Manual

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be in motion be in motion

BAUMÜLLER

b maXX®

BM4400,
BM4600,
BM4700

Basic unit

POWER CONVERSION EQUIPMENT

LISTED
38WA

E	5.04043.10

Read the Operating Manual before starting any work!

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INTRODUCTION

This manual is an important part of your **b maXX® BM4400, BM4600, BM4700** appliance; Please, therefore completely read this manual, before starting operation, last but not least on behalf of your own security.

In this chapter we describe the first steps, which have to be done after you have received the device. Terms are defined, which are continuously used in this manual. We will inform you about duties, which must be considered when using this device.

1.1 Survey of the device series b maXX® BM4400, BM4600, BM4700

A device from the **b maXX® BM4400, BM4600, BM4700** series consists off power unit and controller cartridge, which are arranged both in one case. The controller part is permanently installed into the controller cartridge. The controller cartridge has slots and can be extended with plug-in modules. The devices are available in graded construction- and capacity sizes.

BM4400 are universal converters, for achieving electrical drives in industrial applications. BM4400 offers the largest configuration possibilities as well as the available options.

BM4600 are especially developed servo drives derivaded from BM4400 for acceleration applications. Characteristic for these devices is, that the peak current is twice as large as the rated current, even at large output currents. The Devices were developed for a cycle, which could provide the peak current for 1.25 s at a hole cycle duration of 5 s according to ▷Figure 71◁ on page 182.

BM4700 are especially for main drives developed servo converters, derivaded from BM4400. The devices were developed with the requirement, to maximize the available rated current by forceful and exclusive use of water as coolant for the power electronic semiconductor components. For this reason these devices are only available with water cooling (Cooling type -F and -Z) and with none or very low peak current.

In this manual the Baumüller device series „**b maXX® BM4400, BM4600, BM4700**“, the connection and the commissioning are explained .

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

For all persons working on or with devices of the b maXX® series this manual has to be available and they have to observe the contained informations and instructions - especially the safety instructions.

1.2 Validity of this manual

This manual is valid for **b maXX® BM4400, BM4600, BM4700** devices with the below mentioned type keys and replaces manual 5.01040:

BM44XX - xxx - XX0XX[Ryy] - XX (without 7-segment display)
BM44XX - xxx - XX1XX[Ryy] - XX (without 7-segment display)
BM44XX - xxx - XX2XX[Ryy] - XX (with 7-segment display)
BM44XX - xxx - XX3XX[Ryy] - XX (with 7-segment display)
BM46XX - xxx - XX3XX[Ryy] - XX (with 7-segment display)
BM47XX - xxx - XX3XX[Ryy] - XX (with 7-segment display)

1.3 First steps

- Check delivery, see ▷Transportation and packing◁ from page 25.
- Provide for qualified personnel for the mounting, installation and commissioning.
- Hand over this manual to the personnel for mounting, installation and commissioning. Assure that especially the safety instructions are understood and obeyed.

1.4 Used terms

In this manual we will also use the term 'device' for the Baumüller product '**b maXX®**'. A list of the abbreviations which are used are to be found in ▷Appendix A - Abbreviations◁ from page 169.

1.5 Copyright and trade mark

b maXX®	is a registered trade mark of Baumüller Nürnberg GmbH
HIPERFACE®	is a registered trade mark of SICK/Stegmann

2

FUNDAMENTAL SAFETY INSTRUCTIONS

2.1 General notes

In this chapter dangers are described, arising when working with the Baumüller-device. Dangers are pointed up with symbols (icons). All symbols that are used in this manual are listed and explained.

How you can protect yourself against the single dangers in the concrete case, we will not explain in this chapter. This chapter contains only general protective measures. The concrete protective measures we will always give directly after the note to the danger.

The operation of the described devices is permissible, if the mentioned methods/procedures/measures are obeyed to. Everything else, that means also the operation of devices in installations, which are not shown here, is not permitted and must be checked with the company in each particular case. Any kind of claim to warranty will expire, if the devices are operated other than here described.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard information is showing you the hazards which can lead to injury or even to death.

Always observe the hazard information given in this documentation.

2.2 Hazard information and commands

Each hazard is classified in one of three different hazard classes. Every hazard class has one of the following characteristic signal words:

DANGER

- serious property damage
- serious personal injury
- death - **will** occur

WARNING

- serious property damage
- serious personal injury
- death - **may** occur

CAUTION

- minor to medium personal injury or
- environmental pollution or
- property damage - **may** occur

2.2.1 Hazard information structure

The following two examples show you how the hazard informations are constructed. The triangle is used when indicating a hazard for human beings. When there is a circle instead of the triangle, the hazard information is only for possible property damage.

A triangle indicates hazard for human beings.
The shade of grey of the outline reflects the severity of the hazard - darker grey means rising hazard.

The icon within the square illustrates the hazard.
The outline´s shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)

The icon in the circle represents a command.
(Not every hazard information has a circle representing the hazard, so we have shown it as draft here)

The circle indicates hazard for property.

The icon within the square illustrates the hazard.
The outline´s shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)

The text beneath the icons is constructed as follows:

HERE STANDS THE SIGNAL WORD WHICH INDICATES THE DEGREE OF THE HAZARD

Here we tell if one or more of the consequences described lower will occur if this hazard information is not observed.

- here we describe the possible consequences. The worst consequence stands on the right side.

Here we describe the hazard.

Here we describe what you can do to avoid this hazard.

2.2.2 Form of the hazard sign (triangular or round)

If there is a triangle like ⚠ or ⚠ or ⚠ in front of the signal word, the hazard information is referring to personal damage.

If there is a round hazard signal like (!) in front of the signal word, the hazard information is referring to property damage.

2.2.2.1 Hazard information on personal injury

To distinguish each class of hazard information, we use a characteristic outline for both the triangular hazard signs and the square-form icons

For the hazard class **DANGER** the ⚠ danger sign is used. The hazard information of this hazard class used in this documentation is listed below:

DANGER

The following **will occur**, if you do not observe this danger information:

- serious personal injury
- death

The hazard is: ***electricity.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

DANGER

The following **will occur**, if you do not observe this danger information:

- serious personal injury
- death

The hazard is: ***mechanical influence.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

For the hazard class **WARNING** the warning sign ⚠ is used. The following hazard information of this hazard class is used in this documentation.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard is: ***electricity.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard is: ***mechanical influence.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard is: ***electro-conductive liquid together with electricity.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard is: ***electro-magnetic radiation.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard is: ***liquid coolant.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

For the hazard class **CAUTION** the caution sign ⚠ is used when there is hazard for persons or of environmental pollution. The following hazard information of this hazard class is used in this documentation.

CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***hot surface.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***sharp edges.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

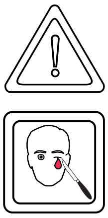
CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***rotating parts.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***injury of the eye caused by ricochetting particles.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***noise.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

The hazard is: ***hazard of sliding caused by liquid.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION

The following **may occur**, if you do not observe this danger information:

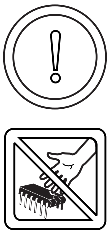
- environmental pollution.

The hazard is: ***unadequate disposal.*** *Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

2.2.2.2 Hazard information on property damage

If there is a round caution sign (!) in front of the signal word, the safety information refers to property damage.



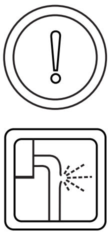
CAUTION

The following **may occur**, if you do not observe this caution information:

- property damage.

*The hazard is: **electro-static discharge.** Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



CAUTION

The following **may occur**, if you do not observe this caution information:

- property damage.

*The hazard is: **damage of the coolant hose.** Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

2.2.2.3 Command signs used

wear safety gloves

wear safety shoes

wear eye protection

wear ear protection

Use this fire extinguishing agent:

„fire extinguishing agent“

2.3 Information sign

NOTE

This note is a very important information.

2.4 Legal instructions

This documentation is addressed to technical qualified personnel, who is specifically skilled and who is thoroughly familiar with all warnings and maintenance procedures.

The devices are made according to the state-of-the-art technology and are fail-safe. They can be installed safe, can be put into operation and they function without problems, if it is assured, that the instructions of the documentation are followed.

The user is responsible for the execution of service and commissioning according to the safety instructions of the prevailing standards and other relevant national and local instructions concerning conductor dimensioning and protection, earthing, disconnector, overcurrent protection and so on.

For damages, which result from the mounting or from the connection, the one is liable, who has carried out the mounting or the installation.

2.5 Appropriate use

Always use the device according to the terms. Stated below we have carried a few important notes together. The notes stated below shall give you a feeling for the according to the terms usage of the device. We do not raise any claim for the completion of the notes stated below - follow all instructions given in this operating instruction.

- project the application in such a way, that you always operate the device within its specification.
- use this device only as converter for three-phase drives.
- make sure, that only qualified personnel work with/at this device.
- install this device only on an adequate carrying wall.
- install this device in the way as it is described in the documentation.
- make sure, that the mains/power supply unit always applies to the predetermined specifications.
- only operate the device, if it is technical faultlessly.
- operate this device only in combination with released components of the company Baumüller Nürnberg GmbH.
- always operate the device in an area as it is instructed in the "Technical data“.
- Operate the device in environments of second mode (industrial environment). The device was developed in such a way, that it meets the requirements of the category C3 according to IEC 61800-3:2005. The device is not provided for the connection to the public network. The operation of the device in an environment of the first mode of category C2/C1 (living-, business and industry area without intermediate transformer directly at a public secondary distribution system), in order to reduce the RFI-emission

(cable-guided and blasted) special measures must be provided for and must be proved by the control cabinet manufacturer, because EMC-interferences can occur, if no additional measures have been taken. If a device, which was described here, reaches the category C2/C1, even with additional measures, can not be ensured.

- always operate the device in serialized condition.
  Due to safety reasons you must not rebuild the device.
- consider all instructions referring to this, if you intend to store the device.

You are using the device according to the terms, as soon as you regard all notes and information in this operating manual.

2.6 Inappropriate use

Listed below you will find some examples of non-appropriate application. The information below is intended to give you some impression of what non-appropriate application is. However we cannot state all possible non-appropriate applications here. All applications, where the notes and information given in this documentation is disregarded, are non-appropriate and therefore forbidden.

Examples:

- You disregarded the notes in this manual.
- The device has not been specifically applied as a converter in order to control a motor.
- The device has been
  - mounted incorrectly,
  - connected incorrectly,
  - commissioned incorrectly,
  - operated incorrectly,
  - mounted, connected, commissioned, operated and/or maintained by not qualified or inadequately qualified personnel,
  - inappropriately maintained or not maintained
    (also consider the descriptions of the components),
  - overloaded it,
  - operated
    - with defective safety devices,
    - with incorrectly mounted safety devices or without safety devices,
    - with incorrectly working safety- and protection devices,
    - outside the specified environmental conditions.
- You have modified the device.
- You have insufficiently monitored the parts, which are subject to a wearing.
- You have improperly carried out a repair.
- You have combined the device with improper products, which are not enabled for devices described in this manual.
- You have combined the device with faulty and/or faulty documentated products of other manufacturers.
- The device has been operated in an explosive environment.

2.7 Safety equipment

The mentioned device types must be built into a suitable control cabinet, in order to comply with the required protection classes in EN61800-5-1, chapter 4.2.3.3 (IP30: only the upper horizontal surfaces; IP20: all the other surfaces).

Protection classes see ▷D.33 Type of protection◁ on page 261

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The danger is: ***electricity.***

Operate the device in a control cabinet, which provides a protection against a direct touching of the devices and fulfills at least the demands of the EN61800-5-1, chapter 4.2.3.3.

2.8 Training of the personnel

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

Devices of the company Baumüller Nürnberg GmbH may only be assembled, installed, operated and maintained by qualified personnel.

Qualified personnel (professionals) is defined below:

Qualified personnel

Authorized electronic engineers and skilled persons of the customer or third persons, who have learned the installation and commissioning of Baumüller drive systems and who are authorized, to put circuits and devices into operation according to the standards of the safety technology, to ground and to label.

Qualified personnel has a training or an instruction due to the local valid standards of the safety technique in maintenance and usage of an adequate safety equipment.

Requirements to the operating personnel

The operating of the drive system must only be executed by persons, who have had a training, who have been instructed and who have been authorized for this.

Fault clearance, servicing, cleaning, maintenance and exchange must only be carried out by skilled or instructed personnel. These persons must know the operating manual and must act according to this.

The commissioning as well as the instruction must only be carried out by qualified personnel.

2.9 Safety precautions in normal operation

- at the location of your appliance regard the safety regulations for the plant, into which the appliance has been built in.

- if safety regulations require additional monitoring or safety devices supply your appliance with them.

2.10 Dangers due to residual energy

Electrical residual energy

After separation of the device from the mains parts under voltage as e. g. power connections may be only then touched if the capacitors in the device are discharged (see „discharging time“ in ▷D.8 Electrical data - BM441X basic unit◁ on page 190 to ▷D.21 Electrical data - BM477X basic unit◁ on page 222). Also pay regard to the instructions on the device. If you have additional capacitors connected to the DC-link, the DC-link discharging also can last much longer. In this case you must determine the necessary waiting time on yourself or measure whether the device is off-circuit.

NOTE

After disconnecting the device from mains the parameter power-unit mains voltage actual value (P0483) displays a fraction of the DC link voltage sometimes.

Mechanical residual energy

The mechanical residual energy is dependent upon the application. As we don't know the application, we cannot make any exact statements. Driven parts also rotate/move after disconnection of the mains supply for a certain time. Please, provide adequate safety arrangements.

2.11 Disposal of the device

The accurate disposal of the device is described in ▷12 Disposal◁ on page 165.

2.12 Fire fighting

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

*The danger is: **Electricity when using a conductive fire fighting appliance.***

Use this fire extinguishing agent:

ABC powder / CO_2

2.13 Responsibility and liability

To be able to work as safe as possible with this device, you must know and follow the danger notes as well as the safety instructions.

2.13.1 Observing the safety notes and safety instructions

In this manual we use visually unified safety instructions, which are intended to prevent from personal injury or damage to property.

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

All persons, who work with this device, must know and regard the safety notes and the safety instructions in this manual.

Apart from this, any and all persons who work on this device must additionally know and regard to all regulations and instructions, that are valid at the location.

2.13.2 Dangers when handling this device

The device „**b maXX**®“ was developed and manufactured according to the state-of-the-art technology and in compliance with the valid regulations and standards. It is still possible that dangers can arise during use. An overview of possible dangers is to be found in chapter ▷Fundamental safety instructions◁ from page 11.
We warn you against the acute danger at the respective places in this manual.

2.13.3 Warranty and Liability

All information in this manual is non-binding customer information; it is subject to ongoing further development and is updated on a continuous basis by our revision service.

Warranty- and liability claims against Baumüller Nürnberg GmbH are excluded if in particular one or more of the causes listed in ▷Inappropriate use◁ from page 21 has/have caused the damage.

TRANSPORTATION AND PACKING

In this chapter we describe, which conditions have to be adhered to at transportation, how you check the device after receipt and what you should have to consider, if you dispose the packing.

3.1 To be considered by transportation

For the first transportation of the device, the device was packed in the manufacturer company. In case you transport the device, assure, that the following conditions are fulfilled during the whole transportation:

- 2K3 (climatic category) [1]
- - 25 °C to +70 °C (temperature range)
- max. 1 g (vibration, shock, repetitive shock)

[1] DIN EN IEC 60721-3-3

3.2 Unpacking

After receipt of the device, which is still packed:

- Avoid strong transportation vibrations and severe hits, e.g. when setting down.
- Check, if transportation damages are visible!

If so:

- Immediately complain to the deliverer. Let the claim be confirmed in writing and immediately contact the substitution of Baumüller Nürnberg GmbH, which is in charge for your company.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

*The danger is: **electricity.***

Do not operate the device, if you have recognized a transportation damage or if you assume this. In this case immediately contact Baumüller Nürnberg GmbH

If there is no transportation damage recognizable:

- Open the packing of the device.
- Check the scope of supply with the help of the delivery note.

The minimum scope of supply is:

- **b maXX® BM4400, BM4600, BM4700**
- This manual inclusively the copy of the declaration of conformity/declaration of manufacturer
- Claim at the Baumüller substitution, which is in charge, in case the delivery is not complete.

3.3 Dispose packing

The packing is made of cardboard, plastics, metal parts, corrugated cardboard and/or wood.

- Regard the local disposal instructions, in case you dispose the packing.

4

DESCRIPTION OF THE DEVICES

In this chapter the basic construction of the devices **b maXX® BM4400, BM4600, BM4700** and the slots of the controller cartridge are described and the type key on the devices is explained.

NOTE

The devices of the **b maXX® BM4400, BM4600, BM4700**-series are provided for the operation in the ’second environment’ (industrial environment) according to EN 61800-3. At connection to the public mains EMC problems can appear. Also see ▷Appropriate use◁ from page 20.

NOTE

Components of the Baumüller Nürnberg GmbH are provided for assembly into commercial control cabinets.“

There are a number of reasons, which lead to operate the components and devices in commercial control cabinets. Particularly by the mounting into control cabinets is ensured,

- that the protection against accidental contact, required by the user could be realized,
- that the thermal environmental conditions (temperatures, relative air humidity, cleanness of the cooling media, …) displayed in the technical data of the components and devices could be ensured,
- that the mechanical environmental conditions (oscillations, vibrations, …) displayed in the technical data of the components and devices could be ensured,
- that the notes for EMC-compatible planning and EMC-compatible construction (conception of shielding, principles of wiring, executions, …), displayed in the technical data of the components and devices, can be achieved.

NOTE

A correct operation of **b maXX® BM4400, BM4600, BM4700 power modules** can only be assured in combination with Baumüller power converters or mains inverters.

4.1 Structure

The devices of the b maXX®-series are servo converters of Baumüller Nürnberg GmbH. The devices consist of a power unit with an integrated slot for the controller cartridge (narrow or wide). The controller cartridge itself possess, besides a firmly installed controller (slot F), rows of slots, that can be filled with optional modules.

The rated current of the devices reach from 2,5 A to 720 A. The devices differ in size, power, equipment (hard- and software) and cooling types.

This data is available in the type key (see ▹Marking of the device - type key◃ on page 34).

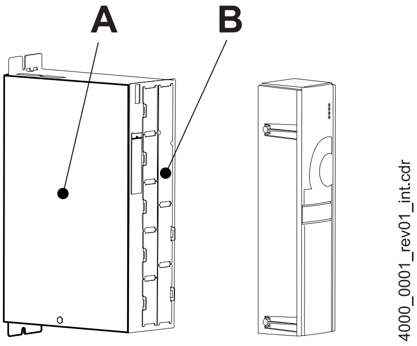


Figure 1: Power unit (A) - controller unit (B)

A device of the series **b maXX® BM4400, BM4600, BM4700** consists of the following parts:

A: Power unit (converter)	This part is a power semiconductor converter combination which is build up with power semiconductor components.

b maXX® BM4400, BM4600, BM4700

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

b maXX® BM4400, BM4600, BM4700 power module

The output sided inverter generates via the DC link connection a three-phase system from the direct voltage with variable frequency and voltage for the supply of the connected motor.

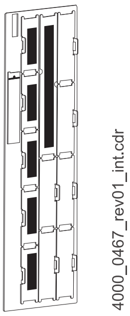
B: Controller unit

The controller unit controls the power unit. You can operate the controller part either with the operating software WinBASS II (up to FW 3.09) or ProDrive (from FW 3.07) or via a PLC or via a field bus and PLC. PLC and field bus interface are available as plug-in module.

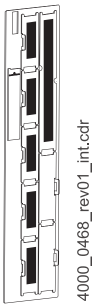
4.2 Controller unit versions

There are three versions of the controller unit:

single row

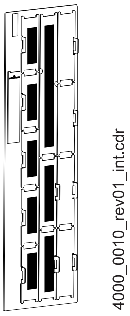


This version is a 1-row equipped controller unit in a 3-rowed installation space.
This controller unit is available for every b maXX® BM4400 except for the BM441X-XXX-X0 and the BM441X-XXX-X1.

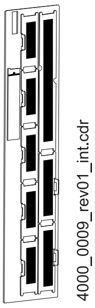


This version is a 1-row equipped controller unit in a 2-rowed installation space. This controller unit is available only in the BM441X-XXX-X0.

2-rowed

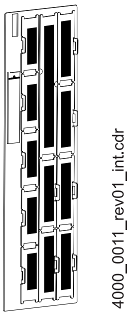


This version is a 2-row equipped controller unit in a 3-rowed installation space.
This controller unit is available for every b maXX® BM4400 except for the BM441X-XXX-X0 and the BM441X-XXX-X1.



This version is a 2-row equipped controller unit in a 2-rowed installation space. This controller unit is available only in the BM441X-XXX-X1.

3-rowed

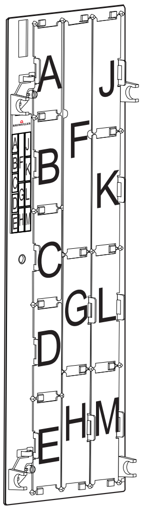


This version is a 3-row equipped controller unit in a 3-rowed installation space. This controller unit is available for every b maXX® BM4400.
In case you order a b maXX® 441X with this controller unit, you will receive the device BM441X-XXX-X2.

4.2 Controller unit versions

4.2.1 Slots

In slots of the controller unit functional- or optional modules are plugged, which extend the functional range of the controller unit. Every slot is clearly identified by a code letter.



1-, 2- and 3-rowed	**A**	The controller communicates via a functional module bus with plug-in modules in these slots. Slot D is interrupt-capable. Therewith slot D is particularly is suitable for modules e. g. measurement sensing. In these slots functional modules can be inserted. Optional modules can **not** be inserted into these slots.
	B	
	C	
	D	
	E	
	F	Controller module, permanently installed.
2- and 3-rowed	**G**	The controller communicates via the BACI-bus with plug-in modules in these slots. In these slots option modules can be inserted. Function modules can **not** be inserted into these slots.
	H	
3-rowed	**J**	With plug-in modules in these slots the controller communicates via the BACI-bus. In these slots option modules can be inserted. Function modules can **not** be inserted into these slots.
	K	
	L	
	M	

Every plug-in module is delivered with an appropriate manual. In the manual of the module amongst other things the mounting and the installation of the module is described.

CAUTION

The following **may occur**, if you disregard these safety notes:

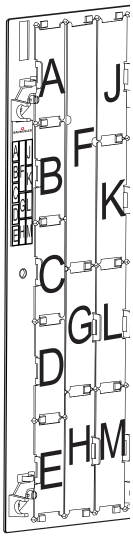
- Property damage

The danger is: ***Plug-in module, which has not been manufactured from Baumüller Nürnberg GmbH*** *Modules of other manufacturers can damage/destroy the device.*

Only use BM4-F-XXX- and BM4-O-XXX-plug-in modules.

Dependable of the existing controller unit version on your device you can retrofit optional plug-in modules (functional modules and optional modules). The slots differ in size and function.

4.2.1.1 Combination possibilities plug-in module-controller slots



4000_0012_rev01_int.cdr

	Function modules									Option modules														
	BM4-F-ENC-XX (encoder 1 for motor control recommended)	BM4-F-ENC-XX (encoder 2)	BM4-F-AIO-01 (analog I/O)	BM4-F-AIO-02/03/04 (analog I/O)	BM4-F-DIO-XX (digital I/O)	BM4-F-FIO-XX (fast digital I/O)	BM4-F-IEE-XX (incremental encoder emulation)	BM4-F-SIE-XX (SSI-SSI encoder emulation)	BM4-F-CAN-01 (CANsync slave) **in prep.**	BM4-O-SER-XX (Sercos slave)	BM4-O-CAN-05 (CANsync slave)	BM4-O-PRO-01 (Profibus slave)	BM4-O-CAN-03 (CANopen slave)	BM4-O-DNT-XX (DISC-NT slave module)	BM4-O-PLC-XX (SPS)	BM4-O-CAN-06* (CANsync master)	BM4-O-CAN-04* (CANopen master)	BM4-O-IEI-XX* (incremental encoder emulation)	BM4-O-ETH-01* (Ethernet)	BM4-O-ETH-02* (Ethernet + CANopen master)	BM4-O-ECT-01 (EtherCAT slave) for controller	BM4-O-ECT-01* (EtherCAT slave) for PLC	BM4-O-ECT-02* (Ethernet + EtherCAT master)	BM4-O-ECT-03* (Ethernet + EtherCAT cluster)
A	X	-	-	-	o	o	-	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	-	X	-	-	o	o	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	o	o	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	X	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F	Controller unit, permanently installed																							
G	-	-	-	-	-	-	-	-	-	o	o	o	o	o	o	X	X	X	X	X	**o**	X	X	X
H	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	-	o	-	o	o	X	o	o	o
J	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	-	o	o	o
L	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	-	o	o	o
M	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	-	o	o	o

X: **preferred slot**
Baumüllter Nürnberg GmbH recommends, in order to reach the highest functional range, to insert the plug-in modules into these slots.

o: **possible slot**
only if the preferred slot is occupied, we recommend in order to reach the highest functional range, to insert the plug-in modules into this slot.

P: only possible, if on slot G or H a PLC module (PLC) is plugged and the PLC (and not the controller) executes the communication to the field bus slave module.

-: not possible - card doesn’t work in this slot.

* Precondition for these cards is an inserted PLC module (PLC).

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Figure 2: Slot combinations

NOTE

EtherCAT option modules **must not** be plugged in slot **J** of a 3-rowed controller unit, because the module can be damaged.

In case another BM4X-X-XXX plug-in module is plugged in an unsuitable slot, it will not operate. We have made sure, that neither the module nor the device are damaged.

4.3 Interconnect the devices

The device is part of the Baumüller series **b maXX® BM4400, BM4600, BM4700** and can be connected together with other Baumüller devices.

Because of the many possible combinations and of the many applications that can be driven with **b maXX® BM4400, BM4600, BM4700**, we have refrained from drawing up a guide for the interconnection of the devices in written form. Please contact the for you responsible sales department or the for you responsible employees of the application department, to discuss your concrete questions on the requirements, why devices have to be interconnected, and to develop together a solution for your problem.

4.4 Overview of dangerous areas

The following overview shows the existing danger areas on the particular device. Use this survey for an overview of the existing danger areas, if you incorporate into the handling of this device. The explanation of the symbols, which are used you will find in ▷Hazard information and commands◁ from page 12.

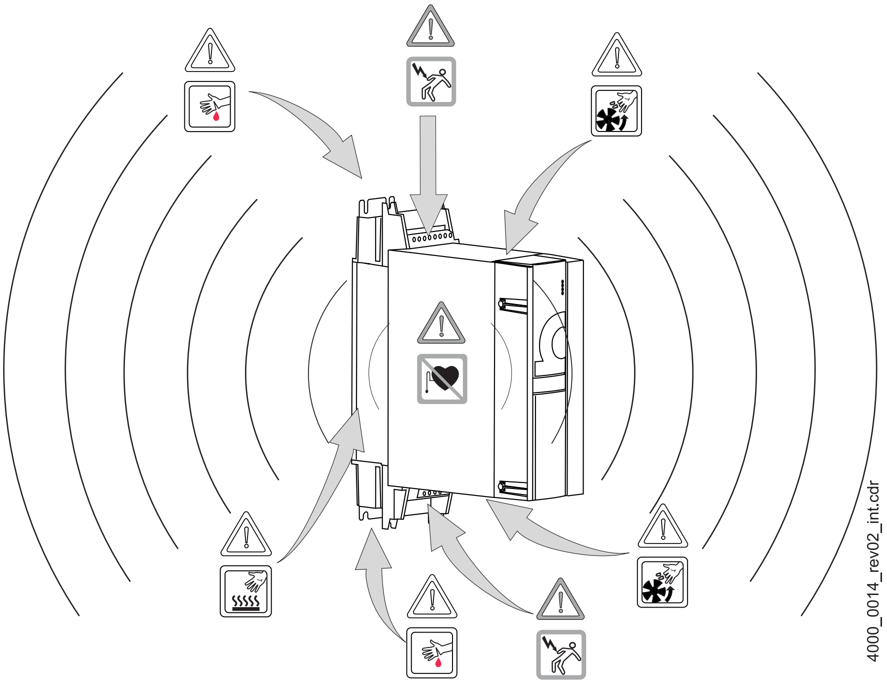


Figure 3: Danger areas BM441X, BM442X, BM443X, BM444X, BM463X, BM464X

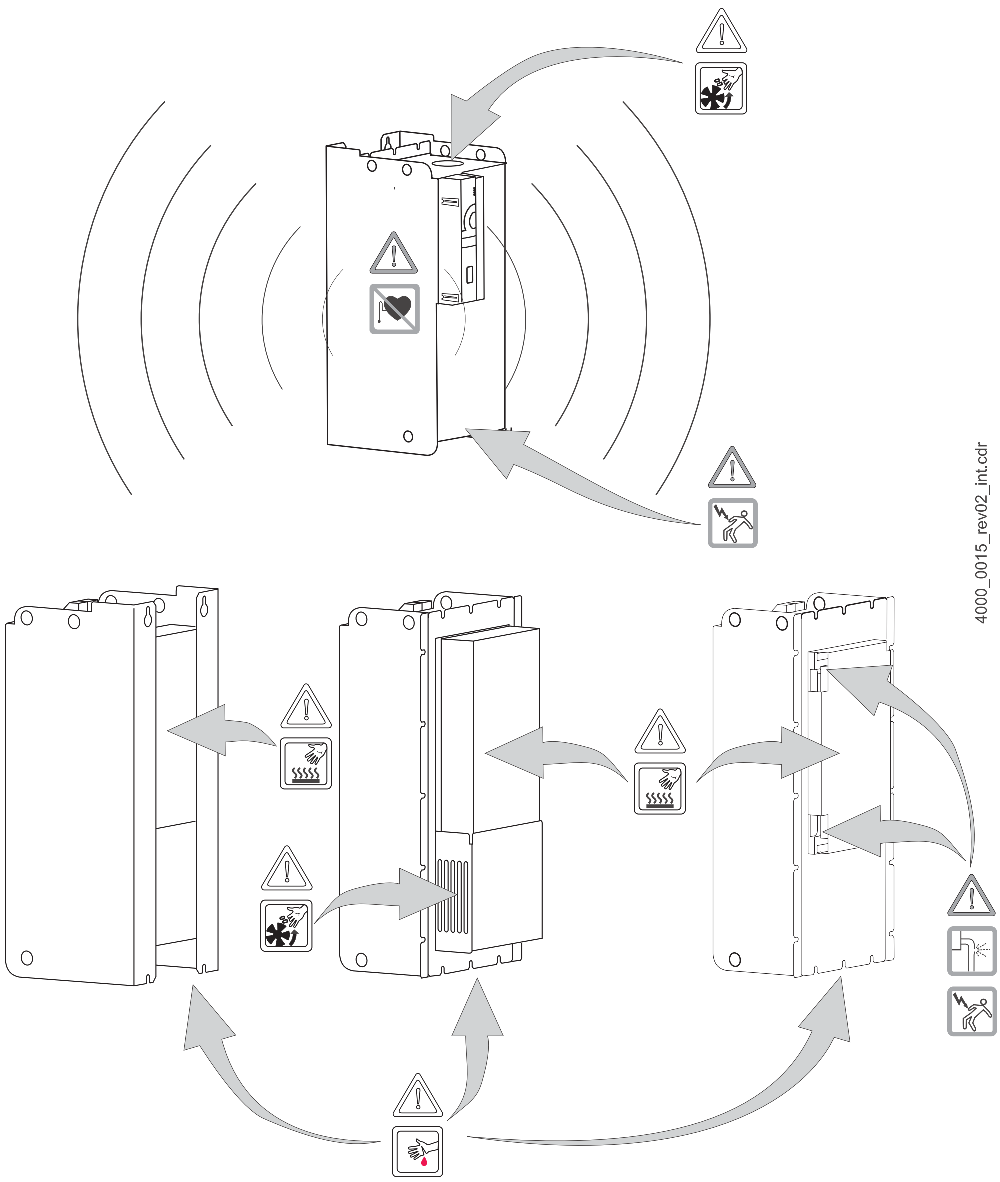
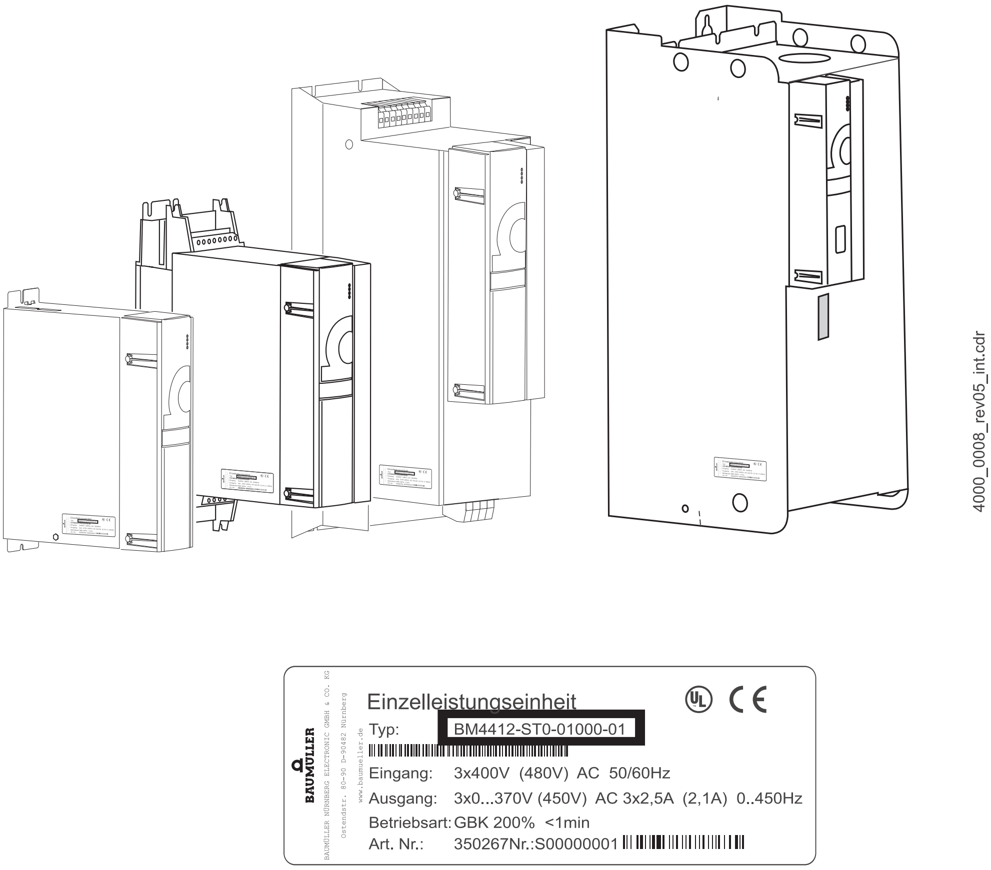


Figure 4: Danger areas BM445X, BM446X, BM447X, BM465X, BM466X, BM47XX

4.5 Marking of the device - type key

On the type plate (label) you will find, besides others, the type key of the device.



BAUMÜLLER

BAUMÜLLER NÜRNBERG ELECTRONIC GMBH & CO. KG
Ostendstr. 80-90 D-90482 Nürnberg
www.baumueller.de

Einzelleistungseinheit

Typ: BM4412-ST0-01000-01
Eingang: 3x400V (480V) AC 50/60Hz
Ausgang: 3x0...370V (450V) AC 3x2,5A (2,1A) 0..450Hz
Betriebsart: GBK 200% <1min
Art. Nr.: 350267Nr.:S00000001

Figure 5: Position of type key label

The type key has the form: BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX. Directly behind the type key is the design code (-XXXX - X - XXX - XXX).

In the following table the type key is explained.

BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Device generation
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Type 4: Vector controller with and without encoder feedback (closed loop / open loop) 5: for M-controller oder V-controller developed devices, see manual 5.05022 6: Vector controller like 4, but optimzed for max. peak current 7: Vector controller like 4, but optimzed for max. nominal current
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Size of cabinet 1 to 7 (from cabinet size 1 there are two different wide versions)
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Current grading (output rated current) 0 to 6 (current value is dependent on the cabinet size), see appendix D
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Cooling type S: air-cooled with air supply and with air outlet in the control cabinet A: air-cooled with air supply and with air outlet outside the control cabinet Z: water-cooled with water cooler in the control cabinet F: water-cooled with water cooler outside the control cabinet C: (cold plate) cooling via mounting wall of the control cabinet
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Mains type T: TN- or TT-mains I: IT-mains and 'grounded delta'
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Safety relay 0: no module 1: Module with one relay and high power current contacts 2: Module with two relays and high power current contacts 3: Module with one relay and low current contacts 4: Module with two relays and low current contacts 5: Module with one relay and all current contacts 6: Module with two relays and all current contacts
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Hardware type/power unit type 0: Rectifier and inverter with chopper resistor transistor U_{DC} = 540 V 1: Rectifier and inverter with chopper resistor transistor U_{Mains} =230 V ± 10 %, U_{DC} =310 V 2: Power module (only output sided inverter). Operation as power module, U_{DC} = 540 V 3: Rectifier and inverter with chopper resistor transistor U_{DC} = 540 V short packaging for BM465X, BM466X, BM475X und BM476X
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Hardware type/controller unit versions 1: Module in slots A to H pluggable 2: Modules in slots A to M pluggable
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - XX	Hardware type (internal information via Baumüller Nürnberg GmbH. 0XX: Controller without 7-segment display (RS 485 interface) 1XX: Controller without 7-segment display (RS 485 interface) 2XX :Controller with 7-segment display (RS 485 interface) 3XX :Controller with 7-segment display (Ethernet interface))

BM4XXX - XXX - XXXXX[Ryy] - XX Optional chopper resistor

R16: Chopper resistor with 16 Ω
R10: Chopper resistor with 10 Ω
R05: Chopper resistor with 5 Ω
R03: Chopper resistor with 3 Ω

BM4XXX - XXX - XXXXX[Ryy] - XX State of software controller (firmware)

01: Series version 1.x
03: Series version 3.x

NOTE

This type key is only for the basic device without the plug-in modules. Every plug-in module (except the controller) has its own type key.

NOTE

A device with safety relay, whose part number does **not** start with „**06**“, does not apply as a safety device as defined by the PL classification according to ISO 13849 or SIL according to EN 61800.

This device is not certificated for safety functions

NOTE

Only a device which is affixed with the test mark of the TUEV Rheinland has a certificated safety function.

4.6 UL-notes

The notes below must be observed at a cUL - conformity drive.

In case you consider UL 508 C observe the notes below also:

- ▷Parameter Manual b maXX BM4400, BM4600, BM4700◁
  - Adjustment for motor overload monitoring
- ▷Requirements to the connecting cables◁ on page 77
  - Use 60 °C/75 °C copper wire only for all devices
  - Use Class 1 wire only.
- ▷Connection data of the connections◁ on page 101
  - Note tightening torque for field wiring terminals
- Only for water-cooled devices:
  - In order to avoid internal condensation: Temperature of cooling water shall be specified to be at least equal to the specified surrounding air temperature.
  - Maximum cooling water temperature 60°C.
  - Maximum water pressure 3 bar / 300 kPa in the cooling circuit.
- ▷D.4 Required environmental conditions◁ on page 184
  - Use the device only in a pollution degree 2 environment
  - Observe the maximum ambient temperature and the derating
- ▷D.1 Requirements on the power supply◁ on page 180
  - Observe the short circuit current capability. The device is rated for Short Circuit Current Rating (SCCR) of 65 kA, 480 V AC max.
  - 24 V supply must not reach more than 30 V DC. Additional fuse protection with max. 4 A fuse.
- ▷D.29 Fuse protection◁ on page 237
  - Converters may be used with listed fuses or listed circuit breakers DIVQ as overcurrent protection.
- ▷D.37 Temperature sensors of the motor◁ on page 266
  - Observe the connecting data of the motor temperature sensor.

4.6.1 cUL-notes

Additional only for Canada:

NOTE

Overvoltage Protection Device have to be installed in front of the input circuitry of the device to limit the maximum overvoltage peak to 2.5 kV.

5

MOUNTING

In this chapter we describe the mechanical mounting of the device into a control cabinet. Data about the installation space is available in this manual (see ▹Installation space◃ from page 41).

Mounting consists of the following steps:

1 Prepare mounting (drill holes/cut-out segments)

2 Install device

WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

At execution of any mounting workings it must be assured that no strange substances (e.g. drilling chips, copper wire etc.) get into the device. If possible the drillings should be done before mounting the device and the assembling of the cables should be done outside the control cabinet. If this is not possible, the device must be covered accordingly.

5.1 General safety instructions

CAUTION

The following **may occur**, if you disregard these safety notes:

- Property damage

The danger is: ***electrostatic discharge.*** *Connections of the device sometimes are dangerous to ESD.*

Regard the corresponding notes.

➲ Please regard to the information in chapter ▹Fundamental safety instructions◃ from page 11.

- Pay attention to all areas at the device, which could be dangerous for you while mounting. Use this survey only for the mechanical mounting. Dangers, which, for example, result from electricity are not shown here.

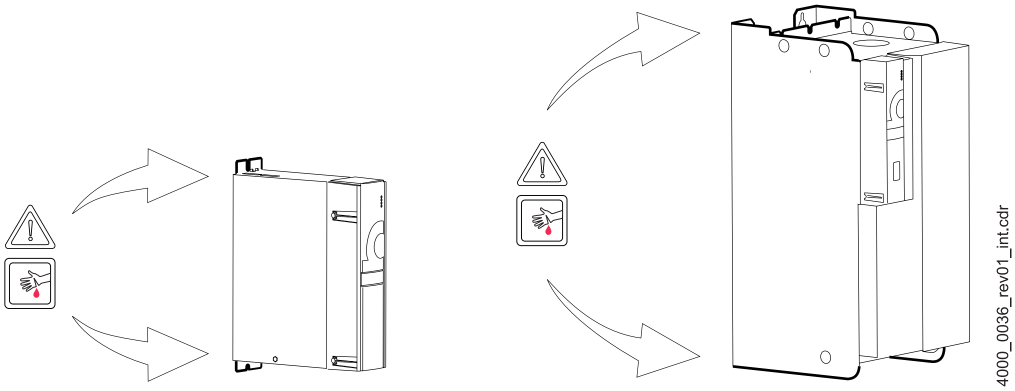


Figure 6: Danger areas by the mechanical mounting

5.2 Requirements to the executing personnel

CAUTION

The following **can occur**, if you disregard this warning instruction:

- minor to medium personal injury.

The danger is: ***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.*

Make sure, that only qualified personnel, who is familiar with the safety- as well as with mounting instructions, works on this unit.

Wear safety gloves

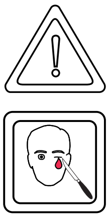
Wear safety shoes

Qualified personnel are persons, who have been instructed by the responsible person, based on their training, experience, the instructions they were given as well as their knowledge about relevant standards and instructions, knowledge of the accident prevention instructions and of the company, to execute the necessary operations and thereby are able to recognize and avoid the dangers which could happen. The required qualifications for the work with this unit are for example:

- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

5.3 Prepare mounting

You can prepare the mounting with the configuring manual for your installation. With the project manual and the drill figures (see ▹Drilling patterns◃ from page 57) you can determine the dimensions for the cut-outs and for the fastening drills.

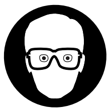


CAUTION

The following **can occur**, if you disregard this warning instruction:

- minor to medium personal injury.

The danger is: ***Eye injury due to catapulting particles.*** *While executing the drillings and the cut-out metal particles are catapulted.*



Wear eye protection

➲ Execute the drilling and if necessary the cut-outs.

5.4 Installation space

The following drawings show the main dimensions of the devices in mm. Use these drawings, in order to determine the required space in the control cabinet. For the construction of the necessary drilling/cut-outs use the drawings in ▹Drilling patterns◃ from page 57.

5.4 Installation space

5.4.1 Installation space BM441X

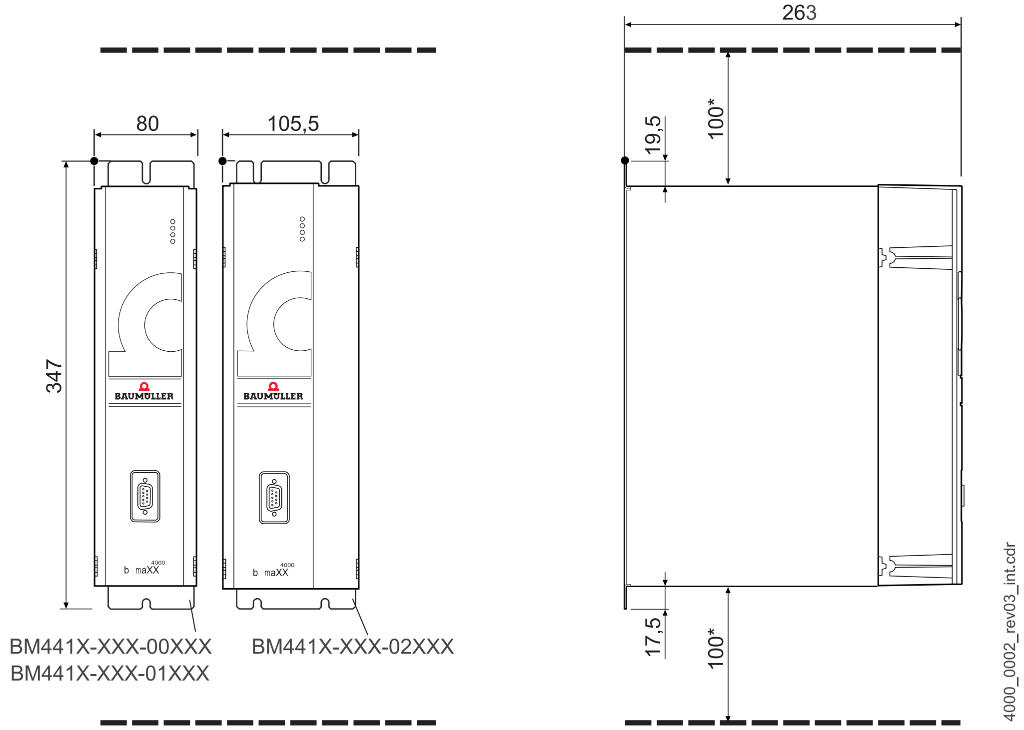


Figure 7: Installation space BM441X

*: min. expansion space, also consider ▹Cooling◃ on page 187

5.4.2 Installation space BM442X

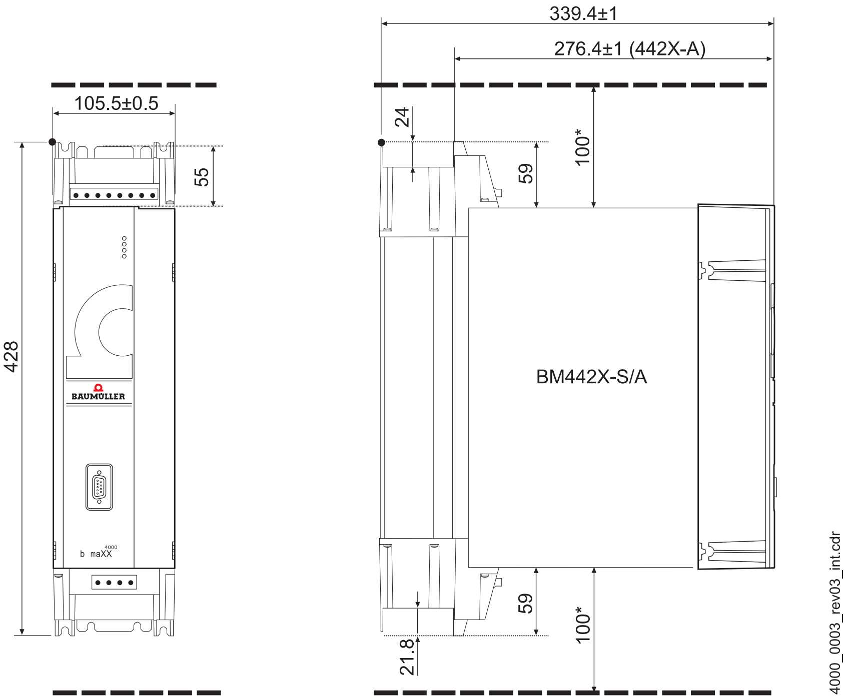


Figure 8: Installation space BM442X-S/A *: min. expansion space, also consider ▹Cooling◃ on page 187

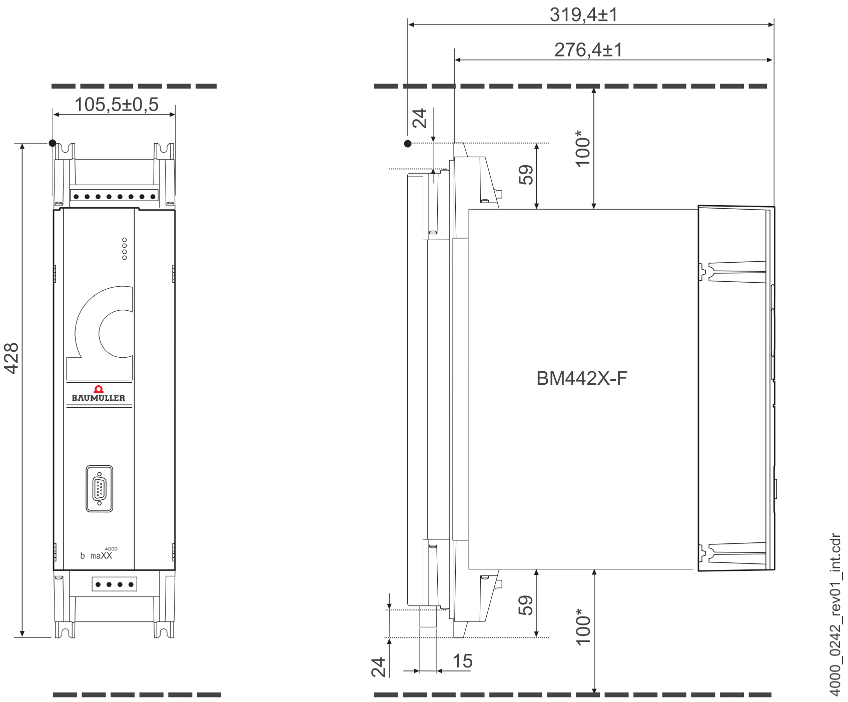


Figure 9: Installation space BM442X-F *: min. Expansion space, also consider ▹Cooling◃ on page 187

Installation space

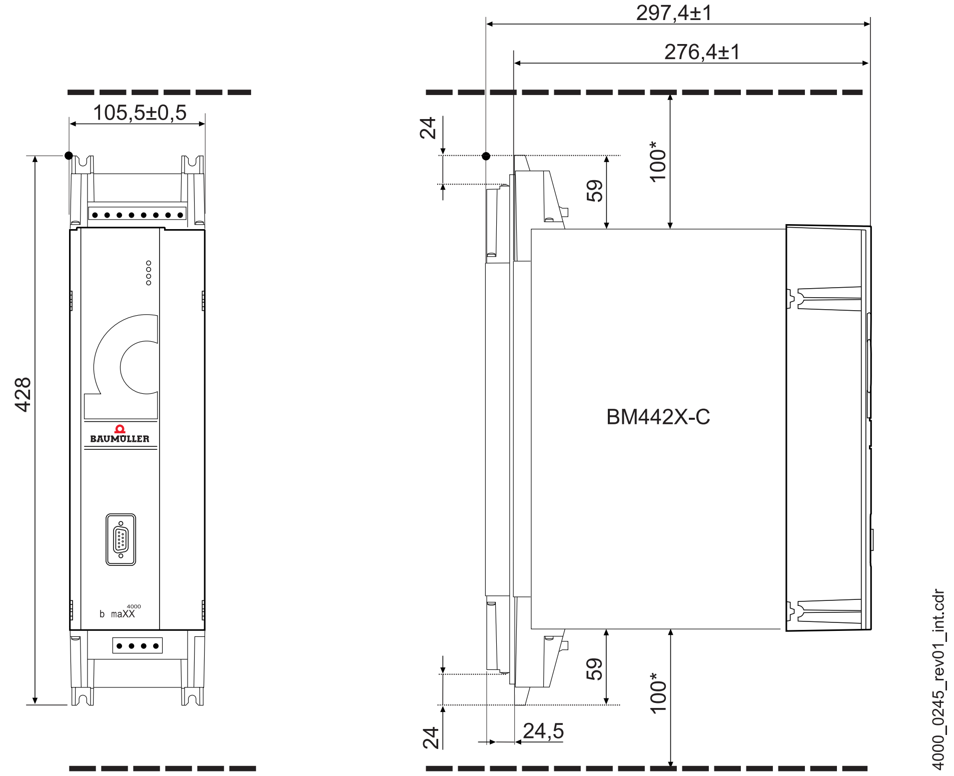


Figure 10: Installation space BM442X-C

*: min. expansion space, also consider ▷Cooling◁ on page 187

5.4.3 Installation space BM4X3X

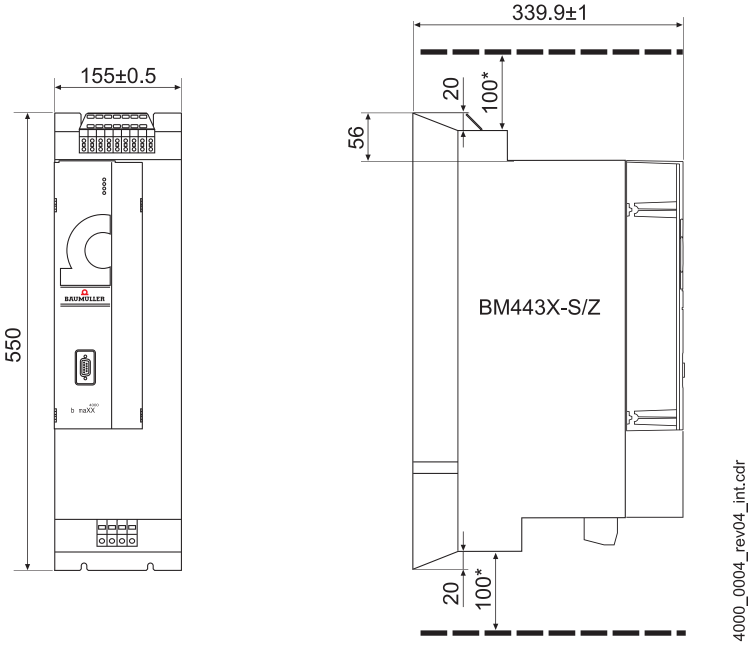


Figure 11: Installation space BM443X-S/Z

*: min. expansion space, also consider ▹Cooling◃ on page 187

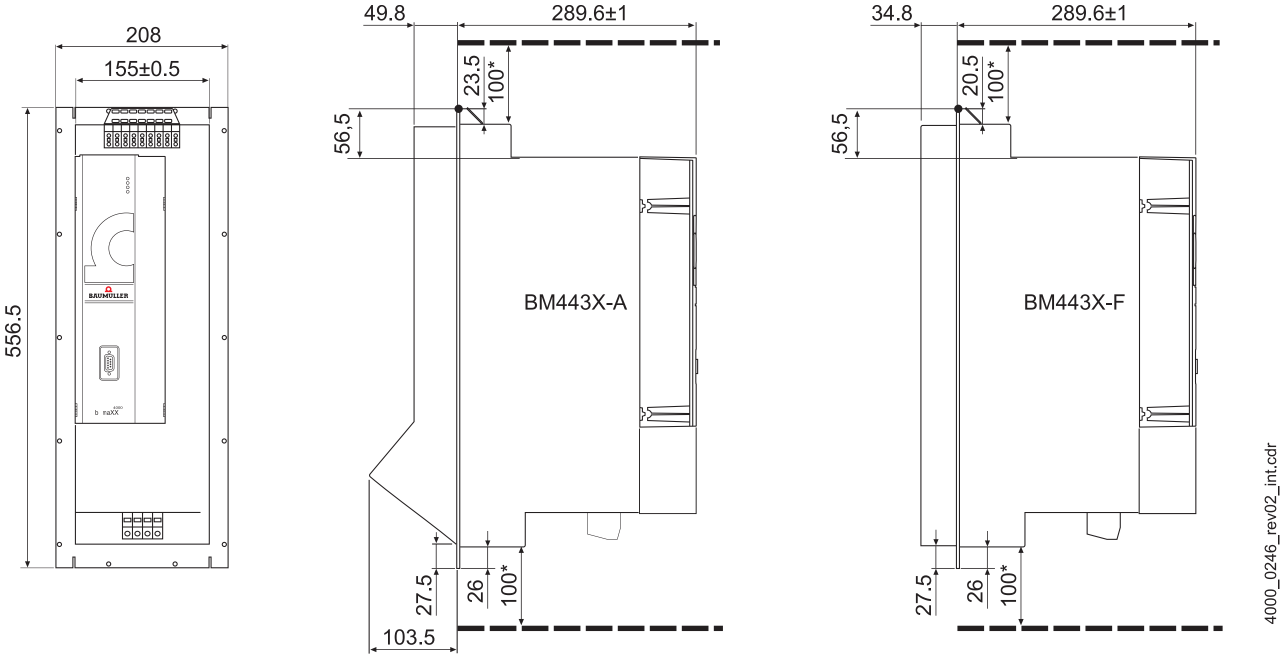


Figure 12: Installation space BM443X-A/F

*: min. expansion space, also consider ▹Cooling◃ on page 187

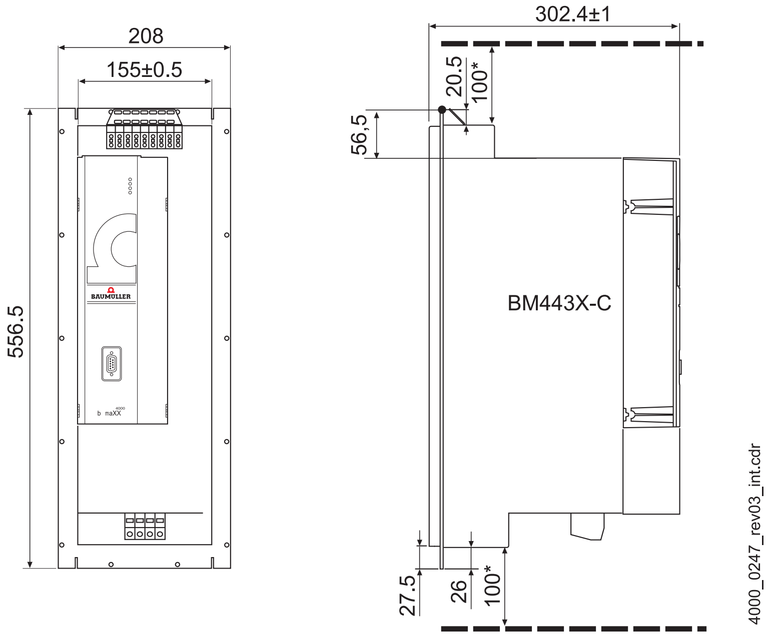


Figure 13: Installation space BM443X-C

*: min. expansion space, also consider ▷Cooling◁ on page 187

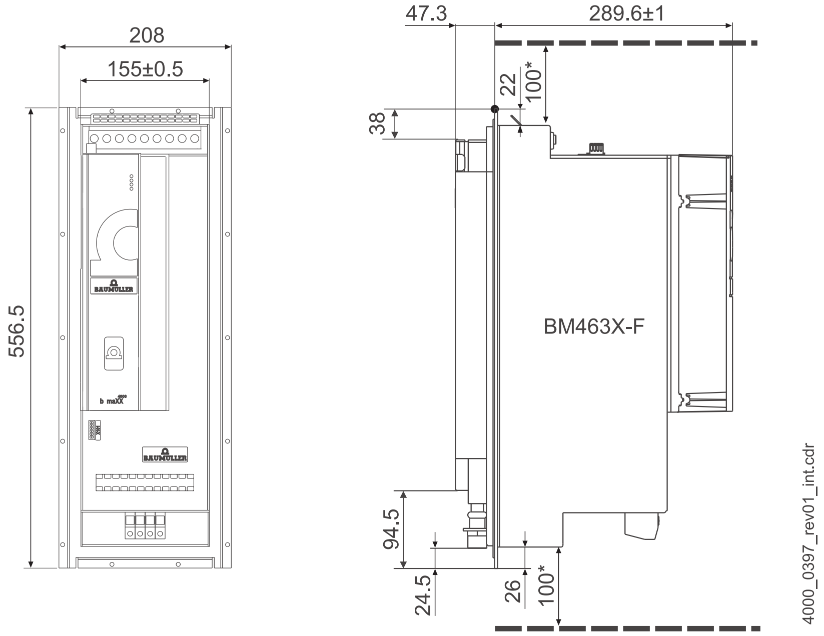


Figure 14: Installation space BM463X-F

*: min. expansion space, also consider ▷Cooling◁ on page 187

5.4.4 Installation space BM4X4X

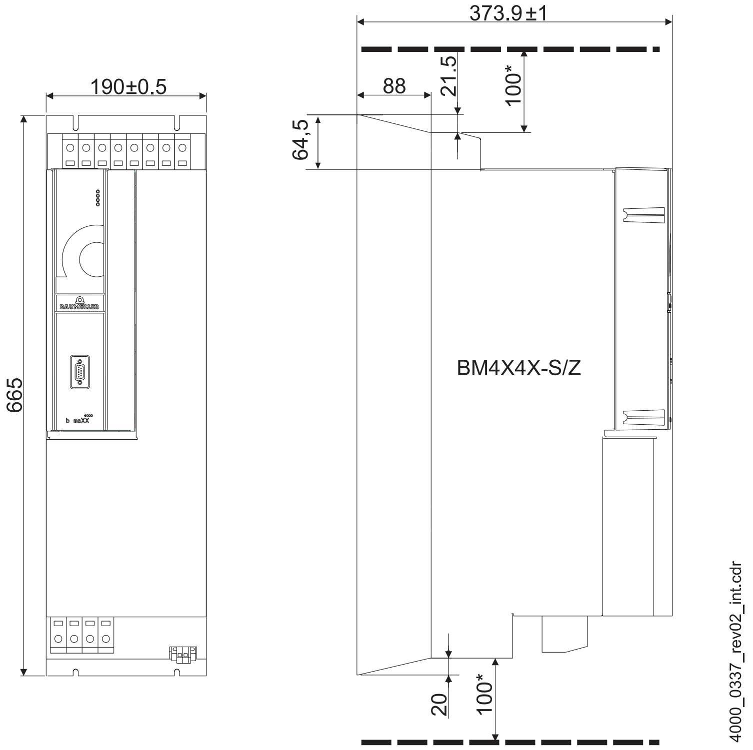


Figure 15: Installation space BM444X-S/Z *: min. expansion space, also consider ▷Cooling◁ on page 187

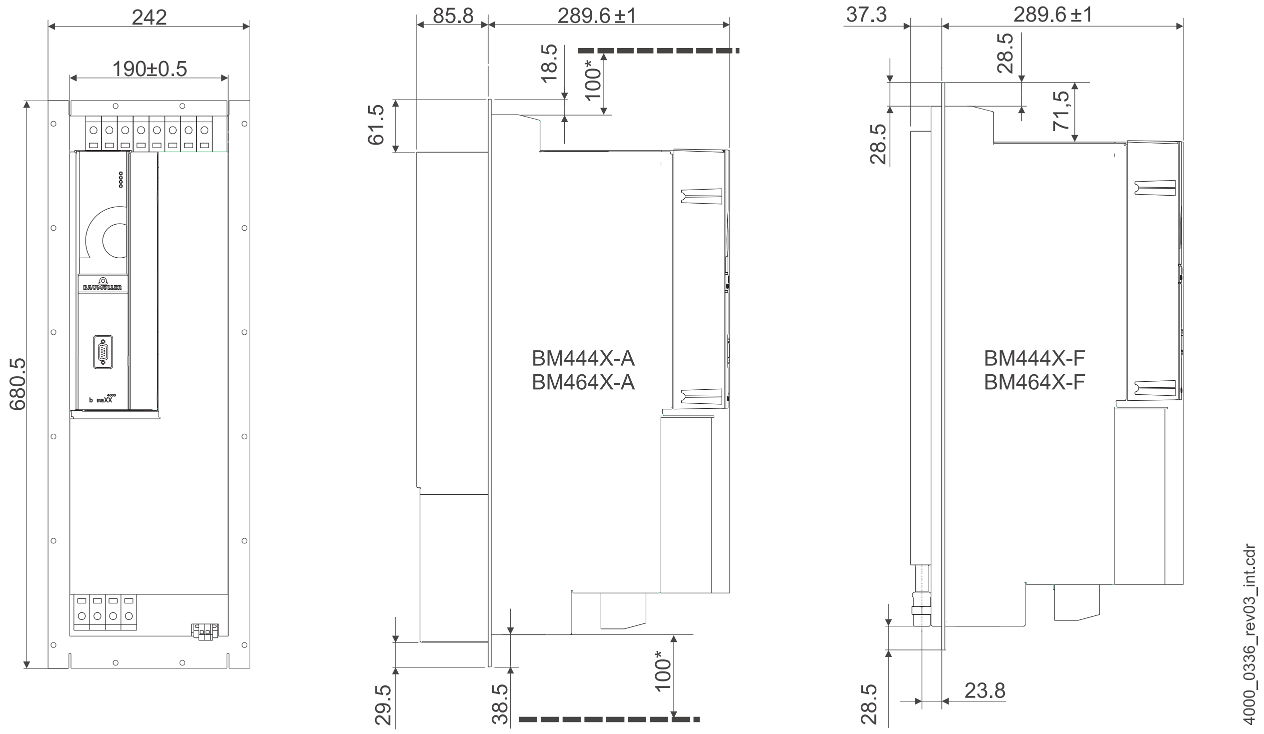


Figure 16: Installation space BM444X-A/F, BM464X-A/F *: min. expansion space, also consider ▷Cooling◁ on page 187

5.4.5 Installation space BM4X5X

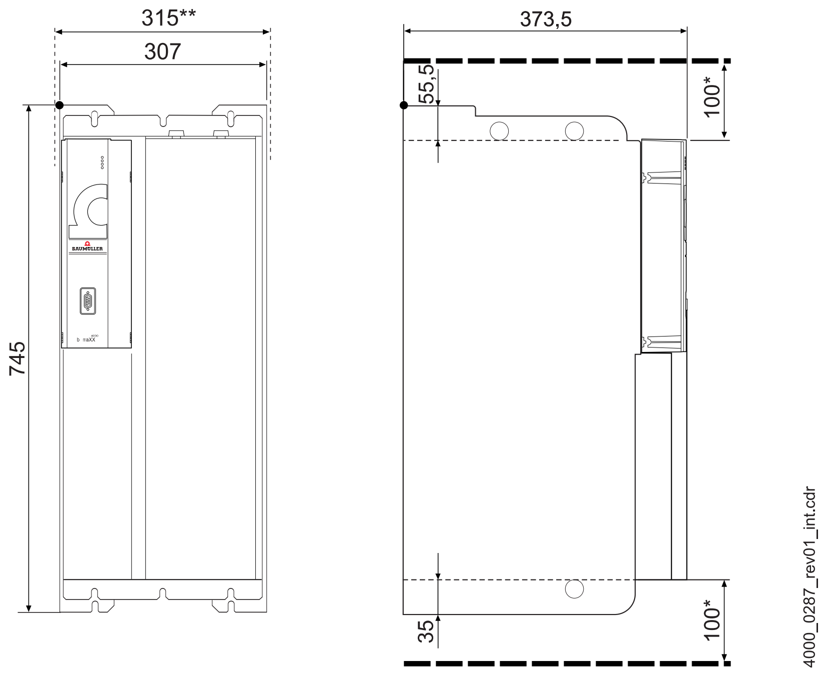


Figure 17: Installation space BM445X-S/Z, BM465X-S/Z

*: min. expansion space, also consider ▹Cooling◃ on page 187
**: width inclusively bolt heads

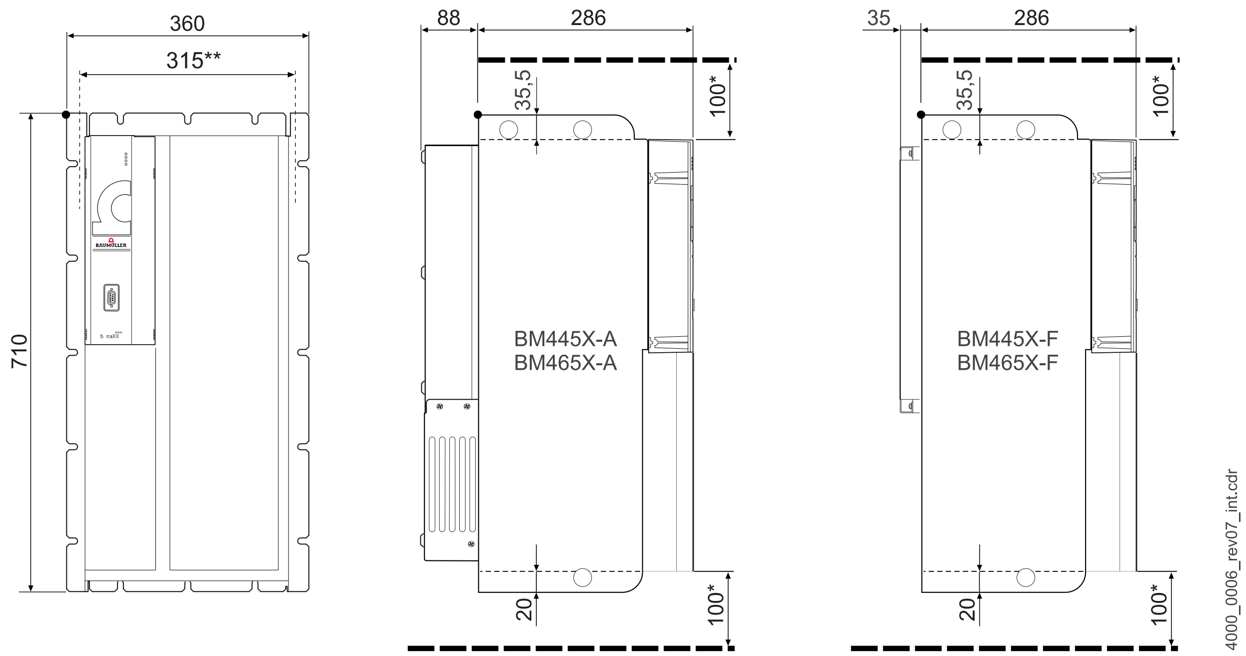


Figure 18: Installation space BM445X-A/F

*: min. Expansion space, also consider ▹Cooling◃ on page 187
**: width inclusively bolt heads

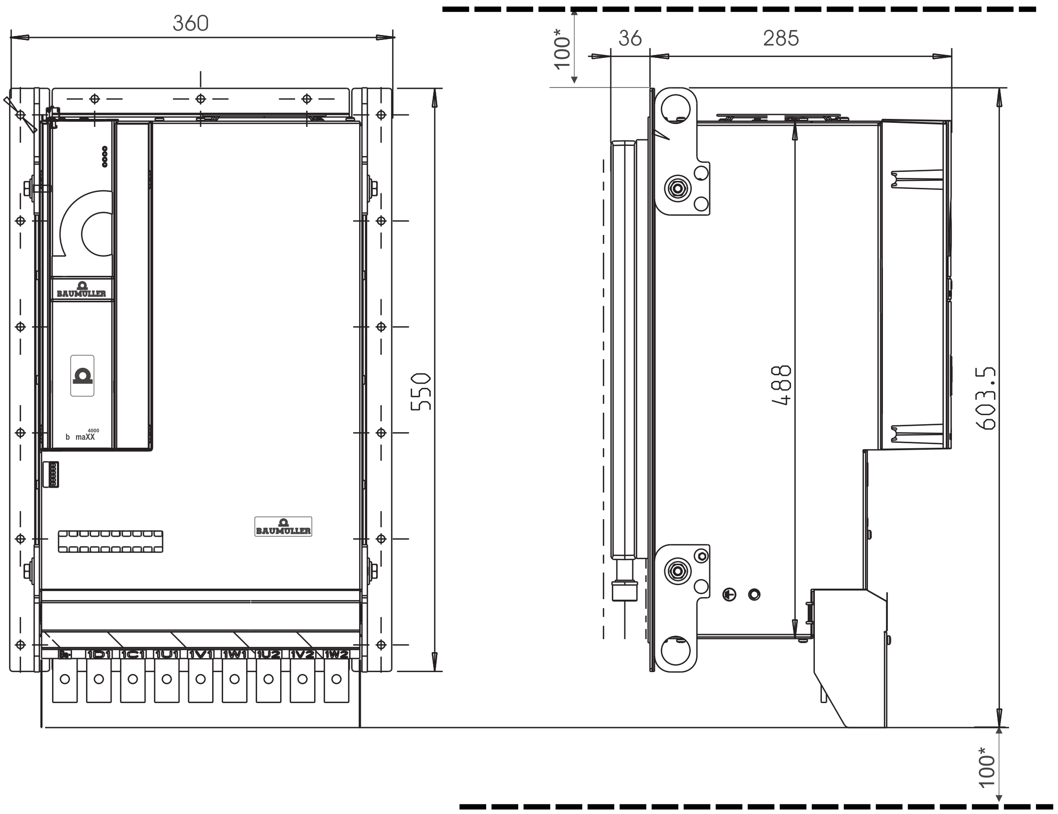


Figure 19: Installation space BM465X-FXX-3XXXX and BM475X-FXX-3XXXX

*: min. Expansion space, also consider ▷Cooling◁ on page 187

5.4 Installation space

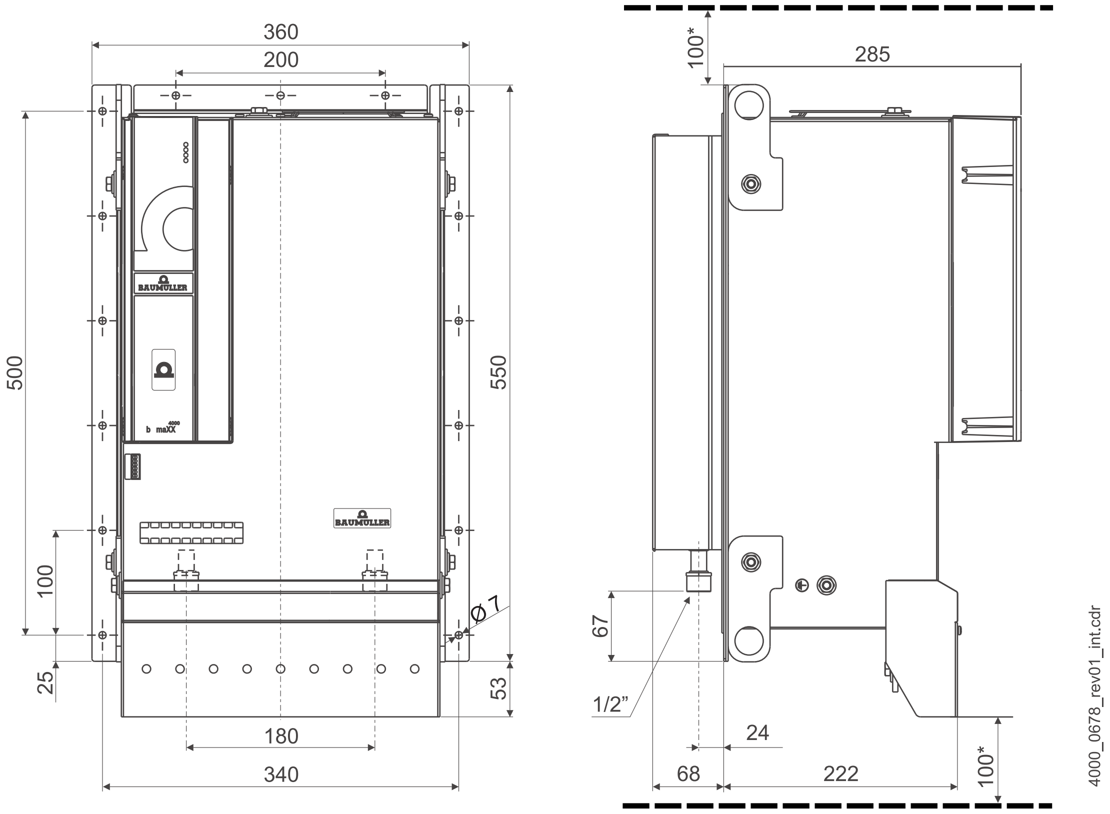


Figure 20: Installation space BM465X-FXX-3XXXX-RYY and BM475X-FXX-3XXXX-RYY

*: min. Expansion space, also consider ▹Cooling◃ on page 187

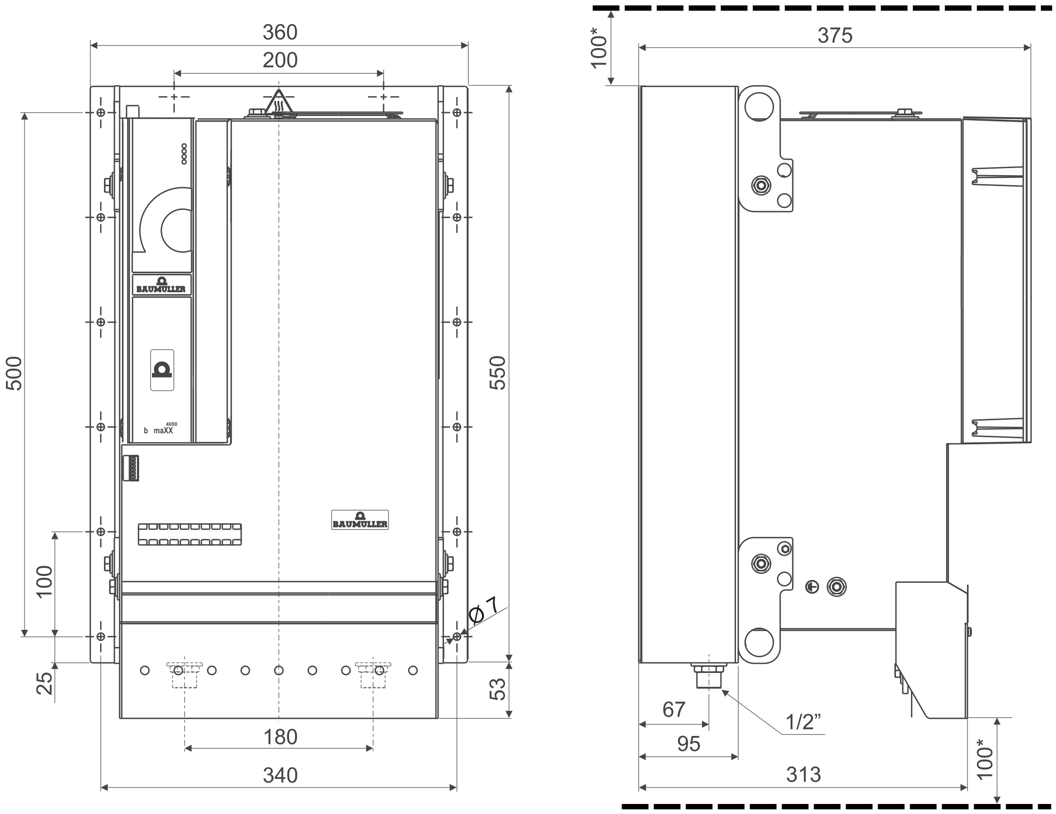


Figure 21: Installation space
BM465X-ZXX-3XXXX, BM465X-ZXX-3XXXX-RYY, BM475X-ZXX-3XXXX and BM475X-ZXX-3XXXX-RYY
*: min. Expansion space, also consider ▷Cooling◁ on page 187

5.4.6 Installation space BM4X6X

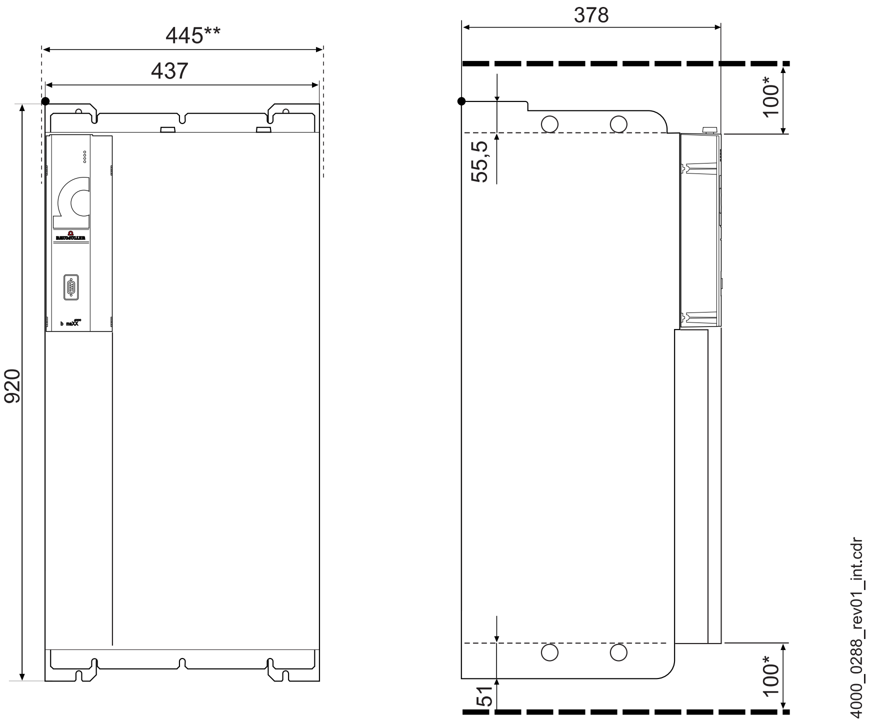


Figure 22: Installation space BM446X-S/Z

*: min. expansion space, also consider ▹Cooling◃ on page 187
**: width inclusively bolt heads

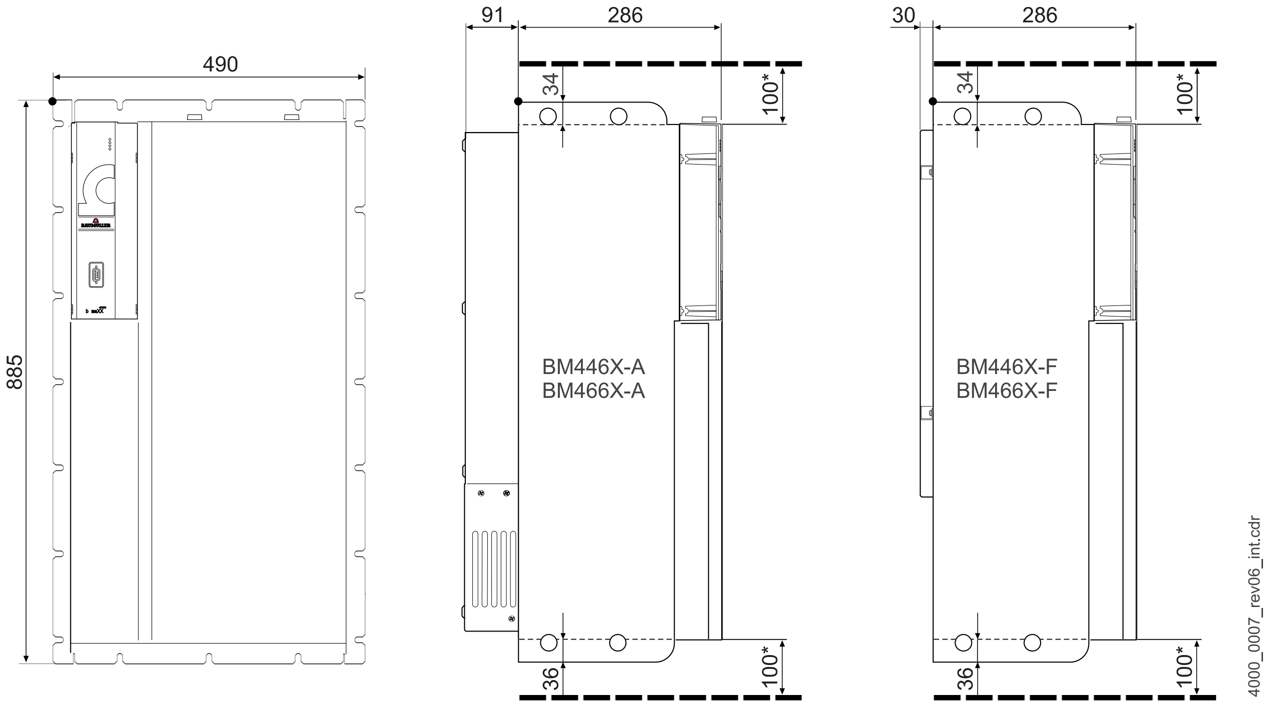


Figure 23: Installation space BM446X-A/F

*: min. expansion space, also consider ▹Cooling◃ on page 187
**: width inclusively bolt heads

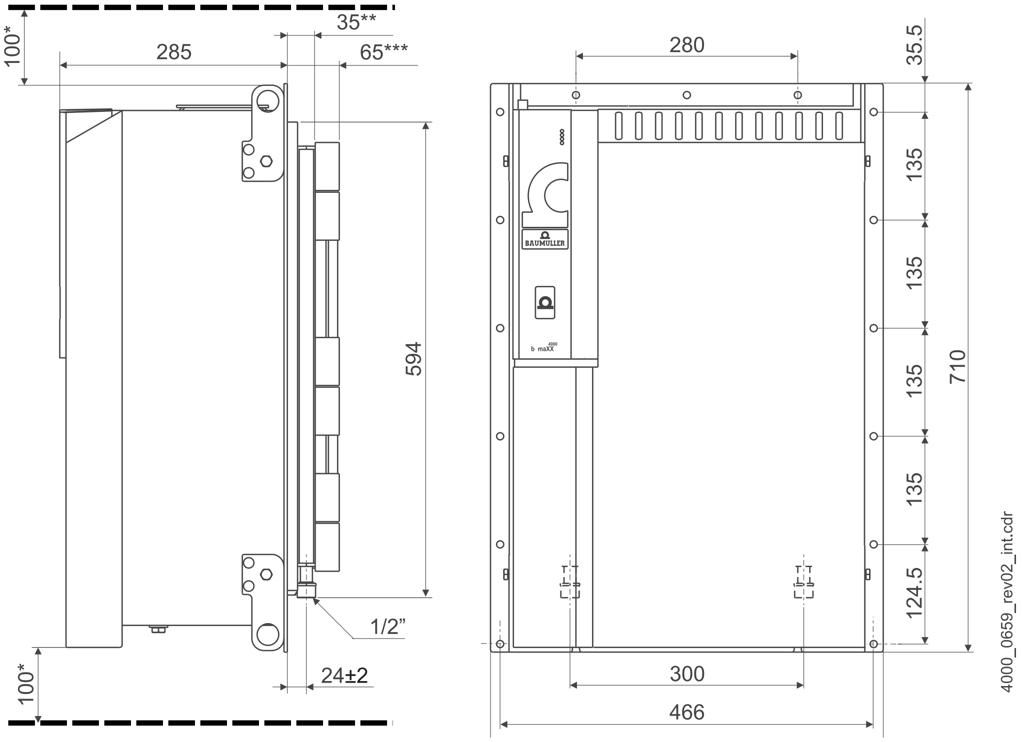


Figure 24: Installation space BM466X-FXX-3XXXX and BM476X-FXX-3XXXX

*: min. Expansion space, also consider ▹Cooling◃ on page 187
**: without chopper resistor
***: with chopper resistor

Installation space

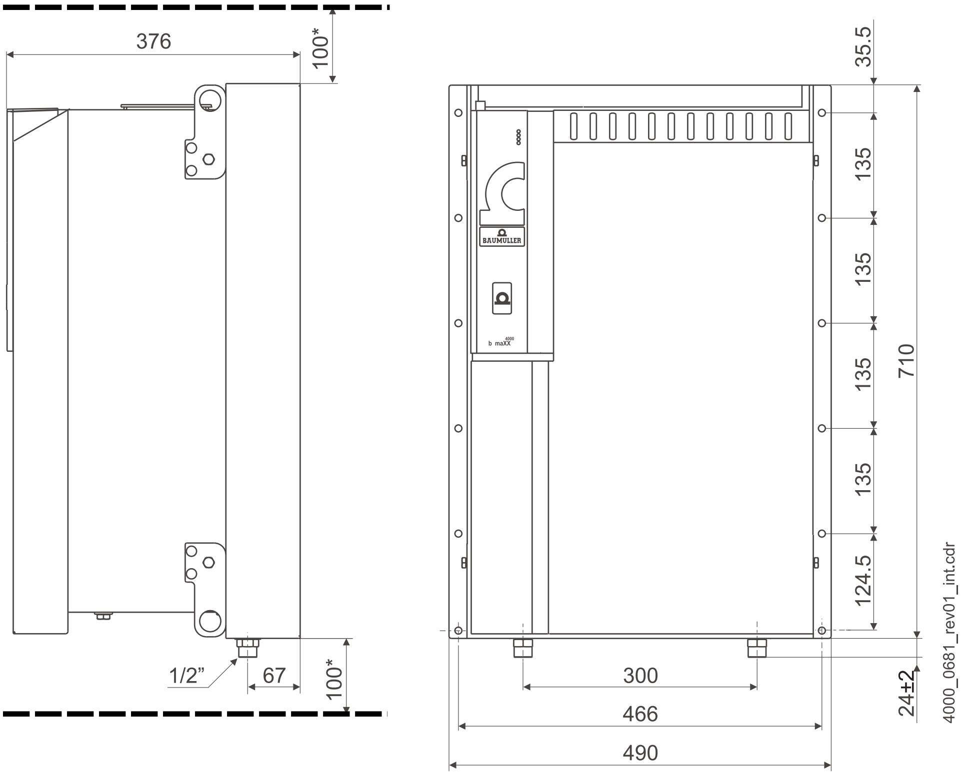


Figure 25: Installation space BM466X-Z-3XXXX and BM476X-Z-3XXXX

*: min. Expansion space, also consider ▹Cooling◃ on page 187

5.4.7 Installation space BM4X7X

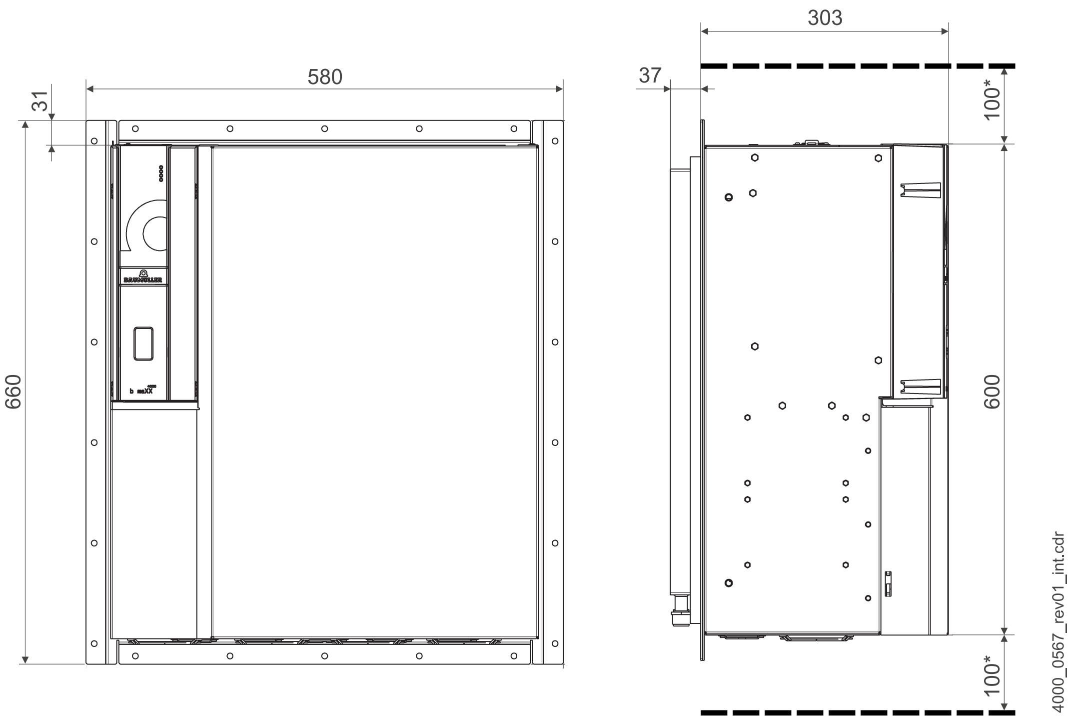


Figure 26: Installation space BM447X-F, BM477X-F

*: min. expansion space, also consider ▷Cooling◁ on page 187

Installation space

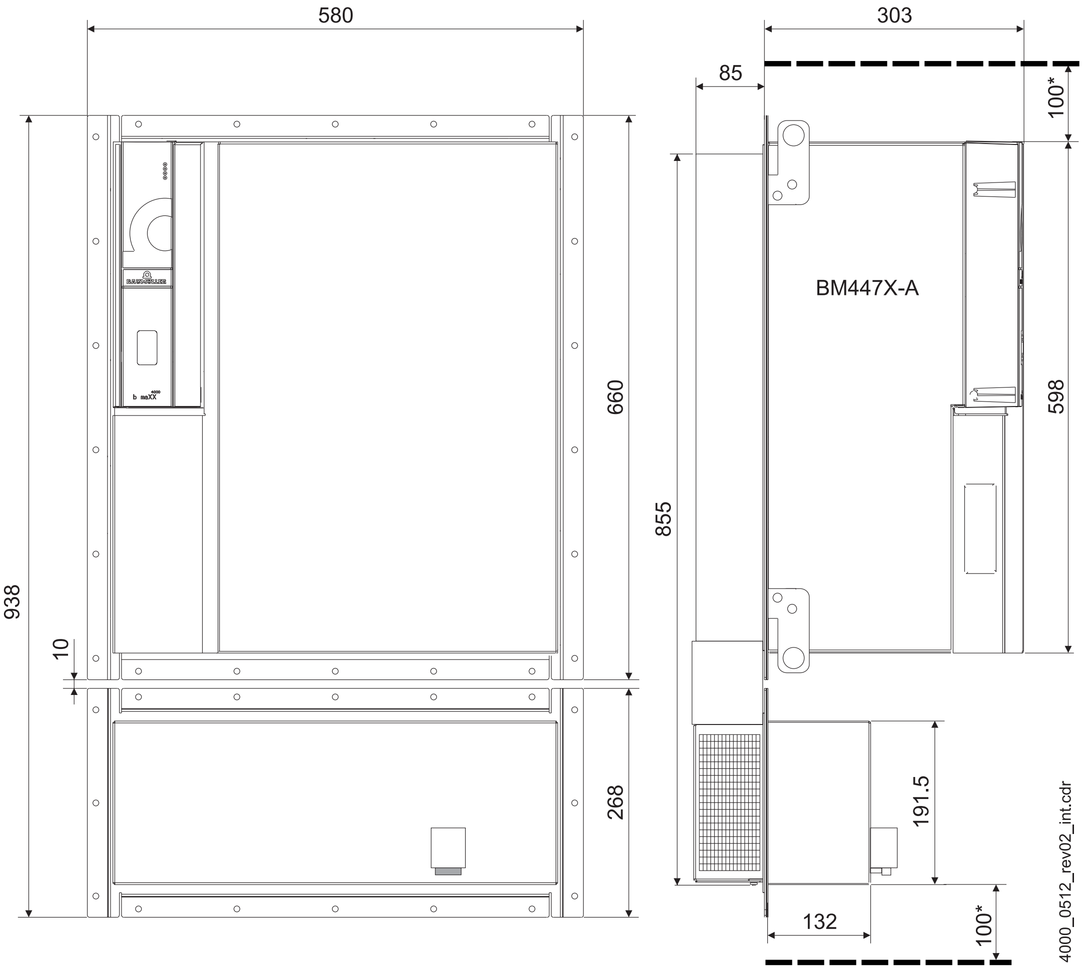


Figure 27: Installation space BM447X-A

*: min. expansion space, also consider ▷Cooling◁ on page 187

5.5 Drilling patterns

The following drawings show the drilling patterns of the devices. Use these drawings, to prepare the necessary drilling/cut-outs. Use the drawings under ▹Installation space◃ from page 41, to determine the required space in the control cabinet.

Tolerance indication for drilling patterns

Dimensioning drill holes	±0,2mm
Dimensioning openings	+1,0mm
Tolerance of any partition to each other	±0,1mm

5.5.1 Drilling patterns BM441X

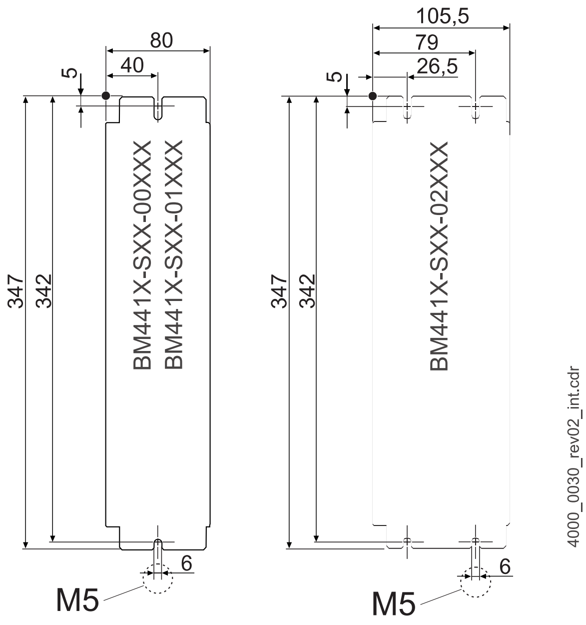


Figure 28: Drilling pattern BM441X

5.5.2 Drilling patterns BM442X

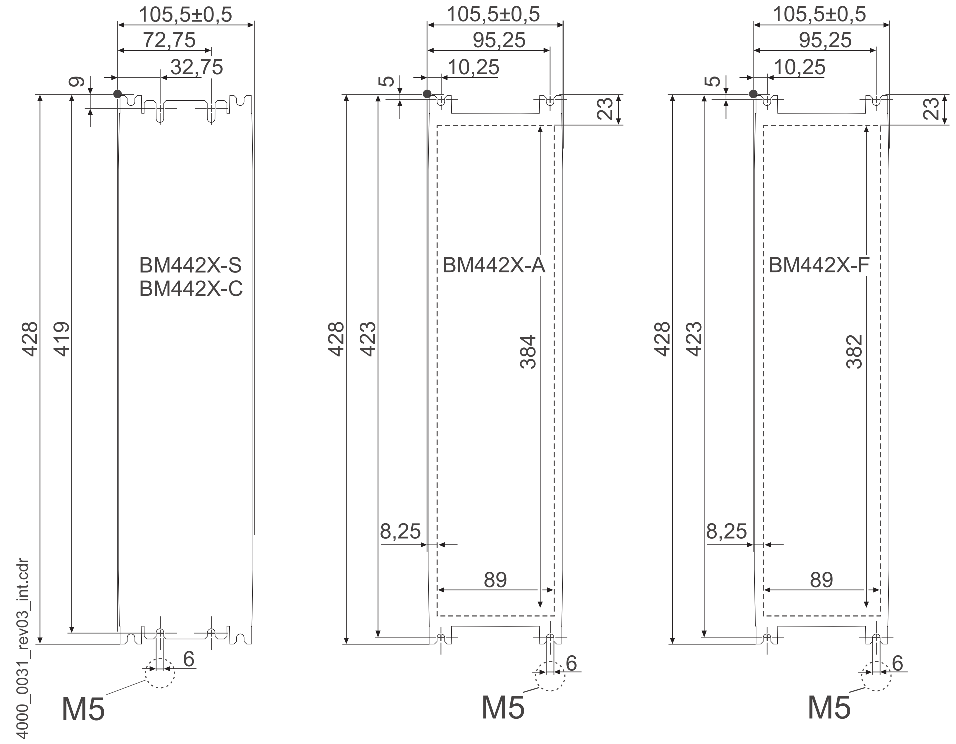


Figure 29: Drilling pattern BM442X

5.5.3 Drilling patterns BM4X3X

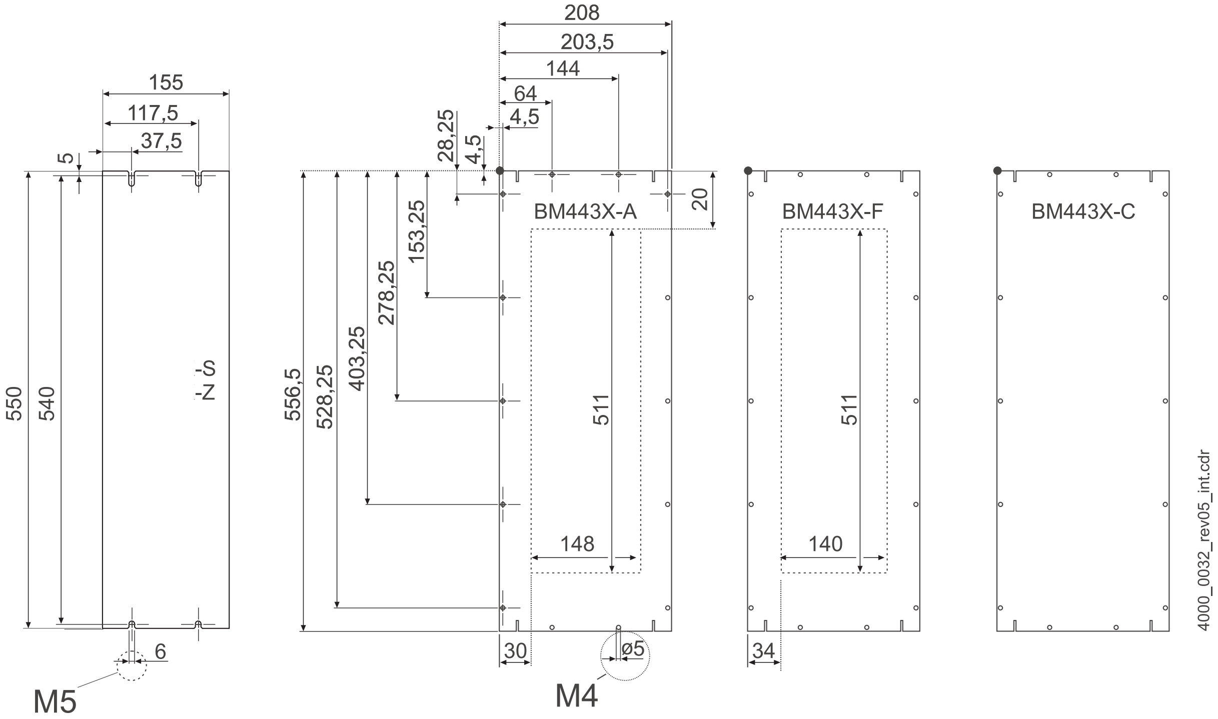


Figure 30: Drilling pattern BM443X, BM463X

5.5.4 Drilling patterns BM4X4X

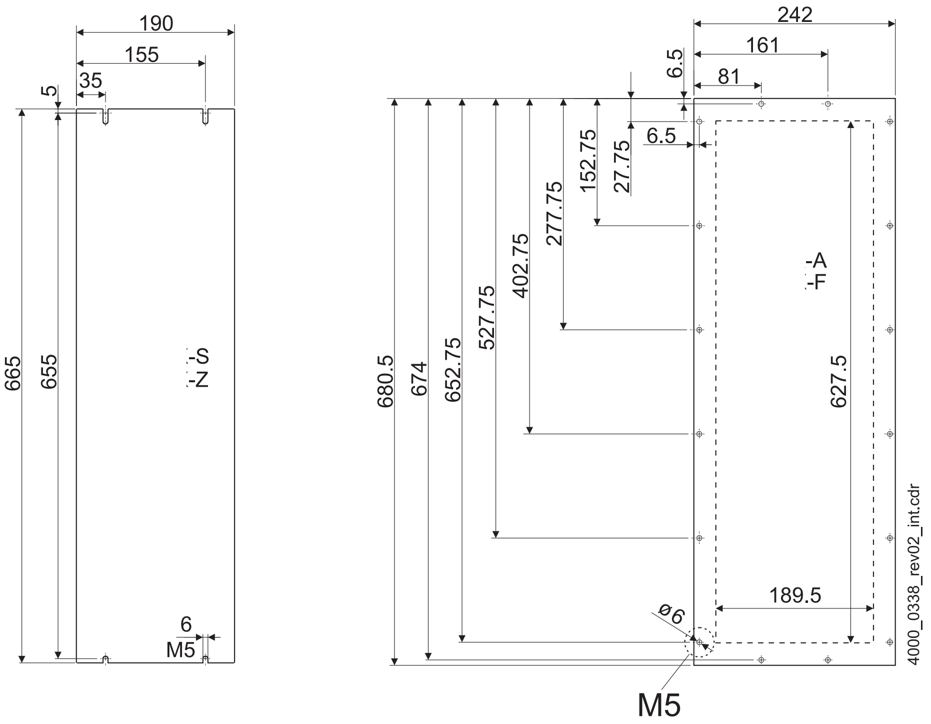


Figure 31: Drilling pattern BM444X, BM464X

5.5.5 Drilling patterns BM4X5X

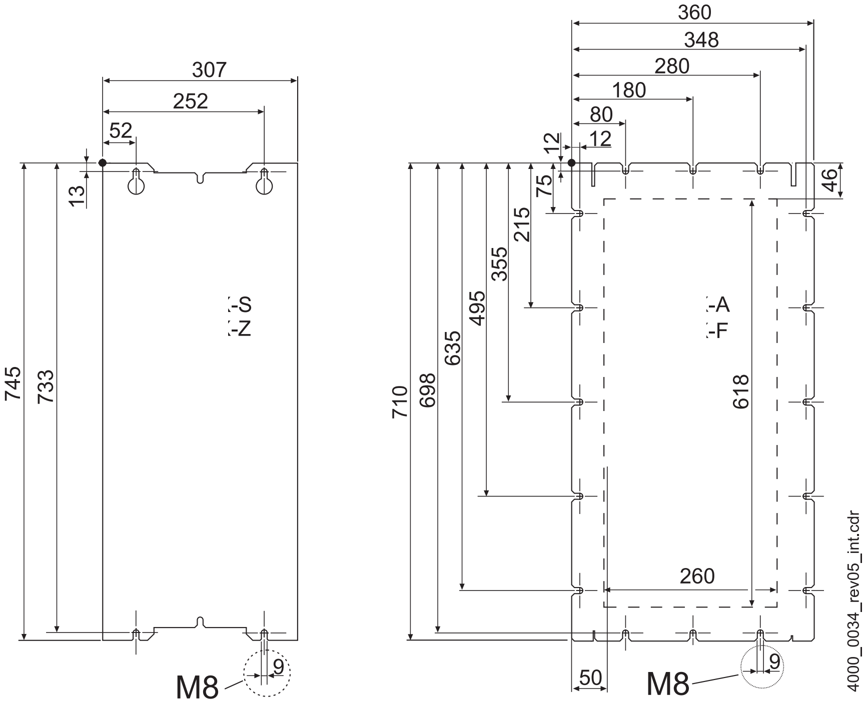


Figure 32: Drilling pattern BM445X, BM465X

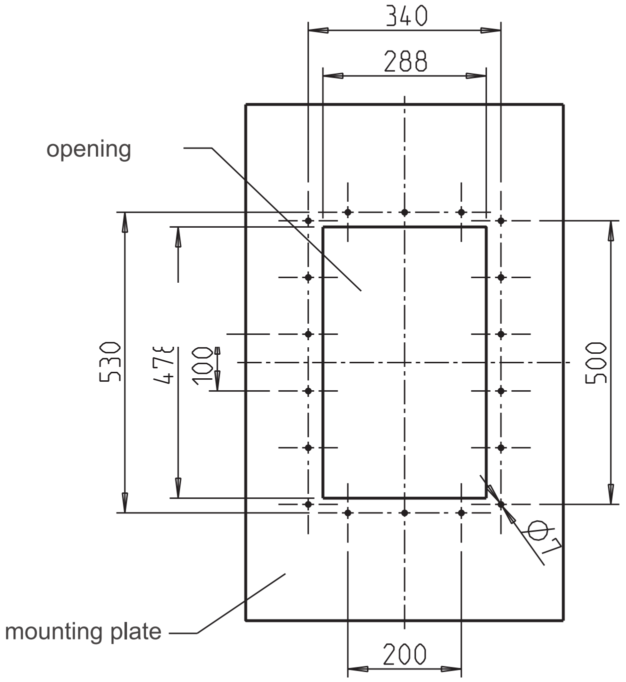


Figure 33: Drilling pattern BM465X-FXX-3XXXX, BM475X-FXX-3XXXX

5.5.6 Drilling patterns BM4X6X

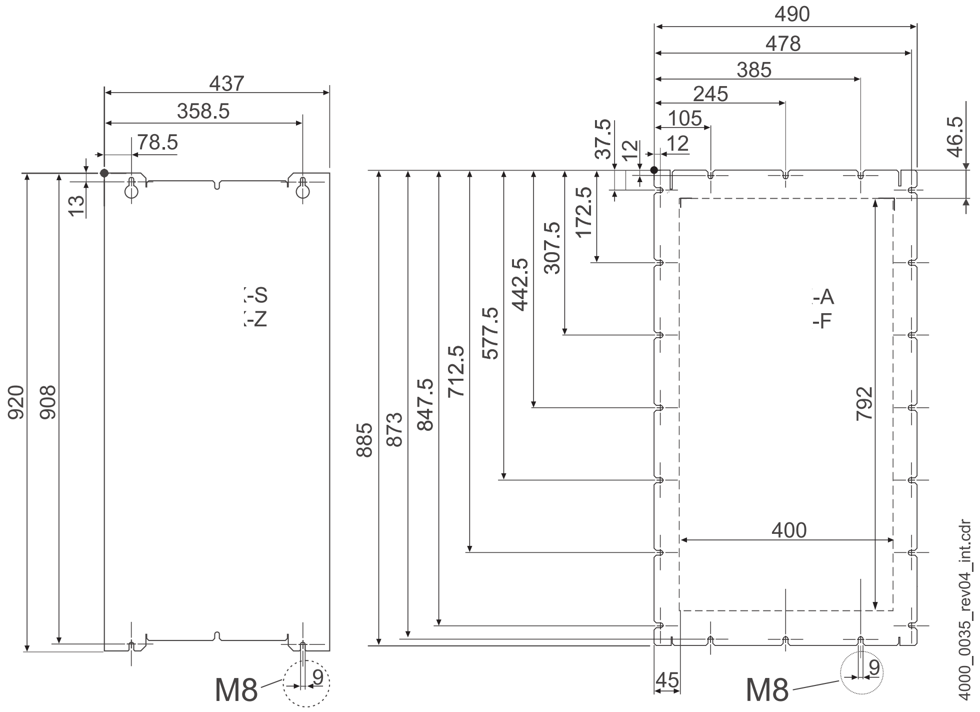


Figure 34: Drilling pattern BM446X, BM466X

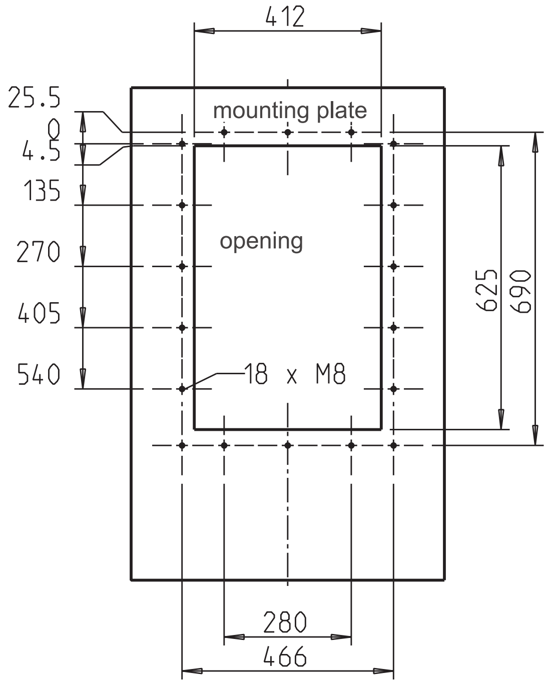


Figure 35: Drilling pattern BM466X-FXX-3XXXX, BM4766-FXX-3XXXX

5.5.7 Drilling patterns BM4X7X

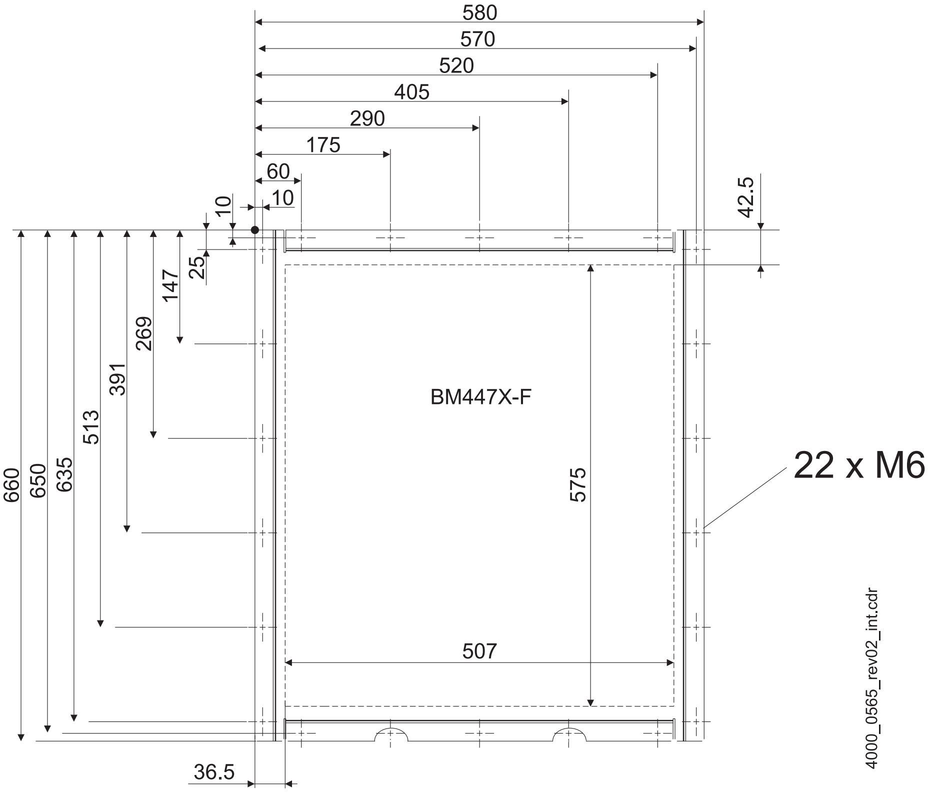


Figure 36: Drilling pattern BM447X-F, BM477X-F

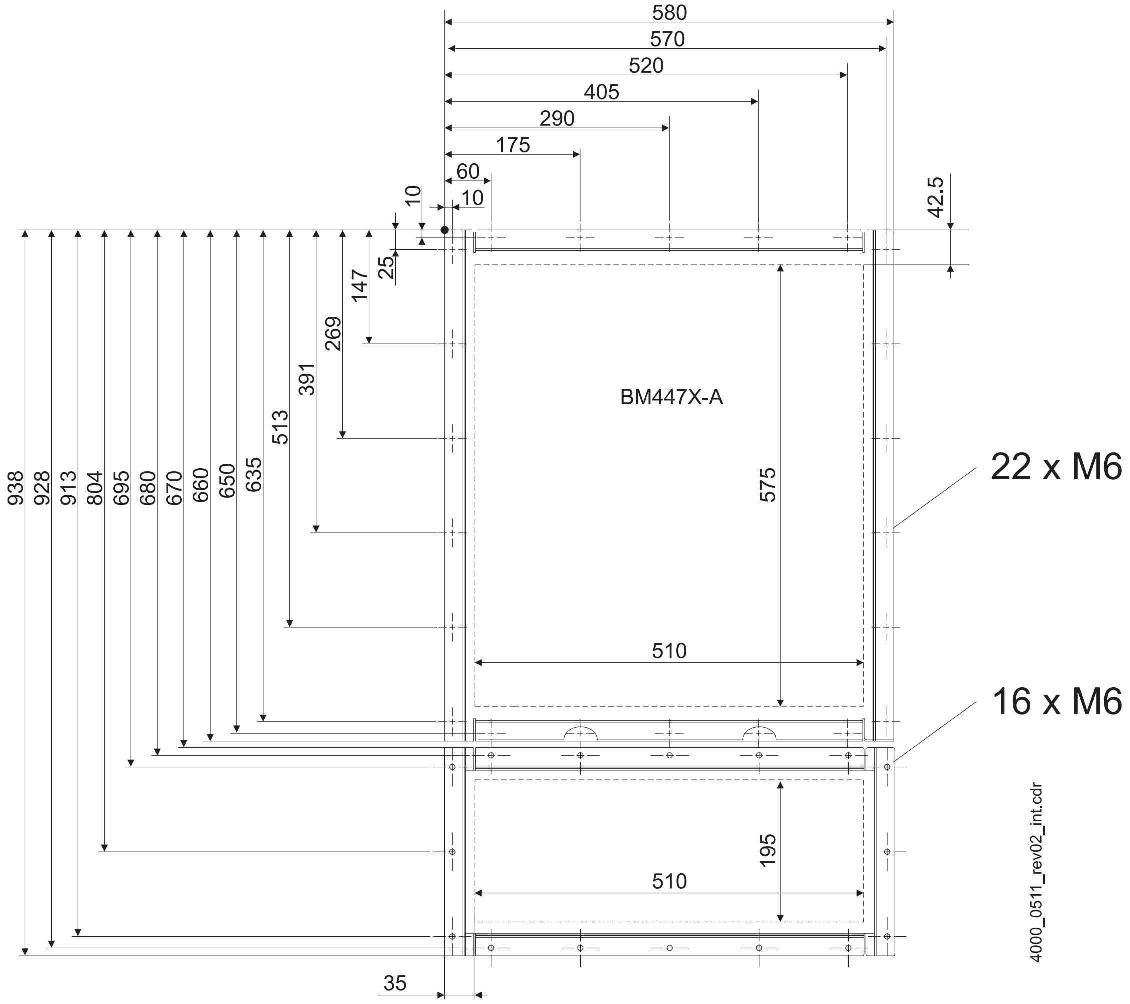


Figure 37: Drilling pattern BM447X-A

5.6 Mounting instructions

There are different mounting technics. Every mounting procedure is shown as a chart (see ▷Figure 38◁ on page 65 to ▷Figure 41◁ on page 68. Below the chart is the list of the devices, for which the particular instruction is to be used. The screws and washers you need for mounting are to be found below the particular chart.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury ● death

The danger is: ***mechanical effects.*** *A device of the size 446X weighs about 70,0 kg and can seriously injure, if it falls off.*

Transport the device in a way, so that it cannot drop. Use an appropriate lift when mounting it.

CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

The danger is: ***sharp edges.*** *In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, the feet can be cut.*

Wear safety gloves

Wear safety shoes

Complete the mounting in the following way:

1 if necessary, provide a suitable transportation-/lift equipment

2 provide suitable mounting accessories

3 mount the device.

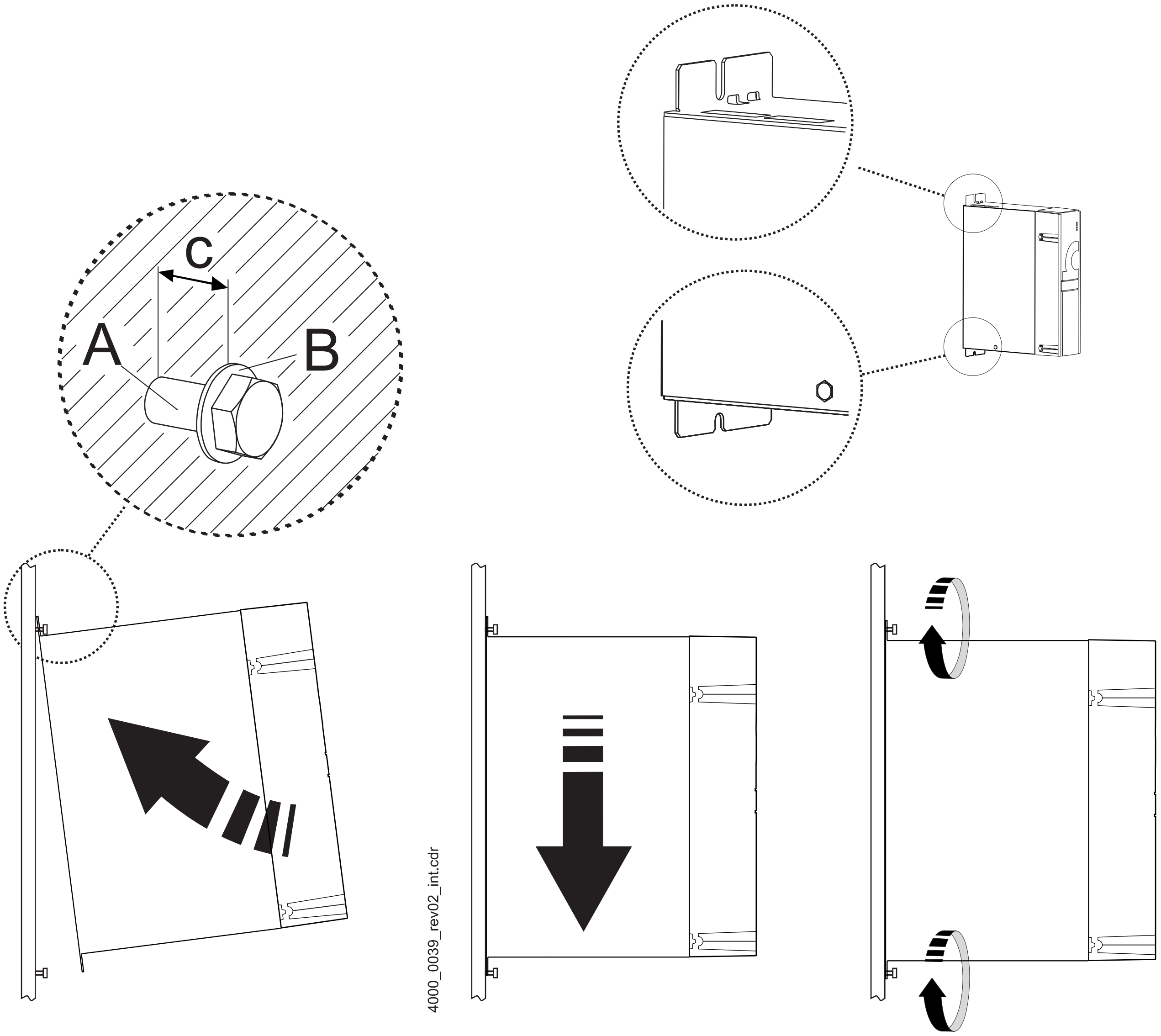


Figure 38: Mounting instruction BM441X, BM442X-S, BM443X-S/Z, BM463X-S/Z, BM444X-S/Z, BM464X-S/Z

Device	**BM441X-XXX -XO -X1**	**BM441X-XXX -X2**	**BM442X-S**	**BM443X-S/Z BM463X-S/Z**	**BM444X-S/Z BM464X-S/Z**
A - screws	2 x M5	4 x M5	4 x M5	4 x M5	4 x M5
B - washers	2 x (5.3 x 10)	4 x (5.3 x 10)	4 x (5.3 x 10)	4 x (5.3 x 10)	4 x (5.3 x 15)
c - mount spacing	c = 5 mm	c = 5 mm	c = 5 mm	c = 5 mm	c = 5 mm

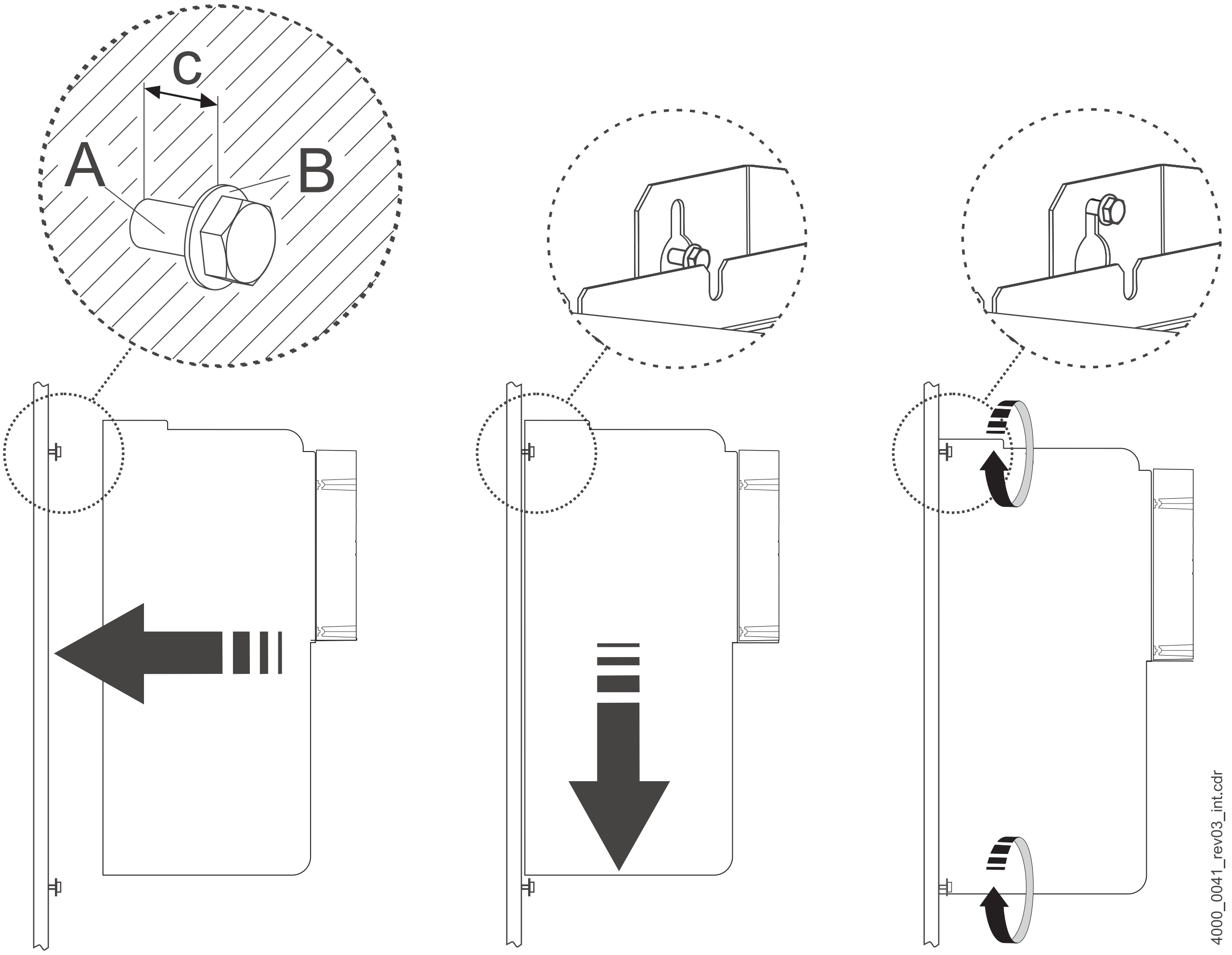
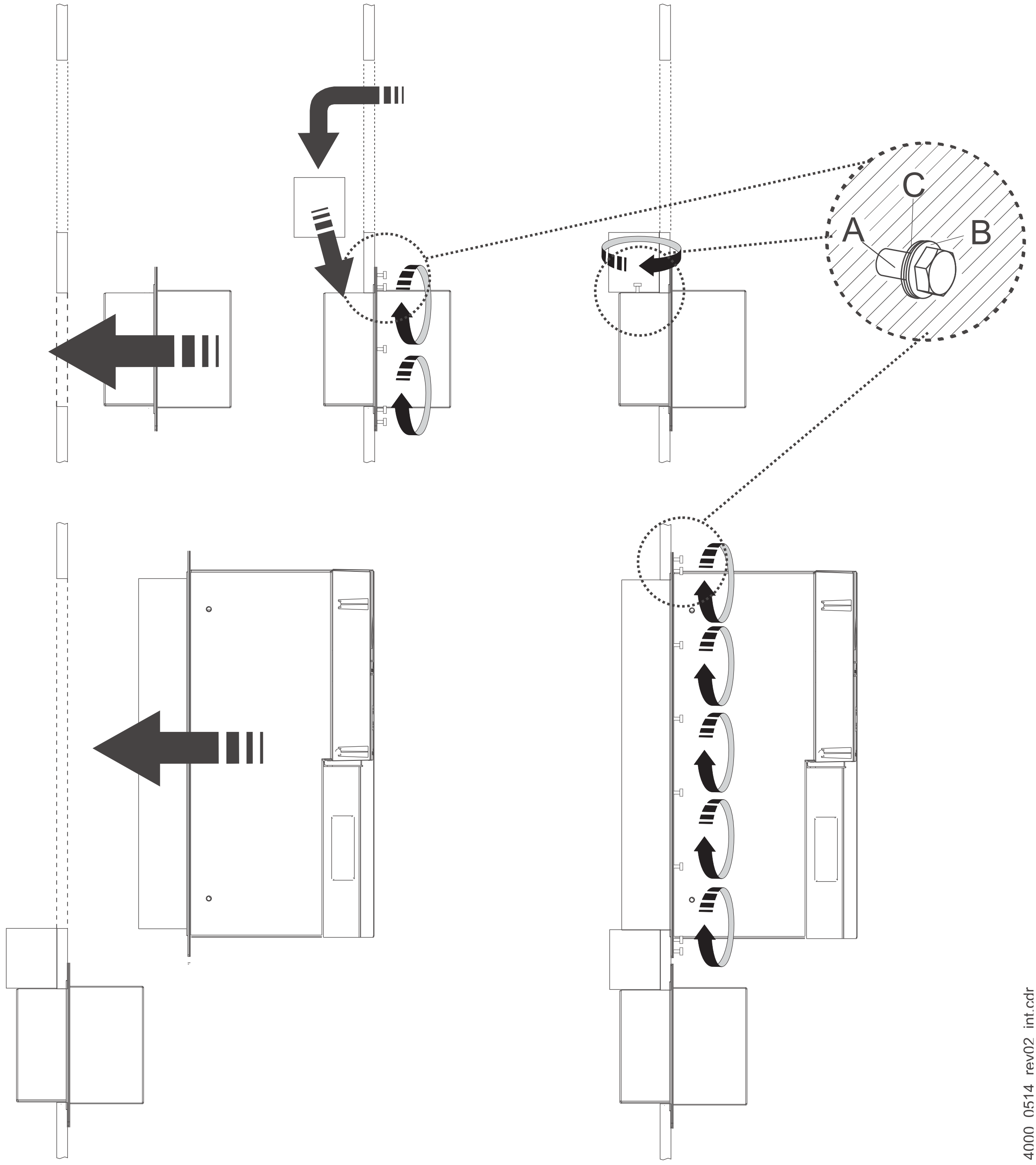


Figure 39: Mounting instruction BM445X-S/Z, BM465X-S/Z, BM446X-S/Z and BM466X-S/Z

Device	**BM445X-S/Z** **BM465X-S/Z**	**BM446X-S/Z** **BM466X-S/Z**
A - screws	4 x M8	4 x M8
B - washers	4 x (8.4 x 21)	4 x (8.4 x 21)
c - mount spacing	c = 7 mm	c = 7 mm



4000 0514 rev02 int.cdr

Figure 40: Mounting instruction BM447X-A/F, BM477X-FXX-3XXXX

Device	**BM447X-S/A**	**BM447X-F** **BM477X-FXX-3XXXX**
A - screws	38 x M6	22 x M6
B - spring washers	38 x DIN6796-6-FST	22 x DIN6796-6-FST
C - washers	38 x (6.4 x 12.5)	22 x (6.4 x 12.5)

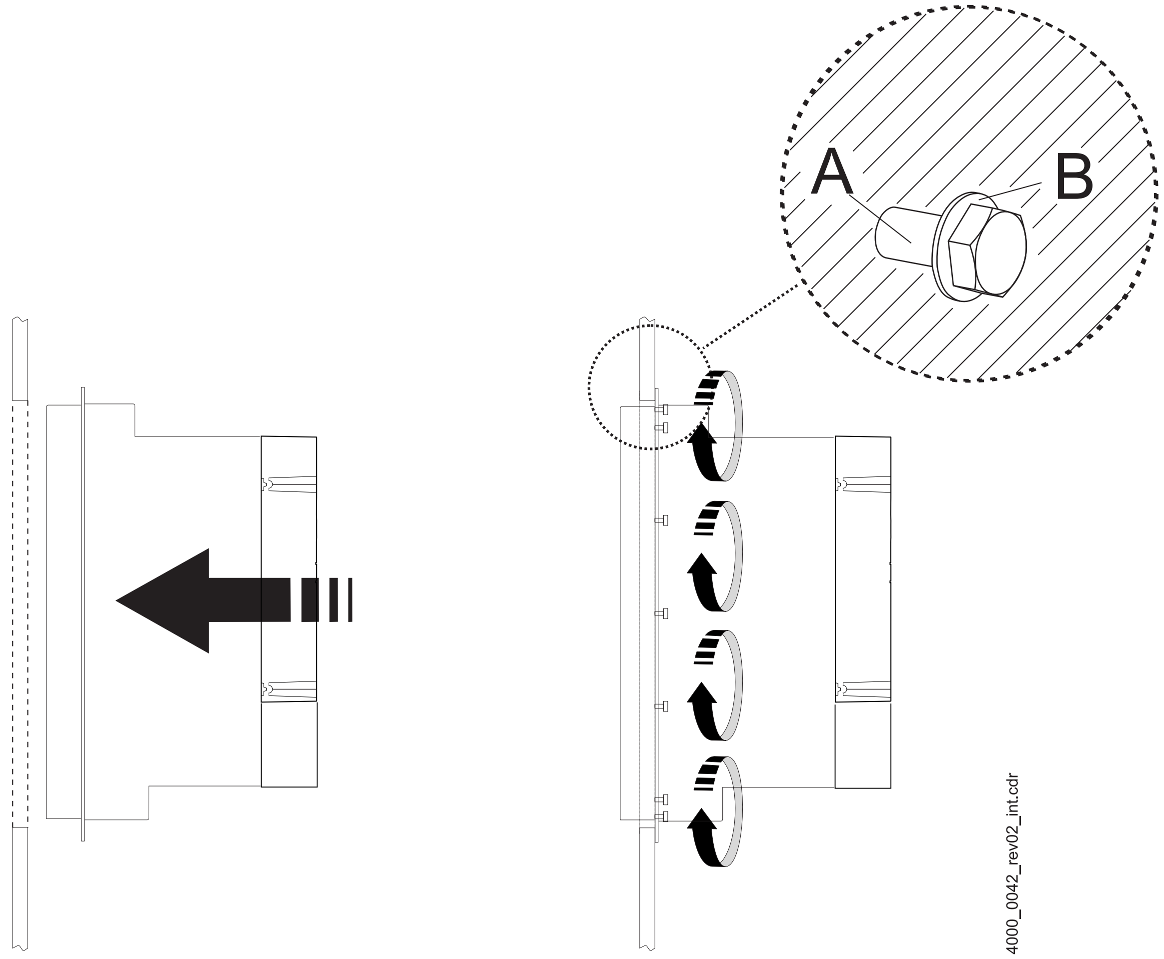


Figure 41: Mounting instruction 'miscellaneous'

Device	**BM454X-A/F/Z/C**	**BM443X-A/F/C** **BM463X-A/F**	**BM444X-A/F** **BM464X-A/F**	**BM445X-A/F** **BM465X-A/F**	**BM446X-A/F** **BM466X-A/F**
A - screws	4 x M5	14 x M4	16 x M5	16 x M8	20 x M8
B - washers	4 x (5.3 x 10)	14 x (4.3 x 9)	16 x (5.3 x 15)	16 x (8.4 x 21)	20 x (8.4 x 21)

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***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 enter the control cabinet.*

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

Type of protection: control cabinet with built in through-hole devices BM442X-A/F

NOTE

The following required control cabinet mounting is only valid for control cabinets with protection class IP54 or higher.

☐ IP protection class for air-cooled through-hole devices: IP44

☐ IP protection class for air-cooled through-hole devices: IP54

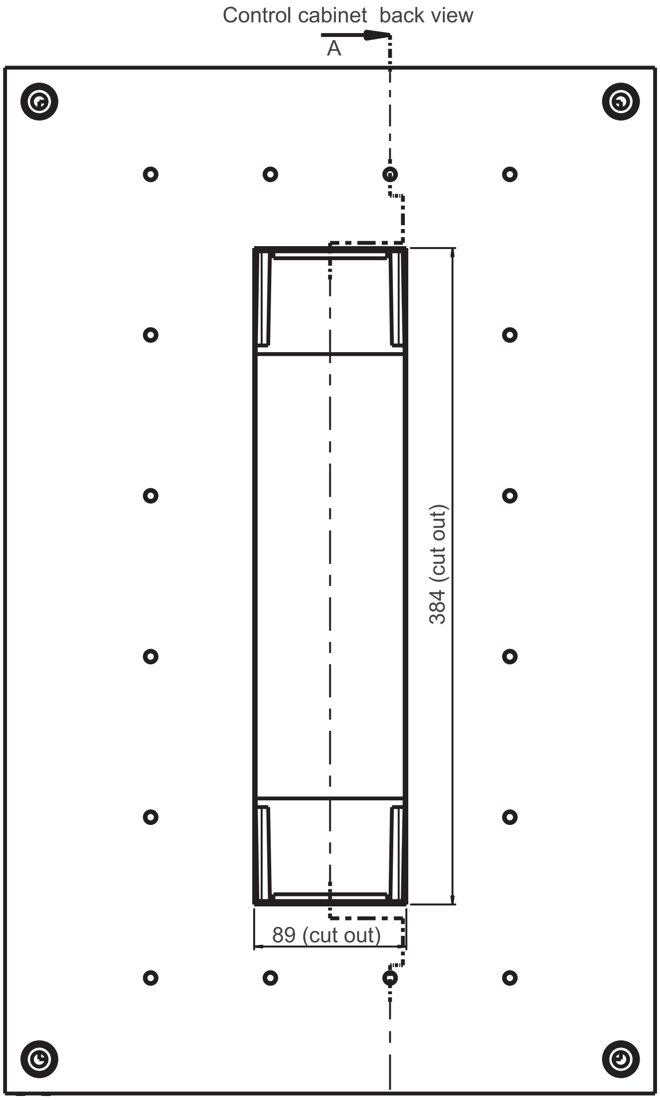


Figure 42: Control cabinet mounting BM442X-A/F

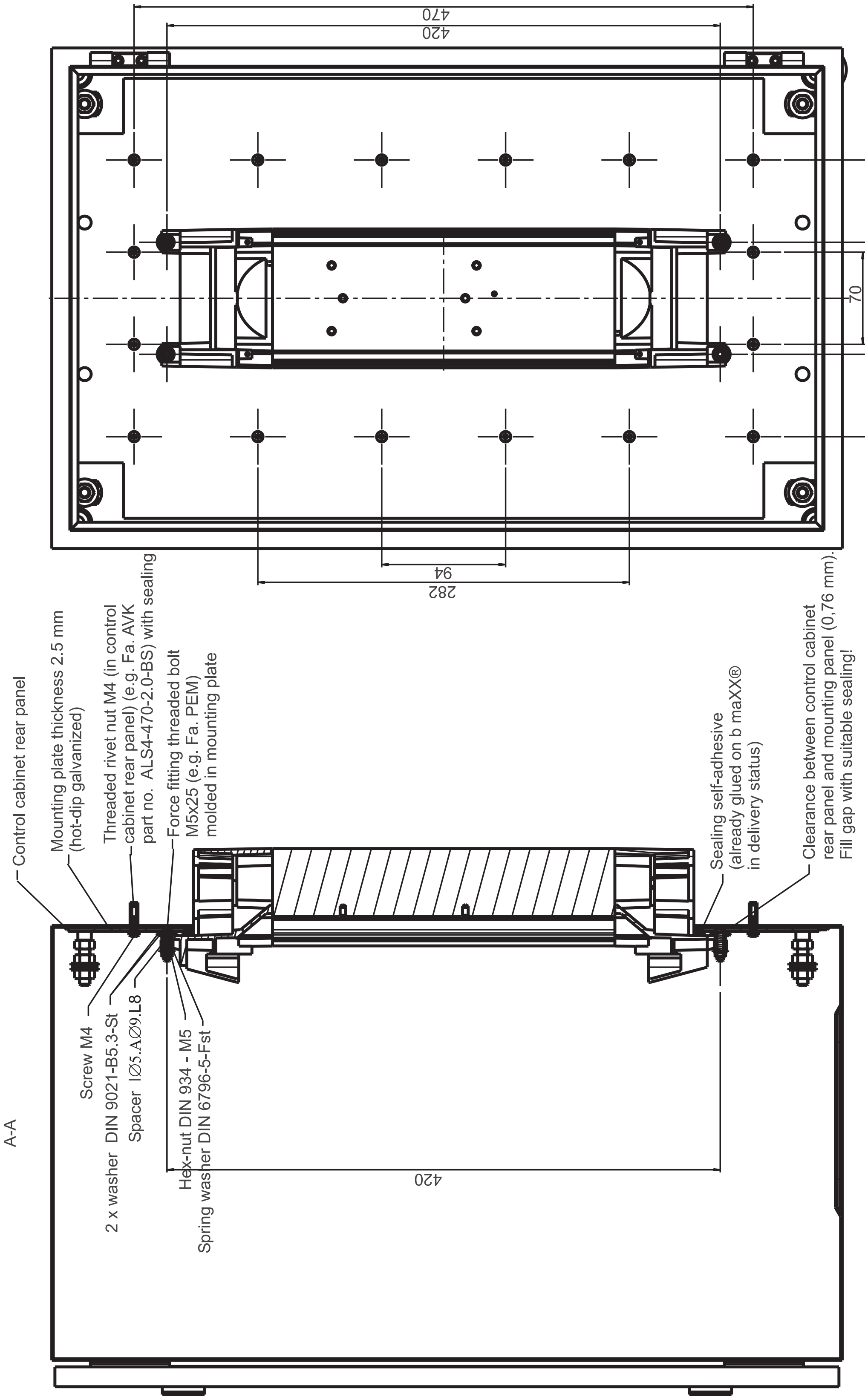


Figure 43: Control cabinet mounting BM442X-A/F

5.7 Connecting the water cooler

With water cooled devices (BM44XX-F, BM46XX-F, BM47XX-F and BM44XX-Z, BM46XX-Z, BM47XX-Z) you connect the coolant circulation before you install the electric. The water cooler has on its bottom side two pressfitting-transition pieces 15mm x R 1/2 ’ AG for flat washers.

➲ Connect the cooling circulation to the water coolerr

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

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

6

INSTALLATION

In this chapter we describe the electric installation of the device. The mechanical installation is described in ▷Mounting◁ from page 39.

Before installing assure, that the technical preconditions are fulfilled:

1. Check the requirements to the electrical mains and check if the existing mains is suitable.
2. Check the requirements to the electrical cables and provide the according cables.
3. Check the characteristics of the connections and configure the connections accordingly.

6.1 General safety instructions

- Pay attention to the information in the chapters ▷Fundamental safety instructions◁ from page 11.
- Pay attention to all areas at the device, which could be dangerous for you during the electrical installation.

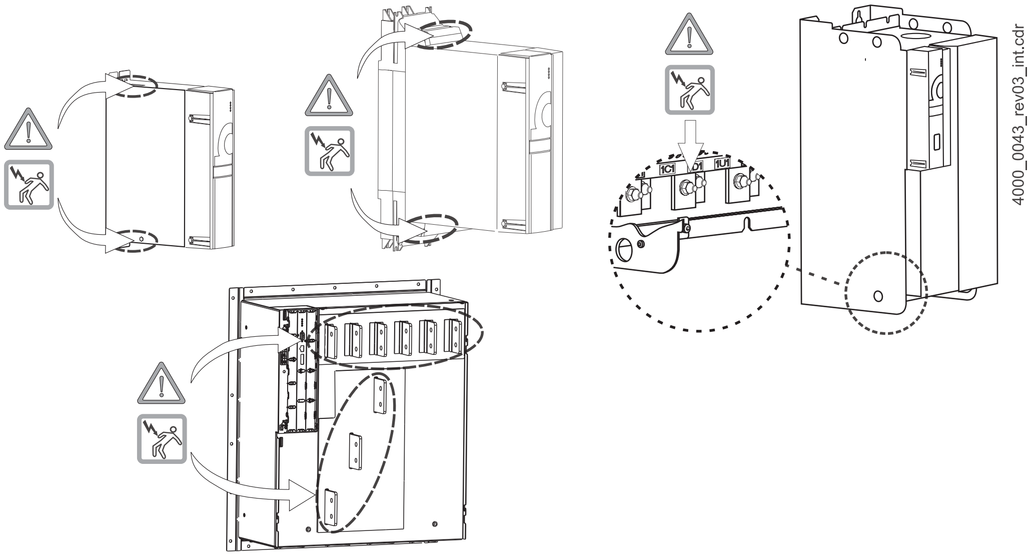


Figure 44: Danger areas at the electrical installation

6.2 Requirements to the executing personnel

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Make sure, that only qualified personnel, who are familiar with the safety- as well as with mounting-, operating- and maintenance instructions, work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

6.3 Voltage check

At routine test of these units a voltage check is executed acc. to EN 61800-5-1, chapter 5.2.3.2 by Baumüller Nürnberg GmbH.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.***

Subsequent checks of unit with high voltages must be made only by
Baumüller Nürnberg GmbH.

6.4 Requirements to the electrical mains

All important data is to be found in ▷D.1 Requirements on the power supply◁ on page 180. Small deviations of the electrical mains from the requirements can lead to malfunctions of the device. In case the mains deviates strongly from the requirements, the device can be destroyed. **b maXX® BM4400, BM4600, BM4700**-devices must not be operated in low-voltage mains in order to supply buildings in residential areas. The destruction of the device can cause personnel injury.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

The danger is: ***electricity.*** *In case you do not ensure the requirements to the electrical mains, the device can be damaged/destroyed and can thereby endanger persons severely.*

Assure before installation, that the requirements of the electrical mains are fulfilled.

NOTE

If the phases are not clockwise connected, devices size 3 and higher (b maXX® 443X and larger) will not charge the DC link.

- Connection instructions at special mains situations (is not valid for **b maXX®** power modules)
  - Single phase connection (BM441X)

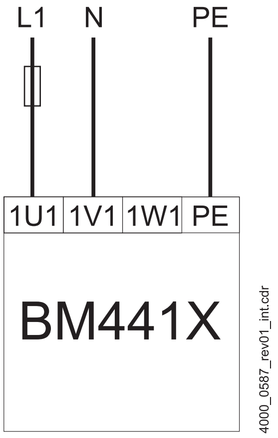


Figure 45: Single phase connection BM441X

- Connection to single phase grounded mains, is not valid for **b maXX**® power modules (BM442X for IT systems, BM443X ... BM447X)

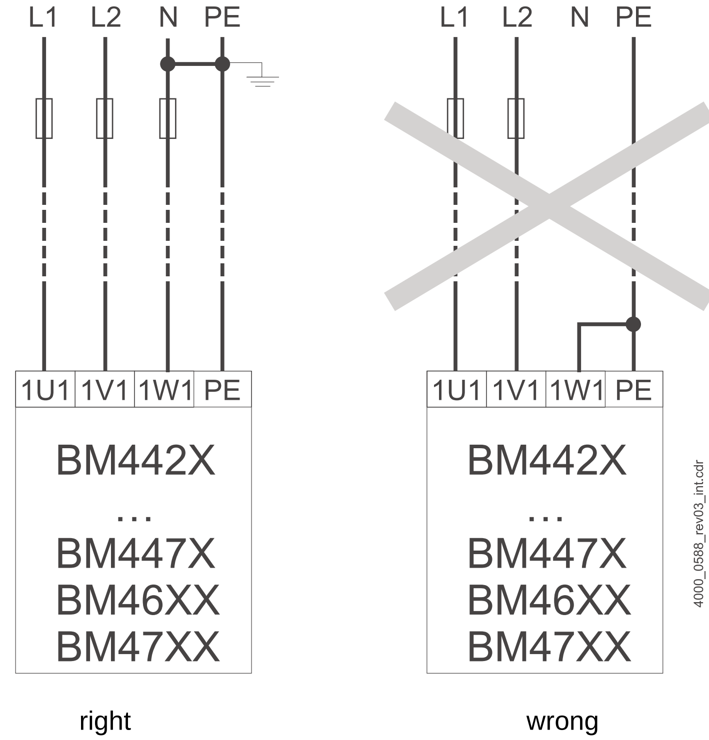


Figure 46: Connection to single phase grounded mains (BM443X ... BM447X, without power modules)

- Connection to single phase grounded mains with isolated transformer for the following cases
  1) BM441X, BM442X except for IT systems, without power modules
  2) BM443X ... BM447X, BM46XX, BM47XX
     at operating altitude > 2000 m, without power modules

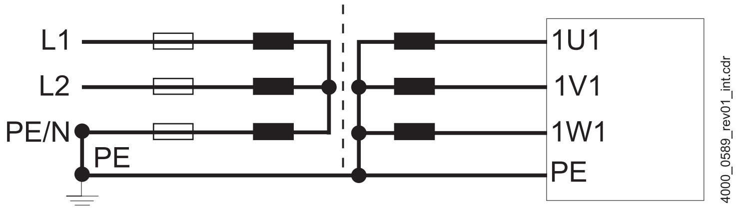


Figure 47: Connection to single phase grounded mains with an isolated transformer

6.5 Requirements to the connecting cables

- You must consider IEC/EN 60204-1: 2006, chapter 12 at selection of connection cables.
- The protective conductor cross section of the cable must be executed accordant to IEC/EN 60204-1: 2006, section 5.2, tab. 1.
- The permanent connection of the protective conductor is imperatively regulated for the operation of the device.
- Use a copper cable for at least 60°C (drives < 3 x 100 A) or 75°C (drives ≥ 3 x 100 A) incase you consider UL 508 C.

Additional data (e.g. maximum permissible length) is available in ▷D.30 Cables mains-device◁ from page 257 to ▷D.31 Cables device-motor◁ on page 259.

6.6 Protection of the device and of the cable respectively

In order to protect the device or the cables against damage/destruction by the mains, you must install fuses. Data of the necessary fuses are to be found in ▷D.29 Fuse protection◁ from page 237.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

*The danger is: **electricity.** Parts, which are under tension are perilous.*

The use of semiconductor fuses is obligatory at the mains connection of BM447X, BM477X devices. Semiconductor fuses are required in the chopper resistor connection except the user assures the short-circuit protection of resistor and cable.

6.7 PE connection and RCD compatibility

Due to the operating principle leakage current can flow via the protective conductor > 3.5 mA_{AC} or > 10 mA_{DC}. On this account a permanent protective conductor is prescribed.In addition to the plugged protective connection, the screw terminal, which is marked with „PE“ must be connected to the PE (see ▷Figure 54◁ on page 90).

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

This product can cause direct current in the protective conductor.If, in case of a direct or indirect contact a residual-current-operated protective device (RCD) is used, then a RCD of type B is permitted on the power supply side only.Otherwise other safety precautions must be made as e. g. environmental separation with a double or strengthened insulation or by the separation of the power supply with an isolated transformer.

Due to high leakage currents, which arise due to the operating principle of the device, can result in an early enabling of the RCD or generally can avoid an enable.

6.8 Requirements on the laying (EMC notes device)

NOTE

The emission of radio interferences is to a high level dependent on the wiring, the volume expansion and the arrangement of the components in the installation. That is why the assurance of the electromagnetic compatibility according to the statutory provisions only is possible on the completed installation and therefore is in the responsibility range of the manufacturer of the installation or of the operating authority (EMVG § 6, sec. 9).

NOTE

In this Manual the most important information for an EMC-compatible installation is available. Further notes, which necessarily have to be considered in order to mount a CE-conform installation are to be found in the manual ’filters for mains applications’.

- Use Baumüller motor cables and Baumüller components.
- Use a suitable mains filter of Baumüller Nürnberg GmbH
- Mount all components to one single mounting board with well electroconductive surface (e. g. galvanized steel plate).
- Execute the ground connection converter/ground plane as short as possible (< 30 cm) with fine-wired cables and a great cross section (> 10 mm^2).
- When installing, attend to the correct order:
  Mains - fuse - filter - choke - (ferrite core) - **BM4400, BM4600, BM4700** - motor.
  A choke is not necessary for BM441X and BM442X (except BM4426)
- Assure, that the motor cables always consist of one piece.
  Do not interrupt the motor cables e. g. by terminals, contactors, fuses a.s.o.
- Run the cables directly on the surface of the grounded mounting board.
  (smallest possible effective aerial height).
- Keep a minimum clearance of 30 cm between signal/control and 24V-wires towards electric power cables at parallel laying.
- Cross cables with different EMC categories (signal cables - supply cables or motor cables) only in a 90° angle.
- Contact the external cable screens when passing through walls, which separate different EMC ranges.
- Connect the cable shields of the **b maXX**®-devices plane on both ends and highly conductive with ground.
- It is recommended to use protection elements against overvoltage in each 24 V control cabinet sub-distribution (e.g. PhoenixContact part no. 2839318 type: PT2-PE/S-24AC-ST) when using a peripheral 24 V supply (that means the 24 V power supply is not within the device’s control cabinet).

NOTE

The capacitive coupling of the signals is reduced by factor 5 if a clearance of at least 30 cm is maintained compared with a cable laying directly side by side.

Baumüller has already considered on EMC view that the recommended clearance of 30 cm is not maintained on the supply and the Baumüller devices, therefore this is uncritical and permitted.

6.9 Requirements to the temperature sensor of the motor

In order to protect the motor against unacceptable overheating a motor-temperature-sensor can be connected to the **b maXX**®-device. When exceeding an adjusted limit temperature the converter switches off the motor. Requirements to the temperature sensor you will find in ▷Temperature sensors of the motor◁ on page 266.

NOTE

The motor temperature sensor is to be executed in such a way, that the electrical separation is guaranteed. The motor temperature sensors, which are build in at Baumüller correspond to these requirements. At connection of an external motor the operator has to assure, that the motor temperature sensor, which was installed into the motor of the external manufacturer complies with the function Electrical separation.

6.10 Operating sequence of installation

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury ● death

*The danger is: **electricity.** Parts, which are under tension are perilous.*

Assure, that during the entire mounting the device, the parts, which must be mounted (e. g. supply cables) and the mounting range are off-circuit.

NOTE

Steps which are not necessary for the installation of **b maXX® 4400 power modules** are marked.

6.10 Operating sequence of installation

The following steps must be carried out at installation:

1 Lay all cables EMC-compatible.

2 Connect cables (see ▹Connection diagrams◃ from page 88) (refer to the permissible torque).

- Connect the motor via the terminals 1U2, 1V2, 1W2, PE. Attend to the in-phase connection (rotational direction).
  (refer to the permissible torque.)
- Connect the fuses (S1) - not necessary for power modules.
  (in case you consider UL 508 C: use the semiconductor- or total-range-fuses, which are UL-listed in chapter ▹D.29 Fuse protection◃ from page 237.)
- Connect the mains filter (L2) - not necessary for power modules.
- Connect the choke (L1) at the mains filter output (for BM441X, BM442X (except BM4426) and for power modules not necessary) .
- Connect the device via the mains input terminals 1U1, 1V1 and 1W1 to the mains choke output - not necessary for power modules.
- Connect the protective conductor to the terminal PE (a permanent PE connection is required imperatively).
- Connect the 24 V supply via terminals X100-1/2, X100-5/6.
  (in case you consider UL 508 C: limit the current to 4 A).
- Connect the encoder (see manual of the encoder modules).

NOTE

The plugging and pulling of the encoder cable is not permissible under voltage.

- Connect the temperature sensor of the motor.
- Connect a signal encoder for the pulse enable via terminals X3-5, X3-3.
- Connect a signal encoder for the quickstop via the terminals X3-4, X3-3.
- Perhaps connect (dependent on the application - not necessary for power modules) a chopper resistor (R_B) via terminals Ba+, Ba-.
- Perhaps connect the brake of the motor via the terminals X101-1/2 and X101-3/4.
- Connect the safety relay (if existing) via X102-3 and X102-4 as well as X103-3 and X103-4 (connection data safety relay also see ▹E.5 Technical data safety relay module◃ on page 291).

6.11 Connection diagrams

6.11.1 b maXX® BM44XX, BM46XX, BM47XX (without power modules)

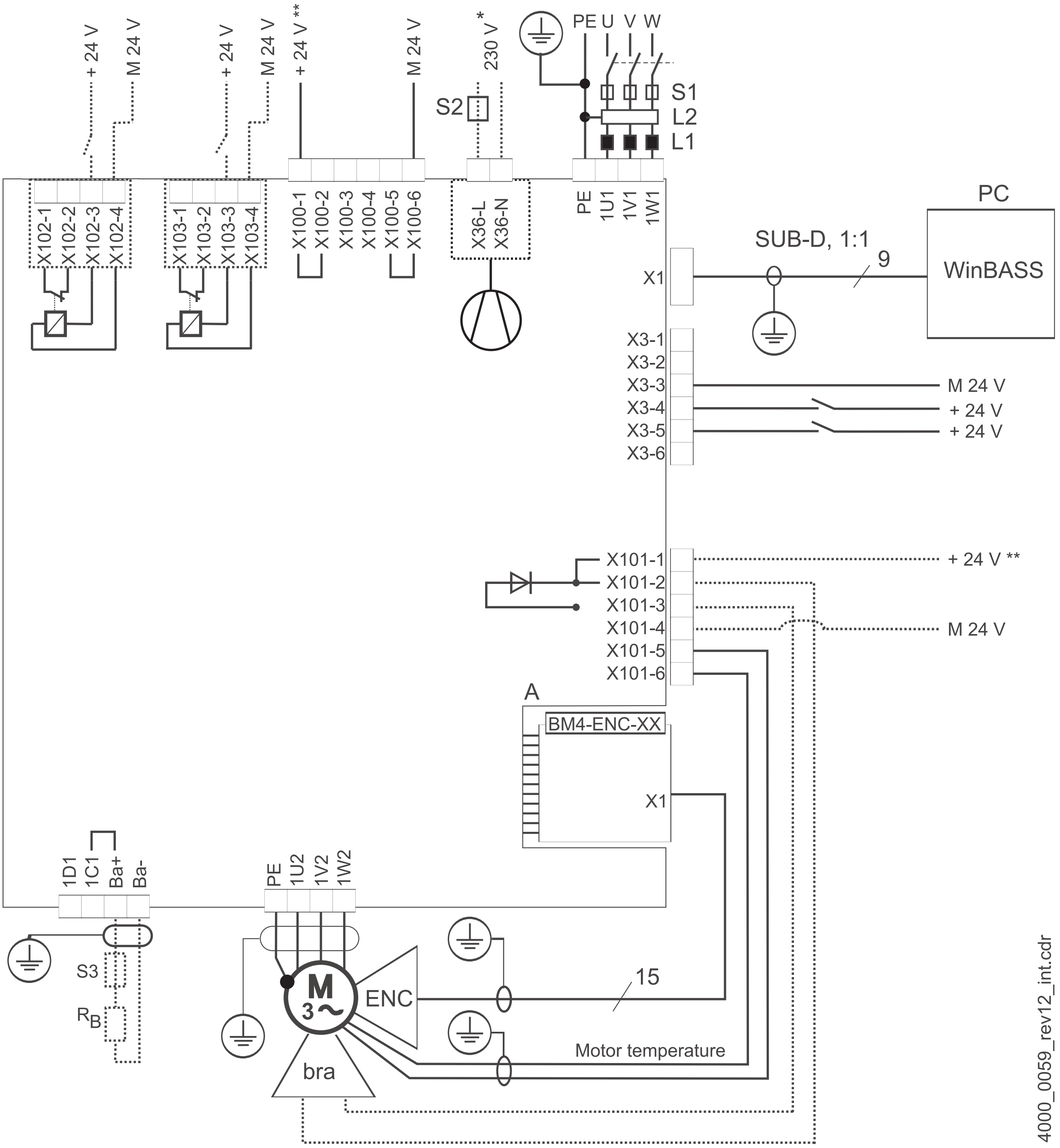


Figure 48: Connection diagram with a directly controlled motor brake - without power modules

NOTE

If the motor brake is connected directly via X101-2 and X101-3 (see ▹Figure 48◃ on page 81) the shown direct installation is allowed only. It is not allowed within a multi-axis installation e.g. to connect the plus and ground connections of all motor brakes with each other.

An additional relay is necessary, if the voltage of the brake is ≠24V, or if the current of the brake is greater than the switching capacity of X101 (see ▹X101 (SELV/PELV)◃ on page 106) or if you consider UL508C and the current of the brake is greater 4 A.
Perhaps consider a limited operating voltage range of the brake because of the internal voltage drop up to max. 2.6 V.

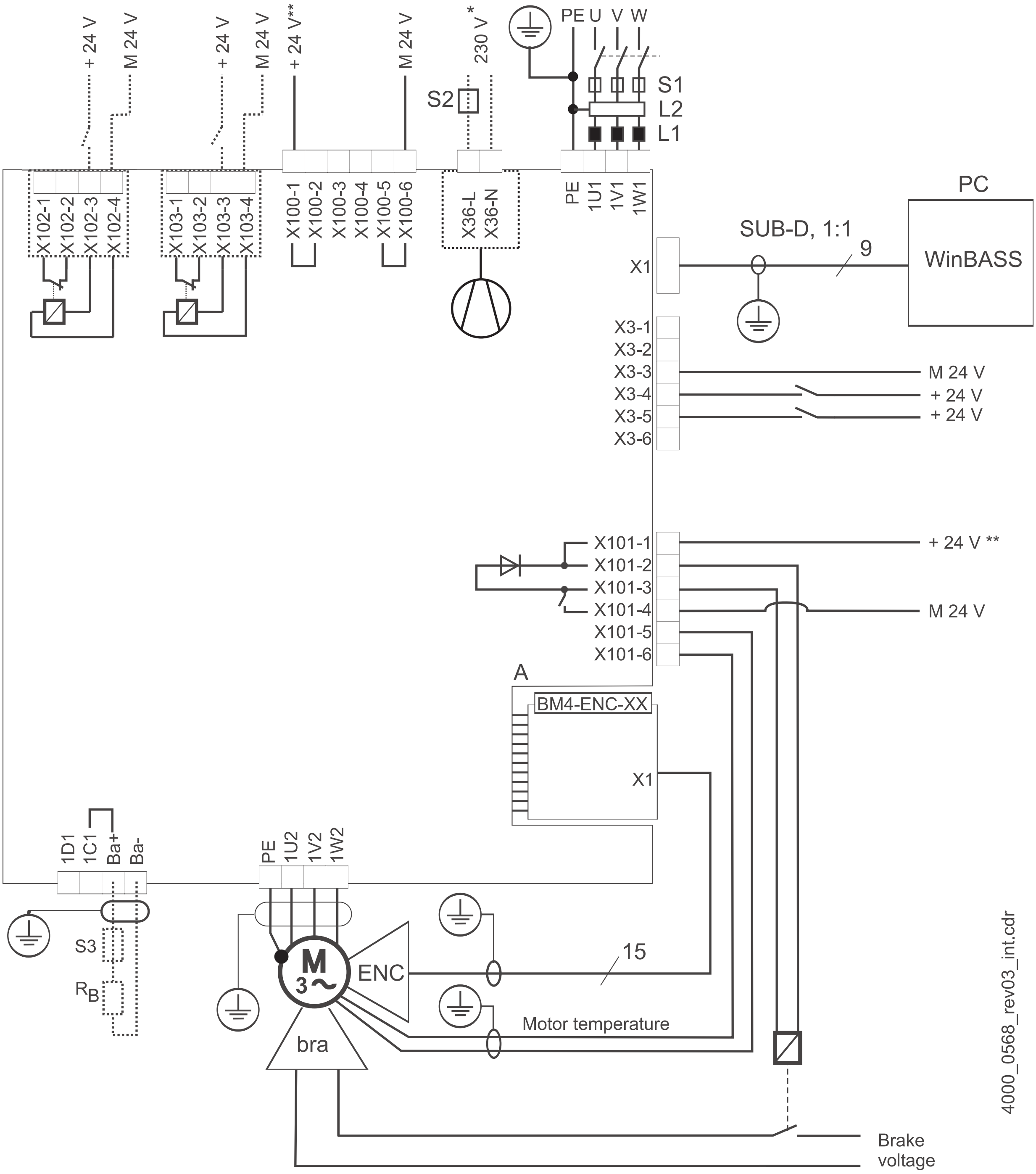


Figure 49: Connection diagram with motor brake controlled via an additional relay - without power modules

6.11.2 b maXX® BM44XX, BM46XX, BM47XX power modules

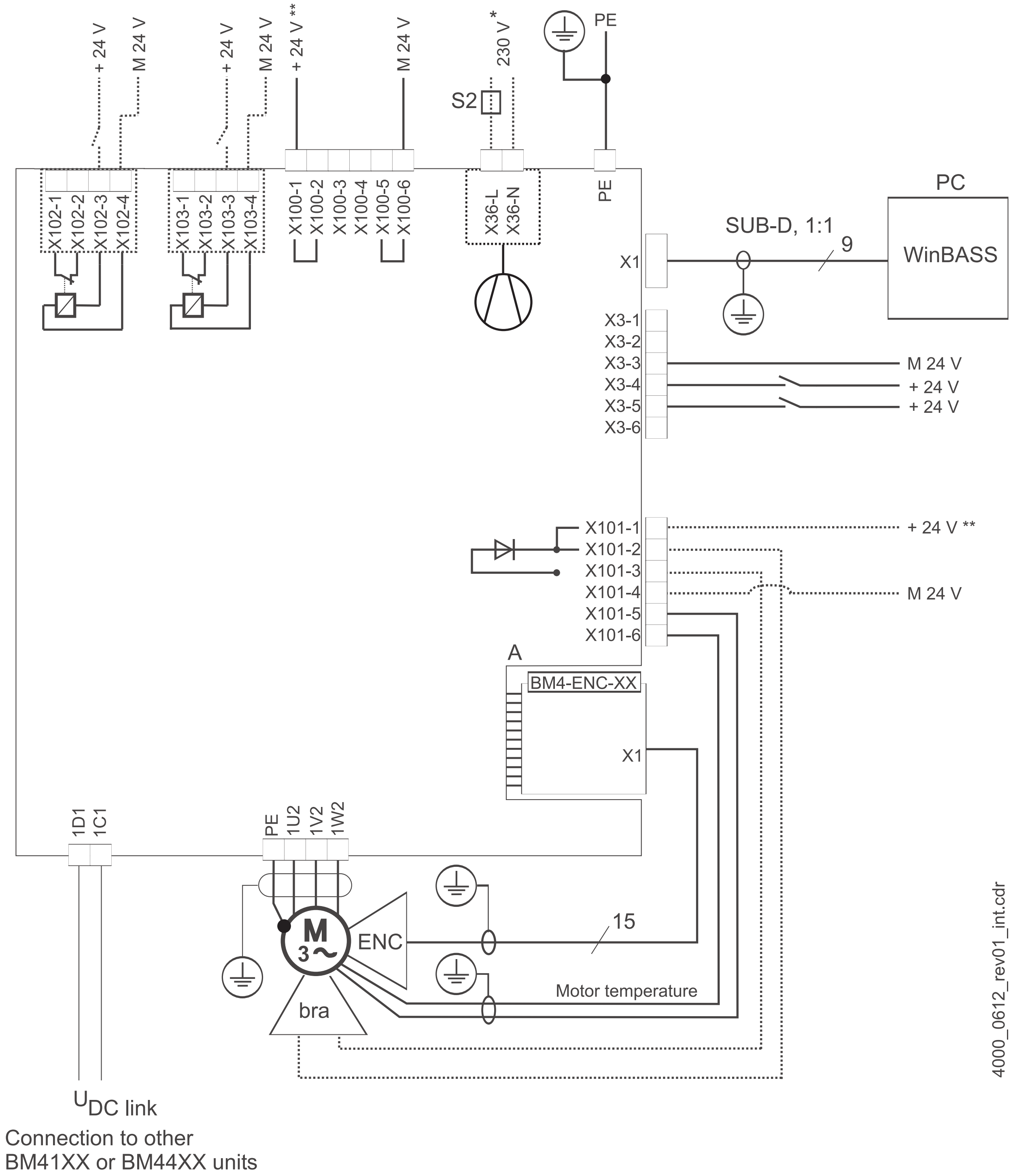


Figure 50: Connection diagram with a directly controlled motor brake - power modules

NOTE

If the motor brake is connected directly via X101-2 and X101-3 (see ▷Figure 48◁ on page 81) the shown direct installation is allowed only. It is not allowed within a multi-axis installation e.g. to connect the plus and ground connections of all motor brakes with each other.

An additional relay is necessary, if the voltage of the brake is ≠24V, or if the current of the brake is greater than the switching capacity of X101 (see ▷X101 (SELV/PELV)◁ on page 106) or if you consider UL508C and the current of the brake is greater 4 A.
Perhaps consider a limited operating voltage range of the brake because of the internal voltage drop up to max. 2.6 V.

Connection diagrams

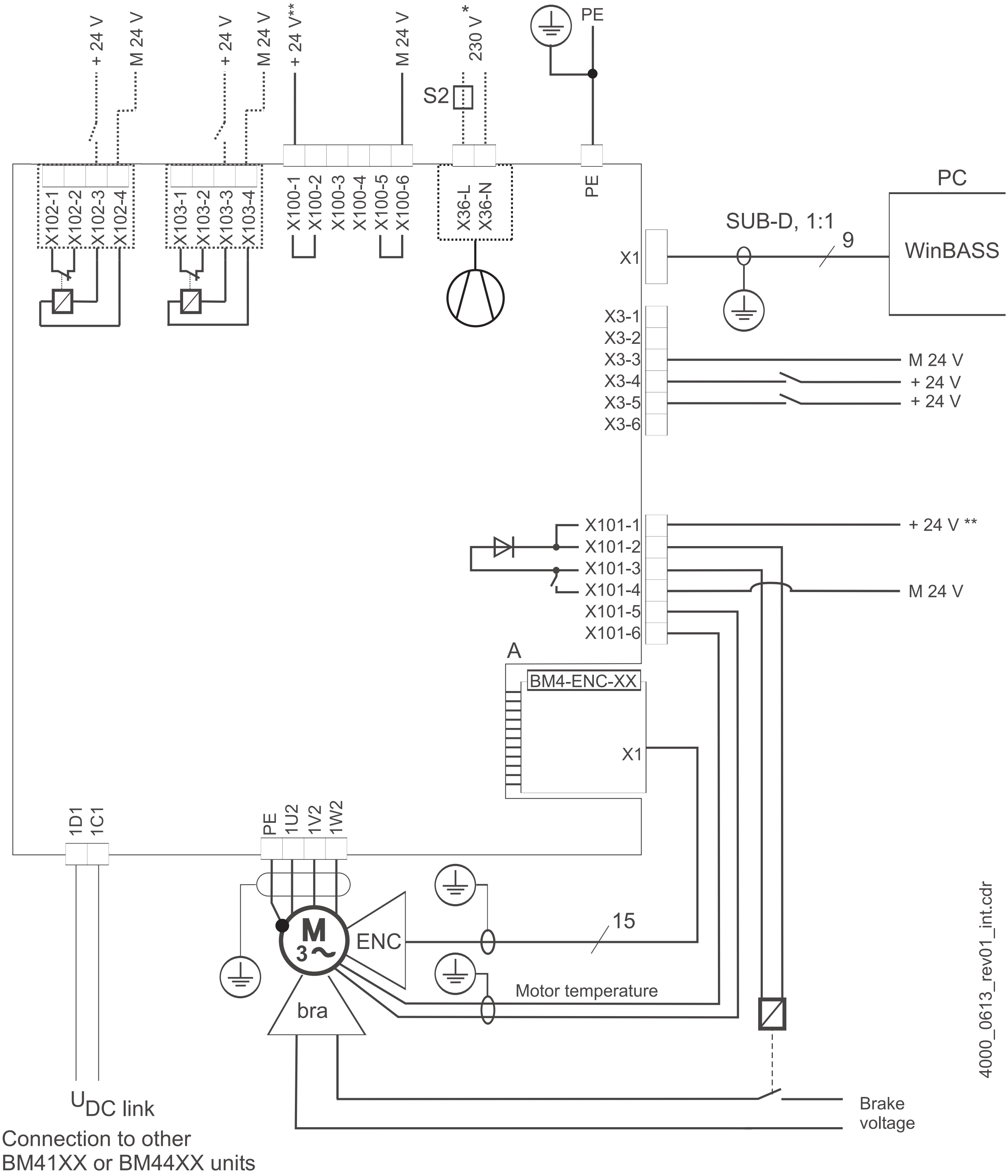


Figure 51: Connection diagram with motor brake controlled via an additional relay - power modules

*	is only valid for BM444X, BM464X, BM445X, BM465X, BM446X, BM466X accordingly the cooling versions S and A, for BM447X cooling version -A:

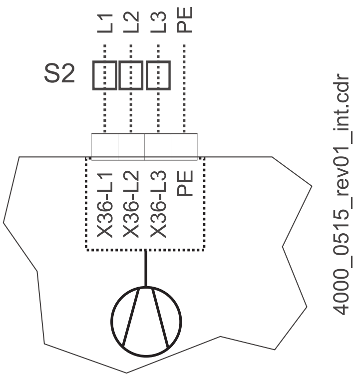


Figure 52: Connection fan BM447X-A

**	The power supply at X100 or X101 must externally be protected. At selection of the fuse you must consider the cross-section of the connecting cable and the maximum allowable load capacity (for X100: see X100 on ▹Page 105◃, for X101: see X101 on ▹Page 106◃). In case you consider UL 508 C, you must limit the power supply to 100 W or fuse it with a UL-listed 4 A fuse.
Ba- ... 1D1	Connections for chopper resistor and DC link, see ▹Figure 53◃ on page 89 and the following.
R_B	Chopper resistor
PE....1W1	Mains connection, see ▹Figure 53◃ on page 89 ff.
S1	Fuses (circuit cable + device)
S2	Fuse (fan) *)
S3	Fuse chopper resistor connection (required for BM447X, BM477X), see ▹D.29.38 Semiconductor fuses aR (device) 447X, model NH◃ on page 255.
L1	Mains choke (not necessary for BM441X and BM442X except BM4426)
L2	Mains filter
X1	Serial interface (RS 232), see ▹Figure 62◃ on page 99.
X3	Connections for ready-for-use, quickstop, pulse enable, see ▹Figure 62◃ on page 99.
X36	Connections for fan (only BM444X-S/-A, BM445X-S/-A, BM465X-S/-A, BM446X-S/-A, BM466X-S/-A, BM447X-A)
X100	Connections for 24 V power supply, additional data see ▹Figure 62◃ on page 99 (SELV/PELV) and table ▹X100 (SELV/PELV)◃ on page 105.
X101	Connections for brake, motor temperature, see ▹Figure 53◃ on page 89 and the following (SELV/PELV) and table X101 from ▹Page 89◃.
X102	Connections of the safety relay, see -▹Figure 53◃ on page 89 and the following (SELV/PELV) and table ▹X102 (option) Safety relay◃ on page 106.
X103	Terminals of the optional, second safety relay (only BM443X - BM447X, BM46XX, BM47XX), see ▹Figure 56◃ on page 92 and the following (SELV/PELV) and table ▹X103 (option) Safety relay◃ on page 106.

A - X1	Encoder module, see manual 5,01042 (SELV/PELV)
ENC	Encoder
BRE	Brake
PE....1W2	Connections for motor, see ▹Figure 53◃ on page 89

6.12 Connection diagrams

▹Figure 53◃ on page 89 and the following show the connections for protective conductors, mains, motor, chopper resistor, DC-link, safety relays and motor temperature sensor (X101). ▹Figure 62◃ on page 99 shows the control voltage and the connections of the controller unit.

NOTE

When having a switched off safety relay it is not possible at BM441X and BM442X to use a chopper resistor.

NOTE

The characterization 1C1 and 1D1 is from the standard DIN EN 60445.
1C1 is the connection to the positive DC link cable/current bar and was labeled with ZK+ by Baumüller in the past.
1D1 is the connection to the negative DC link cable/current bar and was labeled with ZK- by Baumüller in the past.

The electrical connections for devices **BM4412** and **BM4413** are shown in the following figure:

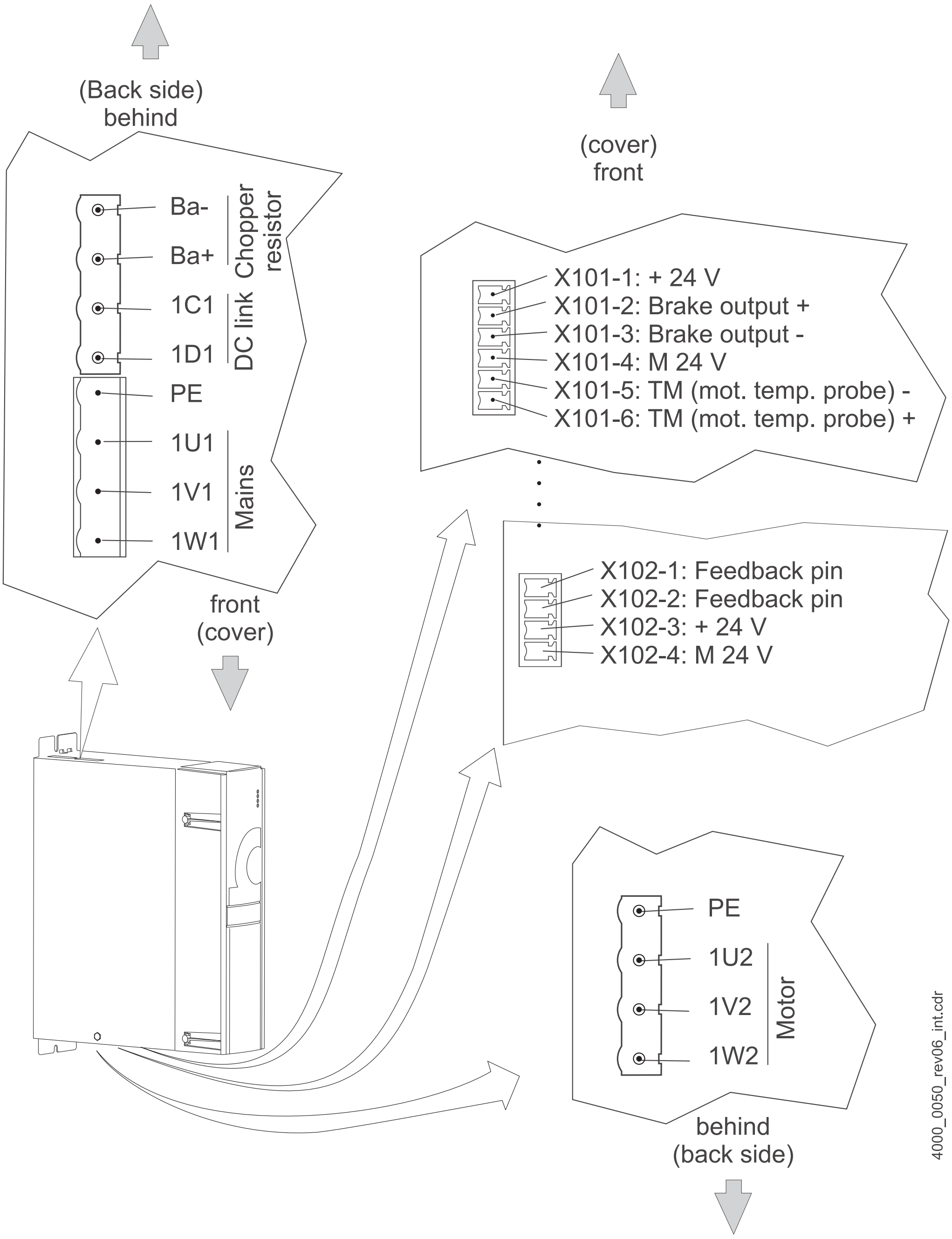


Figure 53: Electrical connections for mains, motor, upon others for BM4412 and BM4413

The electrical connections for device **BM4414** are shown in the following figure:

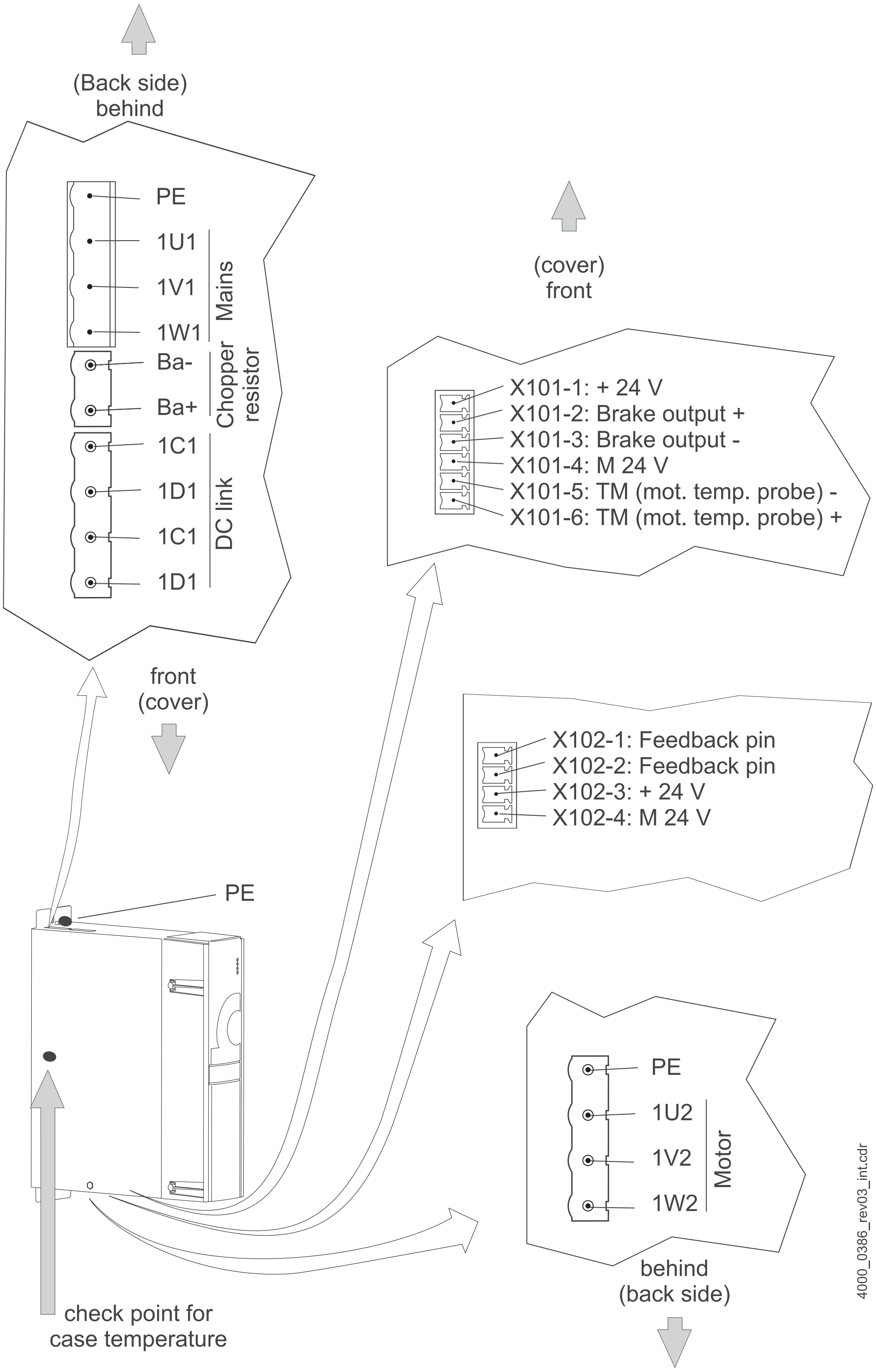
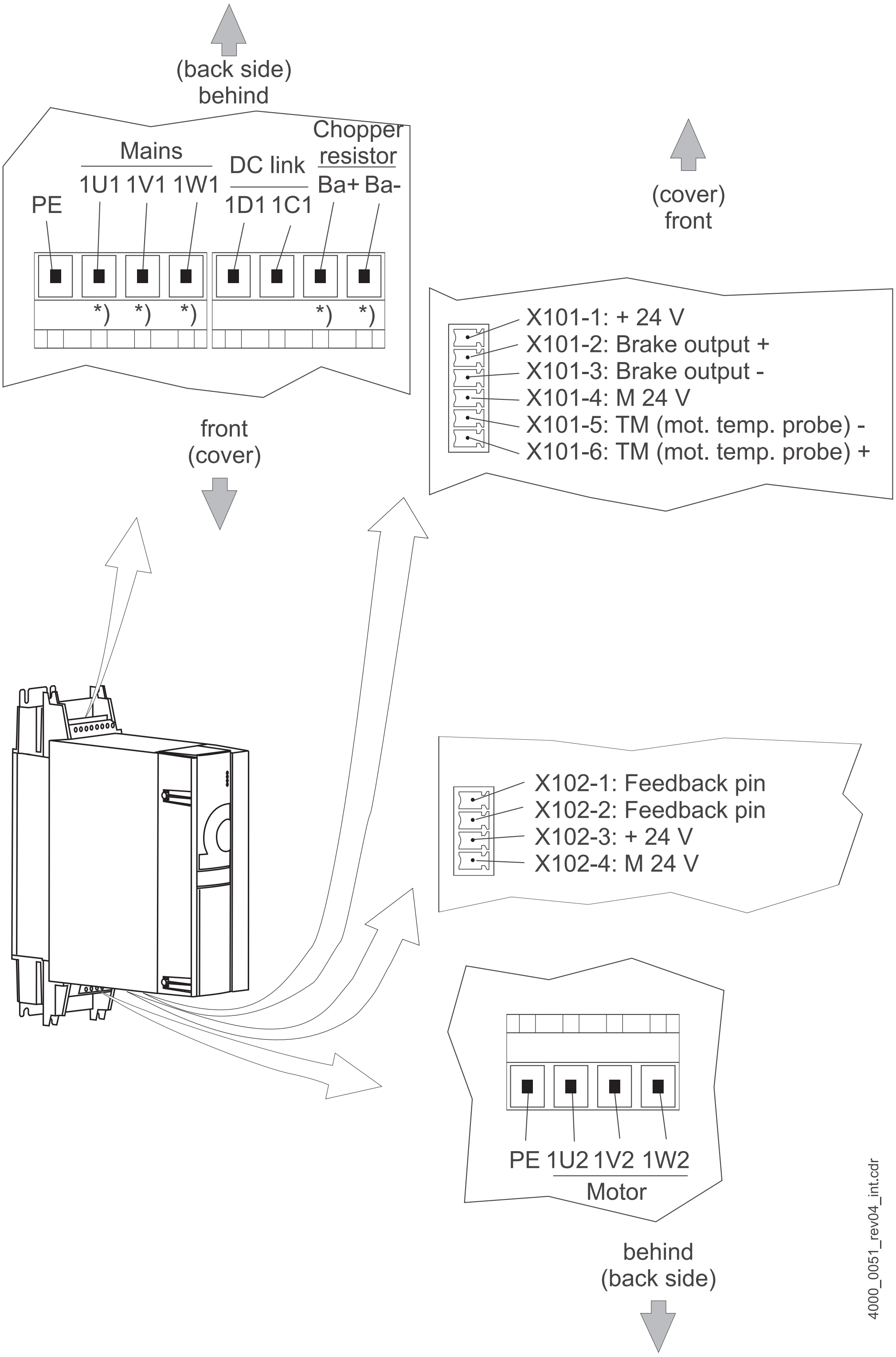


Figure 54: Electrical connections for mains, motor, upon others for BM4414

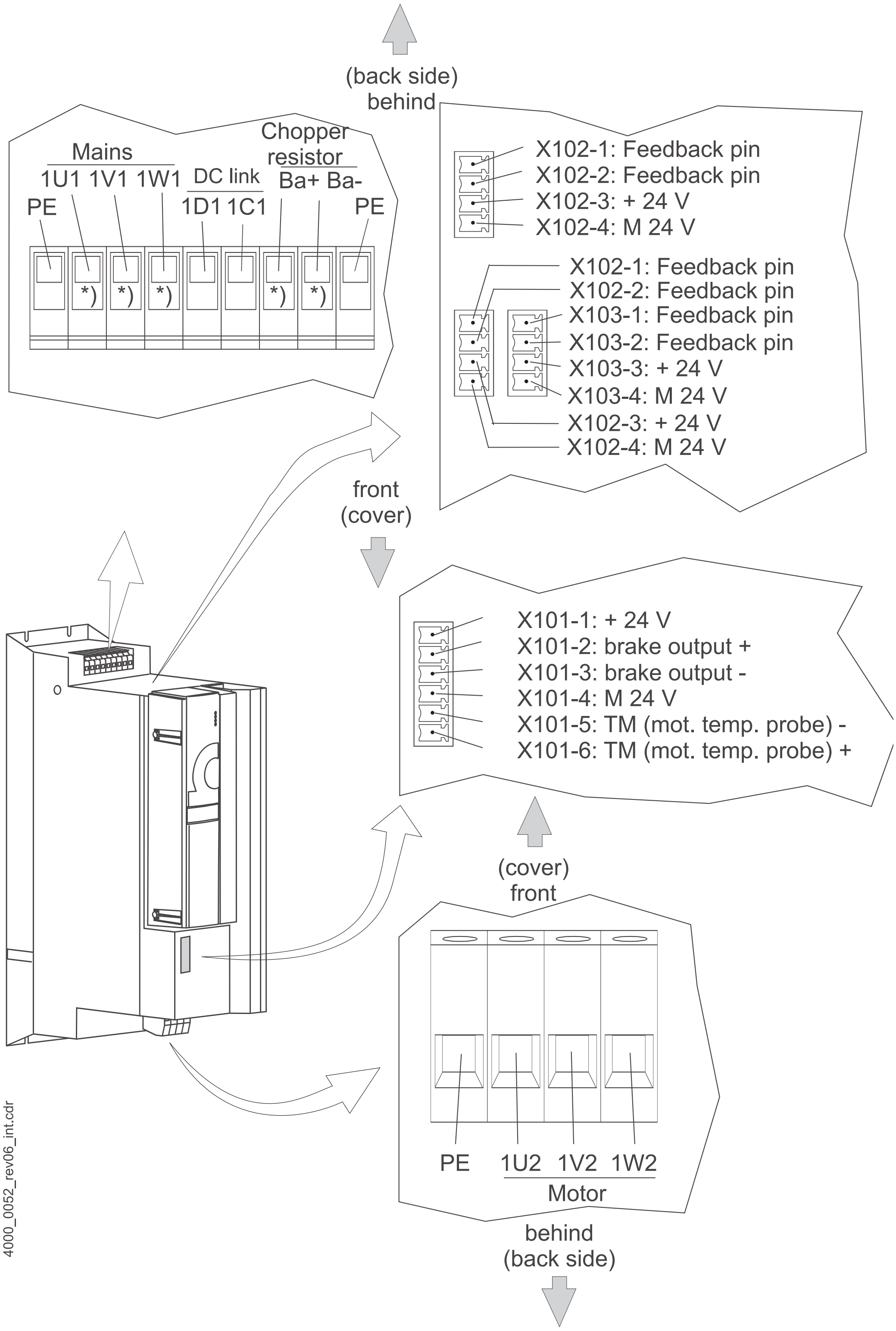
The electrical connections for device **BM442X** are shown in the following figure:



*) Do not apply terminals when using a power module!

Figure 55: Electrical connections for mains, motor, upon others for BM442X

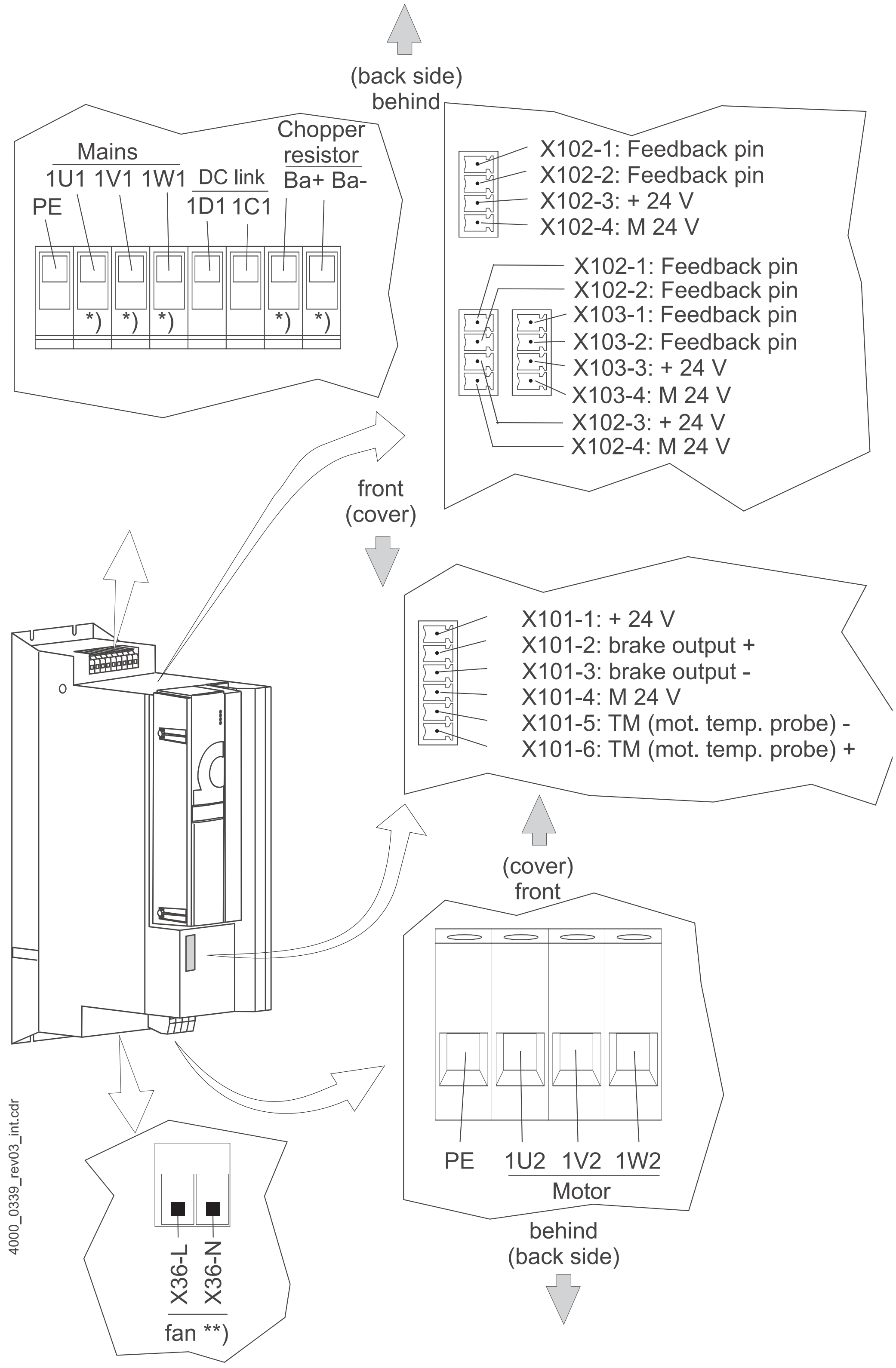
The electrical connections for device **BM443X, BM463X** are shown in the following figure:



*) Do not apply terminals when using a power module!

Figure 56: Electrical connections for mains, motor, upon others for BM443X, BM463X

The electrical connections for device **BM444X, BM464X** are shown in the following figure:

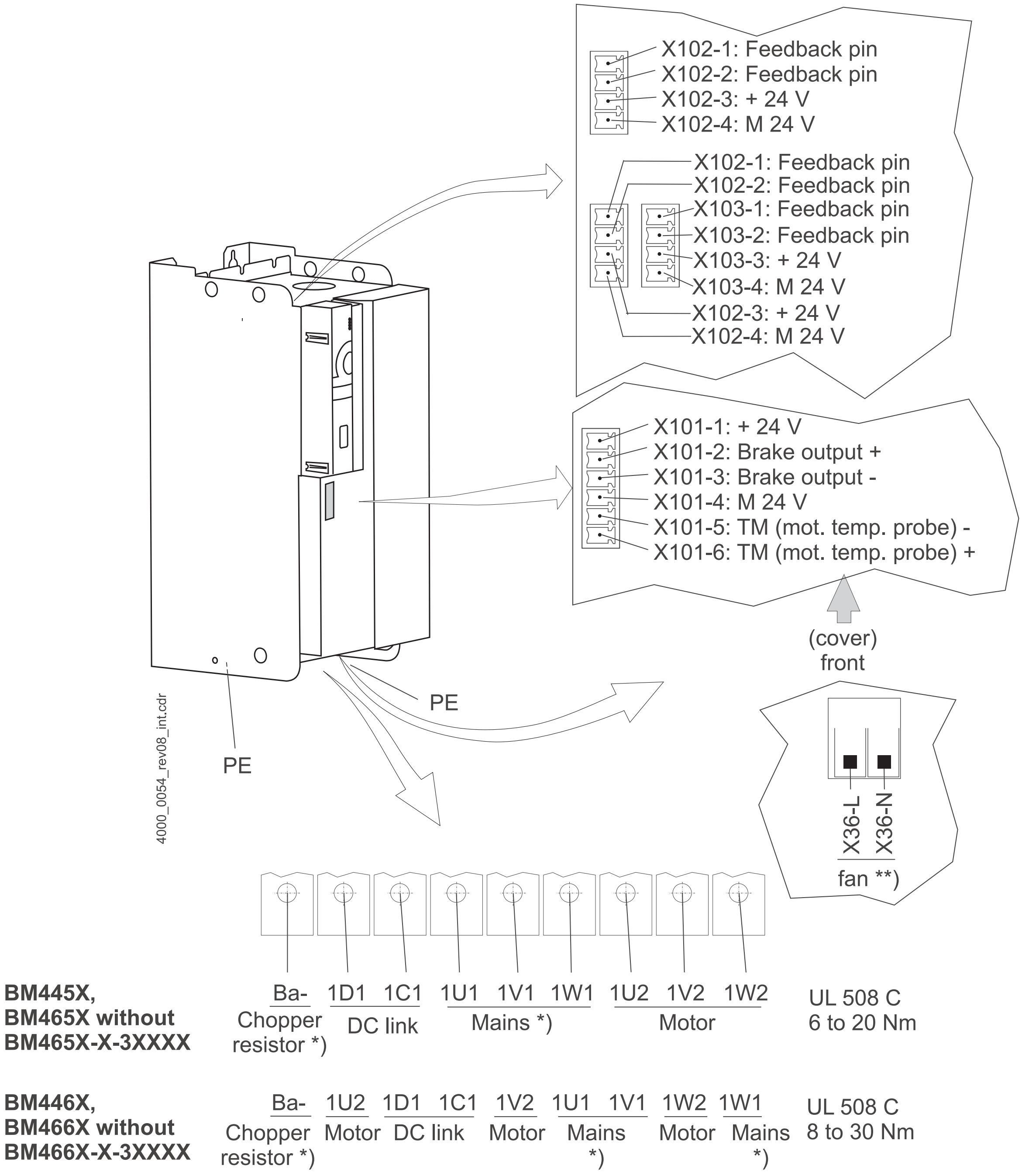


*) Do not apply terminals when using a power module!
**) only BM444X-S/-A, BM464X-S/-A

Figure 57: Electrical connections for mains, motor, upon others for BM444X, BM464X

6.12 Connection diagrams

The electrical connections for the devices **BM445X, BM446X, BM465X, BM466X** are shown here:



*) Do not apply terminals when using a power module!

**) only BM445X-S/-A, BM465X-S/-A and BM446X-S/-A, BM466X-S/-A

Figure 58: Electrical connections for mains, motor, upon others for BM445X, BM465X, BM446X , BM466X

NOTE

The chopper resistor is connected at the devices BM445X and BM446X between Ba- and 1C1.
Also see ▹Figure 48◃ on page 81.

The electrical connections for device **BM466X** and **BM476X** are shown in the following figure:

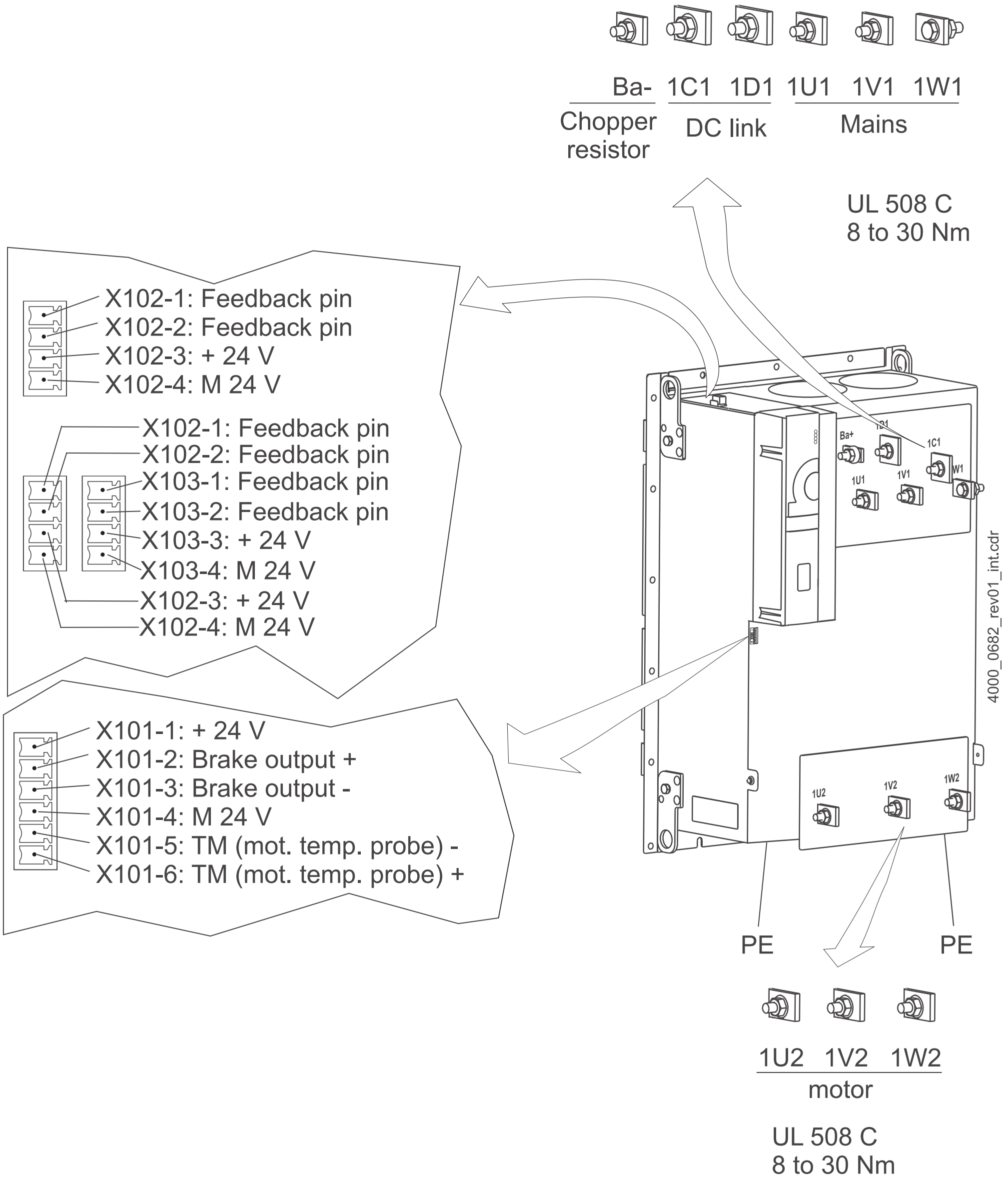


Figure 59: Electrical connections for mains, motor, upon others for BM466X and BM476X

6.12 Connection diagrams

The electrical connections for device **BM4755** are shown in the following figure:

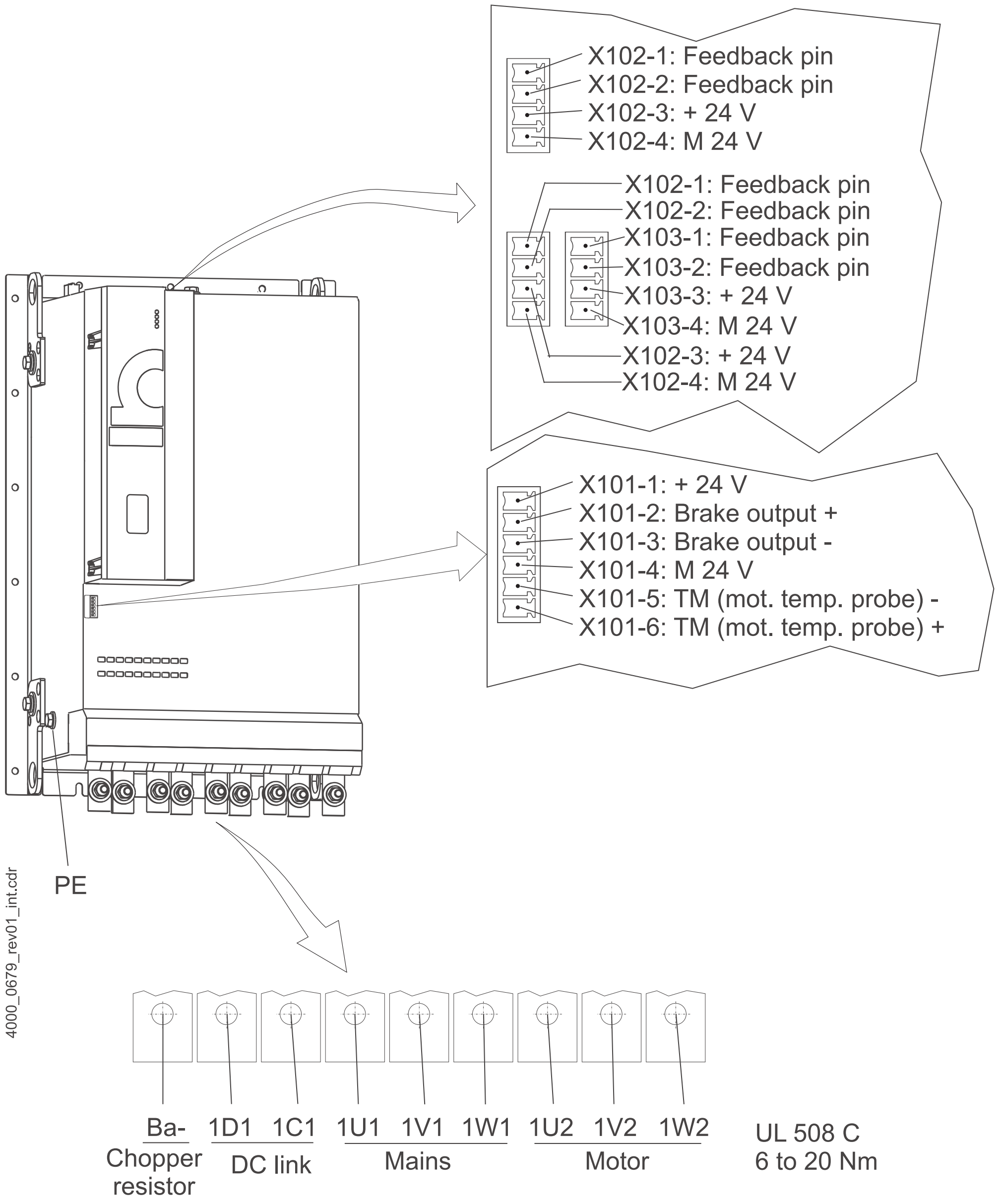
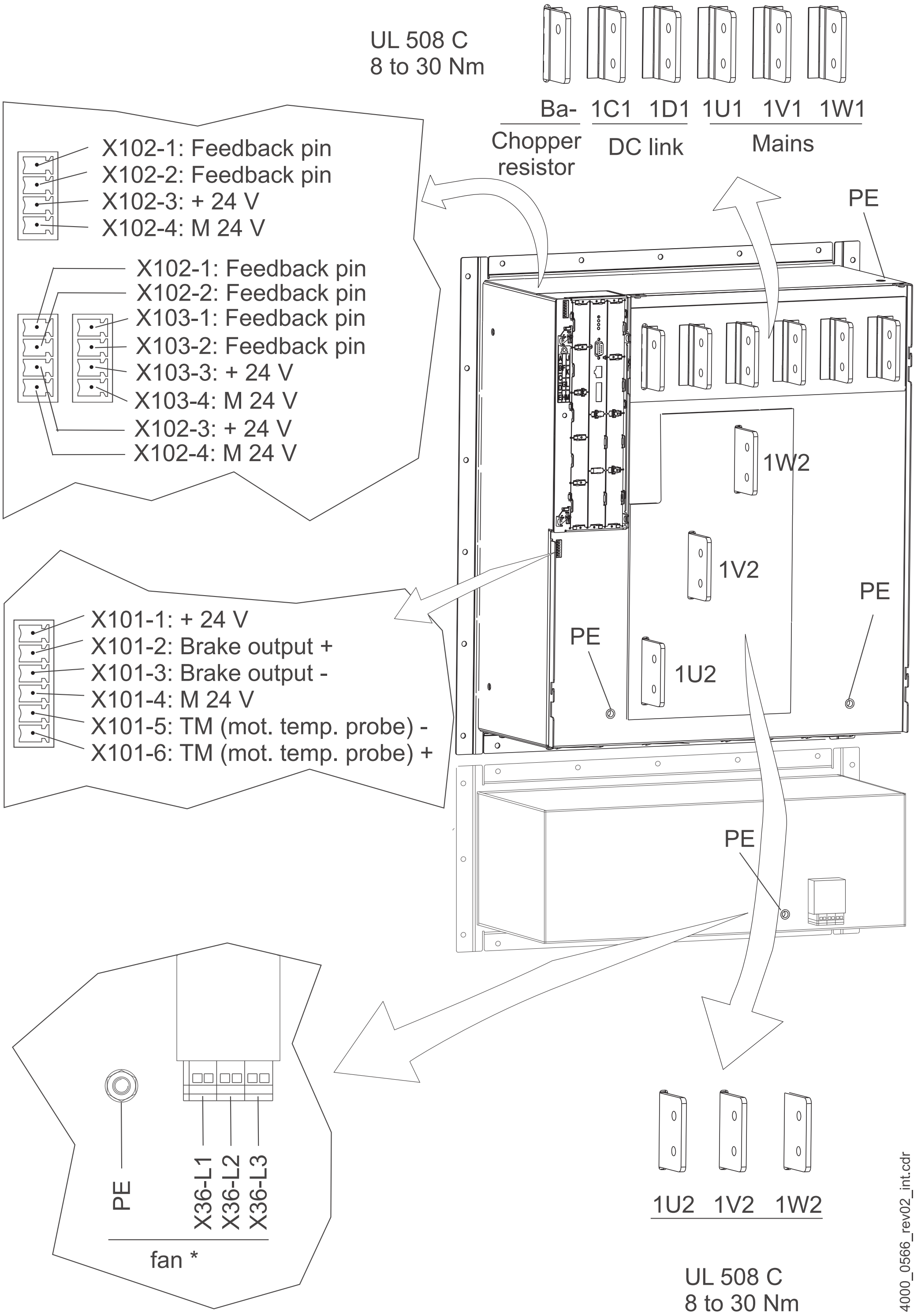


Figure 60: Electrical connections for mains, motor, upon others for BM4755

The electrical connections for devices **BM447X** and **BM4773** are shown in the following figure:



*) only BM447X-A

Figure 61: Electrical connections for mains, motor, upon others for BM447X and BM4773

NOTE

The chopper resistor is connected at the devices BM447X, BM477X between Ba- and 1C1. Also see ▷Figure 48◁ on page 81.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *Parts, which are under tension are perilous.*

After attaching all power cables to the device BM447X and BM477X, screw on the cover careful to all screwing points by using the enclosed screws (6xM4x12) and washers.The cover only must be able to be removed from the device with use of tools.

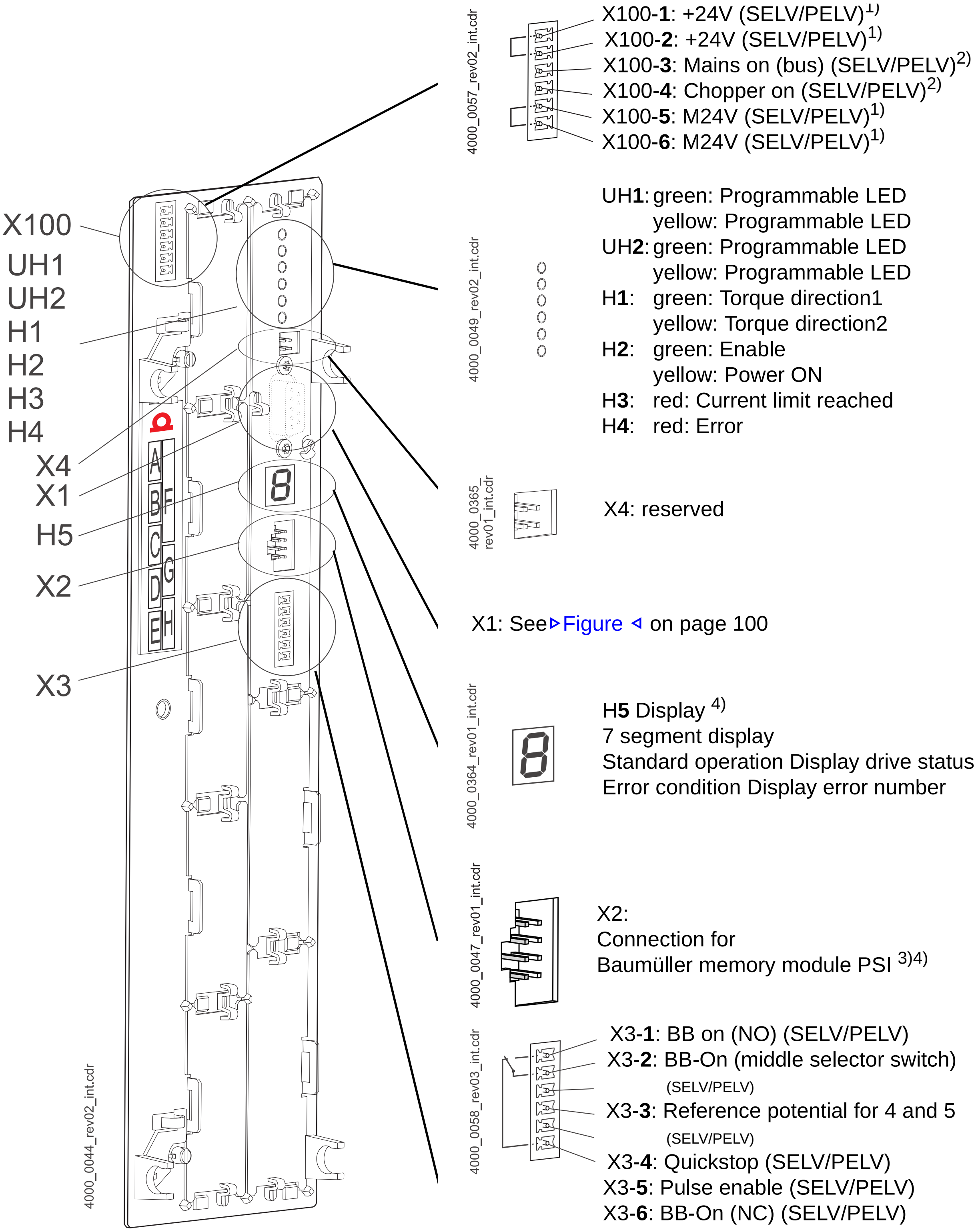
WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *Parts, which are under tension are perilous.*

The use of semiconductor fuses is obligatory at the mains connection of BM447X, BM477X devices. Semiconductor fuses are required in the chopper resistor connection except the user assures the short-circuit protection of resistor and cable.



X100-**1**: +24V (SELV/PELV)$^{1)}$
X100-**2**: +24V (SELV/PELV)$^{1)}$
X100-**3**: Mains on (bus) (SELV/PELV)$^{2)}$
X100-**4**: Chopper on (SELV/PELV)$^{2)}$
X100-**5**: M24V (SELV/PELV)$^{1)}$
X100-**6**: M24V (SELV/PELV)$^{1)}$

UH**1**:	green: Programmable LED yellow: Programmable LED
UH**2**:	green: Programmable LED yellow: Programmable LED
H**1**:	green: Torque direction1 yellow: Torque direction2
H**2**:	green: Enable yellow: Power ON
H**3**:	red: Current limit reached
H**4**:	red: Error

X4: reserved

X1: See ▷Figure ◁ on page 100

H**5** Display $^{4)}$
7 segment display
Standard operation Display drive status
Error condition Display error number

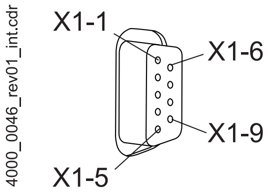
X2:
Connection for
Baumüller memory module PSI $^{3)4)}$

X3-**1**: BB on (NO) (SELV/PELV)
X3-**2**: BB-On (middle selector switch) (SELV/PELV)
X3-**3**: Reference potential for 4 and 5 (SELV/PELV)
X3-**4**: Quickstop (SELV/PELV)
X3-**5**: Pulse enable (SELV/PELV)
X3-**6**: BB-On (NC) (SELV/PELV)

Figure 62: Connection X100 and connections of the controller unit

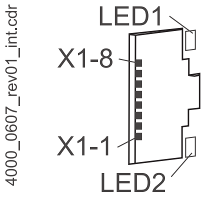
X1: According to controller type

BM44XX - XXX - XX**0**XX[Ryy] - XX (with RS 232 interface)
BM44XX - XXX - XX**1**XX[Ryy] - XX (with RS 232 interface)
BM44XX - XXX - XX**2**XX[Ryy] - XX (with RS 232 interface)



1: reserved
2: TxD RS232
3: RxD RS232
4: DTR, DSR
5: Grounding RS232
6: DTR, DSR
7: RTS
8: CTS
9: reserved

BM44XX - XXX - XX**3**XX[Ryy] - XX (with Ethernet interface)



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

LED1		**LED2**	
Color	Meaning	Color	Meaning
off	no activity	off	no connection
yellow	half duplex	yellow	10 Mbs
green	full duplex	green	100 Mbs

NOTE

[1] in case you consider UL 508 C: limit the current to 4 A.

[2] Do not apply voltage to the terminals X100-3 or X100-4, if the device is not supplied via X100-1/2 with voltage.
(the signals ’mains on’ and ’chopper resistor’ are internal digital control signals of the system b maXX®. They are used at applications with DC link connection.)

[3] The PSI-module may not be attached or withdrawn, if the b maXX® device 24 V power supply is ON. Beforehand switch off the device.
Further notes for the usage of the PSI module are to be found in parameter manual.

[4] not BM44XX - XXX - XX**0**XX and BM44XX - XXX - XX**1**XX

6.12.1 Connection data of the connections

Mains
1U1, 1V1, 1W1, PE

not valid for power modules

	Max. connection cross-section	Connection technology	Torque	Load capacity
BM441X	2,5 mm^2	plug-in contact	-	see ▹D.29 Fuse protection◃ from page 237
BM442X	4,0 mm^2	screw terminals	min. 0.5 Nm	
BM443X	10 mm^2	screw terminals	min. 1.2 Nm	
BM443X-XXX-XXXXX-S01 BM463X	25 mm^2	screw terminals	min. 2 Nm	
BM444X BM464X	50 mm^2	screw terminals	min. 6 Nm	
BM445X BM465X BM475X	2 x 95 mm^2 1)3)	cable lug for M8	min. 10 Nm	
BM446X BM466X BM476X	2 x 185 mm^2 2)3)	cable lug for M10	min. 12 Nm	
BM447X BM477X	2 x 185 mm^2 2) 4 x 95 mm^2 1)	cable lug for M10	min. 12 Nm	

1) The cable lug may be 25 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 95 mm^2, you may also use stronger cables than 95 mm^2. Also see ▹Cables mains-device◃ on page 257.

2) The cable lug may be 35 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 185 mm^2, you may also use stronger cables than 185 mm^2. Also see ▹Cables mains-device◃ on page 257.

3) One cable of the mentioned cross section is sufficient for the operation.

DC link
1C1 and 1D1[2)]
Chopper resistor
Ba+ and Ba- [1)]

	Max. connection cross-section	Connection technology	Torque	Load capacity 1C1 and 1D1 [2)] Ba+ and Ba-[3)]
BM441X	2,5 mm^2	plug-in contact	-	see ▹D.8 Electrical data - BM441X basic unit◃ on page 190 and the following.
BM442X	4,0 mm^2	Screw terminals	min. 0.5 Nm	
BM443X	10 mm^2	Screw terminals	min. 1.2 Nm	
BM443X-XXX-XXXXX-S01 BM463X	25 mm^2	Screw terminals	min. 2 Nm	
BM444X BM464X	50 mm^2	Screw terminals	min. 6 Nm	
BM445X BM465X BM475X	2 x 95 mm^2 [4)6)]	Cable lug for M8	min. 10 Nm	
BM446X BM466X BM476X	2 x 185 mm^2 [5)6)]	Cable lug for M10	min. 12 Nm	
BM447X BM477X	2 x 185 mm^2 [5)]	Cable lug for M10	min. 12 Nm	

[1)] not short-circuit-proof, consider maximum load! See ’Chopper resistor external’ in chapter ▹Technical data◃ from page 179.

[2)] not short-circuit-proof, consider maximum load! See ’connected load DC link’ in chapter ▹Technical data◃ from page 179.

[3)] See ’permissible chopper resistor continuous power’ in chapter ▹Technical data◃ from page 179.

[4)] The cable lug may be 25 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 95 mm^2, you may also use stronger cables than 95 mm^2.

[5)] The cable lug may be 35 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 185 mm^2, you may also use stronger cables than 185 mm^2.

[6)] One cable of the mentioned cross section is sufficient for the operation.

Motor
1U2, 1V2, 1W2, PE

	Max. connection cross-section	Connection technology	Torque	Load capacity
BM441X	2,5 mm^2	plug-in contact	-	is limited by the device Also see ▹Appendix D - Technical data◃ from page 179.
BM442X	4,0 mm^2	screw terminals	min. 0.6 Nm	
BM443X BM463X	16 mm^2	screw terminals	min. 2 Nm	
BM444X BM464X	50 mm^2	screw terminals	min. 6 Nm	
BM445X BM465X BM475X	2 x 95 mm^2 1)	cable lug for M8	10 Nm	
BM446X BM466X BM476X	2 x 185 mm^2 2)3)	cable lug for M10	min. 12 Nm	
BM447X BM477X	2 x 185 mm^2 2) 4 x 95 mm^2 1)	cable lug for M10	min. 12 Nm	

1) The cable lug may be 25 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 95 mm^2, you may also use stronger cables than 95 mm^2.Also see ▹Cables device-motor◃ on page 259.

2) The cable lug may be 35 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 185 mm^2, you may also use stronger cables than 185 mm^2. Also see ▹Cables device-motor◃ on page 259.

3) One cable of the mentioned cross section is sufficient for the operation.

Fan
X36

	max. connection cross section	Connection technology	Loading
BM444X-S/-A BM464X-S/-A BM445X-S/-A BM465X-S/-A BM446X-S/-A BM466X-S/-A BM447X-A	4.0 mm^2	spring clip	max. **1.0** A 1)

1) For fuse protection a fuse with the tripping characteristic ’delayed’ must be used.

X1 (RS 232)

Recommended connection cable	Connection technology	Note
LIYCY 6x2x0.14 mm^2	SUB-D, 9-pin	Available as cable sets: see ▷B.1 Interface cable◁ on page 171

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***mechanical effects.*** *If a PC is not connected via an isolated transformer, the machine can run unexpected actions.*

Connect the PC via an isolated transformer or use a battery operated PC (e. g. laptop, notebook) without connecting a charger.

NOTE

In case you don´t use an optically decoupled interface cable, the cable shield has only to be connected to the connector housing at the controller connector.

The company Baumüller Nürnberg GmbH recommends the usage of optically decoupled transmitters (e.g. from the company Ratioplast part no. 901SV232C6095 and part no. 901SV232T6095)

You can get an optically decoupled interface cable as an accessories named programming cable from Baumüller Nürnberg GmbH (see ▷B.1 Interface cable◁ on page 171).

In case the cable is produced self, please use the instructions stated below:

1. Use the following materials:
   - Cable: LIYCY 6x2x0.14 mm^2
   - Sub-D connectors, 9-pin, female, cabinet plastics metallized
   - Sub-D connector, 9-pin, male, cabinet plastics metallized
2. connect the cable shield with the cabinet and with the shield of the Sub-D connector

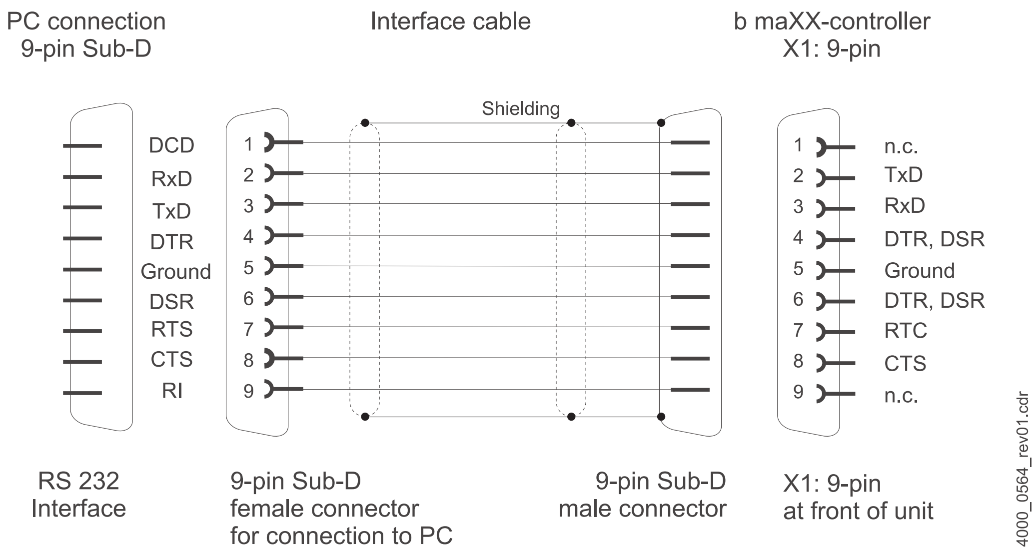


Figure 63: Interface cable RS 232

X3 (SELV/PELV)
BB-On
Quickstop
Pulse enable

Max. connection cross-section	Connection technology	Load capacity Voltage level
1.5 mm^2	plug-in contact	BB-On;X3-1, X3-2 and X3-6: max **0.2** A
		Quickstop X3-4 Pulse enable; X3-5: 0 (Low) 0 V to 5 V 1 (High) 12 V to 28 V

Notes on the usage of an OSSD test pulse see ▷Requirements on an OSSD test pulse◁ on page 290.

X100 (SELV/PELV)

24 V power supply

Max. connection cross-section	Connection technology	Load capacity
1.5 mm^2	plug-in contact	X100-1, X100-2, X100-5 and X100-6: max. **8.0** A, if you consider UL508C:max. 4.0 A

X101 (SELV/PELV)

Brake

	Max. connection cross-section	Connection technology	Load capacity
BM4412 BM4413 BM442X	1.5 mm^2	plug-in contact	X101-1 to X101-4: min. **0.1** A, max. **0.5** A
BM4414 BM443X BM463X	1.5 mm^2	plug-in contact	X101-1 to X101-4: min. **0.1** A, max. **1.0** A
BM444X BM464X	1.5 mm^2	plug-in contact	X101-1 to X101-4: min. **0.1** A, max. **4.0** A
BM445X BM446X BM447X BM445X BM446X BM447X	1.5 mm^2	plug-in contact	X101-1 to X101-4: min. **0.1** A, max. **8.0** A In case you refer to UL508C: max. **4.0** A

X102 (option)
Safety relay

(SELV/PELV)

Max. connection cross-section	Connection technology	Load capacity Voltage level
1.5 mm^2	plug-in contact	See ▷E.5 Technical data safety relay module◁ on page 291

Notes on the usage of an OSSD test pulse see ▷Requirements on an OSSD test pulse◁ on page 290.

X103 (option)
Safety relay

(SELV/PELV)

Max. connection cross-section	Connection technology	Load capacity Voltage level
1.5 mm^2	plug-in contact	See ▷B.1 Interface cable◁ on page 171

Notes on the usage of an OSSD test pulse see ▷Requirements on an OSSD test pulse◁ on page 290.

6.12.2 Requirements for the screwing

NOTE

Follow the mentioned torques in ▷Figure 58◁ on page 94 and ▷Figure 61◁ on page 97 to ensure an adequate conductivity.

7

OPERATION

In this chapter we describe, how the device works during operation and how you handle the device during operation.

7.1 Safety instructions

- Refer to the safety instructions from the chapter ▹Fundamental safety instructions◃ from page 11.

CAUTION

The following **may occur**, if you disregard these safety notes:

- Property damage

The danger is: ***Environmental conditions, that do not refer to the demands***.

Assure, that the environmental conditions are referred to during operation (see ▹D.4 Required environmental conditions◃ on page 184).

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *The control cabinet, in which the device is built in, shall protect against contacts with parts, which are under voltage.*

Assure, that during operation all doors of the control cabinet are closed.

Assure, that during operation all safety devices work.

7.2 Requirements to the executing personnel

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.****When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Assure, that only qualified personnel work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

7.3 Operating concept

After the device has been taken into operation, it is parametrized (adjusted to the application). When the parameterization is completed, you can operate the device with one of the following systems:

System 1

- two enable signals (see ▷Enable signals◁ on page 109).
- I/Os (see manuals to the I/O plug-in modules)

System 2

- two enable signals (see ▷Enable signals◁ on page 109).
- I/Os (see manuals to the I/O plug-in modules)
- superimposed control, which controls the two enable signals and the I/Os

The operating software WinBASS II is not necessary during operation. The operating software WinBASS II is only necessary, if an error occurs or if parameters have to be changed. In case of an error the service engineer can, with the help of WinBASS II, determine, which error has occurred.

7.3.1 Enable signals

These signals must have a signal level of 24 V (DC) and must be connected to the terminals X3-4 and X3-5 (▹Figure 62◃ on page 99).

Pulse enable During operation the signal ’pulse enable’ must constantly be created, so that the device supplies power. Additionally the pulse enable has to be done by the controller. Both signals are AND-linked, so the failure of one of these signals results in impulse inhibit of the power unit.

Quickstop Disable the signal ’quickstop’ only, if you must stop the installation/device as quick as possible.

During operation the signal ’quickstop’ must be applied, so that the device supplies power.

7.4 Mains switch-on-frequency/DC-link charging

7.4.1 Mains switch-on-frequency BM441X and BM442X

The devices use a rectifier with 6 diodes (B6U circuit). There is a resistor between rectifier and DC link capacitor limiting the charging surge. The resistor is bridged by a relay after the charging. Smaller waiting periods between the DC link discharge and charge reduce the lifetime of the devices. The specified waiting time of the device is increased to at least 90 seconds when an additional external DC link capacity is connected. The maximum permitted external DC link capacity depends on the mains voltage (see ▹Figure 74◃ on page 193 or ▹Figure 76◃ on page 197).

7.4.2 Mains switch-on-frequency BM443X (without STO module)

The devices use a rectifier with 3 diodes and 3 thyristors (B6HK circuit). From the voltage on the thyristors a sawtooth shaped voltage with mains-frequency is generated. This synchronous voltage is compared with a voltage decreasing from a start value to 0 V within ca. 10 seconds. If the current values of both voltages are equal, a thyristor is turned on and current flows from mains to the DC link capacitor.

The maximum rechargeable total capacity is limited by the power rating of the thyristors and diodes to 20 mF.

The thyristors are fired if the DC link charge is finished and a voltage drops in reverse direction on the thyristors.

When using the recommended fuses the rectifier is protected against overcurrent destruction.

When observing the limits of amplitude and frequency of mains voltage and the value of the external capacity and the mounting of the recommended mains inductor the user ensures, that the input rectifier is operated in the permitted operating range.

The phase sequence, meaning clockwise rotating field or counterclockwise rotating field, is not relevant for charging the DC link and the operation of the device.

Below, the behavior described in the former paragraphs is characterized as „time-controlled charge procedure“

7.4.3 Mains switch-on-frequency BM444X to BM446X

- up to
  BM 4 4 4 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **4005** -X-XXX-XXX
  BM 4 4 5 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **5003** -X-XXX-XXX
  BM 4 4 6 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **6003** -X-XXX-XXX
  BM 4 6 4 X - X X X - XXXXX[Ryy]
  BM 4 6 5 X - X X X - XXXXX[Ryy]
  BM 4 6 6 X - X X X - XXXXX[Ryy]
  BM 4 7 X X - X X X - XXXXX[Ryy]

Above shown character string shows the type key on the type plate. The bold group of four strings (fifth segment of type key) determine the power unit’s technical status. All devices with type to **4005-**, **-5003-** and **-6003-** use the before mentioned time-controlled charge procedure and behave similar to BM443X, but the charging time of the DC link is approximately 1 second.

Instead of the technical status shown directly on the type plate, the version of the power unit firmware can be shown in WinBASS (page power unit, top left, device data: firmware version). Up to version 03.06 ▹Mains switch-on-frequency BM443X (without STO module)◃ from page 109 is valid.

- ab
  BM 4 4 3 X - X X X - XXXXX[Ryy] - STO - XX[xx] -
  BM 4 4 4 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **4006** -X-XXX-XXX
  BM 4 4 5 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **5004** -X-XXX-XXX
  BM 4 4 6 X - X X X - XXXXX[Ryy] - [XXX] - XX[xx] - **6004** -X-XXX-XXX
  BM 4 6 3 2 - X X X - XXXXX[Ryy]
  BM 4 6 4 X - X X X - XXXXX[Ryy]
  BM 4 6 5 X - X X X - XXXXX[Ryy]
  BM 4 6 6 X - X X X - XXXXX[Ryy]
  BM 4 7 X X - X X X - XXXXX[Ryy]

For technical status higher than the above mentioned, an alternative procedure is implemented.

This version of the power unit firmware can be shown in WinBASS. It is 04.00 and higher.

The devices use a rectifier with 3 diodes and 3 thyristors (B6HK circuit). The circuit measures the voltage on the phase conductor and the DC link. The corresponding thyristor is fired, if the phase conductor voltage minus DC link voltage is lower than a fixed threshold. Thereby an almost constant voltage time area is applied to the series connection of phase conductor and DC link capacitor. The charge of the DC capacitor is done with current pulses of approx. same level. This level depends on the inductance of the commutation choke, the impedance of the feeding mains and the mains voltage. The thyristors are fired, if the DC link is charged to 50 V difference between peak mains voltage and DC link voltage and there is a potential drop in blocking direction. The thyristor shows a behavior like a diode.

7.4.4 Calculating the maximum allowable external capacity

If a maximum allowable external capacity is specified in the technical characteristics, then it is either a device with diode rectification or one with the "old" charge circuit (time controlled charging). If, however, it is referred on this chapter the maximum external DC link capacity is calculated as followed prescribed.

NOTE

Please check first if it is a device with the old charge circuit (see ▷Page 110◁). Should it be such a device of the sizes 3 to 6, then it is to consider that the maximum allowable capacity of the entire DC link (device internal capacity plus external capacity) has not to be larger than 20 mF.

The time for a charge sequence depends on the height of the charging current pulses and also the height of the internal and external capacity (see ▷Table of charging times◁ on page 112). After 20 seconds the charging is discontinued. For the charging function the device must be connected to a mains with clockwise rotating field. No charging is started at failure of one or two mains phases. The external chargeable capacity is not limited because the height of the loading current of the DC link capacitor is approx. constant. But the time until the complete charge of the DC link is increased proportional to the capacity, that has to be charged. Error 089 („power unit not ready-to-operate“ is generated, if the charging is not finished after 20 s.

Example: BM4443 on 480 V.

From ▷Table of charging times◁ on page 112 results a charge time of 0,4 s with the built in capacity of 1880 µF.

$$\text{Maximum external capacity} = \text{built in capacity} \cdot \left(\frac{20\text{s}}{\text{Charging time according table}} - 1\right)$$

$$= 1880\mu\text{F} \cdot \left(\frac{20\text{s}}{0,4\text{s}} - 1\right) = 94\text{mF}$$

It is recommended to choose the external capacity 20 % lower, because the charging time can vary depending on the height of the mains voltage.

7.4.5 Effects of the different charging circuits

Following incompatibilities result because of the charging and must be checked by the user operating devices with the new current-controlled charging-method.

- Charging time: Adapt timeout values in master-control to avoid possible error messages because of not in time ready-to-operate signal.
- Ensure clockwise-rotating-field. The device does not identify the direction of the rotating field. In case of a counter-clockwise-rotating-field no charging is done, after 20 s the attempt of charging is stopped and error 089 (power unit not ready-to-operate) is generated. If so two mains phases must be exchanged, e. g. the cables connected to 1U1 and 1V1, assumed there is no other error.

The advantages of the current-controlled charging are (in short):

- The maximum chargeable DC link capacity is higher than without the current-controlled charging.
- The dependency of the DC link capacity on the charging current is reduced. The self-protection level of the device against incorrect dimensioning is improved.

7.4.6 Table of charging times

Device	Inductance mains choke	Internal capacity	Charging time at 300 V	Charging time at 400 V	Charging time at 480 V	Charging time at 530 V
BM4632	0,19 mH	3000 µF	0,08 s	0,18 s	0,34 s	0,48 s
BM4443	0,36 mH	1880 µF	0,1 s	0,22 s	0,4 s	0,56 s
BM4444	0,26 mH	2350 µF	0,1 s	0,22 s	0,42 s	0,5 s
BM4445 BM4642	0,26 mH	3055 µF	0,11 s	0,26 s	0,47 s	0,65 s
BM4446	0,18 mH	3760 µF	0,09 s	0,22 s	0,4 s	0,57 s
BM4452	0,26 mH	3000 µF	0,11 s	0,25 s	0,47 s	0,66 s
BM4453	0,18 mH	3000 µF	0,08 s	0,18 s	0,32 s	0,45 s
BM4454 BM4652 BM4755	105 µH	6600 µF	0,1 s	0,24 s	0,4 s	0,58 s
BM4462	105 µH	6000 µF	0,09 s	0,22 s	0,38 s	0,52 s
BM4463	80 µH	6000 µF	0,07 s	0,16 s	0,29 s	0,4 s
BM4466 BM4766	80 µH	13,2 mF	0,14 s	0,33 s	0,61 s	0,86 s
BM447X	39 µH	19,8 mF	0,12 s	0,29 s	0,51 s	0,7 s
BM477X	32,6 µH	19,8 mF	0,1 s	0,24 s	0,4 s	0,58 s

7.5 Display elements - LED

BM4XXX - XXX - XX0XX and BM4XXX - XXX - XX1XX:

On the front side of the device there are 4 LEDs. The 4 LEDs (H1 to H4) show information about the operating status and are also displayed in the operating software.

BM4XXX - XXX - XX2XX:

On the front side of the device there are 6 LEDs. Both upper LEDs (UH1 and UH2: 2) are freely programmable. The four lower LEDs (H1 to H4) show information abut the operating status and are also displayed in the operating software.

▷Figure 62◁ on page 99 shows the position of the display elements.

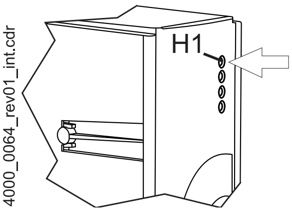
7.5.1 Freely programmable LED (UH1, UH2)*):

*): not BM4XXX - XXX - XX0XX and BM4XXX - XXX - XX1XX

Both LEDs UH1 and UH2 are not led through to the design cover.

7.5.2 Operating condition (H1, H2)

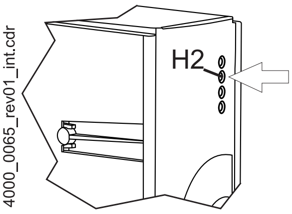
Both of the upper LEDs (H1 and H2) indicate, how the device is working at the time.



green: the motor rotates, torque direction 1.
orange: the motor rotates, torque direction 2.

NOTE

The LED H1 cannot be taken as rotational direction indicator. It only shows the torque directions.



green: Pulse enable. The motor is power supplied by the power unit.

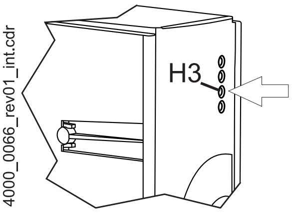
orange: Power ON, the device is ready-to-operate. In case the LED lights up orange colored during operation, maybe the pulse enable is missing or the quickstop was activated.

Flashing in turn green/orange:
Pulses for field generation at asynchronous machines enabled.
No torque enable yet.

green with orange-colored flashing or
orange with short green flashing:
Memory operation active in the EEPROM,
if possible do not switch off the device in this phase.

7.5.3 Current limit (H3)

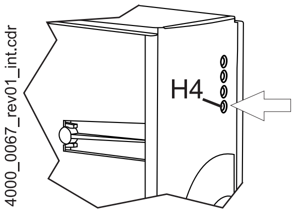
The third LED (H-3) indicates whether the current limit has been reached.



red: adjusted current limit of the controller has been reached.

- Application is adapted or ’no reaction’.

7.5.4 Error (H4)



LED doesn't light up: the internal monitoring have not found an error.

Red, continuously: Error.

- Remove the error with help of the operating program WinBASS II. Additional data is available in ▹Error detection and troubleshooting◃ from page 117.

red, flashing: Warning.

- Warnings you are able to see in the device manager of the operating program WinBASS II. Warnings do not affect operation of the device. Additional data is available in ▹Error detection and troubleshooting◃ from page 117.

7.5.5 Display (not BM4XXX - XXX - XX0XX and BM4XXX - XXX - XX1XX)

The 7-segment-display in normal operation shows the operation status. In case of error the error number is shown.

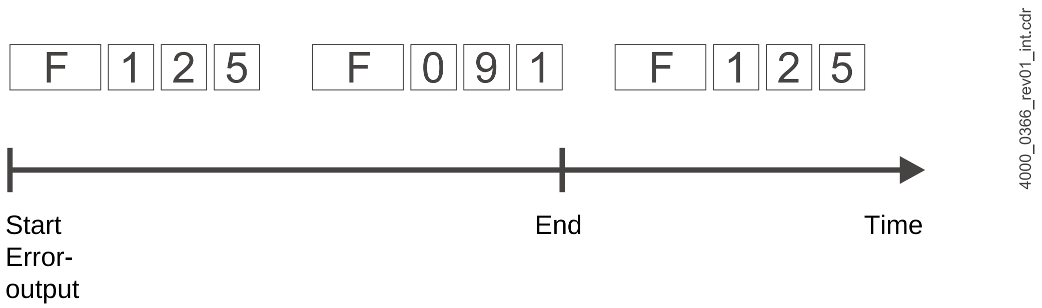
Display	Status	Meaning
0	NOT READY TO START	Initialization phase, pulses inhibited.
1	INHIBIT START	Pulses inhibited, initialization completed error-free.
2	READY-TO-START	Pulses inhibited
3	SWITCHED ON	Pulses for field generation at asynchronous machines enabled, no torque generation yet.
4	OPERATION ENABLED	Pulses enabled, drive function enabled
5	Inhibit operation active	Pulses enabled, braking procedure active
6	Shutdown active	Pulses enabled, braking procedure active
7	QUICKSTOP ACTIVE	Pulses enabled, braking procedure active
E	ERROR REACTION ACTIVE	Pulses enabled, braking procedure active
F	ERROR	Pulses inhibited, error status In the display the error number is shown.

The single drive statuses are specified in chapter device management in parameter manual 5.03039.

In the status error the error numbers are shown in the display. Only the errors are shown, which enable an error reaction in the drive or have enabled one. Errors without reaction and also warnings are not displayed.

The display of error No. starts therewith, that „F“ is shown for 1.5 s. Then the three error code positions are displayed. The separate figures are displayed for about 0.8 s, interrupted by a short pause. 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 125 and 91 are existing:



7.6 Monitoring

The controller unit monitors the device during the operation. If the controller unit recognizes a status, which deviates from normal operation, the device either issues a warning or an error message.

Warning If the controller unit recognizes an operating condition, which is close to an error condition, an accordant warning message is shown in WinBASS II and by the control resp. The device shows the most important warning (current limit reached) also via the LED H3 (see ▹Current limit (H3)◃ on page 114).

Error message If the controller recognizes that the device is not working error-free, this is displayed via the LED H4 (see ▹Error (H4)◃ on page 115) and via the 7-segment display. Either an error text is displayed by WinBASS II or the control is able to read out the error code from the device.

Additional data is available in chapter (▹Error detection and troubleshooting◃ from page 117).

7.7 Maintenance

Maintenance is first of all the monitoring of the environmental conditions. With accordant projection of your installation you can execute the monitoring of the environmental conditions in the running operation and don’t have to interrupt the operation for the maintenance.

Additional data is available in ▹Maintenance◃ from page 155.

8

ERROR DETECTION AND TROUBLESHOOTING

In this chapter the error messages of the device are described: Error- and warning messages, their meanings and how you can react.

8.1 Safety instructions

- Refer to ▹Fundamental safety instructions◃ from page 11.

8.2 Requirements to the executing personnel

The personnel, who works with the **b maXX**® device, must be introduced in the safety instructions and in the operation of the device and must be familiar with the accurate operating of the device. Especially the reaction to failure indications and -conditions requires special knowledge, which the operator must have.

8.3 Monitoring functions

A survey of the most important monitoring functions and of the from the monitoring functions generated warning-/error messages you will find in the following table. How to recognize the errors is explained in ▷Error detection◁ from page 109.

Monitoring function	Warning/error	Warning	Error	Threshold adjustable	Reaction adjustable	Reaction	Adjusting of Limit in parameters	Activation by parameter
Mains voltage	Mains undervoltage	X	X	-	-	IS	-	-
	Mains overvoltage	X	X	-	-	IS	-	-
Phase monitoring	Phase error	X	X	-	-	IS	-	-
	Mains failure	X	X	X	-	IS[2]	P0486	P0486
Ground fault [1]	Fault current to ground	-	X	-	-	IS	-	-
Overcurrent	Overcurrent motor	-	X	-	-	IS	-	-
DC	DC link overvoltage	-	X	-	-	IS	-	-
	DC-link-undervoltage relative	X	-	-	-	-	-	-
Ixt-threshold	Peak current not possible at the moment	X	X	X	-	IS	-	-
Temperature heat sink	Temperature > threshold 1	X	-	X	-	-	P0018	-
	Temperature > shutdown threshold	-	X	-	-	IS	P0019	-
Temperature device interior space	Temperature > threshold 1	X	-	X	-	-	P0016	-
	Temperature > shutdown threshold	-	X	-	-	IS	P0017	-
Temperature motor	I^2t-threshold exceeded	-	X	-	-	IS	P0073	P0093
	Threshold 1 exceeded [3]	X	-	X	-	-	P0088	P0093
	Threshold 2 exceeded [3]	X	-	X	-	-	P0089	P0093
	Short circuit sensor or temp. < -30 °C [3]	-	X	-	-	-	-	P0093
	Sensor not connected or temp. > 250 °C [3]	-	X	-	-	-	-	P0093
	Maximum temperature exceeded [3]	-	X	X	-	IS	P0090	P0093

[1] nonexistent at BM441X and BM442X

[2] Pulse inhibit operates according to adjustable time

[3] only when using the KTY sensor

[4] adjustable with P0299

[5] adjustable with P0298

[6] nonexistent at power modules

IS: Pulse inhibit
SH: Quickstop
X: Implemented
-: not possible

Monitoring function	**Warning/error**	**Warning**	**Error**	**Threshold adjustable**	**Reaction adjustable**	**Reaction**	**Adjusting of Limit in parameters**	**Activation by parameter**
Position controller	Position deviation dynamic	-	X	X	-	SH	P1054	P1050
	Position deviation static	-	X	X	-	SH	P1055	P1050
Digital output	Short-circuit digital output	-	X	-	-	-	-	-
Controller synchronizing	Controller not synchronous with ext. Signal	X	X	X	X	4)	P0533	P0299
Encoder 1	Cable break	-	X	-	-	IS	-	-
	Cable break ($\sin^2 + \cos^2$)	-	X	-	-	IS	-	-
	Overspeed	-	X	X	-	IS	P1072	-
Encoder	Cable break	-	X	-	-	IS	-	-
	Cable break ($\sin^2 + \cos^2$)	-	X	-	-	IS	-	-
	Overspeed	-	X	X	-	IS	P1082	-
Ramp-up option modules	Error at module initialization	-	X	X	-	IS	P0838	P0838
Cyclical set point transmission to the optional modules	Transmission timeout	-	X	X	X	5)	P0839	P0298
Safety relay	Supply voltage is missing or safety relay faulty	-	X	-	-	IS	-	-
Safety relay	Safety relay - warning	X	-	-	-	-	-	-
Block monitoring	Drive blocked	-	X	X	-	IS	P1260	P1260

1) nonexistent at BM441X and BM442X

2) Pulse inhibit operates according to adjustable time

3) only when using the KTY sensor

4) adjustable with P0299

5) adjustable with P0298

6) nonexistent at power modules

IS: Pulse inhibit
SH: Quickstop
X: Implemented
-: not possible

8.3 Monitoring functions

8.3.1 Monitoring functions - explanations

Mains voltage - nonexistent at power modules

This monitoring function checks, if the mains voltage has a value within the adjusted voltage range. If the value is lower, the warning ’undervoltage mains’ is indicated. If the value is higher the warning ’overvoltage mains’ is indicated.

Phase monitoring - nonexistent at power modules

This monitoring function checks the three phases of the mains voltage. If an outer conductor is missing, the warning ’Phase failure’ is reported after at most 4s.

If all of the three outer conductors are missing the warning ’Mains failure’ is reported after at most 4s to the controller. After reaching the adjusted delay time by parameter P0486 the controller generates the error message ’mains failure’.

NOTE

If you work without the mains filter the mains and phase failure-recognition takes place within 100 ms. If the device is operated with the mains filter the mains and 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 occurs, there is immediately a pulse enable.
This monitoring function doesn’t exist by BM441X and BM442X.

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

DC This monitoring function checks the voltage of the. In case the voltage sinks below a value, which was internally specified (about 50 V under the setpoint), the DC link undervoltage is signaled from the controller and a warning is generated. In case the voltage exceeds an adjusted value about 820 V), the error ’DC link overvoltage’ is signaled from the controller and an immediate pulse inhibit operates.

Ixt-threshold This monitoring function checks the heat sink temperature as well as the current load thereupon, if the power unit can enable the peak current or the maximum nominal current. In case the peak current is not possible, the message ’Ixt-threshold 1 exceeded’ is displayed.

Temperature device interior 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 gives a warning.
- In case the temperature is too high, immediately an pulse inhibit operates.

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 gives a warning.
- In case the temperature is too high, immediately an pulse inhibit operates.

Temperature motor This monitoring function checks the temperature of the motor. In case the I^2t-threshold is exceeded, the error ’I^2t-overload’ is given from the controller.

only by KTY84-Sensor In case the adjusted temperature threshold 1 is exceeded, the warning ’temperature threshold 1 exceeded’ is signaled from the controller.
In case the adjusted temperature threshold 2 is exceeded, the warning ’temperature threshold 2 exceeded’ is signaled from the controller.
The KTY84-sensor has a minimal measuring value of about -30°C. If the temperature falls below

if there is a short-circuit at the sensor, the error ’short-circuit temperature sensor’ is signaled. The KTY84-sensor has a maximum measuring value of 250 °C. In case this temperature is exceeded, or in case the sensor is not connected, the error ’temperature sensor not connected’ is signaled from the controller.

At all sensors — In case the threshold (depending on the model), which is determined in the temperature switch or in the PTC-sensor is exceeded, the error ’overtemperature’ is given from the controller and immediately an pulse inhibit operates.

Position controller — This monitoring function checks the position deviation limit statical/dynamical. In case the position deviation error is statical/dynamical greater than the adjusted 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 given an immediate pulse inhibit operates.

Safety relay — This monitoring function checks if the safety relay functions and if the control voltage in order to activate the safety relay is connected. In case of an error the controller either signals an error or a warning, depending on, if the pulse enable is active or not.

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 given to the controller and an immediate pulse inhibit takes place.

- Motor speed = 0
- the motor current which is supplied by the device is the same as the adjusted motor limit current (current limit).

8.4 Error detection

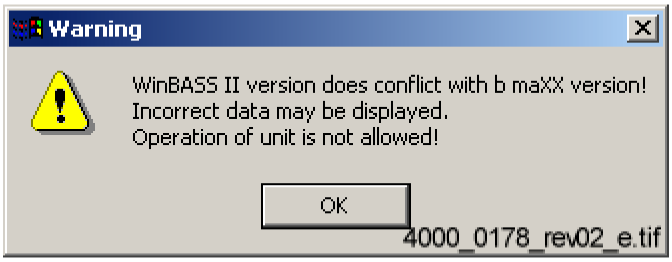
In the following we will inform you about the different errors and the consequential error messages. The errors can either be of mechanical or of electrical causes. The devices of the series b maXX® 4400 signal an error status via the lighting up of the lowest red LED H4 on the front side of the cabinet. Additionally the error No. is shown via the 7-segment display on the front side of the cabinet (not BM4XXX - XXX - XX0XX and BM4XXX - XXX -XX0XX). By the error number the error message can be determined with help of the error list in this manual. The shown error via the 7-segment display is without exception an LEVEL 2 error (P0201 - P0216). Furthermore the error message is shown in the operating software:

- Start the operating program WinBASS II (up to FW 3.09) or ProDrive (from FW 3.07), if it isn’t running yet.

NOTE

In order to work with the operating software, the software version of the controller and the operating software version must comply with one another.

In case the software version of the controller and the WinBASS II version do not comply with one another, you will receive the following message:



WinBASS II version does conflict with b maXX version!
Incorrect data may be displayed.
Operation of unit is not allowed!

4000_0178_rev02_e.tif

A further working in this condition is not possible, break up your work and contact Baumüller Nürnberg GmbH in order to receive the right version.

Only max. 3 LEDs light up The meaning of the specific LEDs we explain in ▹Figure 53◃ on page 89. Here mainly the lowest red LED H4 'Error' is of importance. If this LED lights up, also in the operating software at least one error message has been generated.

NOTE

If warnings or errors occur without error reaction the LED H4 'error' *blinks*. Only error messages with error reaction are signaled *by constantly lighting up*.

The error message signaled with ’error’ is in ProDrive / WinBASS II:

- Open a list in the project tree by clicking on the **+** in front of ’Management’.

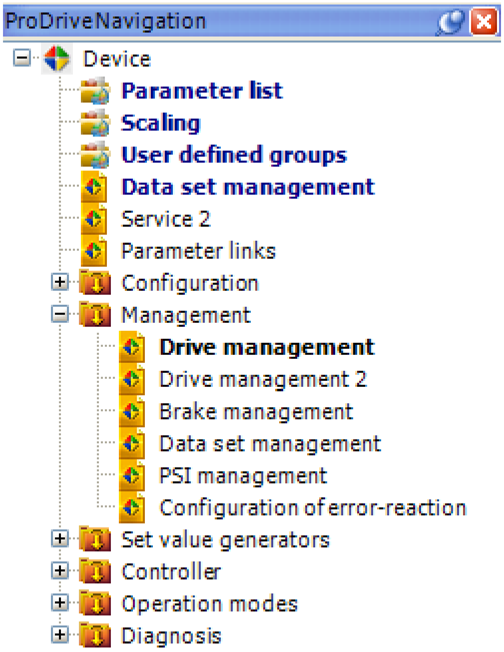
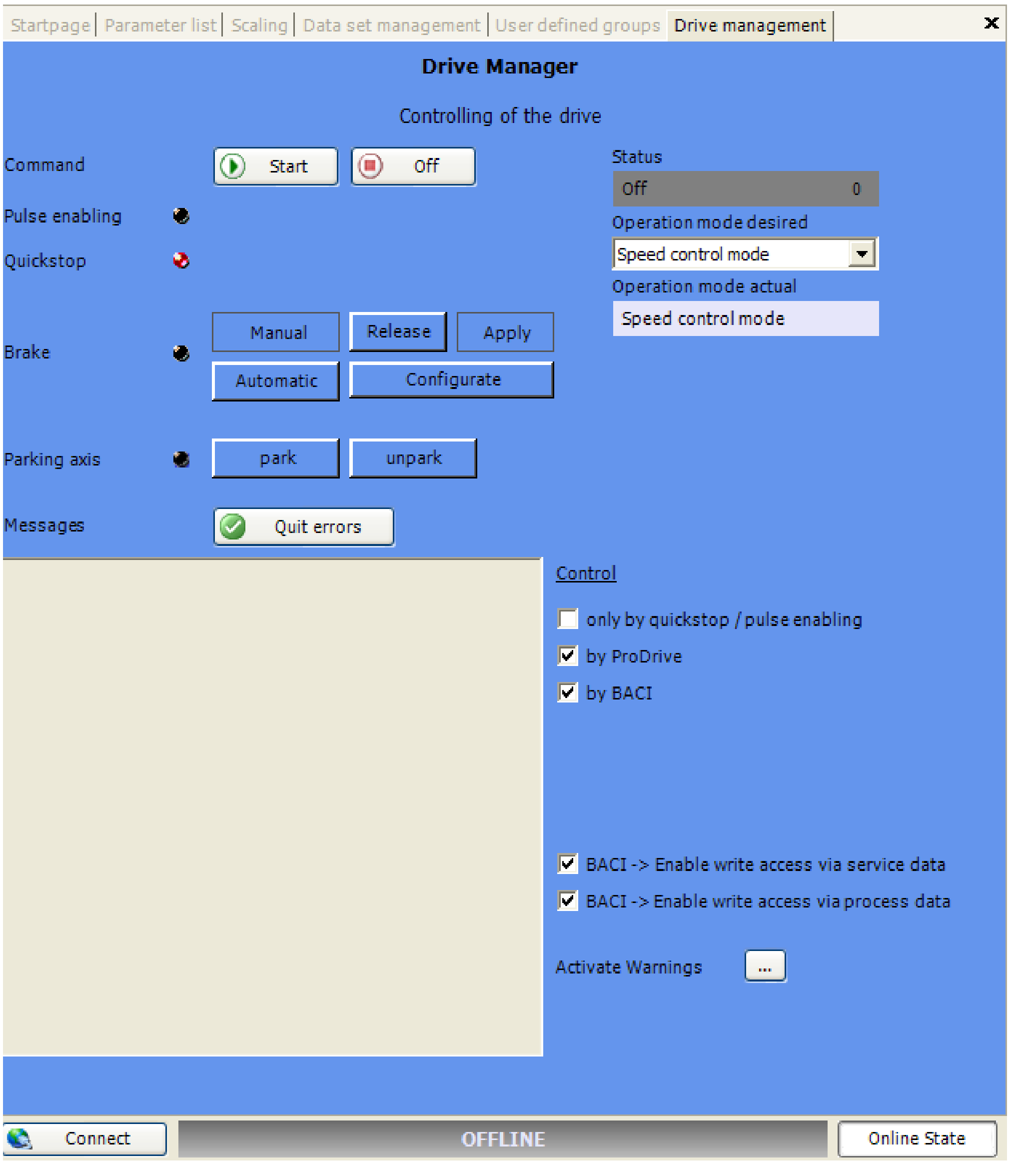


Figure 64: Project tree in ProDrive

- Select from this list ’Device management’.

In the ▹Figure 54◃ on page 112 there is the window ’Device manager’ with a few exemplary (error-) messages. The messages in this window demonstrate an internal list, before the communication between controller and pc/laptop with ProDrive / WinBASS II begins, which is arranged according to the error numbers. After take-up of communication the newly occurring messages are added onto the end of the list.



Status: Off 0

Operation mode desired: Speed control mode

Operation mode actual: Speed control mode

- ☐ only by quickstop / pulse enabling
- ☑ by ProDrive
- ☑ by BACI
- ☑ BACI -> Enable write access via service data
- ☑ BACI -> Enable write access via process data

Figure 65: Device manager in WinBASSII

NOTE

If you are not able to start the motor, although the red LED H4 isn't lighting up and although the LED H2 is lighting up green, check the parameterization of the b maXX4400 with the parameter list in ProDrive / WinBASS II.
Error possibilities are e. g.: torque limit = 0 has been set or notch position is not correct (also see parameter manual b maXX 4400).

If no LEDs are lighting up on the front side of the device, check the 24V supply.

For troubleshooting you must however know, that the error messages in the system are built up hierarchically, see ▹Figure 55◃ on page 113. An error message can result from a beneath in the hierarchic arranged error message. This is why the message 'SysError1' (level 1) can base on an error, which e. g. has appeared in „ModuleError“ (level 2), because there is a failure in „Function module1“ (level e. g. Sincos-encoder module).This is why you always have to track an error to the lowest level, in order to detect/remove it.

8.4.1 Structure of the error list - survey of the error parameter names

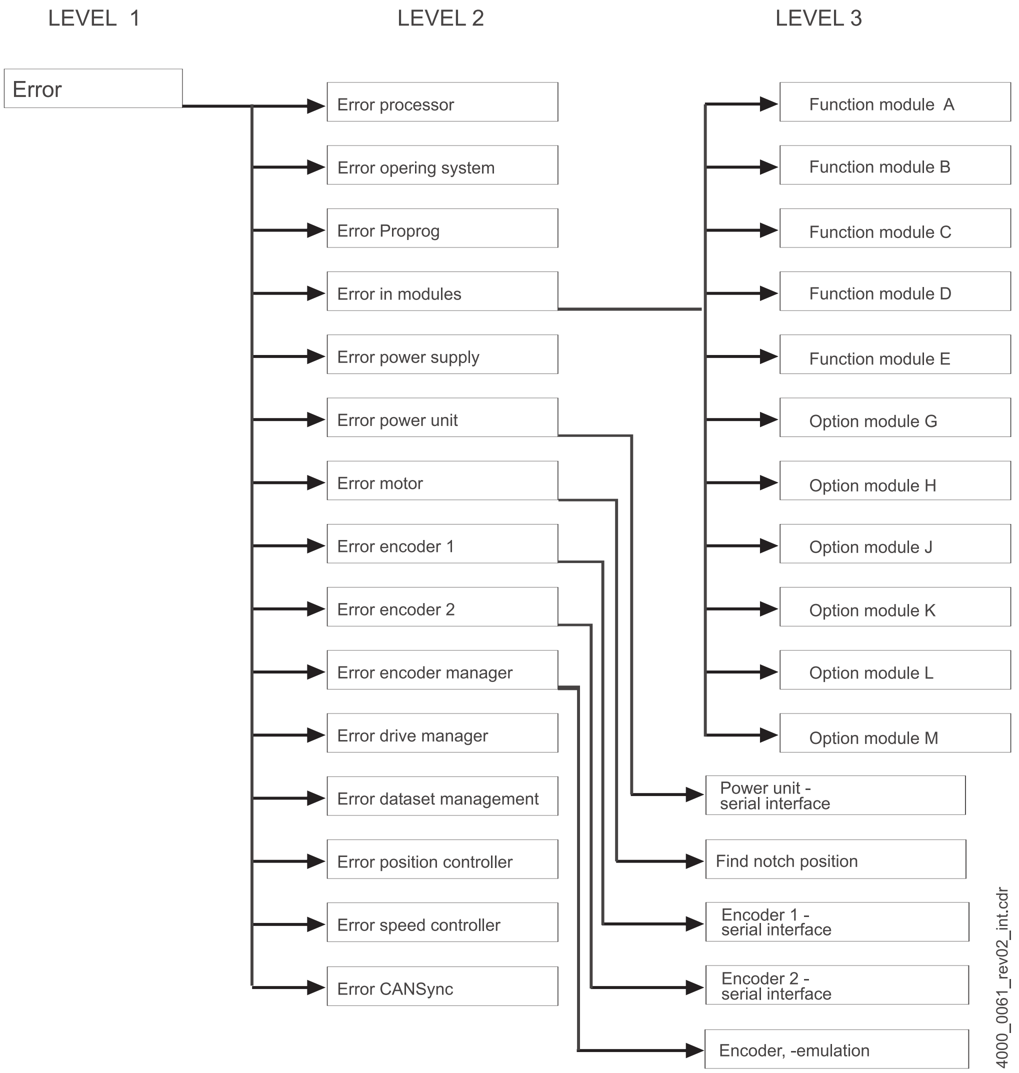


Figure 66: Structure of the error list - survey

From firmware 3.11 onwards an internal fault memory exists to read out errors by a higher-level open-loop control. All occurent errors which lead to an error response of the drive are saved chronologically in this fault memory.

A read access to the fault memory occurs element by element with an index parameter (P0258) and a value parameter (P0259).

The fault memory will be deleted completely at error acknowledgment (Bit 7 = 1 in control word).

For a further description see parameter P0257 in the Parameter Manual.

8.5 Troubleshooting

The error messages are based on the troubleshooting in the b maXX® devices, which also are termed as error lists (see ▷Error parameters - error messages (error list) - error reactions◁ from page 115). If an error appears, the according definite error message is displayed within a short time in ProDrive / WinBASS II in the menu „device manager', whose meaning you can look up in the error list.

NOTE

The device is delivered with predefined error reactions. You are able to set the error reaction of the device in 'Depending on settings' in the column 'Reaction' marked error messages. An exception here are errors, which have to have an immediate pulse inhibit as a consequence. These can not be changed due to safety reasons.

8.5.1 Reset errors

If the red error LED is lighting up, there is at least one error. You can react upon this, by 'resetting' the error in ProDrive / WinBASS II, that means, that you inform the device, that you have noted the error, that you have removed it or that you want to pass over it. Due to error reset all error messages are reset. An individual error reset is not possible. The acceptance causes a resetting of the error, in case the reset was possible due to the error situation.

There are four methods to reset errors:

- Via WinBASS II (up to FW 3.09) or ProDrive (from FW 3.07):
  Use the button "Acknowledge errors" (either in the dialog box "Device manager" or on the page "Device manager"
  Note: If errors shall be acknowledged via WinBASS, the control for WinBASS must be active in parameter Communication source.
- Via writing access to control word (P0300):
  Here a rising edge must be generated in bit 7 (of the control or per input to parameter list of the operating software).
  Note For the according communication source the drive control must be active (see parameter P1001 Communication source).

- Via a digital input:
  Via the parameter P0575 digital input for error acknowledge a digital input of a DIO-module can be selected. With the rising edge at this input the errors are acknowledged.

- Via the pulse enable-input:
  Precondition is, that the drive is only controlled via the hardware inputs (that means that the motor guide is neither set via the operating software nor via another communication source).Furthermore the option “Acknowledge error via pulse enable” in parameter P1002 Options device manager must be active.With the first rising edge of pulse enable the errors then are acknowledged.But the drive still does not start. Therefore you then need a second rising edge for the enable.

Additional data according the subject resetting of error messages is available in the ’parameter manual’.

8.5.2 Error parameters - error messages (error list) - error reactions

In the following you will find all error messages. An (error) message is shown in WinBASS II in the window ’device manager’. In the list field „Messages“ you find the (abbreviated) error name, at Hiperface®-errors also the device unit, the error number (not at errors after Hiperface®-specification) and, separated by a colon, the meaning of this error, e. g. „MotorError 96: „Short circuit temperature sensor“. At Hiperface®-errors e. g.: „Encoder 1 communication: „Parity error“.

1st level **SysError1**, only interesting for the access to errors via parameters, to be used without WinBASS II, e. g. at Field bus communication. This error is not shown in WinBASS II.

Bit mapping see description of the parameter P0200.

2nd level Next level below SysError1. Here you find errors, which you can remove directly with help of the displayed information or also information on the next level in which the error could be.

We have arranged the error messages according to the survey ▹Structure of the error list - survey◃ from page 113.

In the column you find ’Reaction’ the reaction of the system to the error:

- ’IS’ = pulse inhibit;
- „Adjustable“ = You can set the error reaction via the operating software (page „Device manager 2, toolbar button „Error reaction“).
- ’no reaction’ means, the drive is continuing to work and the red error LED is blinking.
- In the column ’troubleshooting’ you will find hints for troubleshooting:
  Details on this you will find in the ’parameter manual’.

Error processor P0201

Error no.	Meaning	Reaction	Troubleshooting
0	reserved		
1	Watchdog-Error	IS	Execute a restart of b maXX® 4400
2	Incorrect or unexpected interrupt has occurred	IS	Execute a restart of b maXX® 4400
3	NMI interrupt/bus error	IS	Execute a restart of b maXX® 4400
4 to 15	reserved Not assigned = 0		

Error operating system P0202

Error no.	Meaning	Reaction	Troubleshooting
16	Errors while booting	IS	Execute a restart of b maXX® 4400
17	Software error:	IS	Execute a restart of b maXX® 4400
18	Time slot configuration	IS	Execute a restart of b maXX® 4400
19	Time slot - time error	IS	Execute a restart of b maXX® 4400; Change configuration of the time slice operation system
20	1 = No free memory	IS	Execute a restart of b maXX® 4400
21	Invalid error code	IS	Execute a restart of b maXX® 4400
22	Invalid warning code	IS	Execute a restart of b maXX® 4400
23	False FPGA version	IS	Contact Baumüller
24	Two position controller: error while writing to target parameter	IS	Ensure that the target parameter is writeable in these operating conditions and the value to write is in the valid value margin.
25	Checksum error flash system data	IS	The system data in the controller flash is invalid and was replaced by default values. These default values are written to the flash by switching off and on.
26	Power unit is not supported	IS	Use an appropriate power unit or contact Baumüller
27 to 31	reserved Not assigned = 0		

Error Proprog communication P203

Error no.	Meaning	Reaction	Troubleshooting
32	Timeout protocol	Adjustable	Execute a restart of b maXX® 4400
33	Protocol structure	Adjustable	Execute a restart of b maXX® 4400
34	Wrong module type	Adjustable	Contact Baumüller
35	too many data in the telegram	Adjustable	Contact Baumüller
36	Not enough data in telegram	Adjustable	Contact Baumüller
37	Invalid operand	Adjustable	Contact Baumüller
38	Invalid memory type	Adjustable	test RAM
39	Invalid operand address	Adjustable	enter a valid address
40	Value less than the minimum value	Adjustable	Check data set and adjust
41	Value greater than the maximum value	Adjustable	Check data set and adjust
42	Parameter is write-protected	Adjustable	Check data set and adjust
43	Parameters in this operation status not writeable	Adjustable	Check operating condition and parameterization
44	Invalid parameter value	Adjustable	Enter with a valid value
45	Communication error WinBASS controller	Adjustable	Establish connection again or set parameter P0290 to 0.
46 to 47	reserved Not assigned = 0		

Error in function or option modules P0204

Error no.	Meaning	Reaction	Troubleshooting
48	Error in Function module A	Level 3 error	see ▹Error function module A to E P0240 to P0244◃ on page 133 (= 3. level)
49	Error in Function module B	Level 3 error	see ▹Error function module A to E P0240 to P0244◃ on page 133 (= 3. level)
50	Error in Function module C	Level 3 error	see ▹Error function module A to E P0240 to P0244◃ on page 133 (= 3. level)
51	Error in Function module D	Level 3 error	see ▹Error function module A to E P0240 to P0244◃ on page 133 (= 3. level)
52	Error in Function module E	Level 3 error	see ▹Error function module A to E P0240 to P0244◃ on page 133 (= 3. level)
53	Error in Option module G	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
54	Error in Option module H	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
55	Error in Option module J	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
56	Error in Option module K	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
57	Error in Option module L	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
58	Error in Option module M	Level 3 error	see ▹Error option module G to M P0245 to P0250◃ on page 134 (= 3. level)
59	Timeout when waiting for the RST signal of the slaves	IS	Execute a restart
60	CRC error in SPI transmission module ▸ controller	Adjustable	Error indicates high EMC interferences; please reduce these. Contact Baumüller.
61	CRC error in SPI transmission Controller ▸ module	Adjustable	Error indicates high EMC interferences; please reduce these. Contact Baumüller.
62 to 63	reserved Not assigned = 0		

Error power supply P0205

Error no.	Meaning	Reaction	Troubleshooting
64	Mains failure	Adjustable	Restore the connection to the power supply
65	Phase failure	IS	Check if all phases are correctly connected and voltage-carrying
66	Mains undervoltage	IS	Assure the compliance with the mains specifications (see techn. data)
67	Mains overvoltage	IS	Assure the compliance with the mains specifications (see technical data)
68	Undervoltage 24V	IS	Assure the compliance with the mains specifications (see technical data)
68 to 78	reserved Not assigned = 0		
79	Mains monitor collected errors	Adjustable	See P0236

Error power unit P0206

Error no.	Meaning	Reaction	Troubleshooting
80	Communication error after HIPERFACE ® specification	IS	see ▷Error power unit - serial interface P0233◁ on page 128 (= 3. level)
81	Heat sink temperature	IS	Let the device cool down and/or reduce the load
82	U DC link overvoltage	IS	Reduce the DC link voltage
83	Overcurrent	IS	Reduce the load and check the current controller settings as well as the cabling and the motor
84	Ground current	IS	Check the installation of the device (from b maXX® 443x) and check the motor for ground fault
85	Device interior overtemperature	IS	Make sure of a sufficient ventilation in the device and/or check the temperature of cooling air
86	Cable break interior temperature sensor or interior temperature < 5 °C	IS	Make sure the ambient temperature (or heat sink temperature of the device) is ≥ 5 °C. If the error occurs even at a heat sink temperature ≥ 5 °C pass on the device for repair
87	Safety relay off (or defect)	IS	Check the safety relay, exchange it for a new
88	Bridge short-circuit	IS	Execute a restart. At recurring error messages renew the controller cartridge

Error no.	Meaning	Reaction	Troubleshooting
89	Power unit not ready-to-operate	IS	Complete the operational readiness to the power unit. Check if the rotating field of the mains is connected correctly.
90	Phase failure	IS	Check if all phases are correctly connected and voltage-carrying
91	Mains failure	IS	Restore the mains supply
92	Mains undervoltage	IS	Assure the compliance with the mains specification (see technical data)
93	Mains overvoltage	IS	Assure the compliance with the mains specification (see technical data)
94	Undervoltage $U_{DC\ link}$	IS	Check the power connections
95	reserved Not assigned = 0		

Error motor P0207

Error no.	Meaning	Reaction	Troubleshooting
96	Short-circuit temperature sensor (T_M <= -30 °C)	Adjustable	Remove the short-circuit in the temperature sensor
97	Temperature sensor - motor not connected (T_M > +300 °C)	Adjustable	Remove open circuit in the temperature sensor circuit
98	Motor overtemperature	IS	Remove motor over temperature by cooling down and/or reducing the load
99	Error I^2t > 100 %	IS	Let the drive in a inhibited status until I^2t-actual value decreases under 100 %
100	Power unit maximal current > motor maximal current	Adjustable	Set power unit maximal current P1241 lower than motor maximal current P0069
101	reserved Not assigned = 0		
102	Collective error finding notch position	IS	see ▹Error finding notch position P0237◃ on page 133 (= 3. level)
103 to 111	reserved Not assigned = 0		

Error Encoder1 P0208

Error no.	Meaning	Reaction	Troubleshooting
112	Communication error (Hiperface®-Specification)	IS	see encoder 1 (Hiperface®) P0234 (= 3rd level)
113	reserved		
114	Error at overwriting of Encoder position information	IS	Execute the command again.If the error occurs again, contact Baumüller Nürnberg GmbH.
115	Cable break encoder 1	IS	Remove the cable break in the encoder cable of encoder 1 or check the assignment of the encoder cable
116	Overspeed encoder 1	IS	Check the allowable rotational speed for encoder 1
117	Amplitude limit exceeded	IS	Check the encoder cable and the encoder function. Use a different encoder
118	Encoder type unknown	IS	Check if the correct encoder is connected or use another encoder
119	Invalid data field for motor data	IS	Use another encoder
120	Incorrect motor data	IS	Use another encoder
121	Saving error of motor data	IS	Use another encoder
122	Motor data write-protected. (is not valid for BM motors)	IS	Use another encoder
123	Field angle error	IS	Check the shielding of the encoder cable
124	Encoder without temperature measuring	Adjustable	Use an encoder module with temperature measuring
125	Memory capacity in the encoder for electronic type plate too small	Adjustable	Use another encoder with a greater memory
126 to 127	reserved not assigned = 0		

Error encoder 2 P0209

Error no.	Meaning	Reaction	Troubleshooting
128	Communication error (hiperface specification)	IS	See encoder 2 (hiperface) P0235 **(= 3rd level)**
129	Module code invalid	IS	Use a different encoder
130	reserved		
131	Cable break encoder 2	IS	Remove the cable break in encoder cable of encoder 2, check assignment of encoder cable
132	Overspeed encoder 2	IS	Check the permissible speed for encoder 2
133	Amplitude limit exceeded	IS	Check the encoder cable and the encoder function. Use a different encoder
134	Unknown encoder type	IS	Check, if the correct encoder is connected or use a different encoder
135	Invalid data field for motor data	IS	Use a different encoder
136	Invalid motor data	IS	Use a different encoder
137	Error at storage of motor data	IS	Use a different encoder^
138	Motor data write protected. (invalid for BM motors)	IS	Use a different encoder
139	Field angle error	IS	Check the screening of the encoder cables
140	Encoder without temperature measuring	no reaction	Use an encoder module with temperature measuring
141 to 143	reserved not assigned = 0		

Error encoder manager P0210

Error no.	Meaning	Reaction	Troubleshooting
144	Absolute position of encoder 1 unknown	IS	Use a different encoder If error occurs at sine incremental encoder, set P0150 bit 9 = 1 (error message „absolute position of encoder 1 unknown“ is surpressed)
145	Absolute position of encoder 2 unknown	IS	Use a different encoder If error occurs at sine incremental encoder, set P0160 bit 9 = 1 (error message „absolute position of encoder 2 unknown“ is surpressed)
146	Encoder module 1 is missing	IS	Check if the correct encoder is connected to slot A
147	Encoder module 2 is missing	IS	Check if the correct encoder is connected to slot B
148	Encoder module for measured value storage is missing	IS	Install the encoder module
149	No measured value storage possible at the resolver	IS	Use a SinCos- or incremental encoder
150	Triggering not possible, because no incremental encoder	IS	Use for this option an incremental encoder
151	Digital I/O module is missing	IS	Install the digital I/O module
152	Incremental encoder emulation module is necessary and is missing	IS	Install the incremental encoder emulation module
153	Encoder module 1 is necessary for incremental encoder emulation and is missing	IS	Install the encoder module on slot A
154	Encoder module 2 is necessary for incremental encoder emulation and is missing	IS	Install encoder module on slot B
155	Inizialization error of the incremental encoder emulation module	IS	Restart system
156	Incremental encoder emulation module (HW) signals error	IS	Restart system, switch module at repetitive error message
157	Error incremental encoder emulation module	IS	Use for this option an incremental encoder
158	SSI encoder emulation module is missing	IS	Install SSI encoder emulation module
159	Error in setpoint source encoder 1 or encoder 2	IS	see encoder error message

Error device manager P0211

Error no.	Meaning	Reaction	Troubleshooting
160	Timeout communication	Adjustable	Remove the timeout of the Proprog communication
161	Timeout BACI	Adjustable	Remove the timeout of the BACI communication option module
162	Timeout cyclic communication	Adjustable	Remove the timeout of the Cyclic communication:
163	Timeout required data	Adjustable	Remove the timeout of the required data communication
164	Field bus error	Adjustable	Check the field bus communication
165	Controller not synchronous to external signal	Adjustable	set the Sync-Offset and / or Sync-tolerance
166	Error at brake control	IS	Check the wiring and the function of the brake
167	No release of holding brake when starting the drive	IS	Check the holding brake
168	No closing of holding brake at stopping of drive	Adjustable	Check the holding brake
169	Error holding brake status (cyclic monitoring)	Adjustable	Check the holding brake
170	Error holding brake lining	Adjustable	Check the holding brake
171	Initialize holding brake error	IS	Check, if there is a DIO module, if it is in the correct position and if it is correctly parameterized (also see P0883)
172	Error holding brake: holding torque not reached	IS	Ensure that the torque limits are not set too small |P1402| < Min (|P1036|, |P1037|, |P1038|)
173 to 175	reserved Not assigned = 0		

Error data record manager P0212

Error no.	Meaning	Reaction	Troubleshooting
176	EEPROM copy error	Adjustable	Copy the data set once more
177	Write timeout EEPROM	Adjustable	The data in the EEPROM are invalid, please safe all data records
178	Checksum error EEPROM	IS	EEPROM faulty or described faulty
179	No boot data set	IS	The data in the EEPROM are invalid, please safe all data records
180	Incompatible software	IS	The data in the EEPROM are invalid, please safe all data records
181	There is no data set	Adjustable	The data in the EEPROM are invalid, please safe all data records
182	Checksum error im PSI module	Adjustable	PSI EEPROM faulty or described faulty
183	PSI is reset	Adjustable	Please save all data records
184	PSI data invalid	Adjustable	The data in the PSI are invalid, please save all data records
185	Autotuning tables invalid.	Adjustable	Restart autotuning
186	A/D correction table invalid	Adjustable	Replace the controller cartridge
187	EEPROM is reset	IS	The data in the EEPROM are invalid, please safe all data records
188 to 191	reserved Not assigned = 0		

Error position controller P0213

Error no.	Meaning	Reaction	Troubleshooting
192	Position deviation dynamic	Adjustable	Remove the dynamical position deviation error
193	Position deviation static	Adjustable	Remove the statical position deviation error
194	Encoder 1 is used for position control, but is inactive. This error is also shown, if the faulty positioning is in one of the inactive data records.	IS	activate encoder 1
195	Encoder 2 is used for position control, but is inactive. This error is also shown, if the faulty positioning is in one of the inactive data records.	IS	Activate encoder 2
196	Software limit switch 1 exceeded	Adjustable	Check the target position with the by the limit switch enabled travelling range
197	Software limit switch 2 exceeded	Adjustable	Check the target position with the by the limit switch enabled travelling range
198	Hardware limit switch 1 exceeded	Adjustable	Check the target position with the by the limit switch enabled travelling range
199	Hardware limit switch 2 exceeded	Adjustable	Check the target position with the by the limit switch enabled travelling range
200	Homing necessary and not yet executed	Adjustable	Execute homing
201	Setpoint in mode Set-of-setpoints didn’t arrive in time	Adjustable	Assure, that positioning data and handshake take place in time (also see parameter manual)
202	Target position ≥ Modulo position	Adjustable	Minimize target position or adjust Modulo position P1239
203	Spindle positioning: Error while initialization of the trigger	Adjustable	Used encoder without triggersignal (zero pulse) or incorrect adjustment in P1425 spindle positioning mode
204	Spindle positioning: Timeout at trigger signal	Adjustable	Check encoder for zero pulse; check encoder connector; check zero pulse signal by means of the toggle bit (encoder 1/2 status bit 8)
205	Error occured while executing homing	Adjustable	Check the function of the reference switch and the hardware limit switch; adjust the encoder input selection where necessary; select only supported homing methods
206 to 207	Not assigned = 0		

Error speed controller P0214

Error no.	Meaning	Reaction	Troubleshooting
208	Drive blocked	IS	Remove the blockade of the drive
209	Encoder 1 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records.	IS	You have got to either activate the encoder in the encoder 1 (modeP0150) or you set the encoder 2 as encoder for the position control (parameter P1030)
210	Encoder 2 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records.	IS	You either have got to activate the encoder in the encoder 2 (P0160) or you set the encoder 1 as encoder for the position control (parameter P1030)
211	Overspeed Open loop	IS	Check parameterization and reduce speed
212 to 223	Not assigned = 0		

Error free control section P0215

Error no.	Meaning	Reaction	Troubleshooting
224 to 234	Not assigned = 0	Adjustable	
235	Torque coupling: General error in the master	Adjustable	
236	Torque coupling: Operating mode in the slave is not speed control	IS	
237	C onfiguration error reaction return motion is invalid	IS	
238	Return motion destination was not reached	Adjustable	
239	Application error (enabled by P0302 bit 1)	Adjustable	

Error CANsync P0216

Error no.	Meaning	Reaction	Troubleshooting
240 to 245	Not assigned = 0	No reaction	Check the parameterization of the DC link parameters, see parameter manual
246	Invalid DIP switch settings	according to setting	Correct the wrong setting of DIP switches on the module
247 to 255	Not assigned = 0		

3. Level **Error power unit - serial interface** P0233

(communication error to the power unit)

Error code	Meaning	Troubleshooting
6	Data overflow	Error indicates high EMC problems; please reduce these. Contact Baumüller
7	Bit frame error	Error indicates high EMC problems; please reduce these. Contact Baumüller
8	Invalid command state	Contact Baumüller
9	Parity error	Restart of b maXX®
10	Checksum error	Error indicates high EMC problems; please reduce these. Contact Baumüller
11	Unknown error code	Error indicates high EMC problems; please reduce these. Contact Baumüller
12	Data number error	Error indicates high EMC problems; please reduce these. Contact Baumüller
13	Invalid argument	Error indicates high EMC problems; please reduce these. Contact Baumüller
14	Data field is write protected	Error indicates high EMC problems; please reduce these. Contact Baumüller
15	Invalid access code	Error indicates high EMC problems; please reduce these. Contact Baumüller
16	Data field is not changeable in its size	Error indicates high EMC problems; please reduce these. Contact Baumüller
17	Word address outside of data field	Error indicates high EMC problems; please reduce these. Contact Baumüller
18	Data field is nonexistent	Error indicates high EMC problems; please reduce these. Contact Baumüller

Error code	Meaning	Troubleshooting
36	Wrong data checksum	Error indicates high EMC problems; please reduce these. Contact Baumüller
37	No response	Error indicates high EMC problems; please reduce these. Contact Baumüller
66	Invalid response	Restart of b maXX®

2 encoders can be connected to a b maXX® 4400 at most. Accordingly maximum errors can appear in function module 1 and function module 2. The term 'encoder 1' or 'encoder 2' in the column 'device part' stands for one of the five currently existing encoder module types.

Error encoder 1 - serial interface P0234

Error encoder 2 - serial interface P0235

(communication error after Hiperface specification in the encoder 1 /encoder 2)

Error code	Meaning	Troubleshooting
1	Analog signals outside specification	Check the encoder cable and if the encoder has been connected correctly.
2	Error in internal angle offset	Check the encoder cable and if the encoder has been connected correctly.
3	Data field partitioning table destroyed	Check the encoder cable and if the encoder has been connected correctly.
4	Analog limit values not available	Check the encoder cable and if the encoder has been connected correctly.
5	Internal I^2C-bus not operative	Check the encoder cable and if the encoder has been connected correctly.
6	Internal checksum error	Check the encoder cable and if the encoder has been connected correctly.
7	Internal watchdog error - encoder reset	Check the encoder cable and if the encoder has been connected correctly.
8	Overflow of the counter	Check the encoder cable and if the encoder has been connected correctly.
9	Parity error	Check the encoder cable and if the encoder has been connected correctly.
10	Checksum error	Check the encoder cable and if the encoder has been connected correctly.
11	Unknown error code	Check the encoder cable and if the encoder has been connected correctly.
12	Data number error	Check the encoder cable and if the encoder has been connected correctly.
13	Invalid argument	Check the encoder cable and if the encoder has been connected correctly.
14	Data field is write protected	Check the encoder cable and if the encoder has been connected correctly.
15	Invalid access code	Check the encoder cable and if the encoder has been connected correctly.
16	Data field is not changeable in its size	Check the encoder cable and if the encoder has been connected correctly.
17	Word address outside of data field	Check the encoder cable and if the encoder has been connected correctly.
18	Data field is nonexistent	Check the encoder cable and if the encoder has been connected correctly.

Error code	Meaning	Troubleshooting
19 to 27	reserved	
28	Absolute monitoring of the analog signals	Check the encoder cable and if the encoder has been connected correctly.
29	Transmission current critical	Check the encoder cable and if the encoder has been connected correctly.
30	Encoder temperature critical	Check the motor temperature
31	Speed too high - no position generation possible	Check the encoder cable and if the encoder has been connected correctly.
32	Position singleturn unreliable	Internal encoder error Contact Baumüller
33	Multiturn position error	Internal encoder error Contact Baumüller
34	Multiturn position error	Internal encoder error Contact Baumüller
35	Multiturn position error	Internal encoder error Contact Baumüller
36	Invalid power unit data checksum	Check the encoder cable and if the encoder has been connected correctly.
37	No response from encoder	Check the encoder cable and if the encoder has been connected correctly.
38	Encoder address unknown	Check the encoder cable and if the encoder has been connected correctly.
39	Error reading the absolute angle position	Check the encoder cable and if the encoder has been connected correctly.
40	Invalid checksum of received data	Check the encoder cable and if the encoder has been connected correctly.
41	Unknown encoder type	Check the encoder cable and if the encoder has been connected correctly.
42 to 63	reserved	
64	No response of Hiperface® encoder	Check the encoder cable and if the encoder has been connected correctly.
65	No response from EnDat encoder	Check the encoder cable and if the encoder has been connected correctly.
66	Useless response to encoder command	Check the encoder cable and if the encoder has been connected correctly.
67 to 79	reserved	
80	CRC has determined an error	Check the encoder cable and if the encoder has been connected correctly.

Error code	Meaning	Troubleshooting
81	Invalid command	Check the encoder cable and if the encoder has been connected correctly.
82	Error in response telegram	Check the encoder cable and if the encoder has been connected correctly.
83	Alarm bit is set	Restart the system
84	Memory is occupied	Check the encoder cable and if the encoder has been connected correctly.
85	Incorrect data checksum	Check the encoder cable and if the encoder has been connected correctly.
86	Motor data length and/or data version of encoder and controller firmware are not identical	Check the encoder cable and if the encoder has been connected correctly.
87	No EnDat interface	Check the encoder cable and if the encoder has been connected correctly.
88	Exceeding of transmission format which is able to be evaluated	Use another Length measuring system type
89	Exceeding of the evaluable measuring step	Use another Length measuring system type
90	Signal period length < measuring step length	Use another Length measuring system type
91 to 95	reserved	
96	Error lighting	Exchange encoder
97	Error signal amplitude	Exchange encoder
98	Error position value	Exchange encoder
99	Error overvoltage	Exchange the encoder module
100	Error undervoltage	Exchange the encoder module
101	Error overcurrent	Exchange the encoder module
102	Error battery	Exchange encoder

Error finding notch position P0237

Bit	Meaning	Troubleshooting
0	Overcurrent step 1 Error occurs at 180 % of maximum current P1241.	Method 2: Either allow higher current, increase peak current P1241, or impress less current, reduce amplitude of voltage P2122 (or P2148)
1	Overcurrent step 2 Error occurs at 180 % of maximum current P1241.	Method 2: Either allow higher current, increase peak current P1241, or impress less current, reduce amplitude of voltage P2123 (or P2149)
2	Plausibility step 1 ● Method 0: Current is too low or shaft is too immovable or the direction of the rotating field P0087 is wrong. ● Method 2: Tracking controller does not converge to a steady rotor position (the tracking controller should calculate the same value from different start values with unchanged rotor position). If the measures for troubleshooting could not assist, then the motor is possibly not qualified for the injection procedere (e.g. the magnetic anisotropism of the motor is not enough impressed, magnetic unbalance of the three phases, etc.)	Method 0: Check amplitude of current, the movability of the shaft and/or the direction of phase rotation P0087. Method 2: Increase gain of the tracking controller P2124 and / or Increase amplitude of voltage P2122 (or P2148). If P2122 (or P2148) is at maximum already, then P2120 reduce the frequency of the current
3	Plausibility step 2 The measured part of the 2nd harmonic (P2147 from FW 3.10) is less than the minimal saturation level P2125. If the measures for troubleshooting could not assist, then the motor is possibly not qualified for the injection procedere (e.g. the magnetic anisotropism of the motor is not enough impressed, magnetic unbalance of the three phases, etc.)	Method 2: Increase amplitude of voltage P2123 (or P2149). If P2123 is at maximum already, then P2121 reduce the frequency of the current If current is at maximum, then reduce carefully the minimal saturation level P2125. (If the minimal saturation level P2125 is too less, the interference resistance of the process is reduced.)
8 ... 4	Reserved	
9	Plausibility step 2 Test invalid (from FW 03.10) The amplitude of the injected signal is too low, to determine the part of the 2nd harmonic actually.	Method 2: Increase amplitude of voltage P2123 (or P2149). If P2123 is at maximum already, then P2121 reduce the frequency of the current
15 ... 10	Not assigned = 0	

Error mains monitor P0236

Error code	Meaning	Reaction	Troubleshooting
0	Mains monitor has detected error Mains failure	Adjustable	System incident
1	Mains monitor has detected error Phase failure	Adjustable	System incident
2	Mains monitor has detected error Undervoltage mains	Adjustable	System incident
3	Mains monitor has detected error Overvoltage mains	Adjustable	System incident
4	Mains monitor has detected error Mains frequency at the lower frequency limit	Adjustable	System incident
5	Mains monitor has detected error Mains frequency at the upper frequency limit	Adjustable	System incident
15 ... 6	Reserved		

Error function module A to E P0240 to P0244

Error code	Meaning	Reaction	Troubleshooting
0	reserved error		
1	Module not recognized	IS	Check if you have plugged in the right module at the right position
2	Recognized module not permitted at this position	no response	Check if you have plugged in the right module at the right position
3	Digital output short-circuited or 24 V supply not connected at DIO module	no response	Check the cabling of the digital outputs
4	Invalid target parameter value by digital input	no response	Check the parameterization of the input channel
5	Direct PLC-I/O access for this module not permitted.	no response	Don’t select the module
6	Required module is missing, only for BM4100 active mains rectifier unit	IS	Connect the required module for active mains rectifier unit operation - see Operation Manual b maXX BM4100 Active Mains Rectifier Unit
7	Module must not be used for actual active mains rectifier unit mode or controller mode	no response	
8	Reserved	no response	
9	Too much Analog I/O modules connected	no response	More than 2 Analog modules are not allowed

Error code	Meaning	Reaction	Troubleshooting
10	AIO-04: Current < 4 mA	no response	Current source not connected, disconnection or short-circuit
11	AIO-04: Current > 20 mA	no response	Current source impress too much current
12 bis 15	Reserved		

Error option module G to M P0245 to P0250

Error code	Meaning	Reaction	Troubleshooting
4096	Wrong parameter no. at setpoint parameter 1	Adjustable	Check the according setpoint parameter
4097	Wrong parameter no. at setpoint parameter 2	Adjustable	Check the according setpoint parameter
4098	Wrong parameter no. at setpoint parameter 3	Adjustable	Check the according setpoint parameter
4099	Wrong parameter no. at setpoint parameter 4	Adjustable	Check the according setpoint parameter
4100	Wrong parameter no. at setpoint parameter 5	Adjustable	Check the according setpoint parameter
4101	Wrong parameter no. at setpoint parameter 6	Adjustable	Check the according setpoint parameter
4102	Wrong parameter no. at setpoint parameter 7	Adjustable	Check the according setpoint parameter
4103	Wrong parameter no. at setpoint parameter 8	Adjustable	Check the according setpoint parameter
4104	Wrong parameter no. at setpoint parameter 9	Adjustable	Check the according setpoint parameter
4105	Wrong parameter no. at setpoint parameter 10	Adjustable	Check the according setpoint parameter
4106	Wrong parameter no. at setpoint parameter 11	Adjustable	Check the according setpoint parameter
4107	Wrong parameter no. at setpoint parameter 12	Adjustable	Check the according setpoint parameter
4108	Wrong parameter no. at setpoint parameter 13	Adjustable	Check the according setpoint parameter
4109	Wrong parameter no. at setpoint parameter 14	Adjustable	Check the according setpoint parameter

Error code	Meaning	Reaction	Troubleshooting
4110	Wrong parameter no. at setpoint parameter 15	Adjustable	Check the according setpoint parameter
4111	Wrong parameter no. at setpoint parameter 16	Adjustable	Check the according setpoint parameter
4112	Wrong parameter no. at actual value parameter 1	Adjustable	Check the according actual value parameter
4113	Wrong parameter no. at actual value parameter 2	Adjustable	Check the according actual value parameter
4114	Wrong parameter no. at actual value parameter 3	Adjustable	Check the according actual value parameter
4115	Wrong parameter no. at actual value parameter 4	Adjustable	Check the according actual value parameter
4116	Wrong parameter no. at actual value parameter 5	Adjustable	Check the according actual value parameter
4117	Wrong parameter no. at actual value parameter 6	Adjustable	Check the according actual value parameter
4118	Wrong parameter no. at actual value parameter 7	Adjustable	Check the according actual value parameter
4119	Wrong parameter no. at actual value parameter 8	Adjustable	Check the according actual value parameter
4120	Wrong parameter no. at actual value parameter 9	Adjustable	Check the according actual value parameter
4121	Wrong parameter no. at actual value parameter 10	Adjustable	Check the according actual value parameter
4122	Wrong parameter no. at actual value parameter 11	Adjustable	Check the according actual value parameter
4123	Wrong parameter no. at actual value parameter 12	Adjustable	Check the according actual value parameter
4124	Wrong parameter no. at actual value parameter 13	Adjustable	Check the according actual value parameter
4125	Wrong parameter no. at actual value parameter 14	Adjustable	Check the according actual value parameter
4126	Wrong parameter no. at actual value parameter 15	Adjustable	Check the according actual value parameter
4127	Wrong parameter no. at actual value parameter 16	Adjustable	Check the according actual value parameter
4128	Invalid value at setpoint parameter no. 1	Adjustable	Make sure that you have got correct values within the permitted value range.

Error code	Meaning	Reaction	Troubleshooting
4129	Invalid value at setpoint parameter no. 2	Adjustable	Make sure that you have got correct values within the permitted value range.
4130	Invalid value at setpoint parameter no. 3	Adjustable	Make sure that you have got correct values within the permitted value range.
4131	Invalid value at setpoint parameter no. 4	Adjustable	Make sure that you have got correct values within the permitted value range.
4132	Invalid value at setpoint parameter no. 5	Adjustable	Make sure that you have got correct values within the permitted value range.
4133	Invalid value at setpoint parameter no. 6	Adjustable	Make sure that you have got correct values within the permitted value range.
4134	Invalid value at setpoint parameter no. 7	Adjustable	Make sure that you have got correct values within the permitted value range.
4135	Invalid value at setpoint parameter no. 8	Adjustable	Make sure that you have got correct values within the permitted value range.
4136	Invalid value at setpoint parameter no. 9	Adjustable	Make sure that you have got correct values within the permitted value range.
4137	Invalid value at setpoint parameter no. 10	Adjustable	Make sure that you have got correct values within the permitted value range.
4138	Invalid value at setpoint parameter no. 11	Adjustable	Make sure that you have got correct values within the permitted value range.
4139	Invalid value at setpoint parameter no. 12	Adjustable	Make sure that you have got correct values within the permitted value range.
4140	Invalid value at setpoint parameter no. 13	Adjustable	Make sure that you have got correct values within the permitted value range.
4141	Invalid value at setpoint parameter no. 14	Adjustable	Make sure that you have got correct values within the permitted value range.
4142	Invalid value at setpoint parameter no. 15	Adjustable	Make sure that you have got correct values within the permitted value range.
4143	Invalid value at setpoint parameter no. 16	Adjustable	Make sure that you have got correct values within the permitted value range.
4144	Invalid value for Setpoint period	Adjustable	Make sure that you have got correct values within the permitted value range.
4145	Invalid value for Actual value period	Adjustable	Make sure that you have got correct values within the permitted value range.
4146	False value for Cycle offset setpoints	Adjustable	Make sure that you have got correct values within the permitted value range.
4147	False value for Cycle offset actual values	Adjustable	Make sure that you have got correct values within the permitted value range.

Error code	Meaning	Reaction	Troubleshooting
4148	BACI timeout at cyclic data	Adjustable	Check the communication rate with the adjusted timeout P0839
4149	BACI timeout at Service data	Adjustable	
4150	Check results in faulty checksum	IS	Execute a restart by switching on and off
4151	ramp-up Timeout when waiting for the slave type or when waiting for the resetting of config-pending-flag	Adjustable	Execute a restart by switching on and off
4152	Invalid data transfer structure type	Adjustable	Contact Baumüller
4153	Internal error: Wrong BACI status	Adjustable	Contact Baumüller
4154	Access conflicts with slave at cyclic Communication:	Adjustable	Contact Baumüller
4155	Error cyclic Communication: Parameter value wrong	Adjustable	Contact Baumüller
4156	Error cyclic Communication: Alive-counter conflict	Adjustable	Check the value of the transmitted parameter
4157	Cmd interface: Channel number wrong (0 or > 6)	Adjustable	Check if the option module and the controller are synchronous.
4158	Cmd interface: The channel which was indicated does not exist	Adjustable	Contact Baumüller
4159	Cmd interface: Internal error - wrong pointer	Adjustable	Contact Baumüller
4160	Cmd interface: Internal error - wrong status	Adjustable	Contact Baumüller
4161	Cmd interface: Wrong package number	Adjustable	Contact Baumüller
4162	Cmd interface: Wrong command number	Adjustable	Contact Baumüller
4163	Cmd interface: Wrong status when handling the package	Adjustable	Contact Baumüller
4164	Cmd interface: Timeout at command processing	Adjustable	Contact Baumüller
4165	Cmd interface: Wrong package length	Adjustable	Contact Baumüller
4166	Cmd interface: Descriptor not available	Adjustable	Contact Baumüller
4167	Cmd interface: Wrong package type	Adjustable	Contact Baumüller
4168	Cmd interface: Checksum error	Adjustable	Contact Baumüller

Error code	Meaning	Reaction	Troubleshooting
4169	Module identification: PCI-error when reading	Adjustable	Check the reliability performance of the option module
4170	Module identification: PCI-error when writing	Adjustable	Check the reliability performance of the option module
4171	Module identification: general Reading error	Adjustable	Check the reliability performance of the option module
4172	Module identification: general Error at writing	Adjustable	Check the reliability performance of the option module
4173	Internal error	Adjustable	Contact Baumüller
4174	Configuration cyclic services: Parameters are not cyclic writeable	Adjustable	Select another parameter
4175	Configuration cyclic services: Invalid parameter number	Adjustable	Select another parameter
4176	Wrong option module error code	Adjustable	Contact Baumüller
4177 to 8191	reserved		
8192	Error CANopen timeout on CAN bus	Adjustable	Error node guarding Additional data is available in the programming manual CANopen Slave for b maXX® controller

8.5.3 Parameter description – warnings (warning bit list)

Warning power supply P0261

Warning no.	Meaning	Troubleshooting
0	not used = 0	
1	Undervoltage 24V	Assure the compliance with the specification (see ▹Appendix C - Technical data◃ from page 159)
2	Mains undervoltage	Assure the compliance with the mains specification (see ▹Appendix C - Technical data◃ from page 159)
3	Mains overvoltage	Assure the compliance with the mains specification (see ▹Appendix C - Technical data◃ from page 159)
4	Mains failure	Restore the mains supply
5	Phase failure	Check if all phases are correctly connected and voltage-carrying
6 to 15	not used = 0	

Warnings power unit P0262

Warning no.	Meaning	Troubleshooting
16	Inside temperature of device	Establish the specified environmental conditions, assure correct ventilation conditions
17	Heat sink temperature	Reduce the power output, check the fans of the device
18	Timeout charge process DC link	Check the correct order of mains phases (clockwise rotating field!) and avoid that the DC link supplies energy while charging.
19	not used = 0	
20	Safety relay not controlled	Check the cabling of the safety relay
21 to 22	reserved warning	
23	Difference of voltage Mains DC link > 40 V	Check the power connections
24	Ixt-threshold 1 is exceeded	Take steps, so that the Ixt actual value doesn't exceed 100%
25 to 31	not used = 0	

Warnings motor P0263

Warning no.	Meaning	Troubleshooting
32	Temperature threshold 1 exceeded	Reduce the power output of the motor
33	Temperature threshold 2 exceeded	Reduce the power output of the motor
34	I²t threshold exceeded	Reduce the power output of the motor
35 to 47	not used = 0	

Global drive warnings P0264

Warning no.	Meaning	Troubleshooting
48	Drive not synchronous	
49 to 51	Reserved	
52	Warning encoder 1	Encoder replacement recommended
53	Warning encoder 2	Encoder replacement recommended
54 to 63	Not assigned = 0	

Warnings mains monitor P0265

Warning no.	Meaning	Troubleshooting
64	Mains monitor has determined warning Mains failure	
65	Mains monitor has determined warning Phase failure	
66	Mains monitor has determined that warning limit is below P2058 Mains undervoltage	
67	Mains monitor has determined that the warning limit has been exceeded P2059 Mains overvoltage	
68	Mains monitor has determined that the warning limit Frequency P2060 is below	
69	Mains monitor has determined an exceeding of the upper warning limit Frequency P2061	

9

MAINTENANCE

In this chapter we describe, how you can safely maintain your device.

9.1 Safety instructions

- Refer to ▹Fundamental safety instructions◃ from page 11.
- Refer to the danger areas of the devices.

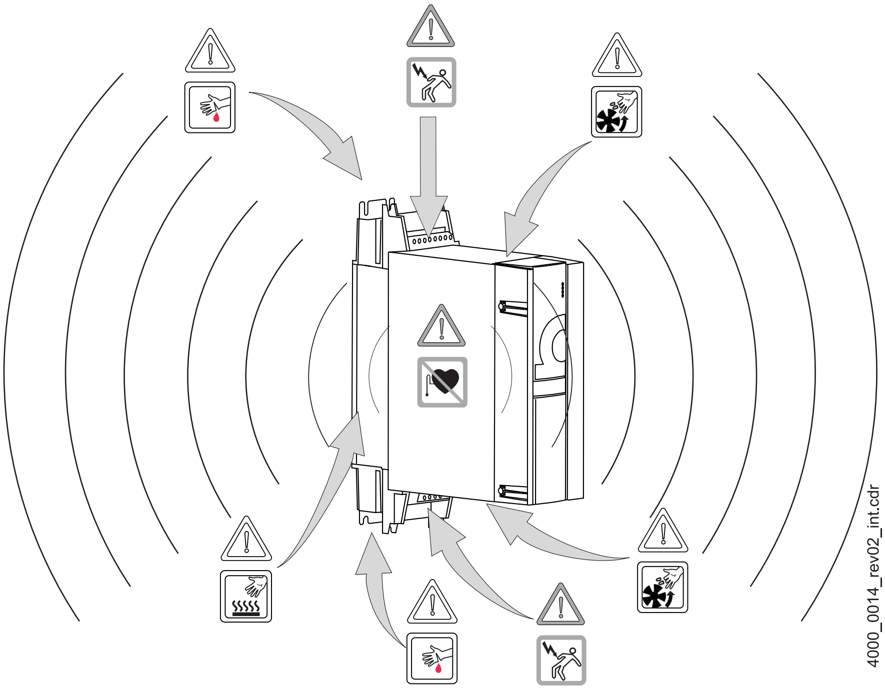


Figure 67: Danger areas smaller mounting form

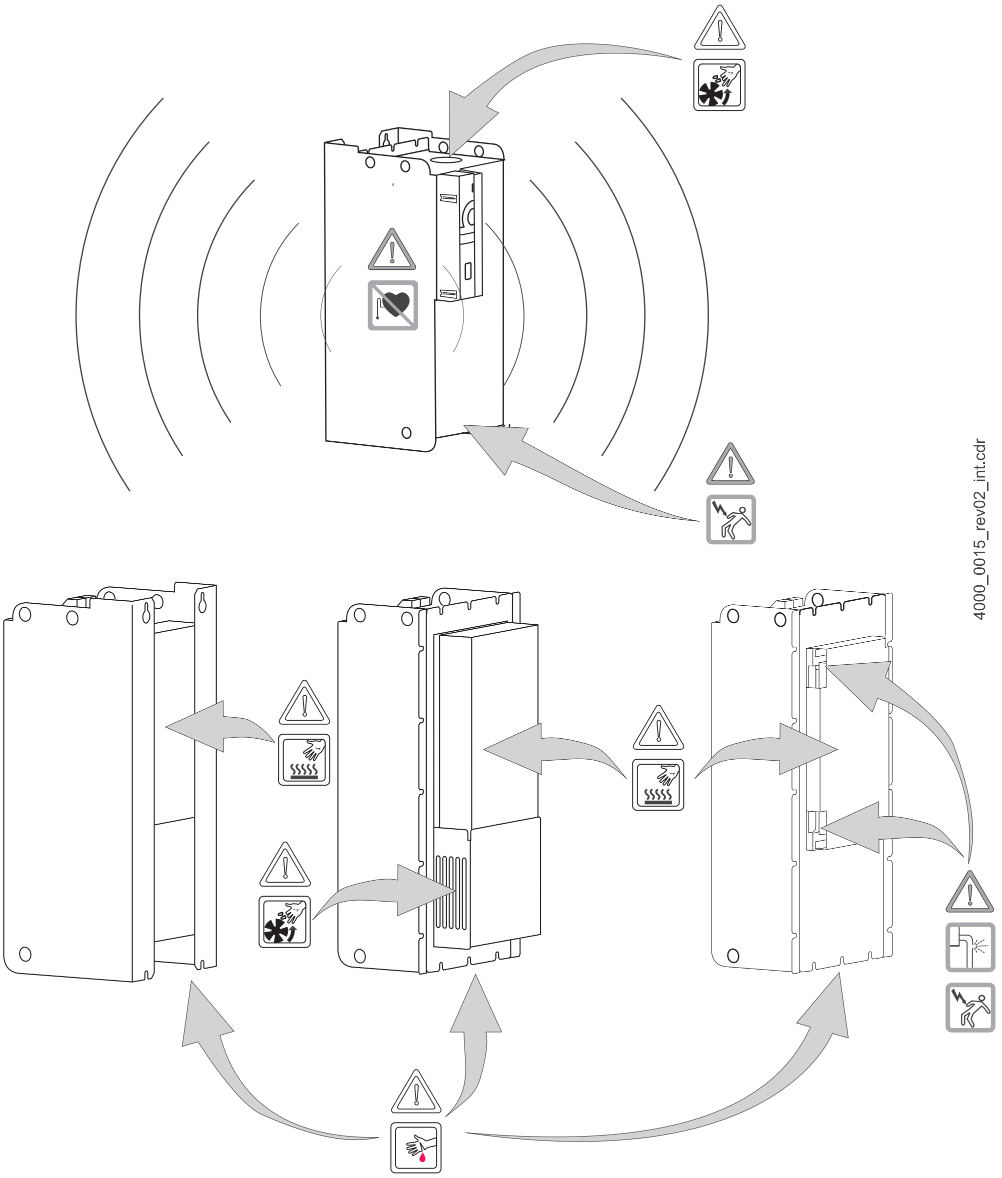


Figure 68: Danger areas larger mounting form

9.2 Environmental conditions

If the prescribed environmental conditions are complied with, the device is maintenance-free. The prescribed environmental conditions are to be found in chapter ▷Appendix D - Technical data◁ from page 179. The most important prescribed environmental conditions are:

- dustless ambient air
- Temperature: min. 5 °C bis max. 55 °C (pay attention to the over 40 °C derating!)
- Relative air humidity: 5% to 85%, no condensation

NOTE

Condensation is possible, if a device is straightly built in and started after it is fetched from the storage.

9.3 Inspection intervals - maintenance notes

Baumüller Nürnberg GmbH recommends a steady checking of the environmental conditions. Thus you will receive the possibility, to react immediately, in case the actual conditions deviate from the prescribed conditions.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *The unit carries dangerous voltages and currents, as well as residual charges in the DC link.*

Assure, that when working in the control cabinet, that all devices in the control cabinet are off-circuit and are safe against re-starting.

Await the discharging of the DC link, before maintenance work is carried out. The capacitors, which are used in the device of the DC link are **10 min.** after interruption of the supply voltage discharge so far, that the connections can be demounted without danger. If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time yourself and you must determine the deenergization at all terminals of the device (also see ▹Dangers due to residual energy◃ on page 23).

- Check at least once a day the equipment at the control cabinet, which ensure the required environmental air (e.g. air filters).
- Maintain the air filters according to the indications of the manufacturer.

In the case of polluted environmental air, the required cooling air rate can not be reached anymore, if dirt deposits narrow/block up the ventilation slots. If the devices are dirty, contact Baumüller Nürnberg GmbH, in order to initiate a servicing or send the device to the company for inspection.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *The device can be damaged by incorrect maintenance in such a way, that a safe operating isn't possible anymore.*

Do not maintain the device yourself.

Never remove dirt deposits especially in the inside of the device with sharp objects like screwdrivers or by the usage of e. g. compressed air, steam jet appliances/high pressure cleaners.

10

REPAIR

In this chapter we describe, where the devices are repaired.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *After a faulty repair the device doesn't fulfill the safety instructions anymore.*

Have the devices be commissioned only by
Baumüller Nürnberg GmbH or the authorized service points.

11

SHUTDOWN, STORAGE

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

11.1 Safety instructions

- Refer to ▹Fundamental safety instructions◃ from page 11 and the information in ▹Transportation and packing◃ from page 25.

The shutdown of the device may only be carried out by for this qualified personnel.

DANGER

The following will occur**,** if you disregard this safety note:

- serious personal injury • death

The danger is: ***Electricity*** *and* ***electrical charge, which was saved.*** *Electrical connections, which are not in a current-free state, carry hazardous voltage levels.The modules in the device (e. g. capacitors) also can carry hazardous charges after it was switched off!*

Assure, that all electric connections are current-free and are safe against re-start.

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.

The capacitors which are used in the device are **10 min.** after interruption of supply voltage discharged so far, that the connections can be demounted without danger. Dependent on the size of the device there are different discharging times. These you find from ▹D.8 Electrical data - BM441X basic unit◃ from page 190. If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time self (also see ▹Dangers due to residual energy◃ on page 23).

11.2 Requirements to the executing personnel

The personnel, who is appointed to setting out of operation, must have the required knowledge and instructions, which is necessary for an execution according to the rules. Select the personnel in such a way, that the safety instructions, which are mounted to the device and its parts as well as to the connections, are understood and applied to.

11.3 Shutdown

Execute the setting out of operation as follows:

1. put the device off-circuit and assure the device against unintentional restart.
2. check the isolation from supply of all connections (earliest 10 minutes after switching off).
3. demount the connections and protect the connections according to the safety instructions.
4. document the shut down setting.

11.4 Demounting

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

CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

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.

Wear safety gloves

Wear safety shoes

1. secure the device against falling off/out.
2. loosen all mechanical connections.
3. lift the device out of the control cabinet.
4. store the device in a suitable packing.
5. at transportation pay attention to, that the device is not damaged by wrong storage or severe shocks, also see ▹To be considered by transportation◃ on page 25.

In case you want to dispose the device, additional data is available in chapter ▹Disposal◃ from page 165.

11.5 Storage conditions

The device is maintenance-free. If you keep to the environmental conditions during the entire period of storage, you can assume, that the device will not be damaged. In case the environmental conditions during storage are not kept, you should assume that the device is damaged after storage.

CAUTION

The following **can occur**, if you disregard this warning instruction:

- Property damage

The danger is: ***incorrect environmental conditions.*** *Incorrect storage can damage/destroy the device.*

Assure, that the environmental conditions are kept during the entire period of storage:

- Climatic category 1K4
- Temperature range -25 °C to +55 °C

The danger is: ***recommissioning without forming of the capacitors.*** *From six months storage period on, the capacitors are destroyed during commissioning, if they are not formed beforehand.*

- Reform the DC link capacitors by supplying the device ready-to-operate for at least one hour with supply voltage, but do not transmit a pulse enable during this time.
- Consider, that it is imperative, to connect the accordingly prescribed line commutating reactor for this forming procedure.Devices, where no line commutating reactor is necessary can directly be supplied with mains voltage.

11.6 Recommissioning

Execute commissioning as with a new device, see
▷Mounting◁ from page 39, ▷Installation◁ from page 73
.

The danger is: ***recommissioning without forming of the capacitors.*** *From six months storage period on, the capacitors can be destroyed during commissioning, if they are not formed beforehand.*

- Form 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 mains voltage.

12

DISPOSAL

In this chapter we describe the correct and safe disposal of the devices of the series **b maXX**®. During the disposal you will mainly get metal parts (iron- and non-iron metal), electronic scrap and plastics.

NOTE

Baumüller products do not belong to the scope of the EU guideline for the disposal of electrical and electronics devices (WEEE, 2002/96/EG). Therefore, no costs are to be carried by Baumüller for the canceling and disposal of old devices.

12.1 Safety instructions

- Refer to ▷Fundamental safety instructions◁ from page 11.

DANGER

The following **will occur**, if you disregard this safety note:

- serious personal injury
- death

The danger is: ***electricity****. The containing components in the device (e. g. capacitors) can contain dangerous charges! The capacitors used in the device are after* ***10 min.*** *automatically so far discharged, that they can be demounted without danger.*

If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time self (also see ▷Dangers due to residual energy◁ on page 23).

Demount the capacitors only then, if you have verified yourself of the isolation from supply.

CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

The danger is: ***sharp edges.*** The components of the device, sheet metal components, heat sinks and so on can have sharp edges!

In case you lift a device during demounting with non-protected hands, your fingers/palms can be cut. If the device falls off, your feet can be cut up.

Wear safety gloves

Wear safety shoes

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

The danger is: ***mechanical effects.*** *A device of the size 446X weighs 70,0 kg and can injure you seriously or even kill you, if it falls off.*

Assure, that the device cannot fall off, by appropriate actions like supports, cranes, helpers.

CAUTION

The following **can occur**, if you disregard this warning instruction:

- Environmental pollution

The danger is: ***incorrect disposal.***

You may only dispose under consideration of the safety instructions. If necessary, also refer to the local regulations. In case you cannot execute a secure disposal, contact a certified disposal business.

Dangerous materials may result or may be set free from a fire.

Do not expose electronic components to high temperatures.

The inner insulation e. g. various power semiconductors hold beryllium oxide. When opened, the beryllium dust is dangerous to your health.

Do not open the electronical components.

12.2 Requirements to the executing personnel

The personnel, whom you instruct to dispose/demount the device must have the knowledge and training to execute these works properly. The personnel is to be selected in such a way, that the safety instructions on the device and its parts is understood and referred to by the personnel.

12.3 Disposal instructions

Preconditions

- The device has already properly been demounted.
- All technical appliances for demounting are prepared and are technically in good order and condition.

12.3.1 Modules

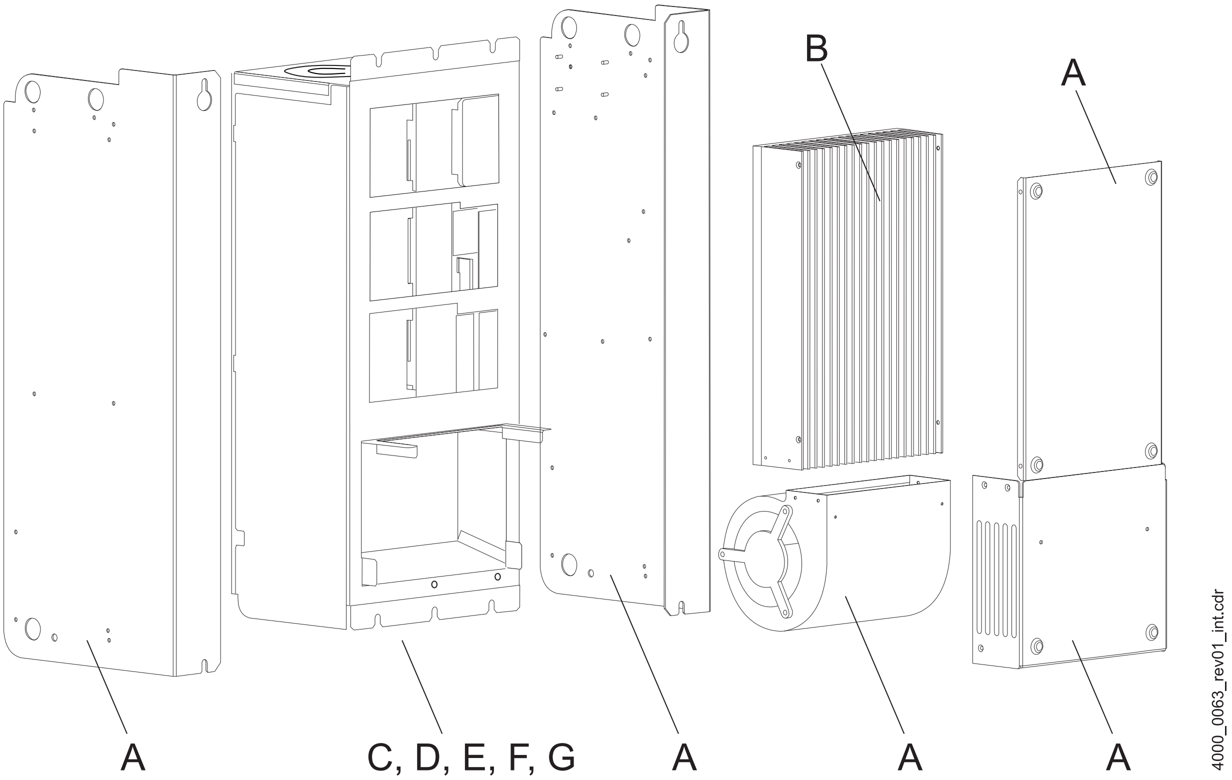


Figure 69: Demounting scheme

The components/modules given in round brackets you will find in the above figure.

Sheet steel	**(A)** Sheet steel must be given to the iron metal recycling.
Aluminium	**(B)** Aluminium must be given to the non-iron metal recycling.
Aluminium/copper compound	**(C)** Aluminium/copper compound must be given to the non-iron metal recycling.
Plastics	**(D)** The plastic parts of the housing as well as the plastic covers and further small plastic parts must be given to the plastics recycling.

CAUTION

The following **can occur**, if you disregard this warning instruction:

- Environmental pollution

The danger is: ***incorrect disposal.***

Capacitors, semiconductor modules and electronic scrap is to be recycled as special waste.

Capacitors	**(E)** Capacitors are to be recycled as special waste. Thereby refer to the relevant instructions.
Semiconductor modules	**(F)** Semiconductor modules are to be recycled as special waste. Thereby refer to the relevant instructions.
Electronic scrap	**(G)** The electronic scrap from PCBs, which no further can be demounted, must be recycled as special waste. Thereby refer to the relevant instructions.

12.4 Recycling plants/offices

Assure, that the disposal is carried out according to your company's regulations and the regulations of the disposal companies and official administrations. In case of doubt, contact the local business administration, which is responsible for your company or the environmental office.

APPENDIX A - ABBREVIATIONS

A	Ampere
AC	Alternating current
AIO	Function module analog input/output
ASCII	American Standard Code for Information Interchange
BACI	Baumüller drives communication interface
BB	Ready-to-operate
BBext	Ready-to-operate (external)
BBint	Ready-to-operate (internal)
BCC	Block Check Character
BSA	Reference potential analog
BSD	Reference potential digital
CAL	CAN Application Layer
CAN	Network for controller ambience
CiA	CAN in Automation
COB-ID	Identification for CAN object
CPU	Central processing unit
DC	Direct current
DIN	Deutsches Institut für Normung e.V. (German Institute for Standardization)
DIO	Function module digital input/output
DSV	Data set manager
EDS	Electronic data sheet
EMF	Electromotive force
EMC	Electromagnetic compatibility
EN	European standard
ENC	Function module incremental encoder
ESD	Electrostatic discharge
EXT, ext	external
FI	Residual current
FIO	Function module fast digital input output
GL	Synchronous operation
HLG	Ramp function generator
HS	Main contactor
HSE	Main contactor on
HSF	Main contactor enable
Î	Peak current, curve shape not defined
I2t	Function module overload monitoring
I_{AC}	Effective value, alternating current
I_{Aist}	Armature current actual value
I_{DC}	Effective value, direct current
I_{eff}	Effective value, alternating current
IF	Impulse enable
I_F	Field current
I_{Fmax}	Maximum field current (nominal current)
I_{Fmin}	Minimum field current
I_{Fsoll}	Field current setpoint value
IEE	Function module incremental encoder emulation
ID-no.	Identification number
Inc	Counting unit of position
Ink	PPR count of incremental encoder
IS	Impulse inhibit
ISO	International Organization for Standardization
I_{soll}	Armature current setpoint
IW	Actual value

IWK	Actual value channel
LT	Power unit
M24	Reference potential 24 V
MR1	Torque direction 1
MR2	Torque direction 2
n = 0	Speed = 0
n_{ist}	Speed actual value
n_{max}	Maximum speed
n_{min}	Minimum speed
NN	Altitude over sea level
n_{soll}	Speed setpoint value
PDO	Process data object
PE	Protective conductor
PELV	Protective extra-low voltage with safety separation, earthed
POS	Positioning
PSI	Program Storage Interface
PWM	Function module pulse-width modulation
PZD	Process data
R_A	Armature resistance
RF	Controller enable
SDO	Service data object
SELV	Safety extra-low voltage with safety separation
SIE	Function module SSI encoder emulation
SM	Synchronous motor
SR	Safety relay
SW	Setpoint value, software
SWG	Setpoint value generator
SYNC	Synchronization message
TM	Motor temperature sensor
U	Voltage
Û	Peak voltage
U_A	Armature voltage
U_{AC}	Effective value, alternating voltage
U_{DC}	Effective value, direct-current voltage
U_{eff}	Effective value, alternating voltage
U_{ZK}	DC-link voltage
V	Volt
VBG	German Administerial Occupation Co-operative
VDE	Association for Electrical, Electroninc & Information Technologies
VE	Logic element
ZK	DC-link

APPENDIX B - SPARE PARTS AND ACCESSORIES

In this appendix we are listing the spare-/accessory parts for the devices of the series **b maXX**®. In case you have questions and suggestions according the accessories, do not hesitate to contact our product management.

B.1 Interface cable

The company Baumüller Nürnberg GmbH recommends the usage of optically decoupled transmitters (e.g. from the company Ratioplast part no. 901SV232C6095 and part no. 901SV232T6095, also see ▹X1 (RS 232)◃ on page 104)

You can get an optically decoupled interface cable as an accessories named programming cable.

Interface	Identification	Length	Item number
X1 (RS 232)	Programming cable	3 m	on request

Other lengths on request.

B.2 Dust cover and connector

	BM4412 BM4413 1)	BM4412 BM4413 2)	BM4414 1)	BM4414 2)	BM442X	BM443X, BM463X	BM444X, BM464X	BM445X, BM465X, BM475X	BM446X, BM466X, BM476X	BM447X, BM477X	Part no.
Dust cover (yellow) narrow	X	-	X	-	-	-	-	-	-	-	351209
Dust cover (yellow) wide	-	X	-	X	X	X	X	X	X	X	351210
Connector „motor“ Phoenix: GIC 2,5/4-ST-7,62, 1828825	X	X	X	X	-	-	-	-	-	-	354746
Connector „1C1/1D1“ or „1C1/1D1/Ba“ Phoenix: GIC 2,5/4-ST-7,62, 1828825	X	X	X	X	-	-	-	-	-	-	354746
Connector „Ba+/Ba-“ Phoenix: GIC 2,5/2-ST-7,62	-	-	X	X	-	-	-	-	-	-	381872
Connector „mains“ Phoenix: GMSTB 2,5/4-ST, 1766903 Wieland: 8313B/4 OBGN, 25.360.3453.7	X	X	X	X	-	-	-	-	-	-	309377
Connector X3 Phoenix: FK-MCP 1,5/6-ST-3,81, 1851083	X	X	X	X	X	X	X	X	X	X	354874
Connector X100 and X101 Wieland: 8513 BFK, 25.630.3653.0	X	X	X	X	X	X	X	X	X	X	354810
Connector X102 3)4) Phoenix: FK-MCP 1,5/4-ST-3,81, 1851067	-	-	-	-	-	X	X	X	X	X	363845
Wieland: 8513 BFK, 25.630.3453.7	X	X	X	X	X	-	-	-	-	-	354809
Connector X103 4) Phoenix: FK-MCP 1,5/4-ST-3,81, 1851067	-	-	-	-	-	X	X	X	X	X	363845

1) BM441X - XXX - 01

2) BM441X - XXX - 02

3) BM44XX - XX1, BM44XX - XX3, BM44XX - XX5

4) BM44XX - XX2, BM44XX - XX4, BM44XX - XX6

B.3 Shield clamping bracket

Identification	**Part no.**
Gauge 11mm, for cable diameter up to 8mm	00312171
Gauge 19mm, for cable diameter 7mm to 16mm	00397366
Gauge 27mm, for cable diameter 6mm to 24mm	00397375
Gauge 43mm, for cable diameter 22mm to 40mm	00397376

ANHANG C - DECLARATION OF CONFORMITY

In this section general information about EC directives, the CE symbol and the Declaration of Conformity is provided.

C.1 What is an EC directive?

EC directives specify requirements. The directives are written by the relevant bodies within the EU (which used to be called the EC, and the EEC before that, hence the now illogical term EC directive), and are implemented by all the member countries of the EU in national law. In this way the EC directives guarantee free trade within the EU.

An EC directive only contains essential minimum requirements. You will find detailed requirements in standards, to which references are made in the directive.

C.2 What the CE symbol indicates

a) The CE marking symbolizes conformity to all the obligations incumbent on manufacturers for the product by virtue of the Community directives providing for its affixing.

…

b) The CE marking affixed to industrial products symbolizes the fact that the natural or legal person having affixed or been responsible for the affixing of the said marking has verified that the product conforms to all the Community total harmonization provisions which apply to it and has been the subject of the appropriate conformity evaluation procedures.

…

Council Decision 93/465/EEC, Annex I B. a) + c)

The CE mark is affixed to the equipment and to the operating instructions as soon as it is established that the requirements of the relevant directives are satisfied.

The electrical safety and function of the device will be checked with the harmonized standard EN 61800-5-1.

With specified application of this Baumüller equipment in your machinery, you can act on the assumption that the equipment satisfies the requirements of 2006/42/EC (machinery directive).

Therefore the equipment is developed and constructed in such a way, that the requirements of the harmonized standards EN 60204-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061 and EN 61800-5-2 can be met by the electrical installation.

Devices supplied by the Baumüller Nürnberg GmbH satisfy the requirements of 2004/108/EC (EMC Directive) by satisfying the requirements of the harmonized standard EN 61800-3.

To enable you to market your machine within the EU, you must be in possession of the following:

- Conformity mark (CE mark)
- Declaration(s) of Conformity regarding the directive(s) relevant to the machine

C.3 Definition of the term Declaration of Conformity

A Declaration of Conformity as defined by this operating instruction is a declaration that the electrical equipment brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

C.4 Declaration of Conformity

be in motion be in motion be in motion

BAUMÜLLER

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EG - Declaration of Conformity

Doc.-No. **5.10065.01**
Date: **01.12.2010**

according to EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC

The Manufacturer:	Baumüller Nürnberg GmbH Ostendstraße 80-90 90482 Nürnberg, Germany

declares, that the products:

Designation:	b maXX 4400, b maXX 4600 and b maXX 4700 without safety relay
Type:	BM44xx, BM46xx, BM47xx
manufactured since:	30.11.2010

are developed, designed and manufactured in accordance with the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.

Applied harmonised standards:

Standard	Title
DIN EN 62061:2010-05	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
DIN EN 61800-5-1:2008-04	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements. Electrical, thermal and energy
DIN EN 61800-5-2:2008-04	Adjustable speed electrical power drive systems. Part 5-2: Safety requirements. Functional
DIN EN 61800-3:2005-07	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods

Attention should be paid to the safety instructions in the manual.

Nuremberg / 01.12.2010
Location / Date

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

C.4 Declaration of Conformity

be in motion be in motion be in motion
BAUMÜLLER
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EG - Declaration of Conformity

Doc.-No. **5.10065.01**
Date: **01.12.2010**

according to Machinery Directive 2006/42/EC

The Manufacturer:	Baumüller Nürnberg GmbH Ostendstraße 80-90 90482 Nürnberg, Germany

declares, that the products:

Designation:	b maXX 4400, b maXX 4600 and b maXX 4700 with safety relay
Type:	BM44xx…S, BM46xx...S, BM47xx…S
manufactured since:	30.11.2010

are developed, designed and manufactured in accordance with the Machinery Directive 2006/42/EC.
These products complies with the requirements of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.

Applied harmonised standards:

Norm	Titel
EN 62061:2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2008	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
EN ISO 13849-2:2008	Safety of machinery - Safety-related parts of control systems Part 2: Validation
EN 61800-5-1:2007	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements. Electrical, thermal and energy
EN 61800-5-2:2007	Adjustable speed electrical power drive systems. Part 5-2: Safety requirements. Functional
EN 60204-1:2006	Safety of machinery. Electrical equipment of machines Part 1:General requirements
EN 61800-3:2004	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods

Authorised person to compile the technical files:

Name:	Werner Düpjohann, Baumüller Nürnberg GmbH, Section CA
Adress:	Ostendstraße 80-90, 90482 Nürnberg, Germany

Notified body executed the EC type-examination procedures according to Machinery Directive 2006/42/EC:

Name:	TÜV Rheinland Industrie Service GmbH
Adress:	Am Grauen Stein, 51105 Köln / Germany
Identification number:	0035
Registration numbers:	01/205/0725/10 (BM443x-447x-PLe), 01/205/5030/10 (BM443x-447x-PLd), 01/205/0724/10 (BM441x-2x), 01/205/5048/10 (BM4600), 01/205/5064/10 (BM4700)

Attention should be paid to the safety instructions in the manual.
This product is to be used in machinery and must not put into operation until the machinery, into with it is incorporated, has been declared to be in conformity with the Machinery Directive 2006/42/EC.

Nuremberg / 01.12.2010
Location / Date

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

APPENDIX D - TECHNICAL DATA

In this chapter you find the detailed technical data for all sizes of the device series **b maXX® BM4400, BM4600, BM4700**.

D.1 Requirements on the power supply

Mains	BM44XX - X**T**X[12] BM46XX - X**T**X[12] BM47XX - X**T**X[12]	Industrial system with direct or low impedance grounded star point (TN-mains or TT-mains)
	BM44XX - X**I**X BM46XX - X**I**X BM47XX - X**I**X	Industrial supply network with a grounded star point (IT-system), which has no or high impedance Industrial system with direct or low impedance earthed junction of phases (grounded delta wye)
Inductance (sum of mains inductance and mains choke inductance)	BM441X, BM442X	min. $u_k = 0,4\%$ max. $u_k = 4\%$
	BM4426, BM443X, BM444X, BM463X, BM464X	min. $u_k = 2,4\%$ max. $u_k = 4\%$
	BM445X, BM465X, BM475X, BM446X, BM466X, BM476X, BM447X, BM477X	min. $u_k = 4\%$ max. $u_k = 6\%$
Rated mains input voltage/-frequency [1] [8] (U_{AC}) device		3 x 400 V 50/60 Hz
Absolute minimum supply voltage device [1] [8] (U_{ACmin}) Absolute maximum supply voltage device [1] [8] (U_{ACmax})		3 x 207 V / 50/60 Hz 3 x 528 V / 50/60 Hz
Absolute minimum frequency [9] Absolute maximum frequency [9]		47 Hz 63 Hz
Harmonics (mains voltage)		$THD_U \leq 10\%$ [2]
Unbalanced mains voltage		max. 3% [3]
Commutating dip		Depth of dip < 40%, area < 250% x degree [2]
Voltage dip		10% to 100% [11] [1]
Voltage variations/-fluctuations		+/-10% [10] +10% to -15% at duration ≤ 1 min [10]
Short Circuit Current Rating (SCCR) [7]		65 kA
Rated mains input voltage -frequency (U_{AC}) fan [6]	BM444X-S/A, BM445X-S/A, BM446X-S/A, BM464X-S/A, BM465X-S/A, BM466X-S/A	230 V ± 10% 50/60 Hz
	BM447X-S/A	3 x 400 V ± 10% 50/60 Hz
Control voltage [4] (U_{DC})		+ 24 V -15% / +20% [5]

[1] The error 'power supply not ready-to-operate' is generated if the supply voltage falls below U_{ACmin} for t > 0.1 s.

[2] EN 61800-3, chapter 5.2.1, class 3

[3] EN 61000-2-4, tab. 1, class 3

[4] 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. It, therefore, may be necessary, to reduce the output currents as well.
In case you refer to UL508C: limit the current to 4 A with UL-listed fuses and to a voltage of max. 30 V_{DC}.

[5] Referring to EN61131-2:1994, table 7. Output power of the power supply unit: see 'power loss referring to control voltage' in 'electrical data'.

[6] Is only valid for BM444X/BM445X/BM446X/BM464X/BM465XBM466X cooling versions S and A and BM447X cooling version A.

[7] Only necessary in order to comply with UL508C.

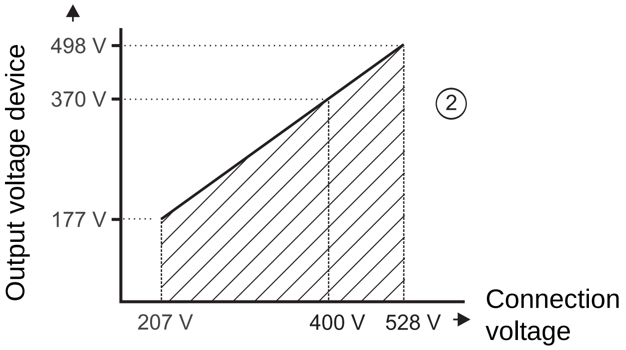
[8] The rated voltage is 400 V.
At mains input voltage is below 400 V the output power of the device reduces (see curves).

[9] Change rate of mains frequency max. 1 Hz/s (EN 61000-2-4, class 3)

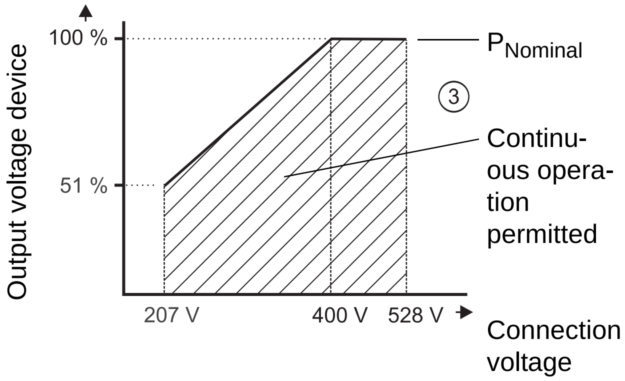
[10] EN 61200-2-4, class 3

[11] EN 61200-2-1

[12] The connection or operation of a device with the marking BM4XXX-X**T**X at an IT system or at a grounded delta wye is not permissible.



② Curve ’output voltage’



③ If you multiply the output current with the output voltage you will get the output power of the device.

$S_{output} = U_{output} \times_{output} \times\sqrt{3}$

In order to receive the specified curve/area, it is necessary, that output current is reduced between 400 and 528 V.

The characteristic curves ’Output current in dependence of the supply voltage’ you will find in the electrical data of the individual devices from ▹Page 190◃.

D.2 Relation between nominal and peak currents

- Calculation of the thermal effective RMS current within a rating cycle

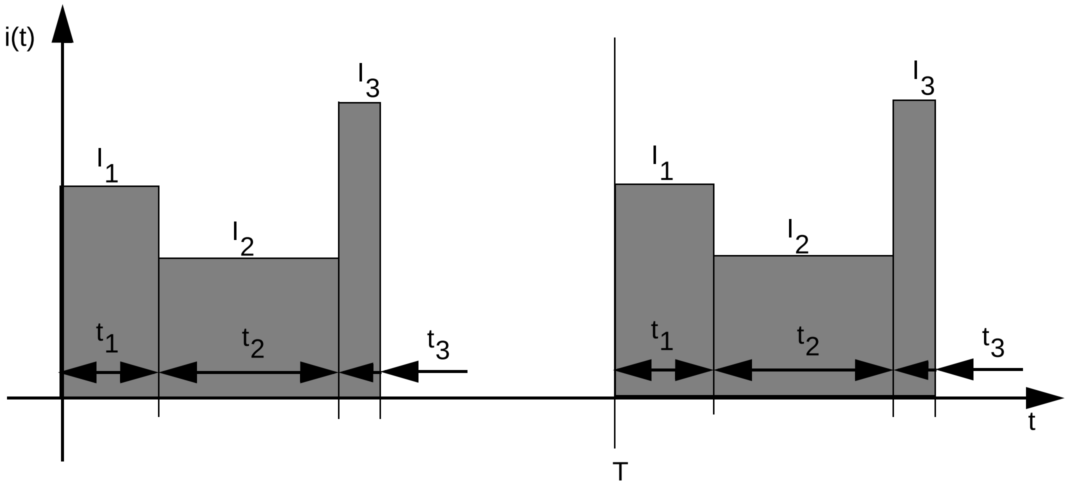


Figure 70: Calculation of the thermal effective RMS current

$$I_{RMS} = \sqrt{\sum_{n=1}^{k} I_n^2 \cdot \frac{t_n}{T}} = \sqrt{I_1^2 \cdot \frac{t_1}{T} + I_2^2 \cdot \frac{t_2}{T} + I_3^2 \cdot \frac{t_3}{T}}$$

- Relation between peak and nominal current for rating a motion cycle

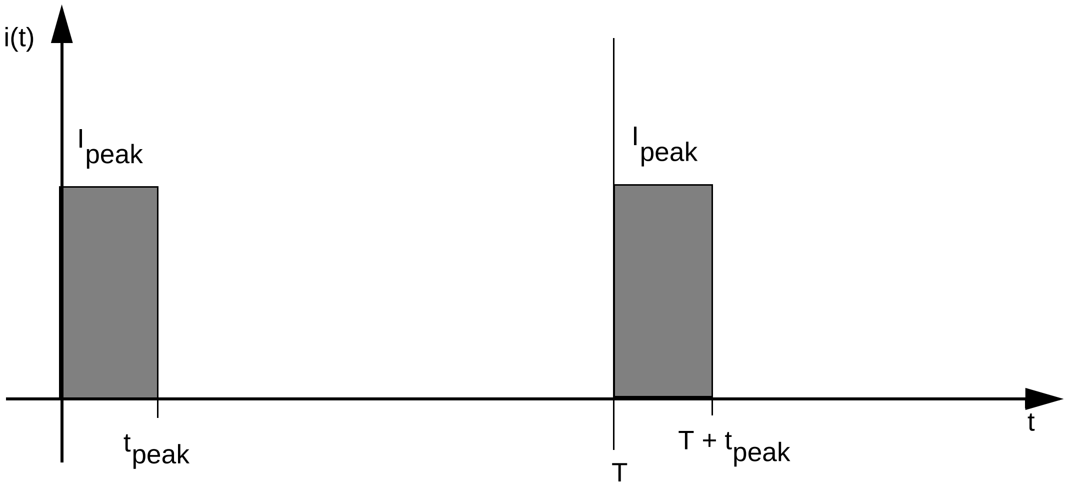


Figure 71: Relation between peak and nominal current

$$\frac{t_{peak}}{T} = \left(\frac{I_{nom}}{I_{peak}}\right)^2$$

- Relation between drive’s peak current and peak break current

Assumption: $P_{shaft,acceleration} = P_{shaft,deceleration}$, $\cos \varphi_{acceleration} = \cos \varphi_{deceleration}$

$$\frac{I_{max,phase,acceleration}}{I_{max,phase,deceleration}} = \frac{U_{DClink,deceleration}}{U_{DClink,acceleration}}\left(\frac{1}{\eta_{motor}}\right)^2$$

Typical values:

$U_{DC\ link,deceleration} = 780\ V$

$U_{DC\ link,acceleration} = 540\ V$

$\eta_{motor} = 0{,}9$

Therefore typically:

$$I_{max,phase,deceleration} = 0{,}56 \cdot I_{max,phase,acceleration}$$

D.3 Requirements to the motor

The **b maXX® BM4400, BM4600, BM4700** is designed for operating three-phase motors with a motor terminal voltage of 3 x 350 V (typical for servo motors of Baumüller) or 3 x 400 V (typical for standard asynchronous motors and for customer-specific special motors of Baumüller). The motors must be operated in star connection. The nominal DC link voltage is 540 V_{DC}. Anticipate an increasing DC link voltage up to 780 V and 800 V in braking operation. The connected motor must be designed for this DC link voltage.

If **b maXX® BM4400, BM4600, BM4700** power modules are operated on a controlled DC link, the DC link voltage is permanently between 640 V and 760 V (not only in braking operation mode). The connected motor must be designed for a continuos operation on the voltage.

The use of the devices also is possible with a lower-rated voltage, e.g. 3 x 230 V.This however requires that the used three-phase motors are enabled for the operation at the inverters with a DC link voltage of up to 800 V, because the chopper start-up voltage (see ▷D.8 Electrical data - BM441X basic unit◁ from page 190 and the following) remain unchanged. Therewith only three-phase motors with $U_{DC\ link,\ nominal} \geq 540\ V$ is used.

D.4 Required environmental conditions

Transportation temperature range	- 25 °C to + 70 °C
Transportation climatic category	2K3 1)
Storage temperature range	- 25 °C to + 55 °C
Storage climatic class	1K4 1)
Operation electrical environment	Industrial supply network 2)
Operation temperature range 4)	min. 5 °C to max. 55 °C 3)
Operation climatic class	3K3 1)
Relative humidity (operation)	Relative humidity 5 % to 85 % no condensation 1) and absolute humidity 1g/m^3 to 25g/m^3
Mounting height 4)	absolute altitude up to 2000 m
Vibration, shock and repetitive shock 5)	max 0.5 g at operation (1 g tested)
Degree of pollution	2 6)
Environmental conditions (EN 60721-3-3)	3K3, 3B1

1) EN 60721-3-3

2) For the operation in an environment of category C2 according to IEC 61800-3:2005, additional measures could be required.The plant manufacturer/user must, in this case, provide evidence, that these additional measures are successful and that the specified limit values of category C2, which are described in IEC 61800-3, are adhered to.

3) Rated temperature = 40° C

4) See also chapter ▷D.5 Correction factor with changed environmental conditions◁ from page 185.

5) EN 50178, chapter 9.4.3.2

6) EN IEC 61800-5-1

NOTE

Normally only a non-conductive pollution occurs. Any conductive pollution (for a short period or continuous) is not permitted and can lead to the destruction of the device. The customer is responsible for destructions based on pollution with conductive substance or materials.

D.5 Correction factor with changed environmental conditions

If devices of the b maXX® series are operated in environmental conditions which lead to different correction factors, you have to consider all correction factors by multiplication when calculating the permitted output power or output current.

Installation altitude

When operating the basic units and power modules of the b maXX® series above an installation altitude of 1000 m the output apparent power S compared with S_{Rated} must be reduced according following figure.

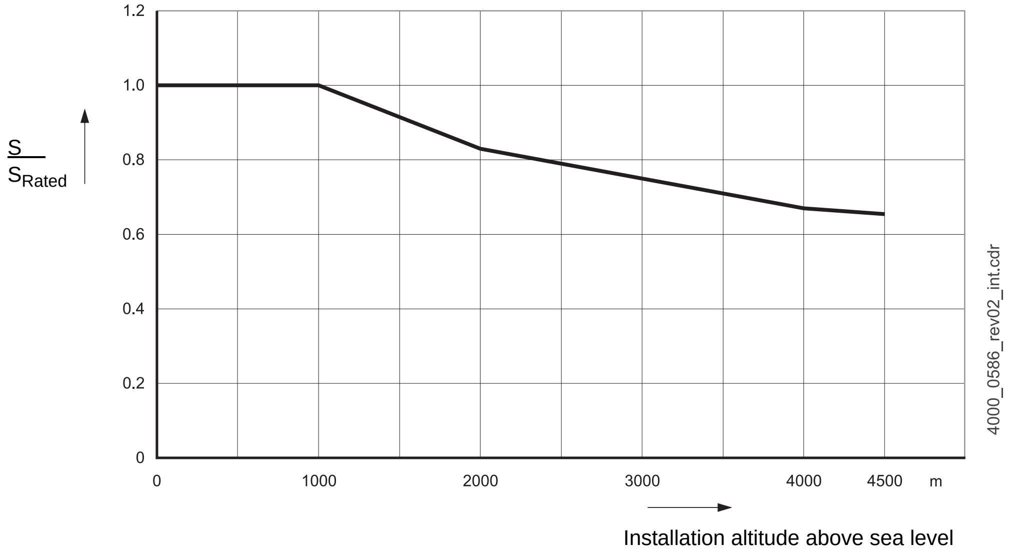


Figure 72: Derating of output apparent power against the installation altitude.

NOTE

Baumüller devices, which are provided for the operation at grounded delta systems or IT supply systems, at these systems only may have an operating altitude of 2000 m. If the altitude is higher than 2000 m to 4000 m these devices must be operated at TN systems and TT systems. Such systems, e. g. can be achieved with an isolating transformer with a secondary-sided star point.

Correction factor with changed environmental conditions

Environmental temperature

The basic unit and power modules of the b maXX® series are designed for environmental temperature of T_{Rated} = 40 °C. Between 40° C and 55° C the output current must be reduced. The allowable output current (I_O) is calculated with the following formula:

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

The coolant temperature complies with the environmental temperature of air-cooled devices and with the water temperature of water-cooled devices.

Input voltage

The output currents at constant output power must be reduced with input voltages higher than the rated input voltage. Figures of the derating values with increased input voltage see electrical data of the respective device.

D.6 Cooling

Cooling air temperature 1)	min. 5 °C to max. 55 °C 2)
Cooling air requirement 3)	see electrical data
Cooling water temperature 4) 8)	absolute min. 5 °C and min. „cooling air temperature“ 1) up to max. 60 °C
Cooling water flow rate 4)5)8)	
BM 443X, BM444X, BM445X, BM446X	min. 4 l/min. up to max. 15 l/min.
BM 463X, BM464X, BM465X, BM466X	min. 4 l/min. up to max. 15 l/min.
BM465X-FXX-§XXXX, BM466X-FXX-§XXXX	min. 10 l/min. up to max. 15 l/min.
BM447X, BM477X	min. 15 l/min. up to max. 25 l/min.
Cooling water pressure 4)5)	max. 6 bar 6)
Cooling water hysteresis	max. 5 K in the static and in the dynamic operation
Hot water generation (cooling water inlet to -outlet) 4) 5) [K]	$< 14{,}35 \left[\frac{l/min}{kW}\cdot K\right]\cdot\frac{\text{power loss}[kW]}{\text{cooling water flow}[l/min]}$
Pressure loss at water cooler 4)5)	0.5 bar at 10 l/min
Mounting board temperature 7)	min. ’Cooling air temperature’ 1) to max 55 °C 2)

1) Air temperature in the entire suction area of the device.

2) Rated temperature = 40° C

3) The cooling air requirement corresponds at least to that of a free-blowing device. Free-blowing means, that the air inlet and the air outlet operates unrestricted. With the mounting of the device into a control cabinet it therefore can be necessary to use additional fans, so that the necessary cooling air requirement is covered. If the necessary cooling air requirement of the power heat sink is not provided, then the output power of the device has to be reduced.

4) only by BM44XX - FXX and BM44XX - ZXX,
only by BM46XX - FXX - 0XXXX and BM46XX - FXX - 3XXXX,
only by BM47XX - FXX - 3XXXX

5) In case of water cooling is assumed, that the water flow is continous with the specified flow rate and the specified water temperature.
Rated flow = 10 l/min
With other cooling water flow rates as mentioned above please contact Baumüller Nürnberg.
The cooling water must meet the following requirements:

pH-value	6.5... 9.5
Conductivity	50... 600 µS/cm
Water hardness (inclusive $CaCO_3$)	< 100 ppm
Suspended matters	< 10 ppm
Particle size	< 100 µm
Ryznar Stability Index (RSI)	5.0 ... 6.0

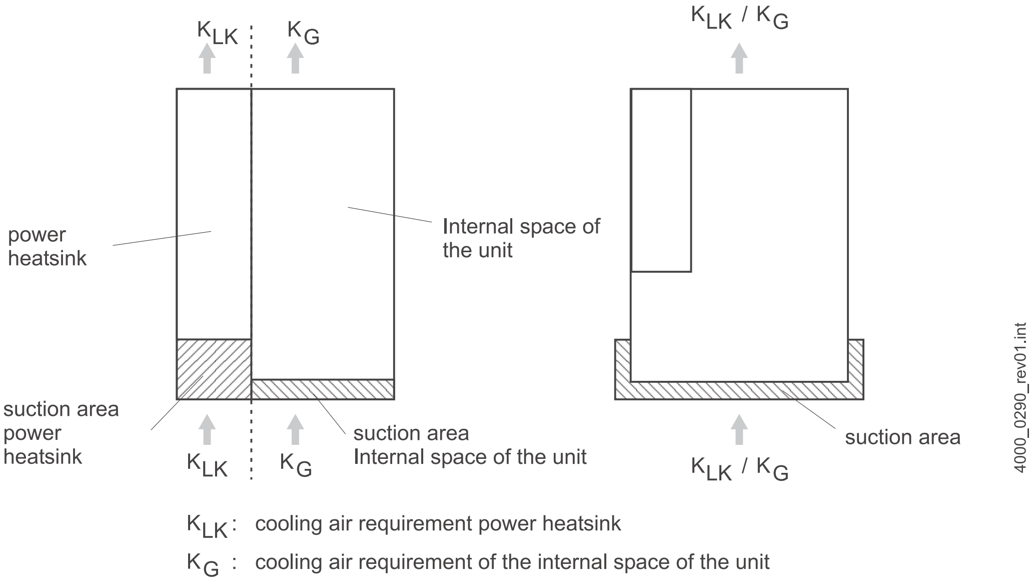
Manganese (Mn)	< 0.05 ppm
Copper (Cu)	< 0.1 ppm
Chlorine (Cl_2)	< 1 ppm
Chloride (Cl^-)	< 500 ppm
Sulfate (SO^{2-}_4)	< 500 ppm

The corrosion-resistant compared with further materials you can take from the DECHEMA-material tables.
Use a corrosion-resistant and a closed cooling circuit.

6) In case you refer to UL508C: max. 3 bar. There must be a pressure-relief valve with a threshold pressure of maximum 6 bar in the cooling circulation.

7) only by BM44XX - CXX

[8] Recommendation:
In order to avoid dew, the temperature of the water inlet is greater or equal to the interior temperature of the device. With other cooling water temperatures as mentioned above please contact Baumüller Nürnberg.



NOTE

Instead of the continuous circulatory through water coolers it is possible to work with a temperature controlled, switched water feed. In this case the customer has to plan a control unit to enable or avoid the circulatory of the water. The control unit has to read in and process the value "heatsink temperature" which is available from the controller. To avoid condensation it is recommended to enable water circulatory when reached 58 °C and to disable again at 57 °C. A maximum hysteresis of 5 K is allowable, therefore the choice of 60 °C for switch on- and of 55 °C for switch off-temperature is possible. But it is better to choose a smaller hysteresis, e.g. 58 °C switch on-temperature and 56 °C switch off-temperature. The controller offers a two-level-controller which can be free parameterized to achieve this function. The advantage is, that the integrated two-level-controller can directly take effect on the variable "heatsink temperature".

The advantage of the temperature controlled , switched water feed is, the possibility to use significantly colder water , because of the two-level-hysteresis controller of the heatsink temperature forbidden condensation can be avoid. That allows, if necessary, to disspate even more power by the heatsink. This is particularly an advantage if water cooled devices with integrated braking resistor (see ▷Additional data BM44XX with water-cooled chopper resistors◁ from page 234) are used.

Please contact the for you responsible Baumüller sales department to get concrete assistance on planning the here mentioned alternative cooling water temperature control.

D.7 Non-electrical data

Device	Dimensions (W x H x D)	Weight with controller, without plug-in modules	Noise development
BM441**X**[2]	80 x 347 x 263 mm 105,5 x 347 x 263 mm	4,0/4,4 kg	max. 80 db(A) [1]
BM442**X**[3]	105,5 x 428 x 340 mm	7,0 kg	max. 80 db(A) [1]
BM443**X**[3] BM463**X**[3]	155 x 540 x 340 mm	15,7 kg	max. 80 db(A) [1]
BM444**X**[3] BM464**X**[3]	190 x 665 x 374 mm	26.4 kg	max. 80 db(A) [1]
BM445**X**[3] BM465**X**[3]	304 x 745 x 380 mm	50,0 kg	max. 80 db(A) [1]
BM465**X**-FXX-3XXXX BM475**X**-FXX-3XXXX	360 x 604 x 320 mm		max. 80 db(A) [1]
BM446**X**[3] BM466**X**[3]	437 x 920 x 380 mm	70,0 kg	max. 80 db(A) [1]
BM466**X**-FXX-3XXXX BM476**X**-FXX-3XXXX	490 x 710 x 322 mm		max. 80 db(A) [1]
BM447**X**[4] BM477**X**[4]	580 x 660 x 340 mm	82.0 kg	max. 80 db(A) [1]

[1] 98/37/EG, appendix I, chapter 1.7.4.f, paragraph 8

[2] The first value provides the measurements of the device BM441X - XXX - 00XXX - XX and BM441X - XXX - 01XXX - XX. The second value specifies the dimensions of the device BM441X - XX - 02XX - XX.

[3] Predetermined are the dimensions for the devices BM44XX-S and BM46XX-S. The dimensions for the other cooling variants are to be found in ▹Installation space◃ from page 41.

[4] Specified are the dimensions for the device BM447X-F or BM477X-FXX-3XXXX, the specified depth is the total depth of the device. Also see ▹Figure 26◃ on page 55.

D.8 Electrical data - BM441X basic unit

		BM441**2-XTX**	BM441**3-XTX**
Input rated power $^{1)}$		1.9 kVA	3.3 kVA
Input rated current $^{1)}$ (I_{eff})		2.8 A	4.8 A
Distortion factor of the input current $^{1)}$ (THD_I)		119%	110%
Input current max. (I_{eff})		5.2 A	9.0 A
DC-link rated voltage $^{1\,)}$$(U_{DC})$		540 V_{DC}	
DC link capacity (internal)		110 µF	240 µF
DC link discharging time (internal DC link capacity)		80 s	175 s
DC link capacity (external), permitted		see ▷Figure 74◁ on page 193	
Delay time between two circuit closings $^{11)}$		at least 60 s	
Output voltage $^{1)}$ (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency $^{12)}$		0 Hz to 450 Hz	
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 2.5 A	max. 4.5 A
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 2.5 A	max. 4.5 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 5.0 A	max. 9.0 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 5.0 A	max. 9.0 A
Max. peak current time $^{7)}$		60 s	
Output power DC link terminals $^{10)}$		max. 2.0 kW	
Chopper current, permissible (Î)		max. 5.9 A	
Chopper resistor external		≥ 130 Ω	
Chopper start-up voltage (Û)		780 V	
Chopper peak power		4.5 kW	5.0 kW
Permissible chopper continuous power externaly		1.0 kW	1.5 kW
Power loss referring to mains voltage		33 W	60 W
Power loss referring to control voltage		max. 60 W	
Current of the integrated brake interface		max. 0.5 A	

Footnotes see following page.

		BM441**4-STx** [9]	BM441**4-CTx** [8][9]
Input rated power [1]		5.1 kVA	6.9 kVA
Input rated current [1] (I_{eff})		7.3 A	10.0 A
Distortion factor of the input current [1] (THD_{I})		109%	113%
Input current max. (I_{eff})		20.0 A	20.0 A
DC-link rated voltage [1] (U_{DC})		540 V_{DC}	
DC link capacity (internal)		330 μF	330 μF
DC link discharging time (internal DC link capacity)		240 s	240 s
DC link capacity (external), permitted		see ▹Figure 74◃ on page 193	
Delay time between two circuit closings [11]		at least 60 s	
Output voltage [1] (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency		0 Hz to 450 Hz	
Output rated current [1][4][5][6] (I_{AC})	at 4 kHz [3]	max. 5.5 A	max. 7.5 A
Output rated current [1][4][5][6] (I_{AC})	at 8 kHz [3]	max. 5.0 A	max. 5.0 A
Output peak current [1][4][5][7] (I_{AC})	at 4 kHz [3]	max. 20.0 A	max. 20.0 A
Output peak current [1][4][5][7] (I_{AC})	at 8 kHz [3]	max. 12.0 A	max. 12.0 A
Max. peak current time [7]		1 s	
Output power DC link terminals [10]		max. 3.0 kW	max. 4.3 kW
Chopper current, permissible (Î)		max. 12.0 A	
Chopper resistor external		≥ 65 Ω	
Chopper start-up voltage (Û)		780 V	
Chopper peak power		9.4 kW	9.4 kW
Permissible chopper continuous power externaly		3.0 kW	3.0 kW
Power loss referring to mains voltage		80 W	102 W
Power loss referring to control voltage		max. 60 W	
Current of the integrated brake interface		max. 1.0 A	

[1] All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

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

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

[5] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

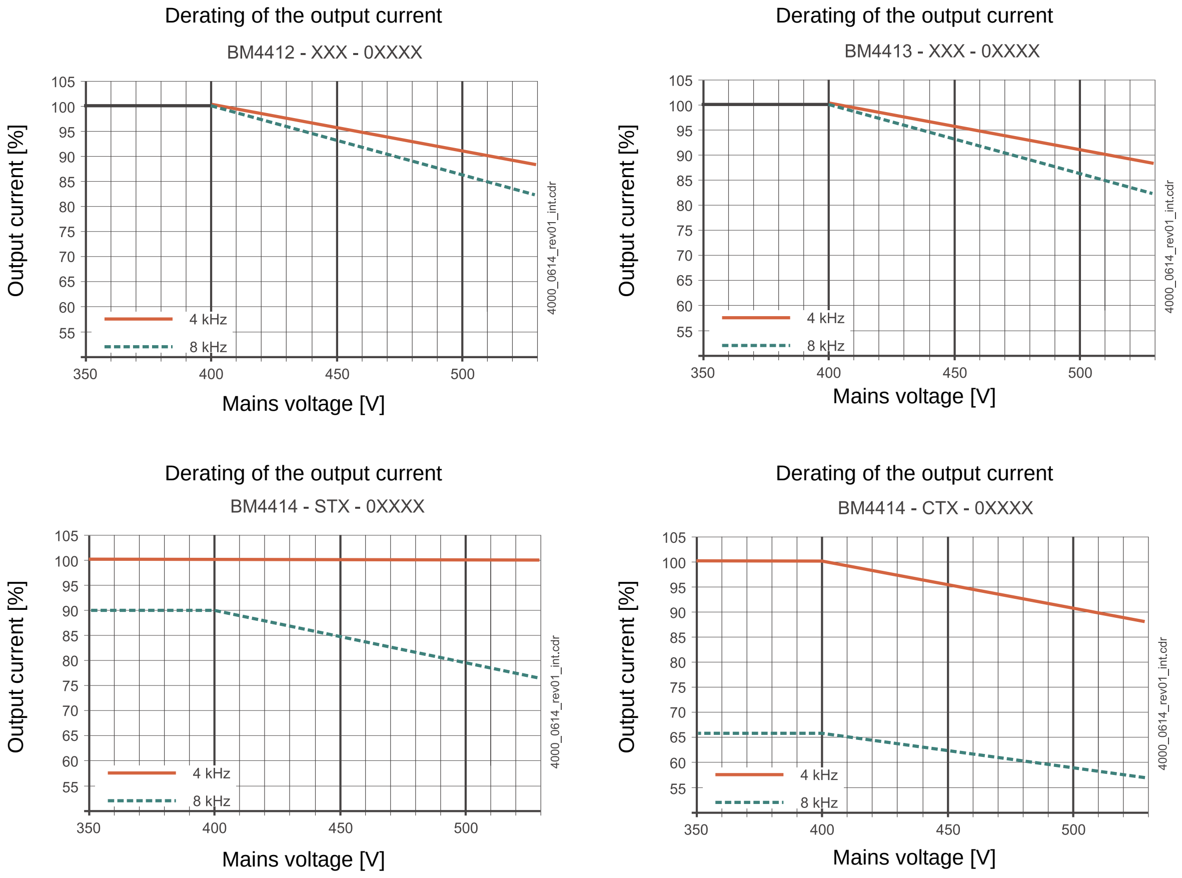


Figure 73: Derating of the output current BM 441X basic unit

[6] Between 40° C and 55° C the output current must be reduced.
The allowable output current (I_0) is calculated with the following formula:

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

[7] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[8] Values are valid at mounting on a heat-conducting surface with a thermal resistance of 0.115 K/W.The maximum allowable length case temperature at the measuring point, see ▹Figure 54◃ on page 90, is 75°C.

[9]

NOTE

For the BM4414 further limitation are valid for peak current at braking operation only.
The possible peak currents are:15 A at 4 kHz and 10 A at 8 kHz switch frequency.

[10] The sum of the average active power, which was transmitted via the DC link terminals and of the average active power transmitted to the motor terminals may not exceed 3.0 kW (BM4414-STx) or 4.3 kW (BM4414-CTx).

[11] The specified value is only valid, if there is no additional DC link capacity connected to the DC link terminals. Also see ▹Mains switch-on-frequency/DC-link charging◃ on page 109 and ▹Figure 74◃ on page 193.

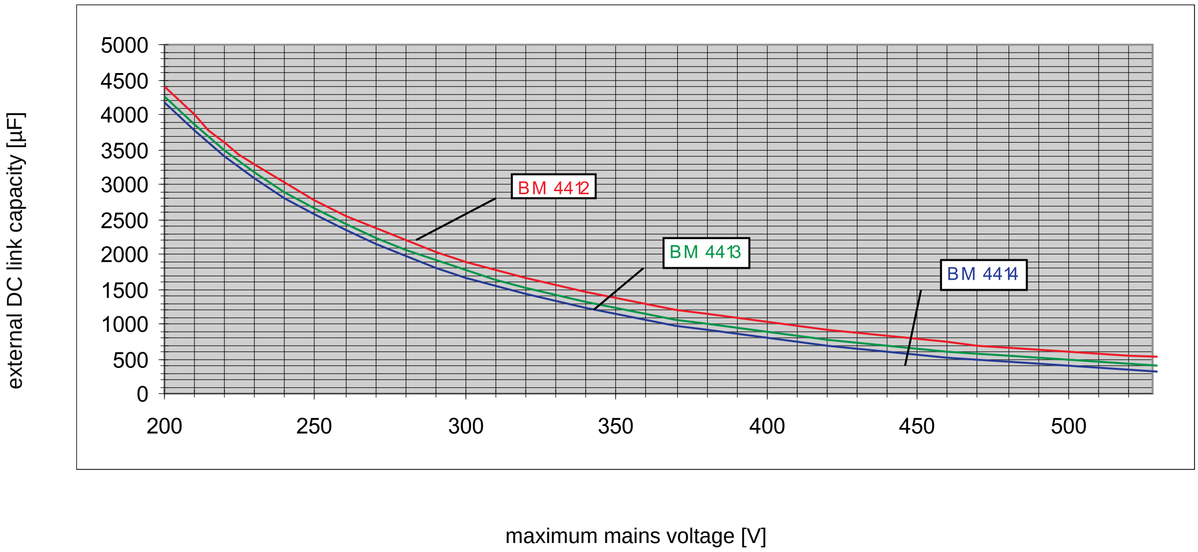


Figure 74: Maximum external DC link capacity BM441X

[12] The maximum output frequency must satisfy the equation $f \le 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.9 Electrical data - BM442X basic unit

		BM442**2**	BM442**3**	BM442**4**
Input rated power 1)		5.6 kVA	8.6 kVA	11.8 kVA
Input rated current 1) (I_{eff})		8.1 A	12.4 A	17.0 A
Distortion factor of the input current (THD_I)1)		107 %	109 %	109 %
Input current, max. (I_{eff})		15.1 A	23.2 A	31.8 A
DC-link rated voltage 1) (U_{DC})		540 V_{DC}		
DC link capacity (internal)		470 µF	470 µF	705 µF
DC link discharging time (internal DC link capacity)		340 s	340 s	510 s
DC link capacity (external), permitted		see ▹Figure 76◃ on page 197		
Delay time between two circuit closings 9)		at least 60 s		
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V		
Output frequency 11)		0 Hz to 450 Hz		
Derating at static output frequency		there is no derating required		
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 7.5 A	max. 11.0 A	max. 15.0 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 6.0 A	max. 8.8 A	max. 12.0 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 15.0 A	max. 22.0 A	max.30.0 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 12.0 A	max. 17.6 A	max. 24.0 A
Max. peak current time 8)		60 s		
Output power DC link terminals 10)		max. 5.0 kW		
Chopper current, permissible (Î)		max. 9.0 A	max. 13.0 A	max. 18.0 A
Chopper resistor external		≥ 86 Ω	≥ 60 Ω	≥ 44 Ω
Chopper start-up voltage (Û)		780 V		
Chopper peak power		7 kW	10 kW	14 kW
Permissible chopper continuous power externaly		3.4 kW	5 kW	6.8 kW
Power loss referring to mains voltage		102 W	150 W	204 W
Power loss referring to control voltage		max. 63 W		
Current of the brake control		max. 0.5 A		

Footnotes see following page.

		BM442**5**	BM442**6-XTX**
Input rated power 1)		11.8 kVA	13.2 kVA
Input rated current 1) (I_{eff})		17.0 A	19,0 A 2)
Distortion factor of the input current (THD_I) 1)		109%	54% 2)
Input current, max. (I_{eff})		34.0 A	37.0 A 2)
DC-link rated voltage 1) (U_{DC})		540 V_{DC}	
DC link capacity (internal)		705 µF	705 µF
DC link discharging time (internal DC link capacity)		510 s	510 s
DC link capacity (external), permitted		see ▹Figure 76◃ on page 197	
Delay time between two circuit closings 9)		at least 60 s	
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency 11)		0 Hz to 450 Hz	
Derating at static output frequency		there is no derating required	see ▹Page 236◃
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 15.0 A	max. 22.5 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 12.0 A	max. 18.0 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 40.0 A	max. 45.0 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 32.0 A	max. 36.0 A
Max. peak current time 8)		1 s	4 s
Output power DC link terminals 10)		max. 5.0 kW	
Chopper current, permissible (Î)		max. 25.0 A	
Chopper resistor external		≥ 32 Ω	
Chopper start-up voltage (Û)		780 V	
Chopper peak power		20 kW	
Permissible chopper continuous power externaly		6.8 kW	
Power loss referring to mains voltage		204 W	300 W
Power loss referring to control voltage		max. 63 W	
Current of the brake control		max. 0.5 A	

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the commutation choke with the part No. 00368377 at a mains with $u_{K,mains} = 0.4\ \%$

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

[6] At rated input supply voltage the device supplies the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

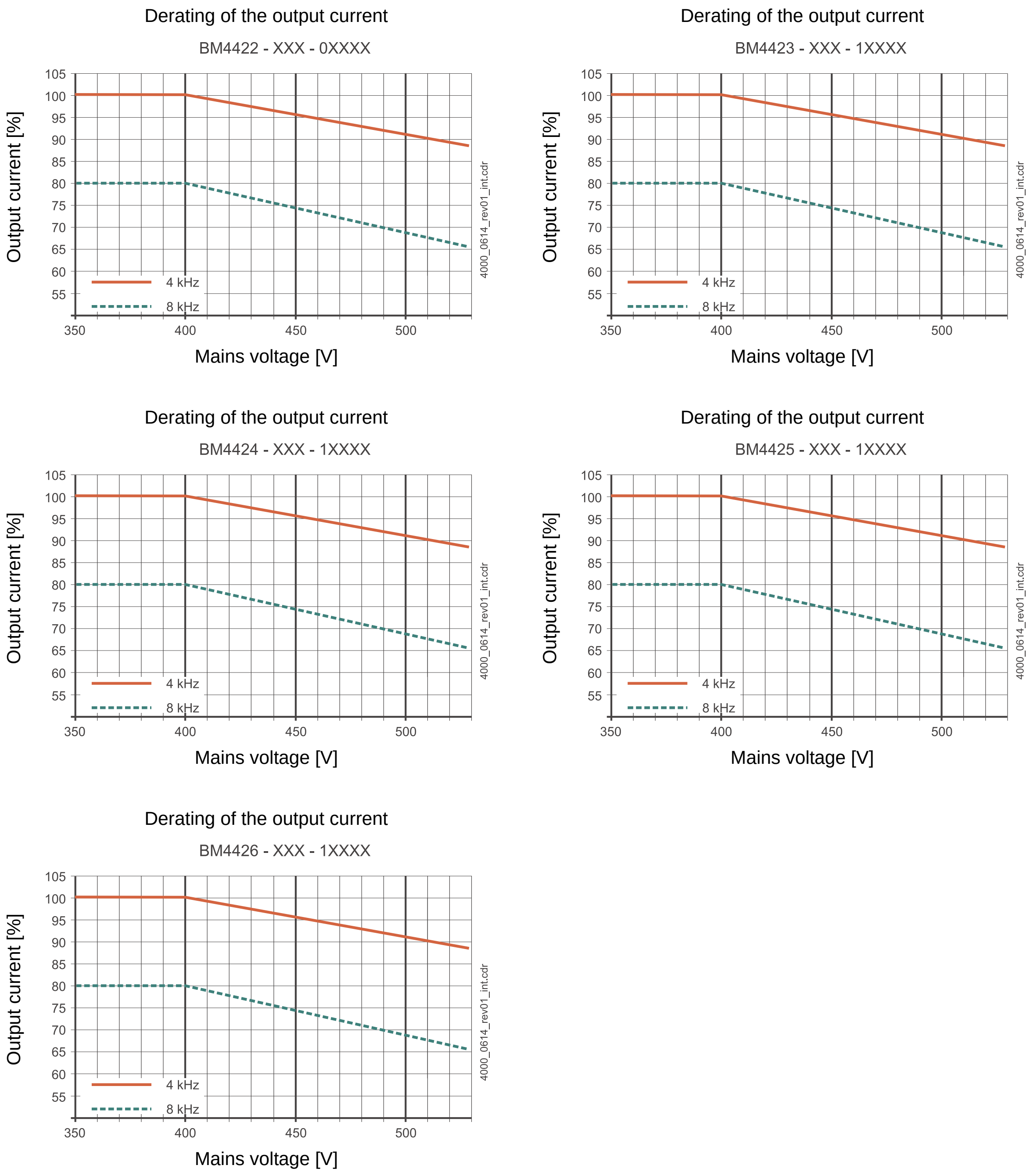


Figure 75: Derating of the output current BM 442X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The allowable output current (I_0) is calculated with the following formula:

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] The specified value is only valid, if there is no additional DC link capacity connected to the DC link terminals. Also see ▷Mains switch-on-frequency/DC-link charging◁ on page 109 and ▷Figure 76◁ on page 197.

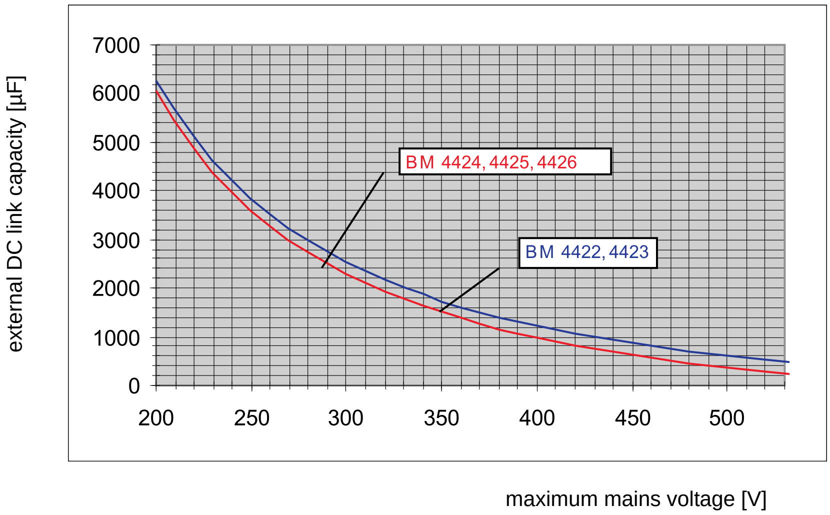


Figure 76: Maximum external DC link capacity BM442X

[10] The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

[11] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.10 Electrical data - BM443X basic unit

		BM443**2**	BM443**3**
Input rated power 1)2)		13.3 kVA	16.8 kVA
Input rated current 1)2) (I_{eff})		19.2 A	24.2 A
Distortion factor of the input current 1)2) (THD_I)		60%	54%
Input current, max. 2) (I_{eff})		37.0 A	45.0 A
DC-link rated voltage 1)(U_{DC})		540 V_{DC}	
DC link capacity (internal)		820 µF	1230 µF
DC link discharging time (internal DC link capacity)		123 s	185 s
DC link capacity (external), permitted		max. 20 mF	
Delay time between two circuit closings		none	
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency 10)		0 Hz to 450 Hz	
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 22.5 A	max. 30.0 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 18.0 A	max. 24.0 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 45.0 A	max. 60.0 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 36.0 A	max. 48.0 A
Max. peak current time 8)		60 s	
Output power DC link terminals 9)		max. 10.0 kW	
Chopper current, permissible (Î)		max. 36.0 A	
Chopper resistor external		≥ 22 Ω	
Chopper start-up voltage (Û)		780 V	
Chopper peak power		29 kW	
Permissible chopper continuous power externaly		10 kW	
Power loss referring to mains voltage		300 W	390 W
Power loss referring to control voltage		max. 88 W	
Current of the brake control		max. 1.0 A	

Footnotes see following page.

		BM443**4**	BM443**5**
Input rated power 1)2)		26.3 kVA	36.7 kVA
Input rated current 1)2) (I_{eff})		38.0 A	53.0 A
Distortion factor of the input current 1)2) (THD_I)		57%	57%
Input current, max. 2) (I_{eff})		71.0 A	71.0 A
DC-link rated voltage 1)		540 V_{DC}	
DC link capacity (internal)		1640 µF	2000 µF
DC link discharging time (internal DC link capacity)		250 s	300 s
DC link capacity (external), permitted		max. 20 mF	
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency 10)		0 Hz to 450 Hz	
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 45.0 A	max. 60.0 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 36.0 A	max. 48.0 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 90.0 A	max. 90.0 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 72.0 A	max. 72.0 A
Max. peak current time 8)		60 s	
Output power DC link terminals 9)		max. 10.0 kW	
Chopper current, permissible $(\hat{I})$		max. 50.0 A	
Chopper resistor external		≥ 16 Ω	
Chopper start-up voltage $(\hat{U})$		780 V	
Chopper peak power		40 kW	
Permissible chopper continuous power externaly		10 kW	
Power loss referring to mains voltage		600 W	840 W
Power loss referring to control voltage		max. 88 W	
Current of the brake control		max. 1.0 A	

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4432 Part no. 00368377, BM4433: Part no. 00368377, BM4434: Part no. 00368378, BM4435: Part no. 00368379.

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced

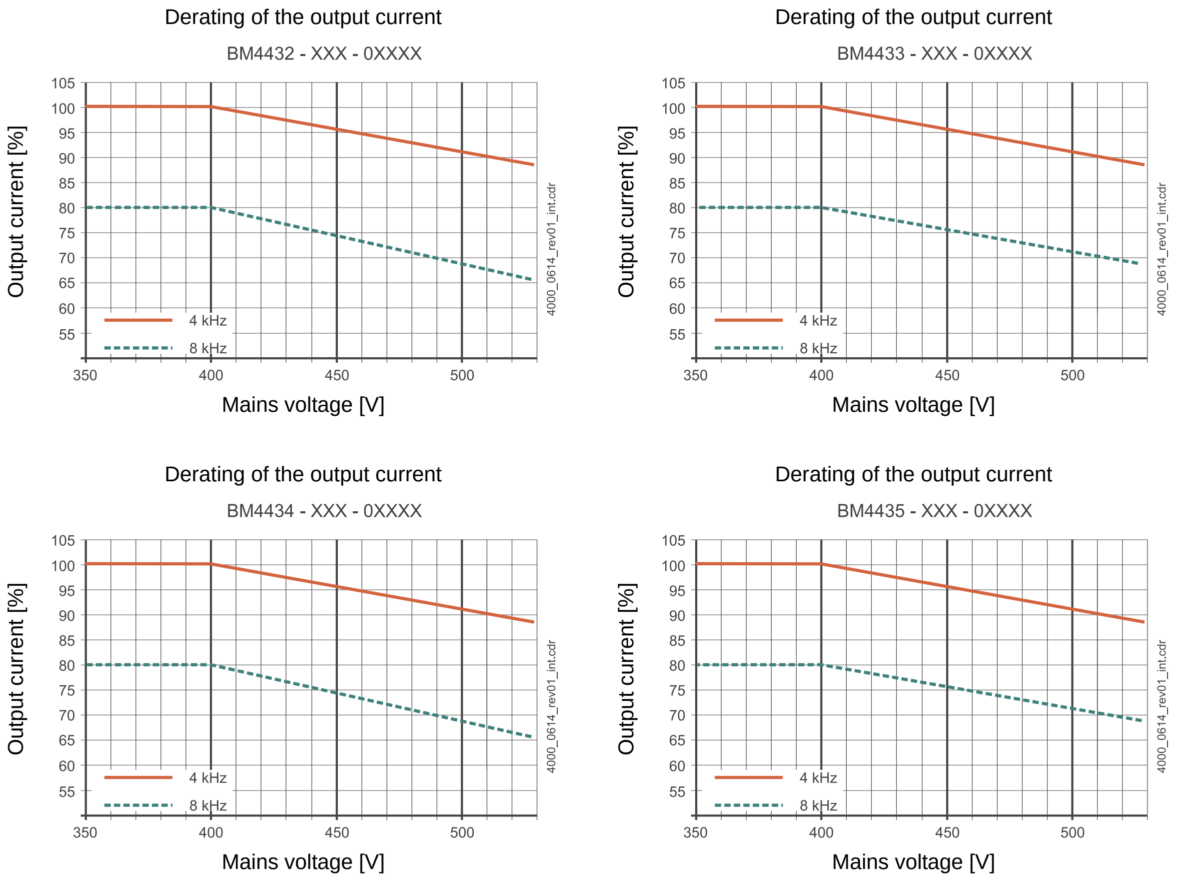


Figure 77: Derating of the output current BM 443X basic unit

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[7] Between 40° C and 55° C the output current must be reduced.
The allowable output current (I_0) is calculated with the following formula:

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

[10] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.11 Electrical data - BM463X basic unit

		BM4632 [11]
Input rated power [1][2]		36.7 kVA
Input rated current [1][2] (I_{eff})		53.0 A
Distortion factor of the input current [1][2] (THD_I)		57%
Input current, max. [2] (I_{eff})		71.0 A
DC-link rated voltage [1]		540 V_{DC}
DC link capacity (internal)		3000 µF
DC link discharging time (internal DC link capacity)		123 s
DC link capacity (external), permitted		see ▹Page 111◃
Delay time between two circuit closings		none
Output voltage [1] (U_{AC})		3 x 0 V to 3 x 370 V
Output frequency [10]		0 Hz to 450 Hz
Output rated current [1][5][6][7] (I_{AC})	at 4 kHz [4]	max. 60.0 A
Output rated current [1][5][6][7] (I_{AC})	at 8 kHz [4]	max. 48.0 A
Output peak current [1][5][6][8] (I_{AC})	at 4 kHz [4]	max. 120.0 A
Output peak current [1][5][6][8] (I_{AC})	at 8 kHz [4]	max. 96.0 A
Max. peak current time [8]		1.25 s
Output power DC link terminals [9]		max. 10.0 kW
Chopper current, permissible (Î)		max. 70.0 A
Chopper resistor external		≥ 11 Ω
Chopper start-up voltage (Û)		780 V
Chopper peak power		56 kW
Permissible chopper continuous power externaly		10 kW
Power loss referring to mains voltage		840 W
Power loss referring to control voltage		max. 88 W
Current of the brake control		max. 8.0 A

[1] All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

[2] In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4632 Part no. 00368382

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V} \right)$$

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

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced

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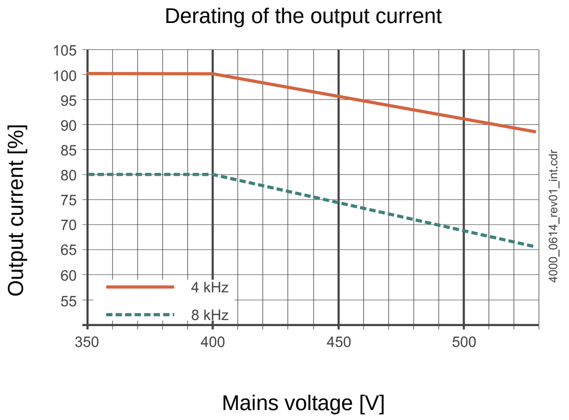


7) Between 40° C and 55° C the output current must be reduced.
The allowable output current (I_0) is calculated with the following formula:

$$I_0 = I_{0(40°C)} \cdot \left(1 - \left(\frac{(\text{Coolant temperature}) - 40°C}{°C} \cdot 0,03\right)\right)$$

8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

9) The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

10) The maximum output frequency must satisfy the equation $f \leq 0,1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

11) The controller firmware has to be 3.10 or higher.

D.12 Electrical data - BM444X basic unit

		BM444**3**	BM444**4**	BM444**5**	BM444**6** 12)
Input rated power 1)2)		49 kVA	58 kVA	73 kVA	94 kVA
Input rated current 1)2) (I_{eff})		70,0 A	84 A	105 A	136 A
Distortion factor of the input current 1)2) (THD_I)		60 %	59 %	45 %	38 %
Input current, max. 2) (I_{eff})		105 A	105 A	133 A	187 A
DC-link rated voltage 1)		540 V_{DC}			
DC link capacity (internal)		1880 µF	2350 µF	3055 µF	3760 µF
DC link capacity (external), permitted		see ▹Page 111◃			
DC link discharging time (internal DC link capacity)		43 s	54 s	70 s	86 s
Delay time between two circuit closings		none			
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency 13)		0 Hz to 450 Hz			
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 80 A	max. 100 A	max. 130 A	max. 150 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 75 A	max. 72 A	max. 94 A	max. 105 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 120 A	max. 130 A	max. 170 A	max. 200 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 90 A	max. 94 A	max. 130 A	max. 150 A
Max. peak current time 8)9)		60 s			
Output power DC link terminals 11)		max. 90 kW			
Chopper current, permissible ($\hat{I}$)		max. 67 A	max. 100 A		
Chopper resistor external		≥ 12 Ω	≥ 8 Ω		
Chopper start-up voltage ($\hat{U}$)		780 V			
Chopper peak power		53 kW	80 kW		
Permissible chopper continuous power		36 kW	45 kW	58 kW	75 kW
Power loss referring to mains voltage		1080 W	1350 W	1740 W	2000 W
Power loss referring to control voltage		max. 75 W			
Power loss of equipment fan according to 230 V_{AC} 10)		87 W			
Current of the brake control		max. 8,0 A 14)			
Cooling air requirement of power heat sink		260 m^3/h		210 m^3/h	
Cooling air requirement of the interior space of device		60 m^3/h			
Requirements on the water cooling		see ▹Page 187◃			

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4443 Part no. 00368380, BM4444: Part no. 00368381, BM4445: Part no. 00368381.

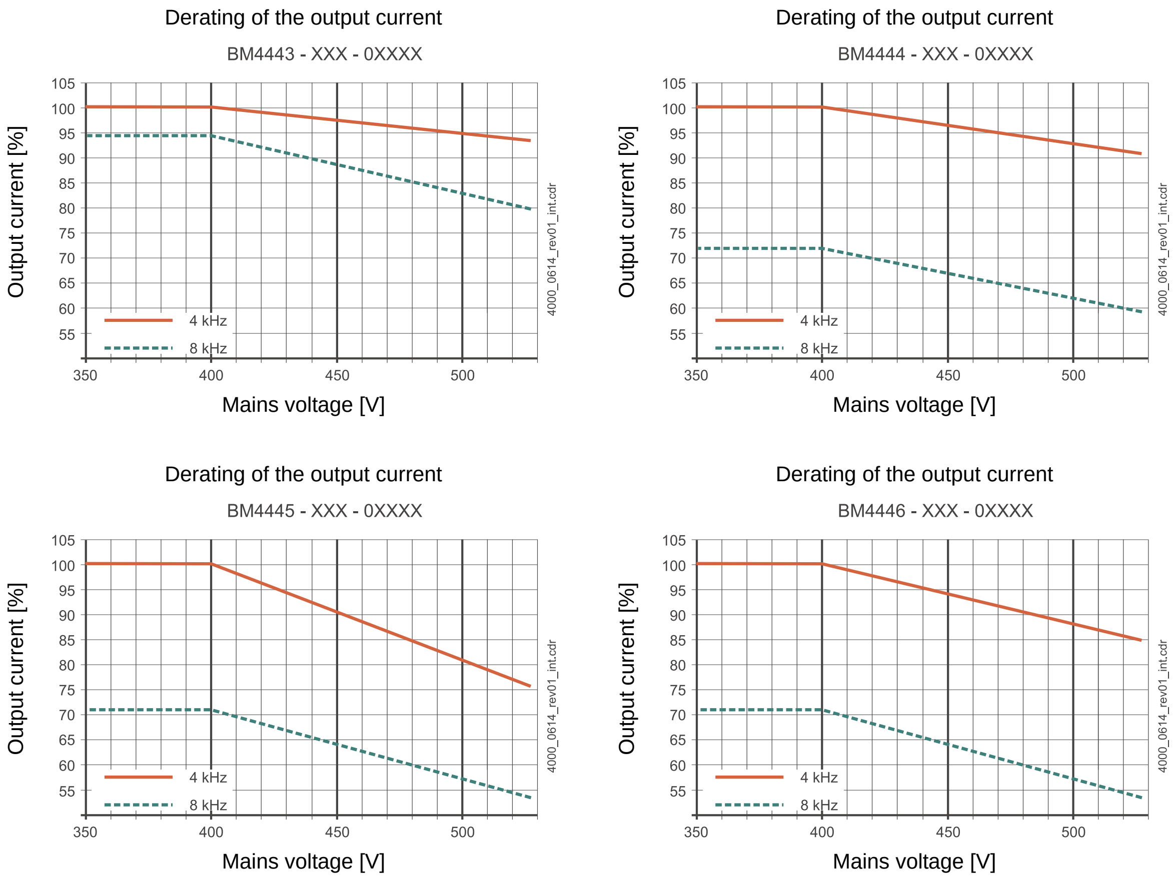
[3] The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

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

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.



Derating of the output current

BM4443 - XXX - 0XXXX

Derating of the output current

BM4444 - XXX - 0XXXX

Derating of the output current

BM4445 - XXX - 0XXXX

Derating of the output current

BM4446 - XXX - 0XXXX

Figure 78: Derating of the output current BM 444X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula:

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] The peak current can only be achieved at a heat sink temperature of <75 °C (BM4443) or <80 °C (BM4444).
If the heat sink temperature threshold is exceeded, then the output current is automatically reduced to the rated current.

[10] This is only valid for cooling versions S and A.

[11] The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

[12] Only available at devices with type code BM44XX-XXX-XX3XX-03-4-yyy, whereas yyy > 024 is **and** the controller firmware is 3.09 or newer.
The possibility to switch-off the device because of a motor short circuit without damage can be limited.

[13] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

[14] With hardware version < 4006 or in case you refer to UL508C: max. 4 A

D.13 Electrical data - BM464X basic unit

		BM4641 14)	BM4642 14)
Input rated power 1)2)		57 kVA	65 kVA
Input rated current 1)2) (I_{eff})		82 A	95 A
Distortion factor of the input current 1)2) (THD_I)		50 %	50 %
Input current, max. 2) (I_{eff})		164 A	190 A
DC-link rated voltage 1)		540 V_{DC}	540 V_{DC}
DC link capacity (internal)		3055 µF	3055 µF
DC link capacity (external), permitted		see ▷Page 111◁	
DC link discharging time (internal DC link capacity)		70 s	70 s
Delay time between two circuit closings		none	none
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency 13)		0 Hz to 450 Hz	
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	85 A	max. 100 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	64 A	max. 75 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	170 A	max. 200 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	128 A	max. 150 A
Max. peak current time 8)9)		1.25 s	
Output power DC link terminals 11)		max. 60 kW / 120kW (1 s)	
Chopper current, permissible (Î)		max. 100 A	
Chopper resistor external		≥ 8 Ω	
Chopper start-up voltage (Û)		780 V	
Chopper peak power		80 kW	
Permissible chopper continuous power		58 kW	
Power loss referring to mains voltage		1350 W	
Power loss referring to control voltage		max. 75 W	
Power loss of equipment fan according to 230 V_{AC} 10)		87 W	
Current of the brake control		max. 8,0 A 13)	
Cooling air requirement of the interior space of device		60 m^3/h	
Requirements on the water cooling		see ▷Page 187◁	

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4443 Part no. 00368380, BM4444: Part no. 00368381, BM4445: Part no. 00368381.

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

$$U_{AC} = 3 \times 0\ \text{V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right)$$

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

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

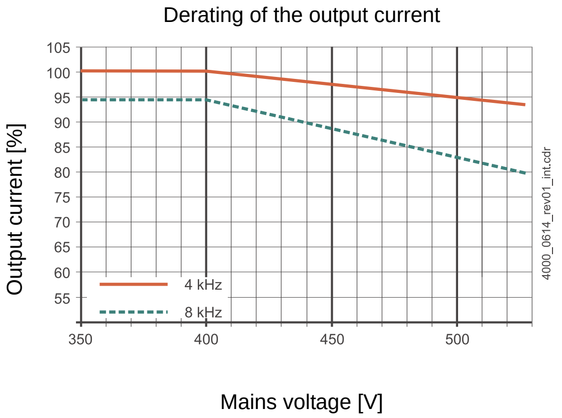


Figure 79: Derating of the output current BM 464X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula:

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] The peak current can only be achieved at a heat sink temperature of <75 °C (BM4643) or <80 °C (BM4644).
If the heat sink temperature threshold is exceeded, then the output current is automatically reduced to the rated current.

[10] This is only valid for cooling versions S and A.

[11] The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

[12] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

[13] With hardware version < 4006 or in case you refer to UL508C: max. 4 A

[14] The controller firmware has to be 3.10 or higher

D.14 Electrical data - BM445X basic unit

		BM445**2**	BM445**3**	BM445**4**
Input rated power [1][2]		75.5 kVA	94.2 kVA	138.6 kVA
Input rated current [1][2] (I_{eff})		109 A	136 A	200 A
Distortion factor of the input current [1][2] (THD_I)		42%	38%	38%
Input current, max. [2] (I_{eff})		146 A	182 A	270 A
DC-link rated voltage [1]		540 V_{DC}		
DC link capacity (internal)		3000 µF	3000 µF	6600 µF
DC link capacity (external), permitted		max. 20 mF (see ▹Page 111◃)		
DC link discharging time (internal DC link capacity)		63 s	63 s	139 s
Delay time between two circuit closings		none		
Output voltage [1] (U_{AC})		3 x 0 V to 3 x 370 V		
Output frequency [13]		0 Hz to 450 Hz		
Derating at static output frequency		see ▹Page 236◃		[12]
Output rated current [1][5][6][7] (I_{AC})	at 4 kHz [4]	max. 120 A	max. 150 A	max. 210 A
Output rated current [1][5][6][7] (I_{AC})	at 8 kHz [4]	max. 96 A	max. 116 A	max. 150 A
Output peak current [1][5][6][8] (I_{AC})	at 4 kHz [4]	max. 180 A	max. 195 A	max. 260 A
Output peak current [1][5][6][8] (I_{AC})	at 8 kHz [4]	max. 144 A	max. 150 A	max. 185 A
Max. peak current time [8]		60 s		
Output power DC link terminals		max. 110 kW		
Chopper current, permissible ($\hat{I}$)		max. 150 A		
Chopper resistor external		≥ 5.2 Ω		
Chopper start-up voltage ($\hat{U}$) [11]		780 V		
Chopper peak power		117 kW		
Permissible chopper continuous power		78 kW		
Power loss referring to mains voltage		1800 W	2250 W	3300 W
Power loss referring to control voltage		max. 75 W		
Power loss of equipment fan according to 230 V_{AC} [9]		190 W		
Current of the brake control		max. 8.0 A[10]		
Cooling air requirement of power heat sink		450 m^3/h	450 m^3/h	400 m^3/h
Cooling air requirement of the interior space of device		135 m^3/h	135 m^3/h	135 m^3/h

[1] All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

[2] In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4452: Part no. 00368381, BM4453: Part no. 00368382, BM4454: Part no. 00368384.

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

$$U_{AC} = 3 \times 0\ \text{V to}\ 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

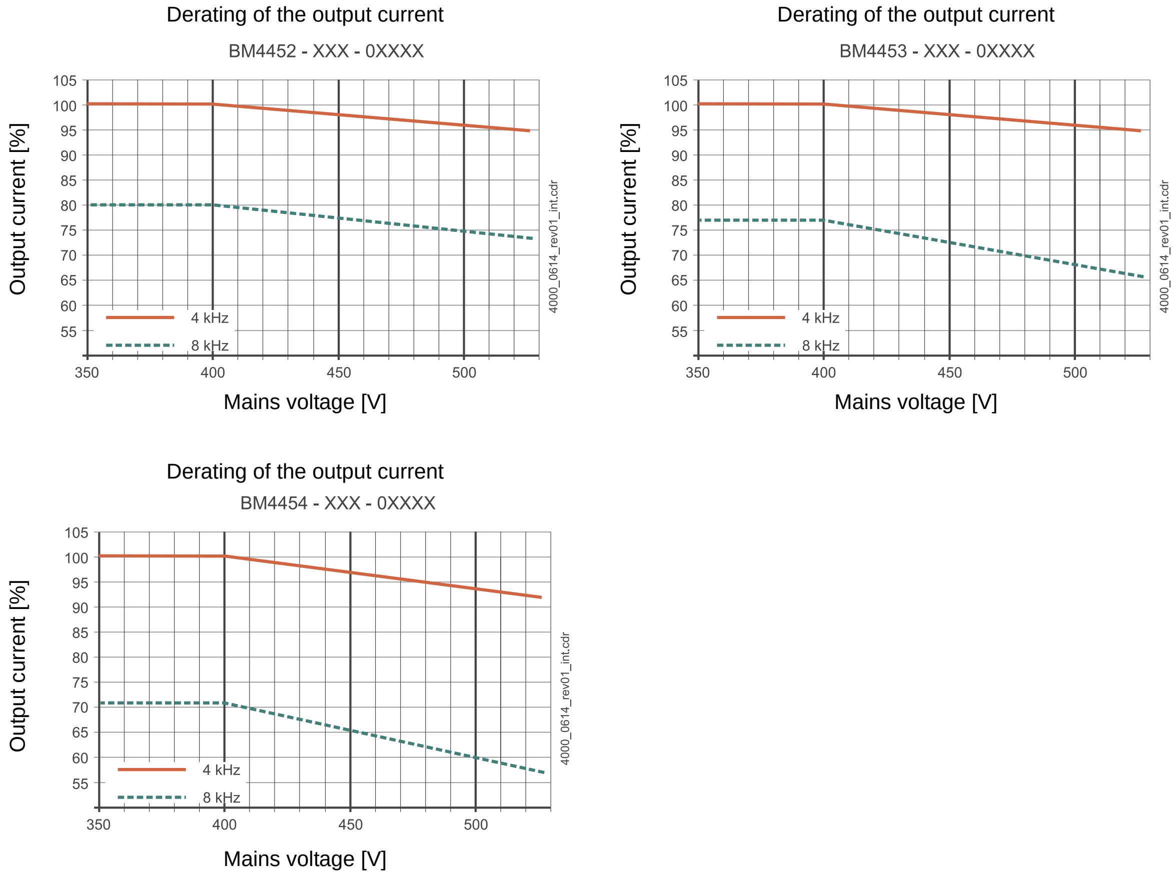


Figure 80: Derating of the output current BM 445X basic unit

7) Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula

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

8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

9) This is only valid for cooling versions S and A.

10) In case you refer to UL508C: max. 4.0 A

11) Also refer to ▷D.3 Requirements to the motor◁ on page 183.

12) An output current of max. 80 % of the output rated current is allowed at output frequencies lower than 0.5 Hz.

13) The maximum output frequency must satisfy the equation $f \leq 0,1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.15 Electrical data - BM465X basic unit

		BM465**0** 14)	BM465**1** 14)	BM465**2** 14)
Input rated power 1)2)		86 kVA	110 kVA	139 kVA
Input rated current 1)2) (I_{eff})		125 A	160 A	190 A
Distortion factor of the input current 1)2) (THD_I)		40 %	40 %	40 %
Input current, max. 2) (I_{eff})		250 A	320 A	380 A
DC-link rated voltage 1)		540 V_{DC}		
DC link capacity (internal)		6600 µF	6600 µF	6600 µF
DC link capacity (external), permitted		see ▹Page 111◃		
DC link discharging time (internal DC link capacity)		140 s	140 s	140 s
Delay time between two circuit closings		none		
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V		
Output frequency 13)		0 Hz to 450 Hz		
Derating at static output frequency		0 - 10 Hz (75% bis 100%)		
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 130 A	max. 165 A	max. 200 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 97 A	max. 123 A	max. 150 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 260 A	max. 330 A	max. 400 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 194 A	max. 264 A	max. 300 A
Max. peak current time 8)		1.25 s		
Output power DC link terminals		max. 110 kW		
Chopper current, permissible (Î)		max. 150 A		
Chopper resistor external		≥ 5.2 Ω		
Chopper start-up voltage (Û) 11)		780 V		
Chopper peak power		120 kW		
Permissible chopper continuous power		80 kW		
Power loss referring to mains voltage		2100 W	2300 W	3000 W
Power loss referring to control voltage		max. 75 W		
Power loss of equipment fan according to 230 V_{AC} 9)		190 W		
Current of the brake control		max. 8.0 A10)		
Cooling air requirement of the interior space of device		135 m^3/h		
Requirements on the water cooling		see ▹Page 187◃		

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4650: Part no. 00368383, BM4651: Part no. 00368384, BM4652: Part no. 00368385.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

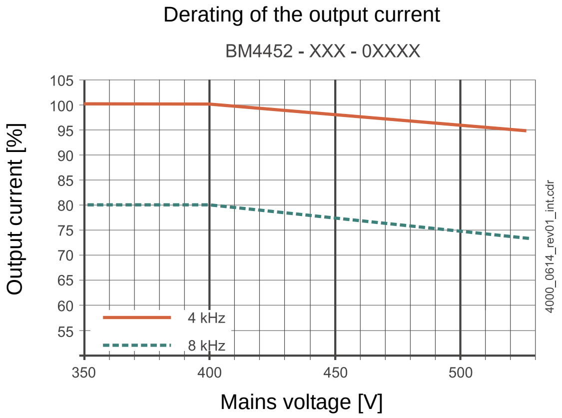


Figure 81: Derating of the output current BM 465X basic unit

7) Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_O) is calculated with the following formula

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

8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

9) This is only valid for cooling versions S and A.

10) In case you refer to UL508C: max. 4.0 A

11) Also refer to ▹D.3 Requirements to the motor◃ on page 183.

12) An output current of max. 80 % of the output rated current is allowed at output frequencies lower than 0.5 Hz.

13) The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

14) The controller firmware has to be 3.10 or higher

D.16 Electrical data - BM475X-FXX-3XXXX basic unit

		BM475**5**
Input rated power 1)2)		139 kVA
Input rated current 1)2) (I_{eff})		190 A
Distortion factor of the input current 1)2) (THD_I)		40 %
Input current, max. 2) (I_{eff})		380 A
DC-link rated voltage 1)		540 V_{DC}
DC link capacity (internal)		6600 µF
DC link capacity (external), permitted		see ▷Page 111◁
DC link discharging time (internal DC link capacity)		140 s
Delay time between two circuit closings		none
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V
Output frequency 13)		0 Hz to 450 Hz
Derating at static output frequency		▷Page 236◁
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 260 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 185 A
Output power DC link terminals		max. 110 kW
Chopper current, permissible (Î)		max. 150 A
Chopper resistor external		≥ 5.2 Ω
Chopper start-up voltage (Û) 11)		780 V
Chopper peak power		120 kW
Permissible chopper continuous power		80 kW
Power loss referring to mains voltage		3000 W
Power loss referring to control voltage		max. 75 W
Power loss of equipment fan according to 230 V_{AC} 9)		190 W
Current of the brake control		max. 8.0 A10)
Cooling air requirement of the interior space of device		135 m^3/h
Requirements on the water cooling		see ▷Page 187◁

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4755: Part no. 00368383.

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

$$U_{AC} = 3 \times 0\ \text{V to}\ 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\ \text{V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

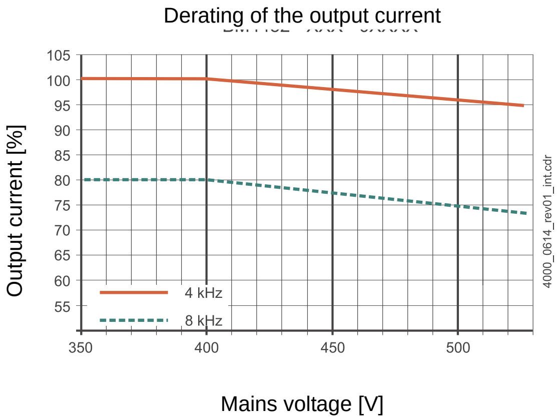


Figure 82: Derating of the output current BM 465X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] This is only valid for cooling versions S and A.

[10] In case you refer to UL508C: max. 4.0 A

[11] Also refer to ▹D.3 Requirements to the motor◃ on page 183.

[12] An output current of max. 80 % of the output rated current is allowed at output frequencies lower than 0.5 Hz.

[13] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.17 Electrical data - BM446X basic unit

		BM446**2**	BM446**3**	BM446**6** 14)
Input rated power 1)2)		164 kVA	204 kVA	238 kVA
Input rated current 1)2) (I_{eff})		237 A	295 A	344 A
Distortion factor of the input current 1)2) (THD_I)		43%	50%	50%
Input current max. 2) (I_{eff})		320 A	395 A	455 A
DC-link rated voltage 1)		540 V_{DC}		
DC link capacity (internal)		6000 µF	6000 µF	13200 µF
DC link capacity (external), permitted		see ▷Page 111◁		
DC link discharging time (internal DC link capacity)		126 s	126 s	277 s
Delay time between two circuit closings		none		
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V		
Output frequency 12)		0 Hz to 450 Hz		
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	max. 250 A	max. 300 A	max. 350 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	max. 200 A	max. 240 A	max. 240 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 325 A	max. 390 A	max. 450 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 260 A	max. 312 A	max. 312 A
Max. peak current time 8)		60 s		
Output power DC link terminals		max. 160 kW		
Chopper current, permissible $(\hat{I})$		max. 230 A		max. 236 A
Chopper resistor external		≥ 3.4 Ω		≥ 3.33 Ω
Chopper start-up voltage $(\hat{U})$ 11)		780 V		
Chopper peak power		179 kW		183 kW
Permissible chopper continuous power		130 kW		
Power loss referring to mains voltage		3960 W	4800 W	
Power loss referring to control voltage		max. 80 W		
Power loss of the equipment fan according to 230 V_{AC} 9)		174 W		
Current of the brake control		max. 8.0 A 10)		
Cooling air requirement of power heat sink		400 m^3/h		
Cooling air requirement of the interior space of device		200 m^3/h		

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4462: Part no. 00368384, BM4463: Part no. 00368385, BM4466: Part no. 00368386.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

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

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

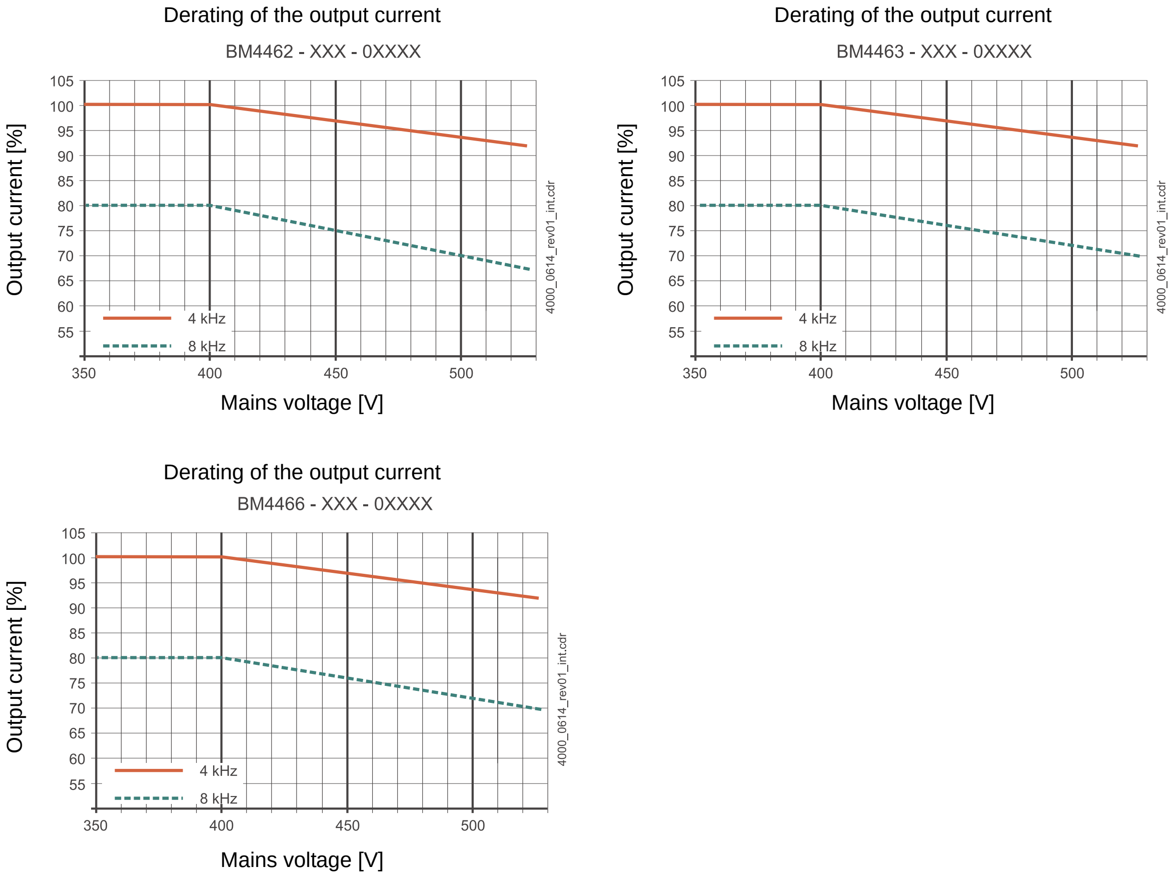


Figure 83: Derating of the output current BM 446X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] This is only valid for cooling versions S and A.

[10] In case you refer to UL508C: max. 4.0 A

[11] Also refer to ▹D.3 Requirements to the motor◃ on page 183.

[12] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

[13] When using the internal copper resistor the chopper continuous power is 5 kW.

[14] The possibility to shut down a motor short circuit without damaging the device may be limited.

D.18 Electrical data - BM466X basic unit

		BM4661[13]	BM4662[13]
Input rated power [1][2]		170 kVA	200 kVA
Input rated current [1][2] (I_{eff})		240 A	285 A
Distortion factor of the input current [1][2] (THD_I)		50%	50%
Input current max. [2] (I_{eff})		480 A	570 A
DC-link rated voltage [1]		540 V_{DC}	
DC link capacity (internal)		6000 µF	6000 µF
DC link capacity (external), permitted		see ▷Page 111◁	
DC link discharging time (internal DC link capacity)		126 s	
Delay time between two circuit closings		none	
Output voltage [1] (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency [12]		0 Hz to 450 Hz	
Output rated current [1][5][6][7] (I_{AC})	at 4 kHz [4]	250 A	300 A
Output rated current [1][5][6][7] (I_{AC})	at 8 kHz [4]	187 A	225 A
Output peak current [1][5][6][8] (I_{AC})	at 4 kHz [4]	500 A	600 A
Output peak current [1][5][6][8] (I_{AC})	at 8 kHz [4]	374 A	450 A
Max. peak current time [8]		1.25 s	
Output power DC link terminals		max. 160 kW	
Chopper current, permissible ($\hat{I}$)		max. 230 A	
Chopper resistor external		≥ 3.4 Ω	
Chopper start-up voltage ($\hat{U}$)[11]		780 V	
Chopper peak power		179 kW	
Permissible chopper continuous power		130 kW	
Power loss referring to mains voltage		3500 W	4200 W
Power loss referring to control voltage		max. 80 W	
Power loss of the equipment fan according to 230 V_{AC} [9]		174 W	
Current of the brake control		max. 8.0 A[10]	
Cooling air requirement of power heat sink		400 m^3/h	
Cooling air requirement of the interior space of device		200 m^3/h	

[1] All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

[2] In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4661: Part no. 00368384, BM4662: Part no. 00368385.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V} \right)$$

4) Switching frequency of the inverter (adjustable).

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

6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

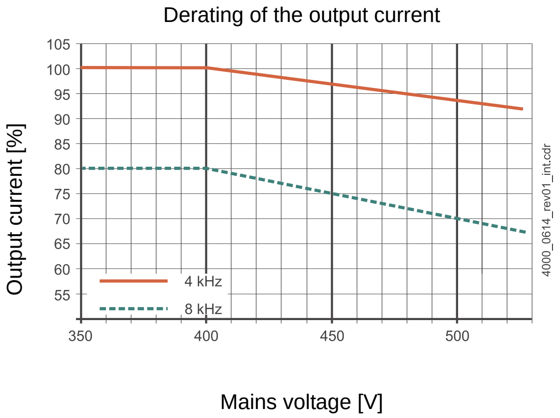


Figure 84: Derating of the output current BM 466X basic unit

7) Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula

$$I_0 = I_{0(40°C)} \cdot \left(1 - \left(\frac{(\text{Coolant temperature}) - 40°C}{°C} \cdot 0,03\right)\right)$$

8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

9) This is only valid for cooling versions S and A.

10) In case you refer to UL508C: max. 4.0 A

11) Also refer to ▹D.3 Requirements to the motor◃ on page 183.

12) The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

13) The controller firmware has to be 3.10 or higher.
The possibility to shut down a motor short circuit without damaging the device may be limited.

D.19 Electrical data - BM476X-FXX-3XXXX basic unit

		BM476**6**13)
Input rated power 1)2)		238 kVA
Input rated current 1)2) (I_{eff})		344 A
Distortion factor of the input current 1)2) (THD_I)		50%
Input current max. 2) (I_{eff})		455 A
DC-link rated voltage 1)		540 V_{DC}
DC link capacity (internal)		13200 µF
DC link capacity (external), permitted		see ▷Page 111◁
DC link discharging time (internal DC link capacity)		277 s
Delay time between two circuit closings		none
Output voltage 1) (U_{AC})		3 x 0 V to 3 x 370 V
Output frequency 12)		0 Hz to 450 Hz
Output rated current 1)5)6)7) (I_{AC})	at 4 kHz 4)	450 A
Output rated current 1)5)6)7) (I_{AC})	at 8 kHz 4)	305 A
Output power DC link terminals		max. 160 kW
Chopper current, permissible (Î)		max. 236 A
Chopper resistor external		≥ 3.33 Ω
Chopper start-up voltage (Û)11)		780 V
Chopper peak power		183 kW
Permissible chopper continuous power		130 kW
Power loss referring to mains voltage		4800 W
Power loss referring to control voltage		max. 80 W
Power loss of the equipment fan according to 230 V_{AC} 9)		174 W
Current of the brake control		max. 8.0 A10)
Cooling air requirement of power heat sink		400 m^3/h
Cooling air requirement of the interior space of device		200 m^3/h

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4766: Part no. 00368385.

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

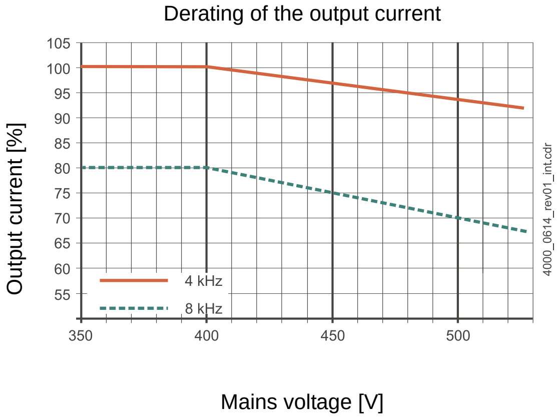


Figure 85: Derating of the output current BM 476X basic unit

[7] Between 40° C and 55° C the output current must be reduced.
The acceptable output current (I_0) is calculated with the following formula

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

[8] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[9] This is only valid for cooling versions S and A.

[10] In case you refer to UL508C: max. 4.0 A

[11] Also refer to ▹D.3 Requirements to the motor◃ on page 183.

[12] The maximum output frequency must satisfy the equation $f \le 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

[13] The possibility to shut down a motor short circuit without damaging the device may be limited.

D.20 Electrical data - BM447X basic unit

		BM447**2 - A/F**	BM447**3 - A/F**
Input rated power $^{1)2)}$		328 kVA	412 kVA
Input rated current $^{1)2)}$ (I_{eff})		474 A	594 A
Distortion factor of the input current $^{1)2)}$ (THD_I)		54%	54%
Input current max. $^{2)}$ (I_{eff})		602 A	760 A
DC-link rated voltage $^{1)}$		540 V_{DC}	
DC link capacity (internal)		19.8 mF	19.8 mF
DC link capacity (external), permitted		0 mF	0 mF
DC link discharging time (internal DC link capacity)		150 s	150 s
Delay time between two circuit closings		none	
Output voltage $^{1)3)}$ (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency $^{14)}$		0 Hz to 450 Hz	
Output rated current $^{1)5)6)7)13)}$ (I_{AC})	at 4 kHz $^{4)}$	max. 450 A	max. 615 A
Output rated current $^{1)5)6)7)13)}$ (I_{AC})	at 8 kHz $^{4)}$	max. 338 A	max. 450 A
Output peak current $^{1)5)6)8)}$ (I_{AC})	at 4 kHz $^{4)}$	max. 585 A	max. 780 A
Output peak current $^{1)5)6)8)}$ (I_{AC})	at 8 kHz $^{4)}$	max. 439 A	max. 585 A
Max. peak current time $^{9)}$		60 s	
Output power DC link terminals		max. 250 kW	max. 315 kW
Chopper current, permissible (Î)		max. 300 A	
Chopper resistor external		≥ 2.6 Ω	
Chopper start-up voltage (Û) $^{12)}$		780 V	
Chopper peak power		234 kW	
Permissible chopper continuous power		180 kW	
Power loss referring to mains voltage		4700 W	6450 W
Power loss referring to control voltage		max. 170 W	
Power loss of the device fans according to 400 V_{AC}		max. 540 W	
Current of the brake control		max. 8.0 A$^{11)}$	

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4472: Part no. 368388, BM4473: Part no. 368390.

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

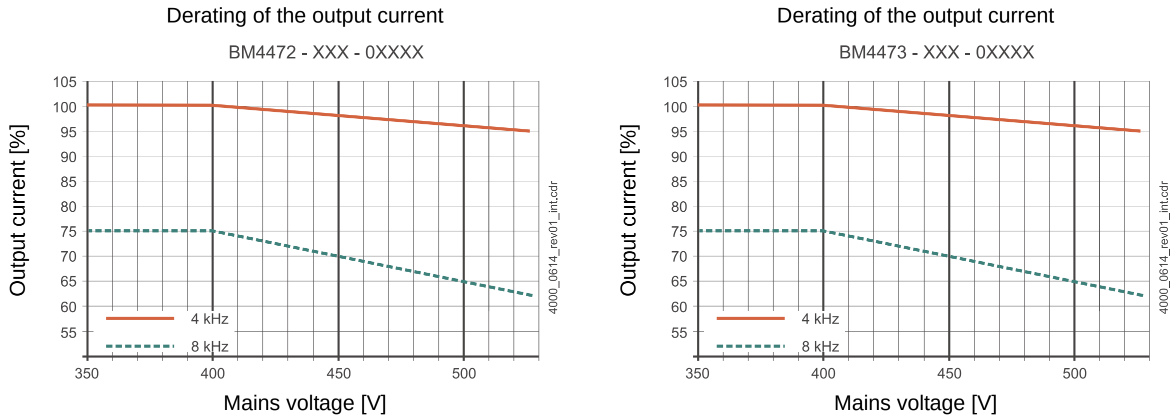


Figure 86: Derating of the output current BM 447X basic unit

7) The output current must be reduced between 40° C and 55° C.
The allowable output current (I_O) is calculated with the following formula:

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

8) Possibly there are two temperature values (cooling air, which flows through the inner space of the device/cooling air which flows through the heat sink).
Here use the higher value.
Example: output rated current) = 150 A, environmental temperature = 46° C

$$I_O = 150A \cdot \left(1 - \left(\frac{46°C - 40°C}{°C} \cdot 0,03\right)\right) = 150A \cdot 0,03$$

Therewith the output current must be reduced: 123 A

9) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

10) The sum of the immediately via the DC link terminals taken power and at the same time the power, which is picked up from the motor (motor power/motor efficiency) may not exceed the maximum output power of 250 kW or 315 kW.

11) In case you refer to UL508C: max. 4.0 A

12) Also refer to ▷D.3 Requirements to the motor◁ on page 183.

13) In case you refer to UL508C:
The maximum permitted typical motor power is limited to 295 kW.
Therefore the device BM4473 belongs to the category < 400 HP, < 298 kW ratings according table 45.1 of UL508C and the short circuit test can be done with 18 kA. Baumüller offers no devices for the class up to 600 HP, 447 kW with 30 kA short circuit current according UL508C.

14) The maximum output frequency must satisfy the equation $f \leq 0,1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.21 Electrical data - BM477X basic unit

		BM4773 **- FXX - 3XXXX**
Input rated power 1)2)		475 kVA
Input rated current 1)2) (I_{eff})		685 A
Distortion factor of the input current 1)2) (THD_I)		54%
Input current max. 2) (I_{eff})		772 A
DC-link rated voltage 1)		540 V_{DC}
DC link capacity (internal)		19.8 mF
DC link capacity (external), permitted		0 mF
DC link discharging time (internal DC link capacity)		150 s
Delay time between two circuit closings		none
Output voltage 1)3) (U_{AC})		3 x 0 V to 3 x 370 V
Output frequency 14)		0 Hz to 450 Hz
Output rated current 1)5)6)7)13) (I_{AC})	at 4 kHz 4)	max. 720 A
Output rated current 1)5)6)7)13) (I_{AC})	at 8 kHz 4)	max. 495 A
Output peak current 1)5)6)8) (I_{AC})	at 4 kHz 4)	max. 780 A
Output peak current 1)5)6)8) (I_{AC})	at 8 kHz 4)	max. 495 A
Max. peak current time 9)		60 s
Output power DC link terminals		max. 360 kW
Chopper current, permissible (Î)		max. 300 A
Chopper resistor external		≥ 2.6 Ω
Chopper start-up voltage (Û) 12)		780 V
Chopper peak power		234 kW
Permissible chopper continuous power		180 kW
Power loss referring to mains voltage		7800 W
Power loss referring to control voltage		max. 170 W
Current of the brake control		max. 8.0 A 11)

1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.

2) In case you use the following commutation chokes at a mains with $u_{K,mains}$=0.4%:
BM4773: Part no. 368390.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

4) Switching frequency of the inverter (adjustable).

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

[6] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

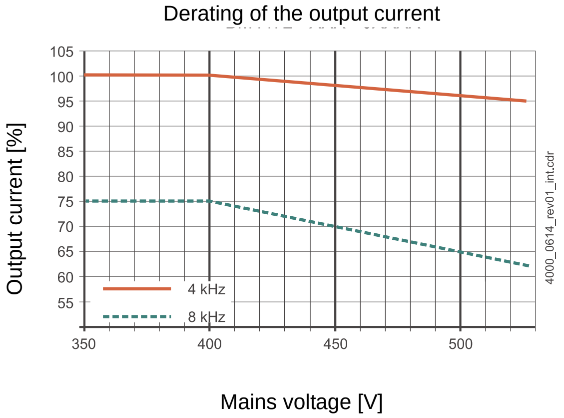


Figure 87: Derating of the output current BM 477X basic unit

[7] The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

[8] Possibly there are two temperature values (cooling air, which flows through the inner space of the device/cooling air which flows through the heat sink).
Here use the higher value.
Example: output rated current) = 150 A, environmental temperature = 46° C

$$I_o = 150A \cdot \left(1 - \left(\frac{46°C \text{ - } 40°C}{°C} \cdot 0,03\right)\right) = 150A \cdot 0,03$$

Therewith the output current must be reduced: 123 A

[9] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[10] The sum of the immediately via the DC link terminals taken power and at the same time the power, which is picked up from the motor (motor power/motor efficiency) may not exceed the maximum output power of 250 kW or 315 kW.

[11] In case you refer to UL508C: max. 4.0 A

[12] Also refer to ▹D.3 Requirements to the motor◃ on page 183.

[13] In case you refer to UL508C:
The maximum permitted typical motor power is limited to 295 kW.
Therefore the device BM4473 belongs to the category < 400 HP, < 298 kW ratings according table 45.1 of UL508C and the short circuit test can be done with 18 kA. Baumüller offers no devices for the class up to 600 HP, 447 kW with 30 kA short circuit current according UL508C.

[14] The maximum output frequency must satisfy the equation $f \leq 0,1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.22 Electrical data - BM442X power module

		BM442**2**- XXX - **2**XXXX	BM442**3** - XXX - **2**XXXX	BM442**4** - XXX - **2**XXXX	BM442**5** - XXX - **2**XXXX
Input rated power [1]		4,3 kW	6,2 kW	8,2 kW	8,2 kW
Input rated current [1](I_{eff})		7,8 A	11,5 A	15,2 A	15,2 A
Input current, max. (I_{eff})		15,5 A	23,0 A	30,4 A	40,6 A
DC link rated voltage [1] (U_{DC})		540 V_{DC}			
DC link capacity (internal)		470 µF		705 µF	
DC link discharging time (internal DC link capacity)		260 s		390 s	
Output voltage [1][2] (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency [8]		0 Hz to 450 Hz			
Derating at static output frequency		no derating			
Output rated current [1][4][5][6] (I_{AC})	at 4 kHz [3]	max. 7,5 A	max. 11,0 A	max. 15,0 A	max. 15,0 A
Output rated current [1][4][5][6] (I_{AC})	at 8 kHz [3]	max. 6,0 A	max. 8,8 A	max. 12,0 A	max. 12,0 A
Output peak current [1][4][5][7] (I_{AC})	at 4 kHz [3]	max. 15,0 A	max. 22,0 A	max. 30,0 A	max. 40,0 A
Output peak current [1][4][5][7] (I_{AC})	at 8 kHz [3]	max. 12,0 A	max. 17,6 A	max. 24,0 A	max. 32,0 A
Max. peak current time [7]		60 s			1 s
Power loss referring to mains voltage		102 W	150 W	204 W	
Power loss referring to control voltage		max. 63 W			
Current of the brake control		max. 0,5 A			

[1] All rated values refer to a DC link voltage of 540 V_{DC} and a control voltage of 24 V.

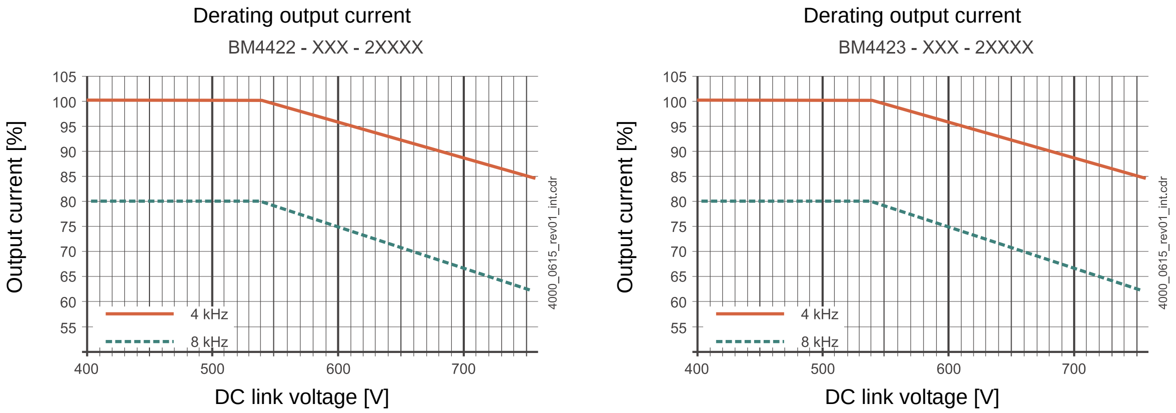
[2] The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

[3] Switching frequency of the inverter (adjustable)

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

[5] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.



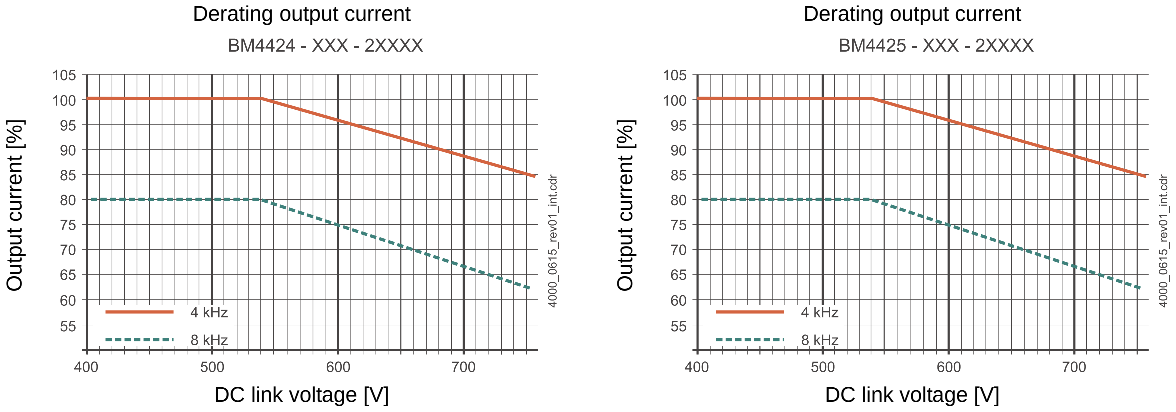


Figure 88: Derating output current BM 442X power modules

[6] The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

[7] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[8] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.23 Electrical data - BM443X power module

		BM443**2**- XXX - **2**XXXX	BM443**3** - XXX - **2**XXXX	BM443**4** - XXX - **2**XXXX	BM443**5** - XXX - **2**XXXX
Input rated power [1]		12,0 kW	15,3 kW	23,3 kW	32,3 kW
Input rated current [1](I_{eff})		22,3 A	28,4 A	43,2 A	59,8 A
Input current, max. (I_{eff})		44,7 A	56,8 A	86,4 A	89,7 A
DC link rated voltage [1] (U_{DC})		540 V_{DC}			
DC link capacity (internal)		820 µF	1230 µF	1640 µF	2000 µF
DC link discharging time (internal DC link capacity)		138 s	207 s	276 s	336 s
Output voltage [1][2] (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency [8]		0 Hz to 450 to			
Output rated current [1][4][5][6] (I_{AC})	at 4 kHz [3]	max. 22,5 A	max. 30,0 A	max. 45,0 A	max. 60,0 A
Output rated current [1][4][5][6] (I_{AC})	at 8 kHz [3]	max. 18,0 A	max. 24,0 A	max. 36,0 A	max. 48,0 A
Output peak current [1][4][5][7] (I_{AC})	at 4 kHz [3]	max. 45,0 A	max. 60,0 A	max. 90,0 A	max. 90,0 A
Output peak current [1][4][5][7] (I_{AC})	at 8 kHz [3]	max. 36,0 A	max. 48,0 A	max. 72,0 A	max. 72,0 A
Max. peak current time [7]		60 s			
Power loss referring to mains voltage		300 W	390 W	600 W	840 W
Power loss referring to control voltage		max. 88 W			
Current of the brake control		max. 1,0 A			

[1] All rated values refer to a DC link voltage of 540 V_{DC} and a control voltage of 24 V.

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

$$U_{AC} = 3 \times 0\text{ V to }3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10\text{ V}\right)$$

[3] Switching frequency of the inverter (adjustable)

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

[5] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

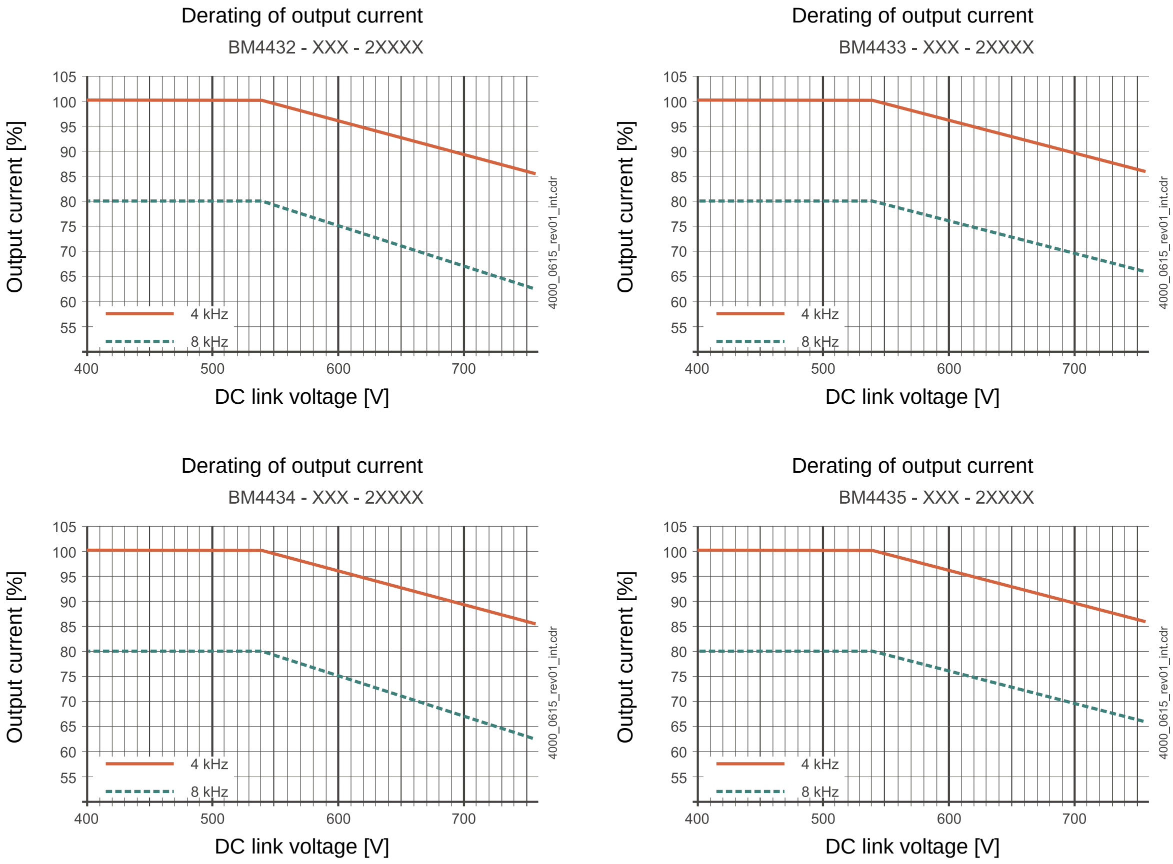

Derating of output current
BM4432 - XXX - 2XXXX
Derating of output current
BM4433 - XXX - 2XXXX
Derating of output current
BM4434 - XXX - 2XXXX
Derating of output current
BM4435 - XXX - 2XXXX

Figure 89: Derating of output current BM 443X power modules

[6] The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

[7] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[8] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.24 Electrical data - BM444X power module

		BM444**3**- XXX - **2**XXXX	BM444**4**- XXX - **2**XXXX	BM444**5** - XXX - **2**XXXX	BM444**6** - XXX - **2**XXXX $^{9)}$
Input rated power $^{1)}$		41 kW	50 kW	64 kW	84 kW
Input rated current $^{1)}$(I_{eff})		76 A	93 A	119 A	155 A
Input current, max. (I_{eff})		113 A	120 A	155 A	207 A
DC link rated voltage $^{1)}$ (U_{DC})		540 V_{DC}			
DC link capacity (internal)		1880 µF	2350 µF	3055 µF	3760 µF
DC link discharging time (internal DC link capacity)		43 s	54 s	70 s	86 s
Output voltage $^{1)2)}$ (U_{AC})		3 x 0 V to 3 x 370 V			
Output frequency $^{10)}$		0 Hz to 450 Hz			
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 80 A	max. 100 A	max. 130 A	max. 150 A
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 75 A	max. 72 A	max. 94 A	max. 105 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 120 A	max. 130 A	max. 170 A	max. 200 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 90 A	max. 94 A	max. 130 A	max. 150 A
Max. peak current time $^{7)}$		60 s			
Power loss referring to mains voltage		800 W	1000 W	1300 W	1400 W
Power loss referring to control voltage		max. 75 W			
Power loss of equipment fan according to 230 V_{AC} $^{8)}$		87 W			
Current of the brake control		max. 8,0 A $^{11)}$			
Cooling air requirement of power heat sink		260 m³/h		210 m³/h	
Cooling air requirement of the interior space of device		60 m³/h			

[1] All rated values refer to a DC link voltage of 540 V_{DC} and a control voltage of 24 V.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

[3] Switching frequency of the inverter (adjustable)

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

5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

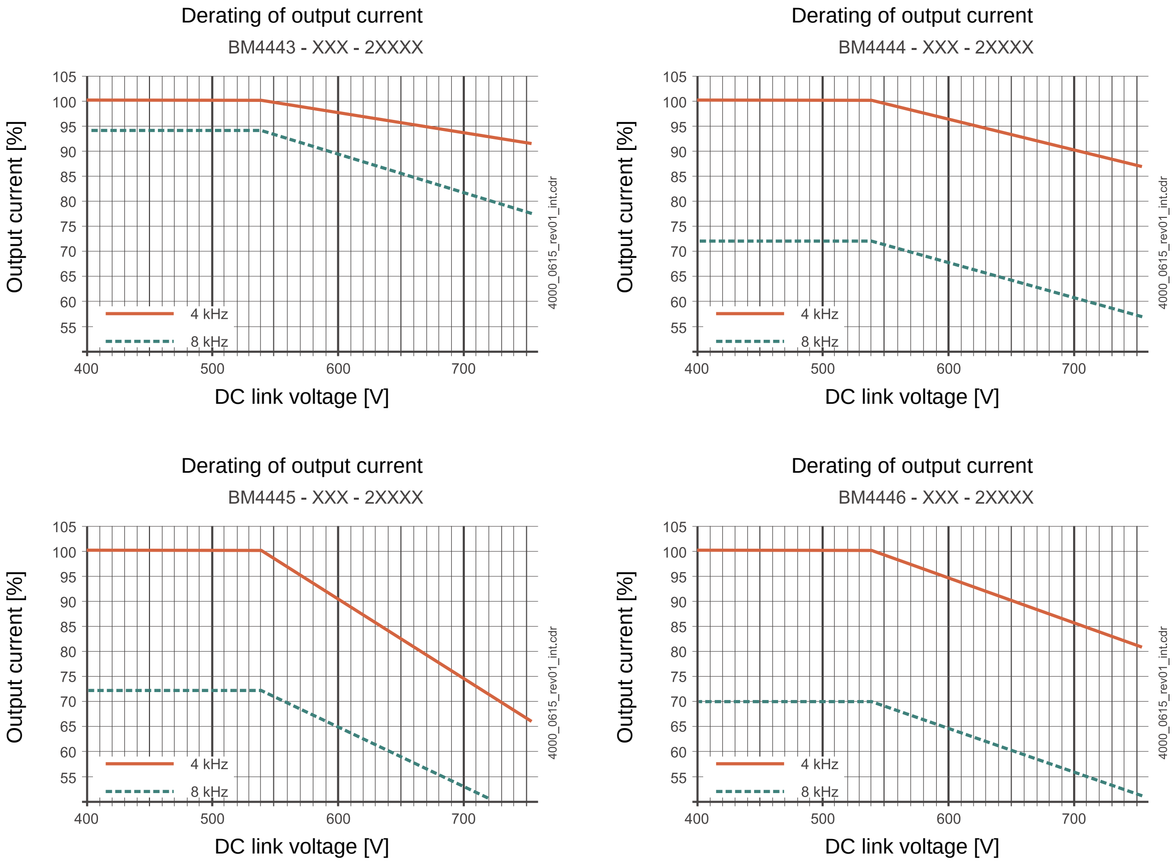


Figure 90: Derating of output current BM 444X power modules

6) The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

8) This is only valid for cooling versions S and A.

9) **Preliminary information**: Only available at devices with controller type code BM44XX-XXX-XX3XX-03-4-yyy, whereas yyy > 024 is **and** the controller firmware is 3.09 or newer.

10) The maximum output frequency must satisfy the equation $f \le 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

11) With hardware version < 4006 or in case you refer to UL508C: max. 4 A

D.25 Electrical data - BM445X power module

		BM445**3**- XXX - **2**XXXX
Input rated power $^{1)}$		85 kW
Input rated current $^{1)}$(I_{eff})		158 A
Input current, max. (I_{eff})		206 A
DC link rated voltage $^{1)}$ (U_{DC})		540 V_{DC}
DC link capacity (internal)		3000 µF
DC link discharging time (internal DC link capacity)		75 s
Output voltage $^{1)2)}$ (U_{AC})		3 x 0 V to 3 x 370 V
Output frequency $^{9)}$		0 Hz to 450 Hz
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 150 A
Output rated current $^{1)4)5)6)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 116 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 4 kHz $^{3)}$	max. 195 A
Output peak current $^{1)4)5)7)}$ (I_{AC})	at 8 kHz $^{3)}$	max. 150 A
Max. peak current time $^{7)}$		60 s
Power loss referring to mains voltage		800 W
Power loss referring to control voltage		max. 75 W
Power loss of equipment fan according to 230 V_{AC} $^{8)}$		190 W
Current of the brake control		max. 8,0 A $^{9)}$
Cooling air requirement of power heat sink		450 m³/h
Cooling air requirement of the interior space of device		135 m³/h

---

1) All rated values refer to a DC link voltage of 540 V_{DC} and a control voltage of 24 V.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

3) Switching frequency of the inverter (adjustable)

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

[5] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

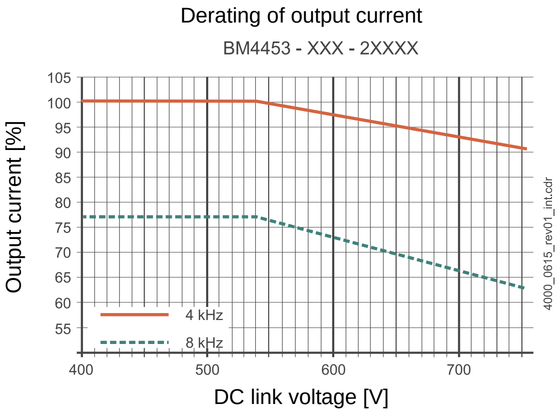


Figure 91: Derating of output current BM 445X power modules

[6] The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

[7] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[8] This is only valid for cooling versions S and A.

[9] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.26 Electrical data - BM446X power module

		BM446**2**- XXX - **2**XXXX	BM446**3**- XXX - **2**XXXX
Input rated power 1)		150 kW	180 kW
Input rated current 1) (I_{eff})		278 A	335 A
Input current, max. (I_{eff})		392 A	436 A
DC link rated voltage 1) (U_{DC})		540 V_{DC}	
DC link capacity (internal)		6000 µF	
DC link discharging time (internal DC link capacity)		150 s	
Output voltage 1)2) (U_{AC})		3 x 0 V to 3 x 370 V	
Output frequency 10)		0 Hz to 450 Hz	
Output rated current 1)4)5)6) (I_{AC})	at 4 kHz 3)	max. 250 A	max. 300 A
Output rated current 1)4)5)6) (I_{AC})	at 8 kHz 3)	max. 200 A	max. 240 A
Output peak current 1)4)5)7) (I_{AC})	at 4 kHz 3)	max. 325 A	max. 390 A
Output peak current 1)4)5)7) (I_{AC})	at 8 kHz 3)	max. 260 A	max. 312 A
Max. peak current time 7)		60 s	
Power loss referring to mains voltage		3960 W	4800 W
Power loss referring to control voltage		max. 80 W	
Power loss of equipment fan according to 230 V_{AC} 8)		174 W	
Current of the brake control		max. 8,0 A 9)	
Cooling air requirement of power heat sink		400 m³/h	
Cooling air requirement of the interior space of device		200 m³/h	

---

1) All rated values refer to a DC link voltage of 540 V_{DC} and a control voltage of 24 V.

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

$$U_{AC} = 3 \times 0 \text{ V to } 3 \times \left(\frac{U_{DC}}{\sqrt{2}} - 10 \text{ V}\right)$$

3) Switching frequency of the inverter (adjustable)

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

[5] At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

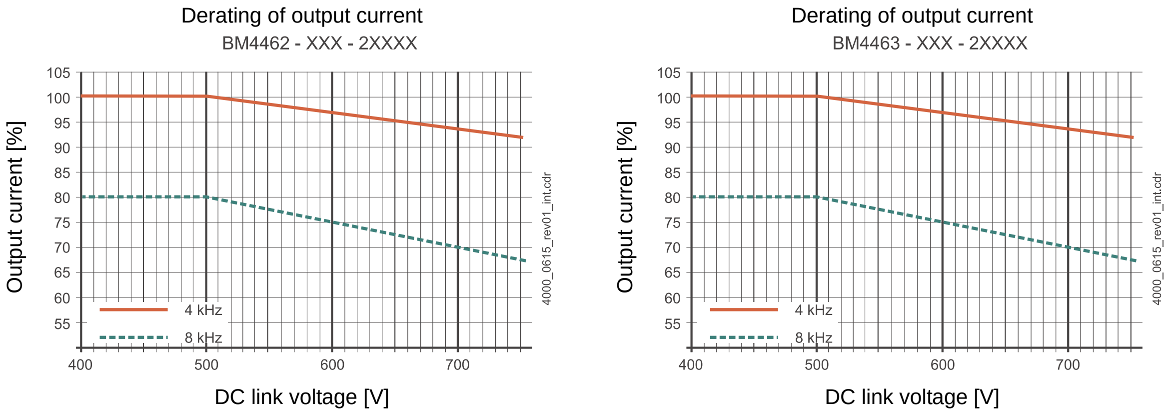


Figure 92: Derating of output current BM 446X power modules

[6] The output current must be reduced between 40° C and 55° C.
The allowable output current (I_0) is calculated with the following formula:

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

[7] This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

[8] This is only valid for cooling versions S and A.

[9] In case you refer to UL508C: max. 4.0 A

[10] The maximum output frequency must satisfy the equation $f \leq 0{,}1 \cdot f_{PWM}$, that means an output frequency of 200 Hz is possible at 2 kHz PWM frequency, whereas an output frequency of 800 Hz is possible at 8 kHz.

D.27 Additional data BM44XX with water-cooled chopper resistors

Technical data of water-cooled chopper resistors:

Type of device	Chopper resistor	Chopper resistor current	Peak power	Continuous output [2]	Depth of device[1]
BM4434-ZIX/FIX-XXXXXR16 BM4435-ZIX/FIX-XXXXXR16 BM4635-ZIX/FIX-XXXXXR16	16 Ω	49 A	38 kW	2 kW	+ 20 mm
BM4444-ZIX/FIX-XXXXXR10 BM4445-ZIX/FIX-XXXXXR10 BM4446-ZIX/FIX-XXXXXR10 BM4644-ZIX/FIX-XXXXXR10 BM4645-ZIX/FIX-XXXXXR10 BM4646-ZIX/FIX-XXXXXR10	10 Ω	78 A	61 kW	1.5 kW	+ 35 mm
BM445X-ZIX/FIX-XXXXXR05 BM465X-ZIX/FIX-XXXXXR05 BM465X-ZIX/FIX-3XXXXR05 BM475X-FIX-3XXXXR05	5 Ω	156 A	122 kW	3 kW	+ 35 mm
BM446X-ZIX/FIX-XXXXXR03 BM466X-ZIX/FIX-XXXXXR03 BM466X-ZIX/FIX-3XXXXR03 BM476X-FIX-3XXXXR03	3.33 Ω	234 A	183 kW	5 kW	+ 35 mm
BM447X-FIX-XXXXXR03 BM477X-FIX-3XXXXR03	3.33 Ω	234 A	183 kW	3.5 kW	+ 35 mm

[1] The total depth of the device in cooling version F increases by the specified value (also see ▹Installation space◃ from page 41).The device measurings of cooling version Z do not change.

[2] The mentioned continuous output are only then achieved, if the water flow rate is at least 10 l/min. and if the inlet temperature does not exceed 45°C.
At flow temperatures >45°C to <60°C the chopper resistor dissipation decreases from the nominal value to zero.

NOTE

Although the water-cooled chopper resistors provide an optimum according to the amount of heat to be dissipated at a minimum volume, about 10 % of the chopper resistor power is not dissipated via the cooling water but is given off to the ambient air.
At operation with nominal power, therewith the chopper resistors reach temperatures of max. 200°C on the reverse side.

For the devices of cooling version F/W (through-hole devices) this means:
Make sure, that there is a sufficient protection against contact, e. g. by the mounting of lattice around the heat sink and the resistors. Assure, that the air can circulate and that no heat accumulation can occur under the protective cover.

For the devices of cooling version Z (mounting in control cabinet) this means:
Mount the devices in the control cabinet, so that there is no heat accumulation above the devices. Air circulation must be possible. Take into consideration, that, although there is air circulation, that there can be an increase of temperature above the devices. Do not lay cables or cable channels in the area above the devices. The connecting cables at the devices BM443X and BM444X must be installed in such a way, that they do not run directly above the devices, and therewith in the area of the hot ascending air at the mounting board.

At dimensioning of control cabinet cooling, take into consideration, that 10% of the chopper resistor power is not dissipated via the cooling water, but heats up the cabinet as an additional power loss. Make sure that there is a sufficient ventilation in the device.

D.28 Output-frequency-dependent current-derating

All Baumüller devices were developed in such a way, that the specified output-measuring currents are continuously, i. e. in the S1 operation, that they are permissible from an electric output frequency of more than 15 Hz. If the static converter output frequency is less than 15 Hz and if the frequency lasts longer than 5 seconds between 0 and 15 Hz, the continuously permissible output current must be reduced according to the following characteristic curve.

For example the following are concerned (but not exclusively):

- Applications with speed control without positioning or
- Applications, where, at standstill, you must apply current in order to hold the torque/to hold the power or
- Applications, where a mechanic blocking can occur, e. g. when starting cold extruders.

Consequential the following applications are not concerned:

- Typical positioning applications
- Applications with motors, which have an operational brake at standstill.
- Applications, where the higher-level control contains a standstill- and a block monitoring.

Provided that the derating area is quickly passed through, the application of I_{rated} is permitted.Hereby, to pass through quickly means, that the frequency change is ≥15 Hz/s.

Derating of the motor-sided inverter output current I against the dimensioning output current I_{rated} in dependence of the static inverter output frequency f.

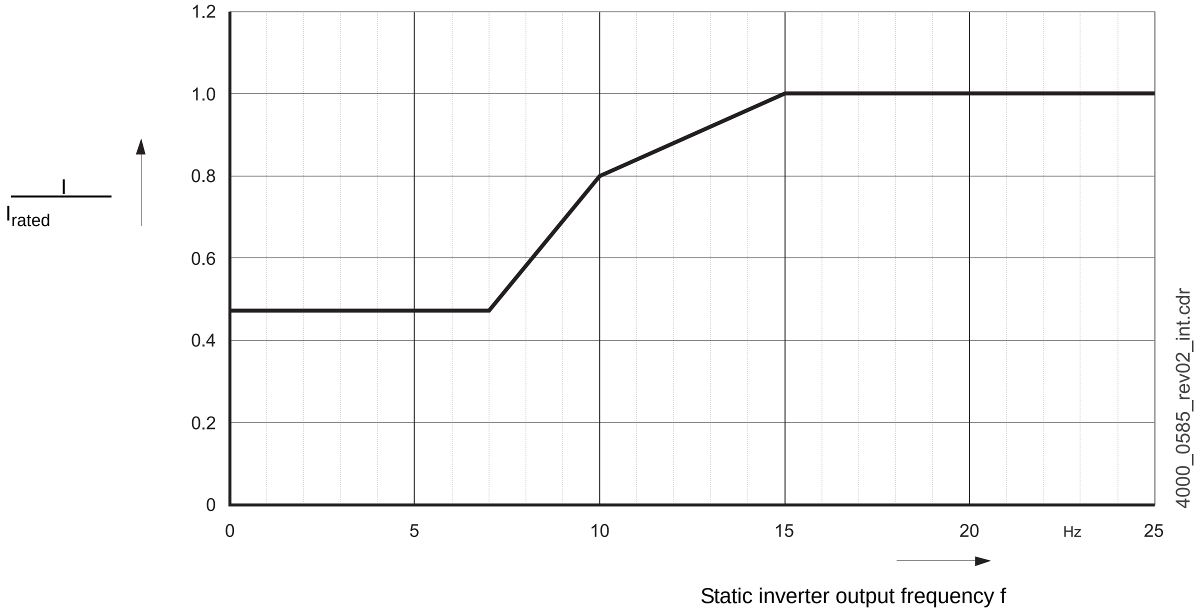


Figure 93: Derating at static inverter frequency < 15 Hz

If there is another derating at a certain device, this can be taken from the section „Electrical data“. Otherwise the derating is valid, which is specified here.

D.29 Fuse protection

We differ between the protection of the supply cables and the protection of the device. In order to fulfill the CE specifications - here especially EN60204-1 - you have to protect the supply cables.

Protect the device in UL-certified installations with suitable semiconductor- or total range fuses.

NOTE

In UL-certificated installations you must place the UL-listed fuses or „Circuit breaker“.

Cable protection Place in safety fuses of the operation class gL DIN VDE 0636-201 / IEC 60269-2-1 / HD 630.2.1 54 or cable protection switches with the triggering characteristic K referring to DIN VDE 0636-201 / IEC 60204-1 60269-2-1 / HD 630.2.1 54, to protect the cables. These fuses protect against overloading and from consequential damages from faults e. g. by fire. You cannot prevent, that the device is extensively destroyed, if a short circuit or an ground fault occurs in the DC link.

Execute the protection according to EN 60204-1 (’Electrical equipment of machines’). Dimension the cable protection fuses, dependent on the used cross section according to the, at the time, valid, national standards and local regulations.

Device protection Place in semiconductor fuses with the triggering characteristic aR DIN VDE 0636-201 / IEC 60269-2-1 HD 630.2.1 54. Switch these in series to the cable protection fuses. These protect the input-sided rectifier-triggering, in case of a short circuit, against completely destruction, so that a repair of the device is possible.

Dimension the suitable device protection fuses, dependent on the peak current and the under ▹Device protection◃ on page 239 required limit load integral i^2t_{OFF}.

Cable protection + device protection You have two possibilities to protect the cable and the device:

- connect fuses and semiconductors in series
- use whole range fuses with trigger characteristic gR (DIN VDE 0636-201/IEC 60269-2-1/HD 630.2.154)

Dimension the suitable cable and device protection fuses dependent on the used cross section of the used mains line, from the peak current and the under ▹Device protection◃ on page 239 demanded limit load integral i^2t_{OFF}.

Deviant to the fuses these devices and supply systems also may also assure be UL-listed „Circuit breaker“ (DIVQ).

Permitted are only „Circuit breaker“ without tripping delay. Circuit breakers with a thermal tripping characteristic are not checked and therewith not approved.In case of an error it must be considered, that the device is not protected against destruction, but only is protected against fire danger.

Dimension the suitable „Circuit breaker“ dependent of the cross section of the inserted supply system, as well as from the nominal- and peak current of the converter.

D.29 Fuse protection

D.29.1 Cable protection

The current-carrying capacity of conductors is determined in table 6 of EN60204-1: 2006. For your operation you must determine the accordant value in the standard yourself, by taking into consideration, amongst other things the cable mounting.

Here you will find an extraction for the laying of PVC- isolated cables on open cable racks:

Cable cross section	**Fuse-Rated current**
1.5 mm^2	16.1 A
2.5 mm^2	22 A
4 mm^2	30 A
6 mm^2	37 A
10 mm^2	52 A
16 mm^2	70 A
25 mm^2	88 A
35 mm^2	110 A
50 mm^2	133 A
70 mm^2	171 A
95 mm^2	207 A
120 mm^2	240 A

Use suitable fuses with the enable characteristic gL or gR.

D.29.2 Device protection

Device	Maximum load value [1]
BM44**12**	≤ 310 A^2s
BM44**13**	≤ 310 A^2s
BM44**14**	≤ 325 A^2s
BM44**22**	≤ 400 A^2s
BM44**23**	≤ 450 A^2s
BM44**24**	≤ 800 A^2s
BM44**25**	≤ 800 A^2s
BM44**26**	≤ 800 A^2s
BM44**3X**	≤ 1.500 A^2s
BM46**3X**	≤ 9.500 A^2s
BM44**4X** BM44**4X**	≤ 15,000 A^2s
BM44**5X** BM46**5X**	≤ 97,000 A^2s
BM44**6X** BM46**6X** BM47**5X**	≤ 245,000 A^2s
BM44**7X** BM47**6X** BM47**7X**	≤ 1,125,000 A^2s

[1] Use fuses in the **operating point** of the device, which fall below the stated tripping integral (i^2t_{off}).

D.29.3 Cable protection + device protection

Consider by your choice of the whole range fuses the current-carrying capacity of the, to the device connected mains cables and the allowable maximum load of the device.

D.29.4 Whole range fuses gR (device and cable) BM4412X, BM4413, model NH

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

Size

D.29.5 Semiconductors aR (device) BM4412, BM4413, model NH

Bussmann	00	20A/1000V: 170M2673	25A/1000V: 170M2674
	1	40A/690V: 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	
	00	20A/690V: 6.9 URD 00 PV 020	25A/690V: 6.9 URD 00 PV 025
		32A/690V: 6.9 URD 00 PV 032	
	0	32A/690V: 6.9 URD 0 PV 032	40A/690V: 6.9 URD 0 PV 040

Size

D.29.6 Whole range fuses gR (device and cable) BM4414, model NH

Bussmann	000	25A/690V: 170M1561	32A/690V: 170M1562
Ferraz Shawmut	000	16A/690V: 6.9 GGR 000 PV 016	20A/690V: 6.9 GGR 000 PV 020
	00	16A/690V: 6.9 GGR 00 PV 016	
SIBA	000	16A/690V: 2047734/16A	20A/690V: 2047734/20A
	00	35A/690V: 2047720/35A	
	0	16A/1000V: 2038404/16A	25A/1000V: 2038404/25A
		32A/1000V: 2038404/32A	40A/1000V: 2038404/40A
Siemens	000	16A/690V: 3NE1 813-0 cURus	20A/690V: 3NE1 814-0 cURus
	00	25A/690V: 3NE8 015-1 cURus	35A/690V: 3NE8 003-1 cURus
		25A/690V: 3NE8 715-1 cURus	32A/690V: 3NE8 701-1 cURus
	0	32A/1000V: 4NE4 101	40A/1000V: 4NE4 102

Size

D.29.7 Semiconductors aR (device) BM4414, model NH

Bussmann	00	20A/1000V: 170M2673	25A/1000V: 170M2674
		32A/1000V: 170M2675	35A/1000V: 170M2676
	1	40A/690V: 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
	00	25A/690V: 6.9 URD 00 PV 025	32A/690V: 6.9 URD 00 PV 032
		40A/690V: 6.9 URD 00 PV 040	
	0	32A/690V: 6.9 URD 0 PV 032	40A/690V: 6.9 URD 0 PV 040

Size

D.29.8 Whole range fuses gR (device and cable) BM4422X, model NH

Bussmann	000	16A/660V: 170M1559 UR	20A/660V: 170M1560 UR
		25A/660V: 170M1561 UR	32A/660V: 170M1562 UR
	00	16A/690V: 170 m	20A/690V: 170 m
		25A/690V: 170 m	32A/690V: 170 m
SIBA	000	16A/690V: 2047734/16A cURus	
	00	20A/690V: 2047720/20A	25A/690V: 2047720/25A
Siemens	00	16A/690V: 3NE1 813-0 cURus	20A/660V: 3NE8 714
		25A/660V: 3NE8 715	25A/660V: 3NE8 015
		32A/660V: 3NE8 701	
	0	32A/1000V: 3NE4 101 cURus	

Size

D.29.9 Semiconductors aR (device) BM4422, model 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

D.29.10 Whole range fuses gR (device and cable) BM4423X, model NH

Bussmann	000	20A/660V: 170M1560 RU	25A/660V: 170M1561 RU
		32A/660V: 170M1562 RU	
	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 cRUus	
	00	20A/690V: 2047720/20A	25A/690V: 2047720/25A
Siemens	00	20A/660V: 3NE8 714	20A/690V: 3NE8 814-0 cRUus
		25A/660V: 3NE8 715	25A/660V: 3NE8 015
		32A/660V: 3NE8 701	
	0	32A/1000V: 3NE4 101 cRUus	

Size

D.29.11 Semiconductors aR (device) BM4423, model 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

D.29.12 Whole range fuses gR (device and cable) BM4424, BM4425 and BM4426, model NH

Bussmann	000	25A/660V: 170M1561 UL	32A/660V: 170M1562 UL
	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 cULus	
	00	25A/690V: 2047720/25A	
Siemens	00	25A/660V: 3NE8 715	25A/660V: 3NE8 015
		25A/690V: 3NE1 815-0 cULus	32A/660V: 3NE8 701
	0	32A/1000V: 3NE4 101 cULus	

Size

D.29.13 Semiconductors aR (device) BM4424, BM4425 and BM4426, model NH

Bussmann	00	25A/1000V: 170M2674	32A/1000V: 170M2675
		40A/1000V: 170M2676	
	1	40A/660V: 170M3808	50A/660V: 170M3809
		63A/660V: 170M3810	
Ferraz Shawmut	000	25A/690V: 6.9 URD 000 PV 025	32A/690V: 6.9 URD 000 PV 032
		40A/690V: 6.9 URD 000 PV 040	50A/690V: 6.9 URD 000 PV 050
Siemens	00	660V/40A: 3NE8 702	

Size

D.29.14 Whole range fuses gR (device and cable) BM443X model NH

Bussmann	000	50A/660V: 170M1564 UL	63A/660V: 170M1565 UL
	00	50A/690V: 170M2697	63A/690V: 170M2698
	1	50A/690V: 170M4176	63A/690V: 170M4177
SIBA	00	63A/690V: 2047720/63A	
	1	63A/690V: 2021120/63A	
Siemens	00	63A/660V: 3NE8 018-1 c UL us	
	0	50A/1000V: 3NE4 117	

Size

D.29.15 Semiconductors aR (device) BM443X, model NH

Bussmann	00	50A/1000V: 170M2678	63A/1000V: 170M2679
	1	63A/690V: 170M3810	80A/690V: 170M3811
SIBA	0	63A/1000V: 2038404/63A	80A/1000V: 2038404/80A
Siemens	00	50A/660V: 3NE8 717	63A/660V: 3NE8 718
	0	63A/1000V: 3NE4 118 c UL us	

Size

D.29.16 Whole range fuses gR (device and cable) BM463X, model NH

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

Size

D.29.17 Semiconductors aR (device) BM463X, model NH

Bussmann	000	125A/690V: 170M1568D cULus	
Ferraz Shawmut	00	125A/690V: NH00GS69V125PV	
SIBA	00C - 80 mm	125A/690V: 2028220.125 cULus	
	0	125A/1000V: 2038404.125 cULus	
Siemens	0	100A/690V: 3NE8021-1 cULus	

Size

D.29.18 Full-range fuses gR, gRL, gR/gS, gGR (device and cable) BM444X, model NH

Bussmann	00	80A/690V: 170M2699	100A/690V: 170M2700
		125A/690V: 170M2701 [1]	
	1	80A/690V: 170M4178	100A/690V: 170M4179
		125A/690V: 170M4180	160A/690V: 170M4181
Ferraz Shawmut	000	80A/690V: 6.9 GGR 000 PV 080/ 6,9 GGR 000 D08L 080	
	00	80A/690V: 6.9 GGR 00 PV 080/ 6,9 GGR 00 D08L 080	
SIBA	1	80A/690V: 2021120-80A	100A/690V: 2021120-100A
		80A/690V: 2021134-80A cULus	100A/690V: 2021134-100A cULus [1]
Siemens	000	80A/690V: 3NE1 820-0 cULus	

Size

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[1] For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.19 Semiconductors aR (device) BM444X, model NH

Bussmann	000	80A/690V: 170M1566 cURus	100A/690V: 170M1567 cURus
		125A/690V: 170M1568 cURus	160A/690V: 170M1569 cURus
	00	80A/1000V: 170M2680	100A/1000V: 170M2681
		125A/1000V: 170M2682	
	1	80A/690V: 170M3811 cURus	100A/690V: 170M3812 cURus
		125A/690V: 170M3813 cURus	160A/690V: 170M3814 cURus 1)
SIBA	1	125A/690V: 2021120/125A 1)	
Siemens	000	80A/690V: 3NE8 720-1 cURus	100A/690V: 3NE8 721-1 cURus
		125A/690V: 3NE8 722-1 cURus	160A/690V: 3NE8 724-1 cURus
	00	80A/690V: 3NE8 020-1 cURus	100A/690V: 3NE8 021-1 cURus
		125A/690V: 3NE8 022-1 cURus	160A/690V: 3NE8 024-1 cURus
	0	80A/1000V: 3NE4 120 cURus	100A/1000V: 3NE4 121 cURus
		125A/1000V: 3NE4 122 cURus	
	1	100A/1000V: 3NE3 221 cURus	125A/1000V: 3NE3 222 cURus
		160A/1000V: 3NE3 224 cURus	

Size

1) For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.20 Whole range fuses gR (device and cable) BM4641 model NH

SIBA	1	100A/690V: 2021134.100 cURus	
Siemens	00	125A/690V: 3NE1022-2 cURus	

Size

D.29.21 Semiconductors aR (device) BM4641, model NH

Bussmann	000	200A/690V: 170M1570D cRUus	
Ferraz Shawmut	00	160A/690V: NH00GS69V16PV	
SIBA	00C - 80 mm	160A/690V: 2028220.160 cRUus	
Siemens	00	125A/690V: 3NE8022-1 cRUus	

Size

D.29.22 Whole range fuses gR (device and cable) BM4642 model NH

Siemens	00	125A/690V: 3NE1022-2 cRUus	

Size

D.29.23 Semiconductors aR (device) BM4642, model NH

Bussmann	000	200A/690V: 170M1570D cRUus	
Ferraz Shawmut	00	160A/690V: NH00GS69V16PV	
SIBA	00C - 80 mm	200A/690V: 2028220.200 cRUus	
	1	250A/690V: 2021120.250 cRUus	
Siemens	00	160A/690V: 3NE8024-1 cRUus	

Size

D.29.24 Whole range fuses gR (device and cable) BM445X model NH

Bussmann	00	100A/690V: 170M2700	125A/690V: 170M2701
		160A/690V: 170M2702	
	1	125A/690V: 170M4180	160A/690V: 170M4181
		200A/690V: 170M4182 [1]	250A/690V: 170M4183 [1]
	2	200A/690V: 170M5881	250A/690V: 170M5882 [1]
		315A/690V: 170M5883 [1]	
	3	350A/690V: 170M6080 [1]	
Ferraz Shawmut	000	100A/690V: 6.9 GGR 000 PV 100	
	00	100A/690V: 6.9 GGR 00 PV 100	
		125A/690V: 6.9 GGR 00 PV 125 [1]	
		160A/690V: 6.9 GGR 00 PV 160 [1]	
SIBA	00	100A/690V: 2020934/100AcURus	125A/690V: 2020934/125AcURus [1]
	1	100A/690V: 2021134/100AcURus	125A/690V: 2021134/125AcURus [1]
		160A/690V: 2021134/160AcURus [1]	200A/690V: 2021134/200AcURus [1]
	2	160A/690V: 2021234/160AcURus [1]	200A/690V: 2021234/200AcURus [1]
Siemens	00	100A/690V: 3NE1 021-0 cURus	125A/690V: 3NE1 022-0 cURus [1]
	1	160A/690V: 3NE1 224-0 cURus [1]	200A/690V: 3NE1 225-0 cURus [1]

Size

---

[1] For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.25 Semiconductors aR (device) BM445X, model NH

Bussmann	000	125A/660V: 170M1568 ЯU	160A/660V: 170M1569 ЯU
		200A/660V: 170M1570 ЯU	250A/660V: 170M1571 ЯU 1)
		315A/660V: 170M1572 ЯU 1)	
	00	125A/1000V: 170M2682	160A/1000V: 170M2683 1)
		200A/900V: 170M2684 1)	225A/900V: 170M2685 1)
	1	160A/660V: 170M3814	200A/660V: 170M3815
		250A/660V: 170M3816	315A/660V: 170M3817 1)
		350A/660V: 170M3818 1)	400A/660V: 170M3819 1)
	2	400A/660V: 170M5808 1)	450A/660V: 170M5809 1)
	3	500A/660V: 170M6808 1)	
Ferraz Shawmut	000	125A/690V: 6.9 URD 000 PV 0125	
		160A/690V: 6.9 URD 000 PV 0160	
		200A/690V: 6.9 URD 000 PV 0200	
		250A/690V: 6.9 URD 000 PV 0250 1)	
		315A/690V: 6.9 URD 000 PV 0315 1)	
Siemens	00	125A/660V: 3NE8 022 cЯUus	125A/660V: 3NE8 722
		160A/660V: 3NE8 024	160A/660V: 3NE8 724
		200A/660V: 3NE8 725	250A/660V: 3NE8 727 1)
		315A/660V: 3NE8 731 1)	
	0	100A/1000V: 3NE4 121 cЯUus	125A/1000V: 3NE4 122 cЯUus
		160A/1000V: 3NE4 124 cЯUus	
	1	125A/1000V: 3NE3 222 cЯUus	160A/1000V: 3NE3 224 cЯUus
		200A/1000V: 3NE3 225 cЯUus	250A/1000V: 3NE3 227 cЯUus 1)
		315A/1000V: 3NE3 230-0BcЯUus 1)	350A/1000V: 3NE3 231 cЯUus 1)
		400A/1000V: 3NE3 232-0BcЯUus 1)	
	2	400A/1000V: 3NE3 332-0BcЯUus 1)	

Size

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1) For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.26 Whole range fuses gR (device and cable) BM4650 model NH

SIBA	1	160A/690V: 2021134.160A cULus 1)	
Siemens	1	200A/690V: 3NE1225-2 cULus 1)	

Size

D.29.27 Semiconductors aR (device) BM4650, model NH

Bussmann	00	315A/690V: 170M1572D cULus	
Ferraz Shawmut	1	250A/690V: NH1GS69V250PV	
SIBA	00C - 80 mm	315A/690V: 2028220.315 cULus	
Siemens	1 - 110 mm	200A/1000V: 3NE3225 cULus	

Size

D.29.28 Whole range fuses gR (device and cable) BM4651 model NH

SIBA	1	200A/690V: 2021134.200A cULus 1)	
Siemens	1	200A/690V: 3NE1227-2 cULus 1)	

Size

D.29.29 Semiconductors aR (device) BM4651, model NH

Bussmann	00	315A/690V: 170M1572D cULus	
Ferraz Shawmut	1	250A/690V: NH1GS69V250PV	
SIBA	00C - 80 mm	350A/690V: 2028220.350 cULus	
Siemens	1 - 110 mm	250A/1000V: 3NE3227 cULus	

Size

D.29.30 Whole range fuses gR (device and cable) BM4652 model NH

Siemens	1	250A/690V: 3NE1227-2 cRUus	

Size

D.29.31 Semiconductors aR (device) BM4652, model NH

Bussmann	00	315A/690V: 170M1572D cRUus	
Ferraz Shawmut	2	250A/690V: NH2GS69V315PV	
SIBA	1	315A/690V: 2021120.315 cRUus	
	00C - 80 mm	400A/690V: 2018920.400 cRUus	
Siemens	1 - 110 mm	315A/1000V: 3NE3230-0B cRUus	
	1 - 110 mm	450A/1000V: 3NE3233 cRUus	

Size

D.29.32 Whole range fuses gR (device and cable) BM446X model NH

Bussmann	1	250A/690V: 170M4183	315A/690V: 170M4184 1)
		350A/690V: 170M4185 1)	400A/690V: 170M4186 1)
	2	250A/690V: 170M5882	315A/690V: 170M5883 1)
		350A/690V: 170M5884 1)	400A/690V: 170M5885 1)
		450A/690V: 170M5886 1)	
	3	350A/690V: 170M6080 1)	400A/690V: 170M6081 1)
		450A/690V: 170M6082 1)	
SIBA	1	250A/690V: 2021134/250A cRUus 1)	315A/690V: 2021134/315A cRUus 1)
	2	250A/690V: 2021234/250A cRUus 1)	315A/690V: 2021234/315A cRUus 1)
		350A/690V: 2021234/350A cRUus 1)	
	3	315A/690V: 2021334/315A 1)	350A/690V: 2021334/350A 1)
Siemens	1	250A/690V: 3NE1 227-0 cRUus 1)	315A/690V: 3NE1 230-0 cRUus 1)

Size

1) For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.33 Semiconductor fuses aR (device) 446X, model NH

Bussmann	000	250A/660V: 170M1571 ЯU	315A/660V: 170M1572 ЯU
	00	225A/900V: 170M2685 1)	
	1	250A/660V: 170M3816	315A/660V: 170M3817
		350A/660V: 170M3818	400A/660V: 170M3819 1)
	2	400A/660V: 170M5808	450A/660V: 170M5809 1)
		500A/660V: 170M5810 1)	550A/660V: 170M5811 1)
		630A/660V: 170M5812 1)	
	3	500A/660V: 170M6808	550A/660V: 170M6809 1)
		630A/660V: 170M6810 1)	700A/660V: 170M6811 1)
Ferraz Shawmut	000	250A/690V: 6.9 URD 000 PV 0250	
		315A/690V: 6.9 URD 000 PV 0315	
	00	250A/690V: 6.9 URD 00 PV 0250	315A/690V: 6.9 URD 00 PV 0315
	0	250A/690V: 6.9 URD 0 PV 0250	315A/690V: 6.9 URD 0 PV 0315
	1	250A/690V: 6.9 URD 1 PV 0250	315A/690V: 6.9 URD 1 PV 0315
		350A/690V: 6.9 URD 1 PV 0350	400A/690V: 6.9 URD 1 PV 0400 1)
	2	250A/690V: 6.9 URD 2 PV 0250	315A/690V: 6.9 URD 2 PV 0315
		350A/690V: 6.9 URD 2 PV 0350	400A/690V: 6.9 URD 2 PV 0400
		450A/690V: 6.9 URD 2 PV 0450 1)	500A/690V: 6.9 URD 2 PV 0500 1)
		560A/690V: 6.9 URD 2 PV 0560 1)	630A/690V: 6.9 URD 2 PV 0630 1)
	3	315A/690V: 6.9 URD 3 PV 0315	350A/690V: 6.9 URD 3 PV 0350
		400A/690V: 6.9 URD 3 PV 0400	450A/690V: 6.9 URD 3 PV 0450
		500A/690V: 6.9 URD 3 PV 0500 1)	560A/690V: 6.9 URD 3 PV 0560 1)
		630A/690V: 6.9 URD 3 PV 0630 1)	700A/690V: 6.9 URD 3 PV 0700 1)
Siemens	00	250A/660V: 3NE8 727	315A/660V: 3NE8 731
	1	250A/1000V: 3NE3 227 cЯUus	315A/1000V: 3NE3 230-0B cЯUus
		350A/1000V: 3NE3 231 cЯUus 1)	400A/1000V: 3NE3 232-0B cЯUus 1)
		450A/1000V: 3NE3 233 cЯUus 1)	
	2	400A/1000V: 3NE3 332-0B cЯUus 1)	450A/1000V: 3NE3 333 cЯUus 1)
		500A/1000V: 3NE3 334-0B cЯUus 1)	560A/1000V: 3NE3 335 cЯUus 1)

Size

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1) For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

D.29.34 Whole range fuses gR (device and cable) BM4661 model NH

SIBA	1	315A/690V: 2021134.315 cURus	
Siemens	1	315A/690V: 3NE1230-2 cURus	

Size

D.29.35 Semiconductors aR (device) BM4661, model NH

Bussmann	1	500A/690V: 170M4864D cURus	
		550A/690V: 170M5811D cURus	
Ferraz Shawmut	2	350A/690V: NH2GS69V350PV	
SIBA	1 - 110 mm	500A/690V: 2061331.500 cURus	
Siemens	1 - 110 mm	400A/1000V: 3NE3232-0B cURus	

Size

D.29.36 Whole range fuses gR (device and cable) BM4662 model NH

SIBA	1	315A/690V: 2021134.315 cURus	
	2	350A/690V: 2021134.350 cURus	
Siemens	2	400A/690V: 3NE1332-2 cURus	
	2	500A/690V: 3NE1334-2 cURus	

Size

D.29.37 Semiconductors aR (device) BM4662, model NH

Bussmann	2	550A/690V: 170M5811D cURus	
Ferraz Shawmut	2	400A/690V: NH2GS69V400PV	
SIBA	1 - 110 mm	630A/690V: 2061331.630 cURus	
Siemens	1 - 110 mm	450A/1000V: 3NE3233 cURus	
	1 - 110 mm	560A/1000V: 3NE3235 cURus	

Size

D.29.38 Semiconductor fuses aR (device) 447X, model NH

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *Parts, which are under tension are perilous.*

The use of semiconductor fuses is obligatory at the mains connection of BM447X devices. Semiconductor fuses are required in the chopper resistor connection except the user assures the short-circuit protection of resistor and cable.

BM4472:

Siemens	2	500A/1000V: 3NA3 334-0B RU	560A/1000V: 3NA3 335 RU
	2	710A/900V: 3NE3 337-8 RU	

Size

NOTE

The 710A fuse is recommended if the BM4472 is operated constantly at nominal power and/or peak power is required frequently, because the 710A fuse provides higher thermal reserve compared with 500A/560A fuses and therefore the risk of fuse tripping at normal run (without real error) is reduces.

BM4473, BM4773:

Siemens	2	800A/800V: 3NE3 338-8 RU	

Size

BM447X, BM477X UL fuse in the chopper resistor circuit:

Siemens	1	350A/1000V: 3NE3 231 RU	

Size

D.29.39 UL fuse in the chopper resistor circuit

BM445X, BM465X and BM4755:

Siemens		160A/700V: 3NE8 724-1	

Size

BM446X, BM466X and BM4766:

Siemens		250A/700V: 3NE8 727-1	

Size

D.29.40 24V-extra-low voltage protection

In case you refer to UL 508 C:

Assure, that all marked e.l.v. connections (24 V) at the device have a maximum voltage of 30 V_{DC}. Additionally these connections must be protected with fuses which are in accordance with UL 248 with a triggering current of maximum 4 A.

NOTE

If a current consumption of 4 A is undershoot, several connections can be protected together with a UL-listed fuse (release current max. 4 A).

D.30 Cables mains-device

Device	Numer of wires x cross section 1)	Connection to device 3)	Maximum length 2)
BM44**1X**	4 x 0.5 to 2,5 mm^2 (AWG 16 - 12)	flexible cable with/without wire end ferrule (plug-in terminal)	mains to mains filter: user-defined mains filter to mains choke/ device: max. 30 cm
BM44**2X**	4 x 0.5 to 4 mm^2 (AWG 24 - 10)	flexible cable with wire end ferrule (screw terminal)	
BM44**32** BM44**33** BM44**34**	4 x 0.5 to 10 mm^2 (AWG 20 - 6)	flexible cable with wire end ferrule (screw terminal)	
BM44**35**	4 x 16 mm^2 63 A-fuses must be provided for the cable protection and a cable with 16 mm^2 cross section must be used.	pin-cable-lugs according to DIN 46230 The terminals at the BM4435 are provided for cross sections up to 10 mm^2, therefore at the BM4435 pin-cable-lugs according to DIN 46230 must be used.	
BM46**32**	4 x 25 mm^2 63 A-fuses must be provided for the cable protection and a cable with 25 mm^2 cross section must be used.	flexible cable with wire end ferrule (screw terminal)	
BM44**4X** BM46**4X**	4 x 16 to 50 mm^2 (AWG 6 -0)	flexible cable with wire end ferrule (screw terminal)	
BM44**5X** BM46**5X** BM47**5X**	4 x 25 to ca. 185 mm^2	Cable lug max. Width: 25 mm (current bar) 5)	
BM44**6X** BM46**6X** BM47**6X**		Cable lug max. Width: 35 mm (current bar) 6)	
BM44**7X** 7) BM47**7X** 7)	max. 4 cables with (4 x 95 mm^2) max. 2 cables with (4 x 185 mm^2)	Cable lug max. Width: 25 mm or 35 mm (current bar) 7)	

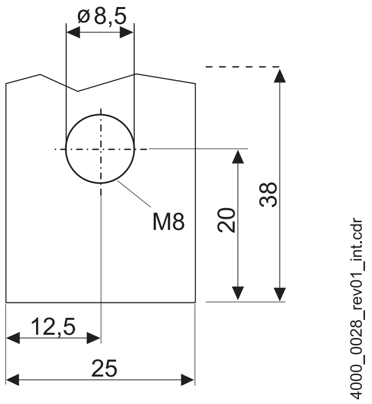
1) Possible cross section
For UL conform machines/installations you must use UL certified circuit cables.

2) The length of the cable between mains filter and mains is not of importance for the compliance to the EMC regulation.

3) The installing of the cables is user-defined.

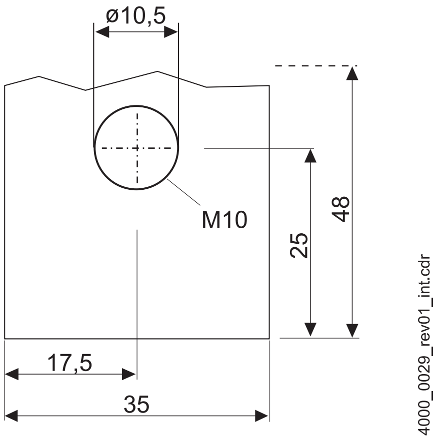
4) NOTE BM4435, BM4635
The BM4435 has an input current of 53 A, the appropriate mains filter (BFN3-1-56-001) has a rated current of 53 A, too.

5)



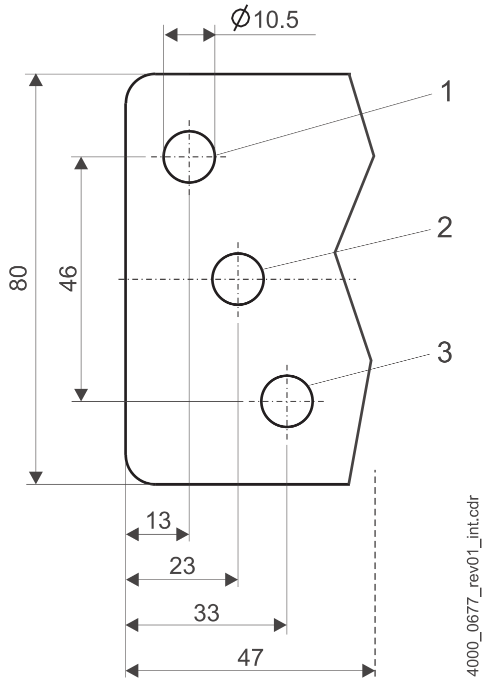
Connection lugs (current bars).Position see ▹Figure 58◃ on page 94.
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

6)



Connection lugs (current bars). Position see ▹Figure 58◃ on page 94
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

7)



Connection lugs (current bars). Position see ▹Figure 61◃ on page 97

At connection cross-section 95 mm^2,Cable lug width max. 25 mm:
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

At connection cross-section 185 mm^2,Cable lug width max. 35 mm:
Screw two cable lugs to the current bar at maximum- one on the front side, one on the reverse side of the bar.

D.31 Cables device-motor

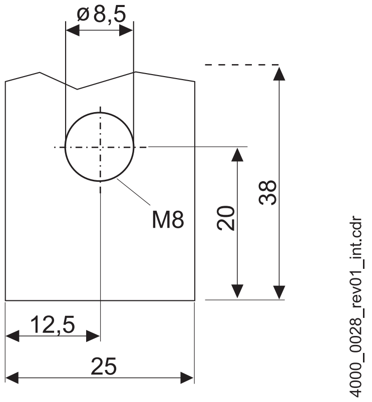
Device	Numer of wires x cross section [1]	maximum length [2][3]	Connection to device
BM44**1X**	4 x (1 to 2,5 mm^2) (AWG 16 - 12)	100 m	flexible cable with/without wire end ferrule (plug-in terminal)
BM44**2X**	4 x (2 to 4 mm^2) (AWG 24 -10)	1.5 to 2,5 mm^2: 100m from 4 mm^2: 60 m	flexible cable with wire end ferrule (screw terminal)
BM44**3X** BM46**32**	4 x (4 to 16 mm^2) (AWG 20 - 4)	60 m	
BM44**4X** BM46**4X**	4 x (16 to 50 mm^2) (AWG 6 - 0)	up to 25 mm^2: 60m from 35 mm^2: 50m	
BM44**5X** BM46**5X** BM47**5X**	4 x (20 to ca. 185 mm^2)	up to 50 mm^2: 50m > 50 mm^2: 15m	Cable lug max. Width: 25 mm (current bar) [4]
BM44**6X** BM46**6X** BM47**6X**			Cable lug max. Width: 35 mm (current bar) [5]
BM44**7X**[6] BM47**7X**[6]	max. 4 cables each with (4 x 95 mm^2) max. 4 cables each with (2 x 185 mm^2)	at 95 mm^2: 15 m at 185 mm^2: 30 m	Cable lug max. Width: 25 mm or 35 mm (current bar) [6]

[1] Possible cross section
Use a screened circuit Baumüller-line, optical shield coverage > 85%. Do not use single conductors.
For UL conform machines/installations you must use UL certified circuit cables.

[2] Only for Baumüller cables with this maximum length and by usage of a Baumüller mains filter you can assume, that the limit values of the EMC product standard EN 61800-3 are complied with.

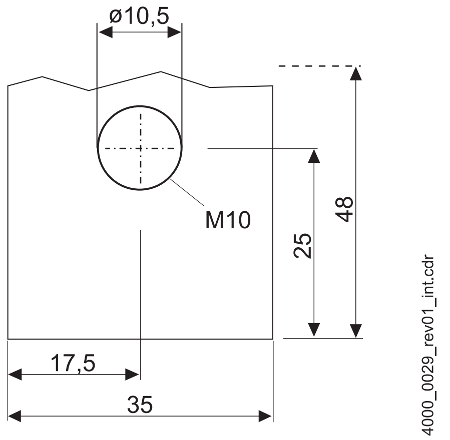
[3] In case you use parallel-installed motor cables, the maximum length is to be reduced by the factor 1/n.

[4]



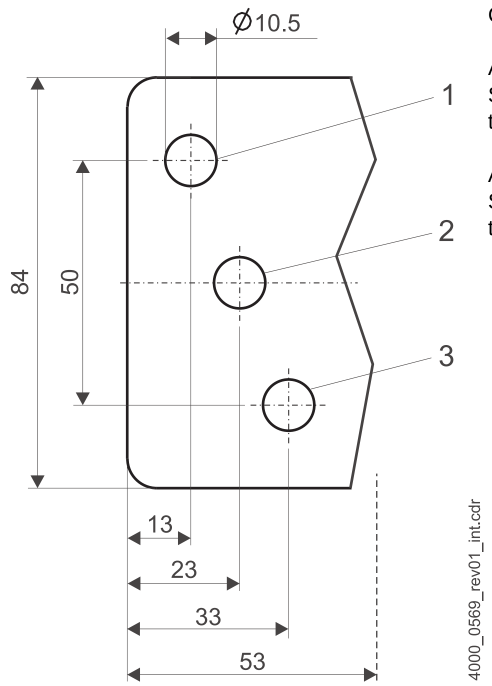
Connection lugs (current bars). Position see ▹Figure 58◃ on page 94.
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

5)



Connection lugs (current bars). Position see ▹Figure 58◃ on page 94
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

6)



Connection lugs (current bars). Position see ▹Figure 61◃ on page 97

At a connection cross-section of 95 mm^2, cable lug width max. 25 mm:
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

At a connection cross-section of 185 mm^2, cable lug width max. 35 mm:
Screw two cable lugs to the current bar at maximum- one on the front side, one on the reverse side of the bar.

D.32 Cable control voltage supply/signals

Cross section [1)]	≤ 1.5 mm^2
Maximum length [2)]	user-defined
Connection to device	with /without wire end ferrules (plug-in terminal)

[1)] The installing of the cables is user-defined.

[2)] The length of the cable has no influence on the compliance to the EMC regulation.

D.33 Type of protection

Type of protection	
BM 441X, BM 442X	IP 20
BM 443X, BM 444X BM 463X, BM 464X	IP 20, if safe-to-touch connection according to IP 20, otherwise IP 10
BM 445X, BM 446X, BM 447X BM 465X, BM 466X BM 475X, BM 476X, BM 477X	IP 00

D.34 Fire fighting appliances

Fight fire with	ABC-Pulver

D.35 Mains filters BM441X to BM447X

In order to comply with the required limit values of the EMC product standard a mains filter is necessary for each device.

Insert in proportion of the application a mains filter from the following table.

TN-mains

$I_{Bem\ AC}$ [1]	Type	Item number
7 A	BFN 3-1 - 7 - 001	314277
16 A	BFN 3-1 - 16 - 001	314278
30 A	BFN 3-1 - 30 - 001	314279
42 A	BFN 3-1 - 42 - 001	314280
56 A	BFN 3-1 - 56 - 001	314281
75 A	BFN 3-1 - 75 - 001	314282
100 A	BFN 3-1 - 100 - 001	314283
130 A	BFN 3-1 - 130 - 001	314284
180 A	BFN 3-1 - 180 - 001	314285
250 A	BFN 3-1 - 250 - 001	373891
320 A	BFN 3-1 - 320 - 001	373896
400 A	BFN 3-1 - 400 - 001	373900
600 A	BFN 3-1 - 600 - 001	Type A: 373901 Type B: 419997
1000 A	BFN 3-1 - 1000 - 001	423683

1) Rated temperature = 40° C

IT-mains

$I_{Bem\ AC}$ [1]	Type	Item number
250 A	BFN 3-1 - 250 - 002	373620
320 A	BFN 3-1 - 320 - 002	373894
400 A	BFN 3-1 - 400 - 002	373898
600 A	BFN 3-1 - 600 - 002	373902

1) Rated temperature = 40° C

D.36 Mains chokes

For the devices BM441X, BM4422, BM4423, BM4424 and BM4425 mains chokes are not necessary.

Current Select the mains chokes depending on their application on the basis of the input rated current. Take into account that the max. input current may not bring the choke into saturation.

Inductance Furthermore, chose the mains chokes dependent on the short circuit voltage of the mains, so that the demanded mains inductance, under ▹Requirements on the power supply◃ on page 180, is complied with.

NOTE

at 60 Hz there is another short-circuit voltage with the same choke as with 50 Hz; with the formula $u_k = (\omega L \times I_N \times \sqrt{3}) / U_N$ (with $\omega = 2\pi \times f$) you can calculate the short-circuit voltage at another mains frequency.

NOTE

The nominal inductance is constant up to 1,1 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 or 60 s) peak current at peak power is needed, chose a commutation choke with a peak current smaller or equal of the 1,1 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.

D.36 Mains chokes

D.36.1 Type code mains choke

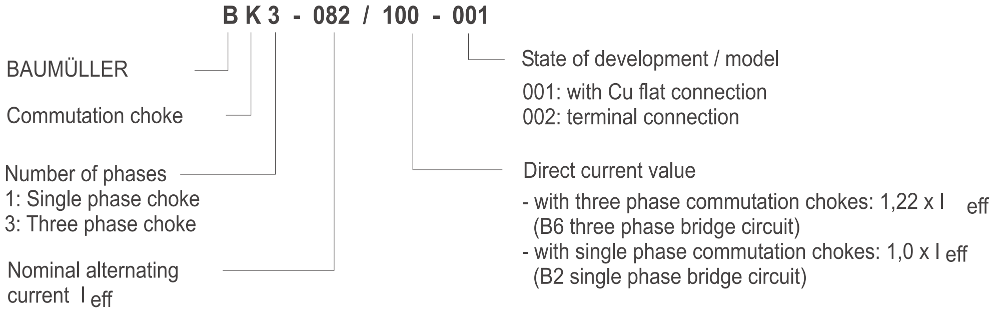


Figure 94: Type code mains choke

$I_{\text{rated AC}}$	Inductance	Type designation	Part No. Type -001, Connection copper conductor bar	Part No. Type -002, Connection terminal
25 A	1,18 mH	BK3-0025/0030	368377	399136
40 A	0,72 mH	BK3-0040/0050	368378	399137
65 A	0,45 mH	BK3-0065/0080	368379	399138
80 A	0,36 mH	BK3-0080/0100	368380	399139
115 A	0,26 mH	BK3-0115/0140	368381	399140
165 A	0,18 mH	BK3-0165/0200	368382	399141
195 A	0,15 mH	BK3-0195/0240	368383	-
275 A	105 µH	BK3-0275/0340	368384	-
365 A	80 µH	BK3-0365/0450	368385	-
450 A	65 µH	BK3-0450/0550	368386	-
530 A	55 µH	BK3-0530/0650	368387	-
615 A	48 µH	BK3-0615/0750	368388	-
750 A	39 µH	BK3-0750/0920	368389	-
920 A	32,6 µH	BK3-0900/1100	368390	-
1020 A	28 µH	BK3-1020/1250	395020	-

The listed chokes are specified for the operation at 400 V /50 Hz or 480 V / 60 Hz.
At a mains voltage of 400 V and a frequency of 50 Hz at rated current the chokes have a short-circuit voltage > 3% of the mains voltage.

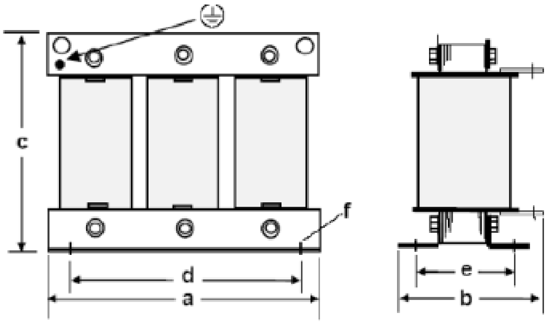


Figure 95: Drawing sheet A1 for mains chokes

BK3- ... - 001	Art.-No.	I_{AC} [A]	I_{DC} [A]	Draw-ing	a mm	b mm	c mm	d mm	e mm	f × g mm	Weight kg	Flat con-nection Ø mm × mm
0025/0030	368377	25	30	A1	155	130	132	130	72	8×12	6	20×2 for M6
0040/0050	368378	41	50	A1	190	120	158	170	58	8×12	7	20×2 for M6
0065/0080	368379	66	80	A1	190	140	158	170	78	8×12	10	20×2 for M6
0080/0100	368380	82	100	A1	230	165	202	180	98	8×12	12	25×3 for M8
0115/0140	368381	115	140	A1	230	190	202	180	122	8×12	18	25×3 for M10
0165/0200	368382	164	200	A1	240	195	211	190	125	11×15	23	25×3 for M10
0195/0240	368383	197	240	A1	265	195	230	215	126	11×15	28	25×3 for M10
0275/0340	368384	297	340	A1	300	225	271	240	145	11x15	38	30×5 for M10
0365/0450	368385	369	450	A1	360	220	320	310	125	11×15	47	40×5 for M12
0450/0550	368386	451	550	A1	360	260	320	310	140	11×15	58	50×5 for M12
0530/0650	368387	533	650	A1	360	260	320	310	140	11×15	63	50×5 for M12
0615/0750	368388	615	750	A1	420	285	375	370	151	11×15	68	60×5 for M12
0750/0920	368389	754	920	A1	420	285	375	370	151	11×15	78	60×5 for M12
0900/1100	368390	902	1100	A1	420	285	380	370	166	11×15	90	60×10 for M12

BK3- ... - 001	Art.-No.	I_{AC} [A]	I_{DC} [A]	Draw-ing	a mm	b mm	c mm	d mm	e mm	f × g mm	Weight kg	Flat con-nection Ø mm × mm
1020/1250	395020	1020	1250	A1	420	330	380	370	181	11×15	115	60×10 for M12
1150/1400	408679	1150	1400	A1	420	330	380	370	181	11x15	130	60×10 for M12
1270/1550	408698	1270	1550	A1	480	350	430	430	210	13x18	135	60x10 for M12
1350/1650	408699	1350	1650	A1	480	350	430	430	210	13x18	145	60x10 for M12
1430/1750	408700	1430	1750	A1	480	350	430	430	210	13x18	150	60x10 for M12
1680/2050	408701	1680	2050	A1	480	350	430	430	210	13x18	170	60x10 for M12

D.37 Temperature sensors of the motor

Type	additional requirements	Insulation
KTY84	-	SELV/PELV
MSKL[1] (PTC)	R = 1KΩ at $T_{protection}$, I_{max} < 2mA	SELV/PELV

[1] Motor protection PTC according to DIN 44080-082

NOTE

The motor temperature sensor is to be executed in such a way, that the electrical separation (EN 61800-5-1) is guaranteed. The motor temperature sensors, which are build in at Baumüller motors correspond to these requirements. When connecting an motor produced by an external manufacturer, the operator has to assure, that the motor temperature sensor, which was installed into the motor complies with the function electrical separation.

APPENDIX E - SAFE STOP

In this chapter the safety function „Safe stop“ is described for BM4400. This safety function also obtains for devices of the BM4600 and BM4700 series.

E.1 Methods to avoid an unexpected starting

In order to avoid danger for persons, for example operators, service- and maintenance technics, the machine has to be kept in a safe state (safe stop), while taking action in the dangerous area of the machine. Therefore a reliable prevention of a unexpected starting is demanded (Machine Directive 06/42/EG, attachment I, 1.2.4; EN ISO 12100-1; EN 60204-1, 5.4; EN 62061; EN 61800-5-2). Unexpected starting is each starting, which causes a risk for persons by its unexpected occurrence (EN 292-1). Moreover, besides the transition of the enable- to the operating state of the machine also the unexpected ramp-up of the machine, this means the transition from the safe stop into an unsafe moving has to be considered. This is necessary, because the unexpected ramp-up usually is to be led back to an interruption of the control loop of the machine. In this case the drive is, because of its control system, anxious to achieve highest speed at maximum acceleration. If an unexpected starting occurs, the operator therefore doesn’t have the possibility anymore to remove himself or his hand from the danger area. This is why the drive has to be stopped and has to be kept safe in its ’off-position’, when having opened, electrical interlocked safety devices. The motor may not have torque and thus cannot generate a dangerous movement.

The prevention of an unexpected starting of the machine can be reached by electrical separated safety devices, e.g. contactors.

But this form of shutdown no longer corresponds to the current state of the art, since the contact-switching operation in the power circuit of the drive may lead to unnecessary wear on the switching element and a relatively long response times in the machine.

By some machine types it has to be done without the isolation of the electrical connection of the drive to the mains, if e. g. a drive supplied by a power converter is very often and in short intervals stopped and started again. The constant dis- and re-charging of the DC link represents a great stress for the concerned parts and may often lead to disturbing delays and early failures of parts.

The integration of the protection function is more efficient for preventing an unexpected start directly into the inverter. Here, the drive itself is not isolated from the power supply, however, the commutation safety prevents the power semiconductors in the inverter.

In Baumüller inverters of the b maXX BM4400, this occurs by the safety relay, which switches off the power supply for the IGBT control.

In the Baumüller converters of the b maXX BM4400 series this is realized by the safety relay, which switches the power supply for the IGBT control off.

Here are device models with optional one safety relay (BM4400 size 1 - 7) or two safety relay available (BM4400, size 3 - 7). For the version with one safety relay this path is called shutdown path 1, for the version with double safety relay these are the shutdown paths 1 and 2.

In order to achieve a safe two-channel shutdown even with only one safety relay, here is a second shutdown path at the Baumüller BM4400 controller LC3 via the pulse enable circuit of the controller achieved. Additional the pulses for the IGBT control are disabled by this circuit.

Further information on the versions of the safe two-channel shutdown, on the particular safety classifications according to EN ISO 13849-1 and EN 62061, on the functional principle STO, on the here absolute adhered safety instructions and on the connection diagrams are found in chapter ▹E.2 Safe Torque Off (STO)◃ from page 270.

Physical relationship

The precondition of starting an three-phase motor is the generation of a rotating field, which drives the inductor of the motor. When having variable-speed three-phase current drives, usually in the micro-processors a complex pulse pattern is generated, then the pulses are amplified and are used for the switching of the power semiconductors. If either no defined pulse pattern is available or the amplifying connection is interrupted, e. g. by switching off of the power supply with a relay (safety relay), no rotary field can be generated. An error at the pulse pattern generation therefore cannot lead to a starting of the motor, as long as the second precondition, namely the interruption of the amplifying power supply is available and contrary. The protection against unexpected starting is reached by an electromechanical method which is superior to the electronics. It is reached by a safe isolation - elsewhere than in the load circuit.

The power supply to the windings of the motor is reached at a stoppage by inhibiting the power semiconductor. As semiconductors possibly can fail or be started, because of electromagnetic interferences, the behavior of the shut down drive has to be considered if such an error scenario arises. The breakdown or ’accidental’ turning on of a single or of several power semiconductors at the same DC-link pole does not lead to an uncontrollable starting, as no current flow is accomplished. Not until additionally a further power semiconductor is enabled at another pole, current is able to flow through the motor. If, thereby the is directly short-circuited, the fuses which are upstreamed to the converter are tripped, the motor doesn’t start. If the is ’short-circuited’ over a winding of the motor, a magnetic field can be set up in the motor. If it is an asynchronous motor, then the generated d. c. magnetic properties cannot cause a lurch of the inductor. By the permanent-magnetic synchronous motor the inductor will rotate into a notch position. The therewith angular movement which is covered is dependable of the inductor’s position and the number of pole pairs of the motor. It amounts to maximum 180°/number of pole pairs. Subsequently the enabled DC link operates like a brake, this means after the ending of the lurching movement the drive is in a blocked state. A starting of the drive is impossible. If a machine with a synchronous motor is planned, the possible sudden movement must be considered, because it can lead to a dangerous movement. Therefore the machinist must carry out a safety evaluation for the residual movement.

NOTE

In the unlikely event of total failure of an internal driver (IGBT) or an actuator element, it can trigger a temporary excitement of the drive (also in the STO state).

If the link to a winding of the motor is "shorted", a magnetic field can develop in the motor. If this concerns an induction motor, the resulting DC field cannot effect a jolt of the rotor.

The rotor in a permanently energized synchronous motor will rotate into a no-load position. The angular movement covered in this case depends on the rotor position and the number of pole pairs of the motor. It amounts to a maximum of 180°/number of pole pairs.

The potential jolting movement must be considered when planning a machine with a synchronous motor.

NOTE

The function is limited to the prevention of an unexpected starting. The switching of the safety relay, while the inductor of the motor is rotating, causes an uncontrolled 'coasting' of the machine, a braking with help of the converter is not possible anymore.

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***electricity.*** *Both on the motor and at the unit there can be mains voltage although the function STO/safe stop is activated.*

If required, switch the appliance off-circuit like an appliance without a safety relay - the safety relay does **not** switch the appliance and the motor off- circuit!

NOTE

To activate the function STO/safe stop has no isolation from the supply system as a consequence. Therefore, mains potential can be both at the converter and at the motor. In the case of maintenance-, service- and repair- works on electrical components of the drive system, the protection against dangers must be provided by other means (e. g. main switch).

NOTE

When having a switched off safety relay it is not possible at BM441X and BM454X to use of a chopper resistor.

E.2 Safe Torque Off (STO)

E.2.1 Safety classification and safety instructions

according to EN ISO 13849-1 and EN 62061

The Baumüller - converter of the b maXX series in the device models BM44xx-xxY-xxxxx[Ryy]-**S01**-xx have in conjunction with the Baumüller BM4000 controller LC3 the safety function STO (Safe Torque Off).

In function STO the drive is switched torqueless.

If no load acts on the drive shaft, the drive will stop after coming to a rest (coasting). No active threat therefore comes from the drive, provided that the STO function is selected.
A start of the drive without the withdrawal of the STO function is not possible.

NOTE

A device with safety relay, whose part number does **not** start with „**06**“, does not apply as a safety device as defined by the PL classification according to ISO 13849 or SIL according to EN 61800.

This device is not certificated for safety functions

NOTE

Only a device which is affixed with the test mark of the TUEV Rheinland has a certificated safety function.

TÜVRheinland®
Functional Safety
Type Approved
FS

The STO function meets the following classifications and standards:

1) Connection of the shutdown on two channels via 1 safety relay at the basic unit and the pulse enable circuit of the BM4400- controller LC3:

Device models BM44xx-xxY-xxxxx[Ryy]-**S01**-xx
with Y= 1, 3 or 5 (Devices with a safety relay):
Size 1 - 7

- PL-d according to EN ISO 13849-1
  with the following parameters:
  - Structure: cat 3
  - MTTFd: high
  - DC: low
- SIL 2 according to EN 62061 and 61508
  with $PFH_{DssD} = 1{,}5 \times 10^{-10}$

2) Connection of the shutdown on two channels via 2 safety relays:

Device models BM44xx-xxY-xxxxx[Ryy]-**S01**-xx
with Y= 2, 4 or 6 (devices with two safety relays):
Size 3 - 7

- PL-e according to EN ISO 13849-1 with the following parameters:
- Structure: cat 4
  - MTTFd: high
  - DC: high
- SIL 3 according to EN 62061 and 61508 with PFH_{DssD} = 2,4 x 10^{-10}

Additional instructions for the STO function: EN 61800 Teil 5.2.

For further information ask the application department.

NOTE

The above safety levels apply only if the safety instructions listed below will be considered and respected.

- The classification of the safety category applies only to the STO function.
- The following switching measures must be met to achieve the safety function:
  - Two-channel connection of the shutdown via 1 safety relay and the pulse enable circuit of the BM4400- controller LC3 for applications which require a risk minimization according to PL-d or SIL 2.
  - Two-channel connection of the shutdown via 2 safety relays for applications which require a risk minimization according to PL-e or SIL 3.
  - Control of the force-operated opener
  - Using an external circuit or a switching device that is suitable for the two-channel circuit with the necessary control (i.e., safety relay or safety controller)
- The perfect function of the relay must be checked at least once a year. The relay must hereby be unplugged, and the NC contact must be monitored for the closing function.
- Prior to switching on the drive for the first time (via a safety device), the state of the NC contact must be monitored for its closing function.
- Abruptly stopping the drive or an out-of-round operation can be triggered by an error in the safety chain. The drive must be switched off when this error occurs.
- Function STO separates the drive only from its torque and not the voltage. For safe separation of the supply, another action (i.e. the use of a main switch) must be used.
- In the unlikely event of total failure of an internal driver (IGBT) or an actuator element, it can trigger a temporary excitement of the drive (also in the STO state). The angular movement covered in this case depends on the rotor position and the number of pole pairs of the motor. It amounts to a maximum of 180°/number of pole pairs.
- The safety function STO must not be used on drives, on which an external force effect is possible.
- The external control has to do a plausibility monitoring between the request signals for STO and the checkback signal.
- The mounting has to be done in a installation space with a protective system of at least IP 54.

- The cabling has to be done in such way shorts or cross circuits won´t be possible.
- The additional application has to meet at least the requirements of the requested risk minimization (PL-d,/SIL2 or PL-e/SIL3).

E.2.2 Function principle STO

1) Applications that require a risk minimization according to performance level d (EN ISO 13849-1) or SIL 2 (EN 62061) according to chapter ▷E.2.1 Safety classification and safety instructions◁ from page 270 must have 2 independent shutdown paths, which are used to shut down the commutation in the power section of the inverter.

For this risk minimization the two-channel shutdown via 1 safety relay with feedback on the basic unit and the pulse enable circuit of the BM4400 controller LC3 is realized.

The following Baumüller inverters of the b maXX® series of the device model BM44xx-xxY-xxxxx[Ryy]-**S01**-xx in combination with the Baumüller BM4000 controller LC3 in the respective device model have this shutdown paths:

BM44xx-xxY-xxxxx[Ryy]-**S01**-xxwith Y = 1, 3, 5:
device model with one safety relay and a discrete pulse enable circuit (size 1-7)

2) Applications for a risk minimization according to performance level e (EN ISO 13849-1) or SIL 3 (EN62061) therefore need 2 independent shutdown paths, too.
In contrast to **1)** for this risk minimization the two-channel shutdown has to be relized via two safety relays.

The Baumüller inverters of the b maXX® series of the device model BM44xx-xxY-xxxxx[Ryy]-**S01**-xx in combination with the Baumüller BM4000 controller LC3 in the respective device model have this shutdown paths:

BM44xx-xxY-xxxxx[Ryy]-**S01**-xx with Y= 2, 4, 6:
device model with two safety relays (size 3-7)

Beside the shutdown by the two safety relays at this device models there is an additional functional shutdown by the pulse enable circuit of the BM4000 contoller LC3 possible.
Because of reaching the performance levels e and SIL 3 with the shutdown by two safety relays, this third shutdown path is not regarded for safety.

For this two-channel shutdowns the connection diagrams in ▷E.2.2.3 Connection diagram◁ from page 277 and the instructions according to ▷E.2.1 Safety classification and safety instructions◁ from page 270 have to be regarded absolutely.

E.2.2.1 Shutdown paths

Shutdown path A

Safety relay for the inverter BM44xx

The function of the safety relay is executed in fail-safe-technic, also named closed-circuit principle. The safety function “safe stop” is active, as long as no voltage is applied to the input connectors (102-3/4; X103-3/4). Consequently the functioning of the safety function is guaranteed if power failure takes place. In order to deactivate “safe stop” a voltage of 24 V has to be applied to the connectors, which are intended for this use (102-3/4; X103-3/4).

For the external error monitoring of the safety relay, the instantaneous control state can be interrogated at its positively driven status signal contact (X102-1/2; X103-1/2). In case there is no voltage applied to the safety relay (102-3/4; X103-3/4), that means during the “safe stop”, then the status signal contact is closed (NC contact). Also a parting of a cable can thusly be recognized as an error.

If the voltage at the input connectors the relay (X102-3/4; X103-3/4) is switched off, then the inverter generates either the message „power unit warning 20: undervoltage safety relay“ or the message „power unit error 87: error safety relay“. With pulse enable disabled the warning message (warning is not stored) and with pulse enable enabled the error message (error message is stored) is generated. Commissioning or enabling the drive is with no error written in the error memory. This error memory can be reseted e.g. by the digital input X1/1 at the function module DIO-01. Therefore the input X1/1 has to be set up accordingly. The starting pulse length at X1/1 has to be present for at least 5 ms.

NOTE

The closing- and opening sequence of the release signals as well as of the safety relay must be considered in order to assure a faultless operation of the drive. See ▹Figure 97◃ on page 274.

Schematic diagram safety relay

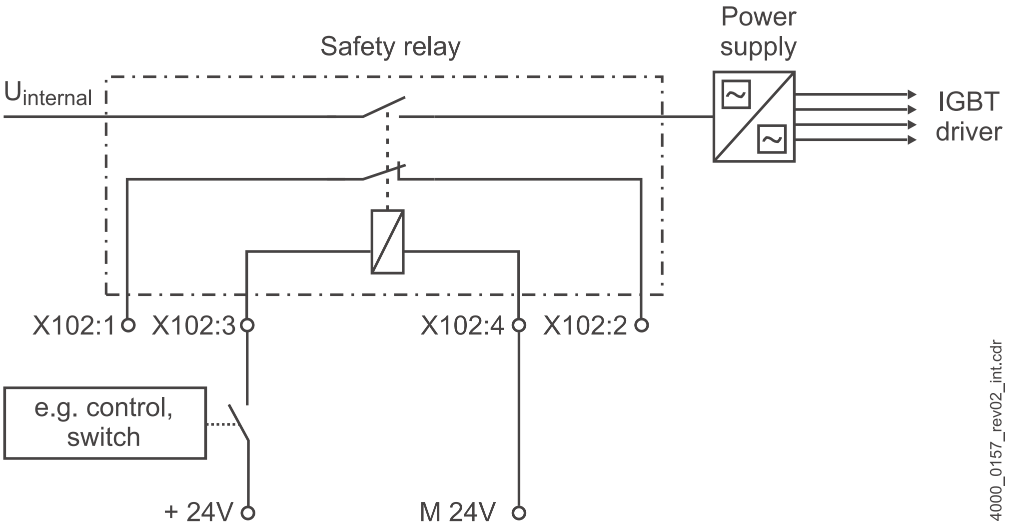


Figure 96: Schematic diagram safety relay

Shutdown path B

Pulse enable at the BM4000 controller LC3

The safety function pulse enable is as long active as no voltage applies to the input connectors (X3-3/5). In this case the pulses for the IGBT trigger are disabled.

For disabling the safety function a voltage of 24 V has to be applied on the destined connectors (X3-3/5).

E.2.2.2 Sequence diagram

The closing- and opening sequence of the release signals as well as of the safety relay must be considered in order to assure a faultless operation of the drive.

NOTE

Before the commissioning of the machine, in which the converter with the safety relay is built in, this safety function must be checked. For that purpose a safety device must be executed (for example door contact). The motor must now be zero-torque.

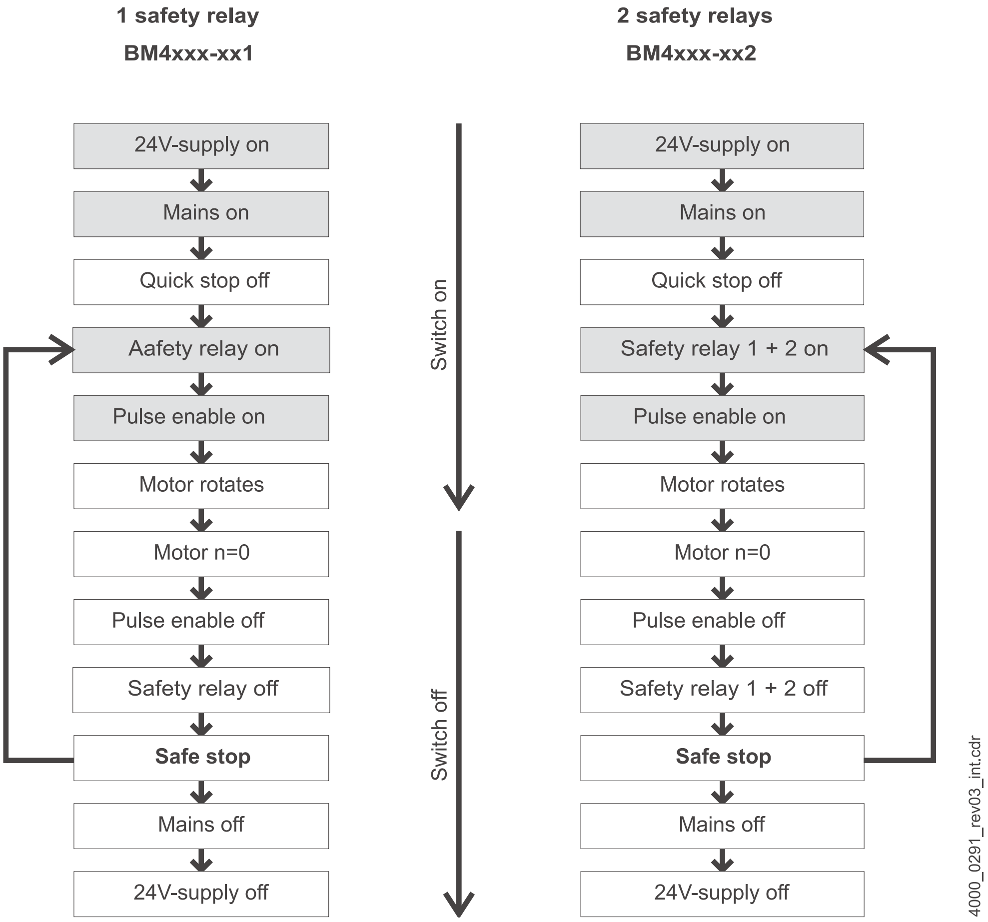


Figure 97: Sequence diagram of 1 or 2 safety relays

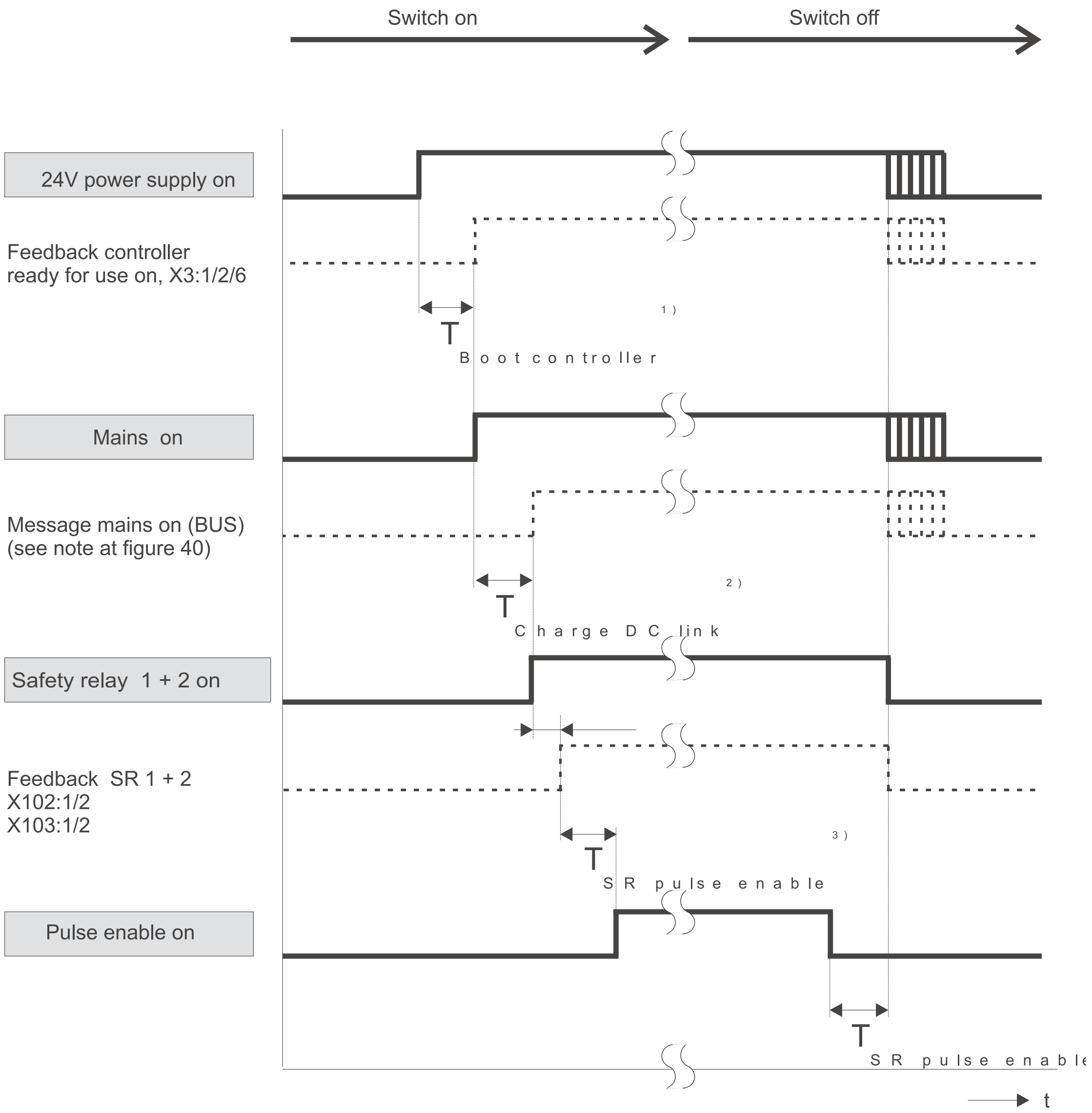


Figure 98: Timing diagram: recommended closing/opening sequence. Different closing/opening sequence possible. See table ▹Different closing/opening options BM441x to BM447x◃ on page 276.

(1) $T_{Boot\_controller}$ dependent on the used option module (from firmware version 03.05) approx. 5 s.

(2) $T_{charge\ DC\ link}$: 1,5 s (exception b maXX® 443X: 6 s).

(3) $T_{SR\_pulse\ enable}$: 20 ms (exception b maXX® 442X: 200 ms).

Different closing/opening options BM441x to BM447x

closing/opening condition	BM441x	BM442x	BM443x	BM444x	BM445x	BM446x	BM447x
Auxiliary supply (24 V) and safety relay 1 + 2 and mains simultaneous ON	yes	yes	yes	yes	yes	yes	yes
Auxiliary supply (24 V) and safety relay 1 + 2 simultaneous ON	yes	yes	yes	yes	yes	yes	yes
Mains „OFF“ → mains „ON“ at IS	yes	yes	yes	yes	yes	yes	yes
Pulse enable „ON“ at already switched on safety relay	yes	yes	yes	yes	yes	yes	yes
Pulse enable and safety relay 1 + 2 simultaneous „ON“	no	no	no	no	no	no	no
Pulse enable and safety relay 1 + 2 simultaneous „OFF“	no	no	no	no	no	no	no
Safety relay 1 + 2 “ON“ 20 ms **before** pulse enable	yes	no 1)	yes	yes	yes	yes	yes
Safety relay 1 + 2 “OFF“ 20 ms **after** pulse enable	yes	no 1)	yes	yes	yes	yes	yes

1) „yes“, if $T_{SR\_pulse\ enable}$ = 200 ms

E.2.2.3 Connection diagram

- **Device models BM4400 with one safety relay and pulse enable** at the BM4000 controller LC3 (size 1 - 7)

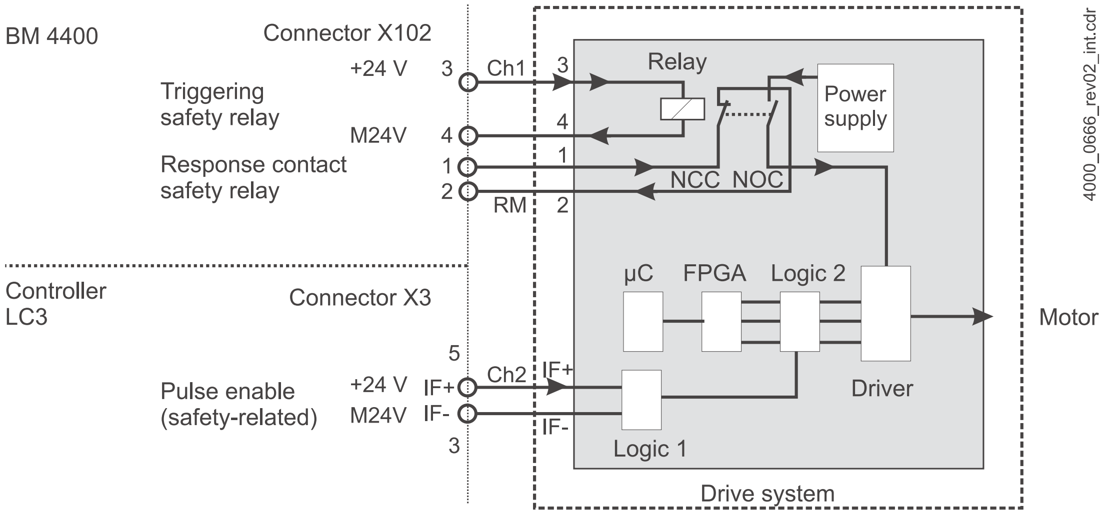


Figure 99: Shutdown paths for BM4400 with one safety relay (1. safe shutdown path) and pulse enable at the controller LC3 (2. safe shutdown path)

- **Device models BM4400 with two safety relays**

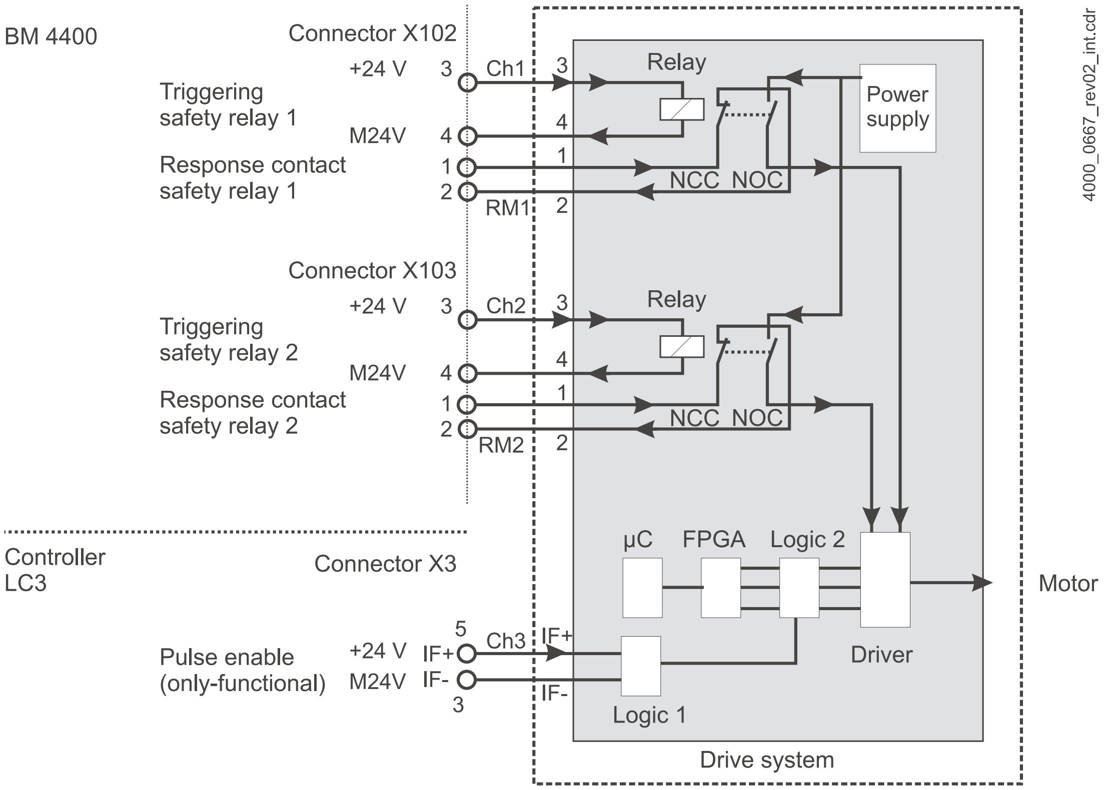


Figure 100: Shutdown paths for BM4400 with two safety relays (safe shutdown paths) and pulse enable at the controller LC3 (functional)

The shutdown paths on the terminals X102 and X103 of the inverter BM4400 (safety relay) are relaized by force-operated relays, which interrupt the drive supply for the motor control.

Only when the relays are current-carrying the drive can set in motion (control inputs X102-3/4; X103-3/4).

The state of the relay contacts can be interrogated by the force-operated opener (signal outputs X102-1/2; X103-1/2)

At the device model BM4400 with one safety relay, the second shutdown path is realized by the pulse enable at the device of the BM4400 controller LC3.

The safety function pulse enable is as long active as no voltage applies to the input connectors (X3-3/5). In this case the pulses for the IGBT trigger are disabled.

For disabling the safety function a voltage of 24 V has to be applied on the destined connectors (X3-3/5).

E.3 Safe stop

E.3.1 Safety categories according to EN 954-1

Dependent on the possible dangers (these are rated due to the consideration of the severity of the injuries, the frequency of the length of stay within the danger area and possibilities in order to prevent dangers) safety-related components of machines must meet certain safety criteria. The requirements to safety-based parts are divided into five categories in the standard EN 954-1.

In category B basic demands, in 1 additionally safety-technical checked components and principles are claimed. In category 2 an error between inspection intervals can lead to a loss of the safety function.

Category 3 accords to the level 'the single-error-certainty to recognize errors partially". The safety-related components must be in such a way, that a single error doesn't lead to a loss of the safety function, whereat not the complete possible errors can be self-contained recognized by the system. Therefore an accumulation of unrecognized errors can lead to a loss of the safety function.

Category 4 accords to the level 'Self-monitoring". This component recognizes self-contained possible errors and signals these in time of the loss of the safety function. Also if up to three from one another independent errors arise the safety function is always maintained.

The Baumüller converter of series b maXX (BM443X-XX2, BM444X-XX2, BM445X-XX2, BM446X-XX2, BM447X-XX2), which can be carried out optional with two safety relays (BM4XXX-XX2), comply with die requirements of **category 4** as well as with **category 3** (EN 954-1) for the safety function „Safe stop“.

The Baumüller converter of series b maXX (BM441X-XX1, BM442X-XX1, BM443X-XX1, BM444X-XX1, BM445X-XX1, BM446X-XX1, BM447X-XX1), which are optional carried out with one safety relay (BM4XXX-XX1), comply with the requirements of **category 3** (EN 954-1) for the safety function „Safe stop“.

E.3.2 The safety relay

The function of the safety relay is executed in fail-safe-technic, also named closed-circuit principle. The safety function ’Safe stop” is active, as long as no voltage is applied to the input terminals (X102-3/4; X103-3/4). Consequently the functioning of the safety function is guaranteed if power failure operates. In order to deactivate ’Safe stop” a voltage of 24 V must be applied to the terminals, which are concerned
(X102-3/4; X103-3/4).

For external monitoring of the safety relay´ the present state signal can be scanned at its positively-driven status signal contacts(X102-1/2; X103-1/2). In case there is no voltage applied to the safety relay (X102-3/4; X103-3/4), that means during the ’Safe stop”, then the status signal contacts are closed (NC contact). Also a parting of a cable can thusly be recognized as an error.

If the voltage at the input terminals of the relay (X102-3/4;X103-3/4)is switched off, the converter either generates the message “Power unit warning 20: Undervoltage safety relay” or the message “Power unit Error 87: Error safety relay”. At inhibited pulse enable the warning message (warning will not be saved) is generated and at a given pulse enable the fault indication or error message (error message will be saved) is generated. A commissioning or an enable of the drive is only possible, if there is no error in the error storage. This error storage can, for example, be reset over the digital input X1/1 of the function module DIO-01. For this the input X1/1 accordingly must be configured. The switch-on pulse length at X1/1 must be 5 ms minimum.

E.3.3 Application example for machine of category 3

Exemplary, the following diagram shows the usage and cabling of a Baumüller converter of the series b maXX in a machine tool, at which the safe taking of work pieces at opened cover is possible according to category 3 (EN 954-1).

- Application example for machine of category 3 with two switch-off channels:
  Pulse enable and a safety relay.

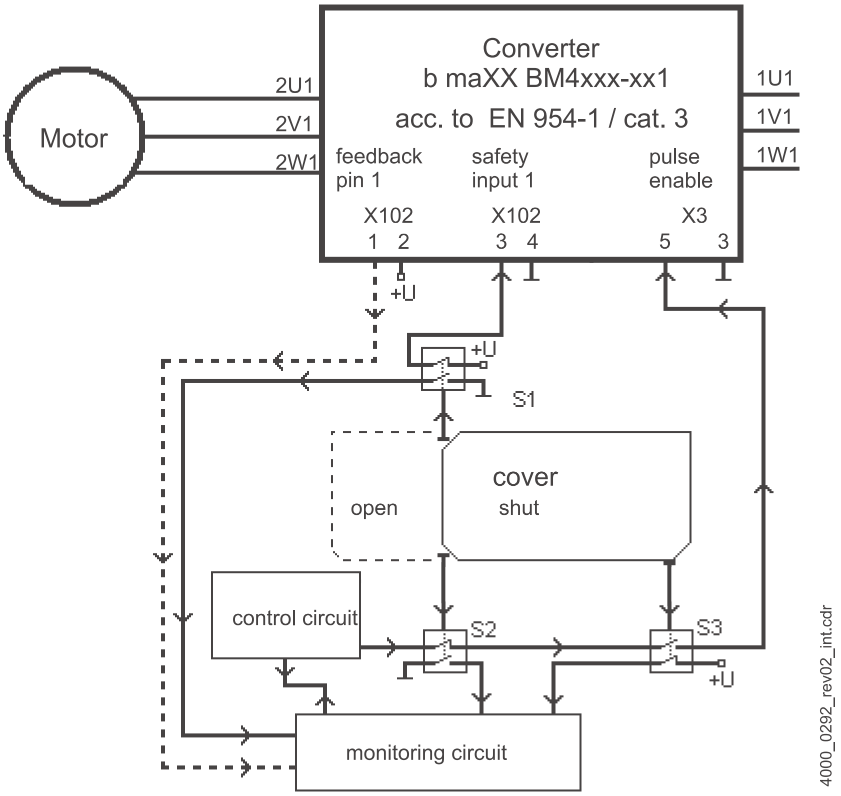


Figure 101: Version with one safety relay (BM4XXX-XX1)

The switching-off of the electrical drive motor operates dual-ported.

- S2 (NC contact) and S3 (NO contact) effectuate the pulse enable input of the converter by hardware (X3-5). Only if S2 and S3 display a closed cover (and therewith a safe state) voltage is being applied to the pulse enable input of the converter.
- S1 (NC contact) has hardware effects on the safety relay of the converter. Only if S1 shows a closed cover (and therewith a safe state) there is voltage at the safety relay input (X102: 3) and therewith a torque is possible to be generated at the shaft of the motor. The NO contact of S1 is connected with the monitoring circuit.
- The monitoring circuit, a fail-safe monitoring control of the category 3 (EN 954-1), checks on its own the directly connected switching contacts of the position switch S1 (NO contact), S2 (NO contact) and S3 (NC contact). The control circuit will not receive an enable signal from the monitoring circuit, if the cover is not completely closed or if there is a theoretically impossible state of the position switch contacts (e. g. if S1 and S2 are showing a differing switch state or if S2 and S3 are showing the same switch state). A missing enable signal of the monitoring device leads to a direct switching off of the converter by means of the control circuit. If

the monitoring circuit has recognized an error (for example different switch state of S1 and S2), this is displayed to the operator and a commissioning of the drive is not possible until the error has been repaired.

- The status signal contact of the safety relay (X102:1; NC contact) can additionally be evaluated by the monitoring circuit (not imperative).
- The position switches, which are used, must unavoidable have actuated and mechanical connected contacts as well as a dual-port connection (NC contact/ NO contact). The mechanical operating at the safety device must take place unavoidable, that means tamper-resistant.

The connection cables between the safety relay input (X102-3/4) and the control as well as between the pulse enable input at the converter (X3-5) and the control must not be installed outside the control cabinet in a common cable channel.

E.3.4 Application example for machine of category 4

The diagram shows exemplary the usage and cabling of a Baumüller converter of the series b maXX (BM443X-XX2, BM444X-XX2, BM445X-XX2, BM446X-XX2, BM447X-XX2) of a machine tool, at which the safe taking of work pieces at opened cover according to category 4 (EN 954-1) is possible.

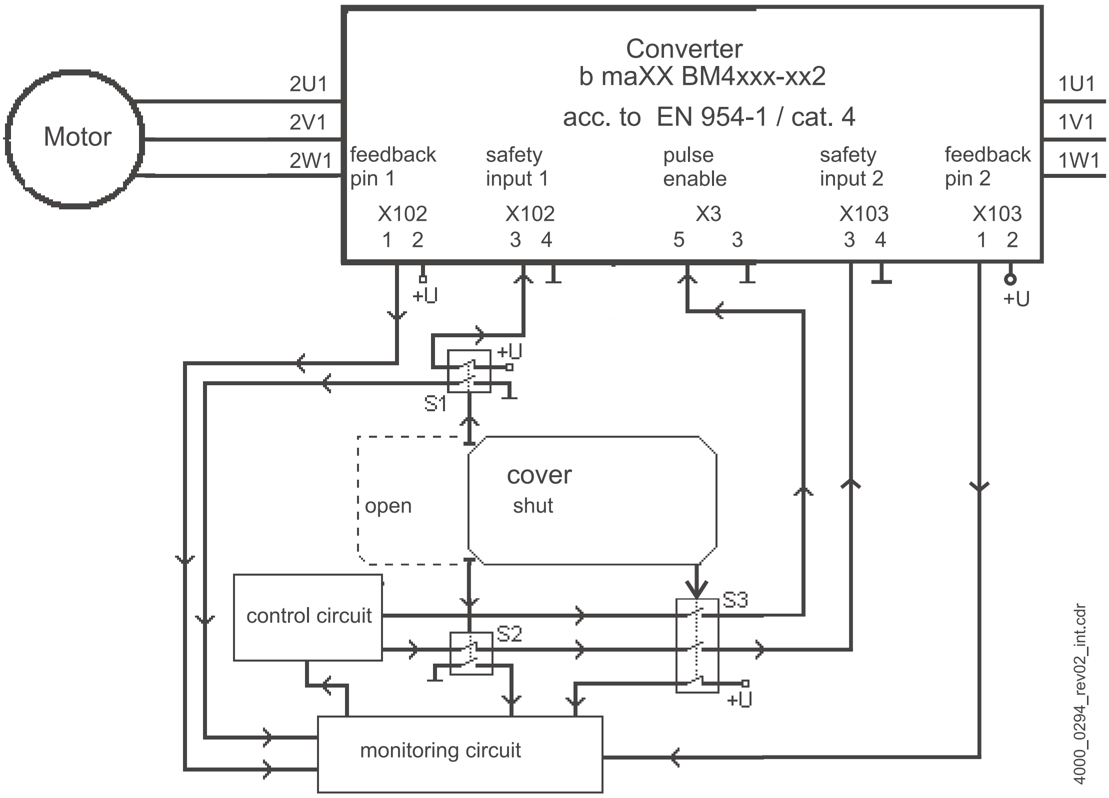


Figure 102: Version with two safety relays (BM4XXX-XX2)

The switching-off of the electrical drive motor takes place with three channels.

- S1 (NC contact) has hardware effects on the safety relay of the converter. Only if S1 shows a closed cover (and therewith a safe state) there is voltage at the safety relay input (X102: 3) and therewith a torque is possible to be generated at the shaft of the motor. The NO contact of S1 is connected with the monitoring circuit.
- S2 (NC contact) and S3 (NO contact) effectuate the safety relay of the converter. Only if S2 and S3 display a closed cover (and therewith a safe state) there is voltage at the safety relay input (X103: 3) and therewith makes a generation of a torque possible at the shaft of the motor.
- S3 (NO contact) has hardware effects on the pulse enable input of the converter (X3: 5). Only if S3 displays a closed barrier (and therewith a safe state) voltage is applied to the pulse enable input of the converter.

- The monitoring circuit, a fail-safe monitoring control of the category 4 (EN 954-1), checks on its own the directly connected switch contacts of the position switches S1 (NO contact), S2 (NO contact), S3 (NC contact) and the status signal contacts of the safety relay (X102: 1/2 NC contact, X103: 1,2 NC contact) as well as the contactor K1 (NO contact). X103-1/2 NC contact). If the cover is not completely closed or if there is a theoretically impossible state of the position switch contacts (e. g. S1 and S2 display a differing switch state or if S2 and S3 display the same switch state or if the status signal contact of the safety relay is opened/ closed, although the status signal contact of S1 is opened/closed), the control circuit does not receive an enable signal from the monitoring circuit. A missing enable signal of the monitoring device leads to a direct switching off of the converter by means of the control circuit. If the monitoring circuit has recognized an error (for example different switch condition of S1 and S2), this if displayed to the operator and the commissioning of the drive is not possible until the error has been repaired.
- The position switches, which are used, must unavoidable have actuated and mechanical connected contacts as well as a dual-port connection (NC contact/ NO contact). The mechanical operating at the safety device must take place unavoidable, that means tamper-resistant.

The connection cables between the safety relay inputs (X102-3/4; X103-3/4) as well as between the pulse enable input (X3-5) and the control circuit may not be run together in a cable channel outside the control cabinet.

All information given in the manual for the converter, especially the chapters safety instructions, installation and commissioning, must absolutely be observed.

For the use and the installation of the safety devices the relevant legal and official requirements of the Safety Authorities and of the EU Directives for safety-engineering regulations at installations and machines (for example EN 60204-1, security of machines, electric equipment and EN 292-2, security of machines - general configuration guidelines).

E.3.5 Application upgrade

At the converter of series b maXX (BM443X-XX2 to BM447X-XX2) the safety function „Safe stop“ is achieved via three independent switch off channels and a hardware pulse enable input (category 4 acc. to EN 954-1).

However, in many ranges it is not necessary, that the „Safe Stop“ is executed in category 4.

In the following, application examples are viewed, at which only two of the three switch off channels are used.

- **Application example 1**
  Application example for machine of category 3 with hardwired pulse enable input and process data communication via a field bus.
  Switching off occurs by means of safety relay 1 and safety relay 2.

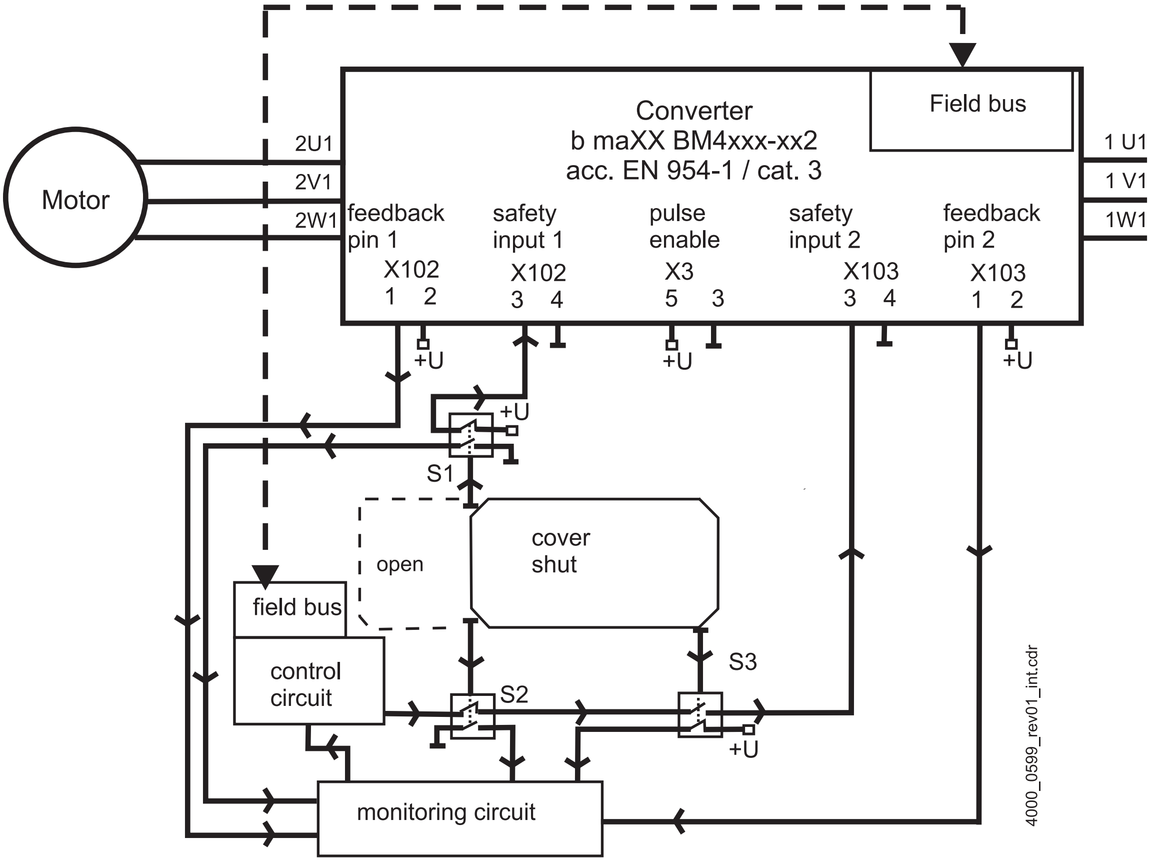


Figure 103: Version with two safety relays (BM4XXX-XX2)

At this sample the hardware pulse enable input (X3:5) is hardwired. The activation of the „Safe Stop“ occurs with two channels via the safety relay 1 and 2 (X102:3 / X103:3).

The release of the converter and the process data communication occurs via field bus.

- **Application example 2**
  Application example for machine of category 3 with two switch off channels:
  Pulse enable and a second common switch off channel for safety relay 1 and safety relay 2.

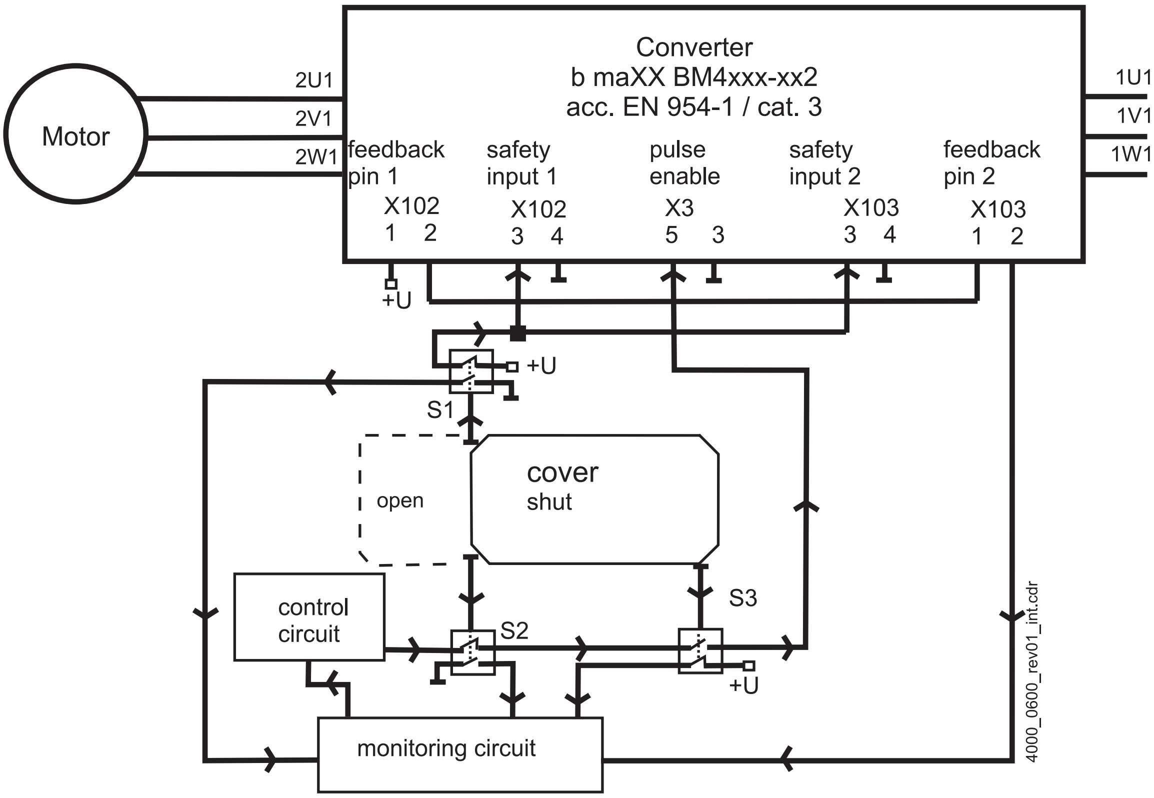


Figure 104: Version with two safety relays (BM4XXX-XX2)

At this example the safety relays 1 and 2 of a position switch are set and together form the first channel. The hardware pulse enable input forms the second channel, which is set, independent of the safety relay.

- **Application example 3**
  Pulse enable and only one safety relay

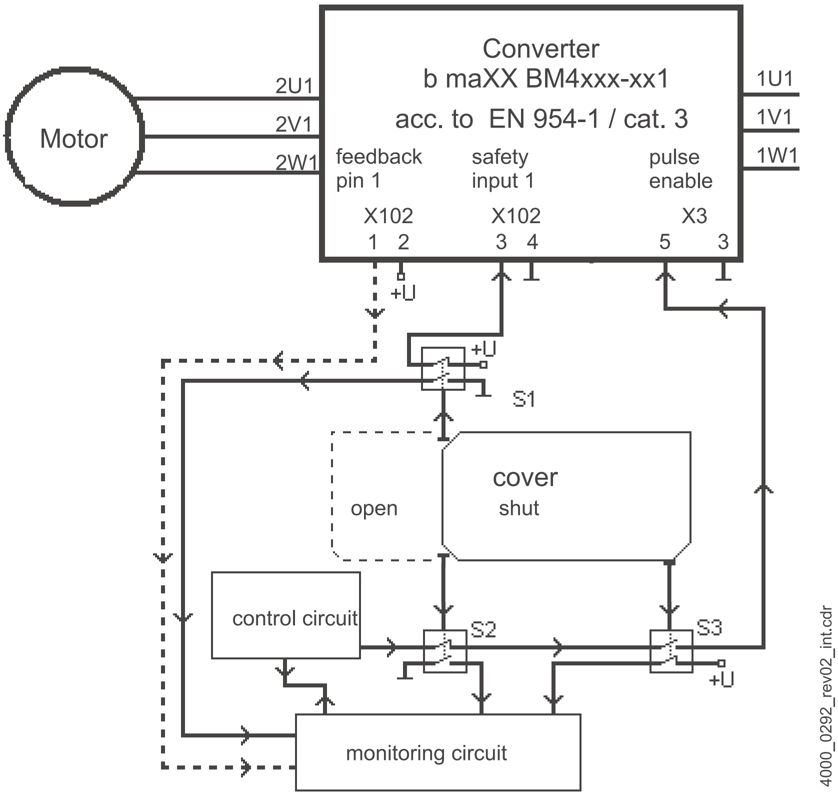
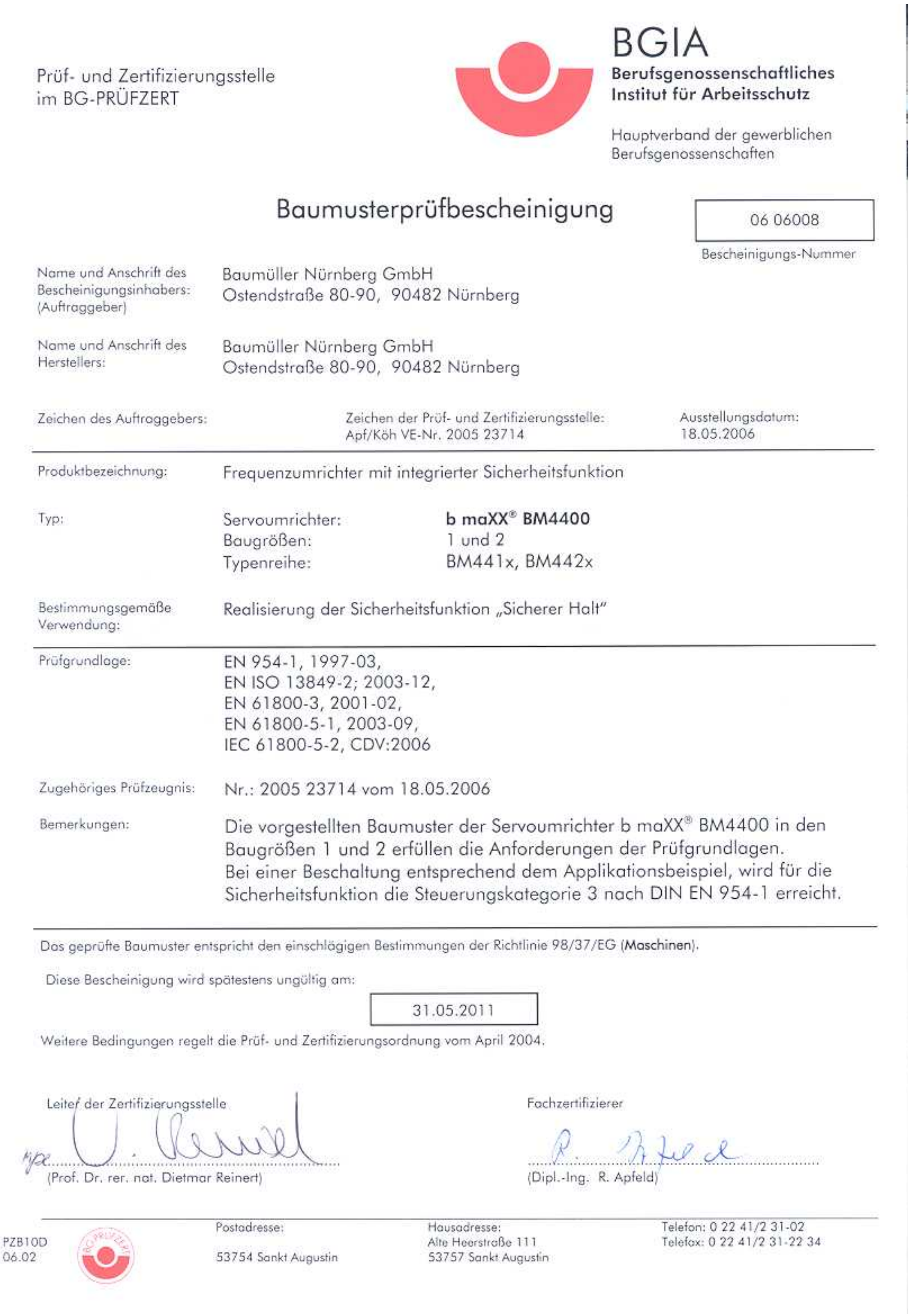


Figure 105: Version with a safety relay (BM4XXX-XX1)

This version of converter b maXX is equipped with one safety relay only. The hardware is identic with the other converters of this series - only the second relay is not equipped. The internal relay switch off paths are combined and together form the first channel.

The second channel forms a hardware pulse enable input, which is set independent of the safety relay.

E.3.6 Type Test Certificate BGIA



Prüf- und Zertifizierungsstelle
im BG-PRÜFZERT

BGIA
Berufsgenossenschaftliches
Institut für Arbeitsschutz

Hauptverband der gewerblichen
Berufsgenossenschaften

Baumusterprüfbescheinigung

06 06008
Bescheinigungs-Nummer

Name und Anschrift des Bescheinigungsinhabers: (Auftraggeber)	Baumüller Nürnberg GmbH Ostendstraße 80-90, 90482 Nürnberg
Name und Anschrift des Herstellers:	Baumüller Nürnberg GmbH Ostendstraße 80-90, 90482 Nürnberg

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle:
Apf/Köh VE-Nr. 2005 23714

Ausstellungsdatum:
18.05.2006

Produktbezeichnung:	Frequenzumrichter mit integrierter Sicherheitsfunktion	
Typ:	Servoumrichter:	**b maXX® BM4400**
	Baugrößen:	1 und 2
	Typenreihe:	BM441x, BM442x
Bestimmungsgemäße Verwendung:	Realisierung der Sicherheitsfunktion „Sicherer Halt"	
Prüfgrundlage:	EN 954-1, 1997-03, EN ISO 13849-2; 2003-12, EN 61800-3, 2001-02, EN 61800-5-1, 2003-09, IEC 61800-5-2, CDV:2006	
Zugehöriges Prüfzeugnis:	Nr.: 2005 23714 vom 18.05.2006	
Bemerkungen:	Die vorgestellten Baumuster der Servoumrichter b maXX® BM4400 in den Baugrößen 1 und 2 erfüllen die Anforderungen der Prüfgrundlagen. Bei einer Beschaltung entsprechend dem Applikationsbeispiel, wird für die Sicherheitsfunktion die Steuerungskategorie 3 nach DIN EN 954-1 erreicht.	

Das geprüfte Baumuster entspricht den einschlägigen Bestimmungen der Richtlinie 98/37/EG (**Maschinen**).

Diese Bescheinigung wird spätestens ungültig am:

31.05.2011

Weitere Bedingungen regelt die Prüf- und Zertifizierungsordnung vom April 2004.

Leiter der Zertifizierungsstelle
(Prof. Dr. rer. nat. Dietmar Reinert)

Fachzertifizierer
(Dipl.-Ing. R. Apfeld)

PZB10D
06.02

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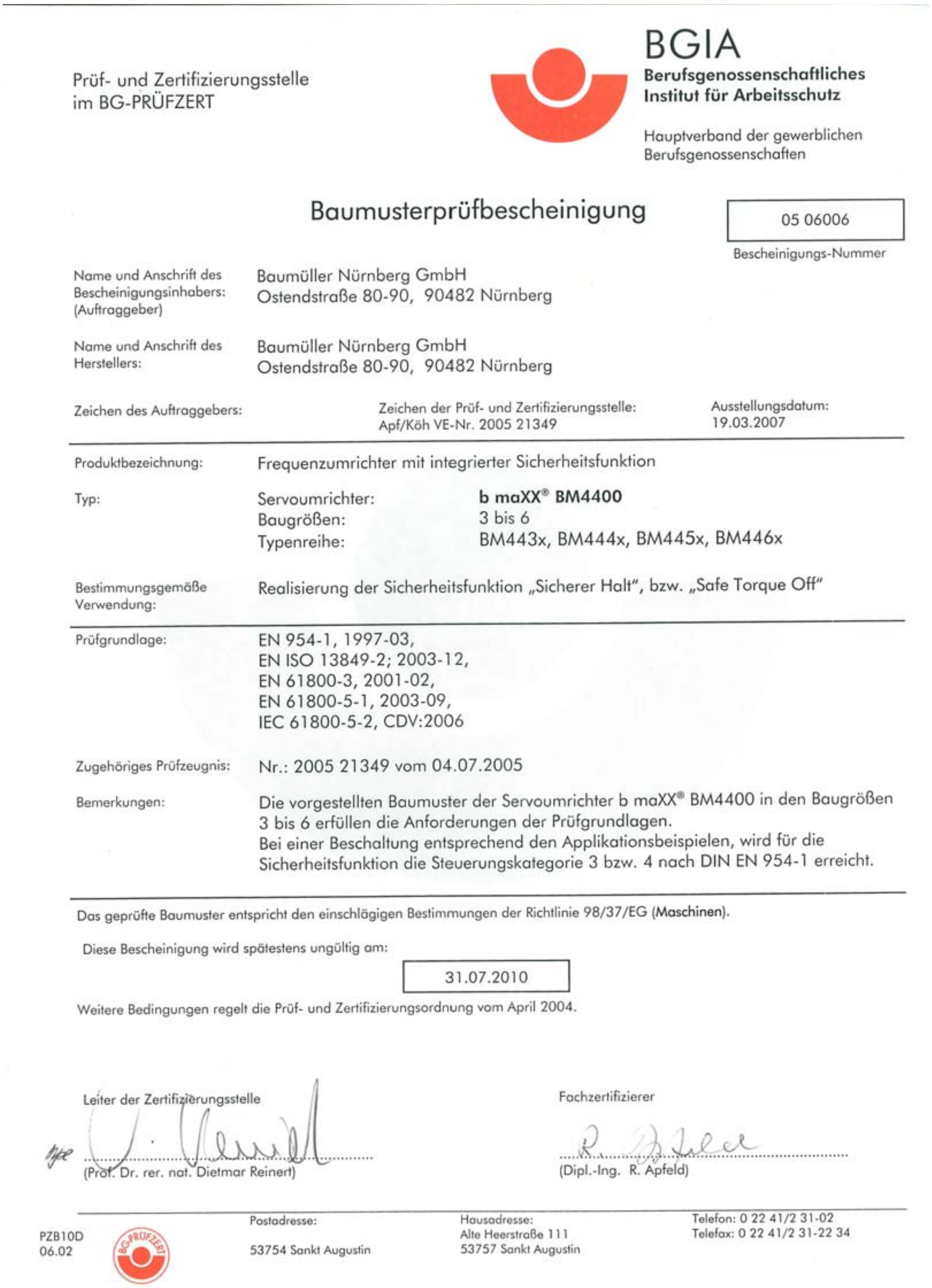

Prüf- und Zertifizierungsstelle
im BG-PRÜFZERT

BGIA
Berufsgenossenschaftliches
Institut für Arbeitsschutz
Hauptverband der gewerblichen
Berufsgenossenschaften

Baumusterprüfbescheinigung

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Name und Anschrift des Herstellers:
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Ostendstraße 80-90, 90482 Nürnberg

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle:
Apf/Köh VE-Nr. 2005 21349

Ausstellungsdatum:
19.03.2007

Produktbezeichnung: Frequenzumrichter mit integrierter Sicherheitsfunktion

Typ:
Servoumrichter: **b maXX® BM4400**
Baugrößen: 3 bis 6
Typenreihe: BM443x, BM444x, BM445x, BM446x

Bestimmungsgemäße Verwendung: Realisierung der Sicherheitsfunktion „Sicherer Halt“, bzw. „Safe Torque Off“

Prüfgrundlage:
EN 954-1, 1997-03,
EN ISO 13849-2; 2003-12,
EN 61800-3, 2001-02,
EN 61800-5-1, 2003-09,
IEC 61800-5-2, CDV:2006

Zugehöriges Prüfzeugnis: Nr.: 2005 21349 vom 04.07.2005

Bemerkungen: Die vorgestellten Baumuster der Servoumrichter b maXX® BM4400 in den Baugrößen 3 bis 6 erfüllen die Anforderungen der Prüfgrundlagen.
Bei einer Beschaltung entsprechend den Applikationsbeispielen, wird für die Sicherheitsfunktion die Steuerungskategorie 3 bzw. 4 nach DIN EN 954-1 erreicht.

Das geprüfte Baumuster entspricht den einschlägigen Bestimmungen der Richtlinie 98/37/EG (**Maschinen**).

Diese Bescheinigung wird spätestens ungültig am:

31.07.2010

Weitere Bedingungen regelt die Prüf- und Zertifizierungsordnung vom April 2004.

Leiter der Zertifizierungsstelle
(Prof. Dr. rer. nat. Dietmar Reinert)

Fachzertifizierer
R.
(Dipl.-Ing. R. Apfeld)

PZB10D
06.02

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E.3.7 Supplement for the test certificate 2005 21349

The series b maXX® (BM443X to BM446X) fulfills the requirements of the category 4 as well as the category 3 according to EN 954-1 provided that the circuit-technical implementation complies with the demands ▹E.3.5 Application upgrade◃ from page 285.

E.4 Requirements on an OSSD test pulse

The test pulses should detect static error conditions in the safety-related cicuits. The implementation of the test pulses occurs automatically in the background without affecting drive or safety functions.

In the device models **BM4400, BM4600, BM4700** the inputs pulse enable (X3-5) and safety relay (X102-3/4, X103-3/4) are for the use of an OSSD test pulse provided.

The test pulses have to keep the following absolute maximum ratings:

	value	**declaration**
t_{TPLmax}	3 ms	maximum low time of the test pulse
t_{TPmin}	100 ms	minimum period of the test pulse

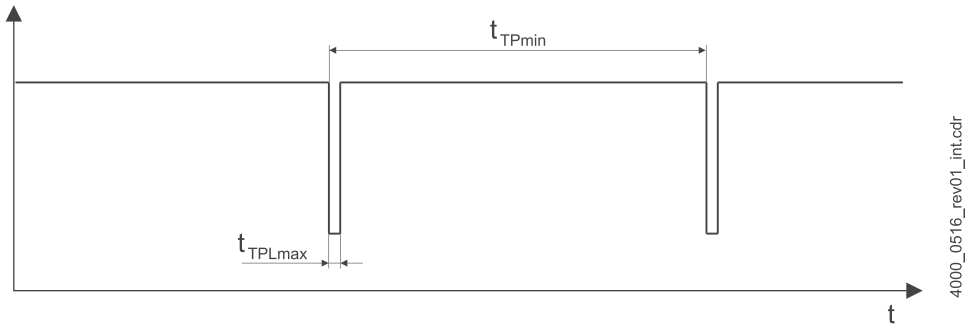

Figure 106: OSSD test pulse

Thresholds for the inputs X3-5 and X102-3/4, X103-3/4:

input	**threshold**
X3-5 (pulse enable)	low level: 0 V to 5 V high level: 12 V to 28 V
X102-3/4, X103-3/4 (safety relay)	high legel: 20 V to 28 V (24 V -15 % / +20 %)

E.5 Technical data safety relay module

WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

The danger is: ***mechanical influence*** *by failure of safety relay.*

Assure, the minimum current of the contacts X102-1 and X102-2 (or X103-1 and X103-2) not falling below during operation. Operate the safety relay within the specification.

NOTE

A device with safety relay, whose part number does **not** start with „**06**“, does not apply as a safety device as defined by the PL classification according to ISO 13849 or SIL according to EN 61800.

This device is not certificated for safety functions

NOTE

Only a device which is affixed with the test mark of the TUEV Rheinland has a certificated safety function.

Single safety relay:

	BM4XXX-XX**1**-XXXXX-S01 Single safety relay module with high power current contacts	BM4XXX-XX**3**-XXXXX-S01 Single safety relay module with low power current contacts1)	BM4XXX-XX**5**-XXXXX-S01 Single safety relay module Elestra
	Coil side, input signal of one safety relay (X102-3, X102-4)		
Nominal voltage U_{DC}	24 V	24 V	24 V
Operating voltage range	-15% / +20%	-15 % / +20 %	-15% / +20%
Control current I_{DC}	max. 70 mA	max. 70 mA	max. 35 mA
	Status signal contact, 1 x NC contact (X102-1, X102-2)		
Switching voltage U_{DC}	24 V	24 V	24 V
Switching current I_{DC}	10 mA to 4 A 2)	10 mA to 300 mA 2)	10 mA to 4 A 2)
Switch-on frequency	max. 6/min	max. 10/s	max. 12/s
Activation delay time at nominal voltage U_{DC}	max. 25 ms	max. 15 ms	max. 15 ms
Deactivation delay time	max. 15 ms	max. 12 ms	max. 12 ms
Electrical durability	at least 10^5 operating cycles	at least 10^5 operating cycles	at least 10^5 operating cycles
Mechanical durability	at least 1 x 10^7 switching cycles	at least 5 x 10^7 switching cycles	at least 1 x 10^7 switching cycles

1) only customer-specific versions
Please contact Baumüller Nürnberg GmbH before using this version.

2) A current on contact of at least 20 mA is recommended. If the load is below 20 mA the current on contact can be increased (see ▹Figure 107◃ on page 293).

Double safety relay:

	BM4XXX-XX**2**-XXXXX-S01 Double safety relay module with high power current contacts	BM4XXX-XX**4**-XXXXX-S01 Double safety relay module with low power current contacts1)	BM4XXX-XX**6**-XXXXX-S01 Double safety relay module Elestra
	Coil side, input signal of two safety relays (X102-3, X102-4) (X103-3, X103-4)		
Nominal voltage U_{DC}	24 V	24 V	24 V
Operating voltage range	-15% / +20%	-15 % / +20 %	-15% / +20%
Control current I_{DC}	max. 70 mA	max. 70 mA	max. 35 mA
	Status signal contact, 1 x NC contact (X102-1, X102-2) (X103-1, X103-2)		
Switching voltage U_{DC}	24 V	24 V	24 V
Switching current I_{DC}	10 mA to 4 A 2)	10 mA to 300 mA 2)	10 mA to 4 A 2)
Switch-on frequency	max. 6/min	max. 10/s	max. 12/s
Activation delay time at nominal voltage U_{DC}	max. 25 ms	max. 15 ms	max. 15 ms
Deactivation delay time	max. 15 ms	max. 12 ms	max. 12 ms
Electrical durability	at least 10^5 operating cycles	at least 10^5 operating cycles	at least 10^5 operating cycles
Mechanical durability	at least 1 x 10^7 switching cycles	at least 5 x 10^7 switching cycles	at least 1 x 10^7 switching cycles

1) only customer-specific versions
Please contact Baumüller Nürnberg GmbH before using this version.

2) A current on contact of at least 20 mA is recommended. If the load is below 20 mA the current on contact can be increased (see ▹Figure 107◃ on page 293).

- Installation of the feedback contact with permanent load

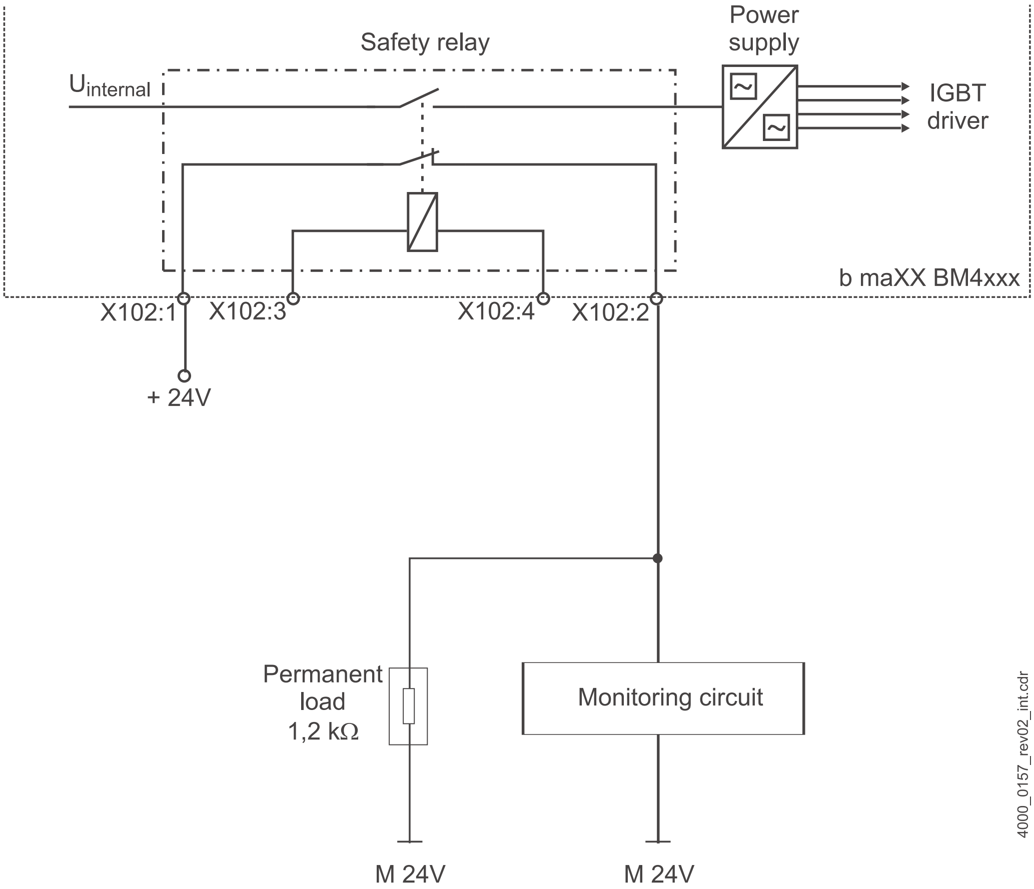

Figure 107: Installation of the feedback contact with permanent load

Permanent load e.g.:

Housing:	Phoenix Contact, EMG12-B2 Part No.: 2948306
Transparent cover:	Phoenix Contact, BMG12-H 7,5 mm Part No.: 2947116
Resistor:	1,2 kΩ / 1 W at T_U = 70 °C

Table of figures

Index

Revision survey

Version	Version	Changing
5.04043.03	28.07.2005	Chapter Revision survey inserted, technical data safety relay, b maXX® 4472 / 4473, interface cable RS 232, additional data water-cooled chopper resistors, instructions on hardware types XX**0**XX, XX**1**XX, XX**2**XX, X**0**XXX, X**1**XXX and X**2**XXX (type key), prototype test certification in chapter E „Safe stop“, polarity temperature sensor changed in the connection diagrams.
5.04043.04	02.05.2006	Protection type BM443X, BM444X, Chapter Fuses revised, dimensions/drilling patterns updated, derating curves for the installation altitude/lower frequency range inserted, BM447X included, chapter „safe stop“ completed, technical data safety module changed
5.04043.05	03.08.2007	Chapter Technical data updated, power modules added.
5.04043.06	13.11.2007	Chapter Fuses revised
5.04043.07	05.02.2008	Requirement on the motor, output frequency, DC link charge, safety relay, electrical data, connectors, interfaces revised
5.04043.08	24.11.2010	b maXX® 46XX / 47XX added. Safety engineering revised. STO added. Drilling pattern BM443X corrected.
5.04043.09	05.04.2011	BM4426 max. peak current time changed. Technical data BM4661, BM4662 and BM 4766 completed. Chapter Declaration of Conformity inserted. Pin-cable-lugs for BM4632 from chapter ▷D.30 Cables mains-device◁ on page 257 deleted.
5.04043.10	16.08.2011	Ch. 4.2.1.1 Slot combinations updated Ch. 4.6 UL-notes added Ch. 8.4.1 complemented and Figure updated Ch. 8.5 Error AIO-04 complemented Ch. D17 Commutation chokes BM4466 Part-no. changed Ch. D26.1 Mains chokes - dimensions complemented Note added concerning part number „06“

Notes:

be in motion

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