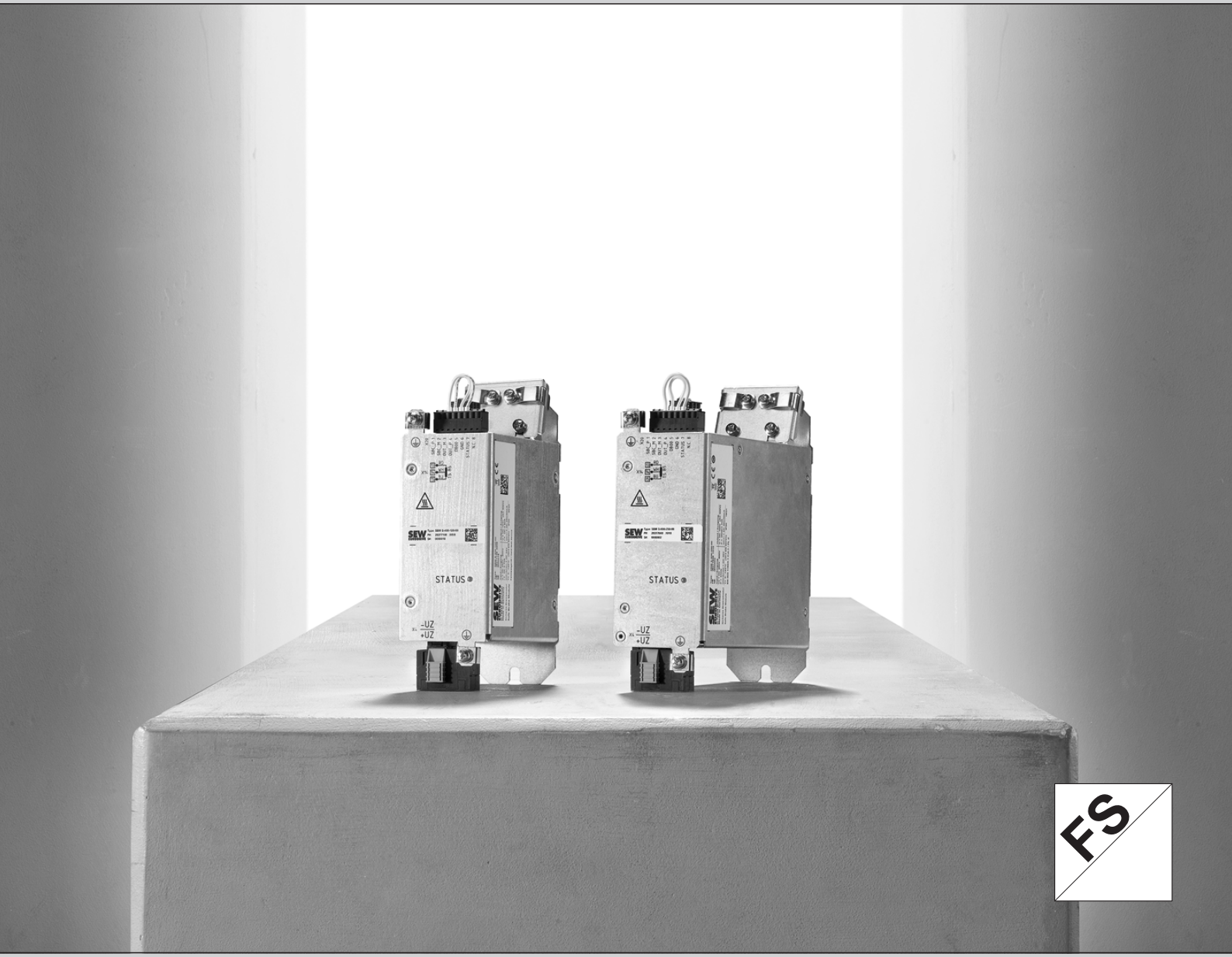
SEW EURODRIVE

Operating Instructions



FS

MOVI-C®

SBM safe brake module for control cabinet installation

Edition 05/2025

31990924/EN

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1 General information

1.1 About this documentation

The documentation at hand is the original.

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the graduation and meaning of the signal words in the safety notes.

Signal word	Meaning	Consequences if not observed
⚠ **DANGER**	Imminent danger	Death or severe injuries
⚠ **WARNING**	Possibly dangerous situation	Death or severe injuries
⚠ **CAUTION**	Possibly dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

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Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of hot surfaces

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous step.

This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD!** Type and source of danger. Possible consequence(s) if disregarded. Measure(s) to prevent danger.

1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.4 Content of the documentation

This documentation contains additional safety-related information and conditions for operation in safety-related applications.

1.5 Applicable documentation

Observe the other applicable documentation regarding the devices connected to the SBM safe brake module.

Make sure you always use the latest documentation and software version.

Our documentation is available in various languages for download from the SEW-EURODRIVE homepage (www.sew-eurodrive.com). If you are unclear about any of the information in this documentation or if you require further information, consult SEW-EURODRIVE.

If required, you can order printed copies of the documentation from SEW-EURODRIVE.

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1.6 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

1.7 Product names and trademarks

The product names mentioned in this documentation are trademarks or registered trademarks of the respective titleholders.

1.8 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- The national and regional regulations governing safety and the prevention of accidents
- Product safety label on the product
- All other associated project planning documents, installation and startup instructions, as well as connection and wiring diagrams
- Do not assemble, install, or operate damaged products
- All system-specific specifications and regulations

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

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2.3 Target group

Specialist for mechanical work

Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product, and who possess the following qualifications:

- Qualifications in the field of mechanics in accordance with the national regulations
- Familiarity with this documentation

Specialist for electrotechnical work

Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product, and who possess the following qualifications:

- Qualifications in the field of electrical engineering in accordance with the national regulations
- Familiarity with this documentation

Additional qualifications

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation.

The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transport, storage, installation, operation and waste disposal may only be carried out by persons who are trained and instructed appropriately. These instructions must enable the persons to carry out the required activities and work steps safely and in accordance with regulations.

2.4 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product or the packaging is damaged, do not assemble, install, connect, or start up the product. If the packaging is damaged, the product itself may also be damaged.

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact.

If necessary, use suitable, adequately dimensioned transport aids.

Observe the notes on the climatic conditions in accordance with chapter "Technical data" in the corresponding product manual.

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2.5 Designated use

The product is intended for use in industrial and commercial systems.

The product is intended for use as:

- Safety-related component for functionally safe interruption of the energy supply of a brake connected to the product
- Safety-related component pursuant to Machinery Directive 2006/42/EC
- SRP/CS pursuant to EN ISO 13849
- Device for implementing a safety sub-function (a PDS(SR)) pursuant to EN ISO 61800-5-2

In the case of installation in electrical systems or machines, it is prohibited to start the proper operation of the product until it is determined that the machine meets the requirements stipulated in the local laws and directives.

The Machinery Directive 2006/42/EC applies in particular in the European region.

The standards given in the declaration of conformity apply to the product.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

2.5.1 Restrictions under the European WEEE Directive 2012/19/EU

Options and accessories from SEW-EURODRIVE may only be used in combination with products from SEW-EURODRIVE.

2.6 Electrical connection

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

You will find notes on EMC-compliant installation (shielding, grounding, arrangement of filters and routing of lines) in chapter "Measures for electromagnetic compatibility". The manufacturer of the system or machine is responsible for maintaining the limits established by EMC legislation.

2.7 Installation/assembly

Ensure that the product is installed and cooled in accordance with the regulations in the documentation.

Protect the product from excessive mechanical strain. The product and its mounted components must not protrude into the path of persons or vehicles. Ensure that no components are deformed or no insulation spaces are modified, particularly during transportation. Electrical components must not be mechanically damaged or destroyed.

Observe the notes in chapter "Mechanical installation" (→ 🗎 30) in the documentation.

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2.8 Startup/operation

Observe the safety notes in the chapters "Startup" (→ 🗎 55) and "Operation" (→ 🗎 56) in the documentation.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts as well as hot surfaces during operation.

Mechanical blocking or internal protective functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive restarting automatically. If, for safety reasons, this is not permitted for the drive-controlled machine, first disconnect the product from the supply system and then start troubleshooting.

The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

In the event of deviations from normal operation, switch off the product. Possible deviations are increased temperatures, noise, or vibration, for example. Determine the cause. Contact SEW-EURODRIVE if necessary.

Do not deactivate monitoring and protection devices of the machine or system, even for a test run.

Additional preventive measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.

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3 Functional safety

3.1 Underlying standards

The safety assessment is based on the following standards and safety classes.

SBM safe brake module	
Safety class/underlying standards	Performance level (PL) according to EN ISO 13849-1 (applicable up to category 3)

Note the versions of the relevant standards on the declaration of conformity or on the TÜV certificate.

3.2 TÜV certification

A TÜV certificate is available for the product. A copy of the TÜV certificate can be obtained from SEW-EURODRIVE.

3.3 Safe condition

For the SBM safe brake module, the safe state is defined as follows:

- The electrical power supply to the brake is safely interrupted.

The safety concept is based on this definition.

3.4 Safety concept

3.4.1 Description

- The SBM safe brake module features a dual-channel, safe digital input SBC_P/ SBC_M. A connected safety relay activates the safe state of the SBM when the safe digital input is disconnected. A safety relay is any signal source that generates an input signal within the scope of the specification of the safe digital input.
- The disconnection of the safe digital input reliably prevents any control of the power semiconductors in the SBM safe brake module. As a result, the power supply required to release the connected brake is safely interrupted. The brake is or remains applied although the voltage supply is still present at the SBM.
- The SBM safe brake module also features a digital input DB00 for functional control of the brake. The digital input DB00 must not be used for safe disconnection of the brake. The safe digital input SBC_P/_M has a higher priority over DB00. This means that the safe state is activated on the SBM whenever SBC_P/_M is disconnected, regardless of the switching state of DB00.

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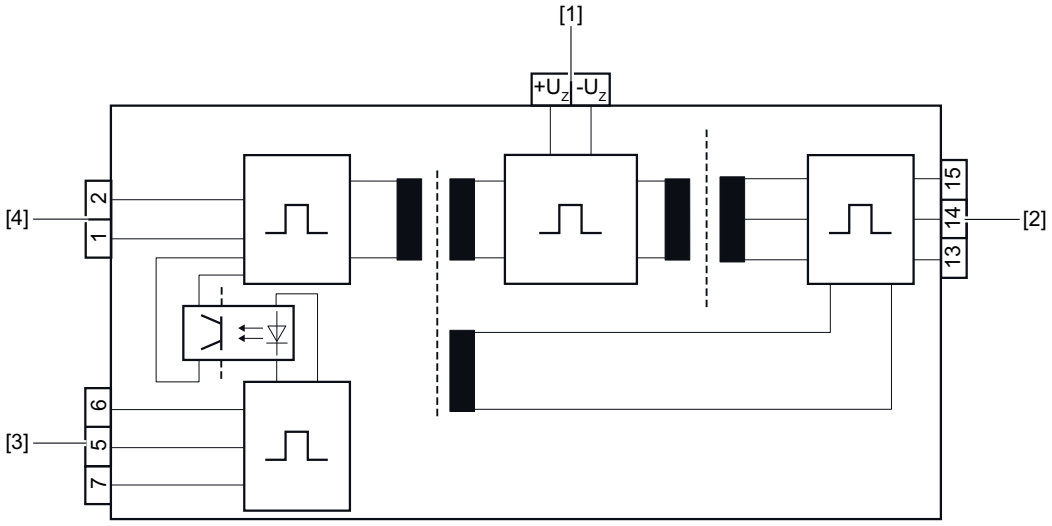
3.4.2 Block diagram of SBM brake module



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[1] Voltage supply input U_Z (terminal $+U_Z$/$-U_Z$)
[2] Brake output (terminal 13/14/15)
[3] Digital output DB00 (terminal 5/6), digital output STATUS (terminal 7)
[4] Safe digital input SBC (terminal 1/2)

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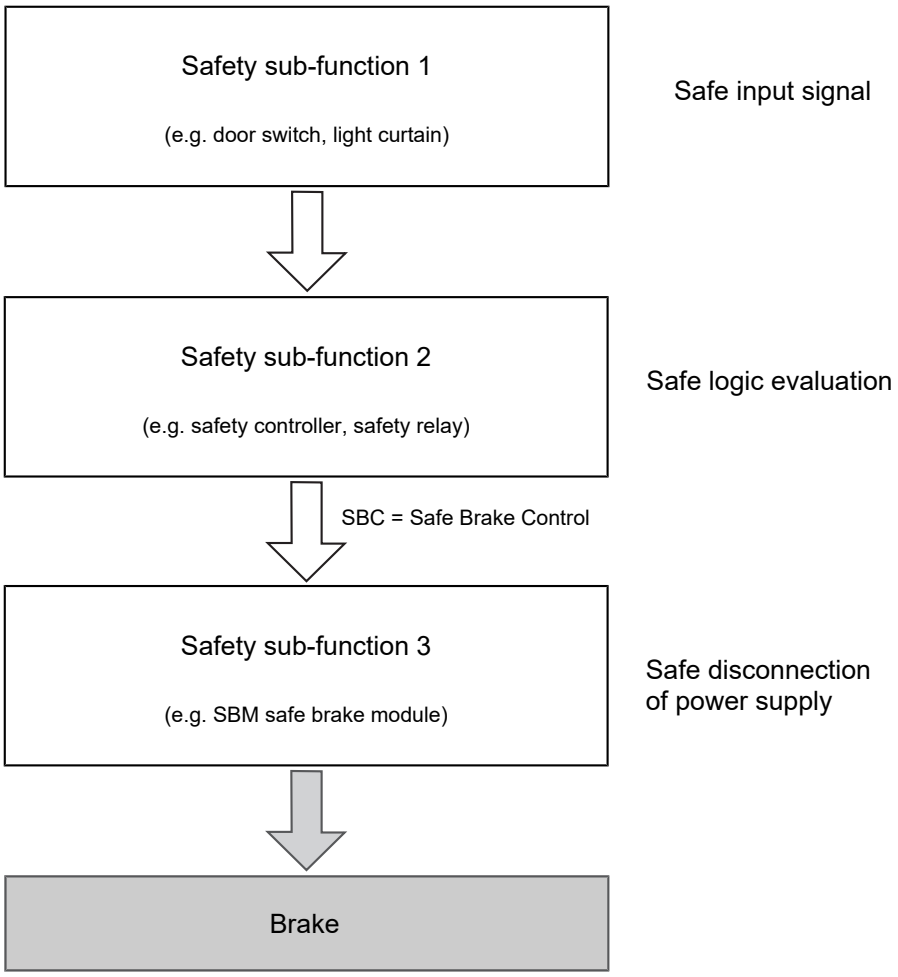
3.5 Safety function

In the event of a safety-related request from a brake, it must be ensured that the brake is applied in the entire system. For this purpose, the power supply to the brake must be safely interrupted. The safety function to be implemented consists of multiple safety sub-functions.

Example system representation



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The SBM safe brake module implements the following safety sub-function:

- Safe disconnection of the power supply to the brake

  The SBM safe brake module safely interrupts the electrical power supply to the brake by disconnecting the safe digital input SBC_P/_M at terminals 1 and 2. The disconnection is performed by a safety relay – e.g. via the SBC (Safe Brake Control) output function.

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3.6 Brake control / brake application time

The design of the "safe disconnection of power supply" safety sub-function is optimized for the control of brakes from SEW-EURODRIVE with 3-wire technology.

To configure the braking distance with functional control, you can use the switching times of the brake $t_{2,II}$ for DC and AC control.

To evaluate the overall system, the brake application times $t_{2,II}$ for cut-off in the AC circuit must be used for configuring the braking distance with safe control via SBC. The brake-specific switching times can be found in the documentation for the brake.

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After an emergency stop and stopping by the brake, the brake must be checked by a brake test, for example. If the cut-off in the DC and AC circuit is no longer effective in the event of a device-internal defect of the SBM, the brake can be thermally overloaded. The power supply of the brake is still safely switched off via the SBM.

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4 Safety requirements

4.1 Requirements on the installation

- Never install defective or damaged brake modules. Before installation, check the devices for external damage and replace any damaged devices.
- In accordance with their degree of protection, the brake modules must always be installed, started and operated in a closed installation space (e.g. in a control cabinet).
- The brake module must be protected against conductive dirt, e.g. by installing it in a control cabinet with degree of protection IP54 according to IEC 60529. If conductive dirt can be excluded at the installation site, a control cabinet with a lower degree of protection is permitted under observance of the applicable standards (e.g. EN 60204-1).
- The power cables (voltage supply connection to U_Z brake connection to X14:13/14/15) and control cables at the safe digital input SBC_P/_M must be routed separately from one another.
- The maximum length of the control cables at the digital input DB00 and at the safe digital input SBC_P/_M to the brake module is 30 m.
- The maximum cable length between the brake module and the connected brake is 200 m.
- The wiring must comply with EN 60204-1.
- Shielded cables are required outside a closed installation space. It is essential that you apply the shielding at both ends on the housing. Route the cables so that they are protected against external damage.
- Single conductors can be routed within an electrical installation space. Adhere to the regulations in force for the application.
- The values specified for the safety components must be strictly adhered to when designing the safety circuits.
- Use only voltage sources with safe electrical disconnection (PELV or SELV) according to EN 61131-2 and EN 60204-1 for the DC 24 V supply voltages at the safe digital input SBC_P/_M and the digital input DB00.

  In the event of a single fault, the DC voltage between the outputs or between any output and grounded parts must not exceed DC 60 V.
- For group disconnection of multiple brake modules, the switching capacity of the safety relay and the permitted voltage drop at the safe digital input SBC_P/_M must be observed.
- Parallel connection of a brake to several safe SBM brake modules (connections X14:13/14/15 on the SBM) is not permitted.
- The parallel connection of a maximum of 2 brakes to a safe SBM brake module is permitted. The 2 brakes must be the same in terms of size and type for this purpose. SEW-EURODRIVE recommends that you provide a safe brake module for every brake. This enables separate control of the two brakes, e.g. for a brake test.
- Adhere to the general installation instructions in the "Electrical installation" (→ 🗎 40) chapter.

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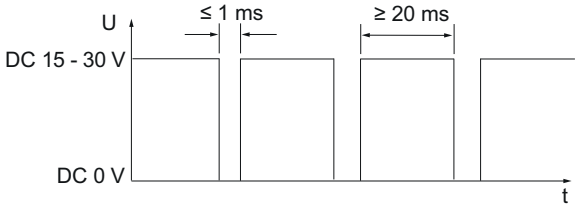
4.2 Safe control requirements

The safe control of the brake module is performed by a safety relay at the safe digital input SBC_P/_M. The following requirements must be observed:

- The devices and all other safety-related subsystems must fulfill at least the safety class that is required in the overall system for the safety function.
- The electrical connection to the safe digital input SBC_P/_M must be suitable for the required safety class.
- The safe digital input SBC_P/_M can be safely disconnected either at the positive pole SBC_P (single-channel) or at the positive and negative poles SBC_P and SBC_M (dual-channel). SEW-EURODRIVE recommends dual-channel disconnection of the safety circuit.
- The DC 24 V voltage at the safe digital input SBC_P/_M must not be used for feedback.
- The brake module does not detect any short circuits, crossfaults or interference voltages of the DC 24 V voltage at the safe digital input SBC_P/_M. It is therefore essential that:
  - There is no parasitic voltage on the DC 24 V voltage at the safe digital input SBC_P/_M

    or
  - The safety relay detects short circuits, crossfaults and interference voltages of the DC 24 V voltage at the safe digital input SBC_P/_M.
- Observe the values specified for the device when designing the safety circuits.
- The switching capacity of the outputs on the safety relay must be configured for the required input current of the SBC_P safe digital input as a minimum. If jumpers are installed between X20:3/6 and X20:4/5, the input current of the digital input DB00 must also be taken into account. When using the digital output STATUS, the input current of the evaluation device for the STATUS signal must also be taken into account. **The manufacturer's information regarding the permitted load at the device outputs and potentially required fusing must be observed. If the manufacturer provides no specific information in this regard, the device outputs must be protected with 0.6 times the nominal value of the maximum load specified by the manufacturer.**
- Measures to protect against an unexpected restart of a machine – e.g., according to EN ISO 14118 – must be considered in the risk assessment for the machine. Necessary measures must be implemented in the safety circuit.
- The safe digital input SBC_P/_M (X20:1/2) features integrated polarity reversal protection as well as a buffer capacitor with C = 2.5 µF. The buffer capacitor value applies to operation with 1 or 2 control cables (with/without jumpers). This must be considered as load when designing the safety relay.
- Switch-on test pulses are not permitted on the SBC and or digital input DB00s.
- Switch-off test pulses from the safety relay to the safe digital input SBC must meet the following conditions.



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4.3 Startup requirements

Following startup of the brake module, you must perform and document the following tests on the brake module, either by visual inspection or by means of measurements.

- Check the following electrical connections for control via a control cable to SBC:
  - DC 24 V voltage at X20:1/2 (SBC)
  - Correct connection of the 2 jumpers to X20:3/6 and X20:4/5
- Check the following electrical connections for control via 2 control cables to SBC and DB00:
  - DC 24 V voltage at X20:1/2 (SBC)
  - Check whether the 2 jumpers at X20:3/6 and X20:4/5 are removed correctly.
  - DC 24 V voltage at X20:5/6 (DB00)
- Functional test:
  - After a successful startup, check whether the brake module switches the connected brake as expected. To do so, switch the safe digital input SBC and the digital input DB00 and check whether the connected brake switches as expected. You can also observe the status change of the status LED and the digital output STATUS during switching.
  - SEW-EURODRIVE recommends additionally measuring the stopping distance. The measurement is used to verify the expected stopping distance to the actual stopping distance.

4.4 Operational requirements

- Operation is permitted only within the limits specified in the corresponding documentation. This applies both to the brake module and to the connected devices.
- You must check the functionality of the safety function implemented with the brake module at least once a year. To do so, switch the safe digital input SBC and the digital input DB00 and check whether the connected brake switches as expected. You can also observe the status change of the status LED and the digital output STATUS during switching.

  SEW-EURODRIVE recommends additionally measuring the stopping distance. The measurement is used to verify the expected stopping distance to the actual stopping distance.
- Observe the information in chapter "Service" (→ 🗎 76).

4.5 Approval

The system manufacturer must perform an overall evaluation in order to determine the safety of a machine or a system.

The effectiveness of each risk minimization must be checked. It must also be checked if the required safety integrity (SIL and/or PL) is reached for each implemented safety function.

The "Sistema" calculation tool of the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA), for example, can be used to verify the achieved safety integrity level.

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5 Device structure

5.1 Device version

This documentation applies to the following device versions:

- SBM safe brake module, device version 1010 or later. The device version is given on the nameplate (see chapter "Nameplate").

5.2 Type designation and nameplate

5.2.1 Type designation

The type designation is structured as follows.

SBM S-400-120-00	Type designation	
SBM	Series: Safe brake module	
S	Type:	
	S	Control cabinet installation
400	Nominal output voltage (rated range):	
	230	AC 230 V/DC 94 V (DC 90 V to DC 98 V)
	400	AC 400 V/DC 165 V (DC 158 V to DC 170 V)
	460	AC 460 V/DC 188 V (DC 181 V to DC 194 V)
120	Nominal output power	
	120	Size 1: 120 W
	250	Size 2: 250 W
00	Options/functional expansion	
	00	Standard

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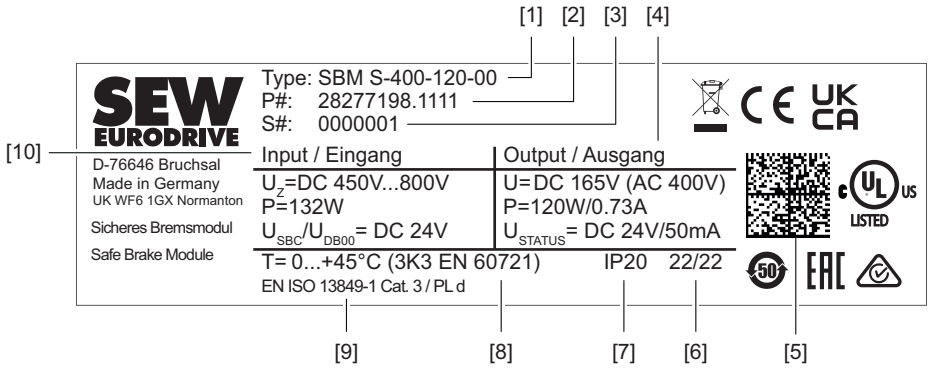
5.2.2 Nameplate

The following figure shows an example nameplate of the SBM brake module. The nameplate is attached to the side of the unit.



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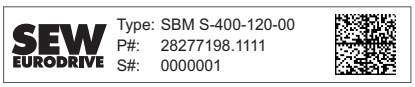
[1] Type designation (in this case: SBM S-400-120-00)
[2] Part number P# (in this case: 28277198) and device version (in this case: 1111)
[3] Serial number S# (in this case: 0000001)
[4] Output electrical data:
- U: Voltage to supply the brake
- P: Nominal output power / nominal output voltage
- U_{STATUS}: Output voltage / output current of digital output

[5] DataMatrix code with type designation, part number, device version and serial number
[6] Manufacturing date in format ww/yy (in this case: 22/22)
[7] IP degree of protection
[8] Ambient temperature T and climate class
[9] Underlying standard and safety class
[10] Input electrical data:
- U_Z: Voltage supply
- P: Nominal power consumption
- U_{SBC}/U_{DB00}: Input voltage of the safe digital input SBC and digital input DB00

DataMatrix code label



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The DataMatrix code label is attached to the front panel of the brake module. The DataMatrix code contains the following data:

- Type designation
- Part number P# (in this case: 28277198)
- Serial number S# (in this case: 0000001)
- Device version (in this case: 1111)

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5.3 Available SBM device types

The following SBM device types are available.

5.3.1 SBM size 1

Type designation	Compatible brakes
SBM S-460-120-00	Brakes with a nominal voltage of DC 181 V to DC 194 V (AC 460 V) and coil power ≤ 120 W.
SBM S-400-120-00	Brakes with a nominal voltage of DC 158 V to DC 170 V (AC 400 V) and coil power ≤ 120 W.
SBM S-230-120-00	Brakes with a nominal voltage of DC 90 V to DC 98 V (AC 230 V) and coil power ≤ 120 W.

5.3.2 SBM size 2

Type designation	Compatible brakes
SBM S-460-250-00	Brakes with a nominal voltage of DC 181 V to DC 194 V (AC 460 V) and coil power ≤ 250 W.
SBM S-400-250-00	Brakes with a nominal voltage of DC 158 V to DC 170 V (AC 400 V) and coil power ≤ 250 W.
SBM S-230-250-00	Brakes with a nominal voltage of DC 90 V to DC 98 V (AC 230 V) and coil power ≤ 250 W.

5.4 Scope of delivery

5.4.1 Basic SBM devices

<table>
<tr><th>Size 1</th><th>Part number</th><th>Scope of delivery</th></tr>
<tr><td>SBM S-230-120-00</td><td>28277171</td><td rowspan="10">The scope of delivery of the brake modules includes the following components:
• Brake module
• Accessory bag 1 (part no. 28238346) with the following contents:
– Shield plate with fasteners
• Accessory bag 2 (part no. 28277716) with the following contents:
– Plug connector
– 2 screws, M4 × 14, each with washer and terminal clip for PE connection
– UL label (Branch Circuit Protection). For more information, see chapter "UL-compliant installation".</td></tr>
<tr><td>SBM S-400-120-00</td><td>28277198</td></tr>
<tr><td>SBM S-460-120-00</td><td>28277201</td></tr>
<tr><th>Size 2</th><th>Part number</th></tr>
<tr><td>SBM S-230-250-00</td><td>28277732</td></tr>
<tr><td>SBM S-400-250-00</td><td>28277848</td></tr>
<tr><td>SBM S-460-250-00</td><td>28277864</td></tr>
</table>

5.4.2 Accessories

Type designation	Part number	Scope of delivery
Mounting base	28270835	The base is used to mount the brake module at a specific distance from the mounting plate. The mounting base allows cables to be routed under the brake module and to the frequency inverter. The scope of delivery includes the following components: • Mounting base with set screw, M6 × 10 • 2 x M6 nuts with attached washers for fastening the brake module to the mounting base
DIN rail adapter	28232518	The DIN rail adapter is used to mount the brake module on a DIN rail. The scope of delivery includes the following components: • DIN rail adapter • 2 flat-head screws, M4 × 8, for fastening the DIN rail adapter to the brake module

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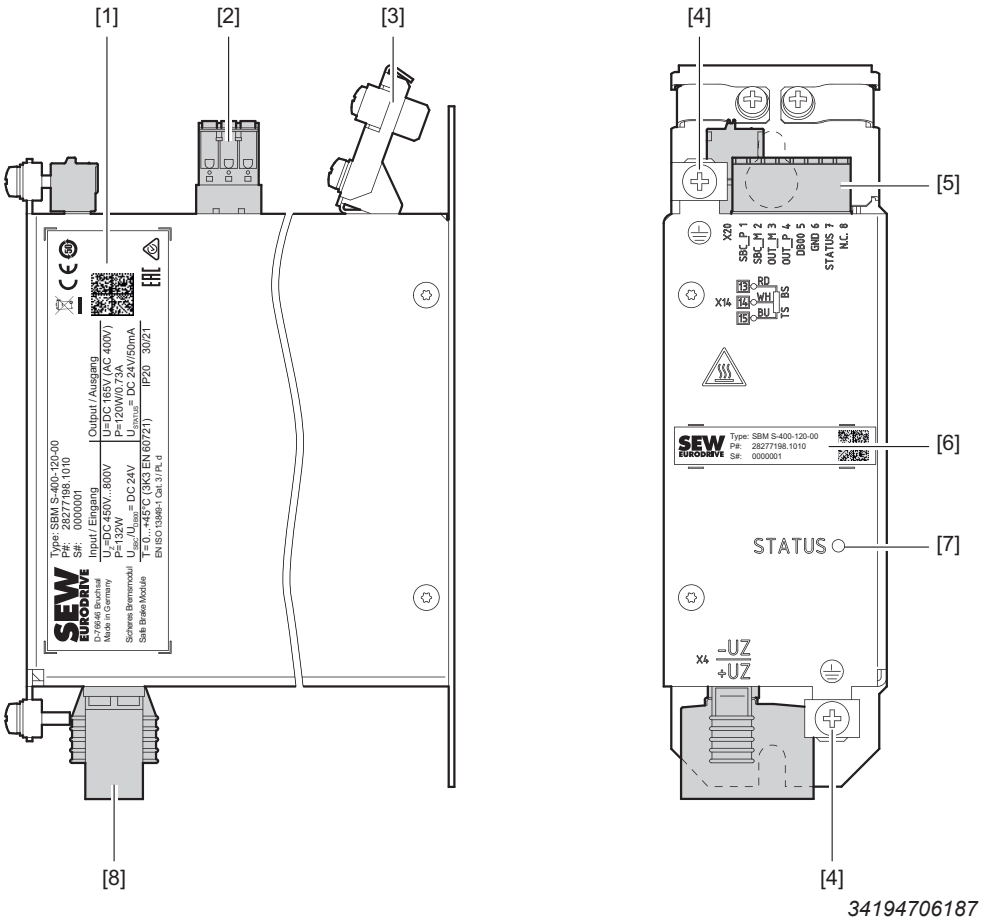
5.5 SBM safe brake module

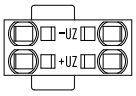
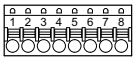
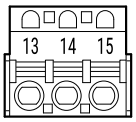
The following figure shows the device structure of the SBM brake module:



[1] Nameplate
[2] X14 plug connector: brake connection
[3] Retaining plate/shield plate
[4] PE connection
[5] X20 plug connector: connection for digital input, safe digital input and digital output
[6] Label with DataMatrix code and device details
[7] Status LED: STATUS
[8] X4 plug connector: voltage supply connection

5.6 Terminal assignment

- The device-internal reference potential is designated as GND in the following table. The reference potentials GND and SBC_M are not connected to the PE connection internally.
- The technical data for the power and control electronics connections is provided in the "Technical data" chapter.
- The X4 plug connector is a push-in connector with clip latch and laterally offset lock slides.
- The X14 and X20 plug connectors are push-in connectors.

Terminal			Function
Representation	Designation	Assignment	
	X4:-U_Z X4:+U_Z	-U_Z +U_Z	Voltage supply connection
	X20:1	SBC_P	Safe digital input, sourcing output
	X20:2	SBC_M	Safe digital input, sinking output
	X20:3	OUT_M	Digital output (optional: jumper to X20:6)
	X20:4	OUT_P	Digital output (optional: jumper to X20:5)
	X20:5	DB00	Digital input for brake control
	X20:6	GND	Reference potential DB00/STATUS
	X20:7	STATUS	Digital output for SBM status
	X20:8	N.C.	Unassigned
	X14:13	13	Brake connection (conductor color on brake: RD)
	X14:14	14	Brake connection (conductor color on brake: WH)
	X14:15	15	Brake connection (conductor color on brake: BU)
	⏚	PE	PE connection

5.7 Permitted unit combinations

The SBM safe brake module can be used in combination with the following products.

INFORMATION

The brake module does not have an integrated heating function. The brake module is not suitable for brake applications in ambient conditions that necessitate brake control with an integrated heating function.

Take the actual operating conditions into consideration when selecting the brake module for the brake.

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5.7.1 Brakes on asynchronous AC motors/servomotors

Possible combinations of the SBM safe brake module with brakes on motors of the DR../EDR.. series.

The following assignment applies for brakes down to an ambient temperature of -40 °C.

- x = operation is permitted (recommended combination)
- 0 = operation is permitted (optional combination)
- - = operation is not permitted

Brake type	Brake voltage	Size 1 (BG1)	Size 2 (BG2)
BE02 to BE20 BF11, BF20	230 V	x	0
	400 V	x	0
	460 V	x	0
BE30, BE32 BF30	230 V	-	x
	400 V	x	0
	460 V	x	0
BE60, BE62	230 V	-	x
	400 V	-	x
	460 V	-	x
BE120, BE122	230 V	-	x
	400 V	-	x
	460 V	-	x

5.7.2 Brakes on synchronous servomotors

Possible combinations of the SBM safe brake module with brakes on motors of the CM.. series.

The following assignment applies for brakes down to an ambient temperature of -40 °C.

- x = operation is permitted (recommended combination)
- 0 = operation is permitted (optional combination)

Brake type	Brake voltage	Size 1 (BG1)	Size 2 (BG2)
BY2 to BY14	230 V	x	0
	400 V	x	0
	460 V	x	0
BZ05 to BZ5	230 V	x	0
	400 V	x	0
	460 V	x	0

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5.7.3 Other brakes

Other brakes with 3-wire or 2-wire technology are permitted if the specifications in these operating instructions are observed (e.g., chapter "Technical data" (→ 🗎 79)).

INFORMATION

The specified figures for the operating current and power consumption of brakes are typically nominal values and are based on normal ambient temperatures.

Take the real operating currents of the brake into consideration, in particular with low ambient temperatures.

5.7.4 Frequency inverter

INFORMATION

Observe the documentation for the respective frequency inverter with regard to the connection of the brake module to the DC link

MOVIDRIVE® modular

- Sizes 1 to 6 in unit design 3 × AC 380 to 500 V are permitted.
- The brake module can be combined with power supply modules (standard design, with controlled DC link voltage, with block-shaped/sinusoidal regenerative power supply).

MOVIDRIVE® system

- Sizes 1 to 8 in unit design 3 × AC 380 to 500 V are permitted.

MOVIDRIVE® technology

- Sizes 1 to 8 in unit design 3 × AC 380 to 500 V are permitted.

MOVITRAC® advanced

- Sizes 0L, 3 to 8 in unit design 3 × AC 380 to 500 V are permitted.
- Size 0S does not have a DC link connection and is not compatible with the brake module.

MOVIDRIVE® B

- Sizes 0 to 7 in unit design 3 × AC 380 to 500 V are permitted.
- When connecting the brake module to MOVIDRIVE® B size 7, you must also use the DC link adapter 2Q DLZ12B (part number 18227295) or 4Q DLZ14B (part number 18227287).

MOVITRAC® LTP-B

- Sizes 2 to 7 in unit design 3 × AC 380 to 480 V are permitted.

MOVITRAC® LTE-B

- Sizes 4 and 5 in unit design 3 × AC 380 to 480 V are permitted.

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MOVITRAC® B

- Sizes 2S to 5 in unit design 3 × AC 380 to 500 V are permitted.
- Size 0 does not have a DC link connection (U_z) and is not compatible with the brake module.

MOVIAXIS®

- The brake module can be connected to supply and regenerative modules as well as capacity and buffer modules.
- When connecting the brake module to MOVIAXIS® MXP, MXR, MXC and MXNB, you must also use the corresponding connection set (part number 28205952).

Supply and regenerative modules

- Use of the brake module in combination with block-shaped and sinusoidal supply and regenerative modules is permitted.

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6 Mechanical installation

6.1 Important notes

⚠ DANGER

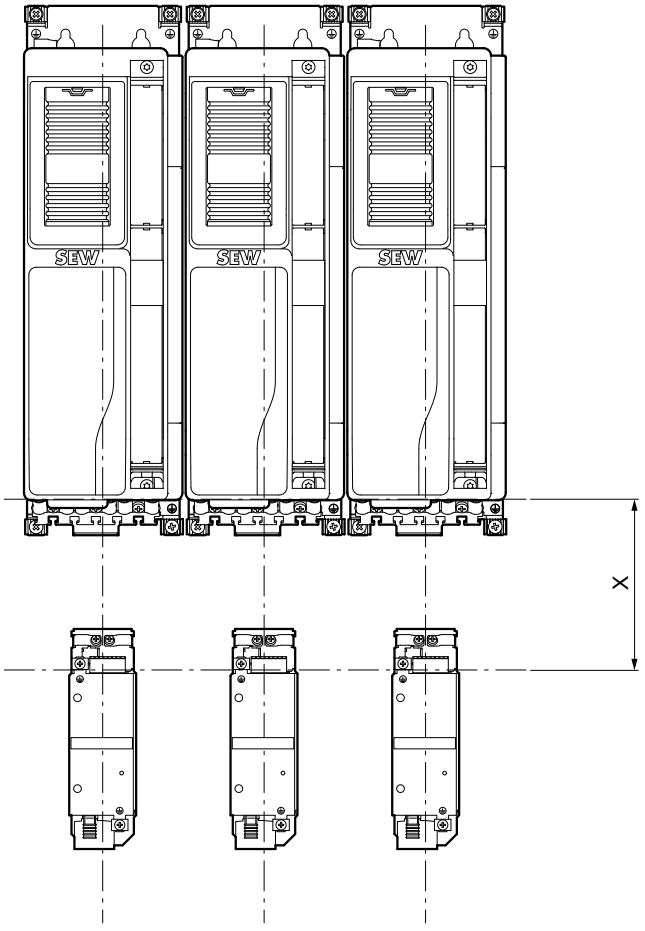
Following disconnection of the voltage supply U_Z, the DC link on the inverter can still carry dangerous voltages due to charged capacitors or energy storage devices.

Death or severe injuries due to electric shock.

- Secure the disconnected voltage supply U_Z against unintentional reconnection.
- Check that no voltage is applied to the terminals of the brake module **before commencing work**.
- Wait at least 10 minutes before commencing work.
- If there is an energy storage unit in the voltage supply U_Z, observe the operating instructions of the energy storage unit and adhere to the wait time before discharging the energy storage unit.

6.2 Arranging the brake modules in the control cabinet

The safe brake modules can be arranged below the inverters. Observe the minimum clearances of the individual devices and the resulting installation clearance "x" between the brake module and inverter.



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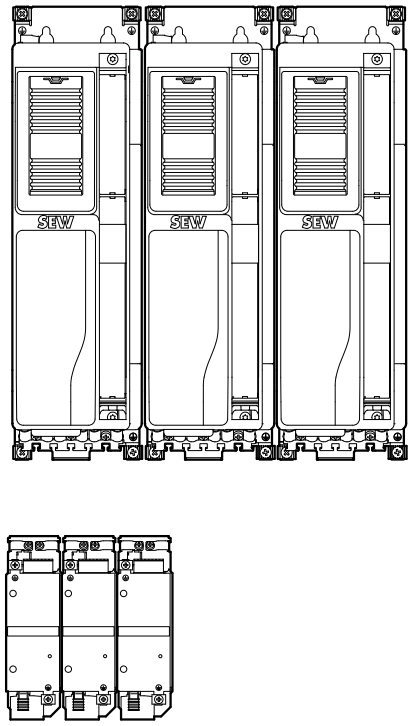
6.2.1 Arranging the brake modules below the inverters

- Variant 1: Arrange the brake modules next to one another without clearance.



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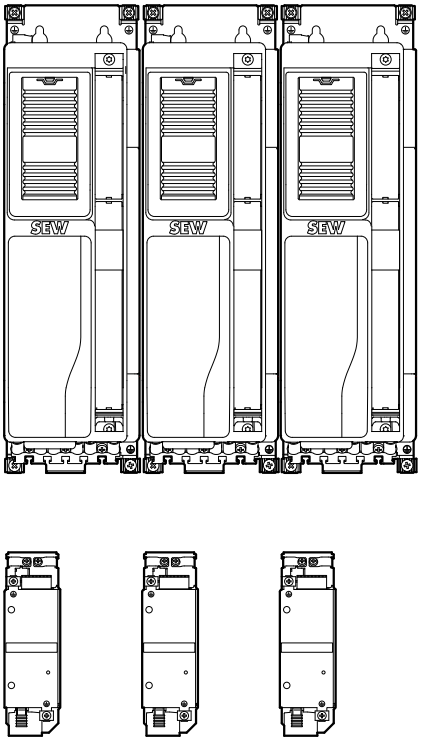
- Variant 2: Arrange the brake modules next to one another with clearance.



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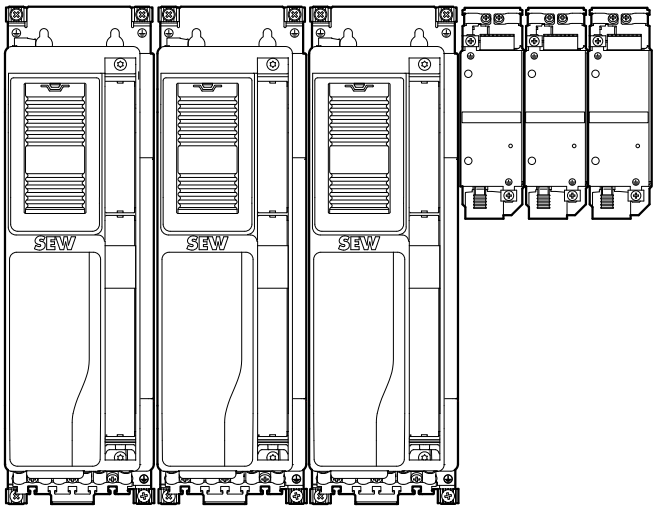
6.2.2 Arranging the brake modules next to the inverters

The brake modules can be arranged side-by-side without lateral clearance.



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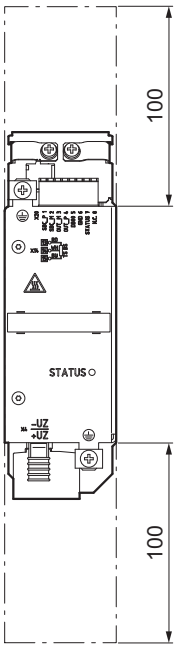
6.3 Minimum clearance and mounting position

- To ensure adequate cooling, leave a 100 mm clearance at both the top and bottom (see following figure). Ensure that the air circulation in this clearance is not impaired by cables or other installation equipment. The devices can be arranged side-by-side without any lateral clearance.
- The devices must not be exposed to the warm exhaust air from other devices.
- The devices must be installed vertically (with the X4 plug connector at the bottom). All other mounting positions are prohibited.



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6.4 Installation options

There are 3 different options for installing the SBM safe brake module in the control cabinet.

1. Attaching the device (without accessories) via the slotted holes on the device base plate
2. Installing the device with the "mounting base" accessory
3. Installing the device with the "DIN rail adapter" accessory

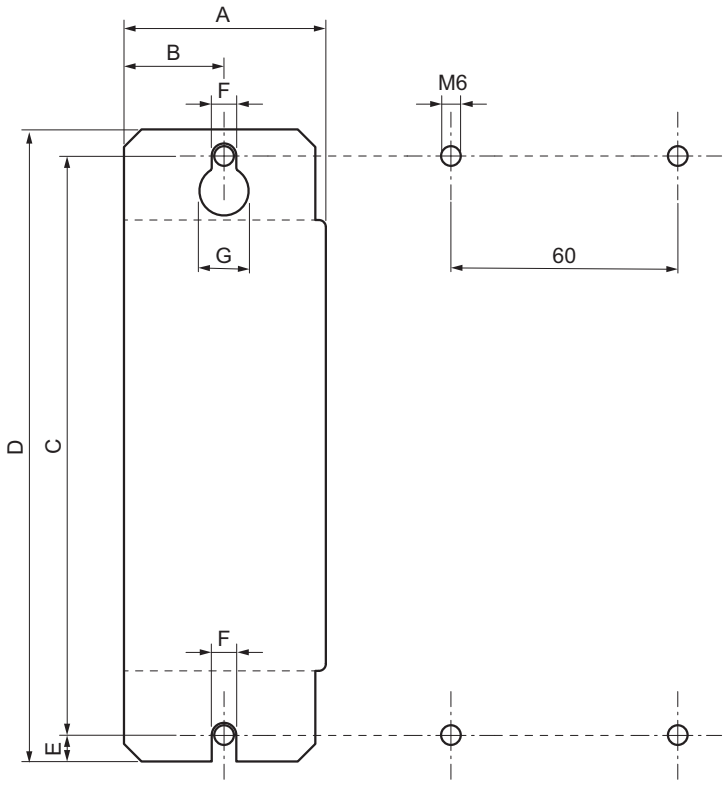
The different installation options are described in the following chapters. The retaining screws for device assembly (not included in scope of delivery) must comply with VDI 2230.

6.5 Attaching the device via the slotted holes on the device base plate

6.5.1 Preparing the control cabinet for brake module installation

The device is attached to the control cabinet directly via the device base plate using suitable screws. SEW-EURODRIVE recommends that you use size M6 flat-head or machine screws. To attach the brake module via the 2 slotted holes on the device base plate, you must drill tapped holes in the control cabinet. In an axis system with multiple brake modules, the devices can be attached as in the SBM mounting grid shown below.

- SBM mounting grid, all dimensions in mm.



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- Measurements of the device base plate. All dimensions in mm.

A	B	C	D	E	F	G
60	30	165	180	8	7	14

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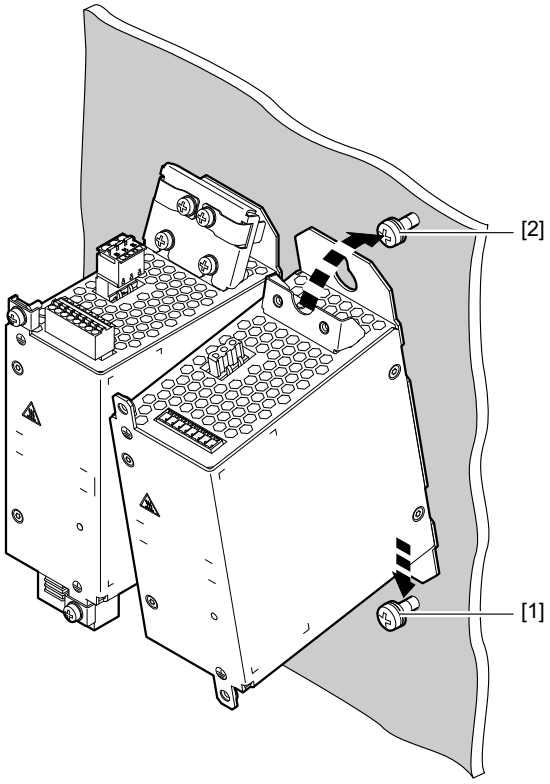
For dimension drawings of the brake module, refer to chapter "Technical data" > "Dimension drawings".

6.5.2 Attaching the brake module via the slotted holes on the device base plate

To mount the brake module in a control cabinet via the 2 slotted holes on the device base plate, proceed as follows:

1. Screw the retaining screws [1] and [2] into the prepared tapped holes in the control cabinet, but do not tighten them.
2. Place the brake module with the 2 slotted holes on the device base plate over the lower retaining screw of the control cabinet [1] from above.



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3. Press the brake module toward the control cabinet retaining screw [2] until the latter fits through the upper slotted hole on the device base plate.
4. Lower the brake module to the end of the lower slotted hole in the device base plate.
5. Tighten the retaining screws [1] and [2].
6. Attach the X4 plug connector so that the clip latch engages. Attach the X14 and X20 plug connectors. Fit the PE connection (M4 screw with terminal clip) and the shield plate (tightening torque 1.4 – 1.6 Nm).

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6.5.3 Detaching the brake module via the slotted holes on the device base plate

To detach the brake module from a control cabinet via the 2 slotted holes on the device base plate, proceed as follows:

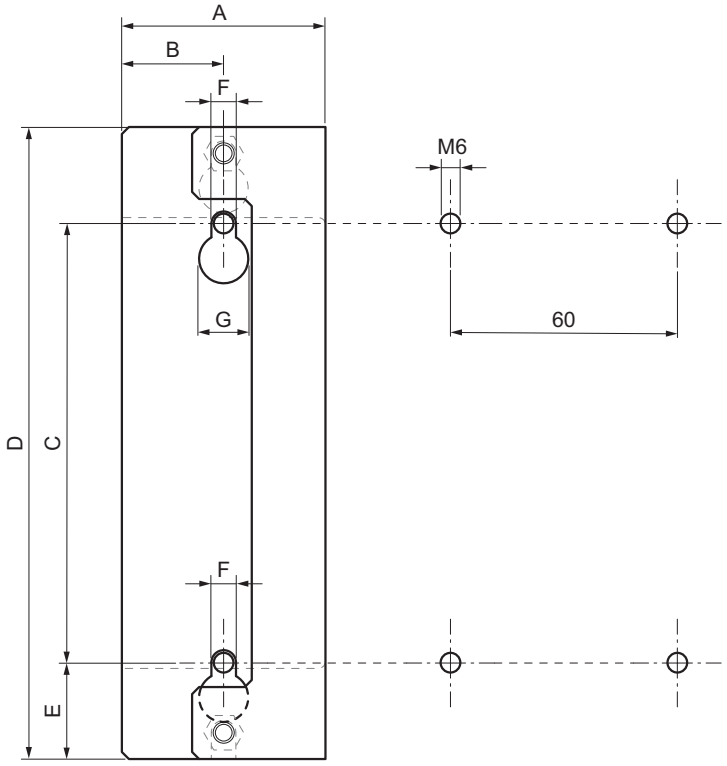
1. First, release the X4 plug connector via the laterally offset lock slides and then disconnect it. Detach the X14 and X20 plug connectors, undo the PE connection and remove the shield plate.
2. Undo the retaining screws on the SBM device base plate, but do not remove them.
3. Push the brake module upward until the upper retaining screw fits through the upper slotted hole on the device base plate.
4. Tilt the brake module forward before lifting it up and out of the lower slotted hole in the device base plate.

6.6 Installing the device with the "mounting base" accessory

6.6.1 Preparing the control cabinet for mounting base attachment

The mounting base is attached directly to the control cabinet using suitable screws. SEW-EURODRIVE recommends that you use size M6 flat-head or machine screws. To attach the mounting base via the slotted holes, you must drill tapped holes in the control cabinet. In an axis system with multiple mounting bases, the bases can be attached as in the mounting grid shown below.

- Mounting base mounting grid, all dimensions in mm.



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- Measurements of the mounting base. All dimensions in mm.

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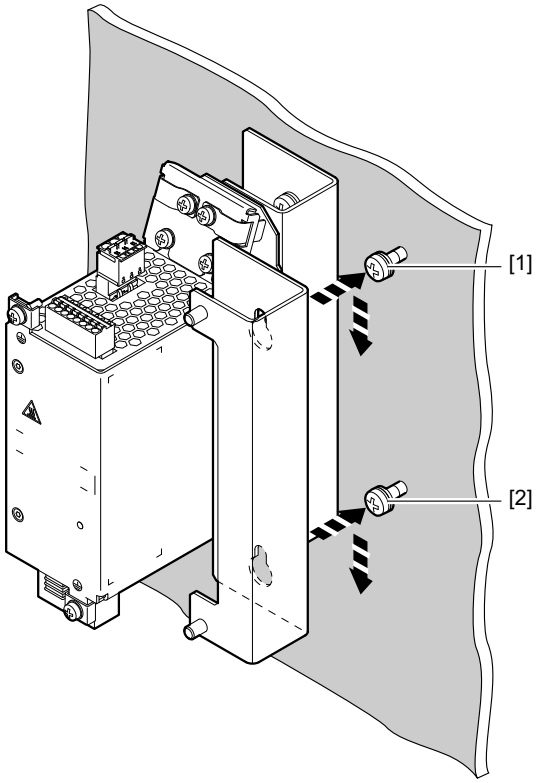
A	B	C	D	E	F	G
60	30	125	180	28	7	14

For dimension drawings of the mounting base, refer to chapter "Technical data" > "Dimension drawings".

6.6.2 Installing the brake module with the "mounting base" accessory

To install the brake module with the "mounting base" accessory, proceed as follows:

1. Screw the retaining screws [1] and [2] into the prepared tapped holes in the control cabinet, but do not tighten them.
2. Place the mounting base over the retaining screws [1] and [2] in the control cabinet as shown and lower it to the end of the slotted holes. Tighten the retaining screws.



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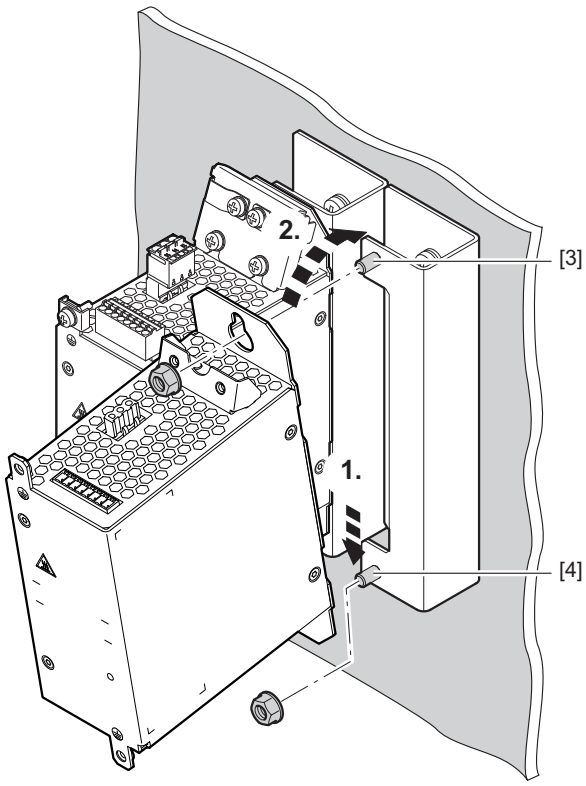
3. First place the brake module with the slotted holes in the device base plate over the two set screws [3], [4] of the mounting base. Then apply the retaining nuts to the set screws and tighten them (tightening torque: 3.1 – 3.5 Nm).



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4. Attach the X4 plug connector so that the clip latch engages. Attach the X14 and X20 plug connectors. Fit the PE connection (M4 screw with terminal clip) and the shield plate (tightening torque 1.4 – 1.6 Nm).

6.6.3 Removing the brake module with the "mounting base" accessory

To remove the brake module with the "mounting base" accessory, proceed as follows:

1. First, release the X4 plug connector via the laterally offset lock slides and then disconnect it. Detach the X14 and X20 plug connectors, undo the PE connection and remove the shield plate.
2. Undo the two retaining nuts (top and bottom) joining the mounting base to the device base plate of the SBM.
3. Remove the brake module from the set screws of the mounting base.

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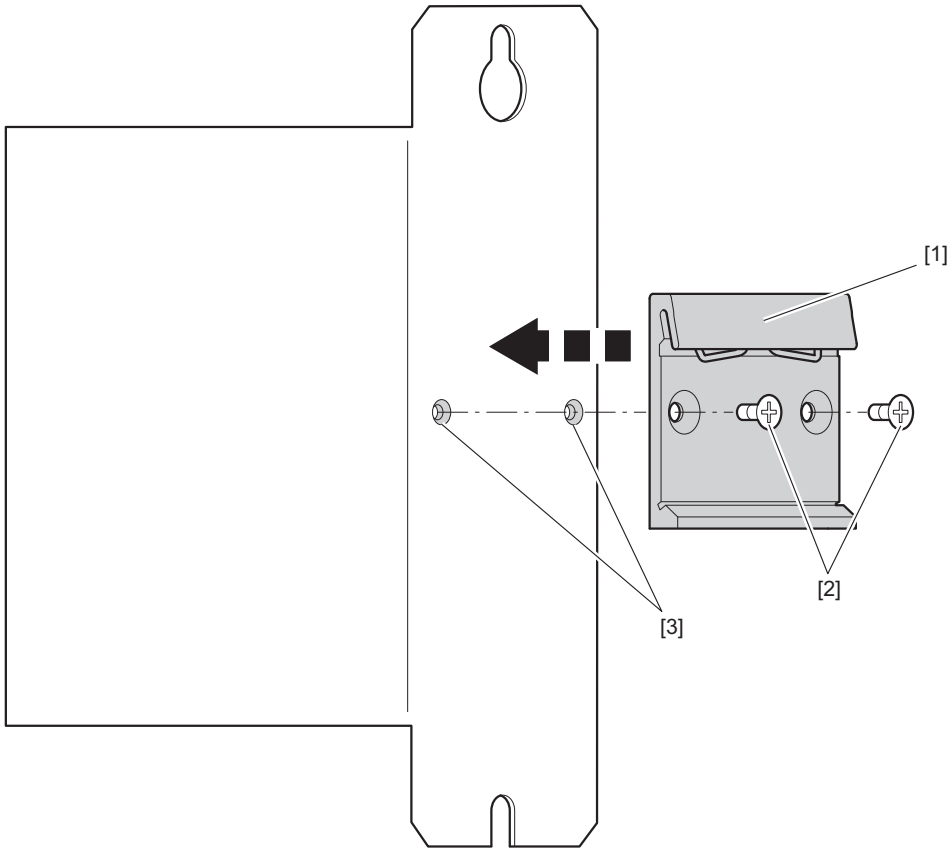
6.7 Attaching the device to a DIN rail with the "DIN rail adapter" accessory

The brake module is mounted on a DIN rail (TH 35-7.5 or TH 35-15 according to IEC 60715) in the control cabinet using the DIN rail adapter.

6.7.1 Attaching the DIN rail adapter to a brake module

Proceed as follows:

1. Attach the DIN rail adapter [1] to the rear of the device [3] using the supplied flat-head screws M4 × 8 [2] (tightening torque: 1.8 to 2.0 Nm), as shown in the following figure.



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[1] DIN rail adapter
[2] M4 × 8 flat-head screws
[3] Rear of device

6.7.2 Attaching the brake module to a DIN rail with the DIN rail adapter

Proceed as follows:

1. The upper holding fixture of the DIN rail adapter [2] is spring-loaded. Start by attaching the brake module [1] to the upper edge of the DIN rail [7] via the upper holding fixture of the DIN rail adapter [2].

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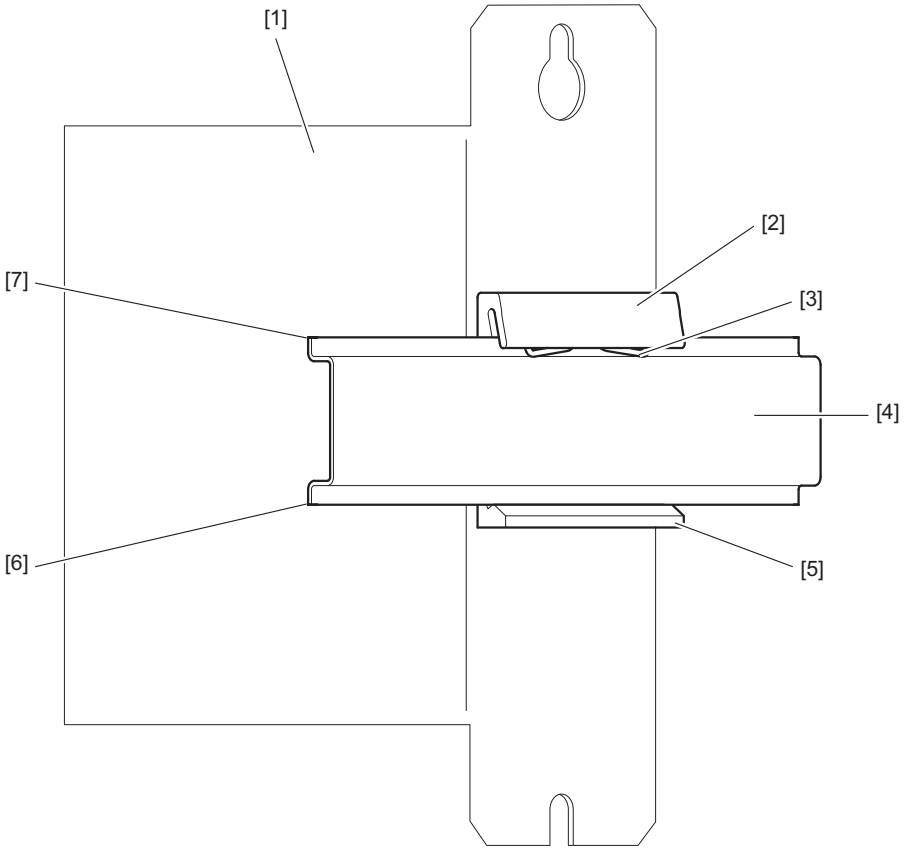
2. Then press the brake module [1] down and toward the DIN rail [4] until the lower holding fixture of the DIN rail adapter [5] engages with the lower edge of the DIN rail [6].

   The spring [3] on the upper holding fixture of the DIN rail adapter [2] ensures that the brake module [1] is locked in place on the DIN rail [4].



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[1] SBM safe brake module
[2] Upper edge of the DIN rail adapter
[3] Spring on DIN rail adapter
[4] DIN rail
[5] Lower edge of DIN rail adapter
[6] Lower edge of DIN rail
[7] Upper edge of DIN rail

6.7.3 Detaching the brake module from a DIN rail

To remove the brake module from a DIN rail, proceed as follows:

1. Press down on the brake module from above. This causes the DIN rail adapter to detach from the lower edge of the DIN rail [6]. At the same time detach the brake module from the lower edge of the DIN rail.
2. When the lower catch is released, you can remove the brake module from the DIN rail.

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7 Electrical installation

7.1 Important notes

⚠ DANGER

Following disconnection of the voltage supply U_Z, the DC link on the inverter can still carry dangerous voltages due to charged capacitors or energy storage devices.

Death or severe injuries due to electric shock.

- Secure the disconnected voltage supply U_Z against unintentional reconnection.
- Check that no voltage is applied to the terminals of the brake module **before commencing work**.
- Wait at least 10 minutes before commencing work.
- If there is an energy storage unit in the voltage supply U_Z, observe the operating instructions of the energy storage unit and adhere to the wait time before discharging the energy storage unit.

⚠ CAUTION

Attaching or detaching the X4 or X14 plug connectors on a live device can cause an electric arc on the plug connectors.

Risk of burns.

- Disconnect the voltage supply $\pm U_z$ before attaching or detaching the X4 or X14 plug connectors to or from the device.

INFORMATION

- Observe the information in the "Installation requirements" (→ 🗎 18) chapter.
- SEW-EURODRIVE recommends that you use closed cable lugs for screw connections to prevent litz strands from escaping.

7.2 Permitted voltage supply systems

Voltage supply system	Note
TN and TT system – voltage system with directly grounded star point.	Use is permitted.
IT system – voltage system with non-grounded star point.	Use is permitted.
Voltage system with grounded outer conductor.	Use is not permitted.

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7.3 Brake module voltage supply

- The brake module is designed for operation with the DC link voltage of SEW-EURODRIVE inverters. The DC link voltage can be supplied via one of the following methods:
  - From a single inverter (single device)
  - From multiple inverters in an axis system with DC link connection
  - From a single device / axis system in combination with a power supply module (standard design, with controlled DC link voltage, with block-shaped/sinusoidal regenerative power supply)
- If multiple brake modules are to be operated on the same voltage supply, the necessary power consumption must be taken into account when configuring the voltage supply.
- Operation of multiple brake modules of different sizes on the same voltage supply is limited to a maximum of 2000 W (total nominal output power).

  Examples:
  - 16 × SBM size 1 = 16 × 120 W = 1920 W
  - 8 × SBM size 2 = 8 × 250 W = 2000 W
  - 8 × SBM size 1 + 4 × SBM BG2 = 8 × 120 W + 4 × 250 W = 1960 W
  - 12 × SBM size 1 + 2 × SBM BG2 = 12 × 120 W + 2 × 250 W = 1940 W

7.3.1 Connection of the voltage supply to the brake module (X4:±U_Z)

NOTICE

Incorrect connection of the voltage supply to X4:+U_Z and X4:−U_Z.

Potential destruction of the brake module.

- You must ensure that the voltage supply is correctly connected to the terminals X4:+U_Z and X4:−U_Z.
- You must only connect the voltage supply to X4 and detach or attach the X4 plug connector when the brake module is de-energized.
- Ensure that the X4 plug connector is correctly engaged with the brake module.

The connection of the voltage supply to X4:+U_Z/-U_Z with push-in connection technology must meet the following conditions:

- Cable cross section: 0.75 mm² – 6 mm²
- Maximum cable length: 5 m
- Twisted cable routing
- The nominal voltage of the cable must be at least V_0/U = 450 V/750 V (according to DIN VDE 0298-3). Observe higher requirements regarding the voltage resistance of the cables by other devices in the voltage supply U_Z, e.g. through energy storage units.

Connecting the voltage supply to multiple brake modules

The X4 plug connector features a total of 4 terminals for connecting the voltage supply +U_Z and -U_Z. This allows the voltage supply +U_Z/-U_Z to be looped from one brake module to the next.

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7.3.2 Fusing of the connection leads to X4

Adhere to country- and system-specific regulations regarding the fusing. If the SBM brake module is used within the scope of the UL, observe the chapter "UL-compliant installation".

SEW-EURODRIVE recommends that you fuse all poles of the connection leads for the brake module voltage supply to X4:+U_Z/-U_Z. In the event of a fault, the fusing will protect the connection lead from short circuits or overload.

The fusing can also protect against damage to the supply unit (e.g., single device / axis system). This can occur, for example, if the brake module is destroyed due to overload.

No fusing is required in the following cases:

- The specifications of VDE 0100, part 430 and EN 60204-1 are complied with.
- The connection lead to the brake module is protected by the line fuse upstream of the voltage supply (e.g., before the single device / axis system).

Fusing is a mandatory requirement in the following cases:

- The total nominal output power of an SBM brake module operated on a voltage supply U_Z amounts to more than 1000 W.
- The voltage supply U_Z contains an energy storage unit with the following features:
  - Double-layer capacitor module connected directly to the voltage supply without a converter.
  - Capacitor modules with a capacitance ≥ 2 mF.

Fusing of the connection leads to X4 without an energy storage unit

SEW-EURODRIVE recommends the following fusing of the connection leads to X4:

Total nominal output power	Nominal current	Nominal voltage	Utilization category/ characteristic
Max. 250 W	≥ 4 A	≥ DC 850 V	gG, gR
Max. 500 W	≥ 6 A		
Max. 1000 W	≥ 10 A		

Fusing of the connection leads to X4 with an energy storage unit

Total nominal output power	Nominal current	Nominal voltage	Utilization category/ characteristic
Max. 1000 W	15 A	DC 1000 V	gR, 30 kA, L/R = 1 ms

SEW-EURODRIVE recommends the following fuse-link:

- Rated current: 15 A
- Rated voltage: DC 1000 V
- Characteristic: gR
- Rated breaking capacity: 30 kA
- Dimensions: 10 × 38 mm
- Part number: 19051603 (scope of delivery: fuse-link without fuse holder)

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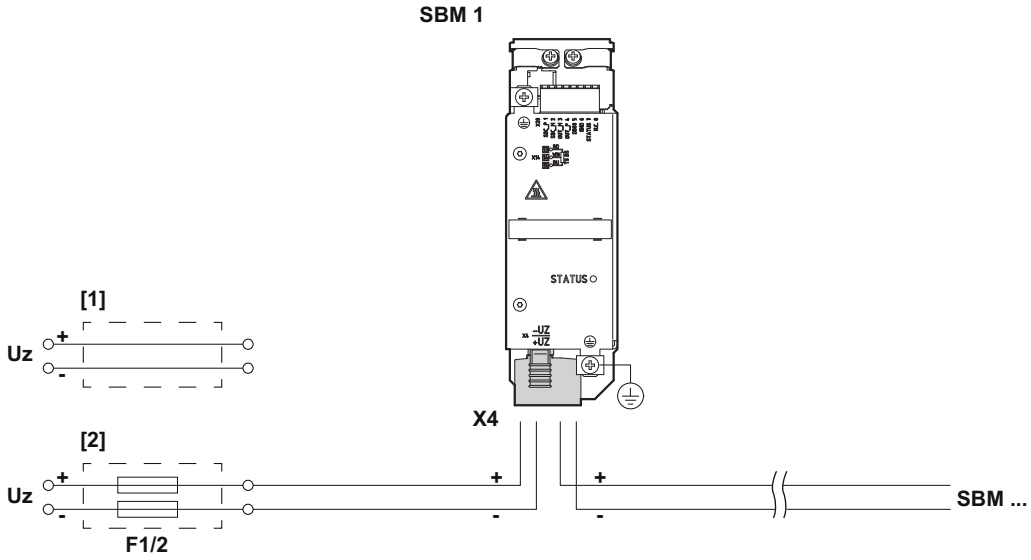
7.3.3 Wiring diagrams

The following wiring diagrams show the different connection options for the brake module voltage supply to X4:+U_Z/-U_Z.

Variant 1: up to max. 1000 W (total nominal output power)



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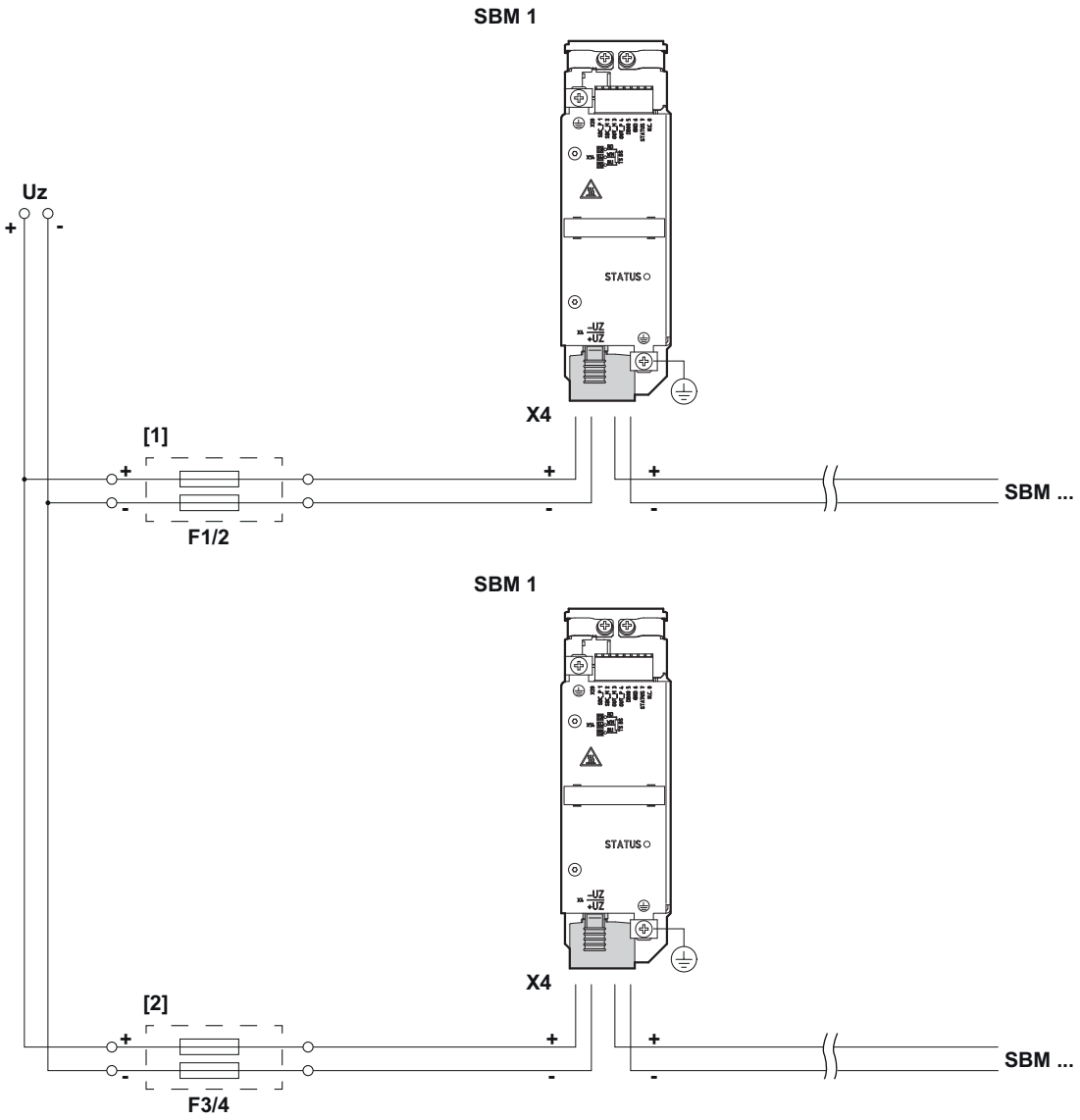
[1] Connection without fusing
[2] Connection with fusing via DC fuses F1/F2

Variant 2: up to max. 2000 W (total nominal output power)

INFORMATION

If the total nominal output power is greater than 1000 W, the connection leads to X4:+U_Z/-U_Z must be fused again as per the following wiring diagram.



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[1] Connection with fusing via DC fuse F1/F2
[2] Connection with fusing via DC fuse F3/F4

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7.4 Connection of the safe digital input SBC (X20:1/2)

The connection of the safe digital input SBC (X20:1/2) with push-in connection technology must meet the following conditions:

- Cable cross section: 0.5 mm^2 – 1.5 mm^2
- Maximum cable length: 30 m

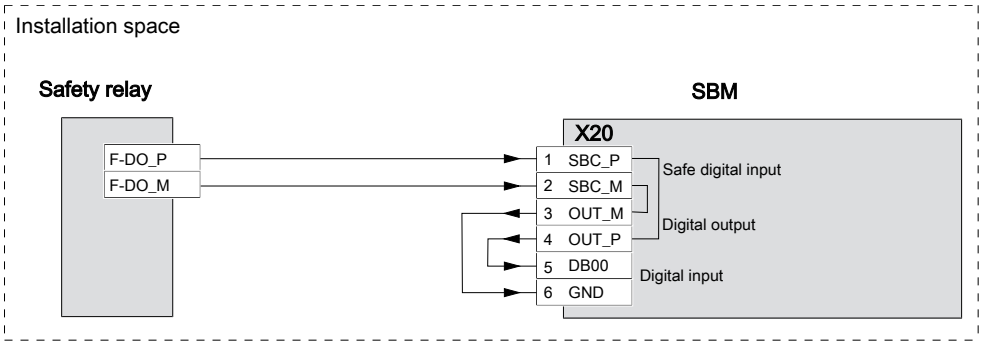
7.4.1 Dual-channel safety relay

The following figures show examples of the electrical connection between the brake module and the safety relay. The safety relay and the SBM brake module can be located in the same installation space or in different installation spaces.

Exclusive control via the safe digital input SBC

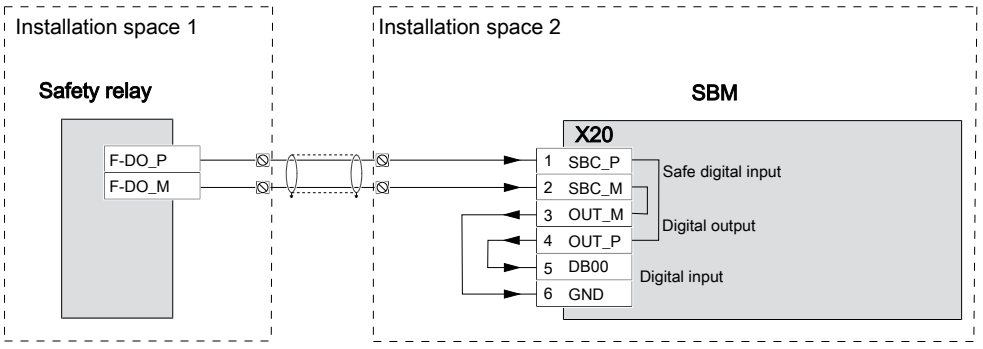
The terminals X20:3/4 of the digital output OUT are jumpered with the terminals X20:6/5 of the digital input DB00 (delivery state).

The following figure shows an example of the electrical connection between the safety relay and SBM brake module in a single installation space.



9007232128318987

The following figure shows an example of the electrical connection between the safety relay and SBM brake module in different installation spaces.

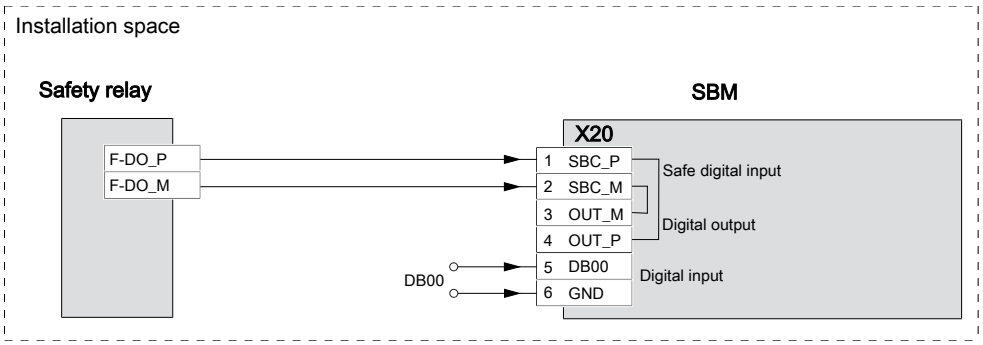


9007232133499275

Separate control via the safe digital input SBC and the digital input DB00

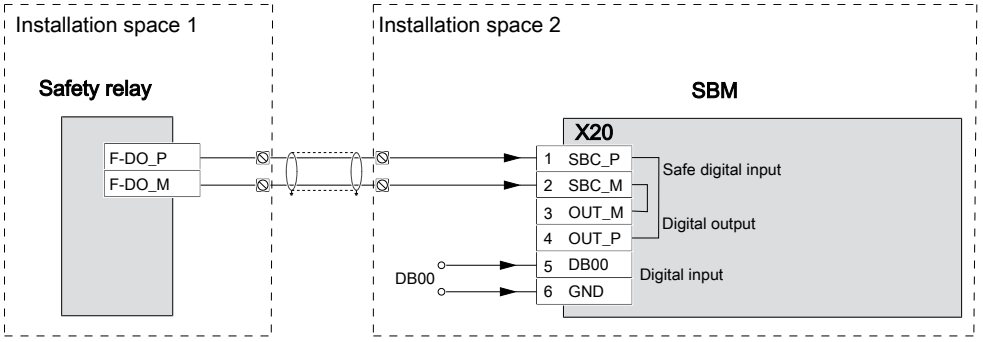
The terminals X20:3/4 must not be connected in this example. You must remove the jumpers fitted between the terminals X20:3/4 and X20:6/5 in the delivery state.

The following figure shows an example of the electrical connection between the safety relay and SBM brake module in a single installation space.



9007232133488011

The following figure shows an example of the electrical connection between the safety relay and SBM brake module in different installation spaces.



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7.4.2 Single-channel safety relay

INFORMATION

- The single-channel safety relay is only permitted if short circuits and interference voltages on any conductor are excluded for the safe DC 24 V voltage between the safety relay and the safe digital input SBC (fault exclusion according to EN ISO 13849-2).
- SEW-EURODRIVE recommends dual-channel disconnection of the safe digital input SBC.
- The single-channel safety relay is not permitted for connection and evaluation of the digital output STATUS (X20:7) and jumpered control inputs (2 jumpers between X20:3/6 and X20:4/5). You must use the dual-channel safety relay in this case.

The following figures show examples of the electrical connection between the SBM brake module and the safety relay within a single installation space.

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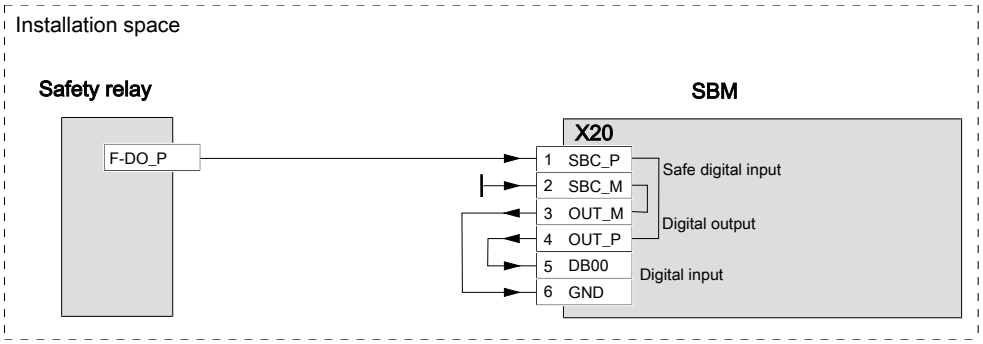
Exclusive control via the safe digital input SBC

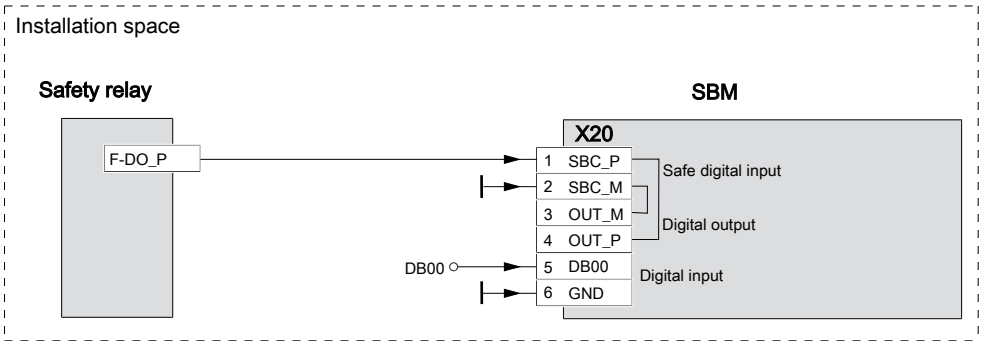
In the following connection example, the terminals X20:3/4 are jumpered with the terminals X20:6/5 of the digital input DB00 (delivery state).



9007232124913547

Separate control via the safe digital input SBC and the digital input DB00

The terminals X20:3/4 must not be connected in the following example. You must remove the jumpers fitted between the terminals X20:3/4 and X20:6/5 in the delivery state.



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7.5 Connection of the brake (X14:13/14/15)

NOTICE

Incorrect connection of the brake (X14:13/14/15) to the brake module.

Potential destruction of the brake module.

- Make sure that the brake is correctly connected to the brake module (see chapter "Wiring diagrams" (→ 🗎 49)).
- Parallel connection of a brake to several safe SBM brake modules is not permitted.

The connection of the brake (X14:13/14/15) with push-in connection technology must meet the following conditions:

- Cable cross section: 0.75 mm^2 – 2.5 mm^2
- Maximum cable length: 200 m

Connect the brake to the brake module as follows:

- SEW-EURODRIVE brakes with two-coil system (3-wire technology):
  - Coil section (TS): X14:14 (white) / X14:15 (blue)
  - Accelerator coil (BS): X14:13 (red) / X14:14 (white)
- Brakes with single-coil system (2-wire technology):
  - Coil: X14:13/15

7.6 PE connection (M4 screw)

The PE connection (M4 screw) must meet the following condition:

- Tightening torque: 1.4 – 1.6 Nm

7.7 Measures for electromagnetic compatibility

- The control cables must be routed according to EMC requirements. Observe the following notes.
  - Observe the regulations applicable to the application and the information in the operating instructions for the inverter.
  - In the case of a 2-channel connection of the control cable, you must route the relevant cables closely together and with the same length.
- When using hybrid cables, you must shield the motor and brake cables at both ends. In the case of insufficient shielding, the brake cable may be subjected to HF interference peaks. This can result in overloading of the SBM safe brake module and damage to the brake coil. Therefore, you must position the inner and outer shields of the cables correctly at the inverter and motor.
- Route the power cables, such as the motor cable, DC link cable, energy storage cable and brake cable, separately from the supply system cable and the control cables.
- Additional information on EMC measures is provided in the manual "Excerpt from Drive Engineering – Practical Implementation, Electromagnetic Compatibility (EMC) in Drive Engineering – EMC-Compliant Installation in Practice". You can download this document at www.sew-eurodrive.com.

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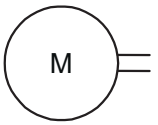
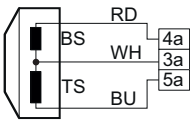
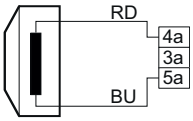
7.8 Wiring diagrams

The following wiring diagrams show an example of the electrical connection (2-channel) of the SBM brake module to an MOVIDRIVE® inverter with CS..A safety option and optional evaluation of the STATUS feedback.

7.8.1 Key for wiring diagrams

The following symbols and abbreviations are used in the wiring diagrams.

Symbol/Abbreviation	Meaning
	Motor
	Brake with 3-wire technology (with 2 coils) • BS = Accelerator coil • TS = Coil section
	Brake with 2-wire technology (with 1 coil)
3a 4a 5a	Auxiliary terminal strip in terminal box
WH	Conductor color white (brake connection)
RD	Conductor color red (brake connection)
BU	Conductor color blue (brake connection)
CS..A	MOVISAFE® CS..A safety option
MDA	MOVIDRIVE® modular multi-axis system
MDP	Power supply module for MOVIDRIVE® modular multi-axis system.
MDX	Control cabinet inverter MOVIDRIVE® system/technology
F-DO00_P	Safe digital output 0 of MOVISAFE® CS..A safety option, sourcing output
F-DO00_M	Safe digital output 0 of MOVISAFE® CS..A safety option, sinking output
F-DO01_P	Safe digital output 1 of MOVISAFE® CS..A safety option, sourcing output
F-DO01_M	Safe digital output 1 of MOVISAFE® CS..A safety option, sinking output
DI01/DI02	Digital inputs on the MOVIDRIVE® modular/system/technology inverter
DB00	Brake control
GND	Reference potential DB00

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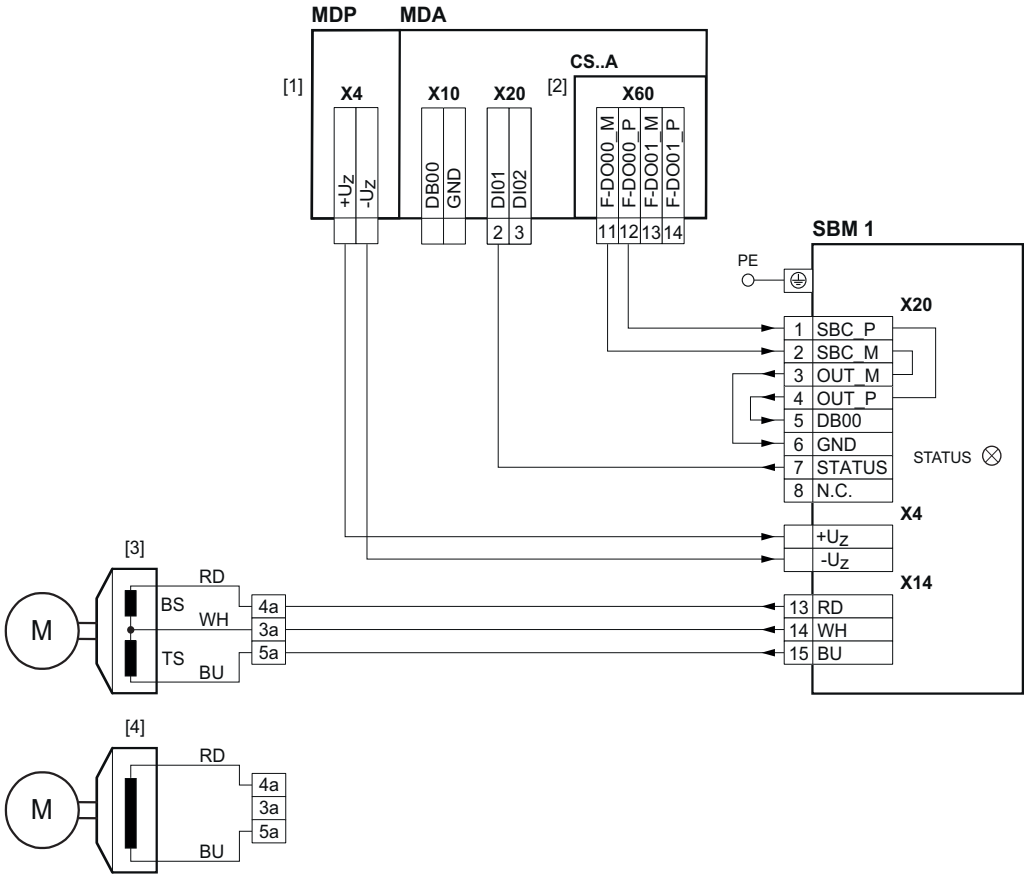
Symbol/Abbreviation	Meaning
SBC1/2	Safe Brake Control (SBC) function of the MOVISAFE® CS..A safety option. • 1: Brake 1 on F-DO00 • 2: Brake 2 on F-DO01

7.8.2 Brake control with 1 control cable

The following wiring diagrams show the (dual-channel) electrical connection with control of the brake module via the safe digital input SBC.

Example 1: Connecting a brake to MOVIDRIVE® modular



27021630629539851

[1] Power supply module (MDP), MOVIDRIVE® modular multi-axis system (MDA)
[2] MOVISAFE® CS..A safety option
[3] Connection of the brake with 3-wire technology (standard)
[4] Connection of the brake with 2-wire technology (optional). There is no connection of terminal X14:14 of the brake module to terminal 3a of the auxiliary terminal strip in this case.

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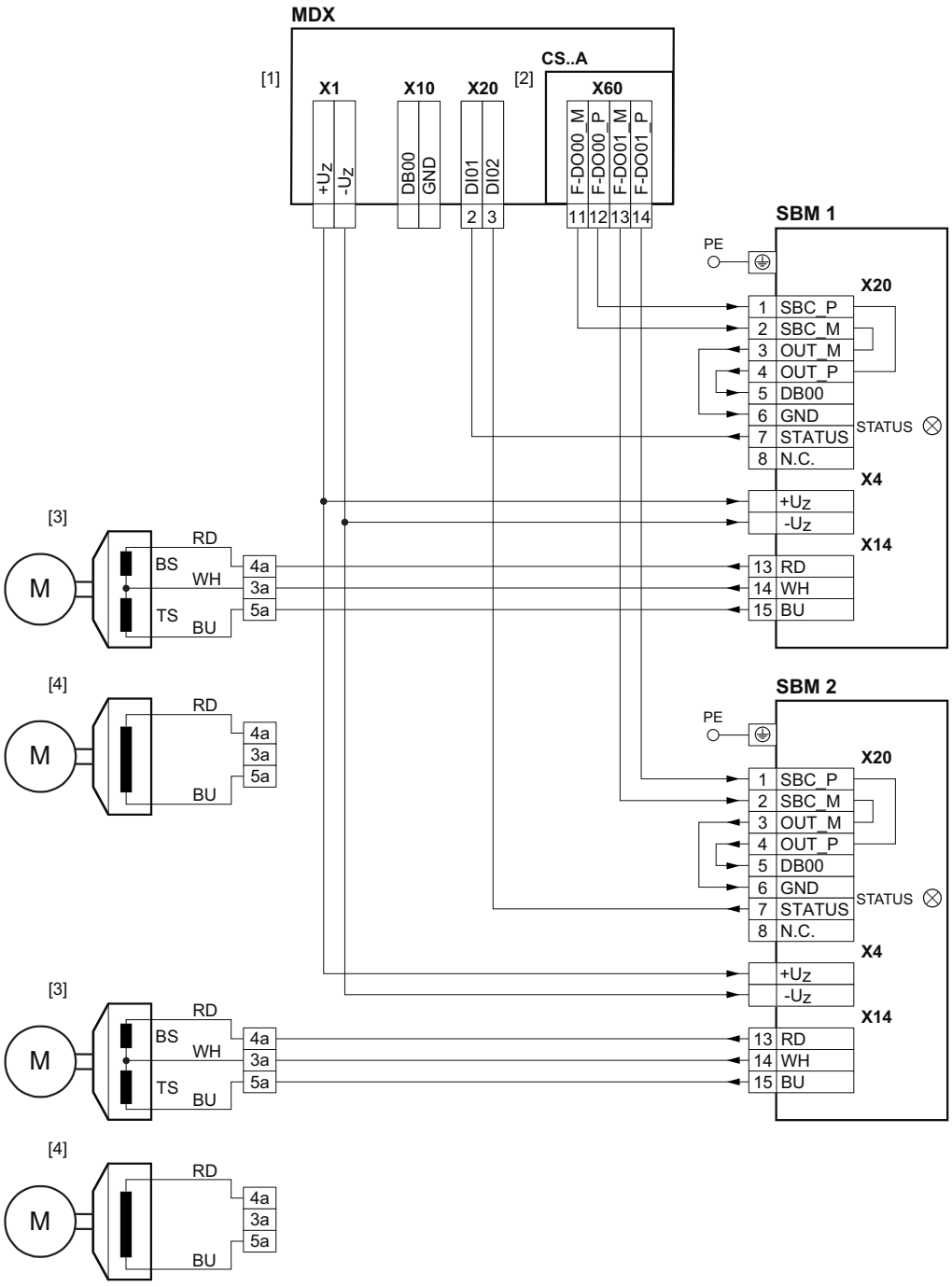
Example 2: Connecting 2 brakes to MOVIDRIVE® system/technology



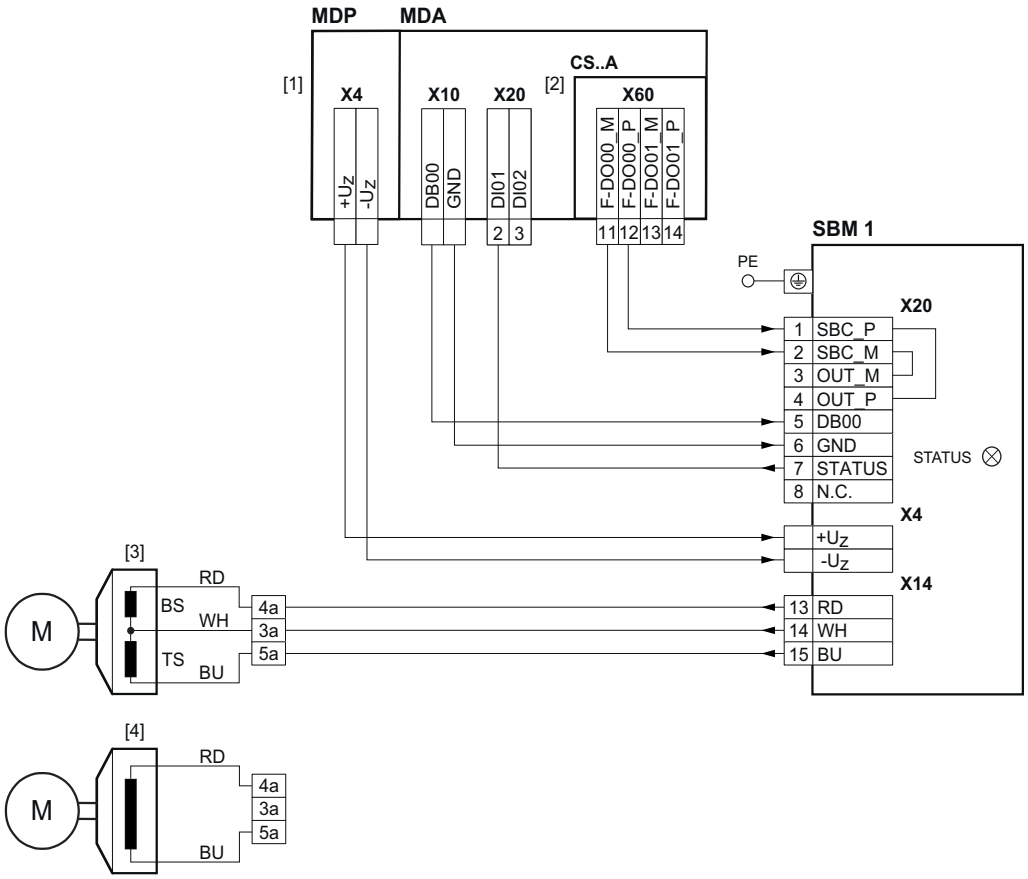
27021630629312523

[1] Control cabinet inverter MOVIDRIVE® system/technology (MDX)
[2] MOVISAFE® CS..A safety option
[3] Connection of the brake with 3-wire technology (standard)
[4] Connection of the brake with 2-wire technology (optional). There is no connection of terminal X14:14 of the brake module to terminal 3a of the auxiliary terminal strip in this case.

7.8.3 Brake control with 2 control cables

The following wiring diagrams show the recommended electrical connection with separate control of the brake module via the digital input DB00 and the safe digital input SBC.

Example 1: Connecting a brake to MOVIDRIVE® modular



27021630628416139

[1] Power supply module (MDP), MOVIDRIVE® modular multi-axis system (MDA)
[2] MOVISAFE® CS..A safety option
[3] Connection of the brake with 3-wire technology (standard)
[4] Connection of the brake with 2-wire technology (optional). There is no connection of terminal X14:14 of the brake module to terminal 3a of the auxiliary terminal strip in this case.

7.9 UL-compliant installation

INFORMATION

Due to UL requirements, the following chapter is always printed in English independent of the language of the documentation.

INFORMATION

The UL label must be attached to the device or in close proximity to the device.

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7.9.1 Field wiring power terminals

- Use 75 °C copper wire only.
- Tighten terminals to in-lbs (Nm) as follows:

Tightening torque in-lbs (Nm)			
Supply connection		Brake terminal	
X4	Spring terminal Wire sizes 19 – 10 AWG	X14	Spring terminal Wire sizes 19 – 14 AWG
PE connection			
M4: 12.39 – 14.16 (1.4 – 1.6)			

7.9.2 Short circuit current rating

Suitable for use on a circuit capable of delivering not more than

- 65,000 rms symmetrical amperes when protected by fuses, circuit breakers as described in the tables below.

7.9.3 Branch circuit protection

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

- If you use cable cross sections that are dimensioned for a smaller current than the rated current of the unit, make sure that the fuse is dimensioned for the used cable cross section.
- For information on selecting cable cross sections, refer to the project planning manual.
- Comply with the country-specific installation regulations in addition to the above notes.

AC 380 V – 480 V / 500 V devices

SCCR: 65 kA / 500 V		
Non semiconductor fuses (currents are maximum values)	Inverse-time circuit breaker (currents are maximum values)	Type E Combination Motor Controller
Max 100 A / 500 V	Max 100 A / 500 V min.	Siemens 3RV2041-4YA10 max. 93 A

Non-Semiconductor fuses Class CA, CB, CC, CD, CF, G, J, K-1, K-5, RK1, RK5, T, can be used.

DC 450 V – 800 V circuits

If the AC fuse used is not covered according to section "AC 380 – 480 V / 500 V devices", or if a DC fuse of the supply line is necessary due to other requirements, the following fuses must be used:

- SCCR: 65 kA / 800 V

Manufacturer	Description	Order code	SEW order code	Ratings	Class	UL
Siba	SQB 1 DIN 110	2071332.50	-	DC 900 V; 50 A; 100 kA	aR	248 – 13

- SCCR: 30 kA / 800 V

Manufacturer	Description	Order code	SEW order code	Ratings	Class	UL
Siba	10 × 38 mm	5019906.15	19051603	DC 1000 V; 15 A; 30 kA	gR	248 – 13

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7.9.4 Ambient temperature

The units are suitable for a maximum surrounding air temperature of max. 60 °C.

7.9.5 Environmental conditions

The units are for use in pollution degree 2 environments.

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8 Startup

8.1 Switching conditions of the brake module for switching the connected brake

The brake module switches the brake subject to the following dependencies.

8.1.1 Releasing the brake

The brake releases when all of the following conditions are met on the brake module:

- Activation of the DC 24 V voltage at the safe digital input SBC_P/_M
- Activation of the DC 24 V voltage at the digital input DB00/GND
- Activation of the voltage supply U_Z
- No active fault response

8.1.2 Applying the brake

The brake applies when one of the following conditions is met on the brake module:

- Deactivation of the DC 24 V voltage at the safe digital input SBC_P/_M
- Deactivation of the DC 24 V voltage at the digital input DB00/GND
- Deactivation of the voltage supply U_Z
- Active fault response (overcurrent detected)

INFORMATION

- **The safe disconnection of the brake is performed solely via the safe digital input SBC.**
- The voltage supply to U_Z is not intended for regular switching of the brake. The digital inputs SBC and DB00 must be used for this purpose.

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9 Operation

9.1 Important information

⚠ CAUTION

The surfaces of the brake module can become very hot during operation.

Risk of burns.

- Allow the brake module to cool before commencing work.

9.2 STATUS LED

The STATUS LED indicates the current operating state of the brake module.

- **STATUS LED: green**

  The green LED display indicates the control of the brake. If all switch-on conditions are met, the STATUS LED lights up green continuously. The brake module switches the brake output X14. The brake releases.

- **STATUS LED: red**

  The red LED display indicates that the brake module has detected a fault. If the input voltages SBC and DB00 are present and the brake module detects an existing fault, the STATUS LED flashes red at approx. 3 Hz.

INFORMATION

- The LED display of the STATUS LED must not be considered safety-relevant.
- The LED display of the STATUS LED does not signify that the brake module is de-energized and the brake is applied.
- When the STATUS LED is not illuminated, the voltage supply U_Z can still be present at the brake module.

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9.3 Internal fault detection

The brake module features a fault detection function. This does not take the form of self-diagnosis via the brake module. The fault detection function checks whether the states of the brake module allow the brake to be switched.

The following faults are detected:

Fault	Possible causes and remedial measures	Fault detection	Fault response
U_Z < 80 V	• Check the U_Z connection. • Check the U_Z fusing.	x	-
Load on brake output lower than minimum current	• Check the brake connection. • Check the connection voltage and the current consumption of the connected brake.	x	-
Overcurrent at brake output	• Check whether there is a short circuit at the brake output. • Check the connection of the accelerator coil and coil section. • Check the connection voltage and power of the connected brake.	x	x
Voltage at brake output too low	• During acceleration, the output voltage is ≤ 27%. • In holding operation, the output voltage is ≤ 71%. • Check the U_Z connection. • Check the brake connection. • Internal device fault (replace the device).	x	-

9.3.1 Meaning of fault detection

A detected fault is indicated by the STATUS LED. The STATUS LED flashes red at approx. 3 Hz. The digital output STATUS is switched off. The other functionalities of the brake module remains unaffected by a detected fault.

9.3.2 Meaning of fault response

The fault "overcurrent at brake output" also produces a fault response. If this fault occurs, a released brake is applied by the brake module. If the brake is already applied, the brake module prevents the brake from being released. Control of the brake via the digital inputs SBC and DB00 is prevented. The brake module locks itself.

After rectifying the fault, you can unlock the brake module by switching the DC 24 V control cable (SBC or DB00) off and back on again. You can then switch the brake again in the usual manner.

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INFORMATION

- The disconnection and locking of the brake module due to the fault response must not be considered safety-relevant.
- Safe disconnection of the brake must always be performed by the safety relay at the safe digital input SBC_P/_M.

9.4 Switching states

The following table lists the switching states of the STATUS LED (green, red), the digital output STATUS and the brake based on the switch-on conditions.

- Overview of switching states with separate control via SBC and DB00.

Switch-on conditions				Switching states			
SBC	DB00	U_z	Fault response	STATUS LED		Digital output STATUS	Brake output X14
				Green	Red		
0	0	0	0	0	0	0	X14 switched off
0	0	1	0	0	0	0	
0	1	0	0	0	0	0	
0	1	1	0	0	0	0	
1	0	0	0	0	0	0	
1	0	1	0	0	0	0	
1	1	0	1	0	1	0	
1	1	1	0	1	0	1	X14 switched on
1	1	1	1	0	1	0	X14 switched off

- Overview of switching states with shared control via SBC.

Switch-on conditions				Switching states			
SBC	DB00	U_z	Fault response	STATUS LED		Digital output STATUS	Brake output X14
				Green	Red		
0	0	0	0	0	0	0	X14 switched off
0	0	1	0	0	0	0	
1	1	0	1	0	1	0	
1	1	1	0	1	0	1	X14 switched on
1	1	1	1	0	1	0	X14 switched off

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9.5 Digital output STATUS

The digital output STATUS signals the operating state of the brake module with DC 24 V signal according to EN 61131-2. The digital output STATUS is powered via the connection DB00/GND. If the brake module is operated with jumpers to SBC, the voltage supply is via the SBC_P/_M connection.

- In the case of operation with 1 control cable to SBC and jumpers from OUT to DB00, the connected load must be taken into account to evaluate the digital output STATUS at the supply of the safe input signal SBC. Existing test pulses at the safe digital input SBC are fed through to the digital output STATUS. The evaluation of the digital output STATUS must tolerate existing test pulses – e.g., by filtering or debouncing pulses with a duration of up to 1 ms.
- In the case of operation with 2 control cables to SBC and DB00 (the jumpers are removed), the connected load must be taken into account to evaluate the digital output STATUS at the supply of the digital input DB00/GND.

The output signal at the digital output STATUS is independent of the voltage supply U_Z.

- The digital output STATUS supplies a high signal.

  This indicates that all conditions for switching the brake are met and no faults exist. The brake module switches the brake.
- The digital output STATUS supplies a low signal.

  This indicates that not all conditions for switching the brake are met or that a fault exists. The brake module does not switch the brake.

INFORMATION

- The operating state of the digital output STATUS must not be considered safety-relevant.
- A low signal at the digital output STATUS does not signify that the brake module is de-energized and the brake is applied.
- When the digital output STATUS supplies a low signal, the voltage supply U_Z can still be present at the brake module.
- The single-channel safety relay is not permitted for connection and evaluation of the digital output STATUS (X20:7) and jumpered control inputs (2 jumpers between X20:3/6 and X20:4/5). You must use the dual-channel safety relay in this case.

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9.6 Switching frequency

NOTICE

Thermal overload of the SBM safe brake module due to exceeding the maximum permitted switching frequency or too little pause times.

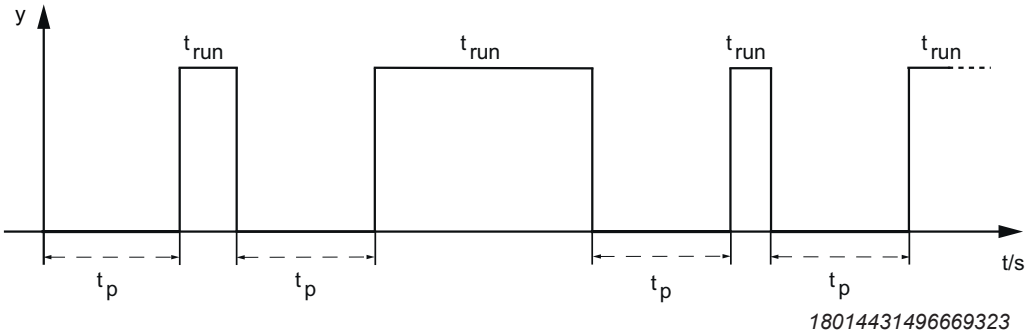
Destruction of the SBM safe brake module.

- Observe the maximum switching pulses and the specified pause times.

9.6.1 Continuous duty

In continuous duty you must adhere to the following pause time after switching off the control voltage (DB00/SBC).

- At least 0.5 seconds with a brake coil power of P < 60 W
- At least 1 second with a brake coil power of P ≥ 60 W



y Control voltage at SBC/DB00
t_{run} Power-applied hours incl. brake switching time
t_p Pause time

The maximum switching frequency of the SBM (connection of the control voltage) must not be exceeded.

The maximum values specified in the following overviews apply for the switching frequency of the SBM with deactivated "Brake control" monitoring function. The monitoring function uses the following limit values for the respective sizes:

- SBM, size 1: 30 switching pulses/2 minutes
- SBM, size 2: 15 switching pulses/2 minutes

INFORMATION

If you would like to use higher switching frequencies, you must deactivate the monitoring function.

For more information on the monitoring function, refer to chapter "Brake control' monitoring function".

SBM, size 1

Brakes on asynchronous AC motors / servomotors.

Brake type	Maximum switching frequency
BE02 to BE1	120 switching pulses/2 minutes
BE2 to BE5	80 switching pulses/2 minutes

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Brake type	Maximum switching frequency
BE11	50 switching pulses/2 minutes
BE20	30 switching pulses/2 minutes
BE30 to BE32	30 switching pulses/2 minutes

SBM, size 2

Brakes on asynchronous AC motors / servomotors.

Brake type	Maximum switching frequency
BE30 to BE32	30 switching pulses/2 minutes
BE60 to BE122	15 switching pulses/2 minutes

SBM, sizes 1 and 2

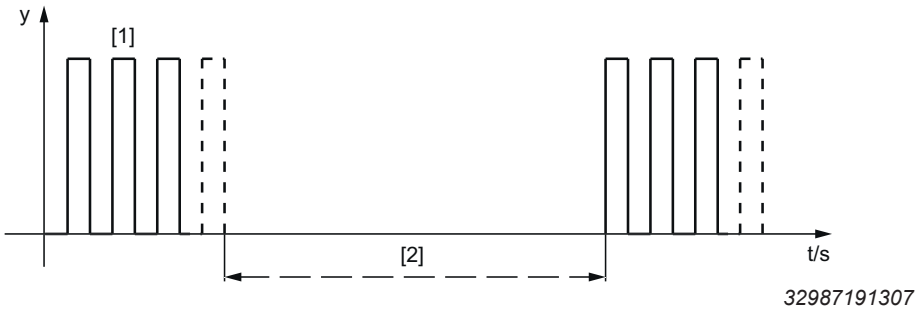
Brakes on synchronous servomotors.

Brake type	Maximum switching frequency
BY2	120 switching pulses/2 minutes
BY4 to BY8	80 switching pulses/2 minutes
BY14	50 switching pulses/2 minutes

Brake type	Maximum switching frequency
BZ05 to BZ1	120 switching pulses/2 minutes
BZ3 to BZ5	80 switching pulses/2 minutes

9.6.2 Setup mode or jog mode

With a brake coil power of P ≥ 60 W, shorter pause times of 0.5 to 1 second are also permitted for brief periods – e.g., for setup or jog mode. A pause time of at least 90 seconds must be adhered to for all SBM devices (size 1 and 2) after 30 switching impulses (connection of the control voltage) at the latest. The switching times for releasing and applying the brake must be taken into account in the cyclic duration factor.



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y Control voltage at SBC/DB00
[1] Max. 30 switching pulses
[2] Pause time of at least 90 seconds

INFORMATION

If the permitted switching frequency for size 2 in setup mode or jog mode of a maximum of 30 switching pulses/90 seconds is required, you must deactivate the "Brake control" monitoring function.

For more information on the monitoring function, refer to chapter "Brake control' monitoring function".

9.7 "Brake control" monitoring function

9.7.1 Functional description

The SBM safe brake module signals the current operating state via the digital output STATUS (STATUS signal).

The "Brake control" monitoring function in the inverters from SEW-EURODRIVE monitors the switching state of the STATUS signals and performs a plausibility check of them with the control signals DB00 and/or SBC of the inverter. If a signal state is implausible, the monitoring function reacts with an adjustable fault response. In addition, the permitted switching frequency of the SBM can be monitored. In doing so, the "Brake control" monitoring function evaluates the number of switching cycles via the STATUS signal. If the permitted switching frequency is exceeded, the monitoring function reacts with an adjustable fault response.

INFORMATION

The operating state of the digital output STATUS on the SBM brake module as well as the "Brake control" monitoring function in the inverter must not be considered safety-relevant.

9.7.2 Overview of functions

The monitoring function is available for up to 2 SBM brake modules and can be set separately for each brake module. With MOVIDIRVE® modular double-axis modules (MDD), this applies per axis.

- Setting/display functions
  - Selection of SBM size
  - Adjustable switch delay
  - Display of the current switching state of the STATUS signal
- Monitoring functions
  - Adjustable fault response for the monitoring of the STATUS signal.

    The function performs a plausibility check of the switching status of the STATUS signal from the safe SBM brake module against the control signals for the brake control (DB00 and/or SBC) from the inverter.
  - Adjustable fault response for the monitoring of the switching frequency of the SBM.

    The function monitors the switching frequency of the SBM with regard to the permitted limit values via the STATUS signal.

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9.7.3 Project planning notes

Requirement

Correct project planning and proper installation of the components is required for successful startup and operation.

For detailed project planning information, refer to the documentation of the respective components.

Hardware

The "Brake control" monitoring function requires one of the following inverters from the MOVI-C® modular automation system.

Inverters	Short designation
MOVIDRIVE® modular (single-axis module)	MDA
MOVIDRIVE® modular (double-axis module)	Double-axis module
MOVIDRIVE® system	MDX
MOVIDRIVE® technology	MDX
MOVITRAC® advanced	MCX

Software

The following compatibility dependencies are relevant for the "Brake control" monitoring function:

- Engineering software: MOVISUITE® V2.30 or later
- Inverter: Firmware version 9.0 or later

Function activation

No special requirements regarding technology/application level are placed on the inverter for the use of the "Brake control" monitoring function.

Drive train

The "Brake control" monitoring function is independent of drive train DT1 or DT2 of the inverter and can be used with both.

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Brake control

The "Brake control" monitoring function is compatible with the following brake controls of the inverters:

- Digital output DB00 on the basic device.
- The safe digital outputs F-DO01/F-DO02 of the MOVISAFE® CS..A safety options configured to the SBC function.

The brake controls can be used individually or in combination depending on the electrical connection of the SBM safe brake module (with or without jumpers between X20:3/6 and X20:4/5).

Information

- Use of the MOVISAFE® CS..A safety option with configured SBC function.

  Set the "Evaluate 'SBC' signal" radio button to "On" (see chapter "Configuring the monitoring function").
- Use of other brake controls

  Other brake controls, e.g. an external safety relay, are not compatible with the monitoring function. In this case, use a brake control compatible with the monitoring function or deactivate the monitoring.

Brake test

Observe the following firmware dependencies for the "Brake control" monitoring function integrated in the MOVI-C® inverter in combination with the "SBT safe brake test" or "FCB21 brake test" functions.

INFORMATION

Other brake tests are not compatible with the monitoring function. In this case, use the SBT safe brake test or FCB21 brake test or deactivate the monitoring function.

SBT safe brake test

- Inverters of the MOVI-C® modular automation system with firmware version 9 to 12:
  - The "Brake control" monitoring function is compatible with the SBT safe brake test, configured for testing a brake.
  - The "Brake control" monitoring function is not compatible with the SBT safe brake test, configured for testing 2 brakes.
  - The "Brake control" monitoring function is automatically deactivated internally for the duration of the active SBT safe brake test. Fault detection for the switching state of the STATUS signal is not possible during the active SBT brake test.
- Inverters of the MOVI-C® modular automation system with firmware version ≥ 13:
  - The "Brake control" monitoring function is compatible with the SBT safe brake test, configured for testing 1 brake or 2 brakes.
  - The "Brake control" monitoring function is automatically deactivated internally for the duration of the active SBT safe brake test. Fault detection for the switching state of the STATUS signal is not possible during the active SBT brake test.

FCB21 Brake test

- Inverters of the MOVI-C® modular automation system with firmware version 9 to 12:

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  - The "Brake control" monitoring function is compatible with the FCB21 brake test, configured for testing 1 brake or 2 brakes.
  - The "Brake control" monitoring function is automatically deactivated internally for the duration of the active FCB21 brake test. Fault detection for the switching state of the STATUS signal is not possible during the active FCB21 brake test.
- Inverters of the MOVI-C® modular automation system with firmware version ≥ 13:
  - The "Brake control" monitoring function is compatible with the FCB21 brake test, configured for testing 1 brake or 2 brakes.
  - The "Brake control" monitoring function remains activated during the active FCB21 brake test. Fault detection for the switching state of the STATUS signal is possible during the active FCB21 brake test.

Test pulses for performance diagnostics

When operating the SBM safe brake module with a control cable to SBC (jumpers between X20:3/6 and X20:4/5), test pulses are transferred from the safety relay to the STATUS signal for performance diagnostics (brief interruption of the output voltage).

The test pulses briefly interrupt the output voltage and can trigger the "Brake control" monitoring function. The "Brake control" monitoring function takes a maximum test pulse duration of 1 ms into account in the evaluation.

INFORMATION

Test pulses with a test pulse duration of > 1 ms can trigger the "Brake control" monitoring function. In this case, reduce the test pulse duration or control the SBM safe brake module with two separate control cables to SBC and DB00 (without jumpers between X20:3/6 and X20:4/5).

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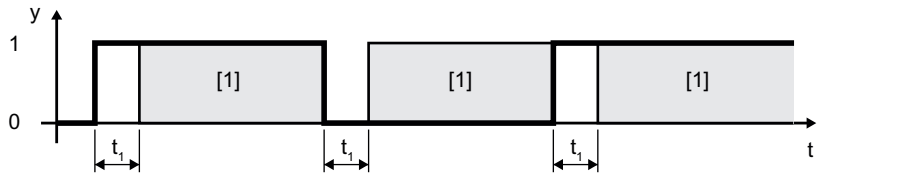
Switching delay

The switching delay is used to set the response time between the brake control signal (DB00/SBC) from the inverter and the STATUS signal from the SBM. The switching delay delays the activation of the monitoring function for the adjustable time of 50 to 500 ms. The set delay time starts with each edge change of the STATUS signal.

When there is an edge change, the STATUS signal of the SBM is filtered for 8 ms, e.g. to eliminate signal peaks. The filter time is within the switching delay.

The following figure illustrates the relationship between the STATUS signal, switching delay, and activation of the monitoring function:



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y STATUS signal
t_1 Switching delay
[1] "Brake control" monitoring function active

9.7.4 Electrical installation

The "Brake control" monitoring function requires the STATUS signal of the SBM brake module. The STATUS signal can be transferred to the inverter as follows.

- Wiring of the STATUS signal to a freely configurable digital input of the basic device or of the I/O extension.

  Parameterize the desired digital input for the basic device or the I/O card in MOVISUITE® with the following function:

  – for SBM 1: Brake control 1 – status (Index 8462.20, Bit 0)

  – for SBM 2: Brake control 2 – status (Index 8462.20, Bit 1)

- Wiring of the STATUS signal to a higher-level controller (PLC). This transmits the signal to the basic device via a freely configurable bit in the control word (process output data).

  Parameterize the desired bit in the control word in MOVISUITE® with the following function:

  – for SBM 1: Brake control 1 – status (Index 8462.20, Bit 0)

  – for SBM 2: Brake control 2 – status (Index 8462.20, Bit 1)

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9.7.5 Startup

INFORMATION

For detailed information on how to use the MOVISUITE® engineering software, refer to the corresponding documentation.

Requirements

- The inverter as well as the SBM safe brake module are correctly installed.
- Observe the installation notes in the documentation of the respective devices and software modules.
- The devices and the software meet the required hardware and software requirements.
- The devices to be started up are displayed in MOVISUITE®.

Calling up the monitoring function

1. In MOVISUITE®, click the required inverter. The configuration menus of the inverter are displayed.
2. The "Brake control" monitoring function can be found in the "Functions" main menu under [Monitoring functions] > [Control functions] in the section "Brake control"

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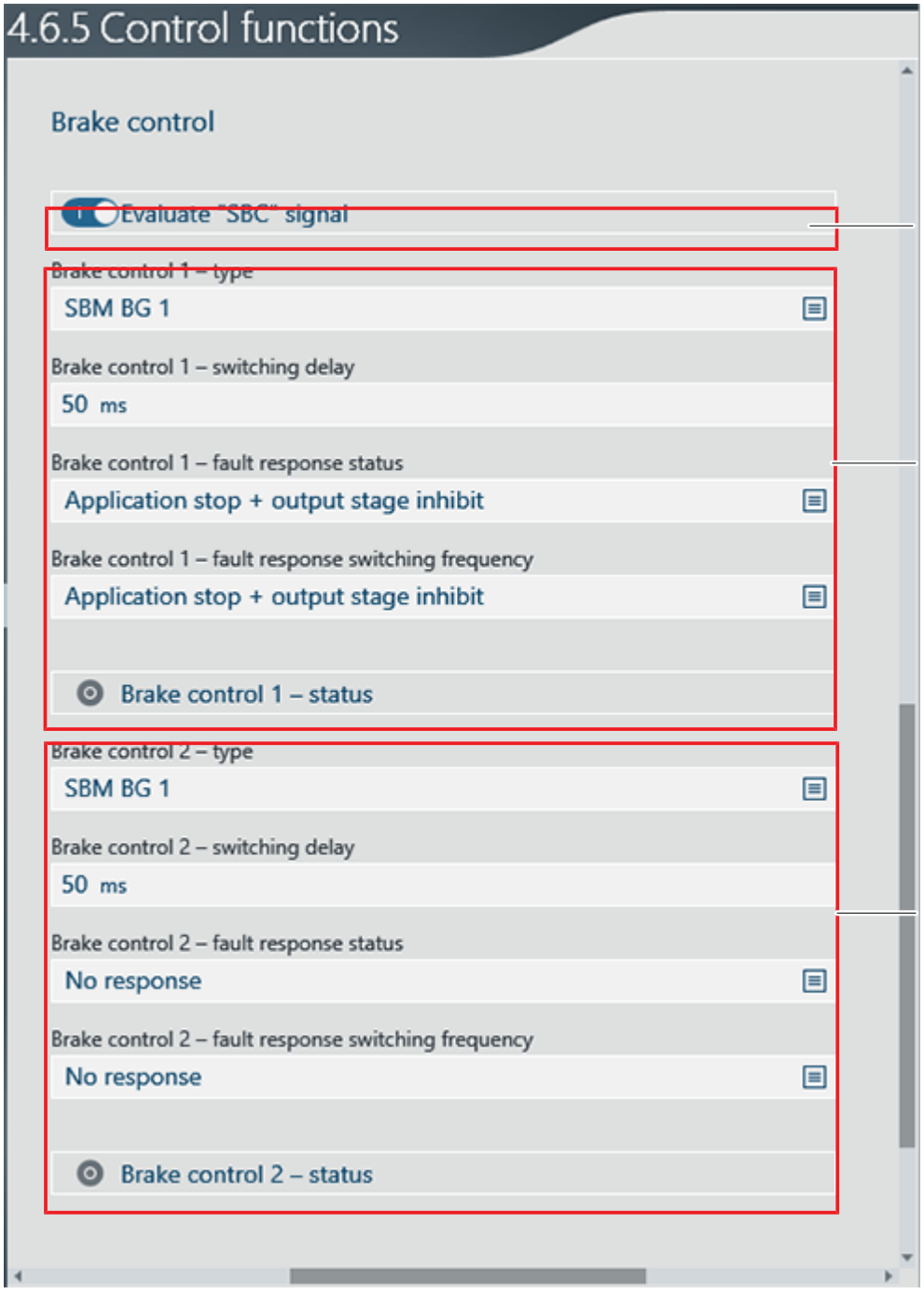
Configuring the monitoring function



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The following setting options are available for configuring the "Brake control" monitoring function. The default settings are shown in bold.

No.	Settings	Description	
[1]	Evaluate "SBC" signal	• **On** The monitoring function takes the SBC safety sub-function of the CS..A safety option into account in addition to the brake control DB00. • Off The monitoring function does not take the SBC safety sub-function of the CS..A safety option into account. **Information:** When using the SBC safety sub-function of the CS..A safety option, the "Evaluate 'SBC' signal" radio button is to be set to "On" so that the monitoring functions correctly.	
		Index: 8462.21, bit 0	• 1 = On • 0 = Off

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No.	Settings	Description	
[2]	**Brake control 1/safe brake module 1**		
	Brake control 1 – type	• **SBM size 1** • SBM BG2 Selection of the size of the safe brake module to be monitored. Limit values for the monitoring are defined internally via the selection of the size.	
		Index: 8462.2	• Value 3 = SBM size 1 • Value 4 = SBM size 2
	Brake control 1 – switching delay	• **50 ms** Setting of the response time between the DB00/SBC signal of the brake control and the STATUS signal of the SBM. After this, the monitoring function is active.	
		Index: 8462.3	Value = 50 – 500 ms
	Brake control 1 – fault response status	• **No response** The monitoring function is deactivated. • Warning If a fault is detected, the inverter switches to the "Warning" status and issues a warning message. • Application stop + output stage inhibit If a fault is detected, the inverter switches to the "Application stop + output stage inhibit" status and issues a fault message.	
		Index: 8462.4	• 0 = No response • 1 = Warning • 2 = Application stop + output stage inhibit
	Brake control 1 – fault response switching frequency	• **No response** The monitoring function is deactivated. • Warning If a fault is detected, the inverter switches to the "Warning" status and issues a warning message. • Application stop + output stage inhibit If a fault is detected, the inverter switches to the "Application stop + output stage inhibit" status and issues a fault message.	
		Index: 8462.5	• 0 = No response • 1 = Warning • 2 = Application stop + output stage inhibit
	Brake control 1 – status	• **Off** The STATUS signal is not present on the inverter. • On The STATUS signal is present on the inverter.	
		Index: 8462.20, bit 0	• 0 = Off • 1 = On

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No.	Settings	Description	
[3]	**Brake control 2/safe brake module 2**		
	Brake control 2 – type	• **SBM size 1** • SBM BG2 Selection of the size of the safe brake module to be monitored. Limit values for the monitoring are defined internally via the selection of the size.	
		Index: 8462.12	• Value 3 = SBM size 1 • Value 4 = SBM size 2
	Brake control 2 – switching delay	• **50 ms** Setting of the response time between the DB00/SBC signal of the brake control and the STATUS signal of the SBM. After this, the monitoring function is active.	
		Index: 8462.13	Value = 50 – 500 ms
	Brake control 2 – fault response status	• **No response** The monitoring function is deactivated. • Warning If a fault is detected, the inverter switches to the "Warning" status and issues a warning message. • Application stop + output stage inhibit If a fault is detected, the inverter switches to the "Application stop + output stage inhibit" status and issues a fault message.	
		Index: 8462.14	• 0 = No response • 1 = Warning • 2 = Application stop + output stage inhibit
	Brake control 2 – fault response switching frequency	• **No response** The monitoring function is deactivated. • Warning If a fault is detected, the inverter switches to the "Warning" status and issues a warning message. • Application stop + output stage inhibit If a fault is detected, the inverter switches to the "Application stop + output stage inhibit" status and issues a fault message.	
		Index: 8462.15	• 0 = No response • 1 = Warning • 2 = Application stop + output stage inhibit
	Brake control 2 – status	• **Off** The STATUS signal is not present on the inverter. • On The STATUS signal is present on the inverter.	
		Index: 8462.20, bit 1	• 0 = Off • 1 = On

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9.7.6 Operation

Switching states of the monitoring function

The evaluation of the signals occurs separately for each of the two STATUS signals.

- Overview of switching states with separate control via SBC and DB00

Control signals		SBM signal	Brake control monitoring function	
DB00 (inverter)	SBC (CS..A)	STATUS	Status	Fault response
0	0	0	0	0
0	1	0	0	0
1	0	0	0	0
1	1	1	1	0
0	0	1	0	1
0	1	1	0	1
1	0	1	0	1
1	1	0	0	1

- Overview of switching states with shared control via SBC.

Control signals		SBM signal	Brake control monitoring function	
DB00 (inverter)	SBC (CS..A)	STATUS	Status	Fault response
-	0	0	0	0
-	1	1	1	0
-	0	1	0	1
-	1	0	0	1

Monitoring of the switching frequency

The evaluation of the switching frequency occurs separately for each of the two STATUS signals.

- Overview of the switching states in continuous duty

Switching frequency STATUS signal	Brake control monitoring function Fault response
Size 1:	
≤ 30 switching pulses/2 minutes	0
> 30 switching pulses/2 minutes	1
Size 2:	
≤ 15 switching pulses/2 minutes	0
> 15 switching pulses/2 minutes	1

- Overview of switching positions in setup mode or jog mode

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Switching frequency STATUS signal	Brake control monitoring function Fault response
Size 1:	
≤ 30 switching pulses/90 seconds	0
> 30 switching pulses/90 seconds	1
Size 2:	
≤ 15 switching pulses/2 minutes	0
> 15 switching pulses/2 minutes	1

INFORMATION

If the permitted switching frequency for size 2 in setup mode or jog mode of a maximum of 30 switching pulses/90 seconds is required, you must deactivate the monitoring of the switching frequency.

Fault responses

The following overview shows the programmable fault responses.

INFORMATION

The meaning of the respective fault responses can be found in the documentation for the inverter.

Error message	Description	Index no.	Programmable fault response
Brake control 1 – status	Setting of the response in the event of fault detection in the switching state of the STATUS signal.	8462.4	• No response • Warning • Application stop (with output stage inhibit)
Brake control 1 – switching frequency	Setting of the response in the event that the maximum permitted switching frequency is exceeded.	8462.5	• No response • Warning • Application stop (with output stage inhibit)
Brake control 2 – status	Setting of the response in the event of fault detection in the switching state of the STATUS signal.	8462.14	• No response • Warning • Application stop (with output stage inhibit)
Brake control 2 – switching frequency	Setting of the response in the event that the maximum permitted switching frequency is exceeded.	8462.15	• No response • Warning • Application stop (with output stage inhibit)

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Fault messages

If the "Brake control" monitoring function detects a fault, this will be displayed by the inverter as follows.

Subfault: 37.1 **Description: Brake control 1 – status**		
	Response: Brake control 1 – status	
	Cause	Measure
	The switching state of the input signal "Brake control 1 – status" differs from the switching state of the brake control (DB 00/SBC).	– Check the connection and function of brake control 1. – Check whether the selected connection is compatible with brake control monitoring. – Check the connection and configuration of the input signal "Brake control 1 – status".

Subfault: 37.2 **Description: Brake control 1 – switching frequency**		
	Response: Brake control 1 – switching frequency	
	Cause	Measure
	Permitted switching frequency of brake control 1 exceeded.	– Check the application. – Check the permitted switching frequency of brake control and the limit value of monitoring.

Subfault: 37.3 **Description: Brake control 2 – status**		
	Response: Brake control 2 – status	
	Cause	Measure
	The switching state of the input signal "Brake control 2 – status" differs from the switching state of the brake control (DB 00/SBC).	– Check the connection and function of brake control 2. – Check whether the selected connection is compatible with brake control monitoring. – Check the connection and configuration of the input signal "Brake control 2 – status".

Subfault: 37.4 **Description: Brake control 2 – switching frequency**		
	Response: Brake control 2 – switching frequency	
	Cause	Measure
	Permitted switching frequency of brake control 2 exceeded.	– Check the application. – Check the permitted switching frequency of brake control and the limit value of monitoring.

Fault reset

A fault message/fault response can be reset via the "Fault reset" function (Index 8365.6, Bit 0).

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10 Response times

Response times play a decisive role in the design and execution of safety functions for systems and machines. To determine the response time of a safety function, you must always take the entire system – from the sensor (command device) to the actuator – into account. In the context of a brake module, the following response times are particularly significant:

- Connected sensors
- Communication/F-communication (cycle time, watchdog)
- Processing time of safety relay
- Safe brake module
- Switching time of brake

Establish the response sequence for the safety function with the brake module and determine the maximum response time considering the relevant manufacturer data. In particular, observe the information in the documentation for the used components.

For detailed information on the response times, refer to the "Technical data" (→ 🗎 79) chapter.

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11 Service

11.1 Modification/changes to the device

It is not permitted to make any modifications or changes to the device. If required, contact SEW-EURODRIVE Service.

INFORMATION

The safety certification and any right to claim under warranty from SEW-EURODRIVE become void if the user modifies the device (e.g. replacing components, welding parts).

11.2 Electronics Service by SEW-EURODRIVE

If you are unable to rectify a fault, contact SEW-EURODRIVE Service. For the addresses, refer to www.sew-eurodrive.com.

When contacting SEW-EURODRIVE Service, always specify the following information so that our service personnel can assist you more effectively:

- Information on the device type on the nameplate (e.g. type designation, serial number, part number, product key, purchase order number)
- Brief description of the application
- Fault message on the status display
- Nature of the fault
- Accompanying circumstances
- Any unusual events preceding the problem

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11.3 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Magnets
- Aluminum
- Copper
- Electronic parts
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately:

- Oil and grease

  Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.
- Screens
- Capacitors

Waste disposal according to WEEE Directive 2012/19/EU

This product and its accessories may fall within the scope of the country-specific application of the WEEE Directive. Dispose of the product and its accessories according to the national regulations of your country.

For further information, contact the responsible SEW-EURODRIVE branch or an authorized partner of SEW-EURODRIVE.

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11.4 Device replacement

Before replacing the device, compare the data on the nameplate of the previous brake module with the nameplate data of the new brake module. The type designation must be the same on both devices.

To replace a brake module, proceed as follows:

- Switch off the voltage supply U_Z.
- **⚠ DANGER!**
  Following disconnection of the voltage supply U_Z, the DC link on the inverter can still carry dangerous voltages due to charged capacitors or energy storage devices.

  Death or severe injuries due to electric shock.

  – Secure the disconnected voltage supply U_Z against unintentional reconnection.
  – Check that no voltage is applied to the terminals of the brake module **before commencing work**.
  – Wait at least 10 minutes before commencing work.
  – If there is an energy storage unit in the voltage supply U_Z, observe the operating instructions of the energy storage unit and adhere to the wait time before discharging the energy storage unit.
- **⚠ CAUTION!**
  The surfaces of the brake module can become very hot during operation.

  Risk of burns.

  – Allow the brake module to cool before commencing work.
- First, release the X4 plug connector via the laterally offset lock slides and then disconnect it. Disconnect the X20 plug connector.
- Loosen the PE connection and the shield terminals. Disconnect the individual connection cables.
- Remove the brake module to be replaced. Observe the information in chapter "Mechanical installation" (→ 🗎 30).
- Fit the new brake module. Observe the information in chapter "Mechanical installation" (→ 🗎 30).
- Reconnect the individual connection cables of the shield terminals and the PE connection.
- Reconnect the X4 plug connector so that the clip latch engages. Reconnect the X20 plug connector.
- Carry out a functional check.

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12 Technical data

12.1 Marks

12.1.1 Basic device

According to the nameplate, the SBM safe brake module complies with the following regulations and directives:

Mark	Definition
CE	The CE mark indicates compliance with the following European directives: • Low Voltage Directive 2014/35/EU • EMC Directive 2014/30/EU • Machinery Directive 2006/42/EC • Directive 2011/65/EU for limiting the use of certain hazardous substances in electrical and electronic equipment
	The waste disposal of this product is performed in compliance with the WEEE Directive 2012/19/EU.
EAC	The EAC mark states compliance with the requirements of the technical regulations of the Customs Union (Eurasian Economic Union), Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia.
	The RCM mark declares compliance with the technical regulations of the Australian Communications and Media Authority (ACMA).
	The China RoHS mark states compliance with Directive SJ/T 11364-2014 for limiting the use of hazardous substances in electric and electronic equipment and their packaging.
c UL us LISTED	The UL and cUL marks state UL approval. cUL is equivalent to CSA approval.
UK CA	The UKCA mark states compliance with the following British directives[1)] • Low Voltage Directive S.I. 2016/1101[2)] • EMC S. I. 2016/1091 • Machinery Safety S. I. 2008/1597 • Directive S. I. 2012/3032 for limiting the use of certain hazardous substances in electrical and electronic equipment • Ecodesign Regulation S. I. 2019/539

1) The selectable approvals UKCA (Great Britain) and NM (Morocco) are mutually exclusive.

2) For products with functional safety, the requirements from the Low Voltage Directive are fulfilled by the Machinery Safety S.I. 2008/1597.

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12.2 General technical data

	SBM S-..-..-00, all sizes
Ambient storage temperature	≥ -25 °C to ≤ +70 °C Non-condensing; no moisture condensation
Ambient temperature during operation	≥ 0 °C to ≤ +60 °C Non-condensing; no moisture condensation
Climate class	EN 60721-3-3, class 3K3
Installation altitude	• Up to h ≤ 1000 m above sea level without restrictions • At h ≥ 1000 m above sea level, the following restrictions apply: – The brake module must be handled as an auxiliary device and thus as a system component of the inverter that is used. The restrictions of the inverter that is used must be observed and implemented. – Maximum ambient temperature during operation: +45 °C – Maximum installation altitude: 3800 m above sea level
Degree of protection	IP20
Overvoltage category	2 according to IEC 60664-1
Pollution class	II according to IEC 60664-1
Interference immunity	Meets EN 61800-3, 2nd environment
Interference emission with EMC-compliant installation	Limit value category C2 acc. to EN 61800-3
Mounting	Installation in control cabinet: • Via the device base plate • With optional "mounting base" accessory • With optional "DIN rail adapter" accessory
Dimensions	See "Dimension drawings" chapter
Mass	• Size 1: 0.9 kg • Size 2: 1.4 kg

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12.3 Voltage supply (X4:U_Z)

12.3.1 Size 1

	SBM S-..-120-00
Voltage supply U_Z	DC 450 V – 800 V (briefly up to DC 970 V) (from DC 250 V with output power < 60 W)
Nominal power consumption	132 W (briefly up to 1000 W/300 ms)
Connection	Push-in connection technology
Cable cross section	0.75 mm^2 – 6 mm^2
Permitted cable length	5 m (note specifications in chapter "Connection of the voltage supply to the brake module (X4)")

12.3.2 Size 2

	SBM S-..-250-00
Voltage supply U_Z	DC 450 V – 800 V (briefly up to DC 970 V) (from DC 250 V with output power < 60 W)
Nominal power consumption	275 W (briefly up to 2000 W/400 ms)
Connection	Push-in connection technology
Cable cross section	0.75 mm^2 – 6 mm^2
Permitted cable length	5 m (note specifications in chapter "Connection of the voltage supply to the brake module (X4)")

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12.4 Brake output (X14:13/14/15)

12.4.1 Size 1

	SBM S-230-120-00	SBM S-400-120-00	SBM S-460-120-00
Nominal output voltage U_N (rated range) (terminal 13/15)	AC 230 V / DC 94 V (DC 90 V – 98 V)	AC 400 V / DC 165 V (DC 158 V – 170 V)	AC 460 V / DC 188 V (DC 181 V – 194 V)
Nominal output current I_N (terminal 13/15)	DC 1.28 A	DC 0.73 A	DC 0.62 A
Acceleration current I_B (terminal 13/14)	Depending on brake type: 4 – 8.5 times the holding current of the brake		
Minimum output current for wire break monitoring (I_H and I_B)	DC 40 mA		
Overcurrent shut-off	In holding operation (I_H): DC 2 A During acceleration (I_B): DC 10 A		
Nominal output power P_A	120 W		
Nominal power loss P_V	12 W		
Connection	Push-in connection technology		
Cable cross section	0.75 mm^2 – 2.5 mm^2		
Permitted cable length	200 m		

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12.4.2 Size 2

	SBM S-230-250-00	SBM S-400-250-00	SBM S-460-250-00
Nominal output voltage U_N (rated range) (terminal 13/15)	AC 230 V / DC 94 V (DC 90 V – 98 V)	AC 400 V / DC 165 V (DC 158 V – 170 V)	AC 460 V / DC 188 V (DC 181 V – 194 V)
Nominal output current I_N (terminal 13/15)	DC 2.66 A	DC 1.52 A	DC 1.33 A
Acceleration current I_B (terminal 13/14)	Depending on brake type: 4 – 8.5 times the holding current of the brake		
Minimum output current for wire break monitoring (I_H and I_B)	DC 80 mA		
Overcurrent shut-off	In holding operation (I_H): DC 4 A During acceleration (I_B): DC 20 A		
Nominal output power P_A	250 W		
Nominal power loss P_V	25 W		
Connection	Push-in connection technology		
Cable cross section	0.75 mm^2 – 2.5 mm^2		
Permitted cable length	200 m		

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12.5 Safe digital input SBC (X20:1/2)

The digital input SBC (X20:1/2) is available for all SBM sizes.

INFORMATION

Observe the information regarding test pulses in the chapter "Requirements for safe control".

SBC (X20:1/2)	
Properties	DC 24 V signal level according to EN 61131-2, type 1
Signal level	• Logic "0" = LOW input: DC -6 V to +5 V (< 1.5 mA) • Logic "1" = HIGH input: DC +15 V to +30 V (> 2 mA)
Reference ground	SBC_M
Input current during switch-on	175 mA for 10 ms
Input current	• Operation **without** jumpers between OUT and DB00 LOW: < 1.5 mA HIGH: ≤ 70 mA • Operation **with** jumpers between OUT and DB00 LOW: < 3.0 mA HIGH: ≤ 80 mA When using the digital output STATUS, you must also take its output current into account.
Resistance to PE	> 100 kΩ
Input capacitance with polarity protection diode decoupled	• Operation **without** jumpers between OUT and DB00 < 2.5 µF (typically 1.5 µF) • Operation **with** jumpers between OUT and DB00 < 2.5 µF (typically 1.5 µF) If the capacitance connected to the digital output STATUS is ≥ 50 nF, you must take this into account in addition to the input capacitance at the safe digital input SBC.
Connection	Push-in connection technology
Cable cross section	0.5 mm^2 to 1.5 mm^2
Permitted cable lengths	30 m

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12.6 Digital input DB00 (X20:5/6)

The digital input DB00 (X20:5/6) is available for all SBM sizes.

DB00 (X20:5/6)	
Properties	DC 24 V signal level according to EN 61131-2, type 1
Signal level	• Logic "0" = LOW input: DC -6 V to +5 V (< 1.5 mA) • Logic "1" = HIGH input: DC +15 V to +30 V (> 2 mA)
Reference ground	GND
Input current	LOW: < 1.5 mA HIGH: < 5 mA When using the digital output STATUS, you must take the output current at the digital output STATUS into account in addition to the input current of DB00.
Resistance (to PE)	> 100 kΩ
Input capacitance with polarity protection diode decoupled	≤ 30 nF (typically 20 nF) If the capacitance connected to the digital output STATUS is ≥ 50 nF, you must take this into account in addition to the input capacitance at the digital input DB00.
Connection	Push-in connection technology
Cable cross section	0.5 mm^2 to 1.5 mm^2
Permitted cable lengths	30 m

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12.7 Digital output OUT (X20:3/4)

The digital output OUT (X20:3/4) is available for all SBM sizes. The digital output OUT is only permitted to be used to jumper the control signal on the safe digital input SBC to digital input DB00 (X20:3/6 and X20:4/5). For more information, refer to the chapter "Wiring diagrams".

INFORMATION

Looping the SBC signal (X20:1/2) through the digital output OUT (X20:3/4) to another device is not permitted.

OUT (X20:3/4)	
Properties	DC 24 V signal level according to EN 61131-2, type 1
Signal level	• Logic "0" = LOW input: DC -6 V to +5 V (< 1.5 mA) • Logic "1" = HIGH input: DC +15 V to +30 V (> 2 mA)
Reference ground	OUT_M (= SBC_M)
Resistance to PE	> 100 kΩ
Connection	Push-in connection technology
Cable cross section	0.5 mm^2 to 1.5 mm^2
Permitted cable lengths	0.5 m

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12.8 Digital output STATUS (X20:7)

The digital output STATUS (X20:7) is available for all SBM sizes.

INFORMATION

In the case of a signal source with test pulses at the digital input DB00 or at the safe digital input SBC (with jumpers fitted between OUT and DB00), the pulses are routed to the digital output STATUS. When evaluating the STATUS signal, these test pulses have to be taken into account and, if necessary, filtered. Observe the information in the chapter "Requirements for safe control" in this regard.

STATUS (X20:7)	
Properties	DC 24 V signal level according to EN 61131-2, type 3
Signal level	• Logic "0" = LOW input: DC -3 V to +5 V (< 1.5 mA) • Logic "1" = HIGH input: DC +11 V to +30 V (> 2 mA)
Reference ground	GND
Output current	< 50 mA
Input capacitance	< 1 µF
Connection	Push-in connection technology
Cable cross section	0.5 mm^2 to 1.5 mm^2
Permitted cable lengths	30 m

12.9 Response time until brake release

The response time for releasing the brake via the safe digital input SBC or the digital input DB00 is made up of the sum of the following times:

- Response time of brake module
- Switching time of brake

Brake module response time		Switching time of brake
Time from connection of the DC 24 V voltage at the safe digital input SBC or digital input DB00 until connection of the brake voltage.	≤ 20 ms	• SEW-EURODRIVE brakes with two-coil system (3-wire technology): Use the brake reaction time $t_{1,II}$ for high-speed excitation. The times are provided in the documentation for the brake. • Brakes with single-coil system (2-wire technology): Use the brake reaction time specified in the documentation for the brake.

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12.10 Response time until brake application

The response time for applying the brake via the digital input DB00 or the safe digital input SBC is made up of the sum of the following times:

- Response time of brake module
- Switching time of brake

Brake module response time		Switching time of brake
Duration from disconnection of the DC 24 V voltage at the digital input DB00 or the safe digital input SBC until disconnection of the brake voltage.	≤ 10 ms	• SEW-EURODRIVE brakes with two-coil system (3-wire technology): – To configure the braking distance with functional control, you can use the switching times of the brake $t_{2,II}$ for cut-off in the DC and AC circuit. – To evaluate the overall system, use the brake application time $t_{2,I}$ for cut-off in the AC circuit to configure the braking distance with safe control via SBC. The switching times are provided in the documentation for the brake. • Brakes with single-coil system (2-wire technology): Use the brake application time specified in the documentation for the brake.

12.11 Response time of digital output STATUS

- Control of the brake module via 1 control cable (with 2 jumpers between X20:3/6 and X20:4/5):

  Following control of the safe digital input SBC, a wait time of at least 50 ms is required before the status at the digital output STATUS can be evaluated.
- Control of the brake module via 2 control cables (without jumpers):

  Following control of the digital input DB00, a wait time of at least 50 ms is required before the status at the digital output STATUS can be evaluated.

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12.12 Characteristic safety values

The characteristic safety values apply to all sizes of the SBM safe brake module.

	Characteristic values according to EN ISO 13849-1
Classification	PL d
System structure	Category 3
Probability of dangerous failure per hour (PFH_D value)	0 (fault exclusion)
Mission time/service life	20 years
Safe state	The electrical power supply to the brake is interrupted.
Safety sub-function	Safe disconnection of the power supply to the brake.

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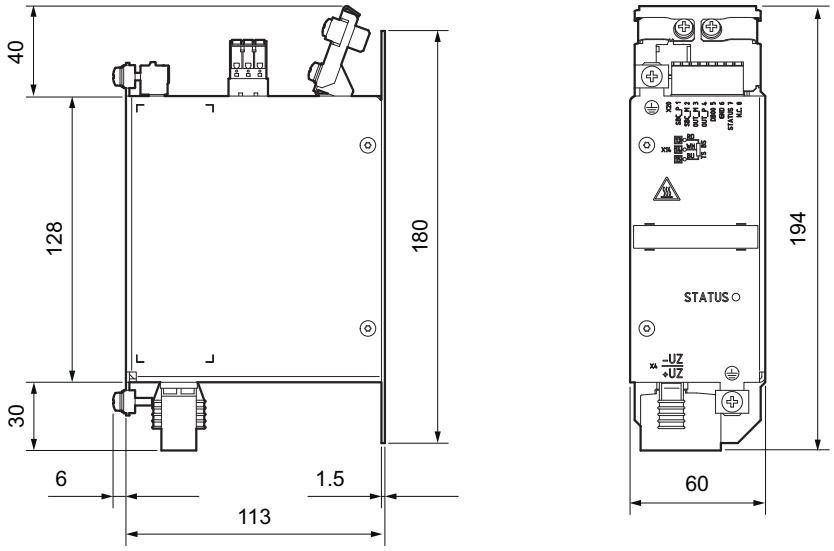
12.13 Dimension drawings

12.13.1 Dimension drawing of safe brake module SBM, size 1

Dimensions in mm.



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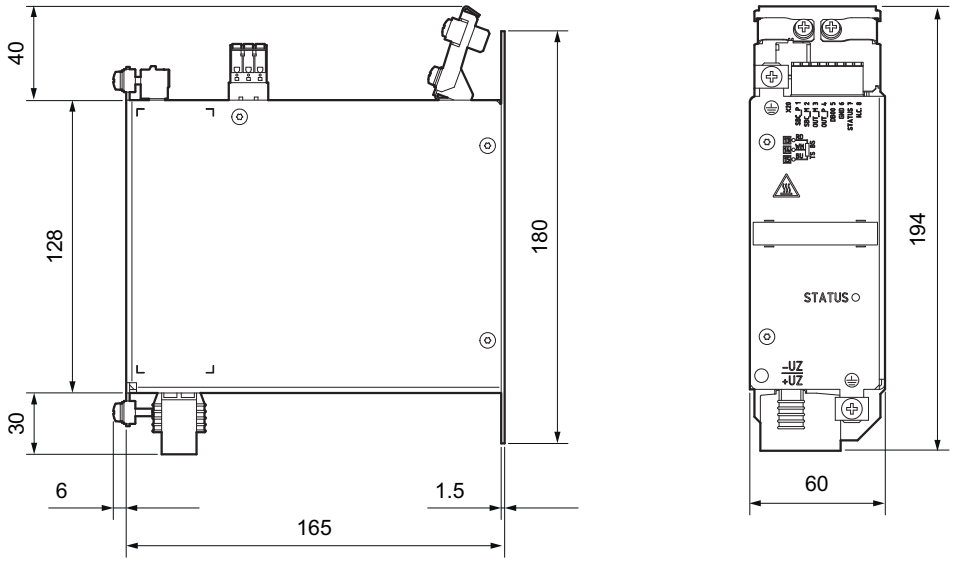
12.13.2 Dimension drawing of safe brake module SBM, size 2

Dimensions in mm.



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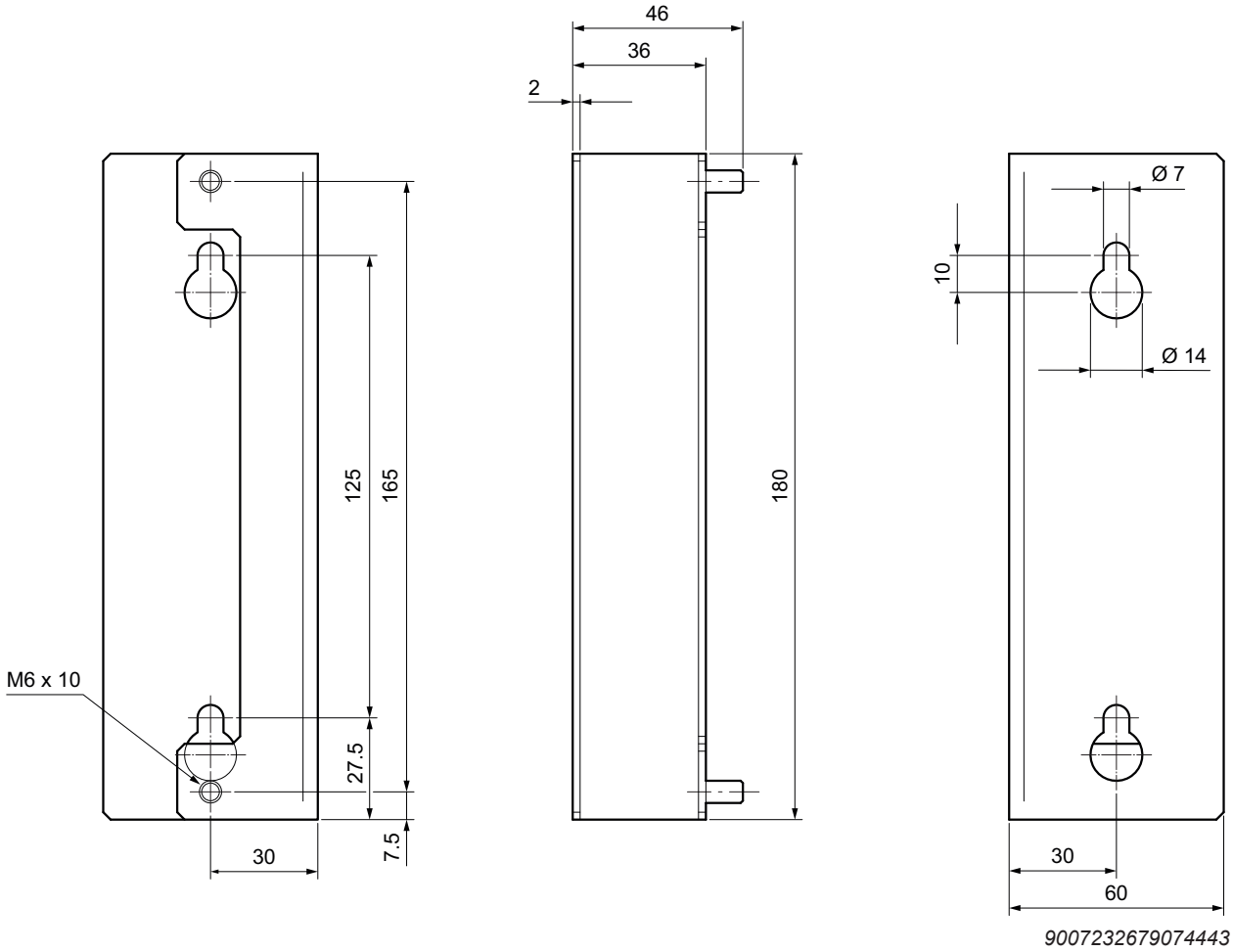
12.13.3 Dimension drawing of mounting base accessory

Dimensions in mm.



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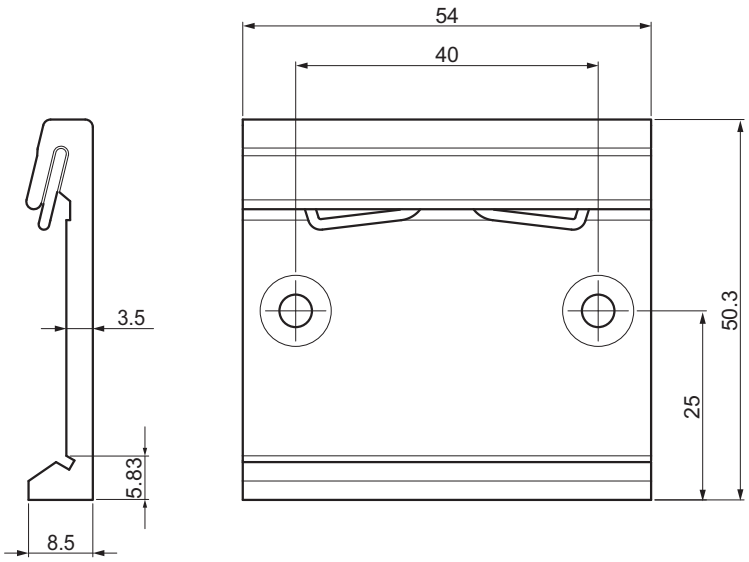
12.13.4 Dimension drawing of DIN rail adapter accessory

Dimensions in mm.



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13 Contacting SEW-EURODRIVE

You can find the worldwide contact data and locations on the **SEW-EURODRIVE website** via the following link or the QR code shown below.

https://www.sew-eurodrive.de/contacts-worldwide

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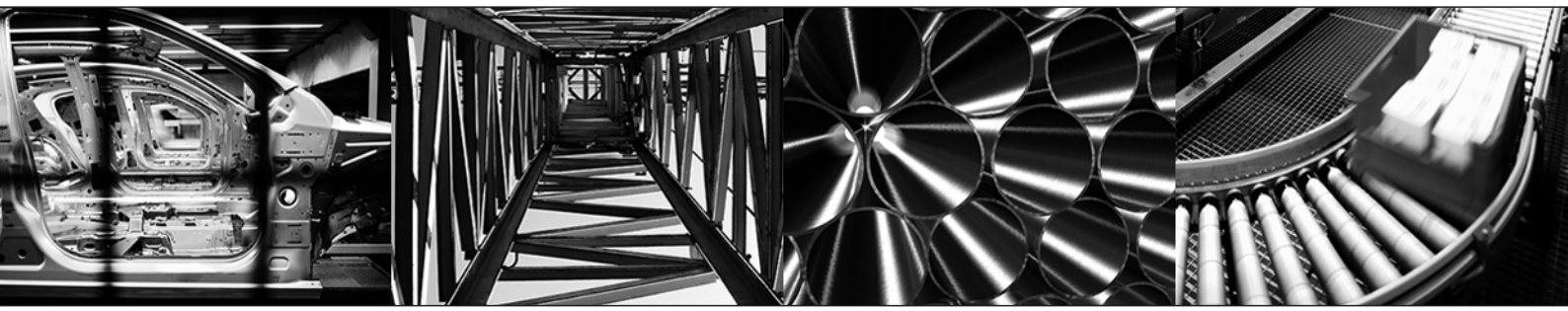

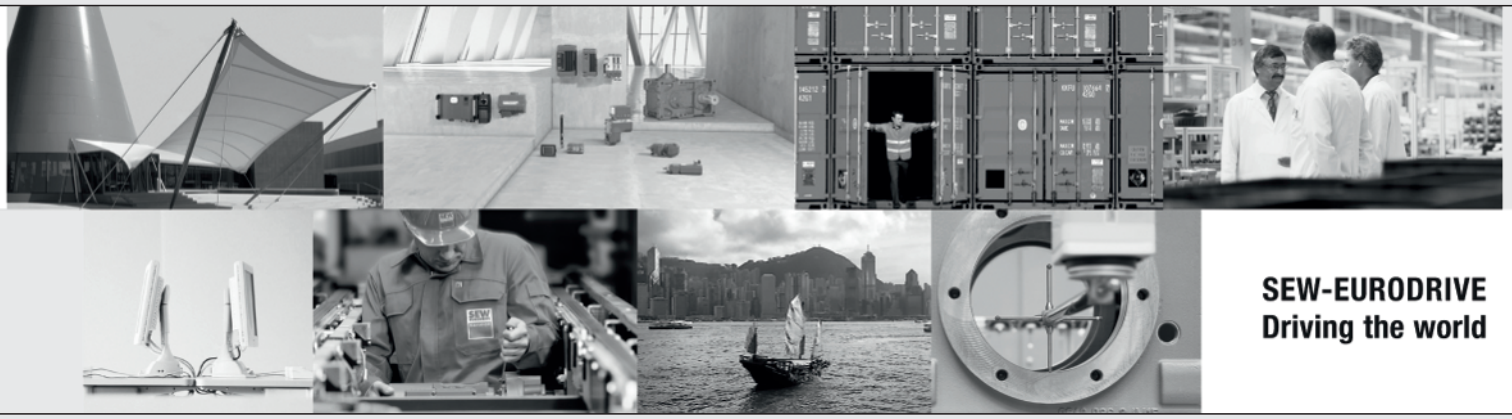

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