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Instruction handbook

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be in motion be in motion

BAUMÜLLER

b maXX 5000

BM5000, BM5100
Mains rectifier/
Active mains rectifier

BM5300
Axis units safety

E	5.09021.19

Read the Instruction handbook before starting any work!

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1

GENERAL

1.1 Information on the instruction handbook

These instruction handbook provides important information on handling the device. A prerequisite for safe work is compliance with all specified safety notes and procedural instructions.

Additionally, the valid accident prevention regulations and general safety regulations applicable to the scope of application the device must be complied with.

Read the instruction handbook, particularly the safety notes chapter, completely before beginning any work on the device. The instruction handbook is part of the product and must be kept accessible to personnel at all times in the immediate vicinity of the device.

1.2 Key to symbols

Warning notes

Warning notes are identified by symbols in these instruction handbook. The notes are introduced by signal words that express the extent of the danger.

It is imperative that these notes be complied with and are conscientiously regarded in order to prevent accidents, personal injury and material damage.



DANGER!

....points out an immediately dangerous situation that will lead to severe injuries or death if not avoided.



WARNING!

....points out a potentially dangerous situation that could lead to severe injuries or death if not avoided.



CAUTION!

....points out a potentially dangerous situation that could lead to minor or slight injuries if not avoided.



NOTICE!

....points out a potentially dangerous situation that could lead to material damage if not avoided.

Recommendations



NOTE!

....highlights useful tips and recommendations, as well as information for efficient and problem-free use.

1.3 Limitation of liability

All specifications and notes in these instruction handbook were compiled taking into account the applicable standards and regulations, the state of the art and our knowledge and experience of many years.

The manufacturer assumes no liability for damages due to:

- non-compliance with the instruction handbook
- usage for other than the intended purpose
- usage by untrained personnel

The actual scope of delivery can vary in case of optional equipment, laying claim to additional order options, or on account of the latest technical changes to the explanations and representations described herein.

The user bears the responsibility for performing service and initial operation in accordance with the safety regulations of the applicable standards and all other relevant governmental or local regulations concerning the dimensioning and protection of conductors, grounding, disconnectors, overcurrent protection, etc.

The person who carried out the mounting or installation is liable for any damage incurred when assembling or connecting the device.

1.4 Copyright protection

The instruction handbook must be treated confidentially. It is to be used exclusively by personnel who work with the device. The consignment of the instruction handbook to third persons without the written permission of the manufacturer is prohibited.



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NOTE!

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1.5 Other applicable documents

Components of other manufacturers are integrated into the device. For these purchased parts, hazard assessments have been performed by the respective manufacturers. The compliance of the design construction with the applicable European and national regulations has been declared for the components by the respective manufacturers.

1.6 Spare parts



WARNING!

False or flawed spare parts can lead to damage, malfunction or complete failure, thus endangering safety.

Therefore:

- Only use original spare parts of the manufacturer.

Procure spare parts through an authorized dealer or directly from the manufacturer.

Refer to ▹Accessories and spare parts◃ as from page 257.

1.7 Disposal

Insofar as no take-back or disposal agreement has been made, please disassemble units correctly and properly recycle the constituent parts.

Refer to ▹Disposal◃ on page 311.

1.8 Guarantee provisions

The guarantee provisions are stated in a separate document of the sales documents.

The devices described herein may only be operated in accordance with the stipulated methods, procedures and conditions. Anything else not presented here, including the operation of devices in mounted positions, is not permitted and must be cleared with the plant on a case-by-case basis. If the devices are operated in any other manner than as described within these instruction handbook, then all guarantee and warranty rights are rendered null and void.

1.9 Customer service

Our customer service is available to provide you with technical information.

Info on the responsible contact persons is available at all times via telephone, fax, mail or the Internet.

1.10 Terms used

The term „device“ or the item designation BM5XXX are also used in this documentation for the Baumüller product „**b maXX 5000**“. A list of the abbreviations used can be found in ▹Appendix A - Abbreviations◃ as from page 315.

1.11 List of other applicable documents

Instruction handbook

	Doc.-No.	Part No. German	Part No. English
Instruction handbook b maXX 5000, 5100, 5300	5.09021	439682	439682
Instruction handbook b maXX 5500, 5600, 5700	5.13008	446683	446684
Instruction handbook b maXX 5800	5.16027	464134	464136

Parameter manual

	Doc.-No.	Part No. German	Part No. English
Parameter manual b maXX 5000	5.09022	428331	431082
Parameter manual b maXX 5800	5.16029	464134	464135

Instruction handbook safety modules

	Doc.-No.	Part No. German	Part No. English
Safety modules for b maXX 5000 BM5-O-SAF-000/-001	5.09013	428339	432449
Safety modules for b maXX 5000 BM5-O-SAF-002/-003	5.01046	354843	372666

Instruction handbook add-on modules

	Doc.-No.	Part No. German	Part No. English
Add-on module IEE / SIE	5.13030	448189	448190
Add-on module EtherNet/IP	5.16010	483089	483090
Add-on module Modbus	5.19015		

Application handbooks

	Doc.-No.	Part No. German	Part No. English
CANopen, CoE, POWERLINK for b maXX 2500/3000/5000	5.14006	450924	450925
SoE-Slave for b maXX 2500/3000/5000	5.14010	452983	452984
PROFINET IRT device for b maXX 2500/3000/5000	5.15009	456326	456327
Servo pump function V1 for b maXX 5000	5.17002	-	466346

1.11 List of other applicable documents

2

SAFETY

This section provides an overview of all of the important safety aspects for optimum protection of personnel as well as for the safe and problem-free operation.

2.1 Contents of the Instruction handbook

Each person who is tasked with performing work on or with the device must have read and understood the instruction handbook before working with the device. This also applies if the person involved with this kind of device or a similar one, or has been trained by the manufacturer.

2.2 Changes and modifications to the device

In order to prevent hazards and to ensure optimum performance, no changes, additions or modifications may be undertaken on the device that have not been explicitly approved by the manufacturer.

2.3 Usage for the intended purpose

The device is conceived and constructed exclusively for usage compliant with its intended purpose described in these instruction handbook.

The devices of the model series **b maXX 5000** are either mains rectifier or active mains rectifier in combination with axis units with servo controller or decentralized drive solutions BM2500. Devices are also available in graduated design size and performance classes.

The device **b maXX 5000** is used exclusively as a converter for controlling a motor.

A device is considered as being used compliant with its intended purpose if all notes and information of these instruction handbook are adhered to.



WARNING!

Danger arising from usage for an unintended purpose!

Any usage that goes beyond the intended purpose and/or any non-compliant use of the device can lead to dangerous situations.

Therefore:

- Only use the device compliant with its intended purpose.
- Observe all specifications of these instruction handbook.
- Ensure that only qualified personnel work with/on this device.
- When configuring, ensure that the device is always operated within its specifications.
- Mount the device on a wall that can sufficiently bear the load.
- The device must always be operated within a control cabinet.
- Ensure that the power supply complies with the stipulated specifications.
- The device may only be operated in a technically flawless condition.
- Only operate the device in combination with components approved by Baumüller Nürnberg GmbH.
- The device has been developed in such a manner that it fulfills the requirements of the category C3 according to IEC 61800-3:2012.
- The device is not intended to be connected to the public mains. To operate the device in primary surroundings of the category C2/C1 (residential, business and commercial areas, directly on a public low-voltage mains without an intermediate transformer), special measures to reduce the transient emissions (line-internal and radiated) must be provided for and certifiable by the system builder. Otherwise, EMC interference could occur without such additional measures.

2.4 Risk assessment according EU Directive

Earth current

Check the quality of the earth connection:
- before connecting the device to the power supply for the first time and
- within the recommended service intervals

Requirements:

- Cross section of the grounding cable according EN 61800-5-1
- Note the required torque of connection!
- Grounded mounting plate made of metal
- Mains filter, device and shielding of the motor cable are on the same HF potential

Stored electric charge

Do not touch electrically live parts before the discharge time of 15 min runs up, check zero-potential before touching.

Electromagnetic fields

The device causes electromagnetic fields when operating.

Any person with individual device for cardiac assistance (pacemaker, defibrillator) must stay in sufficient distance to the operating device.

Burn injuries

Please note that the surface of the device can heat up considerably.

- Wear safety gloves!

Radiatedemission

The high-frequency electromagnetic fields within the operation environment must not exceed the field strength of the second environment according EN 61800-3.

Internal or external ignition source

Internal or external ignition sources are not allowed within the environment of the devices!

- Use ABC powder for extinguishing a fire!

Gas

Toxic fumes can be released in case of failure.

No flammable fume or dust and no flammable/explosive gases are permitted within the environment of the devices!

In order to avoid damage to persons because of explosions:

- ventilate the area and
- immediate evacuation.

Transportation and mounting

Falling down of the device can cause damage to persons.

Note the weight of the device when selecting the mounting screws!

Select the fastening torques of the mounting screws according the specification of the screw manufacturer!

- Wear safety helmets/shoes!

Mounting

Unprotected hands can be injured at the sharp edges of the device.

- Wear safety gloves!

Unprotected eyes can be injured by thrown up metal particles caused by drilling or making cut-outs.

- Wear safety glasses!

Short-circuit in power cables

In case of a short-circuit high current flows. This current induces a magnetic field in cable loops. The magnetic field can cause failures of the device.

To avoid additional damage in case of a short-circuit in power cables,

- The connection between power supply and device or between device and motor must be laid without loop.

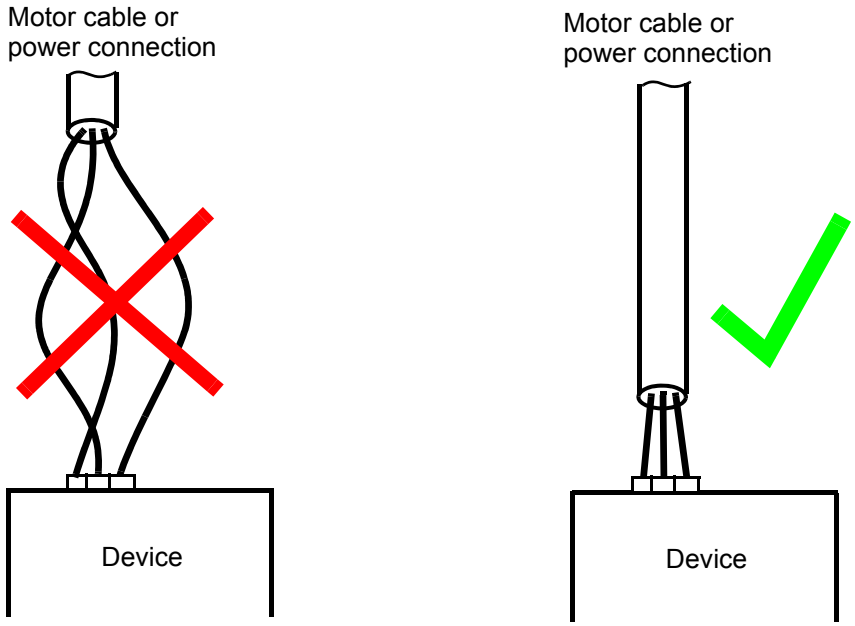


Figure 1: Wiring of the power cables

Installation

If a shielded cable is connected unshielded and this causes failure of the device/danger to persons, the system manufacturer is responsible for.

Brake resistor connection

The dissipation of the heat loss of the external brake resistor must be ensured.

Communication errors

Ensure that a failure of the device will cause no danger to persons.

The safety notes of all further chapters of this documentation need to be carefully observed!

2.5 Responsibility of the operating company

The device is used in commercial areas. Thus, the proprietor of the device is subject to the legal work safety regulations.

Along with the notes on work safety in these instruction handbook, the safety, accident prevention and environmental protection regulations valid for the area of application of this device must be complied with. Whereby:

- The operating company must inform himself about the applicable work health and safety regulations and ascertain, in a hazard assessment, any additional hazards that could arise from the special working conditions in the use area of the device. These must then be implemented in the form of instruction handbook for operation of the device.
- These instruction handbook must be kept accessible to personnel working with the device at all times in the immediate vicinity of the device.
- The specifications of the instruction handbook must be adhered to completely and without exception.
- The device may only be operated in a technically faultless and operationally safe condition.

2.6 Protective devices

IP code	
BM50XX	IP 20
BM517X	IP 20, with a contact-isolated connection in accordance with IP 20, otherwise IP 10.
BM519X	IP 00
BM5323, BM5325	IP 20
BM5326, BM5327, BM5328, BM5331, BM5332, BM5333	IP 10
BM5334, BM5335	IP 20, with a contact-isolated connection in accordance with IP 20, otherwise IP 10.
BM537X	IP 00



DANGER!

Risk of fatal injury from electrical current!

There is an immediate risk of fatal injury if live electrical parts are contacted.

Therefore:

- The device must be in operated inside of a control cabinet that provides protection against direct contact of the devices and at least meets the requirements of EN 61800-5-1, Chapter 4.2.3.3.
- Fault protection according EN 60204-1:2018, section 6.3 is fulfilled by measures of preventing touch voltages.

2.7 Training of the personnel



WARNING!

Risk of injury due to insufficient qualifications!

Improper handling can lead to significant personal injury and material damage.

Therefore:

- Certain activities can only be performed by the persons stated in the respective chapters of these instruction handbook.

In these instruction handbook, the following qualifications are stipulated for various areas of activity:

- **Operating personnel**
  - The drive system may only be operated by persons who have been specially trained, familiarized and authorized.
  - Troubleshooting, maintenance, cleaning, maintenance and replacement may only be performed by trained or familiarized personnel. These persons must be familiar with the instruction handbook and act accordingly.
  - Initial operation and familiarization may only be performed by qualified personnel.

- **Qualified personnel**
  - Electrical engineers authorized by Baumüller Nürnberg GmbH, and qualified electricians of the customer or a third party who have learned to install and maintain Baumüller drive systems and are authorized to ground and identify electrical power circuits and devices in accordance with the safety engineering standards of the company.
  - Qualified personnel have had occupational training or instruction in accordance with the respective locally applicable safety engineering standards for the upkeep and use of appropriate safety equipment.

2.8 Personal protective equipment

The wearing of personal protective equipment is required when working in order to minimize health and safety risks.

- The protective equipment necessary for each respective type of work shall always be worn during work.
- The personal safety signs present in each working area must be observed.



Protective work clothing

should be snug-fitting work clothes, with low tearing resistance, narrow sleeves and with no extending parts. It serves to primarily protect against...

No rings or chains should be worn.



Hard hat

to protect against falling down and flying around objects.



Safety shoes

to protect against heavy objects falling down.



Protective gloves

to protect hands against friction, abrasion, puncturing or more severe injuries, as well as contact with hot objects.

Wear for special work.



Protective eye wear

to protect the eyes against flying around objects and sprayed liquids.

2.9 Special hazards

In the following section, the remaining marginal risks will be stated that have been identified as a result of the hazard analysis.

Observe the safety notes listed here and the warning notes in the further chapters of this Instruction handbook to reduce health risks and dangerous situations.

Electrical current



DANGER!

Risk of fatal injury from electrical current!

There is an immediate risk of fatal injury if live electrical parts are contacted. Damage to the insulation or individual components can be life-threatening.

Therefore:

- Switch off the electrical power immediately in case of damage to the power supply insulation.
- Only allow work on the electrical system to be performed by qualified personnel.
- Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.

Danger from residual energy





DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the rack system = discharge time of the device with the longest DC link discharge time in the rack system.

Refer to ▹Electrical data◃ as from page 60.

Therefore:

- Do not touch electrically live parts before taking into account the discharge time of the capacitors.
- Pay attention to the corresponding notes on the device.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

Moving components



WARNING!

Risk of injury from moving components!

Rotating components and/or components moving linearly can result in severe injury.

Therefore:

- Do not touch moving components during operation.
- Do not open any covering during operation.
- The amount of residual mechanical energy depends on the application. Powered components still turn/move for a certain length of time even after the power supply has been switched off. Ensure that adequate safety measures are taken.

2.10 Fire fighting



DANGER!

Risk of fatal injury from electrical current!

There is a risk of electric shock if an electrically-conductive, fire-extinguishing agent is used.

Therefore:

- Use the following fire-extinguishing agent:



ABC powder / CO_2

2.11 Safety equipment



WARNING!

Risk of fatal injury due to non-functional safety equipment!

Safety equipment provides for the highest level of safety in a facility. Even if safety equipment makes work processes more awkward, under no circumstances may they be circumvented. Safety can only be ensured by intact safety equipment.

Therefore:

- Before starting to work, check whether the safety equipment in good working order and properly installed.

2.12 Conduct in case of danger or accidents

Preventive measures

- Always be prepared for accidents or fire!
- Keep first-aid equipment (e.g. first-aid kits, blankets, etc.) and fire extinguishers readily accessible.
- Familiarize personnel with accident alarm, first aid and rescue equipment.

And if something does happen: respond properly.

- Stop operation of the device immediately with an EMERGENCY Stop.
- Initiate first aid measures.
- Evacuate persons from the danger zone.
- Notify the responsible persons at the scene of operations.
- Alarm medical personnel and/or the fire department.
- Keep access routes clear for rescue vehicles.

2.13 Signs and labels

The following symbols and information signs are located in the working area. They refer to the immediate vicinity in which they are affixed.



WARNING!

Risk of injury due to illegible symbols!

Over the course of time, stickers and symbols on the device can become dirty or otherwise unrecognizable.

Therefore:

- Maintain all safety, warning and operating labels on the device in easily readable condition.



Electrical voltage

Only qualified personnel may work in work areas that identified with this sign.

Unauthorized persons may not touch working materials marked correspondingly.





DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the rack system = discharge time of the device with the longest DC link discharge time in the rack system.

Refer to ▹Electrical data◃ as from page 60.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.



CAUTION!

Risk of injury due to hot surface!

When in operation, the top of the device can heat up to temperatures > 70 °C!

Therefore:

- Wear protective gloves



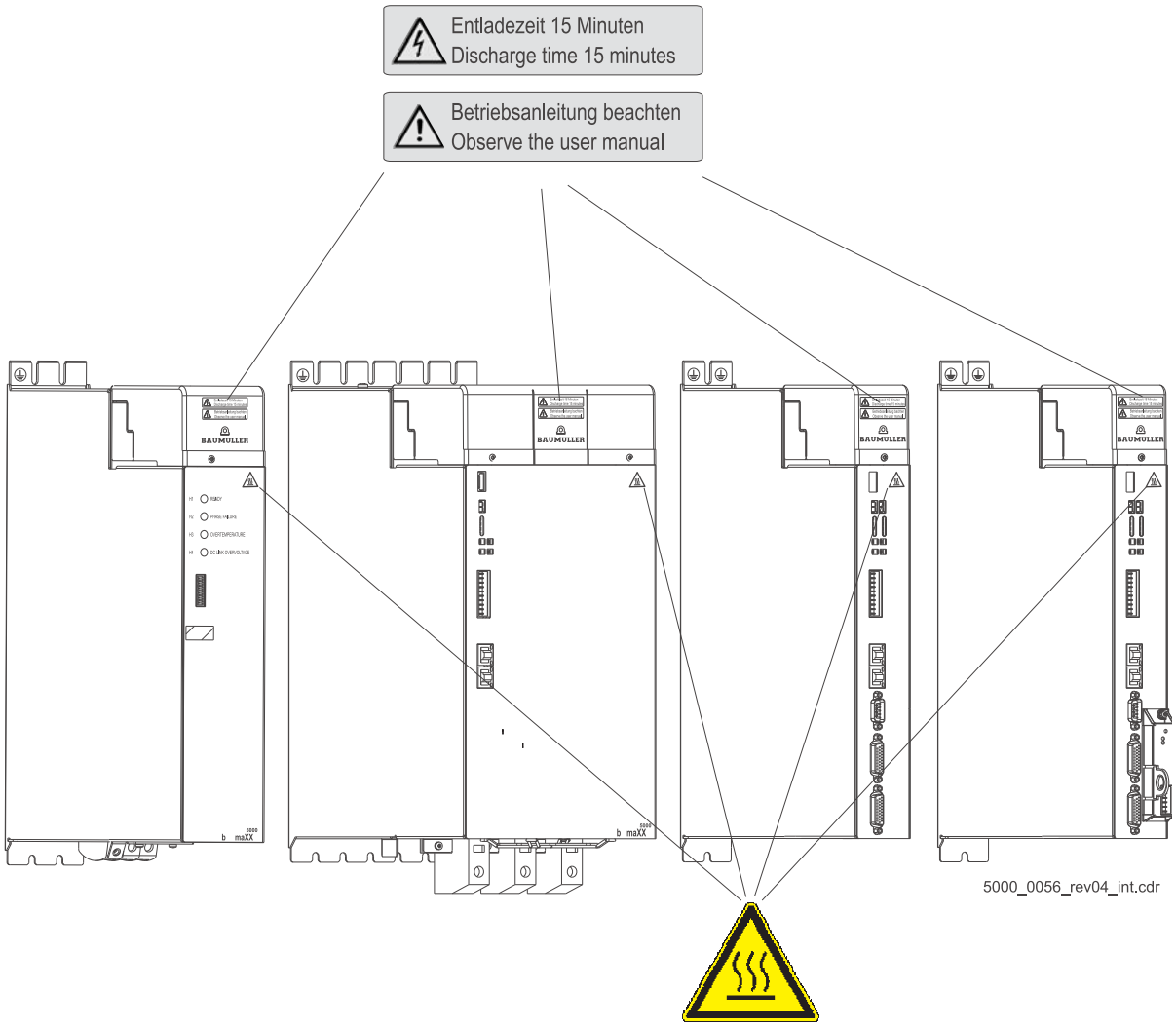


Figure 2: Signs and labels BM5XXX

Signs and labels devices with safety level

NOTE!

Only a device with built in Safety Module SAF XXX, marked with the TÜV Rheinland certification label and the safety label fulfills a certified safety function within the meaning of PL classification according ISO 13849 or SIL according EN 61800.





3

TECHNICAL DATA

3.1 Dimensions

The following drawings show the main dimensions of the devices in millimeters [mm]. The space requirements in the control cabinet are also determined based on these drawings. To make the necessary drill holes/cutout sections, use the drawings in ▹Drilling pattern◃ as from page 117.

3.1.1 BM503X dimensions

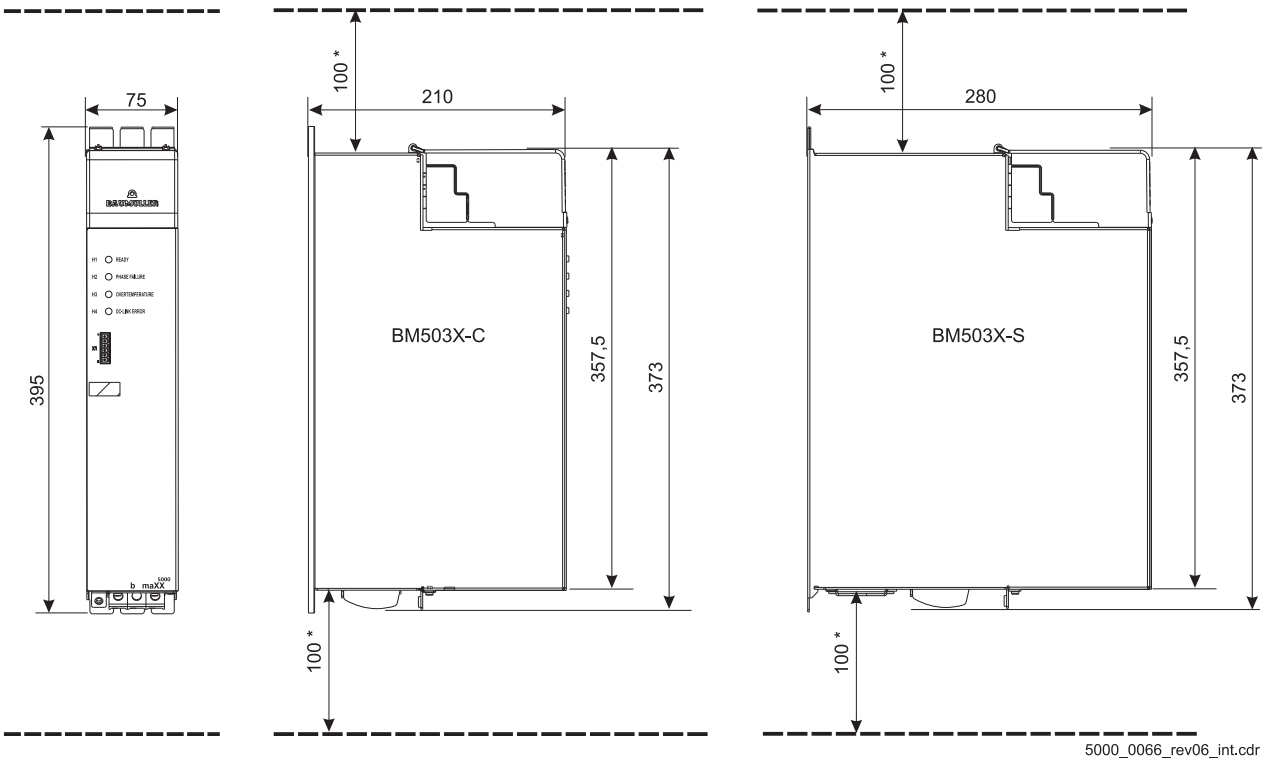


Figure 3: BM503X-C/-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

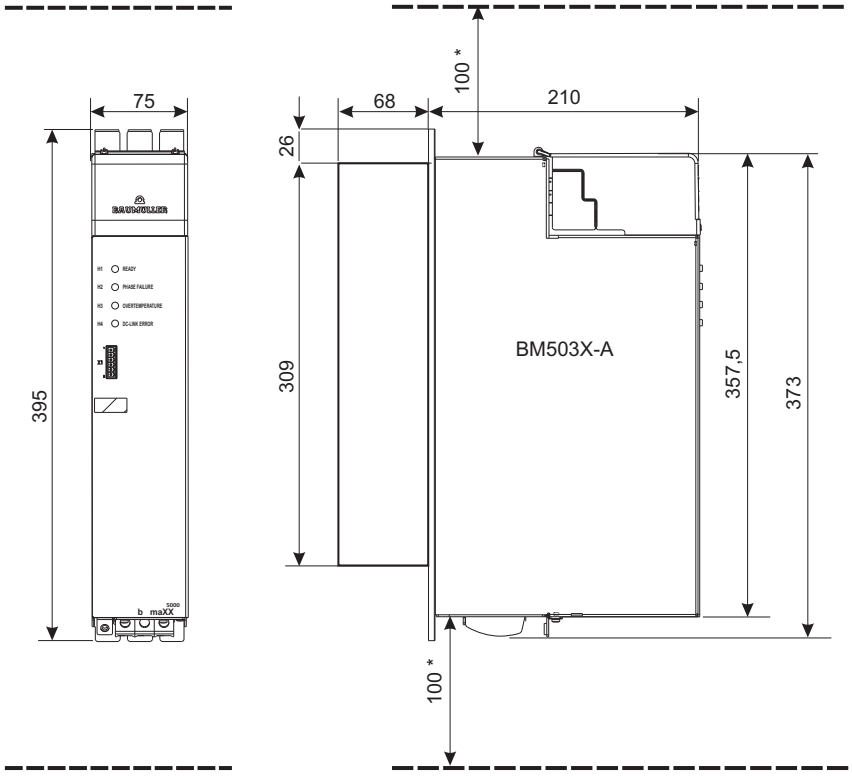


Figure 4: BM503X-A dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

3.1.2 BM504X dimensions

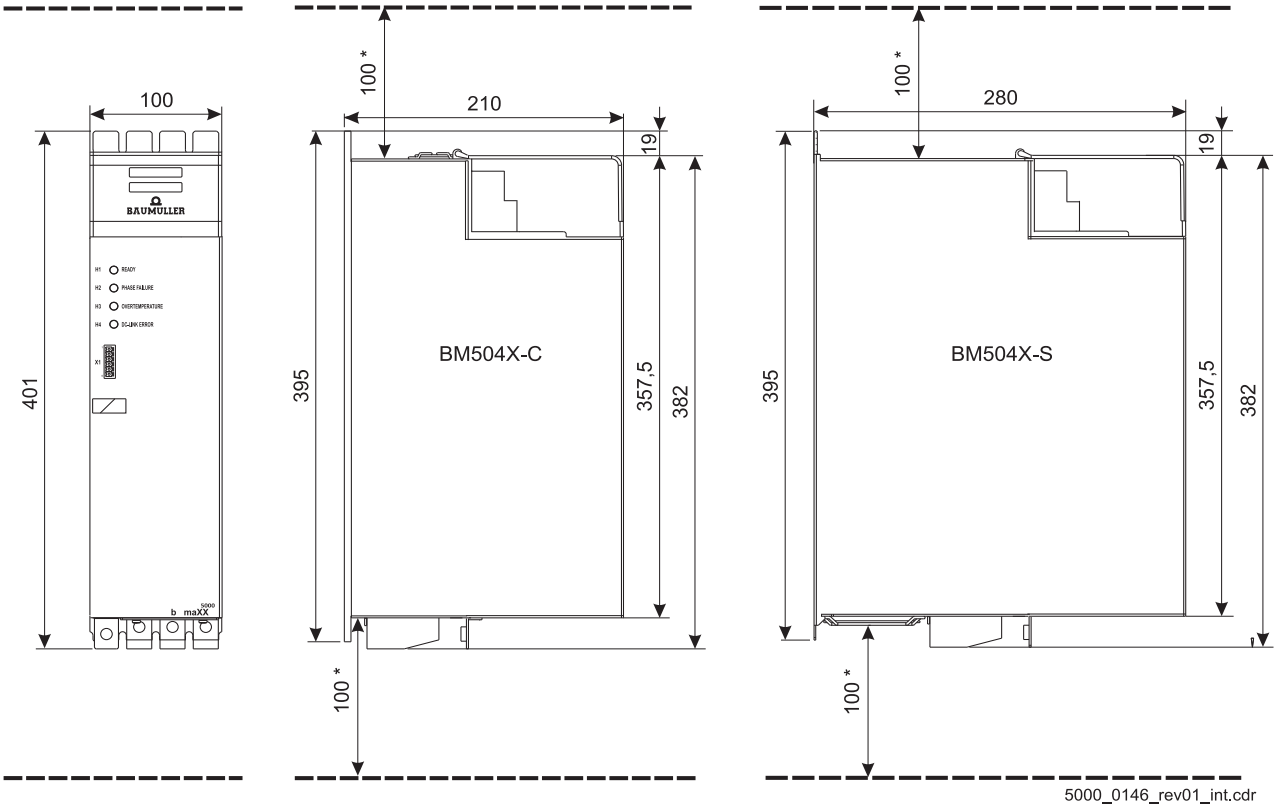


Figure 5: BM504X-C/-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

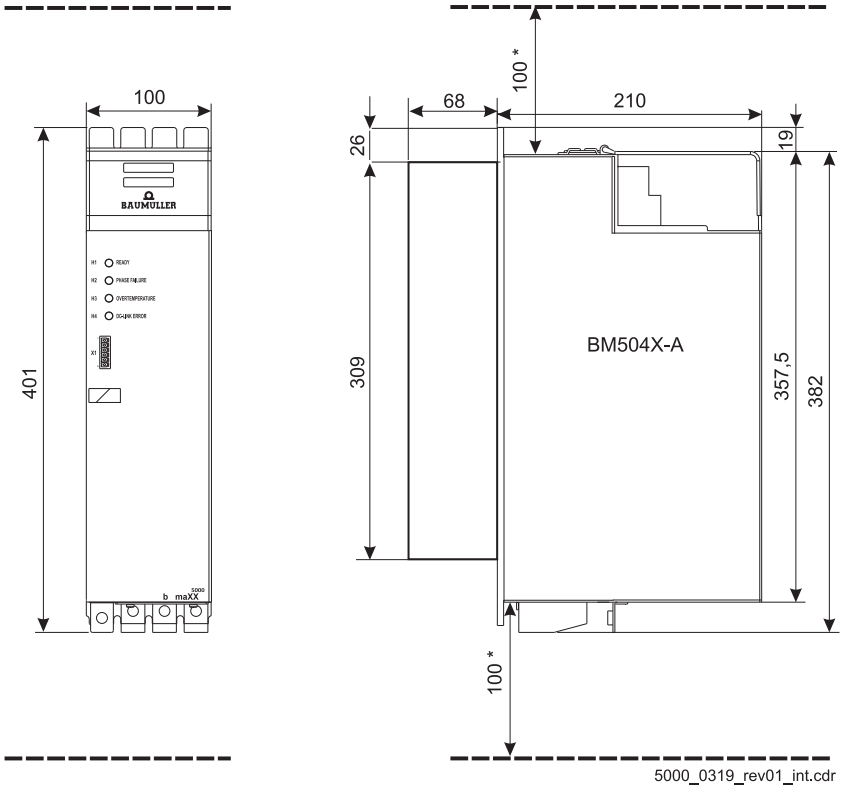


Figure 6: BM504X-A dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

3.1.3 BM507X dimensions

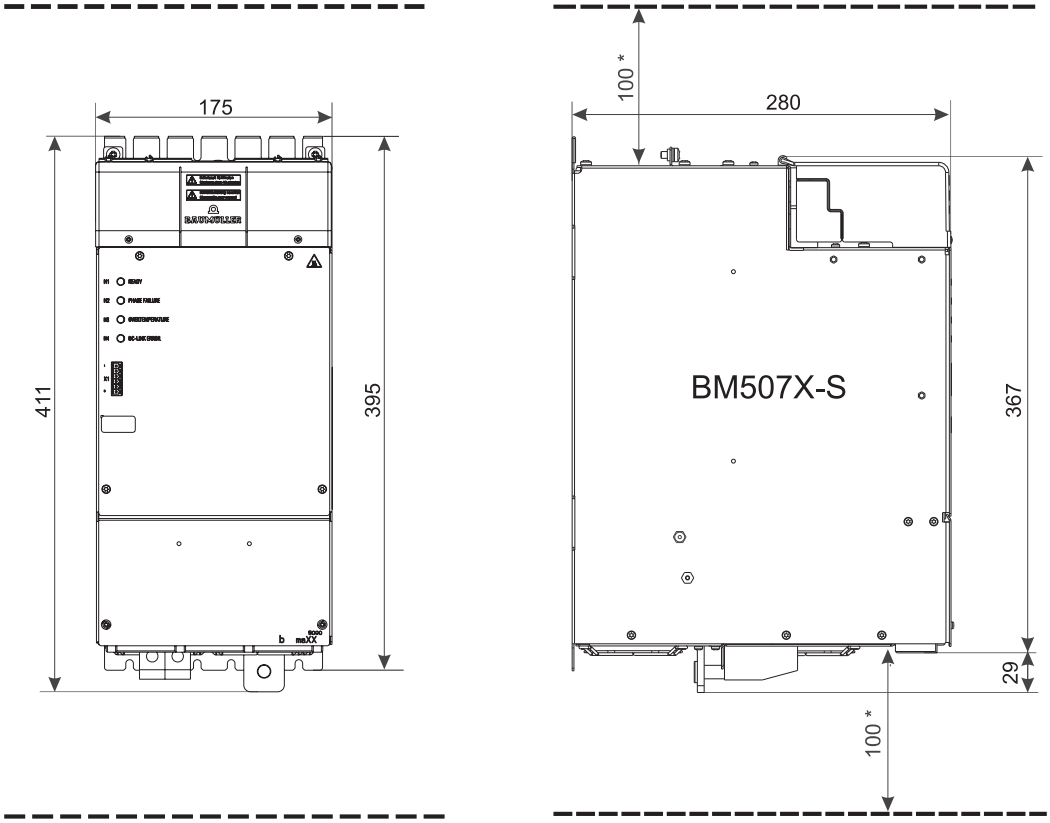
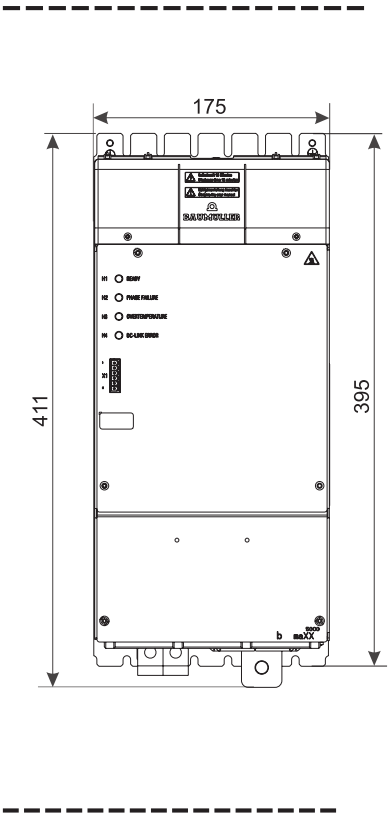


Figure 7: BM504X-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.



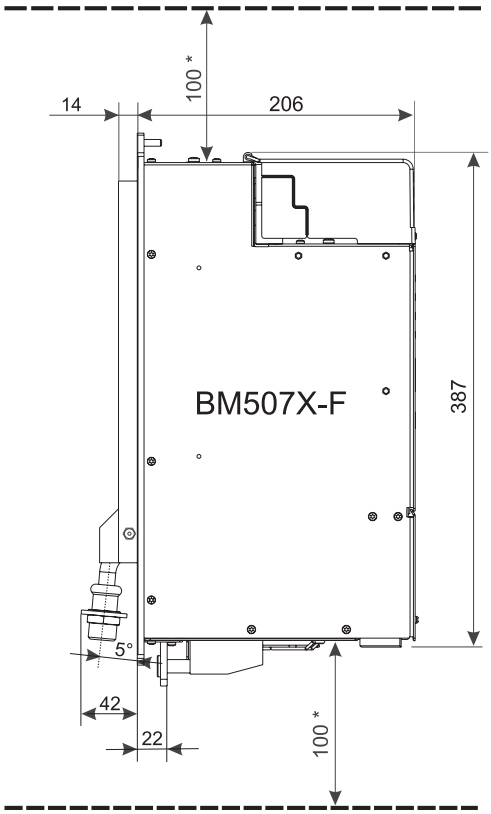
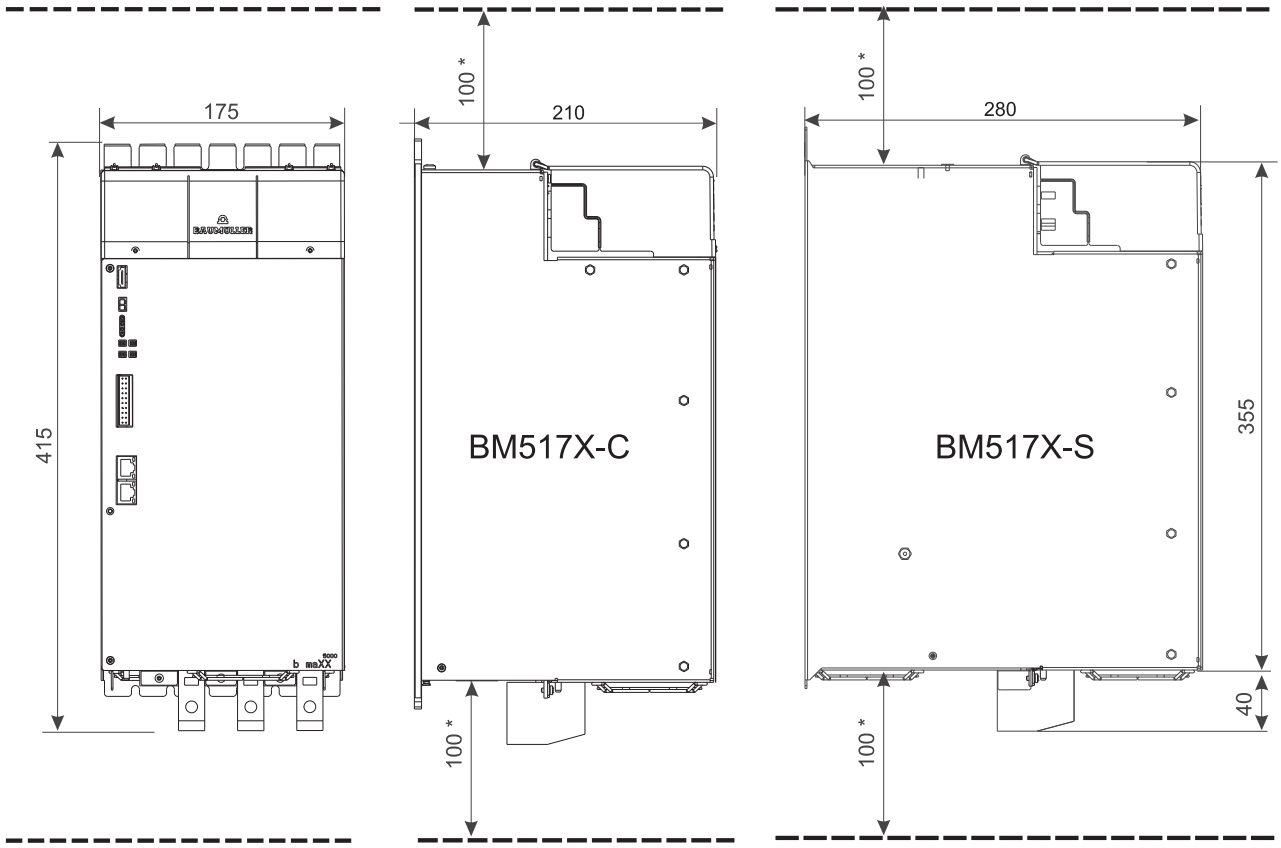


Figure 8: BM504X-F dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

3.1.4 BM517X dimensions



5000_0010_rev06_int.cdr

Figure 9: BM517X-C/-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

3.1.5 BM519X dimensions

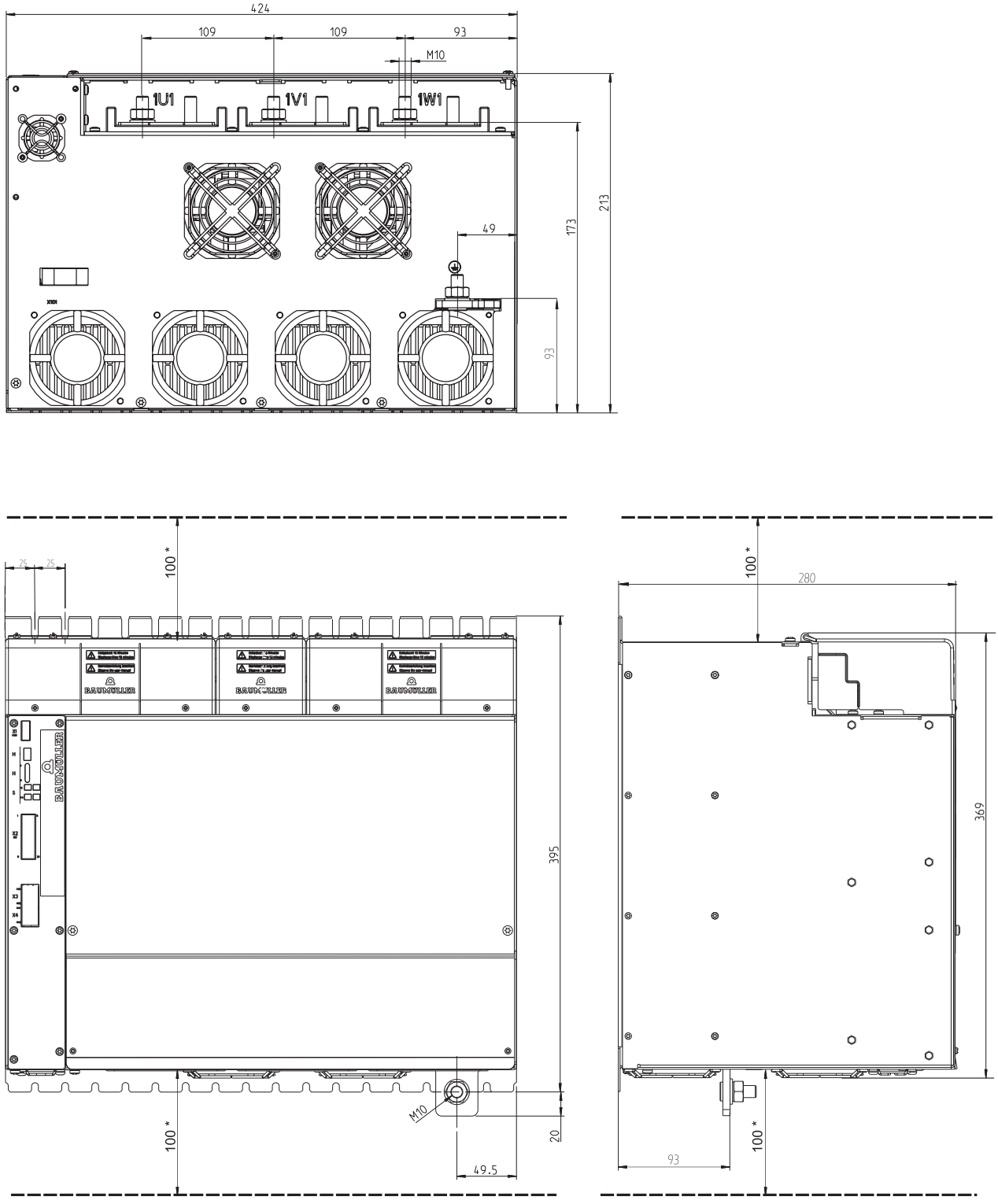


Figure 10: BM519X-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

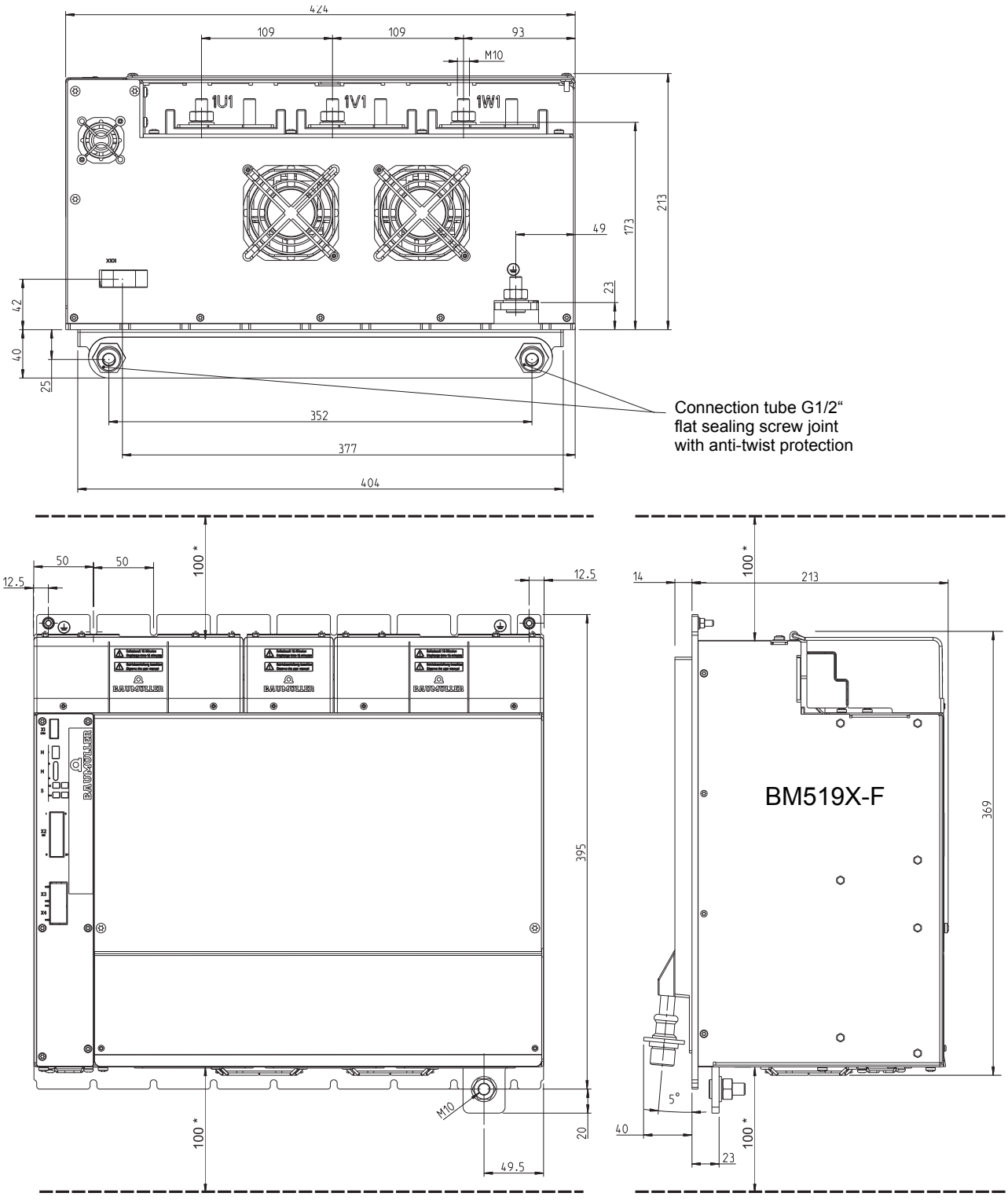


Figure 11: BM519X-F dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

3.1.6 BM53XX dimensions

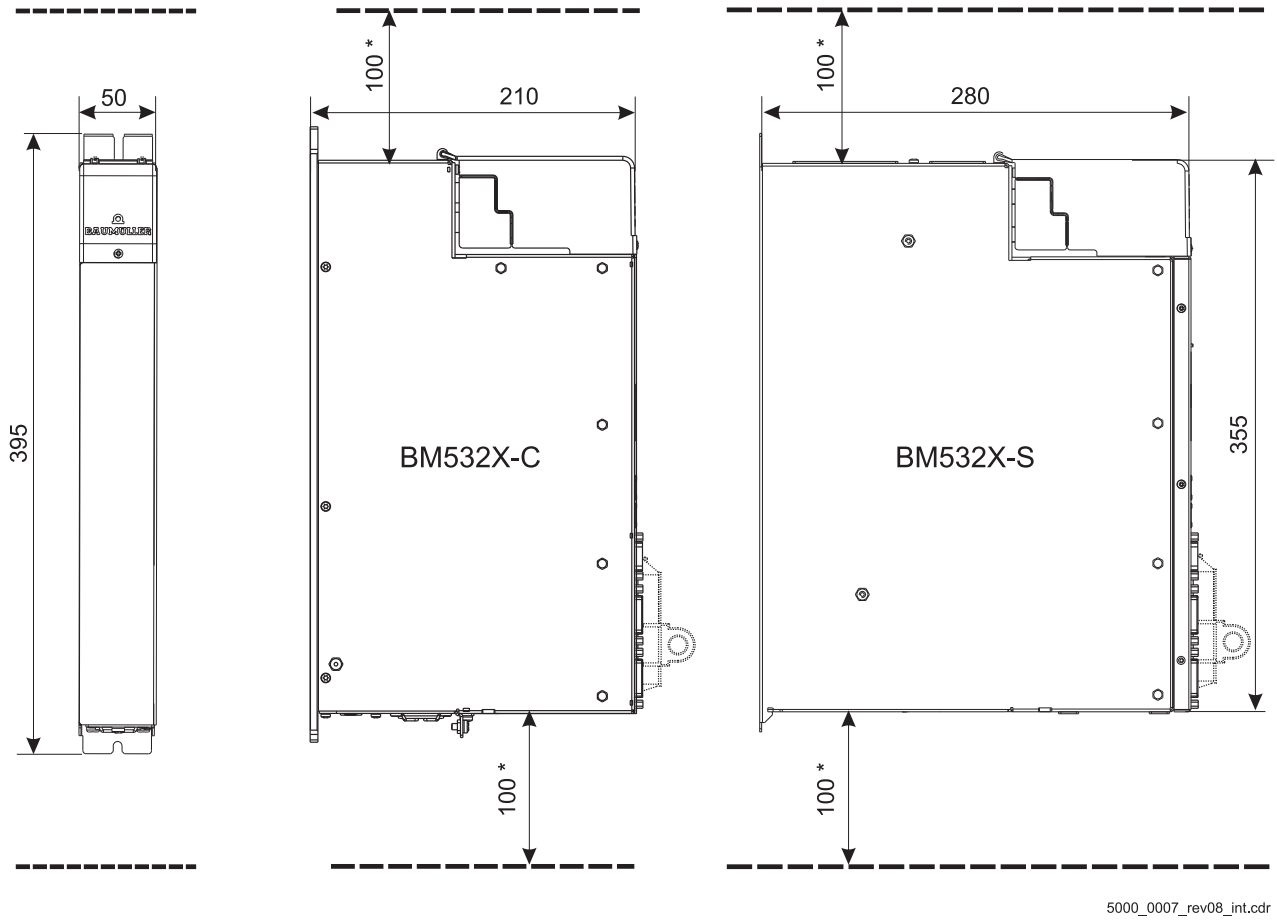


Figure 12: BM532X-C/-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

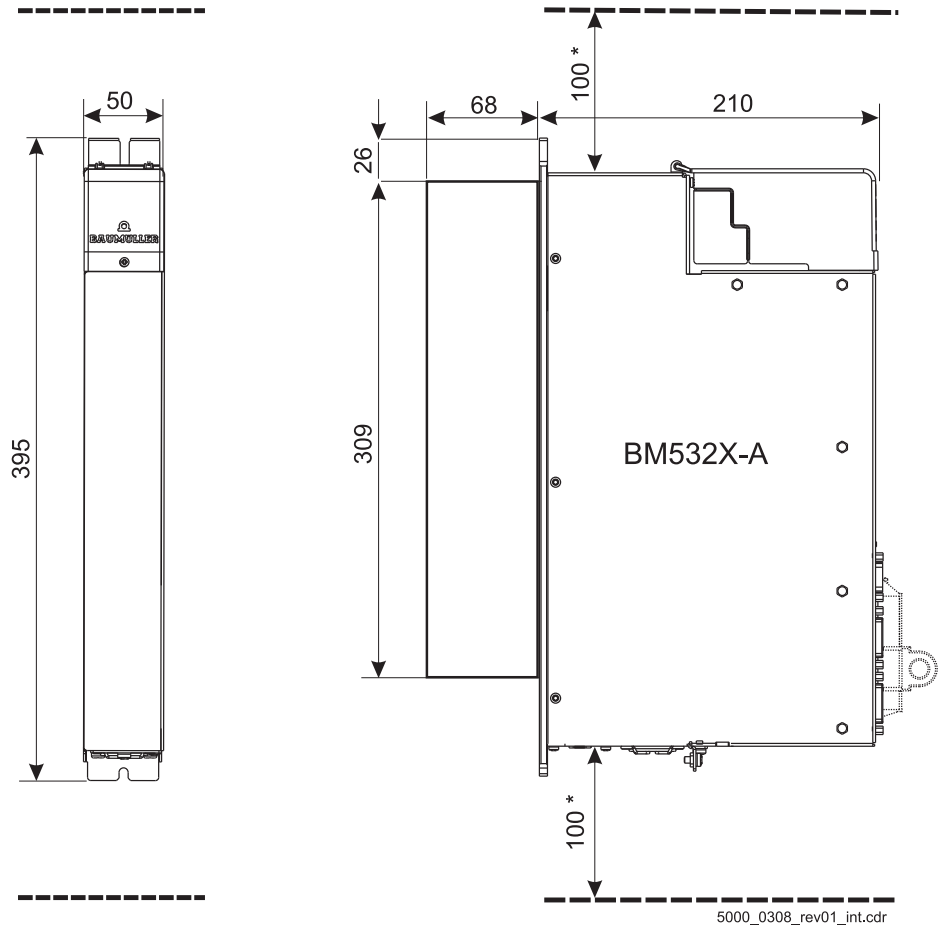


Figure 13: BM532X-A dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

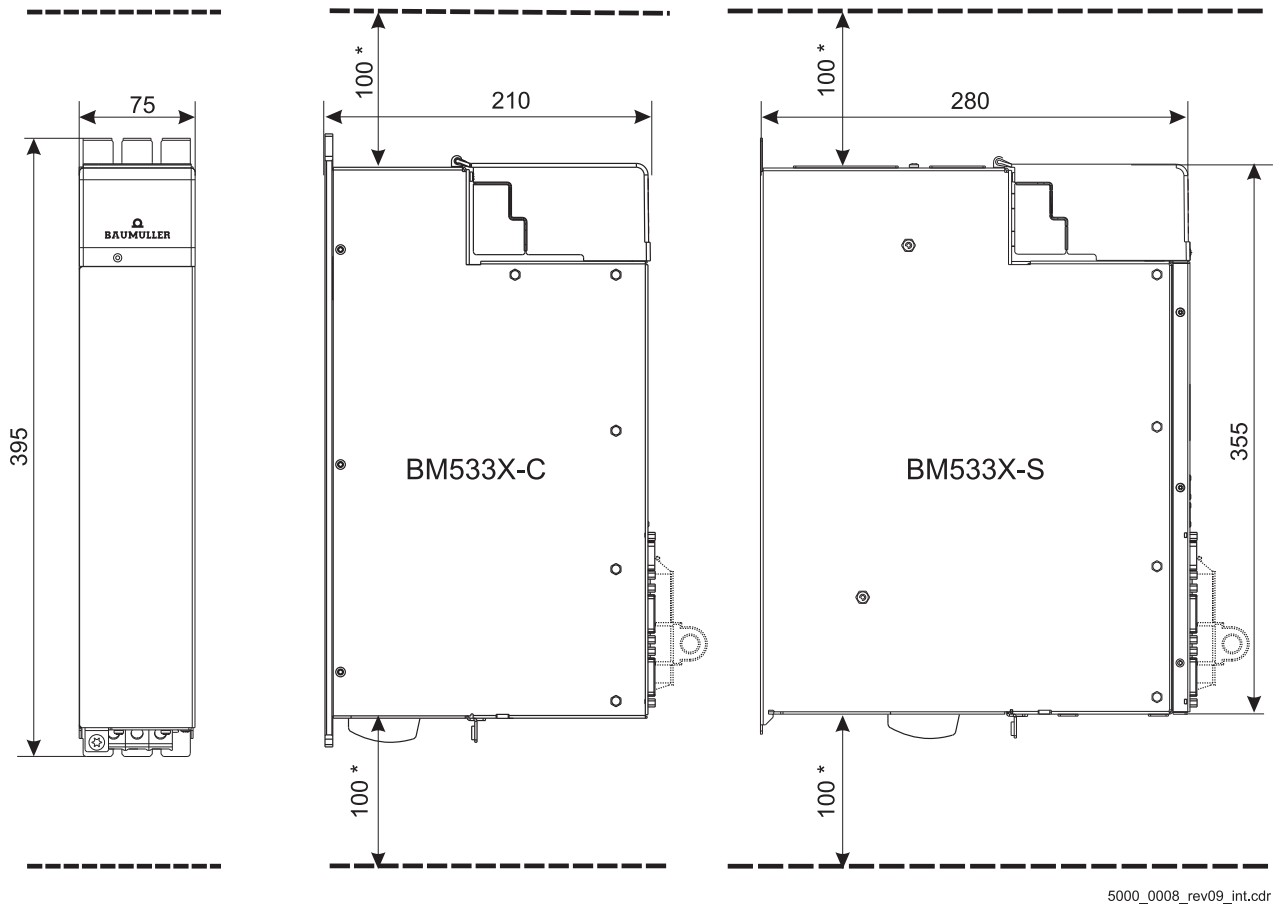


Figure 14: BM533X-C/-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

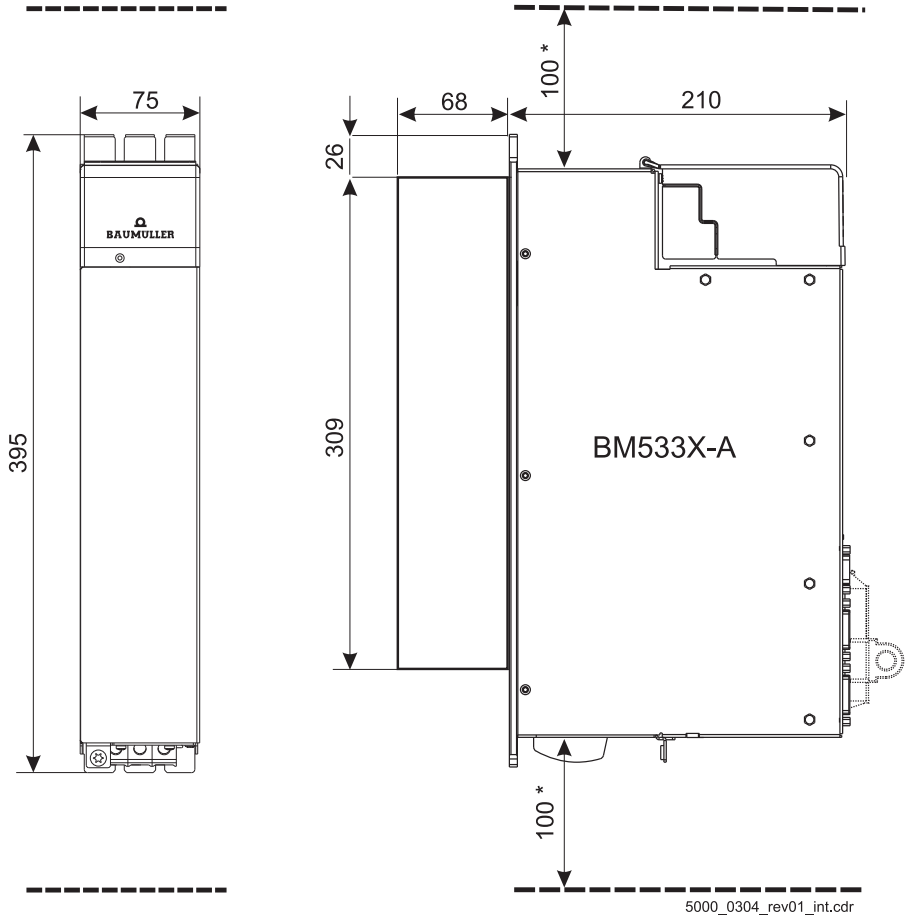


Figure 15: BM533X-A dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

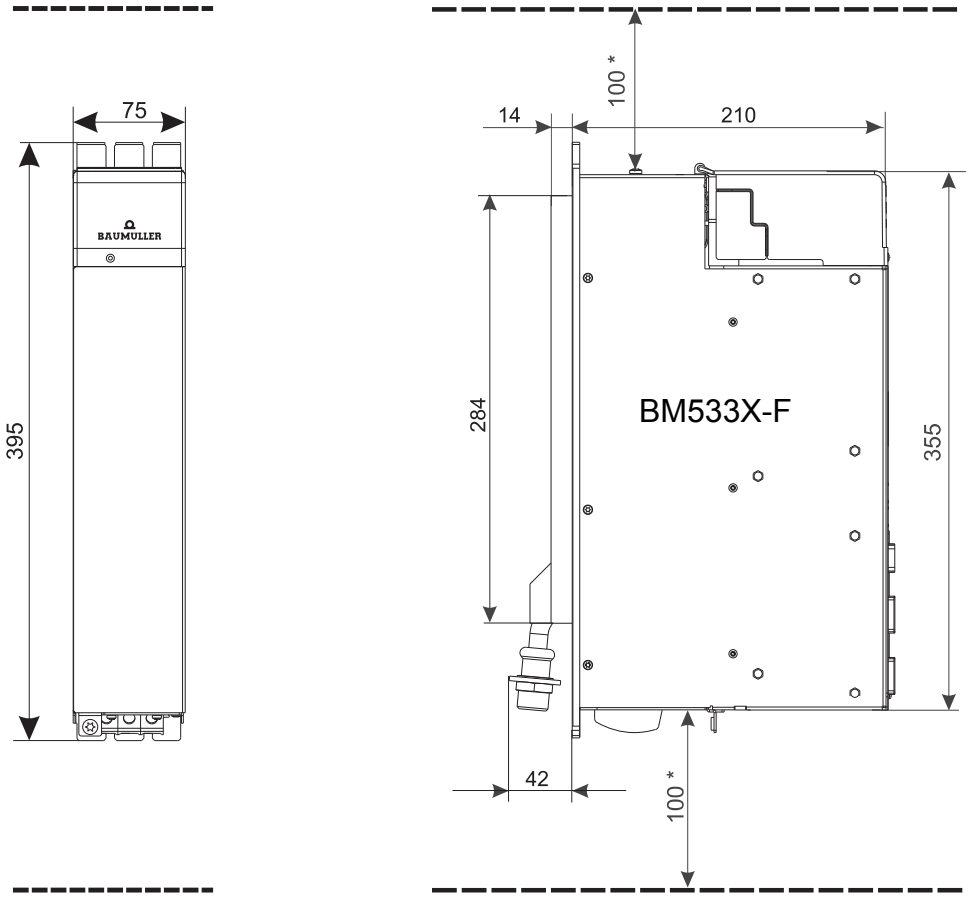


Figure 16: BM533X-F dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

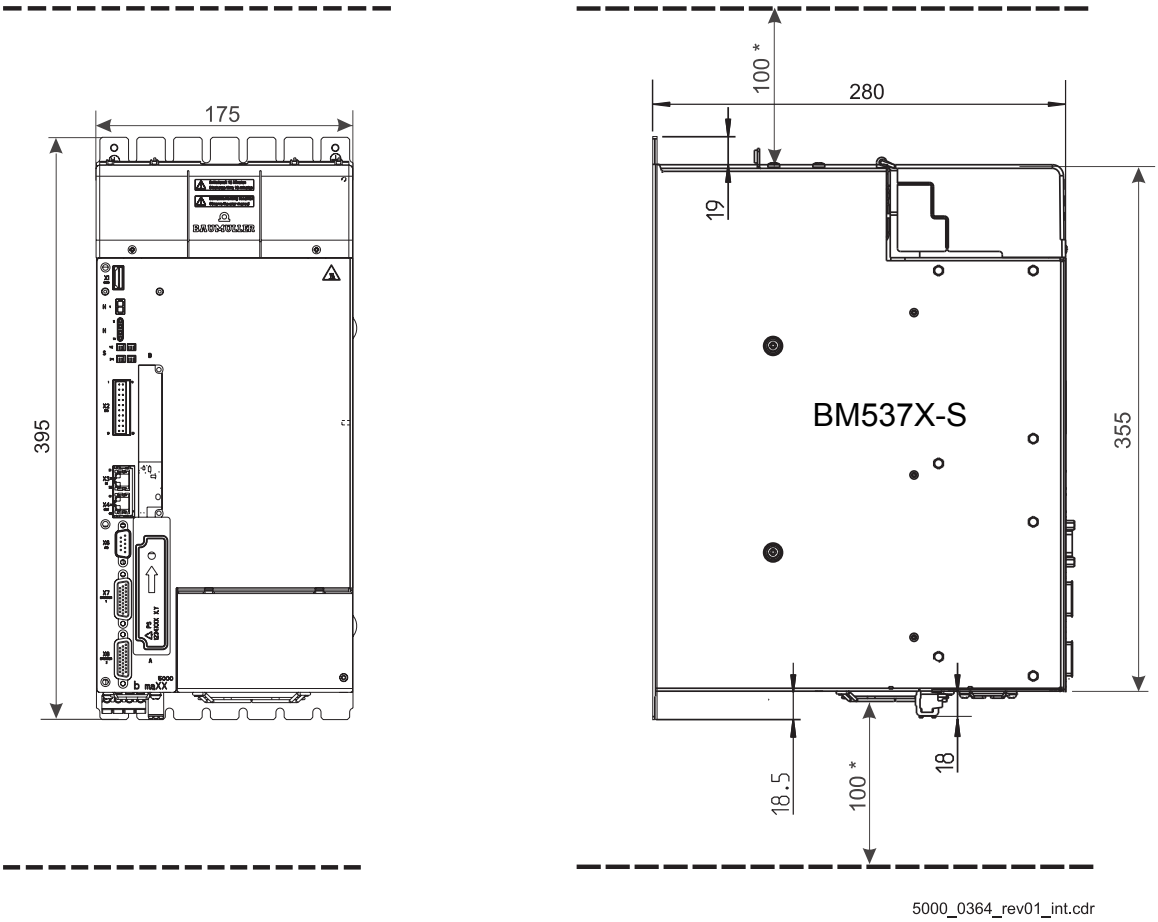


Figure 17: BM537X-S dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and ▹Cooling◃ on page 58.

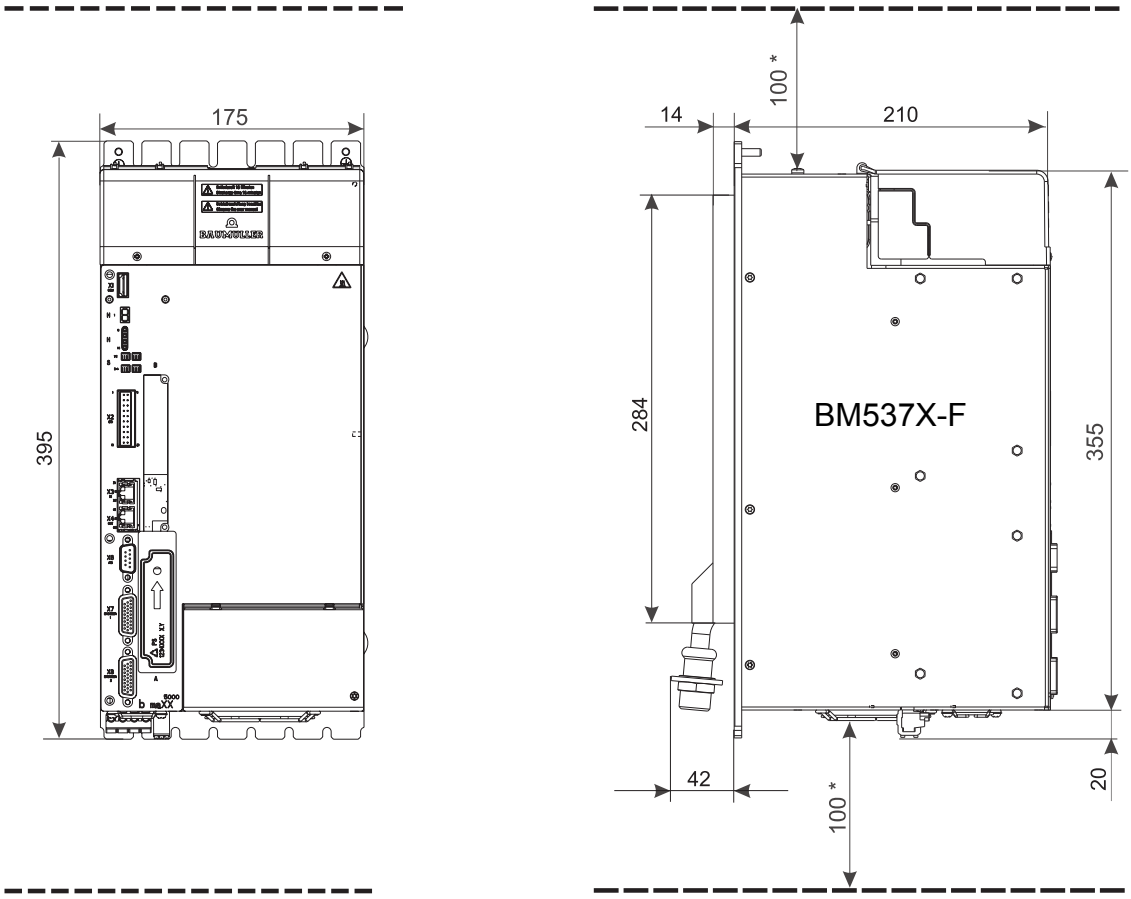


Figure 18: BM537X-F dimensions

*: Observe minimum clearance.
Please follow the notes for mounting and
▹Cooling◃ on page 58.

3.2 Weight

Device	Weight, with controller
BM5**03X**	Approx. 6 kg
BM5**04X**	Approx. 7 kg
BM5**07X** BM5**07X-F**	Approx. 15.8 kg
BM5**17X-S** BM5**17X-C**	Approx. 12.5 kg Approx. 10.0 kg
BM5**19X**	Approx. 25.0 kg
BM5**32X**	Approx. 5.5 kg
BM5**33X** BM5**33X-F**	Approx. 6.5 kg
BM5**37X** BM5**37X-F**	Approx. 13 kg

3.3 Operating conditions

3.3.1 Requirements for power supply / mains supply system

Power supply mains	BM50XX - X**T**XX / - X**R**XX [6] BM51XX - X**T**XX / - X**R**XX [6]	Industrial system, with direct or low impedance grounded neutral point (TN system or TT system)	
	BM50XX - X**I**XX / - X**S**XX	Industrial system with not grounded or with high impedance grounded neutral point (IT system) in addition TN or TT system	
	BM50XX - X**G**XX / - X**W**XX	Industrial system, with direct or low impedance grounded junction of phases (grounded delta wye) in addition TN system, TT or IT system	
Inductance (sum of mains inductance and mains choke inductance)	BM50XX - X**T**.../X**I**.../X**G**... BM51XX - X**T**.../X**I**.../X**G**...	$u_{k\ min}$ = 2.4 % $u_{k\ max}$ = 4 %	
Mains inductance [7]	BM503X - X**R**.../X**S**.../X**W**... BM504X - X**R**.../X**S**.../X**W**...	$u_{k\ min}$ = 0.5 %	
Rated power supply voltage/frequency [1] [2] (U_{AC}) device		3 x 400 V 50/60 Hz	
Power supply voltage Absolute minimum[1] [2] (U_{AC}) device Absolute maximum[1] [2] (U_{AC}) device		BM50XX	3 x 207 V / 50/60 Hz 3 x 528 V / 50/60 Hz
		BM51XX	3 x 360 V / 50/60 Hz 3 x 528 V / 50/60 Hz
Absolute frequency minimum [5] Absolute frequency maximum [5]		47 Hz 63 Hz	
Overvoltage category EN 61800-5-1, chapter 4.3.6		III	
Harmonic frequencies (power supply voltage) EN 61800-3, chapter 5.2.1, class 3		THD_U ≤ 12 %	
Power supply voltage asymmetry EN 61000-2-4, table 1, Class 3		Max. 3 %	
Commutation notches EN 61800-3, chapter 5.2.1, class 3		Notch depth < 40 %, area < 250 % x degree	
Voltage drops EN 61800-3:2004 and A1:2012		10 % to 80 % [1]	
Voltage changes/fluctuation EN 61200-2-4, class 3		+/-10 % +10 % to -15 %, for a duration of ≤ 1 min	
Max. short circuit current power supply [4]		50 000 A	
Prospective short circuit current according EN61800-5-1		BM503X, BM504X, BM517X	5 kA
		BM507X, BM519X	18 kA
Control voltage [3] (U_{DC}) according to EN 61131-2:2008		+ 24 V -15 % / +20 %	

1) In case of power supply failure ((0.9 - 0) x U_{AC} for t > 0.1 s), the error „Power unit not ready-to-operate“ is generated.

2) The rated voltage is 400 V. At an power supply voltage of less than 400 V the output power of the device is reduced, refer to correction values at changed operation conditions ▹Correction values input voltage◃ on page 54.

3) The control voltage must correspond to PELV (EN 61800-5-1, chapter 3.21) or SELV (EN 61800, chapter 3.35). With a control voltage < 24 V the fan output is reduced. Thus, it could be necessary to reduce the output current. If UL 508C is being considered, the current is limited to 4 A (with fuses, in accordance with UL 248) and to a voltage of max. 30 V_{DC}.

4) Only necessary to comply with UL 508C, refer to ▹UL notes◃ as from page 94.

5) Change speed of the mains frequency max. 1 Hz/s (EN 61000-2-4, Class 3)

6) The connection and/or operation of a device with the identifier BM5XXX-X**T**XX on IT mains or grounded delta mains is **not** allowed.

7)

NOTE!
The distortion factor of the input current of following devices
BM50XX-X**R**… /X**S**… /X**W**… ,, is at least **twice as much** the factor at operation with power choke.
The user has to check with the local power supplier whether an operation without power choke is allowed.

3.3.2 Requirements for control voltage / 24 V power supply

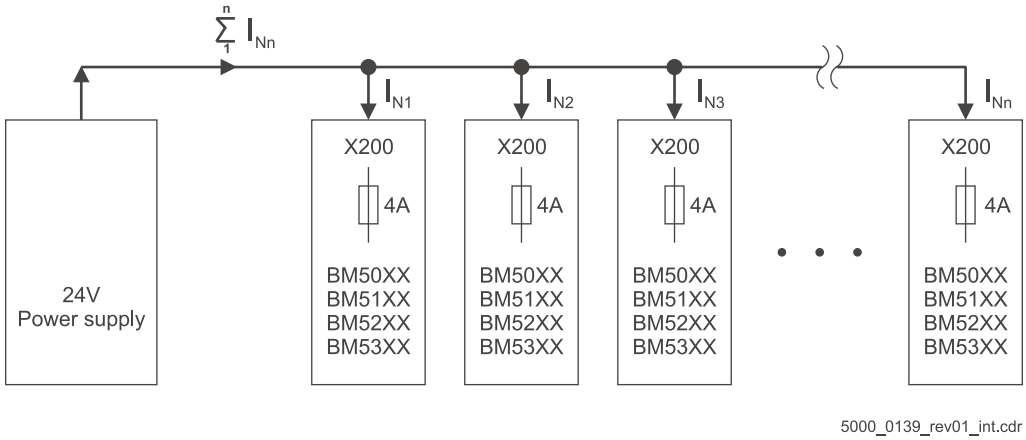


Figure 19: Control voltage / 24 V power supply

The power supply unit for the 24 V voltage supplied must provide at least the rated output that corresponds to the total 24 V power consumption of all devices of the rack system.

3.3.3 Requirements for the motor

The **b maXX 5000** is designed to operate three phase current motors with a motor terminal voltage of 3 x 350 V (typical for servo motors from Baumüller) or 3 x 400 V (typical for standard asynchronous motors and for customer-specific special motors from Baumüller). The motors must be operated in a star connection. The rated DC link voltage is 540 V_{DC}. It can be expected that the DC link voltage increases to up to 780 V or 800 V in brake operation. The connected motor must be designed to handle these DC link voltages.

If **b maXX 5000** axis units are operated with a voltage-controlled DC link (e.g. BM51XX), then the DC link voltage will be permanently (not only in brake operation)
between 640 V and 760 V. The connected motor must be designed to be operated at these voltages in continuous operation.

It is also possible to operate the devices at lower voltages, e.g. 3 x 230 V. A prerequisite, however, is that the three phase current motors used for operation with converters rated for an DC link voltage of up to 800 V, as the brake resistor voltage (refer to ▹Electrical data◃ as from page 60) remains unchanged.
Thus, only three phase current motors with $U_{DC\ link,\ rated} \geq 540$ V may be used in these cases as well.

3.3.4 Required environmental conditions

Transport temperature range	- 25 °C to + 70 °C
Transport climate class (K) EN 60721-3-2	2 K 3
Storage temperature range	- 25 °C to + 55 °C
Storage climate class EN 60721-3-1	1 K 4
Operating environment BM50XX BM517X BM519X	 Industrial supply network C2 Industrial supply network C3 [1], refer to ▹Mounting of toroidal cores◃ as from page 125 Industrial supply network C3
Operating temperature range	Min. 5 °C to max. 55 °C (with derating above 40 °C) [2]
Operating climate class EN 60721-3-3	3 K 3
Installation altitude	Up to 4000 m above MSL (with derating above 1000 m) [2]
Humidity (operating) EN 60721-3-3	Relative humidity: 5 % to 95 % non-condensed, and absolute humidity: 1 g/m^3 to 29 g/m^3
Ionizing and non-ionized radiation	< measurable range
Vibration, shock and continuous shock EN 61800-5-1, chapter 5.2.6.4 vibration test	Max. 1 g when operating
Degree of contamination EN 61800-5-1, table 6, tab. 2	2

[1] If used in areas according to the category C2 of IEC 61800-3:2012, additional measures might be necessary. In this case the plant manufacturer / user has to provide evidence these additional measures take effect and the in IEC 61800-3 required thresholds of the category C2 are met.

[2] Refer to correction values at changed operation conditions at ▹Correction values at changed operating conditions◃ on page 50.



NOTICE!

Normally only a non-conductive dirt buildup occurs. Any conductive dirt buildup, whether short-term or permanent, is prohibited and could lead to destruction of the device. The customer is responsible for destruction resulting from dirt buildup of conductive materials or matter.

3.3.5 Correction values at changed operating conditions

The correction values of the permitted output power and output current must be multiplied, if the devices **b maXX 5000** are used at operation conditions with different correction values.

The following correction values are to be considered if nothing other is specified at the „Electrical data“ of the device:



NOTE!

Baumüller devices that are intended for operation in grounded delta mains or IT mains may only be operated in those types of mains up to an installation altitude of 2000 m above MSL. At an installation altitude of 2000 m and higher these devices are to be operated in TN and TT mains. Power supply of this type can be accomplished by using an isolating transformer with a secondary-side grounded neutral point, for example.



NOTE!

The temperature of the water cooler or the cold plate temperature must be higher or equal to the surrounding temperature to prevent condensation.

3.3.5.1 Correction values for the output current of the mains inverter BM50XX, BM51XX

Installation altitude

If the devices **BM50XX**, **BM51XX** are operated above an absolute altitude of 1000 m, then the permitted output current $I_{permitted}$ (adjusted output rated current) must be reduced against the output rated current (see ▹Electrical data BM50XX; BM51XX◃ as from page 60) according to the following curve.

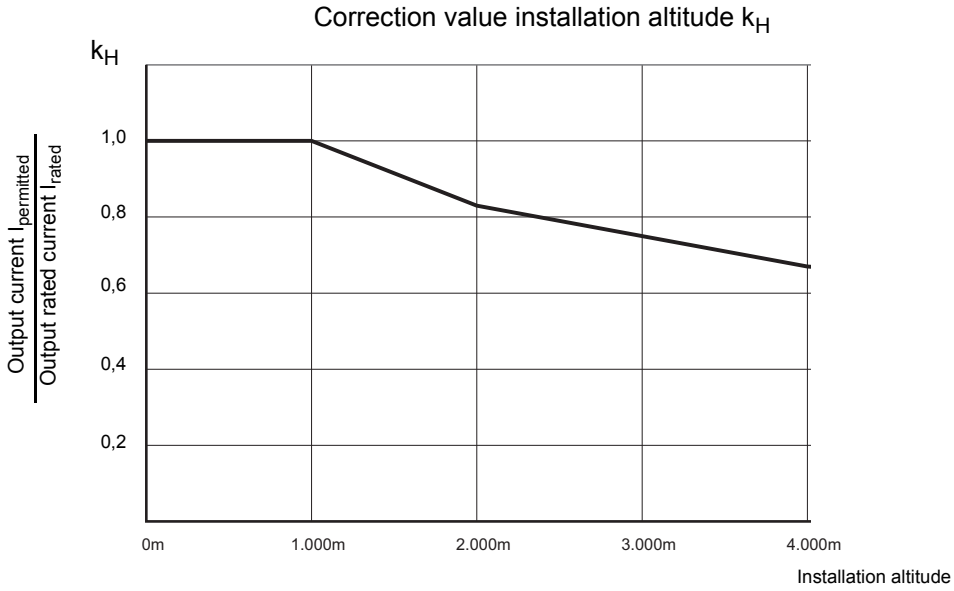


Figure 20: Correction value k_H in dependence on the installation altitude H, BM50XX, BM51XX

Operating temperature

The devices **BM50XX**, **BM51XX** were designed to be operated at an operating temperature of T_{rated} = 40 °C. If the devices are operated at temperatures between 40 °C and 55 °C the permitted output current ($I_{permitted}$) must be reduced:

$$k_T = 1 - \left(\frac{\text{Coolant temperature - 40 °C}}{\text{°C}} \cdot 0{,}03 \right)$$

The coolant temperature complies with the environmental temperature of air-cooled devices, with the water temperature of water-cooled devices and the surface temperature of the cold plate/mounting panel of devices with cold plate cooling.

The permitted output current $I_{permitted}$ (adjusted output rated current) is calculated according following formula:

$$I_{permitted} = I_{rated} \cdot k_T \cdot k_H$$

I_{rated} = Output rated current at 40 °C and up to 1000 m,,
see ▹Electrical data BM50XX; BM51XX◃ as from page 60.

3.3.5.2 Correction values for the output current of the axis units BM53XX

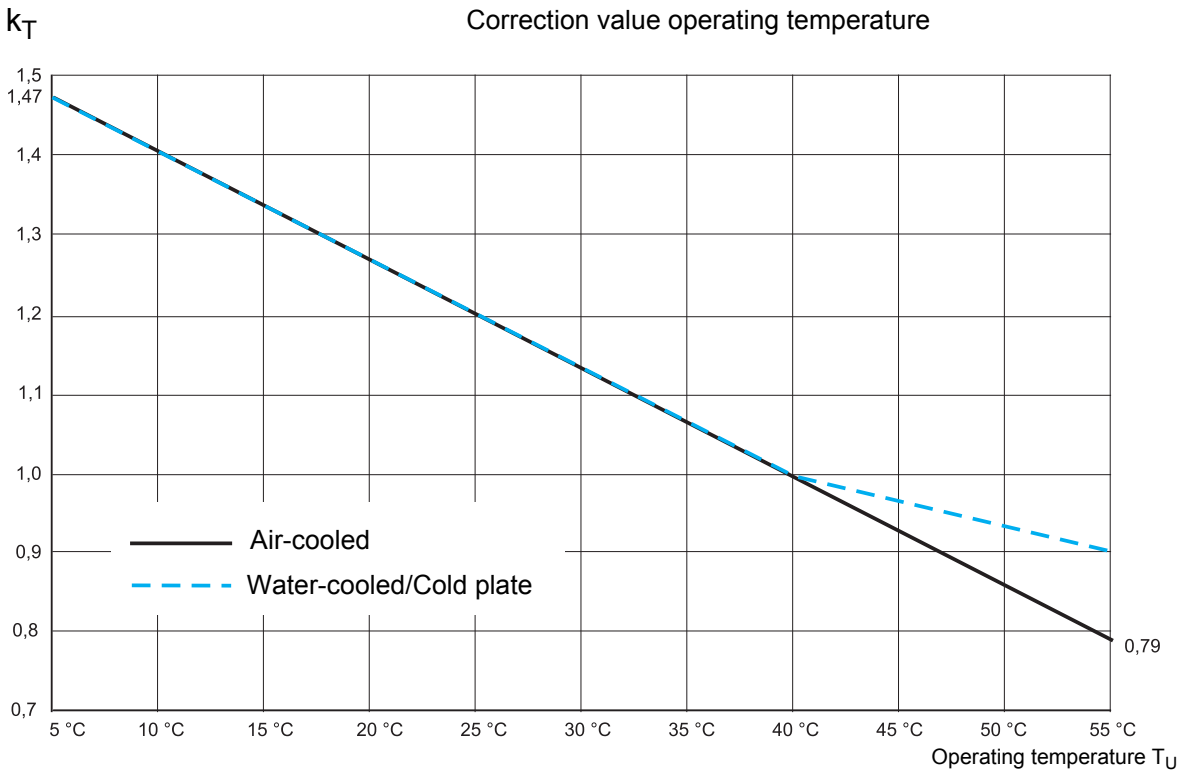


Figure 21: Correction value k_T in dependence of the temperature T_U, BM53XX

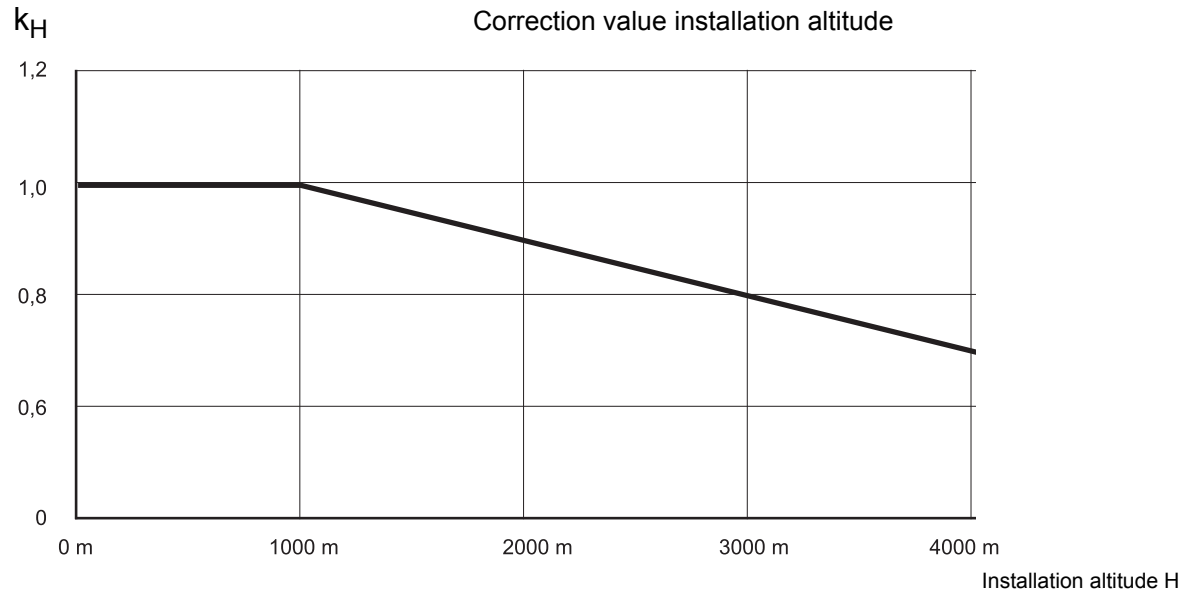


Figure 22: Correction value k_H in dependence on the installation altitude H, BM53XX

The permitted output current $I_{permitted}$ (adjusted output rated current) is calculated according following formula:

$$I_{permitted} = I_{rated} \cdot k_T \cdot k_H$$

I_{rated} = Output rated current at 40 °C and up to 1000 m,
refer to ▹Electrical data of the BM53XX◃ as from page 69.

If $k_T \cdot k_H > 1$, then $I_{permitted} = I_{rated}$,
an output current higher than I_{rated} is not possible.



NOTICE!

The following condition **must** always be met to prevent the device of overload:

$$k_T \cdot k_H \geq 0{,}79$$

If $k_T \cdot k_H > 1$, the operation of the device is permitted and $I_{permitted}$ is limited to I_{rated}.

Examples:

$k_{T\ (25\ °C)} = 1.2$
$k_{H\ (3000\ m)} = 0.8$
$k_{T\ (25\ °C)} * k_{H\ (3000\ m)} = 0.96 \geq 0.79$ Operation permitted
$I_{permitted} = I_{rated} \cdot 0.96$

$k_{T\ (20\ °C)} = 1.27$
$k_{H\ (1500\ m)} = 0.95$
$k_{T\ (20\ °C)} * k_{H\ (1500\ m)} = 1.20 \geq 0.79$ Operation permitted
$I_{permitted} = I_{rated}$

$k_{T\ (40\ °C)} = 1$
$k_{H\ (4000\ m)} = 0.7$
$k_{T\ (40\ °C)} * k_{H\ (4000\ m)} = 0.7 < 0.79$ Operation **not** permitted

3.3.5.3 Correction values input voltage

Above rated power supply voltage

- **Mains rectifier units BM503X, BM504X, BM507X, BM517X, BM519X**

The rated power supply voltage is 3 x 400 V

The output currents must be reduced accordingly when operating with a power supply voltage higher than 400 V.

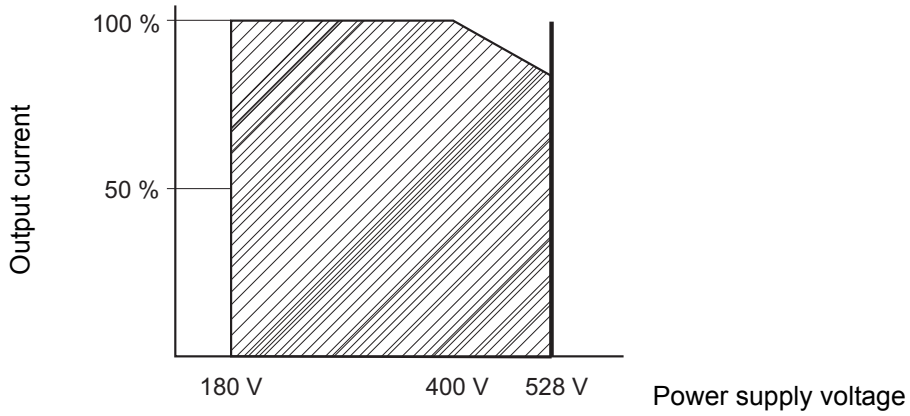


Figure 23: Derating: Output current as a function of the power supply voltage

The device draws the rated/peak current at rated supply voltage. The input current must be reduced if power supply voltage is higher than 400 V and the DC link output power remains constant.

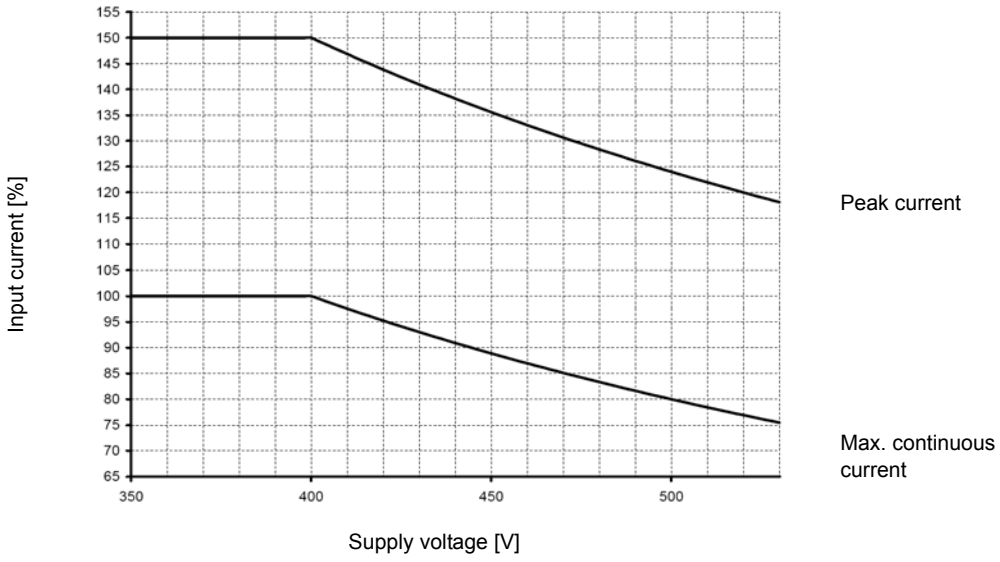


Figure 24: Derating: Input current BM50XX, BM517X, BM519X

Below rated input voltage

- **Mains rectifier units BM503X, BM504X, BM507X**

The rated voltage is 3 x 400 V

The DC link voltage must be reduced when operating with input voltage lower than 400 V.

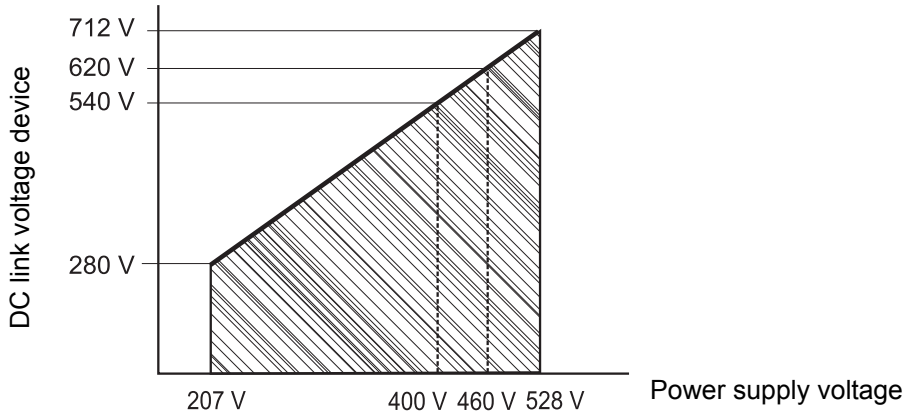


Figure 25: Derating: DC link voltage as a function of the power supply voltage

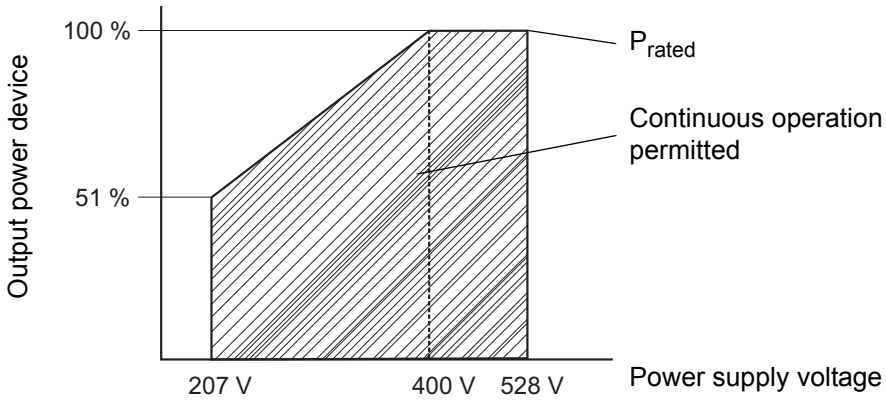


Figure 26: Derating: Output power as a function of the power supply voltage

The output power of the device is calculated by multiplying the output current and the output voltage.

$$S_{out} = U_{out} \times I_{out} \times \sqrt{3}$$

It is necessary to reduce the output current between 400 V and 528 V in order to comply with the curve/area.

Below rated input voltage

- **Mains rectifier units BM517X, BM519X**

The rated voltage is 3 x 400 V

The DC link voltage must be reduced when operating with input voltage lower than 400 V.

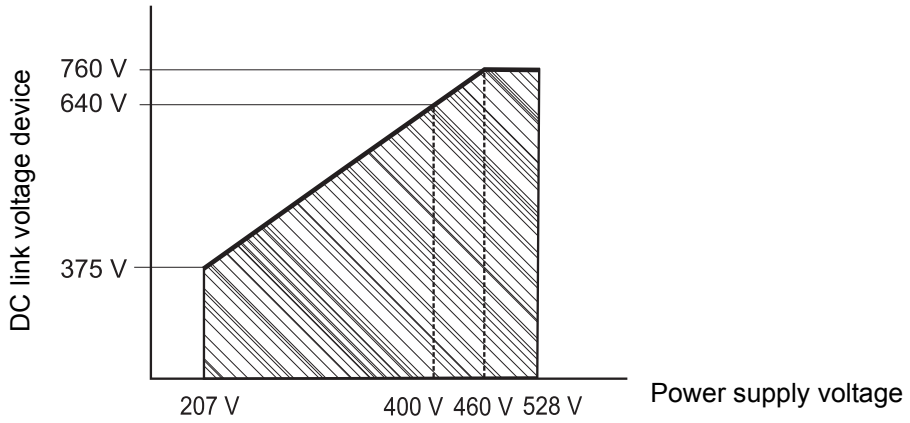


Figure 27: Derating: DC link voltage as a function of the power supply voltage

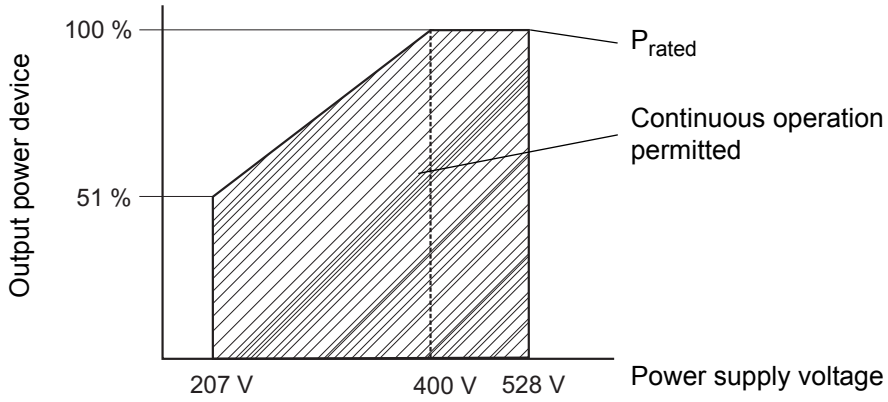


Figure 28: Derating: Output power as a function of the power supply voltage

The output power of the device is calculated by multiplying the output current and the output voltage.

$$S_{out} = U_{out} \times I_{out} \times \sqrt{3}$$

It is necessary to reduce the output current between 400 V and 528 V in order to comply with the curve/area.

3.3.5.4 Correction values DC link voltage

Mains rectifier

BM503X, BM504X, BM507X, BM517X, BM519X

With the permissible continuous DC link power, the power supply current, e.g. with a power supply voltage of 480 V_{AC}, is less by a ratio

$$\frac{400}{480} = 0,833$$

(instead of 31 A_{AC} the power supply current is then 25.8 A_{AC}).
When selecting the connected axes ensure that the DC link power is not exceeded.

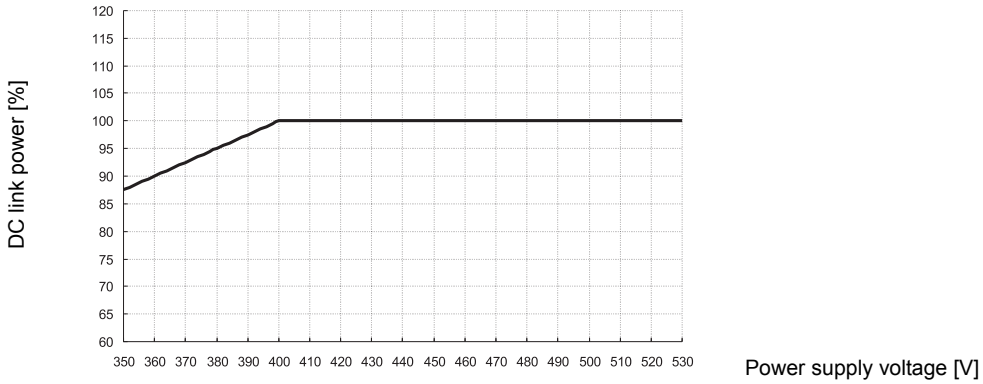


Figure 29: Derating: DC link power B503X, BM504X, BM517X, BM519X

Axis units

BM53XX

The axis units supply the rated/peak currents at rated DC link voltage. The output currents must be reduced accordingly when operating with a DC link voltage is higher than 640 V and output power remains constant.

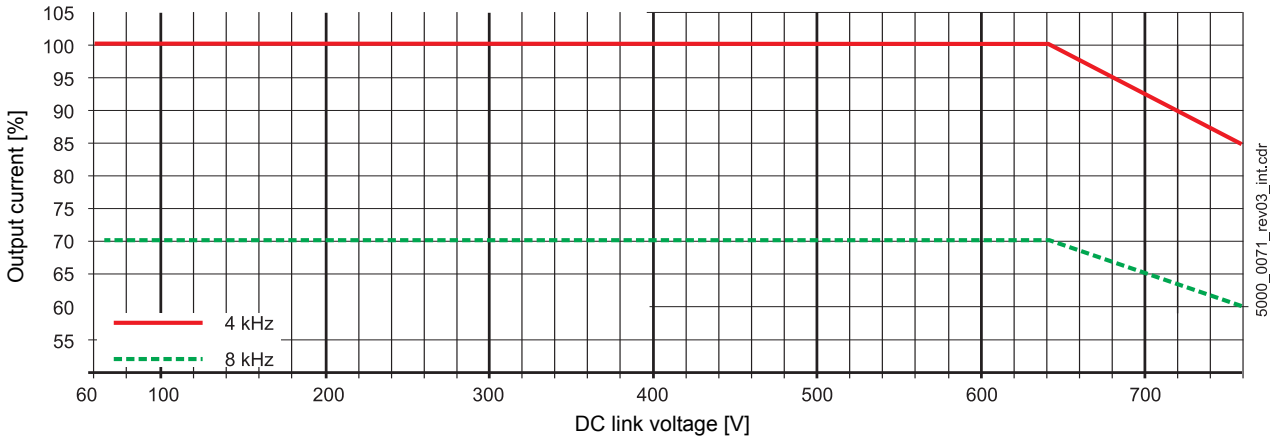


Figure 30: Derating: Output current as function of the DC link voltage axis units

3.3.6 Cooling

Cooling air temperature [1] (rated temperature: 40 °C)	Min. 5 °C to max. 55 °C, refer to correction values temperature ▹page 51◃
Cooling air requirement [2]	Depends on the device, refer to ▹Electrical data◃ as from page 60

Coolant temperature [4]	Min. surrounding temperature up to max. 55 °C (rated temperature: 40 °C), refer to correction values temperature ▹page 51◃
Coolant flow [3] [4] [6]	Min. 4 l/min. to max. 15 l/min
Coolant pressure [3]	Max. 6 bar
Coolant hysteresis	Max. 5 K in static and dynamic operation
Water heating (coolant in to coolant out) [3] [K]	$< 14,35 \left[\frac{\text{l/min}}{\text{kW}} \cdot \text{K}\right] \cdot \frac{\text{power loss[kW]}}{\text{coolant flow [l/min]}}$
Pressure drop at the water cooling unit [3]	0.5 bar at 10 l/min

Surface temperature Cold plate / mounting base [4] [5]	Min. surrounding temperature up to max. 55 °C (rated temperature: 40 °C), refer to correction values temperature ▹page 51◃

[1] Air temperature in the entire intake area of the device.

[2] The cooling air requirement corresponds to at least that of a freely-blowing device. Freely-blowing means that the air flow in and out are unobstructed. Therefore, when installing the device in a control cabinet, it could be necessary to make use of additional fans in order that the necessary cooling air requirement is covered. If the necessary cooling air requirement of the passive cooling unit is not provided for, then the output power of the device must be reduced.

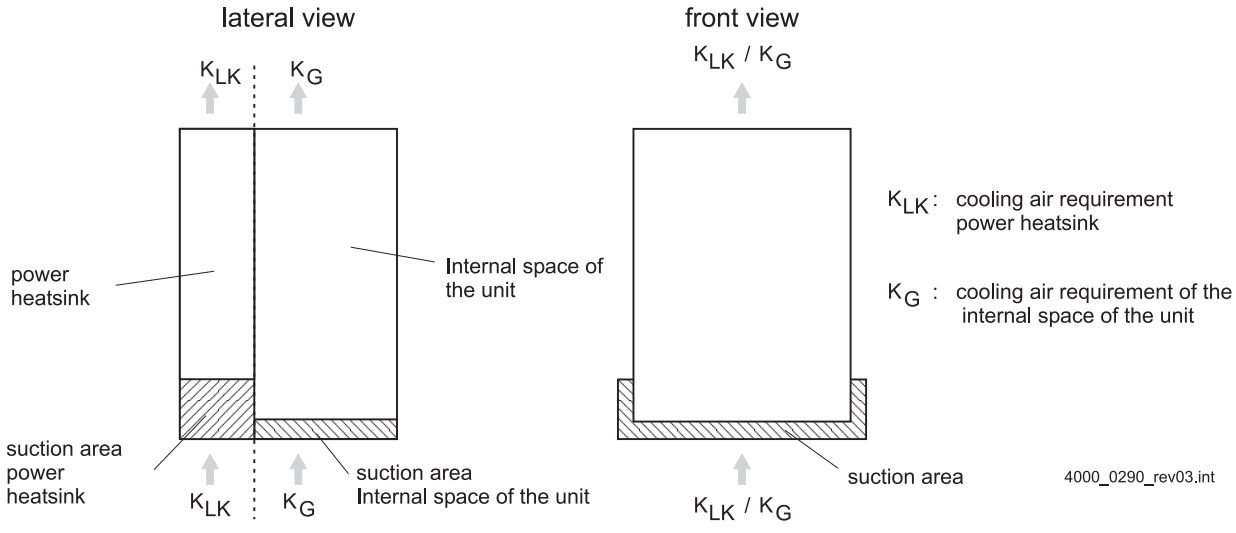


Figure 31: Cooling air requirement

3) Rated flow rate = 10 l/min
For other coolant flow rates than the one stated above, please inquire with Baumüller Nürnberg GmbH.

The water temperature must be between 5 °C and 75 °C. The output power must be reduced in case of water temperature above 40°C

The coolant must meet the following requirements:

pH value	6.5 ... 9.5
Conductivity	50 ... 600 µS/cm
Total water hardness (incl. $CaCO_3$)	< 100 ppm
Suspended matter	< 10 ppm
Particle size	< 100 µm
Ryznar Stability Index (RSI)	5.0 ... 6.0

Manganese (Mn)	< 0.05 ppm
Copper (Cu)	< 0.1 ppm
Chlorine (Cl_2)	< 1 ppm
Chloride (Cl^-)	< 500 ppm
Sulfate (SO^{2-}_4)	< 500 ppm

The corrosion resistance to other substances can be seen in the DECHEMA material tables.
An anti-corrosion agent and a closed cooling circuit are prescribed.

4)

The surface temperature of the water cooler or cold plate outside the cabinet must be higher or the same as the device interior temperature (measured heatsink temperature of the device) to prevent condensation always.
In case of surface temperatures other than those specified, please inquire with Baumüller Nürnberg GmbH.

5) Notes relating to cold plate

The cooling version cold plate is a particular efficient cooling alternative. The heat dissipation is done via 2 contact surfaces. The mounting platform within the control cabinet or on the machine base is one, the device, to be cooled is mounted there. High requirements e.g. to surface roughness and evenness for this surface are specified, to ensure an optimal heat flow. Already a slight damage/pollution of the surface can cause a significant deterioration in heat dissipation to the mounting plate.
For this reason while handle the units protect the sensitive function surface to avoid damage and pollution.

6) By means of the thermal resistance of the cooling system and the thermal power loss, which is supplied to the cooling system, the surface temperature can be calculated.

3.4 Electrical data

3.4.1 Electrical data BM50XX; BM51XX

- BM50**30** mains rectifier unit **without safety function**

	BM50**30** -X**T0**X-.. /-X**I0**X-.. / -X**G0**X-.. without charge resistor	BM50**30** -X**R0**X-.. /-X**S0**X-.. / -X**W0**X-.. with charge resistor
Input rated power [1]	6 kVA	6.9 kVA [14]
Input rated current (I_{eff}) [1] [2] [3]	8.5 A	10.4 A
Distortion factor of the input current (THD_I) [1]	57 % ± 10 %	160 % ± 10 %
Input peak current (I_{eff}) [1] [2] [3]	12.5 A for max. 150 s	15.6 A for max. 150 s
DC link voltage, power supply dependent/rated	540 V_{DC} at $U_{power\ supply}$ = 3 x 400 V	
Internal DC link capacitance (C_{int})	470 µF	
DC link discharge time (C_{int}) [9]	Approx. 450 s	
Waiting period between 2 charging processes (no external DC link capacitance)	36 s	
Total maximum connectable capacitance in the DC link	7.8 mF internal + external	
Waiting time between 2 charging processes with maximum capacitance	600 s [13]	
Connection power at DC link [1] [5]	5 kW	
Peak power at DC link [4] [6]	7.5 kW for max. 150 s	
Capacitance DC link to PE	150 nF	
Ready-to-operate after	≤ 7 s	
Max. charge-up time	≤ 10 s	
External brake resistor R_B	$R_B \geq 33\ \Omega$	
External brake resistor continuous power	5 kW	
Quick discharge resistor	-	
Power loss with regard to power supply [7]	40 W	
Power loss with regard to control voltage supply [8]	Max. 10 W	
Cooling air requirement power heat sink	40 m^3/h	
Cooling air velocity power heat sink	-	
Cooling air requirement internal space of device	8 m^3/h	

Footnotes refer to ▹page 68◃.

- BM50**30** mains rectifier unit with safety function



NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
refer to ▹D.3 Electrical data BM5030 with safety function◃ as from page 324.

- BM50**3**X mains rectifier unit **without safety function**

	BM50**31** -X**T0**X-.. /-X**I0**X-.. / -X**G0**X-.. without charge resistor	BM50**31-A** -X**T0**X-.. /-X**I0**X-.. / -X**G0**X-.. without charge resistor	BM50**31** -X**R0**X-.. /-X**S0**X-.. / -X**W0**X-.. with charge resistor	BM50**31-A** -X**R0**X-.. /-X**S0**X-.. / -X**W0**X-.. with charge resistor
Input rated power [1]	12 kVA		17.5 kVA [14]	
Input rated current (I_{eff}) [1] [2] [3]	17 A		25 A	
Distortion factor of the input current (THD_I) [1]	57 % ± 10 %		180 % ± 10 %	
Input peak current (I_{eff}) [1] [2] [3]	25 A for max. 150 s		37.5 A for max. 150 s	
DC link voltage power supply dependent/rated	540 V_{DC} at U_{supply} = 3 x 400 V			
DC link capacitance (internal)	940 µF			
DC link discharge time (internal DC link capacitance) [9]	Approx. 450 s			
Total max. connectible capacitance in the DC link (internal + external)	20 mF			
Connection power at DC link [1] [5]	10 kW			
Peak power at DC link [4] [6]	15 kW for max. 150 s			
Capacitance DC link to PE	150 nF			
Ready-to-operate after	≤ 7 s			
Max. charge-up time	≤ 10 s			
Quick discharge [10]	≤ 5 s			
External brake resistor R_B	R_B ≥ 33 Ω			
External brake resistor continuous power	18 kW			
Quick discharge resistor	-			
Power loss with regard to power supply [7]	40 W			
Power loss with regard to control voltage supply [8]	Max. 10 W			
Cooling air requirement power heat sink	40 m^3/h	-	40 m^3/h	-
Cooling air velocity power heat sink	-	> 5 m/s	-	> 5 m/s
Cooling air requirement internal space of device	8 m^3/h			

Footnotes refer to ▹page 68◃.

- BM50**3**X mains rectifier unit **without safety function**

	BM50**32**	BM50**32-A**
	-XT0X-.. /-XI0X-.. / -XG0X-.. without charge resistor	
Input rated power [1]	21 kVA	
Input rated current (I_{eff}) [1] [2] [3]	31 A	
Distortion factor of the input current (THD_I) [1]	57 % ± 10 %	
Input peak current (I_{eff}) [1] [2] [3]	46 A for max. 150 s	
DC link voltage power supply dependent/rated	540 V_{DC} at U_{Supply} = 3 x 400 V	
DC link capacitance (internal)	940 µF	
DC link discharge time (internal DC link capacitance) [9]	ca. 450 s	
Total max. connectible capacitance in the DC link (internal + external)	20 mF	
Connection power at DC link [1] [5]	18 kW	
Peak power at DC link [4] [6]	27 kW for max. 150 s	
Capacitance DC link to PE	150 nF	
Ready-to-operate after	≤ 7 s	
Max. charge-up time	≤ 10 s	
Quick discharge [10]	≤ 5 s	
External brake resistor R_B	$R_B \geq 33\ \Omega$	
External brake resistor continuous power	18 kW	
Quick discharge resistor	-	
Power loss with regard to power supply [7]	80 W	
Power loss with regard to control voltage supply [8]	Max. 10 W	
Cooling air requirement power heat sink	40 m^3/h	-
Cooling air velocity power heat sink	-	> 5 m/s
Cooling air requirement internal space of device	8 m^3/h	

Footnotes refer to ▹page 68◃.

- BM504X mains rectifier unit **without safety function**

	BM50**43**	BM50**43-A**	BM50**43**	BM50**43-A**
	-XT0X-.. /-XI0X-.. / -XG0X-.. without charge resistor		**-XR0X-.. /-XS0X-.. / -XW0X-..** with charge resistor	
Input rated power[1)]	45 kVA		61 kVA [14)]	
Input rated current (I_{eff}) [1) 2) 3)]	65 A		88 A	
Distortion factor of the input current (THD_I) [1)]	57 % ± 10 %		180 % ± 10 %	
Input peak current (I_{eff}) [1) 2) 3)]	98 A for max. 150 s		132 A for max. 150 s	
DC link voltage power supply dependent/rated	540 V_{DC} at $U_{power\ supply}$ = 3 x 400 V			
DC link capacitance (internal)	1000 µF			
DC link discharge time (internal DC link capacitance) [9)]	Approx. 350 s			
Total max. connectable capacitance in the DC link (internal + external)	20 mF			
Connection power at DC link [1) 5)]	36 kW			
Peak power at DC link [4) 6)]	54 kW for max. 150 s			
Capacitance DC link to PE	150 nF			
Ready-to-operate after	≤ 7 s			
Max. charge-up time	≤ 10 s			
Quick discharge [10)]	≤ 5 s			
External brake resistor R_B	R_B ≥ 10.5 Ω			
External brake resistor continuous power	58 kW			
Quick discharge resistor	-			
Power loss with regard to power supply [7)]	190 W			
Power loss with regard to control voltage supply [8)]	Max. 25 W			
Cooling air requirement power heat sink	100 m^3/h	-	100 m^3/h	-
Cooling air velocity power heat sink	-	> 5 m/s	-	> 5 m/s
Cooling air requirement internal space of device	8 m^3/h			

Footnotes refer to ▹page 68◃.

- BM504X mains rectifier unit **without safety function**

	BM5044	BM5044-A
	-XT0X-.. /-XI0X-.. / -XG0X-.. without charge resistor	
Input rated power[1)]	90 kVA	
Input rated current (I_{eff}) [1) 2) 3)]	130 A	
Distortion factor of the input current (THD_I) [1)]	57 % ± 10 %	
Input peak current (I_{eff}) [1) 2) 3)]	No overload	
DC link voltage power supply dependent/rated	540 V_{DC} at $U_{power\ supply}$ = 3 x 400 V	
DC link capacitance (internal)	1000 µF	
DC link discharge time (internal DC link capacitance) [9)]	Approx. 350 s	
Total max. connectable capacitance in the DC link (internal + external)	20 mF	
Connection power at DC link [1) 5)]	70 kW	
Peak power at DC link [4) 6)]	No overload	
Capacitance DC link to PE	150 nF	
Ready-to-operate after	≤ 7 s	
Max. charge-up time	≤ 10 s	
Quick discharge [10)]	≤ 5 s	
External brake resistor R_B	$R_B \geq 10.5\ \Omega$	
External brake resistor continuous power	58 kW	
Quick discharge resistor	-	
Power loss with regard to power supply [7)]	390 W	
Power loss with regard to control voltage supply [8)]	Max. 25 W	
Cooling air requirement power heat sink	100 m^3/h	-
Cooling air velocity power heat sink	-	> 5 m/s
Cooling air requirement internal space of device	8 m^3/h	

Footnotes refer to ▹page 68◃.

- BM507X mains rectifier unit **without safety function**

	BM5074	BM5074-F	BM5075	BM5075-F
	-XT0X-.. /-XI0X-.. / -XG0X-.. without charge resistor			
Input rated power[1)]	165 kVA		225 kVA	
Input rated current (I_{eff}) [1) 2) 3)]	240 A		325 A	
Distortion factor of the input current (THD_I) [1)]	57 % ± 10 %			
Input peak current (I_{eff}) [1) 2) 3)]	485 A			
DC link voltage power supply dependent/rated	540 V_{DC} at $U_{power\ supply}$ = 3 x 400 V			
DC link capacitance (internal)	3000 µF			
DC link discharge time (internal DC link capacitance) [9)]	Approx. 350 s			
Total max. connectable capacitance in the DC link (internal + external)	100 mF			
Connection power at DC link [1) 5)]	150 kW		200 kW	
Peak power at DC link [4) 6)]	300 kW			
Capacitance DC link to PE	220 nF			
Ready-to-operate after	≤ 7 s			
Max. charge-up time	≤ 10 s			
Quick discharge [10)]	≤ 5 s			
External brake resistor R_B	$R_B \geq 3\ \Omega$			
External brake resistor continuous power	200 kW			
Quick discharge resistor	-			
Power loss with regard to power supply [7)]	1000 W		1300 W	
Power loss with regard to control voltage supply [8)]	Max. 100 W			
Cooling air requirement power heat sink	450 m^3/h	-	450 m^3/h	-
Cooling air requirement internal space of device	8 m^3/h			

Footnotes refer to ▹page 68◃.

- BM517X active mains rectifier unit

	BM5**173**	BM5**174**
	-XTXX-.. /-XIXX-.. / -XGXX-..	
Input rated power[1)]	39 kVA	69 kVA
Input rated current (I_{eff}) [1) 2) 3)]	56 A	100 A
Distortion factor of the input current (THD_I) [1)]	≤ 6 %	
Input peak current (I_{eff}) [1) 2) 3)]	84 A for max. 120 s [11)]	150 A for max. 120 s [11)]
PWM switching frequency	8 kHz	
DC link voltage power supply dependent/rated	640 V_{DC} to 760 V_{DC} [12)]	
DC link capacitance (internal)	2.5 mF	
DC link discharge time (internal DC link capacitance) [9)]	Approx. 600 s	
Total max. connectable capacitance in the DC link (internal + external)	20 mF	
Connection power at DC link [1) 5)]	36 kW	64 kW
Peak power at DC link [4) 6)]	54 kW for max. 120 s [11)]	96 kW for max. 120 s [11)]
Power factor (inductive only)	0.9 bis 1.0	
Ready-to-operate after	≤ 50 s	
Max. charge-up time	≤ 10 s	
Quick discharge [10)]	≤ 5 s	
External brake resistor R_B	–	
Quick discharge resistor	55 Ω ≤ R ≤ 72 Ω	
Power loss with regard to power supply [7)]	900 W	1600 W
Power loss with regard to control voltage supply [8)]	Max. 60 W	
Cooling air requirement power heat sink	175 m^3/h	
Cooling air velocity power heat sink	-	
Cooling air requirement internal space of device	35 m^3/h	

Footnotes refer to ▹page 68◃.

- BM519X active mains rectifier unit

	BM5192-S	BM5192-F	BM5193-F
	-XTXX-.. /-XIXX-.. / -XGXX-..		
Input rated power[1)]	150 kVA		200 kVA
Input rated current (I_{eff}) [1) 2) 3)]	220 A		290 A
Distortion factor of the input current (THD_I) [1)]	≤ 6 %		
Input peak current (I_{eff}) [1) 2) 3)]	435 A for max. 10 s		435 A for max. 10 s
PWM switching frequency	8 kHz		
DC link voltage power supply dependent/rated	640 V_{DC} to 760 V_{DC} [14)]		
DC link capacitance (internal)	7.5 mF		
DC link discharge time (internal DC link capacitance) [9)]	Approx. 600 s		
Total max. connectable capacitance in the DC link (internal + external)	100 mF		
Connection power at DC link [1) 5)]	150 kW		200 kW
Peak power at DC link [4) 6)]	300 kW for max. 10 s		
Power factor (inductive only)	0.9 bis 1.0		
Ready-to-operate after	≤ 50 s		
Max. charge-up time	≤ 10 s		
Quick discharge [10)]	≤ 5 s		
External brake resistor R_B	–		
Quick discharge resistor	R > 10 Ω		
Power loss with regard to power supply [7)]	2500 W		3300 W
Power loss with regard to control voltage supply [8)]	Max. 100 W	Max. 60 W	

Footnotes refer to ▹page 68◃.

[1] All rated values are based on an power supply voltage of 400 V/50 Hz, a DC link voltage of 540 V (BM50XX) or 640 V (BM51XX), a control voltage of 24 V and a surrounding temperature of 40 °C.

[2] The input current must be reduced between 40 °C and 55 °C, refer to correction values at changed operation conditions, ▹Correction values for the output current of the mains inverter BM50XX, BM51XX◃ on page 51.

[3] The mains rectifier draws the rated/peak current at rated supply voltage. The input current must be reduced if power supply voltage is higher than 400 V and the DC link output power remains constant, refer to ▹Derating: Input current BM50XX, BM517X, BM519X◃ on page 54.

[4] The actual possible overload time depends on the preloading of the device and the heat sink temperature and is detected by the overload monitoring of the device.

[5] With the permissible continuous DC link connected power, the power supply current is reduced. When selecting the connected axes ensure that the DC link connected power is not exceeded, refer to ▹Derating: DC link power B503X, BM504X, BM517X, BM519X◃ on page 57.

[6] This power consumption is only permitted for a short period of time. This must be ensured by means of appropriate configuration of the connected axes.

[7] Including external power choke

[8] Without loads on the digital outputs

[9] Residual voltage < 60 V_{DC}

[10] It is necessary to connect a quick discharge resistor or a brake resistor!

[11] Cold plate version max. 30 s
For details refer to ▹Load cycle according EN61800-6◃ as from page 78

[12] For further information refer to parameter 141.8 DC link voltage set value at parameter manual **b maXX** 5000

[13] Between the min. waiting time (internal DC link capacitance only) and the max. waiting time (maximum DC link capacitance) can be linearly interpolated depending on the total capacitance value.

[14] Mains inductance $u_{k\ min}$ = 0,5 %



NOTE!
The distortion factor of the input current of following devices
BM50XX-X**R**… /X**S**… /X**W**… ,, is at least **twice as much** the factor at operation with power choke.
The user has to check with the local power supplier whether an operation without power choke is allowed.

3.4.2 Electrical data of the BM53XX

- Double axis unit safety

		BM5**323**	BM5**323-A**	BM5**325**	BM5**325-A**
Input rated power [1) 9)]		3.5 kW	5.75 kW	7.0 kW	9.9 kW
Input rated current [1) 9)]		5.5 A	9 A	11 A	15.5 A
DC link voltage (U_{DC}) [1)]		60 V - 760 V			
DC link capacitance (internal)		235 µF			
DC link discharge time (internal DC link capacitance)		250 s			
Output voltage (U_{AC}) [1) 3)]		0 - 500 V			
Output frequency at 4 kHz [4)]		0 - 450 Hz			
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 4 kHz [4)]	2 x 3 A	2 x 4.5 A	2 x 6 A	2 x 8.5 A
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 8 kHz [4)]	2 x 2.1 A	2 x 3.15 A	2 x 4.2 A	2 x 5.9 A
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 16 kHz [4)]	-			
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 4 kHz [4)]	2 x 9 A		2 x 18 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 8 kHz [4)]	2 x 6.3 A		2 x 12.6 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 16 kHz [4)]	-			
Short-time operation KB		300 %	200 %	300 %	
Max. length of time peak current [6)]		Refer to ▹Load cycle according EN61800-6◃ as from page 78			
Power loss with regard to power supply		Max. 55 W	Max. 82.5 W	Max. 100 W	Max. 141 W
Power loss with regard to control voltage supply (air-cooled) [7)]		Max. 35 W			
Power loss with regard to control voltage supply (cold plate cooling) [7)]		Max. 35 W			
Current of the integrated brake control (option) [8)]		Max. 2 x 2.0 A			
Cooling air requirement power heat sink		15 m^3/h	-	15 m^3/h	-
Cooling air velocity power heat sink		-	> 5 m/s	-	> 5 m/s
Cooling air requirement internal space of device		-		10 m^3/h with cold plate	-

Footnotes refer to ▹page 76◃.

		BM5**331**	BM5**331-A**	BM5**332**	BM5**332-A**	BM5**333**	BM5**333-A**
Input rated power [1) 9)]		13.4 kW		22.4 kW		33.6 kW	
Input rated current [1) 9)]		21 A		35 A		53 A	
DC link voltage (U_{DC}) [1)]		60 V - 760 V					
DC link capacitance (internal)		330 µF		660 µF		1175 µF	
DC link discharge time (internal DC link capacitance)		240 s		480 s		900 s	
Output voltage (U_{AC}) [1) 3)]		0 - 500 V					
Output frequency at 4 kHz [4)]		0 - 450 Hz					
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 4 kHz [4)]	2 x 12 A		2 x 20 A		2 x 30 A 2 x 28 A with UL	
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 8 kHz [4)]	2 x 8.4 A		2 x 14 A		2 x 21 A	
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 16 kHz [4)]	2 x 4.8 A		2 x 8 A		2 x 12 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 4 kHz [4)]	2 x 24 A		2 x 40 A		2 x 60 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 8 kHz [4)]	2 x 16.8 A		2 x 28 A		2 x 42 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 16 kHz [4)]	2 x 9.6 A		2 x 16 A		2 x 24 A	
Short-time operation KB		200 %					
Max. length of time peak current [6)]		Refer to ▹Load cycle according EN61800-6◃ as from page 78					
Power loss with regard to power supply		Max. 210 W		Max. 310 W		Max. 460 W	
Power loss with regard to control voltage supply (air-cooled) [7)]		Max. 42 W				Max. 55 W	
Power loss with regard to control voltage supply (cold plate cooling) [7)]		Max. 39 W	-	Max. 39 W	-	Max. 39 W	-
Current of the integrated brake control (option) [8)]		Max. 2 x 2,0 A					
Cooling air requirement power heat sink		55 m^3/h	-	55 m^3/h	-	100 m^3/h	-
Cooling air velocity power heat sink		-	> 5 m/s	-	> 5 m/s	-	> 5 m/s
Cooling air requirement internal space of device		10 m^3/h	-	10 m^3/h	-	10 m^3/h	-

Footnotes refer to ▹page 76◃.

- Single axis unit safety

		BM5**326**	BM5**326-A**	BM5**327**	BM5**327-A**
Input rated power [1]		6.7 kW		11.2 kW	
Input rated current (I_{eff}) [1]		10.5 A		17.5 A	
DC link voltage (U_{DC}) [1]		60 V - 760 V			
DC link capacitance (internal)		165 µF		330 µF	
DC link discharge time (internal DC link capacitance)		300 s			
Output voltage (U_{AC}) [1] [3]		0 - 500 V			
Output frequency at 4 kHz [4]		0 - 450 Hz			
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 4 kHz [4]	12 A		20 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 8 kHz [4]	8.4 A		14 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 16 kHz [4]	4.8 A		8 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 4 kHz [4]	24 A		40 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 8 kHz [4]	16.8 A		28 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 16 kHz [4]	9.6 A		16 A	
Short-time operation KB		200 %			
Max. length of time peak current [6] [10]		Refer to ▹Load cycle according EN61800-6◃ as from page 78			
Power loss with regard to power supply		Max. 105 W		Max. 155 W	
Power loss with regard to control voltage supply (air-cooled) [7]		Max. 39 W		Max. 41 W	
Power loss with regard to control voltage supply (cold plate cooling) [7]		Max. 37 W	-	Max. 37 W	-
Current of the integrated brake control (option) [8]		Max. 4.0 A			
Cooling air requirement power heat sink		10 m^3/h	-	20 m^3/h	-
Cooling air velocity power heat sink			> 5 m/s		> 5 m/s
Cooling air requirement internal space of device		10 m^3/h	-	10 m^3/h	-

Footnotes refer to ▹page 76◃.

		BM5**328**	BM5**328-A**	BM5**334**	BM5**334-A**
Input rated power [1]		16.8 kW		22.4 kW	
Input rated current (I_{eff}) [1]		26.5 A		35 A	
DC link voltage (U_{DC}) [1]		60 V - 760 V			
DC link capacitance (internal)		495 µF		660 µF	
DC link discharge time (internal DC link capacitance)		300 s		480 s	
Output voltage (U_{AC}) [1] [3]		0 - 500 V			
Output frequency at 4 kHz [4]		0 - 450 Hz			
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 4 kHz [4]	30 A 28 A at UL		40 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 8 kHz [4]	21 A		28 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 16 kHz [4]	12 A		16 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 4 kHz [4]	60 A		60 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 8 kHz [4]	42 A		42 A	
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 16 kHz [4]	24 A		24 A	
Short-time operation KB		200 %		150 %	
Max. length of time peak current [6] [10]		Refer to ▹Load cycle according EN61800-6◃ as from page 78			
Power loss with regard to power supply		Max. 230 W		Max. 310 W	
Power loss with regard to control voltage supply (air-cooled) [7]		Max. 45 W		Max. 40 W	
Power loss with regard to control voltage supply (cold plate cooling) [7]		Max. 37 W	-	Max. 35 W	-
Current of the integrated brake control (option) [8]		Max. 4.0 A			
Cooling air requirement power heat sink		35 m^3/h		55 m^3/h	
Cooling air velocity power heat sink		-	> 5 m/s	-	> 5 m/s
Cooling air requirement internal space of device		10 m^3/h	-	10 m^3/h	-

Footnotes refer to ▹page 76◃.

		BM5**335**	BM5**335-A**	BM5**335-F**
Input rated power [1]		33.6 kW		
Input rated current (I_{eff}) [1]		53 A		
DC link voltage (U_{DC}) [1]		60 V - 760 V		
DC link capacitance (internal)		1175 µF		
DC link discharge time (internal DC link capacitance)		900 s		
Output voltage (U_{AC}) [1) 3)]		0 - 500 V		
Output frequency at 4 kHz [4]		0 - 450 Hz		
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 4 kHz [4]	60 A		
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 8 kHz [4]	42 A		
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 16 kHz [4]	24 A		
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 4 kHz [4]	120 A		
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 8 kHz [4]	84 A		
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 16 kHz [4]	48 A		
Short-time operation KB		200 %		
Max. length of time peak current [6) 10)]		According dynamic temperature model		
Power loss with regard to power supply		Max. 460 W		
Power loss with regard to control voltage supply (air-cooled) [7]		Max. 53 W		-
Power loss with regard to control voltage supply (cold plate cooling) [7]		Max. 37 W	-	Max. 37 W
Current of the integrated brake control (option) [8]		Max. 4.0 A		
Cooling air requirement power heat sink		100 m^3/h	-	-
Cooling air velocity power heat sink		-	> 5 m/s	-
Cooling air requirement internal space of device		10 m^3/h	-	-
Requirements of the water cooling		-	-	Refer to ▹Cooling◃ on page 58

Footnotes refer to ▹page 76◃.

		BM5**372-S**	BM5**373-S**	BM5**374-S**	BM5**376-S**
Input rated power [1]		64 kW	80 kW	95 kW	
Input rated current (I_{eff}) [1]		100 A	125 A	150 A	
DC link voltage (U_{DC}) [1]		60 V - 760 V			
DC link capacitance (internal)		1230 µF	2050 µF		
DC link discharge time (internal DC link capacitance)		128 s	214 s		
Output voltage (U_{AC}) [1] [3]		0 - 500 V			
Output frequency at 4 kHz [4]		0 - 450 Hz			
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 2 kHz [4]	120 A	150 A	180 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 4 kHz [4]	90 A	120 A	150 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 8 kHz [4]	63 A	84 A	105 A	
Output rated current (I_{AC} RMS) [1] [2] [5] [11]	at 16 kHz [4]	45 A	50 A		
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 2 kHz [4]	180 A	300 A		420 A
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 4 kHz [4]	180 A	240 A	300 A	420 A
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 8 kHz [4]	126 A	168 A	210 A	294 A
Output peak current (I_{AC} RMS) [1] [5] [6] [11]	at 16 kHz [4]	90 A	100 A		140 A
Short-time operation KB		150 %	200 %	166 %	233 %
Max. length of time peak current [6] [10]		According dynamic temperature model			
Power loss with regard to power supply		Max. 650 W	Max. 900 W	Max. 1120 W	Max. 1300 W
Power loss with regard to control voltage supply [7]		Max. 60 W			
Current of the integrated brake control (option)		Max. 8.0 A [12] [13]			

Footnotes refer to ▹page 76◃.

		BM5372-F	BM5373-F	BM5374-F	BM5375-F	BM5376-F
Input rated power [1]		64 kW	80 kW	95 kW		
Input rated current (I_{eff}) [1]		100 A	125 A	150 A		
DC link voltage (U_{DC}) [1]		60 V - 760 V				
DC link capacitance (internal)		1230 µF	2050 µF			
DC link discharge time (internal DC link capacitance)		128 s	214 s			
Output voltage (U_{AC}) [1) 3)]		0 - 500 V				
Output frequency at 4 kHz [4]		0 - 450 Hz				
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 2 kHz [4]	120 A	150 A	180 A		
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 4 kHz [4]	90 A	120 A	150 A	180 A	
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 8 kHz [4]	63 A	84 A	105 A	130 A	
Output rated current (I_{AC} RMS) [1) 2) 5)11)]	at 16 kHz [4]	45 A	60 A	75 A	90 A	
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 2 kHz [4]	180 A	300 A	300 A	300 A	420 A
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 4 kHz [4]	180 A	240 A	300 A	300 A	420 A
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 8 kHz [4]	126 A	168 A	210 A	260 A	300 A
Output peak current (I_{AC} RMS) [1) 5) 6)11)]	at 16 kHz [4]	90 A	120 A	150 A	180 A	200 A
Short-time operation KB		150 %	200 %	166 %		233 %
Max. length of time peak current [6) 10)]		According dynamic temperature model				
Power loss with regard to power supply		Max. 650 W	Max. 900 W	Max. 1120 W	Max. 1300 W	
Power loss with regard to control voltage supply [7]		Max. 30 W				
Requirements of the water cooling		Refer to ▹Cooling◃ on page 58				
Current of the integrated brake control (option)		Max. 8.0 A [12) 13)]				

Footnotes refer to ▹page 76◃.

[1] All rated values are based on an power supply voltage of 400 V/50 Hz, a DC link voltage of 640 V, a control voltage of 24 V and a surrounding temperature of 40 °C and the switching frequency specified.

[2] The input current must be reduced between 40 °C and 55 °C, refer to correction values at changed operation conditions, ▹Correction values for the output current of the mains inverter BM50XX, BM51XX◃ on page 51.

[3] The output voltage is a pulsed direct voltage. The adjusting range is based on the RMS-value of the fundamental wave.

[4] The range of the output frequency is based on a stationary operation in the linear range of the PWM, i. e. without overmodulation.
The quality of the generated output voltages depends on the ratio between output frequency and current controller frequency $f_{I\text{-}R}$ ($f_{I\text{-}R}$ = 1/cycle time current controller).
The maximum output frequency f_{max}, generated with high quality, is calculated as follows:

$$f_{max} = \frac{f_{I\text{-}R}}{K_{pf}}\text{, typical } K_{Pf} \approx 18$$

Furthermore the controller sets an upper limit for the output frequency of 599 Hz (please contact the responsible Baumüller sales department, keyword: export restriction).

The range of the output frequency is defined as follows:

PWM frequency	Current controller cycle time	Range of the output frequency
2 kHz	250 µs	0 - 225 Hz
4 kHz	125 µs	0 - 450 Hz
8 / 16 kHz	62.5 µs	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller
The device is able to generate output voltages with frequencies between f_{max} and 599 Hz and the controller allows that, however the quality of this voltages cannot be guaranteed.
Typical the devices are marked with the max output frequency at 4 kHz switching frequency: 0 ... 450 kHz.

[5] The device draws the rated/peak current at rated supply voltage. The input current must be reduced if power supply voltage is higher than 400 V and the DC link output power remains constant, refer to ▹Derating: Output current as function of the DC link voltage axis units◃ on page 57.

[6] The actual possible overload time depends on the preloading of the device and the heat sink temperature and is detected by the overload monitoring of the device.
Assumption: initial conditions before the overload occurrence: heat sink temperature 40 °C, I = 0 A,

[7] Without loads on the digital outputs and motor brake.

[8] Short-circuit protected for a maximum of 1 minute.

[9] This power rating is the total power rating of both axes.

[10] 120 s for BM53XX-SXXX
10 s for cold plate devices BM53XX-CXXX, refer to ▹Cooling◃ as from page 58

[11] The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 77 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for over 5 seconds.

[12] Max 6,4 A, when considering safe motor brake:

[13] Max. 4,0 A, when considering UL61800-5-1

3.4.3 Output frequency-dependent current derating

All Baumüller devices have been developed so that the rated output current, as stated, are only continuously permitted (i. e. in S1 operation) with an electrical output frequency of 15 Hz or higher. If the static inverter output frequency is smaller than 15 Hz and the frequency is between 0 and 15 Hz for more than 5 seconds, then the continuously permissible output current must be reduced according to the following characteristic curve.

These are affected, for example, but not exclusively:

- Applications with rpm control but without positioning, or
- Applications in which a current is required to assure a torque / a force at standstill or
- Applications in which blocking of the mechanical parts can occur, e.g. when starting up cold extruders.

Thus, typically, the following applications are not affected:

- Generally, typical positioning applications
- Applications with motors that use a service brake when at standstill.
- Applications in which the higher-level control unit has standstill and blocking monitoring.

Insofar as the derating range has been cycled through with sufficient speed, the application of I_{rated} is permitted. Here, cycled through with sufficient speed means that the frequency change corresponds to ≥ 15 Hz/s.

Derating of the motor-side inverter output current I with respect to the rated output current I_{rated} as a function of the static inverter output frequency f.

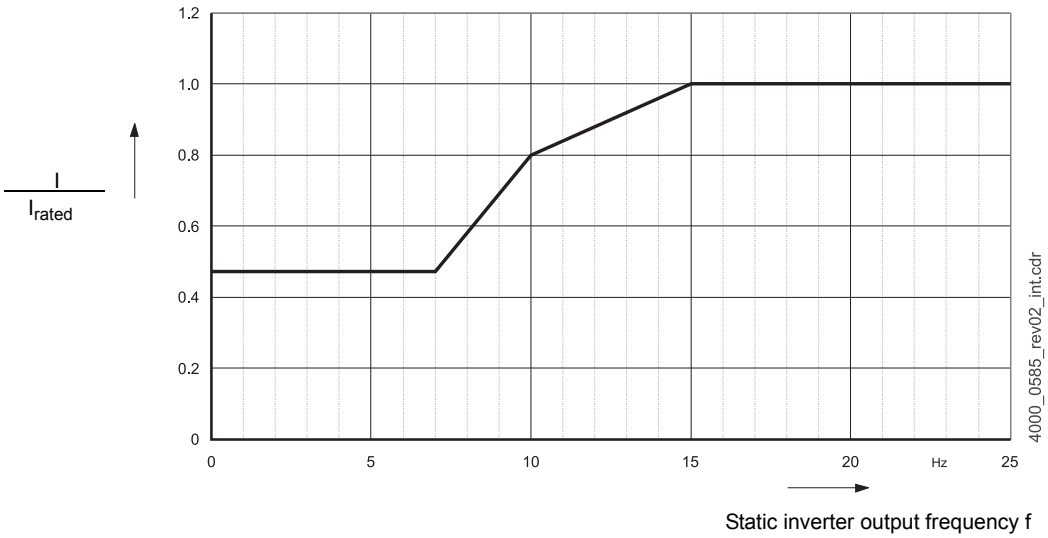


Figure 32: Derating with a static inverter frequency < 15 Hz

3.4.4 Load cycle according EN61800-6

3.4.4.1 Load cycle BM50XX

Operation with constant load

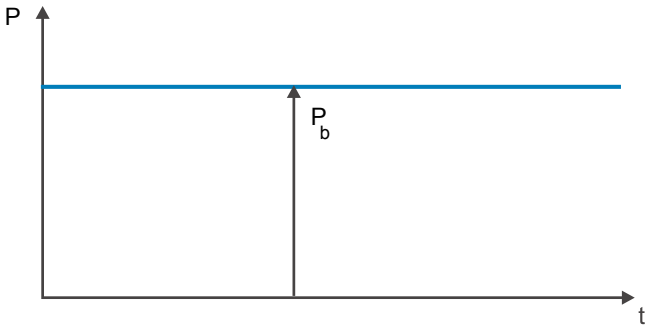


Figure 33: Typical power-time diagram: operation with constant load

	P_b
BM5030	5 kW (100 % P_N)
BM5031	10 kW (100 % P_N)
BM5032	18 kW (100 % P_N)
BM5043	36 kW (100 % P_N)
BM5044	70 kW (100 % P_N)
BM5074	150 kW (100 % P_N)
BM5075	200 kW (100 % P_N)

Intermittent load cycle with peak value

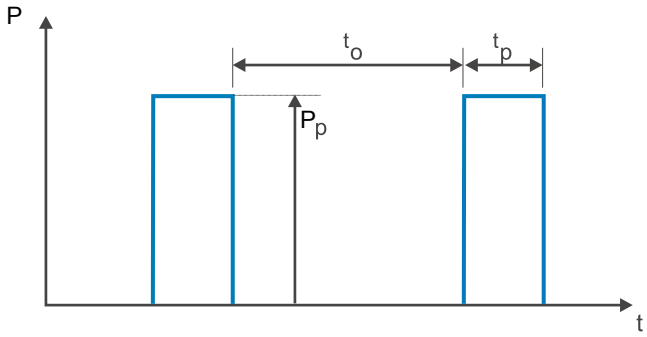


Figure 34: Typical power-time diagram: intermittent load cycle with peak value

This term is valid for possible load cycles:

$$(t_p + t_o) \cdot P_{rated} \geq t_p \cdot P_p$$

	t_o	t_p with P_p = 150 % P_N
BM5030	150 s	75 s
BM5031	150 s	75 s
BM5032	150 s	75 s
BM5043	150 s	75 s
BM5044	No overlaod	
BM5074	10 s	10 s
BM5075	10 s	5 s

Intermittent load cycle with base load

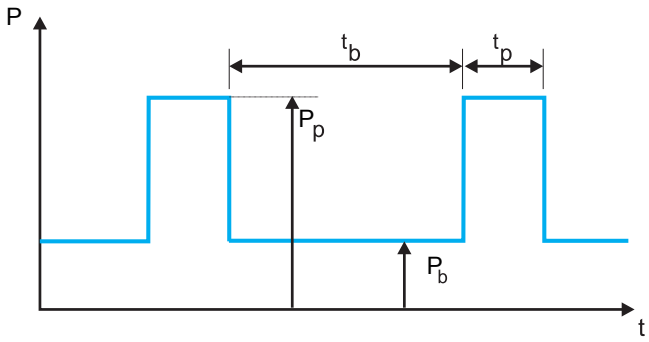


Figure 35: Typical power-time diagram: Intermittent load cycle

This term is valid for possible load cycles:

$$(t_p + t_b) \cdot P_{rated} \geq t_p \cdot P_p + t_b \cdot P_b$$

	t_b with P_b = 60 % P_N	t_p with P_p = 150 % P_N
BM5030	60 s	48 s
BM5031	60 s	48 s
BM5032	60 s	75 s
BM5043	60 s	75 s
BM5044	No overload	
BM5074	6 s	10 s
BM5075	6 s	5 s

3.4.4.2 Load cycle BM51XX, BM53XX

Operation with constant load

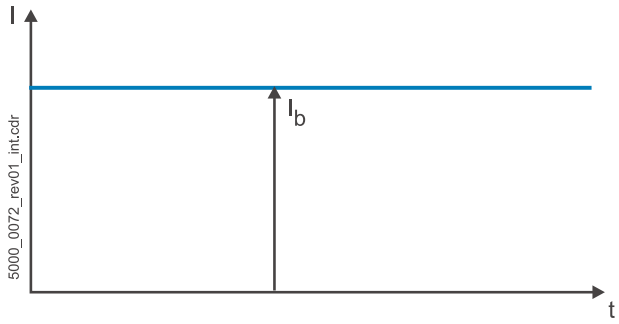


Figure 36: Typical current-time diagram: operation with constant load

BM51XX

	I_b
BM5174 S (air-cooled) BM5174 C (cold plate)	100 A (100 % I_{rated})
BM5192	216 A (100 % I_{rated})
BM5193	290 A (100 % I_{rated})

BM53XX

	I_b at 2 kHz	I_b at 4 kHz	I_b at 8 kHz	I_b at 16 kHz
BM5323	-	2 x 3 A (100 % I_{rated})	2 x 2.1 A (70 % I_{rated})	-
BM5325	-	2 x 6 A (100 % I_{rated})	2 x 4.2 A (70 % I_{rated})	-
BM5326	-	12 A (100 % I_{rated})	8.4 A (70 % I_{rated})	4.8 A (40 % I_{rated})
BM5327	-	20 A (100 % I_{rated})	14 A (70 % I_{rated})	8 A (40 % I_{rated})
BM5328	-	30 A (100 % I_{rated})	21 A (70 % I_{rated})	12 A (40 % I_{rated})
BM5331	-	2 x 12 A (100 % I_{rated})	2 x 8.4 A (70 % I_{rated})	2 x 4.8 A A (40 % I_{rated})
BM5332	-	2 x 20 A (100 % I_{rated})	2 x 14 A (70 % I_{rated})	2 x 8 A (40 % I_{rated})
BM5333	-	2 x 30 A (100 % I_{rated})	2 x 21 A (70 % I_{rated})	2 x 12 A (40 % I_{rated})
BM5334	-	40 A (100 % I_{rated})	28 A (70 % I_{rated})	16 A (40 % I_{rated})
BM5335	-	60 A (100 % I_{rated})	42 A (70 % I_{rated})	24 A (40 % I_{rated})
BM5372-S	120 A (100 % I_{rated})	90 A (75 % I_{rated})	63 A (52 % I_{rated})	45 A (37 % I_{rated})
BM5372-F				
BM5373-S	150 A (100 % I_{rated})	120 A (80 % I_{rated})	84 A (56 % I_{rated})	50 A (33 % I_{rated})
BM5373-F				60 A (40 % I_{rated})
BM5374-S	180 A (100 % I_{rated})	150 A (83 % I_{rated})	105 A (58 % I_{rated})	50 A (27 % I_{rated})
BM5374-F			100 A (55 % I_{rated})	75 A (41 % I_{rated})
BM5375-F	180 A (100 % I_{rated})	180 A (100 % I_{rated})	130 A (70 % I_{rated})	90 A (50 % I_{rated})
BM5376-S	180 A (100 % I_{rated})	150 A (83 % I_{rated})	105 A (58 % I_{rated})	50 A (27 % I_{rated})
BM5376-F		180 A (100 % I_{rated})	130 A (72 % I_{rated})	90 A (50 % I_{rated})

NOTE!

Precondition for the following load cycles:

Output frequency ≥ 100 Hz!

Intermittent load cycle with peak value

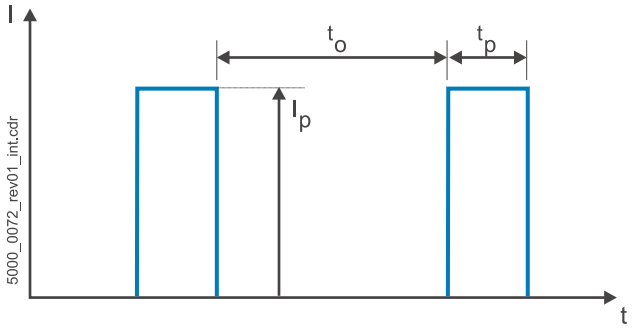


Figure 37: Typical current-time diagram: intermittent load cycle with peak value

This term is valid for possible load cycles:

$$(t_p + t_o) \cdot I^2_{rated} = t_p \cdot I^2_p$$

BM51XX

	t_o	t_p with I_P = 150 % I_{rated}
BM5174 S (air-cooled)	600 s	120 s
BM5174 C (cold plate)		30 s
BM5192	15 s	10 s
BM5193	13 s	10 s

BM53XX

	t_o	t_p with I_P = 150 % I_{rated}	t_p with I_P = 166 % I_{rated}	t_p with I_P = 200 % I_{rated}	t_p with I_P = 233 % I_{rated}	t_p with I_P = 300 % I_{rated}
BM5323	10 s	-	-	3.3 s (I_P = 6 A)	-	1.1 s (I_P = 9 A)
BM5325	10 s	-	-	3.3 s (I_P = 12 A)	-	1.1 s (I_P = 18 A)
BM5326	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5327	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5328	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5331	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5332	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5333	18 s	-	-	6 s (I_P = 24 A)	Not allowed	Not allowed
BM5334	16 s	7 s	-	Not allowed	Not allowed	Not allowed
BM5335	6 s	-	-	2 s	Not allowed	Not allowed
BM5372-S	30 s	24 s (I_P = 180 A)	Not allowed	Not allowed	Not allowed	Not allowed
BM5372 F		28 s (I_P = 180 A)				
BM5373	30 s	24 s (I_P = 225 A)	16 s (I_P = 250 A)	10 s (I_P = 300 A)	Not allowed	Not allowed
BM5374	30 s	24 s (I_P = 270 A)	16 s (I_P = 300 A)	Not allowed	Not allowed	Not allowed
BM5375 F	30 s	24 s (I_P = 270 A)	16 s (I_P = 300 A)	Not allowed	Not allowed	Not allowed
BM5376	30 s	24 s (I_P = 270 A)	16 s (I_P = 300 A)	10 s (I_P = 360 A)	6 s (I_P = 420 A)	Not allowed

Intermittent load cycle with base load

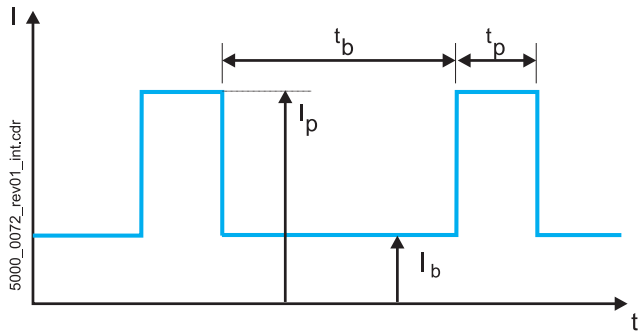


Figure 38: Typical current-time diagram: Intermittent load cycle

This term is valid for possible load cycles:

$$(t_b + t_o) \cdot I_{rated}^2 = t_p \cdot I_p^2 + t_b \cdot I_b^2$$

BM51XX

	t_b with I_P = 60 % I_{rated}	t_p with I_P = 150 % I_{rated}
BM5174 S (air-cooled)	20 s	2 s
BM5174 C (cold plate)		0.5 s
BM5192	13 s	5 s
BM5193	11 s	5 s

BM53XX

	t_b with I_b = 60 % I_{rated}	t_p with I_P = 300 % I_{rated}	t_p with I_P = 200% I_{rated}	t_p with I_P = 150% I_{rated}	t_b with I_b = 60 % I_{rated}	t_p with I_P = 150 % I_{rated}
BM5323	60 s (I_b = 1.8 A)	4.8 s (I_P = 9 A)	12.8 s (I_P = 6 A)	-	600 s (I_b = 1.8 A)	240 s (I_P = 4.5 A)
BM5325	60 s (I_b = 3.6 A)	4.8 s (I_P = 18 A)	12.8 s (I_P = 12 A)	-	600 s (I_b = 3.6 A)	240 s (I_P = 9 A)
BM5326	60 s (I_b = 7.2 A)	not allowed	10 s (I_P = 24 A)	-	600 s [1] (I_b = 7.2 A) 40 s [2] (I_b = 7.2 A)	150 s [1] (I_P = 18 A) 10 s [2] (I_P = 18 A)
BM5327	60 s (I_b = 12 A)	not allowed	10 s (I_P = 40 A)	-	600 s [1] (I_b = 12 A) 40 s [2] (I_b = 12 A)	150 s [1] (I_P = 30 A) 10 s [2] (I_P = 30 A)
BM5328	60 s (I_b = 18 A)	not allowed	10 s (I_P = 60 A)	-	600 s [1] I_b = 18 A) 40 s [2] (I_b = 18 A)	150 s [1] (I_P = 45 A) 10 s [2] (I_P = 45 A)
BM5331	60 s (I_b = 7.2 A)	not allowed	10 s (I_P = 24 A)	-	600 s [1] (I_b = 7.2 A) 40 s [2] (I_b = 7.2 A)	150 s [1] (I_P = 18 A) 10 s [2] (I_P = 18 A)
BM5332	60 s (I_b = 12 A)	not allowed	10 s (I_P = 40 A)	-	600 s [1] (I_b = 12 A) 40 s [2] (I_b = 12 A)	150 s [1] (I_P = 30 A) 10 s [2] (I_P = 30 A)
BM5333	60 s (I_b = 18 A)	not allowed	10 s (I_P = 60 A)	-	600 s [1] I_b = 18 A) 40 s [2] (I_b = 18 A)	150 s [1] (I_P = 45 A) 10 s [2] (I_P = 45 A)
BM5334	150 s [1] (I_b = 24 A) 50 s [2] (I_b = 24 A)	not allowed	not allowed	30 s [1] (I_P = 60 A) 10 s [2] (I_P = 60 A)	150 s [1] (I_b = 24 A) 50 s [2] (I_b = 24 A)	30 s [1] (I_P = 60 A) 10 s [2] (I_P = 60 A)
BM5335	4.7 s (I_b = 36 A)	not allowed	1 s (I_P = 120 A)	-	150 s [1] (I_b = 36 A) 50 s [2] (I_b = 36 A)	30 s [1] (I_P = 120 A) 10 s [2] (I_P = 120 A)
BM5372	60 s (I_b = 72 A)	not allowed	not allowed	30 s (I_P = 180 A)	-	-
BM5373	60 s (I_b = 90 A)	not allowed	12 s (I_P = 300 A)	30 s (I_P = 225 A)	-	-
BM5374	60 s (I_b = 108 A)	not allowed	not allowed	30 s (I_P = 270 A)	-	-
BM5375 F	60 s (I_b = 108 A)	not allowed	not allowed	30 s (I_P = 270 A)	-	-
BM5376	60 s (I_b = 108 A)	not allowed	12 s (I_P = 300 A)	30 s (I_P = 270 A)	-	-

[1] Air-cooled

[2] Cooling by cold plate, refer to ▹Cooling◃ as from page 58.

3.4.5 Proposal for dimensioning

Refer to ▹Accessories and spare parts◃ as from page 257

Device	Fuse	Line filter	Power choke	Cable
BM5030 I_{rated} = 8.5 A I_{max} = 12.5 A Device limits current to rated current!	CE+UL Class J Bussmann DFJ-25 (device is protected against short circuit) CE Semiconductor fuse aR Siemens 3NC1 420 20 A, 14x51 (device is protected against short circuit)	NFI-020 $I_{rated\ (50\ °C)}$ =18 A $I_{rated\ (40\ °C)}$ =20 A	No	≥ 2.1 mm² (AWG14)
BM5031 I_{rated} = 17 A I_{max} = 25 A Device limits current to rated current!	CE+UL Class J Bussmann DFJ-25 (device is protected against short circuit) CE Semiconductor fuse aR Siemens 3NC1 425 25 A, 14x51 (device is protected against short circuit)	BFN3-1-0016 $I_{rated\ (50\ °C)}$ =16 A $I_{rated\ (40\ °C)}$ =17,5 A	BK3-0025/0030 $I_{rated\ (45°C)}$ = 25 A	≥ 5.3 mm² (AWG10)
BM5032 I_{rated} = 31 A I_{max} = 46 A Device limits current to rated current!	CE+UL Class J Bussmann DFJ-35 (device is protected against short circuit) CE Semiconductor fuse aR Siemens 3NC1 440 40 A 14x51 (device is protected against short circuit)	BFN3-1-0030 $I_{rated\ (50\ °C)}$ =30 A $I_{rated\ (40\ °C)}$ =32.9 A	BK3-0040/0050 $I_{rated\ (45°C)}$ = 41 A	≥ 8.4 mm² (AWG8)
BM5043 I_{rated} = 65 A I_{max} = 98 A Device limits current to rated current!	CE+UL Class J Bussmann DFJ-80 (device is protected against short circuit) CE Semiconductor fuse aR Siemens 3NC2 280 80 A 14x51 (device is protected against short circuit)	BFN3-1-0075-001 $I_{rated\ (50\ °C)}$ = 75 A $I_{rated\ (40\ °C)}$ = 82.2 A	BK3-0080/0100 $I_{rated\ (45°C)}$ = 82 A	≥ 21.2 mm ² (AWG4)
BM5044 I_{rated} = 130 A I_{max} = 130 A Device limits current to rated current!	CE+UL Class J Bussmann DFJ-150 (device can be destroyed in case of short circuit but CE+UL are assured) CE Semiconductor fuse aR, Gr. 00 Siemens 3NE8 024-1 160 A (device is protected against short circuit)	BFN3-1-0130-001 $I_{rated\ (50\ °C)}$ = 130 A $I_{rated\ (40\ °C)}$ = 142.4 A	BK3-0165/0200 $I_{rated\ (45°C)}$ = 164 A	CE+UL 53.5 mm² (AWG1/0) CE 50 mm²

Device	Fuse	Line filter	Power choke	Cable
BM5074 I_{rated} = 240 A I_{max} = 485 A	CE+UL Class J Bussmann DFJ-350 CE semiconductor fuse aR, Gr 1 Siemens 3NE3 233 450 A (device is protected against short circuit)	BFN3-1-0250-001	BK3-0275/0340	
BM5075 I_{rated} = 325 A I_{max} = 485 A		BFN3-1-0320-001	BK3-0365/0450	
BM5173	CE+UL Class J Bussmann DFJ-100 (device can be destroyed in case of short circuit but CE+UL are assured) CE semiconductor fuse aR, Gr. 00 Siemens 3NE8 221 100 A (device is protected against short circuit)	Schaffner filter FN 3120H-80-35	BL-3-060-000 Part No. 388168 Part No. 415096	
BM5174	CE+UL Class J Bussmann DFJ-150 (device can be destroyed in case of short circuit, CE+UL are assured) CE semiconductor fuse aR, Gr. 00 Siemens 3NE8 224 160 A (device is protected against short circuit)	EPCOS filter B84143A0150R410 Part No. 437618	BL-3-100-001 Part No. 430926	
BM519X	CE+UL Class J Bussmann DFJ-350 (device can be destroyed in case of short circuit but CE+UL are assured) CE semiconductor fuse aR Siemens 3NE3 233 450 A	LGF mains filter FFU 3x295AB-SBM Part No. 463278	TRAMAG choke D400/110/ -20-D5-01 Part No. 463082	

4

DESIGN AND OPERATION

4.1 Design

The **b maXX 5000** series consists of an (active) mains rectifier unit and one or more axis units, decentralized drive solutions or multi-axis controllers. The possible number of devices, that can be connected depends on the connected load of the DC link of the mains rectifier unit or is limited by the signal bus to a maximum of 12.

b maXX 50XX **Mains rectifier unit**

This is a mains rectifier unit for supplying axis units or decentralized drive solutions BM2500 via the DC link.

The applied AC voltage at the three phase power system is transformed by a rectifier on the input side into DC voltage. The DC link capacitors smooth this DC voltage.

b maXX 51XX **Active mains rectifier unit**

This is an active mains rectifier unit for supplying axis units via the DC link.

The applied AC voltage at the three phase power system is transformed by a rectifier on the input side into DC voltage. The DC link capacitors smooth this DC voltage. The active mains rectifier unit can feed back excess braking energy into the mains as sinusoidal electrical current.

b maXX 53XX **Single axis unit safety, double axis unit safety**

This is a motor inverter that is supplied from a mains rectifier unit or active mains rectifier unit via the DC link.

From the DC voltage at the DC link, the inverter on the output side produces a three-phase current system with variable frequency and voltage for operation of the connected motor.



NOTE!

Correct operation of the **b maXX axis units BM53XX** can only be ensured in combination with Baumüller **mains rectifier units BM50XX, BM51XX** or **basic units BM4XXX** / **BM5XXX**.

Controller The controller unit controls the inverter of the power unit. The controller is operated either by means of operating software or by means of a higher-level control unit.

4.2 Identification of the device

4.2.1 Part number

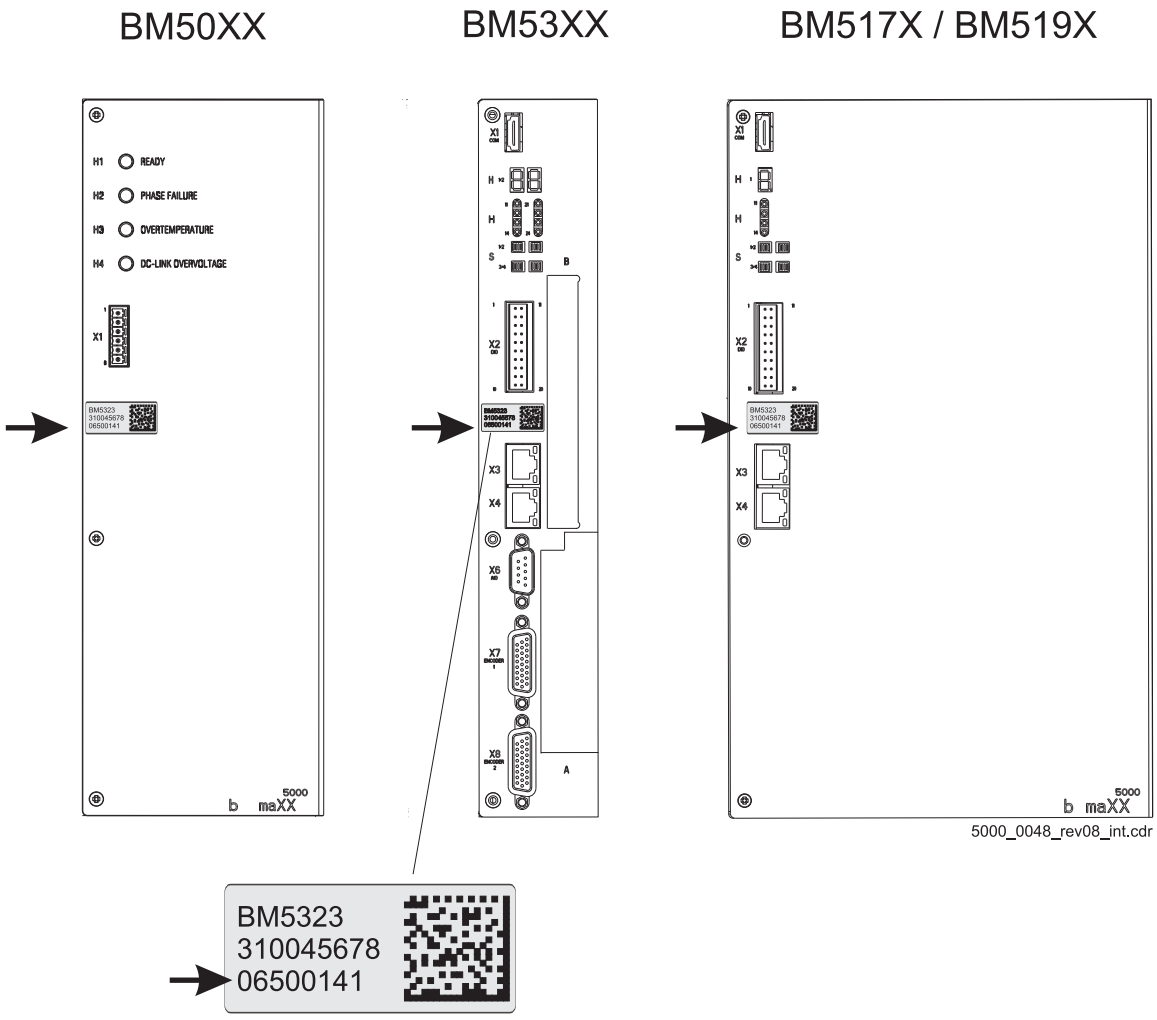


Figure 39: Part number - front

4.2.2 Type plate

Examples of the locations where the type plate is affixed are shown in the figure. Among other things, the type plate also shows the type code of the device.

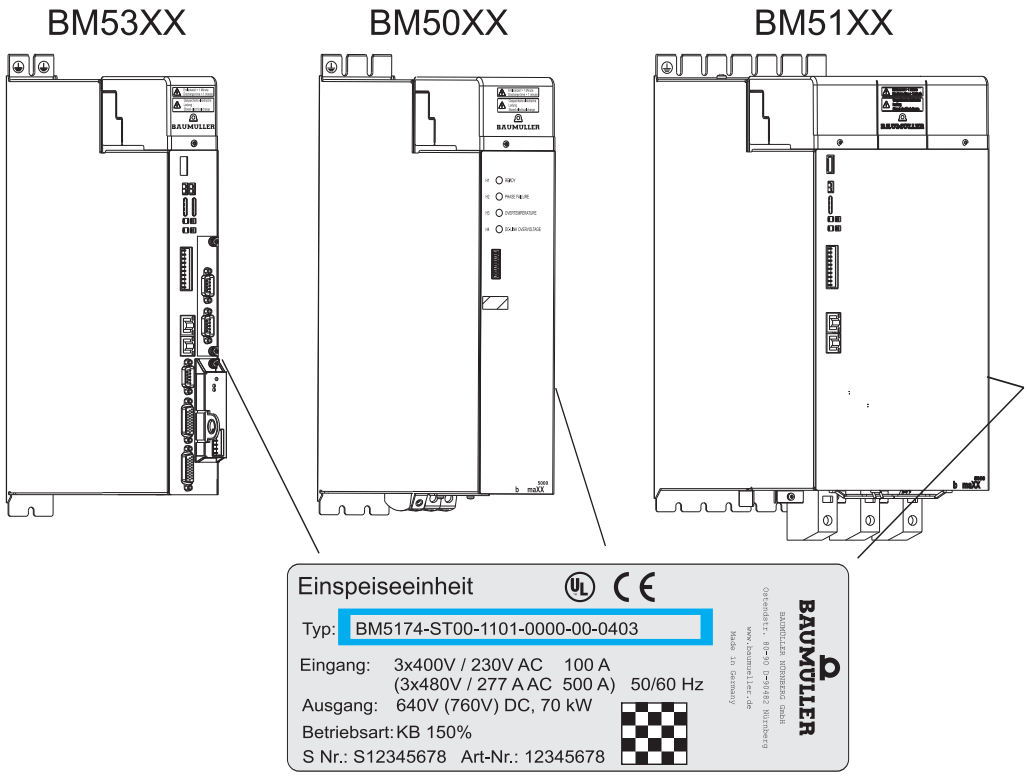


Figure 40: Affixing of the type plate

4.2.3 Type code

The type code has the format: BM5XXX - XXXX - XXXX - XXXX - XX - XXXX.

The type code is explained in the following table.

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Device generation

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Device design

0: Mains rectifier
1: Active mains rectifier
3: Axis unit safety
5: Basic unit/power module safety
6: Basic unit/power module safety, optimized for peak current
7: Basic unit/power module safety, optimized for rated current, water-cooled
8: Multi-axis controller safety

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Housing size

1 to 9,
refer to ▹Dimensions◃ as from page 29.

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Current grading (output rated current)

2 to 8 (current value dependent on the housing size),
refer to ▹Electrical data◃ as from page 60.

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Type of cooling

S: Air-cooled with air supply and with air outlet in the control cabinet
A: Air-cooled with air supply and with air outlet outside the control cabinet
Z: Water-cooled with water cooler in the control cabinet
F: Water-cooled with water cooler outside the control cabinet
C: Cold plate cooling via mounting wall of the control cabinet

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX — Type of power supply system

T: BM50XX, BM51XX: grounded TN or TT systems
I: BM50XX: IT systems, grounded TN or TT systems
G: BM50XX: Grounded delta systems, IT systems, grounded TN or TT systems
R: BM50XX with charge resistor: Grounded TN or TT systems
S: BM50XX with charge resistor: IT systems, grounded TN or TT systems
W: BM50XX with charge resistor: Grounded delta, IT systems, grounded TN or TT systems

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX

SAF modules (BM53XX only) / STO function (BM5030 only)

0: No SAF module / no STO function
1: BM5030 with STO function, basic type with feedback outputs
2: BM5030 with STO function, automatic locking function
refer to ▹Appendix D - BM5030 with Safety Function◃ as from page 321

BM5-O-SAF

A:	-000-000-001	SAF module standard without parameter memory
B:	-000-000-000	SAF module with parameter memory
C:	-001-000-000	STO controllable via I/O, with parameter memory, without automatic restart
D:	-001-000-002	STO controllable via I/O, with parameter memory, with automatic restart
E:	-002-000-000	STO controllable via I/O and FSoE, with parameter memory, with daisy-chain inputs, without separated grounds, with 12h encoder test
F:	-002-001-000	STO controllable via I/O and FSoE, with parameter memory, without daisy-chain inputs, without separated grounds, with 12h encoder test
G:	-003-000-000	STO controllable via I/O and FSoE, with parameter memory, with daisy-chain inputs, without separated grounds, with 12h encoder test
H:	-003-001-000	STO controllable via I/O and FSoE, with parameter memory, without daisy-chain inputs, without separated grounds, with 12h encoder test
I:	-001-001-000	STO controllable via I/O, without parameter memory, with automatic restart, with short-circuit test
K:	-001-001-001	SS1 controllable via I/O (SS1 time is a fixed set value), without parameter memory, with automatic restart, with short-circuit test

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX

Power unit design

BM50XX, BM51XX
0: X1 inhibit input expects NO contact, refer to ▹Figure 70◃ on page 150
1: X1 inhibit input expects NC contact, refer to ▹Figure 71◃ on page 151, error reset via power supply off ⇒ power supply on, refer to ▹Page 254◃

BM532X
2: With motor brake, instruction handbook 5.09021.03 is valid
3: Without motor brake, instruction handbook 5.09021.03 is valid
4: With motor brake, 3-pole motor connector, PE screw terminals
5: Without motor brake, 3-pole motor connector, PE screw terminals

BM533X to BM537X
2: With motor brake
3: Without motor brake

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX

Encoder evaluation

00: None

01: Encoder 1 and Encoder 2:
HIPERFACE®, EnDat® 2.1, SSI, square and sine incremental encoder, resolver
02: Encoder 1 and Encoder 2: EnDat® 2.2
03: Encoder 1 and Encoder 2: HIPERFCACE DSL®

06: Encoder 1: refer to 01, Encoder 2: EnDat® 2.2
07: Encoder 1: refer to 01, Encoder 2: HIPERFCACE DSL®
08: Encoder 1: EnDat® 2.2, Encoder 2: refer to 01

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX Add-on module

00: Without module
01: With option module IEE with external supply
03: With option module SIE with internal supply
04: With option module SVP-001-001, 4 analog inputs (for voltage), 4 analog outputs (voltage)
05: With option module SVP-001-002, 4 analog inputs (2 for voltage, 2 for current), 4 analog outputs (voltage)
06: With option module SVP-001-003, 4 analog inputs (for current) 4 analog outputs (voltage)
07: With option module EIP-001-001 EthernetIP incl. IEE with external supply
08: With option module MOD-001-001 Modbus/TCP incl. IEE with external supply

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX Fieldbus configuration

01: EtherCAT® CoE
02: VARAN
03: CANopen®
04: POWERLINK®
05: ProfiNET RT/IRT
07: EtherCAT® SoE

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX Hardware configuration controller

See ▹Page 93◃.

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX Version

00: Standard
01: PCB with protective lacquer
02: Special version for customer
03: PCB with protective lacquer, without accessories kit, without DC link rails
04: Without accessories kit, without DC link rails
05: Special version for customer

BM5XXX-XXXX-XXXX-XXXX-XX-XXXX Controller software version



NOTE!

Only devices with type code BM5XXX-XXXX-XX**01**/**03** and **-**XX**04/05/06** provide an add-on module!

The add-on modules are built-in and cannot be changed.
It is forbidden to remove the yellow front cover.

Hardware configuration controller

BM5XXX - XXXX - XXXX - XX**XX** - XX - XXXX - EXX

01: BSCsafe Step 1 V.1 (for single and double axis),
with AIO, DIO, encoder, EtherCAT® (RJ45)

02: BSCsafe Step 1 V.2 (for single axis),
with AIO, DIO, encoder, EtherCAT® (RJ45)

04: BSCsafe Step 1 V.4 (for active mains converter),
without AIO, without encoder evaluation, without add-on module

05: Reserved

06: BSCsafe Step 1 V.1 (for single and double axis),
with AIO, DIO, encoder, EtherCAT® (RJ45), with additional +24 V supply for DIO and motor brake

07: BSCsafe Step 1 V.4 (for active mains converter),
without AIO, without encoder evaluation, without add-on module, with additional +24 V supply for DIO

08: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX), with AIO, DIO, encoder, fieldbus (RJ45)

09: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, encoder, fieldbus (RJ45), without DIO

10: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX)
with AIO, DIO, encoder, fieldbus (RJ45), both pulse enables are switched-on permanently

28: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, DIO, encoder, fieldbus (RJ45), 450 MHz

29: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, encoder, fieldbus (RJ45), without DIO, 450 MHz

30: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, DIO, encoder, fieldbus (RJ45), 450 MHz, both pulse enables are switched-on permanently

31: Reserved

58: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX), with AIO, DIO, encoder, fieldbus (M8)

59: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, encoder, fieldbus (M8), without DIO

60: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, DIO, encoder, fieldbus (M8), both pulse enables are switched-on permanently

61: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with fieldbus (M8), DIO (but 4 normal digital inputs only, 2 of them for pulse enable),
without AIO, without 2nd encoder

62: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with fieldbus (M8), without AIO, without DIO, without 2nd encoder

80: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with AIO, DIO, encoder, fieldbus (M8), 450 MHz, both pulse enables are switched-on permanently

81: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with fieldbus (M8), DIO (DIO (but 4 normal digital inputs only, 2 of them for pulse enable), 450 MHz,
without AIO, without 2nd encoder

82: BSCsafe Step 2 (for BM53XX, BM55XX, BM56XX, BM57XX),
with fieldbus (M8), 450 MHz, without AIO, without DIO, without 2nd encoder

Software option SoftDrivePLC

BM5XXX - XXXX - XXXX - XXXX - XX - XXXX - **EXX,**
and XX > 01

Safety Level

BM5XXX - XXXX - XXXX - XXXX - XX - XXXX - [EXX] - **#XX**

Mounting position of b maXX 5000

BM5XXX - XXXX - XXXX - XXXX - XX - XXXX - [EXX] - #XX - **[M0]**,
M0: Mounting position turned by 180°

4.3 UL notes

The notes below must be observed in case you consider UL 508 C.

▹Required environmental conditions◃ on page 49

- Note the maximum surrounding air temperature.
- Use in a pollution degree 2 environment only.

▹Design◃ on page 87

- Axis units (BM5X23, BM5X26, BM5X27, BM5X28, BM5X31, BM5X32, BM5X33, BM5X34, BM5X35)are allowed to be used only in combination with mains rectifiers (BM5031, BM5032, BM5043, BM5044, BM5174).

▹Installation procedure◃ on page 148

- Internal overload protection operates after exceeding 200 % of the motor full load.

▹Electrical connections◃ as from page 164

- Position of wiring terminals to indicate the proper connections for the power supply, load, control circuit, and similar devices refer to ▹Page 164◃.

Connections of ▹Page 174◃ to ▹Page 175◃

- Note tightening torque values marked for field terminals.

▹Requirements for the connection cables◃ on page 134

- Use 60°/75°copper wires only.

▹Requirements for the motor temperature sensors◃ on page 147

- Drives do not provide motor overtemperature sensing.

▹Fuses◃ as from page 277

- Devices are suitable for use on a circuit capable of delivering not more than 50000 rms symmetrical amperes, 480 Volt maximum, when protected by J Class fuses rated
  - BM5031/BM5032:
    branch circuit protection fuse rating: 600 V / max. 60 A
  - BM5043/BM5044/BM5174
    branch circuit protection fuse rating: 600 V / max. 150 A
  - Fuses must be installed on the line side of the mains rectifier (BM50XX, BM51XX)
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes.

▹Electrical data BM50XX; BM51XX◃ as from page 60

- Mains rectifiers BM50XX, BM51XX are not provided with DC link preventing overloading. Total capacity of all axis units BM53XX connected to the mains rectifier shall not exceed the rectifiers rating.

▹Mounting of the DC link bar◃ as from page 122 and ▹DC link bar◃ on page 304

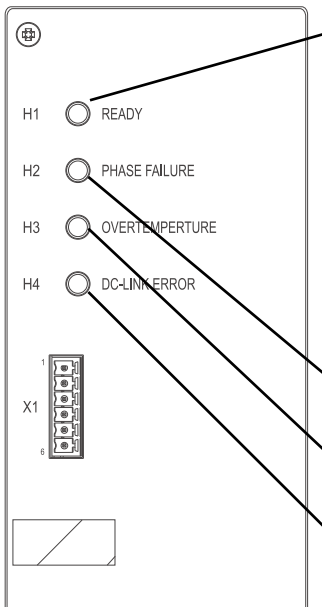
- Proper installation of the DC link bar, refer to ▹Mounting of the DC link bar◃ as from page 122 and proper DC link bar refer to ▹DC link bar◃ on page 304.

4.4 Display and operating elements

NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
refer to ▹D.4 LED display BM5030 with safety function◃ as from page 326.

4.4.1 LED display BM50XX-XX0X-... without safety function



LED **H1** — Mains rectifier unit ready-to-operate

green: Power supply and DC link voltage available, internally OK

red: Power supply failure - automatically restart when power supply returns.

blinking red: Power supply failure longer than 10 s - restart after Power supply return has to be acknowledged (X1:4).
Refer to ▹Error acknowledgment of BM50XX◃ on page 254.

LED **H2** — **red**: Phase failure

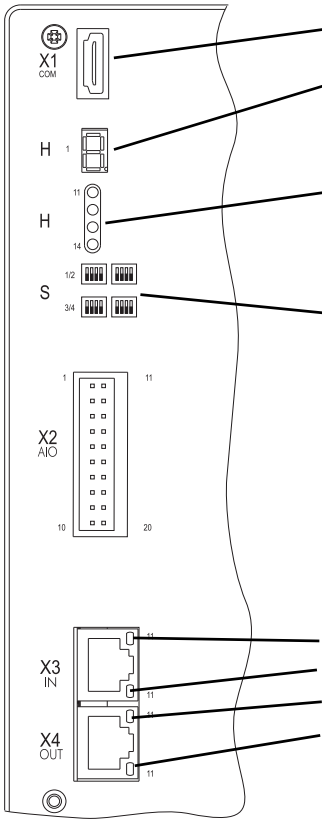
LED **H3** — **red**: Over temperature

LED **H4** — **red**: DC link error:
$U_{DC\ link}$ overvoltage or
$U_{DC\ link}$ overcurrent or
Inhibit input active

Figure 41: Display/operating elements BM50XX without safety function

Naming on the front plate	Meaning	Error	Blinking pattern
H1 (green)	Ready-to-operate	no error	LED lights up
H1 (red)	Mains failure	power supply failure - automatically restart when power supply returns.	LED lights up
		power supply failure longer than 10 s - restart after power supply return has to be acknowledged (X1:4).	LED blinking
H2 (red)	Phase failure	warning: phase failure or asymmetric three phase power supply	LED lights up
H3 (red)	Over temperature	over temperature of heat sink	LED lights up
		temperature of heat sink < - 5 °C	LED lights up
H4 (red)	DC link error	overvoltage DC link	LED lights up
		overcurrent DC link	LED lights up
		rising edge (low-high) on inhibit input	LED lights up

4.4.2 Display and operating elements BM51XX



X1 — Service interface

H1 — 7 segment display
refer to ▹7-segment display BM51XX◃ on page 99

LED
H11 - H14 — Meaning: refer to ▹LED display BM51XX◃ on page 100.

Address switch
S1 - S4 — Setting: refer to ▹Setting the IP address with address switches◃ as from page 106.

LED
H31
H32
H41
H42

Fieldbus, depending on type
(refer to ▹Type code◃ as from page 90)

Meaning:

BM51XX-XXXX-XXXX-**00**XX
no function

BM51XX-XXXX-XXXX-**01**XX
▹LED EtherCAT® .◃ on page 104

BM51XX-XXXX-XXXX-**02**XX
▹LED VARAN◃ on page 104

BM51XX-XXXX-XXXX-**04**XX
▹LED POWERLINK® .◃ on page 105

Figure 42: Display/operating elements BM51XX

NOTE!

Only the service cable BM5-K-USB-XXX is allowed to be used for the service interface X1, refer to ▹Service interface◃ on page 219 and ▹Service interface cable◃ on page 266.

4.4.2.1 7-segment display BM51XX

Refer to parameter manual for detailed description of drive states and state transitions.

0: Low, 1: High

Display	State drive manager	Meaning
0	NOT READY TO SWITCH ON	Device message „Not ready for switching power on“
1	SWITCH-ON INHIBIT	Device disabled
2	READY TO SWITCH ON	Device shutdown Control word: xxxx x110 Pulse enable = 0 Quick discharge = 0
3	SWITCHED ON	Control word: xxxx x111 Pulse enable = 1 Quick discharge = 0
4	OPERATION ENABLED	Control word: xxxx 1111 Pulse enable = 1 Quick discharge = 0
6	OPERATION DISABLED	Pulse enable = 0
7	QUICK DISCHARGE ACTIVE	Quick discharge = 1 (high active)
F	ERROR	Error message Reset via control word 0xxx xxxx or hardware input reset stored errors 0 → 1



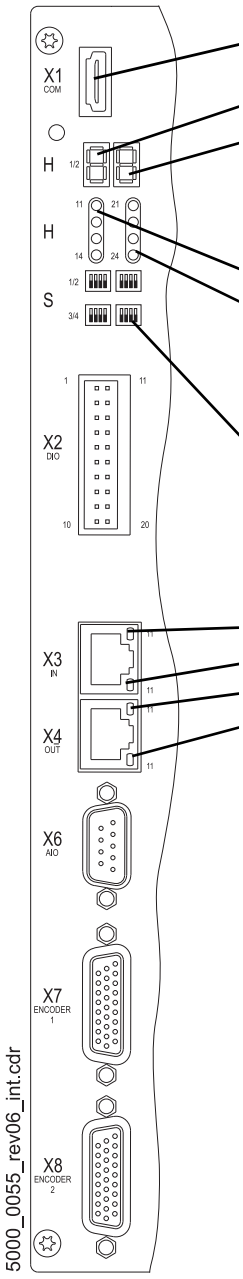
NOTE!

In addition the error No. is displayed, refer to ▹BM51XX and BM53XX error detection◃ as from page 253.

4.4.2.2 LED display BM51XX

Naming on the front plate	Internal identification	Meaning
H11	1.1 green, 1.1 red	Power direction H11 green: supply power H11 red: regenerative braking
H12	1.2 green, 1.2 red	Power on / pulse enable 24 V available H12 green: power ON H12 red
H13	1.3	Current limit H13 red: device operates on current limit
H14	1.4	Error display H14 red: device error message

4.4.3 Display and operating elements BM53XX



X1 Service interface

H1 7 segment display axis 1
H2 7 segment display axis 2 (double axis unit)
Display controller state
Meaning refer to: ▹7-segment display controller◃ on page 102

LED
H11 - H14 LED axis 1
H21 - H24 LED axis 2 (double axis unit)
Meaning: refer to ▹LED display controller◃ on page 103.

Address switch
S1 - S4 Setting: refer to ▹Setting the IP address with address switches◃ as from page 106.

LED
H31
H32
H41
H42

Fieldbus, depending on type
(refer to ▹Type code◃ as from page 90)

Meaning:

BM53XX-XXXX-XXXX-**01**XX
BM53XX-XXXX-XXXX-**07**XX
▹LED EtherCAT® .◃ on page 104

BM53XX-XXXX-XXXX-**02**XX
▹LED VARAN◃ on page 104

BM53XX-XXXX-XXXX-**04**XX
▹LED POWERLINK® .◃ on page 105

Figure 43: Display/operating elements controller BM53XX

NOTE!

Only the service cable BM5-K-USB-XXX is allowed to be used for the service interface X1, refer to ▹Service interface◃ on page 219 and ▹Service interface cable◃ on page 266.

4.4.3.1 7-segment display controller

Refer to parameter manual for detailed description of drive states and state transitions.

0: Low, 1: High

Display	State drive manager	Meaning
0	NOT READY TO SWITCH ON	Drive message „Not ready for switching power on“
1	SWITCH-ON INHIBIT	Inhibit voltage, e.g. quick stop active
2	READY TO SWITCH ON	Drive shutdown Control word: xxxx x110 Pulse enable = 0 Quick stop = 1 (low active)
3	SWITCHED ON	Control word: xxxx x111 Pulse enable = 1 Quick stop = 1
4	OPERATION ENABLED	Control word: xxxx 1111 Pulse enable = 1 Quick stop = 1
5	BETRIEB SPERREN AKTIV	
6	OPERATION INHIBIT ACTIVE	Pulse enable = 0
7	QUICK STOP ACTIVE	Quick stop = 0 (low active)
E	ERROR RESPONSE ACTIVE	
F	ERROR	Error message Reset via control word 0xxx xxxx or reset stored errors 0 → 1
P	Parking axis	



NOTE!

In addition the error No. is displayed, refer to ▹BM51XX and BM53XX error detection◃ as from page 253.

4.4.3.2 LED display controller

Naming on the front plate	Internal identification	Meaning	
H11	1.1 green, 1.1 red	Axis 1:	Torque direction H11 green: Positive torque direction H11 red: Negative torque direction
H12	1.2 green, 1.2 red	Axis 1:	Power on / pulse enable 24 V available H12 green: Power ON H12 red:
H13	1.3	Axis 1:	Current limit H13 red: Device operates on current limit
H14	1.4	Axis 1:	Error display H14 red: Device error message
H21	2.1 green, 2.1 red	Axis 2:	Torque direction H21 green: Positive torque direction H21 red: Negative torque direction
H22	2.2 green, 2.2 red	Axis 2:	Power on / pulse enable 24 V available H22 green: Power ON H22 red:
H23	2.3	Axis 2:	Current limit H23 red: Device operates on current limit
H24	2.4	Axis 2:	Error display H24 red: Device error message

4.4.4 LED display fieldbus

LED EtherCAT® Type code

BM5XXX-XXXX-XXXX-**01**XX
BM5XXX-XXXX-XXXX-**07**XX

Naming on the front plate	**Meaning**	**Blinking pattern**	
H31 (green)	X3 Link / Act	Off:	No connection
		On:	Connection
		Blinking:	Data transfer
H32 (yellow)	ERROR	On:	ERROR (receiver error Phy1/Phy2)
H41 (green)	X4 Link / Act	Off:	No connection
		On:	Connection
		Blinking:	Data transfer
H42 (yellow)	RUN	Off:	ERROR/INIT
		500 ms on / 500 ms off:	PREOPERATIONAL
		200 ms on / 1 s off:	SAFEOPERATIONAL
		On:	OPERATIONAL

LED VARAN Type code

BM5XXX-XXXX-XXXX-**02**XX

Naming on the front plate	**Meaning**	**Blinking pattern**	
H31 (green) H41 (green)	LINK	On:	Connection between 2 PHYs (physical interfaces) is established
H32 (yellow) H42 (yellow)	ACTIVE	On:	Data is received or transmitted

LED CANopen® Type code

BM5XXX-XXXX-XXXX-**03**XX

No function

LED POWERLINK®

Type code
BM5XXX-XXXX-XXXX-**04**XX

Naming on the front plate	**Meaning**	**Blinking pattern**	
H31 (green)	X3 Link / Act	Off:	No connection
		On:	Connection
		Blinking:	Data transfer
H32 (yellow)	ERROR	Off:	NMT_CT3, NMT_CT7, NMT_GT2
		On:	NMT_CT11, NMT_GT6
		Blinking:	Configuration error (e.g. address seting)
H41 (green)	X4 Link / Act	Off:	No connection
		On:	Connection
		Blinking:	Data transfer
H42 (green)	STATUS	Off:	NMT_GS_OFF, NMT_GS_INITIALISATION, NMT_CS_NOT_ACTIVE
		50 ms off / 50 ms on:	NMT_CS_BASIC_ETHERNET
		200 ms on / 1 s off:	NMT_CS_PRE_OPERATIONAL_1
		2 x 200 ms on / 1 s off:	NMT_CS_PRE_OPERATIONAL_2
		3 x 200 ms on / 1 s off:	NMT_CS_READY_TO_OPERATE
		On:	NMT_CS_OPERATIONAL
		200 ms on / 200 ms off:	NMT_CS_STOPPED

4.4.5 Setting the IP address with address switches

EtherCAT® CoE **EtherCAT® SoE**	BM5XXX-XXXX-XXXX-**01**XX BM5XXX-XXXX-XXXX-**07**XX
VARAN	BM5XXX-XXXX-XXXX-**02**XX
POWERLINK®	BM5XXX-XXXX-XXXX-**04**XX
EtherNet/IP®	BM5XXX-XXXX-XX**07**-**00**XX
Modbus/TCP	BM5XXX-XXXX-XX**08**-**00**XX

IP-Address S1 to S4

The IP address of the controller consists of 32 bits or 4 bytes (e.g. 192.168.125.203).

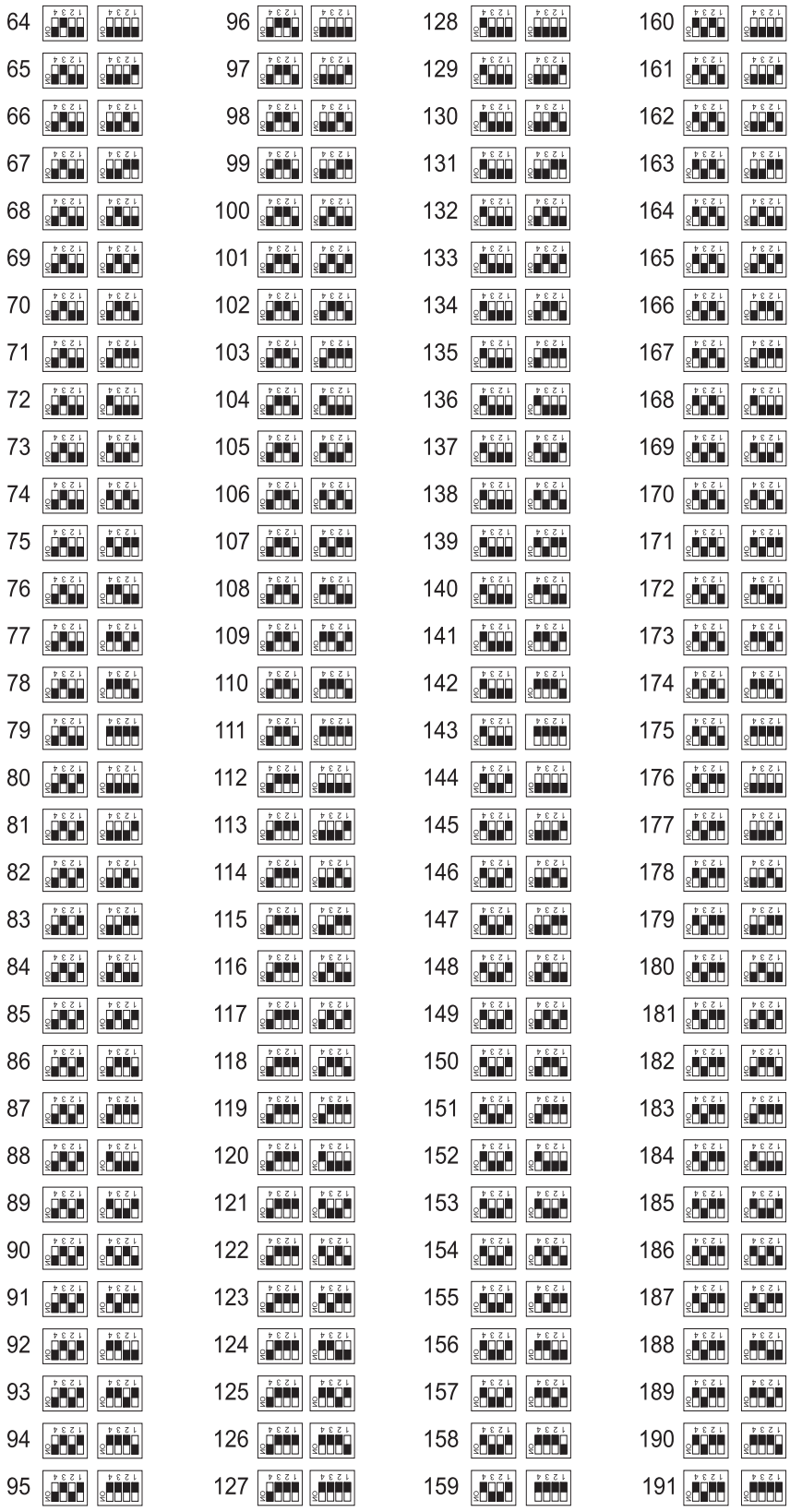
Both of the first bytes are set with the base address (192.168.) at the factory. Both of the last bytes are set by means of the address switches S1, S2, S3 and S4. In the process, S1 and S2 as well as S3 and S4 each represent an 8 bit value.

The IP address 192.168.0.0 or 192.168.100.0 is not permitted/reserved.

For information on changing the base address, refer to the parameter manual.






64 96 128 160
65 97 129 161
66 98 130 162
67 99 131 163
68 100 132 164
69 101 133 165
70 102 134 166
71 103 135 167
72 104 136 168
73 105 137 169
74 106 138 170
75 107 139 171
76 108 140 172
77 109 141 173
78 110 142 174
79 111 143 175
80 112 144 176
81 113 145 177
82 114 146 178
83 115 147 179
84 116 148 180
85 117 149 181
86 118 150 182
87 119 151 183
88 120 152 184
89 121 153 185
90 122 154 186
91 123 155 187
92 124 156 188
93 125 157 189
94 126 158 190
95 127 159 191

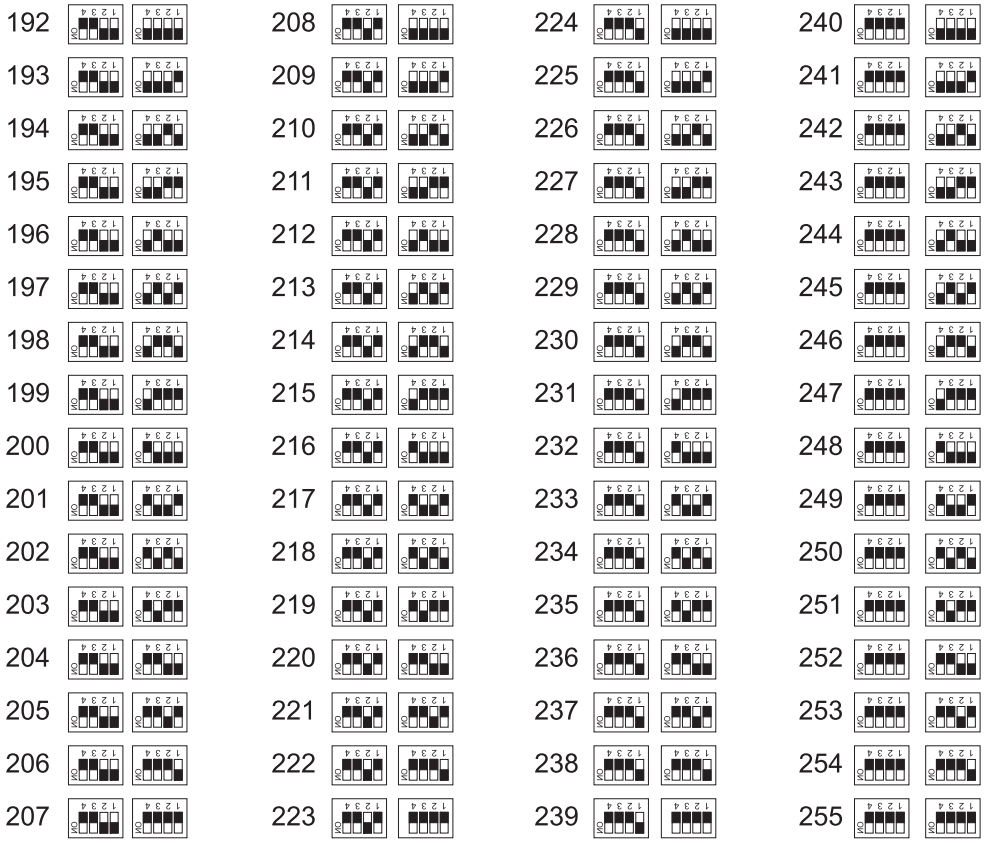
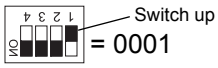


Figure 44: Address switch setting EtherCAT®, POWERLINK®, VARAN

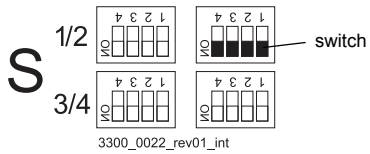
CANopen® BM5XXX-XXXX-XXXX-**03**XX

NOTE!

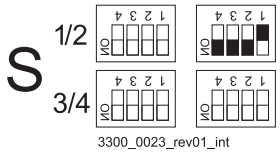


Baud rate S2

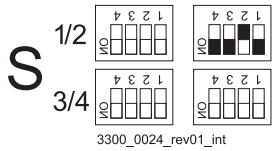
20 kBit/s



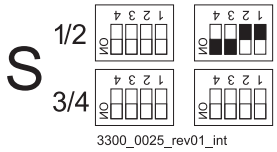
125 kBit/s, default setting



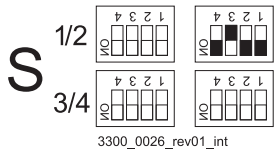
250 kBit/s



500 kBit/s



1 MBit/s



Address S3/S4

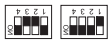
S3/S4	ID	S3/S4	ID	S3/S4	ID	S3/S4	ID
	0		32		64		96
	1		33		65		97
	2		34		66		98
	3		35		67		99
	4		36		68		100
	5		37		69		101
	6		38		70		102
	7		39		71		103
	8		40		72		104
	9		41		73		105
	10		42		74		106
	11		43		75		107
	12		44		76		108
	13		45		77		109
	14		46		78		110
	15		47		79		111
	16		48		80		112
	17		49		81		113
	18		50		82		114
	19		51		83		115
	20		52		84		116
	21		53		85		117
	22		54		86		118
	23		55		87		119
	24		56		88		120
	25		57		89		121
	26		58		90		122
	27		59		91		123
	28		60		92		124
	29		61		93		125
	30		62		94		126
	31		63		95		127

Figure 45: Address setting CANopen®

5

TRANSPORT AND PACKAGING

5.1 Safety notes for transport



NOTICE!

Damage due to unauthorized transport!

Transport handled by untrained personnel can lead to a substantial amount of material damage.

Therefore:

- The unloading of the packages upon delivery as well as the in-house transport should only be done by trained personnel.
- Contact Baumüller Nürnberg GmbH sales office if necessary.



WARNING!

Danger of physical impact!

Secure devices against falling down.

Therefore:

- Take suitable measures, such as supports, hoists, straps, etc., to ensure that device cannot fall down.
- Use appropriate means of transport.

5.2 What to observe when transporting

For initial transport of the device, it is packed at the manufacturer's plant. If the device is to be further transported, ensure that the following conditions are met throughout the entire transport:

- Climate class 2 K 3 as per EN 60721-3-2
- Temperature range - 25 °C up to + 70 °C
- Vibration, shock, continuous shock class 2 M 1 as per EN 60721-3-2

5.3 Transport inspection

Upon receiving the delivered goods, immediately examine them for completeness and transport damage.

If there is outwardly visible transport damage, proceed as follows:

- Do not accept the delivery or conditionally accept it with reservations.
- Note the extent of the damage on the transport documents or on the delivery note of the transport agent.
- Immediately file a complaint with the freight carrier. Have the complaint confirmed in writing and immediately contact the responsible representative of Baumüller Nürnberg GmbH.



NOTE!

The device may not be operated if there is visible transport damage!

5.4 Unpacking

After having received the still packaged device:

- Avoid transport shocks and hard jolts, e.g. when putting an item down.

If no transport damage is visible:

- Open the packaging of the device.
- Verify the delivery scope based on the delivery note.

File a claim with the responsible Baumüller representative if the delivery is incomplete.



NOTE!

Claim each individual deficiency as soon as it has been detected. Damage claims can only be validly asserted within the claim registration period.

5.5 Disposal of the packaging

The packaging consists of cardboard, plastic, metal parts, corrugated cardboard and/or wood.

- When disposing of the packaging, comply with the national regulations valid.

6

MOUNTING

The device is intended for mounting in a control cabinet.

Mounting comprises the following steps:

1 Mounting preparation
(for drilling holes/cutting out sections, see ▹Drilling pattern◃ as from page 117)

only with active mains rectifier to operate within C2 surrounding,
for drilling holes of toroidal cores, see ▹Drilling pattern toroidal cores◃ on page 125

2 Mounting
the device (for fixing, see ▹Mounting instructions◃ on page 119)

possibly mounting toroidal cores
(see ▹Mounting the toroidal cores◃ as from page 126)

6.1 Safety notes



NOTE!

Mounting shall only be performed by employees of the manufacturer or by other qualified personnel.

Qualified personnel are persons who – on account of their occupational training, experience, instruction and knowledge of relevant standards and stipulations, accident prevention regulations and operating conditions – are authorized by the persons responsible for the safety of the facilities to perform the respective activities that are necessary, while at the same time recognizing and preventing any potential risks. The qualifications necessary for working with the device are, for example:

- Occupational training or instruction in accordance with the standards of safety engineering for the care and use of appropriate safety equipment.



WARNING!

Danger as a result of faulty mounting!

The mounting requires qualified personnel with adequate experience. Faulty mounting can lead to life-threatening situations or substantial material damage.

Therefore:

- Only allow mounting to be performed by employees of the manufacturer or by other qualified personnel.



WARNING!

Danger of mechanical impact!

Secure devices against falling down.

Therefore:

- Take suitable measures, such as supports, hoists and assisting personnel, to ensure that device cannot fall down.
- Use appropriate means of transport.



NOTICE!

Danger due to electrostatic discharge.

The connecting terminals of the device are partially at risk due from ESD.

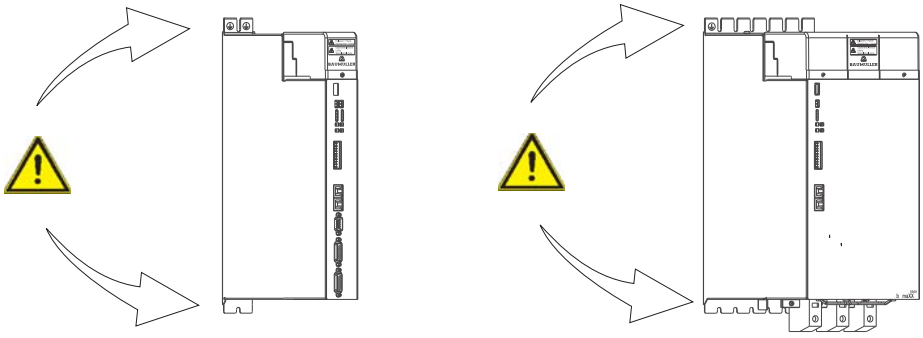
Therefore:

Please heed the respective notes.

CAUTION!

Danger due to sharp edges.

If the device is lifted with unprotected hands during mounting, palms or fingers can be cut. If the device falls, feet could be injured.



5000_0045_rev04_int.cdr

Figure 46: Danger area near the mechanical mounting

Therefore:

- Ensure that only qualified personnel, who are familiar with the safety notes and assembly instructions, mount this device.



Wear safety gloves.



Wear safety shoes.

6.2 Preparing for mounting

Based on the planning documents and the drilling patterns (see ▹Drilling pattern◃ as from page 117), the cutout sections and the positions of the attachment drill holes can be determined.



NOTICE!

Property damage due to conductive contamination.

Therefore:

- When performing installation work of any kind, it must be ensured that no foreign material (e.g. drill shavings, copper strands, etc.) gets into the device as a result.
- If possible, the drilling of the holes should be done before mounting the device and the configuring of the cables should take place outside of the control cabinet. If this is not possible, the device must be appropriately covered.
  Remove this covering again prior to start!



CAUTION!

Eye injury due to flung particles.

Metal particles are flung when making the drill holes and the cutout sections.

Therefore:



Wear protective eye wear!

➲ Preparing drill holes and cutout sections.

6.2.1 Drilling pattern

Use the drilling pattern to make the necessary drill holes/cutout sections.

NOTE!

Consider the minimum clearances for cooling when making the drill holes.

All dimensions in millimeters [mm].

Further notes see ▹Dimensions◃ as from page 29 and ▹Cooling◃ as from page 58.

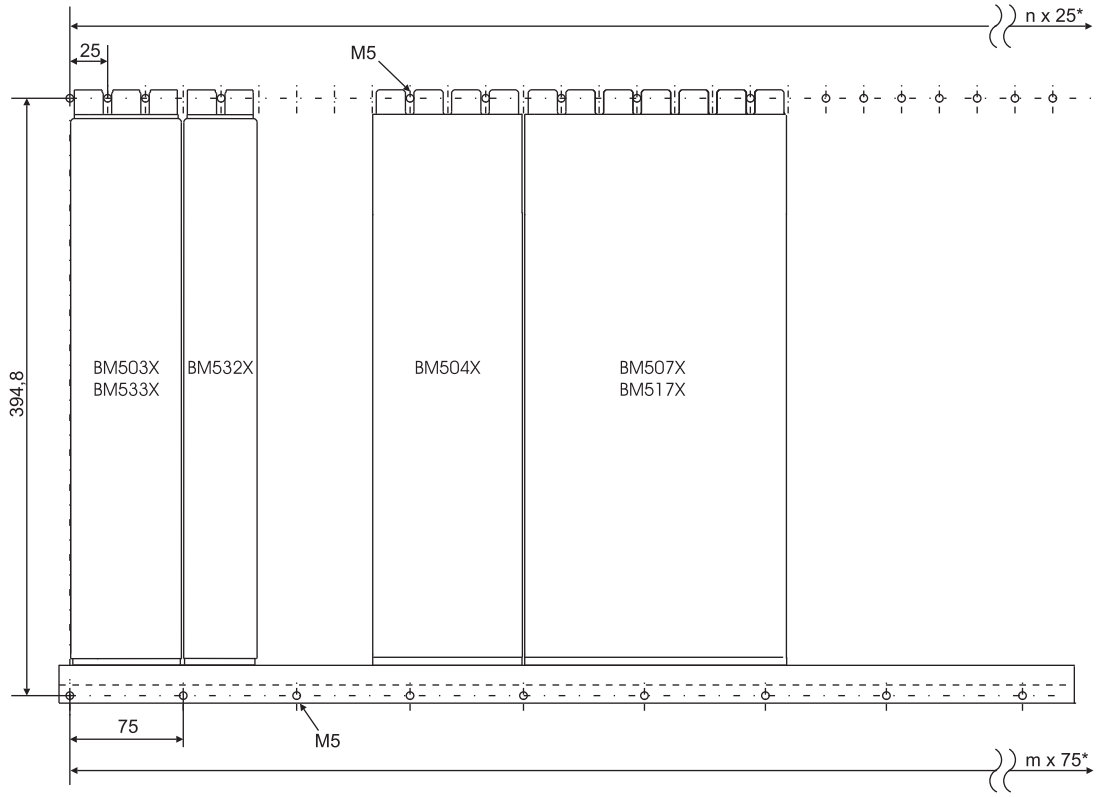
How to determine the required space in the control cabinet, see ▹Dimensions◃ as from page 29.

Tolerance specifications

Drill hole dimensioning	±0.2 mm
Dimensioning openings	+1.0 mm
Relative tolerance of discretionary divisions	±0.1 mm

For air-cooled versions:

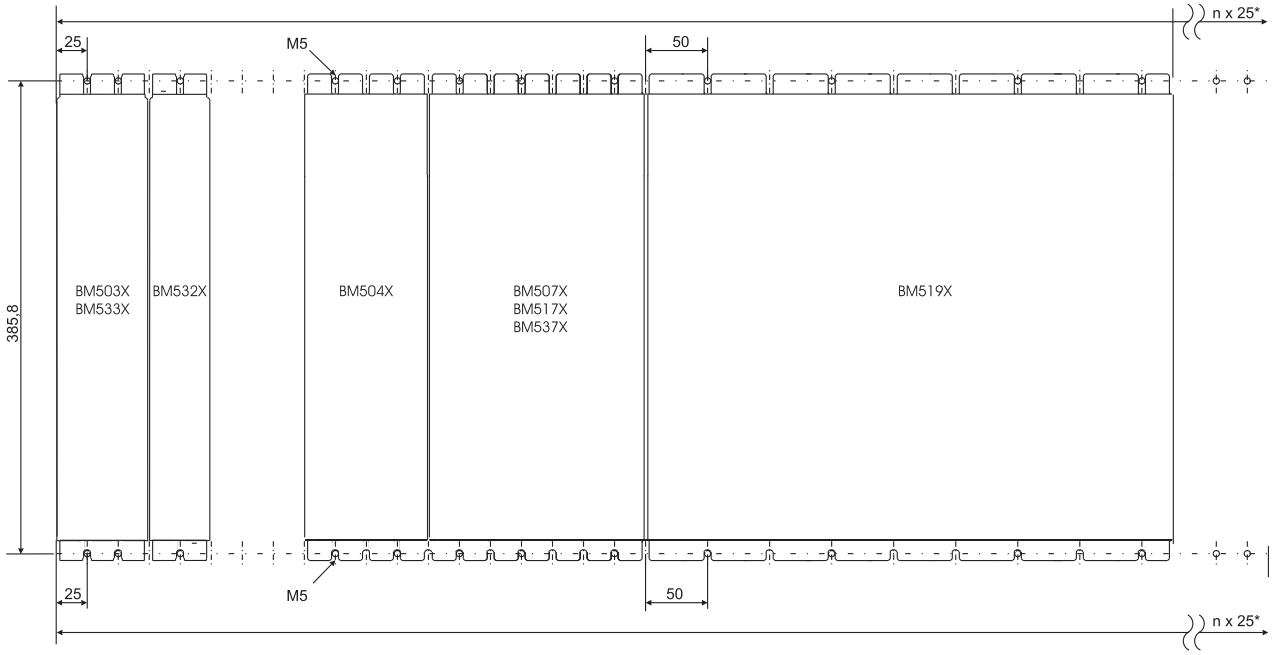
For BM50XX-**S**, BM51XX-**S**, BM53XX-**S** only!



*: Relative tolerance of discretionary divisions: ±0.1 mm

Figure 47: Drilling pattern with mounting rail for BM50XX-S, BM53XX-S, BM51XX-S

For all versions:



*: Relative tolerance of discretionary divisions: ±0.1 mm

Figure 48: Drilling pattern without mounting rail for all versions

Cutout for BM537X-F:

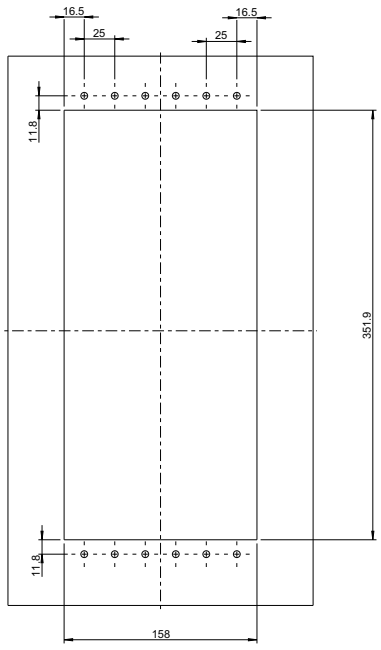


Figure 49: Cutout BM537X-F

6.2.2 Mechanical data of the mounting plate for cold plate

The cooling version cold plate is a particular efficient cooling alternative. The heat dissipation is done via 2 contact surfaces. The first one is the mounting platform within the control cabinet or on the machine base, the other is the cold plate on the device's back. High requirements e.g. to surface roughness and evenness for this surface are specified, to ensure an optimal heat flow. Already a slight damage/pollution of the surface can cause a significant deterioration in heat dissipation to the mounting plate.

For this reason while handle the units protect the sensitive function surface to avoid damage.

Surface flatness (across the entire surface)	0.05 mm
Surface roughness Ra	1.2 µm
Material of the plate (recommendation)	AlMgSi 0.5



NOTICE!

Property damage due to overheating.

Scratches and burrs can inhibit the heat dissipation of cold plate devices.

Therefore

- When mounting cold plate devices, ensure that the surface quality of the mounting plate meets the specifications and ensure that the device's rear panel/mounting plate does not have any scratches or burrs.

6.3 Mounting instructions

There are different mounting procedure.

Each mounting procedure is described in a drawing (see ▹Figure 50◃ on page 120 and ▹Figure 51◃ on page 121).

The screws and washers required for mounting are listed beneath the respective drawing.

Carry out mounting as follows:

1 Provide suitable transport/lifting equipment as needed.

2 Keep suitable fastening components readily available.

3 For cold plate devices

- check the surface quality of device's rear panel/mounting plate, see ▹Mechanical data of the mounting plate for cold plate◃ on page 119

4 Mount the device.

5 Subsequently connect the water-cooling unit.

6.3.1 Mounting with mounting rail

After attaching the mounting rail, push the device from below beneath the upper fastening bolts (1). Then, tilt the device on the mounting plate (2) and slide onto the mounting rail (3). Finally, tighten the upper fastening and grounding bolts (4).

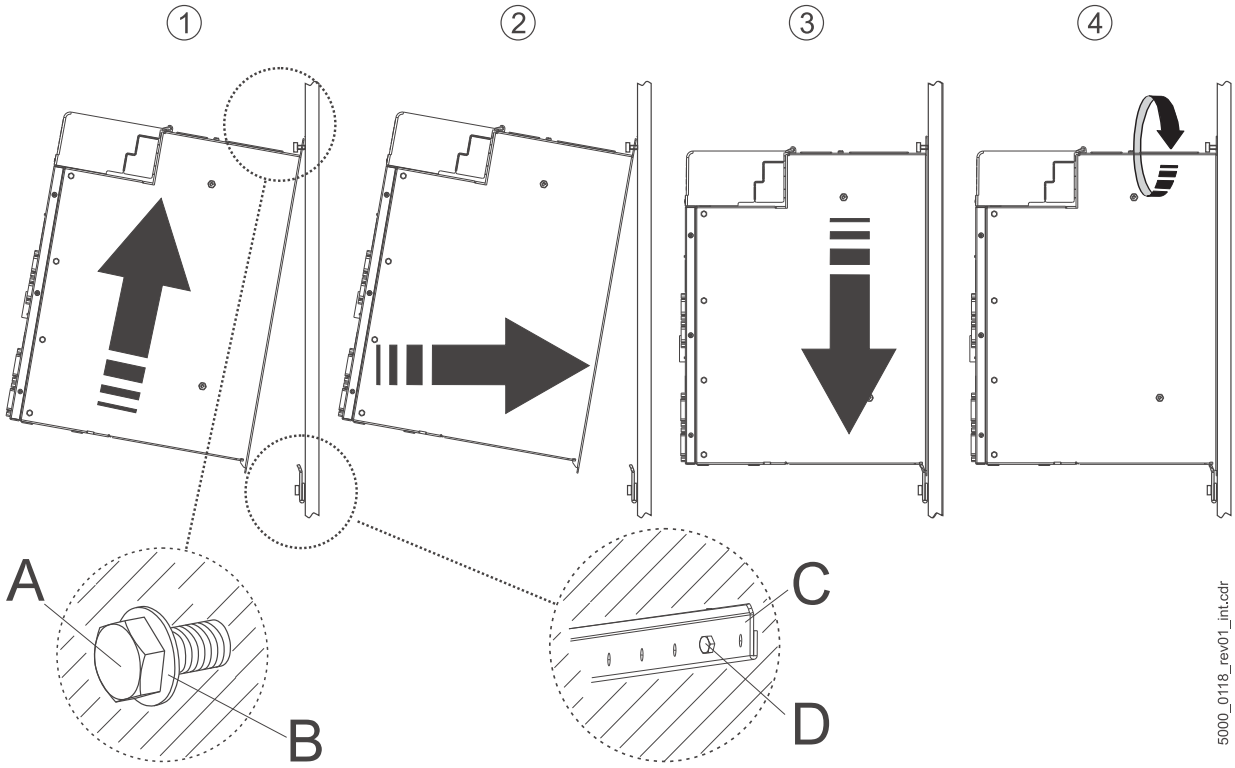


Figure 50: Mounting instructions for the BM51XX and BM53XX, with mounting rail

Device	**BM50XX-S**	**BM507X-S** **BM517X-S**	**BM519X-S**	**BM532X-S** **BM533X-S**
A - screws	2 x M5	3 x M5	8 x M5	2 x M5
B - washers	2 x (5.3 x 10)	3 x (5.3 x 10)	4 x (5.3 x 10)	2 x (5.3 x 10)
C - screws	n x M5 [1)]			
D - Mounting rail 1000 mm	Refer to Accessories and Spare Parts ▹Mounting rail◃ as from page 304			

[1)] Number n depends on the length of the mounting rail

6.3.2 Mounting without mounting rail

Push the device from below beneath the upper fastening bolts (1). Then, tilt the device on the mounting plate (2) and slide into the fastening bolts (3). Finally, tighten all fastening and grounding bolts (4).

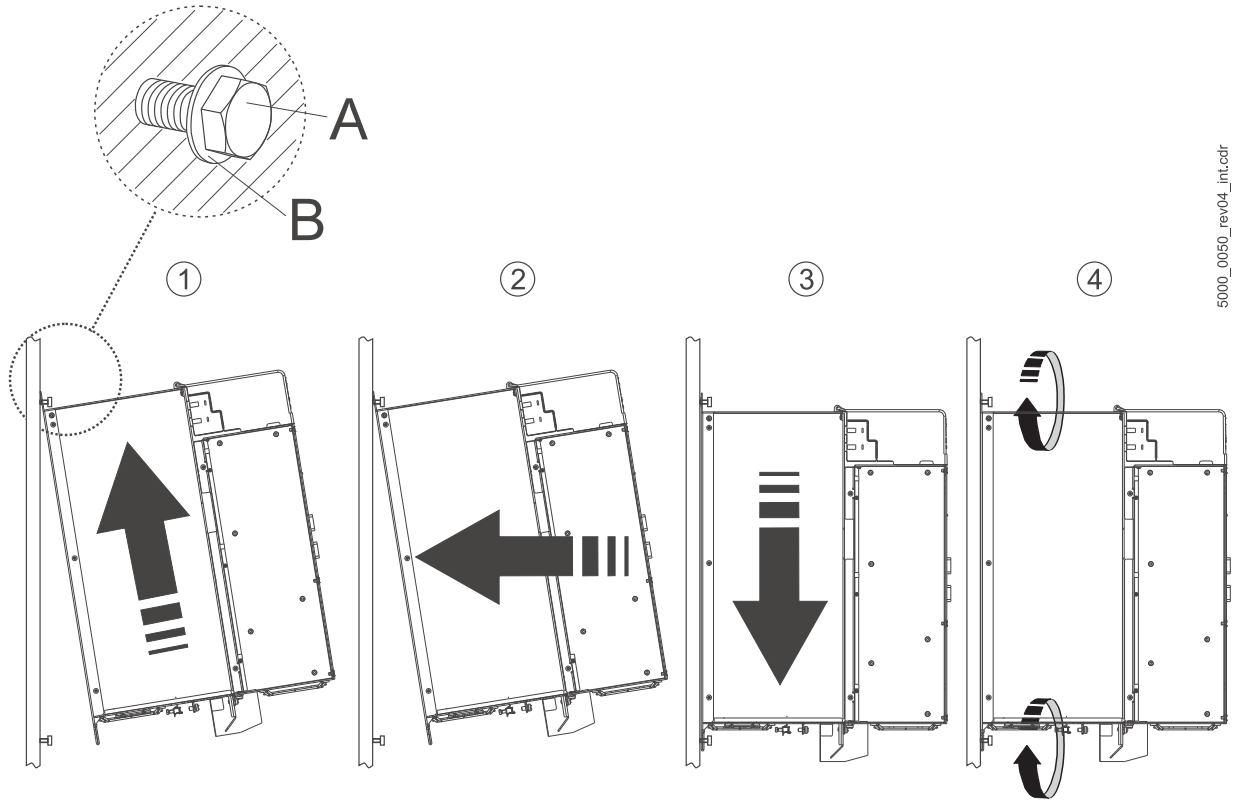


Image 51: Mounting instructions for the BM51XX and BM53XX, without mounting rail

Device	**BM50XX**	**BM507X BM517X BM537X**	**BM519X**	**BM532X BM533X**
A - screw	4 x M5	6 x M5	8 x M5	4 x M5
B - washers	4 x (5.3 x 10)	6 x (5.3 x 10)	8 x (5.3 x 10)	4 x (5.3 x 10)

6.3.3 Mounting of the DC link bar

Observe the following items when mounting the DC link bar:

- Position of the chamber-bevel (detail Y)on bottom
  Position of the screw thread (detail Z) on top.
  The correctly mounting of the distance bushings makes it easier to disassemble the unit in case of service and ensures the captivity of the distance bushings.
  Neck collar screw (1)
  DC link bar (2)
  Distance bushing (3)
  BM5XXX DC link terminal (4)

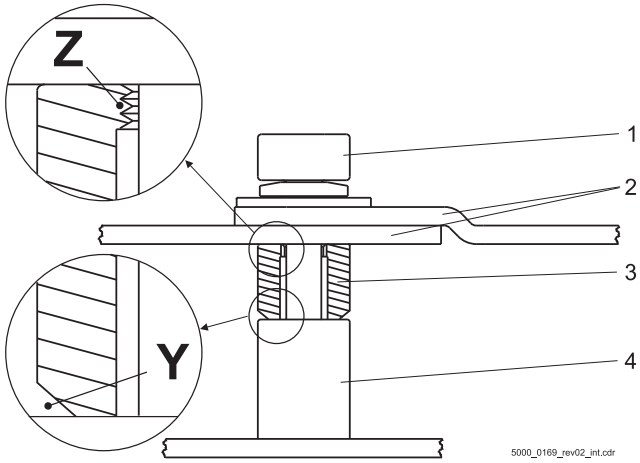


Figure 52: Correctly mounted DC link bar

- Distance bushing and neck collar screw
  It is recommended to assemble the neck collar screw and the distance bushing to the DC link bar before mounting the DC link bar. The correctly mounting of the distance bushings makes it easier to disassemble the unit in case of service and ensures the captivity of the distance bushings.

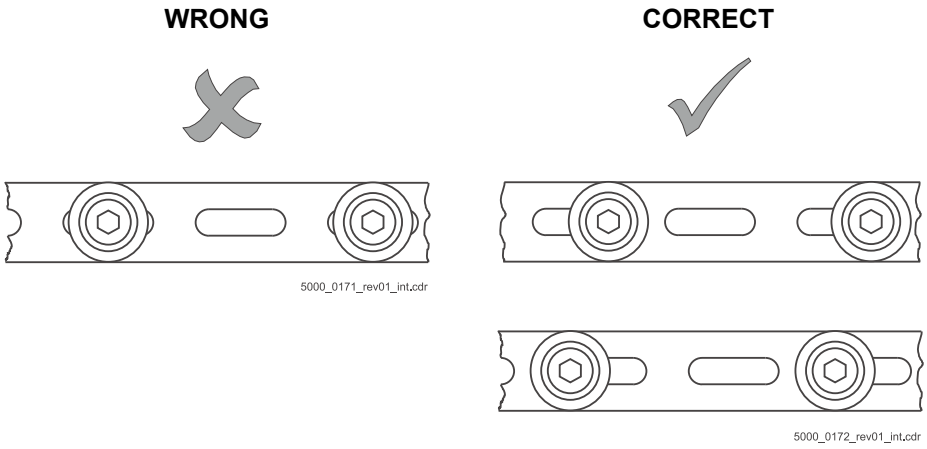


Figure 53: Mounting of the neck collar screw

- DC link bar
  Observe the correct mounting of the DC link bar. There should no mechanical stress affect to the drill hole.

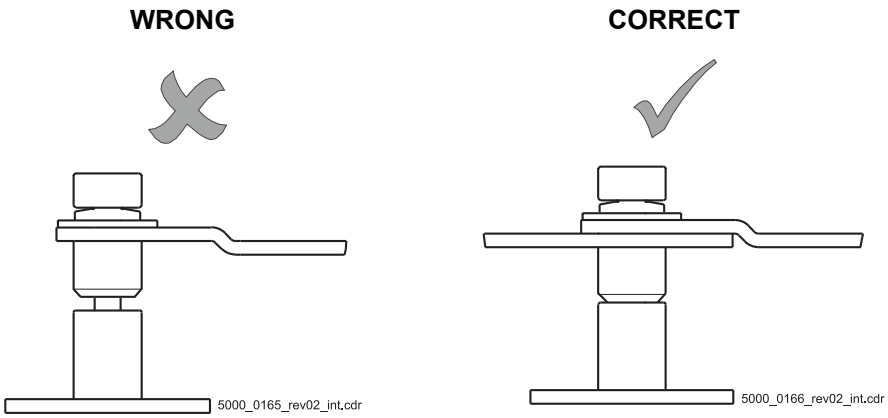


Figure 54: Mounting of the DC link bar

NOTE!

The DC link bar must not overlap the first or last fixing bolt of the rack system. Cut the DC link bar therefore.

6.3.4 Demounting

NOTE!

The yellow cover plate can be removed when mounting/demounting air-cooled devices and there is not enough space above the device (min. 15 cm) for lifting up the cover.

The yellow cover plate must be removed when replacing the cold plate devices, always.

6.3.5 Special DC link connection BM519X, BM537X

NOTE!

The DC link connection is connected within the device if using devices **BM519X** and **BM537X** only.

BM519X and **BM537X** devices can be connected with short DC link bars for easier demounting.

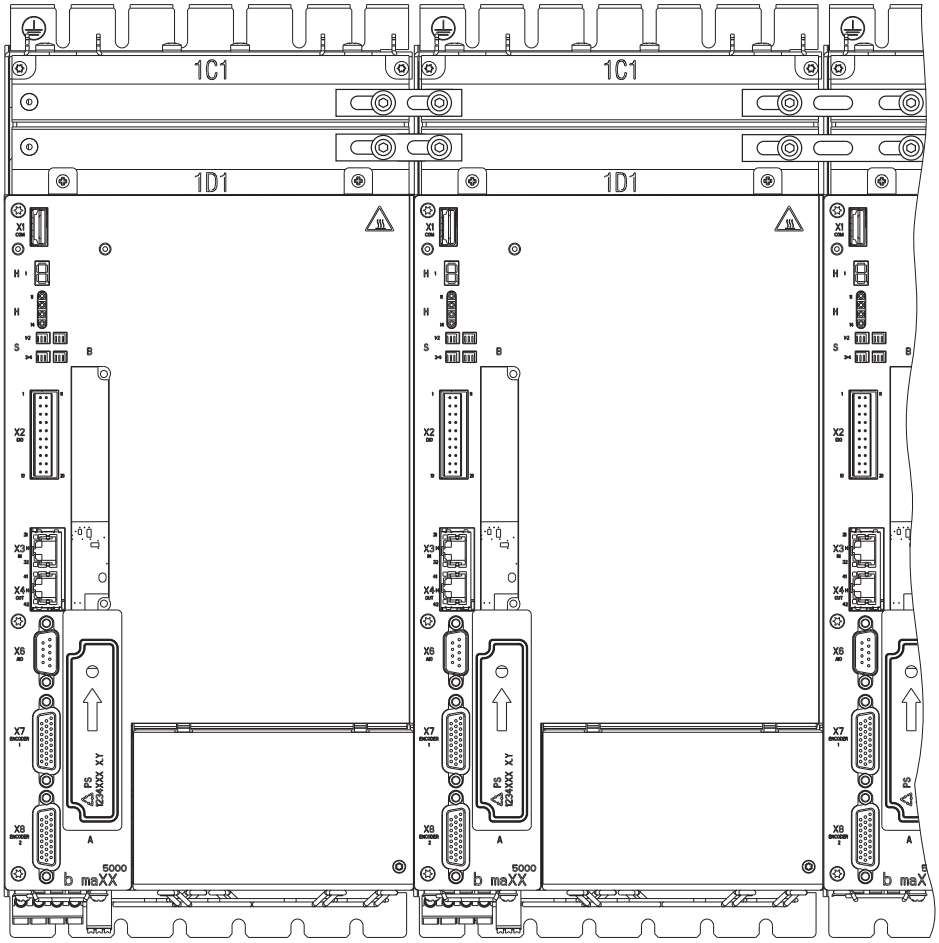


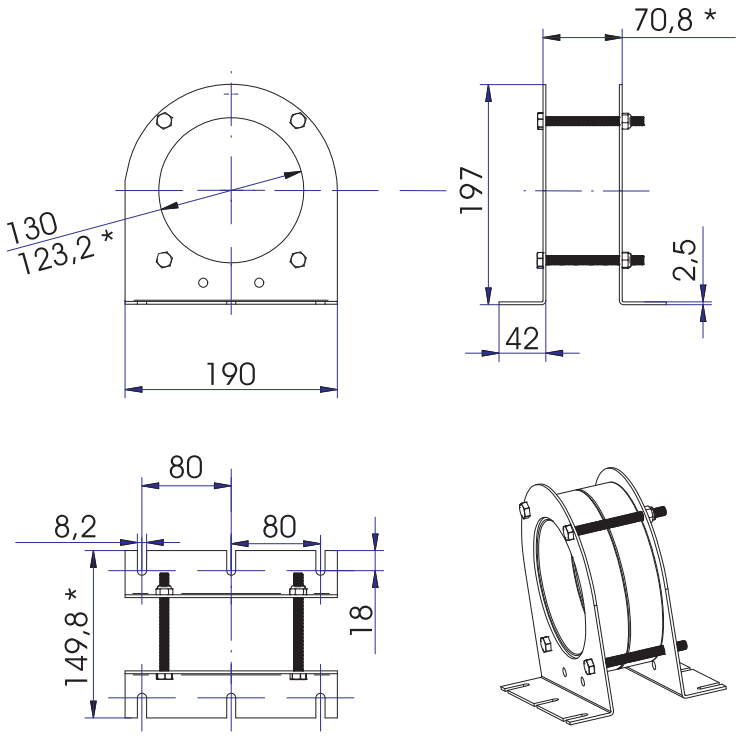
Figure 55: Example DC link connection BM537X

6.4 Mounting of toroidal cores

The use of toroidal cores, see ▹Toroidal cores◃ on page 304 is necessary to ensure the operation of the active mains rectifier **BM51XX** within a C2 surrounding.

6.4.1 Drilling pattern toroidal cores

Use the drilling pattern for drilling the necessary holes.



*: With toroidal cores

Figure 56: Dimensions/drilling pattern toroidal cores

NOTE!

The toroidal core should be mounted approx. 100 mm under the device.

6.4.2 Mounting the toroidal cores

Carry out mounting as follows:

1 Keep suitable fastening components readily available.

2 Mount the toroidal cores

3 Lay the mains cable through the toroidal cores, see ▹Installation procedure◃ as from page 148.

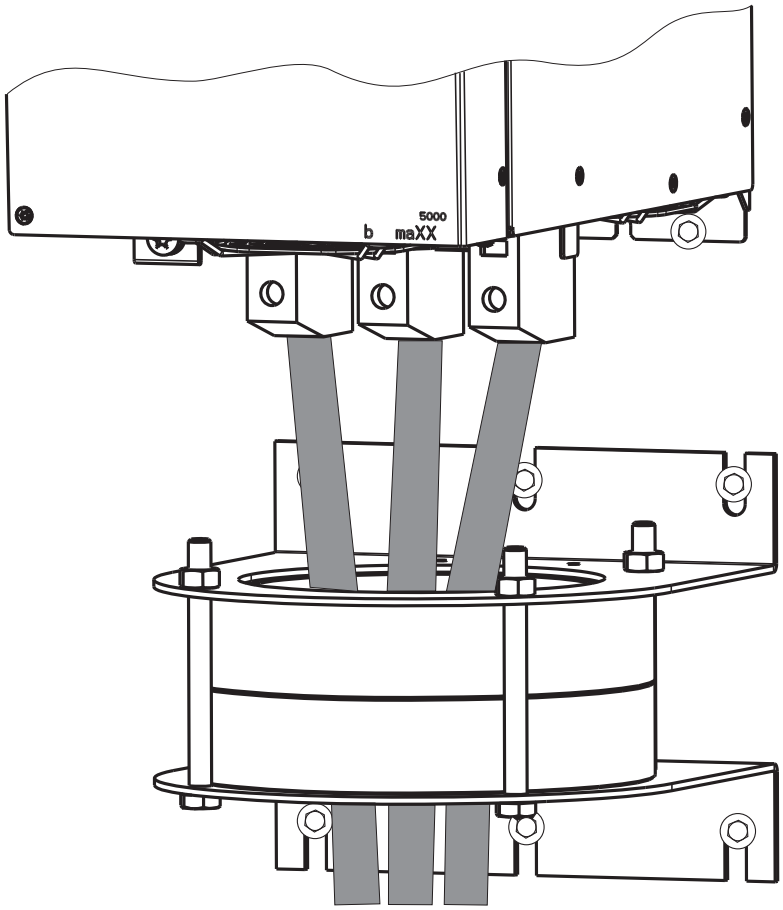


Figure 57: Toroidal cores mounted

Bolts	6 x M8
Washers	6 x (8.4 x 25)

6.4.3 Connecting the water cooler

With water cooled devices (BM5XXX-F) you should connect the coolant circulation before electric installation. The water cooler has on its bottom side two pressfitting-transition pieces 12 mm x R 1/2‘‘ AG for flat seals.

- Connect the cooling circulation to the water cooler:

Tube material	Outer tube-∅	Screwing
G-AlSi9Cu3c, material No. 3.2163.01 alloy No. 226	12 mm	1/2’ AG for flat seals

In case you refer to UL 508 C: There must be a pressure-relief valve with a threshold pressure of maximum 6 bar in the cooling circulation.

7

INSTALLATION

This chapter describes the electrical installation of the device. The mechanical mounting is described in ▹Mounting◃ as from page 113.
Initial commissioning is described in the parameter manual 5.09022 in the chapter Commissioning.

Prior to installation, ensure that the technical prerequisites have been fulfilled:

1 Check the demands on the electrical mains.

2 Check the requirements for the electrical cables and the provision of corresponding cables.

3 Check the properties of the connections and the specified configuration of the respective cables.

7.1 Safety notes



NOTE!

Installation shall only be performed by employees of the manufacturer or by other qualified personnel.

Qualified personnel are persons who – on account of their occupational training, experience, instruction and knowledge of relevant standards and stipulations, accident prevention regulations and operating conditions – are authorized by the persons responsible for the safety of the facilities to perform the respective activities that are necessary, while at the same time recognizing and preventing any potential risks. The qualifications necessary for working with the device are, for example:

- Occupational training or instruction, and the authorization to commission, ground and mark electrical power circuits and devices in accordance with the standards of the safety engineering.
- Occupational training or instruction, in accordance with the standards of work safety, for the care and use of appropriate safety equipment.

WARNING!

Danger due to faulty installation and initial commissioning!

Installation and initial commissioning require qualified personnel with adequate experience. Faulty installation can lead to life-threatening situations or substantial material damage.

Therefore:

- Only allow installation and initial commissioning to be performed by employees of the manufacturer or by other qualified personnel.

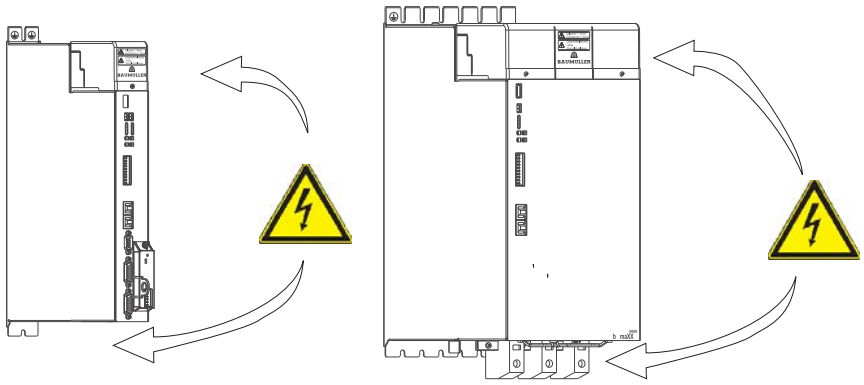
DANGER!

Risk of fatal injury from electrical current!

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous during the electrical installation.
- Pay heed to areas on the device that could still be electrically energized after operation.



5000_0046_rev06_int.cdr

Figure 58: Hazard areas during electrical installation

Danger from residual energy



DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the modular system = discharge time of the device with the longest DC link discharge time in the modular system.

Refer to ▹Electrical data◃ as from page 60.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

7.2 Voltage test



DANGER!

Risk of fatal injury from electrical current!

During the routine test of these devices, a voltage test is performed by Baumüller Nürnberg GmbH in accordance with EN 61800-5-1, Section 5.2.3.2. It is thus unnecessary for the customer to do this.

Therefore:

- Subsequent tests of the devices using high voltages may only be performed by Baumüller Nürnberg GmbH.
- Disconnect the device from the system during high-voltage testing!

7.3 Demands on the electrical mains

For all important data, see ▹Requirements for power supply / mains supply system◃ as from page 46.

Minor deviations from requirements in the electrical mains can lead to malfunctioning of the device. If the mains supply deviates too much from the requirements, the device can be destroyed.

The devices may only be operated in industrial networks C3 without additional measures, refer to ▹Mounting of toroidal cores◃ as from page 125.

The destruction of the device can cause personal injury.



DANGER!

Risk of fatal injury from electrical current!

If the requirements for the electrical mains are not complied, the device can be damaged or destroyed, thereby greatly endangering individuals.

Therefore:

- Prior to installation, ensure that the demands for electrical mains the have been fulfilled.

7.3.1 Connection notes: IT-system or grounded phase conductor system with BM50XX

- The shown wire bridge **W100** must be removed when operating on an IT-system or grounded phase conductor system (Grounded Delta)

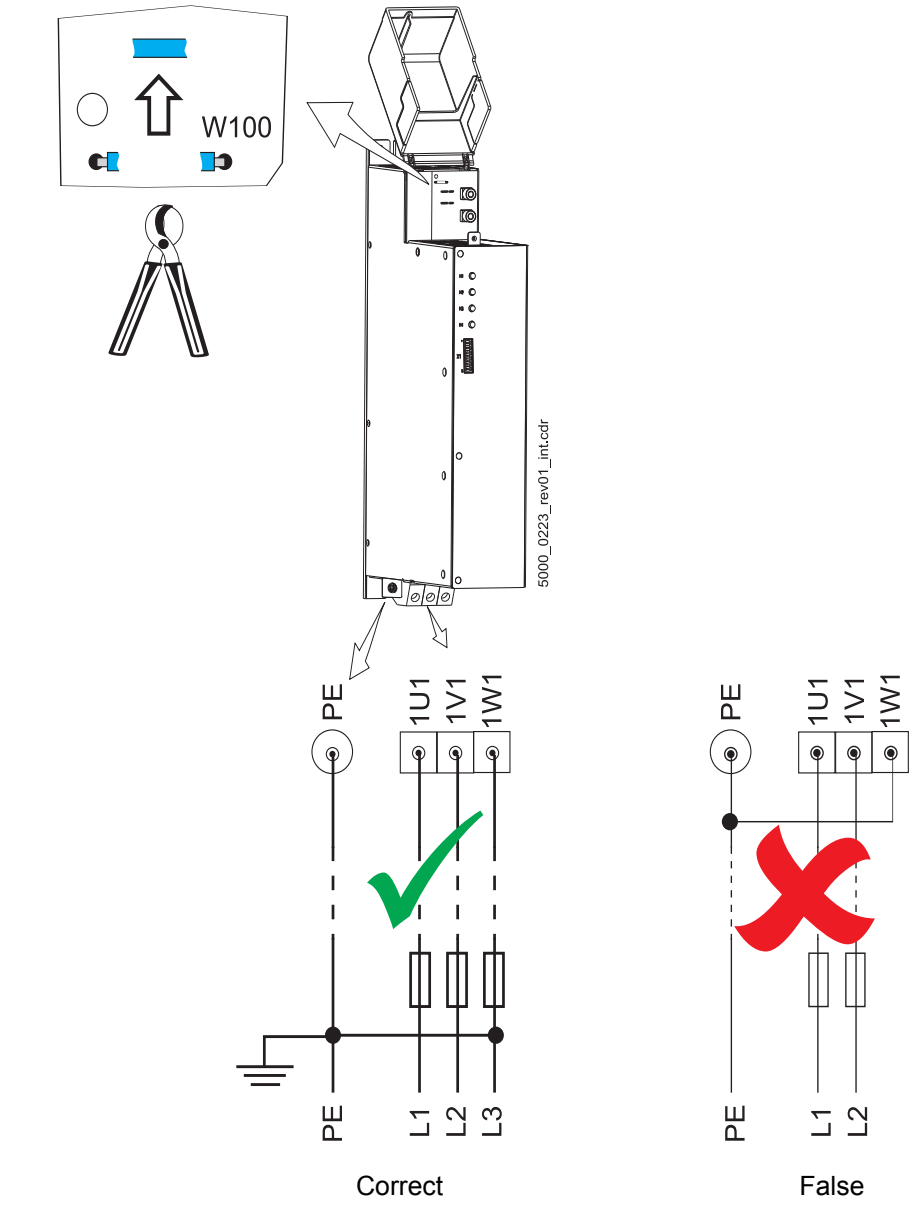


Figure 59: Connection to an IT-system or Grounded Delta system

NOTICE!

The removed wire bridge must not fall into the device.

An operation on an IT-system or grounded phase conductor system (Grounded Delta) at **installation altitudes > 2000 m** is only possible with an isolating transformer.

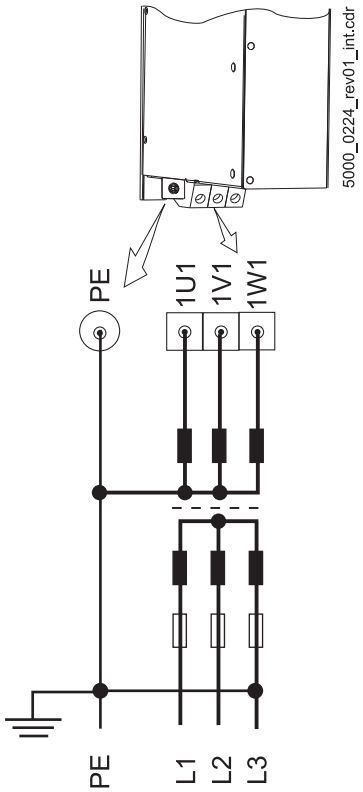


Figure 60: Connecting to IT-system or grounded phase conductor system with isolating transformer

7.4 Requirements for the connection cables

- Take into account IEC/EN 60204-1, chapter 13 when selecting the cable.
- The protective ground cross section of the cable must be compliant with IEC/EN 60204-1, Section 5.2, Tab. 1.
- A fixed connection for the protective ground conductor is mandatory required for operation of the device.
- Use copper cable approved for a minimum of 60 °C (drives < 3 x 100 A) or 75 °C (drives ≥ 3 x 100 A), if comply with UL 508C.

For further details (e.g. maximum allowable length), see ▹Cabling◃ as from page 257.

7.5 Protection of the device and the cable

Cable protection fuses **and** device protection fuses must be installed to protect this device and the cables against overload and possible damage/destruction through the electrical mains. For data on the required fuses, see ▹Fuses◃ as from page 277.

7.6 PE connection and RCD compatibility

Depending on the functional principle, leakage current >3.5 mA_{AC} or >10 mA_{DC} can flow through the protective ground conductor. Consequently, a stationary ground conductor connection in accordance with EN 61800-5-1 is required.



DANGER!

Risk of fatal injury from electrical current!

This product can cause direct and/or alternating current in the protective ground conductor.

The leakage current, due to the functional principle of the device, can lead to premature triggering of the fault current protective device or generally prevent triggering of it.

Therefore:

- Wherever a differential current device (RCD) is used for protection in case of direct or indirect contact, only an RCD of the type B is permitted on the power supply side of the device.
- Otherwise a different protective measure must be utilized, such as separation from the surrounding by means of double or enhanced isolation, or separation from the power supply system by means of an isolating transformer, for example.

7.7 Grounding concept of the side-by-side mounted system

- Grounding concept, each device connected with PE

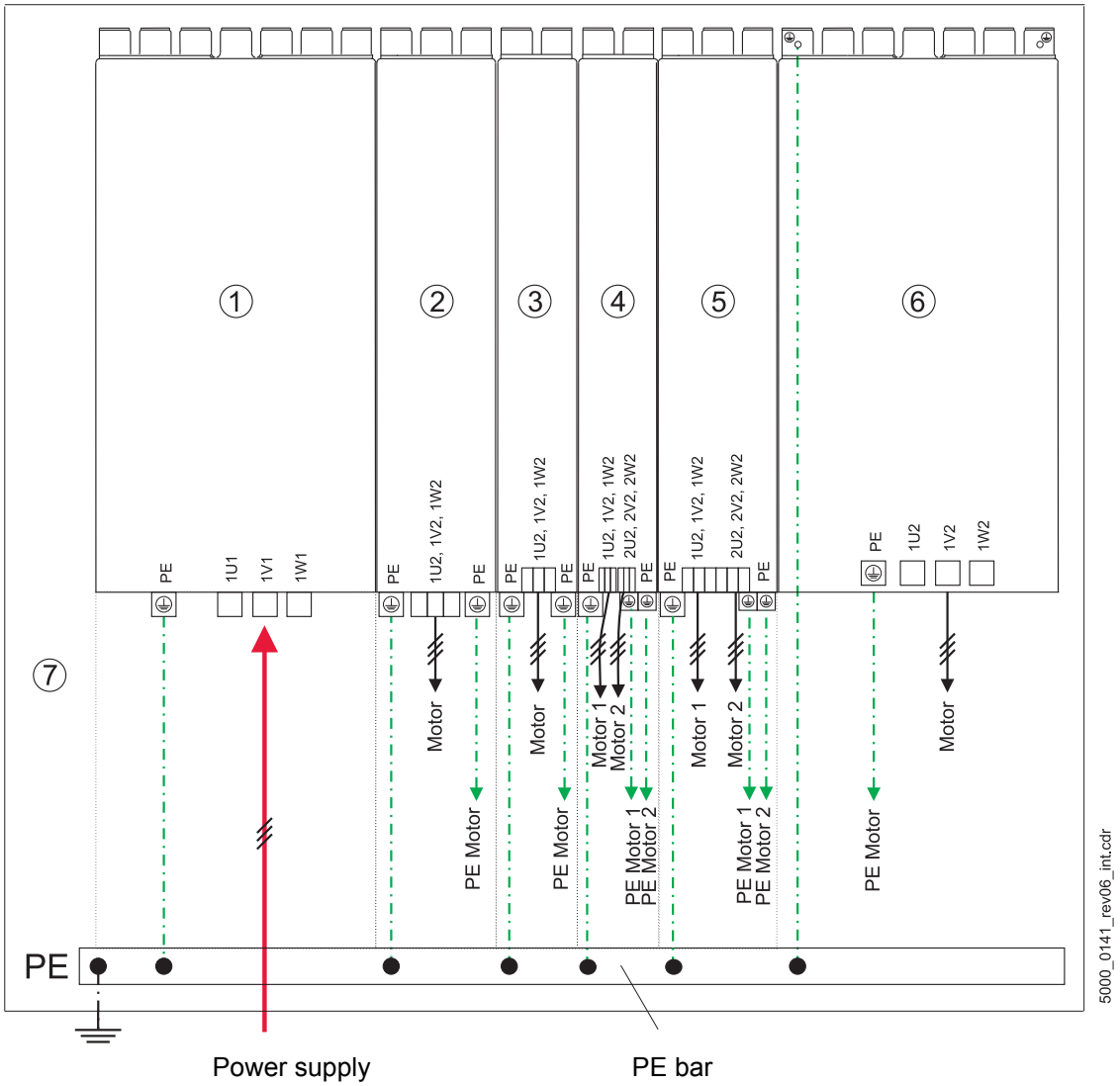


Figure 61: Grounding concept, each device with PE connection

1 (Active) mains rectifier unit: screw terminals for mains connection and PE
2 Single axis unit 75 mm: screw terminals PE, screw terminals motor
3 Single axis unit 50 mm: screw terminals PE, motor connector (1 x 3 pin) [1)]
4 Double axis unit 50 mm: screw terminals PE, motor connector (2 x 3 pin) [2)]
5 Double axis unit 75 mm: screw terminals PE, motor connector (1 x 6 pin)
6 Single axis unit 175 mm: screw terminals PE, screw terminals motor
7 Mounting plate, thickness at least 3 mm

[1)] power unit design 04 and above, refer to ▹Type code◃ as from page 90,
before that, 4-pole motor connector, see Instruction handbook b maXX 5000 5.09021.02 (Part No. 431081)

[2)] power unit design 04 and above, refer to ▹Type code◃ as from page 90,
before that, 2x4-pole motor connector, see Instruction handbook b maXX 5000 5.09021.02 (Part No. 431081)

- Grounding concept, PE-connection from device to device, cooling type S

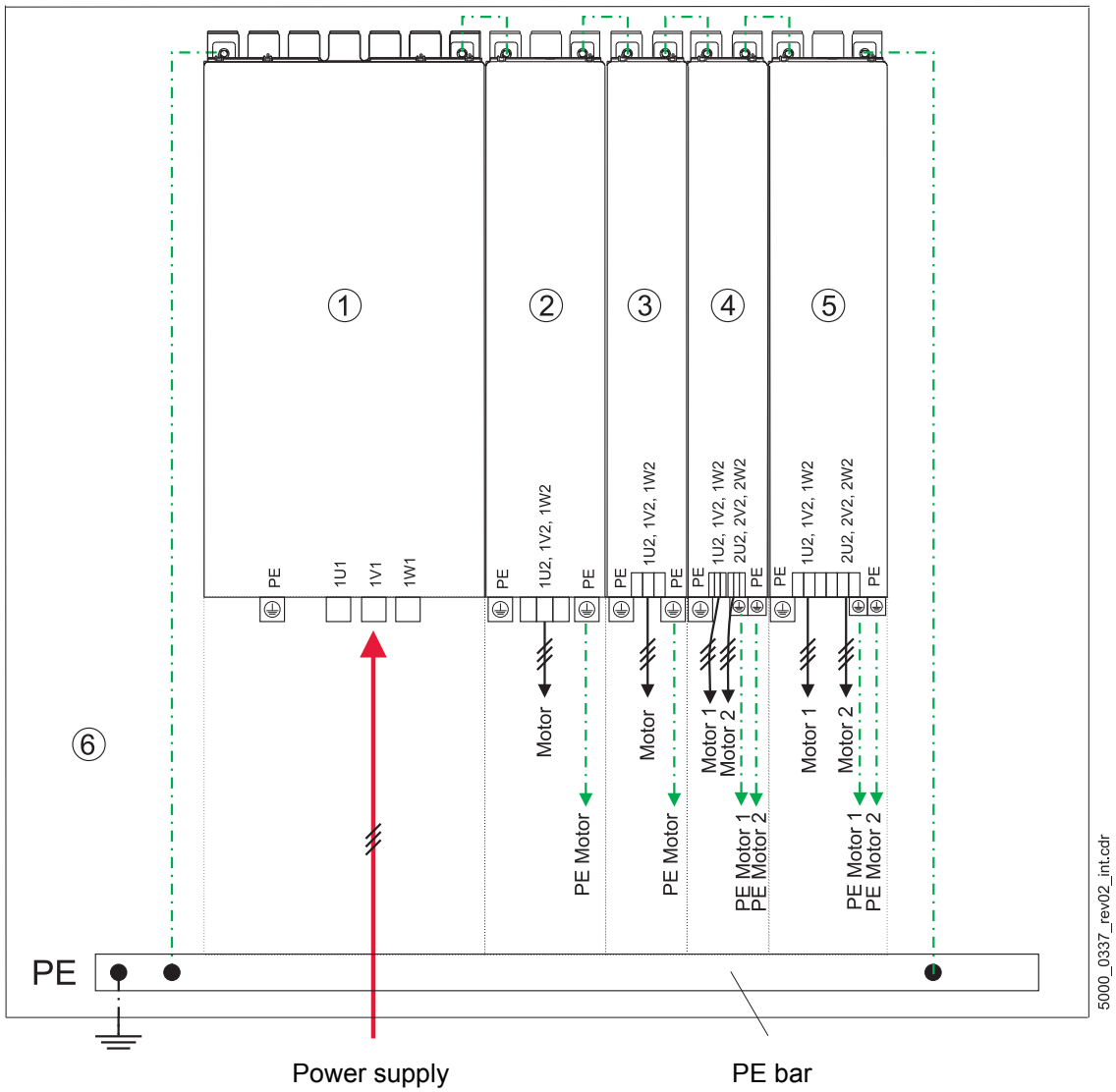


Figure 62: Grounding concept, PE connection from device to device

1 (Active) mains rectifier unit
2 Single axis unit 75 mm
3 Single axis unit 50 mm
4 Double axis unit 50 mm
5 Double axis unit 75 mm
6 Mounting plate, thickness at least 3 mm

NOTE!

The first **and** last device must be connected **directly** with PE if the PE connection is realized from device to device. An accessories kit is available for the connection from device to device, see ▹Accessories kit PE connection from device to device◃ on page 304, part No. 467439.

7.8 Installation requirements with regard to EMC



NOTE!

The emission of radio frequency interference (RFI) is to a great extent dependent on the wiring, spatial expansiveness and the arrangement of the components in the system. Ensuring electromagnetic compatibility compliance in accordance with legal requirements is therefore only possible on the completely assembled system and is thus the responsibility of the system manufacturer or proprietor (Section 9 of the EMVG §6; European EMC law).



NOTE!

The important information on EMC-compliant installation can be found in these instruction handbook. Additional notes on building a CE-compliant system, that are imperative to take heed of, can be found in the Baumüller manual „Filters“, 5.09010. This manual can be obtained from Baumüller Nürnberg GmbH.

In order to have EMC-compliant and problem-free use within the framework of the legislation, the following aspects must be taken into account.
In case of any questions, please contact Sales or the Applications department of Baumüller Nürnberg GmbH.

- Only use Baumüller motor cables and Baumüller components.
- Use suitable mains filters recommended by Baumüller Nürnberg GmbH.
- Mount all components on a single mounting plate with a continuously good electrically-conductive surface (e.g. galvanized steel plate).
- Keep the ground connection device/ground plate as short as possible (< 30 cm), using fine-stranded cables with a large cross section (>10 mm²).
- When installing, be sure to follow the correct sequence:
  electrical mains - fuse - filter - choke - (ferrite core) - **b maXX 5000** - (motor filter) - motor.
- Ensure that the motor cable is continuous, without interruption.
  Do not interrupt motor cables with terminals, contactors or fuses, for example.
- If possible route the cables on the surface of the grounded mounting plate
  (i. e. the least effective antenna height).
- When routing in parallel, minimum clearance of 20 cm should be observed between signal and control cables vis-à-vis the power cables.
- Cables of different EMC categories (e.g. signal cables - mains cables and/or motor cables) should be crossed at a 90 ° angle.
- Contact the major cable shield when laying cables through walls, which separate different EMC areas
- Contact all the cable’s shields on both sides surface-to-surface and also well-conductive with ground, see ▹Shielding plan side-by-side mounted system◃ as from page 139.

7.9 Shielding plan side-by-side mounted system

The shielding of the motor cable as well as of the motor temperature cable must be connected electrically with the mounting plate or with shield sheet (see ▹Shielding connection with shield sheet◃ on page 140).



NOTE!

Baumüller Nürnberg GmbH recommends the shielding connection with shield sheet.



NOTE!

Pay attention to strain relief for all cables!

7.9.1 Shielding connection mounting plate

Establish a large-area contact between the shield and the conductive and grounded mounting plate by means of a conductive clamp.

Refer to ▹Connecting the shield◃ as from page 141.

7.9.2 Shielding connection with shield sheet

7.9.2.1 Mounting shield sheet

Refer to ▹Accessories kit shielding◃ as from page 303.

Air-cooled/ water-cooled devices

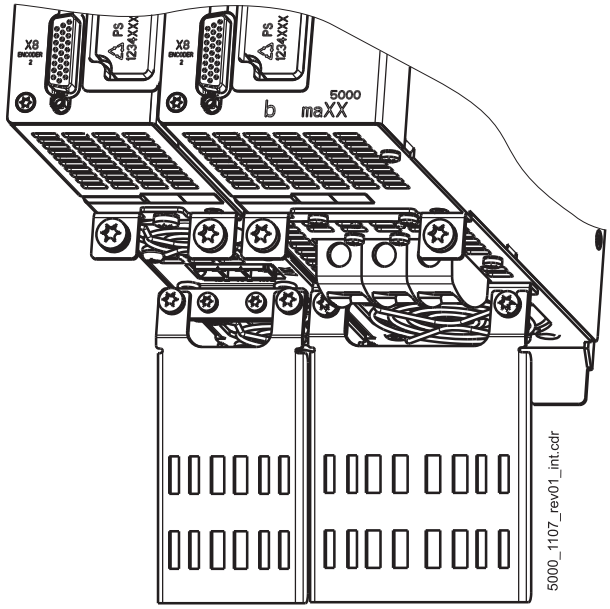


Figure 63: Mounting shield sheet air-cooled devices

Cold plate devices

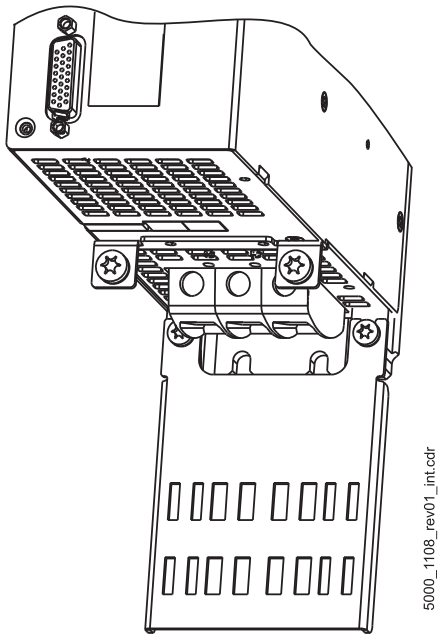


Figure 64: Mounting shield sheet cold plate devices

7.9.2.2 Connecting the shield

It is recommended to connect the shielding according following figure, see also ▹Accessories kit shielding◃ as from page 303.

1 prepare motor cable according figure

2 remove the motor temperature cable's shield from the cable

3 wrap motor temperature cable around motor cable at least 1 turn, form no loop.

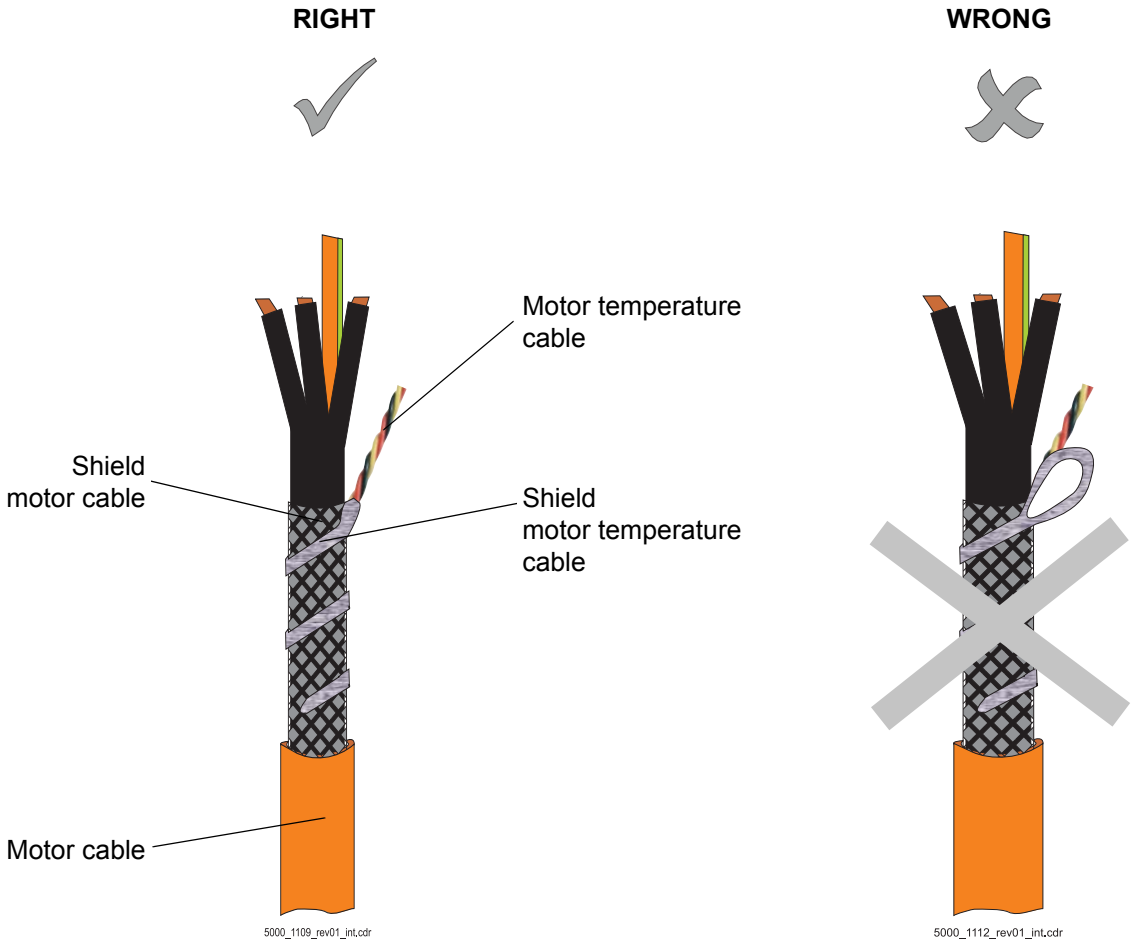


Figure 65: Wrap shield motor temperature cable around motor cable

4 from below wrap conductive metallic adhesive tape around

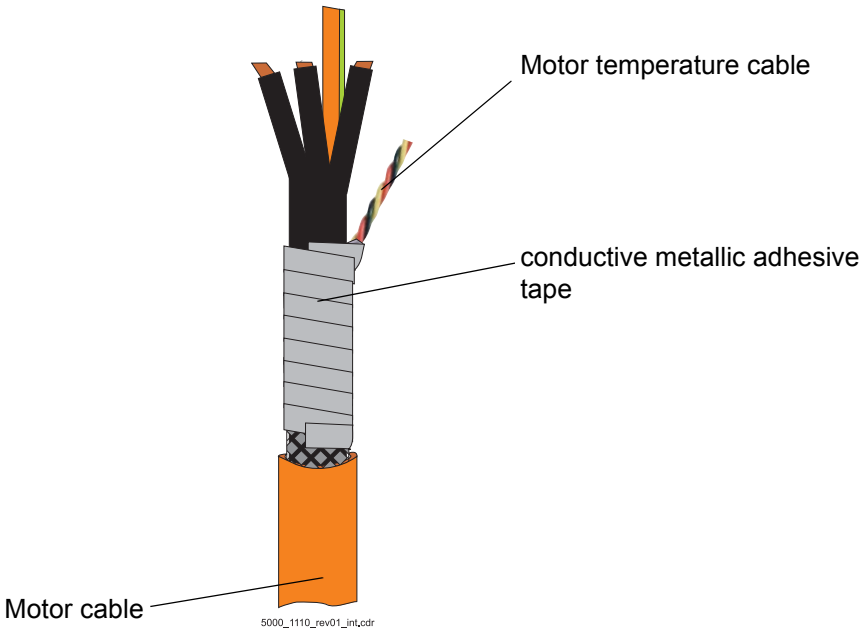


Figure 66: Tape shield motor temperature cable around

NOTE!

The shielding of the motor temperature cable and the shielding of the motor cable is wrapped together with a conductive metallic adhesive tape.

5 connect both shielding with shield clamp on the shield sheet, note locking torque of the fixing screw!

NOTE!

The shield must be connected to the mounting plate with a metallic clamp, if the optional shield sheet is not used!

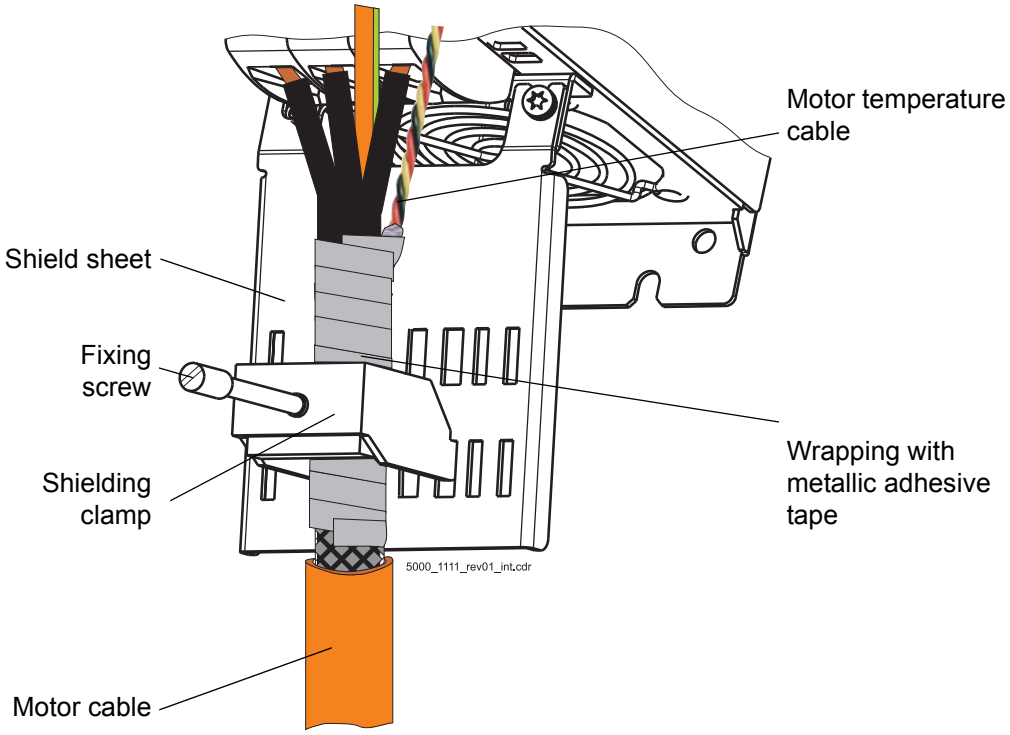


Figure 67: Shield connection motor cable

Locking torque of the fixing screw:

Device		Locking torque
Single axis unit	BM5326, BM5327, BM5328	0.8 Nm cable diameter 5 - 20 mm shielding clamp width 24 mm
Double axis unit	BM5323, BM5325	0.8 Nm cable diameter 3 - 14 mm shielding clamp width 17 mm
Single axis unit	BM5334, BM5335, BM537X, connection 2 x 16 mm²	1 Nm cable diameter 5 - 28 mm shielding clamp width 31 mm
Double axis unit	BM5331, BM5332, BM5333	
Single axis unit	BM537X, connection 50 mm²	1.5 bis 1.8 Nm cable diameter 20 - 35 mm shielding clamp width 40 mm

7.10 Avoid bearing currents

NOTE

The pulsed output voltage of a converter causes additional motor bearing currents.

Bearing currents cause localized melting on ball race and rolling body as well as wear of the lubricant. This leads to a reduced service life of the bearing.

Bearing currents depend on:

- Motor speed
- Switching frequency of the converter
- Grounding

Furthermore the height of the bearing currents depends on:

- the applied bearing voltage
- the dielectric characteristic of the bearing lubrication

NOTE

The reduction of bearing currents requires the consideration of the **whole speed-variable drive system** and its installation!

Baumüller supports you with on-site measurements and with development and implementation of suitable preventative measures.

Avoiding bearing damage

- Basically the **grounding system** must be installed appropriately to ensure a forced return of the common mode current.
- The cause of bearing current damage, that means the amplitude and slope of the common mode voltage is reduced by using toroidal cores.
  The use of toroidal cores is therefore a **preferred measure**.
- In addition the using of **current-isolated bearings** (standard for AC drives from motor size 180 and higher) can reduce the effects of the common mode voltage.
- The shaft can be grounded (and the bearing currents redirected) by using special grounding rings or grounding brush(es).
- Furthermore modified **motor cables** (for high frequencies, cable shield with low impedance, symmetric cable design) can be used in order to lead the capacitive currents to a large extent back to the converter via the cable shield.

Toroidal cores



NOTE

It is recommended to use toroidal cores in order to reduce/to avoid bearing currents.

Part numbers and the number of recommended toroidal cores, see ▹Toroidal cores for motor cables◃ as from page 305 in chapter Accessories and Spare Parts.

- The toroidal cores are made of nanocrystalline material. The toroidal cores cover all three phases of the converter output. The time variable common mode current induces a magnetic field into the toroidal core, which counteracts against the change of the common mode current.
- For this reason the toroidal core operates a current-compensated choke, which limits the rate of change and the amplitude of the common mode voltage and therefore reduces the bearing currents significantly.
- Because of the higher amplitude and frequency of the common mode voltage when using an active mains rectifier unit, there are used toroidal cores with a lower permeability for optimized modulation of the cores (saturation and temperature characteristics).

Installation of toroidal cores

- The three phases **without shielding** and **without PE** must be lead through the cores. The cores must be installed and attached near the motor connection of the **5000.**
- When using toroidal cores it is further recommended to use current isolated bearings on the nondrive end for synchronous/asynchronous main drives sizes 180 and higher.



Figure 68: Mounting - single ring core



Figure 69: Mounting - several ring cores

7.11 Requirements for the motor temperature sensors

To protect the motor against impermissible overheating, a motor temperature sensor can be connected to the **b maXX** device. The device switches off of the motor when a settable threshold temperature has been exceeded.



NOTICE!

The motor must be protected against overtemperature according EN 61800-5-1.
The device‘s integrated monitoring function „Overtemperature Motor“ fulfills this requirement.
The user is responsible for realization of the motor overtemperature monitoring according EN 61800-5-1 in case the used motor is not equipped with a motor temperature sensor or the sensor is not connected.



NOTE!

The thermal memory of the motor and the speed-dependent electronic motor overload protection is not available if no motor temperature sensor is used.

Type	Additional requirements:	Isolation
KTY84/PT1000	-	SELV/PELV
MSKL [1] (PTC)	R = 1 kΩ at $T_{Protection}$, I_{max} < 2 mA	SELV/PELV

[1] Motor protection thermistor (PTC) as per DIN 44080-082



NOTE!

The motor temperature sensor should be installed in such a manner that „electrically protective separation“ is ensured. The motor temperature sensors integrated into Baumüller motors meet these requirements. If third-party motors are connected, the operating company must ensure that the temperature sensors used in the motor of a third-party manufacturer motor comply with the „electrically protective separation“ function.

7.12 Installation procedure



DANGER!

Risk of fatal injury from electrical current!

Electrically live parts are life-threatening.

Therefore:

- Make certain that the parts to be mounted (e.g. mains cables) and the mounting areas are de-energized for the entire duration of mounting the device.

- Route all cables in an EMC-compatible manner.
- Connect cables (see ▹Connection diagrams◃ as from page 150).
  (Observe the permissible torques!)
- For all connections, attentions is to be paid to strain relief

The installation comprises the following steps:

1 Connect the motor through terminals 1U2, 1V2, 1W2 and PE.
Ensure the proper phases when connecting (rotational direction).
Observe the permissible torques!



NOTICE!

Internal overload protection operates exceeding 200 % of the motor rated current (full load current).

2 Connect the DC link - only for **BM53XX**, refer to ▹Mounting of the DC link bar◃ on page 122

3 Connect fuses (F1) - not for **BM53XX**
(if UL 508C is being considered, the UL-listed semiconductor or entire area fuses stated in Chapter ▹Fuses◃ as from page 277 are to be used).

4 Connect the main contactor - not for **BM53XX**

5 Connect the line filters (Z1) - not for **BM53XX**.

6 Connect the choke (L1) to the mains filter output (not necessary for **BM53XX**).

7 Connect devices to the mains choke output via the mains input terminals 1U1, 1V1 and 1W1 - not with **BM53XX**.
The mains cable has to be laid through the toroidal cores to ensure an operation within a C2 environment (see also ▹Mounting of toroidal cores◃ as from page 125)

8 Connect the protective ground conductor to the PE terminal (a fixed ground conductor connection is absolutely mandatory).

9 Connect 24 V power supply:
BM50XX, BM51XX, BM53XX via terminals X200 -1, X200 -2

10 Connect the signal bus cable (see ▹X300 (SELV/PELV)◃ as from page 178).

11 Connect encoders (see ▹Front side axis units BM53XX◃ as from page 183).



NOTE!

Plugging in and pulling out encoder cables while they are energized is prohibited, and could lead to their destruction.
Therefore, always first switch off the 24 V supply voltage and lock the plug connectors in place.

12 Connect the temperature sensor of the motor. (Observe the proper polarity!)

13 Connect the signal generator for the pulse enable:
BM53XX via terminals X2 -20 (IF1), X2 -19 (IF2), X2 -12 (M24V)

14 Connect the signal generator for the quick stop:
BM53XX via terminals X2 -13 (SH1), X2 -14 (SH2), X2 -12 (M24V)

15 Depends on the application - not for **BM53XX** - connect a brake resistor (R_B) via the terminals Ba+ and Ba-.

16 Connect the motor brake:
BM53XX via the terminals X207 and X208 (option)
Assignment pre-assembled Baumüller cable see motor documentation.

7.13 Connection diagrams

The connection diagrams are separated in connection diagrams for the electrical mains, motor etc., ▹page 152◃ and the front side connections ▹page 179◃.

NOTE!

The identifiers 1C1 and 1D1 were taken over from DIN EN 60445. 1C1 is the connection to the positive DC link cable/bar, and in the past was identified by Baumüller in some devices as ZK+. 1D1 is the connection to the negative DC link cable/bar, and in the past was identified by Baumüller in some devices as ZK-.

7.13.1 Connection diagram of BM50XX-XX0X-... mains rectifier without safety function

NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
see ▹D.5 Connection diagram BM5030 with safety function◃ as from page 328.

BM50XX-XX00 Normally open contact expected on the inhibit input.

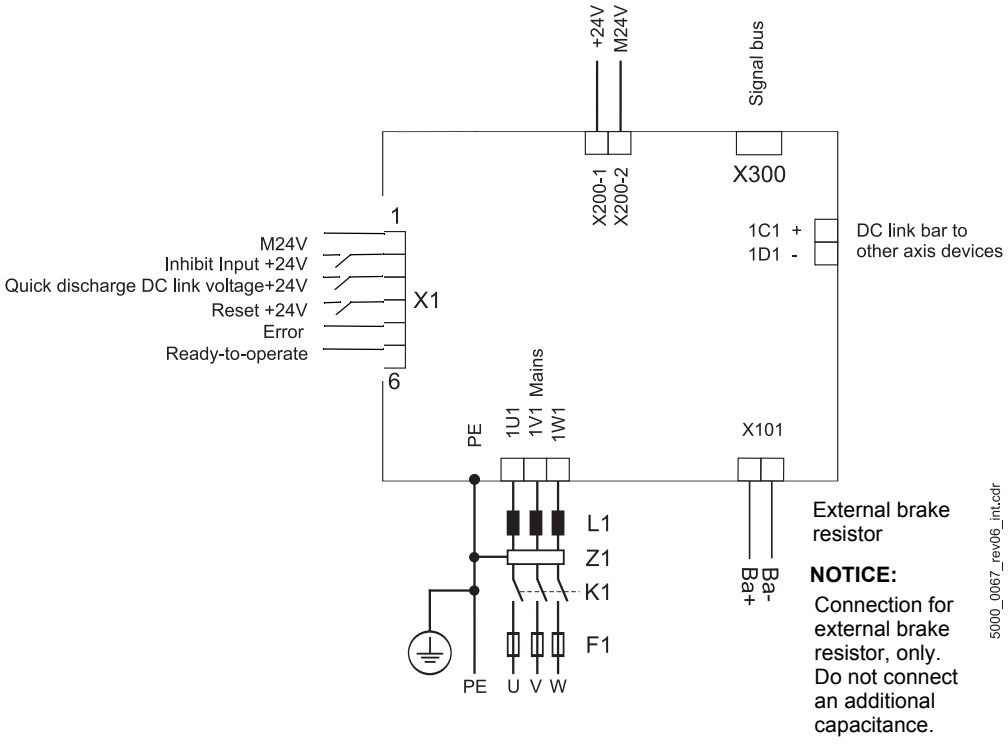


Figure 70: Connection diagram for the BM50XX-XX00 without safety function

BM50XX-XX01 Normally closed contact expected on the inhibit input.

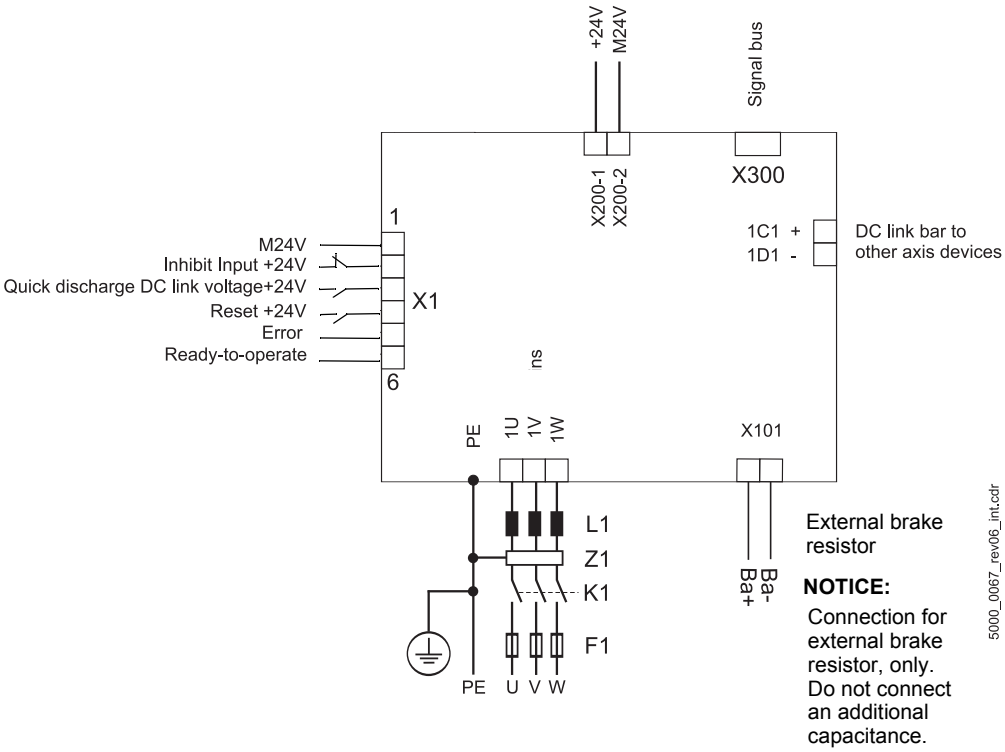


Figure 71: Connection diagram for the BM50XX-XX01 without safety function

NOTE!

The use of a power choke (L1) is mandatory for the function of the mains rectifier unit. An operation without power choke is not allowed.

1C1, 1D1	Connections for the DC link, see ▹Figure 80◃ on page 164.
PE	Power supply PE-connection
1U1, 1V1, 1W1	Power supply connection, see ▹Figure 80◃ on page 164.
F1	Fuses (cable + device)
L1	Power choke
Z1	Line filter
K1	Main contactor (option)
X200	Connections for 24 V voltage supply; for additional information, see ▹Figure 80◃ on page 164 (SELV/PELV).
X1	Control inputs and outputs, for additional information see ▹Figure 80◃ on page 164 and ▹Electrical connections of the BM50XX-XX0X-... without safety function◃ on page 164.
X300	Signal bus
X101	Brake resistor

7.13.2 Connection diagram for the BM51XX active mains rectifier unit

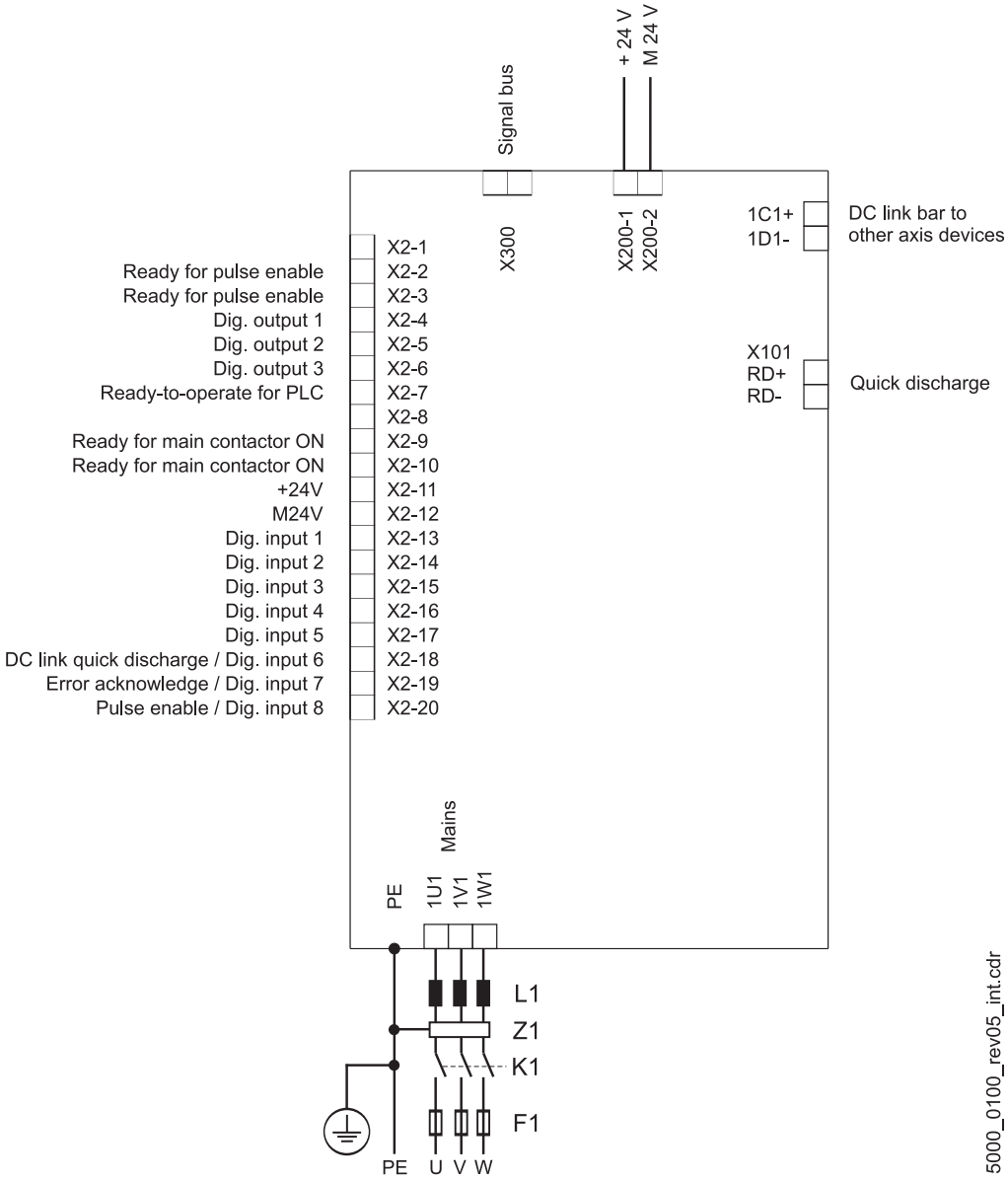


Image 72: Connection diagram for the BM51XX

NOTE!

The use of a power choke (L1) is mandatory for the function of the active mains rectifier unit. Operation without power choke is not allowed.

The mains cable must be led through a toroidal core to ensure an operation in a C2 environment (see also ▹Mounting of toroidal cores◃ as from page 125).

1C1, 1D1	Connections for the DC link, see ▹Figure 82◃ on page 166.
PE	Power supply PE-connection
1U1, 1V1, 1W1	Power supply connection, see ▹Figure 82◃ on page 166.
F1	Fuses (cable + device)
L1	Power choke
Z1	Line filter
K1	Main contactor
X101	Quick discharge R_D+, R_D-
X200	Connections for 24 V voltage supply; for additional information, see ▹Figure 82◃ on page 166 (SELV/PELV).
X2	Connections for pulse enable, etc., see ▹Pin assignment X2◃ on page 182.
X300	Signal bus
BB-HS	Ready for main contactor ON (NO contact)
BB-IF	Ready for pulse enable (NO contact)

7.13.2.1 Connection proposal BM51XX

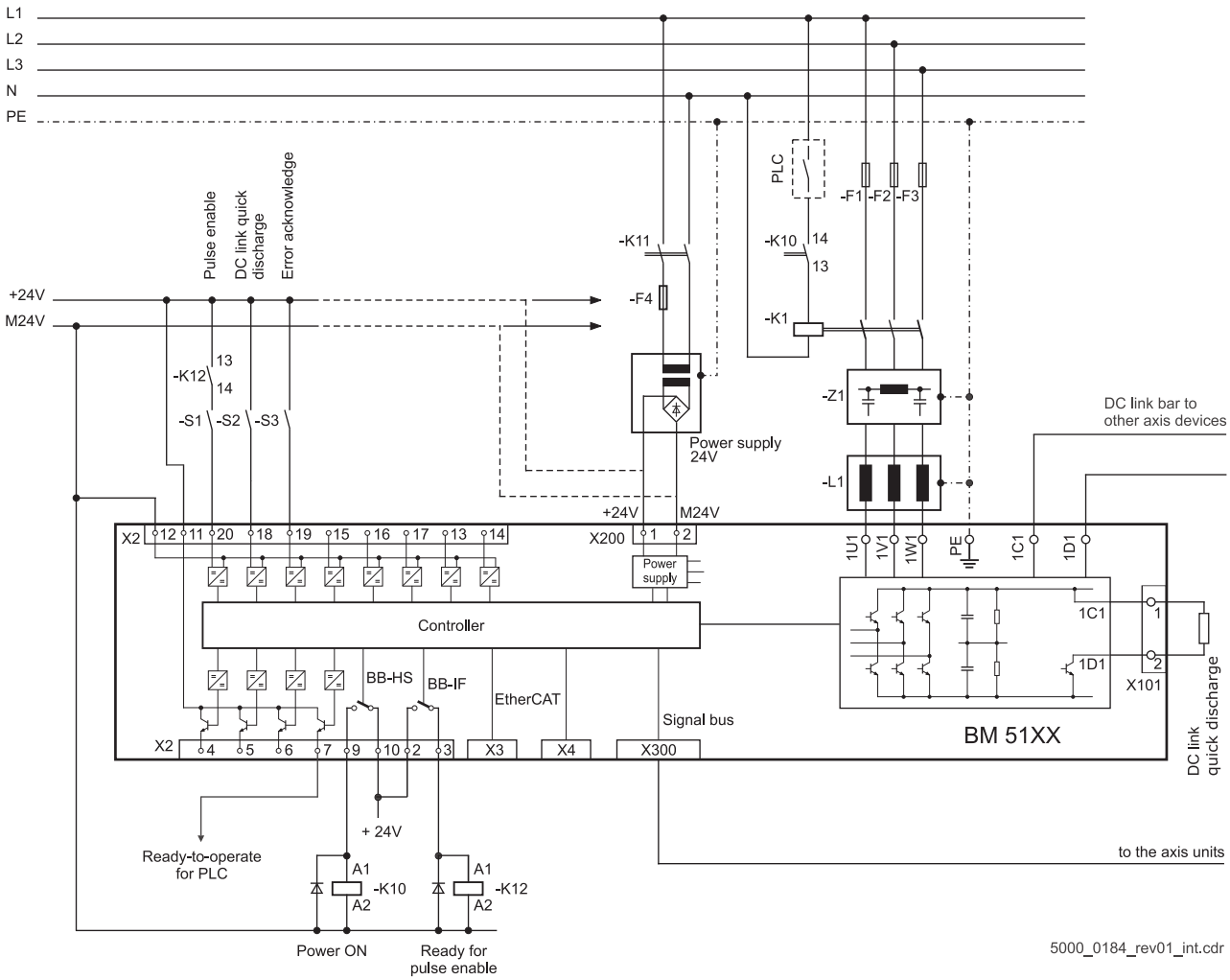


Image 73: Connection proposal BM51XX

7.13.2.2 Connection proposal BM51XX pulse enable control

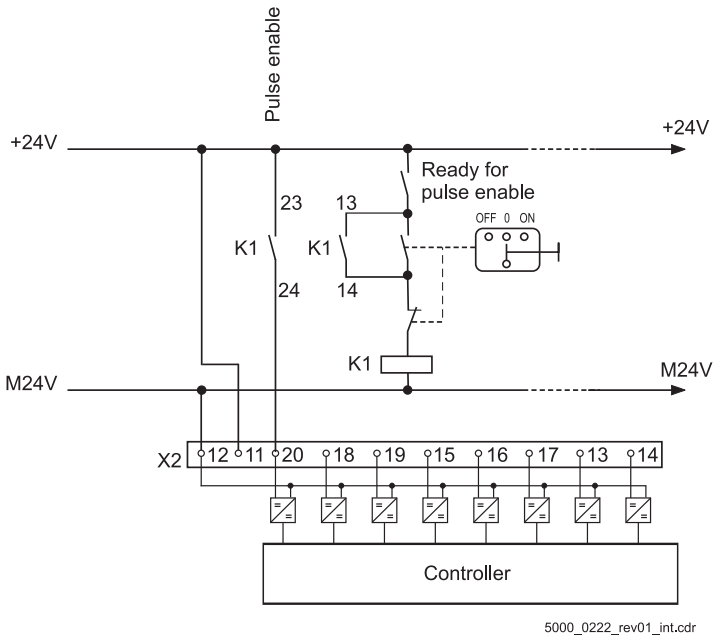
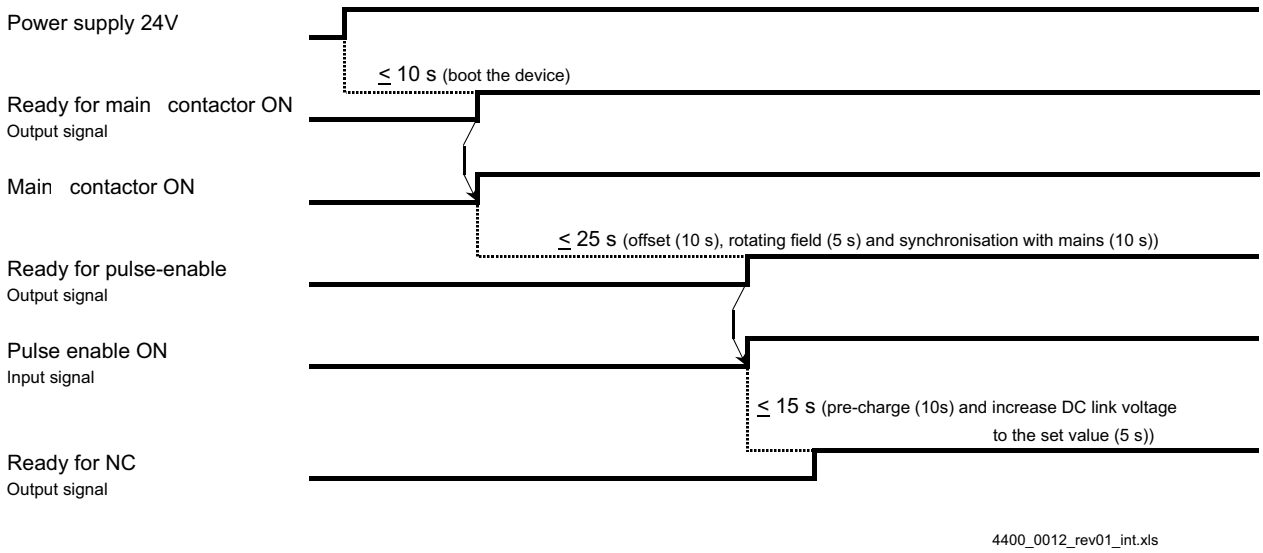


Figure 74: Connection proposal BM51XX pulse enable control

NOTE!

The user must enable pulses intentionally, to recharge and enable the active mains unit after an error or after quick discharge, when using this connection proposal.

7.13.2.3 Timing diagram for switching on BM51XX



Power supply 24V	-	X200-1, X200-2 and X2-11, X2-12 are connected with $24V_{DC}$
Ready for main contactor ON	-	the contact between X2-9, X2-10 is closed
Main contactor ON	-	the main contactor is enabled, the BM51XX is connected to the three-phase system
Ready for pulse enable	-	the contact between X2-2, X2-3 is closed X2-2, X2-3
Pulse enable ON	-	BM51XX is waiting for a $+24V_{DC}$ level on X2:20
Ready-to-operate for NC	-	BM51XX sets X2-7 on $+24V_{DC}$ level - the signal „power supply ready“ is set on the signal bus X300

7.13.3 Connection diagram single axis unit

7.13.3.1 Connection diagram BM5326, BM5327, BM5328

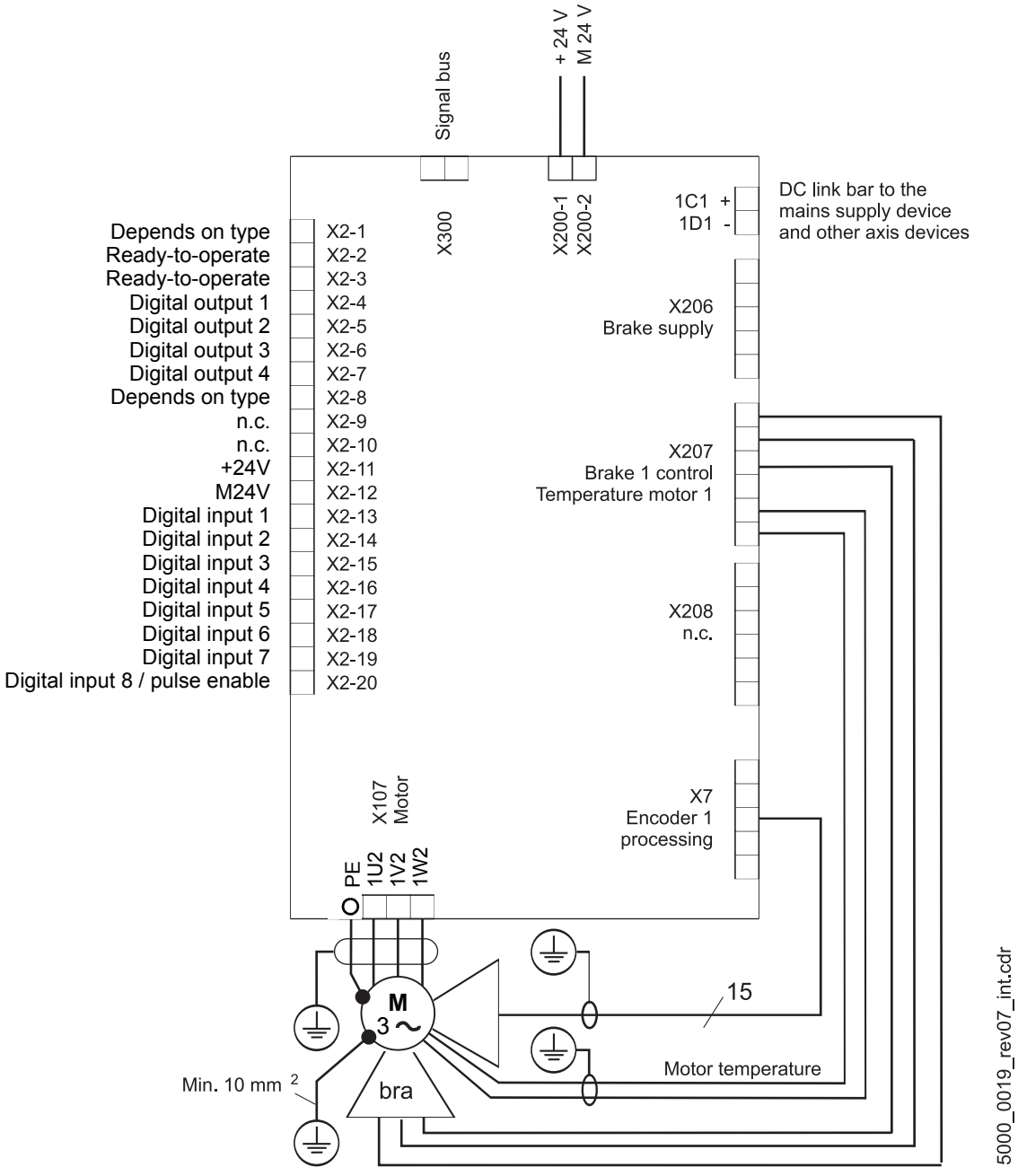


Figure 75: Connection diagram single axis units BM5326, BM5327, BM5328

7.13.3.2 Connection diagram BM5334, BM5335

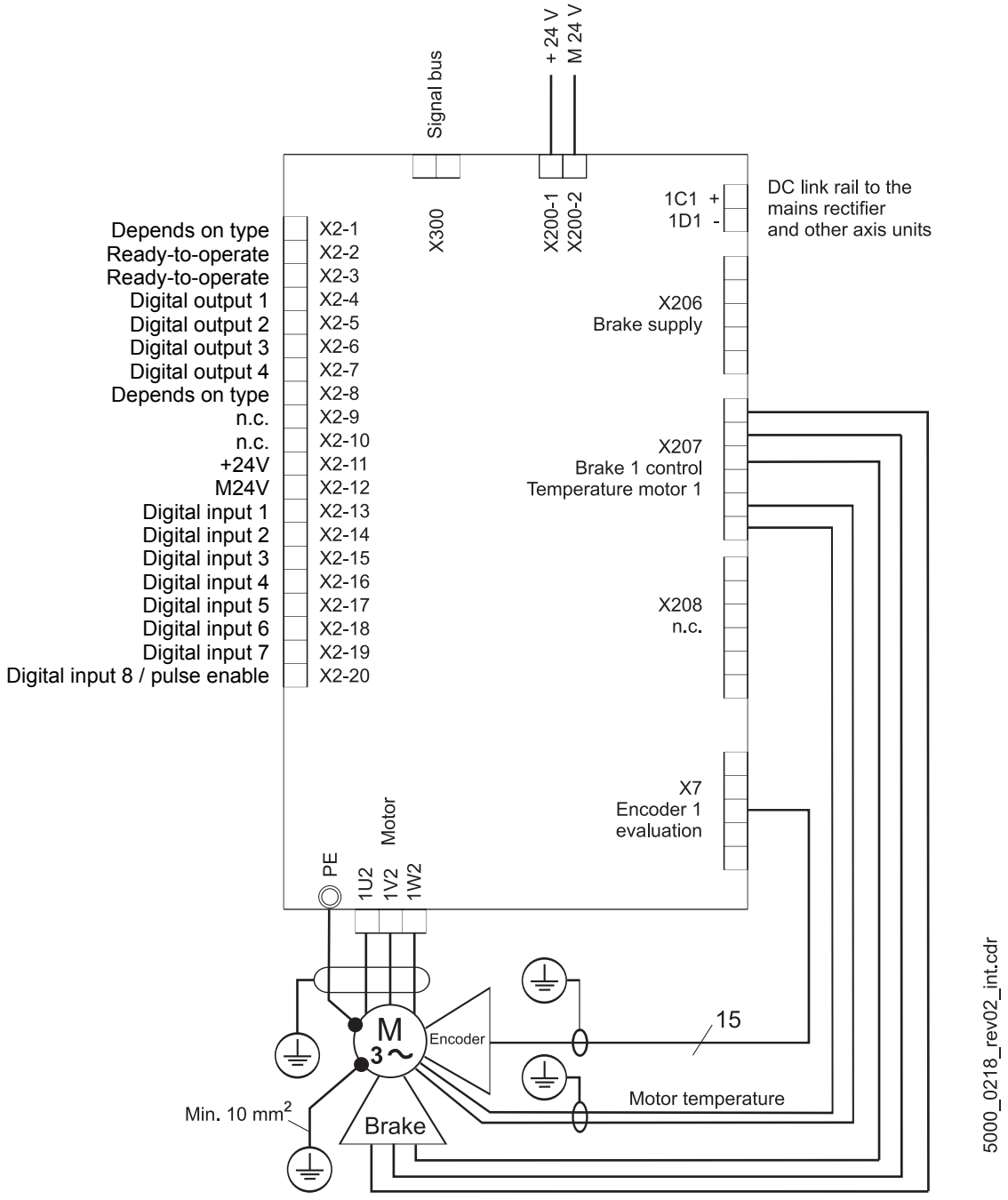


Figure 76: Connection diagram single axis units BM5334, BM5335

7.13.3.3 Connection diagram BM537X

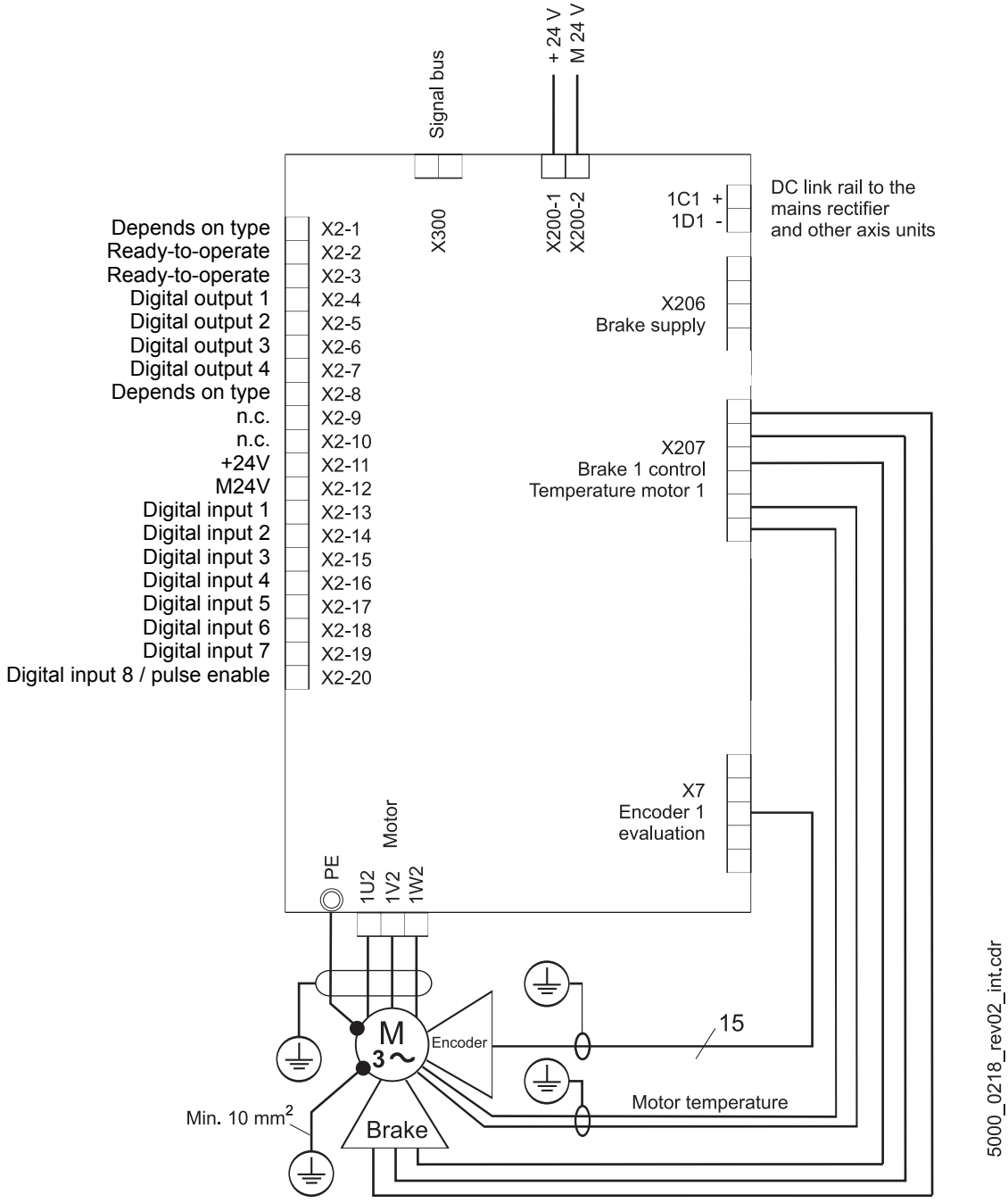


Figure 77: Connection diagram single axis units BM537X

1C1, 1D1	Connections for the DC link, see ▹Figure 84◃ on page 168.
X2	Connections for pulse enable, etc. see ▹X2 Digital inputs/outputs◃ on page 185
X7	Encoder evaluation
X107	Motor connection BM5326, BM5327, BM5328, see ▹Figure 84◃ on page 168
1U2, 1V2, 1W2	Connections for the motor BM5334, BM5335, see ▹Figure 85◃ on page 169. Connections for the motor BM537X, see ▹Figure 86◃ on page 170
X200	Connections for 24 V voltage supply; for additional information, see ▹Figure 84◃ on page 168 (SELV/PELV).
X206	Connection for 24 V voltage supply for the motor brake, see Table X206 on ▹page 176◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X207	Connections for motor temperature and motor brake of motor 1, see table X207 on ▹page 177◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X208	Connections for motor temperature and motor brake of motor 2, see table X208 on ▹page 177◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X300	Signal bus

7.13.4 Connection diagram for the double axis unit

7.13.4.1 Connection diagram BM5323, BM5325

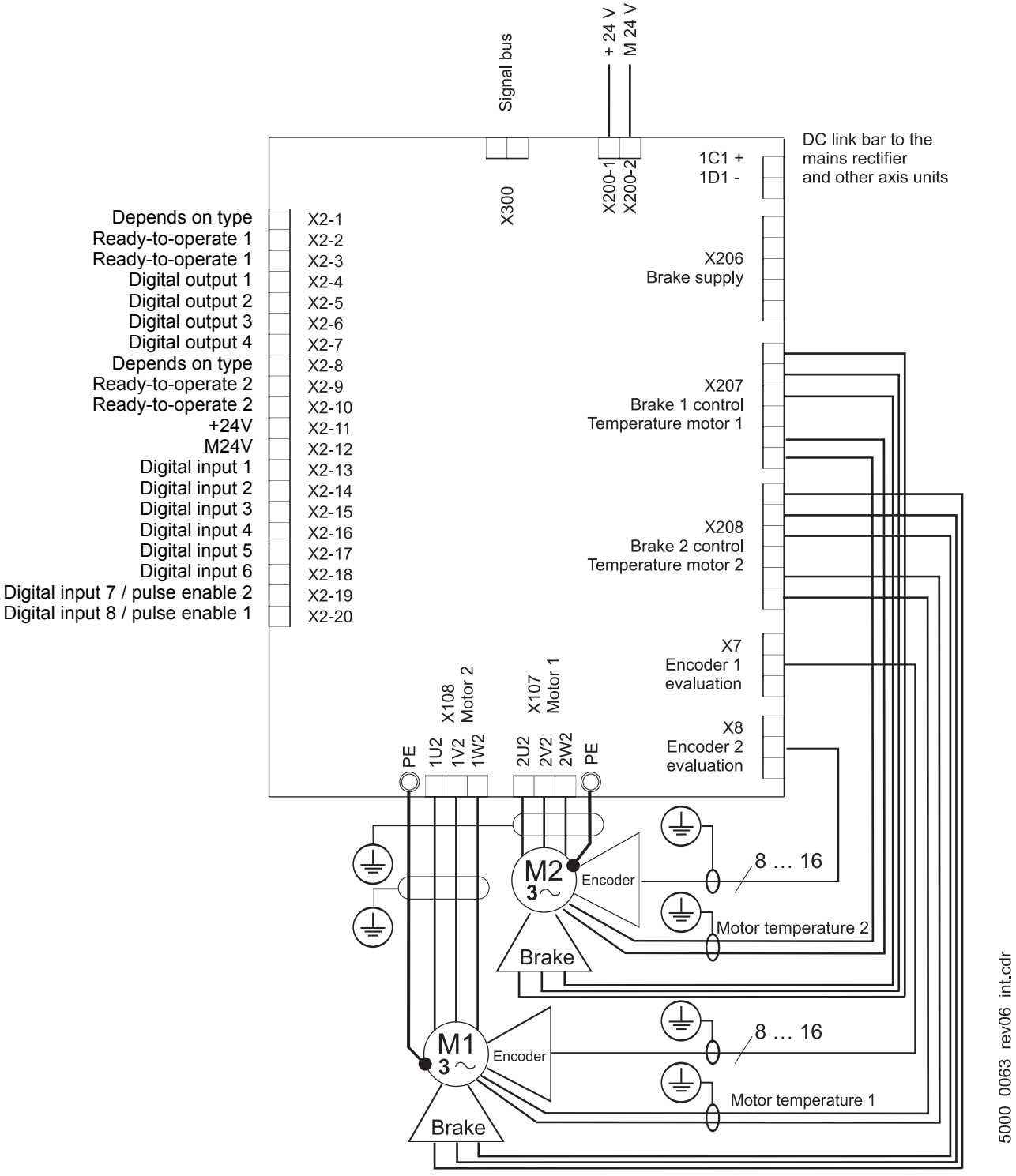


Figure 78: Connection diagram for the double axis unit BM5323, BM5325

7.13.4.2 Connection diagram BM5331, BM5332, BM5333

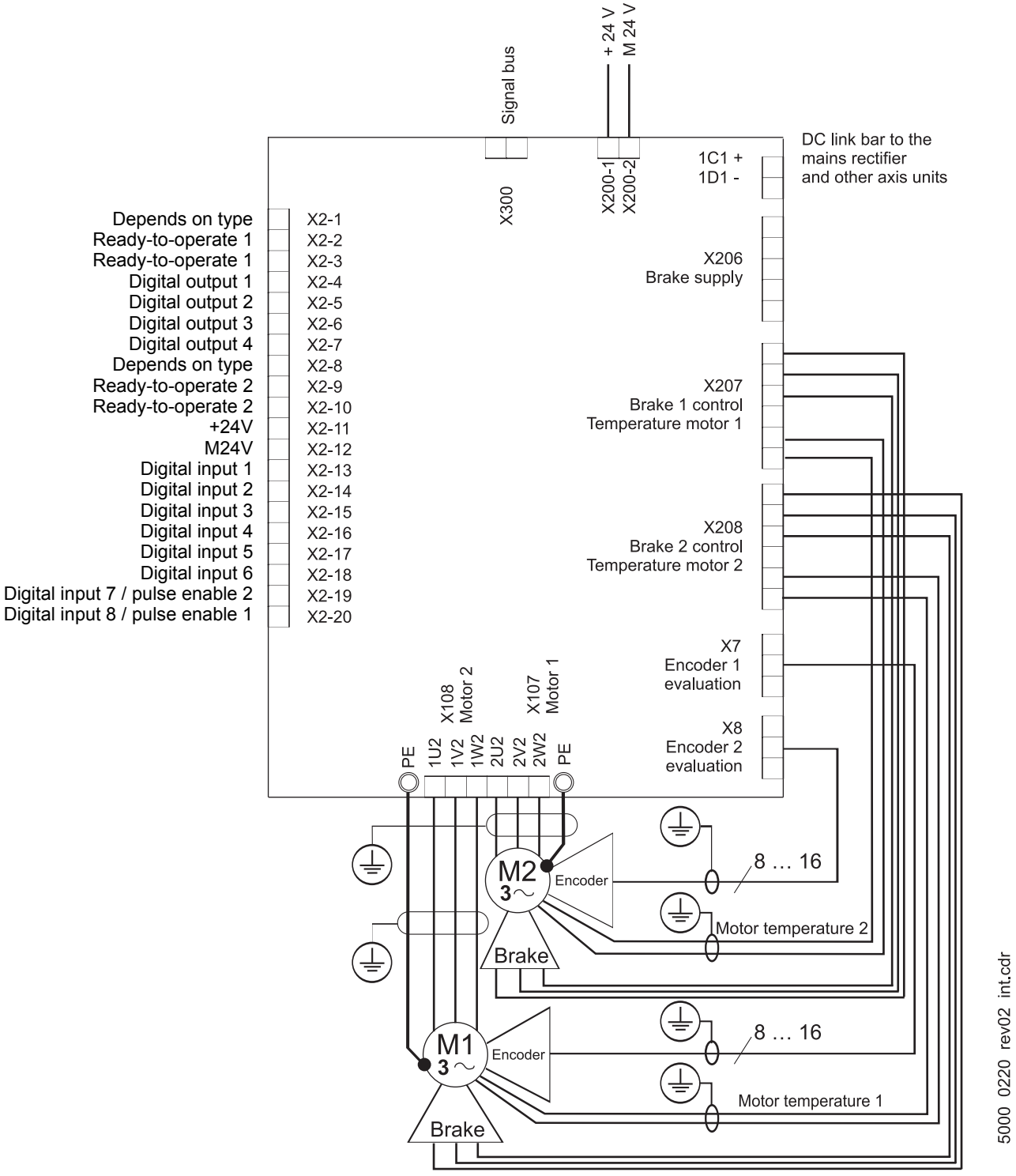


Figure 79: Connection diagram for the double axis unit BM5331, BM5332, BM5333

1C1, 1D1	Connections for the DC link, see ▹Figure 88◃ on page 172.
X2	Connections for pulse enable, etc. see ▹X2 Digital inputs/outputs◃ on page 185
X7	Encoder evaluation 1
X8	Encoder evaluation 2
X107	BM5323, BM5325 Motor connection 1 BM5331, BM5332, BM5333 Motor connection 1 and 2
X108	BM5323, BM5325 Motor connection 2
X200	Connections for 24 V voltage supply; for additional information, see ▹Figure 88◃ on page 172 (SELV/PELV).
X206	Connection for 24 V voltage supply for the motor brake, see Table X206 on ▹page 176◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X207	Connections for motor temperature and motor brake of motor 1, see table X207 on ▹page 177◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X208	Connections for motor temperature and motor brake of motor 2, see table X208 on ▹page 177◃. For connector assignment see ▹X206/X207/X208◃ as from page 212.
X300	Signal bus

7.14 Electrical connections

NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
see ▹D.6 Electrical connections BM5030 with safety function◃ as from page 330.

7.14.1 Electrical connections of the BM50XX-XX0X-... without safety function

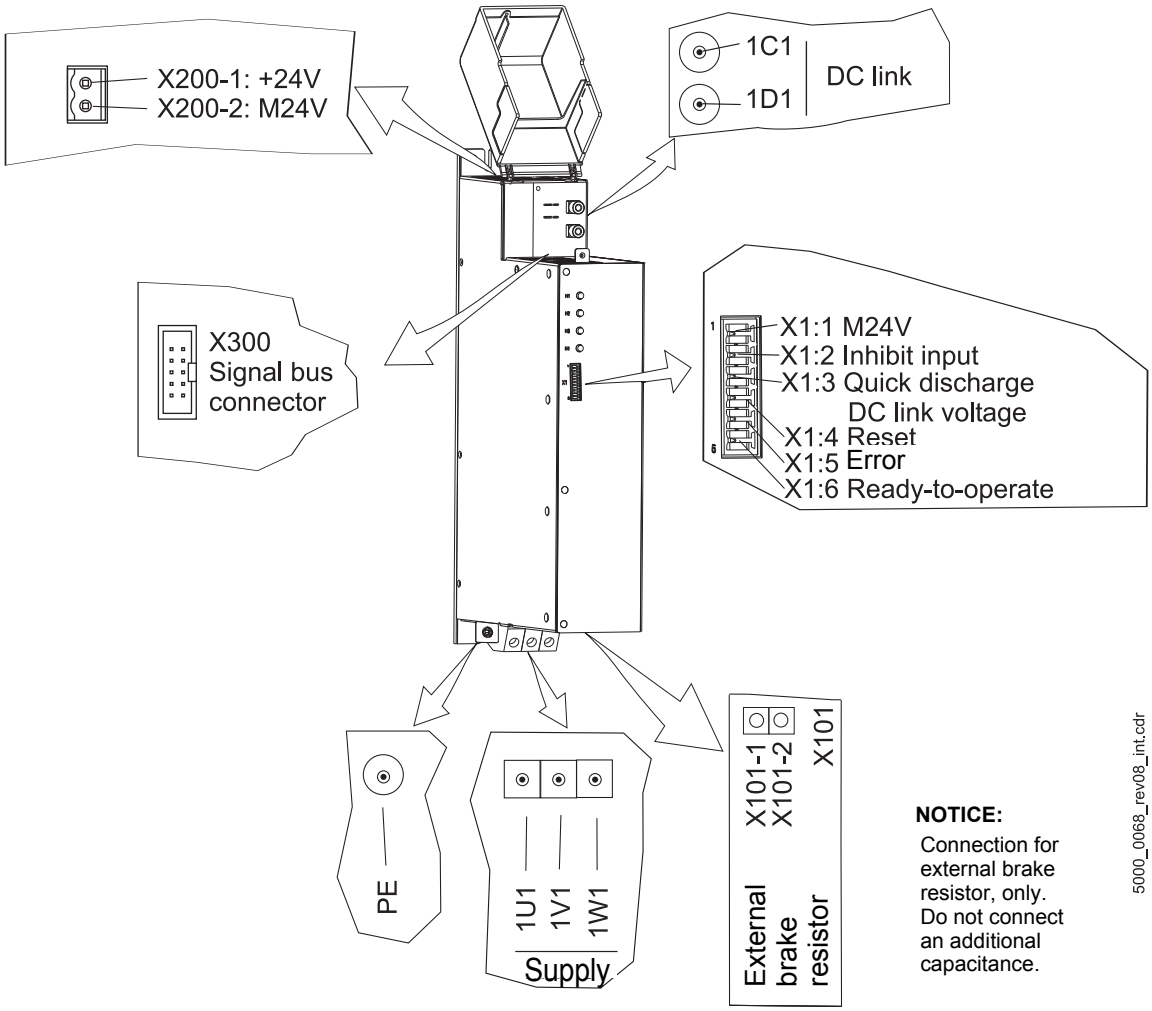


Figure 80: Electrical connections of the BM503, BM504XX without safety function

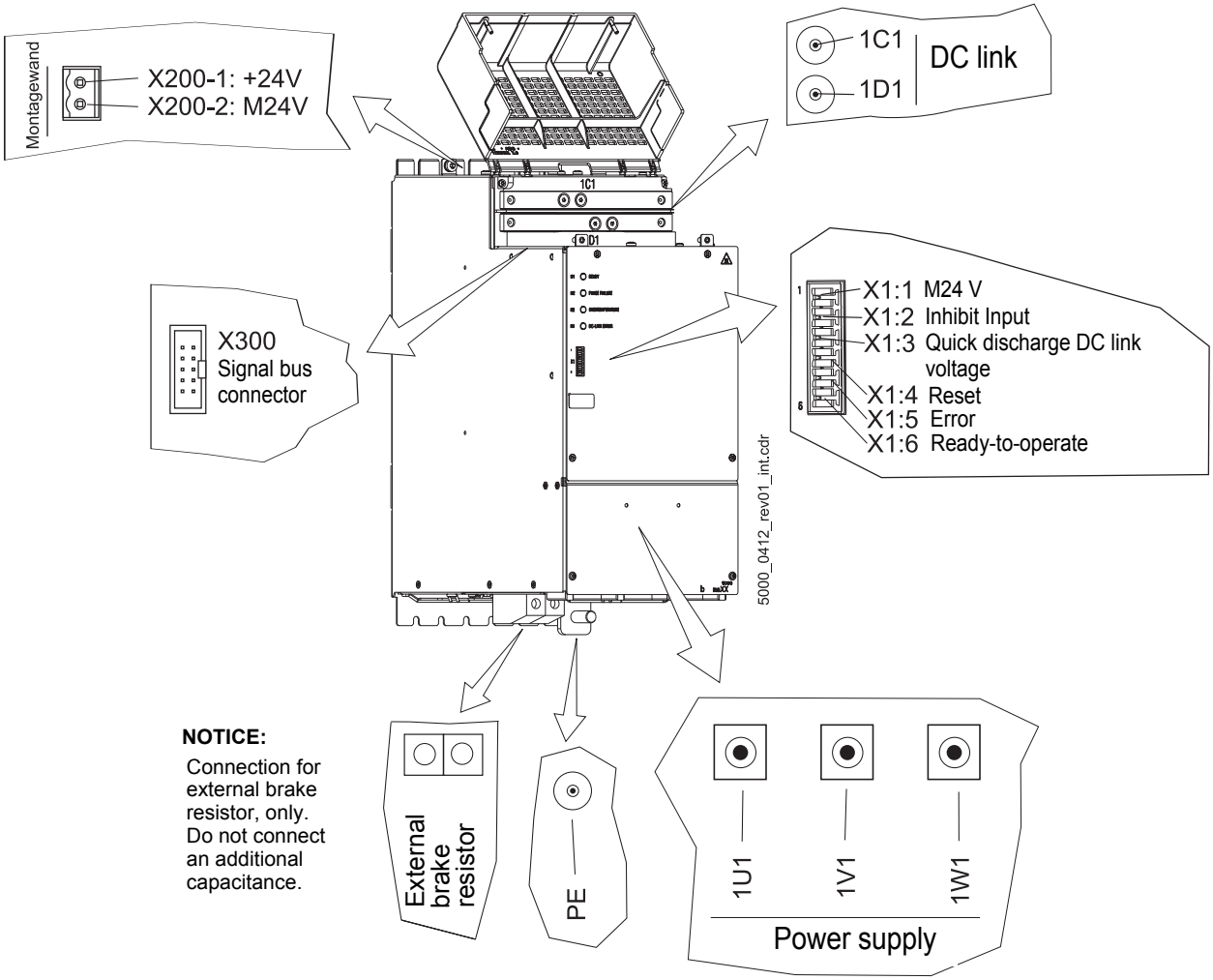


Figure 81: Electrical connections of the BM507X without safety function

7.14.2 Electrical connections of the BM51XX

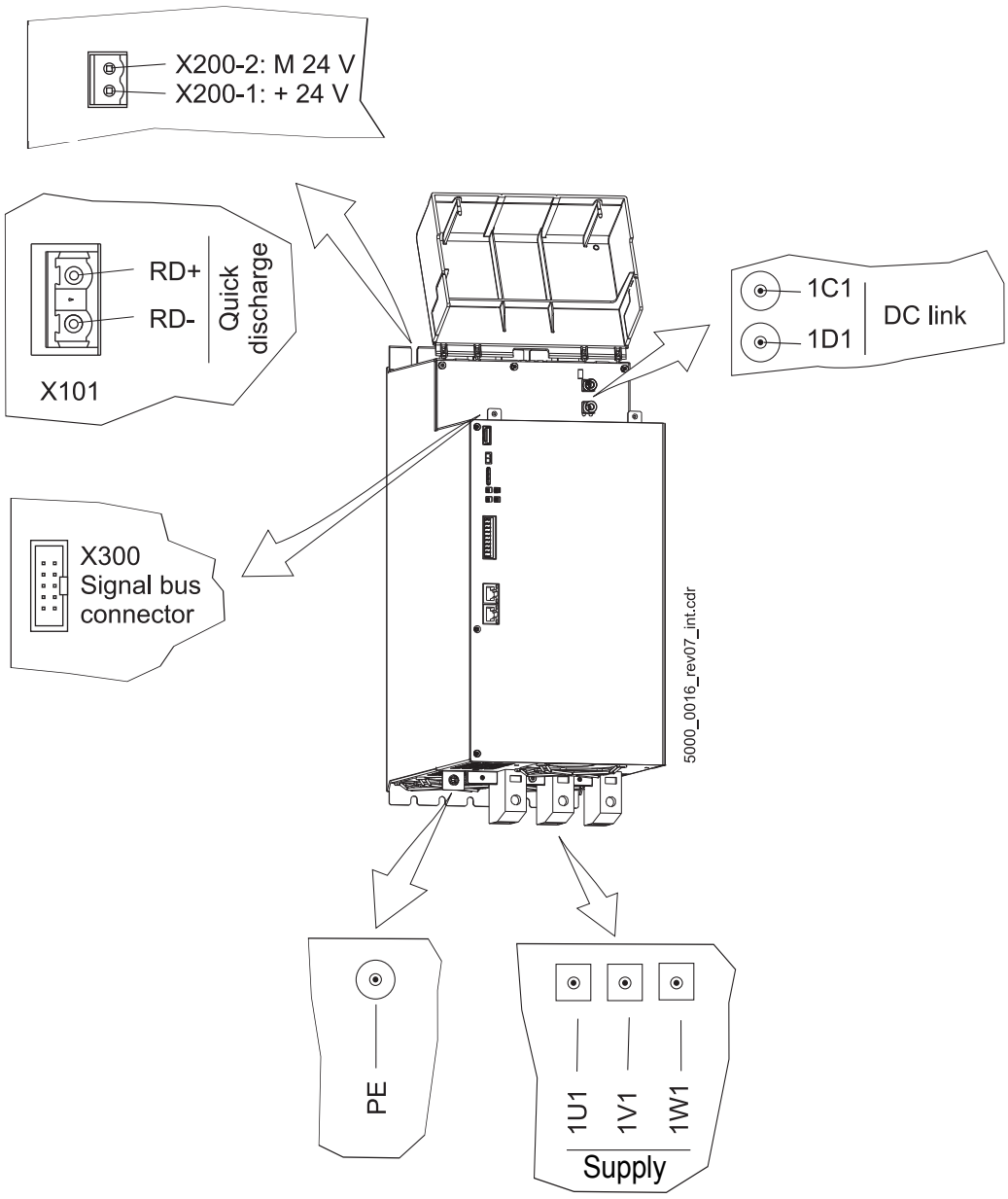


Figure 82: Electrical connections of the BM517X

7.14.3 BM519X connections

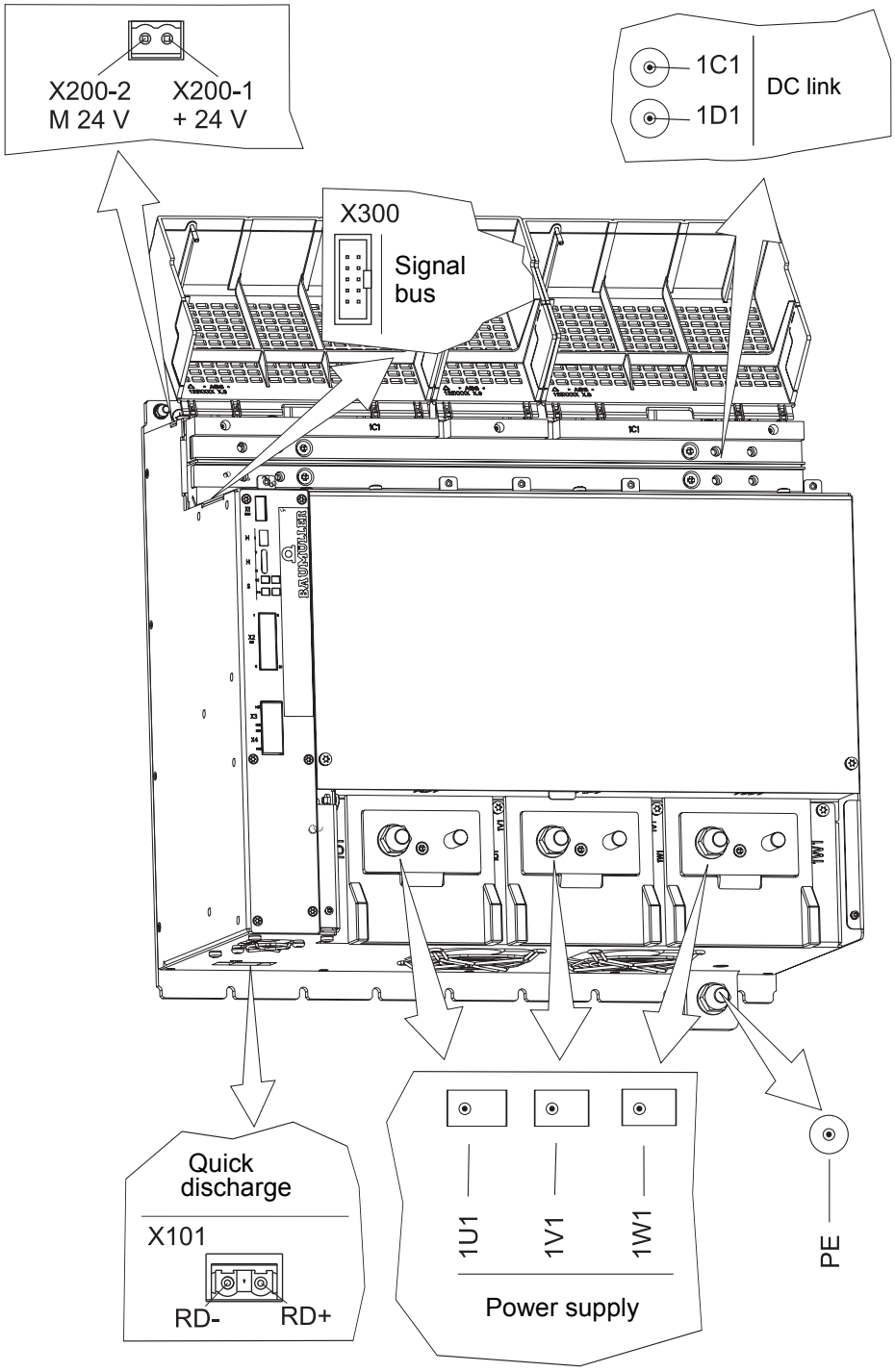


Figure 83: Electrical connections of the BM519X

7.14.4 Electrical connections of the single axis BM5326, BM5327, BM5328

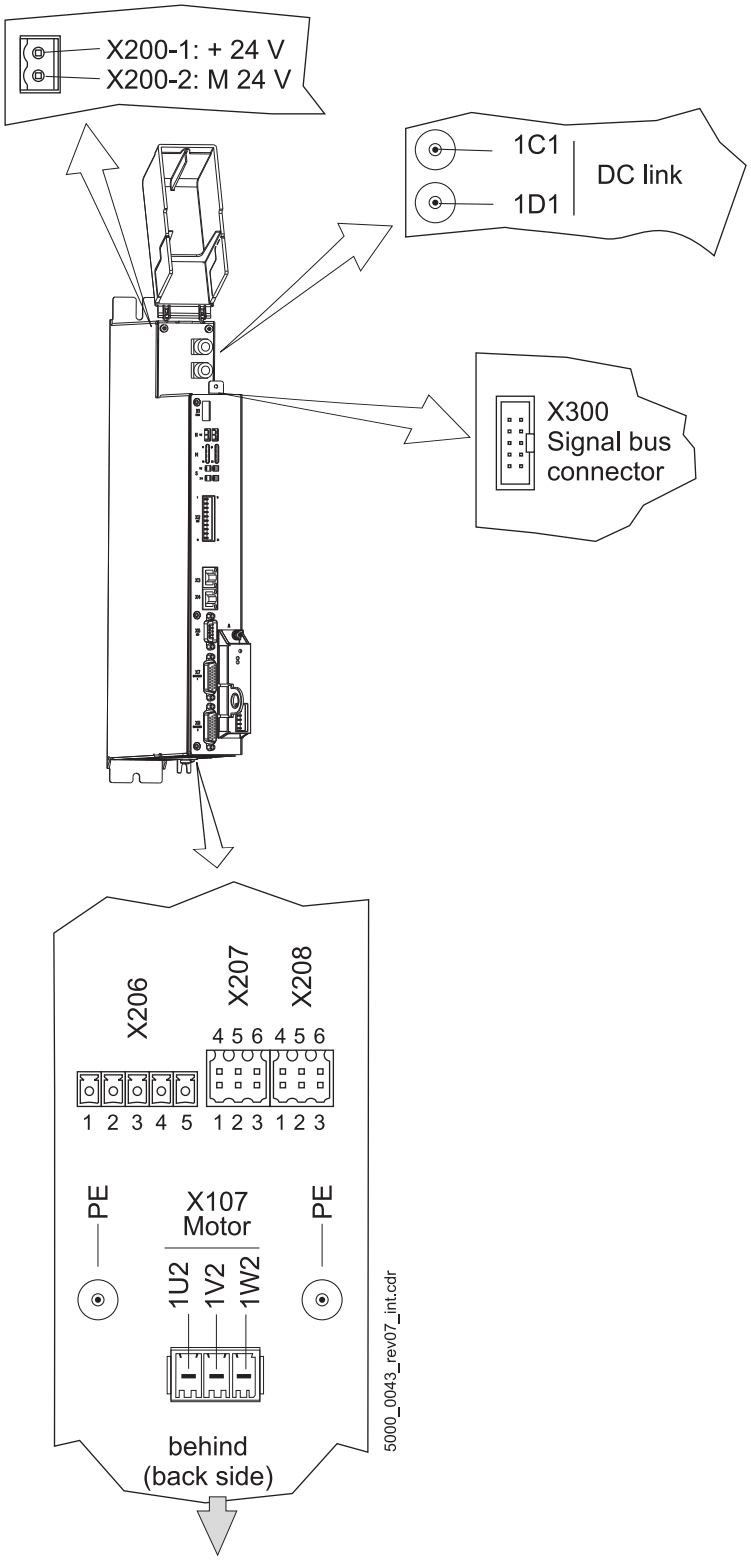


Figure 84: Electrical connections of the single axis BM5326, BM5327, BM5328

7.14.5 Electrical connections of the single axis BM5334, BM5335

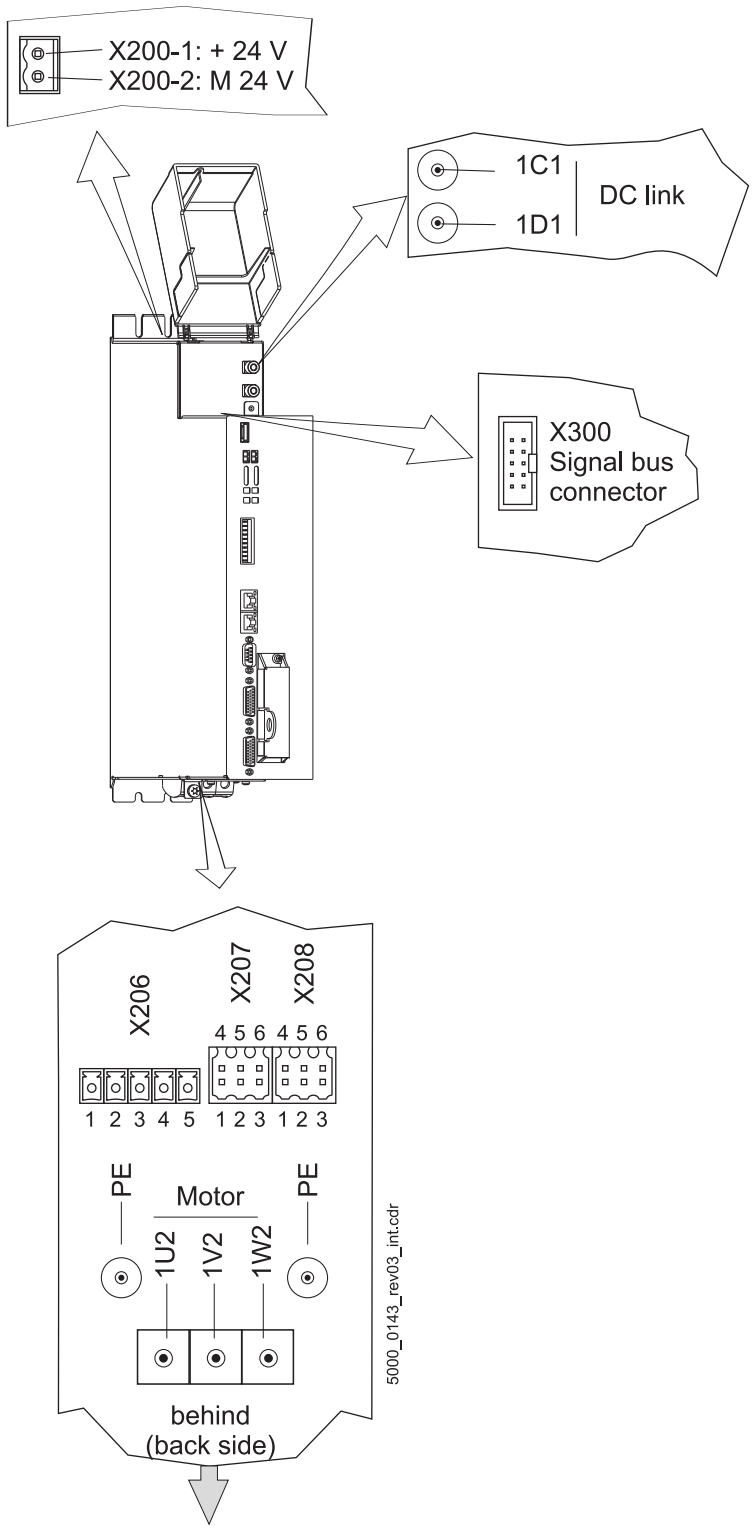


Figure 85: Electrical connections of the single axis BM5334, BM5335

7.14.6 Electrical connections of the single axis BM537X

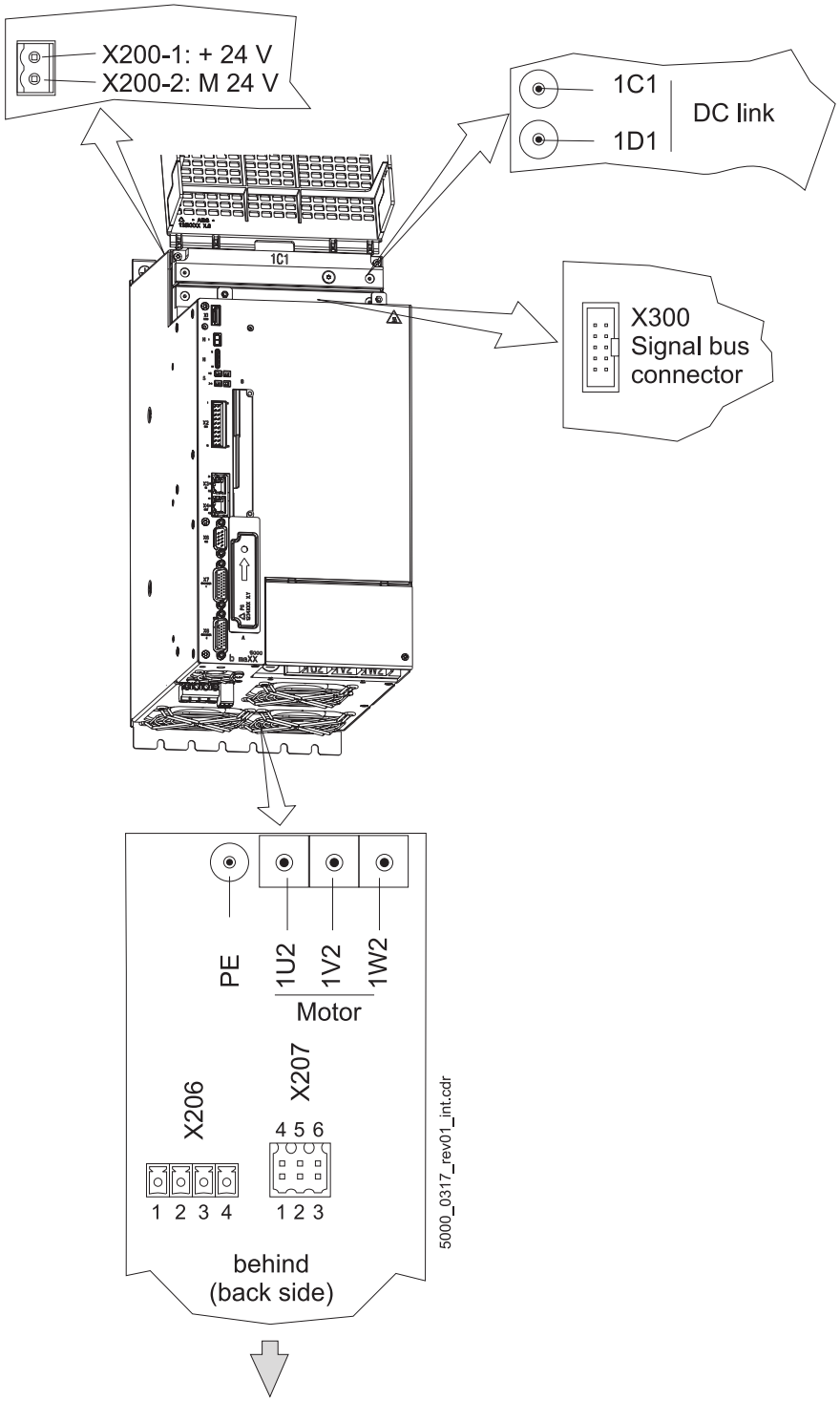
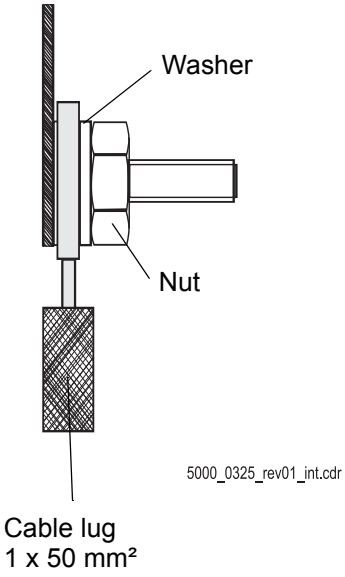


Figure 86: Electrical connections of the single axis BM537X

Connection motor/PE bolt BM507X/BM537X

Connection 1 x 50 mm²



Connection 2 x 16 mm²

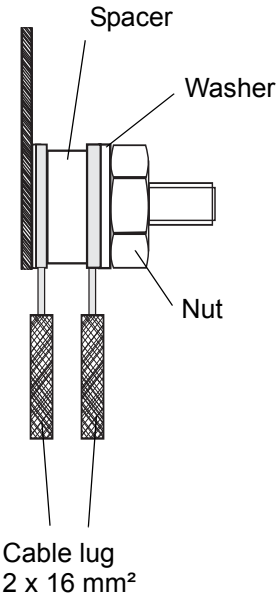


Figure 87: Connection motor/PE bolt

7.14.7 Electrical connections of the double axis BM5323, BM5325

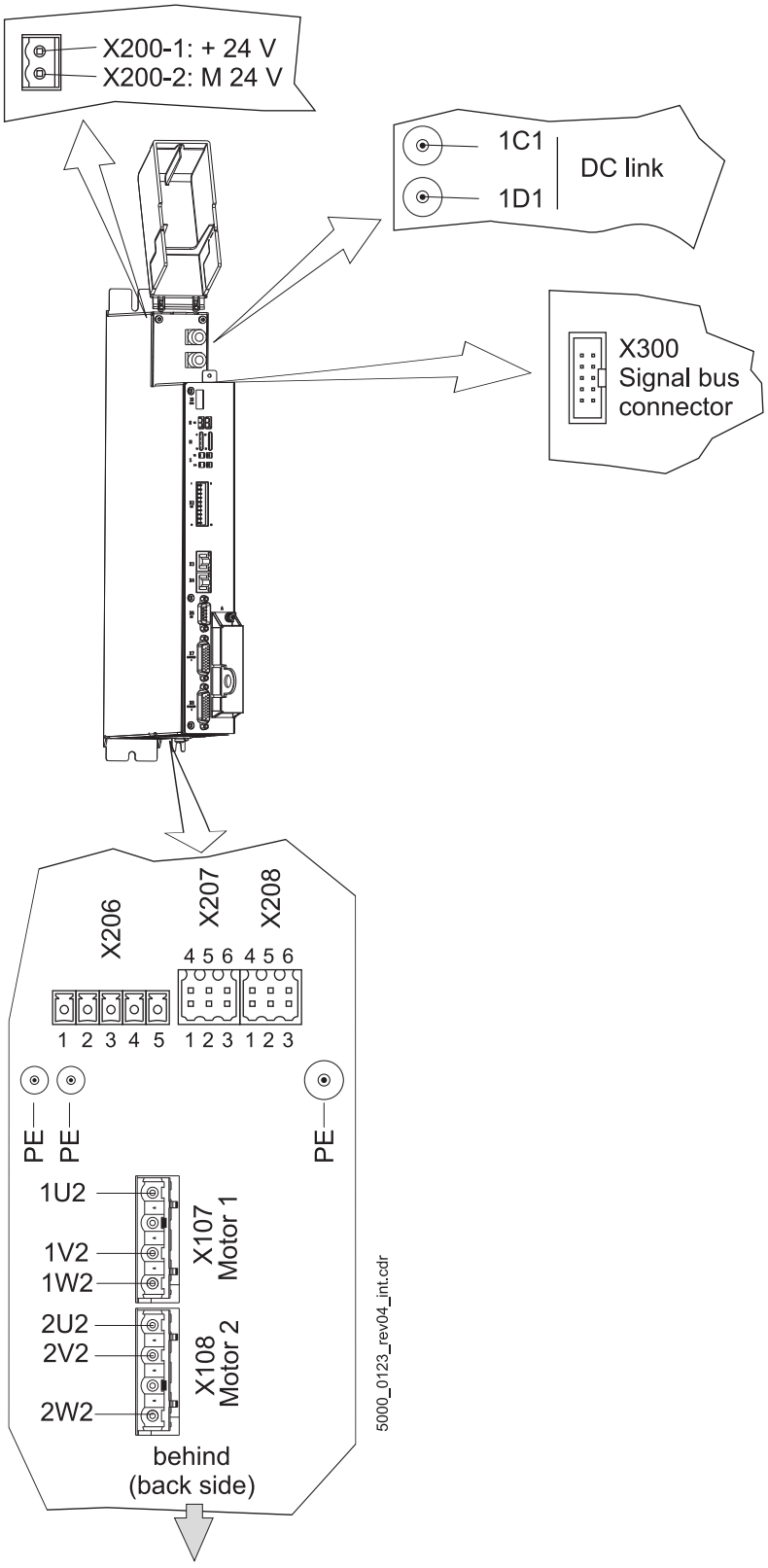


Figure 88: Electrical connections of the double axis BM5323, BM5325

7.14.8 Electrical connections of the double axis BM5331, BM5332, BM5333

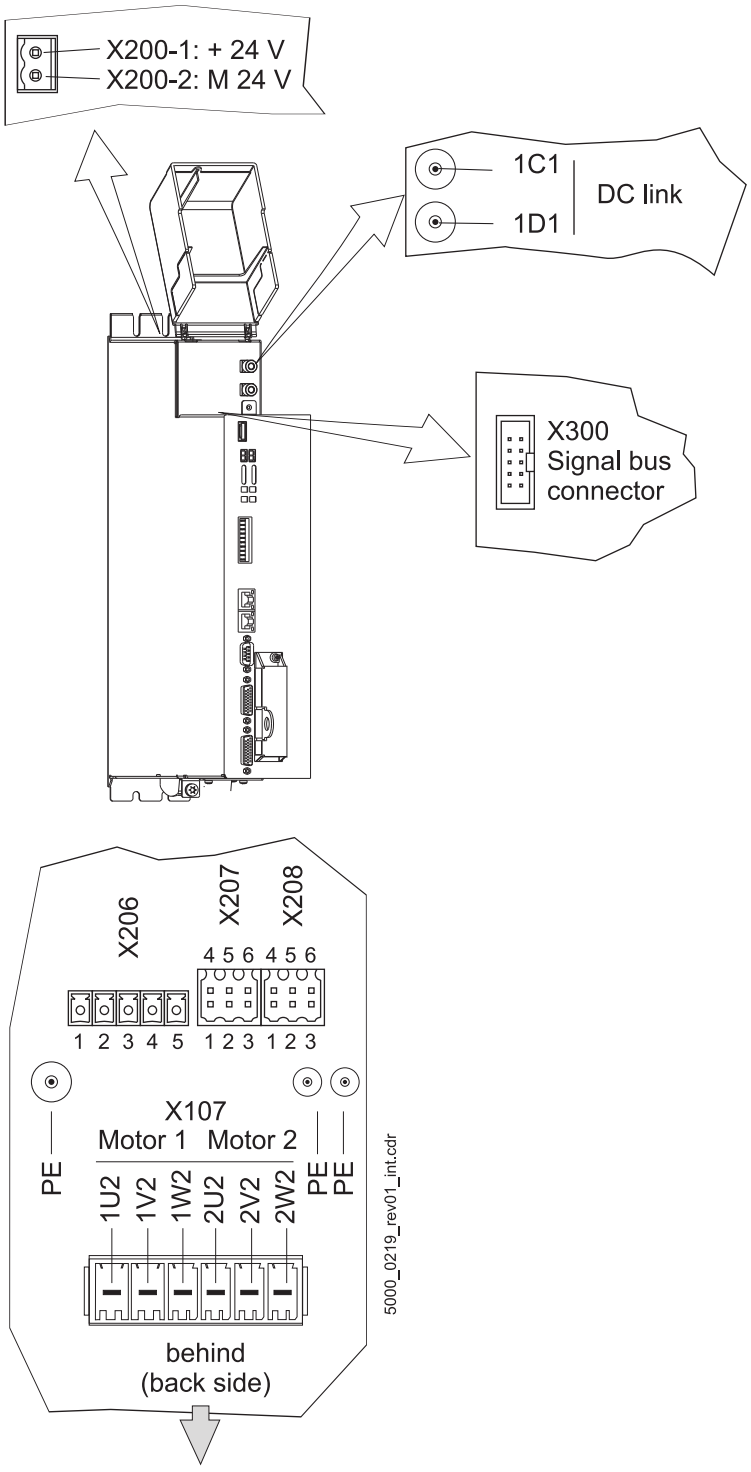


Figure 89: Electrical connections of the double axis BM5331, BM5332, BM5333

7.14.9 Connection data



NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
see ▹D.6.1 Connection data of BM5030 with safety function◃ as from page 331.



NOTE!

To ensure sufficient current load capacity of the connections, adhere to the specified torques!

		Connection cross section	Connection method	Torque	Load capacity
Power supply system 1U1, 1V1, 1W1	BM503X-XX0X	Max. 25 mm²	Screw terminal	Min. 4.0 Nm Max. 4.5 Nm	Refer to ▹Fuses◃ as from page 277
	BM504X BM517X	Max. 50 mm²	Screw terminal	Min. 6.0 Nm Max. 8.0 Nm	
	BM507X BM519X		Cable lug for M10	Min. 30 Nm Max. 40 Nm	
PE power supply system	BM503X-XX0X	Min. 10 mm²	Cable lug for M5	Min. 2.2 Nm Max. 3.0 Nm	-
	BM504X BM517X	½ power supply connection cross section, Min. 16 mm²	Cable lug for M6	Min. 3.0 Nm Max. 4.0 Nm	-
	BM507X BM519X		Cable lug for M10	Min. 30 Nm Max. 40 Nm	
PE device	BM53XX	Min. 10 mm²	Cable lug for M5	Min. 2.2 Nm Max. 3.0 Nm	-

			Torque	Max load capacity of the bar
DC link 1C1 and 1D1	all other devices	DC link bar	Min. 2.2 Nm Max. 3.0 Nm	130 A
	BM507X BM519X		Min. 4,0 Nm Max. 4,8 Nm	300 A

		Connection cross section	Connection method	Torque	Load capacity [2] of the connector
X101 [1] Brake resistor	BM503X-XX0X	Max. 6 mm²	Plug connector, spring-clamp	-	Max. 41A
	BM504X	Max. 16 mm²	Plug connector, threaded connection	Min. 1.7 Nm	Max. 76 A
	BM507X	Max. 50 mm²	Screw terminal	Min. 6.0 Nm Max. 8.0 Nm	
X101 [1] Quick-discharge resistor	BM517X BM519X	Max. 2.5 mm²	Plug connector, threaded connection	Min. 0.5 Nm Max. 0.6 Nm	Max. 16A
	BM519X	Max. 16 mm²	Plug connector, threaded connection	Min. 1.7 Nm	Max. 76 A

[1] Not short-circuit resistant - observe maximum load! Refer to „External brake resistor“ in Chapter ▹Brake resistors◃ as from page 281, it is prohibited to connect an additional capacitance

[2] Refer to „External brake resistor continuous power“ in Chapter ▹Electrical data◃ as from page 60.

		Connection cross section at rated power/ connection	Connection cross section terminal	Connection method	Torque	Load capacity
Motor 1U2, 1V2, 1W2	BM5323 BM5325	Min. 0.75 mm² [a]	Max. 2.5 mm² [a]	Plug connector, threaded connector	Min. 0.4 Nm Max. 0.5 Nm	Limited by the device. Refer to also ▹Electrical data◃ as from page 60
	BM5326 BM5331	Min. 2.5 mm² [a]	Min. 2.5 mm² [a] Max. 6 mm² [a]	Plug connector, spring-clamp connection	-	
	BM5327 BM5332	Min. 4 mm² [a]				
	BM5328 BM5333	Min. 6 mm² [a]				
	BM5334	Min. 10 mm² [a]	Min. 4 mm² [b] Min. 10 mm² [c] Max. 25 mm² [a]	Screw terminal	Min. 4.0 Nm Max. 4.5 Nm	
	BM5335	Min. 16 mm² [a]				
	BM537X	2 x 16 mm² [d]		Cable lug for M8	Min. 10 Nm Max. 13 Nm	
		50 mm² [d]				

[a] with or without wire end ferrule

[b] only with wire end ferrule

[c] without wire end ferrule

[d] The cable lug may be 20 mm wide at most. The maximum cable diameter is dependent on the cable lug. Also see ▹Cable device - motor◃ as from page 258.

		Connection cross section	Connection method	Torque	Load capacity
Motor PE	BM5323 BM5325 BM5331 BM5332 BM5333	refer to motor cable	Cable lug for M4	Min. 1.4 Nm Max. 1.8 Nm	see ▹Electrical data◃ as from page 60
	BM5326 BM5327 BM5328 BM5334 BM5335	refer to motor cable	Cable lug for M5	Min. 2.2 Nm Max. 3.0 Nm	
	BM537X	refer to motor cable	Cable lug for M8	Min. 10 Nm Max. 13 Nm	

	Connection cross section	Connection method	Load capacity
X200 (SELV/PELV) 24 V voltage supply	Max. 1.5 mm² (2 wire 2 pin)	Plug connector, spring-clamp connection	Plug connector, max. 16 A

		Connection cross section	Connection method	Load capacity
X1 (SELV/PELV) Control inputs	BM503X-XX0X	Max. 1.5 mm²	Plug connector, spring-clamp connection	Max. **8.0** A
X2 (SELV/PELV) DIO		Max. 1.0 mm²	Plug connector, spring-clamp connection	Max. **8.0** A
X206 (SELV/PELV) Supply for motor temperature and brake	all other devices	Max. 1.5 mm²	Plug connector, spring-clamp connection	Max. **4** A
	BM537X	Max. 2,5 mm²		Max. **16** A

		Connection cross section	Connection method	Load capacity
X207 Motor temperature and brake motor 1	BM5323 BM5325 BM5331 BM5332 BM5333	Max. 1.0 mm²	Plug connector, spring-clamp connection	Max. **2** A
	BM5326 BM5327 BM5328 BM5334 BM5335			Max. **4** A
	BM537X	Max. 1.5 mm²		Max. **8** A
X208 Motor temperature and brake motor 2	BM5323 BM5325 BM5331 BM5332 BM5333	Max. 1.0 mm²	Plug connector, spring-clamp connection	Max. **2** A



NOTE!

A relay with varistor protection circuit is required in case the customer connects an additional relay.

X300 (SELV/PELV)

Signal bus

	Connection method
BM50XX BM51XX BM53XX	Configured cable

(max. allowable number of axis units: 12)

Notes for the laying of the signal bus cable:

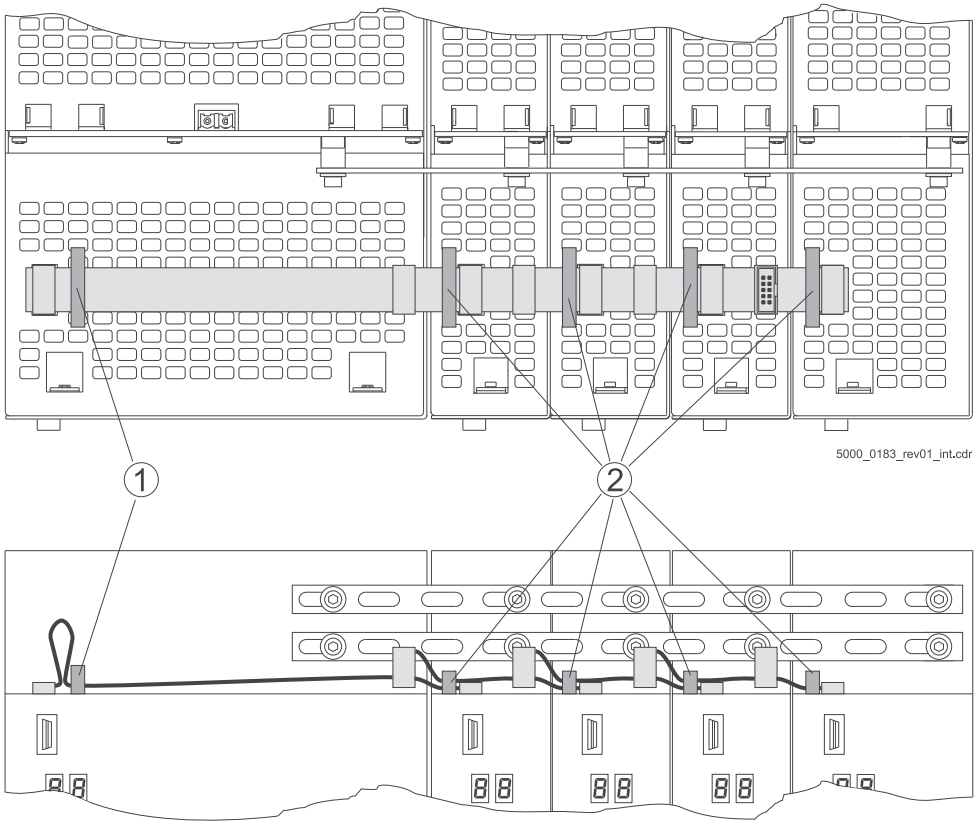


Figure 90: Laying of the signal bus cable

1 Fix the ribbon cable bracket at the first unit from the left side always on this place. Ribbon cable leftover as a loop between the ribbon cable bracket and the connector.

2 From the second unit from the left side on fix the ribbon cable bracket always on this place.

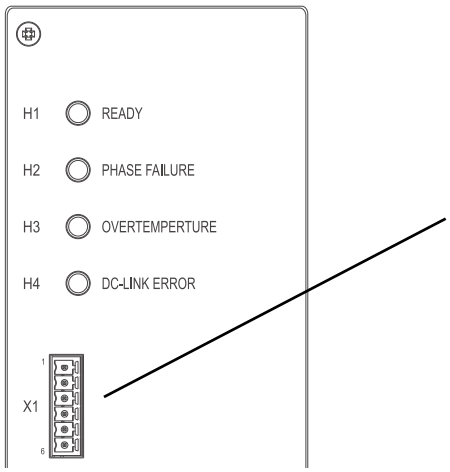
Ribbon cable bracket see ▹Spare parts◃ as from page 299.

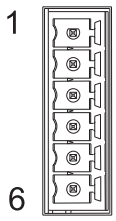
7.15 Connections on the front side

7.15.1 Front side of mains rectifier unit BM50XX-XX0X-... without safety function

NOTE!

Description of BM5030 with safety function BM5030-XX**2**X-...
see ▹D.6.2 Connections front side BM5030 with safety function◃ as from page 333.





X1 Digital inputs/outputs

1:M24V
2: Inhibit input
3: Quick discharge DC link voltage
4: Reset
5: Error
6: Ready-to-operate

Figure 91: Connections front side BM50XX-XX0X-... without safety function

X1 Digital inputs/outputs

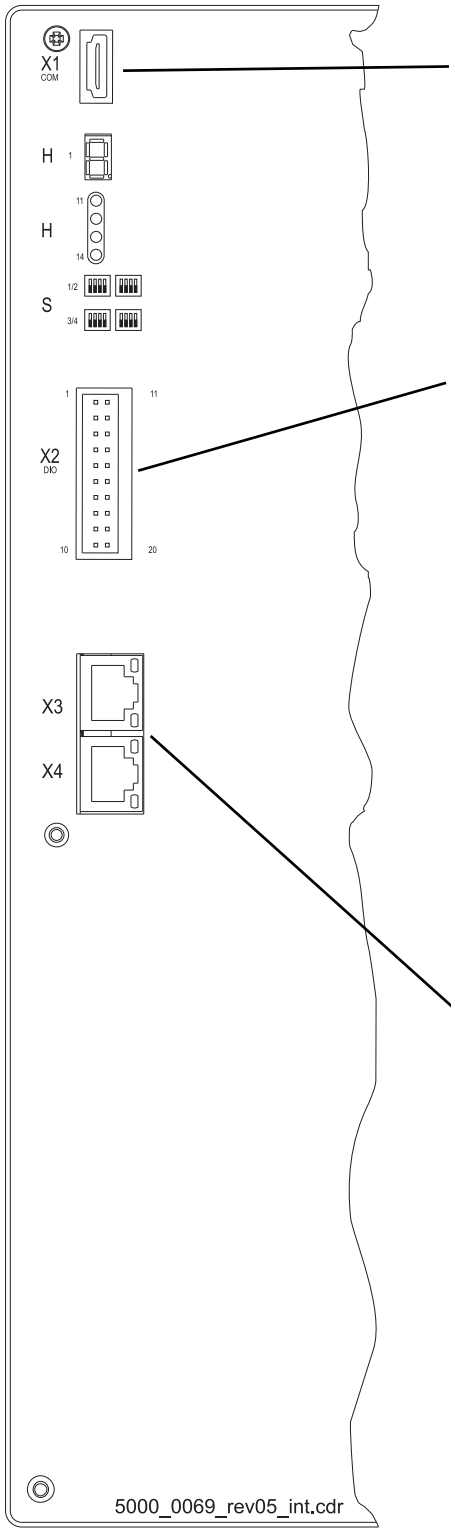
Input current per input	7 mA
Input level	High (12 … 28 V)
Output current per output	500 mA
Output level	High (12 … 28 V)

Pin assignment **X1**

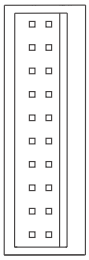
Pin No.	Assignment			
1	dig. input/output	GND 24 V		
2	digital input	Inhibit input [1)]	BM50XX-XX00 input is high active, expects NO contact	BM50XX-XX01 input is low active, expects NC contact
3	digital input	Quick discharge of DC link voltage		
4	digital input	Reset		
5	digital output	Error		
6	digital output	Ready-to-operate		

[1)] An external brake resistor can have a thermo switch. When the external switch is closed or opened the LED H4 (over temperature) lights up and the device state changes to error state. All thyristors are disabled, on the signal bus is error sent.
When the thermo switch changes state to initial condition again the error has to be acknowledged by reset (X1:4). Refer to ▹Error acknowledgment of BM50XX◃ on page 254.

7.15.2 Front side of active mains rectifier BM51XX







X1: Service interface

NOTE!
Only the service cable BM5-K-USB-XXX is allowed to be used for the service interface X1, refer to ▹Service interface◃ on page 219.

X2 Digital inputs/outputs ***)**
1:see ▹page 182◃
2 to **3**: Ready for pulse-enable (SELV/PELV)
4 to **6**: Digital output (SELV/PELV)
7: Ready-to-operate for PLC
8: see ▹page 182◃
9 to **10**: Ready for main contactor on (SELV/PELV)
11: +24V (SELV/PELV)
12: M24V (SELV/PELV)
13: Fast digital input 1 (SELV/PELV)
14: Fast digital input 2 (SELV/PELV)
15 to **17**: Digital input (SELV/PELV)
18: Digital input 6/ quick discharge
19: Digital input 7/ reset errors
20: Digital input 8/ pulse enable

Figure 92: Connections controller part BM51XX

X2 Digital inputs/outputs

Assessment	Signal edge, programmable
Input current of each input	2 mA digital input, 20 mA fast digital input
Input delay time	Max. 4 ms Max. 10 µs for fast inputs
Level	Low (0 ... 5 V) High (12 … 28 V)
Output current of each output	500 mA
Galvanic separation	Optocoupler
Short-circuit resistant	Current limited

Deviating thereof pin No. 2, 3, 9 and 10: NO contact, without a ground reference

Power rating per NO contact:	Max. 30 V, max. 100 mA

Pin assignment **X2**

Pin No.	BM51XX
1	N.C. [1]
	+24 V (supply digital IN/OUT) [2]
2	Ready for pulse enabled
3	Ready for pulse enabled
4	Digital output 1
5	Digital output 2
6	Digital output 3
7	Ready-to-operate for PLC
8	N.C. [1]
	M24V (supply digital IN/OUT) [2]
9	Ready for main contactor ON
10	Ready for main contactor ON

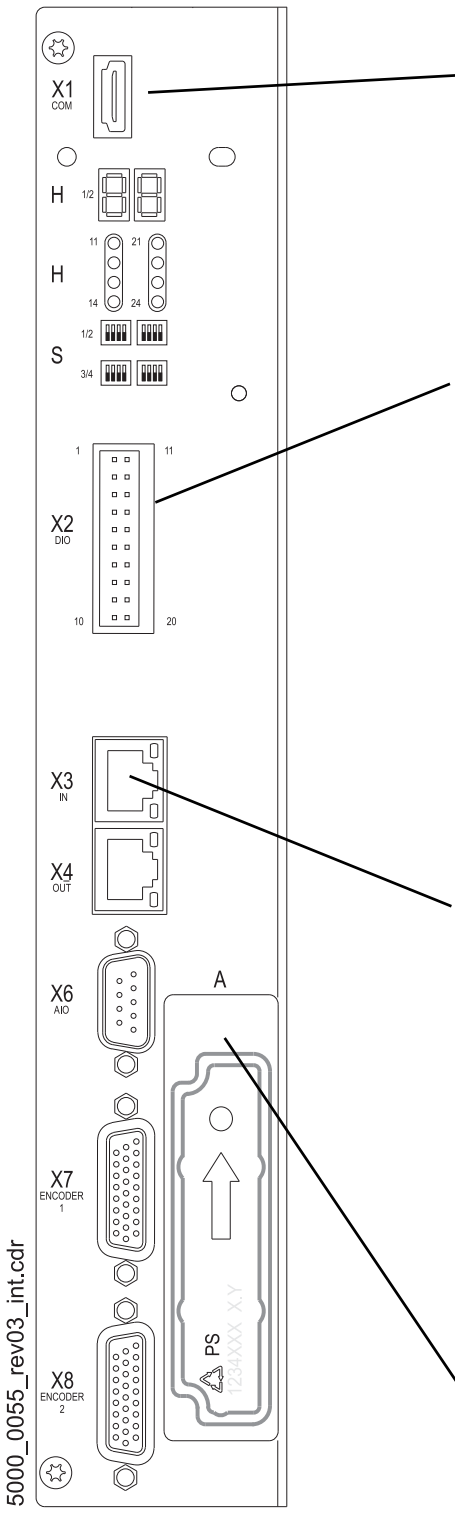
Pin No.	BM51XX
11	+24 V (supply digital IN/OUT)
12	M24V (supply digital IN/OUT)
13	Digital input 1
14	Digital input 2
15	Digital input 3
16	Digital input 4
17	Digital input 5
18	Digital input 6 DC link quick discharge
19	Digital input 7 error reset
20	Digital input 8, pulse enable

[1] Only hardware configuration controller **04**, BM51XX-XXXX-XXXX-XX**04**
refer to ▹Type code◃ as from page 90.

[2] Hardware configuration controller from **07**, BM51XX-XXXX-XXXX-XX**07**
refer to ▹Type code◃ as from page 90.

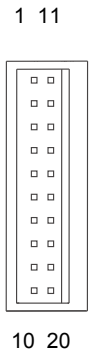
7.15.3 Front side axis units BM53XX

Type code:
BM53XX-XXXX-XXXX-XX**01** or XX**06**



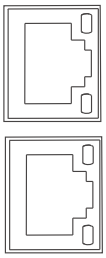
X1: Service interface

NOTE!
Only the service cable BM5-K-USB-XXX is allowed to be used for the service interface X1, refer to ▹Service interface◃ on page 219



X2 Digital inputs/outputs ***)**

1:see ▹page 186◃
2 to **3**: BB1 On (SELV/PELV)
4 to **7**: Digital output (SELV/PELV)
8: see ▹page 186◃
9 to **10**: BB2 On (SELV/PELV). double axis
11: +24V (SELV/PELV)
12: M24V (SELV/PELV)
13: Fast digital input 1 (SELV/PELV)
14: Fast digital input 2 (SELV/PELV)
15 to **18**: Digital input (SELV/PELV)
19: Digital input 7
20: Digital input 8/ pulse enable 1



BM53XX-XXXX-XXXX-**01**XX and
BM53XX-XXXX-XXXX-**07**XX
X3 EtherCAT®-IN **X4** EtherCAT®-OUT

BM53XX-XXXX-XXXX-**02**XX
X3 VARAN-IN **X4** VARAN-OUT

BM53XX-XXXX-XXXX-**03**XX
X3 CANopen®-IN **X4** CANopen®-OUT

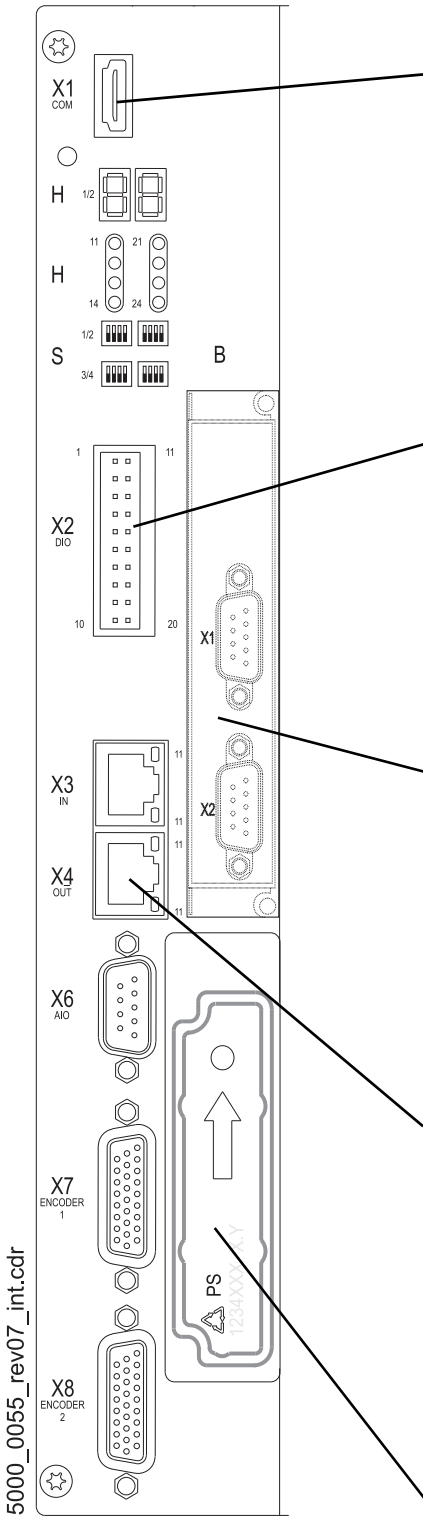
BM53XX-XXXX-XXXX-**04**XX
X3 POWERLINK®-IN **X4** POWERLINK®-OUT

1: TX+ **2**: TX-
3: RX+ **6**: RX-
4, **5**, **7**, **8**: reserved

A: Assembly opening additional module
The delivery status is: empty

The operation is only permitted / possible with an additional module BM5-O-SAF-XXX (Mounting see manual 5.09013 and/or 5.11016)
It is not allowed to plug any other modules in!

Type code: from BM53XX-XXXX-XXXX-XX**08**

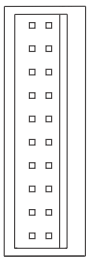




X1: Service interface

NOTE!
Only the service cable BM5-K-USB-XXX is allowed to be used, see ▹Service interface◃ on page 219

1 11



10 20

X2: Digital inputs/outputs *)

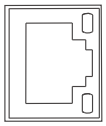
1:+24V (SELV/PELV)
2 to **3**: BB1 On (SELV/PELV)
4 to **7**: Digital output (SELV/PELV)
8: M24V (SELV/PELV)
9 to **10**: BB2 On (SELV/PELV)
11: +24V (SELV/PELV)
12: M24V (SELV/PELV)
13: Fast dig. input 1 (SELV/PELV)
14: Fast dig. input 2 (SELV/PELV)
15 to **18**: Digital input (SELV/PELV)
19: Dig. input 7/ pulse enable 2
20: Dig. input 8/ pulse enable 1

B: Add-on module (option) - not pluggable

BM53XX-XXXX-XX**00** - no add-on module

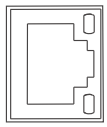
BM53XX-XXXX-XX**XX** - add-on module available

Refer to ▹Add-on modules◃ on page 190



BM53XX-XXXX-XXXX-**01**XX and
BM53XX-XXXX-XXXX-**07**XX
X3 EtherCAT®-IN **X4** EtherCAT®-OUT

BM53XX-XXXX-XXXX-**02**XX
X3 VARAN-IN **X4** VARAN-OUT



BM53XX-XXXX-XXXX-**03**XX
X3 CANopen®-IN **X4** CANopen®-OUT

BM53XX-XXXX-XXXX-**04**XX
X3 POWERLINK®-IN **X4** POWERLINK®-OUT

1: TX+ **2**: TX-
3: RX+ **6**: RX-
4, **5**, **7**, **8**: reserved



A: Assembly opening additional module
The delivery status is: empty

The operation is only permitted / possible with an additional module BM5-O-SAF-XXX (Mounting see manual 5.09013 and/or 5.11016)
It is not allowed to plug any other modules in!

X2 Digital inputs/outputs

Assessment	Signal edge, programmable
Input current per input	2 mA digital input, 20 mA fast digital input
Input delay time	Max. 4 ms Max. 10 µs for fast inputs
Level	Low (0 ... 5 V) High (12 … 28 V)
Output current per output	500 mA
Galvanic separation	Optocoupler
Short-circuit resistant	Current limited

Deviating thereof pin No. 2, 3, 9 and 10: NO contact, without a ground reference

Power rating per NO contact:	Max. 30 V, max. 100 mA

Pin assignment **X2**

Pin Nr.	BM53XX Single axis	BM53XX Double axis
1	N.C. [1]	
	+24 V (supply digital IN/OUT) [2]	
2	Ready-to-operate	Ready-to-operate 1, axis 1
3	Ready-to-operate	Ready-to-operate 1, axis 1
4	Digital output 1	
5	Digital output 2	
6	Digital output 3	
7	Digital output 4	
8	N.C. [1]	
	+24 V (supply digital IN/OUT) [2]	
9	N.C.	Ready-to-operate 2, axis 2
10	N.C.	Ready-to-operate 2, axis 2
11	+24 V (supply digital IN/OUT)	
12	M24V (supply digital IN/OUT)	
13	(fast) digital input 1, Schnellhalt	(fast) digital input 1, quick stop 1, axis 1
14	(fast) digital input 2	(fast) digital input 2, quick stop 2, axis 2
15	Digital input 3	
16	Digital input 4	
17	Digital input 5	
18	Digital input 6	
19	Digital input 7	Digital input 7, pulse enable 2, axis 2
20	Digital input 8, pulse enable	Digital input 8, pulse enable 1, axis 1

[1] only hardware configuration controller **01**, BM53XX-XXXX-XXXX-XX**01**
refer to ▹Type code◃ as from page 90.

[2] hardware configuration controller from **06**, BM53XX-XXXX-XXXX-XX**06**
refer to ▹Type code◃ as from page 90.

X3 / X4 - fieldbus connection

EtherCAT®

Type code **b maXX 5000** with EtherCAT® CoE profile:

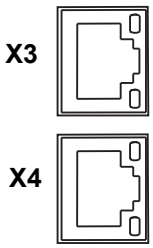
BM5XXX-XXXX-XXXX-**01**XX

Type code **b maXX 5000** with EtherCAT® SoE profile:

BM5XXX-XXXX-XXXX-**07**XX

X3 EtherCAT® IN
X4 EtherCAT® OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ 45
Number of parameters	refer to parameter handbook **b maXX 5000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s

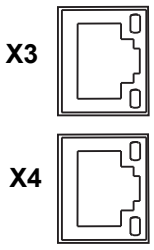


1: TX+
2: TX-
3: RX+
4: reserved
5: reserved
6: RX-
7: reserved
8: reserved

VARAN Type code **b maXX 5000** with VARAN profile:
BM5XXX-XXXX-XXXX-**02**XX

X3 VARAN IN
X4 VARAN OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ 45
Number of parameters	refer to parameter handbook **b maXX 5000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s



1: TX+
2: TX-
3: RX+
4: reserved
5: reserved
6: RX-
7: reserved
8: reserved

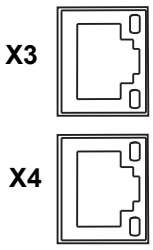
CANopen®

Type code **b maXX 5000** with CANopen®:

BM5XXX-XXXX-XXXX-**03**XX

X3 CANopen® IN
X4 CANopen® OUT

Memory	4 kByte DP-RAM, 256 kByte RAM, 1 MByte Flash-EEPROM
Number of bus connections	2, no slot rules
Bus connection	2 connectors RJ45, 8-pin
Baud rates	20/125/250/500/1000 kBit/s
Address range	7 Bit; address 1 to address 127
Address setting	DIP-switch
Short-circuit proof RJ45-connection	Yes
Isolation	Optocoupler, DC/DC-converter

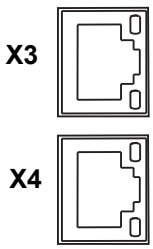


1: CAN_H
2: CAN_L
3: GND
4: reserved
5: reserved
6: reserved
7: GND
8: reserved

POWERLINK® Type code **b maXX 5000** with POWERLINK®:
BM5XXX-XXXX-XXXX-**04**XX

X3 POWERLINK® IN
X4 POWERLINK® OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ 45
Number of parameters	refer to parameter handbook **b maXX 5000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s



1: TX+
2: TX-
3: RX+
4: reserved
5: reserved
6: RX-
7: reserved
8: reserved

Add-on modules

NOTE!

Only devices with type code BM5XXX-XXXX-XX**01**/**03**/**04**/**05**/**06**/**07**/**08** provide an add-on module!

The add-on modules are built-in and cannot be changed.
It is forbidden to remove the yellow front cover.

Add-on module IEE with external supply

Incremental encoder emulation, 2 channels, BM53XX-XXXX-XX**01**

Set values for incremental encoder emulation can be evaluated from following sources:

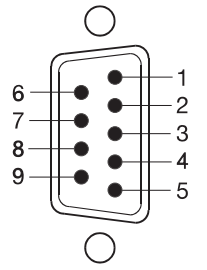
- Position actual values encoder 1 or encoder 2
- Position set values (e. g. internal from positioning)
- Fieldbus set value (external set via bus)

The generated signal can be used either for synchronization of the following axis or for position evaluation of the axis by the master control.

Power supply (external supply)	5 V ± 5 % (without load)
Current (external supply)	Max. 100 mA (without load)
Signal level: output high voltage at I_{0H} = -20 mA	2.5 V
Signal level: output high voltage at I_{0L} = +20 mA	0.5 V
Output frequency track signals	Max. 500 kHz
Switching time: rise time	< 50 ns
Switching time: fall time	< 50 ns
Delay time	It_dI = 1 ≤ 50 ns
Power input	0.525 W
Current output driver	Max. 15 mA

Pin assignment D-sub on front side X1 and X2 (male) of incremental encoder emulation:

Pin assignment



D-sub male connector
9-pin

Pin No.	IEE assignment
1	Ground incremental encoder emulation
2	External power supply +5 V IEE
3	Incremental encoder emulation track 0
4	Incremental encoder emulation track -0
5	Incremental encoder emulation track B
6	Not assigned
7	Incremental encoder emulation track -A
8	Incremental encoder emulation track A
9	Incremental encoder emulation track -B

Connection cable see ▹Connection cable add-on modules◃ as from page 275.

Further information see manual add-on modules IEE/SIE, 5.13030.

Add-on module SIE with internal supply

SSI encoder emulation, 2 channels, BM53XX-XXXX-XX**03**

Set values for SSI encoder emulation can be evaluated from following sources:

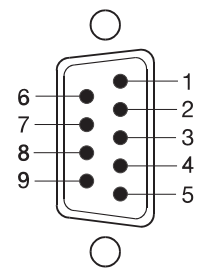
- Position actual values encoder 1 or encoder 2
- Position set values (e. g. internal from positioning)
- Fieldbus set value (external set via bus)

The generated signal can be used either for synchronization of the following axis or for position evaluation of the axis by the master control.

Signal level: output high voltage at I_{0H} = -20 mA	2.5 V
Signal level: output high voltage at I_{0L} = +20 mA	0.5 V
Output frequency track signals	Min. 200 kHz Max. 2 MHz
Switching time: rise time	< 50 ns
Switching time: fall time	< 50 ns
Delay time	$It_dI = 1 \leq 50$ ns
Power input	0.525 W
Current output driver	Max. 15 mA

Pin assignment D-sub on front side X1 and X2 (male) of SSI encoder emulation:

Pin assignment



D-sub male connector
9-pin

Pin No.	SSI assignment
1	Ground incremental encoder emulation
2	Not assigned
3	Not assigned
4	Not assigned
5	DAT +
6	Not assigned
7	CLK +
8	CLK +
9	DAT +

Connection cable see ▹Connection cable add-on modules◃ as from page 275.

Further information see manual add-on modules IEE/SIE, 5.13030.

Add-on module SVP

Module with additional analog/digital inputs/outputs, BM53XX-XXXX-XX**04**
BM53XX-XXXX-XX**05**
BM53XX-XXXX-XX**06**

LED display

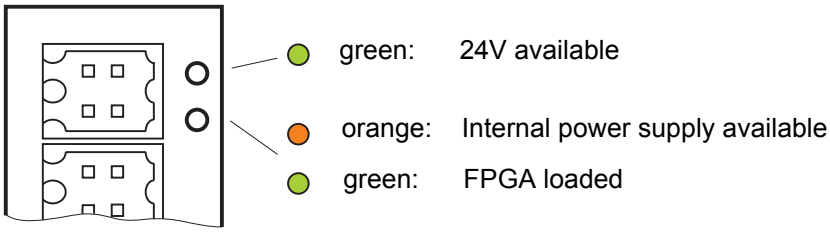


Figure 93: LED display add-on module SVP

Digital inputs/outputs

Evaluation:	Edges, programmable
Input current (per input):	2 mA digital input
Input delay time:	Max. 4 ms,
Level:	Low (0 ... 5 V); High (12 … 28 V)
Output current of each output:	Max. 500 mA
Electrical isolation:	Optocoupler
Short circuit proof:	Current limited, switch-off via temperature

Analog outputs

Resolution	12 bit
Output voltage	-10 V to +10 V
Output current max.	1 mA
Updating rate	125 µs
Short circuit proof	Limited, max. 10 s

Analog inputs

	Voltage input	Current input
Resolution	14 bit	
Type	Differential input	
Input resistance	Approx. 50 kΩ	Approx. 100 Ω
Input current	Max. 250 µA	Min. (0) → 4 A, Max. 20 mA
Input voltage	-10 V to +10 V	Max. 2 V
Sampling rate	125 µs	
Power supply encoder	Max. 250 mA per connection	

Linearity error inputs in LSB

Error	Min	Type	Max
DNL	0	2	4
INL	0	3	6
Offset	0	3	6
Gain	0	3	6

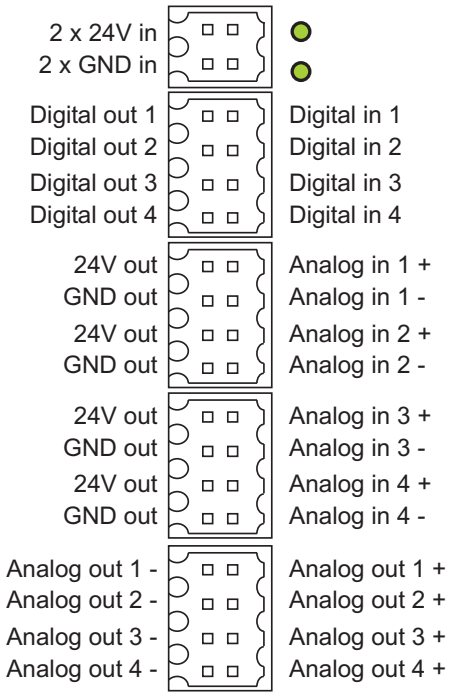


NOTE!

The connections of the cables of the analog channels must be done shielded.

Blade terminals with 6.3 mm width are available for connecting the shields.

Pin assignment front side connectors:



Types

Version	Analog in 1 / 2	Analog in 3 / 4	Analog out 1 ... 4	Digital in 1 ... 4 Digital out 1 ... 4
SVP-001-001 BM53XX-XXXX-XX**04**	Analog voltage inputs ±10 V Resolution 14 bit	Analog voltage inputs ±10 V Resolution 14 bit	4 analog voltage outputs ±10V Resolution 12 bit	4 digital inputs 24 V / 4 digital outputs 24 V
SVP-001-002 BM53XX-XXXX-XX**05**	Analog voltage inputs ±10 V Resolution 14 bit	Analog current inputs (0) 4…20 mA Resolution 14 bit		
SVP-001-003 BM53XX-XXXX-XX**06**	Analog current inputs (0) 4…20 mA Resolution 14 bit	Analog current inputs (0) 4…20 mA Resolution 14 bit		

Connection

- Analog input/output

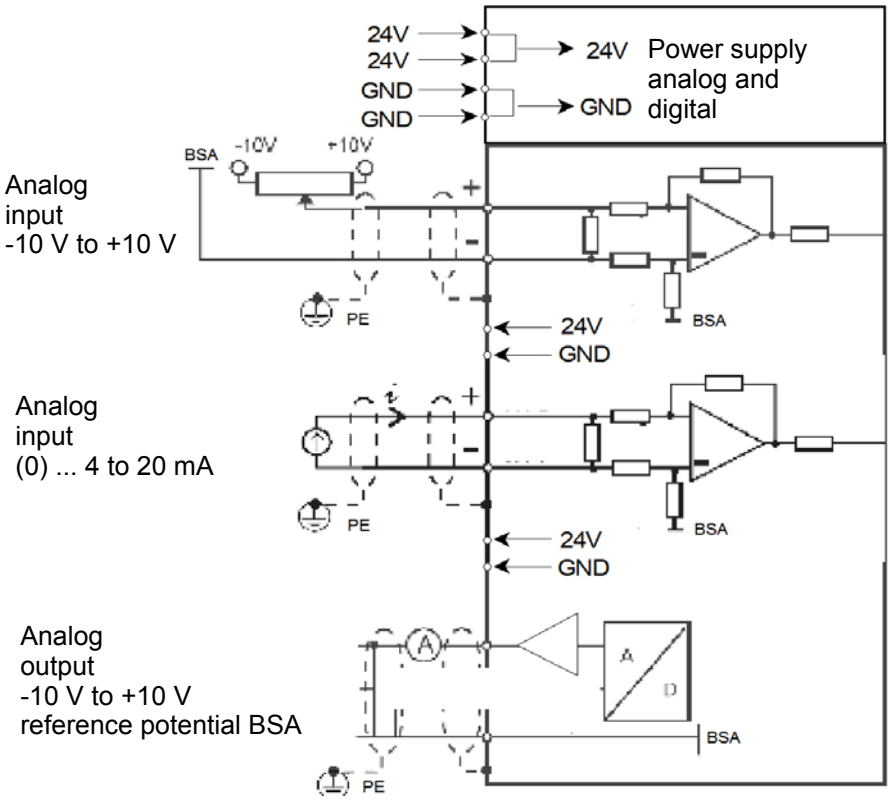


Figure 94: Connection of analog inputs/outputs SVP

- Digital inputs/outputs

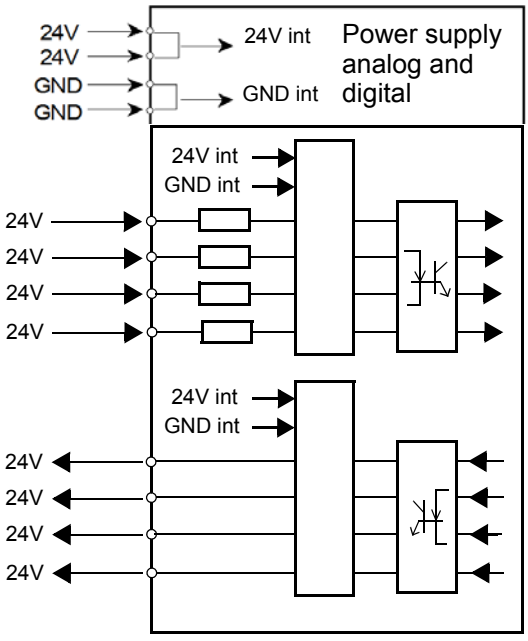


Figure 95: Connection of digital inputs/outputs SVP

Add-on module EtherNet/IP®

EtherNet/IP® and incremental encoder emulation, 2 channels, BM53XX-XXXX-XX**07**

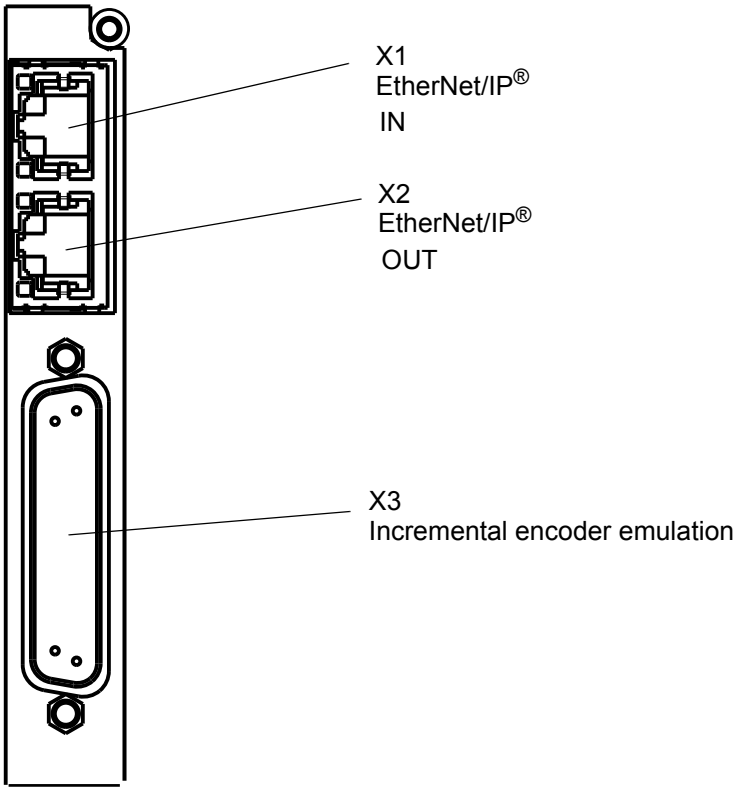
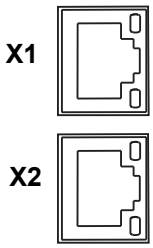


Figure 96: Add-on module EtherNet/IP®

EtherNet/IP®

X1 EtherNet/IP® IN
X2 EtherNet/IP® OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ 45
Number of parameters	refer to parameter handbook **b maXX 5000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s



1: TX+
2: TX-
3: RX+
4: reserved
5: reserved
6: RX-
7: reserved
8: reserved

Incremental encoder emulation

Set values for incremental encoder emulation can be evaluated from following sources:

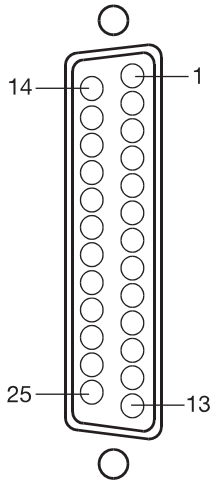
- Position actual values encoder 1 or encoder 2
- Position set values (e. g. internal from positioning)
- Fieldbus set value (external set via bus)

The generated signal can be used either for synchronization of the following axis or for position evaluation of the axis by the master control.

Power supply (external supply)	5 V ± 5 % (without load)
Current (external supply)	Max. 100 mA (without load)
Signal level: output high voltage at I_{0H} = -20 mA	2.5 V
Signal level: output high voltage at I_{0L} = +20 mA	0.5 V
Output frequency track signals	Max. 500 kHz
Switching time: rise time	< 50 ns
Switching time: fall time	< 50 ns
Delay time	$It_dI = 1 \leq 50$ ns
Power input	0.525 W
Current output driver	Max. 15 mA

Pin assignment D-sub on front side X3 (male) of incremental encoder emulation:

Pin assignment



D-sub male connector
25-pin

Pin No.	Channel	Assignment
1	1	Ground incremental encoder emulation
2	1	External power supply +5 V
3	1	Incremental encoder emulation track 0
4	1	Incremental encoder emulation track -0
5	1	Incremental encoder emulation track B
15	1	Incremental encoder emulation track -A
16	1	Incremental encoder emulation track A
17	1	Incremental encoder emulation track -B
9	2	Ground incremental encoder emulation
10	2	External power supply +5 V IEE
11	2	Incremental encoder emulation track 0
12	2	Incremental encoder emulation track -0
13	2	Incremental encoder emulation track B
23	2	Incremental encoder emulation track -A
24	2	Incremental encoder emulation track A
25	2	Incremental encoder emulation track -B

Further information see manual add-on module EtherNet/IP®, 5.16010.

Add-on module Modbus/TCP

Modbus/TCP and incremental encoder emulation, 2 channels, BM53XX-XXXX-XX**08**

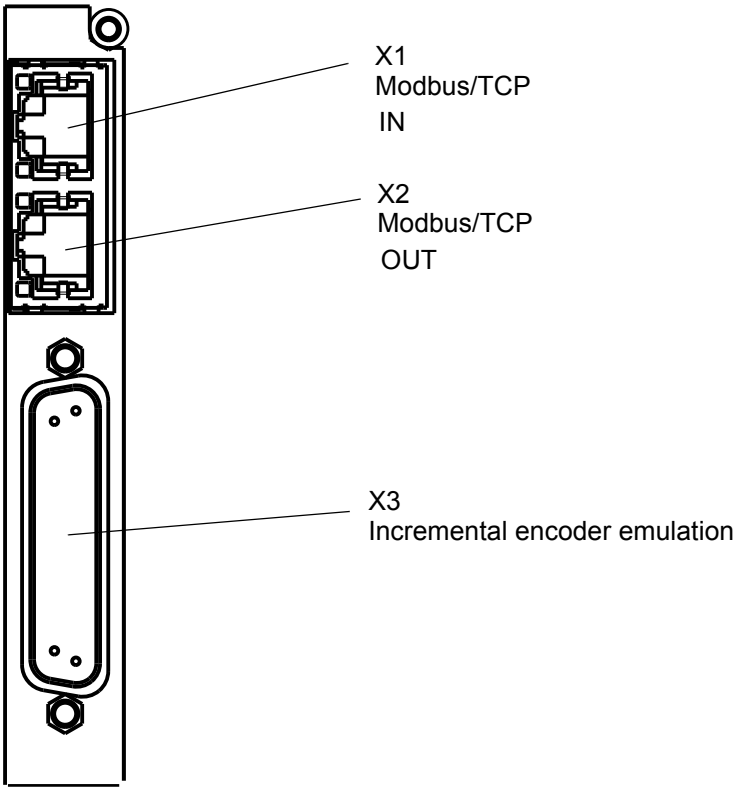
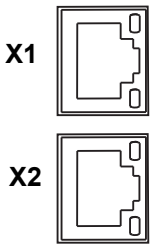


Figure 97: Add-on module EtherNet/IP®

Modbus/TCP

X1	Modbus/TCP IN
X2	Modbus/TCP OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ 45
Number of parameters	refer to parameter handbook **b maXX 5000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s



1: TX+
2: TX-
3: RX+
4: reserved
5: reserved
6: RX-
7: reserved
8: reserved

Incremental encoder emulation

Set values for incremental encoder emulation can be evaluated from following sources:

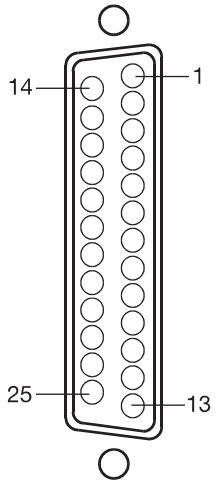
- Position actual values encoder 1 or encoder 2
- Position set values (e. g. internal from positioning)
- Fieldbus set value (external set via bus)

The generated signal can be used either for synchronization of the following axis or for position evaluation of the axis by the master control.

Power supply (external supply)	5 V ± 5 % (without load)
Current (external supply)	Max. 100 mA (without load)
Signal level: output high voltage at I_{0H} = -20 mA	2.5 V
Signal level: output high voltage at I_{0L} = +20 mA	0.5 V
Output frequency track signals	Max. 500 kHz
Switching time: rise time	< 50 ns
Switching time: fall time	< 50 ns
Delay time	$\|t_d\|$ = 1 ≤ 50 ns
Power input	0.525 W
Current output driver	Max. 15 mA

Pin assignment D-sub on front side X3 (male) of incremental encoder emulation:

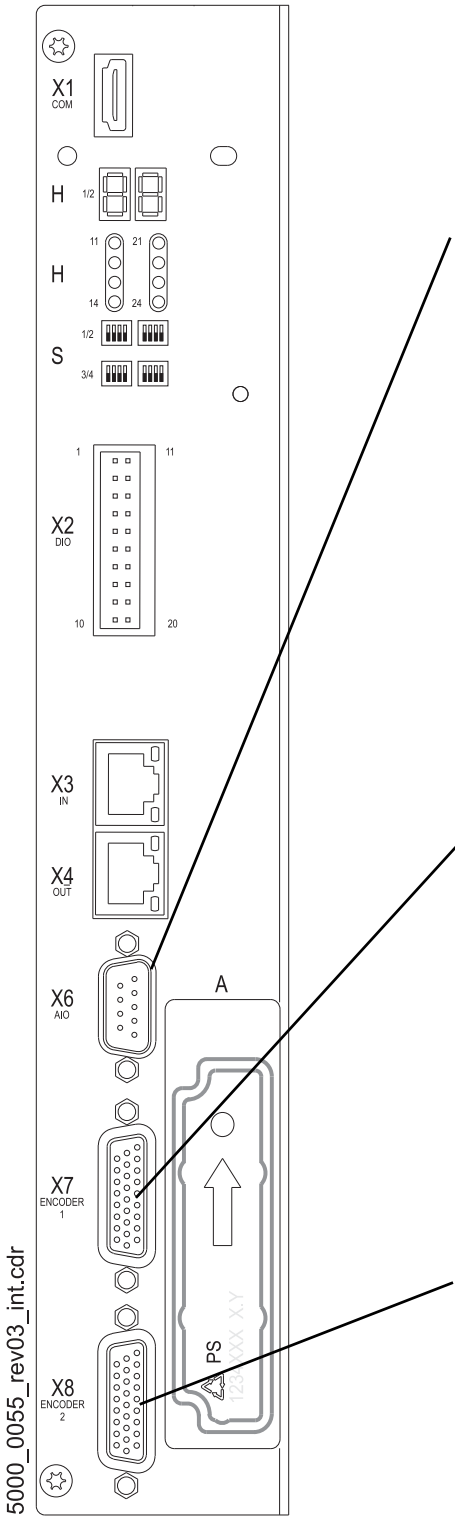
Pin assignment

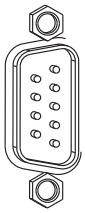


D-sub male connector
25-pin

Pin No.	Channel	Assignment
1	1	Ground incremental encoder emulation
2	1	External power supply +5 V
3	1	Incremental encoder emulation track 0
4	1	Incremental encoder emulation track -0
5	1	Incremental encoder emulation track B
15	1	Incremental encoder emulation track -A
16	1	Incremental encoder emulation track A
17	1	Incremental encoder emulation track -B
9	2	Ground incremental encoder emulation
10	2	External power supply +5 V IEE
11	2	Incremental encoder emulation track 0
12	2	Incremental encoder emulation track -0
13	2	Incremental encoder emulation track B
23	2	Incremental encoder emulation track -A
24	2	Incremental encoder emulation track A
25	2	Incremental encoder emulation track -B

Further information see manual add-on module Modbus, 5.19015.



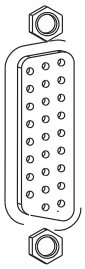


X6 Analog inputs/outputs

1: Input 1 +
2: Input 2 +
3: GND
4: Output 1 +
5: Output 2 +
6: Input 1 -
7: Input 2 -
8: GND
9: GND

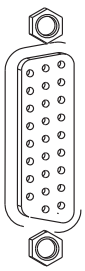


Only one encoder can be connected to each encoder connection.



X7 Encoder 1 ***)**

Switchable:
HIPERFACE®
Resolver
Firmware 1.04 and above:
Encoder with EnDat® 2.1
Sine/square wave incremental encoder
Firmware 1.06 and above:
Encoder with SSI, EnDat® 2.2
HIPERFACE DSL®
Firmware 1.15 and above
Sine incremental encoder with commutation



X8 Encoder 2 ***)**

Switchable:
HIPERFACE®
Resolver
Firmware 1.04 and above:
Encoder with EnDat® 2.1
Sine/square wave incremental encoder
Firmware 1.06 and above:
Encoder with SSI, EnDat® 2.2
HIPERFACE DSL®
Firmware 1.15 and above
Sine incremental encoder with commutation

***)** Option, see ▹Type code◃ as from page 90

Figure 98: Connection of analog inputs/outputs and encoder BM53XX

X6 Analog inputs/ outputs

There are two analog inputs and outputs available.

Pin assignment **X6**

Pin No.	Assignment
1	Analog input 1 +
2	Analog input 2 +
3	GND
4	Analog output 1 +
5	Analog output 2 +
6	Analog input 1 -
7	Analog input 2 -
8	GND
9	GND

Inputs

Resolution	12 bit
Type	Differential input
Input resistance	Approx. 50 kΩ
Input current max.	200 µA
Sampling rate	125 µs
Input voltage	+10 V to -10 V

Outputs

Resolution	12 bit
Output voltage	+10 V to -10 V
Output current max.	1 mA
Update rate	62.5 µs
Short circuit proof	Limited, max. 10 s

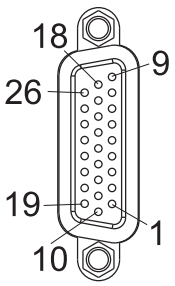
X7 / X8 Encoder evaluation, see ▹Figure 98◃ on page 203

Connector assignment depends on encoder selection.

Resolver evaluation

All encoders, that comply with the following technical specification, may also be used:

Pole pair number	The ratio between the pole pair number of the motor and the pole pair number of the encoder must be an integer.
Current input	Max. 160 mA
Excitation frequency	Approx. 8 kHz
Excitation current	160 mA
Ratio	0.5



D-sub-connector
26-pin

1	GND encoder supply / Ref -
2	reserved *
3	reserved *
4	reserved *
5	reserved *
6	reserved *
7	reserved *
8	reserved *
9	reserved *
10	Resolver Ref +
11	reserved *
12	reserved *
13	reserved *
14	reserved *
15	reserved *
16	reserved *
17	Temperature +
18	Temperature -
19	reserved *
20	reserved *
21	Res A + (COS +)
22	Res A - (COS -)
23	reserved *
24	reserved *
25	Res B + (SIN +)
26	Res B - (SIN -)

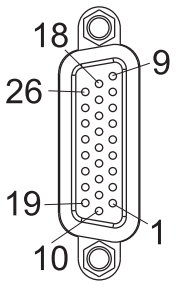
* do not occupy

Encoder evaluation HIPERFACE®

The encoder evaluation is provided with a HIPERFACE®-interface.

The encoders, which meet the following technical specifications, can be used:

Voltage supply	10 V_{DC}
Signal level	HIPERFACE® - specification of the process data channel (~1 V_{SS}; REFSIN/REFCOS 2.5V)
Current input	Max. 250 mA



D-sub-connector
26-pin

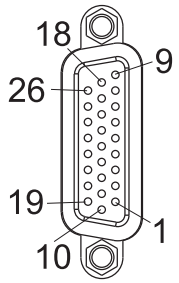
1	GND encoder supply
2	+10 V encoder supply
3	reserved *
4	COS +
5	COS -
6	SIN +
7	SIN -
8	reserved *
9	reserved *
10	reserved *
11	reserved *
12	reserved *
13	reserved *
14	reserved *
15	reserved *
16	reserved *
17	Temperature +
18	Temperature -
19	RS485 Data +
20	RS485 Data -
21	reserved *
22	reserved *
23	reserved *
24	reserved *
25	reserved *
26	reserved *

* do not occupy

Encoder evaluation with EnDat® 2.1 or SSI

The encoders, which meet the following technical specifications, can be used:

Voltage supply	5 V_{DC} controlled
Signal level	~1 V_{SS}
Current input	Max. 250 mA



D-sub-connector
26-pin

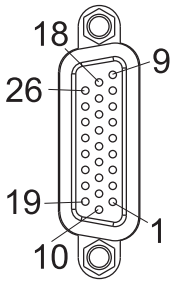
1	GND encoder supply
2	+5 V encoder supply
3	Clock+
4	A + (COS +)
5	A - (COS -)
6	B + (SIN +)
7	B - (SIN -)
8	reserved *
9	reserved *
10	reserved *
11	Sense GND
12	Sense Vcc
13	Clock-
14	reserved *
15	reserved *
16	reserved *
17	Temperature +
18	Temperature -
19	Data +
20	Data -
21	reserved *
22	reserved *
23	reserved *
24	reserved *
25	reserved *
26	reserved *

* do not occupy

Encoder evaluation with EnDat® 2.2

The encoders, which meet the following technical specifications, can be used:

Voltage supply	5 V_{DC} controlled
Signal level	~1 V_{SS}
Current input	Max. 250 mA



D-sub-connector
26-pin

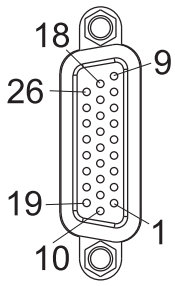
1	GND encoder supply
2	+5 V encoder supply
3	Clock+
4	reserved *
5	reserved *
6	reserved *
7	reserved *
8	reserved *
9	reserved *
10	reserved *
11	Sense GND
12	Sense Vcc
13	Clock-
14	reserved *
15	reserved *
16	reserved *
17	reserved *
18	reserved *
19	Data +
20	Data -
21	reserved *
22	reserved *
23	reserved *
24	reserved *
25	reserved *
26	reserved *

* do not occupy

Sine or square wave encoder evaluation

The encoders, which meet the following technical specifications, can be used:

Voltage supply	5 V_{DC} controlled
Signal level	RS422 (TTL) for square wave incremental encoders ~1 Vss for sine incremental encoders
Current input	Max. 250 mA



D-sub-connector
26-pin

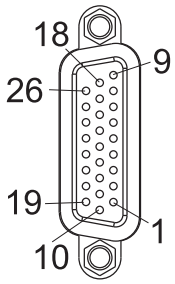
1	GND encoder supply
2	+5 V encoder supply
3	reserved *
4	RS422 A +
5	RS422 A -
6	RS422 B +
7	RS422 B -
8	RS422 0 +
9	RS422 0 -
10	reserved *
11	Sense GND
12	Sense V_{CC}
13	reserved *
14	reserved *
15	reserved *
16	reserved *
17	Temperature +
18	Temperature -
19	reserved *
20	reserved *
21	reserved *
22	reserved *
21	reserved *
22	reserved *
23	reserved *
24	reserved *
25	reserved *
26	reserved *

* do not occupy

Encoder evaluation with HIPERFACE DSL®

The encoders, which meet the following technical specifications, can be used:

Signal level	HIPERFACE DSL®
Current input	Max. 250 mA



D-sub-connector
26-pin

1	GND encoder supply
2	10 V encoder supply
3	reserved *
4	reserved *
5	reserved *
6	reserved *
7	reserved *
8	reserved *
9	reserved *
10	reserved *
11	reserved *
12	reserved *
13	reserved *
14	reserved *
15	reserved *
16	reserved *
17	reserved *
18	reserved *
19	DSL-
20	DSL+
21	reserved *
22	reserved *
21	reserved *
22	reserved *
23	reserved *
24	reserved *
25	reserved *
26	reserved *

* do not occupy

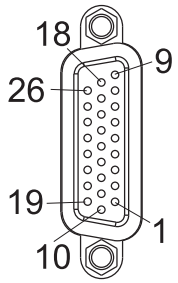
NOTE!

The use of the standard accessory connector included in the accessory kit HIPERFACE DSL® (part No. 460219) is required.

Sine incremental encoder with commutation signals

Encoders with high-resolution incremental signals (sine and cosine signals, e.g. 2048 signal periods per revolution) and in addition commutation signals (sine and cosine track with 1 signal period per revolution), available firmware 1.15 and higher.

Voltage supply	5 V_{DC} controlled	
Signal level	Incremental encoder signals (A and B)	~1 Vss
	Commutation signals (C and D)	~1 Vss
Current input	Max. 250 mA	



D-sub-connector
26-pin

1	GND encoder supply
2	+5 V encoder supply
3	reserved *
4	A +
5	A -
6	B +
7	B -
8	0 + (zero pulse)
9	0 - (zero pulse)
10	reserved *
11	Sense GND
12	Sense V_{CC}
13	reserved *
14	reserved *
15	C + (commutation track)
16	C - (commutation track)
17	Temperature +
18	Temperature -
19	reserved *
20	reserved *
21	reserved *
22	reserved *
21	reserved *
22	reserved *
23	D + (commutation track)
24	D - (commutation track)
25	reserved *
26	reserved *

* do not occupy

NOTE!

There is no continuing monitoring of the commutation signals (C+, C-, D+, D-) and of the reference marks (R+, R-).

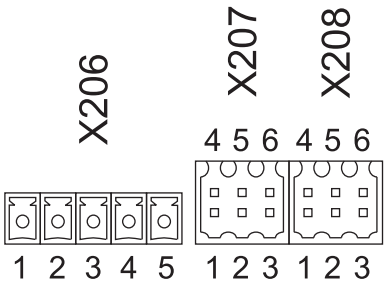
NOTE!

The connection cable is not available as a pre-assembled cable by Baumüller. The user has to provide a suitable cable.

Motor brake/ temperature

Single axis unit BM5326, BM5327, BM5328, BM5334, BM5335

X206/X207/X208



X206

Supply voltage for motor brake

Pin No.	Assignment
1	+24V motor brake
2	M24V motor brake
3	+24V motor brake
4	M24V motor brake
5	PE

X207

Motor 1 motor temperature and motor brake

Pin No.	Assignment
1	Motor brake 1-
2	Feedback signal motor brake 1-
3	Motor temperature 1-
4	Motor brake 1+
5	Feedback signal motor brake 1+
6	Motor temperature 1+

X208 not assigned

X207, X208

Feedback signal motor brake

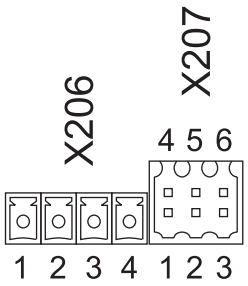
Pin No.	Level
2, 5	Low: 0 V ... 10 V High: 17.5 V ... 30 V

Assignment pre-assembled Baumüller cable see motor documentation.

Motor brake/ temperature

Single axis unit BM537X

X206/X207



X206

Supply voltage for motor brake

Pin No.	Assignment
1	+24V motor brake
2	M24V motor brake
3	+24V motor brake
4	M24V motor brake

X207

Motor 1 motor temperature and motor brake

Pin No.	Assignment
1	Motor brake 1-
2	Response, motor brake 1-
3	Motor temperature 1-
4	Motor brake 1+
5	Response, motor brake 1+
6	Motor temperature 1+

X207, X208

Feedback signal motor brake

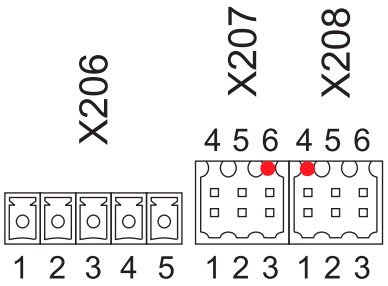
Pin No.	Level
2, 5	Low: 0 V ... 10 V High: 17.5 V ... 30 V

Assignment pre-assembled Baumüller cable see motor documentation.

Motor brake/ temperature

Double axis unit BM5323, BM5325, BM5328, BM5331, BM5332, BM5333

X206/X207/X208



X206

Supply voltage for motor brake

Pin No.	Assignment
1	+24V motor brake
2	M24V motor brake
3	+24V motor brake
4	M24V motor brake
5	PE

X207

Motor 1 motor temperature and motor brake

Pin No.	Assignment
1	Motor brake 1-
2	Feedback signal motor brake 1-
3	Motor temperature 1-
4	Motor brake 1+
5	Feedback signal motor brake 1+
6	Motor temperature 1+

X207

Motor 2 motor temperature and motor brake

Pin No.	Assignment
1	Motor brake 2-
2	Feedback signal motor brake 2-
3	Motor temperature 2-
4	Motor brake 2+
5	Feedback signal motor brake 2+
6	Motor temperature 2+

X207, X208

Response, motor brake

Pin No.	Level
2, 5	Low: 0 V ... 10 V High: 17.5 V ... 30 V

Assignment pre-assembled Baumüller cable see motor documentation.

X300 signal bus

If a system is constructed of BM50XX, BM51XX, BM5300 and BM55XX, then all devices are linked with each other via the signal bus. This bus can poll every client device, including the mains rectifier unit, and send individual signals. Via this bus, the mains rectifier unit can register errors to the axes so that the individual axes can react to these. Each individual axis can itself send messages to the other axes, such as malfunction, braking resistance on, or a signal bus warning.
Timing diagrams see ▷Timing diagrams BM50XX◁ as from page 220.



NOTE!

To avoid uncontrolled operation of the active mains rectifier unit, the signal bus has to be activated.



NOTE!

A maximum of 12 axis units can be linked via the signal bus.

Pin-Nr.	Assignment	Function
1	BUS_BETRIEBSBEREIT	Ready-to-operate, identically with X1:6
2	BUS_PHASENAUSFALL	0 V means all three power supply phases are available, 7,5 V means at least one power supply phase is not available
3	BUS_RBREMS-EIN	The brake resistor will be switched on if 7.5 V is connected to this input. The mains rectifier remains switched on. This input controls the brake resistor switch of the mains rectifier triggered by the connected axis units BM53XX.
4, 5, 6,7,8		Reserved
9		7.5 V Power supply of the signal bus, for connections to BM5000 devices, only.
10		GND

8

OPERATION

Basic information



WARNING!

Risk of injury due to improper operation!

Improper operation can lead to severe personal injury or material damage.

Therefore:

- Perform all operational steps according to the details of these instruction handbook.
- Before beginning any work, ensure that all coverings and protective devices are installed and are functioning properly.
- The control cabinet in which the device is installed should be protected against contact with electrically live parts.
  Keep all doors of the control cabinet closed during operation.



NOTICE!

Environmental conditions that do not meet the requirements.

Environmental conditions that are non-compliant can lead to property damage.

Therefore:

- Ensure that the environmental conditions are kept compliant during operation (see ▹Required environmental conditions◃ on page 49).



WARNING!

Risk of injury due to insufficient qualifications!

Inevitably, when operating this electrical device, certain parts of this device are energized with hazardous voltage. Improper handling can lead to significant personal injury and material damage.

Therefore:

- Only qualified personnel may work on this device!

8.1 Operating concept

After the device has been commissioned it is parameterized (i. e. adapted to the application). Once parameterization has been completed, the device can be operated with one of the two following signal inputs:

- pulse enable
- quick stop (option)

8.1.1 Release signals

These signals must have a signal level of 24 V (DC) and be available via the terminals (▹Connections on the front side◃ as from page 179).

Pulse enable

During operation, the „pulse enable“ signal must be continuously generated in order for the device to provide output. A running motor will come to a standstill if the signal is switched to 0 V.

Quick stop

Only switch off the „quick stop“ signal if the system / the device must be stopped as quickly as possible. The reaction can be adjusted (see the parameter manual)

During operation, the „quick stop“ signal must be continuously provided in order for the device to provide output.

Exactly which digital input can be assessed as a quick stop signal can be parameterized. (Refer to the parameter manual **b maXX 5000** 5.09022)

8.1.2 Service interface

The service interface is used to transmit controller parameter from a PC/laptop to the controller with the software ProDrive.

The mains rectifier unit BM50XX has no service interface.

- connect a not used USB port of the PC/laptop with the controller via the service cable

HINWEIS!
Only the service cable BM5-K-USB-XXX is allowed to be used for the service interface X1, refer to ▹Service interface cable◃ on page 266.

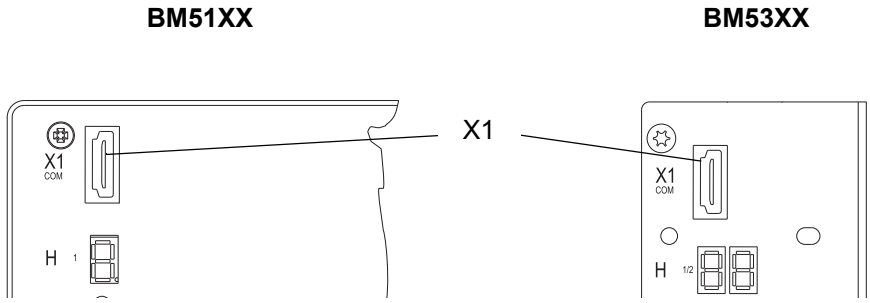


Figure 99: Female connector X1

The driver for this connection has been installed with ProDrive on the PC/laptop. The settings of the connection (baud rate, etc.) is done via ProDrive. Refer to Online help of ProDrive.

HINWEIS!
In case the service cable is not used, keep it in the ESD packaging.

8.2 Timing diagrams BM50XX

HINWEIS!

Signals, that do not change its level are not considered.

- Quick discharge

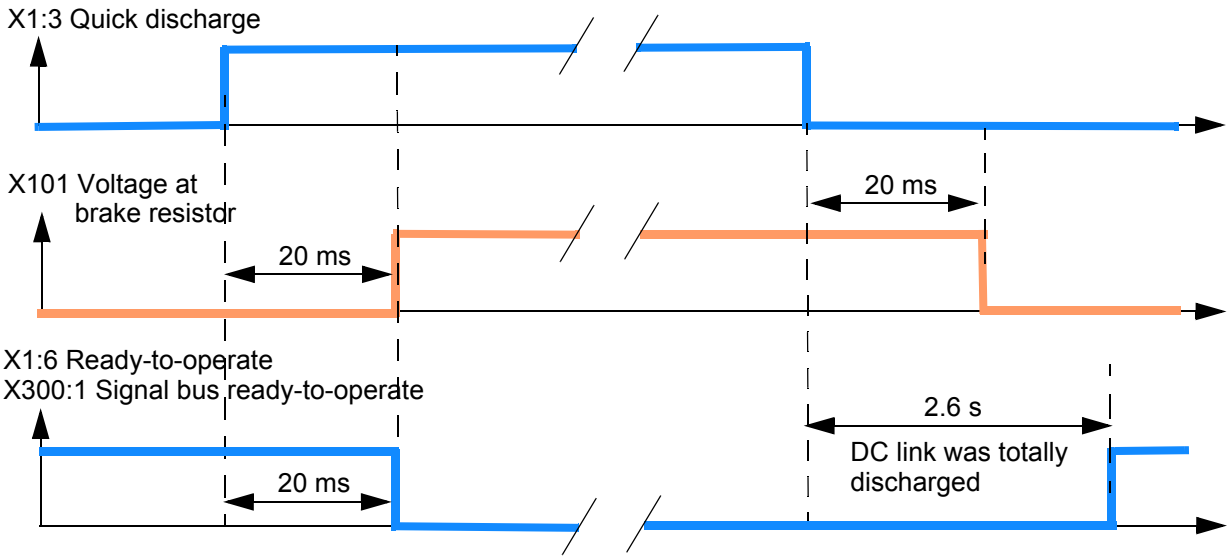


Figure 100: Timing diagram quick discharge

- Brake resistor switch

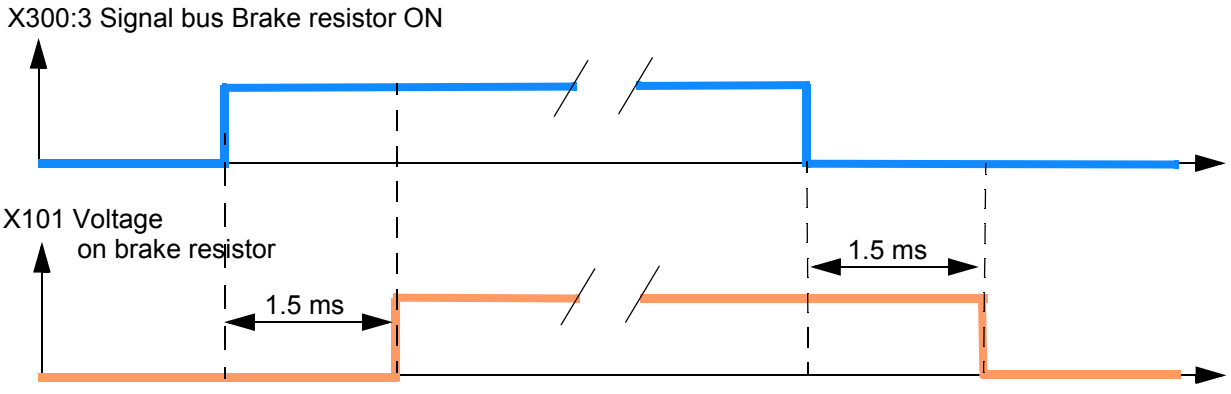


Figure 101: Timing diagram brake resistor switch

- Power supply ON after 24 V ON

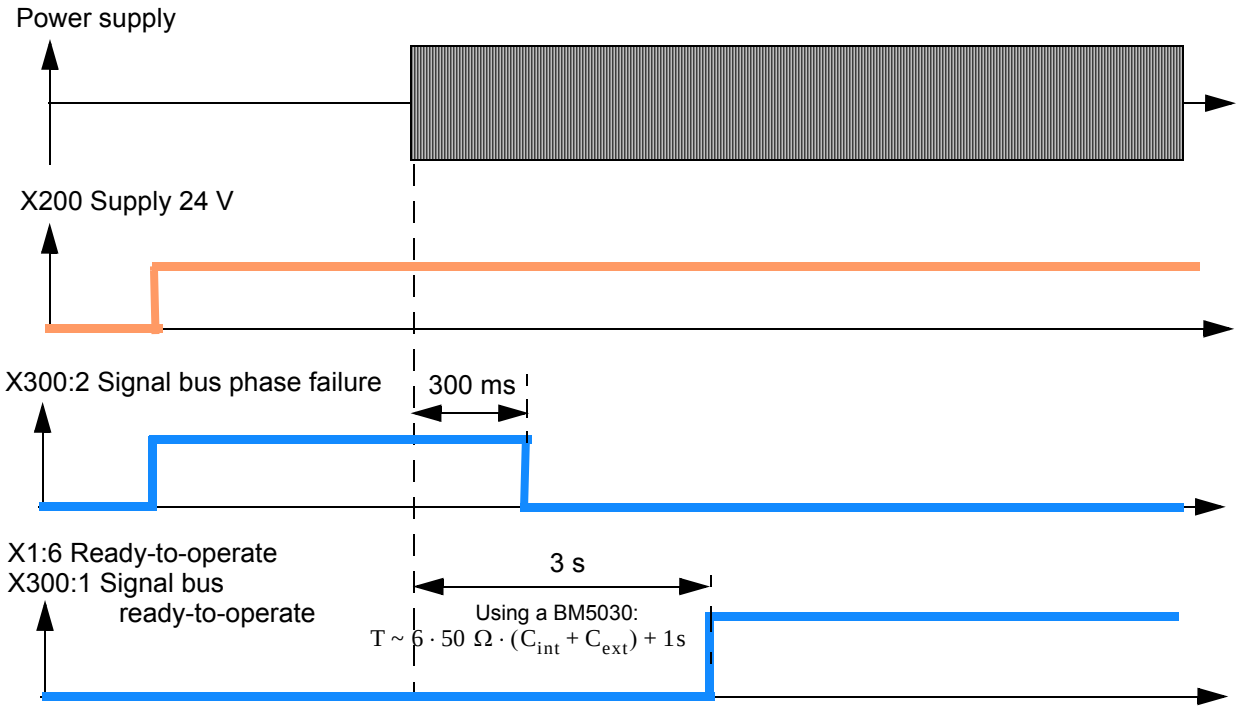


Figure 102: Timing diagram power supply ON after 24 V ON

- 24 V ON before power supply ON signal bus

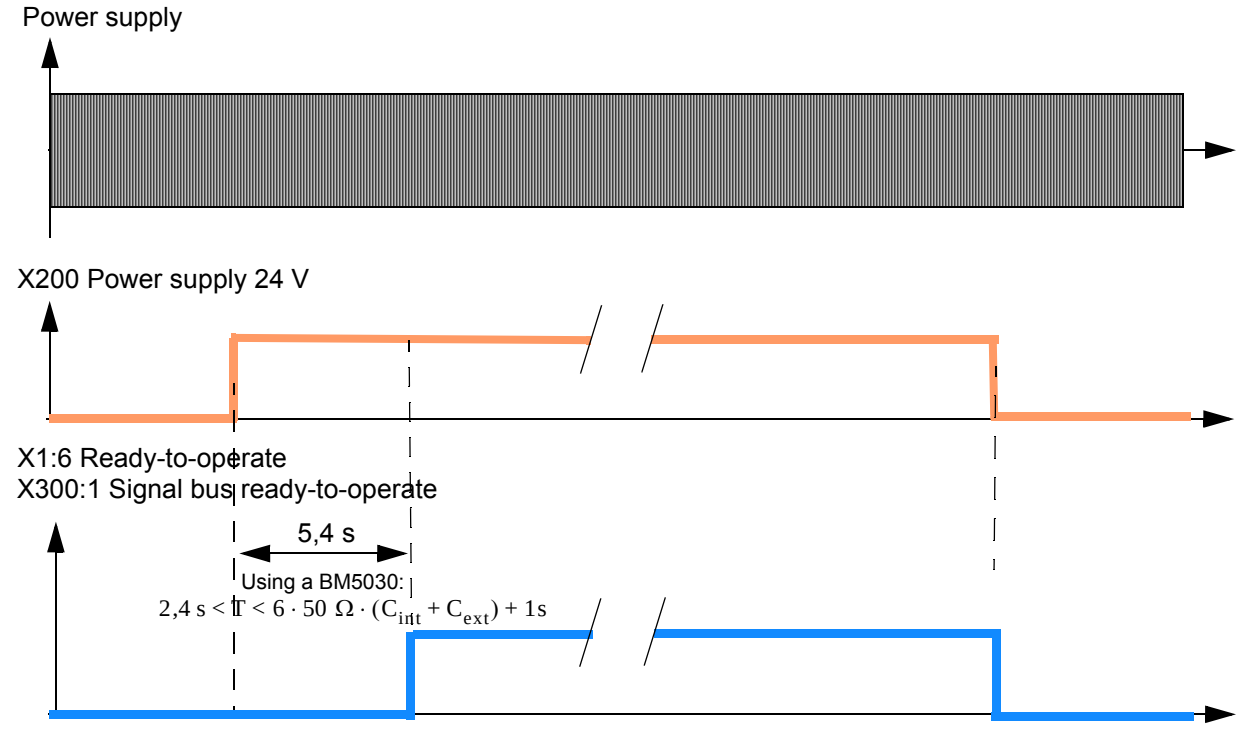


Figure 103: Timing diagram 24 V ON before Power supply ON signal bus

- Short power failure (< 10 s)

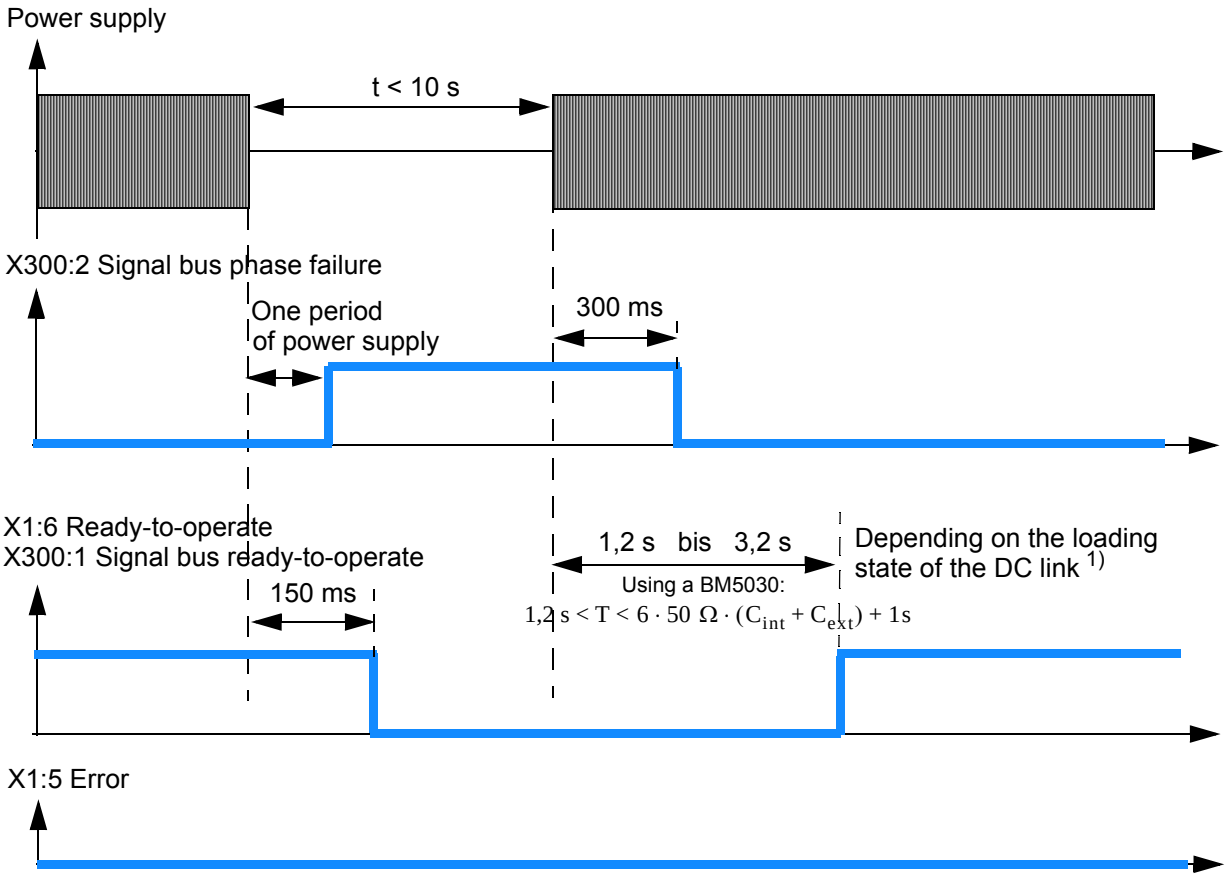


Figure 104: Timing diagram short power failure (< 10 s)

- Phase failure

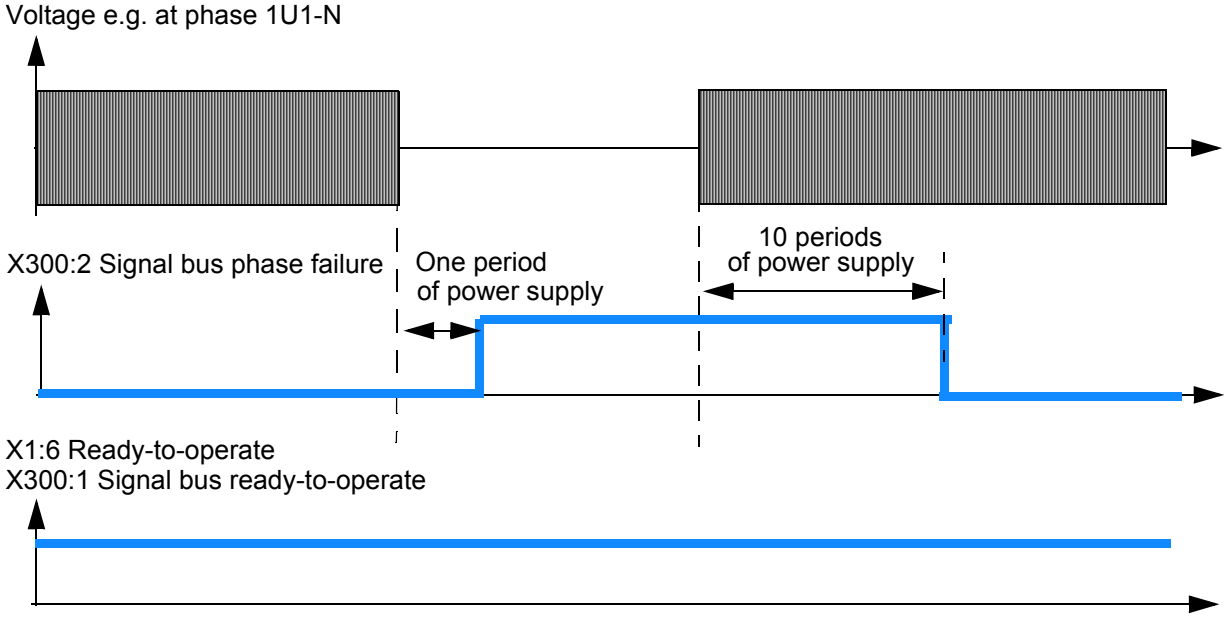


Figure 105: Timing diagram phase failure signal bus

- Long power failure (> 10 s)

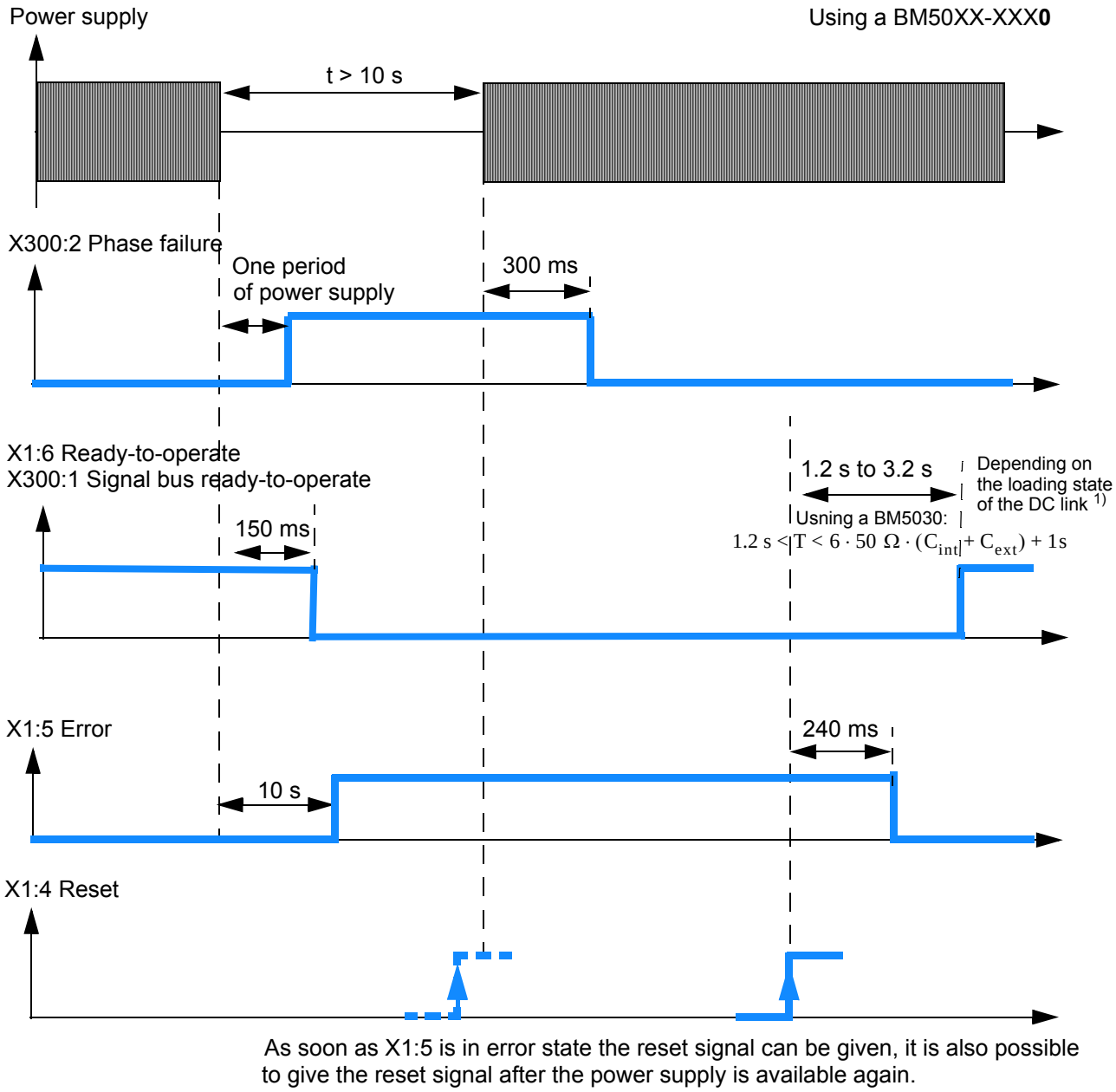


Figure 106: Timing diagram long power failure (> 10 s) BM50XX-XXX0

1) The length of the time period until the Ready-to-operate signal is available again depends on the loading state of the DC link. The higher the DC link voltage has been, the shorter the time period until the returning of the Ready-to-operate signal will be.

- Error acknowledge in case of power recovery

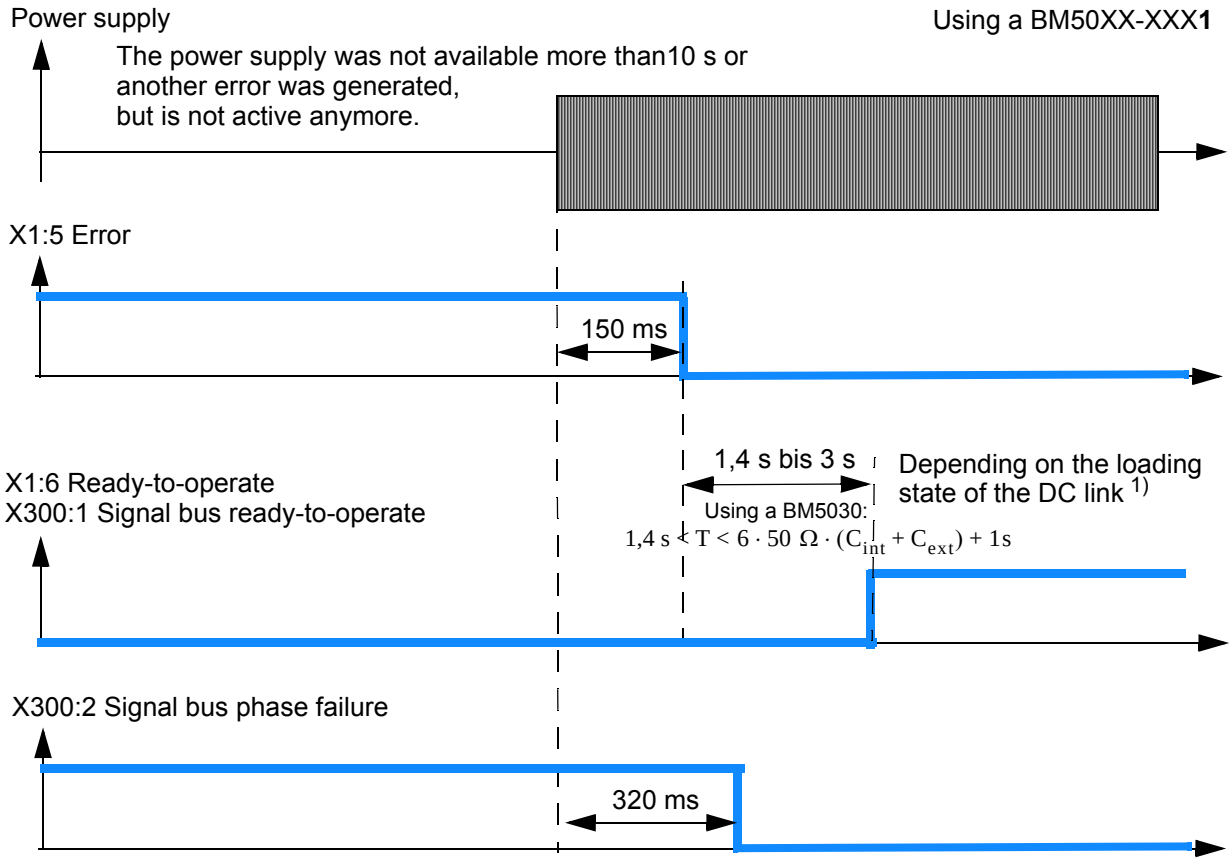


Figure 107: Timing diagram error acknowledge at power recovery BM50XX-XXX1

1) The length of the time period until the Ready-to-operate signal is available again depends on the loading state of the DC link. The higher the DC link voltage has been, the shorter the time period until the returning of the Ready-to-operate signal will be.

- Inhibit input X1:2

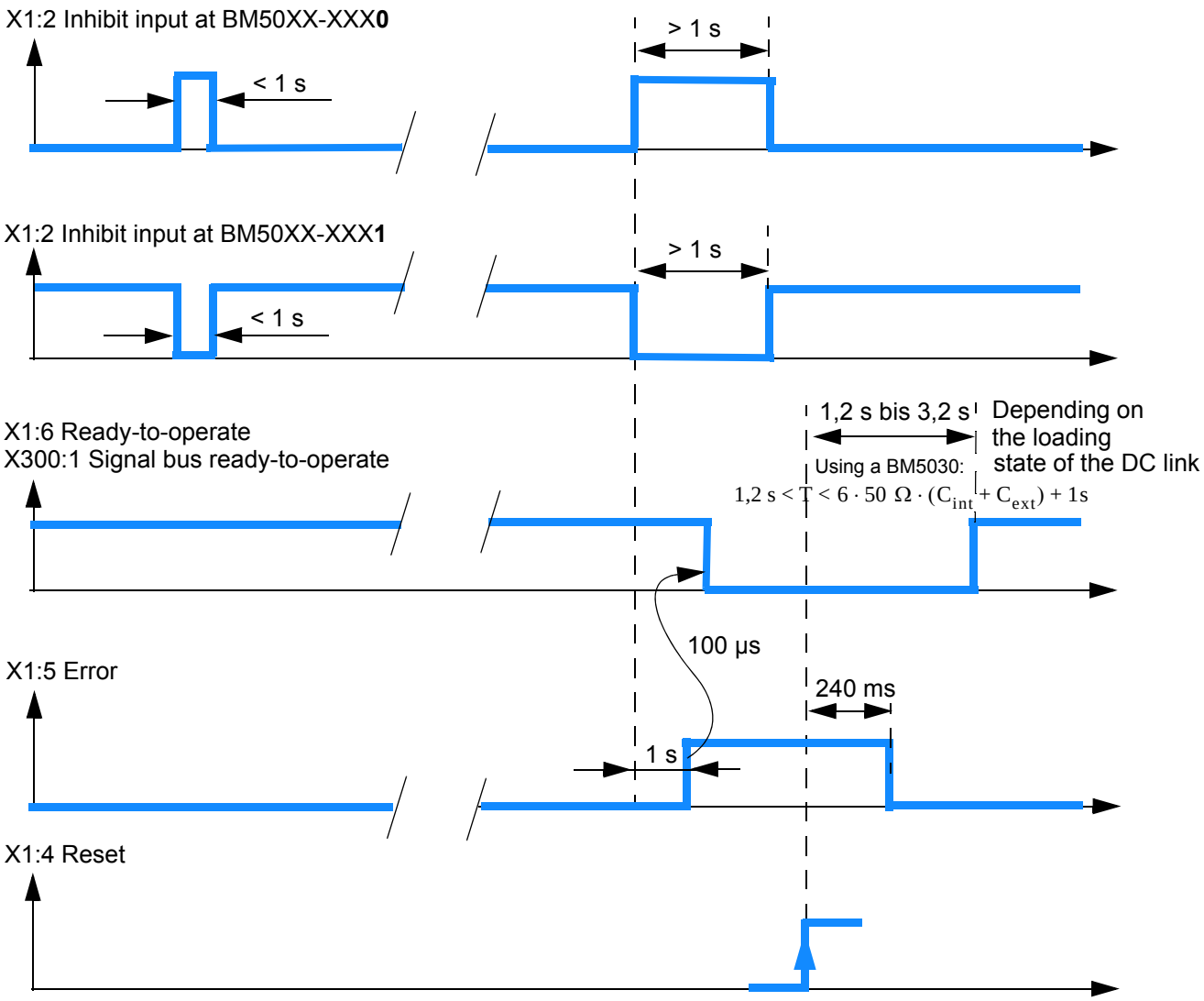


Figure 108: Timing diagram Inhibit input X1:2

[1] The length of the time period until the Ready-to-operate signal is available again depends on the loading state of the DC link. The higher the DC link voltage has been, the shorter the time period until the returning of the Ready-to-operate signal will be.

8.3 Monitoring

8.3.1 Monitoring BM50XX

The controller unit monitors the device during operation. If the controller unit detects a state that deviates from the normal operation condition, the device generates an error message.

Error message

If the controller unit detects that the device is not working error-free, then this is shown via the LEDs H1 to H4 (see ▹Display and operating elements◃ as from page 96 for devices without safety function and see ▹D.4 LED display BM5030 with safety function◃ as from page 326 for devices with safety function).

For further information see ▹Troubleshooting and Fault correction◃ as from page 243.

8.3.2 Monitoring BM51XX, BM53XX

The controller unit monitors the device during operation. If the controller unit detects a state that deviates from the normal operation condition, the device either generates a warning or an error message.

Warning

If the controller unit detects an operating condition that exceeds a warning threshold, a corresponding warning is shown on the display or, respectively, controller. The most important warning message (Current limit reached) is also shown by the device through the LED H13 or H23 (see ▹Display and operating elements◃ as from page 96).

Error message

If the controller unit detects that the device is not working error-free, then this is shown via the LED H14 or H24 (see ▹Display and operating elements◃ as from page 96). A corresponding error code will continue to be shown on the display and/or a controller can read out the error code on the device.

For further information see ▹Troubleshooting and Fault correction◃ as from page 243.

8.4 Fieldbus communication

Depending on the version of **b maXX 5000** (see ▹Type plate◃ on page 89 and ▹Type code◃ as from page 90) different fieldbus systems are provided.

8.4.1 EtherCAT®

Type code **b maXX 5000** with EtherCAT®:

BM5XXX-XXXX-XXXX-**01**XX- CoE profile (CANopen® over EtherCAT®)
BM5XXX-XXXX-XXXX-**07**XX- SoE profile (Servodrive profile over EtherCAT®)

Data can be transmitted to and from other nodes (e. g. from the EtherCAT® master) via the **b maXX 5000** with EtherCAT® slave.

X3 and **X4** on the front side of the device are the RJ45 connections for the EtherCAT®-fieldbus (also see ▹Front side of active mains rectifier BM51XX◃ on page 181 and ▹Front side axis units BM53XX◃ on page 183).

Mounting and installation

The mounting/installation consists of the following steps:

1 De-energize the **b maXX 5000** device
2 Set the **b maXX 5000** IP-address,
see ▹Setting the IP address with address switches◃ as from page 106
3 Connect **b maXX 5000** with Ethernet-connection cables.
- Please, observe an EMC-compatible laying of the Ethernet connection cables!
- The following cables were released for use by Baumüller:
Ethernet-connection cable;
Further information see ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable◃ on page 265.

Commissioning

The following preconditions must be fulfilled before commissioning:

1 **b maXX 5000** with EtherCAT® is installed correctly.
- Ethernet-connection cables are wired correctly.
2 The control cabinet is properly locked and all safety devices are operating.
3 The **b maXX 5000** device is ready-to-use.

Address switch

By means of the address switches S1 to S4 the IP-address is set
(Refer to settings ▹Setting the IP address with address switches◃ as from page 106).
Further information about the setting possibilities of the EtherCAT® slave see „Application Manual“.

Parameters

The parameter settings determine the behavior of the EtherCAT® slave in operation. Parameters are set with the software ProDrive.

1 Start ProDrive

2 Click on „Project Tree“.

3 Communication settings with ProDrive

- Project Tree: Configuration/Fieldbus Slave
  (refer also Parameter manual **b maXX 5000**)
  - set Synchronization to „On“
  - SYNC time = Fieldbus cycle time = EtherCAT® cycle time = 125 µs to 8 ms

    This setting is not necessary if using the CoE profile (CoE: CANopen® over EtherCAT®) and the EtherCAT® master has set the parameter 1C32.02 „Cycle Time“ to a valid value or „Distributed Clock“ is set to Sync0.

    When using the SoE profile (Servodrive profile over EtherCAT®) the fieldbus cycle time can be set via S parameter S-0-0002 or directly via controller parameter fieldbus cycle time. In case „Distributed Clock“ is activated the set fieldbus cycle time must be identical with the Sync0 Unit cycle. The Sync0 Unit cycle is set via the EtherCAT® master. No synchronous operation is possible if this condition is not fulfilled. The slave inhibits the change from PreOperational to SafeOperational and generates an error message.

8.4.2 VARAN

Type code **b maXX 5000** with VARAN:

BM5XXX-XXXX-XXXX-**02**XX-

A **b maXX 5000** with fieldbus option VARAN can communicate with a VARAN master.

X3 and X4 on the front side of the device are the RJ45 connections for VARAN (also see ▹Connections on the front side◃ as from page 179).

Mounting and installation

The mounting/installation consists of the following steps:

1. De-energize the **b maXX 5000** device
2. Set the **b maXX 5000** IP-address,
   see ▹Setting the IP address with address switches◃ as from page 106.
3. Connect **b maXX 5000** with VARAN bus cables (Ethernet-LAN cable at least CAT 5).
   - X3: VARAN-In, X4: VARAN-Out.
     On the first **b maXX 5000** node of a VARAN line X3 is connected with the VARAN master. X4 is connected with X3 of the next **b maXX 5000** slave in the line, and so on. The last node of a VARAN line has no connection of X4 or is connected with a PC (tunneling of Ethernet frames via VARAN to the controller, e. g. to communicate with ProDrive).
     Each slave within the VARAN line can be addressed and parametrized via selection of its IP address.

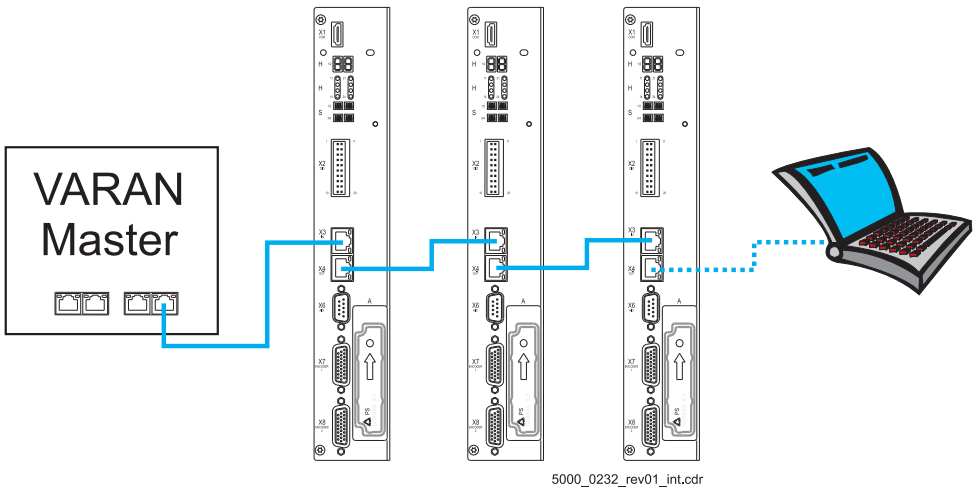


Figure 109: VARAN fieldbus connection

NOTE!

A point-to-point connection between PC (ProDrive) and **b maXX 5000** VARAN slave X4 for commissioning is possible even without a VARAN master.

- Please, observe an EMC-compatible laying of the Ethernet connection cables!
- The following cables were released for use by Baumüller:
  Ethernet connection cable;
  Further information see ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable◃ on page 265.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. **b maXX 5000** with VARAN is installed correctly.
   - Ethernet connection cables are wired correctly.
2. The control cabinet is properly locked and all safety devices are operating.
3. The **b maXX 5000** device is ready-to-use.
4. Create a Lasal-Class2 project using the driver classes for **b maXX 5000** drives for cyclic and service data communication.
5. Start the VARAN control

Address switch

By means of the address switches S1 to S4 the IP-address is set
(Refer to settings ▹Setting the IP address with address switches◃ as from page 106).

Parameters

The parameter settings determine the behavior of the VARAN slave in operation. Parameters are set with the software ProDrive.

1. Start ProDrive
2. Click on „Project Tree“.
3. Communication settings with ProDrive
   - Project Tree: Configuration/Fieldbus slave
     (refer also Parameter manual **b maXX 5000**)
     - set Synchronization to „On“
     - set Fieldbus cycle time according VARAN cycle time (1 ms, 2 ms, 4 ms or 8 ms)
     - set source sync signal to fieldbus

8.4.3 CANopen®

Type code **b maXX 5000** with CANopen®:

BM5XXX-XXXX-XXXX-**03**XX-

The data can be transmitted to all the other CAN-users (e g from CANopen® master) via the **b maXX 5000**.

X3 and **X4** are the RJ45 connections for CAN bus cables (also see ▹Connections on the front side◃ on page 179), which are on the front side of the device.

Mounting and installation

The mounting / installation consists of the following steps:

1 De-energize **b maXX 5000** device

2 Set address and baud rate (transfer rate) at the **b maXX 5000**, see ▹CANopen®◃ on page 109.

3 Connect **b maXX 5000** with CANopen®-bus cables (and, if necessary, a terminated connector).
   - Comply to EMC-oriented laying of CANopen® connection cables!
   - Baumüller released the following cables for use: CANopen® connection cable; further information see ▹Accessories - CANopen®.◃ on page 266.



NOTE!

If the **b maXX 5000** device is the last bus node in the line, X4 must be terminated with a terminating connector (see ▹Accessories - CANopen®.◃ on page 266).

Commissioning

The following preconditions must be fulfilled before commissioning can be made:

1 **b maXX 5000** with CANopen® is correctly installed.
   - CANopen®-connection cables are correctly wired.

2 The control cabinet has been locked correctly and the safety devices have been put into operation.

3 The **b maXX 5000** device is ready-to-use.

Address switch

By means of the address switch S1 to S4 the settings, like e.g. the baud rate (transfer rate) and the address setting (slave No. /ID) are made (see ▹CANopen®◃ on page 109).
Further information about parameter setting of the CANopen® slave, see „Application Manual“.

Process of commissioning

The test-commissioning is divided into the following sections:

1 Configuration of the CANopen® slave

2 Testing of the CANopen® slave

Configuring the CANopen® slave

The CANopen® is configured at the running device with ProDrive and a NMT-Master.

1 Switch on **b maXX 5000** with CANopen®

2 Start ProDrive

3 Ensure, that the CANopen® slave communicates with the NMT-Master (the slave reports to the master with the boot-up telegram), i. e. CAN-telegrams can be send/received.

Make the following settings:

4 ProDrive: Activate communication source (see Parameter Manual: Drive manager)

5 NMT-Master: Create PDO-Mapping
(see Programming Manual CANopen®“)

6 NMT-Master: with the NMT-command :=1 into the state „OPERATIONAL change“, then the cyclic communication starts.

Testing of the CANopen®-Slave

The CANopen® slave is tested, by using the total CANopen® network.

ProDrive does not indicate errors, the CANopen® slave was commissioned.

Operation

Avoid a reset of the **b maXX 5000** in the cyclical operation of the CANopen® slave.



WARNING!

Risk of injury due to moving parts!

Rotating and/or linearly moving parts can cause severe injuries.

If a reset of the **b maXX 5000** device is released in the running cyclical operation or if the communication source is switched off, this can cause unwanted conditions in the active application.

Therefore:

- Ensure, that the NMT master does not execute a reset, as long as the **b maXX 5000** device is in the cyclical operation
- Ensure, that the CANopen® communication source only is able to communicate with the **b maXX 5000** device.



NOTE!

After a reset the booting data set is loaded in the controller. In addition the mapping is set on the CANopen®, which was saved in the controller part before the reset was executed.

8.4.4 POWERLINK®

Type code **b maXX 5000** with POWERLINK®:

BM5XXX-XXXX-XXXX-**04**XX-

b maXX 5000 devices can communicate with a POWERLINK® Managing Node via the fieldbus connection POWERLINK®.

X3 and **X4** on the front side of the device are the RJ45 connections for POWERLINK® (also see ▹Front side of active mains rectifier BM51XX◃ on page 181 and ▹Front side axis units BM53XX◃ on page 183).

Mounting and installation

The mounting/installation consists of the following steps:

1 De-energize the **b maXX 5000** device

2 Set the **b maXX 5000** IP-address,
see ▹Setting the IP address with address switches◃ as from page 106

3 Connect **b maXX 5000** with Ethernet-connection cables.
- Please, observe an EMC-compatible laying of the Ethernet connection cables!
- The following cables were released for use by Baumüller:
Ethernet-connection cable;
Further information see ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable◃ on page 265.

Commissioning

The following preconditions must be fulfilled before commissioning:

1 **b maXX 5000** with POWERLINK® is installed correctly.
- Ethernet-connection cables are wired correctly.

2 The control cabinet is properly locked and all safety devices are operating.

3 The **b maXX 5000** device is ready-to-use.

Address switch

By means of the address switches S1 to S4 the last byte of the IP-address is set (Refer to settings ▹Setting the IP address with address switches◃ as from page 106).
IP address 192.168.100.0 is not allowed.
Further information about the setting possibilities of the POWERLINK® Controlled Node see „Application Manual“.

Parameters

The parameter settings determine the behavior of the POWERLINK® Controlled Node in operation. Parameters are set via the software ProDrive.

1 Start ProDrive

2 Click on „Project Tree“.

3 Communication settings using ProDrive
- Project Tree: Configuration/Fieldbus Slave
(refer also Parameter manual **b maXX 5000**)
  - set Synchronization to „On“
  - SYNC time = Fieldbus cycle time = POWERLINK® cycle time = 500 µs to 8 ms

    This setting is not necessary if using the POWERLINK® profile and the POWERLINK® Managing Node sets a valid value in object 0x1006 „Communication cycle period“.

8.4.5 EtherNet/IP®

Type code **b maXX 5000** with add-on module EtherNet/IP®:

BM5XXX-XXXX-XX**07**-**00**XX-

Devices **b maXX 5000** communicate with the add-on modujle EtherNet/IP® with an EtherNet/IP® scanner.

X1 and **X2** on the add-on module are the RJ45 connections for the EtherNet/IP®
(also see ▹Add-on module EtherNet/IP®◃ on page 197.

Mounting and installation

The mounting/installation consists of the following steps:

1. De-energize the **b maXX 5000** device
2. Set the **b maXX 5000** IP-address,
   see ▹Setting the IP address with address switches◃ as from page 106
3. Connect **b maXX 5000** with Ethernet-connection cables.
   - Please, observe an EMC-compatible laying of the Ethernet connection cables!
   - The following cables were released for use by Baumüller:
     Ethernet-connection cable;
     Further information see ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable◃ on page 265.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. **b maXX 5000** with EtherNet/IP® is installed correctly.
   - Ethernet-connection cables are wired correctly.
2. The control cabinet is properly locked and all safety devices are operating.
3. The **b maXX 5000** device is ready-to-use.

Address switch

By means of the address switches S1 to S4 the IP-address is set
(Refer to settings ▹Setting the IP address with address switches◃ as from page 106).

Parameters

The parameter settings determine the behavior of the EtherNet/IP® in operation.
Parameters are set with the software ProDrive.

1. Start ProDrive
2. Click on „Project Tree“.
3. Communication settings with ProDrive
   - Project Tree: Configuration/Fieldbus Slave
     (refer also Parameter manual **b maXX 5000**)
     - set Synchronization to „On“
     - SYNC time = Fieldbus cycle time = EtherNet/IP® cycle time = 500 µs to 8 ms

       This setting is not necessary if a valid value is set in byte 0 of the EtherNet/IP® scanner.

8.4.6 Modbus/TCP

Type code **b maXX 5000** with add-on module Modbus/TCP:

BM5XXX-XXXX-XX**08**-**00**XX-

Devices **b maXX 5000** communicate with the add-on modujle Modbus/TCP with an Modbus/TCP client.

X1 and **X2** on the add-on module are the RJ45 connections for the Modbus/TCP
(also see ▹Add-on module Modbus/TCP◃ on page 200.

Mounting and installation

The mounting/installation consists of the following steps:

1 De-energize the **b maXX 5000** device

2 Set the **b maXX 5000** IP-address,
see ▹Setting the IP address with address switches◃ as from page 106

3 Connect **b maXX 5000** with Ethernet-connection cables.
- Please, observe an EMC-compatible laying of the Ethernet connection cables!
- The following cables were released for use by Baumüller:
  Ethernet-connection cable;
  Further information see ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable◃ on page 265.

Commissioning

The following preconditions must be fulfilled before commissioning:

1 **b maXX 5000** with EtherNet/IP® is installed correctly.
- Ethernet-connection cables are wired correctly.

2 The control cabinet is properly locked and all safety devices are operating.

3 The **b maXX 5000** device is ready-to-use.

Address switch

By means of the address switches S1 to S4 the IP-address is set
(Refer to settings ▹Setting the IP address with address switches◃ as from page 106).

Parameters

The parameter settings determine the behavior of the EtherNet/IP® in operation.
Parameters are set with the software ProDrive.

1 Start ProDrive

2 Click on „Project Tree“.

3 Communication settings with ProDrive
- Project Tree: Configuration/Fieldbus Slave
  (refer also Parameter manual **b maXX 5000**)
  - set Synchronization to „On“
  - SYNC time = Fieldbus cycle time = EtherNet/IP® cycle time = 500 µs to 8 ms

    This setting is not necessary if the Modbus/TCP client sets a valid value in Modbus register 202..

9

MAINTENANCE

Basic information

WARNING!

Risk of injury due to improperly performed maintenance work!

Improper maintenance can lead to severe personal injury and material damage.

Therefore:

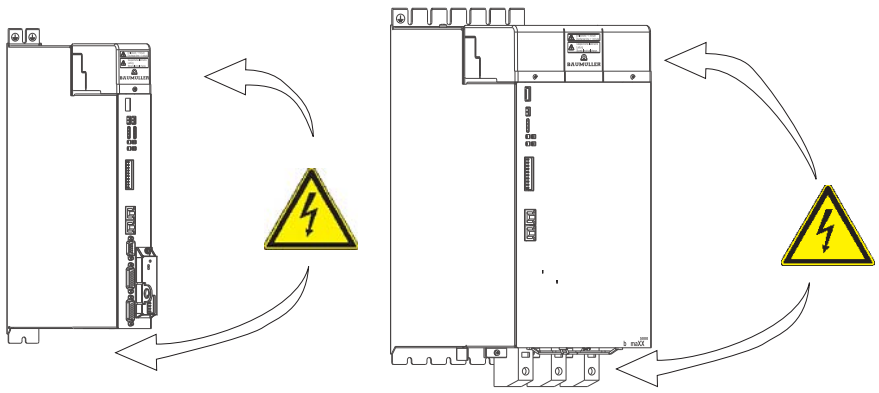
- Before beginning work, make sure that there is enough space for mounting.
- Make sure that the mounting area is kept clean and orderly. Parts and tools that are loosely stacked or lying around are a potential accident source.

DANGER!

Risk of fatal injury from electrical current!

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:
Pay heed to areas on the device that could be dangerous during the maintenance.
Pay heed to areas that could still be electrically energized after operation.



5000_0046_rev06_int.cdr

Figure 110: Hazard areas during electrical installation

9.1 Environmental condition

If the prescribed environmental conditions are adhered to, then the device is maintenance-free. For the prescribed environmental conditions, see ▹Required environmental conditions◃ on page 49.

9.2 Inspection intervals - maintenance notes

Preventive maintenance is prescribed to keep the device in an optimum operating condition and ensure a long service life. It is recommended to have inspections performed regularly by qualified personnel.

Daily inspection:

Basic check points as to whether discrepancies have occurred during operation:

- Does the motor work as desired?
- Is the operating environment normal?
- Is the cooling system working normally?
- If an unusual vibration or noise is noticed during operation.
- Does the motor overheat during operation?

Regularly scheduled inspection:

Before checking, switch off the input voltage and wait until the device's capacitors have discharged.



DANGER!

Risk of fatal injury from electrical current!

Therefore:

- Switch off voltage before performing work!
- Only qualified personnel may mount, install and maintain the devices.
- Please remove all metallic objects worn, such as watches or rings, for example, before beginning to work on the device.
- Only insulated tools are permitted.



DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the rack system = discharge time of the device with the longest DC link discharge time in the rack system.

Refer to ▹Electrical data◃ as from page 60.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.

Periodic maintenance

- Environmental condition

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Check environmental temperature, humidity and vibrations. Check whether dust, oil or drops of water appear.	Visual inspection and measurement of the environmental conditions, comparison with standard values.	O		
Check whether there are hazardous objects in the vicinity.	Visual inspection	O		

- Voltage

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Check the voltage of the power supply system and the control circuits	Measurement and comparison with standard values.	O		

- Mechanical parts

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal noises or vibrations?	Visual and audio check		O	
Are there any loose screws?	Tighten the screws.		O	
Are there any bent or damaged parts?	Visual inspection		O	
Have there been any color changes due to overheating?	Visual inspection		O	
Are there any dust or dirt deposits?	Visual inspection		O	

- Power supply

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any missing or loose screws?	Replace the screws or, respectively, tighten them.		O	
Is there any deformation, cracking, damage or color change on the device as a result of overheating or aging?	Visual inspection		O	
Are there any dust or dirt deposits?	Visual inspection		O	

- Connections and circuitry of the mains power supply

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Does the wiring indicate any color or shape changes due to overheating?	Visual inspection		O	
Is the wiring insulation damaged or is it discolored?	Visual inspection		O	
Is there any damage?	Visual inspection		O	

- Transformer and chokes in the main circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal vibrations or noticeable odors?	Visual inspection, audio check and odor check		O	

- Solenoid switch and relay in the power supply circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any loose screws?	Visual and audio check Tighten screws, if necessary.	O		
Do the switches function correctly?	Visual inspection	O		

- Plug connectors in the power supply circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any loose screws or connectors?	Tighten screws and firmly stick in plug connector.		O	
Are there any noticeable odors or color changes?	Visual inspection and odor check		O	
Is there any cracking, damage, deformation or corrosion?	Visual inspection		O	
Is there any leaking fluid or deformation of the capacitors?	Visual inspection		O	

- Cooling system fans

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal noises or vibrations?	Visual and audio check			O
Are there any loose screws?	Tighten the screws.			O

- Cooling system ventilation duct

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any obstructions in the heat sink, air supply or air outlet?	Visual inspection	O		

- Safety function

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Check the DC-link voltage in STO state	Measured value must be ≤ 60 V			O

9.3 Repairs

In case of device damage, please inform your sales office or:

Baumüller Nürnberg GmbH

Ostendstr. 80 - 90
90482 Nuremberg
Germany

Tel. +49 9 11 54 32 - 0
Fax: +49 9 11 54 32 - 1 30

Mail: mail@baumueller.com
Internet: www.baumueller.com

10

TROUBLESHOOTING AND FAULT CORRECTION

10.1 Behavior in case of malfunctions

Basic information



DANGER!

Risk of fatal injury from electrical current!

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous.



WARNING!

Risk of injury due to improper fault correction!

Therefore:

- Only qualified personnel may work on this device!
- Personnel that work with the **b maXX** device must be trained in the safety regulations and the handling of the device, and be familiar with the correct operation of it. In particular, reacting to error indications and conditions requires that the operator must have special knowledge.

10.2 Monitoring functions

Monitoring function	Warning/error	Warning	Error	Adjustable threshold	Adjustable reaction	Reaction inhibit pulses
Power supply voltage [5]	Power supply undervoltage	X [7]	X	-	-	X
	Power supply overvoltage	X [7]	X	-	-	X
Phase monitoring [5]	Phase failure	X [7]	X	-	-	X
	Power supply failure	X [7]	X	X [7]	-	X [1]
	Power supply frequency too high or too low [6]	X	-	-	-	-
	Power supply synchronization lost [6]	-	X	-	-	X
	No mains synchronization possible [6]	-	X	-	-	X
Ground fault	Fault current to ground [7]	-	X	-	-	X
Overcurrent	Motor overcurrent [6][7]	-	X	-	-	X
	Power supply/DC link overcurrent [5][7]	-	X	-	-	X
	Power supply overcurrent [8]	-	X	-	-	X
Charging [9]	Time out charging	-	X	-	-	X
	Short-circuit in the DC link	-	X	-	-	X
Discharging [9]	Time out quick discharge	-	X	-	-	X
	Power supply current during discharging	-	X	-	-	X
DC link	DC link overvoltage	-	X	-	-	X
	DC link relative undervoltage	X [7]	X [8]	-	-	X [8]
	DC link set value too low [5][6]	X	-	-	-	X

[1] Pulses are inhibited after a adjustable time period (not provided for BM51XX).
[2] Only if KTY/PT1000 sensors are used
[3] Threshold adjustable
[4] Reaction adjustable
[5] Not provided for BM53XX
[6] Not provided for BM50XX
[7] Not provided for BM51XX
[8] Only provided for BM51XX
[9] Not processed by BM51XX, only a message for the axis units.

X: Implemented
-: Not possible

Monitoring function	Warning/error	Warning	Error	Adjustable threshold	Adjustable reaction	Reaction inhibit pulses
Overload monitoring [6]	Peak current not possible at this time	X	-	-	-	-
Heat sink temperature	Temperature > threshold 1	X	-	X	-	-
	Temperature > switch-off threshold	-	X	-	-	X
Internal temperature of device [6]	Temperature > threshold 1	X	-	X	-	-
	Temperature > switch-off threshold	-	X	-	-	X
Motor temperature [6][7]	I^2t threshold exceeded	-	X	-	-	X
	Threshold 1 exceeded [2]	X	-	X	-	-
	Threshold 2 exceeded [2]	X	-	X	-	-
	Sensor short circuit and/or temperature < -30 °C [2]	-	X	-	-	-
	Sensor not connected and/or temperature > 250 °C [2]	-	X	-	-	-
	Maximum temperature exceeded [2]	-	X	X	-	X
Position controller [6][7]	Dynamic position deviation	-	X	X	X	-
	Static position deviation	-	X	X	X	-
Encoder 1 [6][7]	Cable break (square-wave incremental encoder)	-	X	X	X	[4]
	Cable break ($SIN^2 + COS^2$)	-	X	X	X	[4]
	Overspeed	-	X	X	X	[4]
Encoder 2 [6][7]	Cable break (square-wave incremental encoder)	-	X	X	X	[4]
	Cable break ($SIN^2 + COS^2$)	-	X	X	X	[4]
	Overspeed	-	X	X	X	[4]

[1] Pulses are inhibited after a adjustable time period (not provided for BM51XX).
[2] Only if KTY/PT1000 sensors are used
[3] Threshold adjustable
[4] Reaction adjustable
[5] Not provided for BM53XX
[6] Not provided for BM50XX
[7] Not provided for BM51XX
[8] Only provided for BM51XX
[9] Not processed by BM51XX, only a message for the axis units.

X: Implemented
-: Not possible

Monitoring function	Warning/error	Warning	Error	Adjustable threshold	Adjustable reaction	Reaction inhibit pulses
Cyclical specified value transmission to the fieldbus [6]	Time-out during transmission	-	X	X	X	[4]
Blocking monitoring [6][7]	Drive blocked	-	X	X	-	X
Signal bus [9]	Feed-in ready-to-operate	X [9]	X [9]	-	X [9]	-
	Phase failure [7]	X	X	-	X	-
	Brake resistance on [7]	X	X	-	X	-
	Malfunction [7]	X	X	-	X	-
	Signal bus warning [7]	X	X	-	X	-

[1] Pulses are inhibited after a adjustable time period (not provided for BM51XX).
[2] Only if KTY/PT1000 sensors are used
[3] Threshold adjustable
[4] Reaction adjustable
[5] Not provided for BM53XX
[6] Not provided for BM50XX
[7] Not provided for BM51XX
[8] Only provided for BM51XX
[9] Not processed by BM51XX, only a message for the axis units.

X: Implemented
-: Not possible

10.2.1 Monitoring function - explanations BM50XX

Power supply voltage

This monitoring function checks whether the power supply voltage has a value within the set voltage range (see ▹Requirements for power supply / mains supply system◃ on page 46).
If the value is out of this range or 25 % above or 25 % under the default power supply mains voltage, the mains rectifier unit switches off and the LED H1 lights up.

Phase monitoring

This monitoring function checks the voltage of the three power supply phases. If one phase is missing, „Phase failure“ is generated after a period of > 100 ms.

If all three phases are missing, then the error „Power supply failure“ is reported after a period of > 100 ms.

Phase failure

During the missing of a power supply phase the rated power output is possible up to 10 s, after that time only 30 % of the rated power can be supplied for unlimited time.

if this values are exceeded the mains rectifier is shut down and has to be restarted by „reset“ (X1:4).

At bad power supply conditions shutdown can be initiated earlier.

Overcurrent

This monitoring function checks whether the peak value off the DC link current is higher than 160 A (BM5031, BM5032) or 520 A (BM5043, BM5044). If the DC link current exceeds this value the mains rectifier unit is switched off and the LED H4 lights up. This monitoring function provides a „disaster prevention“ in case of a short circuit of the output side.

DC link

This monitoring function checks the voltage of the DC link. If the voltage is lower than an internally set value (approx. 50 V under the specified value), the controller generates „DC link undervoltage“ and a warning is signaled.
If the voltage rises above an internally set value (approximately. 825 V), the mains rectifier unit is switched off and the LED H4 lights up.

Overload monitoring

This monitoring function controls the present load whether the power unit can supply the peak current at the moment. In case the peak current is not possible, the message „Power unit monitoring active and max. torque current is limited“ (warning 206) is generated.

Heat sink temperature

This monitoring function checks the temperature of the heat sink. If the temperature is too high or below -5 °C, then the mains rectifier unit is switched off and LED H3 lights up.

10.2.2 Monitoring function - explanations BM51XX

Power supply voltage

The BM51XX provides 2 settable thresholds to check the power supply voltage. The active mains rectifier generates a message if the power supply voltage is above/below the set thresholds. This message is generated as warning by default, the reaction can be changed to pulse inhibit.
The device generates an error message and a shutdown follows if the mains voltage is in operation out of the permitted range (refer to ▹Requirements for power supply / mains supply system◃ on page 46).

Phase monitoring

This monitoring function checks the voltage of the three power supply phases. The error „Phase failure“ is generated if one phase is missing. The error „Power supply failure“ is generated, if 2 or 3 phases are missing. The active mains rectifier generates a warning first and disables then the active operation with the error message „Power supply synchronization lost“ if the power supply frequency exceeds the permitted range. The active mains rectifier changes to error state generating the message „Power supply synchronization not possible“ if a synchronization to the power supply is not possible before starting active operation.

Charging

This monitoring function checks the charging of the DC link voltage. The error „Timeout DC link“ is generated if the DC link voltage cannot be charged to power supply maximum voltage within 10 s. The active mains rectifier stops the operation with the error message „Short circuit at DC link“ if the DC link voltage does not rise as expected while charging.

Discharging

The device is not separated from the power supply successfully if a mains current is detected while discharging. The discharge resistor would be connected directly to the power supply therefore the error „Power supply current during discharging“ is generated.
If the DC link voltage can not be discharged within approx. 10 s, the error „Time-out quick discharge“ is generated.

DC link

This monitoring function checks the voltage at the DC link. If the voltage is lower than an internally set value (approx. 80 V under the specified value or 87 % of the power supply peak value), the controller generates the error „DC link undervoltage“. If the voltage rises above an internally set value (approx. 835 V), the controller generates the error „DC link overvoltage“ and pulses are inhibited immediately.

The user set value is too low ensuring an adequate dynamic controlling if the set $U_{DC\ link}$ set value at the moment is lower than a threshold 40 V above the power supply peak value. In this case the error „Undervoltage $U_{DC\ link}$ “ is generated.

Overload monitoring

This monitoring function checks the present load whether the power unit can supply the peak current at the moment. In case the peak current is not possible, the message „Power unit monitoring active and max. torque current is limited“ (warning 206) is generated.

Cyclic set value transmission to the fieldbus

The active mains rectifier is able to exchange cyclic data with the master control. If this data exchange is not within a defined time period, the device will generate the errors „Actual values are not received in time“ or „No data available at the moment“.

Temperature of device interior

This monitoring function checks the temperature in the interior of the device.

- If the temperature is higher than the warning threshold, then the controller generates a warning.
- If the temperature is too high, then the pulses are inhibited immediately.

Heat sink temperature

This monitoring function checks the temperature of the heat sink.

- If the temperature is higher than the warning threshold, then the controller generates a warning.
- If the temperature is too high, then the pulses are inhibited immediately.

Signal bus

At axis units all power units are linked together via a so called „signal bus“. The bus signals can be polled and set by every client device, including the mains rectifier unit.

The mains active rectifier can report to the axis units via this bus

- Ready-to-operate for drive

This way, the individual axes can react to this signal.

Signal bus - Mains rectifier unit ready-to-operate

Shows when the mains rectifier unit is in the „ready-to-operate“ state. This signal is generated after reaching the value $U_{DC\ link\ actual} = U_{DC\ link\ set\ value} - 10\ V$.

In case of power supply errors or power supply failure, the ready-to-operate signal is canceled again. The axis units react to this with error state.

Signal bus - Malfunction

The „Malfunction“ signal is an input for mains rectifier unit and active mains rectifier unit. This signal is not evaluated by the active mains rectifier at the moment.

10.2.3 Monitoring function - explanations BM53XX

Ground fault

This monitoring function checks whether there is a short circuit between at least one motor terminal and ground. If a short circuit is detected, pulses are inhibited immediately.

Overcurrent

This monitoring function checks whether the motor current or the mains current is larger than 1.3 times of the peak output current. This monitoring function provides a „disaster prevention“ in case of a short circuit of the output side.

DC link

This monitoring function checks the voltage in the DC link. If the voltage drops below an internally set value (approx. 210 V), the controller reports „DC link undervoltage“ and a warning is signaled. If the voltage rises above an internally set value (approx. 835 V), the controller reports the error „DC link overvoltage“ and pulses are inhibited immediately.

Overload monitoring

This monitoring function checks the present load whether the power unit can supply the peak current at the moment. In case the peak current is not possible, the message „Power unit monitoring active and max. torque current is limited“ (warning 206) is generated.

Internal temperature of device

This monitoring function checks the temperature in the interior of the device.

- If the temperature is higher than the warning threshold, then the controller signals a warning.
- If the temperature is higher than the maximum allowable device interior temperature, then the pulses are inhibited immediately.

Heat sink temperature

This monitoring function checks the temperature of the heat sink.

- If the temperature is higher than the warning threshold, then the controller signals a warning.
- If the temperature is higher than the maximum allowable heat sink temperature, then the pulses are inhibited immediately.

Motor temperature

This monitoring function checks the temperature of motor. If the I²t-threshold is exceeded, then the error message „I²t overload“ is generated by the controller.

Only for KTY84 and PT1000 sensor

If the set temperature threshold 1 is exceeded, then the warning „Temperature threshold 1 exceeded“ is generated by the controller.

If the set temperature threshold 2 is exceeded, then the warning „Temperature threshold 2 exceeded“ is generated by the controller.

If the temperature falls below the minimum measurable value, or if a short circuit occurs at the sensor, then the error message „Temperature sensor short circuit“ is generated.

If the temperature is higher than the maximum measurable temperature, or if the sensor is not connected, then the error message „Temperature sensor not connected“ is generated by the controller.

For all sensors

The error message „Over temperature“ is generated by the controller and the pulses are inhibited immediately if the threshold (type-specific) of the temperature switch or of the sensor is exceeded.

Position controller

This monitoring function checks the position deviation limit statically/dynamically. If the current position deviation is statically/dynamically larger than the set position deviation limit, then the error message „Static position deviation“ or „Dynamic position deviation“ is generated. After the monitoring period (position deviation period) an additional error message is generated and pulses are inhibited immediately. The reaction time can be set.

Blocking monitoring

This monitoring function checks the motor speed and the motor current.
If the following two conditions are met for at least the „Blocking monitoring time“, then the error message „Drive blocked“ is generated by the controller and the pulses are inhibited immediately.

- Motor speed = 0
- The motor current output by the device is the same as the set maximal motor current (current limit).

Signal bus

The signal bus is a connection between the supply unit and the connected axis units in the DC link network. The ready-to-operate signal of the supply unit is signalized to the connected axes via this connection. Furthermore the signal bus can be used to signalize an error or a warning to the other connected devices.

Signal bus - Supply unit ready-to-operate

The mains rectifier unit, the active mains rectifier unit and mono units generate this signal. The connected axis units evaluate this signal.

The signal indicates that the supply unit is in the **ready-to-operate** state and the DC link is supplied. In the event of power supply errors (e.g. power supply failure), the output of the ready fur use signal is stopped. If the signal is not available, an error is generated at the connected axis units.

Signal bus - Supply unit not ready-to-operate

This signal indicates also the state of the mains rectifier unit. It is required, if axis units will be operated in a DC link network with several mono units.

In this case it can only be evaluated by the „Power supply ready-to-operate“ signals whether at least one supplying device is ready, because the signal is a disjunction of the states of all supplying devices. It can not be recognized whether all supplying devices are ready.

In order to recognize that at least one supply unit is in state not ready-to-operate, the signal „Supply not ready-to-operate“ is generated. The evaluation of this signal can be disabled for special applications.

Signal bus - Phase failure

The mains rectifier unit, the active mains rectifier unit and mono units generate this signal if a phase failure is recognized.

The axis units can operate at phase failure only at mains rectifier units and at mono units. Several options are selectable for further operations, see parameter 130.10 Power supply mode.

Signal bus - Brake resistor on

This signal activates the brake resistors of several supplying devices simultaneously. Both mains rectifier unit and mono units provide a brake resistor connection and an own monitoring of the DC link voltage. If the DC link voltage exceeds a fixed threshold, the brake resistor is switched on.

The axis units measure the DC link voltage also and can be configured to generate the „Brake resistor on“ signal. If this signal is set, the brake resistor is switched on at the mains rectifier unit and/or at the mono units.

This signal is not evaluated at the active mains rectifier unit.

Signal bus - Error

The axis units and the mono units can be configured to set the „Error“ signal on the signal bus as soon as the device is no longer in state ready-to-operate.

Furthermore each axis unit or each mono unit can be configured to generate an error message when detecting an „Error“ signal. A simple error reaction for all axis units/mono units is possible, using this function.

This signal is neither evaluated nor set at the active mains rectifier unit and at the mains rectifier unit.

Signal bus - Signal bus warning

Connected devices can exchange warning states among each other with this signal. The signal is evaluated or set only by axis units and mono units. It is neither evaluated nor set by the active mains rectifier unit and by the mains rectifier unit.

10.3 Error detection

10.3.1 BM50XX error detection

The error state is signalized by the lighting up of the red LEDs H1 to H4 on the front side of the housing.

The meaning of the individual LEDs is explained in ▹Display and operating elements◃ as from page 96 for devices without safety function and ▹LED display BM5030 with safety function◃ as from page 326 for devices with safety function.

10.3.2 BM51XX and BM53XX error detection

LED

The error state is signalized by the lighting up of the red LED H14 or H24 on the front side of the housing.

The meaning of the individual LEDs is explained in ▹LED display controller◃ on page 103.

Essentially, the lowest red LEDs H14 and H24 „Malfunction“ are of significance here.



NOTE!

In case of warnings or errors without error reactions, the LEDs H14 or H24 **blink** „Malfunction“. Only error messages with error reaction are signalized by **constant lighting up**.

7-segment display

In the status error the error numbers are shown in the display. Depending on the state of bit No. 16 in parameter **P135.1** (further information see parameter handbook **b maXX 5000**) all error messages (with/without error reaction) or warnings are displayed.

The display of an error code starts therewith, that „F“ is displayed for 1.5 s. Then the four characters of the error code are displayed. The separate characters are displayed for about 0.8 s, interrupted by a short break. If there are other errors, these are displayed in the same manner. The procedure is repeated as soon as all errors were displayed.

Example: Error 702 and 2418 are detected:

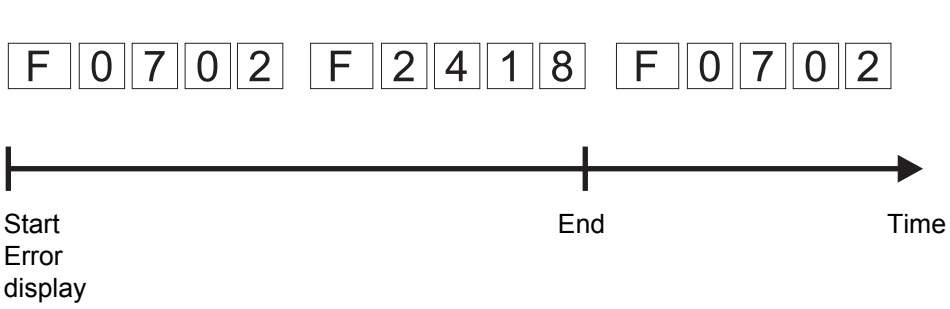


Figure 111: 7-segment display: errors and warnings

For further information on the subjects of error messages and error numbers, see „Parameter manual **b maXX 5000**„.

10.4 Error handling



NOTE!

The device is shipped with predefined error reactions. With regard to the error messages identified with „depending on the setting“ in the „Reaction“ column, the device's error reaction can be adjusted. Error messages that, due to safety reasons, have an immediate pulse inhibit as a consequence, may not be changed.

10.4.1 Error acknowledgment of BM50XX

If the red error LEDs H1 to H4 light up, then at least one error has been detected.

All error messages are reset by error acknowledgment. Individual acknowledgment of errors is not possible. An acknowledgment delete all errors, if deletion was possible on account of the error cause.

Errors can be acknowledged via the digital input X1:4.
Thereby a rising edge (low to high) is evaluated. The high level has to be applied at least 100 ms.

BM50XX-XXX0 For further information, see ▹Figure 70◃ on page 150 and ▹Figure 80◃ on page 164.

BM50XX-XXX1 For further information, see ▹Figure 71◃ on page 151 and ▹Figure 80◃ on page 164.



NOTE!

When using devices **BM5XXX-XXX1** all error messages can be reset with

Power supply off ⇒ Power supply on additionally.

10.4.2 Error acknowledgment of BM51XX and BM53XX

If the red error LEDs H14 or H24 light up, at least one error has been detected.

All error messages are reset by error acknowledgment. Individual acknowledgment of errors is not possible. An acknowledgment delete all errors, if deletion was possible on account of the error cause.

There are three methods of acknowledging an error:

- By means of write access to the control word
- Via a digital input
- Via the pulse enable input:
  - BM51XX
    The pulse enable input of the BM51XX is linked to an additional option therefore it is not possible to quit errors via the pulse enable input on the active mains rectifier.
  - BM53XX
    This is conditional upon the drive only being controlled via the hardware inputs (thus, the control of the motor is not handled via another communications channel). Furthermore, the option „Error acknowledgment by means of pulse enable“ must be activated. The errors are acknowledged with the first rising signal edge of the pulse enable. However, the drive has still not started. A second rising signal edge is then necessary for the release.

For further information on the subject of error acknowledgment, see „Parameter manual **b maXX** 5000".

11

ACCESSORIES AND SPARE PARTS

Accessories/spare parts for devices of the **b maXX** series are listed in this appendix. Product management is happy to handle any queries and suggestions on accessory parts.

11.1 Cabling

11.1.1 Device - mains cabling

Device	Cross-section [1)]	Maximum length [2)]	Connection to device [3)]
BM5**03**X	4 x 4 to 25 mm²	Power supply to mains filter: user-defined	Flexible cable with wire end ferrule (screw terminal)
BM5**04**X BM5**17**X	4 x 16 to 50 mm² (AWG 6 - 0)	Line filter to power choke / device: EMC-compatible	Flexible cable with cable lug (current bars)
BM5**07**X BM5**19**X			

1) Possible cross-section.
For UL-compliant machines/systems, UL-certified cabling must be used.

2) The length of the cable between the mains filter and mains supply is irrelevant to adhering to the EMC directive.

3) The type of routing is user-defined.

11.1.2 Cable device - motor



NOTE

BM50XX
The total parasitic cable capacitance wire/shielding of the motor cables within the system must not exceed 30 nF. Additional measurements have to be taken (e.g. the use of DC link filters) in case of cable capacitances higher than 30 nF.

BM51XX
The length of all motor cables within the system must not exceed 100 m.

Device	Cross-section [1]	Maximum length [2] [3]	Connection to device
BM5**32**X	4 x (0.2 to 6 mm²) (AWG 24 -10)	Dependent on the cross-section used: 4 x 1.5 to 2.5 mm² (AWG 16 -12): 100 m 4 x 4 to 25 mm² (AWG 10 -3): 60 m 4 x 35 mm² (AWG 1): 50 m ≥ 4 x 50 mm² (AWG 1/0): 15 m	Motor connector Flexible cable with wire end ferrule
BM5**33**X	4 x (4 to 16 mm²) (AWG 20 - 4)		Flexible cable with wire end ferrule (clamp terminal)
			Flexible cable with/without wire end ferrule (clamp terminal)
BM5**37**X	4 x (16 to 50 mm²) (AWG 6 - 0)		Cable lug max. width: 20 mm

[1] Possible cross-section.
Use a shielded Baumüller cable, optical shield covering > 85%, no single-wires.
For UL-compliant machines/systems, UL-certified cabling must be used.

[2] Only using Baumüller cables with this maximum length and Baumüller mains filters, it can be assumed that the threshold limit value of the EMC product standard EN 61800-3 is complied with.
Available Baumüller cables see Baumüller motor documentation.

[3] If n parallel-routed motor cabling is used, then the maximum length must be reduced by a factor of 1/n.

11.1.3 Hybrid cable device-encoder-motor

Selection

The trailing cables are suitable for mobile deployment, for example in mobile cable handlers. In addition, the cable sheath can be used in environments with acids and bases (e.g. coolant).

The encoder wires for HIPERFACE DSL® encoders are connected with the device.

Cables

pre-assembled - trailing type; CE UL/CSA, Halogen-free, Silicone-free, FCKW-free, RoHS compliant, additional lengths upon request.

Length	Hybrid cable motor HIPERFACE DSL®				
	15 A speedtec® M23	**20 A** speedtec® M23	**21 A** speedtec® M40	**28 A** speedtec® M40	**36 A** speedtec® M40
	Part No.				
3 m	464201	464217	464235	464278	464294
5 m	464202	464218	464236	464279	464295
7 m	464203	464219	464237	464280	464296
10 m	464204	464220	464238	464281	464297
15 m	464205	464221	464239	464282	464298
20 m	464206	464222	464240	464283	464299
25 m	464207	464223	464241	464284	464300
30 m	464208	464224	464242	464285	464301
35 m	464209	464225	464243	464286	464302
40 m	464210	464226	464244	464287	464303
50 m	464211	464227	464245	464288	464304
60 m	464212	464228	464246	464289	464305

- **Motor cable with HIPERFACE DSL® 15 A**

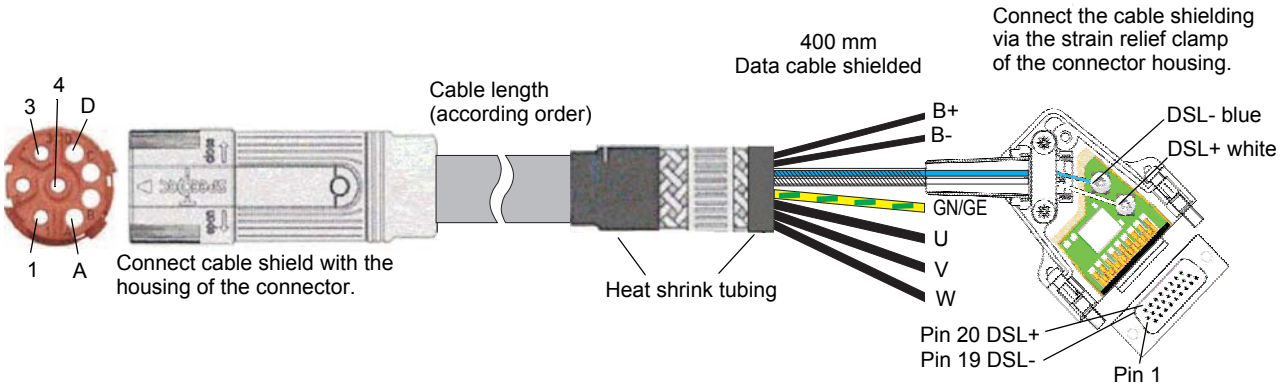
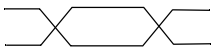
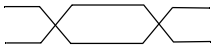


Figure 112: Motor cable with HIPERFACE DSL® 15 A

Cable: 4G1.5+(2x0,75)+(2x22AWG)
Shielding: copper wires, tinned

Motor side:
Circular metal connector speedtec® M23 8-pin
Connect outside shielding and inside shielding with the connector housing.

Device side:
Metal D-sub connector 45°, 26-pin with electronics, part No. 460219
Connect inside shielding with the connector housing.

Circular connector speedtec® M23	Type of stranding	Unconnected wires	Cross section of wire
1	————————	U	1.5 mm² / black / U
3	————————	V	1.5 mm² / black / V
4	————————	W	1.5 mm² / black / W
⏚	————————	GN/GE	1.5 mm² / green-yellow
A		B+	0.75 mm² / black
B		B-	0.75 mm² / black
C		-	22 AWG / white
D		-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 20 A**

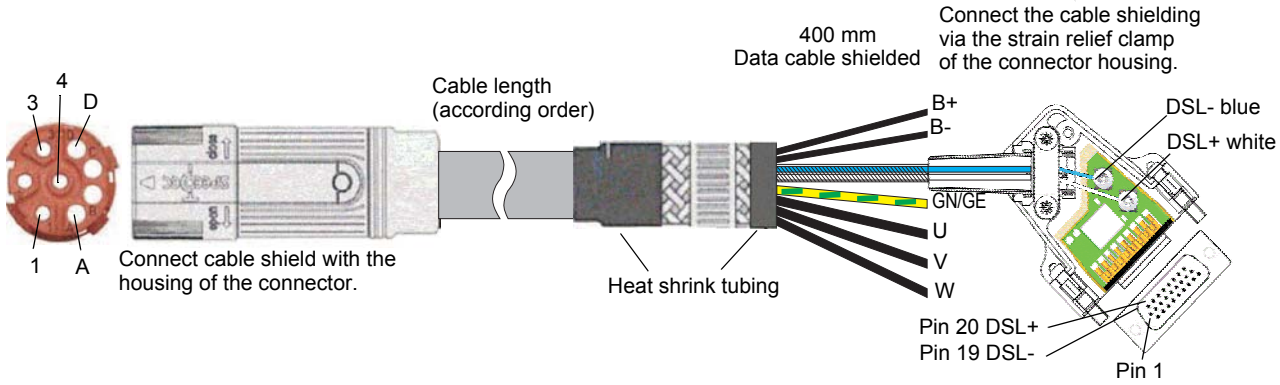
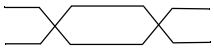
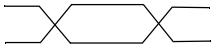


Figure 113: Motor cable with HIPERFACE DSL® 20 A

Cable: 4G2.5+(2x1.0)+(2x22AWG)
Shielding: copper wires, tinned

Motor side:
Circular metal connector speedtec® M23 8-pin
Connect outside shielding and inside shielding with the connector housing.

Device side:
Metal D-sub connector 45°, 26-pin with electronics, part No. 460219
Connect inside shielding with the connector housing.

Circular connector speedtec® M23	Type of stranding	Unconnected wires	Cross section of wire
1	———————	U	2.5 mm² / black / U
3	———————	V	2.5 mm² / black / V
4	———————	W	2.5 mm² / black / W
⏚	———————	GN/GE	2.5 mm² / green-yellow
A		B+	1.0 mm² / black
B		B-	1.0 mm² / black
C		-	22 AWG / white
D		-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 21 A**

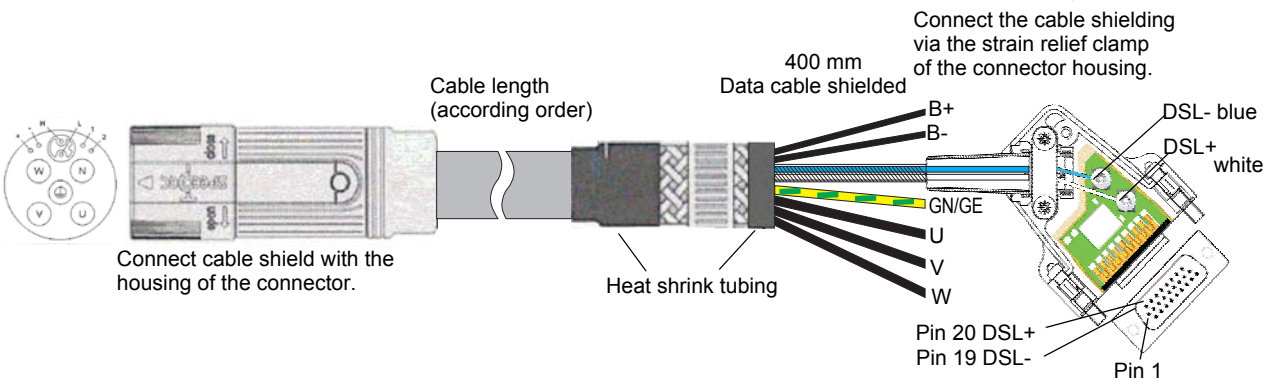
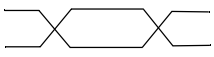
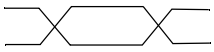


Figure 114: Motor cable with HIPERFACE DSL® 21 A

Cable: 4G2,5+(2x1.0)+(2x22AWG)
Shielding: copper wires, tinned

Motor side:
Circular metal connector speedtec® M40 9-pin
Outside shielding and inside shielding must be wired separately.

Device side:
Metal D-sub connector 45°, 26-pin with electronics, part No. 460219
Connect inside shielding with the connector housing.

Circular connector speedtec® M40	Type of stranding	Unconnected wires	Cross section of wire
U	———————————	U	2.5 mm² / black / U
V	———————————	V	2.5 mm² / black / V
W	———————————	W	2.5 mm² / black / W
⏚	———————————	GN/GE	2.5 mm² / green-yellow
+		B+	1.0 mm² / black
-		B-	1.0 mm² / black
H		DSL+	22 AWG / white
L		DSL-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 28 A**

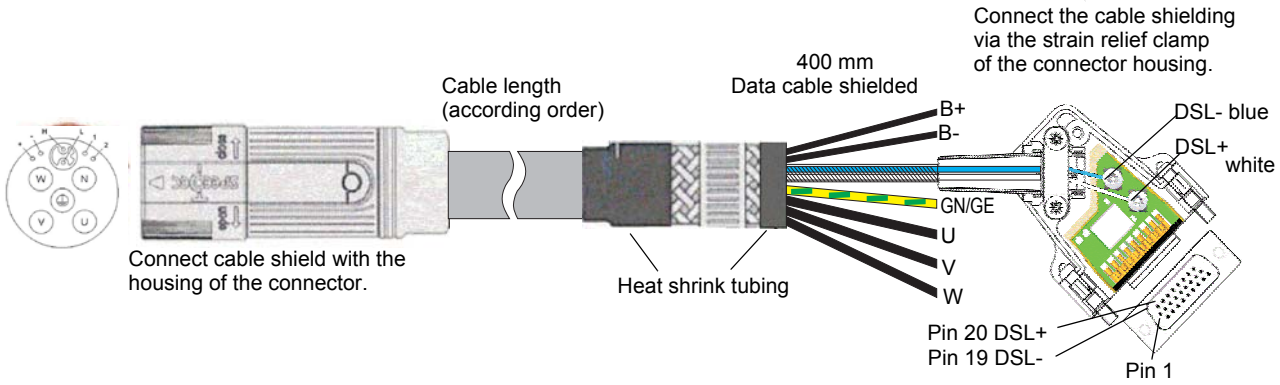
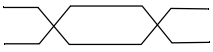
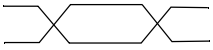


Figure 115: Motor cable with HIPERFACE DSL® 28 A

Cable: 4G4.0+(2x1.0)+(2x22AWG)
Shielding: copper wires, tinned

Motor side:
Circular metal connector speedtec® M40 9-pin
Outside shielding and inside shielding must be wired separately.

Device side:
Metal D-sub connector 45°, 26-pin with electronics, part No. 460219
Connect inside shielding with the connector housing.

Circular connector speedtec® M40	Type of stranding	Unconnected wires	Cross section of wire
U	———————	U	4 mm² / black / U
V	———————	V	4 mm² / black / V
W	———————	W	4 mm² / black / W
⏚	———————	GN/GE	4 mm² / green-yellow
+		B+	1.0 mm² / black
-		B-	1.0 mm² / black
H		DSL+	22 AWG / white
L		DSL-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 36 A**

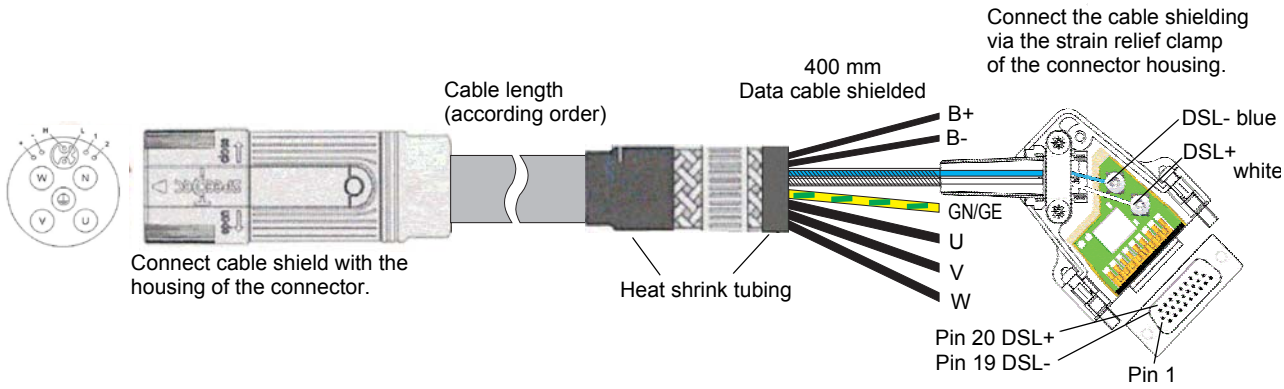
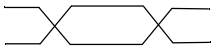
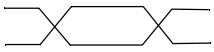


Figure 116: Motor cable with HIPERFACE DSL® 36 A

Cable: 4G6.0+(2x1.0)+(2x22AWG)
Shielding: copper wires, tinned

Motor side:
Circular metal connector-pin speedtec® M40 9-pin
Outside shielding and inside shielding must be wired separately.

Device side:
Metal D-sub connector 45°, 26-pin with electronics, part No. 460219
Connect inside shielding with the connector housing.

Circular connector speedtec® M40	Type of stranding	Unconnected wires	Cross section of wire
U	———————————	U	6 mm² / black / U
V	———————————	V	6 mm² / black / V
W	———————————	W	6 mm² / black / W
⏚	———————————	GN/GE	6 mm² / green-yellow
+		B+	1.0 mm² / black
-		B-	1.0 mm² / black
H		DSL+	22 AWG / white
L		DSL-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

11.1.4 Control voltage supply/signal cable

Cross-section [1]	≤ 1.5 mm²
Maximum length (without digital I/O) [2]	User-defined
Maximum length with digital I/O	30 m
Connection to device	Without/with wire end ferrule (clamp terminal)

[1] The type of routing is user-defined.

[2] The length of the cable has no influence on adherence to the EMC law.

11.1.5 Signal bus cable

Type	Length	Part number
Signal bus cable, 10-pin BM5X2X	50 mm	426781
Signal bus cable, 10-pin BM5X3X	75 mm	426782
Signal bus cable, 10-pin BM5X4X	100 mm	426783
Signal bus cable, 10-pin BM5X7X	220 mm	481585
Signal bus cable, 10-pin BM5X9X	470 mm	481586

(Max. permissible number of axis units for the signal bus: 12)

11.1.6 EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, Modbus® cable

- Available Ethernet connecting cables:
  type: patch cable, STP

Type	Length [m]	Part number
K-ETH-33-0-0.5	0.5	325160
K-ETH-33-0-01	1	325161
K-ETH-33-0-02	2	325162
K-ETH-33-0-03	3	325163
K-ETH-33-0-04	4	325317
K-ETH-33-0-05	5	325164
K-ETH-33-0-10	10	325165

Additional lengths upon request

11.1.7 Accessories - CANopen®

- **CANopen®-connection cables**:

Type	Model	Length [m]	Part No.
BM4-CAN-K-31-01	RJ45-connector, male sub D connector	1	346568
BM4-CAN-K-31-02		2	on request
BM4-CAN-K-31-03		3	346571
BM4-CAN-K-31-05 / 10		5 / 10	on request
BM4-CAN-K-32-01	RJ45-connector, sub D female	1	346572
BM4-CAN-K-32-02		2	on request
BM4-CAN-K-32-03		3	346573
BM4-CAN-K-32-05 / 10		5	on request
BM4-CAN-K-33-01	RJ45-connector, RJ45-connector	1	346577
BM4-CAN-K-33-02		2	on request
BM4-CAN-K-33-03		3	on request
BM4-CAN-K-33-05		5	on request
BM4-CAN-K-33-10		10	on request

- **Terminated connector RJ45**
  (Termination connector CAN, RJ45 with pin assignment according to CIA-standard, 120 Ω, 0.25 W)

Type	Part No.
BM4-CAN-T01	346408

11.1.8 Service interface cable

Type	Length [m]	Part number
BM5-K-USB-018	1.8	430279

PC side interface	USB 2.0
Driver installation	is done with the installation of ProDrive

11.1.9 Encoder cables

Selection of the encoder cables

The trailing cables are suitable for mobile deployment, for example in mobile cable handlers. In addition, the cable sheath can be used in environments with acids and bases (e.g. coolant).

With servo motors using the Resolver encoder system, the temperature sensor is connected to the device via the encoder cable. Additional technical data, connector assignments, application notes and Part numbers can be found in the motor documentation.

Cables

pre-assembled - trailing type; CE UL/CSA, Halogen-free, according to IEC 60754-1, Silicone-free, FCKW-free, RoHS compliant, additional lengths upon request.

	Resolver		**Encoder with HIPERFACE®**		**Sine-/square wave incremental encoder**	
	Part No.		Part No.		Part No.	
Length		speedtec®		speedtec®		speedtec®
1 m	429914	448746	429958	448761	430015	448777
2 m	429915	448747	429959	448762	430016	448778
3 m	429916	448748	429960	448763	430017	448779
5 m	429917	448749	429961	448764	430018	448780
7 m	429918	448750	429962	448765	430019	448781
10 m	429919	448751	429963	448766	430020	448782
15 m	429920	448752	429964	448767	430021	448783
20 m	429921	448753	429965	448768	430022	448784
25 m	429922	448754	429966	448769	430023	448785
30 m	429923	448755	429967	448770	430024	448786
35 m	429924	448756	429968	448772	430025	448787
40 m	429925	448757	429969	448773	430026	448788
50 m	429926	448758	429970	448774	430027	448789
75 m	429927	448759	429971	448775	430028	448790

Length	Encoder with EnDat®/SSI		Encoder with EnDat® 2.2		Encoder with HIPERFACE DSL®	
	Part No.		Part No.		see ▹Hybrid cable device-encoder-motor◃ on page 259	
		speedtec®	M12	speedtec® M23		
1 m	429986	448796	458805	465906		
2 m	429987	448797	458806	465907		
3 m	429988	448798	458807	465908		
5 m	429989	448799	458808	465909		
7 m	429990	448800	458809	465910		
10 m	429991	448801	458810	465911		
15 m	429992	448802	458811	465912		
20 m	429993	448803	458812	465913		
25 m	429994	448804	458813	465914		
30 m	429995	448805	458814	465915		
35 m	429996	448806	458815	465916		
40 m	429997	448807	458816	465917		
50 m	429998	448808	458817	465918		
75 m	429999	448809	458818	465919		

11.1.9.1 Connecting cable for Resolver

The connecting cable is available as accessory part from Baumüller Nürnberg GmbH.

Follow the instructions below if a self-made cable is to be used:

1 Utilize the following materials:

- Cable: Li9YC 1x2x0.25-Li9Y 2x2x0,25-Li9Y C11Y 1x2x0.34GN.
- High-density D-sub connector: 26-pin, male
- Round connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

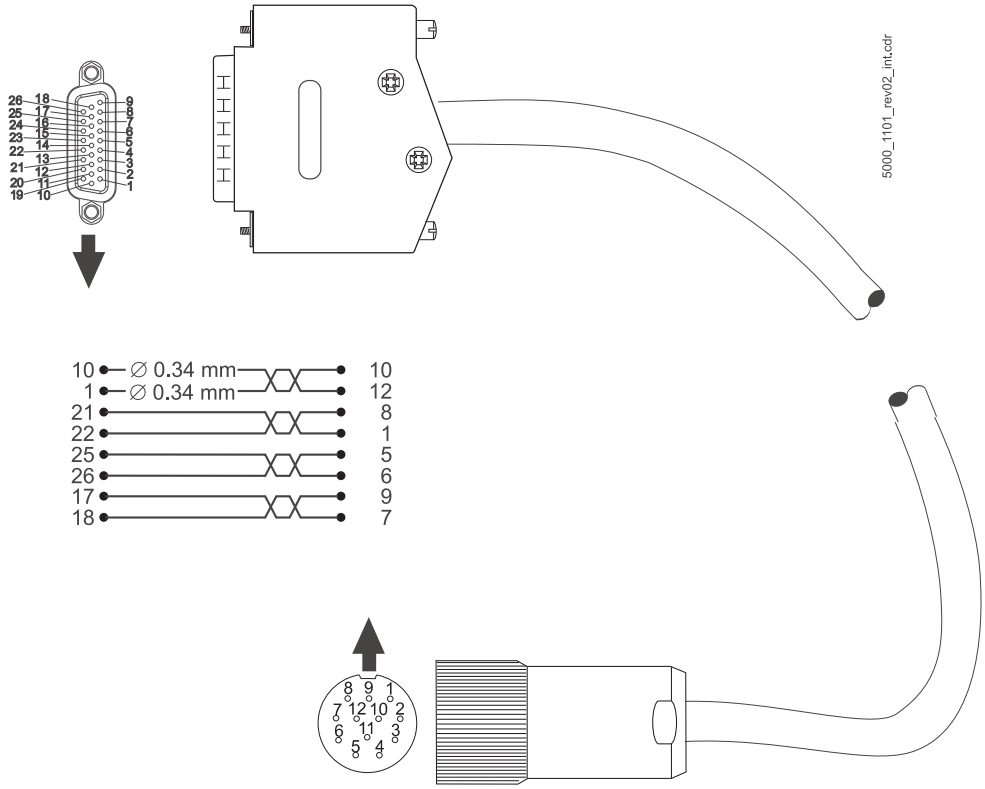


Figure 117: Connecting cable for resolver

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not operable and could lead to defects, both in the encoder module and the encoder!

11.1.9.2 Connecting cable for encoder with HIPERFACE®

The connecting cable is available as accessory part from Baumüller Nürnberg GmbH.

Follow the instructions below if a self-made cable is to be used:

1 Utilize the following materials:

- Cable: Li9YC3x2x0.25-Li9Y3x2x0,25-Li9Y C11Y 1x2x0.34GN. Two cable pairs are not needed and also not connected.
- High-density D-sub connector: 26-pin, male
- Round connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

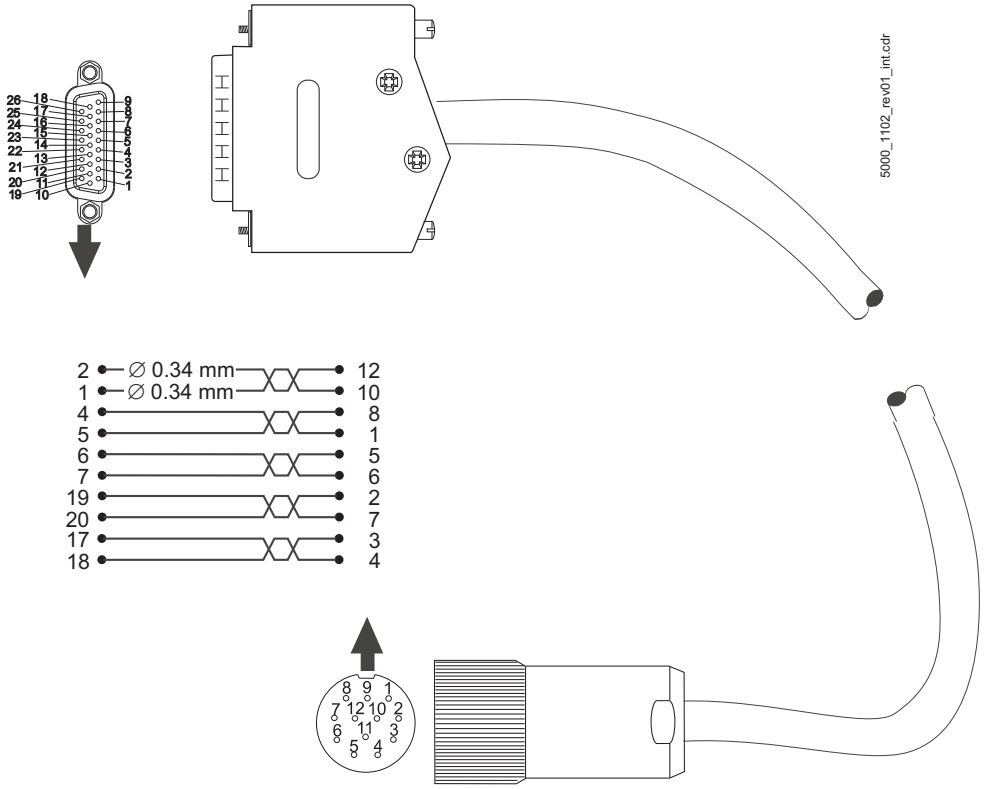


Figure 118: Connecting cable for encoder with HIPERFACE®

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not operable and could lead to defects, both in the encoder module and the encoder!

11.1.9.3 Connecting cable for encoder with EnDat® or SSI

The connecting cable is available as accessory part from Baumüller Nürnberg GmbH.

Follow the instructions below if a self-made cable is to be used:

1 Utilize the following materials:
- Cable: Li9YC3x2x0.25-Li9Y3x2x0,25-Li9Y C11Y 1x2x0.34GN. Two cable pairs are not needed and also not connected.
- High-density D-sub connector: 26-pin, male
- Round connector: 17-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

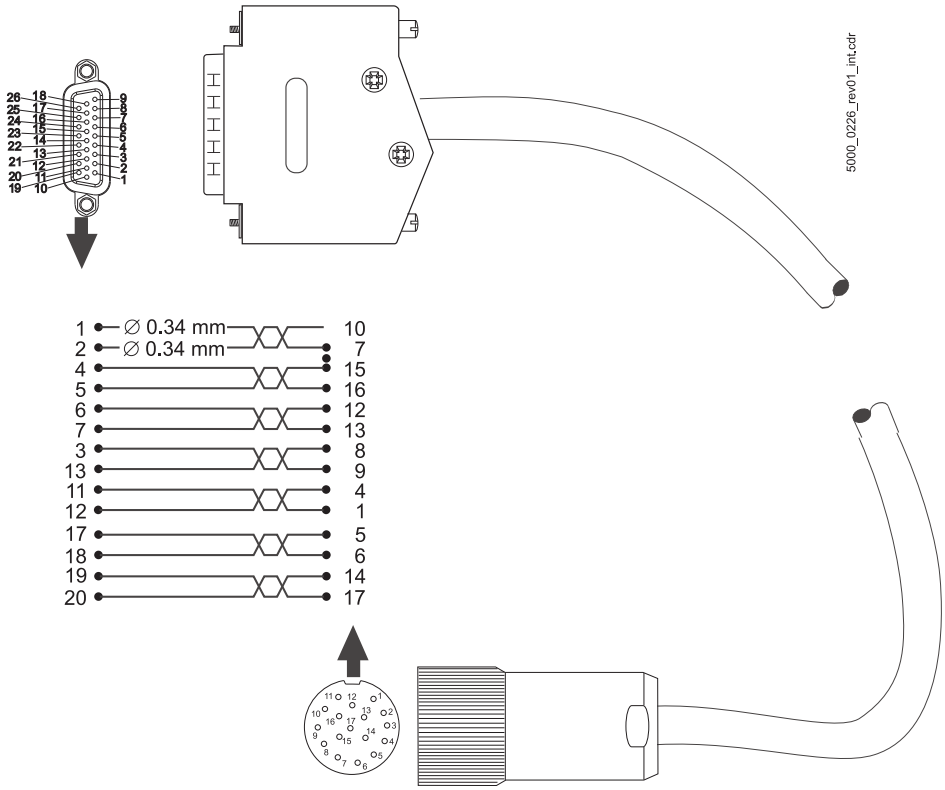


Figure 119: Connecting cable for encoder with EnDat® or SSI

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not functionally operable and could lead to defects, both in the encoder module and the encoder!

11.1.9.4 Connecting cable for encoder with EnDat® 2.2

The connecting cable is available as accessory part with M12 or speedtec® M23 from Baumüller Nürnberg GmbH.

M12

Follow the instructions below if a self-made cable with M12 is to be used:

1 Utilize the following materials:

- Cable: 4x0,38 + 1x(4x0,14)
- High-density D-sub connector: 26-pin, male
- Round connector: 8-pin M12, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

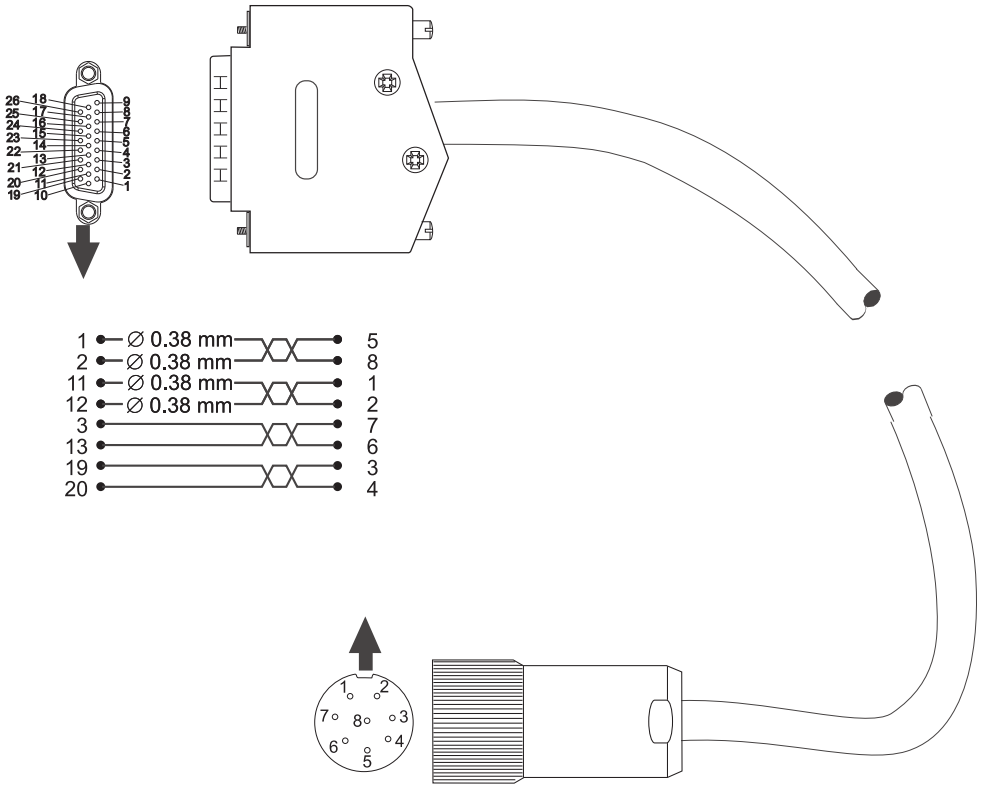


Figure 120: Connecting cable for encoder with EnDat® 2.2 M12

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not functionally operable and could lead to defects, both in the encoder module and the encoder!

speedtec® M23

Follow the instructions below if a self-made cable with speedtec® M23 is to be used:

1 Utilize the following materials:

- Cable: 4x0,38 + 1x(4x0,14)
- High-density D-sub connector: 26-pin, male
- Round connector: 9-pin speedtec® M23, female (Intercontec)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

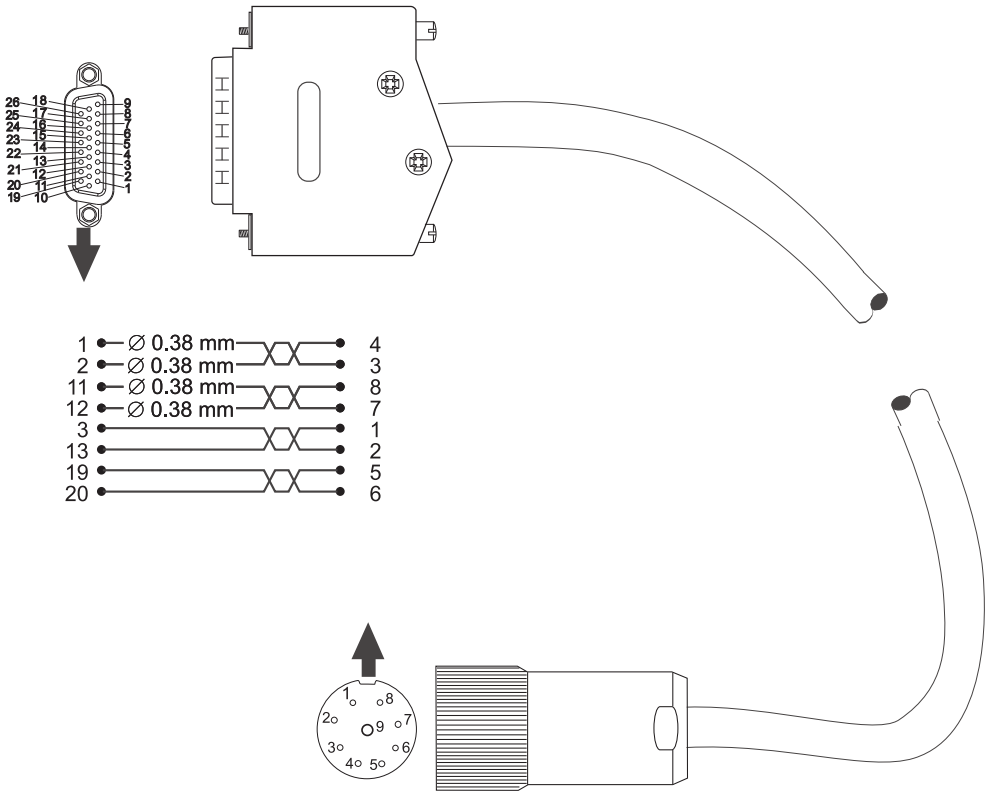


Figure 121: Connecting cable for encoder with EnDat® 2.2 speedtec® M23

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not functionally operable and could lead to defects, both in the encoder module and the encoder!

11.1.9.5 Connecting cable for sine/square-wave incremental encoder

The connecting cable is available as accessory part from Baumüller Nürnberg GmbH.

Follow the instructions below if a self-made cable is to be used:

1 Utilize the following materials:

- Cable: Li9YC3x2x0.25-Li9Y3x2x0,25-Li9Y C11Y 1x2x0.34GN. Two cable pairs are not needed and also not connected.
- High-density D-sub connector: 26-pin, male
- Round connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the round connector and with the shielding of the D-sub connector.

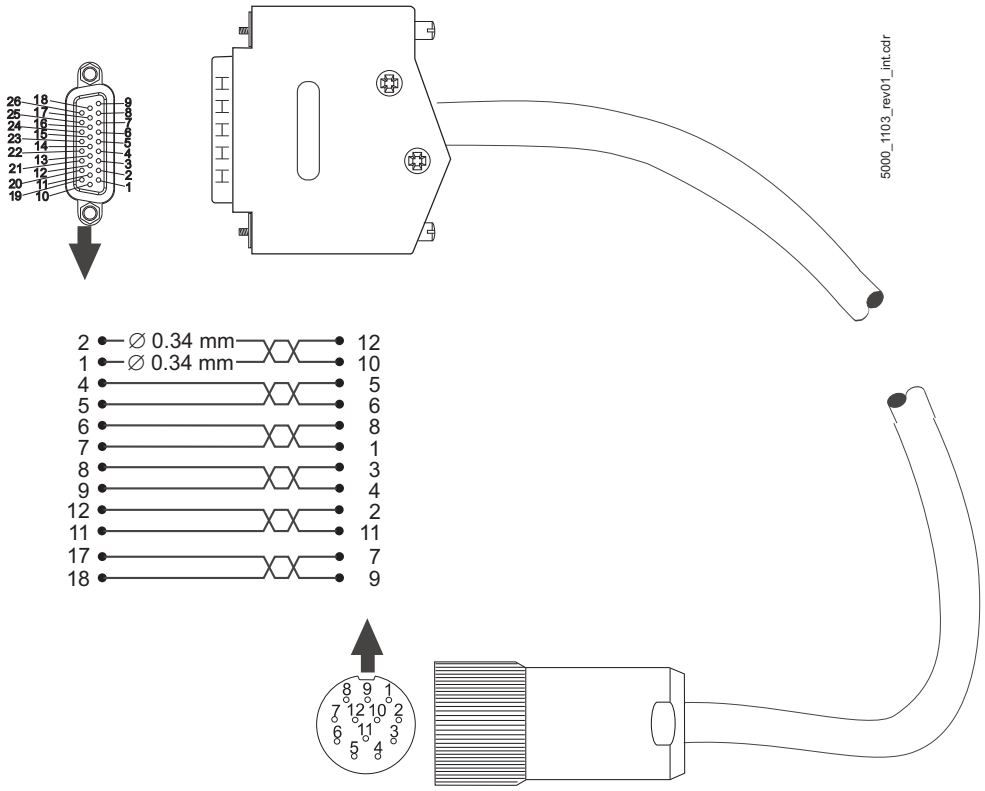


Figure 122: Connecting cable for sine/square wave incremental encoder

NOTE

The connecting cable must be made according to the figure shown above!
If there is a different pin assignment, the cable is not functionally operable and could lead to defects, both in the encoder module and the encoder!

11.1.10 Connection cable add-on modules

IEE

The connection cable is not offered by Baumüller and must be made by the user:

1 Use the following materials:

- Cable: LiYCY 3 x (2 x 0.14 mm²) + 2 x 0,34 mm² Cu braiding.
- D-sub connector: 9-pin, female (IEE side)
- E.g. D-sub connector: 26-pin, male (**b maXX 5000** side)
- Cables must be of twisted pair wire (track -0/0, -A/A, -B/B) from incremental encoder emulation to further master control systems

2 Connect

- the cable shield with the connector shell of the D-sub male/D-sub female connector
- the 9-pin female connector (IEE side) with the cable
- e.g. the 26-pin D-sub male connector (**b maXX 5000** side, pin assignment see ▹Connecting cable for sine/square-wave incremental encoder◃ on page 274) with the other cable ending.

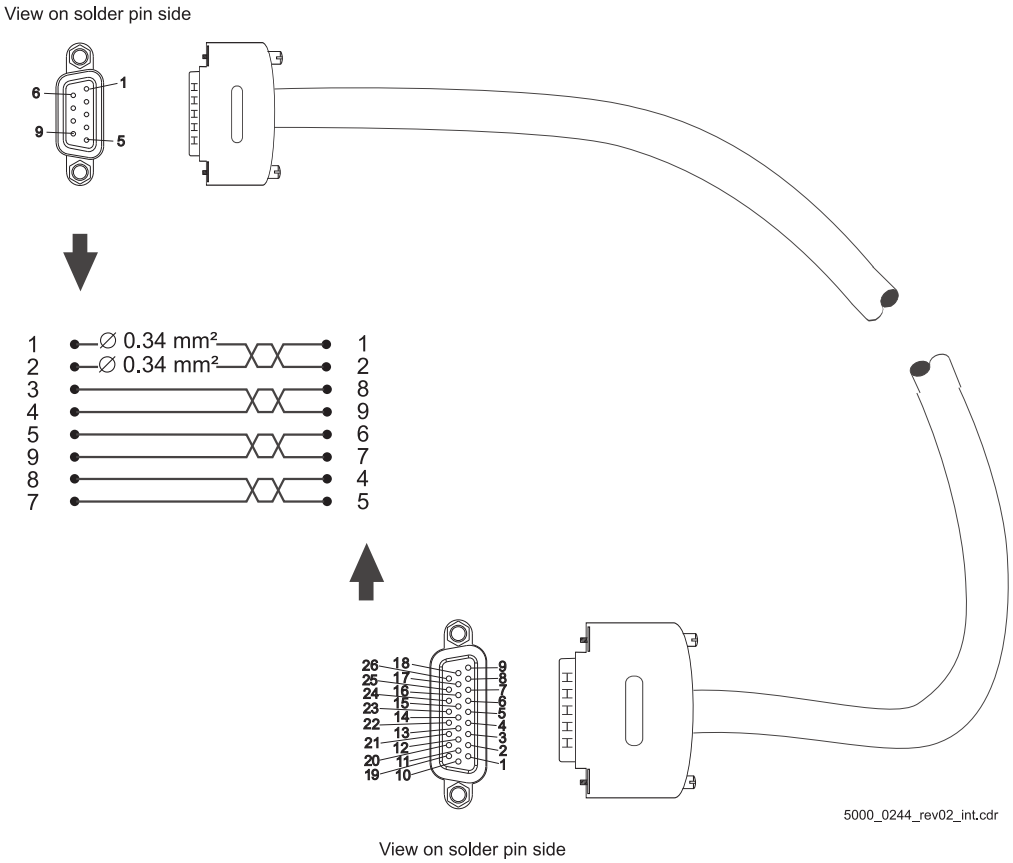


Figure 123: Connection cable IEE with **b maXX 5000**

NOTE!

The connection cable must be made according above mentioned instruction, pin assignment IEE see ▹Add-on modules◃ on page 190!
The cable is inoperable with changed assignment of the pins!

SIE

The connection cable is not offered by Baumüller and must be made by the user:

1 Use the following materials:

- Cable: LiYCY 2 x (2 x 0.14 mm²) + 1x0.34 mm² Cu braiding.
- D-sub connector: 9-pin, female (SIE side)
- E.g. D-sub connector: 26-pin, male (**b maXX 5000** side)
- Cables must be of twisted pair wire (DAT+/DAT-, CLK+/CLK-) from SSI encoder emulation to further master control systems

2 Connect

- the cable shield with the connector shell of the D-sub male/D-sub female connector
- the 9-pin female connector (SIE side) with the cable
- e.g. the 26-pin D-sub male connector (**b maXX 5000** side, pin assignment see ▹Connecting cable for sine/square-wave incremental encoder◃ on page 274) with the other cable ending.

NOTE!

On the SSI encoder emulation side data and clock cables (DATA+/DATA- and CLK+/CLK-) are terminated with 120 Ω. Additional termination resistors are required on the CNC side if this resistors are not provided by its manufacturer.

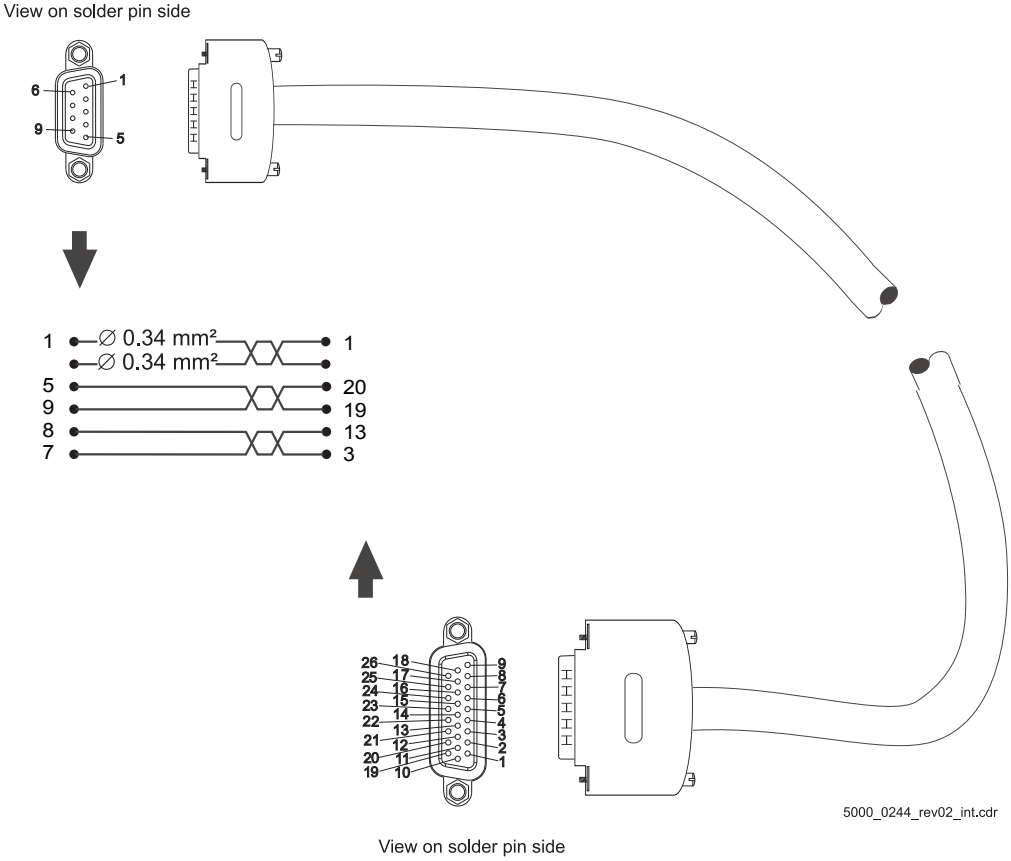


Figure 124: Connection cable IEE with **b maXX 5000**

11.2 Fuses

A distinction is made between protecting the power supply cables and protecting the device. To fulfill CE specifications – here in particular EN 60204-1 – fuse the power supply cables.



NOTE!

Approved, UL-listed safety fuses must be used in UL-authorized systems, refer to ▷UL notes◁ as from page 94.

Cable protection

Use safety fuses of the operating class gL VDE 0636-201 / DIN EN 60269-2-1 / HD 630.2.1 54 or circuit breaker triggering characteristic K, in accordance with VDE 0636-201 / DIN EN 60269-2-1 / HD 630.2.1 54, to protect the cable. These fuses protect against overloads and consequential damage from defects, for example as a result of fire. However, they cannot prevent a device from being extensively destroyed in case of a short-circuit or ground fault in the DC link.

Carry out the fusing in accordance with EN 60204-1 („Electrical Equipment of Machines“). Dimension the cable fuse based on the cross-section of the power supply cable used, and in accordance with the respective applicable national standards and local regulations.

The current-carrying capacity of the cables is specified in Table 5 of EN 60204-1. For your application, the corresponding value must still be determined based on the standard itself, i. e. taking into account the cable routing.



NOTE!

Use suitable fuses with the tripping characteristic gL or gR.



NOTE!

The BM50XX is protected in case of overload because the device limits the output current. This can be considered when dimensioning the cable protection fuses.

Protection of the devices

Use semiconductor fuses with the tripping characteristic aR (VDE 0636-201 / DIN EN 60269-2-1 / HD 630.2.1 54). In the event of a short circuit, these protect the mains rectifier unit circuit on the input side against complete destruction, in order that it is possible to repair the device.

Dimension suitable device protection fuses depending on peak current and the maximum load integral i^2t_{off}.

Device	Maximum load integral [1)]
BM5**030**	≤ 550 A²s
BM5**031** / BM5**032**	≤ 1000 A²s
BM5**043** / BM5**044**	≤ 9500 A²s
BM5**074** / BM5**075**	≤ 300 000 A²s
BM5**173** / BM5**174**	≤ 3000 A²s
BM5**19X**	≤ 88 000 A²s
BM5**3XX**	Fuses integrated in the DC link

1) Use fuses that fall below the specified cutoff integral (i^2t_{off}) **in the operating point**.

11.2.1 BM5030

- Semiconductor fuses aR (device), type NH (for CE only)

Siemens	3NC1 415: 15 A, 14x51	3NC1 420: 20 A, 14x51

- Class J fuses for UL applications

Bussmann	DFJ-15 c UL us	

11.2.2 BM5031, BM5032

- Semiconductor fuses aR, type NH (for CE only)

Bussmann	00	25A/1000V: 170M2674	32A/1000V: 170M2675
		40A/1000V: 170M2676	
	1	40A/660V: 170M3808	50A/660V: 170M3809
		63A/660V: 170M3810	
Ferraz Shawmut	000	25A/690V: 6.9 URD 000 PV 025	32A/690V: 6.9 URD 000 PV 032
		40A/690V: 6.9 URD 000 PV 040	50A/690V: 6.9 URD 000 PV 050
Siemens	00	40A/660V: 3NE8 702	
		3NC1 415: 25 A, 14x51 for BM5031	3NC1 415: 40 A, 14x51 for BM5031

Size ↑

- Class J fuses for UL applications

Bussmann	Class J: DFJ-25 c UL us for BM5031	Class J: DFJ-35 c UL us for BM5032

11.2.3 BM5043, BM5044

- Semiconductor fuses aR, type NH (for CE only

Bussmann	000	80A/690V: 170M1566	100A/690V: 170M1567
		125A/690V: 170M1568	
	00	80A/1000V: 170M2680	100A/1000V: 170M2681
	1	80A/690V: 170M3811	100A/690V: 170M3812
		125A/690V: 170M3813	160A/690V: 170M3814
SIBA	1	125A/690V: 2021120/125A	
Siemens	000	80A/690V: 3NE8 720-1	100A/690V: 3NE8 721-1
		125A/690V: 3NE8 722-1	
	00	80A/690V: 3NE8 020-1	100A/690V: 3NE8 021-1
		125A/690V: 3NE8 022-1	160A/690V: 3NE8 024-1
	0	80A/1000V: 3NE4 120	100A/1000V: 3NE4 121
		125A/1000V: 3NE4 122	
	1	100A/1000V: 3NE3 221	125A/1000V: 3NE3 222
		160A/1000V: 3NE3 224	
		80A/690V: 3NC2 280, 22x58 for BM5043	

Size ↑

- Class J fuses for UL applications

Bussmann	DFJ-80 for BM5043	DFJ-150 for BM5044

11.2.4 BM5074, BM5075

- General purpose fuses gR und gS, type NH (for CE only)

Bussmann	2	450A/690V: 170M5886	
	3	450A/690V: 170M6082	

Size ↑

- Semiconductor fuses aR, type NH (for CE only)

Bussmann	2	450A/66V: 170M5809	
Ferraz Shawmut	2	450A/690V: 6,9 URD 2 PV 0450	
	3	450A/690V: 6,9 URD 3 PV 0450	
Siemens	1	450A/1000V: 3NE3 233	

Size ↑

- Class J fuses for UL applications

Bussmann	DFJ-350 c UL us	

11.2.5 BM5173, BM5174

- Semiconductor fuses aR, type NH (for CE only)

Bussmann	1	100A/690V: 170M3812 c UL us	125A/690V: 170M3813 c UL us
		160A/690V: 170M3814 c UL us	
SIBA	1	100A/690V: 2021120/100A	125A/690V: 2021120/125A
		160A/690V: 2021120/160A	
Siemens	0	100A/1000V: 3NE4 121 c UL us	125A/1000V: 3NE4 122 c UL us
	1	100A/1000V: 3NE3 221 c UL us	125A/1000V: 3NE3 222 c UL us
		160A/1000V: 3NE3 224 c UL us	

Size ⟶

- Class J fuses for UL applications

Bussmann	DFJ-150 c UL us	

11.2.6 BM5192, BM5193

- General purpose fuses gR und gS, type NH (for CE only)

Bussmann	2	450A/690V: 170M5886 c UL us	
	3	450A/690V: 170M6082 c UL us	

Size ⟶

- Semiconductor fuses aR, type NH (for CE only)

Bussmann	2	450A/66V: 170M5809 c UL us	
Ferraz Shawmut	2	450A/690V: 6,9 URD 2 PV 0450	
	3	450A/690V: 6,9 URD 3 PV 0450	
Siemens	1	450A/1000V: 3NE3 233 c UL us	

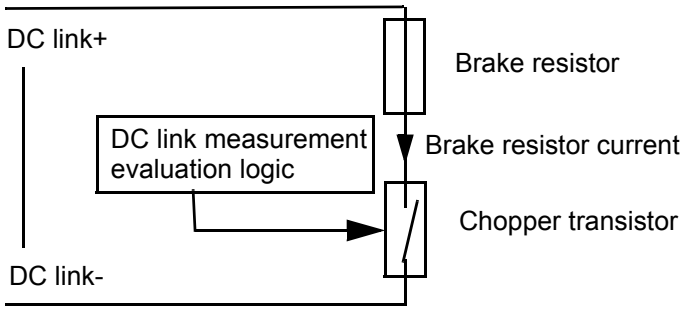
Size ⟶

- Class J fuses for UL applications

Bussmann	DFJ-350 c UL us	

11.3 Brake resistors

The minimum permissible resistance value $R_{min\ brake\ resistor}$ depends on the **b maXX** that is used.



$U_{DC\ link\ brake\ resistor\ on}$ = DC link voltage threshold for brake resistor on (approx. 780 V)

$I_{brake\ resistor}$ = continuous current of the chopper transistor

$P_{brake\ resisitor}$ = brake resistor power

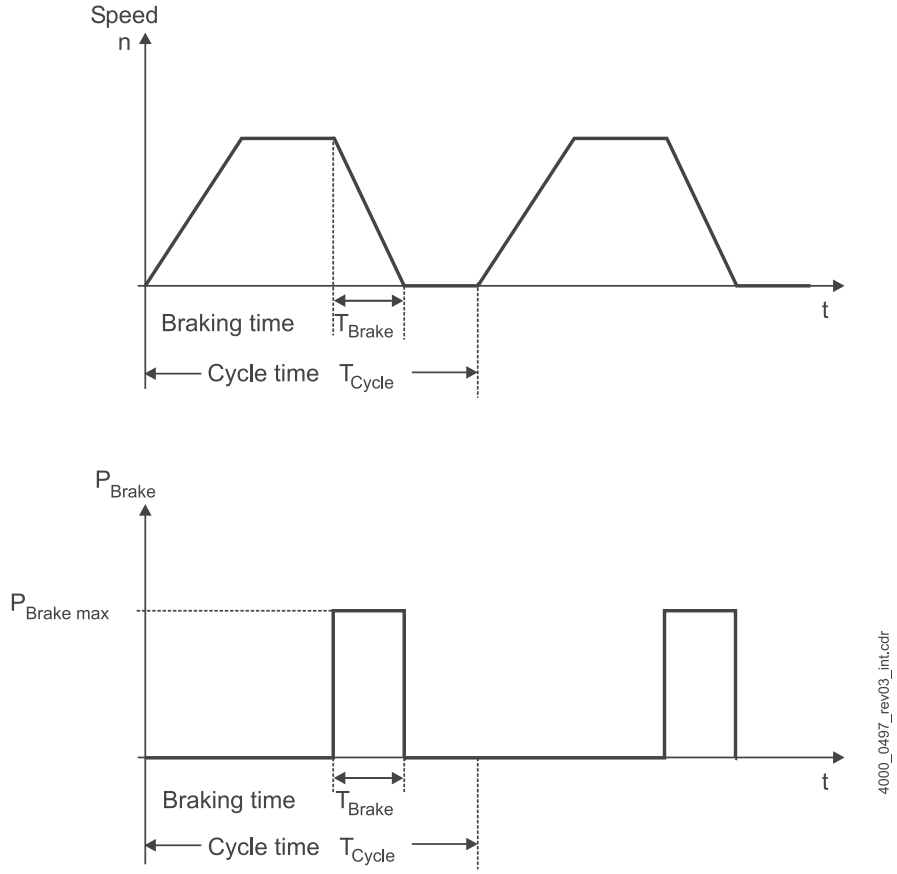
$I_{max\ brake\ resisitor}$ = maximum permissible brake resistor current of the device (see ▹Electrical data◃ as from page 60)

$$I_{brake\ resistor} = \frac{P_{brake\ resistor}}{U_{DClink\ chopper\ resistor\ on}}$$

$$R_{min\ brake\ resistor} = \frac{U_{DClink\ brake\ resisitor\ on}}{I_{max\ brake\ resisitor}}$$

Type	I_{eff} [A]	Typical motor output [kW]	Continuous brake resistor current [A]	Max. brake resistor power [kW]	Min. resistor value [Ω]
BM5031 / BM5032	-	-	23,5	18	33
BM5043 / BM5044	-	-	75	58	10,5
BM5074 / BM5075	-	-	250	200	3

The machine cycle of the application determines the further resistor data.



M_{Brake} = torque of the motor when braking

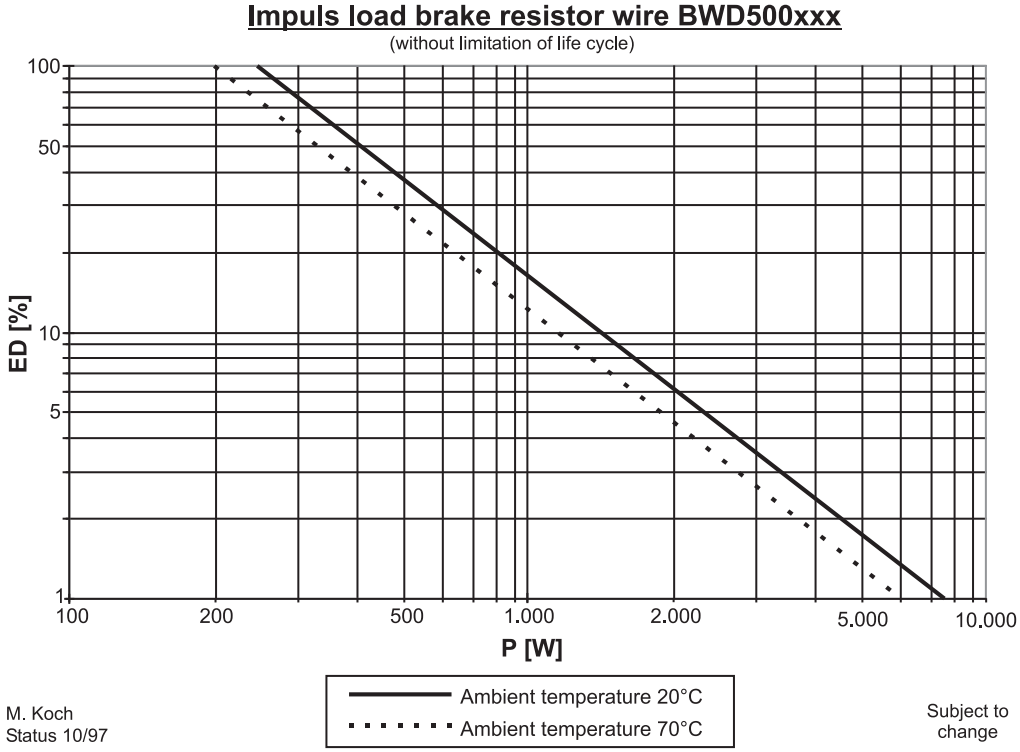
$$P_{Bake\ max.} = \frac{1}{2} \cdot n \cdot M_{Brake}$$ (calculation by means of drive profile)

$$P_{Brake\ rated} = P_{Brake\ max.} \cdot \frac{T_{Brake}}{T_{Cycle}}$$

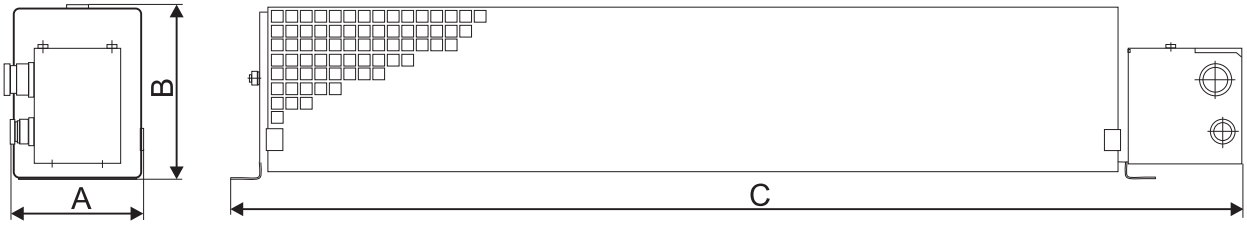
$$ED[\%] = \frac{T_{Brake}}{T_{Cycle}} \cdot 100\ \%$$

Verification of the required data by means of the resistance data sheet

- Rated output at 100% ED, e.g. 250 W
- Peak output at calculated ED, e.g. 500 W at 40% ED
- Verification of the braking time for the brake resistor usage, e.g. 30 s



11.3.1 Fixed tube resistors

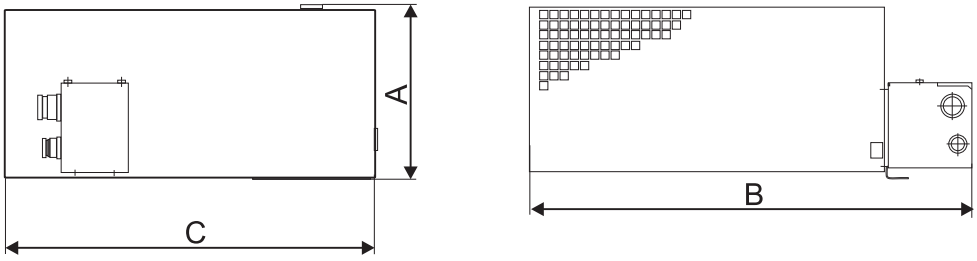


Protection class: IP 20

Approval: UL

Resistance value	Rated output	Dimensions A x B x C	Weight	Temperature switch	Electrical connection	Type	Part number
145 Ω	100 W	121 x 93 x 305	2 kg	210 °C	4 mm²	BMR -130-100-20	353220
145 Ω	200 W	121 x 93 x 405	2.5 kg	220 °C	4 mm²	BMR -130-200-20	353221
145 Ω	450 W	121 x 93 x 605	4.5 kg	240 °C	4 mm²	BMR -130-450-20	353222
95 Ω	700 W	121 x 93 x 705	5.5 kg	260 °C	4 mm²	BMR -86-700-20	353223
73 Ω	930 W	130 x 185 x 505	8.8 kg	260 °C	4 mm²	BMR -65-930-20	353224
50 Ω	1400 W	130 x 182 x 710	10.8 kg	260 °C	4 mm²	BMR -44-1400-20	353225

11.3.2 Fixed frame resistors



Protection class: IP 20

Approval: UL

Resis-tance value	Rated output	Dimensions A x B x C	Weight	Temperature switch	Electrical connection	Type	Part number
25 Ω	2800 W	171 x 430 x 550	10 kg	120 °C	4 mm²	BMR -22-2800-20	353226
18 Ω	3900 W	180 x 445 x 490	10 kg	120 °C	10 mm²	BMR -16-3900-20	353227

11.4 Line filters

Block diagram of filter for mains applications (simplified)

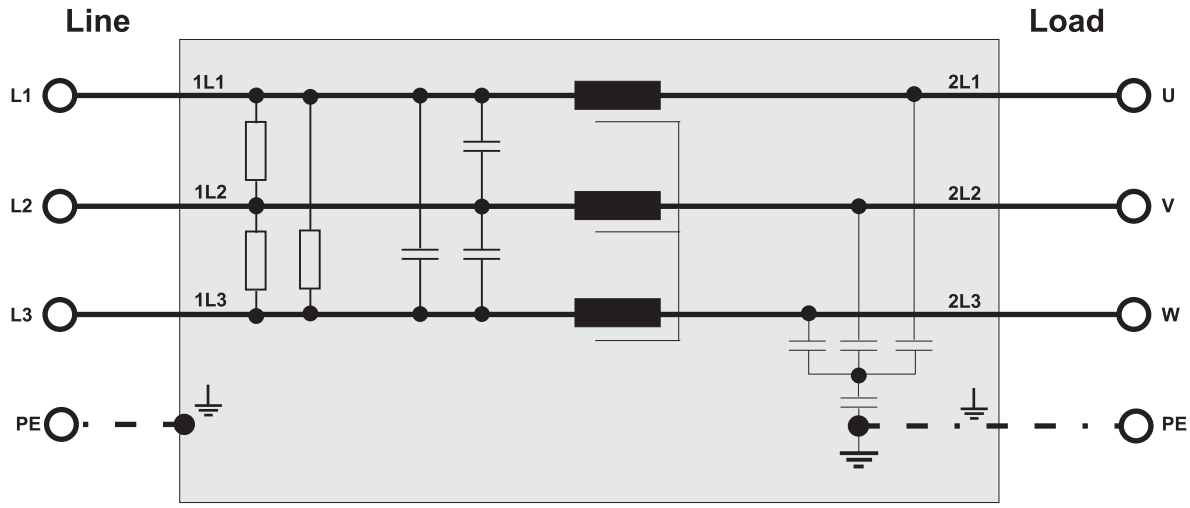


Figure 125: Block diagram

11.4.1 Baumüller mains filter type code

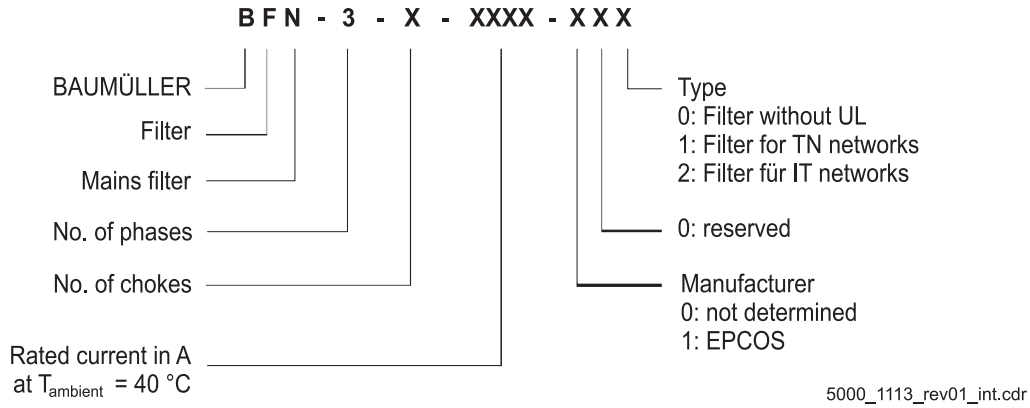


Figure 126: Line filter type code

11.4.2 Selection of the mains filter

IT systems



NOTE!
EMC limit values are not defined for transient emission in power systems without grounded star point (IT system). A fault state (motor ground fault) can lead to the damage of the mains filter.

It is not recommended to use mains filter in IT systems. The transient emission can exceed the limit values of category C3.

TN systems Based on the application, use an mains filter from the following table.

$I_{rated\ AC}$ at		Type	Part number	Use with devices operation at rated power [1]	Use with devices operation at cyclic overload [1]
40°C	50°C				
17.5 A	16 A	BFN 3-1 - 0016 - 001	314278	BM5031	
32.9 A	30 A	BFN 3-1 - 0030 - 001	314279	BM5032	
82.2 A	75 A	BFN 3-1 - 0075 - 001	314282	BM5043	
100 A	100 A	BFN 3-1 - 0100 - 001	314283		BM5043
142.4 A	130 A	BFN 3-1 - 0130 - 001	314284	BM5044	
	250 A	BFN-3-1 - 0250 - 001	373891	BM5074	
	320 A	BFN 3-1 - 0320 - 001	439384	BM5075	
87 A	80 A	Schaffner FN 3120H-80-35		BM5173	
150 A	150 A	EPCOS B84143A0150R410	437618	BM5174	
295 A		LGF FFU 3x295AB-SBM	463278	BM519X	

[1] With lower output at continuous operation, filters with lower rated currents can be used too. Filters with higher rated currents are necessary in case of using the overload capacity of the mains inverters cyclically. If over-current is only needed one-time and non-recurrently (once per hour, for a maximum of 60 s), then the filters suggested for operation at the rated power are sufficient.

Required mains filter surrounding conditions

Transport temperature range	-30 °C to +70 °C
Transport climate class (K)	2 K 3 [1)]
Storage temperature range	-30 °C to +70 °C
Storage climate class	1 K 4 [5)]
Operating environment	Outside of residential areas [2)]
Operating temperature range T_B [3)]	Min. 5 °C to max. 55 °C Derating of the rated current as of 40 °C by 1.4% / °C
Operating climate class	3 K 3 [6)]
Installation altitude	Up to 2000 m above MSL Derating of the rated current as of 1000 m by 3% / 100 m
Relative humidity (operating)	5% to 85% non-condensed [6)]
Ionizing and non-ionized radiation	< Measurable range
Vibration, shock and continuous shock	Drop height (packaged) max. 25 cm [4)]
Drop height (packaged)	Max. 25 cm
Degree of contamination	2
Environmental conditions (EN 60721-3-3)	3 K 3, 3 B 1, 3 C 3 except for salt spray, 3 S 2, 3 M 3

1) EN 60721-3-2

2) If used in residential areas, high-frequency interference must be expected (EN 61800-3, 6.4.2.1)

3) Rated temperature = 40 °C

4) EN 61800-2, Chapter 4.3.3

5) EN 60721-3-1

6) EN 60721-3-3

Electrical data of the mains filter



NOTE!

The rated current of the filters that are used must be larger than or have same RMS-value as the actual mains current (actual mains current = RMS-value of the mains current during the entire cycle time of the drive). During short-time operation (S3), the RMS-value is calculated as follows:

$$I_{rms} = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$



DANGER!

Risk of fatal injury due to high leakage current!

The cross-section of the protective ground conductor must be at least 10 mm² (EN 61800-5-1, Chapter 4.3.5.5.2).

BFN 3-1- ... -001	0007	0016	0030	0042	0056	0075	0100	0130
Max. power supply voltage	3 x 480 V_{AC} +10%, 50/60 Hz							
Rated current (at T_B = 40 °C)	7.6 A	17.5 A	33 A	46 A	70 A	82 A	109 A	142 A
Rated current (at T_B = 50 °C)	7 A	16 A	30 A	42 A	56 A	75 A	100 A	130 A
Peak current	1.5 x I_N for < 1 min per hour							
Max. voltage Outer conductor/GND Neutral point of the outer conductor/GND	305 V_{AC} 0 V							
Max. test voltage line to line line to case	2.1 kV_{DC} for 2 s at 25 °C 2.7 kV_{DC} for 2 s at 25 °C							
Maximum connection cross-section	4 mm²	4 mm²	10 mm²	10 mm²	16 mm²	25 mm²	50 mm²	50 mm²
Power loss (typical)	4 W	8 W	12 W	15 W	18 W	24 W	24 W	30 W
Harmonic frequencies (mains voltage)	THD_U < 10%							
Protection rating	IP 20							
Weight	0.6 kg	1.0 kg	1.3 kg	1.6 kg	1.9 kg	2.6 kg	4.0 kg	4.2 kg

BFN 3-1-... -001	0250	0320
Max. input supply voltage	3 x 480 V_{AC} +10 %, 50/60 Hz	
Rated current (at T_B = 50 °C)	250 A	320 A
Peak current (at T_B = 50 °C)	4 x I_N when switching on 1.5 x I_N for < 1 min / once per hour	
Test voltage	line - line: 2150 V_{DC} / 2 s line - housing: 2700 V_{DC} / 2 s	
Connection	bolt M10	bar with hole ∅ 11mm PE: bolt M12
Power loss (typical)	60 W	40 W
Protection class	IP 00	

	HOWCORE NFI-020	EPCOS B84143A0150R410	LGF FFU 3x295AB-SBM
Max. power supply voltage	3 x 480 V_{AC} +10 %, 50/60 Hz		
Rated current (at T_B = 40 °C)	20 A	150 A	295 A
Peak current (at T_B = 40°)		1.5 x I_N for < 3 min per hour	1.5 x I_N for < 60 s per hour
Max. voltage outer conductor/GND neutral point of the outer conductor/GND		305 V_{AC} 0 V	
Max. test voltage at 25 °C line to line line to case	2.1 kV_{DC} at 25 °C for 2 s	2.2 kV_{DC} for 2 s 2.7 kV_{DC} for 2 s	2.1 kV_{DC} for 2 s 2.7 kV_{DC} for 2 s
Maximum connection cross-section		95 mm²	
Harmonic frequencies (mains voltage)		THD_U < 10 %	
Protection rating		IP 20	
Weight		13.5 kg	

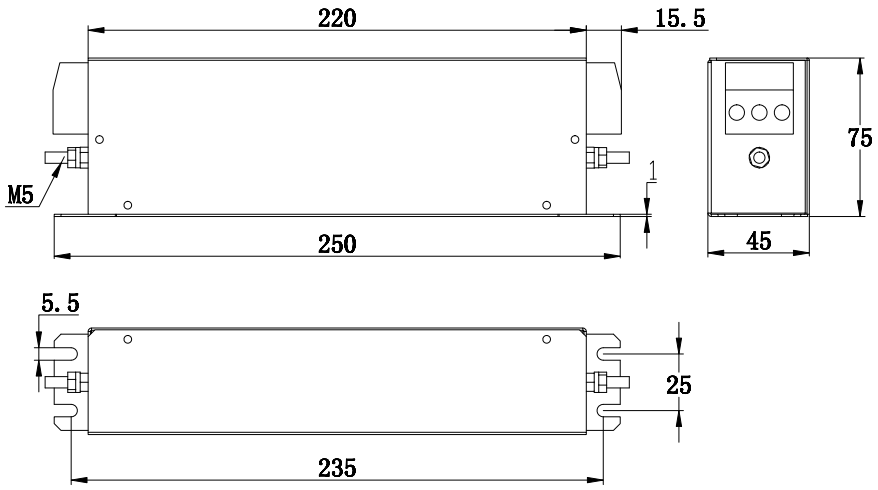


Figure 127: Dimensions HOWCORE NFI-20

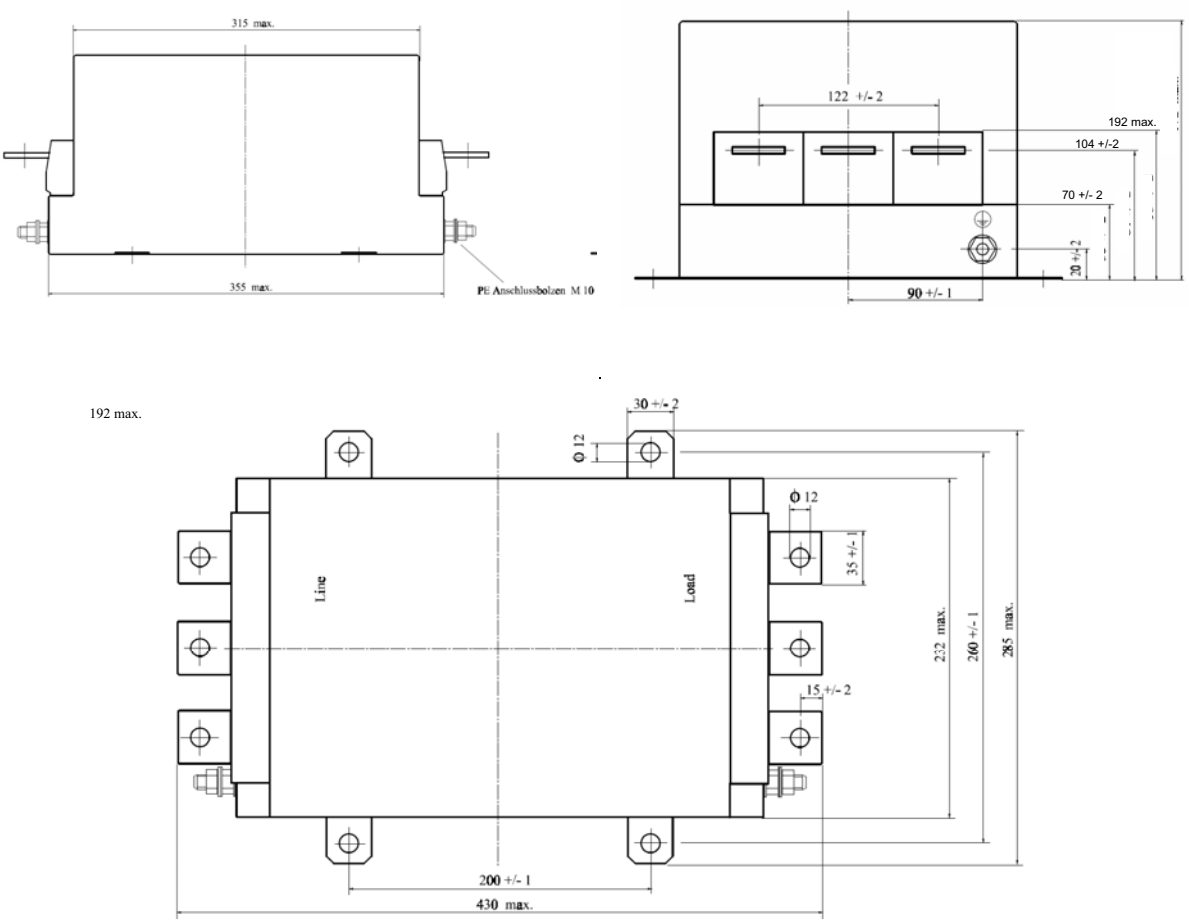


Figure 128: Dimensions LGF FFU 3x295AB-SBM

11.5 Power chokes

It is required to use a power choke when operating (active) mains converter BM50XX and BM51XX. An operation without power choke is prohibited.



NOTE

UL certified power chokes must be used in UL compliant machines/systems.

11.5.1 Power choke BM50XX

Current Select the power chokes dependent upon your application and based on the input rated current. Take into account that the max. input current of the chokes may not lead to saturation.

Inductance Select the power chokes depending on the short-circuit voltage of the mains supply, so that the required mains inductance is adhered to.



NOTE

There is a different short-circuit voltage with the same choke at 60 Hz than there is at 50 Hz; according to the formula $u_k = (\omega L \cdot I_N \cdot \sqrt{3}) / U_N$ (with $\omega = 2\pi \cdot f$) the short-circuit voltage that would result at another mains frequency can be calculated.

The u_k value of a transformer or a choke indicates in percent the voltage drop by its inductance at the rated current, based on the rated voltage.

$$u_k = \frac{2 \cdot \pi \cdot f \cdot L \cdot I_{rated}}{U_{rated}} \ \%$$

Therefore, the frequency, the rated current and the rated voltage of the component are also necessary to determine the u_k value.

For the device, however, it is not this voltage drop but the effect of the inductance on commutation notches, harmonic frequencies and the DC link current that is relevant.

If the u_k value of the inductive component is too small for the device, then the AC current load of the DC link capacitors increases, leading to a rapid aging of the capacitors and thus reducing the service life of the converter substantially. If the u_k value is too large, then the inductive voltage drop reduces the input voltage of the converter, which consequently results in a reduction of the converter output.

When the mains supply and/or transformer inductance is relatively high to the choke inductance ($L_{Transformer} > 40\% \cdot L_{Choke}$), then the harmonic loading of the mains voltage increases disproportionately, which can lead to exceeding of the permissible threshold limit values (see EN 61000-2-4).

The u_k value can be converted into inductance. The advantage of the inductance value is that, in series connections, the individual inductances can be added, which isn't possible with the u_k values.

Example:

A transformer with a u_k value of 5%, 400 V rated voltage and 500 kVA output is operated in a 50 Hz mains. A device with the corresponding three-phase power choke, with 4 % u_k, is connected to this mains.

Thus, the transformer has an inductance of

$$L_{transformer} = \frac{u_k \cdot U_N^2}{2 \cdot \pi \cdot f \cdot S_N} = \frac{0,05 \cdot 400^2 V^2}{2 \cdot \pi \cdot 50Hz \cdot 500kVA} = 51\mu H$$

The inductance of the power choke is then calculated at

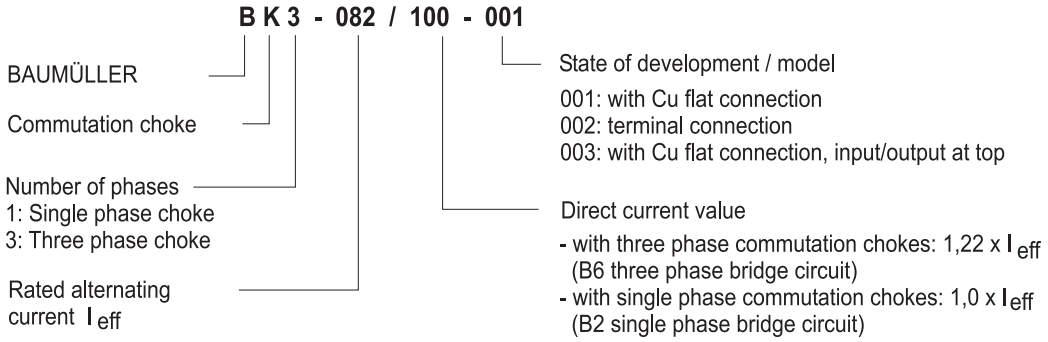
$$L_{choke} = \frac{u_k \cdot U_N}{\sqrt{3} \cdot I_N \cdot 2 \cdot \pi \cdot f} = \frac{400V \cdot 0,04}{\sqrt{3} \cdot 164A \cdot 2 \cdot \pi \cdot 50Hz} = 179\mu H$$

Thus, the effective inductance for the device is

$L_{Total} = L_{Transformer} + L_{Choke} = 230\ \mu H$,

This corresponds to a u_k value for the device of 5.13% relative to the phase voltage.

Power choke type key



Electrical data

Rated voltage max. 550 V, rated frequency 50/60 Hz, flat connector, IP 00,
rated voltage 400 V, u_K = 4% (50 Hz) / 4.8% (60 Hz),
operating temperature for I_{AC} up to 80 A up to 45 °C and for I_{AC} over 80 A up to 40 °C,
with a derating of the current by 1% per °C up to 55 °C.

Power choke	Part No.	I_{AC} [A]	I_{DC} [A]	L [mH]	Power loss [W]	Weight [kg]	Use in operation at rated power [1)]
BK3-0010/0012-002	465574	10	12	2,95	32,1	2,2	BM5030
BK3-0025/0030	368377	25	30	1,18	65	6	BM5031
BK3-0040/0050	368378	40	50	0,72	79	7	BM5032
BK3-0080/0100	368380	80	100	0.36	134	12	BM5043
BK3-0165/0200	368382	165	200	0.18	192	23	BM5044
BK3-0275/0340	368384	275	340	0,105	305	38	BM5074
BK3-0365/0450	368385	365	450	0,08	370	47	BM5075

1) With minimal output in continuous operation, chokes with lower rated currents are also usable. Chokes with larger rated currents are necessary for cyclical utilization of the overload capacity of the devices. If overcurrent is only needed momentarily and non-recurringly (once per hour, for a maximum of 60 s), then the chokes suggested for operation at the rated power are also sufficient.

UL approval
The chokes are design-tested in accordance with UL (e.g. UL1561) and signified by the „ “ symbol.

Dimensions

BK3-	Part No.	I_{AC} [A]	I_{DC} [A]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f × g [mm]	Flat connector Cu terminals [mm × mm]
0025/0030	368377	25	30	155	130	132	130	72	8 × 12	20 × 2 for M6
0040/0050	368378	41	50	190	120	158	170	58	8 × 12	20 × 2 for M6
0065/0080	368379	66	80	190	140	158	170	78	8 × 12	20 × 2 for M6
0080/0100	368380	82	100	230	165	202	180	98	8 × 12	25 × 3 for M8
0115/0140	368381	115	140	230	190	202	180	122	8 × 12	25 × 3 for M10
0165/0200	368382	164	200	240	195	211	190	125	11 × 15	25 × 3 for M10
0195/0240	368383	197	240	265	195	230	215	126	11 × 15	25 × 3 for M10
0275/0340	368384	297	340	300	225	271	240	145	11 × 15	30 × 5 for M10
0365/0450	368385	369	450	360	220	320	310	125	11 × 15	40 × 5 for M10

BK3-	Part No.	I_{AC} [A]	I_{DC} [A]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f × g [mm]	Flat connector Cu terminals [mm × mm]
0450/0550	368386	451	550	360	260	320	310	140	11 × 15	50 × 5 for M12
0530/0650	368387	533	650	360	260	320	310	140	11 × 15	50 × 5 for M12
0615/0750	368388	615	750	420	285	375	370	151	11 × 15	60 × 5 for M12
0750/0920	368389	754	920	420	285	375	370	151	11 × 15	60 × 5 for M12
0900/1100	368390	902	1100	420	285	380	370	166	11 × 15	60 × 10 for M12

Dimensional drawing

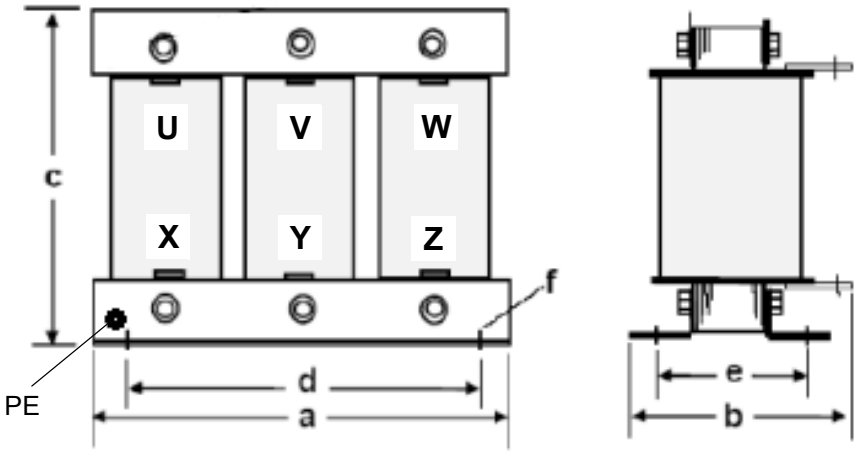


Figure 129: Dimensions of choke BM50XX

Connection diagram

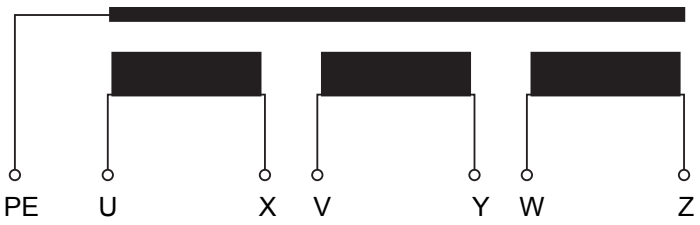


Figure 130: Connection diagram of choke BM50XX

11.5.2 Power chokes for BM51XX

NOTE

Only the power choke mentioned below is permitted for use with BM51XX devices.

BM5173

Marking	Inductance	Part number
BL-3-060-000	1 mH	388168

This power chokes are specified for operation at 400 V/50 Hz bzw. 480 V/60 Hz.

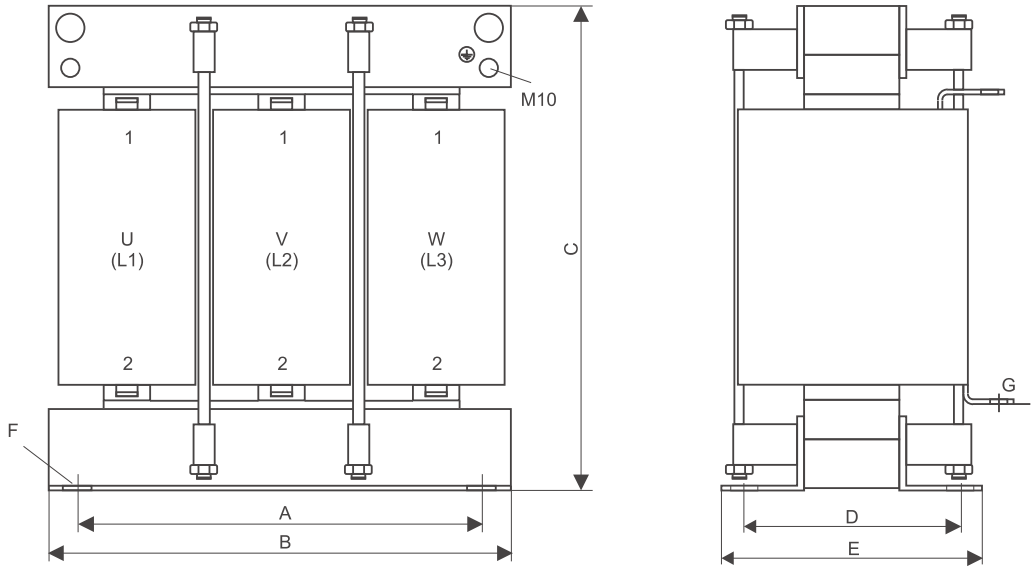


Figure 131: Power choke BM5173

A	B	C	D	E	F	G	Connection	Mounting
260	300	306	110	140	9x13	⌀8,5	Bar with hole M8	M8

- Tramag

UL approval
This chokes are design-tested in accordance with UL (e.g. UL1561) and signified by the „“ symbol.

Name	Inductance	Part number
BL-3-060-001	1 mH	415096

BM5174

Marking	Inductance	Part number
BL-3-100-001	0.6 mH	430926

UL approval
The chokes are design-tested in accordance with UL (e.g. UL1561) and signified by the „ “ symbol.

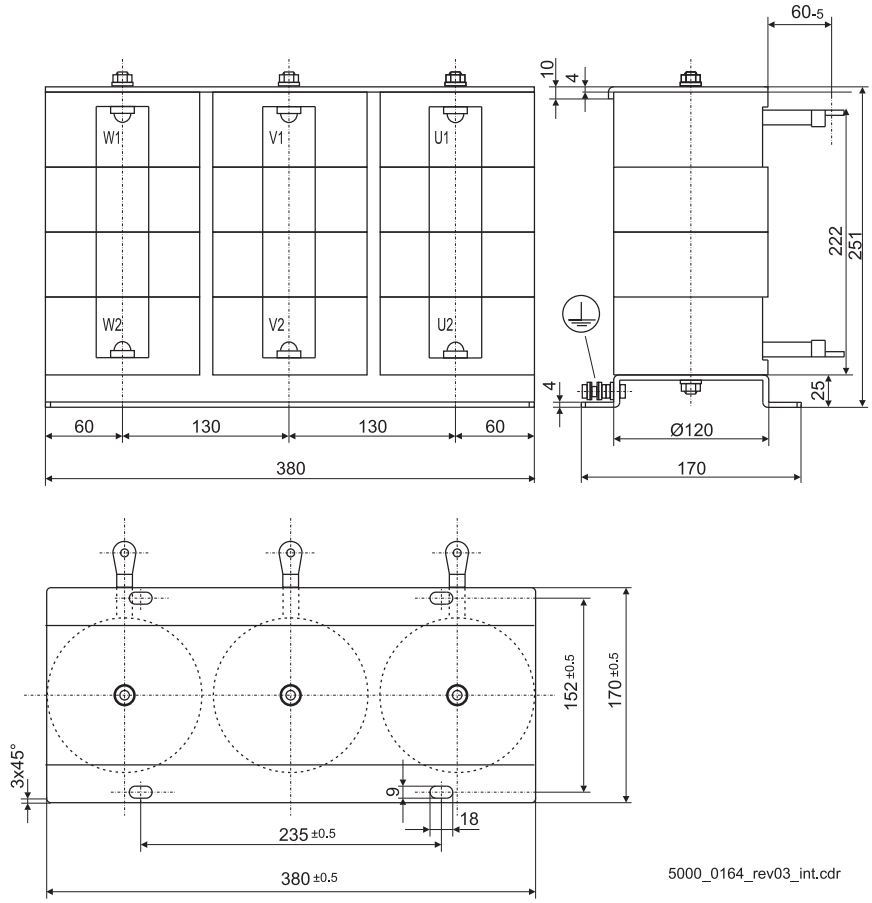


Figure 132: Power choke BM5174

Connection: Cable lugs 10-50
Fixing: M8

Connection diagram:

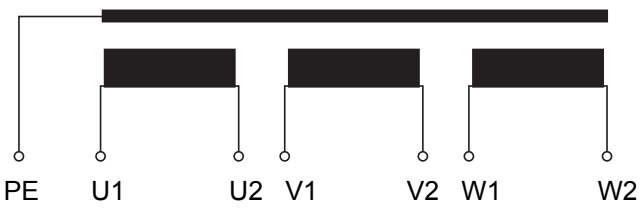


Figure 133: Connection diagram BM5174

BM5192, BM5193

Marking	Inductance	Part number
TRAMAG D400/110/-20-D5-01	0.2 mH	463082

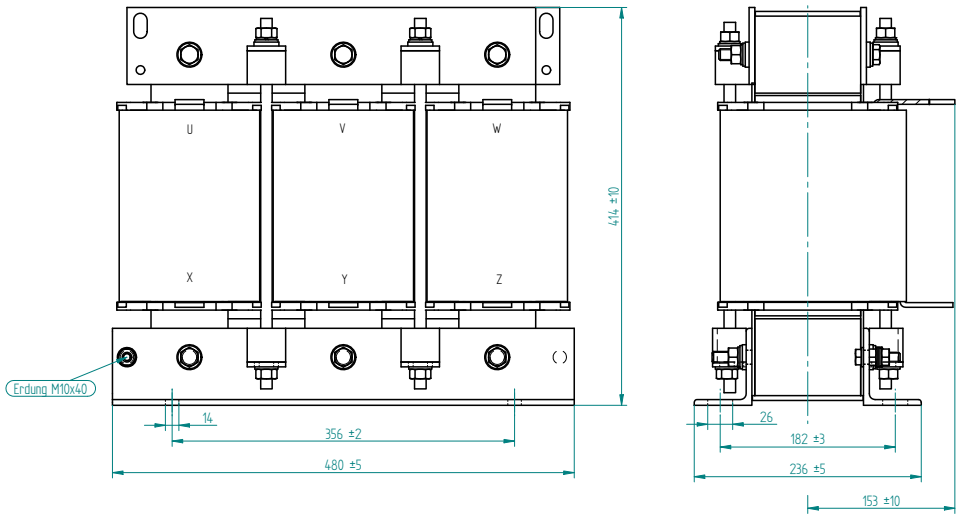


Figure 134: Power choke BM519X

11.6 Spare parts

11.6.1 Plug connectors

(Active) mains rectifier unit

	Stripping length	BM503X	BM504X	BM51XX	Part No.
Connector X200 Wago 231-2302	9 - 10 mm	X	X	X	417197
Connector „Ba+/Ba-“ X101 Phoenix SPC5/2-STCL-7.62, 1718481	15 mm	X	-	-	425794
Connector „Ba+/Ba-“ X101 Phoenix IPC16/2-STF-10.16	12 mm	-	X	-	424416
Connector „RD+/RD-“ X101 Phoenix GIC 2.5 HCV/2-ST-7.62	8 mm	-	-	X	428716
Connector DIO X2 Weidmüller Push-In	7 mm	-	-	X	479956
Connector DIO X1 Phoenix FK-MCP1.5/6-ST-3.81, 1851083	9 mm	X	X	-	354874
Ribbon cable bracket Richco FCCS-2		X	X	X	430152

Axis units double axis

BM5XXX - XXXX - XXXX - XXXX - XX - XXXX - [EXX] - #XX

	Stripping length	BM5323	BM5325	BM5331	BM5332	BM5333	Part No.
Connector X200 Wago 231-2302	9 - 10 mm	X	X	X	X	X	417197
Connector motor X107 Weidmüller 3-pol.	7 mm	X	X	-	-	-	436300
Connector motor X107/108 Phoenix 6-pol.	15 mm	-	-	X	X	X	433298
Connector motor X108 Weidmüller 3-pol.	7 mm	X	X	-	-	-	436299
Connector DIO X2 Weidmüller Push-In	7 mm	X	X	X	X	X	479956
Connector X206 Weidmüller 1690450000	10 mm	X	X	X	X	X	424601
Connector motor temp/brake X207 Weidmüller 1727560000	7 mm	X	X	X	X	X	424595
Connector motor temp/brake X208 Weidmüller 1727640000	7 mm	X	X	X	X	X	421674
Ribbon cable bracket for X300 Richco FCCS-2		X	X	X	X	X	430152

Axis units double axis

BM5XXX - XXXX - XXXX - XXXX - XX - XXXX - [EXX] - #XX - **M0**

	Stripping length	BM5323	BM5325	BM5331	BM5332	BM5333	Part No.
Connector X200 Wago 231-2302	9 - 10 mm	X	X	X	X	X	417197
Connector motor X107 Weidmüller 3-pol.	7 mm	X	X	-	-	-	436300
Connector motor X108 Weidmüller 3-pol.	7 mm	X	X	-	-	-	436299
Connector motor X107 Weidmüller 3-pol.	12 mm	-	-	X	X	X	447103
Connector motor X108 Weidmüller 3-pol.	12 mm	-	-	X	X	X	447101
Connector DIO X2 Weidmüller Push-In	7 mm	X	X	X	X	X	479956
Connector X206 Weidmüller 1690450000	10 mm	X	X	X	X	X	424601
Connector motor temp/brake X207 Weidmüller 1727560000	7 mm	X	X	X	X	X	424595
Connector motor temp/brake X208 Weidmüller 1727640000	7 mm	X	X	X	X	X	421674
Ribbon cable bracket for X300 Richco FCCS-2		X	X	X	X	X	430152

Axis units
single axis

	Stripping length	BM5326	BM5327	BM5328	BM5334	BM5335	BM537X	Part No.
Connector X200 Wago 231-2302	9 - 10 mm	X	X	X	X	X	X	417197
Connector motor X107 Phoenix 3-pol.	15 mm	X	X	X	-	-	-	434867
Connector DIO X2 Weidmüller Push-In	7 mm	X	X	X	X	X	X	479956
Connector X206 Weidmüller 1690450000	10 mm	X	X	X	X	X	-	424601
Connector X206 Weidmüller 1043850000	7 mm	-	-	-	-	-	X	451029
Connector motor temp/brake X207 Weidmüller 1727560000 Weidmüller 1277470000	7 mm	 X X	 X X	 X X	 X X	 X X	 - X	 424595 451695
Ribbon cable bracket for X300 Richco FCCS-2		X	X	X	X	X	X	430152

11.6.2 Accessories kit shielding



NOTE!

Option, not included in delivery!

Air-cooled/ water-cooled devices

Device		Width	Part No.
Single axis unit	BM5326 BM5327	50 mm	437738
	BM5328	75 mm	437739
	BM5334 BM5335	75 mm	437741
	BM537X connection 2 x 16 mm² connection 2 x 25 mm²	175 mm	460011
	BM537X connection 1 x 50 mm²	175 mm	460012
Double axis unit	BM5323 BM5325	50 mm	437736
	BM5323-A BM5325-A		458913
	BM5331, BM5332, BM5333	75 mm	437743
	BM5331-A BM5332-A BM5333-A		458842

Cold plate devices

Device		Width	Part No.
Single axis unit	BM5326, BM5327, BM5328	50 mm	437737
	BM5334, BM5335	75 mm	437740
Double axis unit	BM5323, BM5325	50 mm	437735
	BM5331, BM5332, BM5333	75 mm	437742

11.7 Connection rails

- **DC link bar**

Length	Part No.
DC link bar 1 m	424188
Flexible DC link bar 43 mm	479741

Accessories	Part No.
DC link spacer bushing	424129
Screw	420020

- **Mounting rail**

Length	Part No.
1 m	424187

- **Accessories kit PE connection from device to device**

Accessories	Part No.
Accessories kit PE connection	467439

11.8 Toroidal cores

Toroidal cores for power supply cable



NOTE!

Only for active mains rectifier BM517X to ensure an operation in C2 environment.

Accessories	Part No.
Toroidal core for BM517X	442371

Toroidal cores for motor cables Toroidal cores for reduction of bearing currents.



NOTE

The number of the toroidal cores must be increased depending on the core temperature when using the converter at low speed (<100 rpm) for a longer period or in case the motor is supplied at standstill.

The data sheets of the toroidal core are available as an internal download.

The cores are added to the corresponding converter when ordered.
Please contact Baumüller in case of not-listed combinations or motor types.

Following toroidal cores are recommended for combinations of motors and mono/axis units series **b maXX 5000**:

- **Without** active mains rectifier unit BM41XX/BM51XX

Type motor	Type toroidal core	Part No.	Number of recommended cores
DS/DA 160	M113	432023	2 cores
DA 180	M114	432022	2 cores
DS 200	M114	432022	3 cores
DA 225	M114	432022	3 cores
DA 280	M114	432022	4 cores

- **With** active mains rectifier unit BM41XX/BM51XX

Type motor	Type toroidal core	Part No.	Number of recommended cores
DS/DA 160	M683	434203	3 cores
DA 180	M684	434204	3 cores
DS 200	M684	434204	3 cores
DA 225	M684	434204	3 cores
DA 280	M684	434204	3 cores

12

SHUTDOWN, STORAGE

In this chapter we describe, how you decommission and store the device.

12.1 Safety instructions

➲ Refer to ▹Safety◃ as from page 15 and the information in ▹Transport and Packaging◃ as from page 111.

The shutdown of the device may only be carried out by for this qualified personnel.





DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the system = discharge time of the device with the longest DC link discharge time.

Therefore:

- Do not touch electrically live parts before taking into account the discharge time of the capacitors.
- Assure, that all electric connections are current-free and are safe against switch-on.
- Before working, check at the electrical connections with suitable measuring devices, that the connections are off-circuit.
- Remove the connections not until the safe isolation from supply has been checked.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

12.2 Requirements to the executing personnel

The personnel, who is appointed to setting out of operation, must have the required knowledge and instructions, which is necessary for an execution according to the rules. Select the personnel in such a way, that the safety instructions, which are mounted to the device and its parts as well as to the connections, are understood and applied to.

12.3 Shutdown

Execute the setting out of operation as follows:

1 Put the device off-circuit and assure the device against unintentional restart.

2 Check the isolation from supply of all connections (earliest 10 minutes after switching off).

3 Demount the connections and protect the connections according to the safety instructions.

4 Document the shut down setting.

12.4 Demounting

The demounting assumes a completed, documented setting out of operation.



NOTICE!

Note sharp edges.

In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, your feet can be cut up.

Therefore:

- Ensure that only qualified personnel, who are familiar with the safety notes and assembly instructions, demount this device.



Wear safety gloves.



- Wear safety shoes.

1 Secure the device against falling off/out.
2 Loosen all mechanical connections.
3 Lift the device out of the control cabinet.
4 Store the device in a suitable packing.
5 At transportation pay attention to, that the device is not damaged by wrong storage or severe shocks, also see ▹What to observe when transporting◃ on page 111.

In case you want to dispose the device, additional data is available in chapter ▹Disposal◃ as from page 311.

12.5 Storage conditions

The device is maintenance-free. If you keep to the environmental conditions during the entire period of storage, you can assume, that the device will not be damaged. In case the environmental conditions during storage are not kept, you should assume that the device is damaged after storage.



NOTICE!

Property damage because of incorrect storage conditions

Incorrect storage can damage/destroy the device.

Therefore:

Assure, that the environmental conditions are kept during the entire period of storage:

- Climatic category 1K4
- Temperature range -25 °C to +55 °C



NOTICE!

Recommissioning without forming of the capacitors.

From six months storage period on, the capacitors are destroyed during commissioning, if they are not formed beforehand

- Reform the DC link capacitors:
  - by supplying the device ready-to-operate for at least one hour with supply voltage
  - but do not enable pulses during this time.
- Consider, that it is imperative, to connect the accordingly prescribed line commutating chokes for this forming procedure. Devices, where no line commutating chokes is necessary can directly be supplied with mains voltage.

12.6 Recommissioning

Execute commissioning as with a new device, see
▹Mounting◃ as from page 113, ▹Installation◃ as from page 129.



NOTICE!

Recommissioning without forming of the capacitors.

From six months storage period on, the capacitors are destroyed during commissioning, if they are not formed beforehand

- Reform the DC link capacitors:
  - by supplying the device ready-to-operate for at least one hour with supply voltage
  - but do not transmit a pulse enable during this time.
- Consider, that it is imperative, to connect the accordingly prescribed line commutating choke for this forming procedure. Devices, where no line commutating choke is necessary can directly be supplied with mains voltage.

13

DISPOSAL



NOTE!

Baumüller products are not subject to the scope of application of the EU's Waste Electrical and Electronic Equipment Directive (WEEE, 2012/19/EU). Hence, Baumüller is not obligated to bear any costs for taking back and disposing of old devices.

13.1 Safety regulations





DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the modular system = discharge time of the device with the longest DC link discharge time in the modular system.

Refer to ▹Electrical data◃ as from page 60.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the intermediate circuit, the intermediate circuit discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

CAUTION!

Danger due to sharp edges.

If the device is lifted with unprotected hands during deinstallation, palms or fingers can be cut. If the device falls, feet could be injured.

Therefore:

- Ensure that only qualified personnel, who are familiar with the safety notes and assembly instructions, mount this device.



Wear safety gloves.



Wear safety shoes.

WARNING!

Danger of physical impact!

Secure device against falling down.

Therefore:

- Take suitable measures, such as supports, hoists and assisting personnel, to ensure that device cannot fall down.
- Use appropriate means of transport.

NOTICE!

Avoid polluting the environment as a result of improper disposal.

Therefore:

- Only dispose in compliance with the health and safety regulations.
- Take heed of any special local regulations. If you are unable to directly ensure safe disposal yourself, commission a suitable disposal contractor.
- In the event of a fire, hazardous substances could possibly be generated or released.
- Do not expose electronic components to high temperatures.
- Beryllium oxide is used as inner insulation, for example for various power semiconductors. The beryllium dust that is generated upon opening is injurious to the health.
  Do not open electronic components.
- Dispose of capacitors, semiconductor modules and electronic scrap as special waste.



WARNING!

Danger as a result of faulty deinstallation!

The deinstallation and disposal requires qualified personnel with adequate experience.

Therefore:

- Only allow deinstallation and disposal to be performed by qualified personnel.

13.2 Disposal facilities/authorities

Ensure that the disposal is handled in compliance with the disposal policies of your company, as well as with all national regulations of the responsible disposal facilities and authorities. In case of doubt, consult the bureau of commerce or environmental protection authority responsible for your company.

APPENDIX A - ABBREVIATIONS

A	Amps
AC	Alternating current
BB	Ready-to-operate
CE	Compliant with the directives of the European Union
DC	Direct current
DIN	Deutsches Institut für Normung e.V (German National Standards Institute).
EMC	Electromagnetic compatibility
EMVG	European EMC law
EN	European standard
ESD	Electrostatic discharge
ext	external
GND	Ground
h	Hour
Î	Peak current
I_{AC}	Rms-value of alternating current
I_{DC}	Rms-value of direct current
IEC	International Electrotechnical Commission
IP	Ingress protection; protection rating
IS	pulse inhibit
Chap.	Chapter
K_G	Cooling air requirement of device interior
K_{LK}	Cooling air requirement of heat sink
min	Minute
MSKL	Motor protection thermistor
n = 0	rotational speed = 0
n_{act}	Rotational speed actual value
n_{max}	Maximum rotational speed
n_{min}	Minimum rotational speed
MSL	Height above mean sea level
No.	Number
n_{set}	Rotational speed set value
NTC	Negative temperature coefficient thermistor
PE	Protected ground ground conductor connection
PELV	Protective extra-low voltage, with safe isolation, grounded
ppm	Parts per million
PTC	Positive temperature coefficient thermistor
RCD	Residual current protective device / ground fault circuit breaker
SELV	Safety extra-low voltage, with safe isolation
SH	Quick stop
STO	Safe Torque Off
Tab.	Table
U	Voltage
Û	Peak voltage
U_{AC}	Rms-value, AC voltage
U_{DC}	Rms-value, DC voltage
UL	Underwriters Laboratories
$U_{DC\ link}$	DC link voltage
VA	Stainless steel
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik (German electrical engineering, electronics and IT association)
ZK	DC link

B

APPENDIX B - INFORMATION ACCORDING EU ECO-DESIGN DIRECTIVE 2019/1781



NOTE!

Following devices are excluded from the EU Eco-Design Directive 2019/1781:

Brand:	Baumüller	
Type:	Mains Rectifier Unit:	BM5030, BM5031, BM5032 BM5043, BM5044, BM5074, BM5075
	Active Mains Rectifier Unit:	BM5173, BM5174, BM5192, BM5193

Reasons:

The devices do not operate a motor.



NOTE!

Following devices are excluded from the EU Eco-Design Directive 2019/1781:

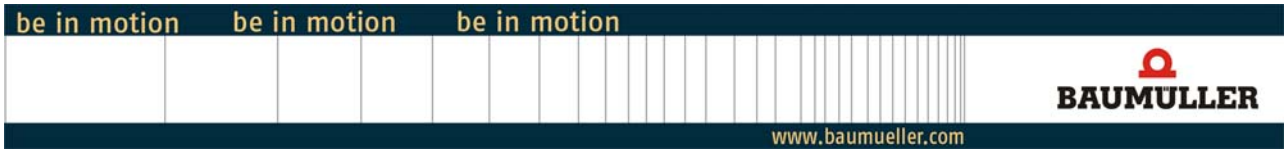
Brand:	Baumüller	
Type:	Double Axis Unit Safety	BM5323, BM5325, BM5331, BM5332, BM5333
	Single Axis Unit Safety:	BM5326, BM5327, BM5328 BM5334, BM5335, BM5372, BM5373, BM5374, BM5375; BM5376
	Double Axis Unit:	BM5223, BM5225, BM5231, BM5232, BM5233
	Single Axis Unit:	BM5226, BM5227, BM5228 BM5234, BM5235, BM5272, BM5273, BM5274, BM5275; BM5276

Reasons:

The devices are not connected to a three-phase system.

C

APPENDIX C - DECLARATION OF CONFORMITY



EU-Declaration of Conformity

Doc.-No.: 5.11002.06
Date: 08-Sep-2020

according to EMC Directive 2014/30/EU and Low Voltage Directive 2014/35/EU

The Manufacturer: Baumüller Nürnberg GmbH
Ostendstraße 80-90
90482 Nuremberg, Germany

declares, that the products with the

Brand name	Baumüller	
Type:	Mains Rectifier Unit:	BM5031, BM5032.
	Single Axis Unit Safety:	BM5326, BM5327, BM5328
	Double Axis Unit Safety:	BM5323, BM5325
	Double Axis Unit:	BM5223, BM5225
Manufactured since:	2010	
Type:	Mains Rectifier Unit:	BM5043, BM5044
	Single Axis Unit Safety:	BM5334, BM5335
Manufactured since:	2011	
Type	Active Mains Rectifier Unit:	BM5173, BM5174
	Double Axis Unit Safety:	BM5331, BM5332, BM5333
	Double Axis Unit	BM5231, BM5232, BM5233
Manufactured since	2012	
Type	Mains Rectifier Unit:	BM5030-XX0X
	Active Mains Rectifier Unit:	BM5192, BM5193
	Single Axis Unit Safety:	M5372, BM5373, BM5374, BM5375; BM5376
Manufactured since:	2016	
Type	Mains Rectifier Unit:	BM5074, BM5075
Manufactured since:	2020	

are developed, designed and manufactured in accordance with the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU.

Applied harmonized standards:

Standard	Title
DIN EN 62061:2016	Safety of Machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
DIN EN 61800-5-1:2017-11	Variable-speed electrical power drive Part 5-1: Safety requirements - Electrical, thermal and energy
DIN EN 61800-5-2:2017-11	Variable-speed electrical power drive Part 5-2: Safety requirements - Functional
DIN EN 61800-3:2019-04	Variable-speed electrical power drive Part 3: EMC requirements and specific test methods

Attention should be paid to the safety instructions in the instruction handbook.

Nuremberg
City / Date

Subject to change of this declaration of EC conformity without notice. Actual valid edition on request.

D

APPENDIX D - BM5030 WITH SAFETY FUNCTION

D.1 Approvals, directives and standards

Safety engineering standards and directives	Area of application	Approvals
EN 61508-1:2010 EN 61508-2:2010	Functional safety of safety-related electric, electronic and programmable electronic systems	Up to SIL 2
EN ISO 13849-1:2015	Safety-related components of control units	Up to performance level d
EN 62061:2005+A1:2013	Safety of machinery - Functional safety of safety-related electric, electronic and programmable electronic systems	
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional safety	

Additional standards	Area of application
EN 61800-3:2004 + A1:2012	Adjustable speed electrical power drive systems - Part 3: EMC requirements
EN 61800-5-1:2007	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61131-2:2007	Programmable controllers - Part 2: Equipment requirements and tests

D.2 Function

The mains rectifier **BM5030 with safety function** converts the AC voltage of the power supply (U_{AC}) to the DC link voltage for the decentralized drive solutions BM2500 (U_{DC}/ $U_{DC\ link}$). The STO function is integrated in this device, disconnecting the DC link voltage (U_{DC}) of the mains rectifier to the axes units ($U_{DC\ link}$). This is a two channel disconnection, i. e. a switch disconnects DC link + and another DC link - (see figure below).
The STO function is available via connector X2.

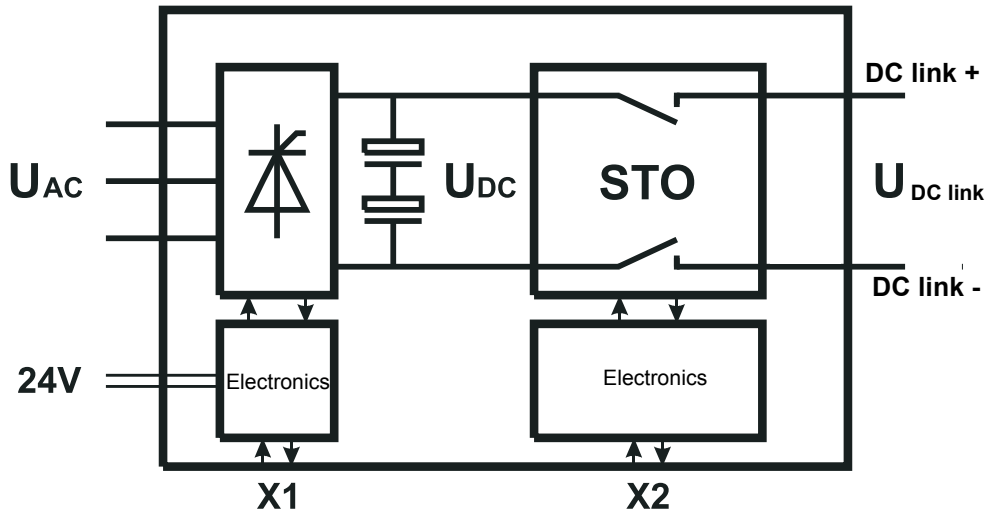


Figure 135: BM5030 with safety function

This STO function is available:

Type of automatic locking function (BM5030-XX**2**X)
In case of a fault of one switch, the device is locked automatically and remains in STO state.

NOTE!

Only a BM5030 with safety function,

type code: BM5030-XX**2**X-...-

marked with the TÜV SÜD certification label and the safety label fulfills a certified safety function within the meaning of PL classification according ISO 13849 or SIL according EN 61508.

D.3 Electrical data BM5030 with safety function

	BM50**30** with safety function BM5030-XX**2**X-...
Input rated power [1]	6 kVA
Input rated current (I_{eff}) [1] [2] [3]	12 A
Distortion factor of the input current (THD_I) [1]	110 % ± 10 %
Input peak current (I_{eff}) [1] [2] [3]	12.5 A for max. 150 s
DC link voltage, power supply dependent/rated	540 V_{DC} at $U_{power\ supply}$ = 3 x 400 V
Internal DC link capacitance C_{int}	330 µF, internal - connected upstream the STO
DC link discharge time (C_{int}) [8]	Approx. 900 s
Maximum connectable DC link capacitance (external) C_{ext}	200 µF, external - connected downstream the STO
DC link discharge time (C_{ext}) [10]	≤ 80 ms
Total maximum connectable capacitance in the DC link	3.15 mF, internal + external connected upstream the STO [9]
Waiting time between 2 charging processes with external connected capacitance	$t > \frac{(C_{int} + C_{ext}) \cdot U_{power\ supply}^2}{2 \cdot 60\ W}$
Connection power at DC link [1] [5]	5 kW
Peak power at DC link [4] [6]	7.5 kW for max. 150 s
Capacitance DC link to PE	150 nF
Ready-to-operate after	≤ 7 s
Max. charge-up time	≤ 10 s
External brake resistor R_B	No connection
External brake resistor continuous power	-
Quick discharge resistor	-
Power loss with regard to power supply	50 W
Power loss with regard to control voltage supply [7]	Max. 25 W
Cooling air requirement power heat sink	40 m^3/h
Cooling air velocity power heat sink	-
Cooling air requirement internal space of device	8 m^3/h

1) All rated values are based on an power supply voltage of 400 V/50 Hz, a DC link voltage of 540 V, a control voltage of 24 V and a surrounding temperature of 40 °C.

2) The input current must be reduced between 40 °C and 55 °C, see correction values at changed operation conditions, see ▹Correction values for the output current of the mains inverter BM50XX, BM51XX◃ on page 51.

3) The mains rectifier draws the rated/peak current at rated supply voltage. The input current must be reduced if power supply voltage is higher than 400 V and the DC link output power remains constant, see ▹Derating: Input current BM50XX, BM517X, BM519X◃ on page 54.

4) The actual possible overload time depends on the preloading of the device and the heat sink temperature and is detected by the overload monitoring of the device.

5) With the permissible continuous DC link connected power, the power supply current is reduced. When selecting the connected axes ensure that the DC link connected power is not exceeded, see ▹Derating: DC link power B503X, BM504X, BM517X, BM519X◃ on page 57.

6) This power consumption is only permitted for a short period of time. This must be ensured by means of appropriate configuration of the connected axes.

7) Without loads on the digital outputs

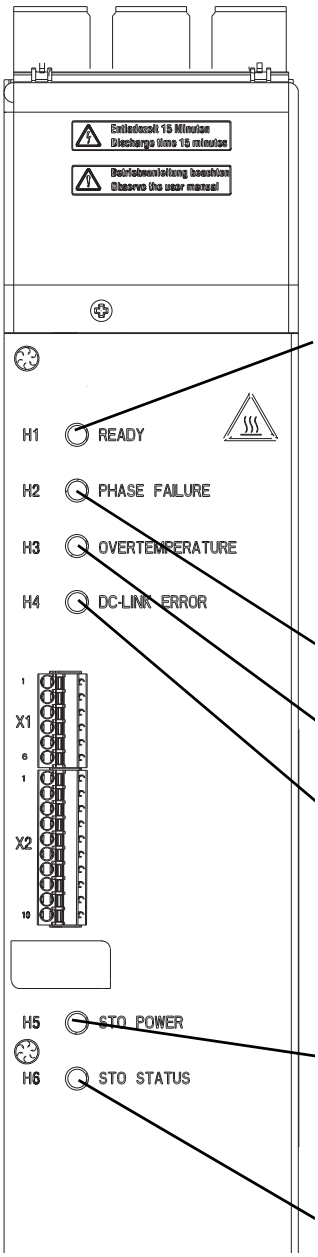
8) Residual voltage < 60 V_{DC}

9) It is allowed to connect an additional capacitance to connector X101.
The total capacitance connected to the DC link (upstream of the STO function) is limited to 3.15 mF.

10) Maximum DC link capacitance connected downstream the STO function.

D.4 LED display BM5030 with safety function

BM5030-XX2X-...



LED READY - Mains rectifier unit ready-to-operate:
H1
green: Power supply and DC link voltage available, internally OK
red: Power supply failure - automatically restart when power supply returns.
blinking red: Power supply failure longer than 10 s - restart after Power supply return has to be acknowledged (X1:4).
Refer to ▹Error acknowledgment of BM50XX◃ on page 254)

LED PHASE FAILURE
H2
red: Phase failure

LED OVERTEMPERATURE
H3
red: Overtemperature

LED DC-LINK ERROR
H4
red: DC link error:
$U_{DC\ link}$ overvoltage or
$U_{DC\ link}$ overcurrent or
Inhibit input active

LED STO POWER
H5
green: U_{DC} is available
orange: U_{DC} is not ready
red: Error

LED STO STATUS
H6
green: Ready-to-operate
orange: $U_{DC\ link}$ charging procedure,
red: STO error

Figure 136: Display/operating elements BM5030-XX2X-...

Naming on the front plate	Meaning	Error	Blinking pattern
H1 (green)	Ready-to-operate	No error	LED lights up
H1 (red)	Power supply failure	Power supply failure - automatically restart when power supply returns.	LED lights up
		Power supply failure longer than 10 s - restart after power supply return has to be acknowledged (X1:4).	LED blinking
H2 (red)	Phase failure	Warning: phase failure or asymmetric three phase power supply	LED lights up
H3 (red)	Over temperature	Over temperature of heat sink	LED lights up
		Temperature of heat sink < - 5 °C	LED lights up
H4 (red)	DC link error	Overvoltage DC link	LED lights up
		Overcurrent DC link	LED lights up
		Rising edge (low-high) on inhibit input	LED lights up
H5	STO power	U_{DC} is available	LED green
		U_{DC} is not ready	LED orange
		Error	LED red
H6	STO status	Ready-to-operate	LED green
		$U_{DC\ link}$ charging procedure	LED orange
		STO error	LED red

D.5 Connection diagram BM5030 with safety function

BM5030-XX20 A normally open contact is expected on the inhibit input.

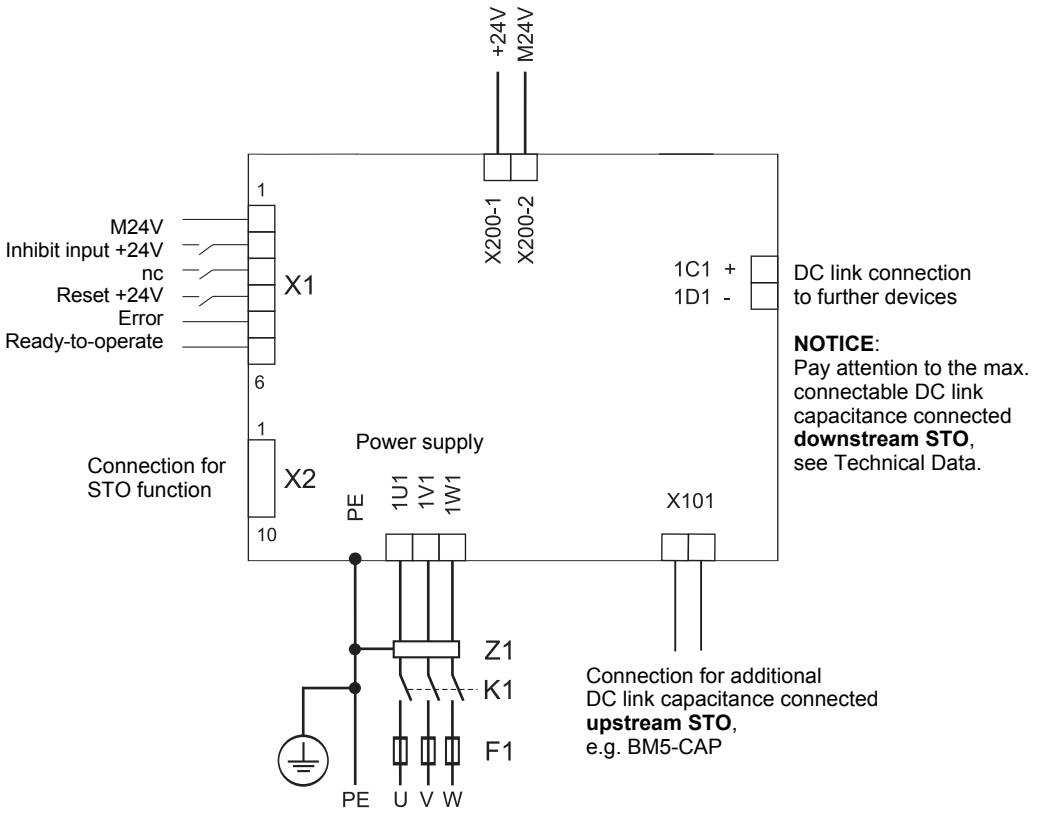


Figure 137: Connection diagram BM5030-XX20-...

BM50XX-XX21 A normally closed contact is expected on the inhibit input.

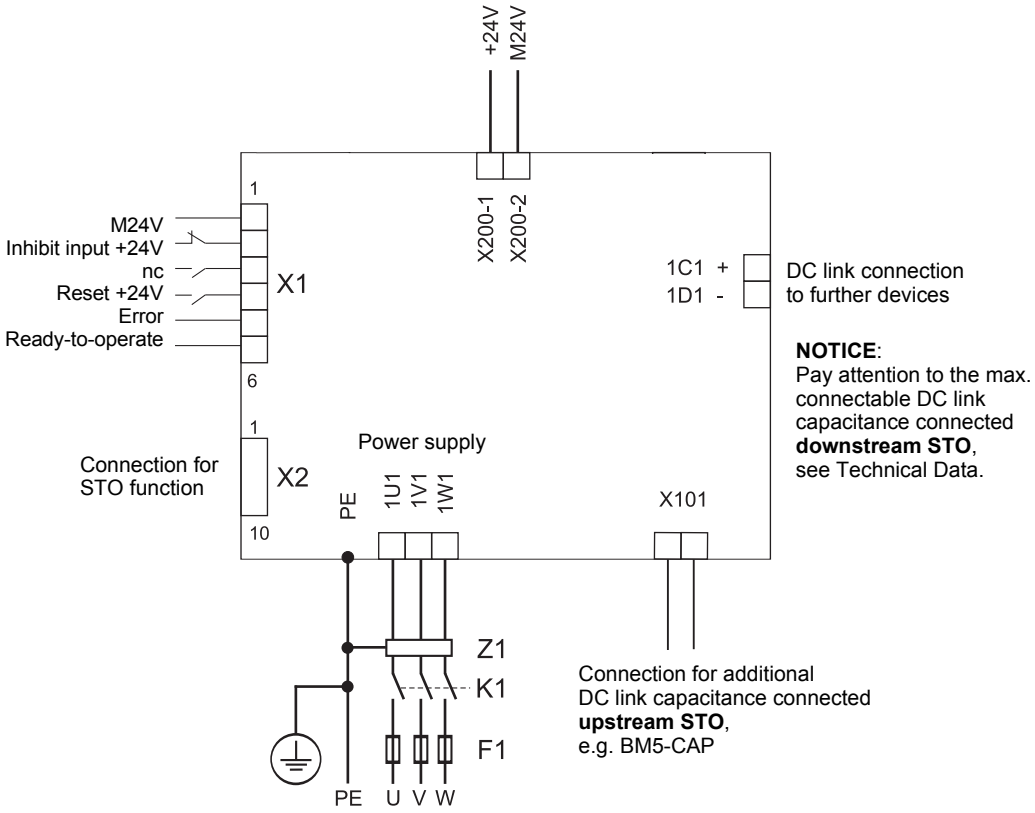


Figure 138: Connection diagram BM5030-XX21-...

1C1, 1D1	Connections for the DC link
PE	Power supply PE-connection
1U1, 1V1, 1W1	Power supply connection
F1	Fuses (cable + device)
Z1	Line filter
K1	Main contactor (option)
X200	Connections for 24 V voltage supply
X1	Control inputs and outputs
X2	Connections of STO function
X101	Connection for additional DC link capacitance, e. g. BM5-CAP

D.6 Electrical connections BM5030 with safety function

BM5030-XX2X-...

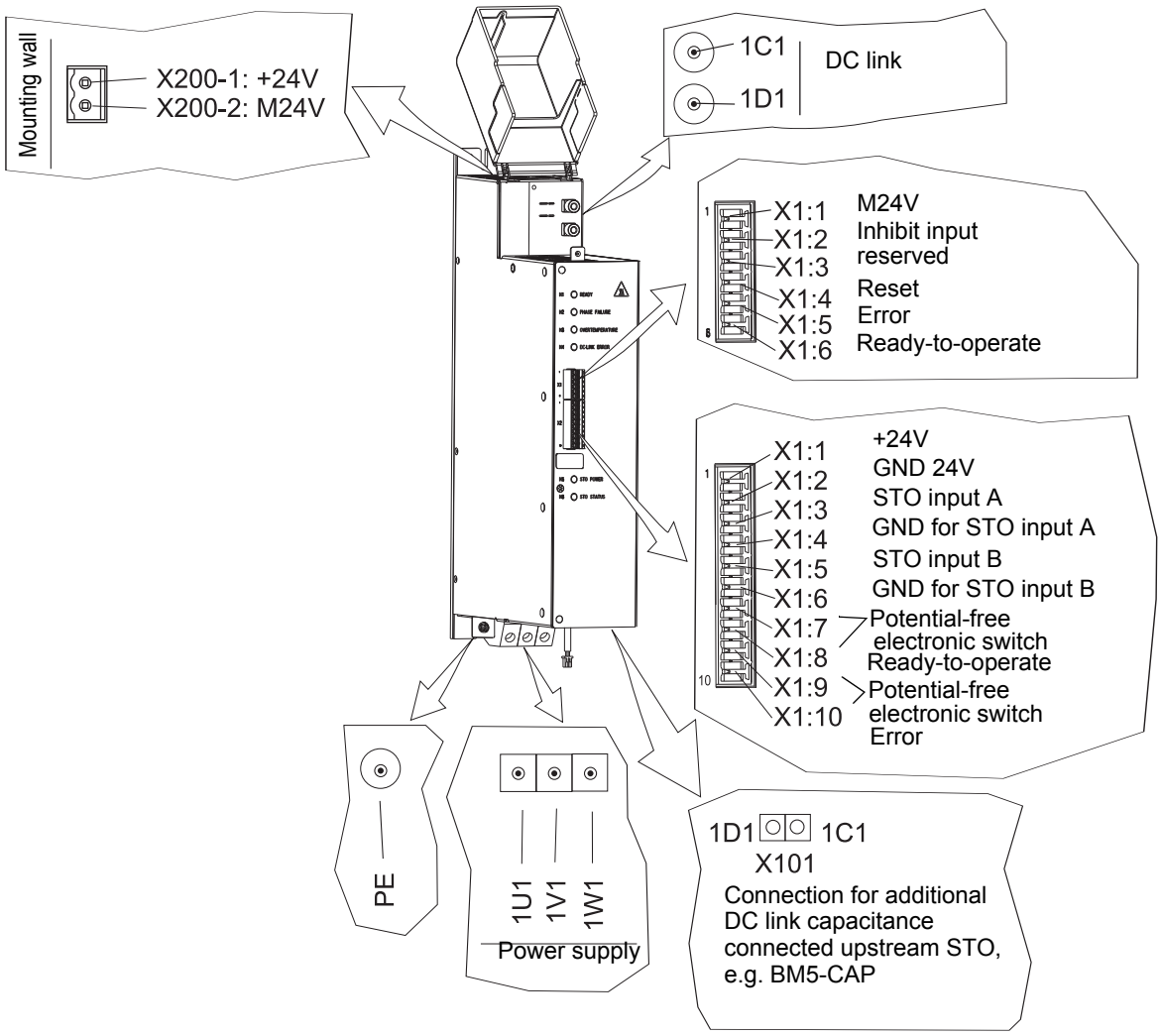


Figure 139: Electrical connections of BM5030-XX2X-...

D.6.1 Connection data of BM5030 with safety function



NOTE!

To ensure sufficient current load capacity of the connections, adhere to the specified torques!

		Connection cross section	Connection method	Torque	Load capacity
Power supply 1U1, 1V1, 1W1	BM5030 with safety function	Max. 25 mm²	Screw terminal	Min. 4.0 Nm Max. 4.5 Nm	Refer to ▹Fuses◃ from page 277
Power supply PE		Min. 10 mm²	Cable lug for M5	Min. 2.2 Nm Max. 3.0 Nm	-

			Torque	Max load capacity of the bar
DC link 1C1 and 1D1	BM5030 with safety function	DC link bar	Min. 2.2 Nm Max. 3.0 Nm	130 A

		Connection cross section	Connection method	Torque	Load capacity
X101 Connection for additional DC link capacitance	BM5030 with safety function	Max. 6 mm²	Plug connector, spring-clamp connection	-	Max. 41 A

	Connection cross section	Connection method	Load capacity
X200 (SELV/PELV) 24 V power supply	Max. 1.5 mm² (2 wire, 2 pin)	Plug connector, spring-clamp connection	Plug connector max. 16 A

		Connection cross section	Connection method	Load capacity
X1 (SELV/PELV) Control inputs	BM5030 with safety function	Max. 1.5 mm²	Plug connector, spring-clamp connection	Max. **8.0** A
X2 (SELV/PELV) STO function inputs/outputs		Max. 1.5 mm²	Plug connector, spring-clamp connection	Max. **8.0** A

D.6.2 Connections front side BM5030 with safety function

X1 **Digital inputs / outputs**

BM5030-XX2X-...

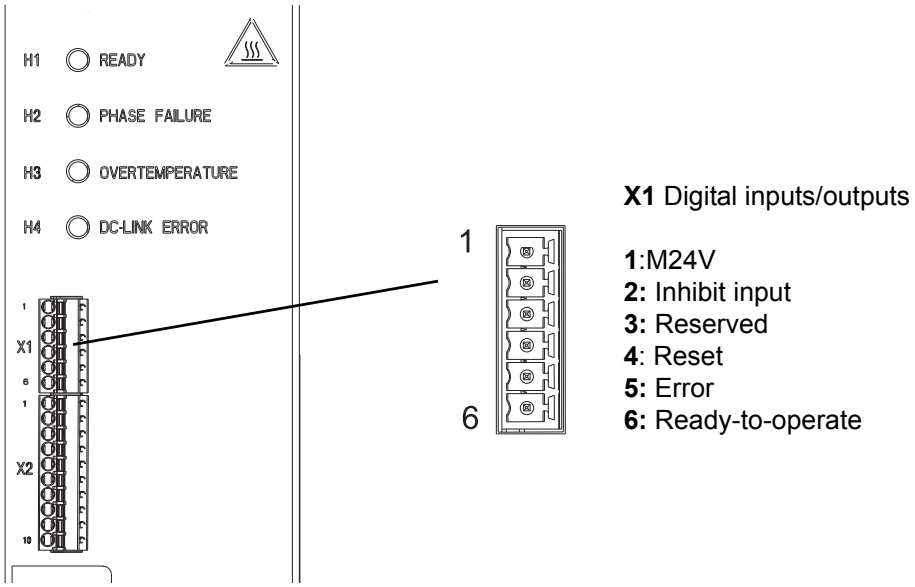


Figure 140: Connection X1 front side BM5030 with safety function

Pin assignment

Pin No.	Assignment			
1	Dig. input/output	GND 24 V		
2	Digital input	Inhibit input [1)]	BM5030-XXX**0** input is high active, expects NO contact	BM5030-XXX**1** input is low active, expects NC contact
3	Digital input	Reserved		
4	Digital input	Reset		
5	Digital output	Error		
6	Digital output	Ready-to-operate		

Input current per input	7 mA
Input level	High (12 … 28 V)
Output current per output	500 mA
Output level	High (12 … 28 V)

X2 **STO function BM5030-XX2X-...**

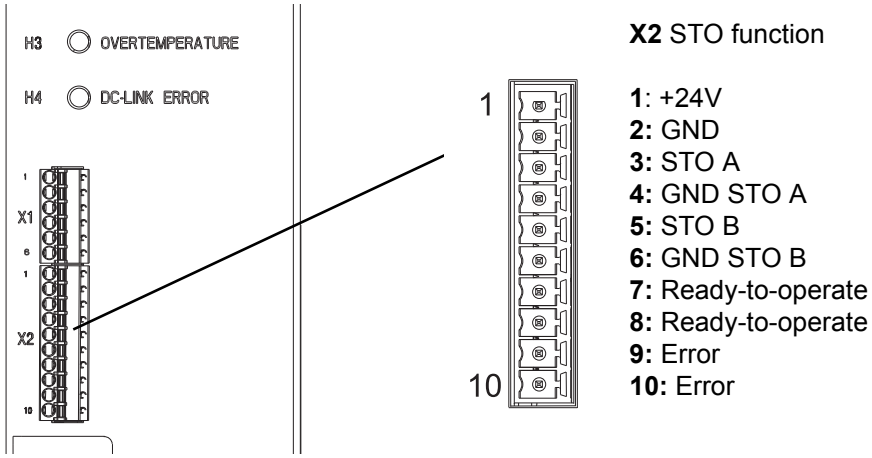


Figure 141: Connection X2 front side BM5030-XX2X-...

Pin assignment

Pin No.	Pin assignment	Description
1	+24 V	+24V DC power supply
2	GND	GND power supply
3	STO A	STO input A 0: DC link + switch open, DC link (+) disconnected 1: DC link + switch closed, DC link (+) connected
4	GND STO A	GND for STO input A
5	STO B	STO input B 0: DC link - switch open, DC link (-) disconnected 1: DC link - switch closed, DC link (-) connected
6	GND STO B	GND for STO input B
7 ... 8	Ready-to-operate	Potential free electronic switch open: DC link is not ready-to-operate closed: DC link is ready-to-operate
9 ... 10	Error	Potential free electronic switch open: Error closed: No error

Power supply voltage X2:1, X2:2

Power supply voltage for the electronics of DC link STO function
Technical data see ▹Power supply of the STO function◃ on page 336.

STO A input X2:3, X2:4

First channel of safe DC link disconnection. This input operates the DC link + switch.
Technical data see ▹Inputs STO function◃ on page 336.

STO B input X2:5, X2:6

Second channel of safe DC link disconnection. This input operates the DC link - switch.
Technical data see ▹Inputs STO function◃ on page 336.

Ready-to-operate output X2:7, X2:8

The DC link capacitors are charged via resistors after switching on the DC link switch. After that the loading resistors are bridged. Now it is possible to draw power from the DC link by the decentralized drive solutions BM2500. This state is shown by the ready-to-operate output ((X2:7 ⇔ X2:8 closed).



NOTICE!

The decentralized drive solutions BM2500 connected to the DC link of the BM5030 must not be enabled to state „**operation enabled**“ before the ready-to-operate output of the BM5030 is active, otherwise a damage of the device is possible.

Error output: X2:9, X2:10

The error output is active (X2:9 ⇔ X2:10 open) as long as the DC link STO function is in error state.

The error state is triggered by following incidents:

- STO error
- Overtemperature heat sink
- Fault of heat sink temperature sensor

STO error:

- At least on DC link switch is closed if the state of the STO inputs changes to „high“.
- t_1 > 5 ms (see ▹STO timing◃ on page 340)

Power supply of the STO function

For the power supply of the STO function on connector X2 a 24 V power supply unit is required, which corresponds with the SELV/PELV standards according EN 50178.

Voltage: $24V_{DC}$ -15 %/+20 %

Inputs STO function

The inputs of connector X2 have been designed according IEC 61131.
The input levels are as follows in case of 24 V DC power supply:

U_{Hmax} = 30 V	I_{Hmax} = 15 mA
U_{Hmin} = 11 V	I_{Hmin} = 2 mA
U_{Lmax} = 5 V	I_{Lmin} = not determined
U_{Lmin} = -3 V	I_{Lmax} = 15 mA

The maximum length of the cable is 30 m.

The safe inputs are designed for an operation with sensors providing OSSD outputs. The maximum test pulse length of 1 ms must not be exceeded.

Both inputs STO A and STO B are necessary for the safety function STO and must be activated separately. If both inputs are activated by one cable, the fault exclusion short-circuit according IEC 61800-5-2 appendix D must be considered.

Outputs BM5030-XX2X-...

Power rating per NO contact: Max. 30 V, max. 100 mA

The maximum cable length is 30 m.

D.7 Description of the safety function STO

NOTICE!

The commissioning is only allowed after the acclimatization of the device.

D.7.1 Safety related characteristics of the STO function

The specified values are valid during operation at the required environmental conditions, see ▹Required environmental conditions◃ on page 49.

PFH Probability of dangerous Failure per Hour

HFT Hardware Fault Tolerance

Characteristics according IEC 61508

	BM5030-XX2X
Safety Integrity Level	SIL2 / High demand mode
PFH	$<1{,}9 \cdot 10^{-7}$
HFT	1
	Type A

$MTTF_D$ (Mean Time To Failure Dangerous

DC_{avg} (Diagnostic Coverage

Characteristics according DIN EN ISO 13849-1

	BM5030-XX2X
Performance level	PLd, category 3
$MTTF_D$	200 years
DC_{avg}	Medium



WARNING!

Function test requirements of the safety function to comply with the **Safety Integrity Level SIL2** respectively with the **Performance level PLd, category 3**:

The safety function has to be tested (activated/deactivated) at least once a year.

The DC-link voltage must be measured in STO state once a year. The measured value must be ≤ 60 V.

No proof test is necessary during the expected device life cycle of 20 years.



CAUTION!

If the user calculates the safety application for the specified values with 20 years, the device must be decommissioned after 20 years. This is the maximum life cycle time of the device. The device must be decommissioned after this time. The device must be properly disposed of.

It is not possible to perform a proof test.



NOTICE!

The proper condition of the controller's fan must be checked before commissioning. The maintenance and cleaning of the fan must be made at least once a year.

D.7.2 Reaction time STO

The reaction time period starting from the change of the input state to U_L (see also ▹Inputs STO function◃ on page 336) to the disconnection of the DC link is maximum 5 ms.



CAUTION!

The existing capacitance of the decentralized drive solutions BM2500 connected to the DC link is discharged in case of active STO function. The time period for this discharge can be significantly greater than the reaction time, depending on the number of connected decentralized drive solutions BM2500. The discharge of the DC link is no part of the safety function.

D.7.3 Cycle time STO

It is allowed to change to the state ready-for-operation only once within 2 seconds (t_{BB}), in order to protect the internal charging and discharging resistors from overheating.

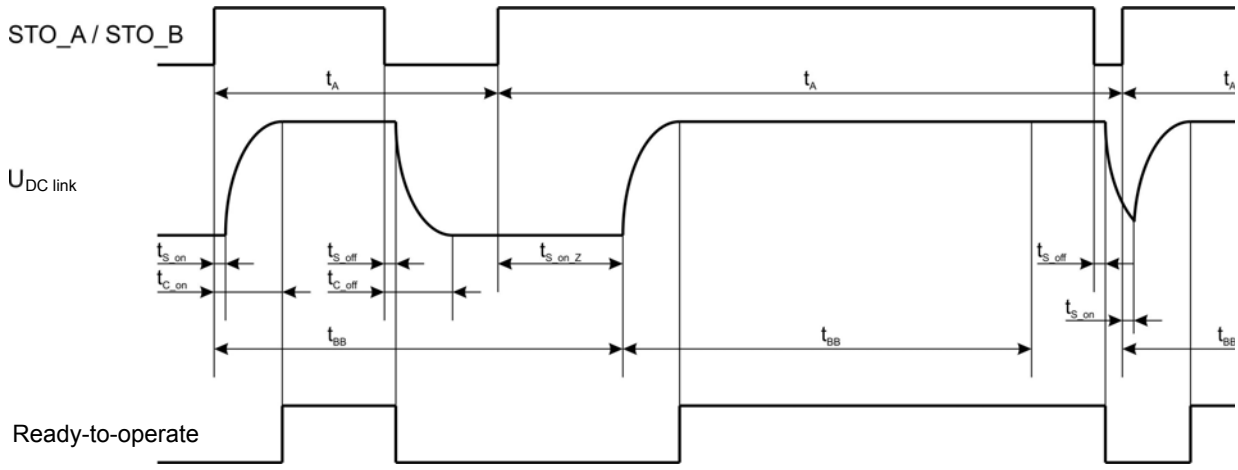


Figure 142: Cycle time STO

t_{S_on}: Reaction time period of STO A = high and STO B = high until the closing of the DC link switch, → max. 5 ms

t_{S_off}: Reaction time period of STO A = low and/or STO B = low until the opening of the DC link switch, → max. 5 ms

t_{C_on}: Time period from STO A = high and STO B = high to ready-to-operate = high, → depends on the capacitive load

t_{C_off}: Time period from STO A = low and/or STO B = low to DC link discharged → depends on the capacitive load

t_{BB}: Ready-to-operate cycle time, → min. 2 s

t_A: Time period between two times ready-to-operate active

$t_{S_on_Z}$: Reaction time period of STO A = high and STO B = high until the closing of the DC link switch, in case $t_A < t_{BB}$

D.7.4 Safety function STO im BM5030-XX2X-...

The STO switch is checked by the device automatically when changing to the state ready-to-operate.

State change from STO ⇒ Ready-to-operate (closing of the switches) is only possible if both switches were open prior to that.

In case of the failure of one of the switches (= closed in state STO), the device remains in state STO. H6 lights red.

STO timing

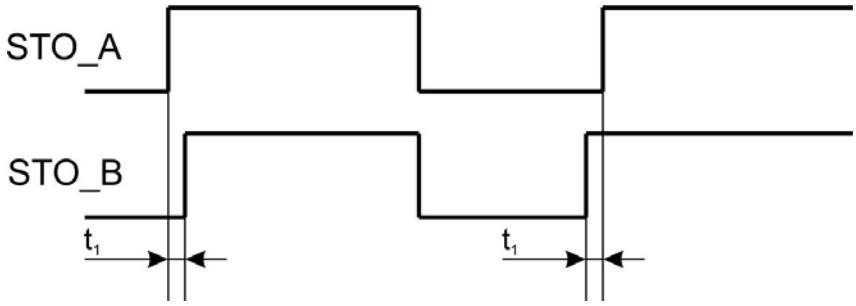


Figure 143: STO timing BM5030-XX2X-...

t_1 maximal 5 ms



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Overview of Revisions

Version	Status	Changes
5.09021.01	03-Sep-2010	Creation
5.09021.02	15-Apr-2011	BM5043 and BM5044 added, BM55XX deleted, SinCos® EnDat® encoder reading deleted, encoder cable and service cable added, notice assembly opening additional module, mounting of the DC link bar and of the signal bus added.
5.09021.03	22-Mar-2012	Pin assignment resolver cable changed, devices BM5331, BM5332, BM5333 added, Netzartshielding concept added, electrical data updated, cold plate cooling type complemented, version without motor temperature measurement deleted, connections reviewed, new connectors added BM51XX added
5.09021.04	21-Nov-2012	Changing in mains filter type code for EPCOS, additions for display function, toroidal cores for mains rectifier
5.09021.05	23-May-2013	New chapters: fieldbus communication EtherCAT® and VARAN, forming of capacitors SSI encoder added
5.09021.06	09-Sep-2013	New chapter: bUL notes Error correction: monitoring functions, error acknowledgment
5.09021.07	10-Jan-2014	New chapter: Add-on module incremental encoder evaluation IEE
5.09021.08	26.-Jun-2014	Error correction, chapter signal bus updated,
5.09021.09	24-Nov-2014	Chapter Fieldbus completed with POWERLINK®
5.09021.10	13-Jul-2015	Chapter Fieldbus completed with CANopen®
5.09021.11	24-Sep-2015	New add-on module SVP
5.09021.12	15-Jun-2016	New cooling type: A New device sizes: BM537X
5.09021.13	15-Nov-2016	New device sizes: BM5030, BM519X, BM5376
5.09021.14	11-May-2017	Hybrid cable device-encoder-motor with HIPERFACE DSL®, encoder with EnDat® 2.2,, BM5030 with safety function
5.09021.15	1-Mar-2018	Chapter: Avoid bearing currents added, update BM5030
5.09021.16	5-Nov-2018	New choke TRAMAG for BM519X
5.09021.17	22-May-2019	New mains inverters 50XX with charge resistor Risk assessment added
5.09021.18	28-Nov-2019	New device sizes: BM5074, new fieldbuses: Modbus® and EtherNet/IP®
5.09021.19	07-Jul-2021	Load cycles added

Notes:

be in motion

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