8 Drive controllers

SI6

8.1 Overview

Drive control in a multi-axis drive system

Features

- Single or double-axis controller with a nominal output current up to 50 A and 250% overload capacity
- Supply modules up to 20 kW nominal power
- 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
- Single-ended nominal power consumption on double-axis controllers for operation of motors with different power
- Variable feed-in power using supply modules that can be connected in parallel

8.1.1 Features

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. 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.

The optimized vector control, sensorless vector control, U/f slip-compensated and U/f controller control types are available for use with asynchronous motors.

Drive control in multi-axis drive systems with SI6 and PS6

As small as a paperback

You save valuable space in your control cabinet because, with a width of just 45 mm, this drive controller is the most compact solution on the market. It offers all the features that a designer requires.

Dimension capacities precisely

4 axes? 16? Or even 97? A single SI6 drive controller can control up to two axes. Thanks to the multi-axis drive system, the number of motors or axes to be controlled can be scaled without limit. If required, SI6 drive controllers can be combined with stand-alone units from the STOBER SC6 or SD6 series. For the general energy supply, the drive controllers from the SI6, SC6 and SD6 series can be connected to each other using Quick DC-Link modules.

Tailored energy usage

The SI6 drive controllers are connected to a central supply module. There is no need for decentralized supply modules or fuses and cabling for each axis. When using double-axis modules, the unused power reserves of one axis can be used for other axes. A significant reduction in space and cost!

Fewer clicks, less wiring

Installation is exceptionally simple. No difficult wiring. The patented Quick DC-Link modules allow for a simple “click” into the standard copper rails, as well as the simple installation and connection of the drive controllers.

Safety functions

The safety concept of the drive controller is based on the STO (Safe Torque Off) function. The concept corresponds to SIL 3 according to DIN EN 61800-5-2 and PL e (Cat. 4) according to DIN EN ISO 13849-1. For double-axis controllers, the STO safety function has a two-channel structure that acts upon both axes. For connection to a higher-level safety circuit, different interfaces are available (terminals or FSoE).

Heavy duty

There is an extremely robust design concealed behind the elegant exterior. All components—from the stable, well-shielded sheet steel housing to the motor connectors—far exceed the reference values of industry standards. The inside is also anything but small-scale: ample computer capacities, high-quality components, careful workmanship.

8.1.2 Software components

Project configuration and commissioning

The 6th generation of DriveControlSuite project configuration and commissioning software has all the functions for the efficient use of drive controllers in single-axis and multi-axis applications. The program guides you step by step through the complete project configuration and parameterization process using wizards.

Open communication

The Ethernet-based EtherCAT and PROFINET fieldbus systems are available in the drive controller as standard. Fieldbus communication can be specified using the firmware.

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.

8.1.3 Application training

STOBER offers a multi-level training program that focuses essentially on application programming of the motion controller and drive controller.

G6 Basic

Training content: System overview, installation and commissioning of the drive controller. Use of option modules. Parameterization, commissioning and diagnostics using the commissioning software. Remote maintenance. Basics of controller optimization. Configuration of the drive train. Integrated software functions. Software applications. Connection to a higher-level controller. Basics of safety technology. Practical exercises on training topics.

Software used: DriveControlSuite.

G6 Advanced

Training content: Special knowledge for regulating, control and safety technology. Practical exercises on training topics.

8.2 Technical data

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

8.2.1 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. 1: 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/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²

Tab. 2: 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/s²

Tab. 3: 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. 4: Discharge times of the DC link circuit

8.2.2 Drive controllers

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

8.2.2.1 Type designation

SI	6	A	0	6	1	Z

Tab. 5: Example code for the SI6 type designation

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

Tab. 6: Meaning of the SI6 example code

8.2.2.2 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. 7: 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.

8.2.2.3 Electrical data

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

An explanation of the formula symbols used can be found in the chapter [▶ 14.1].

8.2.2.3.1 Control unit

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

Tab. 8: Control unit electrical data

8.2.2.3.2 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. 9: 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. 10: 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. 11: SI6 electrical data, size 0, at 8 kHz clock frequency

8.2.2.3.3 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. 12: 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. 13: 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. 14: SI6 electrical data, size 1, at 8 kHz clock frequency

8.2.2.3.4 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. 15: 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. 16: 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. 17: SI6 electrical data, size 2, at 8 kHz clock frequency

8.2.2.3.5 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. 18: 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. 19: 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. 20: SI6 electrical data, size 3, at 8 kHz clock frequency

8.2.2.3.6 Single-ended nominal power consumption 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

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{3}{5} \qquad \text{where} \qquad 0 \le I_{2PU(A)} \le I_{2N,PU}$$

Example 2

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{5}{3} \qquad \text{where} \qquad I_{2N,PU} \le I_{2PU(A)} \le 1{,}6 \times I_{2N,PU}$$

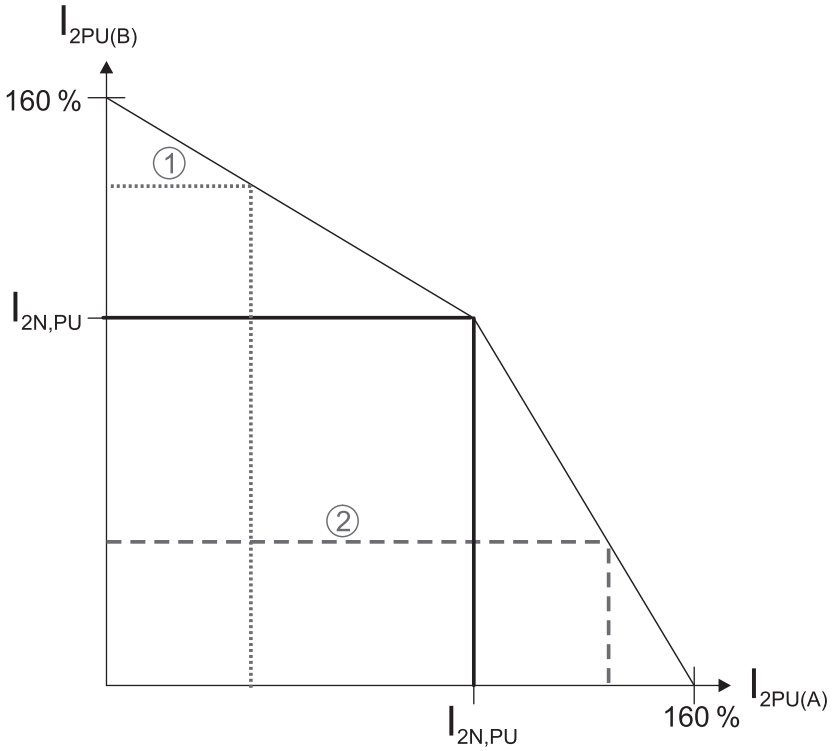

Fig. 1: Asymmetric load on double-axis controllers

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 single-ended nominal power consumption.

8.2.2.3.7 Power loss data in accordance with EN 61800-9-2

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. 21: Power loss data in accordance with EN 61800-9-2 for one axis of a SI6 drive controller

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 × PS6 and 2 × 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 61800-9-2.

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.

[1] Absolute losses for a power unit that is switched off

[2] Operating points for relative motor stator frequency in % and relative torque current in %

[3] IE class in accordance with EN 61800-9-2

[4] Comparison of the losses for the reference drive controller relative to IE2 in the nominal point (90, 100)

8.2.2.4 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.

8.2.2.4.1 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. 22: Nominal output current $I_{2N,PU}$ dependent on the clock frequency

8.2.2.4.2 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 × 2.5% = 87.5%

8.2.2.4.3 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 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 × 1.5% = 92.5%

8.2.2.4.4 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 × 2.5% = 87.5%

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

D_{IA} = 100% − 5 × 1.5% = 92.5%

The output current of importance for projecting is:

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

8.2.2.5 Dimensions

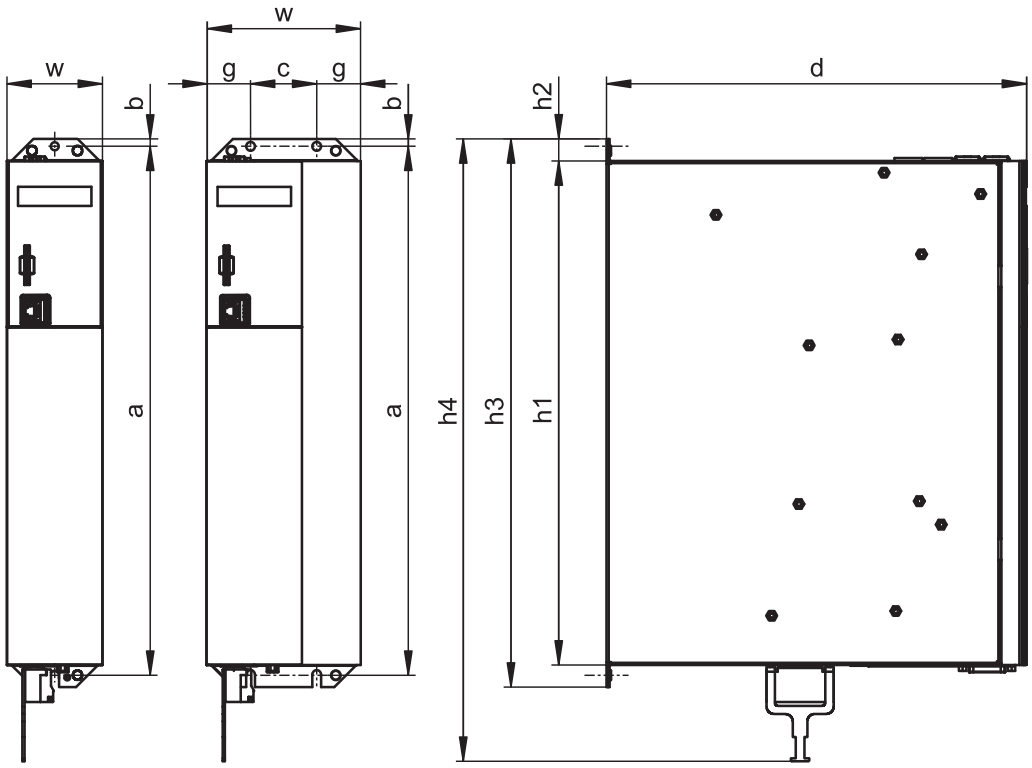

Fig. 2: SI6 dimensional drawing

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. 23: SI6 dimensions [mm]

[5] Single-axis controller

[6] Double-axis controller

8.2.2.6 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. 24: SI6 weight [g]

8.2.3 Supply module

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

8.2.3.1 Type designation

PS	6	A	2	4

Tab. 25: 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. 26: Meaning of the PS6 example code

8.2.3.2 Sizes

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

Tab. 27: 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.

8.2.3.3 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

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

An explanation of the formula symbols used can be found in the chapter [▶ 14.1].

8.2.3.3.1 Control unit

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

Tab. 28: Control unit electrical data

8.2.3.3.2 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}	√2 × U_{1PU}
$P_{N,PU}$	10 kW
$I_{1N,PU}$	25 A
I_{1maxPU}	$I_{1N,PU}$ × 180% for 5 s; $I_{1N,PU}$ × 150% for 30 s
C_{maxPU}	5000 µF

Tab. 29: PS6 electrical data, size 2

8.2.3.3.3 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}	√2 × U_{1PU}
$P_{N,PU}$	20 kW
$I_{1N,PU}$	50 A
I_{1maxPU}	$I_{1N,PU}$ × 180% for 5 s; $I_{1N,PU}$ × 150% for 30 s
C_{maxPU}	10000 µF

Tab. 30: PS6 electrical data, size 3

8.2.3.3.4 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 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. 31: Electrical data for parallel connection: Example combinations

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.

8.2.3.3.5 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. 32: Brake chopper electrical data

8.2.3.3.6 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.

8.2.3.4 Dimensions

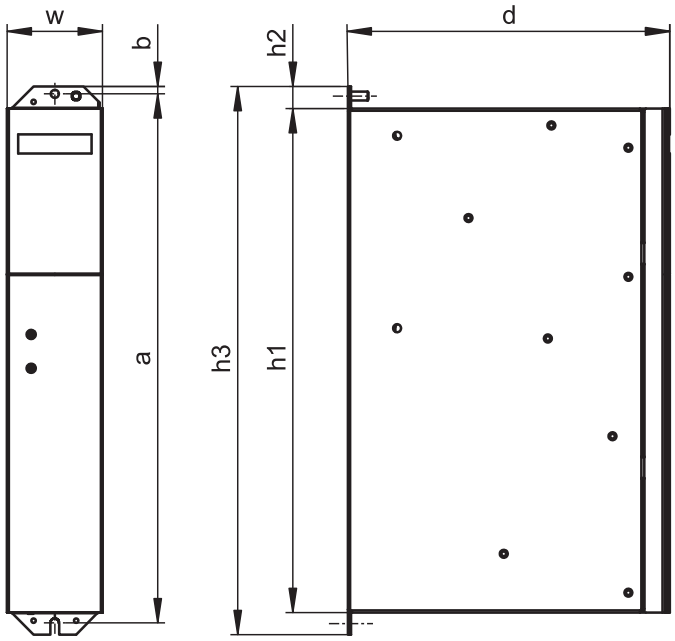

Fig. 3: PS6 dimensional drawing

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. 33: PS6 dimensions [mm]

8.2.3.5 Weight

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

Tab. 34: PS6 weight [g]

8.2.4 DC link connection

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

8.2.4.1 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. 35: 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/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²

Tab. 36: 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/s²

Tab. 37: Operating conditions

8.2.4.2 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. 38: DL6B assignment for SI6 and PS6

8.2.4.3 Dimensions

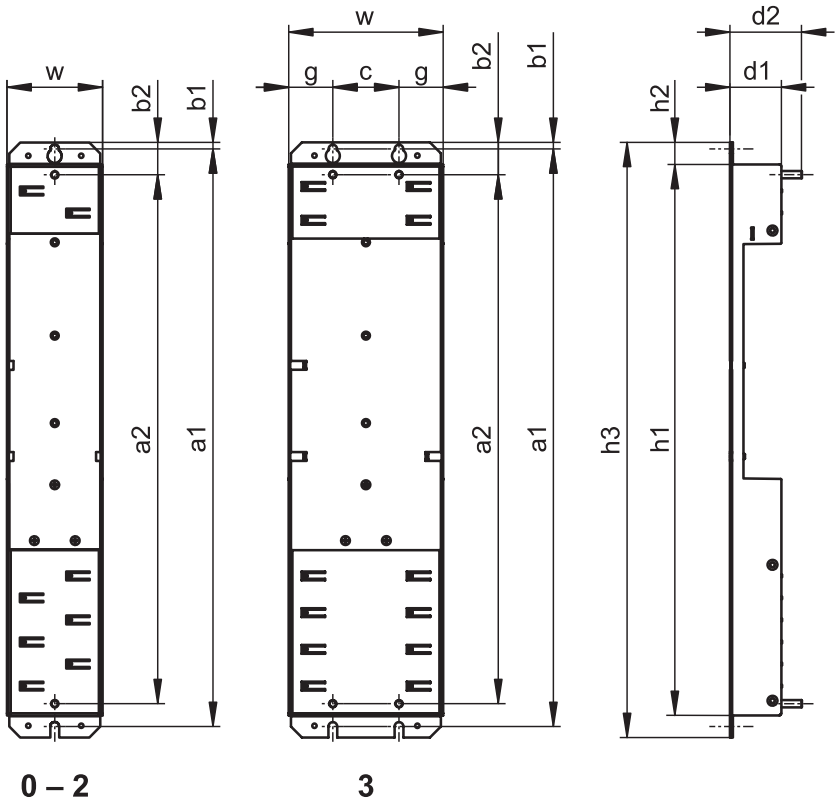

Fig. 4: DL6B dimensional drawing

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. 39: DL6B dimensions [mm]

8.2.4.4 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. 40: DL6B weight [g]

8.2.5 Minimum clearances

Drive controllers and supply modules

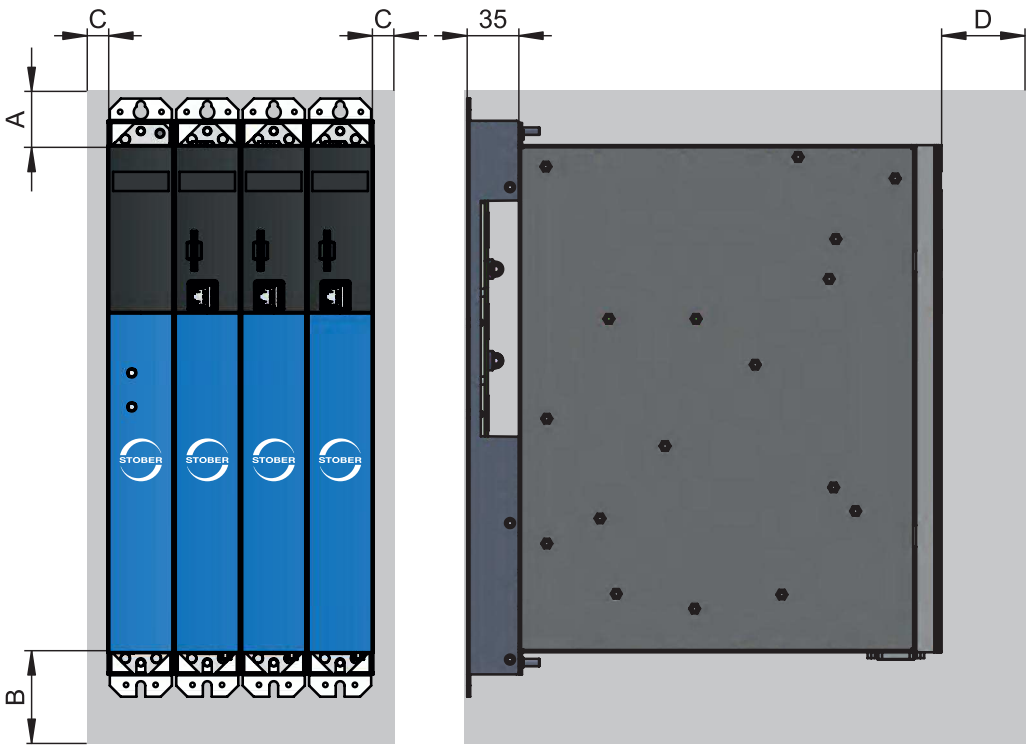

Fig. 5: Minimum clearances

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[7]

Tab. 41: 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.

[7] Minimum clearance to be taken into account for permanent connection of the X9 service interface

8.3 Drive controller/motor combinations

Parameterization of a STOBER drive controller is exceptionally easy, especially together with four-pole STOBER asynchronous motors. The motor is fully typified by inputting just the motor size (e.g. 90L) and its wiring (star or delta). A delta connection (measurement point 230 V, 50 Hz) is available for motors up to 3 kW (size 100). By increasing the voltage at higher frequencies, the full torque can be drawn through the motor up to 87 Hz. It usually makes sense to take this expanded speed adjustment range into account when selecting the gear unit. You can find more detailed information in Chapter [▸ 6.6].

An explanation of the formula symbols used can be found in the chapter [▸ 14.1].

									SI6A061 SI6A062	SI6A161 SI6A162	SI6A261	SI6A262	SI6A361
									$I_{2N,PU}$ [A] ($f_{PWM,PU}$ = 4 kHz)				
	f_T [Hz]	pz	Connection	P_N [kW]	n_N [rpm]	M_N [Nm]	M_k/M_N	I_N [A]	5	12	22	25	50
Δ 230 V / Y 400 V motor winding									$I_{2N,PU}$ / I_N				
IE3D80L4	50	4	Y	0.75	1445	5.0	3.7	1.7	2.9				
IE3D80L4	87	4	Δ	1.3	2503	5.0	3.7	2.94	1.7				
IE3D90S4	50	4	Y	1.1	1440	7.3	3.7	2.5	2.0				
IE3D90S4	87	4	Δ	1.91	2494	7.3	3.7	4.33	1.2				
IE3D90L4	50	4	Y	1.5	1445	9.9	3.5	3.35	1.5				
IE3D90L4	87	4	Δ	2.6	2503	9.9	3.5	5.8		2.1			
IE3D100K4	50	4	Y	2.2	1455	14.4	3.6	4.8	1.0				
IE3D100K4	87	4	Δ	3.81	2520	14.4	3.6	8.31		1.4			
IE3D100L4	50	4	Y	3.0	1455	19.7	4.1	6.4		1.9			
IE3D100L4	87	4	Δ	5.2	2520	19.7	4.1	11.09		1.1	2.0		
IE3D112M4	50	4	Δ	4.0	1460	26.2	4.1	7.95		1.5			
IE3D132S4	50	4	Δ	5.5	1480	35	5.4	12		1.0	1.8	2.1	
IE3D132M4	50	4	Δ	7.5	1475	49	3.9	14.5			1.5	1.7	
IE3D160M4	50	4	Δ	11	1475	71	3.2	21			1.0	1.2	
IE3D160L4	50	4	Δ	15	1490	96	3.9	28					1.8
IE3D180M4	50	4	Δ	18.5	1475	120	3.0	34.5					1.4
IE3D180L4	50	4	Δ	22	1480	142	3.2	40.5					1.2

8.4 Accessories

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

8.4.1 Safety technology

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).

8.4.2 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.

8.4.3 Terminal set

For the connection, you need suitable terminal sets for each PS6 supply module and each SI6 drive controller.

Terminal set for supply module

The following designs are available:
ID No. 138660
Terminal set for PS6A24.
ID No. 138661
Terminal set for PS6A34.

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.

8.4.4 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.

8.4.5 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.

8.4.5.1 Braking resistor assignment – PS6

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

Tab. 42: Braking resistor assignment to PS6 supply module

8.4.5.2 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 mm²)
Weight [kg]	Approx. 2.6
Protection class	IP54
Test symbols	c UL us CE

Tab. 43: KWADQU 420×91 specification

Dimensions

Dimension	KWADQU 420×91
A	420

Tab. 44: KWADQU 420×91 dimensions [mm]

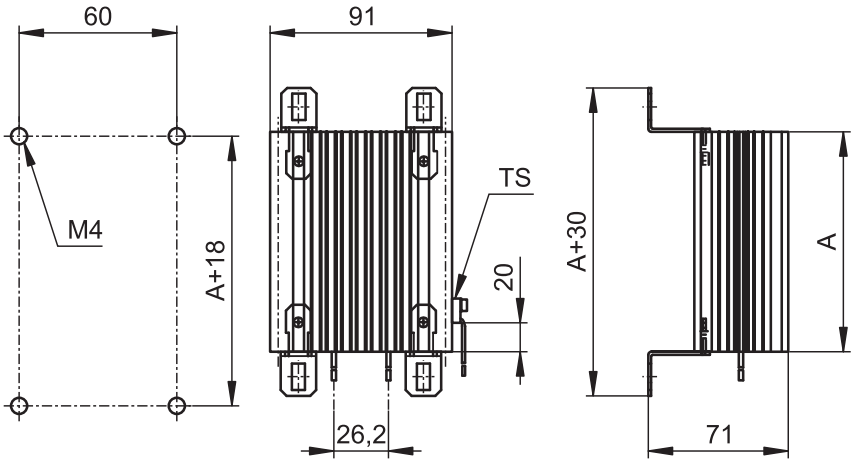

Fig. 6: KWADQU 420×91 dimensional drawing

8.4.5.3 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	cULus CE

Tab. 45: Specification for FZZMQU 400×65

Dimensions

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

Tab. 46: FZZMQU 400×65 dimensions [mm]

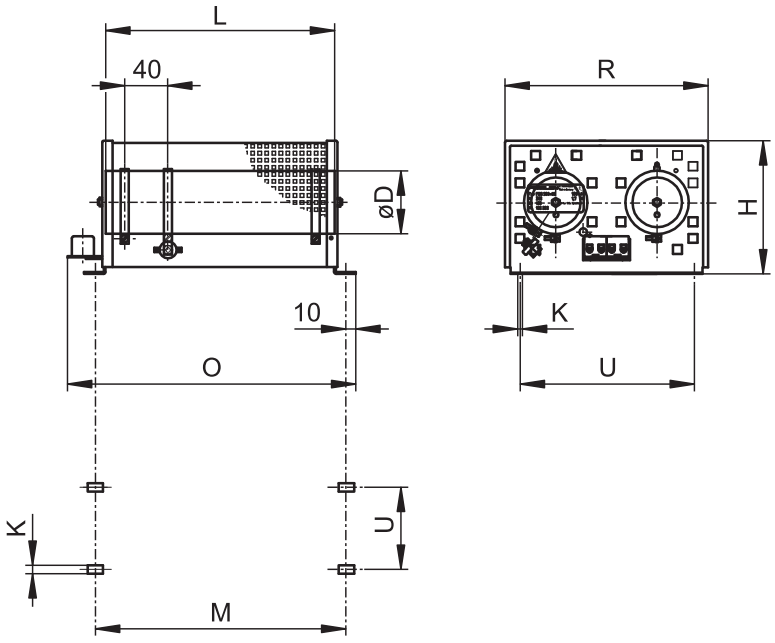

Fig. 7: FZZMQU 400×65 dimensional drawing

8.4.5.4 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. 47: Specification for FGFKQU 31005

Dimensions

Dimension	FGFKQU 31005
A	270
B	295
C	355

Tab. 48: FGFKQU 31005 dimensions [mm]

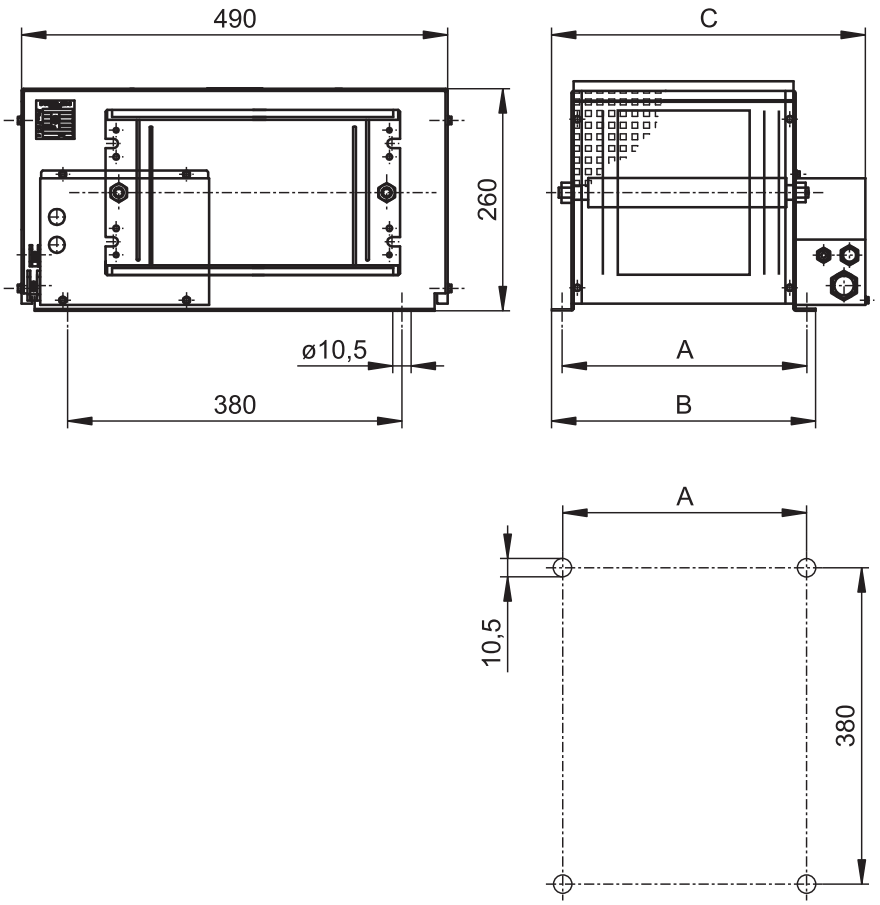

Fig. 8: FGFKQU 31005 dimensional drawing

8.4.6 Choke

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

8.4.6.1 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 mm²		
UL Recognized Component (CAN; USA)	Yes		
Test symbols			

Tab. 49: 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

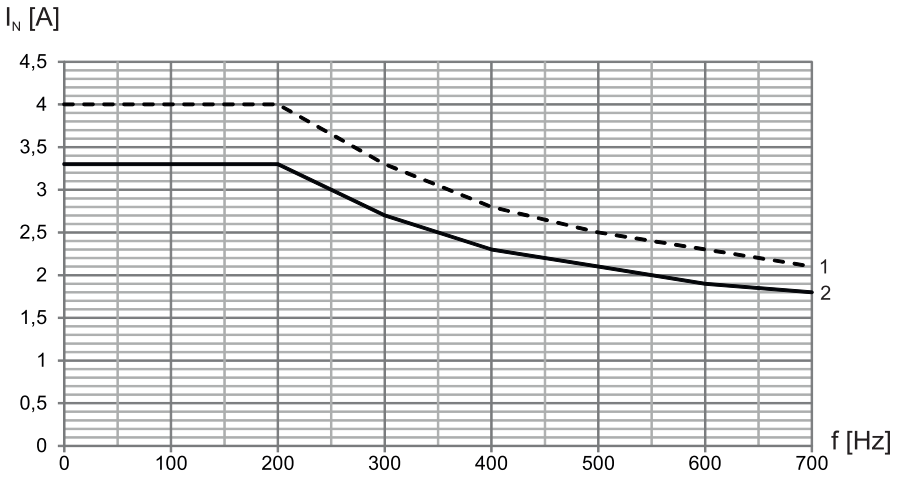

Fig. 9: Derating the nominal current depending on the clock frequency, TEP3720-0ES41

1 4 kHz clock frequency

2 8 kHz clock frequency

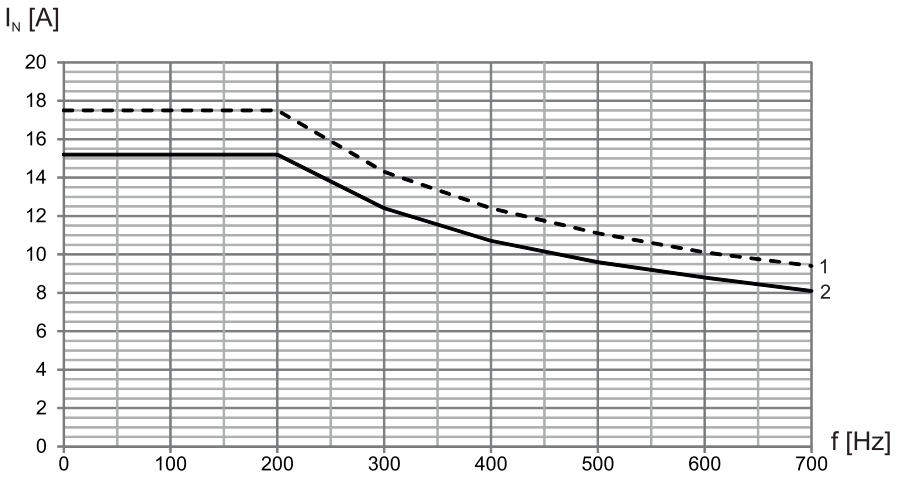

Fig. 10: Derating the nominal current depending on the clock frequency, TEP3820-0CS41

1 4 kHz clock frequency

2 8 kHz clock frequency

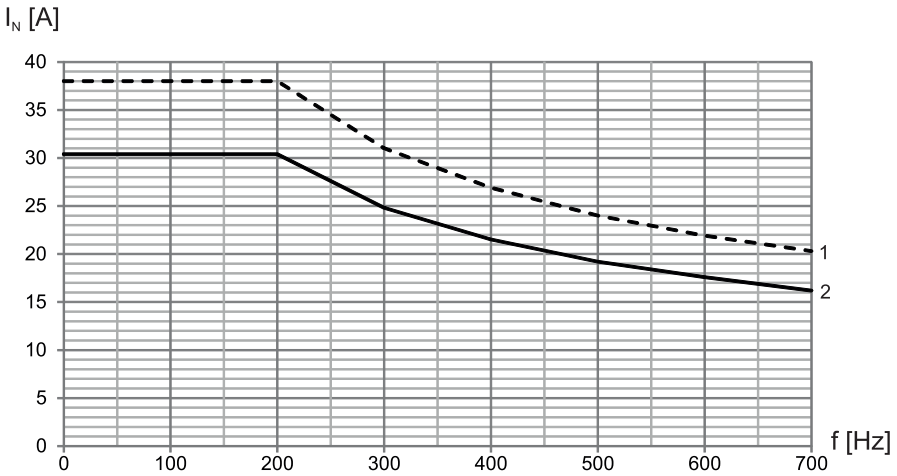

Fig. 11: Derating the nominal current depending on the clock frequency, TEP4020-0RS41

1 4 kHz clock frequency

2 8 kHz clock frequency

Derating – Effect of surrounding temperature

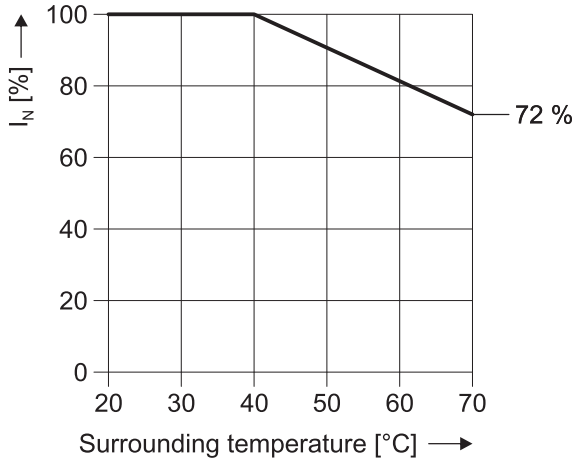

Fig. 12: Derating the nominal current based on surrounding temperature

Derating – Effect of the installation elevation

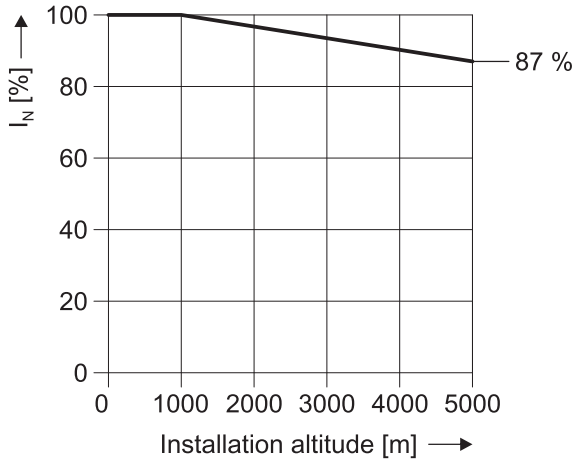

Fig. 13: Derating the nominal current depending on installation elevation

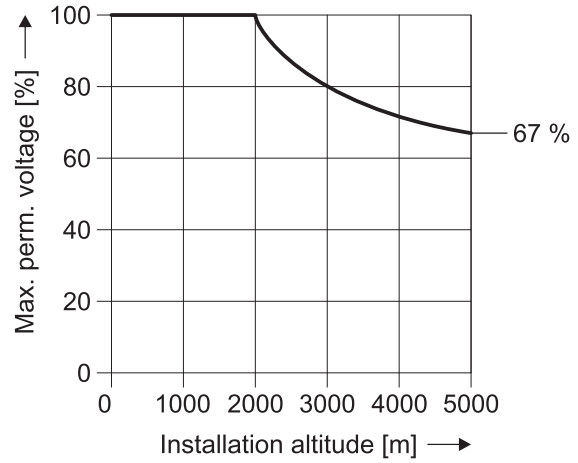

Fig. 14: Derating the voltage depending on installation elevation

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. 50: TEP dimensions and weight

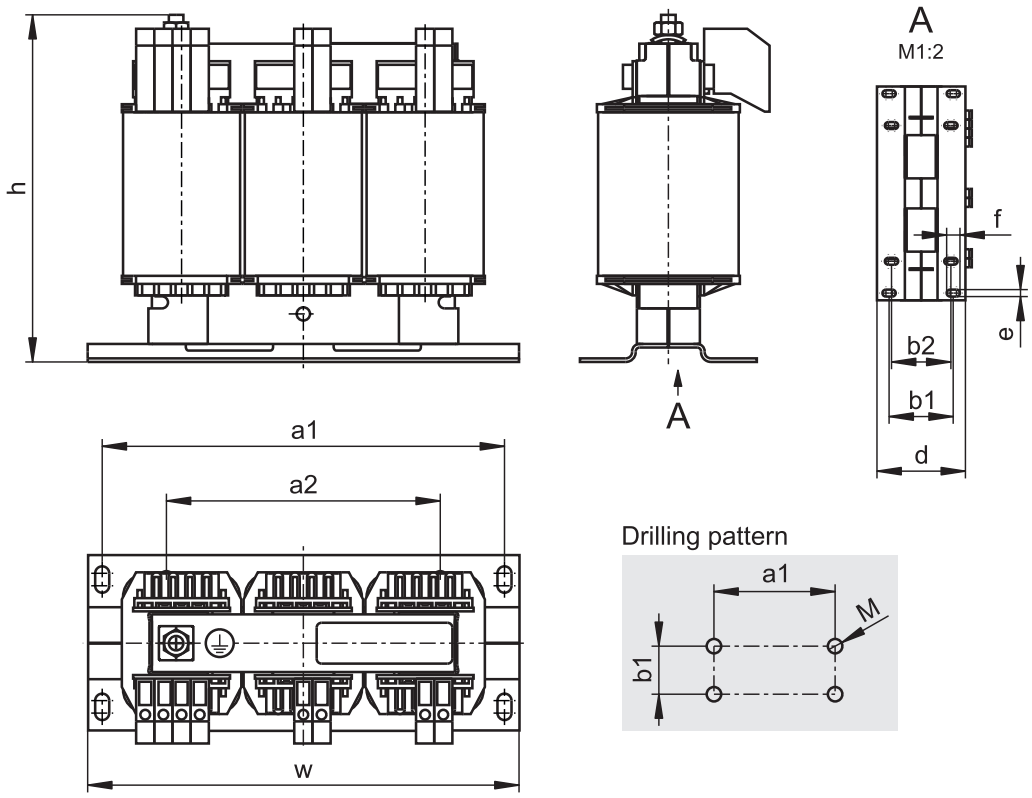

Fig. 15: TEP dimensional drawing

8.4.7 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.

8.5 Further information

8.5.1 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

8.5.2 Symbols, marks and test symbols

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.

8.5.3 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/download

Enter the ID of the documentation in the Search... field.

Documentation	ID
Manual for SI6 drive controllers	442728