SD6 drive controller
Commissioning instructions

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STÖBER

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1 Foreword

STOBER drive controllers of the SD6 series offer maximum precision and productivity for automation technology and mechanical engineering despite ever more complex functions. Highly dynamic drives ensure the shortest recovery times from fast changes in set value and load jumps. There is also an option of connecting the drive controllers in a DC link for multi-axis applications, which improves the energy footprint of the entire system. The SD6 drive controller is available in four sizes with a nominal output current of up to 85 A.

Features

- Control of linear and rotary synchronous servo motors and asynchronous motors
- Multi-functional encoder interfaces
- Automatic motor parameterization from the electronic motor nameplate
- Isochronic system bus (IGB motion bus) for parameterization and multi-axis applications
- Communication over CANopen, EtherCAT or PROFINET
- Safe Torque Off (STO) in the standard version, expanded safety technology (SS1, SS2, SLS, etc.) as an option
- Digital and analog inputs and outputs as an option
- Brake chopper, brake control and line filter
- Energy supply through direct power supply
- Flexible DC link connection for multi-axis applications
- Convenient operating unit consisting of graphical display and keys
- Paramodul removable data storage for quick commissioning and service

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2 User information

This documentation covers the SD6 drive controller. You will receive support for the assembly of the individual modules along with the associated components that you will need to operate the drive controllers in the control cabinet.

You will also find information on wiring the modules correctly and checking their functionality in the group with an initial test.

Combinations with other 6th generation STOBER drive controllers are possible under certain boundary conditions.

2.1 Scope of documentation

This documentation contains important safety instructions as well as a selection of information about the SD6 drive controller that you need for commissioning.

Note that this documentation does not replace the detailed manual. Read the detailed documentation first before working with the devices.

You can find the manual and other documentation in PDF format on the enclosed CD/DVD or on our website.

An overview of the available documentation about the SD6 drive controller can be found in the chapter Detailed information [▶ 161].

2.2 Storage and transfer

As this documentation contains important information for handling the product safely and efficiently, it must be stored in the immediate vicinity of the product until product disposal and be accessible to qualified personnel at all times.

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

2.3 Described product

This documentation is binding for:

Drive controllers of the SD6 series in conjunction with the
DriveControlSuite (DS6) software in V 6.5-B or higher, PASmotion in V 1.3.0 or higher and associated firmware in V 6.5-B or higher.

2.4 Timeliness

Check whether this document is the latest version of the documentation. We make the latest document versions for our products available for download on our website:
http://www.stoeber.de/en/downloads/.

2.5 Original language

The original language of this documentation is German; all other language versions are derived from the original language.

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2.6 Limitation of liability

This documentation was created taking into account the applicable standards and regulations as well as the current state of technology.

No warranty or liability claims for damage shall result from failure to comply with the documentation or from use that deviates from the intended use of the product. This is especially true for damage caused by individual technical modifications to the product or the project configuration and operation of the product by unqualified personnel.

2.7 Formatting conventions

Orientation guides in the form of signal words, symbols and special text markups are used to emphasize specific information so that you are able identify it in this documentation quickly.

2.7.1 Display of safety instructions

Safety instructions are identified with the following symbols. They indicate special risks when handling the product and are accompanied by relevant signal words that express the extent of the risk. Furthermore, useful tips and recommendations for efficient, error-free operation are specially highlighted.

ATTENTION!

Attention

This indicates that damage to property may occur

- if the stated precautionary measures are not taken.

⚠ CAUTION!

Caution

This word with a warning triangle indicates that minor personal injury may occur

- if the stated precautionary measures are not taken.

⚠ WARNING!

Warning

This word with a warning triangle means there may be a considerable risk of fatal injury

- if the stated precautionary measures are not taken.

⚠ DANGER!

Danger

This word with a warning triangle indicates that there is a considerable risk of fatal injury

- if the stated precautionary measures are not taken.

Information

Information indicates important information about the product or serves to emphasize a section in the documentation that deserves special attention from the reader.

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2.7.2 Markup of text elements

Certain elements of the continuous text are distinguished as follows.

Important information	Words or expressions with a special meaning
Interpolated position mode	Optional: File or product name or other name
Detailed information	Internal cross-reference
http://www.samplelink.com	External cross-reference

Software and other displays

The following formatting is used to identify the various information content of elements referenced by the software interface or a drive controller display, as well as any user entries.

Main menu Settings	Window names, dialog box names, page names or buttons, combined proper nouns, functions referenced by the interface
Select `Referencing method A`	Predefined entry
Save your `<own IP address>`	User-defined entry
EVENT 52: COMMUNICATION	Displays (status, messages, warnings, faults) for status information referenced by the interface

Keyboard shortcuts and command sequences or paths are represented as follows.

[Ctrl], [Ctrl] + [S]	Key, shortcut
Table > Insert table	Navigation to menus/submenus (path specification)

Buttons

The buttons of the drive controller are depicted as follows in .

[OK]	

2.7.3 Mathematics and formulas

The following signs are used to represent mathematical relationships and formulas.

- \- Subtraction
- \+ Addition
- × Multiplication
- ÷ Division
- | | Amount

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2.8 Symbols, marks and test symbols

Grounding symbol
Grounding symbol in accordance with IEC 60417, symbol 5019.

RoHS lead-free mark
Marking in accordance with RoHS directive 2011-65-EU.

CE mark
Manufacturer's self declaration: The product meets the requirements of EU directives.

UL test symbol
This product is listed by UL for the United States and Canada.
Representative samples of this product have been evaluated by UL and meet the requirements of applicable standards.

UL recognized component mark
This component or material is recognized by UL. Representative samples of this product have been evaluated by UL and meet applicable requirements.

2.9 Trademarks

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

CANopen®, CiA®	CANopen® and CiA® are registered European Union 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 of patented technologies licensed by Beckhoff Automation GmbH, Verl, Germany.
Hyper-V®	Hyper-V® is a registered trademark of the Microsoft Corporation in the United States and/or other countries.
PLCopen®	PLCopen® is a registered trademark of the PLCopen Organisation, Gorinchem, Netherlands.
PROFIBUS®, PROFINET®	The PROFIBUS and the PROFINET logo are registered trademarks of PROFIBUS Nutzerorganisation e.V., Karlsruhe, Germany.
speedtec®	speedtec® is a registered trademark of TE Connectivity Industrial GmbH, Niederwinkling, Germany.
VirtualBox®	VirtualBox® is a registered trademark of Oracle America, Inc., Redwood Shores, USA.
VMware®	VMware® is a registered trademark of VMware, Inc., Palo Alto, USA.
Windows®, Windows® 7, Windows® 10	Windows®, das Windows®-Logo, Windows® XP, Windows® 7 und Windows® 10 are registered trademarks of Microsoft Corporation in the United States and/or other countries.

All other trademarks 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.

2.10 Licenses

Software from the following licensor is used in the SD6 drive controller:

SEGGER Microcontroller GmbH & Co. KG
In den Weiden 11
40721 Hilden
Germany
Phone+49 2103-2878-0
Fax+49 2103-2878-28
Email: info@segger.com
Internet: http://www.segger.com

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3 General safety instructions

There are risks associated with the product described in this documentation that can be prevented by complying with the described warning and safety instructions as well as the included technical rules and regulations.

3.1 Directives and standards

The following European directives and standards are relevant to the drive controllers:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- EN ISO 13849-1:2015
- EN ISO 13849-2:2012
- EN 61800-3:2004 and A1:2012
- EN 61800-5-1:2007
- EN 61800-5-2:2007

Subsequent references to the standards do not specify the respective year in order to improve readability.

3.2 Qualified personnel

In order to be able to perform the tasks described in this documentation, the persons instructed to perform them must have the appropriate professional qualification and be able to assess the risks and residual hazards when handling the products. For this reason, all work on the products as well as their operation and disposal may be performed only by professionally qualified personnel.

Qualified personnel are persons who have acquired the authorization to perform these activities either through training to become a specialist and/or instruction by specialists.

Furthermore, valid regulations, legal requirements, applicable basic rules, this documentation and the safety instructions included in it must be carefully read, understood and observed.

3.3 Intended use

As defined by EN 50178, SD6 drive controllers are electrical devices operating as power electronics to control the flow of energy in high-voltage systems.

They are intended solely for the operation of motors that meet the requirements of EN 60034-1:

- Synchronous servo motors (e.g. of the EZ series)
- Asynchronous motors
- Linear motors
- Torque motors

The connection of other electronic loads or operation outside applicable technical specifications constitutes improper use.

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When installing drive controllers in machines, commissioning (i.e. commencing intended operation) may not be performed until it has been determined that the machine is in compliance with local laws and directives. For example, in the European region, the following applies:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU

EMC-compliant installation

The SD6 drive controller and accessories must be installed and wired compliant for EMC

Modification

As the user, you may not make any physical, technical or electrical modifications to the SD6 drive controller and the accessories.

Maintenance

The SD6 drive controller and accessories are maintenance-free. However, take appropriate measures to detect or prevent possible errors in the connecting wiring.

3.4 Transport and storage

Inspect the delivery for any transport damage immediately after you receive it. Notify the transport company of any damage immediately. Do not put a damaged product into operation.

To ensure the faultless and safe operation of the products, they must be professionally configured, installed, operated and maintained.

Store the products in a dry and dust-free room if you do not install them immediately.

Transport and store the products in the original packaging and protect the products from mechanical impacts and vibrations. Observe the transport and storage conditions recommended in the technical data.

Initiate reforming on the drive controllers in storage every year or before commissioning; see the chapter Storage [▶ 35].

3.5 Operational environment and operation

The products are subject to sales restrictions in accordance with IEC 61800-3.

The products are not designed for use in a public low-voltage network that supplies residential areas. Radio-frequency interference can be expected if the products are used in this type of network.

The products are intended exclusively for installation in control cabinets with at least protection class IP54.

Always operate the products within the limits specified by the technical data.

The following applications are prohibited:

- Use in potentially explosive atmospheres
- Use in environments with harmful substances as specified by EN 60721, such as oils, acids, gases, vapors, dust and radiation

Implementation of the following applications is permitted only after approval from STOBER:

- Use in non-stationary applications
- The use of active components (drive controllers, supply modules, energy recovery units or discharge units) from third-party manufacturers

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The drive controller is designed exclusively for operation in TN networks or on wye sources. At a nominal voltage of 200 to 480 V_{AC}, they are permitted to supply a maximum differential short-circuit current in accordance with the following table:

Size	Max. differential short-circuit current
Size 0 – size 2	5000 A
Size 3	10000 A

Tab. 1: Maximum differential short-circuit current

The drive controller has a configurable restart. If the drive controller is designed for an automatic restart after energy shutdown, this must be clearly specified on the system in accordance with EN 61800-5-1.

The drive controller has the option of a Safe Torque Off safety function (STO) in accordance with EN 61800-5-2 for safely disconnecting the energy supply to the motor. Measures based on this for protection against unexpected startup are described in EN ISO 12100 and EN ISO 14118, for example.

3.6 Working on the machine

Before all work on machines and systems, apply the 5 safety rules in accordance with DIN VDE 0105-100 (Operation of electrical installations – Part 100: General requirements) in the order listed:

- Disconnect (also ensure that the auxiliary circuits are disconnected).
- Ensure power cannot be switched on again.
- Ensure that everything is de-energized.
- Ground and short circuit.
- Cover adjacent live parts.

Information

Note that you can only determine that voltage is no longer present once the discharge time has elapsed. The discharge time depends on the self-discharge of the drive controller. You can find the discharge time in the general technical data of the drive controller.

3.7 Ensuring traceability

The orderer must ensure traceability of the products using the serial number.

3.8 Decommissioning

In safety-oriented applications, note the mission time T_M = 20 years in the safety-relevant key performance indicators. A drive controller with integrated safety module must be taken out of operation 20 years after the production date. The production date of the drive controller is found on the accompanying nameplate.

Detailed information about using the safety technology can be found in the corresponding manual, see the chapter Detailed information [▶ 161].

3.9 Disposal

Observe the current national and regional regulations when disposing of the packaging and product! Dispose of the packaging and individual product parts depending on their properties, e.g. as:

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

3.10 Firefighting

⚠ DANGER!

Electrical voltage! Risk of fatal injury due to electric shock!

There is a risk of fatal injury due to electric shock when using conductive firefighting equipment.

- Use ABC powder or carbon dioxide (CO_2) for firefighting.

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4 UL-compliant use

This chapter contains relevant information for use under UL conditions (UL – Underwriters Laboratories).

Surrounding air temperature and pollution degree

The maximum surrounding air temperature for UL-compliant operation is 45 °C. Use in an environment with pollution degree 2 is permitted.

Network layout

All device types supplied with 480 V_{AC} are intended solely for operation with grounded wye sources at 480/277 V_{AC}.

Power supply and motor overload protection

Observe the specification of I_{2maxPU} at 8 kHz clock frequency in the electrical data of the drive controller; see the chapter Electrical data [▶ 23].

Line fuse

For UL-compliant line fuses, observe the specifications in the chapter UL-compliant line fuses [▶ 64].

In accordance with CSA-C22.2 No. 14-13, the following applies for use in Canada:

Depending on the device type, additional overvoltage protection must be installed in the network upstream of the device and must fulfill the following conditions.

- 1-phase – SD6A02:
  - Overvoltage category 3
  - Phase-ground = 240 V_{AC} (peak permitted rated surge voltage = 4 kV)
  - Phase-phase (or N) = 240 V_{AC} (peak permitted rated surge voltage = 4 kV)
- 3-phase – starting from SD6A04:
  - Overvoltage category 3
  - Phase-ground = 277 V_{AC} (peak permitted rated surge voltage = 4 kV)
  - Phase-phase (or N) = 480 V_{AC} (peak permitted rated surge voltage = 6 kV)

Motor protection

All models of the 6th STOBER drive controller generation feature a certified i^2t model, a computational model for thermal monitoring of the motor. This fulfills the requirements for solid state motor overload protection in accordance with the amendment to UL 508C from May 2013. In order to activate it and start the protective function, set the parameters as follows (deviating from the default values): U10 = 2:Warning and U11 = 1.00 s. This model can be used instead of or in addition to temperature-monitored motor protection, as described in the chapter X2: Motor temperature sensor [▶ 78].

Motor temperature sensor

The SD6 drive controller features connections for PTC thermistors (NAT 145 °C), KTY temperature sensors (KTY84-130) or Pt temperature sensors (Pt1000). For a proper connection, observe the terminal description for X2 in chapter X2: Motor temperature sensor [▶ 78].

Information

STOBER recommends the use of PTC thermistors as thermal winding protection.

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Braking resistor

If the drive controller is to be provided with an externally mounted braking resistor, overheat protection must be provided separately.

Power terminals

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

24 V supply and fuses

Low-voltage circuits must be supplied by an isolated source with a maximum output voltage that does not exceed 30 V_{DC}.

Fuses for 24 V_{DC} supplies must be approved for DC voltage in accordance with UL 248.

- Use a 1 A fuse (time delay) upstream of relay 1. Observe the terminal description for X1, pin 1 in the chapter X1: Enable and relay 1 [▶ 78].
- Provide the 24 V_{DC} supply of the control unit with a 10 A fuse (time delay). Observe the terminal description for X11 in the chapter X11: 24 V supply [▶ 87].
- Provide the 24 V_{DC} supply for the brake with a 4 A fuse (time delay). Observe the terminal description for X6 in the chapter X6: Brake – Feedback and supply (ST6 option) [▶ 83].
- For the STO safety function via terminal X12: Use a 4 A fuse (time delay) to protect the supply voltage of the status signal. Observe the terminal description for X12 in chapter X12: Safety technology (option ST6) [▶ 88].
- The following applies to interface extensions with terminal module XI6, RI6 or IO6: Protect the 24 V_{DC} supply with a 1 A fuse (time delay). Observe the terminal description for X101, pin 18 or 19 in chapter X101: DI1 – DI5, DO1 – DO2 [▶ 105].

Branch circuit protection

Integral solid state short circuit protection does not provide branch circuit protection (line fuse) upstream of the drive controller. Branch circuit protection must be provided in accordance with the manufacturer instructions, the National Electrical Code, the Canadian Electrical Code, part I, and any additional local codes.

UL test

Only the risks of electric shock and the risk of fire have been examined during UL acceptance. Functional safety aspects have not been assessed during the UL approval process. These are assessed for STOBER by bodies such as the TÜV SÜD certification service.

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5 Technical data

This chapter contains the technical data for the SD6 drive controller, the DC link connection, the safety technology and the brakes. Additional technical data on the drive controller and accessories can be found in the SD6 drive controller manual; see the chapter Detailed information [▶ 161].

5.1 Drive controllers

The following chapters contain specifications for the electrical data, dimensions and weight of the drive controller.

5.1.1 General technical data

The following information applies to all device types.

Device features	
Protection class of the device	IP20
Protection class of the installation space	At least IP54
Protection class	Protection class I in accordance with EN 61140
Radio interference suppression	Integrated line filter in accordance with EN 61800-3, interference emission class C3
Overvoltage category	III in accordance with EN 61800-5-1
Test symbols	

Tab. 2: Device features

Transport and storage conditions	
Storage/ transport temperature	–20 °C to +70 °C Maximum change: 20 K/h
Relative humidity	Maximum relative humidity 85%, non-condensing
Vibration (transport) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²
Fall height for freefall[1] Weight < 100 kg in accordance with EN 61800-2 (or IEC 60721-3-2, class 2M1)	0.25 m

Tab. 3: Transport and storage conditions

Operating conditions	
Surrounding temperature during operation	0 °C to 45 °C with nominal data 45 °C to 55 °C with derating –2.5% / K
Relative humidity	Maximum relative humidity 85%, non-condensing
Installation altitude	0 m to 1000 m above sea level without restrictions 1000 m to 2000 m above sea level with –1.5%/100 m derating
Pollution degree	Pollution degree 2 in accordance with EN 50178
Ventilation	Installed fan
Vibration (operation) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s²

Tab. 4: Operating conditions

[1] Only valid for components in original packaging

Discharge times	
Self-discharge of DC link	6 min

Tab. 5: Discharge times of the DC link circuit

5.1.2 Nameplate

The nameplate is placed on the side of the drive controller.

Fig. 1: SD6A06TEX nameplate

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Designation	Value in example	Meaning
Type	SD6A06TEX	Production information
Date	2030	
S/N	7002418	
Input voltage	3 × 400 V_{AC} 50 Hz UL: 3 × 480 V_{AC} 50–60 Hz	Input voltage
Input current	4.0 A	Input current
Output data	0 to 460 V_{AC} 0 to 700 Hz @8 kHz: 3.4 A	Output voltage Output frequency Output current for 8 kHz clock frequency
Protection class	IP20	Protection class

Tab. 6: Meaning of the specifications on the nameplate

Information

UL and cUL certified devices with the corresponding test symbol meet the requirements of standards UL 508C and UL 840.

5.1.3 Type designation

SD	**6**	**A**	**0**	**6**	**T**	**E**	**X**

Tab. 7: Example code for type designation

Code	Designation	Design
SD	Series	ServoDrive
6	Generation	Generation 6
A, B	Version	
0 – 3	Size	
6 (0 – 9)	Power output stage	Power output stage within the size
T	Safety module	ST6: STO via terminals
E		SE6: Expanded safety functionality via terminals
N	Communication module	Empty
E		EC6: EtherCAT
C		CA6: CANopen
P		PN6: PROFINET
N	Terminal module	Empty
X		XI6: Extended
R		RI6: Resolver
I		IO6: Standard

Tab. 8: Meaning of the example code

5.1.4 Material variant

On the side of the drive controller above the nameplate, there is another sticker with the material variant (MV) and serial number (SN).

Fig. 2: Sticker with MV and serial number

Designation	Value in example	Meaning
MV	MV0000012345	MV number
SN	6001192064	Serial number
—	SD6A06TEX	Device type according to type designation
—	1000914812/001100	Order number/order item

Tab. 9: Meaning of the specifications on the sticker

5.1.5 Sizes

Type	Size
SD6A02	Size 0
SD6A04	Size 0
SD6A06	Size 0
SD6A14	Size 1
SD6A16	Size 1
SD6A24	Size 2
SD6A26	Size 2
SD6A34	Size 3
SD6A36	Size 3
SD6A38	Size 3

Tab. 10: Available SD6 types and sizes

SD6 in sizes 0, 1, 2 and 3

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5.1.6 Electrical data

The electrical data of the available SD6 sizes as well as the properties of the brake chopper can be found in the following chapters.

Information

For the time span between energizing two devices, note that:

- Direct, repeat activation of the supply voltage is possible for cyclical power-on/power-off operation.

Information

The STO safety function is available for safe stopping as an alternative to continuous, cyclical power-on/power-off operation.

An explanation of the formula symbols used can be found in the chapter Formula symbols [▶ 162].

5.1.6.1 Control unit

Electrical data	All types
U_{1CU}	24 V_{DC}, +20%/−15%
I_{1maxCU}	1.5 A

Tab. 11: Control unit electrical data

5.1.6.2 Power unit: Size 0

Electrical data	SD6A02	SD6A04	SD6A06
U_{1PU}	1 × 230 V_{AC}, +20% / −40%, 50/60 Hz	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz	
f_{2PU}	0 – 700 Hz		
U_{2PU}	0 – max. U_{1PU}		
$U_{2PU,ZK}$	√2 × U_{1PU}		
C_{PU}	340 µF	135 µF	135 µF
$C_{N,PU}$	1620 µF	540 µF	540 µF

Tab. 12: SD6 electrical data, size 0

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SD6A02	SD6A04	SD6A06
$f_{PWM,PU}$	4 kHz		
$I_{1N,PU}$	8.3 A	2.8 A	5.4 A
$I_{2N,PU}$	4 A	2.3 A	4.5 A
I_{2maxPU}	180% for 5 s; 150% for 30 s		

Tab. 13: SD6 electrical data, size 0, for 4 kHz clock frequency

Electrical data	SD6A02	SD6A04	SD6A06
$f_{PWM,PU}$	8 kHz		
$I_{1N,PU}$	6 A	2.2 A	4 A
$I_{2N,PU}$	3 A	1.7 A	3.4 A
I_{2maxPU}	250% for 2 s; 200% for 5 s		

Tab. 14: SD6 electrical data, size 0, for 8 kHz clock frequency

Electrical data	SD6A02	SD6A04	SD6A06
U_{onCH}	400 – 420 V_{DC}	780 – 800 V_{DC}	
U_{offCH}	360 – 380 V_{DC}	740 – 760 V_{DC}	
R_{2minRB}	100 Ω		
P_{maxRB}	1.8 kW	6.4 kW	
P_{effRB}	1.0 kW	2.9 kW	

Tab. 15: Brake chopper electrical data, size 0

5.1.6.3 Power unit: Size 1

Electrical data	SD6A14	SD6A16
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. U_{1PU}	
$U_{2PU,ZK}$	√2 × U_{1PU}	
C_{PU}	470 µF	560 µF
$C_{N,PU}$	1400 µF	1400 µF

Tab. 16: SD6 electrical data, size 1

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SD6A14	SD6A16
$f_{PWM,PU}$	4 kHz	
$I_{1N,PU}$	12 A	19.2 A
$I_{2N,PU}$	10 A	16 A
I_{2maxPU}	180% for 5 s; 150% for 30 s	

Tab. 17: SD6 electrical data, size 1, for 4 kHz clock frequency

Electrical data	SD6A14	SD6A16
$f_{PWM,PU}$	8 kHz	
$I_{1N,PU}$	9.3 A	15.8 A
$I_{2N,PU}$	6 A	10 A
I_{2maxPU}	250% for 2 s; 200% for 5 s	

Tab. 18: SD6 electrical data, size 1, for 8 kHz clock frequency

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Electrical data	SD6A14	SD6A16
U_{onCH}	780 – 800 V_{DC}	
U_{offCH}	740 – 760 V_{DC}	
R_{2minRB}	47 Ω	
P_{maxRB}	13.6 kW	
P_{effRB}	6.2 kW	

Tab. 19: Brake chopper electrical data, size 1

5.1.6.4 Power unit: Size 2

Electrical data	SD6A24	SD6A26
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. U_{1PU}	
$U_{2PU,ZK}$	√2 × U_{1PU}	
C_{PU}	680 µF	1000 µF
$C_{N,PU}$	1400 µF	1400 µF

Tab. 20: SD6 electrical data, size 2

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SD6A24	SD6A26
$f_{PWM,PU}$	4 kHz	
$I_{1N,PU}$	26.4 A	38.4 A
$I_{2N,PU}$	22 A	32 A
I_{2maxPU}	180% for 5 s; 150% for 30 s	

Tab. 21: SD6 electrical data, size 2, for 4 kHz clock frequency

Electrical data	SD6A24	SD6A26
$f_{PWM,PU}$	8 kHz	
$I_{1N,PU}$	24.5 A	32.6 A
$I_{2N,PU}$	14 A	20 A
I_{2maxPU}	250% for 2 s; 200% for 5 s	

Tab. 22: SD6 electrical data, size 2, for 8 kHz clock frequency

Electrical data	SD6A24	SD6A26
U_{onCH}	780 – 800 V_{DC}	
U_{offCH}	740 – 760 V_{DC}	
R_{2minRB}	22 Ω	
P_{maxRB}	29.1 kW	
P_{effRB}	13.2 kW	

Tab. 23: Brake chopper electrical data, size 2

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5.1.6.5 Power unit: Size 3

Electrical data	SD6A34	SD6A36	SD6A38
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz		
f_{2PU}	0 – 700 Hz		
U_{2PU}	0 – max. U_{1PU}		
$U_{2PU,ZK}$	√2 × U_{1PU}		
C_{PU}	430 µF	900 µF	900 µF
$C_{N,PU}$	5100 µF	5100 µF	5100 µF

Tab. 24: SD6 electrical data, size 3

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SD6A34	SD6A36	SD6A38
$f_{PWM,PU}$	4 kHz		
$I_{1N,PU}$	45.3 A	76 A	76 A
$I_{2N,PU}$	44 A	70 A	85 A[2]
I_{2maxPU}	180% for 5 s; 150% for 30 s		

Tab. 25: SD6 electrical data, size 3, for 4 kHz clock frequency

Electrical data	SD6A34	SD6A36	SD6A38
$f_{PWM,PU}$	8 kHz		
$I_{1N,PU}$	37 A	62 A	76 A
$I_{2N,PU}$	30 A	50 A	60 A
I_{2maxPU}	250% for 2 s; 200% for 5 s		

Tab. 26: SD6 electrical data, size 3, for 8 kHz clock frequency

Electrical data	SD6A34	SD6A36	SD6A38
U_{onCH}	780 – 800 V_{DC}		
U_{offCH}	740 – 760 V_{DC}		
R_{intRB}	30 Ω (PTC resistance; 100 W; max. 1 kW for 1 s; τ = 40 s)		
R_{2minRB}	15 Ω		
P_{maxRB}	42 kW		
P_{effRB}	19.4 kW		

Tab. 27: Brake chopper electrical data, size 3

Information

Be aware that the internal braking resistor is not active automatically and must be parameterized in DriveControlSuite.

[2] Specification applies to the default setting of the field weakening voltage limit: B92 = 80%.

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5.1.6.6 Enable and relay

You enable the power unit of the drive controller using the enable signal. The function of relay 1 can be parameterized using parameter F75.

Electrical data		All types
Internal device update rate		Cycle time parameterized in A150 of the application: t_{min} = 1 ms
U_{2max}	Relay 1	30 V
I_{2max}		1.0 A
Life span		Mechanical min. 5,000,000 switching cycles; at 24 V_{DC}/1 A (ohm. load): 300,000 switching cycles
High level	Enable	12 – 30 V_{DC}
Low level		0 – 8 V_{DC}
I_{1max}		16 mA

Tab. 28: X1 electrical data

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5.1.7 Dimensions

The dimensions of the available SD6 sizes can be found in the following chapters.

5.1.7.1 Dimensions: sizes 0 to 2

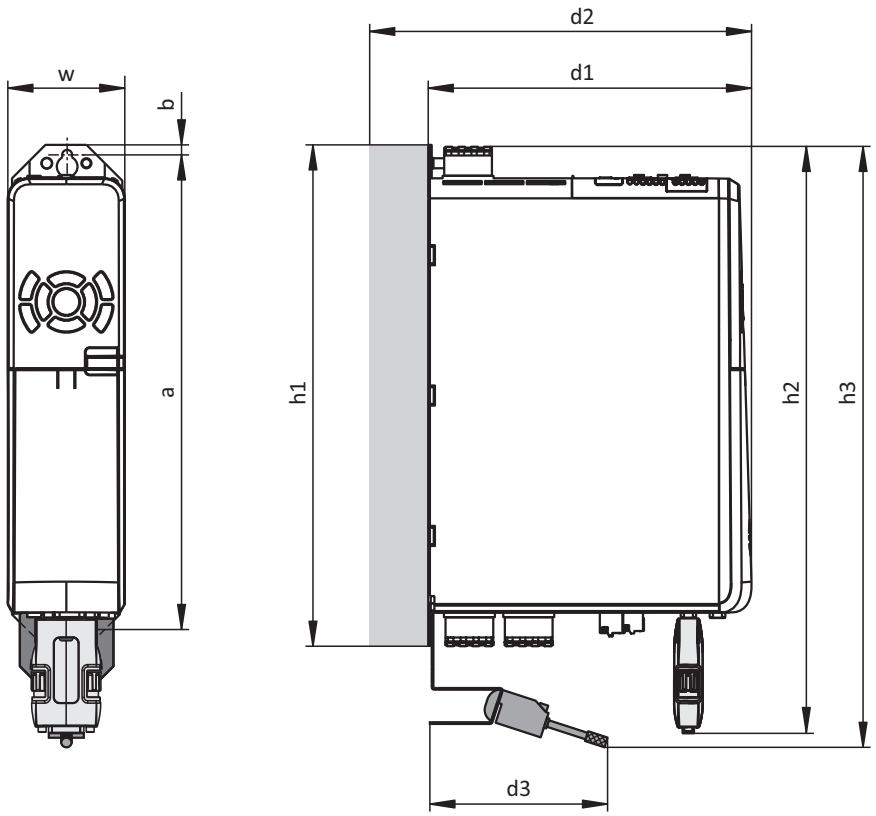

Fig. 3: SD6 dimensional drawing, sizes 0 to 2

Dimension			Size 0	Size 1	Size 2
Drive controller	Width	w	70	70	105
	Depth	d1	194	284	
	Depth incl. RB 5000 braking resistor	d2	212	302	
	Depth incl. Quick DC-Link	d2	229	319	
	Height incl. fastening clips	h1	300		
	Height incl. AES	h2	367		
	Height incl. EMC shroud	h3	approx. 376		
EMC shroud incl. shield connection terminal	Depth	d3	approx. 111		
Fastening holes	Vertical distance	a	283+2		
	Vertical distance to the upper edge	b	6		

Tab. 29: SD6 dimensions, sizes 0 to 2 [mm]

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5.1.7.2 Dimensions: size 3

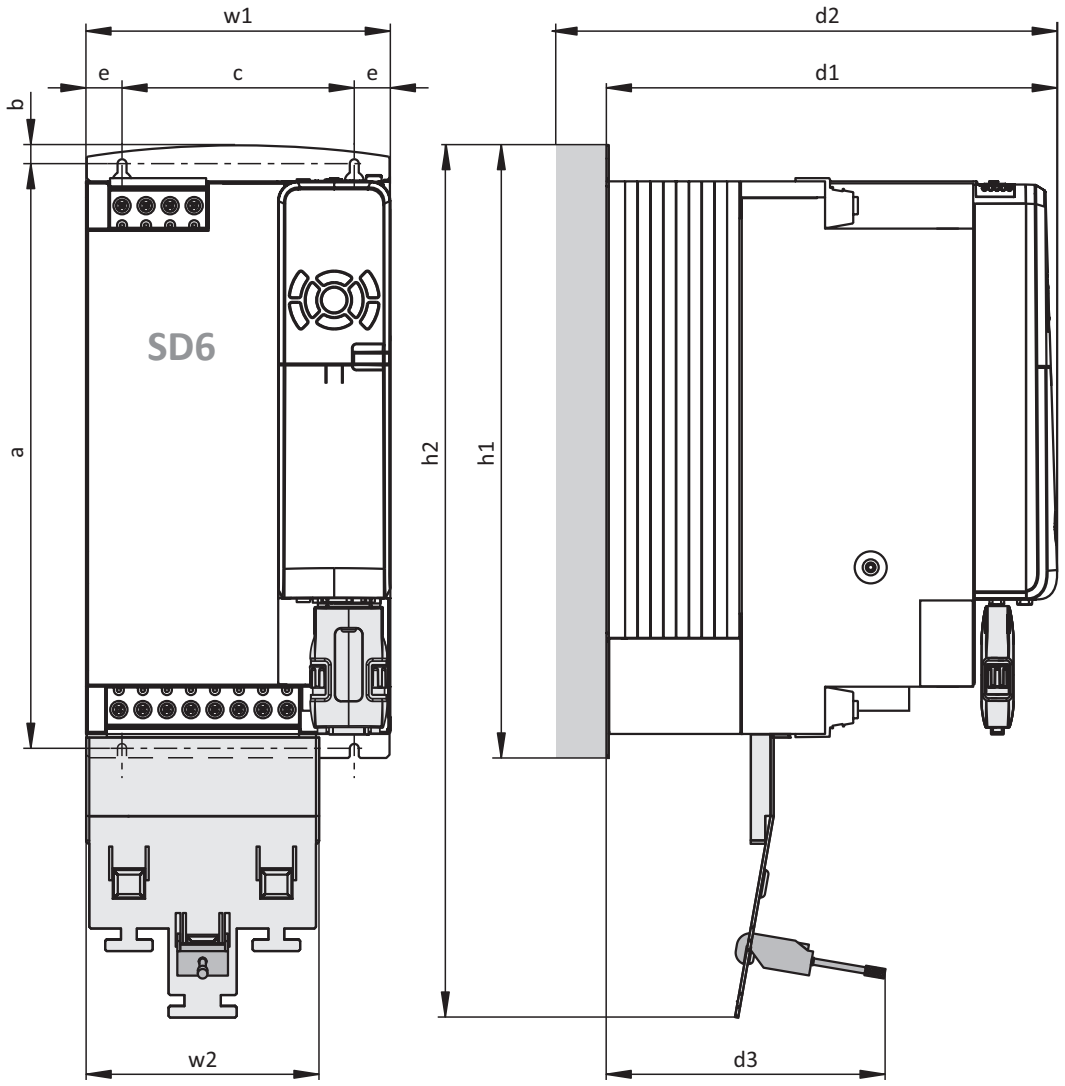

Fig. 4: SD6 dimensional drawing, size 3

Dimension			Size 3
Drive controller	Width	w1	194
	Depth	d1	305
	Depth incl. Quick DC-Link	d2	340
	Height incl. fastening clips	h1	382.5
	Height incl. EMC shroud	h2	540
EMC shroud incl. shield connection terminal	Width	w2	147
	Depth	d3	approx. 174
Fastening holes	Vertical distance	a	365+2
	Vertical distance to the upper edge	b	11.5
	Horizontal distance between the fastening holes of the drive controller	c	150+0.2/−0.2
	Horizontal distance to the side edge of the drive controller	e	20

Tab. 30: SD6 dimensions, size 3 [mm]

5.1.8 Weight

Size	Weight without packaging [g]	Weight with packaging [g]
Size 0	2530	3520
Size 1	3700	5470
Size 2	5050	6490
Size 3	13300	14800

Tab. 31: SD6 weight [g]

If you intend to order the drive controller with accessory parts, the weight increases as follows.

Accessories	Weight without packaging [g]
Communication module	50
Terminal module	135
Safety module	110

Tab. 32: Weight of the accessory part [g]

5.1.9 Cycle times

Possible cycle times can be found in the following table.

Type	Cycle times	Relevant parameters
Application	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in A150
EtherCAT fieldbus, cyclical communication	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in A150
PROFINET fieldbus, cyclical communication	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in A150
Analog and digital inputs and outputs	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in A150
Motion core (movement calculation)	250 µs	—
Control cascade	62.5 µs, 125 µs	Depending on B24

Tab. 33: Cycle times

5.2 DC link connection

The following chapter includes information on the design, dimensions and weight of the DL6A Quick DC-Link modules.

5.2.1 General technical data

The following information applies to all Quick DC-Link modules and corresponds to the general technical data for the base device.

Device features	
Protection class of the device	IP20 (if built over with drive controller or supply module)
Protection class	Protection class I in accordance with EN 61140 (if built over with drive controller or supply module)
Protection class of the installation space	At least IP54

Tab. 34: Device features

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Transport and storage conditions	
Storage/ transport temperature	−20 °C to +70 °C Maximum change: 20 K/h
Relative humidity	Maximum relative humidity 85%, non-condensing
Vibration (transport) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²
Fall height for freefall[3] Weight < 100 kg in accordance with EN 61800-2 (or IEC 60721-3-2, class 2M1)	0.25 m

Tab. 35: Transport and storage conditions

Operating conditions	
Surrounding temperature during operation	0 °C to 45 °C with nominal data 45 °C to 55 °C with derating −2.5% / K
Relative humidity	Maximum relative humidity 85%, non-condensing
Installation altitude	0 m to 1000 m above sea level without restrictions 1000 m to 2000 m above sea level with −1.5%/100 m derating
Pollution degree	Pollution degree 2 in accordance with EN 50178
Vibration (operation) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s²

Tab. 36: Operating conditions

5.2.2 DL6A – SD6 assignment

DL6A is available in the following designs, appropriate for the sizes of the drive controller:

Type	DL6A0	DL6A1	DL6A2	DL6A3
ID No.	56440	56441	56442	56443
SD6A02	X	—	—	—
SD6A04	X	—	—	—
SD6A06	X	—	—	—
SD6A14	—	X	—	—
SD6A16	—	X	—	—
SD6A24	—	—	X	—
SD6A26	—	—	X	—
SD6A34	—	—	—	X
SD6A36	—	—	—	X
SD6A38	—	—	—	X

Tab. 37: Assignment of DL6A to SD6

[3] Only valid for components in original packaging

5.2.3 Dimensions

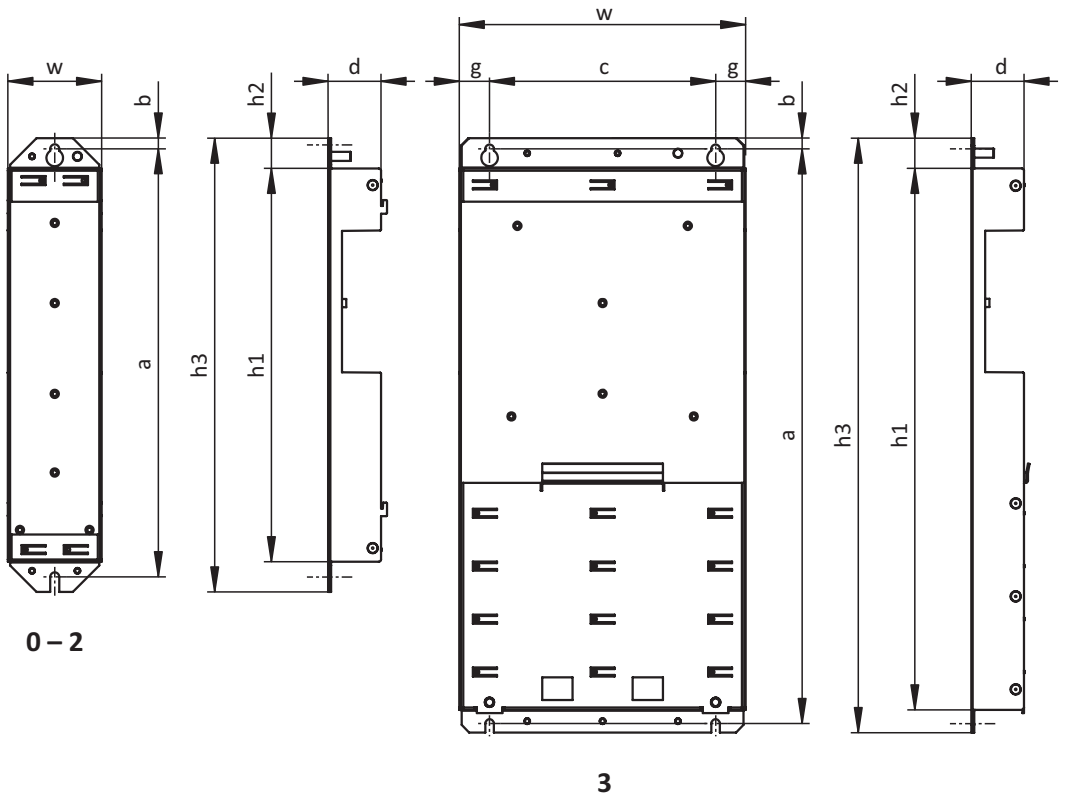

Fig. 5: DL6A dimensional drawing

Dimension			DL6A0 DL6A1	DL6A2	DL6A3
Quick DC-Link	Width	w	62	97	105
	Depth	d	35		
	Height	h1	260		358
	Fastening clip height	h2	20		15
	Height incl. fastening clips	h3	300		393
Fastening holes	Vertical distance (wall mounting)	a	283+2		380+2
	Vertical distance to the upper edge	b	7		
	Horizontal spacing of the fastening holes	c	—		150
	Horizontal distance to the side edge	g	—		20

Tab. 38: DL6A dimensions [mm]

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5.2.4 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
DL6A0	400	500
DL6A1	390	460
DL6A2	540	620
DL6A3	1540	1580

Tab. 39: DL6A weight [g]

5.3 Safety technology

5.3.1 ST6

The ST6 safety module adds the STO safety function to the SD6 drive controller via terminal X12.

Specification	Electrical data
STO_a	U_{1max} = 30 V_{DC} (PELV) High level = 15 – 30 V_{DC} Low level = 0 – 8 V_{DC} I_{1max} = 100 mA I_{1N} = 10 – 15 mA per channel C_{1max} = 100 nF
STO_b	
STO_{status}	$U_2 = U_1 - (200\ m\Omega * I_1)$
STO_{status} supply	U_1 = +24 V_{DC}, +20%/25% I_{1max} = 100 mA
GND	—

Tab. 40: X12 electrical data

5.3.2 SE6

The SE6 safety module adds the expanded safety functions to the SD6 drive controller using terminals X14 and X15.

Electrical data	Digital input	Value
Low level	I0–I7	–3 – +5 V_{DC}
High level		15 – 30 V_{DC}
U_{1max}		30 V_{DC}
I_{1max}		10.8 mA
f_{1max}		< 250 Hz; results from the SE6 cycle time and the configurable filter time constant of the input

Tab. 41: X14 electrical data – Digital inputs (SE6 option)

Electrical data	Digital output	Value
I_{2max}	O0 – O4	0.5 A
Typical voltage drop		25 mV
U_1	24 V_{DC} supply	20.4 – 28.8 V_{DC}

Tab. 42: X15 electrical data – Digital outputs (SE6 option)

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5.4 Controllable brakes

You can control the following brakes:

- 24 V_{DC} brakes connected directly to X5
- Brakes connected indirectly over contactor to X5

Only in combination with SE6 safety module:

- 24 V_{DC} brakes connected directly to X8
- Brakes connected indirectly over contactor to X8

Information

Control modes 48: SSM-vector control incremental encoder and 70: SLM - vector control with commutation finding using Wake and Shake may only be used in combination with a brake for axes without gravity load.

More detailed information can be found in the chapter B20 = 48, 64 or 70.

5.4.1 X5

Electrical data	Brake output
I_{2max}	3 A
I_{2min} (direct brake control)	330 mA
I_{2min} (indirect brake control)	20 mA
f_{2max}	1 Hz
E_{2max}	2.84 J

Tab. 43: Electrical data of the brake output

In combination with the ST6 safety module, the brake connected to X5 is supplied via terminal X6, in combination with the SE6 safety module via terminal X7.

5.4.2 X8 (option SE6)

Electrical data	Brake output
I_{2max}	3.6 A / 2.5 A at surrounding temperature > 45 °C
I_{2min}	0.5 mA
f_{2max}	1 Hz
E_{2max}	4.5 J

Tab. 44: Electrical data of the brake output

The brake connected to X8 is supplied over terminal X7.

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6 Storage

Store the products in a dry and dust-free room if you do not install them immediately.

Observe the Transport and storage conditions [▶ 19] specified in the technical data.

6.1 Drive controllers

The DC link capacitors can lose their electrical strength due to long storage times and must be reformed before commissioning.

This property does not apply to size 3 DC link capacitors. Therefore, size 3 drive controllers do not require reforming even after prolonged storage periods.

ATTENTION!

Material damage due to reduced electrical strength!

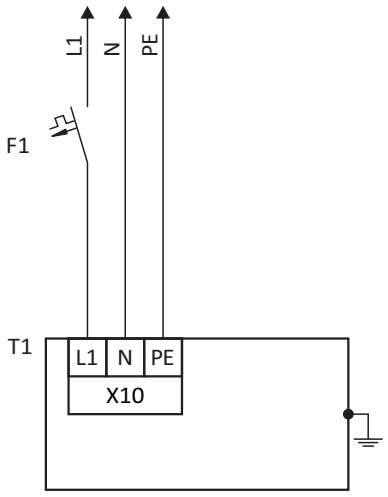
Reduced electrical strength can cause considerable material damage when switching on the drive controller.

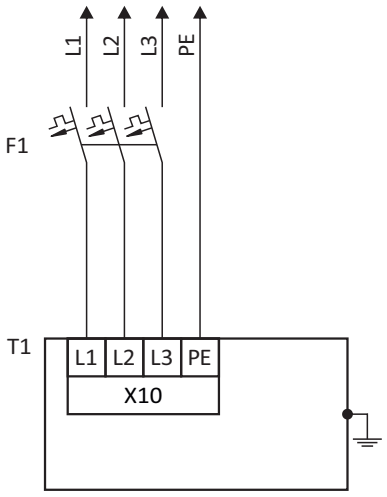
- Reform drive controllers in storage annually or before commissioning.

6.1.1 Annual reforming

To prevent damage to stored drive controllers, STOBER recommends connecting stored devices to the supply voltage once per year for one hour.

The following graphics show the basic line connection for 1-phase and 3-phase devices.





L1 – L3	Lines 1 to 3
N	Neutral conductor
PE	Grounding conductor
F1	Fuse
T1	Drive controller

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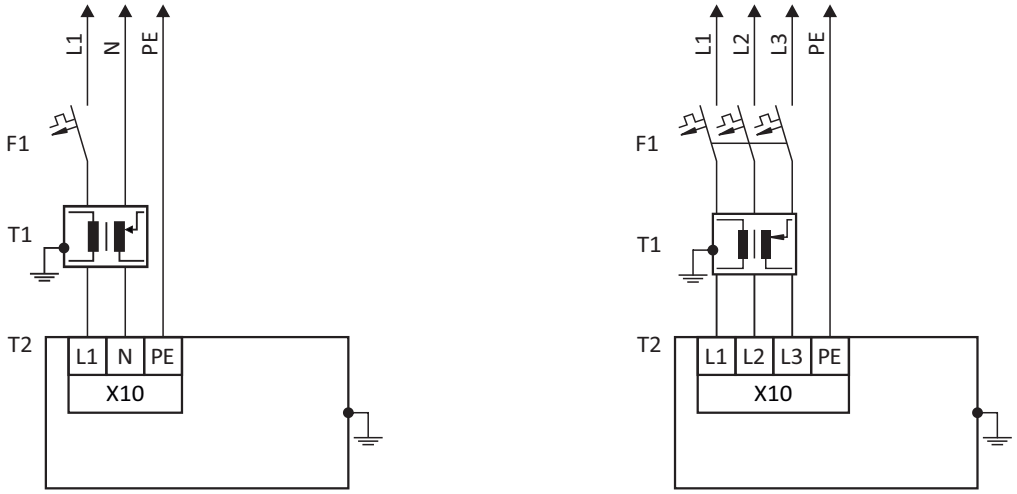
6.1.2 Reforming before commissioning

If annual reforming is not possible, implement reforming on stored devices before commissioning. Note that the voltage levels depend on the storage time.

The following graphic shows the predominant supply connection.



L1 – L3	Lines 1 to 3
N	Neutral conductor
PE	Grounding conductor
F1	Fuse
T1	Variable transformer
T2	Drive controller

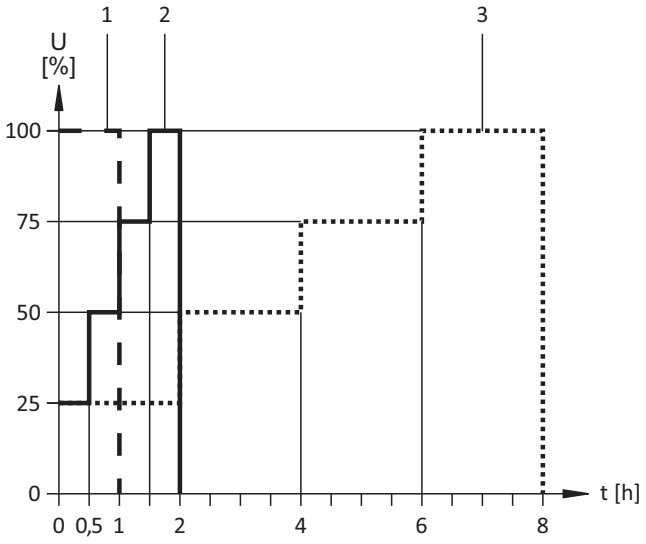


Fig. 6: Voltage levels dependent on storage time

1	Storage time of 1 – 2 years:	Apply voltage for 1 hour before switching on.
2	Storage time of 2 – 3 years:	Implement reforming according to the graph before switching on.
3	Storage time ≥ 3 years:	Implement reforming according to the graph before switching on.
	Storage time < 1 year:	No actions required.

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7 Installation

The following chapters describe the installation of a drive controller and the available accessories.

Information on the replacement of a drive controller can be taken from the chapter Replacement [▶ 147].

7.1 Safety instructions for installation

Installation work is permitted only when no voltage is present. Observe the 5 safety rules; see the chapter Working on the machine [▶ 15].

To protect the devices from overheating, observe the operating conditions described in the technical data and comply with the required minimum clearances for installation.

Protect the devices against falling parts (wire scraps, cores, pieces of metal, etc.) during installation or other work in the control cabinet. Parts with conductive properties may result in a short circuit inside the devices and device failure as a result.

7.2 Basic assembly instructions

Note the points described below for installation.

7.2.1 Drive controllers

Note the following points for installation:

- Prevent condensation, e.g. with anti-condensation heating elements.
- For reasons related to EMC, use installation plates with a conductive surface (unpainted, etc.).
- 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.
- Install the devices vertically.

Reference identification

Attach a sticker to the front on the device with the unique reference identification of the drive controller to prevent mix-ups during installation or replacement.

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7.3 Minimum clearances

Note the minimum clearances for installation below.

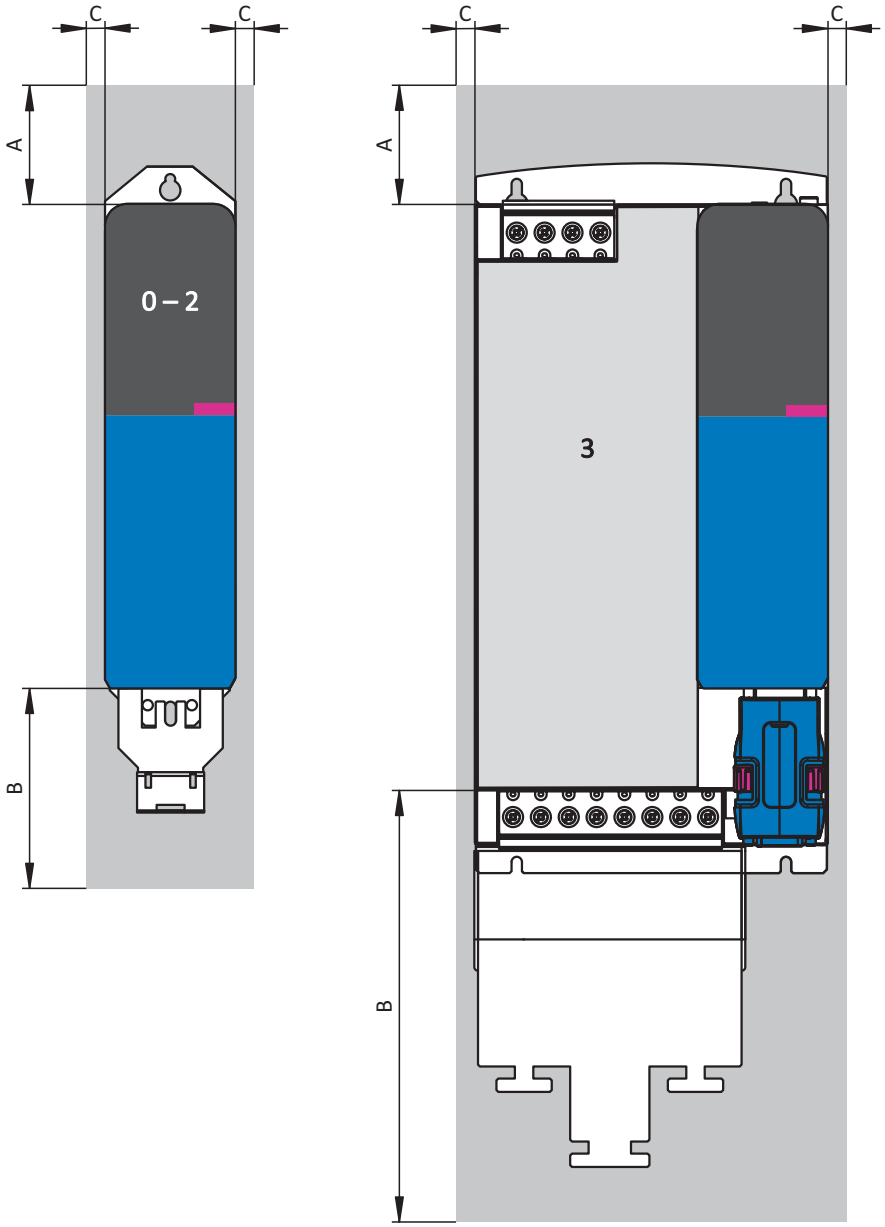

Fig. 7: Minimum clearances

The specified dimensions relate to the outer edges of the drive controller.

Minimum clearance	A (above)	B (below)	C (one the side)[4]
Size 0 – Size 2	100	100	5
... with EMC shroud	100	120	5
Size 3	100	100	5
... with EMC shroud	100	220	5

Tab. 45: Minimum clearances [mm]

[4] Installation without Quick DC-Link module

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Chokes and filters

Avoid installation below drive controllers or supply modules. For installation in a control cabinet, a distance of approximately 100 mm to other neighboring components is recommended. This distance ensures proper heat dissipation for chokes and filters.

Braking resistors

Avoid installation below drive controllers or supply modules. In order for heated air to flow out unimpeded, a minimum clearance of approximately 200 mm must be maintained in relation to neighboring components or walls and approximately 300 mm must be maintained to components above or ceilings.

7.4 Drilling diagrams and bore dimensions

Drilling diagrams and dimensions can be found in the following chapters.

7.4.1 Drive controllers

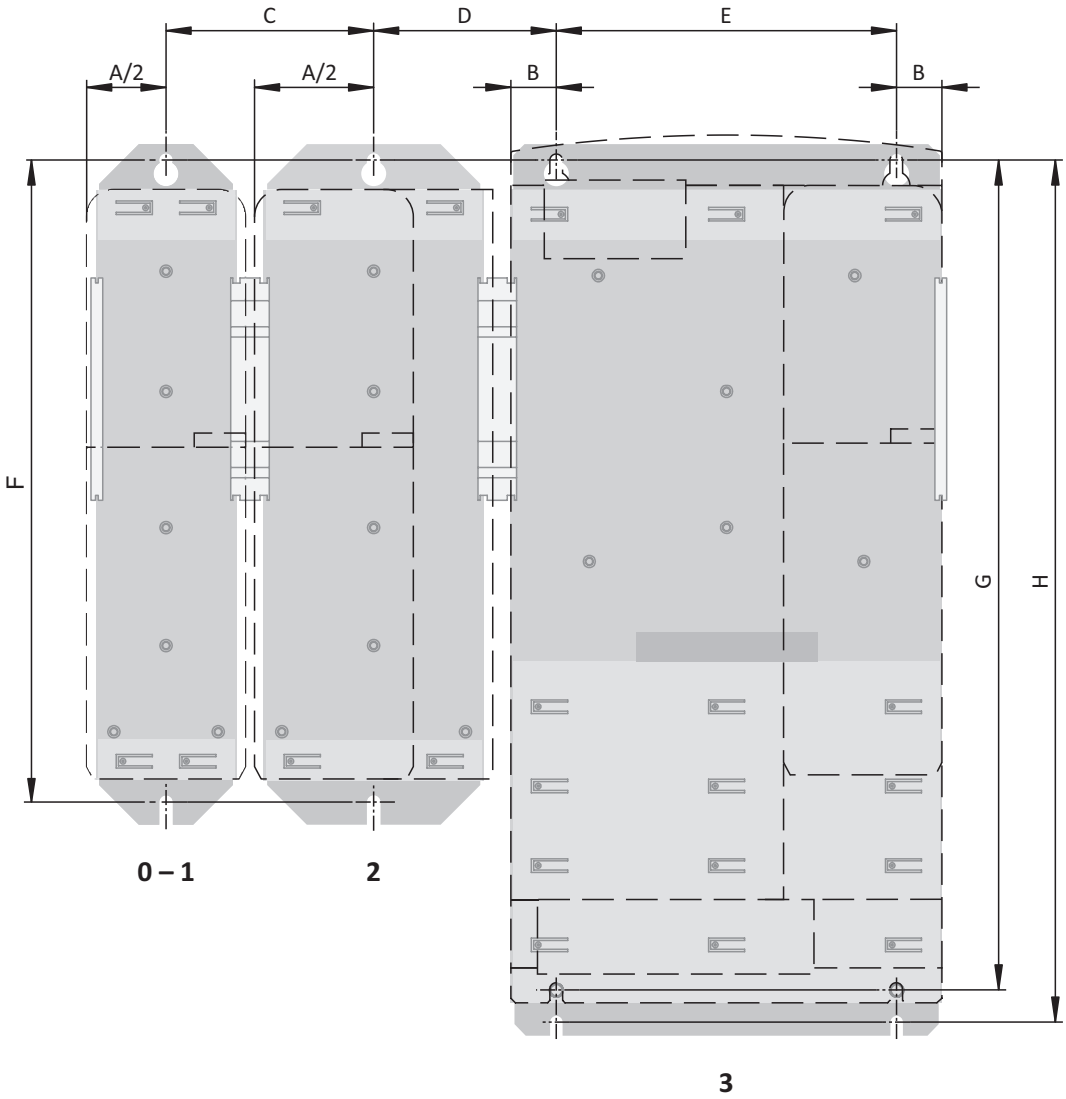

Fig. 8: SD6 and DL6A drilling diagram

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The drilling dimensions depend on the selected design.

The following specifications apply to installation without a rear section module:

SD6 dimension			Size 0, size 1	Size 2	Size 3
Horizontal fastening holes of SD6 ∅ 4.2 (M5)	A		70	105	—
	B		—	—	20
	E		—	—	150+0.2/−0.2
	C	Size 0, size 1	76±1	93.5±1	—
	C	Size 2	93.5±1	111±1	—
	D	Size 0, size 1	—	—	61±1
	D	Size 2	—	—	78.5±1
	D	Size 3	—	—	46±1
Vertical fastening holes of SD6 ∅ 4.2 (M5)	F		283+2	283+2	—
	G		—	—	365+2

Tab. 46: Drilling dimensions for SD6 drive controller [mm]

The following specifications apply to installation with a DL6A Quick DC-Link or rear section braking resistor:

Dimension of DL6A / rear section braking resistor			Size 0, size 1	Size 2	Size 3
Horizontal fastening holes for rear section modules ∅ 4.2 (M5)	A		70	105	—
	B		—	—	20
	E		—	—	150+0.2/−0.2
	C	Size 0, size 1	74+1	91.5+1	—
	C	Size 2	91.5+1	109+1	—
	D	Size 0, size 1	—	—	63+1
	D	Size 2	—	—	80.5+1
	D	Size 3	—	—	52+1
Vertical fastening holes for rear section modules ∅ 4.2 (M5)	F		283+2	283+2	—
	H		—	—	380+2

Tab. 47: Drilling dimensions for DL6A Quick DC-Link or rear section braking resistor [mm]

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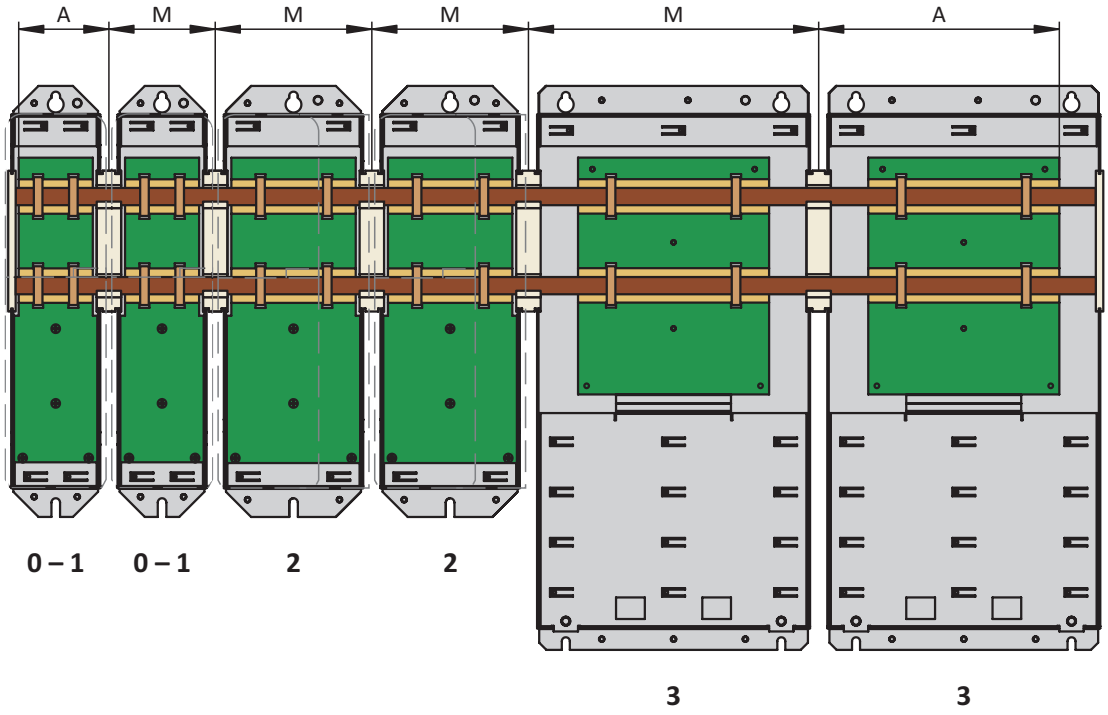
7.5 Length of copper rails

If you would like to connect SD6 drive controllers in the DC link group using a DL6A Quick DC-Link, you need two copper rails with a cross-section of 5 × 12 mm in the correct length.



Note the following specifications for determining the length:

Position	Dimension	Size 0, size 1	Size 2	Size 3
Beginning or end of the group	A	62	97	167
Within the group	M	74	109	202

Tab. 48: Determination of the correct length of the copper rails [mm]

7.6 Installing the communication module

In order to connect EtherCAT, CANopen or PROFINET, you need an EC6, CA6 or PN6 communication module. The communication module is installed in the upper slot. Installation is identical for all communication modules.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

ATTENTION!

Damage to property due to electrostatic discharge!

Take appropriate measures when handling exposed circuit boards, e.g. wearing ESD-safe clothing.

Do not touch contact surfaces.

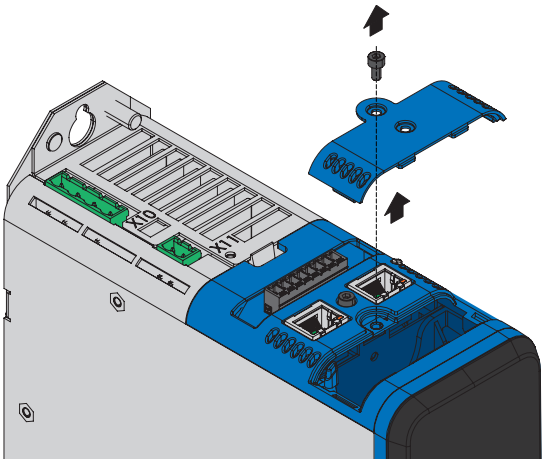
Tools and material

You will need:

- A TORX screwdriver TX10
- The cover and screws included with the communication module

Installation

1. Unscrew the fastening screw of the dummy cover on top of the drive controller and remove the cover.



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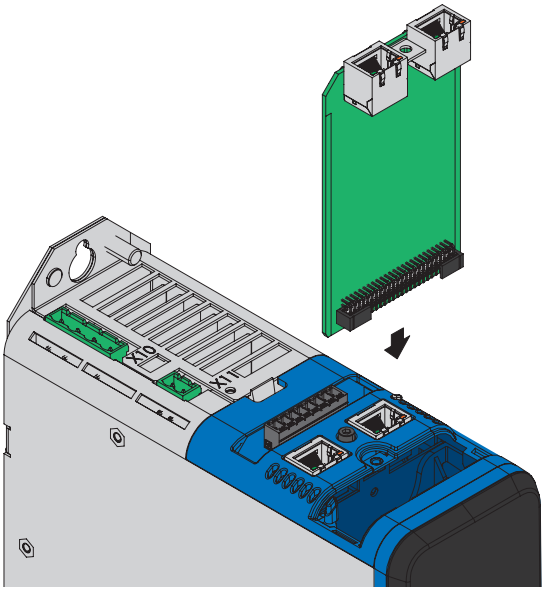
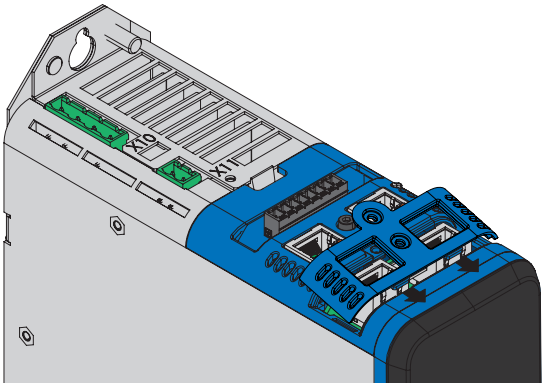
2. Slide the communication module on the guide rails into the drive controller.

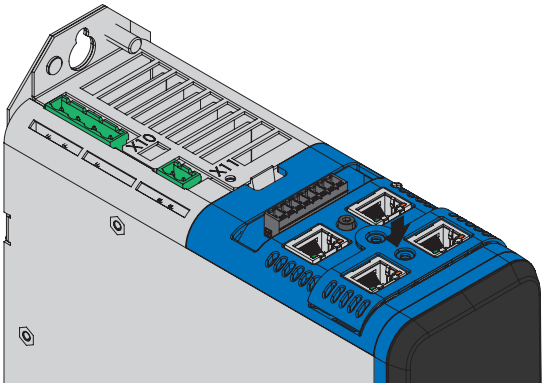


3. Press on the module in order to push the pin contacts into the box header.

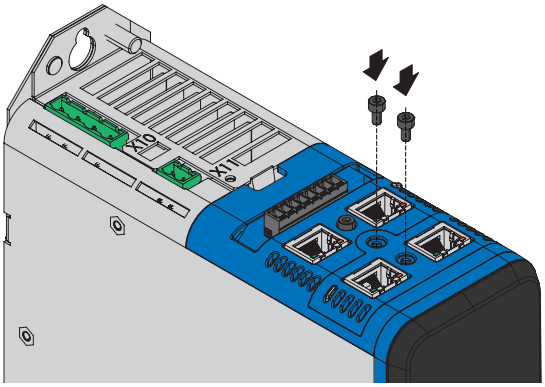
4. Set the tabs of the cover included with the communication module in front into the notch at an angle.



5. Place the cover on the drive controller so that the tabs lie under the edge.



6. Attach the cover using both screws.



7.7 Installing the terminal module

Analog and digital signals can be connected only by means of XI6, RI6 or IO6 terminal modules. Installation is identical for all terminal modules.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

ATTENTION!

Damage to property due to electrostatic discharge!

Take appropriate measures when handling exposed circuit boards, e.g. wearing ESD-safe clothing.

Do not touch contact surfaces.

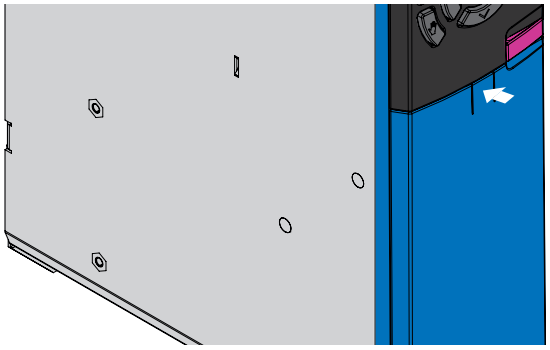
Tools and material

You will need:

- A TX10 Torx screwdriver
- The accessories included with the terminal module

Installation

1. Lightly press the snap closure on the front cover to unlock it.



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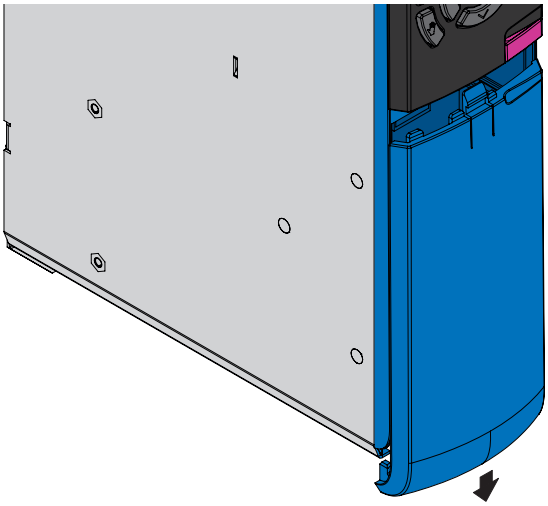
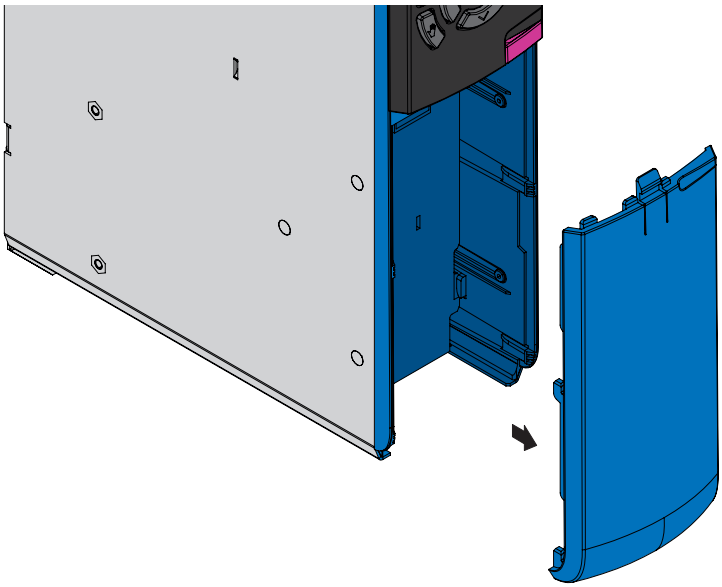
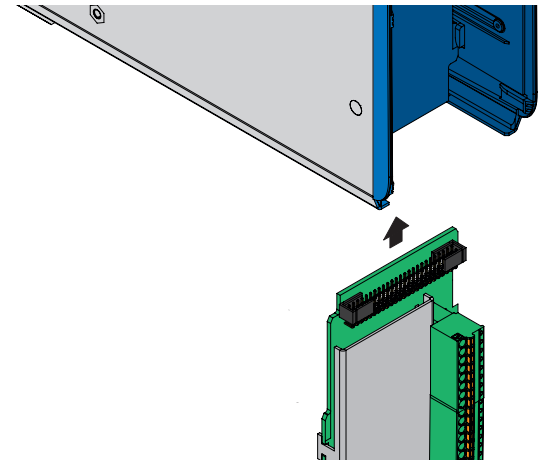
2. Push the front cover down as far as it will go.



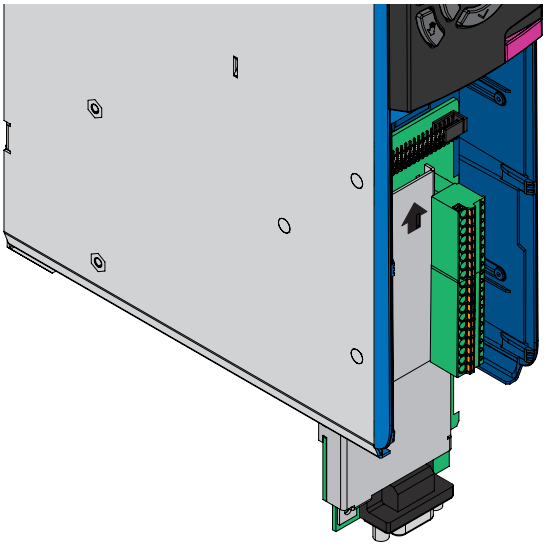
3. Pull the cover forwards to remove it.



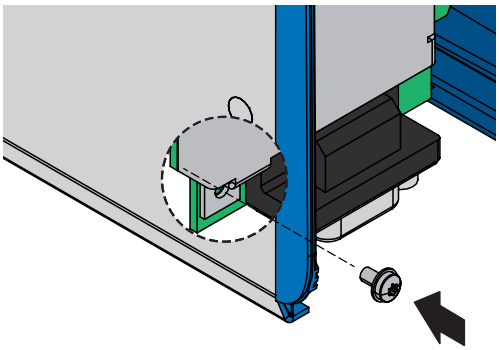
4. Insert the terminal module so that the notches of the module as well as the hold-down devices on the drive controller can be guided past each other. The rear side of the module touches the drive controller.



5. Push the terminal module upwards so that the pin contacts are pushed into the box header.



6. Fasten the terminal module to the drive controller using the fastening screw.



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7.8 Installing the drive controller without a rear section module

This chapter describes the installation of the SD6 drive controller without a rear section module. If you would like to connect SD6 drive controllers in the DC link or insert rear section braking resistors, you must mount the required rear section modules and then build the appropriate drive controllers over them.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Information

Note that drive controllers in storage require reforming each year or before commissioning at the latest.

Tools and material

You will need:

- Fastening screws
- Tool for tightening the fastening screws

Requirements and installation

Perform the following steps for each drive controller within the group and in the specified order.

✓ In accordance with the drilling diagram, taking into consideration the various device dimensions, you have made threaded holes for the threaded bolts on the mounting plate at the mounting position.

✓ The mounting plate has been cleaned (free of oil, grease and swarf).

1. If present, install the communication module; see chapter Installing the communication module [▶ 42].
2. If present, install the terminal module; see the chapter Installing the terminal module [▶ 44].
3. Size 3: Mount the EM6A3 EMC shroud; see the chapter Attaching the EMC shroud [▶ 57].
4. Fasten the top of the drive controller on the mounting plate.
5. Sizes 0 to 2: Mount the EM6A0 EMC shroud; see the chapter Attaching the EMC shroud [▶ 57].
6. Fasten the bottom of the drive controller on the mounting plate.
7. Connect the grounding conductor to the ground bolt. Note the instructions and requirements in the chapter Protective grounding [▶ 66].

⇨ The installation is completed. In the next step, connect the drive controller.

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7.9 Installing the DC link connection

If you would like to connect the SD6 drive controllers in the DC link group, you must first mount the Quick DC-Link modules of type DL6A and then build the appropriate drive controllers over them.

Information

Note that you cannot combine DL6A Quick DC-Link modules and RB 5000 rear section braking resistors within a group.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Tools and material

You will need:

- 2 copper rails with a cross-section of 5 x 12 mm in the correct length; see chapter Length of copper rails [▶ 41]
- The M5 threaded bolts included with the DL6A Quick DC-Link modules and the accompanying screw and washer assemblies (screws with flat and spring washers)
- An 8 mm hexagonal socket wrench
- The insulation connection pieces and quick fastening clips included with the DL6A Quick DC-Link modules
- The insulation end sections for the left and right termination of the group that are available separately

Requirements and installation

Perform the following steps in the specified order.

✓ In accordance with the drilling diagram, taking into consideration the various device dimensions, you have made threaded holes for the threaded bolts on the mounting plate at the mounting position.

✓ The mounting plate has been cleaned (free of oil, grease and swarf).

✓ The copper rails must be straight, smooth, free of burrs and cleaned (free of oil and grease).

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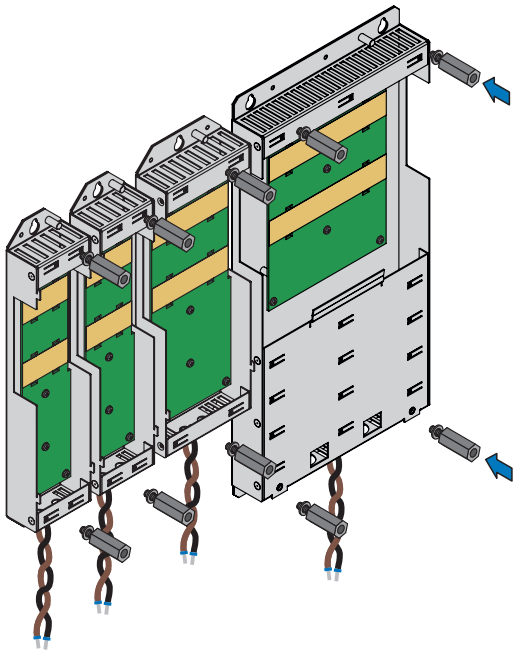
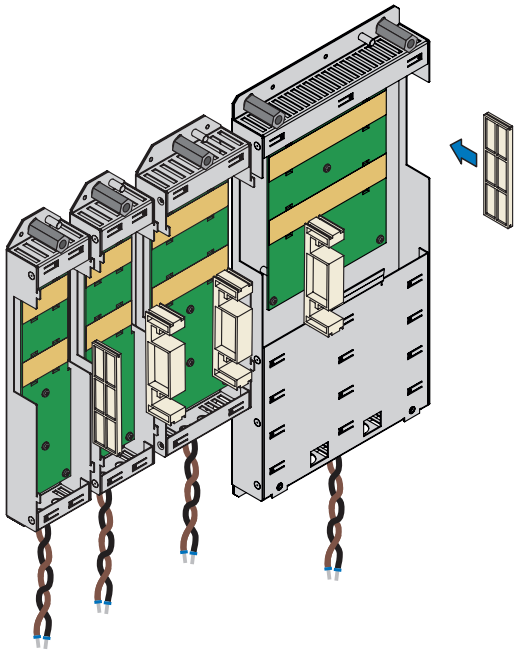
1. Fasten the Quick DC-Link modules to the mounting plate using the threaded bolts.

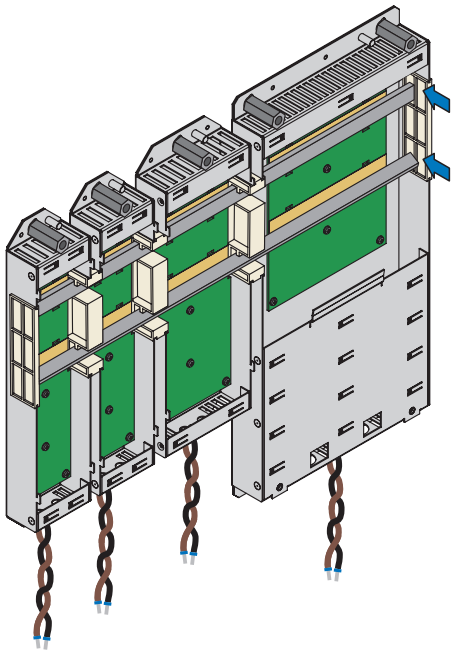


2. Insert the insulation connection pieces between the modules and insulation end section each at the left edge of the first module and at the right edge of the last module.

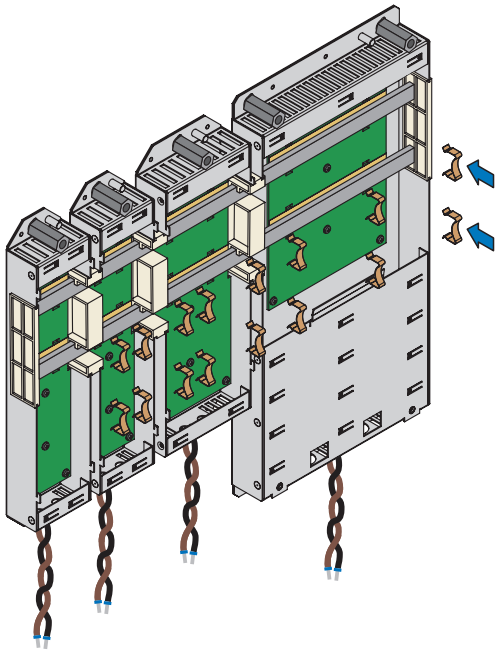


3. Clean the copper rails, especially at the contact points.

4. Insert both copper rails one after the other.



5. Fasten each of the copper rails with two quick fastening clamps per rail and Quick DC-Link module. Make certain the contact points of the copper rails do not become contaminated.



⇨ You have installed the Quick DC-Link. In the next step, build over the Quick DC-Link modules with the appropriate drive controllers.

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7.10 Installing a rear section braking resistor

If you employ the RB 5000 rear section braking resistor provided for drive controllers of sizes 0 to 2, you must mount it first and then build over with the appropriate drive controller.

Information

Note that you cannot combine DL6A Quick DC-Link modules and RB 5000 rear section braking resistors within a group.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Tools and material

You will need:

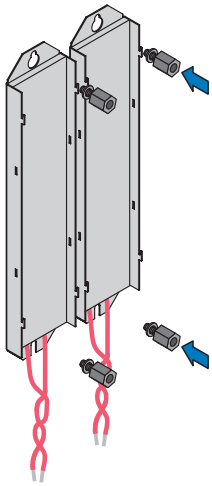
- The M5 threaded bolts included with the rear section braking resistor and the accompanying screw and washer assemblies (screws with flat and spring washers)
- An 8 mm hexagonal socket wrench

Requirements and installation

✓ In accordance with the drilling diagram, taking into consideration the various device dimensions, you have made threaded holes for the threaded bolts on the mounting plate at the mounting position.

✓ The mounting plate has been cleaned (free of oil, grease and swarf).

1. Fasten the rear section braking resistor to the mounting plate using the threaded bolts.



⇨ You have installed the rear section braking resistor. In the next step, build over it with the appropriate drive controller.

7.11 Mounting the drive controller on the rear section module

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Information

Note that drive controllers in storage require reforming each year or before commissioning at the latest.

Tools and material

You will need:

- A PH2 Phillips-head screwdriver

Requirements and installation

Perform the following steps for each drive controller within the group and in the specified order. For size 3 drive controllers, note that terminal X20 cannot be disconnected.

✓ There is a circuit diagram of the system that describes the connection of the drive controllers.

✓ For each drive controller, the appropriate DL6A Quick DC-Link rear section modules or rear section braking resistors have already been installed in the installation position.

1. If present, install the communication module; see chapter Installing the communication module [▶ 42].
2. If present, install the terminal module; see the chapter Installing the terminal module [▶ 44].
3. Size 3: Mount the EM6A3 EMC shroud; see the chapter Attaching the EMC shroud [▶ 57].
4. Sizes 0 to 2: Disconnect the X30 terminal from the drive controller.

Further action varies depending on the type of rear section module.

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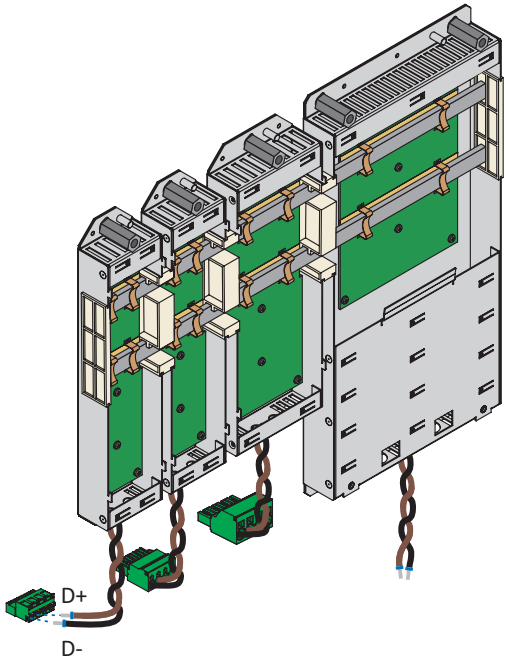
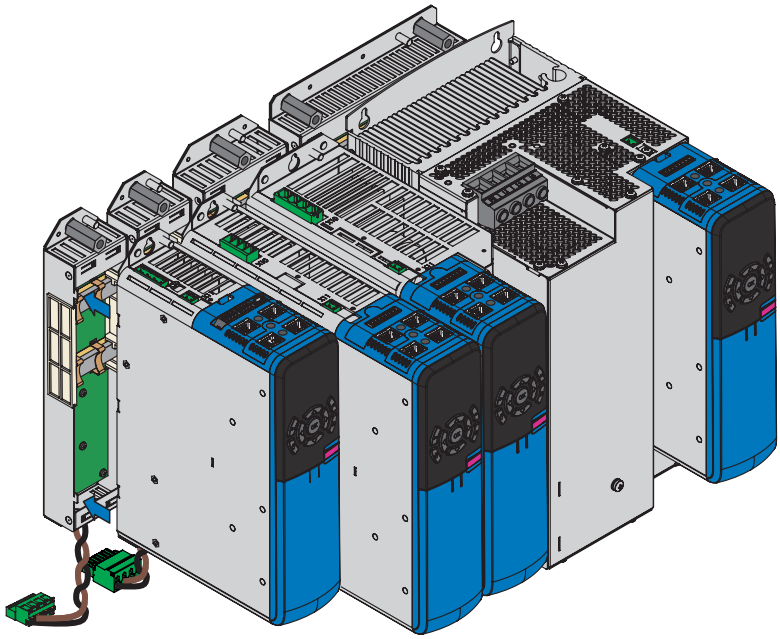
Mounting on a Quick DC-Link module

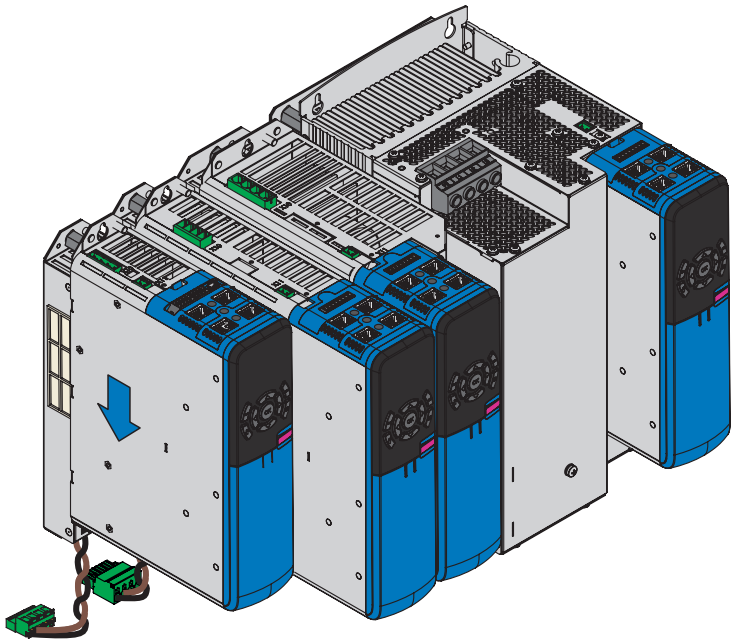
1. Sizes 0 to 2: Connect the brown cable to D+ of terminal X30 and the black cable to D− of terminal X30. Make sure that the conductors of the Quick DC-Link module are twisted pairs.



2. Position the drive controller on the guides of the rear section module.

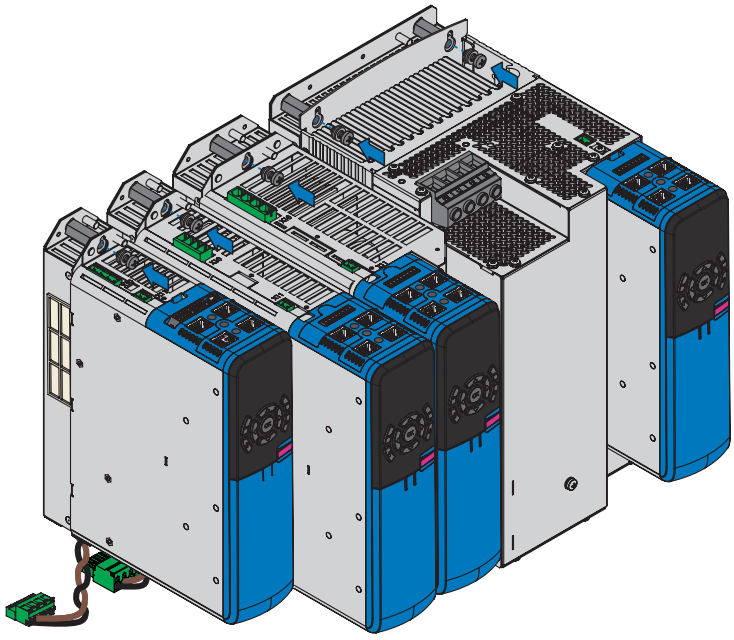


3. Press the drive controller downward onto the guides.



4. Sizes 0 to 2: Mount the EM6A0 EMC shroud; see the chapter Attaching the EMC shroud [▶ 57].

5. Attach the drive controller to the threaded bolts using the screw and washer assemblies.



6. Connect the grounding conductor of the rear section module to the ground bolt of the rear section module and the grounding conductor of the drive controller to the ground bolt of the drive controller. Note the instructions and requirements in chapter Protective grounding [▶ 66].

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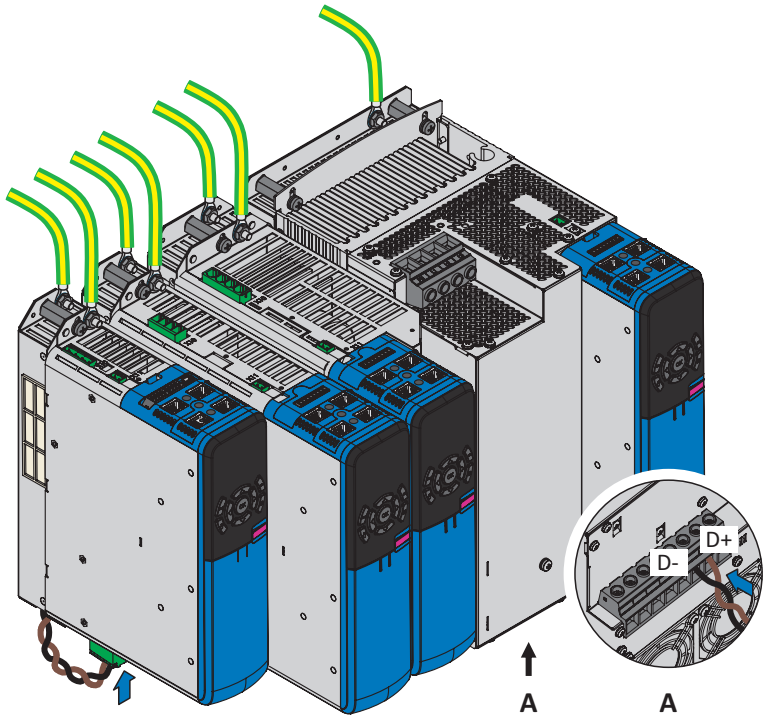
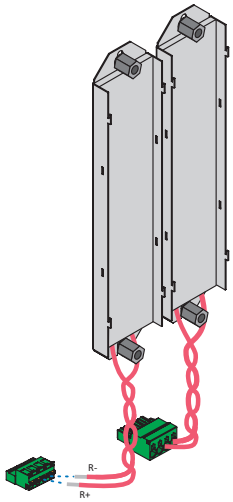
7. Sizes 0 to 2: Attach terminal X30 on the underside of the drive controller.
   Size 3: Connect the brown cable to D+ of terminal X20 and the black cable to D− of terminal X20. Ensure that the connection lines of the Quick DC-Link module are twisted pairs.



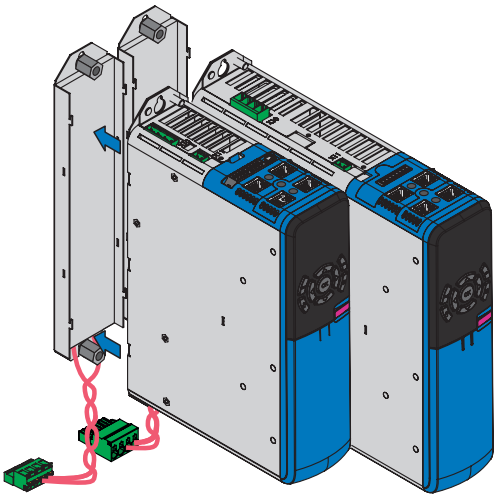
⇨ The installation is completed. In the next step, connect the drive controller.

Mounting on a rear section braking resistor

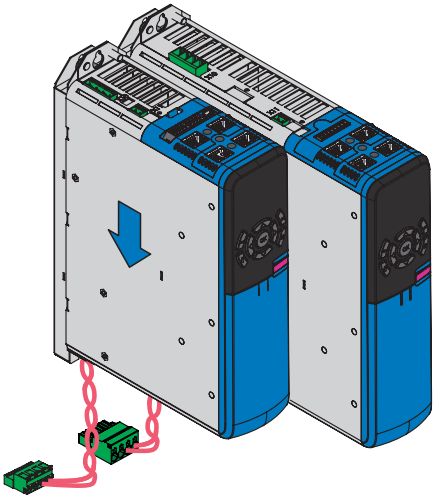
1. Sizes 0 to 2: Connect the two cables to R+ and R− of terminal X30. Ensure that the connection lines of the braking resistor are twisted pairs.



2. Position the drive controller on the guides of the rear section module.

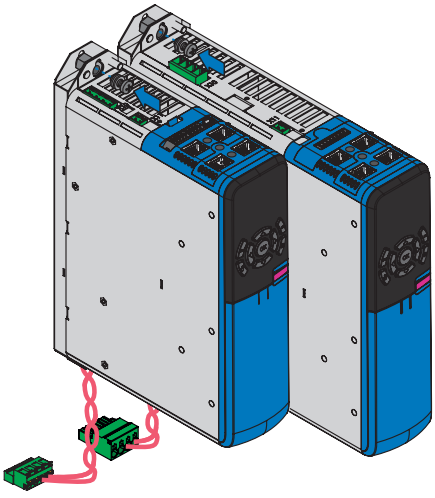


3. Press the drive controller downward onto the guides.



4. Sizes 0 to 2: Mount the EM6A0 EMC shroud; see the chapter Attaching the EMC shroud [▶ 57].

5. Attach the drive controller to the threaded bolts using the screw and washer assemblies.



6. Connect the grounding conductor of the drive controller to the ground bolt of the drive controller. Note the instructions and requirements in chapter Connection of the grounding conductor [▶ 66].

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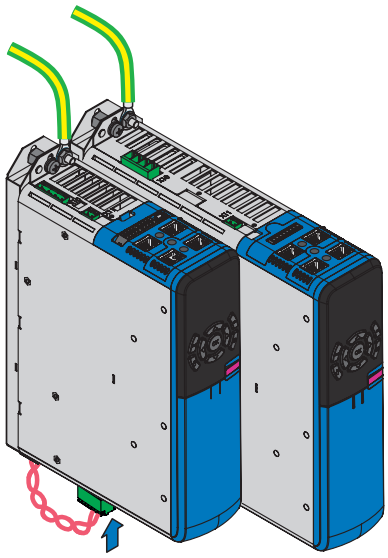
7. Sizes 0 to 2: Attach terminal X30 on the underside of the drive controller.



⇨ The installation is completed. In the next step, connect the drive controller.

7.12 Attaching the EMC shroud

The EMC shroud is used to be able to apply the cable shield of the power cable. You need the EM6A0 shroud for drive controllers of sizes 0 to 2 and the EM6A3 shroud for size 3. Due to the different designs, the attachment of this accessory part to the drive controllers is also different.

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Tools and material

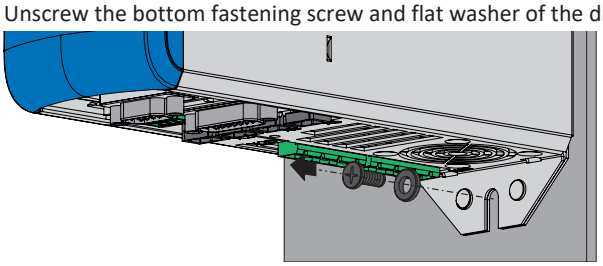
You will need:

- A PH2 Phillips-head screwdriver
- EM6A3: The two screw and washer assemblies included with the shroud (screw with tooth lock washer, M4×8)

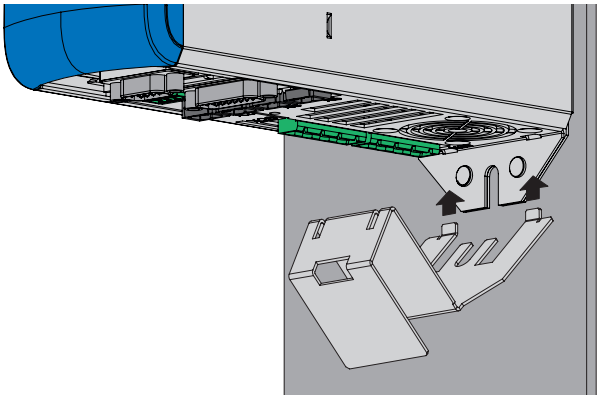
Attaching the EM6A0 to a drive controller up to size 2

✓ The drive controller is already installed in the control cabinet, in combination with a Quick DC-Link or a rear section braking resistor if applicable.

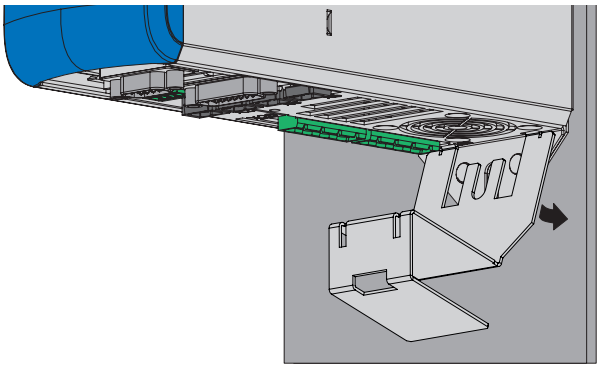
1. Unscrew the bottom fastening screw and flat washer of the drive controller.



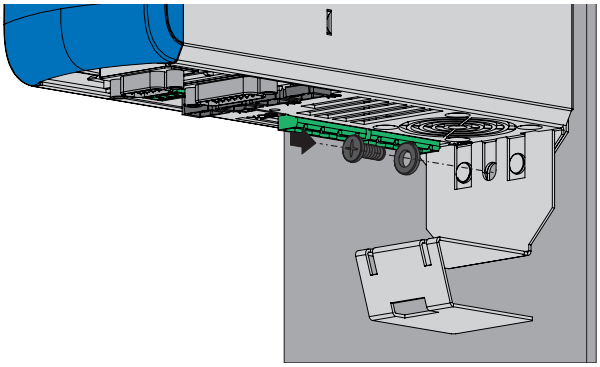
2. Insert the shroud at a slight angle into the openings on the underside of the drive controller.



3. Press the rear side of the shroud either onto the mounting plate directly or onto the threaded bolts of the rear section module.



4. Fasten the shroud using the fastening screw and flat washers to the drive controller and mounting plate or threaded bolt.



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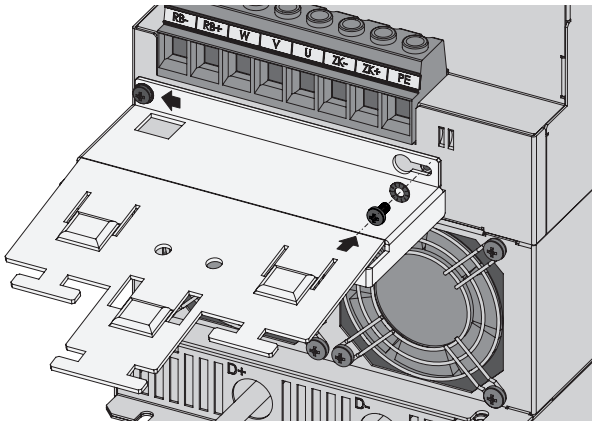
Attaching the EM6A3 to a drive controller of size 3

1. Before installing the drive controller, fasten the shroud to the underside of the drive controller in the threaded holes provided for this purpose using the included screw and washer assemblies (max. tightening torque: 2.4 Nm).



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8 Connection

The following chapter describes the connection of the drive controller and the available accessories.

8.1 Safety instructions for connection

Connection work is permitted only when no voltage is present. Observe the 5 safety rules; see the chapter Working on the machine [▶ 15].

If you couple the drive controller in the DC link, ensure that all Quick DC-Link modules are built over with a drive controller.

The device housing must be closed before you turn on the supply voltage.

When the power supply voltage is turned on, hazardous voltages may be present on the connection terminals and the cables connected to them.

The device is not reliably de-energized simply because the voltage supply is switched off and all displays are blank!

Information

Note that you can only determine that voltage is no longer present once the discharge time has elapsed. The discharge time depends on the self-discharge of the drive controller. You can find the discharge time in the general technical data of the drive controller.

Opening the housing, plugging in or unplugging connection terminals, connecting or removing a connecting wiring, and installing or removing accessories are prohibited while the voltage supply is switched on.

Protect the devices against falling parts (bits or strands of wire, pieces of metal, etc.) during installation or other work in the control cabinet. Parts with conductive properties may result in a short circuit inside the devices and device failure as a result.

Use only copper conductors. For the corresponding conductor cross-sections, consult the standards DIN VDE 0298-4 or EN 60204-1 (Annexes D, G) as well as the relevant terminal specifications in this documentation.

The protection class of the devices is protective grounding (protection class I in accordance with EN 61440). This means that operation is permitted only if the grounding conductor is connected according to requirements.

All protective ground connections are identified by "PE" or the international grounding symbol (IEC 60417, symbol 5019).

The products are not designed for use in a public low-voltage network that supplies residential areas. Radio-frequency interference can be expected if the products are used in this type of network.

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8.2 Line routing

Observe the valid provisions for your machine or system, e.g. IEC 60364 or EN 50110, during the installation of electrical equipment.

8.3 Protective measures

Take the following protective measures into account.

8.3.1 Line fuse

The drive controller is designed exclusively for operation in TN networks or on wye sources. At a nominal voltage of 200 to 480 V_{AC}, they are permitted to supply a maximum differential short-circuit current in accordance with the following table:

Size	Max. differential short-circuit current
Size 0 – size 2	5000 A
Size 3	10000 A

Tab. 49: Maximum differential short-circuit current

The line fuse ensures the line and overload protection in the drive controller. To that end, observe the requirements described below, which vary based on the configuration.

8.3.1.1 Line fuses in stand-alone operation

You can use the following protective devices when operating a single drive controller:

- Full-range safety fuses for cable and line protection with operating class gG in accordance with IEC 60269-2-1 or time delay triggering characteristics in accordance with DIN VDE 0636
- Miniature circuit breakers with triggering characteristic C in accordance with EN 60898
- Circuit breakers

Information

For size 3 device types, only operation with power chokes and line fuses is permitted for operating class gG.

Information on the recommended maximum line fuse can be found in the following table:

Size	Type	$I_{1N,PU}$ (4 kHz) [A]	Recommended max. line fuse [A]
0	SD6A02	8.3	10
	SD6A04	2.8	10
	SD6A06	5.4	10
1	SD6A14	12	16
	SD6A16	19.2	20
2	SD6A24	26.4	35
	SD6A26	38.4	50
3	SD6A34	45.3	50
	SD6A36	76	80
	SD6A38	76	80

Tab. 50: Line fuses in stand-alone operation

Information

To ensure problem-free operation, always comply with the recommended trigger limits and trigger characteristics of the fuse elements.

8.3.1.2 Line fuse in parallel connection

Every drive controller connected to the grid in the DC link group must be protected at the line input against overload and short circuit. To do this, a fuse combination consisting of overload protection and semiconductor short-circuit protection is connected in series. A miniature circuit breaker protects against overload and a safety fuse with gR triggering characteristics protects against short circuit.

You can use the following fuse combinations:

Size	Type	$I_{1N,PU}$ (4 kHz) [A]	I_{1maxPU} (4 kHz) [A]	Fuse selection	
				Miniature circuit breakers	Safety fuse
0	SD6A02	8.3	14.9	EATON Type: FAZ-B10/1, Manufacturer No. 278531 Triggering characteristics: B 10 A	SIBA Type: URZ, Item No. 50 140 06.20 Triggering characteristics: gR 20 A
	SD6A04	2.8	5	EATON Type: FAZ-B6/3, Manufacturer No. 278841 Triggering characteristics: B 6 A	SIBA Type: URZ, Item No. 50 140 06.20 Triggering characteristics: gR 20 A
	SD6A06	5.4	9.7		
1	SD6A14	12	21.6	EATON Type: FAZ-Z20/3, Manufacturer No. 278928 Triggering characteristics: Z 20 A	SIBA Type: URZ, Item No. 50 140 06.32 Triggering characteristics: gR 32 A
	SD6A16	19.2	34.6		
2	SD6A24	26.4	47.5	EATON Type: FAZ-Z40/3, Manufacturer No. 278931 Triggering characteristics: Z 40 A	SIBA Type: URZ, Item No. 50 140 06.80 Triggering characteristics: gR 80 A
	SD6A26	38.4	69.1		
3	SD6A34	45.3	81.5	EATON Type: FAZ-B63/3, Manufacturer No. 278853 Triggering characteristics: B 63 A[5] Siemens Type: SIRUS, Item No. 3RV 1041-4KA10 Triggering characteristics: 57 A–75 A[6]	SIBA Type: URZ, Item No. 50 140 06.100 Triggering characteristics: gR 100 A
	SD6A36	76	136.8		
	SD6A38	76	136.8		

Tab. 51: Line fuse in parallel connection

[5] The input current is reduced from 73 A to 63 A and the output power is lowered as a result; however, reliable rectifier protection is still guaranteed.

[6] Miniature circuit breaker size S3, CLASS 10, adjustable current range: 57 A – 75 A, electromagnetic triggering: 975 A. The rectifier diodes are not protected in the range of 2x to 13x the nominal current.

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Information

To ensure problem-free operation, always comply with the recommended trigger limits and trigger characteristics of the fuse elements.

Maximum number of drive controllers

Multiple drive controllers of the same rating can be connected via a common fuse combination. The fuses and the resulting maximum line input current correspond to that of a single drive controller.

In order to prevent gradual damage to the safety fuse, the maximum number of possible drive controllers on one fuse combination is limited as follows:

- Size 0: Maximum of 4 drive controllers
- Size 1: Maximum 2 drive controllers
- Size 2: maximum 5 drive controllers
- Size 3: Maximum of 2 drive controllers

ATTENTION!

Damage due to overload!

In order to ensure an even distribution of charging current on all AC-supplied drive controllers, all circuit breakers must be closed when engaging the power supply.

- In order that the input rectifier is not overloaded in the event of a possible fuse failure in the group, evaluation of the grid monitoring for AC-supplied drive controllers must lead to deactivation of the entire DC link group.

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8.3.1.3 UL-compliant line fuses

For UL-compliance, use the following fuses for the powered drive controller:

- Fuses of class RK1 (e.g. Bussmann KTS-R-xxA/600 V), CF, J, T or G
- For drive controllers of sizes 0 and 1, you can alternatively use fuses of class CC
- For drive controllers of sizes 0 to 2, you can alternatively use type E motor starters, which consist of a circuit breaker and supply terminal

More detailed specifications about the appropriate fuses can be found in the following table:

Size	Type	Class CC [A]	Class RK1, CF, J, T or G [A]	Type E motor starter
0	SD6A02	10	10	EATON PKZM0-10/SP + BK25/3-PKZ0-E
	SD6A04	10	10	EATON PKZM0-10/SP + BK25/3-PKZ0-E
	SD6A06	10	10	EATON PKZM0-10/SP + BK25/3-PKZ0-E
1	SD6A14	15	15	EATON PKZM0-16/SP + BK25/3-PKZ0-E
	SD6A16	20	20	EATON PKZM0-25/SP + BK25/3-PKZ0-E
2	SD6A24	—	35	EATON PKZM0-32/SP + BK25/3-PKZ0-E
	SD6A26	—	50	EATON PKZM4-50 + BK50/3-PKZ4-E
3	SD6A34	—	50	—
	SD6A36	—	80	—
	SD6A38	—	80	—

Tab. 52: UL-compliant line fuses

The pre-configured Type E motor starters can be assembled as an alternative from the individual components in accordance with the following table:

Type E motor starter	Circuit breakers		Supply terminal		Lockable knob	
	Type	Item No.	Type	Item No.	Type	Item No.
PKZM0-10/SP + BK25/3-PKZ0-E	PKZM0-10	72739	BK25/3-PKZ0-E	262518	AK-PKZ0	30851
PKZM0-16/SP + BK25/3-PKZ0-E	PKZM0-16	46938				
PKZM0-25/SP + BK25/3-PKZ0-E	PKZM0-25	46989				
PKZM0-32/SP + BK25/3-PKZ0-E	PKZM0-32	278489				
PKZM4-50 + BK50/3-PKZ4-E	PKZM4-50	222355	BK50/3-PKZ4-E	272165		

Tab. 53: Individual components of Type E motor starters

Information

To ensure problem-free operation, always comply with the recommended trigger limits and trigger characteristics of the fuse elements.

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8.3.2 Residual current protective device

STOBER devices can be protected with a residual current protective device (RCD) to detect residual currents. Residual current protective devices prevent electrical accidents, especially ground fault through the body. They are generally classified by their triggering limit and suitability for detecting different types of residual currents.

Depending on the function, leakage currents may occur when operating drive controllers. Leakage 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 magnitude as well as the profile of the possible leakage or residual current when selecting a suitable RCD.

⚠ DANGER!

Electrical voltage! Risk of fatal injury due to electric shock!

This product can cause a direct current in the protective grounding conductor.

- If a residual current protective device (RCD) or residual current monitoring device (RCM) is used for protection in case of direct or indirect contact, only one RCD or RCM of type B is permitted on the power supply side of this product.

⚠ DANGER!

Electrical voltage! Risk of fatal injury due to electric shock!

The combination of 1-phase installations and protective devices of type A or AC can lead to false triggering of the RCDs. Leakage currents with a DC current component may occur in 3-phase installations.

- Always protect 1-phase drive controllers using type B universal current-sensitive residual current protective devices or type F mixed frequency-sensitive devices.
- Always protect 3-phase installations with type B residual current protective devices, sensitive to all currents.

False triggering – Causes

Depending on stray capacitances and imbalances, leakage currents above 30 mA may occur during operation. Undesirable false triggering occurs under the following conditions:

- When connecting installations to the supply voltage. This false triggering can be rectified by using short-time delayed (super-resistant), selective (delayed switch-off) RCDs or RCDs with increased trigger current (e.g. 300 or 500 mA).
- Due to higher frequency leakage currents for long power cables under normal operating conditions. This false triggering can be rectified using low-capacitance cables or an output choke, for example.
- Due to imbalances in the supply grid. This false triggering can be rectified, e.g. using an isolating transformer.

Information

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

⚠ DANGER!

Electrical voltage! Risk of fatal injury due to electric shock!

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

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

8.3.3 Protective grounding

In order to dimension the grounding, it must be ensured that the upstream fuse is triggered in the event of a short circuit. Observe the requirements described below for the correct connection of the protective grounding.

8.3.3.1 Minimum cross-section of the grounding conductor

Leakage currents > 10 mA can arise in normal operation. To fulfill local safety regulations such as EN 60204-1, connect the grounding bolt with a copper conductor according to the following table:

Cross-section A Power grid line	Minimum cross-section A_{min} Grounding conductor at grounding bolt
A ≤ 2.5 mm²	2.5 mm²
2.5 < A ≤ 16 mm²	A
16 – 35 mm²	≥ 16 mm²
> 35 mm²	A/2

Tab. 54: Minimum cross-section of the grounding conductor

8.3.3.2 Connection of the grounding conductor

You connect the grounding conductor to the drive controller over terminal X10.

Additional requirements for protective equipotential bonding apply in the event of ground leakage currents > 10 mA. At least one of the following conditions must be fulfilled:

- The grounding conductor must have a minimum cross-section of 10 mm² Cu over its overall length
- If the grounding conductor has a cross-section of less than 10 mm², a 2nd grounding conductor must be provided with a cross-section of at least the same size, as at terminal X10, up to the point at which the grounding conductor exhibits the minimum cross-section of 10 mm²

A grounding bolt is mounted to the devices for connecting the 2nd grounding conductor.

You will need an open-ended wrench or external hex key with a width across flats of 10 mm.

Note the tightening torque of 4.0 Nm, 35 Lb.inch.

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Observe the order for assembly:

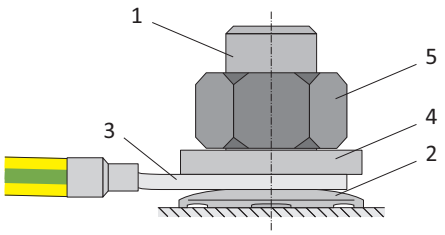

Fig. 9: Connection of the grounding conductor

1 M6 ground bolt
2 Contact disk
3 Cable lug
4 Washer
5 Nut

The contact disk, washer and nut are supplied with the drive controller.

8.3.4 EMC recommendations

Information

This chapter provides general information on EMC-compliant installation. These are recommendations. Depending on the application, the ambient conditions as well as the legal requirements, measures beyond these recommendations may be required.

Lay the power line, power cable and signal lines separately from each other, e.g. in separate cable ducts.

Only use shielded, low-capacitance cables as power cables.

If the brake line is carried in the power cable, it must be shielded separately. Also close the brake lines on the drive controller if you are using a motor without a brake.

Connect the shield of the power cable over a wide area and in the immediate vicinity of the drive controller. To do so, use the EM6 EMC shroud, for example.

The connection lines for braking resistors as well as the conductors of the Quick DC-Link modules must be implemented as twisted pairs. At line lengths of 30 cm or more, the lines also must be implemented with shielding and the shield must be applied over a wide area in the immediate vicinity of the drive controller.

For motors with terminal boxes, connect the shield to the terminal box over large contact areas. For example, use EMC cable screw connections.

Connect the shield of the control lines on one side to the reference potential of the source, e.g. the PLC or CNC.

You may use chokes to improve the EMC and protect the drive system. Power chokes are used to dampen voltage and current peaks and reduce the load of the power feed-in of the drive controllers or supply modules. Output chokes reduce current peaks caused by line capacity at the power output of the drive controller.

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8.4 Drive controllers

The following section contains detailed information about the terminals and the correct connection of the drive controller.

Information

For UL-compliant operation: The connections marked with PE are intended solely for the functional grounding.

8.4.1 Overview with ST6 safety module

The images for the connection overviews described in this chapter show the SD6 drive controller in every size with the following equipment:

- ST6 safety module (STO using terminals)
- XI6 terminal module
- EC6 communication module (EtherCAT)

Alternatively, the following equipment is available:

- RI6 or IO6 terminal modules
- CA6 (CANopen) or PN6 (PROFINET) communication modules

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8.4.1.1 Sizes 0 and 1

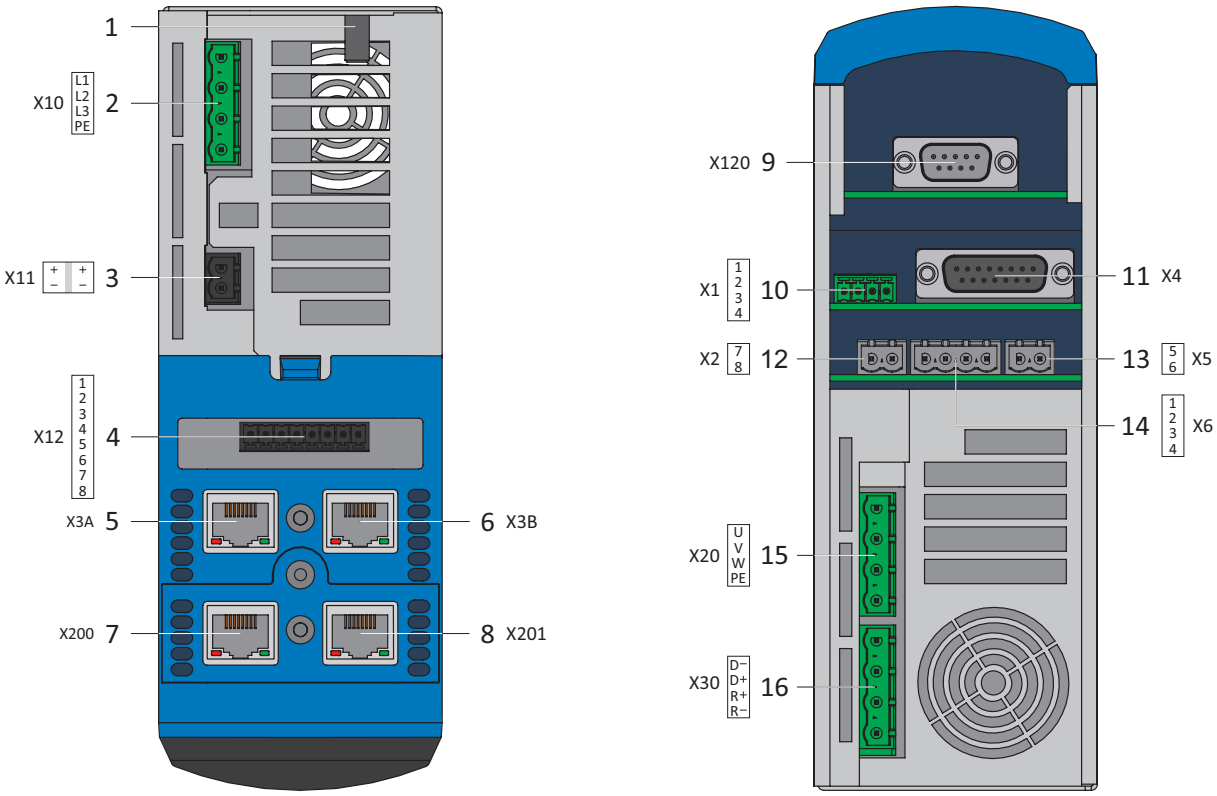

Fig. 10: Connection overview of sizes 0 and 1 with ST6 safety module

1	Ground bolt	9	X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)
2	X10: 230/400 V_{AC} supply	10	X1: Enable and relay 1
3	X11: 24 V_{DC} supply	11	X4: Encoder
4	X12: ST6 safety technology	12	X2: Motor temperature sensor
5	X3A: PC, IGB	13	X5: Brake (actuation)
6	X3B: PC, IGB	14	X6: Brake (feedback and supply)
7	X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)	15	X20: Motor
8	X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)	16	X30: Quick DC-Link, braking resistor

8.4.1.2 Size 2

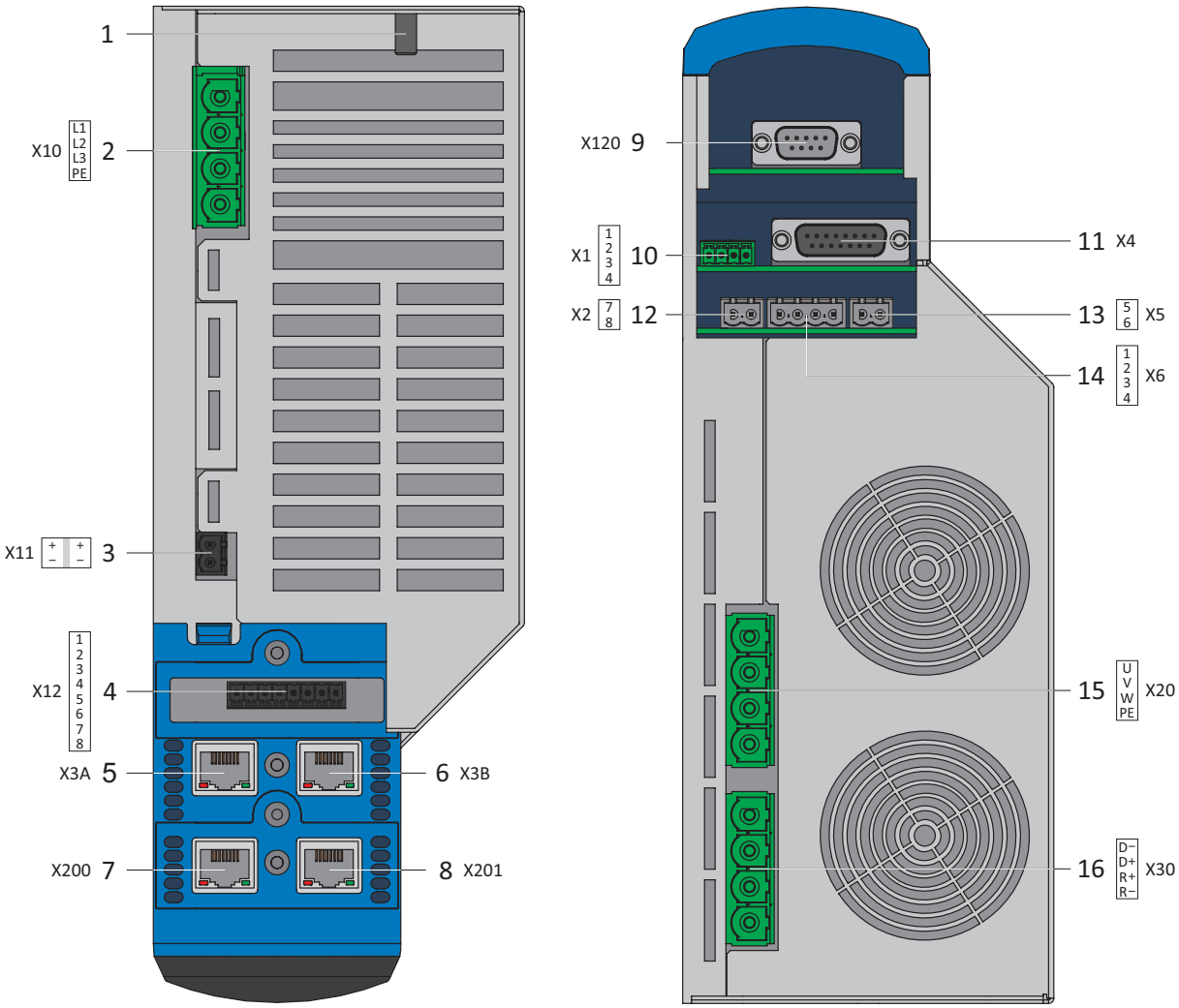

Fig. 11: Connection overview of size 2 with ST6 safety module

1	Ground bolt	9	X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)
2	X10: 400 V_{AC} supply	10	X1: Enable and relay 1
3	X11: 24 V_{DC} supply	11	X4: Encoder
4	X12: ST6 safety technology	12	X2: Motor temperature sensor
5	X3A: PC, IGB	13	X5: Brake (actuation)
6	X3B: PC, IGB	14	X6: Brake (feedback and supply)
7	X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)	15	X20: Motor
8	X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)	16	X30: Quick DC-Link, braking resistor

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8.4.1.3 Size 3

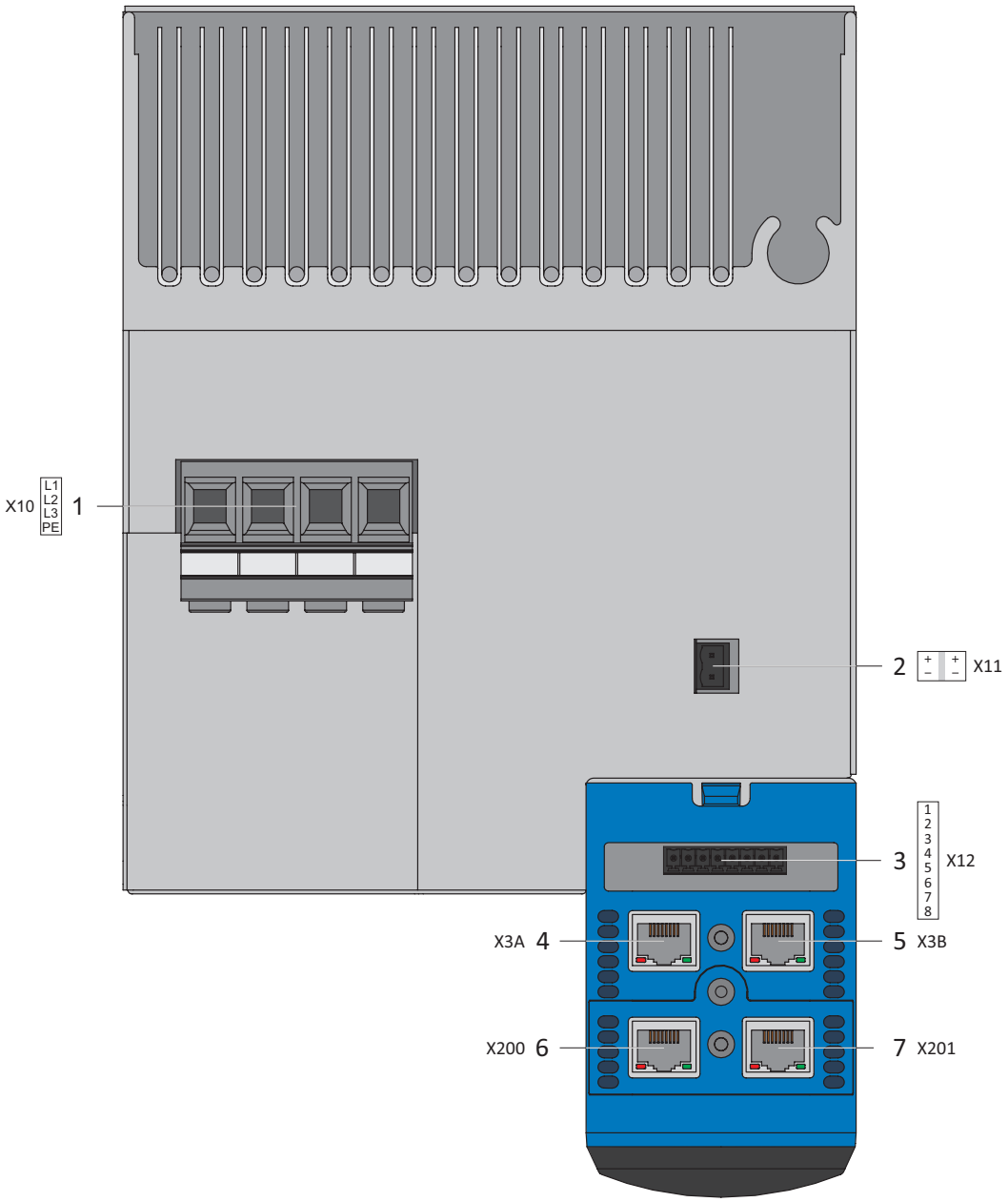

Fig. 12: Connection overview of size 3 with ST6 safety module, top of device

1 X10: 400 V_{AC} supply

2 X11: 24 V_{DC} supply

3 X12: ST6 safety technology

4 X3A: PC, IGB

5 X3B: PC, IGB

6 X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)

7 X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)

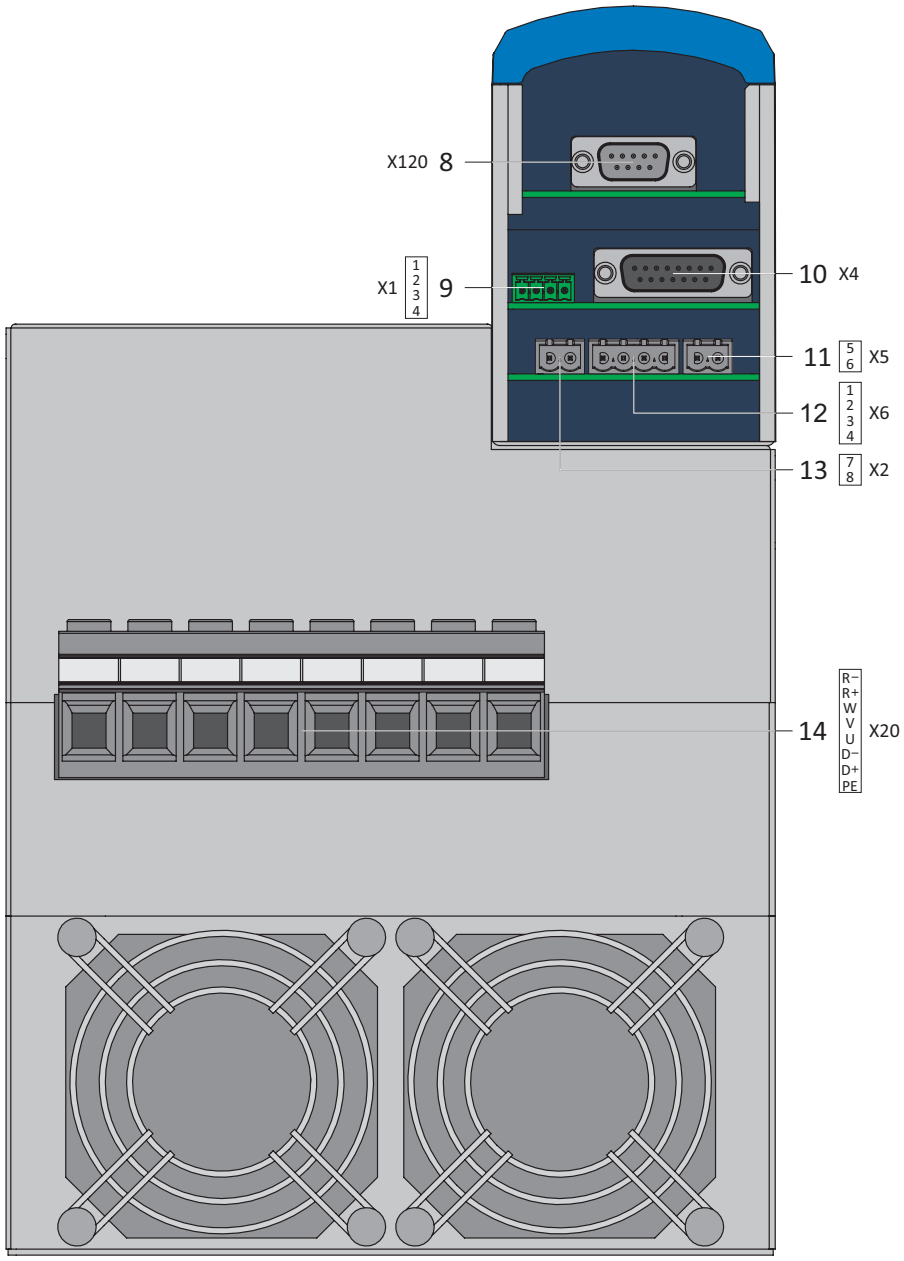

Fig. 13: Connection overview of size 3 with ST6 safety module, bottom of device

8	X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)
9	X1: Enable and relay 1
10	X4: Encoder
11	X5: Brake (actuation)
12	X6: Brake (feedback and supply)
13	X2: Motor temperature sensor
14	X20: Motor, Quick DC-Link, braking resistor

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8.4.2 Overview with SE6 safety module

The images for the connection overviews described in this chapter show the SD6 drive controller in every size with the following equipment:

- SE6 safety module (expanded safety functionality via terminals)
- XI6 terminal module
- EC6 communication module (EtherCAT)

Alternatively, the following equipment is available:

- RI6 or IO6 terminal modules
- CA6 (CANopen) or PN6 (PROFINET) communication modules

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8.4.2.1 Sizes 0 and 1

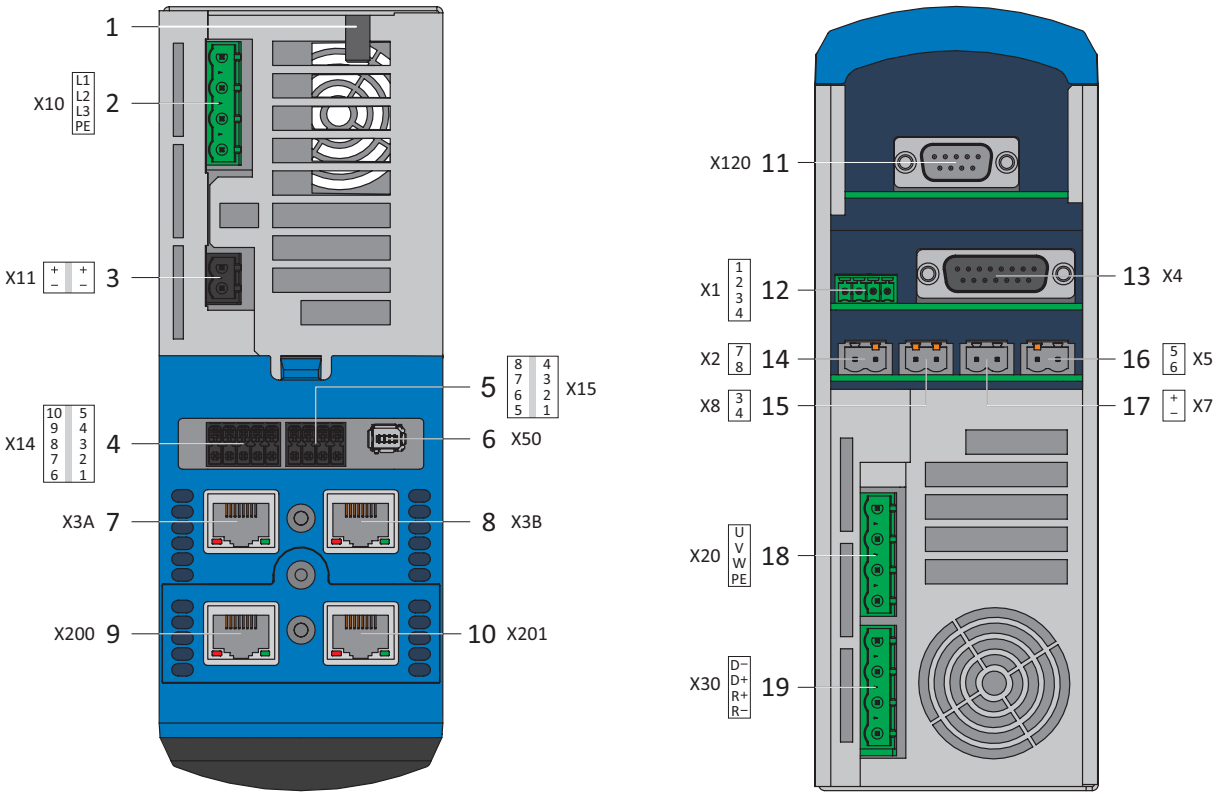

Fig. 14: Connection overview of sizes 0 and 1 with SE6 safety module

1	Ground bolt	11	X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)
2	X10: 230/400 V_{AC} supply	12	X1: Enable and relay 1
3	X11: 24 V_{DC} supply	13	X4: Encoder
4	X14: SE6 safety technology – Safe inputs	14	X2: Motor temperature sensor
5	X15: SE6 safety technology – Safe outputs and supply for X50	15	X8: Brake 2 (SBC+/–)
6	X50: SE6 safety technology – Plausibility encoder	16	X5: Brake 1 (BD1/BD2)
7	X3A: PC, IGB	17	X7: Supply for brake(s)
8	X3B: PC, IGB	18	X20: Motor
9	X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)	19	X30: Quick DC-Link, braking resistor
10	X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)		

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8.4.2.2 Size 2

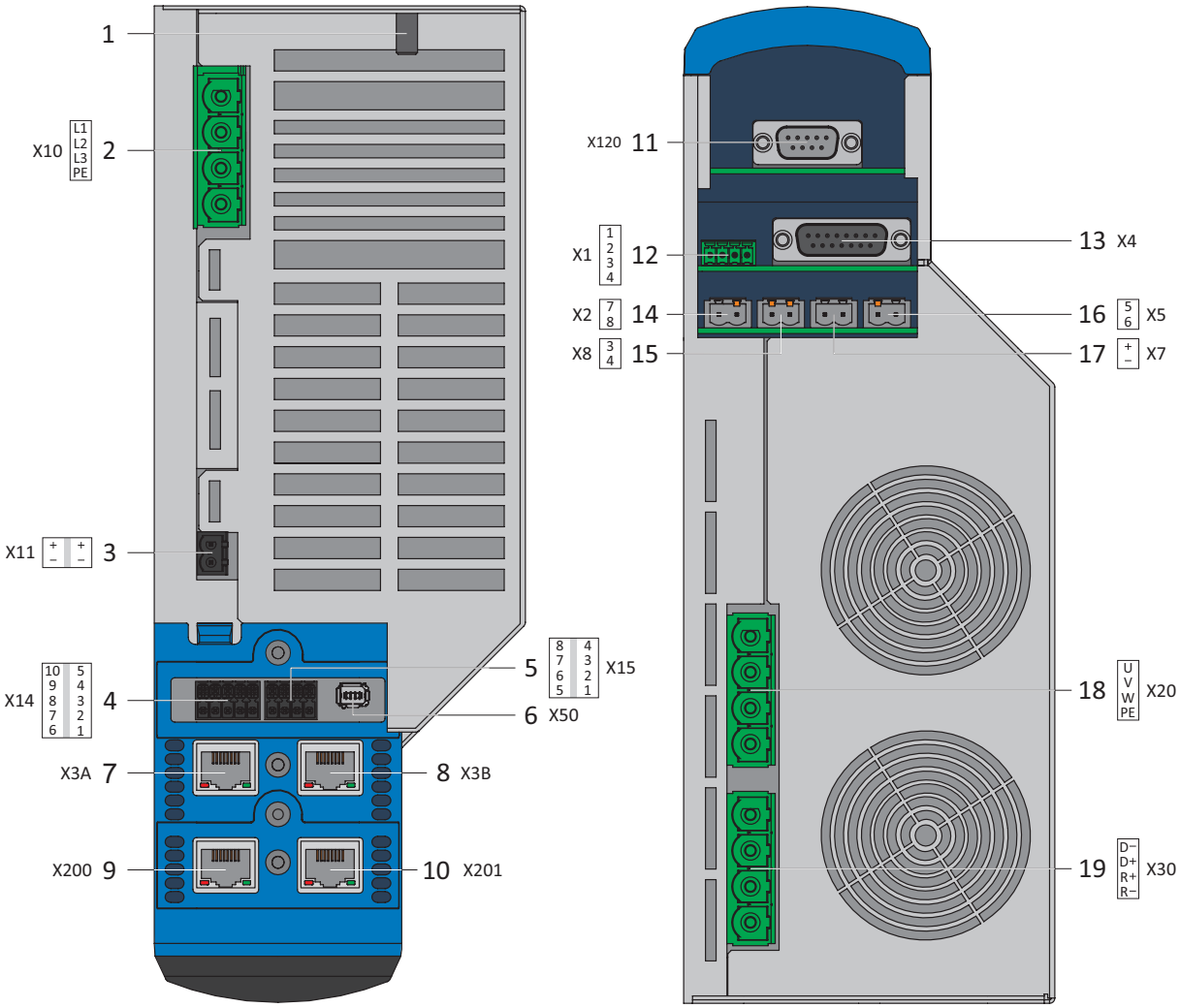

Fig. 15: Connection overview of size 2 with SE6 safety module

1	Ground bolt	11	X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)
2	X10: 230/400 V_{AC} supply	12	X1: Enable and relay 1
3	X11: 24 V_{DC} supply	13	X4: Encoder
4	X14: SE6 safety technology – Safe inputs	14	X2: Motor temperature sensor
5	X15: SE6 safety technology – Safe outputs and supply for X50	15	X8: Brake 2 (SBC+/–)
6	X50: SE6 safety technology – Plausibility encoder	16	X5: Brake 1 (BD1/BD2)
7	X3A: PC, IGB	17	X7: Supply for brake(s)
8	X3B: PC, IGB	18	X20: Motor
9	X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)	19	X30: Quick DC-Link, braking resistor
10	X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)		

8.4.2.3 Size 3

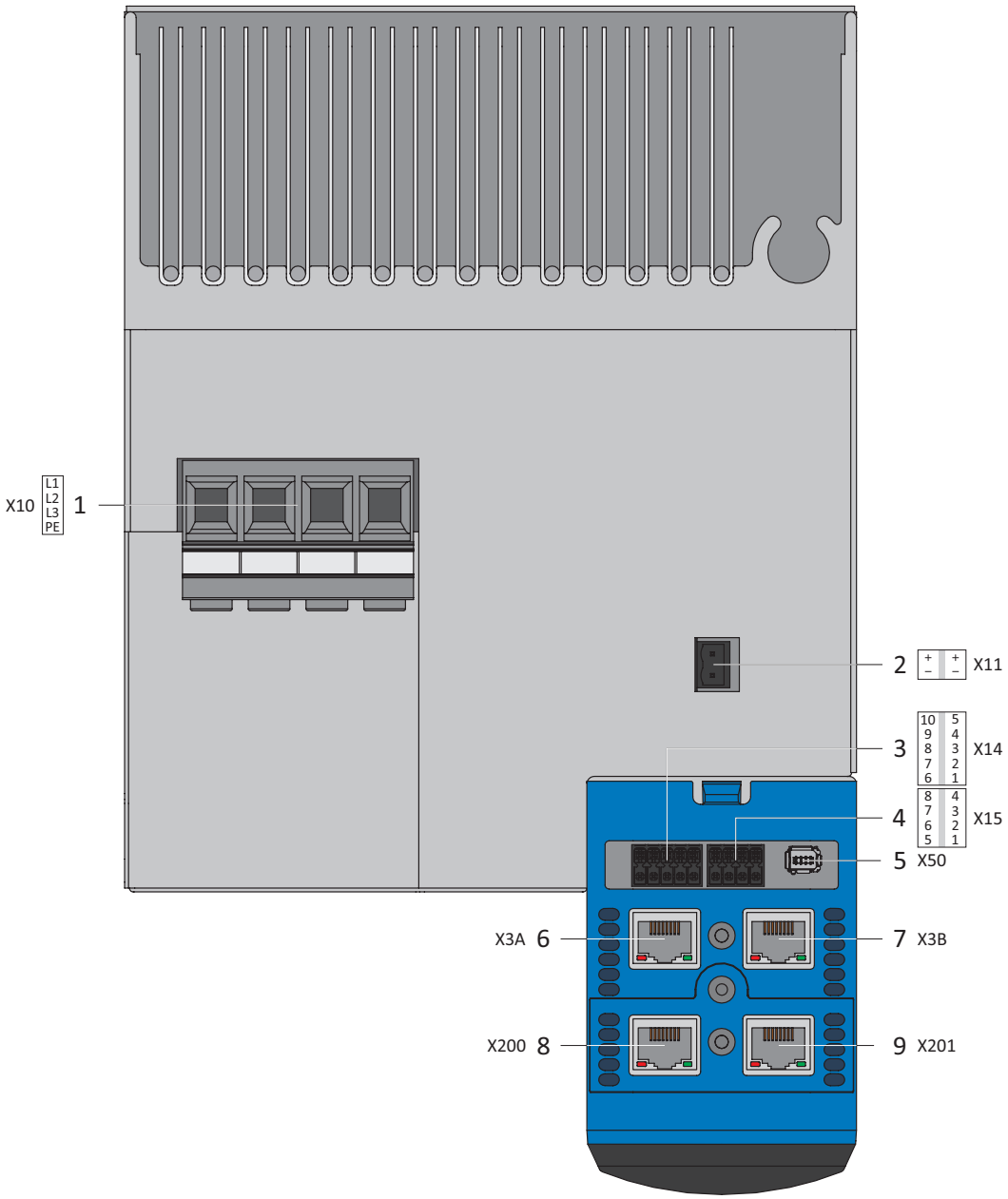

Fig. 16: Connection overview of size 3 with SE6 safety module, top of device

1 X10: 400 V_{AC} supply

2 X11: 24 V_{DC} supply

3 X14: SE6 safety technology – Safe inputs

4 X15: SE6 safety technology – Safe outputs and supply for X50

5 X50: SE6 safety technology – Plausibility encoder

6 X3A: PC, IGB

7 X3B: PC, IGB

8 X200: EtherCAT on the optional EC6 communication module (alternatively CANopen on CA6 communication module or PROFINET on PN6 communication module)

9 X201: EtherCAT on the optional EC6 communication module (alternatively PROFINET on PN6 communication module)

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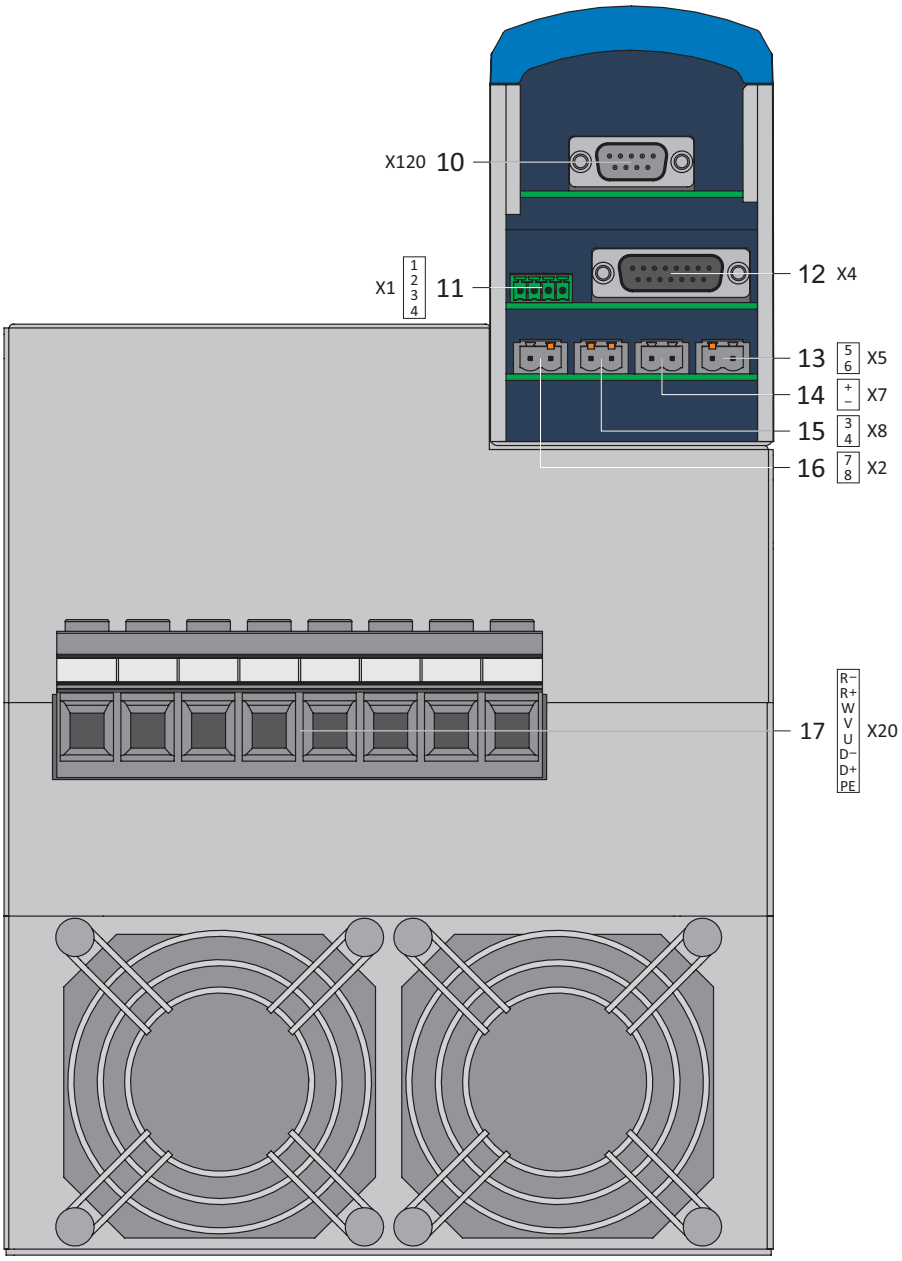


Fig. 17: Connection overview of size 3 with SE6 safety module, bottom of device

10 X120: Encoder connection on optional XI6 terminal module (alternatively X120 and X140: Encoder connections on RI6 terminal module or IO6 terminal module without encoder connection)

11 X1: Enable and relay 1

12 X4: Encoder

13 X5: Brake 1 (BD1/BD2)

14 X7: Supply for brake(s)

15 X8: Brake 2 (SBC+/−)

16 X2: Motor temperature sensor

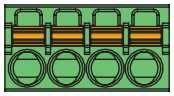
17 X20: Motor, Quick DC-Link, braking resistor

8.4.3 X1: Enable and relay 1

You enable the power unit of the drive controller using the enable signal. The function of relay 1 can be parameterized using parameter F75.

Technical data

Observe the technical data for X1; see the chapter Enable and relay [▶ 27].

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	NO contact	Relay 1; recommended fuse protection: max. 1 AT[7]
	2		
	3	0 V GND	Enable
	4	Input	

Tab. 55: X1 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FMC 1,5 -ST-3,5 [▶ 152].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 56: Cable length [m]

8.4.4 X2: Motor temperature sensor

Terminal X2 is provided for connecting motor temperature sensors. The following can be connected to all SD6 drive controller device types:

- A KTY84-130 in one winding
- A Pt1000 in one winding
- A PTC triplet

Information

Evaluation of the temperature sensor is always active. If operation without a temperature sensor is permitted, the connections must be bridged to X2. Otherwise a fault is triggered when the device is switched on.

Information

STOBER recommends the use of PTC thermistors as thermal winding protection.

Motor temperature sensor wires in the resolver or EnDat cable for SDS 4000

If you replace an SDS 4000 with an SD6, the wires of the motor temperature sensor are maintained in the previously used encoder cable. To be able to continue using the cable, you need the RI6 terminal module, to which you can connect the cable via an AP6 interface adapter. The adapter is available in three different designs.

[7] For fuse protection, use a 1 A fuse (time delay) upstream of relay 1. For UL-compliant use, be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.

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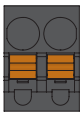
Connection description

	Pin	Designation	Function
 7 | 8	7	1TP1/1K1	PTC/Pt1000/KTY connection
	8	1TP2/1K2	

Tab. 57: X2 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BFL 5.08HC 180 SN [▶ 154].

Cable requirements

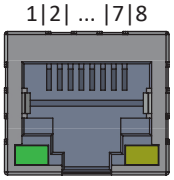
Feature	All sizes
Max. cable length	100 m

Tab. 58: Cable length [m]

8.4.5 X3A, X3B: PC, IGB

You can implement the IGB function (Integrated Bus) using the X3A and X3B interfaces:

- Direct connection to the PC
- IGB motion bus
- Remote maintenance

Socket	Pin	Designation	Function
1|2| ... |7|8 	1	Tx+	Ethernet communication
	2	Tx–	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx–	Ethernet communication
	7	—	—
	8	—	—

Tab. 59: X3A and X3B connection description

Cable requirements

Information

To ensure proper functionality, we recommend using cables from STOBER that are matched to the complete system. If unsuitable connection cables are used, we reserve the right to reject claims under the warranty.

STOBER offers ready-made cables for:

- Direct connection of PC and drive controller
- Setup of Integrated Bus

It is also possible to use cables with the following specification:

Ethernet patch cables or crossover cables meeting the CAT 5e quality level are the ideal cables. The Fast Ethernet technology allows a maximum cable length of 100 m between two nodes.

Information

Ensure that you only use shielded cables with an SF/FTP, S/FTP or SF/UTP design.

8.4.6 X4: Encoder

The encoders described below can be connected to X4.

ATTENTION!

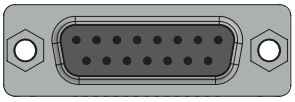
Risk of encoder destruction!

X4 may not be plugged in or unplugged when the device is switched on!

Evaluable encoders

The technical data of the evaluable encoders at X4 can be found in the manual for the SD6 drive controller; see the chapter Detailed information [▶ 161].

EnDat 2.1/2.2 digital encoders and SSI encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	—	—
	2	0 V GND	Reference potential for encoder supply to pin 4
	3	—	—
	4	U_2	Encoder supply
	5	Data +	Differential input for DATA
	6	—	—
	7	—	—
	8	Clock +	Differential input for CLOCK
	9	—	—
	10	0 V Sense	Optional reference potential of the Sense connection for regulating the encoder supply
	11	—	—
	12	U_2 Sense	Sense connection for regulating the encoder supply
	13	Data −	Inverse differential input for DATA
	14	—	—
	15	Clock −	Inverse differential input for CLOCK

Tab. 60: X4 connection description for EnDat 2.1/2.2 digital encoders and SSI encoders

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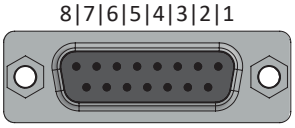
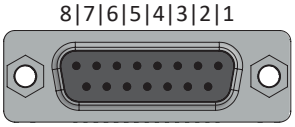
Differential HTL incremental encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	B +	Differential input for B channel
	2	0 V GND	Reference potential for encoder supply to pin 4
	3	N +	Differential input for N channel
	4	U_2	Encoder supply
	5	—	—
	6	A +	Differential input for A channel
	7	—	—
	8	—	—
	9	B –	Inverse differential input for B channel
	10	N –	Inverse differential input for N channel
	11	A –	Inverse differential input for A channel
	12	U_2 Sense	Sense connection for regulating the encoder supply
	13	—	—
	14	—	—
	15	—	—

Tab. 61: X4 connection description for differential HTL incremental encoders

Differential TTL incremental encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	—	—
	2	0 V GND	Reference potential for encoder supply to pin 4
	3	—	—
	4	U_2	Encoder supply
	5	B +	Differential input for B channel
	6	—	—
	7	N +	Differential input for N channel
	8	A +	Differential input for A channel
	9	—	—
	10	—	—
	11	—	—
	12	U_2 Sense	Sense connection for regulating the encoder supply
	13	B –	Inverse differential input for B channel
	14	N –	Inverse differential input for N channel
	15	A –	Inverse differential input for A channel

Tab. 62: X4 connection description for differential TTL incremental encoders

Cable requirements

Feature	All sizes
Max. cable length	100 m, shielded

Tab. 63: Cable length [m]

Information

To ensure proper functionality, we recommend using cables from STOBER that are matched to the complete system. If unsuitable connection cables are used, we reserve the right to reject claims under the warranty.

8.4.7 X5: Brake – Actuation

The brake is connected to X5.

Information

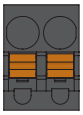
Note that brakes from other manufacturers may be connected only after consultation with STOBER.

Controllable brakes

Note the technical data of the brakes controllable at X5; see the chapter X5 [▶ 34].

Information

In the parameters F93 and F100, you can set whether the brake is connected directly or indirectly and whether brake monitoring is deactivated.

	Pin	Designation	Function
 5 | 6	5	1BD1	Brake actuation
	6	1BD2	Reference potential

Tab. 64: X5 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BFL 5.08HC 180 SN [▶ 154].

Cable requirements

Feature	All sizes
Max. cable length	100 m

Tab. 65: Cable length [m]

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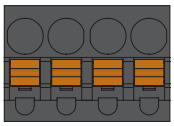
8.4.8 X6: Brake – Feedback and supply (ST6 option)

X6 is used for brake diagnostics and supply. The X6 connection is part of the ST6 safety module.

Electrical data	All types
U_1	24 V_{DC}, +25%
I_{1max}	6 A, UL: 4 A

Tab. 66: Electrical data for the brake supply

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	Feedback	Feedback input of an optional switching amplifier for braking diagnostics; if the brake is connected to SD6 indirectly over a contactor and the switching amplifier is to be monitored, pins 1 and 2 must be connected via an external N/O contact
	2	0 V GND	Reference potential for feedback
	3	+	24 V_{DC} supply for the brake; recommended fuse protection: max. 6 AT[8]
	4	–	Reference potential for supply voltage of the brake

Tab. 67: X6 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BFL 5.08HC 180 SN [▶ 154].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 68: Cable length [m]

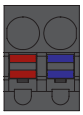
[8] For UL-compliance, use of a 4 A fuse (time delay) is required. Be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.

8.4.9 X7: Brake 2 – Supply (SE6 option)

X7 serves as the brake supply for brake 2. The X7 connection is part of the SE6 safety module.

Electrical data	All types
U_1	24 V_{DC}, +20%
I_{1max}	8 A, UL: 4 A

Tab. 69: Electrical data for the brake supply

	Pin	Designation	Function
 1 | 2	1	+	24 V_{DC} supply for the brakes at X5 and X8; recommended fuse protection: max. 8 AT[9]
	2	–	Reference potential for supply voltage of the brakes

Tab. 70: X7 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BFL 5.08HC 180 SN [▶ 154].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 71: Cable length [m]

[9] For UL-compliance, use of a 4 A fuse (time delay) is required. Note that the fuse meets certification requirements for the relevant DC voltage in accordance with UL 248.

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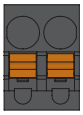
8.4.10 X8: Brake 2 – Safe brake control (SE6 option)

X8 serves as the safe brake control for brake 2. The X8 connection is part of the SE6 safety module.

Controllable brakes

Note the technical data of the brakes controllable at X8; see the chapter X8 (option SE6) [▶ 34].

	Pin	Designation	Function
 3 | 4	3	SBC+	Output for brake control 2 +
	4	SBC–	Output for brake control 2 –

Tab. 72: X8 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BFL 5.08HC 180 SN [▶ 154].

Cable requirements

Feature	All sizes
Max. cable length	100 m; shielded on drive controllers of size 3

Tab. 73: Cable length [m]

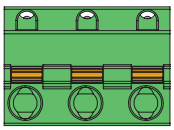
8.4.11 X10: 230/400 V supply

Terminal X10 serves to connect the drive controller to the supply grid.

Conductor cross-sections for the power connection

When selecting the conductor cross-section, note the line fuse, the maximum permitted conductor cross-section of terminal X10, the routing method and the surrounding temperature.

Size 0

Terminal	Pin	Designation	Function
 1 | 2 | 3	1	L1	Power supply
	2	N	Neutral conductor
	3	PE	Grounding conductor

Tab. 74: X10 connection description – Size 0, 1-phase line connection

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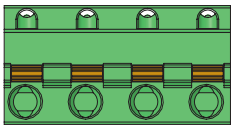
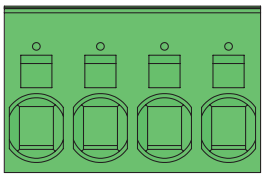
Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	L1	Power supply
	2	L2	
	3	L3	
	4	PE	Grounding conductor

Tab. 75: X10 connection description – Size 0, 3-phase line connection

For connecting wiring, observe the terminal specifications in the chapter GFKC 2,5 -ST-7,62 [▶ 155].

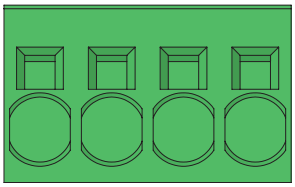
Size 1

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	L1	Power supply
	2	L2	
	3	L3	
	4	PE	Grounding conductor

Tab. 76: X10 connection description – Size 1, 3-phase line connection

For connecting wiring, observe the terminal specifications in the chapter SPC 5 -ST-7,62 [▶ 156].

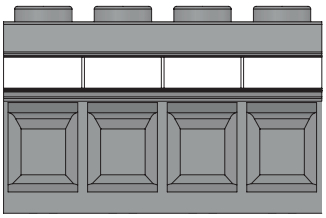
Size 2

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	L1	Power supply
	2	L2	
	3	L3	
	4	PE	Grounding conductor

Tab. 77: X10 connection description – Size 2, 3-phase line connection

For connecting wiring, observe the terminal specifications in the chapter SPC 16 -ST-10,16 [▶ 157].

Size 3

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	L1	Power supply
	2	L2	
	3	L3	
	4	PE	Grounding conductor

Tab. 78: X10 connection description – Size 3, 3-phase line connection

For connecting wiring, observe the terminal specifications in the chapter MKDSP 25 -15,00 [▶ 158].

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8.4.12 X11: 24 V supply

The connection of 24 V_{DC} to X11 is required for the power supply of the control unit.

ATTENTION!

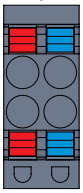
Device damage due to overload!

If the 24 V_{DC} power supply is looped to multiple devices over the terminal, the terminal may be damaged by a current that is too high.

- Make sure that the current over the terminal does not exceed the value 15 A (UL: 10 A).

Electrical data	All types
U_{1CU}	24 V_{DC}, +20%/−15%
I_{1maxCU}	1.5 A

Tab. 79: Control unit electrical data

	Pin	Designation	Function
1 | 3  2 | 4	1	+	24 V_{DC} supply for the control unit; bridged in the terminal; design in accordance with EN 60204: PELV, secondary grounded, recommended fuse protection: max. 15 AT[10]
	2		
	3	−	Reference potential for +24 V_{DC}, bridged in the terminal
	4		

Tab. 80: X11 connection description

Information

The device may not be connected to a DC supply grid. Instead, supply it over a local 24 V_{DC} power supply unit.

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BLDF 5.08 180 SN [▶ 154].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 81: Cable length [m]

[10] For UL-compliance, use of a 10 A fuse (time delay) is required. Be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.

8.4.13 X12: Safety technology (option ST6)

The ST6 safety module adds the STO safety function to the SD6 drive controller via terminal X12.

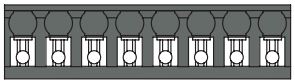
Information

If you would like to use STO safety function over terminals, be sure to read the ST6 manual; see the chapter Detailed information [▶ 161].

If you do not want to use the safety function, connect 24 V_{DC} at STO_a and STO_b, e.g. using a connection with terminal X11.

Technical data

Observe the technical data of the safety options for X12; see the chapter ST6 [▶ 33].

Terminal	Pin	Designation	Function
 1|2|3|4|5|6|7|8	1	STO_a	Input of safety channel 1
	2		
	3	STO_b	Input of safety channel 2
	4		
	5	0 V GND	Reference potential for STO_a and STO_b, internally bridged with terminal 7
	6	STO_{status}	Feedback signal of safety channels 1 and 2 for diagnostic purposes
	7	0 V GND	Reference potential for STO_a and STO_b, internally bridged with terminal 5
	8	$U_{1status}$	STO supply $_{status}$; recommended fuse protection: max. 3.15 AT[11]

Tab. 82: X12 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter BCF 3,81 180 SN [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 83: Cable length [m]

[11] For UL-compliance, use of a 3.15 A fuse (time delay) is required. The fuse must be certified for DC voltage in accordance with UL 248.

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8.4.14 X14: Safety technology – Safe inputs (SE6 option)

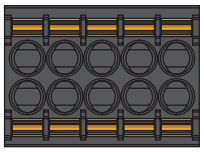
The SE6 safety module adds the expanded safety functions to the SD6 drive controller using terminals X14 and X15.

Information

If you would like to use the expanded safety functionality over terminals, be sure to read the SE6 manual; see the chapter Detailed information [▶ 161].

Technical data

Observe the technical data of the safety options at X14 and X15; see the chapter SE6 [▶ 33].

Terminal	Pin	Designation	Function
6 | 7 | 8 | 9 | 10  1 | 2 | 3 | 4 | 5	1	I0	Safe digital input
	2	I1	Safe digital input
	3	I2	Safe digital input
	4	I3	Safe digital input
	5	0 V GND	Reference potential for digital inputs; internally connected to pin 10
	6	I4	Safe digital input
	7	I5	Safe digital input
	8	I6	Safe digital input
	9	I7	Safe digital input
	10	0 V GND	Reference potential for digital inputs; internally connected to pin 5

Tab. 84: X14 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter DFMC 1.5 -ST-3.5 [▶ 155].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 85: Cable length [m]

8.4.15 X15: Safety technology – Safe outputs, supply for X50 (SE6 option)

The SE6 safety module adds the expanded safety functions to the SD6 drive controller using terminals X14 and X15.

Information

If you would like to use the expanded safety functionality over terminals, be sure to read the SE6 manual; see the chapter Detailed information [▶ 161].

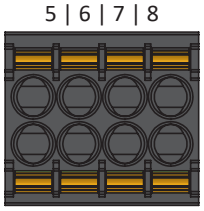
ATTENTION!

Loss of safety!

Overvoltages > 40 V_{DC} in the coupling between the safety module and safety controller can lead to loss of safety. Exposing the digital 1-pole outputs of the safety module to an overvoltage of the safety controller can cause the deactivated outputs to output a 1 signal. For the safety controller, use a power supply unit with overvoltage protection for the output voltage. The output voltage must be limited to a maximum of 40 V_{DC}.

Technical data

Observe the technical data of the safety options at X14 and X15; see the chapter SE6 [▶ 33].

Terminal	Pin	Designation	Function
5 | 6 | 7 | 8  1 | 2 | 3 | 4	1	+24 V	24 V_{DC} supply for digital outputs (PELV); fuse protection: max. 4 AT; the supply voltage is also needed if no safe outputs are used
	2	O0	Safe digital output
	3	O1	Safe digital output
	4	U_2	Power supply voltage for external encoder
	5	O2	Safe digital output
	6	O3	Safe digital output
	7	O4	Safe digital output
	8	0 V GND	Reference potential for external encoder

Tab. 86: X15 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter DFMC 1.5 -ST-3.5 [▶ 155].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 87: Cable length [m]

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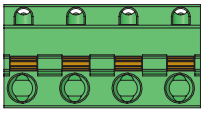
8.4.16 X20: Motor

The motor is connected to X20. For size 3 device types, there is also the connection for the DC link connection and for a braking resistor at terminal X20.

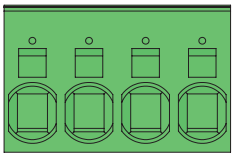
Size 0

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	U	Motor phase U connection
	2	V	Motor phase V connection
	3	W	Motor phase W connection
	4	PE	Grounding conductor

Tab. 88: X20 connection description – Size 0

For connecting wiring, observe the terminal specifications in the chapter GFKC 2,5 -ST-7,62 [▶ 155].

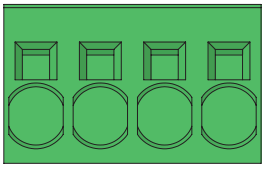
Size 1

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	U	Motor phase U connection
	2	V	Motor phase V connection
	3	W	Motor phase W connection
	4	PE	Grounding conductor

Tab. 89: X20 connection description – Size 1

For connecting wiring, observe the terminal specifications in the chapter SPC 5 -ST-7,62 [▶ 156].

Size 2

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	U	Motor phase U connection
	2	V	Motor phase V connection
	3	W	Motor phase W connection
	4	PE	Grounding conductor

Tab. 90: X20 connection description – Size 2

For connecting wiring, observe the terminal specifications in the chapter SPC 16 -ST-10,16 [▶ 157].

Size 3

Terminal	Pin	Designation	Function
1 | 2 | 3 | 4 | 5 | 6 | 7 | 8	1	R–	Braking resistor
	2	R+	
	3	W	Motor phase W connection
	4	V	Motor phase V connection
	5	U	Motor phase U connection
	6	D–	DC link connection
	7	D+	
	8	PE	Grounding conductor

Tab. 91: X20 connection description – Size 3

For connecting wiring, observe the terminal specifications in the chapter MKDSP 25 -15,00 [▶ 158].

Cable requirements

Motor type	Connection	Size 0 to 2	Size 3
Synchronous servo motor, asynchronous motor	Without output choke	50 m, shielded	100 m, shielded
Synchronous servo motor, asynchronous motor	With output choke	100 m, shielded	—

Tab. 92: Maximum cable length of the power cable [m]

Information

To ensure proper functionality, we recommend using cables from STOBER that are matched to the complete system. If unsuitable connection cables are used, we reserve the right to reject claims under the warranty.

Shielded connection of the power cable

Note the following points for the connection of the power cable:

- Ground the shield of the power cable on the shield contact on the drive controller intended for this.
- Keep the exposed conductors 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.

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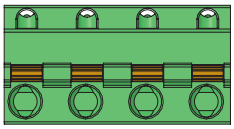
8.4.17 X30: DC link connection, braking resistor

Terminal X30 is available in sizes 0 to 2 for the DC link connection of the drive controller and for the connection of a braking resistor.

For setting up the Quick DC-Link, note the information on project configuration in the manual for the SD6 drive controller; see the chapter Detailed information [▶ 161].

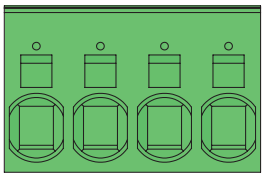
Size 0

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	D–	DC link connection
	2	D+	
	3	R+	Braking resistor connection
	4	R–	

Tab. 93: X30 connection description – Size 0

For connecting wiring, observe the terminal specifications in the chapter GFKIC 2.5 -ST-7.62 [▶ 156].

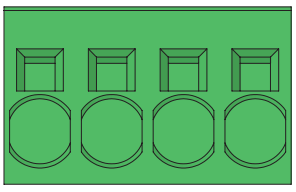
Size 1

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	D–	DC link connection
	2	D+	
	3	R+	Braking resistor connection
	4	R–	

Tab. 94: X30 connection description – Size 1

For connecting wiring, observe the terminal specifications in the chapter SPC 5 -ST-7,62 [▶ 156].

Size 2

Terminal	Pin	Designation	Function
 1 | 2 | 3 | 4	1	D–	DC link connection
	2	D+	
	3	R+	Braking resistor connection
	4	R–	

Tab. 95: X30 connection description – Size 2

For connecting wiring, observe the terminal specifications in the chapter ISPC 16 -ST-10,16 [▶ 158].

Size 3

For size 3 device types, the connections for the braking resistor and Quick DC-Link are part of terminal X20.

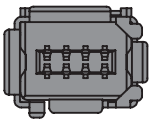
8.4.18 X50: Plausibility encoder (SE6 option)

At X50, differential TTL incremental encoders or SSI encoders can be connected. X50 is part of the SE6 safety module. X50 serves as the encoder plausibility check when using asynchronous motors or when using the SLP safety function.

Evaluable encoders

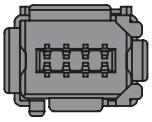
The technical data of the evaluable encoders at X50 can be found in the manual for the SD6 drive controller; see the chapter Detailed information [▶ 161].

SSI encoders

Socket	Pin	Designation	Function
1 | 3 | 5 | 7  2 | 4 | 6 | 8	1	U_2	Encoder supply (see terminal X15, pin 4)
	2	0 V GND	Reference potential for encoder supply to pin 1 (see terminal X15, pin 8)
	3	—	—
	4	Clock +	Differential input for CLOCK
	5	Clock –	Inverse differential input for CLOCK
	6	—	—
	7	Data +	Differential input for DATA
	8	Data –	Inverse differential input for DATA

Tab. 96: X50 connection description for SSI encoders

Differential TTL incremental encoders

Socket	Pin	Designation	Function
1 | 3 | 5 | 7  2 | 4 | 6 | 8	1	U_2	Encoder supply (see terminal X15, pin 4)
	2	0 V GND	Reference potential for encoder supply to pin 1 (see terminal X15, pin 8)
	3	—	—
	4	A +	Differential input for A channel
	5	A –	Inverse differential input for A channel
	6	—	—
	7	B +	Differential input for B channel
	8	B –	Inverse differential input for B channel

Tab. 97: X50 connection description for differential TTL incremental encoders

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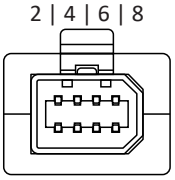
8.4.18.1 X50 adapter cable (SE6 option)

The adapter cable with open cable ends for connection to X50 is used to connect the plausibility encoder.

Differential TTL incremental encoders

Connector	Pin	Designation	Color
2 | 4 | 6 | 8  1 | 3 | 5 | 7	1	U_2	WH
	2	0 V GND	BN
	3	N +	GN
	4	A +	GY
	5	A –	PK
	6	N –	YE
	7	B +	BU
	8	B –	RD

Tab. 98: X50 connector description for differential TTL incremental encoders

8.4.19 Connecting a drive controller (ST6 option)

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Tools and material

You will need:

- Tool for assembling the accessory part and tightening the fastening screws.

Requirements and connection

Bottom of the device:

✓ You have a system circuit diagram describing the connection of the drive controller.

1. Disconnect all terminals on the underside of the drive controller. For size 3 drive controllers, note that terminal X20 cannot be disconnected.

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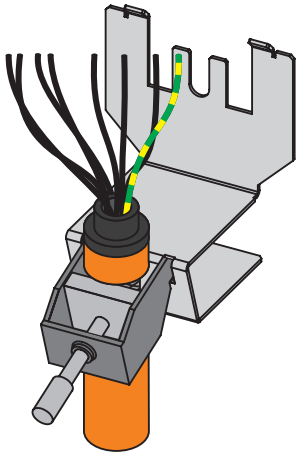
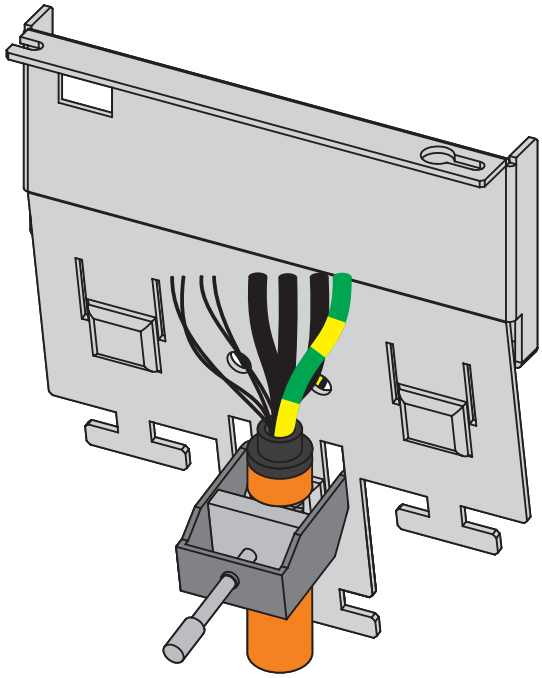
2. Sizes 0 to 2: In order to connect the motor temperature sensor, the control of the brake and the motor itself to the drive controller, wire the cores of the power cables with terminals X2, X5 and X20. Attach the power cable to the EMC shroud.



3. Size 3: Start by attaching the power cable to the EMC shroud. Then wire the cores of the power cable to terminals X2, X5 and X20 in order to connect the motor temperature sensor, the brake control and the motor itself to the drive controller.



4. Sizes 0 to 2: Attach terminal X20.
5. Connect the supply voltage for the brake to terminal X6 and attach it.
6. Attach terminals X2 and X5.
7. Optional: Connect an encoder to terminal X4.
8. Wire the enable signal (pins 3 and 4) and optional relay 1 (pins 1 and 2) to terminal X1 and attach them.

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Top of the device:

✓ There is a circuit diagram of the system that describes the connection of the drive controller

1. Connect the power supply to terminal X10.
2. Connect the 24 V_{DC} power supply for the control electronics to terminal X11.
3. Connect terminal X12 according to your safety configuration.
4. Optional: In order to use the IGB Motion Bus function, connect additional drive controllers to an IGB network via sockets X3A and X3B.
5. Optional: Connect the EtherCAT, CANopen or PROFINET fieldbuses via the EC6, CA6 or PN6 modules to the sockets X200 and X201.

Wiring examples can be found in the chapter Wiring examples [▶ 159].

8.4.20 Connecting a drive controller (SE6 option)

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

Tools and material

You will need:

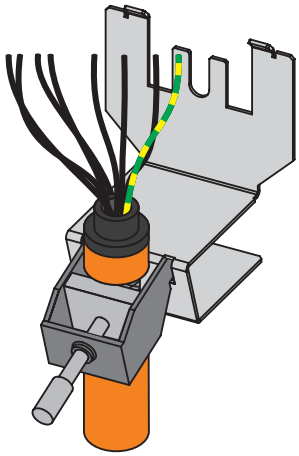
- Tool for assembling the accessory part and tightening the fastening screws.

Requirements and connection

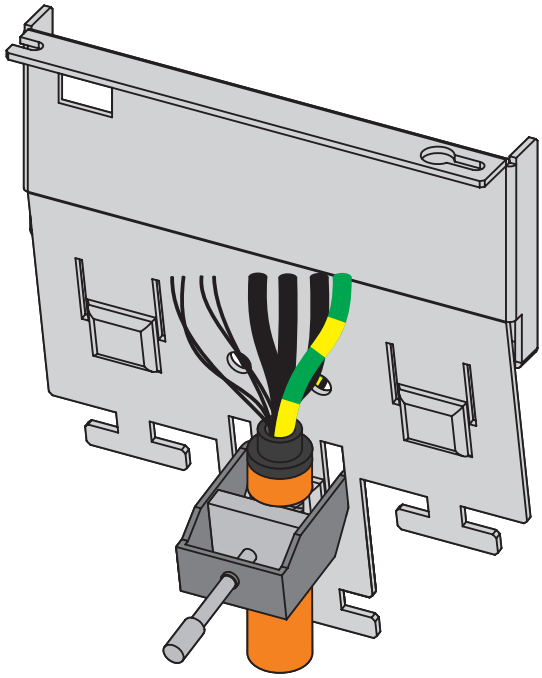
Bottom of the device:

✓ You have a system circuit diagram describing the connection of the drive controller.

1. Disconnect all terminals on the underside of the drive controller. For size 3 drive controllers, note that terminal X20 cannot be disconnected.
2. Sizes 0 to 2: In order to connect the motor temperature sensor, the brakes and the motor itself to the drive controller, wire the cores of the power cables to terminals X2, X5, X8 and X20. Attach the power cable to the EMC shroud.



3. Size 3: Start by attaching the power cable to the EMC shroud. Then wire the cores of the power cable to terminals X2, X5, X8 and X20 in order to connect the motor temperature sensor, the brakes and the motor itself to the drive controller.



4. Sizes 0 to 2: Attach terminal X20.
5. Connect the supply voltage for the brakes to terminal X7 and attach it.
6. Attach terminals X2, X5 and X8.
7. Optional: Connect an encoder to terminal X4.
8. Wire the enable signal (pins 3 and 4) and optional relay 1 (pins 1 and 2) to terminal X1 and attach them.

Top of the device:

✓ You have a system circuit diagram describing the connection of the drive controller.

1. Connect the power supply to terminal X10.
2. Optional: Connect the 24 V_{DC} power supply for the control electronics to terminal X11.
3. Connect terminals X14 and X15 according to your safety configuration and, optionally, connect the plausibility encoder to X50.
4. Optional: In order to use the IGB Motion Bus function, connect additional drive controllers to an IGB network via sockets X3A and X3B.
5. Optional: Connect the EtherCAT, CANopen or PROFINET fieldbuses via the EC6, CA6 or PN6 modules to the sockets X200 and X201.

Wiring examples can be found in the chapter Wiring examples [▶ 159].

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8.5 Communication module

The connection descriptions of the optional communication modules can be found in the following chapters.

8.5.1 EC6: EtherCAT

For the EtherCAT connection, you need the optional EC6 accessory part.

8.5.1.1 Overview

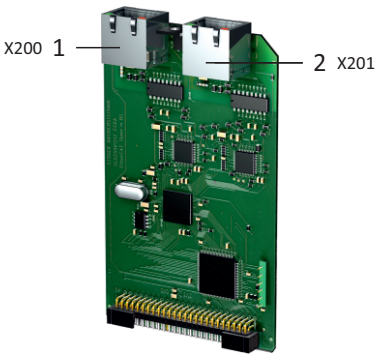

Fig. 18: Connection overview for EC6 communication module

1	X200: EtherCAT In
2	X201: EtherCAT Out

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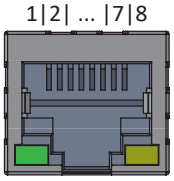
8.5.1.2 X200, X201: EtherCAT

The drive controllers have both RJ-45 sockets X200 and X201. The sockets are located on top of the device. The associated pin assignment and color coding correspond to the EIA/TIA-T568B standard.

X200 is to be connected as an input with the cable coming from the EtherCAT master. X201 is to be connected as an output with any subsequent EtherCAT nodes.

Socket	Pin	Designation	Function
1|2| ... |7|8 	1	Tx+	Communication
	2	Tx–	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx–	Communication
	7	—	—
	8	—	—

Tab. 99: X200 and X201 connection description

Cable requirements

Information

To ensure proper functionality, we recommend using cables from STOBER that are matched to the complete system. If unsuitable connection cables are used, we reserve the right to reject claims under the warranty.

STOBER provides ready-made cables for the EtherCAT connection. It is also possible to use cables with the following specification:

Ethernet patch cables or crossover cables meeting the CAT 5e quality level are the ideal cables. The Fast Ethernet technology allows a maximum cable length of 100 m between two nodes.

Information

Ensure that you only use shielded cables with an SF/FTP, S/FTP or SF/UTP design.

Detailed information about the fieldbus connection can be found in the corresponding manual for communication with EtherCAT.

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8.5.2 CA6: CANopen

The optional CA6 accessory part is available for the CANopen connection.

8.5.2.1 Overview

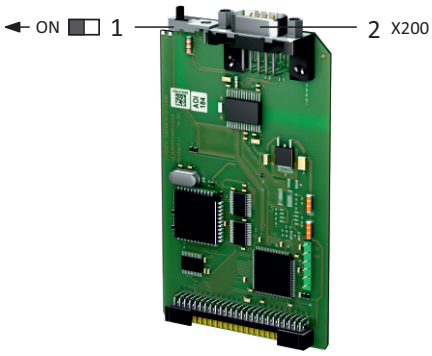


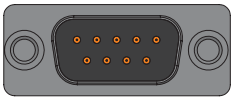
Fig. 19: Connection overview for CA6 communication module

1 Terminating resistor; must be activated at the last networked drive controller (slider to "ON")

2 X200: CANopen

8.5.2.2 X200: CANopen

The CA6 communication module provides a 9-pole D-sub connector for connecting the drive controllers to each other.

Connector	Pin	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	—	—
	2	CAN-L	CAN low wire
	3	GND	Reference potential
	4	—	—
	5	—	—
	6	—	—
	7	CAN-H	CAN high wire
	8	—	—
	9	—	—

Tab. 100: X200 connection description

Cable requirements

In order to ensure error-free operation—especially at high transmission rates—we recommend using bus wires that meet the requirements listed in ISO 11898-2, such as the following:

- Characteristic impedance: 95 – 140 Ω
- Maximum operating capacitance: 60 nF/km
- Conductor resistance: 70 mΩ/m

Detailed information about the fieldbus connection can be found in the corresponding manual, see the chapter Detailed information [▶ 161].

8.5.3 PN6: PROFINET

For a PROFINET connection, you need the optional PN6 accessory part.

8.5.3.1 Overview

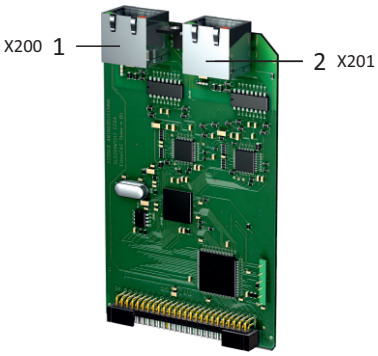


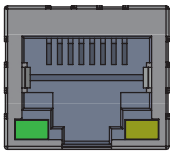
Fig. 20: Connection overview for PN6 communication module

1 X200: PROFINET
2 X201: PROFINET

8.5.3.2 X200, X201: PROFINET

In order to be able to connect the drive controllers to other PROFINET nodes, an integrated switch with both X200 and X201 RJ-45 sockets is provided. The sockets are located on top of the device. The associated pin assignment and color coding correspond to the EIA/TIA-T568B standard.

Connect X200 or X201 with the IO controller and the remaining connection with the next drive controller.

Socket	Pin	Designation	Function
1|2| ... |7|8 	1	Tx+	Communication
	2	Tx–	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx–	Communication
	7	—	—
	8	—	—

Tab. 101: X200 and X201 connection description

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Cable requirements

A PROFINET network generally consists of symmetrical, shielded copper cables twisted in pairs (shielded twisted pair, CAT 5e quality level).

Signals are transmitted according to the 100BASE TX method, i.e. with a transfer rate of 100 Mbps at a frequency of 125 MHz.
A maximum of 1440 bytes can be transferred per frame. The maximum cable length is 100 m.

PROFINET cables exist in different versions that are tailored to different application scenarios and ambient conditions.

We recommend using the cables specified in the PROFINET installation guidelines. They are adjusted for use in automation technology with regard to usage, resistance, EMC properties and color coding.

There are type A, B and C cables, differentiated by installation type:

- Type A
  4-wire shielded copper cable for fixed installation
- Type B
  4-wire shielded copper cable for flexible installation
- Type C
  4-wire shielded copper cable for constant movements

Detailed information about the fieldbus connection can be found in the corresponding manual for communication with PROFINET.

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8.6 Terminal module

The connection descriptions of the optional terminal modules can be found in the following chapters.

You can find the technical data for the terminal modules in the manual for the SD6 drive controller; see the chapter Detailed information [▶ 161].

8.6.1 XI6

8.6.1.1 Overview

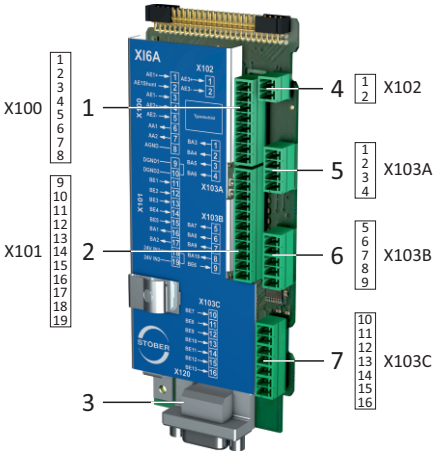
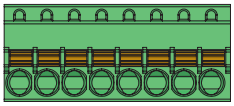


Fig. 21: Connection overview for the XI6 terminal module

1	X100: AI1 – AI2, AO1 – AO2
2	X101: DI1 – DI5, DO1 – DO2
3	X120: X120 encoder connection
4	X102: AI3
5	X103A: DO3 – DO6
6	X103B: DI6, DO7 – DO10
7	X103C: DI7 – DI13

8.6.1.2 X100: AI1 – AI2, AO1 – AO2

Terminal	Pin	Designation	Function
 1|2|3|4|5|6|7|8	1	AI1 +	AI1+ input
	2	AI1 shunt	Current input; shunt connection pin 2 is to be bridged to pin 1
	3	AI1 –	AI1– input
	4	AI2 +	AI2+ input
	5	AI2 –	AI2– input
	6	AO1	AO1 output
	7	AO2	AO2 output
	8	0 V AGND	Reference potential

Tab. 102: X100 connection description

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Connecting wiring

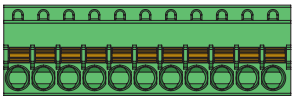
For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 103: Cable length [m]

8.6.1.3 X101: DI1 – DI5, DO1 – DO2

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	Digital inputs
	12	DI2	
	13	DI3	
	14	DI4	
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[12]
	19		

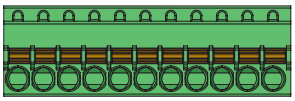
Tab. 104: X101 connection description for digital signals

Use the digital inputs DI3 to DI5 to evaluate incremental or pulse/direction signals. For the simulation, use the digital outputs DO1 and DO2.

Hall sensors with single-ended HTL signal levels can be connected to digital inputs DI1 through DI3 directly.

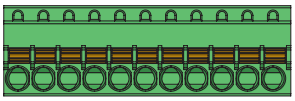
[12] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.

Single-ended HTL incremental encoders

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	Evaluation: N channel
	14	DI4	Evaluation: A channel
	15	DI5	Evaluation: B channel
	16	DO1	Simulation: A channel
	17	DO2	Simulation: B channel
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[13]
	19		

Tab. 105: X101 connection description for single-ended HTL incremental signals

Single-ended HTL pulse/direction interface

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	—
	14	DI4	Evaluation: Pulse
	15	DI5	Evaluation: Direction
	16	DO1	Simulation: Pulse
	17	DO2	Simulation: Direction
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[14]
	19		

Tab. 106: X101 connection description for single-ended HTL pulse/direction signals

[13] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.
[14] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.

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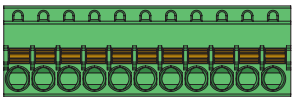
Single-ended HTL Hall sensor

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	HALL A
	12	DI2	HALL B
	13	DI3	HALL C
	14	DI4	Digital inputs
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[15]
	19		

Tab. 107: X101 connection description for single-ended HTL Hall sensor signals

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 108: Cable length [m]

8.6.1.4 X102: AI3

	Pin	Designation	Function
1|2	1	AI3 +	AI3+ input; differential input voltage
	2	AI3 −	AI3− input

Tab. 109: X102 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FMC 1,5 -ST-3,5 [▶ 152].

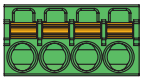
Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 110: Cable length [m]

[15] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for relevant DC voltage in accordance with UL 248.

8.6.1.5 X103A: DO3 – DO6

Terminal	Pin	Designation	Function
 1|2|3|4	1	DO3	Digital outputs
	2	DO4	
	3	DO5	
	4	DO6	

Tab. 111: X103A connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FMC 1,5 -ST-3,5 [▶ 152].

Cable requirements

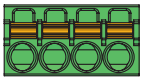
Feature	All sizes
Max. cable length	30 m

Tab. 112: Cable length [m]

8.6.1.6 X103B: DI6, DO7 – DO10

Information

In the event of failure of the 24 V_{DC} supply, the digital input DI6 displays the signal state 0, regardless of the physical signal state.

Terminal	Pin	Designation	Function
 5|6|7|8|9	5	DO7	Digital outputs
	6	DO8	
	7	DO9	
	8	DO10	
	9	DI6	Digital input

Tab. 113: X103B connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FMC 1,5 -ST-3,5 [▶ 152].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 114: Cable length [m]

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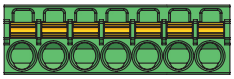
8.6.1.7 X103C: DI7 – DI13

Information

In the event of failure of the 24 V_{DC} supply, the digital inputs DI7 to DI13 display the signal state 0, regardless of the physical signal state.

Terminal	Pin	Designation	Function
 10|11| ... |15|16	10	DI7	Digital inputs
	11	DI8	
	12	DI9	
	13	DI10	
	14	DI11	
	15	DI12	
	16	DI13	

Tab. 115: X103C connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FMC 1,5 -ST-3,5 [▶ 152].

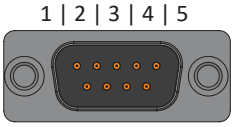
Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 116: Cable length [m]

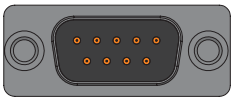
8.6.1.8 X120

SSI encoders

Connector	Pin	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	—	—
	3	—	—
	4	Clock –	Inverse differential input/output for CLOCK
	5	Clock +	Differential input/output for CLOCK
	6	Data +	Differential input/output for DATA
	7	Data –	Inverse differential input/output for DATA
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

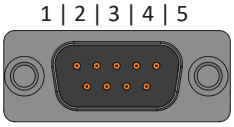
Tab. 117: X120 connection description for SSI encoders

Differential TTL incremental encoders

Connector	Pin	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	N +	Differential input/output for N channel
	3	N –	Inverse differential input/output for N channel
	4	A –	Inverse differential input/output for A channel
	5	A +	Differential input/output for A channel
	6	B +	Differential input/output for B channel
	7	B –	Inverse differential input/output for B channel
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

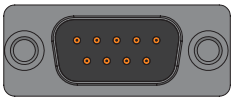
Tab. 118: X120 connection description for differential TTL incremental encoder

Differential TTL Hall sensor

Connector	Pin[16]	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	HALL C +	Differential input for HALL C
	3	HALL C –	Inverse differential input for HALL C
	4	HALL A –	Inverse differential input for HALL A
	5	HALL A +	Differential input for HALL A
	6	HALL B +	Differential input for HALL B
	7	HALL B–	Inverse differential input for HALL B
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

Tab. 119: X120 connection description for differential TTL Hall sensors

Differential TTL pulse/direction interface

Connector	Pin[17]	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	—	—
	3	—	—
	4	Pulse –	Inverse differential input for pulses
	5	Pulse +	Differential input for pulses
	6	Direction +	Differential input for direction
	7	Direction –	Inverse differential input for direction
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

Tab. 120: X120 connection description for differential TTL pulse/direction signals

[16] 1:1 connection to LA6: Pin assignment corresponds to terminal X301
[17] 1:1 connection to LA6: Pin assignment corresponds to terminal X301

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Cable requirements

Feature	All sizes
Max. cable length	50 m, shielded

Tab. 121: Cable length [m]

8.6.2 RI6

8.6.2.1 Overview

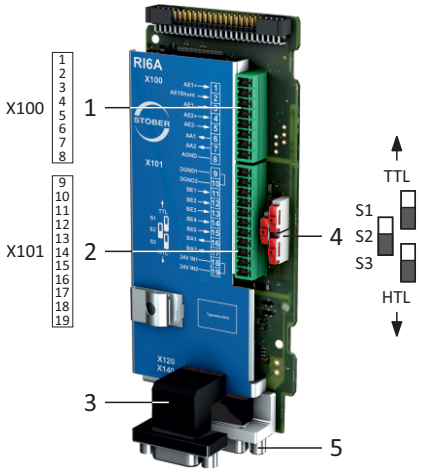
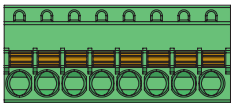


Fig. 22: Connection overview for the RI6 terminal module

1 X100: AI1 – AI2, AO1 – AO2
2 X101: DI1 – DI5, DO1 – DO2
3 X120: Encoder connection
4 3 sliders for the HTL/TTL level conversion
5 X140: Encoder connection

8.6.2.2 X100: AI1 – AI2, AO1 – AO2

Terminal	Pin	Designation	Function
 1|2|3|4|5|6|7|8	1	AI1 +	AI1+ input
	2	AI1 shunt	Current input; shunt connection pin 2 is to be bridged to pin 1
	3	AI1 –	AI1– input
	4	AI2 +	AI2+ input
	5	AI2 –	AI2– input
	6	AO1	AO1 output
	7	AO2	AO2 output
	8	0 V AGND	Reference potential

Tab. 122: X100 connection description

Connecting wiring

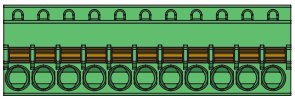
For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 123: Cable length [m]

8.6.2.3 X101: DI1 – DI5, DO1 – DO2

Terminal	Pin	Designation	Function
 9|10|11| … |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	Digital inputs
	12	DI2	
	13	DI3	
	14	DI4	
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[18]
	19		

Tab. 124: X101 connection description for digital signals

Use the digital inputs DI3 to DI5 to evaluate incremental or pulse/direction signals. For the simulation, use the digital outputs DO1 and DO2.

Hall sensors with single-ended HTL signal levels can be connected to digital inputs DI1 through DI3 directly.

[18] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.

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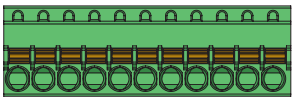
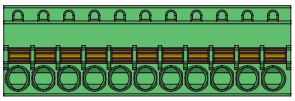
Single-ended HTL and single-ended TTL incremental encoders

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	Evaluation: N channel
	14	DI4	Evaluation: A channel
	15	DI5	Evaluation: B channel
	16	DO1	Simulation: A channel
	17	DO2	Simulation: B channel
	18	+24 V_{DC}	24 V_{DC} supply, internally bridged; recommended fuse protection: max. 1 AT[19]
	19		

Tab. 125: X101 connection description for single-ended HTL and single-ended TTL incremental signals

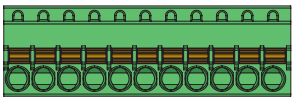
Single-ended HTL and single-ended TTL pulse/direction interface

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	—
	14	DI4	Evaluation: Pulse
	15	DI5	Evaluation: Direction
	16	DO1	Simulation: Pulse
	17	DO2	Simulation: Direction
	18	+24 V_{DC}	24 V_{DC} supply, internally bridged; recommended fuse protection: max. 1 AT[20]
	19		

Tab. 126: X101 connection description for single-ended HTL and single-ended TTL pulse/direction signals

[19] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.
[20] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.

Single-ended HTL Hall sensor

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	HALL A
	12	DI2	HALL B
	13	DI3	HALL C
	14	DI4	Digital inputs
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[21]
	19		

Tab. 127: X101 connection description for single-ended HTL Hall sensor signals

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 128: Cable length [m]

[21] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for relevant DC voltage in accordance with UL 248.

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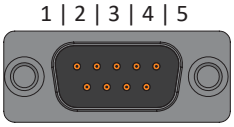
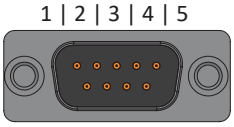
8.6.2.4 X120

SSI encoders

Connector	Pin	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	—	—
	3	—	—
	4	Clock –	Inverse differential input/output for CLOCK
	5	Clock +	Differential input/output for CLOCK
	6	Data +	Differential input/output for DATA
	7	Data –	Inverse differential input/output for DATA
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

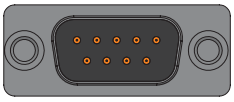
Tab. 129: X120 connection description for SSI encoders

Differential TTL incremental encoders

Connector	Pin	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	N +	Differential input/output for N channel
	3	N –	Inverse differential input/output for N channel
	4	A –	Inverse differential input/output for A channel
	5	A +	Differential input/output for A channel
	6	B +	Differential input/output for B channel
	7	B –	Inverse differential input/output for B channel
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

Tab. 130: X120 connection description for differential TTL incremental encoder

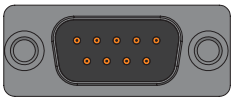
Differential TTL Hall sensor

Connector	Pin[22]	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	HALL C +	Differential input for HALL C
	3	HALL C –	Inverse differential input for HALL C
	4	HALL A –	Inverse differential input for HALL A
	5	HALL A +	Differential input for HALL A
	6	HALL B +	Differential input for HALL B
	7	HALL B–	Inverse differential input for HALL B
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

Tab. 131: X120 connection description for differential TTL Hall sensors

[22] 1:1 connection to LA6: Pin assignment corresponds to terminal X301

Differential TTL pulse/direction interface

Connector	Pin[23]	Designation	Function
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	GND Enc	Reference potential for pin 2 to pin 7
	2	—	—
	3	—	—
	4	Pulse –	Inverse differential input for pulses
	5	Pulse +	Differential input for pulses
	6	Direction +	Differential input for direction
	7	Direction –	Inverse differential input for direction
	8	U_2	Encoder supply
	9	0 V GND	Reference potential for pin 8

Tab. 132: X120 connection description for differential TTL pulse/direction signals

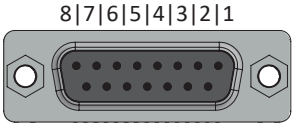
Cable requirements

Feature	All sizes
Max. cable length	50 m, shielded

Tab. 133: Cable length [m]

8.6.2.5 X140

EnDat 2.1/2.2 digital encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	—	—
	2	0 V GND	Reference for encoder supply at pin 4
	3	—	—
	4	U_2	Encoder supply
	5	Data +	Differential input for DATA
	6	—	—
	7	—	—
	8	Clock +	Differential input for CLOCK
	9	—	—
	10	0 V Sense	Optional reference potential of the Sense connection for regulating the encoder supply
	11	—	—
	12	U_2 Sense	Sense signals for voltage regulation
	13	Data –	Inverse differential input for DATA
	14	—	—
	15	Clock –	Inverse differential input for CLOCK

Tab. 134: X140 connection description for EnDat 2.1/2.2 digital encoders

[23] 1:1 connection to LA6: Pin assignment corresponds to terminal X301

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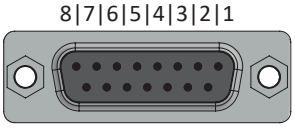
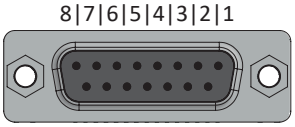
Resolver

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	S4 Sin +	Sin input
	2	R1 Ref –	Reference potential for pin 6
	3	S3 Cos +	Cos input
	4	—	—
	5	—	—
	6	R2 Ref +	Resolver excitation signal
	7	1TP1	Reserve
	8	—	—
	9	S2 Sin –	Reference potential for pin 1
	10	—	—
	11	S1 Cos –	Reference potential for pin 3
	12	—	—
	13	—	—
	14	1TP2	Reserve
	15	—	—

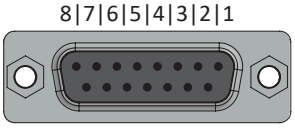
Tab. 135: X140 connection description for resolvers

EnDat 2.1 sin/cos encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	B – (Sin –)	Reference potential for sin input
	2	0 V GND	Reference potential for encoder supply to pin 4
	3	A – (Cos –)	Reference potential for cos input
	4	U_2	Encoder supply
	5	Data +	Differential input for DATA
	6	—	—
	7	1TP1	Reserve
	8	Clock +	Differential input for CLOCK
	9	B + (Sin +)	Sin input
	10	0 V Sense	Optional reference potential of the Sense connection for regulating the encoder supply
	11	A + (Cos +)	Cos input
	12	U_2 Sense	Sense signals for voltage regulation
	13	Data –	Inverse differential input for DATA
	14	1TP2	Reserve
	15	Clock –	Inverse differential input for CLOCK

Tab. 136: X140 connection description for EnDat 2.1 sin/cos encoders

Sin/cos encoders

Socket	Pin	Designation	Function
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	B – (Sin –)	Reference potential for sin input
	2	0 V GND	Reference potential for encoder supply to pin 4
	3	A – (Cos –)	Reference potential for cos input
	4	U_2	Encoder supply
	5	—	—
	6	—	—
	7	—	—
	8	—	—
	9	B + (Sin +)	Sin input
	10	0 V Sense	Optional Sense connection for regulating the encoder supply
	11	A + (Cos +)	Cos input
	12	U_2 Sense	Sense signals for voltage regulation
	13	—	—
	14	—	—
	15	—	—

Tab. 137: X140 connection description for sin/cos encoders

Cable requirements

Feature	All sizes
Max. cable length	100 m, shielded

Tab. 138: Cable length [m]

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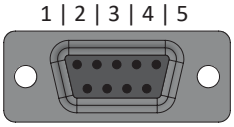
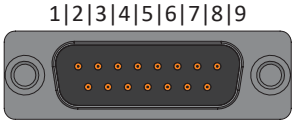
8.6.2.6 AP6 interface adapter (resolver)

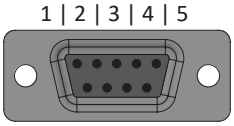
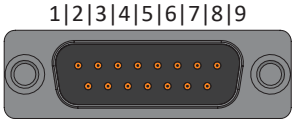
AP6A00 – Resolver (9-pin to 15-pin)

Socket[24]	Pin	Designation	Function	Pin	Connector[25]
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	—	—	—	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	1TP1	—	—	
	3	S2 Sin –	Sin input reference potential	9	
	4	S1 Cos –	Cos input reference potential	11	
	5	R1 Ref –	Resolver excitation signal reference potential	2	
	6	1TP2	—	—	
	7	S4 Sin +	Sin input	1	
	8	S3 Cos +	Cos input	3	
	9	R2 Ref +	Resolver excitation signal	6	

Tab. 139: AP6A00 connection description for resolver (9-pin to 15-pin)

AP6A01 – Resolver and motor temperature sensor (9-pin to 15-pin)

Interface adapter with temperature sensor cores routed out on the side.

Socket[26]	Pin	Designation	Function	Pin	Connector[27]
1 | 2 | 3 | 4 | 5  6 | 7 | 8 | 9	1	—	—	—	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	1TP1	Motor temperature sensor connection, if included in the encoder cable connector; routed out for the direct connection to terminal X2	—	
	3	S2 Sin –	Sin input reference potential	9	
	4	S1 Cos –	Cos input reference potential	11	
	5	R1 Ref –	Resolver excitation signal reference potential	2	
	6	1TP2	Motor temperature sensor connection, if included in the encoder cable connector; routed out for the direct connection to terminal X2	—	
	7	S4 Sin +	Sin input	1	
	8	S3 Cos +	Cos input	3	
	9	R2 Ref +	Resolver excitation signal	6	

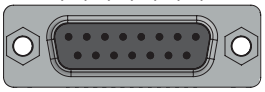
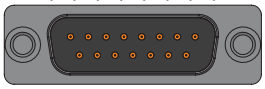
Tab. 140: AP6A01 connection description for the resolver and motor temperature sensor (9-pin to 15-pin)

[24] View of 9-pin D-sub for connecting the SDS 4000-compatible resolver cable
[25] View of 15-pin D-sub for connecting to SD6, terminal X140 (RI6)
[26] View of 9-pin D-sub for connecting the SDS 4000-compatible resolver cable
[27] View of 15-pin D-sub for connecting to SD6, terminal X140 (RI6)

8.6.2.7 AP6 interface adapter (EnDat 2.1 sin/cos)

AP6A02 – EnDat 2.1 sin/cos encoder (15-pin to 15-pin)

Interface adapter with temperature sensor cores routed out on the side.

Socket[28]	Pin	Designation	Function	Pin	Connector[29]
8|7|6|5|4|3|2|1  15|14|13|12|11|10|9	1	B – (Sin –)	Sin input reference potential	1	1|2|3|4|5|6|7|8|9  10|11|12|13|14|15
	2	0 V GND	Encoder supply reference potential	2	
	3	A – (Cos –)	Cos input reference potential	3	
	4	U_2	Encoder supply	4	
	5	Data +	Differential input for DATA	5	
	6	—	—	6	
	7	1TP1	Motor temperature sensor connection, if included in the encoder cable; routed out for the direct connection to X2	—	
	8	Clock +	Differential input for CLOCK	8	
	9	B + (Sin +)	Sin input	9	
	10	0 V Sense	Optional reference potential of the Sense connection for regulating the encoder supply	10	
	11	A + (Cos +)	Cos input	11	
	12	U_2 Sense	Sense signals for voltage excitation	12	
	13	Data –	Inverse differential input for DATA	13	
	14	1TP2	Motor temperature sensor connection, if included in the encoder cable; routed out for the direct connection to X2	—	
	15	Clock –	Inverse differential input for CLOCK	15	

Tab. 141: AP6A02 connection description for EnDat 2.1 sin/cos encoder and motor temperature sensor (15-pin to 15-pin)

[28] View of 15-pin D-sub for connecting the SDS 4000-compatible EnDat cable
[29] View of 15-pin D-sub for connecting to SD6, terminal X140 (RI6)

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8.6.3 IO6

8.6.3.1 Overview

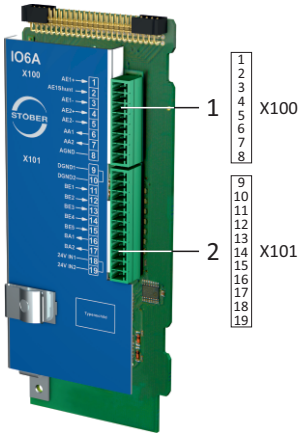
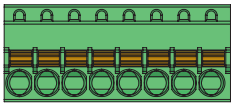


Fig. 23: Connection overview for the IO6 terminal module

1 X100: AI1 – AI2, AO1 – AO2

2 X101: DI1 – DI5, DO1 – DO2

8.6.3.2 X100: AI1 – AI2, AO1 – AO2

Terminal	Pin	Designation	Function
 1|2|3|4|5|6|7|8	1	AI1 +	AI1+ input
	2	AI1 shunt	Current input; shunt connection pin 2 is to be bridged to pin 1
	3	AI1 –	AI1– input
	4	AI2 +	AI2+ input
	5	AI2 –	AI2– input
	6	AO1	AO1 output
	7	AO2	AO2 output
	8	0 V AGND	Reference potential

Tab. 142: X100 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 143: Cable length [m]

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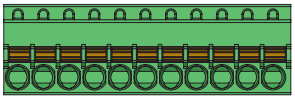
8.6.3.3 X101: DI1 – DI5, DO1 – DO2

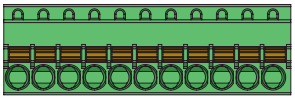
Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	Digital inputs
	12	DI2	
	13	DI3	
	14	DI4	
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[30]
	19		

Tab. 144: X101 connection description for digital signals

Use the digital inputs DI3 to DI5 to evaluate incremental or pulse/direction signals. For the simulation, use the digital outputs DO1 and DO2.

Hall sensors with single-ended HTL signal levels can be connected to digital inputs DI1 through DI3 directly.

Single-ended HTL incremental encoders

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	Evaluation: N channel
	14	DI4	Evaluation: A channel
	15	DI5	Evaluation: B channel
	16	DO1	Simulation: A channel
	17	DO2	Simulation: B channel
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[31]
	19		

Tab. 145: X101 connection description for single-ended HTL incremental signals

[30] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248.
[31] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.

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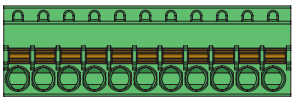
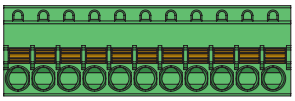
Single-ended HTL pulse/direction interface

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	—
	12	DI2	—
	13	DI3	—
	14	DI4	Evaluation: Pulse
	15	DI5	Evaluation: Direction
	16	DO1	Simulation: Pulse
	17	DO2	Simulation: Direction
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[32]
	19		

Tab. 146: X101 connection description for single-ended HTL pulse/direction signals

Single-ended HTL Hall sensor

Terminal	Pin	Designation	Function
 9|10|11| ... |17|18|19	9	0 V DGND	Reference potential, internally bridged
	10		
	11	DI1	HALL A
	12	DI2	HALL B
	13	DI3	HALL C
	14	DI4	Digital inputs
	15	DI5	
	16	DO1	Digital outputs
	17	DO2	
	18	+24 V_{DC}	External 24 V_{DC} supply; recommended fuse protection: max. 1 AT[33]
	19		

Tab. 147: X101 connection description for single-ended HTL Hall sensor signals

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter FK-MCP 1,5 -ST-3,5 [▶ 153].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 148: Cable length [m]

[32] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements in accordance with UL 248.
[33] For the fuse protection, use a 1 A fuse (time delay). For UL-compliant use, be sure that the fuse meets certification requirements for relevant DC voltage in accordance with UL 248.

9 Operation

The operating unit of the drive controller consists of a graphic display (LCD) and buttons.

9.1 Overview

Fig. 24: Operating unit of the SD6 drive controller

OK	Select levels, parameter groups and parameters or apply modified parameter values
Esc	Display parameters of the start display, navigate to a previous level, reject modified parameter values or acknowledge fault
^	Select parameters within a parameter group or change parameter values
v	
<	Select a parameter group or select a character position of a parameter
>	
✋	Activate or deactivate local operation; a deactivation causes the enable signal to be cleared
I/0	Enable drive in local operation, if parameterized
💾	Non-volatile data storage: Press and hold button for 3 seconds

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9.2 Menu structure and navigation

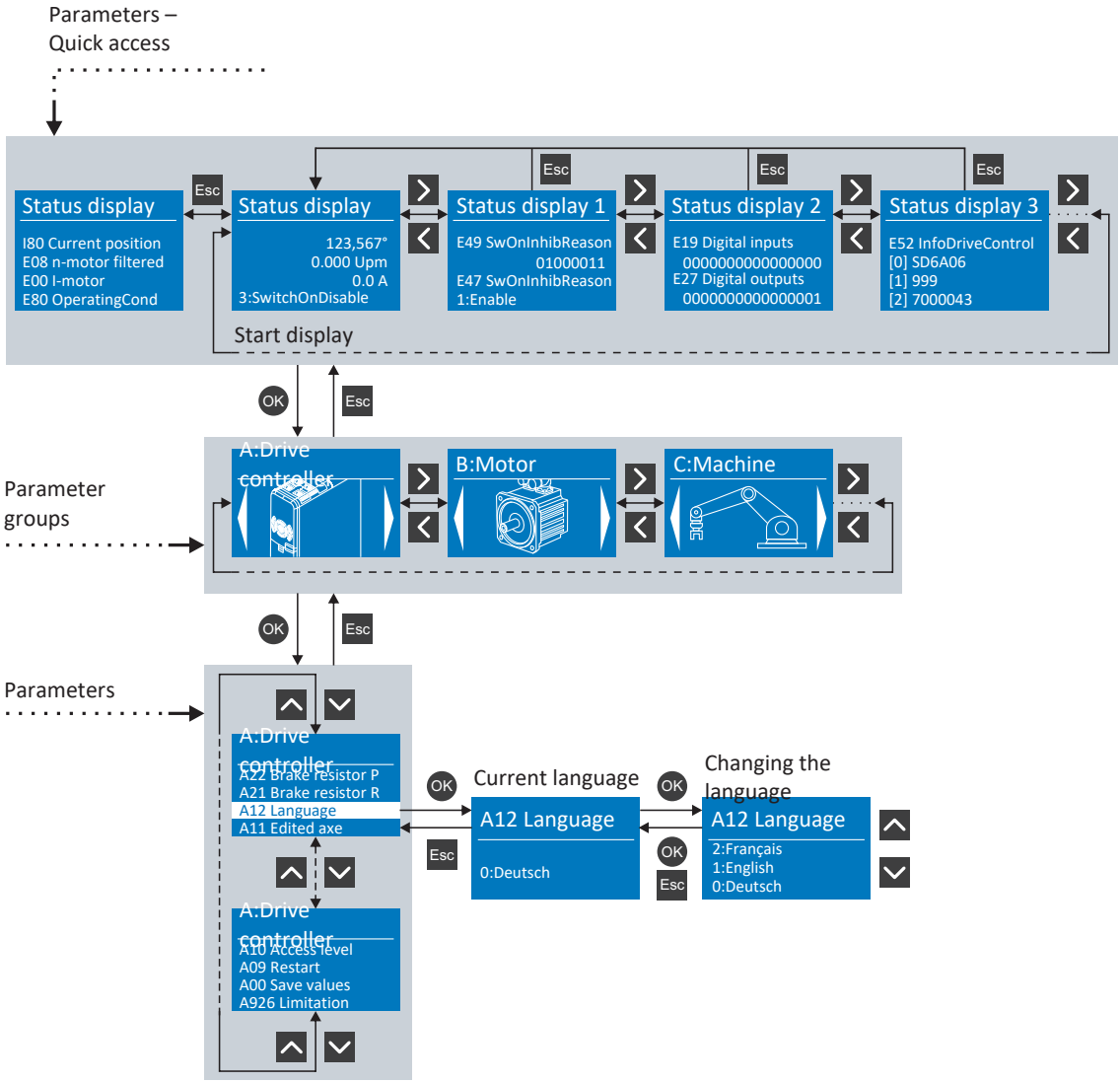

Fig. 25: Menu structure and navigation using the SD6 operating unit

Parameters – Quick access

Using quick access, you get direct access to the status of the most important (diagnostic) parameters. This level consists of the STATUS DISPLAY start display and three additional topic-specific overviews: STATUS DISPLAY 1, for example, provides information about the causes of a possible switch-on lockout, STATUS DISPLAY 2 provides information about analog and digital inputs and outputs, STATUS DISPLAY 3 provides information about the general data of the drive controller, such as type, firmware, integrated option modules, etc. You can navigate within this level using the left and right arrow keys. You can use the up and down arrow keys to navigate within the current overview to see more information.

You can access parameters hidden behind the four values on the STATUS DISPLAY start display by using [Esc]. These four parameters can be configured individually using parameter A144.

Parameter groups

Parameters are combined into groups by their functional properties, such as "Drive controller", "Motor", "Machine", "Terminal", etc. You can navigate within this level using the right and left arrow buttons; you can select one of the possible groups with [OK].

Parameters

Within a parameter group, you can navigate using the up and down arrow buttons; you can select one of the possible parameters with [OK]. If you would like to change a parameter value, select the corresponding character position using the right and left arrow buttons and select the new value using the up and down arrow buttons. You can apply changes with [OK] or reject them with [Esc].

Information

Note that modified values can be placed in non-volatile storage via an operating unit using the memory button or parameter A00.

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10 What you should know before commissioning

The following chapters provide a quick introduction to the structure of the program interface and accompanying window designations as well as relevant information about parameters and generally saving your project configuration.

10.1 DS6 program interface

Using the graphical interface of the DriveControlSuite commissioning software (DS6), you can project, parameterize and commission your drive project quickly and efficiently.

Information

The program interface of DriveControlSuite is available in German, English and French. To change the language of the program interface, select Settings > Language.

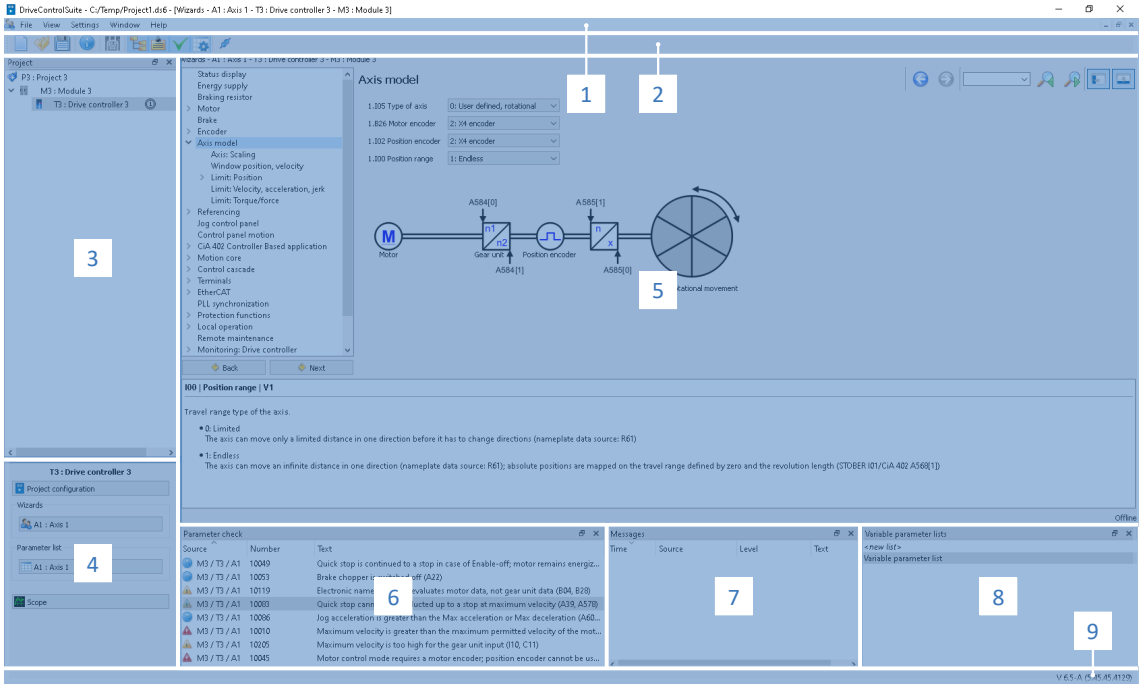


Fig. 26: DS6: Program interface

No.	Area	Description
1	Menu bar	Using the File, View, Settings and Window menus, you can open and save projects, display and hide program windows, select the interface language and access level and change between different areas of the program interface.
2	Toolbar	The toolbar enables quick access to frequently needed functions, like opening and saving projects and hiding and displaying windows in the program interface.
3	Project tree	The project tree forms the structure of your drive project in the form of modules and drive controllers. Select an element using the project tree first in order to edit it using the project menu.
4	Project menu	The project menu offers you various functions for editing the project, module and drive controller. The project menu adapts to the element that you selected in the project tree.
5	Workspace	The different windows which can be used to edit your drive project, such as the configuration dialog, wizards, the parameter list or the scope analysis tool, open in the workspace.

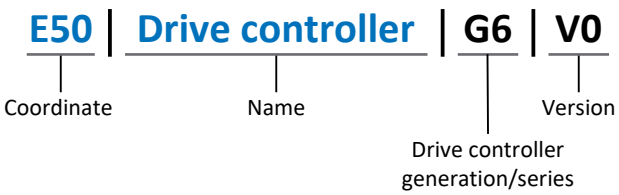
No.	Area	Description
6	Parameter check	The parameter check points out irregularities and inconsistencies that were detected in the plausibility check of calculable parameters.
7	Messages	The entries in the messages log the connection and communication status of the drive controllers, incorrect inputs caught by the system, errors when opening a project or rule violations in the graphical programming.
8	Variable parameter lists	You can use variable parameter lists to compile any parameters in individual parameter lists for a quick overview.
9	Status bar	In the status bar, you can find the specifications of the software version and get additional information about the project file, the devices and the progress of the process during processes such as loading projects.

10.2 Meaning of parameters

You can adapt the function of the drive controller to your individual application using parameters. In addition, parameters visualize the current actual values (actual velocity, actual torque, etc.) and trigger general actions like Save values, Test phase, etc.

Interpretation of parameter identification

Parameter identification consists of the following elements, where short forms are also possible, i.e. only specifying a coordinate or the combination of coordinate and name.



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10.2.1 Parameter groups

Parameters are assigned to individual groups by topic. The 6th generation of STOBER drive controllers differentiates between the following parameter groups.

Group	Topic
A	Drive controllers, communication, cycle times
B	Motor
C	Machine, velocity, torque/force, comparators
D	Set value
E	Display
F	Terminals, analog and digital inputs and outputs, brake
G	Technology – Part 1 (application-dependent)
H	Encoders
I	Motion (all motion settings)
J	Motion blocks
K	Control panel
L	Technology – Part 2 (application-dependent)
M	Profiles (application-dependent)
N	Additional functions (application-dependent; extended cam control unit)
P	Customer-specific parameters (programming)
Q	Customer-specific parameters, instance-dependent (programming)
R	Production data for the drive controller, motor, brakes, motor adapter, gear unit and geared motor
S	Safety (safety technology)
T	Scope
U	Protection functions
Z	Fault counter

Tab. 149: Parameter groups

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10.2.2 Parameter types and data types

In addition to topic-based sorting in individual groups, all parameters belong to a certain data type and parameter type. The data type of a parameter is displayed in the parameter list, properties table. The connections between parameter types, data types and their value range can be found in the following table.

Type	Style	Length	Value range (decimal)
INT8	Integer or selection	1 byte (signed)	-128 – 127
INT16	Integer	2 bytes (1 word, signed)	-32768 – 32767
INT32	Integer or position	4 bytes (1 double word, signed)	-2147483648 – 2147483647
BOOL	Binary number	1 bit (internal: LSB in 1 byte)	0, 1
BYTE	Binary number	1 byte (unsigned)	0 – 255
WORD	Binary number	2 bytes (1 word, unsigned)	0 – 65535
DWORD	Binary number or parameter address	4 bytes (1 double word, unsigned)	0 – 4294967295
REAL32 (single type according to IEE754)	Floating-point number	4 bytes (1 double word, signed)	-3.40282×10^{38} – 3.40282×10^{38}
STR8	Text	8 characters	—
STR16	Text	16 characters	—
STR80	Text	80 characters	—

Tab. 150: Parameters: Data types, styles, possible values

Parameter types: Use

- Integer, floating-point number
  For general computing processes
  Example: Set and actual values
- Selection
  Numeric value to which a direct meaning is assigned
  Example: Sources for signals or set values
- Binary number
  Bit-oriented parameter information that is collected in binary
  Example: Control and status words
- Position
  Integer combined with associated units and decimal places
  Example: Actual and set values of positions
- Velocity, acceleration, deceleration, jerk
  Floating-point number combined with the associated units and decimal places
  Example: Actual and set values for velocity, acceleration, deceleration, jerk
- Parameter address
  Corresponds to the storage location of another parameter
  Example: Indirect read sources for analog and digital outputs and for fieldbus mapping
- Text
  Outputs or messages

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10.2.3 Parameter types

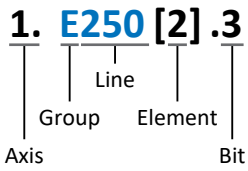
The following types of parameters are differentiated.

Parameter type	Description	Example
Simple parameters	Consist of one group and one line with a defined value.	A21 Brake resistor R: Value = 100 ohms
Array parameters	Consist of a group, a line and multiple sequential (listed) elements, which have the same properties but different values.	A10 Access level ▪ A10[0] access level: Value = Access level via operating unit ▪ A10[2] access level: Value = Access level via CANopen and EtherCAT ▪ A10[4] access level: Value = Access level via PROFINET
Structure parameters	Consist of a group, a line and multiple sequential (listed) elements, which can have different properties and different values.	A00 Save values ▪ A00[0] Start: Value = Start action ▪ A00[1] Progress: Value = Display action progress ▪ A00[2] Result: Value = Display action result

Tab. 151: Parameter types

10.2.4 Parameter structure

Every parameter has specific coordinates with the following pattern.



- Axis
  The axis to which a parameter is assigned in the case of multiple axes (optional).
- Group
  The thematic group to which a parameter belongs.
- Line
  Distinguishes the parameters within a parameter group.
- Element
  Elements of an array or structure parameter (optional).
- Bit
  Selection of an individual bit for complete data addressing (optional).

10.2.5 Parameter visibility

The visibility of a parameter depends on the access level defined in the software, the dependency of other parameters, the selected application and the version of the associated firmware.

Access level

The access options for the individual software parameters are ranked hierarchically and divided into individual levels. This means that parameters can be hidden for a specific purpose and, relatedly, their configuration options can be locked starting from a specific level. The following levels are present:

- Level 0
  Elementary parameters
- Level 1
  Important parameters of an application
- Level 2
  Important parameters for service with extensive diagnostic options
- Level 3
  All parameters needed for commissioning and optimizing an application

Parameter A10 Access level controls general access to parameters:

- Over the SD6 drive controller display (A10[0])
- Over CANopen or EtherCAT (A10[2])
- Over PROFINET (A10[3])

Hiding functions

Hiding functions are used to hide parameters with regard to their logical relationships to other option modules or parameters.

For example, a drive controller can evaluate an encoder using terminal X120, provided that terminal module XI6 has been installed. The accompanying evaluation is activated using parameter H120. However, this parameter is visible only if terminal module XI6 was initially selected during the drive project configuration.

Applications

Applications generally differ in terms of functions and their activation. For this reason, different parameters are available with each application.

Firmware

A newer version of the firmware may introduce new parameters. Parameters that have been configured for files of an older firmware function may not be visible in newer versions. In such cases, the respective parameter description includes a corresponding note.

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10.3 Signal transmission and fieldbus mapping

The transmission of control signals and set values in DriveControlSuite meets the following principles.

Signal transmission

Drive controllers are either controlled over a fieldbus, using mixed operation consisting of a fieldbus system and terminals or exclusively using terminals.
You can use the corresponding selection parameters, referred to as data sources, to configure whether the signals and set values are obtained over a fieldbus or using terminals.

In case of activation over a fieldbus, parameters that are selected as data sources for control signals or set values must be part of the subsequent fieldbus mapping; in the case of activation using terminals, the respective analog or digital inputs are specified directly.

Fieldbus mapping

If you are working with a fieldbus system and have selected the source parameters for signals and set values, configure the fieldbus-specific settings, e.g. the layout of process data channels for transmitting receive and transmit process data, as the last step.
The respective procedure can be found in the accompanying STOBER fieldbus manuals.

10.4 Power-loss protected storage

All project configurations, parameterizations and related changes to parameter values are in effect after transmission to the drive controller, but are not yet stored in non-volatile memory.

Saving to a drive controller

You have the following options for saving the configuration to a drive controller in non-volatile memory:

- Saving the configuration using the Save values wizard:
  Project menu > Wizards area > Projected axis > Save values wizard: Select the Save values action
- Saving the configuration using the parameter list:
  Project menu > Parameter list area > Projected axis > Group A: Drive controller > A00 Save values: Set the parameter A00[0] to the value 1: Active
- Saving the configuration using the operating unit:
  SD6 drive controller > Operating unit: Press the save button for 3 seconds

Saving to all drive controllers within a project

You have the following options for saving the configuration to multiple drive controllers in non-volatile memory:

- Saving the configuration using the toolbar:
  Toolbar > Save values symbol: Click on the Save values symbol
- Saving the configuration using the Assignment and live firmware update window:
  Project menu > Assignment and live firmware update area > Projected axis > Assignment and live firmware update window: Click on Save values (A00)

Information

Do not shut off the drive controller while saving. If the supply voltage to the control unit is interrupted while saving, the drive controller starts without an executable configuration when it is next switched on. In this case, the configuration must be transferred to the drive controller again and saved in non-volatile memory.

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11 Commissioning

The following chapters describe how to commission your drive system using the DriveControlSuite software.

For the components of your axis model, we require a STOBER synchronous servo motor with EnDat 2.1/2.2 digital encoder and optional brake. These motors together with all relevant data for the project configuration are saved in the motor database of DriveControlSuite as well as in the electronic nameplate.
Upon selecting the motor from the database, such as when reading out the nameplate, all data is transferred to the corresponding parameters. There is no need for complex parameterization of the motor, brake or encoder.

All other motor types need to have their parameters configured manually.

Note that the system nodes must be wired and supplied with control voltage before commissioning.

Information

Always perform the steps included in the following chapters in the specified order!

Some parameters of the DriveControlSuite are interdependent and do not become accessible to you until you have first configured certain settings. Follow the steps in the specified sequence so that you can finish the parameterization completely.

11.1 Initiating the project

In order to be able to configure all drive controllers and axes of your drive system using DriveControlSuite, you must record them as part of a project.

11.1.1 Projecting the drive controller and axis

Create a new project and project the first drive controller along with the accompanying axis.

Creating a new project

1. Start DriveControlSuite.
2. Click on Create new project in the Welcome window.
   ⇨ The new project is created and the configuration dialog for the first drive controller opens.
   ⇨ The Drive controller button is active.

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Projecting the drive controller

1. Properties tab:
   Establish the relationship between your circuit diagram and the drive controller to be projected in DriveControlSuite.
   Reference: Specify the reference code (equipment code) of the drive controller.
   Designation: Give the drive controller a unique name.
   Version: Version your project configuration.
   Description: If necessary, specify additional supporting information, such as the change history of the project configuration.
2. Drive controller tab:
   Select the series and device type of the drive controller.
3. Option modules tab:
   Communication module: If the drive controller communicates using a fieldbus with a controller, select the corresponding communication module.
   Terminal module: If you are controlling the drive controller using analog and digital inputs, select the corresponding terminal module (in addition to the communication module in mixed operation).
   Safety module: If the drive controller is part of a safety circuit, select the corresponding safety module.
4. Device controller tab:
   Device controller: Select the device controller that defines the underlying activation signals for the drive controller.
   Rx process data, Tx process data: If you control the drive controller using a fieldbus, select the fieldbus-specific receive and send process data.

Projecting the axis

1. Click on Axis 1.
2. Properties tab:
   Establish the connection between your circuit diagram and the axis to be projected in DriveControlSuite.
   Reference: Specify the reference code (equipment code) of the axis.
   Designation: Give the axis a unique name.
   Version: Version your project configuration.
   Description: If necessary, specify supporting additional information such as the change history of the project configuration.
3. Application tab:
   Select the desired control or drive-based application.
4. Motor tab:
   Select the motor category, the series and the type of motor operated using this axis. If you are working with motors from third-party suppliers, enter the accompanying motor data at a later time.
5. Confirm with OK.

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11.1.2 Configuring safety technology

In the next step, you have to configure the safety technology in accordance with the commissioning steps outlined in the corresponding manual; see the chapter Detailed information [▶ 161].

11.1.3 Creating other modules and drive controllers

We recommend sorting all drive controllers of your project in DriveControlSuite either functionally by groups and combining a group under a module, or organizing several drive controllers in corresponding modules based on their distribution to different control cabinets.

1. Highlight your P1 project in the project tree > Context menu Create new module.
   ⇨ Your M2 module is created in the project tree.
2. Highlight your M2 module in the project tree > Context menu Create new drive controller.
   ⇨ Your T2 drive controller is created in the project tree.
3. Mark your T2 drive controller in the project tree.
4. Change to the project menu and click Project configuration.
5. Project the drive controller and specify the newly created module.
6. Repeat the steps for all other drive controllers and modules of your project.

11.1.4 Projecting the module

Give your module a unique name, enter the reference code and, as an option, store additional information like the version and change history of the module.

1. Mark the module in the project tree and click on Project configuration in the project menu.
   ⇨ The configuration dialog for the module opens.
2. Establish the relationship between your circuit diagram and the module in DriveControlSuite.
   Reference: Specify the reference code (equipment code) of the module.
   Designation: Give the module a unique name.
   Version: Version the module.
   Description: If necessary, specify additional supporting information, such as the change history of the module.
3. Confirm with OK.

11.1.5 Projecting the project

Give your project a unique name, enter the reference code and, as an option, store additional information like the version and change history of the project.

1. Mark the project in the project tree and click on Project configuration in the project menu.
   ⇨ The configuration dialog for the project opens.
2. Establish the relationship between your circuit diagram and the project in DriveControlSuite.
   Reference: Specify the reference code (equipment code) of the project.
   Designation: Give the project a unique name.
   Version: Version the project.
   Description: If necessary, specify additional supporting information, such as the change history of the project.
3. Confirm with OK.

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11.2 Mapping the mechanical axis model

To be able to put your real drive train with one or more drive controllers into operation, you must map your complete mechanical environment in DriveControlSuite.

11.2.1 Parameterizing the STOBER motor

You have projected a STOBER synchronous servo motor with EnDat 2.1/2.2 digital encoder and optional brake.

By projecting the corresponding motor, limit values for currents and torques as well as associated temperature data are automatically transferred to the respective parameters of the individual wizards. All additional data on the brake and encoder is transferred at the same time.

Motor protection

All models of the 6th STOBER drive controller generation feature a certified i^2t model, a computational model for thermal monitoring of the motor. In order to activate it and start the protective function, set the parameters as follows (deviating from the default values): U10 = 2: Warning and U11 = 1.00 s. This model can be used instead of or in addition to temperature-monitored motor protection.

11.2.2 Parameterizing the axis model

Parameterize the setup of your drive in this order:

- Define the axis model
- Scale the axis
- Parameterize the position and velocity window
- Limit the axis (optional)
  - Limit the position
  - Limit the velocity, acceleration and jerk
  - Limit the torque and force

11.2.2.1 Define the axis model

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Axis model wizard.
3. I05 Type of axis:
   Define whether the axis type is rotational or translational.
   3.1. If you would like to configure the units of measure and the number of decimal places individually for specifying and displaying position set values, velocities, accelerations and jerk, select 0: User defined, rotational or 1: User defined, translational.
   3.2. If the units of measure and the number of decimal places for specifying and displaying position set values, velocities, accelerations and jerk are to be fixed, select 2: Rotational or 3: Translational.
4. B26 Motor encoder:
   Define the interface to which the motor encoder is connected.
5. I02 Position encoder (optional):
   Define the interface to which the position encoder is connected.
6. I00 Position range:
   Define whether the travel range of the axis is limited or endless (modulo).
7. If you have selected 1: Endless for I00, parameterize a revolution length as described in the chapter Scale the axis [▶ 139].

Information

If you parameterize I05 Type of axis, you can either use the selections 0: User defined, rotational or 1: User defined, translational to configure units of measure and the number of decimal places for the axis model individually or use the selections 2: Rotational and 3: Translational to revert to default values.

Selecting 2: Rotational sets the following units of measure for the axis model: position in °, velocity in rpm, acceleration in rad/s^2, jerk in rad/s^3.

Selecting 3: Translational sets the following units of measure for the axis model: position in mm, velocity in m/s, acceleration in m/s^2, jerk in m/s^3

Information

If you do not parameterize it differently for I02 Position encoder, B26 Motor encoder is used for position control as standard.

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11.2.2.2 Scale the axis

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Axis model wizard > Axis: Scaling.
3. Scale the axis by configuring the overall gear ratio between the motor and output.
   To simplify this scaling for you, you are provided with the scaling calculator **Conversion of position, velocities, accelerations, torque/force**, which calculates the effects of changed movement variables on the entire system.
4. I01 Circular length:
   If you have selected 1: Endless for I00 Position range, enter the revolution length.
5. I06 Decimal places position (optional):
   If you have selected 0: User defined, rotational or 1: User defined, translational for I05 Type of axis, define the desired number of decimal places.
6. I09 Measure unit (optional):
   If you have selected 0: User defined, rotational or 1: User defined, translational for I05 Type of axis, define the desired unit of measure.

Information

A change to parameter I06 moves the decimal separator for all axis-specific values!
Ideally, change I06 before parameterizing other axis-specific values and then check them afterwards.

Information

Parameter I297 Maximum speed position encoder must be parameterized according to your application case. If I297 is set too low, the permitted maximum speed is exceeded even at normal operating speeds. On the other hand, if I297 is set too high, measuring errors of the encoder can be overlooked.

I297 depends on the following parameters: I05 Type of axis, I06 Decimal places position, I09 Measure unit as well as I07 Distance factor numerator position and I08 Distance factor denominator position for Drive Based or A585 Feed constant for CiA 402. If you have made changes to one of the parameters listed, select I297 accordingly as well.

11.2.2.3 Parameterize the position and velocity window

Enter position limits and velocity zones for set values. To do so, parameterize boundary values for reaching a position or velocity.

1. Select the Axis model wizard > Window position, velocity.
2. C40 Velocity window:
   Parameterize a tolerance range for velocity tests.
3. I22 Target window:
   Parameterize a tolerance range for position tests.
4. I87 Actual position in window time:
   Parameterize how long a drive must stay in the specified position range before a corresponding status message is output.
5. Parameterize a tolerance range for lag tests.

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11.2.2.4 Limiting the axis

If necessary, limit the movement variables for position, velocity, acceleration, jerk as well as torque/force according to the applicable conditions for your axis model.

Limiting the position (optional)

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Axis model wizard > Limit: Position.
3. If necessary, limit the position of your axis using a software or hardware limit switch to secure the travel range.

Limiting velocity, acceleration, jerk (optional)

The specified default values are designed for slow velocities without gear units. For this reason, adapt the saved values.

Note that the velocity of the motor is parameterized in units other than that of the axis model. Verify the velocity of the motor against the velocity of the output accordingly.

1. Select the Motor wizard.
2. To determine the maximum velocity at the output, copy the value of the B13 Nominal motor speed parameter to the clipboard.
3. Select the Axis model wizard > Axis: Scaling > Conversion of positions, velocities, accelerations, torque/force area.
4. Velocity line:
   Paste the copied value of the B13 parameter from the clipboard without the unit and confirm with ENTER.
   ⇨ The maximum velocity of the motor has been transferred to the output.
5. Select the Axis model wizard > Limit: Velocity, acceleration, jerk.
6. I10 Maximal speed:
   Limit the maximum velocity of the output taking into account the configured Nominal motor speed in B13.
7. Determine the limiting values for acceleration and jerk if necessary and enter them into the associated parameters.

Limiting torque/force (optional)

The specified default values take into account the rated operation together with the overload reserves.

1. Select the Axis model wizard > Limit: Torque/force.
2. If the motor force must be limited, adapt the saved values as necessary.

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11.3 Testing the configuration

You can quickly and easily test the project configuration using the DriveControlSuite software or directly using the drive controller display.

11.3.1 Test using DriveControlSuite

Before you continue parameterizing your application, we recommend testing your projected axis model using the jog control panel.

Check your projected axis model as well as your configured electrical and mechanical data for plausibility by transferring your configuration to one of your drive controllers for test purposes and controlling the drive using the jog control panel instead of using a controller.

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Jog control panel wizard.
3. The predefined test motion variables are default values. Check them and, if necessary, change the values such that you can intervene in an emergency before personal injury or material damage can occur.

Information

Always check the suitability of the default values for your application before starting the test. If they appear too large or unsuitable compared with the results of the scaling calculator, always replace them with values that are more suitable for test operation.

11.3.1.1 Transmitting the configuration

In order to transmit and save the configuration to one or more drive controllers, you must connect your PC and the drive controllers over the network.

⚠ WARNING!

Injury to persons and material damage due to axis movement!

If there is an online connection between DriveControlSuite and the drive controller, changes to the configuration can lead to unexpected axis movements.

- Only change the configuration if you have visual contact with the axis.
- Make sure that no people or objects are within the travel range.

Information

During the search, all drive controllers within the broadcast domain are found via IPv4 limited broadcast.

Prerequisites for finding a drive controller in the network:

- Network supports IPv4 limited broadcast
- All drive controllers are in the same subnet (broadcast domain)

Drive controller without SE6 option

✓ You have verified the plausibility of the predefined test motion variables.

✓ The drive controllers are switched on.

1. In the project tree, highlight the module under which you have recorded your drive controller and click Assignment and live firmware update in the project menu.
   ⇨ The Add connection window opens. All drive controllers found via IPv4 limited broadcast are displayed.
2. Direct connection tab > IP address column:
   Activate the IP addresses in question and confirm your selection with OK.
   ⇨ The Assignment and live firmware update window opens. All drive controllers connected through the previously selected IP addresses are displayed.
3. Select the drive controller to which you want to transmit a configuration and change the selection of the transmission type from Read to Send.
4. Change the selection Create new drive controller:
   Select the configuration that you would like to transfer to the drive controller.
5. Repeat steps 3 and 4 for all other drive controllers to which you would like to transfer your configuration.
6. Online tab:
   Click on Establish online connection.

⇨ The configurations are transferred to the drive controllers.

Drive controller with SE6 option

✓ You have verified the plausibility of the predefined test motion variables.

✓ The drive controllers are switched on.

1. In the project tree, highlight the module under which you have recorded your drive controller and click Assignment and live firmware update in the project menu.
   ⇨ The Add connection window opens. All drive controllers found via IPv4 limited broadcast are displayed.
2. Direct connection tab > IP address column:
   Activate the IP addresses in question and confirm your selection with OK.
   ⇨ The Assignment and live firmware update window opens. All drive controllers connected through the previously selected IP addresses are displayed.
3. Select the drive controller to which you want to transmit a configuration and change the selection of the transmission type from Read to Send.
4. Change the selection Create new drive controller:
   Select the configuration that you would like to transfer to the drive controller.
5. Repeat steps 3 and 4 for all other drive controllers to which you would like to transfer your configuration.
6. Online tab:
   Click on Establish online connection.

⇨ The configurations are transferred to the drive controllers.

⇨ A dialog box prompts you to open the PASmotion configuration tool.

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1. Confirm the dialog box with Yes.
   ⇨ PASmotion opens.
2. In the PASmotion project administration, navigate to the safety module for the drive controller and double-click to open it.
   ⇨ The dialog box for the password prompt opens.
3. Enter the password and confirm with OK.
   ⇨ The wizard for device synchronization opens.
   ⇨ Device configuration and configuration are checked against each other automatically.
4. Optional: If the configurations match, click on Done after device synchronization has finished.
5. Optional: If the configurations do not match, click on Next after device synchronization has finished.
   5.1. Confirm the production number of the safety module and click Next.
   5.2. Enter the password for the configuration on the safety module and click Next.
   5.3. Click Upload to transfer the device configuration to the project.
   5.4. After the successful transfer, click Done.
6. Exit PASmotion.

⇨ The safety configuration is transferred to the selected drive controller.

11.3.1.2 Saving the configuration

✓ You have successfully transferred the configurations.

1. Assignment and live firmware update window:
   Click on Save values (A00).
   ⇨ The Save values (A00) window opens.
2. Click on Start action.
   ⇨ The configurations are saved.
3. Close the Save values (A00) window.
4. Assignment and live firmware update window:
   Click on Restart (A09).
   ⇨ The Restart (A09) window opens.
5. Click on Start action.
6. Confirm the safety instruction with OK.
   ⇨ The Restart (A09) window closes.
   ⇨ The fieldbus communication and connection to DriveControlSuite are interrupted.
   ⇨ The drive controllers restart.

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11.3.1.3 Activating the control panel and testing the configuration

⚠ WARNING!

Injury to persons and material damage due to axis movement!

By activating the control panel, you have sole control over the movements of the axis using DriveControlSuite. If you are using a controller, it no longer monitors the axis movements after the control panel is activated. The controller cannot intervene to prevent collisions. The controller takes over control again when the control panel is deactivated, which can cause unexpected axis movements.

- Only use the control panel if you have visual contact with the axis.
- Make sure that no people or objects are within the travel range.

✓ You have successfully saved the configurations.

✓ There must not be any active safety function.

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Jog control panel wizard.
3. Click Control panel on and then Enable.
   ⇨ The drive is controlled using the activated control panel.
4. Move the axis step-by-step and test the direction of motion, velocity, distances, etc. using the Jog+, Jog–, Jog step+ and Jog step– buttons.
5. Optimize your project configuration based on your test results as necessary.
6. To deactivate the control panel, click on Control panel off.

Information

Jog+ and Jog– cause a continual manual movement in the positive or negative direction. Jog step+ and Jog step- move the axis relative to the current actual position by the increment specified in I14.

Jog+ and Jog– have a higher priority than Jog step+ and Jog step–.

11.3.2 Test using the operating unit of the drive controller

You have connected the SD6 drive controller along with its accessories as described and would like to test the components in the group for correct wiring and functionality. STOBER standard parameterization enables an initial function test if you are operating the drive controller together with a STOBER synchronous servo motor and an EnDat encoder. In this case, the electronic nameplate of the motor is read out when the device starts and the accompanying data is transferred into the drive controller.

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11.3.2.1 Schematic test sequence

Schematic test sequence

The following illustration shows the schematic sequence of the wiring and function test.

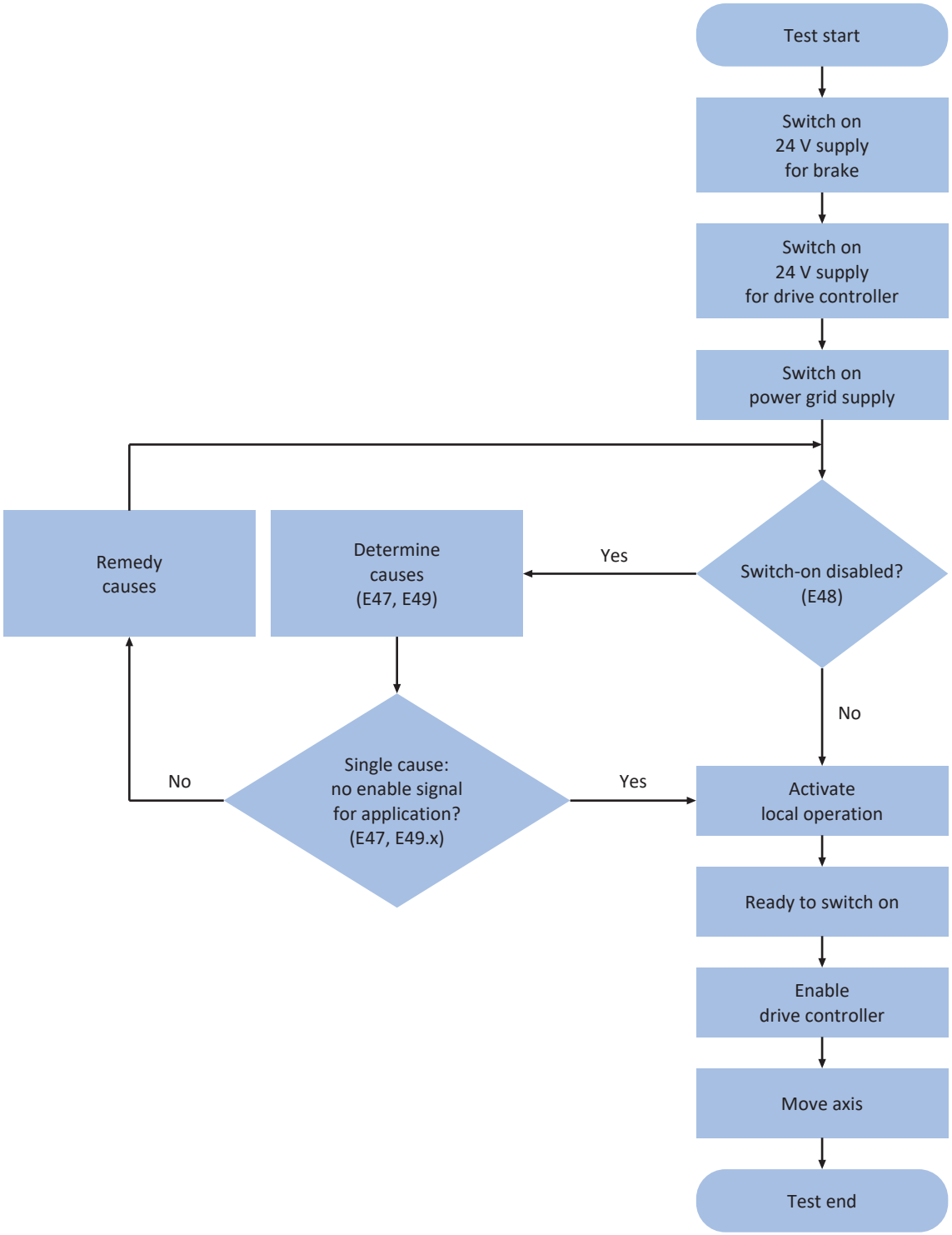

Fig. 27: Schematic test sequence for wiring and function test

11.3.2.2 Practical test sequence

⚠ DANGER!

Danger to life from moving parts!

Motor shaft rotates during the wiring and function test described below!

- Clear the danger area before the test.
- Do not connect any downstream mechanical parts to the motor or gear unit until the test has finished.
- Make sure that components attached to the motor, such as feather keys or coupling elements, are sufficiently secured against centrifugal forces.

Perform the individual steps in the specified order.

Preparing for the test

1. Switch on the 24 V_{DC} supply of the brake.
2. Switch on the 24 V_{DC} supply of the drive controller.
3. Switch on the power grid supply.
4. Optional: If you are using the ST6 safety module, deactivate the STO safety function, such as by connecting 24 V_{DC} to terminal X12.
5. Optional: If you use the SE6 safety module, deactivate the STO safety function by connecting terminals X14 and X15 according to your safety configuration.

⇨ The drive controller either switches to the "ready to switch on" or "locked" state.

Performing the test

✓ Drive controller is ready to switch on:

1. Activate local operation using the [Manual] button.
2. Enable the drive controller using the [I/O] button.
3. Rotate the motor axis using the left and right arrow buttons at the velocity and acceleration configured in parameter I12.

⇨ You have correctly wired all components; the function test completed successfully.

✓ Drive controller is locked (display = 1: Switch-on disable, parameter E48):

1. Determine the causes for the switch-on lockout and remedy them:
   Parameter E49 outputs possible causes in code and parameter E47 shows them in plain text.
2. Then, carry out the test (see the section "Drive controller is ready to switch on").

Information

If the lack of enable signal for the CiA 402 application is the sole cause for the switch-on lockout, switch to local operation directly and carry out the test (see the section "Drive controller is ready to switch on").

Finishing the test

1. Lock the drive controller using the [I/O] button.
2. Switch to normal operation using the [Manual] button.

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12 Replacement

The following chapters describe the replacement of a drive controller and the available accessories.

12.1 Safety instructions for device replacement

Replacement work is permitted only when no voltage is present. Observe the 5 safety rules; see the chapter Working on the machine [▶ 15].

When the power supply voltage is turned on, hazardous voltages may be present on the connection terminals and the cables connected to them.

The device is not reliably de-energized simply because the voltage supply is switched off and all displays are blank!

Information

Note that you can only determine that voltage is no longer present once the discharge time has elapsed. The discharge time depends on the self-discharge of the drive controller. You can find the discharge time in the general technical data of the drive controller.

Protect the devices against falling parts (bits or strands of wire, pieces of metal, etc.) during installation or other work in the control cabinet. Parts with conductive properties may result in a short circuit inside the devices and device failure as a result.

Opening the housing, plugging in or unplugging connection terminals, connecting or removing a connecting wiring, and installing or removing accessories are prohibited while the voltage supply is switched on.

If you couple the drive controllers in the DC link, make sure that all Quick DC-Link modules are built over with a drive controller again after replacement.

The device housing must be closed before you turn on the supply voltage.

12.2 Notes on the safety configuration

A drive controller with expanded safety function through the SE6 safety module always requires a valid safety configuration. If this is missing, an error message is generated.

The safety configuration of the safety module has a unique CRC overall checksum which also uses encryption to store the serial number of the safety module. Various safety modules can have identical safety functions despite this. In this case, the CRC checksums match the safety functions.

The safety configuration is saved on the safety module. In addition, a copy of the configuration is saved on the Paramodul. If you replace a drive controller, you can continue using the Paramodul and, as a result, the safety configuration of the drive controller being replaced. You can find a description of the procedure in chapter Replacing the drive controller [▶ 148].

The checksums are displayed using parameter S09 Safety modul SE6 checksum of safety configuration. The checksum of the safety functions is output in element 2.

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12.3 Notes on motor replacement

When replacing a STOBER synchronous servo motor with EnDat encoder and electronic nameplate, the drive controller detects that a motor replacement has been performed upon switching on the drive controller (prerequisite: B04 = 64: Active).

As a response, the drive controller reads out the changed data from the electronic nameplate, transmits this data to the corresponding parameters and reports the process using a fault of type 81: Motor allocation. Based on the cause of the fault, you can recognize what has changed.

In order to accept the changed data into the Paramodul and thus save it in non-volatile memory, you must carry out the action Save values in parameter A00. As an alternative, save the data using the save button on the display.

Otherwise, the next time the drive controller is switched on, the electronic nameplate is read out again and the changed data is reported using a fault of type 81: Motor allocation.

12.4 Replacing the drive controller

⚠ WARNING!

Electrical voltage! Risk of fatal injury due to electric shock!

- Always switch off all power supply voltage before working on the devices!
- Note the discharge time of the DC link capacitors in the general technical data. You can only determine the absence of voltage after this time period.

ATTENTION!

Loss of absolute position!

The absolute position in the encoder is lost if the encoder cable is disconnected from the AES battery module.

- Do not disconnect the encoder cable from the AES during service work! Disconnect the AES from the drive controller.

ATTENTION!

Damage to property due to electrostatic discharge!

Take appropriate measures when handling exposed circuit boards, e.g. wearing ESD-safe clothing.

Do not touch contact surfaces.

Information

The safety module is a permanently integrated component in the drive controller where any design, technical and electrical modifications are prohibited!

Tools and material

You will need:

- Tool for loosening and tightening the fastening screws

Requirements and replacement

✓ Drive controllers of the same series and same power can be replaced interchangeably.

✓ The hardware and firmware of the drive controller being installed have the same or a newer version than the drive controller being replaced. You can find information about firmware updates in chapter Replacing or updating firmware using DS6 [▶ 150].

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✓ The Paramodul of the drive controller being replaced is present; the original project is stored on the Paramodul.

1. Optional: If an AES battery module is present, disconnect the AES from the drive controller.
2. Remove all terminals from the drive controller being uninstalled.
3. Release the grounding conductor from the ground bolt.
4. Sizes 0 to 2: Unscrew the upper fastening screw slightly and remove the lower one to allow removal of the EM6A0 EMC shroud.
5. Remove the fastening screws and take the drive controller out of the control cabinet. Note that, if you couple the drive controller to the DC link over Quick DC-Link or you use a rear section braking resistor, you first have to press the drive controller up at the guides before you can remove it from the control cabinet.
6. Remove the Paramodul of the new drive controller being installed.
7. Insert the Paramodul with the original project into the drive controller being installed.
8. Optional: Remove the communication and terminal modules from the drive controller being replaced if no accessories have been provided with the new drive controller.
9. Optional: Install the accessories into the new drive controller.
10. Install the new drive controller in the control cabinet.
11. Connect the grounding conductor to the ground bolt. Note the instructions and requirements in the chapter Protective grounding [▶ 66].
12. Reattach the terminals.
13. Optional: If an AES battery module was present, attach it to the drive controller with the associated encoder cable. Tighten the knurled screws so that AES is securely connected to the drive controller.
14. Start the drive controller.
15. Optional: If you are using the expanded safety functionality through the SE6 safety module, press the left and right arrow buttons simultaneously for 2 seconds after the corresponding prompt in order to activate the safety functions.
    ⇨ The transmission of configuration data from the Paramodul starts.
    ⇨ Data transmission is shown on the display.
    ⇨ The safety configuration saved on the Paramodul is saved in the safety module.
    ⇨ After successful data transmission, a fault event is shown on the display.
16. Optional: If the safety functions have activated in the previous step, acknowledge the fault event with [Esc].
17. Take the inserted Paramodul back out and insert the new Paramodul removed in step 5 into the drive controller.
18. Press the [Save] button for 3 seconds.
    ⇨ All data is saved into the non-volatile memory on the Paramodul.
19. Then restart the drive controller, such as using control unit's 24 V_{DC} power supply.
20. Optional: If you are using the expanded safety functionality through the SE6 safety module, check whether the checksum stored in the replaced drive controller's machine documentation for the safety functions matches the checksum of the new drive controller. The checksum is shown on the display. Acknowledge the display with [Esc]. Alternatively, parameter S09 Safety modul SE6 checksum of safety configuration in element 2 is used to display the checksum.

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12.5 Replacing or updating firmware using DS6

If you need a different firmware version or a drive controller needs to be updated with an older firmware version, you can change the firmware using the DriveControlSuite commissioning software. You can prepare a live firmware update while the drive controller and machine are operating. The update does not take effect until after a restart. This dual firmware behavior prevents a firmware loss or appearance of a case of service, since it ensures, for example, that the existing firmware can be accessed if the connection is interrupted.

In order to perform a live firmware update, you must connect your PC and the drive controller over the network.

Information

During the search, all drive controllers within the broadcast domain are found via IPv4 limited broadcast.

Prerequisites for finding a drive controller in the network:

- Network supports IPv4 limited broadcast
- All drive controllers are in the same subnet (broadcast domain)

Carrying out a live firmware update

✓ The drive controller is switched on.

1. Start DriveControlSuite.
2. Click Assignment and live firmware update.
   ⇨ The Add connection window opens.
3. Direct connection tab > IP address column:
   Activate the IP address in question and confirm your selection with OK.
   ⇨ The Assignment and live firmware update window opens. The drive controller that is connected using the selected IP address is displayed.
4. Live firmware update tab:
   By default, the newest firmware version suitable for the DriveControlSuite version is selected. Click Assign default version to all drive controllers.
   ⇨ The selection No live firmware update for the drive controller changes to Default version.
5. Optional: If you want to assign an alternative, locally saved firmware version to a drive controller, proceed as follows:
   5.1. Click on Add new firmware version, navigate to the directory and load the file.
   5.2. Then change the selection from Default version of the drive controller to Alternative version and select the previously uploaded firmware version from the associated picklist.
6. Live firmware update tab:
   Click Start live firmware update.
7. Confirm the safety instruction with OK.
   ⇨ The firmware update is transferred.
8. Since the firmware update only takes effect after the drive controller is restarted, click Restart all drive controllers after completing the transfer.
9. Confirm the restart with Yes.

⇨ The fieldbus communication and connection to DriveControlSuite are interrupted and the drive controller restarts.

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13 Appendix

13.1 Terminal specifications

Relevant information for project configuration of the connecting wiring can be taken from the following chapters.

EN 60204-1 contains basic recommendations that should be taken into account when selecting conductors. The chapter "Conductors and cables" provides specifications for the maximum current carrying capacity of conductors based on the way they are laid as well as tips for derating, for example in the case of increased surrounding temperatures or lines with multiple loaded individual conductors.

⚠ WARNING!

Personal injury and material damage due to electric shock and thermal overload!

- Prepare the conductor ends according to the terminal specifications.
- In the case of pre-made cables and conductors, check the conductor ends and adjust them if necessary.

13.1.1 Overview

The following tables clarify which specifications must be observed for which connections depending on the type of drive controller or accessory.

Drive controller

Type	X1	X10, X20	X11	X30
SD6A02	FMC 1,5 -ST-3,5 [▶ 152]	GFKC 2,5 -ST-7,62 [▶ 155]	BLDF 5.08 180 SN [▶ 154]	GFKIC 2.5 -ST-7.62 [▶ 156]
SD6A04				
SD6A06				
SD6A14		SPC 5 -ST-7,62 [▶ 156]		ISPC 5 -STGCL-7,62 [▶ 157]
SD6A16				
SD6A24		SPC 16 -ST-10,16 [▶ 157]		ISPC 16 -ST-10,16 [▶ 158]
SD6A26				
SD6A34		MKDSP 25 -15,00 [▶ 158]		—
SD6A36				
SD6A38				

Tab. 152: Terminal specifications for the base device

Safety module

Type	X2, X5, X6[34]	X12
ST6	BFL 5.08HC 180 SN [▶ 154]	BCF 3,81 180 SN [▶ 153]

Tab. 153: Terminal specifications of the ST6 safety module

Type	X2, X5, X7, X8[35]	X14, X15
SE6	BFL 5.08HC 180 SN [▶ 154]	DFMC 1.5 -ST-3.5 [▶ 155]

Tab. 154: Terminal specifications of the SE6 safety module

Terminal modules

Type	X100, X101	X102, X103
XI6	FK-MCP 1,5 -ST-3,5 [▶ 153]	FMC 1,5 -ST-3,5 [▶ 152]
RI6		—
IO6		—

Tab. 155: Terminal specifications for the terminal modules

Encoder adapter box

Type	X302, X305, X306	X303
LA6	FK-MCP 1,5 -ST-3,5 [▶ 153]	BFL 5.08HC 180 SN [▶ 154]

Tab. 156: Terminal specifications for the encoder adapter box

13.1.2 FMC 1,5 -ST-3,5

Feature	Line type	Value
Contact spacing	—	3.5 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 8 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm²
	Flexible with end sleeve without plastic collar	1.5 mm²
	Flexible with end sleeve with plastic collar	0.75 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	16
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	24
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 157: FMC 1,5 -ST-3,5 specification

[34] In addition to connections for the safety technology, the functional connections X2, X5, X6 are also located on the ST6 safety module (not related to the safety technology).
[35] In addition to connections for the safety technology, the connections X2 and X5 are also located on the SE6 safety module (not related to the safety technology).

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13.1.3 FK-MCP 1,5 -ST-3,5

Feature	Line type	Value
Contact spacing	—	3.5 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 8 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm²
	Flexible with end sleeve without plastic collar	1.5 mm²
	Flexible with end sleeve with plastic collar	0.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	16
Min. conductor cross-section	Flexible without end sleeve	0.14 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	28
Insulation stripping length	—	9 mm
Tightening torque	—	—

Tab. 158: FK-MCP 1,5 -ST-3,5 specification

13.1.4 BCF 3,81 180 SN

Feature	Line type	Value
Contact spacing	—	3.81 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 16 A/10 A/11 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm²
	Flexible with end sleeve without plastic collar	1.0 mm²
	Flexible with end sleeve with plastic collar	1.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	16
Min. conductor cross-section	Flexible without end sleeve	0.14 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 159: BCF 3.81 180 SN BK specification

13.1.5 BFL 5.08HC 180 SN

Feature	Line type	Value
Contact spacing	—	5.08 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 16 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm²
	Flexible with end sleeve without plastic collar	2.5 mm²
	Flexible with end sleeve with plastic collar	2.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.2 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 160: BFL 5.08HC 180 SN specification

13.1.6 BLDF 5.08 180 SN

Feature	Line type	Value
Contact spacing	—	5.08 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 14 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm²
	Flexible with end sleeve without plastic collar	2.5 mm²
	Flexible with end sleeve with plastic collar	2.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.2 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 161: BLDF 5.08 180 SN specification

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13.1.7 DFMC 1.5 -ST-3.5

Feature	Line type	Value
Contact spacing	—	3.5 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 8 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm²
	Flexible with end sleeve without plastic collar	1.5 mm²
	Flexible with end sleeve with plastic collar	0.75 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	16
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	24
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 162: Specification for DFMC 1.5 -ST-3.5

13.1.8 GFKC 2,5 -ST-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 12 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm²
	Flexible with end sleeve without plastic collar	2.5 mm²
	Flexible with end sleeve with plastic collar	2.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	1.0 mm²
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm²
	AWG according to UL/CSA	26/24
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 163: GFKC 2,5 -ST-7,62 specification

13.1.9 GFKIC 2.5 -ST-7.62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 12 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm²
	Flexible with end sleeve without plastic collar	2.5 mm²
	Flexible with end sleeve with plastic collar	2.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	1.0 mm²
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm²
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 164: Specification for GFKIC 2.5 -ST-7.62

13.1.10 SPC 5 -ST-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 32 A/35 A/35 A
Max. conductor cross-section	Flexible without end sleeve	6.0 mm²
	Flexible with end sleeve without plastic collar	6.0 mm²
	Flexible with end sleeve with plastic collar	4.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	1.5 mm²
	AWG according to UL/CSA	8
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.25 mm²
	AWG according to UL/CSA	24
Insulation stripping length	—	12 – 15 mm
Tightening torque	—	—

Tab. 165: SPC 5 -ST-7,62 specification

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13.1.11 ISPC 5 -STGCL-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 32 A/35 A/35 A
Max. conductor cross-section	Flexible without end sleeve	6.0 mm²
	Flexible with end sleeve without plastic collar	6.0 mm²
	Flexible with end sleeve with plastic collar	4.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	1.5 mm²
	AWG according to UL/CSA	8
Min. conductor cross-section	Flexible without end sleeve	0.2 mm²
	Flexible with end sleeve without plastic collar	0.25 mm²
	Flexible with end sleeve with plastic collar	0.25 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.25 mm²
	AWG according to UL/CSA	24
Insulation stripping length	—	15 mm
Tightening torque	—	—

Tab. 166: ISPC 5 -STGCL-7,62 specification

13.1.12 SPC 16 -ST-10,16

Feature	Line type	Value
Contact spacing	—	10.16 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 55 A/66 A/66 A
Max. conductor cross-section	Flexible without end sleeve	16.0 mm²
	Flexible with end sleeve without plastic collar	16.0 mm²
	Flexible with end sleeve with plastic collar	10.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	4.0 mm²
	AWG according to UL/CSA	4
Min. conductor cross-section	Flexible without end sleeve	0.75 mm²
	Flexible with end sleeve without plastic collar	0.75 mm²
	Flexible with end sleeve with plastic collar	0.75 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.75 mm²
	AWG according to UL/CSA	20
Insulation stripping length	—	18 mm
Tightening torque	—	—

Tab. 167: SPC 16 -ST-10,16 specification

13.1.13 ISPC 16 -ST-10,16

Feature	Line type	Value
Contact spacing	—	10.16 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 55 A/66 A/66 A
Max. conductor cross-section	Flexible without end sleeve	16.0 mm²
	Flexible with end sleeve without plastic collar	16.0 mm²
	Flexible with end sleeve with plastic collar	10.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	4.0 mm²
	AWG according to UL/CSA	4
Min. conductor cross-section	Flexible without end sleeve	0.75 mm²
	Flexible with end sleeve without plastic collar	0.75 mm²
	Flexible with end sleeve with plastic collar	0.75 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.75 mm²
	AWG according to UL/CSA	20
Insulation stripping length	—	18 mm
Tightening torque	—	—

Tab. 168: SPC 16 -ST-10,16 specification

13.1.14 MKDSP 25 -15,00

Feature	Line type	Value
Contact spacing	—	15.0 mm
Nominal current at ϑ_{amb} = 40 °C	—	CE/UL/CSA: 125 A/115 A/115 A
Max. conductor cross-section	Flexible without end sleeve	35.0 mm²
	Flexible with end sleeve without plastic collar	35.0 mm²
	Flexible with end sleeve with plastic collar	35.0 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	16.0 mm²
	AWG according to UL/CSA	2
Min. conductor cross-section	Flexible without end sleeve	0.5 mm²
	Flexible with end sleeve without plastic collar	1.0 mm²
	Flexible with end sleeve with plastic collar	1.5 mm²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm²
	AWG according to UL/CSA	20
Insulation stripping length	—	18 mm
Tightening torque	Conductor cross-sections ≤ 25.0 mm²	2.5 Nm
	Conductor cross-sections > 25.0 mm²	4.5 Nm

Tab. 169: MKDSP 25 -15,00 specification

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13.2 Wiring examples

The following chapters show the basic connection using examples.

Information

For UL-compliant operation: The connections marked with PE are intended solely for the functional grounding.

13.2.1 Stand-alone operation with direct brake control

The following graphic shows a wiring example for the stand-alone operation of SD6 with direct brake control.

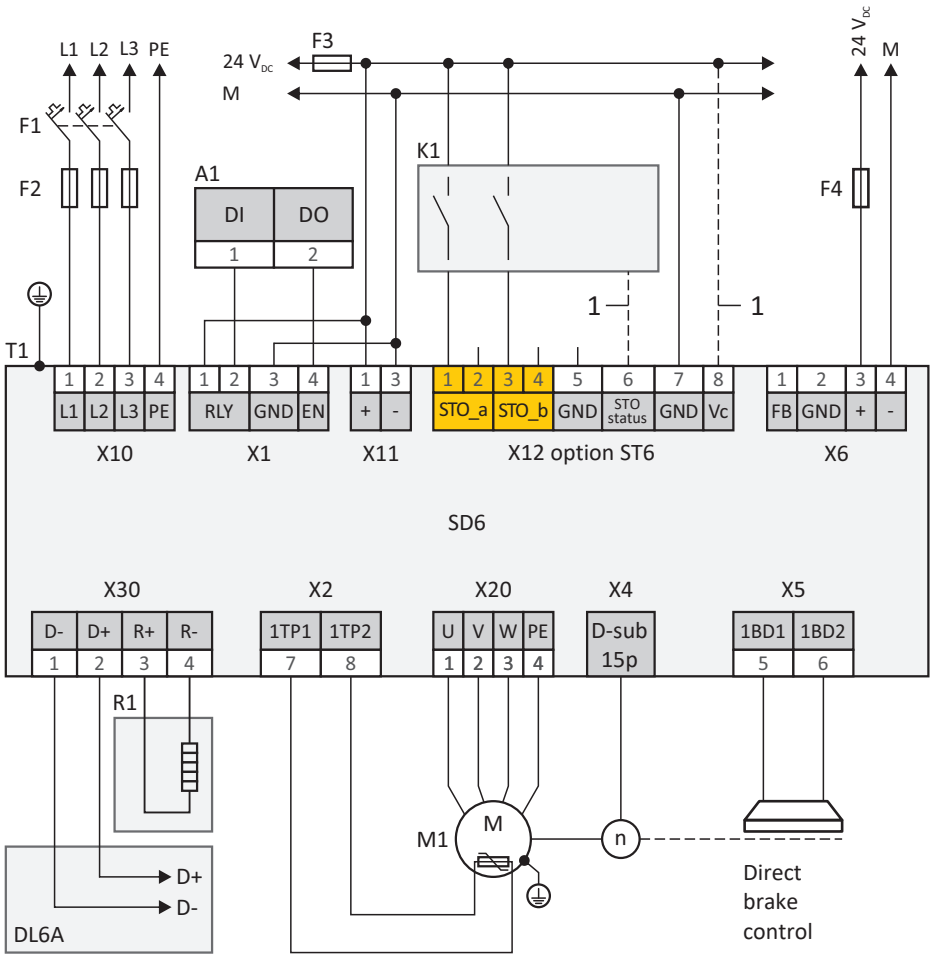

Fig. 28: Wiring example of stand-alone operation with direct brake control

A1	Controller
F1 – F4	Fuse
K1	Safety relay
L1 – L3	Three-phase power supply
M	Reference potential
M1	Motor
R1	Braking resistor
T1	Drive controller
1	Optional connection

13.2.2 Stand-alone operation with indirect brake control

The following graphic shows a wiring example for the stand-alone operation of SD6 with indirect brake control.

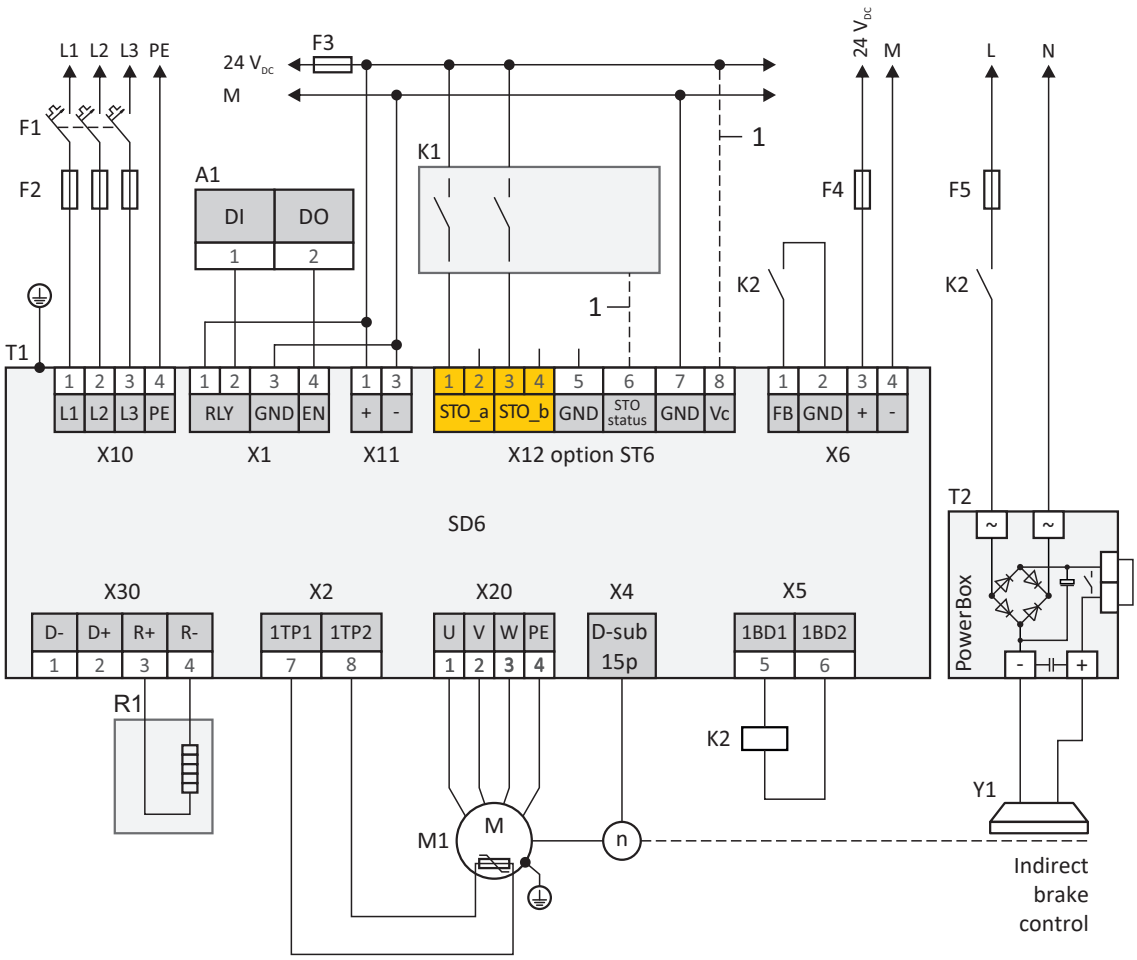

Fig. 29: Wiring example of stand-alone operation with indirect brake control

A1	Controller
F1 – F5	Fuse
K1	Safety relay
K2	Contactor
L	230 V_{AC} supply
L1 – L3	Three-phase power supply
M	Reference potential
24 V_{DC}	24 V_{DC} supply
M1	Motor
N	Neutral conductor
R1	Braking resistor
T1	Drive controller
T2	Brake rectifier
Y1	Brake
1	Optional connection

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13.3 Detailed information

The documentation listed in the following table offers additional relevant information.

Current document versions can be found at http://www.stoeber.de/en/downloads/.

Device/Software	Documentation	Contents	ID
SD6 drive controller	Manual	System design, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442426
Connection method	Manual	Selection of encoder, power and hybrid cables, accessories, technical data, connection	443102
CiA 402 application – SD6	Manual	Project planning, configuration, parameterization, function test, detailed information	443077
Drive Based (DB) application	Manual	Project planning, configuration, parameterization, function test, detailed information	442706
Drive Based Synchronous (DBS) application	Manual	Project planning, configuration, parameterization, function test, detailed information	443046
ST6 safety technology – STO via terminals	Manual	Technical data, installation, commissioning, diagnostics	442478
SE6 safety technology – Safe drive monitoring via terminals	Manual	Technical data, installation, commissioning, diagnostics	442796
CANopen communication – SD6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	442637
EtherCAT communication – SD6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	442516
PROFINET communication – SD6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	442710

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13.4 Formula symbols

Symbol	Unit	Explanation
C_{maxPU}	F	Maximum charging capacity of the power unit
C_{PU}	F	Self-capacitance of the power unit
f_{2PU}	Hz	Output frequency of the power unit
$f_{PWM,PU}$	Hz	Frequency of the pulse width modulation of the power unit
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_{2max}	A	Maximum output current
I_{2maxPU}	A	Maximum output current of the power unit
$I_{2N,PU}$	A	Nominal output current of the power unit
P_{effRB}	W	Effective power at the external braking resistor
P_{maxRB}	W	Maximum power at the external braking resistor
$P_{N,PU}$	W	Nominal power of the power unit
R_{2minRB}	Ω	Minimum resistance of the external braking resistor
R_{intRB}	Ω	Resistance of the internal braking resistor
U_{1CU}	V	Input voltage of the control unit
U_{1PU}	V	Input voltage of the power unit
U_2	V	Output voltage
U_{2max}	V	Maximum output voltage
U_{2PU}	V	Output voltage of the power unit
U_{offCH}	V	Switch-off threshold of the brake chopper
U_{onCH}	V	On limit of the brake chopper

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13.5 Abbreviations

Abbreviation	Meaning
AC	Alternating Current
AI	Analog Input
AO	Analog Output
BG	Baugröße (en: size)
CAN	Controller Area Network
CiA	CAN in Automation
CNC	Computerized Numerical Control
DC	Direct Current
DI	Digital Input
DO	Digital output
EMC	Electromagnetic Compatibility
EtherCAT	Ethernet for Control Automation Technology
HTL	High Threshold Logic
I/O	Input/Output
IP	International Protection
IP	Internet Protocol
NAT	Nennansprechtemperatur (en: Nominal response temperature)
PE	Protective Earth (i.e. grounding conductor)
PELV	Protective Extra Low Voltage
PL	Performance Level
PTC	Positive Temperature Coefficient
RCD	Residual Current protective Device
SBC	Safe Brake Control
SIL	Safety Integrity Level
PLC	Programmable Logic Controller
SSI	Serial Synchronous Interface
STO	Safe Torque Off
TTL	Transistor-Transistor Logic
UL	Underwriters Laboratories

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14 Contact

14.1 Consultation, service and address

We would be happy to help you!

We offer a wealth of information and services to go with our products on our website:
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http://www.stoeber.de/en/support

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applications@stoeber.de

Do you need a replacement device?:
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replace@stoeber.de

Call our 24-hour service hotline:
Phone +49 7231 582-3000

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14.2 Your opinion is important to us

We created this documentation to the best of our knowledge with the goal of helping you build and expand your expertise productively and efficiently with our products.

Your suggestions, opinions, wishes and constructive criticism help us to ensure and further develop the quality of our documentation.
If you want to contact us for a specific reason, we would be happy to receive an e-mail from you at:
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Thank you for your interest.
Your STOBER editorial team

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