

# Technical Manual

22xx...BX4 CSD/CCD/COD

32xx...BX4 CS/CC/CO

3564...B CS/CC/CO

## Imprint

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from improper use of the equipment.

The relevant regulations regarding safety engineering  
and interference suppression as well as the requirements  
specified in this document are to be noted and followed  
when using the software.

Subject to change without notice.

The respective current version of this technical manual is  
available on FAULHABER's internet site:  
[www.faulhaber.com](http://www.faulhaber.com)

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## About this document

# 1 About this document

## 1.1 Validity of this document

This document describes the installation and use of the following series:

- 22xx...BX4 CSD/CCD/COD
- 32xx...BX4 CS/CC/CO
- 3564...B CS/CC/CO

This document is intended for use by trained experts authorised to perform installation and electrical connection of the product.

All data in this document relate to the standard versions of the series listed above. Changes relating to customer-specific versions can be found in the data sheet.

## 1.2 Associated documents

For certain actions during commissioning and operation of FAULHABER products additional information from the following manuals is useful:

Manual	Description
Communications manual	Interface description – RS232
Communications manual	Interface description – CANopen with FAULHABER channel
Communications manual	Interface description – CANopen CiA 402
Software manual	Operating instructions for FAULHABER Motion Manager PC software

These manuals can be downloaded in PDF format from the Internet page [www.faulhaber.com/manuals/](http://www.faulhaber.com/manuals/).

## 1.3 Using this document

- ▶ Read the document carefully before undertaking configuration, in particular chapter "Safety".
- ▶ Retain the document throughout the entire working life of the product.
- ▶ Keep the document accessible to the operating and, if necessary, maintenance personnel at all times.
- ▶ Pass the document on to any subsequent owner or user of the product.

## About this document

### 1.4 List of abbreviations

Abbreviation	Meaning
AnIn	Analogue Input
AGND	Analogue Ground
CAN	Controller Area Network
CAN_L	CAN-Low
CAN_H	CAN-High
CC CCD	Controller with CANopen interface (Faulhaber channel)
CO COD	Controller with CANopen interface acc. to CiA 402
CS CSD	Controller with serial RS232 interface
DigIn	Digital input
DigOut	Digital output
EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
FAULT	Fault output
GND	Ground
PLC	Programmable Logic Controller
PWM	Pulse Width Modulation
RxD	Receive data
TTL	Transistor Transistor Logic
TxD	Transmit data

## About this document

### 1.5 Symbols and designations



#### **CAUTION!**

Hazards to persons. Disregard may lead to minor injuries.

- ▶ Measures for avoidance



#### **CAUTION!**

Hazards due to hot surfaces. Disregard may lead to burns.

- ▶ Measures for avoidance



#### **NOTICE!**

Risk of damage.

- ▶ Measures for avoidance



Instructions for understanding or optimising the operational procedures

- ✓ Pre-requirement for a requested action

1. First step for a requested action

- ↪ Result of a step

2. Second step of a requested action

- ↪ Result of an action

- ▶ Request for a single-step action

## 2 Safety

### 2.1 Intended use

The motors described here are designed for applications in decentralised systems used in automation technology and in pick-and-place machines and machine tools. The following points must be observed to ensure that the motors are used as intended:

- Handle the motors in accordance with the ESD regulations.
- Do **not** use the motors in environments where it will come into contact with water, chemicals and/or dust, **nor** in explosion hazard areas.
- Always operate the motors within the limits specified in the data sheet.
- Please ask the manufacturer for information about individual use under special environmental conditions.

### 2.2 Safety instructions



#### NOTICE!

**Electrostatic discharges can damage the electronics.**

- ▶ Wear conductive work clothes.
- ▶ Wear an earthed wristband.



#### NOTICE!

**Penetration of foreign objects can damage the electronics.**

- ▶ Do not open the housing.



#### NOTICE!

**Connection and disconnection of cables while the supply voltage is still being applied at the device can damage the electronics.**

- ▶ Do not connect or disconnect cables while the supply voltage is still being applied at the device.



#### NOTICE!

**Exposure of the motors to mechanical shock will damage the bearings and reduce the service life of the motor.**

- ▶ Do not exceed the shock and vibrational loads defined in DIN EN 60068-2-27 and DIN EN 60068-2-6.

### 2.3 Environmental conditions

- ▶ Select the installation location so that clean dry air is available for cooling the motor.
- ▶ Select the installation location so that the air has unobstructed access to flow around the drive.
- ▶ When installed within housings and cabinets take particular care to ensure adequate cooling of the motor.
- ▶ Select a supply voltage that is within the defined tolerance range.
- ▶ Protect the motor against heavy deposits of dust, in particular metal dust and chemical pollutants.
- ▶ Protect the motor against humidity and wet.

### 2.4 EC directives on product safety

- ▶ The following EC directives on product safety must be observed.
- ▶ If the Motion Control Systems are being used outside the EU, international, national and regional directives must be also observed.

#### **Machinery Directive (2006/42/EC)**

Because of their small size, no serious threats to life or physical condition can normally be expected from electric miniature drives. Therefore the Machinery Directive does not apply to our products. The products described here are not "incomplete machines". Therefore installation instructions are not normally issued by FAULHABER.

#### **Low Voltage Directive (2014/35/EU)**

The Low Voltage Directive applies for all electrical equipment with a nominal voltage of 75 to 1500 V DC and 50 to 1000 V AC. The products described in this device manual do not fall within the scope of this directive, since they are intended for lower voltages.

#### **EMC Directive (2014/30/EU)**

The directive concerning electromagnetic compatibility (EMC) applies to all electrical and electronic devices, installations and systems sold to an end user. In addition, CE marking can be undertaken for built-in components according to the EMC Directive. Conformity with the directive is documented in the Declaration of Conformity.



## Product description

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### 3 Product description

#### 3.1 General product description

The drive systems integrate a brushless DC servomotor, a high-resolution actual value encoder and a Motion Controller in a compact, complete drive unit.


The motor commutation is achieved electronically so that the service life of a FAULHABER Motion Control Systems depends mainly on the service life of the motor bearings. FAULHABER uses high-precision, preloaded ball bearings in all of its systems with integrated Motion Controller. The following factors influence the service life of the bearings:

- Static, dynamic, axial and radial bearing loads
- Thermal environmental conditions
- Speed
- Vibrational and shock loads
- Level of precision to which the shaft is coupled to the given application

For highly dynamic servo applications requiring very high torque in the most compact dimensions, the integrated FAULHABER BX4 Series 4-pin DC-Servomotors are recommended. They have the following features:

- Robust design with just a few components
- Adhesive-free construction
- Long service life
- Ideal for hostile ambient conditions (e.g. extreme temperatures and high vibrational and shock loads)

Thanks to their robust construction and their compact design, the FAULHABER Motion Control Systems of the V2.5 generation are perfectly suited for use in automation applications.

 As an option, the motor and control electronics can be supplied with power separately (important for safety-relevant applications). In this case, the 3rd input is no longer available.

Depending on the drive, additional programming adapters and connection aids are available.

Special preconfiguration of the modes and parameters is possible on request.

## Product description

### 3.2 Product information

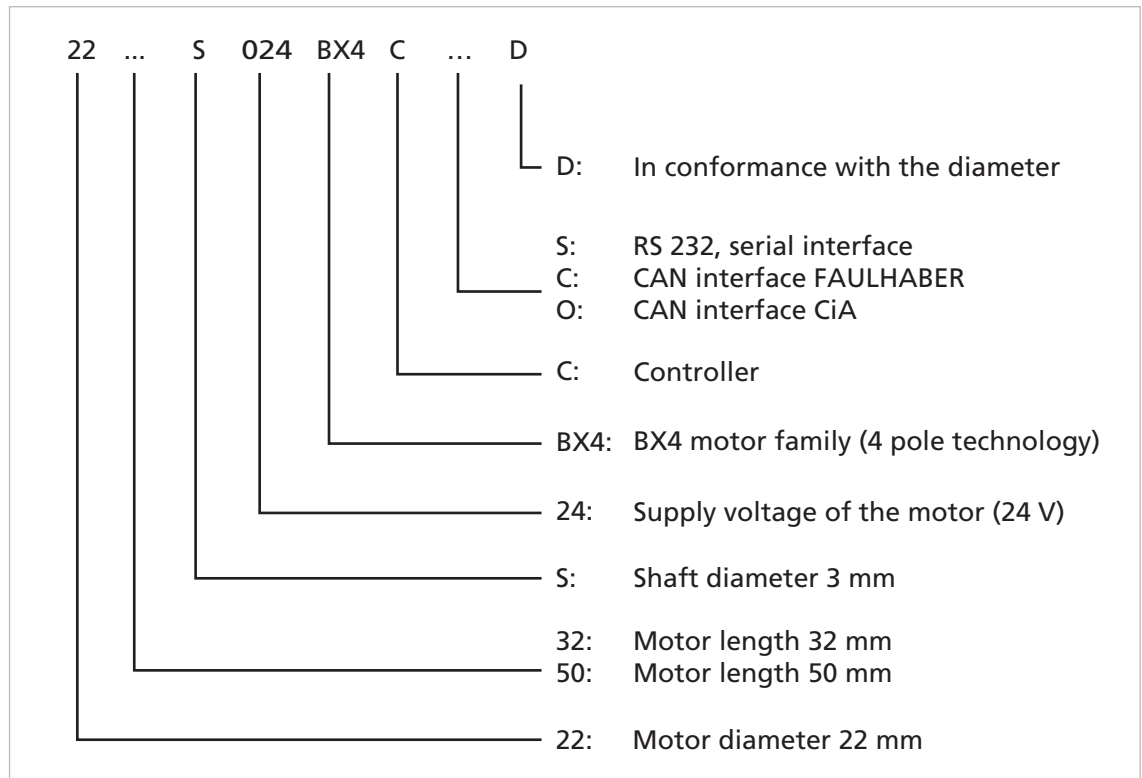


Fig. 1: Designation key for motor series 22xx

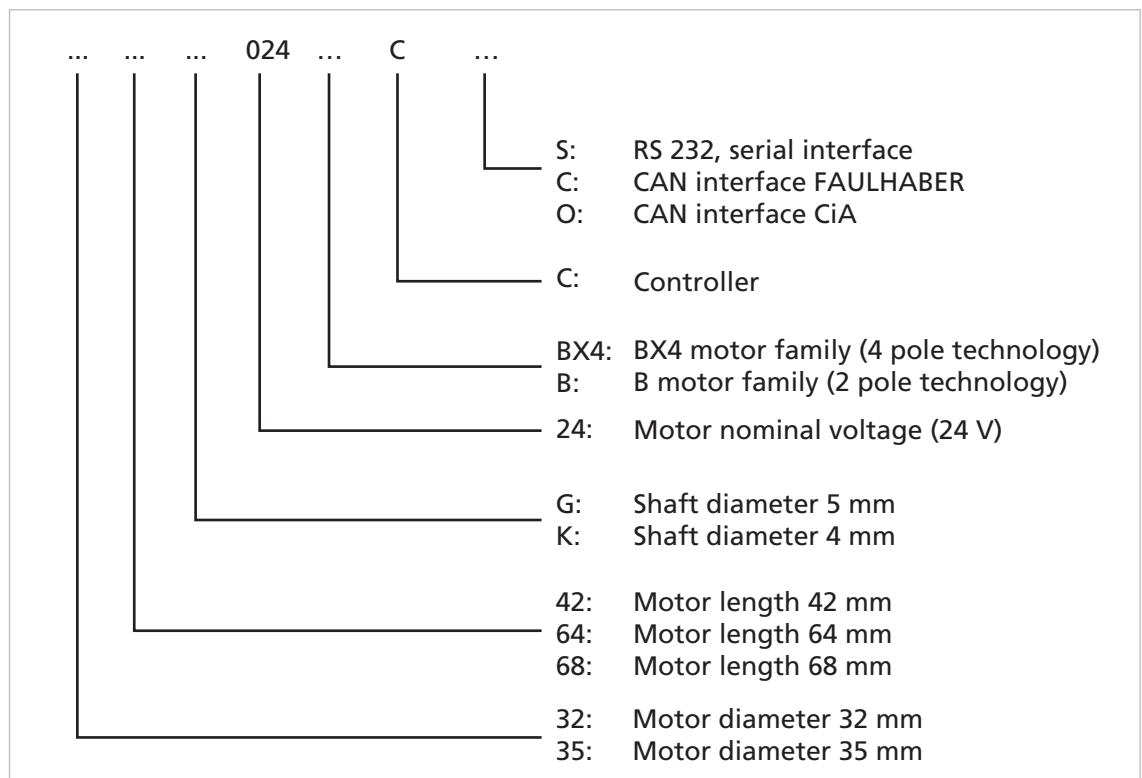


Fig. 2: Designation key for motor series 32xx and 3564

## Product description

### 3.3 Product variants

Tab. 1: Product variants – Motion Control Systems

Motor series	Sensors	Speed range (rpm) <sup>a)</sup>	Supply voltage Electronics/motor (V DC) <sup>b)</sup>	Peak current (A) <sup>c)</sup>
2232...BX4 CxD	Analogue Hall	5...8 000	8...30	3
2250...BX4 CxD	Analogue Hall	5...7 000	8...30	3
3242...BX4 Cx	Analogue Hall	5...6 500	12...30	5
3268...BX4 Cx	Analogue Hall	5...6 500	12...30	8
3564...B Cx	Analogue Hall	5...12 000	12...30	8

a) Speed range depends on the supply voltage.

b) As an option, the motor and control electronics can be provided with separate power supplies, e.g. for safety-relevant applications (special number 2993). In this case, the 3rd input for digital signals is no longer available.

c) Depending on the cooling factor, operating point and ambient temperature, the current limitation parameter can be adapted using the FAULHABER Motion Manager. The specified values apply in the case of 22 °C ambient temperature and max. 60 °C motor temperature and the nominal voltage for motor and electronics.

## Installation

### 4 Installation

- ▶ This description must be carefully read and observed before commissioning.
- ▶ Observe the environmental conditions (see chap. 2.3, p. 8).

Only trained experts and instructed persons with knowledge of the following fields may install and commission the motors with integrated Speed Controller:

- Automation technology
- Standards and regulations (such as the EMC Directive)
- Low Voltage Directive
- Machinery Directive
- VDE regulations (DIN VDE 0100)
- Accident prevention regulations

#### 4.1 Mounting

##### 4.1.1 Mounting instructions



##### **CAUTION!**

The motor can become very hot during operation.

- ▶ Place a guard against contact and warning notice in the immediate proximity of the motor.
- ▶ Ensure that adequate heat dissipation is provided.



##### **NOTICE!**

Installation and connection of the motor when the power supply is applied can damage the device.

- ▶ Prior to all aspects of installation and connection work on the motor, switch off the power supply.



##### **NOTICE!**

The motor can be damaged if mounted incorrectly.

- ▶ Observe the maximum screw-in depth of the fastening screws (see Tab. 2).



##### **NOTICE!**

Excessive loads on the motor shaft can cause irreparable damage to the motor.

- ▶ When attaching parts to the motor shaft, observe the maximum permissible load values (see the product data sheet) of the shaft.



##### **NOTICE!**

Excessive radial loads on the servomotor or excessively tightened fastening screws can cause irreparable damage to the mounting flange.

- ▶ Observe the maximum permissible radial load on the motor (see Tab. 2).
- ▶ Make sure that the screws are tightened in accordance with Tab. 2.

## Installation

### 4.1.2 Mounting the motor

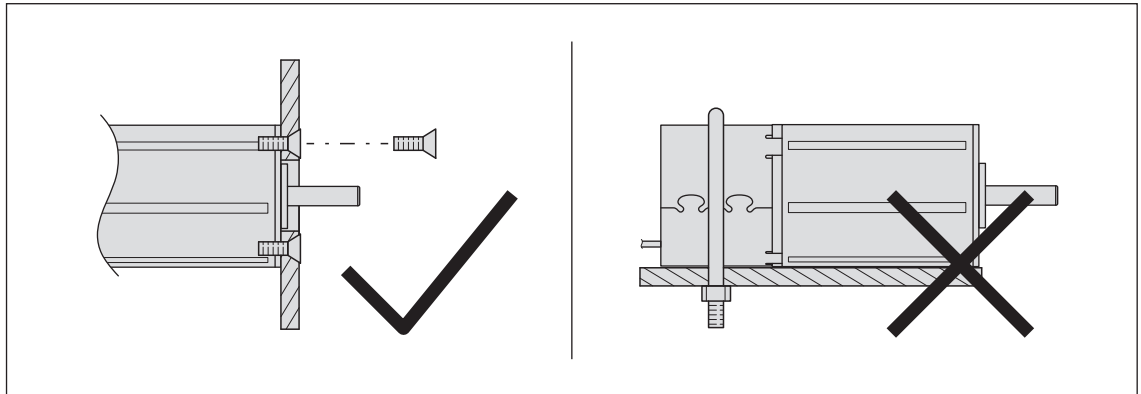



Fig. 3: Mounting example – 22xxBX4 CxD series

1. Secure the front flange of the motor to a suitable surface using fastening screws (for the screw size and torque, see Tab. 2).
2. Protect the fastening screws to prevent displacement due to the effect of heat.
3. If necessary, attach parts to the motor shaft.

 Information on the used flange can be found in the product data sheet.

Tab. 2: Attachment specifications

Motor series	Screw type	Thread depth (mm)	Max. tightening torque (Ncm)	Radial motor load, max. (N)
22xx...BX4 CxD	M2	3.0	50	30
32xx...BX4 Cx	M3	4.0	50	30
3564...B Cx	M2	5.0	50	30

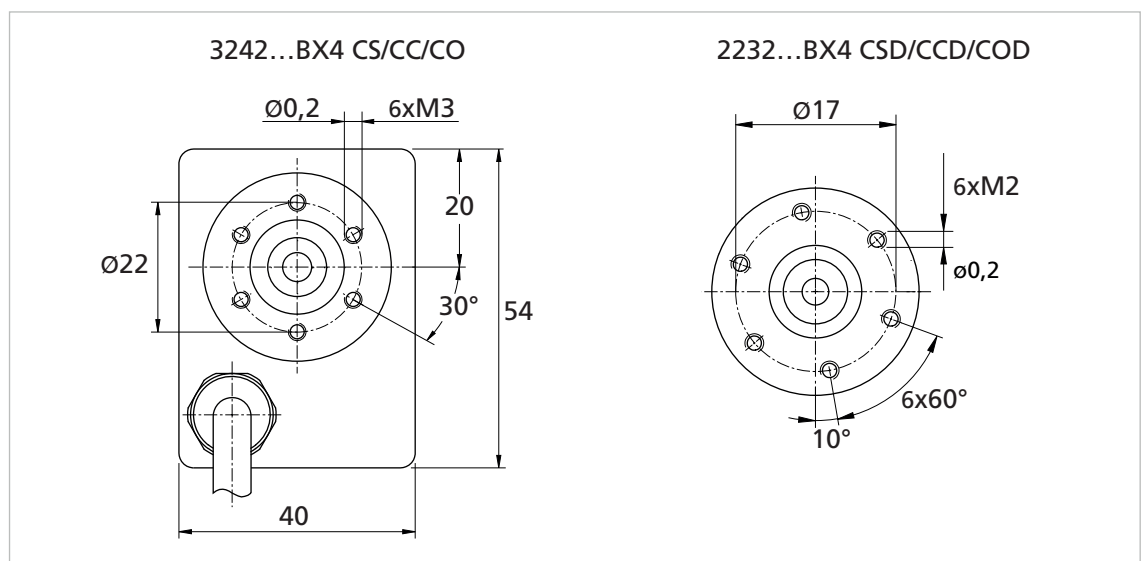


Fig. 4: Flange details (examples)

## Installation

### 4.2 Electrical connection

#### 4.2.1 Notes on the electrical connection



##### NOTICE!

Electrostatic discharges to the motor connections can damage the electronic components

- ▶ Observe the ESD protective measures.
- ▶ Carry out work only at ESD-protected workstations.
- ▶ Connect the connections as per the pin assignment (see chap. 4.2.3.1, p. 17)



##### NOTICE!

**Risk of damage caused by back-induced voltage.**

If the motor shaft is driven externally, the motor acts as a generator. The generated voltage can damage the electronics of the motor. The generated DC voltage ( $U_B$ ) corresponds to the product of speed ( $n$ ) and electromotive force constant ( $k_n$ ).

- ▶ Connect the electronics supply of the motor to a power supply unit during installation or connect the  $U_B$  and GND connections to each other.
- ▶ Do not drive the motor above the specified maximum and nominal speed, even if a gearhead is used.
- ▶ Use an EMC suppressor circuit (see chap. 4.2.2.2, p. 16).



##### NOTICE!

**Extreme static or dynamic loads on the connection cable can cause the cable to be damaged.**

- ▶ Make sure that the connection cable is not subjected to abrasion, crushing or excessively tight bending radii during installation and operation.
- ▶ Do not bend the cable at temperatures  $< -10^\circ\text{C}$ .
- ▶ Observe the permissible loads (see Tab. 3).

Tab. 3: Permissible loads of the connection cables

Motor series	Cable type	Permissible loads
22xx...BX4 CxD	1.27 AWG26 Ribbon cable	Maximum tensile load: 30 N Continuous tensile load: $<17\text{ N}$ Bending radius with repeated installation: $>10\text{ mm}$ Bending radius with one-off installation: $>1.2\text{ mm}$
32xx...BX4 Cx	8-wire AWG24 Round cable	Maximum tensile load: 50 N Continuous tensile load: $<25\text{ N}$ Bending radius with repeated installation: $>15\text{ mm}^{\text{a)}$ Bending radius with one-off installation: $>15\text{ mm}^{\text{a)}$
3564...B Cx	8-wire AWG24 Round cable	Maximum tensile load: 50 N Continuous tensile load: $<25\text{ N}$ Bending radius with repeated installation: $>15\text{ mm}^{\text{a)}$ Bending radius with one-off installation: $>15\text{ mm}^{\text{a)}$

a) Special version (e.g. for drag chain operation) on request

## Installation

### 4.2.2 Electrical connection of motor

#### 4.2.2.1 Connection of supply



##### NOTICE!

**Risk of damage caused by inadequately dimensioned power supply unit.**

Using an inadequately dimensioned power supply unit can result in malfunctions.

▶ Make sure that the power supply unit is adequately dimensioned.

✓ The connection cables are <3 m

1. Take the appropriate EMC protective measures (see chap. 4.2.2.2, p. 16).
2. Take the appropriate ESD protective measures.
3. Connect the ribbon cable and round cable as per the pin assignment (see chap. 4.2.3.1, p. 17).
4. Connect the power supply as described in the explanation below.

There are 2 options for supplying power to the motor and the FAULHABER Motion Controller:

##### Power supply with common electronics supply

In the case of power supply with common electronics supply, the controller and motor are switched off simultaneously if a fault occurs. After interruption of the power supply, the reference run must be performed again.

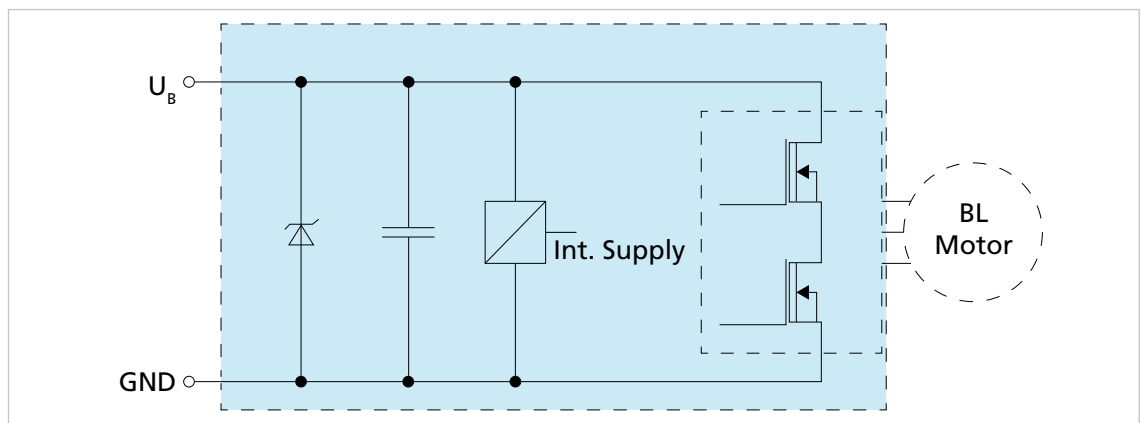


Fig. 5: Circuit diagram – common electronics supply

##### Power supply with separate electronics supply

In the case of power supply with separate electronics supply, the motor supply can be switched off (e.g. by means of a safety relay) in the event of a fault while the controller continues to be supplied. As a result, the reference run does not need to be performed again after a fault because the sensor supply of the motor was maintained during the fault. In the case of a separate electronics supply, power is supplied using the connection 3. In /  $U_{EL}$  in addition to the connection  $U_B$ . Motion Controllers with a separate electronics supply do not therefore have a third digital input.

## Installation

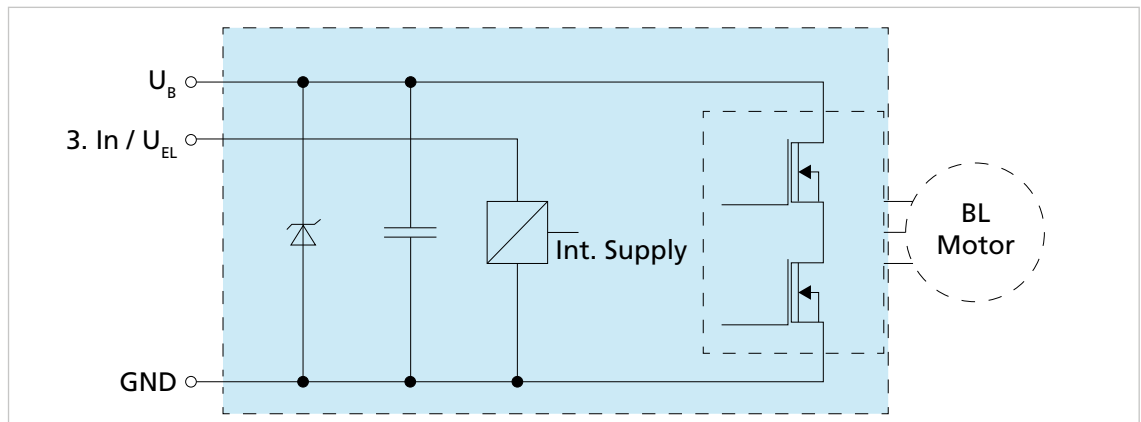


Fig. 6: Circuit diagram – separate electronics supply

### 4.2.2.2 EMC protective measures

**i** To provide the required interference resistance in industrial applications, it may be necessary to use an EMC filter or a screen and an EMC suppressor circuit.

To reduce the effects on the DC power supply network, L1 ferrite sleeves (such as WE 742 700 790) can be used on the supply cables.

To protect against overvoltage on the supply side (surge), it is recommended to additionally connect an external diode D1 (e. g. NTE 4934, 1500 W).

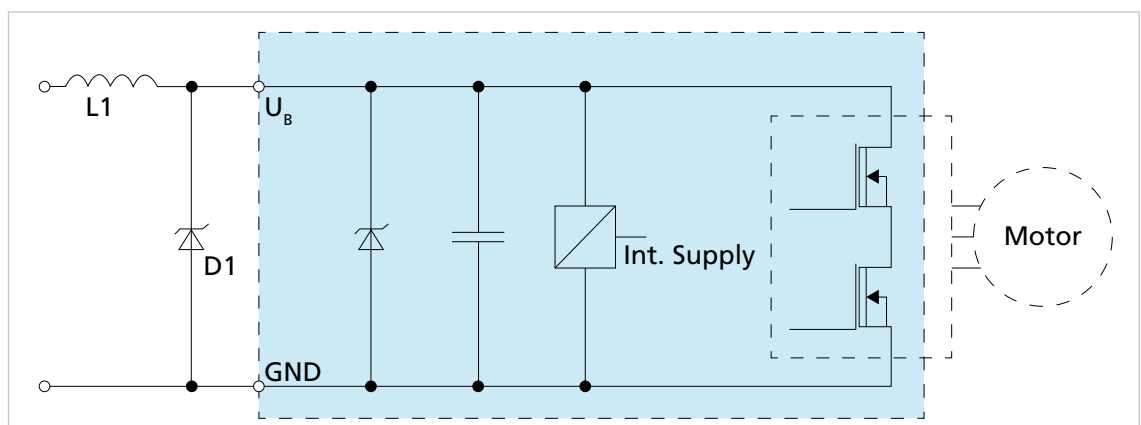


Fig. 7: EMC suppressor circuit

### **!** NOTICE!

**Risk of damage caused by EMC interaction in the case of separate electronics supply**

- ▶ In the case of a separate electronics supply, EMC protective measures must be taken for both supply connections.

**i** In the case of a separate electronics supply (see Fig. 6), the suppressor circuit (see Fig. 7) must be such that it protects both supply connections.



## Installation

### 4.2.3 Supply connections

#### 4.2.3.1 Pin assignment



#### NOTICE!

Incorrect polarity can cause irreparable damage to the electronics

- ▶ Connect the motor in accordance with the pin assignment.

#### 22xx...BX4 CxD



The signal level of the digital inputs can be reconfigured to TTL via the interface.

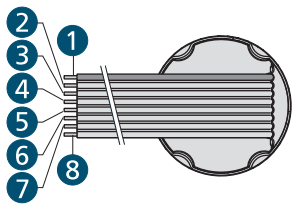
- Standard (PLC): low 0...4.5 V / high 12.5 V... $U_B$
- TTL: low 0...0.5 V / high 2.5 V... $U_B$



The following controller parameters are preset:

- Sampling rate: 200  $\mu$ s
- Resolution of internal encoders: 3,000 lines per revolution

Tab. 4: Pin assignment of ribbon cable 22xx...BX4 CxD

	Wire	Designation	Meaning
	1 <sup>a)</sup>	3. In	3rd input, optional electronics supply $U_{EL}$
	2	$U_B$	Supply voltage
	3	GND	Common ground
	4	AnIn	Analogue input
	5	AGND	Analogue GND
	6	FAULT	Fault output
	7	RxD/CAN-L	RS232 RxD/CAN-Low
	8	TxD/CAN-H	RS232 TxD/CAN-High

a) Wire 1 is highlighted in a different colour

Tab. 5: Electrical data for 22xx...BX4 CSD/CCD/COD

Wire	Designation	Value
1 (3. In)	Digital input	Input resistance $R_{in} = 22 \text{ k}\Omega$
	Supply voltage of the electronics <sup>a)</sup>	8...30 V DC
2 ( $U_B$ )	Supply voltage	8...30 V DC
3 (GND)	Ground	Ground reference $U_B$
4 (AnIn)	Analogue input for speed set value	Voltage signal $\pm 10 \text{ V}$
	PWM input for speed set value	Frequency range 100...2,000 Hz Duty cycle 50%: 0 rpm
	Digital input	Input resistance 5 k $\Omega$ / 24 V
	External encoder (CH A)	$f_{max} = 400 \text{ kHz}$
	Input for step frequency	$f_{max} = 400 \text{ kHz}$
5 (AGND)	Ground reference AnIn	
	External encoder (CH B)	$f_{max} = 400 \text{ kHz}$

## Installation

Wire	Designation	Value
6 (FAULT)	Fault output	No fault → switched through to GND
	Digital output	Open collector, max. $U_B$ / 30 mA
	Digital input	Input resistance $R_{in} = 100\text{ k}\Omega$
7 (RxD/CAN-L) <sup>b)</sup>	Communication	RS232 RxD/CAN-L
8 (TxD/CAN-H) <sup>b)</sup>	Communication	RS232 TxD/CAN-H

a) special number 2993

b) Wiring depends on the selected product CSD/CCD/COD

### 32xx...BX4 Cx and 3564...B Cx

**i** The signal level of the digital inputs can be reconfigured to TTL via the interface.

- Standard (PLC): low 0...7.0 V / high 12.5 V... $U_B$
- TTL: low 0...0.5 V / high 3.5 V... $U_B$

**i** The following controller parameters are preset:

- Sampling rate: 200  $\mu\text{s}$
- Resolution of internal encoders: 3,000 lines per revolution

Tab. 6: Pin assignment of round cable 32xx...BX4 CS/CC/CO and 3564...B CS/CC/CO

Colour	Designation	Meaning
Red	3. In	3rd input, optional electronics supply $U_{EL}$
Pink	$U_B$	Supply voltage
Blue	GND	Common ground
Brown	AnIn	Analogue input
Grey	AGND	Analogue GND
White	FAULT	Fault output
Yellow	RxD/CAN-L	RS232 RxD/CAN-Low
Green	TxD/CAN-H	RS232 TxD/CAN-High

Tab. 7: Electrical data for 32xx...BX4 CS/CC/CO and 3564...B CS/CC/CO

Wire	Designation	Value
Red (3.In)	Digital input	Input resistance $R_{in} = 22\text{ k}\Omega$
	Supply voltage of the electronics <sup>a)</sup>	12...30 V DC
Pink ( $U_B$ )	Supply voltage	12...30 V DC
Blue (GND)	Ground	Ground reference $U_B$
Brown (AnIn)	Analogue input for speed set value	Voltage signal $\pm 10\text{ V}$
	PWM input for speed set value	Frequency range 100...2,000 Hz Duty cycle 50%: 0 rpm
	Digital input	Input resistance 5 k $\Omega$ / 24 V
	External encoder (CH A)	$f_{max} = 400\text{ kHz}$
	Input for step frequency	$f_{max} = 400\text{ kHz}$
	Ground reference AnIn	
Grey (AGND)	External encoder (CH B)	$f_{max} = 400\text{ kHz}$

## Installation

Wire	Designation	Value
White (FAULT)	Fault output	No fault → switched through to GND
	Digital output	Open collector, max. $U_B / 30 \text{ mA}$
	Digital input	Input resistance $R_{in} = 100 \text{ k}\Omega$
Yellow (RxD/CAN-L) <sup>b)</sup>	Communication	RS232 RxD/CAN-L
Green (TxD/CAN-H) <sup>b)</sup>	Communication	RS232 TxD/CAN-H

a) special number 2993

b) Wiring depends on the selected product CS/CC/CO

### 4.2.3.2 I/O circuit diagrams

#### Analogue input internal circuit

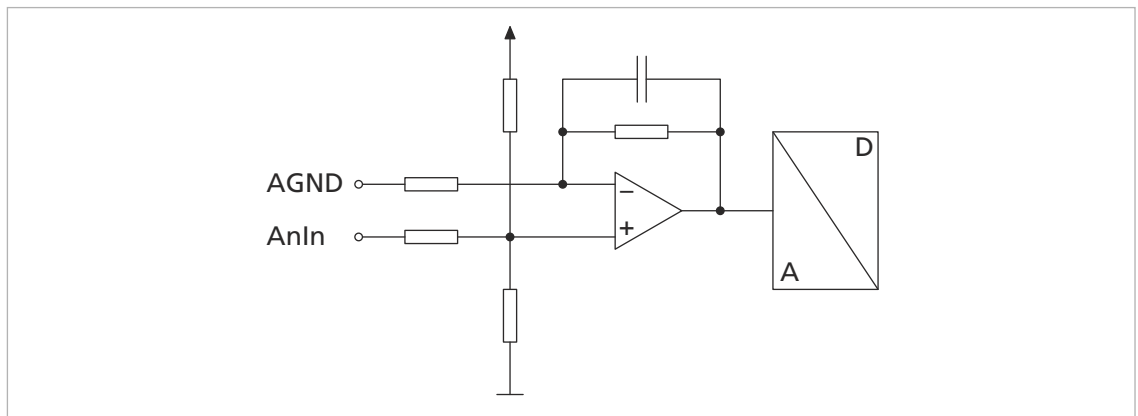


Fig. 8: Analogue input circuit diagram (internal)



Evaluation of the analogue input (AnIn) is done by determining the difference relative to AGND.

- AGND must be connected to ensure safe operation.
- If AGND is switched directly to GND, the resulting signal can change if the voltage on the ground cable (GND) drops under load.
- Connect AGND directly to the reference point of the set value source.
- Connect ground of the voltage source (GND).

Depending on the selected option and configuration, the analogue input can have the following functions:

- Speed set value specification via analogue voltage
- Speed set value specification via PWM signal
- Current limitation value via analogue voltage
- Specification of the set position via analogue voltage
- Digital input for reference and limit switches
- Connection for an external pulse encoder

## Installation

### Internal circuit – 3rd input

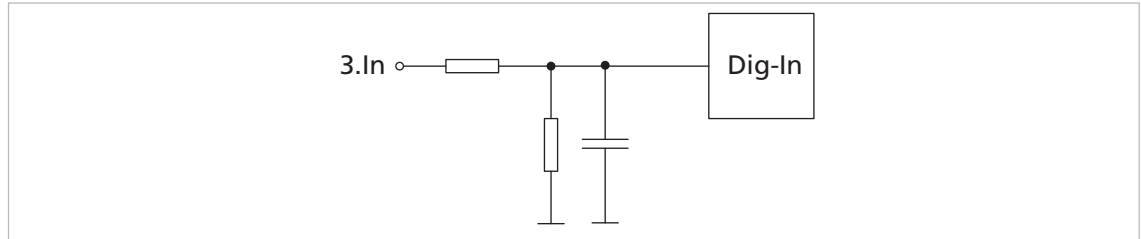


Fig. 9: Internal circuit – 3rd input

The input level of the digital input (3.In) can be switched (PLC/TTL). The digital input (3. In) can have the following functions:

- Digital input for reference and limit switches
- Input for the electronics voltage supply in the case of motor versions with separate electronics supply

### Internal circuit – fault (Dig I/O)

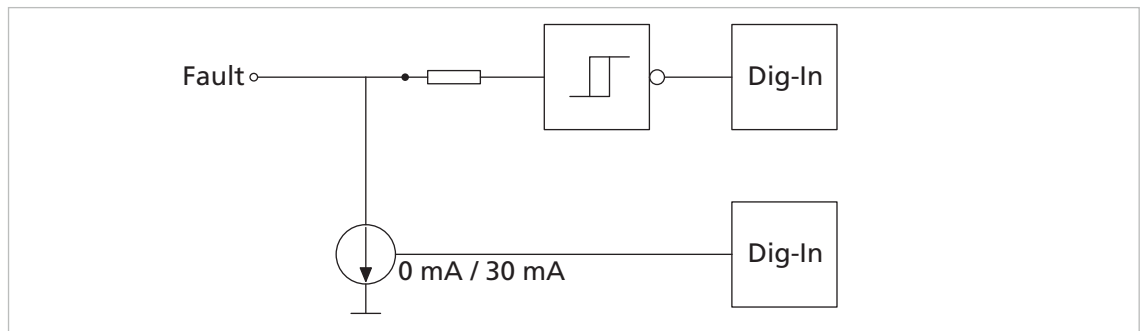


Fig. 10: Internal circuit – fault (Dig I/O)



### NOTICE!

#### Damage to electronics

The electronics of the fault connection can be damaged in the following cases:

Fault output is not configured as an input and a voltage is being applied to the fault output. Voltage applied at the fault output is greater than the supply voltage of the Motion Controller.

Voltage supply of the sensors is active while the voltage supply of the Motion Controller is inactive.

- ▶ Check the settings of the fault output before applying a voltage.
- ▶ Match the supply voltage of the sensors and of the Motion Controller to each other. The supply voltage of the sensors must not be greater than the supply voltage of the Motion Controller.



Recommendation: If the fault output is used as an input, connect an external resistor (1 kΩ/0.25 W) in series.

The fault output is factory-configured as an output. Before being wired as an input, the FAULT pin must be configured accordingly (see Communications Manual).

## Installation

The fault output has the following features:

- Open collector switch to ground
- Output resistance in open state (high level): 100 k $\Omega$
- Switch opens in the event of a fault (high level)
- Output current limited to approx. 30 mA. The voltage in the open state must not exceed the supply voltage (maximum  $U_B$ ).
- Short-circuit-proof

The fault output can be configured for the following functions:

- Pulse output
- Digital output (freely programmable)
- Reference input or digital input
- Rotation direction input

### 4.2.3.3 Connection examples: 22xx...BX4 motor series

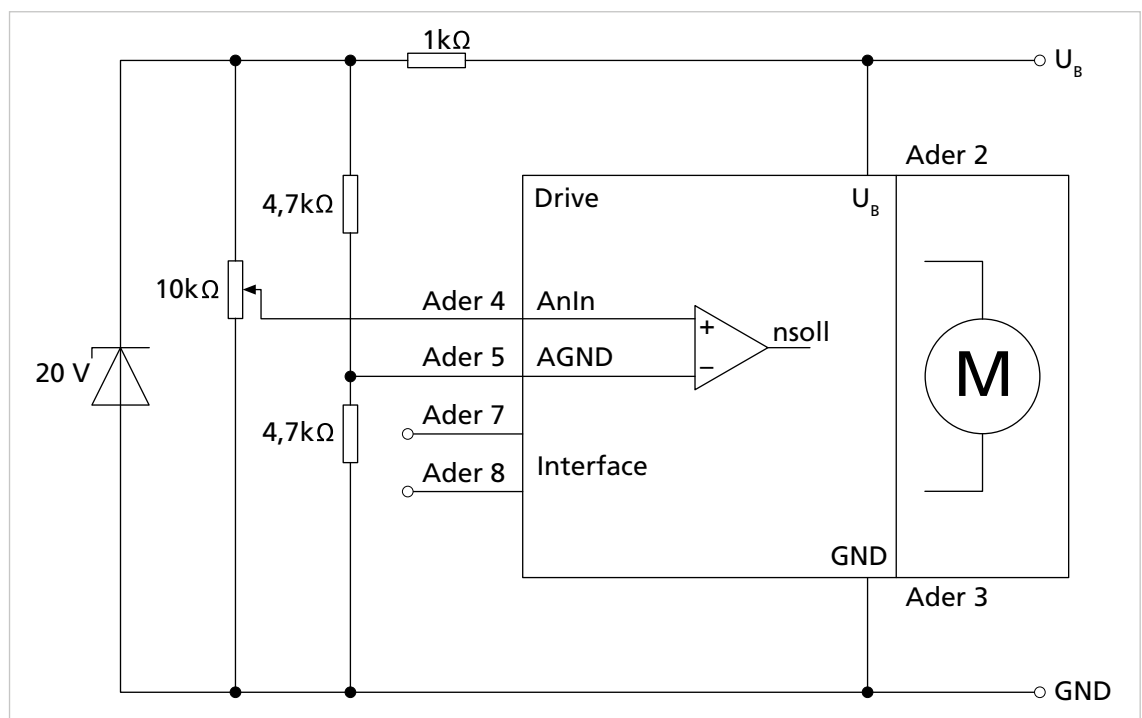


Fig. 11: Connection example of bipolar analogue set value specification via potentiometer (22xx...BX4)

## Installation

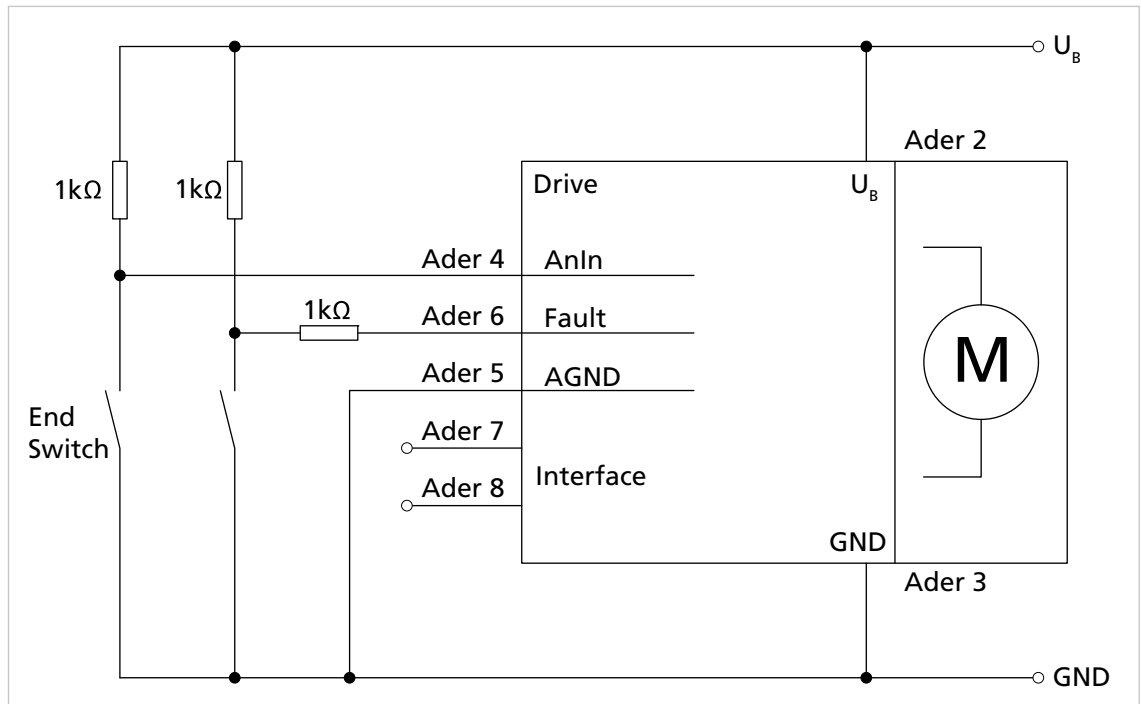


Fig. 12: Connection example: reference and limit switches (22xx...BX4)

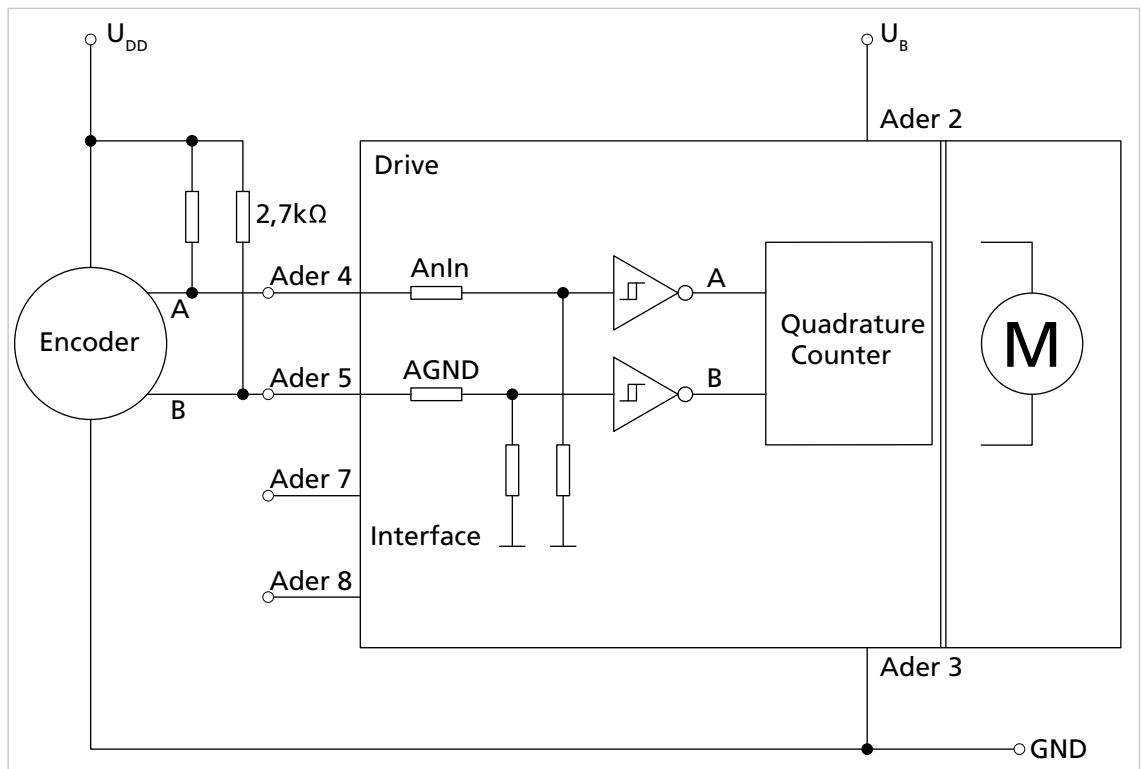


Fig. 13: Connection example: external encoder (22xx...BX4)

**i** Depending on the type of encoder it may be necessary to use external pull-up resistors. No pull-up resistors are required for FAULHABER IE2, IE3 and IER3 encoders.

## Installation

### 4.2.3.4 Connection examples: 32xx...BX4 motor series

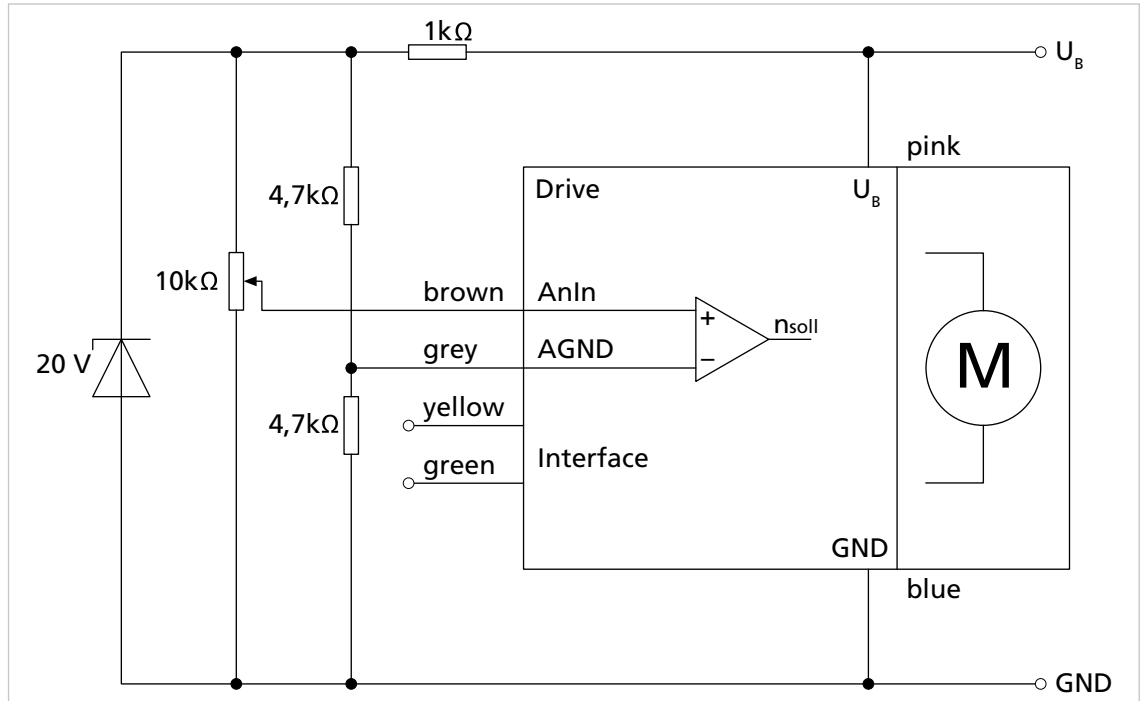


Fig. 14: Connection example of bipolar analogue set value specification via potentiometer (32xx...BX4)

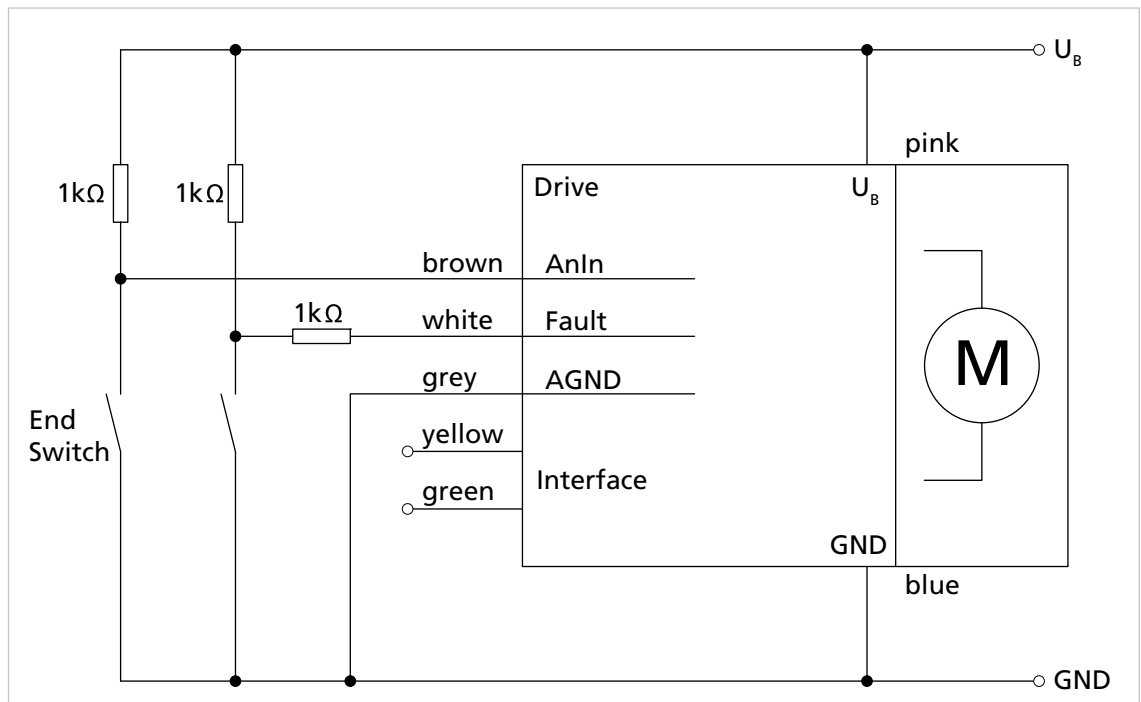


Fig. 15: Connection example: reference and limit switches (32xx...BX4)

## Installation

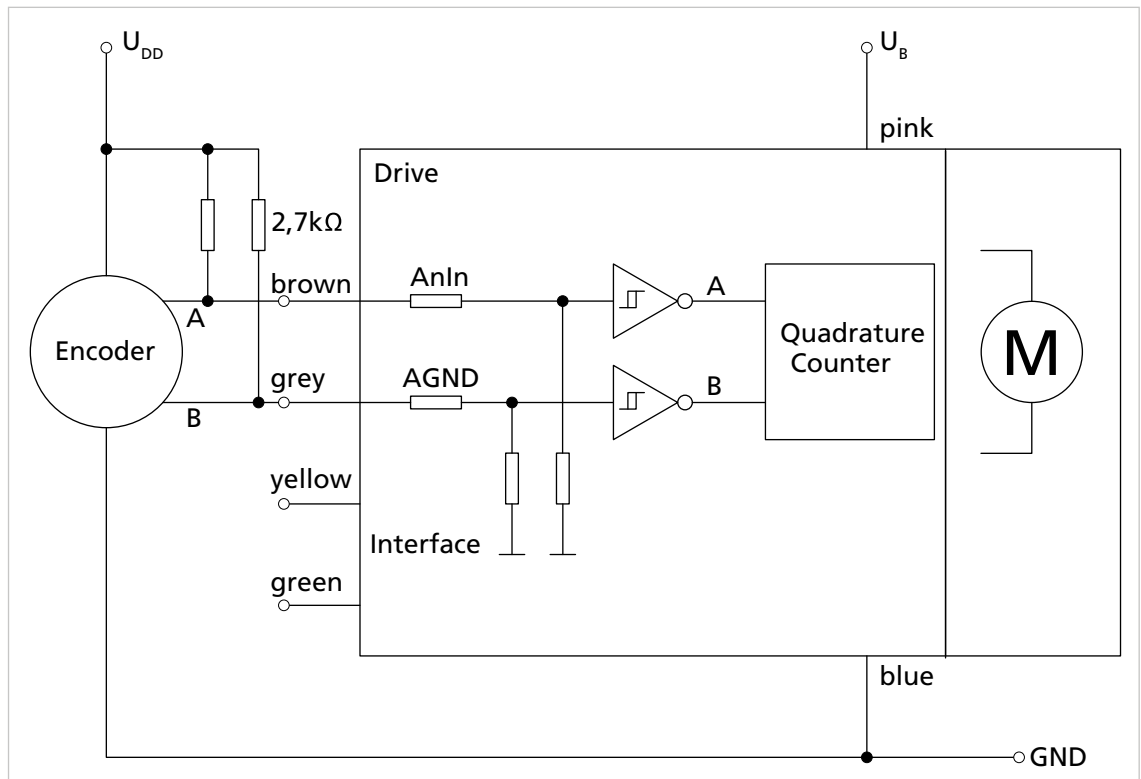


Fig. 16: Connection example: external encoder (32xx...BX4)

### 4.2.3.5 Connection examples: communication

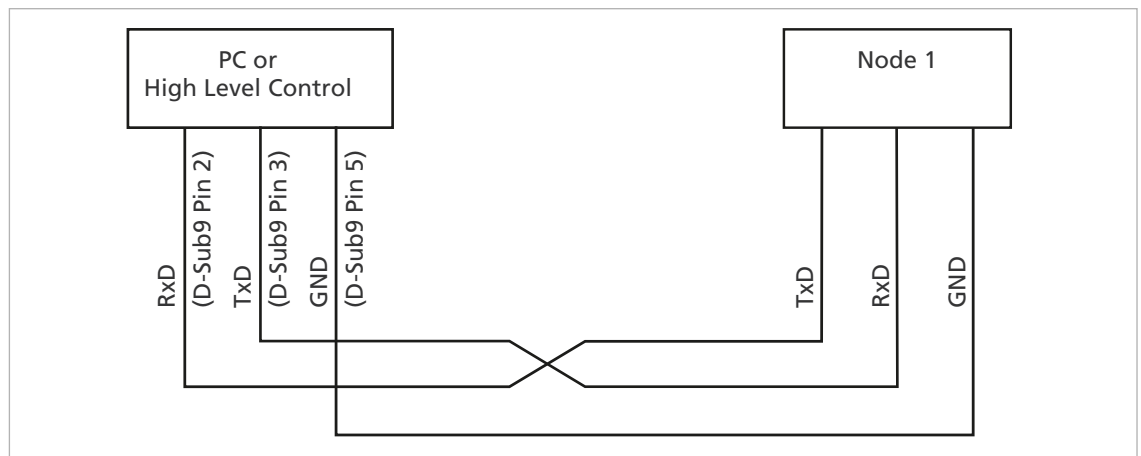


Fig. 17: Wiring between PC/controller and a drive



## Installation

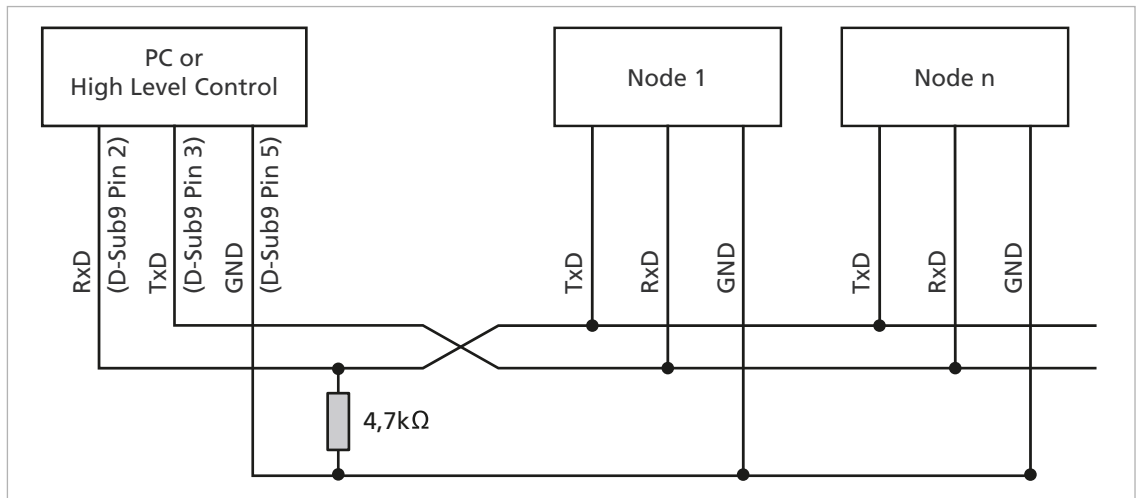


Fig. 18: Wiring with several Motion Control Systems in RS232 network operation

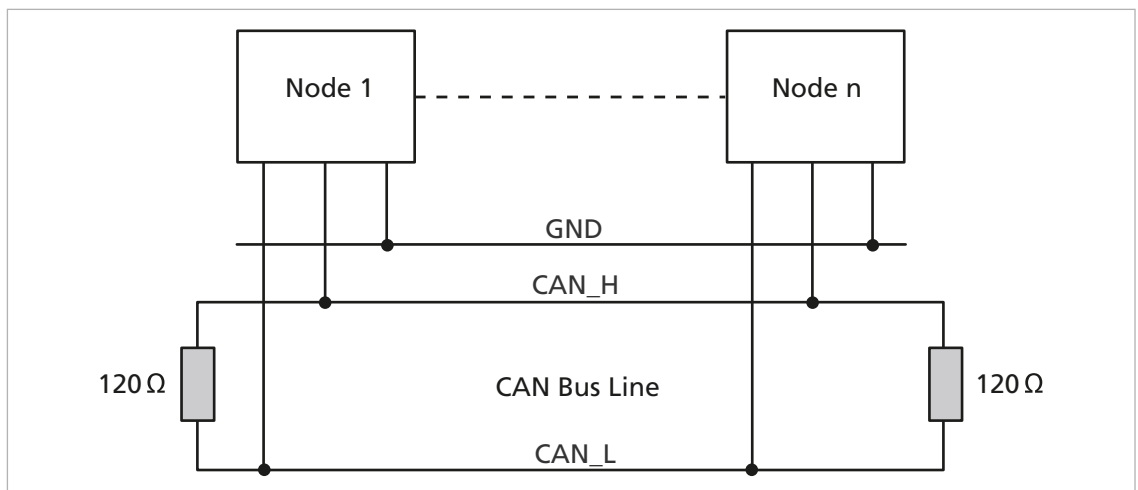


Fig. 19: Connection to the CANopen network

- i** The baud rate and node number are set using the Motion Manager or by entering a command directly (see Communications Manual and Software Manual).
- i** The maximum cable length is limited by the transmission rate and the signal propagation time as shown in Tab. 8.

Tab. 8: Maximum cable length as a function of baud rate

Baud rate (kBit/s)	Max. cable length (incl. stub cable)
1000	25 m
500	100 m
250	250 m
125	500 m
50	1000 m
25	2500 m
10	5000 m

## Installation

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CAN is a bus system to which all nodes are connected in parallel. A connection resistance of  $120\ \Omega$  must be connected at both ends of the bus cable. In addition to the two signal lines CAN\_H and CAN\_L, the nodes also need to be connected to each other by means of a common GND cable.

- ▶ If several electrical devices or controllers are networked by means of RS232 or CAN, make sure that the potential difference between the earth potentials of the various parts of the system is less than 2 V.
- ↪ The cross-section of the required potential equalisation conductors between the various parts of the system is specified in VDE 100 and must satisfy the following conditions:
  - At least  $6\ \text{mm}^2$
  - Larger than half the cross-section of the supply conductor

## 5 Maintenance

### 5.1 Maintenance instructions



#### **NOTICE!**

**Damage to the motor caused by contact with solvents.**

- ▶ During operation and maintenance protect the housing against contact with solvents or substances containing solvents.

### 5.2 Maintenance tasks

The motor is generally maintenance-free. Where the device is mounted in a cabinet, depending on the deposition of dust the air filter should be regularly checked and cleaned if necessary.

### 5.3 Troubleshooting

If unexpected malfunctions occur during operation according to the intended use, please contact your support partner.

## Accessories

### 6 Accessories

The following accessories are available:

Article	Article no.
Contact adapter	6501.00065
Contact adapter	6501.00113

**i** Details on configuration can be found in the Motion Manager manual (see chap. 1.2, p. 4).

**i** Details on the connection sequence can be found in the product data sheet of the respective contact adapter.

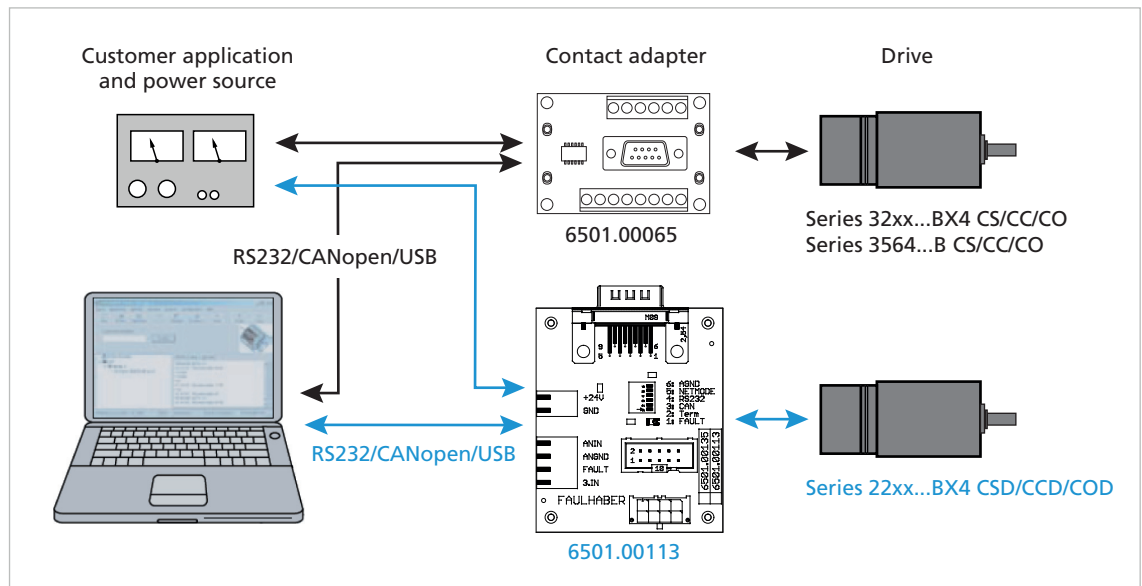


Fig. 20: Setup with contact adapter

**i** Information on other accessories can be found in the main catalogue.

## Warranty

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### **7 Warranty**

Products of the company Dr. Fritz Faulhaber GmbH & Co. KG are produced using the most modern production methods and are subject to strict quality inspections. All sales and deliveries are performed exclusively on the basis of our General Conditions of Sale and Delivery which can be viewed on the FAULHABER home page [www.faulhaber.com/agb](http://www.faulhaber.com/agb) and downloaded from it.

