STÖBER

POSIDRIVE® FDS 5000

Projecting manual

Installation

Connecting

Accessories

V 5.6-N or later

03/2015 en

Table of contents

STÖBER

1 Introduction

1.1 Purpose of the manual

This document will give you technical data and information about the installation and connection of the inverter and its accessories. This technical documentation will enable the following personnel to perform their tasks correctly.

- Project engineer - planning
- Electrical specialist - installation and connection

Original version
The original version of this manual is in German.

1.2 Further documentation

Manual	Contents	ID
Commissioning Instructions FDS 5000	Reinstallation, replacement, function test	442293
Operating manual FDS 5000	Set up the inverter	442281
Operating manual CANopen	Connection of the inverter to the CANopen fieldbus system	441686
Operating manual EtherCAT	Connection of the inverter to the EtherCAT fieldbus system	441896
Operating manual PROFIBUS	Connection of the inverter to the PROBIBUS fieldbus system	441687
Operating manual PROFINET	Connection of the inverter to the PROFINET fieldbus system	442340
Operating manual ASP 5001	Integration of the safety technology with the ASP 5001 option	442181

You can find the latest document versions at www.stoeber.de.

1.3 Further support

If you have technical questions that are not answered by this document, please contact:

- Phone: +49 7231 582-3060
- E-mail: applications@stoeber.de

If you have questions about the documentation, please contact:

- E-mail: electronics@stoeber.de

If you have questions about training sessions, please contact:

- E-mail: training@stoeber.de

1.4 Abbreviations, formula symbols and indices

Abbreviations	
AA	Analog output
AC	Alternating Current
AE	Analog input
AES	Absolute Encoder Support
BA	Binary output
BAT	Battery
BE	Binary input
BG	Size
CAN	Controller Area Network
CH	Brake chopper
CNC	Computerized Numerical Control
CU	Control Unit
DC	Direct Current
I/O	Input/Output
EMC	Electromagnetic Compatibility
HTL	High threshold logic
IP	International Protection
PE	Protective Earth
PELV	Protective Extra Low Voltage
PTC	Positive Temperature Coefficient
PU	Power Unit
PWM	Pulse Width Modulation
RB	Brake Resistor
RCD	Residual Current Device
PLC	Programmable logic controller
SSI	Serial Synchronous Interface
TTL	Transistor-transistor logic
UL	Underwriters Laboratories
ZK	DC link

Formula symbols	Unit	Explanation
f	**Hz**	**Frequency**
f_2	Hz	Output frequency
f_{2PU}	Hz	Output frequency of the inverter power board
f_{max}	Hz	Maximum frequency
$f_{PWM,PU}$	Hz	Internal pulse clock frequency of the inverter power board
I	**A**	**Current**
I_1	A	Input current
I_{1maxPU}	A	Maximum input current of the inverter power board
I_{1maxCU}	A	Maximum input current of the inverter control board
$I_{1N,PU}$	A	Nominal input current of the inverter power board
I_2	A	Output current
I_{2max}	A	Maximum output current
I_{2maxPU}	A	Maximum output current of the inverter power board
I_{2min}	A	Minimum output current
$I_{2N,PU}$	A	Nominal output current of the inverter power board
I_N	A	Nominal current
n	**rpm**	**Speed**
n_N	rpm	Nominal speed: Speed at which the nominal torque M_N is reached.
P	**W**	**Power**
P_{2maxPU}	W	Maximum sum of drive power
P_{maxRB}	W	Maximum power at the external braking resistor
$P_{V,PU}$	W	Power loss of the inverter power board
$P_{V,CU}$	W	Power loss of the inverter control board
R	**Ω**	**Resistance**
R_{2minRB}	Ω	Minimum resistance of the external braking resistor
R_{int}	Ω	Internal resistance
ϑ	**°C**	**Temperature**
$\vartheta_{amb,max}$	°C	Maximum surrounding temperature
τ_{th}	s	Thermal time constant

t	**s**	**Time**
t_{min}	s	Minimum time
R	**V**	**Voltage**
U_1	V	Input voltage
U_{1PU}	V	Input voltage of the inverter power board
U_{1max}	V	Maximum input voltage
U_2	V	Output voltage
U_{2BAT}	V	Output voltage of the backup battery
U_{2PU}	V	Output voltage of the inverter power board
U_{max}	V	Maximum voltage
U_{maxPU}	V	Maximum voltage of the inverter power board
U_{offCH}	V	Off limit of the brake chopper
U_{onCH}	V	On limit of the brake chopper
		Other
p		Number of pole pairs

1.5 Symbols, identifiers, marks

Symbols	
	**EN 61558-2-20** Choke without overload protection.
	Grounding symbol according to IEC 60417-5019 (DB:2002-10).

Identification and test symbols	
	**Lead-free identifier for RoHS** Lead-free identifier according to RoHS directive 2011-65-EU.
	**CE mark** Manufacturer's self declaration: The product meets the requirements of EU directives.
	**UL test mark** This product is listed by UL for the USA and Canada. Representative samples of this product have been evaluated by UL and meet the requirements of applicable standards.

Identification and test symbols	
c UL us	**UL test marks for recognized component** This component or material is recognized by UL. Representative samples of this product have been evaluated by UL and meet applicable requirements.

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2 Notes on safety

The devices can represent a source of danger. Therefore observe
- the safety guidelines, technical rules and regulations given in the following sections and the
- Generally applicable technical rules and regulations.

Always read the corresponding documentation as well. STÖBER ANTRIEBSTECHNIK GmbH & Co. KG shall assume no liability for damage resulting from failure to comply with the instruction manual or relevant regulations. This documentation is purely a production description. It does not include any guaranteed features in terms of a warranty right. We reserve the right to make technical changes for the purpose of improving the devices.

2.1 Component part of the product

The technical documentation is a component part of a product.
- Since the technical documentation contains important information, always keep it handy in the vicinity of the device until the machine is disposed of.
- If the product is sold, disposed of, or rented out, always include the technical documentation with the product.

2.2 Operation in accordance with its intended use

As defined by DIN EN 50178 (previously VDE 0160), the inverters are electrical equipment operating as power electronics to control the flow of energy in high voltage systems. They are designed exclusively for installation in the control cabinet with at least protection class IP54 and for supplying asynchronous motors. Designated use does not include connecting other electrical loads!

2.3 Risk assessment

Before the manufacturer may bring a machine onto the market, he must conduct a risk assessment according to Machine Directive 06/42/EC. As a result, the risks associated with the use of the machine are determined. The risk assessment is a multi-stage and iterative process. On no account can sufficient insight into the Machine Directive be given as part of this documentation. For this reason, seek detailed information about the norms and legal position. When installing the inverter in machines, commissioning is forbidden until it has been determined that the machine meets the requirements of EC Directive 06/42/EC.

2.4 Ambient conditions

The inverters are products subject to sales restrictions in accordance with IEC 61800-3. In a residential environment this product may cause high-frequency interference. If this occurs the user may be asked to take suitable measures to reduce it.
The inverters are not designed for use in a public low frequency network that supplies residential areas. High-frequency interference can be expected if the inverters are used in a network of this type. The inverters are designed exclusively for operation in TN networks. The inverters are only suitable for use in supply current networks that are able to provide a maximally symmetrical nominal short circuit current at maximally 480 volts according to the following table:

Size	Max. symmetrical nominal short-circuit current
0 and 1	5,000 A

Install the inverter in a control cabinet in which the admissible surrounding temperature will not be exceeded.

The following applications are prohibited:
- Use in areas subject to explosion hazard
- Use in environments with harmful substances as specified by EN 60721, for example oils, acids, gases, vapors, dust and radiation
- Use with mechanical vibration and impact loads exceeding the limits specified in the technical data in the projecting manuals

Implementation of the following applications is only permitted after approval is obtained from STOBER:
- Use in non-stationary applications

2.5 Qualified personnel

Since the devices may harbor residual risks, all configuration, transportation, installation and commissioning tasks including operation and disposal may only be performed by trained personnel who are aware of the possible risks.
Personnel must have the qualifications required for the job. The following table lists examples of occupational qualifications for the jobs:

Activity	Possible occupational qualifications
Transportation and storage	Worker skilled in storage logistics or comparable training
Configuration	- Graduate engineer (electro-technology or electrical power technology) - Technician (m/f) (electro-technology)
Installation and connection	Electronics technician (m/f)
Commissioning (of a standard application)	- Technician (m/f) (electro-technology) - Master electro technician (m/f)

Activity	Possible occupational qualifications
Programming	Graduate engineer (electro-technology or electrical power technology)
Operation	- Technician (m/f) (electro-technology) - Master electro technician (m/f)
Disposal	Electronics technician (m/f)

In addition, the valid regulations, the legal requirements, the reference books, this technical documentation and, in particular, the safety information contained therein must be carefully

- read,
- understood and
- complied with.

2.6 Transportation and storage

Immediately upon receipt, examine the delivery for any transportation damages. Immediately inform the transportation company of any damages. If damages are found, do not commission the product. If the device is not to be installed immediately, store it in a dry, dust-free room. Please see the documentation for how to commission an inverter after it has been in storage for a year or longer.

2.7 Installation and connection

Installation and connection work are only permitted after the device has been isolated from the power!

The accessory installation instructions allow the following actions during the installation of accessories:

- The housing in the upper slot can be opened.

Opening the housing in another place or for other purposes is not permitted.

Use only copper conductors. For the line cross sections to be used, refer to DIN VDE 0298-4 or DIN EN 60204-1 Appendix D and Appendix G.

The permissible protection class is protective ground. Operation is not permitted unless the protective ground is connected in accordance with the regulations.

Comply with the applicable instructions for installation and commissioning of motor and brakes.

Main equipment grounding markings: The main ground connections are marked "PE" or with the international ground symbol (IEC 60417, Symbol 5019 ⏚).

The motor must have an integrated temperature monitor with basic isolation in acc. with EN 61800-5-1 or external motor overload protection must be used.

Protect the device from falling parts (pieces of wire, leads, metal parts, and so on) during installation or other tasks in the switching cabinet. Parts with conductive properties inside the inverter can cause short circuits or device failure.

Note for UL-compliant use additionally 2.11.

2.8 Commissioning, operation and service

Remove the additional covers before commissioning so that the device will not overheat. Note the minimum open areas specified in the projecting manuals during installation to prevent the inverter from overheating. The inverter housing must be closed before you turn on the power supply voltage. When the power supply voltage is turned on, hazardous voltages may be present on the connection terminals and the cables and motor terminals connected to them. Note that the device is not reliably free of voltage simply because all the displays are blank.

The following actions are prohibited while the supply voltage is applied
- Opening the housing,
- Connecting or disconnecting connection clamps and
- Installing accessories.

Apply the 5 safety rules in the order stated before performing any work on the machine:
1. Disconnect.
   Also ensure that the auxiliary circuits are disconnected.
2. Protect against being turned on again.
3. Check that voltage is not present.
4. Ground and short circuit.
5. Cover adjacent live parts.

Information
Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

You can carry out work on the inverter later. Repairs may only be performed by STOBER.

Send faulty devices with a fault description to:
STÖBER ANTRIEBSTECHNIK GmbH & Co. KG
Abteilung VS-EL
Kieselbronner Str.12
75177 Pforzheim
GERMANY

2.9 Disposal

Please comply with the latest national and regional regulations! Dispose of the individual parts separately depending on their nature and currently valid regulations such as, for example:
- Electronic scrap (PCBs)
- Plastic
- Sheet metal
- Copper
- Aluminum

2.10 Residual dangers

The connected motor can be damaged with certain settings of inverters:
- Longer operation against an applied motor halting brake
- Longer operation of self-cooled motors at slow speeds

Drives can reach dangerous excess speeds (e.g., setting of high output frequencies for motors and motor settings which are unsuitable for this). Secure the drive accordingly.

2.11 UL-compliant use

Additional information for use under UL conditions (UL – Underwriters Laboratories).

Surrounding temperature and pollution degree
The maximum surrounding temperature for UL-compliant operation is 45° C.
Observe the specifications in the general data for use in an environment with pollution degree, see section 3.1.1.

Power grid type
All device types that are supplied with 480 V are designed exclusively for operation on Wye sources with 480/277 V.

Power supply and motor overload protection
Observe the specifications in the electrical data of the inverter for this, see section 3.2.

Line fuse
Observe the specifications for the UL-compliant line fuse in section 5.3.1.

Motor protection
All models of STOBER 5th generation inverters have a certified i²t model, a calculation model for thermal monitoring of the motor. This fulfills the requirements for semiconductor motor overload protection in accordance with the change to UL 508C dated May 2013. To activate the protective function and set it up, make the following parameter settings – which differ from the default values: U10 = *2:Warning* and U11 = 1.00 s. This module can be used as an alternative or in addition to motor protection with temperature monitoring as described in section 5.8.

Information
STÖBER ANTRIEBSTECHNIK GmbH & Co. KG recommends using PTC thermistors as thermal motor protection.

Motor temperature sensor
All models of the 5th generation of STOBER inverters starting with HW 200 have connections for PTC thermistors (NAT 145° C) or KTY temperature sensors (KT84-130). Observe the terminal description X2 for proper connection, see section 5.8.

Braking resistor
If the inverters will be fitted with an externally mounted braking resistor, separate overtemperature protection must be made available.

24 V power supply
Low-voltage circuits shall be supplied by an isolating source such that the maximum open circuit voltage available to the circuit is not more than 28.8 V.
Observe terminal description X11 for this, see section 5.4.

Lines
Use only copper conductors for an surrounding temperature of 60/75° C.

Fuses
Use a 1 A fuse (time lag) upstream from relay 1. The fuse must be approved in accordance with UL 248.
Refer to the connection example of terminal description X1 for this, see section 5.5.

Branch circuit protection
An integral solid state short circuit protection does not provide branch circuit protection. If you would like to branch the output of the inverter, branch circuit protection must be ensured in conformity with the instructions of STOBER, the National Electrical Code and all additional applicable local regulations or equivalent specifications.

UL test
During the UL acceptance process of STÖBER ANTRIEBSTECHNIK GmbH & Co. KG, only risks for electrical shock and fire hazard were investigated. Aspects of functional safety were not assessed. These aspects are assessed for STOBER by the TÜV SÜD certification authority, for example.

2.12 Presentation of notes on safety

NOTICE

Notice

means that property damage may occur

▶ if the stated precautionary measures are not taken.

⚠ CAUTION!

Caution

with warning triangle means that minor injury may occur

▶ if the stated precautionary measures are not taken.

⚠ WARNING!

Warning

means that there may be a serious danger of death

▶ if the stated precautionary measures are not taken.

⚠ DANGER!

Danger

means that serious danger of death exists

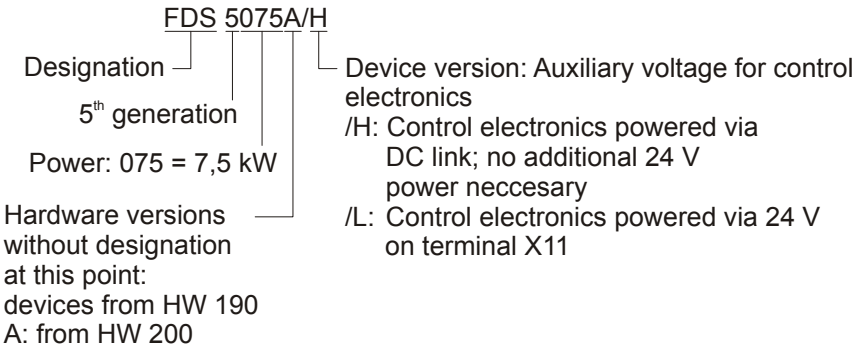
▶ if the stated precautionary measures are not taken.

Information

refers to important information about the product or serves to emphasize a section in the documentation to which the reader should pay special attention.

3 Technical data

Product key



Please note:
Unless an explicit difference is noted between the hardware variants in the technical data, the information applies to both hardware versions.

3.1 General data of the inverters

3.1.1 Transportation, storage and operating environment

NOTICE

Material damage!

The DC link capacitors in devices of sizes 0, 1 and 2 can lose their electrical strength through long storage times. Considerable material damage can arise from a reduced electrical strength of the DC link capacitors when switching on.

▶ Use devices in storage annually or before startup.

Maximum surrounding air temperature during operation	0° C to 45° C for rated data Up to 55° C with power reduction, 2.5 %/K
Temperature during storage/transportation	-20° C to +70° C Maximum change: 20 K/h
Humidity	Relative humidity: 85 %, no condensation
Installation altitude	Up to 1000 m above sea level without restrictions 1000 to 2000 m above sea level with power reduction, 1.5 %/100 m
Pollution degree	2 as per EN 50178
Ventilation	Built-in fan
Vibration (operation) acc. to DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s
Vibration (transportation) acc. to DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s 200 Hz ≤ f ≤ 500 Hz: 15 m/s

3.1.2 Device features

Protection rating	IP20
Interference suppression	EN 61800-3, interference emission, class C3
High-voltage category	III as per EN 61800-5-1

3.1.3 Weight

Device	Weight	
	Without Packaging [kg]	With Packaging [kg]
FDS 5007	2.1	2.9
FDS 5004		
FDS 5008		
FDS 5015		
FDS 5022	3.7	4.8
FDS 5040		
FDS 5055		
FDS 5075		

If you order an inverter with accessory parts, the weight increases by the following amounts:

- Accessory parts for higher option (fieldbus): 0.1 kg

3.2 Electrical data of the inverters

Information
An explanation of the most important formula symbols can be found in section 1.4 Abbreviations, formula symbols and indices.

3.2.1 Size 0 (BG 0): FDS 5007 to FDS 5015

Device	FDS 5007	FDS 5004	FDS 5008	FDS 5015
ID no. device version /H up to HW 190 (FDS 5xxx) start. from HW 200 (FDS 5xxxA)	45962 55421	45961 55420	45963 55422	45964 55423
ID no. device version /L up to HW 190 (FDS 5xxx) start. from HW 200 (FDS 5xxxA)	49295 55413	49294 55412	49296 55414	49297 55415
Recommended motor power	0.75 kW	0.37 kW	0.75 kW	1.5 kW
U_{1PU}	(L1 – N) 1 × 230 V +20 % / -40 % 50/60 Hz	(L1 – L3) 3 × 400 V, +32 % / -50 %, 50 Hz (L1 – L3) 3 × 480 V, +10 % / -58 %, 60 Hz		
$I_{1N,PU}$	ID 45962/49295: 1 × 5.9 A ID 55421/55413: 1 × 5.9 A	ID 45961/49294: 3 × 1.4 A ID 55420/55412: 3 × 1.4 A	ID 45963/49296: 3 × 2 A ID 55422/55414: 3 × 2.2 A	ID 45964/49297: 3 × 3.7 ID 55423/55415: 3 × 4 A
f_{2PU}	0 to 400 Hz			
U_{2PU}	0 to 230 V	0 to 400 V		

Operation with asynchronous motor (control types U/f, SLVC, VC)

$I_{2N,PU}$	ID 45962/49295: 3 × 4 A ID 55421/55413: 3 × 4 A	ID 45961/49294: 3 × 1.3 A ID 55420/55412: 3 × 1.3 A	ID 45963/49296: 3 × 2.1 A ID 55422/55414: 3 × 2.3 A	ID 45964/49297: 3 × 4 A ID 55423/55415: 3 × 4.5 A
I_{2maxPU}	180 % for 5 s; 150 % for 30 s			
$f_{PWM,PU}$	4 kHz (adjustable up to 16 kHz, see chap. 3.2.3 Derating by increasing the switching frequency)			

$P_{V,PU}$ ($I_2 = I_N$)	80 W	50 W	65 W	90 W
$P_{V,CU}$ ($I_2 = 0$ A)[a)]	Max. 30 W			
U_{maxPU}	440 V	830 V		
U_{onCH}	400 V to 420 V	780 V to 800 V		
U_{offCH}	360 V to 380 V	740 V to 760 V		
R_{2minRB}	100 Ω	ID 45961/45963/45964/49294/49296/49297: 200 Ω ID 55420/55422/55423/55414/55412/55415: 100 Ω		
P_{maxRB}	1.8 kW	ID 45961/45963/45964/49294/49296/49297:3.2 kW ID 55420/55422/55423/55414/55412/55415: 6.4 kW		

a) Depends on the connected option boards and sensors (e.g., encoder).

3.2.2 Size 1 (BG 1): FDS 5022 to FDS 5075

Device	FDS 5022	FDS 5040	FDS 5055	FDS 5075
ID no. device version /H up to HW 190 (FDS 5xxx) start. from HW 200 (FDS 5xxxA)	45965 55424	45966 55425	45967 55426	45968 55427
ID no. device version /L up to HW 190 (FDS 5xxx) start. from HW 200 (FDS 5xxxA)	49298 55416	49299 55417	49300 55418	49307 55419
Recommended motor power	2.2 kW	4.0 kW	5.5 kW	7.5 kW
U_{1PU}	(L1 – L3) 3 × 400 V, +32 % / -50 %, 50 Hz (L1 – L3) 3 × 480 V, +10 % / -58 %, 60 Hz			
$I_{1N,PU}$	1 × 5.3 A	3 × 9.3 A	3 × 12.3 A	3 × 15.8
f_{2PU}	0 to 400 Hz			
U_{2PU}	0 to 400 V			

Operation with asynchronous motor (control types U/f, SLVC, VC)

$I_{2N,PU}$	3 × 5.5 A	3 × 10 A	3 × 12 A	3 × 16 A
I_{2maxPU}	180 % for 5 s; 150 % for 30 s			
$f_{PWM,PU}$	4 kHz (adjustable up to 16 kHz, see chap. 3.2.3)			

$P_{V,PU}$ ($I_2 = I_N$)	110 W	170 W	180 W	200 W
$P_{V,CU}$ ($I_2 = 0$ A)[a)]	Max. 30 W			
U_{maxPU}	830 V			
U_{onCH}	780 V to 800 V			
U_{offCH}	740 V to 760 V			
R_{2minRB}	100 Ω	ID 45966/49299: 100 Ω ID 55425/55417: 47 Ω	47 Ω	
P_{maxRB}	6.4 kW	ID 45966/49299: 6.4 kW ID 55425/55417: 13.6 kW	13.6 kW	

a) Depends on the connected option boards and sensors (e.g., encoder).

3.2.3 Derating by increasing the switching frequency

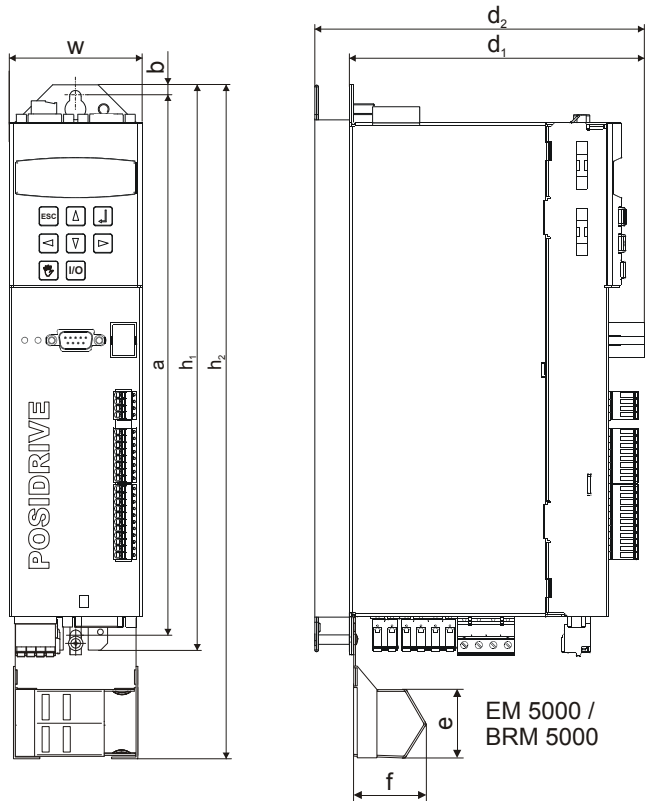
Based on the switching frequency $f_{PWM,PU}$ (Parameter *B24*), the following values of the output currents $I_{2N,PU}$ result.

Output current $I_{2N,PU}$

Switching frequency	4 kHz	8 kHz	16 kHz
FDS 5004	1.3 A	1.0 A	0.7 A
FDS 5007	4.0 A	3.0 A	2.0 A
FDS 5008 – ID 45963/49296: – ID 55422/55414:	 2.1 A 2.3 A	 1.5 A 1.7 A	 1.1 A 1.2 A
FDS 5015 – ID 45964/49297: – ID 55423/55415:	 4.0 A 4.5 A	 3.0 A 3.4 A	 2.0 A 2.2 A
FDS 5022	5.5 A	4.0 A	2.6 A
FDS 5040	10.0 A	6.0 A	3.3 A
FDS 5055	12.0 A	7.5 A	4.8 A
FDS 5075	16.0 A	10.0 A	5.7 A

3.3 Dimensions

3.3.1 Size 0 to 2: FDS 5007 to FDS 5150



Dimensions [mm]			Size 0	Size 1
Inverter	Height	h_1	300	
		h_2 a)	360	
	Width	w	70	
	Depth	d_1	157	242
		d_2 b)	175	260
EMC shroud	Height	e	37,5	
	Depth	f	40	
Fastening holes	Vertical distance	a	283	
	Vertical distance to upper edge	b	6	

a) h_2 = Height incl. EMC shroud EM 5000 or brake module BRM 5000

b) d_2 = Depth incl. brake resistor RB 5000

3.4 Brake resistors FDS 5xxx

3.4.1 FZM, FZMU

Braking resistor – inverter assignment

Type	FZM 330x35	FZMU 400x65
ID no.	40376	49010
FDS 5007	—	X
FDS 5004	X	—
FDS 5008	X	—
FDS 5015	X	—
FDS 5022	—	X
FDS 5040	—	X
FDS 5055	—	X
FDS 5075	—	X

The internal connections are wired with heat-resistant, silicon-insulated strands of wire on terminals. Also ensure a heat-resistant and stress-resistance design for the connection!

Conductor cross-section

Connection type	Conductor cross-section [mm²]
Rigid	0.5 – 4.0
Flexible with cable end sleeve	0.5 – 2.5

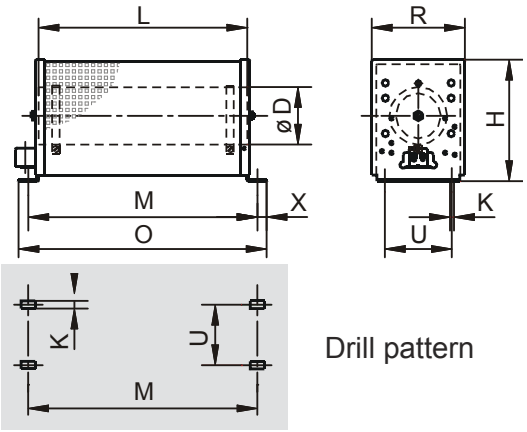
Properties

Type	FZM 330x35	FZMU 400x65
ID no.	40376	49010
Resistance [Ω]	300	100
Power [W]	250	600
Therm. time const. τ_{th} [s]	40	40
Pulse power for < 1 s [kW]	7.5	18
Weight [kg]	Approx. 1.1	Approx. 2.2
Protection class	IP20	IP20
Test marks		c UL us

Dimensions [mm]

Type	FZM 330x35	FZMU 400x65
ID no.	40376	49010
L x D	330 x 35	400 × 65
H	77	120
K	4.5 × 9	6.5 × 12
M	352	430
O	367	485
R	66	92
R	44	64
X	7	10

FZM(U)



Drill pattern

3.4.2 VHPR

Braking resistor – inverter assignment

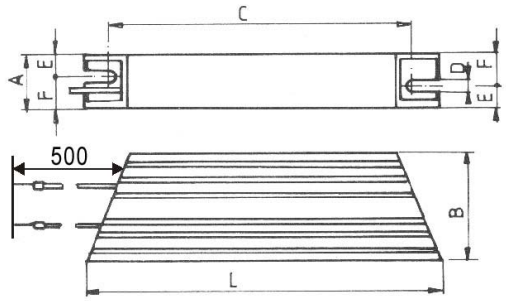
Type	VHPR150V		VHPR500V
ID no.	45972	45973	45974
FDS 5007	—	X	—
FDS 5004	X	—	—
FDS 5008	X	—	—
FDS 5015	X	—	—
FDS 5022	—	X	—
FDS 5040	—	X	—
FDS 5055	—	X	—
FDS 5075	—	X	X

Properties

Type	VHPR150V		VHPR500V
ID no.	45972	45973	45974
Resistance [Ω]	300	100	47
Power [W]	150		400
Therm. time const. τ_{th} [s]	46.6	80	65
Pulse power for < 1 s [kW]	13		19.5
Weight [g]	Approx. 310		Approx. 1020
Protection class	IP54		IP54
Test marks	c UL us		c UL us

Dimensions [mm]

Type	VHPR150V		VHPR500V
ID no.	45972	45973	45974
L	212		337
C	193 ± 2		317 ± 2
B	40		60
A	21		31
D	4.3		5.3
E	8		11.5
F	13		19.5



3.4.3 Bottom brake resistor RB 5000

Braking resistor – inverter assignment

Type ID no.	RB 5047 44966	RB 5100 44965	RB 5200 44964
FDS 5007	—	X	X
FDS 5004	—	—	X
FDS 5008	—	—	X
FDS 5015	—	—	X
FDS 5022	—	X	—
FDS 5040	—	X	—
FDS 5055	X	X	—
FDS 5075	X	—	—

Note the attachment to the inverter (section 4 Installation)!

Properties

Type ID no.	RB 5047 44966	RB 5100 44965	RB 5200 44964
Resistance [Ω]	47	100	200
Power [W]	60	60	40
Therm. time const. τ_{th} [s]	8		6
Pulse power for < 1 s [kW]	1.5	1.0	0.5
U_{max} [V]	800		
Weight [g]	Approx. 460	Approx. 440	
Cable design	Radox		
Cable length [mm]	250		
Cable cross-section [AWG]	18/19 (0.82 mm²)		
Maximum torque for studs [Nm]	5		
Protection class	IP 40		
Test marks	c UL us		

Dimensions [mm]

Type	RB 5047	RB 5100	RB 5200
ID no.	44966	44965	44964
Height	300		
Width	62		
Depth	18		
Drilling pattern corresponds to size:	1	0 and 1	0

3.5 Brake resistors FDS 5xxxA

3.5.1 FZMU, FZZMU

Braking resistor – inverter assignment

Type ID no.	FZMU 400x65 49010	FZZMU 400x65 53895
FDS 5007A	X	—
FDS 5004A	X	—
FDS 5008A	X	—
FDS 5015A	X	—
FDS 5022A	X	—
FDS 5040A	—	X
FDS 5055A	—	X
FDS 5075A	—	X

The internal connections are wired with heat-resistant, silicon-insulated strands of wire on terminals. Also ensure a heat-resistant and stress-resistance design for the connection!

Conductor cross-section

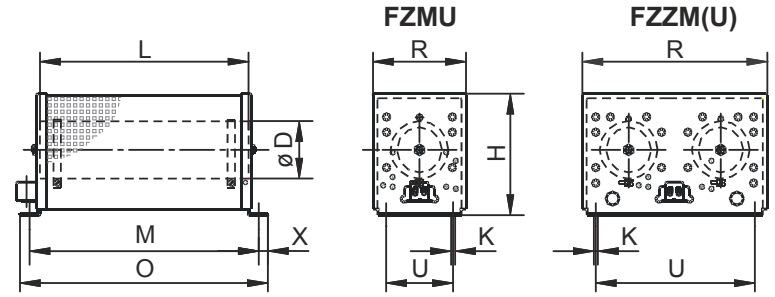
Connection type	Conductor cross-section [mm^2]
Rigid	0.5 – 4.0
Flexible with cable end sleeve	0.5 – 2.5

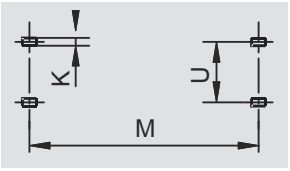
Properties

Type ID no.	FZMU 400x65 49010	FZZMU 400x65 53895
Resistance [Ω]	100	47
Power [W]	600	1200
Therm. time const. τ_{th} [s]	40	40
Pulse power for < 1 s [kW]	18	36
U_{max} [V]	848	848
Weight [kg]	Approx. 2.2	Approx. 4.2
Protection class	IP20	IP20
Test marks	c UL us	c UL us

Dimensions [mm]

Type	FZMU 400x65	FZZMU 400x65
ID no.	49010	53895
L x D	400 × 65	400 × 65
H	120	120
K	6.5 × 12	6.5 × 12
M	430	426
O	485	450
R	92	185
R	64	150
X	10	10





Drill pattern

3.5.2 GVADU, GBADU

Braking resistor – inverter assignment

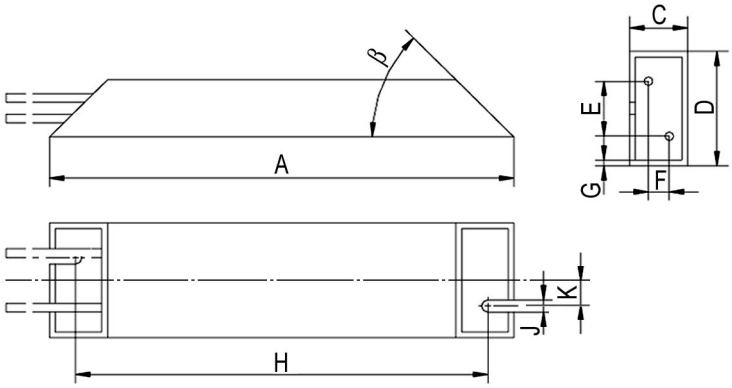
Type	GVADU 210x20	GBADU 265x30	GBADU 335x30	GBADU 405x30
ID no.	**55441**	**55442**	**55443**	**55499**
FDS 5007A	X	X	—	X
FDS 5004A	X	X	—	X
FDS 5008A	X	X	—	X
FDS 5015A	X	X	—	X
FDS 5022A	X	X	—	X
FDS 5040A	—	—	X	—
FDS 5055A	—	—	X	—
FDS 5075A	—	—	X	—

Properties

Type	GVADU 210×20	GBADU 265×30	GBADU 335×30	GBADU 405×30
ID no.	**55441**	**55442**	**55443**	**55499**
Resistance [Ω]	100	100	47	100
Power [W]	150	300	400	500
Therm. time const. τ_{th} [s]	60	60		
Pulse power for < 1 s [kW]	3.3	6.6	8.8	11
U_{max} [V]	848	848		
Cable design	Radox	FEP		
Cable length [mm]	50	50		
Cable cross-section [AWG]	18/19 (0.82 mm²)	14/19 (1.9 mm²)		
Weight [g]	300	950	1200	1450
Protection class	IP54	IP54		
Test marks	c UL us	c UL us		

Dimensions [mm]

Type	GVADU 210×20	GBADU 265×30	GBADU 335×30	GBADU 405×30
ID no.	**55441**	**55442**	**55443**	**55449**
A	210	265	335	405
H	192	246	316	386
C	20	30	30	30
D	40	60	60	60
E	18.2	28.8	28.8	28.8
F	6.2	10.8	10.8	10.8
G	2	3	3	3
K	2.5	4	4	4
J	4.3	5.3	5.3	5.3
β	65°	73°	73°	73°



3.5.3 Bottom brake resistor RB 5000

Braking resistor – inverter assignment

Type ID no.	RB 5047 44966	RB 5100 44965	RB 5200 44964
FDS 5007A	—	X	X
FDS 5004A	—	X	X
FDS 5008A	—	X	X
FDS 5015A	—	X	X
FDS 5022A	—	X	—
FDS 5040A	X	X	—
FDS 5055A	X	X	—
FDS 5075A	X	—	—

Properties

Type ID no.	RB 5047 44966	RB 5100 44965	RB 5200 44964
Resistance [Ω]	47	100	200
Power [W]	60	60	40
Therm. time const. τ_{th} [s]	8		6
Pulse power for < 1 s [kW]	1.5	1.0	0.5
U_{max} [V]	800		
Weight [g]	Approx. 460	Approx. 440	
Cable design	Radox		
Cable length [mm]	250		
Cable cross-section [AWG]	18/19 (0.82 mm²)		
Maximum torque for studs [Nm]	5		
Protection class	IP 40		
Test marks	c UL us		

Dimensions [mm]

Type	RB 5047	RB 5100	RB 5200
ID no.	44966	44965	44964
Height	300		
Width	62		
Depth	18		
Drilling pattern corresponds to size:	1	0 and 1	0

3.6 Output derater

⚠ WARNING!

Risk of burns! Fire hazard! Material damage!

Chokes can heat up to over 100°C under permitted operating conditions.

- ▶ Take protective measures against accidental and intentional contact with the choke.
- ▶ Make sure that no flammable material is in the vicinity of the choke.
- ▶ Do not install chokes under or near the inverter.

⚠ WARNING!

Fire hazard!

Using chokes outside of the nominal data (cable length, current, frequency, etc.) can cause the chokes to overheat.

- ▶ Always comply with the maximum nominal data when operating the chokes.

NOTICE

Danger of machine standstill!

The motor temperature sensor evaluation is malfunctioning due to cable capacities.

- ▶ If you use cables which are longer than 50 m and the cables are not from STOBER, the cores for the motor temperature sensor and the brake must be separate (maximum length: 100 m).

Information

The following technical data applies for a rotary field frequency of 200 Hz. For example, this rotary field frequency is achieved with a motor with 4 pole pairs and a nominal speed of 3000 rpm.
Always observe the specified derating for higher rotary field frequencies.
Also observe the dependency of the cycle frequency.

Type	Output derater TEP3720-0ES41	Output derater 4EP3820-0CS41
ID no.	**53188**	**53189**
Voltage range	3 x 0 to 480 V	
Frequency range	0 to 200 Hz	
Rated current of the output derater at 4 kHz	4 A	17.5 A
Max. permitted motor cable length with output derater	100 m	
Max. surrounding temperature $\vartheta_{amb,max}$	40° C	
Design	Open	
Protection class	IP 00	
Winding losses	11 W	29 W
Iron losses	25 W	16 W
Connections	Screw terminals	
Max. conductor cross-section	10 mm^2	
Approvals	c UL us	

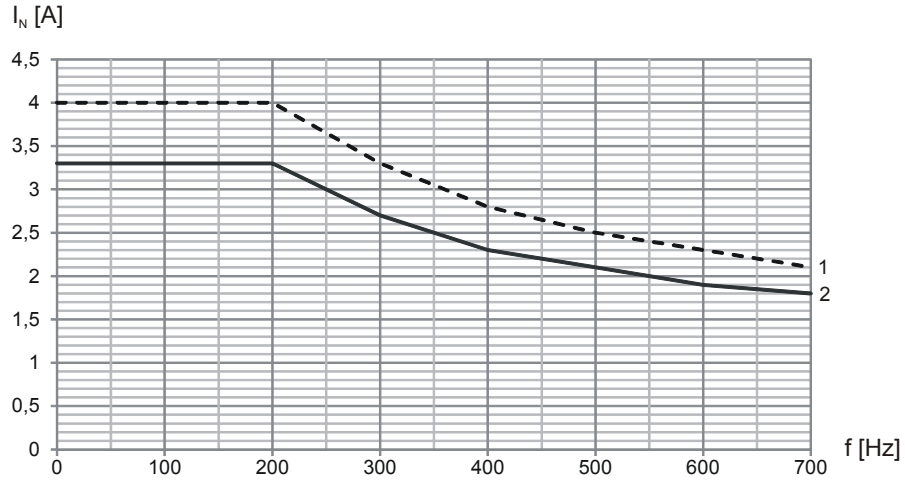
Projecting

Select the output chokes according to the rated currents of the motor and output chokes. In particular, observe the derating of the output choke for rotary field frequencies higher than 200 Hz.
You can calculate the rotary field frequency for your drive with the following formula:

$$f = n_N \cdot \frac{p}{60}$$

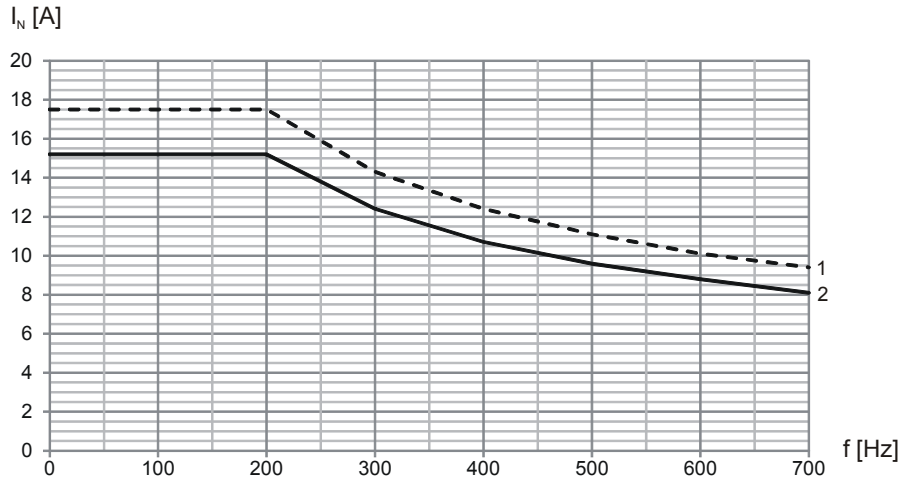
f Rotary field frequency in Hz
n Speed in rpm
p Number of pole pairs
N Nominal value

Derating TEP3720-0ES41



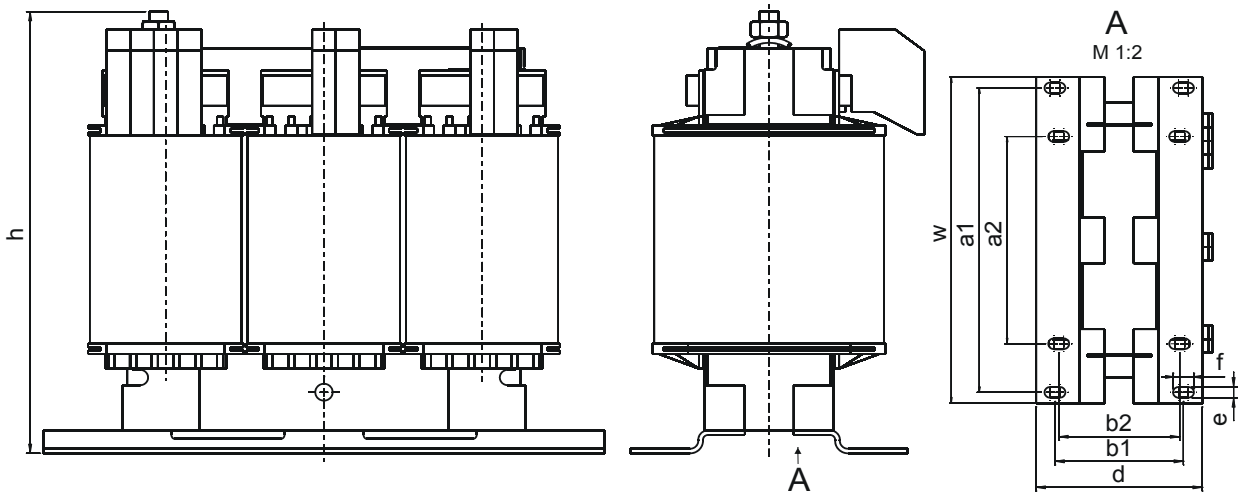
1 Cycle frequency 4 kHz
2 Cycle frequency 8 kHz

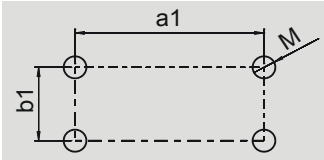
Derating 4EP3820-0CS41



1 Cycle frequency 4 kHz
2 Cycle frequency 8 kHz

Dimensions	TEP3720-0ES41	4EP3820-0CS41
Height h [mm]	Max. 153	Max. 153
Width w [mm]	178	178
Depth d [mm]	73	88
Vertical distance – fastening holes a1 [mm]	166	166
Vertical distance – fastening holes a2 [mm]	113	113
Horizontal distance – fastening holes b1 [mm]	53	68
Horizontal distance – fastening holes b2 [mm]	49	64
Drill holes – depth [mm]	5.8	5.8
Drill holes – width f [mm]	11	11
Screw connection – M	M5	M5
Weight [kg]	2.9	5.9





Mounting borings in acc. to DIN EN 60852-4

4 Installation

This chapter will give you information about installation. This includes:

- Installation of the inverter in the switching cabinet
- Installation of accessories on or in the inverter

⚠ WARNING!

Danger of personal injury and material damage due to electric shock!

▶ Always switch off all power supply voltage before working on the inverter! Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

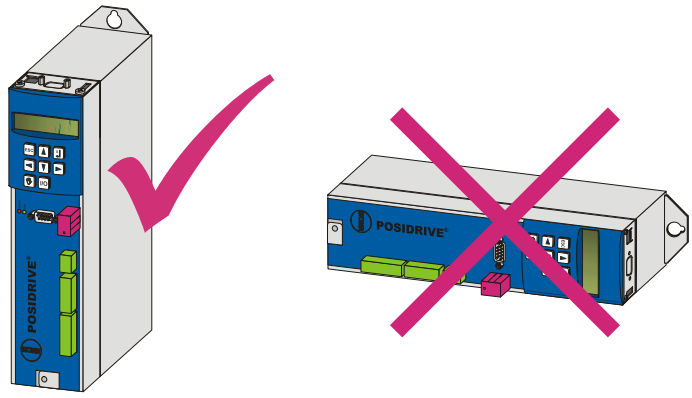
4.1 Installation of the inverter in the switching cabinet

NOTICE

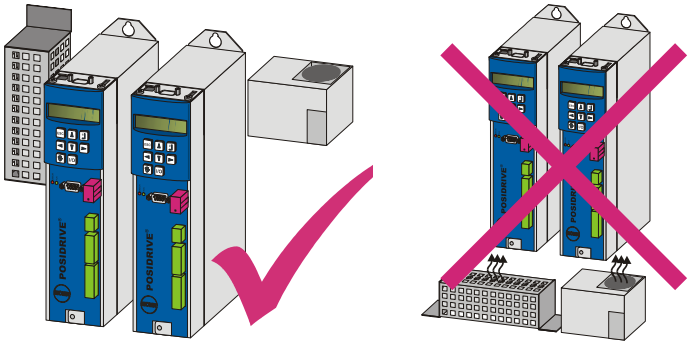
Danger of property damage from incorrect installation of the devices!

▶ It is essential to comply with the following installation instructions to avoid damage to the devices.

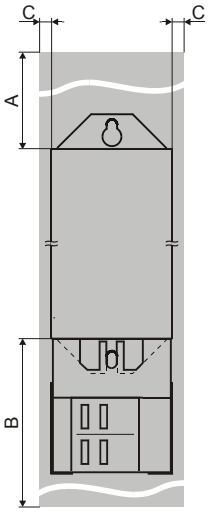
- The inverters must be installed in a control cabinet with at least protection class IP54.
- The installation location must be free of dust, corrosive vapors and all fluids (in accordance with pollution degree 2 as per EN 60204/EN 50178).
- The installation location must be free of atmospheric moisture.
- Prevent condensation, for example with anti-condensation heating elements.
- For reasons related to EMC, use mounting plates with a conductive surface (unpainted, etc.).
- Fasten the inverters onto the mounting plate with M5 screws.
- The inverters must be installed vertically:



- Avoid installation above or in the immediate vicinity of heat-generating devices, e.g. output chokes or braking resistors:



- To ensure there is sufficient air circulation in the control cabinet, observe the minimum clearances.



Min. clearance [dimensions in mm]	A Above	B Below	C On the side
Size 0 and size 1	100	100	5
... With EMC shroud or brake module	100	120	5

4.2 Accessories

4.2.1 Installation of bottom brake resistor

⚠ WARNING!

Danger of personal injury and material damage due to electric shock!

▶ Always switch off all power supply voltage before working on the inverter! Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

Requirements:

- You have tapped holes for threaded bolts on the mounting plate in the control cabinet at the installation location, taking into consideration the different device dimensions. The threaded bolts are included with the submounting braking resistor.

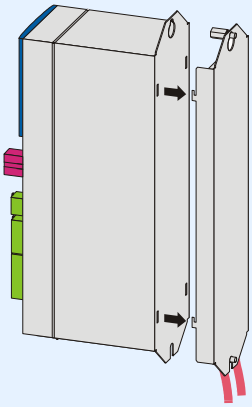
You need:

- The threaded bolts included with the submounting brake resistor.
- The screws and washers included with the submounting brake resistor.
- A PH2 Phillips screwdriver.
- An 8 mm hexagonal socket wrench.

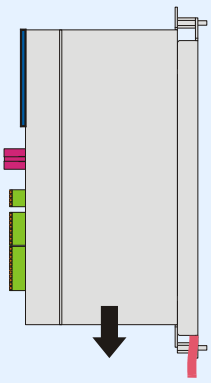
Installation of the submounting brake resistor

1. Attach the bottom brake resistor to the mounting plate with the studs:

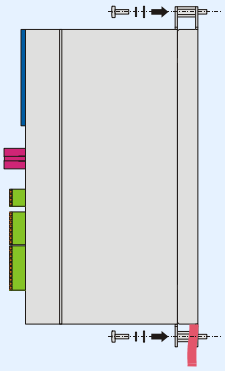
2. Place the device on the guides:



3. Press the device down on the guides:



4. Attach the device to the studs with the screws and washers:



⇨ You have installed the submounting brake resistor.

5. Connect the braking resistor.
   Refer to the terminal description X21 for proper connection of the cable, see section 5.9.
6. Parameterize the braking resistor in the inverter.

4.2.2 Installation of EMC shroud or brake module

⚠ WARNING!

Danger of personal injury and material damage due to electric shock!

▶ Always switch off all power supply voltage before working on the inverter! Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

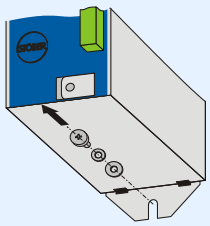
You can use the EMC shroud EM 5000 to connect the cable shield of the power cable. The brake module BRM 5000 additionally includes the power electronics for the optional brake controller for a 24 V brake. BRM 5000 and EM 5000 are identical with regard to the mechanical elements. The attachment for both accessory parts is therefore the same and is treated in the same way in the following sections.

Prerequisites:
- You have already installed the inverter in the switching cabinet.

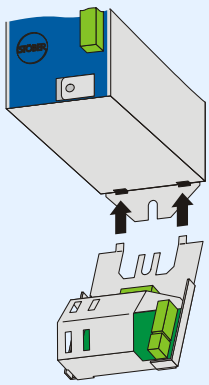
You will need
- A tool to unscrew the mounting screw

Installation of EMC shroud EM 5000 or brake module BRM 5000 on the inverter

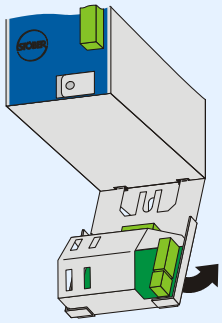
1. Remove the bottom mounting screw and washers from the inverter:



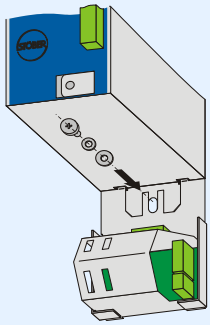
2. Slide the component into the openings at a slight angle:



3. Press the back of the component onto the wall of the switching cabinet:



4. Attach the component to the mounting plate and inverter with the mounting screw and the washers:



⇨ You have now installed the accessory.

4.2.3 Installation of terminal extension LEA 5000

⚠ WARNING!

Danger of personal injury and material damage due to electric shock!

▶ Always switch off all power supply voltage before working on the inverter! Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).

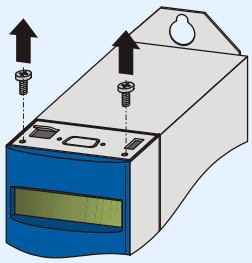
▶ Do not touch the contact surfaces.

The LEA 5000 accessory adds 8 binary inputs and 8 binary outputs to the standard terminals of the FDS 5000. The accessory part is installed above the inverter's display.

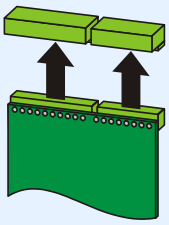
You will need the following for installation of LEA 5000:
- The covering plate which is included with the LEA 5000 accessory
- Phillips screwdriver

Installation of a LEA 5000 in an FDS 5000

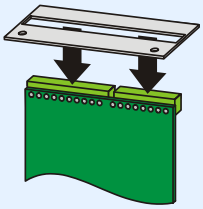
1. Remove the mounting screws and take off the cover plate:



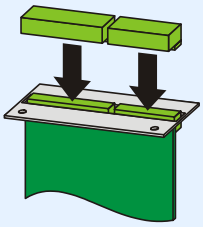
2. Disconnect the plug connectors from the terminal extension LEA 5000.



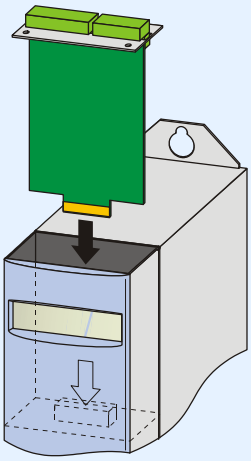
3. Place the plate over the base strips. Check alignment of the plate!



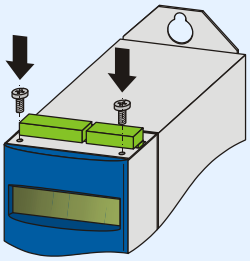
4. Reconnect the plug connectors to the terminal extension.



5. Guide the option board into the inverter so that the gold contacts slide into the black connector:



6. Secure the metal plate to the inverter with the mounting screws:



⇨ You have now installed the accessory.

4.2.4 Installation of CANopen, PROFIBUS, EtherCAT or PROFINET accessories

⚠ WARNING!

Danger of personal injury and material damage due to electric shock!

▶ Always switch off all power supply voltage before working on the inverter! Note that the discharge time of the DC link capacitors is up to 5 minutes. You can only determine the absence of voltage after this time period.

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).

▶ Do not touch the contact surfaces.

You will need the following accessories for the connection of CANopen or PROFIBUS. The accessory part is installed above the inverter's display.

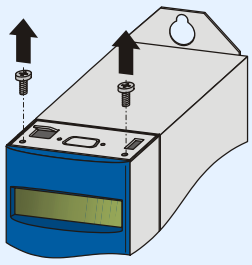
- CANopen: CAN 5000
- PROFIBUS: DP 5000

You will need the following for installation of CAN 5000 or DP 5000.

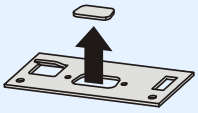
- A TX10 Torx screwdriver
- A pair of pliers
- Hexagon socket wrench, 4.5 mm

Installation of a CAN 5000 or DP 5000 in an inverter

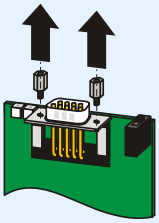
1. Remove the mounting screws and take off the cover plate:



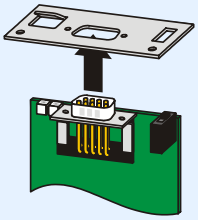
2. Remove the metal plate punch-out with a pair of pliers:



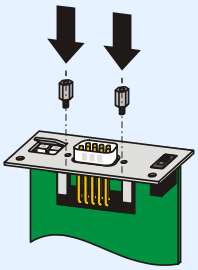
3. Remove the screws from the option board:



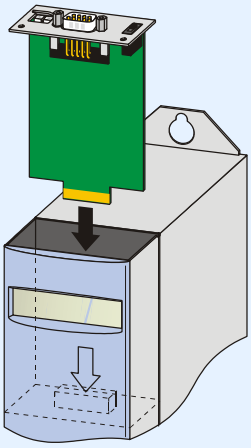
4. From below, thread the sub D plug connector of the PCB through the metal plate:



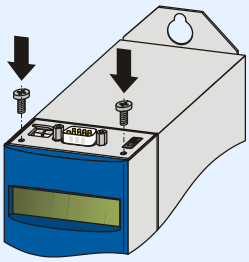
5. Secure the PCB to the metal plate with the screws which you removed in step 3:



6. Guide the option board into the inverter so that the gold contacts slide into the black connector:



7. Secure the metal plate to the inverter with the mounting screws:



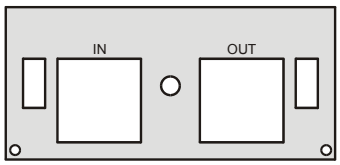
⇨ You have now installed the accessory.

You will need the following accessories for the connection of EtherCAT or PROFINET. The accessory part is installed above the inverter's display:

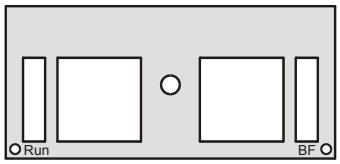
- EtherCAT: ECS 5000
- PROFINET: PN 5000

You will require the following for installation:

- A TX10 Torx screwdriver; a Phillips screwdriver
- the following cover plate, which is included in the accessories, is required for installing the ECS 5000:



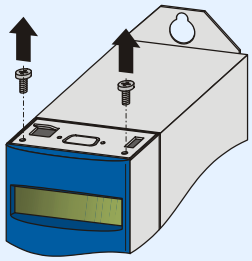
- the following cover plate, which is included in the accessories, is required for installing the PN 5000:



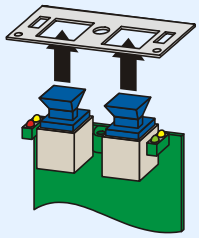
- The screw with locking disk which is included with the ECS 5000 accessories.

Installation of an ECS 5000 or PN 5000 in an inverter

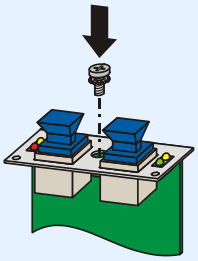
1. Remove the mounting screws and take off the cover plate:



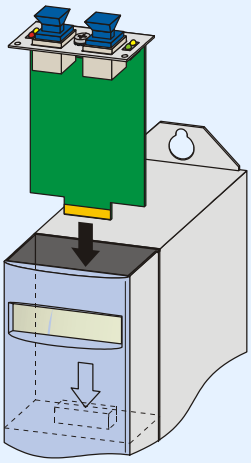
2. From below, guide the RJ45 plug connector of the PCB through the metal plate which is included with the accessory:



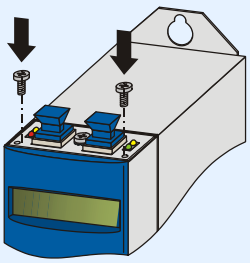
3. Secure the metal plate on the PCB with the included screw with locking disk:



4. Guide the option board into the inverter so that the gold contacts slide into the black connector:



5. Secure the metal plate on the PCB with the included screws:

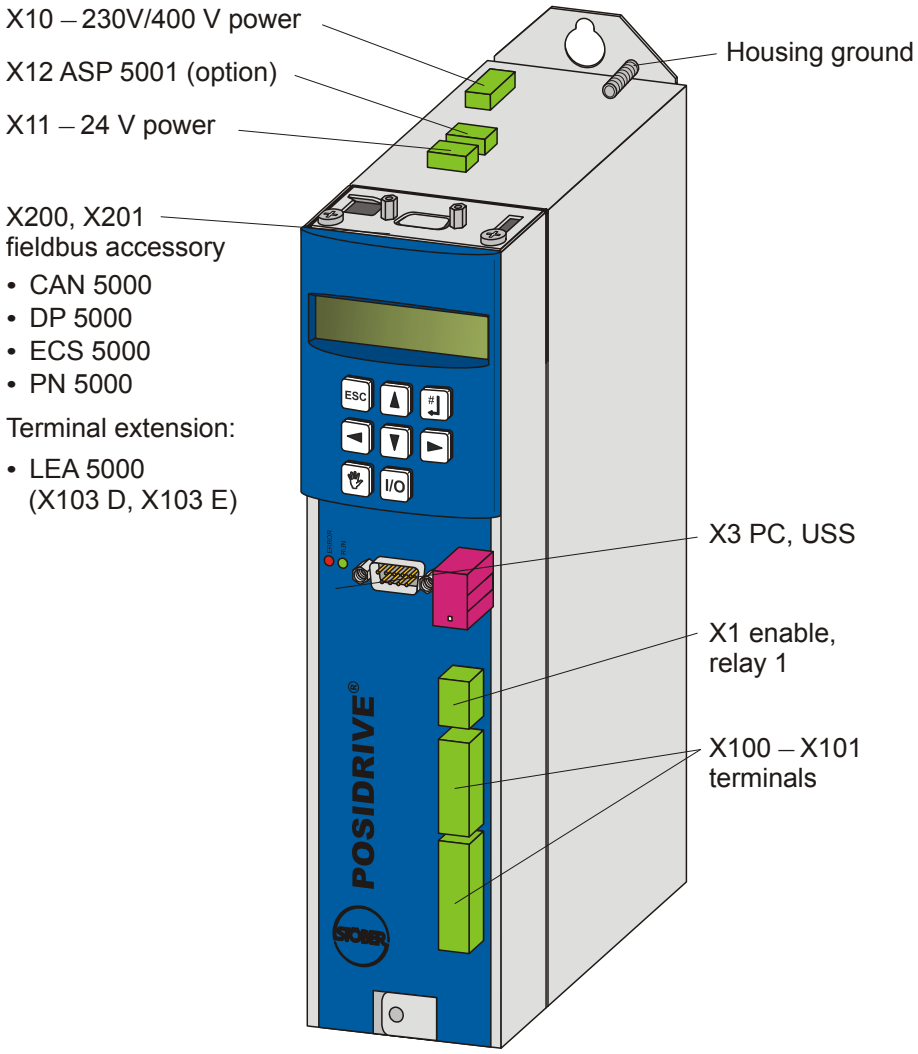


⇨ You have now installed the accessory.

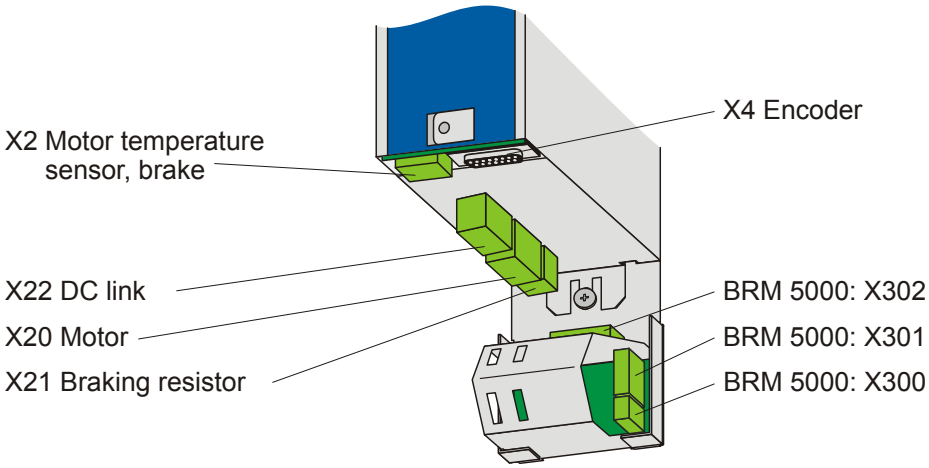
5 Connection

5.1 Overview of terminals

Front and top of the device



Bottom of the device



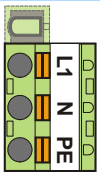
5.2 EMC connection

Information
This chapter contains general information on EMC-suitable installation. These are only recommendations. Depending on the application, the ambient conditions and the legal requirements, measures in addition to this recommendations may be required.

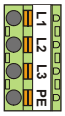
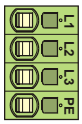
- Install power line, motor cable and signal lines separately from each other (e.g., in separate cable ducts).
- Use only shielded cables for the motor cable.
- If the brake line is installed together with the motor cable, the brake line must be shielded separately.
- Apply the shield of the motor cable over a large surface and in the immediate vicinity of the inverter. Use the EMC shroud EM 5000 or the mechanically identical brake module.
- Shield the cable for the connection of a brake resistor if the cable is longer than 30 cm. In this case apply the shield over a large surface in the immediate vicinity of the inverter.
- Always place the canopy with considerable spacing around the terminal box in the case of motors with terminal boxes. You should use EMC cable connections.
- Connect the shield of the control lines on one side to the reference ground of the source (e.g., the PLC or CNC).

5.3 X10: 230 V/400 V power

Terminal description – single-phase power connection Size 0

Pin	Designation	Function	Data
	—	Plastic dummy plug	—
	L1	Input voltage	230 V +20 %/-40 % 50/60 Hz
	N	Neutral conductor	—
	PE	Protective ground	—

Terminal description – three-phase power connection

Pin		Designation	Function	Data
Size 0	Size 1			
		L1	Input voltage	3 x 400 V +32 %/-50 % 50 Hz or 3 x 480 V +10 %/-58 % 60 Hz
		L2		
		L3		
		PE	Protective ground	—

Minimum tightening torque M_{min} – screw-type terminals

Size	Size 1	
Unit	[Nm]	[lb-in]
M_{min}	0.5	4.4

Maximum conductor cross-section of power terminals

Size	0	1
Cross-section [mm^2]	2.5	4

5.3.1 Line fuse

The device's cables and output are protected by means of line protection. Various protective devices may be used for this purpose:

- Full range fuse (class "gG" in accordance with IEC class specification or "time lag" in accordance with VDE)
- Line circuit breaker
  Use line circuit breaker with trigger characteristics C in accordance with EN 60898.
- Power circuit breaker

Use fuses of class RK1 for UL-compliant applications, for example Bussmann KTS-R-xxA/600 V. For devices of sizes BG 0 and BG 1 It is also possible to uses fuses of class CC.

Type	Input current	Protection rating		
	$I_{1N,PU}$	Recommended	for UL-compliant use	for DC link connection in group 1
FDS 5007	1 x 5.9 A	1 x 10 A	1 x 10 A	1 x 10 A
FDS 5004	3 x 1,4 A	3 x 6 A	3 x 6 A	3 x 10 A
FDS 5008	3 x 2 A	3 x 6 A	3 x 6 A	3 x 10 A
FDS 5015	3 x 3,7 A	3 x 10 A	3 x 10 A	3 x 10 A
FDS 5022	3 x 5,3 A	3 x 10 A	3 x 10 A	3 x 20 A
FDS 5040	3 x 9,3 A	3 x 16 A	3 x 15 A	3 x 20 A
FDS 5055	3 x 12,3 A	3 x 16 A	3 x 15 A	3 x 20 A
FDS 5075	3 x 15,8 A	3 x 20 A	3 x 20 A	3 x 20 A

The inverters are only suitable for use in supply current networks that are able to provide a maximally symmetrical nominal short circuit current at 480 volts according to the following table:

Size	Max. symmetrical nominal short circuit current
Size 0 and size 1	5000 A

5.3.2 Residual current safety device

STOBER devices can be protected with a Residual Current protective Devices (RCD) to detect residual currents. Residual current protective devices prevent electrical accidents, especially ground fault through the body. They are generally distinguished according to their triggering limit and suitability for detecting different types of residual current.
Depending on the function, stray currents may occur when operating inverters. Stray currents are interpreted as residual currents by residual current protective devices and may therefore lead to false triggering.
Depending on the relevant power supply connections, residual currents may occur with or without a DC current component. Because of this, you should take into consideration both the height and also the shape of the possible stray or residual current when selecting a suitable RCD.

⚠ DANGER!

Electric shock hazard!

The combination of single-phase inverters and residual current protective devices type A or AC can lead to false triggering of the RCDs.

Stray currents with a DC current component may occur in 3-phase inverters.

- ▶ Always protect single-phase inverters with *residual current protective devices type B, sensitive to all currents*, or with type F, sensitive to mixed currents.
- ▶ Always protect 3-phase inverters with *residual current protective devices type B, sensitive to all currents*.

False triggering – causes

Depending on stray capacitances and asymmetries, stray currents up to 40 mA may occur during operation.
Undesirable false triggering occurs

- ... when inverters to the supply voltage.
  This false triggering can be rectified by using short-time delayed (super-resistant), selective (delayed switch-off) residual current protective devices or RCDs with increased trigger current (for example 300 or 500 mA).
- ... Due to higher frequency stray currents for long motor cables under normal operating conditions:
  This false triggering can be rectified for example using low-capacitance cables or output deraters.
- ... due to unbalances in the supply network.
  This false triggering can be rectified for example using an isolating transformer.

Information
Check whether the use of residual current protective devices with increased trigger current as well as with short-time delayed or delayed switch-off trigger characteristics are permitted in your application.

Installation:

DANGER!

Electric shock hazard!

Stray and residual currents with a DC current component can restrict the functionality of residual current protective devices types A and AC.

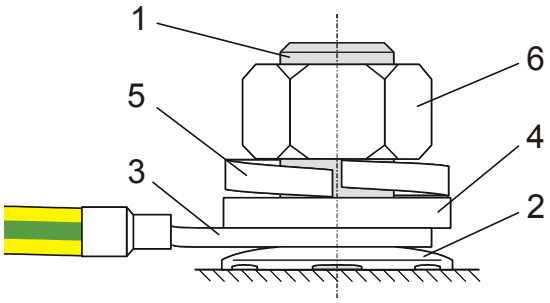
▶ Always follow the installation instructions for the protective devices you are using.

5.3.3 Housing ground

Note the following information on the connection of the protective earth to ground the housing correctly:

- Note the assembly sequence on the M6 earth bolts (1):
  - 2 Contact disk
  - 3 Cable socket
  - 4 Washer
  - 5 Return spring (optional)
  - 6 Nut

  Contact disk, washer, return spring and nuts are supplied with the inverter.



- Tightening torque: 4 Nm
- Stray currents > 10 mA can arise in normal operation.
  To fulfill DIN EN 61800-5-1 and EN 60204-1, connect the earth bolts with a copper conductor according to the following table:

Cross-section A Feeder	Minimum cross-section A_P Earth conductor at earth bolts
A ≤ 2.5 mm^2	2.5 mm^2
2.5 < A ≤ 16 mm^2	A
16 – 35 mm^2	≥ 16 mm^2
> 35 mm^2	A/2

5.3.4 Forming

NOTICE

Material damage!

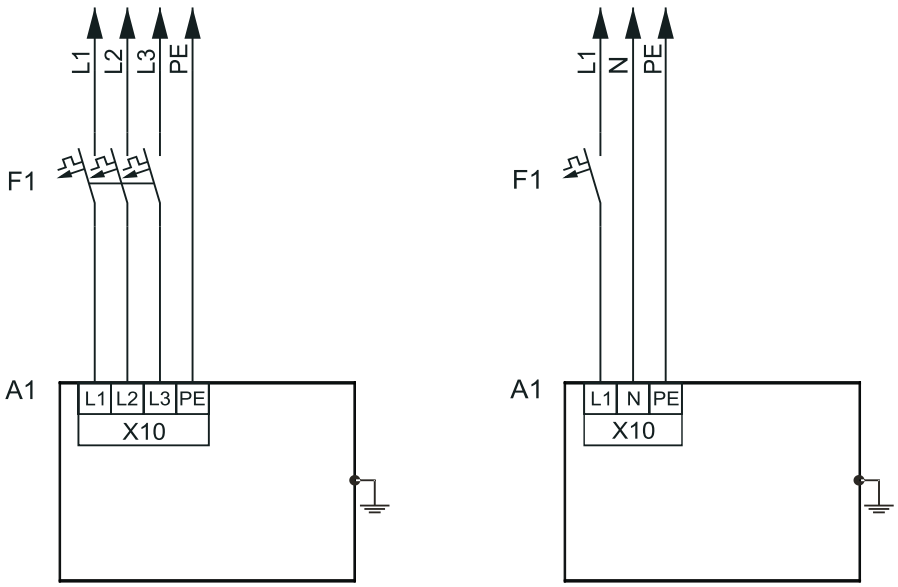
The DC link capacitors in devices of sizes 0, 1 and 2 can lose their electrical strength through long storage times. Considerable material damage can arise from a reduced electrical strength of the DC link capacitors when switching on.

▶ Use devices in storage annually or before startup.

Perform forming for stored devices.

Information
STOBER recommends connecting stored devices to the supply voltage according to the wiring shown for one hour every year. Please note that the inverters are designed exclusively for operation in TN networks.

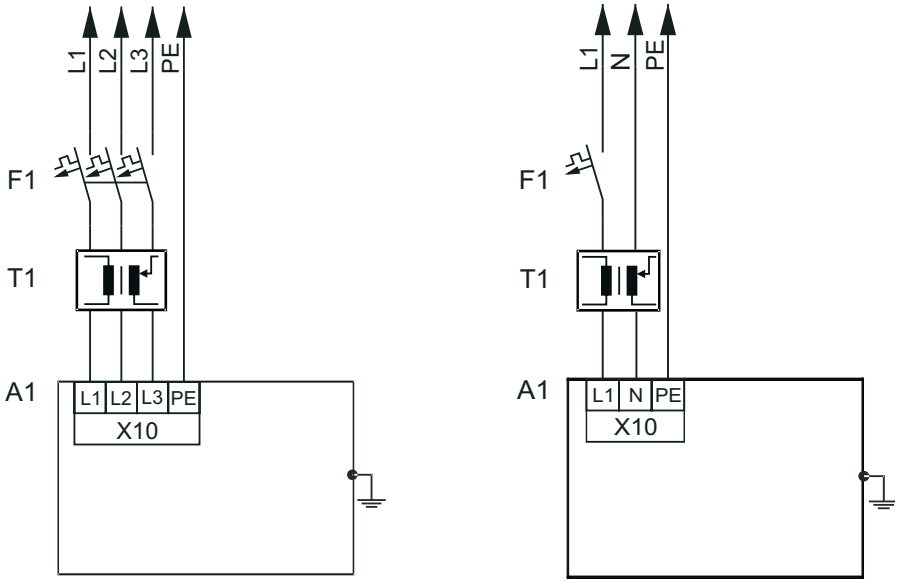
The graphics below show the principle network connection for 3-phase and 1-phase devices.



Legend

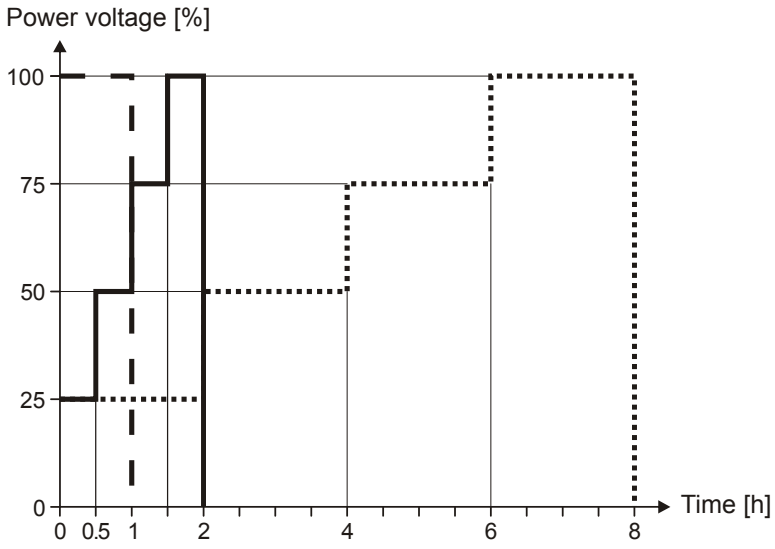
L1–L3 = lines 1 to 3
N = neutral conductor
PE = protective ground
F1 = fuse
A1 = inverter

If annual forming is not possible, form the stored devices before commissioning according to the wiring and voltage levels shown below.



Legend

L1–L3 = lines 1 to 3
N = neutral conductor
PE = protective ground
F1 = fuse
T1 = variable transformer
A1 = inverter



– –	Storage time 1 - 2 years:	Before enabling, apply voltage for one hour.
———	Storage time 2 - 3 years:	Before enabling, form as per curve.
·····	Storage time ≥3 years:	Before enabling, form as per curve.
	Storage time under 1 year:	No action required.

5.4 X11: 24 V power

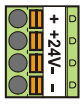
With device version /L, connection of 24 V on X11 is required for the powering of the control unit.

NOTICE

Danger of damage to the device due to overload!

▶ If the 24 V power is looped through, a max. of four devices may be powered on one line.

Terminal description – size 0 and size 1

Pin		Designation	Function	Data
	+	+ 24 V	Auxiliary voltage (PELV) for powering the control electronics	U_1 = 20.4 – 28.8 V I_{1max} = 1.5 A
	+	+ 24 V		
	–	GND	Reference potential for +24 V	—
	–	GND		

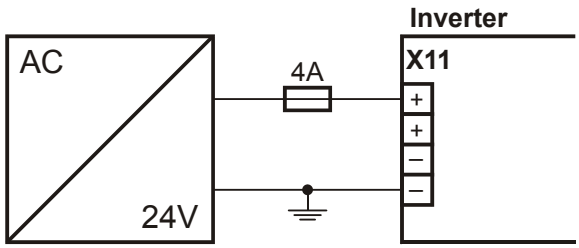
Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm²]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

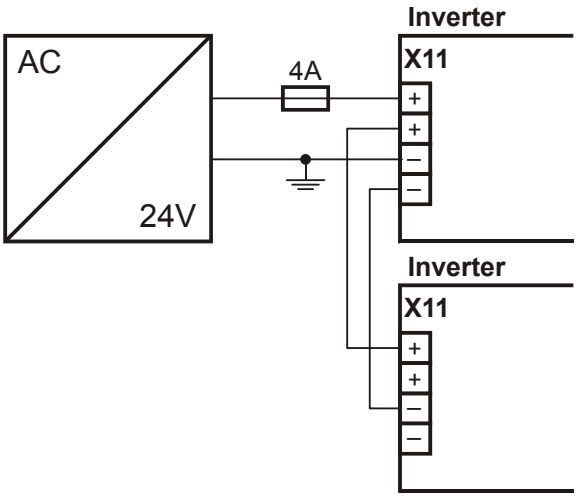
Example of connection

If the 24 V power is looped through, a max. of four devices may only be powered on one line. For conformity with UL, a 4 A fuse must be used on the 24 V incoming line. The fuse must be approved as per UL 248.

Size 0 and size 1



Example of the connection of two devices

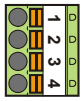


5.5 X1: Enable and relay 1

Use the enable signal to enable the power pack of the inverter. Starting with V 5.5-C, the function of relay 1 can be adjusted in parameter *F10*.

General specification	
Maximum cable length	30 m

Terminal description

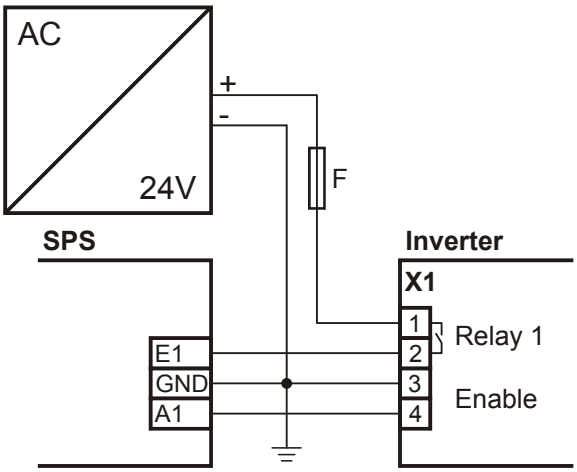
Pin		Designation	Function	Data
	1	Contact 1	Relay 1	U_{max} = 30 V I_{max} = 1.0 A Life expectation (number of switching operations): • Mechanical min. 5 000 000 switching operations; • at 24 V/1A (ohm. load): 300 000 switching operations. Recommended fuse: max. 1 A (time lag)
	2	Contact 2		
	3	GND	Enable power board	High level ≥12 V Low level < 8 V I_{1max} = 16 mA U_{1max} = 30 V
	4	+ input		

Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm²]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

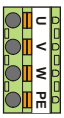
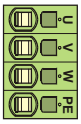
Example of connection

For a UL-compliant application, the use of a 1 A fuse before relay 1 is mandatory. The fuse must be approved as per UL 248.



5.6 X20: Motor

Terminal description - size 0 and size 1

Pin		Designation	Function
Size 0	Size 1		
		U	Motor connection, phase U
		V	Motor connection, phase V
		W	Motor connection, phase W
		PE	Protective ground

Minimum tightening torque M_{min} – screw-type terminals

Size	Size 1	
Unit	[Nm]	[lb-in]
M_{min}	0.5	4.4

Maximum conductor cross-section of power terminals

Size	0	1
Cross-section [mm^2]	2.5	4

Max. cable length

Remember the maximum motor cable lengths in accordance with the following table:

Size	Size 0 and size 1
Without output derator	50 m
With output derator	100 m

Connection without output derater

Observe the following points when connecting the motor without the output derater:

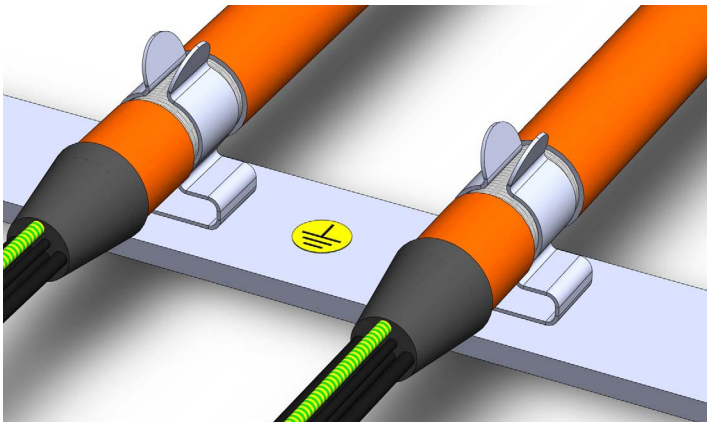
- Ground the shield of the motor cable with the shield connection clamp on the EMC shroud.
- Keep the exposed conductor as short as possible. All devices and circuits that are sensitive to EMC must be kept at a distance of at least 0.3 m.

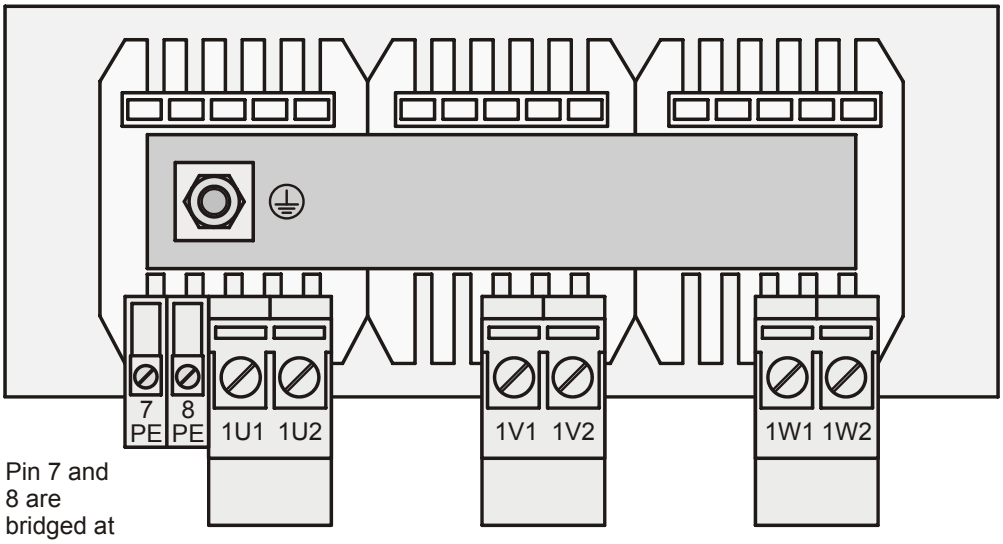
Connection with output derater

Observe the following points when connecting the motor to the output derater:

- Ground the shield of the motor cable with large area contacts in the immediate vicinity of the output derater, for example with electrically conductive metal cable terminals on a grounded connection rail.
- Keep the exposed conductor as short as possible. All devices and circuits that are sensitive to EMC must be kept at a distance of at least 0.3 m.

The graphic below shows an example for the shielded connection of a motor with output derater (graphic: icotek GmbH).



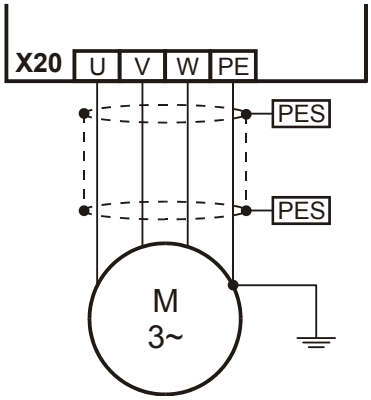


Pin 7 and 8 are bridged at the output derator

Example of connection

PES: HF shield connection via large-surface connection to PE

Inverter

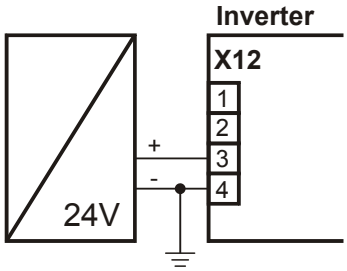


5.7 X12: ASP 5001 – Safe Torque Off

Information
If you are going to use this safety function, you will need the ASP 5001 option. It is imperative you read the operating instructions ASP 5001 (see section 1.2 Further documentation) and integrate the safety technology in your safety circuit in accordance with the description given there. Connect the ASP 5001 option as per the following description if you are not using any safety technology.

Information
Please remember that the following description only applies to the ASP 5001. Go to applications@stoeber.de for the description of the ASP 5001.

Terminal description X12

Pin	Des.	Function	Data	Circuiting (If safety technology is not used!)
1	NC contact (break contact element)	Feedback contact; must be integrated in the safety circuit of the controller!	Note the specifications in the operating instructions ASP 5001, see section 1.2 Further documentation.	
2				
3	Relay coil+	Activation[a)]	U_1 = 20.4 – 28.8 V_{DC} (PELV) I_{1Typ} = 50 mA I_{1max} = 70 mA Note the specifications in the operating instructions ASP 5001, see section 1.2 Further documentation.	
4	Relais coil-			

a) To conform with UL, a 4 A delayed fuse must be used in the 24 V feeder line. The fuse must be approved in accordance with UL 248.

Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

5.8 X2; X300 – X302; X141: Motor temperature sensor, motor holding brake

Connect the motor temperature sensor and the power switch for controlling the motor holding brake at terminal X2.

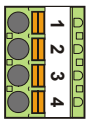
Motor holding brake connection
Note that the switch contact at X2 is not suitable for the direct connection of a brake. Instead use the accessory part
BRM 5000 or a suitable power switch.

Motor temperature sensor connection
Motor windings are monitored thermally using the motor temperature sensors such as PTC or KTY sensors. *PTC sensors* are thermistors and their resistance changes significantly with the temperature. When a PTC reaches its defined nominal response temperature, the resistance increases dramatically, by twice or more the original resistance to several kOhms. PTC sensors therefore allow for effective motor protection.
On the other hand, *KTY sensors* are temperature sensors with characteristic resistance curves that follow the temperature almost linearly. KTY sensors therefore allow for analog measurements of motor temperatures. However, the measurements are limited to one motor winding, which also restricts motor protection considerably compared with PTC drillings.

Information
Note that the evaluation of a KTY84-130 on the FDS 5000 is possible with a hardware version of 200 or higher. Before using a KTY, note that motor protection is not ensured to the same extent as when monitoring with PTC drilling.

Information
Note that evaluation of the temperature sensors is always active. If operation without temperature sensor is permitted, the connections must be bridged on X2. Otherwise a fault will be triggered when the device is switched on.

Terminal description X2

Pin		Function	Data
	1	1BD1	Max. • 250 V_{AC}/5 A • 30 V_{DC}/5 A (ohm. load • 30 V_{DC}/0.3 A (ind. load) UL • 30 V_{DC}/3 A (ohm. load t_2 = 1 ms Switch time: 15 ms Operating cycles: • mechanical 30 000 000 • 100 000 at 250 V_{AC}/0.6 A (ohm. load) • 300 000 at 30 V_{AC}/0.3 A (ohm. load) Recommended fuse: max. 1 A (time lag)
	2	1BD2	
	3	1TP1/1K1 +	Max. 6 PTC (connected in series) or a KTY84-130, max. cable length: 50 m
	4	1TP2/1K2 -	

Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm^2]
Rigid	2,5
Flexible	2,5
Flexible with cable end, without plastic sleeve	2,5
Flexible with cable end, with plastic sleeve	2,5
2 leads with the same cross-section with double cable end	1,5

Connection of a 24 V motor halting brake and the temperature sensor with BRM 5000

You can use the optional braking module BRM 5000 to connect a 24 V motor halting brake to the inverter.

Terminal description – X300 on BRM 5000

Connect the 24 V power supply of the braking module to terminal X300.

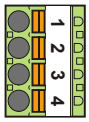
Pin		Designation	Function	Data
	+	24 V	Feedin for brake control	U_1 = 24 – 30 V I_{1max} = 2.5 A
	–	GND	Reference potential for 24 V	—

Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm²]
Rigid	2,5
Flexible	2,5
Flexible with cable end, without plastic sleeve	2,5
Flexible with cable end, with plastic sleeve	2,5
2 leads with the same cross-section with double cable end	1,5

Terminal description – X301 on BRM 5000

Connect the motor halting brake and the motor temperature sensor to terminal X301.

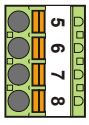
Pin		Designation	Function	Data
	1	1BD2	Reference potential for Pin 2	—
	2	1BD1	Control brake	I_{2max} ≤ 2.5 A: max. of 10 switching cycles per minute
	3	1TP1/1K1+	Temperature sensor	Max. 6 PTC or one KTY84-130, max. cable length: 50 m
	4	1TP2/1K2-		

Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm²]
Rigid	2,5
Flexible	2,5
Flexible with cable end, without plastic sleeve	2,5
Flexible with cable end, with plastic sleeve	2,5
2 leads with the same cross-section with double cable end	1,5

Terminal description – X302 on BRM 5000

Connect terminal X302 to terminal X2 on the inverter.

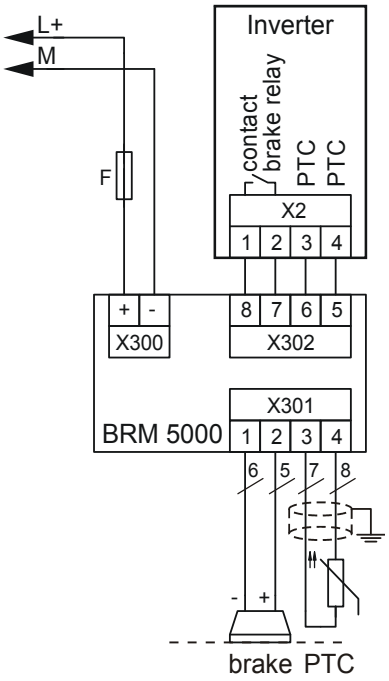
Pin		Designation	Function
	5	1TP2/1K2-	Temperature sensor, connect with pin 4 on X2
	6	1TP1/1K1+	Temperature sensor, connect with pin 3 on X2
	7	1BD2	Control brake, connect with pin 2 on X2
	8	1BD1	Control brake, connect with pin 1 an X2

Maximum conductor cross-section

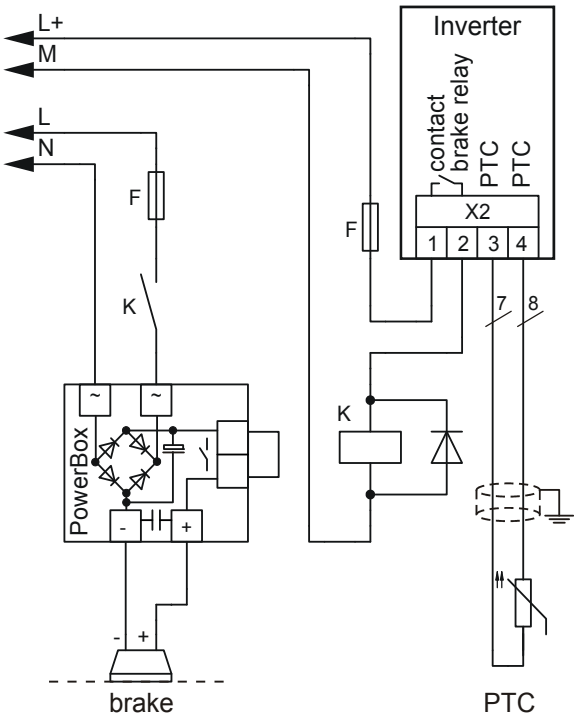
Connection type	Maximum conductor cross-section [mm²]
Rigid	2,5
Flexible	2,5
Flexible with cable end, without plastic sleeve	2,5
Flexible with cable end, with plastic sleeve	2,5
2 leads with the same cross-section with double cable end	1,5

Information
Remember that one LED is installed on the brake module. These LED indicate the status of the brake control:
- LED on: brake output, energized (active)
- LED off: brake output, not energized (inactive)

Brake connection with BRM 5000 for 24 V DC brake



Indirect brake control



5.9 X21: Braking resistor

An external braking resistor may be necessary during generating operation. For the technical data on the braking resistors, see chapter 3.

Terminal description – size 0 and size 1

Pin		Designation	Function
Size 0	Size 1	RB	Connection of braking resistor
		RB	

Minimum tightening torque M_{min} – screw-type terminals

Size	Size 1	
Unit	[Nm]	[lb-in]
M_{min}	0.5	4.4

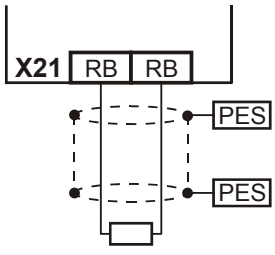
Maximum conductor cross-section of power terminals

Size	0	1
Cross-section [mm^2]	2.5	4

Example of connection

Use a shielded cable for cables longer than 30 cm between braking resistor and device.

Inverter



5.10 X22: DC link coupling

Information
Remember that the DC link coupling described here can only be used with the device families MDS 5000, SDS 5000 and FDS 5000.

When you have axes in your system which operate in combination and are continuously regenerative and motor-driven, the DC link coupling may offer advantages. The DC link coupling takes the excess power and offers it to other axes as drive power instead of converting it into heat via a braking resistor. Remember that you will need a braking resistor to absorb the power peaks when all drives in the DC link coupling brake at the same time.

DANGER!

Danger of device damage! When single-phase and three-phase devices are coupled, the single-phase devices will be destroyed.

- ▶ Only use three-phase devices for the DC link coupling!

NOTICE

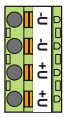
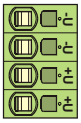
Danger of device damage!

Because the failure of one device could damage other devices, failure of a device must cause the entire DC link compound system to be disconnected from the power supply.

- ▶ Make a note of the wiring and parameterization of relay 1 in Section Principal circuit diagram (X1.1 and X1.2).
- ▶ After a failure, replace all the devices in a group.

Information
Remember that the parameter *A38 DC power-input* must be set before the DC link coupling can function correctly:
Group 1: *A38 = 0: inactive*
Groups 2 and 3: *A38 = 1: active*
See the description of the parameter.

Terminal description X22 – size 0 and size 1

Pin		Designation	Function
Size 0	Size 1		
		-U	Reference potential for DC link
		-U	
		+U	+ Potential of DC link
		+U	

Minimum tightening torque M_{min} – screw-type terminals

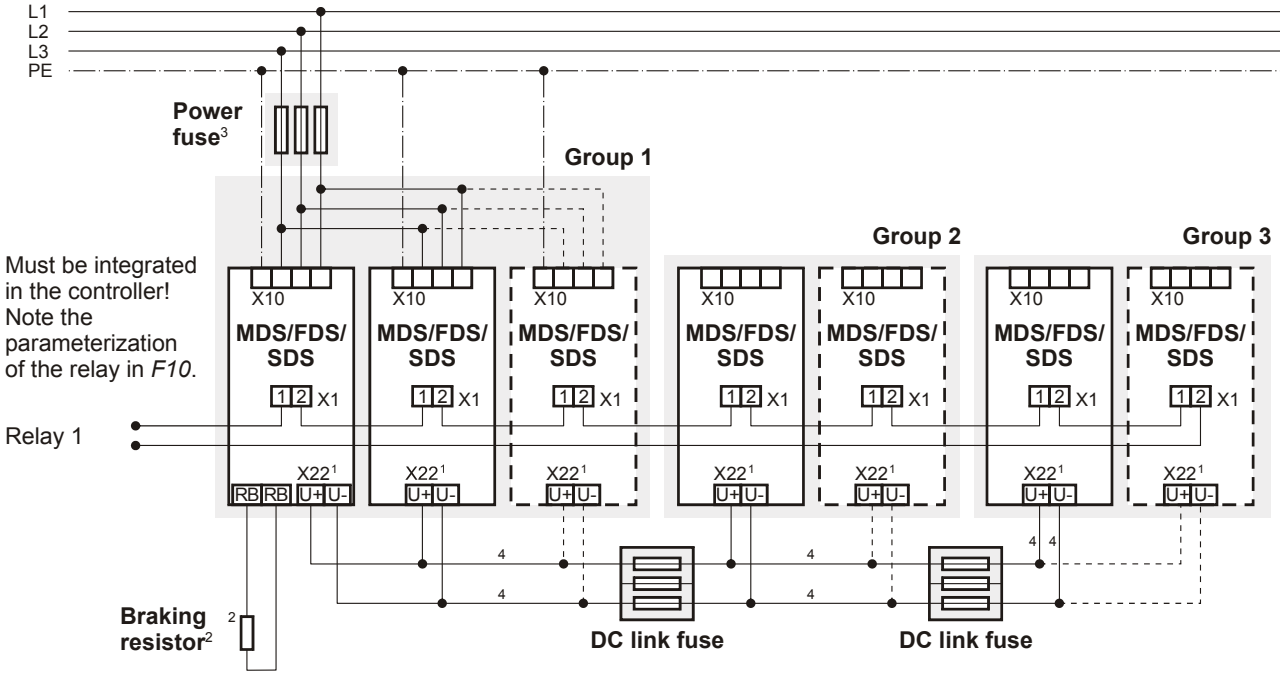
Size	Size 0		Size 1	
Unit	[Nm]	[lb-in]	[Nm]	[lb-in]
M_{min}	0,5	4,4	0,5	4,4

Maximum conductor cross-section of power terminals

Size	0	1
Cross-section [mm^2]	2.5	4

Principal circuit diagram

The following circuit diagram shows the principal circuit diagram of the DC link coupling. The inverters can be linked together in up to three groups. The table on the next page shows the possible combinations. The combination determines the types of line fuses and the DC link fuse.



1 With size 3 MDS 5000 and SDS 5000 devices: X20, terminals ZK+, ZK-.
2 Dimension the braking resistor in accordance with the braking performance of the DC link coupling and the technical data of the device.
3 See chapter 5.3.
4 Dimension the conductor cross-sections of the DC link connection according to the requirements of your application. A reference point can be the maximum cross-section for the terminals X22 for size 0 to 2 or X20 for size 3.

Combinations

The following table shows the possible combinations for the DC link connection. There are a total of 15 combinations available.

Example: Combination no. 7:
With combination no. 7, you can combine an inverter of size 1 in group 1 with two devices of size 0 in group 2. Group 3 is not set up. The line fuse must have a rated current of 20 A. The groups are separated via the DC link fuse of type 1. Wait three minutes before switching on the devices of the DC link connection again.

	Group 1				DC link fuse	Group 2		DC link fuse	Group 3	t_{min} a)
Device family	MDS/FDS/SDS		MDS/SDS			MDS/FDS/SDS			MDS/FDS/SDS	
Size	Size 0	Size 1	Size 2	Size 3		Size 0	Size 1		Size 0	
Line fuse	10 A	20 A b)	50 A b)	80 A b)		—	—		—	
P_{2maxPU} c)	4 kW	10 kW	20 kW	45 kW		—	—		—	
Combination no.										
1	Max. 4	—	—	—	—	—	—	—	—	1
2	—	Max. 4	—	—	—	—	—	—	—	5
3	—	3	—	—	Type 1	2	—	—	—	5
4	—	3	—	—	Type 1	1	—	—	—	3
5	—	2	—	—	Type 1	2	—	—	—	3
6	—	2	—	—	Type 1	1	—	—	—	4
7	—	1	—	—	Type 1	2	—	—	—	3
8	—	—	Max. 3	—	—	—	—	—	—	2
9	—	—	3	—	Type 2	—	1	Type 1	2	2
10	—	—	3	—	Type 1	2	—	—	—	2
11	—	—	3	—	Type 2	—	1	—	—	2
12	—	—	2	—	Type 2	—	1	—	—	2
13	—	—	2	—	Type 2	—	1	Type 1	1	2
14	—	—	1	—	Type 2	1	—	—	—	2
15	—	—	—	Max. 3	—	—	—	—	—	1

a) Restart time

b) Note the list of line fuses for UL-compliant use in section 5.3.1 Line fuse

c) Maximum sum of drive power

Instead of delaying the process by the restart time, you can determine the restart time by evaluating the *E14* parameter. The parameter in all devices connected to the network must show that the load relay is open before the supply voltage may be switched on again. You can query the parameter via the fieldbus or binary output. If you are setting up a DC link connection only with devices from the SDS 5000 family or A-devices (HW version 200 or higher), you do not need to note the restart time.

Fuses

⚠ CAUTION!

Danger of machine standstill! If a fuse element fails, the second fuse element will be damaged.

▶ Always replace the elements of a fuse in pairs.

Remember the following points during mounting and operation:

- Shield the DC link connections if the cables are longer than 20 cm. This prevents EMC problems.
- Use the two outer elements of the fuse holder to ensure adequate safe flashover distance.
- Use the following fuses to protect the DC link:

	Type 1	Type 2
Manufacturer	SIBA Sicherungs-Bau GmbH Borker Straße 22 D-44534 Lünen www.siba.de	
Size	10 x 38	
Operating class	gRL	
Rated voltage	AC 600 V	
Rated current	10 A	20 A
Power loss per element	1.6 W	3.5 W
Art. no. of fuse	6003434.10	6003434.20
Art. no. of fuse holder	5106304.3	

5.11 X100 – X103: Analog and binary signals

Remember that the terminals X100 and X101 are integrated in the device. Terminals X103D and X103E are integrated on the optional LEA 5000 accessory.

⚠ WARNING!

Danger of faulty machine behavior due to EMC faults!

▶ Use exclusively cables up to 30 m in length for analog and binary inputs and outputs (AE, AA, BE, BA)!

Information
Note that the sampling time of the inputs and the refresh rate of the outputs correspond to the cycle time set in parameter *A150*.
For time critical functions such as a print mark control, a time stamp is also available for the binary inputs.
If BE encoders or BA encoder simulation is used, the sampling time and refresh rate is independent of the set cycle time (see section 5.12.2 BE encoder and BA encoder simulation).

Terminal description X100

NOTICE

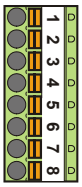
Machine movement by unexpected reference value

The inverter detects a reference value setting of +5V for an unconnected analog input.

▶ Always operate the inverter with a connected analog input.

General specification	
Maximum cable length	30 m, shielded

Terminal description

Pin		Designation	Function	Data
	1	AE1+	+ input of analog input AE1 resolution: 10 bit + sign	Reference: Pin 3 U_1 = ± 10 V R_{int} = 40 kΩ U_{1max} against pin 3 = 30 V U_{1max} against protective ground 15 V U_{1max} against AGND = 30 V
	2	AE1 shunt	Current input; shunt connection pin 2 is to be bridged with pin 1.	Reference: Pin 3 I_1 = ± 20 mA R_{int} = 510 Ω
	3	AE1-	Inverted input of analog input AE1	U_{1max} against pin 1 = 30 V U_{1max} against protective ground = 15 V U_{1max} against AGND = 30 V
	4	AE2+	+ input of the analog input AE2; Resolution: 10 bit + sign	Reference: Pin 5 U_1 = ± 10 V R_{int} = 40 kΩ U_{1max} against pin 5 = 30 V U_{1max} against protective ground = 15 V U_{1max} against AGND = 30 V
	5	AE2-	Inverted input of analog input AE2	U_{1max} against protective ground = 15 V U_{1max} against AGND = 30 V
	6	AA1	Analog output 1	Reference: Pin 8 I_{2max} = 10 mA R_{int} = 20 Ω Resolution: • FDS 5000: 10 bit + sign • FDS 5000A: 11 bit + sign
	7	AA2	Analog output 2	
	8	AGND	Reference ground for analog signals	—

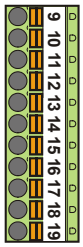
Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

Terminal description X101

General specification	
Maximum cable length	30 m, shielded

Terminal description

Pin		Designation	Function	Data
	9	GND 18 V	Reference ground for pin 19	—
	10	DGND	Reference ground for pins 11 to 18	—
	11	BE1	Binary input	High level: 12 – 30 V Low level: 0 – 8 V U_{1max} = 30 V I_{1max} = 16 mA at U_{1max}
	12	BE2		
	13	BE3[a)]		
	14	BE4[a)]		
	15	BE5[a)]		
	16	BA1	Binary output	I_{2max} = 20 mA (up to HW version 190) I_{2max} = 50 mA (from HW version 200)
	17	BA2		
	18	24 V-In	24 vdc power supply for binary outputs	Input range: 18 – 28.8 V
	19	18 V-Out	Auxiliary voltage 18 V	U_2 = 16 – 18 V I_{2max} = 50 mA

a) BE3, BE4 and BE5 can be used as an encoder input. Also note section 5.12.2 BE encoder and BA encoder simulation.

Maximum conductor cross-section

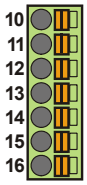
Connection type	Maximum conductor cross-section [mm²]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

Information
When the 24 V power fails, binary inputs BE6 to BE13 have signal status 0 (regardless of the physical signal state).

Terminal description X103 C – XEA 5001

General specification	
Maximum cable length	30 m, shielded

Terminal description

Pin		Designation	Function	Data
	10	BE7	Binary input	Reference: Pin 10 of terminal X101 High level: 12 – 30 V Low level: 0 – 8 V U_{1max} = 30 V I_{1max} = 3 mA at U_{1max}
	11	BE8		
	12	BE9		
	13	BE10		
	14	BE11		
	15	BE12		
	16	BE13		

Terminal description X103E – LEA 5000

General specification	
Maximum cable length	30 m, shielded

Terminal description

Pin		Designation	Function	Data
	9	BE6	Binary input	Reference: Pin – (GND) of terminal X103D High level: 12 – 30 V Low level: 0 – 8 V U_{1max} = 30 V I_{1max} = 3 mA at U_{1max}
	10	BE7		
	11	BE8		
	12	BE9		
	13	BE10		
	14	BE11		
	15	BE12		
	16	BE13		

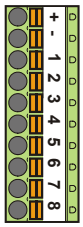
Maximum conductor cross-section

Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

Terminal description X103E – LEA 5000

General specification	
Maximum cable length	30 m, shielded

Terminal description

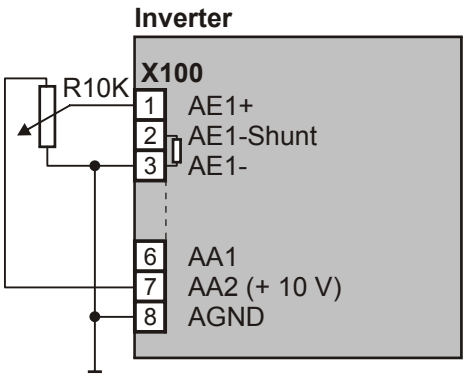
Pin		Designation	Function	Data
	+	+ 24 V	Power supply	U_{1max} = 20.4–28.8 V I_{1max} = 1.5 A
	-	GND		
	1	BA3	Binary output	I_{2max} = 50 mA
	2	BA4		
	3	BA5		
	4	BA6		
	5	BA7		
	6	BA8		
	7	BA9		
	8	BA10		

Maximum conductor cross-section

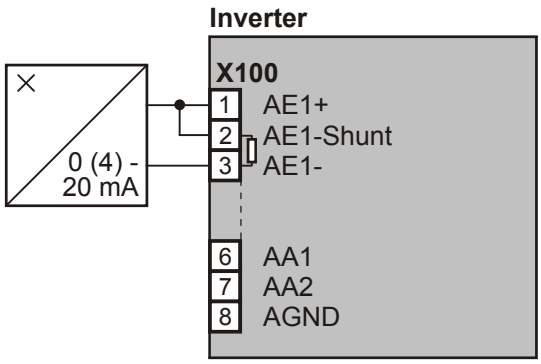
Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

Connection examples

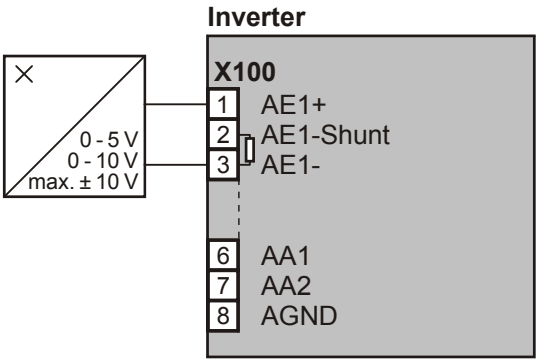
Potentiometer



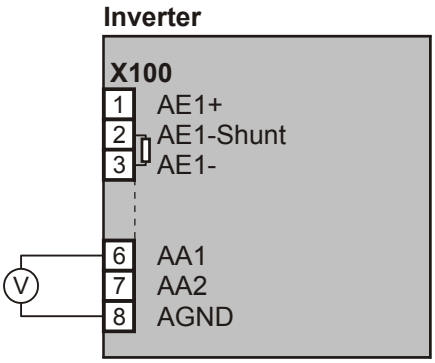
Current (0 - 20 mA, 4 - 20 mA)



Voltage (max. ± 10 V)



Analog output voltage



5.12 Encoder

Information
Remember that the encoder interfaces can usually evaluate or simulate several systems (e.g., HTL and TTL incremental encoder). In the parameters enter the particular system that you are connecting to an interface. Please consult the inverter operating manual in this case.

5.12.1 X4

NOTICE

Danger of encoder destruction!

▶ X4 may not be connected or disconnected when the device is on!

General specification	
U_2	15 – 16 V
I_{2max}	300 mA
Maximum cable length	100 m

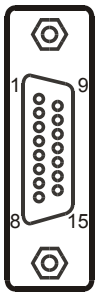
Specification for incremental signals	
Encoder type	Only TTL and HTL encoders with N channel may be connected to X4. Encoders without N channel generate a fault when the device starts.
f_{max}	Evaluation: ≤ 1 MHz Simulation: < 250 kHz
Signal level	TTL and HTL

Calculation example – limit frequency f_{max}
... for an encoder with 2,048 pulses per revolution:
3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution
= 102,400 pulses per second
= 102.4 kHz

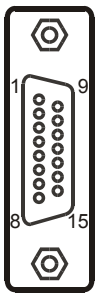
Encoder supply

U_2	Through	Remarks
15 – 16 V	Encoder sense line connected	—

Terminal description X4 for HTL encoder

Pin		Designation	Function, data
Socket 	1	B+	Differential input for B-track
	2	GND	Reference for encoder power on pin 4
	3	N+	Differential input for N-track
	4	U_2	Encoder power
	5	—	—
	6	A+	Differential input for A-track
	7	—	—
	8	—	—
	9	B-	Inverse, differential input for B-track
	10	N-	Inverse, differential input for N-track
	11	A-	Inverse, differential input for A-track
	12	Sense	Sensor lead for power supply to settle the encoder power
	13	—	—
	14	—	—
	15	—	—

Terminal description X4 for TTL encoder

Pin		Designation	Function, data
Socket 	1	—	—
	2	GND	Reference for encoder supply to pin 4
	3	—	—
	4	U_2	Encoder supply
	5	B+	Differential input for B channel
	6	—	—
	7	N+	Differential input for N channel
	8	A+	Differential input for A channel
	9	—	—
	10	—	—
	11	—	—
	12	Sense	Sensor line for the supply voltage to adjust the encoder supply
	13	B-	Inverse, differential input for B channel
	14	N-	Inverse, differential input for N channel
	15	A-	Inverse, differential input for A channel

5.12.2 BE encoder and BA encoder simulation

To evaluate single-ended incremental encoder or stepper motor signals, use binary inputs BE3, BE4 and BE5. If you would like to simulate them, use outputs BA1 and BA2.
Hall encoders are connected to binary inputs BE1, BE2 and BE3.

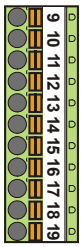
General specification	
Maximum cable length	30 m
Signal level	HTL

Evaluation – incremental and stepper motor signals	
High level	12 – 30 V
Low level	0 – 8 V
U_{1max}	30 V
I_{1max}	16 mA
f_{max}	100 kHz

Simulation – incremental and stepper motor signals	
I_{2max}	up to HW version 190: 20 mA from HW version 200: 50 mA
Eff. update rate	1 kHz
f_{max}	250 kHz
Extrapolation frequency	1 MHz

Calculation example – limit frequency f_{max}
... for an encoder with 2,048 pulses per revolution:
3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution
= 102,400 pulses per second
= 102.4 kHz

Terminal description X101 incremental encoder and stepper motor signals

Pin		Designation	Function	Data
	9	GND 18 V	Reference ground for pin 19	—
	10	DGND	Reference ground for pins 11 to 18	—
	11	BE1	—	—
	12	BE2	—	
	13	BE3	Evaluation: Incremental encoder: N Stepper motor signals: –	
	14	BE4	Evaluation: Incremental encoder: A Stepper motor signals: freq.	
	15	BE5	Evaluation: Incremental encoder: B Stepper motor signals: direction	
	16	BA1	Simulation Incremental encoder: A Stepper motor signals: freq.	—
	17	BA2	Simulation Incremental encoder: B Stepper motor signals: direction	
	18	24 V-In	24 V power	Input range: 18 – 28.8 V
	19	18 V-Out	Auxiliary voltage 18 V	U_2 = 16 – 18 V I_{2max} = 50 mA

5.13 Fieldbus

5.13.1 X200: CANopen

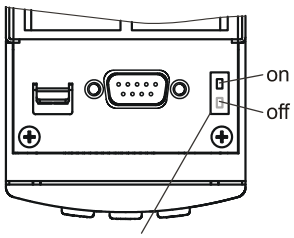
Prerequisite for the CANopen link:

- CAN 5000

Information
Please see the supplementary documentation of CANopen (see section 1.2 Further documentation)!

Terminal description X200

Pin		Designation	Function
Plug 	1	—	—
	2	CAN-low	CAN-low line
	3	GND	Signal Ground
	4	—	—
	5	—	—
	6	CAN-low	CAN-low line connected internally with pin 2
	7	CAN-high	CAN-high line
	8	—	—
	9	CAN-high	CAN-high line connected internally with pin 7



internal terminating resistance 120 Ω can be activated

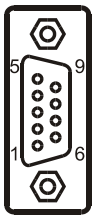
5.13.2 X200: PROFIBUS

Prerequisite for the PROFIBUS link:

- DP 5000

Information
Please see the supplementary documentation of PROFIBUS DP (see section 1.2 Further documentation)!

Terminal description X200

Pin		Designation	Function
socket 	1	—	—
	2	—	—
	3	B	RxD / TxD-P (send/receive data +)
	4	RTS	Direction control for repeater +
	5	GND	Ground to + 5 V
	6	+5 V	Power for terminating resistors
	7	—	—
	8	A	RxD / TxD-N (send/receive data -)
	9	—	—

5.13.3 X200, X201: EtherCAT

Prerequisite for the EtherCAT link:
- ECS 5000

Information
Please see the supplementary documentation of EtherCAT (see section 1.2 Further documentation)!

X200 and X201 terminal description

Pin		Designation	Function
	1	TxData+	EtherCAT communication
	2	TxData-	
	3	RecvData+	
	4	—	—
	5	—	—
	6	RecvData-	EtherCAT communication
	7	—	—
	8	—	—

Cable specification
STOBER provides ready-made cables for the EtherCAT connection. These cables must be used to ensure proper functionality.
It is also possible to use cables with the following specification:

Plug wiring	Patch or crossover
Quality	CAT5e
Shielding	SFTP or PIMF

5.13.4 X200, X201: PROFINET

Requirement for the die PROFINET connection:

- PN 5000

Information
Observe the PROFINET operating manual (see section 1.2 Further documentation)!

X200 and X201 terminal description
The terminal configuration is determined by T 568-B.

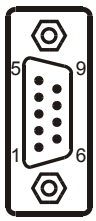
Pin		Designation	Function
	1	TxData +	PROFINET communication
	2	TxData -	
	3	RecvData +	
	4	—	Connect via RC-link with housing
	5	—	
	6	RecvData -	PROFINET communication
	7	—	Connect via RC-link with housing
	8	—	

Observe the PROFINET installation guideline for the cable specification (PROFINET Order No. 8.071, identification: TC2-08-0001); you can obtain the document at www. profibus.com.

5.14 X3: PC, USS

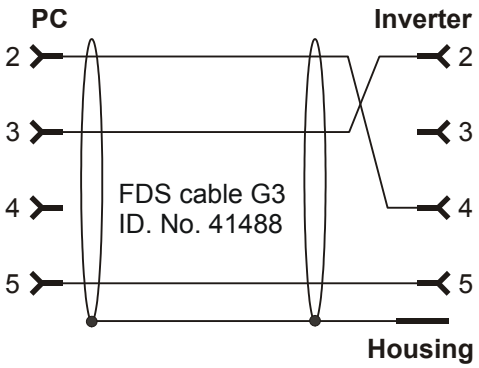
Connection to the PC or USS can be implemented with serial interface X3 on the front of the inverter. Setting up the PC connection is described in the inverter operating manual.

Terminal description X3

Pin		Designation	Function	Data
Plug 	1	+10 V	Power for Controlbox	I_{2max} = 30 mA
	2	Rx	Communication: Receiving input	—
	3	nc	Used internally. Do not activate!	—
	4	Tx	Communication: Sending output	—
	5	SG	Reference potential for pins 2 and 4	—
	6	nc	Used internally. Do not activate!	—
	7	nc		
	8	nc		
	9	nc		

Specifications of the cables

STOBER offers fabricated cables for the connection to the PC.Correct function is not guaranteed unless these cables are used. Read and comply with chapter 7 Accessories.



5.15 Cables

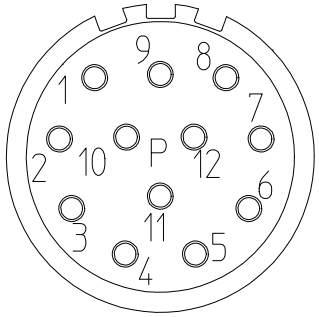
Information
To ensure proper functionality of the drive we recommend using cables from STOBER that are coordinated with the system. In case of use of unsuitable connection cables, we reserve the right to reject claims under the warranty.

5.15.1 Encoder Cables

5.15.1.1 Encoder HTL

HTL incremental encoders can be combined with STOBER motors of series ED/EK or EZ.
The suitable encoder cable is described below.

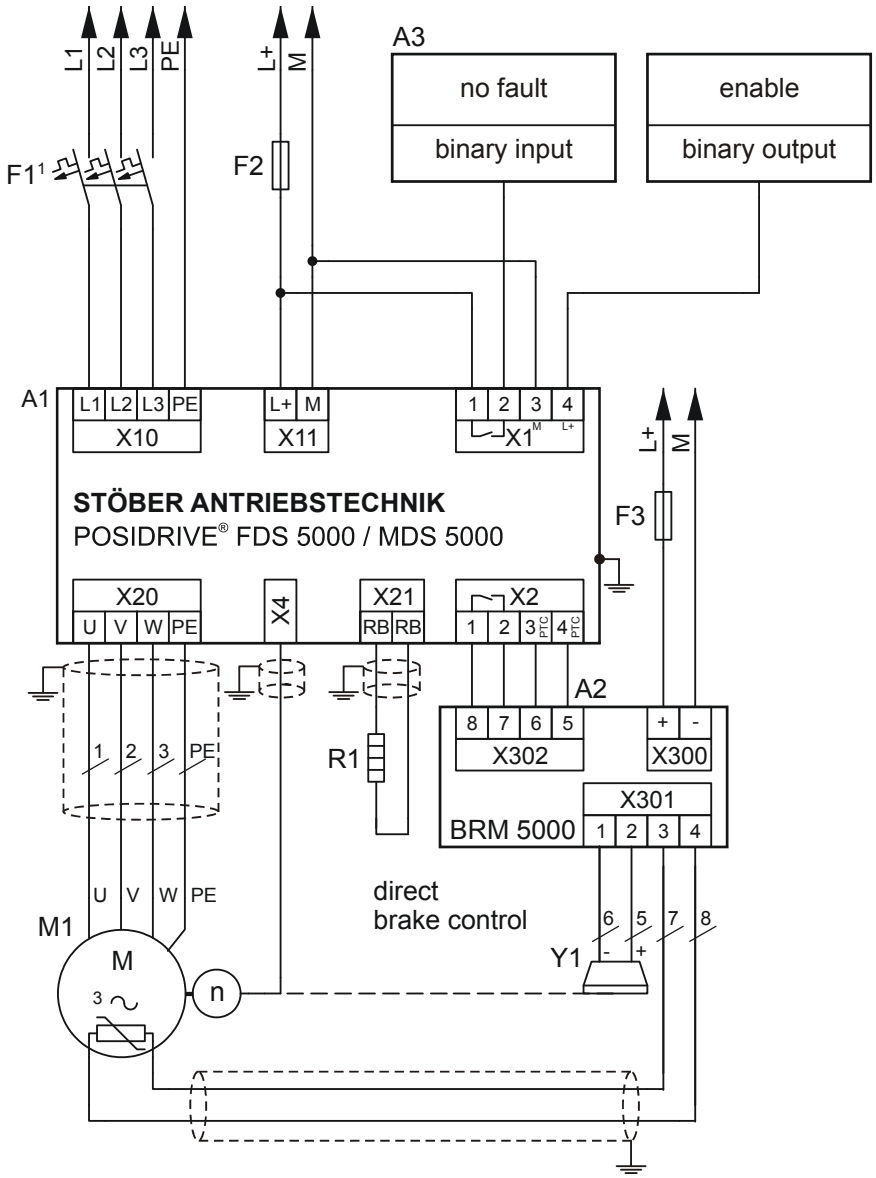
Encoder cable – plug connector con.23

Motor		Signal	Wire colors		Sub-D connector (X4)
Angle flange socket	Pin		Motor-internal	Encoder	Pin
	1	B-	PK	YE	9
	2	—	—	—	—
	3	N+	RD	PK	3
	4	N-	BK	GY	10
	5	A+	BN	BN	6
	6	A-	GN	WH	11
	7	—	—	—	—
	8	B+	GY	GN	1
	9	—	—	—	—
	10	GND	WH	BU	2
	11	—	—	—	—
	12	U_2	BN	RD	4
	Housing	Shield			

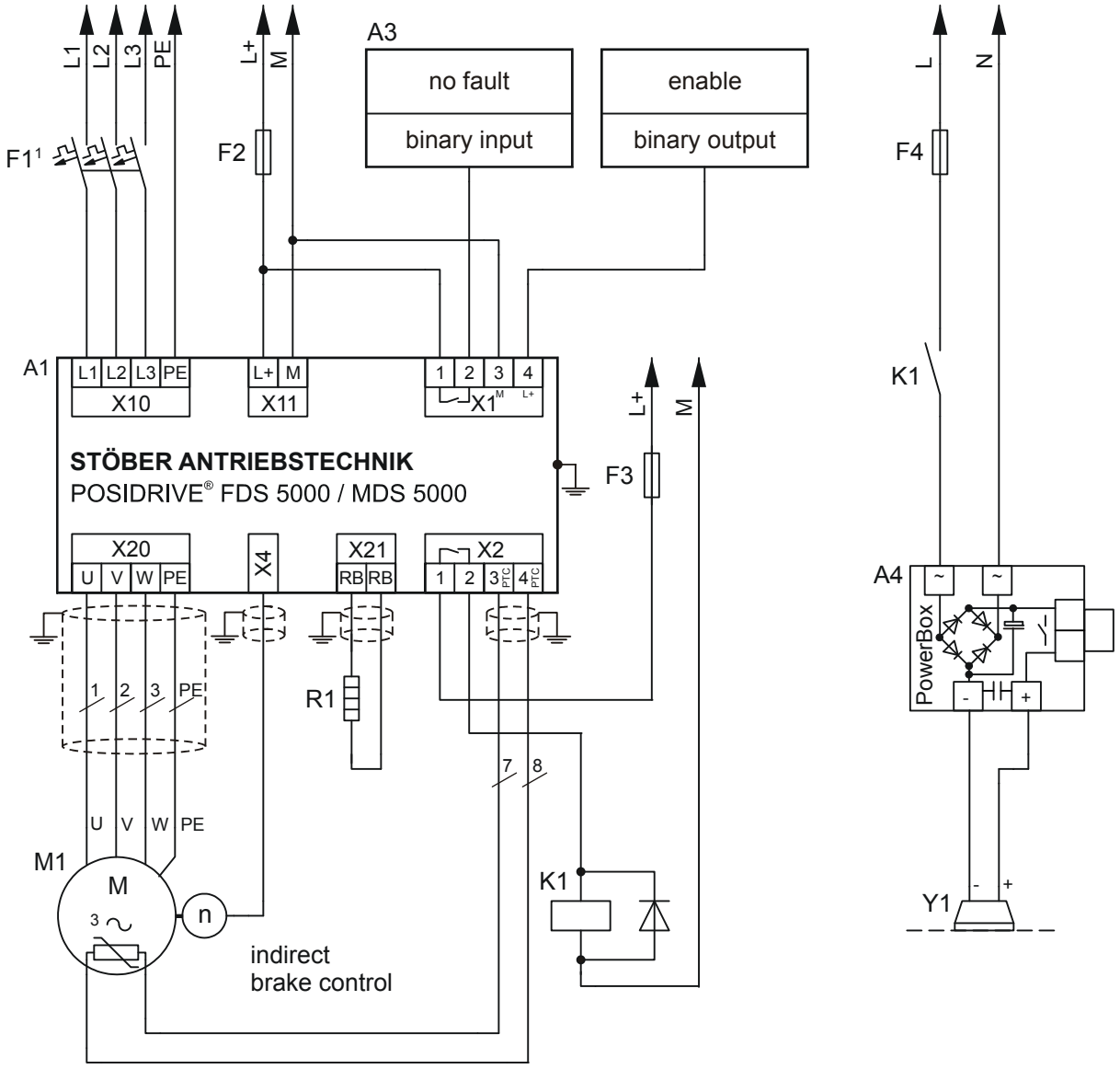
Cable color – key

BK	BLACK	PK	PINK
BN	BROWN	RD	RED
BU	BLUE	VT	VIOLET
GN	GREEN	WH	WHITE
GY	GREY	YE	YELLOW
OG	ORANGE		

6 Examples of connections



[1] circuit protection
tripping characteristics C



[1] circuit protection
tripping characteristics C

7 Accessories

I/O terminal module LEA 5000

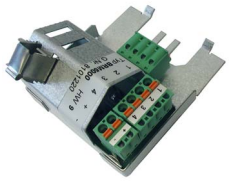
ID no. 49029

Terminals:

- 8 binary inputs
- 8 binary outputs

Brake module for 24 V brake BRM 5000

ID no. 44571



Control of a motor holding brake.

EMC shroud EM 5000

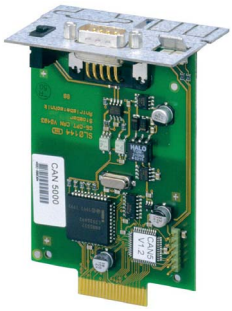
ID no. 44959

Accessory part for shield connection of the motor line.
Attachable on the basic housing.
Including shield connection terminal

Inverter	HW status of the inverter	CAN 5000	DP 5000	ECS 5000	PN 5000
FDS 5000A	200 or higher	Yes	Yes	Yes	Yes
FDS 5000	up to 199	Yes	Yes	Yes	No

Fieldbus module CANopen DS-301 CAN 5000

ID no. 44574



Accessory part for connecting CAN bus.

Fieldbus module PROFIBUS DP-V1 DP 5000

ID no. 44575

Accessory module for connecting PROFIBUS DP-V1.

Fieldbus module EtherCAT ECS 5000

ID no. 49014

Accessory part for connecting EtherCAT (CANopen over EtherCAT).

EtherCAT cable

EtherNet patch cable, CAT5e, yellow.

The following versions are available:

ID no. 49313: approx. 0.2 m.
ID no. 49314: approx. 0.35 m.

Fieldbus module PROFINET PN 5000

ID no. 53893

Accessory part for connecting PROFINET.

ASP 5001 – Safe Torque Off

Available with the standard version.

The ASP 5001 may only be installed by STÖBER ANTRIEBSTECHNIK GmbH & Co. KG!
The ASP 5001 must be ordered with the basic device.

Connection cable G3

ID no. 41488

Description: Connection of inverter at terminal X3 and the PC, Sub-D connector, 9-pin, socket/ socket, approx. 5 m.

STÖBER

USB adapter on RS232

ID no. 45616

Control box

Operating device for parameterization and configuration of the inverter.
The connection cable with a length of 1.5 is included in the scope of delivery.

The following versions are available:

ID no. 42224: Service versions.

ID no. 42225: Installation DIN housing 96 x 96 mm, protection class IP54.

Control box cable

Connection cable from control box to inverter.

The following versions are available:

ID no. 43216: 5 m.
ID no. 43217: 10 m.

Paramodule

Memory module for configuration and parameters.

The following versions are available:

ID no. 49319:
for FDS 5000 (HW version < 190), 128 kB.
ID no. 55463:
for FDS 5000A (HW version > 200), 1 MB.

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Address registers

Always up to date on the internet: *www.stober.com* (Contact)

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- **Global presence for advice and marketing in about 25 countries**
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