Jetter
automation

User Manual

JetMove 1000 - Servo Amplifier

60879032

We automate your success

Item no.: 60879032

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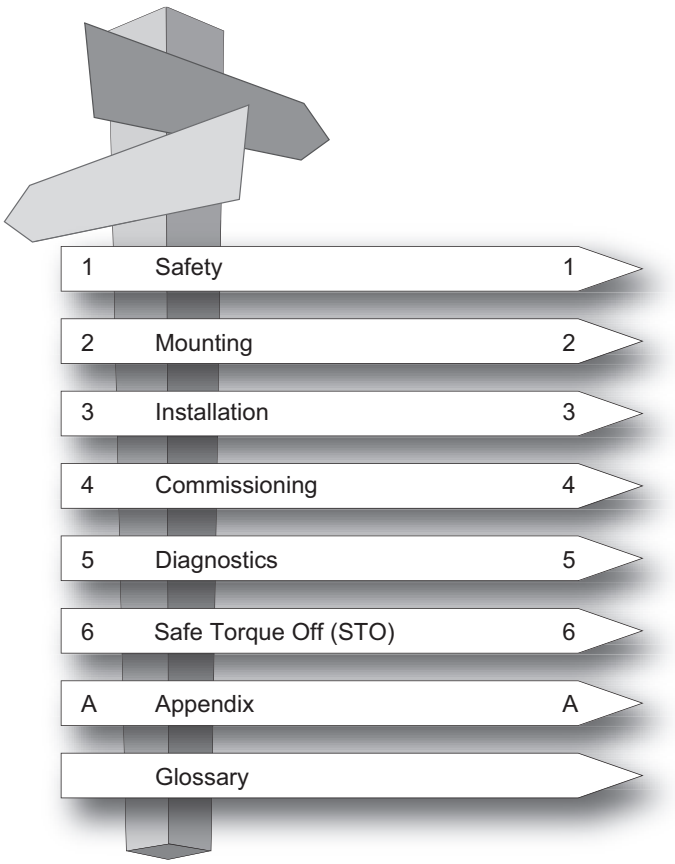
How to use this document

To be able to start using your new JM-1000 quickly and without problems, we ask you to read this user manual thoroughly beforehand.

Step	Action	Comment
1.	This user manual will enable you to install and commission the JM-1000 drive system very quickly and easily.	Quick-start guide
2.	Simply follow the step-by-step tables in the chapters.	Off you go!



Order number code

The order designation JM-1xxx-xxxxxxx provides information on the related configuration variant of the servo amplifier supplied. The significance of the individual characters of the order designation is given in the following order number code. You will find an overview of all servo amplifiers and options in the Jetter Industrial Automation catalog.

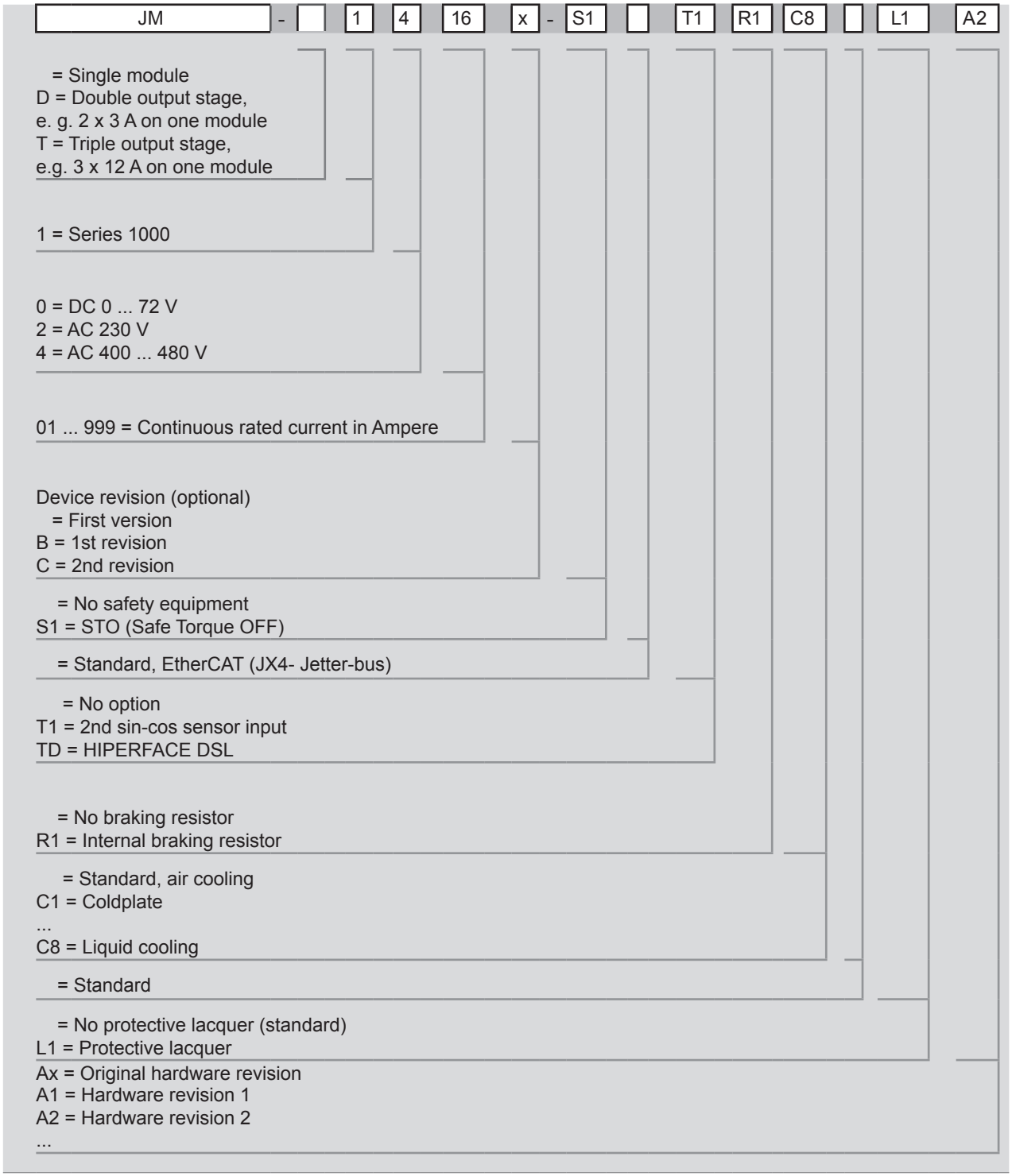


Fig. 0.1 Order number code JM-1000

Data on manufacture

On the nameplate of the JM-1000 servo amplifier you will find the serial number from which you can identify the date of manufacture based on the following key. For the location of the nameplate on the JM-1000 refer to Fig. 3.1 on page 21.

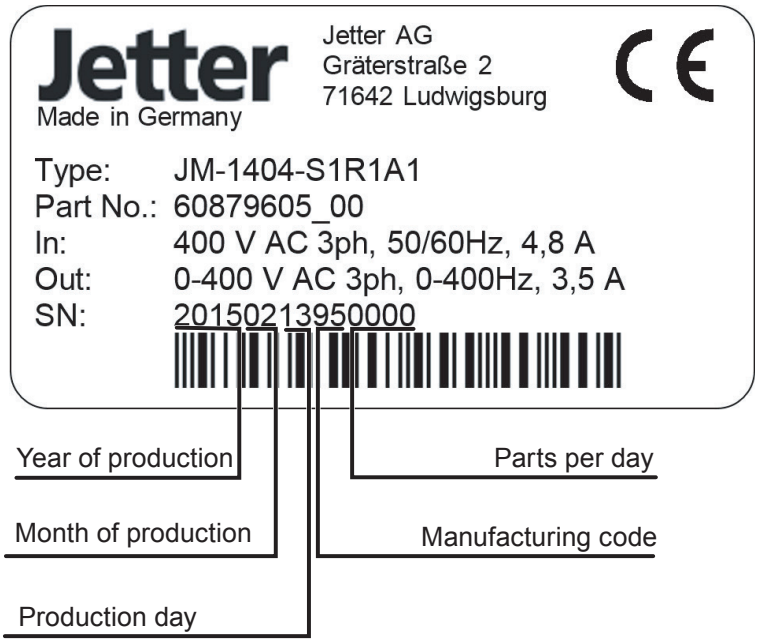


Fig. 0.2 Nameplate of the JM-1000 hardware

Scope of delivery

The scope of delivery includes:

- JM-1000 servo amplifier
- Terminal kit for control and power terminals (depending on device power and variant)
- Set consisting of screen connecting plates and fixing material
- Product DVD

Pictograms

For improved clarity, this user manual uses pictograms. Their meanings are set out in the following table. The pictograms always have the same meanings, even where they are placed without text, such as next to a connection diagram.

Warnings (see also section 1.1)	
	**ATTENTION!** Incorrect operation may result in damage to the drive or in malfunctions.
	**DANGER DUE TO ELECTRICAL POWER!** Incorrect behavior may endanger human life.
	**DANGER DUE TO ROTATING PARTS!** Drive may start up automatically.
Hints & tips	
	NOTE: Useful information or reference to other documents.
	**STEP:** Action in a sequence of multiple actions.

Contents

Contents

1 Safety

1.1 For your safety

The instructions set out below should be read through prior to initial commissioning to prevent injury and/or damage. The safety instructions must be followed at all times.

Read the user manual first!

- Follow the safety instructions!
- Follow the information for use!

Electric motion systems are always dangerous:

- Voltages of 230 V to 480 V
- Dangerously high voltages of ≥ 50V may still be present 10 minutes after the power is cut (capacitor charge). So check that electrical power is not present!
- Rotating parts
- Hot surfaces

Protection against magnetic and/or electromagnetic fields during installation and operation:

Persons fitted with heart pacemakers, metallic implants and hearing aids etc. must not be allowed access to the following areas:

- Areas where drive systems are installed, repaired and operated.
- Areas where motors are installed, repaired and operated. Motors with permanent magnets pose a particular hazard.
- If it is necessary to access such areas, suitability to do so must be determined beforehand by a doctor.

Your qualification:

- To prevent personal injury or damage, only personnel with electrical engineering qualifications may work on the device.
- The qualified personnel must be familiar with the contents of the user manual (cf. IEC 364, DIN VDE 0100).
- Awareness of national accident prevention regulations (e.g. BGV A3 in Germany) is paramount.

During installation observe the following instructions:

- Always comply with the connection conditions and technical specifications.
- Comply with the standards for electrical installations, e.g. wire cross-section, protective earth conductor and earth connections.
- Do not touch electronic components and contacts (electrostatic discharge may destroy components).

1.2 Warning symbols

The safety instructions detail the following hazard classes.
The hazard class defines the risk posed by failing to comply with the safety instruction.

Warning symbols	General explanation	Hazard classification to ANSI Z 535
	**Attention!** Incorrect operation may result in damage to the drive or malfunctions.	Serious injury or damage may occur.
	**Danger due to high voltage!** Improper behaviour may endanger human life.	Death or serious injury will occur.
	**Danger due to rotating parts!** Drive may start up inadvertently..	Death or serious injury will occur.

Table 1.1 Explanations of warning symbols

1.3 Intended use

The JM-1000 servo amplifiers are open-chassis units designed solely for vertical installation in stationary electrical systems or machines.

When installed in machines the commissioning of the servo amplifier (i.e. start-up of intended operation) is prohibited, unless it has been ascertained that the machine fully complies with the provisions of the Machinery Directive 2006/42/EC; compliance with EN 60204 is mandatory.

Commissioning (i.e. start-up of intended operation) is only permitted on compliance with the EMC Directive (2004/108/EC).

CE The JM-1000 conforms to the Low Voltage Directive 2006/95/EC.

The servo amplifiers fulfil the requirements of the harmonized product standard EN 61800-5-1.

If the servo amplifier is used for special applications, such as in areas subject to explosion hazard, the required standards and regulations (e. g. in a potentially explosive atmosphere DIN EN 60079-0, “General requirements” and DIN EN 60079-1, “Equipment protection by flameproof enclosures”) must always be observed.

Repairs may only be carried out by authorised repair workshops. Unauthorised opening and incorrect intervention could lead to death, physical injury or damage. The warranty provided by Jetter AG will be rendered void.

NOTE:

Usage of the servo amplifiers in mobile equipment does not comply with the standard regarding the ambient conditions. It is therefore only permissible upon special agreement.

1.4 Responsibility

Electronic devices are not fail-safe.. The company setting up or operating the machine or plant is solely responsible for ensuring that the drive is rendered safe if the device fails.

In the section on “Electrical equipment of machines” the standard EN 60204-1/DIN VDE 0113 “Safety of machines” stipulates safety requirements for electrical control systems. They are intended to protect personnel and machinery, and to maintain the function capability of the machine or plant concerned, and must be observed.

The function of an emergency stop system does not necessarily have to cut the power supply for the drive. As a precaution against dangers, it is useful to maintain individual motion systems in operation or to initiate specific safety sequences. The design of the emergency stop measure is assessed by means of a risk assessment of the machine or plant, including the electrical equipment in accordance with EN ISO 12100:2011-03 (previously EN 14121), and is determined in accordance with EN ISO 13849-1 (previously EN 954-1), "Safety of machines - Safety-related parts of controls" by selecting the circuit category.

2 Mounting

2.1 Notes on mounting

IT IS IMPERATIVE YOU PREVENT THE FOLLOWING:

- The penetration of moisture into the device,
- Aggressive or conductive substances in the environment,
- Drill chippings, screws or foreign bodies falling into the device,
- The covering of ventilation openings, as otherwise the device may be damaged.

Note the following points:

- Cooling air must be able to flow through the device without restriction.
- On installation in switch cabinets with convection (= heat loss is discharged to the outside via the control cabinet walls), always mount an internal air circulation fan.
- The panel must be safely earthed.
- The device is designed only for vertical installation in switch cabinets. The control cabinet must as a minimum provide degree of protection IP4x.
- To attain the best result for effective EMC installation , use a chromated or galvanised panel. If panels are varnished, remove the coating from the contact area! The devices themselves have an aluminium back panel.
- Max. pollution degree 2

ATTENTION!

According to EN ISO 13849-2 the control cabinet must have comply with protection IP54 or higher when using the STO (Safe Torque OFF) safety function.

You will find further information on environmental conditions in the appendix.

2.2 Wall mounting

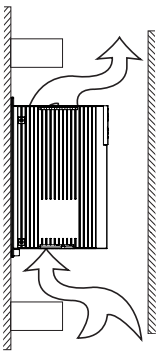
Step	Action	Comment
1.	Mark out the position of the tapped holes on the panel. Tap a thread for each fixing screw in the panel.	Dimensional drawings/hole spacing - see Fig. 2.1, Fig. 2.2 and Fig. 2.3 The thread area will provide a good surface contact.
2.	Mount the servo amplifier **vertically** on the panel.	Observe the mounting clearances! The contact area must be bare metal.
3.	Mount the other components, e.g. the line filter, mains choke etc., on the panel.	The cable between line filter and servo amplifier is allowed to be max. 30 cm long.
4.	Continue with the electrical installation in section 3.	

Table 2.1 Mounting

Note:

Forced cooling by external air flow is necessary for all frame sizes of the JM-1000. The air must be able to flow unhindered through the device. If a temperature cut-out occurs, the cooling conditions must be improved.

Air flow: min. 1.2 m/s



2.2.1 Dimensions of the servo amplifiers

JM-1000	BG3	BG4	BG5
	JM-1206 JM-1404	JM-1407	JM-1416
Weight [kg]	1.5	2.8	5.9
B (width)	55		90
H (height)[1)]	210	290	291
T (depth)[1)]	189	235.5	
A	27.5		20
A1	-	40	50
C	225	305	310
C1	5		6
D Ø	4.8		
E	for direct butt mounting (see note)		
F [2)]	≥150		
G [2)]	≥235	≥280	
H1	235	315	324
Screws	2 x M4	4 x M4	

All dimensions in mm

1) Without terminals/connectors

2) The bending radius of the connecting cables must be taken into account

Table 2.2 JM-1000 dimensions - see Fig. 2.1 and Fig. 2.2

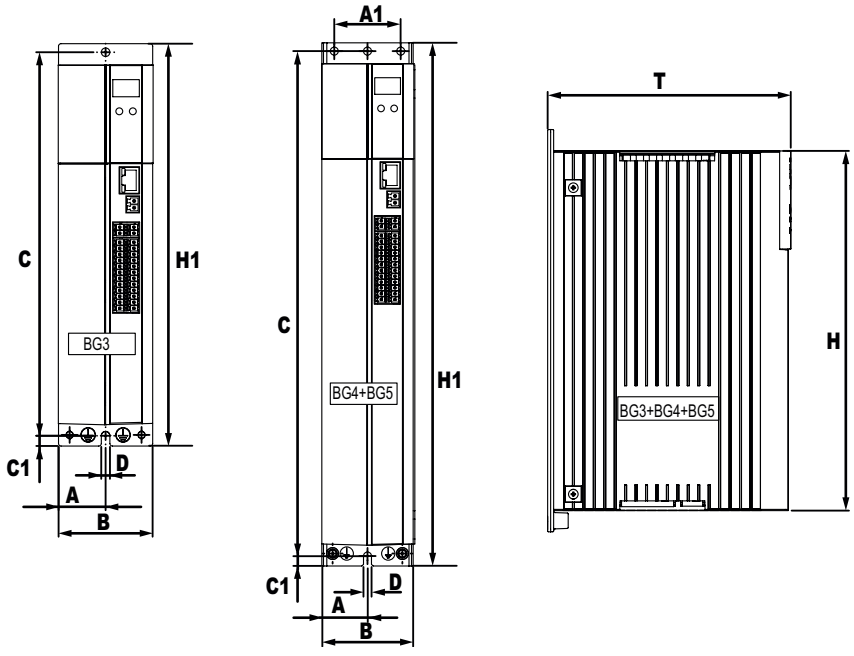


Fig. 2.1 Dimensions (in mm) of the BG3, BG4

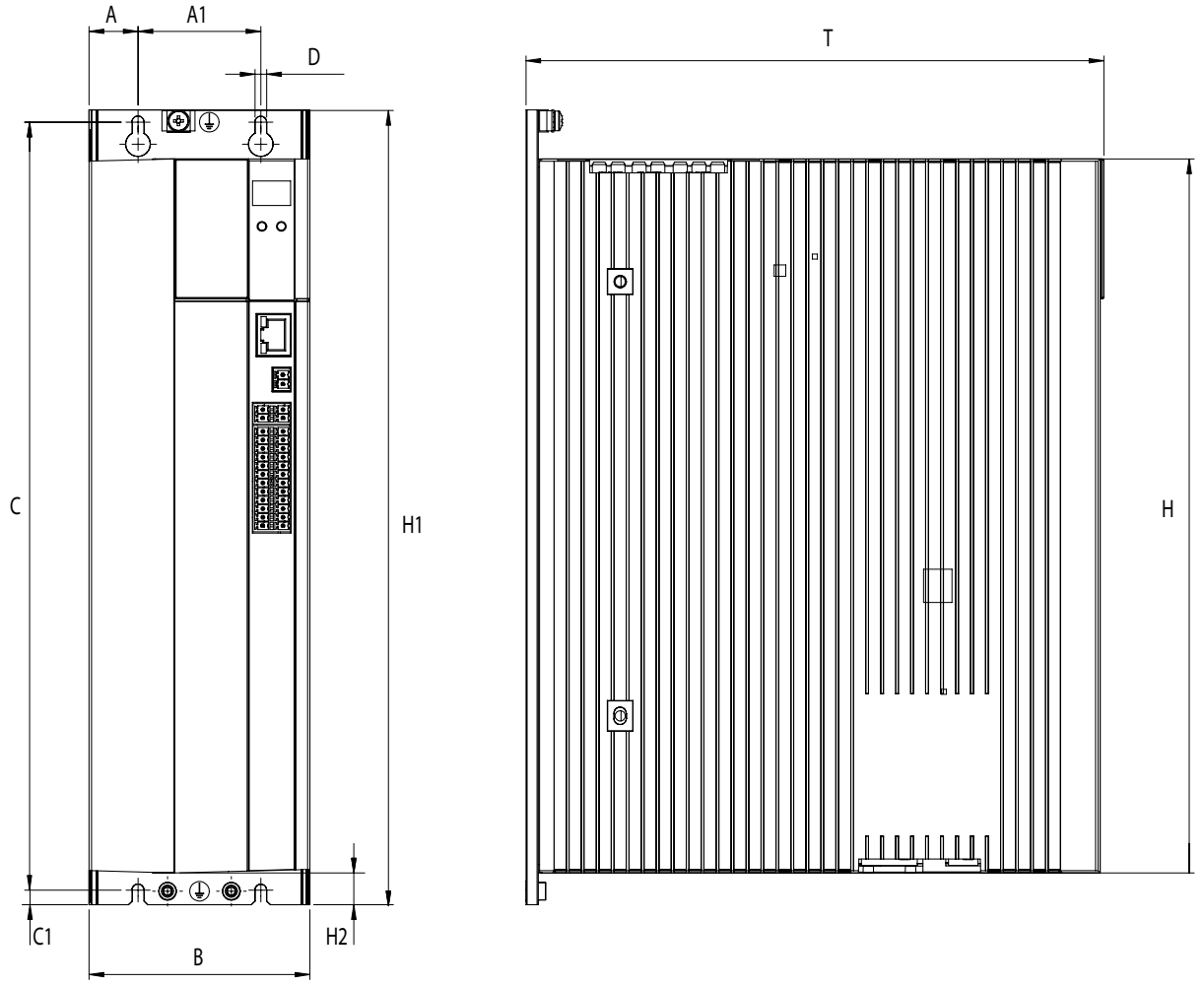


Fig. 2.2 Dimensions (in mm) of the BG5

Mounting clearances

NOTE:

The minimum distance specified in the table applies to devices of the same power. On butt mounting devices with different drive power you should arrange the devices according to their power (e. g., viewed from the left, BG5-BG4-BG3). This arrangement minimizes the mutual thermal effects.

On butt mounting JM-1000 servo amplifiers together with other devices, you must make sure that these devices do not affect each other thermally.

JM-1000	BG3	BG4	BG5
	JM-1206 JM-1404	JM-1407	JM-1416
E	Direct butt mounting (see note)		
F 2)	≥150		
G 2)	≥235	≥280	

All dimensions in mm

2) The bending radius of the connecting cables must be taken into account

Table 2.3 JM-1000 - Mounting clearances

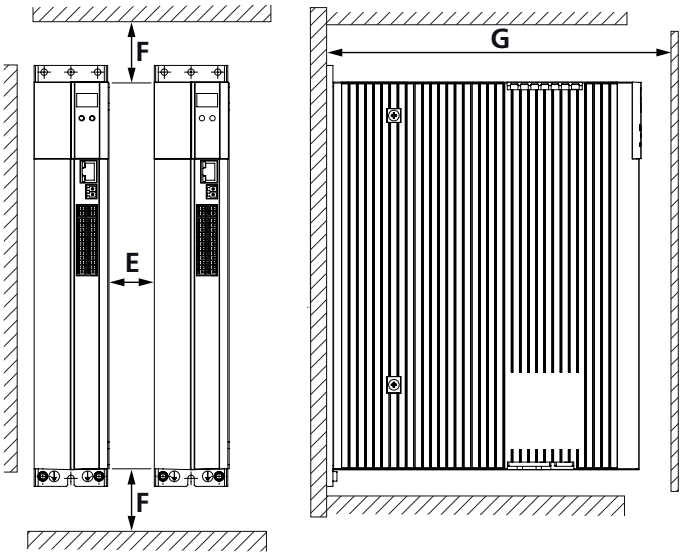


Fig. 2.3 Mounting clearances (in mm)

3 Installation

3.1 Notes on installation

ATTENTION! Qualified personnel:

Installation must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

During installation work:

Strictly avoid that ...

- screws, cable rests or foreign bodies drop into the device
- moisture enters into the device

DANGER CAUSED BY HIGH VOLTAGE!

Danger of life!

- Never wire or disconnect electrical connections while they are live. Isolate the device from the mains supply (230/400/460/480 V AC) before working on it. Dangerously high voltages of ≥ 50 V may still be energized 10 minutes after the power is cut (capacitor charge). Work on the device must only be carried out after the DC link voltage has dropped below a residual voltage of 50 V (indicated by monitoring LED H1 and to be measured on terminals X1/L- and L+).
- A hazardous voltage may be present on the device, even if the device is not emitting any visual or audible signals/indications (e. g. the mains voltage is present at terminal X3 and there is no control supply +24 V DC on X2)!

The following general guidelines apply for the installation of servo amplifiers:

- *Compliance with the EMC product standard*
  - Commissioning (i.e. starting intended operation) is only permitted when strictly complying with EMC product standard EN 61800-3. The installer/ operator of a machine and/or item of plant must provide proof of compliance with the protection targets stipulated in the standard.
- *Cable type*
  - Use only shielded mains, motor and signal lines with double copper braiding that is overlapping by 60 to 70 %.
- *Routing of cables*
  - Route mains, motor and signal cables separated from one another. If possible, keep a distance of at least 0.2 m, otherwise use separators. They should not run in parallel. If crossovers are unavoidable, they should wherever possible be configured as perpendicular (at a 90° angle).

  - Always route the motor cable without interruptions and the shortest way out of the control cabinet. If, using a motor contactor for example, the component should be mounted next to the servo amplifier and the screen on the motor cable should not be stripped back too far.
  - If possible signal lines should only enter from one side into the control cabinet.
  - Lines of the same electric circuit must be twisted.
  - Avoid unnecessary cable lengths and loops.
- *Earthing measures*
  - Earthing measures of relevance for the servo amplifier are described in section "3.6 Connection PE conductor". Screening measures
  - Do not strip the cable shields too soon, and lay them across wide areas both on the component and on the backing plate or on the PE rail (main ground) of the backing plate.
- *External components*
  - Place larger consumers near the supply.
  - Contactors, relays, solenoid valves (switched inductivities) must be wired with fuses. The wiring must be directly connected to the respective coil.
  - Any switched inductance should be at least 0.2 m distant from the process controlled assemblies.

Additional information can be found in the corresponding connection description. For further detailed information on installation, please consult the Jetter hotline (see "Hotline, support and service" on page 62).

3.2 Layout

The following shows the layout with the corresponding positions of plugs and terminals. For improved clarity an abbreviation has been added to the designations of connectors and terminals.

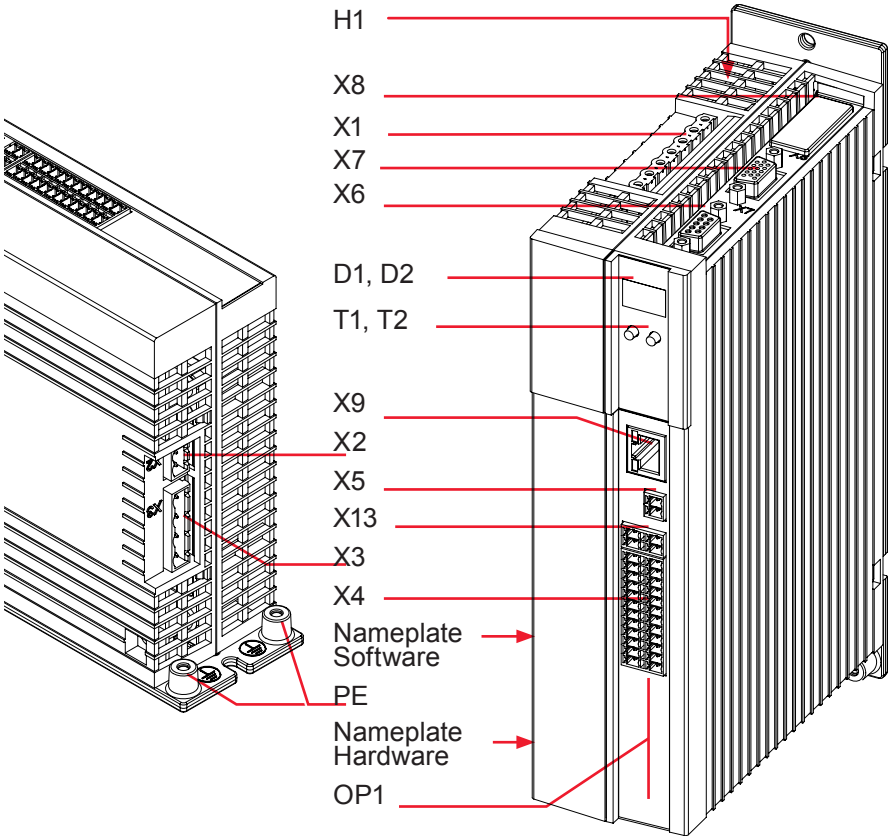


Fig. 3.1 JM-1000 - Layout of BG3 and BG4

Number	Designation
D1, D2	7-segment display
H1	DC link voltage indicator LED (only frame size BG3 to BG4)
OP1	Installation space for option 1 (communication)
T1, T2	Button
X1	Power connections (only frame size BG3 to BG4)
X2	Connection control supply U_V
X3	Connection of AC power supply PE (bottom)
	Device protective earth conductor connection
X4	Terminals
X5	Motor temperature monitoring
X6	Connection resolver
X7	Connection high-resolution sensors
X8	Option 2 (technology)
X9	Ethernet interface
X13	Connection of the motor brake

Table 3.1 JM-1000 - Key to layout of BG3 and BG4

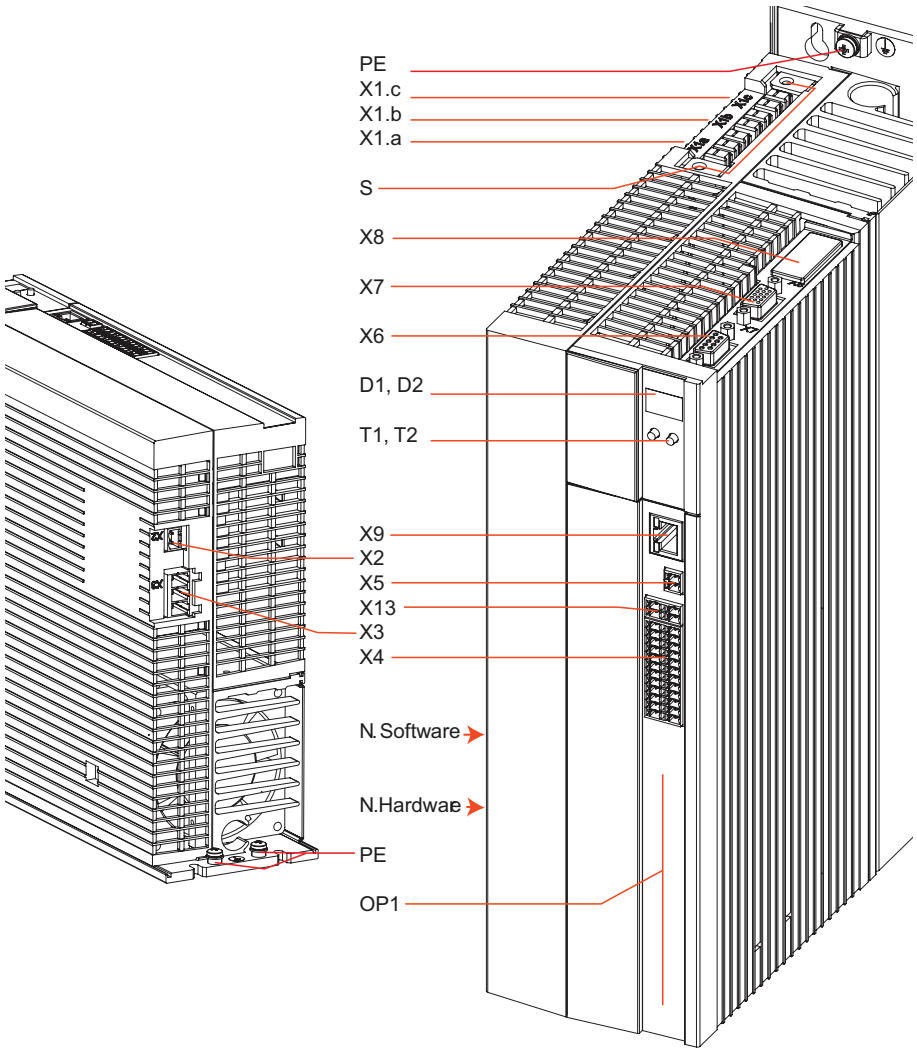


Fig. 3.2 JM-1000 - Layout of BG5

Number	Designation
D1, D2	7-segment display
OP1	Installation space for option 1 (communication)
T1, T2	Button
PE (top)	Motor PE connection
X1.a	Motor connection (only frame size BG5)
X1.b	Measuring point for DC link voltage (only frame size BG5)
X1.c	Braking resistor connection (only frame size BG5)
X2	Connection of the control supply U_V
X3	Connection of the AC power supply
PE (bottom)	Device protective earth conductor connection
X4	Terminals
X5	Motor temperature monitoring

Table 3.2 JM-1000 - Key to layout of BG5

Number	Designation
X6	Connection resolver
X7	Connection for high resolution sensors
X8	Option 2 (technology)
X9	Ethernet interface
X13	Connection of the motor brake
S	"Detail 1: Motor cable" on page 31)
N. Software	Software nameplate
N. Hardware	Hardware nameplate

Table 3.2 JM-1000 - Key to layout of BG5

3.3 Connection diagram BG3 to BG4

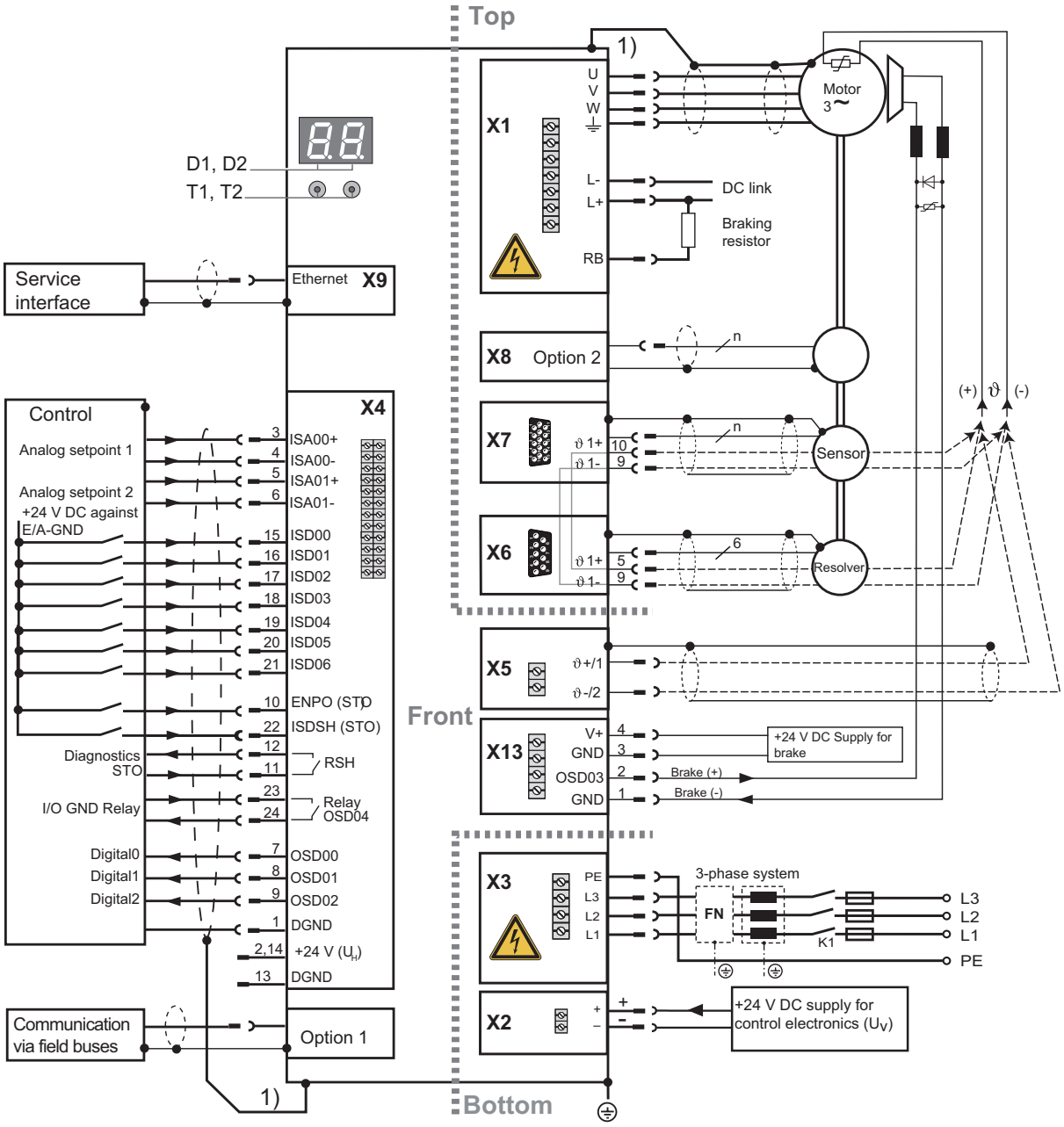


Fig. 3.3 Connection diagram of BG3 to BG4

Number	Designation	Details
D1, D2	7-segment display	page 60
T1, T2	Button	page 60
X1	Connection of motor, braking resistor and measuring point for DC link voltage	page 51
X2	Connection of the control supply	page 37
X3	Connection of the AC power supply	page 40
X4	Terminals	page 43
X5	Connection of the motor temperature monitoring [1)]	page 51
X6	Connection resolver [1)]	page 48
X7	High-resolution sensor connection [1)]	page 49
Option 1	Communication	page 46
PE	PE connection	page 35
X8 (Option 2)	Technology	page 46
X9	Ethernet interface	page 46
X13	Connection of the motor brake	page 46
1)	Screen connections via separate screen plates	page 28
⏚	Connection of the enclosure serving as a conductor for protective earth	page 35

1) Note: The thermal sensor for the motor winding can, optionally, be connected via the sensor cables (X6 or X7) or to terminal X5.

Table 3.3 Key to connection diagram of the BG3 to BG4

3.4 Connection diagram - BG5

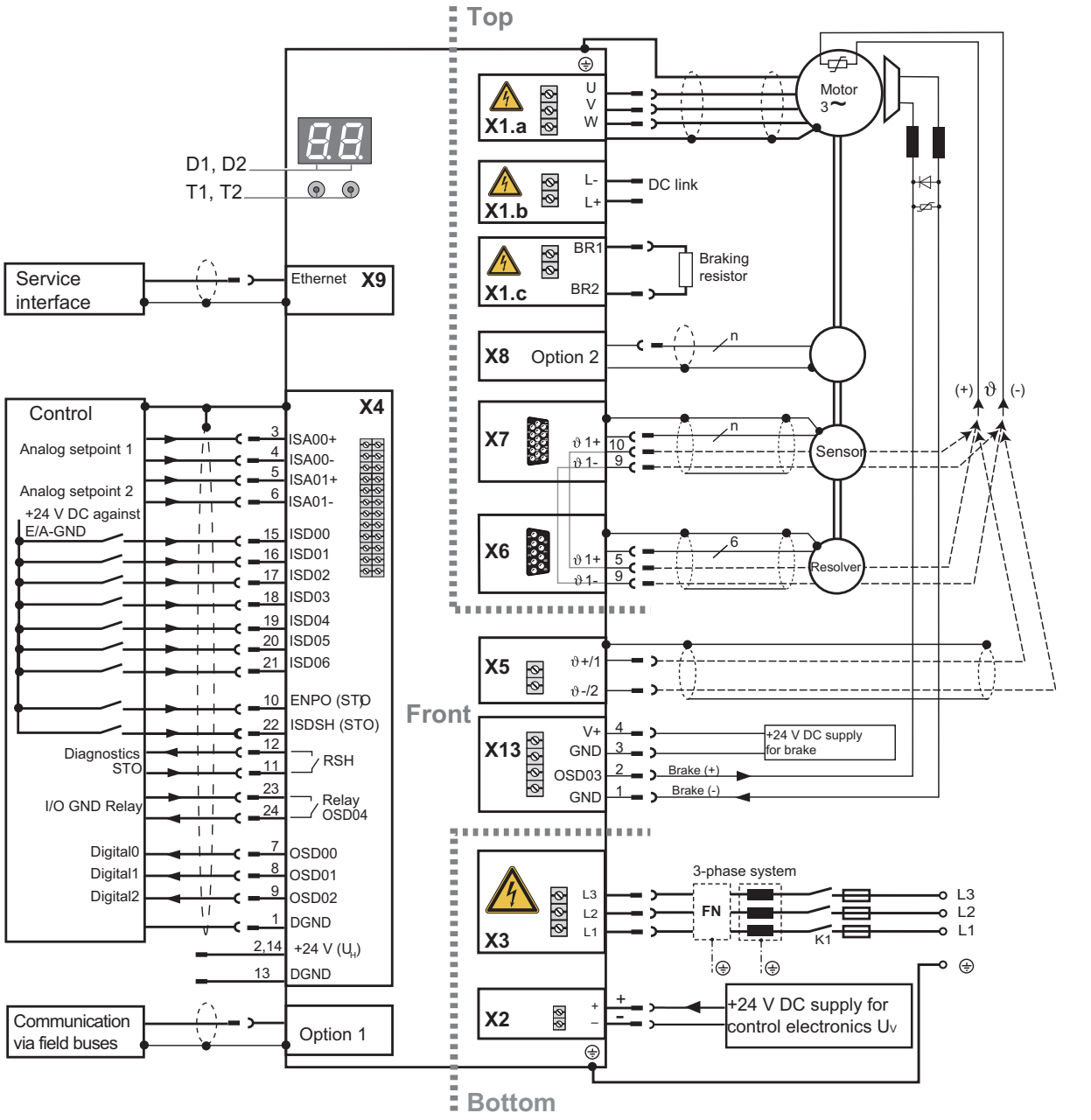


Fig. 3.4 Connection diagram - JM-1000 BG5

Number	Designation	Details
D1, D2	7-segment display	page 60
T1, T2	Button	page 60
X1.a	Motor connection	page 51
X1.b	Measuring point for DC link voltage	-
X1.c	Connection of the braking resistor	page 51
X2	Connection of the control supply	page 37
X3	Connection of the AC power supply	page 40
X4	Terminals	page 43
X5	Connection of motor temperature monitoring device [1)]	page 51
X6	Connection of the resolver [1)]	page 48
X7	Connection of the high-resolution [1)]	page 49
Option 1	Communication	page 46
PE	Connection of the PE conductor	page 35
X8 (Option 2)	Technology	page 46
X9	Ethernet interface	page 46
X13	Connection of the motor brake	page 46

1) Note: The thermal sensor for the motor winding can, optionally, be connected via the sensor cables (X6 or X7) or to terminal X5.

Table 3.4 Connection diagram - BG5

3.5 Effective EMC installation

3.5.1 Interference immunity of servo amplifiers

ATTENTION!

This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate measures.

External radio frequency interference suppression filters (JEMCxxx) are available for the servo amplifiers. With the measurement method specified and the external line filter, these servo amplifiers conform to the EMC product standard IEC 61800-3 for "First environment" (residential C2) and "Second environment" (industrial C3).

3.5.2 Specimen setup

The specimen setup presented on the following pages is intended to illustrate the key measures necessary to ensure EMC-compatible setup.

NOTE:

The specimen setup merely presents a recommendation, and does not automatically guarantee compliance with applicable EMC directives. The installer/ operator of a machine and/or item of plant must provide proof of compliance with the protection targets stipulated in the standard.

Overview

Fig. 3.5 presents an overview of the minimum components required:

A. Panel with cable ducts
B. JM-1000
C. Line filter
D. Mains choke
E. Distributor rail for AC power supply an control supply (+24 V DC)

The layout and cabling are based on the instruction set out in section "Notes on installation" on page 19. The numbered red arrows refer to four very important detailed notes given on the following pages.

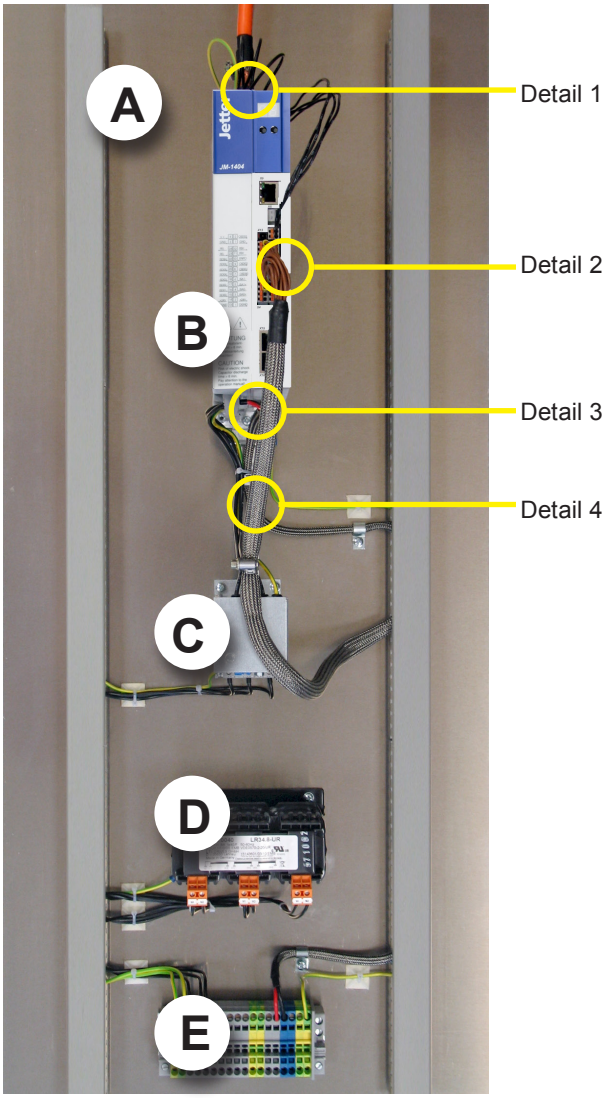


Fig. 3.5 Specimen setup - Overview

Detail 1: Motor cable

On BG3 to BG4 devices make sure the motor connection is connected to terminal (X1) and on BG5 devices to terminal (X1a, X1b, X1c):

- Fasten the screen connection plate supplied (screen plate for BG3 to BG4 see Fig. 3.66, screen plate for BG5 see Fig. 3.7) to the top of the device. Ensure that the plate has large surface area contact with the heat sink on the JM-1000 and with the panel. Use a serrated washer.

Fig. 3.6 Screen plate of BG3 to BG4

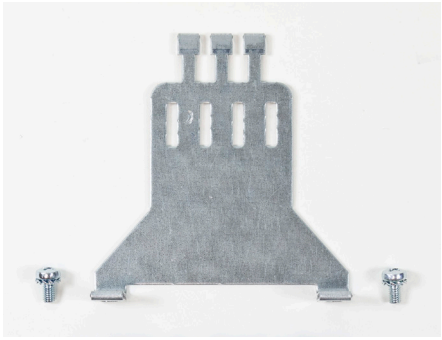


Fig. 3.7 Screen plate of the BG5

- Strip the screen on the motor cable back only as far as absolutely necessary.
- Connect the motor cable screen to the screen connection plate with a large surface area connection using the clamp supplied.

NOTE:

Pre-fabricated servo motor cables are available for Jetter servo motors. You will find details in the accessories catalog (item no.: on request) or in the Industrial Automation catalog for servo motors (item no.: 60872949).

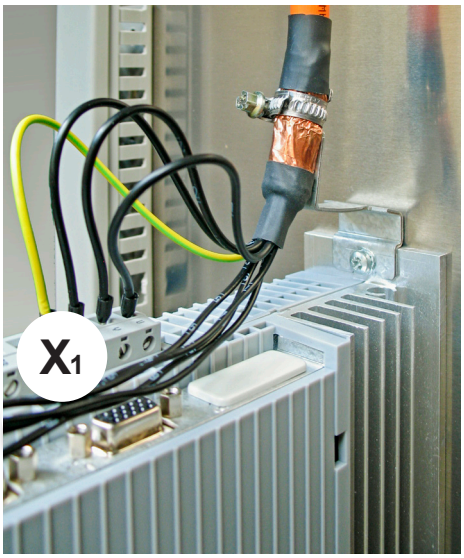


Fig. 3.8 Screen plate of BG3 to BG4

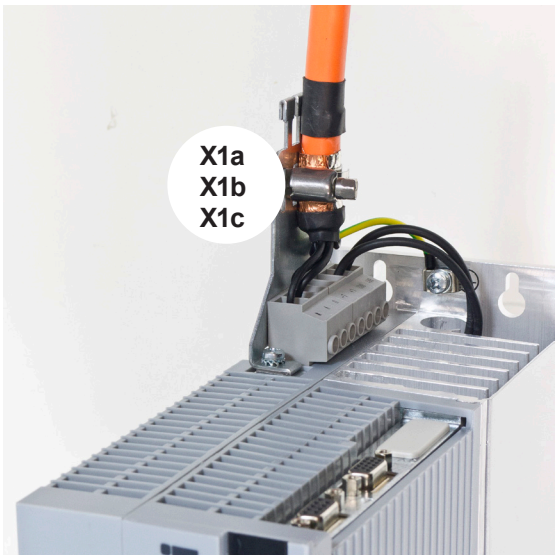


Fig. 3.9 Shield plate of the BG5

Detail 2: Control supply (+24 V DC)

On connecting the control voltage (X2):

- Secure the second of the two screen connection plates supplied using the screw for fastening the bottom of the device on the underside of the device. Ensure that the plate has a large area contact with the heat sink on the JM-1000 and with the panel. Use a serrated washer.
- Fit a screen sleeve over the control supply cable and strip it back only as far as necessary before the control supply connection (X2).
- Connect the screen sleeve on the control supply cable to the screen connection plate with a large surface area connection using the clamp supplied.

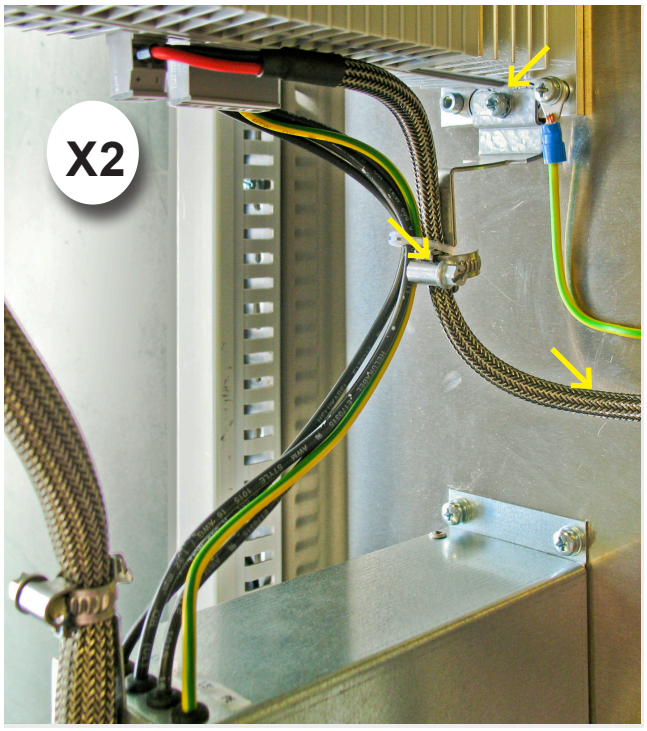


Fig. 3.10 Specimen setup - Detail 2: Control supply

Detail 3: Line filter and mains connection

At the output of the line filter and the AC mains connection (X3):

- Connect the wires on the output of the line filter directly to the AC mains connection (X3) on the JM-1000. The wires must **not** be extended, therefore the line filter is to be installed correspondingly close to the
  JM-1000. However, ensure the necessary minimum clearance is maintained (see Table 2.1 on page 14).
- Fix the wires to the screen connection plate using a cable tie as necessary.
- The leakage current of the JM-1000 is >3.5 mA. Therefore connect:
  - The protective earth conductor leading from the output of the line filter to the connection (X3) on the JM-1000 BG1000 to B4 or to the enclosure of the JM-1000 BG5 **and**
  - One of the protective earth connections on the heat sink of the JM-1000 using a cable of at least the same cross-section to the main earth for the distributor rail.

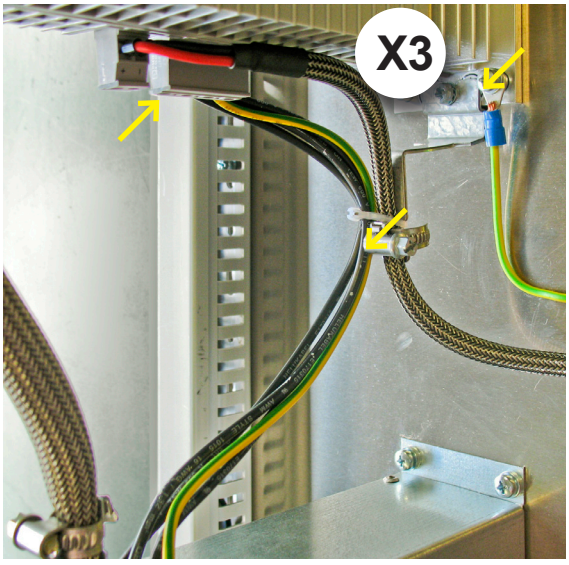


Fig. 3.11 Specimen setup - Detail 3: Line filter and mains connection

Detail 4: Control cables

At the control terminals (X4) on the JM-1000:

- Strip the screen of the control wires back only as far as absolutely necessary.
- Connect the control wire screens to the screen connection tab on the line filter with a large surface area connection using the clamp supplied. If this is not possible, lay the control wire screen on the panel directly adjacent to the JM-1000 with a large surface area connection.

Fig. 3.12 Specimen setup - Detail 4: Control cables

3.6 Connection of the PE conductor

Step	Action	PE mains connection in accordance with DIN EN 61800-5-1
1.	Earth each of the servo amplifiers! Connect the terminal ⏚ **in a star configuration and with a large surface area** to the PE bar (main earth) in the control cabinet.	For the PE connection the following applies (as leakage current >3.5 mA): Use protective earth conductors with the same cross-section as the mains power cables, however at least 10 mm². Also comply with local and national regulations and conditions.
2.	Also connect the protective earth conductor terminals on all other components, such as mains choke, filter, etc. in a **star configuration and with a large surface area** to the PE bar (main earth) in the control cabinet.	

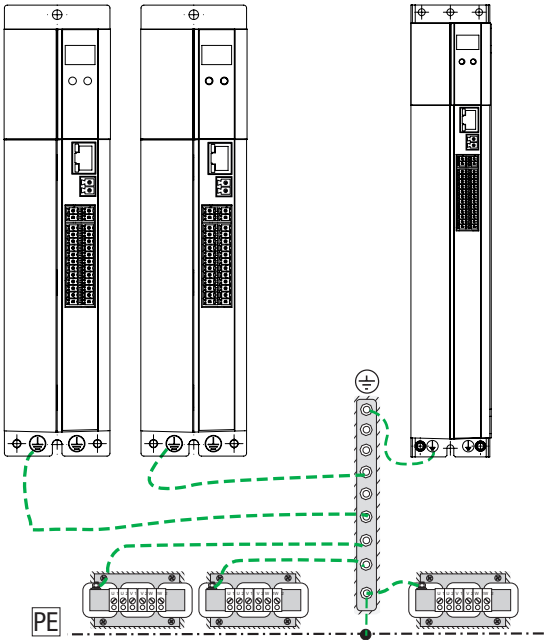


Fig. 3.13 Star configuration layout of the protective earth conductor

3.7 Electrical isolation concept

The control electronics, with the logic (µP), the sensor terminals and the inputs and outputs are electrically isolated from the power element (power supply/DC-link). All control terminals are designed as safety extra-low voltage/protective extra-low voltage (SELV/PELV) circuits and must only be operated with such SELV/PELV voltages, as per the relevant specification. This aspect provides reliable protection against electric shock on the control side.

A separate control supply, compliant with the requirements of a SELV/ PELV, is therefore needed.

The overview shows the potential supplies for the individual terminals in detail.

This concept also delivers higher operational safety and reliability of the servo amplifier.

SELV = Safety Extra Low Voltage
PELV = Protective Extra Low Voltage

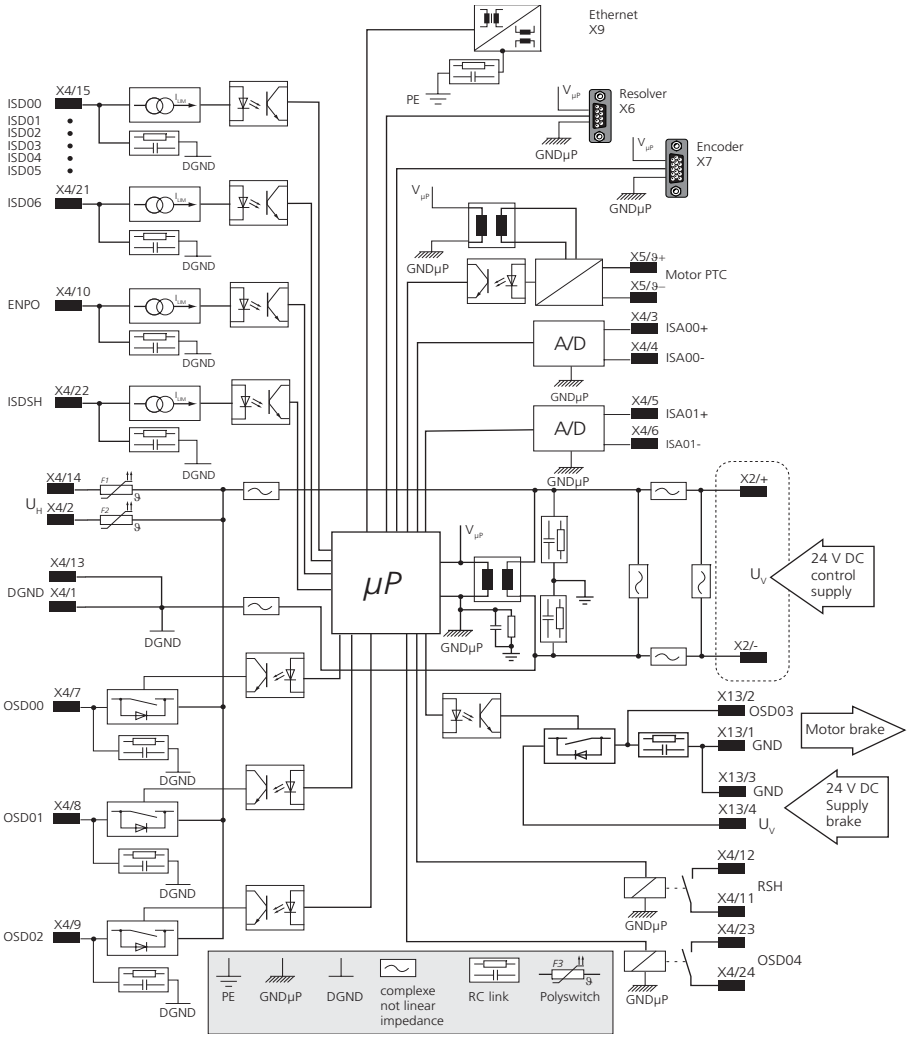


Fig. 3.14 Electrical isolation concept of JM-1000

3.8 Connection of supply voltages

There must be individual voltage supplies for the control and for the power element of the JM-1000. The control supply must always be connected **first**, so that the device parameters can be configured using JetSym starting from version 5.3 and, above all, set to the correct power supply.

ATTENTION!

Only when the mains voltage has been set and the JM-1000 restarted (if the mains voltage or switching frequency has been changed) may the mains power supply be activated. Otherwise the device may be destroyed!

3.8.1 Connection of control supply (+24 V DC)

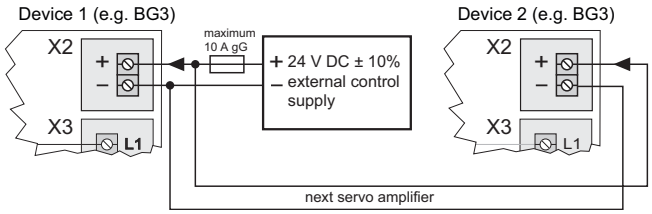


Fig. 3.15 JM-1000 - Connection of the control supply

Control supply (specification)		
Control supply	X2/+ X2/-	• U_V = +24 V DC ±10%, stabilised and filtered. • I_V = 2 A (BG3 to BG5) • Internal polarity reversal protection • The power supply unit used must have a safe isolation in relation to the mains as per EN 50178 or EN 61800-5-1

Table 3.5 JM-1000 - Specificaiton of the control supply

ATTENTION!

Suitable measures must generally be taken to provide adequate line protection.

DANGER DUE TO HIGH VOLTAGE!

When the mains voltage is conenected to terminal X3 and there is no control supply (+24 V DC on X2), a hazardous voltage is present at the device with no visual signal on the display or acoustic indication by fan noise. If visible in the installed state, LED H1 (see Fig. Fig. 3.1) indicates whether voltage is connected to the device. Even when H1 is off, X1 must be checked for being de-energized.

NOTE:

The start-up current for the supply voltage to the BG3 to BG5 may be two to three times the operating current.

ATTENTION:

On the servo amplifier for the BG5 with integrated braking resistor, the internal braking resistor must be disconnected on the connection of an external braking resistor to X1.c. Parallel operation with both braking resistors is not allowed!

3.8.2 Connection of the mains supply

Procedure:

Step	Action	Comment
1.	Specify the cable cross-section to suit the peak current and ambient temperature.	Cable cross-section as per local regulations and conditions.
2.	Wire the servo amplifier with the line filter*), maximum cable length 0.3 m (with non-screened cable)!	
3.	Wire the mains choke *) (if used)	Reduces the voltage distortion (THD) in the system and prolongs the service life of the servo amplifier.
4.	Install a circuit breaker K1 (power circuit breaker, contactor, etc.).	Do not switch on the power!
5.	Use mains fuses (duty class gG) to isolate all poles of the servo amplifier from the mains.	For compliance with equipment safety requirements laid down in EN 61800-5-1

*) *optional*

DANGER DUE TO HIGH VOLTAGE!

Danger of life!
Never wire or disconnect electrical connections while these are live. Always disconnect the device from the mains before working on the device. Dangerously high voltages of ≥50V may still be present 10 minutes after the power is cut (capacitor charge). So check the device for being de-energized!

ATTENTION!

If local regulations require the installation of an earth-leakage current breaker, the following applies:
In case of a fault the servo amplifier is able to generate DC leak currents without zero crossing. Servo amplifiers therefore must only be operated with residual current devices (RCDs) [1] type B for AC fault currents, pulsating or smooth DC fault currents, which are suitable for servo amplifier operation, see IEC 60755. RCMs [2] can also be used for monitoring purposes.

1) engl.: residual current protective device
2) engl.: residual current monitor

Note the following points:

- Switching the mains power:
  - In case of too frequent switching the device protects itself by high-resistance isolation from the system. After a rest phase of a few minutes the device is ready to start once again.
- TN and TT system: Operation is permitted in the following cases:
  - In the case of single-phase devices for 1 x 230 V AC the supply system conforms to the maximum installation category III as per EN 61800-5-1.
  - In the case of three-phase devices with phase voltages 3 x 230 V AC, 3 x 400 V AC, 3 x 460 V AC and 3 x 480 V AC
  - **if the supply system** is earthed
  - The supply system conforms to the maximum installation category III as per EN 61800-5-1 at a system voltage (external conductor → neutral point) of maximum 277 V.
- IT system: **not** permitted!
  - In the event of a ground fault the electrical voltage is approx. twice as high. Clearances and creepage distances to EN 61800-5-1 are no longer maintained.
- Connection of the servo amplifiers via a mains choke is imperative:
  - Where the servo amplifier is used in applications with interference corresponding to environment class 3, as per EN 61000-2-4 and above (harsh industrial environment)
  - In the case of single-phase mains supply
  - For compliance with EN 61800-3 or IEC 61800-3
- For further information on permissible current loads, technical data and ambient conditions please refer to the appendix.

NOTE:

Please be aware that the JM-1000 is not rated for environment class 3. Further measures are imperative to attain this environment class! For further information please consult your project engineer.

Servo amplifier	Device connected load [1] [kVA]		Max. cable cross-section[2] in the terminal [mm²]		Specified mains fuse, duty class gG [A]
	with mains choke (4% u_K)	without mains choke	Ferr. with insul.[3]	Ferr. w/o insul.[3]	
JM-1206	2.6	3.2	2.5	2.5	1 x 16 maximum (1-phase) 3 x 16 maximum (3-phase)
JM-1404	2.7	3.3			3 x 10 maximum
JM-1407	5.0	6.1	4	4	3 x 16 maximum
JM-1416	10.2	13.2	4	6	3 x 40 maximum[4]

1) At 3 x 230 V AC or 3 x 400 V AC mains voltage and FT ≥ 8 kHz

2)The minimum cross-section of the mains power cable depends on the local regulations and conditions, as well as on the continuous rated current of the servo amplifier.

3) Ferr. with insul. = Ferrule with plastic insulation, Ferr. w/o insul. = Ferrule without plastic insulation

4) = Device protection

Table 3.6 Connected load and mains fuse

Mains supply of the BG3

NOTE:

Before commissioning, the value of the mains voltage connected must be set on the servo amplifier (factory settings = 3 x 230 V AC / 3 x 400 V AC).

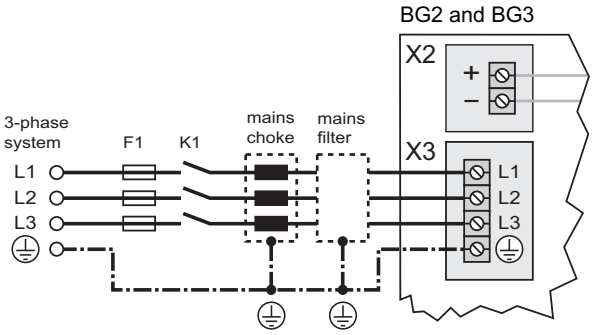


Fig. 3.16 Connection of BG3 to mains supply 3 x 230 V (JM-12xx) or 3 x 400 V (JM-14xx) depending on device version

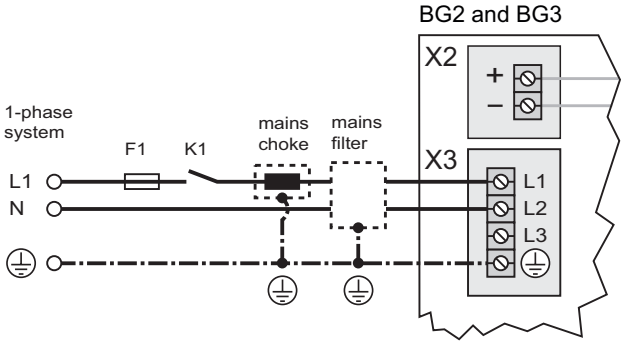


Fig. 3.17 Connection of BG3 to mains supply 1 x 230 V (JM-12xx)

Mains supply BG4

NOTE:

Before commissioning, the value of the mains voltage connected must be set on the servo amplifier (factory settings = 3 x 230 V AC /3 x 400 V AC).

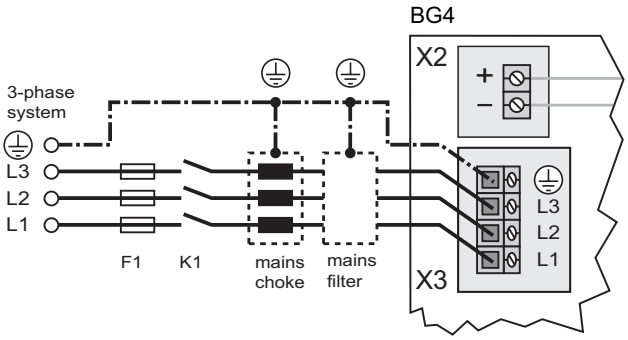


Fig. 3.18 Connection of BG4 to mains supply 3 x 230 V (JM-14xx) or 3 x 400 V (JM-14xx) depending on device version

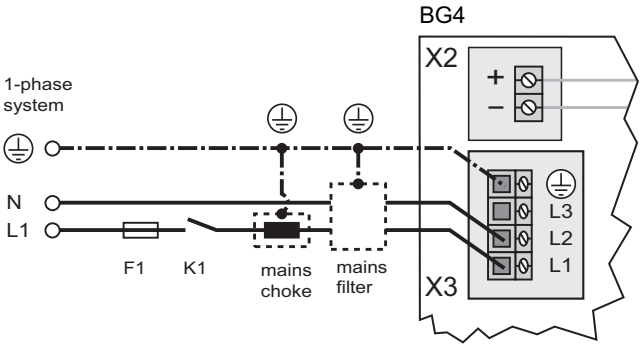


Fig. 3.19 Connection of BG4 to mains supply 1 x 230 V (JM-14xx)

Mains supply BG5

NOTE:

Before commissioning, the value of the mains voltage connected must be set on the servo amplifier (factory settings = 3 x 400 V AC).

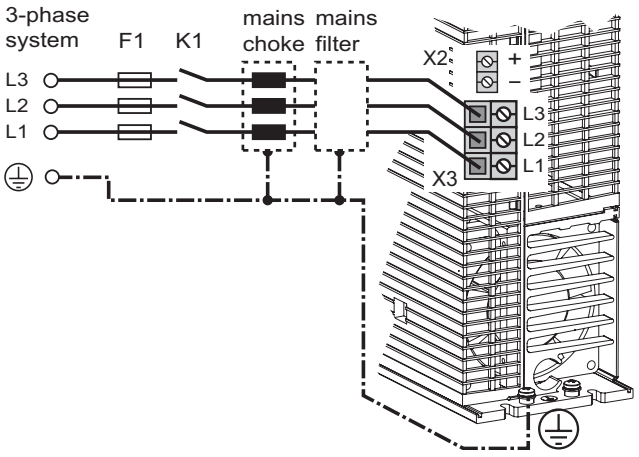


Fig. 3.20 Connection of BG5 to mains supply 3 x 400 V (JM-14xx) depending on device version

3.9 Control connections

Step	Action	Comment
1.	Check whether a complete device setup is already available, i.e. whether the drive has already been configured.	
2.	If this is the case, a special control terminal assignment applies. Please contact your project engineer to obtain the terminal assignment!	
3.	Choose a connecting assignment.	Initial commissioning
4.	Wire the control terminals with screened cables. The following is imperative: STO request X4/22, ENPO X4/10 and a start signal (with control via terminal).	Ground the cable shields over a wide area at both ends. Conductor sizes fixed: 0.2 to 1.5 mm² Flexible conductor sizes: - Ferrule without plastic sleeve: 0.2 to 1.5 mm² - Ferrule with plastic sleeve: 0.2 to 0.75 mm²
5.	Keep all contacts open (inputs inactive).	
6.	Check all connections again!	Continue with Commissioning , as described in section 4.

Note the following points:

- Always wire the control terminals with shielded cables.
- Keep a distance between the control wires and the mains power and motor cables.
- A cable type with double copper braiding, of 60 - 70% coverage, must be used for all screened connections.

3.9.1 Specification of control connections

Designation	Terminal	Specification of	Electrical isolation
Analog inputs			
ISA0+ ISA0- ISA1+ ISA1-	X4/3 X4/4 X4/5 X4/6	• U_{IN} = ±10 V DC • Resolution 12 Bit; R_{IN} approx. 101 kΩ • Terminal scan cycle in "IP mode" = 125 µs, otherwise = 1 ms • Tolerance: U ±1% of the measuring range end value	no
Digital inputs			
ISD00 ISD01 ISD02 ISD03 ISD04	X4/15 X4/16 X4/17 X4/18 X4/19	• Frequency range <500 Hz • Terminal scan cycle in = 1 ms • Switching level Low/High: ≤4.8 V / ≥18 V • $U_{IN\ max}$ = +24 V DC +20% • I_{IN} at +24 V DC = typ. 3 mA	yes
ISD05 ISD06	X4/20 X4/21	• Frequency range ≤500 kHz • Switching level Low/High: ≤4.8 V / ≥18 V • $U_{IN\ max}$ = +24 V DC +20% • $I_{IN\ max}$ at +24 V DC = 10 mA, R_{IN} approx. 3 kΩ • internal signal delay time < 2 µs suitable as trigger input for quick saving of actual position	yes
ENPO	X4/10	• Disable restart inhibit (STO) and enable output stage = high level • OSSD-capable • Reaction time approx. 10 ms • Switching level Low/High: ≤4.8 V / ≥18 V • $U_{IN\ max}$ = +24 V DC +20% • I_{IN} at +24 V DC = typ. 3 mA	yes
Digital outputs			
OSD00 OSD01 OSD02	X4/7 X4/8 X4/9	• No destruction in case of short-circuit (+24 V DC -> DGND), but device may briefly shut down. • I_{max} = 50 mA, PLC-compatible • Terminal scan cycle in = 1 ms • High-side driver	yes

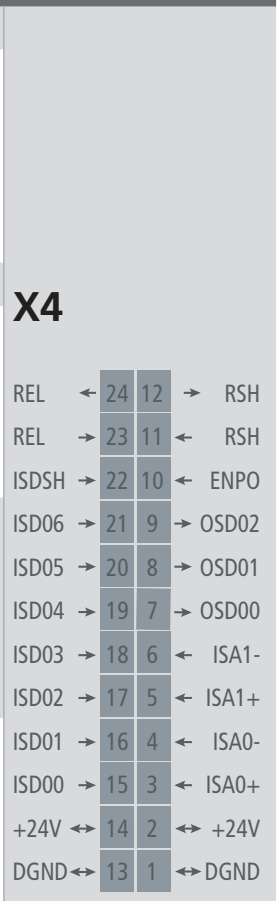


Table 3.7 Specification of control connections X4

Designation	Terminal	Specification of		Electrical isolation
STO "Safe Torque Off"				
ISDSH (STO)	X4/22	• "Request STO" input = Low level • OSSD-capable • Switching level Low/High: ≤4.8 V / ≥18 V • $U_{IN\ max}$ = +24 V DC +20% • I_{IN} at +24 V DC = typ. 3 mA		yes
RSH RSH	X4/11 X4/12	Diagnostics STO, both tripping channels active, one NO contact with automatically resetting circuit-breaker (polyswitch) • 25 V / 200 mA AC, cos φ = 1 • 30 V / 200 mA DC, cos φ = 1	X4/12 X4/11	yes
Relay outputs				
REL	X4/23 X4/24	Relay, 1 NO contact • 25 V / 1.0 A AC, cos φ = 1 (AC1) • 30 V / 1.0 A DC, cos φ = 1 (DC1) • Switching delay approx. 10 ms • Cycle time 1 ms	X4/23 X4/24	
Auxilliary voltage				
+24 V	X4/2 X4/14	• Auxiliary voltage output (U_H) for feeding the digital control inputs • $U_H = U_V - \Delta U$ (ΔU typically approx. 1.2 V), no damage in the event of short circuit (+24 V DC -> DGND), but device may briefly shut down. • I_{max} = 80 mA (per pin) with self-resetting circuit breaker (polyswitch)		yes
Digital ground				
DGND	X4/1 X4/13	Reference ground for +24 V DC		yes

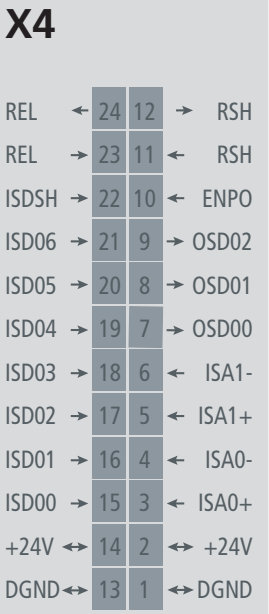


Table 3.7 Specification of control connections X4

3.9.2 Motor brake connection X13

The connector X13 is intended for the connection of a motor brake.

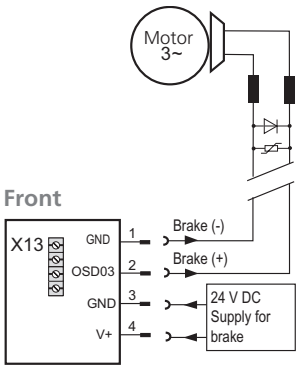
Designation	Terminal	Connection	Specification
OSD03 GND GND V+	X13/2 X13/1 X13/3 X13/4		• Short-circuit proof • External control supply +24 V DC (I_{IN} = 2.1 A) required via X13/3 (GND) and X13/4 (V+) • $U_{BR} = U_V - \Delta U`$ ($\Delta U`$ typically approx. 1.4 V) • To operate a motor holding brake up to I_{BR} = 2.0 A max. (for brakes with higher current requirements a relay must be interposed). • Overcurrent causes cyclic shutdown • Also usable as configurable digital output • Cable break monitoring can be deactivated < 200 mA typically in condition "1"

Table 3.8 Specification of the terminal connections X13

3.10 Specification of Ethernet interface

This interface is not required in the Jetter system. Teaching and parameter configuration is carried out via the control system and the bus system.

Specification of interface:

- Transfer rate 10/100 MBits/s BASE
- Line protocol IEEE802.3 compliant

3.11 Option 1

On the JM-1000, option 1 has EtherCAT as standard.

You will find all available options in the Jetter Industrial Automation catalog. More detailed information is available on request.

3.12 Option 2

Option 2 can be factory-configured with various technology options. Additional or special sensors can be evaluated using this option for example.

You will find all available options in the Jetter Industrial Automation catalog. More detailed information is available on request.

3.13 Sensor connection

All sensor connections are located on the top of the device.

Sensor connection of Jetter motors

Please use the ready made-up motor and sensor cables by Jetter AG to connect the Jetter synchronous motors (see accessories catalog).

Matching motor - sensor cable - servo amplifier

Compare the nameplates on the components. Make absolutely sure to use the correct components according to variant A, B or C!

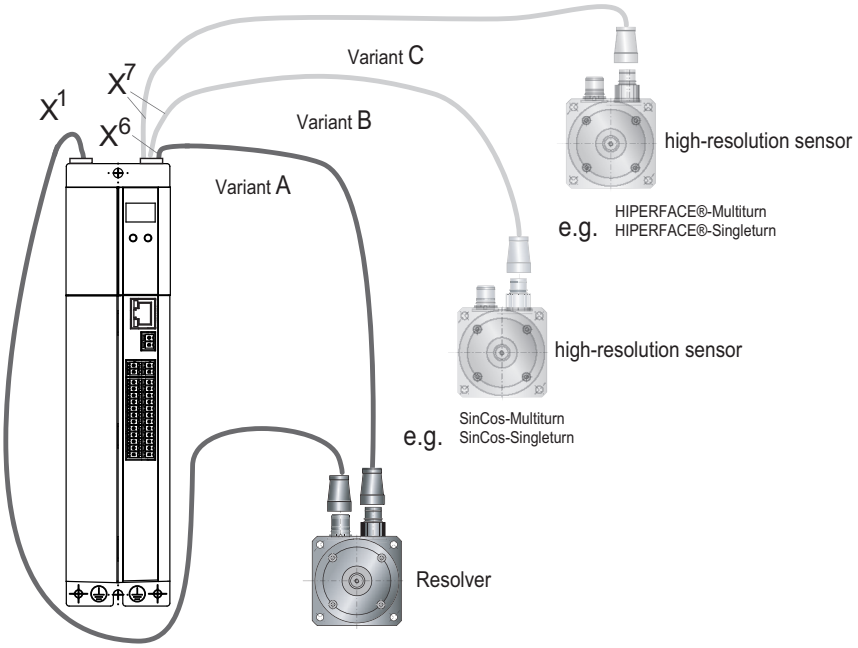


Fig. 3.21 Matching motor/sensor cable

NOTE:

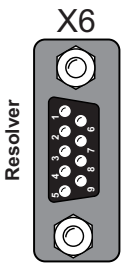
Do not split the sensor cable, e.g. to route the signals via terminals in the control cabinet. The knurled screws on the sub-D connector housing must be screwed tight!

	Motor (with installed sensor)	Sensor cable	Connection of the servo amplifier
Variant A with resolver without further options		See accessories catalog	X6
Variant B	SinCos multiturn sensor with SSI/EnDat interface	See accessories catalog	X7
	SinCos singleturn sensor with SSI/EnDat interface	See accessories catalog	X7
Variant C	SinCos singleturn sensor with HIPERFACE® interface	See accessories catalog	X7
	SinCos multiturn sensor with HIPERFACE® interface	See accessories catalog	X7

Table 3.9 Variants of motors, sensor type and sensor cable

3.13.1 Resolver connection X6

A resolver is connected to socket X6 (9-pin sub-D socket).

Fig.	X6/Pin	Function
	1	Sin+ / (S2) analog differential input track A
	2	Refsin / (S4) analog differential input track A
	3	Cos+ / (S1) analog differential input track B
	4	Supply voltage 5 ... 12 V, internally connected to X7/3
	5	ϑ+ (PTC, KTY, Klixon) internally connected to X7/10 [1)]
	6	R2 analog excitation
	7	R1 analog excitation (ground reference point for pin 6 and pin 4)
	8	Refcos / (S3) analog differential input B
	9	ϑ- (PTC, KTY, Klixon) internally connected to X7/9 [1)]

1) It is imperative you follow the ATTENTION note in Table 3.13 !

Table 3.10 Pin assignment of the X6 resolver connection

3.13.2 Connection of high-resolution sensor

The interface X7 enables evaluation of the following sensor types.

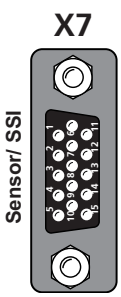
Fig.	Function
	SinCos sensor with zero pulse (e. g. Heidenhain ERN1381, ROD486
	Heidenhain Heidenhain SinCos sensor with EnDat interface (e. g. 13-bit singleturn sensor (ECN1313.EnDat01) and 25-bit multiturn sensor (EQN1325-EnDat01)
	Heidenhain sensor with digital EnDat interface Single- or multiturn sensor
	SinCos sensor with SSI interface (e. g. 13-bit singleturn and 25-bit multiturn sensor (ECN413-SSI, EQN425-SSI)
	Sick-Stegmann SinCos sensor with HIPERFACE® interface Single- and multiturn sensor, e.g. SRS50, SRM50

Table 3.11 Suitable sensor types on X7

NOTES:

- The usage of sensors not included in the range supplied by Jetter requires special approval by Jetter.
- The maximum signal input frequency is 500 kHz.
- Sensors with a power supply of 5 V ± 5% must have a separate sensor cable connection. The sensor cable detects the actual supply voltage at the sensor; it is then possible to compensate for the voltage drop on the cable. Only use of the sensor cable ensures that the sensor is supplied with the correct voltage. The sensor cable must always be connected.

Select the cable type specified by the motor or sensor manufacturer. During this process bear in mind the following:

- Always used shielded cables. Apply the shield on both sides.
- Connect the differential track signals A/B, R or CLK, DATA using via twisted wires.
- Do not split the sensor cable, e.g. to route the signals via terminals in the control cabinet.

X7 pin	SinCos and TTL	SinCos absolute encoder SSI/EnDat	Absolute encoder EnDat (digital)	Absolute encoder HIPERFACE®
1	A-	A-	-	REFCOS
2	A+	A+	-	+COS
3	+5 V DC ±5%, IOUT max = 250 mA (150 mA for hardware versions 0..1), monitoring via sensor cable7 to 12 V (typ. 11 V) max. 100 mA			
4	R+	Data +	Data +	Data +
5	R-	Data -	Data -	Data -
6	B-	B-	-	REFSIN
7	-	-	-	U_S - Switch
8	GND	GND	GND	GND
9	ϑ- (PTC, KTY, Klixon) internally connected to X6/9 [1]			
10	ϑ+ (PTC, KTY, Klixon) internally connected to X6/5 [1]			
11	B+	B+	-	+SIN
12	Sense +	Sense +	Sense +	U_S - Switch
13	Sense -	Sense -	Sense -	-
14	-	CLK+	CLK+	-
15	-	CLK -	CLK -	-

The sum of the currents tapped at X7/3 and X6/4 must not exceed the specified value!

After connecting pin 7 to pin 12, a voltage of 11.8 V is set at X7/3 and X6/4!

1) It is imperative you follow the ATTENTION note in Table 3.13!

Table 3.12 Pin assignment of the X7 terminal connection

NOTE:

The sensor supply at X7/3 is short-circuit proof on both 5 V and 11 V operation. The servo amplifier remains in operation such that on the evaluation of sensor signals a corresponding error message can be generated.

3.14 Motor connection

Step	Action	Comment
1.	Specify the cable cross-section dependent on the maximum current and ambient temperature.	Cable cross-section according to local and country-specific regulations and conditions.
2.	Connect the screened motor cable to terminals X1/ U, V, W and earth the motor on ⏚.	Connect screen at both ends to reduce interference emissions.
3.	Wire the motor temperature sensor and activate temperature evaluation using JetSym. See also related note.	Mount shield at both ends to reduce interference emission.

Motor temperature sensor		
	**ATTENTION!** The motor temperature sensor when connected to X5 must be designed with **basic insulation** in relation the motor winding and when connected to X6 or X7 must be designed with **reinforced insulation** as per EN 61800-5-1.	
X5	Temperature switch (Klixon), PTC	Sensor with basic insulation
X6	Temperature switch (Klixon), PTC, KTY	Sensor with increased insulation
X7	Temperature switch (Klixon), PTC, KTY	Sensor with increased insulation

Table 3.13 Configuration of the motor temperature sensor terminal

NOTE:
In the event of a short-circuit or ground fault in the motor cable, the output stage is disabled and an error message is issued.

3.14.1 Connection of the Jetter motors

We recommend the usage of pre-fabricated, tested servo cables for the connection and operation of Jetter servo motors. You will find an overview of all available motor and sensor cables in the accessories catalog.

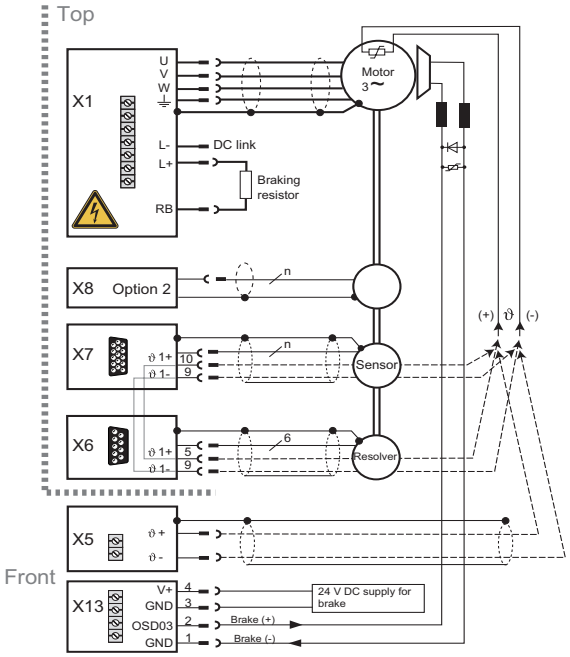


Fig. 3.22 Connection of motor BG3 to BG4

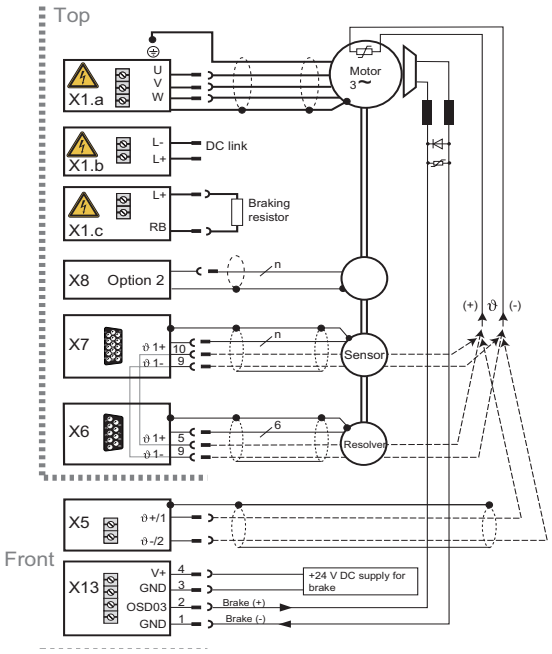


Fig. 3.23 Connection of motor BG5

ATTENTION!

DC linking of multiple servo amplifiers is **not** permitted!

NOTE:

Wires 5 and 6 (PTC) are required only for motors in which the motor PTC cannot be connected via the sensor cable. On Jetter motors with resolver, the PTC is connected via the resolver cable.

3.14.2 Switching in the motor cable

ATTENTION!

As a rule switching in the motor cable must take place with the power switched off and the output stage disabled, as otherwise problems such as burnt contactor contacts may occur.

To ensure unpowered switch-on, you must make sure that the contacts on the motor contactor are closed before the servo amplifier output stage is enabled. At the moment the contactor is switched off it is necessary for the contact to remain closed until the servo amplifier output stage is shut down and the motor current is 0. This situation is achieved by inserting appropriate safety times for switching of the motor contactor in the control sequence of your machine.

NOTE:

Despite these measures, the possibility cannot be ruled out that the servo amplifier may malfunction during switching in the motor cable.

3.15 Braking resistor (BR)

In regenerative operation, e.g. when braking the drive, the motor feeds energy back to the servo amplifier. This increases the voltage in the DC link. If the voltage exceeds a threshold value, the internal braking transistor is activated and the regenerated power is converted into heat by means of a braking resistor.

3.15.1 Protection in the event of a brake chopper fault

ATTENTION!

The error messages in the JM-1000 (also BC_FAIL as protection on errors in the brake chopper) are configured such that the relay output DO04 opens if a serious error occurs.

We recommend integrating the relay DO04 in the operation of the contactor for the 400 VAC supply to the JM-1000.

3.15.2 Configuration with integrated braking resistor (BG3+4+5)

The user manual only specifies the peak braking power for the servo amplifiers with integrated braking resistor (configuration JM-1xxx-xxR1xx). The permissible continuous braking power must be calculated. It depends on the effective loading of the controller in the corresponding application.

The servo amplifier is thermally designed in such a way that no energy input due to the internal braking resistor is permitted during continuous operation with continuous rated current and at maximum ambient temperature.

Consequently, a controller design featuring an integrated braking resistor is only appropriate if the effective servo amplifier load is ≤80 % or the braking resistor is designed for one-off emergency stop. In the event of an emergency stop, only the thermal capacity of the braking resistor can be used for a one-off braking action. The permissible energy W_{IBr} can be taken from the following table.

Device	Technology	Rated resistance R_{BR}	Peak braking power P_{PBr}	Pulse energy W_{IBr}	K1
JM-1206	Wire resistance	100 Ω	1500 W *1)*	150 Ws	120
JM-1404		420 Ω	1000 W *2)* 1300 W *3)* 1400 W *4)*	140 Ws	50
JM-1407		90 Ω	4700 W *2)* 6170 W *3)* 6500 W *4)*	6000 Ws	120
JM-1416		90 Ω	4700 W *2)* 6170 W *3)* 6500 W *4)*	6000 Ws	120

1) Data referred to 1 x 230 V AC mains voltage (BR switch-on threshold 390 V DC)
2) Data referred to 3 x 400 V AC mains voltage (BR switch-on threshold 650 V DC)
3) Data referred to 3 x 460 V AC mains voltage (BR switch-on threshold 745 V DC)
4) Data referred to 3 x 480 V AC mains voltage (BR switch-on threshold 765 V DC)
K1 = Factor for the calculation of the permissible continuous braking power

Table 3.14 Data of the integrated braking resistor (configuration JM-1xxx-xxR1xx)

If the drive is not permanently operated at its power limit, the reduced power dissipation of the drive can be used as braking power.

NOTE:

The following calculations assume that the servo amplifier is used at maximum permissible ambient temperature. This means that any additional energy input due to the internal braking resistor caused by a low ambient temperature is not taken into account.

Method to calculate the continuous braking power:

- Calculation of effective servo amplifier load in a cycle T:

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

- Determination of permissible continuous braking power based on unused drive power:

$$P_{DBr} = \left(1 - \frac{I_{eff}}{I_N}\right) \times K1$$

Marginal conditions

- A single braking action must not exceed the maximum pulse energy of the braking resistor.

$$W_{IBr} \geq P_{PBr} \times T_{Br}$$

- The continuous braking power calculated for the device must be greater than the effective braking power of a clock cycle.

$$P_{DBr} \geq \frac{1}{T} \times \int_0^T P_{PBr} dt_{Br}$$

This results in the minimum permissible cycle time T with calculated continuous braking power:

$$T = \frac{P_{PBr}}{P_{DBr}} \times \int_0^T dt_{Br}$$

The maximum total on-time of the braking resistor over a specified cycle time T with calculated continuous braking power:

$$T_{BrSum} = \frac{P_{PBr}}{P_{DBr}} \times T$$

ATTENTION!
No additional external braking resistor may be connected to servo amplifiers JM-1206 to JM-1416 with integrated braking resistor.

3.15.3 Connection of an external braking resistor

ATTENTION!

- Be sure to follow the installation instructions for the external braking resistor.
- The temperature sensor (bimetal switch) on the braking resistor must be wired in such a way that the output stage is deactivated and the connected servo amplifier is disconnected from the mains supply if the braking resistor overheats.
- The minimum permissible connection resistance of the servo amplifier must not be infringed. You will find the technical data in the **technical data sheet in the packaging or on the Jetter homepage**. For more detailed information see section A.2 on page 68.
- The braking resistor must be connected using a screened cable.

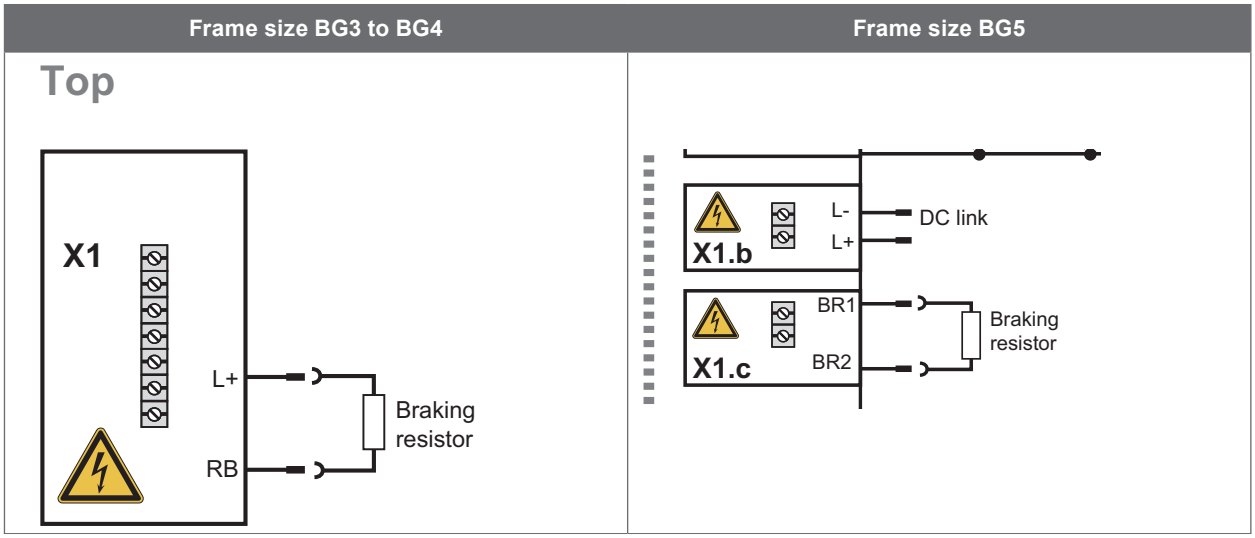


Fig. 3.24 Braking resistor - Connection

ATTENTION!

No additional external braking resistor is allowed to be connected to the servo amplifiers with integrated braking resistor of the frame size 3, 4 and 5.

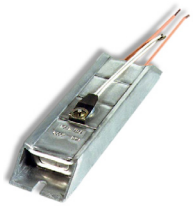
DANGER DUE TO VOLTAGE!

Danger of life! Never wire or disconnect electrical connections while these are live. Always disconnect the device from the mains before working on the device. Dangerously high voltages of ≥50 V may still be present 10 minutes after the power is cut (capacitor charge). So check the device for being de-energized!

ATTENTION!

The external braking resistor must be monitored by the control. The temperature of the braking resistor is monitored by a temperature watchdog (Klixon). In the event of overheating the servo amplifier must be disconnected from the mains supply.

Available braking resistors (excerpt)

Designation	Continuous braking power	Resistance[1)]	Peak braking power [2)]	Protection	Fig.
JBR-090.01.540-UR	35 W	90 Ω	6250 W	IP54	 Example: JBR-090.01.540-UR
JBR-090.02.540-UR	150 W		6250 W	IP54	
JBR-090.03.540-UR	300 W		6250 W	IP54	
JBR-090.10.650-UR	1000 W		6250 W	IP65	

1) Tolerance ±10%

2) The maximum possible braking power dependent on ON-time and cycle time

Table 3.15 Braking resistors - Technical data

NOTE:

The available braking resistors with the exact specifications, in particular the surface temperature, the maximum system voltage and dielectric strength at high voltages, are set out in the technical data sheet in the packaging or on the Jetter homepage.

Please consult your projecting engineer for more detailed information on the design of braking resistors.

4 Commissioning

4.1 Notes on operation

ATTENTION! Safety instructions:

During operation pay attention to the notes on safety in chapter "1 Safety"

During operation it is imperative you prevent ...

- Foreign objects or moisture entering the device
- Aggressive or conductive substances in the environment
- The covering of ventilation openings

Cooling:

- The device heats up during the operation and the temperature on the heat sink may reach 100 °C. Danger of burns on touching.
- Cooling air must be able to flow through the device without restriction.

4.2 Serial commissioning

An existing parameter dataset can be transferred to other JM-1000 servo amplifiers using JetSym. Details can be found in the JetSym help system.

4.3 Integrated control unit

The built-in control unit permits diagnostics of the JM-1000. The control unit comprises the following elements, all located on the front of the device:

- 2-digit 7-segment display (D1, D2)
- 2 buttons (T1, T2)

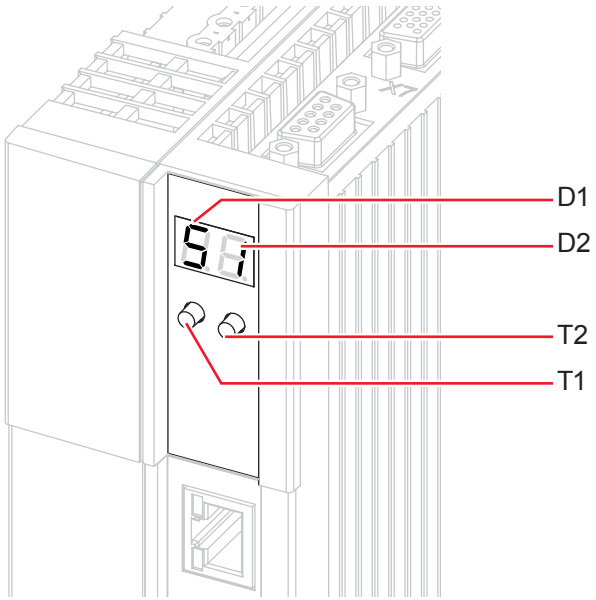


Fig. 4.1 Integrated control unit JM-1000

The following functions and indications are available:

- Indication of device state (see section 5.1 "Device states" on page 61)
  The device state is displayed after switching on the control voltage. If no input is made via the keypad for 60 seconds, the display switches back to the indication of the device state.
- Indication of device error state (see page 61)
  If a device error occurs the display immediately switches to the indication of the error code.

5 Diagnostics

The device states and error displays are indicated on the device by the 7-segment display on the integrated operator control unit.

5.1 Device states

Display	System status
	Device in reset state
	Self-initialisation on device startup
 *)	Not ready to switch on (no DC link voltage) [1]
 *)	Start inhibit (DC link in order, output stage not ready) [1]
	Ready (output stage ready)
	Switched on (drive powered on) [2]
	Drive ready (drive powered on and ready for setpoint input) [2]
	Quick stop [2]
	Error response active [2]

**) Not a "safe indication" as specified in EN 61800-5-2.*
STO (Safe Torque Off) function is active, display goes out when function is inactive.
2) The dot flashes when the output stage is active.

Table 5.1 Device states

5.2 Error display

The 7-segment display shows the specific error codes. Each error code comprises the alternating sequence ”Er” ►error number ►error location.

Display	Meaning
	Device error
↓ Display changes after approx. 1 s	
	Error number (decimal) Example: 05 = Overcurrent
↓ Display changes after approx. 1 s	
	Error location (decimal) Example: 01 = Hardware monitoring
↑ After approx. 1 s the display jumps to ER	

Table 5.2 Display of the error code

NOTE:

The errors can be reset in accordance with their programmed reaction (ER) or only via a +24 V DC reset (X2) (ER.). Errors marked with a dot can only be reset when the cause of the fault has been eliminated.

5.3 Error codes

NOTE:

You will find detailed information on the error codes and on error management under JM-1000 in the JetSym online help.

5.4 Hotline, support and service

Our hotline can provide you with fast, specific assistance if you have any technical queries relating to project planning or commissioning of the servo amplifier. Please collect the following information prior to making contact:

1. Type designation, serial number and software version of the devices (see software nameplate)
2. JetSym version used (menu ►Help ►About JetSym...)
3. Error code displayed (on 7-segment display or in JetSym)
4. Description of the error symptoms, how it occurred and relevant circumstances
5. Save device settings to file in JetSym
6. Name of company and contact, telephone number and e-mail address

The hotline is available Monday to Friday from 8 a.m. to 5 p.m. (CET), and can be accessed by telephone, e-mail or over the Internet:

Phone: +49 7141 2550-444
E-mail: hotline@jetter.de
Internet: http:/www.jetter.de ►Support

NOTE:

If you need more detailed assistance and advice, you will find all the services we offer in the Industrial Automation catalog. You can download the Industrial Automation catalog from the "Quicklinks" section of our website at http://www.jetter.de.

6 Safe Torque Off (STO)

NOTE:

You will find all information on the "STO" function in the 24-language document “Description of the STO Safety Function" (item no. 60879033).

Space for your own notes

A Appendix

A.1 Interference immunity of servo amplifiers

The maximum permissible output current of the servo amplifier and the peak current are dependent on the mains voltage, the motor cable length, the switching frequency of the output stage and the ambient temperature. If the conditions change, the maximum permissible current capacity of the servo amplifiers also changes.

JM-1000 for 1 x 230 V

Device	Switching frequency of output stage [kHz]	Ambient temperature max. [°C]	Continuous rated current I_N [A_{eff}] at 1 x 230 V	Peak current 200% (2 I_N) [A_{eff}]	Peak current 200% (2 I_N) for time [s]	Peak current 300% (3 I_N) [A_{eff}]	Peak current 300% (3 I_N) for time [s]
JM-1206	4	45	5.9	11.8	10	-	-
	8	40					
	16	40					

1) The switching frequency of the output stage changes to 4 kHz.
Data applies for a motor cable length ≤10 m. Maximum permissible motor cable length: 30 m.
All current ratings with recommended maisn choke.

Table A.1 Rated current and peak current of BG3 (1 x 230 V AC)

JM-1000 for 3 x 230 V

Device	Switching frequency of power stage [kHz]	Ambient temperature max. [°C]	Rated current I_N [A_{eff}] at 3 x 230 V	Peak current 200% (2 I_N) [A_{eff}]	Peak current 200% (2 I_N) for time [s]	Peak current 300% (3 I_N) [A_{eff}]	Peak current 300% (3 I_N) for time [s]
JM-1206	4	45	5.9	11.8	10	17.7	0.08
	8	40				17.7 [1)]	
	16	40				17.7 [1)]	

1) The switching frequency of the output stage changes to 4 kHz.
Data applies for a motor cable length ≤10 m. Maximum permissible motor cable length: 30 m.

Table A.2 Rated current and peak current of BG3 (3 x 230 V AC)

JM-1000 for 3 x 400 V

Device	Output stage switching frequency	Ambient temperature	Rated current I_N	Peak current			
				200 % I_N (2 I_N)		300 % I_N (3 I_N)	
	[kHz]	max. [°C]	[A_{eff}]	[A_{eff}]	for time [s]	[A_{eff}]	for time [s]
JM-1404	4	45	5.5	7.0	10 [2]	10.5	0.08 [2]
	8	40	3.5	7.0		10.5 [1]	
	16	40	2.2	4.4		6.6 [1]	
JM-1407	4	45	8.5	13.0	10 [2]	19.5	0.08 [2]
	8	40	6.5	13.0		19.5 [1]	
	16	40	4.0	8.0		12.0 [1]	
JM-1416	4	40	20	40	10 [2]	60	0.10 [2]
	8	40	16	32		38.2	
	16	40	9	18		22.8	

1) The switching frequency of the output stage changes to 4 kHz.
2) Shutdown as per I^2t characteristic
Data applies for a motor cable length ≤10 m. Maximum permissible motor cable length: 30 m.

Table A.3 Rated current and peak current of BG3 to BG5 (3 x 400 V AC)

JM-1000 for 3 x 460 V

Device	Switching frequency of power stage	Ambient temperature	Rated current I_N	Peak current			
				200% (2 I_N)		300% (3 I_N)	
	[kHz]	max. [°C]	[A_{eff}]	[A_{eff}]	for time [s]	[A_{eff}]	for time [s]
JM-1404	4	45	4.8	6.2	10 [2]	9.2 [1]	0.08 [2]
	8	40	3.5	7.0		10.5 [1]	
	16	40	1.3	2.6		3.9 [1]	
JM-1407	4	45	7.4	11.8	10 [2]	17.8	0.08 [2]
	8	40	6.5	13.0		19.5 [1]	
	16	40	2.4	4.8		7.2 [1]	
JM-1416	4	40	20	40	10 [2]	54.2 [1]	0.10 [2]
	8	40	15	26.1		-	
	16	40	6.5	12.2		-	

1) The switching frequency of the output stage changes to 4 kHz.
2) Shutdown as per I^2t characteristic
Data applies for a motor cable length ≤10 m. Maximum permissible motor cable length: 30 m.

Table A.4 Rated current and peak current of BG3 to BG5 (3 x 460 V AC)

JM-1000 for 3 x 480 V

Device	Switching frequency of power stage	Ambient temperature	Rated current I_N [A_{eff}]	Peak current			
				200% (2 I_N)		300% (3 I_N)	
	[kHz]	max. [°C]	at 480 V	[A_{eff}]	for time [s]	[A_{eff}]	for time [s]
JM-1404	4	45	4.6	6.0	10 2)	8.8 1)	0.08 2)
	8	40	2.6	5.2		7.8 1)	
	16	40	-	-		-	
JM-1407	4	45	7.0	11.2	10 2)	16.8	0.08 2)
	8	40	6.5	13.0		19.5 1)	
	16	40	1.9	3.8		5.7 1)	
JM-1416	4	40	20	40	10 2)	45.8 1)	0.1 2)
	8	40	14	24.4		-	
	16	40	6	10.3		-	

1) The switching frequency of the output stage changes to 4 kHz.
2) Shutdown as per I^2t characteristic
Data applies for a motor cable length ≤10 m. Maximum permissible motor cable length: 30 m.

Table A.5 Rated current and peak current of BG3 to BG5 (3 x 480 V AC)

A.2 Technical data of the JM-1000

Technical data \ Designation		JM-1206
Output, motor side		
Voltage		3 phase U_{Mains}
Continuous current effective (I_N)		5.9 A [1) 2)A)]
Peak current (2 x I_N / 3 x I_N)		See Tables A.1 and A.2
Rotating field frequency		0 ... 400 Hz
Switching frequency of output stage		4, 8, 16 kHz
Input, mains side		
Mains voltage		(1 x 230 V AC / 3 x 230 V AC) -20%/+15%
Device connected load (with mains choke)		2.6 kVA [1)]
Current consumption (with mains choke)	1 x 230 V AC	10.6 A
	3 x 230 V AC	6.5 A
Asymmetry of mains voltage		±3% max.
Permissible system frequency		50/60 Hz ±10%
Power dissipation at I_N		150 W [1)]
DC link		
Braking chopper switch-on threshold		390 V DC [1)]
DC link capacitance		1320 µF
Minimum ohmic resistance of an externally installed braking resistor		72 Ω [3)]
Continuous power of the brake chopper with external braking resistor		2.1 kW
Peak power of the brake chopper with external braking resistor		2.1 kW
Internal braking resistor		100 Ω [3)]
Continuous power of the brake chopper with internal braking resistor		Dependent on the effective loading of the servo amplifier in the corresponding application
Peak power of the brake chopper with external braking resistor		1500 W

1) Data referred to mains voltage 230 V AC and switching frequency 8 kHz,
2) For rated current refer to Table A.1 and Table A.2!
3) On configuration with integrated braking resistor (JM-1xxx-xxR1xx). Connection of an external braking resistor is not permitted.
4) Braking resistor is always integrated. Connection of an external resistor is permissible.

Table A.6 Technical data of the JM-1206

NOTE:

For more information on the switch-on threshold of the brake chopper also refer to section 3.15 on page 53.

JM-1404 and JM-1416

Designation / Technical data	JM-1404	JM-1407	JM-1416
Output, motor side[1)]			
Voltage	3 phase U_{Mains}		
Continuous current effective (I_N)	3.5 A [1) 2)]	6.5 A)	16 A [1) 2)A)]
Peak current (2 x I_N / 3 x I_N)	See Table A.3 and A.4 and A.5		
Rotating field frequency			
Switching frequency of output stage	4, 8, 16 kHz		
Input mains side			
Mains voltage	(3 x 400 V AC / 3 x 460 V AC / 3 x 480 V AC) ±10%		
Device connected load (with mains choke)	2.7 kVA [1)]	5.0 kVA [1)]	10.2 kVA [1)]
Current consumption (with mains choke)	3.9 A [1)]	7.2 A [1)]	16.8 A [1)]
Asymmetry of mains voltage	±3% max.		
Frequency	50/60 Hz ±10%		
Power dissipation at I_N	80 W [1)]	150 W [1)]	316 W [1)]
DC link			
Braking chopper switch-on treshold	650 V DC [1)]		
DC link capacitance	330 µ F	440 µ F	1120 µ F
Minimum ohmic resistance of an externally installed braking resistor	180 Ω [3)]	72 Ω [3)]	25 Ω [3)]
Continuous power of the brake chopper with external braking resistor	2.3 kW	5.9 kW	16.9 kW
Peak power of the brake chopper with external braking resistor	2.3 kW	5.9 kW	16.9 kW
Internal braking resistor	420 Ω [3)]	90 Ω [3)]	90 Ω [5)]

1) Data referred to mains voltage 400 V AC and switching frequency 8 kHz,

2) For rated current refer to Table A.3 and A.4 and A.5!

3) On configuration with integrated braking resistor (JM-1xxx-xxR1xx). Connection of an external braking resistor is not permitted.

4) Braking resistor is always integrated. Connection of an external resistor is permissible.

5) On configuration of BG5 with integrated braking resistor (JM-1xxx-xxR1xx). Connection of an external braking resistor is only permitted if int. braking resistor is disconnected. Parallel operation of both resistors is not permitted!

Table A.7 Technical data of the JM-1404 to JM-1416

Designation / Technical data	JM-1404	JM-1407	JM-1416
Continuous power of the brake chopper with internal braking resistor	Dependent on the effective loading of the servo amplifier in the corresponding application		
Peak power of the brake chopper with external braking resistor	1000 W [1]	4700 W [1]	4700 W [1]

1) Data referred to mains voltage 400 V AC and switching frequency 8 kHz,

2) For rated current refer to Table A.3 and A.4 and A.5!

3) On configuration with integrated braking resistor (JM-1xxx-xxR1xx). Connection of an external braking resistor is not permitted.

4) Braking resistor is always integrated. Connection of an external resistor is permissible.

5) On configuration of BG5 with integrated braking resistor (JM-1xxx-xxR1xx). Connection of an external braking resistor is only permitted if int. braking resistor is disconnected. Parallel operation of both resistors is not permitted!

Table A.7 Technical data of the JM-1404 to JM-1416

NOTE:

For more information on the switch-on threshold of the brake chopper also refer to section 3.15 on page 53.

A.3 Ambient conditions

Ambient conditions	JM-1000
Degree of protection	IP20 except terminals (IP00)
Accident prevention regulations	according to local regulations (in Germany e.g. BGV A3)
Installation altitude	Up to 1000 m above MSL, over 1000 m above MSL, with power reduction (1% per 100 m, max. 2000 m above MSL)
Pollution degree	2
Type of installation	Open-chassis unit, only for vertical installation in a control cabinet with min. degree of protection of IP4x, on using STO safety function: min. IP54

in transit	as per EN 61800-2, IEC 60721-3-2 class 2K3 [1]	
	Temperature	-25 °C to +70 °C
	Relative humidity	95 % at max. +40 °C
in storage	as per EN 61800-2, IEC 60721-3-1 classes 1K3 and 1K4 [2]	
	Temperature	-25 °C to +55 °C
	Relative humidity	5 to 95%

1) The absolute humidity is limited to max. 60 g/m³. This means that, at 70° C for example, the relative humidity may only be max. 40 %.

2) The absolute humidity is limited to max. 29 g/m³. This means that the maximum values for temperature and relative humidity stipulated in the table must not occur simultaneously.

3) The absolute humidity is limited to max. 25 g/m³. This means that the maximum values for temperature and relative humidity stipulated in the table must not occur simultaneously.

Table A.8 Ambient conditions of the JM-1000

in operation	as per EN 61800-2, IEC 60721-3-3 class 3K3 [3]	
	Temperature	-10 °C to +45 °C (4 kHz), up to 55 °C with power reduction (2%/°C) -10 °C to +40 °C (8, 16 kHz), up to 55 °C with power reduction (2%/°C)
	Relative humidity	5 to 85% without condensation

1) The absolute humidity is limited to max. 60 g/m³. This means that, at 70° C for example, the relative humidity may only be max. 40 %.

2) The absolute humidity is limited to max. 29 g/m³. This means that the maximum values for temperature and relative humidity stipulated in the table must not occur simultaneously.

3) The absolute humidity is limited to max. 25 g/m³. This means that the maximum values for temperature and relative humidity stipulated in the table must not occur simultaneously.

Table A.8 Ambient conditions of the JM-1000

Mechanical conditions	**JM-1000**		
Vibration limit in transit	as per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	**Amplitude [mm]**	**Acceleration [m/s²]**
	2 ≤ f < 9	3.5	Not applicable
	9 ≤ f < 200	not applicable	10
	200 ≤ f < 500	not applicable	15
Shock limit in transit	as per EN 61800-2, IEC 60721-2-2 class 2M1		
	Free falls height of packed device: maximum 0.25 m		
Vibration limit of the system[1]	as per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	**Amplitude [mm]**	**Acceleration [m/s²]**
	2 ≤ f < 9	0.3	not applicable
	9 ≤ f < 200	not applicable	1

1) Note: The devices are only designed for stationary use.

Table A.9 Mechanical conditions of the JM-1000

ATTENTION!

- No continuous vibration!
  The servo amplifiers must not be installed in areas where they would be permanently exposed to vibration.
- Control cabinet min. IP54 for STO!
  According to EN ISO 13849-2 the control cabinet must have degree of protection of IP54 or higher when using the STO (Safe Torque OFF) safety function.
- Observe cooling conditions!
  Forced cooling by external air flow necessary. Air must be able to flow unhindered through the device (air flow at least 1.2 m/s). If a temperature cut-out occurs, the cooling conditions must be improved.

A.4 UL certification

You will find a description of all additional measures for compliance with the UL approval in the document
"JM-1000_bi_ul508c-01_ul-user-information_en.pdf"
(item no.: 60880103)

Glossary

Symbols

A

B

C

D

E

F

H

I

J

L

M

N

O

P

Q

R

S

T

U

W

X

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