BAUMÜLLER

b maXX 6000

Instruction handbook
b maXX 6500 Mono units / Power modules

E	5.22004.06

Read the Instruction handbook before starting any work!

Language **English** (Translation)
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Preliminary information

Warning Insofar as this document is identified as being preliminary information, the following applies:
this version is regarded as providing advance technical information to users of the described devices and their functions at an early enough time in order to adapt to any possible changes or expanded functionality.
This information must be regarded as being preliminary, as it has not yet passed through Baumüller's internal review process. In particular, this information is still subject to changes, thus no legal liability can be derived from this preliminary information. Baumüller assumes no liability for damages that might arise from this possibly faulty or incomplete version.
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Obligatory

This Instruction handbook are a part of the equipment/machine. This Instruction handbook must be available to the operator at all times and must be in legible condition. If the equipment/machine is sold or moved another location, these Instruction handbook must be passed on by the owner together with the equipment/machine.
After any sale of the equipment/machine, this original and all copies must be handed over to the buyer. After disposal or any other end use, this original and all copies must be destroyed.

When the present Instruction handbook are handed over, corresponding sets of instruction handbooks of a previous version are automatically invalidated.
Please note that the specifications/data/information **are current values according to the printing date**. These statements are **not legally binding** with regard to measurements, computation or calculations.
Baumüller Nürnberg GmbH reserves the right, in developing its products further, to change the technical specifications and handling of it products concerned without prior notice.

No liability can be accepted concerning the correctness of these Instruction handbook unless otherwise specified in the General Conditions of Sale and Delivery.

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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 Approved devices

The following devices are available for order and are included in the CE Declaration; refer to ▷Appendix B - Declaration of Conformity◁ as from page 299.

- BM651X
- BM653X
- BM654X
- BM655X
- BM656X

NOTE!

For mono units BM65**2**X and power modules BM65**D**X, BM65**E**X and BM65**F**X this instruction handbook is intended solely as preliminary information.

1.3 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.

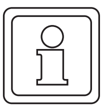
	**DANGER!** ....points out an immediately dangerous situation that will lead to severe injuries or death if not avoided.

	**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.

1.4 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.

1.5 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.

NOTE!

The specific contents, text, drawings, images and other representations are copyrighted and subject to industrial property rights. Any prohibited usage is punishable by law.

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NOTE!

Please note, that BAUMÜLLER is not responsible to examine whether any (industrial property) rights of third parties are infringed by the application-specific use of the BAUMÜLLER products/components or the execution.

1.6 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.

1.7 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 235.

1.8 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 287.

1.9 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.

1.10 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.

1.11 List of applicable documentation

Parameter manual

	Doc.-No.
Parameter manual b maXX 5000 / 6000	5.22005

Safety

NOTE!

For devices with safety functions

F-Code ≠ 0000 0000

the following additions to the instruction handbook apply:

- Integrated hardware-based safety function ISF STO/SS1
  only F: 0040 0001, F: 0040 2001, Doc.-No. 5.23015
- Integrated safety function ISF
  Doc.-No. 5.23016

(refer to ▹Identification of the device◃ on page 104 and ▹Fail safe code◃ on page 107)

	Doc.-No.
Addition to Instruction handbook b maXX 6000 Integrated hardware-based safety function ISF STO/SS1	5.23015
Addition to Instruction handbook b maXX 6000 Integrated safety function ISF	5.23016

Instruction handbook add-on modules

	Doc.-No.
Add-on module IEE / SIE	5.25013

Application handbooks

	Doc.-No.
Servo pump function V1 for b maXX 5000/6000	5.17002
Servo pump function V2 for b maXX 3000/5000/6000	5.17016

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 **BM65XX** are mono units with servo controller for connection to a power supply system.

The devices of the model series **BM65DX, BM65EX, BM65FX** are power modules with servo controller for connection to a DC link supply.

The devices are available in graduated design size and performance classes.

The device **BM65XX** 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.

2.3 Usage for the intended purpose

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 power supply. To operate the device in primary environments of the category C2/C1 (residential, business and commercial areas, directly on a public low-voltage power supply 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
- Line filter, power chokes, 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 20 min runs up, check zero-potential before touching.

Electromagnetic fields

The device causes electromagnetic fields when operating.

Any person with pacemakers and implants must maintain a distance of at least 1 m during operation.

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.

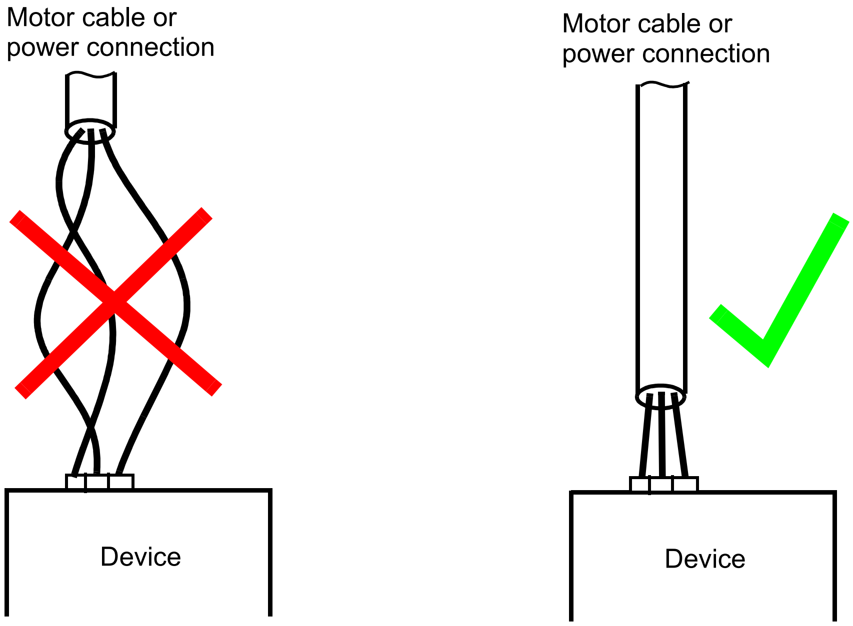


Figure 1: Wiring of the power cables

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	
BM651X BM652X	IP 20
BM653X	IP 20, with a contact-isolated connection in accordance with IP 20
BM654X, BM65DX BM655X, BM65EX BM656X, BM65FX	IP 00, when using the correct accessories IP 20

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.

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.

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

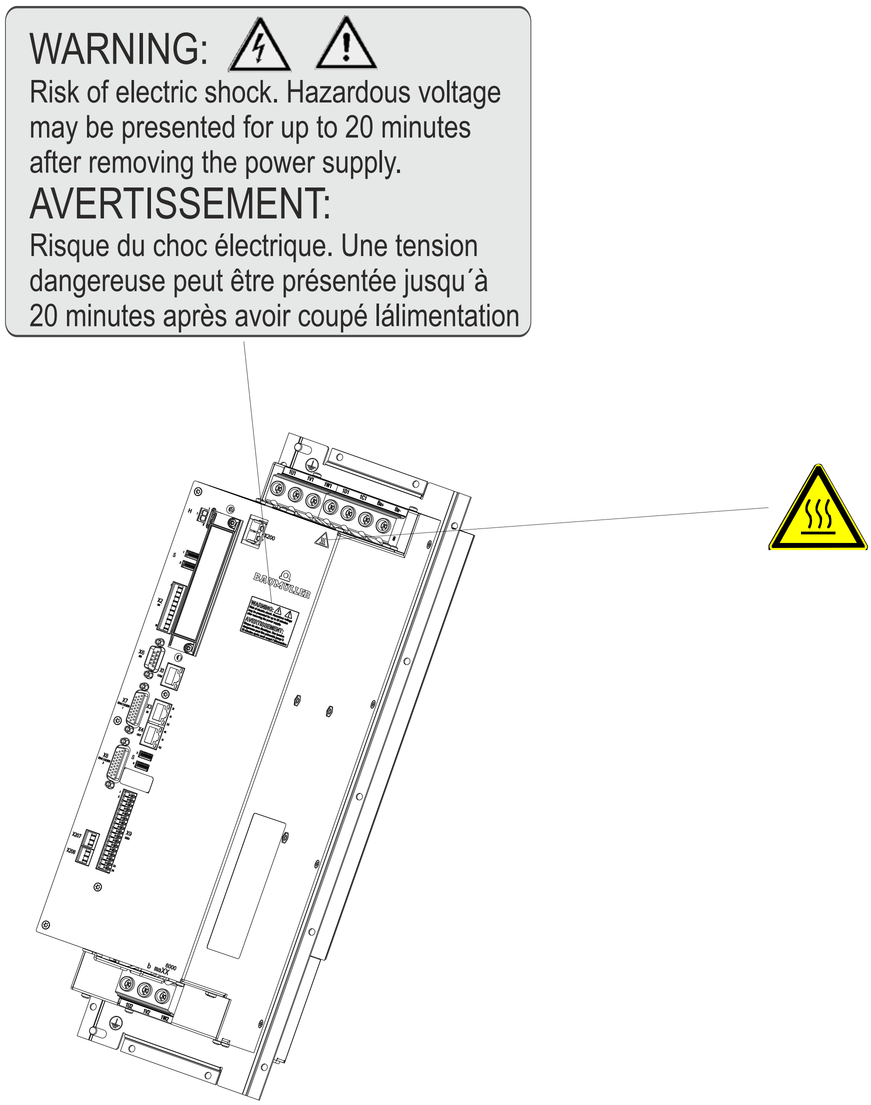


Figure 2: Signs and labels

3

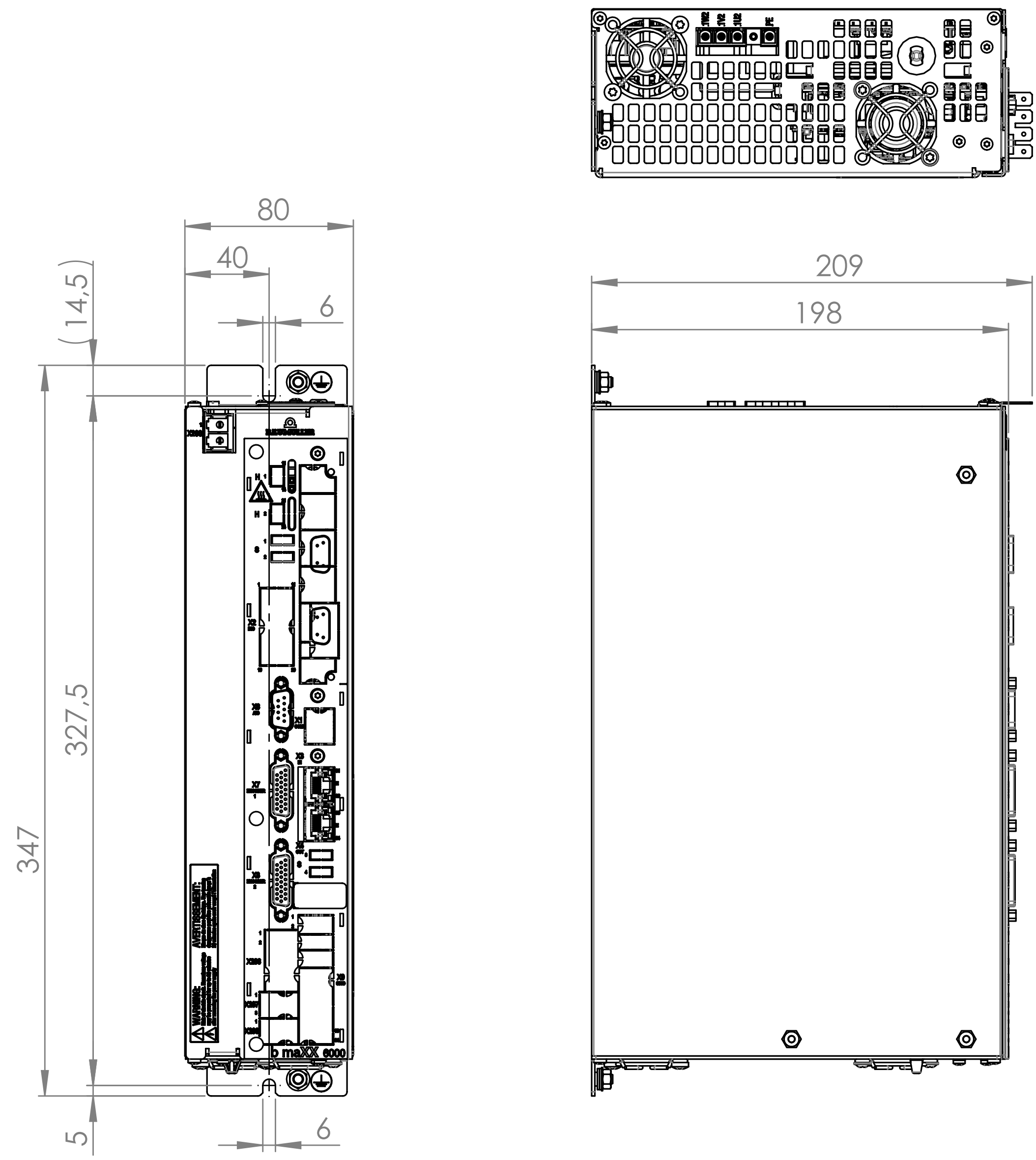
TECHNICAL DATA

3.1 Dimensions

The following drawings show the 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 127.

3.1 Dimensions

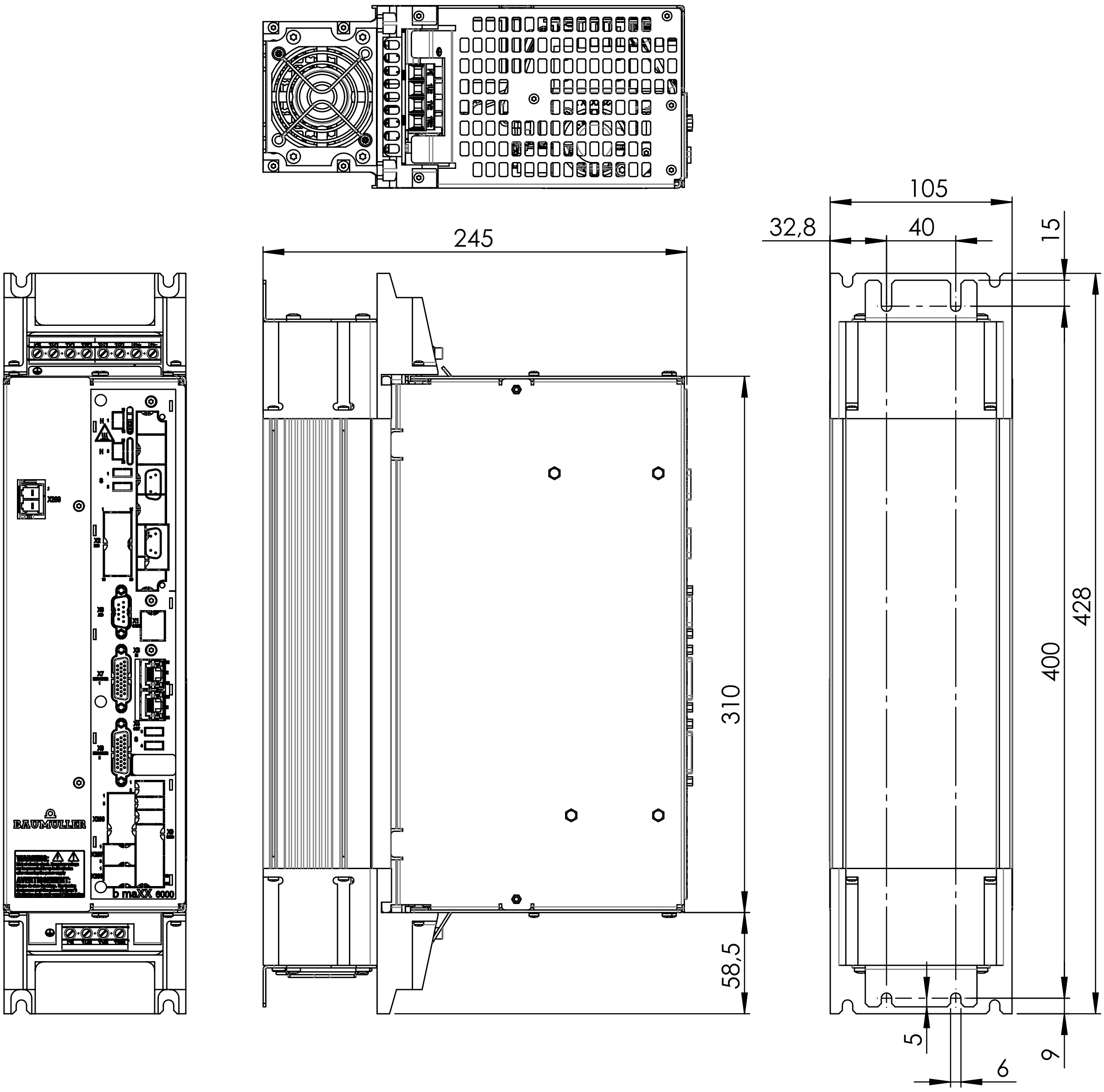
3.1.1 Dimensions BM651X



Please follow the notes for mounting and ▷Cooling◁ on page 64.

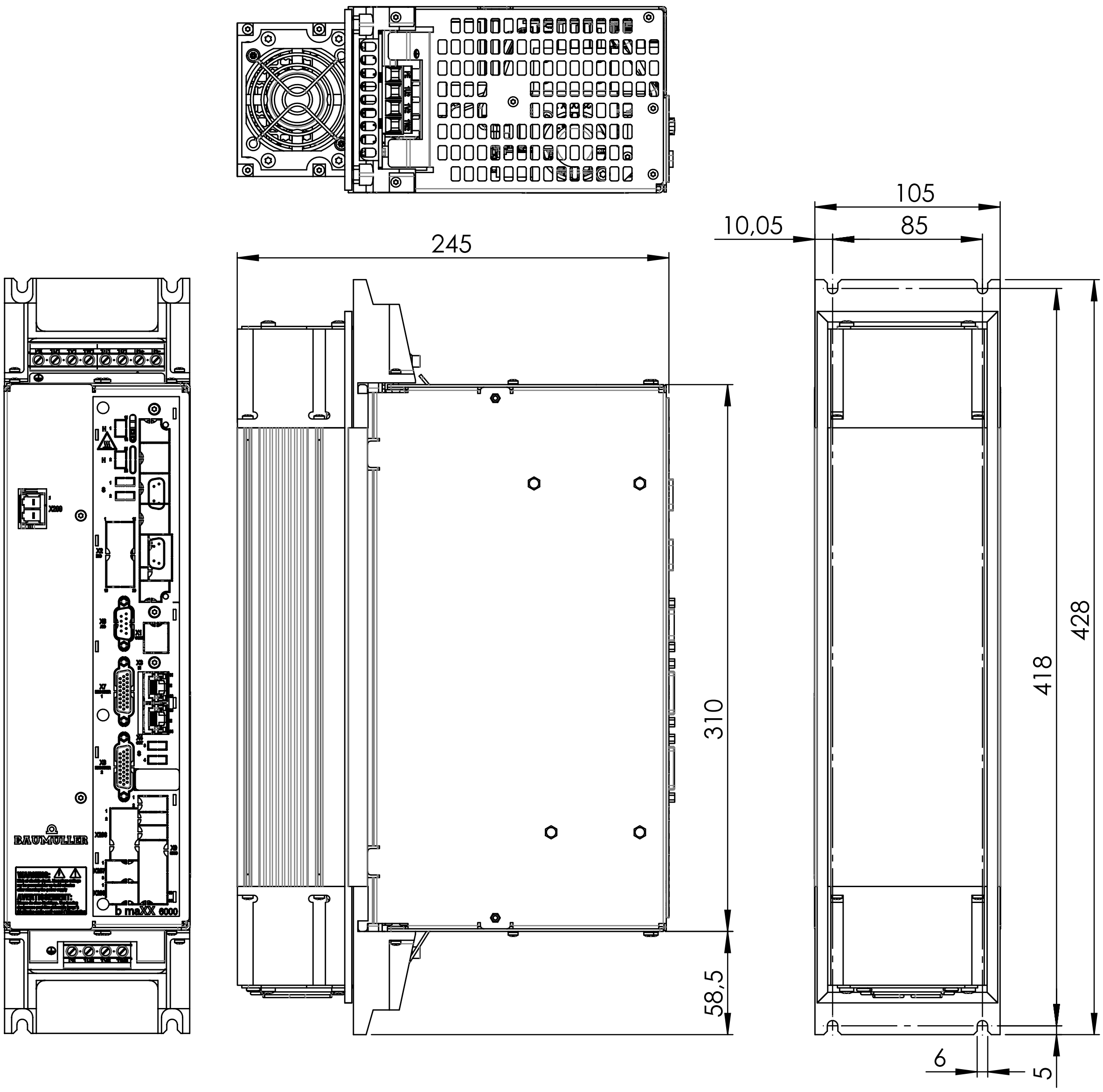
Figure 3: Dimensions BM651X-S

3.1.2 Dimensions BM652X



Please follow the notes for mounting and ▷Cooling◁ on page 64.

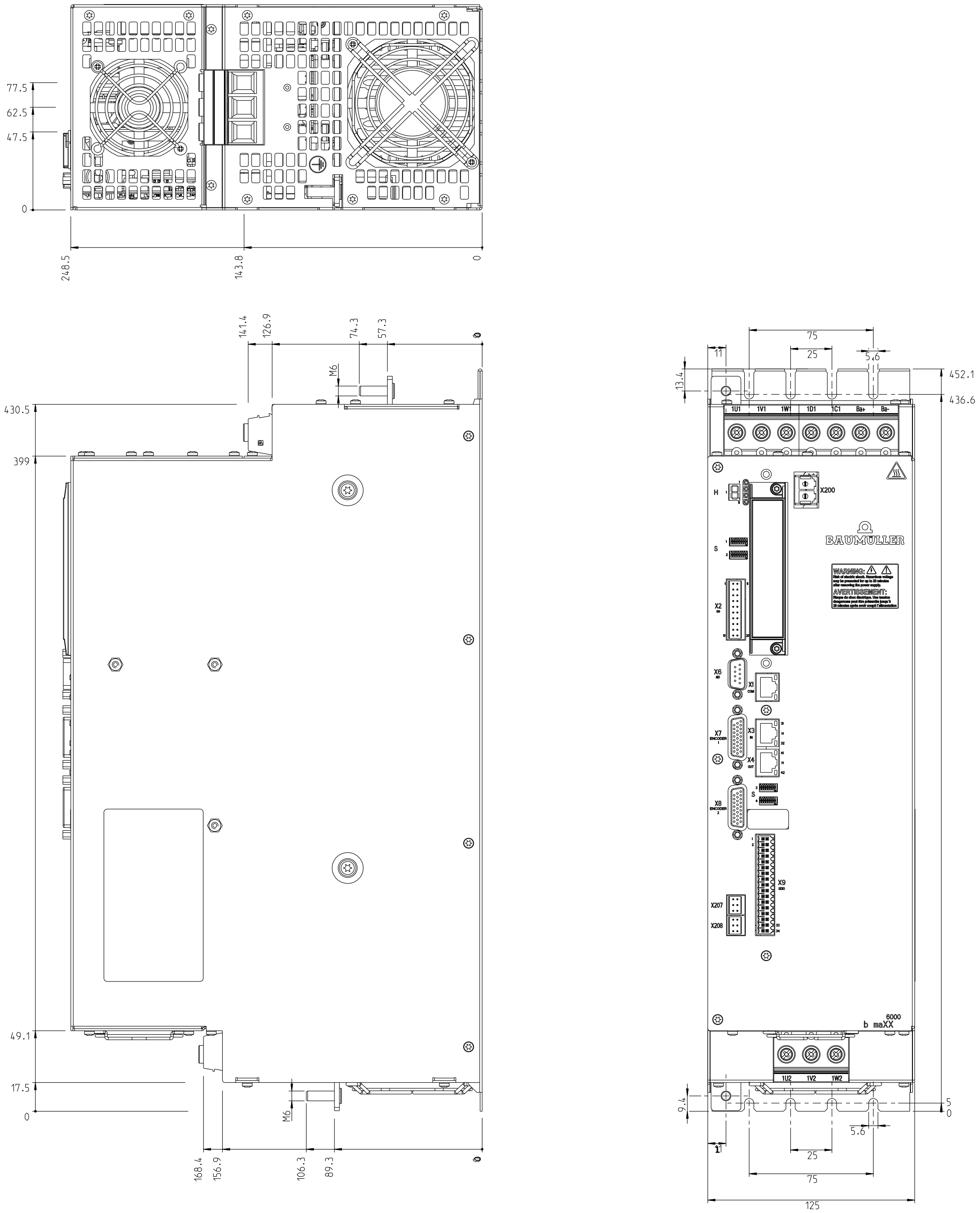
Figure 4: Dimensions BM652X-S



Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 5: Dimensions BM652X-A

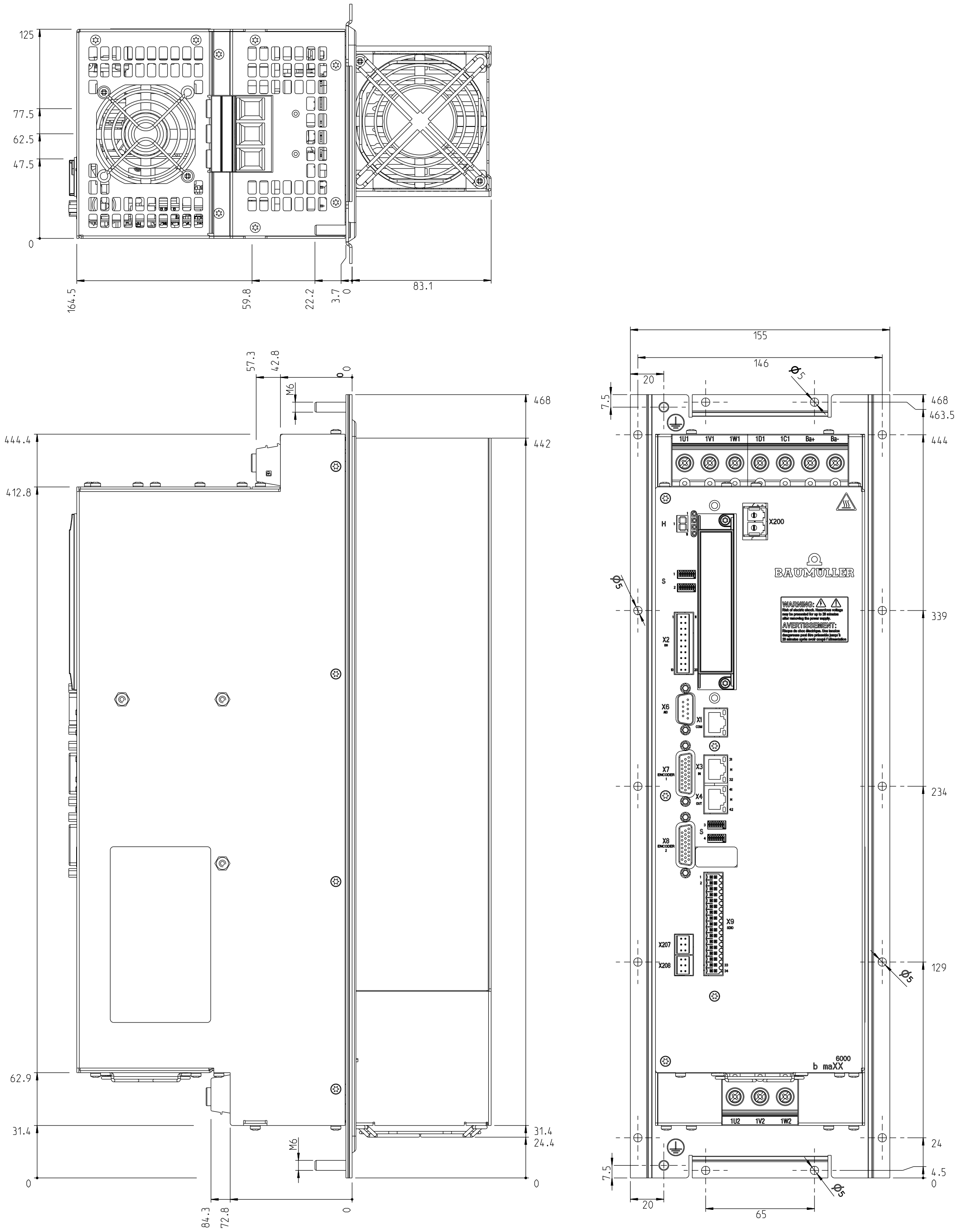
3.1.3 Dimensions BM653X



Please follow the notes for mounting and ▹Cooling◃ on page 64.

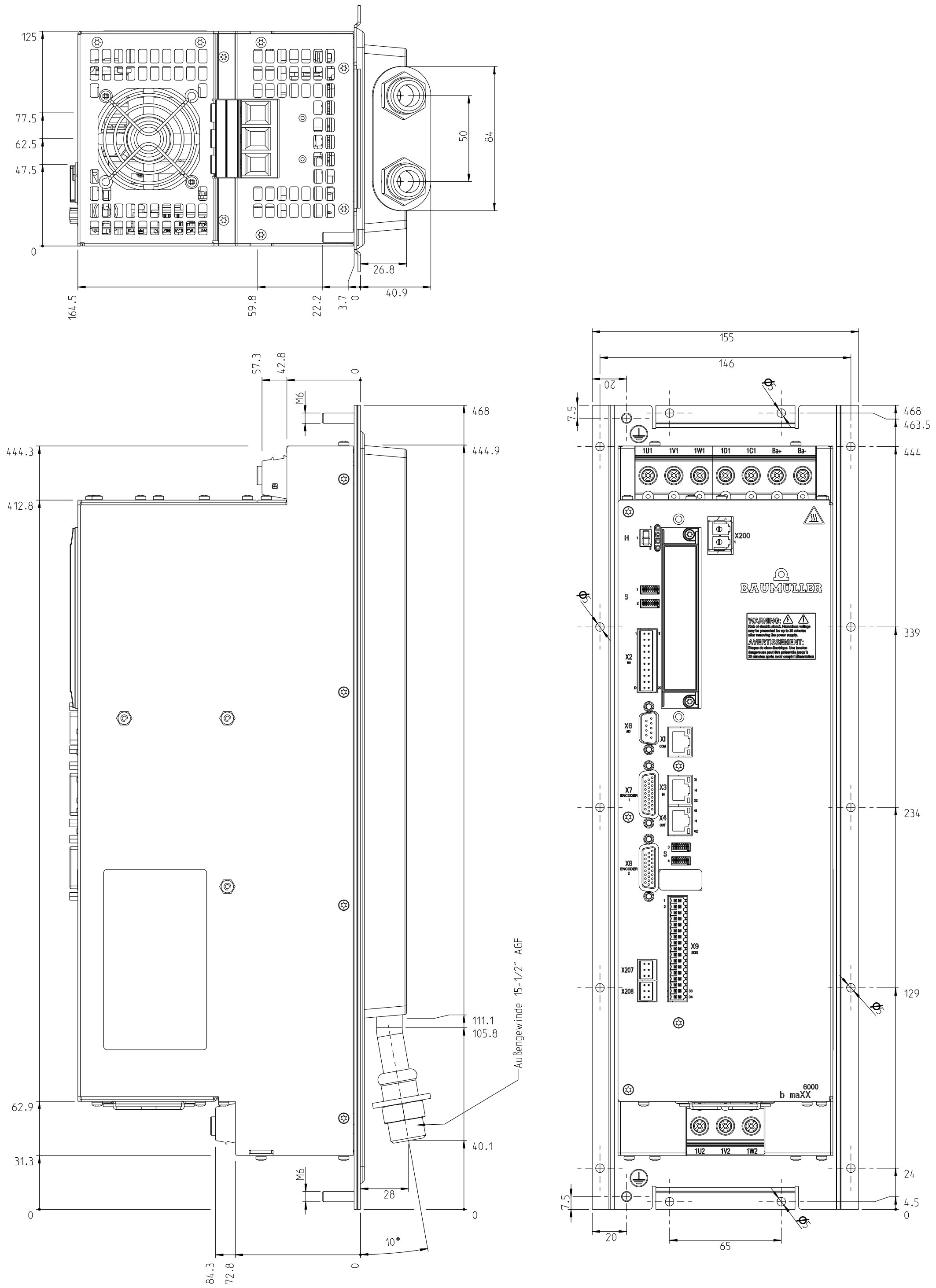
Figure 6: Dimensions BM653X-S

3.1 Dimensions



Please follow the notes for mounting and ▷Cooling◁ on page 64.

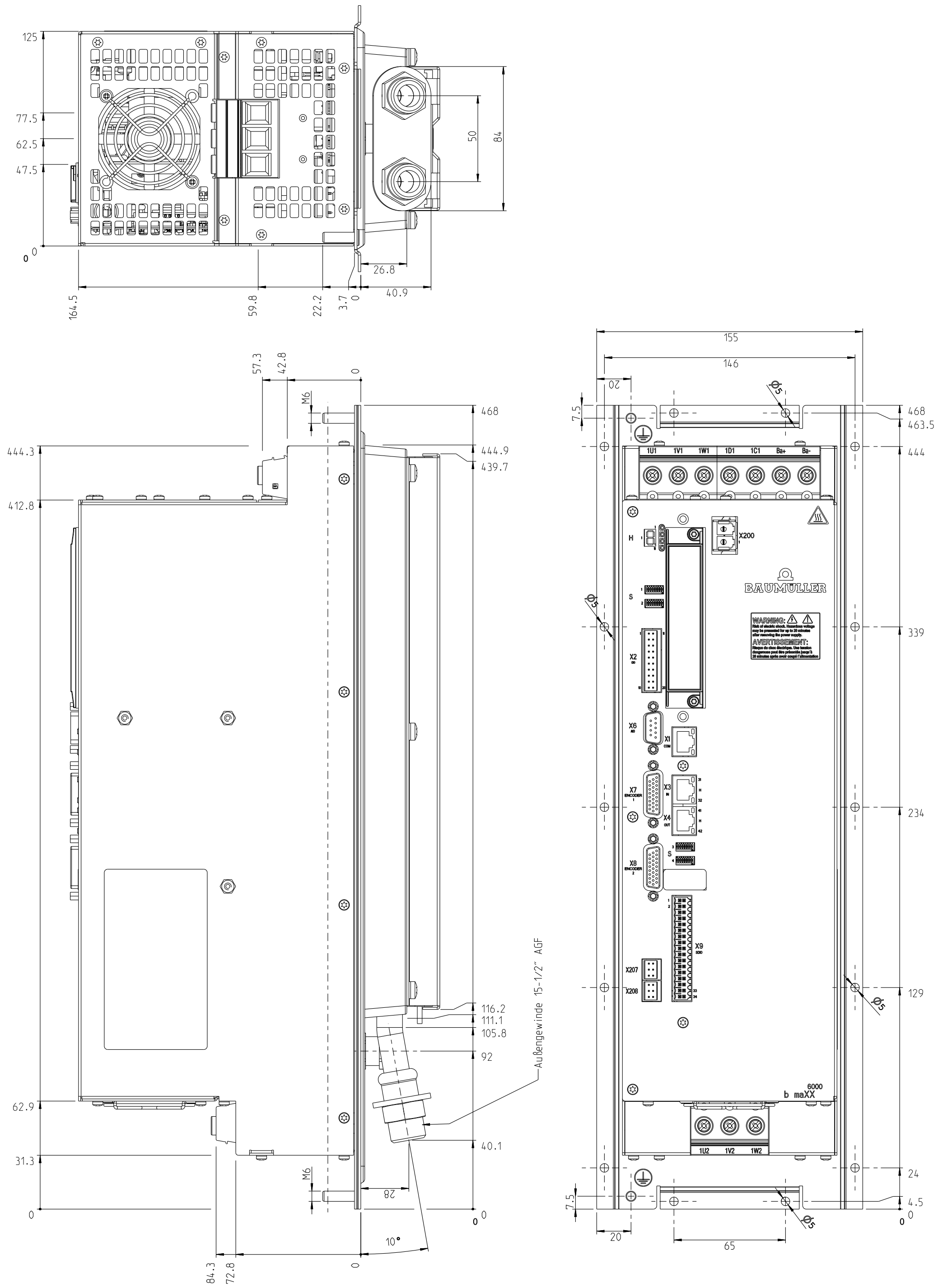
Figure 7: Dimensions BM653X-A



Please follow the notes for mounting and ▹Cooling◃ on page 64.

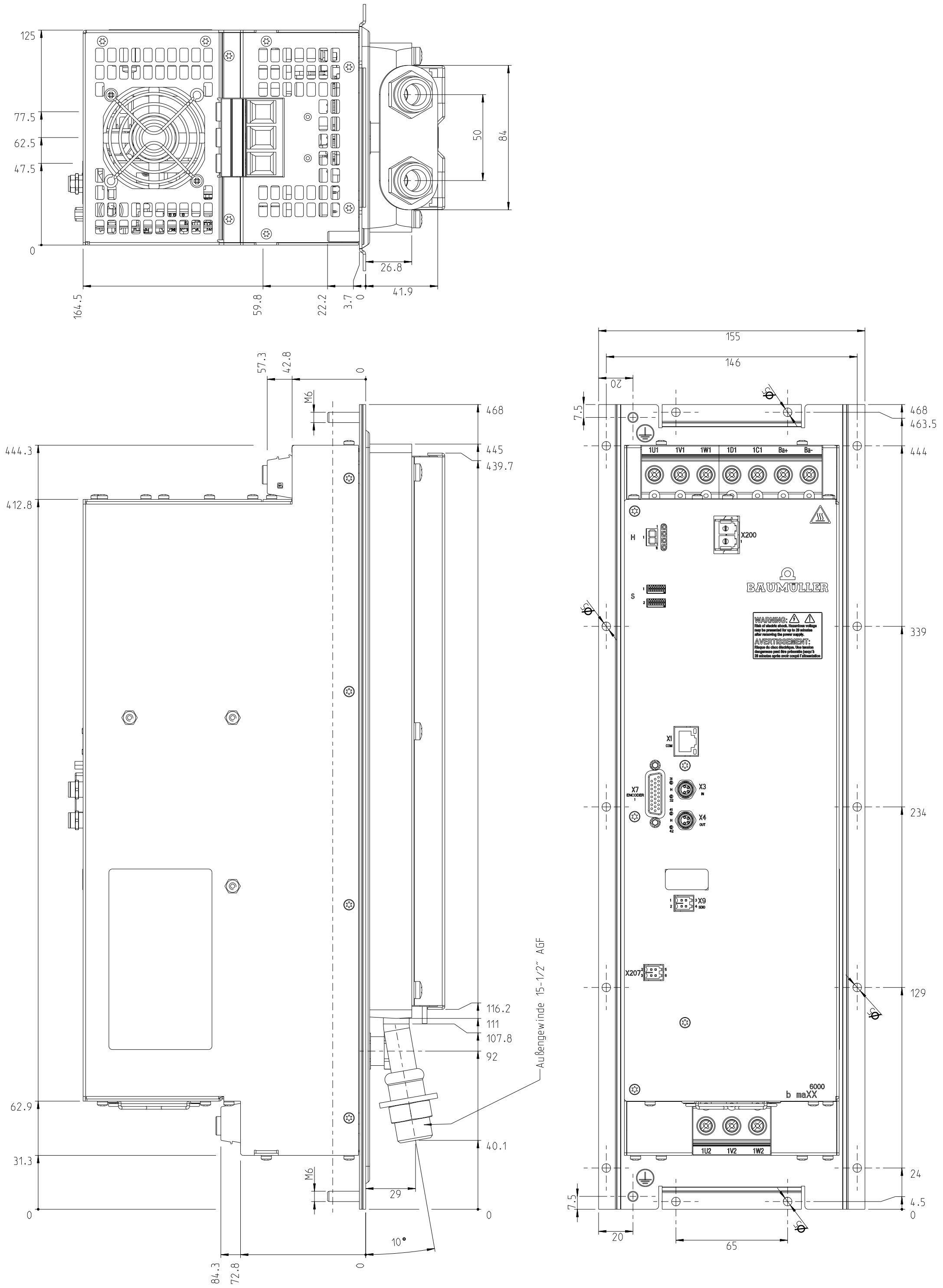
Figure 8: Dimensions BM653X-FXXX00

3.1 Dimensions



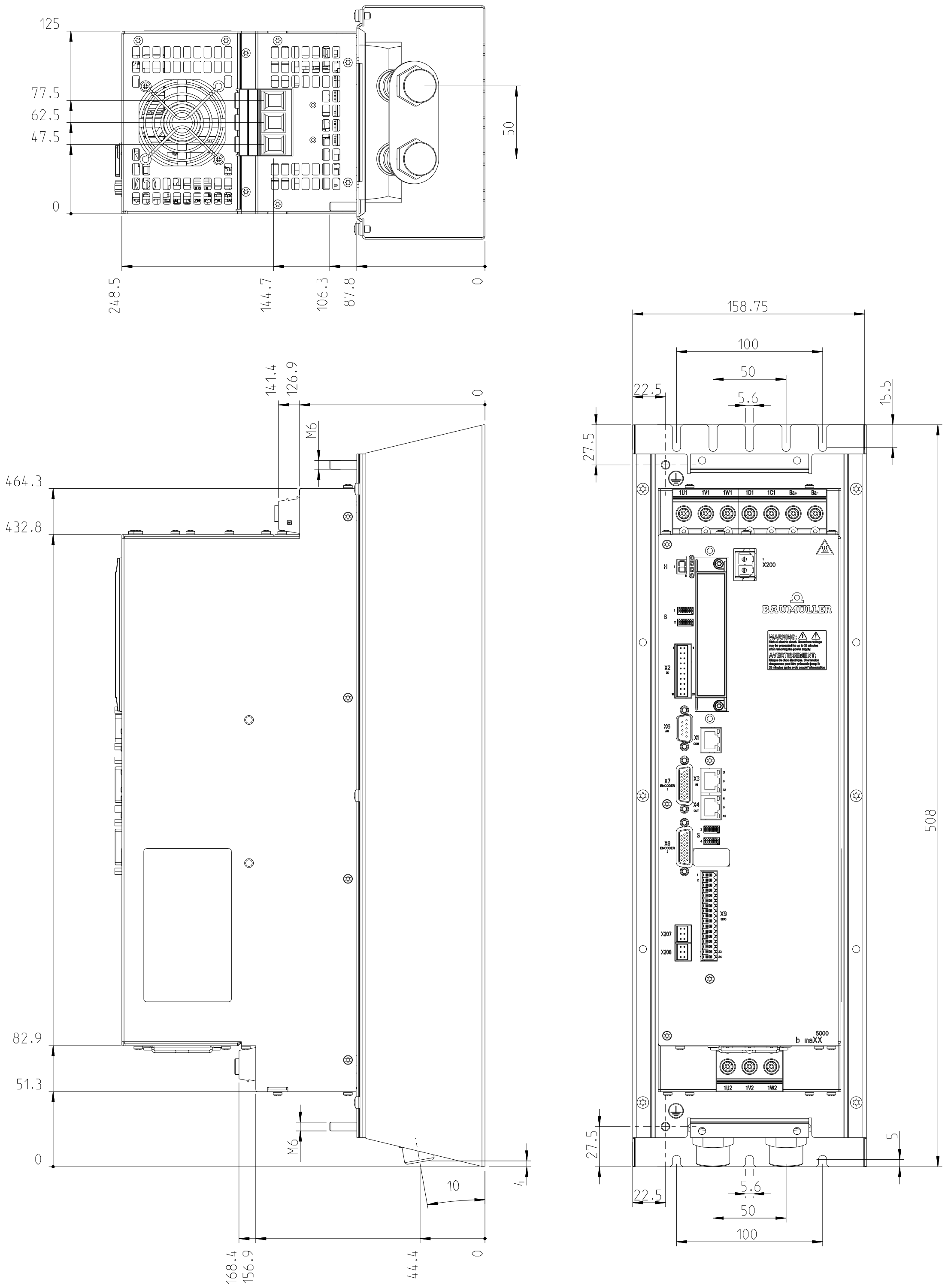
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 9: Dimensions BM653X-FXXXYY



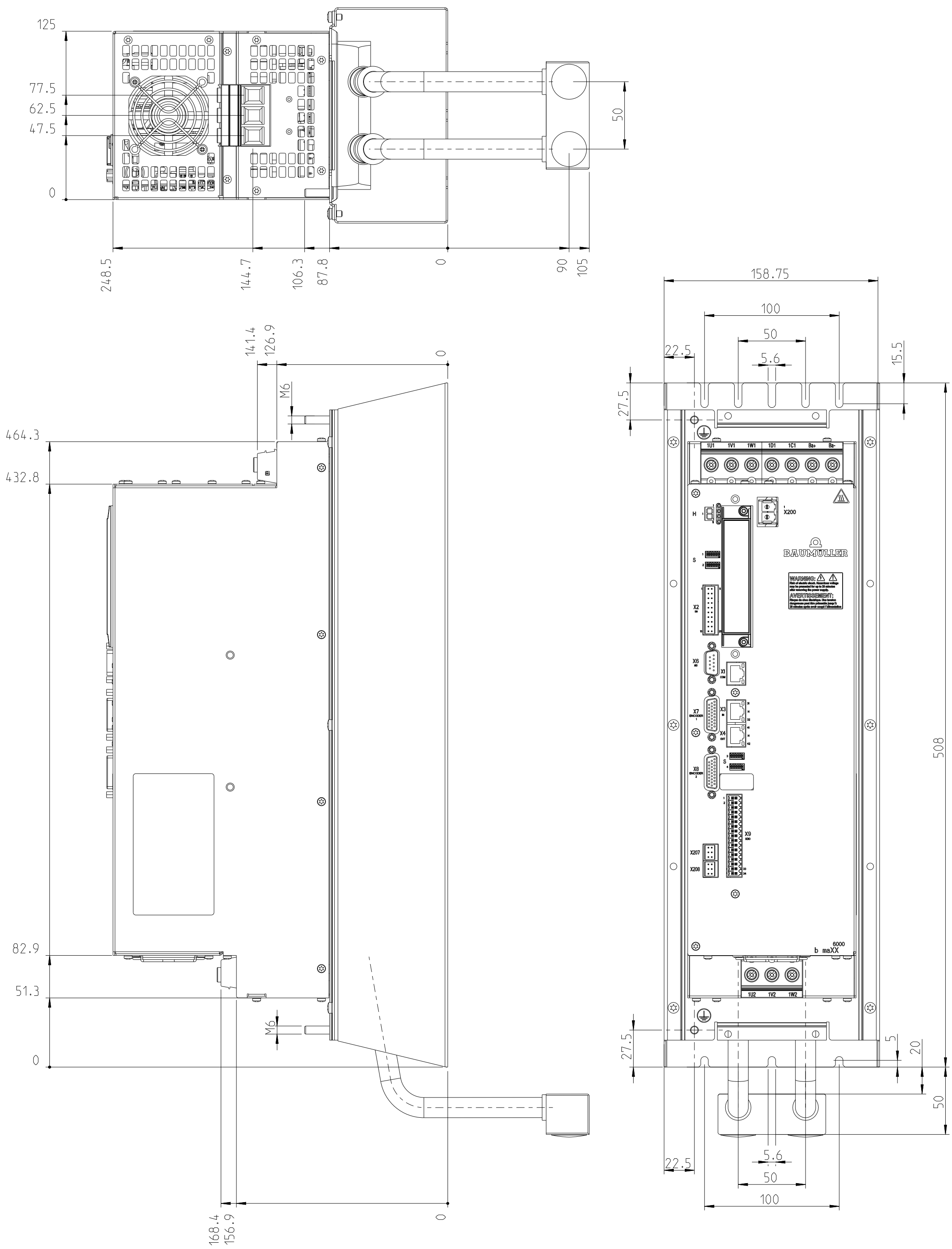
Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 10: Dimensions BM653X-FXXXYY-7



Please follow the notes for mounting and ▷Cooling◁ on page 64.

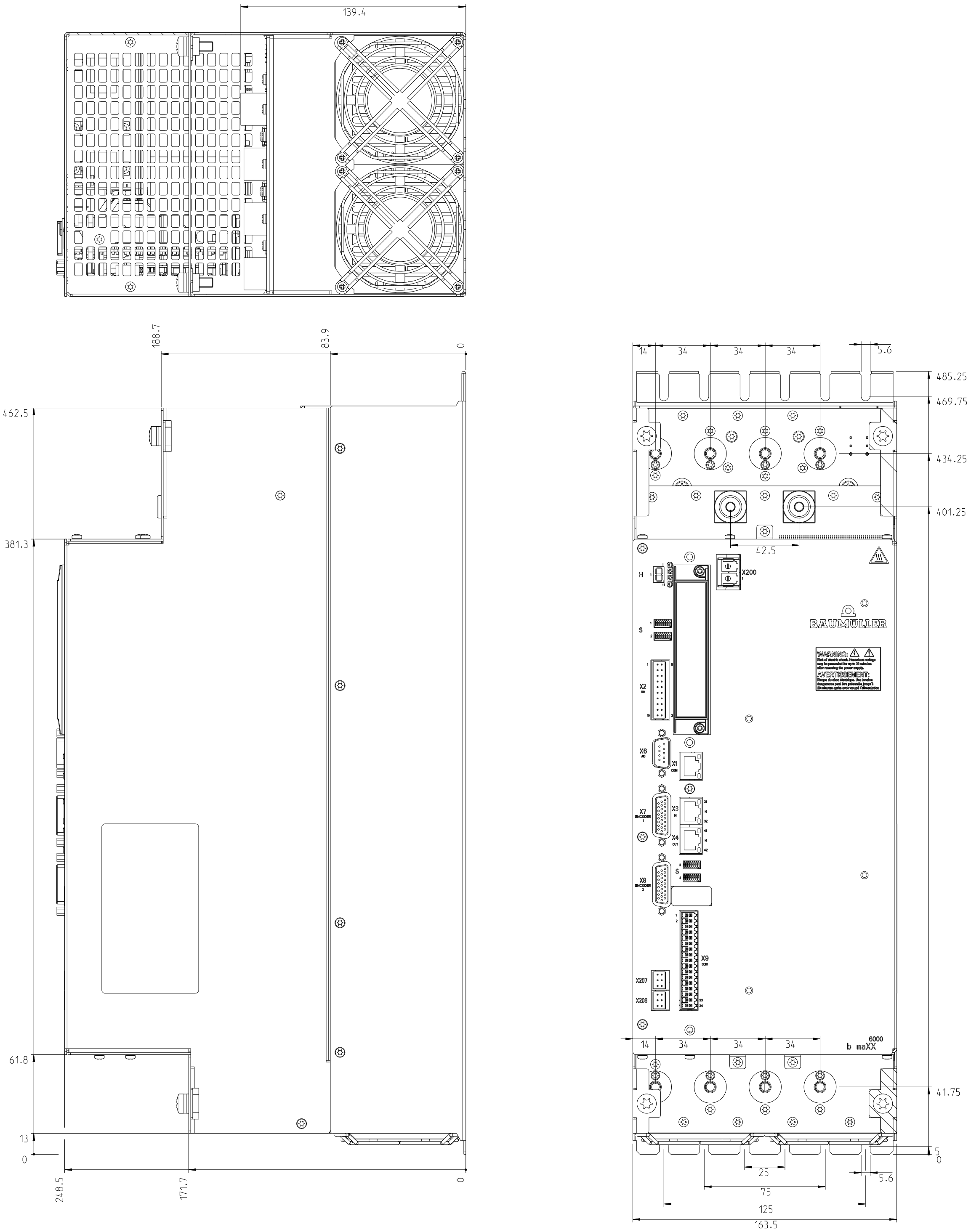
Figure 11: Dimensions BM653X-ZXXX00



Please follow the notes for mounting and ▹Cooling◃ on page 64.

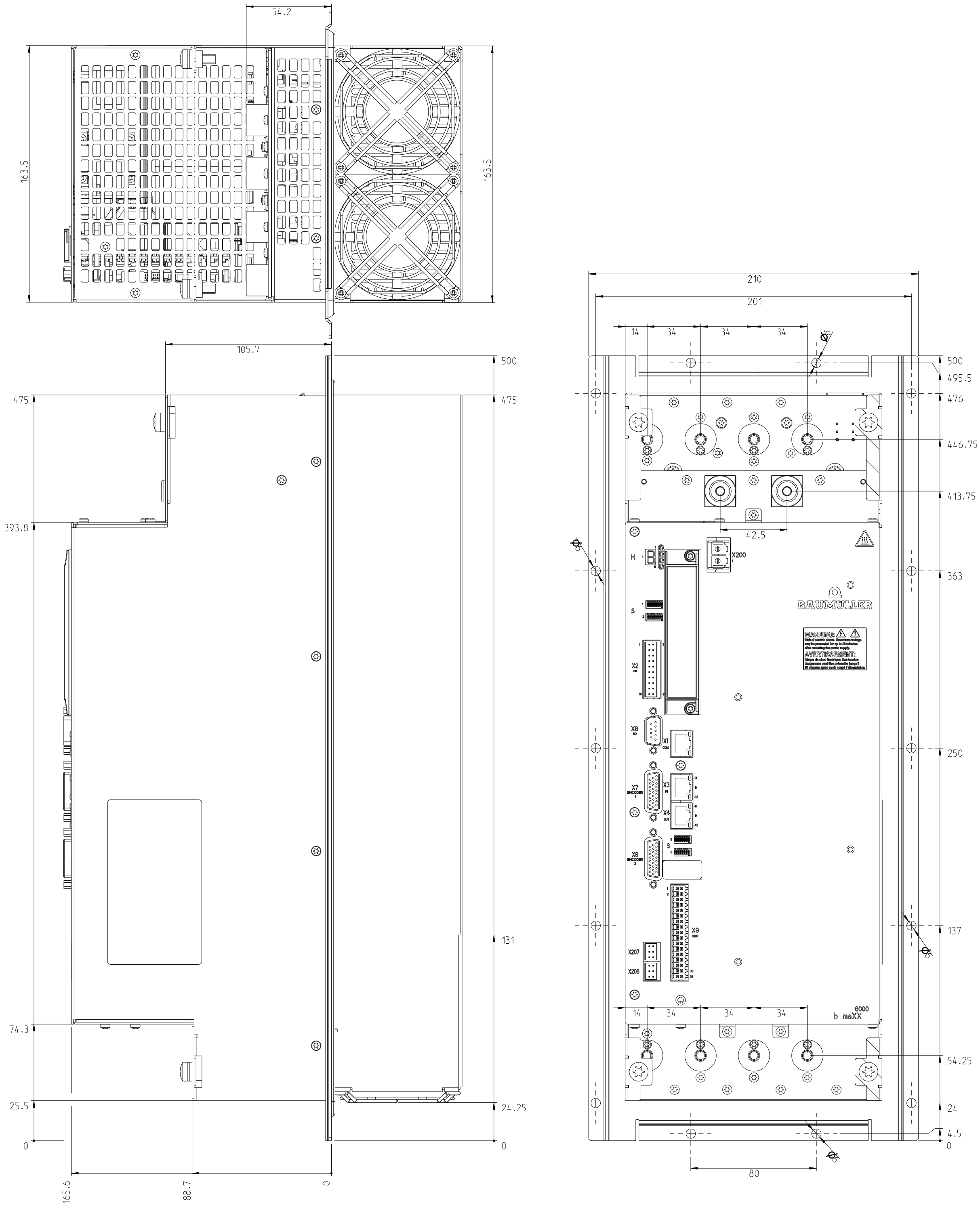
Figure 12: Dimensions BM653X-ZXXXYY-XXX-XX-05

3.1.4 Dimensions BM654X/BM65DX



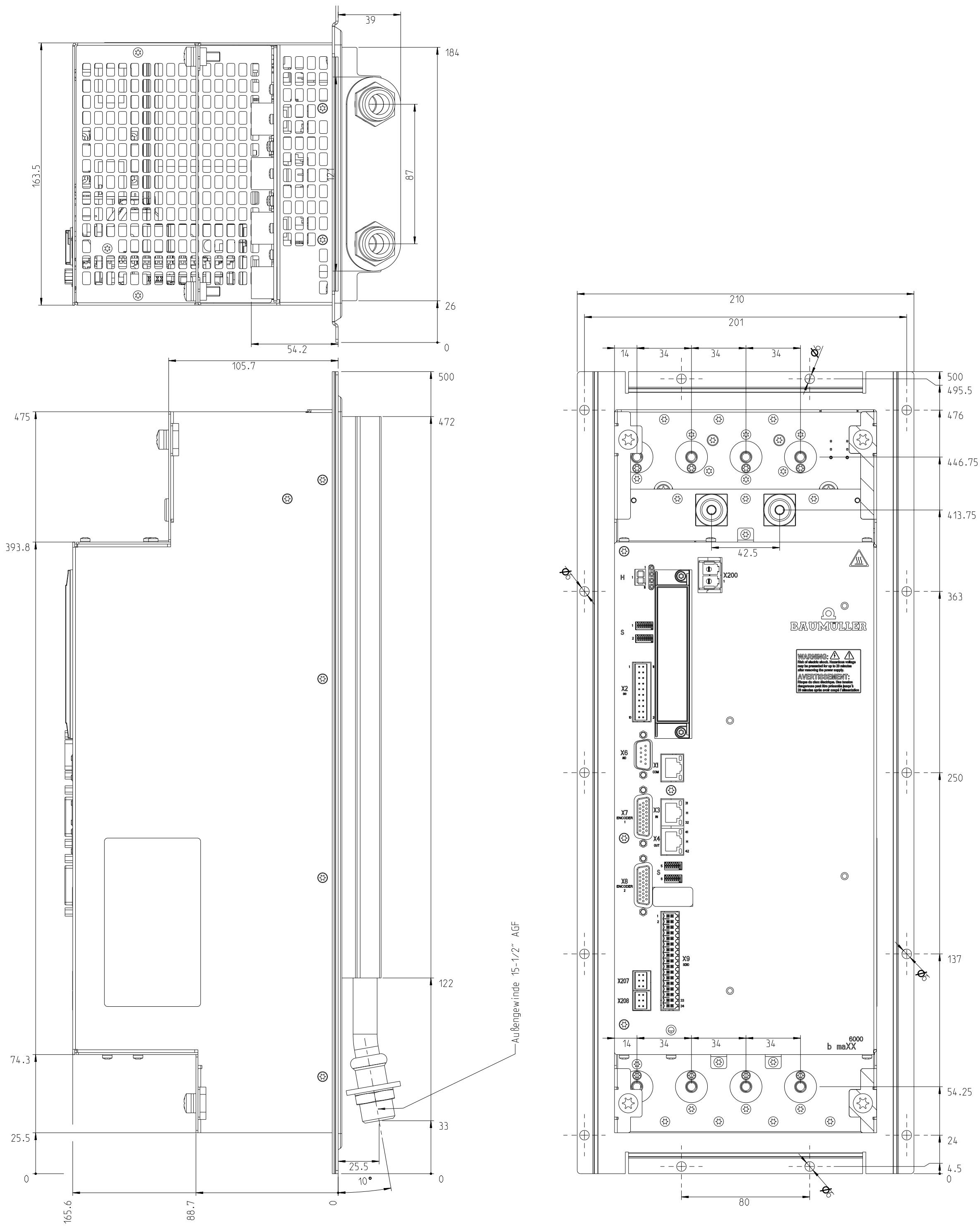
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 13: Dimensions BM654X/BM65DX-S



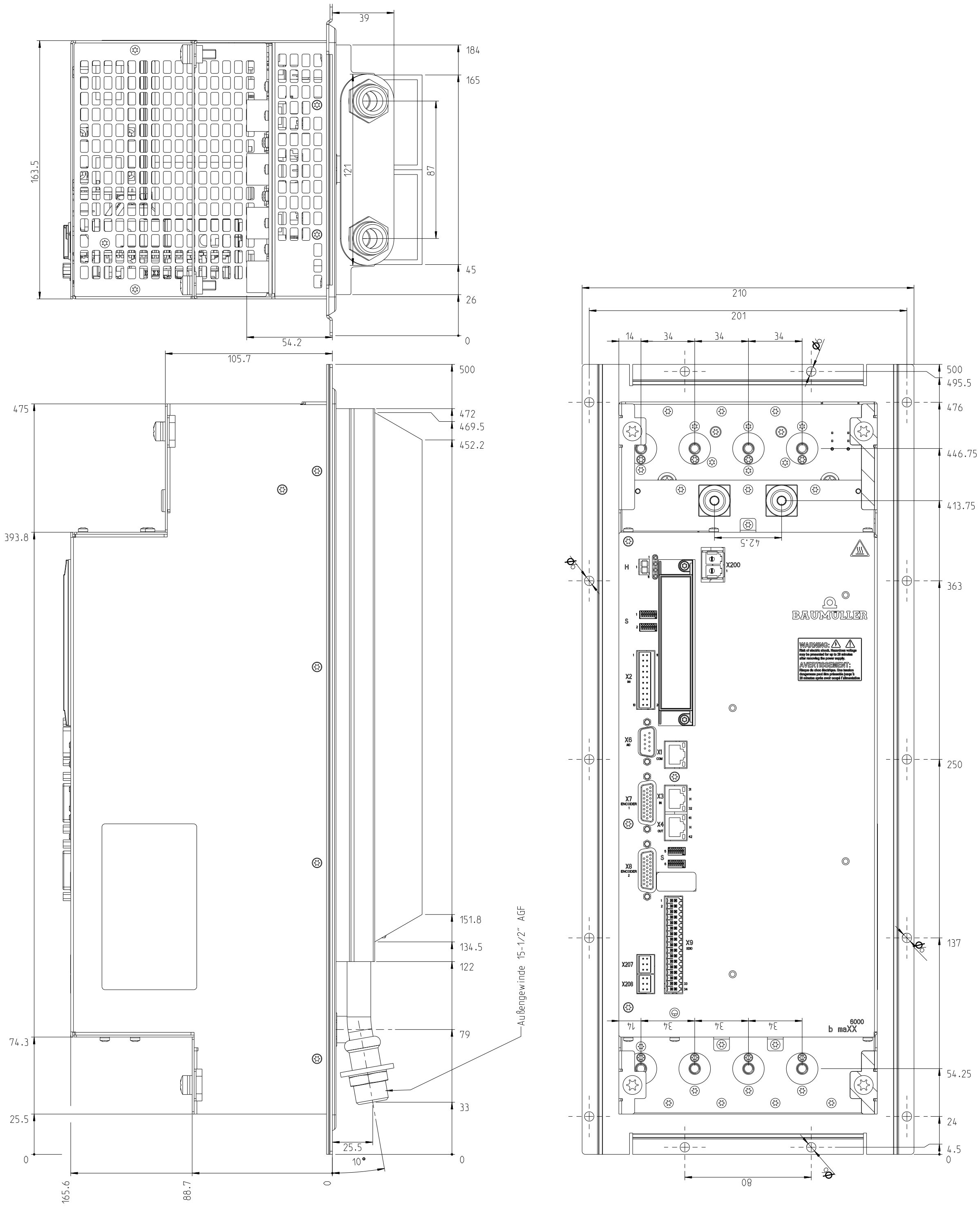
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 14: Dimensions BM654X/BM65DX-A



Please follow the notes for mounting and ▹Cooling◃ on page 64.

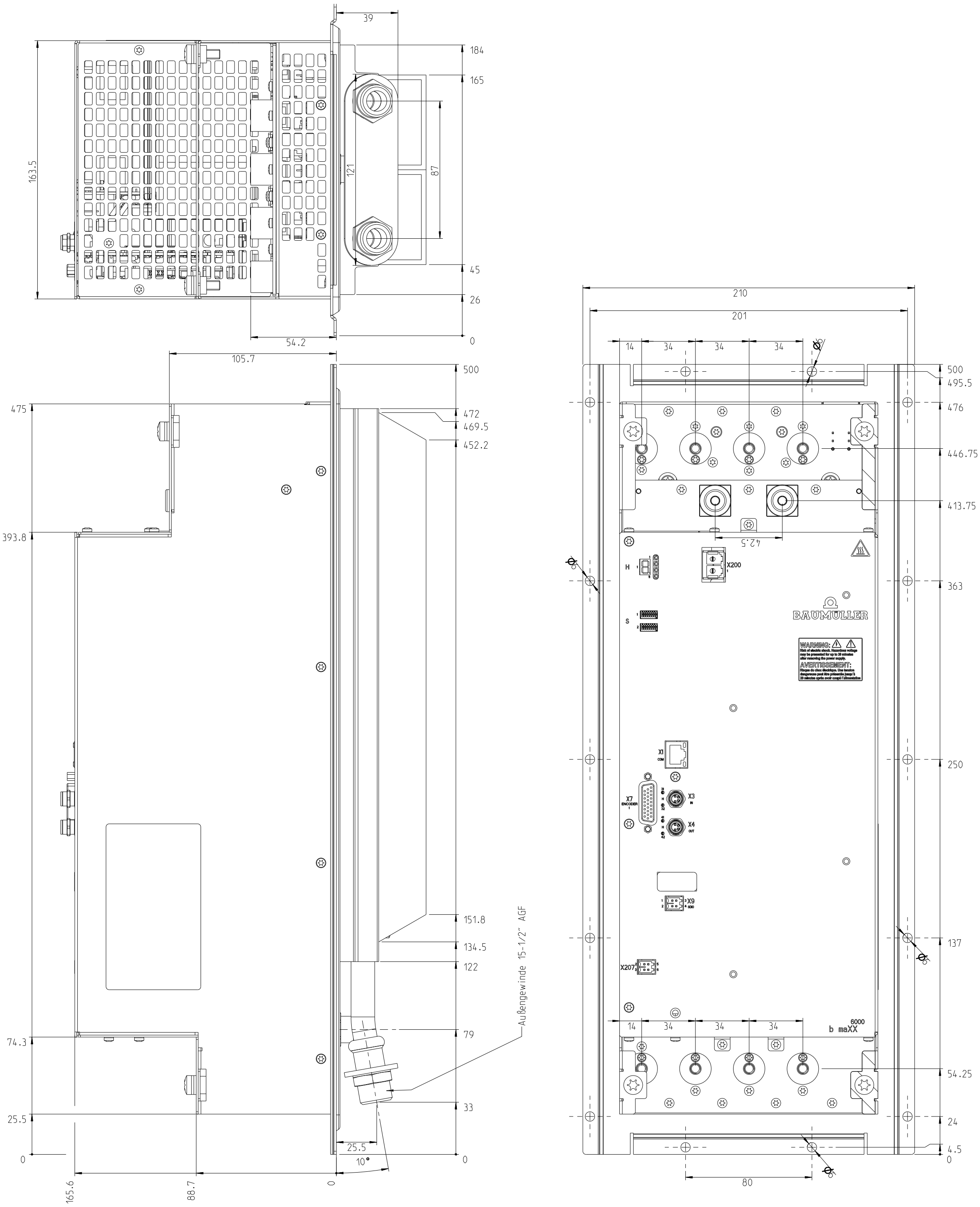
Figure 15: Dimensions BM654X/BM65DX-FXXX00



Please follow the notes for mounting and ▷Cooling◁ on page 64.

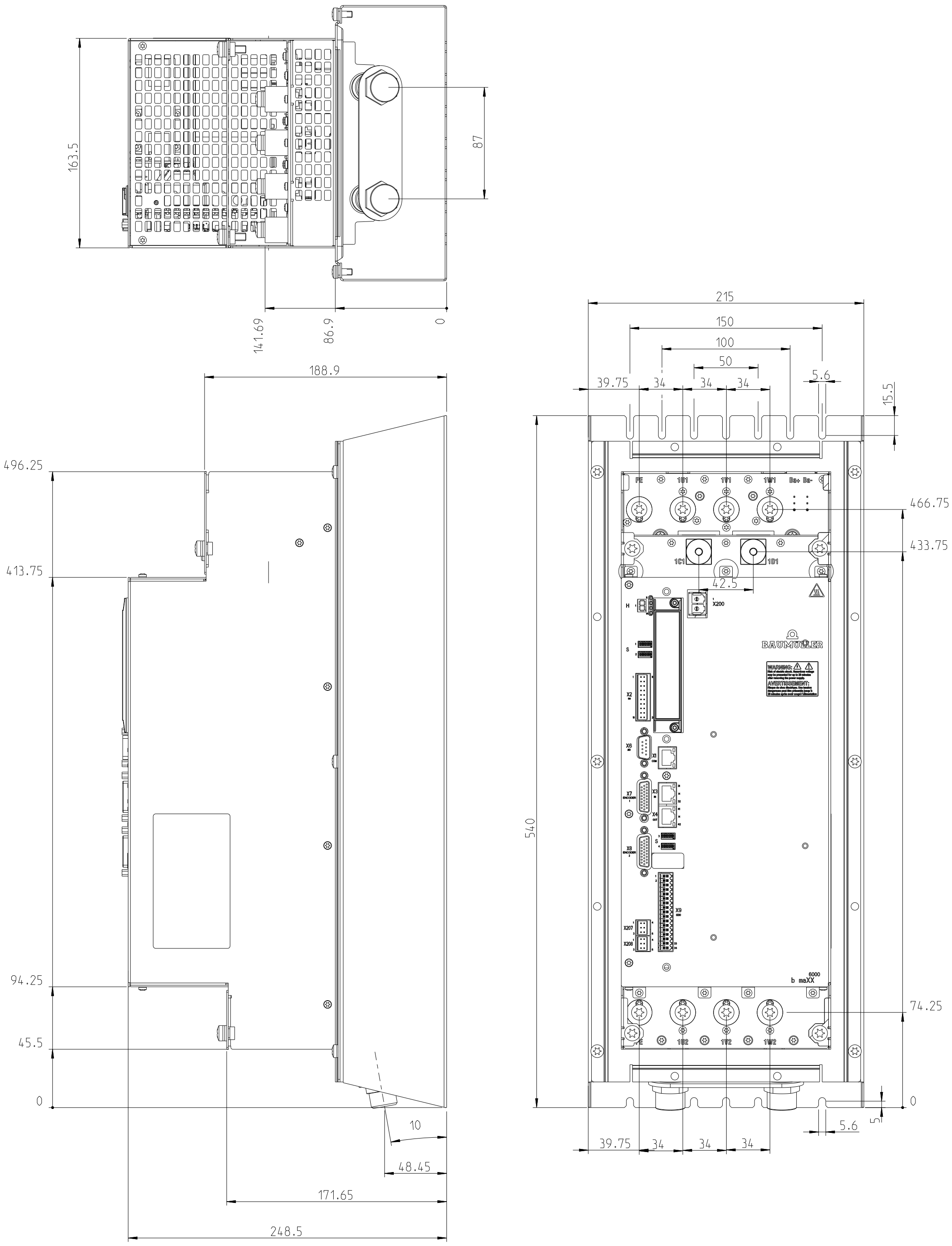
Figure 16: Dimensions BM654X/BM65DX-FXXXYY

3.1 Dimensions



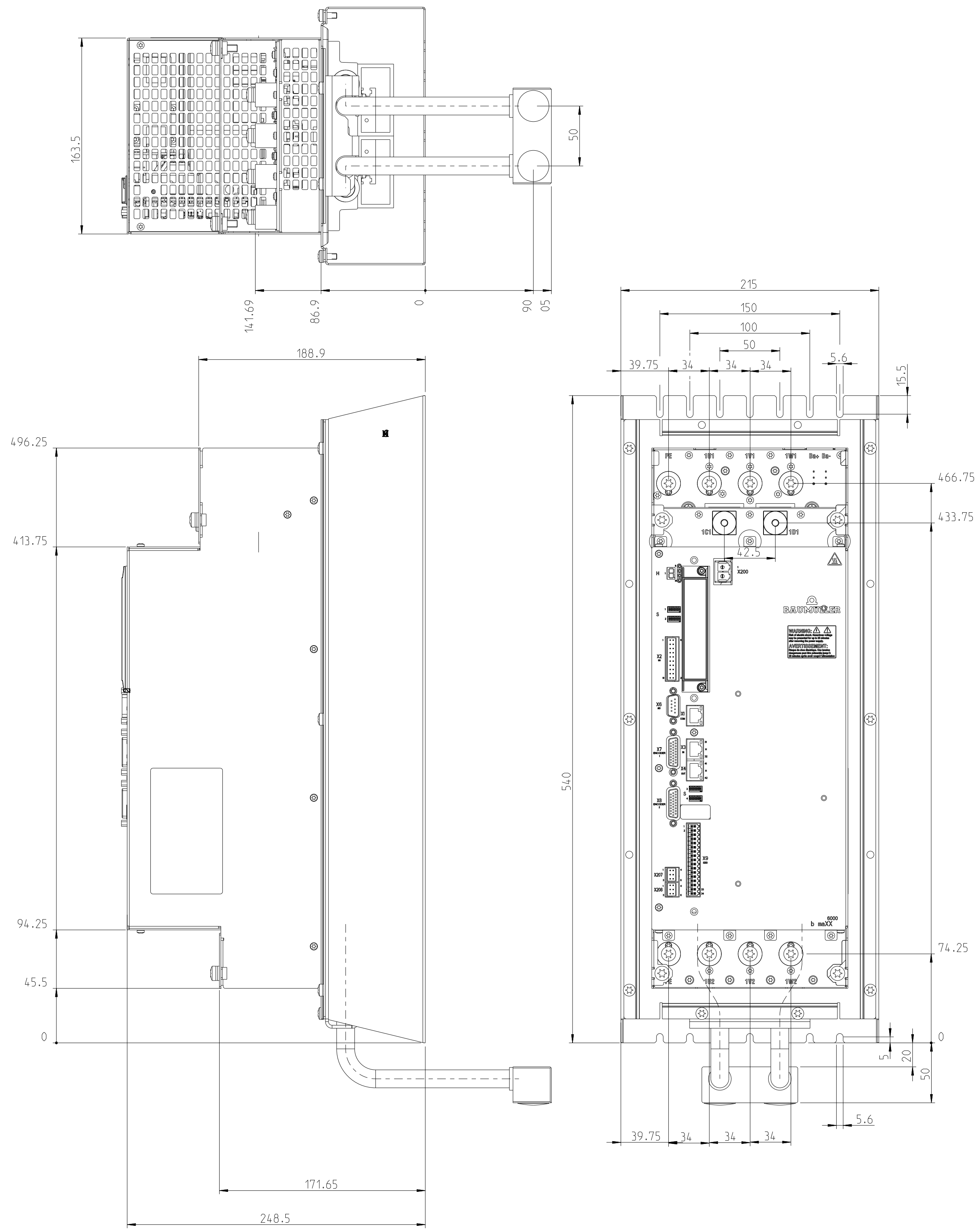
Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 17: Dimensions BM654X/BM65DX-FXXXYY-7



Please follow the notes for mounting and ▹Cooling◃ on page 64.

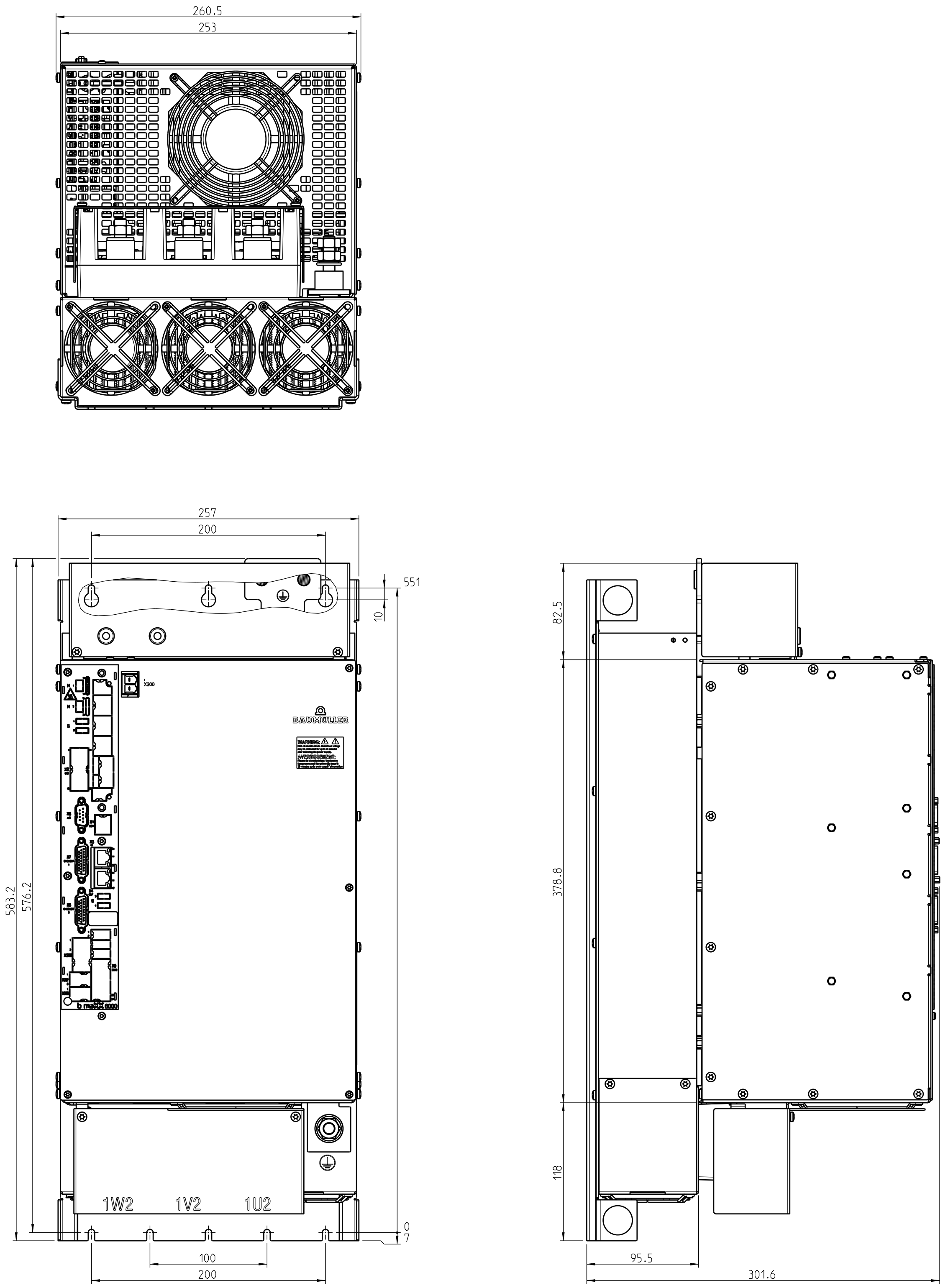
Figure 18: Dimensions BM654X/BM65DX-ZXXX00



Please follow the notes for mounting and ▷Cooling◁ on page 64.

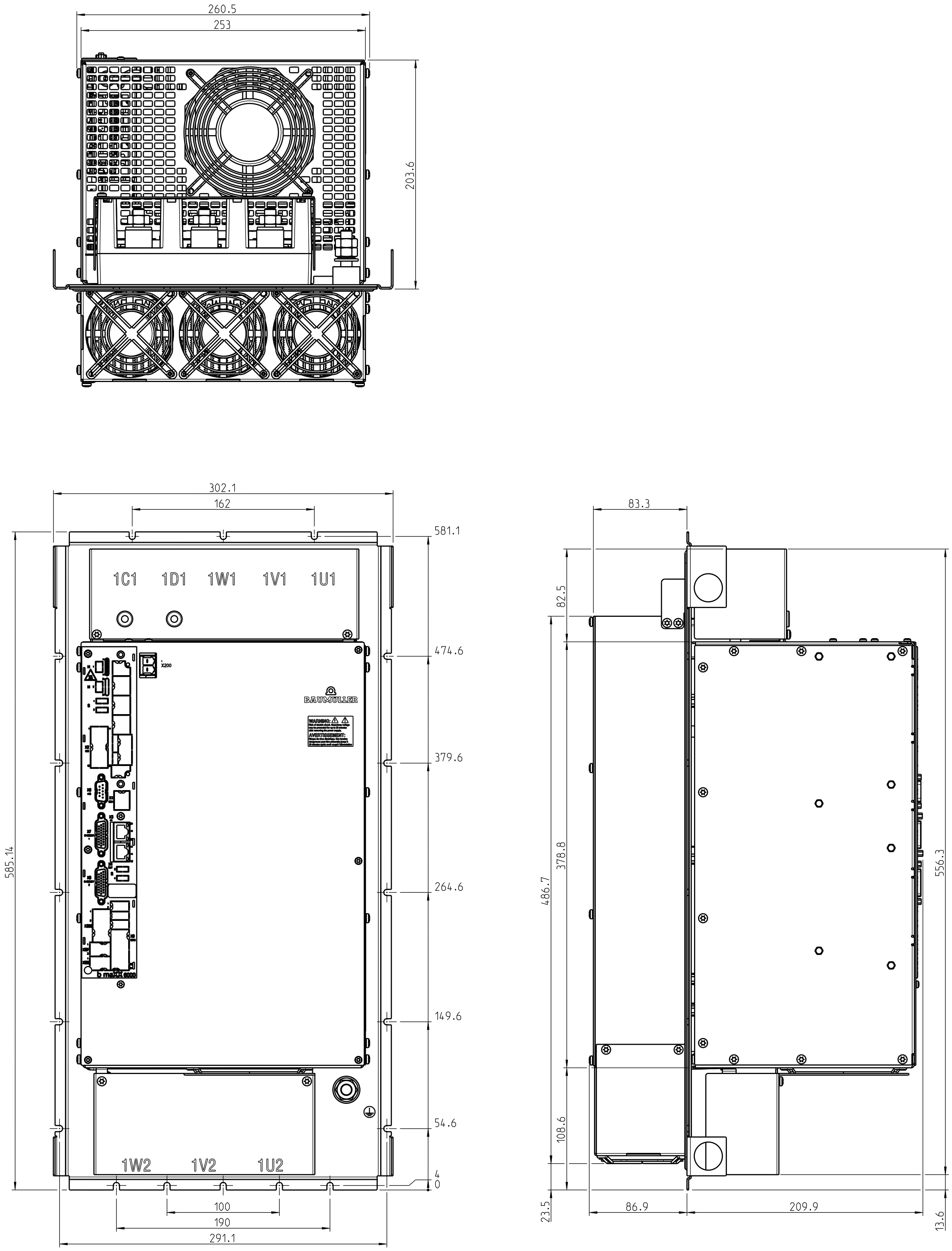
Figure 19: Dimensions BM654X/BM65DX-ZXXXYY-XXX-XX-05

3.1.5 Dimensions BM655X/BM65EX



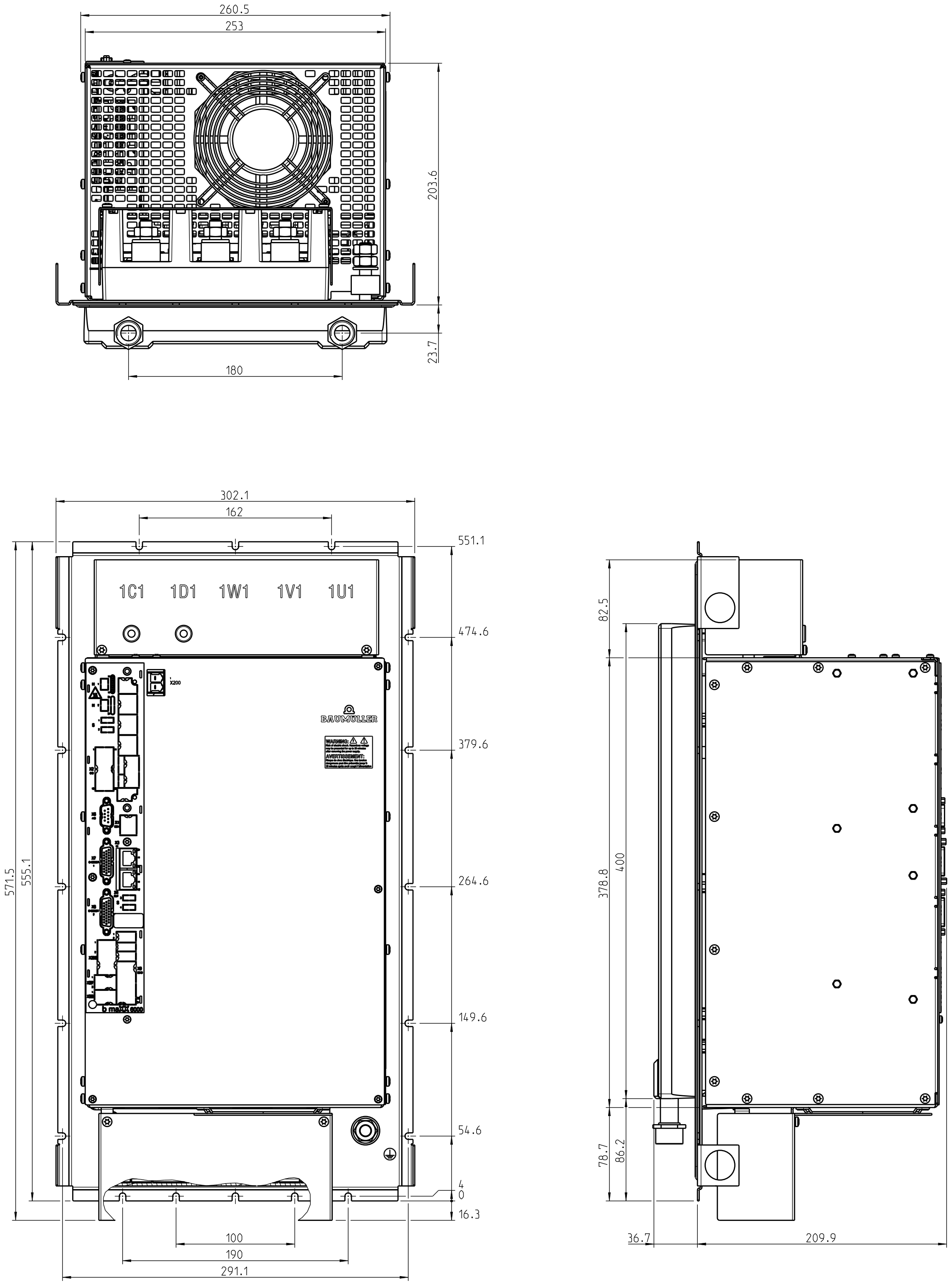
Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 20: Dimensions BM655X/BM65EX-S



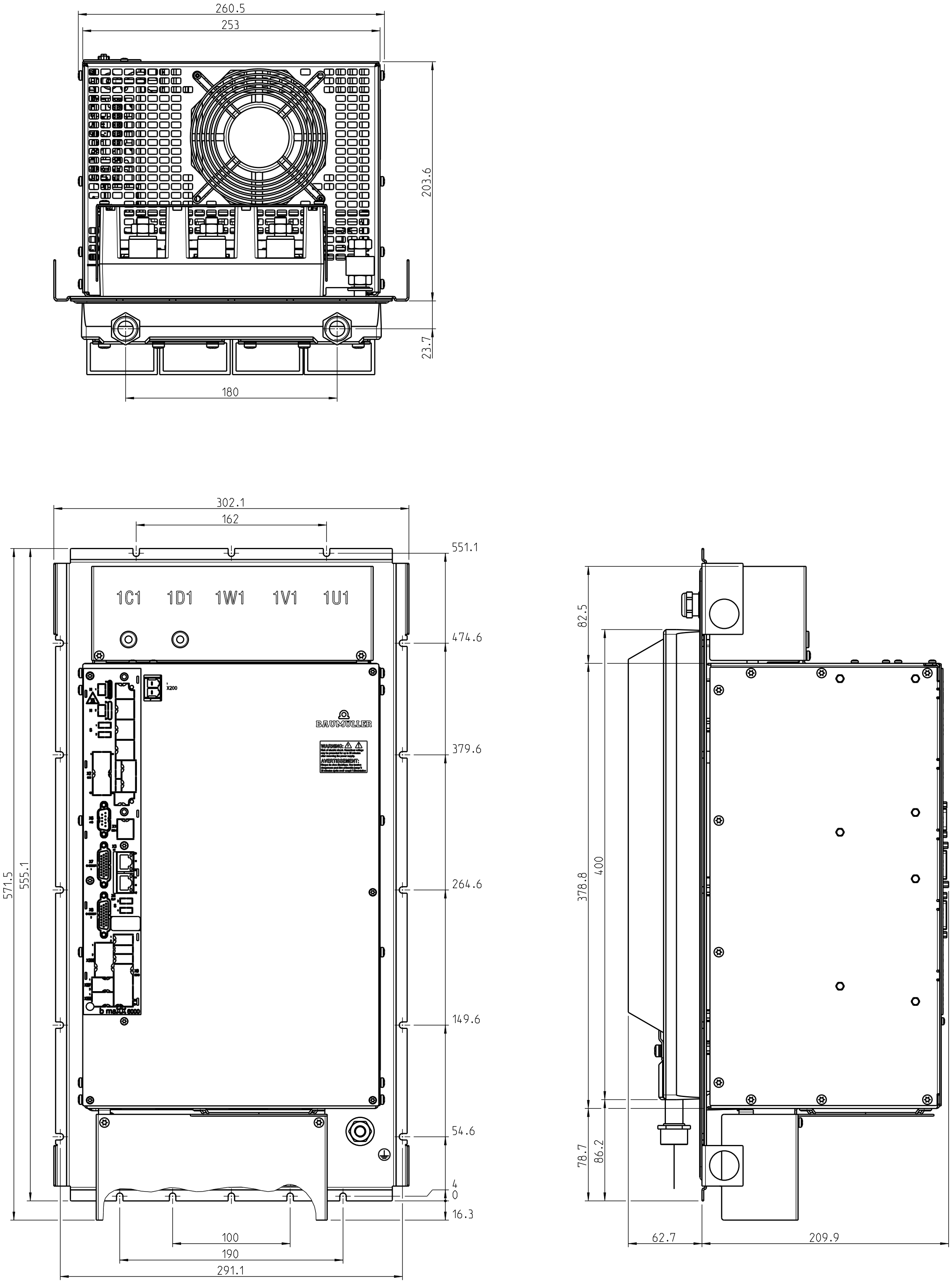
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 21: Dimensions BM655X/BM65EX-A



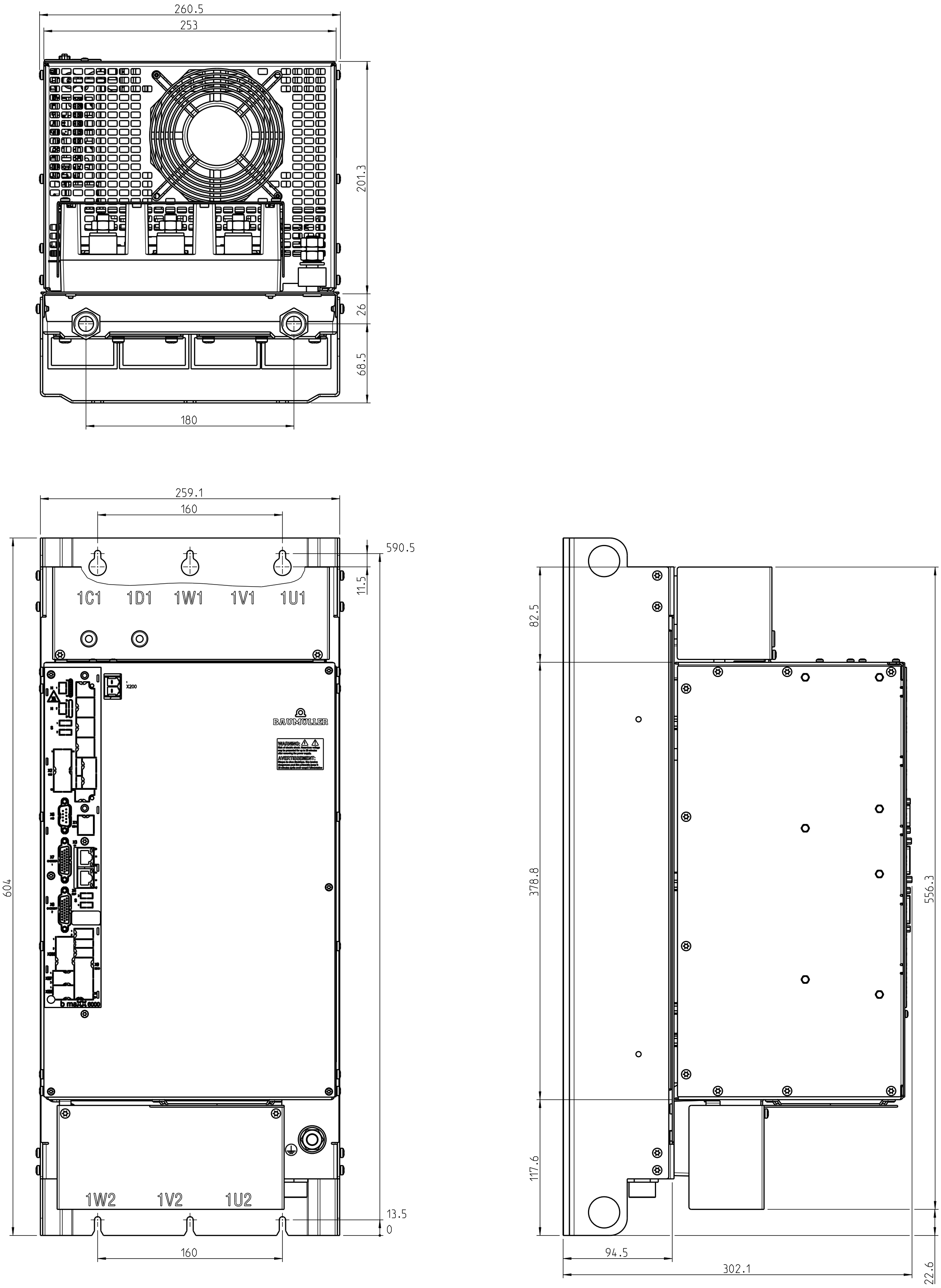
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 22: Dimensions BM655X/BM65EX-FXXX00



Please follow the notes for mounting and ▷Cooling◁ on page 64.

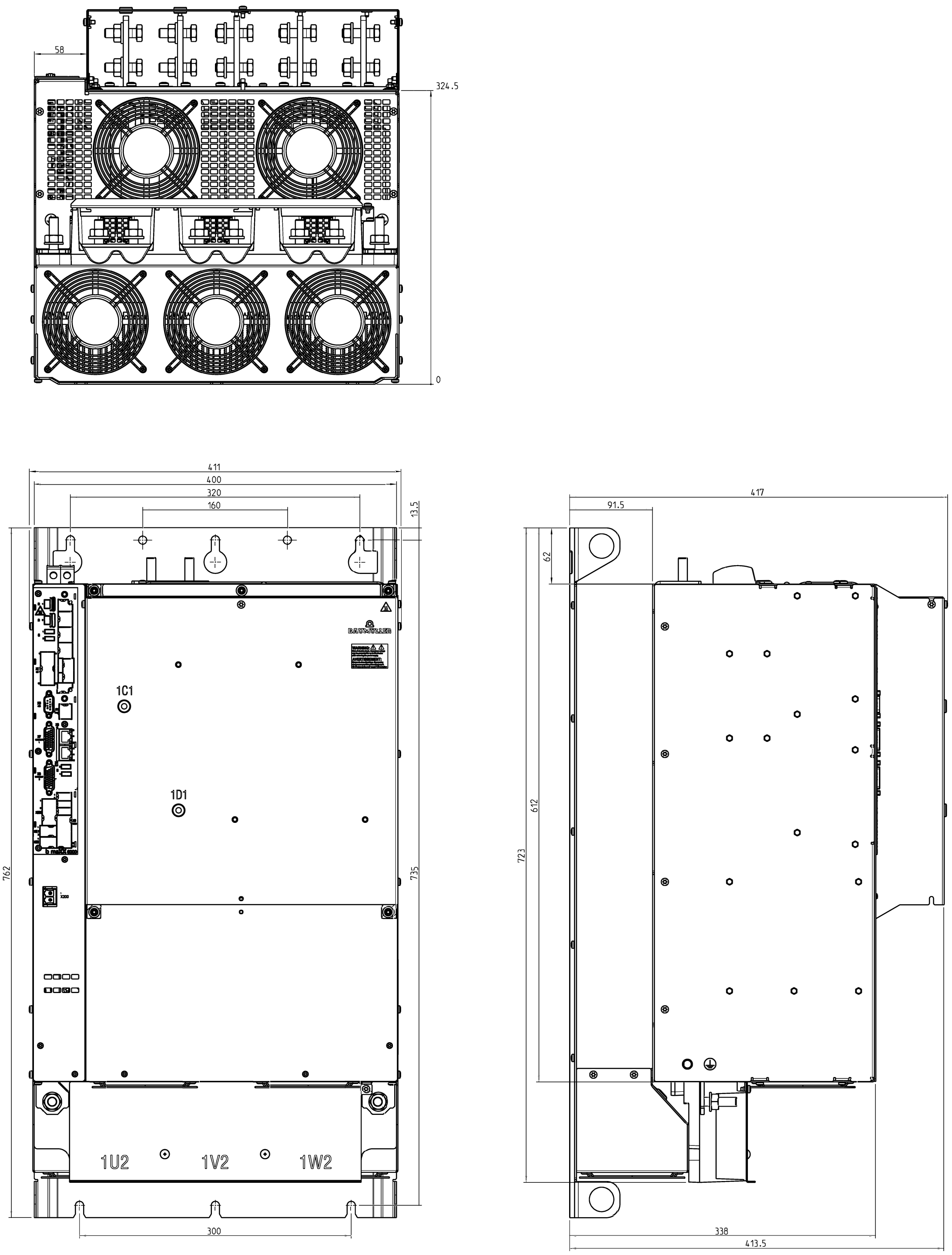
Figure 23: Dimensions BM655X/BM65EX-FXXXYY



Please follow the notes for mounting and ▷Cooling◁ on page 64.

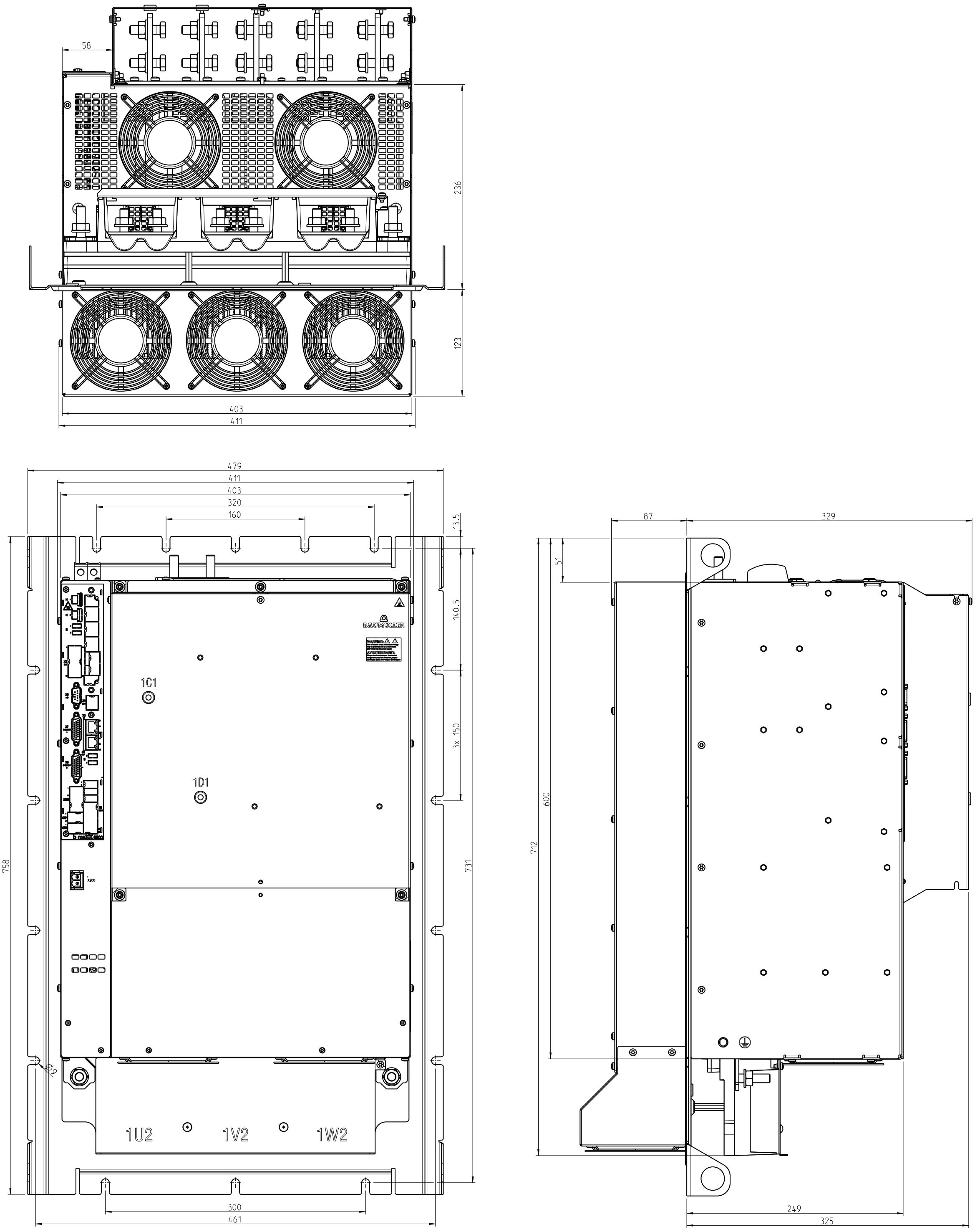
Figure 24: Dimensions BM655X/BM65EX-ZXXXYY

3.1.6 Dimensions BM656X/BM65FX



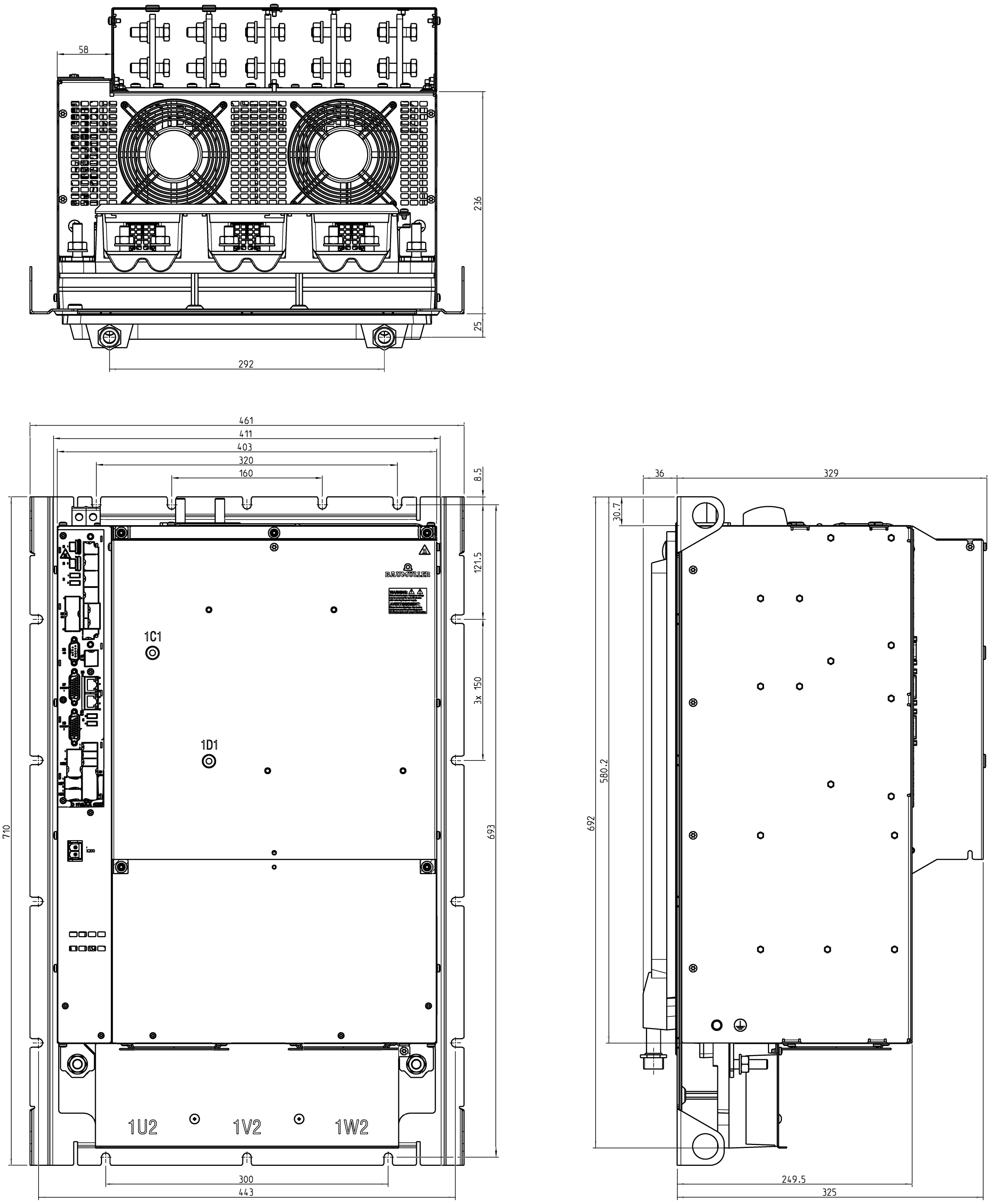
Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 25: Dimensions BM656X/BM65FX-S



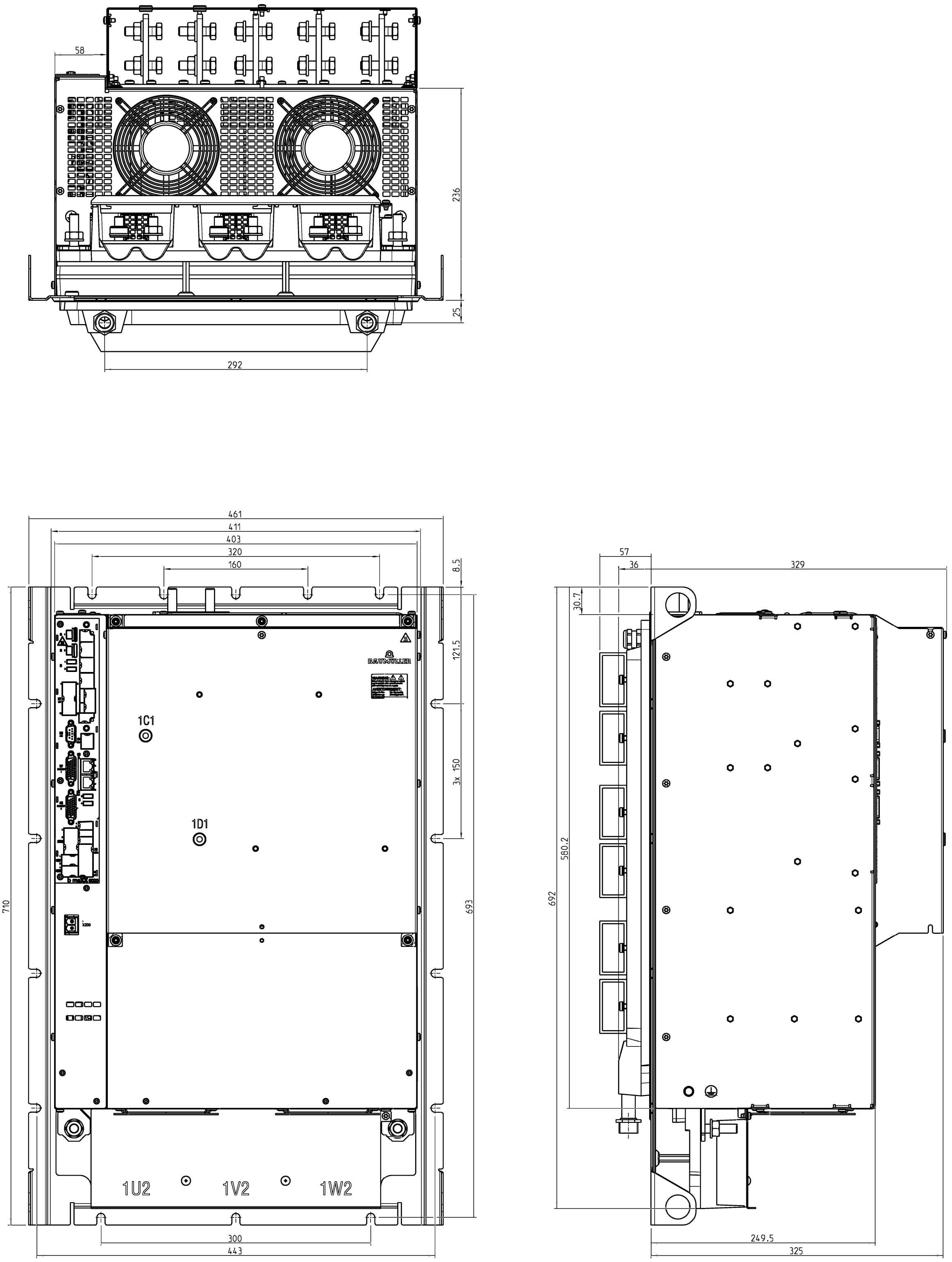
Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 26: Dimensions BM656X/BM65FX-A



Please follow the notes for mounting and ▷Cooling◁ on page 64.

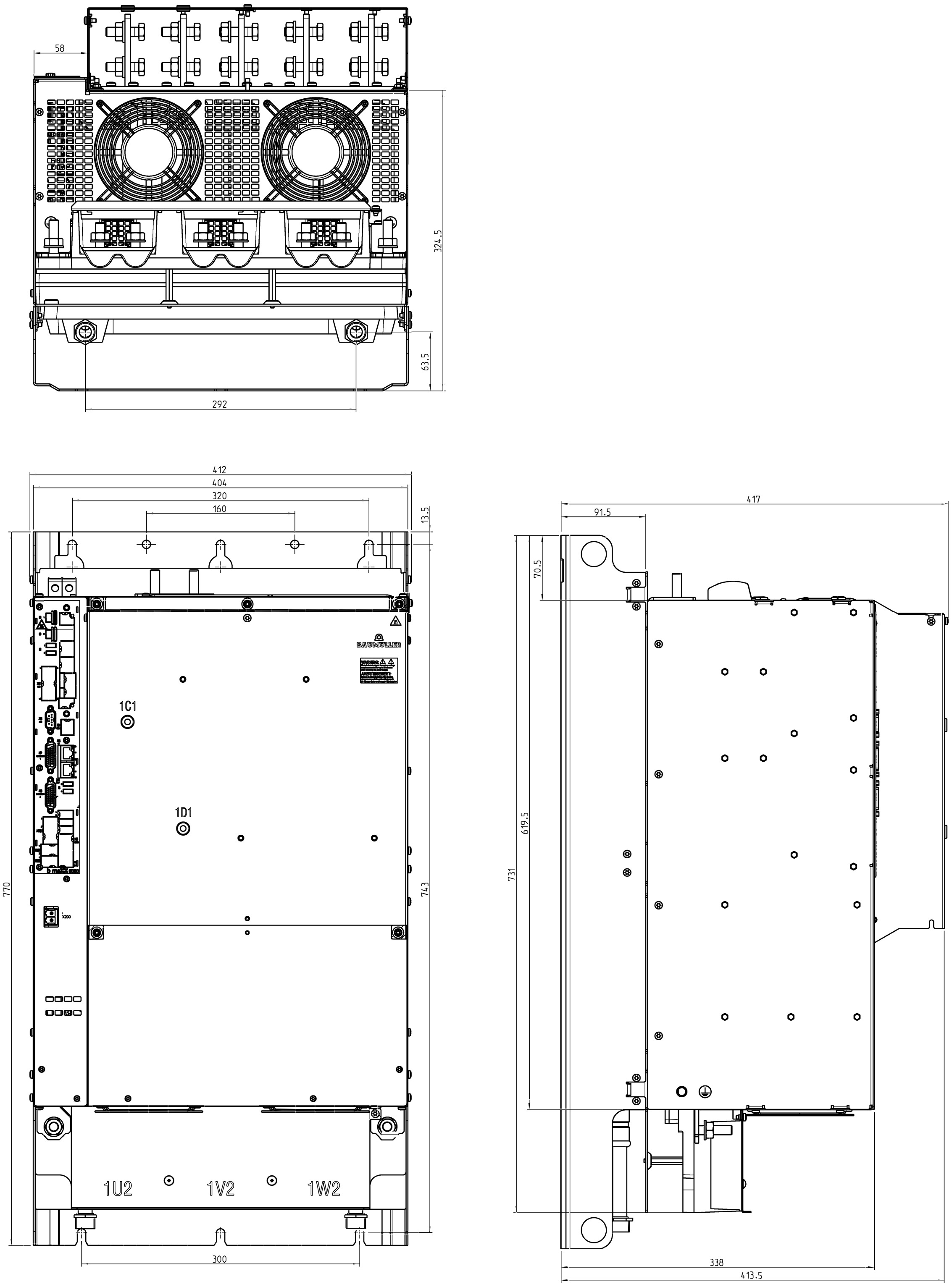
Figure 27: Dimensions BM656X/BM65FX-FXXX00



Please follow the notes for mounting and ▹Cooling◃ on page 64.

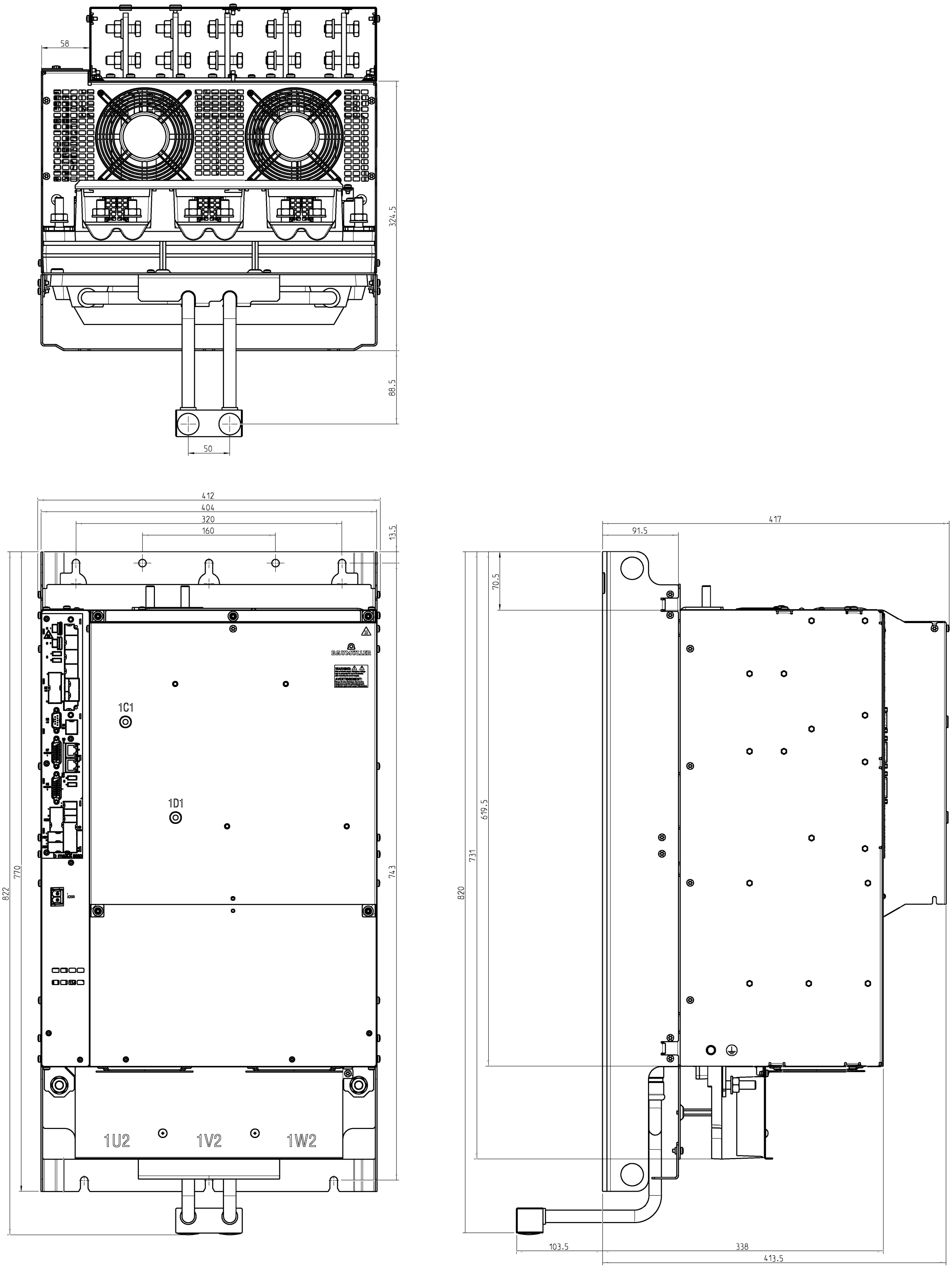
Figure 28: Dimensions BM656X/BM65FX-FXXXYY

3.1 Dimensions



Please follow the notes for mounting and ▹Cooling◃ on page 64.

Figure 29: Dimensions BM656X/BM65FX-ZXXXYY



Please follow the notes for mounting and ▷Cooling◁ on page 64.

Figure 30: Dimensions BM656X/BM65FX-ZXXXYY (customer version)

3.2 Weight

3.2.1 Weight mono unit

Device	Weight, with controller
BM65**1**X-**S**	Approx. 3.2 kg
BM65**2**X-**S / -A**	Approx. 6.6 kg
BM65**3**X-**S**	Approx. 12 kg
BM65**3**X-**F**	Approx. 10 kg
BM65**4**X-**S**	Approx. 14 kg
BM65**4**X-**FXXX00**	Approx. 13 kg
BM65**4**X-**FXXXYY**	Approx. 15 kg
BM65**5**X-**S**	Approx. 32 kg
BM65**5**X-**FXXX00**	Approx. 28 kg
BM65**5**X-**FXXXYY**	Approx. 32 kg
BM65**6**X-**S**	Approx. 72 kg
BM65**6**X-**FXXX00**	Approx. 61 kg
BM65**6**X-**FXXXYY**	Approx. 66 kg

3.2.2 Weight power module BM65DX, BM65EX, BM65FX

Device	Weight, with controller
BM65**D**X-**S**	Approx. kg
BM65**D**X-**FXXX00**	Approx. kg
BM65**D**X-**FXXXYY**	Approx. kg
BM65**E**X-**S**	Approx. kg
BM65**E**X-**FXXX00**	Approx. kg
BM65**E**X-**FXXXYY**	Approx. kg
BM65**F**X-**S**	Approx. kg
BM65**F**X-**FXXX00**	Approx. kg
BM65**F**X-**FXXXYY**	Approx. kg

3.3 Operating conditions

3.3.1 Requirements for mains supply system mono unit

Supply system	BM65XX - X**T**XX [5)]	Industrial system with a direct grounded neutral point or with a by a low impedance grounded neutral point (TN system or TT system)
	BM65XX - X**I**XX	Industrial system with a grounded star point (IT-system), which has no or high impedance, TN system, TT system
	BM65XX - X**G**XX	Industrial system with direct or low impedance earthed phase junctions (grounded delta wye), TN system, TT system or IT system
Inductance (sum of power supply inductance and choke inductance)	BM65XX - X**T**.../X**I**.../X**G**...	$u_{k\,min}$ = 2.4 % $u_{k\,max}$ = 4 % (rated value)
Min. power supply inductance Refer to ▹P code◃ on page 108, bit No. 25 = 1	BM65**1**Xwithout power choke BM65**2**X without power choke [7)] BM65**3**X without power choke	$55\ \mu H \cdot \frac{U^2_{Power\ supply}}{400^2\ V^2}$, e.g. 55 µH at 400 V
	BM65**4**X without power choke BM65**5**X without power choke BM65**6**X without power choke	$50\ \mu H \cdot \frac{U^2_{Power\ supply}}{400^2\ V^2}$, e.g. 50 µH at 400 V
Rated supply voltage/-frequency [1) 2)] (U_{AC})		3 x 400 V 50/60 Hz
Absolute minimum supply voltage device[1) 2)] (U_{AC}) Absolute maximum supply voltage device[1) 2)] (U_{AC})		3 x 207 V / 50/60 Hz 3 x 528 V / 50/60 Hz
Absolute minimum frequency [4)] Absolute maximum frequency [4)]		47 Hz 63 Hz
Overvoltage category EN 61800-5-1, chapter 4.3.6		III
Harmonics (power supply voltage) EN 61800-3, chapter 5.2.1, class 3		THD_U ≤ 12 %
Unbalanced power supply voltage EN 61000-2-4, Tab. 1, class 3		Max. 3 %
Commutating dips EN 61800-3, chapter 5.2.1, class 3		Depth of dip < 40 %, area < 250 % x degrees
Voltage dips EN 61800-3:2004 and A1:2012		10 % to 80 % [1)]
Voltage changes / fluctuations EN 61200-2-4, Klasse 3		+/-10 % +10 % bis -15 % duration ≤ 1 min
Max. short circuit current power supply [6)] BM65**1**X, BM65**2**X, BM65**3**X BM65**4**X BM65**5**X BM65**6**X		 5 kA 10 kA 18 kA 30 kA
Control voltage [3)] (U_{DC}) based on EN 61131-2:2008		+ 24 V -15 % / +20 %

1) The error „power supply not ready-to-operate“ is generated if the supply voltage is interrupted ((0,9 - 0) x U_{AC} for t > 0,1 s)

2) Rated voltage is 400 V.
With lower supply voltages the output power of the device is reduced, refer to ▹Correction values at changed operating conditions◃ as from page 59.

3) The control voltage must accord to PELV (EN 61800-5-1, chapter 3.21) or SELV (EN 61800-5-1, chap. 3.35).
At control voltage of < 24 V the ventilation power output is reduced.

4) Rate of change of the power supply frequency 1 Hz/s at a maximum (EN 61000-2-4, class 3).

5) The connection and operation of a device with the identification BM65XX-X**T**XX at an IT system or a grounded delta system, is **not** permitted.

6) Only necessary to comply with EN 61800-5-1.

7) Operation without a mains choke is not permitted for the devices BM6526 and BM6527.

3.3.2 Requirements DC link supply for power modules BM65DX, BM65EX, BM65FX

NOTE!

Proper operation of **BM65DX, BM65EX, BM65FX** power modules can only be guaranteed with Baumüller supply units BM50XX, BM51XX and mono units BM65XX or BM55XX/BM56XX/BM57XX.

DC link rated voltage (U_{DC})	V_{DC}
Minimum Anschlussspannung [1] (U_{DC}) Maximum Anschlussspannung [1] (U_{DC})	
Control voltage [2] (U_{DC}) based on EN 61131-2:2008	+ 24 V -15 % / +20 %

1) Rated voltage is 540 V_{DC}.
With higher supply voltages the output power of the device is reduced, refer to ▹Correction values at changed operating conditions◃ as from page 59.

2) The control voltage must accord to PELV (EN 61800-5-1, chapter 3.21) or SELV (EN 61800-5-1, chap. 3.35).
At control voltage of < 24 V the ventilation power output is reduced.

3.3.3 Requirements for control voltage / 24 V power supply

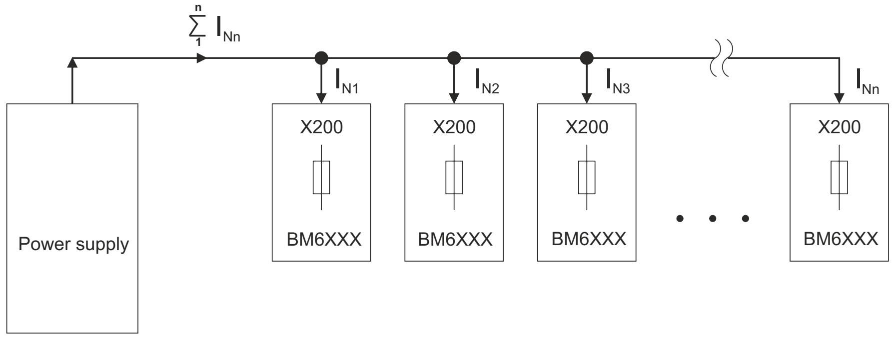


Figure 31: Control voltage / 24 V power supply

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.

3.3.4 Requirements for the motor

The **b maXX 6500** 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 power modules **BM65XX** are operated with a voltage-controlled DC link, 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 mono units◁ as from page 66) remains unchanged. Thus, only three phase current motors with $U_{DC\ link,\ rated} \geq 540$ V may be used in these cases as well.

3.3.5 Required environmental conditions

Transport temperature range	- 25 °C to + 70 °C	
Transport climate class (K) EN IEC 60721-3-2:2018	2K12	
Storage temperature range	- 25 °C to + 55 °C	
Storage climate class EN IEC 60721-3-1:2018	1K22	
Operating environment	BM651X BM652X BM653X	Industrial network C2
	BM654X	Industrial network C3 Industrial network C2 when using ferrite cores in the power supply cables (Accessory pack part No. 504546, 6 ferrite cores), refer to ▹Installation procedure◃ as from page 161
	BM655X	Industrial network C3 Industrial network C2 when using ferrite cores in the power supply cables (Accessory pack part No. 504547, 2 ferrite cores), refer to ▹Installation procedure◃ as from page 161
	BM656X	Industrial network C3 Industrial network C2 when using 2 ferrite cores in the motor cables (M116-03) and Würth Ferrit 742 712 21 in the 24V supply cables, refer to ▹Installation procedure◃ as from page 161
Operating temperature range	Min. 5 °C to max. 55 °C (with derating above 40 °C) [1)]	
Operating climate class EN IEC 60721-3-3:2018	3K22	
Installation altitude	Up to 4000 m above MSL except BM651X up to 2000 m (with derating above 1000 m) [1)]	
Humidity (operating) EN IEC 60721-3-3:2018	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) Refer to correction values at changed operation conditions at ▹Correction values at changed operating conditions◃ on page 59.

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.

3.3.6 Correction values at changed operating conditions

The correction values of the permitted output power and output current must be multiplied, if the devices **BM6500** 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 **BM6500** that are intended for operation in grounded delta power supply or IT power supply may only be operated in those types of power supply 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 power supply. 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.

NOTE!

For correction values temperature BM651X refer to ▷Electrical data BM651X◁ as from page 66.

For correction values temperature BM652X refer to ▷Electrical data BM652X◁ as from page 69.

NOTICE!

Devices BM651X, BM6526 and BM6527 have an operating altitude of maximum 2000 m.

Temperature/ Installation altitude

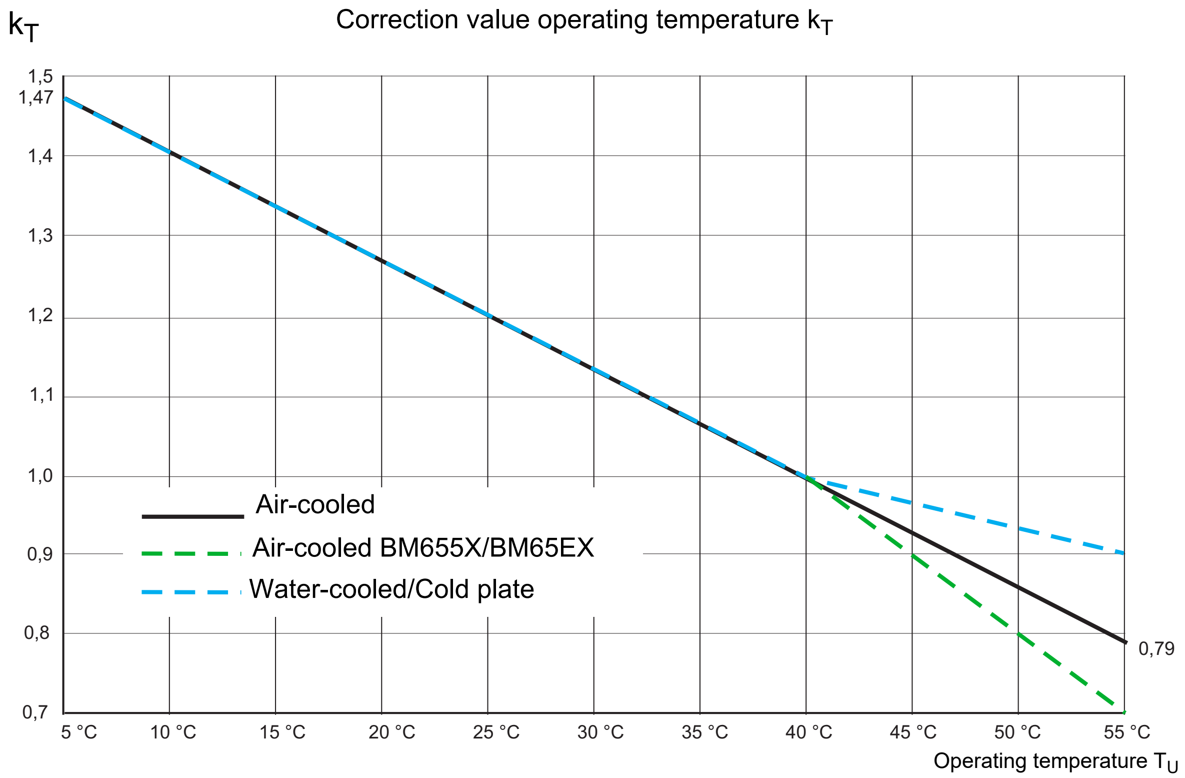


Figure 32: Correction value k_T in dependence of the temperature T_U

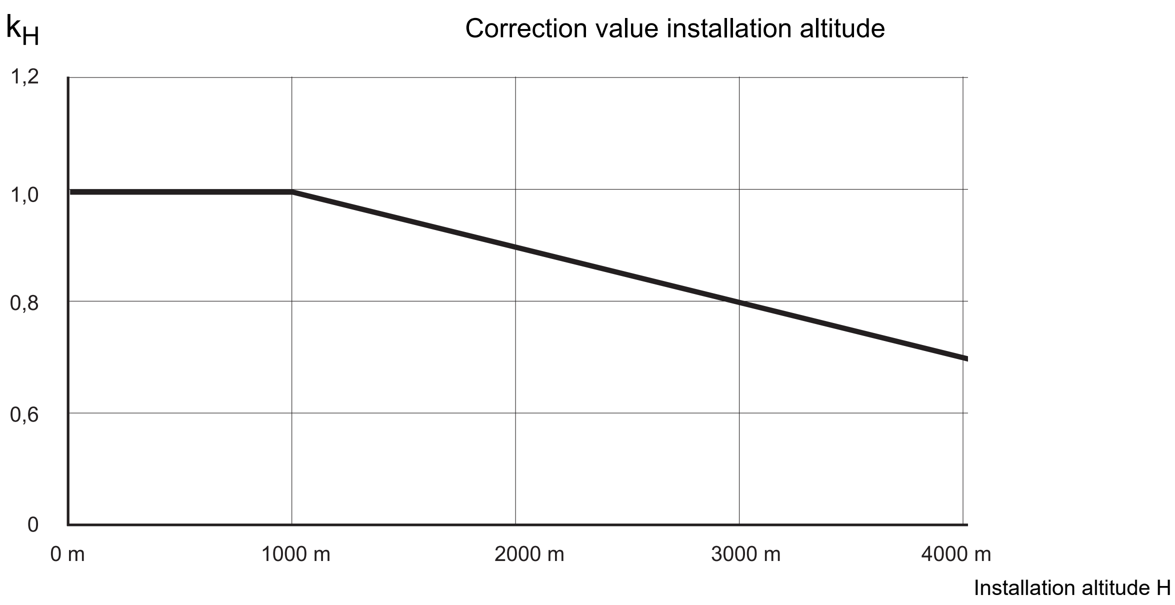


Figure 33: Correction value k_H in dependence on the installation altitude H

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

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

I_{rated} = Output rated current at 40 °C and up to 1000 m, refer to Electrical data as from ▷page 73◁.

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:

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

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
$I_{permitted} = I_{rated} \cdot 0.96$

$k_{T\,(20\,°C)} = 1.27$
$k_{H\,(1500\,m)} = 0.9$
$k_{T\,(20\,°C)} * k_{H\,(1500\,m)} = 1.15 \geq 0.79$ 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

Supply voltage mono unit BM65XX

Above rated supply voltage BM65XX

The rated voltage is 3 x 400 V

When having input voltages above the rated supply voltage the output currents must accordingly be reduced at a constant output power.

This characteristic curve only applies if no individual characteristic curve is specified for the device.

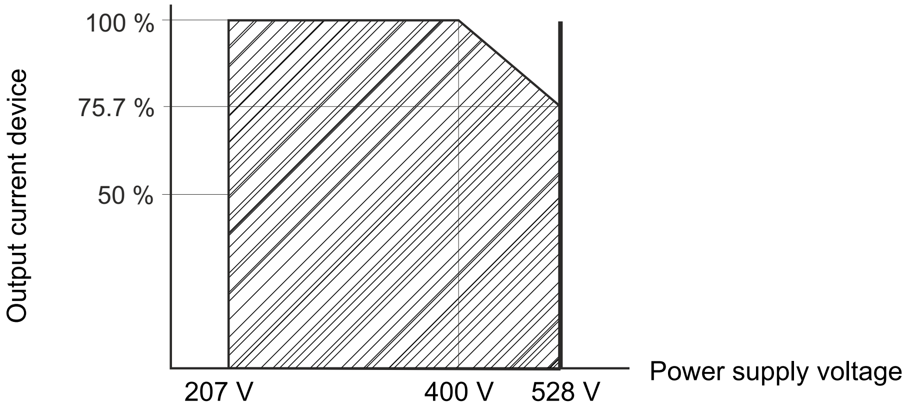


Figure 34: Output current in dependence of the power supply voltage

Below rated supply voltage BM65XX

The rated voltage is 3 x 400 V.

The output power of the device reduces with lower power supply voltages.

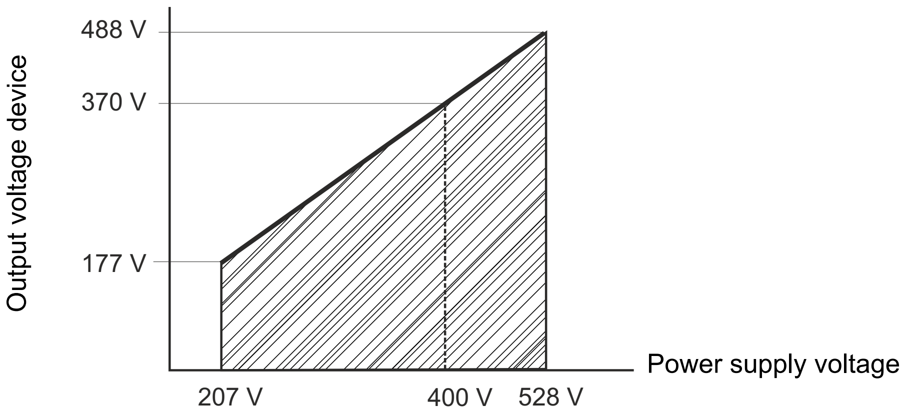


Figure 35: Reducing the output voltage in dependence of the power supply voltage

Output power BM65XX

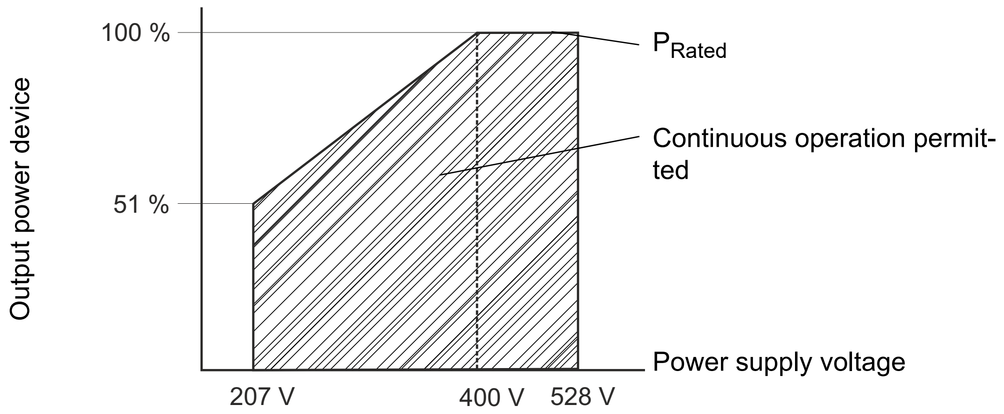


Figure 36: Reducing the output power in dependence of the power supply voltage

The output power of the device is obtained by multiplying the output current with the output voltage.

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

It is necessary to reduce the output current to a value between 400 V and 528 V, in order to obtain the specified curve / surface.

3.3.7 Cooling

Cooling air temperature [1)] (rated temperature: 40 °C)	Min. 5 °C to max. 55 °C, (rated temperature 40 °C) refer to correction values temperature ▹page 60◃
Cooling air requirement [2)]	Depends on the device, refer to ▹Electrical data mono units◃ as from page 66

Coolant temperature [4)]	Min. surrounding temperature up to max. 55 °C (rated temperature: 40 °C), refer to correction values temperature ▹page 60◃
Coolant flow [3) 4) 5)]	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)]	Max. 0.5 bar at 10 l/min

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.

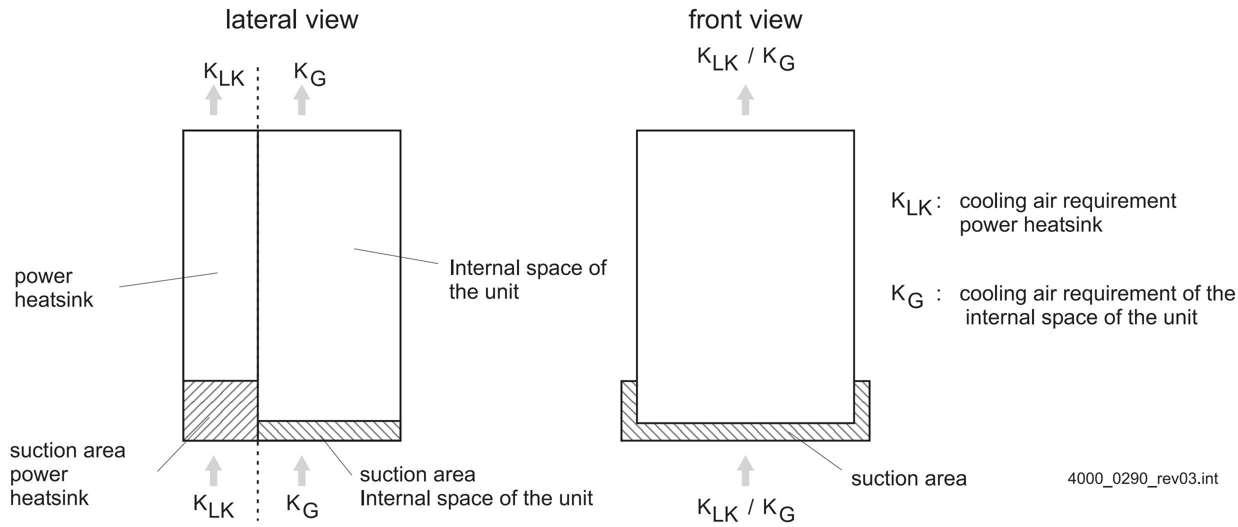


Figure 37: Cooling air requirement

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

4) 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.

5)

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 heat sink temperature of the device) to prevent condensation always.
In case of surface temperatures other than those specified, please inquire with Baumüller Nürnberg GmbH.

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 mono units

3.4.1 Electrical data BM651X

- Without power choke BM651X-XT [11]

		BM651**2**	BM651**3**	BM651**4**	BM651**5**	BM651**6**
Rated input power [1]		2.3 kVA	4.3 kVA	5.9 kVA	7.3 kVA	8.9 kVA
Rated input current [1] (I_{eff})		3.6 A	6.9 A	9.5 A	11.8 A	14.3 A
Total harmonic distortion input current (THD_I) [1]		134 %	151 %	175 %	153 %	134 %
Max. input current (I_{eff})		5.2 A	9.0 A	20 A		
Rated DC link voltage [1]		540 V_{DC}				
DC link capacitance (internal)		110 µF	240 µF	330 µF		
DC link capacitance (external), permitted		[9]				
Capacitance DC link to PE		400 nF				
Waiting period between two switching-on operations		≥ 60 s				
Output voltage [1,2] (U_{AC})		3 x 0 V to 3 x 370 V				
Output frequency at 4 kHz[8]		0 Hz to 450 Hz				
Rated output current [1,4,5,6] (I_{AC})	at 2 kHz [3] at 4 kHz [3]	2.5 A	4.5 A	5.5 A	7.5 A	10.0 A
Rated output current [1,4,5,6] (I_{AC})	at 8 kHz [3]	2.5 A	4.5 A	5.0 A	6.0 A	8.0 A
Output peak current [1,4,5,6,7] (I_{AC})	at 2 kHz [3] at 4 kHz [3]	5.0 A	9.0 A	20.0 A		
Output peak current [1,4,5,6,7] (I_{AC})	at 8 kHz [3]	5.0 A	9.0 A	12.0 A	16.0 A	16.0 A
Nominal power (cos φ = 0,9)		1.6 kW	2.8 kW	3.5 kW	4.8 kW	6.4 kW
Max. peak current period [7]		60 s		30 s		
Max. power supply of DC link terminals [10]		1.6 kW	2.8 kW	3.5 kW	4.8 kW	6.4 kW
Brake resistor current, permitted (Î)		Max.5.9 A		Max. 12.0 A		
Brake resistor, internal		-				
Brake resistor, external		≥ 130 Ω		≥ 65 Ω		
Brake resistor threshold (Û)		780 V				
Brake resistor peak power		4.5 kW	5.0 kW	9.4 kW		
Permitted continuous brake resistor power, internal		-				
Permitted continuous brake resistor power, external		1.0 kW	1.5 kW	3.0 kW		
Power loss referring to power input		33 W	60 W	80 W		
Power input referring to control voltage		Max. 50 W controller + 4 W fan				
Current of the integrated brake control		2.0 A				
Cooling air requirement power heats ink		17 m³/h (air)				
Cooling air requirement internal space		10 m³/h				
Requirements to the water cooling		-				

1) All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

2) The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right) \quad \text{without overmodulation of the PWM.}$$

3) Switching frequency of the inverter (adjustable).

4) RMS at an surrounding temperature of 40 °C.

5) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

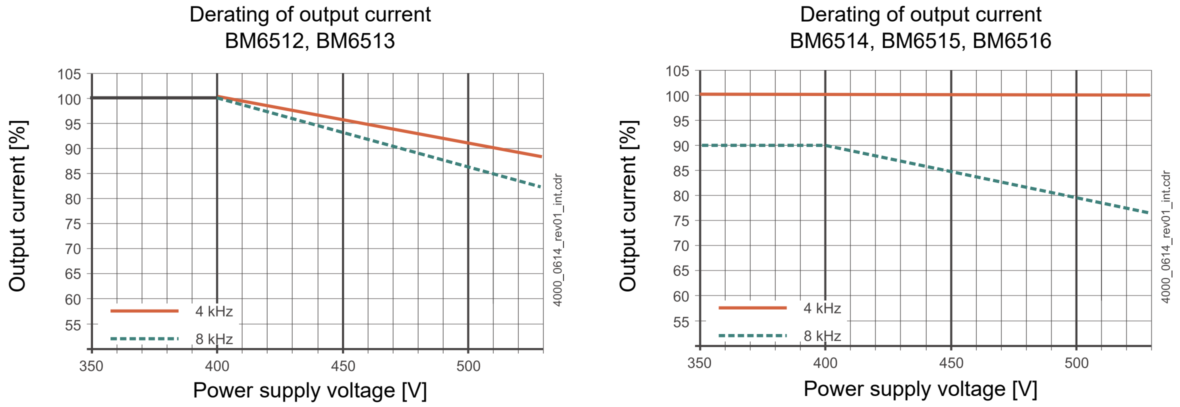


Figure 38: Derating the output current BM651X

6) The current must be reduced between 40 °C and 55 °C.

BM6512, BM6513, BM6514:

$$I_O = I_{O(40°C)} \cdot \left(1 - \left(\frac{\text{Operating temperature} - 40°C}{°C} \cdot 0,03\right)\right)$$

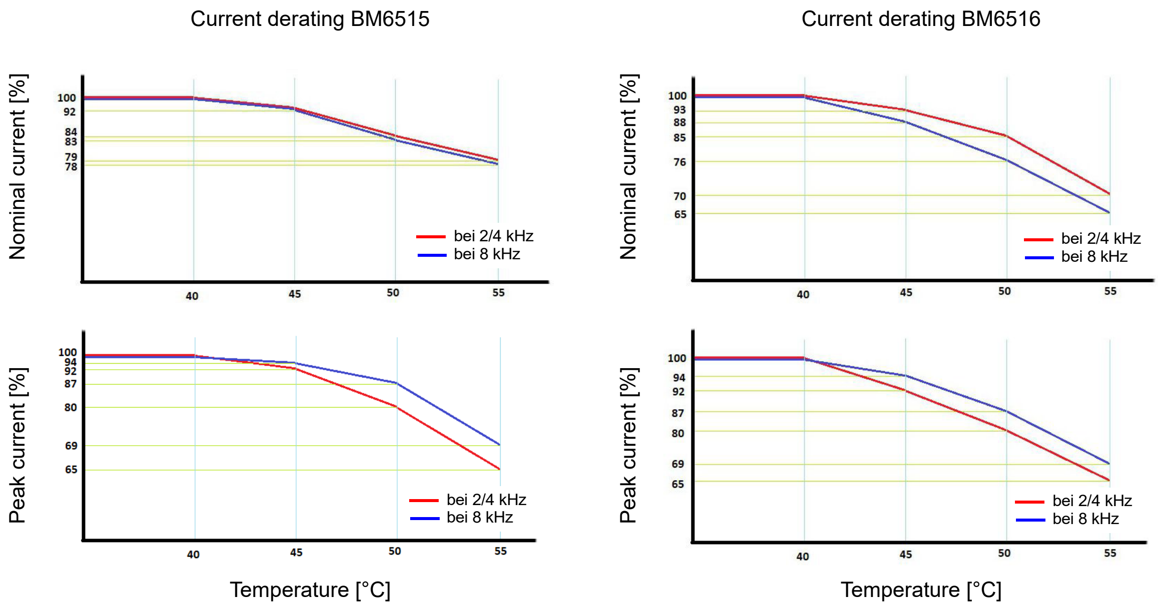


Figure 39: Current derating as a function of temperature

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[7] The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

[8] 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:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz [*])

[*] 900 Hz could be generated by the controller

[9] The specified value is only valid if there is no additional DC link capacitance connected to the DC link terminals.

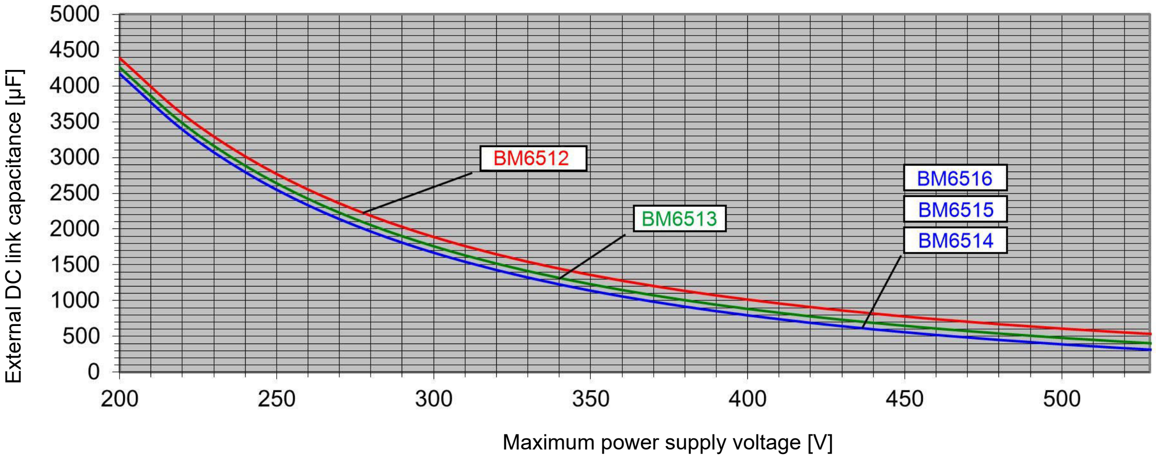


Figure 40: Maximum external DC link capacitance BM651X

[10] The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

[11] BM651X devices are not suitable for power supply types “I” and “G.”

3.4.2 Electrical data BM652X

- Without power choke BM652X

		BM6522	BM6523	BM6524	BM6525
Rated input power 1)		7.9 kVA	10.7 kVA	15.5 kVA	15.5 kVA
Rated input current 1) (I_{eff})		11.4 A	15.4 A	22.4 A	22.4 A
Total harmonic distortion input current (THD_I) 1)		148 %	128 %	145 %	145 %
Max. input current (I_{eff})		19.9 A	26.3 A	40.7 A	49.3 A
Rated DC link voltage 1)		540 V_{DC}			
DC link capacitance (internal)		470 µF		705 µF	
DC link capacitance (external), permitted		9)			
Capacitance DC link to PE		400 nF			
Waiting period between two switching-on operations		≥ 60 s			
Output voltage 1)2) (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency at 4 kHz8)		0 Hz to 450 Hz			
Rated output current 1)4)5)6) (I_{AC})	at 2 kHz 3) at 4 kHz 3)	7.5 A	11.0 A	15.0 A	15.0 A
Rated output current 1)4)5)6) (I_{AC})	at 8 kHz 3)	6.0 A	8.8 A	12.0 A	12.0 A
Output peak current 1)4)5)6)7) (I_{AC})	at 2 kHz 3) at 4 kHz 3)	15.0 A	22.0 A	30.0 A	40.0 A
Output peak current 1)4)5)6)7) (I_{AC})	at 8 kHz 3)	12.0 A	17.6 A	24.0 A	32.0 A
Nominal power (cos φ = 0,9)		4.3 kW	6.3 kW	8.7 kW	8.7 kW
Max. peak current period 7)		60 s			
Max. power supply of DC link terminals 10)		4.3 kW	6.3 kW	8.7 kW	8.7 kW
Brake resistor current, permitted (Î)		Max. 9.0 A	Max. 13.0 A	Max. 18.0 A	Max. 25.0 A
Brake resistor, internal		-			
Brake resistor, external		≥ 86 Ω	≥ 60 Ω	≥ 44 Ω	≥ 32 Ω
Brake resistor threshold (Û)		780 V			
Brake resistor peak power		7 kW	10 kW	14 kW	20 KW
Permitted continuous brake resistor power, internal		-			
Permitted continuous brake resistor power, external		3.4 kW	5 kW	6.8 kW	6.8 kW
Power loss referring to power input		102 W	150 W	204 W	204 W
Power input referring to control voltage		Max. 50 W controller			
Current of the integrated brake control		2.0 A			
Cooling air requirement power heats ink		39 m³/h	56 m³/h		
Cooling air requirement internal space		10 m³/h			
Requirements to the water cooling		-			

- With power choke BM652X

		BM6526	BM6527
Rated input power [1]		14.5 kVA	17.3 kVA
Rated input current [1] (I_{eff})		21.0 A	25.0 A
Total harmonic distortion input current (THD_I) [1]		41 %	39 %
Max. input current (I_{eff})		41.3 A	41.3 A
Rated DC link voltage [1]		540 V_{DC}	
DC link capacitance (internal)		705 µF	1020 µF
DC link capacitance (external), permitted		[9]	
Capacitance DC link to PE		400 nF	
Waiting period between two switching-on operations		≥ 60 s	
Output voltage [1][2] (U_{AC})		3 x 0 V bis 3 x 370 V	
Output frequency at 4 kHz[8]		0 Hz bis 450 Hz	
Rated output current [1][4][5][6][11] (I_{AC})	at 2 kHz [3] at 4 kHz [3]	22.5 A	27.0 A
Rated output current [1][4][5][6][11] (I_{AC})	at 8 kHz [3]	18.0 A	22.0 A
Output peak current [1][4][5][6][7][11] (I_{AC})	at 2 kHz [3] at 4 kHz [3]	45.0 A	
Output peak current [1][4][5][6][7][11] (I_{AC})	at 8 kHz [3]	36.0 A	
Nominal power (cos φ = 0,9)		13 kW	15.6 kW
Max. peak current period [7]		60 s	
Max. power supply of DC link terminals [10]		13 kW	15.6 kW
Brake resistor current, permitted (Î)		Max. 25.0 A	
Brake resistor, internal		-	
Brake resistor, external		≥ 32 Ω	
Brake resistor threshold (Û)		780 V	
Brake resistor peak power		20 kW	
Permitted continuous brake resistor power, internal		-	
Permitted continuous brake resistor power, external		6.8 kW	
Power loss referring to power input		300 W	350 W
Power input referring to control voltage		Max. 50 W Regler	
Current of the integrated brake control		2.0 A	
Cooling air requirement power heats ink		56 m^3/h	
Cooling air requirement internal space		10 m^3/h	
Requirements to the water cooling		-	

1) All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

2) The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right) \quad \text{without overmodulation of the PWM.}$$

3) Switching frequency of the inverter (adjustable).

4) RMS at an surrounding temperature of 40 °C.

5) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

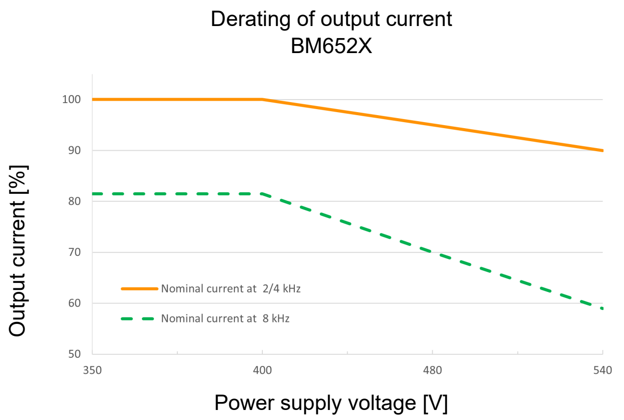


Figure 41: Derating the output current BM652X

6) The current must be reduced between 40 °C and 55 °C.

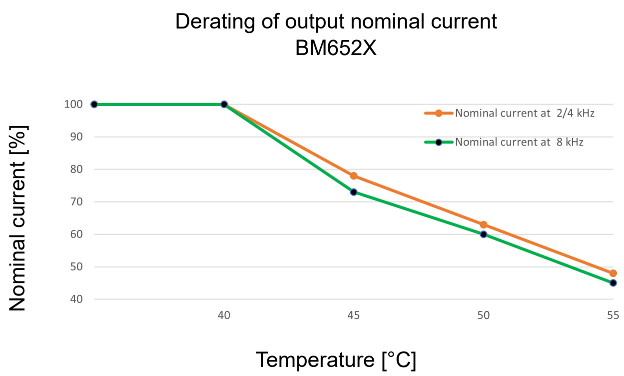


Figure 42: Current derating as a function of temperature BM652X

7) The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

8) 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:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller

9) The specified value is only valid if there is no additional DC link capacitance connected to the DC link terminals.

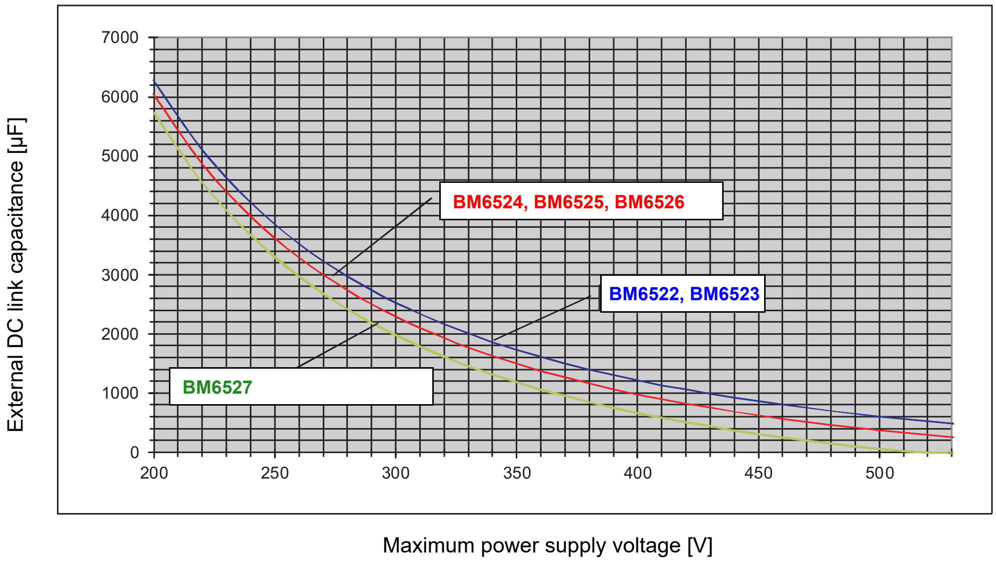


Figure 43: Maximum external DC link capacitance BM652X

10) The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

11) The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

3.4.3 Electrical data BM653X

- With power choke BM653X

		BM6532	BM6533	BM6534	BM6535 [14)]	
		S/A/F/Z	**S/A/F/Z**	**S/A/F/Z**	**S/A**	**F/Z**
Rated input power [1)2)]		15 kVA	19 kVA	29 kVA	39 kVA	
Rated input current [1)2)] (I_{eff})		21 A	28 A	42 A	56 A	
Total harmonic distortion input current (THD_I) [1)2)]		41 %	41 %	42 %	41 %	
Max. input current [2)] (I_{eff})		41 A	55 A	83 A	110 A	
Rated DC link voltage [1)] (U_{DC})		$540\ V_{DC}$				
DC link capacitance (internal)		500 µF	1000 µF		1500 µF	
DC link capacitance (external), permitted		Max. 20 mF				
Capacitance DC link to PE		400 nF				
Waiting period between two switching-on operations		None				
Output voltage [1))] (U_{AC})		3 x 0 V to 3 x 370 V				
Output frequency at 4 kHz [10)]		0 Hz to 450 Hz				
Rated output current [1)5)6)7)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	22.5 A	30.0 A	45.0 A	60,0 A	
Rated output current [1)5)6)7)12)] (I_{AC})	at 8 kHz [4)]	18.0 A	24.0 A	36.0 A	48,0 A	
Output peak current [1)5)6)8)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	45.0 A	60.0 A	90.0 A	120,0 A	
Output peak current [1)5)6)8)12)] (I_{AC})	at 8 kHz [4)]	36.0 A	48.0 A	72.0 A	96,0	
Nominal power (cos φ = 0,9)		13 kW	17.3 kW	26 kW	34.6 kW	
Max. peak current period [8)]		60 s			30 s	60 s
Max. power supply of DC link terminals [9)]		13 kW	17.3 kW	26 kW	34.6 kW	
Brake resistor current, permitted (Î)		Max. 50 A				
Brake resistor, internal		Refer to ▷page 97◁				
Brake resistor, external		≥ 16 Ω				
Brake resistor threshold (Û)		780 V				
Brake resistor peak power		38 kW				
Permitted continuous brake resistor power, internal		Refer to ▷page 97◁				
Permitted continuous brake resistor power, external		10 kW				
Power loss referring to power input		178 W	248 W	400 W	503 W	
Power input referring to control voltage		70 W (air) / 55 W (water)			70 W	55 W
Current of the integrated brake control		4 A				
Cooling air requirement power heats ink		150 m³/h (air)			150 m³/h	-
Cooling air requirement internal space		37 m³/h				
Requirements to the water cooling		Refer to ▷page 64◁ (for water cooling only)				

- Without power choke BM653X

		BM653**2**	BM653**3**	BM653**4**	BM653**5** [14)]	
		S/A/F/Z	**S/A/F/Z**	**S/A/F/Z**	**S/A**	**F/Z**
Rated input power [1)2)]		23 kVA	28 kVA	42 kVA	55 kVA	
Rated input current [1)2)] (I_{eff})		32.6 A	41 A	60 A	79 A	
Total harmonic distortion input current (THD_I) [1)2)]		139 % [12)]	130 % [12)]	123 % [12)]	118 % [12)]	
Max. input current [2)] (I_{eff})		63 A	79 A	116 A	154 A	
Rated DC link voltage [1)] (U_{DC})		540 V_{DC} [13)]				
DC link capacitance (internal)		1000 µF	1500 µF			
DC link capacitance (external), permitted		Max. 20 mF				
Capacitance DC link to PE		400 nF				
Waiting period between two switching-on operations		None				
Output voltage [1)3)] (U_{AC})		3 x 0 V to 3 x 370 V				
Output frequency at 4 kHz[10)]		0 Hz to 450 Hz				
Rated output current [1)5)6)7)11)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	22.5 A	30.0 A	45.0 A	60.0 A	
Rated output current [1)5)6)7)11)] (I_{AC})	at 8 kHz [4)]	18.0 A	24.0 A	36.0 A	48.0 A	
Output peak current [1)5)6)8)11)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	45.0 A	60.0 A	90.0 A	120.0 A	
Output peak current [1)5)6)8)11)] (I_{AC})	at 8 kHz [4)]	36.0 A	48.0 A	72.0 A	96.0 A	
Nominal power (cos φ = 0,9)		13 kW	17.3 kW	26 kW	26 kW	
Max. peak current period [8)]		60 s			30 s	60 s
Max. power supply of DC link terminals [9)]		13 kW	17.3 kW	26 kW	26 kW	
Brake resistor current, permitted (Î)		Max. 50 A				
Brake resistor, internal		Refer to ▷page 97◁				
Brake resistor, external		≥ 16 Ω				
Brake resistor threshold (Û)		780 V				
Brake resistor peak power		38 kW				
Permitted continuous brake resistor power, internal		Refer to ▷page 97◁				
Permitted continuous brake resistor power, external		10 kW				
Power loss referring to power input		174 W	248 W	400 W	582 W	
Power input referring to control voltage		70 W (air) / 55 W (water)			70 W	55 W
Current of the integrated brake control		4 A				
Cooling air requirement power heats ink		150 m³/h (air)			150 m³/h	-
Cooling air requirement internal space		37 m³/h				
Requirements to the water cooling		Refer to ▷page 64◁				

[1] All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

[2] Using the power choke listed in ▷Power chokes mono units◁ as from page 274 at a power supply with $U_{K,power\ supply}$ = 0.4 %.

[3] The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\ \text{V to}\ 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right) \quad \text{without overmodulation of the PWM.}$$

[4] Switching frequency of the inverter (adjustable).

[5] RMS at an surrounding temperature of 40 °C.

[6] At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

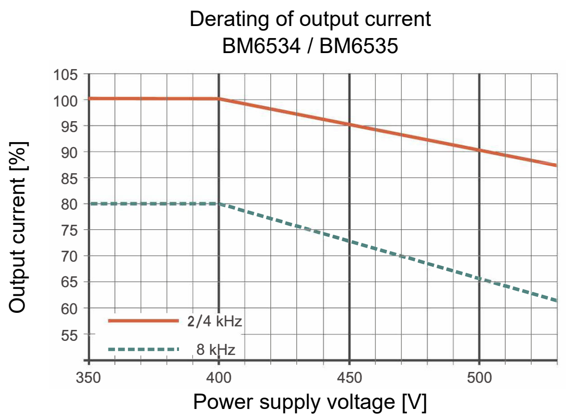


Figure 44: Derating the output current BM653X universal units

[7] The input current must be reduced between 40 °C and 55 °C. Refer to ▷Correction values at changed operating conditions◁ as from page 59.

[8] The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

[9] The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

[10] 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:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller

[11] The continuously permitted output current must be reduced complying with ▷Output frequency-dependent current derating◁ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

[12]The distortion factor of the input current is approx. 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.

[13]Operating the device without power choke causes an increase of the AC component of the DC link voltage compared with the operation using a power choke. As result the minimum DC link voltage can be lower than the value with power choke. Therefore the voltage reserve can be too low at high speed.

[14]Max. peak current duration at a peak current of 90 A: 60 s

3.4.4 Electrical data BM654X

- With power choke BM654X

		BM6543	BM6544	BM6545	BM6546
Rated input power 1)2)		52 kVA	65 kVA	90 kVA	98 kVA
Rated input current 1)2) (I_{eff})		75 A	94 A	122 A	141 A
Total harmonic distortion input current (THD_I) 1)2)		41 %	42 %	42 %	42 %
Max. input current 2) (I_{eff})		147 A	184 A	208 A	231 A
Rated DC link voltage 1) (U_{DC})		540 V_{DC}			
DC link capacitance (internal)		2050 µF	2460 µF	2870 µF	3280 µF
DC link capacitance (external), permitted		Max. 20 mF			
Capacitance DC link to PE		400 nF			
Waiting period between two switching-on operations		None			
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency at 4 kHz10)		0 Hz to 450 Hz			
Rated output current 1)5)6)7)11) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	80 A	100 A	130 A	150 A
Rated output current 1)5)6)7)11) (I_{AC})	at 8 kHz 4)	75 A	80 A	95 A	105 A
Output peak current 1)5)6)8)11) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	160 A	200 A	225 A	250 A
Output peak current 1)5)6)8)11) (I_{AC})	at 8 kHz 4)	150 A	160 A	164 A	175 A
Nominal power (cos φ = 0,9)		46.1 kW	57.7 kW	75 kW	86.5 kW
Max. peak current period 8)		60 s			
Max. power supply of DC link terminals 9)		46.1 kW	57.7 kW	75 kW	86.5 kW
Brake resistor, internal		Refer to ▷page 97◁			
Brake resistor, external		≥ 8 Ω			
Brake resistor threshold (Û)		780 V			
Brake resistor peak power		75 kW			
Permitted continuous brake resistor power, internal		Refer to ▷page 97◁			
Permitted continuous brake resistor power, external		15 kW			
Power loss referring to power input		800 W	1000 W	1400 W	1600 W
Power input referring to control voltage		Max. 50 W controller + 83 W fan			
Current of the integrated brake control		4 A			
Cooling air requirement power heats ink		380 m³/h			
Cooling air requirement internal space		150 m³/h			
Requirements to the water cooling		Refer to ▷page 64◁			

- Without power choke BM654X

		BM654**3**	BM654**4**	BM654**5**	BM654**6**
Rated input power [1)2)]		70 kVA	69 kVA	72 kVA	85 kVA
Rated input current [1)2)] (I_{eff})		101 A	99 A	104 A	123 A
Total harmonic distortion input current (THD_I) [1)2)]		117 % [12)]	113 % [12)]	110 % [12)]	105 % [12)]
Max. input current [2)] (I_{eff})		199 A	241 A	265 A	289 A
Rated DC link voltage [1)] (U_{DC})		540 V_{DC} [13)]			
DC link capacitance (internal)		2050 µF	2460 µF	2870 µF	3280 µF
DC link capacitance (external), permitted		Max. 20 mF			
Capacitance DC link to PE		400 nF			
Waiting period between two switching-on operations		None			
Output voltage [1)3)] (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency at 4 kHz[10)]		0 Hz to 450 Hz			
Rated output current [1)5)6)7)11)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	80 A	100 A	130 A	150 A
Rated output current [1)5)6)7)11)] (I_{AC})	at 8 kHz [4)]	75 A	80 A	95 A	105 A
Output peak current [1)5)6)8)11)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	160 A	200 A	225 A	250 A
Output peak current [1)5)6)8)11)] (I_{AC})	at 8 kHz [4)]	150 A	160 A	164 A	175 A
Nominal power (cos φ = 0,9)		45 kW [14)]	45 kW [14)]	48 kW [14)]	60 kW [14)]
Max. peak current period [8)]		60 s			
Power DC link terminals [9)]		45 kW	45 kW	48 kW	60 kW
Brake resistor, internal		Refer to ▹page 97◃			
Brake resistor, external		≥ 8 Ω			
Brake resistor threshold (Û)		780 V			
Brake resistor peak power		75 kW			
Permitted continuous brake resistor power, internal		Refer to ▹page 97◃			
Permitted continuous brake resistor power, external		15 kW			
Power loss referring to power input		800 W	1000 W	1300 W	1450 W
Power input referring to control voltage		Max. 50 W controller + 83 W fan			
Current of the integrated brake control		4 A			
Cooling air requirement power heats ink		380 m³/h			
Cooling air requirement internal space		150 m³/h			
Requirements to the water cooling		Refer to ▹page 64◃			

[1] All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

[2] Using the power choke listed in ▹Power chokes mono units◃ as from page 274 at a power supply with $U_{K,power\ supply}$ = 0.4 %.

[3] The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\ \text{V to}\ 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right) \quad \text{without overmodulation of the PWM.}$$

[4] Switching frequency of the inverter (adjustable).

[5] RMS at an surrounding temperature of 40 °C.

[6] At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

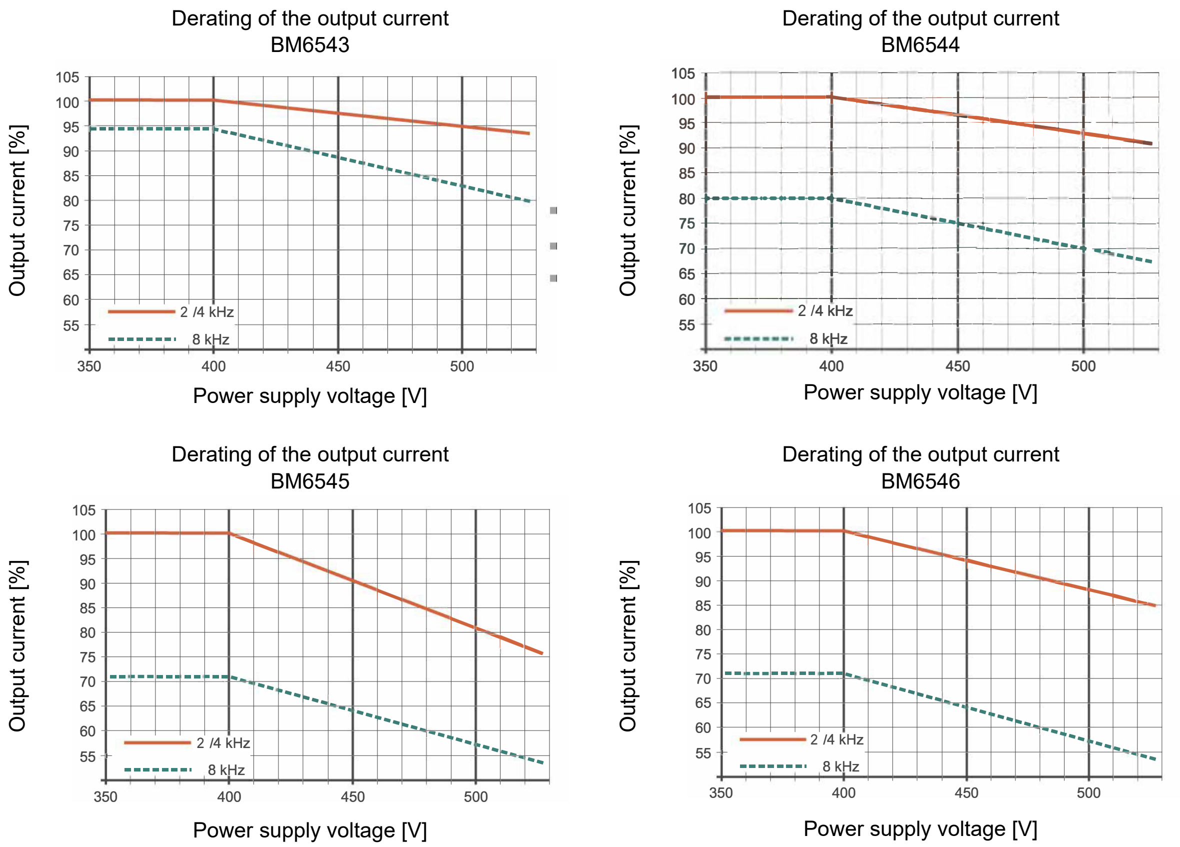


Figure 45: Derating the output current BM654X

[7] The input current must be reduced between 40 °C and 55 °C. Refer to ▹Correction values at changed operating conditions◃ as from page 59.

[8] The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

[9] The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

[10] 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:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller

11) The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

12) The distortion factor of the input current is approx. 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.

13) Operating the device without power choke causes an increase of the AC component of the DC link voltage compared with the operation using a power choke. As result the minimum DC link voltage can be lower than the value with power choke. Therefore the voltage reserve can be too low at high speed.

14) Power Supply: u_K = 1.1 %

3.4.5 Electrical data BM655X

- With power choke BM655X

		BM6554-S/A	BM6554-F/Z	BM6555-S/A	BM6555-F/Z	BM6556-F/Z
Rated input power [1)2)]		143 kVA		170 kVA		204 kVA
Rated input current [1)2)] (I_{eff})		205 A		244 A		294 A
Total harmonic distortion input current (THD_I) [1)2)]		46 %				
Max. input current [2)] (I_{eff})		291 A		376 A		379 A
Rated DC link voltage [1)] (U_{DC})		540 V_{DC}				
DC link capacitance (internal)		5250 µF		6750 µF		7500 µF
DC link capacitance (external), permitted		Max. 20 mF				
Capacitance DC link to PE		400 nF				
Waiting period between two switching-on operations		None				
Output voltage [1)3)] (U_{AC})		3 x 0 V to 3 x 500 V				
Output frequency at 4 kHz[10)]		0 Hz to 450 Hz				
Rated output current [1)5)6)7)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	210 A		250 A		300 A
Rated output current [1)5)6)7)12)] (I_{AC})	at 8 kHz [4)]	147 A		175 A		210 A
Output peak current [1)5)6)8)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	300 A		390 A		390 A
Output peak current [1)5)6)8)12)] (I_{AC})	at 8 kHz [4)]	210 A		273 A		273 A
Nominal power (cos φ = 0,9)		126 kW		150 kW		180 kW
Max. peak current period [8)]		60 s		30 s	60 s	60 s
Max. power supply of DC link terminals [9)]		126 kW		150 kW		180 kW
Average continuous ballast current		40 A				
Brake resistor, internal		-	Refer to ▹page 97◃	-	Refer to ▹page 97◃	
Brake resistor, external		≥ 2,5 Ω				
Brake resistor threshold (Û)		780 V				
Brake resistor peak power		240 kW for 100 ms, 180 kW for 200 ms, 150 kW for 300 ms, 100 kW for 1 s				
Permitted continuous brake resistor power, internal		-	Refer to ▹page 97◃	-	Refer to ▹page 97◃	
Permitted continuous brake resistor power, external		34 kW				
Power loss referring to power input		2320 W		2696 W		3993 W
Power input referring to control voltage		198 W	84 W	198 W	84 W	84 W

	BM6554-**S/A**	BM6554-**F/Z**	BM6555-**S/A**	BM6555-**F/Z**	BM6556-**F/Z**
Current of the integrated brake control	8 A				
Cooling air requirement power heats ink	500 m³/h	-	500 m³/h	-	-
Cooling air requirement internal space	200 m³/h				
Requirements to the water cooling	-	Refer to ▷page 64◁	-	Refer to ▷page 97◁	

- Without power choke BM655X

		BM6554-S/A	BM6554-F/Z	BM6555-S/A	BM6555-F/Z	BM6556-F/Z
Rated input power [1)2)]		167 kVA		195 kVA		228 kVA
Rated input current [1)2)] (I_{eff})		241 A		281 A		328 A
Total harmonic distortion input current (THD_I) [1)2)]		78 % [12)]		70 % [12)]		65 % [12)]
Max. input current [2)] (I_{eff})		335 A		408 A		408 A
Rated DC link voltage [1)] (U_{DC})		540 V_{DC} [13)]				
DC link capacitance (internal)		7500 µF		9000 µF		9000 µF
DC link capacitance (external), permitted		Max. 20 mF				
Capacitance DC link to PE		400 nF				
Waiting period between two switching-on operations		None				
Output voltage [1)3)] (U_{AC})		3 x 0 V to 3 x 500 V				
Output frequency at 4 kHz[10)]		0 Hz to 450 Hz				
Rated output current [1)5)6)7)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	210 A		250 A		300 A
Rated output current [1)5)6)7)12)] (I_{AC})	at 8 kHz [4)]	147 A		175 A		210 A
Output peak current [1)5)6)8)12)] (I_{AC})	at 2 kHz [4)] at 4 kHz [4)]	300 A		390 A		390 A
Output peak current [1)5)6)8)12)] (I_{AC})	at 8 kHz [4)]	210 A		273 A		273 A
Nominal power (cos φ = 0,9)		126 kW		150 kW		180 kW
Max. peak current period [8)]		60 s		30 s	60 s	60 s
Max. power supply of DC link terminals [9)]		126 kW		150 kW		180 kW
Average continuous ballast current		40 A				
Brake resistor, internal		-	Refer to ▷page 97◁	-	Refer to ▷page 97◁	
Brake resistor, external		≥ 2,5 Ω				
Brake resistor threshold (Û)		780 V				
Brake resistor peak power		240 kW for 100 ms, 180 kW for 200 ms, 150 kW for 300 ms, 100 kW for 1 s				
Permitted continuous brake resistor power, internal		-	Refer to ▷page 97◁	-	Refer to ▷page 97◁	
Permitted continuous brake resistor power, external		34 kW				
Power loss referring to power input		2662 W		3074 W		3934 W
Power input referring to control voltage		198 W	84 W	198 W	84 W	84 W
Current of the integrated brake control		8 A				

	BM6554-S/A	BM6554-F/Z	BM6555-S/A	BM6555-F/Z	BM6556-F/Z
Cooling air requirement power heats ink	500 m³/h	-	500 m³/h	-	-
Cooling air requirement internal space	200 m³/h				
Requirements to the water cooling	-	Refer to ▹page 64◃	-	Refer to ▹page 64◃	

1) All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

2) Using the power choke listed in ▹Power chokes mono units◃ as from page 274 at a power supply with $U_{K,power\ supply}$ = 0.4 %.

3) The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\ V \text{ to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ V\right) \quad \text{without overmodulation of the PWM.}$$

4) Switching frequency of the inverter (adjustable).

5) RMS at an surrounding temperature of 40 °C.

6) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

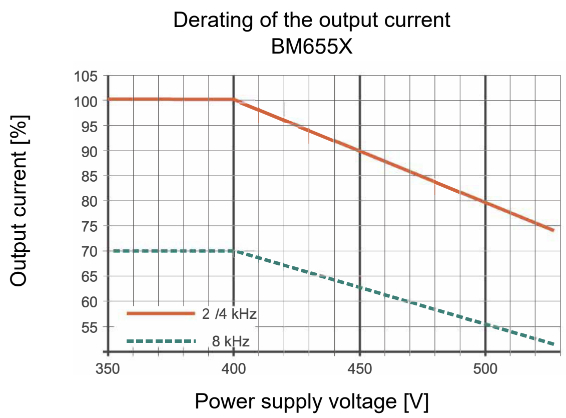


Figure 46: Derating the output current BM655X

7) The input current must be reduced between 40 °C and 55 °C. Refer to ▹Correction values at changed operating conditions◃ as from page 59.

8) The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

9) The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

10) 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-R} (f_{I-R} = 1/cycle time current controller).
The maximum output frequency f_{max}, generated with high quality, is calculated as follows:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases ($K_{pf} < 18$).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz [*]))

[*]) 900 Hz could be generated by the controller

[11)]The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

[12)]The distortion factor of the input current is approx. 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.

[13)]Operating the device without power choke causes an increase of the AC component of the DC link voltage compared with the operation using a power choke. As result the minimum DC link voltage can be lower than the value with power choke. Therefore the voltage reserve can be too low at high speed.

3.4.6 Electrical data BM656X

- With power choke BM656X

		BM6563-		BM6564-		BM6565-		BM6566-	
		S/A	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**
Rated input power 1)2)		195 kVA		227 kVA		272 kVA		323 kVA	390 kVA
Rated input current 1)2) (I_{eff})		281 A		327 A		393 A		466 A	562 A
Total harmonic distortion input current (THD_I) 1)2)		41 %		41 %		41 %		40 %	41 %
Max. input current 2) (I_{eff})		397 A		462 A		554 A		736 A	741 A
Rated DC link voltage 1) (U_{DC})		540 V_{DC}							
DC link capacitance (internal)		7.5 mF		9 mF		12 mF		15 mF	
DC link capacitance (external), permitted		Max. 20 mF							
Capacitance DC link to PE		800 nF							
Waiting period between two switching-on operations		None							
Output voltage 1)3) (U_{AC})		3 x 0 V bis 3 x 370 V							
Output frequency at 4 kHz 10)		0 Hz bis 450 Hz							
Rated output current 1)5)6)7)12) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	300 A		350 A		420 A		500 A	600 A
Rated output current 1)5)6)7)12) (I_{AC})	at 8 kHz 4)	210 A		245 A		295 A		350 A	420 A
Output peak current 1)5)6)8)12) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	430 A		500 A		600 A		800 A	
Output peak current 1)5)6)8)12) (I_{AC})	at 8 kHz 4)	300 A		350 A		420 A		560 A	
Nominal power (cos φ = 0,9)		173 kW		202 kW		242 kW		288 kW	346 kW
Max. peak current period 8)		60 s				30 s		30 s	60 s
Max. power supply of DC link terminals 9)		173 kW		202 kW		242 kW		288 kW	346 kW
Brake resistor, internal		-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω
Brake resistor, external		2 Ω /3.3 Ω							
Brake resistor threshold (Û)		780 V							
Brake resistor peak power		183 kW /304 kW							
Permitted continuous brake resistor power, internal			Refer to ▹page 97◃		Refer to ▹page 97◃		Refer to ▹page 97◃		Refer to ▹page 97◃

	BM6563-		BM6564-		BM6565-		BM6566-	
	S/A	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**
Permitted continuous brake resistor power, external	70 kW							
Power loss referring to power input	3.2 kW		3.7 kW		4.5 kW		5.4 kW	6.5 kW
Power input referring to control voltage	550 W	170 W	550 W	170 W	550 W	170 W	550 W	170 W
Current of the integrated brake control	4 A							
Cooling air requirement power heats ink	1700 m³/h	-	1700 m³/h	-	1700 m³/h	-	1700 m³/h	-
Cooling air requirement internal space	300 m³/h							
Requirements to the water cooling	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁

- Without power choke BM656X

		BM6563-		BM6564-		BM6565-		BM6566-	
		S/A	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**
Rated input power 1)2)		215 kVA		245 kVA		282 kVA		328 kVA	390 kVA
Rated input current 1)2) (I_{eff})		311 A		354 A		407 A		474 A	562 A
Total harmonic distortion input current (THD_I) 1)2)		67 %		61 %		51 %		46 %	41 %
Max. input current 2) (I_{eff})		422 A		483 A		564 A		741 A	
Rated DC link voltage 1) (U_{DC})		540 V_{DC}							
DC link capacitance (internal)		10.5 mF				12 mF		18 mF	
DC link capacitance (external), permitted		Max. 20 mF							
Capacitance DC link to PE		800 nF							
Waiting period between two switching-on operations		None							
Output voltage 1)3) (U_{AC})		3 x 0 V bis 3 x 370 V							
Output frequency at 4 kHz10)		0 Hz bis 450 Hz							
Rated output current 1)5)6)7)12) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	300 A		350 A		420 A		500 A	600 A
Rated output current 1)5)6)7)12) (I_{AC})	at 8 kHz 4)	210 A		245 A		295 A		350 A	420 A
Output peak current 1)5)6)8)12) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	430 A		500 A		600 A		800 A	
Output peak current 1)5)6)8)12) (I_{AC})	at 8 kHz 4)	300 A		350 A		420 A		560 A	
Nominal power (cos φ = 0,9)		173 kW		202 kW		242 kW		288 kW	346 kW
Max. peak current period 8)		60 s				30 s		30 s	60 s
Max. power supply of DC link terminals 9)		173 kW		202 kW		242 kW		288 kW	346 kW
Brake resistor, internal		-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω	-	2 Ω / 3.3 Ω
Brake resistor, external		2 Ω /3.3 Ω							
Brake resistor threshold (Û)		780 V							
Brake resistor peak power		183 kW /304 kW							
Permitted continuous brake resistor power, internal			Refer to ▹page 97◃		Refer to ▹page 97◃		Refer to ▹page 97◃		Refer to ▹page 97◃
Permitted continuous brake resistor power, external		70 kW							
Power loss referring to power input		3.2 kW		3.7 kW		4.5 kW		5.4 kW	6.5 kW

	BM6563-		BM6564-		BM6565-		BM6566-	
	S/A	F/Z	S/A	F/Z	S/A	F/Z	S/A	F/Z
Power input referring to control voltage	550 W	170 W	550 W	170 W	550 W	170 W	550 W	170 W
Current of the integrated brake control	4 A							
Cooling air requirement power heats ink	1700 m³/h	-	1700 m³/h	-	1700 m³/h	-	1700 m³/h	-
Cooling air requirement internal space	300 m³/h							
Requirements to the water cooling	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁	-	Refer to ▷page 64◁

1) All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

2) Using the power choke listed in ▷Power chokes mono units◁ as from page 274 at a power supply with $U_{K,power\ supply}$ = 0.4 %.

3) The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$ without overmodulation of the PWM.

4) Switching frequency of the inverter (adjustable).

5) RMS at an surrounding temperature of 40 °C.

6) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

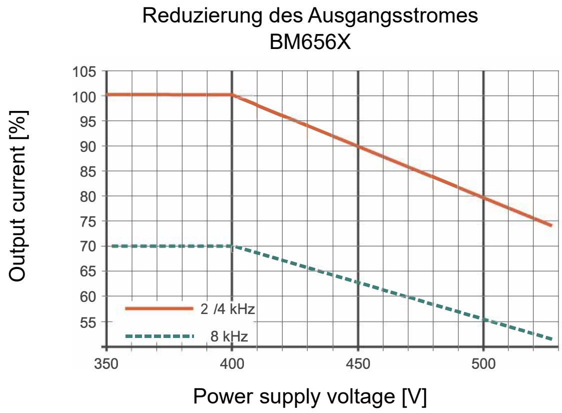


Figure 47: Derating the output current BM656X

7) The input current must be reduced between 40 °C and 55 °C. Refer to ▷Correction values at changed operating conditions◁ as from page 59.

8) The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

9) The sum of the power drawn via the DC link terminals and the motor terminals must not exceed the rated power of the device.

[10] 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-R} (f_{I-R} = 1/cycle time current controller).
The maximum output frequency f_{max}, generated with high quality, is calculated as follows:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz [*)])

[*)] 900 Hz could be generated by the controller

[11] The continuously permitted output current must be reduced complying with ▷Output frequency-dependent current derating◁ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

[12] The distortion factor of the input current is approx. 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.

[13] Operating the device without power choke causes an increase of the AC component of the DC link voltage compared with the operation using a power choke. As result the minimum DC link voltage can be lower than the value with power choke. Therefore the voltage reserve can be too low at high speed.

3.5 Electrical data power modules BM65DX, BM65EX, BM65FX

3.5.1 Electrical data BM65DX

		BM654**3**	BM654**4**	BM654**5**	BM654**6**
Rated input voltage [1]		$540\ V_{DC}$			
Rated input current [1]		89 A	111 A	145 A	167 A
Max. input current		178 A	223 A	250 A	278 A
DC link capacitance (internal)		2050 µF	2460 µF	2870 µF	3280 µF
DC link capacitance (external), permitted		Max. 20 mF			
Capacitance DC link to PE		0			
Waiting period between two switching-on operations		None			
Output voltage [1,2] (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency at 4 kHz[8]		0 Hz to 450 Hz			
Rated output current [1,4,5,6,9] (I_{AC})	at 2 kHz [4] at 4 kHz [4]	80 A	100 A	130 A	150 A
Rated output current [1,4,5,6,9] (I_{AC})	at 8 kHz [4]	75 A	80 A	95 A	105 A
Output peak current [1,4,5,7,9] (I_{AC})	at 2 kHz [4] at 4 kHz [4]	160 A	200 A	225 A	250 A
Output peak current [1,4,5,7,9] (I_{AC})	at 8 kHz [4]	150 A	160 A	164 A	175 A
Nominal power (cos φ = 0,9)		46.1 kW	57.7 kW	75 kW	86.5 kW
Max. peak current period [7]		60 s			
Power loss referring to power input		800 W	1000 W	1300 W	1450 W
Power input referring to control voltage		Max. 50 W controller + 83 W fan			
Current of the integrated brake control		4 A			
Cooling air requirement power heats ink		380 m³/h			
Cooling air requirement internal space		150 m³/h			
Requirements to the water cooling		Refer to ▹page 64◃			

1) All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

2) The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\ \text{V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right)$$ without overmodulation of the PWM.

3) Switching frequency of the inverter (adjustable).

4) RMS at an surrounding temperature of 40 °C.

5) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

Derating of the output current
BM65D3

Output current [%]

Power supply voltage [V]

Derating of the output current
BM65D4

Output current [%]

Power supply voltage [V]

Derating of the output current
BM65D5

Output current [%]

Power supply voltage [V]

Derating of the output current
BM65D6

Output current [%]

Power supply voltage [V]

Figure 48: Derating the output current BM65DX

[6] The input current must be reduced between 40 °C and 55 °C. Refer to ▹Correction values at changed operating conditions◃ as from page 59.

[7] The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

[8] 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-R} (f_{I-R} = 1/cycle time current controller).
The maximum output frequency f_{max}, generated with high quality, is calculated as follows:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller

[9] The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

3.5.2 Electrical data BM65EX

		BM6E54-S/A	BM6E54-F/Z	BM6E55-S/A	BM6E55-F/Z	BM6E56-F/Z
Rated input voltage [1]		540 V_{DC}				
Rated input current [1]		243 A		289 A		347 A
Max. input current		347 A		376 A		451 A
DC link capacitance (internal)		5250 µF		6750 µF		7500 µF
DC link capacitance (external), permitted		Max. 20 mF				
Capacitance DC link to PE		0				
Waiting period between two switching-on operations		No				
Output voltage [1)2)] (U_{AC})		3 x 0 V to 3 x 500 V				
Output frequency at 4 kHz[8]		0 Hz to 450 Hz				
Rated output current [1)4)5)6)9)] (I_{AC})	at 2 kHz [4] at 4 kHz [4]	210 A		250 A		300 A
Rated output current [1)4)5)6)9)] (I_{AC})	at 8 kHz [4]	147 A		175 A		210 A
Output peak current [1)4)5)7)9)] (I_{AC})	at 2 kHz [4] at 4 kHz [4]	300 A		390 A		390 A
Output peak current [1)4)5)7)9)] (I_{AC})	at 8 kHz [4]	210 A		273 A		273 A
Nominal power (cos φ = 0,9)		126 kW		150 kW		180 kW
Max. peak current period [7]		60 s		30 s	60 s	60 s
Power loss referring to power input		2662 W		3074 W		3934 W
Power input referring to control voltage		198 W	84 W	198 W	84 W	84 W
Current of the integrated brake control		8 A				
Cooling air requirement power heats ink		500 m³/h	-	500 m³/h	-	-
Cooling air requirement internal space		200 m³/h				
Requirements to the water cooling		-	Refer to ▹page 64◃	-	Refer to ▹page 97◃	

[1] All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

[2] The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\ \text{V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right)$$ without overmodulation of the PWM.

[3] Switching frequency of the inverter (adjustable).

[4] RMS at an surrounding temperature of 40 °C.

5) At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

Derating of the output current
BM65EX

Output current [%]

Output current [%]

Power supply voltage [V]

Figure 49: Derating the output current BM65EX

6) The input current must be reduced between 40 °C and 55 °C. Refer to ▹Correction values at changed operating conditions◃ as from page 59.

7) The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

8) 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:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases (K_{pf} < 18).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz *))

*) 900 Hz could be generated by the controller

9) The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

3.5.3 Electrical data BM65FX

		BM6F63-		BM6F64-		BM6F65-		BM6F66-	
		S/A	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**	**S/A**	**F/Z**
Rated input voltage 1)		540 V_{DC}							
Rated input current 1)		334 A		390 A		467 A		556 A	667 A
Max. input current		422 A		483 A		564 A		890 A	
DC link capacitance (internal)		7,5 mF		9 mF		12 mF		15 mF	
DC link capacitance (external), permitted		Max. 20 mF							
Capacitance DC link to PE		0							
Waiting period between two switching-on operations		No							
Output voltage 1)2) (U_{AC})		3 x 0 V to 3 x 370 V							
Output frequency at 4 kHz 8)		0 Hz to 450 Hz							
Rated output current 1)4)5)6)9) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	300 A		350 A		420 A		500 A	600 A
Rated output current 1)4)5)6)9) (I_{AC})	at 8 kHz 4)	210 A		245 A		295 A		350 A	420 A
Output peak current 1)4)5)7)9) (I_{AC})	at 2 kHz 4) at 4 kHz 4)	430 A		500 A		600 A		800 A	
Output peak current 1)4)5)7)9) (I_{AC})	at 8 kHz 4)	300 A		350 A		420 A		560 A	
Nominal power (cos φ = 0,9)		173 kW		202 kW		242 kW		288 kW	346 kW
Max. peak current period 7)		60 s				30 s		30 s	60 s
Power loss referring to power input		3.2 kW		3.7 kW		4.5 kW		5.4 kW	6.5 kW
Power input referring to control voltage		550 W	170 W	550 W	170 W	550 W	170 W	550 W	170 W
Current of the integrated brake control		4 A							
Cooling air requirement power heatsink		1700 m³/h	-	1700 m³/h	-	1700 m³/h	-	1700 m³/h	-
Cooling air requirement internal space		300 m³/h							
Requirements to the water cooling		-	Refer to ▹page 97◃	-	Refer to ▹page 97◃	-	Refer to ▹page 97◃	-	Refer to ▹page 97◃

[1)] All rated values refer to a DC link voltage of 540 V, a control voltage of 24 V and an surrounding temperature of 40 °C.

[2)] The output voltage is a pulsed DC voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right) \quad \text{without overmodulation of the PWM.}$$

[3)] Switching frequency of the inverter (adjustable).

[4)] RMS at an surrounding temperature of 40 °C.

[5)] At rated power supply voltage the unit supplies rated / maximum output currents. With input voltages above the rated power supply voltage the output currents must be reduced at constant output power.

Derating of the output current
BM65FX

Output current [%]

Output current [%]

Power supply voltage [V]

Figure 50: Derating the output current BM65FX

[6)] The input current must be reduced between 40 °C and 55 °C. Refer to ▹Correction values at changed operating conditions◃ as from page 59.

[7)] The possible overload time at this moment is dependent of the device load and the heat sink temperature. The device load is determined by the overload monitoring of the device.

[8)] 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-R} (f_{I-R} = 1/cycle time current controller).
The maximum output frequency f_{max}, generated with high quality, is calculated as follows:

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

The quality of the output voltages decreases as the ratio of the frequencies decreases ($K_{pf} < 18$).
However, the maximum frequency of 599 Hz, to which the controller is limited, can be generated with sufficient accuracy (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	Maximum output frequency	Ideal range of the output frequency
2 kHz	250 µs	599 Hz	0 - 225 Hz
4 kHz	125 µs	599 Hz	0 - 450 Hz
8 / 16 kHz	62.5 µs	599 Hz	0 - 599 Hz (900 Hz [*)])

[*)] 900 Hz could be generated by the controller

[9)] The continuously permitted output current must be reduced complying with ▹Output frequency-dependent current derating◃ on page 101 if the statical output frequency is lower than 15 Hz and the frequency remains between 0 and 15 Hz for more than 5 seconds.

3.6 Additional data referring to water-cooled brake resistors

Device version	Brake resistor	Additional device weight	Brake resistor current	Depth of device 1)	Brake peak power P_{Smax} 3)	Brake continuous power P_{Dmax} 2) 3)	Constants for calculation C_1	C_2	C_3
BM65**3**X-XXXX16	16 Ω	1.6 kg	49 A	+25 mm	38 kW	2 kW	0.139 K/W	0.05081 K/Ws	-6.7751 s^{-1}
BM65**4**X-XXXX10 BM65**D**X-XXXX10	10 Ω	2 x 1.2 kg	78 A	+25 mm	61 kW	1.2 kW	0.200 K/W	0.01605 K/Ws	-0.9169 s^{-1}
BM65**5**X-XXXX05 BM65**E**X-XXXX05	5 Ω	4 x 1.2 kg	156 A	+25 mm	122 kW	3 kW	0.100 K/W	0.00802 K/Ws	-0.9169 s^{-1}
BM65**6**X-XXXX03 BM65**F**X-XXXX03	3.3 Ω	6 x 1.2 kg	236 A	+30 mm	183 kW	5 kW			
BM65**6**X-XXXX02 BM65**F**X-XXXX02	2 Ω	6 x 1,2 kg	390 A	+30 mm	304 kW	5 kW			

1) The total depth of the device in the cooling version F increases by the specified value (refer to ▹Dimensions◃ as from page 25). At devices of the cooling version Z the dimensions of the device do not change.

2) The DC link voltage must not exceed 800 V.
Calculation of the permitted length of the braking procedure refer to ▹Calculations◃ as from page 98.

3) The mentioned continuous power is reached if the water flow amount is at least 10 l/min. The inlet temperature may not be greater than 45 °C.
The brake resistor output power diminishes to a rated value of 0 if the inlet temperature is between >45°C and <60°C.

NOTE!
The water-cooled brake resistors offer the optimum of power loss, which can be dissipated, at a minimum unit volume. However, 10 % of the brake resistor power is not dissipated via the cooling water. It is emitted to the environmental air.
At operation with rated power the brake resistors reach temperatures of 200 °C on the rear side.

Preconditions for the cooling versions A/F (through hole devices):
Provide adequate protection against contact. Install grids around the heat sink and the resistors. Assure, that enough air can circulate and that no heat accumulation can develop under the protective cover.

Preconditions for cooling version Z (mounting into the control cabinet):
Install the devices into the control cabinet, that no heat accumulation can develop above the devices. Air circulation must be possible. In spite of air circulation elevated temperatures can occur above the devices. Do not install cables or cable channels above the devices. At the devices BM65XX do not install the connection cables directly above the mounting plate of the device, where the hot air rises.

When dimensioning, consider that 10 % of brake resistor power is not dissipated via the cooling water, but is an additional power loss, which heats the cabinet. Provide an adequate fresh air supply.

Calculations

Precondition for calculation:
The brake power of the internal brake resistors must decrease straight proportional from the brake peak power to 0.

The brake power time area A must be converted in an equivalent triangular time area. The resulting parameters P_S and t_{on} must be used for the further calculations.

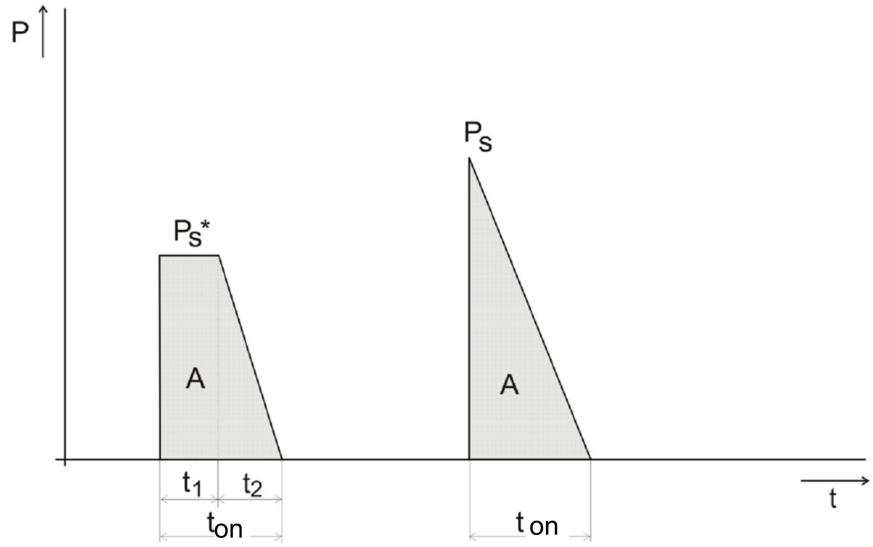


Figure 51: Conversion brake power time area in triangular time area

$$A = t_1 \cdot P^*_S + \frac{1}{2} \cdot t_2 \cdot P^*_S = \frac{1}{2} \cdot t_{on} \cdot P_S$$

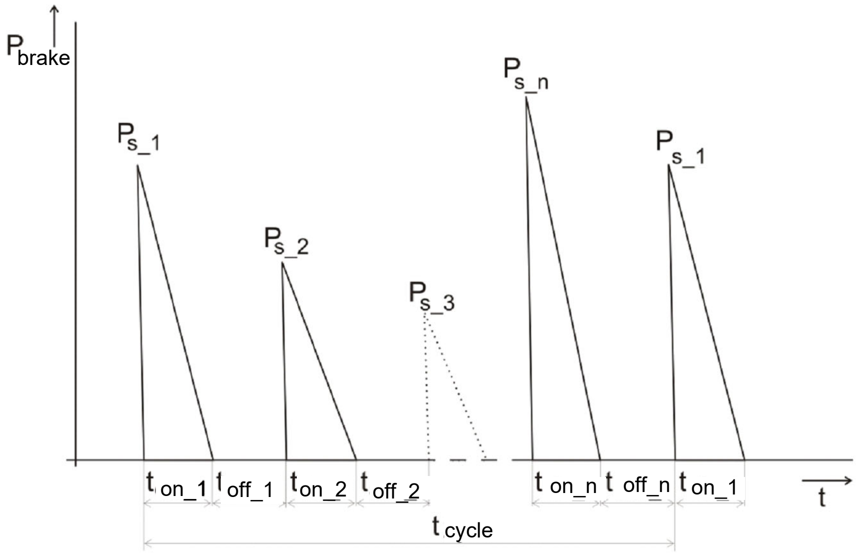
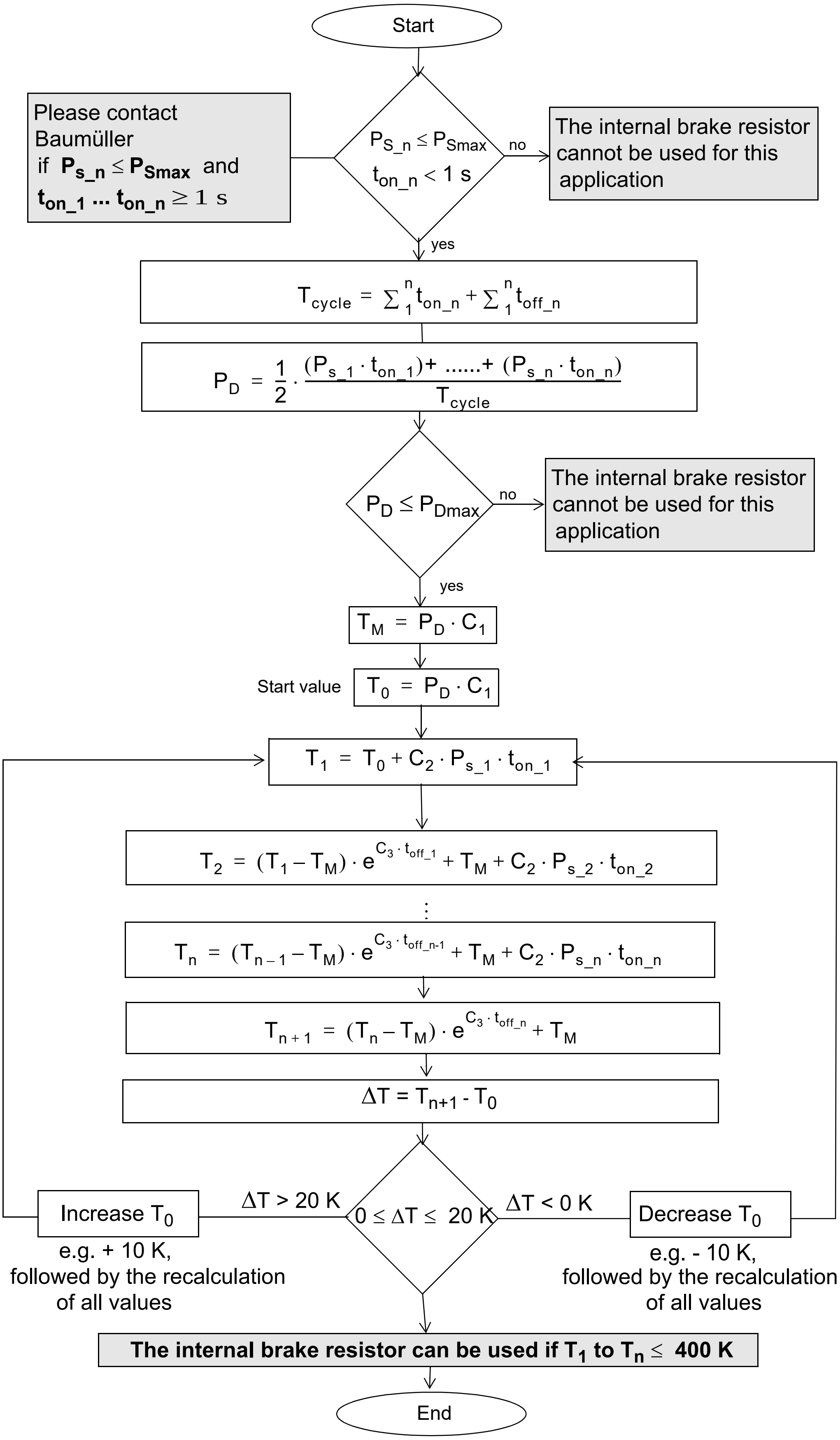


Figure 52: Braking cycle

P_D	Average continuous brake power of one cycle
P_{Dmax}	Maximum continuous brake power, refer to ▷page 97◁
n	Number of brake operations within one cycle
P_{S_1} to P_{S_n}	Brake peak power, numbered in chronological order
t_{on_1} bis t_{on_n}	Brake time periods
t_{off_1} bis t_{off_n}	Off time periods, between the brake time periods
T_{cycle}	Total cycle
C_1, C_2, C_3	Constants, refer to ▷page 97◁

3.6 Additional data referring to water-cooled brake resistors



3.7 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.

The output current must be reduced independent on the length of frequency < 15 Hz if it is a **periodically** dynamic load.

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.

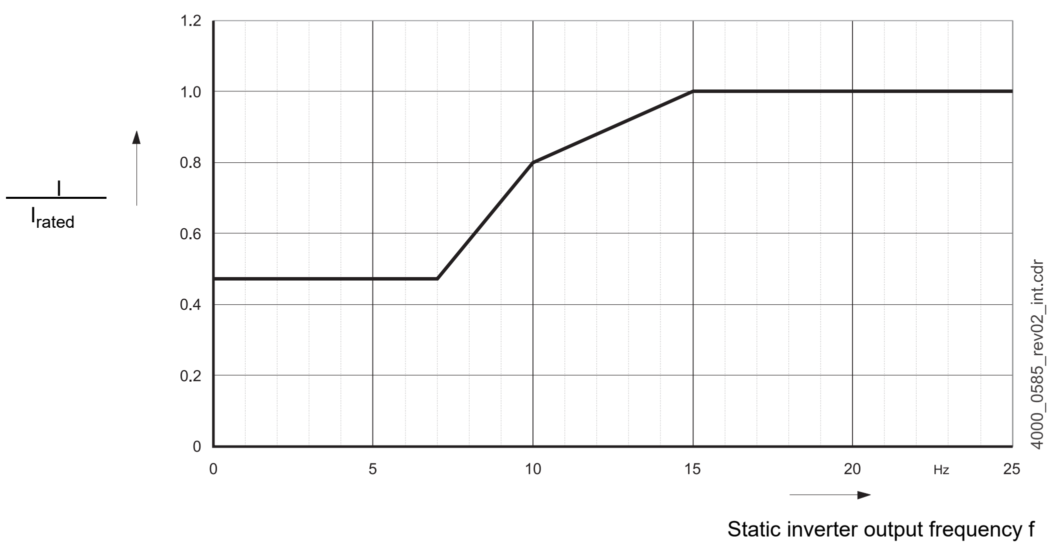


Figure 53: Derating with a static inverter frequency < 15 Hz

4

Design and Operation

4.1 Design

BM65XX

Mono unit safety

The mono units **BM65XX** consist of a mains rectifier unit and an axis unit in the same housing.

The present alternating voltage at the three-phase system is converted into direct voltage by the input sided rectifier. The DC link capacitors smooth this DC link direct voltage. The output sided inverter generates a three-phase system from the direct voltage with variable frequency and voltage for the supply of the connected motor.

Additionally you can draw d. c. from the device via the DC link connections.

BM65DX, BM65EX, BM65FX

Power module safety

This is a motor inverter that is supplied from the DC link via a BM50XX mains rectifier/ BM51XX active mains rectifier or a BM55XX or BM65XX mono unit.

The output-side inverter generates a three-phase system with variable frequency and voltage from the DC link to operate the connected motor.

NOTE!

Proper operation of power modules **BM65XX** can only be guaranteed with Baumüller supply units BM50XX, BM51XX and mono units **BM65XX** or BM55XX/BM56XX/ BM57XX.

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.

NOTE!

Only the operation with ProDrive is described. If the software is not available, please contact Baumüller Nürnberg GmbH or visit our Website www.baumueller.com for download.

4.2 Identification of the device

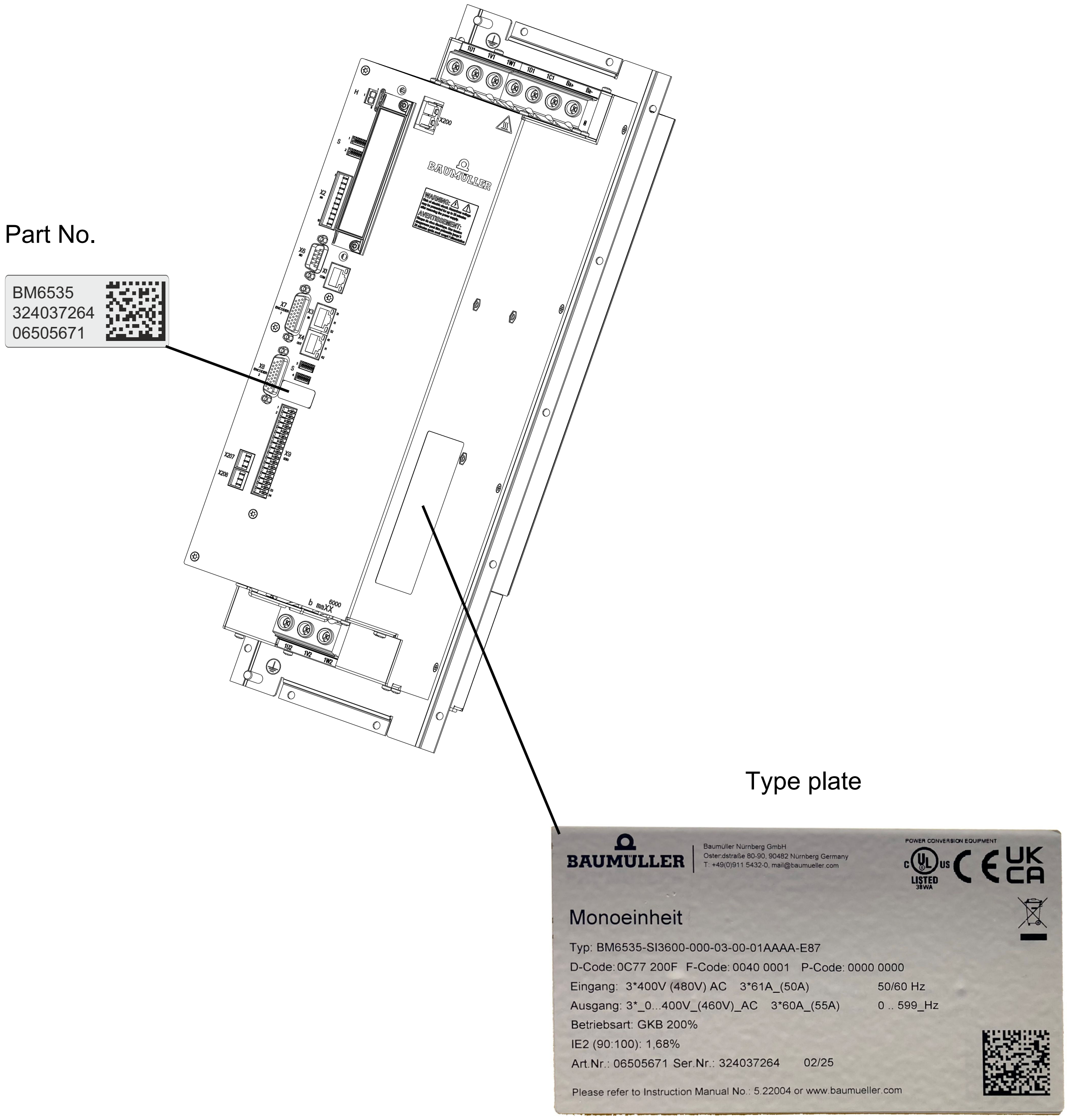


Figure 54: Location of part number / type code

NOTE!

The values in brackets are for UL applications.

4.3 Type code

The type code has the format: BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Manufacturer

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Device generation

6: BM65XX

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Device design

5: Mono unit prepared for integrated safety
8: Power module prepared for integrated safety

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Housing size

Refer to ▹Dimensions◃ as from page 25.

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Current grading (output rated current)

Refer to ▹Electrical data mono units◃ as from page 66.

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

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

BMXXXX-XXXXYY-XXX-XX-XX-XXXXX-EXX

Type of power supply system

T: Grounded TN or TT systems
I: IT systems, grounded TN or TT systems
G: Grounded delta systems, IT systems, grounded TN or TT systems

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Controller generation

3: BSCsafe Step 3

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Power unit type

6: BM65XX: $U_{Power\ supply}$ = 400 V_{AC}
7: BM65XX: $U_{Power\ supply}$ = 230 V_{AC}

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Option brake resistor

00: No brake resistor
YY: E.g. 06: Brake resistor with 6 Ω attached on the water cooler

4.3 Type code

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Customer identification

0: Standard version

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Add-on module

00: Without module
01: IEE with external supply
02: Reserved
03: SIE with internal supply
04: SVP-001-001,
4 analog inputs (for voltage), 4 analog outputs (voltage)
05: SVP-001-002, 4 analog inputs (2 for voltage, 2 for current),
4 analog outputs (voltage), 4 digital inputs, 4 digital outputs
06: SVP-001-003, 4 analog inputs (for current),
4 analog outputs (voltage), 4 digital inputs, 4 digital outputs
60: drive PLC type X (in preparation)

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Fieldbus configuration

00: None
01: EtherCAT® CoE
03: CANopen®
02: VARAN
04: POWERLINK®
05: PROFINET
07: EtherCAT® SoE

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Specific requests

00: Standard
…
71: PCB with protective lacquer: power unit
72: PCB with protective lacquer: controller and power unit
73: PCB with protective lacquer: controller, option modules and power unit

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Incompatible firmware release controller

1st digit: 0: Standard
2nd digit: Firmware release of the controller firmware version e.g. V0**1**.13.02 $\Rightarrow$ **1**

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Compatible firmware release controller

„Frozen“ Firmware release: V01.**13.02** $\Rightarrow$ **1302**

„Not frozen“ Firmware release: AAAA

BMXXXX-XXXXYY-XXX-XX-XX-XXXXXX-EXX

Software functionality

E0X: Standard device
E8X: Export device output frequency $\leq$ 599 Hz

EX0: Standard device
EX1: SoftDrive PLC
EX3: Servo pump V1
EX4: Servo pump V2
EX7: Servo pump V2+
EX8: Crosscutter
EXA: Energy monitoring

Drive code

D: XXXX-XXXX — Drive code

D: XXXX-XXXX — Hexadecimal value with 8 digits (e.g. FFFF $FFFF_{hex}$)

Bit No.	Description	
0	Encoder 1: Encoder type	Resolver
1	Encoder 1: Encoder type	Analog encoder
2	Encoder 1: Encoder type	Digital encoder
3	Encoder 1: Encoder type	Hall sensor
4	Encoder 2: Encoder type	Resolver
5	Encoder 2: Encoder type	Analog encoder
6	Encoder 2: Encoder type	Digital encoder
7	Encoder 2: Encoder type	Hall sensor
8	Encoder 1 and encoder 2	0: V_{CC} internal / 1: V_{CC} external
12	Analog I/O standard	2 In / 2 Out
13	Analog I/O adjusted	2 In / 2 Out
14	Fieldbus connector type	0: RJ45 1: M8
16	Service	7 segment display, DIP switch, RJ45 service interface
17	Digital I/O	8 In / 4 Out (standard)
18	Touch probe	2
20	Signal bus	1: available / 0: not available
21	Motor brake control	1: available / 0: not available
22	Motor temperature interface	1: available / 0: not available
24	DC link fuse	1: available / 0: not available
25	Operation without power choke possible	1: yes / 0: no
26	Brake resistor transistor	1: available / 0: not available
27	DC link connection	1: available / 0: not available
28	Device mounting orientation	1: 180° rotated

Fail safe code

F: XXXX-XXXX — Fail safe code

F: XXXX-XXXX — Hexadecimal value with 8 digits (e.g. FFFF $FFFF_{hex}$)

Bit No.	**Description**	**Type**
0	Safety function	STO
1	Safety function	SS1
2	Safety function	SS2
3	Safety function	SOS
4	Safety function	SLS
5	Safety function	SLP
6	Safety function	SLI
7	Safety function	SLA
8	Safety function	SDI
9	Safety function	SBC
10	Safety function	SSM
11	Safety function	SCA
12	Safety function	SP
13	Safety function	STO with SS1-t 200ms
18	Safe communication	FSoE communication
22	Safe I/O	2 x 2 channel safe input (STO)
23	Safe I/O	2 x 2 channel safe input (STO)
24	Safe I/O	6 x 2 channel safe input
25	Safe I/O	2 x 2 channel safe output
26	Safe I/O	1 x 2 channel clock output
27	Safe I/O	2 x 2 channel daisy chain input
28	Safe I/O	2 x 2 channel daisy chain output

4.3 Type code

ISF-01 software release ISF-01 software release corresponds with the software release of the Nios firmware of ISF module.

ISF-01 FW: XX.YY	ISF-01 software release
ISF-01 FW: XX.YY	XX Incompatible software release YY Compatible software release

P code

P: XXXX-XXXX	P code
P: XXXX-XXXX	Hexadecimal value with 8 digits (e.g. FFFF $FFFF_{hex}$)

Bit No.	Description	Type
0	RAM: 512MB	Memory DDR RAM 3 / 512MB
1	RAM: 1GB	Memory DDR RAM 3 / 1GB
2	RAM: 2GB	Memory DDR RAM 3 / 2GB
4	NOVRAM 8KB	NOVRAM <= 8KB
5	NOVRAM 16KB	NOVRAM <= 16KB
6	NOVRAM 32KB	NOVRAM <= 32KB
8	Micro SD Slot	Micro SD slot for industrial µSD cards
9	eMMC 4GB	eMMC 4GB
10	eMMC 8GB	eMMC 8GB
11	eMMC 16GB	eMMC 16GB
12	QSPI Flash	QSPI flash 64Mbit = 8Mbyte
13	Flash 128 MB	Flash memory 128MB
14	Flash 256 MB	Flash memory 256MB
15	Flash 512 MB	Flash memory 512MB
16	2 analog inputs	2 analog inputs on add-on PCB
17	2 analog outputs	2 analog outputs on add-on PCB
18	2 digital inputs	2 digital inputs on add-on PCB
19	2 digital outputs	2 digital outputs on add-on PCB
20	Add. Ethernet port	Additional Ethernet port (No. 2)
21	Add. Ethernet port	Additional Ethernet port (No. 3)
22	EtherCAT master	1: available; 0: not available
23	CanOpen	CanOpen master on add-on PCB
24	RTC with SuperCAP	Real time clock with buffer capacitor

4.4 UL notes

The notes below must be observed in case you consider UL 61800-5-1 and/or C22.2 No. 274.

▹Required environmental conditions◃ on page 58

- Maximum surrounding air temperature: 55 °C.
- Liquid cooled models: Maximum cooling water temperature 60°C. Maximum water pressure 6 bar/600 kPa.
- Use in a pollution degree 2 environment only.

▹Requirements for mains supply system mono unit◃ on page 55

- A minimum grid inductance is required for operation

- Motor over temperature protection with thermal memory retention is not provided by the drive.

▹Electrical connections◃ as from page 169

- DC-input rated models are intended for use only in combination with listed AC/DC converters manufactured by Baumueller.

▹Connection data◃ as from page 179

- Note tightening torque values marked for field terminals.

- Use 75 °C wires only.

- Mechanical data using SI or English units - dimensional drawing, mass information, packing, unpacking, moving, lifting, handling and mounting instructions including warnings of any hazards which can be experienced during installation, refer to:
- ▹Transport and Packaging◃ as from page 121
- ▹Dimensions◃ as from page 25
- ▹Mounting◃ as from page 123

- Marking for proper electrical connections, interconnection and wiring diagrams; range of values or a nominal value of tightening torque in pound-inches to be applied to the clamping screws of field wiring located in the motor circuit, refer to:
- ▹Electrical connections◃ as from page 169
- ▹Electrical connections◃ as from page 169
- ▹Connection data◃ as from page 179

- Instructions for safe earthing the equipment:
  ▹Electrical connections◃ as from page 169

▷Fuses mono units◁ as from page 255

- 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.

- Suitable for use on a circuit capable of delivering not more than - see SCCR table - rms symmetrical amperes, 480 Volts maximum and when protected with fuses class J.

Model name	Fuse rating max.	SCCR [rms symmetrical amperes]
BM651X	20 A	65000 A
BM652X	50 A	65000 A
BM653X	125 A	65000 A
BM654X	225 A	65000 A
BM655X	350 A	65000 A
BM656X	600 A	65000 A

- Suitable for use on a circuit capable of delivering not more than - see SCCR table - rms symmetrical amperes, 480 Volts maximum and when protected with a circuit breaker.

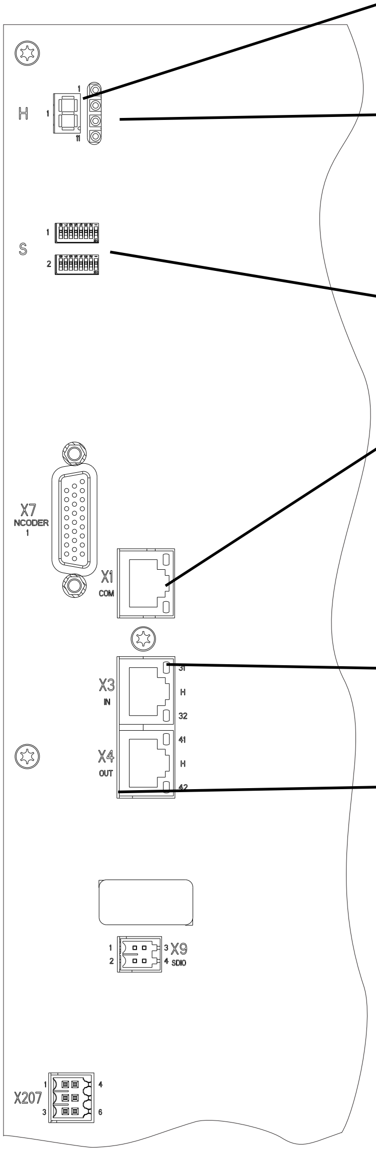
Model name	Circuit breaker rating max.	SCCR [rms symmetrical amperes]
BM651X	20 A	65000 A
BM651X	20 A	65000 A
BM652X	50 A	65000 A
BM653X	125 A	65000 A
BM654X	250 A	65000 A
BM655X	350 A	65000 A
BM656X	800 A	65000 A

NOTE!

Please reduce the rated current of the fuse according to the current rating of the device or the current requirement of the device in the application.

4.5 Display and operating elements

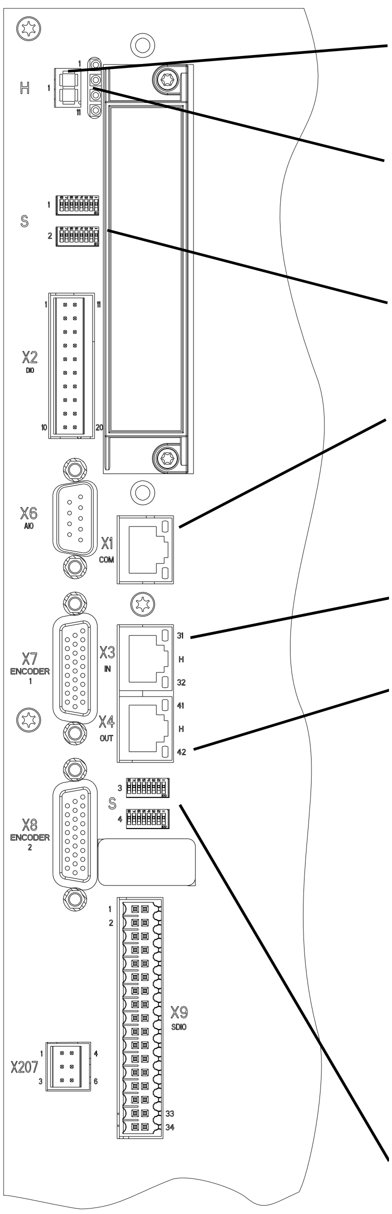
4.5.1 Display and operating elements minimum configuration



7 segment display **H1**	Display of controller state Meaning: refer to ▹7-segment display controller◃ on page 113
LED **H11 - H14**	Meaning: refer to ▹LED display controller◃ on page 114.
Address switch **S1 - S2**	Setting: refer to ▹Setting address switches◃ as from page 118.
Service interface **X1**	Setting: refer to ▹LED display service interface◃ on page 114
LED **H31** **H32** **H41** **H42**	Fieldbus, depending on type (refer to ▹Type code◃ as from page 105) Meaning: BM65XX-XXXXYY-XXX-**01** BM65XX-XXXXYY-XXX-**07** ▹LED EtherCAT® .◃ on page 115 BM65XX-XXXXYY-XXX-**02**- ▹LED VARAN◃ on page 115 BM65XX-XXXXYY-XXX-**04** ▹LED POWERLINK® .◃ on page 116 BM65XX-XXXXYY-XXX-**05** ▹LED PROFINET .◃ on page 117

Figure 55: Display/operating elements controller minimum configuration

4.5.2 Display and operating elements



7 segment display **H1**	Display of controller state Meaning: refer to ▹7-segment display controller◃ on page 113
LED **H11 - H14**	Meaning: refer to ▹LED display controller◃ on page 114.
Address switch **S1 - S2**	Setting: refer to ▹Setting address switches◃ as from page 118.
Service interface **X1**	Setting: refer to ▹LED display service interface◃ on page 114
LED **H31** **H32** **H41** **H42**	Fieldbus, depending on type (refer to ▹Type code◃ as from page 105) Meaning: BM65XX-XXXXYY-XXX-**01** BM65XX-XXXXYY-XXX-**07** ▹LED EtherCAT® .◃ on page 115 BM65XX-XXXXYY-XXX-**02** ▹LED VARAN◃ on page 115 BM65XX-XXXXYY-XXX-**04** ▹LED POWERLINK® .◃ on page 116 BM65XX-XXXXYY-XXX-**05** ▹LED PROFINET .◃ on page 117
Address switch **S3 - S4**	Setting FSoE: refer to additional handbook ▹Safety◃ on page 12

Figure 56: Display/operating elements controller

4.5.3 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	

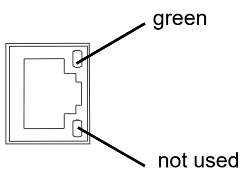
NOTE!

In addition the error No. is displayed, refer to ▷Figure 104◁ on page 233.

4.5.4 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

4.5.5 LED display service interface

	Meaning	Blinking pattern
	Link / Act	Off: No connection
		On: Connection
		Blinking: Data transfer

4.5.6 LED display fieldbus

LED EtherCAT® Type code

BM65XX-XXXXYY-XXX-**01**
BM65XX-XXXXYY-XXX-**07**

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

LED VARAN Type code

BM65XX-XXXXYY-XXX-**02**

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

LED CANopen® Type code

BM6XXX-XXXXYY-XXX-**03**-XX-XXXXXX-EXX-MX

No function

LED POWERLINK®

Type code
BM65XX-XXXXYY-XXX-**04**

Naming on the front plate	Meaning	Blinking pattern	
H31 (green)	X3 Link / Act	Off:	No connection
		On:	Connection
		Blinking:	Data transfer
H32 (red)	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

LED PROFINET Type code

BM65XX-XXXXYY-XXX-**05**

Naming on the front plate	Meaning	Blinking pattern	
H31 (green/orange)	X3 Link / Act	off:	No connection
		on:	Connection
		orange blinking:	Data transfer
H32 (red)	SF (System error)	off:	No error
		3 x (500 ms on / 500 ms off) / 3 s off:	DCP signal service is initiated via bus
		on:	Watchdog timeout; Chanell, generic or extended diagnosis available; System error
H41 (green/orange)	X4 Link / Act	off:	No connection
		on:	Connection
		orange blinking:	Data transfer
H42 (red)	BF (Bus error)	off:	No error
		250 ms on / 250 ms off:	No data transfer
		on:	No configuration; or slow physical connection; or no physical connection

4.5.7 Setting address switches

4.5.7.1 IP address fieldbus

VARAN BM65XX-XXXXYY-XXX-**02**

POWERLINK® BM65XX-XXXXYY-XXX-**04**

PROFINET IRT BM65XX-XXXXYY-XXX-**05**

EtherCAT® CoE BM65XX-XXXXYY-XXX-**01**
EtherCAT® SoE BM65XX-XXXXYY-XXX-**07**

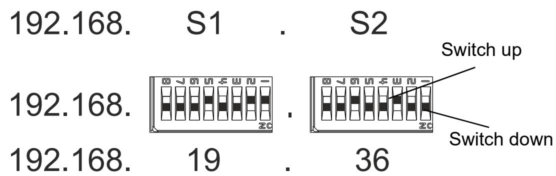
The IP address of the controller consists of 32 bits or 4 bytes (e.g. 192.168.125.203).

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 and S2. S1 and S2 each represent an 8 bit value.

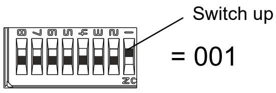
The IP address 192.168.0.0 or 192.168.100.0 is not permitted/Reserved.

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

Address setting



NOTE!



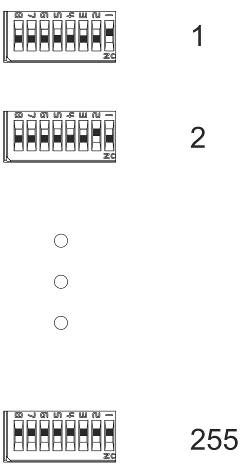
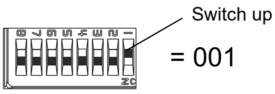


Figure 57: Address setting IP address

CANopen® BM65XX-XXXXYY-XXX-**03**

HINWEIS!



Baudrate S1

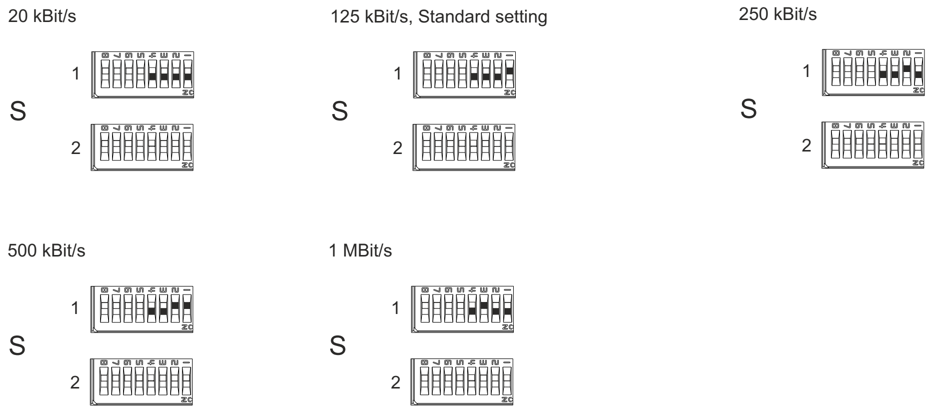


Figure 58: Setting baud rate CANopen

Adresse S2

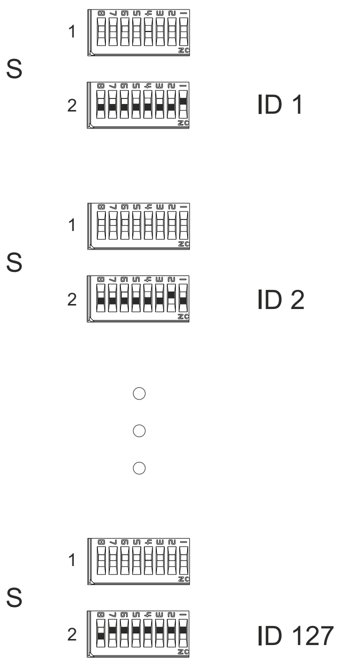


Figure 59: Setting address CANopen

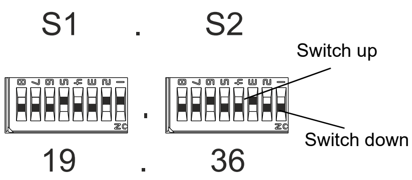
4.5.7.2 Device ID EtherCAT®

EtherCAT® CoE BM65XX-XXXXYY-XXX-**01**
EtherCAT® SoE BM65XX-XXXXYY-XXX-**07**

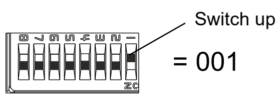
There are basically 2 ways to save the device ID locally in the slave:

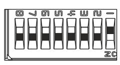
- Saving the value in the form of the SII Configured Station Alias in the EEPROM of the slave
- Setting the value on the ID address switch and reading it out with “Requesting ID Mechanism Reg 0x0134” (not recommended for new projects)

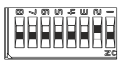
ID address setting



NOTE!




1


2

○
○
○

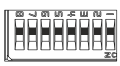

255

Abbildung 60: Setting device ID EtherCAT®

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 2K12 (EN IEC 60721-3-2:2018)
- Temperature range - 25 °C up to + 70 °C
- Vibration, shock, continuous shock class 2M4 as per EN IEC 60721-3-2:2018

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.

	CAUTION! **Fire hazard** To ensure extended fire protection, the appliance must be operated in a cabinet or in a suitable enclosure.

Mounting comprises the following steps:

1 Mounting preparation
(for drilling holes/cutting out sections, refer to ▹Drilling pattern◃ as from page 127)

2 Mounting
the device (for fixing, refer to ▹Mounting instructions◃ on page 149)

	NOTE!	
	Tightening torques:	
	M4 screws:	Min. 1.4 Nm (12.4 lbf in) to max. 1.8 Nm (16 lbf in)
	M5 screws:	Min. 2.2 Nm (20 lbf in) to max. 3.0 Nm (27 lbf in)

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.

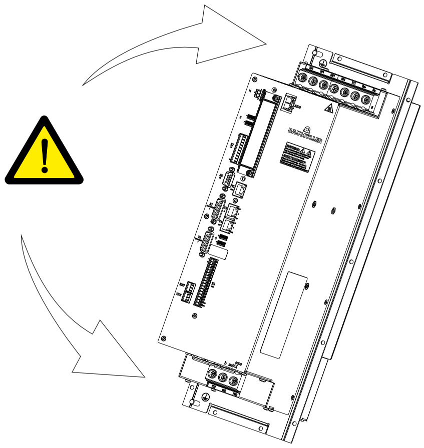


Figure 61: Danger area near the mechanical mounting

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 (refer to ▷Drilling pattern◁ as from page 127), 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 refer to ▹Dimensions◃ as from page 25 and ▹Cooling◃ as from page 64.

How to determine the required space in the control cabinet, refer to ▹Dimensions◃ as from page 25.

Tolerance specifications

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

BM651X-S

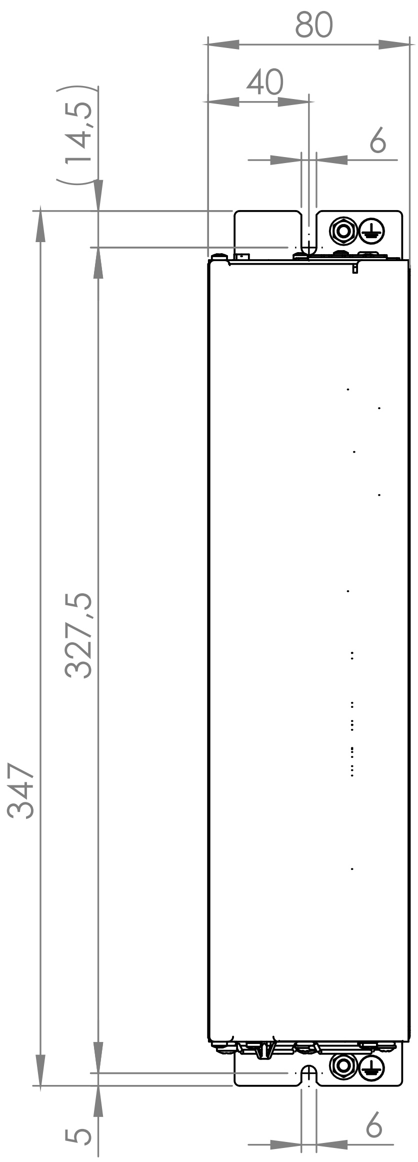


Figure 62: Drilling pattern BM651X-S

BM652X-S

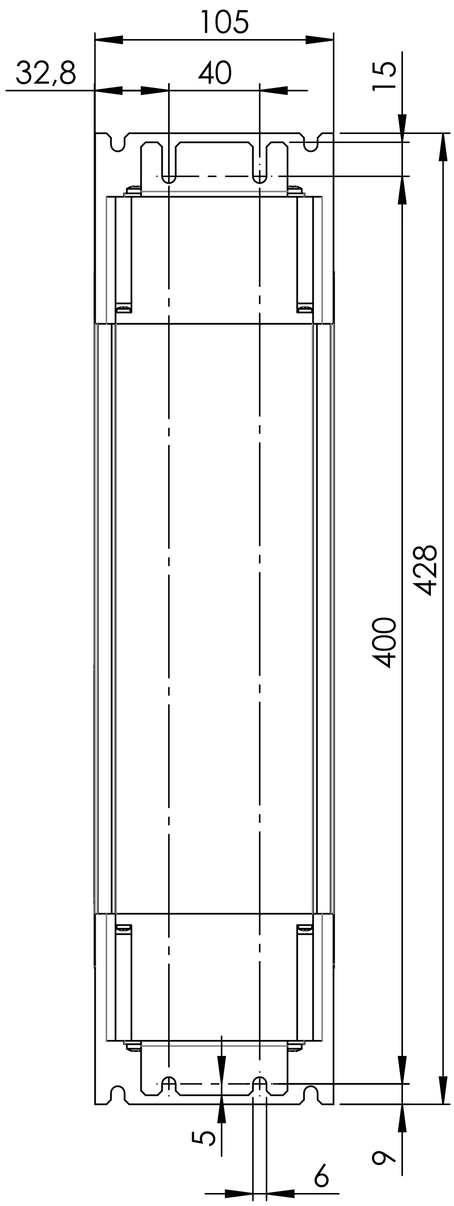


Figure 63: Drilling pattern BM652X-S

BM652X-A

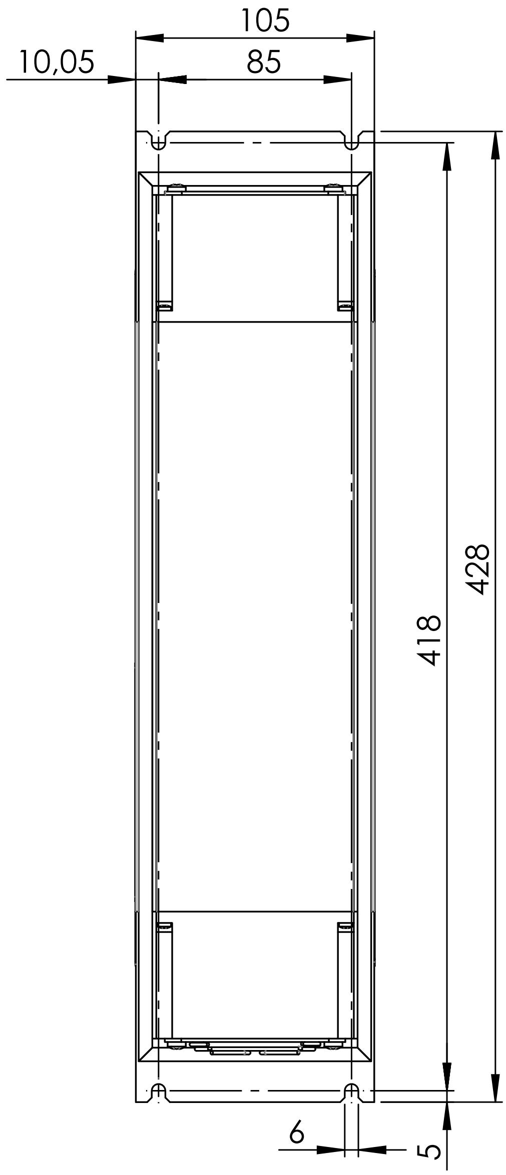


Figure 64: Drilling pattern BM652X-A

Cutout BM652X-A

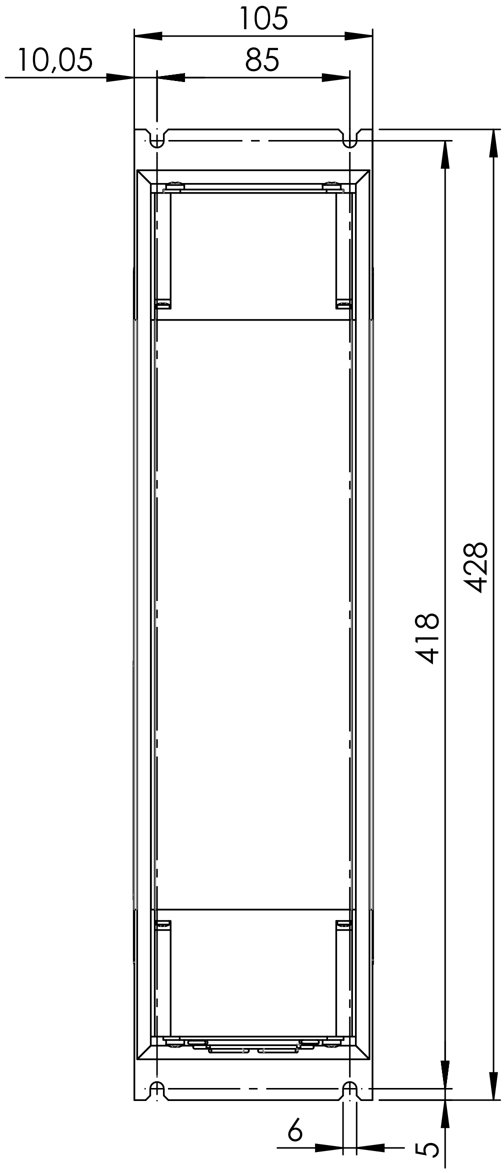


Figure 65: Cutout BM652X-A

BM653X-S

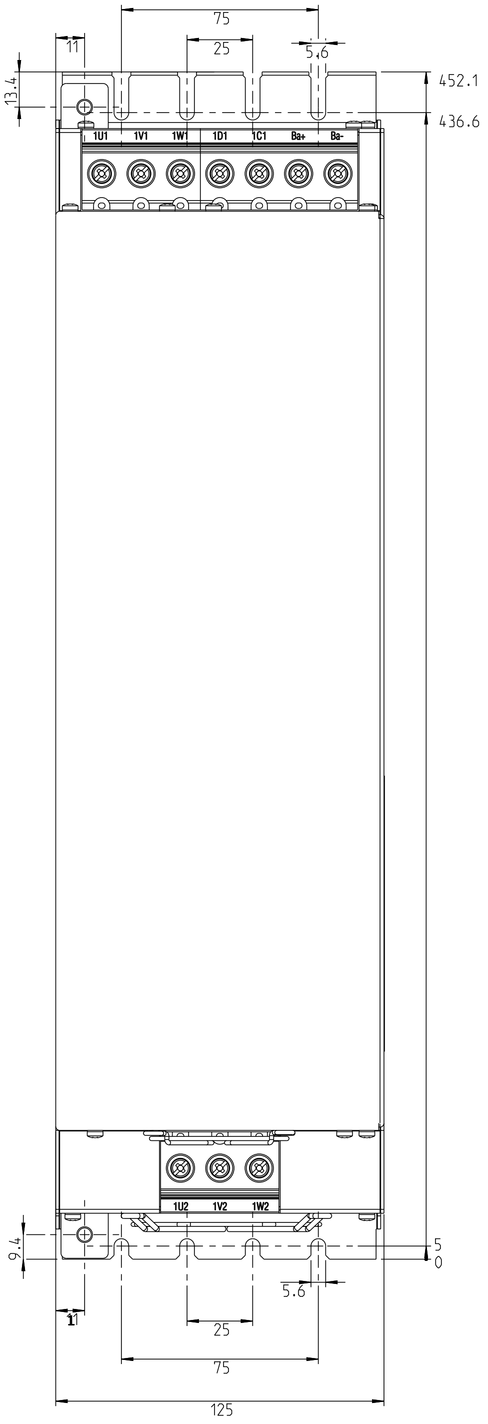


Figure 66: Drilling pattern BM653X-S

BM653X -A/ -F

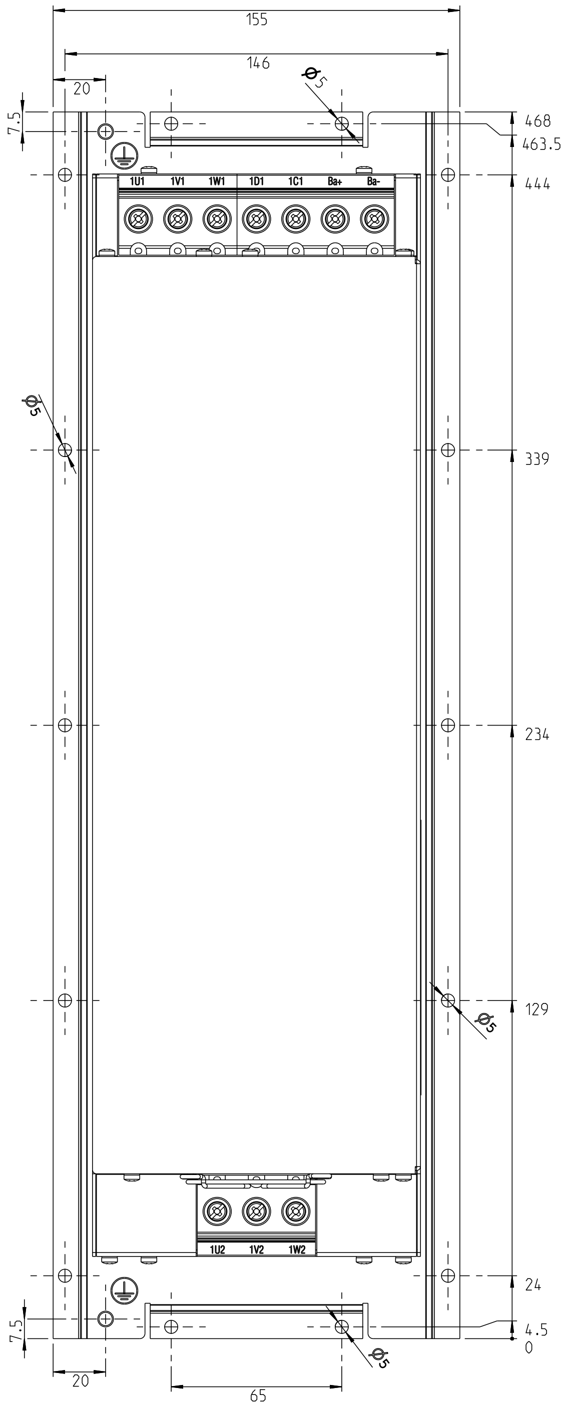


Figure 67: Drilling pattern BM653X -A/ -F

Cutout
BM653X -A / -F

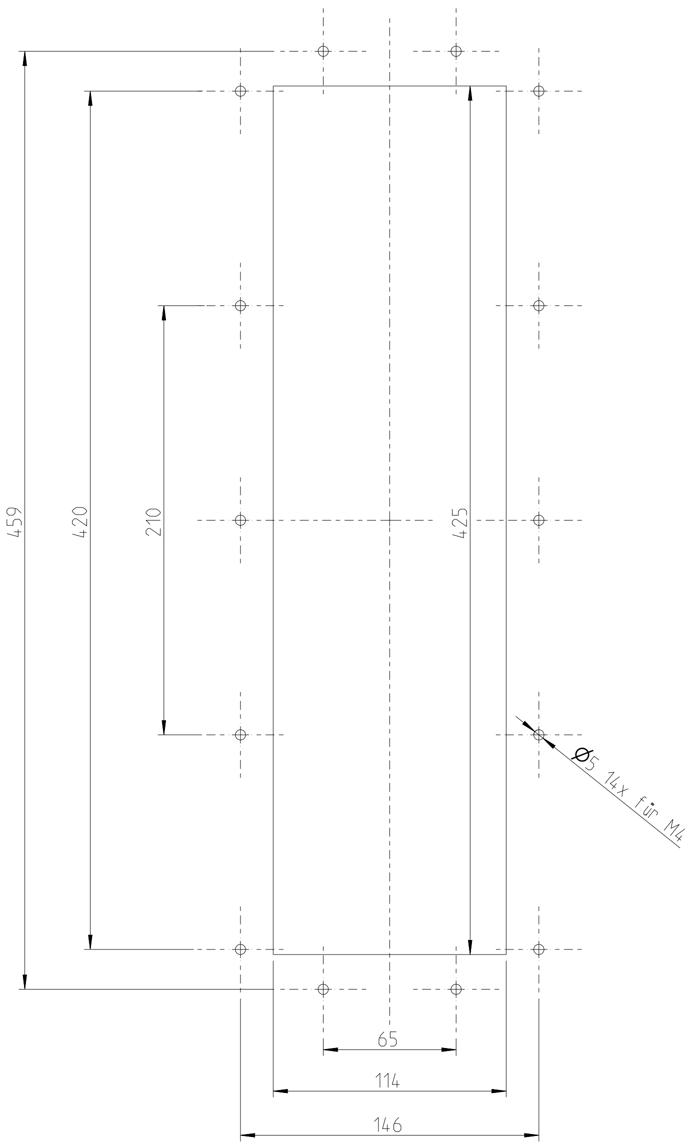


Figure 68: Cutout BM653X -A / -F

BM654X-S
BM658X-S

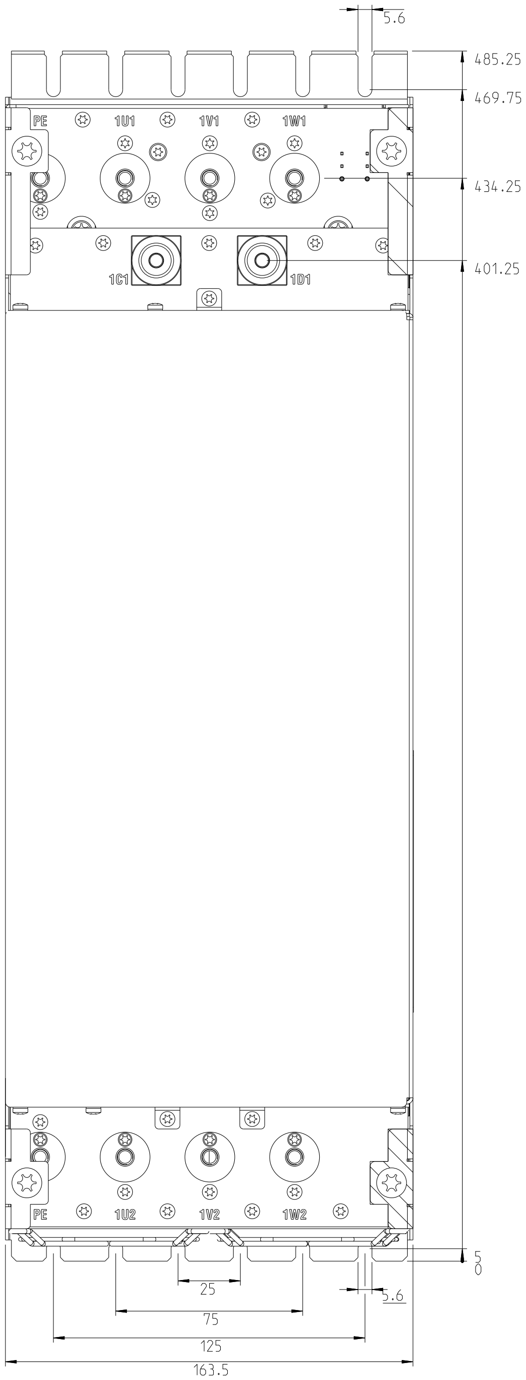


Figure 69: Drilling pattern BM654X/BM65DX-S

BM654X -A/ -F
BM65DX -A/ -F

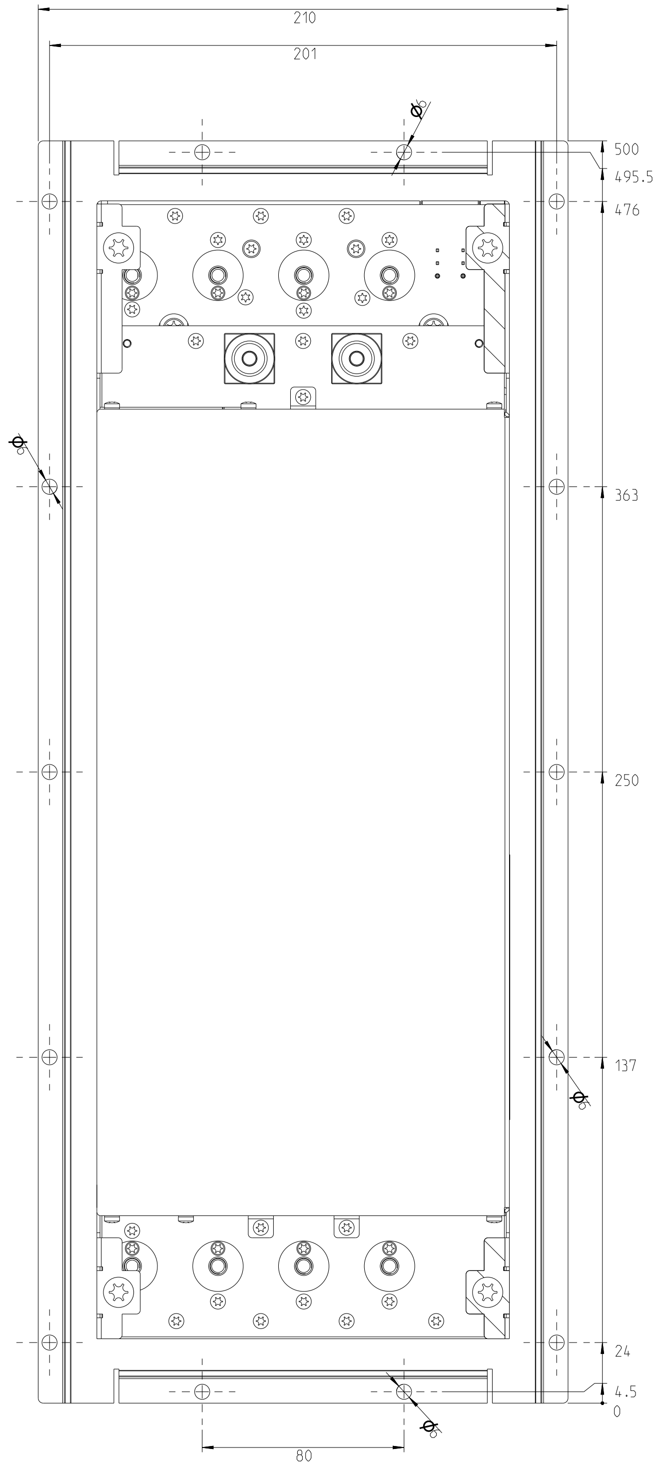


Figure 70: Drilling pattern BM654X/BM65DX -A/ -F

Cutout
BM654X -A / -F
BM65DX -A / -F

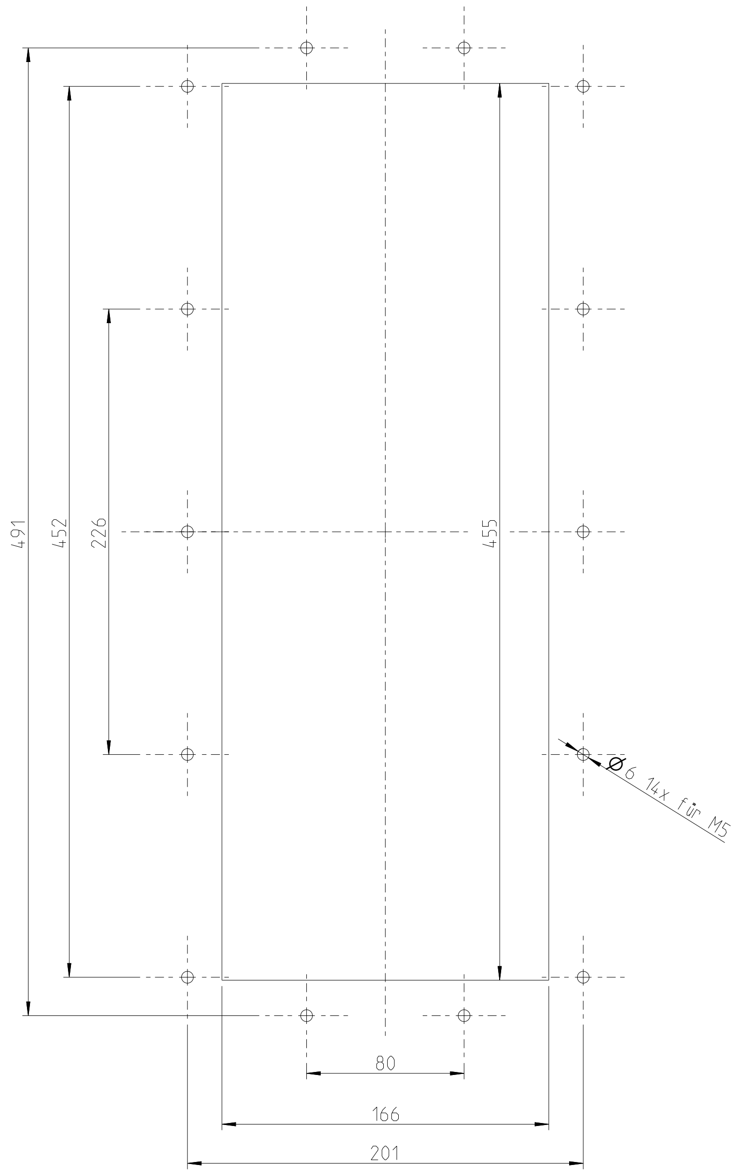


Figure 71: Cutout BM654X/BM65DX -A / -F

BM655X-S
BM658X-S

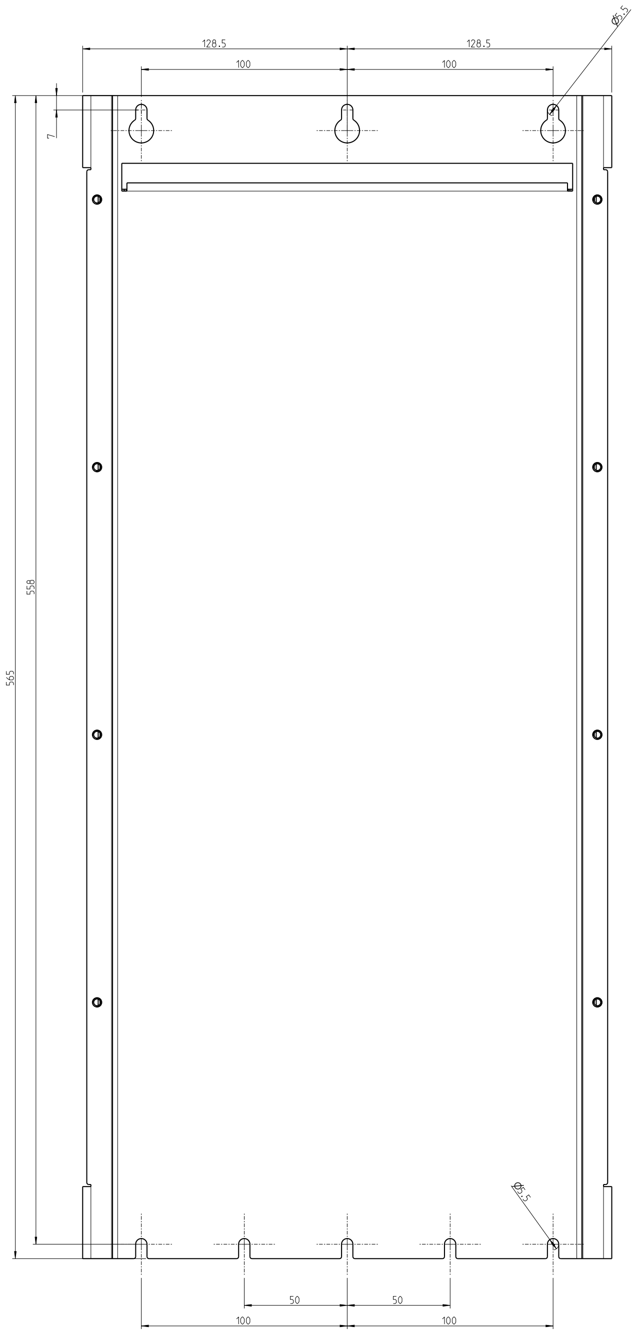


Figure 72: Drilling pattern BM655X/BM65EX-S

BM655X- AXXXYY
BM65EX- AXXXYY

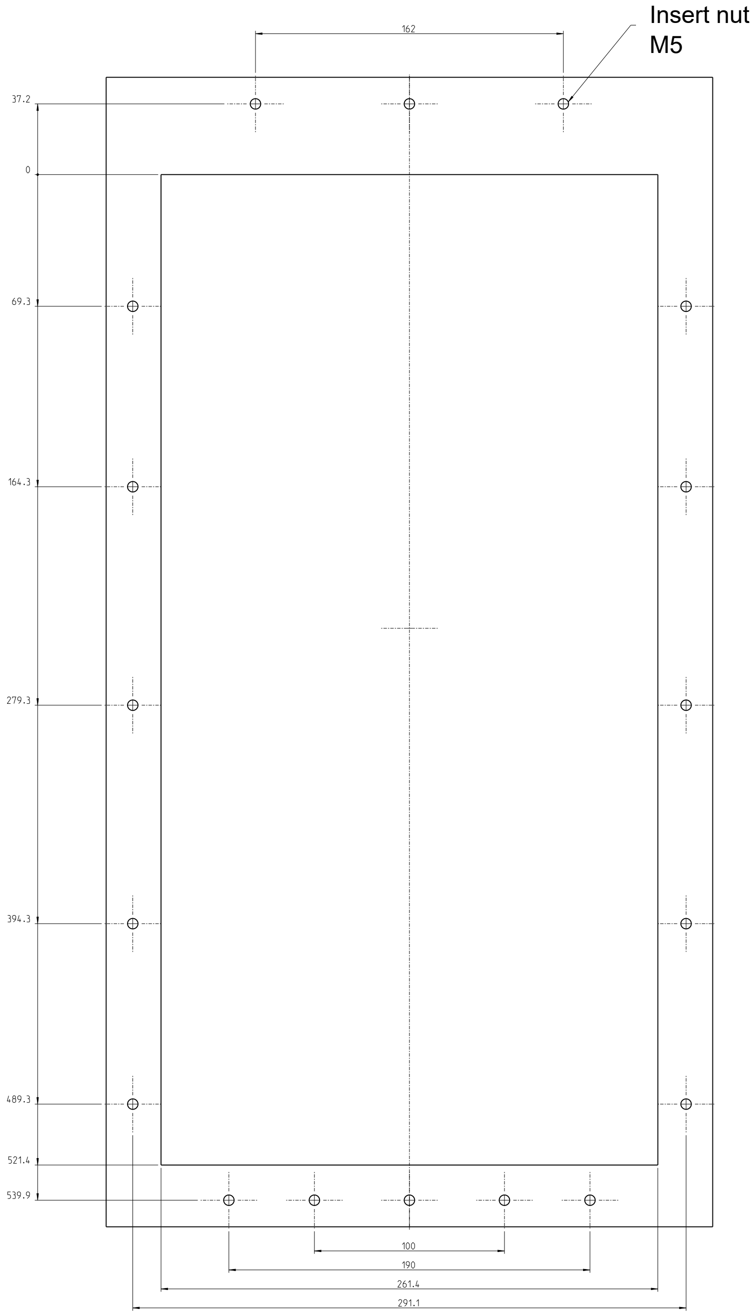


Figure 73: Drilling pattern/ cutout BM655X/BM65EX-AXXXYY

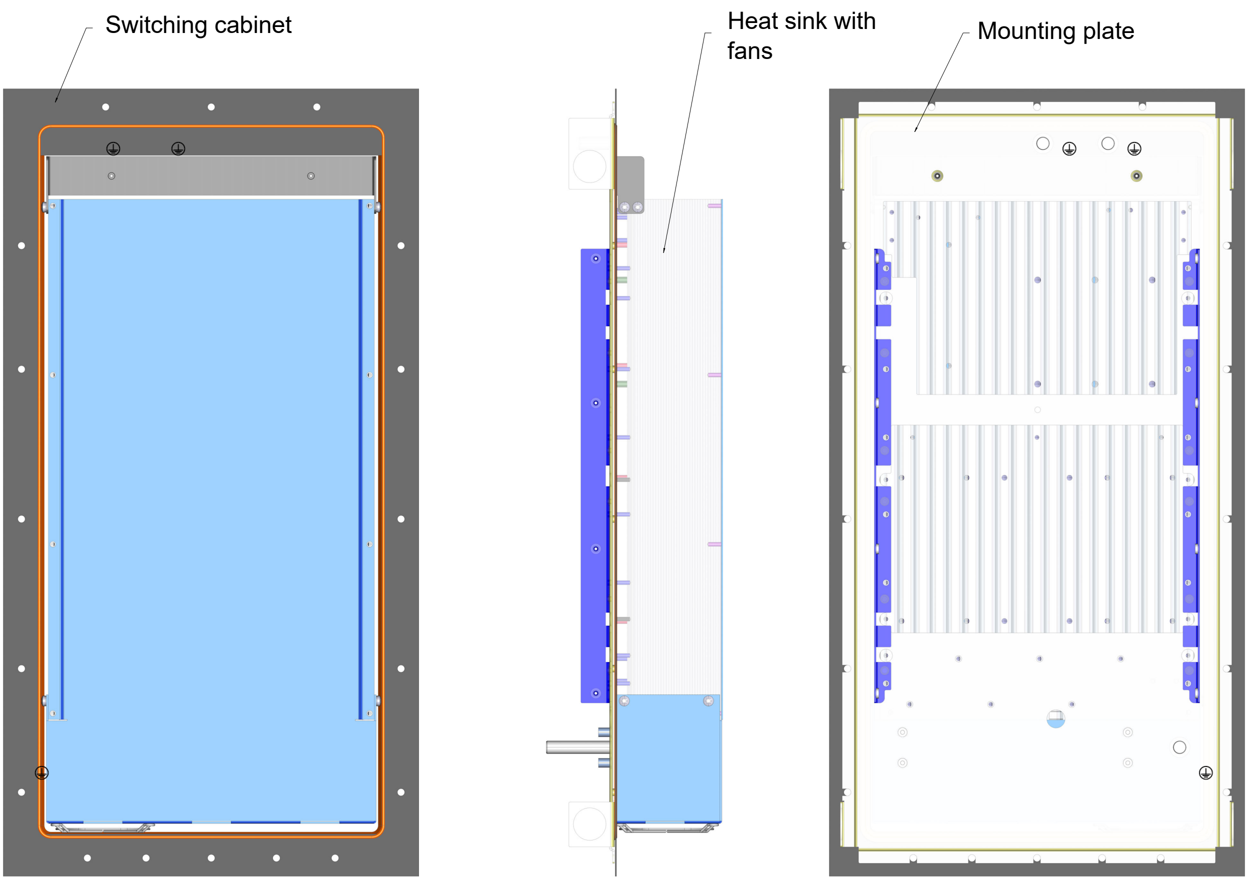


Figure 74: Mounting BM655XBM65EX-AXXXYY

BM655X - F
BM65EX - F

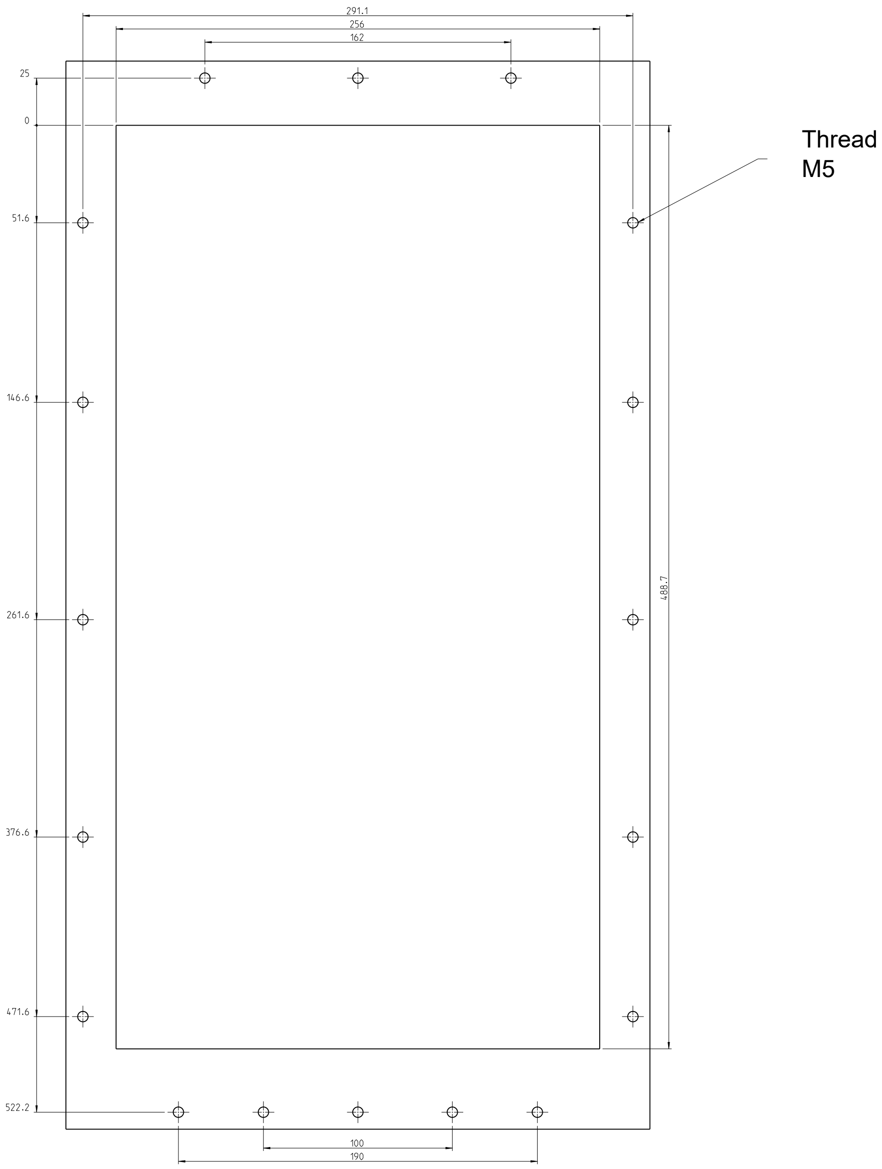


Figure 75: Drilling pattern/cutout BM655X/BM65EX-FXXX00

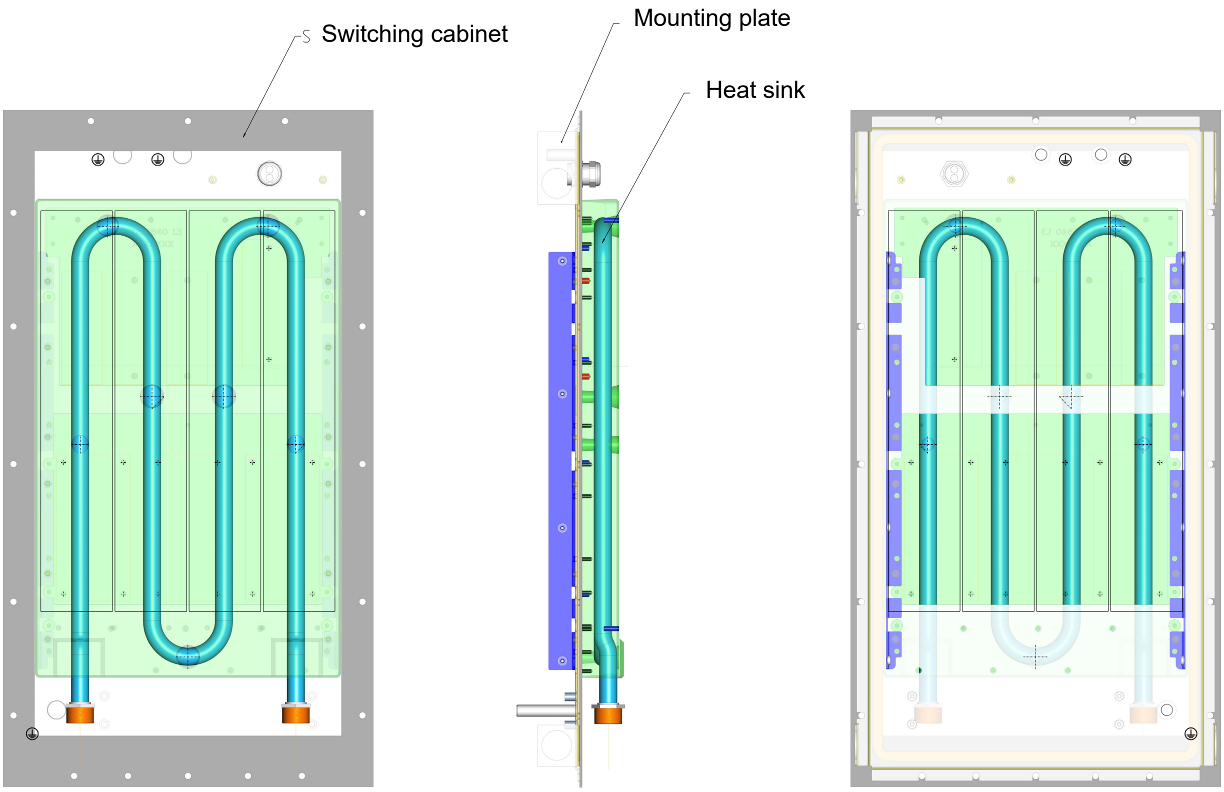


Figure 76: Mounting BM655X-F

BM655X - ZXXXYY
BM65EX - ZXXXYY

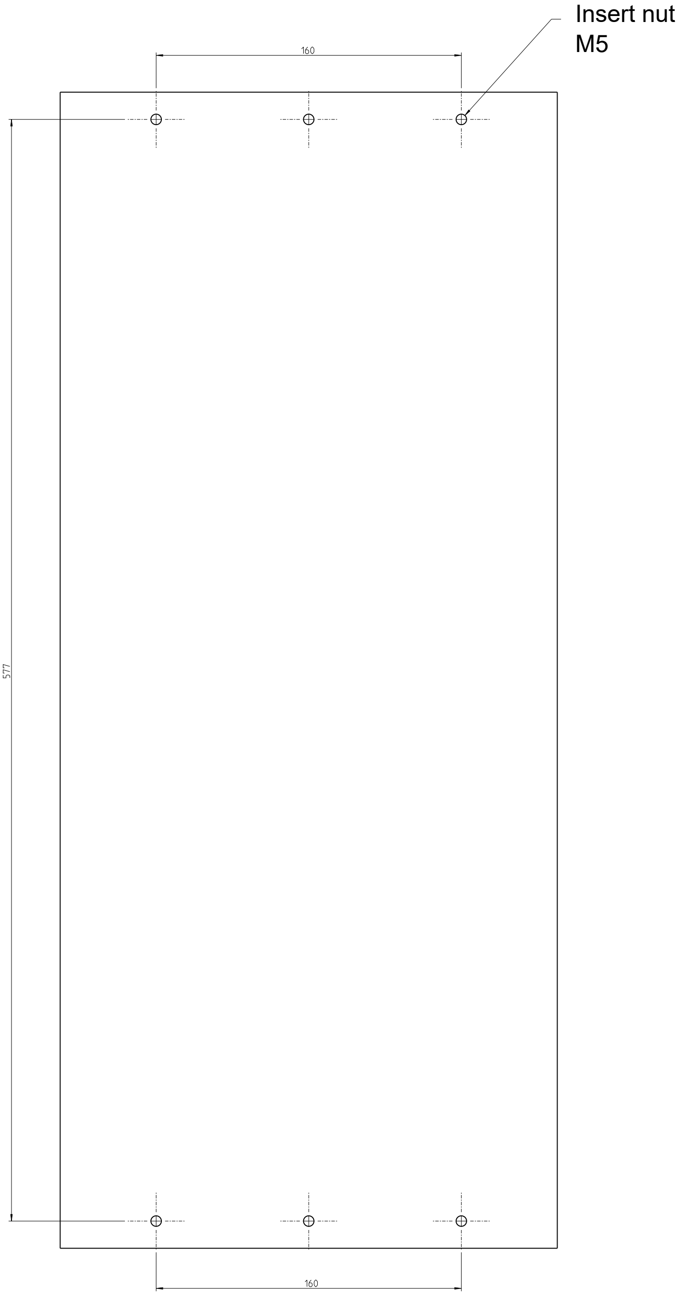


Figure 77: Drilling pattern/cutout BM655X/BM65EX-ZXXXYY

BM656X-S
BM65FX-S

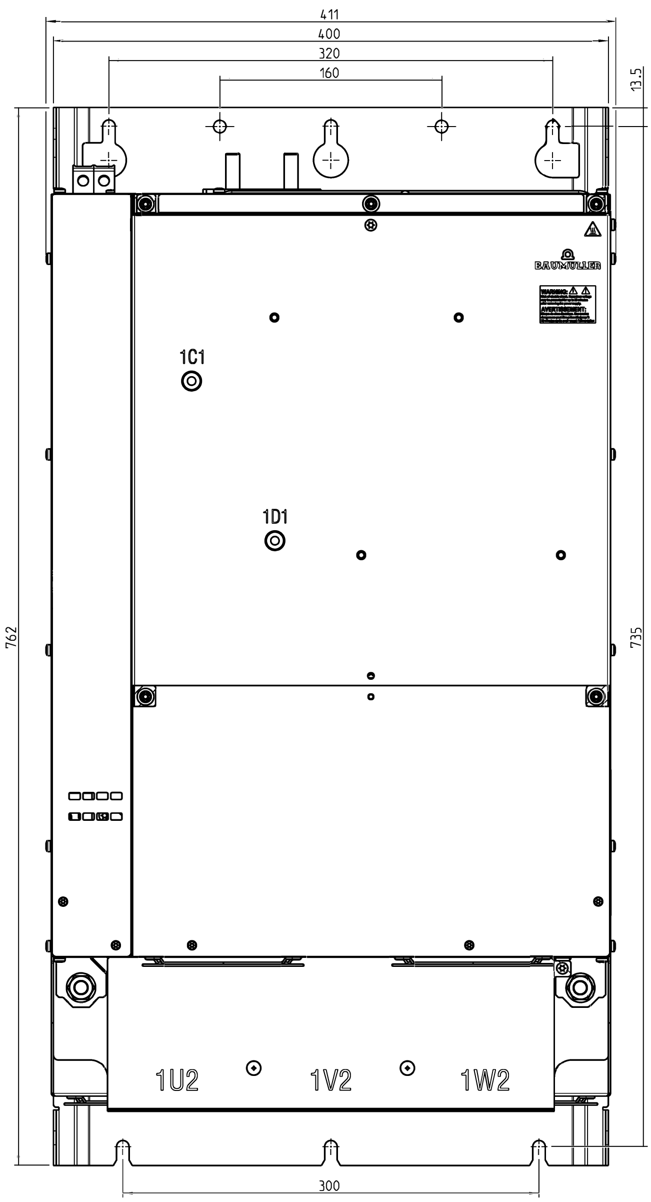


Figure 78: Drilling pattern BM656X/BM65FX-S

BM656X- A
BM65FX- A

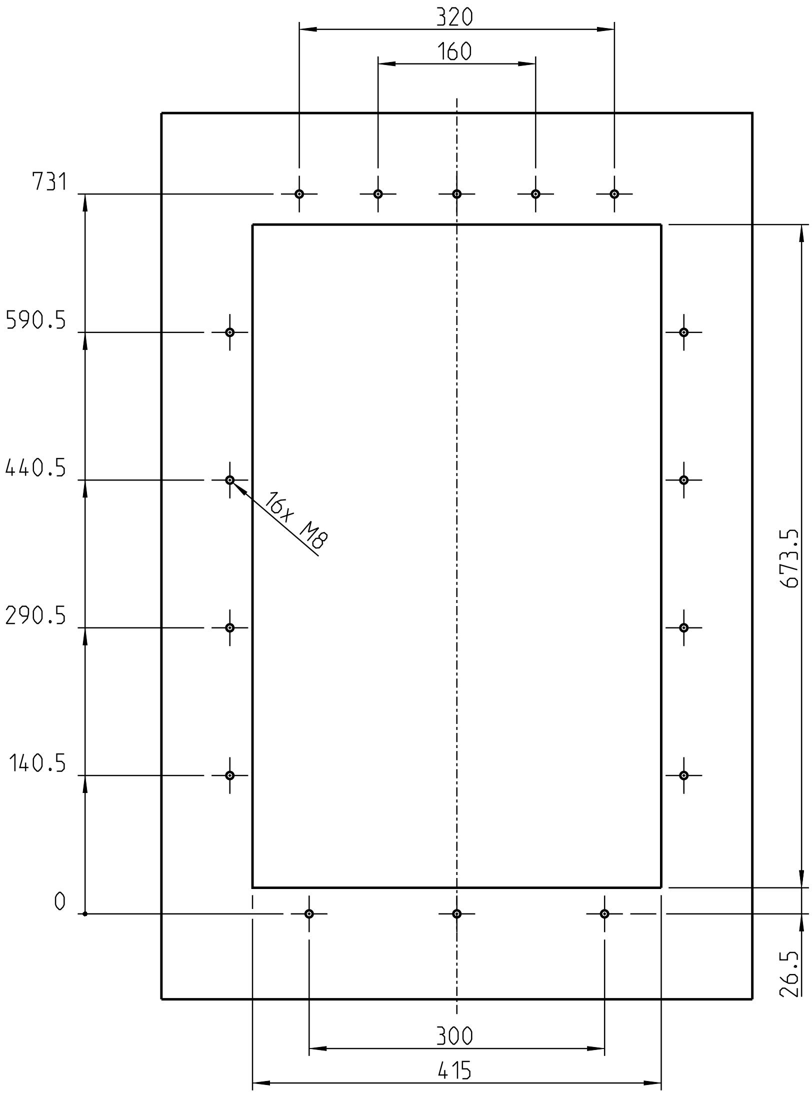


Figure 79: Drilling pattern/cutout BM656X/BM65FX-A

BM656X - F
BM65FX - F

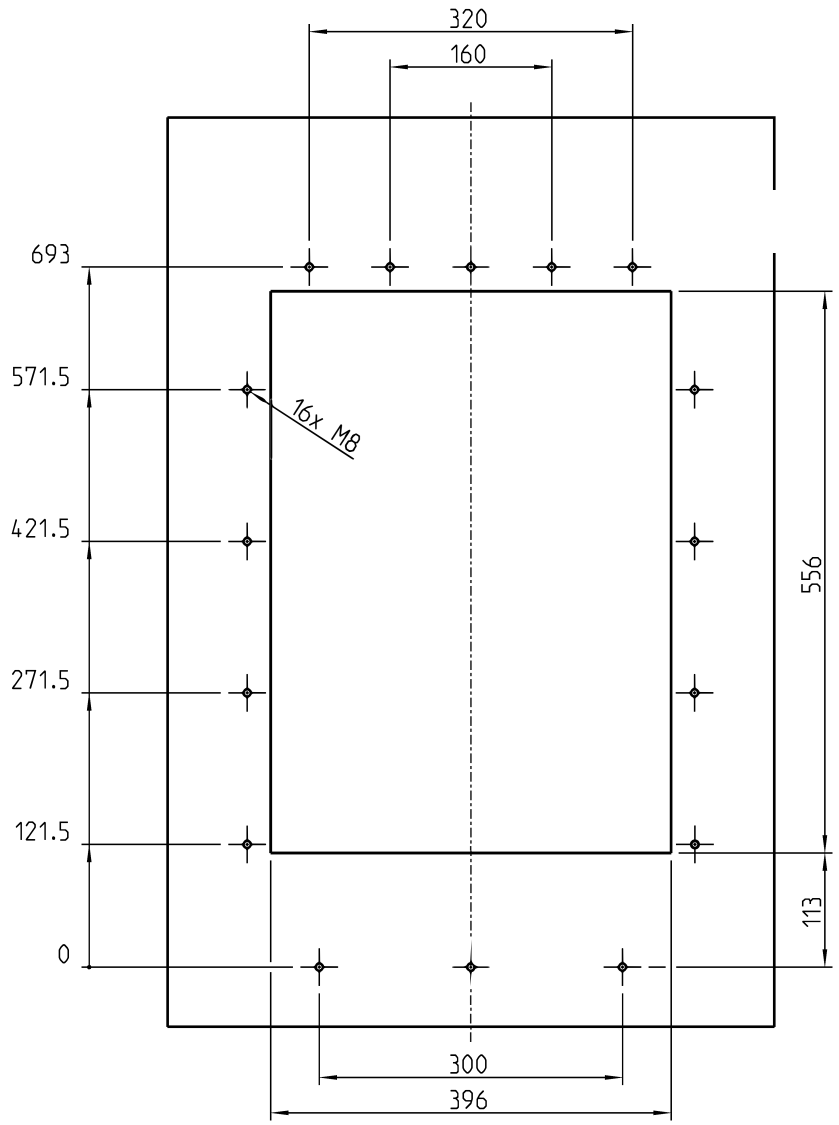


Figure 80: Drilling pattern/cutout BM656X/BM65FX-F

BM656X - ZXXXYY
BM65FX - ZXXXYY

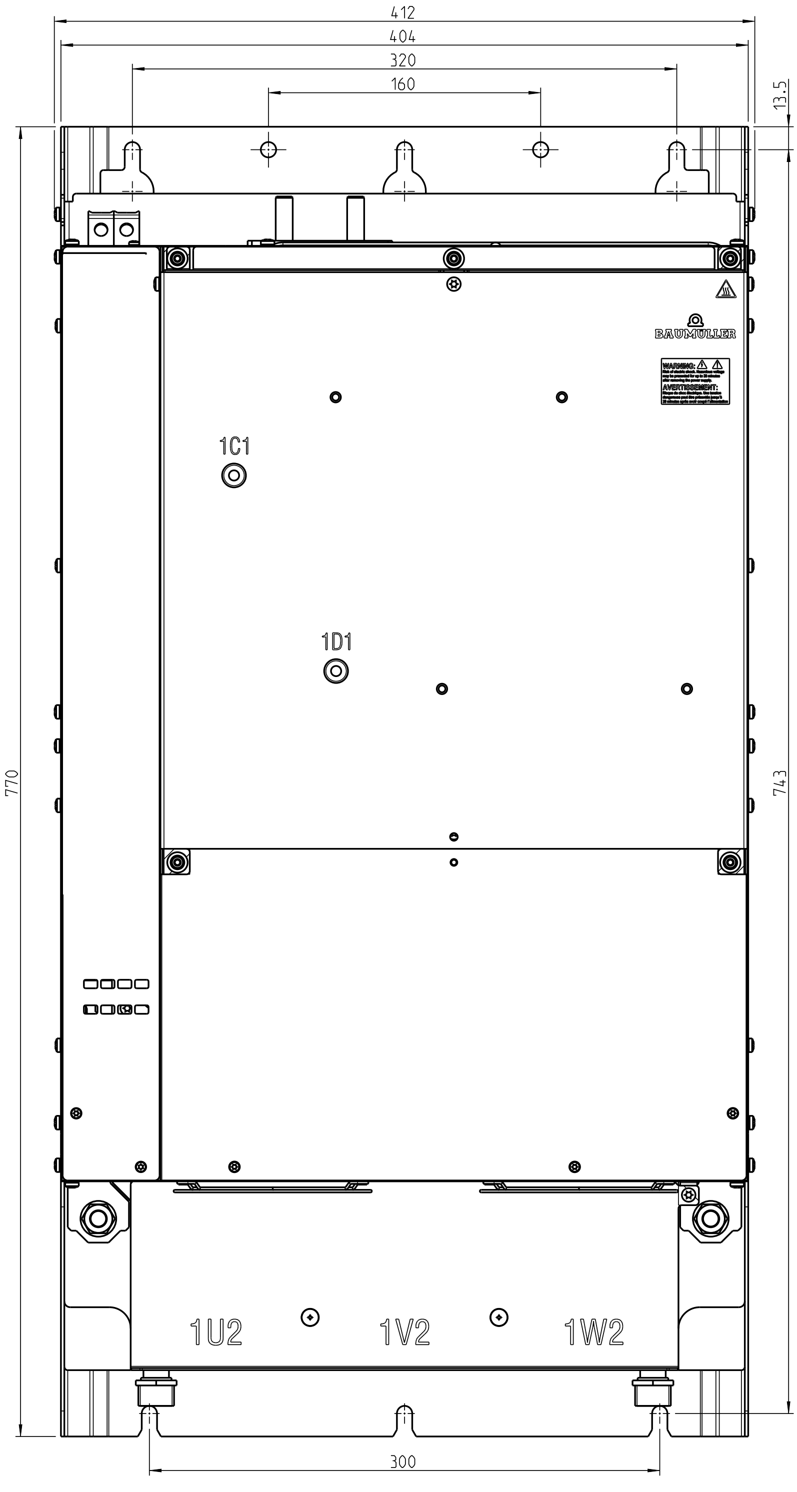


Figure 81: Drilling pattern/cutout BM656X/BM65FX-ZXXXYY

BM656X - ZXXXYY
BM65FX - ZXXXYY
customer version

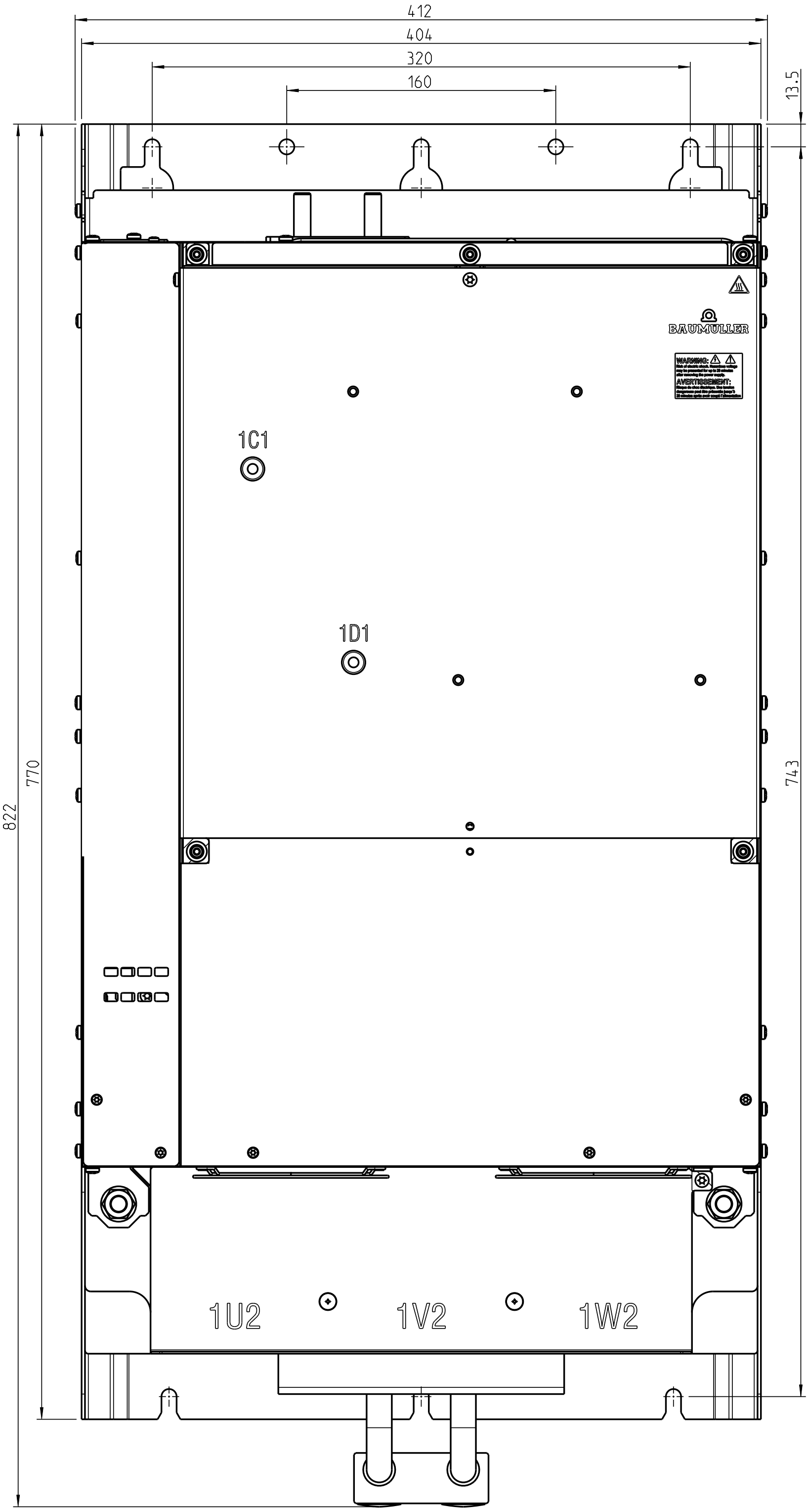


Figure 82: Drilling pattern BM656X/BM65FX-ZXXXYY customer version

6.3 Mounting instructions

There are different mounting procedure.

Each mounting procedure is described in a drawing (refer to figures from ▷Page 150◁).

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, refer to ▷Mounting instructions◁ on page 149

4 Mount the device.

5 Subsequently connect the water-cooling unit.

6.3 Mounting instructions

6.3.1 Mounting cooling type S

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).

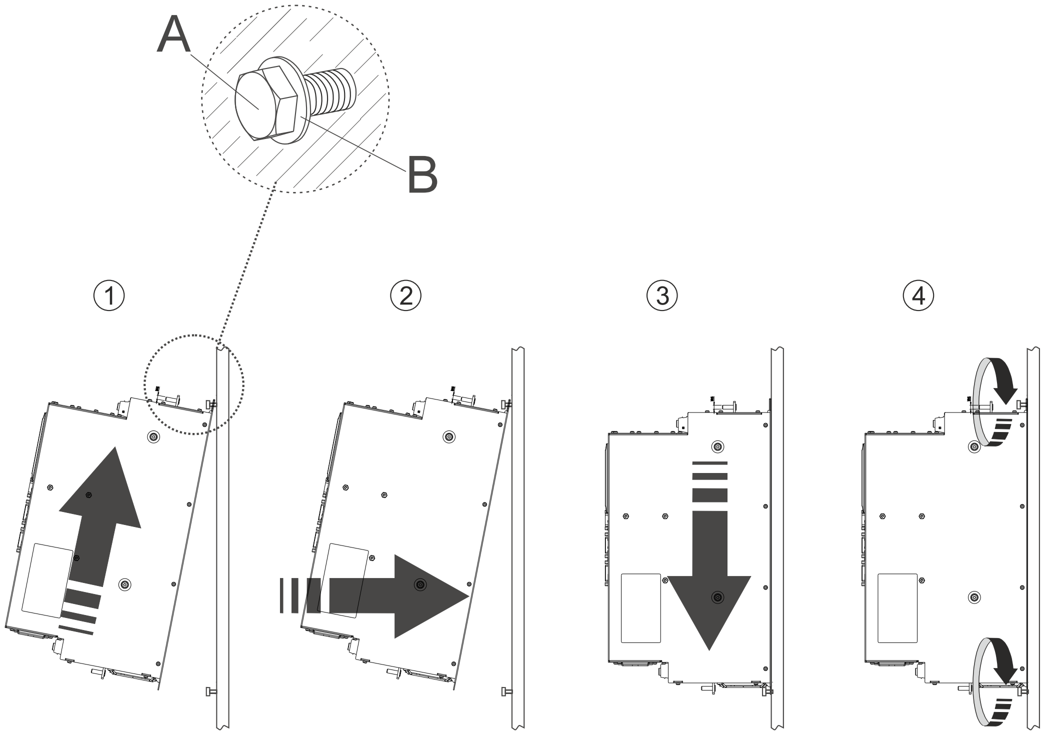


Figure 83: Mounting instructions cooling type S

Device	BM651X-S	BM652X-S	BM653X-S	BM654X-S	BM655X-S	BM656X-S
A - screw	2 x M5	4 x M5			6 x M5	6 x M5
B - washers	2 x (5,3 x 10)	4 x (5,3 x 10)			6 x (5,3 x 10)	6 x (5,3 x 10)

NOTE!

Tightening torques:

M5 screws: Min. 2.2 Nm (20 lbf in) to max. 3.0 Nm (27 lbf in)

6.3.2 Mounting cooling types A and F

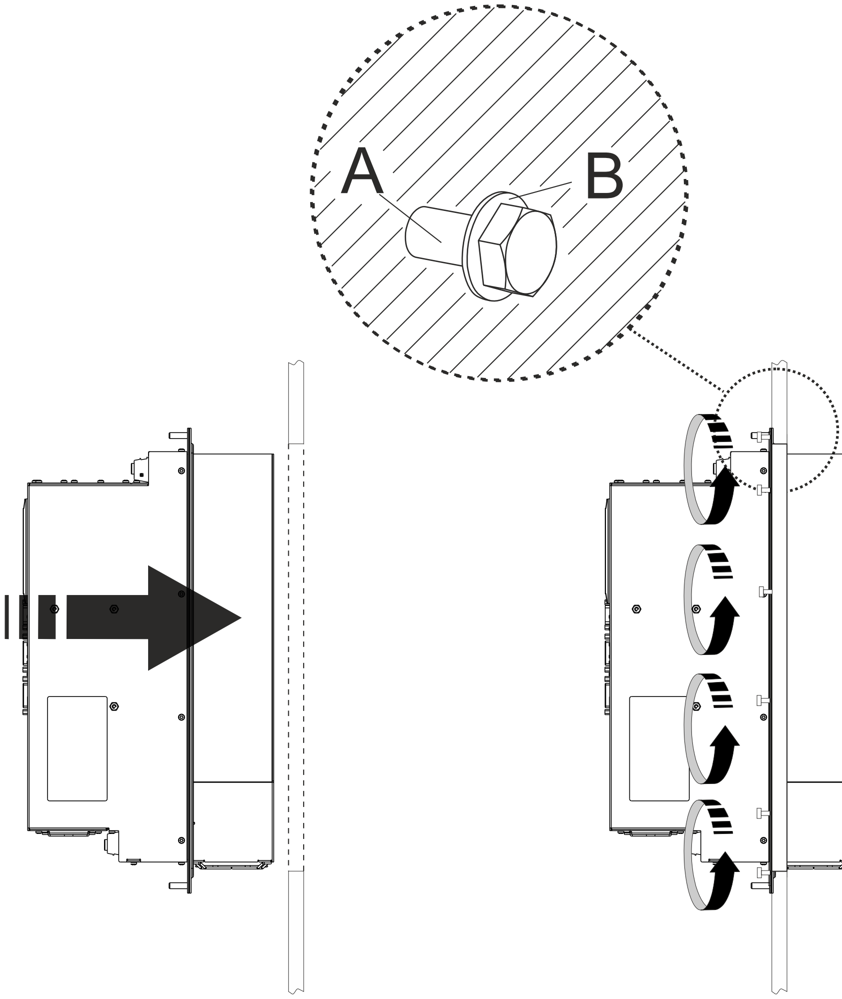


Figure 84: Mounting instruction cooling types A / F

Device	**BM652X-A**	**BM653X-A/F**	**BM654X-A/F**	**BM655X-A/F**	**BM656X-A/F**
A - screw	4 x M5	10 x M4	10 x M5	12 x M5	12 x M5
B - washers	4 x (5,3 x 10)	10 x (5,3 x 10)	10 x (5,3 x 15)	12 x (5,3 x 15)	12 x (5,3 x 15)

NOTE!

Tightening torques:

M4 screws: Min. 1.4 Nm (12.4 lbf in) to max. 1.8 Nm (16 lbf in)

M5 screws: Min. 2.2 Nm (20 lbf in) to max. 3.0 Nm (27 lbf in)

WARNING!

Danger because of conductive fluid in connection with electricity!

The mounting drills are outside of the gasket. With non-waterproof fastening holes, e. g. the liquid coolant can ingress into the control cabinet.

- Seal the mountings against water. Use, e.g., waterproof draw-in bolts and sealants between screws and bolts.

6.3.3 Connecting the water cooler

With water cooled devices (BM65XX-F, BM65XX-Z) you connect the coolant circulation before electric installation. The water cooler has on its bottom side two pressfitting-transition pieces 15 mm x R 1/2“ AG for flat washers.

➲ Connect the cooling circulation to the water cooler.

Tube material	Outer tube-∅	Screwing
1.4571 X6CrNiMoTi17-12-2	15 mm	1/2’ AG for flat washer

There must be a pressure-relief valve with a threshold pressure of maximum 6 bar in the cooling circulation.

NOTE!

When tightening the screw connection on the BM65XX’s fitting, use an open-end wrench to brace it in place to prevent leaks.

7

INSTALLATION

This chapter describes the electrical installation of the device. The mechanical mounting is described in ▷Mounting◁ as from page 123.

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 power supply.

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.

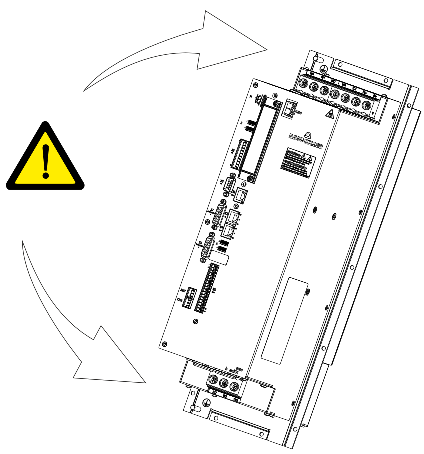


Figure 85: Hazard areas during electrical installation

Danger from residual energy

DANGER!

Risk of fatal injury from electrical current!

Stored electric charge.

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 power supply

For all important data, refer to ▷Requirements for mains supply system mono unit◁ as from page 55 and ▷Requirements DC link supply for power modules BM65DX, BM65EX, BM65FX◁ on page 56.

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

The destruction of the device can cause personal injury.

DANGER!

Risk of fatal injury from electrical current!

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

Therefore:

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

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.
- For UL applications, refer to ▷UL notes◁ as from page 109.

For further details (e.g. maximum allowable length), refer to ▷Cabling◁ as from page 236.

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 power supply. For data on the required fuses, refer to ▷Fuses mono units◁ as from page 255.

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 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 line 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:
  - Mains power supply - fuse - filter - choke - (ferrite core) - Mono unit **BM65XX** - (motor filter) - motor.
  - DC link - (fuse) - Power module **BM65XX** - (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 - power supply 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, refer to ▷Avoid bearing currents◁ as from page 158.

7.8 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, refer to ▷Toroidal cores for motor cables◁ as from page 280 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**.**
- 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.

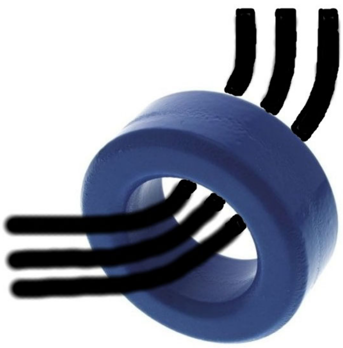


Figure 86: Mounting - single ring core

Figure 87: Mounting - several ring cores

7.9 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.

7.10 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. power supply cables) and the mounting areas are de-energized for the entire duration of mounting the device.

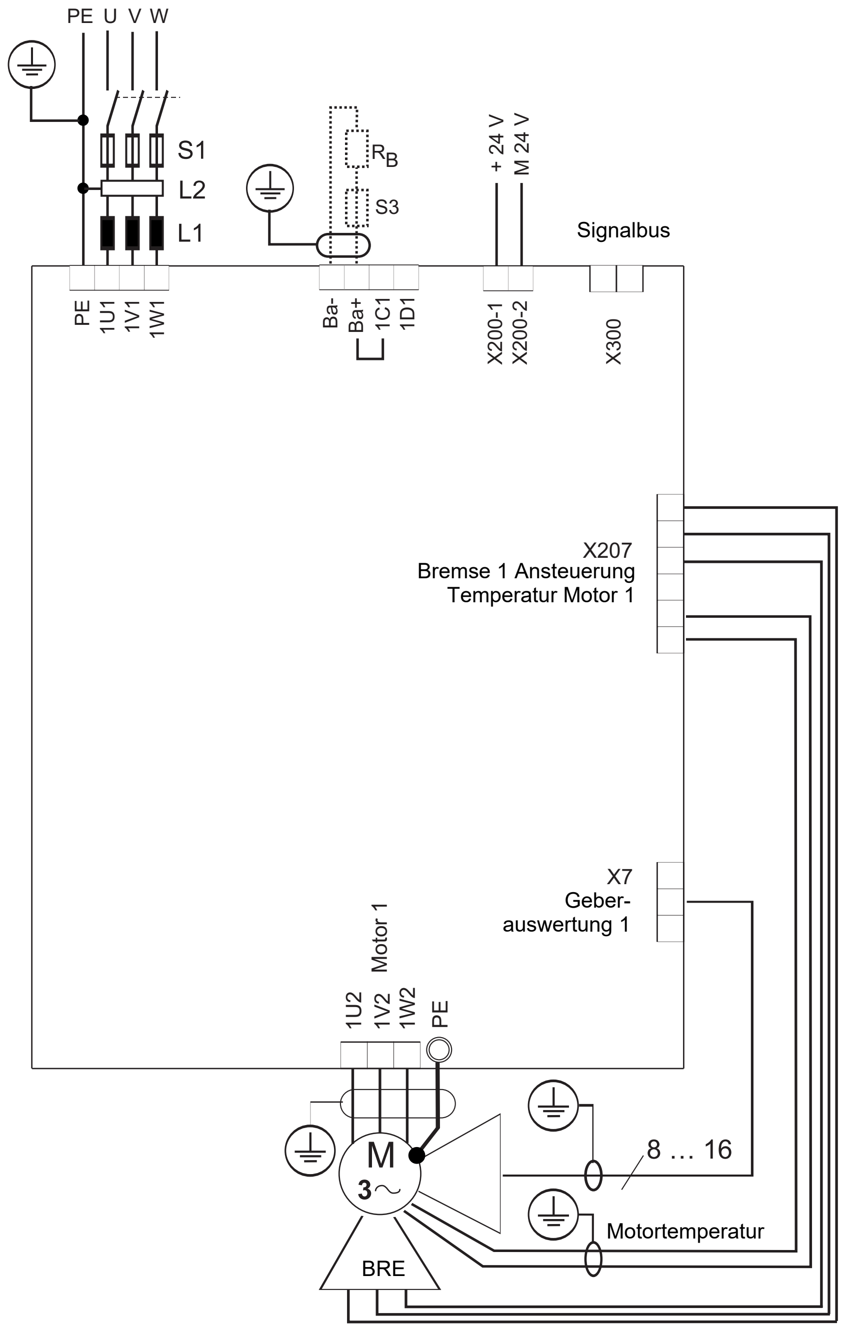
- Route all cables in an EMC-compatible manner.
- Connect cables (refer to ▷Electrical connections◁ as from page 169).
  (Observe the permissible torques!)
- For all connections, attentions is to be paid to strain relief

NOTE!

The connection diagrams are separated in connection diagrams for the mains power supply, motor etc., ▷page 169◁ and the front side connections ▷page 183◁.

7.10.1 Installation mono unit

Connection diagram power supply/motor



Ba-... 1D1	Connections for brake resistor and DC link, refer to ▹Figure 89◃ on page 169 and further
R_B	Brake resistor extern, optional
PE....1W1	Power supply connection, refer to ▹Figure 89◃ on page 169 and further
S1	Fuses (cable + device)
L1	Power choke
L2	Line filter
X7	Encoder evaluation 1
X200	Connections for 24 V power supply, for further information refer to table X200 on ▹page 181◃ (SELV/PELV).
X207	Connections for motor brake 1 or motor temperature 1, refer to table ▹page 181◃. Pin assignment refer to ▹page 181◃ and further.
X208	Not connected
X300	Signal bus, refer to ▹Signal bus◃ on page 182.
PE....1W2	Connections for motor, refer to ▹Figure 89◃ on page 169 and further
BRA	Brake

HINWEIS!

No external brake resistor is allowed if the device is equipped with an internal brake resistor.

The following steps must be carried out at installation:

1 Connect the motor through terminals 1U2, 1V2, 1W2 and PE.
Ensure the proper phases when connecting (rotational direction).
Use toroidal cores if necessary, refer to ▹Avoid bearing currents◃ as from page 158.
Observe the permitted torques!

NOTE!

Only BM656X:

Install 2 ferrite cores M116-03 in motor cable to achieve industrial network C2.

2 Connect fuses (S1)
(in case you consider UL 61800-5-1, refer to ▹UL notes◃ as from page 109).

3 Connect main contactor

4 Connect line filter
(each device must have its own line filter)

5 Connect the power choke (L1) at the line filter output
(if the use of a choke is necessary, each device must have its own choke)

6 Connect the device via the power supply terminals 1U1, 1V1 and 1W1 to the power choke output.

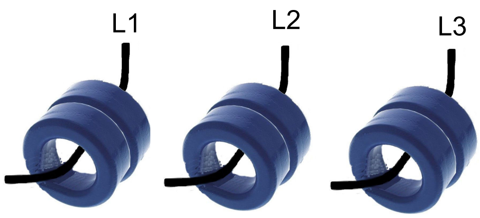
NOTE!

Only BM654X and BM655X:

Install accessory pack ferrite cores in power supply cable to achieve industrial network C2.

BM654X (part No. 504546)

2 ferrite cores per phase



BM655X (part No. 504547)

2 ferrite cores all phases together

7 Connect the protective conductor to the terminal PE (a fixed ground conductor connection is mandatorily specified).

8 Connect 24 V power supply: Terminals X100-1/2.

NOTE!

Only BM656X:

Install Würth ferrite core 742 712 21 in 24V power supply cable to achieve industrial network C2.

9 Connect encoder (refer to ▷X7 / X8 encoder evaluation◁ as from page 194)

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 encoder connectors when operating.

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

11 Connect the input for pulse enable via connector X2, pin assignment refer to ▷X2 DIO digital inputs/outputs◁ on page 186.

12 Connect the input for quick stop via connector X2, pin assignment refer to pin assignment refer to ▷X2 DIO digital inputs/outputs◁ on page 186.

13 Depends on the application connect a brake resistor (R_B) via terminals Ba+, Ba-.

14 Connect the motor brake (option): Terminals X207.
Assignment pre-assembled Baumüller cable refer to motor documentation.

7.10.2 Installation power module BM65DX, BM65EX, BM65FX

Connection diagram DC link supply/motor

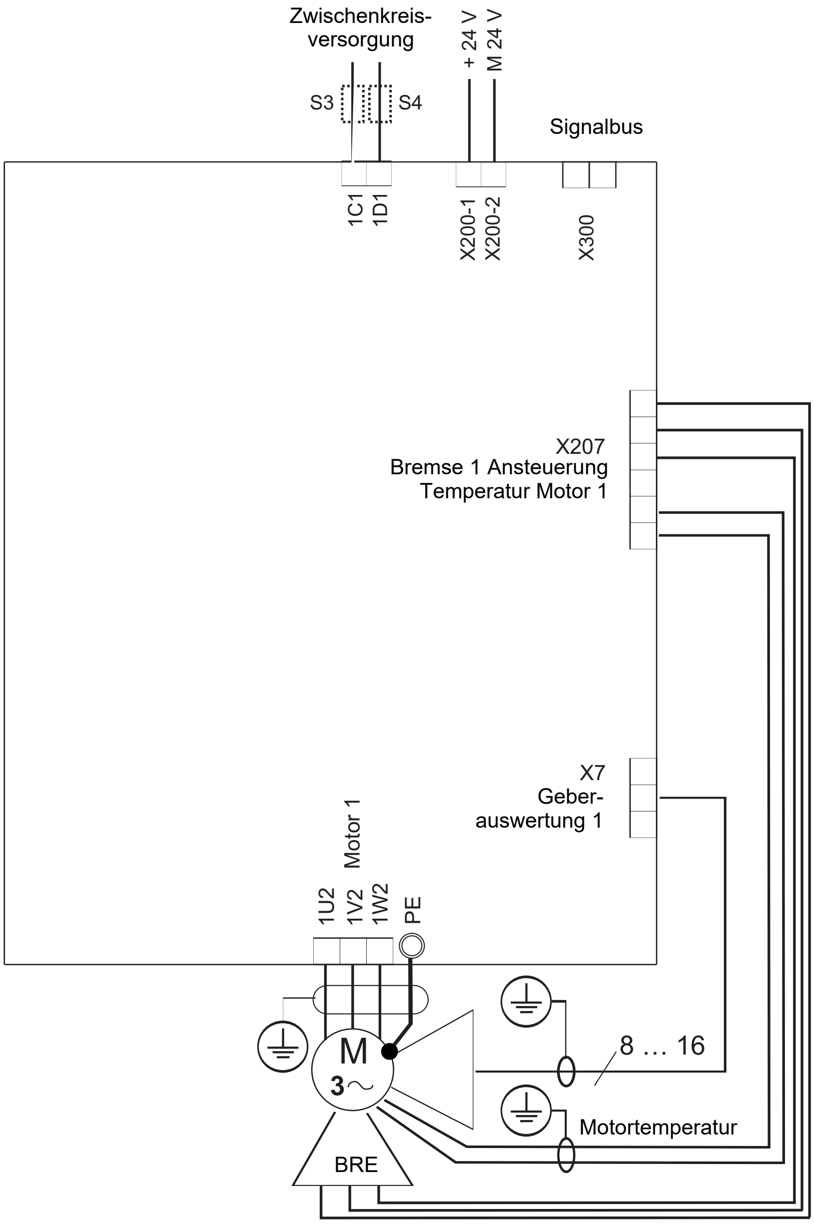


Figure 88: Connection diagram DC link supply / motor power module BM65XX

1C1, 1D1	Connection for DC link, refer to ▷Figure 89◁ on page 169 and further
S3, S4	DC link fuses (BM65EX, BM65FX)
X7	Encoder evaluation 1
X200	Connections for 24 V power supply, for further information refer to table X200 on ▷page 181◁ (SELV/PELV).
X207	Connections for motor brake 1 or motor temperature 1, refer to table ▷page 181◁. Pin assignment refer to ▷page 181◁ and further.
X300	Signal bus, refer to ▷Signal bus◁ on page 182.
PE....1W2	Connections for motor, refer to ▷Figure 89◁ on page 169 and further
BRA	Brake

The following steps must be carried out at installation:

NOTE!

Proper operation of power modules **BM65XX** can only be guaranteed with Baumüller supply units BM50XX, BM51XX and mono units **BM65XX** or BM55XX/BM56XX/BM57XX.

1 Connect the motor through terminals 1U2, 1V2, 1W2 and PE.
Ensure the proper phases when connecting (rotational direction).
Use toroidal cores if necessary, refer to ▷Avoid bearing currents◁ as from page 158.
Observe the permitted torques!

2 Connect DC link supply via fuses (S3 / S4) to 1C1/1D1
(if UL61800-5-1 is taken into account, refer to ▷UL notes◁ as from page 109).

3 Connect the protective conductor to the terminal PE (a fixed ground conductor connection is mandatorily specified).

4 Connect 24 V power supply: Terminals X100-1/2.

5 Connect encoder (refer to ▷X7 / X8 encoder evaluation◁ as from page 194)

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 encoder connectors when operating.

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

7 Connect the input for pulse enable via connector X2, pin assignment refer to ▷X2 DIO digital inputs/outputs◁ on page 186.

8 Connect the input for quick stop via connector X2, pin assignment refer to pin assignment refer to ▷X2 DIO digital inputs/outputs◁ on page 186.

9 Connect the motor brake (option): Terminals X207.
Assignment pre-assembled Baumüller cable refer to motor documentation.

7.11 Electrical connections

7.11.1 Electrical connections BM651X

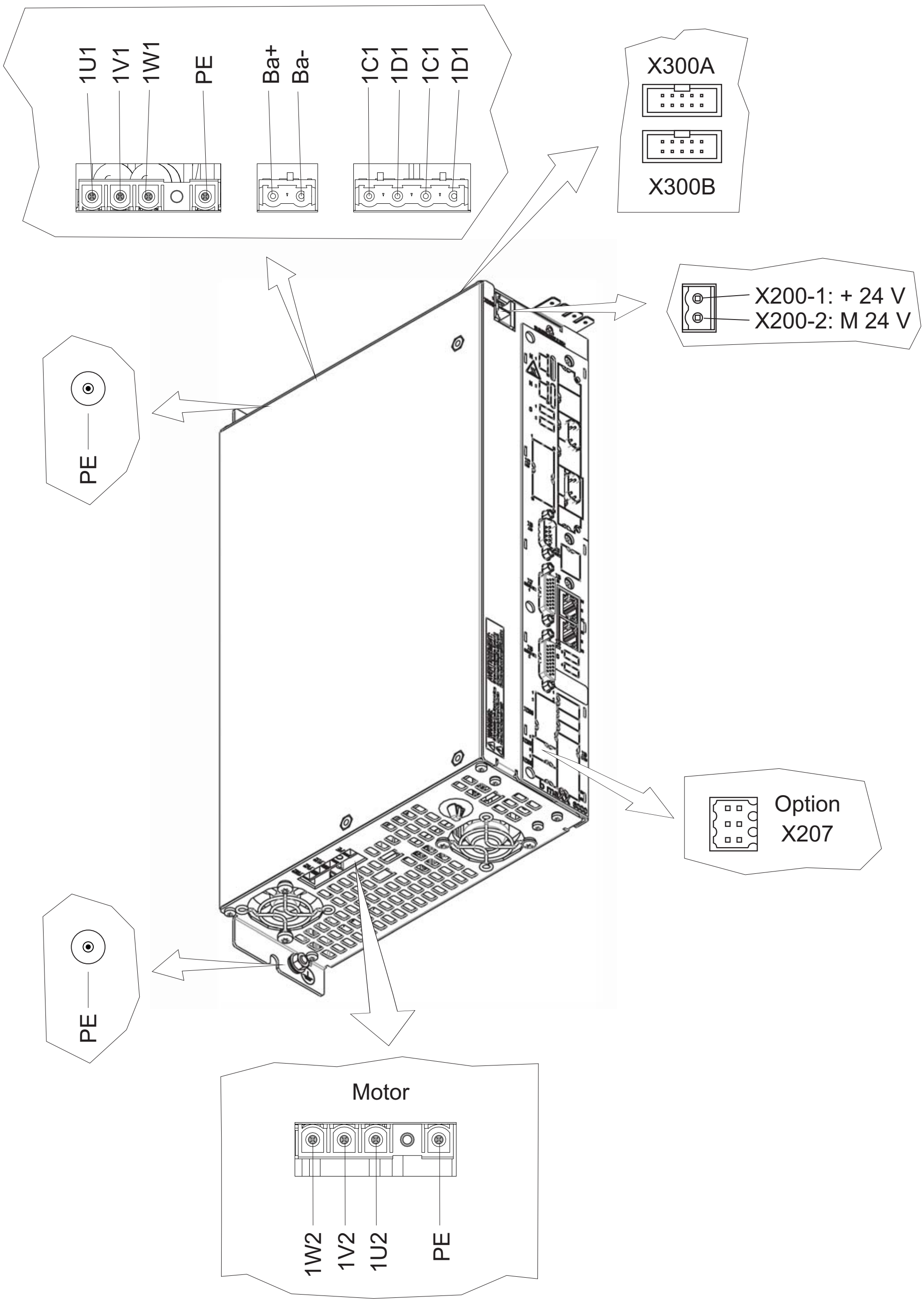


Figure 89: Electrical connections BM651X

7.11.2 Electrical connections BM652X

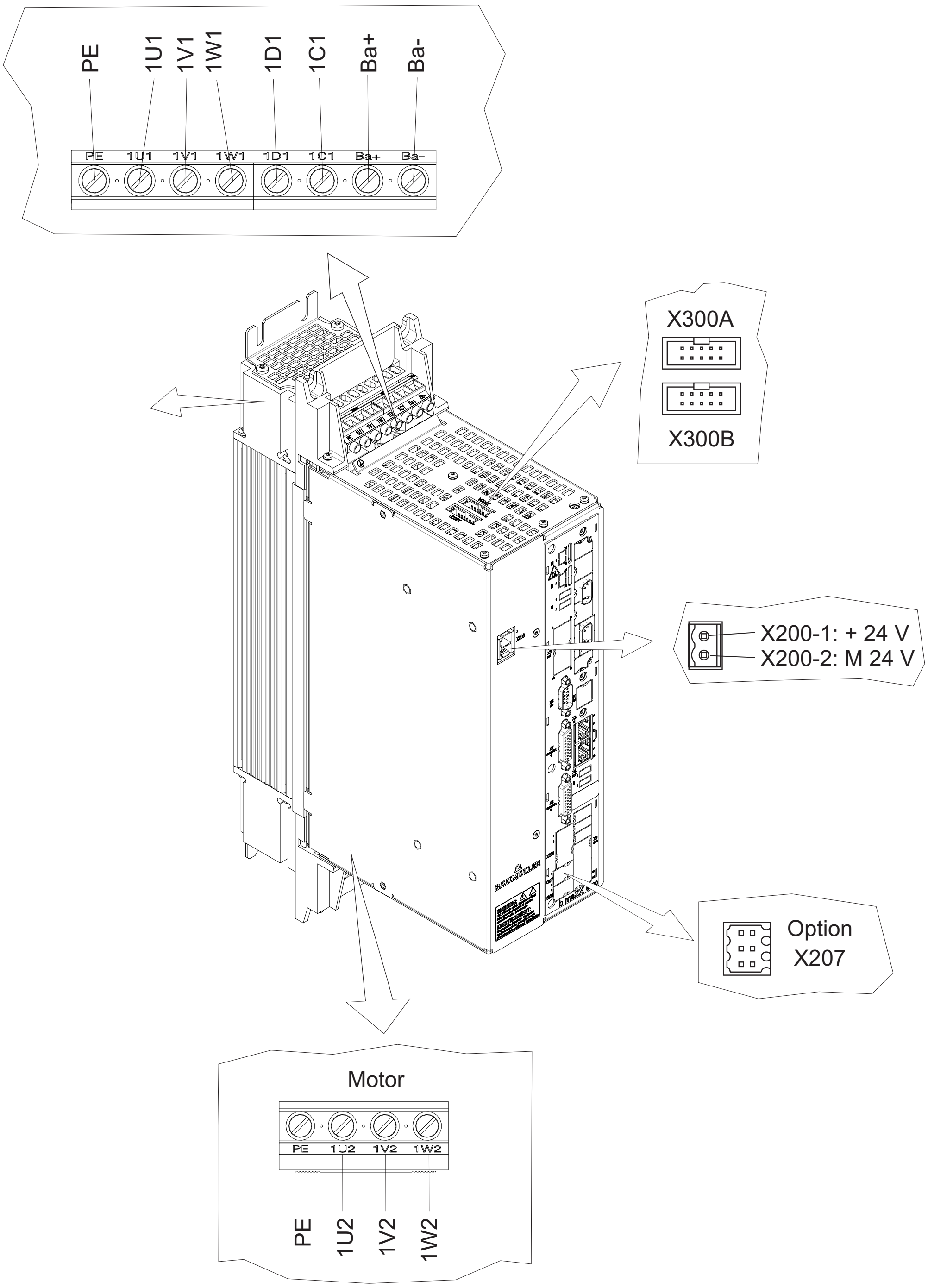


Figure 90: Electrical connections BM652X

7.11.3 Electrical connections BM653X

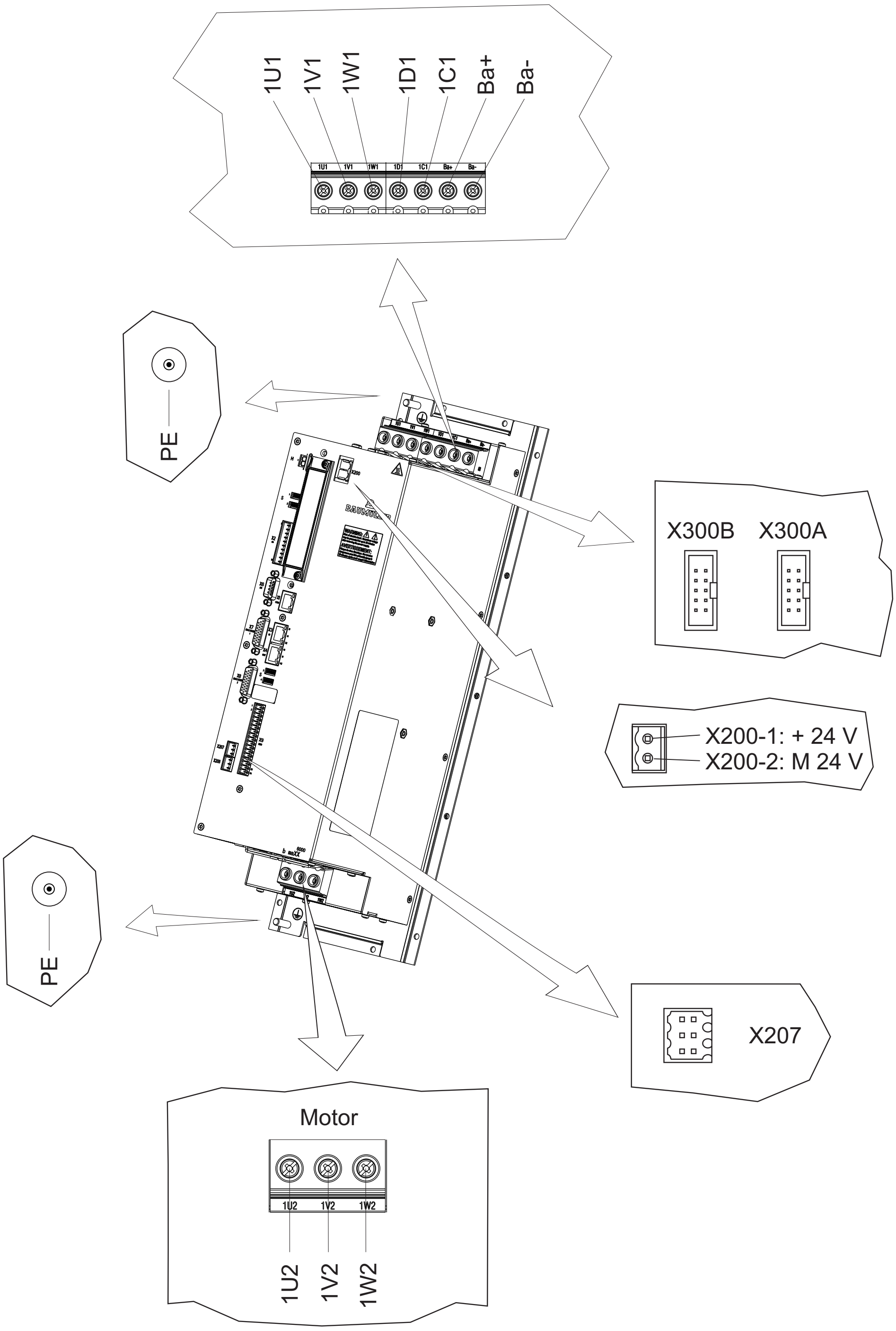


Figure 91: Electrical connection BM653X

7.11.4 Electrical connections BM654X

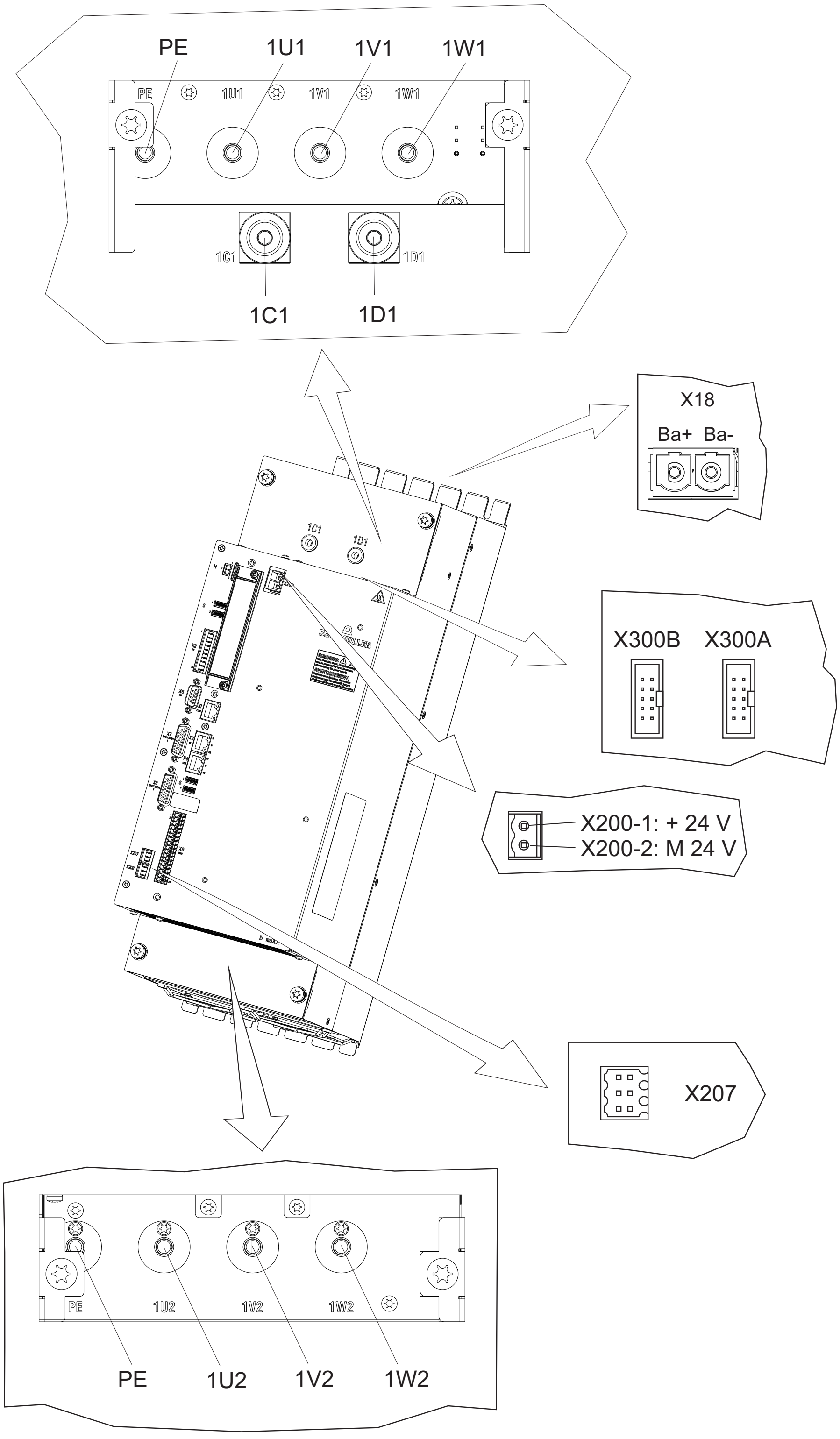


Figure 92: Electrical connections BM654X

7.11.5 Electrical connections BM65DX

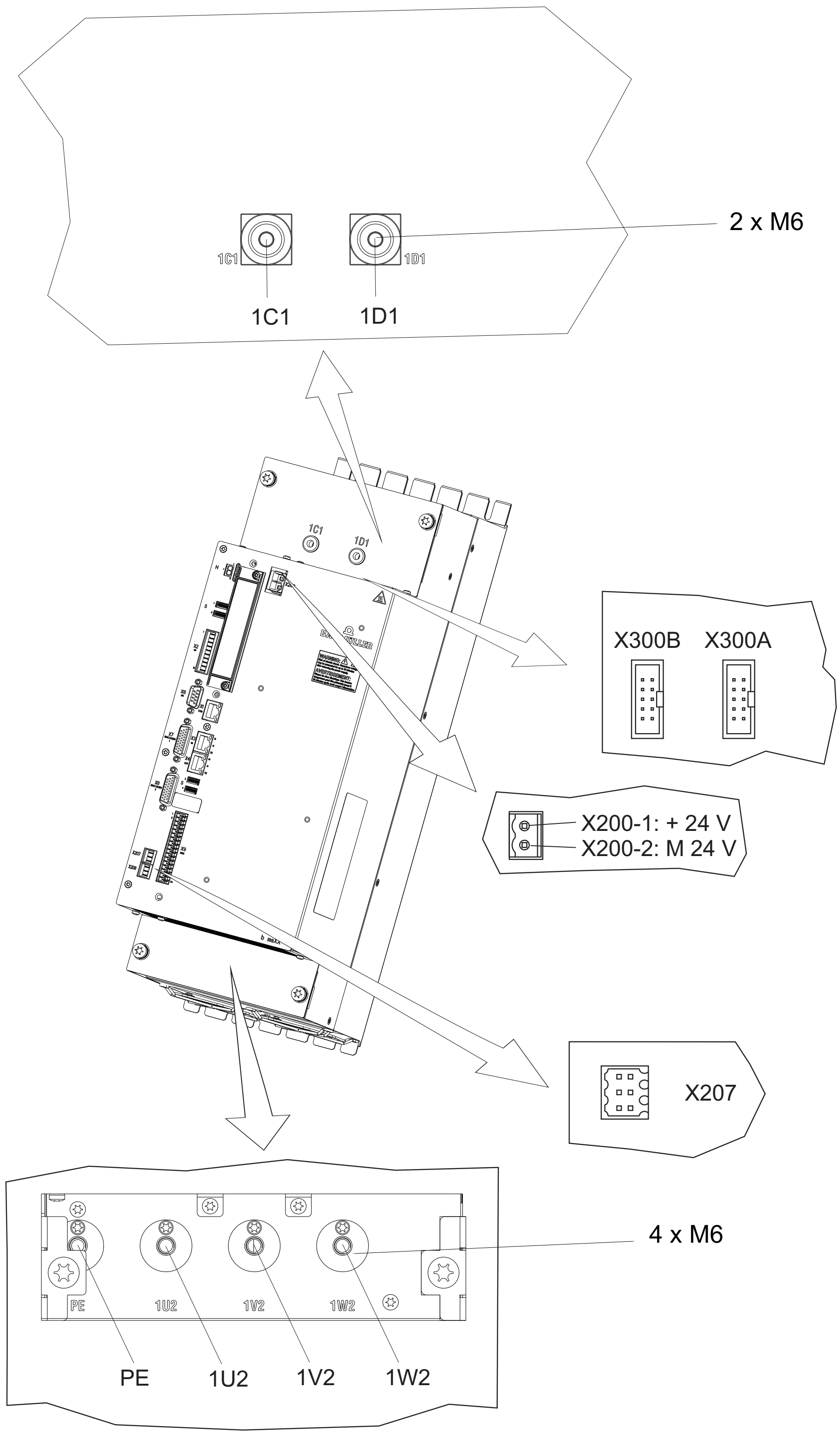


Figure 93: Electrical connections BM65DX

7.11.6 Electrical connections BM655X

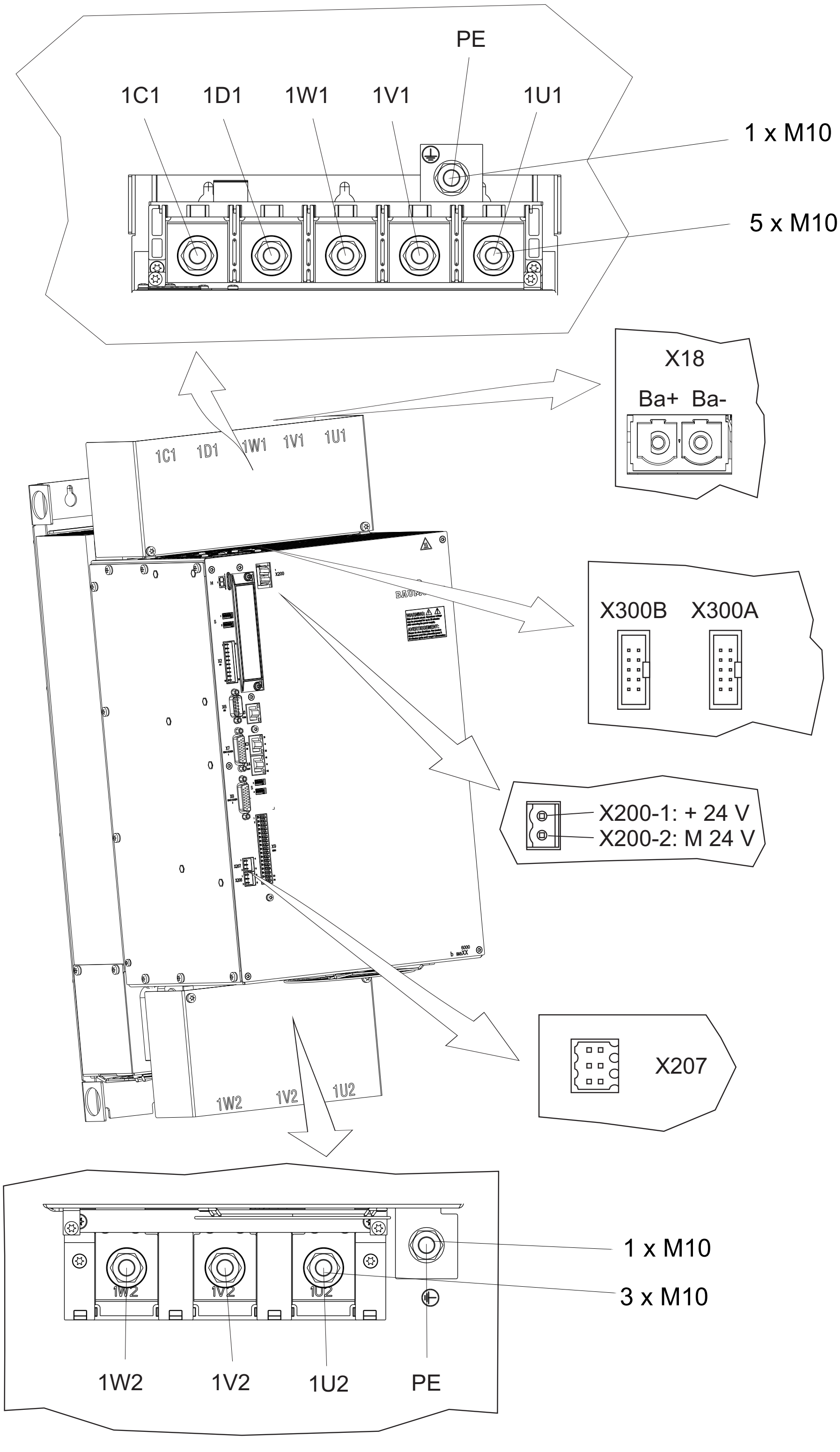


Figure 94: Electrical connections BM655X

7.11.7 Electrical connections BM65EX

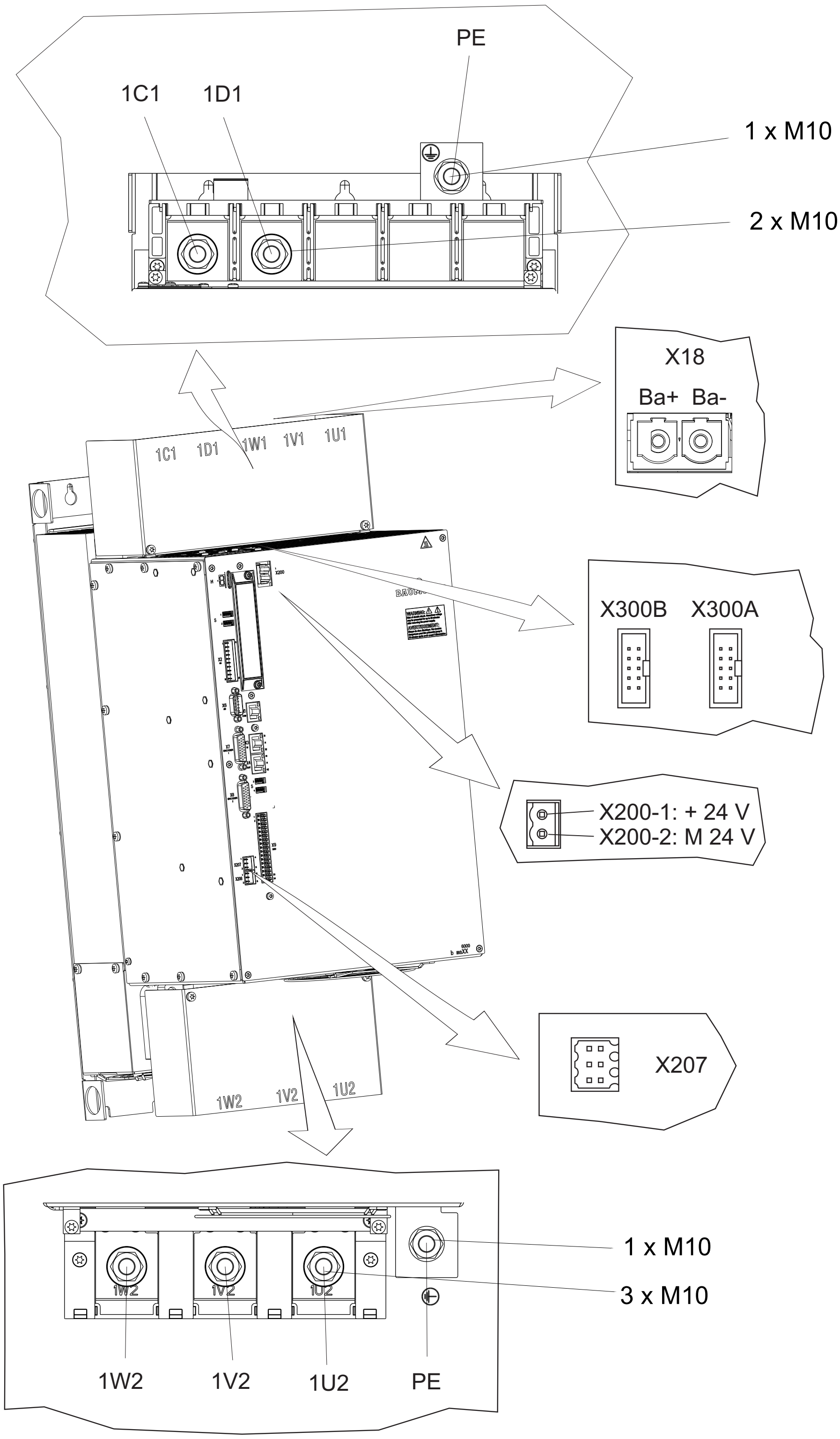


Figure 95: Electrical connections BM65EX

Connection bolt power supply, motor, PE

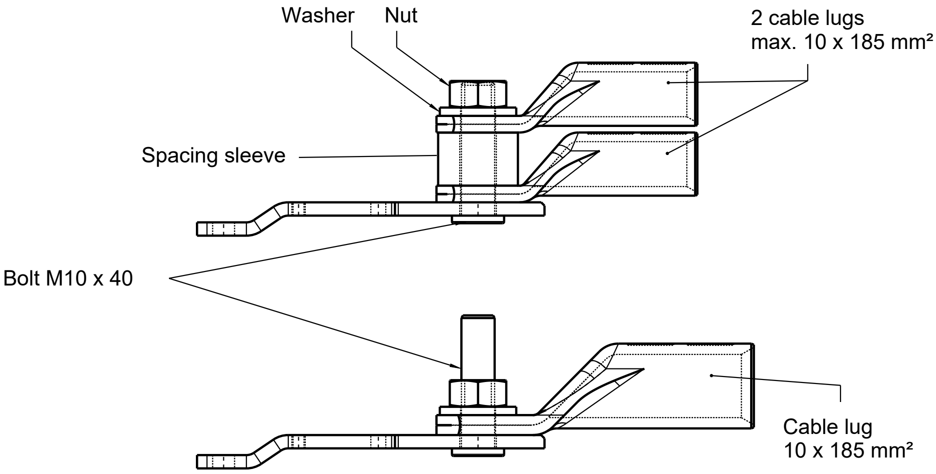


Figure 96: Connection bolt BM655X / BM65EX

7.11.8 Electrical connections BM656X

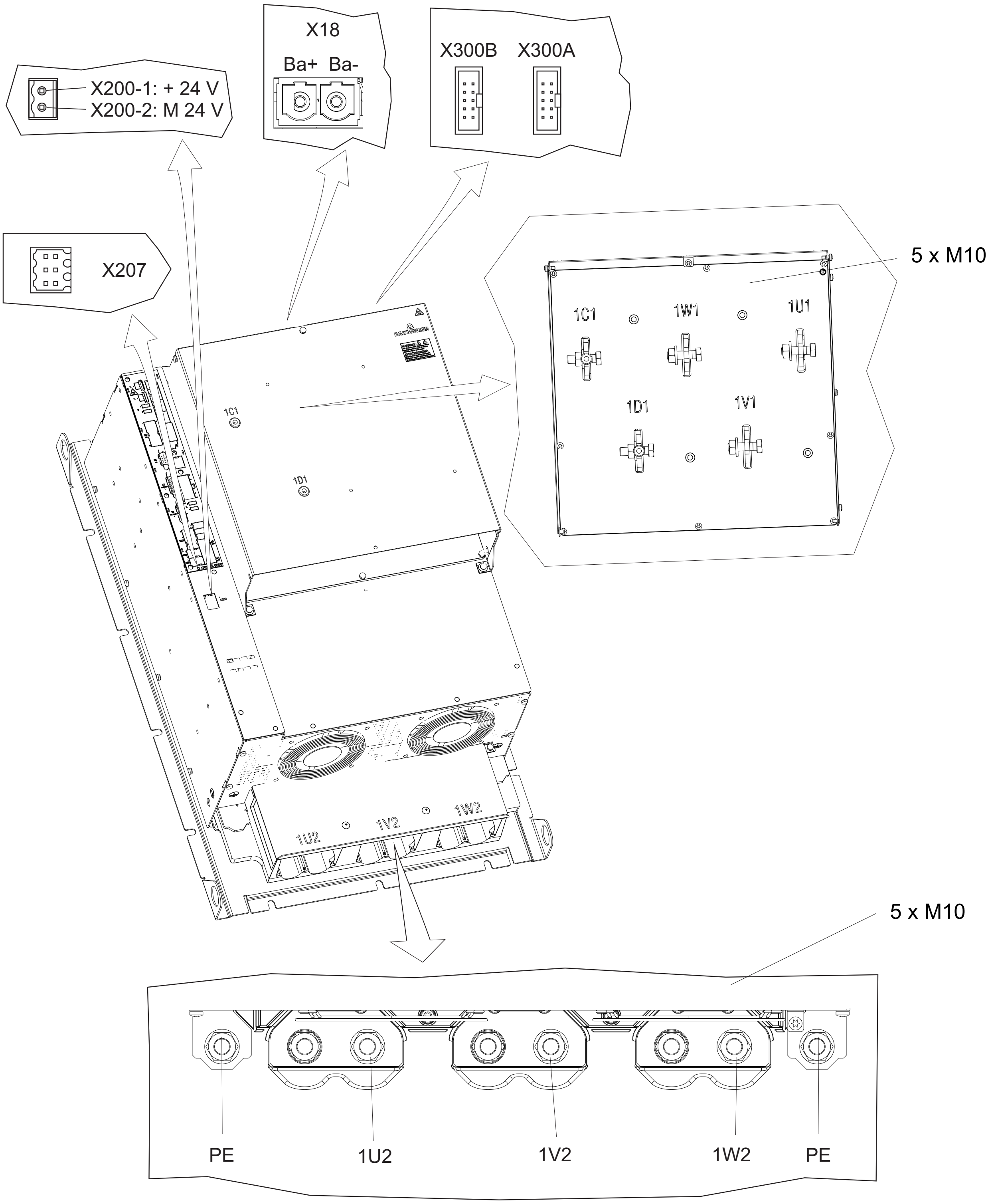


Figure 97: Electrical connections BM656X

7.11.9 Electrical connection BM65FX

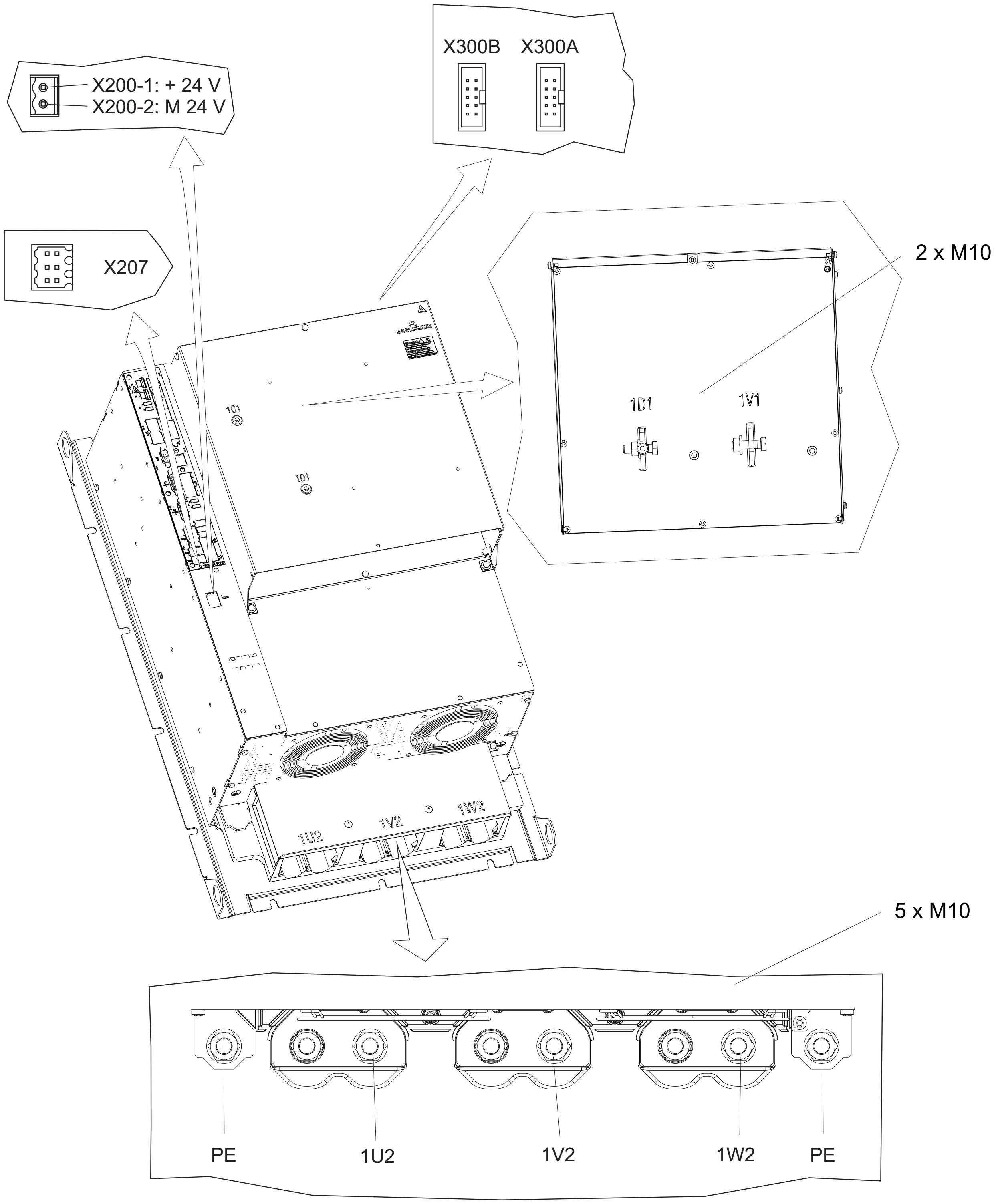


Figure 98: Electrical connection BM65FX

7.11.10 Connection data

Power supply
1U1, 1V1, 1W1, PE

	Max. cross-section of connection	Connection technology	Torque	Load capacity
BM651X	2.5 mm^2	Terminal block	-	Refer to ▷Fuses mono units◁ as from page 255
BM652X	4.0 mm^2	Screw terminal	Min. 0.5 Nm / 4.4 lbf in Max. 0.6 Nm / 5.3 lbf in	
BM653X	25 mm^2	Screw terminal	Min. 2 Nm / 17.7 lbf in Max. 2.3 Nm / 20.3 lbf in	
BM654X	50 mm^2	Cable lug for M6	Min. 4,9 Nm / 43 lbf in Max. 6 Nm / 53 lbf in	
BM655X BM656X	185 mm^2	Cable lug for M10 [1]	Min. 12 Nm / 106 lbf in Max. 25 Nm / 221 lbf in	

[1] Use cable lug DIN 46235 for connection cross-section 185mm², no restrictions for other cross-sections.

DC link
1C1 and 1D1 [1]

	Max. cross-section of connection	Connection technology	Torque	Load capacity [1]
BM651X	2.5 mm^2	Terminal block	-	Refer to ▷Electrical data mono units◁ as from page 66 or ▷Electrical data power modules BM65DX, BM65EX, BM65FX◁ as from page 91
BM652X	4.0 mm^2	Screw terminal	Min. 0.5 Nm / 4.4 lbf in Max. 0.6 Nm / 5.3 lbf in	
BM653X	25 mm^2	Screw terminal	Min. 2 Nm / 17.7 lbf in Max. 2.3 Nm / 20.3 lbf in	
BM654X BM65DX	50 mm^2	Cable lug for M6	Min. 4,9 Nm / 43 lbf in Max. 6 Nm / 53 lbf in	
BM655X BM65EX	185 mm^2	Cable lug for M10 [2]	Min. 12 Nm / 106 lbf in Max. 25 Nm / 221 lbf in	
BM656X BM65FX	185 mm^2	Cable lug for M10 [2]	Min. 12 Nm / 106 lbf in Max. 25 Nm / 221 lbf in	

[1] Not short-circuit-proof, consider maximum load! Refer to „Power supply DC link terminals“ in chapter Electrical data.

[2] Use cable lug DIN 46235 for connection cross-section 185mm², no restrictions for other cross-sections.

Ballast
Ba+ and Ba- [1]

	Max. cross-section of connection	Connection technology	Torque	Load capacity [1]
BM651X	2.5 mm^2	Terminal block	-	Refer to ▹Electrical data mono units◃ as from page 66
BM652X	4.0 mm^2	Screw terminal	Min. 0.5 Nm / 4.4 lbf in Max. 0.6 Nm / 5.3 lbf in	
BM653X	25 mm^2	Screw terminal	Min. 2 Nm / 17.7 lbf in Max. 2.3 Nm / 20.3 lbf in	
BM654X	16 mm^2	Terminal block, spring-cage	-	
BM655X	16 mm^2	Terminal block, spring-cage	-	
BM656X	25 mm^2	Terminal block, spring-cage	-	

[1] Not short-circuit-proof, consider maximum load! Refer to „Brake resistor external“ in chapter Electrical data.

NOTE!

Connection external brake resistor BM653X only.

No external brake resistor is allowed to be connected if the device is equipped with an internal brake resistor.

Motor
1U2, 1V2, 1W2, PE

	Max. cross-section of connection	Connection technology	Torque	Load capacity
BM651X	2.5 mm^2	Terminal block	-	Is limited by the device, also refer to ▹page 73◃ and further
BM652X	4.0 mm^2	Screw terminal	Min. 0.5 Nm / 4.4 lbf in Max. 0.6 Nm / 5.3 lbf in	
BM653X	16 mm^2	Screw terminal	Min. 2 Nm / 17.7 lbf in Max. 2.3 Nm / 20.3 lbf in	
BM654X BM65DX	50 mm^2	Cable lug for M6	Min. 4,9 Nm / 43 lbf in Max. 6 Nm / 53 lbf in	
BM655X BM65EX BM656X BM65FX	185 mm^2	Cable lug for M10 [1]	Min. 12 Nm / 106 lbf in Max. 25 Nm / 221 lbf in	

[1] Use cable lug DIN 46235 for connection cross-section 185mm², no restrictions for other cross-sections.

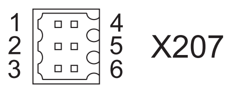
	Max. cross-section of connection	Connection technology	Load capacity
X200 (SELV/PELV) 24 V power supply	0,2 mm² - 6 mm² (AWG24-AWG8)	Terminal block, spring-cage	Terminal block max. 16 A

	Max. cross-section of connection	Connection technology	Load capacity
X207 Motor temperature and -brake or motor temperature only	Max. 1.0 mm²	Terminal block, spring-cage	Max. 4.0 A

NOTE!

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

7.11.11 Pin assignment X207



X207

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+

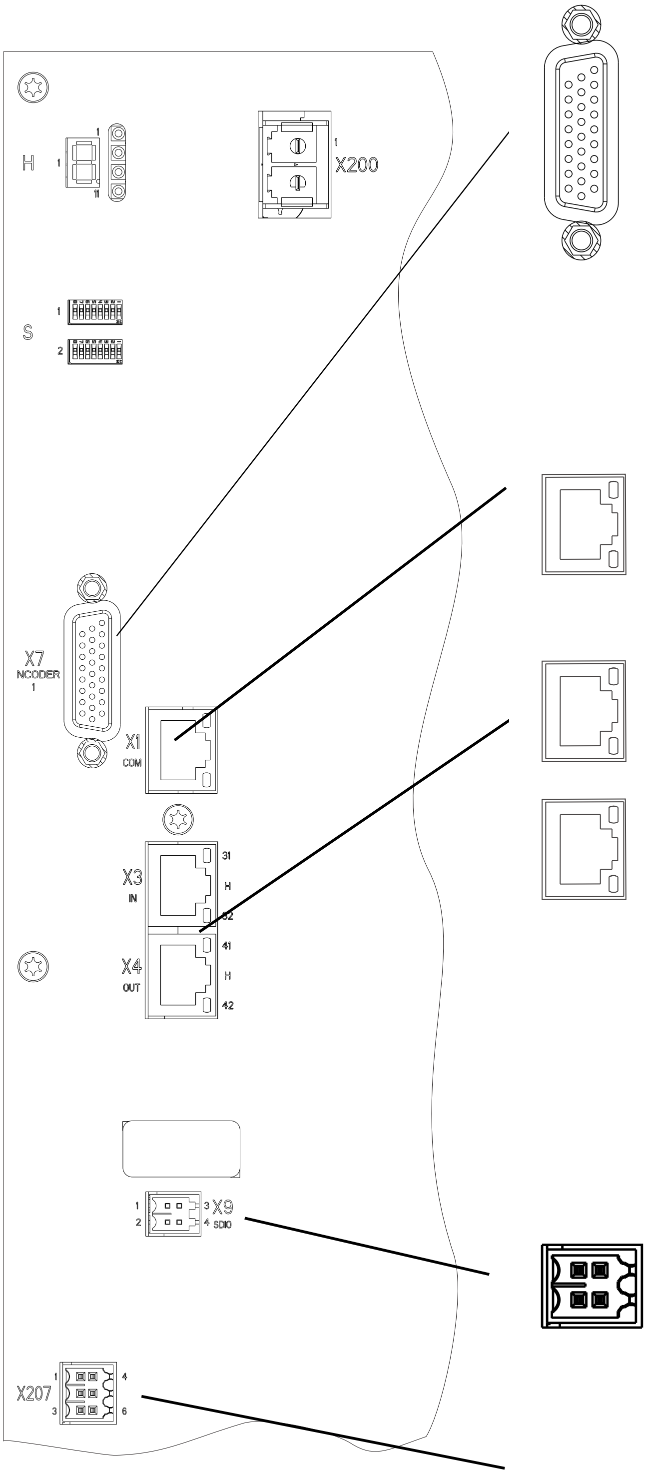
7.12 Signal bus

Refer to ▹Signal bus◃ as from page 231.

Pin-Nr.	Assignment	Function
1	**Supply unit ready-to-operate**	7,5 V means supply unit ready-to-operate, identically with X1:6 at BM50XX and BM51XX
2	**Phase failure**	0 V means all three power supply phases are available, 7,5 V means at least one power supply phase is not available
3	**Brake resistor on**	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 BM5300/BM63XX.
	Error	7,5 V means error message from power supply or controller
	Warning	7,5 V means warning message from power supply or controller
	Supply unit not ready-to-operate	7,5 V means supply unit is not ready-to-operate, (used if several supply units are connected)
7,8		Reserved
9		7.5 V Power supply of the signal bus, for connections to BM5000/BM6000 devices, only.
10		GND

7.13 Connections controller

Controller minimum configuration



X7 Encoder 1

Switchable (refer to ▹Drive code◃ on page 107)

Encoder with HIPERFACE®
Resolver
Encoder with EnDat® 2.1
Sine/square wave incremental encoder
Encoder with SSI, EnDat® 2.2 and HIPERFACE DSL®
Sine/square wave incremental encoder with commutation

Refer to ▹X7 / X8 encoder evaluation◃ as from page 194.

X1 Service interface

Refer to ▹X1 Service interface◃ on page 186.

BM65XX-XXXXYY-XXX-**01** und
BM65XX-XXXXYY-XXX-**07**
X3 EtherCAT®-IN / **X4** EtherCAT®-OUT

BM65XX-XXXXYY-XXX-**02**
X3 VARAN-IN / **X4** VARAN-OUT

BM65XX-XXXXYY-XXX-**04**
X3 POWERLINK®-IN
X4 POWERLINK®-OUT

BM65XX-XXXXYY-XXX-**05**
X3 PROFINET-IN / **X4** PROFINET-OUT

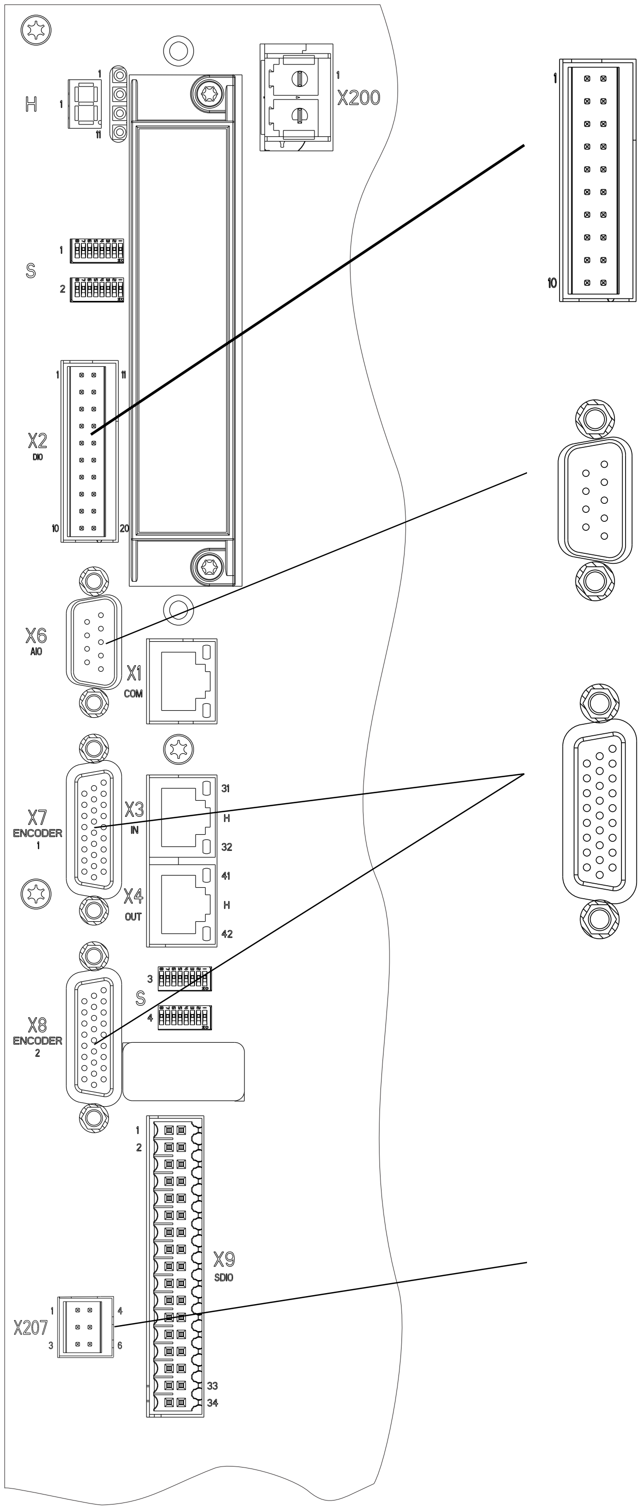
Refer to ▹X3 / X4 fieldbus connection◃ as from page 188.

X9 SDIO digital inputs Safety

Refer to ▹X9 SDIO digital inputs safety◃ as from page 202.

X207
Refer to table and ▹Pin assignment X207◃ on page 181.

Controller maximum configuration



X2 DIO Digital inputs

Refer to ▹X2 DIO digital inputs/outputs◃ as from page 186

X6 AIO Analog inputs/outputs

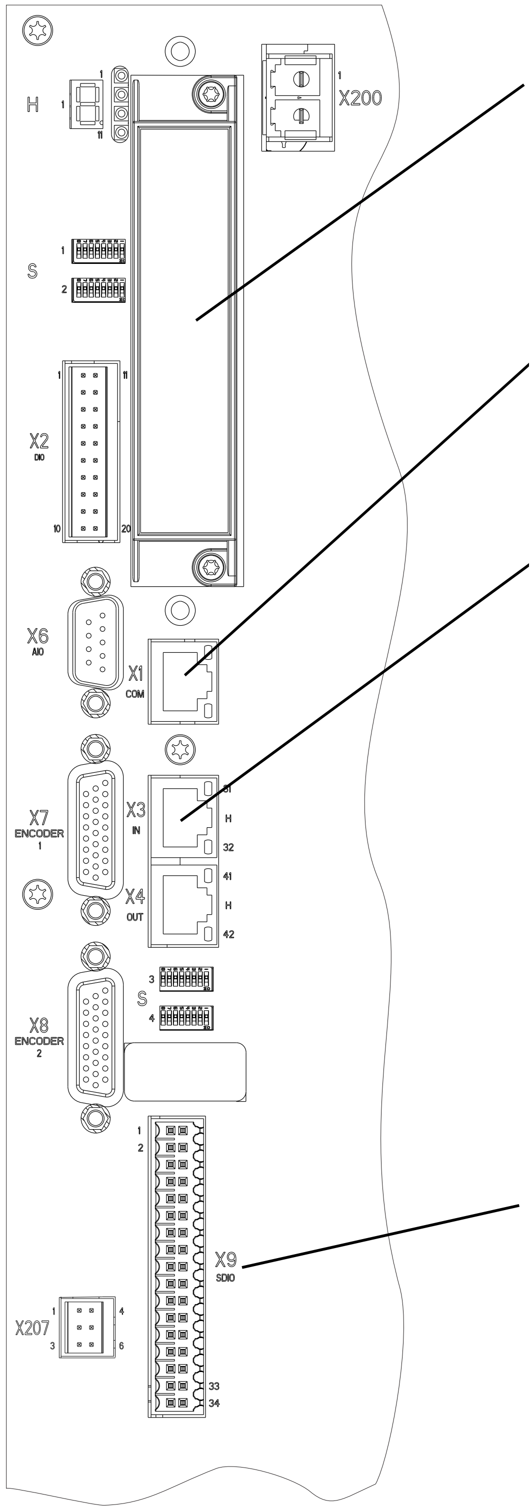
Refer to ▹X6 AIO analog inputs/outputs◃ as from page 193

X7 Encoder 1 / **X8** Encoder 2

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

Refer to ▹X7 / X8 encoder evaluation◃ as from page 194.

X207
Refer to table and ▹Pin assignment X207◃ on page 181.

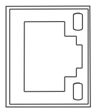


Add-on module (option) - not pluggable

BM65XX-XXXXYY-X**00 -** no add-on module

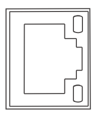
BM65XX-XXXXYY-X**XX -** add-on module

Refer to ▹Add-on modules◃ as from page 204

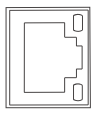


X1 Service interface

Refer to ▹X1 Service interface◃ on page 186.



BM65XX-XXXXYY-XXX-**01** und
BM65XX-XXXXYY-XXX-**07**
X3 EtherCAT®-IN / **X4** EtherCAT®-OUT

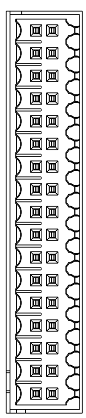


BM65XX-XXXXYY-XXX-**02**
X3 VARAN-IN / **X4** VARAN-OUT

BM65XX-XXXXYY-XXX-**04**
X3 POWERLINK®-IN
X4 POWERLINK®-OUT

BM65XX-XXXXYY-XXX-**05**
X3 PROFINET-IN / **X4** PROFINET-OUT

Refer to ▹X3 / X4 fieldbus connection◃ as from page 188.



X9 SDIO Digital inputs safety

Refer to ▹X9 SDIO digital inputs safety◃ as from page 202

7.13 Connections controller

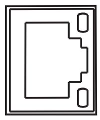
7.13.1 X1 Service interface

The service interface transmits controller parameters from PC/laptop to the controller using the ProDrive software.

- Connect USB-Port of PC/laptop with X1 of controller.

Pin assignment

X1



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

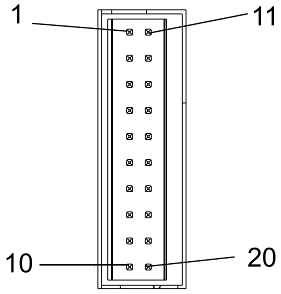
7.13.2 X2 DIO digital inputs/outputs

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 No.	Assignment
1	Not connected
2	Ready-to-operate
3	Ready-to-operate
4	Digital output 1
5	Digital output 2
6	Digital output 3
7	Digital output 4
8	M24V digital IN/OUT
9	Not connected
10	Not connected
11	Not connected
12	M24V digital IN/OUT
13	(fast) digital input 1, quick stop
14	(fast) digital input 2
15	Digital input 3
16	Digital input 4
17	Digital input 5
18	Digital input 6
19	Digital input 7
20	Digital input 8, pulse enable

NOTE!

The BM65XX and the digital inputs must be supplied from the same 24 V power supply.

NOTE!

Pin 8 and pin 12 are internally connected.

7.13.3 X3 / X4 fieldbus connection

EtherCAT®

Type code with EtherCAT® CoE profile:

BM65XX-XXXXYY-XXX-**01**

Type code with EtherCAT® SoE profile:

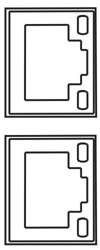
BM65XX-XXXXYY-XXX-**07**

X3 EtherCAT® -IN
X4 EtherCAT® -OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ45/ M8
Number of parameters	Refer to parameter handbook **b maXX 6000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s

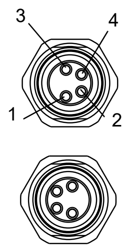
Pin assignment

X3
X4



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

X3
X4



1: TX+
2: RX+
3: RX-
4: TX-

VARAN Type code with VARAN profile:

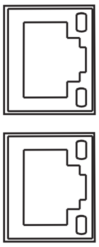
BM65XX-XXXXYY-XXX-**02**

X3 VARAN-IN
X4 VARAN-OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ45
Number of parameters	Refer to parameter handbook **b maXX 6000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s

Pin assignment

X3
X4



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

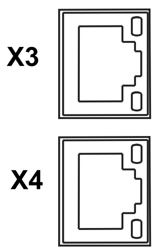
CANopen® Type code with CRJ45ANopen®:

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	RJ45
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

Pin assignment



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

POWERLINK® Type code with POWERLINK®:

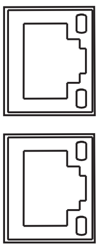
BM65XX-XXXXYY-XXX-**04**

X3 POWERLINK® IN
X4 POWERLINK® OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ45
Number of parameters	Refer to parameter handbook **b maXX 6000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s

Pin assignment

X3
X4



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

PROFINET IRT Type code with PROFINET IRT:

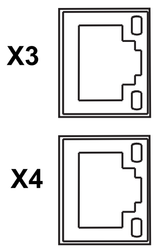
BM65XX-XXXXYY-XXX-**05**

X3 PROFINET IN

X4 PROFINET OUT

Number of bus connections	1 IN / 1 OUT
Bus connection	RJ45
Number of parameters	Refer to parameter handbook **b maXX 6000**
Data size of parameters	16 / 32 Bit
Baud rates	10 / 100 Mbit/s

Pin assignment



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

7.13.4 X6 AIO analog inputs/outputs

There are two analog inputs and outputs available.

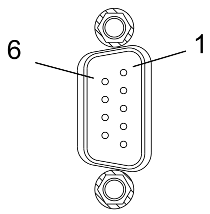
Inputs

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

Pin 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

7.13.5 X7 / X8 encoder evaluation

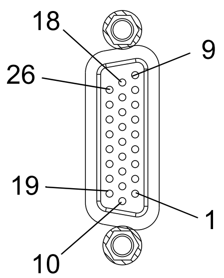
Connector assignment depends on used encoder.

Resolver encoder 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 integer.
Current input	Max. 160 mA
Field current	Approx. 8 kHz
Field current	160 mA
Ratio	0.5

Pin assignment



Sub-D-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

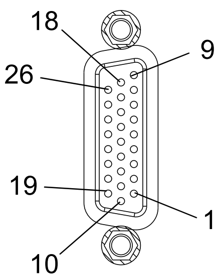
Encoder evaluation with HIPERFACE®

The Sine cosine 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 Vpp; REFSIN/REFCOS 2.5V)
Current input	Max. 250 mA

Pin assignment



Sub-D-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 *

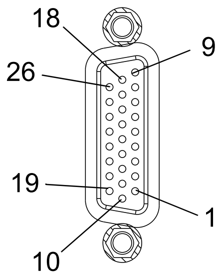
* do not occupy

Encoder evaluation with EnDat® 2.1 or SSI

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

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

Pin assignment



Sub-D-connector
26-pin

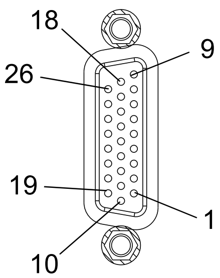
1	GND encoder supply
2	+5 V encoder supply
3	Clock +
4	A + (COS +)
5	A - (COS -)
6	B + (SIN +)
7	B - (SIN -)
8	Reserved *
9	Reserved *
10	Reserved *
11	Sense GND
12	Sense V_{CC}
13	Clock -
14	Reserved *
15	Reserved *
16	Reserved *
17	Temperature +
18	Temperature -
19	Data +
20	Data -
21	Reserved *
22	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} regulated
Signal level	~1 Vpp
Current input	Max. 250 mA



Sub-D-connector
26-pin

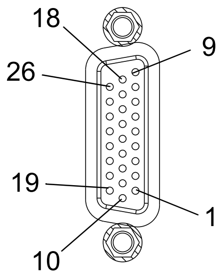
1	GND encoder supply
2	+5 V encoder supply
3	Clock+
4	Reserved *
5	Reserved *
6	Reserved *
7	Reserved *
8	Reserved *
9	Reserved *
10	Reserved *
11	Sense GND
12	Sense Vcc
13	Clock-
14	Reserved *
15	Reserved *
16	Reserved *
17	Reserved *
18	Reserved *
19	Data +
20	Data -
21	Reserved *
22	Reserved *
23	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} regulated
Signal level	RS422 (TTL) for square wave incremental encoders ~1 Vpp for sine incremental encoders
Current input	Max. 250 mA



Sub-D-connector
26-pin

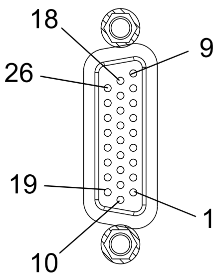
1	GND encoder supply
2	+5 V encoder supply
3	Reserved *
4	RS422 A +
5	RS422 A -
6	RS422 B +
7	RS422 B -
8	RS422 0 +
9	RS422 0 -
10	Reserved *
11	Sense GND
12	Sense V_{CC}
13	Reserved *
14	Reserved *
15	Reserved *
16	Reserved *
17	Temperature +
18	Temperature -
19	Reserved *
20	Reserved *
21	Reserved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



Sub-D-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

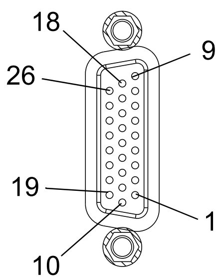
NOTE!

The use of the standard accessory connector included in the accessory kit HIPER-FACE 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 V01.15 and higher:

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



Sub-D-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 (0+, 0-).

NOTE!

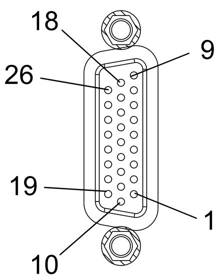
The connection cable is not available as a pre-assembled cable by Baumüller. The user has to provide a suitable cable.

Encoder evaluation with SSI interface 10 V

The encoders, which meet the following technical specifications, can be used, available Firmware V01.18 and higher:

Voltage supply	10 V_{DC}
Signal level	~1 Vpp
Current input	Max. 250 mA

Pin assignment



Sub-D-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	Reserved *
12	Reserved *
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

7.13.6 X9 SDIO digital inputs safety

NOTE!

For devices with safety functions

F-Code ≠ 0000 0000

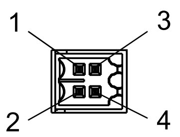
the following additions to the instruction handbook apply:

- Integrated hardware-based safety function ISF STO/SS1
  only F: 0040 0001, F: 0040 2001, Doc.-No. 5.23015
- Integrated safety function ISF
  Doc.-No. 5.23016

(refer to ▹Identification of the device◃ on page 104 and ▹Fail safe code◃ on page 107)

X9 SDIO 4-pin

Pin assignment

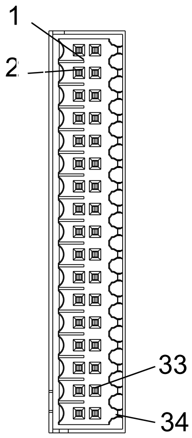


Pin No.	Assignment
1	Input A
2	GND A
3	Input B
4	GND B

X9 SDIO 34-pin

The reference potential of inputs and outputs is the ground of BM6500 24V power supply. Excepted are the inputs 1A, 1B, 2A and 2B.

Pin assignment



Pin No.	Assignment	Pin No.	Assignment
1	Input 1A	18	Input 1B
2	GND 1A	19	GND 1B
3	Input 2A	20	Input 2B
4	GND 2A	21	GND 2B
5	CLK A	22	CLK B
6	Input 3A	23	Input 3B
7	Input 4A	24	Input 4B
8	Output 1A	25	Output 1B
9	Chain Input 1A	26	Chain Input 1B
10	Chain Output 1A	27	Chain Output 1B
11	Input 5A	28	Input 5B
12	Input 6A	29	Input 6B
13	Input 7A	30	Input 7B
14	Input 8A	31	Input 8B
15	Output 2A	32	Output 2B
16	Chain Input 2A	33	Chain Input 2B
17	Chain Output 2A	34	Chain Output 2B

7.14 Add-on modules

NOTE!

Only devices with type code

BM65XX-XXXXYY-X**XX** with **XX** not equal 00

provide an add-on module, refer to ▷Type code◁ as from page 105!

The add-on modules are built-in and cannot be changed.

It is forbidden to remove the yellow front cover.

7.14.1 Add-on module IEE with external supply

Incremental encoder emulation, 2 channels, BM65XX-XXXXYY-X**X1**

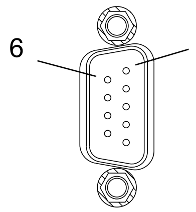
Set values for incremental encoder emulation can be evaluated from following sources:

- 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 X1 and X2 (male) of incremental encoder emulation:

Pin assignment	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 connected
	7	Incremental encoder emulation track -A
Sub-D-male-connector	8	Incremental encoder emulation track A
9-pin,	9	Incremental encoder emulation track -B

Connection cable refer to ▷Connection cable add-on modules◁ as from page 253.

Further information refer to manual add-on modules IEE/SIE 5.25013.

7.14.2 Add-on module SIE

SSI encoder emulation, 2 channels, BM65XX-XXXXYY-X**X3**

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

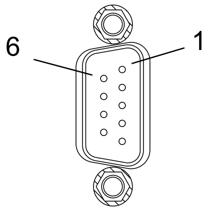
- Position actual values encoder 1 or encoder 2
- Position set values (e. g. internal from positioning)
- Fieldbus set value (external set via bus)

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	$|t_d| = 1 \leq 50$ ns
Power input	0.525 W
Current output driver	Max. 15 mA

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

Pin assignment



Sub-D 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 refer to ▹Connection cable add-on modules◃ as from page 253.

Further information refer to manual add-on modules IEE/SIE 5.25013.

7.14.3 Add-on module SVP

Module with additional analog/digital inputs/outputs, BM65XX-XXXXYY-X**X4**

BM65XX-XXXXYY-X**X5**

BM65XX-XXXXYY-X**X6**

LED display

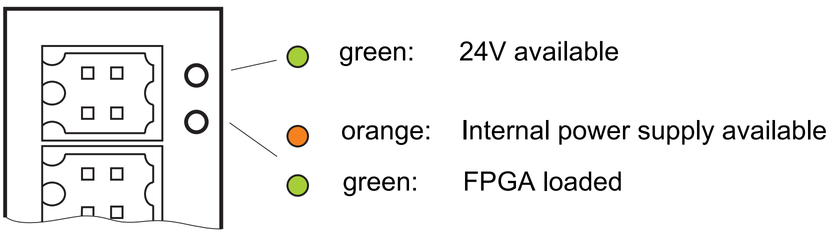


Figure 99: LED display add-on module SVP

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

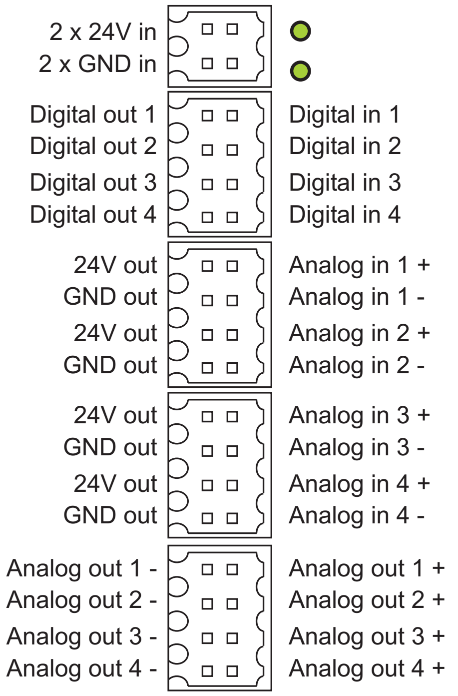
Error	Min	Type	Max
DNL	0	2	4
INL	0	3	6
Offset	0	3	6
Gain	0	3	6

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 BM63XX-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 BM63XX-XXXX-XX**05**	Analog voltage inputs ±10 V Resolution 14 bit	Analog current inputs (0) 4…20 mA Resolution 14 bit		
SVP-001-003 BM63XX-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

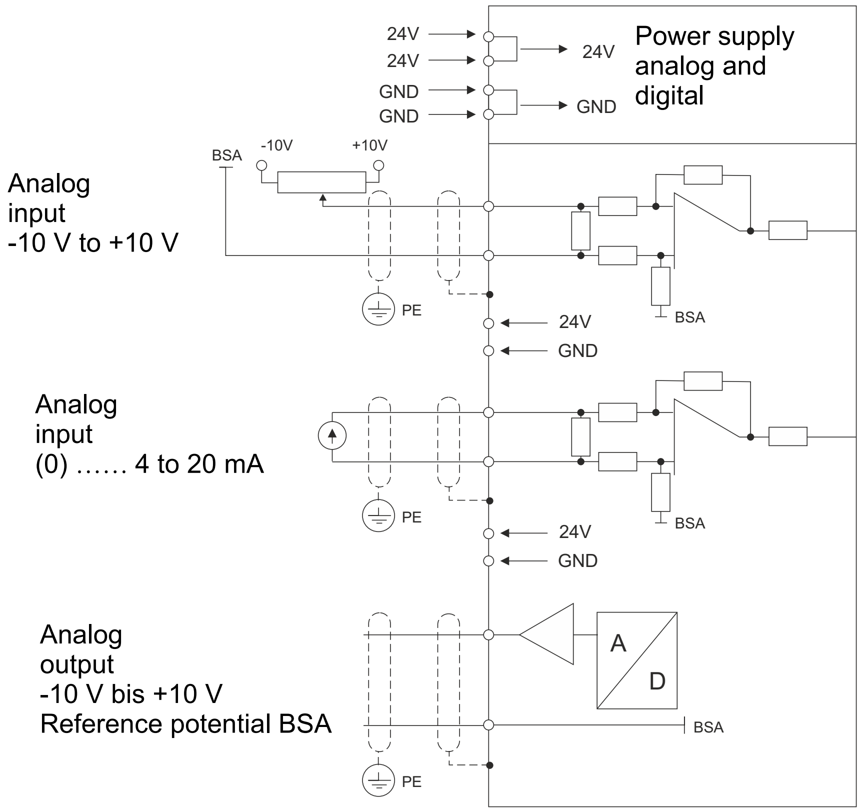


Figure 100: Connection of analog inputs/outputs SVP

- Digital inputs/outputs

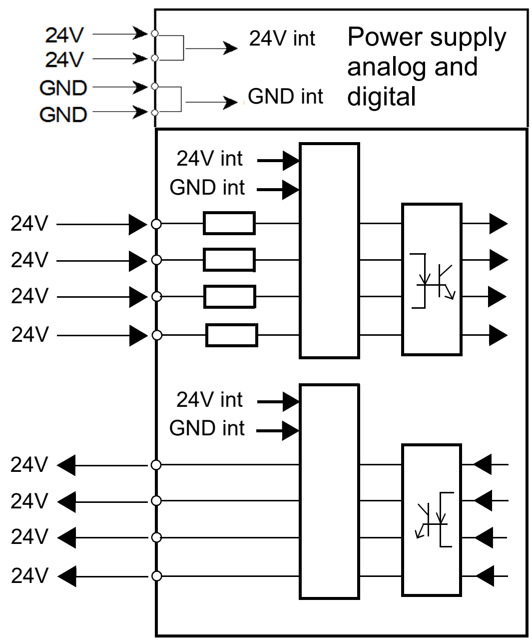


Figure 101: Connection of digital inputs/outputs SVP

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 (refer to ▷Required environmental conditions◁ on page 58).

	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)

Release signals These signals must have a signal level of 24 V (DC) and be available via the terminals.

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 (refer to 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 6000**).

8.2 Monitoring

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 (refer to ▹Display and operating elements◃ as from page 111).

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 (refer to ▹Display and operating elements◃ as from page 111). 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.

Refer to ▹Troubleshooting and Fault correction◃ as from page 227.

8.3 Fieldbus communication

Depending on the device version (refer to ▷Type code◁ as from page 105) different field-bus systems are provided.

8.3.1 EtherCAT®

Type code with EtherCAT®:

BM65XX-XXXXYY-XXX-**01** CoE -Profil (CANopen® over EtherCAT®)
BM65XX-XXXXYY-XXX-**07** SoE -Profil (Servodrive-Profil over EtherCAT®)

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

X3 and **X4** on the front side of **b maXX 6500** are the connections for the EtherCAT®-field-bus (also refer to ▷Connections controller◁ on page 183).

Mounting and installation

The mounting/installation consists of the following steps:

1. De-energize the device
2. Set the IP-address,
   refer to ▷Setting address switches◁ as from page 118.
3. Connect **b maXX 6500** 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;
     refer to spare parts ▷EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, PROFINET IRT, service interface cable◁ on page 243.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. Device 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 device is ready-to-use.

Address switch

By means of the address switches the IP-address is set

(refer to ▷Setting address switches◁ as from page 118).

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 6000**)
  - 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.

8.3.2 VARAN

Type code with VARAN:

BM65XX-XXXXYY-XXX-**02**

A device with fieldbus option VARAN can communicate with a VARAN master.

X3 and X4 on the front side of **b maXX 6500** are the connections for VARAN (also refer to ▹Connections controller◃ as from page 183).

Mounting and installation

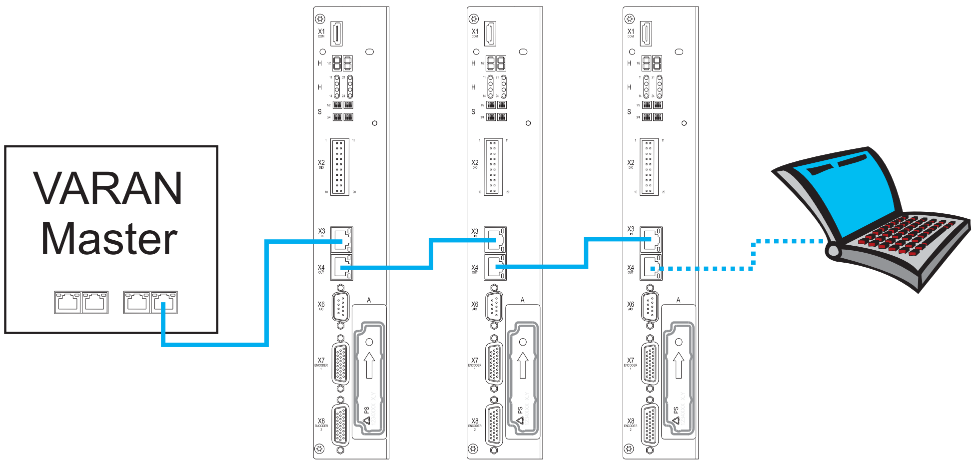
The mounting/installation consists of the following steps:

1 De-energize the device

2 Set the IP-address,
refer to ▹Setting address switches◃ as from page 118.

3 Connect **b maXX 6500** with VARAN bus cables (Ethernet-LAN cable at least CAT 5).

- X3: VARAN-In, X4: VARAN-Out.
  On the first node of a VARAN line X3 is connected with the VARAN master. X4 is connected with X3 of the next 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.



5000_0232_rev01_int.cdr

Figure 102: VARAN fieldbus connection

NOTE!

A point-to-point connection between PC (ProDrive) and **b maXX 6500** 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;
  refer to spare parts ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, PROFINET IRT, service interface cable◃ on page 243.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. Device 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 device is ready-to-use.
4. Create a Lasal-Class2 project using the driver classes for **b maXX 6500** drives for cyclic and service data communication.
5. Start the VARAN control

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 6000**)
     - 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

8.3.3 CANopen®

Type code with CANopen®:

BM65XX-XXXXYY-XXX-**03**

The data can be transmitted to all the other CAN-users (e g from CANopen® master) via the **b maXX 6500** with CANopen® slave.

X3 and **X4** are the RJ45 connections for CAN bus cables (also refer to ▹Connections controller◃ on page 183), which are on the front side of **b maXX 6500**.

Mounting and installation

The mounting / installation consists of the following steps:

1. De-energize device
2. Set address and baud rate (transfer rate) at the **b maXX 6500**, refer to ▹CANopen®◃ on page 113.
3. Connect **b maXX 6500** with CANopen®-bus cables (and, if necessary, a terminated connector).
   - Please, observe an EMC-compatible laying of the CANopen® connection cables!
   - The following cables were released for use by Baumüller: CANopen® connection cable; further information refer to ▹Accessories - CANopen®.◃ on page 260.

NOTE!

If the **b maXX 6500** device is the last bus node in the line, X4 must be terminated with a terminating connector (refer to ▹Accessories - CANopen®.◃ on page 260).

Commissioning

The following preconditions must be fulfilled before commissioning can be made:

1. **b maXX 6500** 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 6500** device is ready-to-use.

Address switch

By means of the address switch S1 to S2 the settings, like e.g. the baud rate (transfer rate) and the address setting (slave No. /ID) are made (refer to ▹CANopen®◃ on page 113).

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 6500** 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 (refer to Parameter Manual: Drive manager)

5 NMT-Master: Create PDO-Mapping (refer to 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 6500** 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 6500** 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 6500** device is in the cyclical operation
- Ensure, that the CANopen® communication source only is able to communicate with the **b maXX 6500** 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.

8.3.4 POWERLINK®

Type codewith POWERLINK®:

BM65XX-XXXXYY-XXX-**04**

Devices can communicate with a POWERLINK® Managing Node via the fieldbus connection POWERLINK®.

X3 and **X4** on the front side of **b maXX 6500** are the connections for POWERLINK® (also refer to ▹Connections controller◃ as from page 183).

Mounting and installation

The mounting/installation consists of the following steps:

1. De-energize the device
2. Set the IP-address, refer to ▹Setting address switches◃ as from page 118.
3. Connect **b maXX 6500** 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; refer to spare parts ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, PROFINET IRT, service interface cable◃ on page 243.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. Device 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 device is ready-to-use.

Address switch

By means of the address switches the last byte of the IP-address is set (Refer to settings ▹Setting address switches◃ as from page 118).

IP address 192.168.100.0 is not allowed.

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)
     - 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“.

8.3.5 PROFINET IRT

Type code with PROFINET IRT:

BM65XX-XXXXYY-XXX-**05**

Devices can communicate with a PROFINET IRT controller via the fieldbus connection PROFINET IRT.

X3 and **X4** on the front side of **b maXX 6500** are the connections for PROFINET IRT (also refer to ▹Connections controller◃ as from page 183).

Mounting and installation

The mounting/installation consists of the following steps:

1. De-energize the device
2. Set the IP-address, refer to ▹Setting address switches◃ as from page 118.
3. Connect **b maXX 6500** 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; refer to spare parts ▹EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, PROFINET IRT, service interface cable◃ on page 243.

Commissioning

The following preconditions must be fulfilled before commissioning:

1. Device with PROFINET IRT is installed correctly.
   - Ethernet-connection cables are wired correctly.
2. The control cabinet is properly locked and all safety devices are operating.
3. The device is ready-to-use.

Address switch

By means of the address switches the last byte of the IP-address is set (Refer to settings ▹Setting address switches◃ as from page 118).

IP address 192.168.100.0 is not allowed.

For further information on the setting options for the PROFINET IRT device, refer to the PROFINET application manual ▹Page 12◃.

Parameters

The parameter settings determine the behavior of the PROFINET IRT Device 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)
     - set Synchronization to „On“
     - SYNC time = Fieldbus cycle time = PROFINET IRT cycle time = 250 µs to 8 ms

       If “Clock-synchronous operation” has been selected in the PROFINET IRT controller and a valid transmission clock has been entered, this point does not apply.

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.

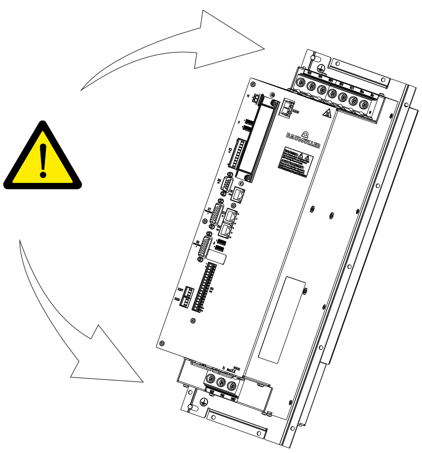


Figure 103: Hazard areas during electrical installation

9.1 Environmental condition

If the prescribed environmental conditions are adhered to, then the device is maintenance-free. For the prescribed environmental conditions, refer to ▷Required environmental conditions◁ on page 58.

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.

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-annu-ally	Annu-ally
Check surrounding 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-annu-ally	Annu-ally
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-annu-ally	Annu-ally
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-annu-ally	Annu-ally
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-annu-ally	Annu-ally
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-annu-ally	Annu-ally
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-annu-ally	Annu-ally
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
Phase monitoring [4)]	Phase failure	X	X	-	-	X
	power supply failure	X	X	-	-	X
Ground fault	Fault current to ground	-	X	-	-	X
Overcurrent	Motor overcurrent	-	X	-	X	-
DC link	DC link overvoltage	-	X	-	-	X
	DC link relative undervoltage	-	X	-	-	X
Overload monitoring	Peak current not possible at this time	X	X	-	-	X
Heat sink temperature	Temperature > threshold 1	X	-	-	-	-
	Temperature > switch-off threshold	X	-	X	-	-
Temperature of device interior	Temperature > threshold 1	-	X	-	-	X
	Temperature > switch-off threshold	X	-	X	-	-
Motor temperature	I^2t threshold exceeded	-	X	-	-	X
	Threshold 1 exceeded [2)]	-	X	X	-	X
	Threshold 2 exceeded [2)]	X	-	X	-	-
	Sensor short-circuit and/or temperature < -30 °C [2)]	X	-	X	-	-
	Sensor not connected and/or temperature > 250 °C [2)]	-	X	-	-	-
	Maximum temperature exceeded [2)]	-	X	-	-	-
Position controller	Dynamic position deviation	-	X	X	-	X
	Static position deviation	-	X	X	X	-
Encoder 1	Cable break	-	X	X	X	-
	Cable break ($SIN^2 + COS^2$)	-	X	X	X	-
	Excessive rotational speed	-	X	X	X	-

1) Pulses inhibited after a set time interval
2) Only if KTY/PT1000 sensor used
3) Adjustable
4) Not available at power modules BM65XX

X: Implemented
-: Not possible

Monitoring function	Warning/error	Warning	Error	Adjustable threshold	Adjustable reaction	Reaction inhibit pulses
Encoder 2	Cable break	-	X	X	X	3)
	Cable break (SIN² + COS²)	-	X	X	X	3)
	Excessive rotational speed	-	X	X	X	3)
Cyclical specified value transmission to the fieldbus	Time-out during transmission	-	X	X	X	3)
Blockage monitoring	Drive blocked	-	X	X	X	3)
Signal bus	Feed-in ready-to-operate	-	X	X	-	X
	Phase failure	X	X	-	X	-
	Brake resistance on	X	X	-	X	-
	Malfunction	X	X	-	X	-
	Signal bus warning	X	X	-	X	-

1) Pulses inhibited after a set time interval

2) Only if KTY/PT1000 sensor used

3) Adjustable

4) Not available at power modules BM65XX

X: Implemented
-: Not possible

Phase monitoring - not available at power modules BM65XX -

This monitoring function checks the three phases of the power supply voltage.

If one phase is missing, the warning „Phase failure“ is reported after at most 5 s. The motor can be supplied with nominal current for a limited time (refer to P130.24) or with phase failure error current (refer to P129.25) unlimited.

If all phases are missing the error „Power supply failure“ is generated after at most 5 s.

NOTE

If you work without a line filter a power supply failure or phase failure is recognized after 100 ms. If the device is operated with a line filter the power supply failure or phase failure can be detected after about 5 s. According to load state the failure can also be detected considerably earlier.

Ground fault This monitoring function checks if there is a short-circuit between the motor terminals and the ground. If a short-circuit is detected, there is immediately a pulse inhibit.

Overcurrent This monitoring function checks if the motor current is greater than 1.3 times output peak current. It serves as „Disaster prevention“ in case of an output-sided short-circuit.

DC link	This monitoring function checks the voltage of the DC link. In case the voltage is below a value, which was internally specified, the warning DC link undervoltage is generated by the controller. In case the voltage exceeds an adjusted value (about 820 V), the error „DC link overvoltage“ is signaled by the controller and the pulses are inhibited immediately.
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.
Temperature device internal space	This monitoring function checks the temperature in the internal space of the device. • In case the temperature is higher than the warning threshold, the controller generates a warning. • In case the temperature is too high, the pulses are inhibited immediately.
Temperature heat sink	This monitoring function checks the temperature of the heat sink. • In case the temperature is higher than the warning threshold, the controller generates a warning. • In case the temperature is too high, the pulses are inhibited immediately.
Motor temperature	This monitoring function checks the temperature of motor. If the I^2t-threshold is exceeded, then the error message „I^2t 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 exceeds 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	If the threshold set (type-specific) in the temperature switch or in the sensor is exceeded, then the error message „Over temperature“ is generated by the controller and the pulses are inhibited immediately.
Position controller	This monitoring function checks the position deviation limit statical/dynamical. In case the position deviation error is statical/dynamical greater than the set position deviation error limit, there is an error message „position deviation error statical“ and „position deviation error dynamical“. After monitoring time (position deviation time), additionally an error message is generated and the pulses are inhibited immediately.
Block monitoring	This monitoring function checks the motor speed and the motor current. If, for the period of time „block monitoring time“, the following two conditions are fulfilled, the error/warning „drive blocked“ is generated by the controller and the pulses are inhibited immediately. • Motor speed = 0 • The motor current which is supplied by the device is equal to the set motor limit current (current limit).
Signal bus	Refer to ▷Signal bus◁ as from page 231.

10.3 Signal bus

The signal bus is a connection between the supply unit (e.g., BM50XX mains rectifier, BM51XX active mains rectifier, or BM55XX/BM56XX/BM57XX or BM65XX mono units) and the connected BM53XX/BM63XX axis units or BM65XX power modules in the DC link network. This connection is used to signal to the connected axis units/power modules that the supply unit is ready for operation or that there is a phase failure. The signal bus can also be used to signal a fault or 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/power modules 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/power modules.

Signal bus - Supply unit not ready-to-operate

This signal indicates also the state of the supply unit. It is required, if axis units/power modules will be operated in a DC link network with supply units.

In this case it can only be evaluated by the „Power supply ready-to-operate“ signals whether at least one supply unit is ready, because the signal is a disjunction of the states of all supply units. It can not be recognized whether all supply units 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/power modules 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 supply units 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/power modules 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/power modules 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/power module 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/power modules/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/power modules and mono units. It is neither evaluated nor set by the active mains rectifier unit and by the mains rectifier unit.

10.4 Error detection

> **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. Errors that, due to safety reasons, have an immediate pulse inhibit as a consequence, may not be changed.

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 114.

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 6000**) 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:

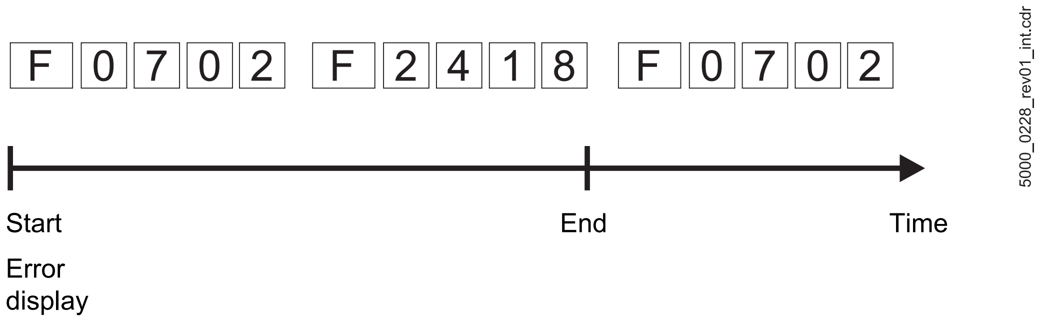


Figure 104: 7-segment display: errors and warnings

10.4.1 Error acknowledgment

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:
  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 6000**“.

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 - Power supply cabling

Device	Cross-section [1)]	Maximum length	Connection to device
BM65**1**X	4 x 0.5 bis 2.5 mm^2 (AWG 16 - 12)	Power supply to line filter: user-defined Line filter to power choke / device: EMC-compatible	Flexible cable with/without wire end ferrule (terminal block)
BM65**2**X	4 x 0.5 bis 4 mm^2 (AWG 24 - 10)		Flexible cable with wire end ferrule (screw terminal)
BM65**3**X	4 x 1.5 to 25 mm^2		
BM65**4**X	4 x 16 to 50 mm^2 (AWG 6 - 0)		
BM65**5**X BM65**6**X	4 x 25 to 185 mm^2		Cable lug max. width: 36 mm

1) Possible cross-section.
For UL-compliant machines/systems UL-certified cabling must be used, refer to ▷UL notes◁ as from page 109.

11.1.2 Cable device - motor

Device	Number of wires x cross section [1)]	Maximum length [2) 3)]	Connection to device
BM65**1**X	4 x 0.5 bis 2.5 mm^2 (AWG 16 - 12)	100 m	Flexible cable with/without wire end ferrule (terminal block)
BM65**2**X	4 x 0.5 bis 4 mm^2 (AWG 24 - 10)	1.5 to 2.5 mm^2: 100 m 4 mm^2 and larger: 60 m	Flexible cable with wire end ferrule (screw terminal)
BM65**3**X	4 x 1.5 to 25 mm^2	60 m	
BM65**4**X, BM65**D**X	4 x 16 to 50 mm^2 (AWG 6 - 0)	Up to 25 mm^2: 60 m 35 mm^2 and larger: 50 m	
BM65**5**X, BM65**E**X, BM65**6**X, BM65**F**X	4 x 25 to 185 mm^2	90 m	Cable lug max. width: 36 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, refer to ▷UL notes◁ as from page 109.

2) Only using Baumüller cables with this maximum length and Baumüller line filters, it can be assumed that the threshold limit value of the EMC product standard EN 61800-3 is complied with.
Available Baumüller cables refer to 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, Halogen-free, Silicone-free, FCKW-free, RoHS compliant, additional lengths upon request. For UL applications refer to ▷UL notes◁ as from page 109.

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**

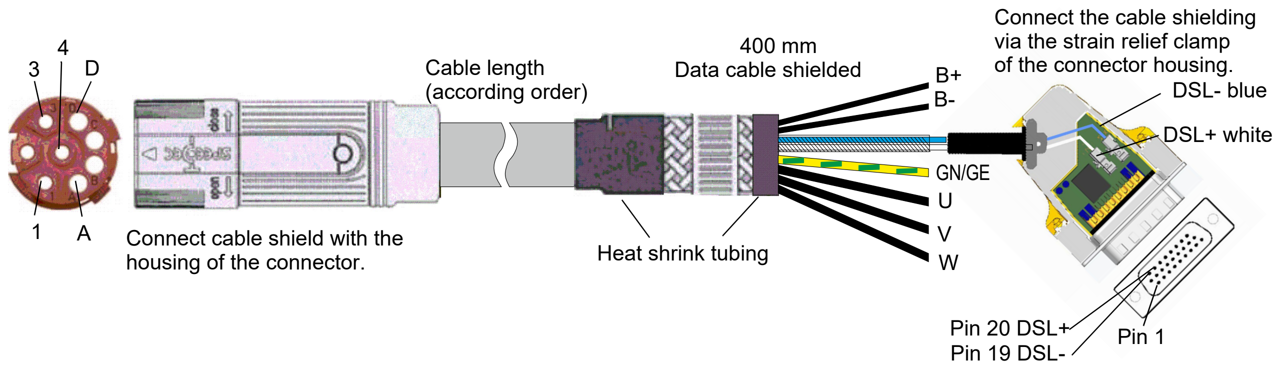


Figure 105: Motor cable with HIPERFACE DSL® 15 A

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	twisted pair	B+	0.75 mm² / black
B		B-	0.75 mm² / black
C	twisted pair	-	22 AWG / white
D		-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 20 A**

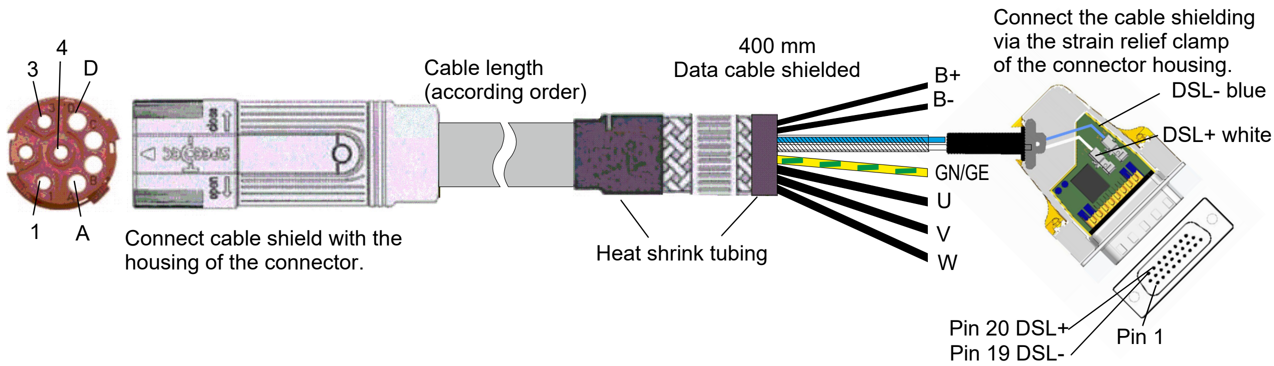


Figure 106: Motor cable with HIPERFACE DSL® 20 A

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	twisted	B+	1.0 mm² / black
B		B-	1.0 mm² / black
C	twisted	-	22 AWG / white
D		-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 21 A**

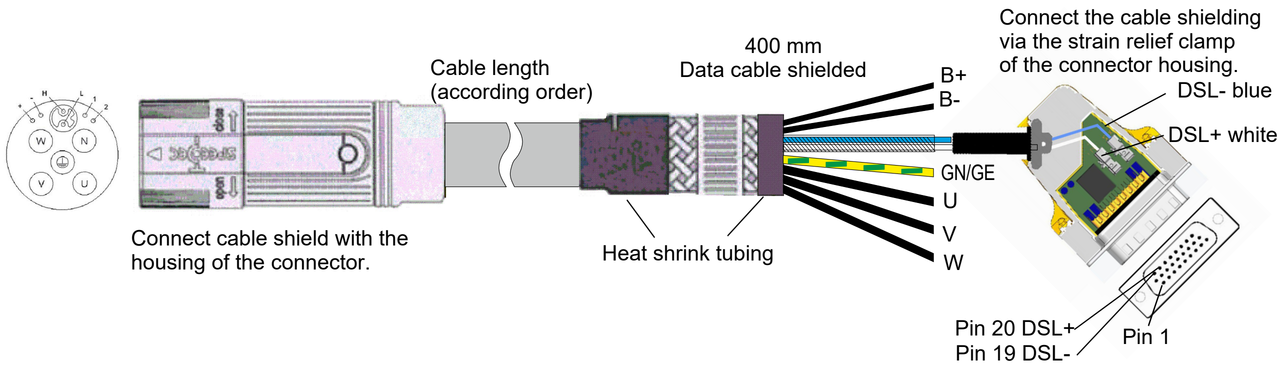


Figure 107: Motor cable with HIPERFACE DSL® 21 A

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
+	twisted	B+	1.0 mm² / black
-		B-	1.0 mm² / black
H	twisted	DSL+	22 AWG / white
L		DSL-	22 AWG / blue
Housing		-	Outside shielding
Housing		-	Inside shielding

- **Motor cable with HIPERFACE DSL® 28 A**

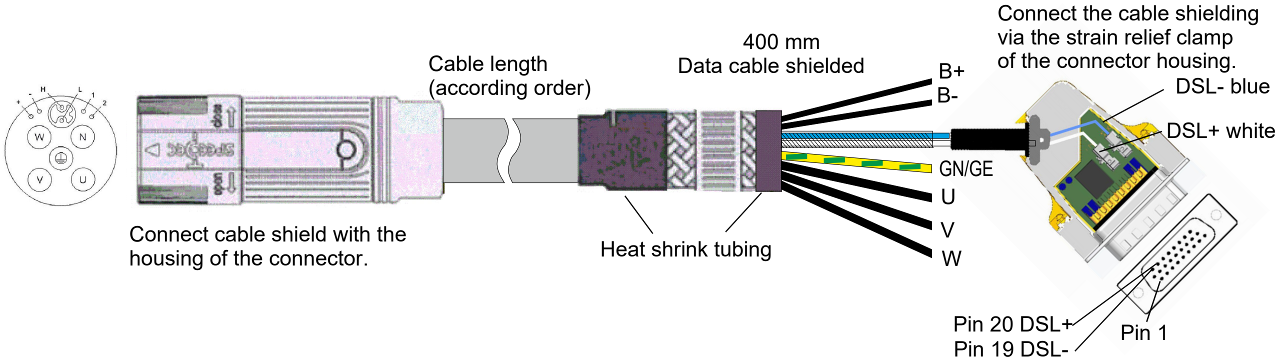


Figure 108: Motor cable with HIPERFACE DSL® 28 A

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**

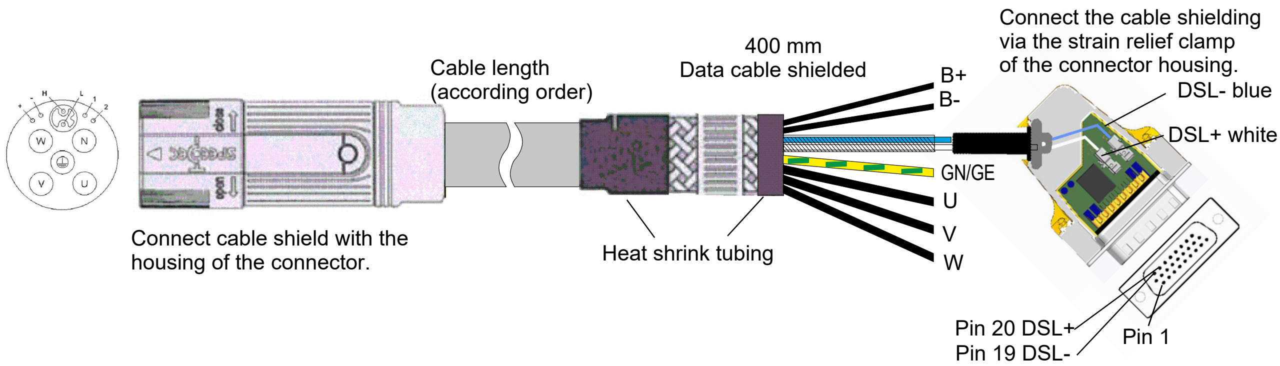


Figure 109: Motor cable with HIPERFACE DSL® 36 A

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 EtherCAT®, VARAN, POWERLINK®, EtherNet/IP®, PROFINET IRT, service interface 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

11.1.6 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

11.1.7 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 foand in the motor documentation.

Cables

Pre-assembled - trailing type; CE, Halogen-free, according to IEC 60754-1, Silicone-free, FCKW-free, RoHS compliant, additional lengths upon request. For UL applications refer to ▹UL notes◃ as from page 109.

	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.		refer to ▷Hybrid cable device-encoder-motor◁ on page 237
		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	

11.1.7.1 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
- Roand connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

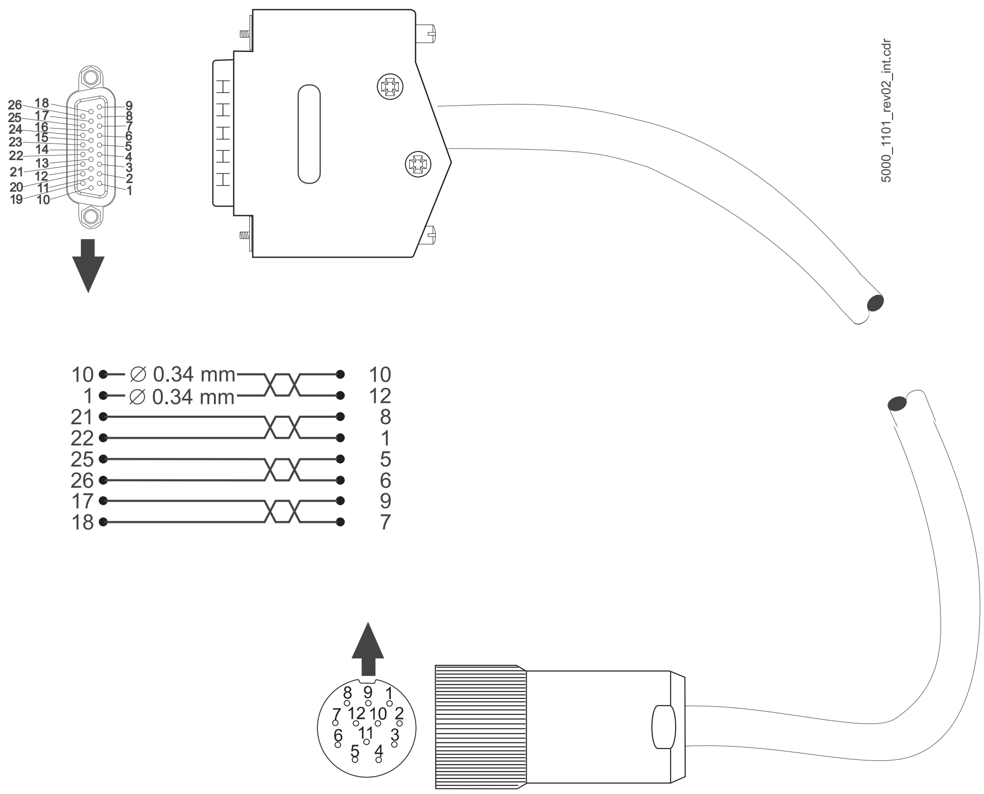


Figure 110: Connecting cable for resolver

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!

11.1.7.2 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
- Roand connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

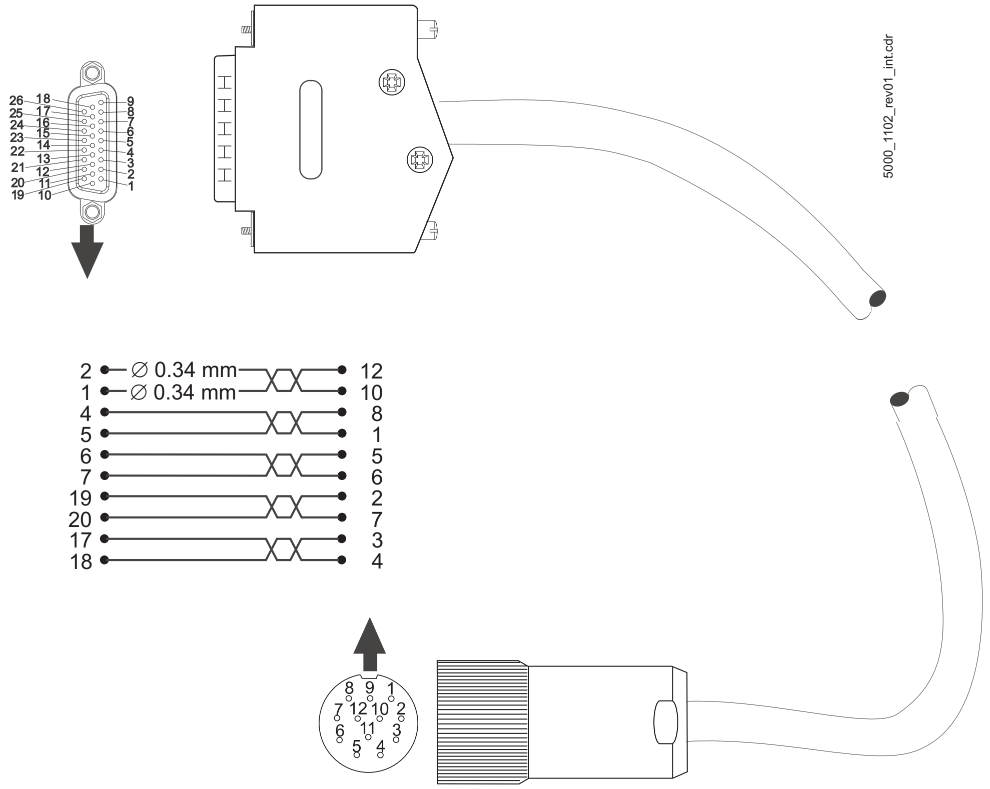


Figure 111: Connecting cable for encoder with HIPERFACE®

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!

11.1.7.3 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
- Roand connector: 17-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

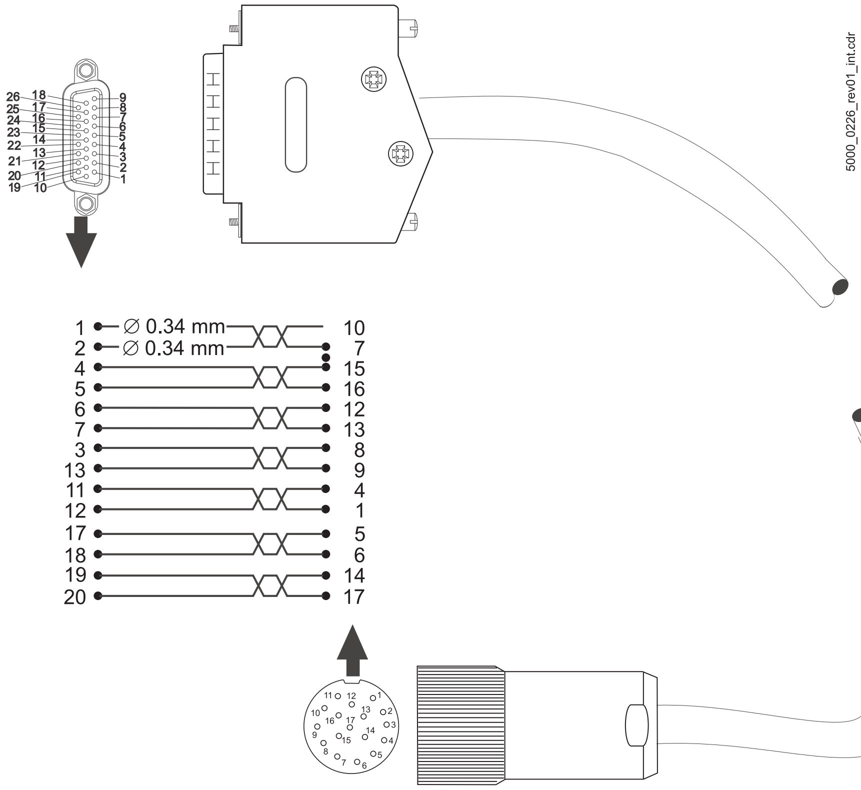


Figure 112: Connecting cable for encoder with EnDat® or SSI

	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!

11.1.7.4 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
- Roand connector: 8-pin M12, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

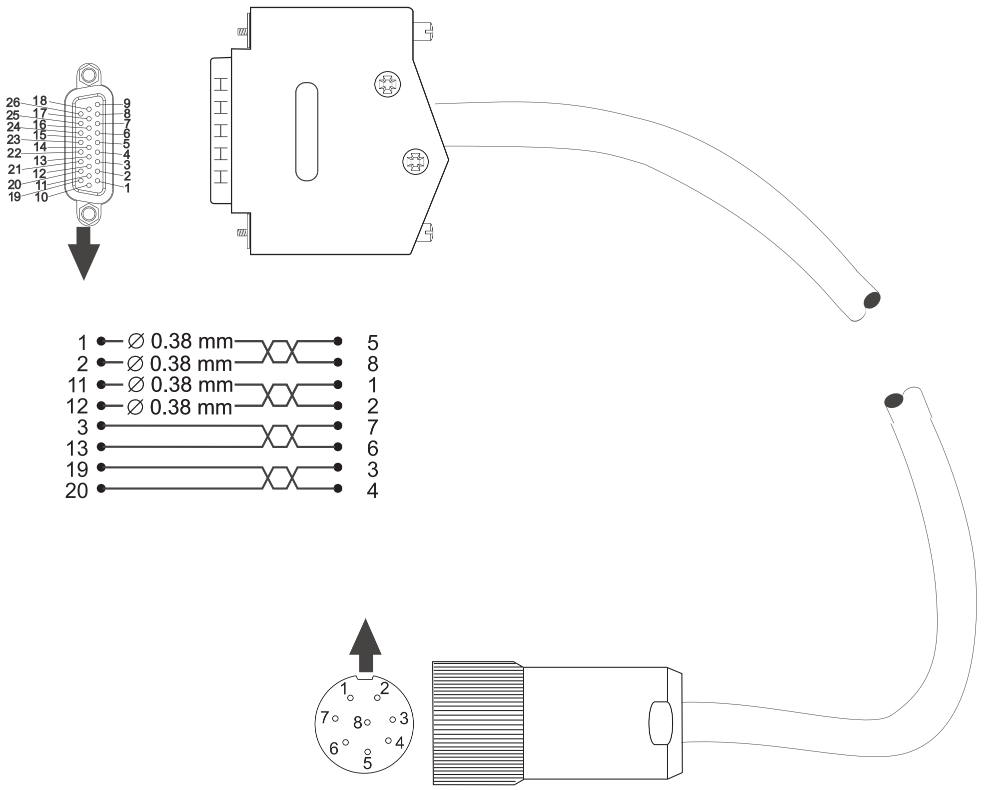


Figure 113: Connecting cable for encoder with EnDat® 2.2 M12

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
- Roand connector: 9-pin Speedtec® M23, female (Intercontec)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

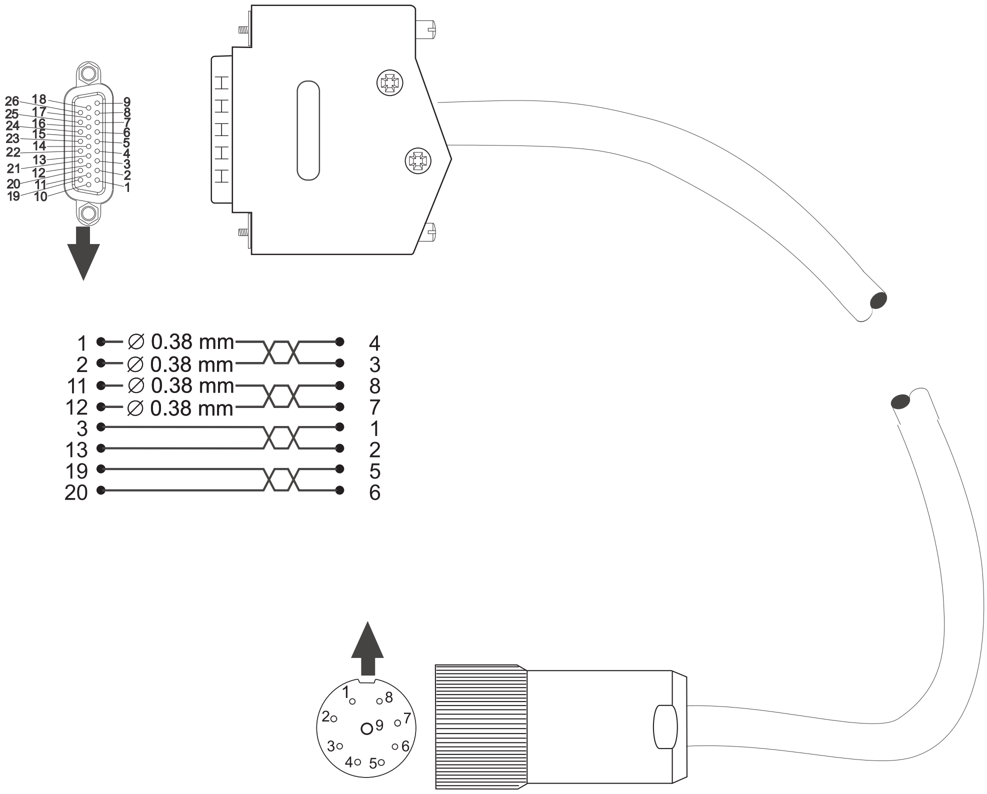


Figure 114: Connecting cable for encoder with EnDat® 2.2 Speedtec® M23

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!

11.1.7.5 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
- Roand connector: 12-pin, female (e.g. from Interconnectron)

2 Fully adjoin the cable shield with the housing of the roand connector and with the shielding of the D-sub connector.

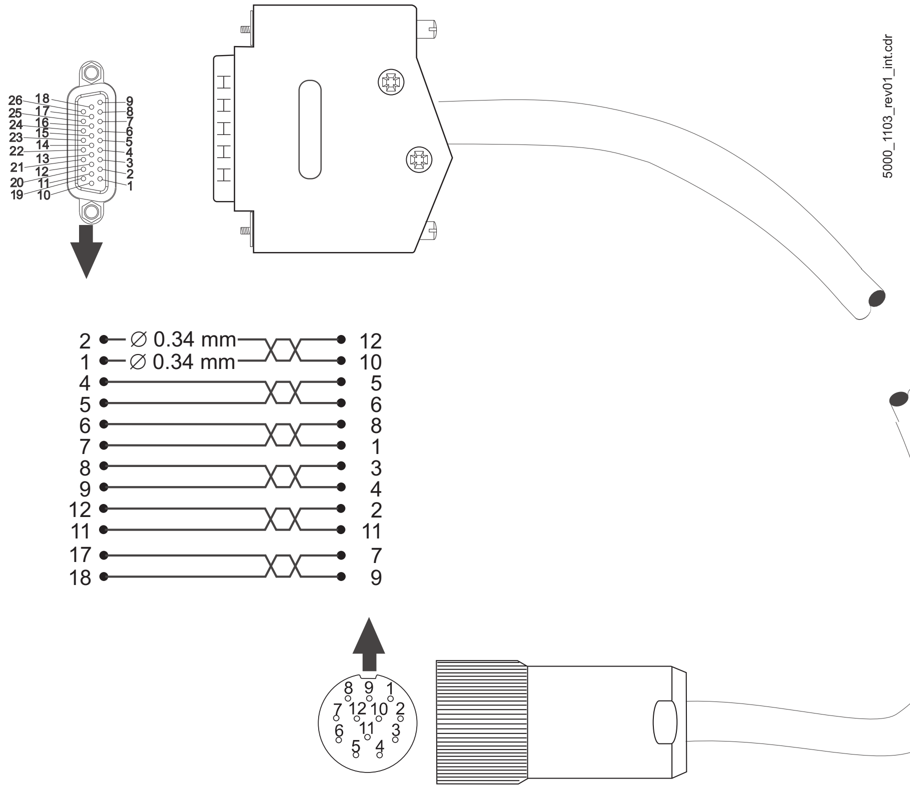


Figure 115: Connecting cable for sine/square wave incremental encoder

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!

11.1.8 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 6000** 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 6000** side, pin assignment refer to ▹Connecting cable for sine/square-wave incremental encoder◃ on page 252) with the other cable ending.

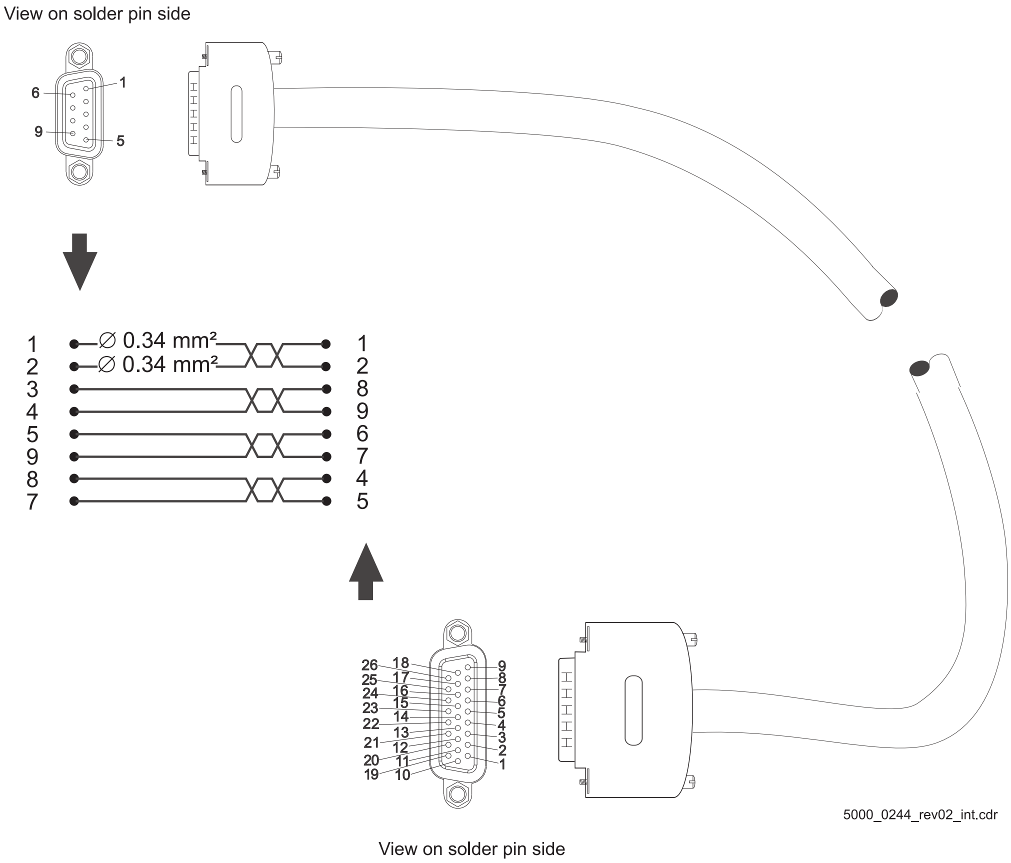


Figure 116: Connection cable IEE

NOTE!

The connection cable must be made according above mentioned instruction, pin assignment IEE refer to ▹Add-on modules◃ on page 204!

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 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 side, pin assignment refer to ▷Connecting cable for sine/square-wave incremental encoder◁ on page 252) 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.

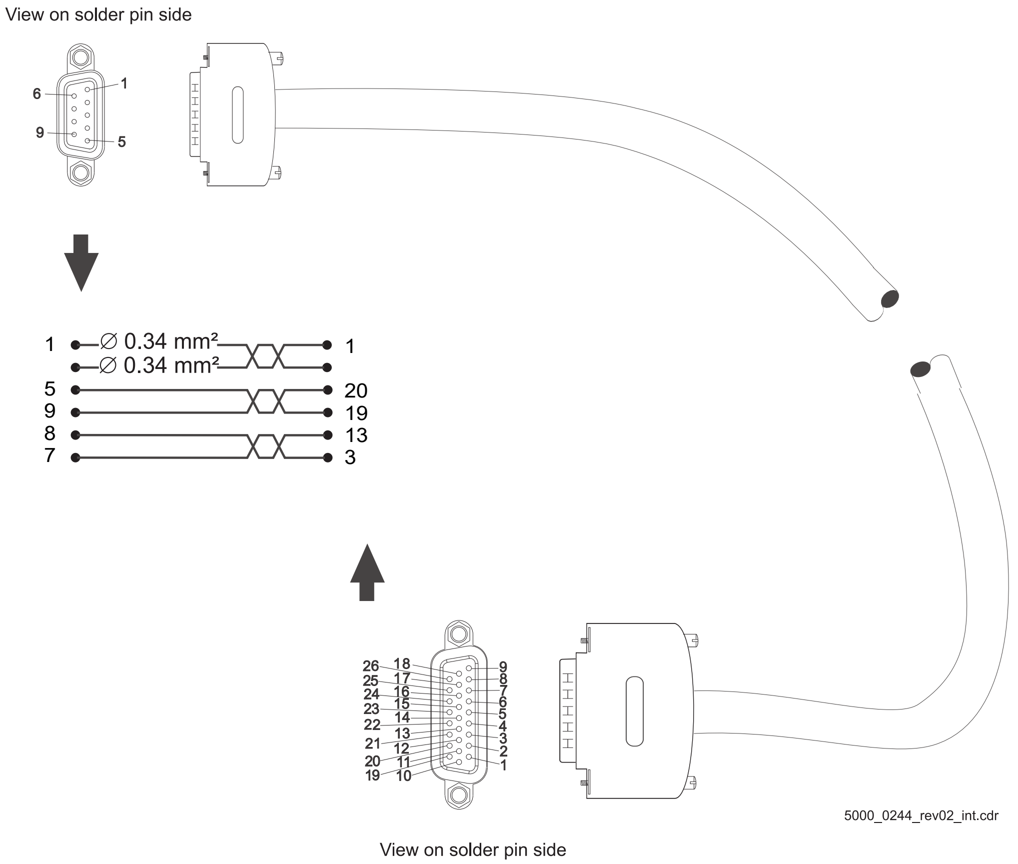


Figure 117: Connection cable IEE

11.2 Fuses mono units

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 fuses must be used in UL-authorized systems, refer to ▷UL notes◁ as from page 109.

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 groand 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.

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 destruction.

Dimension suitable device protection fuses depending on peak current and the maximum load integral i^2t_{off}.

Device	Maximum load integral 1)
BM65**1**X	≤ 310 A^2s
BM65**22**	≤ 400 A^2s
BM65**23**	≤ 450 A^2s
BM65**24**	≤ 650 A^2s
BM65**25**, BM65**26**, BM65**27**	≤ 800 A^2s
BM65**3**X	≤ 9 500 A^2s

11.2 Fuses mono units

Device	Maximum load integral [1]
BM65**4**X	≤ 28 500 A^2s
BM65**5**X	≤ 125 000 A^2s
BM65**6**X	≤ 360 000 A^2s

[1] Use fuses that fall below the specified cutoff integral (i^2t_{off}) **in the operating point**.

NOTICE!

Each device must be protected with its own protection fuse.

The specified fuses are recommendations from the fuse manufacturer.

The user should nevertheless check the suitability of the fuse for his application. The fuse may age prematurely, especially ander heavy alternating loads.

11.2.1 Fuses BM651X

- General purpose fuses gR and gS, type NH

Bussmann	000	16A/690V: 170M1559	20A/690V: 170M1560
		25A/690V: 170M1561	
SIBA	000	16A/690V: 2047734/16A	
	00	20A/690V: 2047720/20A	25A/690V: 2047720/25A
	0	16A/1000V: 2038404/16A	20A/1000V: 2038404/20A
		25A/1000V: 2038404/25A	32A/1000V: 2038404/32A
Siemens	000	16A/690V: 3NE1 813-0	
	00	25A/690V: 3NE8 015-1	20A/690V: 3NE8 714-1
		25A/690V: 3NE8 715-1	
	0	32A/1000V: 3NE4 101	

Size

11.2.2 Fuses BM652X

- BM6522: full-range fuses gR and gS, type NH

Bussmann	000	16A/660V: 170M1559	20A/660V: 170M1560
		25A/660V: 170M1561	32A/660V: 170M1562
	00	16A/690V: 170M2692	20A/690V: 170M2693
		25A/690V: 170M2694	32A/690V: 170M2695
SIBA	000	16A/690V: 2047734/16A c US	
	00	20A/690V: 2047720/20A	25A/690V: 2047720/25A
Siemens	00	16A/690V: 3NE1 813-0 c US	20A/660V: 3NE8 714
		25A/660V: 3NE8 715	25A/660V: 3NE8 015
		32A/660V: 3NE8 701	
	0	32A/1000V: 3NE4 101 c US	

Size

- BM6522: semiconductor fuses aR, type NH

Bussmann	00	20A/1000V: 170M2673	25A/1000V: 170M2674
		32A/1000V: 170M2675	
	1	40A/660V: 170M3808	
Ferraz Shawmut	000	16A/690V: 6,9 URD 000 PV 016	20A/690V: 6,9 URD 000 PV 020
		25A/690V: 6,9 URD 000 PV 025	32A/690V: 6,9 URD 000 PV 032

Size

- BM6523: full-range fuses gR and gS, type NH

Bussmann	000	20A/660V: 170M1560	25A/660V: 170M1561
		32A/660V: 170M1562	
	00	20A/690V: 170M2693	25A/690V: 170M2694
		32A/690V: 170M2695	
Ferraz Shawmut	000	20A/690V: 6,9 GGR 000 PV 020	
	00	20A/690V: 6,9 GGR 00 PV 020	
SIBA	000	20A/690V: 2047734/20A c US	
	00	20A/690V: 2047720/20A	25A/690V: 2047720/25A

Size

Siemens	00	20A/660V: 3NE8 714	20A/690V: 3NE1 814-0
		25A/660V: 3NE8 715	25A/660V: 3NE8 015
		32A/660V: 3NE8 701	
	0	32A/1000V: 3NE4 101	

Size

- BM6523: semiconductor fuses aR, type NH

Bussmann	00	20A/1000V: 170M2673	25A/1000V: 170M2674
		32A/1000V: 170M2675	
	1	40A/660V: 170M3808	
Ferraz Shawmut	000	20A/690V: 6,9 URD 000 PV 020	25A/690V: 6,9 URD 000 PV 025
		32A/690V: 6,9 URD 000 PV 032	40A/690V: 6,9 URD 000 PV 040

Size

- BM6524, BM6525 and BM6526: full-range fuses gR and gS, type NH

Bussmann	000	25A/660V: 170M1561	32A/660V: 170M1562
	00	25A/690V: 170M2694	32A/690V: 170M2695
Ferraz Shawmut	000	25A/690V: 6,9 GGR 000 PV 025	
	00	25A/690V: 6,9 GGR 00 PV 025	
SIBA	000	25A/690V: 2047734/25A	
	00	25A/690V: 2047720/25A	
Siemens	00	25A/660V: 3NE8 715	25A/660V: 3NE8 015
		25A/690V: 3NE1 815-0	32A/660V: 3NE8 701
	0	32A/1000V: 3NE4 101	

Size

- BM6524, BM6525 and BM6526: semiconductor fuses aR, type NH

Bussmann	00	25A/1000V: 170M2674	32A/1000V: 170M2675
		40A/1000V: 170M2676	
	1	40A/660V: 170M3808	50A/660V: 170M3809
		63A/660V: 170M3810	

Size

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	

Size

- BM6527: full-range fuses gR and gS, type NH

Bussmann	000	32A/660V: 170M1562	
	00	32A/690V: 170M2695	
Siemens	00	32A/660V: 3NE8 701	
	0	32A/1000V: 3NE4 101 c us	

Size

- BM6527: semiconductor fuses aR, type NH

Bussmann	00	32A/1000V: 170M2675	40A/1000V: 170M2676
	1	40A/660V: 170M3808	50A/660V: 170M3809
		63A/660V: 170M3810	
Ferraz Shawmut	000	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	

Size

11.2.3 Fuses BM653X

- General purpose fuses gR and gS, type NH

SIBA	1	80A/690V: 2021134.80
Siemens	000	80A/690V: 3NE1820-0
	00	100A/690V: 3NE1021-2

Size

- Semiconductor fuses aR, type NH

Bussmann	000	125A/690V: 170M1568D	
SIBA	000/80	125A/690V: 2028220.125	

Size

Siemens	0	100A/1000V: 3NE4 121	
	00	100A/690V: 3NE8021-1	125A/690V: 3NE8022-1
	000/80	125A/690V: 3NE8 722-1	
	1/110	125A/1000V: 3NE3 222	

Size

11.2.4 Fuses BM654X

- Semiconductor fuses aR, type NH

Bussmann	000	200A/690V: 170M1570D
Ferraz Shawmut	00	160A/690V: NH00GS69V16PV
SIBA	00C/80	160A/690V: 2028220.160

Size

11.2.5 Fuses BM655X

- BM6554 with power choke:
  Semiconductor fuses aR

Bussmann	NH1	400A/690V: 170M3819D
SIBA	NH1	350A/690V: 2021132.350RC210
Mersen	32/ DIN80	315A/690V: PC32UD69V315A
Siemens	NH1	250A/690V:3NE3230-0B

Size

- BM6554 without power choke:
  Semiconductor fuses aR

Bussmann	NH1	400A/690V: 170M3819D
SIBA	NH1	350A/690V: 2021132.400RC240
Mersen	32/ DIN80	315A/690V: PC32UD69V350A
Siemens	NH1	350A/1000V:3NE3231

Size

- BM6555 with power choke:
  Semiconductor fuses aR

Bussmann	NH2	500A/690V: 170M5810D
SIBA	NH1	450A/690V: 2021132.450RC270
Mersen	32/ DIN80	400A/690V: PC32UD69V400A
Siemens	NH1	400A/1000V:3NE3232-0B
Size		

- BM6555 without power choke:
  Semiconductor fuses aR

Bussmann	NH2	500A/690V: 170M5810D
SIBA	NH1	500A/690V: 2021132.500RC300
Mersen	32/ DIN80	450A/690V: PC32UD69V450A
	33/ DIN80	450A/690V: PC32UD69V450A
Siemens	NH1	450A/1000V:3NE3233
Size		

- BM6556 with power choke:
  Semiconductor fuses aR

Bussmann	NH3	550A/690V: 170M6809D
SIBA	NH1	500A/690V: 2021132.500RC300
Mersen	32/ DIN80	400A/690V: PC32UD69V400A
Siemens	NH1	400A/1000V:3NE3232-0B
Size		

- BM6556 without power choke:
  Semiconductor fuses aR

Bussmann	NH3	550A/690V: 170M6809D
SIBA	NH1	550A/690V: 2021132.550RC330
Mersen	32/ DIN80	450A/690V: PC32UD69V450A
	33/ DIN80	450A/690V: PC32UD69V450A
Siemens	NH1	450A/1000V:3NE3233
Size		

11.2.6 Fuses BM656X

- BM6563 with power choke:
  Semiconductor fuses aR

Siemens	NH2	400A/1000V:3NE3332-0B
	NH2	450A/1000V:3NE3333
	NH2	500A/1000V:3NE3334-0B
	NH2	560A/1000V:3NE3335

Size

- BM6563 without power choke:
  Semiconductor fuses aR

Siemens	NH2	400A/1000V:3NE3332-0B
	NH2	450A/1000V:3NE3333
	NH2	500A/1000V:3NE3334-0B
	NH2	560A/1000V:3NE3335

Size

- BM6564 with power choke:
  Semiconductor fuses aR

Siemens	NH2	500A/1000V:3NE3334-0B
	NH2	560A/1000V:3NE3335
	NH2	710A/900V:3NE3337-8

Size

- BM6564 without power choke:
  Semiconductor fuses aR

Siemens	NH2	500A/1000V:3NE3334-0B
	NH2	560A/1000V:3NE3335
	NH2	710A/900V:3NE3337-8

Size

- BM6565 with power choke:
  Semiconductor fuses aR

Siemens	NH2	560A/1000V:3NE3335
	NH2	710A/900V:3NE3337-8
	NH2	800A/800V:3NE3338-8

Size

- BM6565 without power choke:
  Semiconductor fuses aR

Siemens	NH2	560A/1000V:3NE3335
	NH2	710A/900V:3NE3337-8
	NH2	800A/800V:3NE3338-8

Size

- BM6566 with power choke:
  Semiconductor fuses aR

Siemens	NH2	800A/800V:3NE3338-8
	NH3	1100A/690V:3NC3342-1U

Size

- BM6566 without power choke:
  Semiconductor fuses aR

Siemens	NH2	800A/800V:3NE3338-8
	NH3	1100A/690V:3NC3342-1U

Size

11.3 Circuit breaker mono units

- BM651X / BM652X

Siemens	3VA5112-6ED31-0AA0: 65 kA @ 480 V, I_n = 125 A

- BM653X

Siemens	3VA5112-6ED31-0AA0: 65 kA @ 480 V, I_n = 125 A
Eaton	NZMB2-AF125-NA: 25 kA @ 480 V, I_n = 125 A

- BM654X

Siemens	3VA5225-6ED31-0AA0: 65 kA @ 480 V, I_n = 250 A
Eaton	NZMB2-AF250-NA: 25 kA @ 480 V, I_n = 250 A

- BM655X

Siemens	3VA5335-6EC31-0AA0: 65 kA @ 480 V, I_n = 350 A
Eaton	NZMN3-AEF350-NA: 42 kA @ 480 V, I_n = 350 A

- BM656X

Siemens	3VA5460-6EC31-0AA0: 65 kA @ 480 V, I_n = 600 A
Eaton	NZMN3-AEF600-NA-NA: 48 kA @ 480 V, I_n = 600 A

11.4 DC link fuses power modules BM65DX, BM65EX, BM65FX

NOTICE!

A fuse is required in the 1C1 line and one in the 1D1 line with devices BM**E**X and BM**F**X.

- BM65DX

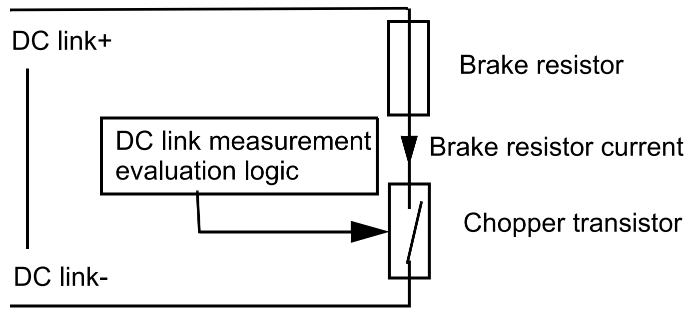
Siemens	400 A: 3NB1234-4KK11
Eaton Bussmann	700 A: 170M5447 700 A: 170M5147 700 A: 170M5197
Littlefuse	630 A: PSR072UL0630.X
Mersen	800 A: PC73UD12C800D1A
Siba	630 A: 90 281 25.630 800 A: 90 290 25.800 630 A: 90 545 25.630

- BM65FX

Eaton Bussmann	800 A: 170M5198

11.5 Brake resistors

The minimum permissible resistance value $R_{min\ brake\ resistor}$ depends on the device 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

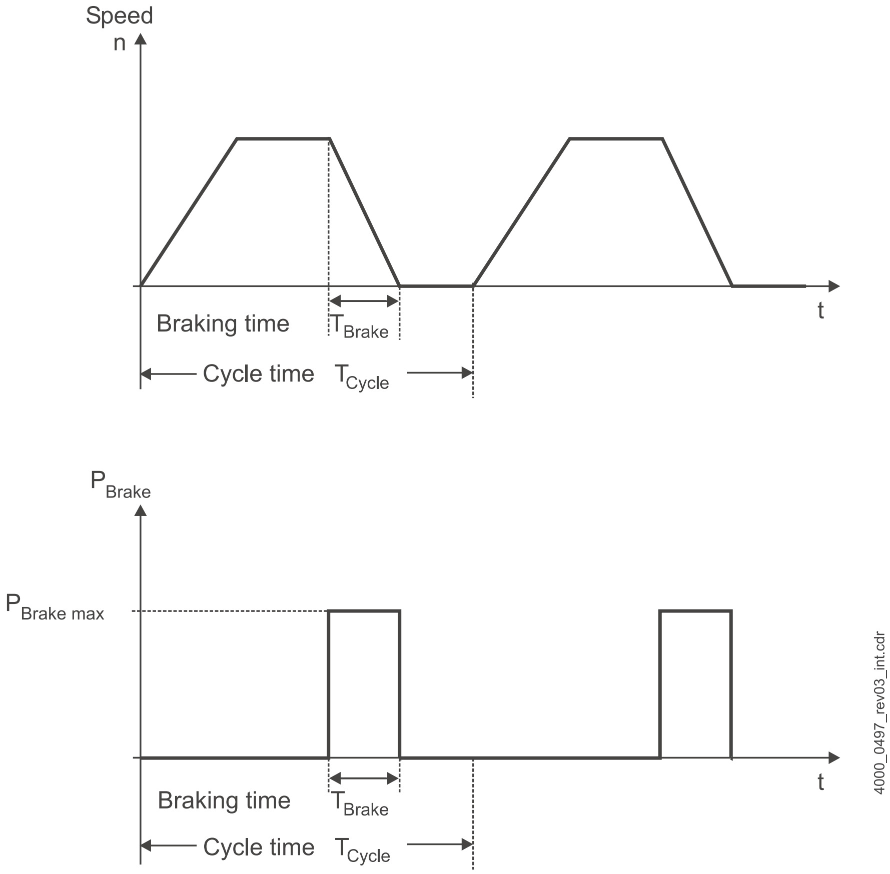
$P_{brake\ resisitor}$ = brake resistor power

$I_{max\ brake\ resisitor}$ = maximum permissible brake resistor current of the device (refer to ▹Electrical data mono units◃ as from page 66)

$$I_{brake\ resistor} = \frac{P_{brake\ resistor}}{U_{DClink\ chopper\ resistor\ on}}$$

$$R_{min\ brake\ resistor} = \frac{U_{DClink\ brake\ resisitor\ on}}{I_{max\ brake\ resisitor}}$$

The machine cycle of the application determines the further resistor data.



M_{Brake} = torque of the motor when braking

$$P_{Bake\ max.} = \frac{1}{2} \cdot n \cdot M_{Brake} \quad \text{(calculation by means of drive profile)}$$

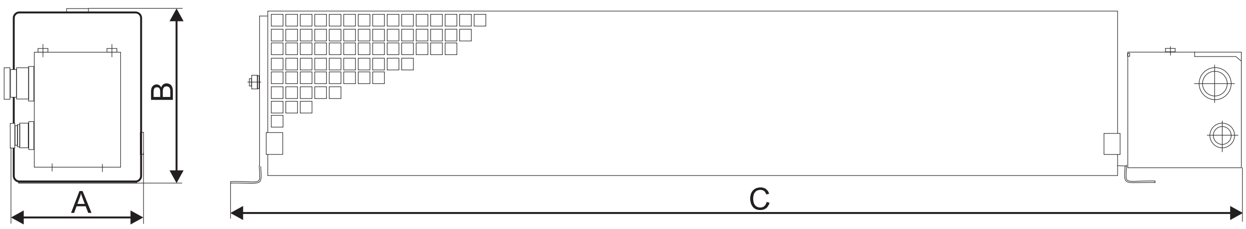
$$P_{Brake\ rated} = P_{Brake\ max.} \cdot \frac{T_{Brake}}{T_{Cycle}}$$

$$ED[\%] = \frac{T_{Brake}}{T_{Cycle}} \cdot 100\ \%$$

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

11.5.1 Fixed tube resistors

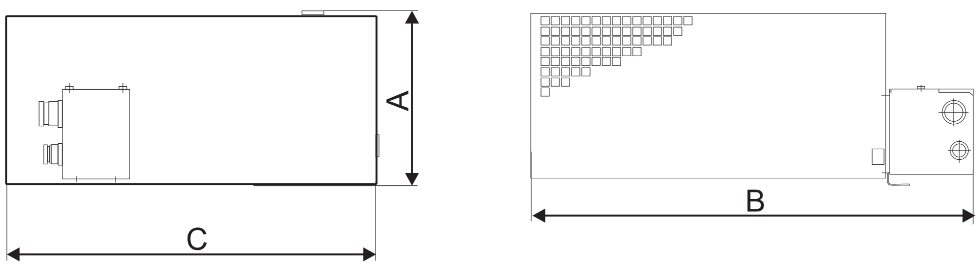


Protection class: IP 20

Approval: Approved UL-certified resistors must be used in UL-compliant systems, see ▷UL notes◁ as from page 109.

Resis-tance value	Rated output	Dimensions A x B x C	Weight	Tempera-ture 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

11.5.2 Fixed frame resistors



Protection class: IP 20

Approval: Approved UL-certified resistors must be used in UL-compliant systems, see ▷UL notes◁ as from page 109.

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

11.6 Line filters mono units

DANGER!

Risk of fatal injury due to high leakage current!

The cross-section of the protective groand conductor must be at least 10 mm² (EN 61800-5-1, Chapter 4.3.5.5.2).

NOTE!

Each device must have its own line filter.

Block diagram of filter for mains applications (simplified)

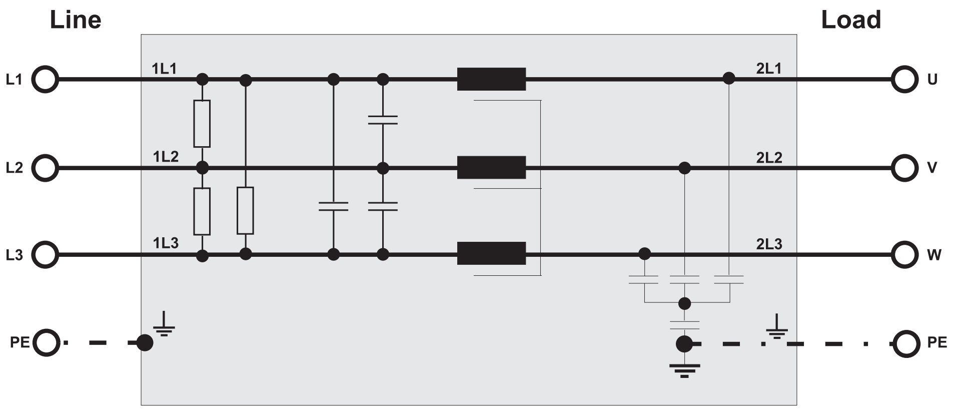


Figure 118: Block diagram

Filter type code

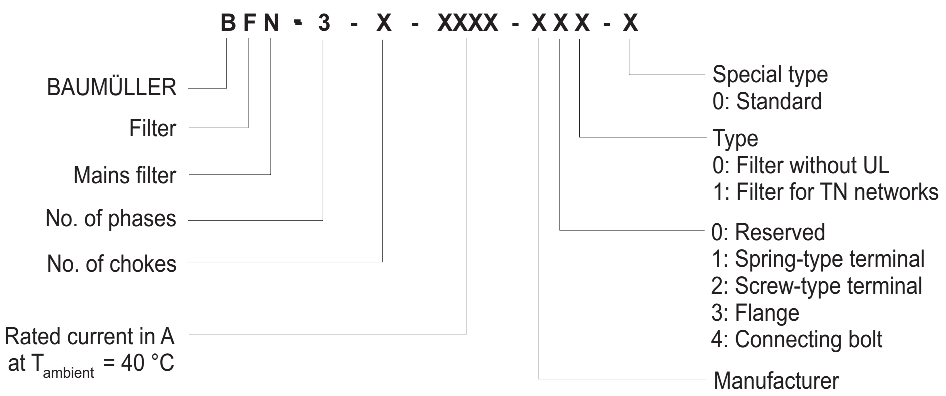


Figure 119: Line filter type code

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 groand fault) can lead to the damage of the line filter.

It is not recommended to use line filter in IT systems. The transient emission can exceed the limit values of category C3.

TN systems Based on the application, use an line filter from the following table.

$I_{rated\ AC}$ at 50°C	Type [2]	Part number	Use with devices operation at rated power [1]
7 A	BFN-3-1 - 0007 - 001	314277	BM6512
16 A	BFN-3-1 - 0016 - 001	314278	BM6513, BM6522
30 A	BFN-3-1 - 0030 - 001	498320	BM6514, BM6515, BM6516 BM6523, BM6524, BM6525, BM6526, BM6527 BM6532
42 A	BFN-3-1 - 0042 - 001	498341	BM6533
75 A	BFN 3-1 - 0075 - 001	314282	BM6534, BM6535
100 A	BFN 3-1 - 0100 - 001	314283	BM6543, BM6544
130 A	BFN 3-1 - 0130 - 001	314284	BM6545
150 A	TDK B84143A0150R410	437618	BM6546
250 A 320 A	BFN 3-1 - 0250 - 001 BFN 3-1 - 0320 - 001	373891 439384	BM6554
320 A 400 A	BFN 3-1 - 0320 - 001 BFN 3-1 - 0400 - 001	439384 373900	BM6555, BM6556, BM6563
400 A	BFN 3-1 - 0400 - 001	373900	BM6564
600 A	BFN 3-1 - 0600 - 001	373901	BM6565, BM6566

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 overcurrent 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.

2) Depending on how often and how long peak current is needed.

Environmental conditions

Transport temperature range	-30 °C to +70 °C
Transport climate class	2K12 [1)]
Storage temperature range	-30 °C to +70 °C
Storage climate class	1K22 [1)]
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	3K22 [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 [5)]
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 [6)]	3K3, 3B1, 3C3 except for salt spray, 3S2, 3M3

1) EN IEC 60721-3-2:2018

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 IEC 60721-3-1:2018

6) EN IEC 60721-3-3:2018

Electrical data

NOTE!

The rated current of the filters that are used must be larger than or have same RMS-value as the actual power supply current (actual power supply current = RMS-value of the power supply current during the entire cycle time of the drive). During short-time operation (S3), the RMS-value is calculated as follows:

$$I_{rms} = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$$

BFN 3-1- ... -001	0007	0016	0030	0042	0056	0075	0100	0130	180
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	195 A
Rated current (at T_B = 50 °C)	7 A	16 A	30 A	42 A	56 A	75 A	100 A	130 A	180 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	95 mm²
Power loss (typical)	4 W	8 W	12 W	15 W	18 W	24 W	24 W	30 W	35 W
Harmonic frequencies (power supply 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	6.0 kg

BFN 3-1-... -001	0250	0320	0400	0600
Max. supply voltage	3 x 480 V_{AC} +10 %, 50/60 Hz			
Rated current (at T_B = 50 °C)	250 A	320 A	400 A	600 A
Peak current (at T_B = 50 °C)	4 x I_N at switch-on 1,5 x I_N for < 1 min / once per hour			
Test voltage	Cable - Cable: 2150 V_{DC} / 2 s Cable - Cabinet: 2700 V_{DC} / 2 s			
Connection	Bolt M10	rail with hole ∅ 11mm PE: Bolt M12		
Power loss (typical)	60 W	40 W	50 W	65 W
Protection class	IP 00			

BFN 3-1-... -101	0320	0400	0600	1000
Max. supply voltage	3 x 480 V_{AC} +10 %, 50/60 Hz			
Rated current (at T_B = 50 °C)	320 A	400 A	600 A	1000 A
Peak current (at T_B = 50 °C)	1.5 x I_N for < 3 min per hour or 2.5 x I_N for 30 s per hour			
Test voltage	Cable - Cable: 2280 V_{DC} / 2 s Cable - Cabinet: 2690 V_{DC} / 2 s			
Connection	Rail with hole ∅ 11mm PE: Bolt M10			Rail with hole ∅ 14mm PE: Bolt M12
Power loss (typical)	31 W	48 W	84 W	
Protection class	IP 00			

11.7 Power chokes mono units

NOTE

UL certified power chokes must be used in UL compliant machines/systems.

NOTE!

If the use of a choke is necessary, each device must have its own choke

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 power supply, so that the required power supply 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 power supply frequency can be calculated.

NOTE

The nominal inductance is constant up to 1.5 times of nominal current. You can expect that the inductance is reduced if the current flow through the commutation choke is higher than this value. If it is important for the application, that the commutation inductance is equal its nominal value when for longer time (e. g. with 30 s) peak current at peak power is needed, chose a commutation choke with a peak current smaller or equal of the 1.5 times of the nominal value of the commutation choke.

If you have any doubt selecting a commutation choke for a specific application, please contact the responsible sales representative of Baumüller.

Type key

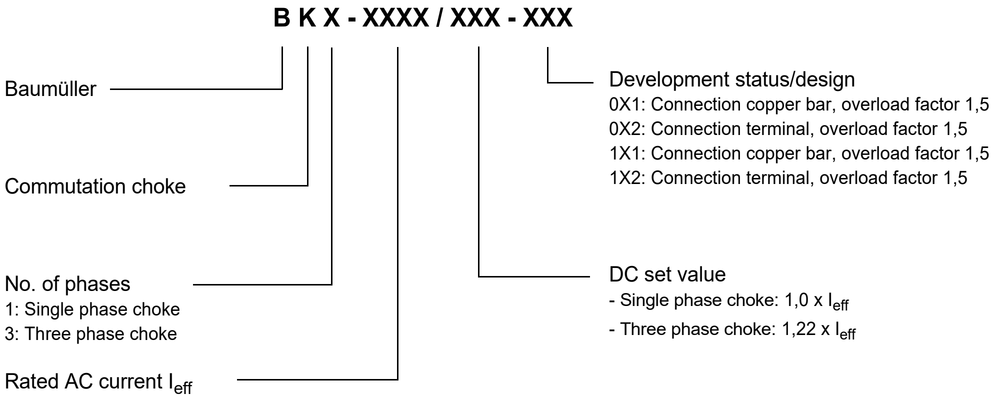


Figure 120: Type code power chokes

Electrical data

Rated voltage max. 600 V, rated frequency 50/60 Hz,
terminal / flat connector, IP 00,
operating temperature up to 45 °C, with a current derating by 1 % per °C up to 55 °
operating height up to 2000 m, with a current derating by 1 % per 100 m above 2000 m

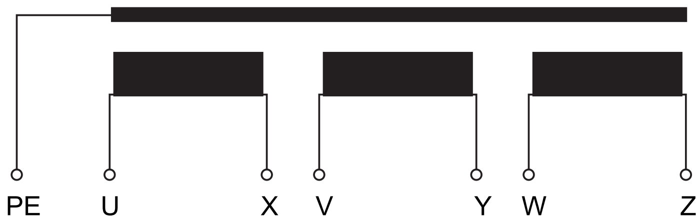
Power choke	I_{AC} [A]	I_{DC} [A]	L [mH]	Power loss [W]	Weight [kg]	Use in operation at rated power 1)
BK3-0022-0027-112 BK3-0022-0027-111	22	27	1.31	57	6.8	BM6526 BM6532
BK3-0030-0037-112 BK3-0030-0037-111	30	37	0.72	66	7.5	BM6527 BM6533
BK3-0045-0055-112 BK3-0045-0055-111	45	55	0.6536	122	10	BM6534
BK3-0080-0098-112 BK3-0080-0098-111	80	98	0.3676	137	16,5	BM6535 BM6543
BK3-0100-0122-112 BK3-0100-0122-111	100	122	0.2941	185	19,0	BM6544
BK3-0165-0201-112 BK3-0165-0201-111	165	201	0.1783	214	29,5	BM6545, BM6546
BK3-0210-0256-111	210	256	0.1401	255	29,5	BM6554
BK3-0260-0317-111	260	317	0.1131	333	42,2	BM6555
BK3-0280-0341-112	280	341	0.105	293	53,7	BM6556
BK3-0350-0427-111	350	427	0.084	344	51,8	BM6563
BK3-0370-0451-112	370	451	0.08	299	63,5	BM6564

11.7 Power chokes mono units

Power choke	I_{AC} [A]	I_{DC} [A]	L [mH]	Power loss [W]	Weight [kg]	Use in operation at rated power [1)]
BK3-0450-0549-111	450	549	0.065	418	62	BM6565
BK3-0520-0634-111	520	634	0.0566	465	65,5	BM5666-S/A
BK3-0615-0750-111	615	750	0.048	570	92,5	BM5666-F/Z

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.

Connection diagram



Dimensions

BK3-	Connection Terminal	Part No.	I_{AC} [A]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	F [mm]	PE
0022/0027-112	2,5-10 mm²	496543	22	155	160	105	130	72	8,0	M6-30
0030/0037-112	2,5-16 mm²	497981	30	190	235	110	170	58	8,0	M6-30
0045/0055-112	4-16 mm²	496536	45	190	235	110	170	58	8,0	M6-30
0080/0098-112	10-50 mm²	495922	80	230	298	145	180	98	4-8,5x14	M6-30
0100/0122-112	10-50 mm²	496548	100	230	298	180	180	122	4-10x15	M6-30
0165/0201-112	50-95 mm²	495924	165	240	315	195	190	125	4-11x18	M6-30
0280-0341-112	70-150 mm²	496540	280	330	305	260	298	195	4-10x25	M8-30
0370-0451-112	70-240 mm²	496550	370	394	305	325	358	245	4-10x15	M8-30

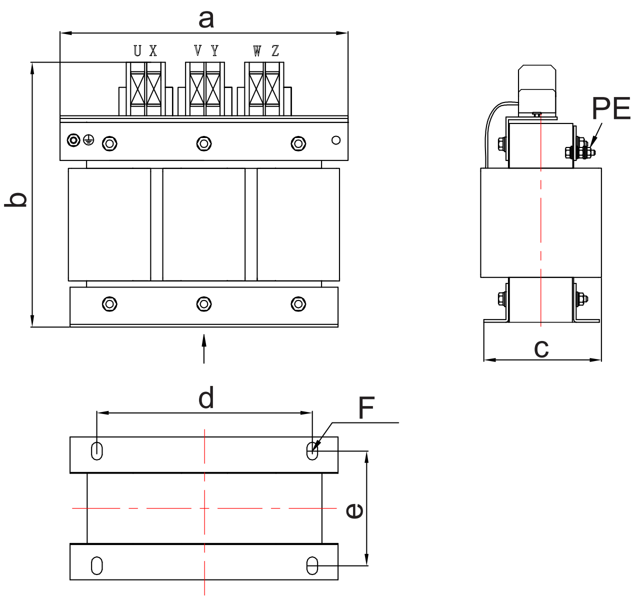


Figure 121: Dimensions power choke with terminal

BK3-	Flat connection g/h ∅i [mm]	Part No.	I_{AC} [A]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f [mm]	F [mm]	PE
0022/0027-111	20/11 ∅ 8	496545	22	155	137	140	100	130	72	8	M6-30
0045/0055-111	20/11 ∅ 8	496546	45	190	163	130	120	170	58	8	M6-30
0080/0098 -111	25/13 ∅ 11	496538	80	230	206	175	152	180	98	4-10x15	M6-30
0100/0122 -111	25/13 ∅ 11	495923	100	230	202	195	152	180	122	4-10x15	M6-30
0165/0201 -111	25/13 ∅ 11	496539	165	240	216	215	160	190	125	4-11x18	M6-30
0210-0256 -111	25/13 ∅ 11	495925	210	265	230	205	175	215	126	4-11x18	M8-30

BK3-	Flat connection g/h ∅i [mm]	Part No.	I_{AC} [A]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f [mm]	F [mm]	PE
0260-0317-111	30/15 ∅ 11	495926	260	300	270	225	200	240	145	4-10x15	M8-30
0350-0427-111	40/20 ∅ 13	495927	350	362	320	230	240	310	125	4-11x18	M8-30
0450-0549-111	50/23 ∅ 13	496541	450	360	325	270	240	310	140	4-11x18	M8-30
0520-0634-111	50/23 ∅ 13	495928	520	362	325	270	240	310	140	4-11x18	M8-30
0615-0750-111	60/25 ∅ 13	496551	615	420	375	285	280	370	151	4-11x18	M8-30

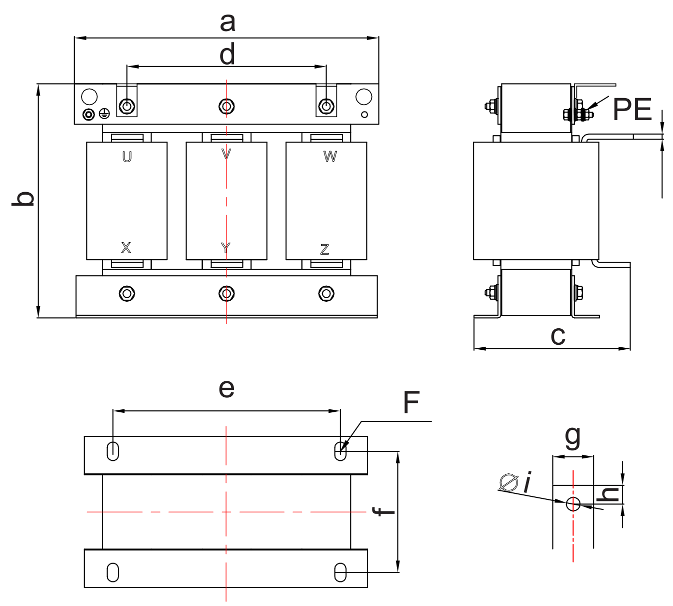


Figure 122: Dimension power choke with flat connection

11.8 Spare parts

11.8.1 Plug connectors

	Stripping length	BM651X	BM652X	BM653X	BM654X	BM655X	BM656X	Part No.
Connector DIO X2 Weidmüller 20-pin 1277550000	7 mm	X	X	X	X	X	X	479956
Connector SDIO X9 Weidmüller 4-pin 1277460000	7 mm	X	X	X	X	X	X	454680
Connector SDIO X9 Weidmüller 34-pin 1277630000	7 mm	X	X	X	X	X	X	483653
Connector Ba+/Ba- X18 Phoenix 2-pin 1711268	18 mm				X	X	X	493094
Connector ballast X101 Phoenix 2-pin 1745629	8 mm	X						428716
Connector Zwischenkreis X102 Phoenix 2-pin 1745645	8 mm	X						416909
Connector power supply X103 Weidmüller 4-pin 1173530000	7 mm	X						505476
Connector X200 Phoenix 2-pin THT 1711708	9 - 10 mm	X	X	X	X	X	X	425794
Connector Motor X201 Weidmüller 4-pin 1173530000	7 mm	X						505475
Connector motor temp/brake X207 Weidmüller 6-pin 2671700000	7 mm	X	X	X	X	X	X	451695
Ribbon cable bracket for X300 Richco FCCS-2		X	X	X	X	X	X	430152

11.8.2 Accessory pack ferrite cores (to achieve industrial network C2)

Device	Part-No.
BM654X	504546
BM655X	504547

11.8.3 Encoder adapter BM4000 to BM6000

Type of encoder	Part-No.
Resolver	50988
SinCos Encoder	509888
Incremental encoder	509889
Endat 2.1 encoder	509890

11.9 Toroidal cores

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 basic/axis units series **b maXX 6500**:

- **BM65XX** or system **without** active mains rectifier unit (system without 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, DISPOSAL

In this chapter we describe, how you decommission and store the device.

12.1 Safety instructions

- Refer to ▹Safety◃ as from page 13 and the information in ▹Transport and Packaging◃ as from page 121.

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.

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 necedörk
- ssary 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.

12.1 Safety instructions

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.

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.

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.

12.2 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.

12.3 Demounting

The demounting assumes a completed, documented setting out of operation.

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 refer to ▷What to observe when transporting◁ on page 121.

In case you want to dispose the device, additional data is available in chapter ▷Disposal◁ as from page 287.

12.4 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 1K22 (EN IEC 60721-3-1:2018)
- Temperature range -25 °C to +55 °C

12.5 Recommissioning

Execute commissioning as with a new device, refer to ▹Mounting◃ as from page 123, ▹Installation◃ as from page 153.

NOTICE!

Recommissioning without forming of the capacitors.

From 12 months storage period on, the capacitors can be 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 reactor for this forming procedure. Devices, where no line commutating reactor is necessary can directly be supplied with power supply voltage.

From a storage period of 24 months, extended forming is necessary, refer to ▹Forming of the capacitors◃ as from page 285.

12.6 Forming of the capacitors

12.6.1 Connection diagram

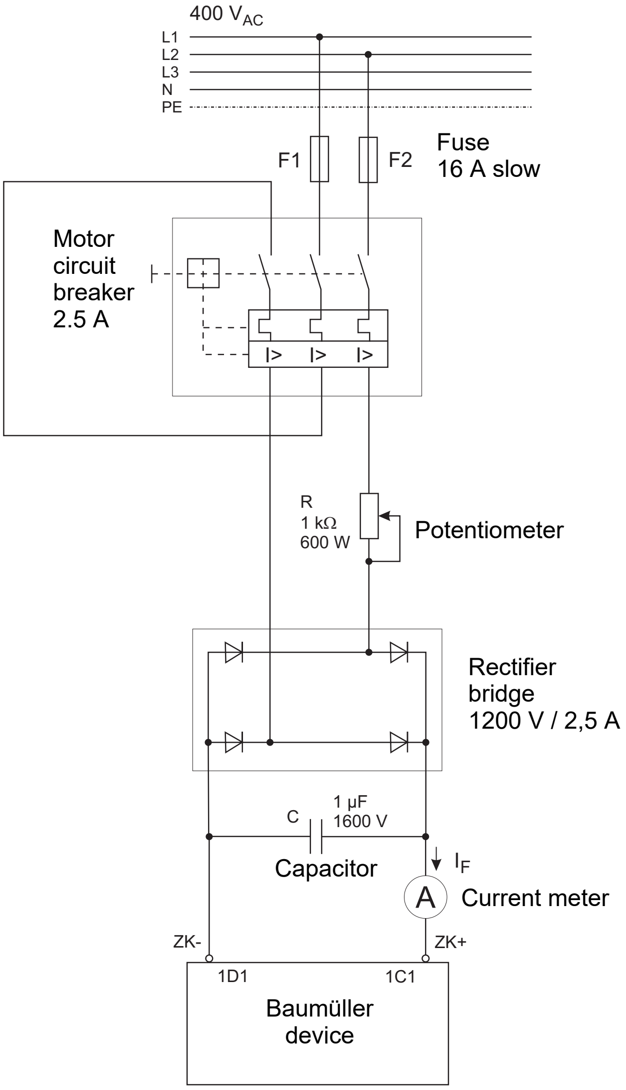


Figure 123: Connecting diagram forming

12.6.2 Installation procedure forming

Preparation

1. Check the demands on the power supply.
2. Check the properties of the connections and the specified configuration of the respective cables.
3. Build circuit (set R to 1 kΩ) and connect, refer to ▷Connection diagram◁ on page 285.
4. Read max. residual current from table ▷Page 287◁ and following.
5. Switch on mains power supply.

12.6 Forming of the capacitors

NOTE!

Forming shall only be performed by employees of the manufacturer or by other qualified personnel, for further notes refer to ▷Installation◁ as from page 153.

Forming the capacitors can be may require a longer time.

Forming

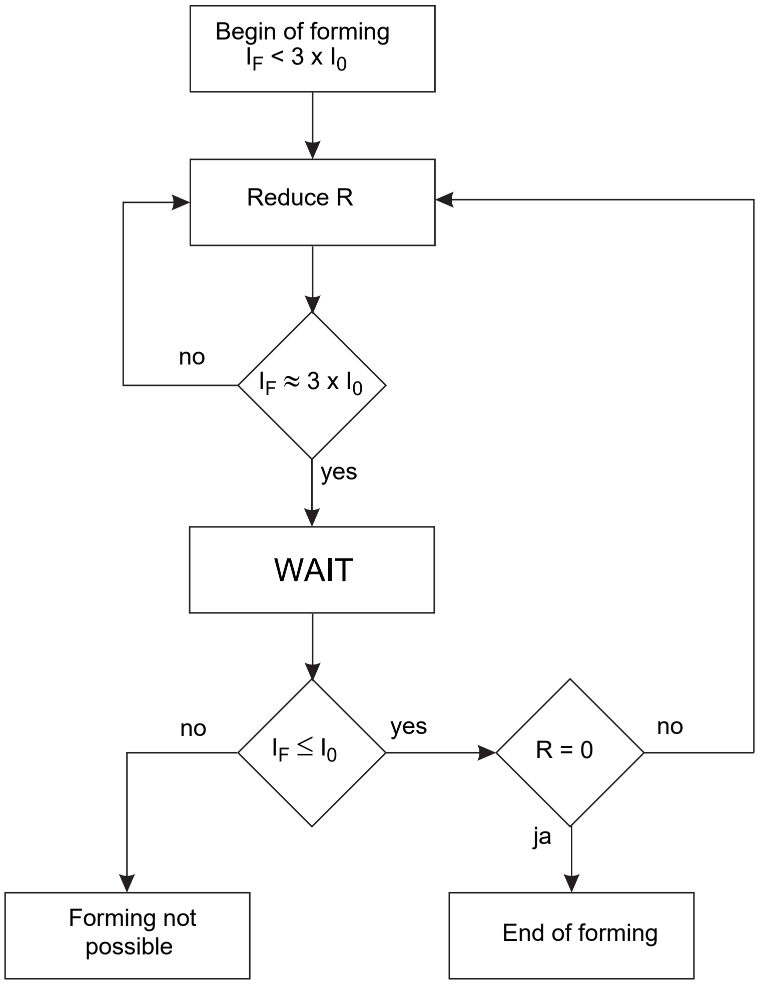


Figure 124: Forming procedure

NOTICE!

Forming of the capacitors will not be possible if the current $I_F \leq I_0$ is not reached although a longer time has passed. Do not operate the device and contact the customer service.

12.6.3 Forming residual currents

Device	I_0
BM65**1**X	2 mA
BM65**2**X	3 mA
BM65**3**X	8 mA
BM65**4**X, BM65**D**X	23 mA
BM65**5**X, BM65**E**X	24 mA
BM65**6**X, BM65**F**X	47 mA

12.7 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.

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.

A

APPENDIX A - INFORMATION ACCORDING EU ECO-DESIGN DIRECTIVE 2019/1781

NOTE!

Following devices are excluded from the EU Eco-Design Directive 2019/1781:

Brand:	Baumüller	
Type:	Power module safety	BM65DX, BM65EX, BM65FX

Reason:
The devices are not connected to a three-phase system.

Model	BM651X						
Manufacturer	Baumüller						
Type	BM6512	BM6513	BM6514	BM6515	BM6516		Operation point (% nominal output frequency; % nominal output current)
	without power choke						
Power loss of output apparent power S_N	2.44	1.56	1.24	2.83	0.31	%	12;25
	2.66	1.81	1.24	3.05	2.17	%	12;50
	3.17	2.37	1.82	3.61	2.42	%	12;100
	2.48	1.59	1.27	2.91	3.06	%	50;25
	2.76	1.88	1.49	3.27	2.72	%	50;50
	3.45	2.55	1.98	4.32	4.01	%	50;100
	2.87	1.95	1.55	3.55	3.08	%	90;50
	3.74	2.75	2.14	5.19	5.18	%	90;100
Power loss in standby	max. 18					W	
Efficiency level IEC61800-9-2	IE2						
Output apparent power	1.56	2.65	4.01	4.8	6.4	kVA	
Indicative nominal output power P_N	1.1	2	2.7	3.2	4.3	kW	
Nominal output current	2.5	4.5	5.5	7.5	10	A	
Maximum operation temperature	55					°C	
Nominal input frequency	50					Hz	
Nominal input voltage	400					V	

Model	BM652X							
Manufacturer	Baumüller							Operation point (% nominal output frequency; % nominal output current)
Type	BM6522 -S-, -A-	BM6523 -S-, -A-	BM6524 -S-, -A-	BM6525 -S-, -A-	BM6526 -S-, -A-	BM6527 -S-, -A-		
Power loss of output apparent power S_N	0.92	0.82	0.82	0.82	0.60	0.51	%	12;25
	1.15	1.10	1.08	1.05	0.84	0.75	%	12;50
	1.68	1.75	1.70	1.58	1.40	1.32	%	12;100
	0.96	0.86	0.85	0.86	0.64	0.56	%	50;25
	1.24	0.23	1.20	1.16	0.96	0.87	%	50;50
	1.91	2.13	2.04	1.92	1.73	1.65	%	50;100
	1.33	1.38	1.33	1.30	1.06	0.94	%	90;50
	2.18	2.56	2.43	2.31	1.88	1.80	%	90;100
Power loss in standby	19.96						W	
Efficiency level IEC61800-9-2	IE2							
Output apparent power	4.95	6.42	8.65	8.65	13.47	17.02	kVA	
Indicative nominal output power P_N	3.4	5	6.8	6.8	10	11.5	kW	
Nominal output current	7.5	11	15	15	22.5	27	A	
Maximum operation temperature	55						°C	
Nominal input frequency	50						Hz	
Nominal input voltage	400						V	

Model	BM652X							
Manufacturer	Baumüller							Operation point (% nominal output frequency; % nominal output current)
Type	BM6522 -F-, -Z-	BM6523 -F-, -Z-	BM6524 --F-, -Z-	BM6525 -F-, -Z-	BM6526 -F-, -Z-	BM6527 -F-, -Z-		
Power loss of output apparent power S_N	0.88	0.74	0.76	0.76	0.56	0.48	%	12;25
	1.10	1.02	1.03	0.99	0.80	0.72	%	12;50
	1.63	1.68	1.64	1.52	1.37	1.29	%	12;100
	0.91	0.78	0.80	0.80	0.61	0.53	%	50;25
	1.19	1.15	1.14	1.10	0.92	0.84	%	50;50
	1.86	2.05	1.98	1.86	1.69	1.62	%	50;100
	1.28	1.30	1.27	1.24	1.02	0.92	%	90;50
	2.13	2.48	2.37	2.25	1.85	1.77	%	90;100
Power loss in standby	17.56						W	
Efficiency level IEC61800-9-2	IE2							
Output apparent power	4.95	6.42	8.65	8.65	13.47	17.02	kVA	
Indicative nominal output power P_N	3.4	5	6.8	6.8	10	11.5	kW	
Nominal output current	7.5	11	15	15	22.5	27	A	
Maximum operation temperature	55						°C	
Nominal input frequency	50						Hz	
Nominal input voltage	400						V	

Model	BM653X						
Manufacturer	Baumüller						
Type	BM6532	BM6533	BM6534	BM6535	BM6535		Operation point
	with power choke				without power choke		(% nominal output frequency ; % nominal output current)
Power loss of output apparent power S_N	0.7	0.7	0.7	0.4	0.6	%	12;25
	0.9	0.8	0.7	0.6	0.9	%	12;50
	1.4	1.3	1.2	1.2	1.6	%	12;100
	0.8	0.7	0.6	0.5	0.6	%	50;25
	1.0	0.9	0.8	0.7	1.0	%	50;50
	1.6	1.5	1.4	1.3	1.8	%	50;100
	1.1	1.0	0.9	0.8	1.1	%	90;50
	1.8	1.6	1.6	1.5	2.4	%	90;100
Power loss in standby	max. 68					W	
Efficiency level IEC61800-9-2	IE2						
Output apparent power	14	18.7	28	37.4	29	kVA	
Indicative nominal output power P_N	12	15.9	23.8	31.8	24.7	kW	
Nominal output current	22.5	30	45	60	60	A	
Maximum operation temperature	55					°C	
Nominal input frequency	50					Hz	
Nominal input voltage	400					V	

Model	BM654X									
Manufacturer	Baumüller									
Type	BM 6543	BM 6544	BM 6545	BM 6546	BM 6543	BM 6544	BM 6545	BM 6546		Operation point (% nominal output frequency ; % nominal output current)
	with power choke				without power choke					
Power loss of output apparent power S_N	0.57	0.5	0.44	0.43	0.59	0.64	0.72	0.8	%	12;25
	0.81	0.76	0.72	0.73	0.84	0.97	1.17	1.37	%	12;50
	1.41	1.42	1.47	1.52	1.47	1.81	2.39	2.85	%	12;100
	0.62	0.54	0.49	0.47	0.67	0.72	0.81	0.88	%	50;25
	0.91	0.76	0.83	0.84	1.04	1.17	1.38	1.57	%	50;50
	1.62	1.63	1.69	1.75	1.82	2.16	2.9	3.28	%	50;100
	1.03	0.98	0.95	0.99	1.33	1.46	1.67	1.86	%	90;50
	1.96	1.88	1.96	2.03	2.43	2.77	3.55	3.81	%	90;100
Power loss in standby	133								W	
Efficiency level IEC61800-9-2	IE2									
Output apparent power	49.9	62.4	81	93.5	49.9				kVA	
Indicative nominal output power P_N	45	55	75	90	45				kW	
Nominal output current	80	100	130	150	80	100	130	150	A	
Maximum operation temperature	55								°C	
Nominal input frequency	50								Hz	
Nominal input voltage	400								V	

Model	BM655X							
Manufacturer	Baumüller							
Type	BM 6543	BM 6544	BM 6545	BM 6543	BM 6544	BM 6545		Operation point (% nominal output frequency; % nominal output current)
	with power choke			without power choke				
Power loss of output apparent power S_N	0.51	0.41	0.32	0.51	0.41	0.32	%	12;25
	0.77	0.68	0.61	0.76	0.68	0.60	%	12;50
	1.40	1.34	1.30	1.38	1.33	1.29	%	12;100
	0.55	0.45	0.37	0.55	0.45	0.37	%	50;25
	0.88	0.80	0.73	0.89	0.80	0.73	%	50;50
	1.72	1.65	1.62	1.73	1.67	1.66	%	50;100
	0.98	0.90	0.83	1.02	0.94	0.88	%	90;50
	1.90	1.81	1.83	2.09	2.03	2.05	%	90;100
Power loss in standby	370	250	130	370	250	130	W	
Efficiency level IEC61800-9-2	IE2							
Output apparent power	131	155	187	131	155	187	kVA	
Indicative nominal output power P_N	126	150	180	126	150	180	kW	
Nominal output current	210	250	300	210	250	300	A	
Maximum operation temperature	55						°C	
Nominal input frequency	50						Hz	
Nominal input voltage	400						V	

Model	BM656X							
Manufacturer	Baumüller							
Type	BM 6563	BM 6564	BM 6565	BM 6563	BM 6564	BM 6565		Operation point (% nominal output frequency; % nominal output current)
	with power choke			without power choke				
Power loss of output apparent power S_N	0.69	0.63	0.58	0.69	0.63	0.58	%	12;25
	1.00	0.95	0.91	0.99	0.95	0.90	%	12;50
	1.77	1.75	1.77	1.74	1.74	1.74	%	12;100
	0.74	0.68	0.63	0.74	0.69	0.63	%	50;25
	1.14	1.09	1.06	1.12	1.09	1.03	%	50;50
	2.19	2.15	2.19	2.12	2.15	2.11	%	50;100
	1.27	1.21	1.18	1.25	1.22	1.15	%	90;50
	2.39	2.35	2.41	2.44	2.46	2.34	%	90;100
Power loss in standby	Max. 850						W	
Efficiency level IEC61800-9-2	IE2							
Output apparent power	192	224	269	192	224	269	kVA	
Indicative nominal output power P_N	165	193	234	165	193	234	kW	
Nominal output current	300	350	420	300	350	420	A	
Maximum operation temperature	55						°C	
Nominal input fre-quency	50						Hz	
Nominal input voltage	400						V	

Model	BM656X					
Manufacturer	Baumüller					
Type	BM 6566-S 6566-A	BM 6566-F 6566-Z	BM 6566-S 6566-A	BM 6566-F 6566-Z		Operation point (% nominal output frequency; % nominal output current)
	with power choke		without power choke			
Power loss of output apparent power S_N	0.57	0.45	0.57	0.45	%	12;25
	0.89	0.80	0.89	0.79	%	12;50
	1.75	1.73	1.73	1.71	%	12;100
	0.62	0.51	0.61	0.50	%	50;25
	1.03	0.95	1.02	0.93	%	50;50
	2.12	2.15	2.08	2.09	%	50;100
	1.15	1.08	1.14	1.05	%	90;50
	2.34	2.40	2.31	2.33	%	90;100
Power loss in standby	1.000	750	1.000	750	W	
Efficiency level IEC61800-9-2	IE2					
Output apparent power	320	385	320	385	kVA	
Indicative nominal output power P_N	278	335	278	335	kW	
Nominal output current	500	600	500	600	A	
Maximum operation temperature	55				°C	
Nominal input frequency	50				Hz	
Nominal input voltage	400				V	

APPENDIX B - DECLARATION OF CONFORMITY

BAUMÜLLER

Baumüller Nürnberg GmbH
Ostendstraße 80-90, 90482 Nürnberg, Phone: +49(0)911 5432-0, Fax: +49(0)911 5432-130, www.baumueller.com

EU – Declaration of Conformity

Doc.-No.: 5.24008.04
Date: 14-Apr-2026

according to Machinery Directive 2006/42/EC,
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:

Brand name: Baumüller
Type Mono units (with Safety function)

BM651□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM653□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM654□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM655□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM656□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□

□: Placeholder for 0 to 9 or a to Z
[□□]: corresponding part of the type code can be omitted

are developed, designed and manufactured in accordance with the Machinery Directive 2006/42/EC, the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU.

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Applied harmonized standards:

Standard	Title
EN 61800-5-1: 2007+A1:2017+A11:2021	Variable-speed electrical power drives Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-5-2: 2017	Variable-speed electrical power drives Part 5-2: Safety requirements - Functional
EN IEC 61800-3: 2019	Variable-speed electrical power drives Part 3: EMC requirements and specific test methods
DIN EN ISO 13849-1: 2023	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
EN 61508 Part 1-7: 2010	Functional safety of electrical/ electronic/ programmable electronic safety-related systems

Notified body for Machinery Directive 2006/42/EC: NB 0035, Cert. No. 01/205/5940.01/25

Attention must be paid to the safety instructions in the instruction handbook.

Subject to change of this declaration of EC conformity without notice.
Actual valid edition on request.

Baumüller Nürnberg GmbH

Ostendstraße 80-90, 90482 Nürnberg, Phone: +49(0)911 5432-0, Fax: +49(0)911 5432-130, www.baumueller.com

EU – Declaration of Conformity

Doc.-No.: **5.24008.04**
Date: **14-Apr-2026**

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:

Brand name: Baumüller

Type Mono units (without Safety function)

BM651□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM653□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM654□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM655□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□
BM656□ - □□□□[□□] - □□□ - □□ - □□ - □□□□□□ - E□□

□: Placeholder for 0 to 9 or a to Z
[□□]: corresponding part of the type code can be omitted

are developed, designed and manufactured in accordance with the EMC Directive 2014/30/EU and the Low Voltage Directive 2014/35/EU.

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Applied harmonized standards:

Standard	Title
EN 61800-5-1: 2007+A1:2017+A11:2021	Variable-speed electrical power drives Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-5-2: 2017	Variable-speed electrical power drives Part 5-2: Safety requirements - Functional
EN IEC 61800-3: 2019	Variable-speed electrical power drives Part 3: EMC requirements and specific test methods

Attention must be paid to the safety instructions in the instruction handbook.

Subject to change of this declaration of EC conformity without notice.
Actual valid edition on request.

Subject to change of this declaration of EC conformity without notice.
Actual valid edition on request.

Table of Figures

Overview of Revisions

Version	Status	Changes
5.22004.04	11-Apr-2024	First edition
5.22004.05	22-May-2025	Adaptions EtherCAT, Supplements UL notes, New devices BM656X
5.22004.06	14-Apr-2026	Eco-Design Directive BM656X New Declaration of Conformity New devices BM651X, BM652X (preliminary) New device generation power modules BM65XX (preliminary)

Notes:

HOUSE OF AUTOMATION

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