



User Manual

JetMove 3000 - Servo Amplifier

608880297

We automate your success

Item no.: 60880297

Revision 1.00

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The German version is the original of this user manual.

How to use this document

To be able to start using your new JM-3000 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-3000 servo amplifier very quickly and easily.	Quick start guide
 2.	Simply follow the step-by-step tables in the chapters.	Let's get started!

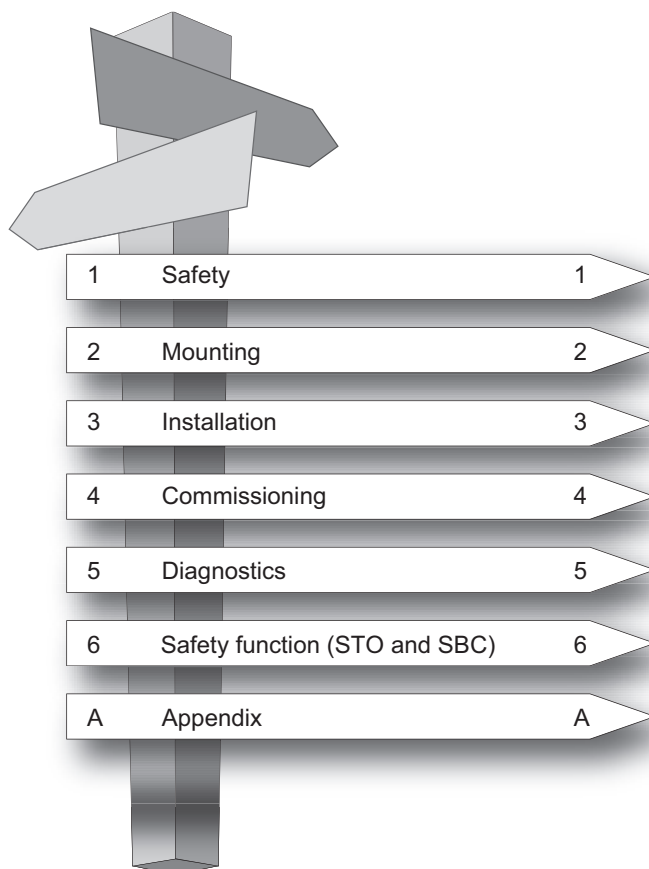
NOTE:

This user manual only describes the JM-3000 servo amplifiers. Information on the JSC-3000* safety controller and supply unit is provided in the respective user manuals.

** in preparation*

Association number of axes, continuous rated current and frame sizes

Servo amplifier with ...	Unit	BG1				BG2			
		Rated current $I_{N, eff}$ [A]				Rated current $I_{N, eff}$ [A]			
1 axis	A		6	12	18	-	-	24	32
2 axes	A	2 x 3	2 x 6	-	-	2 x 12	2 x 16	-	-
3 axes	A	3 x 3	3 x 6	-	-	3 x 12	-	-	-



Documentation for JM-3000

Document	Contents	Item no.	Format
JM-3000 Supply Unit User manual	Installation, mounting, safety, specification	60880299	PDF
JM-3000 Servo Amplifier User Manual	Installation, mounting, safety, specification	60880297	PDF
JM-3000-S1 User Manual	Description of the STO and SBC safety functions	60880300	PDF

¹⁾ in preparation

Related documents

Document	Contents	Item no.	Format
Industry catalogue	<ul style="list-style-type: none"> Overview and ordering information for: JM-1000, JM-1432, JM-3000 multi-axis system, configuration variant and accessories 		PDF

Order number code servo amplifier

The order designation 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.

JM	-		3	5	16	x	-	S1	Ix	Tx	Rx	Cx	Fx	Lx	Ax		
<div>= Single module D = Double output stage, e.g 2 x 3 A on one module T = Triple output stage, e.g 3 x 12 A on one module</div>			<div>3 = Series 3000</div>			<div>5 = DC 560 V of supply unit</div>			<div>01 ... 999 = Continuous rated current in ampere</div>			<div>Device revision (optional) = First version B = 1. Revision</div>					
<div>= No safety equipment S1 = ST0 (Safe Torque Off) + SBC (Safe Brake Control) S2 = expanded functional safety (e.g. SLS, SLT, ...) for encoder resolver and HIPERFACE DSL® ¹⁾</div>			<div>= Standard, EtherCAT (JX4-Jetter-Bus)</div>			<div>= No option TD = HIPERFACE DSL</div>			<div>= No braking resistor</div>			<div>= Standard, air cooling C1 = Coldplate</div>					
<div>= Standard</div>			<div>= No protective lacquer (standard) L1 = Protective lacquer</div>			<div>Ax = Current hardware revision A0 = Hardware revision 0 A1 = Hardware revision 1 A2 = Hardware revision 2 ...</div>											

1) in preparation

¹⁾ in preparation

Fig. 0.1 Order number code JM-3000 servo amplifier

Data of manufacturer

On the nameplate of the JM-3000 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-3000 refer to Fig. 0.3 on page 6 and Fig. 0.4 on page 7.

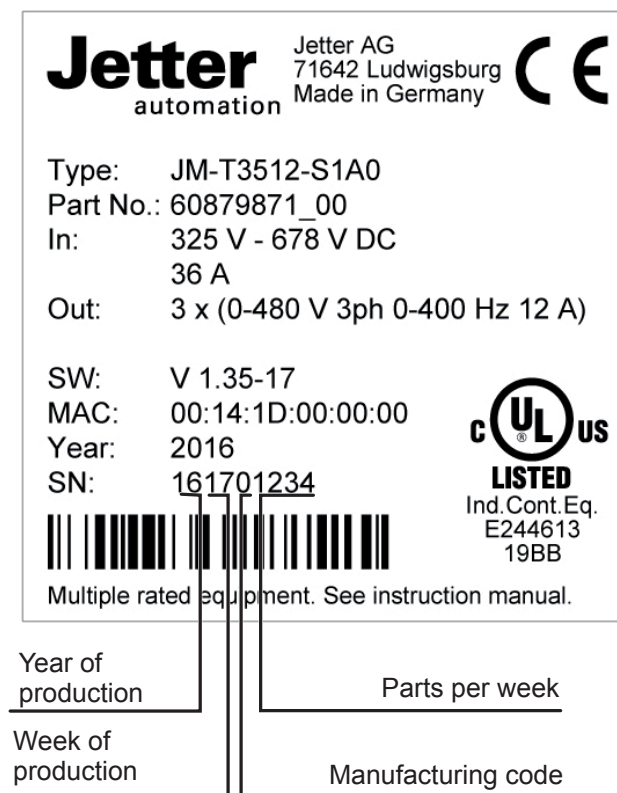


Fig. 0.2 Nameplate hardware JM-3000

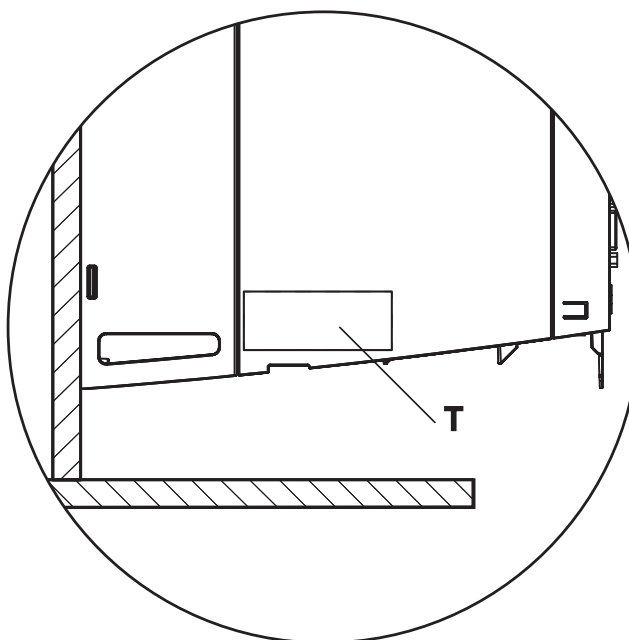


Fig. 0.3 Nameplate hardware JM-3000 (T)

A second nameplate (T1) which only contains the most important particulars is located on the top of the busbar cover. As a result, the nameplates are also visible when the devices are installed in a row.

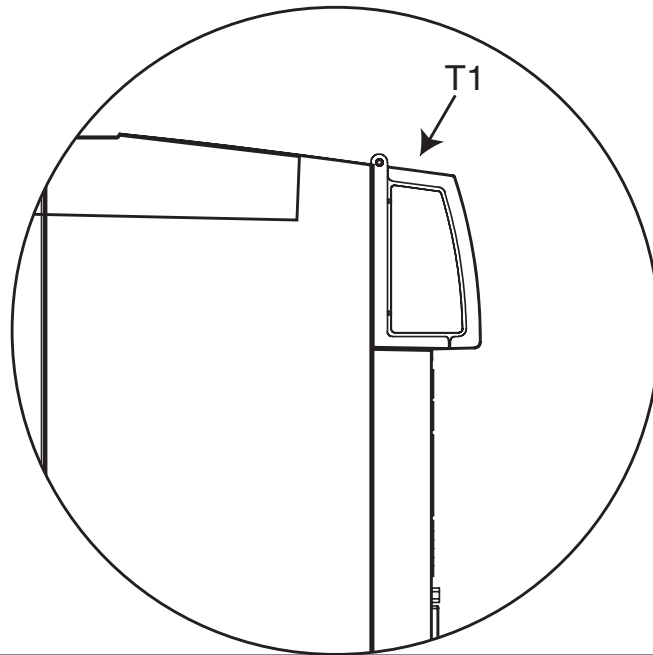


Fig. 0.4 Nameplate hardware JM-3000 (T1)

Scope of delivery

The scope of delivery includes:

- JM-3000 servo amplifier
- Pre-fabricated connecting cables for cross-communication and EtherCAT
- Pre-installed busbar elements for 24 V control supply (U_{st}) and DC link supply (U_{zk})
- Mating connector
- 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 chapter 1.1)



ATTENTION!

Incorrect operation may result in damage to the drive or in malfunctions.



DANGER DUE TO HIGH VOLTAGE!

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.

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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!

- Implementation should only start when you have understood these instructions.



Electric motion systems are always dangerous:

- Electrical voltages of 400 V AC or 565 V DC to 480 V AC or 678 V DC
- Dangerously high voltages of ≥ 50 V may still be present 3 minutes after the power is cut (capacitor charge). Therefore, ensure that the device is voltage-free!
- Note the warning sign on the device (see front of the device).



Protection from hot surfaces:

Temperatures up to 100 °C can occur at the heat sink of the device. Adjacent components, in particular those above the heat sink, can be damaged as a result. Burns can occur on contact.

- Keep sufficient distance to neighboring components!
- Ensure that there is suitable touch protection at the heat sink.



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 danger.
 - 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).



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 conductor connections 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 instructions.

Warning symbols	Hazard classification to ANSI Z 535	Risk due to non-compliance
	Danger!	Means that death or serious physical injury will occur if the relevant precautions are not taken.
	Warning!	Means that death or serious physical injury may occur if the relevant precautions are not taken.
	Caution!	Means that damage to property or minor physical injury may occur if the relevant precautions are not taken.
	Danger due to high voltage!	Death or serious physical injury will occur if the relevant precautions are not taken.
	Caution hot surface!	Means that damage to property or minor physical injury may occur if the relevant precautions are not taken.

Table 1.1 Warning symbols explanation

1.3 Intended use

The JM-3000 servo amplifiers are components designed for installation in industrial and commercial plants and machines. Installation is only permitted in stationary equipment.

The JM-3000 multi-axis system consists at least of 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 installed in machines, the commissioning of the servo amplifiers (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. Commissioning (i.e. start-up of intended operation) is only permitted in compliance with the EMC Directive (2004/108/EC).



CAUTION!

In accordance with EN ISO 13849-2, the control cabinet must have a degree of protection of IP54 or higher when the STO (Safe Torque OFF) safety function is used.



The JM-3000 servo amplifiers comply with the Machinery Directive 2006/42/EC. They have been tested and certified according to applicable standards (see Declaration of conformity).

1.4 Unintended use

The use of servo amplifiers outside of a control cabinet is not permitted.

In addition, they may not be used for unrelated purposes, for example for the creation of higher-frequency wiring systems from a DC battery.

Their use when connected to third-party supply units of other manufacturers is also prohibited.

1.5 EC declaration of conformity

In accordance with Machinery Directive 2006/42/EC

Konformitätserklärung *Declaration of Conformity*

Jetter

Hersteller
Manufacturer

Jetter AG
Gräterstr. 2
D-71642 Ludwigsburg

Geräteart / Model: Servoverstärker inkl. Option S1 / *Servoamplifier incl. option S1*

Produkt / Product: Serie JM-35xx-S1A0 / *Product family JM-35xx-S1A0*
 Serie JM-35xx-S1TDA0 / *Product family JM-35xx-S1TDA0*
 Serie JM-D35xx-S1A0 / *Product family JM-D35xx-S1A0*
 Serie JM-T35xx-S1A0 / *Product family JM-T35xx-S1A0*

Die aufgeführten Produkte entsprechen unter Beachtung der zugehörigen Produktdokumentation den folgenden EG-Richtlinien und Normen.

The listed products comply with the following EU Directives and standards provided the appurtenant product documentation is observed during installation.

- EG-Richtlinien
EU directives
 - 2006/42/EG Maschinen-Richtlinie und Ergänzungen
Machinery directive and amendments
- Harmonisierte, internationale oder nationale Normen
Harmonized, international or national standards
 - DIN EN ISO 13849-1:2008 +AC:2009
Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - allgemeine Gestaltungsleitsätze
Safety of machinery - safety-related parts of control systems - general principles for design
 - DIN EN 61800-3:2004 + A1:2012
Drehzahlveränderbare elektrische Antriebe - EMV-Anforderungen einschließlich spezieller Prüfverfahren
Adjustable speed electrical power drive systems - EMC requirements and specific test methods
 - DIN EN 60204-1:2006/A1:2009
Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Allgemeine Anforderungen
Safety of machinery - electrical equipment of machines - general requirements
 - DIN EN 62061:2005
Sicherheit von Maschinen - Funktionale Sicherheit sicherheitsbezogener elektrischer, elektronischer und programmierbarer elektronischer Steuerungssysteme
Safety of machinery - functional safety of safety-related electrical, electronic and programmable electronic control systems
 - DIN EN 61800-5-1:2007
Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Anforderungen an die Sicherheit - Elektrische, thermische und energetische Anforderungen
Adjustable speed electrical power drive systems - safety requirements - electrical, thermal and energy

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Konformitätserklärung *Declaration of Conformity*

Jetter

DIN EN 61326-3-1:2009

Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 3-1: Störfestigkeitsanforderungen für sicherheitsbezogene Systeme und für Geräte, die für sicherheitsbezogene Funktionen vorgesehen sind (Funktionale Sicherheit)

Electrical equipment for measurement, control and laboratory use - EMC requirements - immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety)

DIN EN 61800-5-2:2007

Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Anforderungen an die Sicherheit - Funktionale Sicherheit

Adjustable speed electrical power drive systems - safety requirements - functional

IEC 61508-1:2010 * IEC 61508-2:2010 * IEC 61508-3:2010 * IEC 61508-4:2010 *

IEC 61508-5:2010 * IEC 61508-6:2010 * IEC 61508-7:2010

Funktionale Sicherheit sicherheitsbezogener elektrischer/elektronischer/programmierbarer elektronischer Systeme

Functional safety of electrical/electronic/programmable electronic safety-related systems

Die Inbetriebnahme der genannten Produkte ist so lange untersagt, bis das Produkt in die Maschine eingebaut wird und den zutreffenden Richtlinien entspricht. Die Informationen und Anweisungen in der Dokumentation des gelieferten Produkts sind zusätzlich zu beachten.

It is prohibited to bring the named products into service until it is integrated in the machine and conforms to the relevant directives. The information and instructions contained in the product documentation must also be observed.

Zur Zusammenstellung technischer Unterlagen bevollmächtigte Person
Authorised person for compiling technical files

Jetter AG, Gräterstr. 2, D-71642 Ludwigsburg

Jahr der CE-Kennzeichnung / Year of CE marking: 2015

EG-Baumusterprüfung / EC type examination

Benannte Stelle / *Notified body*: TÜV Rheinland Industrie Service GmbH
Alboinstr. 56
12103 Berlin-Schönefeld

Kenn-Nr. / *Identification no.*: 0035

Bescheinigungs-Nr. / *Certificate no.*: 01/205/5466.00/15

Anschrift / *Address*: Gräterstr. 2
71642 Ludwigsburg

Ort und Datum / *Date & place*: Ludwigsburg, 03.12.2015

Unterzeichner / *Signed by*: Christian Benz
Vorstandsvorsitzender / CEO



1.6 Responsibility

Electronic devices are not fail-safe as a rule. 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 0113-1 "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 (in accordance with EN 60204) leads to the power supply unit of the motion systems being switched off, which means that the drives coasts to a stop in an uncontrolled manner. To ward off dangers, it is useful to make provision for an emergency stop function, which keeps individual motion systems running or initiates specific safety sequences. Emergency stop means that movement is stopped using Voltage Off or Safe Torque Off (STO).

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 DIN EN ISO 12100:2011-03 (previously EN 14121), and is determined in accordance with EN ISO 13849-1 (previously DIN EN 954-1), "Safety of machines - General principles for design - Risk assessment and risk reduction" by selecting the circuit category.

1.7 Maintenance

Procedures for the maintenance of the device are not required. In the event of a fault, the device must be replaced and returned to the manufacturer.

1.8 Repair

Repairs may only be carried out by authorized repair workshops. Unauthorized opening and incorrect intervention could lead to death, physical injuries and damage to property. The warranty provided by Jetter is rendered void.

2 Installation

2.1 Notes on installation

**STRICTLY AVOID THAT ...**

- Moisture enters into the device,
- Drill chippings, screws or foreign bodies fall into the device.

Note the following points:

- The device is only intended for installation in a stationary control cabinet. The control cabinet must at least comply with IP44 degree of protection. In accordance with EN ISO 13849-2, the control cabinet must have a degree of protection of IP54 or higher when the safety functions (STO and SBC) are used in the servo amplifier.
- The servo amplifiers must not be installed in areas where they would be exposed to continuous vibration. You will find more information in the Appendix.
- Maximum pollution degree 2 in accordance with EN 60664-1. You will find further information on environmental conditions in the Appendix.
- To attain the best result for effective EMC installation, use a chromated or galvanized panel. If panels are varnished, remove the coating from the contact area! The devices themselves have a blue chromated zinc frame.

NOTE:

For the installation of servo amplifiers within the axis group, it is imperative that the instruction handbooks of the other devices (supply unit, control system) are observed.

2.1.1 Sequence and layout

The following general guidelines apply for the layout and installation of the servo amplifiers or supply unit:

Butt mounting and orientation

- The devices can be installed directly next to each other without any gaps between them. They are mounted on the panel using two/four screwed connections. Control and power are supplied to the servo amplifier (JM-3000) via the DC link and the 24 V DC busbar from the supply unit (JM-3000). With the same cooling concept, this is possible without additional compensation measures or device depth.
- The devices must be butt mounted in the prescribed order as shown in Fig. 2.1. A different order is not permitted, as this causes problems with the busbar and mutual thermal effects.

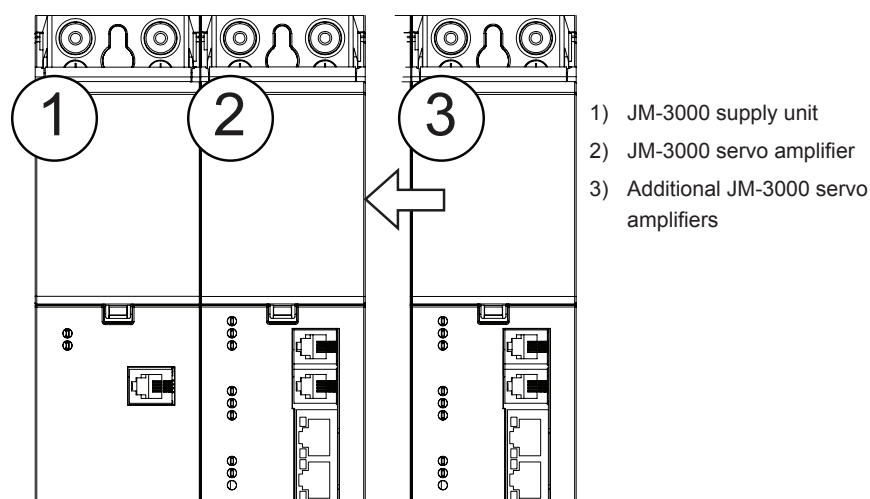


Fig. 2.1 Order of butt mounting



CAUTION! Hot surfaces

Protection from hot surfaces during operation. Temperatures up to 100 °C can occur at the back of the housings. Please ensure there is sufficient distance to neighboring components, in particular above the heat sink.



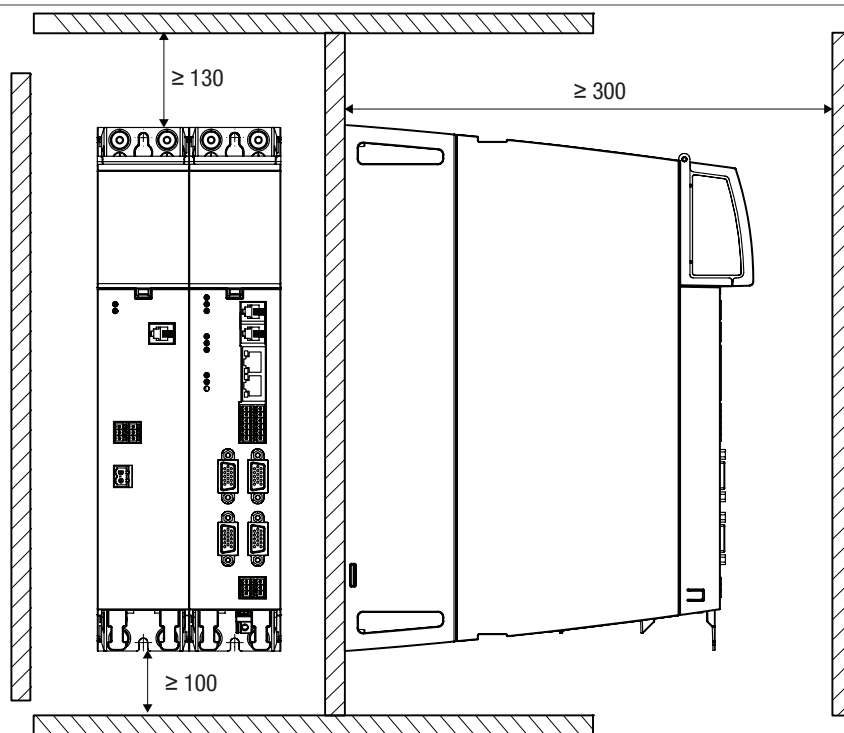
CAUTION!

Protection from hot surfaces during operation. Ensure that there is suitable touch protection at the heat sink.

2.2 Mounting clearances

**CAUTION!**

The minimum distance specified in Fig. 2.1 for above, below and in front applies to all devices (JM-3000 supply unit and JM-3000 servo amplifier). The distance above is important to avoid heat build-up, the distance below and in front is important to facilitate correct cable guidance.



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

Fig. 2.2 Installation distances JM-3000

2.3 Cooling of devices

Cooling air must be able to flow through the device (interior and heat sink) without restriction. On installation in switch cabinets with natural convection (= heat loss is discharged to the outside via the control cabinet walls), always mount an internal air circulation fan. If a temperature cut-out occurs, the cooling conditions must be improved.

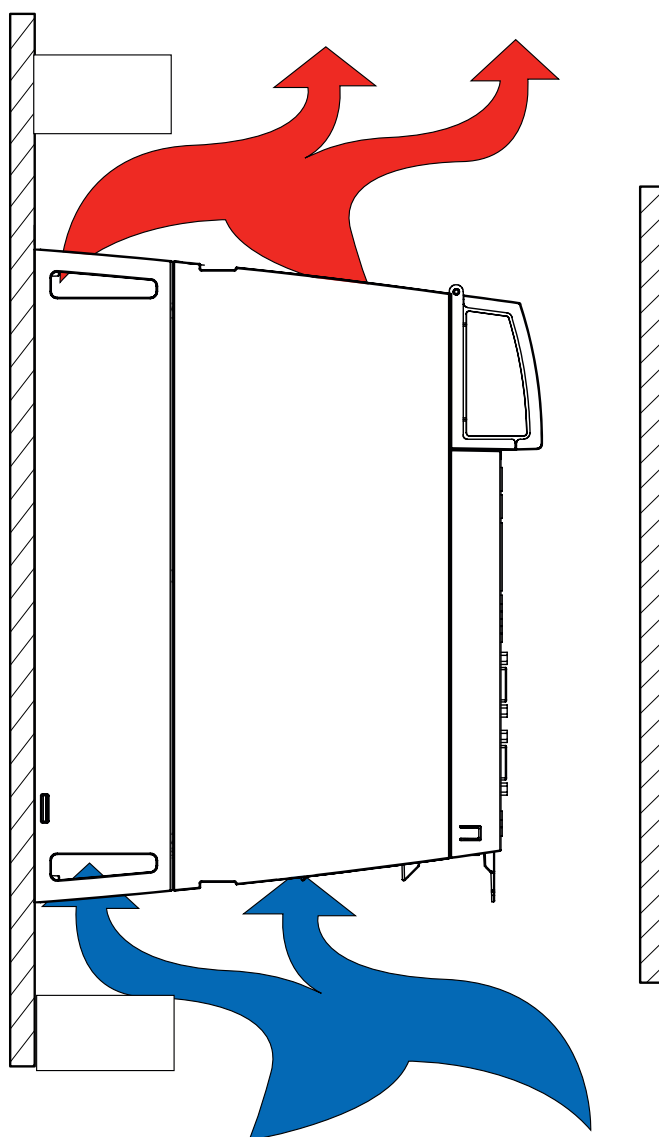





Fig. 2.3 Cooling air flows through the device without restriction

2.4 Device installation for wall mounting

Step	Action	Comment
 1.	<p>Arrange the devices on the panel in accordance with Fig. 2.1.</p> <p>Align all devices of the multi-axis group on a line along the upper edge of the device.</p>	This is necessary to carry out the DC link connection to the rails.
 2.	<p>Mark out the position of the tapped holes on the panel.</p> <p>Drill holes into the panel and tap a thread for each fixing screw.</p>	<p>The bending radius of the connecting cables must be taken into account!</p> <p>Hole distances and dimensional drawings see Table 2.1 Fig. 2.4 and Fig. 2.5</p>
 3.	<p>Mount the servo amplifier vertically on the panel, butt mounted with the supply unit.</p>	The contact area must be bare metal and conductive.

2.4.1 Dimensions configuration wall mounting

JM-3000	BG1	BG2
	JM-D3503 JM-T3503 JM-3506 JM-D3506 JM-T3506 JM-3512 JM-3518	JM-D3512 JM-T3512 JM-D3516 JM-3524 JM-3532
Weight [kg]	2.7 kg	4.5 kg
H (height) ¹⁾	310	
H1	299	
H2	6	
B (width)	55	110
T (Depth)	241	
T1	222	
A	27.5	27.5
Lateral distance	For direct butt mounting	
C (screws)	2 x M4	4 x M4
<i>All dimensions in mm</i>		
<i>Drawing see Fig. 2.3 and Fig. 2.5</i>		

Table 2.1 Dimensions and installation distances

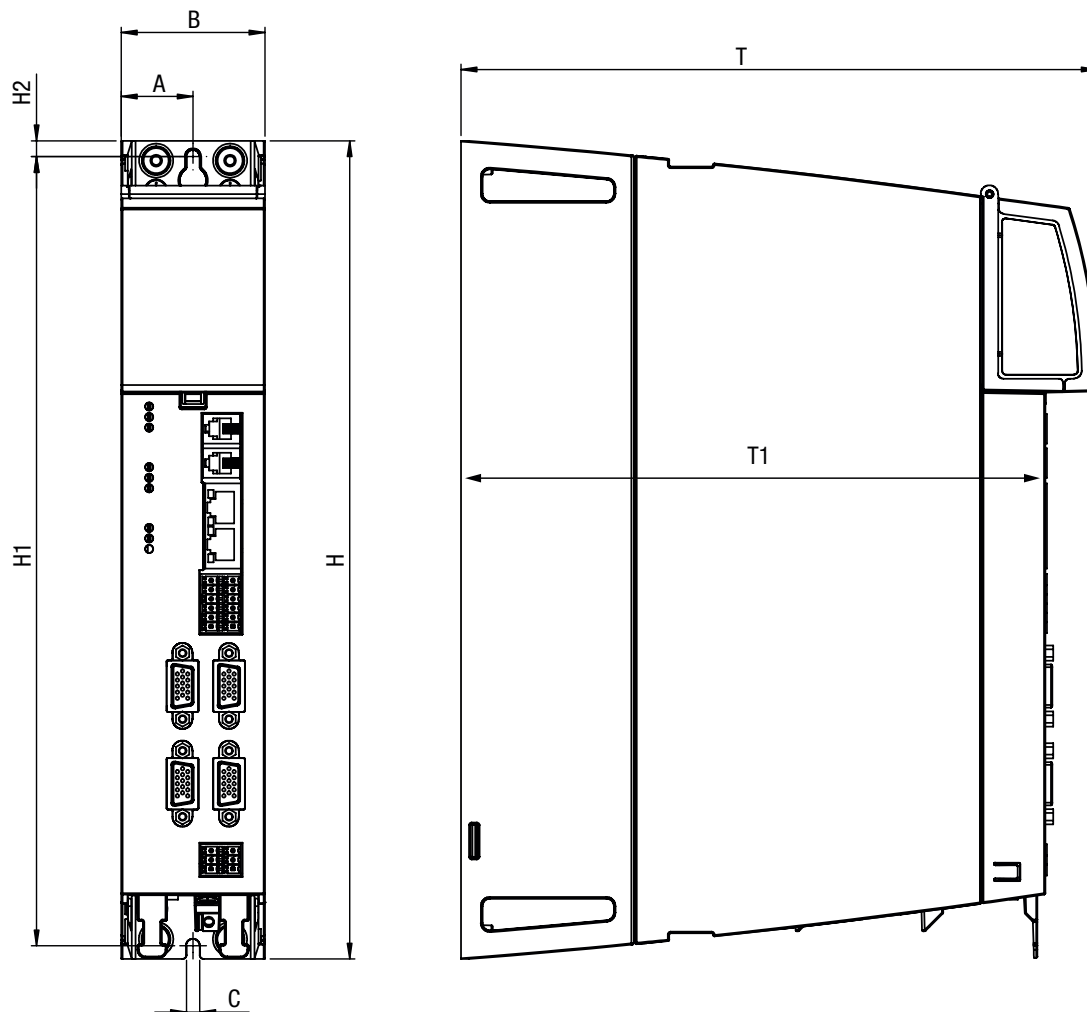


Fig. 2.4 Dimensional drawing JM-3000 servo amplifier BG1 (dimensions see Table 2.1)

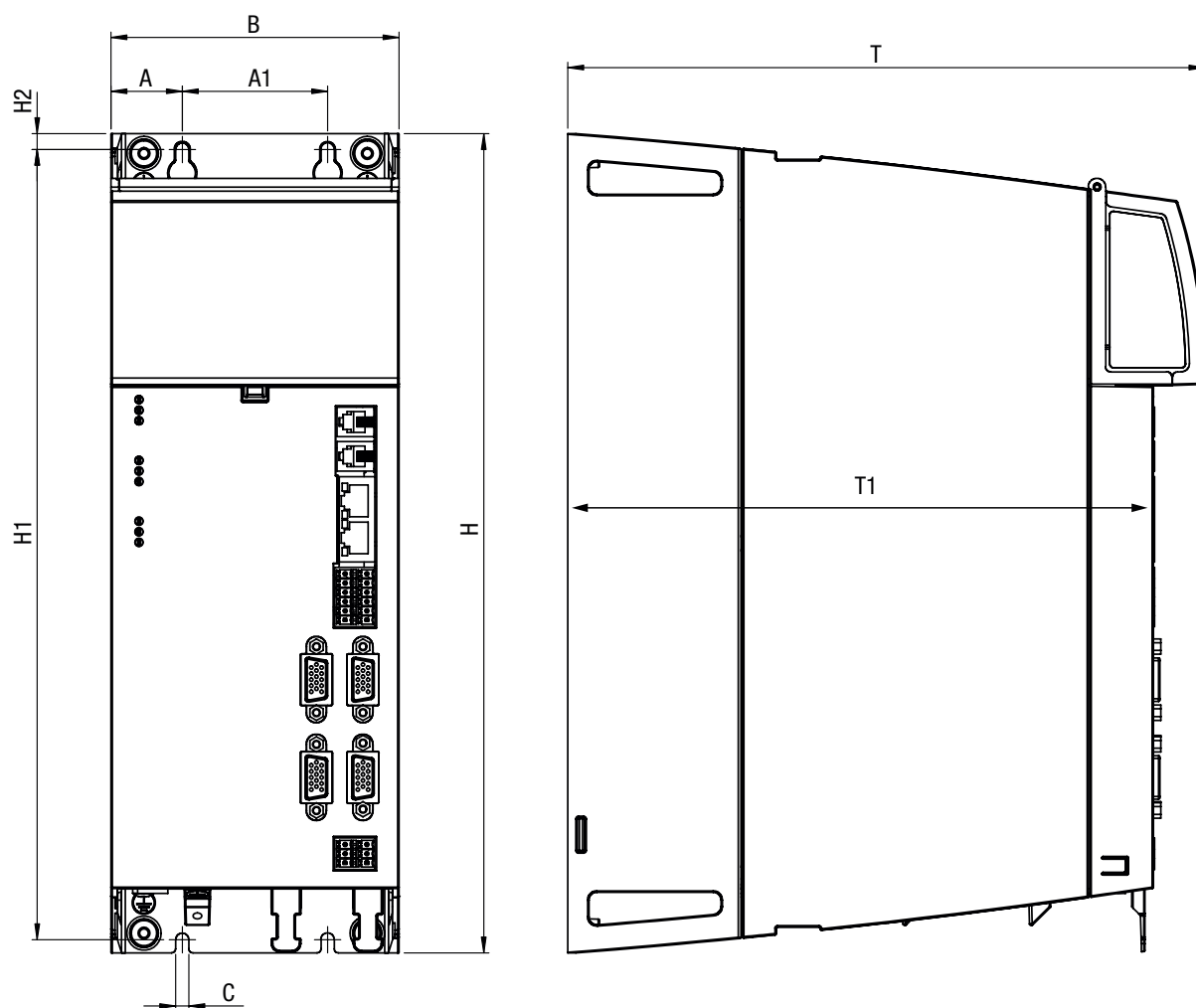





Fig. 2.5 Dimensional drawing JM-3000 servo amplifier BG2 (dimensions see Table 2.1)

2.5 Installation of devices for Coldplate

Step	Action	Comment
 1.	Arrange the devices on the panel in accordance with Fig. 2.1. Align all devices of the multi-axis group on a line along the upper edge of the device.	This is necessary to carry out the DC link connection to the rails. See Table 2.1 for the mounting clearances.
 2.	Mark out the position of the tapped holes on the cooler provided. Drill holes into the cooler and tap a thread for each fixing screw.	The bending radius of the connecting cables must be taken into account! Hole distances and dimensional drawings see Table 2.1.
 3.	The heat conductive foil is already glued to the back wall of the Coldplate devices. Butt mount the devices vertically on the cooler. Tighten the screws evenly, so that the thermal resistance remains as low as possible.	Ensure that the surface of the cooler is free from drill chippings or other contamination.
The next steps for the electrical installation are listed in chapter 3.		

2.5.1 Dimensions configuration wall mounting

JM-3000	BG1	BG2
	JM-D3503 JM-T3503 JM-3506 JM-D3506 JM-T3506 JM-3512 JM-3518	JM-D3512 JM-T3512 JM-D3516 JM-3524 JM-3532
Weight [kg]	2.3 kg	3.7 kg
H (height)	310	
H1	299	
H2	6	
B (width)	55	109
T (Depth)	188.5	
T1	170	
A	27.5	27.5
Lateral distance	For direct butt mounting	
C (screws)	2 x M4	4 x M4

All dimensions in mm

Drawing see Fig. 2.3 and Fig. 2.5

Table 2.2 Dimensions and installation distances

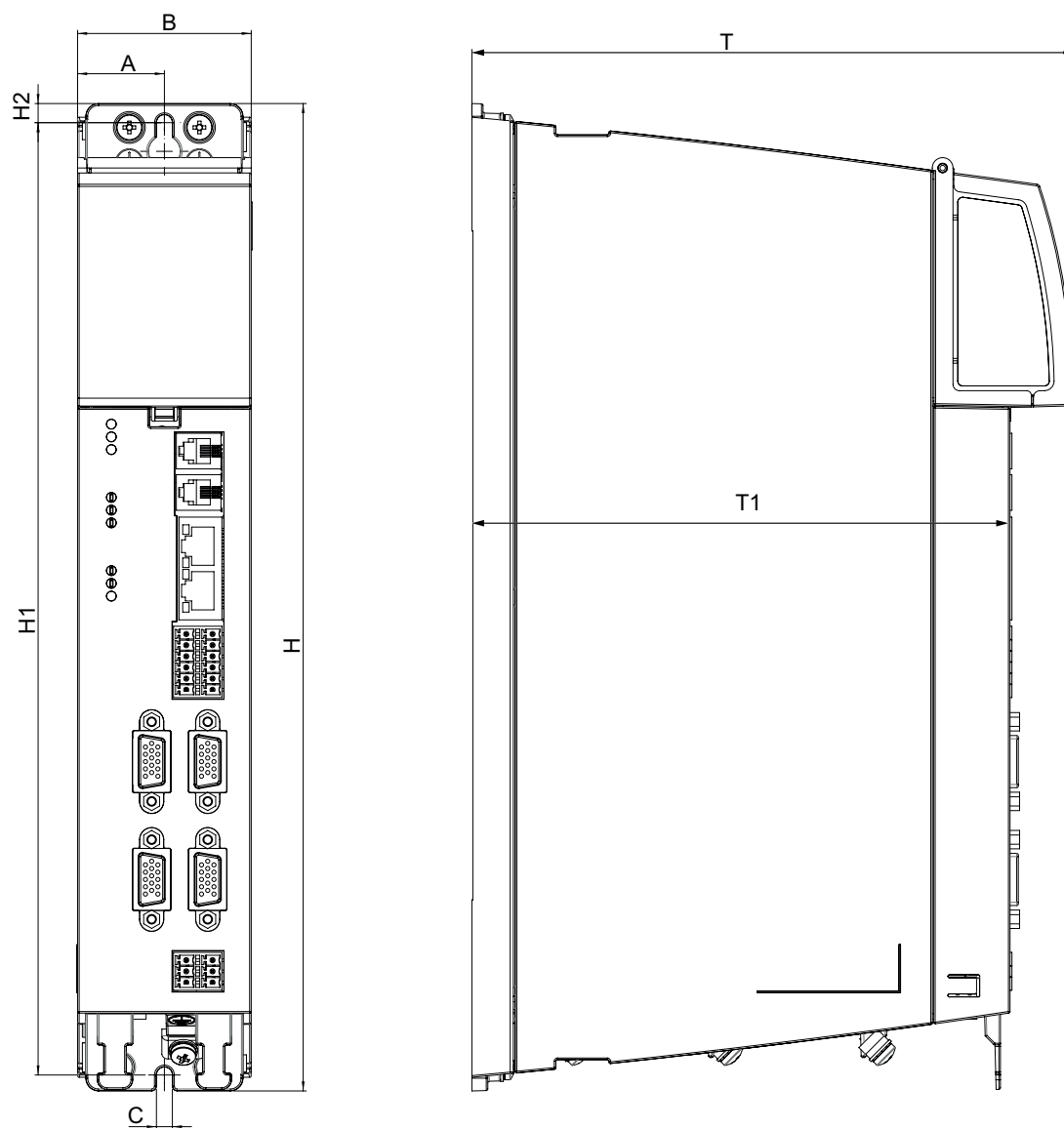


Fig. 2.6 Dimensional drawing JM-3000 servo amplifier BG1 Coldplate (dimensions see Table 2.2)

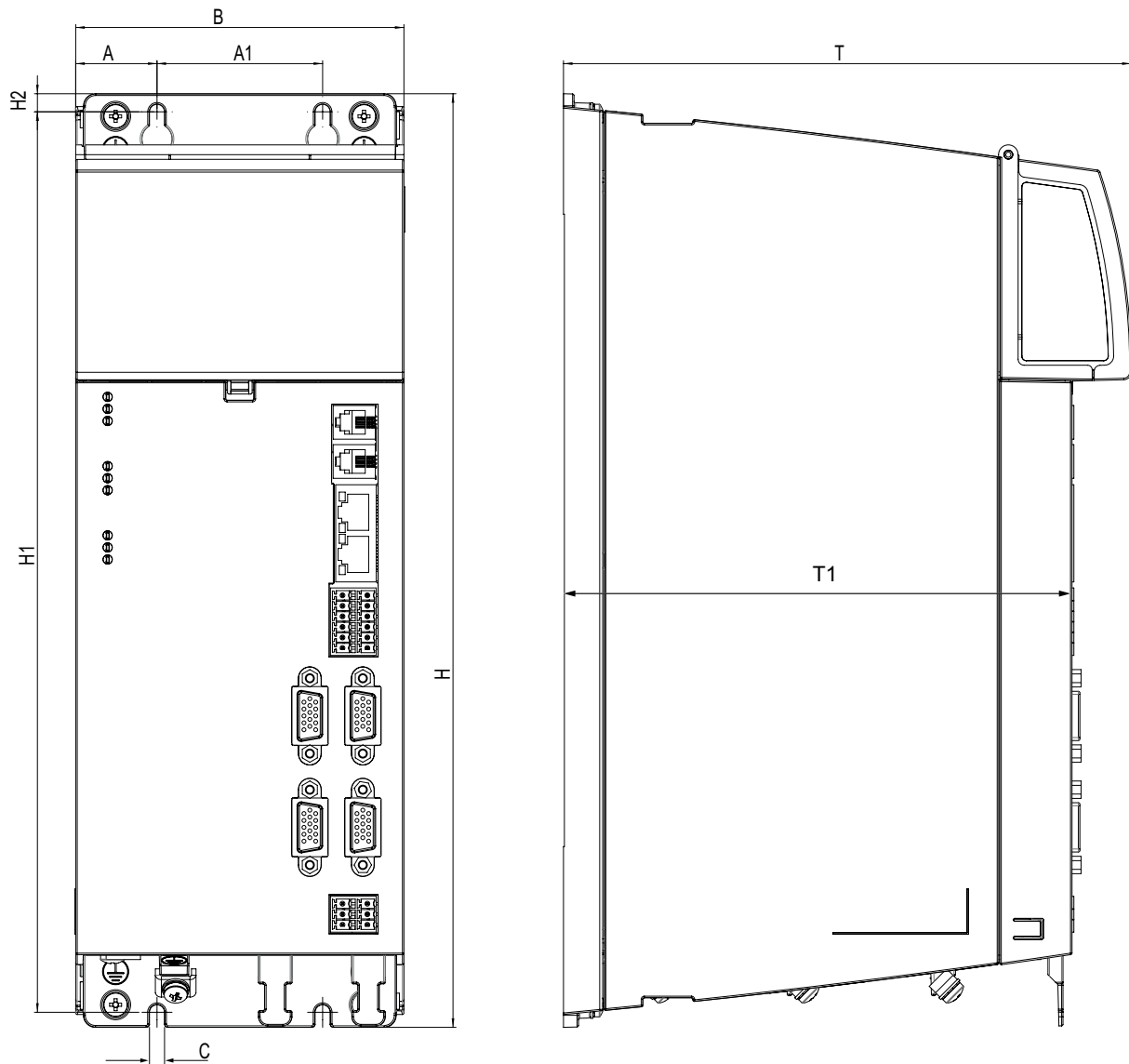


Fig. 2.7 Dimensional drawing JM-3000 servo amplifier BG2 Coldplate (dimensions see Table 2.2)

2.5.2 Installation on the cooler

For optimal heat transfer from the back wall of the device to the cooler provided, a heat conductive film is already glued to the Coldplate of the device (see Fig. 2.8). The film is laminated with aluminum on the cooler side. The device can be mounted and removed with the film.

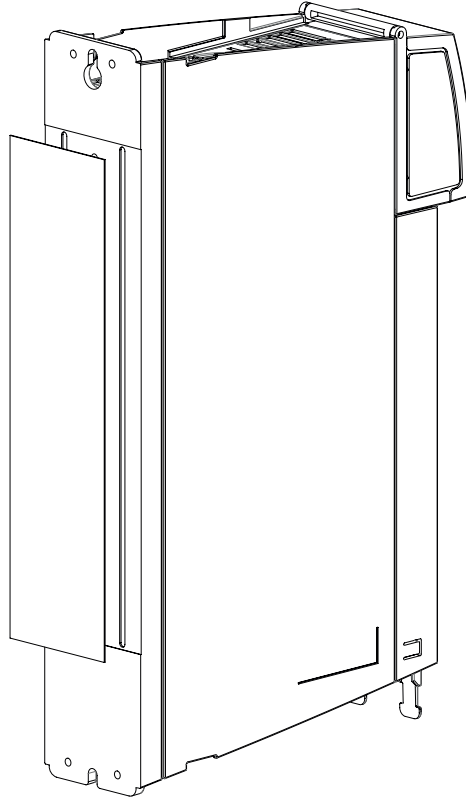


Fig. 2.8 Back wall with film JM-3000 servo amplifier BG1 (Coldplate)



CAUTION!

Ensure that there is no dirt between the cooler and the back wall of the device during installation. Failure to observe this would cause the device to overheat, due to impaired heat transfer. This would lead to device failure.

Because devices with frame size BG2 are twice as wide, a correspondingly wider heat conductive film is applied to the Coldplate of the device (see Fig. 2.9).

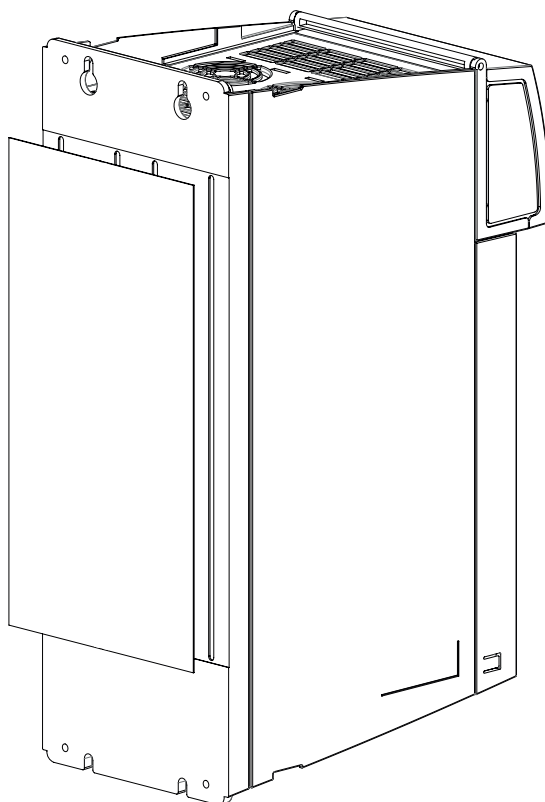


Fig. 2.9 Back wall with film JM-3000 servo amplifier BG2 (Coldplate)

2.5.3 Dimensioning of cooler

JM-3000	JM-3000 BG1	JM-3000 BG2
Thermal resistance $R_{th} K^{1)}$	0.02 K/W	0.01 K/W
Thermal capacity of Coldplate at device	390 Ws/K	780 Ws/K
Max. temperature Coldplate device	85 °C	
Surface of cooler	Max. surface roughness $R_z = 6.3$	

1) Thermal resistance between active cooling surface of device and cooler

Table 2.3 Characteristics Coldplate variant

2.6 Physical dimensions of the system

JM-3000 plus Safety
(example safety control,
supply unit with two
servo amplifiers BG1)

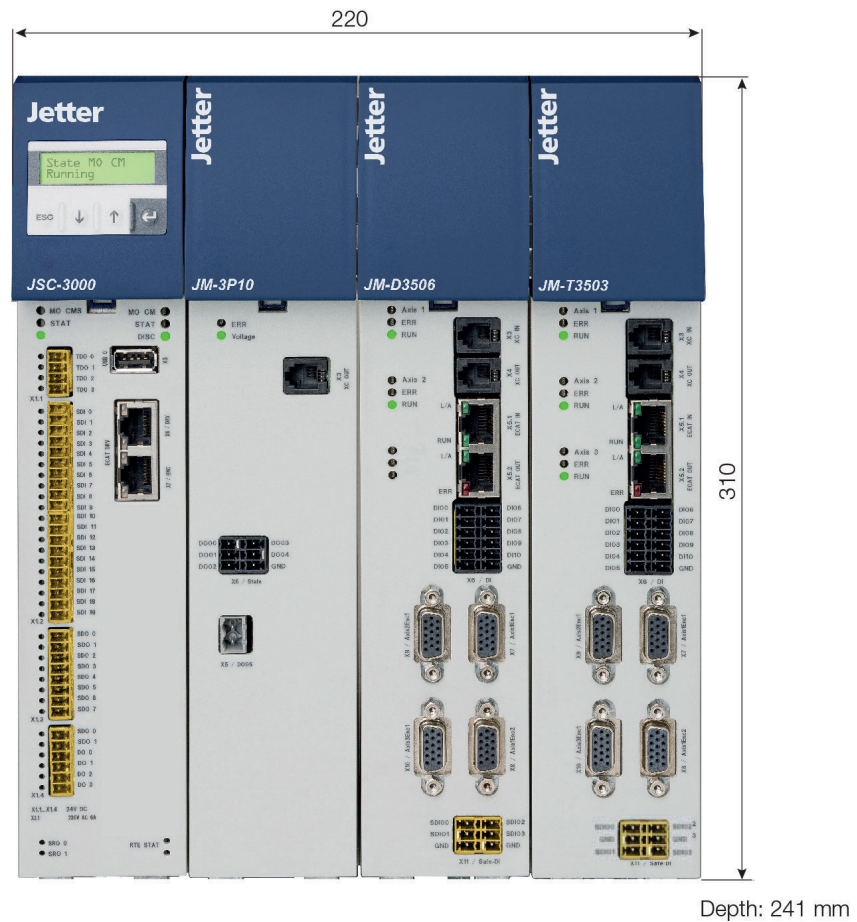


Fig. 2.10 JM-3000 plus Safety

JM-3000 (example supply unit with two servo amplifiers BG1)

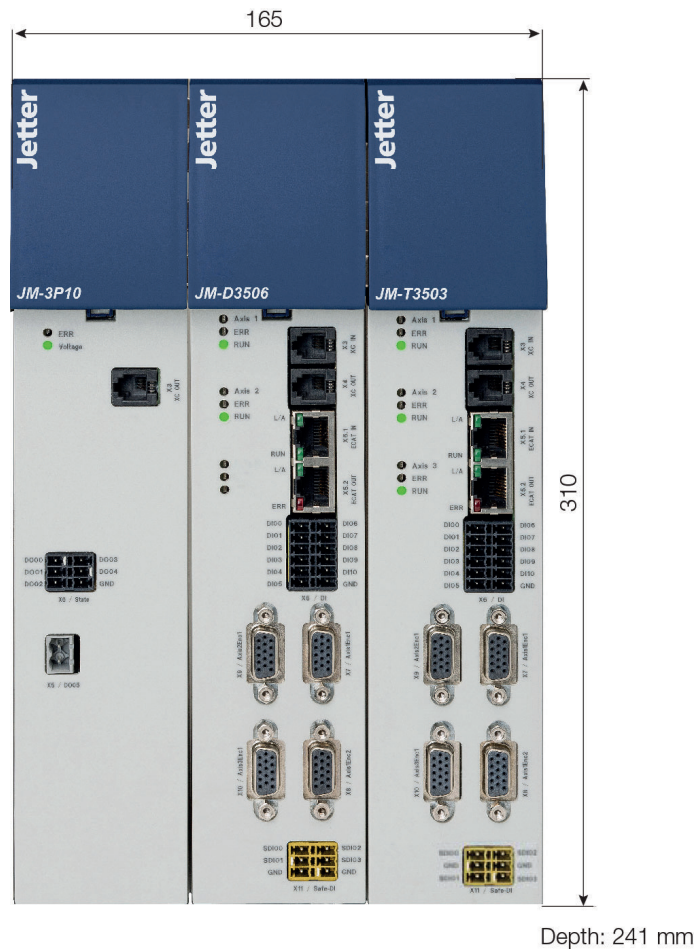


Fig. 2.11 JM-3000

JM-3000 (example supply
unit with one servo
amplifier BG1)



Fig. 2.12 JM-3000

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 DUE TO HIGH VOLTAGE!**

Danger to life!

- Never wire or disconnect electrical connections while they are live!
Always disconnect the device from the mains supply (400 V AC or 565 V DC to 480 V AC or 678 V DC) before working on it.
Dangerously high voltages of $\geq 50V$ may still be present 3 minutes after the power is cut (capacitor charge). Therefore, ensure that the device is voltage-free!
- A hazardous voltage may be present on the device, even if the device is not emitting any visual or audible signals/indications!

NOTE:

For the installation of servo amplifiers within a JM-3000 multi-axis system, it is imperative that the instruction handbooks of the other devices (supply unit, control system) are observed.

3.2 Effective EMC installation

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 in compliance 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.
 - The essential EMC measures are already implemented in the design of the devices through optimized enclosure shielding, PCB layout, filtering measures and selection of suitable connector plugs with screening shield. In addition to the internal measures, the following installation steps must be heeded:
- *Cable type*
 - Use only screened mains, motor and signal cables with double copper braiding that is overlapping by 60 to 70 %.
- *Routing of cables*
 - If possible, signal cables 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.

NOTE:

When using third-party connection cables, these must be at least equivalent. However, Jetter cannot guarantee stable and safe operation when such cables are used.

- *Earthing measures*
 - The devices must be attached to a conductive, earthed panel. Earthing measures are described in chapter "3.4 Protective conductor connection".
- *External components*
 - Place larger consumers near the supply.
 - Contactors, relays, solenoid valves (switched inductors) must be wired with fuses. The wiring must be directly connected to the respective coil.
 - Any switched inductors should be at least 0.2 m distant from the process controlled assemblies.
- *Screening measures*
 - Do not strip the cable shields too soon, and use the shield lugs on the respective plug-in connectors for establishing contact at the components (see Fig. 3.1). Lay the other part of the cable shield across wide areas on both the PE rail (main earth) or the panel.

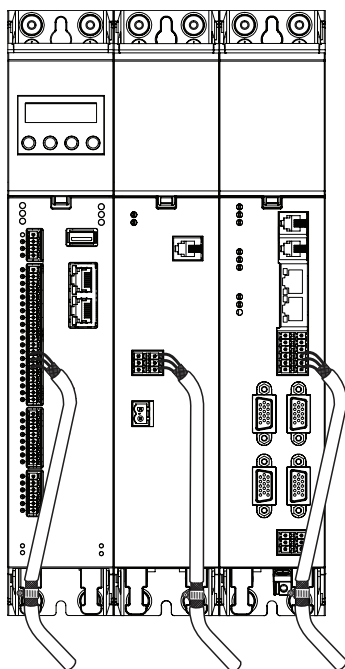


Fig. 3.1 Example shield connection control connections

Additional information can be found in the corresponding connection description. For further detailed information on installation, please consult the Jetter hotline (see "Hotline, support & service" on page 73).

3.3 Overview of connections

The following shows three layouts for the JM-3000 single axis, twin axis and triple axis servo amplifier. The position of the respective position of the connectors and terminals is shown on the layouts. For improved clarity, an abbreviation has been added to the designations of connectors and terminals.

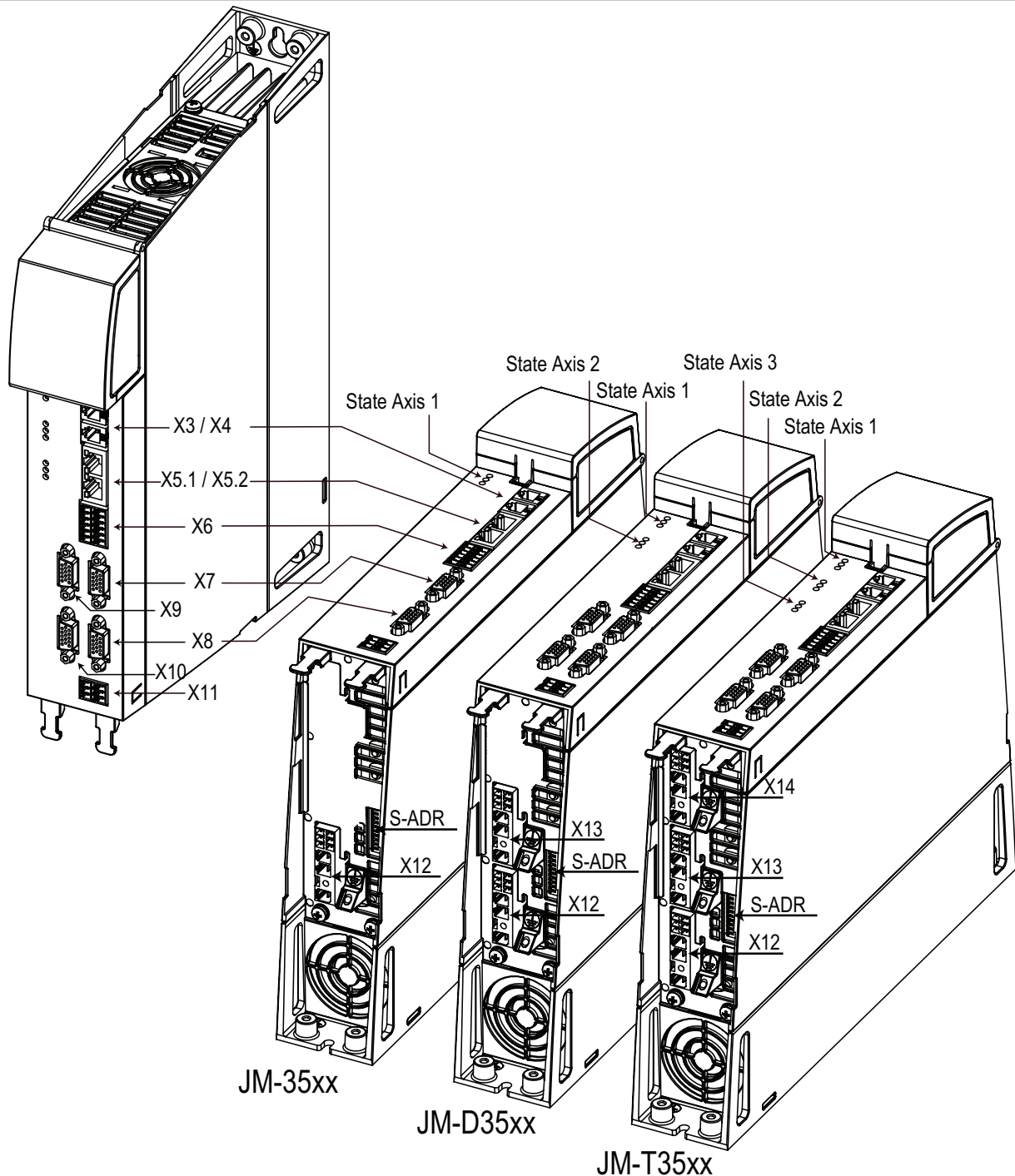


Fig. 3.2 Layout JM-3000 servo amplifier

Abbreviation	Designation	Details
Via busbar	24 V supply voltage control system	See 3.6.1 on page 55
	DC link supply (DC-Link +/-)	See 3.6.2 on page 55
X3	Input cross-communication	See 3.10 on page 65
X4	Output cross-communication	
X5.1	EtherCAT IN, input Fieldbus	Can also be used as an Ethernet interface for PC.
X5.2	EtherCAT OUT, output Fieldbus	See 3.11 on page 66
X6	Digital inputs (programmable)	See 3.7.1 on page 58
X7	Encoder interface	See Table 3.2 ff
X8	Encoder interface	
X9	Encoderinterface	
X10	Encoder interface	
X11	Digital inputs (safety function)	See 3.7.2 on page 58
S-ADR	DIP switch block for configuration of S1 functionality	See JM-3000 S1 user manual (Item No.: 60880300)
X12	Power connection motor 1	With integrated connections for motor brake and temperature monitoring See chapter 3.8.1
X13	Power connection motor 2	
X14	Power connection motor 3	
JM-35xx	JM-3000 single axis servo amplifier	
JM-D35xx	JM-3000 twin axis servo amplifier	
JM-T35xx	JM-3000 triple axis servo amplifier	

Table 3.1 Key connection JM-3000 servo amplifier

3.3.1 Single axis servo amplifier

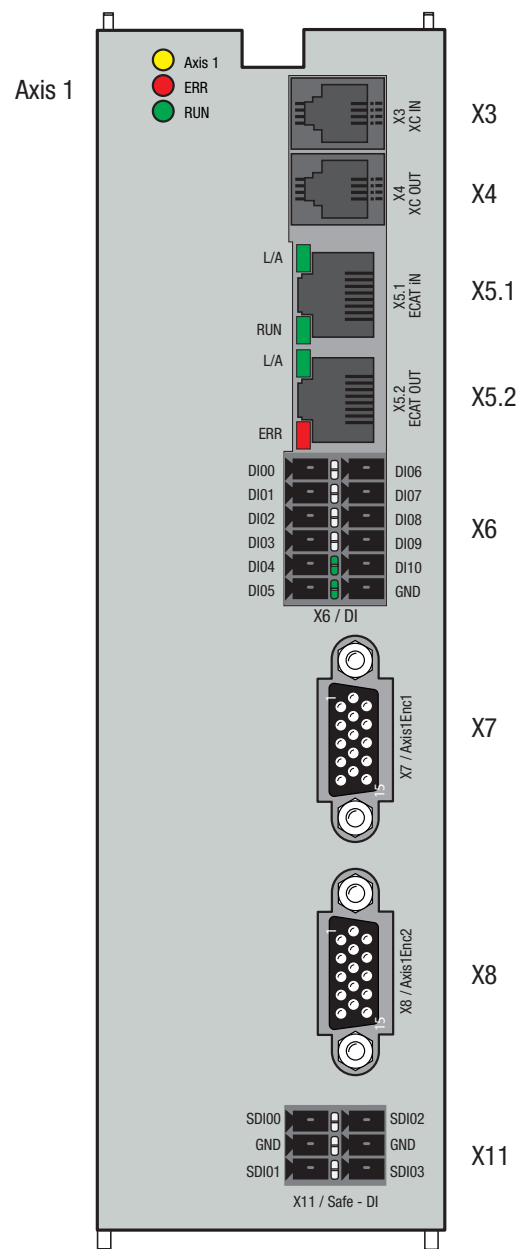


Fig. 3.3 Layout single axis servo amplifier

Abbreviation	Designation	Details
X3	Cross-communication input	Connections for cross-communication. Caution: Only for intra-system use/communication
X4	Cross-communication output	
X5.1	EtherCAT IN, input Fieldbus	Can also be used as an Ethernet interface for PC.
X5.2	EtherCAT OUT, output Fieldbus	
X6	Digital inputs	
X7	Encoder connection 1 (axis 1)	Enc1 (Multi-encoder interface)
X8	Additional encoder connection (axis 1)	Enc2 (single encoder interface)
X9	Not present	Only used for twin axis and triple axis servo amplifiers.
X10	Not present	
X11	Digital inputs safety function	
Axis 1	LED yellow	Status axis 1 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	

Table 3.2 Key connection diagram single axis servo amplifier

Single axis servo amplifier encoder axis 1

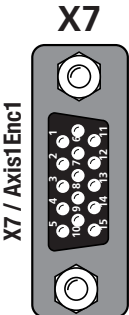
Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver
	1	A-		REFCOS	S3/COS- (A-)
	2	A+		+COS	S1/COS+ (A+)
	3	max. +5.25 V		-	-
	4	R+	Data +		-
	5	R-	Data -		-
	6	B-		REFSIN	S4/SIN-(B-)
	7	-	-	"7-12 V" (= 11 V)	-
	8				-
	9	-	-	-	R1 (Resolver excitation -)
	10	-		-	R2 (Resolver excitation +)
	11	B+		+SIN	S2/SIN+ (B+)
	12	Safety Sense +		-	-
	13	Safety Sense -		-	-
	14	-	CLK+	-	-
	15	-	CLK-	-	-

Table 3.3 Pin assignment of plug connector X7 (Enc1) single axis servo amplifier


Fig.	X8 Pin	SinCos and TTL
	1	A-
	2	A+
	3	max. +5.25 V
	4	R+
	5	R-
	6	B-
	7	-
	8	GND (earth)
	9	-
	10	-
	11	B+
	12	-
	13	-
	14	-
	15	-

Table 3.4 Pin assignment of plug connector X8 (Enc1) single axis servo amplifier

3.3.2 Twin axis servo amplifier

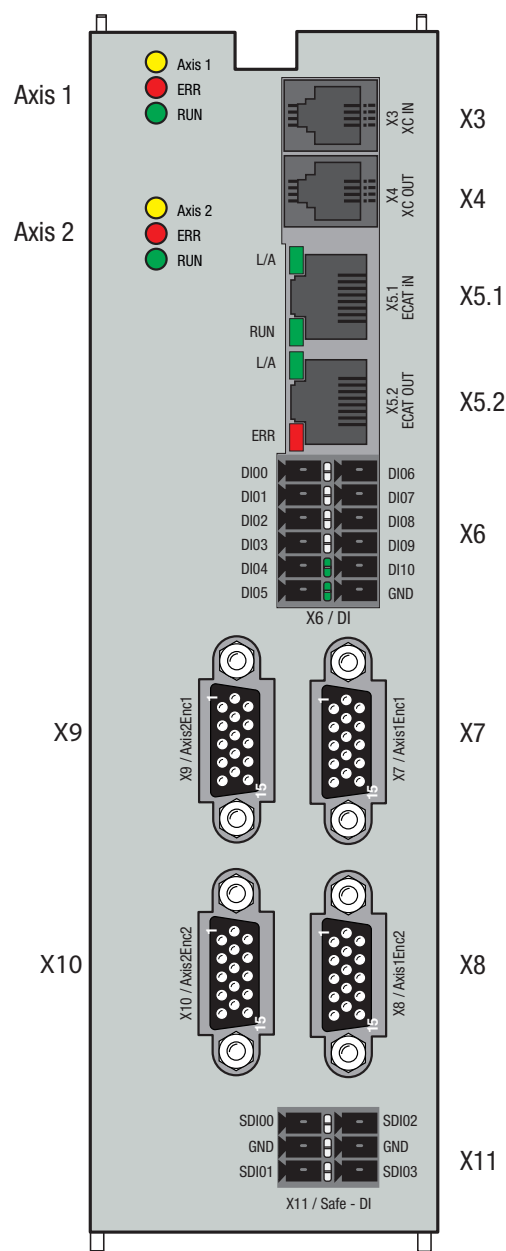


Fig. 3.4 Layout twin axis servo amplifier

Abbreviation	Designation	Details
X3	Input cross-communication	Connections for cross-communication. Caution: Only for intra-system use/communication
X4	Output cross-communication	
X5.1	EtherCAT IN, input Fieldbus	Can also be used as an Ethernet interface for PC.
X5.2	EtherCAT OUT, output Fieldbus	
X6	Digital control inputs	
X7	Encoder connection 1 (axis 1)	Enc1 (Multi-encoder interface)
X8	Additional encoder connection (axis 1)	Enc2 (single encoder interface)
X9	Encoder connection 1 (axis 2)	Enc1 (Multi-encoder interface)
X10	Additional encoder connection (axis 2)	Enc2 (single encoder interface)
X11	Digital inputs safety function	
Axis 1	LED yellow	Status axis 1 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	
Axis 2	LED yellow	Status axis 2 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	

Table 3.5 Key connection diagram twin axis servo amplifier

Twin axis servo amplifier encoder axis 1


Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver
	1	A-		REFCOS	S3/COS- (A-)
	2	A+		+COS	S1/COS+ (A+)
	3	max. +5.25 V		-	-
	4	R+	Data +		-
	5	R-	Data -		-
	6	B-		REFSIN	S4/SIN-(B-)
	7	-	-	"7-12 V" (= 11 V)	-
	8				-
	9	-	-	-	R1 (Resolver excitation -)
	10	-		-	R2 (Resolver excitation +)
	11	B+		+SIN	S2/SIN+ (B+)
	12	Safety Sense +		-	-
	13	Safety Sense -		-	-
	14	-	CLK+	-	-
	15	-	CLK-	-	-

Table 3.6 Pin assignment of plug connector X7 (Enc1) twin axis servo amplifier axis 1

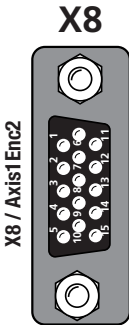
Fig.	X8 Pin	SinCos and TTL
	1	A-
	2	A+
	3	max. +5.25 V
	4	R+
	5	R-
	6	B-
	7	-
	8	GND (earth)
	9	-
	10	-
	11	B+
	12	-
	13	-
	14	-
	15	-

Table 3.7 Pin assignment of plug connector X8 (Enc1) twin axis servo amplifier axis 1

Twin axis servo amplifier encoder axis 2

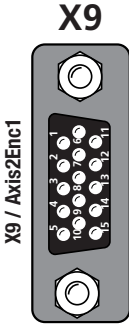
Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver
	1	A-		REFCOS	S3/COS- (A-)
	2	A+		+COS	S1/COS+ (A+)
	3	max. +5.25 V		-	-
	4	R+		Data +	-
	5	R-		Data -	-
	6	B-		REFSIN	S4/SIN-(B-)
	7	-	-	"7-12 V" (= 11 V)	-
	8				-
	9	-	-	-	R1 (Resolver excitation -)
	10	-		-	R2 (Resolver excitation +)
	11	B+		+SIN	S2/SIN+ (B+)
	12	Safety Sense +		-	-
	13	Safety Sense -		-	-
	14	-	CLK+	-	-
	15	-	CLK-	-	-

Table 3.8 Pin assignment of plug connector X9 (Enc1) twin axis servo amplifier axis 2


Fig.	X10 Pin	SinCos and TTL
	1	A-
	2	A+
	3	max. +5.25 V
	4	R+
	5	R-
	6	B-
	7	-
	8	GND (earth)
	9	-
	10	-
	11	B+
	12	-
	13	-
	14	-
	15	-

Table 3.9 Pin assignment of plug connector X10 (Enc1) twin axis servo amplifier axis 2

3.3.3 Triple axis servo amplifier

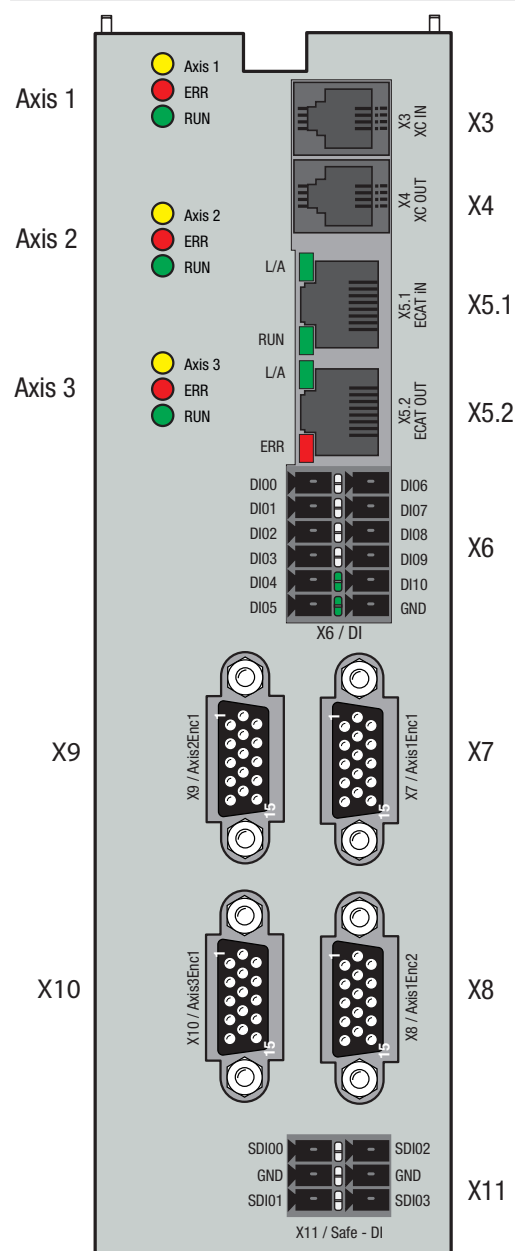
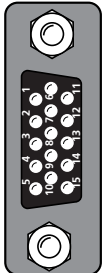


Fig. 3.5 Layout triple axis servo amplifier

Abbreviation	Designation	Details
X3	Input cross-communication	Connections for cross-communication. Caution: Only for intra-system use/communication
X4	Output cross-communication	
X5.1	EtherCAT IN, input Fieldbus	Can also be used as an Ethernet interface for PC.
X5.2	EtherCAT OUT, output Fieldbus	
X6	9 digital and 2 fast control inputs	Programmable, three inputs and 2 touch probe inputs per axis
X7	Encoder connection 1 (axis 1)	Enc1 (Multi-encoder interface)
X8	Additional encoder connection (axis 1)	Enc2 (single encoder interface)
X9	Encoder connection 1 (axis 2)	Enc1 (Multi-encoder interface)
X10	Encoder connection 1 (axis 3)	Enc1 (Multi-encoder interface)
X11	Digital inputs safety function	
Axis 1	LED yellow	Status axis 1 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	
Axis 2	LED yellow	Status axis 2 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	
Axis 3	LED yellow	Status axis 3 See chapter 4.1 for details
ERR	LED red	
RUN	LED green	

Table 3.10 Key connection diagram triple axis servo amplifier

**Triple axis servo amplifier
encoder axis 1**



X7
X7 / Axis1Enc1

Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver	
	1	A-		REFCOS	S3/COS- (A-)	
	2	A+		+COS	S1/COS+ (A+)	
	3	max. +5.25 V		-	-	
	4	R+	Data +		-	
	5	R-	Data -		-	
	6	B-		REFSIN	S4/SIN-(B-)	
	7	-	-	"7-12 V" (= 11 V)	-	
	8					-
	9	-	-	-	R1 (Resolver excitation -)	
	10	-		-	R2 (Resolver excitation +)	
	11	B+		+SIN	S2/SIN+ (B+)	
	12	Safety Sense +		-	-	
	13	Safety Sense -		-	-	
	14	-	CLK+	-	-	
	15	-	CLK-	-	-	

Table 3.11 Pin assignment of plug connector X7 (Enc1) triple axis servo amplifier axis 1

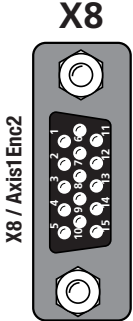
Fig.	X8 Pin	SinCos and TTL
	1	A-
	2	A+
	3	max. +5.25 V
	4	R+
	5	R-
	6	B-
	7	-
	8	GND (earth)
	9	-
	10	-
	11	B+
	12	-
	13	-
	14	-
	15	-

Table 3.12 Pin assignment of plug connector X8 (Enc1) triple axis servo amplifier axis 1

Triple axis servo amplifier encoder axis 2

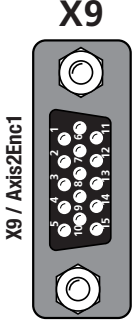
Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver
	1	A-		REFCOS	S3/COS- (A-)
	2	A+		+COS	S1/COS+ (A+)
	3	max. +5.25 V		-	-
	4	R+		Data +	-
	5	R-		Data -	-
	6	B-		REFSIN	S4/SIN-(B-)
	7	-	-	"7-12 V" (= 11 V)	-
	8				-
	9	-	-	-	R1 (Resolver excitation -)
	10	-		-	R2 (Resolver excitation +)
	11	B+		+SIN	S2/SIN+ (B+)
	12	Safety Sense +		-	-
	13	Safety Sense -		-	-
	14	-	CLK+	-	-
	15	-	CLK-	-	-

Table 3.13 Pin assignment of plug connector X9 (Enc1) twin axis servo amplifier axis 2

**Triple axis servo amplifier
encoder axis 3**

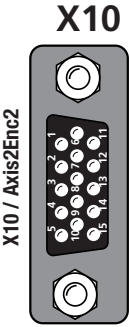
Fig.	X7 Pin	SinCos and TTL	EnDat/SSI	HIPERFACE®	Resolver
	1	A-		REFCOS	S3/COS- (A-)
	2	A+		+COS	S1/COS+ (A+)
	3	max. +5.25 V		-	-
	4	R+	Data +		-
	5	R-	Data -		-
	6	B-		REFSIN	S4/SIN-(B-)
	7	-	-	"7-12 V" (≈.11 V)	-
	8				-
	9	-	-	-	R1 (Resolver excitation -)
	10	-		-	R2 (Resolver excitation +)
	11	B+		+SIN	S2/SIN+ (B+)
	12	Safety Sense +		-	-
	13	Safety Sense -		-	-
	14	-	CLK+	-	-
	15	-	CLK-	-	-

Table 3.14 Pin assignment of plug connector X10 (Enc1) triple axis servo amplifier axis 3

3.4 Protective conductor connection

Step	Action	PE mains connection in accordance with DIN EN 61800-5-1
1.	<p>Every device in the axis group must be earthed!</p> <ul style="list-style-type: none"> Interconnect the PE connections of the supply unit, the servo amplifiers and the control system in a row. Establish a connection from one of the devices to the PE rail (main earth) in the control cabinet (see "Fig. 3.6 Protective conductor connection of the JM-3000 system"). 	<p>As leakage current > 3.5 mA, the following applies for the PE connection:</p> <ul style="list-style-type: none"> Use protective conductors with the same cross-section as the mains power cables. If the cross-section of the power cable is < 10 mm², the PE connections must be doubled (see Fig. 3.7), or a cable with a minimum cross section of 10 mm² copper cable must be laid.
2.	<p>Connect the protective conductor connections of all other components, such as line filter*), line reactor*) etc., in a star configuration on the PE rail (main earth) in the control cabinet.</p>	<p>*) Components are only required for the JM-3000 power supply unit.</p>

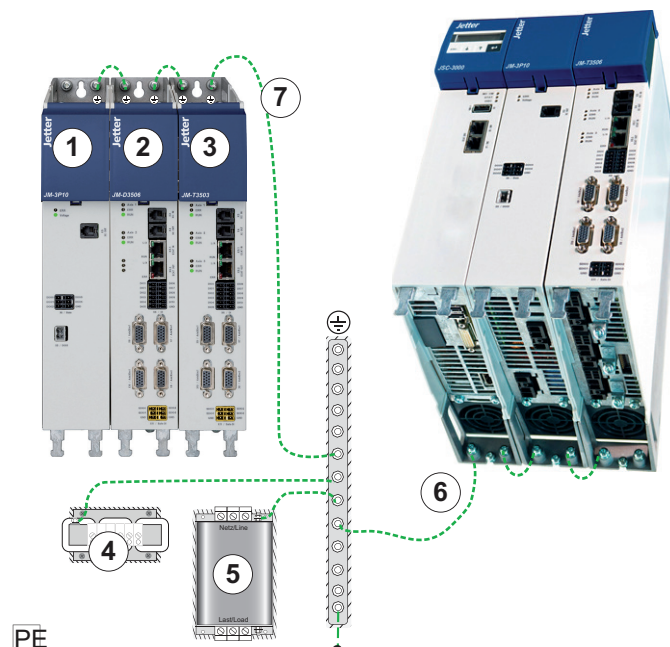


Fig. 3.6 Protective conductor connection of the JM-3000 system

- 1) Supply unit
- 2) Servo amplifier
- 3) Servo amplifier
- 4) Line reactor
- 5) Line filter
- 6) Earthing in a row from below
- 7) Alternatively, earth connection from above

NOTE:

Also comply with local and country-specific regulations and conditions at all times.

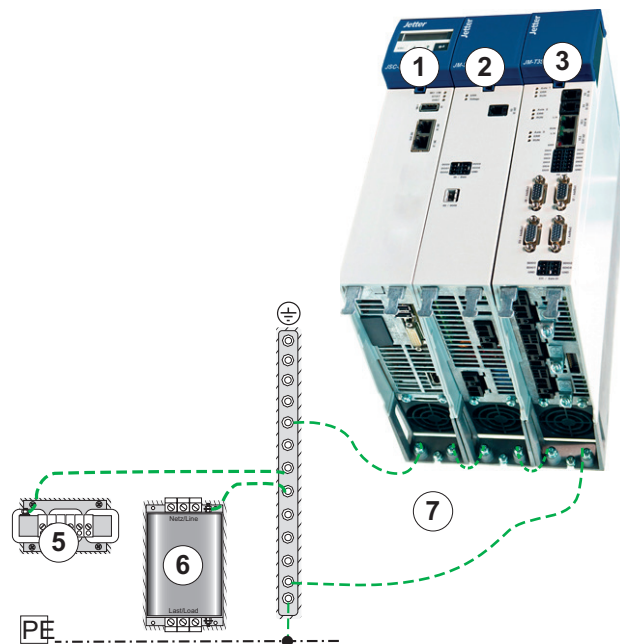


Fig. 3.7 Connection of the JM-3000 system with double PE cables

- 1) JSC-3000 safety control
- 2) Supply unit
- 3) Servo amplifier
- 5) Line reactor
- 6) Line filter
- 7) Earth connection double



CAUTION!

The protective conductor connection is a safety device. For this reason, ensure that good contact is established for all connections and that they are so tight that they cannot become loose by themselves.

A wiring diagram of the axis group, which also provides details of the protective conductor connections, is provided in chapter 3.12.

3.5 Electrical isolation concept

All control connections are designed as protective extra-low voltage (PELV) and must only be operated with such PELV connections in accordance with the respective specification. This means reliable protection against electric shock at the control side.

The DC Link +/-, X12 - U/V/W, X13 - U/V/W and X14 - U/V/W connections are at mains potential (low voltage).

The adjoining overview shows the potential supplies for the individual connections in detail.

This concept also results in a higher operational safety of the servo amplifier.

Servo amplifier connections (12)	Description	Potential	Abbreviation
Busbar 24 V DC	Supply voltage control unit	Protective extra low voltage circuit ³⁾	PELV
Busbar DC link	Supply voltage DC link	Low voltage ¹⁾	ZK
X3/X4	Cross-communication	Protective extra low voltage circuit ³⁾	PELV
X5.1/X5.2	EtherCAT IN/OUT Fieldbus connection	Protective extra low voltage circuit ³⁾	PELV
X6/DI	Digital control inputs	Protective extra low voltage circuit ³⁾	PELV
X11/Safe - DI	Safe digital inputs	Protective extra low voltage circuit ³⁾	PELV
X7/X8/X9/X10	Encoder connections	Protective extra low voltage circuit ³⁾	PELV
BRK - X12/X13/X14	Connection motor holding brake	Protective extra low voltage circuit ³⁾	PELV
∅ motor - X12/X13/X14	Connection motor temperature encoder	Basic insulation ²⁾	BI
U/V/W - X12/X13/X14	Connection motor phases	Low voltage ¹⁾	ZK

1) Low voltage = AC: $U \leq 1000 \text{ V}$

2) Simple separation to low-voltage grid and PELV network

3) PELV = protective extra low voltage AC: $U \leq 50 \text{ V}$
A connection of the extra low voltage is earthed.

4) Secure separation to low-voltage grid and PELV network

Table 3.15 Key to "electrical isolation concept" overview

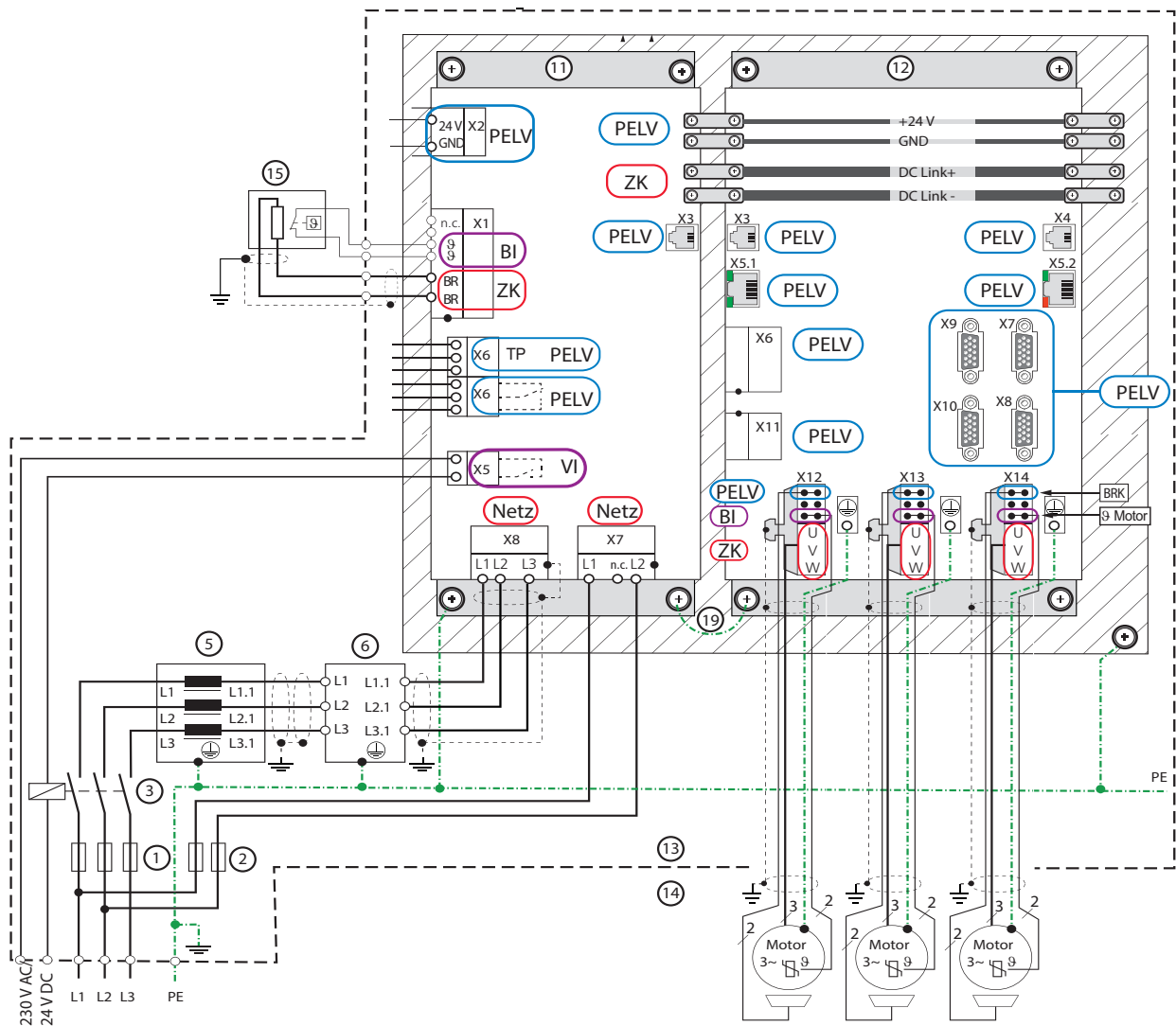






Fig. 3.8 Electrical isolation concept with key

- 1) Main fuse for DC link supply
- 2) Main fuse for switching power supply
- 3) Mains contactor (optional)
- 5) Line reactor (accessory)
- 6) Line filter (accessory)
- 11) Supply unit
- 12) Servo amplifier
- 13) Control cabinet
- 14) Field
- 15) Braking resistor with temperature monitoring (external)
- 19) Protective conductor connection to next device in a row

3.6 Connection of supply voltages

There must be separate voltage supplies for the control unit and for the switching device of the JM-3000. The 24 V supply of the control unit is supplied via the upper busbar (+24V DC and GND) from the switching power supply of the supply unit.

The switching device of the servo amplifier also receives its DC link supply from the supply unit through the lower busbar (DC link+ and DC link).

Step	Action	Comment
 1.	First, ensure that all JM-3000 servo amplifiers are arranged in a row with the JM-3000 supply unit and are butt mounted.	See installation instructions in chapter 2.1
 2.	The 24 V supply voltage control system for the servo amplifiers must always be connected first. When several servo amplifiers are used, all 24 V DC and all GND connections must be connected respectively.	For this purpose, use the pre-assembled rail elements in accordance with Fig. 3.9. The screws must be slightly open so that the rail elements can be turned.
 3.	Only connect the DC link supply when commissioning the servo amplifier. When several servo amplifiers are used, all DC link+ and all DC link connections must be connected respectively.	Here too, use the pre-assembled rail elements in accordance with Fig. 3.10. The screws must be slightly open so that the rail elements can be turned.
 4.	Once all rail elements have been placed, the screws must be firmly tightened again!	



CAUTION!

Ensure that good contact is established for all connections and that they are so tight (2.1 Nm), that they cannot become loose by themselves. Jetter cannot guarantee stable and safe operation when connection elements are used that do not meet the specifications!

3.6.1 Supply voltage control system (+24 V DC)

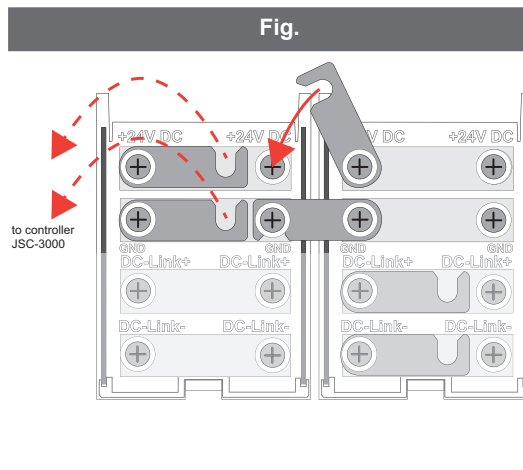
Fig.	Specification
	<ul style="list-style-type: none"> • $U_V = +24 \text{ V DC} \pm 20\%$ stabilized and filtered • Output power of switching power supply max. 470 W • Internal polarity reversal protection • The power supply unit used must have a safe separation to the mains as per EN 61131-2 • Torque for rail screw connection 2.1 Nm

Fig. 3.9 Busbar 24 V supply voltage control system

3.6.2 DC link supply

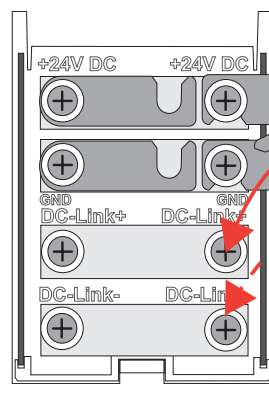
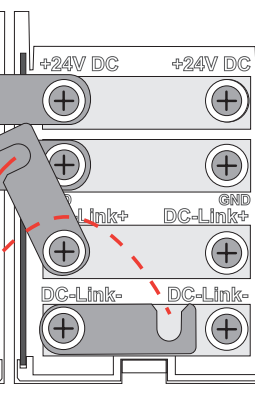
Fig.	Specification
<div style="display: flex; justify-content: space-around;"> <div> <p>JM-3000 supply unit</p>  </div> <div> <p>JM-3000 servo amplifier</p>  </div> </div> <p>The diagram shows a red dashed line connecting the DC-Link+ terminal of the supply unit to the DC-Link+ terminal of the servo amplifier. A red arrow points from the DC-Link- terminal of the supply unit to the DC-Link- terminal of the servo amplifier.</p>	<ul style="list-style-type: none"> • JM-3000 servo amplifier • $U_V = +24 \text{ V DC} \pm 20\%$ stabilized and filtered • Output power of switching power supply max. 470 W • Internal polarity reversal protection • The power supply unit used must have a safe separation to the mains as per EN 61131-2 • Torque for rail screw connection 2.1 Nm

Fig. 3.10 Busbar DC link supply

3.6.3 Overview busbar configuration in the group

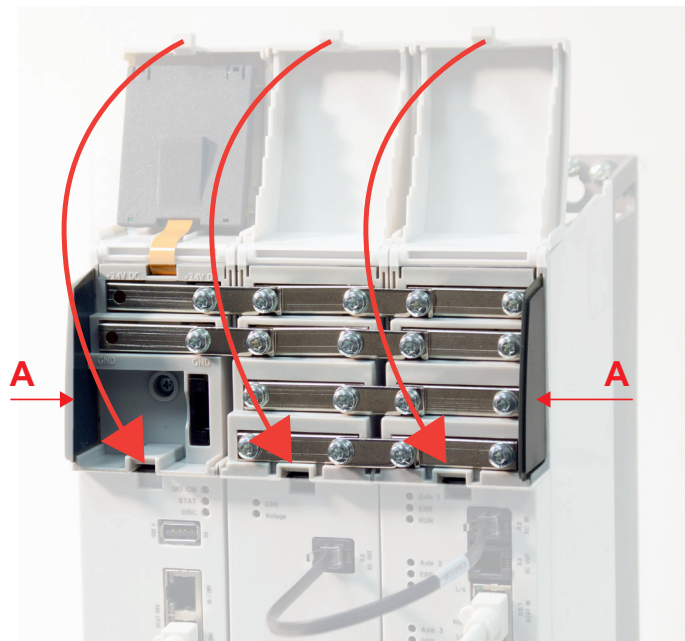








Fig. 3.11 Busbar covers



DANGER DUE TO HIGH VOLTAGE!

The multi-axis system must only be operated when the rail covers are closed! Here, it is also important that the side covers (A) are inserted. Both constitute touch protection against bare and live parts. Death or serious physical injury can occur if this precaution is not taken.

3.7 Control connections

Step	Action	Comment
 1.	Connect the X3 connection of the supply unit with the X3 connection of the first servo amplifier. Then connect the X4 connection of the first servo amplifier with the X3 connection of the next servo amplifier, etc.	Cross-communication see chapter 3.10
 2.	Establish a connection between the EtherCAT interface X5.1 of the first servo amplifier and the motion control system or another compatible control system.	Specification EtherCAT interface see chapter 3.11
 3.	Connect all additional servo amplifiers with the first servo amplifier via the EtherCAT interfaces X5.1 and X5.2	Specification EtherCAT interface see chapter 3.11
 4.	If required, wire the control inputs at X6 with shielded cables. Earth the cable shields over a wide area at both ends.	See chapter 3.7.1
 5.	If you want to use the STO and/or STB safety function, wire the safe control inputs at X11 with shielded cables. Earth the cable shields over a wide area at both ends.	See chapter 3.7.2
 6.	Check all connections again!	

3.7.1 Digital inputs at X6 (standard functions)

The digital inputs are designed for tasks close to the axis, such as limit switches. They can be individually programmed via the EtherCAT bus system. The DI09 and DI10 inputs are suitable for touch probe tasks, due to their quick signal processing. The axis mapping can also be programmed via the EtherCAT bus system.

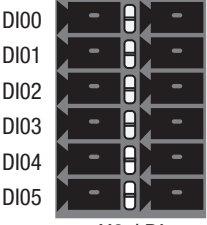
Fig.	Ref.	Type	Function	Axis 1	Axis 2	Axis 3
 <p>I/O terminal X6/DI</p>	DI00	Dig. input	See Table 3.17	DI01	-	-
	DI01	Dig. input		DI02	-	-
	DI02	Dig. input		DI03	-	-
	DI03	Dig. input		-	DI01	-
	DI04	Dig. input		-	DI02	-
	DI05	Dig. input		-	DI03	-
	DI06	Dig. input		-	-	DI01
	DI07	Dig. input		-	-	DI02
	DI08	Dig. input		-	-	DI03
	DI09	Fast dig. input	Touch probe TP1	All axes		
	DI10	Fast dig. input	Touch probe TP2	All axes		
	GND (earth)	DGND	Ground reference			

Table 3.16 Assignment of the control inputs (example triple axis servo amplifier)

3.7.2 Digital inputs at X11 (safe digital inputs)

The digital inputs are designed for tasks close to the axis, such as limit switches. They can be individually programmed via the EtherCAT bus system. The DI09 and DI10 inputs are suitable for touch probe tasks, due to their quick signal processing. The axis mapping can also be programmed via the EtherCAT bus system.

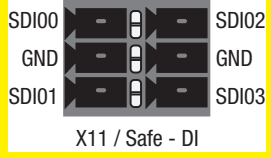
Fig.	X11	Type	Function
 <p>X11/Safe-DI</p>	SDI00	Safe digital input	STO 1 CH1
	SDI01	Safe digital input	STO 1 CH2
	SDI02	Safe digital input	STO 2 CH1
	SDI03	Safe digital input	STO 2 CH2
	GND (earth)	Ground reference	GND (earth)
	GND (earth)	Ground reference	GND (earth)

Table 3.17 Specification of the control inputs X11/Safe-DI

NOTE:

Additional details on the S1 function in connection with the S-ADR DIP switch block are provided in the document “JM-3000-S1 user manual” (Item No.: 60880300).

Specification of terminals

The X6 control terminal is implemented with a 2-tier 2x 6-pin plug-in terminal, contact spacing 3.5 mm by Phoenix Contact.

- Type: MCDN 1.5/6-G1-3.5





The X11 safety terminal is implemented with a 2-tier 2x 3-pin plug-in terminal, contact spacing 3.5 mm by Phoenix Contact.

- Type: MCDN 1.5/3-G1-3.5

**CAUTION!**

Large currents through the earth terminals can give rise to high-impedance isolation against the chassis ground. This can lead to a malfunction of the drive (avoid circular currents in the wiring).

3.8 Motor connection

Step	Action	Comment
 1.	Determine the cable cross-section, depending on peak current and ambient temperature.	Select the cable cross-section in accordance with the local and country-specific regulations and conditions.
 2.	Connect the screened motor cable to the terminals X12/X13/X14 - U, V and W and earth the motor at \oplus .	Screen for reduction of noise emission, connect screen at both ends. Attach screen connecting plate of motor connection X12/13/14 with both screws.
 3.	Wire the temperature monitor (if present) to X12/13/14 with separate screened wires and activate the temperature evaluation using DriveManager 5.	Screen for reduction of noise emission, connect screen at both ends.
 4.	If present, connect the motor holding brake to X12/X13/X14 - 1 and 2.	See Fig. 3.12

NOTE:

Only use motors which exclusively allow the motor temperature monitor to be connected to the motor terminals X12/13/14 of the servo amplifier. This must be explicitly specified when ordering the motor.

**CAUTION!**

If an earth fault or short-circuit occurs in the motor cable during operation, the output stage is disabled and an error message is issued. The motor coasts to a stop.

3.8.1 Connection diagram motor

Motor cable

All motor cables must be screened. Use a pre-fabricated motor cable by Jetter to connect the servo motor. The available cables are listed in Appendix Table A.8. Equivalent screened cables must be used for the connection of third-party motors.

Motor connection

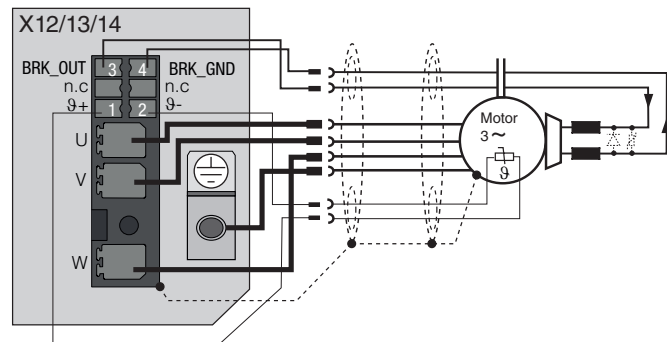


Fig. A:

Recommended connection of motor holding brake up to max. 2 A motor brake current.

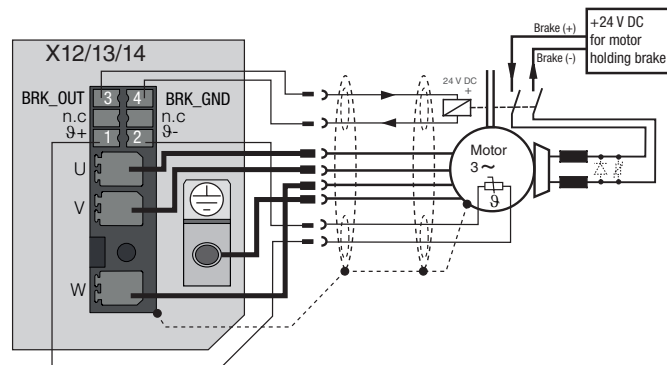


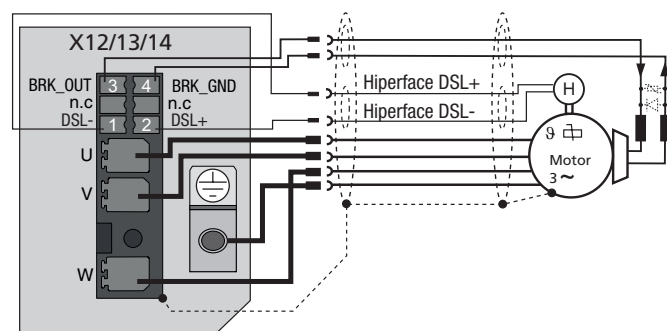
Fig. B:

Recommended connection of motor holding brake up from 2 A motor brake currents.

This circuit does not have broken wire detection!

The thermal encoder connection is represented in the configuration by "standard encoder interface".

Fig. 3.12 Connection of a servo motor with motor holding brake



Recommended connection of motor holding brake up to max. 2 A motor brake current.

In the "HIPERFACE DSL" configuration (see order number code page 5), the two-wire connection of the encoder is connected to the terminals X12/13/14 - 1 and 2.

Fig. 3.13 Connection of a servo motor with HIPERFACE DSL encoder system



CAUTION!

For terminals X12/13/14 - 1 and 2 it must be ensured that the temperature monitor used has a basic insulation in accordance with EN 61800-5-1 to the motor winding.

3.8.2 Monitoring output motor holding brake

The motor brake output (BRK_Out and BRK_GND) is permanently monitored, independently of the use of SBC.


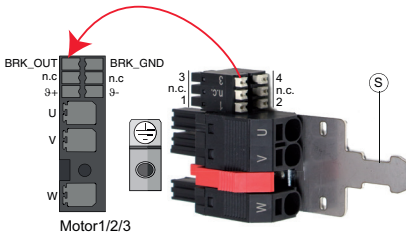
The monitoring works with switch-off test pulses, which are sent in a maximum time frame of 7.5 ms (dependent on the load) and a minimum time frame of 1.5 ms.

NOTE:

This short switch-off can trigger a "time frame exceeded" error in high impedance consumers.

3.8.3 Specification of motor terminals

The X12/X13/X14 terminals are designed for up to three motors with motor temperature monitoring and motor holding brake. The motor connectors required must be ordered separately, depending on the number of the motors intended.

X12 (motor 1) X12 (motor 2) X12 (motor 3)	Function	Specification
2 (9-/DSL+) 1 (9+/DSL-)	<ul style="list-style-type: none"> Connection motor temperature encoder or HIPERFACE DSL 	<ul style="list-style-type: none"> Cross-section 0.14 ... 1.5 mm² AWG 24 ... AWG 16 I_N = 10 A
3 (BRK_OUT) 4 (BRK_GND)	<ul style="list-style-type: none"> Connection motor holding brake I_{BR} = 2 A max. 	
U/V/W	<ul style="list-style-type: none"> Connection motor phases 	Cross-communication = 6 mm ² max.
	<ul style="list-style-type: none"> PE connection of the motor 	M4 screw with shakeproof washer for eyelet
(S)	<ul style="list-style-type: none"> Connection cable shield 	
		
Connector set *		Item no.
M = motor connector		Single axis servo amplifier
		60879942_00
		Twin axis servo amplifier
		60879943_00
		Triple axis servo amplifier
		60879944_00

* In addition to the motor connectors, the connector set also contains the connectors for the control connections (X6 and X11).

Table 3.18 Specification of motor terminals X12/X13/X14

3.8.4 Switching in the motor cable



CAUTION!

Switching in the motor cable is not permitted. Failure to observe this can give rise to errors in the device and lead to the shut-down of the servo amplifier. It cannot be ruled out that switching in the motor cable can lead to the destruction of the servo amplifier.

The STO safety function is available to safely interrupt the power supply to the servo motor, see "Standard configuration S1" on page 75 .

3.9 Encoder connection

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

Encoder connections of Jetter motors

Please use the pre-fabricated motor and encoder cables by Jetter AG to connect the Jetter synchronous motors (see Accessories catalog).

Matching motor -encoder cable - servo amplifier

Compare the nameplates of the components. Make absolutely sure to use the correct components in accordance with variant A, B or C!

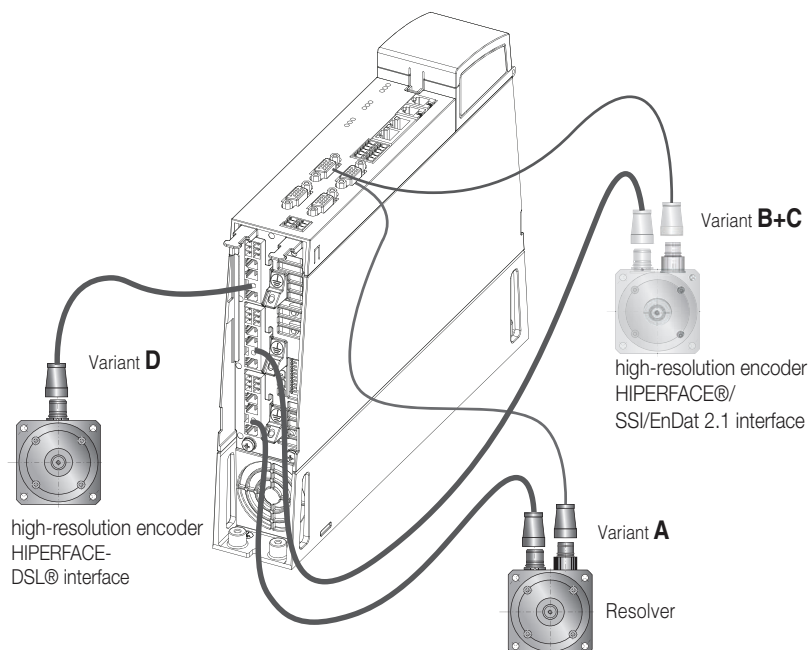


Fig. 3.14 Matching motor/encoder cable (a twin axis servo amplifier is shown as an example)

	Motor (with built-in encoder)	Encoder cable	Motor cable
Jetter servo motors			
Variant A	with resolver	See accessory catalog	
Variant B	Absolute encoder with HIPERFACE® interface	See accessory catalog	
Variant C	Absolute encoder with EnDat®/SSI interface	See accessory catalog	
Jetter servo motors			
Variant D	Absolute encoder with HIPERFACE DSL® interface	HIPERFACE DSL Single cable solution	

Table 3.19 Variants of motors, encoder type and encoder cable

NOTE:

Do not split the encoder 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!

3.9.1 Connection for high-resolution encoders

The interfaces X7, X9 and X10 enable the evaluation of the following encoder types, depending on the design as single axis, twin axis or triple axis servo amplifiers. X8, however, can always only be SinCos oder TTL.

Fig.	Function
	SinCos encoder with zero pulse, e.g. Heidenhain ERN1381, ROD486
	Heidenhain SinCos encoder with EnDat interface, e.g. 13-bit single-turn encoder (ECN1313.EnDat01) and 25-bit multi-turn encoder (EQN1325-EnDat01)
	SinCos encoder with SSI interface, e.g. 13-bit single-turn encoder and 25-bit multi-turn encoders (ECN413-SSI, EQN425-SSI)
	Sick-Stegmann SinCos encoder with HIPERFACE® interface Single-turn and multi-turn encoder, e. g. SRS50, SRM50

Table 3.20 Suitable encoder types on X7/X9/X10

NOTES:

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

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

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

NOTE:

The encoder supply at X7, X9 and X10 is short-circuit proof in both 5 V and 11 V operation. The servo amplifier remains in operation, so that a corresponding error message can be generated when the encoder signals are evaluated.

3.9.2 Connection for additional encoder (X8)

The interface X8 enables evaluation of the following encoder types. X8, however, can always only be SinCos oder TTL.

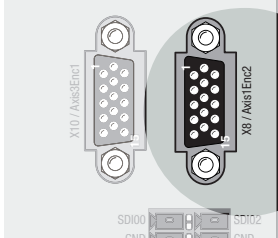
Fig.	Function
	SinCos encoder with zero pulse, e.g. Heidenhain ERN1381, ROD486
	TTL encoder

Table 3.21 Suitable encoder types on X8

- The usage of encoders not included in the range supplied by Jetter requires special approval by Jetter.
- The maximum signal input frequency is 500 kHz.
- Encoders with a power supply of $5\text{ V} \pm 5\%$ must use the supply of X8/ pin 3 (max. 5.25 V).

NOTES:

The encoder supply at X8 is short-circuit proof in 5 V operation. The servo amplifier remains in operation, so that a corresponding error message can be generated when the encoder signals are evaluated.

3.10 Specification of cross-communication

Ref.	Terminal	Specification	Fig.
XC IN Input cross-communication	X3	<ul style="list-style-type: none"> Connection via RJ10 connector Internal RS-485 network 	
XC OUT Output cross-communication	X4		

Table 3.22 Cross-communication

NOTE:

Connections are exclusively used for internal communication between the supply unit and the servo amplifiers. Connections must be established prior to commissioning, otherwise error messages will occur.

Connection example:



Fig. 3.15 Connection example cross-communication

3.11 Specification EtherCAT interface

The EtherCAT field bus interface X 5.1 is typically designed for the connection of the Jetter JetControl control systems with EtherCAT master.

It can also be used as a service and diagnostics interface. It is then, however, only suitable for connecting a PC for commissioning, service and diagnostics with JetSym software (please contact us if you have any queries in relation to this).

Technical specification:

- Transfer rate 10/100 MBit/s BASE-T
- Transfer profile IEEE802.3 compliant.

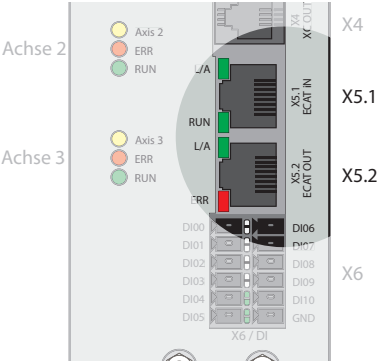
Ref.	Terminal	Specification	Fig.
ECAT IN Input EtherCAT	X5.1	• Connection via RJ45 connector	
ECAT OUT Output EtherCAT	X5.2		
LEDs Ethernet connections			
L/A	Green	Port0 Link/Activity	
RUN	Green	Device/EtherCAT RUN	
L/A	Green	Port1 Link/Activity	
ERR	Red	Device/EtherCAT ERROR	

Table 3.23 EtherCAT connections

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

- Cat 5e patch cable, S/STP 4 x 2 x 0.14 mm², twisted-pair screened data cables with characteristic impedance $R_w = 100 \Omega \pm 15 \%$

NOTE:

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

Connection example:

Fig. 3.16 EtherCAT connection (example)

3.12 Connection example supply unit/servo amplifier

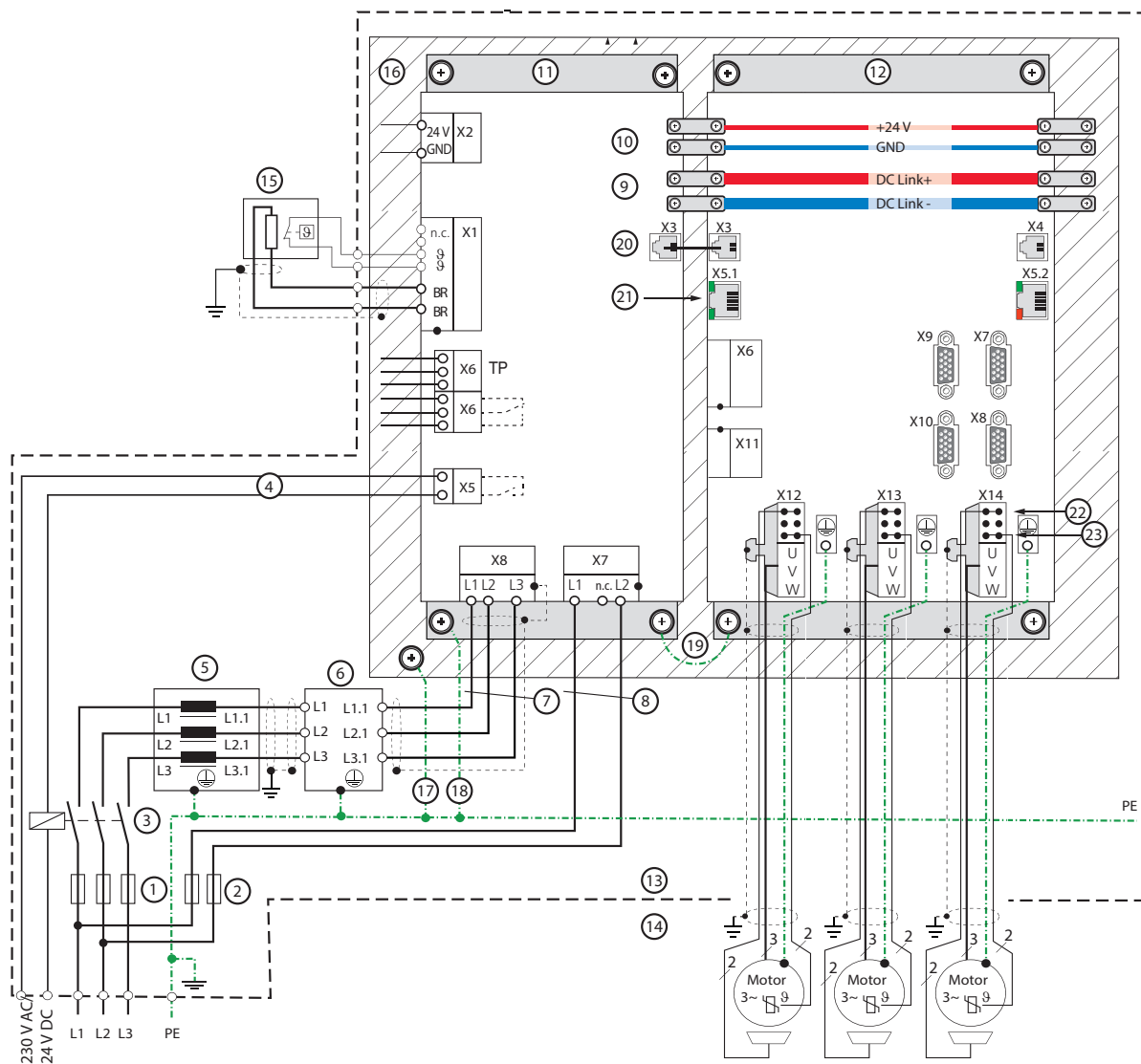


Fig. 3.17 Connection example (schematic diagram)

**Key for connection
example**

	Designation
(1)	Mains fuses for DC link supply
(2)	Main fuse for switching power supply
(3)	Mains contactor with suppressor circuit
(4)	Switching contact programmable as mains contactor
(5)	Line reactor (optional)
(6)	Line filter (optional)
(7)	AC mains connection (power supply)
(8)	AC mains connection (24 V switching power supply)
(9)	Busbar DC link
(10)	Busbar 24 V DC (PELV)
(11)	Supply unit
(12)	Servo amplifier
(13)	Control cabinet
(14)	Field
(15)	External braking resistor with temperature monitoring
(16)	Panel
(17)	Earthing of panel
(18)	PE- protective conductor connection
(19)	Protective conductor connection to next device in a row
(20)	Cross-communication
(21)	EtherCAT connections
(22)	Connection motor holding brake
(23)	Connection motor temperature monitoring

Table 3.24 Key connection example

4 Diagnostics

4.1 LEDs: Axis status

Depending on the design of the servo amplifier (single axis amplifier, twin axis amplifier, triple axis amplifier) up to three times 3 LEDs are provided as status indicators. The LEDs are located on the front of the device and are assigned to axis 1 to axis 3 from top to bottom. The meaning of the LEDs is identical for each axis, as follows:

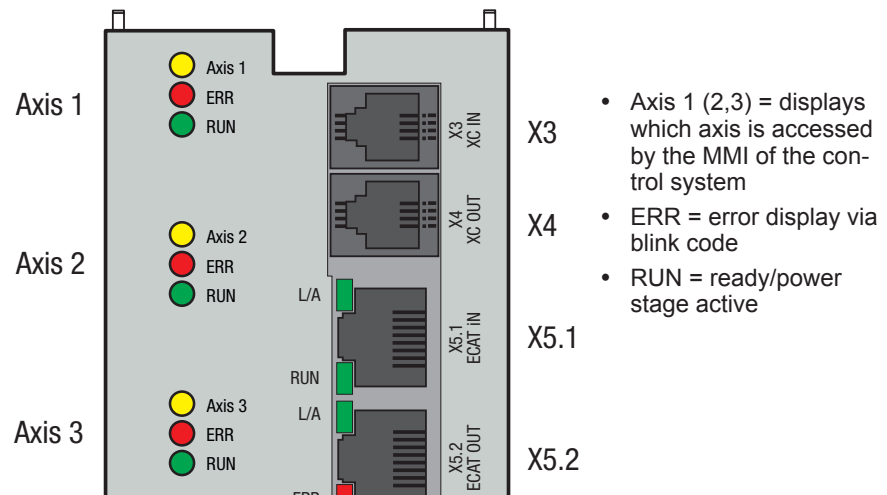


Fig. 4.1 Specimen setup – overview

4.1.1 Blink code

The yellow LED only has a defined function during a software update:

LED yellow	LED red long (0.8 s)	LED green		Axis status
		long (0.8 s)	short (0.4 s)	
on	on	on	-	Reset/starting or loading firmware update
-	-	-	-	Self-initialization on device startup (initialization)
-	off	1 x	1 x	Not ready (not ready to switch on)
-	off	2 x	2 x	Switch on disabled
-	off	3 x	3 x	Axis ready (ready to switch on)
-	off	4 x	4 x	Axis switched on
-	off	5 x	5 x	Operation enabled
-	off	6 x	6 x	Quick stop
-	Error code	7 x	7 x	Fault reaction active
	Error code	8 x	8 x	Fault

LED green long = in standby mode

LED green short = feedback control active

Table 4.1 Status LEDs blink code

4.2 Hotline, support & 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 device (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>.

5 Standard configuration S1

The S1 configuration includes the STO (Safe Torque Off) and SBC (Safe Brake Control) safety functions. It is controlled via safe digital inputs on the control board of the servo amplifier.

NOTE:

For all additional information about the “STO” and “SBC” function, see the document “HB JM 3000 S1 BA DE EN” (Item no.: 60880300).

Standard configuration S1

Space for your own notes

A Appendix

A.1 Technical data JM-3000 servo amplifier part 1

JM-3000 servo amplifier	Unit	JM-D3503	JM-T3503
Control unit			
Control voltage	V DC	24 ± 10 %	
Control voltage when using a motor holding brake with line length < 50 m	V DC	24 - 5 %/+ 10 %	
Max. inrush current at 24 V power supply unit per device	A	1.8 @ 24 V/1 s and 2.2 @ 18 V/1 s	
Typical power consumption	W	54	60
Power output brake driver	W	2 x 48 max.	3 x 48 max.
DC link			
DC link capacitance	μF	165	165
DC resistance in DC link (DC+ to DC-)	kΩ	146	146
Rated power @ 3 x 230 V	kW	0.6	0.6
Rated power @ 3 x 400/480 V	kW	1.1	1.1
Switching device			
Permissible switching frequencies	kHz	2/4/8/12/16	
Rise of voltage at output with 10 m motor cable ((10% ... 90 %))	kV/μs	3 ... 8	
Output frequency range @ 2/4 kHz	Hz	0 ... 400	
Output frequency range @ 8 kHz	Hz	0 ... 800	
Output frequency range @ 16 kHz	Hz	0 ... 1600	
Ambient temperature	°C	5 ... 40, up to 50 with derating	
Servo amplifier			
Power dissipation @ (400 V/4 kHz/I _N) in interior	W	76	88
Power dissipation @ (400 V/4 kHz/P _N) via heat sink	W	48	72

Table A.1 Technical data 3 Amps servo amplifier

NOTE:

Until the type test is completed, all technical information represent only calculated values and not assured characteristics!

A.2 Switching device current data 3 Amps servo amplifier

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-D3503	JM-T3503
Continuous rated current	230 V	2 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 9	3 x 9
Peak current at F _M = 0 Hz			A	2 x 7.35	3 x 7.35
Continuous rated current	230 V	4 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 9	3 x 9
Peak current at F _M = 0 Hz			A	2 x 6.15	3 x 6.15
Continuous rated current	230 V	8 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 6.25	3 x 6.25
Peak current at F _M = 0 Hz			A	2 x 4.0	3 x 4.0
Continuous rated current	230 V	12 kHz	A	2 x 2	3 x 2
Peak current for 10 s			A	2 x 4	3 x 4
Peak current for 500 ms			A	2 x 4.85	3 x 4.85
Peak current at F _M = 0 Hz			A	2 x 3.1	3 x 3.1
Continuous rated current	230 V	16 kHz	A	2 x 1.45	3 x 1.45
Peak current for 10 s			A	2 x 2.9	3 x 2.9
Peak current for 500 ms			A	2 x 3.8	3 x 3.8
Peak current at F _M = 0 Hz			A	2 x 2.4	3 x 2.4
Continuous rated current	400 V	2 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 9	3 x 9
Peak current at F _M = 0 Hz			A	2 x 7.35	3 x 7.35
Continuous rated current	400 V	4 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 9	3 x 9
Peak current at F _M = 0 Hz			A	2 x 6.15	3 x 6.15
Continuous rated current	400 V	8 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 6.25	3 x 6.25
Peak current at F _M = 0 Hz			A	2 x 4.0	3 x 4.0

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.2 Current data 3 Amps servo amplifier

JM-3000 servo amplifier	U_{network}	F_s	Unit	JM-D3503	JM-T3503
Continuous rated current	400 V	12 kHz	A	2 x 2	3 x 2
Peak current for 10 s			A	2 x 4	3 x 4
Peak current for 500 ms			A	2 x 4.85	3 x 4.85
Peak current at $F_M = 0$ Hz			A	2 x 3.1	3 x 3.1
Continuous rated current	400 V	16 kHz	A	2 x 1.45	3 x 1.45
Peak current for 10 s			A	2 x 2.9	3 x 2.9
Peak current for 500 ms			A	2 x 3.8	3 x 3.8
Peak current at $F_M = 0$ Hz			A	2 x 2.4	3 x 2.4
Continuous rated current	480 V	2 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 9.0	3 x 9.0
Peak current at $F_M = 0$ Hz			A	2 x 6.2	3 x 6.2
Continuous rated current	480 V	4 kHz	A	2 x 3	3 x 3
Peak current for 10 s			A	2 x 6	3 x 6
Peak current for 500 ms			A	2 x 8.0	3 x 8.0
Peak current at $F_M = 0$ Hz			A	2 x 5.1	3 x 5.1
Continuous rated current	480 V	8 kHz	A	2 x 2.6	3 x 2.6
Peak current for 10 s			A	2 x 5.2	3 x 5.2
Peak current for 500 ms			A	2 x 5.2	3 x 5.2
Peak current at $F_M = 0$ Hz			A	2 x 3.3	3 x 3.3
Continuous rated current	480 V	12 kHz	A	2 x 1.35	3 x 1.35
Peak current for 10 s			A	2 x 2.7	3 x 2.7
Peak current for 500 ms			A	2 x 3.6	3 x 3.6
Peak current at $F_M = 0$ Hz			A	2 x 2.3	3 x 2.3
Continuous rated current	480 V	16 kHz	A	2 x 0.6	3 x 0.6
Peak current for 10 s			A	2 x 1.2	3 x 1.2
Peak current for 500 ms			A	2 x 2.75	3 x 2.75
Peak current at $F_M = 0$ Hz			A	2 x 1.75	3 x 1.75

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.2 Current data 3 Amps servo amplifier

A.3 Technical data JM-3000 servo amplifier part 2

JM-3000 servo amplifier	Unit	JM-3506	JM-D3506	JM-T3506
Control unit				
Control voltage	V DC	24 ± 10 %		
Control voltage when using a motor holding brake with line length < 50 m	V DC	24 - 5 %/+ 10 %		
Max. inrush current at 24 V power supply unit per device	A	1.8 @ 24 V/1 s and 2.2 @ 18 V/1 s		
Typical power consumption	W	48	54	60
Power output brake driver	W	48 max.	2 x 48 max.	3 x 48 max.
DC link				
DC link capacitance	μF	165	165	165
DC resistance in DC link (DC+ to DC-)	kΩ	146	146	146
Rated power @ 3 x 230 V	kW	0.6	0.6	0.6
Rated power @ 3 x 400/480 V	kW	1.1	1.1	1.1
Switching device				
Permissible switching frequencies	kHz	2/4/8/12/16		
Rise of voltage at output with 10 m motor cable (10% ... 90 %)	kV/μs	3 ... 8		
Output frequency range @ 2/4 kHz	Hz	0 ... 400		
Output frequency range @ 8 kHz	Hz	0 ... 800		
Output frequency range @ 16 kHz	Hz	0 ... 1600		
Ambient temperature	°C	5 ... 40, up to 50 with derating		
Servo amplifier				
Power dissipation @ (400 V/4 kHz/I _N) in interior	W	67.6	83.2	98.8
Power dissipation @ (400 V/4 kHz/P _N) via heat sink	W	40	80	119

Table A.3 Technical data 6 Apms servo amplifier

JM-3000 servo amplifier	Unit	JM-3512	JM-D3512	JM-T3512
Control unit				
Control voltage	V DC	24 ± 10 %		
Control voltage when using a motor holding brake with line length < 50 m	V DC	24 - 5 %/+ 10 %		
Max. inrush current at 24 V power supply unit per device	A	1.8 @ 24 V/1 s and 2.2 @ 18 V/1 s		
Typical power consumption	W	43	54	60
Power output brake driver	W	48 max.	2 x 48 max.	3 x 48 max.
DC link				
DC link capacitance	µF	405	405	405
DC resistance in DC link (DC+ to DC-)	kΩ	146	146	146
Rated power @ 3 x 230 V	kW	1.8	1.8	1.8
Rated power @ 3 x 400/480 V	kW	3.1	3.1	3.1
Switching device				
Permissible switching frequencies	kHz	2/4/8/12/16		
Rise of voltage at output with 10 m motor cable (10% ... 90 %)	kV/µs	3 ... 8		
Output frequency range @ 2/4 kHz	Hz	0 ... 400		
Output frequency range @ 8 kHz	Hz	0 ... 800		
Output frequency range @ 16 kHz	Hz	0 ... 1600		
Ambient temperature	°C	5 ... 40, up to 50 with derating		
Servo amplifier				
Power dissipation @ (400 V/4 kHz/I _N) in interior	W	95	118	141
Power dissipation @ (400 V/4 kHz/P _N) via heat sink	W	87.3	174.7	262

Table A.4 Technical data 12 Apms servo amplifier

JM-3000 servo amplifier	Unit	JM-3518 ¹⁾	JM-D3516
Control unit			
Control voltage	V DC	24 ± 10 %	
Control voltage when using a motor holding brake with line length < 50 m	V DC	24 - 5 %/+ 10 %	
Max. inrush current at 24 V power supply unit per device	A	1.8 @ 24 V/1 s and 2.2 @ 18 V/1 s	
Typical power consumption	W	48	54
Power output brake driver	W	48 max.	2 x 48 max.
DC link			
DC link capacitance	µF	225	405
DC resistance in DC link (DC+ to DC-)	kΩ	350	146
Rated power @ 3 x 230 V	kW	0.8	1.8
Rated power @ 3 x 400/480 V	kW	1.5	3.1
Switching device			
Permissible switching frequencies	kHz	2/4/8/12/16	
Rise of voltage at output with 10 m motor cable (10% ... 90 %)	kV/µs	3 ... 8	
Output frequency range @ 2/4 kHz	Hz	0 ... 400	
Output frequency range @ 8 kHz	Hz	0 ... 800	
Output frequency range @ 16 kHz	Hz	0 ... 1600	
Ambient temperature	°C	5 ... 40, up to 50 with derating	
Servo amplifier			
Power dissipation @ (400 V/4 kHz/I _N) in interior	W	101.4	128.7
Power dissipation @ (400 V/4 kHz/P _N) via heat sink	W	120	233

Table A.5 Technical data 16 Amps and 18 Amps servo amplifier

JM-3000 servo amplifier	Unit	JM-3524	JM-3532
Control unit			
Control voltage	V DC	24 ± 10 %	
Control voltage when using a motor holding brake with line length < 50 m	V DC	24 - 5 %/+ 10 %	
Max. inrush current at 24 V power supply unit per device	A	1.8 @ 24 V/1 s and 2.2 @ 18 V/1 s	
Typical power consumption	W	48	48
Power output brake driver	W	48 max.	48 max.
DC link			
DC link capacitance	μF	675	675
DC resistance in DC link (DC+ to DC-)	kΩ	146	146
Rated power @ 3 x 230 V	kW	3.0	3.0
Rated power @ 3 x 400/480 V	kW	5.2	5.2
Switching device			
Permissible switching frequencies	kHz	2/4/8/12/16	
Rise of voltage at output with 10 m motor cable (10% ... 90 %)	kV/μs	3 ... 8	
Output frequency range @ 2/4 kHz	Hz	0 ... 400	
Output frequency range @ 8 kHz	Hz	0 ... 800	
Output frequency range @ 16 kHz	Hz	0 ... 1600	
Ambient temperature	°C	5 ... 40, up to 50 with derating	
Servo amplifier			
Power dissipation @ (400 V/4 kHz/I _N) in interior	W	103	112.2
Power dissipation @ (400 V/4 kHz/P _N) via heat sink	W	176	240

Table A.6 Technical data 24 Amps and 32 Amps servo amplifier

A.4 Switching device current data 6 Amps to 32 Amps servo amplifier

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-3506	JM-D3506	JM-T3506
Continuous rated current	230 V	2 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	18	2 x 18	3 x 18
Peak current at F _M = 0 Hz			A DC	14.7	2 x 14.7	3 x 14.7
Continuous rated current	230 V	4 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	18	2 x 18	3 x 18
Peak current at F _M = 0 Hz			A DC	3	2 x 3	3 x 3
Continuous rated current	230 V	8 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	12.5	2 x 12.5	3 x 12.5
Peak current at F _M = 0 Hz			A DC	8	2 x 8	3 x 8
Continuous rated current	230 V	12 kHz	A	4	2 x 4	3 x 4
Peak current for 10 s			A	8	2 x 8	3 x 8
Peak current for 500 ms			A	9.7	2 x 9.7	3 x 9.7
Peak current at F _M = 0 Hz			A DC	6.2	2 x 6.2	3 x 6.2
Continuous rated current	230 V	16 kHz	A	2.9	2 x 2.9	3 x 2.9
Peak current for 10 s			A	5.8	2 x 5.8	3 x 5.8
Peak current for 500 ms			A	7.6	2 x 7.6	3 x 7.6
Peak current at F _M = 0 Hz			A DC	4.8	2 x 4.8	3 x 4.8
Continuous rated current	400 V	2 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	18	2 x 18	3 x 18
Peak current at F _M = 0 Hz			A DC	14.7	2 x 14.7	3 x 14.7
Continuous rated current	400 V	4 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	18	2 x 18	3 x 18
Peak current at F _M = 0 Hz			A DC	3	2 x 3	3 x 3
Continuous rated current	400 V	8 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	12.5	2 x 12.5	3 x 12.5
Peak current at F _M = 0 Hz			A DC	8	2 x 8	3 x 8

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.7 Current data of 6 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _S	Unit	JM-3506	JM-D3506	JM-T3506
Continuous rated current	400 V	12 kHz	A	4	2 x 4	3 x 4
Peak current for 10 s			A	8	2 x 8	3 x 8
Peak current for 500 ms			A	9.7	2 x 9.7	3 x 9.7
Peak current at F _M = 0 Hz			A DC	6.2	2 x 6.2	3 x 6.2
Continuous rated current	400 V	16 kHz	A	2.9	2 x 2.9	3 x 2.9
Peak current for 10 s			A	5.8	2 x 5.8	3 x 5.8
Peak current for 500 ms			A	7.6	2 x 7.6	3 x 7.6
Peak current at F _M = 0 Hz			A DC	4.8	2 x 4.8	3 x 4.8
Continuous rated current	480 V	2 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	18	2 x 18	3 x 18
Peak current at F _M = 0 Hz			A DC	12.3	2 x 12.3	3 x 12.3
Continuous rated current	480 V	4 kHz	A	6	2 x 6	3 x 6
Peak current for 10 s			A	12	2 x 12	3 x 12
Peak current for 500 ms			A	16	2 x 16	3 x 16
Peak current at F _M = 0 Hz			A DC	10.2	2 x 10.2	3 x 10.2
Continuous rated current	480 V	8 kHz	A	5.2	2 x 5.2	3 x 5.2
Peak current for 10 s			A	10.4	2 x 10.4	3 x 10.4
Peak current for 500 ms			A	10.4	2 x 10.4	3 x 10.4
Peak current at F _M = 0 Hz			A DC	6.6	2 x 6.6	3 x 6.6
Continuous rated current	480 V	12 kHz	A	2.7	2 x 2.7	3 x 2.7
Peak current for 10 s			A	5.4	2 x 5.4	3 x 5.4
Peak current for 500 ms			A	7.2	2 x 7.2	3 x 7.2
Peak current at F _M = 0 Hz			A DC	4.6	2 x 4.6	3 x 4.6
Continuous rated current	480 V	16 kHz	A	1.2	2 x 1.2	3 x 1.2
Peak current for 10 s			A	2.4	2 x 2.4	3 x 2.4
Peak current for 500 ms			A	5.5	2 x 5.5	3 x 5.5
Peak current at F _M = 0 Hz			A DC	3.5	2 x 3.5	3 x 3.5

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.7 Current data of 6 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-35012	JM-D3512	JM-T3512
Continuous rated current	230 V	2 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	36	2 x 36	3 x 36
Continuous rated current	230 V	4 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	29.5	2 x 29.5	3 x 29.5
Continuous rated current	230 V	8 kHz	A	10	2 x 10	3 x 10
Peak current for 10 s			A	20	2 x 20	3 x 20
Peak current for 500 ms			A	29.3	2 x 29.3	3 x 29.3
Peak current at F _M = 0 Hz			A DC	20.2	2 x 20.2	3 x 20.2
Continuous rated current	230 V	12 kHz	A	6.4	2 x 6.4	3 x 6.4
Peak current for 10 s			A	12.8	2 x 12.8	3 x 12.8
Peak current for 500 ms			A	19.9	2 x 19.9	3 x 19.9
Peak current at F _M = 0 Hz			A DC	13.7	2 x 13.7	3 x 13.7
Continuous rated current	230 V	16 kHz	A	5.1	2 x 5.1	3 x 5.1
Peak current for 10 s			A	10.2	2 x 10.2	3 x 10.2
Peak current for 500 ms			A	14.7	2 x 14.7	3 x 14.7
Peak current at F _M = 0 Hz			A DC	10.1	2 x 10.1	3 x 10.1
Continuous rated current	400 V	2 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	36	2 x 36	3 x 36
Continuous rated current	400 V	4 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	29.5	2 x 29.5	3 x 29.5
Continuous rated current	400 V	8 kHz	A	10	2 x 10	3 x 10
Peak current for 10 s			A	20	2 x 20	3 x 20
Peak current for 500 ms			A	29.3	2 x 29.3	3 x 29.3
Peak current at F _M = 0 Hz			A DC	20.2	2 x 20.2	3 x 20.2
Continuous rated current	400 V	12 kHz	A	6.4	2 x 6.4	3 x 6.4
Peak current for 10 s			A	12.8	2 x 12.8	3 x 12.8
Peak current for 500 ms			A	19.9	2 x 19.9	3 x 19.9
Peak current at F _M = 0 Hz			A DC	13.7	2 x 13.7	3 x 13.7

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.8 Current data of 12 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _S	Unit	JM-35012	JM-D3512	JM-T3512
Continuous rated current	400 V	16 kHz	A	5.1	2 x 5.1	3 x 5.1
Peak current for 10 s			A	10.2	2 x 10.2	3 x 10.2
Peak current for 500 ms			A	14.7	2 x 14.7	3 x 14.7
Peak current at F _M = 0 Hz			A DC	10.1	2 x 10.1	3 x 10.1
Continuous rated current	480 V	2 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	36	2 x 36	3 x 36
Continuous rated current	480 V	4 kHz	A	12	2 x 12	3 x 12
Peak current for 10 s			A	24	2 x 24	3 x 24
Peak current for 500 ms			A	36	2 x 36	3 x 36
Peak current at F _M = 0 Hz			A DC	26	2 x 26	3 x 26
Continuous rated current	480 V	8 kHz	A	8.7	2 x 8.7	3 x 8.7
Peak current for 10 s			A	17.4	2 x 17.4	3 x 17.4
Peak current for 500 ms			A	20.9	2 x 20.9	3 x 20.9
Peak current at F _M = 0 Hz			A DC	14.4	2 x 14.4	3 x 14.4
Continuous rated current	480 V	12 kHz	A	5.2	2 x 5.2	3 x 5.2
Peak current for 10 s			A	10.4	2 x 10.4	3 x 10.4
Peak current for 500 ms			A	15.5	2 x 15.5	3 x 15.5
Peak current at F _M = 0 Hz			A DC	15.1	2 x 15.1	3 x 15.1
Continuous rated current	480 V	16 kHz	A	4	2 x 4	3 x 4
Peak current for 10 s			A	8	2 x 8	3 x 8
Peak current for 500 ms			A	12.4	2 x 12.4	3 x 12.4
Peak current at F _M = 0 Hz			A DC	8.5	2 x 8.5	3 x 8.5

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

Table A.8 Current data of 12 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-3518	JM-D3516
Continuous rated current	230 V	2 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	48	2 x 40
Peak current at F _M = 0 Hz			A DC	53	2 x 36
Continuous rated current	230 V	4 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	48	2 x 40
Peak current at F _M = 0 Hz			A DC	44.4	2 x 29.5
Continuous rated current	230 V	8 kHz	A	16	2 x 13.3
Peak current for 10 s			A	32 ²⁾	2 x 26.6
Peak current for 500 ms			A	32	2 x 29.3
Peak current at F _M = 0 Hz			A DC	28.7	2 x 20.2
Continuous rated current	230 V	12 kHz	A	12.4	2 x 8.5
Peak current for 10 s			A	24.8 ²⁾	2 x 17
Peak current for 500 ms			A	24.8	2 x 19.9
Peak current at F _M = 0 Hz			A DC	22.3	2 x 13.7
Continuous rated current	230 V	16 kHz	A	9.6	2 x 6.8
Peak current for 10 s			A	19.3 ²⁾	2 x 13.6
Peak current for 500 ms			A	19.3	2 x 14.7
Peak current at F _M = 0 Hz			A DC	17.4	2 x 10.1
Continuous rated current	400 V	2 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	48	2 x 40
Peak current at F _M = 0 Hz			A DC	53	2 x 36
Continuous rated current	400 V	4 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	48	2 x 40
Peak current at F _M = 0 Hz			A DC	44.4	2 x 29.5
Continuous rated current	400 V	8 kHz	A	16	2 x 13.3
Peak current for 10 s			A	32 ²⁾	2 x 26.6
Peak current for 500 ms			A	32	2 x 29.3
Peak current at F _M = 0 Hz			A DC	28.7	2 x 20.2
Continuous rated current	400 V	12 kHz	A	12.4	2 x 8.5
Peak current for 10 s			A	24.8 ²⁾	2 x 17
Peak current for 500 ms			A	24.8	2 x 19.9
Peak current at F _M = 0 Hz			A DC	22.3	2 x 13.7

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.
 2) for 2 s 3) for 3 s

Table A.9 Current data of 16 Amps and 18 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-3518	JM-D3516
Continuous rated current	400 V	16 kHz	A	9.6	2 x 6.8
Peak current for 10 s			A	19.3 ²⁾	2 x 13.6
Peak current for 500 ms			A	19.3	2 x 14.7
Peak current at F _M = 0 Hz			A DC	17.4	2 x 10.1
Continuous rated current	480 V	2 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	48	2 x 40
Peak current at F _M = 0 Hz			A DC	44.5	2 x 50.9
Continuous rated current	480 V	4 kHz	A	18	2 x 16
Peak current for 10 s			A	36 ²⁾	2 x 32 ³⁾
Peak current for 500 ms			A	40.8	2 x 37.8
Peak current at F _M = 0 Hz			A DC	36.7	2 x 26
Continuous rated current	480 V	8 kHz	A	13.2	2 x 11.6
Peak current for 10 s			A	26.4 ²⁾	2 x 21
Peak current for 500 ms			A	26.4	2 x 20.9
Peak current at F _M = 0 Hz			A DC	23.7	2 x 14.4
Continuous rated current	480 V	12 kHz	A	9.2	2 x 6.9
Peak current for 10 s			A	18.4 ²⁾	2 x 13.8
Peak current for 500 ms			A	18.4	2 x 15
Peak current at F _M = 0 Hz			A DC	16.5	2 x 10.7
Continuous rated current	480 V	16 kHz	A	7	2 x 5.3
Peak current for 10 s			A	14 ²⁾	2 x 10.6
Peak current for 500 ms			A	12.6	2 x 12.4
Peak current at F _M = 0 Hz			A DC	12.6	2 x 8.5

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.

2) for 2 s 3) for 3 s

Table A.9 Current data of 16 Amps and 18 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-3524	JM-3532
Continuous rated current	230 V	2 kHz	A	24	32
Peak current for 10 s			A	48	64 ²⁾
Peak current for 500 ms			A	72	80
Peak current at F _M = 0 Hz			A DC	53.9	99
Continuous rated current	230 V	4 kHz	A	24	32
Peak current for 10 s			A	48	64 ²⁾
Peak current for 500 ms			A	66.8	80
Peak current at F _M = 0 Hz			A DC	39.2	91.9
Continuous rated current	230 V	8 kHz	A	20	27.8
Peak current for 10 s			A	45.7	55.6 ²⁾
Peak current for 500 ms			A	45.7	69.5
Peak current at F _M = 0 Hz			A DC	26.8	72.7
Continuous rated current	230 V	12 kHz	A	12.5	17.8
Peak current for 10 s			A	31	35.6 ²⁾
Peak current for 500 ms			A	31	44.5
Peak current at F _M = 0 Hz			A DC	18.2	49.5
Continuous rated current	230 V	16 kHz	A	9.9	14.1
Peak current for 10 s			A	22.9	28.2 ²⁾
Peak current for 500 ms			A	22.9	35.3
Peak current at F _M = 0 Hz			A DC	13.4	36.35
Continuous rated current	400 V	2 kHz	A	24	32
Peak current for 10 s			A	48	64 ²⁾
Peak current for 500 ms			A	72	80
Peak current at F _M = 0 Hz			A DC	53.9	99
Continuous rated current	400 V	4 kHz	A	24	32
Peak current for 10 s			A	48	64 ²⁾
Peak current for 500 ms			A	66.8	80
Peak current at F _M = 0 Hz			A DC	39.2	91.9
Continuous rated current	400 V	8 kHz	A	20	27.8
Peak current for 10 s			A	45.7	55.6 ²⁾
Peak current for 500 ms			A	45.7	69.5
Peak current at F _M = 0 Hz			A DC	26.8	72.7
Continuous rated current	400 V	12 kHz	A	12.5	17.8
Peak current for 10 s			A	31	35.6 ²⁾
Peak current for 500 ms			A	31	44.5
Peak current at F _M = 0 Hz			A DC	18.2	49.5

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.
2) for 2 s

Table A.10 Current data of 24 Amps and 32 Amps servo amplifiers

JM-3000 servo amplifier	U _{network}	F _s	Unit	JM-3524	JM-3532
Continuous rated current	400 V	16 kHz	A	9.9	14.1
Peak current for 10 s			A	22.9	28.2 ²⁾
Peak current for 500 ms			A	22.9	35.3
Peak current at F _M = 0 Hz			A DC	13.4	36.35
Continuous rated current	480 V	2 kHz	A	24	32
Peak current for 10 s			A	48	64
Peak current for 500 ms			A	72	80
Peak current at F _M = 0 Hz			A DC	52.5	95.5 ²⁾
Continuous rated current	480 V	4 kHz	A	24	32
Peak current for 10 s			A	48	64
Peak current for 500 ms			A	59	80
Peak current at F _M = 0 Hz			A DC	34.6	88.4 ²⁾
Continuous rated current	480 V	8 kHz	A	17.1	24.3
Peak current for 10 s			A	32.6	48.6
Peak current for 500 ms			A	32.6	48.6
Peak current at F _M = 0 Hz			A DC	19.1	51.9 ²⁾
Continuous rated current	480 V	12 kHz	A	10.1	14.4
Peak current for 10 s			A	24	28.8
Peak current for 500 ms			A	24.1	36
Peak current at F _M = 0 Hz			A DC	14.2	38.5 ²⁾
Continuous rated current	480 V	16 kHz	A	8.2	11.7
Peak current for 10 s			A	19.3	23.4
Peak current for 500 ms			A	19.3	29.3
Peak current at F _M = 0 Hz			A DC	11.3	30.7 ²⁾

Note: Current data per axis in servo amplifier 230/400/480 V AC relates to the supply voltage of the supply unit.
2) for 2 s

Table A.10 Current data of 24 Amps and 32 Ampsservo amplifiers

A.5 Ambient conditions

Ambient conditions	JM-3000
Degree of protection	Device: IP20 - except terminals: IP10 - (touch protection back of hand)
Accident prevention regulations	in accordance with local regulations (in Germany e.g. BGV A3)
Installation altitude	up to 1000 m above NSL, above 1000 m NSL with power reduction (1% per 100 m, max. 2000 m aboveMSL)
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 safety function STO min. IP54

Table A.11 Ambient conditions JM-3000

Ambient conditions	JM-3000
During transport	in accordance with EN 61800-2, IEC 60721-3-2 class 2K3 ¹⁾
	Temperature -25 °C ... +70 °C
	Relative air humidity 95 % at max. +40 °C
During storage	in accordance with EN 61800-2, IEC 60721-3-1 classes 1K3 and 1K4 ²⁾
	Temperature -25 °C ... +55 °C
	Relative air humidity 5 ... 95 %
During operation	in accordance with EN 61800-2, IEC 60721-3-3 class 3K3 ³⁾
	Temperature 5 °C ... +40 °C (4, 8, 16 kHz) up to 50 °C with power reduction (5 %/°C)
	Relative air humidity 5 ... 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 peak 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 peak values for temperature and relative humidity stipulated in the table must not occur simultaneously.

Table A.12 Ambient conditions JM-3000

NOTE:

The ambient conditions apply to the device. They must therefore also be adhered to in the control cabinet.

Mechanical conditions		JM-1000	
Vibration limit in transit	in accordance with 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	in accordance with EN 61800-2, IEC 60721-2-2 class 2M1		
	Free falls height of packed device: maximum 0.25 m		
Vibration limit of the plant ¹⁾	in accordance with 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.13 Mechanical conditions JM-1000



CAUTION!

- In accordance with EN ISO 13849-2, the control cabinet must have a degree of protection of IP54 or higher when the STO (Safe Torque OFF) safety function is used.

NOTE:

The devices are only designed for stationary use.

A.6 UL certification

A.6.1 CE certification

The JM-3000 servo amplifiers meet the requirements of the Low Voltage Directive 2006/95/EC and of the product standard EN 61800-5-1.

The JM-3000 servo amplifiers therefore meet the requirements for installation in a machine or plant within the meaning of the Machine Directive 2006/42/EC.

The servo amplifiers are CE marked accordingly. The CE mark on the nameplate indicates conformity with the above mentioned guidelines.

A.6.2 UL certification

The UL certification for the JM-3000 servo amplifiers is in preparation.

A.6.3 Reactive system load through harmonics

(note to
EN 61000-3-2:2006)

The devices of the JM-3000 system are "professional devices" in the sense of EN 61000, so that they are within the scope of the standard at a nominal rated load of ≤ 1 kW (or ≤ 16 A per supply phase). When the supply unit is connected directly ≤ 1 kW to the public low-voltage grid, measures must either be taken to comply with the standard, or the relevant power supply company must issue connection approval. If you use our drive units as a component in your machine/plant, the scope of the standard must be tested for the complete machine/plant.

A.7 Accessories

The JM-3000 system has been complemented with extensive accessories. Important components include, for example:

- Synchronous servo motors
- Encoder types: Resolver, HIPERFACE® multi-turn and HIPERFACE® single-turn (additional encoder types in preparation)
- Pre-fabricated motor cable
- Pre-fabricated encoder cable
- Data cables - for Fieldbus and cross-communication
- Connector sets, PE connecting plate
- PC user software - e.g. JetSym
- Line filter - reduces the conducted high-frequency interferences of the drive control system (for use on the JM-3000 supply unit)
- Line reactor - reduces the voltage distortions (THD) in the network and increases the service life of the servo amplifier (for use on the JM-3000 supply unit).
- Braking resistor - converts excess regenerative energy into heat, allowing an even more dynamic process (for use on the JM-3000 power supply unit).

A.7.1 Connecting cables for communication



Type: XCOM



Type: ECAT

Jetter item no. 60879945_00

Communication cable set JM-3000 1 pc each:

- RJ-10 cross-communication, 0.25m
- RJ-45 patch cable SF/UTP, Cat 5e, 0.25m

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