POSIDRIVE® FDS 5000

Projecting manual

Installation

Connecting

Accessories

I75 Posi LatchMod
0:Steig.Flanke

V 5.6-S or later

08/2020   en

Table of contents

WE KEEP THINGS MOVING

WE KEEP THINGS MOVING

STÖBER

1 Introduction

1.1 About this 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 language of this documentation is German.

Please note:

This documentation is valid for device types from hardware version 200. Device types with hardware version up to 199 are described in the documentation up to version V 5.6-N.

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

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

You can find information on the POSITool software in the following manuals:

Manual	Contents	ID
POSITool operating manual	Information on the basic functions of POSITool	442233
Programming manual	Information on programming with POSITool	441693

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

Note that the programming functionality of POSITool can only be used after training by STOBER. You can find information on training at www. stoeber.de.

WE KEEP THINGS MOVING

The devices of the 5th generation of STOBER inverters can be optionally connected with different fieldbus systems. The connection is described in the following manuals:

Manuals	ID
PROFIBUS DP operating manual	441687
CANopen operating manual	441686
EtherCAT operating manual	441896
PROFINET operating manual	442340
USS operating manual	441707

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

The accessories of the inverter are documented in the following manuals:

Manual	Product description	ID
ASP 5001 operating manual	Safe technical integration of the inverter in a machine	442181
Operating instructions POSISwitch AX 5000	Sequential switchover between up to four axes	441689
Control box operating manual	Operating device for parameterization and configuration of the inverter.	441479
Operating manual Absolute Encoder Support AES	For buffering the power supply when using the inductive absolute value encoder EnDat 2.2 digital with battery-buffered multiturn power unit, for example EBI1135, EBI135.	442343

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

STÖBER

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
Size	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
EtherCAT	Ethernet for Control Automation Technology
HTL	High Threshold Logic
IGB	Integrated bus
IP	International Protection
MAC	Media Access Control
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 protective Device
SPS	Programmable logic controller
SSI	Serial Synchronous Interface
STO	Safe Torque Off
TTL	Transistor-transistor logic
UL	Underwriters Laboratories
ZK	DC link

WE KEEP THINGS MOVING

Formula symbols	Unit	Explanation
f	**Hz**	**Frequency**
f_2	Hz	Output frequency
f_{2PU}	Hz	Output frequency of the power unit
f_{max}	Hz	Maximum frequency
$f_{PWM,PU}$	Hz	Internal pulse clock frequency of the power unit
I	**A**	**Current**
I_1	A	Input current
I_{1max}	A	Maximum input current
I_{1maxCU}	A	Maximum input current of the control unit
I_{1maxPU}	A	Maximum input current of the power unit
$I_{1N,PU}$	A	Nominal input current of the power unit
I_2	A	Output current
I_{2max}	A	Maximum output current
I_{2maxPU}	A	Maximum output current of the power unit
I_{2min}	A	Minimum output current
$I_{2N,PU}$	A	Nominal output current of the power unit
I_N	A	Nominal current
n	**rpm**	**Speed**
n_N	rpm	Nominal speed: the speed for which the nominal torque M_N is specified
P	**W**	**Power**
P_{2maxPU}	W	Maximum sum of drive power
P_{maxRB}	W	Maximum power at the external braking resistor
P_V	W	Power loss
$P_{V,CU}$	W	Power loss of the control unit
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_{1CU}	V	Input voltage of the control unit
U_{1PU}	V	Input voltage of the power unit
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 power unit
U_{max}	V	Maximum voltage
U_{maxPU}	V	Maximum voltage of the power unit
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	
	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.
	UL test marks for recognized components This component or material is recognized by UL. Representative samples of this product have been evaluated by UL and meet applicable requirements.

WE KEEP THINGS MOVING

POSIDRIVE®, POSIDYN® and POSISwitch® are trademarks of STÖBER Antriebstechnik GmbH + Co. KG.

The following names that are used in conjunction with the device, its optional equipment and its accessories are trademarks or registered trademarks of other companies:

Trademarks	
CANopen®, CiA®	CANopen® and CiA® are registered Community trademarks of CAN in Automation e.V., Nuremberg, Germany.
EnDat®	EnDat® and the EnDat® logo are registered trademarks of Dr. Johannes Heidenhain GmbH, Traunreut, Germany.
EtherCAT®, Safety over EtherCAT®, TwinCAT®	EtherCAT®, Safety over EtherCAT® and TwinCAT® are registered trademarks and patented technologies that are licensed by Beckhoff Automation GmbH, Verl, Germany.
PROFIBUS®, PROFINET®	The PROFIBUS®/PROFINET® logo is a registered trademark of PROFIBUS Nutzerorganisation e. V. Karlsruhe, Germany.

All other trademarks that are not listed here are the property of their respective owners.

Products that are registered as trademarks are not specially indicated in this documentation. Existing property rights (patents, trademarks, protection of utility models) are to be observed.

WE KEEP THINGS MOVING

STÖBER

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

As this documentation includes important information for the safe and efficient handling of the product, always keep it in the immediate vicinity of the product until product disposal and ensure it can be accessed by qualified personnel at any time.

Also pass on this documentation if the product is handed over or sold to a third party.

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.

WE KEEP THINGS MOVING

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

STÖBER

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)
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.

WE KEEP THINGS MOVING

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.

STÖBER

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 and its accessories 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/removing or attaching/detaching 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 6 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
Department VS-EL
Kieselbronner Str.12
75177 Pforzheim
GERMANY

WE KEEP THINGS MOVING

2.9 Disposal

Please observe the current national and regional regulations! Dispose of the individual parts separately depending on the quality and currently applicable regulations, e.g. as

- Electronic waste (circuit boards)
- Plastic
- Sheet metal
- Copper
- Aluminum
- Battery

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 a pollution degree, see section 3.3.1.

Mains configuration
All device types that are supplied with 480 V are designed exclusively for operation on Wye source with 480/277 V.

Power supply and motor overload protection
Observe the specifications in the electrical data of the inverter for this, see section 3.4.

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

Motor protection
All models of the 5th generation of STOBER inverters have a certified i²t model, a calculation model for thermal monitoring of the motor. This fulfills the requirements of a semiconductor motor overload protection in accordance with the change to UL 508C from May 2013. To activate the protective function and set it up,

WE KEEP THINGS MOVING

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 (KT84-130) or Pt temperature sensors (Pt1000). 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 vdc power supply
Low voltage circuits must be supplied by a source isolated from the mains whose maximum output voltage does not exceed 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) before relay 1. The fuse must be approved according to 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 examined. Aspects of functional safety were not assessed. These aspects are assessed for STOBER by the TÜV SÜD certification authority, for example.

WE KEEP THINGS MOVING

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.

WE KEEP THINGS MOVING

STÖBER

3　Technical data

3.1　Type designation

Sample code

FDS	5	075	A	/H

Explanation

Code	Designation	Design
FDS	Series	
5	Generation	5th Generation
075	Power	075 = 7.5 kW
– **A**	Hardware variants	No identification: up to HW 199 A: HW 200 and above
/H /L	Version	Auxiliary voltage for control electronics: • Supply of the control electronics via DC link; no additional 24 vdc power supply required. • Supply of the control electronics via 24 V at terminal X11.

3.2　Sizes

The FDS 5000 series includes the following types and sizes:

Type	Size
FDS 5004A	Size 0
FDS 5007A	Size 0
FDS 5008A	Size 0
FDS 5015A	Size 0
FDS 5022A	Size 1
FDS 5040A	Size 1
FDS 5055A	Size 1
FDS 5075A	Size 1

WE KEEP THINGS MOVING

3.3 General data of the inverters

3.3.1 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

3.3.2 Device features

Protection class	IP20
Radio interference suppression	Integrated line filter according to EN 61800-3, interference emission class C3
Overvoltage category	III to EN 61800-5-1

WE KEEP THINGS MOVING

STÖBER

3.3.3 Weight

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

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

• Accessory parts for upper option (fieldbus): 0.1 kg

WE KEEP THINGS MOVING

3.4 Electrical data

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

3.4.1 Size 0: FDS 5007A to FDS 5015A

Type	FDS 5007A	FDS 5004A	FDS 5008A	FDS 5015A
ID no. version /H	55421	55420	55422	55423
ID no. version /L	55413	55412	55414	55415
Recommended motor rating	0.75 kW	0.37 kW	0.75 kW	1.5 kW
U_{1PU}	1×230 V +20 % / -40 % 50/60 Hz	3×400 V, +32 % / -50 %, 50 Hz 3×480 V, +10 % / -58 %, 60 Hz		
$I_{1N,PU}$	1×5.9 A	3×1.4 A	3×2.2 A	3×4 A
f_{2PU}	$0 - 700$ Hz			
U_{2PU}	0 to 230 V	$0 - 400$ V		

Operation with asynchronous motor

$I_{2N,PU}$	3×4 A	3×1.3 A	3×2.3 A	3×4.5 A
I_{2maxPU}	180 % for 5 s; 150 % for 30 s			
$f_{PWM,PU}$	4 kHz[a]			

a) Clock frequency adjustable from 4 to 16 kHz, see section 3.4.5 Derating by increasing the switching frequency.

U_{maxPU}	440 V	830 V
U_{onCH}	400 V to 420 V	780 V – 800 V
U_{offCH}	360 V to 380 V	740 V – 760 V
R_{2minRB}	100 Ω	100 Ω
P_{maxRB}	1.8 kW	6.4 kW

3.4.2 Size 1: FDS 5022A to FDS 5075A

Type	FDS 5022A	FDS 5040A	FDS 5055A	FDS 5075A
ID no. version /H	55424	55425	55426	55427
ID no. version /L	55416	55417	55418	55419
Recommended motor rating	2.2 kW	4.0 kW	5.5 kW	7.5 kW
U_{1PU}	3×400 V, +32 % / -50 %, 50 Hz 3×480 V, +10 % / -58 %, 60 Hz			
$I_{1N,PU}$	3×5.3 A	3×9.3 A	3×12.3 A	3×15.8
f_{2PU}	0 – 700 Hz			
U_{2PU}	0 – 400 V			

Operation with asynchronous motor

$I_{2N,PU}$	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[a]			

a) Clock frequency adjustable from 4 to 16 kHz, see section 3.4.5 Derating by increasing the switching frequency.

U_{maxPU}	830 V			
U_{onCH}	780 V – 800 V			
U_{offCH}	740 V – 760 V			
R_{2minRB}	100 Ω	47 Ω	47 Ω	
P_{maxRB}	6.4 kW	13.6 kW	13.6 kW	

WE KEEP THINGS MOVING

WE KEEP THINGS MOVING

3.4.3 Power loss data of the inverter according to EN 50598

Relative losses

Type	Nominal current $I_{2N,PU}$ [A]	Apparent power [kVA]	Absolute losses $P_{V,CU}$[a] [W]	Working points[b] (0/25)	(0/50)	(0/100)	(50/25)	(50/50)	(50/100)	(90/50)	(90/100) [%]	IE class[c]	Comparison[d] [%]
FDS 5004A	1.3	0.9	6	5.92	5.94	6.20	5.97	6.02	6.36	6.13	6.62	IE2	46.2
FDS 5007A	4	0.9	6	5.01	5.07	5.68	5.20	5.37	6.30	5.88	7.43	IE2	51.8
FDS 5008A	2.3	1.6	6	2.98	3.13	3.49	3.02	3.22	3.71	3.36	4.09	IE2	40.2
FDS 5015A	4.5	3.1	< 9	1.71	1.86	2.24	1.75	1.97	2.51	2.16	3.04	IE2	39.6
FDS 5022A	5.5	3.8	< 9	1.64	1.79	2.16	1.69	1.89	2.38	2.02	2.74	IE2	34.9
FDS 5040A	10	6.9	< 9	1.38	1.54	1.93	1.43	1.64	2.17	1.80	2.57	IE2	37.1
FDS 5055A	12	8.3	< 9	1.10	1.26	1.76	1.15	1.36	2.04	1.51	2.50	IE2	35.7
FDS 5075A	16	11.1	< 9	0.95	1.12	1.67	1.00	1.23	1.98	1.41	2.52	IE2	35.8

Absolute losses P_V

Type	[A]	[kVA]	[W]	(0/25)	(0/50)	(0/100)	(50/25)	(50/50)	(50/100)	(90/50)	(90/100) [W]
FDS 5004A	1.3	0.9	6	53.3	53.5	55.8	53.7	54.2	57.2	55.2	59.6
FDS 5007A	4	0.9	6	45.1	45.6	51.1	46.8	48.3	56.7	52.9	66.9
FDS 5008A	2.3	1.6	6	47.7	50.1	55.8	48.3	51.5	59.3	53.8	65.4
FDS 5015A	4.5	3.1	< 9	52.9	57.6	69.3	54.4	61.0	77.9	67.1	94.1
FDS 5022A	5.5	3.8	< 9	62.4	68.0	82.0	64.1	71.7	90.6	76.9	104.1
FDS 5040A	10	6.9	< 9	95.3	106.1	133.3	98.6	113.2	149.9	123.9	177.0
FDS 5055A	12	8.3	< 9	91.3	104.6	145.9	95.1	113.1	169.2	125.7	207.7
FDS 5075A	16	11.1	< 9	104.9	124.0	184.6	110.3	136.6	219.8	156.0	279.8

a) Absolute losses for a power stage that is switched off
b) Operating points for relative motor stator frequency in % and relative torque current in %
c) IE class according to EN 50598
d) Comparison of the losses for the reference inverter related to IE2 in the nominal point (90, 100)

General conditions

The loss data applies to inverters without accessories.

The power loss calculation based on a three-phase supply voltage with 400 V_{AC} / 50 Hz.

The calculated data includes a supplement of 10 % according to EN 50598.

The power loss specifications refer to a clock frequency of 4 kHz.

The absolute losses for a power stage that is switched off refer to the 24 vdc power supply of the control electronics.

WE KEEP THINGS MOVING

3.4.4   Power loss data of accessories

Type	Absolute losses P_V [W]
Safety module ASP 5001	1
Terminal module LEA 5000	1
Fieldbus module CAN 5000	1
Fieldbus module DP 5000	< 2
Fieldbus module ECS 5000	< 2
Fieldbus module PN 5000	< 4
Brake module BRM 5000	< 1

Information

Also observe the absolute power loss of the encoder (usually < 3 W) as well as the brake for the design.

3.4.5   Derating by increasing the switching frequency

Depending on the clock frequency $f_{PWM,PU}$ (Parameter *B24*), the following values of the nominal output currents $I_{2N,PU}$ arise.

Nominal output current $I_{2N,PU}$

switching frequency	4 kHz	8 kHz	16 kHz
FDS 5004A	1.3 A	1.0 A	0.7 A
FDS 5007A	4.0 A	3.0 A	2.0 A
FDS 5008A	2.3 A	1.7 A	1.2 A
FDS 5015A	4.5 A	3.4 A	2.2 A
FDS 5022A	5.5 A	4.0 A	2.6 A
FDS 5040A	10.0 A	6.0 A	3.3 A
FDS 5055A	12.0 A	7.5 A	4.8 A
FDS 5075A	16.0 A	10.0 A	5.7 A

STÖBER

3.5 Dimensions

3.5.1 Size 0 to 2: FDS 5007A to FDS 5150A
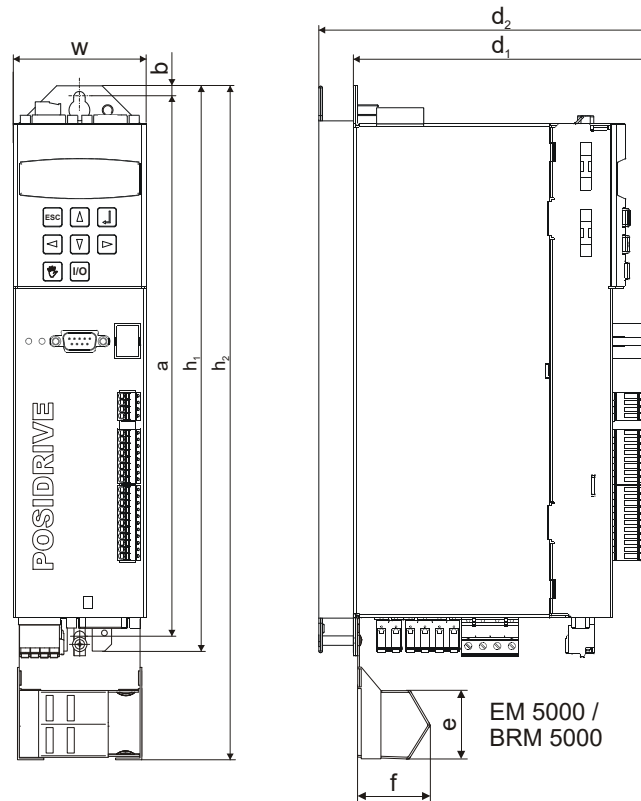
EM 5000 /
BRM 5000

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

3.6 Brake resistors FDS 5xxxA

3.6.1 FZMU, FZZMU

Braking resistor – inverter assignment

Type ID no.	FZMU 400×65 49010	FZZMU 400×65 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 400×65 49010	FZZMU 400×65 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

STÖBER

Dimensions [mm]

Type ID no.	FZMU 400×65 49010	FZZMU 400×65 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

FZMU   FZZM(U)

Drill pattern

WE KEEP THINGS MOVING
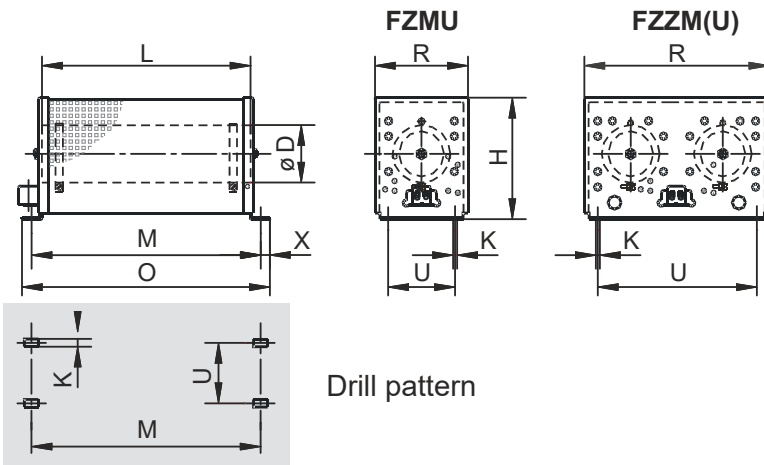
3.6.2 GVADU, GBADU

Braking resistor – inverter assignment

Type ID no.	GVADU 210×20 55441	GBADU 265×30 55442	GBADU 335×30 55443	GBADU 405×30 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 ID no.	GVADU 210×20 55441	GBADU 265×30 55442	GBADU 335×30 55443	GBADU 405×30 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⒩us	c⒩us		

STÖBER

Dimensions [mm]

Type ID no.	GVADU 210×20 55441	GBADU 265×30 55442	GBADU 335×30 55443	GBADU 405×30 55499
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°

WE KEEP THINGS MOVING
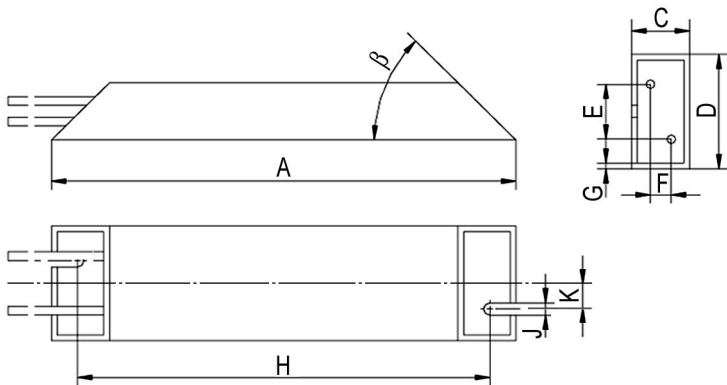
3.6.3 Bottom brake resistor RB 5000

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	—	—

Note the attachment to the inverter (section 4.2.1 Installing the bottom brake resistor and inverter)!

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 M5 threaded bolts [Nm]	5		
Protection class	IP 40		
Test marks	c⏚Lus		

Dimensions [mm]

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

WE KEEP THINGS MOVING

STÖBER

3.7 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 faulting due to cable capacitances.

▶ If you do not use a cable from STOBER for a cable length over 50 m, you must wire the motor temperature sensor and the brake separately (maximum length: 100 m).

WE KEEP THINGS MOVING

> **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 $\mathbf{\Re}$ us	

STÖBER

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

I_N [A]
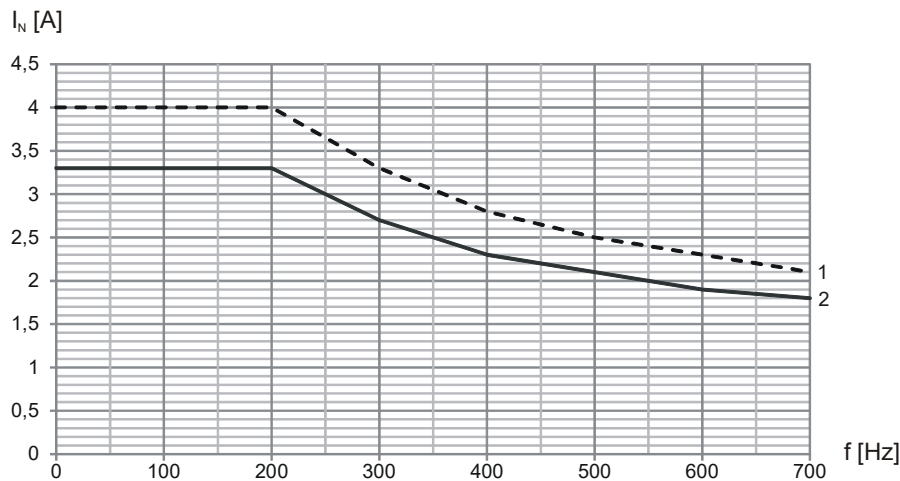
1   Cycle frequency 4 kHz

2   Cycle frequency 8 kHz

Derating TEP3820-0CS41

I_N [A]

1   Cycle frequency 4 kHz

2   Cycle frequency 8 kHz

WE KEEP THINGS MOVING
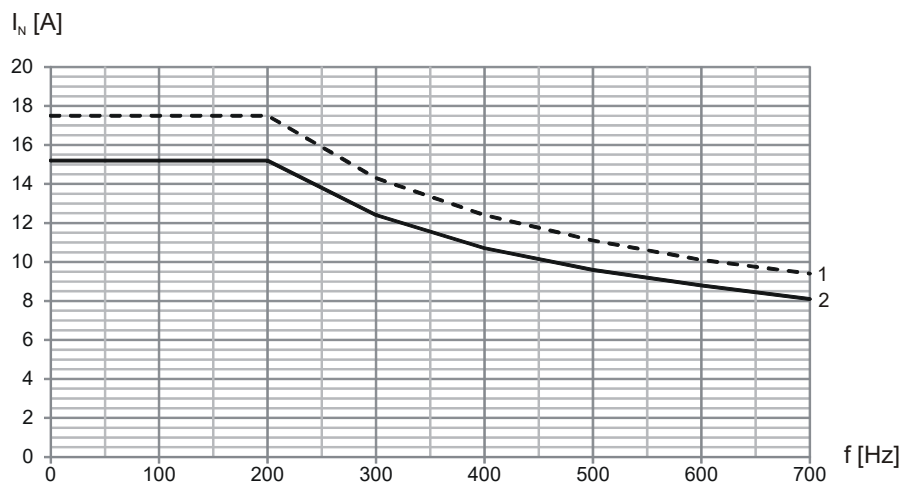
Dimensions	TEP3720-0ES41	4EP3820-0CS41
Height h [mm]	Max. 153	Max. 153
Width w [mm]	178	178
Depth d [mm]	73	88
Vertical distance – fastening holes a1 [mm]	166	166
Vertical distance – fastening holes a2 [mm]	113	113
Horizontal distance – fastening holes b1 [mm]	53	68
Horizontal distance – fastening holes 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

WE KEEP THINGS MOVING

Mounting borings in acc. to DIN EN 60852-4
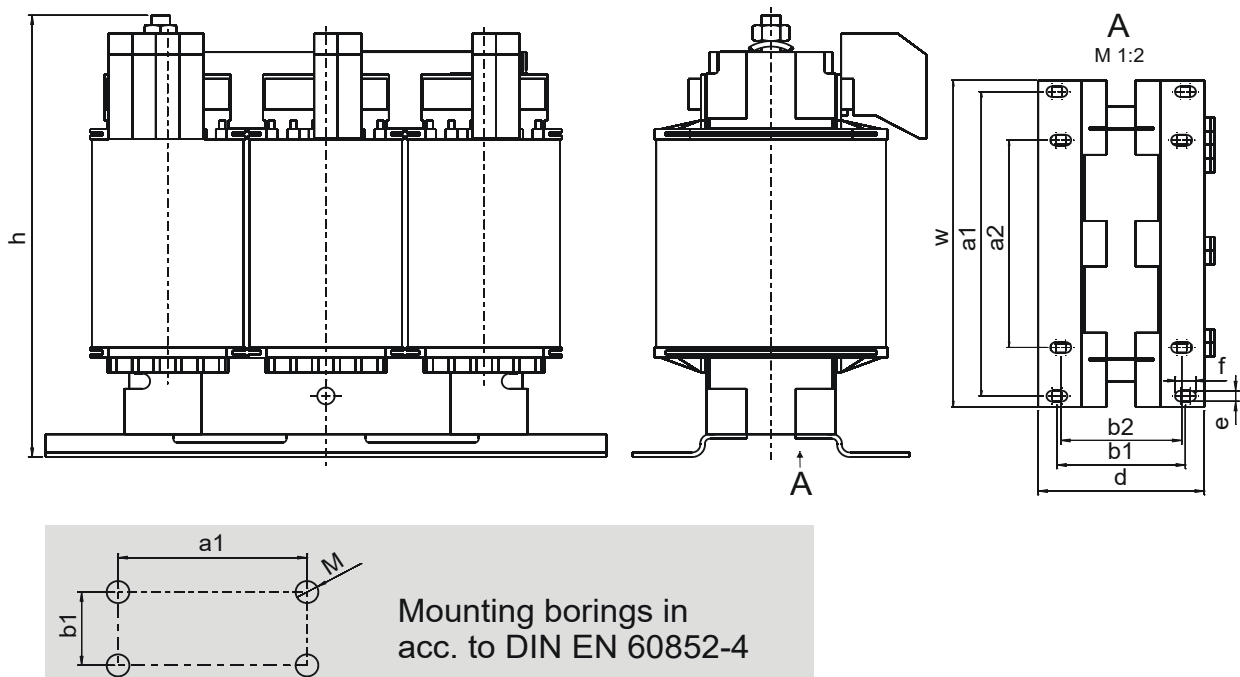
4 Installation

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 6 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:

WE KEEP THINGS MOVING
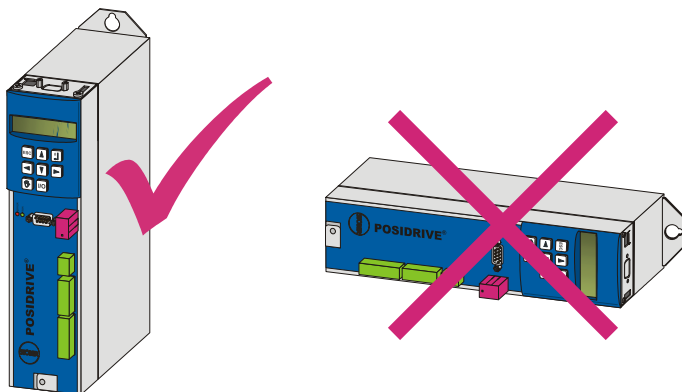
- Avoid installation above or in the immediate vicinity of heat-generating devices, e.g. output chokes or braking resistors:
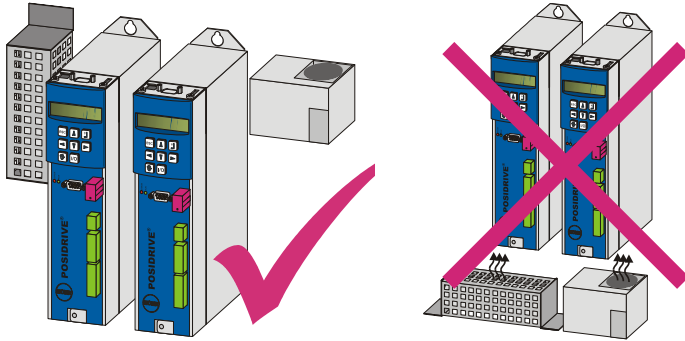
- To ensure there is sufficient air circulation in the control cabinet, observe the minimum clearances.
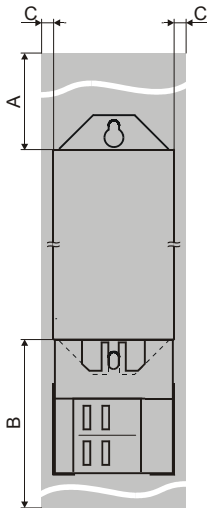
Min. clearance [dimensions in mm]	A Above	B Below	C On the side
Size 0 and size 1	100	100	5
... With EMC shroud or brake module	100	120	5

4.2 Accessories

4.2.1 Installing the bottom brake resistor and 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 6 minutes. You can only determine the absence of voltage after this time period.

Requirements:
- You have tapped holes for M5 threaded bolts on the mounting plate in the control cabinet at the installation location, taking into consideration the different device dimensions.

You need:
- The M5 threaded bolts included with the bottom 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:

WE KEEP THINGS MOVING
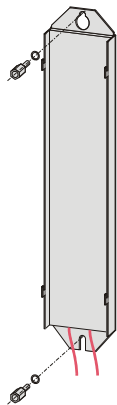
2. Place the device on the guides:
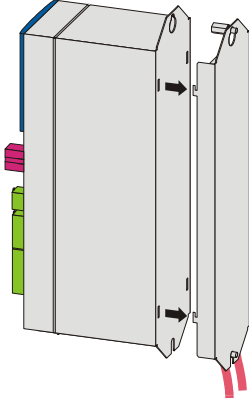
3. Press the device down on the guides:
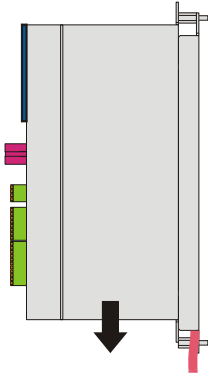
4. Attach the device to the studs with the screws and washers:
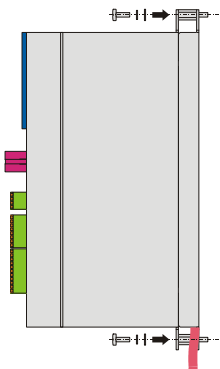
⇨ You have installed the submounting brake resistor.

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.

STÖBER

4.2.2 Installation of EMC shroud or brake module

4.2.2.1 Attaching EMC shroud EM 5000

You can use the EM 5000 EMC shroud to connect the cable shield of the power cable. The EMC shroud EM 5000 and the brake module BRM 5000 are identical in terms of mechanics. The attachment for both accessory parts is therefore the same, see section 4.2.2.2 Attaching brake module BRM 5000.

4.2.2.2 Attaching brake module BRM 5000

You can use the BRM 5000 brake module to connect the cable shield of the power cable. The module also includes power electronics for the optional brake controller for a 24-V brake.

⚠ **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 6 minutes. You can only determine the absence of voltage after this time period.

Requirements:
• You have already installed the inverter in the control cabinet.

You need:
• A Phillips screwdriver for loosening the fastening screw.

Attaching brake module BRM 5000

1. Undo the lower fastening screw and washers of the inverter:

WE KEEP THINGS MOVING
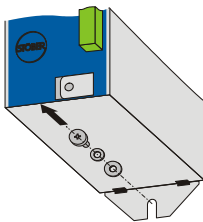
2. Insert the module into the openings on the inverter at a slight angle:
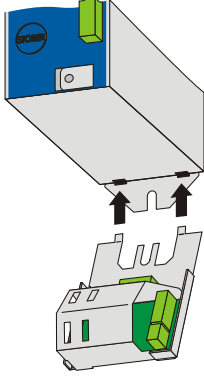
3. Press the back of the component either directly on the mounting plate or on the threaded bolt in the bottom:
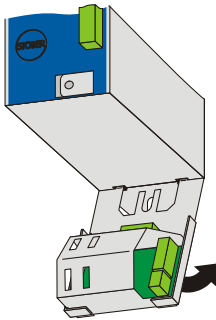
4. Attach the component to the inverter and mounting plate or threaded bolt with the fastening screw and washers.
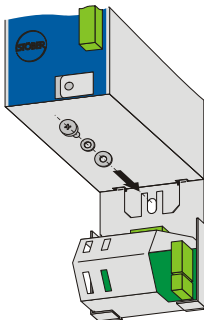
⇨ You have now attached the accessory.

WE KEEP THINGS MOVING

STÖBER

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 6 minutes. You can only determine the absence of voltage after this time period.

NOTICE

Material damage due for example to electrostatic discharge!

▶ Take suitable protective measures when handling open printed circuit boards, for example clothing appropriate for ESD and an 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 need the following to install the LEA 5000:
• The metal plate that comes with the accessory.
• A Phillips screwdriver.

Installing the LEA 5000 in a FDS 5000

1. Undo the fastening screws and take off the cover plate:
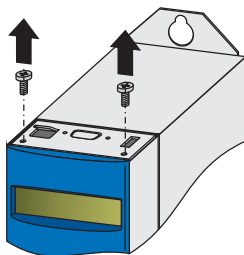
2. Remove the connector from the terminal extension LEA 5000.
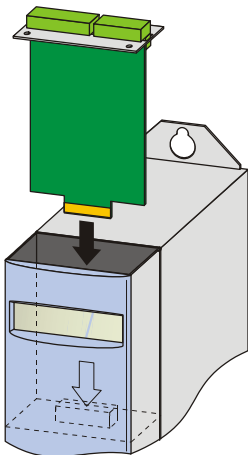

WE KEEP THINGS MOVING
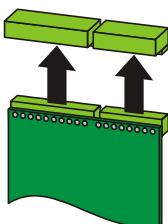
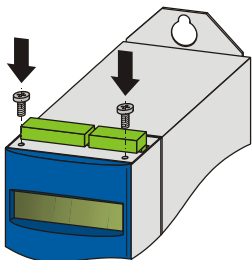3. Put the metal plate over the base strip. Pay attention to the alignment of the metal plate!
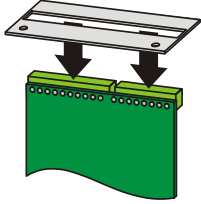
4. Replug the connector on the terminal extension.
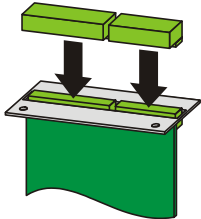
5. Guide the option board in the inverter so that the gold contacts are pushed in the black terminal block:

6. Fasten the plate to the inverter with the fastening screws:

⇨ You have now installed the accessory.

STÖBER

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 6 minutes. You can only determine the absence of voltage after this time period.

NOTICE

Material damage due for example to electrostatic discharge!

▶ Take suitable protective measures when handling open printed circuit boards, for example clothing appropriate for ESD and an environment free of dirt and grease.

▶ Do not touch the contact surfaces.

To connect CANopen or PROFIBUS , you need the following accessory. The accessory is installed above the inverter display:
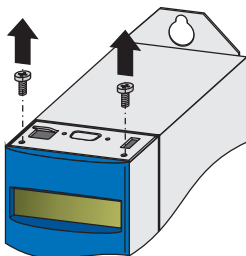
• CANopen: CAN 5000
• PROFIBUS: DP 5000

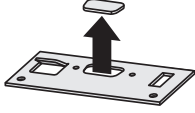To install CAN 5000 or DP 5000, you need the following:

• A Torx screwdriver TX10.
• Pliers.
• 4.5 mm hexagonal socket wrench.

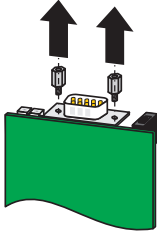**Installing CAN 5000 or DP 5000 in an inverter**

1. Undo the fastening screws and take off the cover plate:
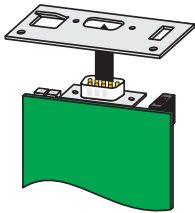
WE KEEP THINGS MOVING

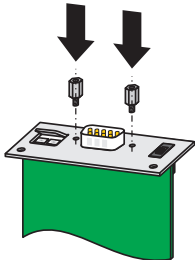2. Remove the punched out metal plate with pliers:
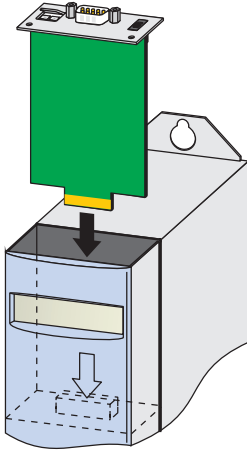
3. Remove the screws on the option board:

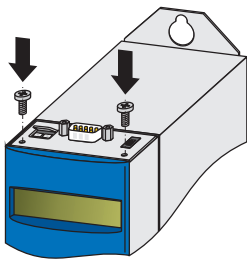4. Guide the D-sub connector of the board from below through the metal plate:

5. Fasten the board on the metal plate with the screws removed in step 3:

6. Guide the option board in the inverter so that the gold contacts are pushed in the black terminal block:

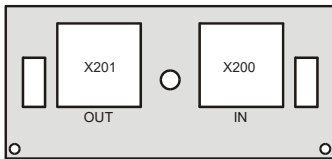7. Fasten the plate to the inverter with the fastening screws:

⇨ You have now installed the accessory.

To connect EtherCAT or PROFINET, you need the following accessory. The accessory is installed above the inverter display:
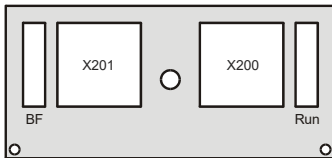
- EtherCAT: ECS 5000
- PROFINET: PN 5000

For installation you need:

- A Torx screwdriver TX10; a Phillips screwdriver.
- To install ECS 5000, the following metal plate that comes with the accessory:

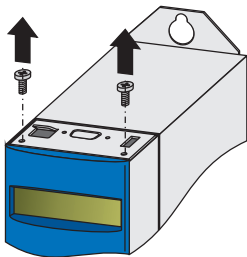- To install PN 5000, the following metal plate that comes with the accessory:

- The screw with the detent edge disk that is included with the accessory.

Installing ECS 5000 or PN 5000 in an inverter

1. Undo the fastening screws and take off the cover plate:

2. Guide the RJ45 connector of the circuit board from below through the plate that is included with the accessory:

WE KEEP THINGS MOVING
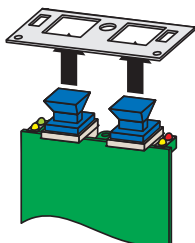
3. Fasten the plate on the circuit board with the screw with the detent edge disk that is included:
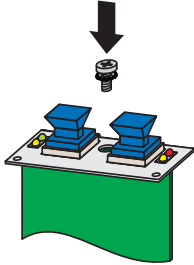
4. Guide the option board in the inverter so that the gold contacts are pushed in the black terminal block:
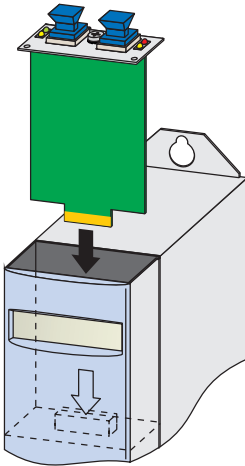
5. Fasten the plate to the inverter with the fastening screws:
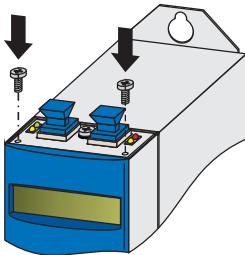
⇨   You have now installed the accessory.

5 Connection

5.1 Overview of terminals

Front and top of the device
(in the example with fieldbus module CAN 5000)

Housing ground

X10 – 230V/400 V power

X12 ASP 5001 (option)

X11 – 24 V power

Fieldbus modules (accessories):
- CANopen CAN 5000 (X200)
- PROFIBUS DP 5000 (X200)
- EtherCAT ECS 5000 (X200, X201)
- PROFINET PN 5000 (X200, X201)

I/O terminal module (accessories):
- Standard LEA 5000 (X103D, X100E)

X3 PC, USS

X1 enable, relay 1

X100 Analog signals

X101 Binary signals

WE KEEP THINGS MOVING

POSIDRIVE®

STÖBER
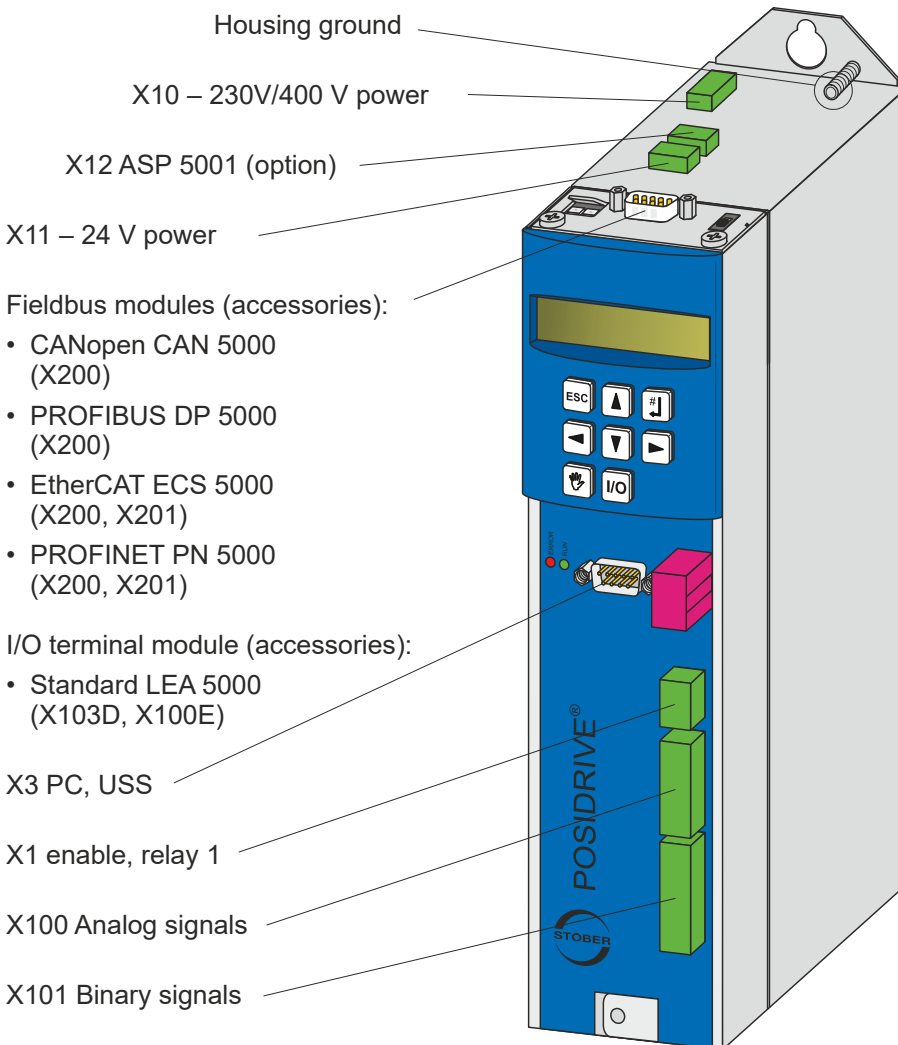
Bottom of the device
(in the example with brake module BRM 5000)

X4 Encoder

X2 Motor temperature
   sensor, brake

X22 DC link

X20 Motor

X21 Braking resistor

BRM 5000: X302

BRM 5000: X301

BRM 5000: X300
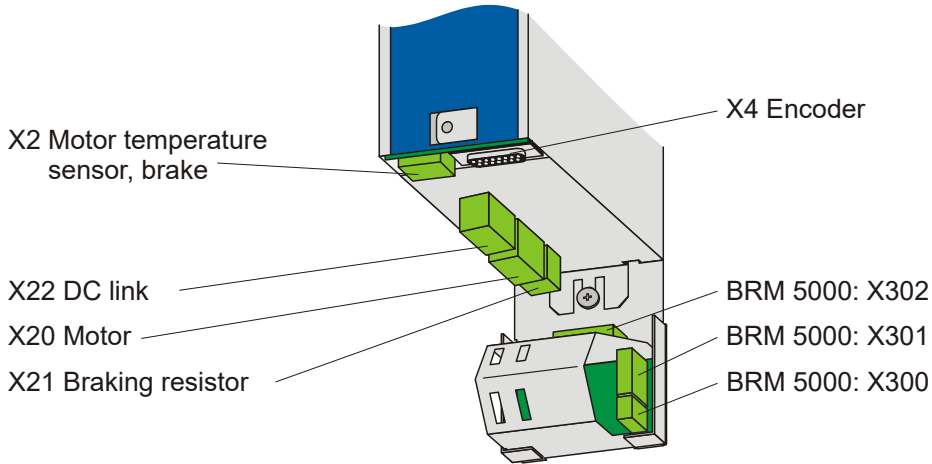
5.1.1   Fieldbus modules

Top of device with fieldbus module CANopen CAN 5000
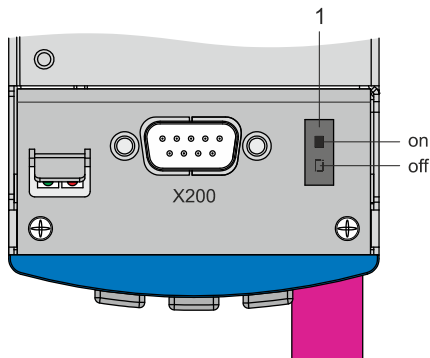
1   Internal terminating resistor 120 Ω switchable

Top of device with fieldbus module PROFIBUS DP 5000

WE KEEP THINGS MOVING

Top of device with fieldbus module EtherCAT ECS 5000

OUT
X201

IN
X200

Top of device with fieldbus module PROFINET PN 5000

BF   X201   X200   Run

STÖBER
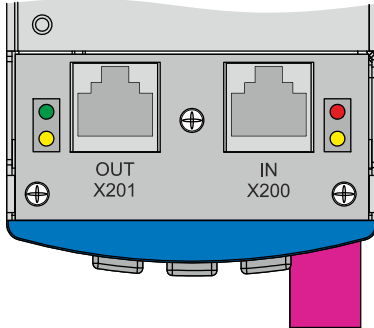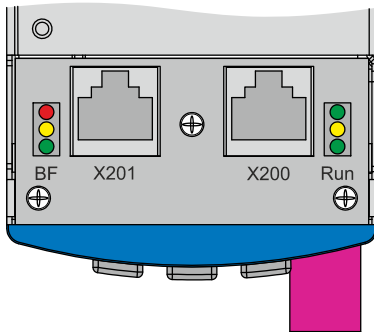
5.2   EMC connection
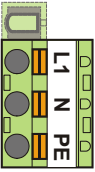
> **Information**
>
> This chapter contains general information on EMC-suitable installation. These are only recommendations. Depending on the application, the ambient conditions and the legal requirements, measures in addition to this recommendations may be required.
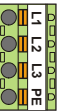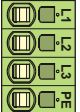
- Install power line, motor cable and signal lines separately from each other (e.g., in separate cable ducts).
- Use only shielded cables for the motor cable.
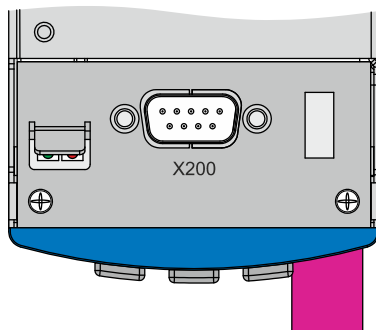- If the brake line is installed together with the motor cable, the brake line must be shielded separately.
- Apply the shield of the motor cable over a large surface and in the immediate vicinity of the inverter. Use the EMC shroud EM 5000 or the mechanically identical brake module.
- Shield the cable 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).

WE KEEP THINGS MOVING

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

STÖBER

5.3.1   Line fuse

The device's cables and output are protected by means of line fuse. Various protective devices may be used for this purpose:
- Full range fuse (class "gG" in accordance with IEC class specification or "slow blow" in accordance with VDE)
- Miniature circuit breaker
  Use line circuit breaker with trigger characteristics C in accordance with EN 60898.
- Circuit breaker

Use fuses of class RK1 for UL-compliant applications (for example Bussmann KTS-R-xxA/600 V), CF, J, T or G. For devices of sizes 0 and 1 it is also possible to uses fuses of class CC.

Type	Input current $I_{1N,PU}$	Protection rating		
		Recommended	For UL-compliant use	For DC link connection in group 1
FDS 5007A	1 x 5.9 A	1 x 10 A	1 x 10 A	1 x 10 A
FDS 5004A	3 x 1.4 A	3 x 6 A	3 x 6 A	3 x 10 A
FDS 5008A	3 x 2 A	3 x 6 A	3 x 6 A	3 x 10 A
FDS 5015A	3 x 3.7 A	3 x 10 A	3 x 10 A	3 x 10 A
FDS 5022A	3 x 5.3 A	3 x 10 A	3 x 10 A	3 x 20 A
FDS 5040A	3 x 9.3 A	3 x 16 A	3 x 15 A	3 x 20 A
FDS 5055A	3 x 12.3 A	3 x 16 A	3 x 15 A	3 x 20 A
FDS 5075A	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

WE KEEP THINGS MOVING

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 above 30 mA may occur during operation. Undesirable false triggering occurs under the following conditions:

- 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 chokes.
- Due to unbalances in the supply network.
  This false triggering can be rectified e.g. using an isolating transformer.

ℹ **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 disc
  - 3 Cable socket
  - 4 Washer
  - 5 Nut

  Contact disk, washer, and nuts are supplied with the inverter.
- 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:
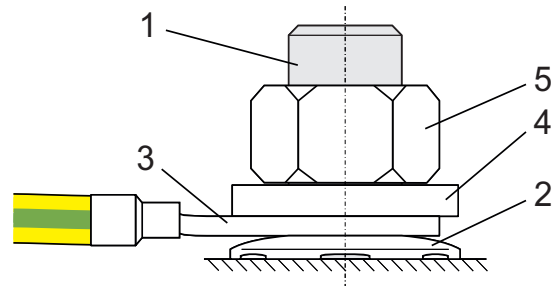
Cross-section A Feeder	Minimum cross-section A_P Earth conductor at earth bolts
$A \leq 2.5$ mm^2	2.5 mm^2
$2.5 < A \leq 16$ mm^2	A
$16 - 35$ mm^2	≥ 16 mm^2
> 35 mm^2	A/2

WE KEEP THINGS MOVING

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.

WE KEEP THINGS MOVING
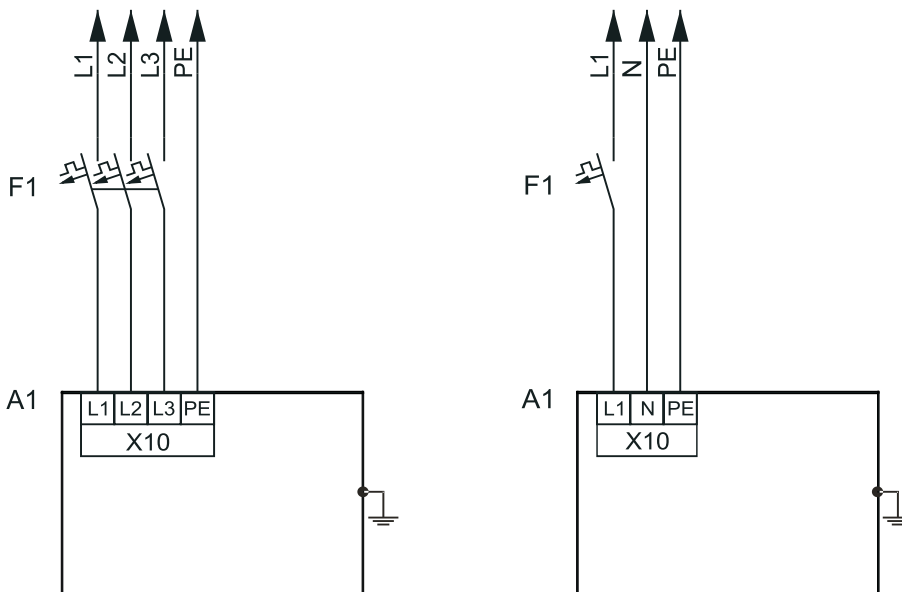
Legend

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

STÖBER

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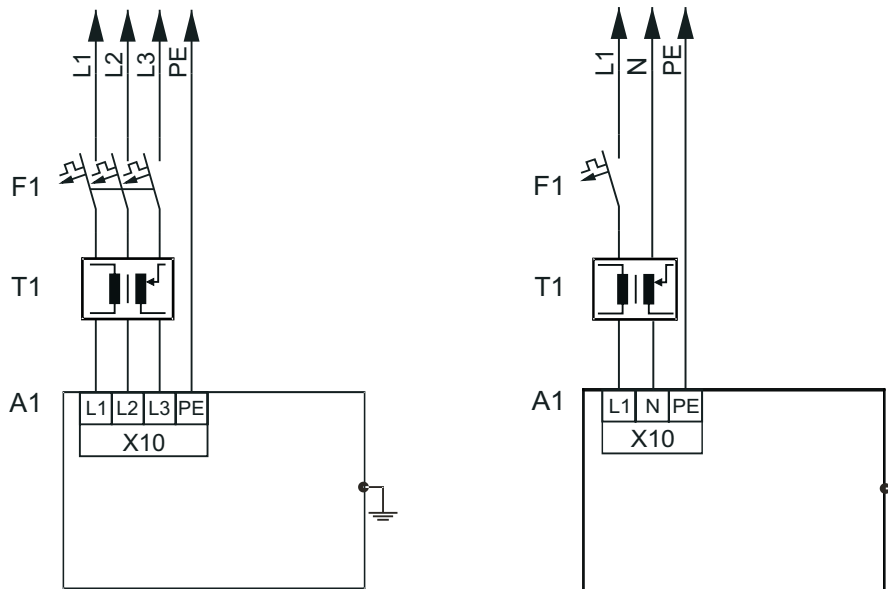
Legend

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

WE KEEP THINGS MOVING
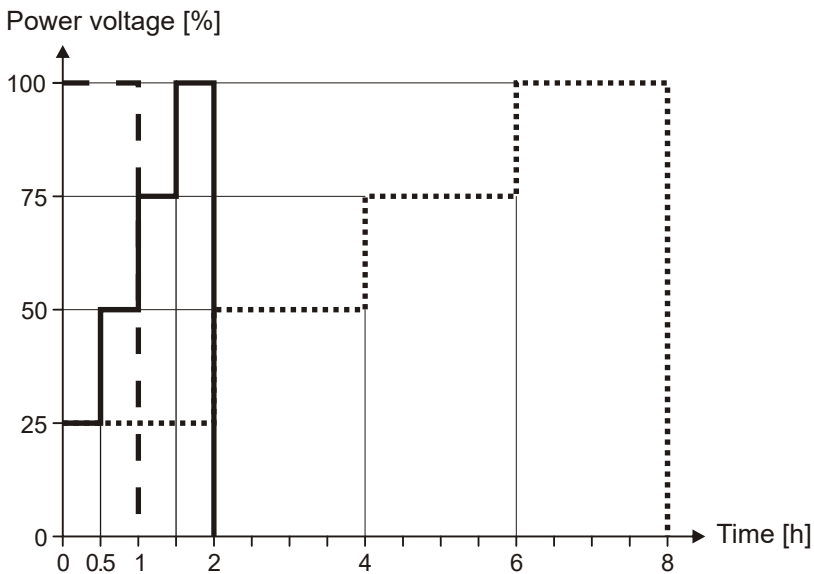
Power voltage [%]

– – – 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.

WE KEEP THINGS MOVING

STÖBER

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 supply of control electronics.	U_{1CU} = 20.4 – 28.8 V I_{1maxCU} = 1.5 A
	+	+ 24 V		
	−	GND	Reference potential for +24 V	—
	−	GND		

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	—

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

WE KEEP THINGS MOVING
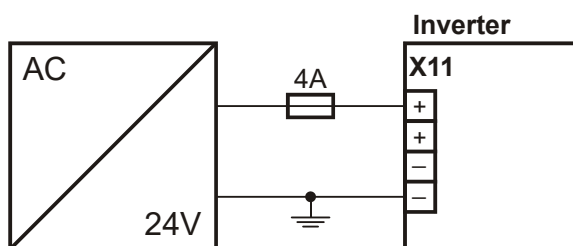
Example of the connection of two devices
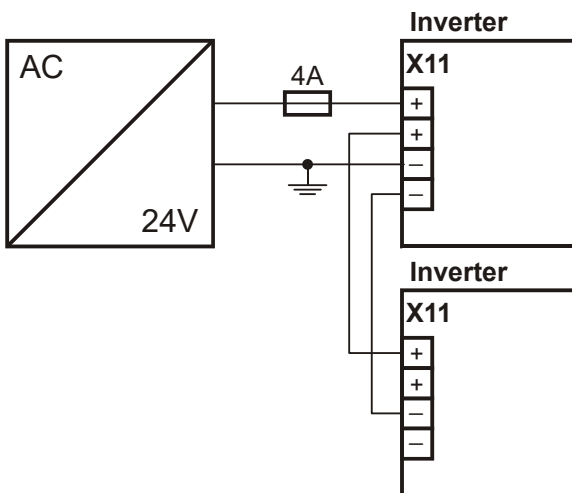
5.5 X1: Enable and relay 1

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		U_{max} = 30 V
	2	Contact 2	Relay 1	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)
	3	GND		High level ≥12 V
	4	+ input	Enable power board	Low level < 8 V I_{1max} = 16 mA U_{1max} = 30 V

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	—
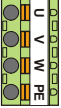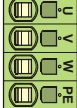
Example of connection

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.
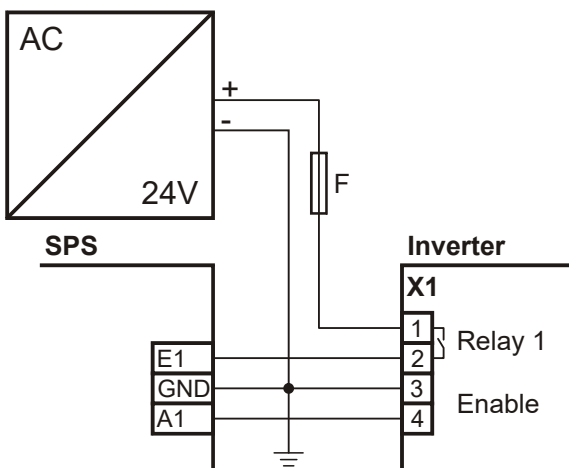
5.6   X20: Motor

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 choke

Observe the following points when connecting the motor without the output choke:
- Ground the shield of the motor cable on the shield contact on the inverter intended for this.
- 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 choke

Observe the following points when connecting the motor to the output choke:
- Ground the shield of the motor cable with large area contacts in the immediate vicinity of the output choke, 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 choke (graphic: icotek GmbH).

7 PE | 8 PE | 1U1 | 1U2 | 1V1 | 1V2 | 1W1 | 1W2
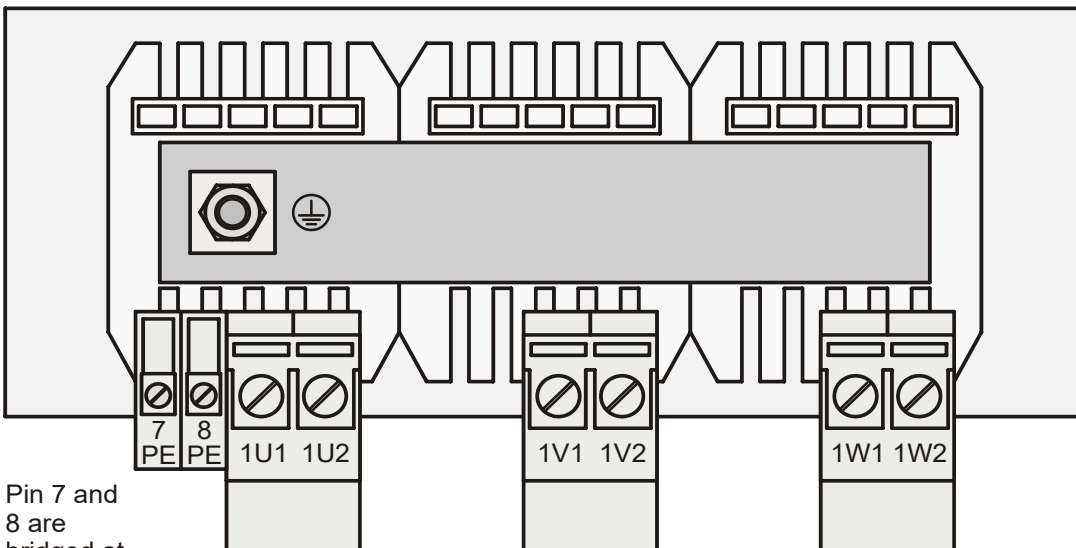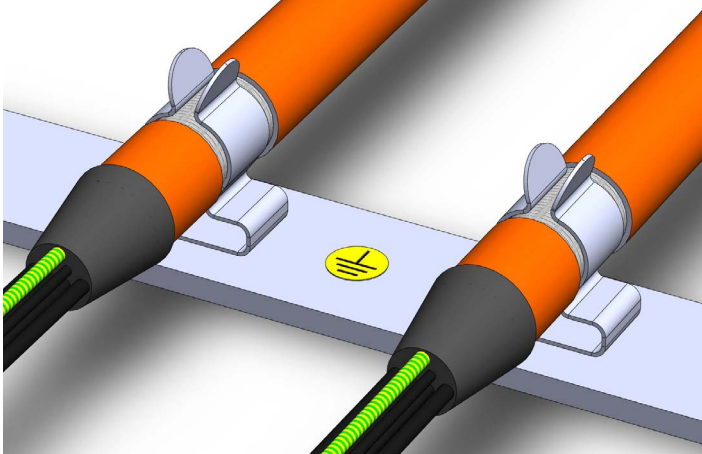
Pin 7 and 8 are bridged at the output derator

Example of connection

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

Inverter
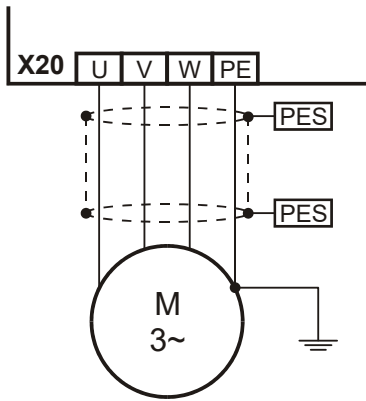
5.7 X12: ASP 5001 – Safe Torque Off

> **Information**
>
> If you want to use the safety function, you need option ASP 5001. 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.
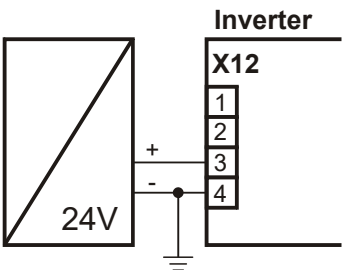
> **Information**
>
> Please remember that the following description only applies to the ASP 5001. Go to applications@stoeber.de for the description of the ASP 5001.

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	Relay 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.

WE KEEP THINGS MOVING

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 circuit breaker 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 circuit breaker.

Motor temperature sensor connection
Motor windings are monitored thermally using the motor temperature sensors such as PTC thermistors, KTY temperature sensors or Pt temperature sensors.

PTC thermistors are thermistors whose 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. As PTC triplets are used, one thermistor monitors each phase of the motor winding. With 3 thermistors, all 3 phases are monitored which brings about effective motor protection.

On the other hand, KTY or Pt temperature sensors are temperature sensors with characteristic resistance curves that follow the temperature linearly. They therefore allow for analog measurements of motor temperatures. However, the measurements are limited to one phase of the motor winding, which also restricts motor protection considerably compared with PTC triplets.

> **Information**
> Note that the evaluation of a Pt1000 is only possible from firmware V 5.6-S. Before using a Pt or KTY sensor, note that motor protection is not ensured to the same extent as when monitoring with PTC triplet.

> **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
	2	1BD2	• 250 V_{AC}/4 A • 30 V_{DC}/3 A (ohm. load) t_2 = 1 ms Switching 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)
	3	1TP1/1K1+	Max. 2 PTC triplets (connected in series) or 1 KTY84-130 or 1 Pt1000
	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

Other cable requirements

Technical Data	
Insulation stripping length	10 mm

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.

⚠ **WARNING!**

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

▶ Ensure sufficient strain relief for the power cable! Note that the option module does not provide the function of strain relief.

Terminal description X300 on BRM 5000

Connect the 24 vdc power supply of the brake module to terminal X300.

Pin		Designation	Function	Data
	+	24 V	Power input for brake controller	U_1 = 24 – 30 V I_{1max} = 2.5 A Fuse: up to max. 6 AT according to brake used
	–	GND	Reference potential for 24 V	—

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

WE KEEP THINGS MOVING

Other cable requirements

Technical Data	
Insulation stripping length	10 mm

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 [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

Other cable requirements

Technical Data	
Insulation stripping length	10 mm

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

WE KEEP THINGS MOVING

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

Other cable requirements

Technical Data	
Insulation stripping length	10 mm

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)

STÖBER

Brake connection with BRM 5000 for 24 V DC brake

Indirect brake control

WE KEEP THINGS MOVING
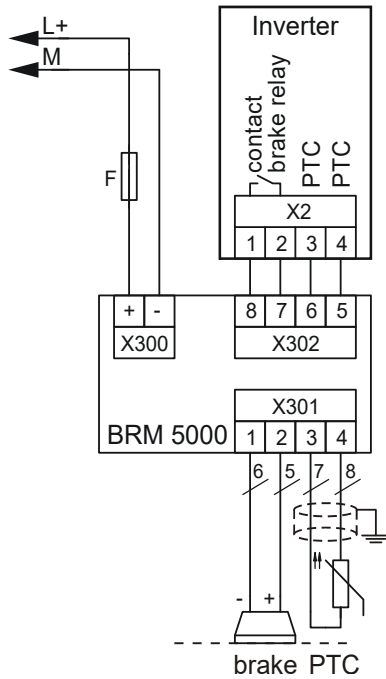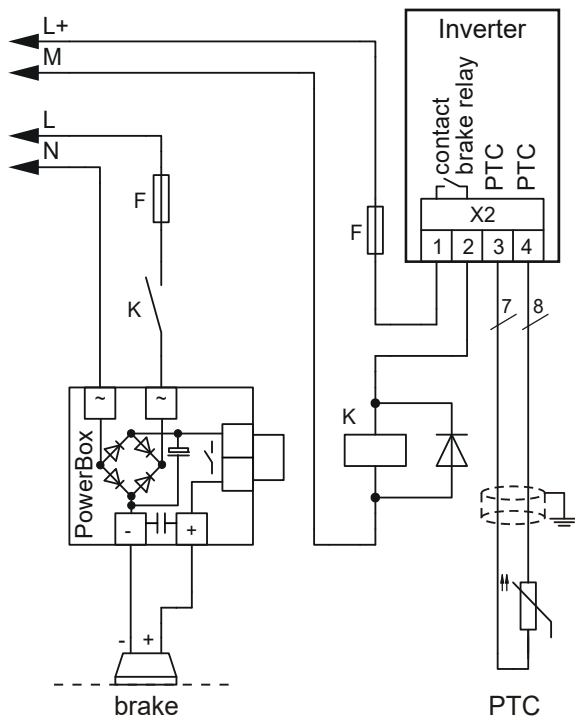
5.9   X21: Braking resistor

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	
		RB	Connection of braking resistor

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

STÖBER
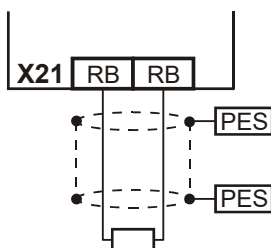
5.10   X22: DC link coupling

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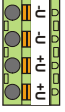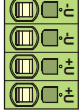
> **Information**
> Remember that the parameter *A38 DC power-input* must be set before the DC link coupling can function correctly:
> Group 1: *A38 = 0: inactive*
> Groups 2 and 3: *A38 = 1: active*
> See the description of the parameter.

WE KEEP THINGS MOVING

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

STÖBER

Principal circuit diagram

The following figure shows the principle circuit diagram of the DC link connection. The inverters can be connected to each other in up to three groups. The possible combinations are shown in the table in the following section. The combination determines the types of line fuse and the DC link fuse.
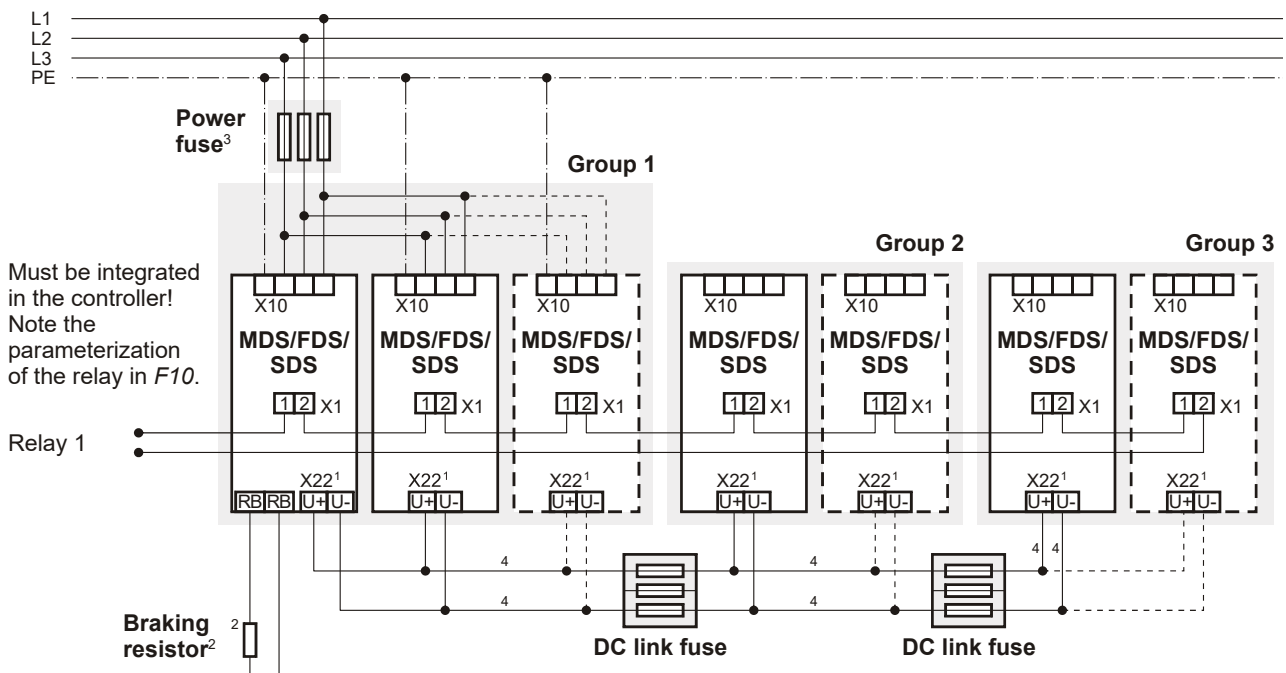
1　For MDS 5000 and SDS 5000, devices of size 3: X20, terminals ZK+, ZK-.

2　Dimension the braking resistor according to the braking output of the compound DC link system and the technical data of the device.

3　On this aspect, pay attention to section 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 size 2 or X20 for size 3.

WE KEEP THINGS MOVING

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.

WE KEEP THINGS MOVING

STÖBER

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	

WE KEEP THINGS MOVING

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)!

> ℹ **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**
>
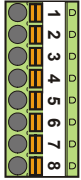> **Machine movement by unexpected reference value**
>
> The inverter detects a reference value setting of +5V for an unconnected analog input.
>
> ▶   Always operate the inverter with a connected analog input.

General specification	
Maximum cable length	30 m, shielded

Terminal description

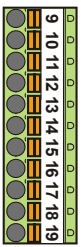| Pin		Designation	Function	Data
	1	AE1+	+ input of the analog input AE1 Resolution: 10 Bit + sign Offset < 100 mV Tolerance < 50 mV	Reference: pin 3 $U_1 = \pm 10$ V $R_{int} = 40$ kΩ U_{1max} against pin 3 = 30 V U_{1max} against protective ground 15 V U_{1max} against AGND = 30 V
	2	AE1 shunt	Current input; shunt connection pin 2 is to be bridged with pin 1.	Reference: pin 3 $I_1 = \pm 20$ 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 Offset < 100 mV Tolerance < 50 mV	Reference: pin 5 $U_1 = \pm 10$ 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 Resolution: 11 bit + sign Offset < 100 mV Tolerance < 50 mV	Reference: pin 8 $I_{2max} = 10$ mA $R_{int} = 20$ Ω
	7	AA2	Analog output 2 Resolution: 11 bit + sign Offset < 100 mV Tolerance < 50 mV	
	8	AGND	Reference ground for analog signals	—

WE KEEP THINGS MOVING

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	$I_{2max} = 50$ mA
	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

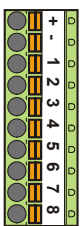| Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

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

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
	-	GND		I_{1max} = 1.5 A
	1	BA3	Binary output	I_{2max} = 50 mA
	2	BA4		
	3	BA5		
	4	BA6		
	5	BA7		
	6	BA8		
	7	BA9		
	8	BA10		
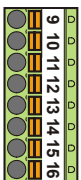
Maximum conductor cross-section

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	—

Terminal description X103E – LEA 5000

General specification	
Maximum cable length	30 m, shielded

Terminal description

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

STÖBER

Maximum conductor cross-section

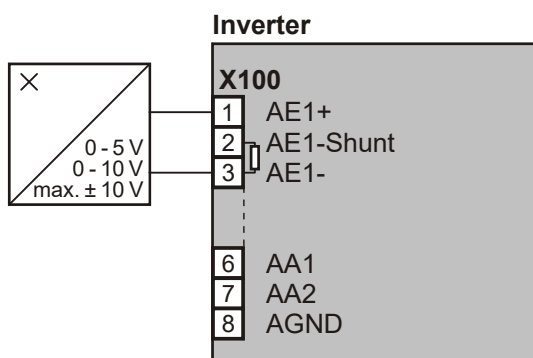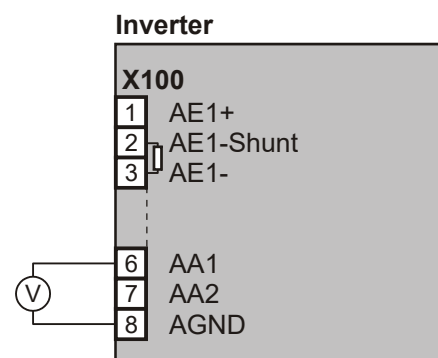| Connection type	Maximum conductor cross-section [mm^2]
Rigid	1.5
Flexible	1.5
Flexible with cable end, without plastic sleeve	1.5
Flexible with cable end, with plastic sleeve	0.5
2 leads with the same cross-section with double cable end	—

Connection examples

Potentiometer
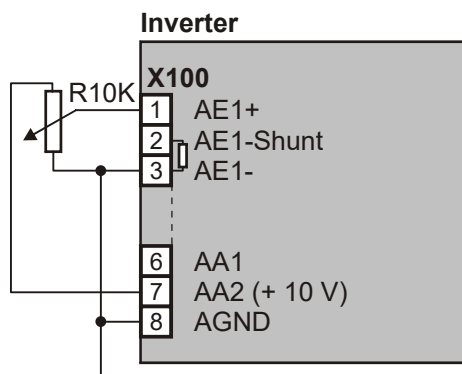
Current (0 - 20 mA, 4 - 20 mA)
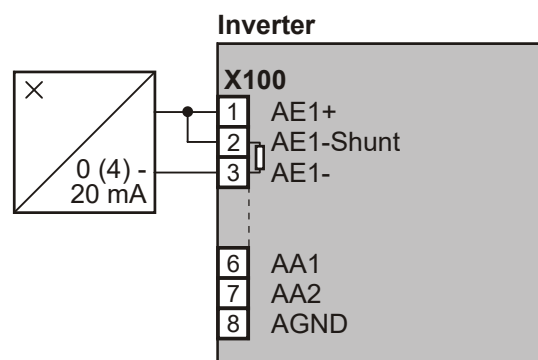
Voltage (max. ± 10 V)

Analog output voltage

WE KEEP THINGS MOVING

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

Incremental encoder specification	
Encoder type	Only TTL and HTL encoders with N channel may be connected to X4. Encoders without N channel generate a fault when at device start-up.
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::
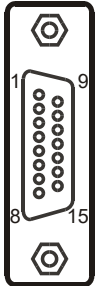> 3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution
> = 102,400 pulses per second
> = 102.4 kHz

STÖBER

Encoder supply

U$_2$	Through		Remarks
15–16 V	Pin 12 (sense) not used		STOBER asynchronous motors
	Pin 12 (sense) bridged with pin 2 (GND)		HTL encoder: Bridge created in the cable plug that is connected to X4.

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	—	—

WE KEEP THINGS MOVING

Terminal description X4 for TTL encoders

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	Sense-	Reference for sense signal to pin 12
	11	—	—
	12	Sense+	Sensor line for the supply voltage to adjust the encoder supply
	13	B-	Inverse, differential input for channel
	14	N-	Inverse, differential input for N channel
	15	A-	Inverse, differential input for A channel

STÖBER
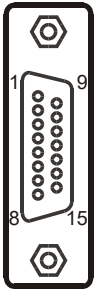
5.12.2 BE encoder and BA encoder simulation

To evaluate single-ended incremental or pulse/directional signals, use binary inputs BE3, BE4 and BE5. If you would like to simulate them, use outputs BA1 and BA2.

General specification	
Maximum cable length	30 m
Signal level	HTL

Evaluation – Incremental encoder and pulse train	
High level	12 – 30 V
Low level	0 – 8 V
U_{1max}	30 V
I_{1max}	16 mA
f_{max}	100 kHz

Simulation – Incremental encoder and pulse train	
I_{2max}	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

WE KEEP THINGS MOVING

Terminal description X101 – Incremental encoder and pulse train

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 Pulse train: –	
	14	BE4	Evaluation: Incremental encoder: A Pulse train: frequency–	
	15	BE5	Evaluation: Incremental encoder: B Pulse train: direction	
	16	BA1	Simulation Incremental encoder: A Pulse train: frequency–	—
	17	BA2	Simulation Incremental encoder: B Pulse train: direction	
	18	24 V-In	24 vdc power supply	Input range: 18 – 28.8 V
	19	18 V-Out	Auxiliary voltage 18 V	$U_2 = 16 - 18$ V $I_{2max} = 50$ mA
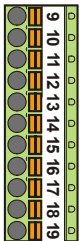
5.13 Fieldbus

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
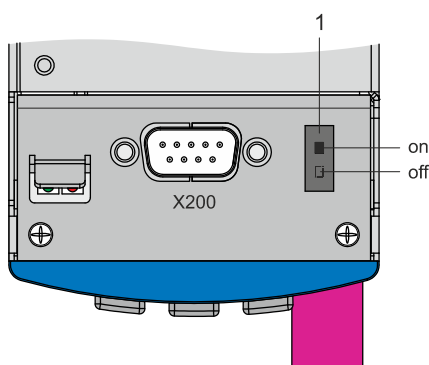
Fig. 5-1Top of device with terminal X200

1   Internal terminating resistor 120 Ω switchable

WE KEEP THINGS MOVING

5.13.2   X200: PROFIBUS
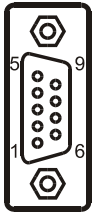
Prerequisite for the PROFIBUS link:

• DP 5000

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

Terminal description X200

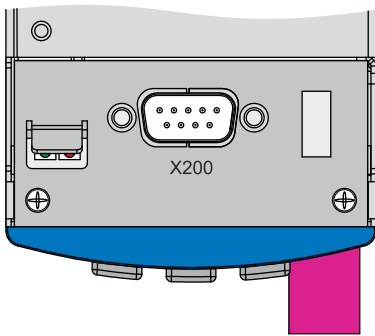| Pin		Designation	Function
socket	1	—	—
	2	—	—
	3	B	RxD / TxD-P (send/receive data +)
	4	RTS	Direction control for repeater +
	5	GND	Ground to + 5 V
	6	+5 V	Power for terminating resistors
	7	—	—
	8	A	RxD / TxD-N (send/receive data -)
	9	—	—

Fig. 5-2Top of device with terminal X200

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

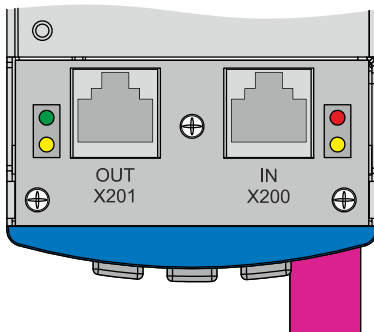| Pin		Designation	Function
	1	TxData+	EtherCAT communication
	2	TxData-	
	3	RecvData+	
	4	—	—
	5	—	—
	6	RecvData-	EtherCAT communication
	7	—	—
	8	—	—

Fig. 5-3Top of device with terminals X201 and X200

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

Terminal description X200 and X201

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	—	

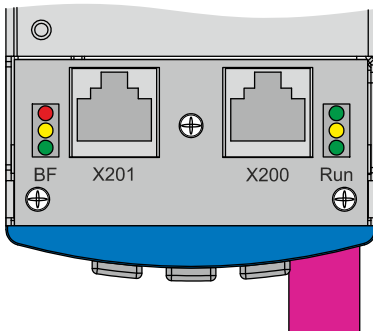
Fig. 5-4Top of device with terminals X201 and X200

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.

WE KEEP THINGS MOVING

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.
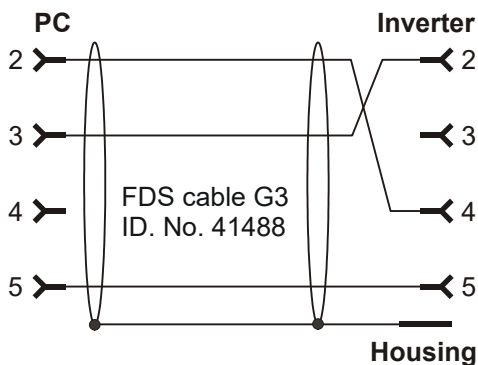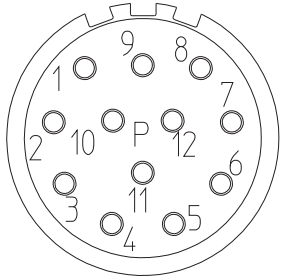
5.15   Cables

> **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 asynchronous motors.
The suitable encoder cable is described below.

Encoder cable – plug connector con.23

Motor	Signal		Wire colors		Sub-D (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			

Dimensions – connector size con.23

Length [mm]	Diameter [mm]
58	26

WE KEEP THINGS MOVING

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		

WE KEEP THINGS MOVING

6 Examples of connections
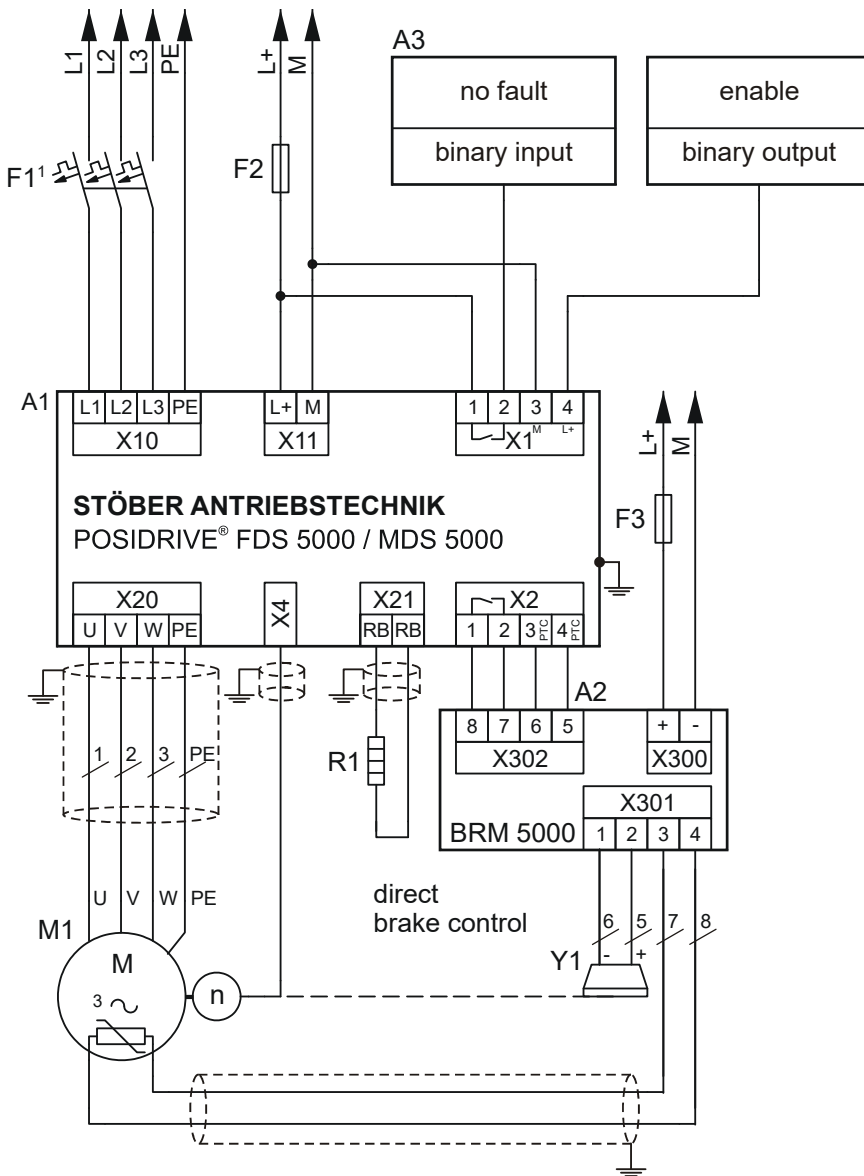
¹ circuit protection
 tripping characteristics C

WE KEEP THINGS MOVING

A3
no fault / binary input
enable / binary output

STÖBER ANTRIEBSTECHNIK
POSIDRIVE® FDS 5000 / MDS 5000

indirect
brake control

PowerBox

[1] circuit protection
  tripping characteristics C

WE KEEP THINGS MOVING
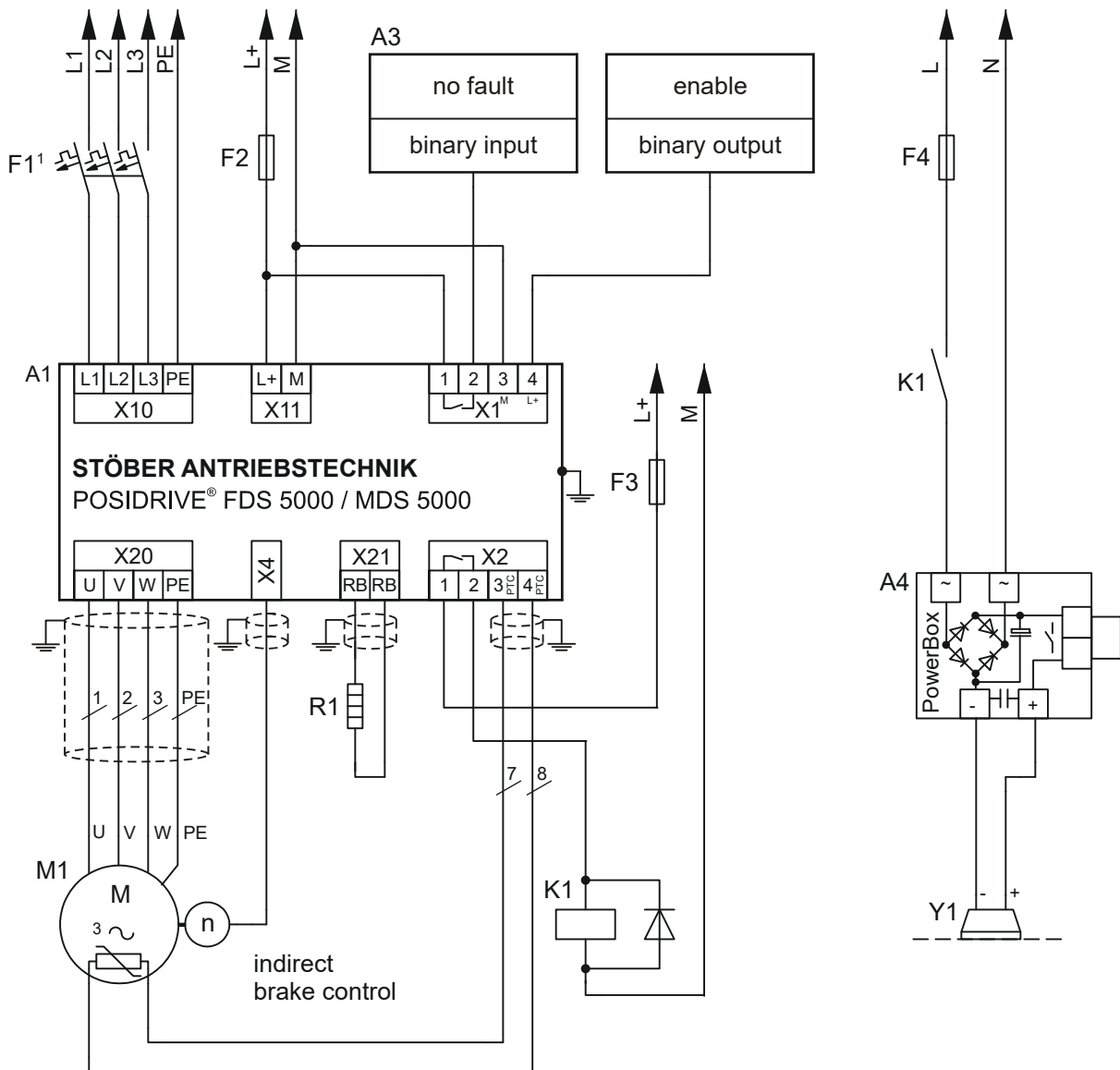
7   Accessories

I/O terminal module LEA 5000

ID no. 49029

Terminals:
- 8 binary inputs
- 8 binary outputs

Brake module BRM 5000

ID no. 44571

Brake module for inverters of series FDS 5000 and MDS 5000.
Accessory part for control of a motor holding brake (24 VDC) and (for inverters up to size 2) for connecting to the shield of the power cable.
Attachable on the basic housing.
Including shield connection terminal.

Technical Data	
Power cable cross-section	1 to 4 mm²
Max. shield diameter	12 mm
Min. shield contact surface (isolated part of the power cable)	15 mm

STÖBER

EMC shroud EM 5000

ID no. 44959

EMC shroud for sizes 0 to 2.
Accessory part for shield connection of the motor line.
Attachable on the basic housing.
Including shield connection terminal.

Technical Data	
Power cable cross-section	1 to 4 mm²
Max. shield diameter	12 mm
Min. shield contact surface (isolated part of the power cable)	15 mm

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.

WE KEEP THINGS MOVING

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.
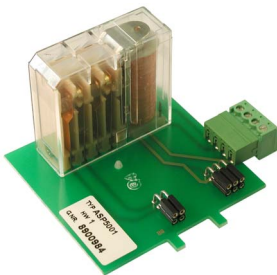
Fieldbus module PROFINET PN 5000

ID no. 53893

Accessory part for connecting PROFINET.

ASP 5001 – Safe Torque Off

Available with the standard version.

Option module for implementation of integrated
safety function Safe Torque Off (STO).
The ASP 5001 may only be installed by
STÖBER Antriebstechnik GmbH + Co. KG!
The ASP 5001 must be ordered with the
basic device.

WE KEEP THINGS MOVING

STÖBER

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.

USB adapter on RS232

ID no. 45616

Adapter for connecting RS232 to a USB connection.

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.

WE KEEP THINGS MOVING

Paramodule

Included in the standard design.

ID no. 55463

Memory module for configuration and parameters.

STÖBER

Address registers

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

- **Technical offices for advice and marketing in Germany**

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

- **Service network Germany**

- **Service network international**

- **STOBER subsidiaries:**

USA

STOBER DRIVES INC.
1781 Downing Drive
41056 Maysville
Fon +1 606 759 5090
sales@stober.com
www.stober.com

Austria

STÖBER ANTRIEBSTECHNIK
GmbH
Hauptstraße 41a
4663 Laakirchen
Fon +43 7613 7600-0
sales@stoeber.at
www.stoeber.at

United Kingdom

STOBER DRIVES LTD.
Centrix House
Upper Keys Business Village
Keys Park Road, Hednesford
Cannock | Staffordshire WS12 2HA
Fon +44 1543 458 858
sales@stober.co.uk
www.stober.co.uk

Turkey

STOBER Turkey
Istanbul
Fon +90 212 338 8014
sales-turkey@stober.com
www.stober.com

Switzerland

STÖBER SCHWEIZ AG
Rugghölzli 2
5453 Remetschwil
Fon +41 56 496 96 50
sales@stoeber.ch
www.stoeber.ch

France

STOBER S.a.r.l.
131, Chemin du Bac à Traille
Les Portes du Rhône
69300 Caluire-et-Cuire
Fon +33 4 78.98.91.80
sales@stober.fr
www.stober.fr

China

STOBER China
German Centre Beijing Unit 2010,
Landmark Tower 2 8 North
Dongsanhuan Road
Chaoyang District BEIJING 10004
Fon +86 10 6590 7391
sales@stoeber.cn
www.stoeber.cn

Taiwan

STOBER Branch Office Taiwan
sales@stober.tw
www.stober.tw

Italy

STÖBER TRASMISSIONI S. r. l.
Via Italo Calvino, 7 Palazzina D
20017 Rho (MI)
Fon +39 02 93909570
sales@stober.it
www.stober.it

South East Asia

STOBER South East Asia
sales@stober.sg
www.stober.sg

Japan

STOBER JAPAN K. K.
Elips Building 4F, 6 chome 15-8,
Hon-komagome, Bunkyo-ku
113-0021 Tokyo
Fon +81 3 5395 6788
sales@stober.co.jp
www.stober.co.jp

www.stober.com

STÖBER