

# Manual

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**be in motion**    **be in motion**



**b maXX<sup>®</sup> BM1000**

**Basic unit**

<b>E</b>	5.07003.06
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**Read the Operating Manual before starting any work!**

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# Table of contents

<b>1</b>	<b>Introduction</b>	<b>7</b>
1.1	Survey of the appliance series <b>b maXX<sup>®</sup> BM1000</b>	7
1.2	First steps	7
1.3	Used terms	8
1.4	Copyright and trade mark	8
<b>2</b>	<b>Fundamental safety instructions</b>	<b>9</b>
2.1	General notes	9
2.2	Hazard information and commands	10
2.2.1	Hazard information structure	11
2.2.2	Form of the hazard sign (triangular or round)	11
2.2.2.1	Hazard information on personal injury	12
2.2.2.2	Hazard information on property damage	14
2.2.2.3	Command signs used	14
2.3	Information sign	14
2.4	Legal instructions	15
2.5	Appropriate use	15
2.6	Inappropriate use	16
2.7	Safety equipment	16
2.8	Training of the personnel	17
2.9	Safety precautions in normal operation	17
2.10	Dangers due to residual energy	17
2.11	Disposal of the device	18
2.12	Fire fighting	18
2.13	Responsibility and liability	18
2.13.1	Observing the safety notes and safety instructions	18
2.13.2	Dangers when handling this device	18
2.13.3	Warranty and Liability	19
<b>3</b>	<b>Transportation and packing</b>	<b>21</b>
3.1	To be considered by transportation	21
3.2	Unpacking	21
3.3	Dispose packing	22
<b>4</b>	<b>Description of the devices</b>	<b>23</b>
4.1	Structure	23
4.2	Interconnect the devices	24
4.3	Overview of dangerous areas	24
4.4	Marking of the device - type key	25
4.5	Preparation for installation and wiring	27
4.5.1	Remove keypad	27
4.5.2	Remove front cover	28
4.5.3	Remove main terminal cover	28
4.5.4	Remove motor terminal cover	28
4.5.5	Remove fan	29
<b>5</b>	<b>Mounting</b>	<b>31</b>
5.1	General safety instructions	31
5.2	Requirements to the executing personnel	32
5.3	Prepare mounting	33



## Table of contents

5.4	Installation space . . . . .	34
5.4.1	Installation space frame 1 . . . . .	34
5.4.2	Installation space frame 2 and 3 . . . . .	35
5.4.3	Installation with metal separation . . . . .	36
5.4.4	Installation without metal separation . . . . .	36
5.5	Dimensions . . . . .	37
5.6	Mounting instructions . . . . .	38
<b>6</b>	<b>Installation . . . . .</b>	<b>41</b>
6.1	General safety instructions . . . . .	41
6.2	Requirements to the executing personnel . . . . .	42
6.3	Requirements to the electrical mains . . . . .	42
6.4	Requirements to the connecting cables . . . . .	43
6.5	Protection of the device and of the cable respectively . . . . .	43
6.6	PE connection and RCD compatibility . . . . .	43
6.7	Requirements on the laying (EMC notes device) . . . . .	44
6.8	Operating sequence of installation . . . . .	45
6.9	Connection diagrams . . . . .	46
6.10	External connections . . . . .	52
6.10.1	Specifications of main circuit terminals . . . . .	54
6.10.2	Connecting main terminals . . . . .	55
6.10.3	Mains power terminals (R/L1, S/L2, T/L3) . . . . .	57
6.10.4	Output terminals (U/T1, V/T2, W/T3) . . . . .	57
6.10.5	Terminals [+B1, B2] for connecting chopper unit / braking resistor . . . . .	58
6.10.6	Grounding terminals . . . . .	59
6.11	Control Terminals . . . . .	60
6.11.1	Specification of control terminals . . . . .	60
6.11.2	Terminal symbols and functions . . . . .	61
6.11.3	Analog input terminals (AVI, ACI, ACM) . . . . .	63
6.11.4	Multi-function-inputs (MI1 to MI6, DCM) . . . . .	63
6.11.5	Multi-function output (MO1, MCM) . . . . .	63
6.12	External parts . . . . .	64
6.13	RFI jumper . . . . .	65
6.14	Connect the DC link of the devices in parallel . . . . .	66
6.15	Applications for mains chokes . . . . .	67
<b>7</b>	<b>Operation . . . . .</b>	<b>69</b>
7.1	Safety instructions . . . . .	69
7.2	Requirements to the executing personnel . . . . .	70
7.3	LEDs . . . . .	70
7.4	Digital keypad (option) . . . . .	71
7.5	Preparations before commissioning . . . . .	74
7.6	Commissioning example . . . . .	75
7.7	Maintenance . . . . .	78
<b>8</b>	<b>Error detection and troubleshooting . . . . .</b>	<b>79</b>
8.1	Safety instructions . . . . .	79
8.2	Requirements to the executing personnel . . . . .	79
8.3	Error information . . . . .	79
8.3.1	Fault code information . . . . .	80
8.4	Warning code information . . . . .	86
8.5	Reset . . . . .	87
8.6	Troubleshooting . . . . .	88
8.6.1	Overcurrent (OC) . . . . .	88
8.6.2	Ground fault . . . . .	89



8.6.3	Overvoltage . . . . .	89
8.6.4	Low voltage (Lv) . . . . .	90
8.6.5	Overheat (OH) . . . . .	91
8.6.6	Overload OL . . . . .	91
8.6.7	Keypad display is abnormal . . . . .	92
8.6.8	Phase Loss (PHL) . . . . .	92
8.6.9	Motor doesn't run . . . . .	93
8.6.10	Motor speed cannot be changed. . . . .	94
8.6.11	Motor stalls during acceleration. . . . .	95
8.6.12	The motor does not run as expected. . . . .	95
8.7	Electromagnetic/induction noise . . . . .	96
8.8	Environmental condition . . . . .	96
8.9	Affecting other machines . . . . .	97
<b>9</b>	<b>Maintenance . . . . .</b>	<b>99</b>
9.1	Safety instructions . . . . .	99
9.2	Environmental conditions. . . . .	100
9.3	Inspection intervals - maintenance notes . . . . .	100
9.3.1	periodical maintenance . . . . .	101
<b>10</b>	<b>Repair . . . . .</b>	<b>105</b>
<b>11</b>	<b>Shutdown, storage. . . . .</b>	<b>107</b>
11.1	Safety instructions . . . . .	107
11.2	Requirements to the executing personnel . . . . .	108
11.3	Shutdown. . . . .	108
11.4	Demounting . . . . .	108
11.5	Storage conditions . . . . .	109
11.6	Recommissioning . . . . .	109
<b>12</b>	<b>Disposal . . . . .</b>	<b>111</b>
12.1	Safety instructions . . . . .	111
12.2	Requirements to the executing personnel . . . . .	112
12.3	Disposal instructions . . . . .	113
12.3.1	Modules. . . . .	113
12.4	Recycling plants/offices . . . . .	113
<b>Appendix A</b>	<b>- Abbreviations . . . . .</b>	<b>115</b>
<b>Appendix B</b>	<b>- Spare parts and accessories . . . . .</b>	<b>117</b>
B.1	Chopper units and braking resistors . . . . .	117
B.1.1	Select a chopper unit /braking resistor . . . . .	118
B.1.2	Chopper units BM1-BTE . . . . .	119
B.1.3	Dimensions and weights for braking resistors . . . . .	125
B.2	Mains filters. . . . .	127
B.3	Chokes . . . . .	128
B.3.1	Mains chokes recommended values . . . . .	128
B.3.2	Output chokes recommended values. . . . .	129
B.4	Fuses for device-protection . . . . .	130
B.5	Non-fuse circuit breaker . . . . .	131
B.6	Digital keypad . . . . .	131
B.7	Digital keypad cable . . . . .	131
B.8	DIN rail . . . . .	132
B.8.1	BM1-MPL-01 . . . . .	132
B.8.2	BM1-MPL-02 . . . . .	133
B.8.3	BM1-EPL-00. . . . .	133



## Table of contents

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B.9	Accessories CANopen .....	134
<b>Appendix C - Declaration of Conformity .....</b>		
<b>135</b>		
C.1	What is an EU directive? .....	135
C.2	What the CE symbol indicates .....	135
C.3	Definition of the term Declaration of Conformity .....	136
C.4	Declaration of Conformity .....	136
<b>Appendix D - Technical data .....</b>		
<b>139</b>		
D.1	Required environmental conditions .....	140
D.2	Non-electrical data .....	140
D.3	Electrical data .....	141
D.4	General specifications .....	142
D.5	Fuse protection .....	144
D.5.1	Cable protection .....	145
D.5.2	Cable protection + device protection .....	145
D.6	Type of protection .....	145
D.7	Fire fighting appliances .....	145
<b>Appendix E - CANopen .....</b>		
<b>147</b>		
E.1	Interface assignment .....	148
E.2	Terminating plug for CANopen .....	148
E.3	Connection cables .....	148
E.4	Input wiring before using CANopen .....	149
E.5	Setting of address and baudrate .....	149
E.5.1	Setting via software parameters P0870 and P0871 .....	149
E.5.2	Setting of address via DIP switch without multiplier .....	150
E.5.3	Setting of address via DIP switch with multiplier .....	152
E.6	CANopen display functions .....	153
E.6.1	LED display .....	153
E.6.2	CANopen error display via digital keypad .....	155
<b>Appendix F - How to select the right b maXX® .....</b>		
<b>157</b>		
F.1	Capacity formulas .....	159
F.2	General precaution .....	161
F.3	How to choose a suitable motor .....	162
F.3.1	Standard motor .....	162
F.3.2	Special motors: .....	163
F.4	Power Transmission Mechanism .....	163
F.5	Motor torque .....	164
<b>Table of figures .....</b>		
<b>165</b>		
<b>Index .....</b>		
<b>167</b>		
<b>Revision survey .....</b>		
<b>171</b>		

# INTRODUCTION

This manual is an important part of your **b maXX® BM1000** appliance. Therefore please read this manual completely, before starting any 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 appliance series **b maXX® BM1000**

---

This manual is to be used for the installation, parameter setting, troubleshooting, and daily maintenance of the Baumüller device '**b maXX® BM1000**'. To guarantee safe operation of the equipment, read the safety guidelines before connecting power to the **b maXX® BM1000**. Keep this operating manual at hand and distribute to all users for reference.

### WARNING



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

m serious personal injury m death

All persons, who work on and with devices of the series **b maXX®**, must have this manual available at their work place and must obey the instructions and notes contained therein - especially the safety instructions.

## 1.2 First steps

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- h Check delivery, see [ZTransportation and packing](#)– from page 21.
- h Provide for qualified personnel for the mounting, installation and commissioning.
- h Hand over this manual to the personnel for mounting, installation and commissioning. Assure that especially the safety instructions are understood and obeyed.

## 1.3 Used terms

---

### 1.3 Used terms

---

In this manual we will also use the term 'device' for the Baumüller product '**b maXX**<sup>®</sup>'. A list of the abbreviations which are used are to be found in [ZAppendix A - Abbreviations](#) from page 115.

### 1.4 Copyright and trade mark

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**b maXX**<sup>®</sup> is a registered trade mark of Baumüller Nürnberg GmbH



# 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:

m serious personal injury    m 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**

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

#### **WARNING**

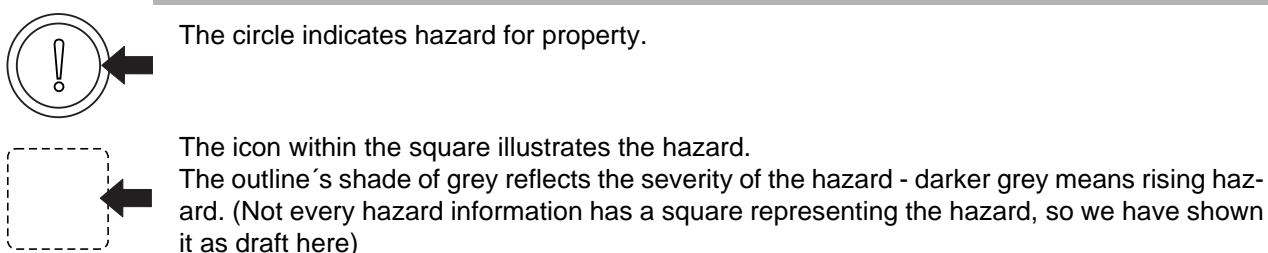
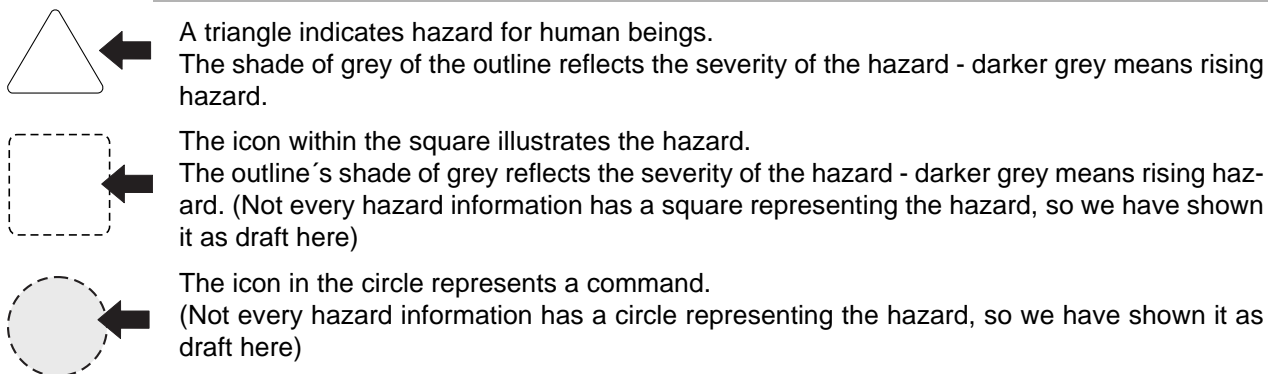
m serious property damage m serious personal injury m death - **may** occur

#### **CAUTION**

m minor to medium personal injury or  
m environmental pollution or  
m 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.



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 Hazard information and commands

---

### 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:  
m serious personal injury    m death



*The hazard is: **electricity**. 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:  
m serious personal injury    m 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:  
m serious personal injury    m 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.

---

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:  
m 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:  
m 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:  
m minor to medium personal injury.



*The hazard is: **injury of the eye caused by ricocheting 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 danger information:  
m environmental pollution.




*The hazard is: **inadequate disposal**. Here the hazard may be described in detail.*  
Here is described what you can do to avoid the hazard.

## 2.3 Information sign

---

### 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:  
m 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.



### 2.2.2.3 Command signs used

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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, disconnecter, 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.

- m project the application in such a way, that you always operate the device within its specification.
- m use this device only as converter for drives.
- m make sure, that only qualified personnel work with/at this device.
- m install this device only on an adequate carrying wall.
- m install this device in the way as it is described in the documentation.
- m make sure, that the mains/power supply unit always applies to the predetermined specifications.
- m only operate the device, if it is technical faultlessly.
- m operate this device only in combination with released components of the company Baumüller Nürnberg GmbH.
- m always operate the device in an area as it is instructed in the „Technical data“.
- m always operate the device in serialized condition.  
Due to safety reasons you must not rebuild the device.
- m 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:

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

### 2.7 Safety equipment

---

The devices **b maXX® BM1000** comply with the protection class IP 20.

#### WARNING

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

- m serious personal injury
- m 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:

m serious personal injury    m 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

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

h 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. To prevent personal injury, please ensure that power has been turned off before opening the **b maXX® BM1000** and wait ten minutes for the capacitors to discharge to safe voltage levels.

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

---

### 2.11 Disposal of the device

---

The accurate disposal of the device is described in [Z12 Disposal](#)– on page 111.

### 2.12 Fire fighting

---



#### WARNING

The following **may occur**, if you do not observe this warning information:  
m serious personal injury m death



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



Use this fire extinguishing agent:  
ABC powder / CO<sub>2</sub>

### 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:  
m serious personal injury m 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 [ZFundamental safety instructions](#)– from page 9.

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 [ZInappropriate use](#)— from page 16 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:

- m -20°C to +60°C (temperature range)
- m max. 1 g (vibration, shock, repetitive shock)

## 3.2 Unpacking

---

After receipt of the device, which is still packed:

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

If so:

- h 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:

- m serious personal injury m 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

---



### 3.3 Dispose packing

---

If there is no transportation damage recognizable:

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

The minimum scope of supply is:

- m **b maXX<sup>®</sup> BM1000**
- m This manual inclusively the copy of the declaration of conformity/declaration of manufacturer
- h 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.

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

## DESCRIPTION OF THE DEVICES

In this chapter the basic construction of the device **b maXX<sup>®</sup> BM1000** is described and the type key on the devices is explained.



### NOTE

The devices of the **b maXX<sup>®</sup> BM1000**-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 [ZAppropriate use](#)— from page 15.

### 4.1 Structure

The devices of the **b maXX<sup>®</sup>**-series are converters of Baumüller Nürnberg GmbH. The devices consist of a power unit with an integrated controller.

The rated current of the devices reach for 1-phase devices from 1.6 A to 11 A and for 3-phase devices from 1.5 A to 24 A. The devices differ in size, power and cooling.



### NOTE

The **b maXX<sup>®</sup> BM1000** is to be used to control 3-phase asynchronous standard motors in the power range of 0.2 to 11 kW (rated power of the drive).

## 4.2 Interconnect the devices

This data is available in the type key (see [ZMarking of the device - type key](#)— on page 25).



Figure 1: b maXX® BM1000

## 4.2 Interconnect the devices

The device is part of the Baumüller series **b maXX® BM1000** and can be connected together with other Baumüller devices.

## 4.3 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 [ZHazard information and commands](#)— from page 10.



Figure 2: Danger areas b maXX® BM1000



### 4.4 Marking of the device - type key

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

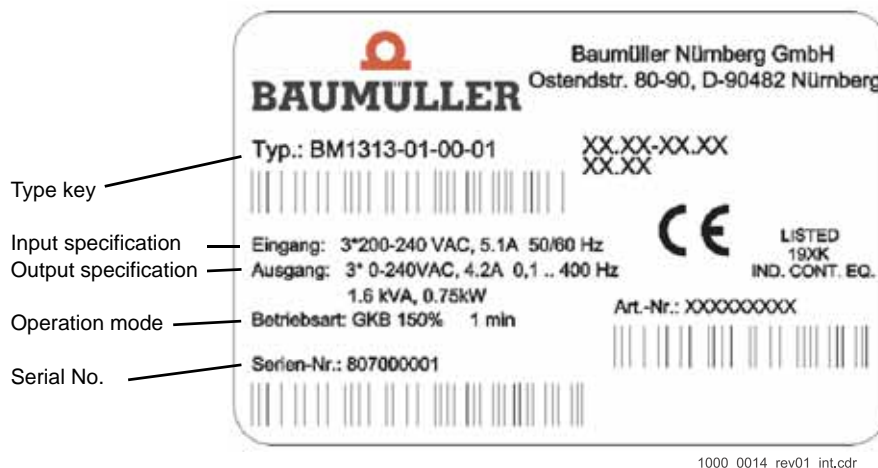


Figure 3: Type plate BM1000

#### m Type key

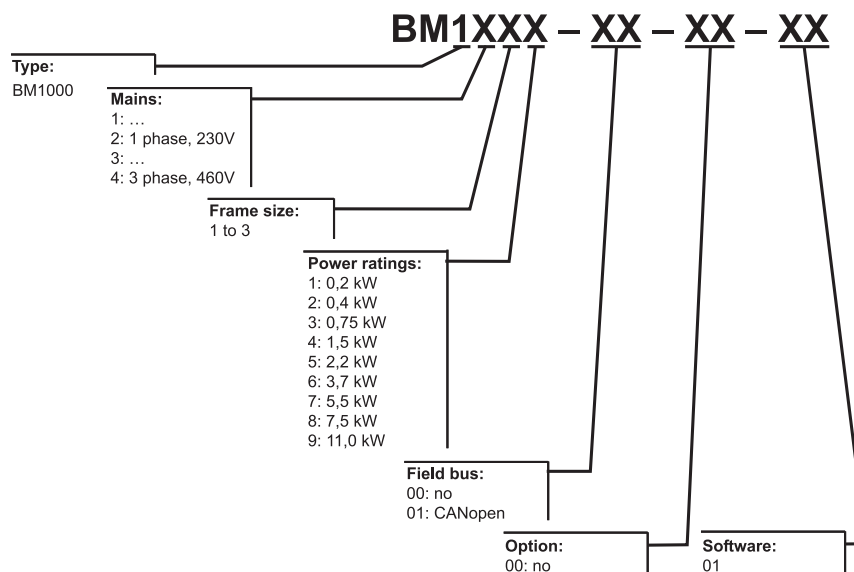


Figure 4: Type key BM1000



#### NOTE

If the type key information does not correspond to your purchase order or if there are any problems, please contact your distributor.

## 4.4 Marking of the device - type key

- m Drive frames
  - n Frame 1 (0,2 -1,5 kW)

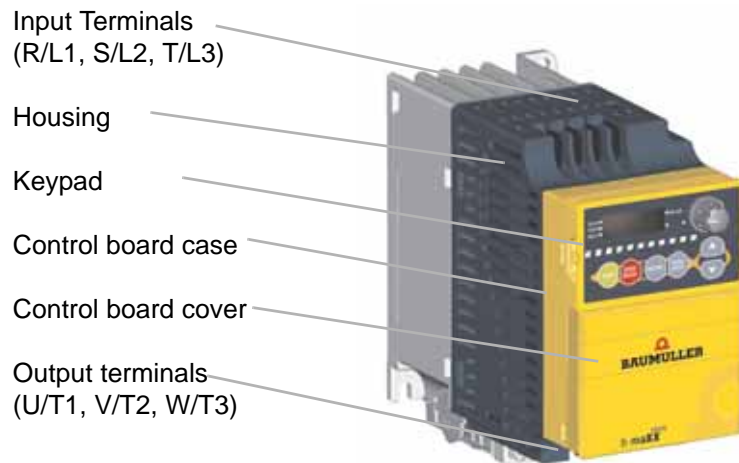


Figure 5: b maXX® BM1000 Frame 1

- n Frame 2 (0,75 - 3,7 kW)



Figure 6: b maXX® BM1000 Frame 2

n Frame 3 (5,5 - 11,0 kW)



Figure 7: b maXX® BM1000 Frame 3

## 4.5 Preparation for installation and wiring

### 4.5.1 Remove keypad



Figure 8: Remove keypad

## 4.5 Preparation for installation and wiring

---

### 4.5.2 Remove front cover

---

Step 1



Step 2



Figure 9: Remove front cover

### 4.5.3 Remove main terminal cover

---

Frame 2 and frame 3



Figure 10: Remove mains terminal cover

### 4.5.4 Remove motor terminal cover

---

Frame 2 and frame 3



Figure 11: Remove motor terminal cover

4.5.5 Remove fan



Figure 12: Remove fan

## 4.5 Preparation for installation and wiring

---

# 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 [ZInstallation space](#)— from page 34).

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:  
m serious personal injury m 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:  
m Property damage



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

Regard the corresponding notes.

h Please regard to the information in chapter [ZFundamental safety instructions](#)— from page 9.

## 5.2 Requirements to the executing personnel

h 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 13: Danger areas by the mechanical mounting

## 5.2 Requirements to the executing personnel



### CAUTION

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

m 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 [ZDimensions](#)— from page 37) 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:  
m 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

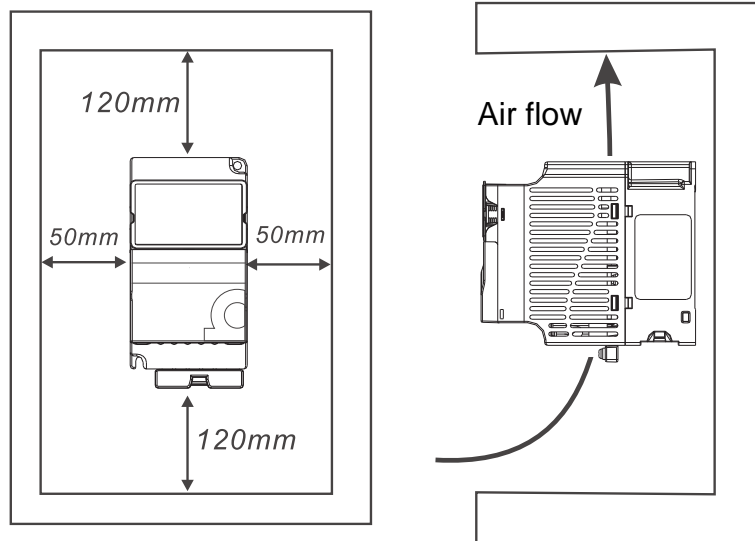
- h Please carry only fully assembled **b maXX<sup>®</sup> 1000** to prevent machine damage.
- h Execute the drilling and if necessary the cut-outs.
- h Mount the **b maXX<sup>®</sup> 1000** vertically on a flat vertical surface by using bolts or screws. Other directions are not allowed.
- h The **b maXX<sup>®</sup> 1000** will generate heat during operation. Allow sufficient space around the unit for heat dissipation.
- h The heat sink temperature may rise to 90°C when running. The material on which the **b maXX<sup>®</sup> 1000** is mounted must be noncombustible and be able to withstand this high temperature.
- h When the device is installed in a confined space (e.g. cabinet), the surrounding temperature must be within 10 to 40°C with good ventilation. DO NOT install the device in a space with bad ventilation.
- h When installing multiple devices **b maXX<sup>®</sup> 1000** in the same cabinet, they should be adjacent in a row with enough space. When installing one **b maXX<sup>®</sup> 1000** below another one, use a metal separation barrier between the **b maXX<sup>®</sup> 1000** to prevent mutual heating. Refer to figure below for details.
- h Prevent fiber particles, scraps of paper, saw dust, metal particles, etc. from adhering to the heatsink.

### 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 [ZDimensions](#)— from page 37.

#### 5.4.1 Installation space frame 1

Option 1 (-10 to +50°C)



Option 2 (-10 to +40°C)

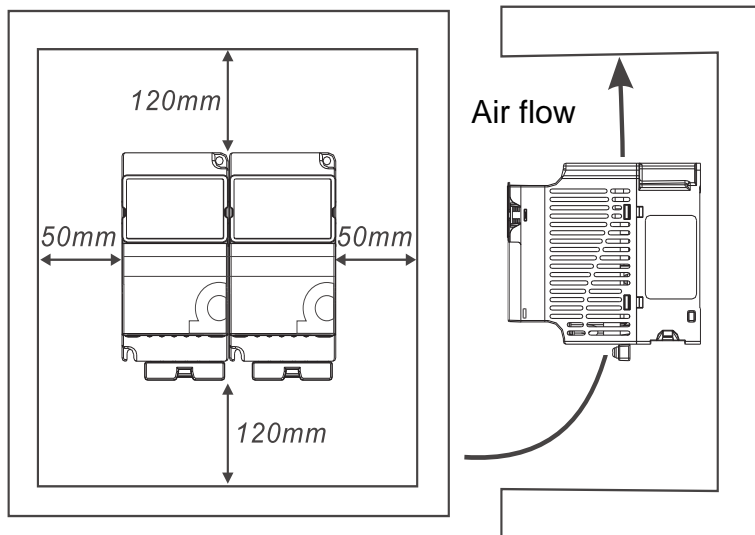
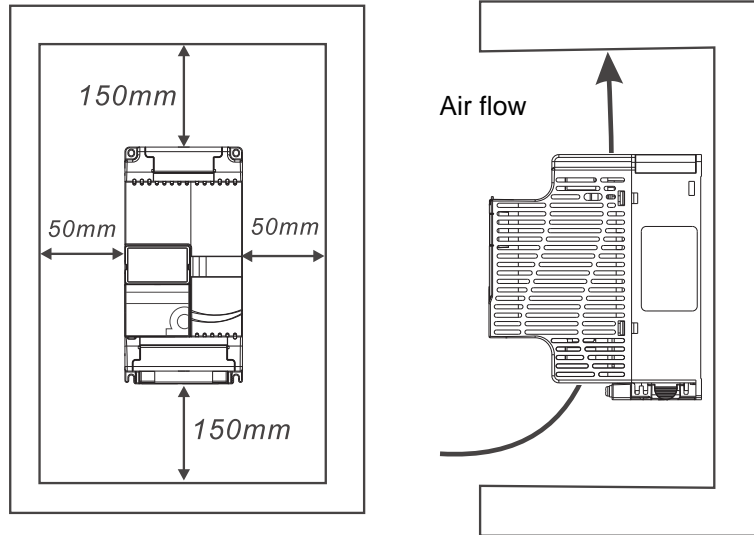


Figure 14: Installation space frame 1

5.4.2 Installation space frame 2 and 3

Option 1 (-10 to +50°C)



Option 2 (-10 to +40°C)

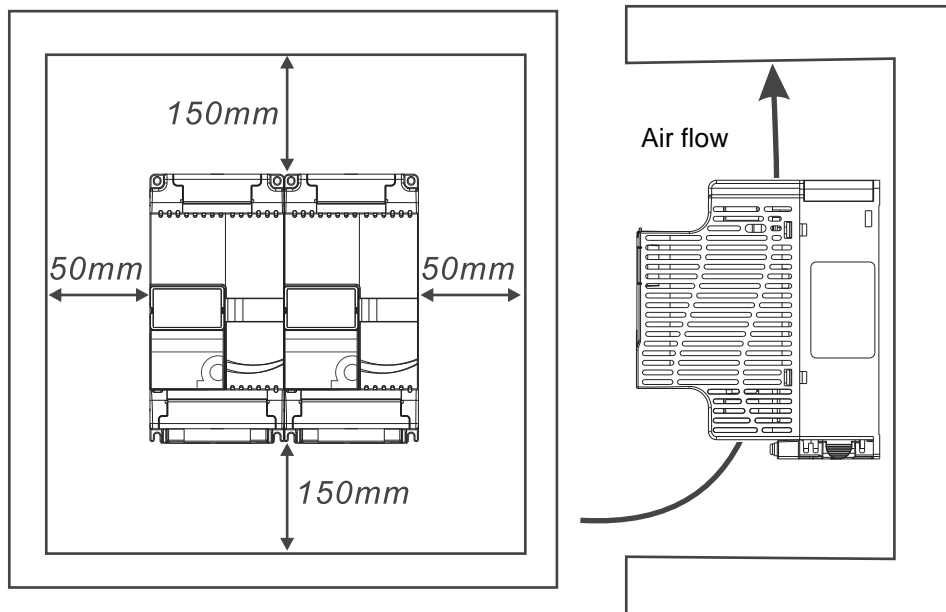


Figure 15: Installation space frame 2 and 3

## 5.4 Installation space

### 5.4.3 Installation with metal separation

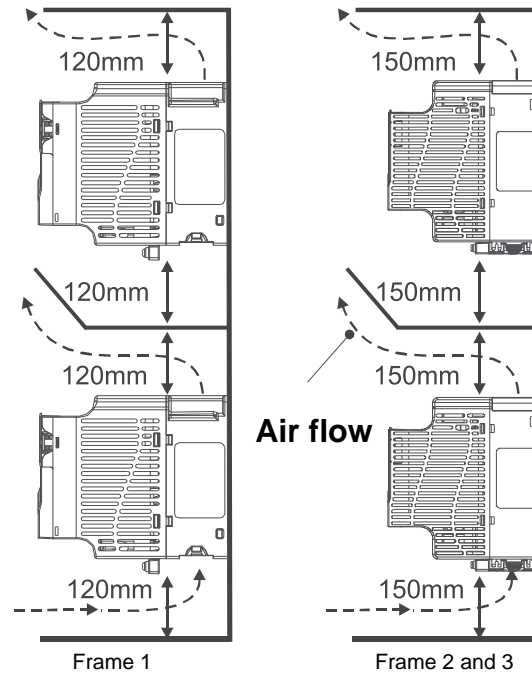


Figure 16: Installation with metal separation

### 5.4.4 Installation without metal separation

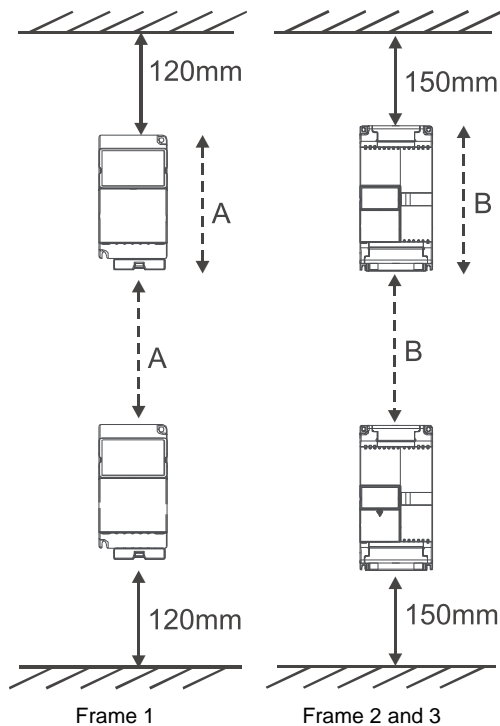


Figure 17: Installation without metal separation

5.5 Dimensions

The following drawings show the dimensions of the devices. Use these drawings, to prepare the necessary drilling/cut-outs. Use the drawings under [ZInstallation space](#)— from page 34, to determine the required space in the control cabinet.

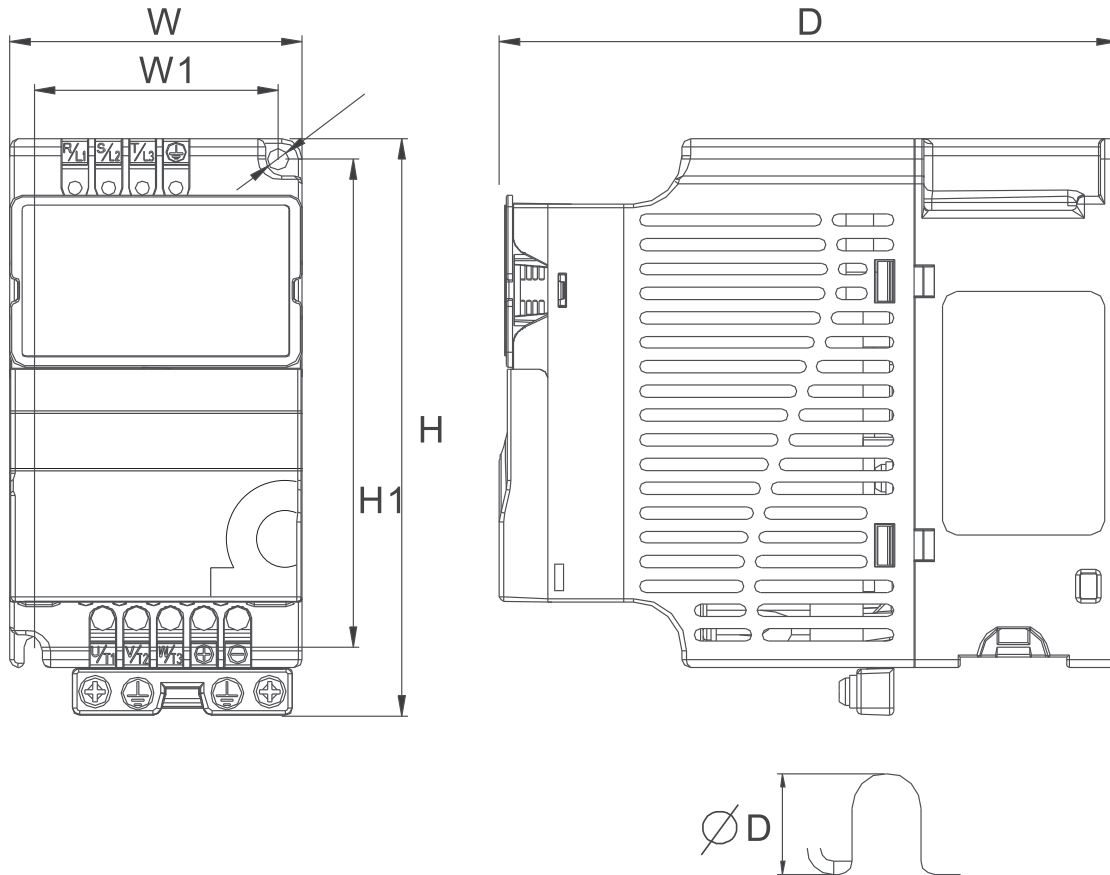
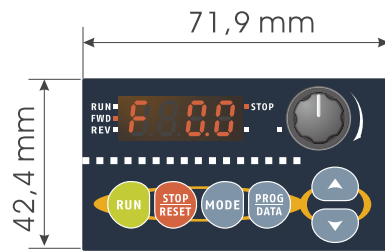


Figure 18: Dimensions

Frame	W	W1	H	H1	D	Ø	DØ
1	72.0	60.0	142.0	120.0	152.0	5.2	7.6
2	100.0	89.0	174.0	162.0	152.0	5.5	9.3
3	130.0	116.0	260.0	246.5	169.0	5.5	9.8

## 5.6 Mounting instructions

m Operation terminal (option keypad):



Depth: 28,8 mm

Figure 19: Dimension operation terminal

## 5.6 Mounting instructions

### CAUTION

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

m 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 provide suitable mounting accessories
- 2 mount the device.

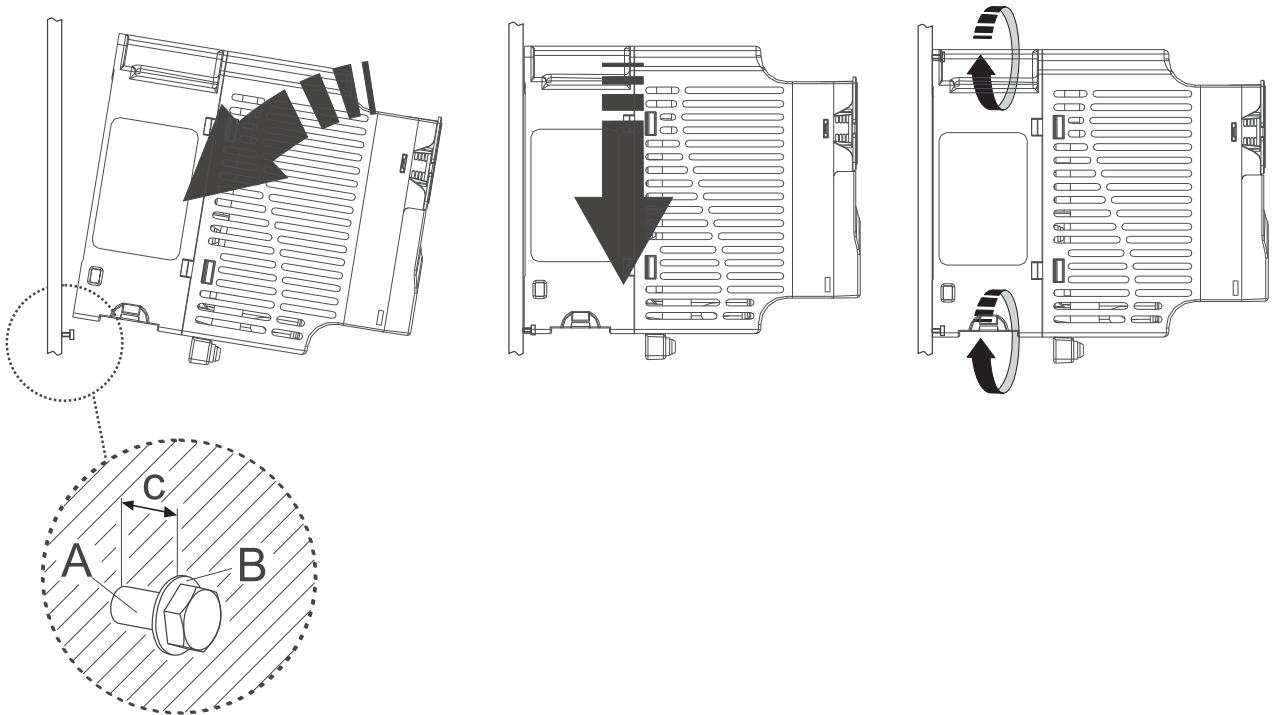


Figure 20: Mounting instruction

Device	Frame 1	Frame 2	Frame 3
A - screws	2 x M4	4 x M4	4 x M5
B - washers	2 x (4.3 x 10)	4 x (4.3 x 10)	4 x (5.3 x 10)
C - mount spacing	c = 12 mm	c = 12 mm	c = 16 mm



**NOTE**

Spare parts for DIN-rail mounting see [ZB.8 DIN rail](#)– on page 132.

## 5.6 Mounting instructions

---



# 6

## INSTALLATION

In this chapter we describe the electric installation of the device. The mechanical installation is described in [ZMounting](#)– from page 31.

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

---

h Pay attention to the information in the chapters [ZFundamental safety instructions](#)– from page 9.

h Pay attention to all areas at the device, which could be dangerous for you during the electrical installation.



Figure 21: Danger areas at the electrical installation

### 6.2 Requirements to the executing personnel



#### WARNING

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

- m serious personal injury m 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:

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

### 6.3 Requirements to the electrical mains

All important data is to be found in [ZD.3 Electrical data](#)– on page 141. 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® BM1000**-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:

- m serious personal injury m 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.

## 6.4 Requirements to the connecting cables

---

- h Always use shielded cables
- h You must consider IEC/EN 60204-1, chapter 13 at selection of connection cables.
- h The protective conductor cross section of the cable must be executed accordant to IEC/EN 60204-1, section 5.2, tab. 1.
- h The permanent connection of the protective conductor is imperatively regulated for the operation of the device.
- h Use a copper cable for at least 60°C (drives < 3 x 100 A) incase you consider UL 508 C.

## 6.5 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 [ZD.5 Fuse protection](#)– from page 144.

## 6.6 PE connection and RCD compatibility

---

Due to the operating principle leakage current can flow via the protective conductor > 3.5 mA<sub>AC</sub> or > 10 mA<sub>DC</sub>. 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 [ZConnection diagrams](#)– from page 46).

---

### WARNING



The following **may occur**, if you disregard these safety notes:  
m serious personal injury m 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.

### 6.7 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'.

- m Use Baumüller motor cables (shielded) and Baumüller components.
- m Use a suitable mains filter of Baumüller Nürnberg GmbH
- m Mount all components to one single mounting board with well electroconductive surface (e. g. galvanized steel plate).
- m Execute the ground connection converter/ground plane as short as possible (< 30 cm) with fine-wired cables and a great cross section (> 10 mm<sup>2</sup>).
- m When installing, attend to the correct order:  
Mains - fuse -mains reactor - filter - **b maXX<sup>®</sup> 1000** - motor)
- m 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.
- m Run the cables directly on the surface of the grounded mounting board.  
(smallest possible effective aerial height).
- m Keep a minimum clearance of 20 cm between signal and control wires towards electric power cables at parallel laying.
- m Cross cables with different EMC categories (signal cables - supply cables or motor cables) only in a 90° angle.
- m Contact the external cable screens when passing through walls, which separate different EMC ranges.
- m Connect the cable shields of the **b maXX<sup>®</sup>**-devices plane on both ends and highly conductive with ground.

## 6.8 Operating sequence of installation



### WARNING

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

m serious personal injury m 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.

All the units must be grounded directly to a common ground terminal to prevent electric shock, fire and interference.

The following steps must be carried out at installation:

- 1 Lay all cables EMC-compatible.
- 2 Connect cables (see [ZConnection diagrams](#)– from page 46)
  - m Connect the motor via the terminals U/T1, V/T2, W/T3, PE. Attend to the in-phase connection (rotational direction).
  - m Connect the fuses.  
(in case you consider UL 508 C: use the semiconductor- or total-range-fuses, which are UL-listed in chapter [ZD.5 Fuse protection](#)– from page 144.)
  - m Connect the mains filter (if necessary).
  - m Connect the reactors (if necessary)
  - m Connect the device via the mains input terminals R/L1, S/L2 and T/L3.
  - m Connect the protective conductor to the terminal PE (a permanent PE connection is required imperatively).
  - m Perhaps connect (dependent on the application) a braking resistor ( $R_B$ ) or a chopper unit.



### NOTE

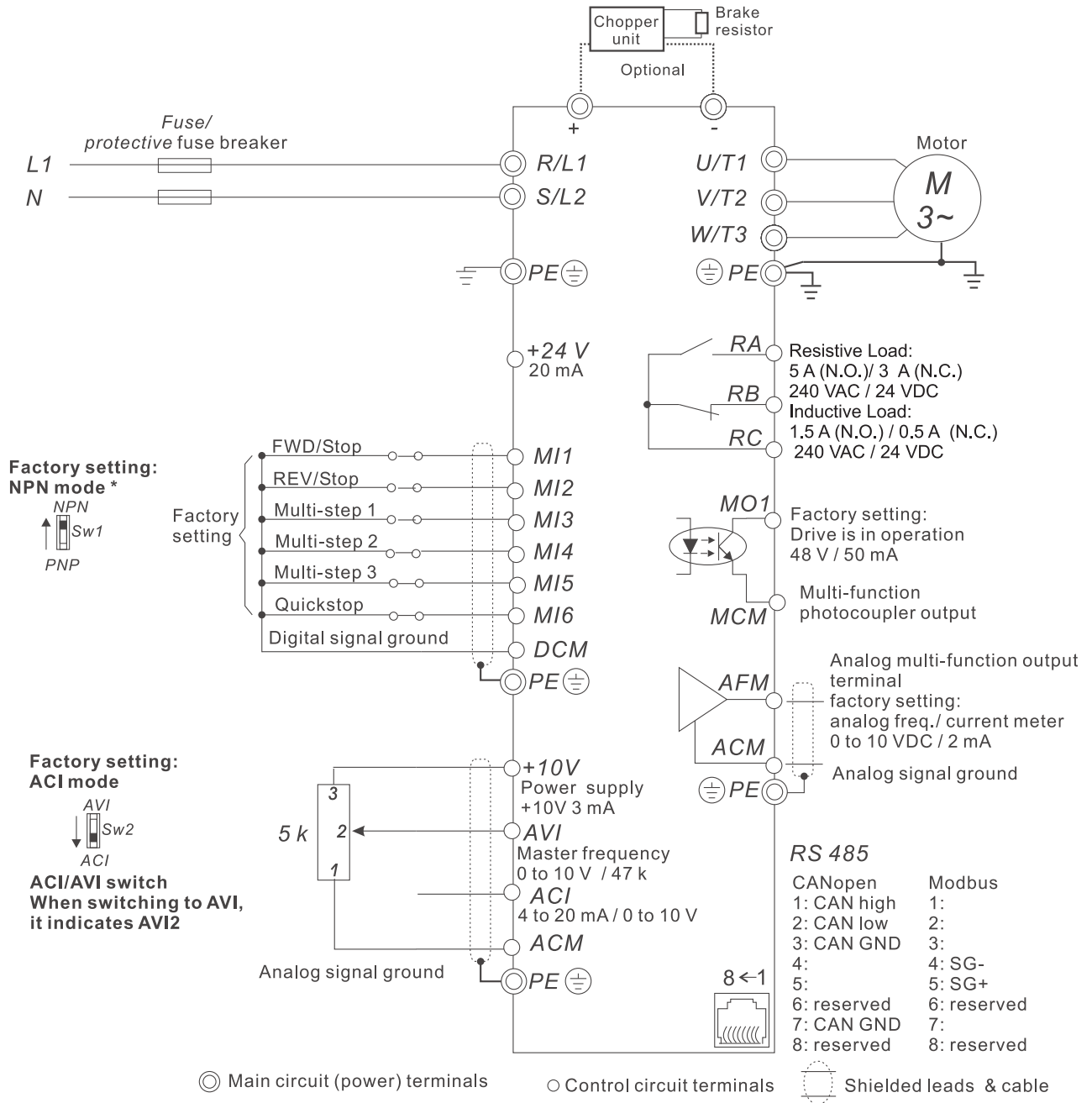
Users must connect wires according to the circuit diagrams on the following pages.

Always use shielded cables.

Do not plug a modem or telephone line to the RS-485 communication port or permanent damage may result. Terminals 1 and 2 are the power supply for the optional copy keypad only and should not be used for RS-485 communication.

## 6.9 Connection diagrams

m BM1211, BM1212, BM1213



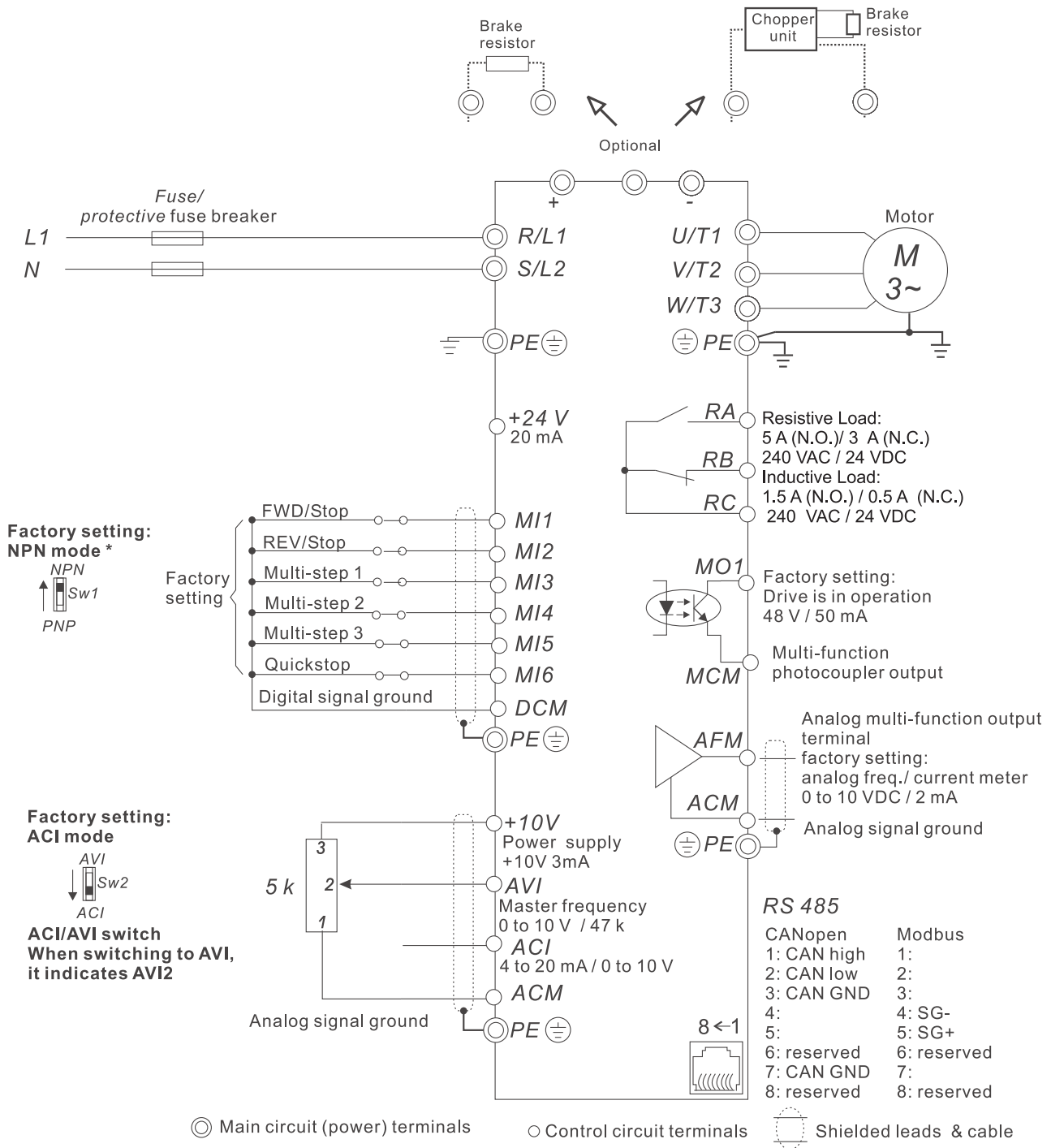
\*: Please refer to [ZFigure 22-](#) on page 50 for wiring of NPN mode and PNP mode.

### NOTE



Single-phase models can only use R/L1, S/L2 to be the power terminals.  
 Single-phase power cannot be used for 3-phase models.

m BM1224, BM1225



\*: Please refer to ZFigure 22– on page 50 for wiring of NPN mode and PNP mode.

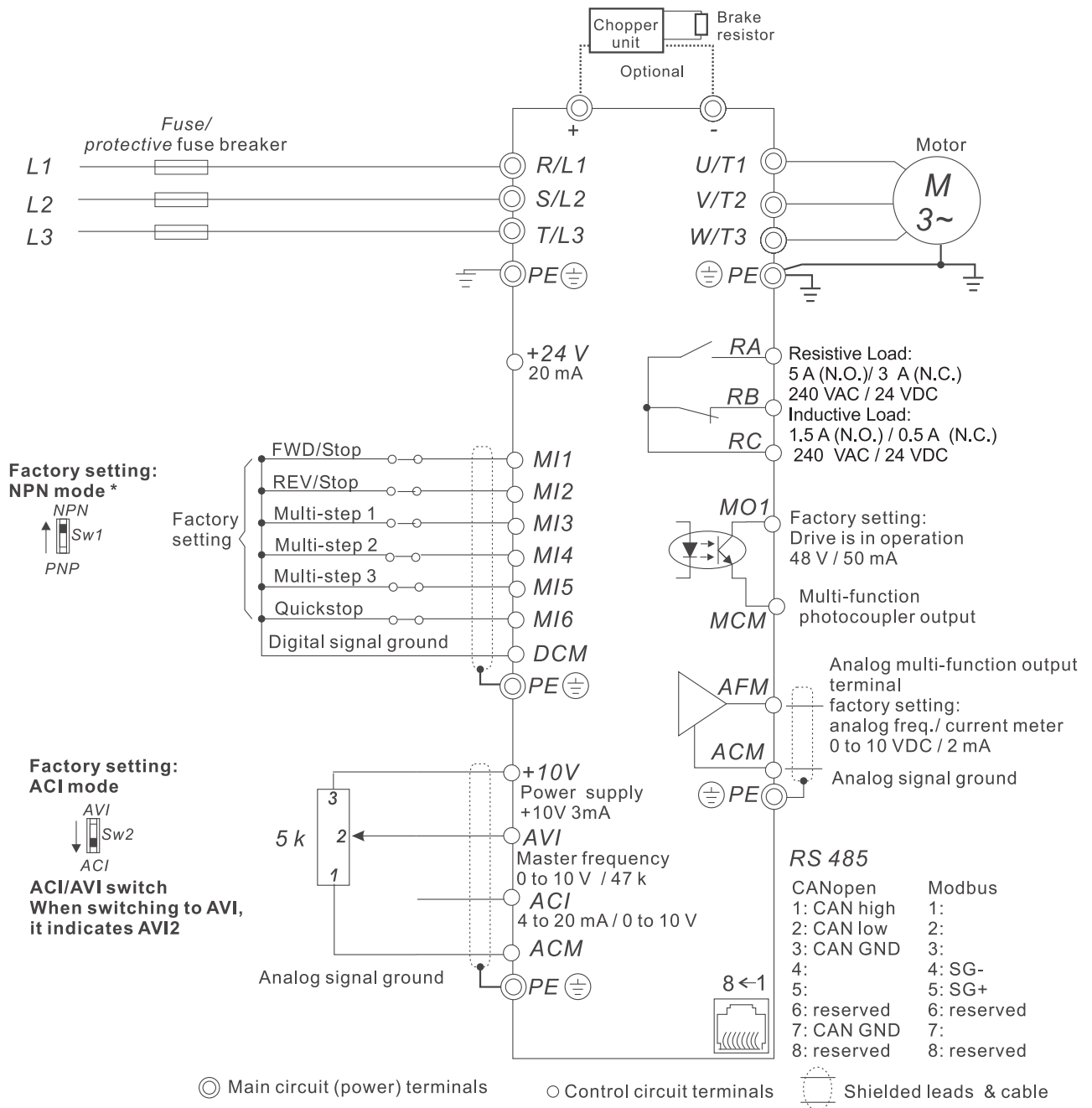
**NOTE**

Single-phase models can only use R/L1, S/L2 to be the power terminals.  
 Single-phase power cannot be used for 3-phase models.



## 6.9 Connection diagrams

m BM1412, BM1413, BM1414



\*: Please refer to [ZFigure 22](#) on page 50 for wiring of NPN mode and PNP mode.

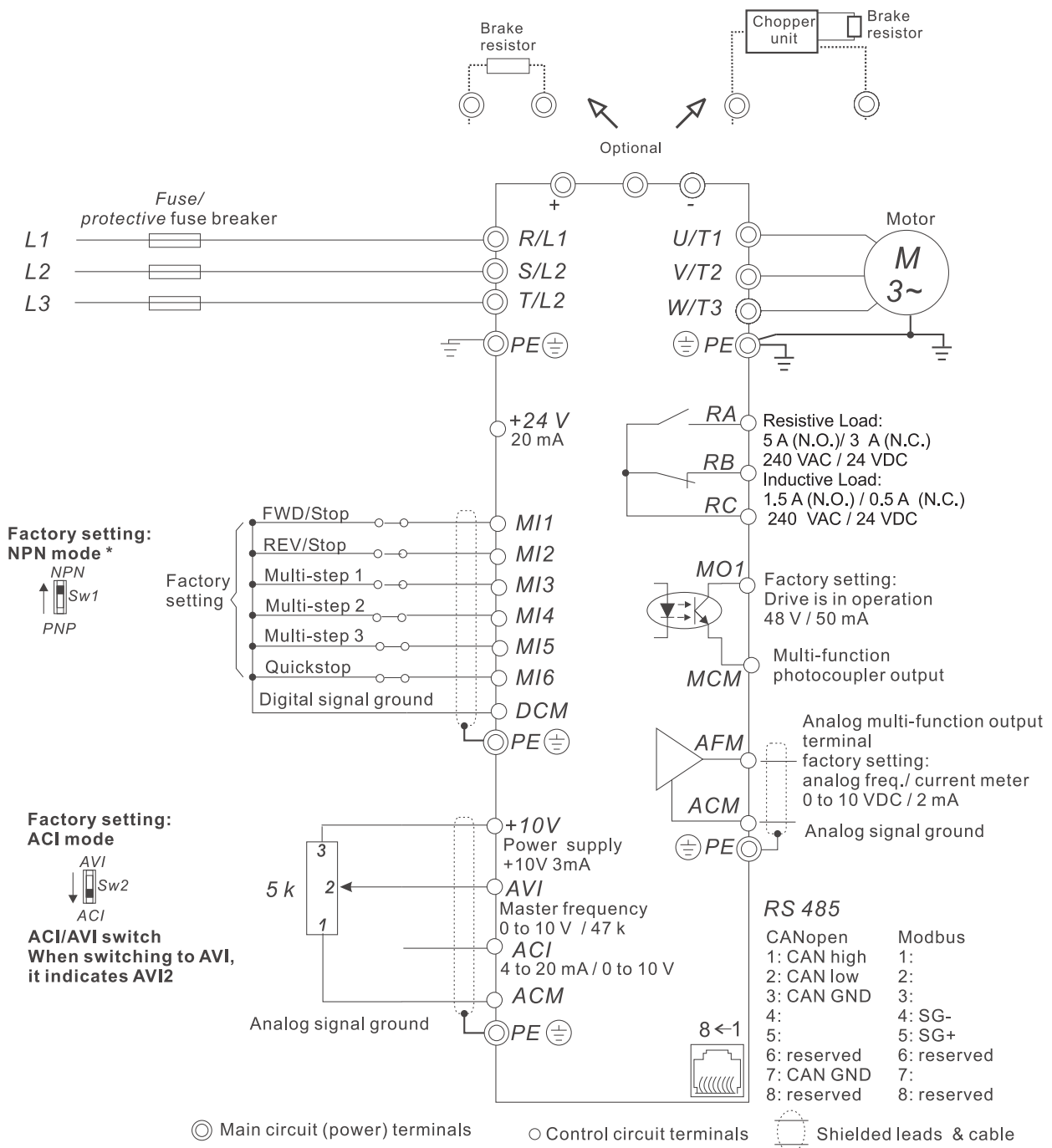
### NOTE



Single-phase models can only use R/L1, S/L2 to be the power terminals.  
 Single-phase power cannot be used for 3-phase models.



m BM1425, BM1426, BM1437, BM1438, BM1439



\*: Please refer to ZFigure 22– on page 50 for wiring of NPN mode and PNP mode.

**NOTE**



Single-phase models can only use R/L1, S/L2 to be the power terminals.  
 Single-phase power cannot be used for 3-phase models.

## 6.9 Connection diagrams

Wiring for NPN mode and PNP mode

m without external power

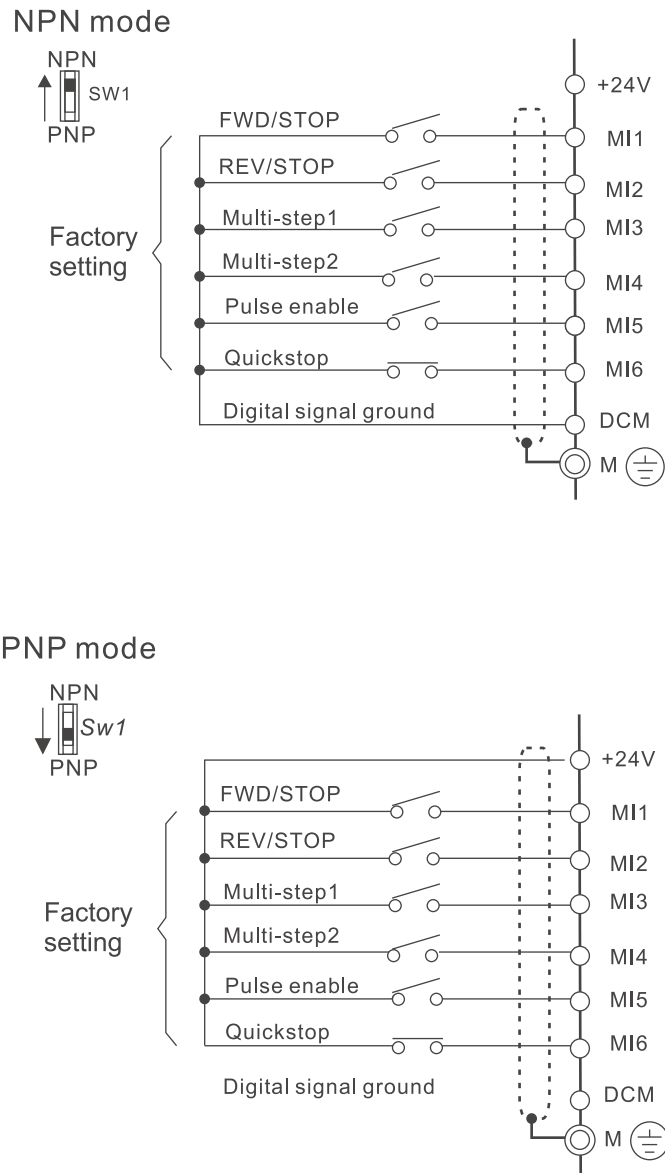


Figure 22: Connection NPN mode and PNP mode - without external power

m with external power

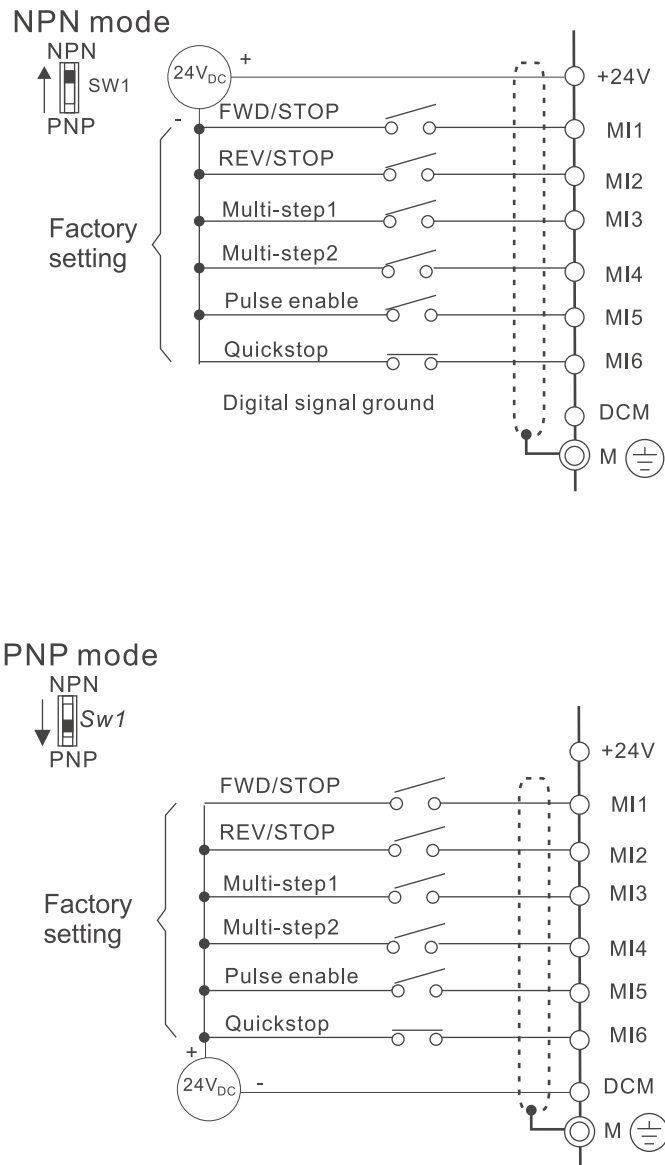


Figure 23: Connection NPN mode and PNP mode - with external power

## 6.10 External connections

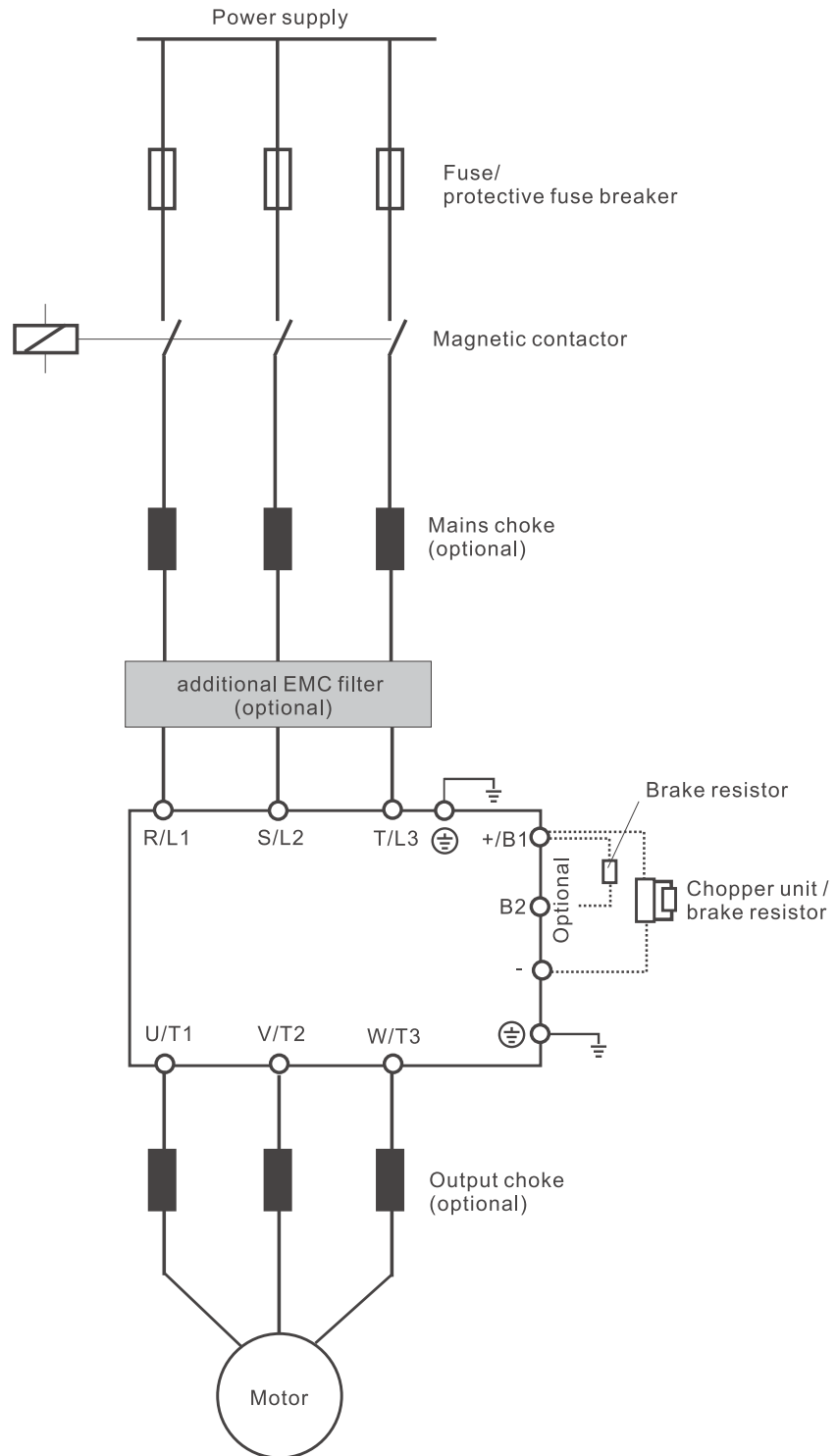


Figure 24: External connections



## 6.10 External connections

### 6.10.1 Specifications of main circuit terminals

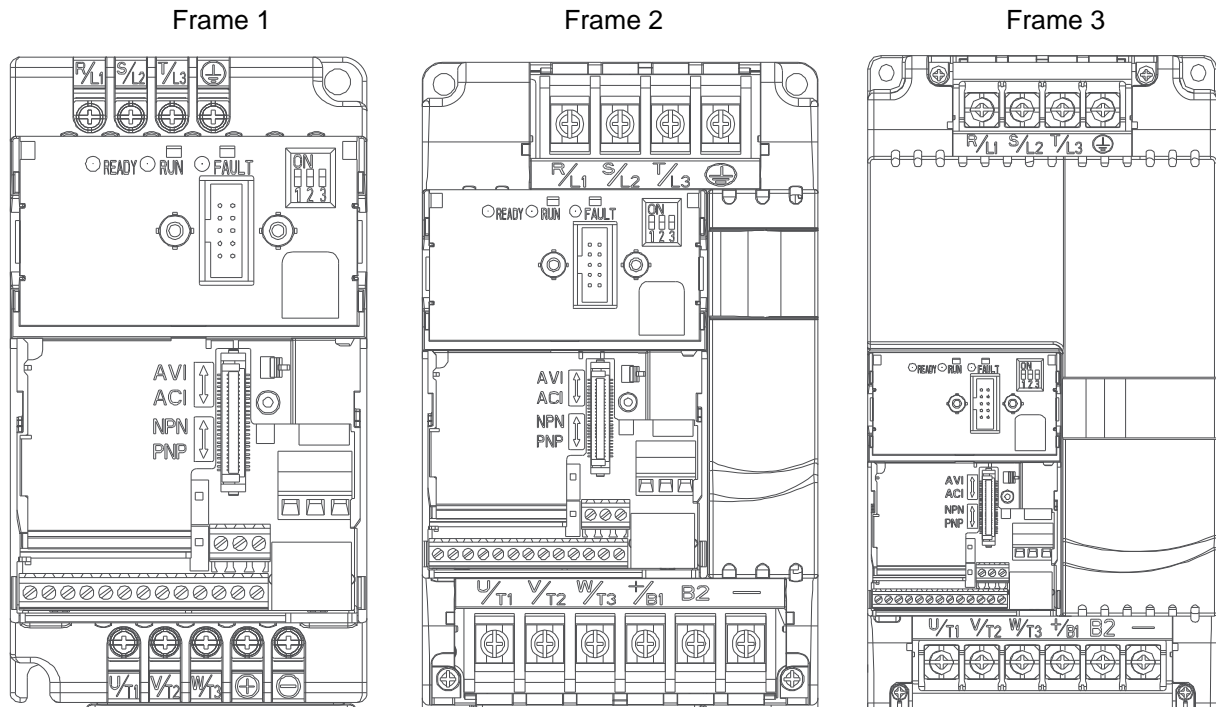


Figure 25: Mains circuit terminals

Frame	Power terminals	Torque	Wire	Wire type
1	R/L1, S/L2, T/L3	1.4 Nm	12-14 AWG, (3.3-2.1 mm <sup>2</sup> )	Copper only, 75° C
	U/T1, V/T2, W/ T3, PE			
2	R/L1, S/L2, T/L3	1.8 Nm	8-18 AWG, (8.4-0.8mm <sup>2</sup> )	Copper only, 75° C
	U/T1, V/T2, W/ T3			
	+/B1, B2, -, PE			
3	R/L1, S/L2, T/L3	3.0 Nm	8-16 AWG, (8.4-1.3mm <sup>2</sup> )	Copper only, 75° C
	U/T1, V/T2, W/ T3			
	+/B1, B2, -, PE			

6.10.2 Connecting main terminals

- m Frame 1 (BM1211, BM1212, BM1213, BM1412, BM1413, BM1414):  
 No built-in chopper unit:  
 Optional use of chopper unit and braking resistor necessary (refer to [ZB.1.2 Chopper units BM1-BTE](#)– from page 119 and [ZB.1.3 Dimensions and weights for braking resistors](#)– from page 125).
- m Frame 2 and 3 (BM1224, BM1225, BM1425, BM1426, BM1437, BM1438, BM1439):  
 Built-in chopper unit:  
 Optional connection of a suitable braking resistor (see [ZB.1.3 Dimensions and weights for braking resistors](#)– from page 125) possible.  
 If the motor generates additional regeneration energy a further chopper unit with braking resistor can be connected.

- m BM1211, BM1212, BM1213 (Frame 1)

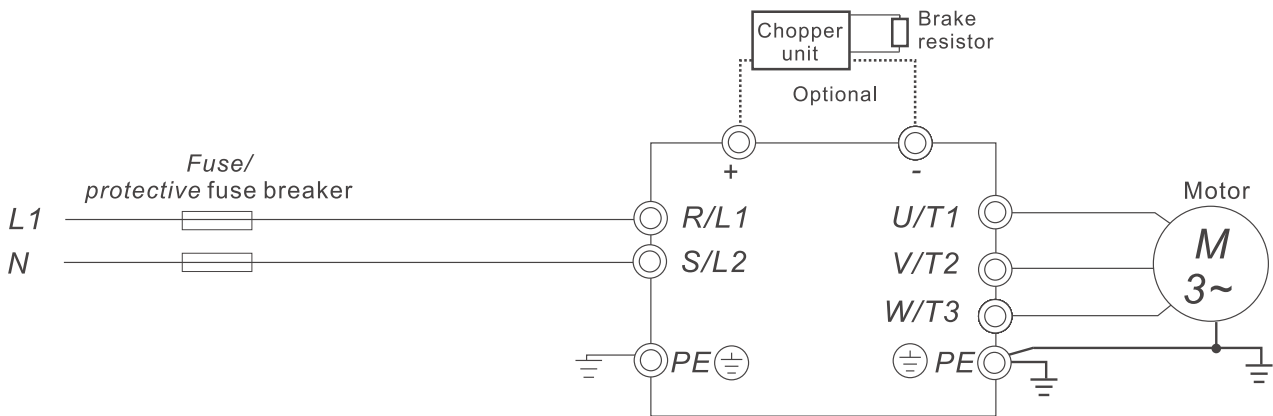


Figure 26: Mains terminals connections 1

- m BM1224, BM1225 (Frame 2)

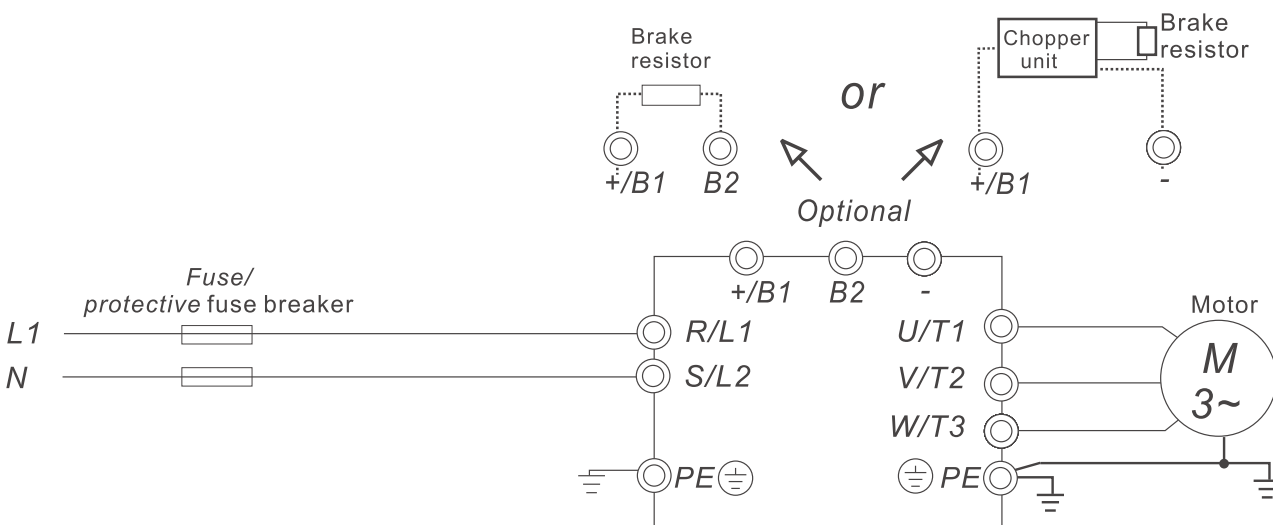


Figure 27: Mains terminals connections 2

## 6.10 External connections

m BM1412, BM1413, BM1414 (Frame 1)

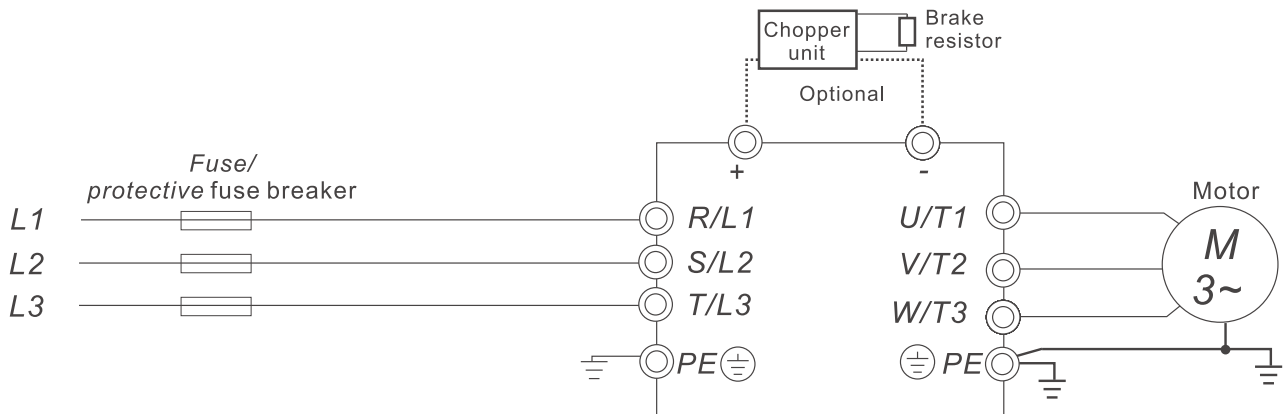


Figure 28: Main terminals connections 3

m BM1425, BM1426, BM1437, BM1438, BM1439 (Frame 2)

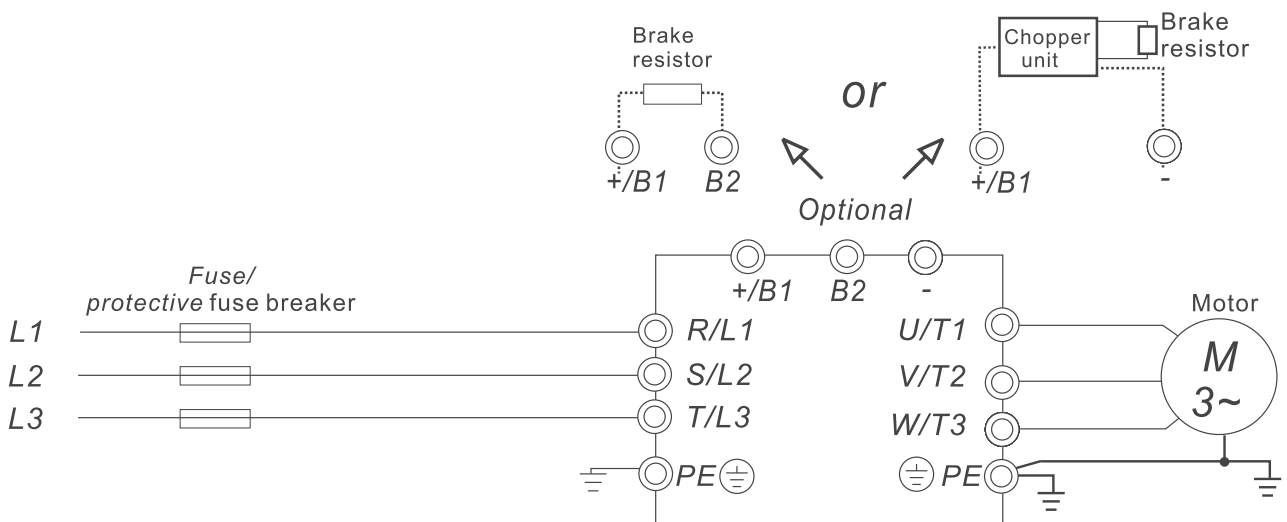


Figure 29: Main terminals connections 4

Terminal Symbol	Explanation of Terminal Function
R/L1, S/L2, T/L3	Input terminals (1-phase/3-phase)
U/T1, V/T2, W/T3	Output terminals for connecting 3-phase motor
+/B1, B2	Connections for braking resistor (optional)
+/B1, -	Connections for external chopper unit (optional)
⊕	Earth connection, please comply with local regulations.



### 6.10.3 Mains power terminals (R/L1, S/L2, T/L3)

- Connect these terminals (R/L1, S/L2, T/L3) via a protective fuse breaker or earth leakage breaker to 3-phase mains power (some models to 1-phase mains power) for circuit protection. It is unnecessary to consider phase-sequence.
- It is recommended to add a magnetic contactor in the power input wiring to cut off power quickly and reduce malfunction when activating the protection function of **b maXX<sup>®</sup> BM1000**. Both ends of the magnetic contactor should have an R-C surge absorber.
- Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration.
- When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA, and not less than 0.1-second detection time to avoid nuisance tripping.
- Do NOT run/stop the **b maXX<sup>®</sup> BM1000** by turning the power ON/OFF. Run/stop the **b maXX<sup>®</sup> BM1000** by RUN/STOP command via control terminals or keypad. If you still need to run/stop the **b maXX<sup>®</sup> BM1000** by turning power ON/OFF, it is recommended to do so only ONCE per hour.
- Do NOT connect 3-phase models to a 1-phase power source.

#### NOTE



No T/L3 terminal on 1-phase models

### 6.10.4 Output terminals (U/T1, V/T2, W/T3)

- The factory setting of the operation direction is forward running. The methods to control the operation direction are: method 1, set by the communication parameters, method 2, control by the optional keypad.
- When the **b maXX<sup>®</sup> 1000** output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, respectively, the motor will rotate counterclockwise (as viewed on the shaft end of the motor) when a forward operation command is received. To permanently reverse the direction of motor rotation, switch over any of the two motor leads.
- DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of the device.
- With long motor cables, high capacitive switching current peaks can cause over-current, high leakage current or lower current readout accuracy. To prevent this, the motor cable should be less than 20 m for 3.7 kW models and below. And the cable should be less than 50 m for 5.5 kW models and above. For longer motor cables use an output choke.
- Use a well-insulated motor, suitable for inverter operation.

### 6.10.5 Terminals [+B1, B2] for connecting chopper unit / braking resistor

- Connect a braking resistor and/or chopper unit in applications with frequent deceleration ramps, short deceleration time, too low braking torque or requiring increased braking torque.
- Connect the terminals [+ , -] of the brake unit to the b maXX<sup>®</sup> 1000 terminals [+B1, -]. The length of wiring should be less than 5 m with twisted cable.
- When not used, please leave the terminals [+B1, -] open.

#### CAUTION



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

- m Short-circuiting [B2] or [-] to [+B1] can damage the b maXX<sup>®</sup> 1000.

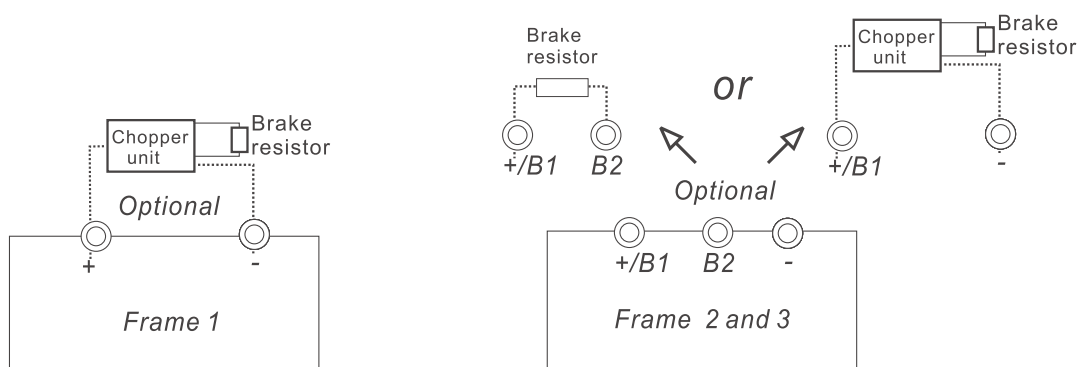


Figure 30: Terminals braking resistor

- m Frame 1 (BM1211, BM1212, BM1213, BM1412, BM1413, BM1414):  
No built-in chopper unit:  
Optional use of chopper unit and braking resistor necessary (refer to [ZB.1.1 Select a chopper unit /braking resistor](#)– from page 118).
  - Please connect an external chopper unit and braking resistor to the terminal [+ , -], see [ZConnecting main terminals](#)– from page 55.
- m Frame 2 and 3 (BM1224, BM1225, BM1425, BM1426, BM1437, BM1438, BM1439):  
Built-in chopper unit:  
Optional connection of a suitable braking resistor possible.  
If the motor generates additional regeneration energy a further chopper unit with braking resistor can be connected (see [ZB.1.1 Select a chopper unit /braking resistor](#)– from page 118).
  - Please connect the external chopper unit to the terminals [+B1, B2], see [ZConnecting main terminals](#)– from page 55.

### 6.10.6 Grounding terminals

- Make sure that the leads are connected correctly and the b maXX<sup>®</sup> 1000 is properly grounded. (Ground resistance should not exceed 0.1Ω.)
- Use ground leads that comply with local regulations and keep them as short as possible.
- Multiple b maXX<sup>®</sup> 1000 units can be installed in one location. All the units should be grounded directly to a common ground terminal, as shown in the figure below.

#### NOTE

Ensure there are no ground loops.

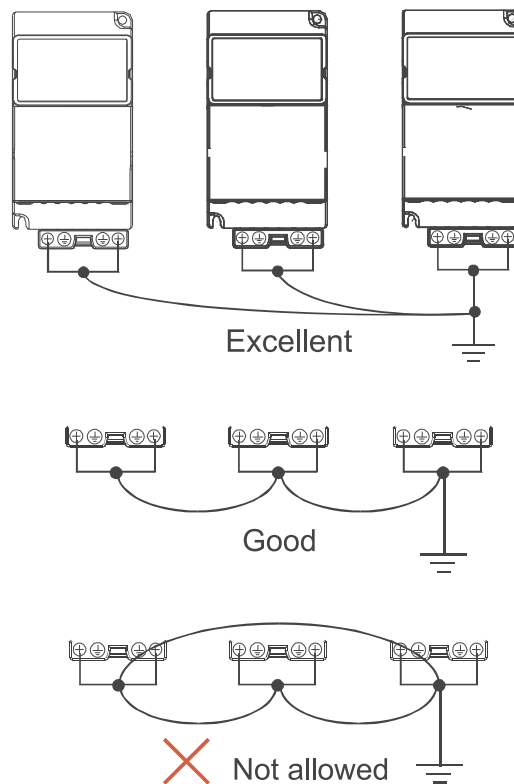
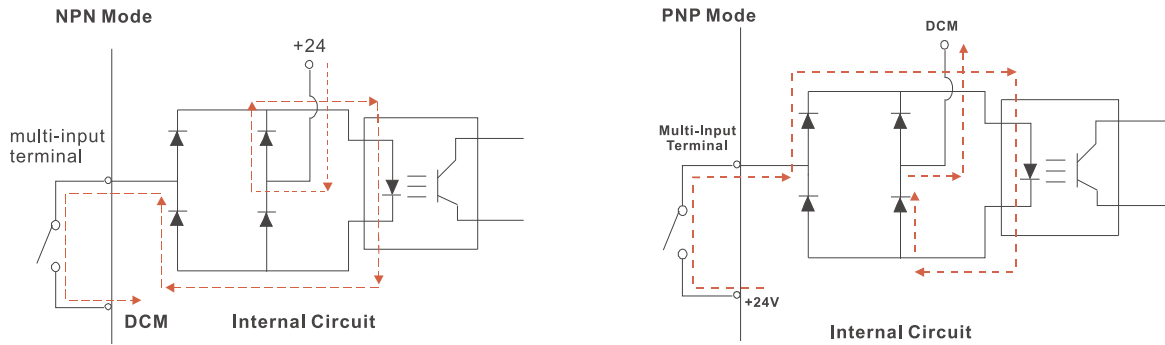


Figure 31: Connecting grounding terminals

## 6.11 Control Terminals

Circuit diagram for digital inputs (NPN current 16 mA.)



### NOTE



Control signal wiring size: 18 AWG (0.75 mm<sup>2</sup>) with shielded wire.

### 6.11.1 Specification of control terminals

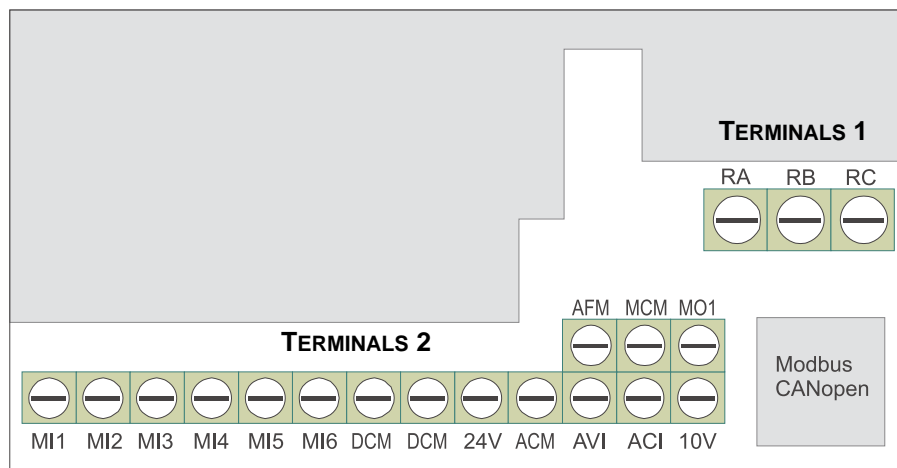
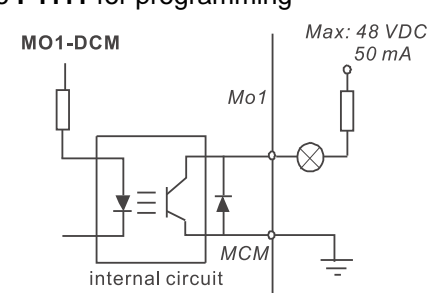
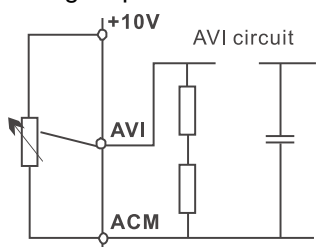


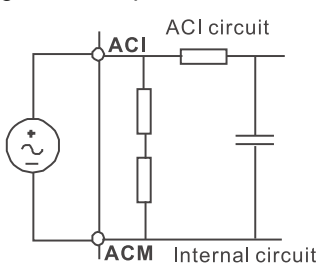
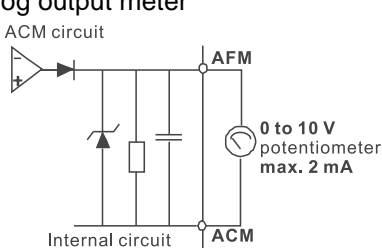
Figure 32: Position of control terminals

Frame	Control terminals	Torque	Wire
1, 2, 3	Terminals 1	0.5 Nm	12-24 AWG (3.3-0.2mm <sup>2</sup> )
	Terminals 2	0.2 Nm	16-24 AWG (1.3-0.2mm <sup>2</sup> )

6.11.2 Terminal symbols and functions

Terminal symbol	Terminal function	Factory settings (NPN mode) ON: connect to DCM
MI1	Forward-Stop command	ON: Run in MI1 direction OFF: Stop according to stop method
MI2	Reverse-Stop command	ON: Run in MI2 direction OFF: Stop according to stop method
MI3	Multi-function input 3	Refer to <b>P1091</b> to <b>P1094</b> for programming the multi-function Inputs. ON: the activation current is 16mA. OFF: leakage current tolerance is 10µA.
MI4	Multi-function input 4	
MI5	Multi-function input 5	
MI6	Multi-function input 6	
+24V	DC voltage source	+24V <sub>DC</sub> , 20 mA used for PNP mode.
DCM	Digital signal ground	Ground for digital inputs and used for NPN mode.
RA	Multi-function relay output (N.O.) a	Resistive Load: 5A (N.O.) / 3A (N.C.) 240 V <sub>AC</sub> 5A (N.O.) / 3A (N.C.) 24 V <sub>DC</sub> Inductive Load: 1.5A (N.O.) / 0.5A (N.C.) 240 V <sub>AC</sub> 1.5A (N.O.) / 0.5A (N.C.) 24 V <sub>DC</sub> Refer to <b>P1110</b> for programming
RB	Multi-function relay output (N.C.) b	
RC	Multi-function relay ground	
MO1	Multi-function output 1 (photocoupler)	Maximum 48 V <sub>DC</sub> , 50 mA Refer to <b>P1111</b> for programming 
MCM	Multi-function output ground	Ground for multi-function outputs
+10V	Potentiometer power supply	+10V <sub>DC</sub> 3 mA
AVI	Analog voltage input 	Impedance: 47 kΩ Resolution: 10 bits Range: 0 to 10 V <sub>DC</sub> = 0 to max. output frequency ( <b>P0033</b> ) Selection: <b>P0801, P0809, P1359</b> Set-up: <b>P1128 to P1132</b>

## 6.11 Control Terminals

Terminal symbol	Terminal function	Factory settings (NPN mode) ON: connect to DCM
ACI	Analog current input  Figure 35: Analog current input	Impedance: 250 $\Omega$ Resolution: 10 bits Range: 4 to 20 mA = 0 to max. output frequency ( <b>P0033</b> ) Selection: <b>P0801, P0809, P1359</b> Set-up: <b>P1128 to P1132</b>
AFM	Analog output meter  Figure 36: Analog output meter	Impedance: 20 k $\Omega$ Output current: 2 mA max. Resolution: 8 bits Range: 0 to 10 V <sub>DC</sub> Function: <b>P1162 and P1163</b>
ACM	Analog control signal (ground)	Ground for AVI, ACI, AFM

- Keep control wiring as far away as possible from the power wiring and in separate conduits to avoid interference. If necessary let them cross only at 90° angle.
- The device control wiring should be properly installed and not touch any live power wiring or terminals.

### NOTE



- If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to the device. EMI can also be reduced by lowering the carrier frequency.
- When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA, and not less than 0.1-second detection time to avoid noise tripping.

### 6.11.3 Analog input terminals (AVI, ACI, ACM)

- Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (< 20 m) with proper grounding. If the noise is inductive, connecting the shield to terminal ACM can bring improvement.
- If the analog input signals are affected by noise from the device, please connect a capacitor (0.1 F and above) and ferrite core as indicated in the following diagrams:

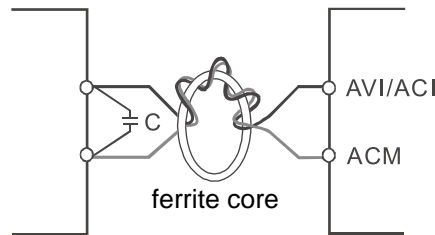


Figure 37: Analog input terminals

#### NOTE

Wind each wires 3 times or more around the core



### 6.11.4 Multi-function-inputs (MI1 to MI6, DCM)

- When using contacts or switches to control the digital inputs, please use high quality components to avoid contact bounce.

#### NOTE

The multi-function inputs MI1 and MI2 are used for operation commands (e.g. STOP, RUN, FWD, REV) only.



### 6.11.5 Multi-function output (MO1, MCM)

- Make sure to connect the digital outputs to the right polarity, see wiring diagrams.
- When connecting a relay to the digital outputs, connect a surge absorber or flyback diode across the coil and check the polarity.

## 6.12 External parts

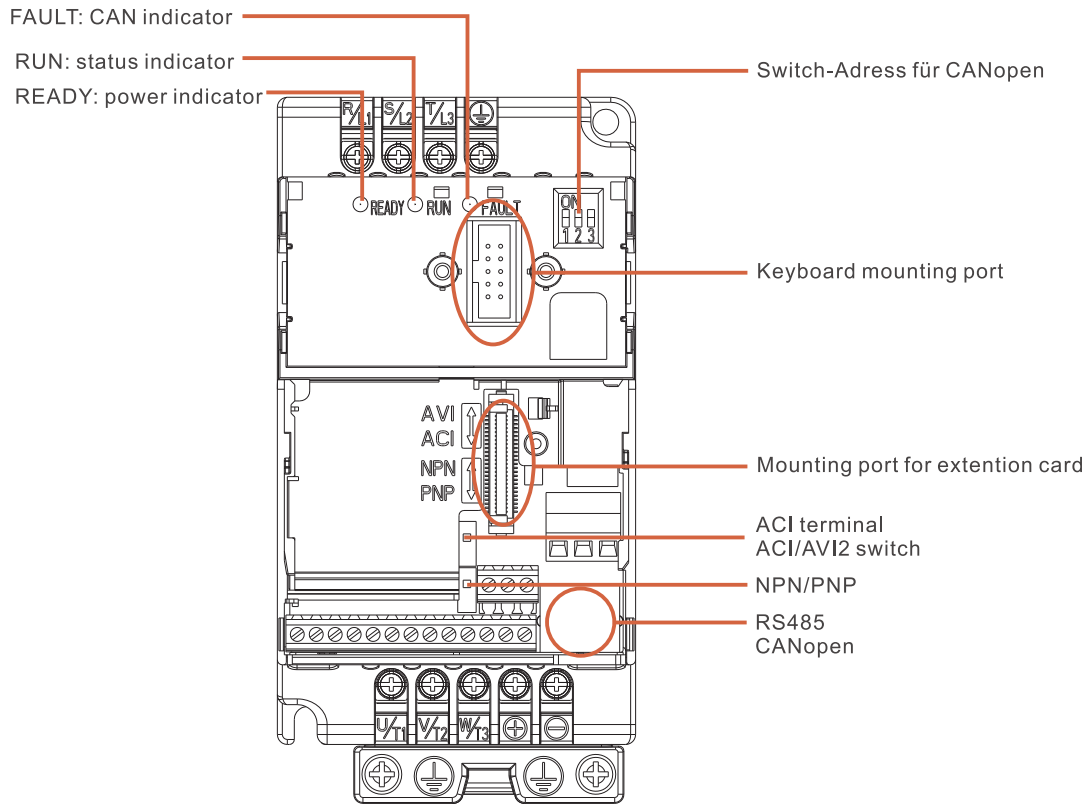


Figure 38: External parts



### 6.13 RFI jumper

Main power isolated from earth:

If the device is supplied from an isolated power (IT power), the RFI jumper must be cut off. Then the RFI capacities (filter capacitors) will be disconnected from ground to prevent circuit damage (according to IEC 61800-3) and reduce earth leakage current. Refer to the following figures for the position of RFI jumper.



Frame 1  
(on the top)



Frame 2  
(at the right side)



Frame 3  
(at the left side)

#### WARNING

The following **may occur**, if you disregard these safety notes:  
m serious personal injury m death

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

- After applying power to the device, do not cut off the RFI jumper. Therefore, please make sure that main power has been switched off before cutting the RFI jumper.
- The gap discharge may occur when the transient voltage is higher than 1,000V. Besides, electro-magnetic compatibility of the device will be lower after cutting the RFI jumper.
- Do NOT cut the RFI jumper when main power is connected to earth.
- The RFI jumper cannot be cut when high voltage tests are performed. The mains power and motor must be separated if high voltage test is performed and the leakage currents are too high.
- To prevent drive damage, the RFI jumper connected to ground shall be cut off if the device is installed on an ungrounded power system or a high resistance-grounded (over 30 Ω) power system or a corner grounded TN system.



## 6.14 Connect the DC link of the devices in parallel

### 6.14 Connect the DC link of the devices in parallel

- m The devices can absorb mutual voltage that generated to DC link when deceleration
- m Enhance brake function and stabilize the voltage of the DC link
- m The brake module can be added to enhance brake function after connecting in parallel
- m Only the same power system can be connected in parallel
- m It is recommended to connect 5 devices in parallel (no limit in power)



#### NOTE

Power should be applied at the same time (only the same power system can be connected in parallel)

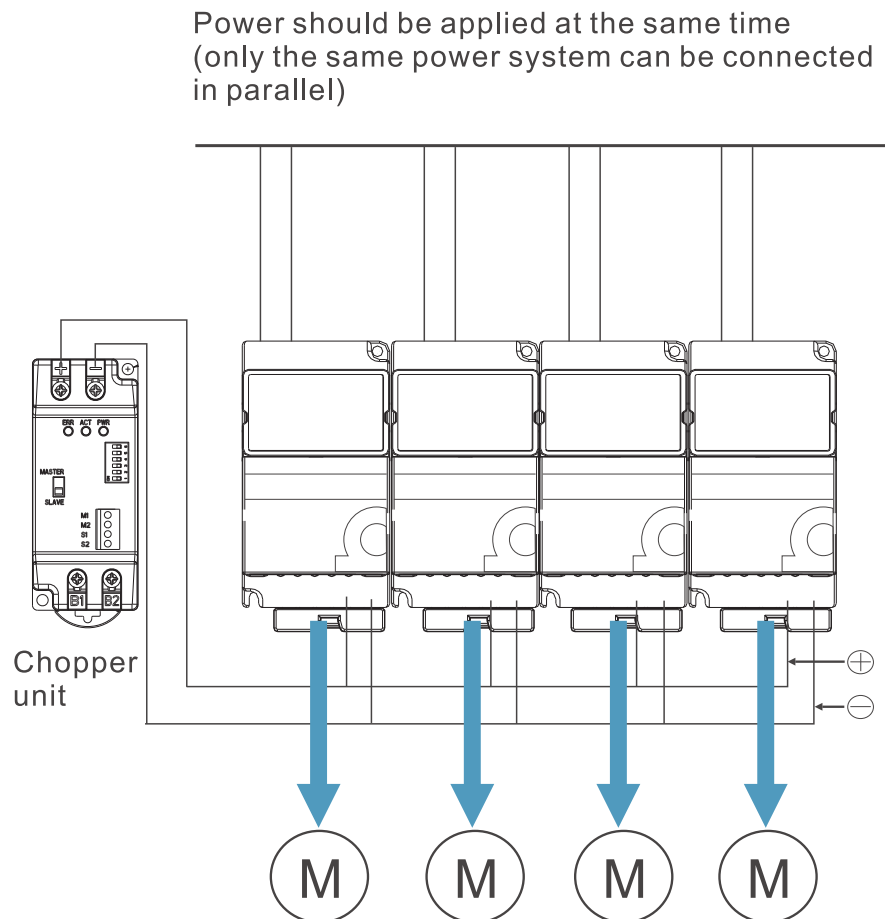


Figure 39: DC link of the devices in parallel

6.15 Applications for mains chokes

Connected in input circuit

Application 1	Question
When more than one device is connected to the same mains power, and one of them is ON during operation.	When applying power to one of the devices, the charge current of the capacitors may cause voltage dip. The device may be damaged when overcurrent occurs during operation.

Correct wiring

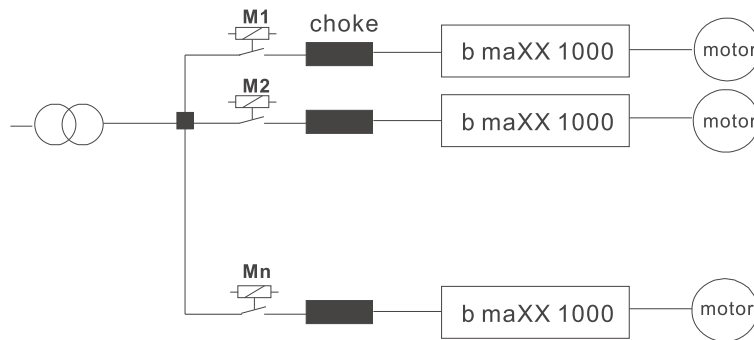


Figure 40: Application 1 mains choke

## 6.15 Applications for mains chokes

Application 2	Question
Silicon rectifier and device are connected to the same power.	Switching spikes will be generated when the silicon rectifier switches on/off. These spikes may damage the mains circuit.

Correct wiring

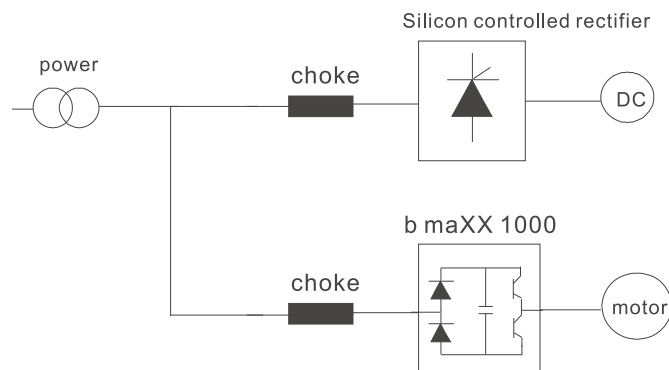


Figure 41: Application 2 mains choke

Application 3	Question
Used to improve the input power factor, to reduce harmonics and provide protection from AC line disturbances (surges, switching spikes, short interruptions, etc.). The chokes should be installed when the power supply capacity is 500 kVA or more and exceeds 6 times the inverter capacity, or the mains wiring distance $\leq 10$ m.	When the mains power capacity is too large, line impedance will be small and the charge current will be too high. This may damage <b>b maXX<sup>®</sup> BM1000</b> drive due to higher rectifier temperature.

Correct wiring



Figure 42: Application 3 mains choke

# OPERATION

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

## 7.1 Safety instructions

---

h Refer to the safety instructions from the chapter [ZFundamental safety instructions](#)— from page 9.



### CAUTION

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

m 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 [ZD.1 Required environmental conditions](#)— on page 140).



### WARNING

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

m serious personal injury m 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:

m serious personal injury m 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:

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

### 7.3 LEDs

There are three LEDs on the front of the **b maXX<sup>®</sup>** when using no optional digital keypad:



H1: READY

It will light up after applying power.

The light won't be off until the capacitors are discharged to safe voltage levels after power off.

H2: **b maXX<sup>®</sup>** drive status

It will light up green, when the drive is in status operation enabled.

It will light up red, when the drive is in error status.

H3: CANopen status

It will light up green, when the CANopen is in operation.

It will light up red, when CANopen is in status bus off.








### 7.4 Digital keypad (option)



Figure 43: Digital keypad

Display Message	Description
	Displays the master frequency.
	Displays the actual output frequency at terminals U/T1, V/T2, and W/T3.
	User defined unit (where $U = F \times P0038$ )
	Displays the output current at terminals U/T1, V/T2, and W/T3.
	Displays the forward run status.
	Displays the reverse run status.
	The counter value (C).
	Displays the selected parameter.

## 7.4 Digital keypad (option)

Display Message	Description
	Displays the actual stored value of the selected parameter.
	External Fault.
	Display „End“ for approximately 1 second if input has been accepted by pressing  key. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use the  and  keys.
	Display „Err“, if the input is invalid.

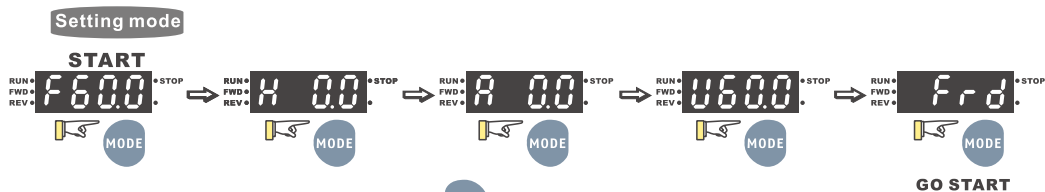
### NOTE



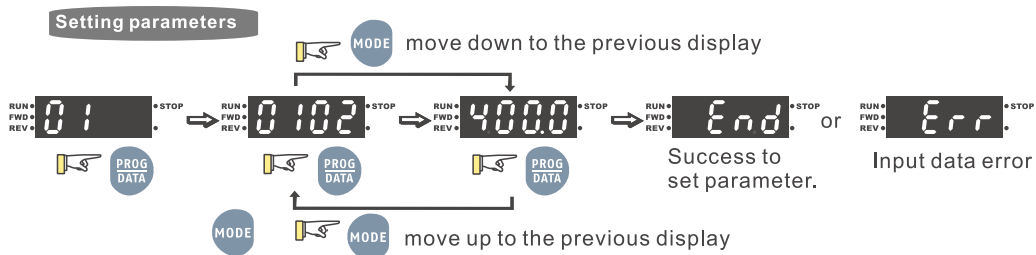
When the setting exceeds 99.99 for those numbers with 2 decimals (i.e. unit is 0.01), it will only display 1 decimal due to 4-digital display.



m How to operate the digital keypad



NOTE In the selection mode, press to set the parameters.



NOTE In the parameter setting mode, you can press to return the selecting mode.

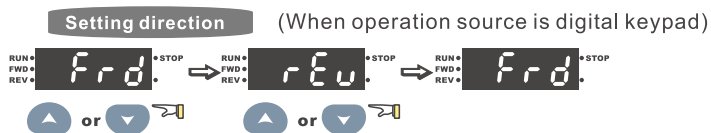
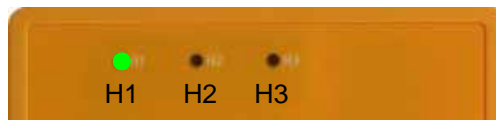


Figure 44: Keypad operation

### 7.5 Preparations before commissioning

Carefully check the following items before proceeding.

- Make sure that the wiring is correct. In particular, check that the output terminals U/T1, V/T2, W/T3 are NOT connected to power and that the drive is well grounded.
- Verify that there are no short-circuits between terminals and from terminals to ground or mains power.
- Check for loose terminals, connectors or screws.
- Verify that no other equipment is connected to the motor.
- Make sure that all switches are OFF before applying power to ensure that the device doesn't start running and there is no abnormal operation after applying power.
- Make sure that the front cover is correctly installed before applying power.
- Do NOT operate the device with humid hands.
- Check the following items after applying power: The display without digital keypad should be as follows.



When power is applied, LED „H1“ should light up

Figure 45: Device ready without digital keypad

- The display with digital keypad should light up as follows (normal status with no error)



When power is ON, it will be displayed „F0.0“ and LED „STOP“ and „FWD“ should light up

Figure 46: Device ready digital keypad

#### NOTE



If the drive has a built-in fan, it should run. The factory setting of Fan control **P0024** = 0 (fan always on).

7.6 Commissioning example

m Source of first command

Required functionality

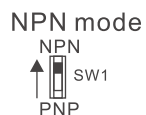
RUN / STOP

from multi-function input MI1

FWD (forward running)

REV (reverse running)

from multi-function input MI2

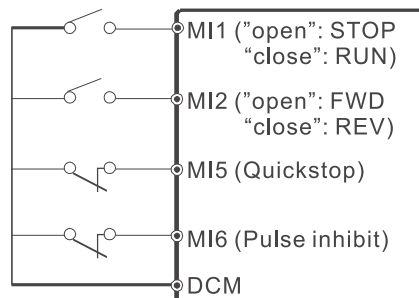


RUN / STOP

FWD / REV

QUICKSTOP

PULSE INHIBIT



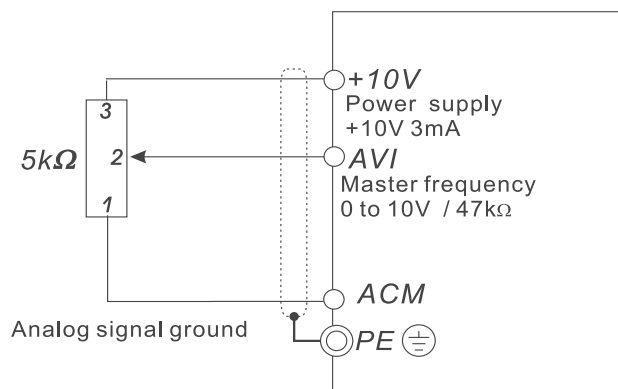
Additional STOP

from digital keypad



m First master frequency

from analog voltage input AVI



## 7.6 Commissioning example

### Required parameter settings

Operation of keypad see [ZDigital keypad \(option\)](#)– from page 71.

Reset parameter to factory setting	<b>P0310</b>	⇒	9
Source of first operation command	<b>P0802</b>	⇒	1
RUN/STOP from multi-function input MI1			
FWD/REV from multi-function input MI2	<b>P1090</b>	⇒	1
Source of first master frequency	<b>P0801</b>	⇒	1

### Execute the auto-tuning function

The autotuning function sequence is necessary for a correct operation of the motor!  
The autotuning function must be executed without motor load.



#### NOTE

- m Stop running immediately if any fault occurs and refer to the troubleshooting guide for solving the problem.
- m Do NOT touch output terminals R/L1, S/L2, T/L3 when power is still applied to U/T1, V/T2, W/T3 even when the device has stopped. The DC-link capacitors may still be charged to hazardous voltage levels, even if the power has been turned off.
- m To avoid damage to components, do not touch them or the circuit boards with metal objects or your bare hands.



#### CAUTION

The motor will rotate!

Operation mode set value	<b>P1000</b>	⇒	249
Autotuning with running motor (without load)	<b>P0850</b>	⇒	2

After finishing autotuning function parameter **P0850** is set to 0.

The autotuning function is completed when LED **RUN** is OFF and LED **STOP** is ON.

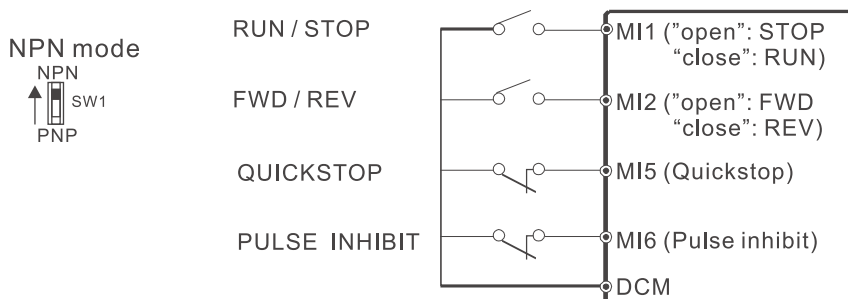


Operation mode set value  
(speed setting 1)

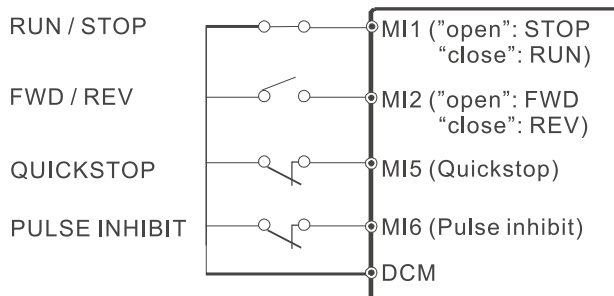
**P1000** ⇒ 2

START from multi-function input MI1

1st step (close Quickstop)




2nd step (close RUN/STOP)



⇒ LED RUN = ON  
⇒ LED STOP = OFF



**Test of functionality**

- START from multi-function input MI1
  - LED RUN or H1 = ON
  - LED STOP or H2 = OFF
- Control the motor speed from analog voltage input AV11.
- Control the motor speed direction from multi-function input MI2.
- And if you want to decelerate to stop, please press  key.

### 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 [ZMaintenance](#)– from page 99.

# 8

## ERROR DETECTION AND TROUBLE-SHOOTING

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

---

h Refer to [ZFundamental safety instructions](#)– from page 9.

### 8.2 Requirements to the executing personnel

---

The personnel, who works with the **b maXX**<sup>®</sup> 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 Error information

---

The **b maxx**<sup>®</sup> **1000** has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the device digital keypad display. The five most recent faults can be read from the digital keypad or communication.

---

#### NOTE



Wait 5 seconds after a fault has been cleared before performing reset via keypad of input terminal.

## 8.3 Error information

### 8.3.1 Fault code information

Fault code	Fault name	Fault description	Error reaction	Corrective actions
0003 <sub>hex</sub>	oc	<b>Over current</b> Abnormal increase in current.	PWM inhibit	<ul style="list-style-type: none"> <li>m Check if motor power corresponds with the device output power.</li> <li>m Check the wiring connections to U/T1, V/T2, W/T3 for possible short circuits.</li> <li>m Check the wiring connections between the device and motor for possible short circuits, also to ground.</li> <li>m Check for loose contacts between device and motor.</li> <li>m Increase the acceleration time.</li> <li>m Check for possible excessive loading conditions at the motor.</li> <li>m If there are still any abnormal conditions when operating the device after a short-circuit is removed and the other points above are checked, it should be sent back to manufacturer.</li> </ul>
0021 <sub>hex</sub>	cPtE cc02 cc04 to cc08	<b>CAN error</b>	P0296	<ul style="list-style-type: none"> <li>m cPtE: initialization error</li> <li>m cc02: Node Guarding or Heartbeat error</li> <li>m cc04: no CAN communication between slave and master</li> <li>m cc05: hardware failure or no CANopen hardware available on processing unit</li> <li>m cc06: no CANopen software available on processing unit</li> <li>m cc07: an update of CANopen is necessary</li> <li>m cc08: hardware error</li> </ul>
0030 <sub>hex</sub>	AnCd	<b>Error in analog option card</b>	P1007	<ul style="list-style-type: none"> <li>m Check or change analog option card</li> </ul>
0035 <sub>hex</sub>	AoFF	<b>Analog option card break off error</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Check or change analog option card</li> </ul>
0050 <sub>hex</sub>	UbCd PE10	<b>Communication error USB (CME-USB-01) or IO COM1 communication time out</b>	P0868	<ul style="list-style-type: none"> <li>m Check or change analog option card</li> </ul>



Fault code	Fault name	Fault description	Error reaction	Corrective actions
0052 <sub>hex</sub>	ov	<b>Over voltage</b> The DC link voltage has exceeded its maximum allowable value.	PWM inhibit	<ul style="list-style-type: none"> <li>m Check if the input voltage falls within the rated device input voltage range.</li> <li>m Check for possible voltage transients.</li> <li>m DC link over-voltage may also be caused by motor regeneration. Either increase the deceleration time or add an optional braking resistor (and brake unit).</li> <li>m Check whether the required braking power is within the specified limits.</li> </ul>
0054 <sub>hex</sub>	GFF	<b>Ground fault</b>	PWM inhibit	<p>When (one of) the output terminal(s) is grounded, short circuit current is more than 50 % of <b>b maXX</b><sup>®</sup> rated current, the drive power module may be damaged.</p> <p>NOTE: The short circuit protection is provided for <b>b maXX</b><sup>®</sup> drive protection, not for protection of the user.</p> <ul style="list-style-type: none"> <li>m Check whether the IGBT power module is damaged.</li> <li>m Check for possible poor insulation at the output line.</li> </ul>
0062 <sub>hex</sub>	PtC1	<b>Motor overheat protection</b>	P0119	<ul style="list-style-type: none"> <li>m Check if the motor is overheated</li> <li>m Check <b>P0117</b> to <b>P0122</b> settings</li> </ul>
0063 <sub>hex</sub>	oL1	<b>Overload 1</b> $I_t > 100\%$	PWM inhibit	<ul style="list-style-type: none"> <li>m Check for possible motor overload.</li> <li>m Check electronic thermal overload setting.</li> <li>m Use a higher power motor.</li> <li>m Reduce the current level so that the drive output current does not exceed the value set by the Motor rated current <b>P0054</b>.</li> </ul>
0070 <sub>hex</sub>	PGEr	<b>Communication error PG card (option card)</b>	P1077	<ul style="list-style-type: none"> <li>m Check or change PG option card</li> </ul>
00A0 <sub>hex</sub>	cE10	<b>Communication error modbus</b>	P0862	<ul style="list-style-type: none"> <li>m Check the RS485 connection between the <b>b maXX</b><sup>®</sup> drive and RS485 master for loose wires and wiring to correct pins.</li> <li>m Check if the communication protocol, address, transmission speed, etc. are properly set.</li> <li>m Use the correct checksum calculation.</li> </ul>

## 8.3 Error information

Fault code	Fault name	Fault description	Error reaction	Corrective actions
00A1 <sub>hex</sub>	cP10	<b>Communication time-out error on the control board or power board</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Press RESET key to set all parameters to factory setting</li> <li>m Return the <b>b maXX</b><sup>®</sup> to the factory</li> </ul>
00B0 <sub>hex</sub>	cF10 cF11 cF20 cF21	<b>EEPROM error</b>	P1007	<ul style="list-style-type: none"> <li>m cF10,cF11: internal EEPROM can not be programmed (return the <b>b maXX</b><sup>®</sup> to the factory)</li> <li>m cF20,cF21: internal EEPROM can not be read (set all parameters to factory setting or return the <b>b maXX</b><sup>®</sup> to the factory)</li> </ul>
00B2 <sub>hex</sub>	Ecnt	<b>Checksum error in EEPROM</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m The parameter (<b>P0077, P0110, P0811, P0812, P0850, P1172, P1173, P1176, P1177, P1180, P1181, P1182, P1183, P1184, P1361, P1362, P1363, P1359</b>) writing to the EEPROM by power off was not completed.</li> </ul>
0500 <sub>hex</sub>	oH1	<b>IGBT Overheating</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Ensure that the ambient temperature is within the specified temperature range.</li> <li>m Make sure that the ventilation holes are not obstructed.</li> <li>m Remove any foreign objects from the heatsink and check for possible dirty heat sink fins.</li> <li>m Check the fan and clean it.</li> <li>m Provide enough spacing for adequate ventilation.</li> </ul>
0501 <sub>hex</sub>	Lv	<b>Low voltage</b> The device detects that the DC link voltage has fallen below its minimum value.	P0297	<ul style="list-style-type: none"> <li>m Check whether the input voltage falls within the device rated input voltage range.</li> <li>m Check for abnormal load in motor.</li> <li>m Check for correct wiring of input power (for 3-phase models) without phase loss.</li> </ul>
0502 <sub>hex</sub>	PHL	<b>Phase loss</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Check input phase wiring for loose contacts</li> </ul>
0503 <sub>hex</sub>	codE	<b>Password invalid</b>	P1007	<ul style="list-style-type: none"> <li>m Return the <b>b maXX</b><sup>®</sup> to the factory</li> </ul>

Fault code	Fault name	Fault description	Error reaction	Corrective actions
0505 <sub>hex</sub>	cF34	<b>Temperature sensor error</b>	PWM inhibit	m Return the <b>b maXX</b> <sup>®</sup> to the factory
0506 <sub>hex</sub>	Aerr	<b>Analog signal error</b>	P0806	m Check the wiring of ACI
0507 <sub>hex</sub>	oL	<b>Overload</b> The device detects excessive drive output current.  NOTE: The device can withstand up to 150 % of the rated current for a maximum of 60 seconds.	PWM inhibit	m Check whether the motor is overloaded. m Reduce torque compensation setting in <b>P0112</b> . m Use the next higher power model.
0509 <sub>hex</sub>	oL2	<b>Overload 2</b> Motor overload.	P1213	m Reduce the motor load. m Adjust the over-torque detection setting to an appropriate setting ( <b>P1213</b> to <b>P1215</b> ).
050A <sub>hex</sub>	HPF1	<b>CC (current clamp)</b>	PWM inhibit	m Return to the factory
050B <sub>hex</sub>	HPF2	<b>OV hardware error</b>	PWM inhibit	
050C <sub>hex</sub>	HPF3	<b>GFF hardware error</b>	PWM inhibit	
050D <sub>hex</sub>	HPF4	<b>OC hardware error</b>	PWM inhibit	
050E <sub>hex</sub>	cF33	<b>DC BUS (0 V or Lv) checking error</b>	PWM inhibit	
0512 <sub>hex</sub>	PtC2	<b>Motor PTC temperature error</b>	P0122	m Check if the motor is overheated m Check <b>P0117</b> to <b>P0122</b> settings
0513 <sub>hex</sub>	FbE	<b>PID feedback error</b>	P1368	m Check parameter settings ( <b>P1360</b> ) and AVI/ACI wiring. m Check parameter settings ( <b>P1381</b> ) offset level for PID control. m Check parameter settings ( <b>P1382</b> ) detection time for PID offset level. m Check parameter settings ( <b>P1368</b> ) for error or warning

## 8.3 Error information

Fault code	Fault name	Fault description	Error reaction	Corrective actions
0515 <sub>hex</sub>	cF30	<b>U-phase error</b>	PWM inhibit	m Return to the factory
0516 <sub>hex</sub>	cF31	<b>V-phase error</b>	PWM inhibit	
0517 <sub>hex</sub>	cF32	<b>W-phase error</b>	PWM inhibit	
0518 <sub>hex</sub>	ocA	<b>Overcurrent during acceleration</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Short-circuit at motor output: Check for possible poor insulation at the output lines.</li> <li>m Torque boost too high: Decrease the torque compensation setting in <b>P0112</b>.</li> <li>m Acceleration time too short: Increase the acceleration time.</li> <li>m Device output power is too small: Replace the device with the next higher power model.</li> </ul>
0519 <sub>hex</sub>	ocd	<b>Overcurrent during deceleration</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Short-circuit at motor output: Check for possible poor insulation at the output line.</li> <li>m Deceleration time too short: Increase the deceleration time.</li> <li>m Device output power is too small: Replace the device with the next higher power model.</li> </ul>

Fault code	Fault name	Fault description	Error reaction	Corrective actions
051A <sub>hex</sub>	ocn	<b>Overcurrent during constant speed operation</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Short-circuit at motor output: Check for possible poor insulation at the output line.</li> <li>m Sudden increase in motor loading: Check for possible motor stall.</li> <li>m Device output power is too small: Replace the device with the next higher power model.</li> </ul>
051B <sub>hex</sub>	oH2	<b>Power board overheat</b>	PWM inhibit	<ul style="list-style-type: none"> <li>m Ensure that the ambient temperature is within the specified temperature range.</li> <li>m Make sure that the ventilation holes are not obstructed.</li> <li>m Remove any foreign objects from the heatsink and check for possible dirty heat sink fins.</li> <li>m Check the fan and clean it.</li> </ul>
051C <sub>hex</sub>	EF	<b>External fault</b>	P0803	<ul style="list-style-type: none"> <li>m When multi-function input terminals (MI3-MI5 or MI7 to MI12) are set to external fault, the device stops output U/T1, V/T2 and W/T3.</li> <li>m Give RESET command after fault has been cleared.</li> </ul>

## NOTE



CANopen error table see [ZE.6.2 CANopen error display via digital keypad](#)— on page 155 and error table in **b maXX<sup>®</sup> 4400** parameter manual.

## 8.4 Warning code information


### 8.4 Warning code information

Warning code	Warning name	Warning descriptions	Parameter
7	cE10	Warning: communication modbus	P0862
8	oL2	Warning: motor load exceeded	P1213
9	AUE	Warning: auto tuning error	-
10	Uc	Warning: under voltage	-
11	SE1	Warning: keypad copy parameter operation error	-
12	SE2	Warning: keypad copy parameter save error	-
13	PtC2	Warning: motor PTC temperature exceeded	P1012
14	PGEr	Warning: PG (encoder) loss	P1077
15	FbE	Warning: PID feedback	P1368
16	SAvE	Warning: keypad copying	-
23	PE10	Warning: IO COM1 communication time out	P0868
25	Lv	Warning: DC BUS voltage has lower than standard voltage	P0297
26	Aerr	Warning: control board ACI (current) loss	P0806
27	bb	Warning: base block	P1091 to P1100
33	CSdo	Warning: CANopen SDO time out	
34	CSfF	Warning: CANopen buffer overflow	
36	CbtU	Warning: CANopen boot up error	
50	cc01	Warning: At least one of the error counters of the CANopen slave has reached the value 96	
51	cc03	Warning : The SYNC-message is not received within the configured time	
52	UbCd	Warning: communication error USB card	P0868
53	cPt2	Warning: CAN error	

## 8.5 Reset

---

There are three methods to reset the device after solving the fault:

- m Press  key on keypad.
- m Set external terminal to „RESET“ (set one of **P1091** to **P1094** to 05) and then set to be ON.
- m Send „RESET“ command by communication.

---

### NOTE



Make sure that RUN command or signal is OFF before executing RESET to prevent damage or personal injury due to immediate operation.

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## 8.6 Troubleshooting

### 8.6.1 Overcurrent (OC)

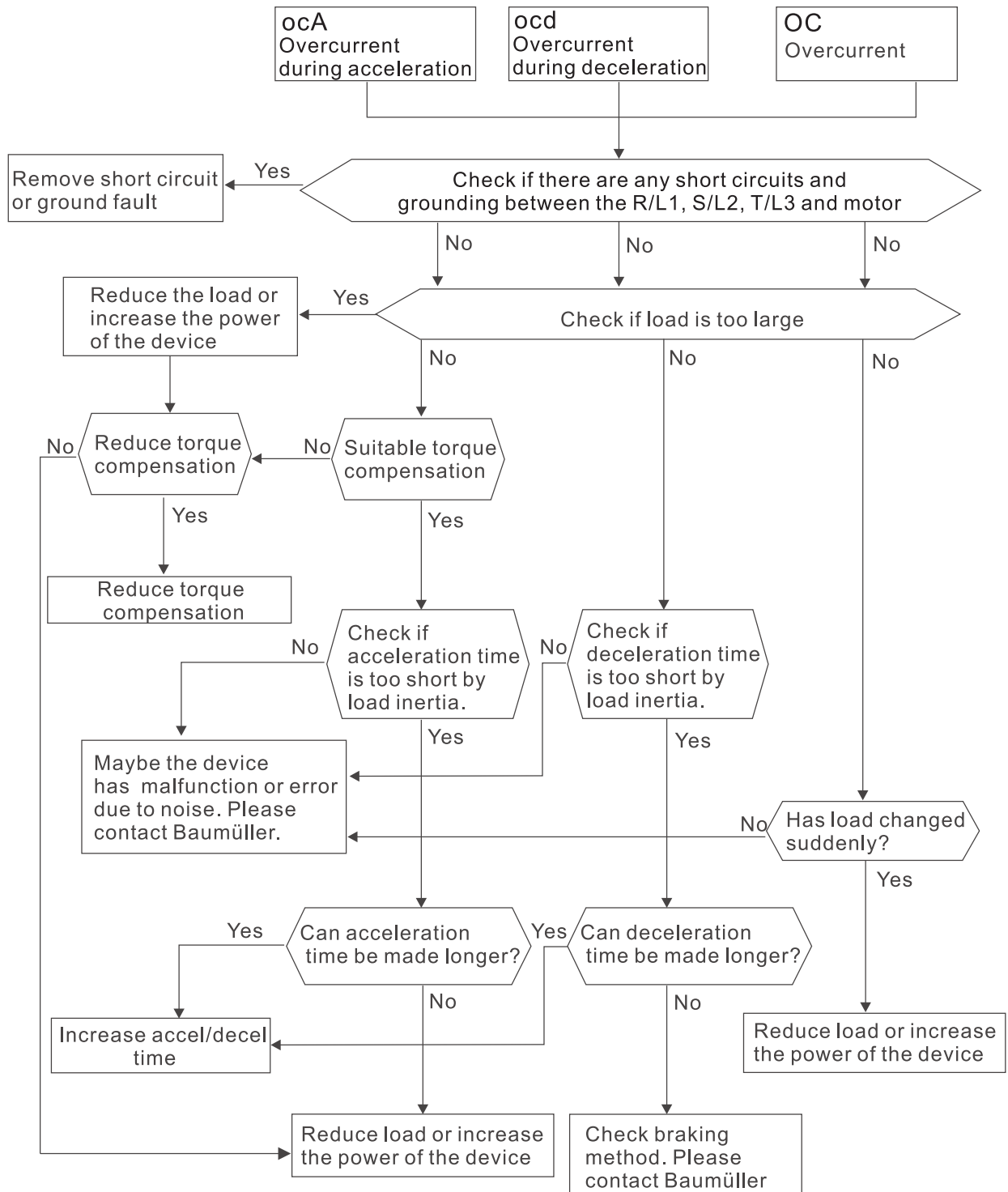


Figure 47: Troubleshooting over current



## 8.6.2 Ground fault

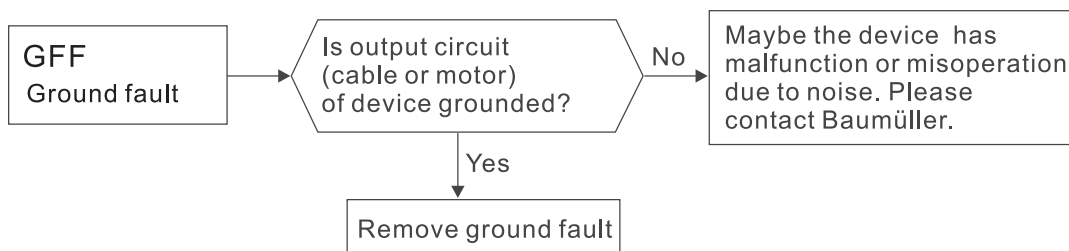


Figure 48: Troubleshooting ground fault

## 8.6.3 Overvoltage

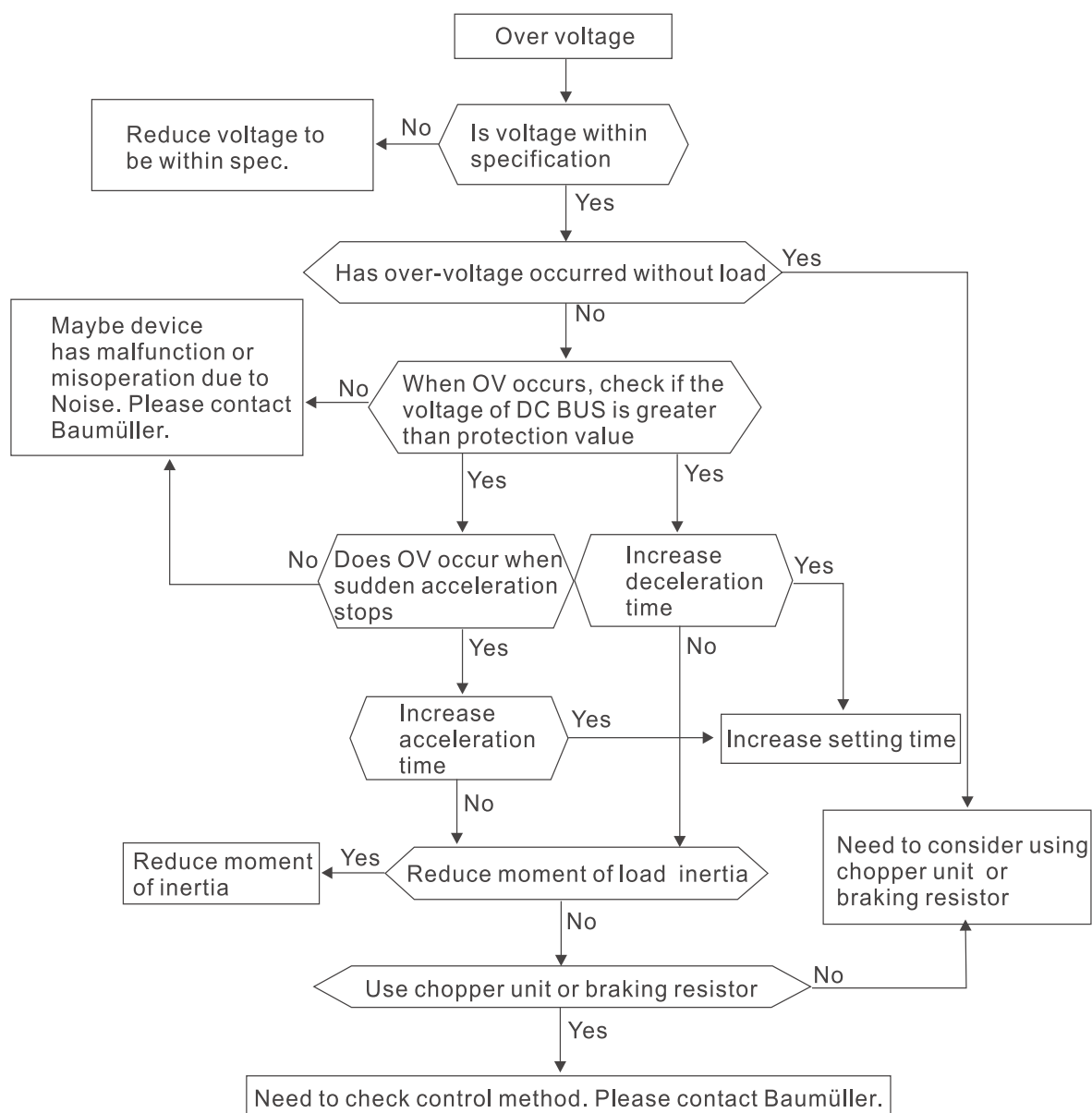


Figure 49: Troubleshooting overvoltage

## 8.6.4 Low voltage (Lv)

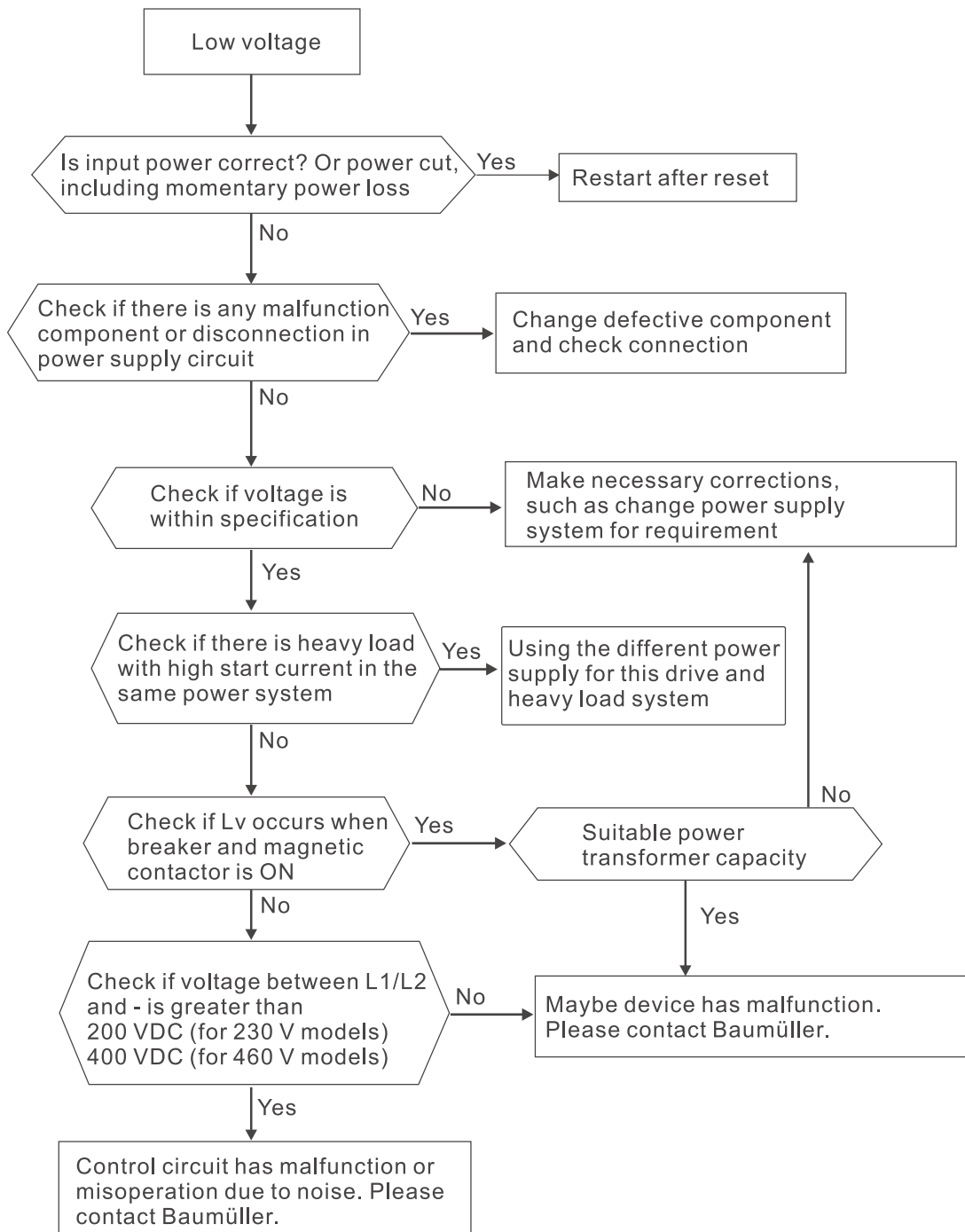


Figure 50: Troubleshooting low voltage

8.6.5 Overheat (OH)

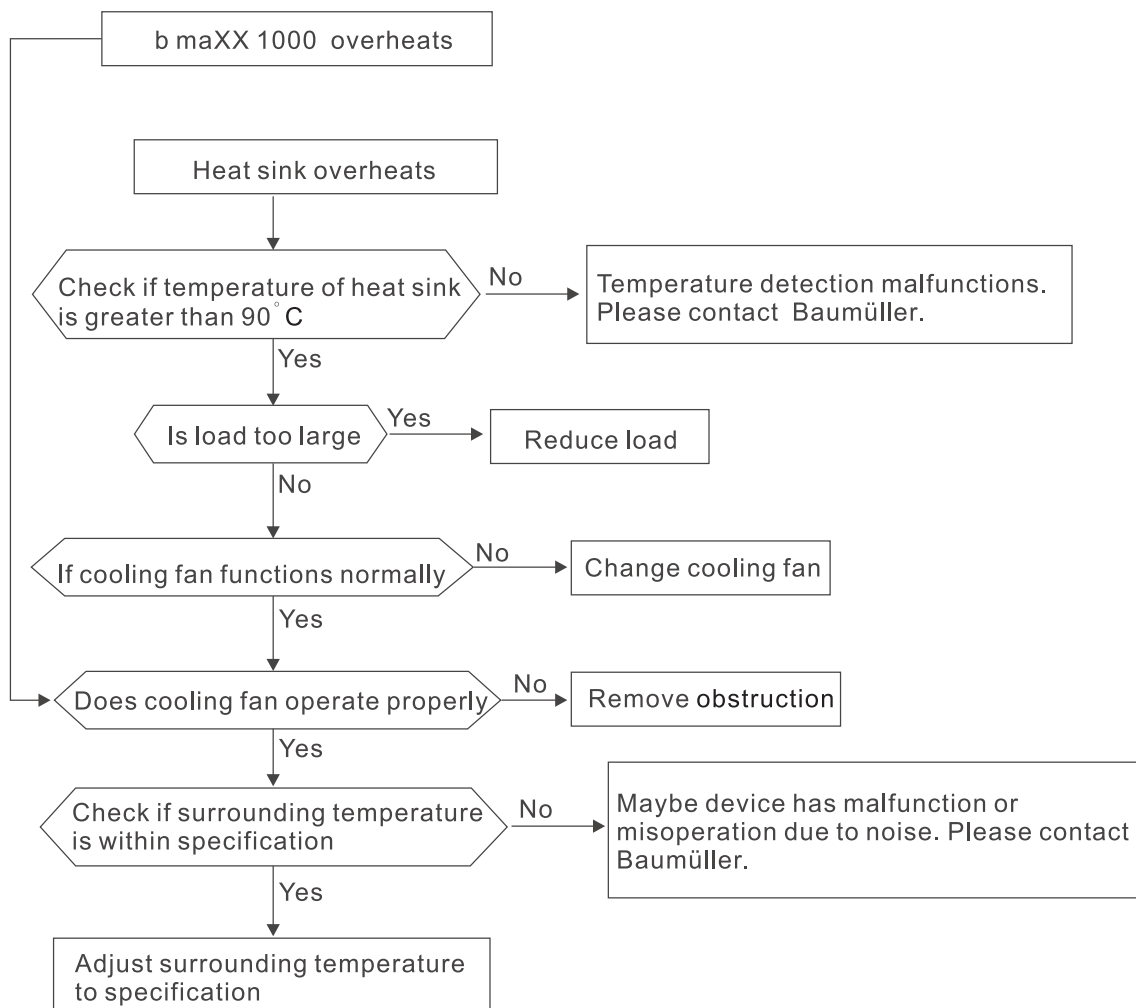


Figure 51: Troubleshooting overheat

8.6.6 Overload OL

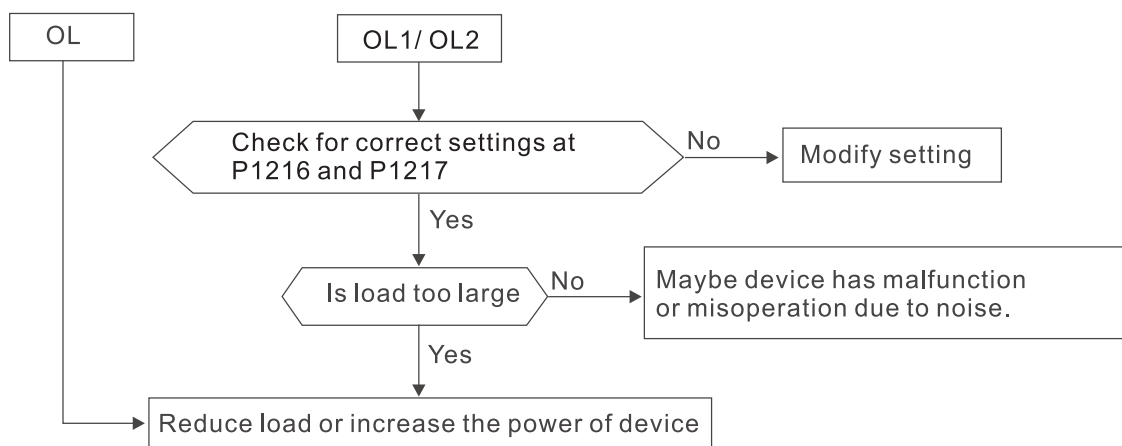


Figure 52: Troubleshooting overload

### 8.6.7 Keypad display is abnormal

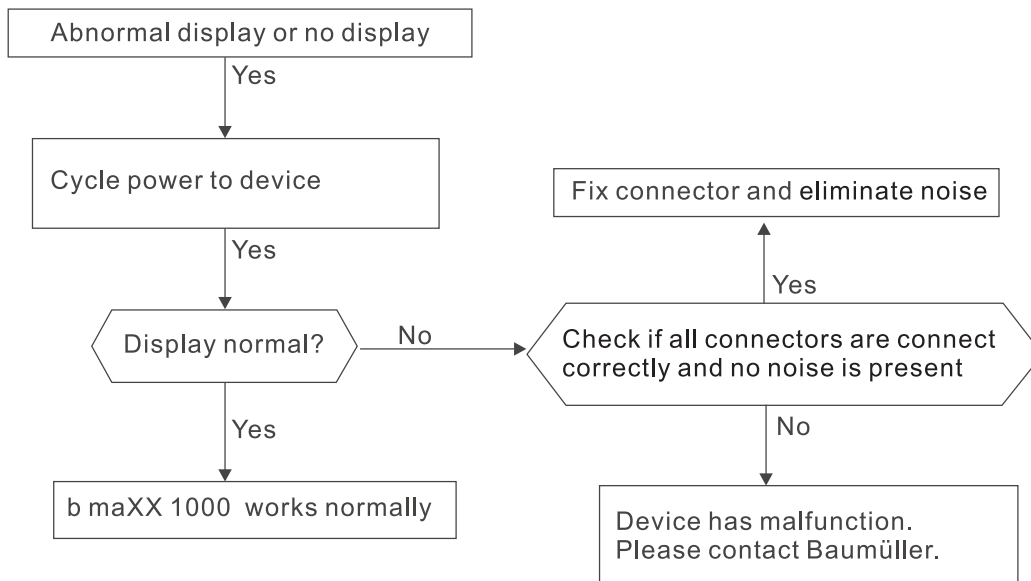


Figure 53: Troubleshooting keypad display

### 8.6.8 Phase Loss (PHL)

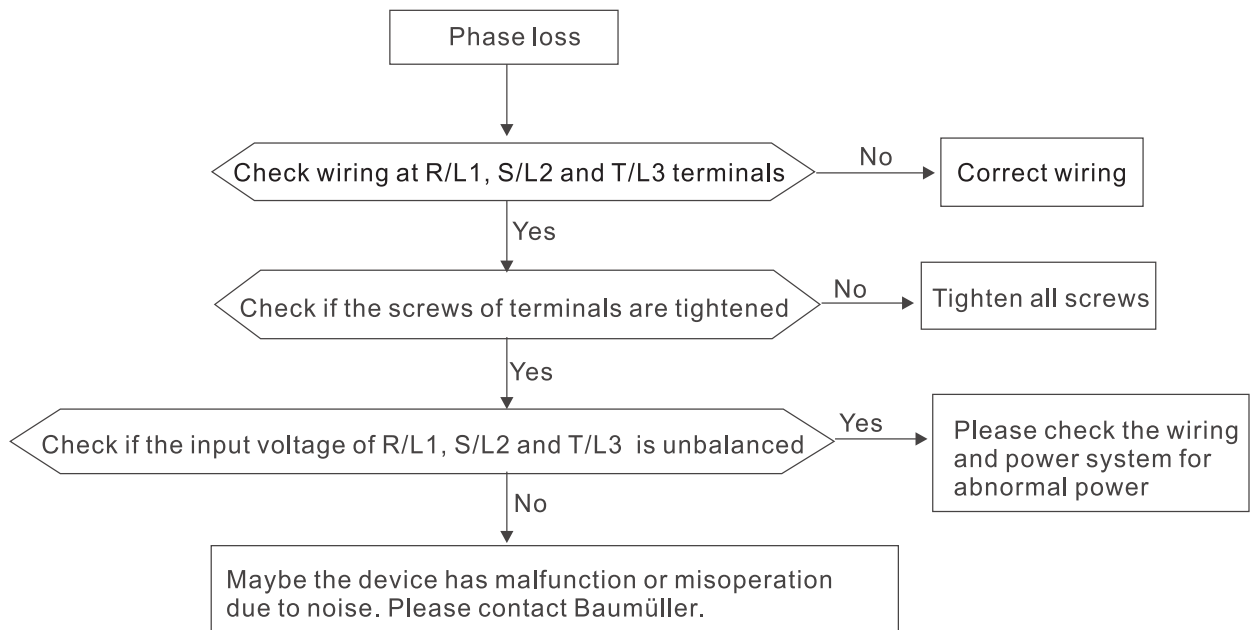


Figure 54: Troubleshooting phase loss

## 8.6.9 Motor doesn't run

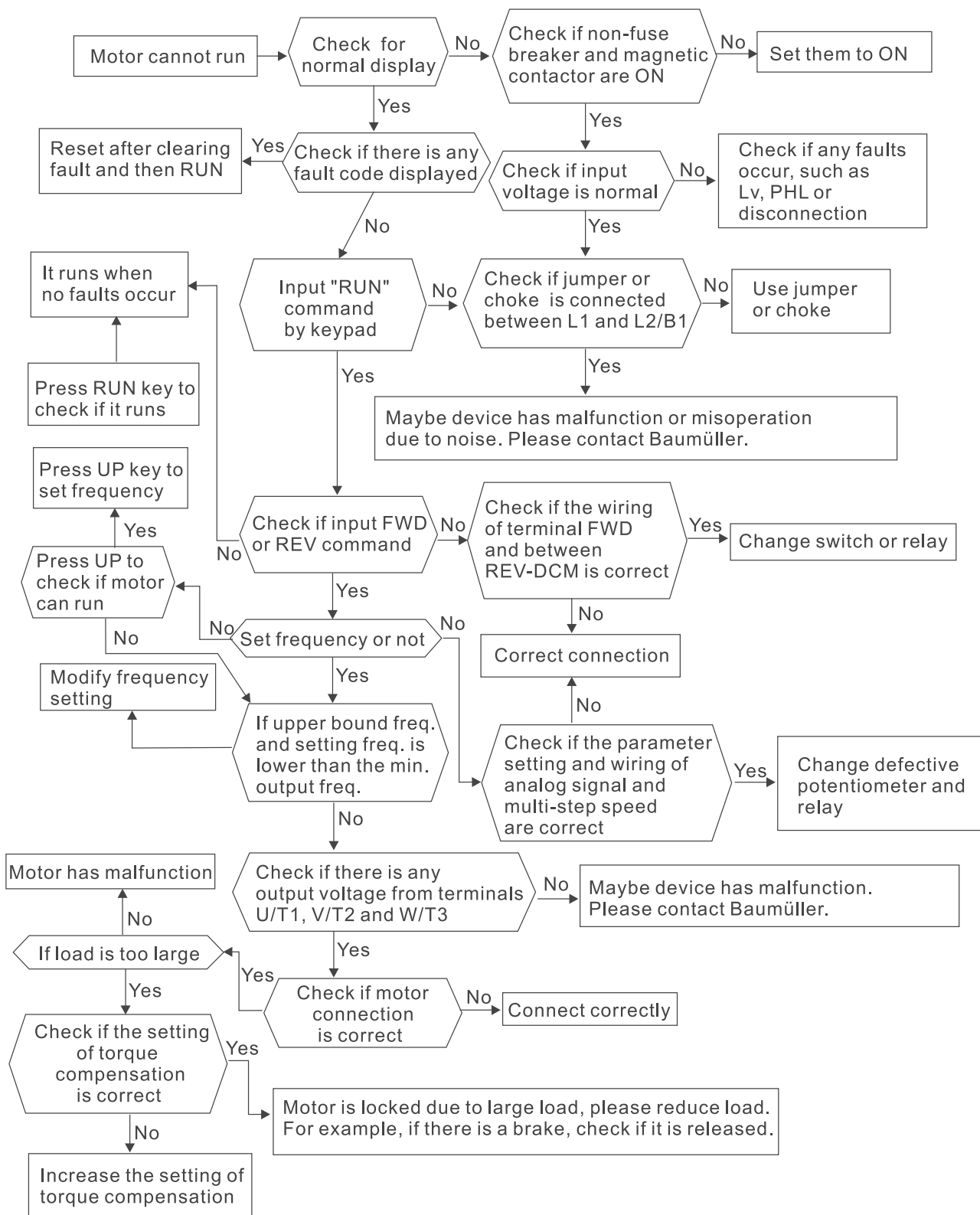


Figure 55: Troubleshooting motor doesn't run

## 8.6.10 Motor speed cannot be changed

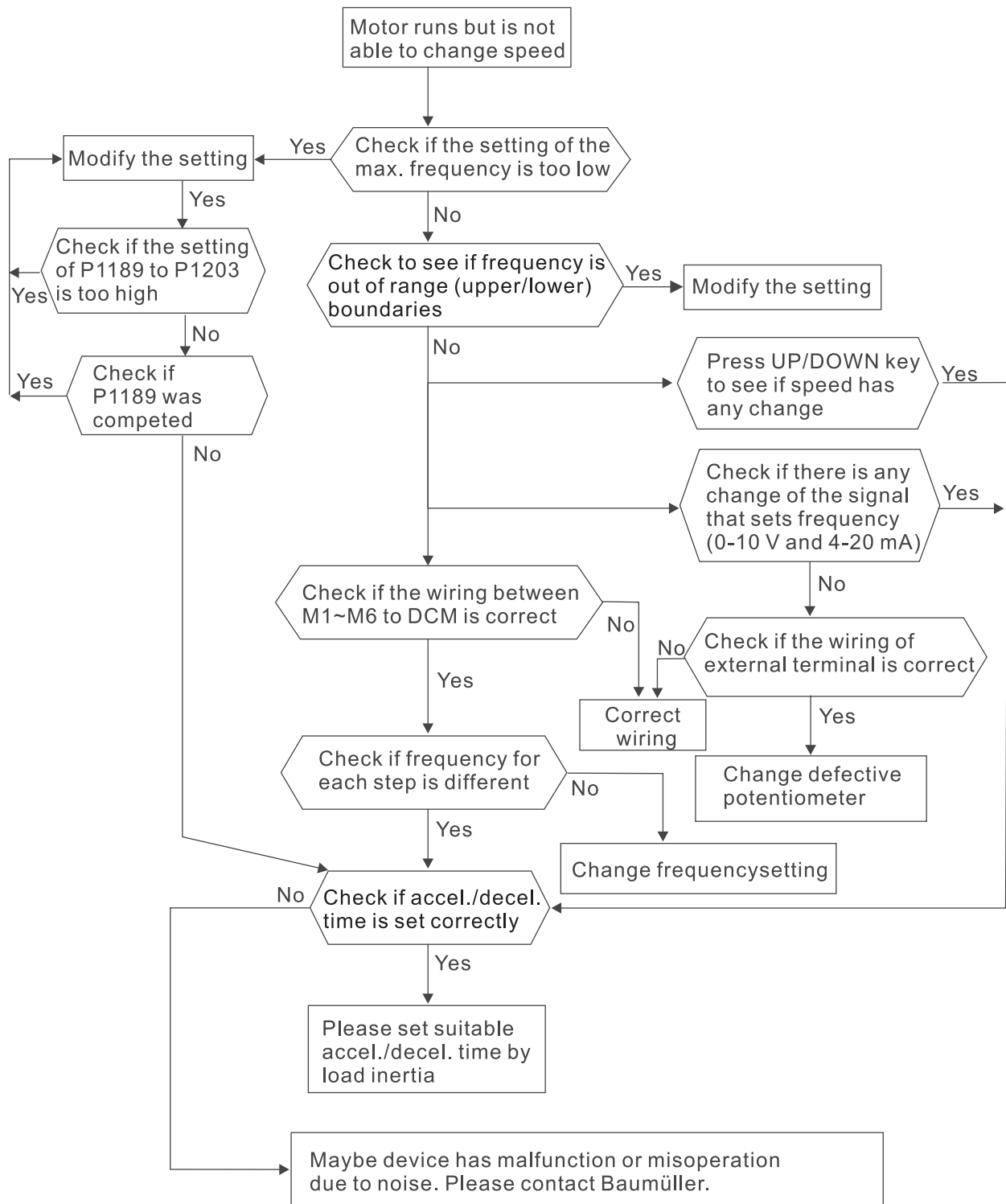


Figure 56: Troubleshooting motor speed cannot be changed

8.6.11 Motor stalls during acceleration

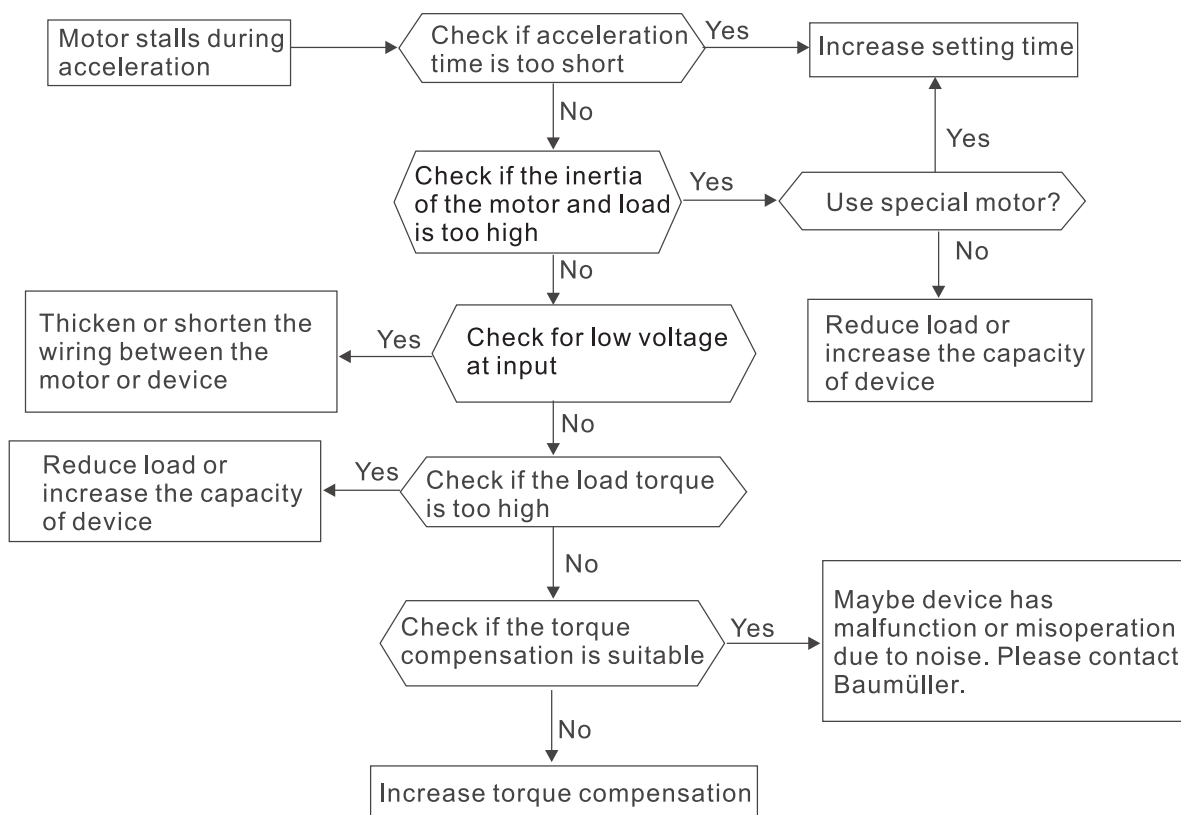


Figure 57: Troubleshooting motor stalls during acceleration

8.6.12 The motor does not run as expected

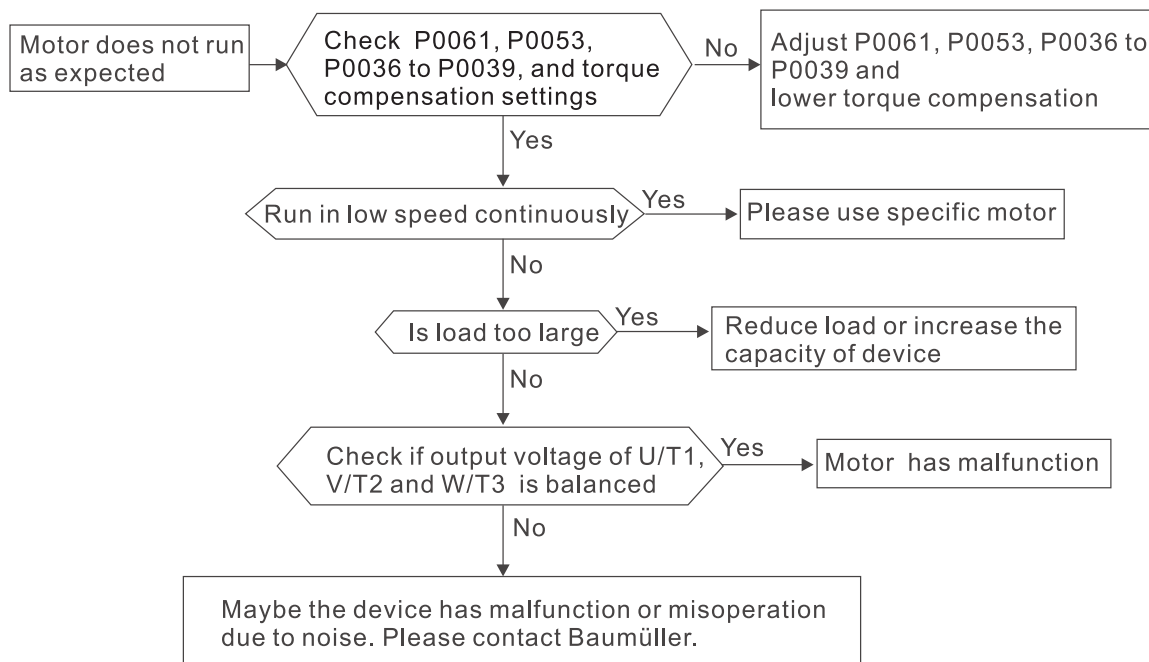


Figure 58: Troubleshooting motor does not run as expected

### 8.7 Electromagnetic/induction noise

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Many sources of noise surround the device and penetrate it by radiation or conduction. It may cause malfunctioning of the control circuits and even damage the device. Of course, there are solutions to increase the noise tolerance of the device. But this has its limits. Therefore it will be the best to solve it from the outside as follows.

- m Add surge suppressor on the relays and contacts to suppress switching surges.
- m Shorten the wiring length of the control circuit or serial communication and keep them separated from the power circuit wiring.
- m Comply with the wiring regulations by using shielded wires and isolation amplifiers for long length.
- m The grounding terminal should comply with the local regulations and be grounded independently, i.e. not to have common ground with electric welding machines and other power equipment.
- m Connect a noise filter at the mains input terminal of the device to filter noise from the power circuit. **b maXX® 1000** can have a built-in filter as option.

In short, solutions for electromagnetic noise exist of „no product“ (disconnect disturbing equipment), „no spread“ (limit emission for disturbing equipment) and „no receive“ (enhance immunity).

### 8.8 Environmental condition

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Since the **b maXX® 1000** is an electronic device, you should comply with the environmental conditions as stated in [ZD.1 Required environmental conditions](#)— from page 140. Here are some remedial measures if necessary.

- m To prevent vibration, the use of anti-vibration dampers is the last choice. Vibrations must be within the specification. Vibration causes mechanical stress and it should not occur frequently, continuously or repeatedly to prevent damage to the device.
- m Store the device in a clean and dry location, free from corrosive fumes/dust to prevent corrosion and poor contacts. Poor insulation in a humid location can cause short-circuits. If necessary, install the device in a dust-proof and painted enclosure and in particular situations, use a completely sealed enclosure.
- m The ambient temperature should be within the specification. Too high or too low temperature will affect the lifetime and reliability. For semiconductor components, damage will occur once any specification is out of range. Therefore, it is necessary to periodically check air quality and the cooling fan and provide extra cooling of necessary. In addition, the microcomputer may not work in extremely low temperatures, making cabinet heating necessary.
- m Store within a relative humidity range of 0 % to 90 % and non-condensing environment. Use an air conditioner and/or exsiccator.



## 8.9 Affecting other machines

A **b maXX<sup>®</sup> 1000** may affect the operation of other machines due to many reasons. Some solutions are:

- High harmonics at power side
  - n High harmonics at power side during running can be improved by
    - m Separate the power system: Use a transformer for the device.
    - m Use a choke or rectifier at the power input terminal of the device or decrease high harmonic by multiple circuit.
    - m If phase lead capacitors are used (never on the device output), use chokes to prevent damage to the capacitors from high harmonics.

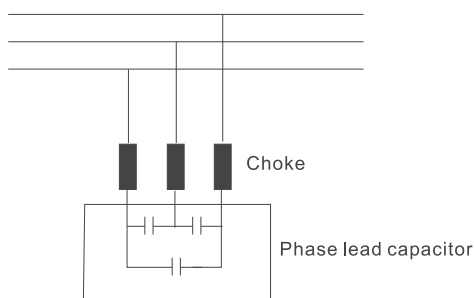


Figure 59: Phase lead capacitors

- Motor temperature rises
  - n When the motor is a standard motor with fan, the cooling will be bad at low speeds, causing the motor to overheat. Besides, high harmonics at the output increases copper and core losses. The following measures should be used depending on load and operation range.
    - m Use a motor with independent ventilation (forced external cooling) or increase the motor rated power.
    - m Use a special inverter-duty motor.
    - m Do NOT run at low speeds for long time.



# MAINTENANCE

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

## 9.1 Safety instructions

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h Refer to [ZFundamental safety instructions](#)— from page 9.

h Refer to the danger areas of the devices.



Figure 60: Danger areas b maXX® BM1000

### 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 [ZAppendix D - Technical data](#)— from page 139. The most important prescribed environmental conditions are:

- m Dustless ambient air
- m Temperature: min. -10 °C to max. +50 °C (14 - 122 °F)  
min. -10 °C to max +40 °C (14 - 104 °F)  
for side-by-side mounting
- m Relative air humidity: 0 to 90 %, no condensation allowed
- m (Operational-) height: Altitude up to 1000 m
- m Atmosphere pressure: 86 - 106 kPa
- m Vibration: <20 Hz: 9.80 m/s<sup>2</sup> (1 G) max.  
20 - 50 Hz: 5.88 m/s<sup>2</sup> (0.6 G)

### 9.3 Inspection intervals - maintenance notes

**b maXX<sup>®</sup> 1000** drives are based on solid-state electronics technology. Preventive maintenance is required to keep the device in its optimal condition, and to ensure a long life. It is recommended to have a qualified technician perform a check-up of the device regularly.

**Daily inspection:** Basic check-up items to detect if there were any abnormalities during operation are:

- m Whether the motors are operating as expected.
- m Whether the installation environment is abnormal.
- m Whether the cooling system is operating as expected.
- m Whether any irregular vibration or sound occurred during operation.
- m Whether the motors are overheating during operation.
- m Always check the input voltage of the device with a voltmeter.

**Periodic inspection:** Before the check-up, always turn off the input power and remove the cover. Wait at least 10 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between ⊕ and ⊖ . It should be less than 25 V<sub>DC</sub>.

#### DANGER



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

- m serious personal injury
- m death



*The hazard is: **electricity**.*

- m Disconnect power before processing!
- m Only qualified personnel shall install, wire and maintain the devices. Please take off any metal objects, such as watches and rings, before operation. And only insulated tools are allowed.
- m Never reassemble internal components or wiring.
- m Prevent electric shocks.

9.3.1 periodical maintenance

m Ambient environment

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
Check the ambient temperature, humidity, vibration and see if there are any dust, gas, oil or water drops	Visual inspection and measurement with equipment with standard specification	○		
Check if there are any dangerous objects in the environment	Visual inspection	○		

m Voltage

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
Check if the voltage of main circuit and control circuit is correct	Measure with multimeter with standard specification	○		

m Keypad

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
Is the display clear for reading?	Visual inspection	○		
Any missing characters?	Visual inspection	○		

m Mechanical parts

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any abnormal sound or vibration	Visual and aural inspection		○	
If there are any loose screws	Tighten the screws		○	
If any part is deformed or damaged	Visual inspection		○	
If there is any color change by overheating	Visual inspection		○	
If there is any dust or dirt	Visual inspection		○	

## 9.3 Inspection intervals - maintenance notes

### m Main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there are any loose or missing screws	Tighten or replace the screw		○	
If machine or insulator is deformed, cracked, damaged or with changed color change due to overheating or ageing	Visual inspection <b>NOTE:</b> Please ignore the color change of copper plate		○	
If there is any dust or dirt	Visual inspection		○	

### m Terminals and wiring of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If the wiring shows change of color change or deformation due to overheat	Visual inspection		○	
If the insulation of wiring is damaged or the color has changed	Visual inspection		○	
If there is any damage	Visual inspection		○	

### m DC capacity of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any leakage of liquid, change of color, cracks or deformation	Visual inspection	○		
Measure static capacity when required	Static capacity $\geq$ initial value X 0.85		○	

### m Resistor of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any peculiar smell or insulator cracks due to overheating	Visual inspection, smell		○	
If there is any disconnection	Visual inspection or measure with multimeter after removing wiring between +1/+2 ~ - Resistor value should be within $\pm 10\%$		○	

## m Transformer and chokes of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any abnormal vibration or peculiar smell	Visual, aural inspection and smell		○	

## m Magnetic contactor and relay of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there are any loose screws	Visual and aural inspection. Tighten screw if necessary	○		
If the contact works correctly	Visual inspection	○		

## m Printed circuit board and connector of main circuit

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there are any loose screws and connectors	Tighten the screws and press the connectors firmly in place.		○	
If there is any peculiar smell and color change	Visual inspection and smell		○	
If there is any crack, damage, deformation or corrosion	Visual inspection		○	
If there is any leaked liquid or deformation in capacitors	Visual inspection		○	

## m Cooling fan of cooling system

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any abnormal sound or vibration	Visual, aural inspection and turn the fan with hand (turn off the power before operation) to see if it rotates smoothly			○
If there is any loose screw	Tighten the screw			○
If there is any change of color due to overheating	Change fan			○

## 9.3 Inspection intervals - maintenance notes

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m Ventilation channel of cooling system

Check items	Methods and criterion	Maintenance period		
		Daily	Half year	One year
If there is any obstruction in the heat sink, air intake or air outlet	Visual inspection	○		



# 10

## REPAIR

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

### WARNING



The following **may occur**, if you disregard these safety notes:  
m serious personal injury m death



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

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



# SHUTDOWN, STORAGE

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

## 11.1 Safety instructions

---

h Refer to [ZFundamental safety instructions](#)– from page 9 and the information in [ZTransportation and packing](#)– from page 21.

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:

m serious personal injury m 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.

---

### 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:

m 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 [ZTo be considered by transportation](#)— on page 21.

In case you want to dispose the device, additional data is available in chapter [ZDisposal](#)— from page 111.

## 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.

The device should be kept in the shipping carton or crate before installation. In order to retain the warranty coverage, the device should be stored properly when it is not to be used for an extended period of time.

- m Store in a clean and dry location free from direct sunlight or corrosive fumes.
- m Store within an ambient temperature range of -20 °C to +60 °C (-4 to 140 °F).
- m Store within a relative humidity range of 0 % to 90 % and non-condensing environment.
- m Store within an air pressure range of 86 kPa to 106 kPa.
- m Store within a vibration of:
  - <20 Hz: 9.80 m/s<sup>2</sup> (1 G) max.
  - 20 - 50 Hz: 5.88 m/s<sup>2</sup> (0.6 G)
- m Store within a pollution degree of 2 (good for factory type environment).



### CAUTION

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

- m 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:

- m DO NOT store in an area with rapid changes in temperature. It may cause condensation and frost.
- m DO NOT place on the ground directly. It should be stored properly. Moreover, if the surrounding environment is humid, you should put exsiccator in the package.
- m If the device is stored for more than 3 months, the temperature should not be higher than 30 °C. Storage longer than one year is not recommended, it could result in the degradation of the electrolytic capacitors.
- m When the device is not used for a long time after installation on building sites or places with humidity and dust, it's best to move the device to an environment as stated above.

## 11.6 Recommissioning

---

Execute commissioning as with a new device, see [ZMounting](#)— from page 31, [ZInstallation](#)— from page 41



# 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

---

h Refer to [ZFundamental safety instructions](#)— from page 9.

---

### DANGER



The following **will occur**, if you disregard this safety note:  
m serious personal injury m 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.*

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

---

## 12.2 Requirements to the executing personnel

---



### CAUTION

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

m 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

---



### CAUTION

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

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

### 12.3.1 Modules

- Sheet steel** Sheet steel must be given to the iron metal recycling.
- Aluminium** Aluminium must be given to the non-iron metal recycling.
- Aluminium/copper compound** Aluminium/copper compound must be given to the non-iron metal recycling.
- Plastics** 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:

- m Environmental pollution

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



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

- Capacitors** Capacitors are to be recycled as special waste. Thereby refer to the relevant instructions.
- Semiconductor modules** Semiconductor modules are to be recycled as special waste. Thereby refer to the relevant instructions.
- Electronic scrap** 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

ACI	Analog current input
ACM	Signal common analog input
AFM	Analog multi-function output
AVI	Analog voltage input
BM	Baumüller Nürnberg GmbH
DCM	Digital signal common multi-function input
EMC	Electromagnetic compatibility
EN	European standard
FWD	Forward speed direction
IP	Class of protection
MCM	Multi-function photocoupler output
MI	Multi-function input
MO1	Multi-function output
N.C	Normally connected
N.O.	Normally open
PE	Protected earth
RCD	Residual-current-operated protective device
REV	Reverse speed direction



# B

## APPENDIX B - SPARE PARTS AND ACCESSORIES

In this appendix we are listing the spare-/accessory parts for the devices of the series **b maXX<sup>®</sup> 1000**. In case you have questions and suggestions according the accessories, do not hesitate to contact our product management.

### B.1 Chopper units and braking resistors

---



#### NOTE

Please only use Baumüller resistors and recommended values. Other resistors and values will void Baumüller's warranty. Please contact your nearest Baumüller representative for use of special resistors. The brake unit should be at least 10 cm away from the device to avoid possible interference.

---

## B.1.1 Select a chopper unit /braking resistor

- in progress -

for further information please contact your nearest Baumüller representative.



### NOTE

- m Please select the brake unit and/or braking resistor according to the table.
- m If damage to the device or other equipment is due to the fact that the braking resistors and the braking resistors in use are not provided by Baumüller, the warranty will be void.
- m Take into consideration the safety of the environment when installing the braking resistors.
- m If the minimum resistance value is to be utilized, consult local dealers for the calculation of the power in Watt.
- m Please select thermal relay trip contact to prevent resistor over load. Use the contact to switch power off to the device!
- m When using more than 2 chopper units, equivalent resistor value of parallel brake unit can't be less than the value in the column „Minimum equivalent resistor value for each device“ (see table below).
- m Please read the wiring information in the user manual of the brake unit thoroughly prior to installation and operation.

Voltage	Device	Applicable motor kW	Full load torque Nm	Resistor value spec for each device	Chopper unit model and quantity	Braking resistors model and quantity	Braking torque 10 % ED	Min. equivalent resistor value for each device	Typical thermal overload relay value
230V series	BM1211	0.2	0.110	200 W 250 Ω	BM1-BTE-23	1 R250-200-20	1 320	200 Ω	2 A
	BM1212	0.4	0.216	200 W 250 Ω	BM1-BTE-23	1 R250-200-20	1 170	100 Ω	2 A
	BM1213	0.75	0.427	200 W 150 Ω	BM1-BTE-23	1 R150-200-20	1 140	80 Ω	2 A
	BM1224	1.5	0.849	300 W 85 Ω	internal		125	40 Ω	
	BM1225	2.2	1.262	450 W 60 Ω	internal		120	40 Ω	
460V series	BM1412	0.4	0.216	300 W 400 Ω	BM1-BTE-46	1 R400-300-20	1 400	400 Ω	1 A
	BM1413	0.75	0.427	300 W 400 Ω	BM1-BTE-46	1 R400-300-20	1 200	200 Ω	1 A
	BM1414	1.5	0.849	400 W 300 Ω	BM1-BTE-46	1 R150-200-20	2 140	160 Ω	
	BM1425	2.2	1.262	600 W 200 Ω	internal	R400-300-20	2 140	140 Ω	
	BM1426	3.7	2.080	750 W 140 Ω	internal		125	96 Ω	
	BM1437	5.5	3.111	1100 W 96 Ω	internal		120	96 Ω	
	BM1438	7.5	4.148	1500 W 69 Ω	internal		125	69 Ω	
	BM1439	11	6.186	2000 W 53 Ω	internal		108	53 Ω	

## B.1.2 Chopper units BM1-BTE

- in progress -

for further information please contact your nearest Baumüller representative.

m Specification

Model BM1-		BTE-23 230 V series	BTE-46 460 V series
Max. motor power (kW)		1.5	1.5
Output rating	Max. peak discharge current (A) 10 % ED	3.6	1.8
	Continuous discharge current (A)	1.141	0.57
	Braking start-up voltage (DC)	328 V/345 V/362 V/ 380 V/397 V/415 V ±3 V	656 V/690 V/725 V/ 760 V/795 V/830 V ±6 V
Input rating	DC Voltage	200 to 400 V <sub>DC</sub>	400 to 800 V <sub>DC</sub>
Protection	Heat sink overheat	Temperature over +95 °C	
	Power charge display	Blackout until bus (+~) voltage below 50 V <sub>DC</sub>	
Environment	Installation location	Indoor (no corrosive gases, metallic dust)	
	Operating temperature	-10 to +50	
	Storage temperature	-20 to +60	
	Humidity	90 % R.H., non-condensing	
	Vibration	9.8m/s <sup>2</sup> (1G) under 20Hz 2m/s <sup>2</sup> (0.2G) at 20 ~ 50Hz	
Mechanical configuration		Wall-mounted enclosed type IP20	

## m Dimension (all dimensions in mm)

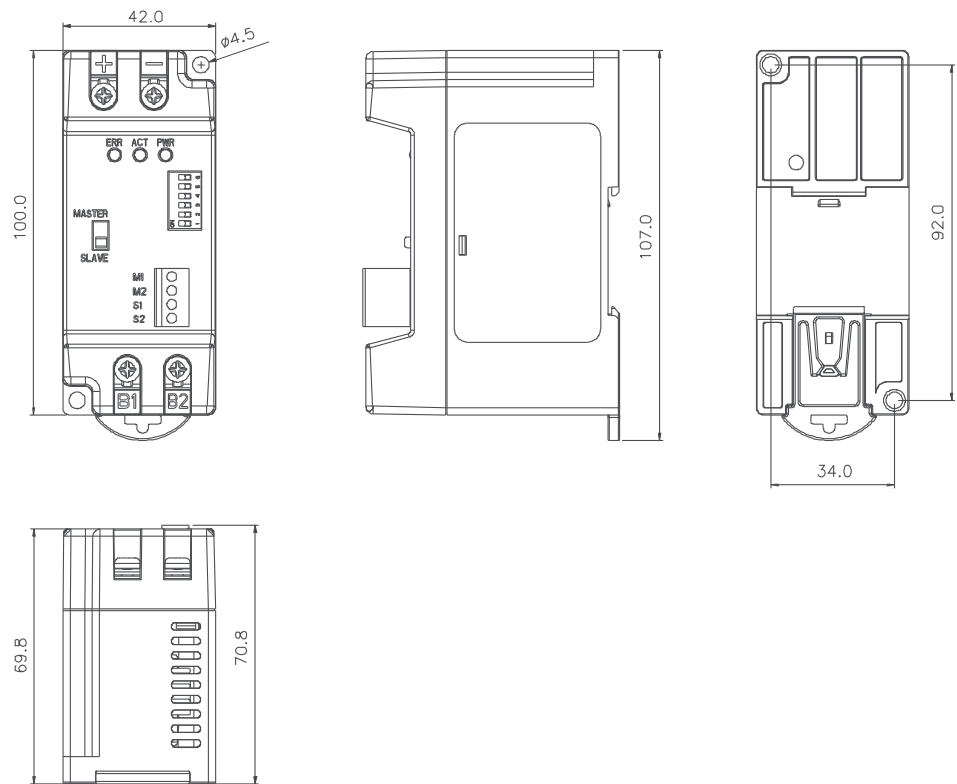


Figure 61: Dimensions chopper unit

## m DIN rail installation

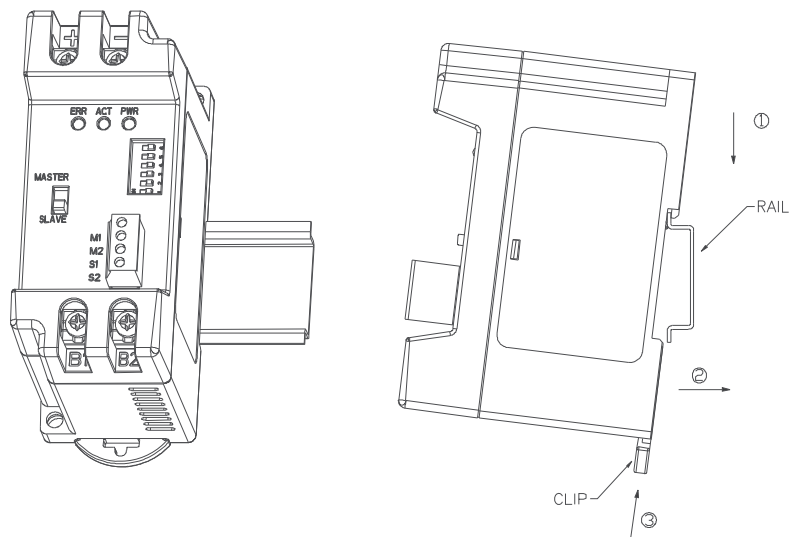


Figure 62: DIN rail installation chopper unit



m Function explanation

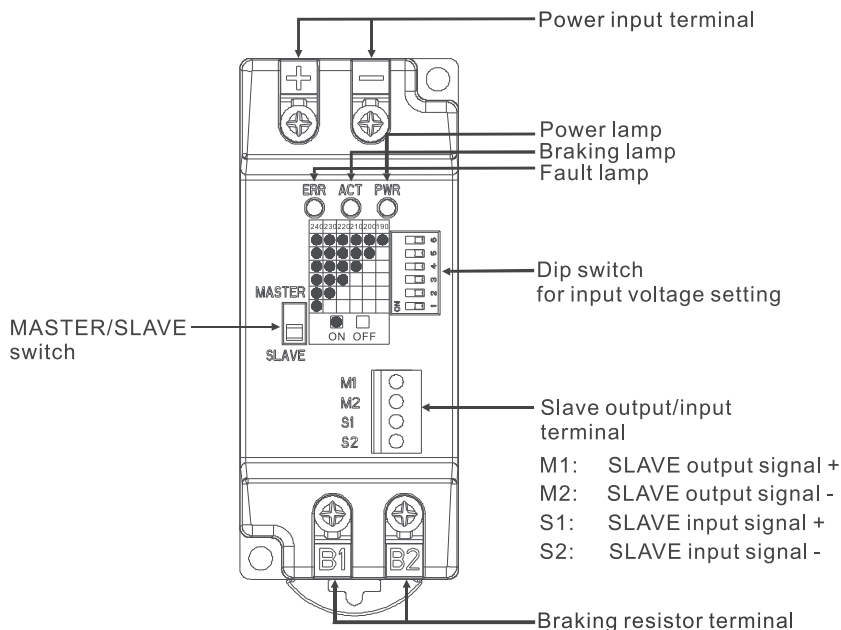


Figure 63: Parts of chopper unit

n Terminals

	Terminal symbol	Wire gauge AWG/mm <sup>2</sup>	Terminal
Power input circuit	+(P), -(N)	20~22AWG/0.5~0.3mm <sup>2</sup>	M4 screw
Braking resistor	B1, B2	20~22AWG/0.5~0.3mm <sup>2</sup>	M4 screw
SLAVE circuit	M1, M2 S1, S2	24AWG/0.2mm <sup>2</sup> M1, M2, S1, S2 with shielded wires	M2 screw

m Basic wiring diagram

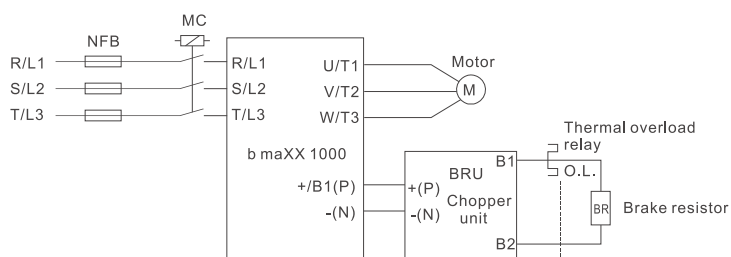


Figure 64: Wiring diagram chopper unit

**NOTE**

Do not wire terminal -(N) to neutral point of power system.





### WARNING

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

m serious personal injury m death

- Do not proceed with wiring while power is applied to the circuit.
- The wire gauge and distance must comply with the electrical data.
- The +(P), -(N) terminals of the **b maXX<sup>®</sup> BM1000**, connected to the chopper unit, must be confirmed for correct polarity lest the drive and the chopper unit be damaged when power on.
- When the chopper unit performs braking, the wires connected to +(P), -(N), B1 and B2 would generate a powerful electromagnetic field for a moment due to high current passing through. These wires should be wired separately from other low voltage control circuits so that do not make interference or mis-operation
- Wiring distance

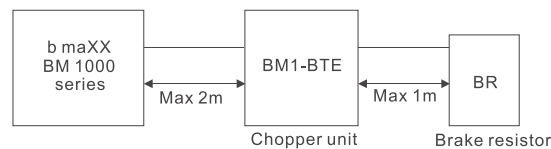


Figure 65: Wiring distance chopper unit

- Inflammable solids, gases or liquids must be avoided at the location where the braking resistor is installed. The braking resistor had better be installed in individual metallic box with forced air-cooling.
- Connect the ground terminal to PE. The ground lead must be at least the same gauge wire as leads +(P), -(N).
- Please install the braking resistor with forced air-cooling or the equivalent when frequent deceleration braking is performed (over 10 % ED).
- To avoid personal injury, do not connect/disconnect wires or regulate the setting of the chopper unit while power on. Do not touch the terminals of related wiring and any component on PCB lest users be damaged by extreme dangerous DC high voltage.
- The ring terminals are suggested to be used for main circuit wiring. Make sure the terminals are fastened before power on.

#### m Operation explanation

- n For safety consideration, install an overload relay between the chopper unit and the braking resistor. In conjunction with the magnetic contactor (MC) prior to the drive, it can perform complete protection against abnormality.
- n The purpose of installing the thermal overload relay is to protect the braking resistor from damage due to frequent braking, or due to braking unit keeping operating resulted from unusual high input voltage. Under such circumstance, just turn off the power to avoid damaging the braking resistor.
- n Please refer to [ZSelect a chopper unit /braking resistor](#)– on page 118 for the specification of the thermal overload relay.

m Definition of braking usage ED %

The definition of the braking usage ED % is for assurance of enough time for the chopper unit and braking resistor to dissipate away heat generated by braking. When the braking resistor heats up, the resistance would increase with temperature, and braking torque would decrease accordingly.

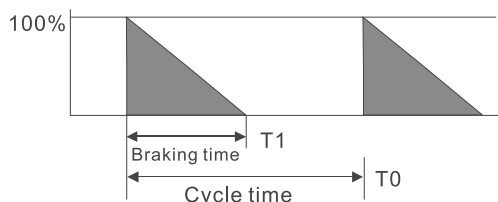


Figure 66: Braking usage ED %

$$ED[\%] = \frac{T1}{T0} \cdot 100[\%]$$

m Voltage settings

The power source of the chopper unit is the DC power from the + (P) and - (N) terminals of the **b maXX<sup>®</sup> BM1000**. Therefore, it is an important step to set the voltage by the input voltage of the **b maXX<sup>®</sup> BM1000** before operation. This setting will affect the voltage level of the chopper unit.

**NOTE**

- Before voltage setting, make sure the power has been turned off.
- Please set power voltage as the possible highest voltage for unstable power system. Take 380V<sub>AC</sub> power system for example. If the voltage may be up to 410V<sub>AC</sub>, 415V<sub>AC</sub> should be regulated.
- For **b maXX<sup>®</sup> BM1000**, please set parameter (over voltage stall prevention) as „close“ to disable over-voltage stall prevention, to ensure stable deceleration characteristic.

230 V series power voltage *	Braking start-up voltage DC Bus (+(P), -(N)) voltage
190 V <sub>AC</sub>	330 V <sub>DC</sub>
200 V <sub>AC</sub>	345 V <sub>DC</sub>
210 V <sub>AC</sub>	360 V <sub>DC</sub>
220 V <sub>AC</sub>	380 V <sub>DC</sub>
230 V <sub>AC</sub>	400 V <sub>DC</sub>
240 V <sub>AC</sub>	415 V <sub>DC</sub>

460 V series power voltage *	Braking start-up voltage DC Bus (+(P), -(N)) voltage
380 V <sub>AC</sub>	660 V <sub>DC</sub>
400 V <sub>AC</sub>	690 V <sub>DC</sub>
420 V <sub>AC</sub>	725 V <sub>DC</sub>
440 V <sub>AC</sub>	760 V <sub>DC</sub>
460 V <sub>AC</sub>	795 V <sub>DC</sub>
480 V <sub>AC</sub>	830 V <sub>DC</sub>

\* Input power with tolerance ±10 %



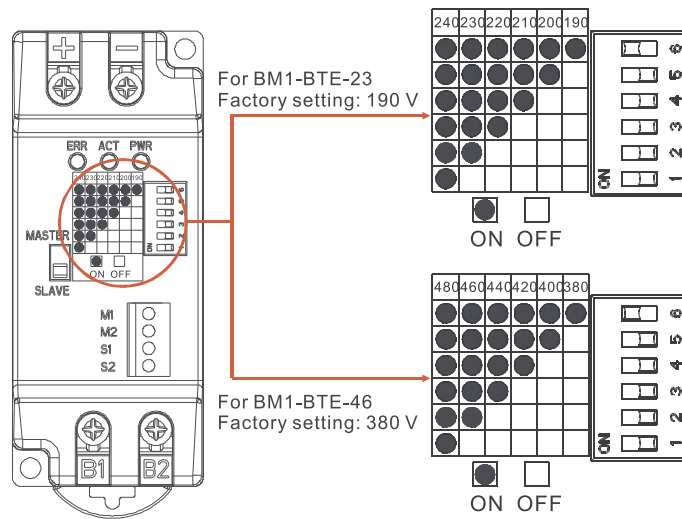


Figure 67: Voltage setting chopper unit

### m Master/Slave setting

The MASTER/SLAVE jumper is set „MASTER“ as factory setting. The „SLAVE“ setting is applied to two or more chopper units in parallel, making these chopper units be enabled/disabled synchronously. Then the power dissipation of each unit will be equivalent so that they can perform the braking function completely.

### n Wiring example

The SLAVE braking application of three chopper units is shown. After wiring, the jumper of first unit shall be set as „MASTER“ and that of others must be set as „SLAVE“ to complete the system installation.

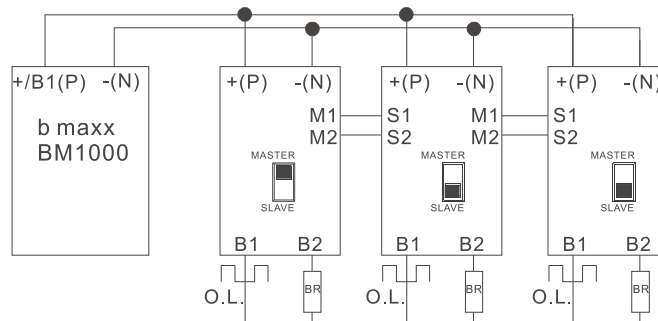


Figure 68: Wiring example Master/Slave setting

### B.1.3 Dimensions and weights for braking resistors

- in progress -

for further information please contact your nearest Baumüller representative.

(all dimensions are in millimeter)

R150-200-20 (150  $\Omega$  / 200 W)

R250-200-20 (250  $\Omega$  / 200 W)

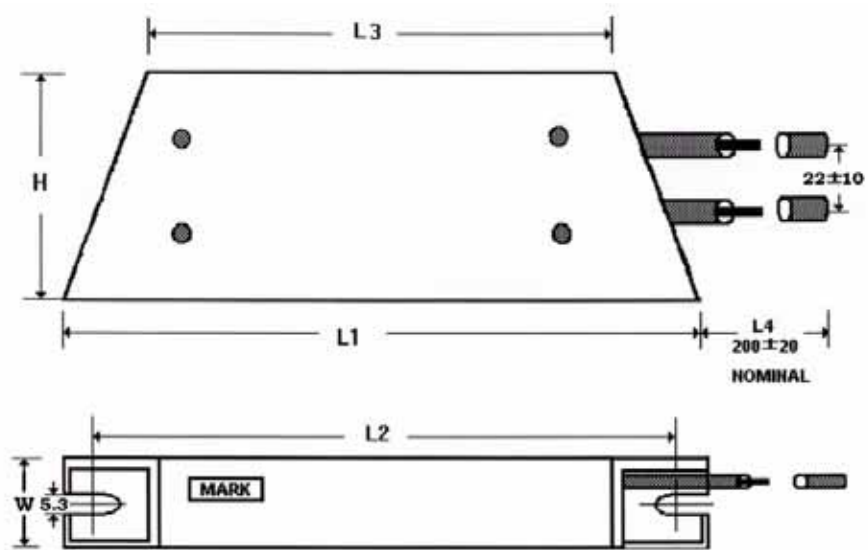


Figure 69: Braking resistor 1

Model no.	L1	L2	L3	W	H
R400-300-20	165	150	110	30	60

R400-300-20 (400 Ω / 300 W)

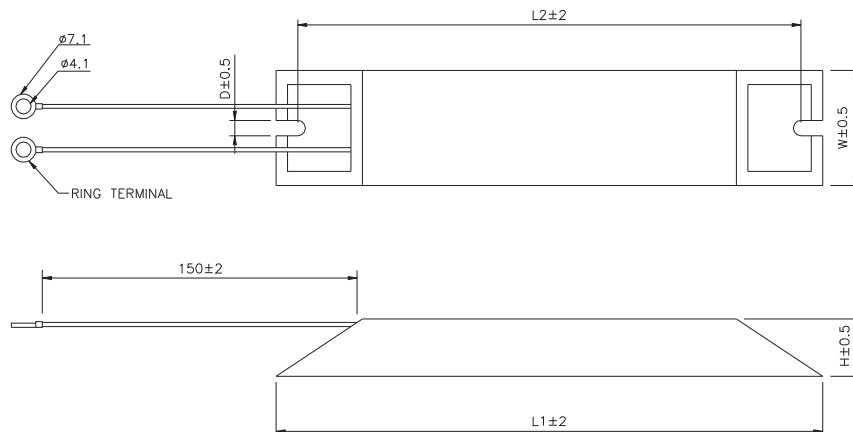


Figure 70: Braking resistor 2

Model no.	L1	L2	H	D	W	Max. weight (g)
R400-300-20	215	200	30	5.3	60	750

## B.2 Mains filters

In order to comply with the required limit values of the EMC product standard an additional filter can be necessary for the device.

### NOTE

The models b maXX<sup>®</sup> 1000 have an built-in EMI filter.

An additional mains filter is necessary for cable lengths > 15 m (cable device - motor).



Device	Filter	Specification	Dimension (length x width x depth)	Manufacturer
BM1211	BFN1-1-16-003	16 A / 240 V <sub>AC</sub>	150 x 65 x 48 mm	Fa. DELTRON- EMCON
BM1212				
BM1213				
BM1224	BFN 1-1-25-003	25 A / 240 V <sub>AC</sub>	174 x 120 x 77 mm	
BM1225				
BM1412	BFN 3-1-6-003	3-phase / 6 A	179 x 45 x 79 mm	
BM1413				
BM1414				
BM1425	BFN 3-1-18-003	3-phase / 18 A	229 x 55 x 114 mm	
BM1426				
BM1437	BFN 3-1-25-003	3-phase / 25 A	229 x 55 x 114 mm	
BM1438				
BM1439				

### B.3 Chokes

#### B.3.1 Mains chokes recommended values

230V, 50/60Hz, 1-phase

Device	kW	Fundamental A	Max. continuous A	Inductance (mH)	
				<b>3~5 % impedance</b>	
BM1211	0.2	4	6	6.5	
BM1212	0.4	5	7.5	3	
BM1213	0.75	8	12	1.5	
BM1224	1.5	12	18	1.25	
BM1225	2.2	18	27	0.8	

460V, 50/60Hz, 3-phase

Device	kW	Fundamental A	Max. continuous A	Inductance (mH)	
				<b>3% impedance</b>	<b>5% impedance</b>
BM1412	0.4	2	3	20	32
BM1413	0.75	4	6	9	12
BM1414	1.5	4	6	6.5	9
BM1425	2.2	8	12	5	7.5
BM1426	3.7	8	12	3	5
BM1437	5.5	12	18	2.5	4.2
BM1438	7.5	18	27	1.5	2.5
BM1439	11	25	37.5	1.2	2



**B.3.2 Output chokes recommended values**

230V, 50/60Hz, 1-phase

Device	kW	Fundamental A	Max. continuous A	Inductance (mH)	
				3 % impedance	5 % impedance
BM1211	0.2	4	4	9	12
BM1212	0.4	6	6	6.5	9
BM1213	0.75	8	12	3	5
BM1224	1.5	8	12	1.5	3
BM1225	2.2	12	18	1.25	2.5

460V, 50/60Hz, 3-phase

Device	kW	Fundamental amps	Max. continuous amps	Inductance (mH)	
				3 % impedance	5 % impedance
BM1412	0.4	2	3	20	32
BM1413	0.75	4	6	9	12
BM1414	1.5	4	6	6.5	9
BM1425	2.2	8	12	5	7.5
BM1426	3.7	12	18	2.5	4.2
BM1437	5.5	18	27	1.5	2.5
BM1438	7.5	18	27	1.5	2.5
BM1439	11	25	37.5	1.2	2

### B.4 Fuses for device-protection



#### NOTE

The following fuses are UL-listed.

Smaller fuses than those shown in the table are permitted.

Model	I (A) Input	I (A) Output	Line Fuse	
			I (A)	Bussmann P/N
BM1211	4.9	1.6	10	JJN-10
BM1212	6.5	2.5	15	JJN-15
BM1412	1.9	1.5	5	JJS-6
BM1213	9.7	4.2	20	JJN-20
BM1413	3.2	2.5	5	JJS-6
BM1224	15.7	7.5	30	JJN-30
BM1414	4.3	4.2	10	JJS-10
BM1225	24	11	50	JJN-50
BM1425	7.1	5.5	15	JJS-15
BM1426	11.2	8.2	20	JJS-20
BM1437	14	13	30	JJS-30
BM1438	19	18	40	JJS-40
BM1439	26	24	50	JJS-50

## B.5 Non-fuse circuit breaker

Per UL 508C, paragraph 45.8.4, part a:

- m For 1-phase drives, the current rating of the breaker shall be 4 times maximum input current rating.
- m For 3-phase drives, the current rating of the breaker shall be 4 times maximum output current rating.

(Refer to [ZD.3 Electrical data](#)– from page 141 for rated input/output current)

1-phase	
Model	Recommended non-fuse breaker [A]
BM1211	10
BM1212	15
BM1213	20
BM1224	30
BM1225	50

3-phase	
Model	Recommended non-fuse breaker [A]
BM1412	5
BM1413	5
BM1414	10
BM1425	15
BM1426	20
BM1437	30
BM1438	40
BM1439	50

## B.6 Digital keypad

BM1-HMI-01-00-00



Figure 71: Digital keypad

## B.7 Digital keypad cable

Model	Length
K-HMI-BM1-006	0.6 m
K-HMI-BM1-010	1.0 m
K-HMI-BM1-020	2.0 m
K-HMI-BM1-030	3.0 m
K-HMI-BM1-050	5.0 m

## B.8 DIN rail

### B.8.1 BM1-MPL-01

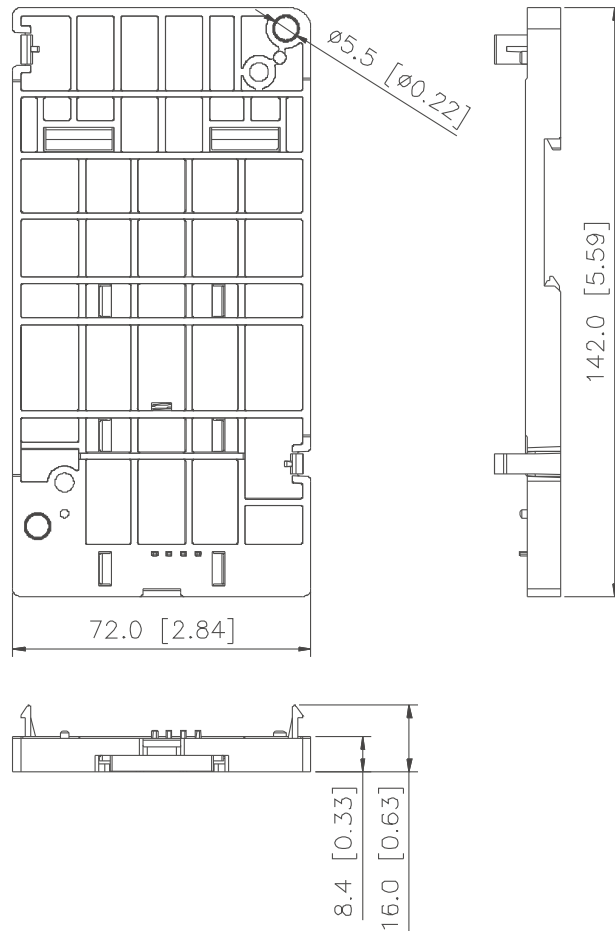


Figure 72: DIN rail 1

B.8.2 BM1-MPL-02

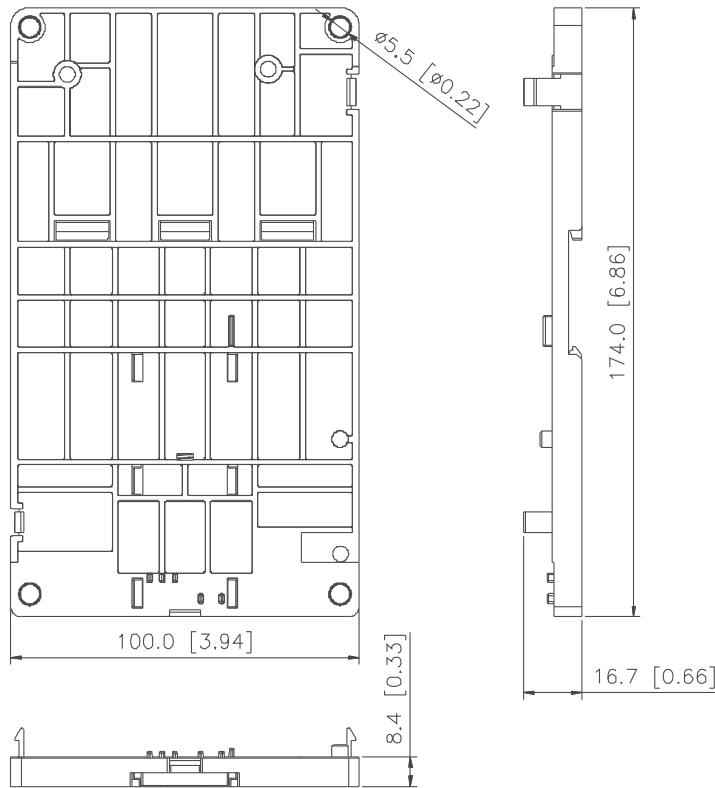


Figure 73: DIN rail 2

B.8.3 BM1-EPL-00

EMC earthing plate for shielding cable

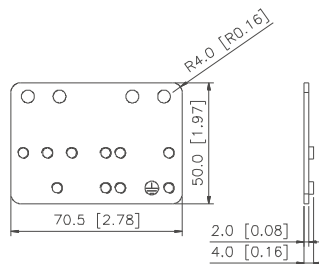


Figure 74: MKE-EP

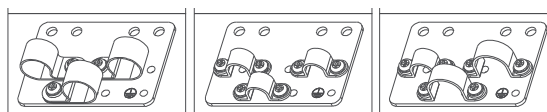


Figure 75: Earthing plate for shielding cable

**B.9 Accessories CANopen**

m Connection cables

Type	Model	Length [m]	Part no.
<b>BM4-CAN-K-31-01</b>	RJ45 male, Sub-D male	1	346568
<b>BM4-CAN-K-31-02</b>		2	on request
<b>BM4-CAN-K-31-02</b>		3	346571
<b>BM4-CAN-K-31-05</b>		5	on request
<b>BM4-CAN-K-31-10</b>		10	on request
<b>BM4-CAN-K-32-01</b>	RJ45 male, Sub-D female	1	346572
<b>BM4-CAN-K-32-02</b>		2	on request
<b>BM4-CAN-K-32-03</b>		3	346573
<b>BM4-CAN-K-32-05</b>		5	on request
<b>BM4-CAN-K-32-10</b>		10	on request
<b>BM4-CAN-K-33-01</b>	RJ45 male, RJ45 male	1	346577
<b>BM4-CAN-K-33-02</b>		2	on request
<b>BM4-CAN-K-33-03</b>		3	on request
<b>BM4-CAN-K-33-05</b>		5	on request
<b>BM4-CAN-K-33-10</b>		10	on request

m Terminating plug RJ45 (CAN, RJ45 with pin-assignment according CIA standard, 120  $\Omega$ , 0,25 W)

Type	Part no.
<b>BM4-CAN-T01</b>	346408



## APPENDIX C - DECLARATION OF CONFORMITY

In this section we provide general information about EU directives, the CE symbol and the Declaration of Conformity/by Manufacturer.

### C.1 What is an EU directive?

---

EU directives specify requirements. The directives are written by the relevant bodies within the EU and are implemented by all the member countries of the EU in national law. In this way the EU directives guarantee free trade within the EU.

An EU 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).

## C.3 Definition of the term Declaration of Conformity

---

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:

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

### C.3 Definition of the term Declaration of Conformity

---

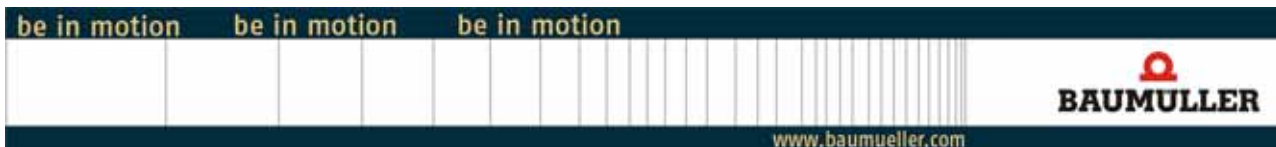
A Declaration of Conformity as defined by this documentation is a declaration that the electrical equipment brought into circulation conforms to all the relevant fundamental safety and health requirements.

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

---





**EG - Declaration of Conformity**

**Doc.-No. 5.11017.00**  
**Date: Sept. 16, 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 1000  
 Type: BM1211-01-00-01, BM1212-01-00-01, BM1213-01-00-01  
 BM1224-01-00-01, BM1225-01-00-01  
 BM1412-01-00-01, BM1413-01-00-01, BM1414-01-00-01  
 BM1425-01-00-01, BM1426-01-00-01  
 BM1437-01-00-01, BM1438-01-00-01, BM1439-01-00-01

manufactured since: October 17, 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 61800-5-1:2008-04	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements. Electrical, thermal and energy
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.





## APPENDIX D - TECHNICAL DATA

In this chapter you find the detailed technical data for all sizes of the device series **b maXX<sup>®</sup> BM1000**.

## D.1 Required environmental conditions

### D.1 Required environmental conditions

Operation	Air Temperature:	-10 to +50 °C (14 to 122 °F)
		-10 to +40 °C (14 to 104 °F) for side-by-side mounting
	Relative Humidity:	< 90 %, no condensation allowed
	Atmospheric pressure:	86 to 106 kPa
	Installation Site Altitude:	< 1000 m
	Vibration:	< 20 Hz: 9.80 m/s <sup>2</sup> (1G) max 20 to 50 Hz: 5.88 m/s <sup>2</sup> (0.6 G) max
Storage Transportation	Temperature:	-20 °C to +60 °C (-4 °F to 140 °F)
	Relative Humidity:	< 90 %, no condensation allowed
	Atmosphere pressure:	86 to 106 kPa
	Vibration:	<20 Hz: 9.80 m/s <sup>2</sup> (1 G) max 20 to 50 Hz: 5.88 m/s <sup>2</sup> (0.6 G) max
Pollution Degree	2	suitable for a factory type environment.

#### NOTE



- m Operating, storing or transporting the **b maXX® BM1000** outside these conditions may cause damage to the device.
- m Failure to observe these precautions may void the warranty!

### D.2 Non-electrical data

Device <b>b maXX® BM1000</b>	Dimensions (W x H x D)	Weight with controller, without plug-in modules	Noise emission
Frame 1	72 x 142 x 152 mm	1.2 kg	max. 54 db(A) <sup>1)</sup>
Frame 2	100 x 174 x 152 mm	1.9 kg	max. 54 db(A) <sup>1)</sup>
Frame 3	130 x 260 x 170 mm	4.2 kg	max. 63 db(A) <sup>1)</sup>

<sup>1)</sup> 98/37/EG, appendix I, chapter 1.7.4.f, paragraph 8


D.3 Electrical data

Voltage		230 V series				
BM		1211	1212	1213	1224	1225
Max. applicable motor output (kW)		0.2	0.4	0.75	1.5	2.2
Output rating	Rated output capacity (kVA)	0.6	1.0	1.6	2.9	4.2
	Rated output current (A)	1.6	2.5	4.2	7.5	11.0
	Maximum output voltage (V)	3-phase proportional to input voltage				
	Output frequency (Hz)	0.1 to 600 Hz				
	Carrier frequency (kHz)	1 to 15				
Input rating	Rated input current (A)	single				
		4.9	6.5	9.5	15.7	24
	Rated voltage/frequency	single 200 to 240 V, 50/60 Hz				
	Voltage tolerance	±10 % (180 to 264 V)				
	Frequency tolerance	±5 % (47 to 63 Hz)				
Cooling method		natural cooling			fan cooling	

Voltage		460 V series								
BM		1412	1413	1414	1425	1426	1437	1438	1439	
Max. applicable motor output (kW)		0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	
Output rating	Rated output capacity (kVA)	1.2	2.0	3.3	4.4	6.8	9.9	13.7	18.3	
	Rated output current (A)	1.5	2.5	4.2	5.5	8.2	13	18	24	
	Maximum output voltage (V)	3-phase proportional to input voltage								
	Output frequency (Hz)	0.1 to 600 Hz								
	Carrier frequency (kHz)	1 to 15								
Input rating	Rated input current (A)	3-phase								
		1.9	3.2	4.3	7.1	11.2	14	19	26	
	Rated voltage/frequency	3-phase, 380 to 480 V, 50/60 Hz								
	Voltage tolerance	±10 % (342 to 528 V)								
	Frequency tolerance	±5 % (47 to 63 Hz)								
Cooling method		natural cooling			fan cooling					

### D.4 General specifications

Control characteristics	Control system		SPWM (Sinusoidal Pulse Width Modulation) control (V/f or sensorless vector control)
	Frequency setting resolution		0.01 Hz
	Output frequency resolution		0.01 Hz
	Torque characteristics		Including the auto-torque/auto-slip compensation; starting torque can be 150 % at 3.0 Hz
	Overload endurance		150 % of rated current for 1 minute
	Skip frequency		Three zones, setting range 0.1 to 600 Hz
	Acceleration/deceleration time		0.1 to 600 seconds (2 Independent settings for accel/decel time)
	Stall prevention level		Setting 20 to 250 % of rated current
	DC braking		Operation frequency 0.1 to 600.0 Hz, output 0 to 100 % rated current Start time 0 to 60 seconds, stop time 0 to 60 seconds
	Regenerated braking torque		Approximately 20 % (up to 125 % possible with optional braking resistor or externally mounted chopper unit, 2.2 to 11 kW models have brake chopper built-in)
	V/f pattern		Adjustable V/f pattern
Operating characteristics	Frequency setting	Keypad	Setting by ▲ ▼
		External signal	Potentiometer 5 k $\Omega$ / 0.5 W, 0 to +10V <sub>DC</sub> , 4 to 20 mA, RS-485 interface; Multi-function inputs 3 to 9 (15 steps, jog, up/down)
	Operation setting signal	Keypad	Set by RUN and STOP
		External signal	2 wires/3 wires (MI1, MI2, MI3), JOG operation, RS-485 serial interface (MODBUS), programmable logic controller
	Multi-function input signal		Multi-step selection 0 to 15, JOG, accel/decel inhibit, 2 accel/decel switches, counter, external base block, auxiliary motor control is invalid, ACI/AVI selections, driver reset, UP/DOWN key settings, NPN/PNP input selection
	Multi-function output indication		Device operating, frequency attained, zero speed, base block, fault indication, overheat alarm, emergency stop and status selections of input terminals
Analog output signal		Output frequency/current	
Alarm output contact		Contact will be on when drive malfunctions (1 form c/change-over contact and 1 open collector output for standard type)	

<p>Operation functions</p>	<p>Built-in PLC, AVR, accel/decel S-curve, over-voltage/over-current stall prevention, 5 fault records, reverse inhibition, momentary power loss restart, DC braking, auto torque/slip compensation, auto tuning, adjustable carrier frequency, output frequency limits, parameter lock/reset, vector control, PID control, external counter, MODBUS communication, abnormal reset, abnormal re-start, power-saving, fan control, sleep/wake frequency, 1st/2nd frequency source selections, 1st/2nd frequency source combination, NPN/PNP selection</p>
<p>Protection functions</p>	<p>Over voltage, over current, under voltage, external fault, overload, ground fault, overheating, electronic thermal, IGBT short circuit, PTC</p>
<p>Display keypad</p>	<p>6-key, 7-segment LED with 4-digits, 5 status LEDs, master frequency, output frequency, output current, custom units, parameter values for setup and lock, faults, RUN, STOP, RESET, FWD/REV, PLC</p>
<p>Approvals</p>	<p style="text-align: center;"> <small>POWER CONVERSION EQUIPMENT</small>    <small>LISTED 38WA</small> </p>

### D.5 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 required limit load integral  $i^2t_{OFF}$ .

See [ZB.4 Fuses for device-protection](#)— on page 130.

**Cable protection + device protection** You have two possibilities to protect the cable and the device:  
m connect fuses and semiconductors in series  
m 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 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.5.1 Cable protection**

The current-carrying capacity of conductors is determined in table 5 of EN60204-1. 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 <sup>2</sup>	16.1 A
2.5 mm <sup>2</sup>	22 A
4 mm <sup>2</sup>	30 A

Use suitable fuses with the enable characteristic gL or gR.

**D.5.2 Cable protection + device protection**

Consider by your choice of the whole range fuses the current-carrying capacity connected mains cables and the allowable maximum load of the device.

Recommended UL-listed fuses, see [ZB.4 Fuses for device-protection](#)– on page 130.

**D.6 Type of protection**

Type of protection	IP 20
--------------------	-------

**D.7 Fire fighting appliances**

Fight fire with	ABC powder
-----------------	------------





## APPENDIX E - CANopen

In this chapter you find the detailed information according to **b maXX<sup>®</sup> BM1000** CANopen interface.

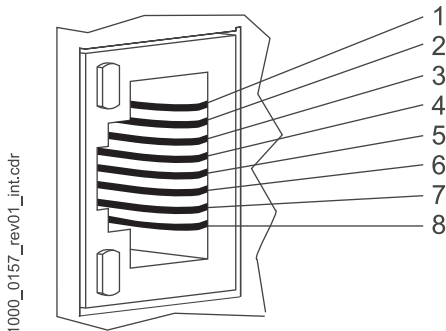
### E.1 Interface assignment

The interface is used to realize the communication within a CANopen ring or to communicate with the **b maXX<sup>®</sup> BM1000** via Modbus.

In addition the interface can be used as a power supply for external devices, e.g. communication modules.

#### Pin assignment

Female connector 8-pin



Pin no.	CANopen	Modbus (RS485)
1	CAN high	
2	CAN low	
3	CAN GND	
4		SG -
5		SG +
6	reserved	reserved
7	CAN GND	
8	reserved	reserved

### E.2 Terminating plug for CANopen

The **b maXX<sup>®</sup> BM1000** must be equipped with a termination plug BM4-CAN-T01 (according CIA Standard 120  $\Omega$ , 0.25 W) if the device is the last participant within the CANopen network, see [ZAccessories CANopen](#)– on page 134.

### E.3 Connection cables

For available connection cables refer to [ZAccessories CANopen](#)– on page 134.

## E.4 Input wiring before using CANopen

E.g. **P1093** = 23.

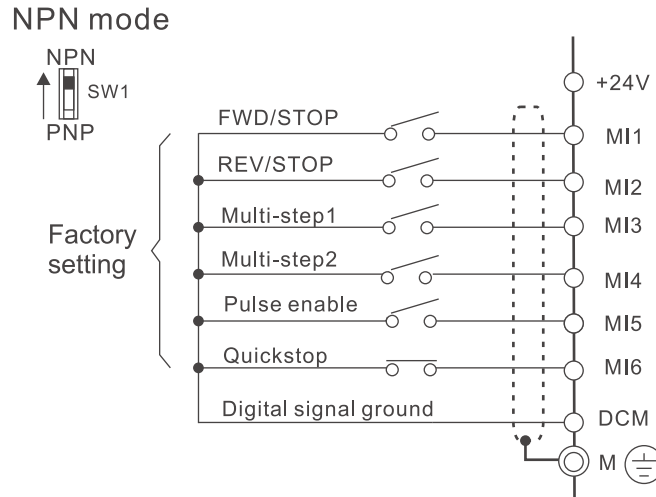


Figure 76: Input wiring

## E.5 Setting of address and baudrate

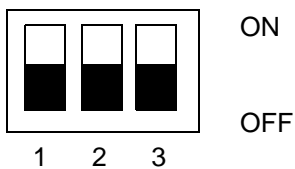
### E.5.1 Setting via software parameters **P0870** and **P0871**

The address and baudrate is set in parameters **P0870** and **P0871** directly. The DIP switches are deactivated.

#### □ DIP switch setting

The DIP switches 1, 2, 3 must be set to OFF to enable the setting of the CANopen address via parameters **P0870** and the baudrate via parameter **P0871**.

$2^0$   $2^1$   $2^2$



CANopen address setting via parameter **P0870**

The settable address range is 1 to 127.

Parameter **P0870** = 0 deactivates the software setting!

Address 1      ⇒    **P0870** = 1

.....

Address 127    ⇒    **P0870** = 127

Default value:      **P0870** = 1

CANopen baudrate setting via parameter **P0871**

Default value:      **P0871** = 1

<b>P0871</b>	Baudrate kbit/s
0	1000
1	500
2	250
3	125
4	100
5	50

### E.5.2 Setting of address via DIP switch without multiplier

---

**P2148** = 0, address setting via DIP switch without multiplier.

The DIP switch setting defines from which parameter **P2141** to **P2147** the CANopen address is read and copied to **P0870**.

The baudrate must be set via **P2140** if the DIP switch is set  $\neq$  0.

The value set in **P2140** is copied internal to **P0871** and used as baudrate.

DIP switch setting

The DIP switch must be set  $\neq$  0. The setting range is 1 to 7.

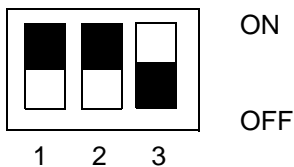
- CANopen address settings via address storage.

The multiplier parameter **P2148** must be set to 0. This setting deactivates the multiplier.

DIP switch setting	Address storage parameter	Default values
1	<b>P2141</b>	21
2	<b>P2142</b>	22
3	<b>P2143</b>	23
4	<b>P2144</b>	24
5	<b>P2145</b>	25
6	<b>P2146</b>	26
7	<b>P2147</b>	27

Example:

$2^0$   $2^1$   $2^2$



DIP switch value = 3 is set, the address is read from **P2143**. The stored address value in **P2143** (23 default value) is copied to **P0870** and used as CANopen address.

The value range of parameters **P2141** to **P2147** is 0 to 127, the address range can be set from 1 to 127.

- CANopen baudrate setting via **P2140**

Default value: **P2140** = 2

<b>P2140</b>	Baudrate kbit/s
0	1000
1	500
2	250
3	125
4	100
5	50

### E.5.3 Setting of address via DIP switch with multiplier

**P2148**  $\neq$  0, address setting via DIP switch with multiplier.

The DIP switch values 1 to 7 select **P2141** to **P2147**. The CANopen address is **P2148** multiplied with the selected parameter (**P2141** to **P2147**) and then copied to **P0870** automatically.

The baudrate must be set via **P2140** if the DIP switch is set  $\neq$  0.

The value set in **P2140** is copied internal to **P0871** and used as baudrate.

DIP switch setting

The DIP switch must be set  $\neq$  0. The setting range is 1 to 7.

The DIP switch values 1 to 7 select **P2141** to **P2147**. The CANopen address is **P2148** multiplied with the selected parameter (**P2141** to **P2147**) and then copied to **P0870** automatically.

CANopen address settings via DIP switch and multiplier

The multiplier parameter **P2148** must be set  $\neq$  0.

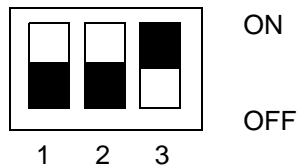
Default value: **P2148** = 8

The CANopen address is calculated as follows:

$$\text{CANopen address} = \text{DIP switch} \cdot \mathbf{P2148}$$

Example:

$$2^0 \quad 2^1 \quad 2^2$$



DIP switch setting	Address storage parameter
1	<b>P2141</b>
2	<b>P2142</b>
3	<b>P2143</b>
4	<b>P2144</b>
5	<b>P2145</b>
6	<b>P2146</b>
7	<b>P2147</b>

For example the DIP switch setting is 4 and the multiplier **P2148** = 4

⇒ CANopen address = 16



Because of the DIP switch setting = 4, the calculated address value (= 16) is stored in address storage parameter **P2144**, copied to **P0870** and used as CANopen address.

□ CANopen baudrate setting via **P2140**

Default value: **P2140 = 2**

P2140	Baudrate kbit/s
0	1000
1	500
2	250
3	125
4	100
5	50

## E.6 CANopen display functions

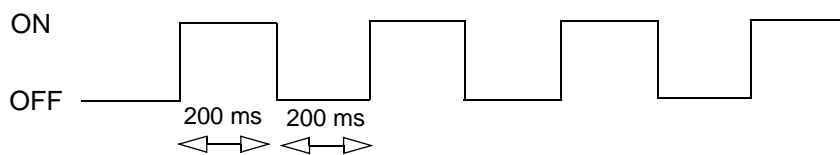
### E.6.1 LED display

LED H3 displays the status of the CANopen interface.

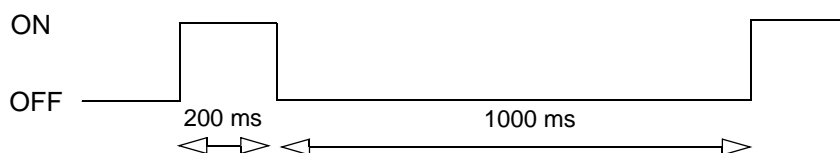
H3 fulfills the specification according „DR-303-3 indicator specification“.

m CANopen initialization display via LED H3 (orange)

n Start of initialization: H3 is blinking in orange color



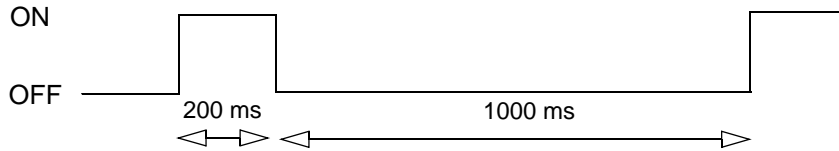
n End of initialization: H3 is blinking in orange color



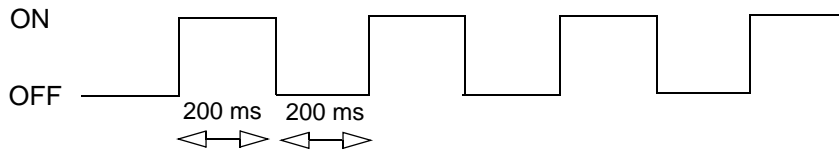
n Initialization completed H3 is off

m CANopen status display via LED H3 (green)

n State **STOPPED**: H3 is blinking in green color



n State **PREOPERATIONAL**: H3 is blinking in green color



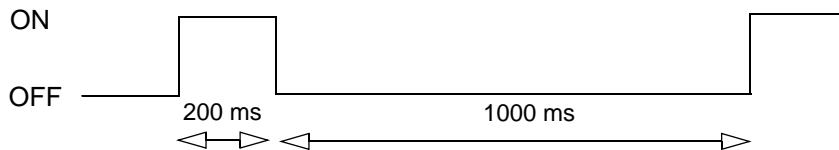
n State **OPERATIONAL**: H3 is ON in green color

n State **RESET**: H3 is OFF during RESET

m CANopen error display via LED H3 (red)

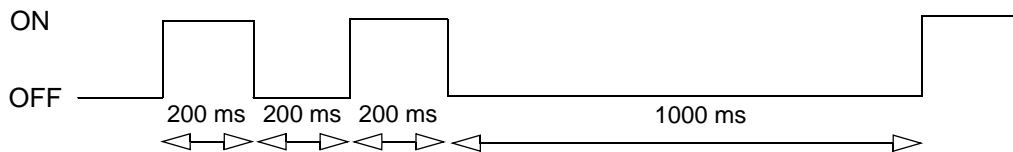
n At least one of the error counters has reached warning level

m H3 is blinking in red color



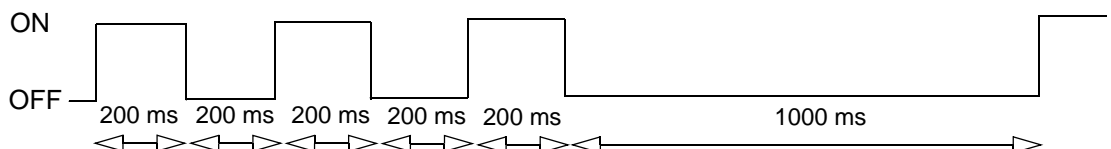
n „Guard“ (NMT master or NMT slave) or „Heartbeat“ event

m H3 is blinking in red color



n Sync message hasn't been received within the configured communication cycle

m H3 is blinking in red color



n No communication between CAN interface and CANopen master

m H3 is ON in red color

## E.6.2 CANopen error display via digital keypad

---

cc01	At least one of the error counters has reached warning level
cc02	„Guard“ (NMT master or NMT slave) or „Heartbeat“ event
cc03	Sync message hasn't received within the configured communication cycle
cc04	No communication between CAN interface and CANopen master
cc05	Hardware failure or no CANopen hardware available on processing unit
cc06	No CANopen software available on processing unit
cc07	An update of CANopen is necessary
cc08	Hardware error





## APPENDIX F - HOW TO SELECT THE RIGHT B MAXX<sup>®</sup>

The choice of the right **b maXX<sup>®</sup>** drive for the application is very important and has great influence on its lifetime. If the capacity of **b maXX<sup>®</sup>** drive is too large, it cannot offer complete protection to the motor and the motor maybe damaged. If the capacity of **b maXX<sup>®</sup>** drive is too small, it cannot offer the required performance and the **b maXX<sup>®</sup>** drive maybe damaged due to overloading.

But by simply selecting the **b maXX<sup>®</sup>** drive of the same capacity as the motor, user application requirements cannot be met completely. Therefore, a designer should consider all the conditions, including load type, load speed, load characteristic, operation method, rated output, rated speed, power and the change of load capacity. The following table lists the factors you need to consider, depending on your requirements.

Item		Related specification			
		Speed and torque characteristics	Time ratings	Overload capacity	Starting torque
Load type	Friction load and weight load Liquid (viscous) load Inertia load Load with power transmission	m			m
Load speed and torque characteristics	Constant torque Constant output Decreasing torque Decreasing output	m	m		
Load characteristics	Constant load Shock load Repetitive load High starting torque Low starting torque	m	m	m	m
Continuous operation, short-time operation Long-time operation at medium/low speeds			m	m	
Maximum output current (instantaneous) Constant output current (continuous)		m		m	
Maximum frequency, Base frequency		m			
Power supply transformer capacity or percentage impedance Voltage fluctuations and unbalance Number of phases, single phase protection Frequency				m	m
Mechanical friction, losses in wiring				m	m
Duty cycle modification			m		

## F.1 Capacity formulas

1 When one **b maXX®** drive operates one motor

The starting capacity should be less than 1.5 x rated capacity of **b maXX®** drive

The starting capacity =

$$\frac{k \cdot N}{973 \cdot \eta \cdot \cos \varphi} \left[ T_L + \frac{GD^2}{375} \cdot \frac{N}{t_A} \right] \leq 1,5 \cdot \text{capacity of the b maXX® drive [kVA]}$$

2 When one **b maXX®** drive operates more than one motor

m The starting capacity should be less than the rated capacity of **b maXX®** drive

n Acceleration time  $\leq$  60 seconds

The starting capacity

$$= \frac{k \cdot N}{\eta \cdot \cos \varphi} [n_r + n_s(k_s - 1)] = P_{C1} \left[ 1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq 1,5 \cdot \text{capacity of the b maXX® drive [kVA]}$$

n Acceleration time  $\geq$  60 seconds

The starting capacity

$$= \frac{k \cdot N}{\eta \cdot \cos \varphi} [n_r + n_s(k_s - 1)] = P_{C1} \left[ 1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq \text{capacity of the b maXX® drive [kVA]}$$

m The current should be less than the rated current of **b maXX®** drive (A)

n Acceleration time  $\leq$  60 seconds

$$n_r + I_M \left[ 1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq 1,5 \cdot \text{rated current of b maXX® drive [A]}$$

n Acceleration time  $\geq$  60 seconds

$$n_r + I_M \left[ 1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq \text{rated current of b maXX® drive [A]}$$

m When it is running continuously

n The requirement of load capacity should be less than the capacity of **b maXX**<sup>®</sup> drive (kVA)

The requirement of load capacity =

$$\frac{k \cdot P_M}{\eta \cdot \cos\varphi} \leq \text{capacity of the b maXX}^{\text{®}} \text{ drive [kVA]}$$

n The motor capacity should be less than the capacity of **b maXX**<sup>®</sup> drive (kVA)

$$k \cdot \sqrt{3} \cdot V_M \cdot I_M \cdot 10^{-3} \leq \text{capacity of the b maXX}^{\text{®}} \text{ drive [kVA]}$$

n The current should be less than the rated current of **b maXX**<sup>®</sup> drive (A)

$$k \cdot I_M \leq \text{the rated current of the b maXX}^{\text{®}} \text{ drive [A]}$$

### Symbol explanation

$P_M$  Motor shaft output for load (kW)

$\eta$  Motor efficiency (normally, approx. 0.85)

$\cos\varphi$  Motor power factor (normally, approx. 0.75)

$V_M$  Motor rated voltage (V)

$I_M$  Motor rated current (A), for commercial power

$k$  Correction factor calculated from current distortion factor (1.05-1.1, depending on PWM method)

$P_{C1}$  Continuous motor capacity (kVA)

$k_s$  Starting current/rated current of motor

$n_r$  Number of motors in parallel

$n_s$  Number of simultaneously started motors

$GD^2$  Total inertia (GD2) calculated back to motor shaft (kg m2)

$T_L$  Load torque

$t_A$  Motor acceleration time

$N$  Motor speed



## F.2 General precaution

### Selection note

- 1 When the **b maXX®** drive is connected directly to a large-capacity power transformer (600 kVA or above) or when a phase lead capacitor is switched, excess peak currents may occur in the power input circuit and the converter section may be damaged. To avoid this, use an input reactor (optional) before **b maXX®** drive mains input to reduce the current and improve the input power efficiency.
- 2 When a special motor is used or more than one motor is driven in parallel with a single **b maXX®** drive, select the **b maXX®** drive current 1.25 x (sum of the motor rated currents).
- 3 The starting and accel./decel. characteristics of a motor are limited by the rated current and the overload protection of the **b maXX®** drive. Compared to running the motor D.O.L. (Direct On-Line), a lower starting torque output with **b maXX®** drive can be expected. If higher starting torque is required (such as for elevators, mixers, tooling machines, etc.) use an **b maXX®** drive of higher capacity or increase the capacities for both the motor and the **b maXX®** drive.
- 4 When an error occurs on the drive, a protective circuit will be activated and the **b maXX®** drive output is turned off. Then the motor will coast to stop. For an emergency stop, an external mechanical brake is needed to quickly stop the motor.

### Parameter settings note

- 1 The **b maXX®** drive can be driven at an output frequency up to 400 Hz (less for some models) with the digital keypad. Setting errors may create a dangerous situation. For safety, the use of the upper limit frequency function is strongly recommended.
- 2 High DC braking operating voltages and long operation time (at low frequencies) may cause overheating of the motor. In that case, forced external motor cooling is recommended.
- 3 Motor accel./decel. time is determined by motor rated torque, load torque, and load inertia.
- 4 If the stall prevention function is activated, the accel./decel. time is automatically extended to a length that the **b maXX®** drive can handle. If the motor needs to decelerate within a certain time with high load inertia that can't be handled by the **b maXX®** drive in the required time, either use an external braking resistor and/or brake unit, depending on the model, (to shorten deceleration time only) or increase the capacity for both the motor and the **b maXX®** drive.

### F.3 How to choose a suitable motor

#### F.3.1 Standard motor

When using the **b maXX**<sup>®</sup> drive to operate a standard 3-phase induction motor, take the following precautions:

- 1 The energy loss is greater than for an inverter duty motor.
- 2 Avoid running motor at low speed for a long time. Under this condition, the motor temperature may rise above the motor rating due to limited airflow produced by the motor's fan. Consider external forced motor cooling.
- 3 When the standard motor operates at low speed for long time, the output load must be decreased.
- 4 The load tolerance of a standard motor is as follows:

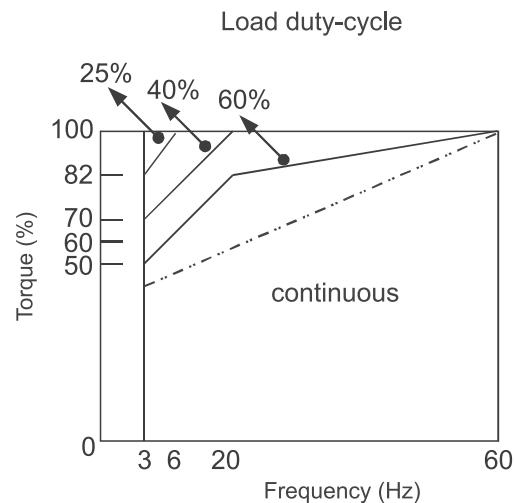


Figure 77: Load duty-cycle

- 5 If 100 % continuous torque is required at low speed, it may be necessary to use a special inverter duty motor.
- 6 Motor dynamic balance and rotor endurance should be considered once the operating speed exceeds the rated speed (60 Hz) of a standard motor.
- 7 Motor torque characteristics vary when an **b maXX**<sup>®</sup> drive instead of commercial power supply drives the motor. Check the load torque characteristics of the machine to be connected.
- 8 Because of the high carrier frequency PWM control of the **b maXX**<sup>®</sup> series, pay attention to the following motor vibration problems:
  - m Resonant mechanical vibration: anti-vibration (damping) rubbers should be used to mount equipment that runs at varying speed.
  - m Motor imbalance: special care is required for operation at 50 or 60 Hz and higher frequency.
  - m To avoid resonances, use the skip frequencies.
- 9 The motor fan will be very noisy when the motor speed exceeds 50 or 60Hz.

### F.3.2 Special motors:

---

**1 Pole-changing (Dahlander) motor:**

The rated current differs from that of a standard motor. Please check before operation and select the capacity of the **b maXX®** drive carefully. When changing the pole number the motor needs to be stopped first. If over current occurs during operation or regenerative voltage is too high, please let the motor free run to stop (coast).

**2 Submersible motor:**

The rated current is higher than that of a standard motor. Please check before operation and choose the capacity of the **b maXX®** drive carefully. With long motor cable between **b maXX®** drive and motor, available motor torque is reduced.

**3 Explosion-proof (Ex) motor:**

The **b maXX®** needs to be installed in a safe place and the wiring should comply with the (Ex) requirements. **b maXX®** motor drives are not suitable for (Ex) areas with special precautions.

**4 Gear reduction motor:**

The lubricating method of reduction gearbox and speed range for continuous operation will be different and depending on brand. The lubricating function for operating long time at low speed and for high-speed operation needs to be considered carefully.

**5 Synchronous motor:**

The rated current and starting current are higher than for standard motors. Please check before operation and choose the capacity of the **b maXX®** drive carefully. When the **b maXX®** drive operates more than one motor, please pay attention to starting and changing the motor.

### F.4 Power Transmission Mechanism

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Pay attention to reduced lubrication when operating gear reduction motors, gearboxes, belts and chains, etc. over longer periods at low speeds. At high speeds of 50/60 Hz and above, life-time reducing noises and vibrations may occur.

## F.5 Motor torque

The torque characteristics of a motor operated by a **b maXX**<sup>®</sup> drive and commercial mains power are different.

Below you'll find the torque-speed characteristics of a standard motor (4-pole, 15 kW):

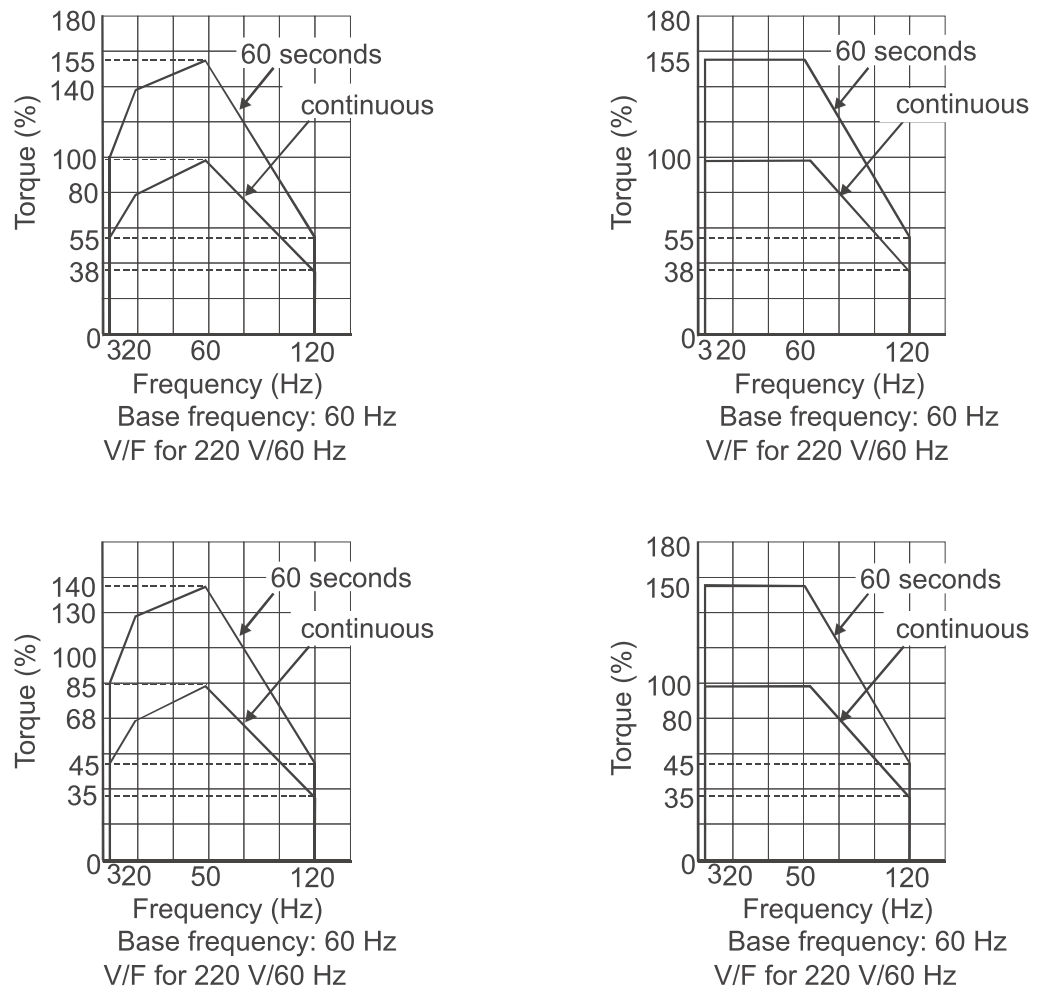


Figure 78: Motor torque



## Table of figures

b maXX <sup>®</sup> BM1000 .....	24
Danger areas b maXX <sup>®</sup> BM1000 .....	24
Type plate BM1000 .....	25
Type key BM1000 .....	25
b maXX <sup>®</sup> BM1000 Frame 1 .....	26
b maXX <sup>®</sup> BM1000 Frame 2 .....	26
b maXX <sup>®</sup> BM1000 Frame 3 .....	27
Remove keypad .....	27
Remove front cover .....	28
Remove mains terminal cover .....	28
Remove motor terminal cover .....	28
Remove fan .....	29
Danger areas by the mechanical mounting .....	32
Installation space frame 1 .....	34
Installation space frame 2 and 3 .....	35
Installation with metal separation .....	36
Installation without metal separation .....	36
Dimensions .....	37
Dimension operation terminal .....	38
Mounting instruction .....	39
Danger areas at the electrical installation .....	41
Connection NPN mode and PNP mode - without external power .....	50
Connection NPN mode and PNP mode - with external power .....	51
External connections .....	52
Mains circuit terminals .....	54
Mains terminals connections 1 .....	55
Mains terminals connections 2 .....	55
Main terminals connections 3 .....	56
Main terminals connections 4 .....	56
Terminals braking resistor .....	58
Connecting grounding terminals .....	59
Position of control terminals .....	60
Multi-function output 1 .....	61
Analog voltage input .....	61
Analog current input .....	62
Analog output meter .....	62
Analog input terminals .....	63
External parts .....	64
DC link of the devices in parallel .....	66
Application 1 mains choke .....	67
Application 2 mains choke .....	68
Application 3 mains choke .....	68
Digital keypad .....	71
Keypad operation .....	73
Device ready without digital keypad .....	74
Device ready digital keypad .....	74
Troubleshooting over current .....	88
Troubleshooting ground fault .....	89
Troubleshooting overvoltage .....	89
Troubleshooting low voltage .....	90
Troubleshooting overheat .....	91
Troubleshooting overload .....	91
Troubleshooting keypad display .....	92
Troubleshooting phase loss .....	92



## Table of figures

---

Troubleshooting motor doesn't run .....	93
Troubleshooting motor speed cannot be changed .....	94
Troubleshooting motor stalls during acceleration .....	95
Troubleshooting motor does not run as expected .....	95
Phase lead capacitors .....	97
Danger areas b maXX <sup>®</sup> BM1000.....	99
Dimensions chopper unit .....	120
DIN rail installation chopper unit .....	120
Parts of chopper unit.....	121
Wiring diagram chopper unit.....	121
Wiring distance chopper unit .....	122
Braking usage ED %.....	123
Voltage setting chopper unit .....	124
Wiring example Master/Slave setting .....	124
Braking resistor 1 .....	125
Braking resistor 2.....	126
Digital keypad .....	131
DIN rail 1 .....	132
DIN rail 2.....	133
MKE-EP.....	133
Earthing plate for shielding cable.....	133
Input wiring .....	149
Load duty-cycle.....	162
Motor torque .....	164



# Index

<b>A</b>	
Accessories	117
Alarm output contact	142
Ambient environment	101
Analog output signal	142
<b>B</b>	
b maXX® 4400	139, 147
BM44XX - Cable protection	145
BM4-CAN-T01	134
Brake resistor	53, 117, 125
Braking usage ED	123
<b>C</b>	
Cable	
EMC instructions	44
Cable protection	144, 145
Cable screens	44
Cables	
laying	44
Capacitors	107
Carrier frequency	141
Chopper unit	53, 117, 119
CIA-Standard	134
Circuit breaker	144
Class of protection	16
Connecting cable	43
Connecting main terminals	55
Construction of the devices	23
Control cabinet	69
Control system	142
Controller cartridge	23
Cooling fan of cooling system	103
Cooling method	141
<b>D</b>	
Danger areas	24
Dangers	9, 18
DC capacity of main circuit	102
Declaration of Conformity	135, 136
Demounting	108
Device description	23
Device protection	144
Digital inputs	63
Digital keypad	131
Digital outputs	63
Dimensions chopper unit	120
DIN rail	132
DIN rail installation chopper unit	120
Display keypad	143
Disposal	111
Disposal instructions	113
Drilling patterns	37
Drive frames	26
<b>E</b>	
Electrical data	141
EMC filter	53
EMC instructions	44
EMC-compatible installation	44
EN 60204 1-1	144
Environmental conditions	69, 100, 140
Error detection	79
Error indications	79
External connections	52
<b>F</b>	
Fault code information	79
Female	148
Fire fighting	18
Fire fighting appliances	145
First steps	7
Frequency setting	142
Frequency setting resolution	142
Frequency tolerance	141
Fuse	53
Fuse protection	144
Fuse specification	130
Fuses	43
<b>I</b>	
IEC 60204-1	43
Inappropriate use	16
Input rating	141
Inspection intervals	100
Installation	41
electrical mains	42
preconditions	41
Installation space	31, 34
Installation with metal separation	36
Interconnect the devices	24
Introduction	7
Isolation	107
<b>K</b>	
Keypad	101
<b>L</b>	
Laying	44
Legal instructions	15
<b>M</b>	
Magnetic contactor	53, 103
Main circuit	102
Mains choke	53, 128
Mains chokes	127
Mains power terminals	57
Maintenance	78, 99
Maintenance notes	100



## Index

Marking	25	Relative air humidity	100
Maximum output voltage	141	Remove fan	29
Meaning of Messages	79	Remove front cover	28
Mechanical parts	101	Remove keypad	27
Modification	16	Remove main terminal cover	28
Modules	113	Remove motor terminal cover	28
Mounting	31	Repair	105
Mounting instructions	38	Residual energy	17
Mounting technic	38	Resistor of main circuit	102
Multi-function output indication	142	Responsibility and liability	18
<b>N</b>		RJ45	134
Non-electrical data	140	<b>S</b>	
<b>O</b>		Safety fuses	144
Operating sequence of installation	45	Safety instructions	9, 18, 79
Operation	69	Safety notes	18
Operation explanation	122	Screwing (UL)	45
Operation functions	143	Screws	39
Operation height	100	Semiconductor fuses	144
Output choke	53, 129	Servo converter	23
Output frequency	141	Shutdown	107, 108
Output frequency resolution	142	Skip frequency	142
Output rating	141	Spare parts	117
Output terminals	57	Specifications of main circuit terminals	54
Overload endurance	142	Storage	107
Overview	24	Storage conditions	109
<b>P</b>		Survey of appliance series	7
Packing	21	<b>T</b>	
Parts of chopper unit	121	Technical data	139, 147
Periodical maintenance	101	Temperature	100
Personnel	17, 79	Terminals and wiring of main circuit	102
qualified	17	Terms	
Pinbelegung	148	definition	8
Power supply	53	Torque characteristics	142
Power unit	23	Transformer and chokes	103
Prepare mounting	33	Transportation	21
Printed circuit board	103	shock	21
Professional	17	temperature range	21
Protection functions	143	Troubleshooting	79
Protective measures	9	Type key	25
<b>Q</b>		Type of protection	145
Qualified personnel	17, 32, 70	<b>U</b>	
<b>R</b>		UL 508 C	43
Rated current	23	Unpacking	21
Rated input current	141	<b>V</b>	
Rated output capacity	141	Ventilation channel of cooling system	104
Rated output current	141	Voltage	101
Rated voltage	141	Voltage settings chopper unit	123
Recommissioning	109	Voltage tolerance	141
Recycling	113		
Regenerated braking torque	142		





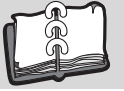
## W

Warning code information	86
Washers	39
WEEE, 2002/96/EG	111
Wiring diagram chopper unit	121
Wiring distance chopper unit	122
Wiring for NPN mode	50



## Index

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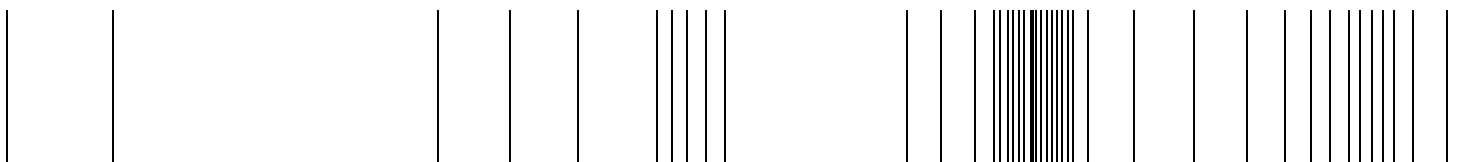
## Revision survey

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5.07003.04	29.02.2007	First edition
5.07003.05	09.05.2011	Mains filter marking changed
5.07003.06	13.10.2011	Declaration of conformity added





**be in motion**



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