAR UINT16 ro	No	- - -
4FA3h	Save/Load Status	-	VAR UINT8 ro	No	0 0 255
4FA4h	Commanded velocity	-	VAR INT32 ro	No	-2147483648 0 2147483647
4FA5h	Electronic Gear Ratio	-	ARRAY - -	No	- - -
4FA5:0h	Number of Entries	-	VAR UINT8 ro	No	2 2 2
4FA5:1h	Electronic Gear Ratio (Numerator)	-	VAR INT32 rww	Yes	1 128 536870911
4FA5:2h	Electronic Gear Ratio (Denominator)	-	VAR INT32 rww	Yes	1 10 2147483647
4FA6h	CANopen Manufacturer Specific SDO Abort Code	-	VAR UINT32 ro	No	0 - 4294967295

## 6000<sub>h</sub> ... 6FFF<sub>h</sub> Device-Specific Object Group

### 60xx<sub>h</sub> Object Group

#### 60xx<sub>h</sub> Device-Specific Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
603F <sub>h</sub>	Error Code	VAR UINT16 ro	Yes	0 - 65535
6040 <sub>h</sub>	Controlword	VAR UINT16 rww	Yes	0 - 65535
6041 <sub>h</sub>	Statusword	VAR UINT16 ro	Yes	0 - 65535
605D <sub>h</sub>	Halt Option Code	VAR INT16 rw	No	1 1 2
6060 <sub>h</sub>	Modes of Operation	VAR INT8 rww	Yes	-128 0 10
6061 <sub>h</sub>	Modes of Operation Display	VAR INT8 ro	Yes	-128 - 10
6062 <sub>h</sub>	Position Demand Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 - 2147483647
6063 <sub>h</sub>	Position Actual Internal Value Unit: Increments	VAR INT32 ro	Yes	-2147483648 - 2147483647
6064 <sub>h</sub>	Position Actual Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 - 2147483647
6065 <sub>h</sub>	Following Error Window Unit: User-defined position unit	VAR UINT32 rww	Yes	0 1280000 4294967295
6066 <sub>h</sub>	Following Error Time Out Unit: ms	VAR UINT16 rww	Yes	0 0 65535
6067 <sub>h</sub>	Position Window Unit: User-defined position unit	VAR UINT32 rww	Yes	0 163840 4294967295
6068 <sub>h</sub>	Position Window Time	VAR	Yes	0

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
	Unit: ms	UINT16 rww		1 65535
606B <sub>h</sub>	Velocity Demand Value Unit: User-defined position unit/s	VAR INT32 ro	Yes	-2147483648 - 2147483647
606C <sub>h</sub>	Velocity Actual Value Unit: User-defined position unit/s	VAR INT32 ro	Yes	-2147483648 - 2147483647
606E <sub>h</sub>	Velocity Window Time Unit: ms	VAR UINT16 rww	Yes	0 0 65535
6070 <sub>h</sub>	Velocity Threshold Time Unit: ms	VAR UINT16 rww	Yes	0 0 65535
6071 <sub>h</sub>	Target Torque Unit: 1/1000 of nominal torque	VAR INT16 rww	Yes	-32768 0 32767
6073 <sub>h</sub>	Maximum Current Unit: 1/1000 of nominal current	VAR UINT16 rww	Yes	0 - 65535
6074 <sub>h</sub>	Torque Demand Value Unit: 1/1000 of nominal torque	VAR INT16 ro	Yes	-32768 - 32767
6075 <sub>h</sub>	Motor Rated Current Unit: mA	VAR UINT32 ro	No	0 - 150
6076 <sub>h</sub>	Motor Rated Torque Unit: mNm	VAR UINT32 rw	No	0 0 4294967295
6077 <sub>h</sub>	Torque Actual Value Unit: 1/1000 of nominal torque	VAR INT16 ro	Yes	-32768 - 32767
6078 <sub>h</sub>	Current Actual Value Unit: 1/1000 of nominal current	VAR INT16 ro	Yes	-32768 - 32767
6079 <sub>h</sub>	DC Link Circuit Voltage Unit: mV	VAR UINT32 ro	Yes	0 - 4294967295
607A <sub>h</sub>	Target Position Unit: User-defined position unit	VAR INT32 rww	Yes	-2147483648 0 2147483647
607C <sub>h</sub>	Home Offset	VAR	Yes	-2147483648

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
	Unit: User-defined position unit	INT32 rww		0 2147483647
607D <sub>h</sub>	Software Position Limit	ARRAY - -	No	- - -
607D:0 <sub>h</sub>	Highest Subindex Supported	VAR UINT8 ro	No	2 2 2
607D:1 <sub>h</sub>	Minimum Software Position Limit Unit: User-defined position unit	VAR INT32 rww	Yes	-2147483648 -1717986906 2147483647
607D:2 <sub>h</sub>	Maximum Software Position Limit Unit: User-defined position unit	VAR INT32 rww	Yes	-2147483648 1717986906 2147483647
607E <sub>h</sub>	Polarity	VAR UINT8 rw	No	0 0 192
607F <sub>h</sub>	Maximum Profile Velocity Unit: User-defined position unit/s	VAR UINT32 rww	Yes	1 - 4294967295
6080 <sub>h</sub>	Maximum Motor Speed Unit: User-defined position unit/s	VAR UINT32 ro	Yes	0 - 4294967295
6081 <sub>h</sub>	Profile Velocity in profile position mode Unit: User-defined position unit/s	VAR UINT32 rww	Yes	0 0 4294967295
6083 <sub>h</sub>	Profile Acceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 4266666667 4294967295
6084 <sub>h</sub>	Profile Deceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 4266666667 4294967295
6085 <sub>h</sub>	Quick Stop Deceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 4266666667 4294967295
6087 <sub>h</sub>	Torque Slope Unit: 1/1000 of nominal torque/s	VAR UINT32 rww	Yes	1 - 30000000
608F <sub>h</sub>	Position Encoder Resolution	ARRAY - -	No	- - -
608F:0 <sub>h</sub>	Highest subindex supported	VAR	No	2



Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		UINT8 rw		2 2
608F:1 <sub>h</sub>	Encoder Increments Unit: Increments	VAR UINT32 rw	No	16 1048576 10000000
608F:2 <sub>h</sub>	Motor Revolutions Unit: Revolutions	VAR UINT32 ro	No	1 1 1
6091 <sub>h</sub>	Gear Ratio	ARRAY - -	No	- - -
6091:0 <sub>h</sub>	Highest subindex supported	VAR UINT8 ro	No	2 2 2
6091:1 <sub>h</sub>	Motor Revolutions	VAR UINT32 rww	Yes	1 1 4294967295
6091:2 <sub>h</sub>	Shaft Revolutions	VAR UINT32 rww	Yes	1 1 4294967295
6092 <sub>h</sub>	Feed Constant User-defined position unit	ARRAY - -	No	- - -
6092:0 <sub>h</sub>	Highest subindex supported	VAR UINT8 ro	No	2 2 2
6092:1 <sub>h</sub>	Feed	VAR UINT32 rw	No	1 1280000 4294967295
6092:2 <sub>h</sub>	Shaft Revolutions	VAR UINT32 rww	Yes	1 1 4294967295
6098 <sub>h</sub>	Homing Method	VAR INT8 rww	Yes	1 2 35
6099 <sub>h</sub>	Homing Speeds	ARRAY - -	No	- - -
6099:0 <sub>h</sub>	Highest subindex supported	VAR UINT8 ro	No	2 2 2
6099:1 <sub>h</sub>	Fast Homing Speed	VAR	Yes	1

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
	Unit: User-defined position unit/s	UINT32 rww		2133332 4294967295
6099:2 <sub>h</sub>	Slow Homing Speed Unit: User-defined position unit/s	VAR UINT32 rww	Yes	1 426667 4294967295
609A <sub>h</sub>	Homing Acceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 640000000 4294967295
60B0 <sub>h</sub>	Position Offset Unit: User-defined position unit	VAR INT32 rww	Yes	-2147483648 0 2147483647
60B1 <sub>h</sub>	Velocity Offset Unit: User-defined position unit/s	VAR INT32 rww	Yes	-2147483648 0 2147483647
60B2 <sub>h</sub>	Torque Offset Unit: 1/1000 of nominal torque	VAR INT16 rww	Yes	-32768 0 32767
60B8 <sub>h</sub>	Touch Probe Function	VAR UINT16 rww	Yes	0 - 65535
60B9 <sub>h</sub>	Touch Probe Status	VAR UINT16 ro	Yes	0 0 65535
60BA <sub>h</sub>	Touch Probe 1 Position Positive Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 0 2147483647
60BB <sub>h</sub>	Touch Probe 1 Position Negative Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 0 2147483647
60BC <sub>h</sub>	Touch Probe 2 Position Positive Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 - 2147483647
60BD <sub>h</sub>	Touch Probe 2 Position Negative Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 - 2147483647
60C0 <sub>h</sub>	Interpolation Sub Mode Select	VAR INT16 rw	No	0 0 2
60C1 <sub>h</sub>	Interpolation Data Record	ARRAY - -	No	- - -
60C1:0 <sub>h</sub>	Highest subindex supported	VAR	No	1

Index	Name	Object type Data type Access	PDO mapping object	Minimum value Factory setting Maximum value
		UINT8 ro		4 254
60C1:1 <sub>h</sub>	Data Record 1	VAR INT32 rww	Yes	-2147483648 0 2147483647
60C1:2 <sub>h</sub>	Data Record 2	VAR INT32 rww	Yes	-2147483648 0 2147483647
60C1:3 <sub>h</sub>	Data Record 3	VAR INT32 rww	Yes	-2147483648 0 2147483647
60C1:4 <sub>h</sub>	Data Record 4	VAR INT32 rww	Yes	-2147483648 0 2147483647
60C2 <sub>h</sub>	Interpolation Time Period	RECORD - -	No	- - -
60C2:0 <sub>h</sub>	Highest subindex supported	VAR UINT8 ro	No	2 2 2
60C2:1 <sub>h</sub>	Interpolation time period value Unit: 10 <sup>(interpolation time index)</sup> seconds	VAR UINT8 rw	No	1 2 255
60C2:2 <sub>h</sub>	Interpolation time index	VAR INT8 rw	No	-128 -3 63
60C4 <sub>h</sub>	Interpolation Data Configuration	RECORD - -	No	- - -
60C4:0 <sub>h</sub>	Highest subindex supported	VAR UINT8 ro	No	6 6 6
60C4:1 <sub>h</sub>	Maximum buffer size Unit: Number of data records	VAR UINT32 ro	No	1 1 1
60C4:2 <sub>h</sub>	Actual buffer size Unit: Number of data records	VAR UINT32 rw	No	1 - 1
60C4:3 <sub>h</sub>	Buffer organization	VAR UINT8 rw	No	0 0 1
60C4:4 <sub>h</sub>	Buffer position	VAR	No	0

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		UINT16 rw		- 0
60C4:5 <sub>h</sub>	Size of data record Unit: Bytes	VAR UINT8 wo	No	4 - 4
60C4:6 <sub>h</sub>	Buffer clear	VAR UINT8 wo	No	0 - 1
60C5 <sub>h</sub>	Maximum Acceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 4153464149 4294967295
60C6 <sub>h</sub>	Maximum Deceleration Unit: User-defined position unit/s <sup>2</sup>	VAR UINT32 rww	Yes	1 4153464149 4294967295
60D5 <sub>h</sub>	Touch probe 1 positive edge counter	VAR UINT16 ro	Yes	0 0 65535
60D6 <sub>h</sub>	Touch probe 1 negative edge counter	VAR UINT16 ro	Yes	0 0 65535
60D7 <sub>h</sub>	Touch probe 2 positive edge counter	VAR UINT16 ro	Yes	0 0 65535
60D8 <sub>h</sub>	Touch probe 2 negative edge counter	VAR UINT16 ro	Yes	0 0 65535
60F2 <sub>h</sub>	Position option code	VAR UINT16 rww	Yes	0 0 65535
60F4 <sub>h</sub>	Following Error Actual Value Unit: User-defined position unit	VAR INT32 ro	Yes	-2147483648 - 2147483647
60FC <sub>h</sub>	Position Demand Internal Value Unit: Increments	VAR INT32 ro	Yes	-2147483648 - 2147483647
60FD <sub>h</sub>	Digital Inputs	VAR UINT32 ro	Yes	0 - 4294967295
60FE <sub>h</sub>	Digital Outputs	ARRAY - -	No	- - -
60FE:0 <sub>h</sub>	Highest subindex supported	VAR	No	2

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
		UINT8 ro		2 2
60FE:1 <sub>h</sub>	Physical Outputs	VAR UINT32 rww	Yes	0 - 4294967295
60FE:2 <sub>h</sub>	Output Mask	VAR UINT32 rw	No	0 0 4294967295
60FF <sub>h</sub>	Target Velocity Unit: User-defined position unit/s	VAR INT32 rww	Yes	-2147483648 0 2147483647

## 65xx<sub>h</sub> Object Group

### 65xx<sub>h</sub> Device Profile Object Group

Index	Name	Object type	PDO mapping object	Minimum value
		Data type		Factory setting
		Access	Maximum value	
6502 <sub>h</sub>	Supported Drive Modes	VAR UINT32 ro	Yes	1005 - 1005



---

# Glossary

## A

### **absolute movement:**

A movement to a position defined from a reference point.

### **analog input:**

Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

### **analog output:**

Converts numerical values within the logic controller and sends out proportional voltage or current levels.

### **ASCII:**

*(American standard code for Information Interchange)* A protocol for representing alphanumeric characters (letters, numbers, certain graphics, and control characters).

### **AWG:**

*(American wire gauge)* The standard that specifies wire section sizes in North America.

## B

### **BOOL:**

*(boolean)* A basic data type in computing. A `BOOL` variable can have one of these values: 0 (`FALSE`), 1 (`TRUE`). A bit that is extracted from a word is of type `BOOL`; for example, `%MW10.4` is a fifth bit of memory word number 10.

### **byte:**

A type that is encoded in an 8-bit format, ranging from 00 hex to FF hex.

## C

### **CAN:**

*(controller area network)* A protocol (ISO 11898) for serial bus networks, designed for the interconnection of smart devices (from multiple manufacturers) in smart systems and for real-time industrial applications. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

### **CANmotion:**

A CANopen-based motion bus with an additional mechanism that provides synchronization between the motion controller and the drives.

### **CANopen:**

An open industry-standard communication protocol and device profile specification (EN 50325-4).

### **CCW:**

Counter ClockWise

### **CiA:**

*(CAN in automation)* A non-profit group of manufacturers and users dedicated to developing and supporting CAN-based higher layer protocols.

---

**COB ID:**

Each COB is uniquely identified in a CAN network by a number called the COB Identifier (COB-ID).

**COB:**

(*communications object*) CANopen refers to a CAN frame as a communications object. Within the CAN frame is the COB-ID, which is normally an 11-bit identifier and defines the designated device (node) for the frame and a function code.

**CSA:**

(*Canadian standards association*) The Canadian standard for industrial electronic equipment in hazardous environments.

**CW:**

ClockWise

**D****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).

**DIN:**

(*Deutsches Institut für Normung*) A German institution that sets engineering and dimensional standards.

**DOM:**

Date of manufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. For example: 31.12.11 corresponds to December 31, 2011; 31.12.2011 corresponds to December 31, 2011

**DTM:**

(*device type manager*) Classified into 2 categories:

- Device DTMs connect to the field device configuration components.
- CommDTMs connect to the software communication components.

The DTM provides a unified structure for accessing device parameters and configuring, operating, and diagnosing the devices. DTMs can range from a simple graphical user interface for setting device parameters to a highly sophisticated application capable of performing complex real-time calculations for diagnosis and maintenance purposes.

**E****Electronic Gear:**

Calculation of a new output velocity for the motor movement based on the input velocity and the values of an adjustable gear ratio; calculated by the drive system.

**EMC:**

Electromagnetic compatibility

**EMCY:**

(*emergency*) The object that enables devices to indicate internal errors detected in and by the device. When the devices receive this signal, other network participants can evaluate the received information and start appropriate manufacturer-specific counter actions.



---

**Encoder :**

Sensor that converts a measured distance or angle into an electrical signal. This signal is evaluated by the drive to determine the actual position of a shaft (rotor) or a driving unit.

**Error:**

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

**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.

**firmware:**

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

**flash memory:**

A non-volatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

**H****hex:**

*(hexadecimal)*

**HMI:**

*(human machine interface)* An operator interface (usually graphical) for human control over industrial equipment.

**homing:**

The method used to establish the reference point for absolute movement.

**I****I/O:**

*(input/output)*

**IEC:**

*(international electrotechnical commission)* A non-profit and non-governmental international standards organization that prepares and publishes international standards for electrical, electronic, and related technologies.

---

**Internal Units:**

Resolution of the power stage at which the motor can be positioned. Internal units are specified in increments.

**IT Mains:**

Mains in which all active components are isolated from ground or are grounded by a high impedance. IT: isolé terre (French), isolated ground. Opposite: Grounded mains, see TT/TN mains

**L****LED:**

*(light emitting diode)* An indicator that illuminates under a low-level electrical charge.

**Limit Switch:**

Switches that signal overtravel of the permissible range of travel.

**LSB:**

*(least significant bit/byte)* The part of a number, address, or field that is written as the right-most single value in conventional hexadecimal or binary notation.

**M****Modbus:**

The protocol that allows communications between many devices connected to the same network.

**Monitoring Function:**

Monitoring functions acquire a value continuously or cyclically (for example, by measuring) in order to check whether it is within permissible limits. Monitoring functions are used for error detection.

**MSB:**

*(most significant bit/byte)* The part of a number, address, or field that is written as the left-most single value in conventional hexadecimal or binary notation.

**ms:**

*(millisecond)*

**N****network:**

A system of interconnected devices that share a common data path and protocol for communications.

**NMT state machine:**

*(network management state machine)* The communication behavior of any CANopen device. The CANopen NMT state machine consists of an initialization state, a pre-operational state, an operational state, and a stopped state. After power-on or reset, the device enters the initialization state. After the device initialization is finished, the device automatically enters the pre-operational state and announces the state transition by sending the boot-up message. In this manner, the device indicates that it is ready to work. A device that stays in pre-operational state may start to transmit SYNC-, Time Stamp-, or Heartbeat message. In this state, the device cannot communicate through a PDO; it communicates with an SDO. In the operational state, the device can use supported communication objects.

---

**node:**

An addressable device on a communication network.

**non-volatile memory:**

A memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

**P****Parameter :**

Device data and values that can be read and set (to a certain extent) by the user.

**PDO:**

*(process data object)* An unconfirmed broadcast message or sent from a producer device to a consumer device in a CAN-based network. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

**PELV:**

Protective Extra Low Voltage, low voltage with isolation. For more information: IEC 60364-4-41

**PE:**

*(Protective Earth)* A common grounding connection to help avoid the hazard of electric shock by keeping any exposed conductive surface of a device at earth potential. To avoid possible voltage drop, no current is allowed to flow in this conductor (also referred to as *protective ground* in North America or as an equipment grounding conductor in the US national electrical code).

**PLC:**

*(programmable logic controller)* An industrial computer used to automate manufacturing, industrial, and other electromechanical processes. PLCs are different from common computers in that they are designed to have multiple input and output arrays and adhere to more robust specifications for shock, vibration, temperature, and electrical interference among other things.

**Position Deviation:**

The position deviation is the difference between reference position and actual position. The current position deviation consists of the load-dependent position deviation and the dynamic position deviation.

**Power Stage :**

The power stage controls the motor. The power stage generates current for controlling the motor on the basis of the motion signals from the controller.

**PWM:**

*(pulse width modulation)* A fast output that oscillates between off and on in an adjustable duty cycle, producing a rectangular wave form (though you can adjust it to produce a square wave). The PTO is well adapted to simulate or approximate an analog output in that it regulates the voltage of the output over its period making it useful in light dimming or speed control applications, among others.

**Q****Quick Stop:**

The quick Stop function can be used for fast deceleration of a movement as a response to a detected error or via a command.

---

## R

### **relative movement:**

Movement by a specified distance from the current position.

### **RJ45:**

A standard type of 8-pin connector for network cables defined for Ethernet.

### **rms:**

"Root Mean Square" value of a voltage ( $V_{rms}$ ) or a current ( $A_{rms}$ )

### **RPM:**

*(revolutions per minute)*

### **RSDO:**

*(receive service data object)* A message received from a producer device to a consumer device in a CAN-based network.

## S

### **Safety Function:**

Safety 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)). If the safety functions are wired properly, they meet the requirements specified in IEC 61800-5-2.

### **SDO:**

*(service data object)* A message used by the field bus master to access (read/write) the object directories of network nodes in a CAN-based. SDO types include service SDOs (SSDOs) and client SDOs (CSDOs).

### **STO:**

*(Safe Torque Off)* The Safety Function STO (IEC 61800-5-2) ("Safe Torque Off") removes power to the motor thereby relieving the torque applied by the motor. There is no monitoring for standstill..

### **SYNC:**

Synchronization Object

## T

### **TN Mains:**

Grounded mains, differ in terms of the ground connection (PE conductor connection). Opposite: Ungrounded mains, see IT mains.

### **touchprobe input:**

Touchprobe inputs are advanced digital inputs. These inputs are used for measuring functions, which accurately detect positions relative to a measure input. Once a touchprobe function has been activated, it runs independently in the system, independent of the IEC program. The IEC program can use parameters to detect the state of the measuring function. This function is supported by hardware and software.

### **TP:**

*(touch probe)* A position capture that is triggered by a fast input signal (quick sensor). On the rising edge of the touch probe input, the position of an encoder is captured.

For example, this is used for packaging machines to capture the position of a printmark on a film to cut on the same position.

---

**TSDO:**

*(transmit service data object)* A message sent from a producer device to a consumer device in a CAN-based network.

**TT Mains:**

Grounded mains, differ in terms of the ground connection (PE conductor connection). Opposite: Ungrounded mains, see IT mains.

**U****UL:**

*(underwriters laboratories)* A US organization for product testing and safety certification.

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