

Multi-axis drive system with SI6 and PS6 Manual



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1 Foreword

The completely re-designed STOBER multi-axis drive system consists of the SI6 drive controller and PS6 supply module combination. Matching Quick DC-Link modules handle the energy supply for the networked drive controllers. The SI6 drive controller is available in four sizes as a single or double-axis controller with a nominal output current of up to 50 A. The PS6 supply module is available in two sizes with a nominal power of 10 kW or 20 kW. As an economically attractive system with a minimized device width, the SI6 opens a new dimension in multi-axis applications.

Features

- Sensorless position control by STOBER Lean motors
- Control of rotary synchronous servo motors, asynchronous motors and torque motors
- HIPERFACE DSL One Cable Solution
- Electronic motor nameplate via HIPERFACE DSL and EnDat 2.2 digital encoder interfaces
- Integrated EtherCAT or PROFINET communication
- STO safety technology using terminals or STO and SS1 using FSoE (Safety over EtherCAT): SIL 3, PL e (cat. 4)
- Integrated brake control
- Energy supply over DC link connection
- Asymmetric load on double-axis controllers for operation of motors with different power
- Variable feed-in power using supply modules that can be connected in parallel

2 User information

This documentation covers the SI6 and PS6 multi-axis drive systems. You will receive support for the assembly of the individual modules along with the associated components that you will need for the operation of the modules in the control cabinet.

You will also find information for 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 general conditions.

Information

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

2.1 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.

2.2 Described product type

This documentation is binding for:

SI6 drive controller and PS6 supply module in combination with DriveControlSuite software in V 6.3-E or later and associated firmware in V 6.3-E or later.

2.3 Timeliness

Check whether this document is the most up-to-date version of the documentation. We provide the latest document versions for our products for download on our website: <http://www.stoeber.de/en/download>.

2.4 Original language

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

2.5 Limitation of liability

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

STOBER shall assume no responsibility for damage resulting 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 projecting and operation of the product by unqualified personnel.

2.6 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.

2.6.1 Use of symbols

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!

Notice

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.

2.6.2 Markup of text elements

Certain elements of the body text are distinguished as follows.

Quick DC-Link module	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.stoeber.de	External cross-reference

Software and display indicators

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

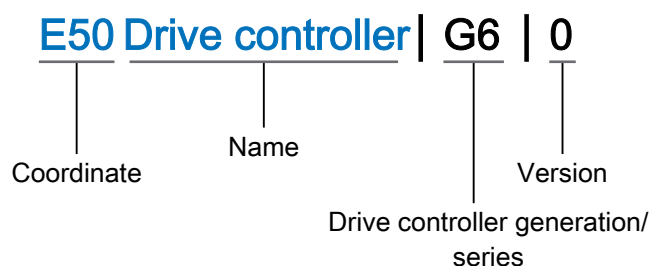
Main menu Settings	Window names, dialog names, page names or buttons, combined proper nouns, functions referenced by the interface
Select Referencing method A	Predefined entry
Save your <own IP address>	User-defined entry
EVENT 52: COMMUNICATION	Display indicators (status, messages, warnings, faults)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

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.



2.6.3 Conventions for cables

In the cable connection descriptions, core colors are shortened and used as follows.

Cable colors

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

Formatting conventions

Two-colored core:	WHYE	WHITEYELLOW (white and yellow)
Single-colored core:	BK/BN	BLACK/BROWN (black or brown)

2.7 Symbols, marks and test symbols

The following symbols, marks and test symbols are used in this document.



Grounding symbol

Grounding symbol in accordance with IEC 60417-5019 (DB:2002-10).



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.

2.8 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.
HIPERFACE [®]	HIPERFACE [®] and the HIPERFACE DSL [®] logo are registered trademarks of SICK STEGMANN GmbH, Donaueschingen, Germany.
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 [®] , springtec [®]	speedtec [®] and springtec [®] are registered trademarks of TE Connectivity Industrial GmbH, 94559 Niederwinkling, Germany.

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.

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 61326-3-1:2008
- EN 61800-3:2004 and A1:2012
- EN 61800-5-1:2007
- EN 61800-5-2:2007
- EN 50178:1997
- IEC 61784-3:2010

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 authorization to perform these tasks 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 DIN EN 50178, SC6 drive controllers and PS6 supply modules are electrical devices operating as power electronics to control the flow of energy in high-voltage systems.

The SI6 drive controller is intended solely for the operation of STOBER LM series Lean motors, synchronous servo motors (e.g. from the STOBER EZ series), asynchronous motors or torque motors.

The PS6 supply module is intended solely for the supply of one or more drive controllers. Only drive controllers of the 6th generation of STOBER drive controllers may be connected to the PS6.

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

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 provisions from the following EC and EU directives:

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

EMC-compliant installation

The SI6 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 SI6 drive controller and the accessories.

Maintenance

The SI6 drive controller and accessories are maintenance-free. For the safety module, take appropriate measures to detect or prevent possible errors in the connection wiring.

Product life span

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.

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. If you have to transport or store the products, you must protect them from mechanical impacts and vibrations as well as observe the recommended transport and storage conditions in the technical data.

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

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 designed exclusively for operation in TN networks.

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

The PS6 supply module is intended only for operation on TN networks and is suitable only for use on supply grids that are able to deliver, at most, a maximum symmetrical nominal short-circuit current in accordance with the following table between 200 and 480 V_{AC}.

Size	Max. symm. nominal short-circuit current
Size 2 and size 3	5000 A

Tab. 1: Maximum symmetrical nominal short-circuit current of the supply module

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 the 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 and, if applicable, the fast discharge. You can find the discharge time in the general technical data.

3.7 Disposal

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

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

3.8 Firefighting



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 (CO₂) for firefighting.

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}.

Project configuration

Observe the notes in the chapter [Project configuration](#) [▶ 76].

You can find an order overview of the hardware components in the chapter [Order overview of the hardware components](#) [▶ 83].

The maximum number of devices in the device group is limited by certain variables. The nominal output current $I_{2N,PU}$ of the supply module, the charging capacity C_{PU} of the supply module and the maximum copper rail length of 1500 mm must not be exceeded.

For this purpose, observe the information in the chapter [Example design for UL-compliant operation](#) [▶ 80].

Line fuse

Mark each device group and observe the specifications in the chapter [UL-compliant line fuse](#) [▶ 105] to ensure that the line fuses of the supply modules with power are UL-compliant.

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 1, and any additional local codes.

Grounding


1. Protective grounding

The external motors which are connected to the inverter units SI6 units shall not be grounded over the modular drive system. The bonding/grounding of the motor(s) shall occur in the end use application in accordance with the requirements of applicable electrical codes/standards.

The grounding provisions present on the terminals X20A/X20B of the SI6 unit are not intended for safety grounding of the motors. The grounding provision present on terminal X10 of the inverter unit is not to be used for the grounding of the drive system.

The chassis of the PS6A/SI6A units is to be bonded through the M6 grounding studs on the PS6A units (4.0 Nm, 35 Lb.inch).

The chassis of the SI6A units are to be bonded by means of proper mounting of the SI6A unit(s) by means of two mounting screws on top of the DL6B unit(s). The specified tightening torque for these mounting screws on the DL6B units is: 3.5 Nm (31 Lb.inch).

The connection for the protective grounding on the housing is identified by the following grounding symbol .

Observe the notes in the chapter [UL-compliant housing grounding \[▶ 108\]](#) for correct installation.

2. Functional grounding

In addition to the protective grounding, a functional grounding is required for proper operation of the PS6 drive system in combination with SI6 and of the motor. The functional grounding of the PS6 drive system in combination with SI6 is connected using the terminal X10. The functional grounding of the motor is connected using the terminals X20A and X20B. The connections for the functional grounding to terminals X10, X20A and X20B are marked with **PE**. For UL-compliant operation: The connections marked with PE are intended solely for the functional grounding.

Terminals

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size. You can see an overview of the available terminal sets in the chapter [Order overview of the hardware components \[▶ 83\]](#).

Motor overload protection/motor temperature protection

Use motor overload protection/motor temperature protection. The SI6 drive controller features connections for PTC thermistors (NAT 145 °C, sensor voltage = 3.3 V, sensor current = 0.6 A). The devices are only intended to be used with motors which have integral thermal protection. In accordance with UL certification, operation without motor overload protection/motor temperature protection in or on the motor (X2 jumpers) is not permitted! For a proper connection, observe the terminal description for X2A in the chapter [X2A: Motor temperature sensor A \[▶ 118\]](#).

Braking resistor

Use braking resistors with thermal monitoring and a resistor with at least 22 Ω.

The temperature switch must be connected to terminal X21 of the PS6 supply module. If the temperature switch reports a braking resistor overload, the PS6 supply module must be removed from the power supply using the WARNING1 relay at terminal X100. You can find an associated wiring example in the chapter [UL-compliant connection of the supply module \[▶ 241\]](#).

Brake

Observe the technical data for the brake in the chapter [Controllable brakes \[▶ 64\]](#).

Binary inputs

Observe the technical data for the binary inputs at X101 and X103 in the chapter [Binary inputs \[▶ 47\]](#).

Conductors

Power terminals: Use 60/75 °C copper conductors only.

Fuses

Fuses must be approved for DC voltage in accordance with UL 248.

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

- Provide the 24 V_{DC} supply for the brake using a 10 A fuse (time delay). Observe the terminal description for X11 in the chapter [X11: 24 V supply \[▶ 112\]](#).
- Provide the supply for the brake using a 10 A fuse (time delay). Observe the terminal description for X300 in the chapter [X300: Brake 24 V supply \[▶ 135\]](#).
- For the STO safety function via terminal X12: Use a 3.15 A fuse (time delay) to protect the supply voltage of the status signal. Observe the terminal description for X12 in the chapter [X12: Safety technology \(SR6 option\) \[▶ 126\]](#).

UL test

Only the risks of electric shock and the risk of fire have been examined during UL acceptance at STOBER. 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.

5 System configuration

The multi-axis drive system consists of at least one PS6 supply module and one SI6 drive controller. For the energy supply of the existing drive controllers in the group, you need suitable Quick DC-Link modules for the DC link connection for each supply module and for each drive controller.

For connecting the drive controller to a higher-level controller, we recommend the EtherCAT fieldbus as well as an application with a CiA 402 interface. You can put the drive controllers into operation with the DriveControlSuite software.

The drive controllers offer the STO safety function in accordance with EN 61800-5-2 as an option. For connection to a higher-level safety circuit, different interfaces are available.

The following graphic explains the principle system configuration.

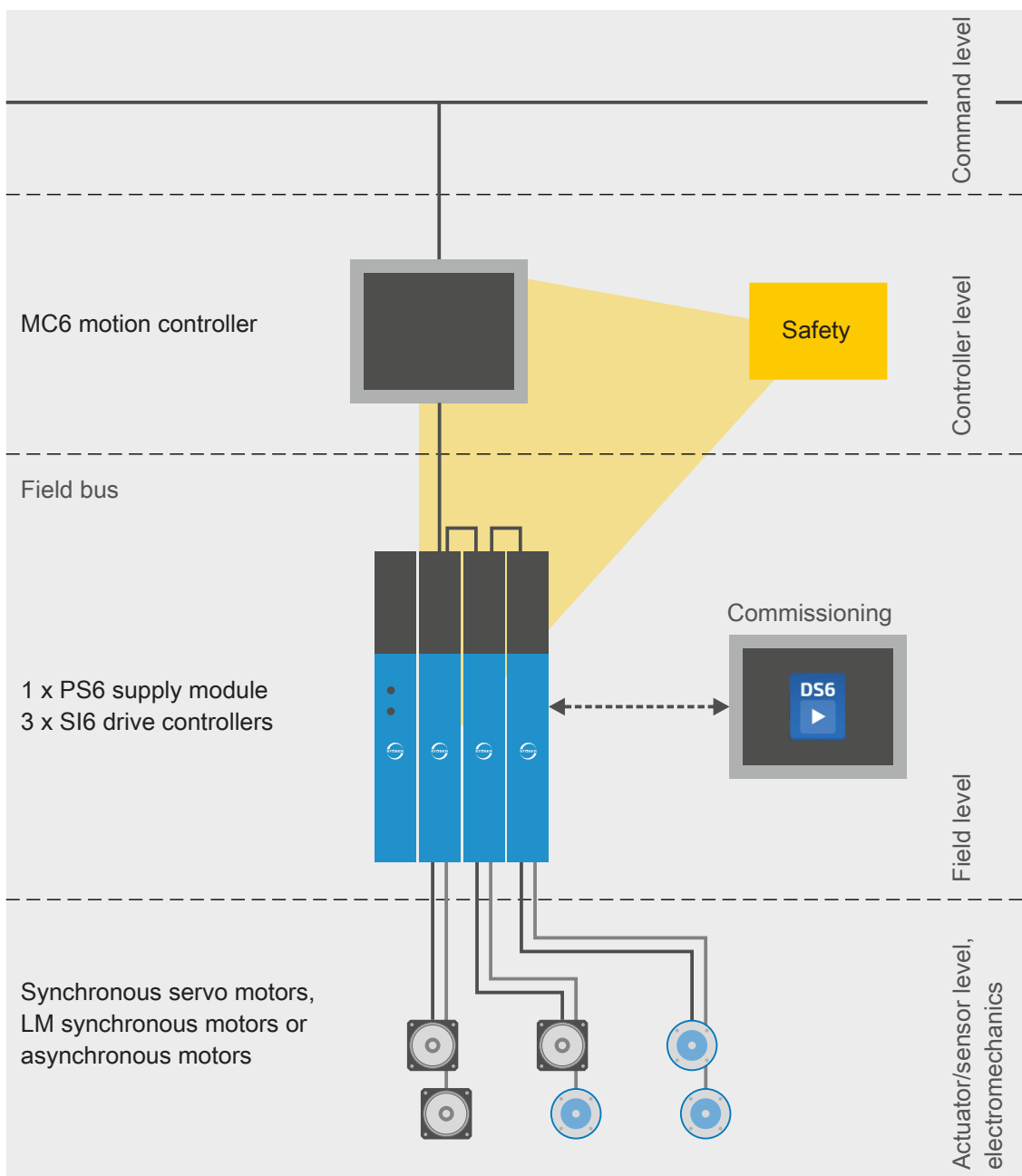


Fig. 1: System overview for the multi-axis drive system with SI6 and PS6

5.1 Hardware components

Below you will find an overview of the available hardware components.

5.1.1 Supply module

The PS6 supply module is available in two sizes. The type specifications used in this documentation refer to the nameplate that is placed on the side of the supply module.

5.1.1.1 Nameplate

STOBER

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Type	ID no.	HW	Date	S/N
PS6A24	56650	003 SAT	1602	9001042

Eingangsspannung
 Input voltage
 Tension d'entrée

UL: 400 V_{AC} 50 Hz
 480 V_{AC} 50-60 Hz

Eingangsstrom
 Input current
 Courant d'entrée

UL: 25.0 A
 23.0 A

3-phase



Ausgangsdaten
 Output data
 Données de sortie


UL: 560 V_{DC} / 10 kW
 680 V_{DC} / 21.4 A



DC link max. charging capacity 5 mF

Schutzart
 Protection class
 Protection

IP20

  For UL/cUL:
 Power Terminals:
 Use 60/75 °C Copper
 Conductors Only

 **UL** **US**
LISTED
 [IND. CONT. EQ.]
 E189114

 **WARNUNG: GEFAHR DES ELEKTRISCHEN SCHLAGS. GEFÄHRLICHE SPANNUNGEN KÖNNEN AUCH NACH DEM ABSCHALTEN FÜR 15 MINUTEN ANLIEGEN.** 
 Inbetriebnahmeanleitung beachten!

WARNING: RISK OF ELECTRIC SHOCK. DANGEROUS VOLTAGE MAY EXIST FOR 15 MINUTES AFTER REMOVING POWER.
 Always observe the commissioning instructions!

AVERTISSEMENT : RISQUE DU CHOC ÉLECTRIQUE. UNE TENSION DANGEREUSE PEUT ÊTRE PRÉSENTÉE JUSQU'À 15 MINUTES APRÈS AVOIR COUPÉ L'ALIMENTATION.
 Veuillez respecter la notice de mise en service !



 

Fig. 2: PS6A24 nameplate

Designation	Value in example	Meaning
Types	PS6A24	Device type according to type designation
ID No.	56650	Identification number
HW	003 SAT	Production information
Date	1602	Production week in format YYWW, in the example shown here year 2016, week 2
S/N	9001042	Serial number
Input voltage	400 V _{AC} UL: 480 V _{AC}	Input voltage
Input current	25.0 A UL: 23.0 A 3-phase	Input current Number of phases
Output data	560 V _{DC} / 10.0 kW UL: 680 V _{DC} / 21.4 A DC link max. charging capacity 5 mF	Output voltage and nominal power or nominal current Maximum charging capacity
Protection class	IP20	Protection class

Tab. 2: Meaning of the specifications on the PS6 nameplate

Information

UL and cUL-certified devices with corresponding test symbols meet the requirements of the standards UL 61800-5-1 and CSA C22.2 No. 274.

5.1.1.2 Line fuse specifications in accordance with UL

On the side of the supply module next to the nameplate, there is another sticker with the following specifications for an UL-compliant line fuse:

Approved for supply grids with a differential short-circuit current up to 5000 A, maximal 480 V_{AC} with a class CC, CF, J, T, G or RK1 fuse:

- PS6A24: max. 30 A, 600 V_{AC}
- PS6A34: max. 60 A, 600 V_{AC}

Approved for supply grids with a differential short-circuit current up to 5000 A, max. 480 V_{AC} with a circuit breaker:

- PS6A24: Type NZMB1-AF30-NA, EATON, 30 A, 480Y/277 V_{AC}, 25 kA
- PS6A34: Type NZMB1-AF60-NA, EATON, 60 A, 480Y/277 V_{AC}, 25 kA

5.1.1.3 Type designation

PS	6	A	2	4
-----------	----------	----------	----------	----------

Tab. 3: Example code for the PS6 type designation

Code	Designation	Design
PS	Series	PowerSupply
6	Generation	Generation 6
A	Version	
2 – 3	Size	
4	Power output stage	

Tab. 4: Meaning of the PS6 example code

5.1.1.4 Sizes

Type	ID No.	Size
PS6A24	56650	Size 2
PS6A34	56651	Size 3

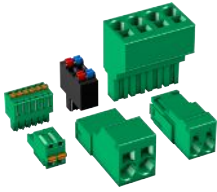
Tab. 5: Available PS6 types and sizes



PS6 in sizes 2 and 3

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size.

Terminal set for supply module



The following designs are available:

ID No. 138660
Terminal set for PS6A24.

ID No. 138661
Terminal set for PS6A34.

5.1.2 Drive controller

The SI6 drive controller is available in several sizes as a single or double-axis controller. In addition, different safety options are available. The type specifications used in this documentation refer to the nameplate that is placed on the side of the drive controller.

5.1.2.1 Nameplate

STOBER

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Type	ID no.	HW	Date	S/N
SI6A061	56645	012 SAT	1712	9001043

Eingangsspannung
 Input voltage
 Tension d'entrée **560 V_{DC}**
UL: 680 V_{DC}

Eingangsstrom
 Input current
 Courant d'entrée **4.2 A**
UL: 4.2 A

Ausgangsdaten
 Output data
 Données de sortie **0..460 V_{AC}**
0..700 Hz
5.0 A
@4 kHz:
3-phase

Schutzart
 Protection class
 Protection **IP20**

For UL/cUL: Power Terminals: Use 60/75 °C Copper Conductors Only **UL US LISTED [IND. CONT. EQ.] E189114**

WARNUNG: GEFAHR DES ELEKTRISCHEN SCHLAGS. GEFÄHRLICHE SPANNUNGEN KÖNNEN AUCH NACH DEM ABSCHALTEN FÜR 15 MINUTEN ANLIEGEN.
Inbetriebnahmeanleitung beachten!

WARNING: RISK OF ELECTRIC SHOCK. DANGEROUS VOLTAGE MAY EXIST FOR 15 MINUTES AFTER REMOVING POWER.
Always observe the commissioning instructions!

AVERTISSEMENT : RISQUE DU CHOC ÉLECTRIQUE. UNE TENSION DANGEREUSE PEUT ÊTRE PRÉSENTÉE JUSQU'À 15 MINUTES APRÈS AVOIR COUPÉ L'ALIMENTATION.
Veuillez respecter la notice de mise en service !

Fig. 3: SI6A061 nameplate

Designation	Value in example	Meaning
Types	SI6A061	Device type according to type designation
ID No.	56645	Identification number of the basic device
HW	012 SAT	Production information
Date	1712	Production week in format YYWW, in the example shown here year 2017, week 12
S/N	9001043	Serial number
Input voltage	560 V _{DC} UL: 680 V _{DC}	Input voltage
Input current	UL: 4.2 A	Input current
Output data	0 to 460 V _{AC} 0 to 700 Hz @4 kHz: 5.0 A 3-phase	Output voltage Output frequency Output current for 4 kHz clock frequency Number of phases
Protection class	IP20	Protection class

Tab. 6: Meaning of the specifications on the SI6 nameplate

Information

UL and cUL-certified devices with corresponding test symbols meet the requirements of the standards UL 61800-5-1 and CSA C22.2 No. 274.

5.1.2.2 Material version

On the side of the drive controller next to the nameplate, there is another sticker with the MV and serial number.



Fig. 4: Sticker with MV and serial number

Designation	Value in example	Meaning
MV	MV0000052345	<u>MV number</u>
SN	SN: 600154723	<u>Serial number</u>
—	SI6A061	Device type according to type designation
—	550007951/000100	Order number / order item

Tab. 7: Meaning of the specifications on the sticker

5.1.2.3 Type designation

SI	6	A	0	6	1	Z
-----------	----------	----------	----------	----------	----------	----------

Tab. 8: Example code for the SI6 type designation

Code	Designation	Design
SI	Series	ServInverter
6	Generation	Generation 6
A	Version	
0 – 3	Size	
6	Power output stage	Power output stage within the size
1 2	Axis controller	Single-axis controller Double-axis controller
Z R Y	Safety technology	SZ6: Without safety technology SR6: STO using terminals SY6: STO and SS1 using FSoE

Tab. 9: Meaning of the SI6 example code

5.1.2.4 Sizes

Type	ID No.	Size	Axis controller
SI6A061	56645	Size 0	Single-axis controller
SI6A062	56646	Size 0	Double-axis controller
SI6A161	56647	Size 1	Single-axis controller
SI6A162	56648	Size 1	Double-axis controller
SI6A261	56649	Size 2	Single-axis controller
SI6A262	56653	Size 2	Double-axis controller
SI6A361	56654	Size 3	Single-axis controller

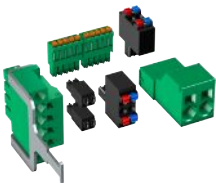
Tab. 10: Available SI6 types and sizes



SI6 in sizes 0 to 3

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size.

Terminal set for drive controller



The following designs are available:

ID No. 138655
Terminal set for SI6A061Z/Y.

ID No. 138656
Terminal set for SI6A062Z/Y.

ID No. 138657
Terminal set for SI6A161Z/Y.

ID No. 138658
Terminal set for SI6A162Z/Y.

ID No. 138659
Terminal set for SI6A261Z/Y.

ID No. 138662
Terminal set for SI6A262Z/Y.

ID No. 138663
Terminal set for SI6A361Z/Y.

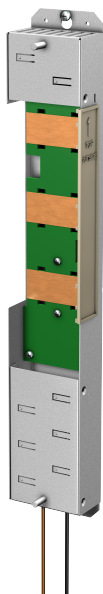
5.1.3 DC link connection

For the energy supply of the existing networked drive controllers, you need suitable Quick DC-Link modules of type DL6B for each PS6 supply module and each SI6 drive controller.

For the horizontal connection, you receive DL6B rear section modules in various designs, matched to the size of the drive controller or supply module.

The quick fastening clamps for attaching the copper rails and an insulation connection piece are contained in the scope of delivery. The copper rails are not included in the scope of delivery. These must have a cross-section of 5 x 12 mm. Insulation end sections are available separately.

DL6B Quick DC-Link for drive controller



The following designs are available:

DL6B10

ID No. 56655

Rear section module for size 0 drive controllers:

SI6A061 and SI6A062

DL6B11

ID No. 56656

Rear section module for drive controllers of size 1 or 2 (single axis controller):

SI6A161, SI6A162 and SI6A261

DL6B12

ID No. 56663

Rear section module for drive controllers of size 2 (double-axis controllers) or 3:

SI6A262 und SI6A361

DL6B Quick DC-Link for supply module



The following designs are available:

DL6B20

ID No. 56657

Rear section module for supply module of size 2:

PS6A24

DL6B21

ID No. 56658

Rear section module for supply module of size 3:

PS6A34

DL6B Quick DC-Link insulation end section



ID No. 56659

Insulation end sections for the left and right termination of the group, 2 pcs.

5.1.4 Controller

The development of the MC6 motion controller and its integration into the STOBER product portfolio opens up new solutions for drive technology, especially for complex functions with demanding requirements for timing and precision.

The SI6 drive controller is connected to the MC6 using EtherCAT.

Detailed information about the MC6 motion controller can be found in the corresponding manual, see the chapter [Detailed information \[► 245\]](#).

5.1.5 Operating motors, encoders and brakes

You can use the SI6 drive controller to operate Lean motors of the STOBER LM series, synchronous servo motors (such as those of the STOBER EZ series), asynchronous motors or torque motors.

Evaluation options for feedback are available on the X4 connection for the following encoders:

- EnDat 2.2 digital encoders
- SSI encoders
- Differential TTL and differential HTL incremental encoders (HTL over HT6 adapters)
- Resolver
- HIPERFACE DSL encoders

In addition, evaluation options for the following encoders are available on the X101 and X103 connection:

- Single-ended HTL incremental encoders
- Single-ended HTL pulse train

All device types of the SI6 drive controller have connections for [PTC thermistors](#) and can control a 24 V_{DC} brake as standard.

5.1.6 Accessories

You can find information about the available accessories in the following chapters.

5.1.6.1 Safety technology

The safety modules are used to realize the STO safety function. They prevent the generation of a rotating magnetic field in the power unit of the drive controller. For an external requirement or in the event of error, the safety module switches the drive controller to the STO state. Different user interfaces and additional safety functions are available depending on the selected design of the accessories.

Information

Note that the drive controller is delivered as a standard version without safety technology (SZ6 option). If you want a drive controller with integrated safety technology, you must order it together with the drive controller. The safety modules are an integrated part of the drive controllers and must not be modified.

Option SZ6 – Without safety technology

ID No. 56660
Standard version.

SR6 safety module – STO through terminals



ID No. 56661
Optional accessory for the use of the Safe Torque Off safety function (STO) in safety-related applications (PL e, SIL 3) in accordance with DIN EN ISO 13849-1 and DIN EN 61800-5-2. Connection to higher-level safety circuit through terminal X12 (included in the terminal set scope of delivery).

SY6 safety module – STO and SS1 using FSoE



ID No. 56662
Optional accessory for using the Safe Torque Off (STO) and Safe Stop 1 (SS1) safety functions in safety-relevant applications (PL e, SIL 3) in accordance with DIN EN ISO 13849-1 and DIN EN 61800-5-2. Connection to the higher-level safety circuit using Fail Safe over EtherCAT (FSoE).

Detailed information about using the safety technology can be found in the corresponding manual, see chapter [Detailed information](#) [▶ 245].

5.1.6.2 Communication

The drive controller has two interfaces for the fieldbus connection on the top of the device as well as an Ethernet service port on the front of the device. Cables for the connection are available separately.

EtherCAT or PROFINET fieldbus system



Please specify the desired fieldbus system when placing your purchase order for the base device.



EtherCAT cables



Ethernet patch cable, CAT5e, yellow.

The following designs are available:

ID No. 49313: Length approx. 0.2 m.

ID No. 49314: length approx. 0.35 m.

PC connecting cables



ID No. 49857

Cable for connecting the X9 service interface to the PC, CAT5e, blue, 5 m.

USB 2.0 Ethernet adapters



ID No. 49940

Adapter for connecting Ethernet to a USB port.

Detailed information about the fieldbus connection can be found in the corresponding manual, see chapter [Detailed information](#) [▶ 245].

5.1.6.3 Braking resistor

STOBER offers [braking resistors](#) in different sizes and performance classes.

More detailed information can be found in the chapter [Braking resistor](#) [▶ 65].

5.1.6.4 Choke

STOBER offers different [chokes](#) corresponding to your application.

More detailed information can be found in the chapter [Choke](#) [▶ 71].

5.1.6.5 Battery module

Absolute Encoder Support (AES)



ID No. 55452
Battery module for buffering the power supply when using the EnDat 2.2 digital inductive encoder with battery-buffered multi-turn stage, for example EBI1135 or EBI135.
A battery is included.

Information

Note that a 15-pin extension cable between the socket and the AES may be necessary for the connection to the drive controller due to limited space.

- a) A commercially available shielded extension cable with a 15-pin D-sub connector and a length of ≤ 1 m can be used between the socket and the AES.

AES replacement battery



ID No. 55453
Replacement battery for AES battery module.

5.1.6.6 HTL-to-TTL adapter

HT6 HTL-to-TTL adapter



ID No. 56665
Adapters for SC6 and SI6 series drive controllers for level conversion from HTL signals to TTL signals.
It is used to connect an HTL differential incremental encoder to terminal X4 of the drive controller.

5.1.6.7 Interface adapters

AP6A00 interface adapters



ID No. 56498
Adapter (9/15-pin) for connecting resolver cables with a 9-pin D-sub connector to the X4 encoder interface of the drive controller.

5.2 Software components

The available software components help you implement your drive system.

5.2.1 Project configuration and parameterization

For project configuration and parameterization, the drive controller can be addressed using the DriveControlSuite commissioning software. The program guides you step by step through the complete project configuration and parameterization process using wizards.

5.2.2 Applications

Controller-based motion control is recommended for the central motion control of complex machines.

Using the controller-based operating modes of the **CiA 402** application, you can implement applications with synchronized, cyclic reference value specification (csp, csv, cst, ip) by a motion controller, such as the MC6. In addition, the drive controllers can also independently handle motion tasks, such as referencing and jogging during commissioning.

STOBER Drive Based and **STOBER Drive Based Synchronous** applications and the drive-based operating modes (pp, pv, pt) of the **CiA 402** application are also available for torque/force mode, velocity mode or positioning mode.


Detailed information about the available applications can be found in the corresponding manual, see the chapter [Detailed information](#) [▶ 245].

6 Technical data

Technical data for the drive controllers, supply modules and accessories can be found in the following chapters.

6.1 General technical data

The following specifications apply equally to the SI6 drive controller and the PS6 supply module.

Device features	
Protection class of the device	IP20
Protection class of the installation space	At least IP54
Radio interference suppression	Integrated line filter in accordance with EN 61800-3:2012, interference emission class C3
Overvoltage category	III in accordance with EN 61800-5-1:2008
Test symbols	

Tab. 11: 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 DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s ² 200 Hz ≤ f ≤ 500 Hz: 15 m/s ²

Tab. 12: 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 DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s ²

Tab. 13: Operating conditions

Discharge times	
Self-discharge of DC link	15 min
DC link circuit fast discharge	Thanks to PS6 supply module in combination with a braking resistor: < 1 min

Tab. 14: Discharge times of the DC link circuit

6.2 Supply module

The following section contains specifications for the electrical data, dimensions and weight of the PS6 supply module.

6.2.1 Electrical data

The electrical data of the available PS6 sizes as well as the properties of the brake chopper can be found in the following chapters.

Information

For cyclic power-on/power-off operation, the following is to be observed to prevent the charging capacities of the supply modules from being exceeded:

- a) PS6 without braking resistor: Direct, repeat activation of the supply voltage possible
- b) PS6 with braking resistor and an interval < 30 s after power-off: Direct, repeat activation of the supply voltage possible
- c) PS6 with braking resistor and an interval > 30 s after power-off: Reactivation of the supply voltage only possible 2 min after previous activation!

Information

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

An explanation of the symbols used for formulas can be found in Chapter [Symbols in formulas](#) [▶ 246].

6.2.1.1 Control unit

Electrical data	All types
U_{1CU}	24 V _{DC} , +20%/–15%
I_{1maxCU}	0.5 A

Tab. 15: Control unit electrical data

6.2.1.2 Power unit: Size 2

Electrical data	PS6A24
U_{1PU}	3 × 400 V _{AC} , +32%/–50%, 50/60 Hz; 3 × 480 V _{AC} , +10%/–58%, 50/60 Hz
U_{2PU}	$\sqrt{2} \times U_{1PU}$
$P_{N,PU}$	10 kW
$I_{1N,PU}$	25 A
I_{1maxPU}	$I_{1N,PU} \times 180\%$ for 5 s; $I_{1N,PU} \times 150\%$ for 30 s
C_{maxPU}	5000 μF

Tab. 16: PS6 electrical data, size 2

6.2.1.3 Power unit: Size 3

Electrical data	PS6A34
U_{1PU}	3 × 400 V _{AC} , +32%/–50%, 50/60 Hz; 3 × 480 V _{AC} , +10%/–58%, 50/60 Hz
U_{2PU}	$\sqrt{2} \times U_{1PU}$
$P_{N,PU}$	20 kW
$I_{1N,PU}$	50 A
I_{1maxPU}	$I_{1N,PU} \times 180\%$ for 5 s; $I_{1N,PU} \times 150\%$ for 30 s
C_{maxPU}	10000 μF

Tab. 17: PS6 electrical data, size 3

6.2.1.4 Parallel connection

The power and current increase if supply modules are connected in parallel. Take into account that the total is derated by a factor of 0.8 in doing so.

The charging capacity of the supply modules can be increased by a parallel connection only if the power grid supply is connected to all supply modules simultaneously. Increasing the charging capacity also requires derating the total by a factor of 0.8.

The following table shows example combinations for parallel connection.

Electrical data	2 × PS6A24	3 × PS6A24	2 × PS6A34	3 × PS6A34
$P_{N,PU}$	16 kW	24 kW	32 kW	48 kW
$I_{1N,PU}$	40 A	60 A	80 A	120 A
C_{maxPU}	8000 μF	12000 μF	16000 μF	24000 μF

Tab. 18: Electrical data for parallel connection: Example combinations

Note the general conditions for parallel connection of supply modules in the chapter [Information on design and operation](#) [► 76].

6.2.1.5 Brake chopper

Electrical data	All types
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. 19: Brake chopper electrical data

Information

Use braking resistors with thermal monitoring (see the chapter [Braking resistor](#) [▶ 65]).

6.2.1.6 Fast discharge

Fast discharge is activated when no power supply is present for 20 s and the DC link voltage has reduced over this time. For active fast discharge, the DC link is discharged via the brake chopper and the braking resistor. Fast discharge does not take place for constant or increasing DC link voltage as this behavior indicates a second supply module in the DC link group. If the temperature sensor of the braking resistor is active, the fast discharge also remains off.

6.2.1.7 Status output

The relay status output of terminal X100 in conjunction with the 3 diagnostic LEDs on the front of the device provides information about the status of the supply module.

Electrical data	Relay
U_{2max}	30 V _{DC}
I_{2max}	2.0 A
Expected service life	Mechanical min. 100 000 000 switch.; at 30 V _{DC} /2 A (ohm. load): 100 000 switch.

Tab. 20: Electrical data

6.2.2 Dimensions

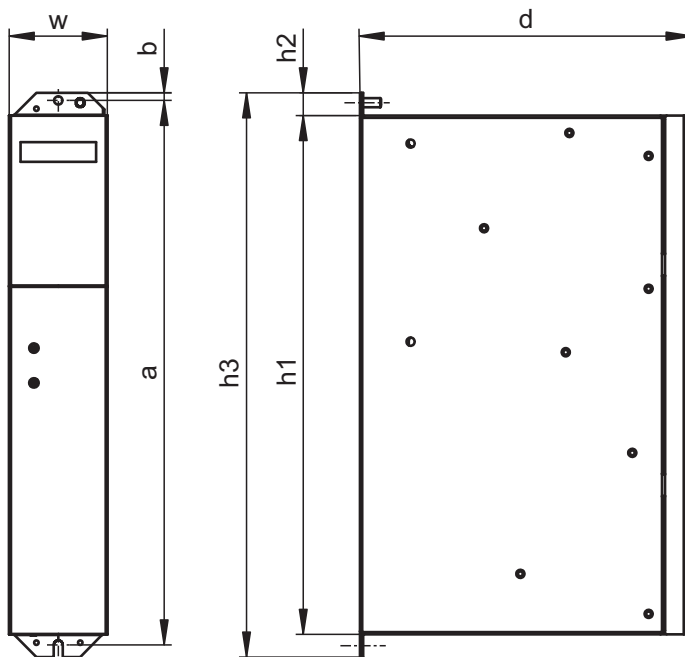


Fig. 5: PS6 dimensional drawing

Dimension			Size 2	Size 3
Supply module	Width	w	45	65
	Depth	d	204	219
	Body height	h1	343	
	Fastening clip height	h2	15	
	Height incl. fastening clips	h3	373	
Fastening holes (M5)	Vertical distance	a	360+2	
	Vertical distance to the upper edge	b	5	

Tab. 21: PS6 dimensions [mm]

6.2.3 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
PS6A24	2680	4180
PS6A34	3820	4920

Tab. 22: PS6 weight [g]

6.3 Drive controllers

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

6.3.1 Electrical data

The electrical data of the available SI6 sizes can be found in the following sections.

An explanation of the symbols used for formulas can be found in Chapter [Symbols in formulas](#) [▶ 246].

6.3.1.1 Control unit

Electrical data	All types
U_{1CU}	$24 V_{DC}, +20\%/-15\%$
I_{1maxCU}	0.5 A

Tab. 23: Control unit electrical data

6.3.1.2 Power unit: Size 0

Electrical data	SI6A061	SI6A062
U_{1PU}	280 – 800 V_{DC}	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	180 μF	270 μF

Tab. 24: SI6 electrical data, size 0

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

Electrical data	SI6A061	SI6A062
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	5 A	2 × 5 A
I_{2maxPU}	210% for 2 s	

Tab. 25: SI6 electrical data, size 0, at 4 kHz clock frequency

Electrical data	SI6A061	SI6A062
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	4.5 A	2 × 4.5 A
I_{2maxPU}	250% for 2 s	

Tab. 26: SI6 electrical data, size 0, at 8 kHz clock frequency

6.3.1.3 Power unit: Size 1

Electrical data	SI6A161	SI6A162
U_{1PU}	280 – 800 V _{DC}	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	470 µF	940 µF

Tab. 27: SI6 electrical data, size 1

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

Electrical data	SI6A161	SI6A162
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	12 A	2 × 12 A
I_{2maxPU}	210% for 2 s	

Tab. 28: SI6 electrical data, size 1, at 4 kHz clock frequency

Electrical data	SI6A161	SI6A162
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	10 A	2 × 10 A
I_{2maxPU}	250% for 2 s	

Tab. 29: SI6 electrical data, size 1, at 8 kHz clock frequency

6.3.1.4 Power unit: Size 2

Electrical data	SI6A261	SI6A262
U_{1PU}	280 – 800 V _{DC}	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	940 µF	2250 µF

Tab. 30: SI6 electrical data, size 2

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

Electrical data	SI6A261	SI6A262
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	22 A	2 × 25 A
I_{2maxPU}	210% for 2 s	

Tab. 31: SI6 electrical data, size 2, at 4 kHz clock frequency

Electrical data	SI6A261	SI6A262
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	20 A	2 × 20 A
I_{2maxPU}	250% for 2 s	

Tab. 32: SI6 electrical data, size 2, at 8 kHz clock frequency

6.3.1.5 Power unit: Size 3

Electrical data	SI6A361
U_{1PU}	280 – 800 V _{DC}
f_{2PU}	0 – 700 Hz
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$
C_{PU}	2250 µF

Tab. 33: SI6 electrical data, size 3

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

Electrical data	SI6A361
$f_{PWM,PU}$	4 kHz
$I_{2N,PU}$	50 A
I_{2maxPU}	210% for 2 s

Tab. 34: SI6 electrical data, size 3, at 4 kHz clock frequency

Electrical data	SI6A361
$f_{PWM,PU}$	8 kHz
$I_{2N,PU}$	40 A
I_{2maxPU}	250% for 2 s

Tab. 35: SI6 electrical data, size 3, at 8 kHz clock frequency

6.3.1.6 Binary inputs

X101 specification for binary signals

Electrical data	Binary input	Value
Low level	BE1 – BE4	0 – 8 V _{DC}
High level		12 – 30 V _{DC}
U _{1max}		30 V _{DC}
I _{1max}		16 mA
f _{1max}	BE1 – BE2	10 kHz
	BE3 – BE4	250 kHz
Internal device update rate	BE1 – BE4	Cycle time for the application parameterized in A150; t _{min} = 1 ms; Also applicable for binary inputs BE3 and BE4: with timestamp correction in an accuracy range of 1 μs
Max. cable length		30 m

Tab. 36: X101 electrical data

X103 specification for binary signals

Electrical data	Binary input	Value
Low level	BE6 – BE9	0 – 8 V _{DC}
High level		12 – 30 V _{DC}
U _{1max}		30 V _{DC}
I _{1max}		16 mA
f _{1max}	BE6 – BE7	10 kHz
	BE8 – BE9	250 kHz
Internal device update rate	BE6 – BE9	Cycle time for the application parameterized in A150; t _{min} = 1 ms; Also applicable for binary inputs BE8 and BE9: with timestamp correction in an accuracy range of 1 μs
Max. cable length		30 m

Tab. 37: X103 electrical data

6.3.1.7 Asymmetric load on double-axis controllers

Operating two motors on one double-axis controller makes it possible to operate one of the motors with a continuous current above the nominal drive controller current if the continuous current of the second connected motor is lower than the nominal drive controller current. This enables economical combinations of double-axis controllers and motors.

The nominal output current for axis B can be determined using the following formula if the output current for axis A is known:

Example 1

$$I_{2PU(B)} = I_{2N,PU} - (I_{2PU(A)} - I_{2N,PU}) \times \frac{3}{5} \quad \text{where} \quad 0 \leq I_{2PU(A)} \leq I_{2N,PU}$$

Example 2

$$I_{2PU(B)} = I_{2N,PU} - (I_{2PU(A)} - I_{2N,PU}) \times \frac{5}{3} \quad \text{where} \quad I_{2N,PU} \leq I_{2PU(A)} \leq 1,6 \times I_{2N,PU}$$

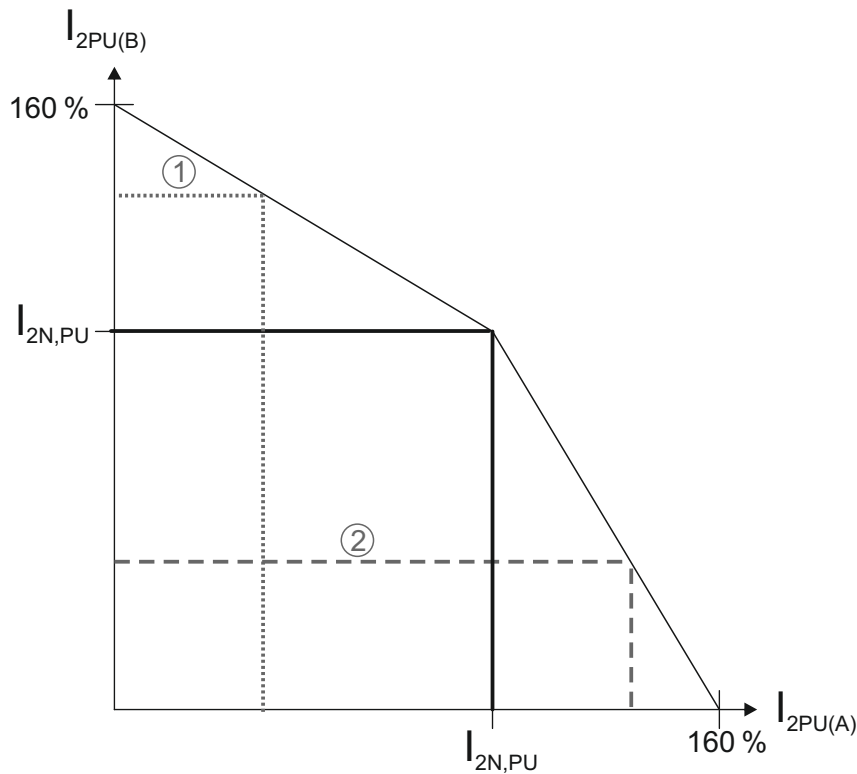


Fig. 6: Asymmetric load on double-axis controllers

Information

Note that the available maximum currents I_{2maxPU} of the axis controllers are also relative to the nominal output current $I_{2N,PU}$ for an asymmetric load.

6.3.1.8 Power loss data in accordance with EN 50598

Type	Nominal current $I_{2N,PU}$	Apparent power	Absolute losses $P_{V,CU}^1$	Operating points ²									IE class ³	Comparison ⁴
				(0/25)	(0/50)	(0/100)	(50/25)	(50/50)	(50/100)	(90/50)	(90/100)			
				Relative losses										
	[A]	[kVA]	[W]	[%]										
SI6A06x	5	3.5	Max. 10	0.71	0.86	1.33	0.76	0.97	1.61	1.13	2.13	IE2		
SI6A16x	12	8.3	Max. 10	0.55	0.71	1.19	0.59	0.80	1.44	0.94	1.87	IE2		
SI6A261	22	16.6	Max. 10	0.55	0.71	1.19	0.59	0.80	1.44	0.94	1.87	IE2		
SI6A262	25	17.3	Max. 10	0.45	0.62	1.12	0.50	0.74	1.47	0.95	2.12	IE2		
SI6A361	50	34.6	Max. 10	0.45	0.62	1.12	0.50	0.74	1.47	0.95	2.12	IE2		
				Absolute losses P_V										
	[A]	[kVA]	[W]	[W]										[%]
SI6A06x	5	3.5	Max. 10	25	30.2	46.5	26.5	33.8	56.5	39.5	74.4	IE2	24.9	
SI6A16x	12	8.3	Max. 10	45.7	58.7	98.7	49.1	66.3	119.6	78.1	155.4	IE2	26.7	
SI6A261	22	16.6	Max. 10	91.5	117.4	197.3	98.2	132.6	239.2	156.2	310.8	IE2	30.8	
SI6A262	25	17.3	Max. 10	77.9	106.5	193.0	87.1	127.9	254.3	163.8	367.6	IE2	36.4	
SI6A361	50	34.6	Max. 10	155.8	213.1	386.0	174.3	255.8	508.6	327.6	735.2	IE2	39.5	

Tab. 38: Power loss data in accordance with EN 50598 for one axis of a SI6 drive controller

¹ Absolute losses for a power unit that is switched off² Operating points for relative motor stator frequency in % and relative torque current in %³ IE class in accordance with EN 50598⁴ Comparison of the losses for the reference drive controller relative to IE2 in the nominal point (90, 100)

General conditions

The specified losses apply to an axis of a drive controller and take into account the proportionate losses of the PS6 supply module for that axis.

For a group with a total of x axes, the values are to be multiplied by the number of axis controllers (x), e.g. $x = 4$ for $1 \times$ PS6 and $2 \times$ SI6A062.

The loss data applies to drive controllers without any accessories.

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

The calculated data includes a supplement of 10% in accordance with EN 50598.

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

The absolute losses for a power unit that is switched off refer to the $24 V_{DC}$ power supply of the control electronics.

6.3.1.9 Power loss data of accessories

If you intend to order the drive controller with accessory parts, losses increase as follows.

Type	Absolute losses P_v [W]
SR6 safety module	1
SY6 safety module	2

Tab. 39: Absolute losses in the accessories

Information

Note the absolute power loss of the encoder (usually < 3 W) and of the brake when designing as well.

Loss specifications for other optional accessories can be found in the technical data of the respective accessory part.

6.3.2 Derating

When dimensioning the drive controller, observe the derating of the nominal output current as a function of the clock frequency, surrounding temperature and installation altitude. There is no restriction for a surrounding temperature from 0 °C to 45 °C and an installation altitude of 0 m to 1000 m. The details given below apply to values outside these ranges.

6.3.2.1 Effect of the clock frequency

Changing the clock frequency f_{PWM} affects the amount of noise produced by the drive, among other things. However, increasing the clock frequency results in increased losses. During project configuration, define the highest clock frequency and use it to determine the nominal output current $I_{2N,PU}$ for dimensioning the drive controller.

Type	$I_{2N,PU}$ 4 kHz [A]	$I_{2N,PU}$ 8 kHz [A]	$I_{2N,PU}$ 16 kHz [A]
SI6A061	5	4.5	3.5
SI6A062	2 × 5	2 × 4.5	2 × 3.5
SI6A161	12	10	6
SI6A162	2 × 12	2 × 10	2 × 6
SI6A261	22	20	10
SI6A262	2 × 25	2 × 20	2 × 10
SI6A361	50	40	20

Tab. 40: Nominal output current $I_{2N,PU}$ dependent on the clock frequency

Information

Select the defined clock frequency using parameter B24. The clock frequency for double-axis controllers always applies to both axis controllers.

6.3.2.2 Effect of the surrounding temperature

Derating as a function of the surrounding temperature is determined as follows:

- 0 °C to 45 °C: No restrictions ($D_T = 100\%$)
- 45 °C to 55 °C: Derating $-2.5\%/K$

Example

The drive controller needs to be operated at 50 °C.

The derating factor D_T is calculated as follows

$$D_T = 100\% - 5 \times 2.5\% = 87.5\%$$

6.3.2.3 Effect of the installation altitude

Derating as a function of the installation altitude is determined as follows:

- 0 m to 1000 m: No restriction ($D_{IA} = 100\%$)
- 1000 m to 2000 m: Derating $-1.5\%/100\text{ m}$

Example

The drive controller needs to be installed at an altitude of 1500 m above sea level.

The derating factor D_{IA} is calculated as follows:

$$D_{IA} = 100\% - 5 \times 1.5\% = 92.5\%$$

6.3.2.4 Calculating the derating

Follow these steps for the calculation:

1. Determine the highest clock frequency (f_{PWM}) that will be used during operation and use it to determine the nominal current $I_{2N,PU}$.
2. Determine the derating factors for installation altitude and surrounding temperature.
3. Calculate the reduced nominal current $I_{2N,PU(red)}$ in accordance with the following formula:

$$I_{2N,PU(red)} = I_{2N,PU} \times D_T \times D_{IA}$$

Example

A drive controller of type SI6A061 needs to be operated at a clock frequency of 8 kHz at an altitude of 1500 m above sea level and a surrounding temperature of 50 °C.

The nominal current of the SI6A061 at 8 kHz is 4.5 A. The derating factor D_T is calculated as follows:

$$D_T = 100\% - 5 \times 2.5\% = 87.5\%$$

The derating factor D_{IA} is calculated as follows:

$$D_{IA} = 100\% - 5 \times 1.5\% = 92.5\%$$

The output current of importance for projecting is:

$$I_{2N,PU(red)} = 4.5\text{ A} \times 0.875 \times 0.925 = 3.64\text{ A}$$

6.3.3 Dimensions

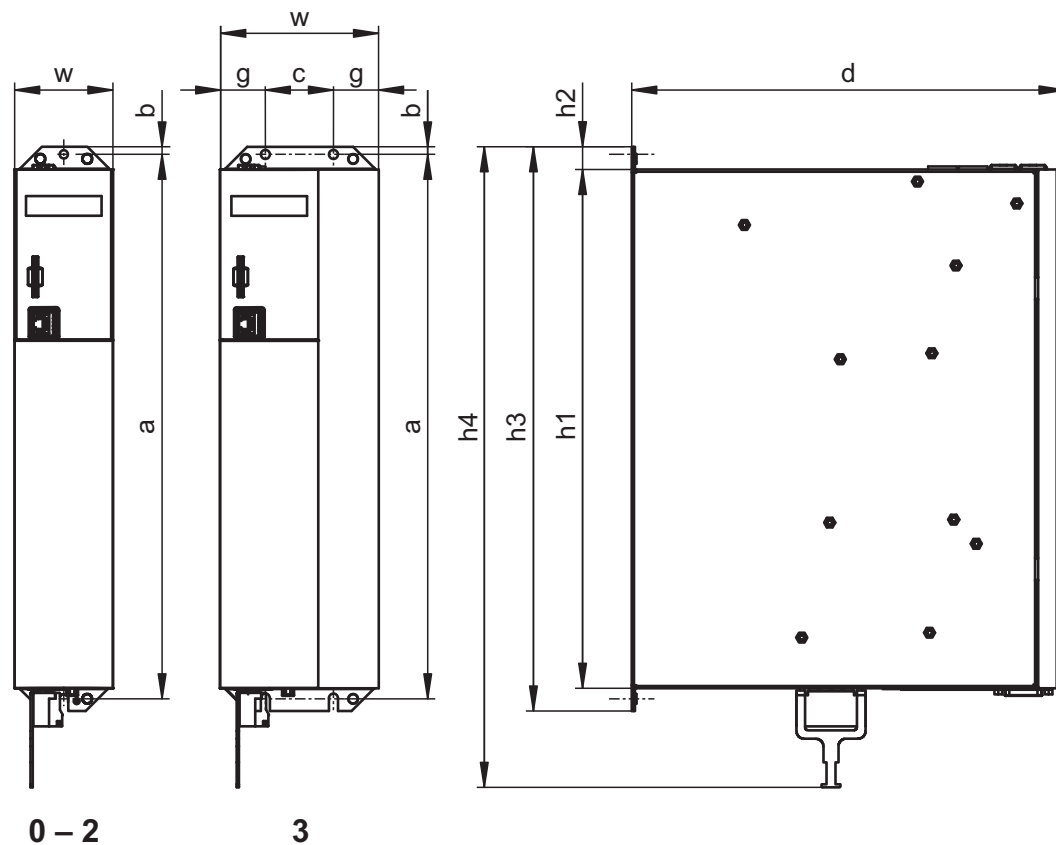


Fig. 7: SI6 dimensional drawing

Dimension		Size 0	Size 1	Size 2 ⁵	Size 2 ⁶	Size 3
Drive controller	Width	w	45	65	105	
	Depth	d	265	286		
	Body height	h1	343			
	Fastening clip height	h2	15			
	Height incl. fastening clips	h3	373			
	Total height incl. shield connection	h4	423			
Fastening holes (M5)	Vertical distance	a	360+2			
	Vertical distance to the upper edge	b	5			
	Horizontal spacing of the fastening holes	c	45			
	Horizontal distance to the side edge	g	30			

Tab. 41: SI6 dimensions [mm]

⁵ Single-axis controller

⁶ Double-axis controller

6.3.4 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
SI6A061	2980	4600
SI6A062	3460	5060
SI6A161	3880	5260
SI6A162	4820	6240
SI6A261	4760	6180
SI6A262	6240	7420
SI6A361	6180	7360

Tab. 42: SI6 weight [g]

6.4 DC link connection

The following section contains specifications for the electrical data, dimensions and weight of DL6B Quick DC-Link modules.

6.4.1 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
Protection class of the installation space	At least IP54

Tab. 43: 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 DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s ² 200 Hz ≤ f ≤ 500 Hz: 15 m/s ²

Tab. 44: 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 DIN EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s ²

Tab. 45: Operating conditions

6.4.2 DL6B assignment – SI6 and PS6

DL6B is available in the following designs suitable for the individual drive controller types and supply module types:

Type	DL6B10	DL6B11	DL6B12	DL6B20	DL6B21
ID No.	56655	56656	56663	56657	56658
SI6A061	X	—	—	—	—
SI6A062	X	—	—	—	—
SI6A161	—	X	—	—	—
SI6A162	—	X	—	—	—
SI6A261	—	X	—	—	—
SI6A262	—	—	X	—	—
SI6A361	—	—	X	—	—
PS6A24	—	—	—	X	—
PS6A34	—	—	—	—	X

Tab. 46: DL6B assignment for SI6 and PS6

6.4.3 Dimensions

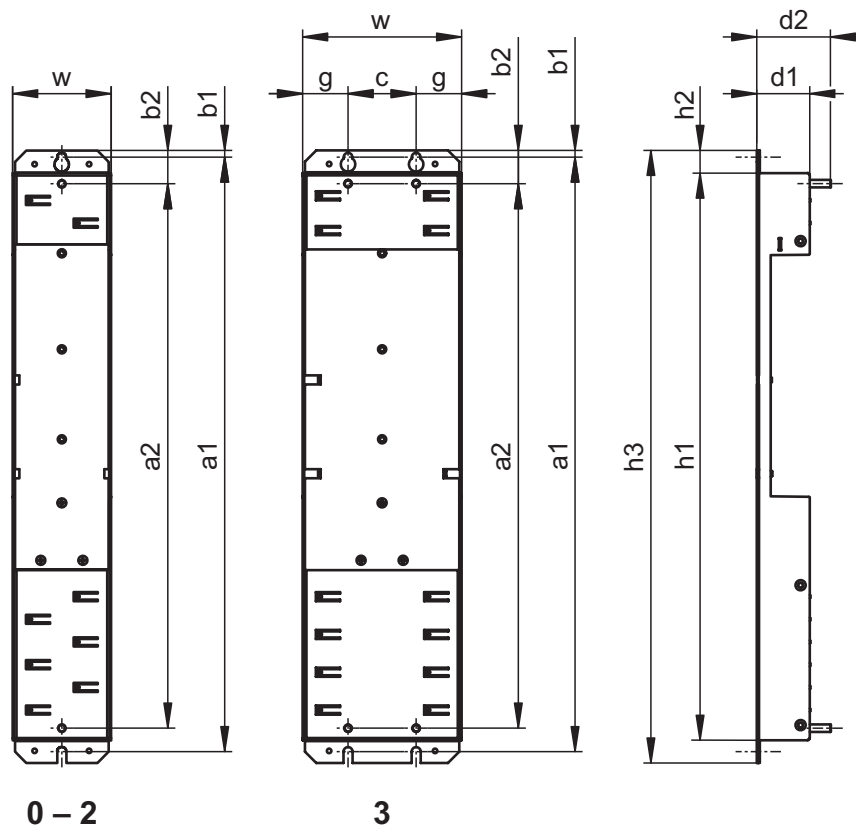


Fig. 8: DL6B dimensional drawing

Dimension			DL6B10 DL6B20	DL6B11 DL6B21	DL6B12
Quick DC-Link	Width	w	45	65	105
	Depth	d1	35		
	Depth incl. attachment bolts	d2	49		
	Height	h1	375		
	Fastening clip height	h2	15		
	Height incl. fastening clips	h3	405		
Fastening holes	Vertical distance (wall mounting)	a1	393+2		
	Vertical distance (module mounting)	a2	360		
	Vertical distance to the upper edge	b1	4.5		
	Vertical distance to the upper edge	b2	22		
	Horizontal spacing of the fastening holes	c	—		45
	Horizontal distance to the side edge	g	—		30

Tab. 47: DL6B dimensions [mm]

6.4.4 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
DL6B10	420	460
DL6B11	560	600
DL6B12	920	960
DL6B20	480	520
DL6B21	740	780

Tab. 48: DL6B weight [g]

6.5 Safety technology

The SR6 option adds the STO safety function to the SI6 drive controller through terminal X12.

Information

If you would like to use STO safety function over terminals, be sure to read the SR6 manual; see the chapter [Detailed information](#) [▶ 245].

Specification	Electrical data
STO _a	$U_{1\max} = 30 V_{DC}$ (PELV) high level = 15 – 30 V_{DC} low level = 0 – 8 V_{DC} $I_{1\max} = 100 \text{ mA}$ (typically < 30 mA for 24 V_{DC}) $I_{\max} = 4 \text{ A}$ $C_{1\max} = 10 \text{ nF}$
STO _b	
STO _{status}	$U_2 = U_1 - (1.5 \Omega * I_1)$
STO _{status} supply	$U_1 = +24 V_{DC}, +20\%/25\%$ $I_{1\max} = 100 \text{ mA}$
GND	—

Tab. 49: X12 electrical data for SR6 option

6.6 Operating motors

You can operate the following motors with the specified control modes on the drive controller.

Motor type	B20 Control mode	Encoders	Other settings	Characteristics
LM Lean motor	32: LM - sensorless vector control	No encoder required	Without field weakening (B91 Field weakening = 0: Inactive)	Dynamics, accuracy, constant speed, overcurrent protection
			Without field weakening (B91 Field weakening = 1: Active)	Dynamics, accuracy, constant speed, overcurrent protection, greater speed range, but also higher current requirement
Synchronous servo motor, torque motor	64: SSM - vector control	Absolute encoder required: EnDat 2.1/2.2 digital, SSI, resolver or HIPERFACE DSL encoders	Without field weakening (B91 Field weakening = 0: Inactive)	High dynamics, high accuracy, very constant speed, high overcurrent protection
			Without field weakening (B91 Field weakening = 1: Active)	High dynamics, high accuracy, very constant speed, high overcurrent protection, greater speed range, but also higher current requirement
Asynchronous motor	2: ASM - vector control	Encoder required	—	High dynamics, high accuracy, very constant speed, high overcurrent protection
	3: ASM - sensorless vector control	No encoder required	—	Dynamics, accuracy, constant speed, overcurrent protection
	1: ASM - V/f-slip compensated		Linear characteristic curve (B21 V/f-characteristic = 0: Linear)	Very constant speed, accuracy
			Quadratic characteristic curve (B21 V/f-characteristic = 1: Square)	Very constant speed, accuracy, especially suitable for fan applications
	0: ASM - V/f-control		Linear characteristic curve (B21 V/f-characteristic = 0: Linear)	Very constant speed
Quadratic characteristic curve (B21 V/f-characteristic = 1: Square)			Very constant speed, especially suitable for fan applications	

Tab. 50: Motor types and control modes

6.7 Evaluable encoders

The technical data of the evaluable encoder can be found in the following chapters.

You can use all of the encoder connections as position encoders. Master encoders may be connected only to connection X4A or X101. The use as a motor encoder depends on which encoder design is required by your motor and supported by the encoder connection.

6.7.1 Overview

The following table explains which connections are available for the various encoders.

Encoders	Connection	Note
EnDat 2.1 digital	X4	—
EnDat 2.2 digital	X4	—
SSI	X4	—
Incremental TTL	X4	TTL signals, differential
Incremental HTL	X4	With HT6 adapter for level conversion: HTL signals, differential
	X101	HTL signals, single-ended
	X103	HTL signals, single-ended
HTL pulse and direction	X101	HTL signals, single-ended
	X103	HTL signals, differential
Resolver	X4	Adjustable number of resolver poles

Tab. 51: Overview of encoder connection

6.7.2 Signal transmission

The following signal levels apply to single-ended signal transmission:

Signal level	HTL, single-ended
Low level	0 to 8 V _{DC}
High level	15 to 30 V _{DC}

The following signal levels are valid for differential signal transmission:

Signal level	Differential HTL	Differential TTL to X4 (RS422 standard)
Low level	-30 to -4.2 V _{DC}	-6 to -0.2 V _{DC}
High level	4.2 to 30 V _{DC}	0.2 to 6 V _{DC}

6.7.3 X4

EnDat 2.1 digital encoders

Specification	EnDat 2.1 digital
U_2	12 V _{DC} (unregulated)
I_{2max}	250 mA
I_{2min}	—
Encoder design	Single-turn and multi-turn; not suitable for linear encoders
Clock frequency	2 MHz
Max. cable length	100 m, shielded

Tab. 52: EnDat 2.1 digital specification

EnDat 2.2 digital encoders

Specification	EnDat 2.2 digital
U_2	12 V _{DC} (unregulated)
I_{2max}	250 mA
Encoder design	Single-turn and multi-turn
Clock frequency	4 MHz
Max. cable length	100 m, shielded

Tab. 53: EnDat 2.2 digital specification

SSI encoders

Specification	SSI signals
U_2	12 V _{DC} (unregulated)
I_{2max}	250 mA
Encoder design	Single-turn and multi-turn
Clock frequency	250 kHz and 600 kHz
Sampling rate	250 μ s
Monoflop time	$\leq 30 \mu$ s
Code	Binary or gray
Format	13, 24 or 25 bits
Transfer	Double or single
Max. cable length	100 m, shielded

Tab. 54: SSI specification

Incremental encoders

Specification	Incremental signals
U_2	12 V _{DC} (unregulated)
I_{2max}	250 mA
f_{max}	1 MHz
Signal level	TTL, differential
Max. cable length	100 m, shielded

Tab. 55: Specification for TTL differential incremental signals

Information**Calculation example – Limit frequency f_{max}**

for an encoder with 2,048 pulses per revolution: 3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution = 102,400 pulses per second = 102.4 kHz
 $\ll 1$ MHz

Information

Using a HT6 adapter for level conversion from HTL signals to TTL signals, it is also possible to connect a differential HTL incremental encoder to terminal X4. Note that, with an external power supply, the maximum level of 20 V_{DC} for the the HTL signals may not be exceeded.

Resolver

Specification	Resolver signals
U_2	$-10 V_{DC}$ to $+10 V_{DC}$
I_{2max}	80 mA
f_2	7 – 9 kHz
P_{max}	0.8 W
Transfer ratio	$0.5 \pm 5 \%$
Number of poles	2, 4 and 6
Signal shape	Sinus
Max. cable length	100 m, shielded

Tab. 56: Specification for resolver signals

HIPERFACE DSL encoders

Specification	HIPERFACE DSL
U_2	12 V_{DC}
I_{2max}	250 mA
Encoder design	Single-turn and multi-turn
Max. cable length	100 m, shielded

Tab. 57: Specification for HIPERFACE DSL

Unsuitable encoder models

The following STOBER encoder models may **not** be connected:

Encoder model	Code according to type designation
ECI 1118	C0
EQI 1130	Q0
ECI 1319	CR
EQI 1329	QP
EQI 1331	QR

Tab. 58: Encoder models with unsuitable supply voltage range

6.7.4 X101 for encoders

Electrical data	Binary input	Incremental signals, pulse train signals
Low level	BE1 – BE4	0 – 8 V _{DC}
High level		15 – 30 V _{DC}
U _{1max}		30 V _{DC}
I _{1max}		16 mA
f _{1max}	BE1 – BE2	10 kHz
	BE3 – BE4	250 kHz
Max. cable length	BE1 – BE4	30 m

Tab. 59: Specification for single-ended HTL incremental signals and single-ended HTL pulse train signals

Information

Calculation example – Limit frequency f_{max}

for an encoder with 2,048 pulses per revolution: 3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution = 102,400 pulses per second = 102.4 kHz < 250 kHz

6.7.5 X103 for encoders

Electrical data	Binary input	Incremental signals, pulse train signals
Low level	BE6 – BE9	0 – 8 V _{DC}
High level		15 – 30 V _{DC}
U _{1max}		30 V _{DC}
I _{1max}		16 mA
f _{1max}	BE6 – BE7	10 kHz
	BE8 – BE9	250 kHz
Max. cable length	BE6 – BE9	30 m

Tab. 60: Specification for single-ended HTL incremental signals and single-ended HTL pulse train signals

Information

Calculation example – Limit frequency f_{max}

for an encoder with 2,048 pulses per revolution: 3,000 revolutions per minute (equivalent to 50 revolutions per second) * 2,048 pulses per revolution = 102,400 pulses per second = 102.4 kHz < 250 kHz

6.8 Controllable brakes

The brake of axis A is connected to X2A. Connect the brake of axis B to X2B for double-axis controllers.

You can control the following brakes:

- Directly connected 24 V_{DC} brakes
- Indirectly connected brakes (e.g. over coupling contactor)

The brake is supplied over X300.

Electrical data	Brake output
U ₂	24 V _{DC} , +20 %
I _{2max}	2.5 A
f _{2max}	1 Hz at I _N ≤ 2.1 A; 0.25 Hz at I _N > 2.1 A
E _{2max}	1.83 J

Tab. 61: Electrical data of the brake output

Information

In the case of a nominal brake current > 2.1 A, the system controller must ensure compliance with the maximum switching frequency of 0.25 Hz.

6.9 Braking resistor

In addition to the supply modules, STOBER offers braking resistors in the various sizes and performance classes described below. For the selection, note the minimum permitted braking resistors specified in the technical data of the supply modules. In the event of a fault, such as a defective brake chopper, the supply module must be disconnected from the power supply.

6.9.1 Braking resistor assignment – PS6


Type	KWADQU	FZZMQU	FGFKQU
ID No.	56634	56635	56636
PS6A24	(—)	(X)	X
PS6A34	(—)	(X)	X

Tab. 62: Braking resistor assignment to PS6 supply module

X	Recommended
(X)	Possible
(—)	Useful under certain conditions
—	Not possible

6.9.2 KWADQU flat resistor

Properties

Specification	KWADQU 420×91
ID No.	56634
Type	Flat resistor with temperature switch (incl. mounting bracket)
Resistance [Ω]	100
Power [W]	600
Thermal time constant τ_{th} [s]	60
Pulse power for < 1 s [kW]	13
U_{max} [V]	848
Cable design	FEP
Cable length [mm]	500
Conductor cross-section [AWG]	14/19 (1.9 mm ²)
Weight [kg]	Approx. 2.6
Protection class	IP54
Test symbols	

Tab. 63: KWADQU 420×91 specification

Information

The temperature switch reports a resistor overload. The evaluation in the form of a warning or line-side shutdown of the power supply must take place separately, e.g. using the PS6 supply module. Observe the wiring example for the supply module in the chapter [UL-compliant connection of the supply module](#) [▶ 241] to ensure UL-compliant operation.

Signal contact

Switching capacity of the signal contact:
2 A / 24 V_{DC}

Dimensions

Dimension	KWADQU 420×91
A	420

Tab. 64: KWADQU 420×91 dimensions [mm]

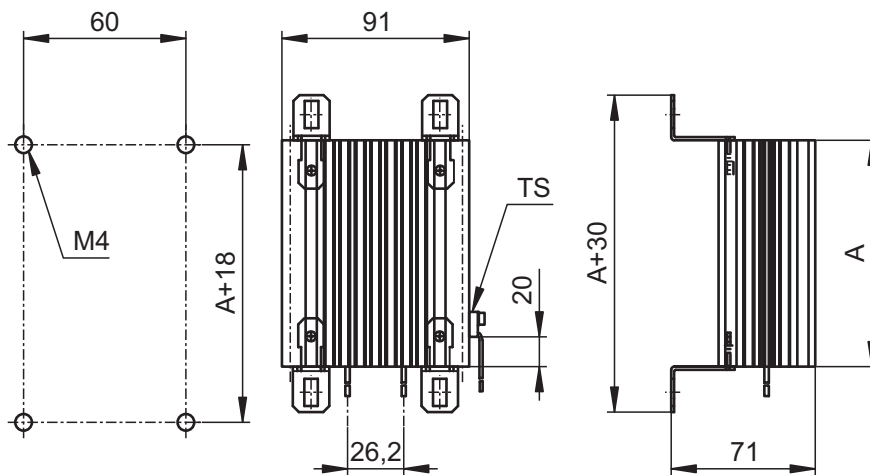



Fig. 9: KWADQU 420×91 dimensional drawing

6.9.3 FZZMQU tubular fixed resistor

Properties

Specification	FZZMQU 400×65
ID No.	56635
Type	Tubular fixed resistor with temperature switch
Resistance [Ω]	47
Power [W]	1200
Thermal time constant τ_{th} [s]	40
Pulse power for < 1 s [kW]	36
U_{max} [V]	848
Weight [kg]	Approx. 4.2
Protection class	IP20
Test symbols	

Tab. 65: Specification for FZZMQU 400×65

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

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

Tab. 66: FZMU conductor cross-section, FZZM(Q)U 400×65

Information

The temperature switch reports a resistor overload. The evaluation in the form of a warning or line-side shutdown of the power supply must take place separately, e.g. using the PS6 supply module. Observe the wiring example for the supply module in the chapter [UL-compliant connection of the supply module \[► 241\]](#) to ensure UL-compliant operation.

Signal contact

Switching capacity of the signal contact:
2 A / 24 V_{DC} (DC11)

Dimensions

Dimension	FZZMQU 400×65
L × D	400 × 65
H	120
K	6.5 × 12
M	426
O	475
R	185
U	150

Tab. 67: FZZMQU 400×65 dimensions [mm]

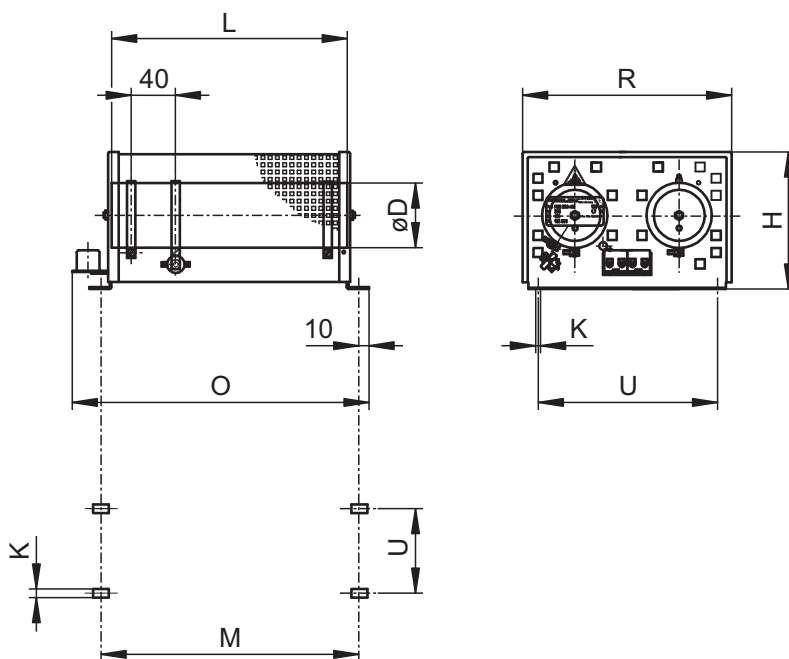



Fig. 10: FZZMQU 400×65 dimensional drawing

6.9.4 FGFKQU steel-grid fixed resistor

Properties

Specification	FGFKQU 31005
ID No.	56636
Type	Steel-grid fixed resistor with temperature switch
Resistance [Ω]	22
Power [W]	2500
Thermal time constant τ_{th} [s]	30
Pulse power for < 1 s [kW]	50
U_{max} [V]	848
Weight [kg]	Approx. 7.5
Protection class	IP20
Test symbols	

Tab. 68: Specification for FGFKQU 31005

Type	Conductor cross-section [mm ²]
Ceramic flat terminal	2.5 – 10

Tab. 69: FGFK(Q)U conductor cross-section

Information

The temperature switch reports a resistor overload. The evaluation in the form of a warning or line-side shutdown of the power supply must take place separately, e.g. using the PS6 supply module. Observe the wiring example for the supply module in the chapter [UL-compliant connection of the supply module](#) [► 241] to ensure UL-compliant operation.

Signal contact

Switching capacity of the signal contact:
2 A / 24 V_{DC} (DC11)

Dimensions

Dimension	FGFKQU 31005
A	270
B	295
C	355

Tab. 70: FGFKQU 31005 dimensions [mm]

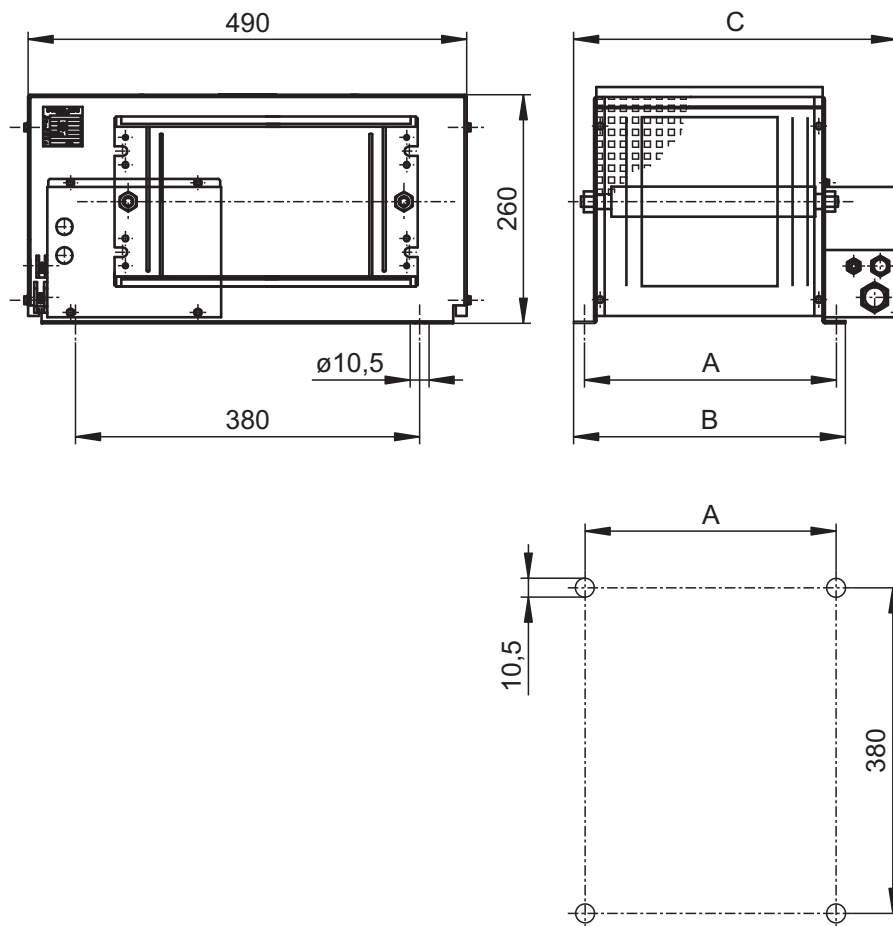


Fig. 11: FGFKQU 31005 dimensional drawing

6.10 Choke

Technical specifications for suitable chokes can be found in the following chapters.


6.10.1 TEP output choke

Output chokes are required for drive controllers of sizes 0 to 2 and for a cable length of 50 m or longer in order to reduce interference pulses and protect the drive system.

Information

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

Properties

Specification	TEP3720-0ES41	TEP3820-0CS41	TEP4020-0RS41
ID No.	53188	53189	53190
Voltage range	3 × 0 to 480 V _{AC}		
Frequency range	0 – 200 Hz		
Nominal current I _{N,MF} at 4 kHz	4 A	17.5 A	38 A
Nominal current I _{N,MF} at 8 kHz	3.3 A	15.2 A	30.4 A
Max. permitted motor cable length with output choke	100 m		
Max. surrounding temperature $\vartheta_{amb,max}$	40 °C		
Protection class	IP00		
Winding losses	11 W	29 W	61 W
Iron losses	25 W	16 W	33 W
Connection	Screw terminal		
Max. conductor cross-section	10 mm ²		
UL Recognized Component (CAN; USA)	Yes		
Test symbols			

Tab. 71: Specification for TEP

Project configuration

Select the output chokes in accordance with the nominal currents of the output chokes, motor and drive controller. In particular, observe the derating of the output choke for rotating magnetic field frequencies higher than 200 Hz. You can calculate the rotating magnetic field frequency for your drive with the following formula:

$$f_N = n_N \times \frac{p}{60}$$

Derating – Effect of the clock frequency

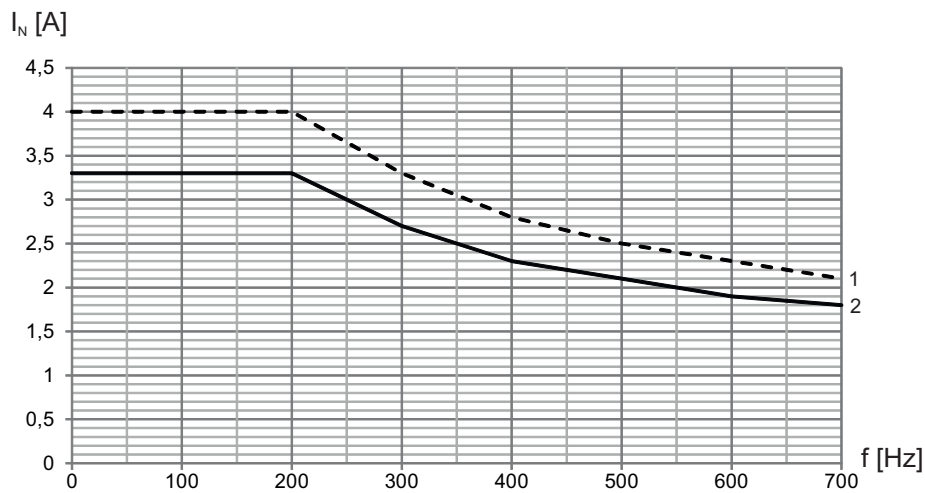


Fig. 12: Derating the nominal current depending on the clock frequency, TEP3720-0ES41

- 1 4 kHz clock frequency
- 2 8 kHz clock frequency

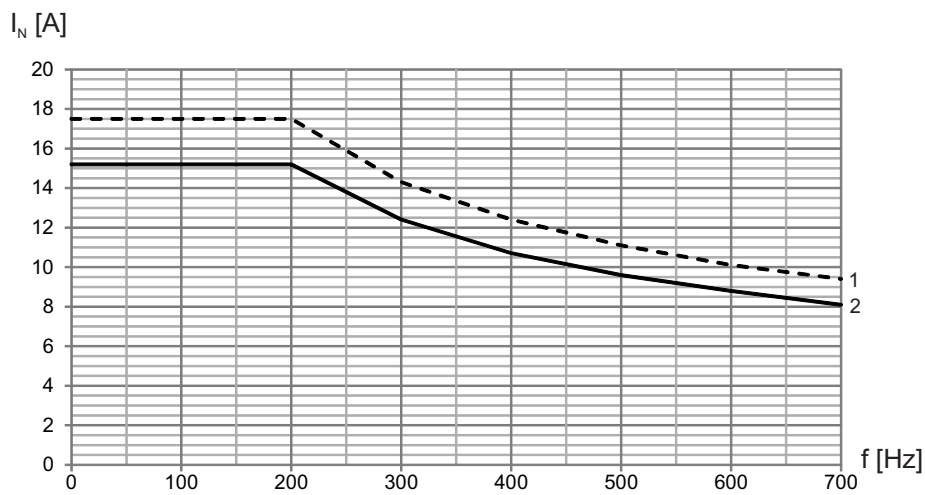


Fig. 13: Derating the nominal current depending on the clock frequency, TEP3820-0CS41

- 1 4 kHz clock frequency
- 2 8 kHz clock frequency

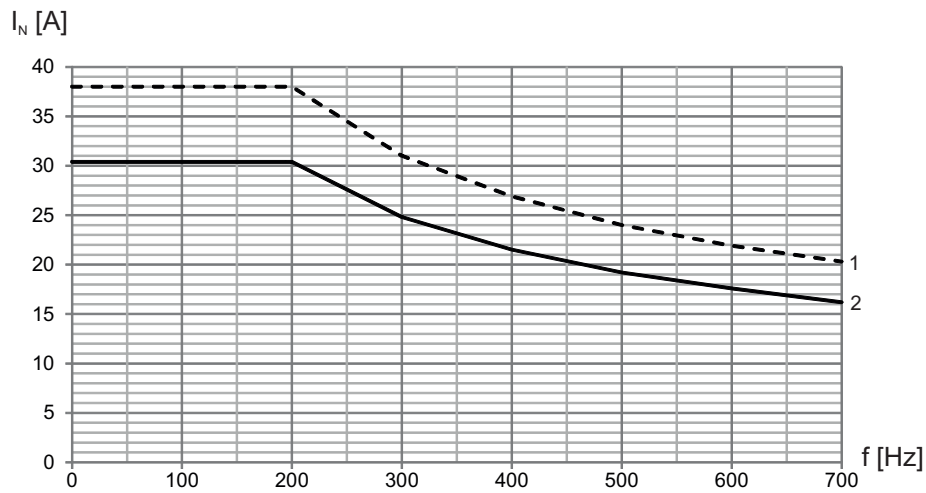


Fig. 14: Derating the nominal current depending on the clock frequency, TEP4020-0RS41

- 1 4 kHz clock frequency
- 2 8 kHz clock frequency

Derating – Effect of surrounding temperature

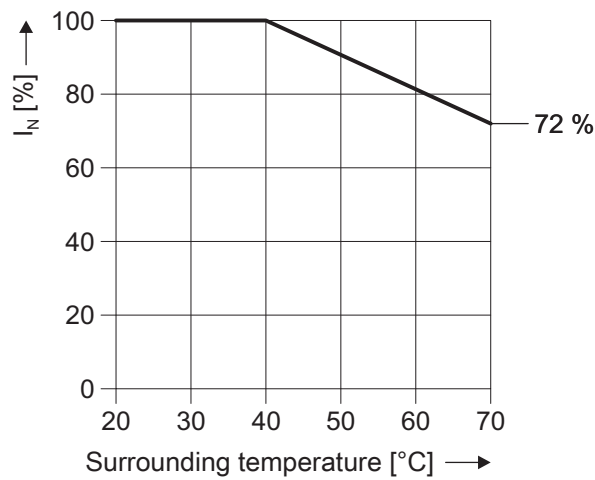


Fig. 15: Derating the nominal current based on surrounding temperature

Derating – Effect of the installation elevation

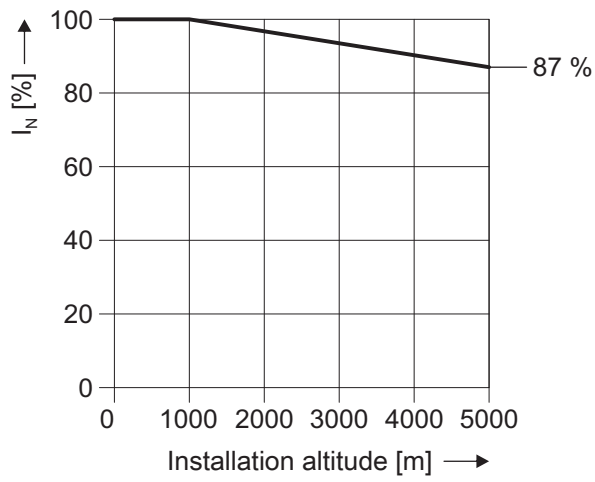


Fig. 16: Derating the nominal current depending on installation elevation

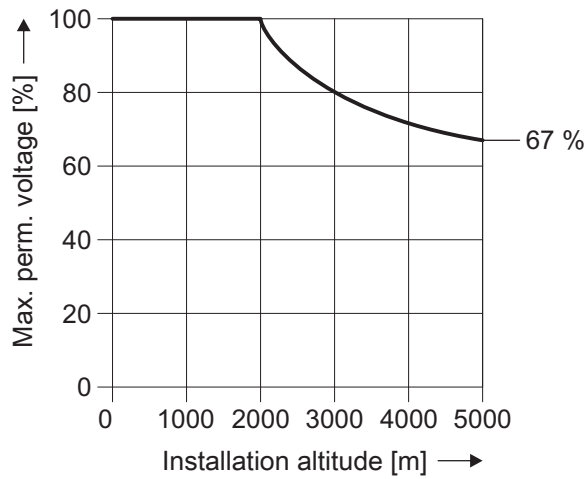


Fig. 17: Derating the voltage depending on installation elevation

Dimensions and weight

Dimension	TEP3720-0ES41	TEP3820-0CS41	TEP4020-0RS41
Height h [mm]	Max. 153	Max. 153	Max. 180
Width w [mm]	178	178	219
Depth d [mm]	73	88	119
Vertical distance – Fastening holes a1 [mm]	166	166	201
Vertical distance – Fastening holes a2 [mm]	113	113	136
Horizontal distance – Fastening holes b1 [mm]	53	68	89
Horizontal distance – Fastening holes b2 [mm]	49	64	76
Drill holes – Depth e [mm]	5,8	5,8	7
Drill holes – Width f [mm]	11	11	13
Screw connection – M	M5	M5	M6
Weight [g]	2900	5900	8800

Tab. 72: TEP dimensions and weight

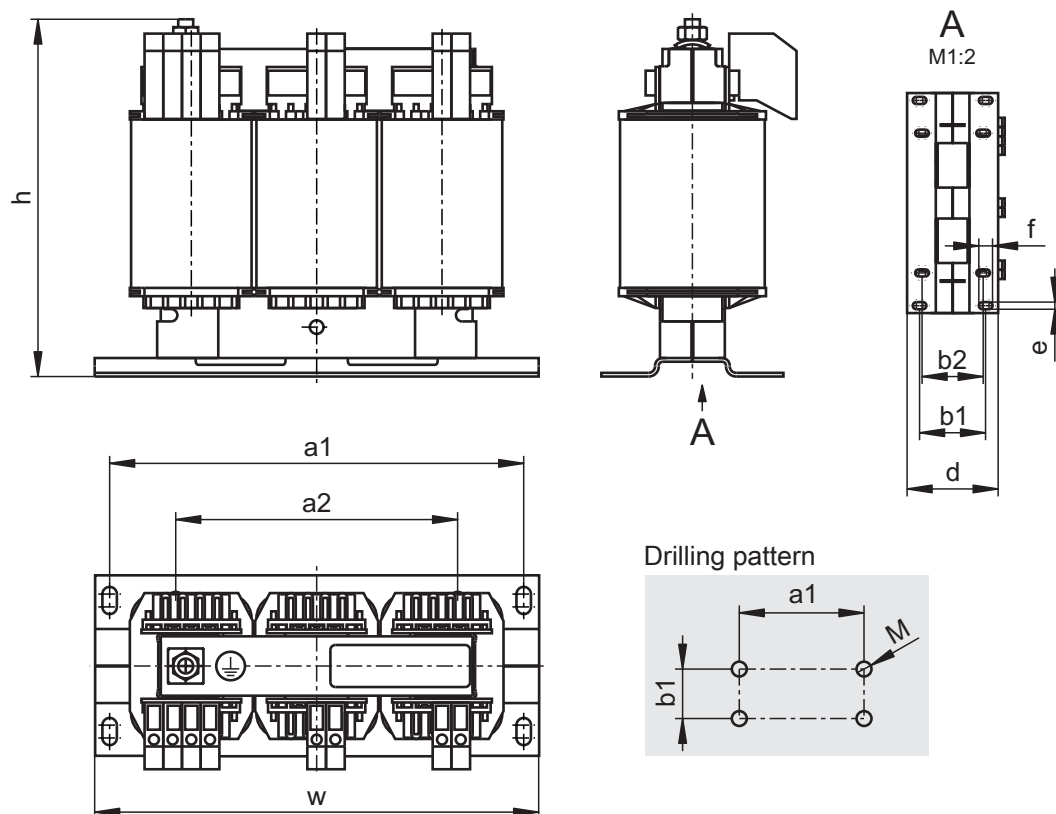


Fig. 18: TEP dimensional drawing

7 Project configuration

Relevant information on the project configuration and design of your drive system can be found in the following chapters.

7.1 Supply module

7.1.1 Information on design and operation

Information

Note for the design of the supply module that the summed self-capacitance of all SI6 drive controllers may not exceed the maximum charging capacity of the supply module.

Minimum time between energizing two devices

The supply modules have temperature-dependent resistors in the charging circuit that prevent devices from being damaged when being connected to the grid after a fault, such as a short-circuited DC link, incorrect wiring, etc. These resistors are heated when charging the DC link.

Information

For cyclic power-on/power-off operation, the following is to be observed to prevent the charging capacities of the supply modules from being exceeded:

- a) PS6 without braking resistor: Direct, repeat activation of the supply voltage possible
 - b) PS6 with braking resistor and an interval < 30 s after power-off: Direct, repeat activation of the supply voltage possible
 - c) PS6 with braking resistor and an interval > 30 s after power-off: Reactivation of the supply voltage only possible 2 min after previous activation!
-

Information

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

7.1.2 Parallel connection of supply modules

The following general conditions apply to the parallel connection of several PS6 supply modules:

- Only the same sizes may be connected in parallel.
- You can connect a maximum of 6 PS6A24 in parallel.
- You can connect a maximum of 3 PS6A34 in parallel.
- For UL-compliant operation:
A single PS6A24 or PS6A34 supply module converts the AC (3-phase) input voltage into a common DC bus output voltage, which is used to feed one or more SI6 drive controllers.
- You can connect one braking resistor for each supply module.
- Observe a derating factor of 0.8 each for the sum in parallel connection for nominal power, current and charging capacity.
- The resistance values of the braking resistors must be the same. Note that the power is output to all braking resistors in equal parts.
- Take into account the specifications for the fuse design for each supply module within the group. Each supply module must be protected individually; see the chapter [CE-compliant line fuse](#) [▶ 104].
- All supply modules must be connected to the same three-phase supply grid.
- The grid must be switched on at all supply modules simultaneously; see the chapter [Grid connection](#) [▶ 105].
- Each supply module also has to be grounded at the ground bolt of the Quick DC-Link module if the cross-section of the grounding conductor at X10 is less than 10 mm²; see the chapter [CE-compliant housing grounding](#) [▶ 107].
- There are no restrictions for the position of a supply module within the group.
- Mixed supply operation with drive controllers of the 6th STOBBER drive controller generation is not permitted.

Parallel connection

The following table shows example combinations for parallel connection. A derating factor of 0.8 is taken into account for the values.

Electrical data	2 x PS6A24	3 x PS6A24	2 x PS6A34	3 x PS6A34
$P_{N,PU}$	16 kW	24 kW	32 kW	48 kW
$I_{1N,PU}$	40 A	60 A	80 A	120 A
C_{maxPU}	8000 µF	12000 µF	16000 µF	24000 µF

Tab. 73: Electrical data for parallel connection: Example combinations

Wiring example

The examples in the chapter [Wiring examples](#) [▶ 239] illustrate the basic connection based on a DC link connection with DL6B Quick DC-Link.

7.2 DC link connection

Braked motors work like generators: Operating with an active drive controller, they convert kinetic energy from movement into electrical energy. This electrical energy is stored in the DC link capacitors of the drive controller. It is supplied to powered motors with connected DC links and thus used efficiently.

The DC link voltage increases when a motor decelerates. However, capacitors in the DC link can only accept a limited amount of energy. If the DC link voltage rises above a defined limit, a chopper circuit is activated that converts the excess energy into heat by means of a connected braking resistor. If the permitted maximum voltage is reached, any possible damage must be prevented. The drive controller switches to the **FAULT** state and shuts down. In a DC link connection, the DC link capacitors of the drive controllers involved are connected in parallel. As a result, the maximum acceptable amount of energy increases in the DC link.

7.2.1 Information on design and operation

In order to connect the capacitors of multiple drive controllers, you need a separate DL6B type Quick DC-Link module for each drive controller and every supply module in the group.

Information

Note that Quick DC-Link can be subject to system or country-specific standards.

Electrical data of the drive controller

For the design and the operation of the Quick DC-Link, the electrical data of the individual drive controller and supply module types must be observed, particularly the following:

- Self-capacitance C_{PU} of the drive controllers
- Charging capacity C_{maxPU} of the supply modules
- Nominal input current $I_{1N,PU}$ of the supply modules
- Derating of the nominal input current

The values can be taken from the technical data of the drive controllers and supply modules.

Maximum voltage and maximum current

The maximum DC link voltage is 750 V_{DC} and the maximum permitted overall current is 200 A.

7.3 Mixed operation

You can combine the PS6 supply module and SI6 drive controller with other drive controllers from the 6th generation of STOBER drive controllers.

For UL-compliant operation, note that mixed operation is not currently possible.

In mixed operation, only device types of the same series and size may be supplied with power. The framework conditions for the supplying device apply.

The graphic below shows an example of the grounding concept in mixed operation with a powered PS6 supply module. The protective connection between the supply module or drive controller and the associated Quick DC-Link rear section module (type DL6B or DL6A) is made using the metallic connection of the housings. The protective connection between the rear section modules of the DL6B type is made using a copper rail. You can find the requirements for the connection of a 2nd grounding conductor for a supply module in the chapter [CE-compliant housing grounding](#) [▶ 107]. The same requirements also apply to drive controllers with DL6A rear section modules.

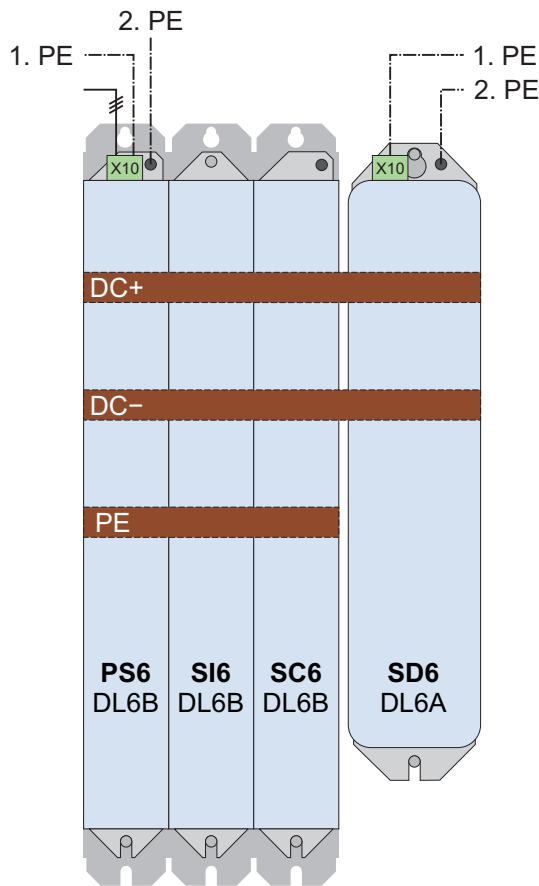


Fig. 19: Grounding concept in mixed operation with powered PS6 supply module

7.4 Example design for UL-compliant operation

The information and examples in this chapter are based on an input voltage of 480 V_{AC}. For a more detailed design, SERVOsoft is helpful mechanical and electrical sizing software for drive systems.

The maximum number of devices in the device group is limited by certain variables. The nominal output current $I_{2N,PU}$ of the supply module, the charging capacity C_{PU} of the supply module and the maximum copper rail length of 1500 mm must not be exceeded.

The following rules must be observed when determining the maximum number of devices and the total load of the modular drive system:

- The sum of all input currents of the drive controllers connected to the supply module must not exceed the maximum nominal output current of the supply module.
- The sum of the self-capacitance of the drive controllers connected to the supply module must not exceed the maximum charging capacity of the supply module.
- The total length of the copper rails used for the device group must not exceed 1500 mm.

Type	Charging capacity C_{max} [mF]
PS6A24	5
PS6A34	10

Tab. 74: Maximum charging capacity of the PS6 supply module

Type	Self-capacitance C_{PU} [mF]
SI6A061	0.18
SI6A062	0.27
SI6A161	0.47
SI6A162	0.94
SI6A261	0.94
SI6A262	2.25
SI6A361	2.25

Tab. 75: Self-capacitance of the SI6 drive controllers connected to the PS6 supply module

7.4.1 Maximum operation on PS6A24

Drive controller				Quick DC-Link	Limiting factor			Examples	
Type	Self-capacitance C_{PU} [mF]	Nominal input current (DC) $I_{IN,PU}$ [A] ⁷	Width [mm]	Type	Charging capacity ($C_{max,PU} = 5$ mF)	Nominal output current ($I_{2N,PU} = 21.4$ A)	Length of the copper rails [max. 1500 mm]	Partial load of 50%	Partial load of 25%
SI6A061	0.18	4.2	45	DL6B10	27 devices	5 devices	32 devices	10 devices	20 devices
SI6A062	0.27	8.4	45	DL6B10	18 devices	2 devices	32 devices	5 devices	10 devices
SI6A161	0.47	10.4	65	DL6B11	10 devices	2 devices	22 devices	4 devices	8 devices
SI6A162	0.94	20.7	65	DL6B11	5 devices	1 device	22 devices	2 devices	4 devices
SI6A261	0.94	19.0	65	DL6B11	5 devices	1 device	22 devices	2 devices	4 devices
SI6A262	2.25	41.2	105	DL6B12	2 devices	0 devices	13 devices	1 device	2 devices
SI6A361	2.25	41.2	105	DL6B12	2 devices	0 devices	13 devices	1 device	2 devices

Tab. 76: Maximum operation on one PS6A24 supply module with DL6B20 rear section module

⁷ Measured value

7.4.2 Maximum operation on PS6A34

Drive controller				Quick DC-Link	Limiting factor			Examples	
Type	Self-capacitance C_{PU} [mF]	Nominal input current (DC) $I_{1N,PU}$ [A] ⁸	Width [mm]	Type	Charging capacity ($C_{max,PU} = \max.$ 10 mF)	Nominal output current ($I_{2N,PU} = \max.$ 42.8 A)	Length of the copper rails [max. 1500 mm]	Partial load of 50%	Partial load of 25%
SI6A061	0.18	4.2	45	DL6B10	55 devices	10 devices	32 devices	20 devices	40 devices
SI6A062	0.27	8.4	45	DL6B10	37 devices	5 devices	32 devices	10 devices	20 devices
SI6A161	0.47	10.4	65	DL6B11	21 devices	4 devices	22 devices	8 devices	16 devices
SI6A162	0.94	20.7	65	DL6B11	10 devices	2 devices	22 devices	4 devices	8 devices
SI6A261	0,94	19,0	65	DL6B11	10 devices	2 devices	22 devices	4 devices	8 devices
SI6A262	2.25	41.2	105	DL6B12	4 devices	1 device	13 devices	2 devices	3 devices
SI6A361	2.25	41.2	105	DL6B12	4 devices	1 device	13 devices	2 devices	3 devices

Tab. 77: Maximum operation on one PS6A34 supply module with DL6B21 rear section module

⁸ Measured value

7.4.3 Sample calculation

Assume 20 motors, each with a nominal current of 2 A and an operating time of 100% (full load). The design calls for 10 SI6A062 double-axis controllers with a nominal output current of 2×5 A.

1. Checking the self-capacitance of the drive controllers versus the charging capacity of the supply module

The DC link capacitance in the group to be charged corresponds to the sum of the self-capacitances of all drive controllers in the group: 10×0.27 mF = 2.7 mF.

The maximum charging capacity of the PS6A24 supply module is 5 mF.

This means one PS6A24 supply module is sufficient.

2. Determining current requirements and checking utilization

The nominal input current (DC) of a SI6A062 is 8.4 A; the nominal output current is 5 A per axis. The motor's nominal current is 2 A.

The current requirement for the specific application is 8.4 A \div 5 A \times 2 A = 3.36 A per drive controller. As a result, 10 drive controllers would need 33.6 A.

The nominal input current of a PS6A24 supply module is 21 A; the nominal input current of a PS6A34 is 42 A.

The PS6A24 supply module is not sufficient in terms of the current requirements. A PS6A34 supply module is needed.

3. Checking the length of the copper rails

The width of a SI6A062 drive controller is 45 mm; the width of the PS6A34 supply module is 65 mm.

The total length of the group corresponds to: 10×45 mm + 65 mm – 2×2.5 mm = 510 mm.

At 1500 mm, the length of a standard copper rail is sufficient.

7.5 Order overview of the hardware components

Device		Terminal set	Quick DC-Link		
Type	ID No.	ID No.	Type	ID No.	Width [mm]
PS6A24	56650	138660	DL6B20	56656	45
PS6A34	56651	138661	DL6B21	56658	65
SI6A061	56645	138655	DL6B10	56655	45
SI6A062	56646	138656	DL6B10	56655	45
SI6A161	56647	138657	DL6B11	56656	65
SI6A162	56648	138658	DL6B11	56656	65
SI6A261	56649	138659	DL6B11	56656	65
SI6A262	56653	138662	DL6B12	56663	105
SI6A361	56654	138663	DL6B12	56663	105

Tab. 78: Overview of hardware components with ID No.

For each device group, another two insulation end sections are needed for the left and right termination of the Quick DC-Link modules (ID No. 56659, 2 pieces).

The quick fastening clamps for fastening the copper rails and an insulation connection piece are included in Quick DC-Link's scope of delivery.

All delivered components (drive controllers, supply modules and accessories) are marked to make it easy to assign connected components (e.g. assignment of a terminal set to the drive controller or supply module).

You can find other available accessories in the chapter "Accessories."

Copper rails

Each device group requires 3 copper rails (DC+, DC-, grounding). The copper rails (EATON CU12X5 034121) with a standard length of 1500 mm must be ordered from STOBER under the ID No. 56676.

The required length of the copper rails corresponds to the total length of the group minus 5 mm:

- V = Number of DL6B20 × 45 mm
- W = Number of DL6B21 × 65 mm
- X = Number of DL6B10 × 45 mm
- Y = Number of DL6B11 × 65 mm
- Z = Number of DL6B12 × 105 mm

Total length = V + W + X + Y + Z - 5 mm

Ensure that the length of at least 3 of the ordered copper rails is sufficient for the calculated total length. During installation, the copper rails must be cut to the actual length of the device group, see the chapter [Length of copper rails](#) [► 94].

8 Storage

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

Observe the [Transport and storage conditions \[► 38\]](#) specified in the technical data.

8.1 Supply module

No reforming is required for the PS6 supply module even after long storage times.

8.2 Drive controller

The DC link capacitors can lose their electrical strength due to long storage times.

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.
-

8.2.1 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 graphic shows the predominant supply connection.

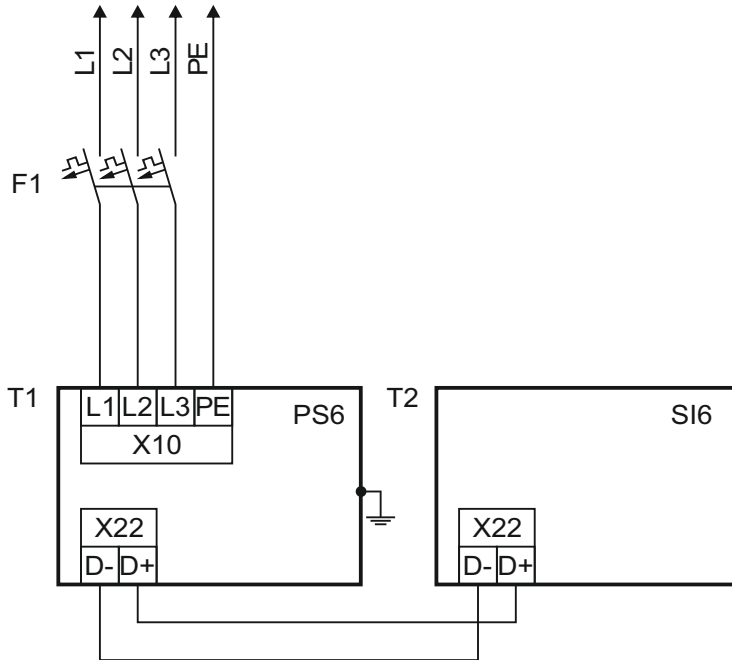


Fig. 20: Annual reforming

- L1 – L3 Lines 1 to 3
- N Neutral conductor
- PE Protective ground
- F1 Fuse
- T1 Supply module
- T2 Drive controller

Information

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

8.2.2 Reforming before commissioning

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

The following graphic shows the predominant supply connection.

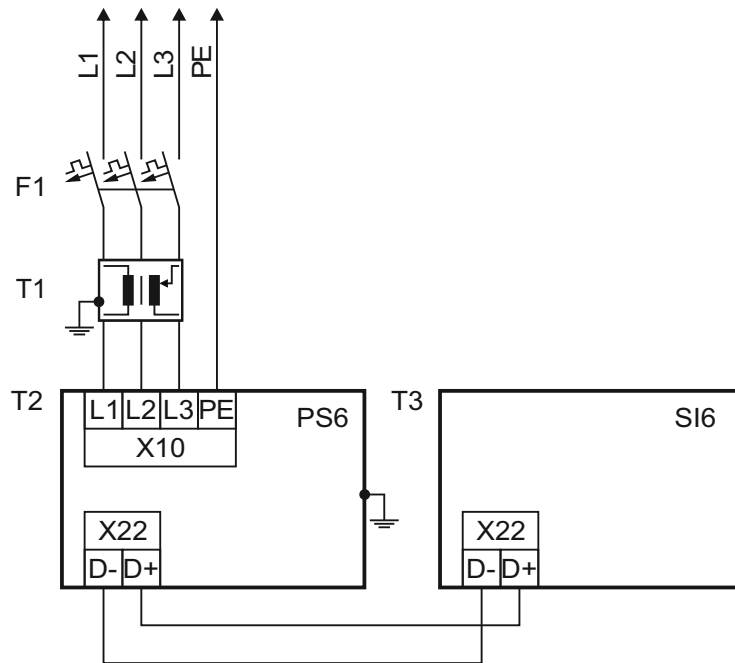


Fig. 21: Reforming before commissioning

- L1 – L3 Lines 1 to 3
- N Neutral conductor
- PE Protective ground
- F1 Fuse
- T1 Variable transformer
- T2 Supply module
- T3 Drive controller

Information

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

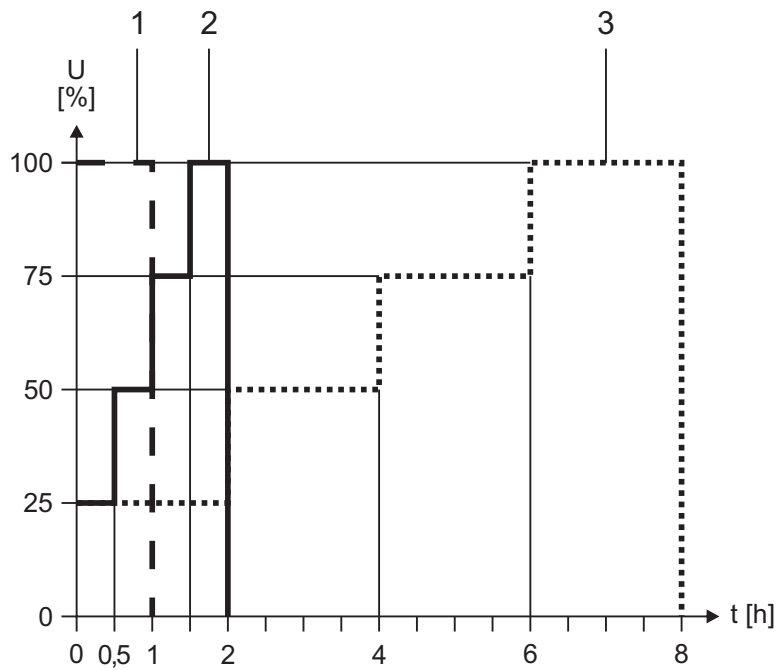


Fig. 22: Voltage levels dependent on storage time

- | | | |
|---|------------------------------|---|
| 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 \geq 3 years: | Implement reforming according to the graph before switching on. |
| | Storage time < 1 year: | No actions required. |

9 Installation

The following chapter describes the installation of the Quick DC-Link rear modules for the DC link connection as well as the subsequent installation of the drive controllers and supply modules.

9.1 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 \[► 17\]](#).

Note the minimum clearances specified during installation to prevent the devices from overheating.

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.

9.2 Basic assembly instructions

Note the points described below for installation.

9.2.1 Drive controllers and supply modules

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 provided field on the front on the device with the unique reference identification of the respective device to prevent mix-ups during installation or replacement.

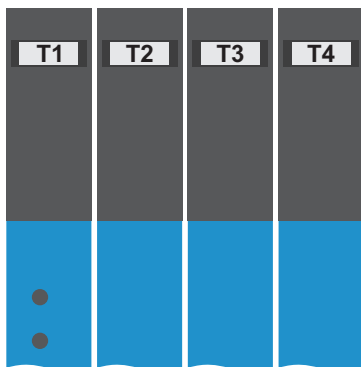
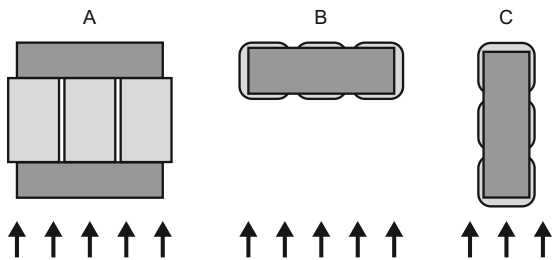


Fig. 23: Fields for equipment identification on the front of the device

9.2.2 Choke

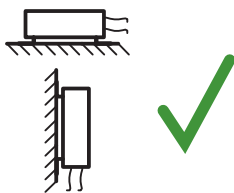
In relation to the flow of cooling air, the following mounting positions are permitted for the TEP output choke:



9.2.3 Braking resistor

Note the permitted mounting positions for the braking resistor.

KWADQU flat resistor



Permitted installation:

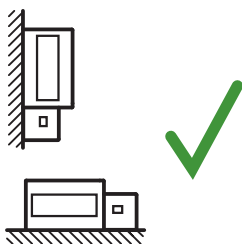
- On vertical surfaces with cables downwards
- On horizontal surfaces
- Installation outside of the control cabinet possible for mechanical protection of the conductors



Impermissible installation:

- On vertical surfaces with cables upwards

FZZMQU tubular fixed resistor



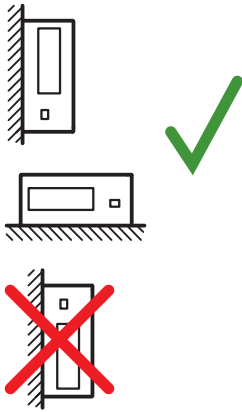
Permitted installation:

- On vertical surfaces with terminals downwards
- On horizontal surfaces
- In control cabinets



Impermissible installation:

- On vertical surfaces with terminals upwards, left or right
- Outside of control cabinets

FGFKQU steel-grid fixed resistor

Permitted installation:

- On vertical surfaces with terminals downwards
- Top and bottom perforated sheets
- On horizontal surfaces
- Installation on, next to or in the control cabinet possible

Impermissible installation:

- On vertical surfaces with terminals upwards, left or right

9.3 Minimum clearances

Note the minimum clearances for installation below.

Drive controllers and supply modules

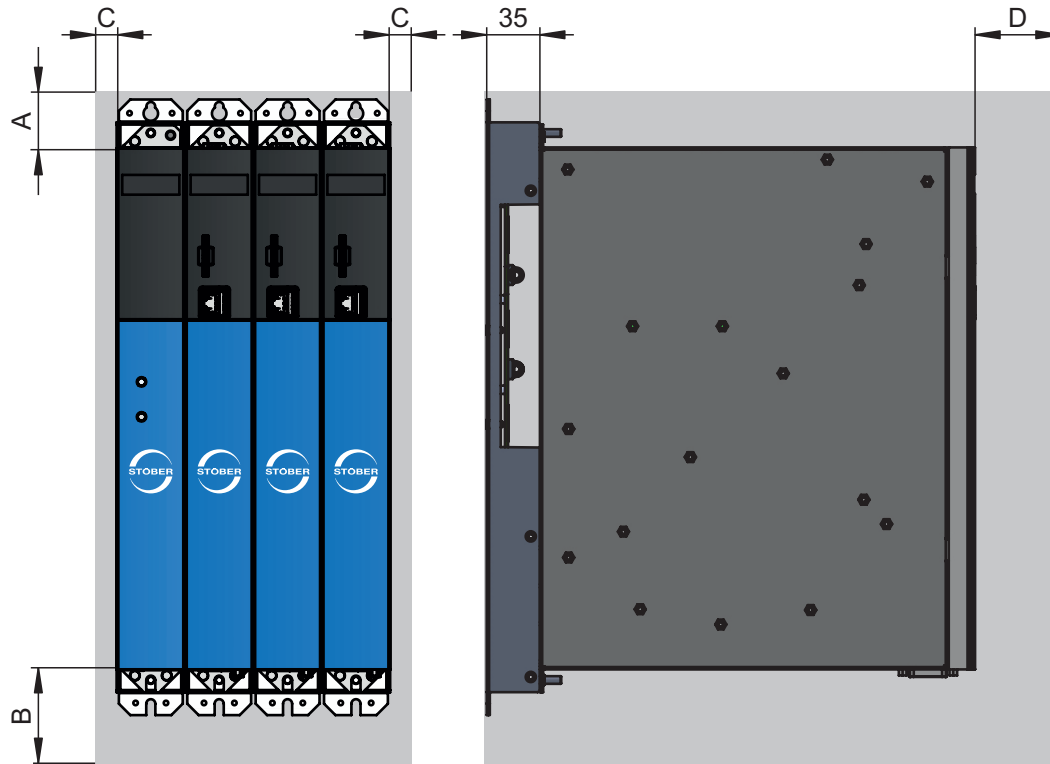


Fig. 24: Minimum clearances

The specified dimensions refer to the outside edges of the drive controller or supply module including the Quick DC-Link rear section module.

Minimum clearance	A (above)	B (below)	C (on the side)	D (in front)
All sizes	100	200	5	50 ⁹

Tab. 79: Minimum clearances [mm]

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 resistor

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.

⁹ Minimum clearance to be taken into account for permanent connection of the X9 service interface

9.4 Drilling diagrams and dimensions

You can find drilling diagrams and dimensions for a multi-axis drive system with SI6 and PS6 and for accessories in the following chapters.

9.4.1 Multi-axis drive system

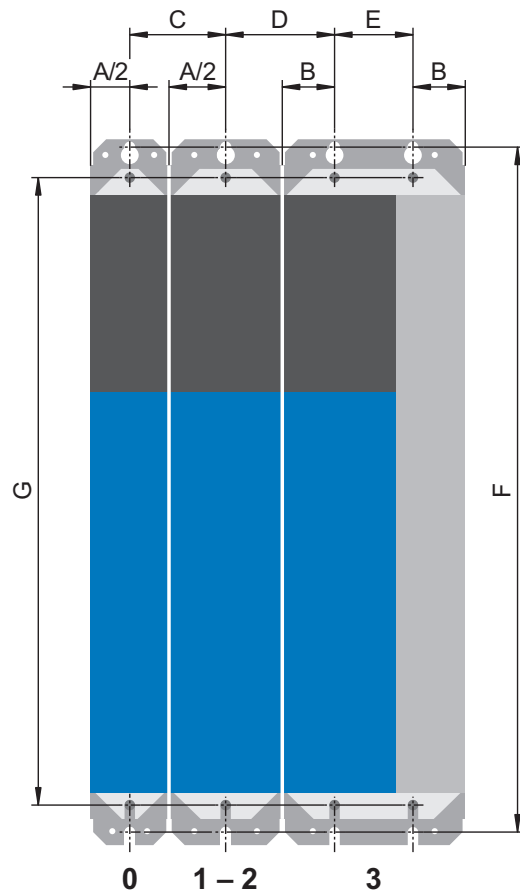


Fig. 25: Drilling diagram for multi-axis drive system

DL6B dimensions		Size 0	Size 1, size 2	Size 3	
Horizontal fastening holes Ø 4.2 (M5)	A	45	65	—	
	B	—	—	30	
	E	—	—	45+0.2/-0.2	
	C	Size 0	46±1	56±1	—
	C	Size 1, size 2	56±1	66±1	—
	D	Size 0	—	—	53.5±1
	D	Size 1, size 2	—	—	63.5±1
Vertical fastening holes Ø 4.2 (M5)	F	393+2			
	G	360			
Vertical distance for drive controllers and supply modules	G	360			

Tab. 80: Drilling dimensions for the multi-axis drive system [mm]

9.5 Length of copper rails

For the installation of the Quick DC-Link modules, you require three prepared copper rails with a cross-section of 5 × 12 mm.

The length of the copper rails is 5 mm shorter than the total width of the group, i.e. the total width of all DL6B Quick DC-Link modules present in the group:

$$B = A - 5 \text{ mm}$$

Note that the correct length of the copper rails can be determined only after installation of all modules:

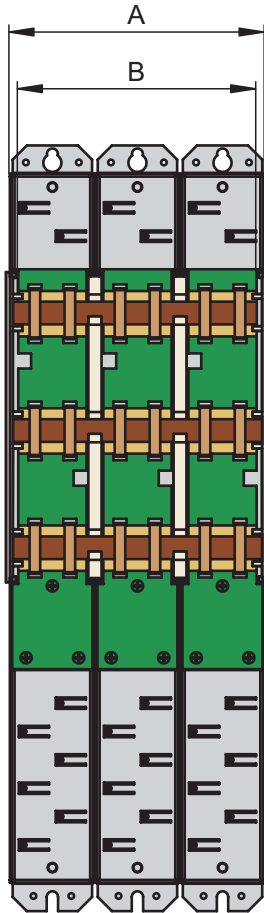


Fig. 26: Determination of the correct length of the copper rails

- A Total width of the group after installation
- B Length of the copper rails = A - 5 mm

9.6 Installing the DC link connection

Observe the installation notes when installing the DC link connection and associated hardware components.

9.6.1 Order overview of the components for the DC link connection

Device		Terminal set	Quick DC-Link		
Type	ID No.	ID No.	Type	ID No.	Width [mm]
PS6A24	56650	138660	DL6B20	56656	45
PS6A34	56651	138661	DL6B21	56658	65
SI6A061	56645	138655	DL6B10	56655	45
SI6A062	56646	138656	DL6B10	56655	45
SI6A161	56647	138657	DL6B11	56656	65
SI6A162	56648	138658	DL6B11	56656	65
SI6A261	56649	138659	DL6B11	56656	65
SI6A262	56653	138662	DL6B12	56663	105
SI6A361	56654	138663	DL6B12	56663	105

Tab. 81: Overview of hardware components necessary for the DC link connection with ID No.

9.6.2 Installing the DC link connection

DANGER!

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

Tools and material

You will need:

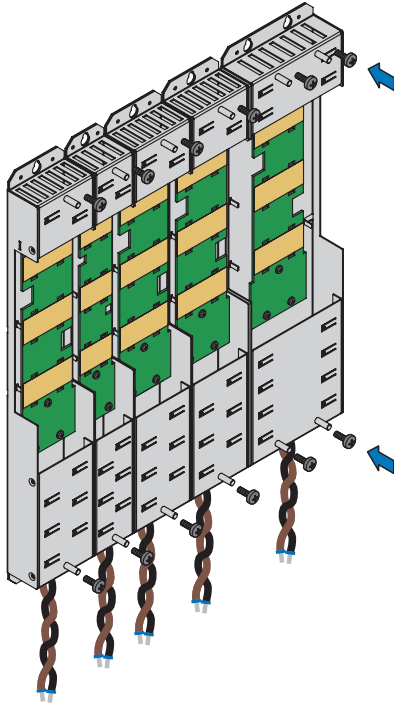
- 3 copper rails with sufficient length and a cross-section of 5 x 12 mm, see the chapter [Length of copper rails \[▶ 94\]](#)
- The nut and washer assemblies (M5), insulation connection pieces and quick fastening clamps included with the DL6B Quick DC-Link modules
- The insulation end sections for the left and right termination of the group that are available separately
- Fastening screws and tool for tightening the fastening screws

Requirements and installation

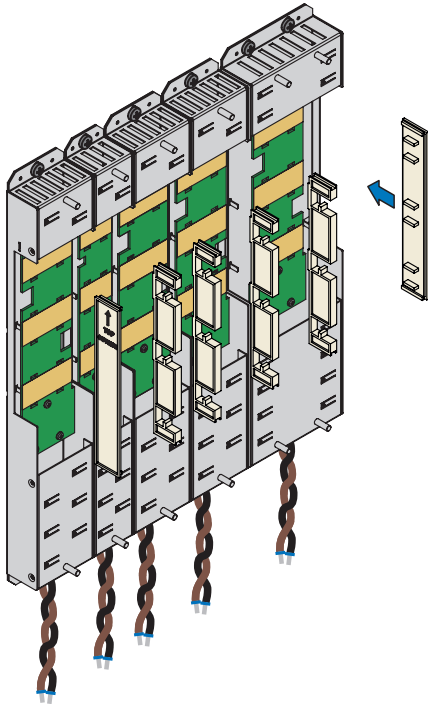
Observe the basic installation instructions in the chapter [Drive controllers and supply modules \[▶ 89\]](#).

Perform the following steps in the specified order.

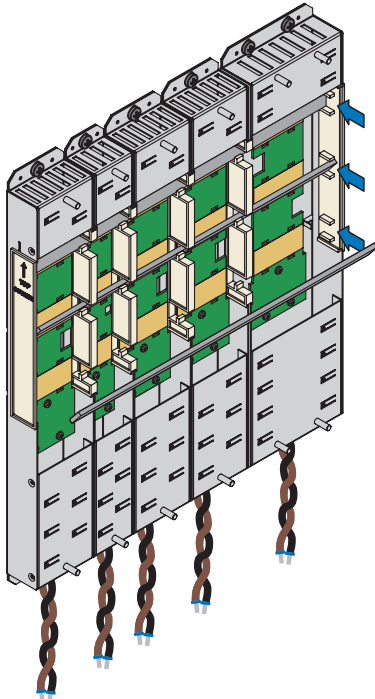
- ✓ You have tapped holes for fastening screws on the mounting plate at the installation location in accordance with the drilling diagram and taking into consideration the different device dimensions.
 - ✓ The mounting plate has been cleaned (free of oil, grease and swarf).
 - ✓ The copper rails must be straight, smooth, free of burrs and cleaned (free of oil and grease).
1. Fasten the Quick DC-Link modules onto the mounting plate with the fastening screws.



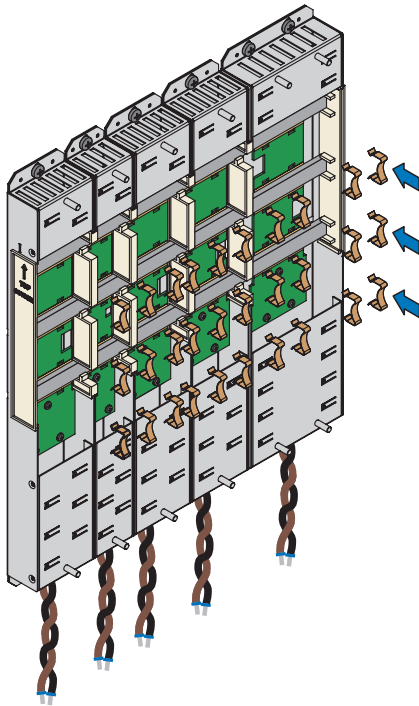
2. Insert the insulation connection pieces between the modules and insulation end section each at the left edge of the first module and at the right edge of the last module. Ensure correct alignment of the end section using the marking on the outside and the insertion aids for the copper rails on the inside.



3. Shorten the copper rails to the correct length.
4. Clean the copper rails, especially at the contact points.
5. Insert the three copper rails one after the other.



6. 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 suitable drive controllers and supply modules.

9.7 Installing drive controllers and supply modules

DANGER!

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. 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:

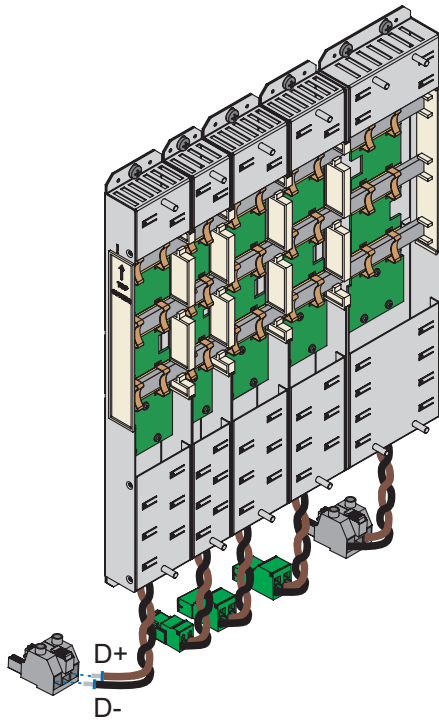
- A suitable terminal set for each drive controller and for each supply module
- A 8 mm hexagonal socket wrench to tighten the nuts

Requirements and installation

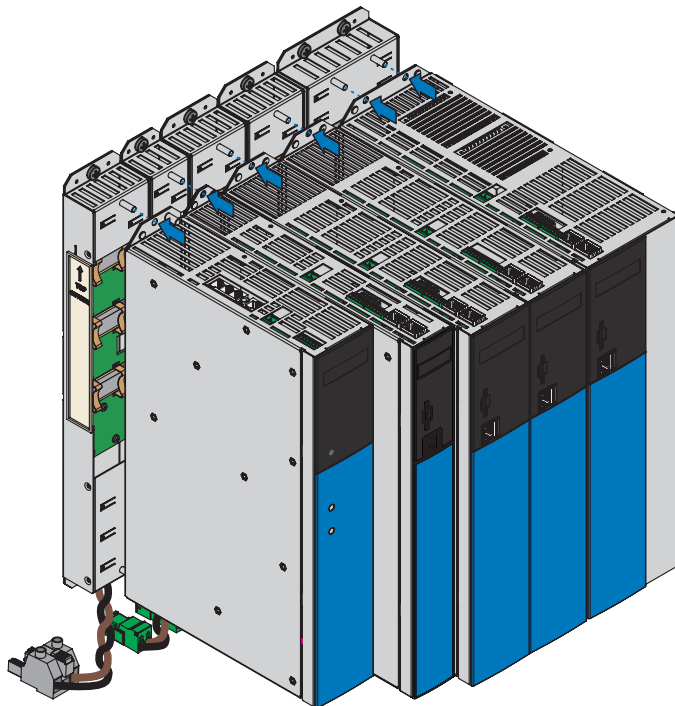
Perform the following steps for each drive controller and for each supply module within the group.

- ✓ A circuit diagram of the system is available containing a description of connecting the drive controllers and supply modules.
- ✓ Suitable DL6B Quick DC-Link rear section modules for the DC link connection are already installed at the installation location for each drive controller and each supply module.

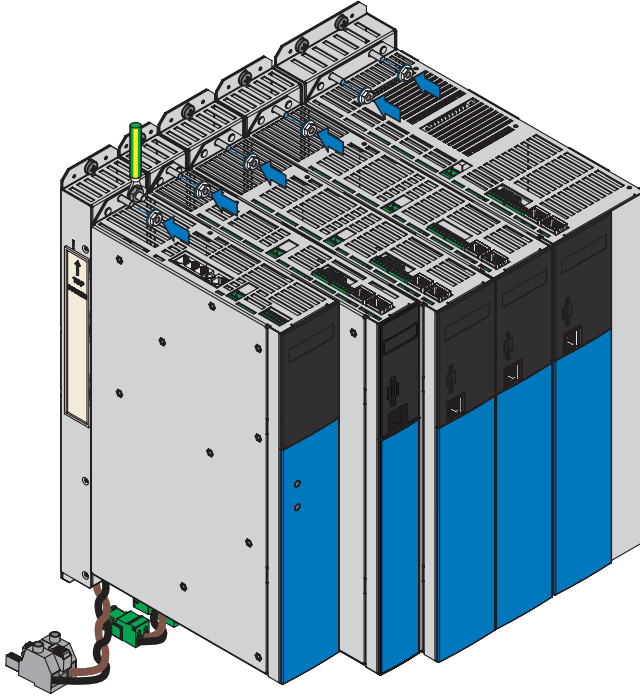
1. Remove terminal X22 from the appropriate terminal set. Connect the brown cable D+ of the bottom of the Quick DC-Link module to D+ of terminal X22, and the black cable D- of the Quick DC-Link module to D- of terminal X22. Note that the terminal is only connected at a later point in time.



2. Place the drive controller or supply module on the bottom threaded bolt of the Quick DC-Link module and properly align the device vertically with the bottom and top threaded bolt.



3. Fasten the drive controller or the supply module with the nut and washer assemblies (M5, 3.5 Nm) to both threaded bolts of the Quick DC-Link module. The nut and washer assemblies are included with the Quick DC-Link module.



10 Connection

The following chapters describe the connection of the supply modules and drive controllers as well as the available accessories.

10.1 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](#) [▶ 17].

Make sure that all Quick DC-Link modules are covered, i.e. built over with a PS6 supply module or SI6 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 the 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 and, if applicable, the [fast discharge](#). You can find the discharge time in the general technical data.

Information

You can check the output voltage at the marked measuring points at the front of the housing of the PS6 supply module that are used for the DC link connection of the drive controllers.

ATTENTION!

Material damage due to overload!

Insufficient electrical strength of the measuring device can cause damage or failure of the measuring device.

- Make sure that the measuring device has an electrical strength of at least $1000 V_{DC}$.

Opening the housing, plugging in or unplugging connection terminals, connecting or removing 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 DIN 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. This means operation is permitted only if the protective grounding conductor is connected according to requirements.

All protective ground connections are identified by "PE" or the international symbol for grounding (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.

10.2 Line routing

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

10.3 Protective measures

Take the following protective measures into account.

10.3.1 Power grid supply

All supply modules must be connected to the same supply grid.

ATTENTION!

Damage to device due to the emission of electromagnetic interference!

If the EMC threshold limits are exceeded during the operation of a DC link connection, devices in the immediate area can be interrupted or damaged.

- Take suitable measures to comply with the electromagnetic compatibility.
- Always route the shortest possible connections for DC links. If they are longer than 30 cm, they must be shielded.

ATTENTION!

Damage to device in case of drive controller failure!

The failure of a supply module in the DC link can result in damage to additional devices.

- A failure must trigger the isolation of the entire DC link group from the grid.

Wiring example

The examples in the chapter [Wiring examples \[▶ 239\]](#) illustrate the basic connection based on a DC link connection with DL6B Quick DC-Link.

10.3.2 CE-compliant line fuse

Every supply module in the group supplied with power must be protected against overload and short circuit at the grid input. To do this, a safety 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 against short circuit.

Information

The installation of short-circuit fuses is not necessary under ideal prerequisites and ambient conditions. However, if the application conditions pose the risk of contaminating the drive controllers and supply modules, short-circuit fuses can protect against damage to or failure of other devices within the DC link group.

Information

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

Information

Note that the charge current after switching on the power supply is less than the nominal input current of the power unit $I_{1N,PU}$.

You can use the following protective devices:

Size	Type	$I_{1N,PU}$ [A]	I_{1maxPU} [A]	Overload protection	Short-circuit protection
Size 2	PS6A24	25	$I_{1N,PU} \times 180\%$ for 5 s; $I_{1N,PU} \times 150\%$ for 30 s	EATON Type FAZ-Z25/3 Order number 278929 Z 25 A	SIBA Type URZ Art. No. 50 124 06.40 gR 40 A
Size 3	PS6A34	50	$I_{1N,PU} \times 180\%$ for 5 s; $I_{1N,PU} \times 150\%$ for 30 s	EATON Type FAZ-Z50/3 Order number 278932 Z 50 A	SIBA Type URZ Order number 50 140 06.80 gR 80 A

Tab. 82: PS6 protective devices

10.3.3 UL-compliant line fuse

Use the supply module with power to ensure UL-compliant use; permitted for supply grids with a differential short-circuit current up to 5000 A, max. 480 V_{AC} with one of the following fuses:

- Class CC, CF, J, T, G or RK1 fuses
- Circuit breakers

The appropriate fuses can be taken from the following table:

Size	Type	Safety fuse		Circuit breakers
		I _N [A]	U _N [V _{AC}]	
2	PS6A24	30	600	EATON NZMB1-AF30-NA Manufacturer No. 281556
3	PS6A34	60	600	EATON NZMB1-AF60-NA Manufacturer No. 272208

Tab. 83: UL-compliant line fuse

10.3.4 Grid connection

The grid must be switched on at all supply modules simultaneously. Simultaneously in this case means that the time difference may be a maximum of 20 ms. This condition is generally met if you use contactors of identical design from one manufacturer.

Provided that the grid connection is made simultaneously, a design with a contactor for each supply module is permitted.

ATTENTION!

Damage due to overload!

If the network does not connect to all modules simultaneously in a design with a contactor for each supply module, their charging resistors can be damaged.

10.3.5 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!**

Leakage currents with a DC current component may occur in 3-phase installations.

- 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 motor cables under normal operating conditions. This false triggering can be rectified for example using low-capacitance cables or an output choke.
- 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.
-

10.3.6 CE-compliant housing grounding

Connect the grounding conductor to the supply module 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 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.

For correct housing ground, connect the 2nd grounding conductor to the grounding bolt of the DL6B Quick DC-Link module of the supply module. The housing grounding connections for the SI6 drive controllers in the group are connected to the grounding conductor circuit over the PE rail of the Quick DC-Link modules.

Note the tightening torque of 4.0 Nm.

Observe the order for assembly:

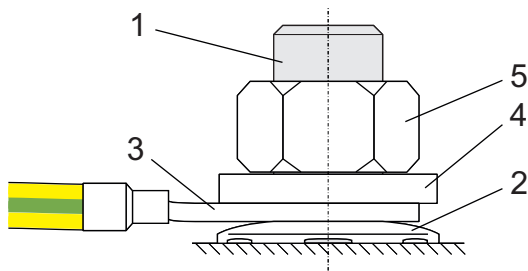


Fig. 27: Connection of the grounding conductor

- 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.

Leakage currents > 10 mA can arise in normal operation. To fulfill DIN EN 61800-5-1 and 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 mm ²	2.5 mm ²
2.5 < A ≤ 16 mm ²	A
16 – 35 mm ²	≥ 16 mm ²
> 35 mm ²	A/2

Tab. 84: Minimum cross-section of the grounding conductor

10.3.7 UL-compliant housing grounding

Note that UL-compliant operation requires just a single grounding conductor.

The chassis of the PS6A/SI6A units is to be bonded through the M6 grounding studs on the PS6A units (4.0 Nm, 35 Lb.inch).

The chassis of the SI6A units are to be bonded by means of proper mounting of the SI6A unit(s) by means of two mounting screws on top of the DL6B unit(s). The specified tightening torque for these mounting screws on the DL6B units is: 3.5 Nm (31 Lb.inch).

Observe the order for assembly:

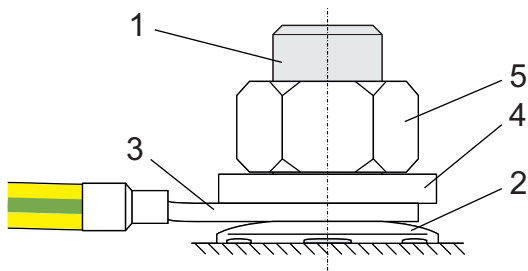


Fig. 28: Connection of the grounding conductor

- 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.

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 wiring example in the chapter [UL-compliant connection of the supply module](#) [▶ 241] to ensure correct connection of the supply module.

10.3.8 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, motor cable and signal lines separately from each other, e.g. in separate conduits.

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

If the brake line is carried in the motor cable, it must be shielded separately. Also close the brake lines on the drive controller if you are using a motor with a brake.

Connect the shield of the motor cable over large contact areas and in the immediate vicinity of the drive controller. To do this, use the shield clamp and shield contact at terminal X20.

The connection lines for braking resistors and the connection lines for Quick DC-Link modules have to be implemented as twisted pairs. At line lengths of 30 cm or more, the lines also have to be implemented with shielding and the shield must be applied over a wide area in immediate proximity to 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 with the reference ground of the source, e.g. the PLC or CNC.

10.4 Supply module

For detailed information about the terminals and correct connection of the supply module, refer to the following chapters.

Information

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

10.4.1 Overview

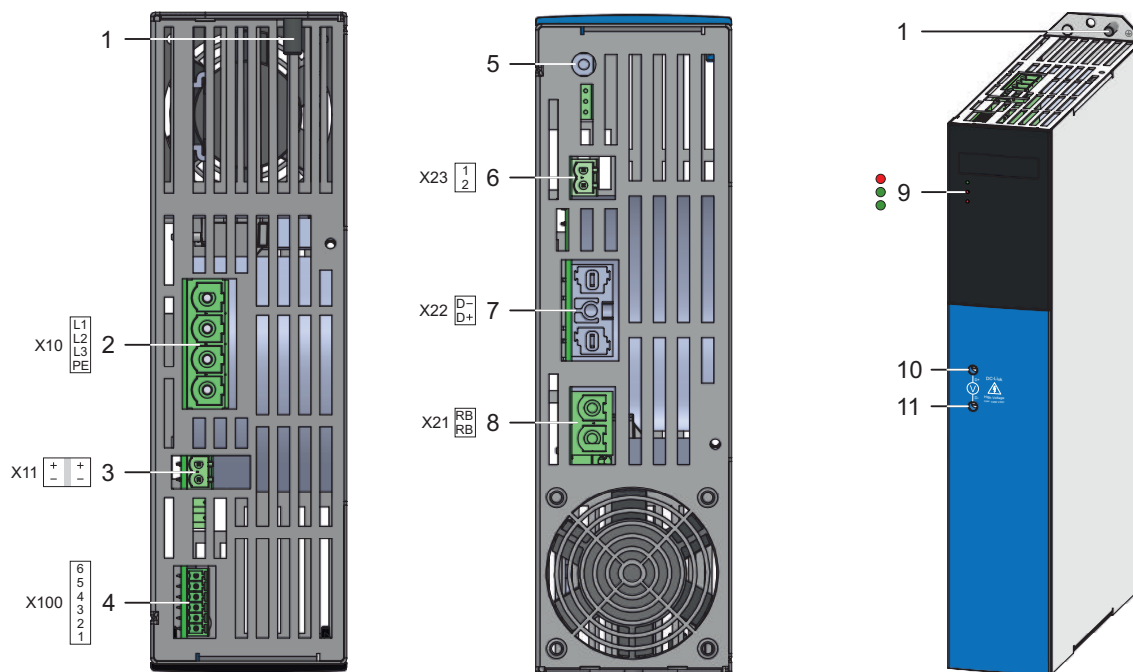


Fig. 29: Connection overview using the example of the PS6A34

Top of the device		Bottom of the device		Front of the device	
1	Ground bolt	5	Fan on/off switch	9	3 diagnostic LEDs
2	X10: 400 V _{AC} supply	6	X23: Braking resistor temperature monitoring	10	D+ DC link potential measuring point
3	X11: 24 V _{DC} supply	7	X22: DC link connection	11	D- DC link potential measuring point
4	X100: Status output	8	X21: Braking resistor		

10.4.2 X10: 400 V supply

Terminal X10 is used to connect the supply module to the supply grid.

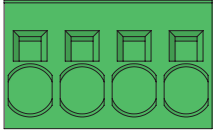
Conductor cross-sections for the power connection

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.

UL-compliant operation

The chassis of the PS6A/SI6A units is to be bonded through the M6 grounding studs on the PS6A units (4.0 Nm, 35 Lb.inch).

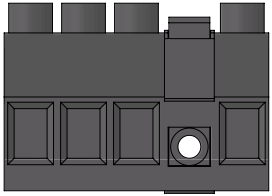
Size 2

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

Tab. 85: X10 connection description – Size 2

For connecting wiring, observe the terminal specifications in the chapter [SPC 16 -ST-10,16](#) [▶ 237](#).

Size 3

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

Tab. 86: X10 connection description – Size 3

For connecting wiring, observe the terminal specifications in the chapter [BUZ 10.16IT 180 MF](#) [▶ 238](#).

10.4.3 X11: 24 V supply

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

ATTENTION!

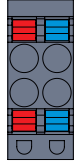
Device damage due to overload!

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}	0.5 A

Tab. 87: Control unit electrical data

	Pin	Designation	Function
	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	–	
	4		

Tab. 88: 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.

For connecting wiring, observe the terminal specifications in the chapter [BLDF 5.08 180 SN \[► 234\]](#).

Cable requirements

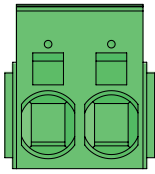
Feature	All sizes
Max. cable length	30 m

Tab. 89: 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.

10.4.4 X21: Braking resistor

Terminal X21 is available for the connection of a braking resistor.

Terminal	Pin	Designation	Function
 1 2	1	RB	Braking resistor connection
	2	RB	

Tab. 90: X21 connection description

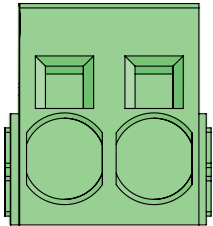
For connecting wiring, observe the terminal specifications in the chapter [ISPC 5 -STGCL-7,62](#) [[▶ 236](#)].

10.4.5 X22: DC link connection

Terminal X22 is available for the DC link connection of the supply module.

For setting up the Quick DC-Link, note the information on project configuration in chapter [DC link connection](#) [[▶ 78](#)].

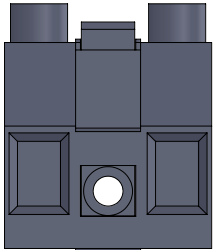
Size 2

Terminal	Pin	Designation	Function
 1 2	1	D-	DC link connection
	2	D+	

Tab. 91: X22 connection description, size 2

For connecting wiring, observe the terminal specifications in the chapter [ISPC 16 -ST-10,16](#) [[▶ 237](#)].

Size 3

Terminal	Pin	Designation	Function
 1 2	1	D-	DC link connection
	2	D+	

Tab. 92: X22 connection description, size 3

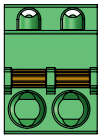
For connecting wiring, observe the terminal specifications in the chapter [BUZ 10.16IT 180 MF](#) [[▶ 238](#)].

Wiring example

The examples in the chapter [Wiring examples](#) [▶ 239] illustrate the basic connection based on a DC link connection with DL6B Quick DC-Link.

10.4.6 X23: Temperature monitoring of braking resistor

Connect the temperature monitoring of the braking resistor to terminal X23. UL-compliant operation: For project configuration of the braking resistor, observe the notes in the chapter [UL-compliant use](#) [▶ 19].

	Pin	Designation	Function
 1 2	1	1TP1	Temperature monitoring connection
	2	1TP2	

Tab. 93: X23 connection description


For connecting wiring, observe the terminal specifications in the chapter [FKC 2,5 -ST-5,08](#) [▶ 234].

10.4.7 X100: Status output

The relay status output of terminal X100 in conjunction with the 3 diagnostic LEDs on the front of the device provides information about the status of the supply module.

Technical data

Observe the technical data for X100; see the chapter [Status output](#) [▶ 41].

Terminal	Pin	Designation	Function
 6 5 4 3 2 1	1	READY	NO contact; Operational status; recommended fuse protection: max. 2 AT
	2		
	3	WARNING1	NO contact; Warning status 1; Overload; recommended fuse protection: max. 2 AT
	4		
	5	WARNING2	NO contact; Warning status 2; grid phase failure; recommended fuse protection: max. 2 AT
	6		

Tab. 94: X100 connection description

Use a 2 A fuse (time delay) upstream of the 3 relays for fuse protection.

For UL-compliant use, be sure that the fuse meets certification requirements for DC voltage in accordance with UL 248. During UL-compliant operation, the PS6 supply module must be removed from the power supply using the WARNING1 relay. An associated application is a notification from the temperature switch when the braking resistor is overloaded.

You can find notes on diagnostics in the chapter [Supply module](#) [▶ 169], and a wiring example for correct connection in the chapter [UL-compliant connection of the supply module](#) [▶ 241].

For connecting wiring, observe the terminal specifications in the chapter [FMC 1,5 -ST-3,5](#) [[▶ 232](#)].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 95: Cable length [m]

10.4.8 Connecting the supply module

DANGER!

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

Tools and material

You will need:

- A suitable terminal set for the supply module
- Tool for tightening the fastening screws

Requirements and connection

Bottom of the device:

- ✓ You have a system circuit diagram describing the connection of the supply module.
1. Connect the braking resistor to terminal X21 and attach the terminal. Ensure that the connection lines are twisted pairs.
 2. Attach the X22 terminal of the Quick DC-Link module. Ensure that the connection lines are twisted pairs.
 3. Connect the temperature monitoring of the braking resistor to terminal X23 and attach the terminal.

Top of the device:

- ✓ You have a system circuit diagram describing the connection of the supply module.
1. Connect the 2nd grounding conductor to the ground bolt. Note the instructions and requirements in the chapters [CE-compliant housing grounding](#) [[▶ 107](#)] and [UL-compliant housing grounding](#) [[▶ 108](#)].
 2. Connect the power supply to terminal X10 and attach the terminal.
 3. Connect the 24 V_{DC} power supply for the control electronics to terminal X11 and attach the terminal.
 4. Connect the status output to terminal X100 and attach the terminal.

10.5 Drive controller

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.

10.5.1 Overview

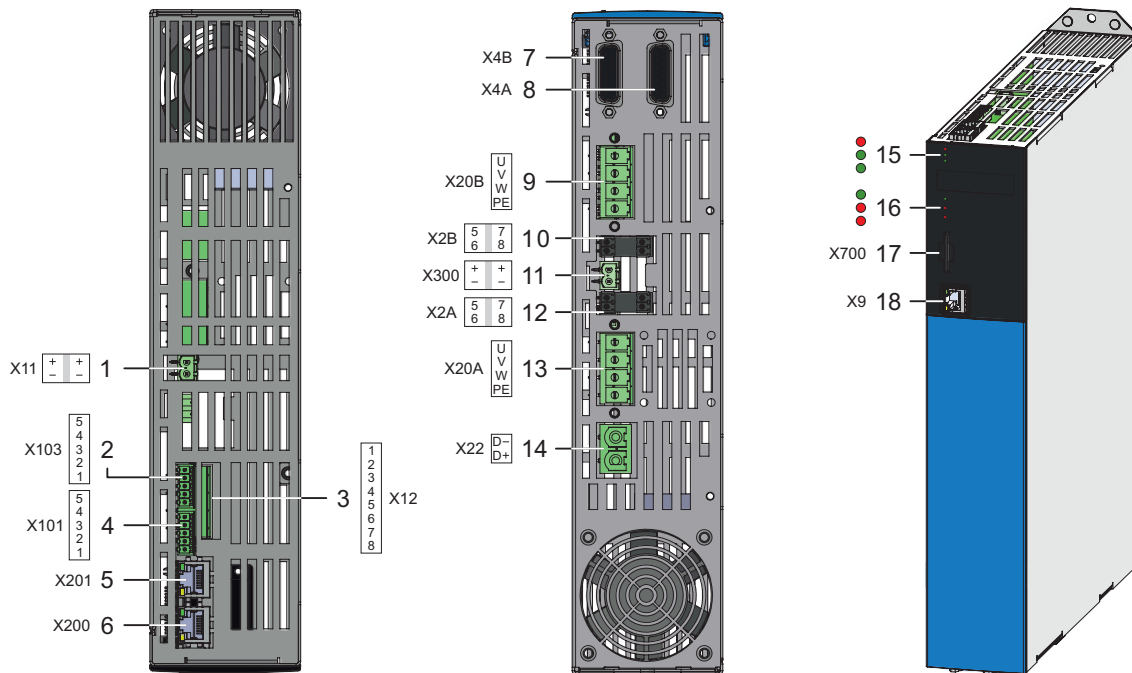


Fig. 30: Connection overview using the example of the SI6A162

Top of the device		Bottom of the device		Front of the device	
1	X11: 24 V _{DC} supply	7	X4B: Encoder B (only for double-axis controllers)	15	3 diagnostic LEDs for communication and safety technology
2	X103: BE6 – BE9	8	X4A: Encoder A	16	3 diagnostic LEDs for drive controller
3	X12: STO via terminals (only for SR6 option)	9	X20B: Motor B (only for double-axis controllers)	17	X700: SD slot
4	X101: BE1 – BE4	10	X2B: Brake B (pin 5/6) and temperature sensor B (pin 7/8); (only for double-axis controllers)	18	X9: Ethernet service interface
5	X201: EtherCAT Out / PROFINET	11	X300: Brake 24 V _{DC} supply		
6	X200: EtherCAT In / PROFINET	12	X2A: Brake A (pin 5/6) and temperature sensor A (pin 7/8)		
		13	X20A: Motor A		
		14	X22: DC link connection		

10.5.2 X2A: Brake A

The brake of axis A is connected to X2A. All device types of the SI6 drive controller can control a 24 V_{DC} brake as standard.


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 X2A; see the chapter [Controllable brakes](#) [▶ 64].

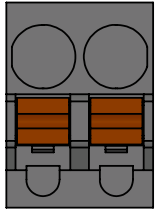
Sizes 0 to 2 (single-axis controllers)

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

Tab. 96: X2A connection description, brake A, sizes 0 to 2 (single-axis controllers)

For connecting wiring, observe the terminal specifications in the chapter [BCF 3,81 180 SN](#) [▶ 233].

Sizes 2 (double-axis controllers) and 3

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

Tab. 97: X2A connection description, brake A, sizes 2 (double-axis controllers) and 3

For connecting wiring, observe the terminal specifications in the chapter [BFL 5.08HC 180 SN](#) [▶ 233].

Cable requirements

Motor connection	Size 0 to 2	Size 3
Without output choke	50 m, shielded	100 m, shielded
With output choke	100 m, shielded	—

Tab. 98: Maximum cable length of the power cable [m]

10.5.3 X2A: Motor temperature sensor A

The motor temperature sensor of axis A is connected to terminal X2A. All device types of the SI6 drive controller have connections for PTC thermistors. You can connect a maximum of two PTC triplets to X2A.

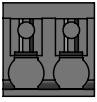
Information

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

Information

Note that a temperature sensor does not have to be connected to terminal X2 for a HIPERFACE DSL encoder. In this case, the temperature sensor signal is transferred together with the encoder signal over connector X4.

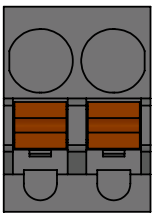
Sizes 0 to 2 (single-axis controllers)

Term.	Pin	Designation	Function
 7 8	7	1TP1+	PTC connection
	8	1TP2-	

Tab. 99: X2A connection description, motor temperature sensor A, sizes 0 to 2 (single-axis controller)

For connecting wiring, observe the terminal specifications in the chapter [BCF 3.81 180 SN](#) [▶ 233](#).

Sizes 2 (double-axis controllers) and 3

Term.	Pin	Designation	Function
 7 8	7	1TP1+	PTC connection
	8	1TP2-	

Tab. 100: X2A connection description, motor temperature sensor A, sizes 2 (double-axis controller) and 3

For connecting wiring, observe the terminal specifications in the chapter [BFL 5.08HC 180 SN](#) [▶ 233](#).

Cable requirements

Motor connection	Size 0 to 2	Size 3
Without output choke	50 m, shielded	100 m, shielded
With output choke	100 m, shielded	—

Tab. 101: Maximum cable length of the power cable [m]

10.5.4 X2B: Brake B

The brake of axis B is connected to X2B for double-axis controllers. Only X2A is available for single-axis controllers. The connection description of X2B matches the X2A description.

10.5.5 X2B: Motor temperature sensor B

The motor temperature sensor of axis B is connected to X2B for double-axis controllers. Only X2A is available for single-axis controllers. The connection description of X2B matches the X2A description.

10.5.6 X4A: Encoder A

The encoder of axis A is connected to terminal X4A.

ATTENTION!

Risk of encoder destruction!

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

ATTENTION!

Risk of encoder destruction!

Only encoders with a suitable input voltage range (minimum 12 V_{DC}) may be connected to X4.

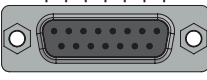
Evaluable encoders

Note the technical data of the evaluable encoders at X4; see the chapter [Evaluable encoders](#) [▶ 59].

Information

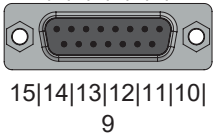
Note that a master encoder must be connected to axis A.

EnDat 2.2 digital encoders and SSI encoders

Socket	Pin	Designation	Function
 <p>8 7 6 5 4 3 2 1 15 14 13 12 11 10 9</p>	1	—	—
	2	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	—	—
	11	—	—
	12	—	—
	13	Data-	Inverse differential input for DATA
	14	—	—
	15	Clock-	Inverse differential input for CLOCK

Tab. 102: X4A connection description for EnDat 2.2 digital encoders and SSI encoders

Differential TTL and differential HTL incremental encoders (HTL over HT6 adapters)

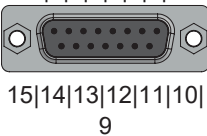
Socket	Pin	Designation	Function
	1	—	—
	2	GND	Reference potential for encoder supply to pin 4
	3	—	—
	4	U ₂	Encoder supply
	5	B+	Differential input for B channel
	6	—	—
	7	N+	Differential input for N channel
	8	A+	Differential input for A channel
	9	—	—
	10	—	—
	11	—	—
	12	—	—
	13	B-	Inverse differential input for B channel
	14	N-	Inverse differential input for N channel
	15	A-	Inverse differential input for A channel

Tab. 103: X4A connection description for differential TTL and differential HTL (HTL over HT6 adapter) incremental encoders

Information

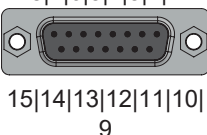
Using a HT6 adapter for level conversion from HTL signals to TTL signals, it is also possible to connect a differential HTL incremental encoder to terminal X4. Note that, with an external power supply, the maximum level of 20 V_{DC} for the the HTL signals may not be exceeded.

Resolver

Socket	Pin	Designation	Function
	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. 104: X4A connection description for resolvers

HIPERFACE DSL encoders

Socket	Pin	Designation	Function
	1	—	—
	2	DSL-	Inverse HIPERFACE DSL signal (motor temperature sensor evaluation over DSL communication)
	3	—	—
	4	DSL+	HIPERFACE DSL signal (motor temperature sensor evaluation over DSL communication)
	5	—	—
	6	—	—
	7	—	—
	8	—	—
	9	—	—
	10	—	—
	11	—	—
	12	—	—
	13	—	—
	14	—	—
	15	—	—

Tab. 105: X4A connection description for HIPERFACE DSL encoders

Cable requirements

Feature	All sizes
Max. cable length	100 m, shielded

Tab. 106: Cable length [m]

Information

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

Unsuitable encoder models

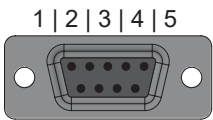
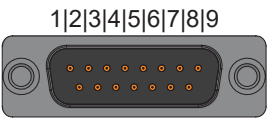
The following STOBER encoder models may **not** be connected:

Encoder model	Code according to type designation
ECI 1118	C0
EQI 1130	Q0
ECI 1319	CR
EQI 1329	QP
EQI 1331	QR

Tab. 107: Encoder models with unsuitable input voltage range

10.5.6.1 AP6 interface adapter (resolver)

AP6A00 – Resolver (9-pin to 15-pin)

Socket ¹¹	Pin	Designation	Function	Pin	Connector ¹²
	1	—	—	—	
	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. 108: Connection description of AP6A00 for resolver (9-pin to 15-pin)

¹¹ View of 9-pin D-sub for connecting the SDS 4000-compatible resolver cable

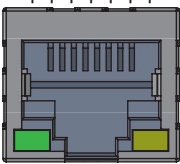
¹² View of 15-pin D-sub for connecting to terminal X4

10.5.7 X4B: Encoder B

The encoder of axis B is connected to X4B for double-axis controllers. Only X4A is available for single-axis controllers. The connection description of X4B matches the X4A description.

10.5.8 X9: Ethernet service interface

X9 is used to connect the drive controller to a PC with installed DriveControlSuite commissioning software.

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

Tab. 109: X9 connection description

Cable requirements

Feature	All sizes
Max. cable length	100 m, shielded

Tab. 110: Cable length [m]

Information

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

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

Feature	Design
Connector wiring	Patch or crossover
Quality	CAT 5e
Shielding	SF/FTP, S/FTP or SF/UTP

Tab. 111: Cable requirements

Device addressing

Information for device addressing can be found in the chapter [Device addressing](#) [▶ 242].

10.5.9 X11: 24 V supply

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

ATTENTION!

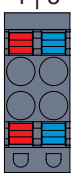
Device damage due to overload!

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}	0.5 A

Tab. 112: Control unit electrical data

	Pin	Designation	Function
	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 ¹³
	2		
	3	–	
	4		

Tab. 113: 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.

For connecting wiring, observe the terminal specifications in the chapter [BLDF 5.08 180 SN \[► 234\]](#).

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 114: Cable length [m]

¹³ 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.

10.5.10 X12: Safety technology (SR6 option)

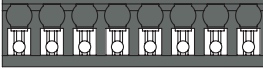
The SR6 option adds the STO safety function to the SI6 drive controller through terminal X12.

Information

If you would like to use STO safety function over terminals, be sure to read the SR6 manual; see the chapter [Detailed information](#) [▶ 245].

Technical data

Observe the technical data of the safety options for X12; see the chapter [Safety technology](#) [▶ 57].

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	GND	Reference potential for STO _a and STO _b , internally bridged with terminal 7
	6	STO _{status}	Acknowledgment signal of safety channels 1 and 2 for diagnostic purposes
	7	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 ¹⁴

Tab. 115: X12 connection description

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter [BCF 3,81 180 SN](#) [▶ 233].

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 116: Cable length [m]

¹⁴ 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.

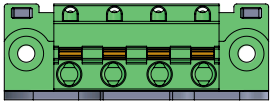
10.5.11 X20A: Motor A

The motor of axis A is connected to X20A.

UL-compliant operation

The external motors which are connected to the inverter units SI6 units shall not be grounded over the modular drive system. The bonding/grounding of the motor(s) shall occur in the end use application in accordance with the requirements of applicable electrical codes/standards.


Size 0

Terminal	Pin	Designation	Function
 1 2 3 4	1	U	Phase U motor connection
	2	V	Phase V motor connection
	3	W	Phase W motor connection
	4	PE	Grounding conductor

Tab. 117: X20A connection description, size 0

For connecting wiring, observe the terminal specifications in the chapter [GFKC 2,5 -ST-7,62](#) [▶ 235].

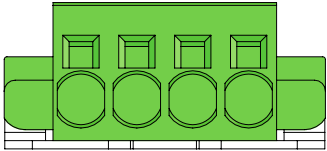
Sizes 1 and 2 (single-axis controllers)

Terminal	Pin	Designation	Function
 1 2 3 4	1	U	Phase U motor connection
	2	V	Phase V motor connection
	3	W	Phase W motor connection
	4	PE	Grounding conductor

Tab. 118: X20A connection description, sizes 1 and 2 (single-axis controllers)

For connecting wiring, observe the terminal specifications in the chapter [SPC 5 -ST-7,62](#) [▶ 236].

Sizes 2 (double-axis controllers) and 3

Terminal	Pin	Designation	Function
 1 2 3 4	1	U	Phase U motor connection
	2	V	Phase V motor connection
	3	W	Phase W motor connection
	4	PE	Grounding conductor

Tab. 119: X20A connection description, sizes 2 (double-axis controllers) and 3

For connecting wiring, observe the terminal specifications in the chapter [SPC 16 -ST-10,16](#) [▶ 237].

Cable requirements

Motor connection	Size 0 to 2	Size 3
Without output choke	50 m, shielded	100 m, shielded
With output choke	100 m, shielded	—

Tab. 120: 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. In case of use of unsuitable connection cables, 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.

10.5.12 X20B: Motor B

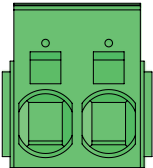
The motor of axis B is connected to X20B for double-axis controllers. Only X20A is available for single-axis controllers. The connection description of X20B matches the X20A description.

10.5.13 X22: DC link connection

Terminal X22 is available for the DC link connection of the drive controller.

For setting up the Quick DC-Link, note the information on project configuration in chapter [DC link connection](#) [[▶ 78](#)].

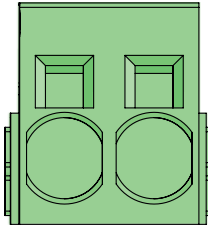
Size 0

Terminal	Pin	Designation	Function
 1 2	1	D-	DC link connection
	2	D+	

Tab. 121: X22 connection description, size 0

For connecting wiring, observe the terminal specifications in the chapter [ISPC 5 -STGCL-7.62](#) [[▶ 236](#)].

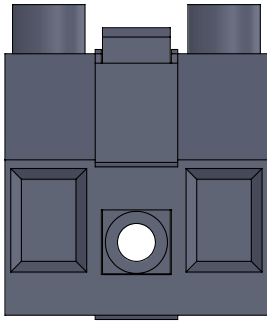
Sizes 1 and 2 (single-axis controllers)

Terminal	Pin	Designation	Function
 1 2	1	D-	DC link connection
	2	D+	

Tab. 122: X22 connection description, sizes 1 and 2 (single-axis controllers)

For connecting wiring, observe the terminal specifications in the chapter [ISPC 16 -ST-10,16](#) [\[▶ 237\]](#).

Sizes 2 (double-axis controllers) and 3

Terminal	Pin	Designation	Function
 D- D+	1	D-	DC link connection
	2	D+	

Tab. 123: X22 connection description, sizes 2 (double-axis controllers) and 3

For connecting wiring, observe the terminal specifications in the chapter [BUZ 10.16IT 180 MF](#) [\[▶ 238\]](#).

Wiring example


The examples in the chapter [Wiring examples](#) [\[▶ 239\]](#) illustrate the basic connection based on a DC link connection with DL6B Quick DC-Link.

10.5.14 X101: BE1 – BE4

The binary inputs 1 to 4 are available on terminal X101.

X101 for binary signals

For evaluating binary signals at X101, note the specification for the binary inputs in the technical data of the drive controller, see the chapter [Binary inputs \[▶ 47\]](#).

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE1	Binary inputs
	2	BE2	
	3	BE3	
	4	BE4	
	5	DGND	Reference ground; not bridged with X103, pin 5

Tab. 124: X101 connection description for binary signals


X101 for encoders

If you would like to use X101 as an encoder connection, note the technical data of the evaluable encoders at X101; see the chapter [X101 for encoders \[▶ 63\]](#).

Information


Note that a master encoder must be connected to axis A or terminal X101.

Single-ended HTL incremental encoders

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE1	—
	2	BE2	N channel
	3	BE3	A channel
	4	BE4	B channel
	5	DGND	Reference ground; not bridged with X103, pin 5

Tab. 125: X101 connection description for single-ended HTL incremental signals, axis A

Single-ended HTL pulse train

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE1	—
	2	BE2	—
	3	BE3	Frequency
	4	BE4	Direction
	5	DGND	Reference ground; not bridged with X103, pin 5

Tab. 126: X101 connection description for single-ended HTL pulse/direction signals, axis A

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter [FMC 1,5 -ST-3,5](#) [▶ 232].

Cable requirements

Feature	All sizes
Max. cable length	30 m

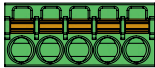
Tab. 127: Cable length [m]

10.5.15 X103: BE6 – BE9

The binary inputs 6 to 9 are available on terminal X103.

X103 for binary signals

For the evaluation of binary signals at X103, observe the technical data of the drive controller; see the chapter [Binary inputs](#) [▶ 47].

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE6	Binary inputs
	2	BE7	
	3	BE8	
	4	BE9	
	5	DGND	Reference ground; not bridged with X101, pin 5

Tab. 128: X103 connection description for binary signals


X103 for encoders

If you would like to use X103 as an encoder connection, note the technical data of the evaluable encoders at X103; see the chapter [X103 for encoders](#) [▶ 63].

Information

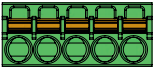
Note that a master encoder must be connected to axis A or terminal X101.

Single-ended HTL incremental encoders

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE6	—
	2	BE7	N channel
	3	BE8	A channel
	4	BE9	B channel
	5	DGND	Reference ground; not bridged with X101, pin 5

Tab. 129: X103 connection description for single-ended HTL incremental signals, axis B

Single-ended HTL pulse train

Terminal	Pin	Designation	Function
 5 4 3 2 1	1	BE6	—
	2	BE7	—
	3	BE8	Frequency
	4	BE9	Direction
	5	DGND	Reference ground; not bridged with X101, pin 5

Tab. 130: X103 connection description for single-ended HTL pulse/direction signals, axis B

Connecting wiring

For connecting wiring, observe the terminal specifications in the chapter [FMC 1,5 -ST-3,5](#) [[232](#)].

Cable requirements

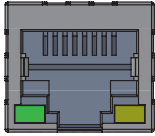
Feature	All sizes
Max. cable length	30 m

Tab. 131: Cable length [m]

10.5.16 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	Tx+	Communication
	2	Tx-	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx-	Communication
	7	—	—
	8	—	—

Tab. 132: 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. In case of use of unsuitable connection cables, 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.

Device addressing and fieldbus connection

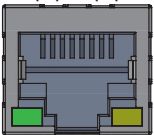
Information for device addressing can be found in the chapter [Device addressing](#) [▶ 242].

Detailed information about the fieldbus connection can be found in the corresponding manual, see chapter [Detailed information](#) [▶ 245].

10.5.17 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	Tx+	Communication
	2	Tx-	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx-	Communication
	7	—	—
	8	—	—

Tab. 133: X200 and X201 connection description

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

Device addressing and fieldbus connection

Information for device addressing can be found in the chapter [Device addressing](#) [► 242].

Detailed information about the fieldbus connection can be found in the corresponding manual, see chapter [Detailed information](#) [► 245].

10.5.18 X300: Brake 24 V supply

X300 is used to supply the brake.

ATTENTION!

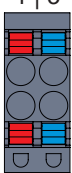
Device damage due to overload!

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	Single-axis controller	Double-axis controller
U ₁	+24 V _{DC} , +25%/–0%	
I _{1max}	2.5 A	2 × 2.5 A

Tab. 134: Electrical data of the control unit brake control

	Pin	Designation	Function
	1	+	24 V _{DC} supply for the brake; bridged in the terminal; design in accordance with EN 60204: PELV, secondary grounded, recommended fuse protection: max. 15 AT ¹⁵
	2		
	3	–	Reference potential for power supply voltage of the brake
	4		
2 4			

Tab. 135: X300 connection description

For connecting wiring, observe the terminal specifications in the chapter [BLDF 5.08 180 SN](#) [▶ 234](#).

Cable requirements

Feature	All sizes
Max. cable length	30 m

Tab. 136: Cable length [m]

¹⁵ 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.

10.5.19 X700: SD slot

The SD slot is used for data backup in the event of service. SD and SDHC cards with storage capacity from 128 MB to 32 GB are supported. SDHC cards with a storage capacity of 64 GB can be used only if they have been first reformatted to max. 32 GB. Since higher capacities increase the controller starting time, STOBER recommends the use of cards with a storage capacity from 2 to 4 GB.

Information

The drive controller has internal configuration memory and can therefore be operated without an inserted SD card. In the DS6 commissioning software, the action A00Save values always saves both to internal configuration memory as well as the inserted SD card. Back up your configuration to a SD card after completing commissioning in order to allow transfer of the configuration to the replacement controller in the event of service. When switching on the replacement controller, the data is loaded giving priority to the inserted SD card. To make a non-volatile back-up in the internal configuration memory, you must run A00Save values.

10.5.20 Connecting a drive controller

⚠ DANGER!

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

Tools and material

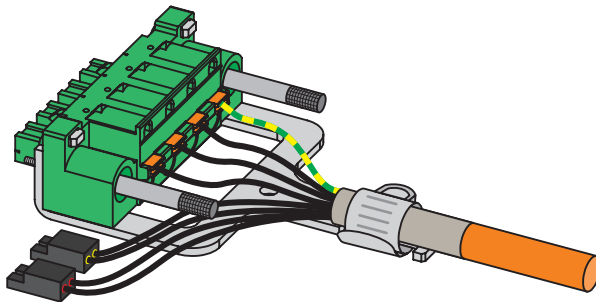
You will need:

- A suitable terminal set for the drive controller
- Tool for 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. Attach the X22 terminal of the Quick DC-Link module. Ensure that the connection lines are twisted pairs.
 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 X2A and X20A.
 3. Attach the power cable with the shield clamp to the shield contact of terminal X20A.



4. Attach terminals X20A and X2A.
5. Optional: Connect the supply voltage for the brakes to terminal X300 and attach it.
6. For double-axis controllers: Repeat steps 2 to 4 for the terminals X2B and X20B.
7. Optional: Connect an encoder to terminal X4A.
8. Optional for double-axis controllers: Connect an encoder to terminal X4B.

Top of the device:

- ✓ You have a system circuit diagram describing the connection of the drive controller.
- 1. Connect the 24 V_{DC} power supply for the control electronics to terminal X11 and attach the terminal.
- 2. If you use the STO safety function, connect it as follows:
 - 2.1. SR6 option: Connect terminal X12 according to your safety configuration.
 - 2.2. SY6 option: In order to be able to identify the safety module in the FSoE network, you must transfer its unique address in the FSoE network to the drive controller using the DIP switches.
- 3. Optional: Connect the binary inputs to terminal X101 and X103 and attach the terminal.
- 4. Connect the fieldbus to the sockets X200 and X201.

You can find examples in the chapter [Wiring examples](#) [▶ 239].

10.6 Output choke

WARNING!

Risk of burns! Fire hazard! Material damage!

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

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

WARNING!

Fire hazard due to overheating!

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

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

10.6.1 Connection description

Designation	Function
1U1	Phase U drive controller connection: X20, Pin 1
1U2	Phase U motor connection
1V1	Phase V drive controller connection: X20, Pin 2
1V2	Phase V motor connection
1W1	Phase W drive controller connection: X20, Pin 3
1W2	Phase W motor connection
7	Drive controller grounding conductor: X20, Pin 4
8	Power cable grounding conductor

Tab. 137: TEP output choke connection description

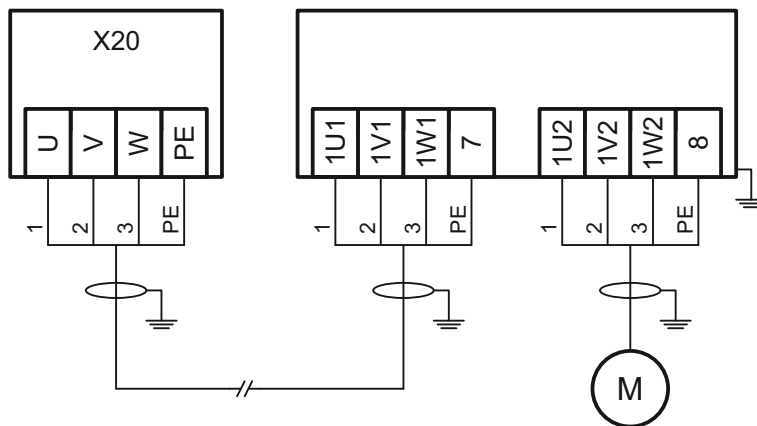


Fig. 31: TEP output choke connection example

Shielded connection of the power cable

Note the following points for the connection of the power cable for a motor with output choke:

- Ground the shield of the power cable over large contact areas in the immediate vicinity of the output choke, for example with electrically conductive metal cable clips on a grounded connection rail.
- 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.

The following graphic shows an example of the shielded connection of the power cable.

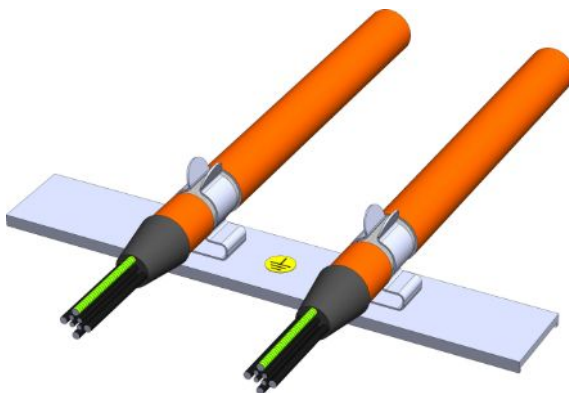


Fig. 32: Shielded connection of the power cable (graphics: icotek GmbH)

Choke housing grounding

Observe the requirements in the chapter [CE-compliant housing grounding \[▶ 107\]](#) to ensure correct connection of the grounding conductor.

10.7 Cables

Note that the motor, cables and drive controller each have electrical properties which influence one another. Unfavorable combinations could possibly result in impermissible voltage peaks on the motor and drive controller and increased wear as a result.

Take into consideration the following instructions when selecting suitable cables:

- Cable cross-sections for connection to the motor:
Note the permitted continuous stall current I_0 for the motor when making your selection.
- Conductor cross-sections for the power connection:
Note the line fuse, the maximum permitted conductor cross-section for terminal X10, the routing method and the surrounding temperature when making your selection.
- Also pay attention to the trailing and torsional strength of the lines.
- When using a motor brake, pay attention to the voltage drop in the supply voltage on the line.

Information

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

Information

Please observe the motor connection diagram that is delivered with every STOBER motor.

10.7.1 Power cables

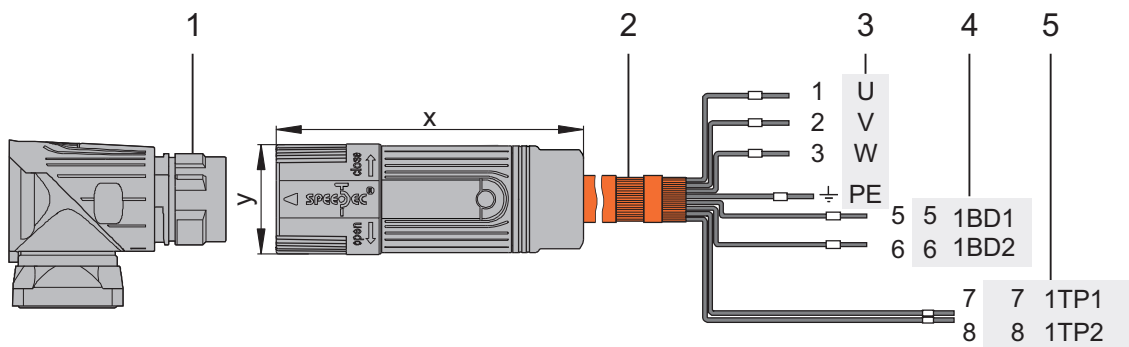
Synchronous servo motors and Lean motors from STOBER are equipped with plug connectors as standard.

STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

10.7.1.1 Connection description

Depending on the size of the motor plug connector, power cables are available in the following designs:

- springtec quick lock for con.15
- speedtec quick lock for con.23 and con.40

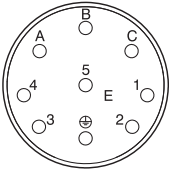



- 1: Plug connector
- 2: STOBER power cable, cable shield
- 3: Connection to terminal X20, motor
- 4: Connection of terminal X300, brake
- 5: Connection to terminal X2, temperature sensor

Motor connection	Size 0 to 2	Size 3
Without output choke	50 m, shielded	100 m, shielded
With output choke	100 m, shielded	—

Tab. 138: Maximum cable length of the power cable [m]

Power cables – con.15 plug connector

Motor connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Int. motor Core color	Core No./ Core color	Pin X20	Pin X300	Pin X2
	A	1U1	BK	1	1	—	—
	B	1V1	BU	2	2	—	—
	C	1W1	RD	3	3	—	—
	1	1TP1 ^{a)}	BK	7	—	—	7
	2	1TP2 ^{a)}	WH	8	—	—	8
	3	1BD1	RD	5	—	5	—
	4	1BD2	BK	6	—	6	—
	5	—	—	—	—	—	—
		PE	GNYE	GNYE	4	—	—
Housing	Shield	—	—	Shield contact	—	—	

Tab. 139: con.15 power cable pin assignment

a) PTC

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 140: con.15 connector dimensions

Power cables – con.23 plug connectors

Motor connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Int. motor Core color	Core No./ Core color	Pin X20	Pin X300	Pin X2
	1	1U1	BK	1	1	—	—
	3	1V1	BU	2	2	—	—
	4	1W1	RD	3	3	—	—
	A	1BD1	RD	5	—	5	—
	B	1BD2	BK	6	—	6	—
	C	1TP1 ^{a)}	BK	7	—	—	7
	D	1TP2 ^{a)}	WH	8	—	—	8
	⊕	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 141: con.23 power cable pin assignment

a) PTC

Length x [mm]	Diameter y [mm]
78	26

Tab. 142: con.23 connector dimensions

Power cables – con.40 plug connectors

Motor connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Int. motor Core color	Core No./ Core color	Pin X20	Pin X300	Pin X2
	U	1U1	BK	1	1	—	—
	V	1V1	BU	2	2	—	—
	W	1W1	RD	3	3	—	—
	+	1BD1	RD	5	—	5	—
	-	1BD2	BK	6	—	6	—
	1	1TP1 ^{a)}	BK	7	—	—	7
	2	1TP2 ^{a)}	WH	8	—	—	8
	⊕	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 143: con.40 power cable pin assignment

a) PTC

Length x [mm]	Diameter y [mm]
99	46

Tab. 144: con.40 connector dimensions

10.7.2 Encoder cables

STOBER motors are equipped with encoder systems and plug connectors as standard.

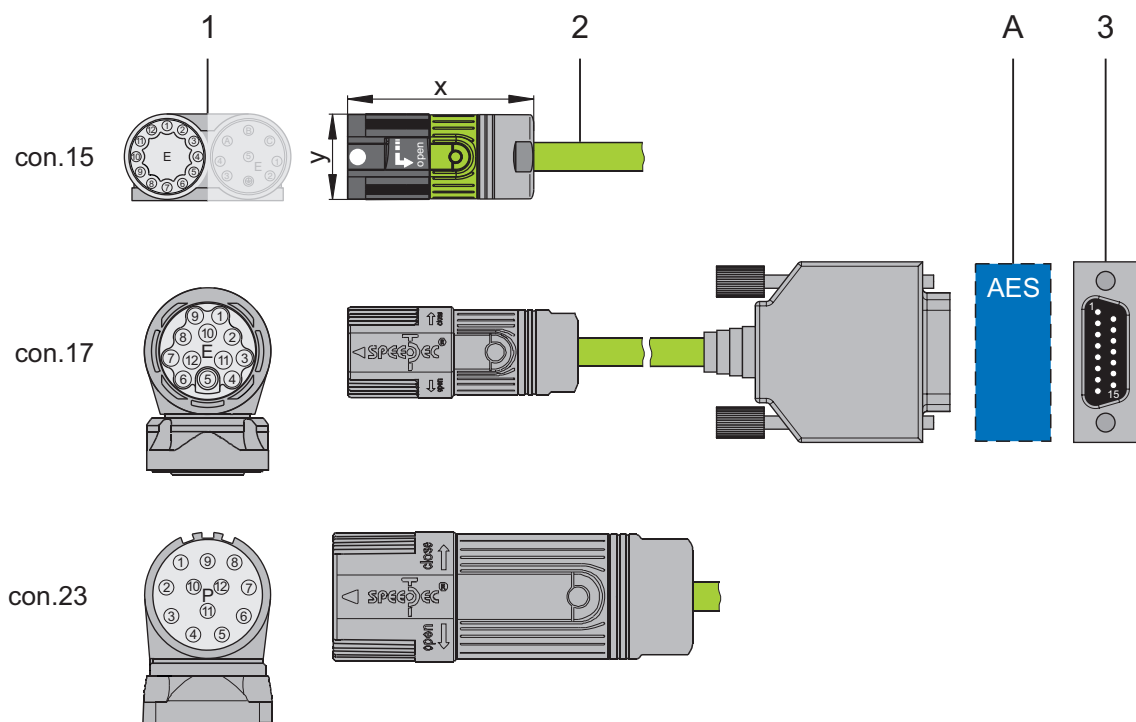
STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

Depending on the respective motor types, different encoder systems can be used.

10.7.2.1 EnDat 2.1/2.2 digital encoders

Suitable encoder cables are described below.

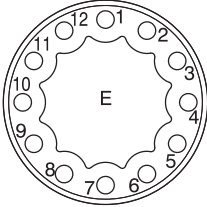
10.7.2.1.1 Connection description



- 1: Plug connector
- 2: STOBER encoder cable
- A: Only con.15 and con.17: Optional Absolute Encoder Support (AES) battery module
- 3: D-sub X4

Encoder cables – con.15 plug connector

The power supply is buffered for EnDat 2.2 digital "EBI 1135" and "EBI 135" inductive encoders with a multi-turn function. In this case, pin 2 and pin 3 of the motor are assigned to the U_{2BAT} buffer battery. Note that the encoder cable must not be connected to the encoder interface of the drive controller, but rather to the AES battery module for these encoders.

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	Clock+	VT	YE	8
	2	Sense U_2	BU	PK	12
		U_{2BAT+} ¹⁶			
	3	—	WH	GY	3
		U_{2BAT-} ¹⁷			
	4	—	—	—	—
	5	Data-	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock-	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
Housing	Shield	—	—	—	

Tab. 145: con.15 encoder cable pin assignment, EnDat 2.1/2.2 digital

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 146: con.15 connector dimensions

¹⁶ Only relevant for EBI encoders

¹⁷ Only relevant for EBI encoders

Encoder cables – con.17 plug connector

The power supply is buffered for EnDat 2.2 digital "EBI 1135" and "EBI 135" inductive encoders with a multi-turn function. In this case, pin 2 and pin 3 of the motor are assigned to the U_{2BAT} buffer battery. Note that the encoder cable must not be connected to the encoder interface of the drive controller, but rather to the AES battery module for these encoders.

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	Clock+	VT	YE	8
	2	Sense U_2	BU	PK	12
		U_{2BAT+} ¹⁸			
	3	—	WH	GY	3
		U_{2BAT-} ¹⁹			
	4	—	—	—	—
	5	Data-	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock-	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U_2	BNGN	RD	4
Housing	Shield	—	—	—	

Tab. 147: con.17 encoder cable pin assignment, EnDat 2.1/2.2 digital

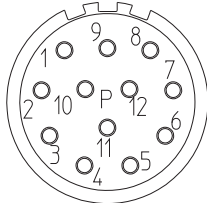
Length x [mm]	Diameter y [mm]
56	22

Tab. 148: con.17 connector dimensions

¹⁸ Only relevant for EBI encoders

¹⁹ Only relevant for EBI encoders

Encoder cables – con.23 plug connector

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	Clock+	VT	YE	8
	2	Sense U ₂	BU	PK	12
	3	—	—	—	—
	4	—	—	—	—
	5	Data-	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock-	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U ₂	BNGN	RD	4
	Housing	Shield	—	—	—

Tab. 149: con.23 encoder cable pin assignment, EnDat 2.1/2.2 digital

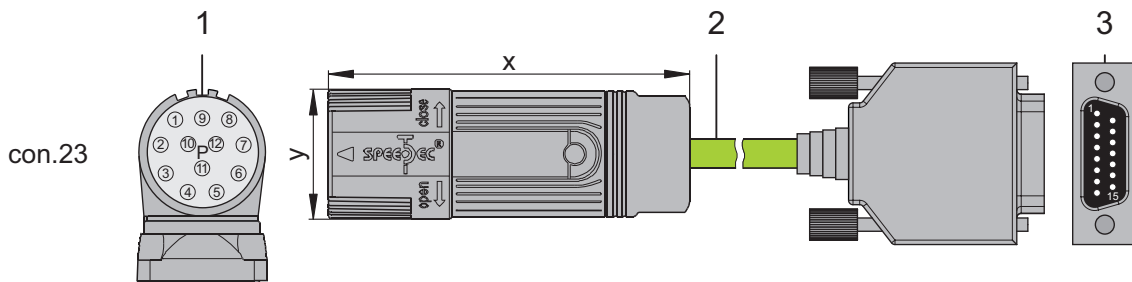
Length x [mm]	Diameter y [mm]
58	26

Tab. 150: con.23 dimensions

10.7.2.2 SSI encoders

Suitable encoder cables are described below.

10.7.2.2.1 Connection description



- 1: Plug connectors
- 2: STOBER encoder cable
- 3: D-sub X4

Encoder cables – con.23 plug connector

Motor (1)		Cable (2)	Drive controller (3)		
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	Clock+	VT	YE	8
	2	Sense U ₂	BNGN	PK	12
	3	—	—	—	—
	4	—	—	—	—
	5	Data-	PK	BN	13
	6	Data+	GY	WH	5
	7	—	—	—	—
	8	Clock-	YE	GN	15
	9	—	—	—	—
	10	GND	WHGN	BU	2
	11	—	—	—	—
	12	U ₂	BNGN	RD	4
Housing	Shield	—	—	—	

Tab. 151: con.23 encoder cable pin assignment, SSI

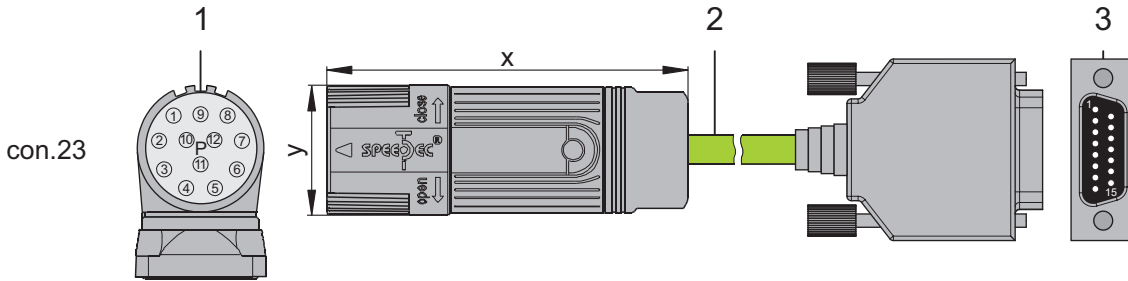
Length x [mm]	Diameter y [mm]
58	26

Tab. 152: con.23 dimensions

10.7.2.3 Differential HTL incremental encoders

Suitable encoder cables are described below.

10.7.2.3.1 Connection description



- 1: Plug connectors
- 2: STOBER encoder cable
- 3: D-sub X4

Information

For the connection of an HTL incremental encoder to terminal X4 of the SC6 or SI6 drive controller, you need the HT6 adapter (ID No. 56665). HT6 takes over level conversion from HTL signals to TTL signals.

Encoder cables – con.23 plug connector

Motor (1)					Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color up to size 80	Core color size 90 or larger	Core color	Pin X4
	1	B-	PK	BK	YE	9
	2	—	—	YE	—	—
	3	N+	BU	PK	PK	3
	4	N-	RD	WH	GY	10
	5	A+	GN	GN	BN	6
	6	A-	YE	BN	WH	11
	7	—	—	—	—	—
	8	B+	GY	GY	GN	1
	9	—	—	—	—	—
	10	GND	WH	BU	BU	2 ²⁰
	11	—	—	VT	—	—
	12	U ₂	BN	RD	RD	4
	Housing	Shield	—	—	—	—

Tab. 153: con.23 encoder cable pin assignment, incremental HTL

²⁰ Pin 12 (Sense) with pin 2 (GND) bridged: The bridge is constructed in the cable connector that is connected to X4.

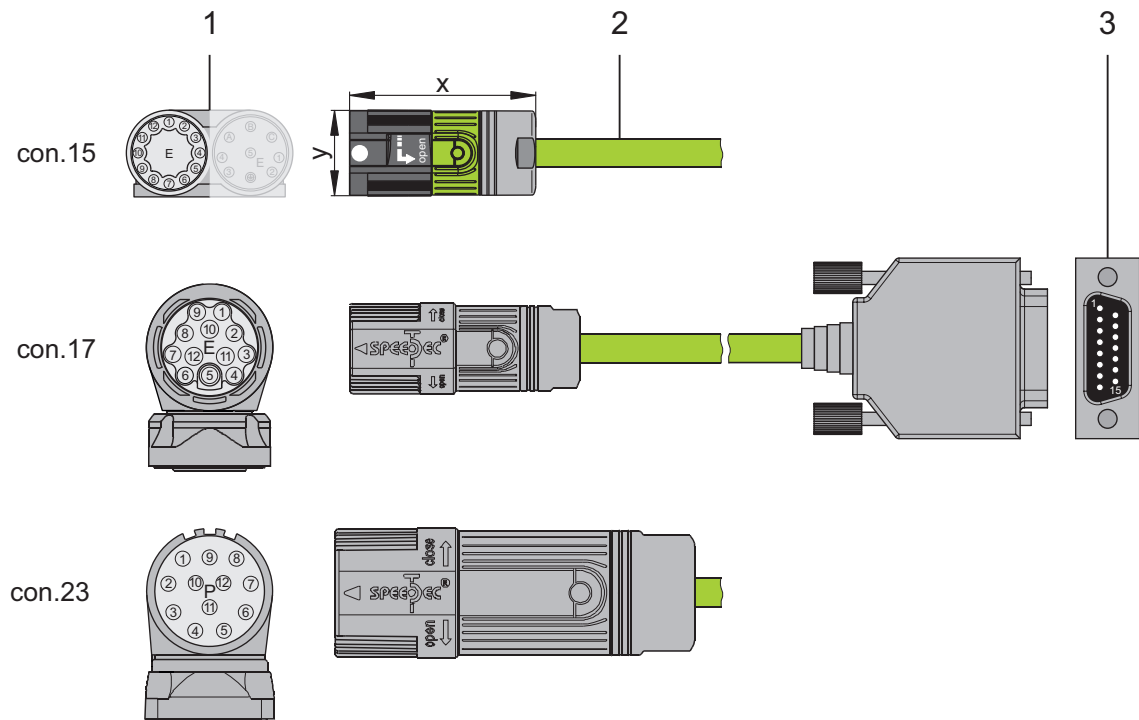
Length x [mm]	Diameter y [mm]
58	26

Tab. 154: con.23 dimensions

10.7.2.4 Resolver

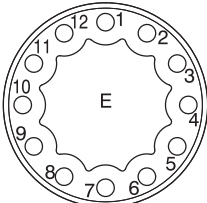
Suitable encoder cables are described below.

10.7.2.4.1 Connection description



- 1: Plug connector
- 2: STOBER encoder cable
- 3: D-sub X4

Encoder cables – con.15 plug connector

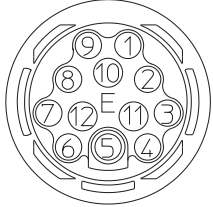
Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	S3 Cos+	BK	YE	3
	2	S1 Cos-	RD	GN	11
	3	S4 Sin+	BU	WH	1
	4	S2 Sin-	YE	BN	9
	5	1TP1	BK	RD	7
	6	1TP2	WH	BU	14
	7	R2 Ref+	YEW/ BKWH	GY	6
	8	R1 Ref-	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

Tab. 155: con.15 encoder cable pin assignment, resolver

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 156: con.15 connector dimensions

Encoder cables – con.17 plug connector

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	S3 Cos+	BK	YE	3
	2	S1 Cos-	RD	GN	11
	3	S4 Sin+	BU	WH	1
	4	S2 Sin-	YE	BN	9
	5	1TP1	BK	RD	7
	6	1TP2	WH	BU	14
	7	R2 Ref+	YEW/ BKWH	GY	6
	8	R1 Ref-	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

Tab. 157: con.17 encoder cable pin assignment, resolver

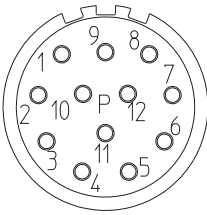
Length x [mm]	Diameter y [mm]
56	22

Tab. 158: con.17 connector dimensions

Encoder cables – con.23 plug connector

Information

For connecting STOBER resolver cables with a 9-pin D-sub connector, you also require the AP6A00 interface adapter (ID No. 56498, 9-pin to 15-pin D-sub), available separately.

Motor (1)				Cable (2)	Drive controller (3)
Connection diagram	Pin	Designation	Core color	Core color	Pin X4
	1	S3 Cos+	BK	YE	3
	2	S1 Cos-	RD	GN	11
	3	S4 Sin+	BU	WH	1
	4	S2 Sin-	YE	BN	9
	5	1TP1	BK	RD	—
	6	1TP2	WH	BU	—
	7	R2 Ref+	YEW/ BKWH	GY	6
	8	R1 Ref-	RDWH	PK	2
	9	—	—	—	—
	10	—	—	—	—
	11	—	—	—	—
	12	—	—	—	—
	Housing	Shield	—	—	—

Tab. 159: con.23 encoder cable pin assignment

Length x [mm]	Diameter y [mm]
58	26

Tab. 160: con.23 dimensions

10.7.3 One Cable Solution

STOBER synchronous servo motors are equipped with plug connectors as standard.

STOBER provides suitable cables in various lengths, conductor cross-sections and connector sizes.

A motor connection as a One Cable Solution (OCS) combined with a HIPERFACE DSL encoder requires hybrid cables which feature encoder communication and power transmission in a shared cable.

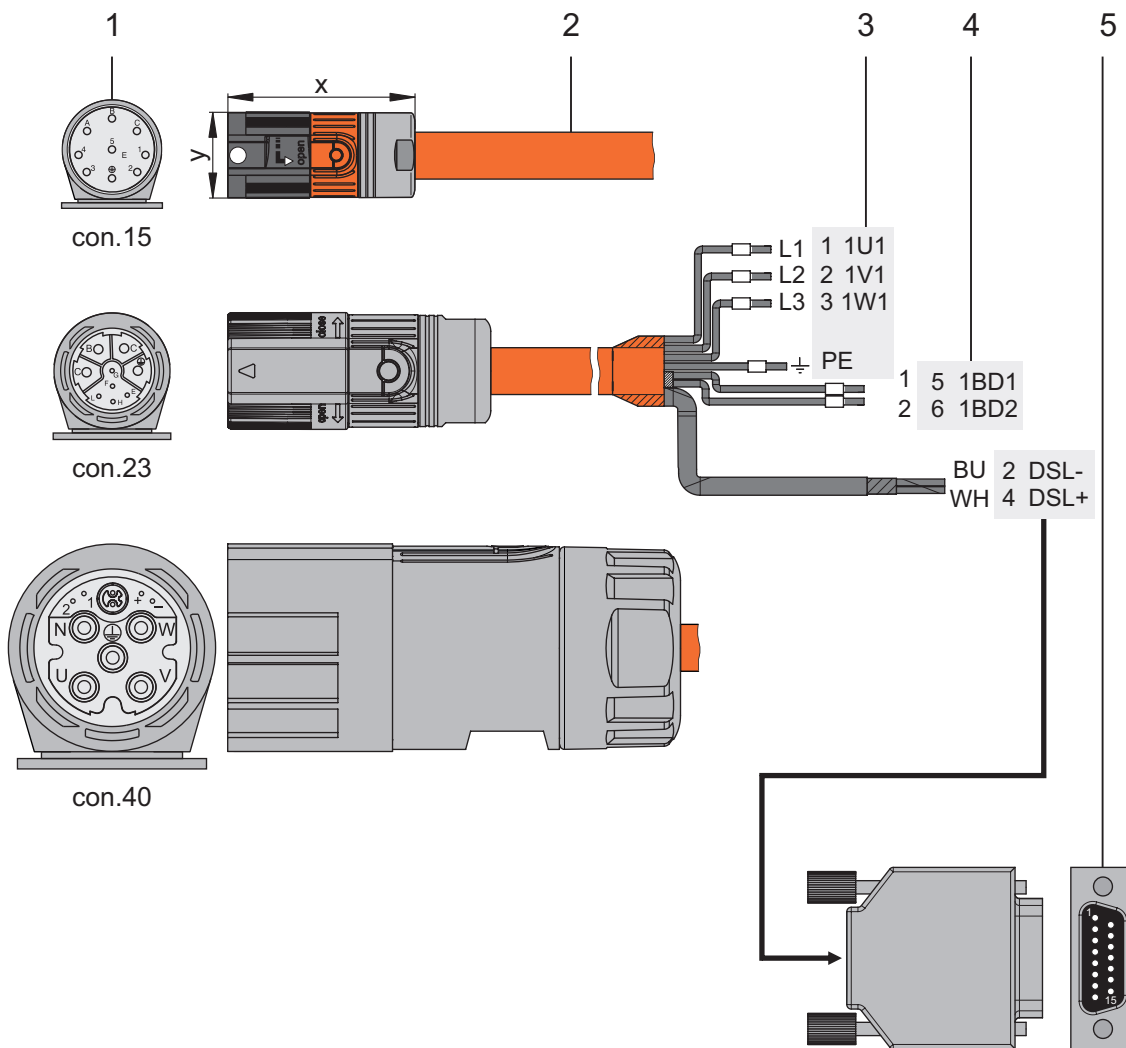
Information

For connecting as a One Cable Solution, use exclusively hybrid cables from STOBER. The use of unsuitable cables or poorly made connections can cause subsequent damage. For this reason, we reserve the right to reject claims under the warranty in this case.

10.7.3.1 Connection description

Depending on the size of the motor plug connector, the hybrid cables are available in the following designs:

- springtec quick lock for con.15
- speedtec quick lock for con.23 and con.40



- 1: Plug connector
- 2: STOBER hybrid cable
- 3: Connection to terminal X20, motor
- 4: Connection to terminal X2, brake supply
- 5: D-sub X4

Hybrid cable – con.15 plug connector

Connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Core color	Core No./ core color	Pin X20	Pin X2	Pin X4
	A	1U1	BK	L1	1	—	—
	B	1W1	RD	L3	3	—	—
	C	1V1	BU	L2	2	—	—
	1	1BD1	RD	1	—	5	—
	2	1BD2	BK	2	—	6	—
	3	DSL+	GY	WH	—	—	4
	4	DSL-	GN	BU	—	—	2
	5	DSL shield	—	—	—	—	Connect or
	⊕	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 161: con.15 hybrid cable pin assignment

Length x [mm]	Diameter y [mm]
42	18.7

Tab. 162: con.15 connector dimensions

Hybrid cable – con.23 plug connector

Connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Core color	Core No./ core color	Pin X20	Pin X2	Pin X4
	A	1U1	BK	L1	1	—	—
	B	1V1	BU	L2	2	—	—
	C	1W1	RD	L3	3	—	—
	E	DSL-	GN	BU	—	—	2
	F	DSL shield	—	—	—	—	Connect or
	G	1BD1	RD	1	—	5	—
	H	DSL+	GY	WH	—	—	4
	L	1BD2	BK	2	—	6	—
	⊕	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 163: con.23 hybrid cable pin assignment

Length x [mm]	Diameter y [mm]
78	26

Tab. 164: con.23 connector dimensions

Hybrid cable – con.40 plug connector

Connection diagram	Motor (1)			Cable (2)	Drive controller (3) – (5)		
	Pin	Designation	Core color	Core No./ core color	Pin X20	Pin X2	Pin X4
	U	1U1	BK	L1	1	—	—
	V	1V1	BU	L2	2	—	—
	W	1W1	RD	L3	3	—	—
	N	—	—	—	—	—	—
	+	1BD1	RD	1	—	5	—
	-	1BD2	BK	2	—	6	—
	F	—	—	—	—	—	—
	G	—	—	—	—	—	—
	H	DSL+	GY	WH	—	—	4
	L	DSL-	GN	BU	—	—	2
	⊕	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 165: con.40 hybrid cable pin assignment

a) Coaxial shield to which the DSL shield is connected.

Length x [mm]	Diameter y [mm]
99	46

Tab. 166: con.40 connector dimensions

11 Commissioning

The following section involves commissioning your drive system with the aid of the DriveControlSuite DS6 software.

You can find information on system requirements and software installation in the chapter [DriveControlSuite](#) [▶ 243].

For the components of your drive model, we require one of the following two combinations:

STOBER synchronous servo motor with EnDat 2.1/2.2 digital encoder or HIPERFACE DSL 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 that you want from the database, as well as upon reading out the nameplate, all data is transferred to the corresponding parameters. There is no need for complex parameter configuration of the motor, encoder and brake.

STOBER LM Lean motor without encoder (with optional brake)

These motors are stored in the motor database of the DriveControlSuite, along with all the data relevant for project configuration. Furthermore, the motor data and the purging and engaging times of the brake are part of the firmware.

By selecting the desired motor from the database, all data is transmitted to the corresponding parameters. The purging and engaging times of the brake are also stored. If a brake is present, you must only activate this manually. However, complex parameterization of the motor and brake is not necessary.

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!

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 Create new project.
- ⇒ The projecting window opens and the Drive controller button is active.

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 supporting additional information such as the change history of the project configuration.
2. Drive controller tab:
Select the SI6 series and the device type of the drive controller.
3. Option modules tab:
Safety module: If the drive controller is part of a safety circuit, select the SR6 or SY6 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.
If you operate the drive controller in combination with the SY6 safety module, select EtherCAT Rx and EtherCAT Tx for transmitting the EtherCAT process data.
If you operate the drive controller in combination with the SR6 safety module or without safety technology (SZ6), the fieldbus connection is optional. If you do not use a fieldbus, project No transmission.

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-part suppliers, enter the accompanying motor data at a later time.
5. Repeat steps 2 – 4 for the 2nd axis (only for double-axis controllers).
6. Confirm with OK.

11.1.2 Configuring the safety module

In the next step, you have to configure the safety technology in accordance with the commissioning steps outlined in the manual; see the chapter [Detailed information \[► 245\]](#).

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 project P1: Project 1 in the project tree > Context menu Create new module.
⇒ Module M2 Module 2 is created in the project tree.
2. Highlight M2: Module 2 in the project tree > Context menu > Create new drive controller.
⇒ Drive controller T2 drive controller 2 is created in the project tree.
3. Highlight the drive controller T2: drive controller 2 in the project tree.
4. Change to the project menu and click Projecting.
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 Specifying a module

After you have created and projected all drive controllers that you want to record under a module, specify the module.

1. Highlight the module M1: Module1 in the project tree.
2. Change to the project menu and click Project configuration.
⇒ The Module window opens.
3. Establish the relationship between your circuit diagram and the newly created module in DriveControlSuite.
Equipment: Specify the equipment code of the module.
Designation: Give a clear and meaningful name to the module.
Version: Specify a version for the module.
Version description: If necessary, specify supporting additional information such as the change history of the module.
4. Confirm with OK.

11.1.5 Specifying the project

Finally, specify your project.

1. Highlight the project P1: Project1 in the project tree.
2. Change to the project menu and click Project configuration.
 - ⇒ The Project window opens.
3. Establish the relationship between your circuit diagram and the newly created project in DriveControlSuite.
 - Equipment: Specify the equipment code of the project.
 - Designation: Give a clear and meaningful name to the project.
 - Version: Specify a version for the project.
 - Version description: If necessary specify supporting additional information such as the change history of the project.
4. Confirm with OK.

11.2 Mechanical drive model

Smooth operation of a drive train in combination with one or more drive controllers requires mapping the associated real mechanical environment in DriveControlSuite. There, you define the mechanical axis model as part of commissioning.

The following chapters provide explanations of the configuration options for rotational and translational drives in combination with different position or motor encoders. Position encoders are generally optional, whereas the use of a motor encoder depends on the control mode and motor type.

11.2.1 Parameterizing the STOBER motor

You have projected one of the following motors:

STOBER synchronous servo motor with EnDat 2.1/2.2 digital encoder or HIPERFACE DSL encoder (with 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.

STOBER LM Lean motor without encoder (with 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. You only have to parameterize the cable length in use. Even the brake purging and engaging times are already stored. You just have to activate the brake.

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 Motor wizard.
3. B101 Cable length:
 - Select the cable length of the power cable in use.
4. Repeat the steps for the 2nd axis (only for double-axis controllers).

Then activate the brake.

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 Brake wizard.
3. F00 Brake:
Select 1: Active.
4. Repeat the steps for the 2nd axis (only for double-axis controllers).

11.2.2 Parameterizing the axis model

Parameterize the setup of your drive in this order:

- Define the axis model
- Scale the axis
- 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:
In order to configure the units of measure and the number of decimal places individually for specifying and displaying position reference values, velocities and accelerations, select 0: User defined, rotational or 1: User defined, translational.
If the units of measures and the number of decimal places for specifying and displaying position reference values, velocities and accelerations 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:
Define the interface to which the position encoder is connected.
6. I00 Position range:
Define the travel range.

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. I06 Decimal places position:
If you have selected 0: User defined, rotational or 1: User defined, translational when defining your axis type, specify the desired number of decimal places in this parameter.
5. I09 Measure unit:
If you have selected 0: User defined, rotational or 1: User defined, translational when defining your axis type, specify the desired unit of measure in this parameter.

Information

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

11.2.2.3 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 drive 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.

11.3 Testing the project configuration

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 project 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 **Jog control panel.**
3. The predefined test movement variables are standard 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 reliability of the standard values before the test start. 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.

Transferring the test configuration

- ✓ You have verified the predefined test movement variables for plausibility. To be able to transfer a test configuration to a drive controller, you must connect your PC to the network. The relevant drive controller is switched on.
1. In the project tree, highlight the module under which you have recorded the drive controller and click **Connection and assignment** in the project menu.
⇒ The **Setting up a connection** window opens.

2. Direct connection tab > IP address column:
Mark the drive controller in question or activate all those listed using the context menu.
Confirm your selection with OK.
⇒ The Assignment window opens. All drive controllers connected to the selected network interface are displayed.
3. Select the first drive controller to which you would like to transfer the test configuration.
Open the corresponding Do not establish connection drop-down menu and select Send.
4. Open the Create new drive controller drop-down menu and select the drive controller to which you would like to transfer the test configuration.
5. Repeat steps 3 and 4 for all other drive controllers to which you wish to transfer your test configuration.
6. Click on Establish online connections.
⇒ The test configuration is transferred to the selected drive controllers.

Saving the test configuration

1. Highlight the drive controller you have transferred the test configuration to in the project tree and click on the first projected axis in the project menu > Wizard section.
2. Select the Save values wizard > Action management section and click on Save values.
3. As the configuration is only effective after a restart of the drive controller, select the Restart wizard > Action management section and click on Restart.

Activating the control panel and testing the project configuration

- ✓ The STO safety function must not be activated.
1. Select Jog control panel.
 2. Click Control panel on and then on Enable.
⇒ The drive is controlled using the activated control panel.
 3. Move the axis step-by-step and test the direction of motion, velocity, distance, etc. using the Jog+, Jog-, JogStep+ and JogStep- buttons.
 4. Optimize your project configuration based on your test results as necessary.
 5. 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. If both buttons are active, no movement is executed.

JogStep+ and JogStep- move the drive relative to the current actual value by the step width specified in I14.

Jog+ and Jog- have a higher priority than JogStep+ and JogStep-.

12 Communication

Two options are available for establishing a communication connection with the SI6 drive controller:

- Direct connection between the drive controller and a PC
- Communication between a controller and a PC by fieldbus

The DriveControlSuite project configuration and commissioning software installed on the PC is able to handle multiple direct connections simultaneously.

12.1 System requirements

Note the following requirements for the direct connection.

12.1.1 Personal firewall

For communication, both DriveControlSuite and the SATMICL communication service must be enabled in the PC's firewall.

Test communication is initiated during the installation of DriveControlSuite that opens a dialog for enabling communication in case of an activated firewall. Note that operation in public networks must also be enabled for the communication using a mobile network adapter.

The required setup file can be found in the STOBER Download Center at <http://www.stoeber.de/en/download>.

Program/service	Path
DS6A.exe (DriveControlSuite)	Standard installation: C:\Program Files (x86)\STOBER\DriveControlSuite\bin Parallel installation of different versions (version 6.X-X): C:\Program Files (x86)\STOBER\DriveControlSuite (V 6.X-X)\bin
SATMICLSVC.exe (SATMICL service)	32-bit Windows 7 or 32-bit Windows 10: C:\Windows\System32 64-bit Windows 7 or 64-bit Windows 10: C:\Windows\SysWOW64

Tab. 167: Programs and services

12.1.2 Protocols and ports for communication using routers

For communication using routers, the protocols and ports used by DriveControlSuite and the SATMICL communication service must be enabled in the routers, if applicable.

Protocol	Port	Use	Program/service
UDP/IP	37915	Connection test (inquiry)	SATMICL service
UDP/IP	37916	Node search	SATMICL service
UDP/IP	30001	Primary port for connection response (response)	SATMICL service
	30002 – 39999	Alternative ports for connection response (response)	
UDP/IP	40000	Primary port for IP address specification	DriveControlSuite
	40001 – 50000	Alternative IP address specification ports	
TCP/IP	37915	Data transmission	DriveControlSuite

Tab. 168: Protocols and ports for a direct connection

12.2 Direct connection

A direct connection is a network connection in which all nodes are in the same network.

In its simplest form, a direct connection is a point-to-point cable connection between the network interface of the PC where DriveControlSuite is installed and the network interface of the drive controller. Switches or routers can also be used in place of a simple network cable.

The IP address required for direct connection is either assigned automatically by DriveControlSuite or using DHCP, or it is specified manually.

Prerequisites

- The socket of the gateway device and the network connection of the PC must have IP addresses from the same subnet
- For setting up the direct connection automatically, the parameter A166 from DriveControlSuite must be set to 2: DHCP + DS6

12.3 Fieldbus

Detailed information about the fieldbus connection can be found in the corresponding manual, see chapter [Detailed information](#) [▶ 245].

13 Diagnostics

LEDs on the top and front give you initial information about the device state of the respective device as well as the states of the physical connection and the communication. In the event of an error or fault, you will receive detailed information through the DriveControlSuite commissioning software.

13.1 Supply module

The PS6 supply module has 3 diagnostic LEDs on the front of the device that light up in different combinations and frequencies and provide information about the state of the supply module.



Fig. 33: Diagnostic LEDs on the front of the PS6 device

- 1 Green: RUN
- 2 Red: ERROR
- 3 Yellow: WARNING

States of the supply module

Warning 1 covers all warnings that are likely to result in a fault if the load remains constant. The connected drives must be stopped at the next opportunity.

Causes:

- Overload of the rectifier or increased temperature
- Overload of the braking resistor
- 1 line phase failed

If the braking resistor is overloaded, it can dissipate energy for another 5 s. After this 5 s, the brake chopper can be activated again only if the braking resistor has left the critical temperature range.

Warning 2 covers all warnings that result in a fault in a very short-term period. The connected drives must be stopped immediately.

Causes:

- Power failure

Fault means that the connected drives must be brought to a stop immediately.
















Causes:

- Excessive temperature in the rectifier
- Overvoltage
- Short-circuit in the brake chopper path
- Grid
- Activation in the short-circuited DC link

Relay and LED state display

The relay and LEDs always display the same state. The states are displayed using the priority list initialization/ready < Warning 1 < Warning 2 < Fault. The display of states with higher priority replaces the display of states with lower priority (example: warning 2 overwrites warning 1). States with a lower priority are only displayed after the higher prioritized state has been displayed for at least 4 s.

LEDs: Green/Red/ Yellow	Behavior	Description	Relay (X100)		
			READY	WARNING1	WARNING2
	Flashing	Initialization	Open	Closed	Closed
	Off				
	Off				
	On	Ready: DC link is charged, charging relay is closed	Closed	Closed	Closed
	Off				
	Off				
	On	Warning 1: Rectifier overload, overload of the braking resistor or 1 line phase failed	Closed	Open	Closed
	Off				
	1x flash				
	On	Warning 2: Line phases failed	Closed	Closed	Open
	Off				
	2x flash				
	Off	Fault: Overtemperature in rectifier	Open	Closed	Closed
	1x flash				
	Off				

LEDs: Green/Red/ Yellow	Behavior	Description	Relay (X100)		
			READY	WARNING1	WARNING2
	Off	Fault: Overvoltage	Open	Closed	Closed
	2x flash				
	Off				
	Off	Fault: Short-circuit in the brake chopper path	Open	Closed	Closed
	3x flash				
	Off				
	Off	Fault: Grid power	Open	Closed	Closed
	4x flash				
	Off				
	Off	Fault: Switch-on in the short-circuited DC link	Open	Closed	Closed
	5x flash				
	Off				
	Off	Device is switched off	Open	Open	Open
	Off				
	Off				

Tab. 169: Meaning of the 3 LEDs (RUN, ERROR and WARNING) on the front of the PS6 device

UL-compliant operation: For project configuration of warning 1, observe the notes on the braking resistor in the chapter [UL-compliant use](#) | 19].

13.2 Drive controller

STOBER drive controllers have diagnostic LEDs that visually indicate the state of the drive controller as well as the states of the physical connection and communication.

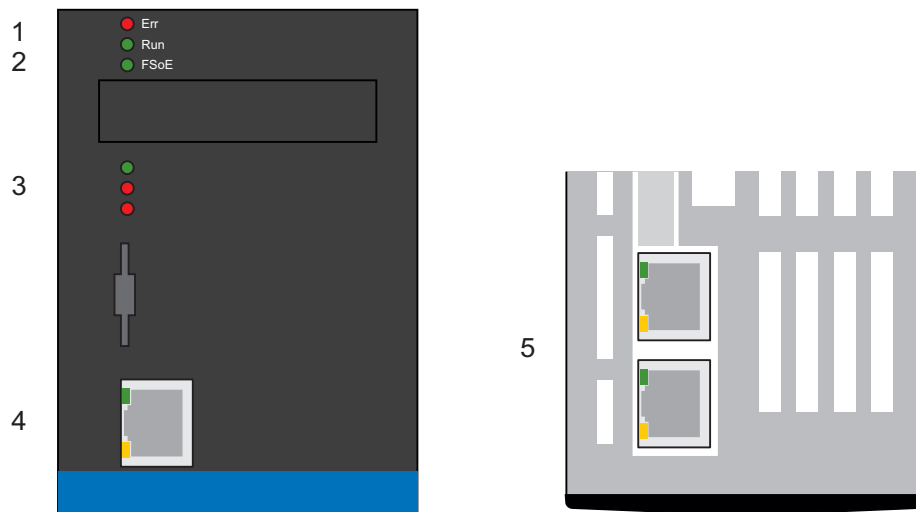


Fig. 34: Positions of the diagnostic LEDs on the front and top of the drive controller

- 1 Fieldbus state
- 2 FSoE state
- 3 Drive controller state
- 4 Service network connection
- 5 Fieldbus network connection

13.2.1 Fieldbus state

The LEDs for the diagnostics of the fieldbus state vary depending on the implemented fieldbus system or communication module.

13.2.1.1 EtherCAT state

There are 2 LEDs on the front of the drive controller that provide information about the connection between EtherCAT master and slave and about the state of the data exchange. This information can also be read out in parameter A255 EtherCAT Device State. If the drive controller includes the SY6 safety module, the STO and SS1 safety functions are activated over EtherCAT FSoE. In this case, an LED on the front of the device provides information about the FSoE state.

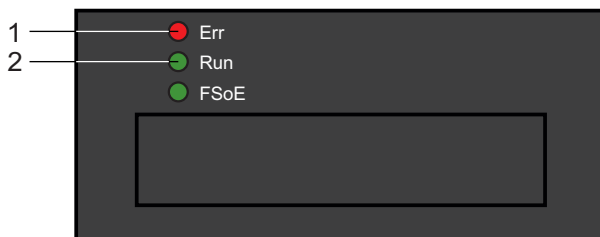


Fig. 35: LEDs for the EtherCAT state

- 1 Red: Error
- 2 Green: Run

Red LED	Behavior	Error	Description
	Off	No Error	No error
	Flashing	Invalid Configuration	Invalid configuration
	1x flash	Unsolicited State Change	The EtherCAT slave changed operating states by itself
	2x flash	Application Watchdog Timeout	The EtherCAT slave did not receive new PDO data during the configured watchdog timeout

Tab. 170: Meaning of the red LED (error)

Green LED	Behavior	Operating state	Description
	Off	Init	No communication between the EtherCAT master and slave; the configuration starts, saved values are loaded
	Flashing	Pre-operational	No PDO communication; the EtherCAT master and slave exchange application-specific parameters via SDOs
	1x flash	Safe-operational	The EtherCAT slave sends the current actual values to the EtherCAT master, ignores its reference values and refers to internal default values
	On	Operational	Normal operation: The EtherCAT master and slave exchange reference and actual values

Tab. 171: Meaning of the green LED (run)

13.2.1.2 PROFINET state

There are 2 LEDs on the front of the drive controller that provide information about the connection between the IO controller and device and about the state of the data exchange. This information can also be read out in parameter A271 PN state.



Fig. 36: LEDs for the PROFINET state

- 1 Red: Bus error
- 2 Green: Run

Red LED	Behavior	Description
	Off	No error
	Rapid flashing	Data exchange with IO controller not active
	On	No network connection

Tab. 172: Meaning of the red LED (BF)

Green LED	Behavior	Description
	Off	No connection
	Flash	Connection is set up to IO controller
	Flash, inverse	IO controller activates DHCP signal service
	Flashing	Existing connection to IO controller; data exchange expected
	On	Existing connection to IO controller

Tab. 173: Meaning of the green LED (run)

13.2.2 FSoE state

If the drive controller includes the SY6 safety module, the STO and SS1 safety functions are activated over EtherCAT FSoE. In this case, an LED on the front of the device provides information about the state of FSoE communication. This information can also be read out in parameter S20 FSoE status.



Fig. 37: LED for the FSoE state

1 Green: FSoE

Green LED	Behavior	Possible in FSoE state	Description
	Off	Pre-Reset	Initialization
	Flashing	Reset, session, connection, parameters	Ready for parameterization
	On	Process data	Normal operation
	Single blink	Failsafe data	Failsafe command from FSoE master received
	Rapid blinking	All	Undefined connection error
	Rapid blinking with 1x flash	Parameters	Error in the safety-related communication settings
	Rapid blinking with 2x flash	Parameters	Error in the safety-related application settings
	Rapid blinking with 3x flash	Connection	Incorrect FSoE address
	Rapid blinking with 4x flash	All	Prohibited command received
	Rapid blinking with 5x flash	All	Watchdog error
	Rapid blinking with 6x flash	All	CRC error

Tab. 174: Meaning of the green LED (FSoE state in accordance with IEC 61784-3)

13.2.3 Drive controller state

3 LEDs on the front of the device provide information about the state of the drive controller.

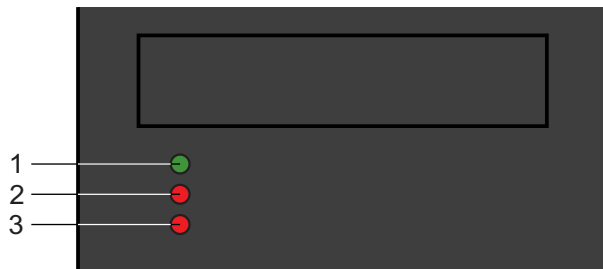


Fig. 38: LEDs for the state of the drive controller

- 1 Green: Run
- 2 Red: Error in axis controller A
- 3 Red: Error in axis controller B (only for double-axis controllers)

Green LED	Behavior	Description
	Off	No supply voltage or axis controller A or B faulty
	Single blink	STO active
	Flashing	At least 1 axis controller ready to switch on; no axis controller faulty
	On	At least 1 axis controller enabled; no axis controller faulty
	Rapid flashing	Data is written to internal memory and the SD card

Tab. 175: Meaning of the green LED (run)

Red LED	Behavior	Description
	Off	No error
	Flashing	Warning
	On	Fault
	Rapid flashing	No configuration active

Tab. 176: Meaning of the red LEDs (error)










Pattern when starting the drive controller

LEDs: Green/Red/Red	Behavior	Description
	On	Short phase while the firmware starts up
	On	
	On	

Tab. 177: States of the LEDs when starting the drive controller

Pattern for the firmware update

The states of the green and red LEDs also apply as described during a live firmware update. In the following exceptional cases, the three LEDs flash in different combinations and frequencies:

LEDs: Green/Red/Red	Behavior	Description
	Off	Deleting the first firmware memory
	Rapid flashing	
	Off	
	Rapid flashing	Copying the second firmware memory into the first
	Off	
	Off	
  	Chaser light	Error during firmware update, service required

Tab. 178: States of the LEDs for firmware updates

13.2.4 Service network connection

The LEDs at X9 on the front of the device display the state of the service network connection.

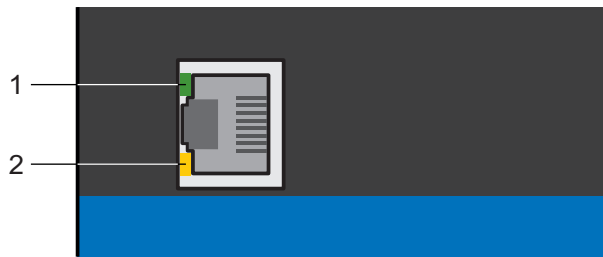







Fig. 39: LEDs for the state of the service network connection

- 1 Green: Link
- 2 Yellow: Activity

Green LED	Behavior	Description
	Off	No network connection
	On	Network connection present

Tab. 179: Meaning of the green LED (link)

Yellow LED	Behavior	Description
	Off	No network connection
	Flashing	Individual data packets are sent or received
	On	Active data exchange

Tab. 180: Meaning of the yellow LED (act.)

13.2.5 Fieldbus network connection

The LEDs for communication diagnostics vary depending on implemented fieldbus system or communication module.

13.2.5.1 EtherCAT network connection

The LEDs LA_{EC}IN and LA_{EC}OUT at X200 and X201 on the top of the device indicate the state of the EtherCAT network connection.

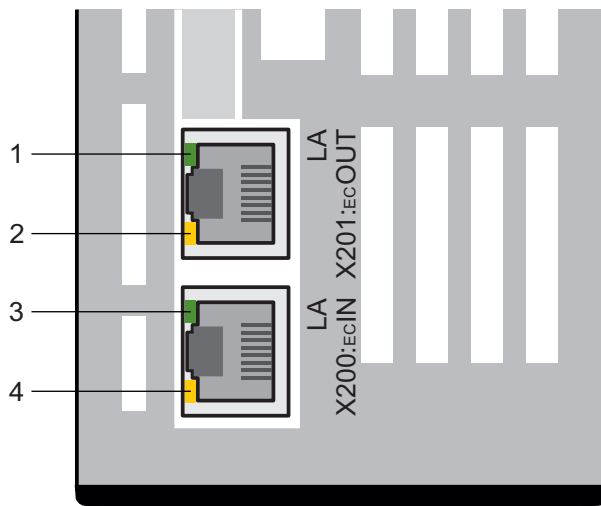


Fig. 40: LEDs for the state of the EtherCAT network connection

- 1 Green: LA_{EC}OUT at X201
- 2 Yellow: No function
- 3 Green: LA_{EC}IN at X200
- 4 Yellow: No function

Green LED	Behavior	Description
	Off	No network connection
	Flashing	Active data exchange with other EtherCAT nodes
	On	Network connection exists

Tab. 181: Meaning of the green LEDs (LA)

13.2.5.2 PROFINET network connection

The Act. and Link LEDs at X200 and X201 on the top of the device indicate the state of the PROFINET network connection.

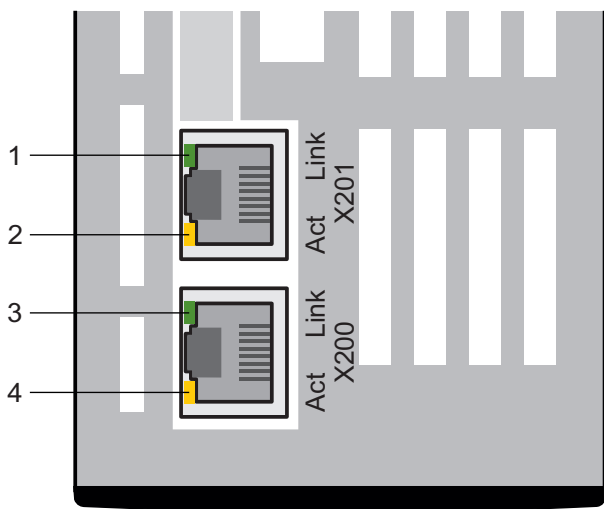






Fig. 41: LEDs for the state of the PROFINET network connection

- 1 Green: Link at X201
- 2 Yellow: Activity at X201
- 3 Green: Link at X200
- 4 Yellow: Activity at X200

Green LED	Behavior	Description
	Off	No network connection
	On	Network connection exists

Tab. 182: Meaning of the green LEDs (Link)

Yellow LED	Behavior	Description
	Off	No data exchange
	Flashing	Active data exchange with IO controller

Tab. 183: Meaning of the yellow LEDs (Act.)

13.3 Events

The drive controller has a self-monitoring system that uses test rules to protect the drive system from damage. Violating the test rules triggers a corresponding event. There is no possible way for you as the user to intervene in some events, such as event Short/ground. In other cases, such as event Overspeed, you can define the triggering threshold and the response.

Possible responses include:

- **Message:** Information that can be evaluated by the controller
- **Warning:** Information that can be evaluated by the controller and becomes a fault after a defined time span has elapsed without the cause being resolved
- **Fault:** Immediate drive controller response; the drive either stops applying torque/force or is brought to a stop through a quick stop or emergency braking

Events, their causes and suitable measures are listed below. If the cause of the error is corrected, you can usually acknowledge the error immediately. If the drive controller has to be restarted instead, a corresponding note can be found in the measures.

13.3.1 Overview

The following table shows the possible events at a glance.

Event
Event 31: Short/ground [▶ 183]
Event 32: Short/ground internal [▶ 183]
Event 33: Overcurrent [▶ 184]
Event 34: Hardware fault [▶ 185]
Event 35: Watchdog [▶ 185]
Event 36: High voltage [▶ 186]
Event 37: Motor encoder [▶ 186]
Event 38: Temperature drive controller sensor [▶ 189]
Event 39: Overtemperature drive controller i2t [▶ 190]
Event 40: Invalid data [▶ 191]
Event 41: Temp.MotorTMP [▶ 192]
Event 44: External fault 1 [▶ 193]
Event 45: Overtemp.motor i2t [▶ 194]
Event 46: Low voltage [▶ 195]
Event 47: Torque limit [▶ 196]
Event 50: Safety module [▶ 197]
Event 51: Virtual master limit switch [▶ 198]
Event 52: Communication [▶ 199]
Event 53: Limit switch [▶ 200]
Event 54: Following error [▶ 201]
Event 56: Overspeed [▶ 202]
Event 57: Runtime usage [▶ 203]

Event
Event 59: Overtemperature drive controller i2t [▶ 204]
Event 60: Application event 0 – Event 67: Application event 7 [▶ 205]
Event 68: External fault 2 [▶ 206]
Event 69: Motor connection [▶ 207]
Event 70: Parameter consistency [▶ 208]
Event 71: Firmware [▶ 209]
Event 72: Brake test timeout [▶ 210]
Event 76: Position encoder [▶ 211]
Event 77: Master encoder [▶ 214]
Event 78: Position limit cyclic [▶ 217]
Event 79: Motor / position monitor [▶ 218]
Event 80: Illegal action [▶ 219]
Event 81: Motor allocation [▶ 219]
Event 85: Excessive jump in reference value [▶ 220]
Event 86: Unknown data record LeanMotor [▶ 221]
Event 87: Reference lostReference loss [▶ 222]
Event 88: Control panel [▶ 223]
Event 89: Maximum current Lm [▶ 224]

Tab. 184: Events

13.3.2 Event 31: Short/ground

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The brake chopper is disabled.

Cause	Check and action
Connection error at the motor	Check the connection and correct it if necessary
Defective motor cable	Check the cable and replace it if necessary
Braking resistor too low	Check the maximum permitted braking resistor power loss for the application and replace the braking resistor if necessary
Short-circuit in the motor winding	Check the motor and replace it if necessary
Short-circuit in the braking resistor	Check the braking resistor and replace it if necessary
Short-circuit/ground fault inside the device	Check whether the fault occurs when switching on the power unit and replace the drive controller if necessary

Tab. 185: Event 31 – Causes and actions

13.3.3 Event 32: Short/ground internal

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The brake chopper is disabled.

Cause	Check and action
Short-circuit/ground fault inside the device	Replacing the drive controller

Tab. 186: Event 32 – Causes and actions

13.3.4 Event 33: Overcurrent

The drive controller is interrupted if:

- U30 = 0: Inactive

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with emergency braking if:

- U30 = 1: Active and
- A29 = 1: Active for STOBER device controller
or
- U30 = 1: Active and
- A540 = 2: slow down on quick stop ramp for CiA 402 device controller

Response:

- The axis is stopped by emergency braking; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)
- At the end of emergency braking, the power unit is disabled and axis movement is no longer controlled by the drive controller

Cause	Check and action
Short acceleration times	Check the actual current using the scope image and reduce the acceleration values if necessary (E00)
Large torque/force limits	Check the actual current using the scope image (E00) and reduce the torque/force limits if necessary (C03, C05)
Wrong drive controller design	Check the design and change the drive controller type if necessary

Tab. 187: Event 33 – Causes and actions

13.3.5 Event 34: Hardware fault

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: FPGA – 12: Timer control board	Defective drive controller	Exchange drive controller; fault cannot be acknowledged
23: FPGA – 30: Internal power supply	Defective drive controller	Exchange drive controller; fault cannot be acknowledged

Tab. 188: Event 34 – Causes and actions

13.3.6 Event 35: Watchdog

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The brake chopper and brake release override are non-functional while the runtime system restarts.

Number	Cause	Check and action
1: Core 0 – 2: Core 1	Microprocessor at full load	Check the runtime utilization using the scope image (E191) and reduce it using a longer cycle time if necessary (A150)
	Microprocessor faulted	Check the connection and shielding and correct them if necessary; replace the drive controller if necessary

Tab. 189: Event 35 – Causes and actions

13.3.7 Event 36: High voltage

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Short delay times	Check the DC link voltage during the braking operation using the scope image (E03) and, if necessary, reduce the delay values, use a (larger) braking resistor or connect a DC link
Braking resistor connection error	Check the connection to the braking resistor and supply module and correct them if necessary
Braking resistor overloaded	Check the supply module on display WARNING 1 ; check that the maximum permitted braking resistor power loss is suitable for the application; replace the braking resistor if necessary
Supply voltage exceeded	Check the supply voltage for an overrun of the permitted input voltage and adjust it if necessary

Tab. 190: Event 36 – Causes and actions

13.3.8 Event 37: Motor encoder

The drive controller is interrupted if:

- U30 = 0: Inactive

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with emergency braking if:

- U30 = 1: Active and
- A29 = 1: Active for STOBER device controller
or
- U30 = 1: Active and
- A540 = 2: slow down on quick stop ramp for CiA 402 device controller

Response:

- The axis is stopped by emergency braking; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)
- At the end of emergency braking, the power unit is disabled and axis movement is no longer controlled by the drive controller

Number	Cause	Check and action
1: Parameter <-> encoder	Inconsistent parameterization	Compare the specification of the connected encoder to the corresponding values of the H parameters and correct them if necessary
2: X4 speed	Exceeded encoder maximum velocity	Check the actual velocity during a movement using the scope image (E15) and adjust the permitted encoder maximum velocity if necessary (B297)
	Connection error	Check the connection and shielding and correct them if necessary
	Dynamic reference values for the Lean motor	Check the dynamics of the application reference values and reduce them if necessary
	Dynamic control of the Lean motor	Check the control settings; if necessary, reduce the gain (C31, I20) and increase the adjustment times (C32)
	Toggling the Lean motor position determination models	Check the switchover filter time constant and increase it if necessary (B137)
6: X4 EnDat encoder found	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
7: X4 channel A/incremental	Connection error	Check the connection and correct it if necessary
8: X4 no encoder found	Connection error	Check the connection and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Defective encoder cable	Check the cable and replace it if necessary; restart the drive controller to switch the encoder supply back on
	Defective power supply	Check the encoder power supply and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00); restart the drive controller to switch encoder supply back on
10: X4 channel A/Clk – 11: X4 channel B/Dat	Defective encoder cable	Check the cable and replace it if necessary
13: X4-EnDat alarm	Defective EnDat encoder	Replace the motor; fault cannot be acknowledged
14: X4 EnDat CRC – 15: X4 double transmission	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	<u>Take EMC recommendations into account [► 109]</u> and, if necessary, increase the fault tolerance (B298)

Number	Cause	Check and action
16: X4 busy	Defective encoder cable	Check the cable and replace it if necessary
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the motor if necessary
17: EBI encoder low battery	Battery in battery module weak	Replace the battery; reference remains intact
18: EBI encoder battery empty	Battery in battery module empty	Replace the battery
	Initial connection	–
	Connection error	Check the connection and correct it if necessary
	Defective encoder cable	Check the cable and replace it if necessary
	Faulty battery module	Check the battery module and replace it if necessary
20: Resolver carrier – 22: Resolver overvoltage	Defective encoder cable	Check the cable and replace it if necessary
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the encoder or motor if necessary; fault cannot be acknowledged
24: Resolver failure	Defective encoder cable	Check the cable and replace it if necessary
48: X4 zero pulse missing	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Late zero toe	Check number of encoder increments per rotation and correct it if necessary (H02)
49: X4 zero pulse distance too small	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Early zero track	Check number of encoder increments per rotation and correct it if necessary (H02)
60: Hiperface synchronisation – 63: Hiperface link	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	Take EMC recommendations into account [▶ 109] and, if necessary, increase the fault tolerance (B298)

Tab. 191: Event 37 – Causes and actions

13.3.9 Event 38: Temperature drive controller sensor

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Surrounding temperatures too high or too low	Check the surrounding temperature of the drive controller and adjust it to the operating conditions of the drive controller if necessary
Too little air circulation in the control cabinet	Check minimum clearance and adjust it if necessary
Defective or blocked fan	Switch on control unit supply; check that the fan starts and replace the drive controller if necessary
Assembly protection film	Remove the assembly protection film
Wrong drive controller design	Check the design and change the drive controller type if necessary
Increased or reduced mechanical friction	Check the service status of the mechanical system and service them if necessary
Mechanical block	Check the output and remove the block if necessary
Short deceleration/acceleration times	Check the actual current during the braking process using the scope image (E00); reduce the deceleration and acceleration values if necessary
Clock frequency too high	Check the utilization of the drive, taking into account derating and the configured clock frequency (E20, B24); reduce the configured clock frequency or replace the drive controller if necessary

Tab. 192: Event 38 – Causes and actions

13.3.10 Event 39: Overtemperature drive controller i2t

The possible effects depend on the configured level (U02):

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The maximum permitted output current is limited to 100% of $I_{2N,PU}$ (R04). If the i^2t value (E24) increases to 105%, event 59: Overtemperature drive controller i2t is triggered.

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Wrong drive controller design	Check the design and change the drive controller type if necessary
Increased or reduced mechanical friction	Check the service status of the mechanics and service them if necessary
Mechanical block	Check the output and correct the block if necessary
Short deceleration/acceleration times	Check the actual current during the braking process using the scope image (E00); reduce the deceleration and acceleration values if necessary
Clock frequency too high	Check the utilization of the drive, taking into account derating and the configured clock frequency (E20, B24); reduce the configured clock frequency or replace the drive controller if necessary

Tab. 193: Event 39 – Causes and actions

13.3.11 Event 40: Invalid data

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Fault – 8: Wrong/illegal serial number	Invalid data in the internal memory of the drive controller or option module	Replace the drive controller or option module; fault cannot be acknowledged
32: Electronic nameplate	No data available in the electronic nameplate	Deactivate the evaluation of the nameplate or replace the motor (B04); fault cannot be acknowledged
33: Electronic motor-type limit	Invalid data in the electronic nameplate	Deactivate the evaluation of the nameplate or replace the motor (B04); fault cannot be acknowledged
48: reverse documentation	Defective memory in the SD card or internal memory of the drive controller	Replace the SD card or drive controller; fault cannot be acknowledged

Tab. 194: Event 40 – Causes and actions

13.3.12 Event 41: Temp.MotorTMP

The possible effects depend on the configured level (U15):

- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Motor sensor connection error	Check the connection and correct it if necessary
Wrong motor design	Check the design and change the motor type if necessary
Surrounding temperatures at the motor too high	Check the surrounding temperature and adjust it if necessary
Mechanical block of the motor	Check the output and remove the block if necessary
Increased or reduced mechanical friction	Check the service status of the mechanical system and service them if necessary

Tab. 195: Event 41 – Causes and actions

13.3.13 Event 44: External fault 1

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Application-specific	Application-specific

Tab. 196: Event 44 – Causes and actions

13.3.14 Event 45: Overtemp.motor i2t

The possible effects depend on the parameterized level (U10):

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Wrong motor design	Check the design and change the motor type if necessary
Mechanical block	Check the output and remove the block if necessary
Increased or reduced mechanical friction	Check the service status of the mechanics and service them if necessary

Tab. 197: Event 45 – Causes and actions

13.3.15 Event 46: Low voltage

The possible effects depend on the configured level (U00):

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Supply voltage does not correspond to the configured supply voltage	Check the supply voltage, parameterized supply voltage and undervoltage limit and correct them if necessary (A36, A35)
Supply voltage below undervoltage limit	Check undervoltage limit and correct it if necessary (A35)

Tab. 198: Event 46 – Causes and actions

13.3.16 Event 47: Torque limit

The possible effects depend on the configured level (U20):

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Incorrectly selected torque/force limits	Check the general machine limit and adjust it if necessary (C03, C05); check the application limits and the parameters dependent on the operating mode and adjust them if necessary (STOBER C132, C133 or CiA 402 A559)
Wrong motor design	Check the design and change the motor type if necessary
Mechanical block	Check the output and correct the block if necessary
Holding brake closed	Check the connection, supply voltage and parameterization and correct them if necessary (F00)
Connection error at the motor	Check the connection and correct it if necessary
Connection error at the encoder	Check the connection and correct it if necessary
Wrong encoder measurement direction	Compare the attachment and measurement direction of the encoder with the corresponding values of the H parameters and correct them if necessary

Tab. 199: Event 47 – Causes and actions

13.3.17 Event 50: Safety module

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Inconsistent request (single channel)	Connection error	Check the connection and correct if necessary, error can be confirmed only if STO was previously requested for at least 100 ms across two channels
2: Wrong safety module	The projected safety module E53 does not match the E54[0] detected on the system side	Check the projecting and drive controller and correct the projecting or exchange the drive controller if necessary; fault cannot be acknowledged
3: Internal error	Defective safety module	Exchange drive controller; fault cannot be acknowledged

Tab. 200: Event 50 – Causes and actions

13.3.18 Event 51: Virtual master limit switch

The possible effects depend on the configured level (U24).

- 0: Inactive
- 1: Message
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: SW-limit switch positive – 2: SW-limit switch negative	End of the travel range reached	Move in the travel range in the direction opposite the limit switch
	Travel range too small	Check the positions of the software limit switch and correct them if necessary (G146, G147)
3: +/- 31 bit computing limit reached	Computing limit of the data type reached	Check the command sequences for multiple successive commands without a breakpoint 3: MC_MoveAdditive and the number of decimal places of the axis model and reduce them if necessary (G46)

Tab. 201: Event 51 – Causes and actions

13.3.19 Event 52: Communication

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
4: PZD-Timeout	Missing process data	Check the IO cycle time in the PROFINET IO controller and the timeout time in the drive controller and correct them if necessary (A109)
6: EtherCAT PDO-Timeout	Missing process data	Check the task cycle time in the EtherCAT master and the timeout time in the drive controller and correct them if necessary (A258)
7: Reserved	Synchronization error	Check the synchronization settings in the EtherCAT master and correct them if necessary
	Connection error	Check the connection and shielding and correct them if necessary
14: PZD parameter figure faulty	Missing mapping	Check the mapping for unmappable parameters and correct them if necessary

Tab. 202: Event 52 – Causes and actions

13.3.20 Event 53: Limit switch

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Hardware-Limit-Switch positive – 2: Hardware-Limit-Switch negative	End of the travel range reached	Move in the travel range in the direction opposite the limit switch
	Connection error	Check the connection and source parameters and correct them if necessary (I101, I102)
	Defective connection cable	Check the cable and replace it if necessary
3: SW-limit switch positive – 4: SW-limit switch negative	End of the travel range reached	Move in the travel range in the direction opposite the limit switch
	Travel range too small	Check the positions of the software limit switches and correct them if necessary (STOBERI50, I51 or CiA A570[0], A570[1])
5: +/- 31 bit computing limit reached	Computing limit of the data type reached	Check the command sequences for multiple successive commands without a breakpoint 3: MC_MoveAdditive and the number of decimal places of the axis model and reduce them if necessary (I06)
7: Both limit switches not connected	Connection error	Check the connection and source parameters and correct them if necessary (I101, I102)
	Defective connection cable	Check the cable and replace it if necessary

Tab. 203: Event 53 – Causes and actions

13.3.21 Event 54: Following error

The possible effects depend on the configured level (U22).

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Incorrectly selected torque/force limits	Check the general machine limit and adjust it if necessary (C03, C05); check the application limits and adjust them if necessary (STOBER C132, C133 and the parameters dependent on the operating mode or CiA 402 A559)
Maximum permitted drag distance too small	Check the maximum permitted drag error and correct it if necessary (STOBER I21 or CiA A546)
Mechanical block	Check the output and correct the block if necessary
Holding brake closed	Check the connection, supply voltage and parameterization and correct them if necessary (F00)

Tab. 204: Event 54 – Causes and actions

13.3.22 Event 56: Overspeed

The drive controller is interrupted if:

- U30 = 0: Inactive

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with emergency braking if:

- U30 = 1: Active and
- A29 = 1: Active for STOBER device controller
or
- U30 = 1: Active and
- A540 = 2: slow down on quick stop ramp for CiA 402 device controller

Response:

- The axis is stopped by emergency braking; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)
- At the end of emergency braking, the power unit is disabled and axis movement is no longer controlled by the drive controller

Cause	Check and action
Maximum permitted velocity too small	Check the maximum permitted velocity and increase it if necessary (I10)
Overshooting control system	Check the actual velocity using the scope image (scope Sensing time: 250 μs, actual motor velocity: E15, E91; actual position velocity I88) and, if necessary, reduce the intensity of the control system (I20, C31)
Wrong commutation offset	Check the commutation offset using the test phases action (B40)
Faulty encoder	Check the velocity display of the encoder at a standstill (motor: E15, E91; position I88) and replace the encoder if necessary

Tab. 205: Event 56 – Causes and actions

13.3.23 Event 57: Runtime usage

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
3: RT3 – 5: RT5	Exceeding the cycle time	Check the utilization (E191) and increase the cycle time if necessary (A150)

Tab. 206: Event 57 – Causes and actions

13.3.24 Event 59: Overtemperature drive controller i2t

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Wrong drive controller design	Check the design and change the drive controller type if necessary
Increased or reduced mechanical friction	Check the service status of the mechanics and service them if necessary
Short deceleration/ acceleration times	Check the actual current during the braking process using the scope image (E00); reduce the deceleration and acceleration values if necessary
Clock frequency too high	Check the utilization of the drive, taking into consideration derating and the configured clock frequency (E20, B24); reduce the configured clock frequency or replace the drive controller if necessary

Tab. 207: Event 59 – Causes and actions

13.3.25 Event 60: Application event 0 – Event 67: Application event 7

The possible effects depend on the configured level (U100, U110, U120, U130, U140, U150, U160, U170):

- 0: Inactive
- 1: Message
- 2: Warning
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Application-specific	Application-specific

Tab. 208: Events 60 – 67 – Causes and actions

13.3.26 Event 68: External fault 2

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Application-specific	Application-specific

Tab. 209: Event 68 – Causes and actions

13.3.27 Event 69: Motor connection

The possible effects depend on the configured level (U12).

- 0: Inactive
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
2: No motor connected	Connection error	Check the connection and correct it if necessary
	Defective motor cable	Check the cable and replace it if necessary
3: Wake and Shake failed	Increased or reduced mechanical friction	Check the service status of the mechanics and service them if necessary
	Mechanical block	Check the output and correct the block if necessary

Tab. 210: Event 69 – Causes and actions

13.3.28 Event 70: Parameter consistency

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Wrong encoder model	Encoder model unsuitable for control mode	Check the control mode, motor encoder and encoder and correct them if necessary (B20, B26, H-parameters)
3: B12<->B20	Nominal motor current is higher than the nominal drive controller current (4 kHz)	Check the nominal motor current against 150% of the nominal drive controller current at 4 kHz clock frequency and reduce the nominal motor current or change the drive controller type if necessary (B12, R04[0])
4: B10<->H31	Unsupported combination of resolver/motor number of poles	Check number of poles of the resolver and number of poles of the motor and correct them if necessary (H08, H148, B10)
5: Negative slip frequency	Negative slip	Check the nominal motor velocity, nominal motor frequency and number of poles of the motor and correct them if necessary (B13, B15, B10)
8: v-max (I10) exceeds maximum (B83)	Maximum permitted velocity exceeds the maximum motor velocity	Check the maximum permitted velocity and the maximum motor velocity and correct them if necessary (I10, B83)
11: Reference retaining	Conditions for reference without tracking not met	Check that the reference is retained and that the measurement range covers the travel range and make corrections if necessary (I46, limited travel range I00: Software limit switch must be parameterized; infinite travel range I00: Measurement range must correspond to the revolution length STOBERR01 or CiA 402 A568[1] or an entire multiple)
13: Motor temperature sensor	Unsupported temperature sensors	Check the motor temperature sensor type in the motor and drive controller series and change the motor or drive controller series if necessary
14: I11>B143	Maximum permitted velocity is above maximum motor acceleration	Check if maximum permitted velocity is above maximum motor acceleration and correct if necessary (I11, B143)

Tab. 211: Event 70 – Causes and actions

13.3.29 Event 71: Firmware

Cause 1:

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause 3:

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Firmware defective	Firmware defective	Update the firmware; fault cannot be acknowledged
3: CRC-error	Firmware defective	Update the firmware; fault cannot be acknowledged

Tab. 212: Event 71 – Causes and actions

13.3.30 Event 72: Brake test timeout

The possible effects depend on the cause. Cause 1 and 2 lead to a fault, cause 3 is output as a message.

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: B311timeout:B300 mandatory	Brake management is active and the timeout for the brake test runs out twice	Test the brake (B300, S18); can be acknowledged for a period of 5 min in order to be able to carry out the test brake action
2: Brake defective:B300 mandatory	Test holding torque not met during the test brake action	Grind the brake (B301, B302) and repeat the brake test (B300, S18); can be acknowledged for a period of 5 min in order to be able to carry out the brake test
	Faulty encoder test run during test brake action	Replace the encoder or motor and repeat the brake test (B300, S18); can be acknowledged for a time period of 5 min in order to be able to carry out the brake test
3: Brake test necessary	Brake management is active and the timeout for the brake test runs out once	Carry out the test brake action (B300, S18); can be acknowledged for a period of 5 min in order to be able to carry out the brake test

Tab. 213: Event 72 – Causes and actions

13.3.31 Event 76: Position encoder

The drive controller is interrupted if:

- U30 = 0: Inactive and
- A29 = 0: Inactive for STOBER device controller
or
- U30 = 1: Active and
- A540 = 0: disable drive, motor is free to rotate for CiA 402 device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA 402 device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with emergency braking if:

- U30 = 1: Active and
- A29 = 1: Active for STOBER device controller
or
- U30 = 1: Active and
- A540 = 2: slow down on quick stop ramp for CiA 402 device controller

Response:

- The axis is stopped by emergency braking; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)
- At the end of emergency braking, the power unit is disabled and axis movement is no longer controlled by the drive controller

The reference is deleted (I86).

Number	Cause	Check and action
0: Inactive	Reference set for inactive Lean motor position determination	Check device status (E48) and, if necessary, activate the enable signal
1: Parameter <-> encoder	Inconsistent parameterization	Compare the specification of the connected encoder to the corresponding values of the H parameters and correct them if necessary

Number	Cause	Check and action
2: X4 speed	Exceeded encoder maximum velocity	Check the actual velocity during a movement using the scope image (E15) and adjust the permitted encoder maximum velocity if necessary (B297)
	Connection error	Check the connection and shielding and correct them if necessary
	Dynamic reference values for the Lean motor	Check the dynamics of the application reference values and reduce them if necessary
	Dynamic control of the Lean motor	Check the control settings; if necessary, reduce the gain (C31, I20) and increase the adjustment times (C32)
	Toggleing the Lean motor position determination models	Check the switchover filter time constant and increase it if necessary (B137)
6: X4 EnDat encoder found	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
7: X4 channel A/incremental	Connection error	Check the connection and correct it if necessary
8: X4 no encoder found	Connection error	Check the connection and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Defective encoder cable	Check the cable and replace it if necessary; restart the drive controller to switch the encoder supply back on
	Defective power supply	Check the encoder power supply and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00); restart the drive controller to switch encoder supply back on
10: X4 channel A/Clk – 11: X4 channel B/Dat	Defective encoder cable	Check the cable and replace it if necessary
14: X4 EnDat CRC – 15: X4 double transmission	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	Take EMC recommendations into account [►_109] and, if necessary, increase the fault tolerance (I298)
16: X4 busy	Defective encoder cable	Check the cable and replace it if necessary
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the encoder or motor if necessary

Number	Cause	Check and action
17: EBI encoder low battery	Battery in battery module weak	Replace the battery; reference is not deleted by the event
18: EBI encoder battery empty	Battery in battery module empty	Replace the battery
	Initial connection	–
	Connection error	Check the connection and correct it if necessary
	Defective encoder cable	Check the cable and replace it if necessary
	Faulty battery module	Check the battery module and replace it if necessary
20: Resolver carrier – 22: Resolver overvoltage	Defective encoder cable	Check the cable and replace it if necessary
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the encoder or motor if necessary; fault cannot be acknowledged
24: Resolver failure	Defective encoder cable	Check the cable and replace it if necessary
48: X4 zero pulse missing	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Late zero toe	Check number of encoder increments per rotation and correct it if necessary (H02)
49: X4 zero pulse distance too small	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Early zero track	Check number of encoder increments per rotation and correct it if necessary (H02)
60: Hiperface synchronisation – 63: Hiperface link	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	<u>Take EMC recommendations into account [▶ 109]</u> and, if necessary, increase the fault tolerance (I298)

Tab. 214: Event 76 – Causes and actions

13.3.32 Event 77: Master encoder

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The reference is deleted (G89).

Number	Cause	Check and action
1: Parameter <-> encoder	Inconsistent parameterization	Compare the specification of the connected encoder to the corresponding values of the H parameters and correct them if necessary
2: X4 speed	Exceeded encoder maximum velocity	Check the actual velocity during a movement using the scope image (E15) and adjust the permitted encoder maximum velocity if necessary (B297)
	Connection error	Check the connection and shielding and correct them if necessary
6: X4 EnDat encoder found	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
7: X4 channel A/incremental	Connection error	Check the connection and correct it if necessary

Number	Cause	Check and action
8: X4 no encoder found	Connection error	Check the connection and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Defective encoder cable	Check the cable and replace it if necessary; restart the drive controller to switch the encoder supply back on
	Defective power supply	Check the encoder power supply and correct it if necessary; restart the drive controller to switch the encoder supply back on
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00); restart the drive controller to switch encoder supply back on
10: X4 channel A/Clk – 11: X4 channel B/Dat	Defective encoder cable	Check the cable and replace it if necessary
13: X4-EnDat alarm	Defective EnDat encoder	Replace the encoder; fault cannot be acknowledged
14: X4 EnDat CRC – 15: X4 double transmission	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	Take EMC recommendations into account [► 109] and, if necessary, increase the fault tolerance (G298)
16: X4 busy	Defective encoder cable	Check the cable and replace it if necessary
	Inconsistent parameterization	Compare the connected encoder to the parameterized encoder and correct it if necessary (H00)
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the encoder if necessary

Number	Cause	Check and action
17: EBI encoder low battery	Battery in battery module weak	Replace the battery; reference is not deleted by the event
18: EBI encoder battery empty	Battery in battery module empty	Replace the battery
	Initial connection	–
	Connection error	Check the connection and correct it if necessary
	Defective encoder cable	Check the cable and replace it if necessary
	Faulty battery module	Check the battery module and replace it if necessary
20: Resolver carrier – 22: Resolver overvoltage	Defective encoder cable	Check the cable and replace it if necessary
	Incompatible encoder	Compare the specification of the encoder with the corresponding specifications from STOBER and replace the encoder or motor if necessary; fault cannot be acknowledged
24: Resolver failure	Defective encoder cable	Check the cable and replace it if necessary
48: X4 zero pulse missing	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Late zero toe	Check number of encoder increments per rotation and correct it if necessary (H02)
49: X4 zero pulse distance too small	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Early zero track	Check number of encoder increments per rotation and correct it if necessary (H02)
60: Hiperface synchronisation – 63: Hiperface link	Defective encoder cable	Check the cable and replace it if necessary
	Connection error	Check the connection and correct it if necessary
	Electromagnetic interference	Take EMC recommendations into account [▶ 109] and, if necessary, increase the fault tolerance (G298)

Tab. 215: Event 77 – Causes and actions

13.3.33 Event 78: Position limit cyclic

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Illegal direction	Reference position outside of the software limit switch	Check the reference position in the controller and software limit switch in the drive controller and correct it if necessary (STOBER I50, I51 or CiA 402 A570)
2: Reference value outside of circular length I01	Reference position outside of the travel range	Check the reference position in the controller and travel range in the drive controller and correct it if necessary (STOBER I01 or CiA 402 A568)
3: Maximum extrapolation time I423 exceeded	Missing update of the reference position	Check the task cycle time in the fieldbus master of the controller and maximum permitted extrapolation in the drive controller and correct it if necessary (I423)

Tab. 216: Event 78 – Causes and actions

13.3.34 Event 79: Motor / position monitor

The possible effects depend on the configured level (U28).

- 0: Inactive
- 1: Message
- 3: Fault

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Connection error	Check the connection and shielding and correct them if necessary
Slip	Check the mechanics between the motor and position encoder and maximum permitted slip and correct them if necessary (I291, I292)
Mechanical damage	Check the mechanics between the motor and position encoder and correct any damage if necessary

Tab. 217: Event 79 – Causes and actions

13.3.35 Event 80: Illegal action

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Illegal	Not supported by the control mode	Check the control mode and correct it if necessary (B20)
2: Brake	Loaded axis	Remove the axis load and start the action again

Tab. 218: Event 80 – Causes and actions

13.3.36 Event 81: Motor allocation

The drive controller is interrupted:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Depending on the cause, data for the motor (in the case of a change to the motor or motor type), the current controller (in the case of a change to the motor type), the holding brake (in the case of a change to the holding brake or motor type) the temperature sensor (in the case of a change to the temperature sensor or motor type) or motor adapter, gear unit and geared motor (in the case of a change to the geared motor) are read out of the electronic nameplate and entered in the respective parameters. In the event of a change to the motor, motor type or even just the commutation (B05), the commutation offset is reset.

Number	Cause	Check and action
1: Different motor type	Modified motor assignment	Check the change to the motor assignment and save the new motor assignment if necessary (A00)
	Modified gear unit assignment	Check the change to the gear unit assignment and save the new motor assignment if necessary (A00)
32: Different motor – 131: Different brake & temperature sensor	Modified motor assignment	Check the change to the motor assignment and save the new motor assignment if necessary (A00)
150: Temperature sensor unknown	Motor with unknown temperature sensor type	Update the firmware or change the motor

Tab. 219: Event 81 – Causes and actions

13.3.37 Event 85: Excessive jump in reference value

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Item	Fast reference position change leads to acceleration that cannot be performed	Check the current reference acceleration against the maximum permitted acceleration in the drive controller (E64, E69) and reduce the reference value change in the controller or change the motor type if necessary
2: Velocity	Fast reference velocity change leads to acceleration that cannot be performed	Check the current reference acceleration against the maximum permitted acceleration in the drive controller (E64, E69) and reduce the reference value change in the controller or change the motor type if necessary

Tab. 220: Event 85 – Causes and actions

13.3.38 Event 86: Unknown data record LeanMotor

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Motor	Motor type not supported by firmware	Update the firmware or change the motor (B100)
2: Cable length	Cable length not supported by firmware	Update the firmware or change the cable (B101)

Tab. 221: Event 85 – Causes and actions

13.3.39 Event 87: Reference lost

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Power unit switched off on moving axis	Reference the drive again and, if necessary, only shut off the power unit when stationary (I199)
Actual position (motor) changes when power unit is shut off	Do not change the actual position (motor) when the power unit is shut off and, if applicable, switch to a motor with a holding brake (F00)

Tab. 222: Event 87 – Causes and actions

13.3.40 Event 88: Control panel

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Cause	Check and action
Commissioning and parameterization computer heavily loaded	Check the number of open windows (DS6) and the number of active programs and reduce the number if necessary
Connection error	Check the connection and correct it if necessary
Defective network cable	Check the cable and replace it if necessary
Faulty network connection	Check the network settings and, if applicable, the switch, router or wireless connections and correct them or contact your network service provider if necessary

Tab. 223: Event 88 – Causes and actions

13.3.41 Event 89: Maximum current Lm

The drive controller is interrupted if:

- A29 = 0: Inactive for STOBER device controller
or
- A540 = 0: disable drive, motor is free to rotate for CiA device controller

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

The drive controller is interrupted with a quick stop if:

- A29 = 1: Active for STOBER device controller
or
- A540 = 2: slow down on quick stop ramp for CiA device controller

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes are controlled by the drive controller and remain released
- At the end of the quick stop, the power unit is disabled and axis movement is no longer controlled by the drive controller; the brakes are no longer controlled by the drive controller and engage in the event of an inactive release override (F06)

Number	Cause	Check and action
1: Id – 2: Iq	Excessive controller gain at low speeds	Check the controller gain and speed controller factors and reduce them if necessary (I19, C31, B146, B147)

Tab. 224: Event 89 – Causes and actions

14 Replacement

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

14.1 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](#) [► 17].

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 and, if applicable, the [fast discharge](#). You can find the discharge time in the general technical data.

Information

You can check the output voltage at the marked measuring points at the front of the housing of the PS6 supply module that are used for the DC link connection of the drive controllers.

ATTENTION!

Material damage due to overload!

Insufficient electrical strength of the measuring device can cause damage or failure of the measuring device.

- Make sure that the measuring device has an electrical strength of at least 1000 V_{DC}.

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 connecting wiring, and installing or removing accessories are prohibited while the voltage supply is switched on.

Make sure that all Quick DC-Link modules are covered again after the replacement, i.e. built over with a PS6 supply module or SI6 drive controller.

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

14.2 Replacing the drive controller

DANGER!

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. 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.

Information

Note that the SD card from the drive controller being replaced can be re-used only for drive controllers of the same series.

Information

The safety module is a permanently integrated component in the drive controller where any design, technical and electrical modifications are prohibited!
Any removal of the safety module from the drive controller as well as any attempt at repair or replacement is prohibited. The drive controller and safety module do not require maintenance.

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 fieldbus variants of the firmware for the drive controller to be installed and to be replaced match. Information on differing fieldbus variants can be found in the chapter [Changing the fieldbus](#) [▶ 228].
- ✓ The hardware and firmware of the drive controller to be installed is of the same or a newer version as that of the drive controller to be replaced. You can find information about firmware updates in the chapter [Replacing or updating the firmware](#) [▶ 228].

- ✓ Optional: The SD card is present in the drive controller being replaced; the original project is stored on the SD card. Or: The control unit of the drive controller being replaced still works; copy the original project to the SD card before removing the drive controller.
- 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. Loosen the fastening screws and take the drive controller out of the control cabinet.
- 4. Optional: Insert the SD card with the original project into the drive controller being installed.
- 5. Install the new drive controller in the control cabinet.
- 6. Reattach the terminals.
- 7. 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.
- 8. Optional: In order to be able to identify the SY6 safety module in the FSoE network, you must transfer its unique address in the FSoE network from the replaced drive controller to the new drive controller (DIP switches). Further information can be found in the SY6 manual, see the chapter [Detailed information \[▶ 245\]](#).

14.3 Exchanging the supply module

DANGER!

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

Tool and material

You will need:

- Tool for loosening and tightening the fastening screws

Requirements and replacement

- ✓ Supply modules of the same series and same power can be replaced interchangeably.
- ✓ The hardware and firmware of the supply module being installed are of the same or a newer version than that of the supply module being uninstalled.
- 1. Remove all terminals from the supply module being uninstalled.
- 2. Loosen the fastening screws and take the supply module out of the control cabinet.
- 3. Install the new supply module in the control cabinet.
- 4. Reattach the terminals.

14.4 Replacing or updating the firmware

Drive controllers from STOBER are normally delivered with the latest firmware version. You can change the firmware at a later point if you need a different firmware version or a device with an older firmware needs to be updated. In order to perform a live firmware update, you have to connect your PC to the network.

- ✓ Your PC is connected to the drive controller. The drive controller is switched on.
- 1. Start DriveControlSuite.
- 2. Click Live firmware update.
 - ⇒ The Setting up a connection window opens.
- 3. Direct connection tab > IP address column:
Highlight the drive controller in question and confirm your selection with OK.
 - ⇒ The Assignment window opens. All drive controllers connected to the selected network interface are displayed.
- 4. Click Live firmware update.
- 5. Confirm the confirmation prompts with OK.
 - ⇒ The Live firmware update dialog box opens.
- 6. Select the firmware version for the corresponding series from the Version list. If you have saved the desired firmware version locally, alternatively click Open file, navigate to the directory and load the file.
- 7. Position column:
Highlight the drive controller in question.
- 8. Click Start live firmware update.
 - ⇒ The firmware update is transferred.
- 9. Because the firmware update only takes effect after the drive controller is restarted, click Restart drive controller after completing the transfer.

14.5 Changing the fieldbus

Fieldbus communication is determined by the firmware. The SI6 drive controller is delivered with the firmware version in the the desired fieldbus variant. If you would like to change the fieldbus afterwards, first contact [STOBER electronics service](#) [► 229].

Information

In the event of a change of the drive controller fieldbus variant without prior consultation with STOBER, any warranty claims are void.

We can expand your warranty on request, such as for replacement part storage with different fieldbus variants.

15 Service

You can find important information on every aspect of our electronics service in this chapter.

15.1 STOBER electronics service

If you need support, please contact our service department. You can find all of the contact data in the chapter [Consultation, service and address](#) [▶ 249].

Please have the following descriptive information on hand so that we can provide you with quick, professional assistance.

Ordering a replacement device

If you would like to order a replacement device, our first level support requires the following information:

- MV and serial number of the drive controller being replaced; see the chapter [Material version](#) [▶ 28]
- Information on subsequent changes (e.g. change in option modules, application or firmware)

The MV number indicates the ordered and delivered material variant, i.e. the device-specific combination of all hardware and software components. The serial number is used to determine your customer information. Both numbers are stored in the STOBER enterprise resource planning system and make reordering a drive controller easier in case of service.

Fieldbus variant change

If you change the fieldbus on a drive controller and would like to expand the warranty for it, please have the following information available for our first level support:

- MV and serial number of the drive controller
- Information on subsequent changes (e.g. change in option modules, application or firmware)

Service request

If you need assistance or have any questions regarding commissioning, create [reverse documentation](#) for your project as your first step. This makes it easier for our first level support to process your request.

15.2 Reverse documentation

If you have questions concerning commissioning and would like to contact our service department, start by first creating reverse documentation and send this to the e-mail address of our first level support (see the chapter [Consultation, service and address](#) [▶ 249]).

15.2.1 Creating reverse documentation in a new project

- ✓ Your PC is connected to the drive controller. The drive controller is ready for operation.
1. Start DriveControlSuite.
 2. Click on Read out project.
 - ⇒ The Setting up a connection window opens.

3. Direct connection tab > IP address column:
Mark the drive controller in question or activate all those listed using the context menu.
Confirm your selection with OK.
 - ⇒ The Assignment window opens. All drive controllers connected to the selected network interface are displayed.
4. Connected drive controllers via communication:
Click on Establish online connections.
 - ⇒ The data connection is established and the project configuration data is transmitted from the drive controller to the PC.
 - ⇒ The drive controller is created in the project tree and is active.
5. Then click in the Assignment window on Disconnect.
6. Confirm the Reverse documentation dialog box with OK.
 - ⇒ The connection is disconnected.
 - ⇒ The drive controller is write-protected (lock status with red R).
7. Save the project in a local directory and send the file to us.

15.2.2 Loading reverse documentation in an existing project

- ✓ Your PC is connected to the drive controller. The drive controller is ready for operation.
 - ✓ A project file for your drive system already exists.
1. Start DriveControlSuite.
 2. Click on Open project.
 3. Navigate to the directory and load the file.
 4. In the project menu, click Connection and assignment.
 - ⇒ The Setting up a connection window opens.
 5. Direct connection tab > IP address column:
Mark the network interfaces in question and confirm your selection with OK.
 - ⇒ The Assignment window opens. All drive controllers that are connected over the selected network interface are displayed and are ignored by default for the data synchronization.
 6. Select Read out from all drive controllers in the context menu in order to activate all drive controllers for data synchronization.
 7. In the context menu, select Assign all drive controllers according to reference.
 8. Then click Establish online connections.
 - ⇒ The data connection is established and the project configuration data is transmitted from the drive controller to the PC.
 - ⇒ The drive controller is created in the project tree and is active.
 9. Then click in the Assignment window on Disconnect.
 10. Confirm the Reverse documentation dialog box with OK.
 - ⇒ The connection is disconnected.
 - ⇒ The drive controller is write-protected (lock status with red R).
 11. Save the project in a local directory and send the file to us.

16 Appendix

16.1 Terminal specifications

Relevant information for projecting the connecting wiring can be taken from the following chapters.

DIN 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!

Risk of personal injury or 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.

16.1.1 Overview

The following tables clarify which specifications must be observed for which connections depending on the type of drive controller and accessory as well as the supply module.

Drive controller

Type	X2A, X2B	X11, X300	X20A, X20B	X22	X101, X103
SI6A061	BCF 3,81 180 SN [▶ 233]	BLDF 5.08 180 SN [▶ 234]	GFKC 2,5 - ST-7,62 [▶ 235]	ISPC 5 - STGCL-7,62 [▶ 236]	FMC 1,5 - ST-3,5 [▶ 232]
SI6A062					
SI6A161					
SI6A162				SPC 5 -ST-7,62 [▶ 236]	
SI6A261					
SI6A262	BFL 5.08HC 180 SN [▶ 233]		SPC 16 - ST-10,16 [▶ 237]	BUZ 10.16IT 180 MF [▶ 238]	
SI6A361					

Tab. 225: Terminal specifications for the base device

Safety technology

Type	X12
SR6	BCF 3,81 180 SN [▶ 233]

Tab. 226: Terminal specifications of the safety technology

Supply module

Type	X10	X11	X21	X22	X23	X100
PS6A24	<u>SPC 16 - ST-10,16</u> ▶ 237]	<u>BLDF 5.08 180 SN</u> ▶ 234]	<u>I SPC 5 - STGCL-7,62</u> ▶ 236]	<u>I SPC 5 - STGCL-7,62</u> ▶ 236]	<u>FKC 2,5 - ST-5,08</u> ▶ 234]	<u>FMC 1,5 - ST-3,5</u> ▶ 232]
PS6A34	<u>BUZ 10.16IT 180 MF</u> ▶ 238]			<u>BUZ 10.16IT 180 MF</u> ▶ 238]		

Tab. 227: Terminal specifications for the supply module

16.1.2 FMC 1,5 -ST-3,5

Feature	Line type	Value
Contact spacing	—	3.5 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 8 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm ²
	Flexible with end sleeve without plastic collar	1.5 mm ²
	Flexible with end sleeve with plastic collar	0.75 mm ²
	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 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	24
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 228: FMC 1,5 -ST-3,5 specification

16.1.3 BCF 3,81 180 SN

Feature	Line type	Value
Contact spacing	—	3.81 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 16 A/10 A/11 A
Max. conductor cross-section	Flexible without end sleeve	1.5 mm ²
	Flexible with end sleeve without plastic collar	1.0 mm ²
	Flexible with end sleeve with plastic collar	1.0 mm ²
	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 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 229: BCF 3,81 180 SN BK specification

16.1.4 BFL 5.08HC 180 SN

Feature	Line type	Value
Contact spacing	—	5.08 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 16 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm ²
	Flexible with end sleeve without plastic collar	2.5 mm ²
	Flexible with end sleeve with plastic collar	2.5 mm ²
	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 mm ²
	Flexible with end sleeve without plastic collar	0.2 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 230: BFL 5.08HC 180 SN specification

16.1.5 BLDF 5.08 180 SN

Feature	Line type	Value
Contact spacing	—	5.08 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 14 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm ²
	Flexible with end sleeve without plastic collar	2.5 mm ²
	Flexible with end sleeve with plastic collar	2.5 mm ²
	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 mm ²
	Flexible with end sleeve without plastic collar	0.2 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 231: BLDF 5.08 180 SN specification

16.1.6 FKC 2,5 -ST-5,08

Feature	Line type	Value
Contact spacing	—	5.08 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 12 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm ²
	Flexible with end sleeve without plastic collar	2.5 mm ²
	Flexible with end sleeve with plastic collar	2.5 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	1.0 mm ²
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm ²
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 232: Specification for FKC 2,5 -ST-5,08

16.1.7 GFKC 2,5 -ST-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 12 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm ²
	Flexible with end sleeve without plastic collar	2.5 mm ²
	Flexible with end sleeve with plastic collar	2.5 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	1.0 mm ²
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm ²
	AWG according to UL/CSA	26/24
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 233: GFKC 2,5 -ST-7,62 specification

16.1.8 GFKIC 2.5 -ST-7.62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 12 A/10 A/10 A
Max. conductor cross-section	Flexible without end sleeve	2.5 mm ²
	Flexible with end sleeve without plastic collar	2.5 mm ²
	Flexible with end sleeve with plastic collar	2.5 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	1.0 mm ²
	AWG according to UL/CSA	12
Min. conductor cross-section	Flexible without end sleeve	0.2 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.5 mm ²
	AWG according to UL/CSA	26
Insulation stripping length	—	10 mm
Tightening torque	—	—

Tab. 234: Specification for GFKIC 2.5 -ST-7.62

16.1.9 SPC 5 -ST-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 32 A/35 A/35 A
Max. conductor cross-section	Flexible without end sleeve	6.0 mm ²
	Flexible with end sleeve without plastic collar	6.0 mm ²
	Flexible with end sleeve with plastic collar	4.0 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	1.5 mm ²
	AWG according to UL/CSA	8
Min. conductor cross-section	Flexible without end sleeve	0.2 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.25 mm ²
	AWG according to UL/CSA	24
Insulation stripping length	—	12 – 15 mm
Tightening torque	—	—

Tab. 235: SPC 5 -ST-7,62 specification

16.1.10 ISPC 5 -STGCL-7,62

Feature	Line type	Value
Contact spacing	—	7.62 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 32 A/35 A/35 A
Max. conductor cross-section	Flexible without end sleeve	6.0 mm ²
	Flexible with end sleeve without plastic collar	6.0 mm ²
	Flexible with end sleeve with plastic collar	4.0 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	1.5 mm ²
	AWG according to UL/CSA	8
Min. conductor cross-section	Flexible without end sleeve	0.2 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.25 mm ²
	AWG according to UL/CSA	24
Insulation stripping length	—	15 mm
Tightening torque	—	—

Tab. 236: ISPC 5 -STGCL-7,62 specification

16.1.11 SPC 16 -ST-10,16

Feature	Line type	Value
Contact spacing	—	10.16 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 55 A/66 A/66 A
Max. conductor cross-section	Flexible without end sleeve	16.0 mm ²
	Flexible with end sleeve without plastic collar	16.0 mm ²
	Flexible with end sleeve with plastic collar	10.0 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	4.0 mm ²
	AWG according to UL/CSA	4
Min. conductor cross-section	Flexible without end sleeve	0.75 mm ²
	Flexible with end sleeve without plastic collar	0.75 mm ²
	Flexible with end sleeve with plastic collar	0.75 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.75 mm ²
	AWG according to UL/CSA	20
Insulation stripping length	—	18 mm
Tightening torque	—	—

Tab. 237: SPC 16 -ST-10,16 specification

16.1.12 ISPC 16 -ST-10,16

Feature	Line type	Value
Contact spacing	—	10.16 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 55 A/66 A/66 A
Max. conductor cross-section	Flexible without end sleeve	16.0 mm ²
	Flexible with end sleeve without plastic collar	16.0 mm ²
	Flexible with end sleeve with plastic collar	10.0 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	4.0 mm ²
	AWG according to UL/CSA	4
Min. conductor cross-section	Flexible without end sleeve	0.75 mm ²
	Flexible with end sleeve without plastic collar	0.75 mm ²
	Flexible with end sleeve with plastic collar	0.75 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	0.75 mm ²
	AWG according to UL/CSA	20
Insulation stripping length	—	18 mm
Tightening torque	—	—

Tab. 238: SPC 16 -ST-10,16 specification

16.1.13 BUZ 10.16IT 180 MF

Feature	Line type	Value
Contact spacing	—	10.16 mm
Nominal current at $\vartheta_{amb} = 40\text{ °C}$	—	CE/UL/CSA: 61 A/60 A/60 A
Max. conductor cross-section	Flexible without end sleeve	16.0 mm ²
	Flexible with end sleeve without plastic collar	16.0 mm ²
	Flexible with end sleeve with plastic collar	10.0 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	4
Min. conductor cross-section	Flexible without end sleeve	0.5 mm ²
	Flexible with end sleeve without plastic collar	0.25 mm ²
	Flexible with end sleeve with plastic collar	0.25 mm ²
	2 conductors, flexible, with double end sleeve with plastic collar	—
	AWG according to UL/CSA	22
Insulation stripping length	—	12 mm
Tightening torque	—	2.0 Nm (18 Lb.inch)

Tab. 239: Specification for BUZ 10.16IT 180 MF

16.2 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.

16.2.1 Operation with 1 supply module

The following graphic shows the principal connection of a PS6 supply module and a SI6 drive controller based on a DC link connection with DL6B Quick DC-Link.

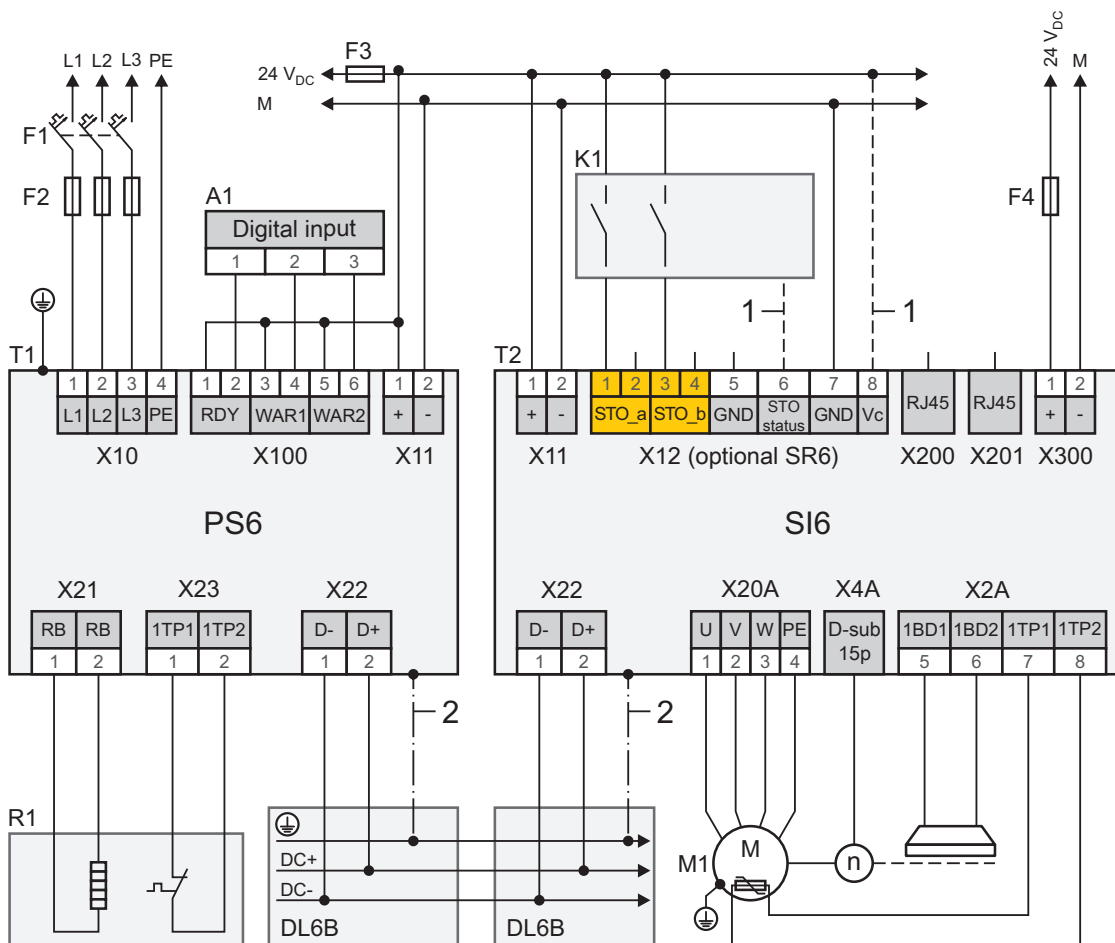


Fig. 42: Wiring example with one supply module and one drive controller

- A1 Controller
- F1 – F4 Fuse
- K1 Safety relay
- L1 – L3 Three-phase power supply
- M Reference ground
- M1 Motor
- R1 Braking resistor
- T1 Supply module
- T2 Drive controller
- 1 Optional connection
- 2 Spring-loaded contact between DL6B and PS6 or SI6

For UL-compliant operation:

The external motors which are connected to the inverter units SI6 units shall not be grounded over the modular drive system. The bonding/grounding of the motor(s) shall occur in the end use application in accordance with the requirements of applicable electrical codes/standards.

16.2.2 Parallel connection

The following graphic shows the principal connection of 3 PS6 supply modules and several SI6 drive controllers based on the DC link connection with DL6B Quick DC-Link.

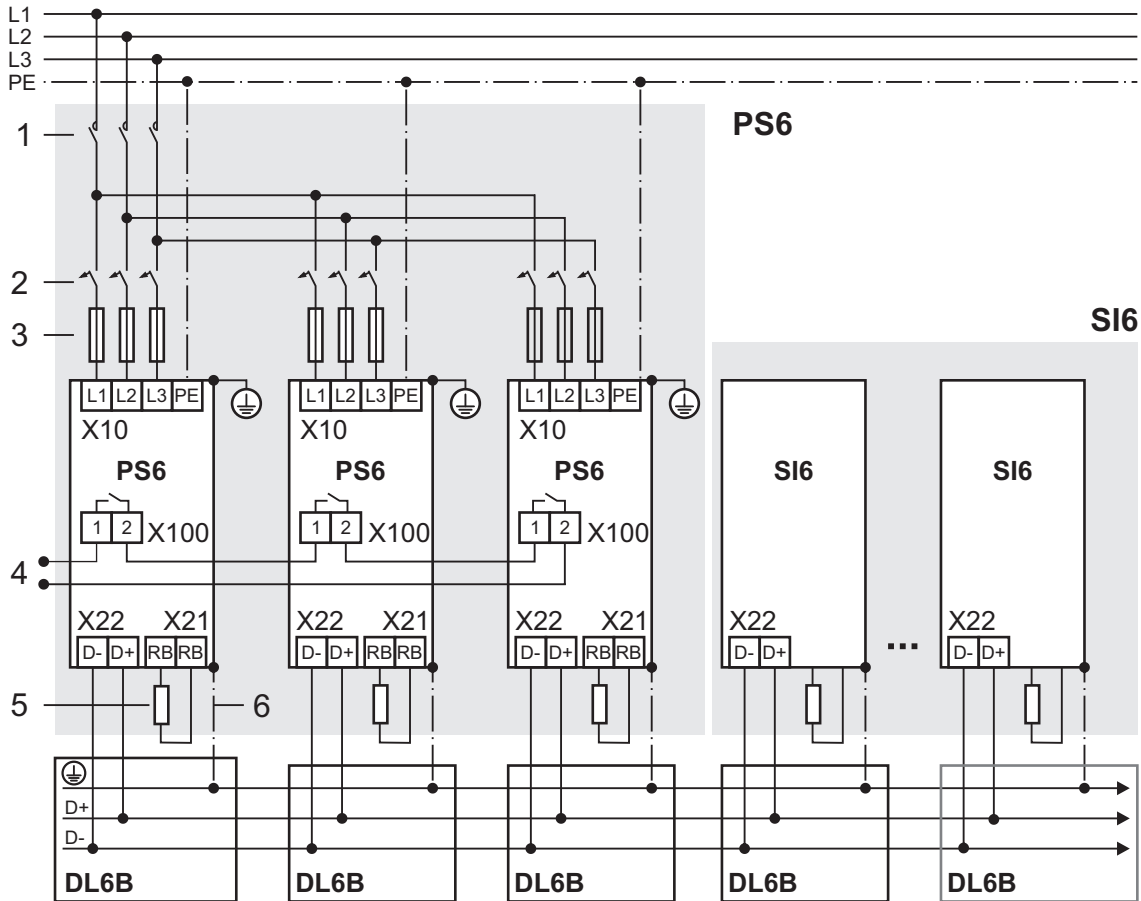


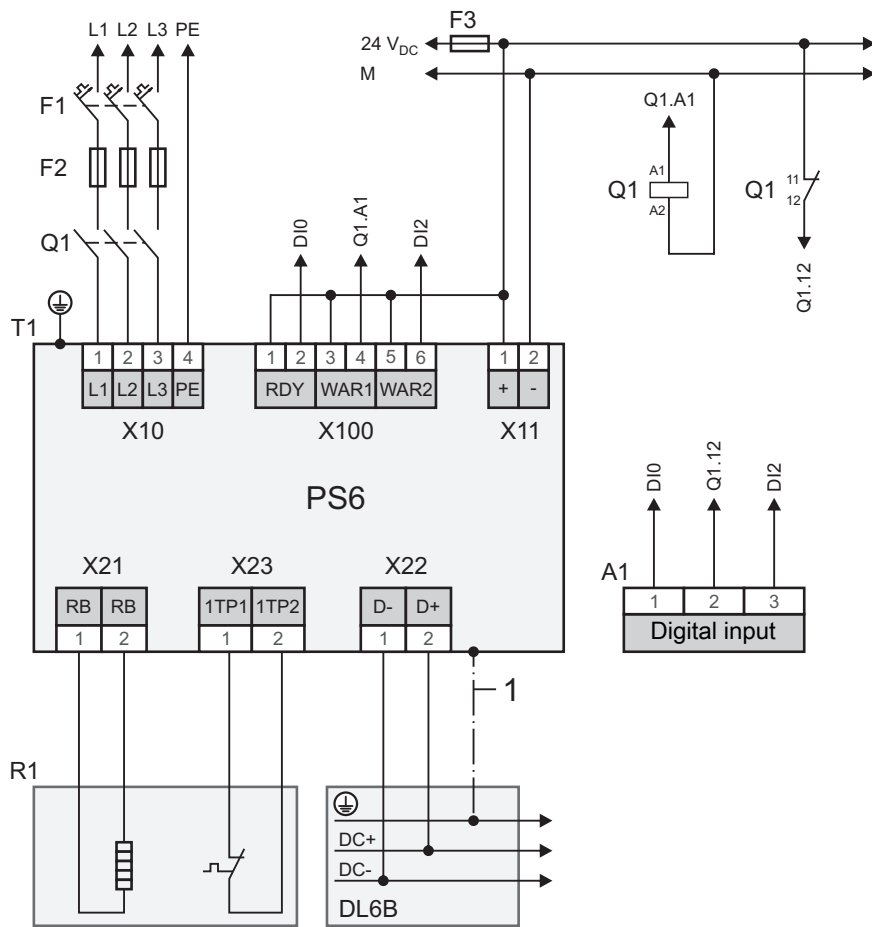
Fig. 43: Wiring example with supply modules connected in parallel

- 1 Contactor
- 2 Overload protection
- 3 Short-circuit protection
- 4 Status relay
- 5 Braking resistor
- 6 Spring-loaded contact between DL6B and PS6 or SI6

For UL-compliant operation:

A single PS6A24 or PS6A34 supply module converts the AC (3-phase) input voltage into a common DC bus output voltage, which is used to feed one or more SI6 drive controllers.

16.2.3 UL-compliant connection of the supply module



- A1 Controller
- F1 – F3 Fuse
- L1 – L3 Three-phase power supply
- T1 Supply module
- R1 Braking resistor
- Q1 Circuit breakers
- 1 Spring-loaded contact between DL6B and PS6

For UL-compliant operation:

For project configuration of the braking resistor, observe the notes in the chapter [UL-compliant use](#) [► 19].

The chassis of the PS6A/SI6A units is to be bonded through the M6 grounding studs on the PS6A units (4.0 Nm, 35 Lb.inch).

16.3 Device addressing

MAC address

A MAC address consists of a fixed and a variable portion. The fixed portion designates the manufacturer and the variable portion distinguishes the individual network nodes and must be universally unique.

The MAC addresses of the interfaces are issued by STOBER and cannot be changed.

Information

The MAC address range of the STOBER hardware is: 00:11:39:00:00:00 – 00:11:39:FF:FF:FF

IP address – Value range

An IPv4 address always consists of 4 decimal numbers, each in a range from 0 to 255, and separated by periods. It must be unique within a (sub)network.

Subnet and subnet mask – Value range

Subnets are created in order to provide standalone networks with their own address range. Each IP address is divided into a network and host address. The subnet mask determines where this division takes place.

Like the IP address, the subnet mask consists of four decimal numbers, each in a range from 0 to 255, separated by periods.

Assignment for direct connection

In the default factory settings, both the IP address and the subnet mask are automatically assigned by DriveControlSuite or using DHCP for a direct connection. Alternatively, you can switch to manual parameterization using parameter A166.

The active address is displayed in parameter A157 and the active subnet mask in parameter A158.

Assignment for fieldbus connection

Note that the IP address and subnet mask are assigned by the controller for a fieldbus connection.

16.4 DriveControlSuite

The DriveControlSuite commissioning software uses wizards to guide you step by step through the installation process. You can find more detailed information on the system requirements and installation in the following chapters.

16.4.1 System requirements

The following minimum requirements for the PC system apply to the installation and operation of the DriveControlSuite commissioning software und the integrated PASmotion component for configuring the SE6 safety module:

- Operating system: Windows 7 SP1 (32-bit, 64-bit *), Windows 10 (32-bit, 64-bit *)
- Processor: Intel Pentium 4 (2 GHz, Dual Core) or equivalent
- Memory: 2 GB
- Free disk space on the hard disk: 1 GB
- Graphics: 1024 × 768 pixel resolution, 65,536 colors
- Font size: 100 % (Standard)
- Interfaces: 100 Mbps Ethernet (Fast Ethernet, copper)
- Display of documentation: Adobe Acrobat Reader in version 7.1.0 or later**

*) 64-bit support: only DriveControlSuite

***) Display: only PASmotion

16.4.2 Installation types

Choose between one of two installation types for the installation.

Standard installation

Select this installation type if you want to install the latest version of DriveControlSuite.

DriveControlSuite is installed in the version-independent .../Programme/STOBER/DriveControlSuite/ directory. During the installation process, you do not need to specify any additional installation instructions.

Provided that you are connected to the Internet, a check is performed prior to installation to determine if a newer software version is available. If a newer version is already available, it is downloaded and installed in place of the started version.

If an older software version is already installed on your PC, it is deleted prior to installation. However, if the latest version is already installed on your PC, a new installation is not performed.

User-defined installation

Select this installation type if you want to install a specific version of DriveControlSuite or if you still need an older version that is already installed on your PC.

You can use this setting to change the standard installation directory and manage the version-dependent destination folders.

Checking whether the software version is up-to-date before installation is optional.

16.4.3 Installing software

You can find current versions of DriveControlSuite in our download center at <http://www.stoerber.de/de/download>.

Information

If you use the expanded safety function via the SE6 safety module, you also need the PASmotion integrated into DriveControlSuite. To this end, the PASmotion installation wizard starts at the end of the DriveControlSuite installation process. You can either perform installation of the component for the safety configuration or cancel it if you do not need it.

DriveControlSuite installation

- ✓ You must have administrator rights to perform the installation.
- 1. Save the setup file in any directory on your PC.
- 2. Exit all versions of DriveControlSuite if they have already been started.
- 3. Execute the setup file, and follow the installation instructions.
- 4. Optional: If you use the expanded safety function via the SE6 safety module, click Next and follow the installation instructions after the PASmotion installation wizard has started.
- 5. Confirm the communication test.
 - ⇒ If a firewall is active, you will receive a safety notice.
- 6. In this case, enable all associated checkboxes to permit communication in DriveControlSuite in public and private networks.
- 7. Exit the installation and start DriveControlSuite.

16.4.4 Updates

In the Help menu of the DriveControlSuite commissioning software, you can search for a newer version and, if available, download and install it.

Information

If the DriveControlSuite version is outdated, but the latest version is already installed on the computer, the check will yield the result that no newer version is available.

16.5 Detailed information

The documentation listed in the following table provides additional relevant information about the multi-axis drive system.

Current document versions can be found at <http://www.stoeber.de/en/download>.

Device/Software	Documentation	Contents	ID
Multi-axis drive system with SI6 and PS6	Commissioning instructions	System setup, technical data, storage, installation, connection, commissioning	442731
MC6 motion controller	Manual	Technical data, installation, commissioning, diagnostics	442461
CiA 402 application – SC6, SI6	Manual	Projecting, configuration, parameterization, function test, more detailed information	443080
STOBER Drive Based (STOBER DB) application	Manual	Projecting, configuration, parameterization, function test, more detailed information	442706
SR6 safety technology – STO via terminals	Manual	Technical data, installation, commissioning, diagnostics	442741
SY6 safety technology – STO and SS1 via FSoE	Manual	Technical data, installation, commissioning, diagnostics	442744
EtherCAT communication – SC6, SI6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	443025
PROFINET communication – SC6, SI6	Manual	Installation, electrical installation, data transfer, commissioning, detailed information	443039

Additional information and sources that form the basis of this documentation or are referenced by the documentation:

EtherCAT Technology Group (ETG), 2012. *ETG.1300 : EtherCAT Indicator and Labeling*. ETG.1300 S (R) V1.1.0. Specification. 2012-01-27.

Information concerning PROFINET

You can find general information on PROFINET on the PROFIBUS & PROFINET International (PI) website at <http://www.profibus.com>. PROFINET-specific guidelines, profiles, presentations, brochures and software are available in the corresponding download area.

16.6 Symbols in formulas

Symbol	Unit	Explanation
C_{1max}	F	Maximum input capacitance
C_{maxPU}	F	Charging capacity of the power unit
C_{PU}	F	Self-capacitance of the power unit
D_{IA}	%	Reduction in the nominal current depending on the installation altitude
D_T	%	Reduction in the nominal current depending on the surrounding temperature
E_{2max}	J	Maximum switch-off energy at the output
f_{1max}	Hz	Maximum input frequency
f_{2max}	Hz	Maximum output frequency
f_{2PU}	Hz	Output frequency of the power unit
f_N	Hz	Rotating magnetic field frequency at nominal speed
$f_{PWM,PU}$	Hz	Frequency of the pulse width modulation of the power unit
I_0	A	Stall current
I_{1max}	A	Maximum input current
I_{1maxCU}	A	Maximum input current of the control unit
I_{1maxPU}	A	Maximum input current of the power unit
$I_{1N,PU}$	A	Nominal input current of the power unit
I_{2max}	A	Maximum output current
I_{2maxPU}	A	Maximum output current of the power unit
$I_{2PU(A)}$	A	Output current of the power unit for axis A
$I_{2PU(B)}$	A	Output current of the power unit for axis B
$I_{2N,PU}$	A	Nominal output current of the power unit
I_N	A	Nominal current
$I_{N,MF}$	A	Nominal current of the choke or motor filter
n_N	rpm	Nominal speed: The speed for which the nominal torque M_N is specified
p	–	Number of pole pairs
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
P_V	W	Power loss
$P_{V,CU}$	W	Power loss of the control unit
R_{2minRB}	Ω	Minimum resistance of the external braking resistor
ϑ_{amb}	$^{\circ}\text{C}$	Surrounding temperature
$\vartheta_{amb,max}$	$^{\circ}\text{C}$	Maximum surrounding temperature
t_{min}	ms	Minimum cycle time of the application
T_{th}	$^{\circ}\text{C}$	Thermal time constant
U_1	V	Input voltage
U_{1CU}	V	Input voltage of the control unit

Symbol	Unit	Explanation
$U_{1\max}$	V	Maximum input voltage
$U_{1\text{PU}}$	V	Input voltage of the power unit
U_2	V	Output voltage
$U_{2\max}$	V	Maximum output voltage
$U_{2\text{PU}}$	V	Output voltage of the power unit
U_{\max}	V	Maximum voltage
U_{offCH}	V	Switch-off threshold of the brake chopper
U_{onCH}	V	On limit of the brake chopper

16.7 Abbreviations

Abbreviation	Meaning
AC	Alternating Current
AEH	Aderendhülse (en: end sleeve)
AWG	American Wire Gauge
BAT	Battery
BE	Binärer Eingang (en: binary input)
BG	Baugröße (en: size)
CiA	CAN in Automation
CNC	Computerized Numerical Control
csp	Cyclic synchronous position mode
cst	Cyclic synchronous torque mode
csv	Cyclic synchronous velocity mode
DC	Direct Current
EMC	Electromagnetic compatibility
ETG	EtherCAT Technology Group
EtherCAT	Ethernet for Control Automation Technology
FSoE	Fail Safe over EtherCAT
HTL	High Threshold Logic
ip	Interpolated position mode
IP	International Protection
IP	Internet Protocol
NAT	Nominal response temperature
PE	Protective Earth (i.e. grounding conductor)
PELV	Protective Extra Low Voltage
PL	Performance Level
pp	Profile position mode
pt	Profile torque mode
PTC	Positive Temperature Coefficient
pv	Profile velocity mode
RCD	Residual Current protective Device
SIL	Safety Integrity Level
PLC	Programmable logic controller
SS1	Safe Stop 1
SSI	Serial Synchronous Interface
STO	Safe Torque Off
TTL	Transistor-Transistor Logic
UL	Underwriters Laboratories

17 Contact

17.1 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:

<http://www.stoeber.de/en/service>

For additional or personalized information, contact our consultation and support service:

<http://www.stoeber.de/en/support>

Do you need our first-level support?:

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applications@stoeber.de

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Phone +49 7231 582-3000

Our address:

STÖBER ANTRIEBSTECHNIK GmbH + Co. KG

Kieselbronner Strasse 12

75177 Pforzheim, Germany

17.2 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:

documentation@stoeber.de

Thank you for your interest.

Your STÖBER editorial team

17.3 Close to customers around the world

We offer you committed, expert advise and support in over 40 countries worldwide:

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Glossary

100Base-TX

Ethernet network standard based on symmetrical copper cables in which the nodes are connected to a switch via copper cables twisted in pairs (shielded twisted pair, CAT 5e quality level). 100Base-TX is the subsequent progression from 10Base-T and includes those properties with the option of a transfer speed of 100 Mbps (Fast Ethernet).

Braking resistor

Ballast resistor that is switched on by a brake chopper in order to avoid a hazard to electrical components in the event of significant brake energy by limiting the DC link voltage. Braking energy, which is usually only present for brief periods, is converted into heat in the resistor.

Choke

Coil that preserves the components of the drive system and reduces interference pulses. It is used to protect components, devices or power supplies while simultaneously increasing their interference immunity and availability.

DC link discharge

Process that causes the DC link capacitors to discharge. Requirements for the discharge process: The power grid supply is disconnected and no energy flows back from the motor to the drive controller.

DC link discharge time

Time until the DC link capacitors are discharged enough that the device can be worked on safely.

Differential (HTL/TTL)

In the context of signal transmission, a process for being able to transmit signals with the highest possible fault tolerance even with longer transmission paths. In this approach, transmission takes place using a pair of signal conductors instead of just one signal conductor. The actual signal is transmitted on one line and the inverse signal on the other.

Electronic nameplate

STOBER synchronous servo motors are generally equipped with absolute encoders that provide special memory. This memory includes the electronic nameplate, i.e. all type-relevant master data as well as special mechanical and electronic values of a motor. When you operate a drive controller with a STOBER synchronous servo motor and an absolute encoder, the electronic nameplate is read and all motor data transferred if the drive controller is connected online. The drive controller automatically determines the associated limit values and control parameters from this data.

Fail Safe over EtherCAT (FSoE)

Protocol for transferring safety-related data via EtherCAT using a FSoE master and an indefinite number of FSoE slaves (i.e. devices that have a Safety over EtherCAT interface). The protocol enables the realization of functional safety via EtherCAT. FSoE and its implementation are TÜV-certified and comply with the SIL 3 requirements in accordance with IEC 61508.

Fast discharge

Active running process that causes the capacitors to discharge. This process is completed significantly faster than the self-discharge process. For example, the PS6 supply module has a fast discharge function but it is only active when a braking resistor is connected and the 24 V power supply is switched on. No fast discharge is possible for overloaded braking resistors.

MV number

The number of the material variant ordered and delivered as stored in STOBER's enterprise resource planning system, i.e. the device-specific combination of all hardware and software components.

Output choke

This type of choke is used to reduce high-frequency currents on electric lines and thus increase the interference immunity and availability of drive systems. They reduce current peaks caused by line capacitance at the power output of the drive controller. They make long motor cables possible, increase the motor service life and reduce harmonic currents.

Performance Level (PL)

In accordance with DIN EN 13849-1: Measure for the reliability of a safety function or a component. The Performance Level is measured on a scale of a – e (lowest – highest PL). The higher the PL, the safer and more reliable the function in question is. The PL can be assigned to a specific SIL. A reversed inference from a SIL to a PL is not possible.

PTC thermistor

Thermistor whose resistance significantly changes with the temperature. When a PTC reaches its defined nominal response temperature, the resistance increases dramatically, by two or more times the original resistance, to several kOhms. Since PTC triplets are used, each thermistor monitors one phase of the motor winding. For 3 thermistors, this means all 3 phases are monitored, achieving effective motor protection.

Reverse documentation

Refers to a read-only file read out by a drive controller that includes the fault memory in addition to the configuration of a drive controller. This file is a snapshot of the time that the connection between the PC and drive controller was interrupted. The information it contains is used for diagnostics as well as for processing service requests.

Safe Stop 1 (SS1)

In accordance with DIN EN 61800-5-2: Procedure for stopping a PDS(SR). With the SS1 safety function, the PDS(SR) performs one of the following functions: a) Triggering and controlling the motor delay variable within defined limits and triggering the STO function if the motor speed falls below a specified limit value (SS1-d), or b) triggering and monitoring the motor delay variable within defined limits and triggering the STO function if the motor speed falls below a specified limit value (SS1-r), or c) triggering the motor delay and triggering the STO function after an application-specific delay (SS1-t). In this case, SS1(-t) corresponds to the time-controlled stop in accordance with IEC 60204-1, stop category 1(-t).

Safe Torque Off (STO)

In accordance with DIN EN 61800-5-2: Procedure for stopping a PDS(SR). The STO safety function prevents the motor from being supplied with any energy that could cause rotation (or motion in a linear motor). The PDS(SR) does not supply the motor with any energy that could generate torque (or force in a linear motor). STO is the most fundamental drive-integrated safety function. It corresponds to an uncontrolled stop in accordance with IEC 60204-1, stop category 0.

Safety Integrity Level (SIL)

In accordance with DIN EN 61800-5-2: Probability of a safety function failure. SIL is divided into levels 1 – 4 (lowest – highest level). SIL precisely assesses systems or subsystems based on the reliability of their safety functions. The higher the SIL, the safer and more reliable the function in question is.

Self-discharge

Passive running process that causes the capacitors to discharge even when no electrical load is connected.

Serial number

Consecutive number stored for a product in STOBER's enterprise resource planning system and used for individual identification of the product and for determining the associated customer information.

Single-ended (HTL/TTL)

In the context of signal transmission, electrical signal transmission takes place using a voltage that changes in relation to a constant reference potential.

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Technische Änderungen vorbehalten.
Errors and changes excepted.



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