VDC-3-49.15-K4
ECI-63.XX-K4

Operating manual

ebmpapst

The engineer's choice



GREEN TECH

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Use

The safety regulations must be noted and followed when using the motors. Read through this operating manual carefully, before you start working on the drive system. Please note and follow the hazard signs and warnings to avoid personal risk and malfunctions.

This operating manual is to be treated as part of the drive system.
If the drive system is sold or passed on the operating manual must be handed over with it.

Copies can be made of the safety, assembly and installation instructions and passed on for the purpose of informing about potential hazards and their prevention.

Subject to change without notice.

The respective current version of this operating manual is available on the ebm-papst internet site: www.ebmpapst.com

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1 Introduction

1.1 Foreword

This operating manual describes the possible uses, the assembly and/or installation, operation and programming of the products listed on the front page.

All the safety instructions listed under Chapter 2 must be followed at all times during the installation and operation of the drive system; outside of Germany the relevant laws, directives, guidelines and regulations of the respective country also apply.

Read through this operating manual carefully before starting any work on the drive system. Note and follow the following warnings in order to avoid personal risk or product malfunctions.

This operating manual is to be thought of and handled as part of the drive system and must be handed over with the drive system if it is sold or passed on.

The safety instructions can be copied and passed on to provide information about potential hazards and their prevention.

Depending on the version or revision status of the products, differences may exist compared to this operating manual. The user must check this before using the manual and take into account any such differences.

1.2 Target group

This operating manual is solely directed at qualified and trained skilled personnel with knowledge of electronics and mechanics.

1.3 Notation used in this document

In this operating manual the significance of texts is denoted by different presentation forms.

Descriptive text is presented without preceding symbol.

- Text with a preceding dot (•) indicates a list which is introduced by a heading.
  - Text with a preceding dash (–) is on a lower level below the list with a dot.

Underlined blue text denotes a cross-reference, which can be clicked in the PDF document. The part of the document named in the text is then displayed.

`Text in Courier font`
is used to represent command sequences in software programs.

1 Introduction

1.4 Warnings and notes

Warnings and notices are always positioned before the instruction, implementation of which can result in a hazard or property damage.

The following **warnings** are used in this document:



DANGER

Hazard.

This notice denotes a hazard with high risk, which will result in imminent fatality or serious physical injuries if it is not avoided.

► This arrow indicates the appropriate precaution to take to avert the hazard.



WARNING

Hazard.

This notice denotes a hazard with moderate risk, which can possibly result in fatality or serious physical injuries if it is not avoided.

► This arrow indicates the appropriate precaution to take to avert the hazard.



CAUTION

Hazard.

This notice denotes a hazard with low risk, which can result in minor or moderate physical injuries or property to damage if it is not avoided.

► This arrow indicates the appropriate precaution to take to avert the hazard.

Notices contain information, which are particularly important in the corresponding position or which facilitate the described operating steps, are highlighted as follows:



NOTE

This notice gives you use recommendations and helpful tips.

1.5 Picture symbols

The following pictograms, where applicable in combination, are used on the ebm-papst products and packagings as hazard warnings.



General warning.



High voltage sign (Electric shock).



Hot surface warning sign.



Crushing hazard / hand injury warning sign.

2 Safety Instructions

The VDC-3-49.15-K4 and ECI-63.XX-K4 drive systems have been developed to the latest electronic and electrical engineering standards as well as recognised guidelines for the safety and protection of users.

The drive systems may only be operated and serviced by authorised skilled personnel, who have read through and understood the complete operating manual. The drive systems must be used with the necessary care, in compliance with all safety instructions described in this operating manual and the local company-specific regulations.

Read all safety information and instructions and keep notices and the operating manual in the same place as the drive systems.

2.1 General safety instructions

- Before starting work, disconnect the drive system or the design application using suitable devices provided and secure it against being switched back on again.
- Before opening the units or entering the danger zone, safely bring all drives to a standstill and secure them against being switched back on again.
- Do not make any changes, add attachments or make modifications to the drive system without ebm-papst's approval.
- If the motor is subjected to unapproved loads, check it for damage and if necessary repair or replace it.
- Do not commission or start up the design application until it has been fully checked for compliance with all relevant legal requirements, directives and guidelines and the safety provisions relevant for its intended use (e.g. accident prevention regulations and technical standards).
- Re-assess any safety risks caused by the drive system after it has been installed in the design application.

2.2 Documentation

In addition to this operating manual, the “Kickstart” PC software is required for making settings and parameterisation (configuration) of the motors. The “ebm-papst Kickstart” software manual describes how it functions.

2.3 Standards, guidelines and directives

- The product does not fall under the Low Voltage Directive 2006/95/EC, as the nominal operating voltage is not within the voltage range from 75 V DC and 1500 V DC.
- The Machinery Directive MD is applicable, as the product is “partly completed machinery” in accordance with Article 2, paragraph g), MD 2006/42/EC. A “CE” marking does not have to be provided on the rating plate. However, a Declaration of Incorporation must be drawn up in accordance with Annex II, Part 1, Section B, MD 2006/42/EC.

2.4 Personnel qualifications

- Only qualified electricians may install the drive system and carry out the trial run and work on the electrical system.
- The drive system may only be transported, unpacked, operated and serviced by instructed and authorised skilled personnel.

2.5 Personal safety

- Provide adequate safeguards / contact protection.
- Wear suitable clothing.
- Do not wear loose clothing or jewellery.
- Keep hair, clothing and gloves away from rotating components.
- Wear personal protective equipment (hearing protection, thermal protection gloves).

2 Safety Instructions

2.6 Electrical / electromagnetic safety

- Check the electrical equipment of the drive system regularly.
- Only use cables and connectors approved by ebm-papst.
- Remove defective cables and loose connections immediately.
- Take suitable measures to avoid impermissible electromagnetic interference emissions.
- Take suitable measures against high-frequency EMC radiation.
- Ensure EMC capability in the terminal device / installation state.
- Use control devices to control the electromagnetic radiation.

2.7 Mechanical safety

- Only carry out work when the system / machine is at a standstill.
- Provide adequate cooling of the drive.
- Remove protective devices and guards on the drive system and design application only for the purpose of carrying out repair and assembly work.

2.8 Intended use

- The drives of the VDC-3-49.15-K4 and ECI-63.XX-K4 series are intended for installation in stationary industrial design applications and machines and may only be operated electrically when installed!
- Commissioning or starting up is therefore prohibited until it has been established that the drive system together with the design application, in which the drive is installed, satisfy the safety and protection requirements of the Machinery Directive.
- This product is not intended for consumers! Use in a home environment is not planned, without further testing and deployment of appropriately adapted EMC protection measures!
- The electronic module is an installation product. It is only intended for use within other equipment or units and has no independent function. It is not intended for passing on to end users or consumers.
- All motor - electronic combinations must be qualified by the end manufacturer within their intended application and validated for overload and blocking safety. The application manufacturer is responsible for the end product and must ensure that adequate safety precautions are taken.

2.8.1 Type-related exclusion

Due to its type or design, the drive system must not be used in the following areas of use; this could result in and hazards and equipment damage:

- In case of special fail-safe requirements.
- In aircraft and space vehicles.
- In rail and motor vehicles.
- In boats and ships.
- In potentially explosive atmospheres (EX protection area).
- For operation near flammable materials or components.
- For use as a safety component or for carrying out safety-relevant functions.

2 Safety Instructions

2.9 Maintenance / repair

- The control electronics are maintenance-free for the period of the planned life.
- Repairs on the product may only be made by qualified personnel or ebm-papst.

2.10 Cleaning

Damage or malfunction if the unit is cleaned by

- cleaning with a water spray or high-pressure (jet) cleaner.
- Use of acids, alkalis and solvent-based cleaning agents.
- Use of pointed and sharp-edged objects.

2.11 Transport / storage

- Transport the motor only in its original packaging.
- Secure the transport goods.
- Do not exceed the vibration values, temperature and climate ranges during the whole transport (refer to technical data from page 16).
- Store the drive system, dry and protected in its original packaging, in a clean environment.
- Do not store the drive system for longer than 1 year.
- Keep to the specified ambient temperature range (refer to technical data from page 16).

2.12 Disposal

On disposing of the product, note and follow all legal and local regulations and requirements applicable in your country.

2.13 Liability and warranty

ebm-papst GmbH & Co. KG does not accept any liability or provide any warranty whatsoever for incidents due to

- Failure to follow this operating manual.
- Incorrect handling and use of the drive system.
- Improper handling.
- Incorrect storage.
- Unsecured transport.
- Use of accessories and spare parts of other manufacturers without the express and written approval of ebm-papst GmbH & Co. KG.
- Changes to the drive system without the express and written approval of ebm-papst GmbH & Co. KG.

3 Product Description

3.1 Description VDC-3-49.15-K4

The VDC-3-49.15-K4 motor is a 3-phase EC drive with a multi-pole magnetised neodymium magnet. The electronically commuted external-rotor motor has an astonishingly high power density and a compact design. Excellent control action is achieved due to the field-orientated control with sinus commutation. The VDC-3-49.15-K4 has fully integrated control electronics with high-performance DSP and extensive interfaces. This enables particularly flexible control of the drive and the drive can therefore be adapted to different applications. The integrated temperature cut-out provides reliable protection against overload.

Rated wattages from 100 to 150 watt are available to choose from.

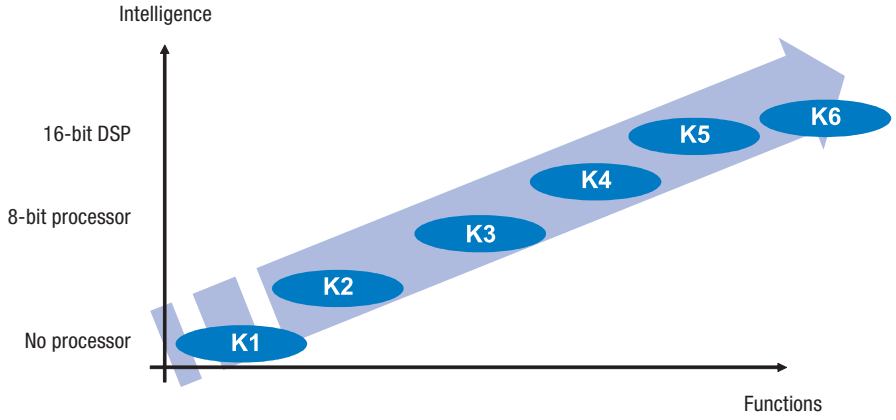
3.2 Description of the ECI-63.XX modular system K4

The ECI-63.20-K4, 63.40-K4 and 63.60-K4 motors are EC drives. The Series ECI electronically commutated internal rotor motors excel with large power density and dynamic performance. The ECI-63.XX modular system K4 has fully integrated class 4 control electronics with several analog and digital interfaces. These can be parameterised via an RS485 interface. This enables particularly flexible control of the drive and the drive can therefore be adapted to different applications.

Nominal outputs from 150 to 400 W with corresponding packet lengths from 20 to 60 mm are available to choose from.

3.3 Description of the electronic classes

ebm-papst uses the designation “K class” to describe the functional scope of an ebm-papst motor system. The higher the digit the greater the functional scope. Of the planned classes 1 – 6, to date classes K1, K4 and K5 are in use.



Overview of the electronic classes

3.3.1 Functional scope of “K classes 1, 4 and 5”

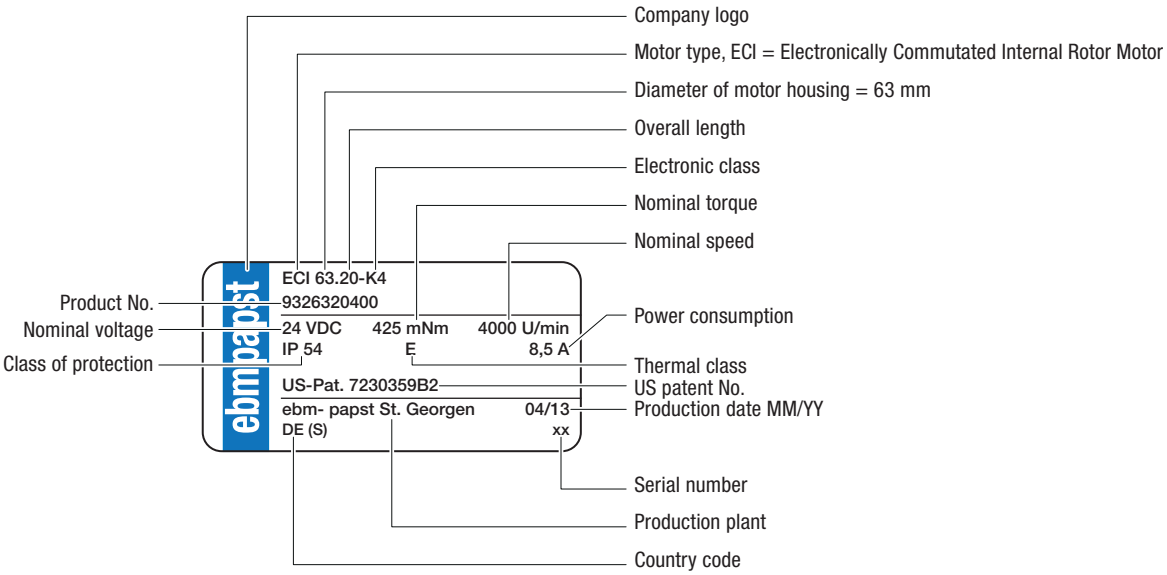
Class	Motor type	Commutation	Function
K1	Motor with rotor position encoder	external	Detection of the rotor position
K4	Motor with enhanced motor control basic features	Sinus commutation with field-orientated control up to n = 0	Speed controller Current controller Position controller
K5	Motor with enhanced motor control	Sinus commutation with field-orientated control up to n = 0	Speed controller Current controller Position controller Enhanced safety functions Bus system, e.g. CANopen, parameterisable Firmware download, etc.

3 Product Description

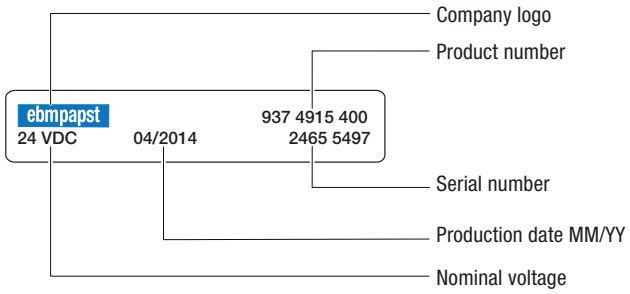
3.4 Rating plate

The rating plate with the respective features of the ECI-63.XX-K4 and VDC-3-49.15-K4 motors is attached to the housing.

3.4.1 Rating plate ECI-63.XX-K4



3.4.2 Rating plate VDC-3-49.15-K4



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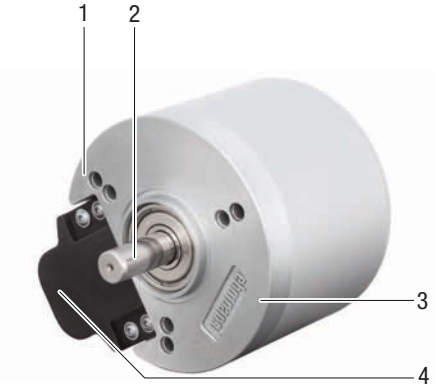
3 Product Description

3.5 Basic configuration

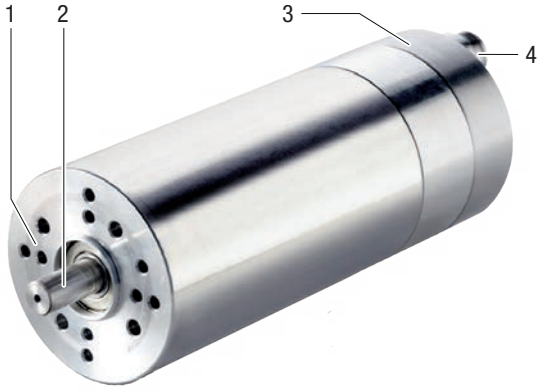
In the VDC-49.15-K4 drive system the control electronics (3) is attached on the motor output end (1). The connection cable is preinstalled in the control electronics (3) in the factory. The motor housing on the output shaft (2) is formed as a flange with various drillholes for fixing and attaching the transmission.

In the drive systems of the ECI-63.XX modular system K4 series, the motor housing and control electronics (3) are configured with same diameter. All necessary electrical connections (4) are integrated in the control electronics (3). The motor housing is formed as a flange at the output shaft (2) with various drillholes for fixing and attaching the transmission.

VDC-49.15-K4



ECI-63.XX-K4



1 Motor output side with fixing option or transmission attachment
2 Output shaft
3 Integrated power and control electronics
4 Power, signal and RS485 link

4 Technical Specifications

This chapter contains the nominal technical data of the following motors:

- ECI-63.20-K4 / ECI-63.40-K4 / ECI-63.60-K4 and
- VDC-3-49.15-K4

and extended technical data for all sizes (see page 20).

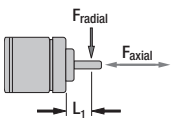
4.1 ECI-63.20-K4

Nominal data

Type	Unit	ECI-63.20-K4-B00	ECI-63.20-K4-D00
Nominal voltage (U_N)	V DC	24	48
Allowable supply voltage range (U_{ZK})	V DC	20 … 28	40 … 53
Nominal speed (n_N)	rpm	4000	4000
Nominal torque (M_N)	mNm	425	450
Nominal current (I_N)	A	8.5	5.4
Nominal output power (P_N)	W	178	188
Free-running speed (n_L) (no-load speed)	rpm	5600	6000
Free-running current (I_L) (no-load current)	A	0.50	0.30
Max. reverse voltage	V DC	35	58
Setpoint input	–	Analog / PWM / Frequency / Digital	Analog / PWM / Frequency / Digital
Recommended speed control range	rpm	0 … 5000	0 … 5000
Locked rotor protection	–	thermal	thermal
Protection on overload	–	yes	yes
Starting torque	mNm	1250	1800
Rotor moment of inertia (J_R)	$kgm^2 \times 10^{-6}$	19	19
Thermal resistance (R_{th})	K/W	3.6	3.6
Allowable ambient temperature range (T_U)	°C	0 … +40	0 … +40
Motor mass (m)	kg	0.85	0.85
Order No. (IP 40)	Stranded (litz) wire type	932 6320 403	932 6320 405
Order No. (IP 54)*	Connector type	932 6320 400	932 6320 402

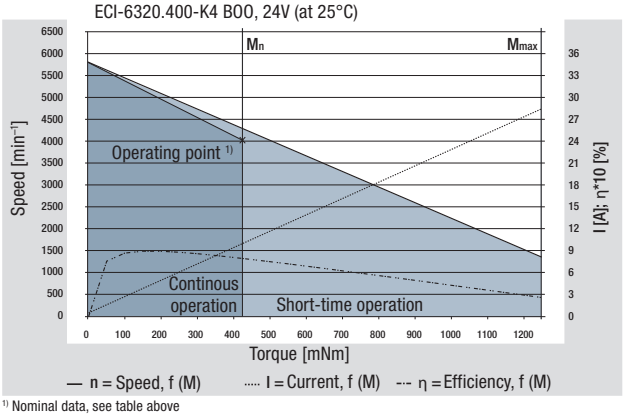
Subject to change without notice

* The degree of protection (IP 54) given refers to the connector type and the installed condition with seal on the flange side.

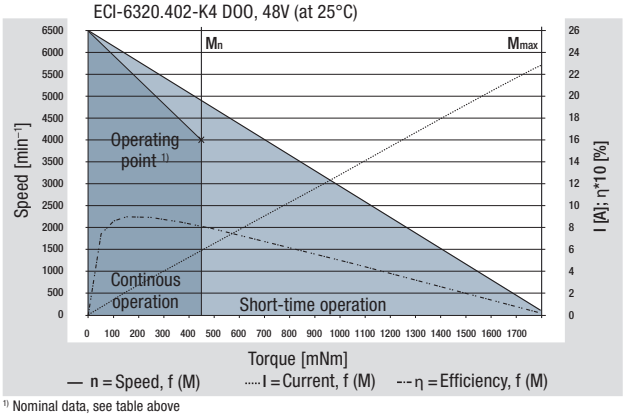


F_{axial} 150 N
F_{radial} 150 N
L_1 20 mm

Allowable shaft load at nominal speed and life expectancy L_{10} about 20000 h**



1) Nominal data, see table above



1) Nominal data, see table above

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4 Technical Specifications

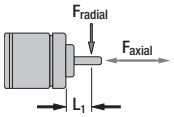
4.2 ECI-63.40-K4

Nominal data

Type	Unit	ECI-63.40-K4-B00	ECI-63.40-K4-D00
Nominal voltage (U_N)	V DC	24	48
Allowable supply voltage range (U_{ZK})	V DC	20 … 28	40 … 53
Nominal speed (n_N)	rpm	4000	4000
Nominal torque (M_N)	mNm	600	750
Nominal current (I_N)	A	12.3	7.2
Nominal output power (P_N)	W	251	314
Free-running speed (n_L) (no-load speed)	rpm	5600	5400
Free-running current (I_L) (no-load current)	A	0.90	0.46
Max. reverse voltage	V DC	35	58
Setpoint input		Analog / PWM / Frequency / Digital	Analog / PWM / Frequency / Digital
Recommended speed control range	rpm	0 … 5000	0 … 5000
Locked rotor protection	–	thermal	thermal
Protection on overload	–	yes	yes
Starting torque	mNm	1300	2700
Rotor moment of inertia (J_R)	$kgm^2 \times 10^{-6}$	38	38
Thermal resistance (R_{th})	K/W	2.9	2.9
Allowable ambient temperature range (T_U)	°C	0 … +40	0 … +40
Motor mass (m)	kg	1.15	1.15
Order No. (IP 40)	Stranded (litz) wire type	932 6340 403	932 6340 405
Order No. (IP 54)*	Connector type	932 6340 400	932 6340 402

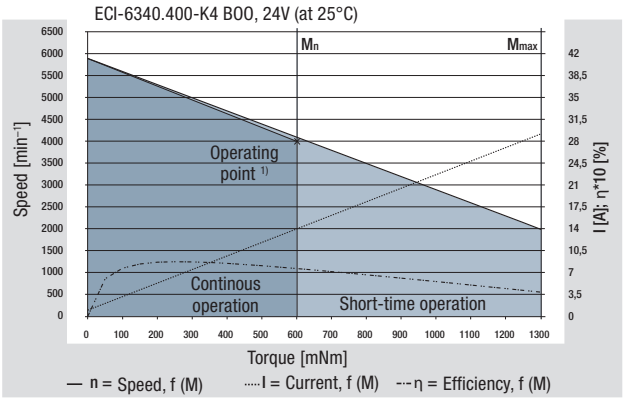
Subject to change without notice

* The degree of protection (IP 54) given refers to the connector type and the installed condition with seal on the flange side.

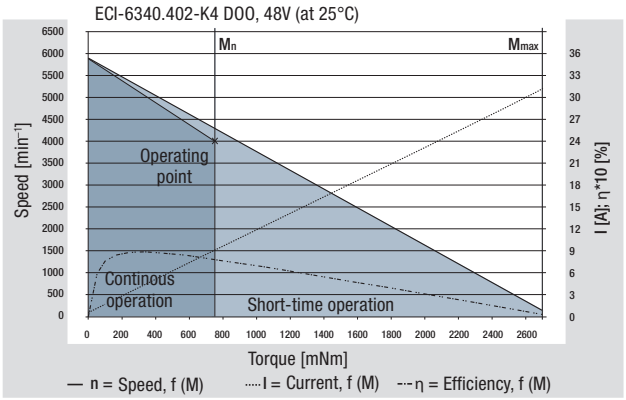


F_{axial} 150 N
F_{radial} 150 N
L_1 20 mm

Allowable shaft load at nominal speed and life expectancy L_{10} about 20000 h**



1) Nominal data, see table above



1) Nominal data, see table above

4 Technical Specifications

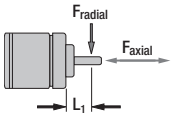
4.3 ECI-63.60-K4

Nominal data

Type	Unit	ECI-63.60-K4-D00
Nominal voltage (U_N)	V DC	48
Allowable supply voltage range (U_{ZK})	V DC	40 … 53
Nominal speed (n_N)	rpm	4000
Nominal torque (M_N)	mNm	850
Nominal current (I_N)	A	8.6
Nominal output power (P_N)	W	356
Free-running speed (n_L) (no-load speed)	rpm	5800
Free-running current (I_L) (no-load current)	A	0.60
Max. reverse voltage	V DC	58
Setpoint input		Analog / PWM / Frequency / Digital
Recommended speed control range	rpm	0 … 5000
Locked rotor protection	–	thermal
Protection on overload	–	yes
Starting torque	mNm	2600
Rotor moment of inertia (J_R)	$kgm^2 \times 10^{-6}$	57
Thermal resistance (R_{th})	K/W	2.5
Allowable ambient temperature range (T_U)	°C	0 … +40
Motor mass (m)	kg	1.5
Order No. (IP 40)	Stranded (litz) wire type	932 6360 405
Order No. (IP 54)*	Connector type	932 6360 402

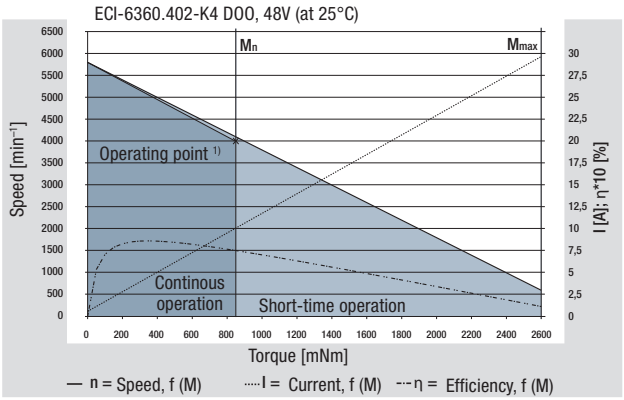
Subject to change without notice

* The degree of protection (IP 54) given refers to the connector type and the installed condition with seal on the flange side.



F_{axial} 150 N
F_{radial} 150 N L_1 20 mm

Allowable shaft load at nominal speed and life expectancy L_{10} about 20000 h**



1) Nominal data, see table above

NOTE

Extended technical data is available on request.

4 Technical Specifications

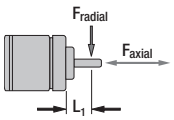
4.4 VDC-3-49.15-K4

Nenndaten

Typ	Unit	VDC-3-49.15-K4 B00	VDC-3-49.15-K4 D00
Nominal voltage (U_N)	V DC	24	48
Allowable supply voltage range (U_{ZK})	V DC	20 … 28	40 … 53
Nominal speed (n_N)	rpm	4000	4000
Nominal torque (M_N)	mNm	235	300
Nominal current (I_N)	A	5	3,2
Nominal output power (P_N)	W	100	125
Free-running speed (n_L)	rpm	5000	5000
Free-running current (I_L)	A	1.0	0.6
Max. reverse voltage	V DC	35	58
Set value input		Analog / PWM / Frequency / Digital	Analog / PWM / Frequency / Digital
Recommended speed control range	rpm	0 … 4500	0 … 4500
Function for motor protection at stall		thermal	thermal
Overload protection		yes	yes
Starting torque	mNm	850	1500
Rotor moment of inertia (J_R)	$kgm^2 \times 10^{-6}$	108	108
Ambient temperature range (T_U)	°C / °F	0 … +40 / -22 … +104	0 … +40 / -22 … +104
Motor mass (m)	kg	0.56	0.56
Order No. (IP 54)*		937 4915 400	937 4915 402

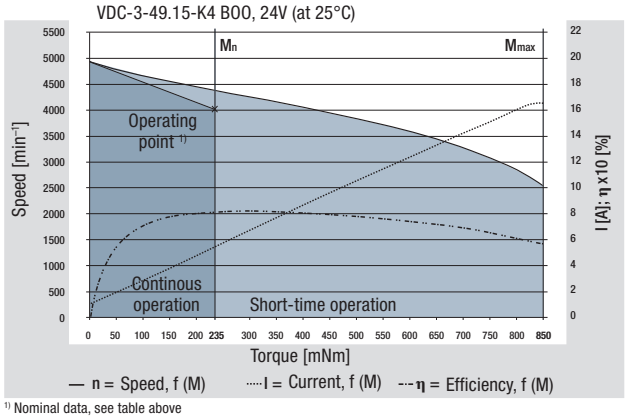
Subject to change without notice

* Classification of protection class refers to installed state with sealing on the flange side.

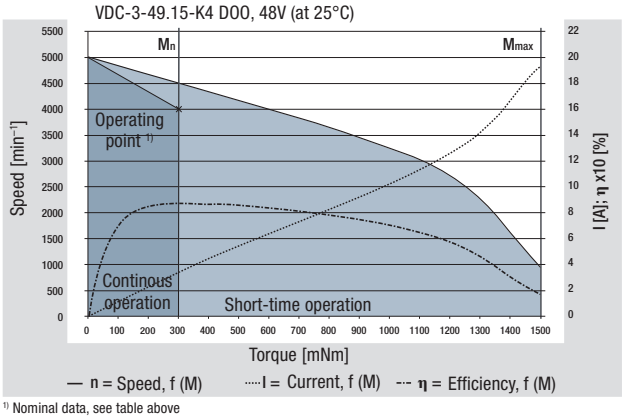


F_{axial} 20 N
F_{radial} 60 N
L_1 10 mm

Allowable shaft load at nominal speed and life expectancy L_{10} about 20000 h**



1) Nominal data, see table above



1) Nominal data, see table above

4 Technical Specifications

4.5 Electronic properties

Inputs IN A, IN B

Properties	Unit	Value / Comment
Input level	–	PLC level
Low level	V	< 5
High level	V	> 15
Protection against polarity reversal and voltages	V	≤ 30
if case of cable break	–	Logic level “0”
Input impedance	kΩ	5.4
Input frequency	kHz	≤ 10
Input dynamic (Tau)	ms	≤ 0.1
Applied logic level	–	IN A = B = 0 = output stage switched off, FK 5 IN A or B = 1 = output stage switched on

Subject to change without notice

Inputs IN 1, IN 2

Properties	Unit	Value / Comment
Input level	–	PLC level
Low level	V	< 5
High level	V	> 15
Protection against polarity reversal and voltages	V	≤ 30
if case of cable break	–	Logic level “0”
Input impedance	kΩ	5.4
Maximum input frequency for command source via PWM / frequency	kHz	15
Input dynamic (Tau)	ms	≤ 0.1

Subject to change without notice

Outputs (PNP)

Properties	Unit	Value / Comment
Output level	–	High side driver dependent on U_{Logic} (logic supply)
Low level	V	Open source
High level	V	> U_{Logic} - 2
Protection against polarity reversal and voltages	V	≤ 30
Output current / channel	mA	≤ 100
Peak output current / channel	A	approx. 600 mA (thermally dependent)
Short-circuit proof	–	yes
Polarity reversal protection	–	no
Overload protected	–	yes (automatic thermal cut-out)
Output frequency @ I_{out} = 100 mA	kHz	≤ 1

Subject to change without notice

4 Technical Specifications

Analog inputs “Analog IN 1…2” (signal connector, differential to GND_{Analog})

Properties	Unit	Value / Comment
Input voltage range (analog IN)	V	0 to 10
GND reference (differential measurement)	–	Analog GND
Input frequency	kHz	≤ 1
Internal resistance	kΩ	8
Signal resolution	bit	10
Measuring tolerance (relative to the end value 10 V)	%	≤ 2
Protection against polarity reversal and voltages	V	≤ 28

Subject to change without notice

RS485 bus interface

Properties	Unit	Value / Comment
Functional scope	–	–
Baud rate	kbit/s	115
Dielectric strength	V	-8 V to +13 V
Internal bus termination	ohm	12k

Subject to change without notice

Safety and monitoring functions

Properties	Unit	Value / Comment
Functional scope	–	• Temperature monitoring of the output stage • Under and overvoltage monitoring of the system voltages incl. U_B overcurrent limitation • Overload protection through I^2t
Temperature cut-out point output stage (PC software) (Hysteresis: 10 K), Error must be acknowledged again by means of software	°C	120
U_{ZK} overvoltage cut-out (Hardware, hysteresis: 1V)	V	63
U_{ZK} undervoltage auto restart (software, cut-off U_{Logic} at 16V), The error must be acknowledged.	V	18
Overload protection I^2t (software)	–	yes
Hardware overcurrent protection circuit as max. current per winding limitation	A	45 for VDC-3-49.15-K4 53 for ECI-63.XX-K4
Resolution of single turn absolute encoder	Bit / revolution	10 (accuracy approx. 3°)

Subject to change without notice

5 Installation

This chapter describes the mechanical and electrical connection of the drive systems.

5.1 Notes

The drives must be checked for visible damage before installation. Damaged drive system must not be installed.
The drives must be fixed onto a flat surface with at least 4 screws. The screws must be secured with suitable measures against loosening.
Use thread-forming screws to DIN 7500 for the fixing.

5.2 Installing the drive

CAUTION

Risk of damage!

When the drives are installed in the motor housing it can be damaged by high radial loads, if the tightening torque applied to the fixing screws is too high or if the fixing screws are too long.

- ► Do not load the motor shaft, either radially or axially, with more than 150 N (ECI-63.XX-K4).
- ► Do not load the motor shaft radially with more than 60 N and axially with more than 20 N (VDC-49.15-K4).
- ► Tighten fixing screws M4 with $3^{\pm 0.2}$ Nm maximum, M5 with $4^{\pm 0.2}$ Nm maximum.
- ► Do not exceed the specified maximum length of the fixing screws (see Chapter “5.2.1 Determine screw length”).

CAUTION

Risk of damage to electronic components!

The discharge of static charge during installation of the drives can damage the electronic component.

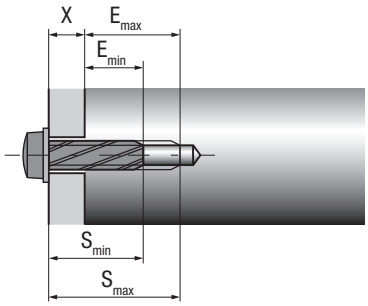
- ► Use ESD protective equipment during installation.

5.2.1 Determine screw length

A minimum screw length S_{min} is required for safe and reliable fixing of the motors.
The maximum allowable screw length S_{max} prevents damage to the motor.

Minimum screw length S_{min}=
Minimum depth of engagement E_{min} 6.5 mm + material thickness X of the mounting plate.

Maximum screw length S_{max} =
Maximum depth of engagement E_{min} 8.0 mm + material thickness X of the mounting plate.

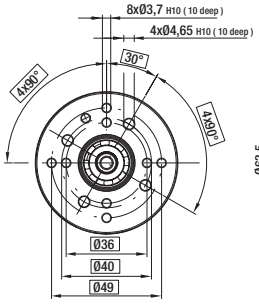


5.2.1 Technische Zeichnungen

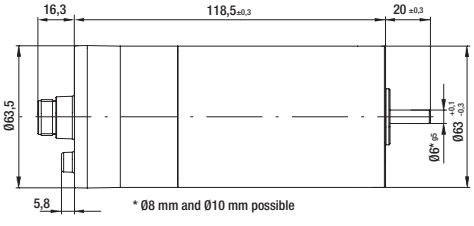
NOTE

Only use the drillholes on the output side of the motors housing to fix the drive. To this end, transfer the necessary drillholes for the pitch circle and size of the fixing holes onto the mounting plate and drill (see sketch).

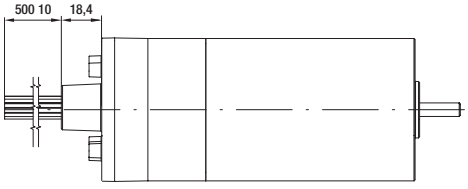
ECI-63.20-K4



Connector type (M16)

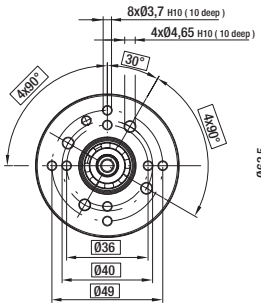


Stranded (litz) wire type
(Cable harness must be ordered separately)

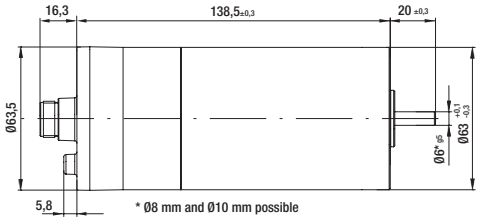


5 Installation

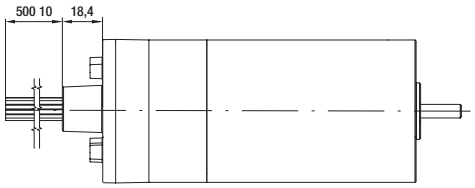
ECI-63.40-K4



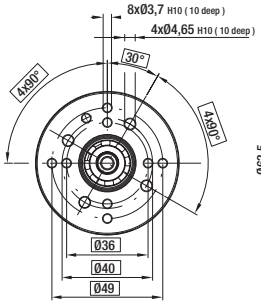
Connector type (M16)



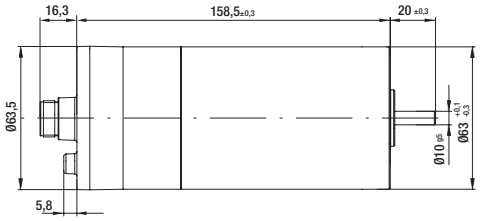
Stranded (litz) wire type
(Cable harness must be ordered separately)



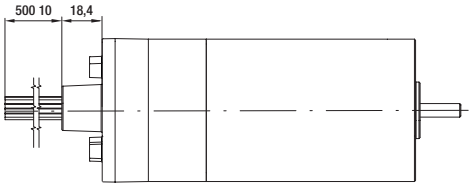
ECI-63.60-K4



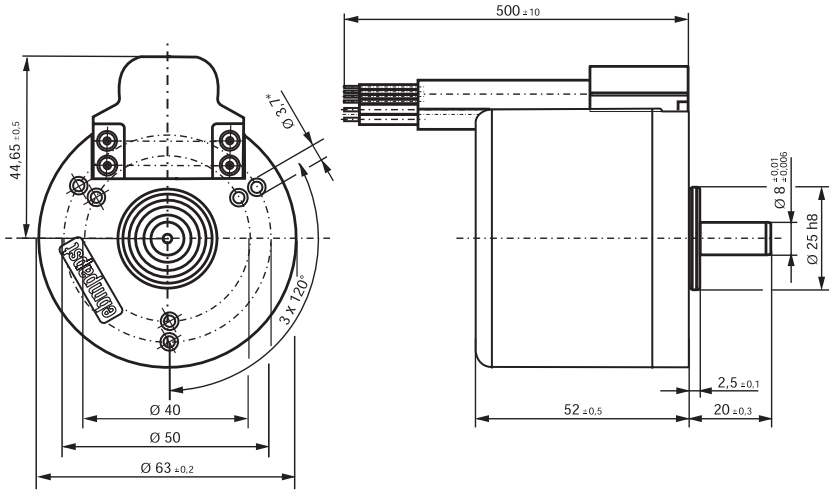
Connector type (M16)



Stranded (litz) wire type
(Cable harness must be ordered separately)



VDC-3-49.15-K4



Tapped blind holes for thread-forming screws in accordance to DIN 7500.

max. screw depth 9,5 mm

max. screw-in torque 3 Nm

Protective cap in aluminium natural.

5 Installation

5.3 Electrical connection

The connection cable for the **VDC-3-49.15-K4** drive system is attached to the motor in the factory, no additional plugs are required for the electrical connection and parameter setting.

The following is required for the electrical connection and parameter setting of the **ECI-63.XX-K4** drive system:

1 Connection cable with 15 pin connector M16 (not for the Litz wire (stranded wire) variant of the **ECI-63.XX-K4**.

1 ebm-papst USB-CAN-RS485 adapter (screw terminal adapter board to the D-SUB 9 connection, USB connection cable to the PC).

1 ebm-papst "Kickstart" PC software.

DANGER

Health hazard!

The drive systems are installed in design applications in which electrical and electromagnetic components are used. These can affect pacemakers, metallic implants or hearing aids and cause severe personal harm.

► Avoid the immediate vicinity, especially areas identified by the warning symbol , if you have a pacemaker, metal implants or wear a hearing aid.

NOTE

- The drive systems are built-in parts and do not have any electrical disconnecting switches.
- Connect the product to suitable electrical circuits only. Please note that the power supply units must have suitable protection against regenerative voltage generated on the secondary side.
- When working on the drive system the system / machine must always be disconnected from the power supply and secured against being switched back on again.

5.3.1 Safety check

Before connecting the drive system, check:

- Supply voltage and product voltage identical?
- Does the rating plate data match the connection data of the power supply unit?
- Connection cable suitable for the current intensity and the ambient conditions and area of use?

5 Installation

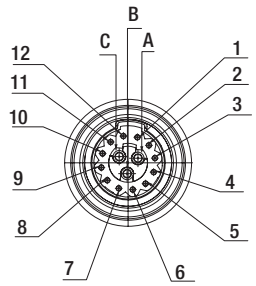
5.3.1 Pin assignment of the connector and Litz wire version

NOTE

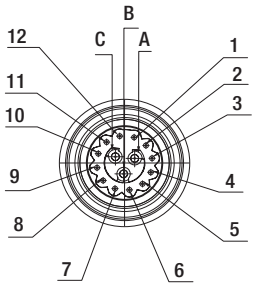
- The connection cable of the VDC-3-49.15-K4 motors is pre-installed on the motor in the factory.
- The connection cable with connector is available for the ECI-63.XX-K4 only. The ECI-63.XX-K4 motors have a 15 pin connector M16 (12+3) on the motor. This is used for the connection of a connector variant connector cable or for the separately supplied cable harness of the Litz wire variant.

A standard cable with classification CF-C11Y (3 x 1.5 mm² / 12 x 0.34 mm²) and connector M16 is required for connection of the motor. 1 m and 3 m cable lengths are available for the connection.

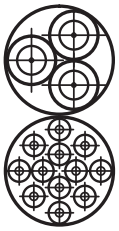
Connector interface ECI-63.XX-K4
(socket on motor)



Wire interface ECI-63.XX-K4
(socket on motor)



Cable connection VDC-3-49.15-K4
(mounted)

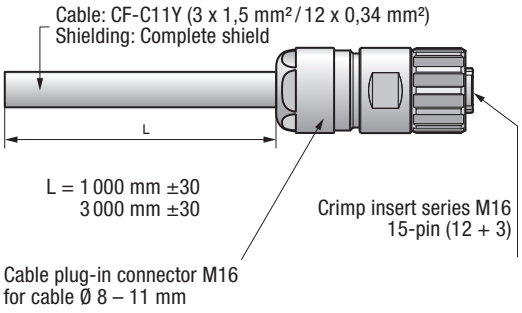


Power
AWG 16
3 x 1,5 mm²

Signal
AWG 24
12 x 0,34 mm²

	Wire	Pin	Configuration	Function	AWG
Signal	white	1	IN A	NPN 24V	24
	brown	2	IN B	NPN 24V	
	green	3	IN 1	NPN 24V	
	yellow	4	IN 2	NPN 24V / analog 0…10V / brake	
	grey	5	OUT 1	PNP 24V	
	pink	6	OUT 2	PNP 24V	
	blue	7	OUT 3*	PNP 24V	
	red	8	Analag IN 1	0…10V (differential)	
	black	9	Analag GND	GND for analog IN 1 (differential)	
	violet	10	RS485 A (+)	Progr.-Bus	
	grey-pink	11	RS485 B (–)	Progr.-Bus	
	red-blue	12	U_{Logik}	Logic power supply + (24V)	
Power	grey	A	Ballast	Ballast resistor	16
	brown	B	U_{ZK}	Power supply	
	black	C	GND	Power- / Signal GND	

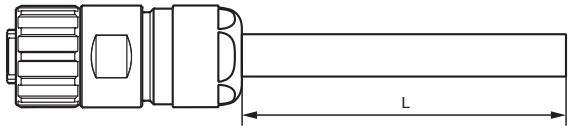
* Output (OUT 3) is only available on ECI-63.XX-K4



5.3.1 Connector type

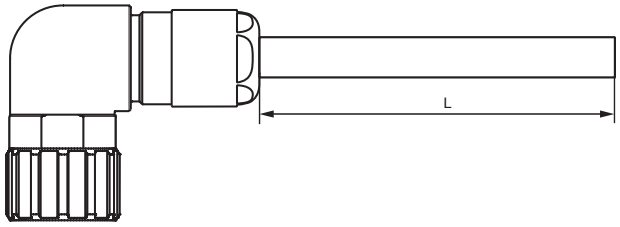
Connection type for ECI-63.XX-K4

Connector interface – straight connector



Length L	Order No.
1 000 ±30	992 0160 034
3 000 ±30	992 0160 035

Connector interface – angled connector

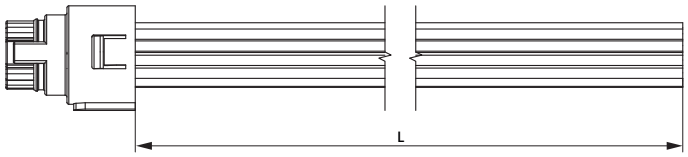


Length L	Order No.
1 000 ±30	992 0160 036
3 000 ±30	992 0160 037

NOTE

Other cable types available on request.

5.3.2 Wire interface



Power
AWG 16
3 x 1,5 mm²

Signal
AWG 24
12 x 0,34 mm²

Length L	Order No.
500 ±5	992 040 0001

NOTE

Other cable types available on request.

5 Installation

5.4 Braking chopper K4

The task of the braking chopper is to convert the energy not required in case of fast speed changes. If the set voltage threshold is exceeded the external resistor is switched on.

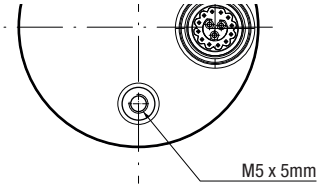
Chopper current	Recommended braking resistor
max. 10 A	24 V systems: >= 3.75 ohm
	48 V systems: >= 5.6 ohm

NOTE

Braking resistor not included in the scope of supply.
The braking resistor must be tested and designed according to the use of the drive.
(Note maximum power loss!)

5.5 Functional ground connection

A functional ground connection must be provided for equipotential bonding.



Functional ground connection on the ECI-63.XX-K4 drive

5.6 RS485 interface

The RS485 interface is used as the parameterisation and diagnostic interface. The “Kickstart” PC software can be used for operation of the interface. A PC and the ebm-papst USB-CAN-RS485 adapter are required for this.

NOTE

The “Kickstart” PC software only operates correctly with the ebm-papst USB-CAN-RS485 adapter.
If you use another USB-CAN-RS485 adapter, you will need the relevant software.

NOTE

The bus interfaces are wired by the user. Depending on the topology, the line termination (resistors) must be realised by the user.

5.7 USB-CAN-RS485 adapter

The USB-CAN-RS485 adapter is required as an accessory for the ebm-papst “Kickstart” software, in order to connect the PC with the K4 drive. The adapter can be ordered under Material No. 914 0000 400.



Functional description of the LED displays

LED name	Colour	Function assignment
Data	red	• No assignment.
	green	• Active data transfer via the USB CAN-RS485 adapter.
Error	red	• No response following request to K4. • Receipt of a faulty data package.
	green	• Received data is ok.
microSD	red	• No assignment.
	green	• Access to the memory card.

5 Installation

Pin assignment (D-SUB pin 9 pole):
Adapter electrically isolated

Pin	Connection
1	n. c.
2	optional – CAN L bus cable
3	**GND**
4	**RS485 +**
5	n. c.
6	**GND**
7	optional – CAN H bus cable
8	**RS485 –**
9	n. c.

USB device drivers of the type “FTDI USB Serial Converter” are required for operation of the USB-CAN-RS485 adapter. In many cases these are already available on the PC or can be installed using the files provided in the subdirectory of the “Kickstart PC-Software\USB-CAN-basic-driver-files”. Detailed installation instructions (in English) for the operating systems Windows 7, Windows Vista and Windows XP are provided as PDF files in the installation directory of the “Kickstart” PC software.

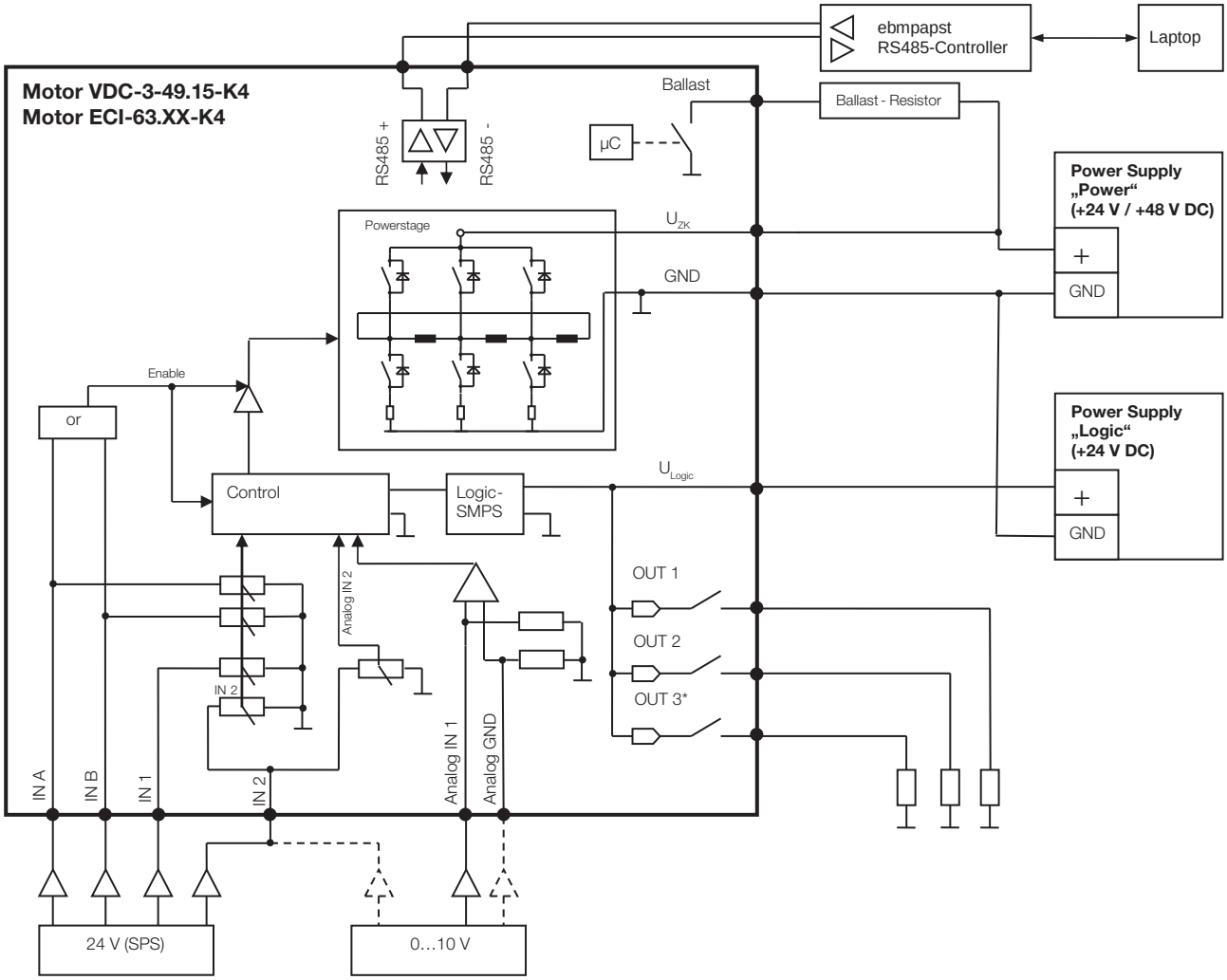
Scope of supply:

1 USB-CAN-RS485 adapter (incl. microSD memory card)
1 Screw terminal adapter board to the D-SUB 9 connection
1 USB connection cable to the PC.

5.8 Connection to the USB-CAN-RS485 adapter

- Connect the cable at Pin 10 (violet) with connection 4 (RS485 +) of the USB-CAN-RS485 adapter.
- Connect the cable at Pin 11 (grey/pink) with connection 8 (RS485 –) of the USB-CAN-RS485 adapter.
- Switch on the “Logic” voltage at the power supply unit.
- Start the “Kickstart” tool at the PC for parameterisation.
- Load an existing project (*.kickzip or *.kicktpl) or create a new project: *.kickpro.

5.9 Circuit diagram



* The OUT 3 connection is only available for the ECI-63.XX-K4 drive systems.

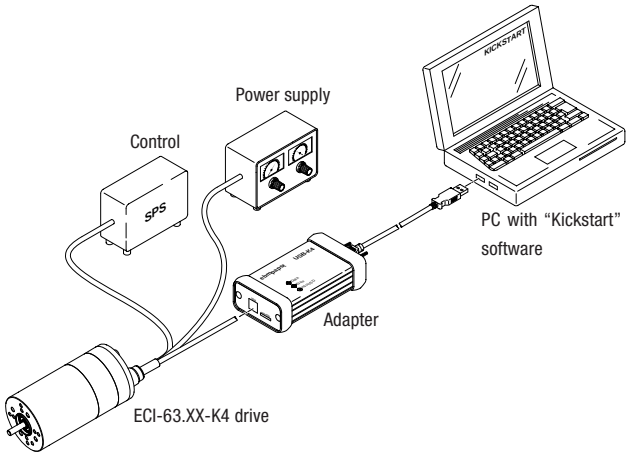
NOTE

The user is responsible for external fusing of the power supply.

5 Installation

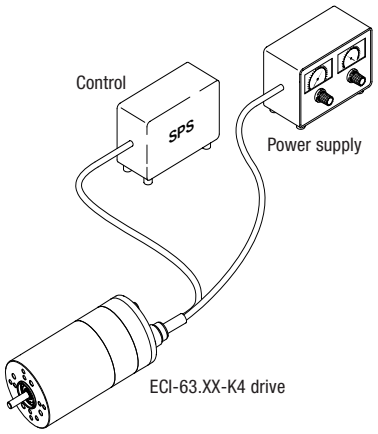
5.10 Schematic layout: parameterisation, commissioning (startup) and automatic operation

5.10.1 Parameterisation and commissioning



5.10.2 Automatic operation

Automatic operation with stored parameters and integrated control



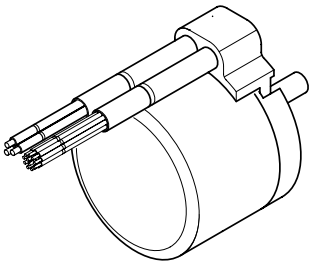
5.10.3 Connecting connector at the motor

CAUTION

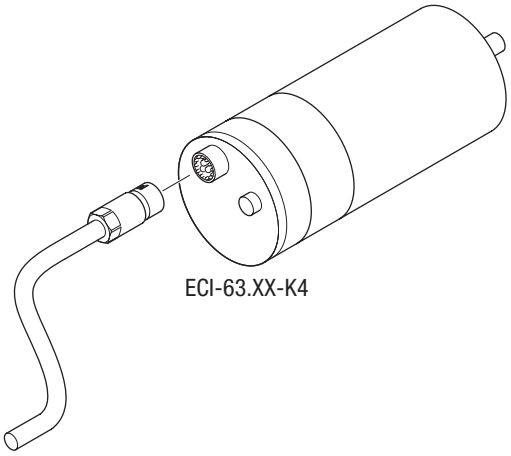
Risk of damage.

When plugging in the connector to the connection on the motor **ECI-63.XX-K4**, ensure that the company logo on the connector is facing upwards towards the housing edge of the motor.

When connecting the Litz wires of the **VDC-3-49.15-K4** motor variant, ensure that the pin assignment is precisely as specified and not incorrectly assigned, as this causes irreparable damage to the motor electronics.



VDC-3-49.15-K4



ECI-63.XX-K4

ebmpapst

6 Parameterisation

82 parameters are available for parameterising the VDC-3-49.15-K4 and ECI-63.XX-K4 drive systems (from page 33). These are managed via the electronic class K4 and are set using the ebm-papst “Kickstart” PC software.
A detailed parameter description see Chapter “10 Parameter Description”, page 95.

6.1 Memory management

The K4 has a management function for the “RAM”, “custom” and “default” memory areas.
To edit the values you will need the password “custom access key”. This is set to 0 on delivery. If you change it, please ensure that it is not lost.

6.1.1 “RAM” memory area

The motor operates with the values in the RAM area.
The memory class “appl func” can be changed (written) if the motor is at a standstill (IN A and IN B input to LOW). If the inputs are not set to zero you will receive an error message in the status display.

The memory class “appl value” can be changed (written) while the motor is in operation and therefore directly affects the motor's performance.

All values can be read out during operation or while the motor is at a standstill.

Parameters that are written in the “RAM” memory area with the “write” command are no longer available if the power supply fails or is switched off.

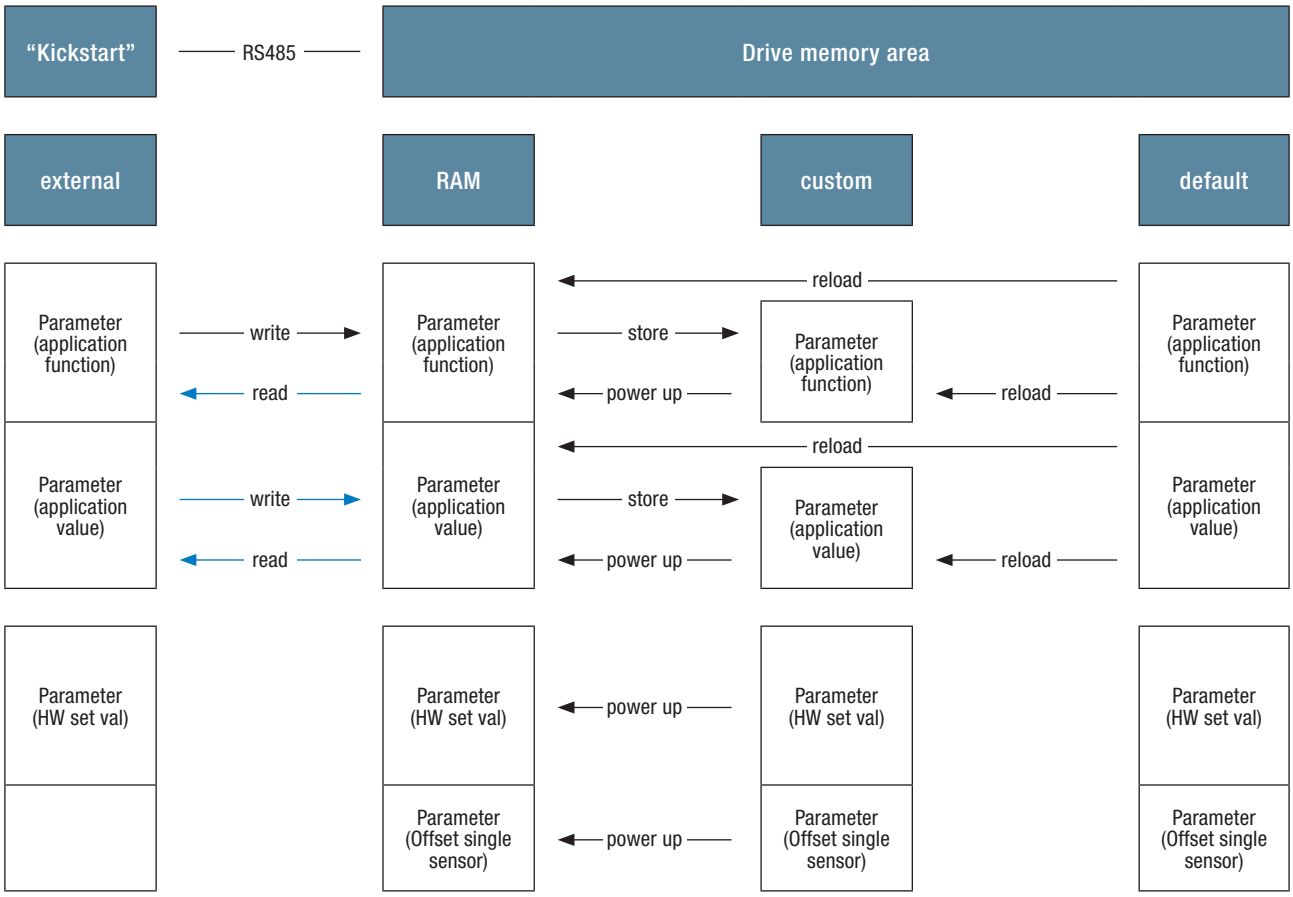
6.1.2 “custom” memory area

To ensure that the data is available permanently, it must be located in the “custom” memory area. The data from the “RAM” area is not written in the “custom” area unless the “store” command is used; after it has been moved the data is then permanently available. On switching on the voltage, the data from the “custom” area is transferred into the “RAM” area.

6.1.3 “default” memory area

The default values loaded in the factory are stored in the “default” memory area. The operating data can be reset to the as-delivered condition by using the “reload” command. The data is written in the “custom” and “RAM” areas.

Access to parameterisation with “customer access key”(password).



Blue arrow = Command is executed in the operational status (clockwise, counterclockwise, braking / positioning)
Black arrow = Command is executed in the state unlock (motor in freewheel)

NOTE

With the command „Save“, the „user access key“ is reseted.

The “store” command is used to reset the “customer access key”.

ebmpapst

6 Parameterisation

6.2 Parameter

The following parameters are available in the K4:

For a detailed parameter description, see Chapter “10 Parameter Description”, page 95.

NOTE

- The data in the “No. [dec]” column is relevant for the parameter descriptions, refer to Chapter “10 Parameter Description”, from page 95.
- The data in the “No. [hex]” column is relevant for the “Kickstart” PC software.
- The data in column No. [hex] is the address of the parameter.
- The guide values for the parameters represent the so-called default parameters in the respective drive system.

Parameter Overview

Parameter No. [hex]	Parameter Name	Units	min.	max.	Memory class
0x1	Mode 1		1	9	appl func
0x2	Mode 2		1	8	appl func
0x3	O1		0	7	appl func
0x4	O2		0	7	appl func
0x5	O3		0	7	appl func
0x6	Restart		0	1	appl func
0x7	intentionally left blank		0	65535	
0x8	intentionally left blank		0	65535	
0x9	intentionally left blank		0	65535	
0xA	intentionally left blank		0	65535	
0xB	FE_Speed_X1	Digits	0	1023	appl func
0xC	FE_Speed_X2	Digits	0	1023	appl func
0xD	FE_Speed_X3	Digits	0	1023	appl func
0xE	FE_Speed_X4	rpm	–30000	29999	appl func
0xF	FE_Speed_Y1	rpm	–30000	29999	appl func
0x10	FE_Speed_Y2	rpm	–30000	29999	appl func
0x11	FE_Speed_Y3	rpm	–30000	29999	appl func
0x12	FE_Speed_Y4	rpm	–30000	29999	appl func
0x13	Speed_X1_Hyst	Digits	0	1023	appl func
0x14	Speed_X2_Hyst	Digits	0	1023	appl func
0x15	Speed_X3_Hyst	Digits	0	1023	appl func
0x16	Speed error	rpm	–30000	29999	appl func
0x17	Fixed speed N1	rpm	–30000	29999	appl value
0x18	Fixed speed N2	rpm	–30000	29999	appl value
0x19	Fixed speed N3	rpm	–30000	29999	appl value
0x1A	t ramp-up cw	ms für 1000 rpm	0	65535	appl value
0x1B	t ramp-down cw	ms für 1000 rpm	0	65535	appl value
0x1C	t ramp-up ccw	ms für 1000 rpm	0	65535	appl value
0x1D	t ram-down ccw	ms für 1000 rpm	0	65535	appl value
0x1E	Speed controller KP		0	65535	appl value
0x1F	Speed controller KI		0	65535	appl value

6 Parameterisation

Parameter Overview

Parameter No. [hex]	Parameter Name	Units	min.	max.	Memory class
0x20	Speed controller KD (currently unused)		0	65535	appl value
0x21	K_ff	1/255	0	65535	appl func
0x22	Actual speed averaging	2^x [ms]	0	15	appl value
0x23	Resolution of the actual outputs	Pulse/mech.revolution	0	100	appl value
0x24	Speed signal threshold	rpm	0	29999	appl value
0x25	Speed signal delta hysteresis		0	29999	appl value
0x26	FE_Current_X1	Digits	0	1023	appl func
0x27	FE_Current_X2	Digits	0	1023	appl func
0x28	FE_Current_X3	Digits	0	1023	appl func
0x29	FE_Current_Y0	%	0	100	appl func
0x2A	FE_Current_Y1	%	0	100	appl func
0x2B	FE_Current_Y2	%	0	100	appl func
0x2C	FE_Current_Y3	%	0	100	appl func
0x2D	FE_Current_Y4	%	0	100	appl func
0x2E	Current_X1_Hyst	Digits	0	1023	appl func
0x2F	Current_X2_Hyst	Digits	0	1023	appl func
0x30	Current_X3_Hyst	Digits	0	1023	appl func
0x31	Current error	%	0	100	appl func
0x32	Current signal threshold	10 mA	0	32767	appl value
0x33	Current signal delta hysteresis	10 mA	0	65535	appl value
0x34	Current time constant	ms	1	5000	appl value
0x35	Current gating time	ms	0	5000	appl value
0x36	Reversing threshold		0	29999	appl value
0x37	Reversing threshold delta hysteresis	rpm	0	29999	appl value
0x38	I_Max_driving_Rechts	10 mA	0	65535	appl value
0x39	I_Max_driving_Links	10 mA	0	65535	appl value
0x3A	I_Max_braking_Rechts	10 mA	0	65535	appl value
0x3B	I_Max_braking_Links	10 mA	0	65535	appl value
0x3C	Hold gain KP_H	1/256	0	65535	appl value
0x3D	PWM/Freq: Lower frequency limit	Hz	25	15000	appl func
0x3E	PWM/Freq: Upper frequency limit	Hz	25	15000	appl func
0x3F	Max. positioning speed	rpm	0	29999	appl value
0x40	Coasting, cw	1/65535 revolutions	0	65535	appl value
0x41	Coasting, cw	revolutions	–32768	32767	appl value
0x42	Coasting ccw	1/65535 revolutions	0	65535	appl value
0x43	Coasting ccw	revolutions	0–32768	32767	appl value
0x44	Distance	1/65535 revolutions	0	65535	appl value
0x45	Distance	revolutions	–32768	32767	appl value

6 Parameterisation

Parameter Overview

Parameter No. [hex]	Parameter Name	Units	min.	max.	Memory class
0x46	Positive positioning window*	1/65535 revolutions	0	65535	appl value
0x47	Positive positioning window*	revolutions	0	65535	appl value
0x48	Negative positioning window*	1/65535 revolutions	0	65535	appl value
0x49	Negative positioning window*	revolutions	0	65535	appl value
0x4A	U_{ZK} overvoltage threshold	10 mV	0	65535	appl value
0x4B	U_{ZK} undervoltage threshold	10 mV	0	65535	appl value
0x4C	U_{ZK} voltage hysteresis	10 mV	0	65535	appl value
0x4D	Ballast chopper switching on threshold	10 mV	0	65535	appl value
0x4E	Ballast chopper– switching off threshold	10 mV	0	65535	appl value
0x4F	Temperature signal threshold	°C	0	110	appl value
0x50	Temperature signal delta hysteresis	°C	0	110	appl value
0x51	Transmission ratio		1	65535	appl value
0x52	Bus address		1	127	appl value
0x8001	Current actual speed	rpm			appl value
0x8002	current electrical current, winding	10 mA			appl value
0x8003	current actual position LoByte	1/65535 revolutions			appl value
0x8004	current actual position HiByte	revolutions			appl value
0x8005	current actual temperature LP	°C			appl value
0x8006	current electrical current I_d	10 mA			appl value
0x8007	current electrical current I_q	10 mA			appl value
0x8008	Output status	digital			appl value
0x8009	Status of inputs: IN A, IN B, IN 1, IN	digital			appl value
0x800A	not used				
0x800B	not used				
0x800C	not used				
0x800D	Analog IN 1	digits			appl value
0x800E	Analog IN 2	digits			appl value
0x800F	Analog internal NTC	digits			appl value

* Parameter 46 + 47 (positive) = 1000
Parameter 48 + 49 (negativ) = 500
Target position = 50000
Here "Position reached" = ACTIVE should be set, if
Actual position > 49500 and actual position < 51000

7 Parameterisation of the Operating Modes

The parameterisation of the operating modes is described in this chapter. 38 operating modes are available to choose from for the electronic class K4. The operating modes are selected using parameters Mode 1 and Mode 2. The descriptions are laid out as follows:

7.1 Application example

Task: The motor should reach a fixed speed via a defined acceleration / braking ramp. If the speed has been reached a corresponding display should appear.

Setpoint values: Target speed n = 3500 rpm, acceleration time = 730 ms.

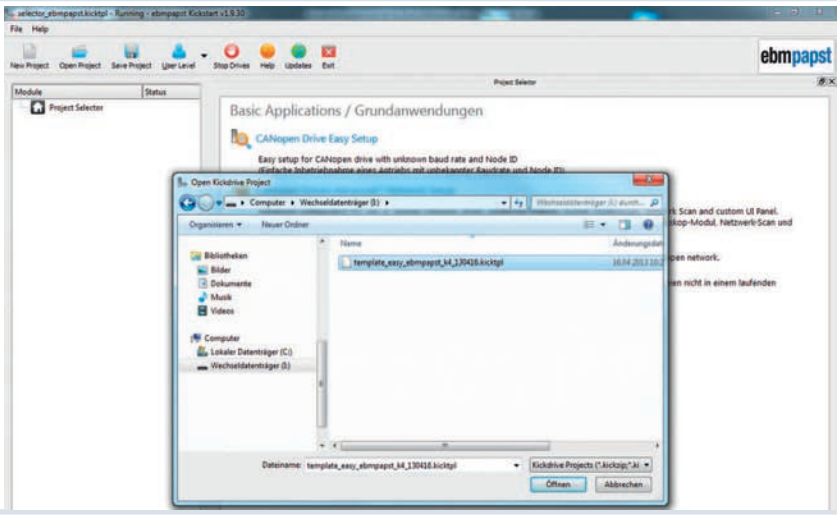
Basic conditions:

After switching off: Brake motor / transition in free-wheeling? The motor should switch to free-wheeling.
Acceleration direction of rotation? Direction of rotation cw
Signal from a higher-level control? Yes. = 1 output (On / Off), 1 input (target speed reached signal).

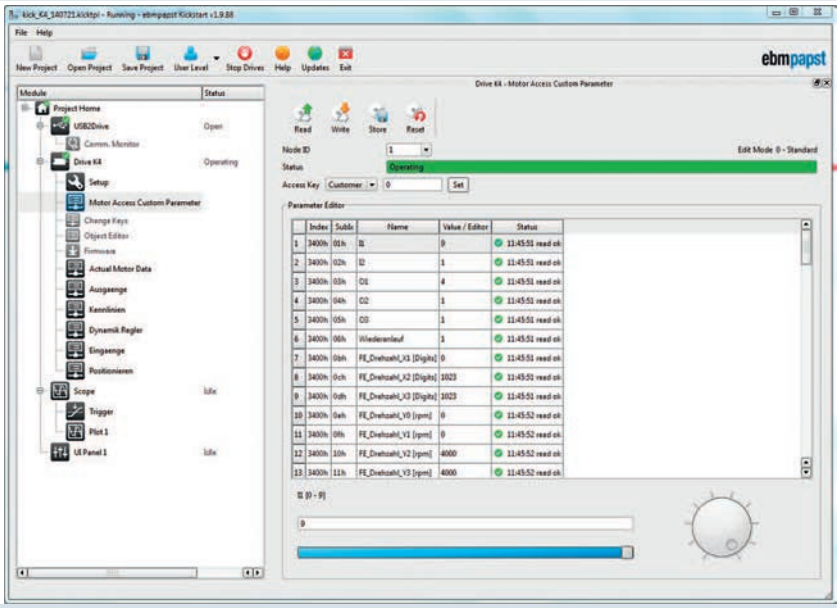
Procedure:

Connect the electrical system (see Chapter 5.2 Installing the drive, page 22).
Start the “Kickstart” PC software at the PC.

1 Open project file
(File type .kicktpl / .kickzip)



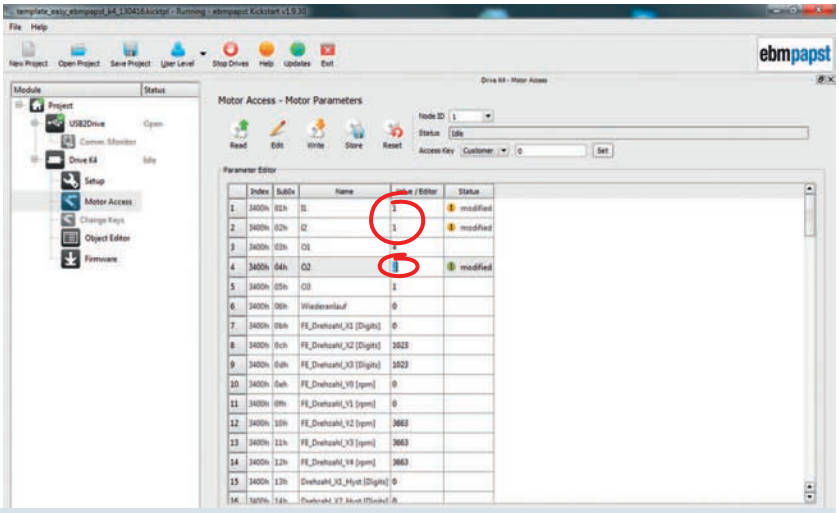
2 Enter user password
(Access Key “Customer” = “0”)
and confirm with “Set”.



7 Parameterisation of the Operating Modes

3

- Operating mode selection:
  Parameter 01h = 1, Parameter 02h = 1
- Speed signal 02 (OUT 2):
  Parameter 04h = 2



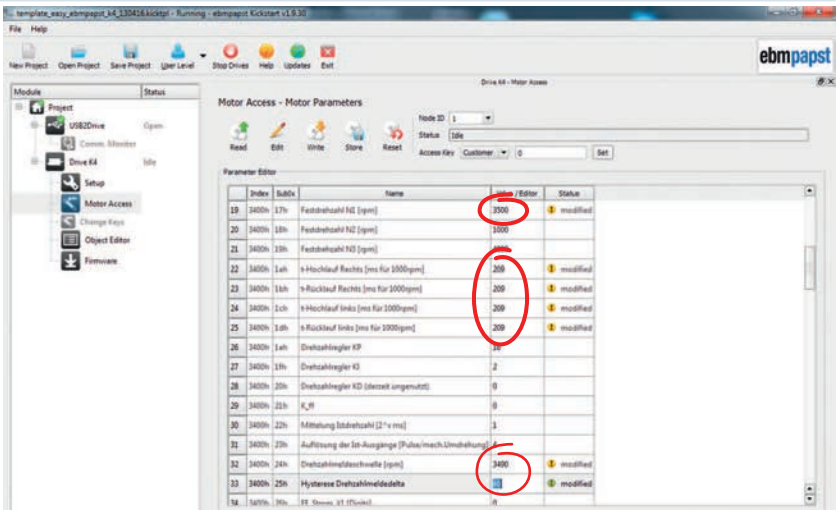
4

- Fixed speed parameterisation:
  Parameter 17h = 3500
- Parameterisation of acceleration / braking (deceleration) ramp:
  Parameter 1ah, 1bh, 1ch, 1dh = 209 *
- Set speed signalling threshold: Parameter 24h = 3490
- Set signalling threshold hysteresis:
  Parameter 25h = 40

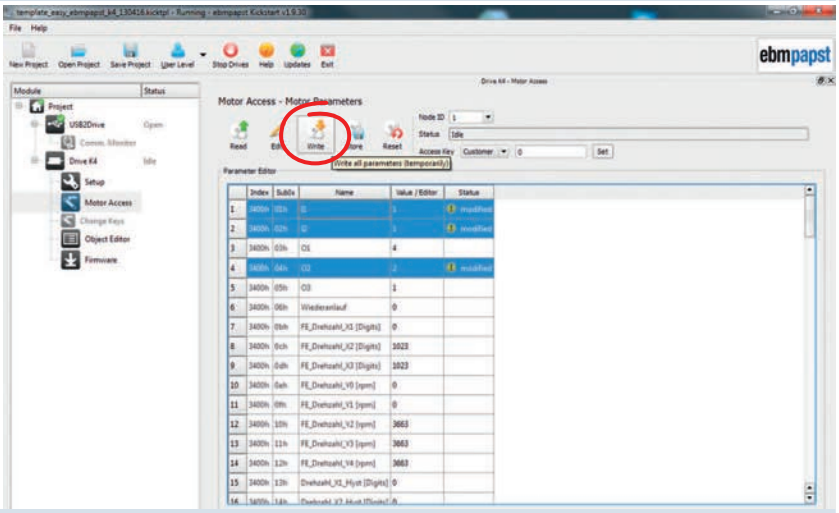
* Determination of the acceleration value in ms for 1000 rpm

Speed input: 3500 rpm, acceleration time: 730 ms

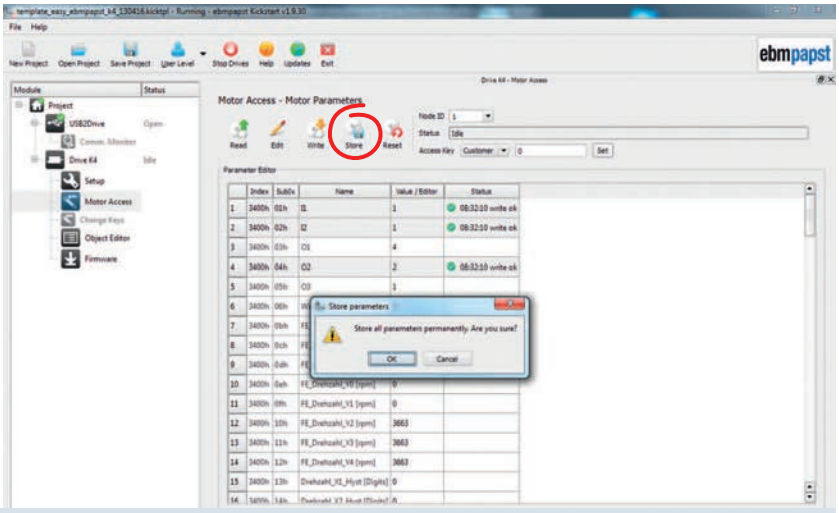
Acceleration value = acceleration time / speed difference x 1000
730 / 3500 x 1000 = 208.57 ~ **209**



5 Write parameters: Mark (select) the set parameters and write in the RAM memory area with the “Write” command.



6 Save parameters: Save the parameters written with the “store” command in the “custom” memory area.



Commissioning (startup)

The following connections must be set up for the commissioning:

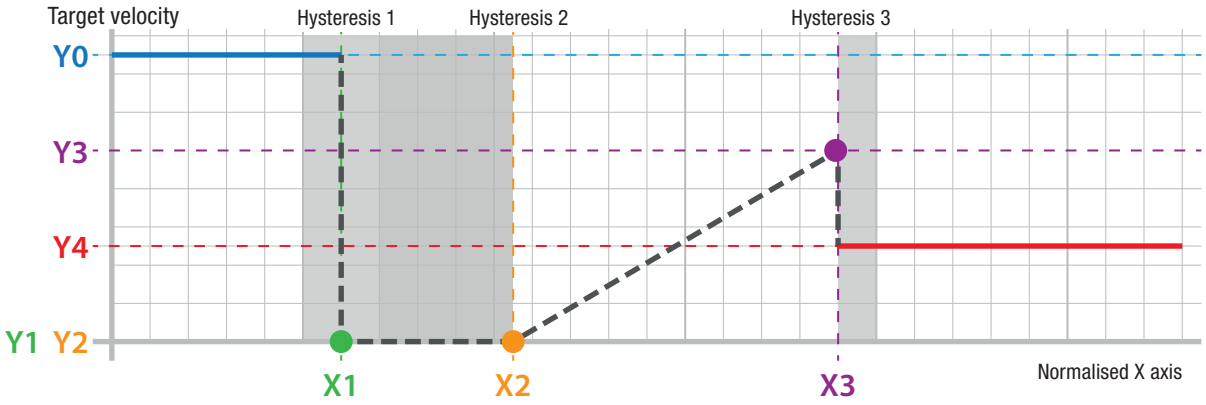
U_{ZK} = supply voltage	IN A= On / Off (see IN A / B logic table, see Chapter 8 Inputs and Outputs, page 78) here: Switch from free-wheeling to rotational direction cw (speed control)
GND = ground / earth	IN 1 = +24V (see logic table - fixed speeds) here: Selection of N1
U_{Logic} = supply voltage +24V	

7.2 Parameterisation of the speed regulation characteristic

The speed regulation characteristic can be defined via three interpolation points. A hysteresis can be set for each interpolation point. In addition, an error speed can be parameterised, which is used if an invalid X axis value results.

The speed regulation characteristic is defined using the following parameters:		
P11 – FE_Speed_X1	P15 – FE_Speed_Y1	P19 – Speed_X1_Hyst
P12 – FE_Speed_X2	P16 – FE_Speed_Y2	P20 – Speed_X2_Hyst
P13 – FE_Speed_X3	P17 – FE_Speed_Y3	P21 – Speed_X3_Hyst
P14 – FE_Speed_Y0	P18 – FE_Speed_Y4	P22 – Error_Speed

The characteristic curve can then take on this shape:



The speed values Y0…Y4 are given in rpm.

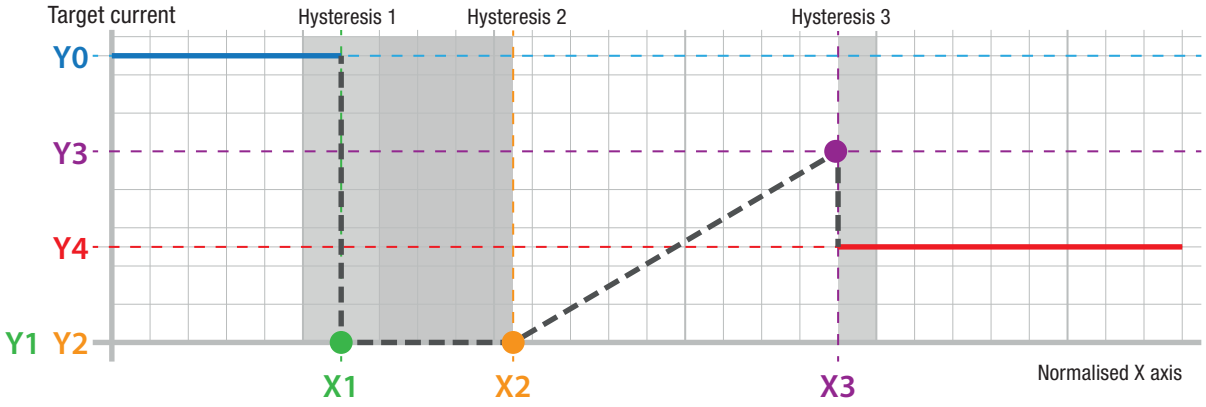
X values: Target value analog IN A1: 0 – 10 V corresponds 0 – 1023.
Target value PWM IN 1: 0 – 100 % corresponds X value 0 – 100.
Target value frequency IN 1: lower cut-off frequency (Parameter 0x3D) corresponds X value 0.
Target value frequency IN 1: upper cut-off frequency (Paramete r 0x3E) corresponds X value 1023.

7.3 Parameterisation of the maximum current characteristic

The maximum current characteristic can be defined via three interpolation points. A hysteresis can be set for each interpolation point. In addition, an error current can be parameterised, which is used if an invalid X axis value results.

The maximum current characteristic is defined using the following parameters:		
P11 – FE_Current_X1	P15 – FE_Current_Y1	P19 – Current_X1_Hyst
P12 – FE_Current_X2	P16 – FE_Current_Y2	P20 – Current_X2_Hyst
P13 – FE_Current_X3	P17 – FE_Current_Y3	P21 – Current_X3_Hyst
P14 – FE_Current_Y0	P18 – FE_Current_Y4	P22 – Error_Current

The characteristic curve can then take on this shape:



7 Parameterisation of the Operating Modes

NOTE

The current limitation is defined via parameters 0x38 - 0x3B. The values of the parameters 0x38 - 0x3B must be the same if the maximum current characteristic is used. If the operational quadrants are changed there are no jumps in the current limitation.

The speed values Y0…Y4 are given in %.

X values: Target value analog IN A1: 0 – 10 V corresponds 0 – 1023.
Target value PWM IN 1: 0 – 100 % corresponds X value 0 – 100.
Target value frequency IN 1: lower cut-off frequency (Parameter 0x3D) corresponds X value 0.
Target value frequency IN 1: upper cut-off frequency (Paramete r 0x3E) corresponds X value 1023.

These are defined via:

P 38 – I_Max_driving_rh

P 39 – I_Max_driving_lh

P 3A – I_Max_braking_rh

P 3B – I_Max_braking_lh

7.4 Operating mode 11: Speed setpoint N1, N2, N3; Analog IN 1

The following example is used to describe operating mode 11 in greater detail.

NOTE

In order for the parameter to function, KP_H must be > 0.

Parameter No.1 (Mode 1) has value = 1
Parameter No.2 (Mode 2) has value = 1

With input circuit IN A = 0 and IN B = 0 the motor is in free-wheeling (free running) state and the inputs IN 1 and IN 2 have no effect.

With input circuit IN A = 1 and IN B = 0 the motor rotates in a positive (clockwise - cw) direction. If the inputs are IN 1 = 0 and IN 2 = 0, the analog value of analog IN 1 is used and the speed depends on this value.

With input circuit IN A = 1 and IN B = 0 the motor rotates in a positive (clockwise - cw) direction. If the inputs are IN 1 = 1 and IN 2 = 0, the speed is controlled to the value that given in N1.

Function IN 1: Selection of the speed setpoint source analog / parameter.
Function IN 2: Selection of the speed setpoint source analog / parameter.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	A1	S	P	N control	
1	0	1	0	pos	N1	S	P	N control	
1	0	0	1	pos	N2	S	P	N control	
1	0	1	1	pos	N3	S	P	N control	
0	1	0	0	neg	A1	S	P	N control	
0	1	1	0	neg	N1	S	P	N control	
0	1	0	1	neg	N2	S	P	N control	
0	1	1	1	neg	N3	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Braking and stopping
1	1	1	0	-	0	S	P	Stop	Braking and stopping
1	1	0	1	-	0	S	P	Stop	Braking and stopping
1	1	1	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.5 Operating mode 12: Speed setpoints N1, A1; dynamic current limitation via A1

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of the speed setpoint source analog A1 / parameter N1.
Function IN 2: selection of static / dynamic current limitation.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	D	A1	F	A1	N control	
1	0	1	0	pos	P	N1	F	A1	N control	
1	0	0	1	pos	F	A1	D	A1	N control	
1	0	1	1	pos	P	N1	D	A1	N control	
0	1	0	0	neg	D	A1	F	A1	N control	
0	1	1	0	neg	P	N1	F	A1	N control	
0	1	0	1	neg	F	A1	D	A1	N control	
0	1	1	1	neg	P	N1	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Braking and stopping
1	1	1	0	-		0	F	A1	Stop	Braking and stopping
1	1	0	1	-		0	D	A1	Stop	Braking and stopping
1	1	1	1	-		0	D	A1	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B
Initialisation speed setpoint = 0

S = Static
P = Parameter
F = Freeze; on level changeover to IN 2 the current level is frozen (Saved) at A1)
D = Dynamic
x = Arbitrary value

7.6 Operating mode 13: Speed setpoints A1, N1; distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of the speed setpoint source analog A1 / parameter N1.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	x	pos	A1	S	P	N control	
1	0	1	x	pos	N1	S	P	N control	
1	0	0	x	pos	A1	S	P	N control	
1	0	1	x	pos	N1	S	P	N control	
0	1	0	x	neg	A1	S	P	N control	
0	1	1	x	neg	N1	S	P	N control	
0	1	0	x	neg	A1	S	P	N control	
0	1	1	x	neg	N1	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	1	0	-	0	S	P	Stop	Stopping
1	1	0	0 -> 1	-	A1	S	P	Distance	Positioning
1	1	1	0 -> 1	-	N1	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus / minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.7 Operating mode 16: Speed setpoints A1, N1; rotational direction

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of the speed setpoint source analog A1 / parameter N1.

Function IN 2: Selecting the rotational direction.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	A1	S	P	N control	
1	0	1	0	pos	N1	S	P	N control	
1	0	0	1	neg	A1	S	P	N control	
1	0	1	1	neg	N1	S	P	N control	
0	1	0	0	neg	A1	S	P	N control	
0	1	1	0	neg	N1	S	P	N control	
0	1	0	1	pos	A1	S	P	N control	
0	1	1	1	pos	N1	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Braking and stopping
1	1	1	0	-	0	S	P	Stop	Braking and stopping
1	1	0	1	-	0	S	P	Stop	Braking and stopping
1	1	1	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

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7.8 Operating mode 17: Speed setpoints A1, N1; dynamic current limit via A2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of the speed setpoint source analog A1 / parameter N1.

Function IN 2: Analog A2 dynamic current limitation.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	A2	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	A2	pos	A1	D	A2	N control	
1	0	1	A2	pos	N1	D	A2	N control	
1	0	0	A2	pos	A1	D	A2	N control	
1	0	1	A2	pos	N1	D	A2	N control	
0	1	0	A2	neg	A1	D	A2	N control	
0	1	1	A2	neg	N1	D	A2	N control	
0	1	0	A2	neg	A1	D	A2	N control	
0	1	1	A2	neg	N1	D	A2	N control	
1	1	0	A2	-	0	D	A2	Stop	Braking and stopping
1	1	1	A2	-	0	D	A2	Stop	Braking and stopping
1	1	0	A2	-	0	D	A2	Stop	Braking and stopping
1	1	1	A2	-	0	D	A2	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.9 Operating mode 18: Speed setpoints A1, N1; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of the speed setpoint source analog A1 / parameter N1.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	0	0	-	0	S	P	Free-wheeling	
1	0	1	0	-	0	S	P	Free-wheeling	
1	0	0	1	pos	A1	S	P	N control	
1	0	1	1	pos	N1	S	P	N control	
0	1	0	0	-	0	S	P	Free-wheeling	
0	1	1	0	-	0	S	P	Free-wheeling	
0	1	0	1	neg	A1	S	P	N control	
0	1	1	1	neg	N1	S	P	N control	
1	1	0	0	-	0	S	P	Free-wheeling	
1	1	1	0	-	0	S	P	Free-wheeling	
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	1	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.10 Operating mode 21: dynamic current limit via A1; speed setpoints A1, N2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of static / dynamic current limitation.

Function IN 2: Selection of the speed setpoint source analog A1 / parameter N2.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	D	A1	F	A1	N control	
1	0	1	0	pos	F	A1	D	A1	N control	
1	0	0	1	pos	P	N2	F	A1	N control	
1	0	1	1	pos	P	N2	D	A1	N control	
0	1	0	0	neg	D	A1	F	A1	N control	
0	1	1	0	neg	F	A1	D	A1	N control	
0	1	0	1	neg	P	N2	F	A1	N control	
0	1	1	1	neg	P	N2	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Braking and stopping
1	1	1	0	-		0	D	A1	Stop	Braking and stopping
1	1	0	1	-		0	F	A1	Stop	Braking and stopping
1	1	1	1	-		0	D	A1	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, Ih.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 1 the current level is frozen (saved) at A1.

D = Dynamic

x = Arbitrary value

7.11 Operating mode 23: dynamic current limit via A1; distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of static / dynamic current limitation.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	0	x	pos	D	A1	F	A1	N control	
1	0	1	x	pos	F	A1	D	A1	N control	
1	0	0	x	pos	D	A1	F	A1	N control	
1	0	1	x	pos	F	A1	D	A1	N control	
0	1	0	x	neg	D	A1	F	A1	N control	
0	1	1	x	neg	F	A1	D	A1	N control	
0	1	0	x	neg	D	A1	F	A1	N control	
0	1	1	x	neg	F	A1	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Stopping
1	1	1	0	-		0	D	A1	Stop	Stopping
1	1	0	0 -> 1	-	D	A1	F	A1	Distance	Positioning
1	1	1	0 -> 1	-	F	A1	D	A1	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 1 the current level is frozen (saved) at A1.

D = Dynamic

x = Arbitrary value

7.12 Operating mode 26: dynamic current limit via A1; rotational direction

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of static / dynamic current limitation.
Function IN 2: Selecting the rotational direction.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	D	A1	F	A1	N control	
1	0	1	0	pos	F	A1	D	A1	N control	
1	0	0	1	neg	D	A1	F	A1	N control	
1	0	1	1	neg	F	A1	D	A1	N control	
0	1	0	0	neg	D	A1	F	A1	N control	
0	1	1	0	neg	F	A1	D	A1	N control	
0	1	0	1	pos	D	A1	F	A1	N control	
0	1	1	1	pos	F	A1	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Braking and stopping
1	1	1	0	-		0	D	A1	Stop	Braking and stopping
1	1	0	1	-		0	F	A1	Stop	Braking and stopping
1	1	1	1	-		0	D	A1	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, Ih.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B
Initialisation speed setpoint = 0

S = Static
P = Parameter
F = Freeze; on level changeover to IN 1 the current level is frozen (saved) at A1.
D = Dynamic
x = Arbitrary value

7.13 Operating mode 28: dynamic current limit via A1; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selection of static / dynamic current limitation.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No current feed
1	0	0	0	-	D	A1	F	A1	Free-wheeling	
1	0	1	0	-	F	A1	D	A1	Free-wheeling	
1	0	0	1	pos	D	A1	F	A1	N control	
1	0	1	1	pos	F	A1	D	A1	N control	
0	1	0	0	-	D	A1	F	A1	Free-wheeling	
0	1	1	0	-	F	A1	D	A1	Free-wheeling	
0	1	0	1	neg	D	A1	F	A1	N control	
0	1	1	1	neg	F	A1	D	A1	N control	
1	1	0	0	-		0	F	A1	Free-wheeling	
1	1	1	0	-		0	D	A1	Free-wheeling	
1	1	0	1	-		0	F	A1	Stop	Stopping
1	1	1	1	-		0	D	A1	Stop	Stopping

NOTE

IN 2 = 0; Brake closed

IN 2 = 1; Brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 1 the current level is frozen (saved) at A1.

D = Dynamic

x = Arbitrary value

7.14 Operating mode 31: Distance; speed setpoints A1, N2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Selection of the speed setpoint source analog A1 / parameter N2.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	x	0	pos	A1	S	P	N control	
1	0	x	0	pos	A1	S	P	N control	
1	0	x	1	pos	N2	S	P	N control	
1	0	x	1	pos	N2	S	P	N control	
0	1	x	0	neg	A1	S	P	N control	
0	1	x	0	neg	A1	S	P	N control	
0	1	x	1	neg	N2	S	P	N control	
0	1	x	1	neg	N2	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	0 -> 1	0	-	A1	S	P	Distance	Positioning
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	0 -> 1	1	-	N2	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.15 Operating mode 32: Distance; dynamic current limit via A1

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Selection of static / dynamic current limitation.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	x	0	pos	D	A1	F	A1	N control	
1	0	x	0	pos	D	A1	F	A1	N control	
1	0	x	1	pos	F	A1	D	A1	N control	
1	0	x	1	pos	F	A1	D	A1	N control	
0	1	x	0	neg	D	A1	F	A1	N control	
0	1	x	0	neg	D	A1	F	A1	N control	
0	1	x	1	neg	F	A1	D	A1	N control	
0	1	x	1	neg	F	A1	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Stopping
1	1	0 -> 1	0	-	D	A1	F	A1	Distance	Positioning
1	1	0	1	-		0	D	A1	Stop	Stopping
1	1	0 -> 1	1	-	F	A1	D	A1	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 2 the current level is frozen (Saved) at A1.

D = Dynamic

x = Arbitrary value

7.16 Operating mode 34: Distance; teach

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Learn a displacement; difference in position between teach start and each stop;
Save in distance = parameter 68 + 69.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	0	-	0	-	-	Free-wheeling	No braking, no current feed, Teach stop
0	0	x	1	-	0	-	-	Free-wheeling	No braking, no current feed, Teach start
1	0	x	0	pos	A1	S	P	N control	Teach stop
1	0	x	1	pos	A1	S	P	N control	Teach start
1	0	x	0	pos	A1	S	P	N control	Teach stop
1	0	x	1	pos	A1	S	P	N control	Teach start
0	1	x	0	neg	A1	S	P	N control	Teach stop
0	1	x	1	neg	A1	S	P	N control	Teach start
0	1	x	0	neg	A1	S	P	N control	Teach stop
0	1	x	1	neg	A1	S	P	N control	Teach start
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	0 -> 1	0	-	A1	S	P	Distance	Positioning
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	0 -> 1	1	-	A1	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.17 Operating mode 36: Distance; rotational direction

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Selecting the rotational direction.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	x	0	pos	A1	S	P	N control	
1	0	x	0	pos	A1	S	P	N control	
1	0	x	1	neg	A1	S	P	N control	
1	0	x	1	neg	A1	S	P	N control	
0	1	x	0	neg	A1	S	P	N control	
0	1	x	0	neg	A1	S	P	N control	
0	1	x	1	pos	A1	S	P	N control	
0	1	x	1	pos	A1	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	0 -> 1	0	-	A1	S	P	Distance	Positioning
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	0 -> 1	1	-	A1	S	P	Distance	Positioning
1	1	0 -> 1	1	-	A1	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.18 Operating mode 37: Distance; dynamic current limit A2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Analog A2 dynamic current limitation.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	A2	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	x	A2	pos	A1	D	A2	N control	
1	0	x	A2	pos	A1	D	A2	N control	
1	0	x	A2	pos	A1	D	A2	N control	
1	0	x	A2	pos	A1	D	A2	N control	
0	1	x	A2	neg	A1	D	A2	N control	
0	1	x	A2	neg	A1	D	A2	N control	
0	1	x	A2	neg	A1	D	A2	N control	
0	1	x	A2	neg	A1	D	A2	N control	
1	1	0	A2	-	0	D	A2	Stop	Stopping
1	1	0 -> 1	A2	-	A1	D	A2	Distance	Positioning
1	1	0	A2	-	0	D	A2	Stop	Stopping
1	1	0 -> 1	A2	-	A1	D	A2	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.19 Operating mode 38: Distance; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	x	0	-	0	S	P	Free-wheeling	
1	0	x	0	-	0	S	P	Free-wheeling	
1	0	x	1	pos	A1	S	P	N control	
1	0	x	1	pos	A1	S	P	N control	
0	1	x	0	-	0	S	P	Free-wheeling	
0	1	x	0	-	0	S	P	Free-wheeling	
0	1	x	1	neg	A1	S	P	N control	
0	1	x	1	neg	A1	S	P	N control	
1	1	0	0	-	0	S	P	Free-wheeling	
1	1	0 -> 1	0	-	0	S	P	Free-wheeling	
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	0 -> 1	1	-	A1	S	P	Distance	Positioning

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.20 Operating mode 43: Teach; distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Learn a displacement; difference in position between teach start and each stop;
Save in distance = parameter 68 + 69.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	0	x	-	0	-	-	Free-wheeling	No braking, no current feed, teach stop
0	0	1	x	-	0	-	-	Free-wheeling	No braking, no current feed, teach start
1	0	0	x	pos	A1	S	P	N control	Teach stop
1	0	1	x	pos	A1	S	P	N control	Teach start
1	0	0	x	pos	A1	S	P	N control	Teach stop
1	0	1	x	pos	A1	S	P	N control	Teach start
0	1	0	x	neg	A1	S	P	N control	Teach stop
0	1	1	x	neg	A1	S	P	N control	Teach start
0	1	0	x	neg	A1	S	P	N control	Teach stop
0	1	1	x	neg	A1	S	P	N control	Teach start
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	1	0	-	0	S	P	Stop	Stopping
1	1	0	0 -> 1	-	A1	S	P	Distance	Positioning
1	1	1	0 -> 1	-	A1	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.21 Operating mode 55: IN A / B logic via IN 1, IN 2; IN A / IN B as release (enable)

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Emulation IN A.

Function IN 2: Emulation IN B.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	-	0	S	P	Free-wheeling	No braking, no current feed
1	0	1	0	pos	A1	S	P	N control	
1	0	0	1	neg	A1	S	P	N control	
1	0	1	1	-	0	S	P	Stop	Braking and stopping
0	1	0	0	-	0	S	P	Free-wheeling	No braking, no current feed
0	1	1	0	pos	A1	S	P	N control	
0	1	0	1	neg	A1	S	P	N control	
0	1	1	1	-	0	S	P	Stop	Braking and stopping
1	1	0	0	-	0	S	P	Free-wheeling	No braking, no current feed
1	1	1	0	pos	A1	S	P	N control	
1	1	0	1	neg	A1	S	P	N control	
1	1	1	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.22 Operating mode 61: Rotational direction; speed setpoints A1, N2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selecting the rotational direction.

Function IN 2: Selection of the speed setpoint source analog A1 / parameter N2.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	A1	S	P	N control	
1	0	1	0	neg	A1	S	P	N control	
1	0	0	1	pos	N2	S	P	N control	
1	0	1	1	neg	N2	S	P	N control	
0	1	0	0	neg	A1	S	P	N control	
0	1	1	0	pos	A1	S	P	N control	
0	1	0	1	neg	N2	S	P	N control	
0	1	1	1	pos	N2	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Braking and stopping
1	1	1	0	-	0	S	P	Stop	Braking and stopping
1	1	0	1	-	0	S	P	Stop	Braking and stopping
1	1	1	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.23 Operating mode 62: Rotational direction; dynamic current limit via A1

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selecting the rotational direction.

Function IN 2: Selection of static / dynamic current limitation.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	0	0	pos	D	A1	F	A1	N control	
1	0	1	0	neg	D	A1	F	A1	N control	
1	0	0	1	pos	F	A1	D	A1	N control	
1	0	1	1	neg	F	A1	D	A1	N control	
0	1	0	0	neg	D	A1	F	A1	N control	
0	1	1	0	pos	D	A1	F	A1	N control	
0	1	0	1	neg	F	A1	D	A1	N control	
0	1	1	1	pos	F	A1	D	A1	N control	
1	1	0	0	-		0	F	A1	Stop	Braking and stopping
1	1	1	0	-		0	F	A1	Stop	Braking and stopping
1	1	0	1	-		0	D	A1	Stop	Braking and stopping
1	1	1	1	-		0	D	A1	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, Ih.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 2 the current level is frozen (Saved) at A1

D = Dynamic

x = Arbitrary value

7.24 Operating mode 63: Rotational direction; distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selecting the rotational direction.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	x	pos	A1	S	P	N control	
1	0	1	x	neg	A1	S	P	N control	
1	0	0	x	pos	A1	S	P	N control	
1	0	1	x	neg	A1	S	P	N control	
0	1	0	x	neg	A1	S	P	N control	
0	1	1	x	pos	A1	S	P	N control	
0	1	0	x	neg	A1	S	P	N control	
0	1	1	x	pos	A1	S	P	N control	
1	1	0	0	-	0	S	P	Stop	Stopping
1	1	1	0	-	0	S	P	Stop	Stopping
1	1	0	0 -> 1	-	A1	S	P	Distance	Positioning
1	1	1	0 -> 1	-	A1	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.25 Operating mode 67: Rotational direction; dynamic current limit via A2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selecting the rotational direction.

Function IN 2: Analog A2 dynamic current limitation.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	A2	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	0	A2	pos	A1	D	A2	N control	
1	0	1	A2	neg	A1	D	A2	N control	
1	0	0	A2	pos	A1	D	A2	N control	
1	0	1	A2	neg	A1	D	A2	N control	
0	1	0	A2	neg	A1	D	A2	N control	
0	1	1	A2	pos	A1	D	A2	N control	
0	1	0	A2	neg	A1	D	A2	N control	
0	1	1	A2	pos	A1	D	A2	N control	
1	1	0	A2	-	0	D	A2	Stop	Braking and stopping
1	1	1	A2	-	0	D	A2	Stop	Braking and stopping
1	1	0	A2	-	0	D	A2	Stop	Braking and stopping
1	1	1	A2	-	0	D	A2	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.26 Operating mode 68: Rotational direction; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Selecting the rotational direction.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	0	0	-	0	S	P	Free-wheeling	
1	0	1	0	-	0	S	P	Free-wheeling	
1	0	0	1	pos	A1	S	P	N control	
1	0	1	1	neg	A1	S	P	N control	
0	1	0	0	-	0	S	P	Free-wheeling	
0	1	1	0	-	0	S	P	Free-wheeling	
0	1	0	1	neg	A1	S	P	N control	
0	1	1	1	pos	A1	S	P	N control	
1	1	0	0	-	0	S	P	Free-wheeling	
1	1	1	0	-	0	S	P	Free-wheeling	
1	1	0	1	-	0	S	P	Stop	Stopping
1	1	1	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.27 Operating mode 71: Speed setpoint PWM, N2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Selection of the speed setpoint source PWM / parameter.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	PWM	0	pos	PWM	S	P	N control	
1	0	PWM	0	pos	PWM	S	P	N control	
1	0	PWM	1	pos	N2	S	P	N control	
1	0	PWM	1	pos	N2	S	P	N control	
0	1	PWM	0	neg	PWM	S	P	N control	
0	1	PWM	0	neg	PWM	S	P	N control	
0	1	PWM	1	neg	N2	S	P	N control	
0	1	PWM	1	neg	N2	S	P	N control	
1	1	PWM	0	-	0	S	P	Stop	Braking and stopping
1	1	PWM	0	-	0	S	P	Stop	Braking and stopping
1	1	PWM	1	-	0	S	P	Stop	Braking and stopping
1	1	PWM	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

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7.28 Operating mode 72: Speed setpoint PWM; dynamic current limitation via PWM

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Selection of static / dynamic current limitation.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No braking, no current feed
1	0	PWM	0	pos	D	PWM	F	PWM	N control	
1	0	PWM	0	pos	D	PWM	F	PWM	N control	
1	0	PWM	1	pos	F	PWM	D	PWM	N control	
1	0	PWM	1	pos	F	PWM	D	PWM	N control	
0	1	PWM	0	neg	D	PWM	F	PWM	N control	
0	1	PWM	0	neg	D	PWM	F	PWM	N control	
0	1	PWM	1	neg	F	PWM	D	PWM	N control	
0	1	PWM	1	neg	F	PWM	D	PWM	N control	
1	1	PWM	0	-		0	F	PWM	Stop	Braking and stopping
1	1	PWM	0	-		0	F	PWM	Stop	Braking and stopping
1	1	PWM	1	-		0	D	PWM	Stop	Braking and stopping
1	1	PWM	1	-		0	D	PWM	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, Ih.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 2 the current setpoint is frozen (saved) at IN 1.

D = Dynamic

x = Arbitrary value

7.29 Operating mode 73: Speed setpoint PWM, distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	PWM	x	pos	PWM	S	P	N control	
1	0	PWM	x	pos	PWM	S	P	N control	
1	0	PWM	x	pos	PWM	S	P	N control	
1	0	PWM	x	pos	PWM	S	P	N control	
0	1	PWM	x	neg	PWM	S	P	N control	
0	1	PWM	x	neg	PWM	S	P	N control	
0	1	PWM	x	neg	PWM	S	P	N control	
0	1	PWM	x	neg	PWM	S	P	N control	
1	1	PWM	0	-	0	S	P	Stop	Stopping
1	1	PWM	0	-	0	S	P	Stop	Stopping
1	1	PWM	0 -> 1	-	PWM	S	P	Distance	Positioning
1	1	PWM	0 -> 1	-	PWM	S	P	Distance	Positioning

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.30 Operating mode 76: Speed setpoint PWM; rotational direction

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Selecting the rotational direction.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	PWM	0	pos	PWM	S	P	N control	
1	0	PWM	0	pos	PWM	S	P	N control	
1	0	PWM	1	neg	PWM	S	P	N control	
1	0	PWM	1	neg	PWM	S	P	N control	
0	1	PWM	0	neg	PWM	S	P	N control	
0	1	PWM	0	neg	PWM	S	P	N control	
0	1	PWM	1	pos	PWM	S	P	N control	
0	1	PWM	1	pos	PWM	S	P	N control	
1	1	PWM	0	-	0	S	P	Stop	Braking and stopping
1	1	PWM	0	-	0	S	P	Stop	Braking and stopping
1	1	PWM	1	-	0	S	P	Stop	Braking and stopping
1	1	PWM	1	-	0	S	P	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.31 Operating mode 77: Speed setpoint PWM; dynamic current limit via A2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Analog A2 dynamic current limitation.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	PWM	A2	pos	PWM	D	A2	N control	
1	0	PWM	A2	pos	PWM	D	A2	N control	
1	0	PWM	A2	pos	PWM	D	A2	N control	
1	0	PWM	A2	pos	PWM	D	A2	N control	
0	1	PWM	A2	neg	PWM	D	A2	N control	
0	1	PWM	A2	neg	PWM	D	A2	N control	
0	1	PWM	A2	neg	PWM	D	A2	N control	
0	1	PWM	A2	neg	PWM	D	A2	N control	
1	1	PWM	A2	-	0	D	A2	Stop	Braking and stopping
1	1	PWM	A2	-	0	D	A2	Stop	Braking and stopping
1	1	PWM	A2	-	0	D	A2	Stop	Braking and stopping
1	1	PWM	A2	-	0	D	A2	Stop	Braking and stopping

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.32 Operating mode 78: Speed setpoint PWM; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for PWM signal.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	PWM	0	-	0	S	P	Free-wheeling	
1	0	PWM	0	-	0	S	P	Free-wheeling	
1	0	PWM	1	pos	PWM	S	P	N control	
1	0	PWM	1	pos	PWM	S	P	N control	
0	1	PWM	0	-	0	S	P	Free-wheeling	
0	1	PWM	0	-	0	S	P	Free-wheeling	
0	1	PWM	1	neg	PWM	S	P	N control	
0	1	PWM	1	neg	PWM	S	P	N control	
1	1	PWM	0	-	0	S	P	Free-wheeling	
1	1	PWM	0	-	0	S	P	Free-wheeling	
1	1	PWM	1	-	0	S	P	Stop	Stopping
1	1	PWM	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.33 Operating mode 81: Speed setpoint frequency, N2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Selection of the speed setpoint source frequency / parameter N2.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	Frequency	0	pos	Frequency	S	P	N control	
1	0	Frequency	0	pos	Frequency	S	P	N control	
1	0	Frequency	1	pos	N2	S	P	N control	
1	0	Frequency	1	pos	N2	S	P	N control	
0	1	Frequency	0	neg	Frequency	S	P	N control	
0	1	Frequency	0	neg	Frequency	S	P	N control	
0	1	Frequency	1	neg	N2	S	P	N control	
0	1	Frequency	1	neg	N2	S	P	N control	
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	1	-	0	S	P	Stop	Stopping
1	1	Frequency	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.34 Operating mode 82: Speed setpoint frequency; dynamic current limitation via frequency

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Selection of static / dynamic current limitation.

				Speed			Current limit			
IN A	IN B	IN 1	IN 2	Direction	Type	Value	Type	Value	Function	Comment
0	0	x	x	-		0	-	-	Free-wheeling	No current feed
1	0	Frequency	0	pos	D	Frequency	F	Frequency	N control	
1	0	Frequency	0	pos	D	Frequency	F	Frequency	N control	
1	0	Frequency	1	pos	F	Frequency	D	Frequency	N control	
1	0	Frequency	1	pos	F	Frequency	D	Frequency	N control	
0	1	Frequency	0	neg	D	Frequency	F	Frequency	N control	
0	1	Frequency	0	neg	D	Frequency	F	Frequency	N control	
0	1	Frequency	1	neg	F	Frequency	D	Frequency	N control	
0	1	Frequency	1	neg	F	Frequency	D	Frequency	N control	
1	1	Frequency	0	-		0	F	Frequency	Stop	Stopping
1	1	Frequency	0	-		0	F	Frequency	Stop	Stopping
1	1	Frequency	1	-		0	D	Frequency	Stop	Stopping
1	1	Frequency	1	-		0	D	Frequency	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Initialisation static current limit = I_max parameter 0x38, 0x39, 0x3A, 0x3B

Initialisation speed setpoint = 0

S = Static

P = Parameter

F = Freeze; on level changeover to IN 2 the current setpoint is frozen (saved) at IN 1.

D = Dynamic

x = Arbitrary value

7.35 Operating mode 83: Speed setpoint frequency, distance

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Travel distance; the distance increases with each high flank (x); displacement = x*distance.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	Frequency	x	pos	Frequency	S	P	N control	
1	0	Frequency	x	pos	Frequency	S	P	N control	
1	0	Frequency	x	pos	Frequency	S	P	N control	
1	0	Frequency	x	pos	Frequency	S	P	N control	
0	1	Frequency	x	neg	Frequency	S	P	N control	
0	1	Frequency	x	neg	Frequency	S	P	N control	
0	1	Frequency	x	neg	Frequency	S	P	N control	
0	1	Frequency	x	neg	Frequency	S	P	N control	
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	0 -> 1	-	Frequency	S	P	Distance	Positioning
1	1	Frequency	0 -> 1	-	Frequency	S	P	Distance	Positioning

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Distance = Parameter 44 + 45; relative distance with plus/minus sign. Positive distances are travelled in a clockwise direction.
Travel distance only if KP_H > 0
For further information, see page 34.

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.36 Operating mode 86: Speed setpoint frequency, rotational direction

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Selecting the rotational direction.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	Frequency	0	pos	Frequency	S	P	N control	
1	0	Frequency	0	pos	Frequency	S	P	N control	
1	0	Frequency	1	neg	Frequency	S	P	N control	
1	0	Frequency	1	neg	Frequency	S	P	N control	
0	1	Frequency	0	neg	Frequency	S	P	N control	
0	1	Frequency	0	neg	Frequency	S	P	N control	
0	1	Frequency	1	pos	Frequency	S	P	N control	
0	1	Frequency	1	pos	Frequency	S	P	N control	
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	0	-	0	S	P	Stop	Stopping
1	1	Frequency	1	-	0	S	P	Stop	Stopping
1	1	Frequency	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.37 Operating mode 87: Speed setpoint frequency; dynamic current limit via A2

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Analog A2 dynamic current limitation.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	Frequency	A2	pos	Frequency	D	A2	N control	
1	0	Frequency	A2	pos	Frequency	D	A2	N control	
1	0	Frequency	A2	pos	Frequency	D	A2	N control	
1	0	Frequency	A2	pos	Frequency	D	A2	N control	
0	1	Frequency	A2	neg	Frequency	D	A2	N control	
0	1	Frequency	A2	neg	Frequency	D	A2	N control	
0	1	Frequency	A2	neg	Frequency	D	A2	N control	
0	1	Frequency	A2	neg	Frequency	D	A2	N control	
1	1	Frequency	A2	-	0	D	A2	Stop	Stopping
1	1	Frequency	A2	-	0	D	A2	Stop	Stopping
1	1	Frequency	A2	-	0	D	A2	Stop	Stopping
1	1	Frequency	A2	-	0	D	A2	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.38 Operating mode 88: Speed setpoint frequency, brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: Input for frequency signal.

Function IN 2: Input for braking voltage; motor only runs if brake released.

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	Frequency	0	-	0	S	P	Free-wheeling	
1	0	Frequency	0	-	0	S	P	Free-wheeling	
1	0	Frequency	1	pos	Frequency	S	P	N control	
1	0	Frequency	1	pos	Frequency	S	P	N control	
0	1	Frequency	0	-	0	S	P	Free-wheeling	
0	1	Frequency	0	-	0	S	P	Free-wheeling	
0	1	Frequency	1	neg	Frequency	S	P	N control	
0	1	Frequency	1	neg	Frequency	S	P	N control	
1	1	Frequency	0	-	0	S	P	Free-wheeling	
1	1	Frequency	0	-	0	S	P	Free-wheeling	
1	1	Frequency	1	-	0	S	P	Stop	Stopping
1	1	Frequency	1	-	0	S	P	Stop	Stopping

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

7.39 Operating mode 91: Operation via RS485; distance / speed

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: none

Function IN 2: none

IN A or IN B are used as release (enable).

Speed run command

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No braking, no current feed
1	0	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	0	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	0	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	0	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
0	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
0	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
0	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
0	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command
1	1	x	x	RS485	RS485	S	RS485	N control / distance	Speed / position run command

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.
If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Position run command

Distance via RS485

Speed 0x3F; current via the distance see

S = Static
P = Parameter
F = Freeze
D = Dynamic
x = Arbitrary value

7.40 Operating mode 98: Operation via RS485; distance / speed; brake

NOTE

In order for the parameter to function, KP_H must be > 0.

Function IN 1: none

Function IN 2: Input for braking voltage; motor only runs if brake released.

IN A or IN B are used as release (enable).

Speed run command

				Speed		Current limit			
IN A	IN B	IN 1	IN 2	Direction	Value	Type	Value	Function	Comment
0	0	x	x	-	0	-	-	Free-wheeling	No current feed
1	0	x	0	-	-	S	RS485	Free-wheeling	
1	0	x	0	-	-	S	RS485	Free-wheeling	
1	0	x	1	RS485	RS485	S	RS485	N control / distance	
1	0	x	1	RS485	RS485	S	RS485	N control / distance	
0	1	x	0	-	-	S	RS485	Free-wheeling	
0	1	x	0	RS485-	-	S	RS485	Free-wheeling	
0	1	x	1	RS485	RS485	S	RS485	N control / distance	
0	1	x	1	RS485	RS485	S	RS485	N control / distance	
1	1	x	0	-	-	S	RS485	Free-wheeling	
1	1	x	0	-	-	S	RS485	Free-wheeling	
1	1	x	1	RS485	RS485	S	RS485	N control / distance	Brake released
1	1	x	1	RS485	RS485	S	RS485	N control / distance	Brake released

NOTE

IN 2 = 0; brake closed

IN 2 = 1; brake open

Stop control = If KP_H > 0; brake and stop in the current position on changeover to IN A = IN B = 1 + Coasting rh, lh.

If KP_H = 0; brake and stop on changeover to IN A = IN B = 1, run speed to 0.

Position run command

Distance via RS485

Speed 0x3F; current via the distance, see page 39.

S = Static

P = Parameter

F = Freeze

D = Dynamic

x = Arbitrary value

8 Inputs and Outputs

8.1 Input circuit

8.1.1 IN A / IN B control inputs

The following logic table applies to the IN A / IN B control inputs:

IN A= 0 AND IN B = 0 => free-wheeling

IN A= 1 AND IN B = 0 => clockwise (positive): Target value, as it comes from the characteristic curve

IN A= 0 AND IN B = 1 => counter-clockwise (negative): Target value multiplied by -1

IN A= 1 AND IN B = 1 => brake / position

The IN A / IN B control inputs are prioritised higher than the position, speed and current target value. If the IN A / IN B control inputs were used to set “brake”, the software brakes the drive and keeps it at a standstill as long as “brake” is activated.

The control type of the IN A / IN B control inputs can still be changed by the change in rotational direction (this has higher priority).

The “free-wheeling” state has the same meaning as “Motor_Quit” or “Motor_OFF” and is active if IN A AND IN B are set to 0.

If the input parameters Mode 1 and Mode 2 are set to IN A logic and B logic, the drive can be enabled, if the physical IN A / IN B control input requests = 0 / 0 (= free-wheeling)
OR
the IN 1 / IN 2 inputs request = 0 / 0 (= free-wheeling).

If the input parameters Mode 1 and Mode 2 are set to IN A logic and B logic, and the IN 1 / IN 2 inputs map the IN A / IN B behaviour, the familiar IN A- / B-Logic can be used:

IN 1 / IN 2 = 0 / 0 = enable

IN 1 / IN 2 = 1 / 0 = clockwise

IN 1 / IN 2 = 0 / 1 = counter-clockwise

IN 1 / IN 2 = 1 / 1 = brake / position

8.1.2 Input IN 1 and Input IN 2

Parameter 0x1: Mode 1 (for IN 1)

Description: The parameter Mode 1 contains the configuration for the IN 1. This parameter describes how this is to be used and which control task it undertakes.

Default value: 1: Fixed speed N1 or dyn. target speed

Scaling:
1: Fixed speed N1 or dynamic target speed selectable via IN 1
2: Changeover to dyn. current limitation with A1 via IN 1
3: Travel distance with IN 1
4: Teach with IN 1
5: A-Logic with IN 1
6: Change direction of rotation with IN 1
7: PWM via IN 1
8: Frequency via IN 1
9: RS485 mode without IN 1 and IN 2

Dependencies: Input IN 2 parameter

Parameter 0x2: Mode 2 (for IN 2)

Description: The parameter Mode 2 contains the configuration for the IN 2. This parameter describes how this is to be used and which control task it undertakes.

Default value: 1: Fixed speed N2

1: Fixed speed N2 or dynamic target speed selectable via IN 2
2: Changeover to dynamic current limitation with dyn. target value via IN 2
3: Travel distance with IN 2
4: Teach with IN 2
5: Teach with IN 2
6: Direction rotation reverse with IN 2
7: Analog input IN 2 as dyn. current limitation
8: Brake to IN 2 (drive may only rotate if brake released)

Dependencies: Input IN 1 parameter

8.1.3 Analog IN A1

5: Analog (IN A1) (analog input (target speed > default))

Input	
Analog IN A1	Analog input (target speed > default) 0…10V (differential)
Analog GND	GND for analog IN 1 (differential)

8.2 Output circuit

8.2.1 Output OUT 1 / Output OUT 2 / Output OUT 3

P03: Use of the output OUT 1

Description: The parameter defines which status output is output at output OUT 1.

Default value: 4 (= drive ready)

Scaling:
0: no function
1: no function (reserved)
2: Speed signal
3: Current signal
4: Ready signal
5: Positioning window reached
6: Temperature signal
7: RS485 controlled

Dependencies: with codes 2 – 6 the corresponding threshold values must contain valid values.

P04: Use of the output OUT 2

Description: The parameter defines which status output is output at output OUT 2.

Default value: 1

Scaling:
0: no function
1: Increment_1
2: Speed signal
3: Current signal
4: Ready signal
5: Positioning window reached
6: Temperature signal
7: RS485 controlled

Dependencies: with codes 2 – 6 the corresponding threshold values must contain valid values.

P05: Use of the output OUT 3

Description: The parameter defines which status output is output at output OUT 3.

Default value: 1

Scaling:
0: no function
1: Increment_2
2: Speed signal
3: Current signal
4: Ready signal
5: Positioning window reached
6: Temperature signal
7: RS485 controlled

Dependencies: with codes 2 – 6 the corresponding threshold values must contain valid values.

U logic (common GND)

9 RS485 Communication

9.1 Communication method

Communication between users and the drive software takes place via so-called telegrams. Each program contains specified data, which has to be received or sent. The drive software ignores telegrams that are not addressed to it.

RS485 communication is possible with the following parameterisation:
Baud rate = 115200
Number of data bits: 8
Number of stop bits: 1
Parity: even

9.2 Cycle time

The telegrams “COM_CRX_FAHRBEFEHL_DREHZAHL” and “COM_CRX_FAHRBEFEHL_POSITION” may only be sent every 10 ms maximum, as otherwise working through the telegrams uses up too much computing time.
If the telegrams are sent faster (< 10 ms) information is lost. The command is incomplete and is not executed. This does not cause any damage to the drive.

9.3 Commands

9.3.1 Commands (RX)

Command	Value	Comment, conditions
UART_CRX_FAHRBEFEHL_DREHZAHL	0x00	FE_SOLLDREHZAHL RS485
UART_CRX_FAHRBEFEHL_POSITION	0x01	FE_SOLLDREHZAHL
UART_CRX_PARAMETER_STORE	0x02	Save parameter from RAM in the EEPROM
UART_CRX_PARAMETER_WR	0x03	Write a parameter in the RAM
UART_CRX_PARAMETER_RD	0x04	Read a parameter from RAM
UART_CRX_STATUS_RD	0x05	Read status
UART_CRX_PARAMETER_RELOAD_DFLT	0x06	Read default parameters from EEPROM into RAM
UART_CRX_SOFTWARE_ID_RD	0x07	Read software ID
UART_CRX_BOOTLOADER_ID_RD	0x08	Read bootloader ID
UART_CRX_CUSTOMER_ACCESS	0x09	Access to parameters
UART_CRX_BACK_TO_BOLO	0x0B	Request jump back to bootloader
UART_CRX_CUSTOMER PASS SET	0x0C	Reset password

9.3.2 Answer commands (TX)

In the response (answer) telegram the recommended start byte from the above table is repeated as the start by. The value is increased by 0x80.

Command	Value	Comment, conditions
COM_CTX_FAHRBEFEHL_DREHZAHL	0x80	FE_SOLLDREHZAHL RS485
COM_CTX_FAHRBEFEHL_POSITION	0x81	FE_SOLLDREHZAHL RS485
COM_CTX_PARAMETER_STORE	0x82	
COM_CTX_PARAMETER_WR	0x83	
COM_CTX_PARAMETER_RD	0x84	
COM_CTX_STATUS_RD	0x85	
COM_CTX_PARAMETER_RELOAD_DFLT	0x86	
COM_CTX_SOFTWARE_ID_RD	0x87	Software-ID
COM_CTX_BOOTLOADER_ID_RD	0x88	Bootloader-ID
COM_CTX_CUSTOMER_ACCESS	0x89	Access to parameters
COM_CTX_BACK_TO_BOLO	0x8B	Jump back into bootloader takes place
COM_CTX_CUSTOMER PASS SET	0x8C	Customer password is reset

If an undefined or incorrect telegram is detected, the telegram “COM_CTX_STATUS_RD” is sent in response.

9.4 Status byte

Unless stated otherwise, the error flags set in the status byte of the answer have the following meaning:

Bit	Meaning
0	Undefined telegram
1	Telegram length too short or checksum incorrect
2	Wrong parameter number
3	Telegram can now not be processed
4	Telegram-dependent
5	Telegram-dependent
6	Telegram-dependent
7	Telegram-dependent

Bit 0 to 3 are identical for all telegrams.

Bit 4 to 7 are telegram-dependent.

9 RS485 Communication

9.5 Motor status byte

The bits of the motor status byte have the following meaning:

Bit	Meaning	Comment
0	bUebertemperatur	1 = Drive detects overtemperature
1	bMotorAktiv	1 = Drive is active
2	bUeberspannung	1 = drive detects overvoltage
3	bUnterspannung	1 = drive detects undervoltage
4	bHWFehler	1 = drive detects hardware fault
5	bUeberstrom	1 = drive detects overcurrent
6	bQuittErforderlich	1 = drive needs an acknowledgement
7	bDBereit	1 = drive is ready

9.6 Checksum

The checksum is calculated as follows:

- All bytes including the start byte are added together.
  - As, in special cases, the sum can be 0 and an empty telegram would be interpreted as “Run command speed with target speed = 0 and maximum current = 0”, the sum is disjuncted with 0 x 55. In this way the special case is detected.

Formula: Checksum = (sum (Byte0..last_Byte)) || 0x55

9.7 “Speed” run command

The “speed” run command described here initiates speed-controlled operation, if the setpoint selector of the drive has been used to activate “RS485 speed input”.

NOTE

In the case of static operation with a speed, the command must be sent cyclically every 2 sec. at the latest, as otherwise the drive detects a bus interruption and specifies an error speed (parameter 0x16).

9.7.1 Requirements

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_FAHRBEFEHL_DREHZAHL
2	Address byte	Bus address
3	Target speed Hi	rpm, -32768…32767
4	Target speed Lo	
5	Maximum current Hi	
6	Maximum current Lo	0-100 %
7	Checksum	

9.7.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_FAHRBEFEHL_DREHZAHL
2	Address byte	Bus address
3	Actual speed Hi	rpm, -32768…32767
4	Actual speed Lo	
5	Actual current Hi	10mA / Digit
6	Actual current Lo	10mA / Digit
7	Actual position HiHi	Revolution, -32768…32767
8	Actual position HiLo	
9	Actual position LoHi	1/65535 revolutions, 0…65535
10	Actual position LoLo	
11	Motor status byte	
12	Status byte	
13	Checksum	

9.8 “Position” run command

The “position” run command described here initiates a positioning run, if the setpoint selector of the drive has been used to activate “RS485 position input”.

9.8.1 Requirements

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_FAHRBEFEHL_POSITION
2	Address byte	Bus address
3	Target position HiHi	Revolutions, -32768…32767
4	Target position HiLo	
5	Target position LoHi	1/65535 revolutions, 0…65535
6	Target position LoLo	
7	Checksum	

9.8.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_FAHRBEFEHL_POSITION
2	Address byte	Bus address
3	Actual speed Hi	rpm, -32768…32767
4	Actual speed Lo	
5	Actual current Hi	10mA / Digit
6	Actual current Lo	10mA / Digit
7	Actual position HiHi	Revolutions, -32768…32767
8	Actual position HiLo	
9	Actual position LoHi	1/65535 Revolutions, 0…65535
10	Actual position LoLo	
11	Motor status byte	
12	Status byte	
13	Checksum	

9.9 Save parameters

Saves all parameters from the RAM in the EEPROM (emulates data flash), provided at least one parameter has been changed since the last reset or the last successful call of this command.

9.9.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_PARAMETER_STORE
2	Address byte	Bus address
3…6	Access key	Customer password
7	Checksum	

9.9.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_PARAMETER_STORE
2	Address byte	Bus address
3	Status byte	
4	Checksum	

9.9.3 Error flags

Bit	Meaning
7	Error, parameters are still inconsistent and cannot be saved
6	Errors occur on writing the data flash
5	No parameters changed, no data saved
4	Incorrect access key, no data saved

9.10 Write parameter

Writes a value in the parameter memory.

9.10.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_PARAMETER_WR
2	Address byte	Bus address
3	Parameter No.	
4	Parameter No.	0…65535
5	Parameter Hi	parameter to be written
6	Parameter Lo	
7	Checksum	

9.10.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_PARAMETER_WR
2	Address byte	Bus address
3	Parameter No.	
4	Parameter No.	0…65535
5	Parameter Hi	written parameter
6	Parameter Lo	
7	Parameter No. Hi	0, if no conflict exists
8	Parameter No. Lo	If conflict exists, No. of the colliding (clashing) parameter
9	Status byte	
10	Checksum	

9.10.3 Error flags

Bit	Meaning
7	
6	
5	Save parameter failed
4	Incorrect access key

9.11 Read parameter

Reads a parameter from the parameter memory.

9.11.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_PARAMETER_RD
2	Address byte	Bus address
3	Parameter No. Hi	
4	Parameter No. Lo	0…65535
5	Checksum	

9.11.2 Answer

RS 485 Char	Use	Value / Comment
1	Start byte	COM_CTX_PARAMETER_RD
2	Address byte	Bus address
3	Parameter No. Hi	
4	Parameter No. Lo	0…65535
5	Parameter Hi	parameter read
6	Parameter Lo	
7	Status byte	
8	Checksum	

9.11.3 Error flags

Bit	Meaning
7	
6	
5	Read parameter failed
4	Incorrect access key

9.12 Read status word

9.12.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_STATUS_RD
2	Address byte	Bus address
3	Checksum	

9.12.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_STATUS_RD
2	Address byte	Bus address
3	Motor status byte	
4	Status byte	
5	Checksum	

9.13 Load “Parameter default values”

The command enables the “Parameter default values” to be loaded into the RAM. To save the “Default values” permanently the “Save parameters” command must be executed (see Chapter 9.9 Save parameters, page 86).

9.13.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_PARAMETER_RESTORE
2	Address byte	Bus address
3…6	Access key	Customer password
7	Checksum	

9.13.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_PARAMETER_RESTORE
2	Address byte	Bus address
3	Status byte	
4	Checksum	

9.13.3 Error flags

Bit	Meaning
7	
6	
5	
4	Incorrect access key

9.14 Read software ID

9.14.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_SOFTWARE_HEADER_RD
2	Address byte	Bus address
3	Checksum	

9.14.2 Response (without / with bootloader)

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_SOFTWARE_HEADER_RD
2	Address byte	Bus address
3…6	Data 01…04	0 / u32AddrCrcEnd
7…10	Data 05…08	0 / u32AddrCodeStart
11…14	Data 09…12	0 / u32AddrPM_Start
15…18	Data 13…16	0 / u32AddrPM_End
19…22	Data 17…20	Software Version, e.g. 'V' - 1 - 0 - 1
23…26	Data 21…24	32 bit still free
27…30	Data 25…28	32 bit still free
31…34	Data 29…32	32 bit still free
35	Checksum	

9.15 Read bootloader ID

9.15.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_APPLBOLOPAT_RD
2	Address byte	Bus address
3	Checksum	

9.15.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_APPLBOLOPAT_RD
2	Address byte	Bus address
3…22	Data 01…19	Bootloader ID
23	Checksum	

9.16 Full write access to parameters

9.16.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	UART_CRX_CUSTOMER_ACCESS
2	Address byte	Bus address
3…6	Data 01…04 (AccessKey)	Customer access key
7	Checksum	

9.16.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	UART_CTX_CUSTOMER_ACCESS
2	Address byte	Bus address
3	Status byte	
4	Checksum	

9.16.3 Error flags

Bit	Meaning
7	
6	
5	
4	Incorrect access key, access is restricted

9.17 Request jump back to bootloader

The jump back into the bootloader is made after transferring the response.

9.17.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_BACK_TO_BOLO
2	Address byte	Bus address
3…6	Data 01…04 (AccessKey)	Customer access key
7	Checksum	

9.17.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_BACK_TO_BOLO
2	Address byte	Bus address
3	Status byte	
4	Checksum	

9.17.3 Error flags

Bit	Meaning
7	
6	
5	Motor is not in free-wheeling, jump back into the bootloader does not take place
4	Incorrect access key, jump back into the bootloader does not take place

9.18 Reset customer password

9.18.1 Request

RS485 Char	Use	Value / Comment
1	Start byte	COM_CRX_CUSTOMER PASS SET
2	Address byte	Bus address
3	Customer password until now HiHi	
4	Customer password until now HiLo	
5	Customer password until now LoHi	
6	Customer password until now LoLo	
7	New customer password HiHi	
8	New customer password HiLo	
9	New customer password LoHi	
10	New customer password LoLo	
11	Checksum	

9.18.2 Answer

RS485 Char	Use	Value / Comment
1	Start byte	COM_CTX_CUST_PASS_SET
2	Address byte	Bus address
3	Status byte	
4	Checksum	

9.18.3 Error flags

Bit	Meaning
7	
6	
5	
4	Incorrect access key

9.19 Undefined telegrams

Undefined telegrams are not answered. Corresponding error flags are set in the start byte of the response. Use of an already defined response should simplify processing on the ho side.

10 Parameter Description

This chapter describes the functions of the available parameters.

NOTE

- For a list of all parameters, see Chapter 6.2 Parameter, page 33. The possible assignable status outputs are listed page 111.

Parameter memory

The parameter memory can store all the parameters listed in the following as non-volatile memory, if a STORE command is received.

Use the RESTORE command to restore the factory settings.

Parameter 0x1: Mode 1

Description: The parameter Mode 1 contains the configuration for the Input IN 1. This parameter describes how the input IN 1 is to be used and which control task it undertakes.

Parameter 0x2: Mode 2

Description: The parameter Mode 2 contains the configuration for the Input IN 2. This parameter describes how the input IN 2 is to be used and which control task it undertakes.

Parameter 0x3: Use the output OUT1

Description: The parameter defines which status output is output at output OUT1.

Parameter 0x4: Use of the output OUT2

Description: The parameter defines which status output is output at output OUT 2.

Parameter 0x5: Use of the output OUT3

Description: The parameter defines which status output is output at output OUT 3.

10 Parameter Description

Parameter 0x6: Restart

Description: The “restart” parameter is used to configure the behaviour according following safety-critical errors. The drive cannot be operated while safety-critical errors are queued. If there are no longer any safety-critical errors, the drive can be switched ready for use automatically or manually via an acknowledgement.

0 = automatic restart

1 = confirmation required

Parameter 0x7, 0x8, 0x9, 0xA: intentionally left blank

Parameter 0xB: FE_DREHZAHL_X1

Description: X1 interpolation point in the target value characteristic curve.

Parameter 0xC: FE_DREHZAHL_X2

Description: X2 interpolation point in the target value characteristic curve.

Parameter 0xD: FE_DREHZAHL_X3

Description: X3 interpolation point in the target value characteristic curve.

Parameter 0xE: FE_DREHZAHL_Y0

Description: Target speed below the first interpolation point.

Parameter 0xF: FE_DREHZAHL_Y1

Description: Target speed value for interpolation point X1.

Parameter 0x10: FE_DREHZAHL_Y2

Description: Target speed value for interpolation point X2.

Parameter 0x11: FE_DREHZAHL_Y3

Description: Target speed value for interpolation point X3.

Parameter 0x12: FE_DREHZAHL_Y4

Description: Target speed value above the interpolation point X3.

Parameter 0x13: DREHZAHL_X1_HYSTERESE

Description: Interpolation point hysteresis value for X1. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X1 = 100,

DREHZAHL_X1_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y1. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y0.

Parameter 0x14: DREHZAHL_X2_HYSTERESE

Description: Interpolation point hysteresis value for X2. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X2 = 100,

DREHZAHL_X2_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y2. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y1.

Parameter 0x15: DREHZAHL_X3_HYSTERESE

Description: Interpolation point hysteresis value for X3. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X3 = 100,

DREHZAHL_X3_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y3. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y2.

Parameter 0x16: FEHLER_DREHZAHL

Description: Speed setpoint in case of setpoint detection errors

10 Parameter Description

Parameter 0x17: Fixed speed N1

Description: Fixed speed value, which is used depending on the setting of the parameter 0x1 and parameter 0x2 and their corresponding inputs IN 1 / IN 2.

Parameter 0x18: Fixed speed N2

Description: Fixed speed value, which is used depending on the setting of the parameter 0x1 and parameter 0x2 and their corresponding inputs IN 1 / IN 2.

Parameter 0x19: Fixed speed N3

Description: Fixed speed value, which is used depending on the setting of the parameter 0x1 and parameter 0x2 and their corresponding inputs IN 1 / IN 2.

Parameter 0x1A: t ramp-up cw

Description: Parameter is to be seen and used as the ramp slope (gradient) for the acceleration process in clockwise rotation (cw). The time given here is to be implemented for a setpoint jump of 1000 rpm. That is to say, the drive follows the setpoint jump ramped up by 1000 revs in the time set here.

Parameter 0x1B: t ramp-down cw

Description: Parameter is to be seen and used as the ramp slope (gradient) for the braking process in clockwise rotation (cw). The time given here is to be implemented for a setpoint jump of 1000 rpm. That is to say, the drive follows the setpoint jump ramped up by 1000 revs in the time set here.

Parameter 0x1C: t-ramp-up ccw

Description: Parameter is to be seen and used as the ramp slope (gradient) for the acceleration process in counter-clockwise rotation (ccw). The time given here is to be implemented for a setpoint jump of 1000 rpm. That is to say, the drive follows the setpoint jump ramped down by 1000 revs in the time set here.

Parameter 0x1D: t-ramp-down ccw

Description: Parameter is to be seen and used as the ramp slope (gradient) for the braking process in counter-clockwise rotation (ccw). The time given here is to be implemented for a setpoint jump of 1000 rpm. That is to say, the drive follows the setpoint jump ramped down by 1000 revs in the time set here.

10 Parameter Description

Parameter 0x1E: Speed controller KP

Description: Amplification factor (gain) for the proportional component in the speed controller.

Parameter 0x1F: Speed controller KI

Description: Amplification factor (gain) for the integral component in the speed controller.

Parameter 0x20: Speed controller KD

Description: Amplification factor (gain) for the differential component in the speed controller.

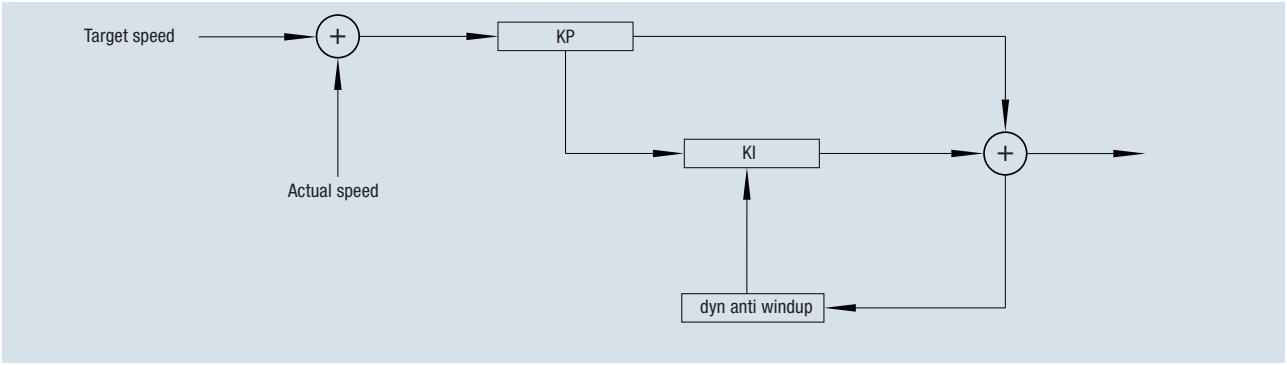
Parameter 0x21: K_ff

Description: The parameter K_ff (speed control input) is a link between the ramp generator target speed output and the setpoint of the speed controller input.

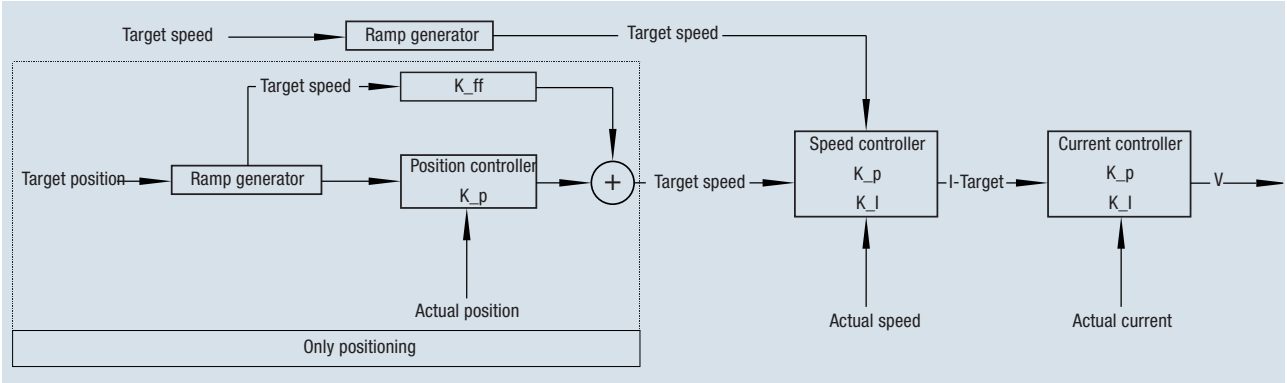
This parameter can be used to zero the setpoint input of the speed controller or pass the ramp generator input to the speed controller with additional gain.

See also "Parameter 0x1E: Speed controller KP".

PI controller structure



Control structure K4



Parameter 0x22: Actual speed value averaging

Description: The registered actual speed is filtered with a digital filter for the period defined here.

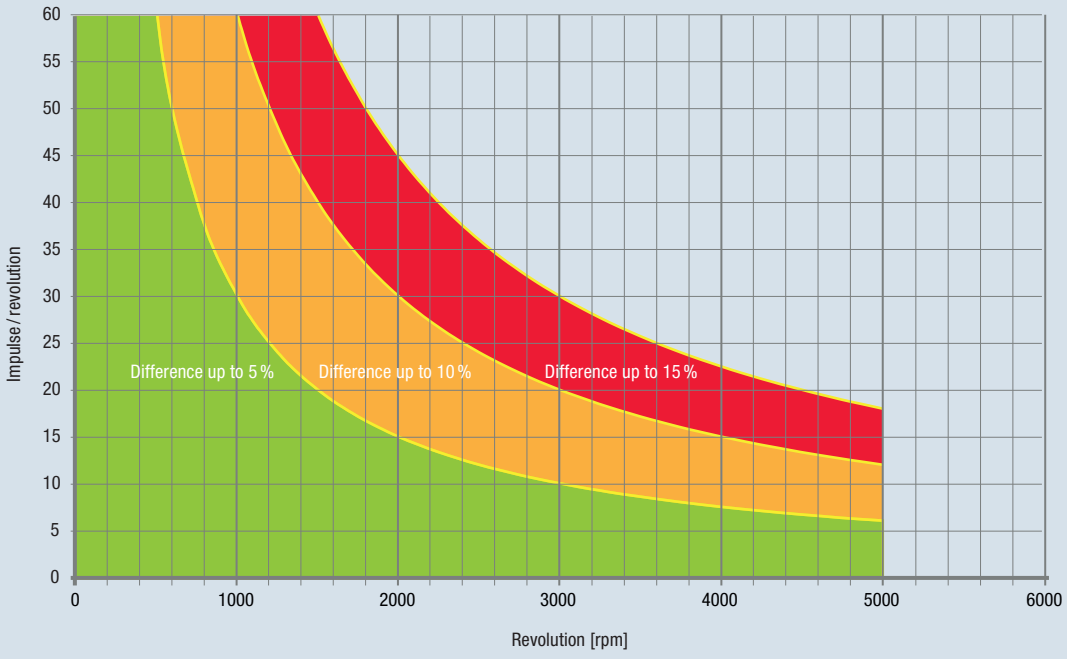
NOTE

The change in the filter time constant must be taken into account in the controller adjustment.

Parameter 0x23: Resolution of the actual outputs

Description: The resolution of the actual outputs (Pulse / revolution).

Tolerance range of the actual outputs



Parameter 0x24: Speed signal threshold

Description: The speed signal threshold (amount) parameter defined from which speed a speed signal is set at an output.

Parameter 0x25: Speed signal delta hysteresis

Description: Parameter is to be understood as being an absolute delta value (amount), which specifies the absolute threshold “speed signal threshold – hysteresis speed signal delta”.

E.g.:

Speed signal threshold = 1000 rpm

Hysteresis speed signal delta = 150 rpm

Here the lower hysteresis threshold of the speed signal is therefore 850 rpm = (1000 – 150)

Parameter 0x26: FE_STROM_X1

Description: X axis interpolation point value X1.

Parameter 0x27: FE_STROM_X2

Description: X axis interpolation value X2.

Parameter 0x28: FE_STROM_X3

Description: X axis interpolation value X3

Parameter 0x29: FE_STROM_Y0

Description: Maximum current percentage below interpolation point X1.

Parameter 0x2A: FE_STROM_Y1

Description: Maximum current percentage for interpolation point X1.

Parameter 0x2B: FE_STROM_Y2

Description: Maximum current percentage for interpolation point X2.

Parameter 0x2C: FE_STROM_Y3

Description: Maximum current percentage for interpolation point X3.

Parameter 0x2D: FE_STROM_Y4

Description: Maximum current percentage above the interpolation point X3.

Parameter 0x2E: STROM_X1_HYST

Description: Interpolation point hysteresis value for X1. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X1 = 100,

DREHZAHL_X1_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y1. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y0.

Parameter 0x2F: STROM_X2_HYST

Description: Interpolation point hysteresis value for X2. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X2 = 100,

DREHZAHL_X2_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y2. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y1.

Parameter 0x30: STROM_X3_HYST

Description: Interpolation point hysteresis value for X3. Value is understood as being the width of the hysteresis on the X axis and is used half under and half above the corresponding interpolation point.

E.g.:

FE_DREHZAHL_X3 = 100,

DREHZAHL_X3_HYSTERESE = 20

If the X axis value moves upwards, from value 110 (= 100 + (20/2)) the characteristic moves to value Y3. If the X axis value moves downwards, from X axis value 90 (= 100 – (20/2)) the characteristic jumps to Y2.

Parameter 0x31: Current error

Description: Maximum current percentage in case of fault registration.

Parameter 0x32: Current signal threshold

Description: The current signal threshold parameter defines from which winding current value the current signal output is activated.

Parameter 0x33: Current signal delta hysteresis

Description: Parameter is to be understood as being an absolute delta value, which specifies the absolute threshold “current signal threshold – hysteresis current signal delta”.

E.g.:

Current signal threshold = 7000 mA

Hysteresis current signal delta = 1000 mA

Here the lower hysteresis threshold of the current signal is therefore 6000 mA = (7000 – 1000)

Parameter 0x34: Current time constant

Description: Delay, which must at least have expired in order for a current signal to be output.

Parameter 0x35: Current gating time

Description: Startup delay, which must at least have expired once on starting a drive in order for a current signal to be output.

Parameter 0x36: Reversing threshold

Description: The reversing threshold is a speed threshold. Above this threshold the current limits within the regenerative range are set to 0. If the actual speed is below this threshold the drive will be able to move into the regenerative range, only then do the Imax limits for regenerative mode apply.

Parameter 0x37: Reversing threshold delta hysteresis

Description: Parameter is to be understood as being an absolute delta value from the reversing threshold, which specifies the absolute threshold “reversing threshold – hysteresis reversing threshold delta”.

E.g.:

Reversing threshold = 100 rpm

Hysteresis start-stop threshold delta = 25 rpm

Here the lower hysteresis threshold of the reversing threshold is therefore 75 rpm = (100 – 25)

Parameter 0x38: I_Max_treibend_Rechts

Description: Maximum current for the driving clockwise rotation.

Parameter 0x39: I_Max_treibend_Links

Description: Maximum current for the driving counter-clockwise rotation.

Parameter 0x3A: I_Max_bremsend_Rechts

Description: Maximum current for the braking / regenerative clockwise rotation.

Parameter 0x3B: I_Max_bremsend_Links

Description: Maximum current for the braking / regenerative counter-clockwise rotation.

Parameter 0x3C: Hold gain KP_H

Description: The hold gain KP_H is defined as the gain factor for the P controller of the position controller (= holding torque controller).

See also "Parameter 0x1E: Speed controller KP" on page 99.

Parameter 0x3D: PWM / Freq: Lower frequency limit

Description: The lower frequency limit indicates the frequency value at which the normalised X axis sets its zero point. As the PWM / freq. registration module operates from 25 Hz to 15 kHz, the frequency range used by the user very probably lies between. The user can use the lower and upper frequency limits to trim precisely the normalised X axis of the characteristic to their frequency range.

Parameter 0x3E: PWM / Freq: Upper frequency limit

Description: The upper frequency limit indicates the frequency value at which the normalised X axis sets its maximum point (= 1023). As the PWM / freq. registration module operates from 25 Hz to 15 kHz, the frequency range used by the user very probably lies between. The user can use the lower and upper frequency limits to trim precisely the normalised X axis of the characteristic to their frequency range.

Parameter 0x3F: Max. positioning speed

Description: Maximum speed (as amount), with which the position controller (= holding controller) may operate.

Parameter 0x40 + Parameter 0x41: Coasting, cw

Description: Number of angle digits, which are added to a hold (stopping) point if the drive has to stop.

Parameter 0x42 Parameter 0x43: Coasting ccw

Description: Number of angle digits, which are added to a hold (stopping) point if the drive has to stop.

10 Parameter Description

Parameter 0x44 Parameter 0x45: Distance

Description: Relative distance with sign (+/-). Positive distances are travelled in a clockwise direction.

Parameter 0x46 Parameter 0x47: Positive Positioning window

Description: Position digits, which describe the upper end of the positioning window. This value is added to the target position.

Parameter 0x48 Parameter 0x49: Negative Positioning window

Description: Position digits, which describe the lower end of the positioning window. This value is added to the target position.

Parameter 0x4A: U_{ZK} overvoltage threshold

Description: U_{ZK} voltage threshold, which is used for monitoring.

Parameter 0x4B: U_{ZK} undervoltage threshold

Description: U_{ZK} voltage threshold, which is used for monitoring.

Parameter 0x4C: U_{ZK} voltage hysteresis

Description: U_{ZK} voltage threshold hysteresis, which is used for monitoring. This hysteresis is understood to be an absolute delta.

Parameter 0x4D: Ballast chopper switch on threshold

Description: The switch on threshold specifies a U_{ZK} voltage value, at which, when exceeded, the ballast output becomes active. The control of the ballast resistor lowers the U_{ZK} once again.

Parameter 0x4E: Ballast chopper switch off threshold

Description: The switch off threshold specifies a U_{ZK} voltage value, at which, when undershot, the ballast output becomes inactive. The control of the ballast resistor, which lowered the U_{ZK} voltage, is switched off.

10 Parameter Description

Parameter 0x4F: Temperature signal threshold

Description: The temperature signal threshold parameter defines from which temperature value the temperature signal output is activated.

Parameter 0x50: Temperature signal delta hysteresis

Description: The parameter is to be understood as being an absolute delta value, which specifies the absolute threshold “temperature signal threshold – hysteresis temperature signal delta”.

E.g.:

Temperature signal threshold = 70°C

Hysteresis temperature signal delta = 3°C

Here the lower hysteresis threshold of the temperature signal is 67°C = (70 – 3)

Parameter 0x51: Transmission ratio

Description: The transmission ratio factor contains a conversion factor which allows the speed at the transmission output to be deduced.

Parameter 0x52: Bus address

Description: The parameter contains the slave address of the drive. Under this address the drive can be addressed via RS485.

Parameter 0x8001: Current actual speed

Description: The parameter contains the current actual speed. The speed is output in revolutions / minute.

Parameter 0x8002: Current winding current

Description: The parameter contains the current actual current, which is calculated as the vector addition of I_q and I_d.

Parameter 0x8003: Current actual position LoByte

Description: The parameter contains the current actual position.

Parameter 0x8004: Current actual position HiByte

Description: The parameter contains the current actual position.

10 Parameter Description

Parameter 0x8005: Current actual temperature of the printed circuit board

Description: The parameter contains the current actual temperature of the printed circuit board.

Parameter 0x8006: Current electrical current I_d

Description: The parameter contains the current electrical current I_d, which is calculated within the Park / Clark transformation.

Parameter 0x8007: Current electrical current I_q

Description: The parameter contains the current electrical current Iq, which is calculated within the Park / Clark transformation.

Parameter 0x8008 Output OUT 1-OUT 3

Description: The parameter contains the statuses of the outputs in bits 0-3. If the outputs are read out, the software replies with the current statuses of the outputs OUT1-OUT3.

If the output has previously been parameterised to „RS485 controlled“, the software accepts only the output statuses at the respective output, if they are set.

Parameter 0x8009: Inputs IN A / IN B / IN 1 / IN 2

Description: The current statuses of inputs IN A / IN B / IN 1 and IN 2 can be read.

Parameter 0x800D: Analog input IN A1

Description: The digitised value of the analog input „IN A1“ can be read. Only the digitised voltage value is returned, not the interpreted setpoint or actual value.

Parameter 0x800E: Analog input IN A2

Description: The digitised value of the analog input "IN A2" can be read. Only the digitised voltage value is returned, not the interpreted setpoint or actual value.

Parameter 0x800F Analog input NTC
Description: The digitised value of the analog input „NTC“ can be read. Only the digitised voltage value is returned, not the interpreted setpoint or actual value.

10.1 Safety functions

Safety functions protect the drive against permanent damage and partially result in the software switching off the drive (= disables).

Acknowledgement via IN A / IN B control inputs
The acknowledgement can be used to switch drive software back on ready for use, if it had to be disabled beforehand.
The acknowledgement via the IN A / IN B control inputs is only required if the corresponding parameter P06 is set to “manual acknowledgement”.
In the case of automatic acknowledgement the drive is ready to operate and run as soon as no error is set.
As soon as an error is detected the drive disables its output stages.
As long as the errors are set the drive remains disabled and no acknowledgement is accepted.
The acknowledgement made manually is achieved if IN A / IN B = free-wheeling and then a rising flank is detected at control input IN A OR a rising flank is detected at control input IN B.
The manually performed acknowledgement then monitors the IN A / IN B control inputs only if at least one error has occurred.
The manually performed acknowledgement acknowledges all errors that have occurred.
All error categories are defined in the troubleshooting chapter.
The acknowledgement switches the drive ready for operation 10 ms following a successful acknowledgement at the latest.

11 Troubleshooting

This chapter describes possible error messages / malfunctions, causes and remedies. If the error / feedback cannot be corrected by the remedy described, please contact ebm-papst.
For contact details, refer to the back page of this manual.

11.1 Error handling

The error handling should evaluate errors in 5 categories:

1. Error has no consequences for the drive.
   - Ballast diagnostics error
   - Overcurrent at braking chopper
2. Error with consequence „emergency run“ with error speed.
   - PWM setpoint detection detects error
   - Freq setpoint detection detects error
   - RS485 timeout
3. Errors, which lead to short-term shutdown (cycle by cycle) of the power FETs.
   - Absolute U_{zk} overvoltage error (hardware)
   - Absolute overcurrent (hardware)
4. Errors, with the consequence „enable drive“, which are optionally acknowledged automatically.
   - U_{ZK} overvoltage error (software)
   - U_{ZK} undervoltage error (software)
   - Overtemperature error (software)
5. Errors, with the consequence „enable drive“, which must only be acknowledged manually.
   - Hardware error (fault)
   - Permanent absolute U_{zk} overvoltage error (hardware)
   - Permanent absolute overcurrent (hardware)

11 Troubleshooting

11.2 Operation

State	Cause of error	Error in detail	Action
Motor does not respond, not ready	U_{ZK}	Overvoltage	Set
		Undervoltage	Set
	U_{Logic}		Supply with 24 V
	Acknowledgement missing		Acknowledge
	Parameter wrong		Correct
	For operation via RS485: Enable missing		Connect enable
Motor controls to 0, target speed cannot be specified	Setpoint missing		Specify setpoint
	Wrong setpoint selected		Set correctly
	Parameter wrong		Correct
Motor is jerky	Control parameter is unsuitable	Speed controller	Set
		Position controller	Set
	K_FF unsuitable		Set
	U_{ZK} fluctuates		Stabilise
Motor is jerky on switching to hold control	K_FF = 0		Set K_FF
Motor does not position itself	Enable missing		IN A / IN B must be set to 1 / 1
	Kp_H missing		Set
	Max positioning speed = 0		Set
	No distance set		Set or teach mode
Dynamics too weak	Motor overloaded		Buy longer motor
	Ramp too flat		Set steeper
	Current limitation		Open current limitation
Motor switches to free-wheeling on braking	Overvoltage	No brake chopper	Use a regenerative feedback-proof power supply unit
			Use brake resistor
		Braking chopper too weak	5 IN A must be able to flow. 24 V: 5 ohm 48 V: 10 ohm

11 Troubleshooting

11.3 Parameterisation

Command	Feedback	Plain text	Action
Set parameter	Status 0x02	Checksum or telegram length wrong	Calculate checksum correctly, see manual
	Status 0x10	Access key wrong	Use correct access key
		Access to provider parameters with customer PW	As customer, no possibility of accessing it
	Status 0x20	Parameter conflict	Not an error, information! But must be corrected. Notification of conflicting parameters.
	Status 0x28	Telegram can now not be processed.	Motor active on access to parameters of the memory class "appl-func" Remedy: IN A / IN B = 0 / 0
Read Parameter	Status 0x30	Access key wrong	Use correct access key
Store parameters	Status 0x10	Access key wrong	Use correct access key
	Status 0x20	No parameters changed since last save	Not an error, parameters in the ROM are up-to-date.
	Status 0x80	Data is inconsistent	Remove the conflict between the parameters
Read status	0x80 0x00	Ready	Everything is ok
	0x82 0x00	Ready and active	Everything is ok
	0x00 0x00	Calibration run missing	Perform calibration run

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