

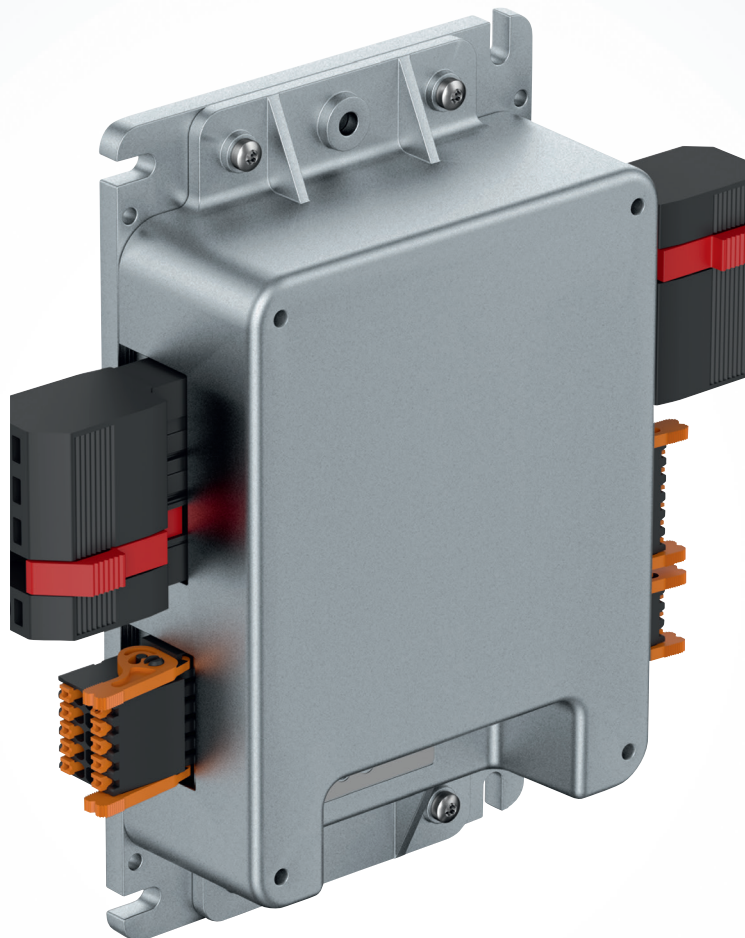
# Control electronics

*VTD-xx.xx-K4S*

Translation of the original operating instructions (EN)

**ebm**papst

the engineer's choice



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## Disclaimer

### Contents of operating instructions

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### Availability of operating instructions

The operating instructions must be available to the user at all times, to ensure the device is used safely. They must be kept at an easily accessible location at the place of installation, where they can be viewed at all times.

### Application

When using the control electronics, it is essential that the safety regulations and the relevant operating instructions in connection with drives or similar are observed. Read these operating instructions carefully before you start working with the control electronics. Observe the hazard and warning notices to avoid the risk of injury or malfunctioning.

These operating instructions are to be viewed as part of the control electronics. The control electronics are only to be sold or passed on together with the operating instructions. Safety regulations and installation instructions may be duplicated and distributed to inform about potential dangers and their prevention. ebm-papst is always looking to advance and enhance its products. As a result, products may differ from these operating instructions.

Subject to change.

You can find the respective current version of these operating instructions in the download area of the information center on our homepage: [www.ebmpapst.com](http://www.ebmpapst.com)

## 1 Introduction

### 1.1 Foreword

These operating instructions outline the application possibilities, installation, operation and programming of the product specified on the title page.

When installing and operating the control electronics, all of the safety information listed in [Chapter 2](#) must be adhered to. Abroad, the corresponding laws, guidelines and regulations of the relevant country also apply.

Read these operating instructions carefully before you start working with the control electronics. Observe the following warning notices in order to avoid risk of injury or product malfunction.

### 1.2 Target group

These operating instructions are only intended for qualified and trained specialist personnel with knowledge of electronics and mechanics.

### 1.3 Written styles in this document

In these operating instructions, the meaning of certain sections is indicated through various means.

Descriptive text is shown without a preceding symbol.

- Text preceded by a dot (•) indicates a list introduced by a heading.

[Underlined blue text](#) indicates a cross reference, which can be clicked on in the PDF document. Upon doing so, the screen will jump to the relevant section of the document.

### 1.4 Warning notices and notices

Warning notices and notices are always shown before an instruction where carrying out the action could result in a hazard or material damage.

In this documentation, the following **warning notices** are used:



#### DANGER

**Hazard.**

This notice indicates a hazard with a high level of risk that will directly result in death or severe bodily injury if it is not avoided.

- ▶ This arrow highlights a corresponding precautionary measure in order to prevent the hazard.



#### WARNING

**Hazard.**

This notice indicates a hazard with a moderate level of risk that may possibly result in death or severe bodily injury if it is not avoided.

- ▶ This arrow highlights a corresponding precautionary measure in order to prevent the hazard.



#### CAUTION

**Hazard.**

This notice indicates a hazard with a low level of risk that may result in light or moderate bodily injury and material damage if it is not avoided.

- ▶ This arrow highlights a corresponding precautionary measure in order to prevent the hazard.

**Notices** contain information that is particularly important at the relevant point or make the operating steps described easier. They are emphasized as follows:



#### NOTICE

This notice provides you with recommendations for use and helpful tips.

## 2 Safety information

The VTD-xx.xx-K4S control electronics have been developed based on state-of-the-art electronics and electrical engineering, as well as recognized guidelines for the safety and protection of users. See also ["2.4 Standards and directives"](#).

The control electronics may only be operated and serviced by authorized specialist personnel who have fully read and understood these operating instructions. These control electronics must be used with due care and in compliance with the safety information outlined in these operating instructions and the country-specific applicable regulations.

Read all of the safety information and instructions, and store notices and these operating instructions with the control electronics.

### 2.1 General safety information

Always observe the following safety information, regardless of the specific operating conditions:

- Before you start working with the device, switch it off and secure it from switching itself on again.
- Before opening the device or entering the danger zone, bring all of the drives to a standstill and secure them from switching themselves on again.
- Do not modify or convert the control electronics, or fit any attachments to them, without approval from ebm-papst.
- If the motor is subjected to unapproved loads, check it for damage and, if necessary, repair or replace it.
- Commissioning may only take place following full verification of compliance with all relevant legal requirements, guidelines and application-related safety regulations (e.g. accident prevention regulations).
- The safety hazards associated with the control electronics must be reassessed following installation in the end application.

### 2.2 Documentation

When using the control electronics in connection with drives or similar, the relevant operating instructions must also be observed.

In addition to these operating instructions, "driveSTUDIO" PC software is required for configuring and parameterizing the motors. The operating principle is also described in the "driveSTUDIO" software manual.

You can find the respective current version of these operating instructions in the download area of the information center on our homepage: [www.ebmpapst.com](http://www.ebmpapst.com)

### 2.3 Mechanical safety

- Only carry out work when the system/machine is stationary.
- Ensure the control electronics have cooled sufficiently.
- Only ever remove the protective devices for repair and assembly work.

### 2.4 Standards and directives

The device falls under the Machinery Directive, as it concerns "partly completed machinery" according to Article 2, Section g, Machinery Directive 2006/42/EC. Applying a CE marking to the nameplate is prohibited. The declaration of incorporation according to Annex II, Part 1, Section B, Machinery Directive, 2006/42/EC has been issued.

## 2.5 Personnel qualifications

The following qualification requirements are specified in these operating instructions:

- **Qualified electricians:** persons who, due to their specialist training and skills, are able to carry out work on electrical systems and independently identify hazards. A qualified electrician must observe the applicable regulations in their country for installing electrical equipment (e.g. DGUV (German Social Accident Insurance) in Germany).
- **Authorized specialist personnel:** Persons who have been trained by the operator about the potential hazards when carrying out their assigned tasks and activities.

Required skills and knowledge by field of work	
Tasks and activities	Required skills and knowledge
Installation	<ul style="list-style-type: none"><li>• Practical electrical training</li><li>• Knowledge of the current electrical safety regulations</li><li>• Knowledge of the relevant electrical safety regulations at the workplace</li></ul>
Configuration	<ul style="list-style-type: none"><li>• Basic knowledge of the structure and set-up of the described connections and interfaces</li><li>• Basic knowledge of data transfer</li></ul>
Servicing	<ul style="list-style-type: none"><li>• Practical technical training</li><li>• Knowledge of the relevant electrical safety regulations at the workplace</li></ul>

- Only qualified electricians are allowed to install the control electronics, carry out the trial run and perform work on the electrical system.
- Only authorized specialist personnel are allowed to transport, unpack, operate and service the control electronics.

## 2.6 Safety of persons

- Provide sufficient protection against accidental contact (e.g. cover electrical contacts).
- Do not wear loose clothing or jewellery.
- Keep hair, clothing and gloves well away from rotating components.
- Use personal protective equipment (e.g. hearing protection, thermal gloves).

## 2.7 Electric/electromagnetic safety

- Depending on the environmental conditions, regularly check the control electronics and connected cables for damage.
- Only use cables and connectors approved by ebm-papst.
- Immediately replace defective cables and loose connections.
- Provide suitable measures for avoiding impermissible electromagnetic interference emissions, such as shielding.
- Provide suitable measures against high-frequency EMC radiation, such as shielding.
- Ensure the end device/installation state is EMC compliant.
- Use control units and control devices for influencing the electromagnetic radiation.



## 2.8 Intended use

This device is an installation product. It is intended solely for use in devices and machines and does not have any independent function. The device is not intended to be passed on to the end customer. The end manufacturer must ensure all of the motor and electronics combinations are qualified for their intended application and are validated as having overload and locking protection. The end manufacturer is responsible for the end product and must take adequate safety measures. Any other usage above and beyond this does not conform with the intended purpose and constitutes misuse of the device.

## 2.9 Improper use

This device must not be used in technical systems that have special requirements with regard to safeguarding against failure. This includes, for example, use in the following environments:

- Aircraft or spacecraft
- Trains, motor vehicles and ships
- Explosive atmospheres (explosion protection area)
- In medical equipment with a life-sustaining or life-support function
- Use as a safety component or to perform safety-related functions



### Risk of injury

**DANGER**

- Potential dangers in the event of non-compliance include personal injury and property damage due to reduced service life or explosions caused by elevated surface temperature or sparking.

## 2.10 Conversions and modifications

Only operate the control electronics in their original and faultless condition. Retrofitting, modifying, and converting the control electronics is strictly prohibited. Any modifications you wish to make must always be agreed with ebm-papst first.

ebm-papst is not liable for any conversions and modifications carried out which have not been expressly approved by us.

This also includes any damage resulting from the use of non-original parts or through operating the device outside of the agreed parameters.

## 2.11 Disposal

When disposing of the device, ensure that all of the legal and local provisions and requirements applicable in your country are complied with.

The control electronics and components are installed as parts in machines and devices. As individual parts for use in the industrial sector, they are not covered by the Electrical and Electronic Equipment Act. If the control electronics and components are installed in end products that are covered by this act, the manufacturer of the end product is responsible for compliance with the legal stipulations.



## 3 Description

### 3.1 VTD-xx.xx-K4S description

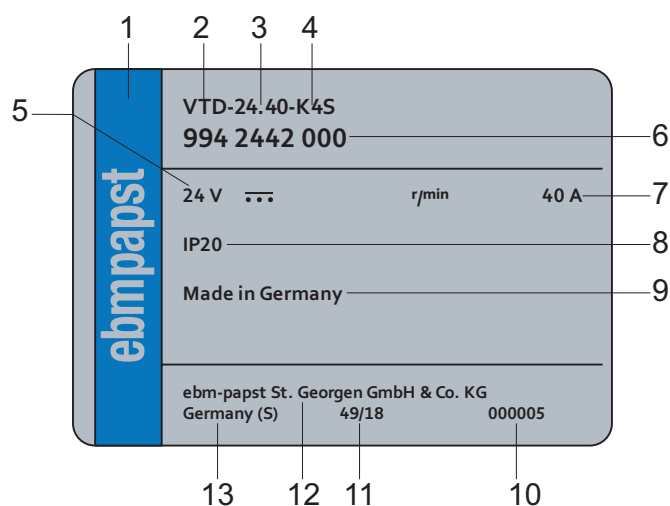
The external VTD-xx.xx-K4S control electronics have been developed for controlled operation of 3-phase BLDC motors with up to 1000 watts of output power. They have a speed, torque and position mode. The control electronics are suitable for use in intralogistic applications, such as cross belt sorters, warehouse shuttles and driverless transport systems, as well as other applications from the automation sector.

The control electronics are designed for nominal voltages of 24 V DC and 48 V DC, as well as peak currents of up to 100 A.

Selecting the operating modes and parameterizing the speed, torque and position is carried out via the parameterization interface (see Chapter ["6.5 Parameterization/description of parameters" on page 23](#)). The control electronics have integrated ballast actuation.

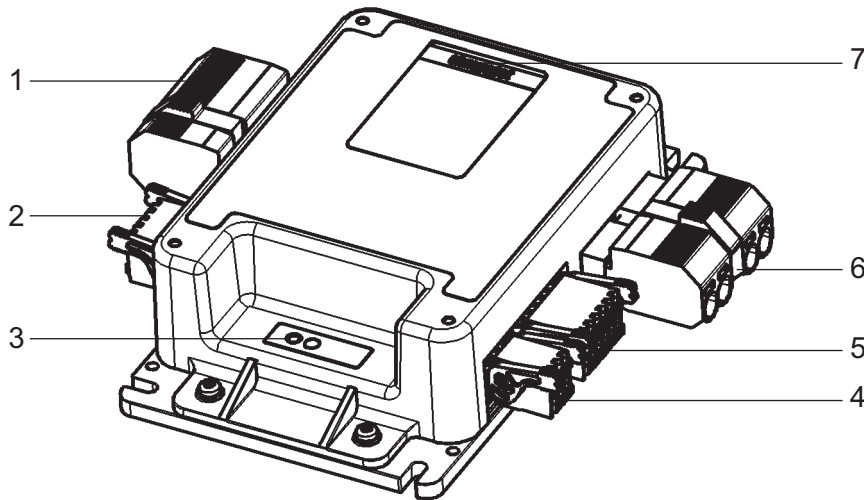
### 3.2 Nameplate

The nameplate with the relevant control electronics characteristics is applied to the exterior of the housing.



Nameplate legend	
Position	Designation
1	Company logo
2	Control electronics type: VTD = Variotronik
3	Type description: 24 = 24 V DC, 40 = 40 V DC (permissible continuous current)
4	K4 – electronics class K4 = positioning controller S – plug connection
5	Nominal voltage
6	Item number
7	Nominal current
8	Protection class
9	Country of manufacture
10	Serial number
11	Date of manufacture
12	Production site
13	Country code

## 3.3 Device view



Device view legend		
Position	Designation	Function
1	Interface X107	Power supply for motor
2	Interface X101	Hall sensors
3	Status LED	Status display
4	Interface X102	Parametrization interface
5	Interface X100	Logic supply signals
6	Interface X106	Power supply for controller
7	Nameplate	Device type information

## 3.4 Status LED

The device has an LED, which indicates the status of the device.

LED color	Illumination behavior	Meaning
Blue	Continuously lit	Control electronics not active, no error
Red	Continuously lit	Error, firmware not available
Green	Continuously lit	Control electronics active, no errors
Blue	Flashes	Control electronics active, ballast error
Red	Flashes	Control electronics not active, Hall signal error
Green	Flashes	Control electronics active, FTL error
Green/red	Flashes alternately	Control electronics not active, category 4 error
Red/blue	Flashes alternately	Control electronics not active, category 5 error
Green/blue	Flashes alternately	Control electronics active, i2t protection active

You can find out more about error categories in Chapter ["8 Error processing" on page 25](#).

## 4 Technical data

### 4.1 Device characteristics

Characteristic	Parameters type 1	Parameters type 2
Nominal voltage	24 V DC	48 V DC
Operating voltage range	18 – 30 V DC	18 – 60 V DC
GND reference	GND <sub>POWER</sub>	
Min. switch-on voltage increase	100 V/s	
Max. voltage ripple	5%	
Nominal current	40 A	20 A
Max. current	100 A	
Nominal efficiency	>95%	
Max. commutation frequency	1 kHz	
Switching frequency	20 kHz	
Direction of rotation (motor)	cw/ccw	
Controller version	4Q	
Dimensions	See dimensional drawing	
Weight	670 g	
Min. terminal inductance, motor	100 µH	

### 4.2 Ambient conditions

Characteristic	Parameters
Ambient temperature (operation)	-30 °C – +40 °C
Ambient temperature (storage)	-40 °C – +85 °C
Relative humidity, non-condensing (operation)	5 – 85%
Relative humidity, non-condensing (storage)	5 – 95%
Maximum installation elevation	1000 m above sea level
Protection class	III
Voltage class V DC	Class A
Overvoltage category	I
Air gap	0.2 mm
Creepage distance	1.2 mm
Insulation material group	> 100 (at least IIIa or IIIb)
Pollution degree	2

## 4.3 Electronic features

### 4.3.1 Digital inputs A, B

Characteristic	Parameters
Input level	PLC level
Low level	< 5 V
High level	> 15 V
Protection against reverse polarity and voltages	≤ 30
In event of cable breakage	Logic level "0"
Input impedance	5.4 kΩ
Input frequency	≤ 10 kHz
Input dynamic (tau)	≤ 0.1 ms
Logic	A = 0 / B = 0 → Output stage switched off A = 1 / B = 0 → Rotation cw A = 0 / B = 1 → Rotation ccw A = 1 / B = 1 → Brake  0 = GND 1 = PLC level (24 V)

### 4.3.2 Digital inputs IN1, IN2

Characteristic	Parameters
Input level	PLC level
Low level	< 5 V
High level	> 15 V
Protection against reverse polarity and voltages	≤ 30
In event of cable breakage	Logic level "0"
Input impedance	5.4 kΩ
Input frequency	≤ 10 kHz
Input dynamic (tau)	≤ 0.1 ms

### 4.3.3 Digital outputs OUT1, OUT2, OUT3

Characteristic	Parameters
Output level	High-side driver depending on UC (logic supply)
Low level	Open source
High level	> $U_C - 2 \text{ V}$
Output current/channel	≤ 100 mA
Peak output current	Approx. 700 mA (thermally dependent)
Short-circuit proof	Yes
Reverse polarity protection	No
Overload proof	Yes (automatic thermal cut-off)
Output frequency to $I_{out} = 100 \text{ mA}$	≤ 2 kHz

## 4.3.4 Analog inputs, analog IN 1 to 2 (signal connector, differential to GND analog)

Characteristic	Parameters
Input voltage range (analog IN)	0 – 10 V
GND reference (differential measurement)	Analog GND
Max voltage	$\leq 28$ V
Input frequency	$\leq 1$ kHz
Internal resistance	8 k $\Omega$
Signal resolution	10 bit
Measurement tolerance (refers to end value of 10 V)	$\leq 2\%$
Reverse polarity protection	$\leq 28$ V

## 4.3.5 RS485 bus interface

Characteristic	Parameters
Baud rate	115 kbit/s
Data bits	8
Stop bit	1
Parity	Straight
Differential voltage A, B	-7 – +13 V
Input impedance	12 k $\Omega$

## 4.3.6 Sensor inputs Hall A, Hall B, Hall C

Characteristic	Parameters
Input level	Open collector
Max voltage	$\leq 30$ V
In event of cable breakage	0 V
Input impedance	67 k $\Omega$
Input frequency	$\leq 0.667$ kHz

## 4.3.7 Sensor supply

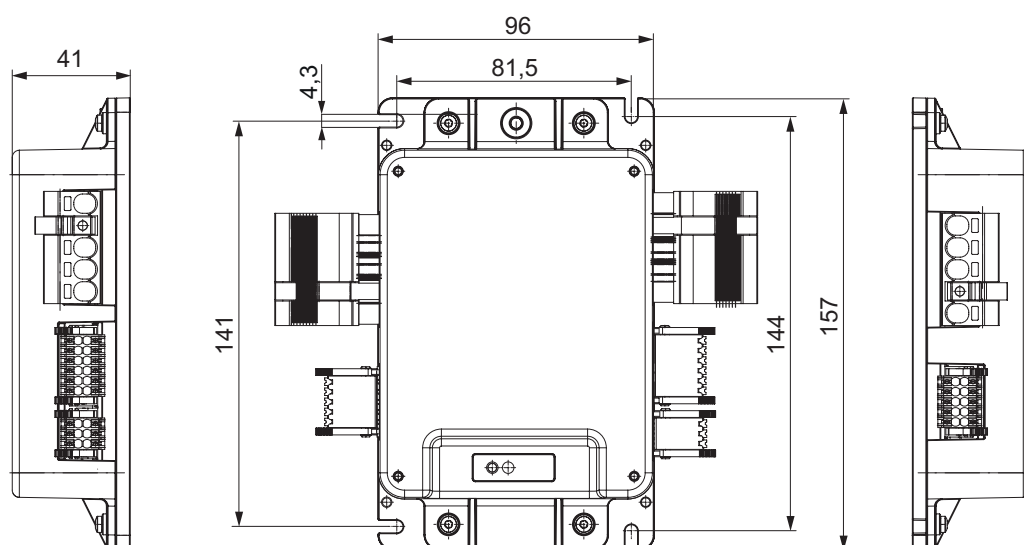
Characteristic	Parameters
Output level	4.5 V
Tolerance	$\pm 5\%$
Max. current	50 mA

## 4.3.8 Cable cross sections

Interface	Cable cross section
X100 – logic supply signals	AWG24; 0.25 mm <sup>2</sup>
X101 – Hall sensors	
X102 – parameterization interface	
X106 – power supply for controller	AWG8; 6mm <sup>2</sup>
X107 – power supply for motor	

## 4.4 Dimensional drawing

All dimensions in mm.



## 5 Installation



### Risk of injury

#### Voltage

#### DANGER

Check the electrical equipment of the product at regular intervals.

- ▶ Even in the event of low power supply, the voltage can increase due to return flow of energy. Motors that slow down or run down work in a similar fashion to a generator, and in this way output electrical power. This can result in lethal voltages.
- ▶ Repair any loose connections and defective cables immediately.
- ▶ All of the connections must only be contacted when they are free from voltage.



### Electrical hookup

**Mechanical installation should be performed first before electrical hookup.**

#### DANGER

#### Danger to life due to electric shock when touching live parts

- ▶ Only allow work to be carried out by a qualified electrician.
- ▶ Make sure that the cables are de-energized.
- ▶ Secure against renewed switch-on of the operating voltage.
- ▶ Never work on live parts.



### Safety and protective features

**Dangerous movements in combination with drives or similar (see operating instructions of the relevant product)**

#### DANGER

Check the electrical equipment of the product at regular intervals.

- ▶ Ensure there are sufficient protective fixtures in the devices/systems, as actuating the motors in the wrong way can lead to dangerous movements.

Possible remedial actions include:

- ▶ No lingering within the movement area of the devices or systems.
- ▶ Ensuring that the stability of the (protection) covers and housing is sufficient enough to resist the maximum movement or rotation energy.
- ▶ Before opening the devices or entering the danger zone, ensure all drives are safely brought to a standstill and are secured against switching on again.



### Impermissibly high load

#### Do not make any modifications to the product

#### WARNING

- ▶ Subjecting the product to impermissible loads (e.g. impact, heat, overvoltage, mechanical load) might damage it. In this case, decommission the product immediately and, before recommissioning it, check that it is in proper condition.



### Electromagnetic radiation

When integrating the product into the system, the interaction may cause interference in terms of electromagnetic compatibility (EMC). Ensure that the entire system is electromagnetically compatible.

#### WARNING



### Health hazards for persons with pacemakers, metal implants and hearing aids

For these people, access to the following areas is prohibited:

#### WARNING

- ▶ Areas in which electrical devices and parts are assembled, operated, or put into operation.
- Areas in which motor parts with permanent magnets are stored, repaired, or assembled.





## WARNING

**Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A)**

Risk of noise-induced hearing loss

- ▶ Take appropriate technical safety measures.
- ▶ Protect operating personnel with appropriate safety equipment, such as hearing protection.



## CAUTION

**Hot surface – risk of scalding**

- ▶ Ensure sufficient protection against accidental contact.
- ▶ Ensure there is sufficient cooling.



## CAUTION

**Mechanical connection**

**Risk of cutting and crushing hazard when removing product from packaging and when assembling**

Carefully remove the product from its packaging, touching only the housing. Never subject to any impacts!

- ▶ Wear safety shoes and cut-resistant safety gloves.
- ▶ Use suitable assembly equipment.



## CAUTION

**Voltage**

**The product is a built-in part and has no isolating switch.**

- ▶ Only connect the product to suitable electrical circuits. Note that the power supply units must be suitably protected against secondary generator voltage.
- ▶ When working on the control electronics, it is imperative that the system/machine is brought to a standstill and secured against switching on again.



## NOTICE

**Electrostatic charging**

Risk of damaging electronic components

- ▶ Use ESD protective equipment during assembly and disassembly.



## NOTICE

**Prerequisites for connection and start-up:**

- ▶ Before connecting the product, make sure that the power supply matches the product voltage.
- ▶ Check whether the information on the nameplate or in the detailed specifications matches the connection data of the power supply.
- ▶ Only use cables designed for the current level indicated on the nameplate and for the corresponding ambient conditions. Ensure the mechanical protection of the electrical hookup.

## 5.1 Scope of delivery

Check the scope of delivery is complete before starting installation.

The following components are contained within the scope of delivery:

- VTD-xx.xx-K4S in the ordered version
- X100 connector (12-pin, logic supply signals)
- X101 connector (10-pin, Hall sensors)
- X102 connector (6-pin, parameterization interface)
- X106 connector (4-pin, power supply for controller)
- X107 connector (4-pin, power supply for motor)

## 5.2 Assembly conditions

The device can be installed in any desired location directly on or in the machine using four screws, or in a switch cabinet with a DIN rail.



### CAUTION

To prevent damage to the device and to ensure the smooth operation thereof, observe the following:

- Do not bend the cables
- Fit the cables to the connectors without tensile stress
- Protect the device and connectors against splashing water

## 5.3 Mechanical installation

### 5.3.1 Assembly directly in the machine

1. Mechanically install the device where the four attachment points in the machine/switch cabinet are located using 4x M4 screws.
2. Electrically connect the device in the machine/switch cabinet using connectors (included in scope of delivery).  
For interfaces, see Chapter ["5.4 Electrical installation" on page 18](#).
3. Establish the power supply.

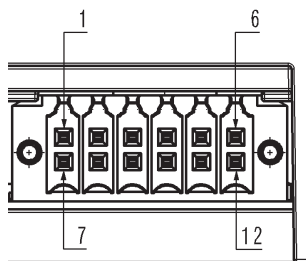
### 5.3.2 Installation on DIN rail

Please contact ebm-papst for information about installation on a DIN rail.

## 5.4 Electrical installation

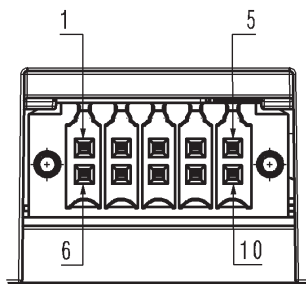
### 5.4.1 Interfaces for power and signals

X100 – logic supply signals



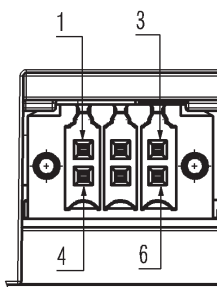
Pin	Designation	Description
1	D-Out 1	PNP 24 V
2	D-Out 2	PNP 24 V
3	D-Out 3	PNP 24 V
4	U logic	Logic supply +24 V
5	GND	Signal GND
6	FE	Functional earth
7	D-IN-A	NPN 24 V
8	D-IN-B	NPN 24 V
9	D-IN-1	NPN 24 V
10	IN-2	NPN 24 V
11	A-IN-2	0 – 10 V (differential)
12	A-GND	GND for analog IN-1 (differential)

## X101 – Hall sensors



Pin	Designation	Description
1	+5 V	Hall supply
2	GND	Signal GND
3	Hall A	Hall signal, digital A
4	Hall B	Hall signal, digital B
5	Hall C	Hall signal, digital C
6	-	-
7	GND	Signal GND
8	SIN	Hall signal, analog sin
9	COS	Hall signal, analog cos
10	FE	Functional earth

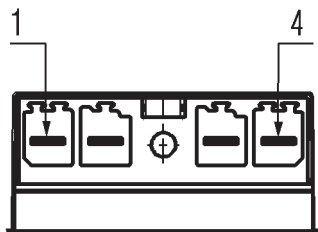
## X102 – parameterization interface



Pin	Designation	Description
1	FE	Functional earth
2	RS485-	Programming bus
3	RS485+	Programming bus
4	FE	Functional earth
5	RS485-	Programming bus
6	RS485+	Programming bus

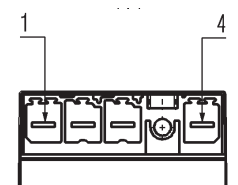
# Installation

X106 – power supply for controller



Pin	Designation	Description
1	Ballast	Ballast resistance
2	GND-P	Power GND
3	$U_{zk}$	Power supply
4	FE	Functional earth

X107 – power supply for motor



Pin	Designation	Description
1	U	Phase U
2	V	Phase V
3	W	Phase W
4	FE	Functional earth

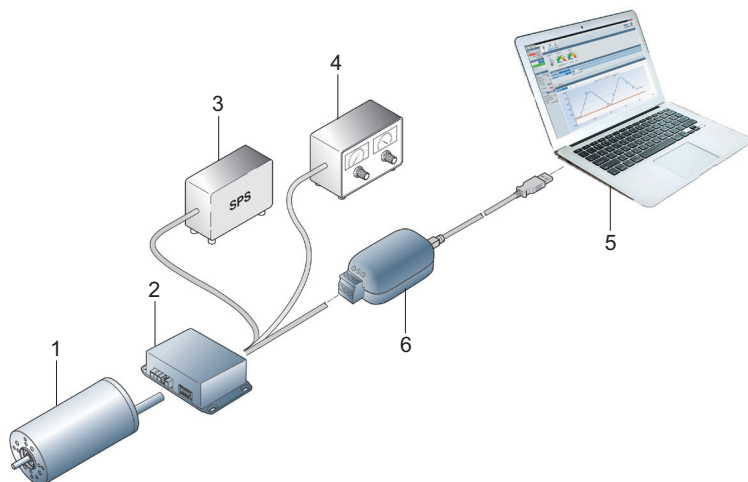
## 5.5 Connect device to electricity source

### 5.5.1 Schematic overview



The USB-RS485 adapter accessory part is not included in the scope of delivery, but is required for commissioning or parameterization with the "driveSTUDIO" software.

#### NOTICE



#### Schematic overview legend

Position	Designation
1	Motor
2	Control electronics
3	PLC
4	Power supply
5	Computer
6	USB-RS485 adapter



#### CAUTION

##### Risk of injury from electric shock

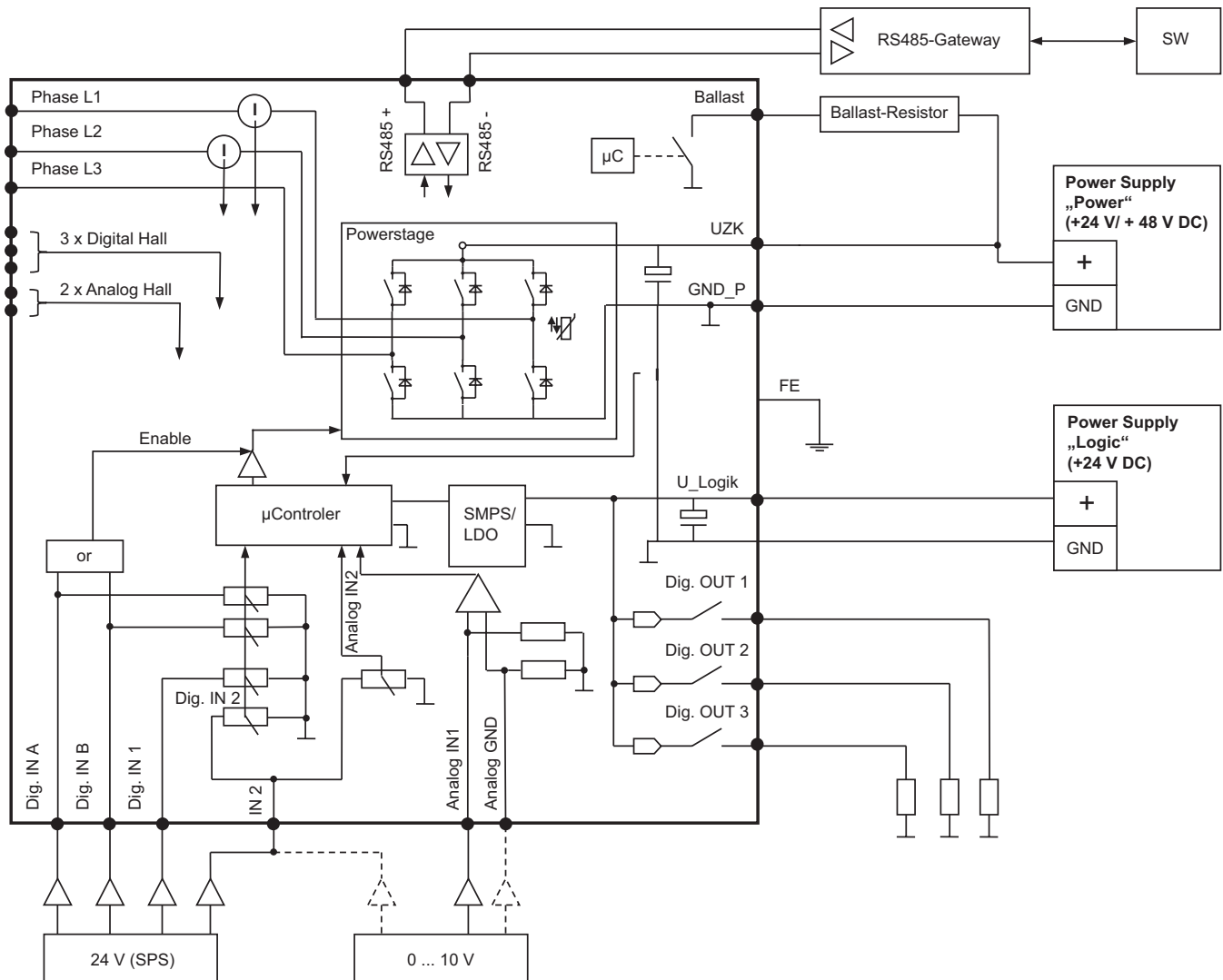
The control electronics are a built-in part without an isolating switch.

- ▶ When working on the control electronics, it is imperative that the system/machine is de-energized and secured against switching on again.
- ▶ Only connect the product to suitable electrical circuits. Make sure that the power supply units are suitably protected against secondary generator voltage.

### 5.5.2 Order of electrical hookup for commissioning

1. Connect PLC (3) to the control electronics (2).
2. Connect control electronics (2) to the USB-RS485 adapter (6).
3. Connect USB-RS485 adapter (6) to the computer (5).
4. Connect motor (1) to the control electronics (2).
5. Connect power supply (4) to the control electronics (2).

## 5.6 Block diagram





## 6 Operation

### 6.1 Switching on the control electronics

Use the higher-level control system to provide the power supply. Switch on the device by activating the enable input.

### 6.2 Setting operating modes

There are various operating modes to choose from. You can set the operating modes using parameters. You can find a detailed description of the individual parameters in the "driveSTUDIO" software manual.

### 6.3 Checking functions

The LED on the device provides information concerning the current operating status, see ["3.4 Status LED" on page 10](#).

### 6.4 Switching off the control electronics

"Take away" approval of the enabler to switch off the control electronics. Use the higher-level control system to switch off the power supply.

### 6.5 Parameterization/description of parameters

Use the "driveSTUDIO" software to carry out the parameterization. You will find further information and a detailed description of the parameters in the software manual.

You will need the USB-RS485 adapter to carry out the commissioning and parameterization (see Chapter ["9.1 Accessories available to order" on page 27](#))

## 7 Maintenance

### 7.1 Servicing

The device does not require servicing. Depending on environmental conditions, the device and all connected cables must undergo regular checks for contamination and damage.

Do not perform any repairs on your product. Send the product to ebm-papst for repair or replacement.

## 8 Error processing

This chapter outlines all of the possible error messages, malfunctions, causes, and remedial actions. If you are unable to correct the error or feedback using the remedial action described, please contact ebm-papst.

Contact details are on the back of these instructions.

### 8.1 Error categories

Errors fall into 5 categories:

1. Error has no consequences for the control electronics.
2. Error with consequence fail-safe with error speed.
3. Errors, which lead to short-term shutdown (cycle by cycle) of the power FETs.
4. Errors with the consequence "enable control electronics", which are optionally acknowledged automatically.
5. Errors with the consequence "enable control electronics", which must only be acknowledged manually.

Category	Error
1	Ballast diagnostics error
	Overcurrent at braking circuit (if can be detected)
2	PWM setpoint detection detects error
	Freq setpoint detection detects error
	RS485 timeout
3	FLTM error
4	U <sub>ZK</sub> overvoltage error
	U <sub>ZK</sub> undervoltage error
	Overtemperature error
5	U <sub>logic24V</sub> overvoltage
	U <sub>logic24V</sub> undervoltage
	U <sub>logic13V5</sub> overvoltage
	U <sub>logic13V5</sub> undervoltage
	FLTM 100Events (omitted potentially if FLTM error covers this)
	Parameterization error
	Rotor position error ( $\sin(x)+\cos(x) = 1$ )
	FET diagnostics error (FET fault)

## 8.2 Error correction

Possible errors and their causes			
State	Cause of error	Error details	Measure
Motor does not respond	$U_{ZK}$	Overvoltage	Set using "drive STUDIO"
		DIN rail for attaching the electronics in a switch cabinet	Set using "drive STUDIO"
	$U_{Logic}$		Supply with 24 V
	Acknowledgment missing		Acknowledge
	Parameters wrong		Correct using "driveSTUDIO"
	Enabler signal missing		Connect enable
Motor regulates to 0, target speed cannot be specified	Setpoint value missing		Specify setpoint
	Wrong setpoint selected		Correct using "driveSTUDIO"
	Parameters wrong		Correct using "driveSTUDIO"
Motor is jerky	Control parameters unsuitable	Speed controller	Set using "drive STUDIO"
		Position controller	Set using "drive STUDIO"
	$K_{FF}$ unsuitable		Set using "drive STUDIO"
	$U_{ZK}$ fluctuates		Stabilize
Motor is jerky when switching to stop control	$K_{FF} = 0$		Set $K_{FF}$ using "driveSTUDIO"
Motor does not carry out positioning	Enable missing		IN A / IN B must be set to 1 / 1
	$K_p_H$ missing		Set using "drive STUDIO"
	Max. positioning speed = 0		Set using "drive STUDIO"
	No distance set		Set using "drive STUDIO" or teach mode
Dynamics too weak	Motor overloaded		Check mechanics; use stronger motor
	Ramp too flat		Set ramp steeper
	Current limitation		Remove current limitation
Motor switches to free running when braking	Overvoltage	Braking circuit not active	Use feedback-protected power supply
			Use brake resistor
		Connected brake resistor too weak	5 A must be able to flow 24 V: 5 ohms 48 V: 10 ohms



In the event of further malfunctions, please contact ebm-papst.

You should have the following information at the ready:

### NOTICE

- Nameplate data
- Type and extent of malfunction
- Circumstances surrounding the malfunction
- Application data (cycle of torque, speed, loads, ambient conditions, etc.)

Do not operate the control electronics until the malfunction is conclusively resolved.

9 Accessories

9.1 Accessories available to order

Designation	Order number	Description
USB-RS485 adapter	914 0000 403	USB interface adapter



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the engineer's choice

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