User Manual

60888212_00

JM-3P22B
Supply unit

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Translation of the german original User Manual

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Table of contents

1 Introduction

1.1 Information on this document

This document forms an integral part of the product and must be read and understood prior to using it. It contains important and safety-related information for the proper use of the product as intended.

Target Groups

This document is intended for specialists with appropriate qualifications.
Only competent and trained personnel are allowed to put this device into operation.
During the whole product life cycle, safe handling and operation of the device must be ensured. In the case of missing or inadequate technical knowledge or knowledge of this document any liability is excluded.

Availability of Information

Make sure this document is kept at the ready in the vicinity of the product throughout its service life.
For information on new revisions of this document, visit the download area on our website. This document is not subject to any updating service.

Start | Bucher Automation - We automate your success.

For further information refer to the following information products:

- Online help for the JetSym software
  Functions of software products with application examples
- Application-oriented manuals
  Product-independent documentation
- Version updates
  Information about changes to the software products and operating system of your device

ⓘ Info

Further information

For further information on the noise immunity of a system, please refer to the Application Note 016 *EMC-Compatible Installation of the Electric Cabinet* available for download on www.bucherautomation.com.

NOTICE

Applicable documents

When installing the supply unit within the multi-axis system, the operating instructions of the other devices (servo amplifier, controller, etc.) as well as the Functional Description of *Integrated Safety Function S1* must be observed.

ⓘ Info

EtherCAT®

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 Typographical conventions

This manual uses different typographical effects to support you in finding and classifying information. Below, there is an example of a step-by-step instruction:

✓ This symbol indicates requirements which have to be met before executing the following action.

► This sign or a numbering at the beginning of a paragraph marks an action instruction that must be executed by the user. Execute the instructions one after the other.

⇨ The target after a list of instructions indicates reactions to, or results of these actions.

ⓘ Info	**Further information and practical tips** In the info box you will find helpful information and practical tips about your product.

2 Safety

2.1 General Information

The product corresponds to the current state of science and technology when placed on the market.
In addition to this user manual, the laws, regulations and directives of the country of operation or the EU apply to the operation of the product. The operator is responsible for compliance with the relevant accident prevention regulations and generally recognized safety rules.

RoHS 2

The device conforms to the EU directive 2011/65/EU (RoHS 2).

2.2 Purpose

2.2.1 Intended use

JM-3000 Supply units are components designed for installation in industrial and commercial systems and machines.

Installation is only permitted in stationary equipment. The JM-3000 multi-axis motion system consists of at least one supply unit and at least one servo amplifier. In motor operating mode, the supply unit draws power from the supply network and provides it to the connected servo amplifiers via the DC link.

When the supply unit is installed in a machine, commissioning (i.e., commencement of intended use) is prohibited until it has been determined that the machine complies with Machinery Directive 2006/42/EC. Commissioning (i.e., commencement of intended use) is only permitted if the EMC Directive (2014/30/EU) is complied with.

RoHS 2

The device conforms to the EU directive 2011/65/EU (RoHS 2).

Correlation of EU directives to directives in the United Kingdom

UK Conformity Assessed (UKCA)

UKCA (UKCA = UK Conformity Assessed) is the British product label required for certain products that are placed on the market in the United Kingdom (England, Wales and Scotland).

Directives, standards and regulations

The table below shows the correlation of fulfilled EU directives to the applicable directives in the United Kingdom.

European Union (EU)	United Kingdom (UK)
2006/42/EC Machinery Directive	Supply of Machinery (Safety) Regulations 2008
2014/30/EU EMC Directive	Electromagnetic Compatibility Regulations 2016
2011/65/EU RoHS Directive	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Tab. 1: Directive EU - UK

2.2.2 Non-intended use

Use of the Supply unit outside of the application areas given here or under operating ranges and ambient conditions other than those described in the documentation is considered non-intended use.

– The Supply unit must not be used outside a control cabinet.
– Servo amplifiers from other manufacturers must not be operated on the Supply unit.

The following application areas are considered non-intended use:

– Installation in vehicles. Use of the device in non-stationary equipment is considered an exceptional environmental condition and is only permitted after special agreement.
– Installation in environments where there are hazardous oils, acids, gases, vapors, dusts, rays, etc.
– Use in special application areas (e.g., where there is a risk of explosion, corrosion or fire).
– Untypical generation of higher frequency on-board networks.

2.2.3 Warnings used in this document

⚠ DANGER

High risk

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Medium risk

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Low risk

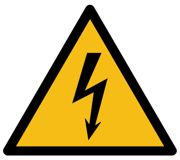
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Material damage

Indicates a situation which, if not avoided, could result in malfunctions or material damage.

2.2.4 General Safety Instructions



⚠ DANGER

Risk due to high electrical voltage

Touching live parts may result in death or severe injury.

- ▶ Carry out the following steps before starting work to ensure safety.

☑ Prepare for turning off the system. Inform everyone involved who will be affected by the process.

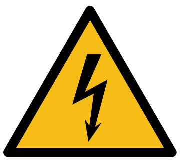
☑ Isolate the drive system from the power supply and secure it against being turned on again.

☑ Wait for the discharge time (approx. 10 minutes) and check all power connections to ensure they are at zero potential.

☑ Ground according to requirements.

☑ Cover over neighboring live parts.

☑ Ensure the drives cannot move.



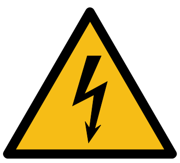
⚠ DANGER

Danger due to high operating voltage!

The high operating voltage of the device leads to severe injuries or death.

Comply with the following rules throughout the entire work process.

- ▶ Do not remove any covers during operation and keep the switch cabinet doors closed.
- ▶ Check whether all live connections are safely protected against contact.
- ▶ Never open the device.
- ▶ Never touch the wiring terminals of the device for voltage supply and DC link voltage during operation.



⚠ DANGER

Risk of electric arc due to improper handling

Improper handling can result in an electric arc, which may lead to severe injury or death.

- ▶ Open the plug connections only in de-energized state.
- ▶ Install the device only in an environment where there is no risk of fire, without any flammable gases or vapors.
- ▶ Observe the specified limit values for voltage.
- ▶ Wire according to regulations.

⚠ WARNING

Non-observance of safety instructions may result in injuries or physical damage

- ▶ Prior to assembling and installing the device, read and follow the safety precautions and restrictions of use as set out in the Safety chapter.
- ▶ Only authorized qualified personnel is allowed to perform any kind work on the device.

⚠ WARNING

Risk of crushing due to uncontrolled axis movements

High mechanical forces due to axis movements and accelerations.

- ▶ Keep out of the hazard zone of the machines.
- ▶ Do not disable any safety equipment.
- ▶ Have malfunctions eliminated by qualified personnel.

⚠ WARNING

Risk of burns due to hot surfaces

The device may become hot during operation and can cause burns if touched.

- ▶ Take protective measures to prevent inadvertent contact with the device, e.g. protective covers.
- ▶ Make sure that no temperature-sensitive parts, e.g. connection cables, are attached or fastened to the device.
- ▶ Ensure there is adequate heat dissipation and maintain the required distances during installation so as not to prevent or restrict ventilation.
- ▶ Allow the device to cool off for a while before carrying out cleaning or maintenance work.
- ▶ Wear personal protective equipment.
- ▶ Avoid all contact with the braking resistor.
- ▶ Do not place any flammable or heat-sensitive components in the vicinity of the braking resistor.

⚠ WARNING

Danger for persons with pacemakers and implants!

Operating the device generates an electromagnetic field. Electric, magnetic and electromagnetic fields are a health risk in particular to persons with pacemakers and implants.

- ▶ If you belong to the above group of persons you must not be in the immediate vicinity of the device.
- ▶ Keep a minimum distance as specified below:
  300 mm from a de-energized device, for example when doing installation work;
  600 mm from an energized device running in normal operation.

⚠ WARNING

Risk of death due to falling loads during lifting and transport processes

Improperly performed lifting and transport processes as well as unsuitable or defective devices and tools can lead to severe or fatal injuries and material damage.

▶ Lifting devices, industrial trucks and load handling attachments must meet requirements.

▶ The load capacity of the lifting equipment and load handling attachments must be in line with the weight of the load being transported.

▶ Fasten and secure the load to be transported carefully to the lifting equipment.

▶ Do not stand in the swivel range of lifting equipment or under suspended loads.

⚠ CAUTION

Risk from unwanted coastdown!

Triggering the STO function by deactivating the digital input only interrupts the energy supply for the drive and the motor movement can no longer be controlled. The voltage of the DC bus is not disconnected!

▶ Always stop the drive before you trigger the STO function.

▶ In case of suspended loads, install a mechanical brake to prevent the load from falling down.

NOTICE

Damaged devices

Damaged devices may cause considerable physical damage.

▶ Check the device for external damage and faulty connections.

▶ Ensure to install only fully functional devices.

NOTICE

Material damage due to loose power connection

Vibrations or insufficient tightening torques can lead to loose power connections. This can lead to fire damage, defects in the device or malfunctions.

▶ Tighten all power connections to the specified tightening torques.

▶ Check all power connections at regular intervals, especially after transport.

NOTICE

Inadequate accessories might cause damage to the product

Parts and equipment from other manufacturers might impede the function of the device and cause damage to the product.

▶ Only use accessories recommended by Bucher Automation AG.

3 Product description

The JM-3P22B supply unit was developed for the supply of devices of the JM-3000 series rev. B.

NOTICE! Devices of the previous JM-3000 series cannot be combined with the new JM-3000 series rev. B.

3.1 Design

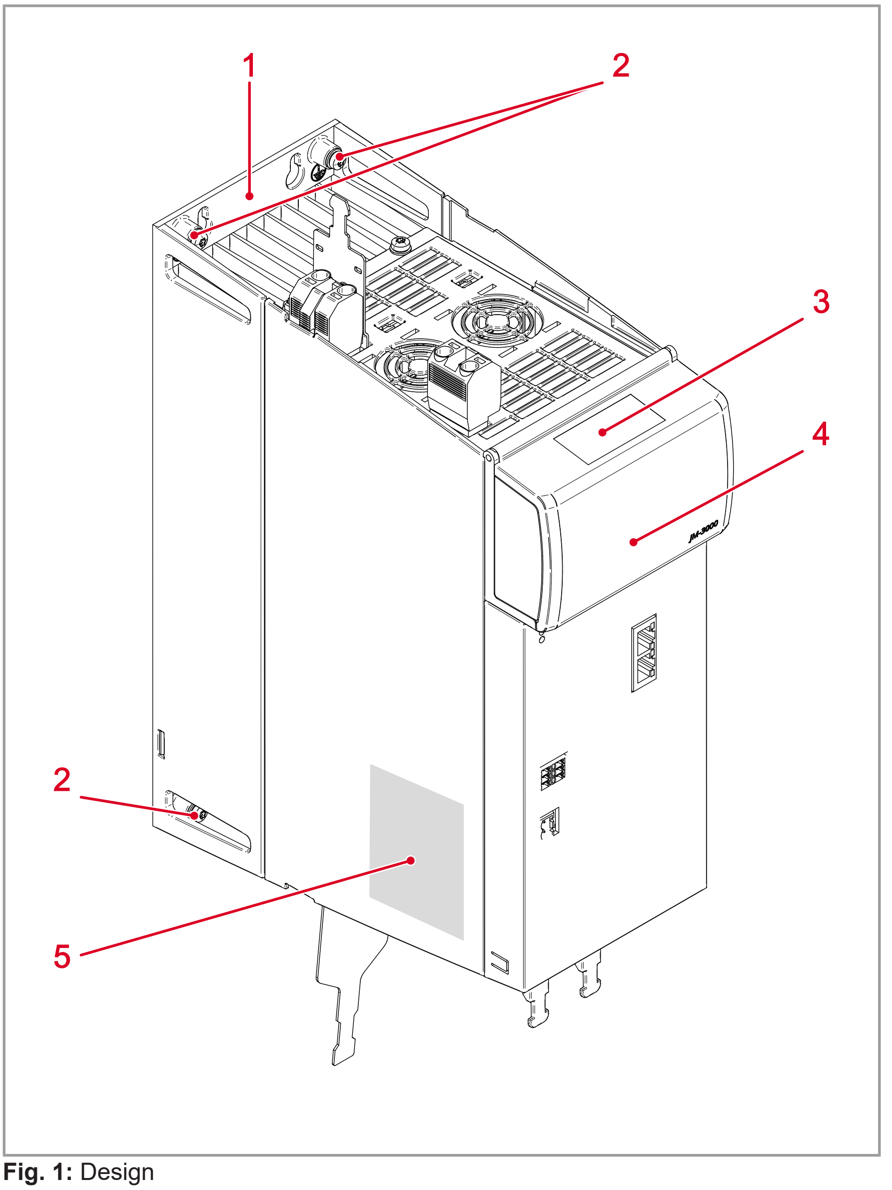


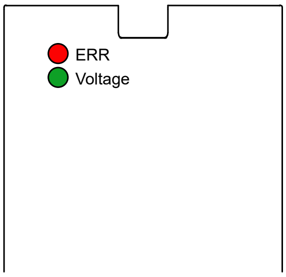
Fig. 1: Design

1	Fastening lug
2	Bonding screw
3	Nameplate, short version
4	Front cover
5	Nameplate

3.2 Product features

- Modular design
- Flexible power bus system
- Compact geometries
- EtherCAT® bus connection
- Braking resistor (R1)
- Easy commissioning

3.3 Status indication



Status indication LEDs indicate the communication status of the device as well as the status of the voltage supply.

The status LEDs are located in the upper part of the JM-3P22B front panel.

Fig. 2: Status indication

3.3.1 Lighting patterns of the LEDs

Parameter	Lighting pattern	Description
OFF	-	LED turned off
ON	Continuously lit	LED turned on
BLK	0.8 s	Slow continuous flashing
FLK	0.4 s	Fast, continuous flashing (flickering)

Tab. 2: Lighting patterns of the LEDs

3.3.2 Function and status of the LEDs

LED	Color	Function	Status	Description
ERR	Red	Error display	OFF	No errors and no warnings
			BLK	There is an active warning, but the Supply unit is ready for operation.
			FLK	-
			ON	There is an active warning. The DC link is disconnected from the power supply. An error message appears in the axis modules.
Voltage	Green	Operating display	OFF	-
			BLK	Ready for operation, the DC link is not connected to the power supply.
			FLK	The Supply unit is in the precharging phase, which may take several seconds.
			ON	The Supply unit has been precharged and is connected to the power supply.

Tab. 3: Function and status

3.4 Nameplate

Main nameplate

The main nameplate is located on the left side of the housing.

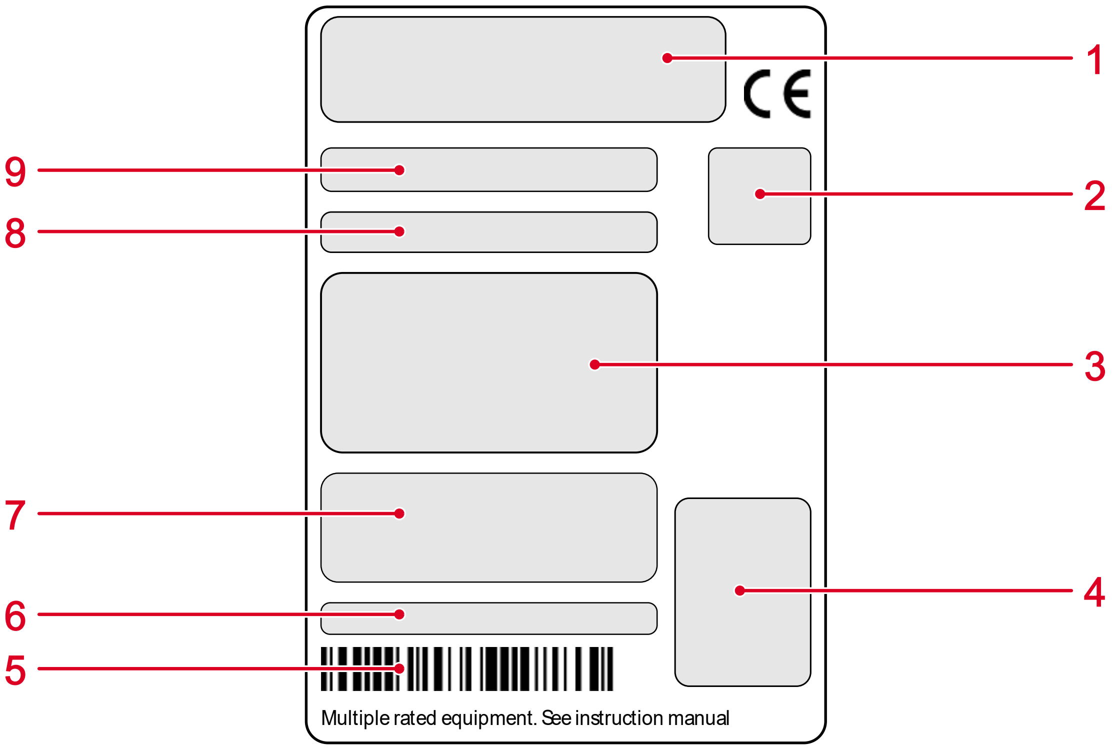


Fig. 3: Main nameplate

1	Company logo and address
2	Mandatory sign
3	Power data
4	Certification mark
5	Barcode serial number
6	Serial number
7	Software revision and various details
8	Item number
9	Model code number

Nameplate, shortened form

The shortened nameplate, located at the top of the front cover, provides access to the most important information when a device is installed.

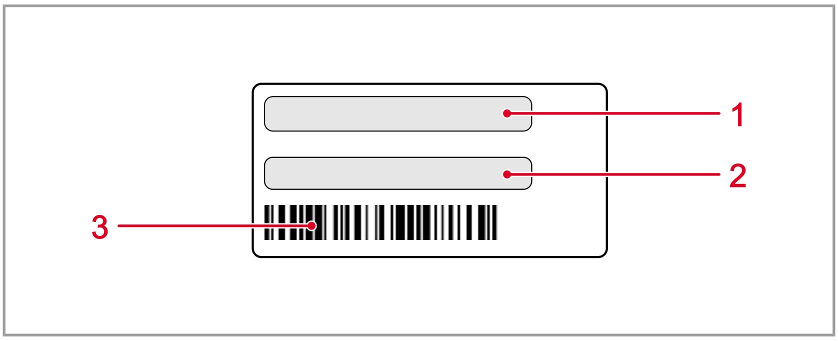


Fig. 4: Nameplate, shortened

1	Model code number
2	Serial number
3	Barcode serial number

Order code [▸ 18]

JetMove 3Pxx

	PC		Module					Options					
Order code	JM	-	3	P	xx	x	-	Mx	Px	Rx	Cx	Lx	Ax

Product class

JM = JetMove

Module

Model series

3 = Series 3000

P = Passive supply unit

Continuous power

10 = 10 kW

22 = 22 kW

Device revision

B = 1st Redesign (new item number)

Options

Supply voltage

_ = 3 x 230-480 VAC

Integrated power supply

_ = Without

P1 = 24VDC/20A power supply unit integrated

P2 = 24VDC/20A integrated for network support

Brake resistor (optional)

_ = Without internal BR. External BR required.

R1 = Internal BR installed

Housing cooling scheme (optional)

_ = Air cooling (default)

C1 = ColdPlate

Protective coating

_ = No protective lacquer (default)

L1 = Protective lacquer

Hardware revision

A = Current hardware revision

A0 = Hardware revision 0

A1 = Hardware revision 1

A2 = Hardware revision 2

... ...

3.5 Scope of delivery

Scope of delivery	Item number	Quantity
JM-3P22B	Depending on options	1
EtherCAT® patch cable, 0.25 m 8-wire, Cat 5 e PE metal bridge	60887985	1 sachet
Pre-installed busbar elements for 24 V controller supply voltage (U_{CV}) and DC link supply ($U_{DC\ link}$)		
Mating connector for power and IOs		
JM-3P22B	60886337	1 sachet
USB stick with complete documentation	60888000	1 per order

3.6 Design variants

3.6.1 Version with integrated brake resistor

Variant JM-3PxxB-R1

Purpose of this variant

In generator operation, e.g., when braking the drive, the motor energy is supplied back to the servo amplifier. This increases the voltage in the DC link. If the voltage exceeds a threshold value, the internal braking transistor in the supply unit is switched on and the regenerative energy is converted into heat by means of a braking resistor.

– The design variant described here is a cost-effective option for braking drives with small masses without additional effort.
– In addition, the integrated braking resistor has the great advantage that no additional space is required as would be the case for an external braking resistor.
– However, the braking power is limited for thermal reasons. See Power data [▸ 26].

3.6.2 Design without 24-V switching power supply unit

Variant JM-3PxxB

Purpose of this variant

This variant enables you to supply the control unit of the JM-3000 system with an already existing external switching power supply unit.

The external switching power supply unit must meet the following minimum requirements:

- U_V = 24 V ±10 %, stabilized and smoothed (operating voltage)
- Output power accordingly the selected supply unit and connected servo amplifier
- Reverse polarity protection, internal
- The power supply unit used must have a safe separation from the power supply in accordance with EN 50178 or EN 61800-5-1.
- The start-up current for the control voltage can be 2-3 times the operating current for a brief time.
- If other devices are supplied by this switching power supply unit, its power rating must be correspondingly higher.

NOTICE

Damage to other devices due to incorrect wiring

The 24 V/GND connection on the supply unit is at earth potential (see PELV). Other consumers can be damaged by connecting control line screens or similar devices.

▶ Please check the connections in advance.

Current consumption of 24-V control supply (A)

Device	Cooling system	Current consumption of 24-V control supply
JM-3P10B	Wall-mounted	0.7 A
	Cold Plate	0.4 A
JM-3P22B	Wall-mounted	1.0 A
	Cold Plate	0.5 A

Tab. 4: Current consumption of 24-V control supply (A)

A connection example can be found here [▶ 49].

4 Technical Specifications

This chapter contains information on both electrical and mechanical data as well as on operating data of the JM-3P22B device.

4.1 Dimensions

Parameter	BG2
Dimensions (W x H x D)	110 x 310 x 241 mm
Device	JM-3P22B

Tab. 5: Overview of components

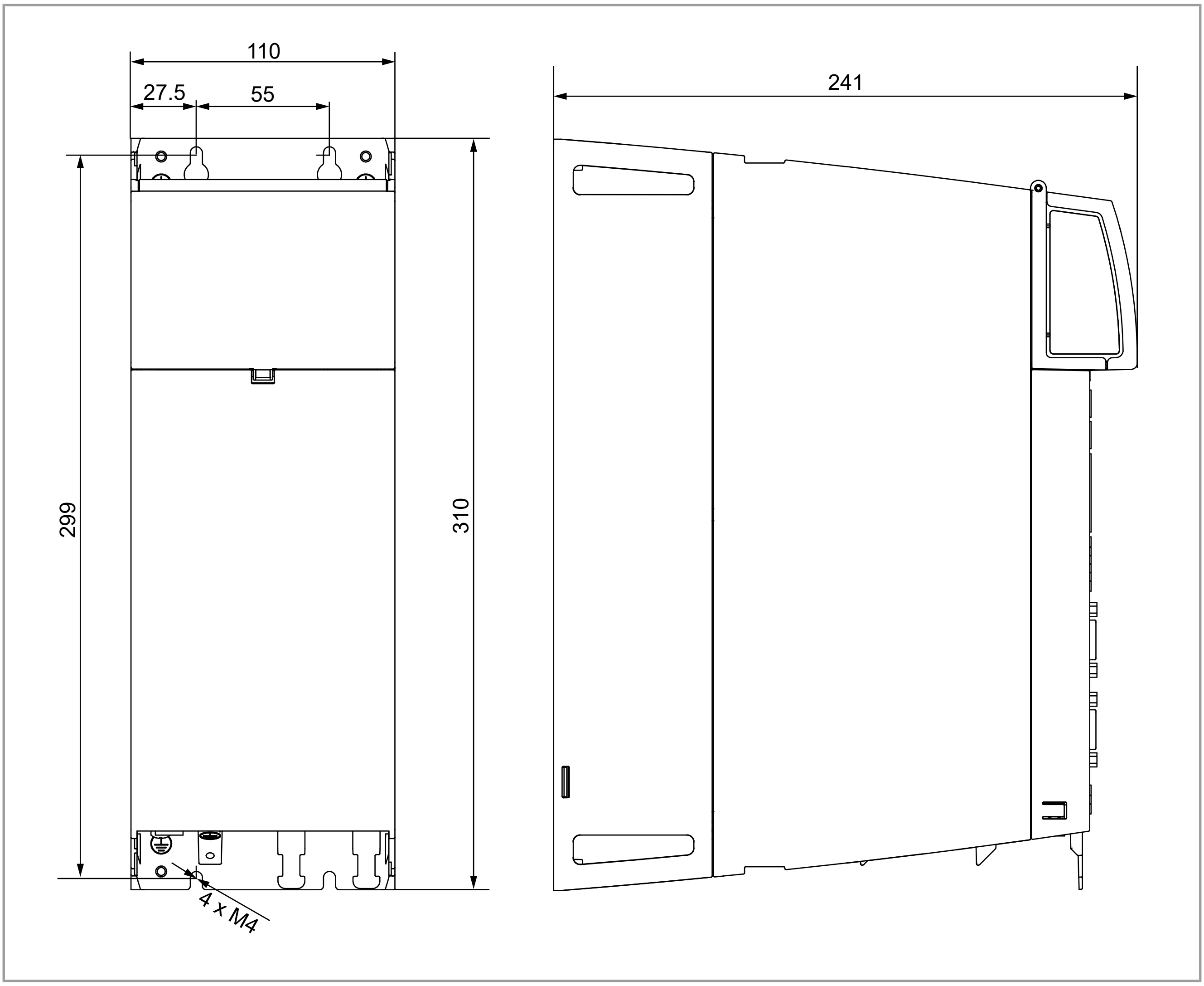


Fig. 5: Dimensions of BG2 – wall mounting

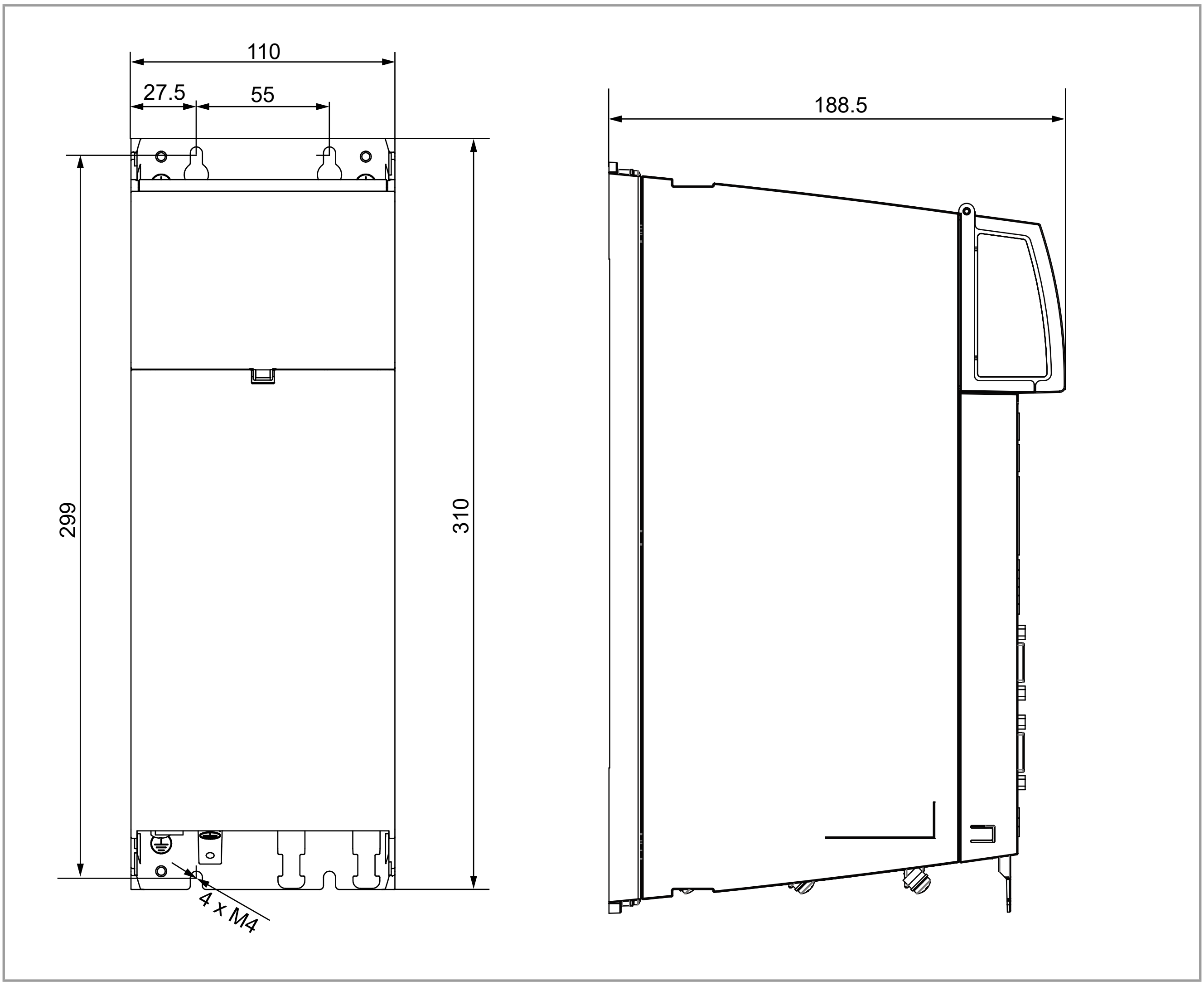


Fig. 6: Dimensions of BG2 – cold plate

ⓘ Info

CAD data

For CAD data go to www.bucherautomation.com and navigate to the product page *JM-3P22B > Downloads*.

4.2 Mechanical specifications

<table>
<tr><th colspan="2">Parameter</th><th>Description</th><th>Standards</th></tr>
<tr><td colspan="2">Mounting orientation</td><td></td><td></td></tr>
<tr><td rowspan="2">Weight</td><td>net</td><td></td><td rowspan="2"></td></tr>
<tr><td>With built-in PSU</td><td></td></tr>
<tr><td colspan="4">Enclosure specifications</td></tr>
<tr><td colspan="2">Material</td><td>Metal</td><td></td></tr>
<tr><td colspan="4">Maximum height of fall</td></tr>
<tr><td colspan="2">with shipping packaging</td><td>0.25 m</td><td rowspan="2">DIN EN 61131-2
DIN EN 60068-2-31</td></tr>
<tr><td colspan="2">with product packaging</td><td>0.25 m</td></tr>
<tr><td colspan="4">Vibration resistance</td></tr>
<tr><td colspan="4">Vibration limit during transport</td></tr>
<tr><td colspan="2">Frequency sweeps</td><td>1 octave/minute, sinusoidal</td><td rowspan="3">EN 61800-2, IEC 60721-3-2 class 2M1</td></tr>
<tr><td colspan="2">Constant amplitude</td><td>3.5 mm</td></tr>
<tr><td colspan="2">Frequency</td><td>2 Hz ≤ f ≤ 9 Hz</td></tr>
<tr><td colspan="2">Constant acceleration</td><td colspan="2">Not applicable</td></tr>
<tr><td colspan="4">System vibration limits
NOTICE! The devices must not be installed in areas where they are exposed to continuous vibrations.</td></tr>
<tr><td colspan="2">Constant amplitude</td><td>0.3 mm</td><td rowspan="3">61800-2, IEC 60721-3-3 class 3M1</td></tr>
<tr><td colspan="2">Frequency</td><td>2 Hz ≤ f ≤ 9 Hz</td></tr>
<tr><td colspan="2">Constant acceleration</td><td>Not applicable</td></tr>
<tr><td colspan="4">Degree of protection</td></tr>
<tr><td colspan="2">Device</td><td></td><td rowspan="2">DIN EN 60529</td></tr>
<tr><td colspan="2">Control cabinet</td><td>min. IP4x, with use of safety function STO min. IP54</td></tr>
</table>

Tab. 6: Mechanical specifications

4.3 Environmental conditions

Parameter		Description	Standards
Operating temperature		5 … 40 °C to 55 °C with power reduction (5 %/°C)	DIN EN 61800-2, IEC 60721-3-3 class 3K3
Storage temperature		-25 … 55 °C	DIN EN 61800-2, IEC 60721-3-1 classes 1K3 and 1K4
Transport temperature		-25 °C ... 70 °C	DIN EN 61800-2, IEC 60721-3-2 class 2K3
Relative humidity for	Transport	95 % at max. 40 °C	
	The absolute humidity is limited to max 60 g/m³. This means that, at 70 °C for example, the relative humidity must not exceed 40 %.		
	Storage	5 … 95 %	
	The absolute humidity is limited to max 29 g/m³. The maximum values for temperature and relative humidity listed in the table must not occur at the same time.		
	Operation	5 % … 85 % at 40 °C, non-condensing	
	The absolute humidity is limited to max 25 g/m³. This means that the maximum values listed in the table for temperature and relative humidity must not occur at the same time.		
Max. operating altitude		1000 m above sea level Over 1000 m above sea level with power reduction (1 % per 100 m, max. 2000 m above sea level)	DIN EN 61131-2
Installation location		Control cabinet **NOTICE! The ambient conditions for the device must also be observed in the control cabinet.**	
Corrosion immunity and chemical resistance		No special anti-corrosion precautions have been taken. The ambient air must not contain higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors and other corrosive or electroconductive contaminants.	
Degree of pollution – Electronics		Level 2	DIN EN 60664-1
		Only non-conductive dirt occurs. However, temporary conductivity due to condensation may occur.	

Tab. 7: Environmental conditions

4.3.1 Power reduction at increased ambient temperature

If the multi-axis system will be operated outside of the specified maximum ambient temperature ($T_{amb\text{-}nom}$), the output power of the supply unit must be reduced depending on the higher ambient temperature, which will also affect the current in the DC link connections. The purpose of this temperature derating is to protect components in the device from overheating.

NOTICE! If the output power is not reduced despite the increased ambient temperature, this will lead to the output stage switching off due to overtemperature.

Device	Operation without derating up to $T_{amb\text{-}nom}$	Operation with derating up to $T_{amb\text{-}max}$	Derating for $T_{amb\text{-}nom}$ < T_{amb} < $T_{amb\text{-}max}$
JM-3P22B	40 °C	55 °C	Reduction of output power by 3.4 % per 1 °C

Tab. 8: Power reduction at $T_{amb\text{-}nom}$ ≥ 40 °C

4.4 Electrical properties

EtherCAT® interfaces X3 IN, X3 XC OUT

Parameter	Description
Connectivity	RJ45 jack
Number of ports	2
Bit rate	100 Mbit/s
Auto-crossover	Yes

Tab. 9: EtherCAT® interfaces X3 IN, X3 XC OUT

"State" connection X6

Parameter	Description
Connectivity	Plug-in terminal, 2-level
Number of pins	6 (2x3)
Type	MCDN 1.5/3-G1-3.5
Manufacturer	Phoenix contact

4.4.1 Power data

Parameter	JM-3P22B		
Input, mains side			
Mains voltage U_N ± 10 %, 3 times	AC 230 V	AC 400 V	AC 480 V
Continuous current [$A_{AC\ RMS}$], typically	41 A_{RMS}		34 A_{RMS}
Peak current [A_{AC}], typically	82 A_{RMS}		68 A_{RMS}
Continuous power (depending on mains impedance)	18.5 kVA	32 kVA	
Power loss of rectifier	110 W		
Mains voltage unbalance	±3 % maximum		
Frequency	50 Hz … 60 Hz ±10 %		
Maximum wire cross-section X12	1.5 mm² ...16 mm² (finely stranded, with/without wire end ferrules)		
DC link output			
DC link voltage, typical (load-dependent)	DC 325 V	DC 565 V	DC 678 V
Continuous current	DC 39 A		DC 32 A
Peak current 2 x I_N for 1 s, line reactor not required	DC 78 A		DC 64 A
Continuous power P_N	12.5 kW	22 kW	
Peak power 2 x P_N for 1 s	25 kW	44 kW	
DC link capacitance (only JM-3PxxB)	840 µF		
Maximum permissible DC link capacitance JM-3000 + JM-3PxxB	4000 µF(1,360 + 840) max.		
Power dissipation P_N in interior	130 W		

Tab. 10: Data for JM-3P22B

BG2 brake chopper

Parameter	JM-3P22B		
Mains voltage	AC 230 V	AC 400 V	AC 480 V
Power electronics - brake chopper			
Operating point - brake chopper	411 V	652 V	765 V
Transient protection	446 V	687 V	800 V
Continuous braking power	3.5 kW	6 kW	
Peak braking power for max. 0.5 s	20 kW	28 kW	30 kW
Maximum ohmic resistance of an externally connected braking resistor	50 Ω	90 Ω	
Minimum ohmic resistance of an externally connected braking resistor	8 Ω	15 Ω	20 Ω
Supply unit with integrated braking resistor			
Continuous braking power	150 W		
Peak braking power for max. 0.5 s (After this time the device is switched off after I^2t)	6 kW		
Ohmic resistance of the integrated braking resistor	28 Ω		

Tab. 11: Data for BG2 brake chopper

4.4.2 Electrical isolation concept

- All control connections are designed as a safety extra-low voltage circuits (PELV) and must only be operated with such PELV voltages according to the respective specification. This means a reliable protection from electric shock on the control side.
- The connections DC Link +/-, X12 - U/V/W, X13 - U/V/W and X14 - U/V/W are at mains potential (low voltage).
- The following overview details the potential references of the individual connections.
- This concept also achieves a higher operational reliability of the supply unit.

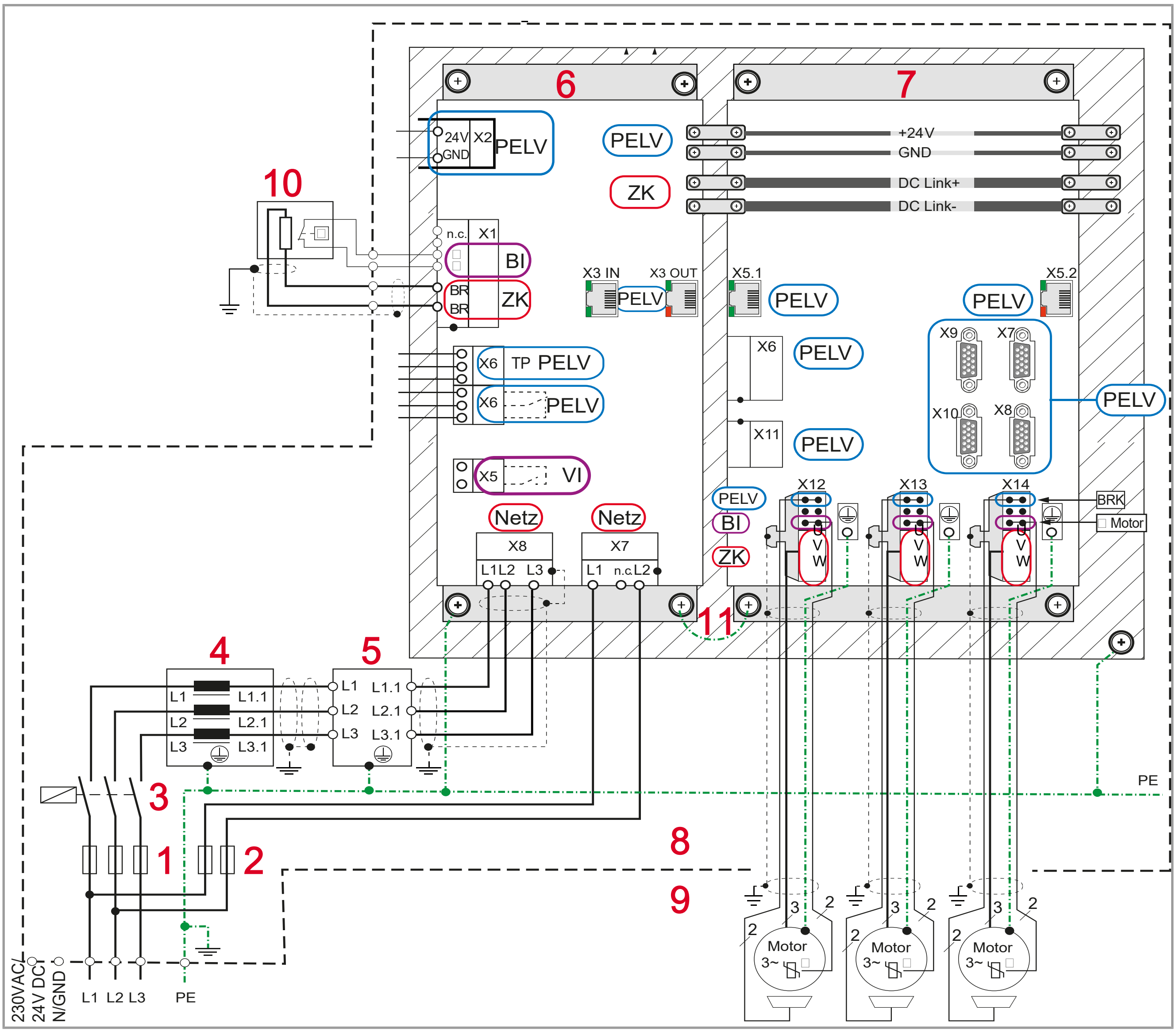


Fig. 7: Electrical isolation concept

1	Mains fuse for DC link supply
2	Mains fuse for switching power supply unit
3	Mains contactor (optional)
4	Line reactor (accessory)
5	Line filter (accessory)
6	Supply unit
7	Servo amplifier
8	Control cabinet

9	Box
10	Braking resistor with temperature monitoring (external)
11	Series protective connection to the next device

The mains contactor can be activated via mains contactors with 230 VAC or alternatively 24 VDC.

Connections Supply unit	Description	Potential	Abbreviation
Busbar 24 V	Output 24 V switching power supply unit	Protective extra-low voltage circuit[3)]	PELV
Busbar DC link	DC link	Low voltage[1)]	DC link
X1 / BR	Connection of external braking resistor (connected to DC link)	Low voltage[1)]	DC link
X1/ϑ	Connection for temperature monitoring of braking resistor (Klixon)	Low voltage with basic insulation[2)]	BI
X2/24 V DC	Output or input of 24-V switching power supply unit	Protective extra-low voltage circuit[3)]	PELV
X3 IN/X3 XC OUT	EtherCAT® looped through, cross communication wired in	Protective extra-low voltage circuit[3)]	PELV
X5	n. c.[4)]		VI
X6 / TP	Two test pulse outputs	Protective extra-low voltage circuit[3)]	PELV
X6 / RO01	Contact of changeover relay, programmable	Protective extra-low voltage circuit[3)]	PELV
X7	Mains supply DC link	Low voltage[1)]	Network
X8	Mains supply of switching power supply unit	Low voltage[1)]	Network

[1)] Low voltage ≤ 1000 V AC or ≤ 1500 V DC

[2)] Simple isolation from low-voltage network: No PELV networks may be connected.

[3)] PELV (Protective Extra-Low Voltage) = protective extra-low voltage AC: U ≤ 50 V; one connection of the extra-low voltage can be grounded.

[4)] Not connected, has no function

Tab. 12: Potential references of individual connections

4.5 Estimate of system capacity

This section includes one example each of calculating the maximum available nominal output in the DC link of an axis system and estimating the nominal output power of a servo amplifier.

4.5.1 Calculation of the maximum nominal output

The maximum nominal output in the DC link of an axis system is limited by:

– Nominal output of the supply unit

– Available DC link circuit capacitance in the axis system

Example 1

A supply unit with 10 kW supplies a 1-axis servo amplifier with 24 A and a 3-axis servo amplifier with 12 A. The supply unit can provide up to 10 kW of effective output continuously in the DC link if the total of all DC link circuit capacitances is ≥ 1000 µF (100 µF is required for 1 kW).

Module	Power	DC link circuit capacity
Supply unit	10 kW	330 µF
Servo amplifier for 1-axis module	24 A	675 µF
Servo amplifier for 3-axis module	12 A	405 µF
Available DC link circuit capacitance		**1410 µF**

Tab. 13: Example 1

The available DC link circuit capacitance in the axis system in this example is 1410 µF. The available effective power in the DC link is therefore 10 kW. All axes together cannot draw more than 10 kW of effective power from the DC link.

Estimate of the output power

The effective power in the DC link as well as the output power of one or more axes depends on the supply unit used and the servo amplifier supplied by the supply unit.

Example 2

A supply unit with 10 kW supplies one 3-axis servo amplifier with 12 A. The supply unit can provide up to 10 kW of effective power continuously in the DC link if the DC link circuit capacitance is sufficient.

Module	Power	DC link circuit capacity
Supply unit	10 kW	330 µF
Servo amplifier for 3-axis module	12 A	405 µF
Available DC link circuit capacitance		**735 µF**

Tab. 14: Example 2

The available DC link circuit capacitance in the axis system in this example is 735 µF and is therefore less than 1000 µF. The effective power is reduced to 7.35 kW due to the DC link circuit capacitance that is actually available.

With a typical efficiency level of 98 % of the axis modules, the total of the available output power is calculated as follows:

7.35 kW x 0.98 = 7.2 kW

The total of the available output power for all axes is 7.2 kW.

With a maximum motor voltage of 326 V (depending on the type of modulation), the available output power for an axis with 12 A is calculated as follows:

326 V x 12 A x $\sqrt{3}$ = 6.78 kW

The available output power of one axis is 6.78 kW.

4.5.2 Reduction of the effective power

BG1 and BG2 22 kW: Supply voltage 3 x 230 V AC

For supply units that can be supplied with 3 x 230 V AC, the effective continuously available power of the DC link is reduced by a factor of 1.732 (√3). The condition of 170 µF per 1 kW of effective power remains unchanged.

BG1: Supply voltage 230 V AC

For supply units that can also be supplied with one-phase 230 V AC, the effective power of the DC link is 1 kW. The peak power is limited to 2 kW. In addition, 900 µF of DC link circuit capacitance is required for 1 kW of effective power.

4.6 External line filter

Compliance with the EMC Directive

Commissioning (i.e., commencement of intended use) is only permitted if the EMC Directive (2014/30/EU) is complied with. The installer/operating company of the machine and/or plant must provide proof of compliance with the protective goals required by the standard.

To ensure that line-borne interference emission remains limited to the permissible level, external line filters are available. The use of these line filters enables compliance with the EMC Directive 2014/30/EU under certain conditions:

– Public low-voltage network "First environment" (residential area C2)

– Industrial low-voltage network "Second environment" (industrial area C3)

Electrical properties

Filter type	I_n/Ph	$I_{overpow.}$/Ph	Leakage current	Power loss[4)]	Clamping area tightening torque
JEMC53.120-UR	53 A	1.5 x I_N for 60 s [1)] 2 x I_N for 10 s [2)] 3 x I_N For 100 ms[2)]	5.7 mA [3)]	16 W	0.5 mm^2 … 16.0 mm^2 2.0 Nm … 2.3 Nm
JEMC53.240-UR			24.5 mA [3)]	13.6 W	
JEMC53.600-UR			43 mA [3)]	14.3 W	

Tab. 15: Technical data – external line filter

Parameter	Description
Rated voltage	3 x 480 V, +10 %, 50/60 Hz [4)]
IEC climate category	25/105/21
Standards	IEC 60939-2 (2006-5), UL 508
Ambient temperature	max. +45 °C (max. +55 °C, 1 % current derating per degree)
Installation altitude	max. 1000 m (up to 2000 m 1 % power reduction per 100 m)
Degree of protection	IP20

Tab. 16: General technical data – three-phase line filters

1) Can be repeated after 30 min

2) Can be repeated after 6 min

3) rms value of the leakage currents to IEC 60939 (2009) at 50 Hz and rated voltage with 2 % asymmetry. The leakage current can be further increased by the device from which interference is being suppressed.

4) If the supply frequency = 60 Hz, the power loss is about 10 % higher!

4.6.1 Selection guide for line filters

The suitable line filter is chosen based on considerations of power (10 kW or 22 kW) and total length of the power cables of all axes (up to 120 m, up to 300 m, up to 600 m).

The following tables provide an initial estimate of which line filter is likely to meet the EMC requirements under the conditions specified. This must be checked by the installer/operator. Under certain conditions it is possible to change to a smaller filter or it is necessary to change to a larger filter.

<table>
<tr><th colspan="2">Max. motor line length [m]</th><th>20</th><th>30</th><th>40</th><th>50</th><th>60</th><th>70</th><th>80</th><th>90</th><th>100</th><th>120</th><th>140</th><th>240</th><th>300</th><th>600</th></tr>
<tr><td colspan="16">Category C2</td></tr>
<tr><td rowspan="3">Clock frequency [kHz]</td><td>4</td><td rowspan="2">JEMC25.120-UR</td><td colspan="6">JEMC25.240-UR</td><td>JEMC25.600-UR</td><td colspan="6">N/A</td></tr>
<tr><td>8</td><td colspan="4">JEMC25.240-UR</td><td colspan="3">JEMC25.600-UR</td><td colspan="6">N/A</td></tr>
<tr><td>16</td><td colspan="3">JEMC25.240-UR</td><td colspan="11">N/A</td></tr>
<tr><td colspan="16">Category C3</td></tr>
<tr><td rowspan="3">Clock frequency [kHz]</td><td>4</td><td colspan="9">JEMC25.120-UR</td><td colspan="3">JEMC25.240-UR</td><td>JEMC25.600-UR</td></tr>
<tr><td>8</td><td colspan="9">JEMC25.120-UR</td><td colspan="3">JEMC25.240-UR</td><td>JEMC25.600-UR</td></tr>
<tr><td>16</td><td colspan="14">N/A</td></tr>
</table>

Tab. 17: Power input current $I_{IN} \leq 25$ A

<table>
<tr><th colspan="2">Max. motor line length [m]</th><th>20</th><th>30</th><th>40</th><th>50</th><th>60</th><th>70</th><th>80</th><th>90</th><th>100</th><th>120</th><th>140</th><th>240</th><th>300</th><th>600</th></tr>
<tr><td colspan="16">Category C2</td></tr>
<tr><td rowspan="3">Clock frequency [kHz]</td><td>4</td><td>JEMC53.120-UR</td><td colspan="2">JEMC53.240-UR</td><td colspan="3">JEMC53.600-UR</td><td colspan="8">N/A</td></tr>
<tr><td>8</td><td>JEMC53.240-UR</td><td colspan="3">JEMC53.600-UR</td><td colspan="10">N/A</td></tr>
<tr><td>16</td><td>JEMC53.240-UR</td><td colspan="2">JEMC53.600-UR</td><td colspan="11">N/A</td></tr>
</table>

<table>
<tr><th colspan="2">Max. motor line length [m]</th><th>20</th><th>30</th><th>40</th><th>50</th><th>60</th><th>70</th><th>80</th><th>90</th><th>100</th><th>120</th><th>140</th><th>240</th><th>300</th><th>600</th></tr>
<tr><td colspan="16">Category C3</td></tr>
<tr><td rowspan="3">Clock frequency [kHz]</td><td>4</td><td colspan="10">JEMC53.120-UR</td><td colspan="3">JEMC53.240-UR</td><td>JEMC53.600-UR</td></tr>
<tr><td>8</td><td colspan="10">JEMC53.120-UR</td><td colspan="3">JEMC53.240-UR</td><td>JEMC53.600-UR</td></tr>
<tr><td>16</td><td colspan="8">JEMC53.120-UR</td><td colspan="5">JEMC53.240-UR</td><td>N/A</td></tr>
</table>

Tab. 18: Power input current $I_{IN} \leq 53$ A

Example

The system in which interference is to be eliminated consists of six axes each with 4 m motor cable length and is operated with automatically switched clock frequency at a maximum of 8 kHz in residential environments. The continuous rated mains current is 18 A.

- Due to the continuous rated current, the table "Power input current $I_{IN} \leq 25$ A" must be selected.
- The sum of the motor cable lengths is 6 x 4 m = 24 m, column "30" must be selected.
- Residential environment = category C2
- Maximum clock frequency = 8 kHz
- The recommended line filter is JEMC25.240-UR

For part numbers of the net filters click here [▶ 70].

4.6.2 Selection of line filter, taking into consideration the cable and motor leakage capacitances

The effect of line filter is generally limited by the total of all leakage capacitances of the components connected to the JM-3000.

This parasitic capacitance is determined significantly by the connected motor cables. Another factor that should not be neglected is the capacitances of the connected motors.

Typical application scenarios and capacitances of the Bucher Automation motor cables and motors were therefore assumed for the development of the filters, from which typical total capacitances are derived. The filters are designed for these total capacitances. The following details apply to the Bucher Automation Motion components:

– Bucher Automation cables have a value of 0.47 nF/m
– Bucher Automation motors have a value of ≤ 10 nF

The 600 m filter variant is based on an application with 12 motors, each with a cable length of 50 m. The data above results in an overall capacitance of 12 x 10 nF + 12 x 50 m x 470 pF/m = 402 nF.

The permitted total leakage capacitances for the other line filters can be determined in the same way.

Filter type	Permitted total leakage capacitance Cx [nF]	Max. cable length that can be connected with 12 axes [m]
JEMCxx.120	176	120
JEMCxx.240	261	300
JEMCxx.600	402	600

Tab. 19: Total leakage capacitances on line filters

A close examination is required for:

– Applications with a higher number of axes or long motor cables
– Use of third-party cables that are not designed for low capacitance
– Third-party or special motors

As the basis for estimating the permitted total cable length use:

Lg = (Cx – Cm) / Ck

Parameter	Description
Lg	Total cable length of all connected axes [m]
Cx	Permitted total leakage capacitance of the line filter [nF]
Cm	Total of the parasitic capacitances of all connected motors [nF]
Ck	Capacitance per unit length of the motor cable used in [nF/m]

Tab. 20: Key

Example

The JM-3000 system offers the option of operating up to 24 axes on a supply unit. The selected line filter is a JEMCxx.600.

Due to the capacitance of 240 nF (24 x 10nF) introduced by the motor, a total cable length of
Lg = (402 nF-240 nF)/0.47 nF/m = 344 m is permitted.

This is equivalent to an average of 14.3 m per axis on a "600 m filter".

4.7 Line reactor

The use of line reactors is optional for supply units of the JM-3000 series.

However, the use of line reactors reduces peak mains currents and therefore voltage distortion (THD) in the mains as well. This increases the service life of the servo amplifiers and supply units.

As with line filters, several servo amplifiers can be connected to one line reactor. The following cases mandate the connection of servo amplifiers via a line reactor:

– When using the servo amplifier in applications with interference variables according to EN 61000-2-4 environmental class 3 and higher (harsh industrial environment)

– To ensure compliance with EN 61800-3 or IEC 61800-3.

► Install the line reactor on the mains side before the line filter. See also the two illustrations in section Protective conductor terminal [▶ 56].

NOTICE! If the nominal output of the supply units of components 1 and 2 are not utilized, smaller line reactors can also be used, adapted to the respective power inlet current.

For the item numbers of the line reactors click here [▶ 70].

5 Mechanical installation

This chapter describes how to install and remove the JM-3P22B.

⚠ WARNING

Non-observance of safety instructions may result in injuries or physical damage

- Prior to assembling and installing the device, read and follow the safety precautions and restrictions of use as set out in the Safety chapter.
- Only authorized qualified personnel is allowed to perform any kind work on the device.

NOTICE

Damaged devices

Damaged devices may cause considerable physical damage.

- Check the device for external damage and faulty connections.
- Ensure to install only fully functional devices.

NOTICE

Damage to the device due to foreign objects

- Take precautions to prevent drilling chips, screws or other foreign objects from entering the device.
- Be absolutely certain that no moisture penetrates into the device.

NOTICE

Applicable documents

When installing the supply unit within the multi-axis system, the operating instructions of the other devices (servo amplifier, controller, etc.) as well as the Functional Description of *Integrated Safety Function S1* must be observed.

5.1 Order and arrangement

The following basic guidelines apply to the arrangement and installation of the supply unit and servo amplifiers:

– The devices can be mounted directly next to each other and without any gaps between them. They are fastened with two/four screws to the mounting plate. Control and power voltages are fed to the servo amplifiers (JM-3000) via DC link and 24 V DC busbars from the supply unit (JM-3000). Thanks to the same cooling concept, this is possible without additional compensation measures with regard to device depth.

– The devices must be mounted in the specified order in series (see illustration). A different order is not permissible, as otherwise problems with the busbar and the mutual thermal influence will occur.

– To protect against access to the rail elements from the side, one of the side plastic parts included with delivery must be inserted in the front panel all the way to the left outside or right outside.

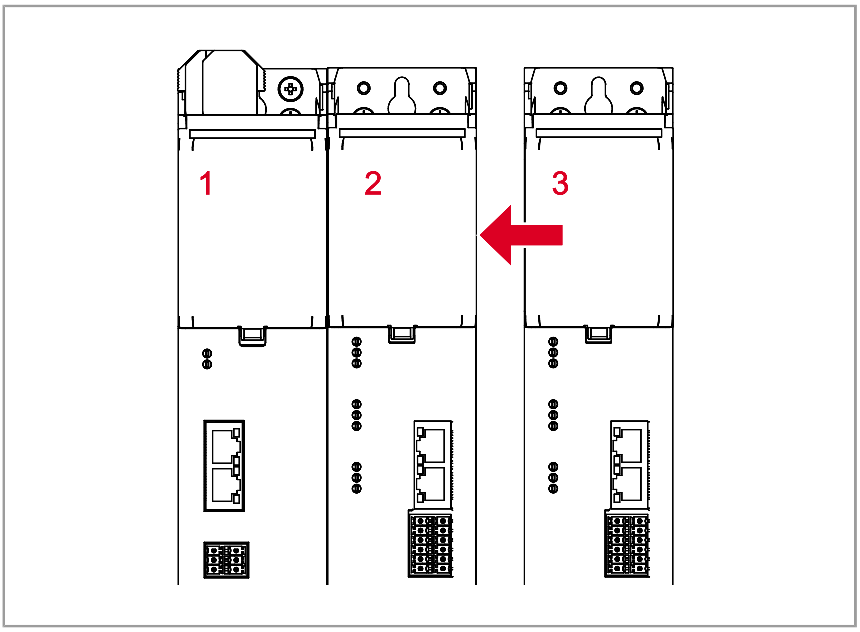


Fig. 8: Order of the devices

1	JM-3000 supply unit
2	JM-3000 servo amplifiers
3	additional JM-3000 servo amplifier

NOTICE! The supply unit must always be mounted to the left of the servo amplifiers. The most powerful servo amplifier should be close to the supply unit. With twin-axis and triple-axis servo amplifiers, the total power counts.

⚠ WARNING

Risk of burns due to hot surfaces

The device may become hot during operation and can cause burns if touched.

- ► Take protective measures to prevent inadvertent contact with the device, e.g. protective covers.
- ► Make sure that no temperature-sensitive parts, e.g. connection cables, are attached or fastened to the device.
- ► Ensure there is adequate heat dissipation and maintain the required distances during installation so as not to prevent or restrict ventilation.
- ► Allow the device to cool off for a while before carrying out cleaning or maintenance work.
- ► Wear personal protective equipment.
- ► Avoid all contact with the braking resistor.
- ► Do not place any flammable or heat-sensitive components in the vicinity of the braking resistor.

NOTICE

Damage to the device due to overload in the DC link

- ► In the overall axis system, a DC link capacitance of ≥ 100 µF/kW (for 3 x 400 V) or ≥ 170 µF/kW (for 3 x 230 V) relative to the highest occurring rated power must be maintained.
- ► Determine the DC link circuit capacitance by adding up the capacitances of the individual devices. The root mean square value of the active power of one load cycle is defined as the active power. See Power data [▸ 26]

5.2 Mounting distances and cooling

Mounting distances

Parameter	JM-3P22B
Mounting distance above	≥ 130 mm
Mounting distance below	≥ 200 mm
Mounting distance in front	≥ 300 mm
The determining factor for the mounting distance below is the mains connection cable of the supply unit:	
Bending radii of the connection cable	approx. 150 … 200 mm
	Depending on the cable design

Tab. 21: Mounting distances

Cooling

– Cooling air must be able to flow unhindered through the unit (interior and heat sink).
– When installing in control cabinets with natural convection (= heat loss is discharged to the outside via the control cabinet walls), always provide an internal fan.
– If the unit is switched off due to a temperature shutoff, the cooling conditions must be improved.

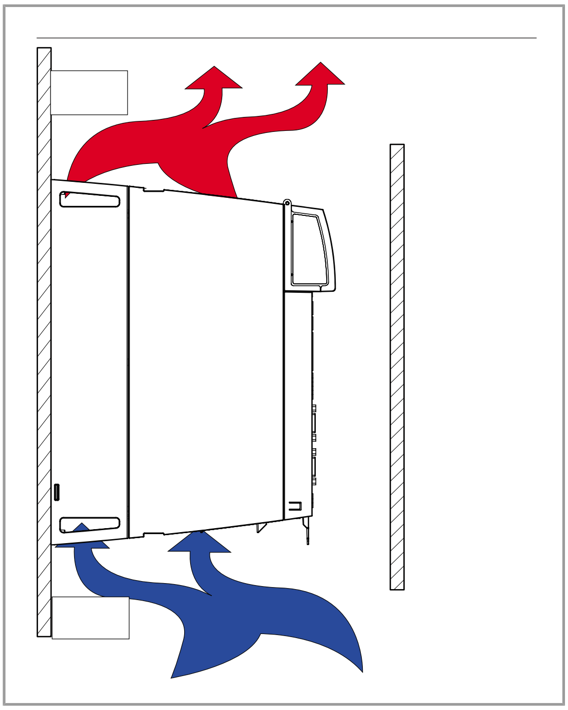


Fig. 9: Cooling by an unobstructed flow of air

5.3 Wall-mounted

For wall mounting of the JM-3P22B, follow the steps below:

✓ The contact surface must be bare metal and conductive.

1. Arrange the devices on the mounting plate as shown in the illustration.
2. Make sure that the distance above and below the Supply unit is in line with the data in the table [▶ 39].
3. Align all devices of the multi-axis system in one line along the upper edge of the device.
4. On the mounting plate, mark the 2 or 4 positions of the mounting holes. For the dimensions, refer to the illustrations in the Dimensions [▶ 21] section.
5. Drill the holes and tap the threads.
6. Mount the Supply unit in series with the servo amplifiers on the mounting plate.
7. Tighten the fastening screws down completely.

5.4 Cold plate mounting

Mounting on the cooler

For optimum heat transfer from the rear panel of the device to the corresponding cooler, a heat conducting film according to components BG1 or BG2 is already glued to the cooling plate of the device (see illustration). On the cooler side, the film is laminated with aluminum. The device can be mounted or dismounted with the film.

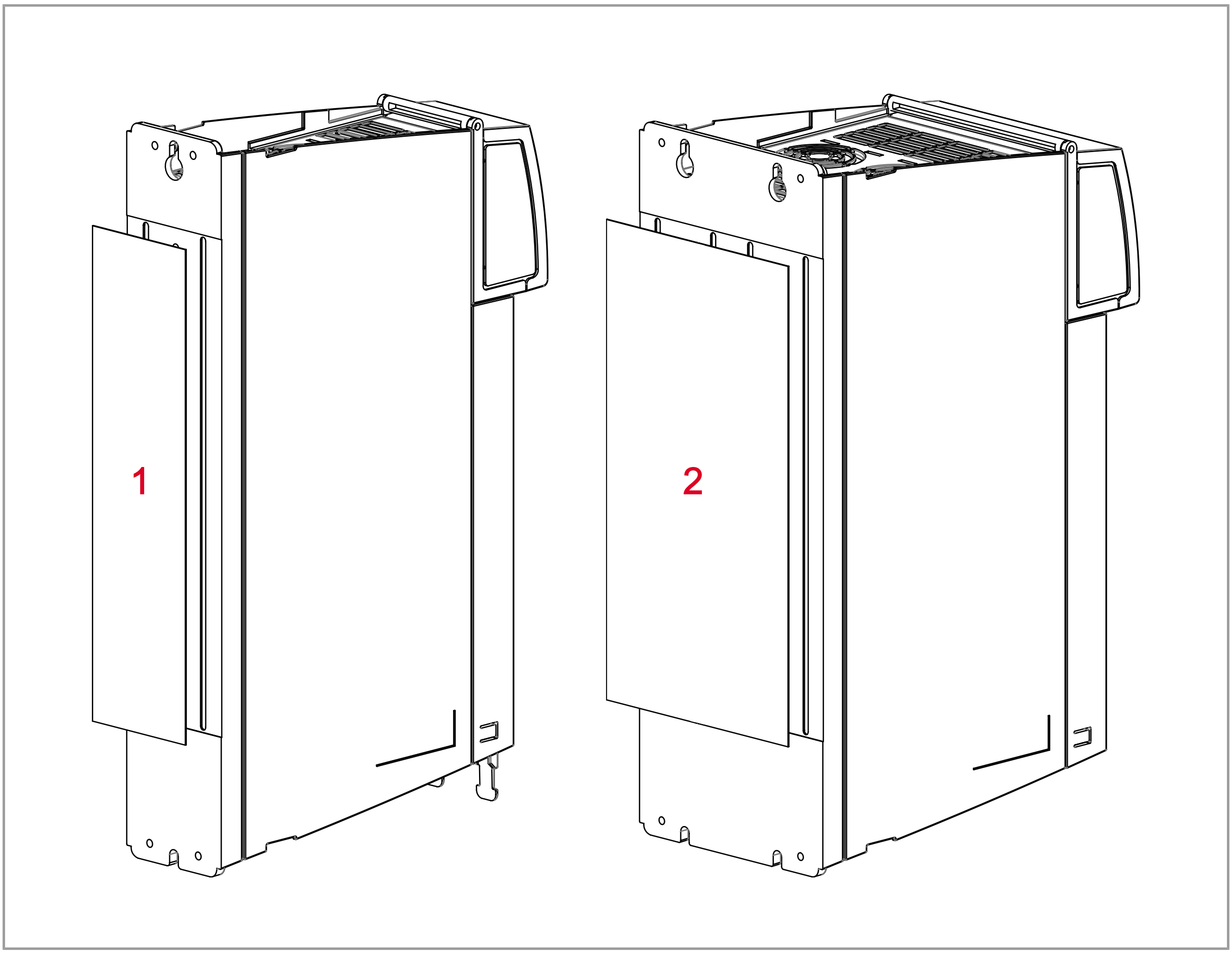


Fig. 10: Rear panel with heat conducting film

1	Rear panel with heat conducting film BG1
2	Rear panel with heat conducting film BG2

Cooler

Parameter	BG2 – JM-3P22B
Thermal resistance between active cooling surface of the device and cooler $R_{th}K$	0.01 K/W
Heat capacity of the cooling plate on the device	780 Ws/K
Max. temperature of cooling plate on the device	85 °C
Cooler surface	Maximum roughness depth R_Z = 6.3

Tab. 22: Dimensioning of the cooler

NOTICE

Device failure due to overheating

Dirt between the cooler and rear of the device will adversely affect thermal transfer and cause the device to overheat.

- Make sure that there is no dirt between the cooler and the rear of the unit during installation.

For cold plate mounting of the JM-3P22B, follow the steps below:

✓ The surface of the cooler is free of drilling chips or other contaminants.

1. Arrange the devices on the mounting plate as shown in the illustration.
2. Make sure that the distance above and below the Supply unit is in line with the data in the table [▶ 39].
3. Align all devices of the multi-axis system in one line along the upper edge of the device.
4. On the cooler provided, mark the 2 or 4 positions of the mounting holes. For the dimensions, refer to the illustrations in the Dimensions [▶ 21] section.
5. Drill the holes and tap the threads.
6. Mount the supply unit vertically and the servo amplifiers in series on the cooler.
7. Tighten the fastening screws evenly to keep the thermal resistance as low as possible.

5.5 Dismantling

Perform the following steps to dismantle the JM-3P22B:

1. De-energize the device.
2. Loosen the 2 or 4 fastening screws by unscrewing them halfway.
3. Lift the device slightly and remove it from the fastening screws.

5.6 Mounting the line filter

For more detailed information about selecting the appropriate line filter click here.

Please note

– Use this line filter only together with a matching servo amplifier.

– Mount the line filter on a grounded mounting plate, preferably chromated or galvanized. Make sure to provide the largest surface possible for contact of the housing with the plate. You can achieve good surface contact with the threaded surface.

– In addition, the line filter should be grounded with a wide ground strap (length max. 300 mm).

– Mount the line filter in the immediate vicinity of the servo amplifier.

Dimensions

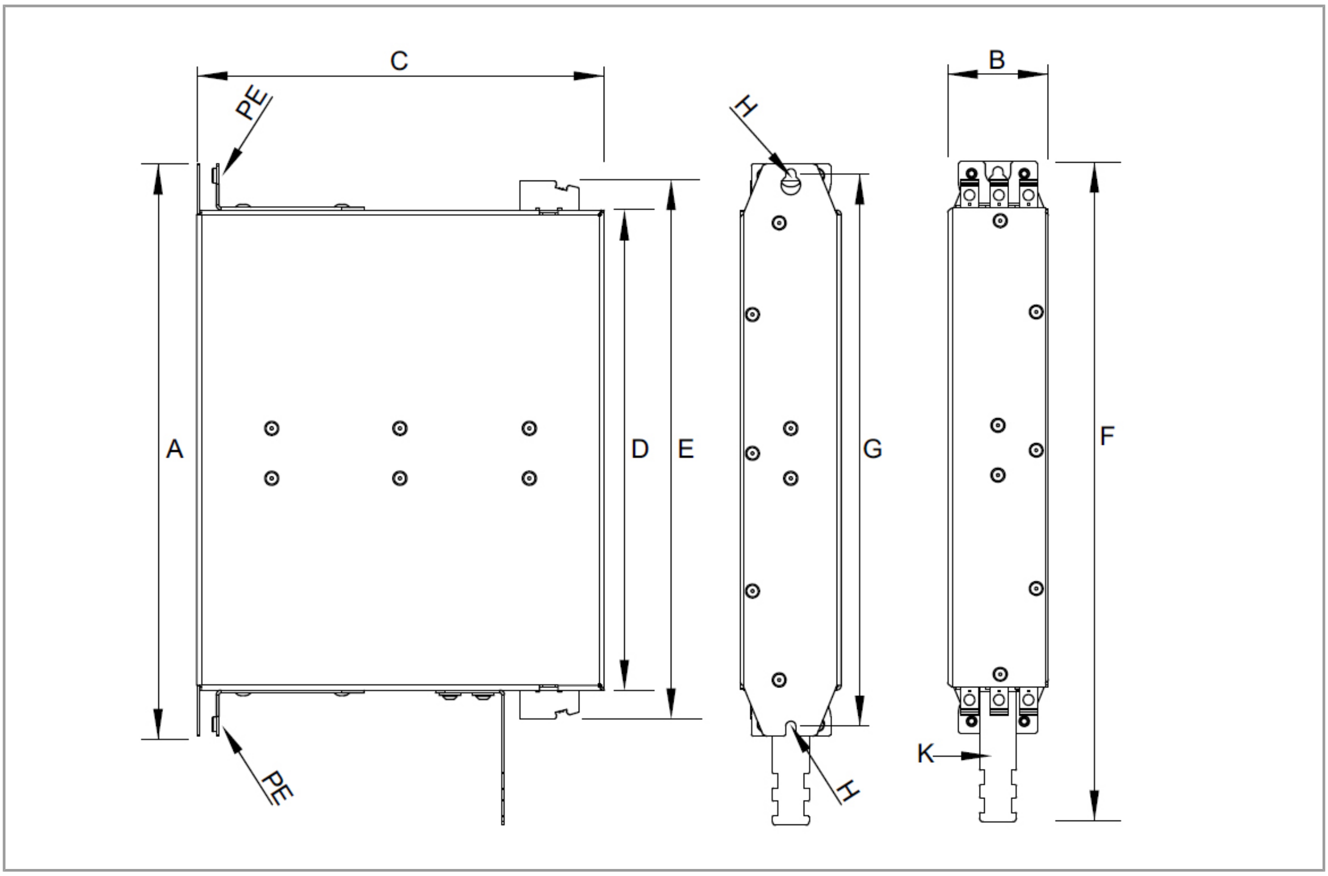


Fig. 11: Ext. dimensions Line filter

Dimensions		JEMC53.120-UR	JEMC53.240-UR	JEMC53.600-UR
A	Height		310 mm	
B	Width		55 mm	
C	Depth		220 mm	
D	Housing		260 mm	
E	Distance be-tween terminals		324.6 mm	
F	Total height		365.3 mm	
G			300 mm	
H	Mounting holes		Ø 5.3 mm	
PE			M4	
Weight		4.1 kg	4.8 kg	5.9 kg

Tab. 23: Dimensions – JM-3P22B external line filters

Shield connecting bracket

NOTICE

Mounting the shield connecting bracket

The shield connecting bracket (K) is designed to ensure contact with the cable shield.

- ► Mount the shield connecting bracket (K) on the line filter **before** you install the line filter.

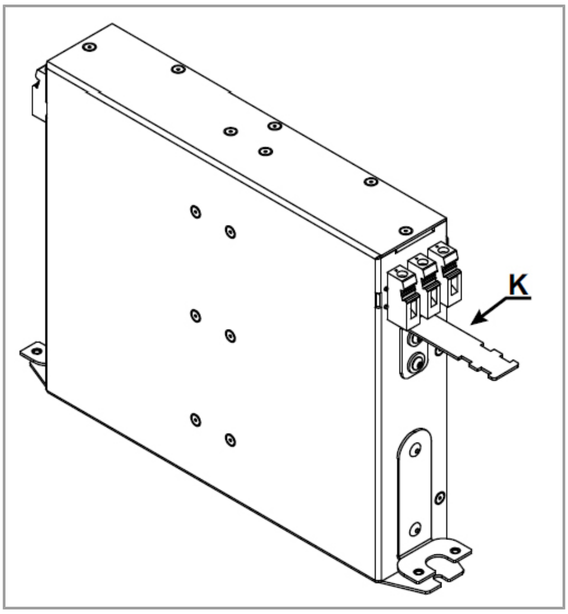


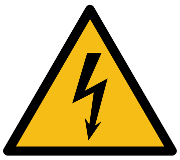
Fig. 12: Mounting the shield connecting bracket on the line filter

Mechanical installation

1. Choose a suitable place for mounting the line filter. Note the bending radii of the connection cables as you do this.
2. Mark the position of the threaded holes on the mounting plate. Cut a thread in the mounting plate for each fastening screw and screw the fastening screws 2 revolutions into the threaded holes.
3. Mount the shielded cable on the shielding bracket (K) with shield clamps and fasten it onto the bottom of the line filter with the enclosed screws.
4. Attach the line filter to the fastening screws and tighten the fastening screws tightly.

6 Electrical connection

⚠ DANGER



Risk due to high electrical voltage

Touching live parts may result in death or severe injury.

▶ Carry out the following steps before starting work to ensure safety.

☑ Prepare for turning off the system. Inform everyone involved who will be affected by the process.

☑ Isolate the drive system from the power supply and secure it against being turned on again.

☑ Wait for the discharge time (approx. 10 minutes) and check all power connections to ensure they are at zero potential.

☑ Ground according to requirements.

☑ Cover over neighboring live parts.

☑ Ensure the drives cannot move.

⚠ WARNING

Non-observance of safety instructions may result in injuries or physical damage

▶ Prior to assembling and installing the device, read and follow the safety precautions and restrictions of use as set out in the Safety chapter.

▶ Only authorized qualified personnel is allowed to perform any kind work on the device.

NOTICE

Applicable documents

When installing the supply unit within the multi-axis system, the operating instructions of the other devices (servo amplifier, controller, etc.) as well as the Functional Description of *Integrated Safety Function S1* must be observed.

6.1 Installation to EMC rules

The noise immunity of a system is determined by its weakest component. Key factors are correct connections, lines and proper shielding. Observe the measures set out in this chapter.

Info

Further Information

For further information on the noise immunity of a system, please refer to the Application Note 016 *EMC-Compatible Installation of the Electric Cabinet* available for download on our website.

The following basic rules apply to the installation of the Supply unit:

Compliance with the EMC product standard

– Commissioning (i.e., the start of operation as intended) is only permitted when EMC Directive (2014/30/EU) is complied with. The installer/operating company of the machine and/or plant must provide proof of compliance with the protective goals required by the standard.

– The essential EMC measures are already implemented in the design of the devices through optimized enclosure shielding, PCB layout, filter measures and selection of suitable connectors with shield plates. In addition to the internal measures, the following installation measures must also be observed:

Cable type

– Use shielded mains, motor and signal cables with double copper braiding providing at least 60 to 70 % overlapping.

Laying cables

– If possible, route signal lines into the control cabinet from only one side.

– Twist the lines of the same circuit.

– Keep cable lengths and loops as minimal as possible.

NOTICE

Inadequate accessories might cause damage to the product

Parts and equipment from other manufacturers might impede the function of the device and cause damage to the product.

▶ Use only connecting cables of other manufacturers that are at least equivalent.

⇨ However, Bucher Automation AG cannot guarantee stable and safe operation with such cables.

Grounding measures

– Mount the devices on a conductive, grounded mounting plate. The mounting plate must be connected with the central grounding rail of the control cabinet.

External components

– Place larger consumers near the electric supply.

– Connect contactors, relays, solenoid valves (switched inductances) with quenching circuits.

  – The wiring must be directly on the respective coil.

– Switched inductances should be at least 0.2 m distant from process-controlled components.

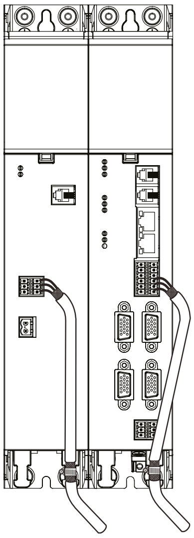


Fig. 13: Example of shield connection of control line connections

Shielding measures

– Strip the cable shields to the required length, but not too soon, and use the shield lugs on the respective connectors for contacting the components.

– Place the other side of the cable shield with the greatest possible surface area on the PE rail (main ground) or the mounting plate.

If you would like more detailed information about installation, please contact our Technical support [▸ 68].

Use with line filter

External line filters are available for the supply units of the JM-3000 series for components BG1 and BG2. When applying the measuring method specified by the standard and using an external line filter, comply with the EMC requirements of the EN 61800-3 product standard for "First environment" (C2 residential) and "Second environment" (C3 industrial).

For more information refer to section Selection guide for line filters.

6.2 Connection example with integrated switching power supply unit

NOTICE

Preconditions

- ▶ A maximum of 8 axis controllers (corresponds to a maximum of 24 axes) can be connected and operated on one supply unit.
- ▶ In the overall axis system, a DC link capacitance of ≥ 100 µF/kW (for 3 x 400 V) or ≥ 170 µF/kW (for 3 x 230 V) relative to the highest occurring rated power must be maintained. See Power data [▸ 26].
- ▶ The supply unit does not protect the upstream components (3, 5, 6) against thermal and electrical hazards. Take appropriate protective measures.

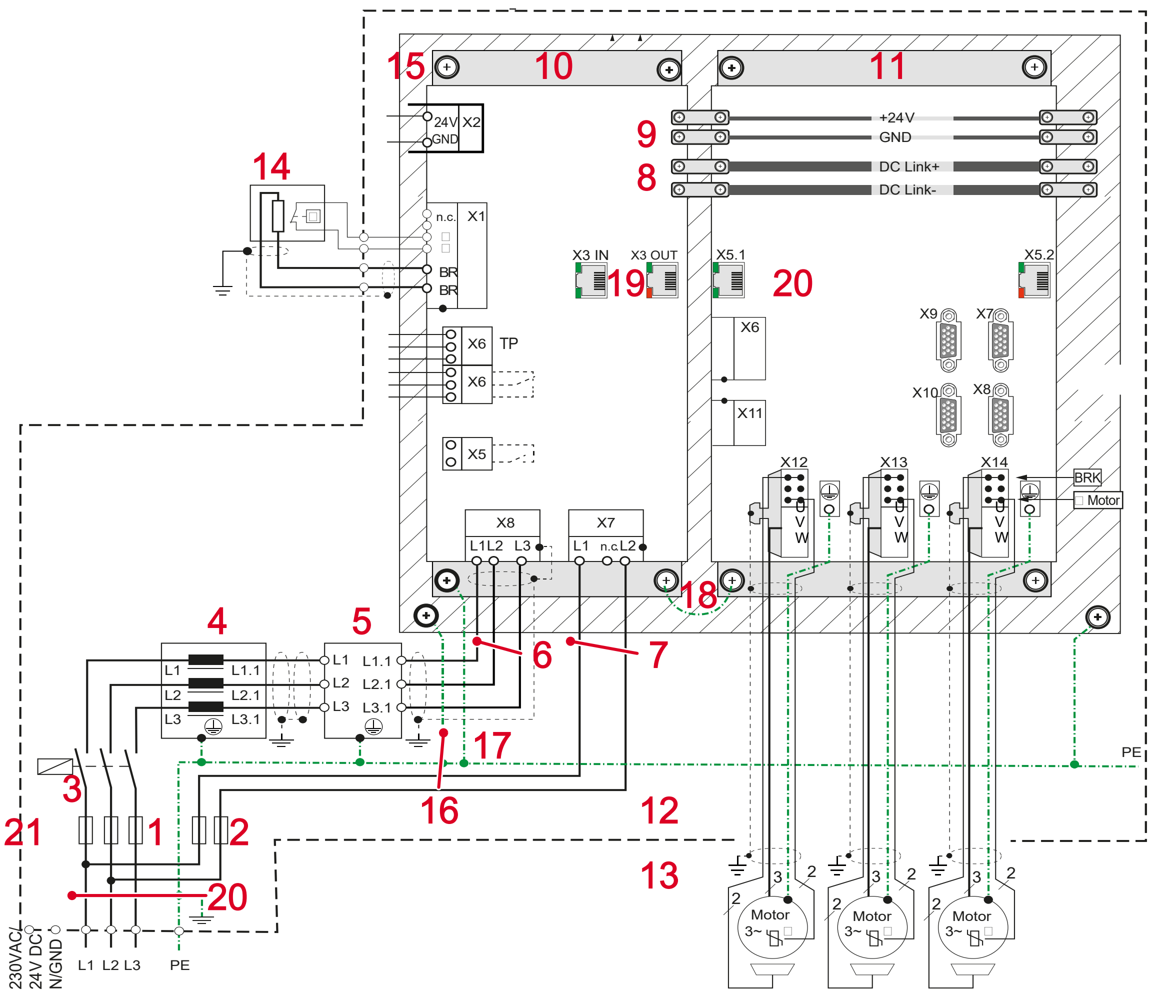


Fig. 14: Connection example of variant with integrated switching power supply unit

1	Mains fuses for DC link supply
2	Mains fuse for switching power supply unit
3	Mains contactor
4	Line reactor (option)
5	Line filter (option)
6	AC mains connection (power supply)
7	AC mains connection (24-V switching power supply unit)
8	DC link busbar
9	24 V DC busbar (PELV)
10	Supply unit
11	Servo amplifier
12	Control cabinet
13	Box
14	External braking resistor with temperature monitoring
15	Mounting plate
16	Mounting plate grounding
17	PE protective conductor connector

18	Series protective conductor connector to the next device
19	EtherCat®
20	Control cabinet feed-in point
21	Terminal for motor holding brake

6.3 Connection example with external switching power supply unit

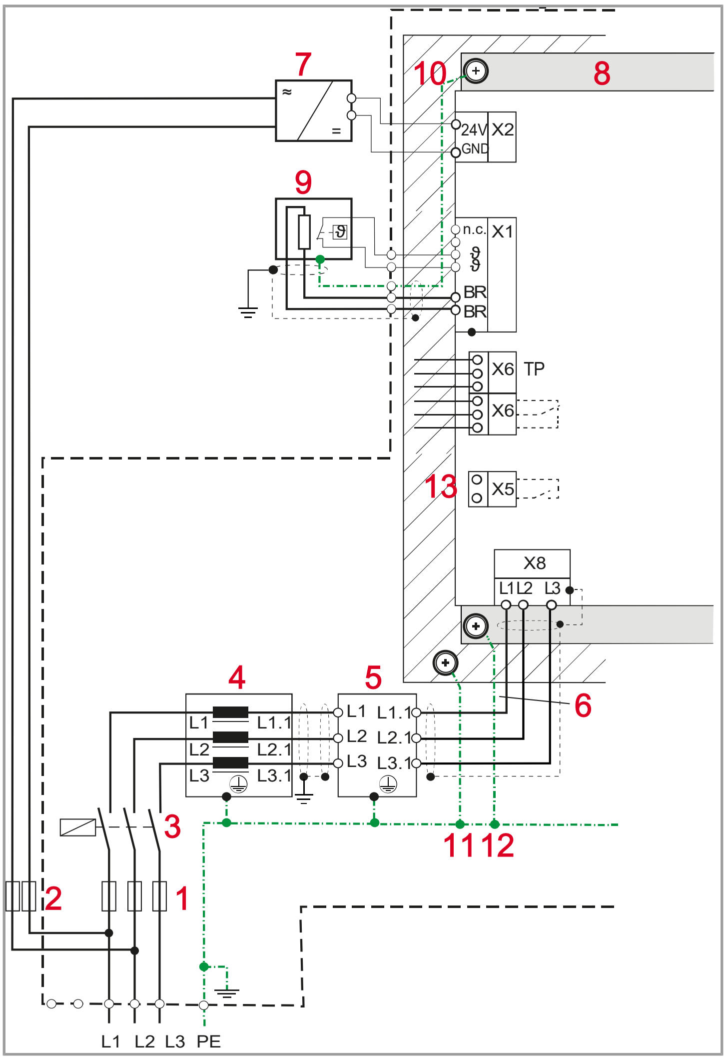


Fig. 15: Connection example with external switching power supply unit

1	Mains fuse for DC link supply
2	Mains fuse for external switching power supply unit
3	Mains contactor (optional)
4	Line reactor (accessory)
5	Line filter (accessory)
6	Mains connection for power supply
7	External switching power supply unit 24 V DC
8	JM-3000B supply unit
9	External braking resistor
10	Mounting plate
11	Mounting plate grounding
12	Device grounding

13	n. c. = not connected (= no function)

6.4 Overview of connections

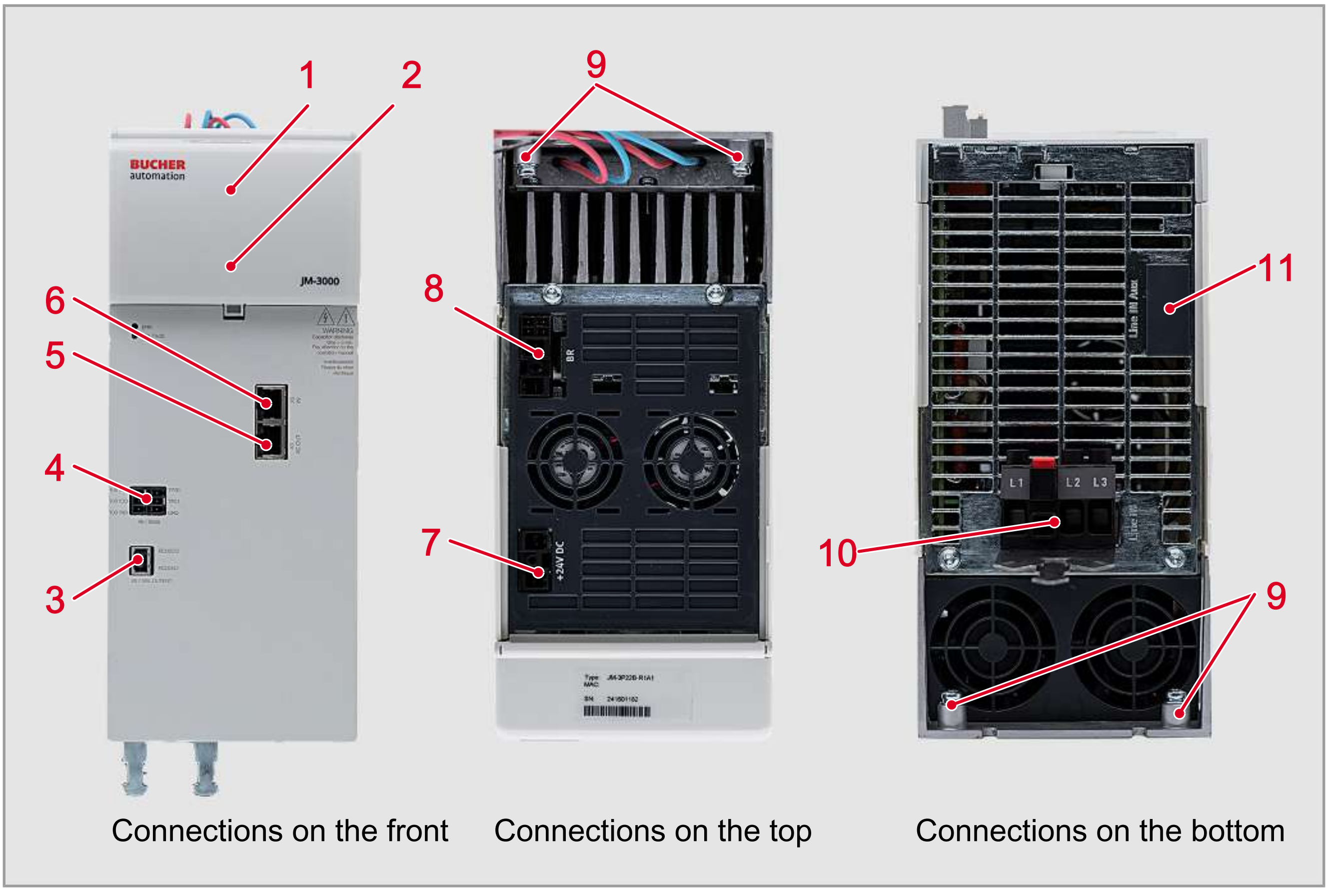


Fig. 16: Connections

1	24 V control supply output via busbar
2	DC link supply output via busbar
3	X5: Relay contact (RO02)
4	X6: Relay contact (RO01), Digital outputs (TPO1, TPO2)
5	X3 XC OUT: EtherCAT OUT, fieldbus output
6	X3 IN: EtherCAT IN, fieldbus input
7	X2: 24 V control supply output via terminals; also 24 V input if no built-in PSU
8	X1: Braking resistor connection
9	Bonding screw
10	X8: Power supply input for DC link voltage
11	X7: AC power supply unit for built-in PSU on JM-3PxxB-P1xxxx model variant

6.5 Connections X3 - rt-Ethernet coupler and cross communication

For a shielded connection up to a length of ≤ 20 m, the following tested cable or one of equivalent quality must be used:

Patch cable Cat 5e, S/STP 4 x 2 x 0.14 mm2, twisted pair and shielded data cable with characteristic impedance Rw = 100 Ω ± 15 %

See Accessories EtherCAT® cables [▸ 69]

NOTICE! For cable lengths ≥ 20 m, special installation cables with larger cross-sections must be used.

6.5.1 Connection X3 IN

Connect the following to socket X3 IN:

– JetControl controller with EtherCAT® master

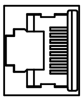


Fig. 17: X3 IN, ECAT IN

6.5.2 Connection X3 XC OUT

Connect the following to socket X3 XC OUT:

– the EtherCAT® input of the axis module connected in series

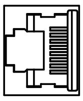


Fig. 18: X3 XC OUT, ECAT OUT

6.6 Connection X1- braking resistor

In generator operation, e.g., when braking the drive, the motor energy is supplied back to the servo amplifier. This increases the voltage in the DC link. If the voltage exceeds a threshold value, the internal braking transistor in the supply unit is switched on and the regenerative energy is converted into heat by means of a braking resistor.

The JM-3000 Supply unit always requires a braking resistor. You can choose between an external braking resistor or the variant "Supply unit with integrated braking resistor," see Bestellschlüssel [▸ 18].

ⓘ Info

If the internal braking resistor is not sufficient, braking resistors for external mounting can be ordered under Accessories [▸ 70].

The **internal** braking resistor must then be disconnected and isolated from connection X1. Then connect the **external** braking resistor to X1.

The temperature monitoring of the external braking resistor must be integrated.

⚠ DANGER

Danger due to high electrical voltage

Touching live parts may result in death or severe injury.

The braking resistor connection is permanently connected to DC link potential (> 300 V DC).

- Never wire or undo any electrical connections while voltage is present!
- Always disconnect the device from the mains before carrying out any work.
- Wait for the discharge time (approx. 10 minutes) and check all power connections to ensure they are at zero potential.

⚠ WARNING

Risk of burns due to hot surfaces

The device may become hot during operation and can cause burns if touched.

- Take protective measures to prevent inadvertent contact with the device, e.g. protective covers.
- Make sure that no temperature-sensitive parts, e.g. connection cables, are attached or fastened to the device.
- Ensure there is adequate heat dissipation and maintain the required distances during installation so as not to prevent or restrict ventilation.
- Allow the device to cool off for a while before carrying out cleaning or maintenance work.
- Wear personal protective equipment.
- Avoid all contact with the braking resistor.
- Do not place any flammable or heat-sensitive components in the vicinity of the braking resistor.

NOTICE

Damage to the device due to additional external braking resistor

- Do not connect any additional, external braking resistor to the devices with integrated braking resistor.

NOTICE

A lack of temperature monitoring can lead to overheating and thus to damage of the external braking resistor.

- The external braking resistor must have a temperature monitor (Klixon) for temperature monitoring, which must be connected to X1-ϑ.
- The external braking resistor must be monitored by the controller. The temperature monitor (Klixon) in the braking resistor must at least have basic insulation in accordance with EN61800-5-1 to the resistor body with mains potential.
- In case of overtemperature, the supply unit must be disconnected from the mains.

For position see Overview of connections [▶ 50]

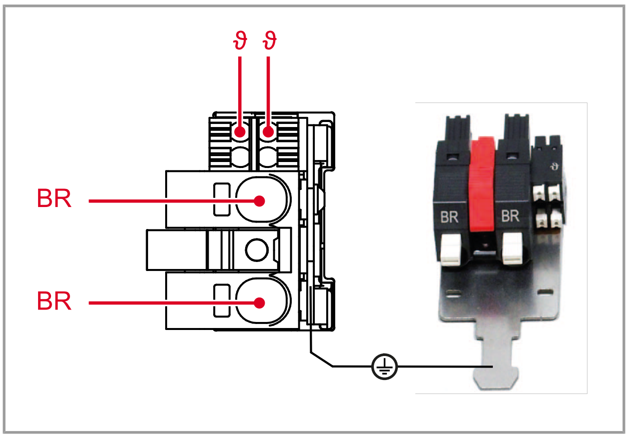


Fig. 19: Braking resistor connection with temperature monitoring

Designation	Terminal	Specification
X1	BR	– Braking resistor connection – Cable cross section: 6 mm² maximum – For technical data refer to Power data [▶ 26] – The connection must be shielded
	ϑ	Temperature monitoring connection (Klixon) of the braking resistor **NOTICE! If no temperature monitoring is connected, the X1-ϑ connections must be bridged!**
	⏚	Cable shield connection (for shield lug)
	PE	► Connect the PE connection of the braking resistor to the "Top" PE bolt on the device.

Tab. 24: Specification X1

6.6.1 Block diagram – external braking resistor

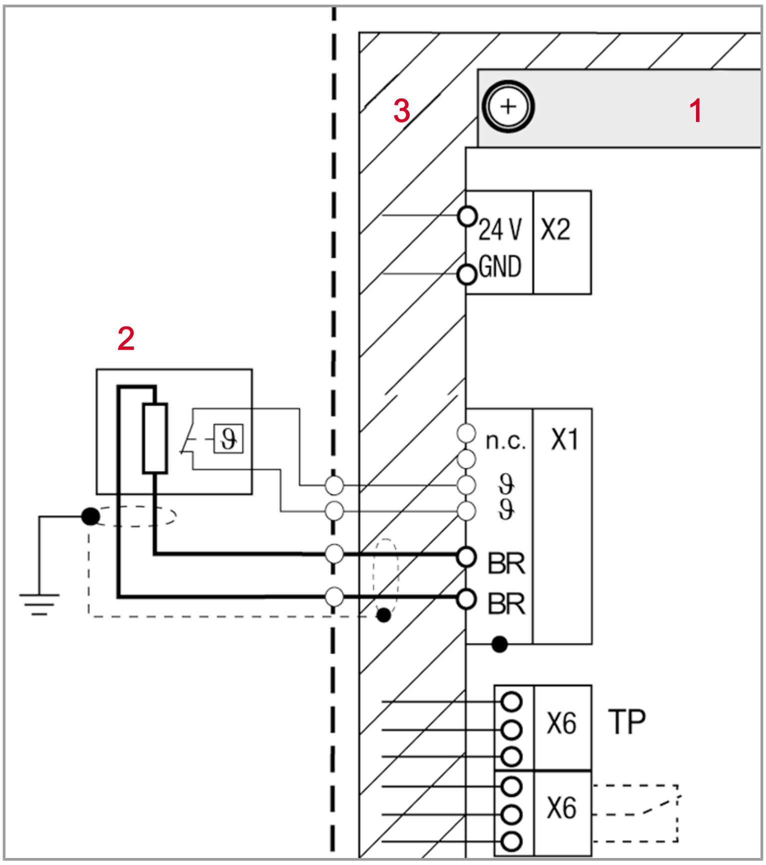


Fig. 20: Braking resistor connection with thermal contact (X1)

1	Supply unit
2	Optional external JBR braking resistor with thermal contact (Klixon) on connecting terminal X1
3	Mounting plate (grounded)

6.7 Connection X2

For position see Overview of connections [▶ 50]

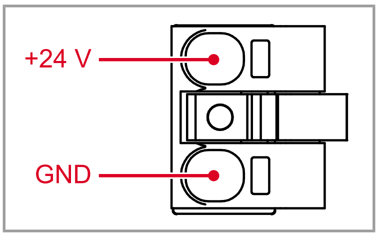


Fig. 21: Connection X2

Designation	Terminal	Variant without integrated switching power supply unit	Variant with integrated switching power supply unit	Specification
X2	+24 V	24 V DC voltage connection of a control cabinet power supply unit	24 V DC connection of the internal power supply unit with max. 470 W	The sum of the power requirement via the busbar and the DC output X2 must not exceed 470 W
		The 24 V DC busbar provides electrical voltage for the axis amplifier and 24 V DC voltage for the control of the motor holding brake		Cable cross section: 6 mm^2 maximum
	GND			

Tab. 25: Specification X2

NOTICE! The same switching power supply unit is installed in both supply units BG1 and BG2. The technical data are therefore identical.

6.8 Connection X5

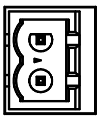

RO02CO
RO02NO

Fig. 22: X5 relay contact connection

Not used!

6.9 Connection X6

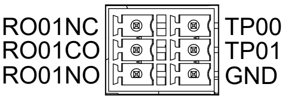
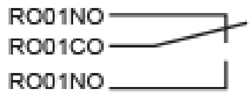


Fig. 23: Connection X6

Designation	Terminal	Specification	Description
X6	RO01NC = NC contact RO01CO = CO contact RO01NO = NO contact		– Signal relay contact for PELV circuit: ≤ 25 V AC or ≤ 30 V DC, 0.5 A max each (ohmic load only) – Active in case of fault
	TP00 = test pulse signal 00 TP01 = test pulse signal 01 GND = Ground reference	Signal driver outputs for internal use for testing for short-circuits and shorts between contacts of the wiring to the safe inputs of the servo amplifiers	

Tab. 26: X6 specification

6.10 Protective conductor terminal

⚠ DANGER

Electric shock

An incorrect connection can lead to high electrical voltage.

▶ Connect the power grid and grounding according to applicable safety requirements.

⚠ CAUTION

Safety hazard due to loose protective conductor terminal

The protective conductor terminal is a safety feature. Insufficient tightening torques or vibrations can lead to loose power connections, resulting in injuries.

▶ Make sure there is good and solid contact for all connections so they cannot come loose by themselves.

▶ Check all power connections at regular intervals.

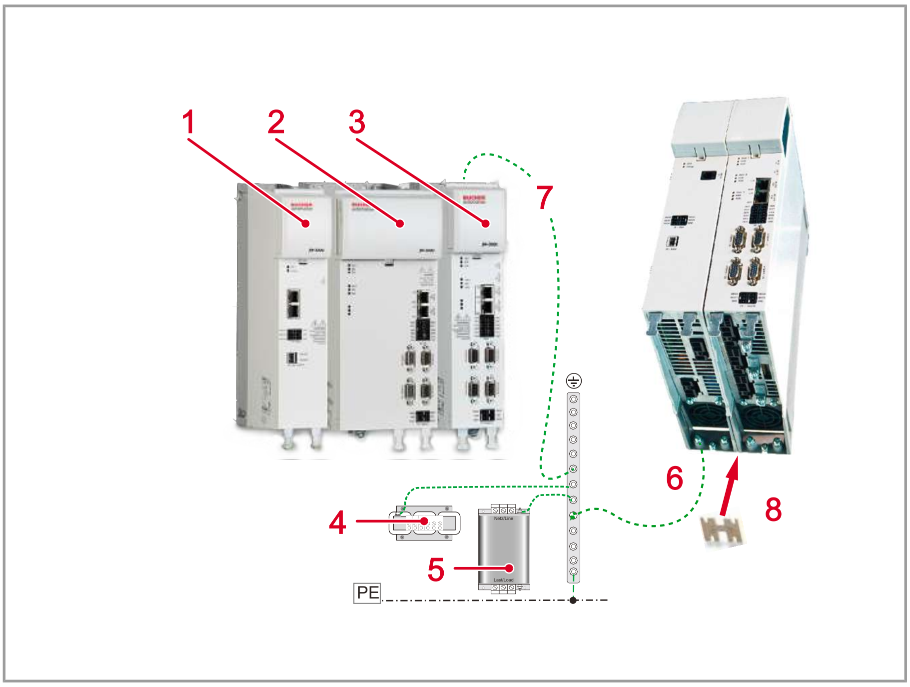


Fig. 24: Protective conductor connector of the JM-3000 system

1	Supply unit
2	Servo amplifier
3	Servo amplifier
4	Line reactor
5	Line filter
6	Grounding in series from below
7	Alternative ground connection from above
8	Connect the devices with the PE metal bridges included with delivery. The connection can be made from below or above.

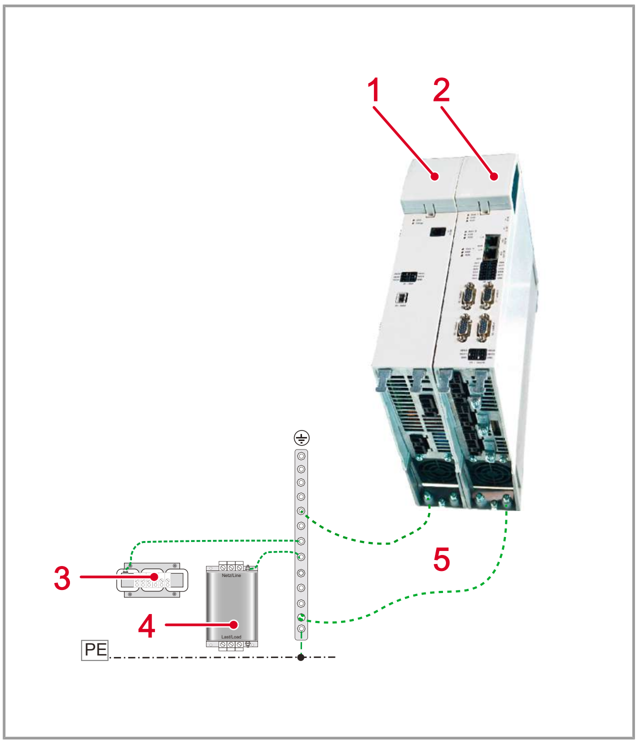


Fig. 25: Connection of the JM system with double PE cables

1	Supply unit
2	Servo amplifier (optional)
3	Line reactor
4	Line filter
5	Double grounding connection

PE mains connection to DIN EN 61800-5-1

Since the leakage current is > 3.5 mA, the following minimum requirements apply to the cross-section of the protective conductor, depending on the cross-section of the outer conductor.

Cross-sectional area of the outer conductors	Minimum cross-sectional area of the protective conductor
Q ≤ 16 mm²	Q but at least 10 mm² (Cu)
16 < Q ≤ 35	16 mm²
Q > 35 mm²	Q/2
Q < 10 mm²	Implement Q x 2 PE twice or one copper line at least 10 mm² (Cu)

Tab. 27: Cross-section of the protective conductor

Connections

1. Connect the PE connections of the supply unit and the servo amplifiers in series.
2. Connect one of the devices to the PE rail (main ground) in the control cabinet.
3. Connect the protective conductor connector of all other components, such as line filter and line reactor, etc. to the PE rail (main ground) in a star configuration in the control cabinet.
4. Always observe the respective local and national regulations and conditions.
   The minimum cross-section of the protective grounding conductor must meet the local safety regulations for protective grounding conductors in equipment with a high leakage current.

6.11 AC mains connection (power supply)

The mains connection cable must always be shielded. The shield connection on the device side is made via the shield lug on connector X8 (Line IN).

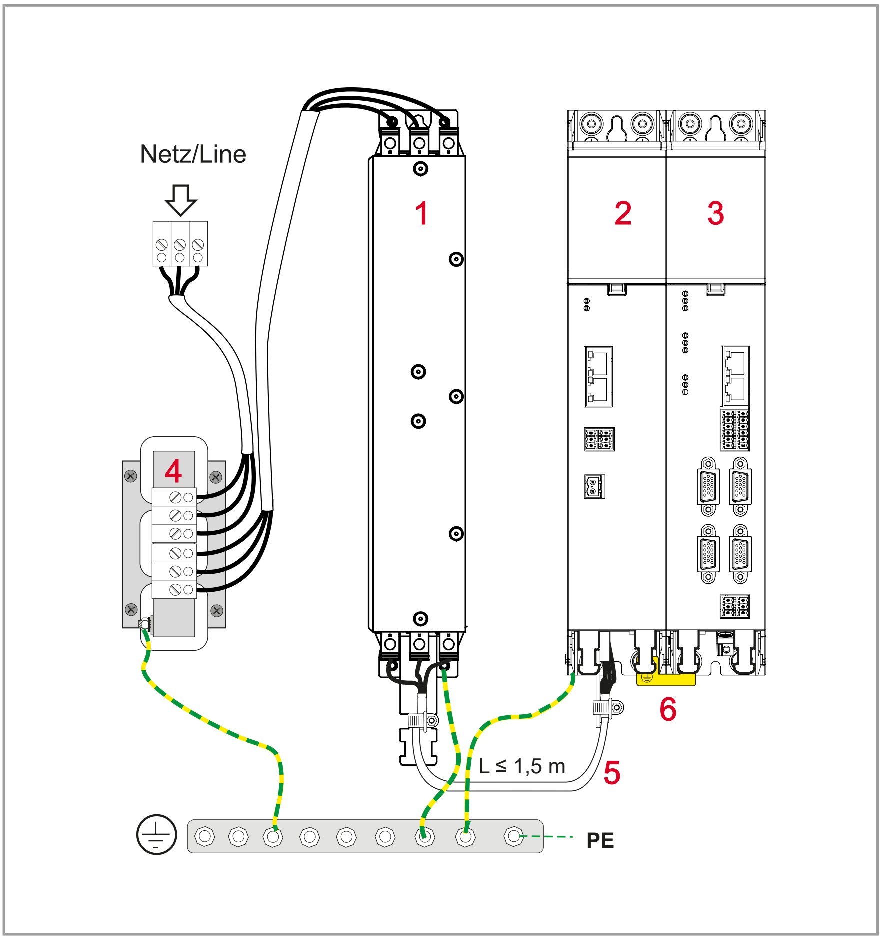


Fig. 26: Connection example of mains supply

1	Line filter
2	Supply unit
3	Servo amplifier
4	Line reactor (option)
5	Line with shield
6	Series protective conductor connector

For interference suppression of the JM-3000 system, provide an optimized filter from Bucher Automation for connection X8 (Line IN) of the supply unit.

The supply current on the one hand and the sum of the motor cable lengths on the other are decisive for dimensioning. For more details refer to section "Line filter".

1. Use a shielded line for the connection of the line filter with the supply unit.
2. Connect the shields at both ends of the cables, see figure (length L ≤ 1.5 m).

– The mains connection cable must always be shielded. The shield connection on the device side is made via the shield lug on connector X8 (Line IN).

– Typically, a suitable line filter for the entire control cabinet is used for suppressing conducted high-frequency interference.

– On the device side, this is done at the shield lug of connector X8 (Line IN).

ⓘ Info

Good shielding on the line filter side is achieved by mounting the line filter on a metallic, conductive and well-grounded base plate and connecting the cable shield to the mounting plate as close as possible to the "Load" connection of the line filter.

6.11.1 Connection X8 - AC mains connection

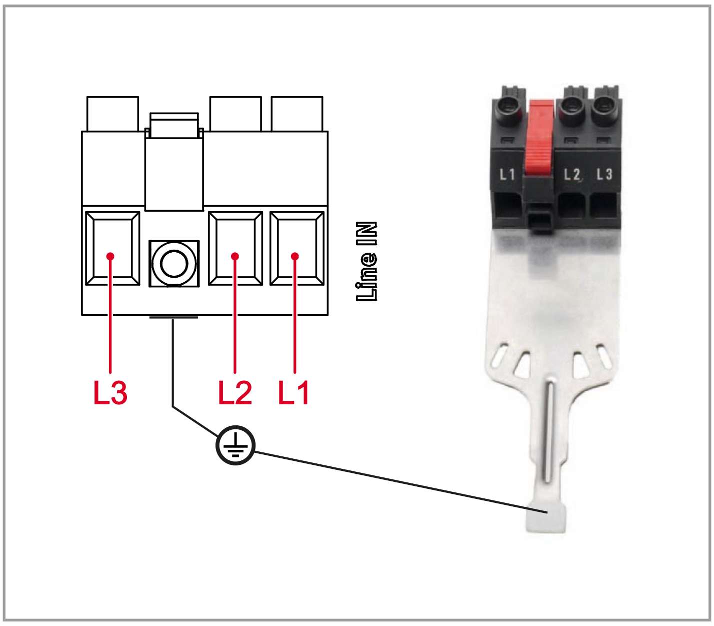


Fig. 27: Connection X8

Designation	Terminal	Specification
X8 LINE IN	L3	– 3 x 400 ... 480 V AC – Approx. 3 x 50 A current consumption – Cable cross section: 16 mm² maximum
	L2	
	L1	
	⏚	Cable shield connection for shield lug

Tab. 28: X8 specifications

NOTICE

The operational regulations on the premises as well as the national and regional regulations for line protection must be observed!

The time span between two switching on processes of the mains voltage must be at least 2 minutes.

Residual current device

If local regulations require an RCD (residual current device) to be provided, the following applies:

NOTICE! In the event of a fault, the servo amplifiers in the axis system can generate DC residual currents without a zero crossing. Therefore, operate the multi-axis system only with a type B residual current device (RCDs) for AC residual currents, pulsating and smooth DC residual currents suitable for drive controller operation (see IEC 60755)!

In addition, residual current monitoring devices (RCMs) suitable for drive controllers can also be used for monitoring tasks.

Fuses X8

- To ensure device safety to EN 61800-5-1, use mains fuses with duty class gG that disconnect the device from the mains in the event of a fault.

Terminal	Designation	Fuse
X8/L1, L2, L3	JM-3P22 (BG2)	3 x 63 A (gG)

Tab. 29: Mains fusing

6.11.2 Connection X7 - AC mains connection 24-V switching power supply unit

The mains connection at X7 supplies the integrated 24-V switching power supply unit.

These 24 V DC are used as control supply voltage for the entire axis system via busbar.

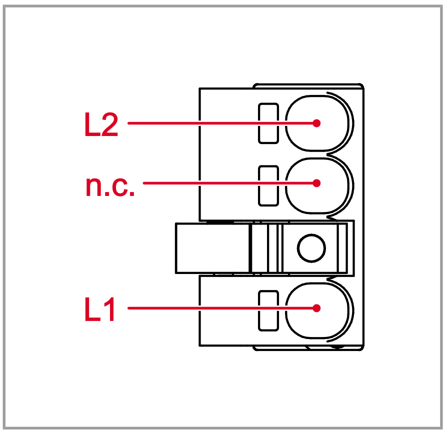


Fig. 28: Connection X7

Designation	Terminal	Specification
X7 LINE IN AUX	L2	2 x 400 ... 480 V AC Approx. 2.5 A current consumption Cable cross section: 6 mm^2 maximum
	n.c.	
	L1	

Tab. 30: Specification X7

NOTICE! The same switching power supply unit is installed in both supply units BG1 and BG2. The technical data are therefore identical.

NOTICE! The supply unit with order number JM-3PxxB comes without a switching power supply unit. In this case the system must be supplied with 24 V DC via connector X2.

Fuses X7

- To ensure device safety to EN 61800-5-1, use mains fuses with duty class gG that disconnect the device from the mains in the event of a fault.

Terminal	Designation	Fuse
X7/L1, L2	JM-3P22 (BG2)	2 x 6 A (gG)

Tab. 31: Mains fusing

6.12 Operation in special networks

Before you use power grid types that differ from TN and TT power grids, please contact Bucher Automation AG.

Technical support [▶ 68] will inform you about boundary conditions that must be observed (such as complying with the EMC Directive, effects on CE and safety functions, etc.).

NOTICE

Damage to the device due to operating error

Mishandling could result in considerable material damage.

▶ Observe all conditions specified for the operation of the devices on deviating power grid types.

6.12.1 TN and TT network

Operation of the supply unit in TN and TT networks is only permitted

– with outer conductor voltages 3 x 230 V, 3 x 400 V and 3 x 480 V or 3 x 400 V AC, 3 x 480 V AC
  – if the neutral point of the supply network is grounded, and
  – the supply network meets the requirements of the maximum overvoltage category III according to EN 61800-5-1 with a system voltage (outer conductor → neutral point) of maximum 277 V.

Operation is not permitted

– for supply with 1 x 230 V or higher one-phase mains voltages

6.12.2 IT network

Operation is possible

– for three-phase supply with 3 x 230 V

NOTICE! Compliance with the EMC Directive 2014/30/EU must be ensured by the user himself!

NOTICE! In this operating mode, the Declaration of Conformity, CE acceptance and all safety-related approval are void.

Operation is not permitted

– for three-phase supply with 3 x 400 V or 3 x 480 V

NOTICE

Possible destruction of the device due to operation with a supply voltage of 400/480 V

In the event of a ground fault, the voltage is as twice as high. Clearances and creepage distances according to EN 61800-5-1 are no longer maintained.

▶ Operation with a supply voltage of 400/480 V is not permitted!

6.13 Connecting the supply voltages

NOTICE

Inadequate accessories might cause damage to the product

Parts and equipment from other manufacturers might impede the function of the device and cause damage to the product.

- Only use accessories recommended by Bucher Automation AG.

The JM-3P22B has separate voltage supplies for the control unit and for the DC link.

– The control unit receives its 24 V supply voltage via the upper busbar (+24 V DC and GND) from the switching power supply integrated into the supply unit or from the 24 V DC power supply unit in the control cabinet.

– The DC link supply comes from an unregulated DC link and is fed to the servo amplifiers via the lower busbar (DC Link + and DC Link -).

Controller supply voltage (+24 V DC)

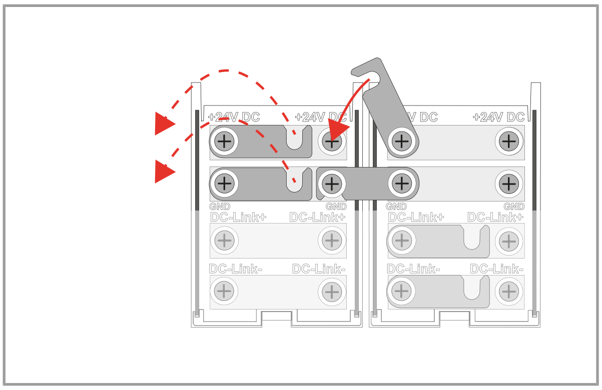


Fig. 29: Supply voltage busbar

Parameter	Value
U_V	+24 V DC ± 20 %, stabilized and smoothed
Output power of the internal switching power supply integrated into the supply unit	Max. 470 W continuous current
Reverse polarity protection	internal
Power supply unit	Safe electrical isolation from the mains in accordance with EN 61131-2 is a precondition
Tightening torque of the busbar screws	2.1 Nm

Tab. 32: Specification of supply voltage busbar

DC link supply

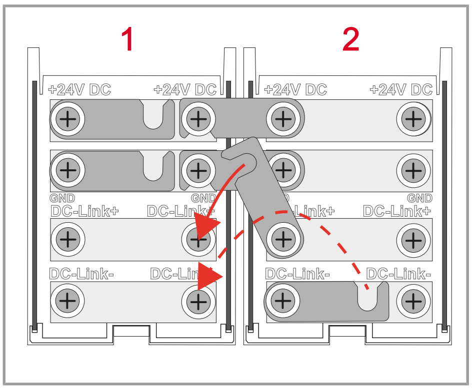


Fig. 30: Busbar connection for DC link supply

1	JM-3000 supply unit
2	JM-3000 servo amplifiers

Parameter		Value
DC link voltage depending on the supply voltage of the supply unit	AC 400 V	DC 565 V
	AC 480 V	DC 678 V
Tightening torque of the busbar screws		2.1 Nm

Tab. 33: Specification of busbar connection for DC link supply

Connections

✓ The supply unit is isolated from the mains.

1. First make sure that all JM-3000 servo amplifiers are arranged in a row with the JM-3000 supply unit.
2. Always connect the 24 V controller supply voltage for the servo amplifiers first. If you are using several servo amplifiers, all 24 V DC and all GND connections must be connected.
3. To do this, use the pre-assembled rail elements as shown in the figure above. To be able to rotate the rail elements, the screws must be slightly open.
4. Only connect the DC link supply when you want to put the servo amplifiers into operation. If you are using several servo amplifiers, all DC Link+ and DC Link- connections must be connected.
5. Use the pre-assembled rail elements for this as well. To be able to rotate the rail elements, the screws must be slightly open.
6. Once all rail elements are in place, the screws must be tightened again!

To protect against access to the rail elements from the side, plastic side parts are included with delivery of the upper folding front panels.

1. Insert one of them in the front panel all the way to the left outside or right outside.
2. Then close the front panels.

⇨ The rail elements are touch-proof.

⚠ DANGER

Danger due to high operating voltage

The high operating voltage will lead to serious injuries or death in case of contact with bare live parts.

- ► Operate the multi-axis system only with the cover of the rails closed and with the side covers inserted as protection against contact.

NOTICE

Susceptibility to malfunction due to differing firmware

All devices in an axis system must have the same firmware.

- ► When replacing a device, adjust the firmware through JetControl.

6.14 Control connections

1. Establish a connection between the X3 IN [▸ 51] EtherCAT® interface of the supply unit for the JetControl motion controller with an 8-wire CAT 5e EtherCAT® cable.
2. Establish a connection with the first servo amplifier via the X3 XC OUT [▸ 51] and X5.1 EtherCAT® interfaces .
3. Wire the programmable relay contact X6 [▸ 56] as well as the test pulse outputs TP01 and TP02 as required.
4. Check all connections again!

7 Maintenance

This device is maintenance free. Therefore, for the operation of the device, no inspection or maintenance is required.

7.1 Repairs

Defective components could cause dangerous malfunctions and could compromise safety.
Only the manufacturer is allowed to repair the device.
It is forbidden to open the device.

Modifications to the device

Modifications and alterations to the device and its functions are not allowed. In the case of modifications to the device, any liability is excluded.

The original parts are specifically designed for the device. Parts and equipment from other manufacturers must, therefore, not be used.

Any liability for any damages resulting from the use of non-original parts and equipment is excluded.

7.2 Storage and Shipment

Storage

When storing the device observe the environmental conditions given in chapter “Technical specifications”.

Shipment and packaging

The device contains electrostatically sensitive components which can be damaged if not handled properly. Damages to the device may impair its reliability.

To protect the device from impact or shock, it must be shipped in its original packaging, or in an appropriate protective ESD packaging.
In case of damaged packaging inspect the device for any visible damage, and inform your freight forwarder and the Bucher Automation AG of the damage caused during shipment. If the device is damaged or has been dropped, it is strictly forbidden to use it.

7.3 Return and Disposal

Disposal options

Return your Bucher Automation AG product to us for proper disposal. Visit our website for detailed information and to download the required Returns form.

Meaning of WEEE icon

Fig. 31: WEEE icon – crossed out trash can

The product is waste electronic equipment and must be disposed of by a certified waste management facility. Do not dispose of the product with normal household waste. Applicable local environmental directives and regulations must be complied with.

Batteries

Prior to disposing of waste electronics, remove any batteries where this is possible in a safe and non-destructive way. Dispose of batteries properly.

Personal data

It is the responsibility of the customers to delete any personal data stored on waste electric and electronic equipment prior to disposal.

8 Service

8.1 Technical support

In case of questions, suggestions, or issues, please contact our experts from Technical Support. You may reach out by phone or through the contact form on our homepage:

Technical Support | Bucher Automation - We automate your success.

Or email us:

support@bucherautomation.com

Please supply the following information when contacting Technical Support:

– Hardware revision and serial number
  The hardware revision and serial number is printed on the nameplate of the product.

9 Spare parts and accessories

NOTICE

Inadequate accessories might cause damage to the product

Parts and equipment from other manufacturers might impede the function of the device and cause damage to the product.

► Only use accessories recommended by Bucher Automation AG.

9.1 Spare parts

Scope of delivery	Item number	Quantity
JM-3P22B	Depending on options	1
EtherCAT® patch cable, 0.25 m 8-wire, Cat 5 e PE metal bridge	60887985	1 sachet
Pre-installed busbar elements for 24 V controller supply voltage (U_{CV}) and DC link supply ($U_{DC\ link}$)		
Mating connector for power and IOs		
JM-3P22B	60886337	1 sachet
USB stick with complete documentation	60888000	1 per order

9.2 Accessories

Accessories can be ordered optionally.

9.2.1 EtherCAT® cables

Connection	Component	Item number
Slave from the last JM-3000 Rev. B on another EtherCAT® slave e.g. JM-100x.	Patch cable 1:1, 0.6 m, 4-wire green, Lütze GmbH, Cat 5e, shielded	60887934
	Patch cable 1:1, 1.0 m, 4-wire green, Lütze GmbH, Cat 5e, shielded	60887935
	Patch cable 1:1, 2.0 m, 4-wire green, Lütze GmbH, Cat 5e, shielded	60887936
From JetControl (EtherCAT® master) on JM-3000 Rev. B supply unit	Patch cable 1:1, 1.0 m 8-wire gray HIROSE	60537500
	Patch cable 1:1, 2.0 m 8-wire gray HIROSE	60854512
	Patch cable 1:1, 3.0 m 8-wire gray HIROSE	60887736

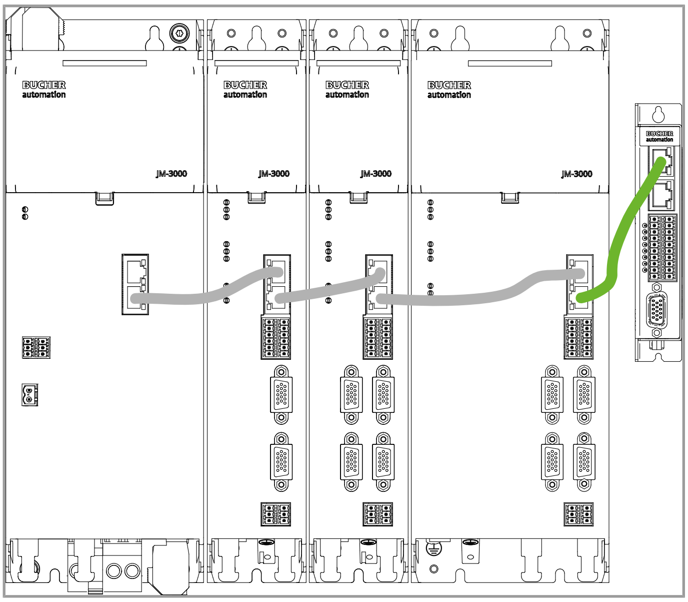


Fig. 32: Example of an EtherCat® cable connection

9.2.2 External line filter

Type	Total line length	Item number
JEMC53.120-UR	Up to 120 m	60880638
JEMC53.240-UR	Up to 240 m	60880640
JEMC53.600-UR	Up to 600 m	60880642

9.2.3 Line reactor

Type	Description	Item number
JLR34.44-UR	Line reactor for JM-3P22B	60880602

9.2.4 Optional external brake resistors

Type	External	Nominal power	Peak power	Assignment of supply unit	Item number
JBR039.02.540-UR	39 Ω	150 W	16000 W	JM-3P10	60880604
JBR039.03.540-UR		300 W			60880606
JBR039.10.201-UR		1000 W			60880608
JBR039.20.201-UR		2000 W			60880610
JBR020.02.540-UR	20 Ω	150 W	32000 W	JM-3P22	60880605
JBR020.03.540-UR		300 W			60880607
JBR020.10.201-UR		1000 W			60880609
JBR020.20.201-UR		2000 W			60880611

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