

ServoOne CM

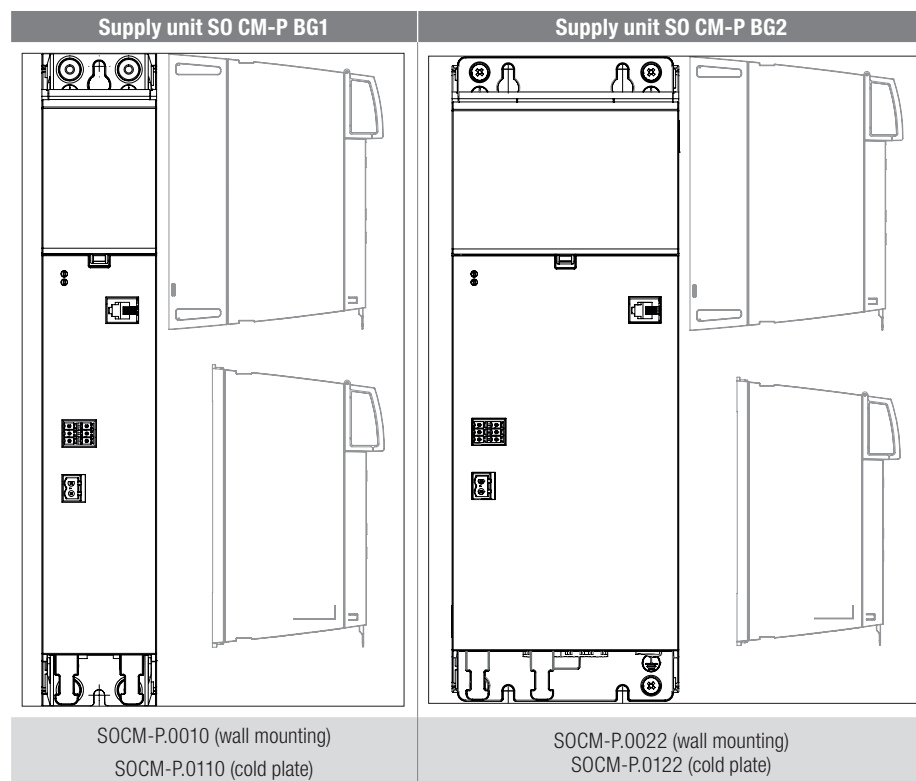
ServoOne CM-P Operation Manual

Passive supply unit BG1+2

Compact multi-axis system ServoOne CM



Overview of supply unit SO CM-P BG1+2



Operation Manual Supply Unit SO CM-P BG1+2 Compact multi-axis system ServoOne CM

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The German version is the original of this documentation.

Compact multi-axis system ServoOne CM

Consisting of the supply unit SO CM-P, the DC-powered axis controllers SO CM and a matching controller MotionOne CM, the SystemOne CM compact multi-axis system offers a high degree of solutions expertise and flexibility in the range from 2 A to 210 A rated current.

With the aid of the expansion module SO CM-E, the axis controllers SO CM BG1+2 can be combined with the axis controllers SO CM BG3+4 without problems. The addition of the capacitance module SO CM-C to the supply unit SO CM-P BG3+4 makes possible usage in even more dynamic applications. The external switched-mode power supply SO CM-S is also available for the 24 V control supply.

Reduction of the wiring and shortening of the installation times are just as easy to achieve as resource-saving, cost-conscious operation.

Subject to technical change without notice

The content of our documentation was compiled with the greatest care and attention, and based on the latest information available to us.

We should nevertheless point out that this document cannot always be updated simultaneously with the ongoing technical development of our products.

Information and specifications may be subject to change at any time. For information on the latest version, please visit www.keba-iti.com.

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1 General

The product DVD from KEBA Industrial Automation Germany GmbH contains the complete documentation for the related product series. The documentation for a product series includes the operation manual (hardware description), device help (software description) as well as further user manuals (e.g. field bus description) and specifications. The documents are available in the formats PDF, HTML or chm.

1.1 Target group

Dear user,

The documentation forms part of the device and contains important information on operation and service. It is aimed at all persons who undertake mounting, installation, commissioning and servicing work on the product.

1.2 Prerequisites

Prerequisites for the usage of devices from KEBA:

- The documentation on the devices is to be stored so it is legible, accessible at all times and for the entire life of the product.
- Read and ensure you understand the documentation on your device.
- Qualification: to prevent injury or damage, personnel may only work on the device if they have electrical engineering qualifications.
- Knowledge required:
 - National health and safety regulations (e.g. DGUV V3 in Germany)
 - Mounting, installation, commissioning and operation of the device

Work in other areas, for example transport, storage and disposal is only allowed to be undertaken by trained personnel.

1.3 Pictograms

To help the user, in this operation manual we use the following pictograms and tables of steps:



NOTE

Useful information or reference to other documents.



Reference to other documents.

You will find the "safety instructions and warnings" used in this operation manual with the related pictograms in *chapter 2 Safety*.

1.4 Disclaimer

Following the documentation on the devices from KEBA is a prerequisite:

- For safe operation.
- To achieve stated performance features and product characteristics.

KEBA does not accept any liability for injuries, damage or financial losses that result from the failure to follow the documentation.

1.5 Reference documents


Note:

You will find all reference documents for this device on our web site:

www.keba-lti.com in **Service → Downloads**

1.6 Order code

The article designation provides information on the related variant of the supply unit supplied. You will find the significance of the individual characters of the order code in the column on the left.

	SOCM	-	P	.	0	0	1	0	.	0	0	0	0	.	0
ServoOne CM															
Supply unit model	P: Passive														
Power supply	0: 3 x 230 - 480 V AC														
Cooling	0: With heat sink 1: Cold plate														
Power	10: 10 kW 22: 22 kW														
Control board supply	0: None 1: 24 V DC, 20 A 2: 24 V back-up on power failure														
Braking resistor	0: External 1: Internal														
Extras	0: None 1: Protective varnish														
Index	0, C, D: KEBA														
Hardware version															

1) In preparation

1.7 Rating plate

On the rating plate for the ServoOne CM-P Supply Unit BG1+2 you will find the serial number. You can identify the date of manufacture based on the following key.



SO CM-P.0010.0000.0 Mac Adr.: MACADR SW: V 0.1 FS SW1:  SN: JJWWSXXXX	T1 FS SW2: A	Serial no. key: - JJ (YY) = Prod. year - WW = Calendar week (CW) - S = Production site - XXXX = Sequential no. per CW
KEBA Industrial Automation Germany GmbH 35633 Lahnau Gewerbestraße 5-9 SO CM-P.0010.0000.0 In: 230 V AC - 480 V AC 46 AAC - 38 AAC Out: 325 V DC - 678 V DC 39 A DC - 32 A DC Multiple rated equipment. See instruction manual Year: 2020  SN: JJWWSXXXXt	A: Revision state, e.g. F T	

Figure 1.1 Hardware rating plate ServoOne CM-P Supply Unit (example)

Position of rating plate

You will find the rating plate (T) on the left side of the device.

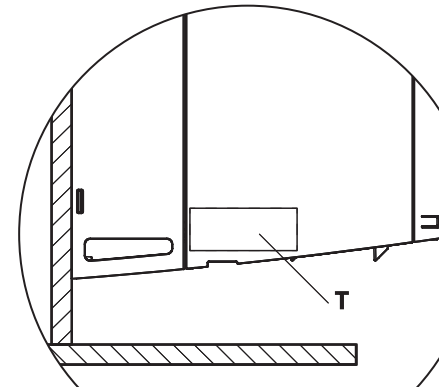


Figure 1.2 Position of rating plate (T)

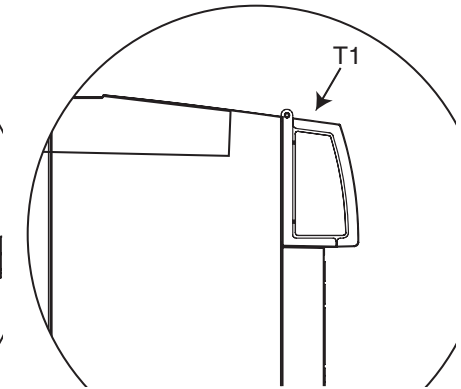


Figure 1.3 Position of second rating plate (T1)

A second rating plate (T1) with only the most important information is on the top of the busbar cover. In this way the rating plate data can also be seen if the devices are installed in a row.

1.8 Brief description



NOTE

Only the ServoOne CM-P supply units are described in this Operation Manual. You will find information on the safety control (SafetyOne SCM), controller (MotionOne CM) and axis controller (ServoOne CM) in the related operation manuals.

1.9 Scope of supply

The scope of supply includes:

- ServoOne CM-P supply unit
- Pre-assembled busbar elements for 24 V control supply -U_{St}- and DC link supply -U_{ZK}-
- Pre-assembled connection cable for communication between supply unit and axis controller
- Product DVD with booklet

1.10 Disposal

Follow the applicable national regulations!

Depending on their characteristics, dispose of individual parts as:

- Electrical waste
- Plastic waste
- Metal scrap

Or engage a certified disposal organisation with scrapping

1.11 Support

Address: KEBA Industrial Automation Germany GmbH
Gewerbestrasse 5-9
35633 Lahnau

If you have any questions about the project planning for your machine or the commissioning of your device, our Helpline will provide you with quick, specific assistance.

The Helpline is available by e-mail or telephone:

Service hours: Mo. - Fr.: 8 a.m. - 5 p.m. (CET)

E-mail: helpline@keba.com

Telephone: +49 6441 966-180

Internet: www.keba-lti.com

Telephone: +49 6441 966-0



Note:

You will find detailed information about our services on our web site www.keba-lti.com → Service

2 Safety

2.1 Overview

Our devices are state-of-the-art and comply with recognised safety regulations, nevertheless hazards can arise. In this chapter:

- We provide information on residual risks and hazards that can emanate from our devices on usage as intended.
- We warn about the foreseeable misuse of our devices.
- We refer to the necessary care and measures to be taken to prevent risks.

2.2 Measures for your safety



Note

Only install and place in operation your device taking into account the documentation for the related device family!

Our devices are quick and safe to operate. For your own safety and for the safe function of your device, please be sure to observe the following points:

1. Follow safety instructions for the devices:

Follow all safety instructions and warnings in the entire documentation related to the device series.

2. Electric drives are dangerous:

- Due to electrical voltages up to 480 V AC and up to 800 V DC
- Even 10 min. after switching off the mains supply, dangerously high voltages of ≥ 50 V may still be present (capacitor charge). So check that electrical power is not present! See also the warning label on the front panel on the device.
- Rotating parts
- Automatically starting drives.
- Hot components and surfaces

3. Protection against magnetic and/or electromagnetic fields during installation and operation.

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

- Areas in the immediate vicinity of electrical equipment!
- Areas where electronics components and drive controllers are installed, repaired and operated!
- Areas where motors are installed, repaired and operated!
Motors with permanent magnets pose particular hazards.

4. During installation observe the following:

- Comply with connection conditions and technical data as per the documentation and the rating plate!
- Comply with standards and directives on electrical installation, such as cable cross-section, shielding, etc.!
- Do not touch electronic components or contacts!
Electrostatic discharge can harm people and destroy components!
- Take protection measures and use protective devices as per the applicable regulations (e.g. EN 60204 or EN 61800-5-1)!
- Take protection measures against electric shock according to IEC 60364-4-41:2005/AMD1:- section 411.3. Protection measure, use additional protective equipotential bonding as described in appendix D of IEC 60364-4-41.
- Take "device earthing" protection measure!

5. Ambient conditions

- Follow the instructions on the transport, storage and correct operation of the devices stated in the operation manual in "A Appendix".

2.3 General safety instructions and warnings




DANGER!	Risk of injury due to electrical power!
	<ul style="list-style-type: none"> • Carelessness will result in serious injuries or death. Follow safety instructions and warnings in this document and on the device.
WARNING!	Risk of injury due to electrical power!
	<ul style="list-style-type: none"> • Carelessness may result in serious injuries or death. Follow safety instructions and warnings in this document and on the device.
CAUTION!	Risk of injury or damage to the device due to incorrect operation!
	<ul style="list-style-type: none"> • Carelessness may result in minor injuries or damage. Follow safety instructions and warnings in this document and on the device.
WARNING!	Risk of injury due to hot surfaces and components!
	<ul style="list-style-type: none"> • Carelessness may result in serious burns. Electronic components may become hot during operation! Follow safety instructions and warnings in this document and on the device!
Caution!	Damage due to electrostatic discharge!
	<ul style="list-style-type: none"> • Electrostatic discharge can destroy components. Do not touch electronic components or contacts! Follow safety instructions and warnings in this document and on the device!
DANGER!	Risk of injury due to rotating parts on the motor!
	<ul style="list-style-type: none"> • Carelessness will result in serious injuries or death. Follow safety instructions and warnings in this document.

Pay attention to **special safety instructions and warnings** that are given here in the document before a specific action and that warn the user about a **specific hazard**!



Note:

The pictograms may also be used on their own with the signal word, e.g. in the connection diagrams, however they have the same function as in the complete warning.

DANGER	WARNING	CAUTION
		

2.4 Intended use

Our devices are components intended for stationary electrical systems and machines in the industrial and commercial sector.



The ServoOne CM-P supply unit conforms to the
Low Voltage Directive 2014/35/EU

Tested and certified in accordance with applicable standards (see declaration of conformity in chap. 2.8).

When installed in machines it is prohibited to start-up intended operation until it has been ascertained that the completed machine fully complies with the provisions of the Machinery Directive (2006/42/EC); compliance with EN 60204 is mandatory.

Starting up intended operation is only permitted on compliance with the [EMC Directive 2014/30/EU](#).

The devices meet the requirements of the harmonised product standard EN 61800-5-1.

You will find information on the installation of your device in chapter "3 Mechanical installation".

2.4.1 Repair

Only have repairs undertaken by authorised repair shops. Unauthorised repairs could lead to death, injury or damage (see previous sections). The warranty provided by KEBA will be rendered void.

2.5 Misuse

Our devices are:

- Not intended for installation in vehicles. Deployment of the device in mobile equipment is classed as non-standard ambient conditions and is permissible only by special agreement.
- Not intended for installation in environments with harmful oils, acids, gases, vapours, dusts, radiation etc.
- Not approved for usage in special applications (e.g. in potentially explosive atmospheres or areas in which there is a risk of fire).
- Not approved for usage outside a switch cabinet.
- Not approved for the generation of high-frequency onboard networks for which the devices are not designed.



Note:

The use of devices in warehouse storage and retrieval systems that are operated inside and outside the rack aisle on rails is allowed provided the vibration does not exceed the maximum standard values 3M1 as per DIN EN 60721-3-3.

2.6 Responsibility

Electronic devices are not fail-safe. The installer and/or operator of a complete machine or system is responsible:

- For ensuring the drive is rendered safe if the device fails
- For ensuring the safety of personnel and machinery
- For ensuring the complete machine is in correct working order
- For the risk assessment on the complete machine or system according to DIN EN 12100:2011 (formerly DIN EN 14121:2007) and EN ISO 13849-1 (formerly DIN EN 954-1)

In EN 60204-1:2006 "Safety of machinery", pay attention to:

- The topic of "Electrical equipment of machines". The safety requirements on electrical machines defined there are intended to protect personnel and machinery or systems.

- The emergency stop function (as per EN 60204) shuts down the supply of power to a machine, which results in the drives coasting down in an uncontrolled manner. To avert hazards, check whether it is appropriate:
 - To keep individual drives in operation
 - To initiate specific safety procedures
 - To incorporate a Safe Torque Off function (Safe Torque Off: movement stop by "switching off the electrical supply" or STO)

2.7 Relevant laws, standards and directives applied

For information on the laws, standards and directives applied by KEBA, refer to the declaration of conformity.



Note:

Depending on the specific application for the devices, other laws, standards and directives with provisions on "safety" may apply. If necessary, contact the machine or system manufacturer.

2.8 Declaration of conformity



EU-Konformitätserklärung

EU Declaration of Conformity

Der Hersteller
The manufacturer

LTI Motion
Gewerbestraße 5-9
35633 Lahnau
Deutschland

erklärt in alleiniger Verantwortung hiermit, dass die folgenden Produkte
declares under sole responsibility, that the following products

Produktbezeichnung:
Product designation:

Versorgungseinheit ServoOne CMP
Supply Unit ServoOne CMP

Produkttypen:
Product types:

SO CM-P.0x10.xxxx.x, SO CM-P.0x22.xxxx.x

den Sicherheitsbestimmungen der nachstehenden EU-Richtlinie entsprechen:
comply with the essential requirements of the following EU Directive:

2014/35/EU
2014/35/EU

Niederspannungsrichtlinie
Low Voltage Directive

und dass die folgend angeführte Norm angewandt wurde:
and that the following standard has been applied:

EN 61800-5-1:2007
Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl – Teil 5-1: Anforderungen an die
Sicherheit; Elektrische, thermische und energetische Anforderungen.
Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy.

Unterzeichnet für und im Namen von LTI Motion

Unterschrift / signature

Name / name:
Stellung / position:
Datum / date:
35633 Lahnau

Dr. Josef Wiesing
Geschäftsführer / Managing Director
09.10.2017

Dokument: 1400.0DK.2-02

FB 0018 EU-Konformitätserklärung NSRL/EMV 2017/07 F

3 Mechanical installation

3.1 Notes for installation

During the installation work it is imperative you avoid ...

- Drill chippings, screws or other foreign bodies falling into the device
- Moisture entering the device

Switch cabinet

- The device is designed only for installation in a stationary switch cabinet. The switch cabinet must as a minimum provide IP44 protection. According to EN ISO 13849-2 the switch cabinet must have IP54 protection or higher when using the safety functions (STO and SBC) in the axis controller.

Environment

- The supply unit must not be installed in areas where it would be permanently exposed to vibration. You will find more information in the appendix.

Soiling

- Maximum pollution degree 2 in accordance with EN 60664-1. Further information on ambient conditions can be found in the appendix.

Effective EMC installation

- To obtain the best result for effective EMC installation you should use a conductive, well-earthed, chromated or galvanised backing plate.
- If backing plates are varnished, remove the coating from the contact area! The devices themselves have a chromated zinc frame.



NOTE:

On installing the supply unit in the axis group it is imperative the operation manuals for the other devices (axis controller, controller, etc.) are also followed.

3.1.1 Order and arrangement

The following basic guidelines apply to the arrangement and installation of the supply unit or axis controllers.

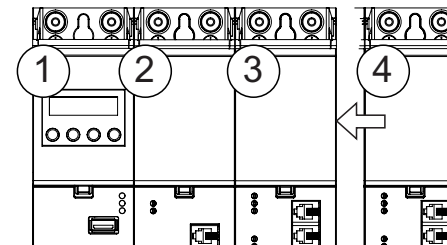
Butt mounting and alignment

- The devices can be mounted directly beside each other without any spacing. They are fastened to the backing plate using two/four screw joints. The control and supply of power to the ServoOne CM axis controllers and the MotionOne CM controller is undertaken with the aid of the DC link and 24 VDC busbars and is possible with the same cooling concept, without additional compensation measures in relation to the device depth.
- The devices must be mounted in the stipulated order one against the other see Figure 3.1. A different order is not allowed, as otherwise there will be problems with the busbars and the thermal interaction between the devices.



Note

A maximum of 8 axis controllers (this corresponds to maximum 24 axes) can be connected and operated on one ServoOne CM-P Supply Unit .




- 1.) MotionOne CM controller
- 2.) ServoOne CM-P supply unit
- 3.) ServoOne CM axis controller
- 4.) Further ServoOne CM axis controller

Figure 3.1 Butt mounting sequence

WARNING!	Risk of injury due to hot surfaces on the device (heat sink)!
	<p>Carelessness may result in serious burns or damage.</p> <ul style="list-style-type: none"> • The device heats up very significantly during operation and can reach temperatures of up to 100 °C. If touched there is a risk of burns to the skin. For this reason provide protection against touching. • Please maintain an adequate distance from neighbouring assemblies, particularly above the heat sink.

3.2 Mounting clearances

CAUTION!	Damage to the device due to incorrect installation conditions!
	<p>The device may suffer irreparable damage if the conditions are not met.</p> <ul style="list-style-type: none"> The minimum clearances stated in the figure below apply to all devices (MotionOne CM, ServoOne CM-P and ServoOne CM). The clearance above the devices is important to prevent the build-up of heat. The clearance underneath and at the front is necessary to permit correct cable laying.

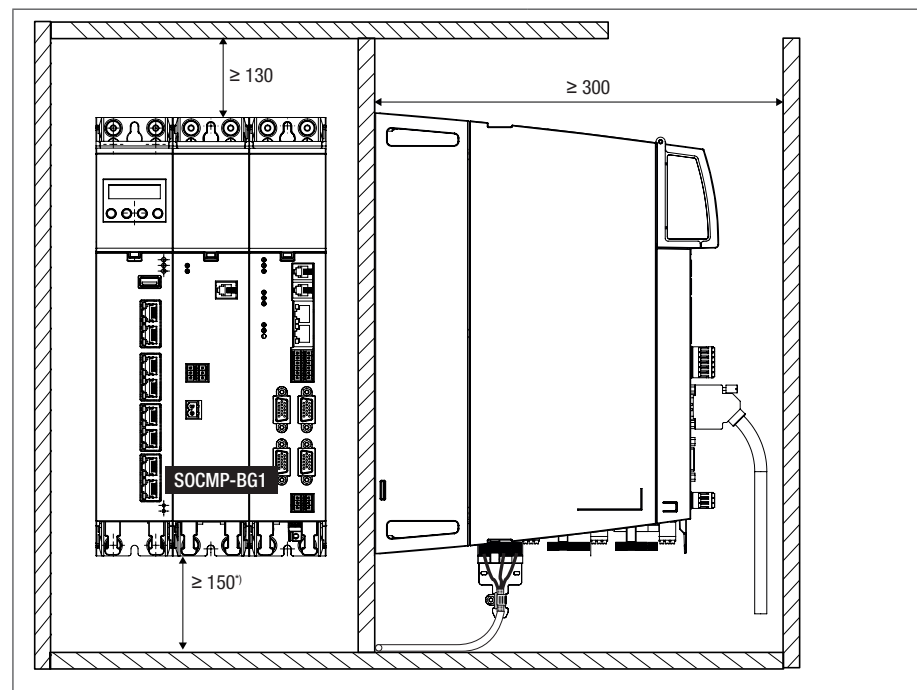
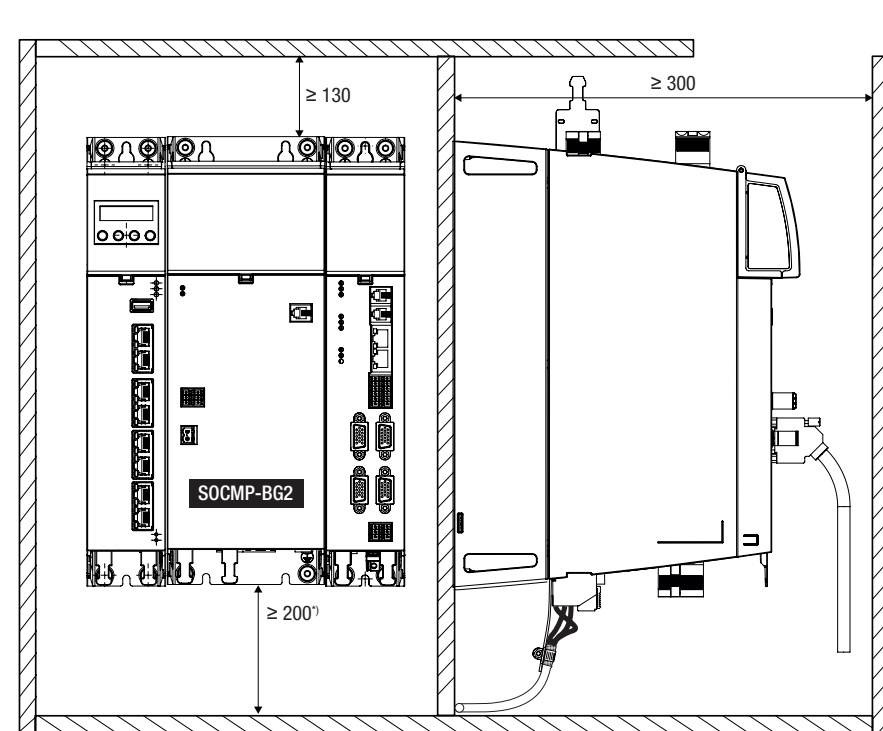


Figure 3.2 Mounting clearances, SystemOne CM-P supply unit



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

The mains connection cable for the supply unit is definitive for the clearance underneath.

Bending radius mains cable up to 3 x 10 mm² (for SOCMP-P-BG1) Approx. 48 to 98 mm (depending on cable type)
 Bending radius mains cable up to 3 x 16 mm² (for SOCMP-P-BG2) Approx. 150 to 200 mm (depending on cable type)

Figure 3.2 Mounting clearances, SystemOne CM-P supply unit

3.3 Cooling the devices

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

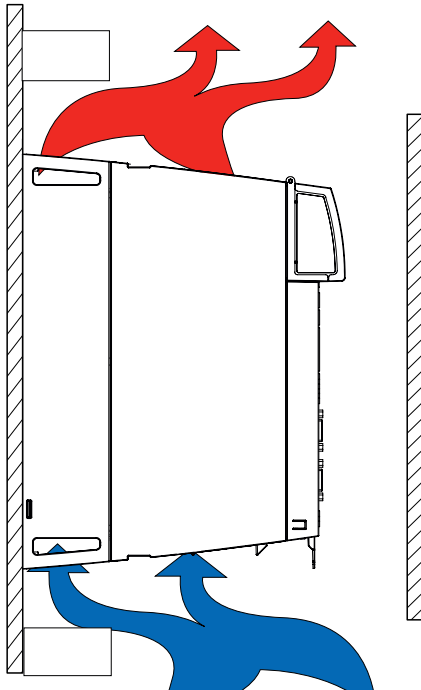


Figure 3.3 Cooling air flows unhindered through the device

3.4 Installation of the devices for wall mounting

Step	Action	Comment
1.	Arrange the supply unit on the backing plate as per Figure 3.1. Please also provide enough space to the left of the supply unit for the MotionOne CM controller. Align all devices in a line along the top edge of the devices.	This action is necessary to be able to couple the DC link using the pre-assembled busbars.
2.	Mark out the position of the tapped holes on the backing plate. Drill holes in the backing plate and cut a thread for each fixing screw in the backing plate.	Pay attention to the bending radius of the connection cables! For hole spacing and dimensional drawings, see Table 3.1 and Figure 3.4.
3.	Mount the ServoOne CM-P supply unit vertically and butt mounted in a row with the axis controllers on the backing plate.	The contact surface must be bare metal and conductive.
Continue with the electrical installation in chapter 4.		

3.4.1 Dimensions (housing with heat sink)

ServoOne CM-P	Supply unit BG1	Supply unit BG2
Type	SOCM-P.0010	SOCM-P.0022
Weight	2.65 kg	5.1 kg
B (width)	55	110
H (height)	310	
H1	299	
H2	6	
T (total depth)	241	
T1	222	
A	27.5	27.5
A1	-	55
C	5	
Side clearance	Direct butt mounting	
Screws	2 x M4	4 x M4

All dimensions in mm

Table 3.1 Dimensions for wall mounting



NOTE:

The supply unit must always be fitted to the left of the axis controllers. The highest power axis controller should be close to the supply unit. For double-axis and triple-axis controllers it is the total power that counts.

3.4.2 Dimensional sketches, wall mounting

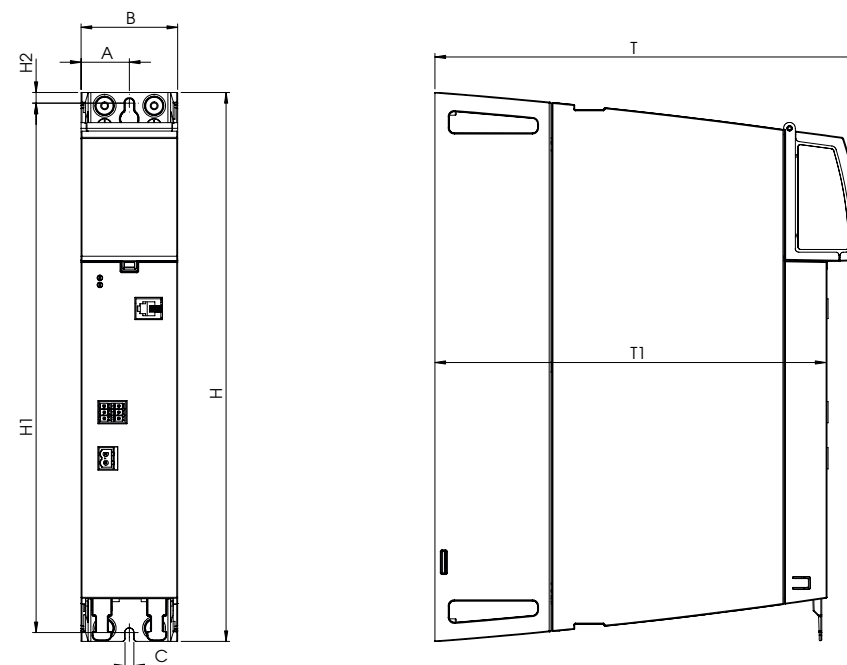


Figure 3.4 Dimensional drawing, supply unit BG1, for dimensions see Table 3.1

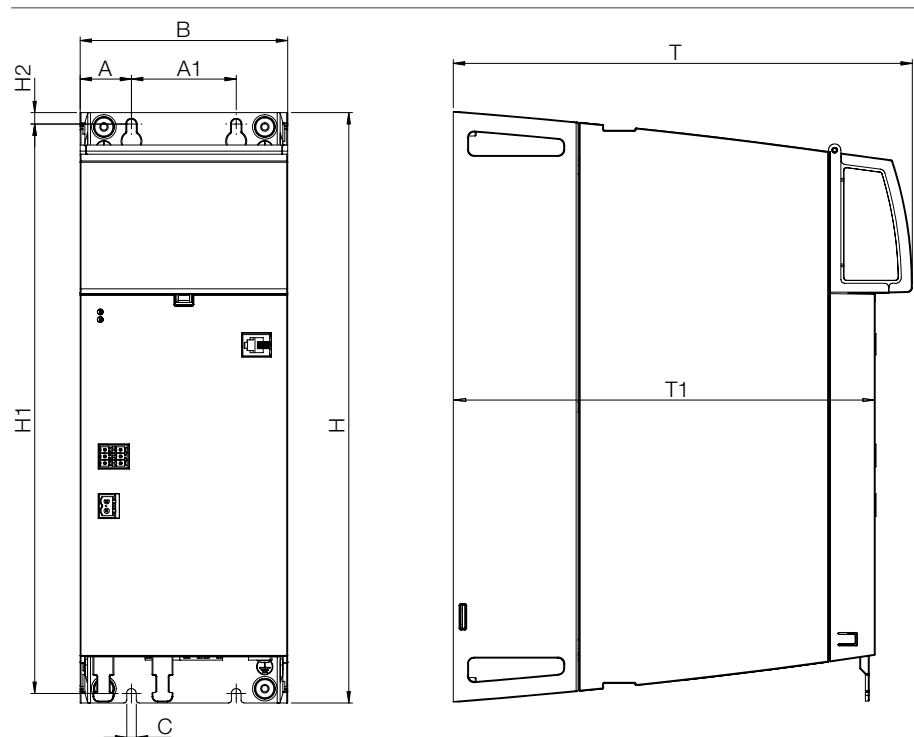


Figure 3.5 Dimensional drawing, supply unit BG2, for dimensions see Table 3.1

3.5 Installation of the devices for cold plate

Step	Action	Comment
1.	<p>Arrange the supply unit on the backing plate as per Figure 3.1.</p> <p>Also provide enough space to the left of the supply unit for the MotionOne CM controller.</p> <p>Align all devices in a multi-axis group in a line along the top edge of the devices.</p>	<p>This action is necessary to be able to couple the DC link using the busbars.</p> <p>For information on the mounting clearances see Table 3.1.</p>
2.	<p>Mark out the position of the tapped holes on the cooler to be used.</p> <p>Drill holes in the cooler and cut a thread for each fixing screw in the backing plate.</p>	<p>Pay attention to the bending radius of the connection cables!</p> <p>For hole spacing and dimensional drawings see Table</p>
3.	<p>The thermally conductive film is already bonded to the rear wall of the cold plate devices.</p> <p>Mount the devices vertically and butt mounted in a row on the backing plate. Tighten the screws evenly so that the thermal resistance remains as low as possible.</p>	<p>Make sure the surface of the cooler is free of drill chippings or other soiling.</p>
Continue with the electrical installation in chapter 4.		

3.5.1 Dimensions, cold plate model

ServoOne CM-P	Supply unit BG1	Supply unit BG2
Type	SOCM-P.0110	SOCM-P.0122
Weight	2.2 kg	4.2 kg
B (width)	54.5	109
H (height)	310	
H1	299	
H2	6	
T (total depth)	188.5	
T1	170	
A	27.25	27.25
A1	-	55
C	5	
Side clearance	Direct butt mounting	
Screws	2 x M4	4 x M4

All dimensions in mm

Table 3.2 Dimensions, cold plate



NOTE:

The supply unit must always be fitted to the left of the axis controllers. The highest power axis controller should be close to the supply unit. For double-axis and triple-axis controllers it is the total power that counts.

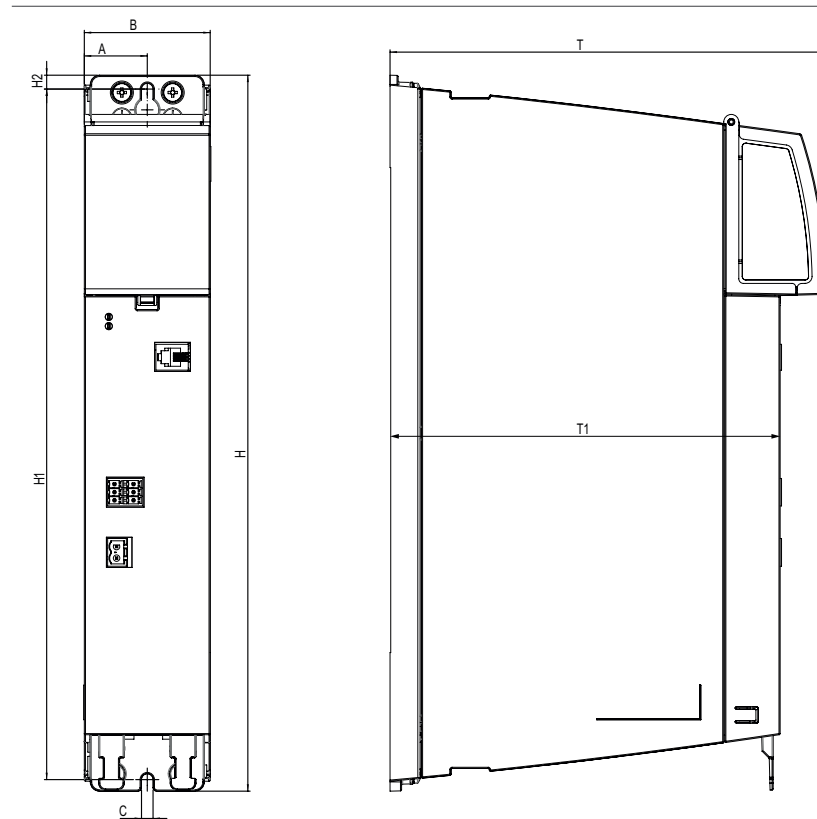


Figure 3.6 Dimensional drawing, ServoOne CM axis controller BG1 cold plate (see Table 3.2)

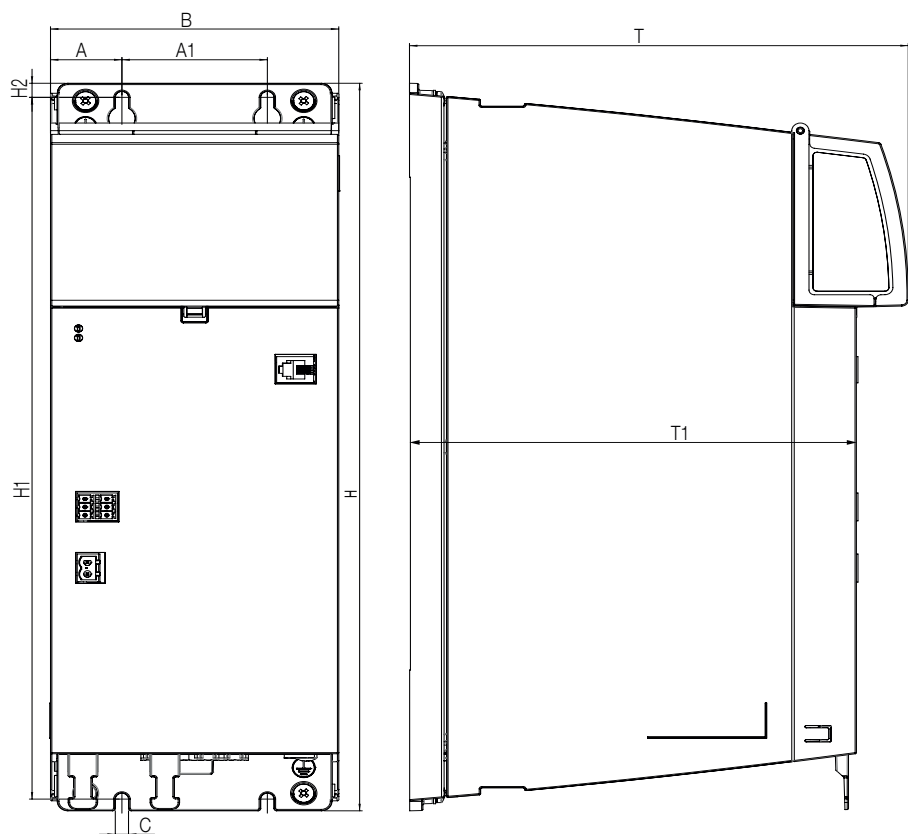


Figure 3.7 Dimensional drawing, ServoOne CM axis controller BG2 cold plate (see Table 3.2)

3.5.2 Installation on the cooler

For the optimal transfer of heat from the rear wall of the device to the cooler provided, a thermally conductive film is already bonded to the cooling plate on the device (see Figure 3.8). The film is laminated with aluminium toward the cooler. The device can be mounted and also removed with the film.

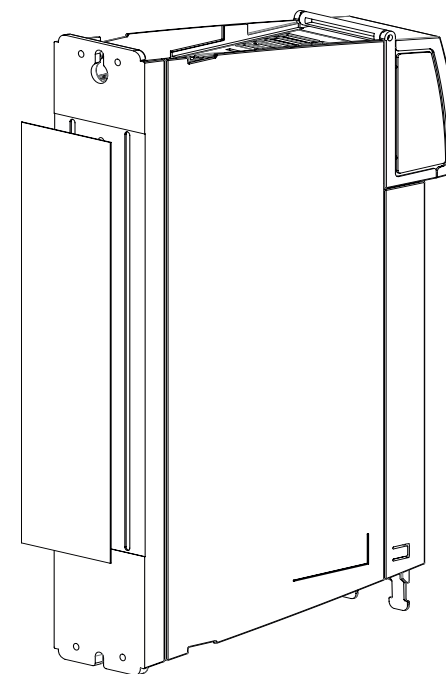


Figure 3.8 Rear wall with film ServoOne CM axis controller BG1 (cold plate)

CAUTION!

Damage to the device due to incorrect mounting!



If this instruction is not followed, the device will overheat due to the poor thermal transfer. The device would fail as a result.

- Please ensure that there is no dirt between the cooler and the rear wall of the device during mounting.

As the devices of size BG2 are twice as wide, a correspondingly wider piece of thermally conductive film is attached to the cooling plate (see Fig. Figure 3.9).

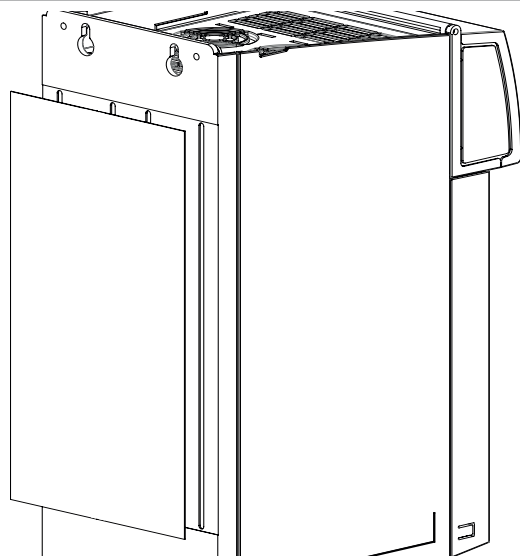


Figure 3.9 Rear wall with film ServoOne CM axis controller BG2 (cold plate)

3.5.3 Sizing the cooler

	ServoOne CM-P BG1	ServoOne CM-P BG2
Thermal resistance $R_{th}K$ ¹⁾	0.02 K/W	0.01 K/W
Thermal capacity of the cooling plate at the device	390 Ws/K	780 Ws/K
Max. temperature of the cooling plate at the device	85 °C	
Surface finish on the cooler	Max. roughness $R_z = 6.3$	

¹⁾ Thermal resistance between active cooling surface on the device and cooler

Table 3.3 Characteristics of cold plate model

4 Electrical installation



NOTE:

On installing the supply unit in the axis group it is imperative the Operation Manuals for the other devices (axis controller, controller) are also followed.

4.1 Before you start

During the installation work it is imperative you avoid ...

- Screws, cable residue or other foreign bodies falling into the device
- Moisture entering the device

It is imperative you pay attention to the following warnings and safety instructions before and during installation.

DANGER!	Risk of injury due to electrical power!
	<p>Carelessness will result in serious injuries or death.</p> <ul style="list-style-type: none">• Never make or disconnect electrical connections while they are electrically live! Always disconnect the power before working on the device. Even 10 min. after switching off the mains supply, dangerously high voltages of ≥ 50 V may still be present (capacitor charge). So check that electrical power is not present!• Only once the DC Link voltage has dropped to a residual voltage of less than 50 V (to be measured at the DC link busbars) is it allowed to work on the device.• Any existing additional DC link connections as well as the connections for all components in the mains input area are to be checked in relation to each other and in relation to earth to ensure they are not carrying any electrical power. If necessary, all cable connections are to be discharged using suitable means.• Pay attention to warning sign on the device (see front of device)
	<p>Carelessness will result in serious injuries or death.</p> <ul style="list-style-type: none">• A dangerous voltage may be present at the device, even if the device does not emit any visual or audible signals/indications (e.g. with mains voltage applied to terminal X8 and missing supply from switched-mode power supply on X7!)• Pay attention to warning sign on the device (see front of device)

4.2 Effective EMC installation

Compliance with the EMC Directive

Commissioning (i.e. start-up of intended usage) is only permitted while strictly complying with the EMC Directive (2014/30/EU). The installer/operator of a machine and/or system 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 in the form of optimised housing shielding, printed circuit board layout, filter measures and selection of suitable connectors with shield plate. In addition to the internal measures, the following installation measures are to be noted:

Routing of cables

- If possible, signal cables should only enter from one side into the switch cabinet.
- It is recommended to twist lines of the same electric circuit.
- Avoid unnecessary cable lengths and "loops of spare cable".

Shielding measures

- Do not strip back the cable shields too far and use the shield lugs on the related connectors for making the connection to the components (see Figure 4.1). Connect the other end of the cable shield to the PE rail (main earth) or the backing plate using a large area connection.

Cable type

- Use only shielded cables with double copper braiding with 60 to 70 % coverage. To connect KEBA servomotors we recommend the usage of pre-assembled motor and encoder cables from KEBA, as all EMC tests have been undertaken successfully with these cables.

Mains filter

- Please use the mains filter recommended by KEBA.

Mains choke

- We recommend the utilisation of mains chokes in harsh industrial systems.
- To reduce the system interactions of the peak system currents and increase the service life of the DC link capacitors.



NOTE:

If connection cables from other suppliers are used, these cables must as a minimum be equivalent. However, an assurance of reliable operation with such cables cannot be given by KEBA.

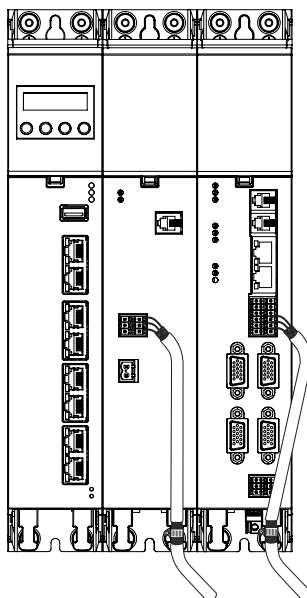


Figure 4.1 Example shield connection, control connections



NOTE:

We recommend the additional Cu strap (1410..579.0) between the mains filter and the first component in the row to improve the EMC properties. See Figure 4.2.

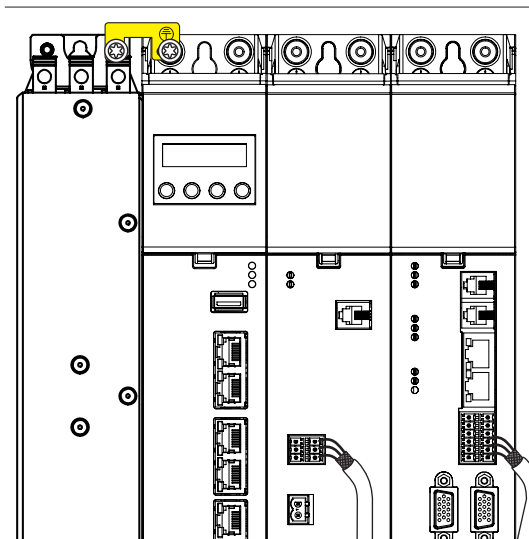


Figure 4.2 Cu strap for improvement of EMC

Earthing measures

- The devices are to be fastened to a conductive, earthed backing plate. Earthing measures to EN61800-5-1 are described in Chapter 4.4.

External components

- Place larger loads near the supply.
- Contactors, relays, solenoid valves (switched inductances) must be wired with suppressors. The wiring must be directly connected to the respective coil.
- Any switched inductance should be at least 0.2 m away from the process controlled assemblies.

If you require further detailed information on installation, you should consult the KEBA Helpline, see “1.11 Support”.

4.2.1 Usage with mains filter

External radio frequency interference suppression filters are available for the supply units SO CM-P BG1+2. With the measurement method specified by the standard and the external mains filter, these conform to the EMC product standard EN 61800-3 for "First environment" (residential C2) and "Second environment" (industrial C3).



NOTE:

You will find more information and selection aids for mains filters in Chapter A.7

- "Table A.9 Selection, mains filter for SOCM-P.0010 / SOCM-P.0110"
- "Table A.10 Selection, mains filter for SOCM-P.0022 / SOCM-P.0122"

4.3 Overview of the connections

The following shows the layout of ServoOne CM-P supply unit with the corresponding positions of connectors and terminals. For improved clarity we have added an abbreviation to the designation for the connectors and terminals.

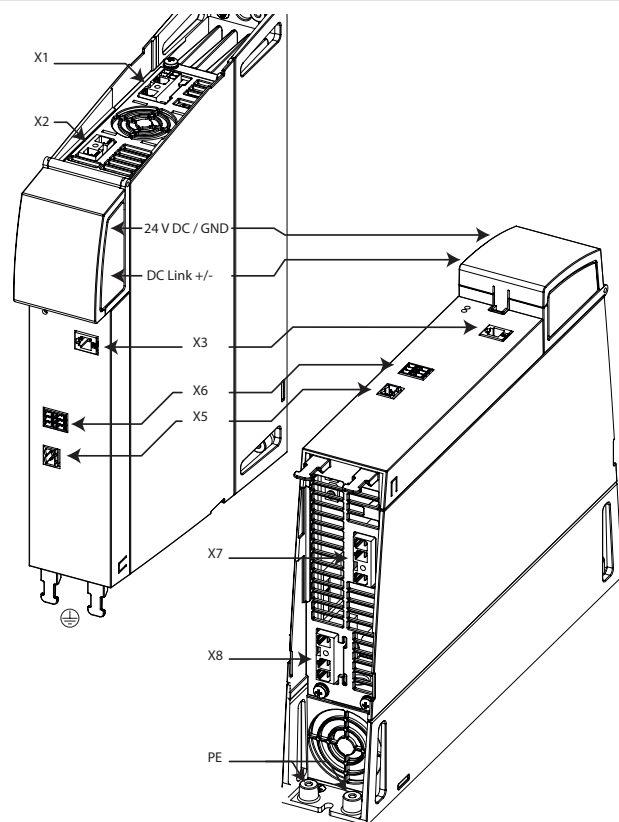


Figure 4.3 Layout, ServoOne CM-P supply unit

Abbreviation	Designation	Details
24 V DC / GND	24 V control supply output via busbars	See Chapter 4.12
DC Link +/-	DC link supply output via busbars	See Chapter 4.12
X1	Connection for braking resistor	See Chapter 4.10
X2	24 V control supply output via terminals	See Chapter 4.11
X3	Cross-communication output (XC out)	See Chapter 4.13
X5	Relay contact (R002), programmable	See Chapter 4.13
X6	Relay contact (R001) Digital outputs (TP01, TP02)	See Chapter 4.13
X7	Switched-mode power supply mains input (L1, L2 / 2 x 400 V AC)	See Chapter 4.8
X8	DC link supply mains input (L1, L2, L3 / 3 x 230/400/480 V AC)	See Chapter 4.6
PE	Protective earth conductor connection	See Chapter 4.4
⊕	Shield connection, control cable	

Table 4.1 Key to the ServoOne CM-P supply unit layout

4.4 Protective earth conductor connection

Step	Action	Comment
1.	Each device in the axis group must be earthed! • Connect together the PE connections on the supply unit, the axis controllers and the controller in series . Make a connection from one of the devices to the PE rail (main earth) in the switch cabinet	• (see) Figure 4.4
2.	Connect the protective earth conductor connections on all other components, such as mains filter*, mains choke*) etc. in a star topology to the PE rail (main earth) in the switch cabinet.	*) Components are only required for the SO CM-P supply unit.
3.	Please take into account the local and national regulations and conditions. The minimum cross-section of the protective earth conductor must comply with the local safety requirements for protective earth conductors in equipment with high leakage current.	

4.4.1 PE connection according to DIN EN 61800-5-1

The leakage current is $> 3.5 \text{ mA}$. This situation results in the following minimum requirements for the protective earth conductor cross-section as a function of the phase conductor cross-section, as per EN 61800-5-1.

Cross-section of the phase conductors	Minimum cross-section of the protective earth conductor
$Q \leq 16 \text{ mm}^2$	Q however at least 10 mm^2 (Cu)
$16 < Q \leq 35$	16 mm^2
$Q > 35 \text{ mm}^2$	$Q/2$
$Q < 10 \text{ mm}^2$	$Q \times 2$ PE lay doubled (see Figure 4.5) or a copper wire of at least 10 mm^2 (Cu)

Table 4.2 Protective earth conductor cross-section

4.4.2 Connection principle

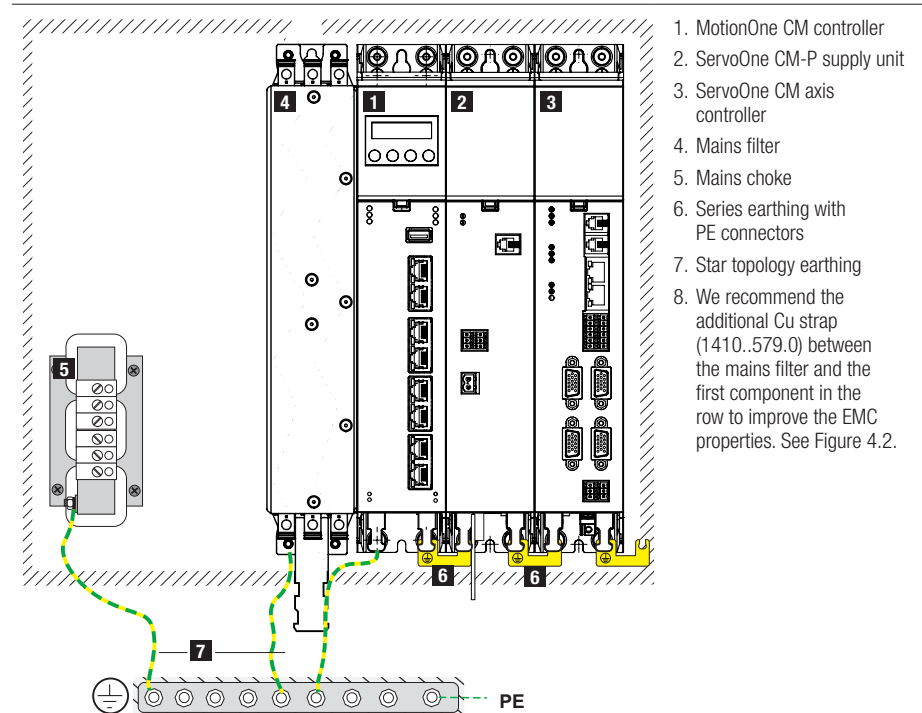


Figure 4.4 Protective earth conductor connection on the ServoOne CM system

CAUTION!	Risk of injury due to incorrect wiring!
	Carelessness may result in injuries. The protective earth conductor connection is a safety feature. Therefore, make sure that all connections have good contact and are sufficiently secure that they cannot come loose.

You will find a wiring example for the axis group in which you will also find detailed information on the protective earth conductor connections in Figure 4.17

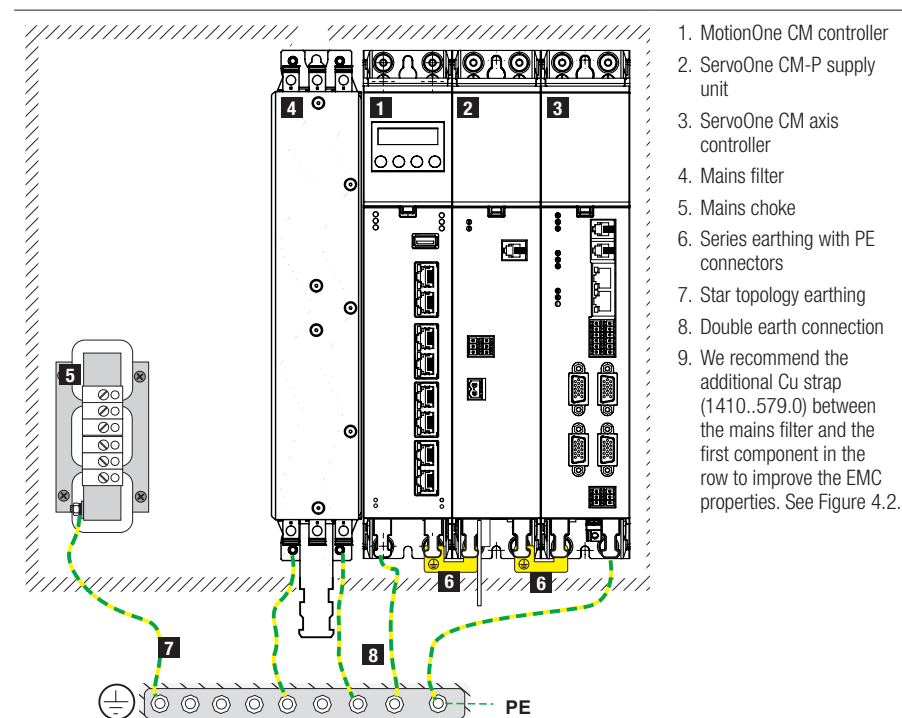


Figure 4.5 Protective earth conductor connection with double PE conductors

CAUTION!	Risk of injury due to incorrect wiring!
	Carelessness may result in injuries. <ul style="list-style-type: none"> The protective earth conductor connection is a safety feature. Therefore, make sure that all connections have good contact and are sufficiently secure that they cannot come loose.

4.5 Electrical isolation concept

The control terminals are designed as protective extra low voltage (PELV) circuits and must only be operated with such PELV voltages, as per the relevant specification. This design provides reliable protection against electric shock on the control side.

The connections X1, X5, X7, X8 are at mains potential (low voltage).

The overview opposite shows the potential references for the individual connections in detail. This concept also delivers higher operational safety and reliability of the supply unit.

Supply unit connections (11)	Description	Potential	Abbreviation
X1 /BR	Connection for external braking resistor (connected to DC link)	Low voltage ¹⁾	ZK
X1/9	Connection for temperature monitoring, braking resistor (Klixon)	Extra low voltage with basic insulation ²⁾	BI
X2/ 24 V DC	24 V switched-mode power supply output	Protective extra low voltage circuit ³⁾	PELV
X3	Cross-communication	Protective extra low voltage circuit ³⁾	PELV
X5	Relay contact, programmable	Reinforced insulation ⁴⁾	VI
X6 /TP	Two test pulse outputs	Protective extra low voltage circuit ³⁾	PELV
X6/ R001	Relay changeover contact, programmable	Protective extra low voltage circuit ³⁾	PELV
X7	Mains supply, switched-mode power supply	Low voltage ¹⁾	Mains
X8	Mains supply, DC link	Low voltage ¹⁾	Mains
Busbars 24 V	24 V switched-mode power supply output	Protective extra low voltage circuit ³⁾	PELV
Busbars DC Link	DC link	Low voltage ¹⁾	ZK

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

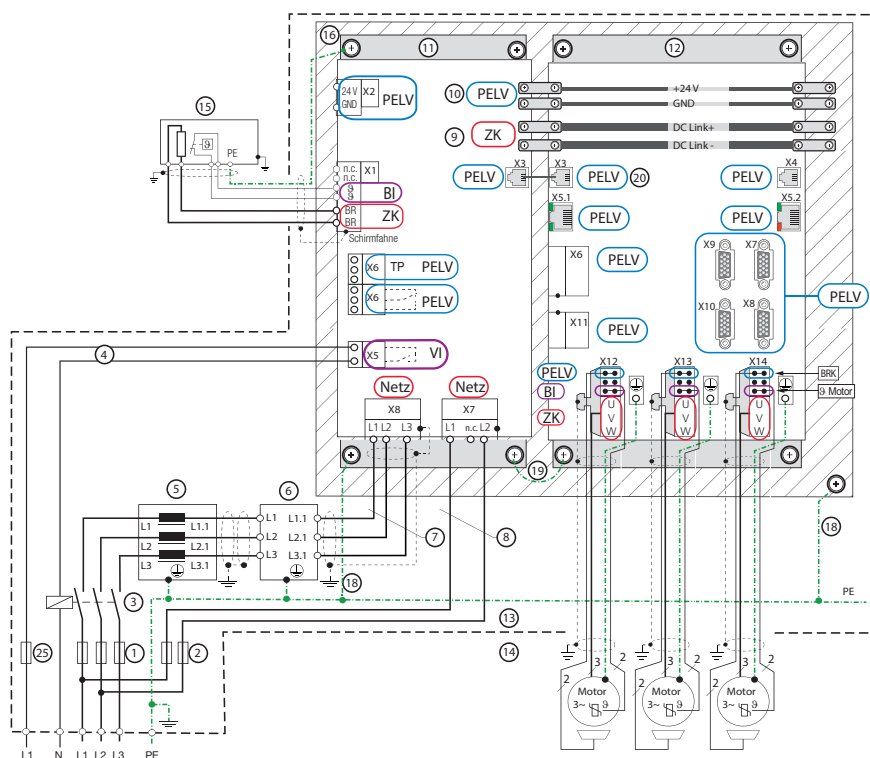
2) Single isolation from the low-voltage network: PELV networks are not allowed to be connected.

3) PELV = Protective Extra Low Voltage AC: $U \leq 50$ V

A connection for the extra low voltage can be earthed.

4) Safe isolation from the low-voltage network and PELV network. A PELV or also a low voltage (max. 250 V AC) is allowed to be connected.

Table 4.3 Key to the overview "Electrical isolation concept"



(1) Mains fuse for DC link supply	(12) Axis controller
(2) Mains fuse for switched-mode power supply	(13) Switch cabinet
(3) Mains contactor (optional)	(14) Panel
(5) Mains choke (accessory)	(15) Braking resistor with temp. monitoring (external)
(6) Mains filter (accessory)	(16) Backing plate
(7) AC mains supply (IPower)	(17) Backing plate earthing
(8) AC mains supply (24 V SMPS)	(18) PE protective earth conductor connection
(9) Busbars DC link	(19) Series protective earth conductor connection to the next device
(10) Busbars 24 V DC (PELV)	(20) Cross-communication
(11) Supply unit	(25) Cable protection (6 A gG)

Figure 4.6 Electrical isolation concept overview



NOTE:

The electrical isolation concept complies with the product standard EN 61800-5-1.

4.6 AC mains connection (power supply)

The mains connection cable is always to be laid shielded. The shield connection at the device is made using the shield lug on the connector X8 (Line IN).

For interference suppression on the ServoOne CM system, an optimised filter from KEBA is to be fitted to the connection X8 (Line IN) on the supply unit. The supply current and the total motor cable length must be taken into account for sizing the filter. You will find details in chapter "A.6 Mains filter".

Use a shielded cable to connect the mains filter to the supply unit. Connect shield at both ends, see figure (length $L \leq 1.5$ m).

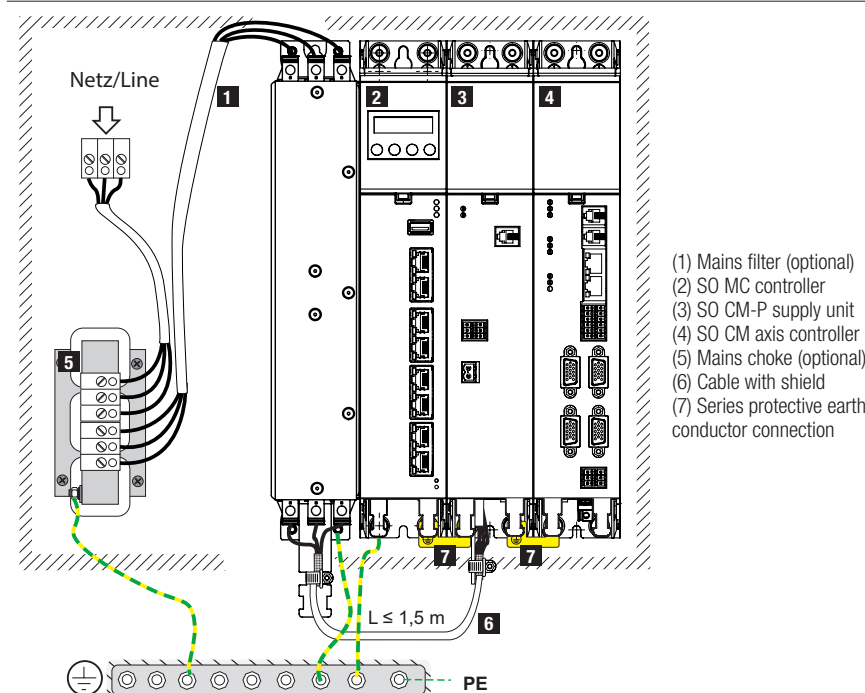


Figure 4.7 Connection example, mains supply

At the device end, the connection is made to the shield lug on the connector X8 (Line IN). Good shielding of the connection on the mains filter can be achieved by

mounting the mains filter on a metal, conductive and well-grounded base plate and the connecting the cable shield to the backing plate as close as possible to the "Load" connection on the mains filter.

This cable can also be unshielded up to a cable length of max. 0.3 m.

4.6.1 Layout, underside X7 and X8

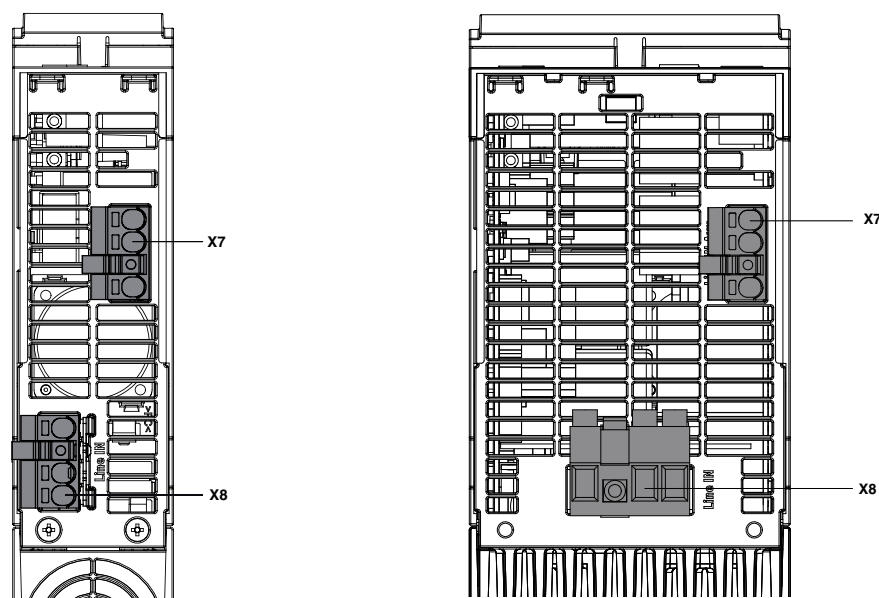


Figure 4.8 Layout, BG1 (underside)

Figure 4.9 Layout, BG2 (underside)

4.6.2 Connector specification

Term.	Specification X8 BG1
L3	<ul style="list-style-type: none"> 3 x 230 V AC
L2	<ul style="list-style-type: none"> 3 x 400-480 V AC
L1	<ul style="list-style-type: none"> Approx. 3 x 25 A current consumption Connection cross-section: 6 mm² max.
⏏	<ul style="list-style-type: none"> Shield lug on the connector is only for the connection of the cable shield (see photograph). For ordering information on the connector set, see note.

Table 4.4 Specification, AC mains connection X8 BG1

Term.	Specification X8 BG2
L3	<ul style="list-style-type: none"> 3 x 400-480 V AC
L2	<ul style="list-style-type: none"> Approx. 3 x 50 A current consumption
L1	<ul style="list-style-type: none"> Connection cross-section: 16 mm² max.
⏏	<ul style="list-style-type: none"> Shield lug on the connector is only for the connection of the cable shield (see photograph). For ordering information on the connector set, see note.

Table 4.5 Specification, AC mains connection X8 BG2

**NOTE:**

For ordering information on connector sets, see system catalogue "Automation System SystemOne" (ID no. 1400.205B.x-xx).

**NOTE:**

The operating regulations in the place of use as well as national and regional regulations for cable protection are to be followed!
The time between the two switch-on processes for the mains voltage must be at least 2 minutes.

4.6.3 Residual current device

If local regulations require the installation of a residual current device, the following applies:

**NOTE:**

In case of a fault the axis controller in the axis group is able to generate DC fault currents without zero crossing. The multi-axis system must therefore only be operated with type B residual current device (RCDs) for AC fault currents, pulsating or smooth DC fault currents that are suitable for drive controller operation, see IEC 60755.

Residual current monitoring devices (RCMs) suitable for drive controllers can also be used for monitoring purposes.

4.6.4 Fuses

For compliance with device safety as per EN61800-5-1, use mains fuses of utilisation class gG that disconnect the device from the mains in the event of a fault.

Terminal	Device	Fuse
X8/L1, L2, L3	SOCM-P.0004, SOCM-P.0010 (BG1)	3 x 35 A (gG)
X8/L1, L2, L3	SOCM-P.0022 (BG2)	3 x 63 A (gG)

See also connection example in Chapter 4.15.1

Table 4.6 Mains fuses, ServoOne CM-P supply unit

4.7 Operation on different mains systems

Before you use systems other than TN or TT, please contact us. Your sales representative or application engineer at KEBA will be pleased to provide you with information on the boundary conditions that are to be met (e.g. compliance with the EMC Directive, effects on CE and the safety functions, etc.)

CAUTION!	Damage to the device due to incorrect operation!
	Carelessness may result in significant damage. Pay attention to all conditions stipulated for the operation of the devices on different mains systems.

4.7.1 Operation of the ServoOne CM-P on **TN and TT** system:

Operation is only allowed:

- With phase voltages 3 x 230 V, 3 x 400 V and 3 x 480 V
- If the star point of the supply system is earthed and
- The supply system conforms to maximum overvoltage category III as per EN 61800-5-1 at a system voltage (phase conductor → star point) of maximum 277 V.

Operation is not allowed:

- For supply with 1 x 230 V or higher single-phase mains voltages

4.7.2 Operation of the ServoOne CM-P on **IT system**:

Operation is possible:

- For three-phase supply with 3 x 230 V
- Compliance with the EMC Directive 2014/30/EU must be ensured by the user!




NOTE:

In this operation mode, the declaration of conformity, CE acceptance and all safety-related approvals are void.

Operation is not allowed:

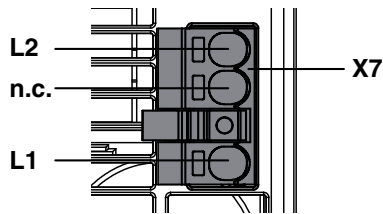
- For three-phase supply with 3 x 400 V or 3 x 480 V

CAUTION!	Damage to the device due to incorrect operation!
	Operation with 400/480 V supply voltage is not allowed! If there is an earth fault the voltage is approx. twice as high. Clearances and creepages to EN 61800-5-1 are no longer maintained. The device may be destroyed in the process.

4.8 AC mains connection, 24 V switched-mode power supply

The mains connection on X7 supplies the integrated 24 V switched-mode power supply. These 24 V DC supply the entire axis group control supply via busbars.

4.8.1 Connector specification

Des.	Term.	Specification	Connection
X7 Line IN Aux	L2	<ul style="list-style-type: none"> • 2 x 400-480 V AC • Approx. 2.5 A current consumption • Connection cross-section: 6 mm² max. 	
	n.c.		
	L1		

For layout see Figure 4.8 and Figure 4.9

Table 4.7 Specification, mains connection switched-mode power supply X7

4.8.2 Fuses

For compliance with device safety as per EN61800-5-1, use mains fuses of utilisation class gG that disconnect the device from the mains in the event of a fault.

Terminal	Device	Fuse
X7/L1, L2	SOCM-P.0004.x, SOCM-P.0010.x (BG1)	2 x 6 A (gG)
X7/L1, L2	SOCM-P.0022.x (BG2)	2 x 6 A (gG)

See also connection example in Chapter 4.15.1

Table 4.8 Mains fuses for 24 V switched-mode power supply (X7)



NOTE:

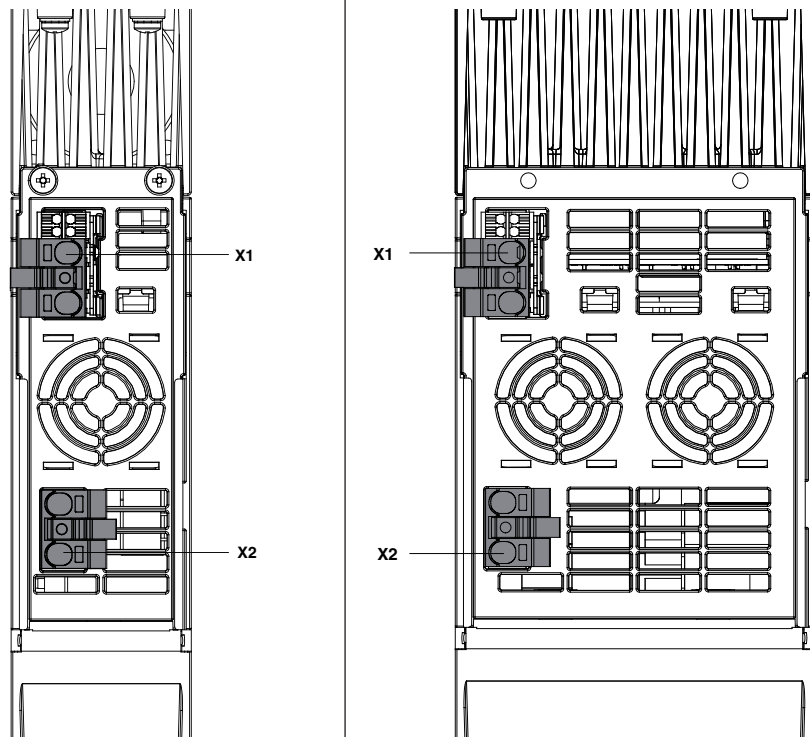
The same switched-mode power supply is installed in supply unit BG1 and in BG2. The technical data are therefore identical.



NOTE:

The supply unit in the order variant SO CM-P.xxxx.0xxx.x is delivered without a switched-mode power supply. For more details see section 6.3

4.9 Layout, top X1 and X2



X1 = brake chopper connection X2 = 24 V DC output (terminal)

Figure 4.10 Layout, top BG1 top

Figure 4.11 Layout, top BG2 top

4.10 Brake chopper connection

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

The ServoOne CM-P supply unit in principle requires a braking resistor. You can choose between an ext. braking resistor or the variant "Supply unit with integrated braking resistor", see order code.

4.10.1 Connector X1 specification




Term.	Specification X1 BG1 + BG2	
BR	<ul style="list-style-type: none"> Connection for braking resistor Max. connection cross-section for the terminal 6 mm² For tech. data, see Table A.2 and A.4. Connection cable must be shielded 	
9	<ul style="list-style-type: none"> Connection for temperature monitoring (Klixon) braking resistor¹⁾ 	
⏏	<ul style="list-style-type: none"> Shield lug on the connector²⁾ for cable shield (see photograph) 	
PE	<ul style="list-style-type: none"> Connect PE connection on the braking resistor to the PE stud on the "top" of the device. 	See Figure 4.12

For layout see Figure 4.10 and Figure 4.11

1) If temperature monitoring is not connected, a jumper must be connected to the connections X1- I

2) Connector set not included in the scope of supply: BG1: Order no. 1451.600.0 BG2: Order no. 1452.600.0

Table 4.9 Connection, braking resistor with temperature monitoring on X1 BG1+2

DANGER!	Risk of injury due to electrical power! <div>  <p>Carelessness will result in serious injuries or death.</p> <ul style="list-style-type: none"> Terminal BR is permanently connected to DC link potential (>300 V DC). Never make or disconnect electrical connections while they are electrically live! Always disconnect the power before working on the device. Even 10 min. after switching off the mains supply, dangerously high voltages of ≥50 V may still be present (capacitor charge). So check that electrical power is not present! </div>
CAUTION!	Damage to the ext. braking resistor due to lack of temperature monitoring! <div>  <p>Carelessness can result in overheating of the ext. braking resistor.</p> <ul style="list-style-type: none"> The ext. braking resistor must be monitored by the controller. The temperature sensor (Klixon) in the braking resistor must have, as a minimum, basic isolation as per EN61800-5-1 in relation to the body of the resistor at mains potential. In the event of overtemperature, the supply unit must be disconnected from the mains. </div>
WARNING!	Damage to neighbouring assemblies and risk of injury due to hot surfaces on the ext. braking resistor! <div>  <p>Carelessness may result in serious burns.</p> <ul style="list-style-type: none"> Intensive thermal radiation is produced by the braking resistor (>300 °C). For this reason maintain sufficient clearance to neighbouring assemblies or install the braking resistor outside the switch cabinet. If the braking resistor is mounted outside the switch cabinet, please provide adequate protection against touching that reliably protects against hot surfaces. </div>

For technical data of the design of the braking resistors see chapter Appendix. The cable cross-section is dependent on the braking resistor's power rating. The cables are to be protected by suitable means.

4.10.2 Connection example with ext. braking resistor

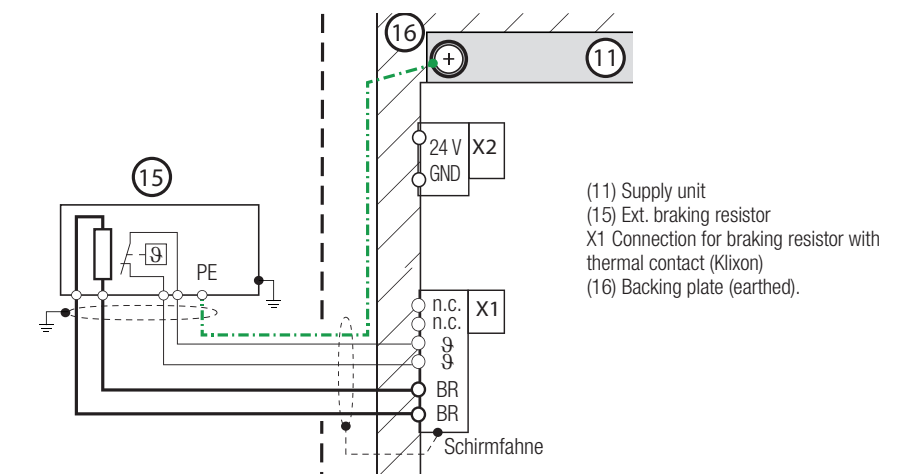
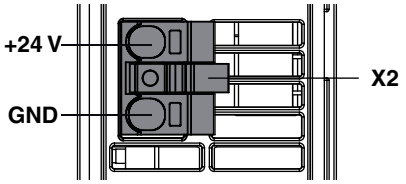


Figure 4.12 Connection, braking resistor with thermal contact (X1)

4.11 24 V DC output

Along with the busbars, the 24 V DC output voltage from the switched-mode power supply is also available on connector X2. Here it is to be noted that the sum of the power required on the busbars and the connector X2 is not allowed to exceed the max. output power of 470 W.

4.11.1 Connector X2 specification

Des.	Term.	Specification	Connection
X2	+24 V	<ul style="list-style-type: none"> • 24 VDC • Connection cross-section: 6 mm² max. 	
	GND		

For layout see Figure 4.10 and Figure 4.11

Table 4.10 Specification 24 V DC output X2 BG1 and BG2



NOTE:

The same switched-mode power supply is installed in supply unit BG1 and in BG2. The technical data are therefore identical.

4.12 Busbars for the supply voltages

The supply unit supplies the power to the axis controllers separately for the control section and DC link. The control section receives its 24 V supply from the switched-mode power supply in the supply unit via the upper busbar (+24 V DC and GND, see Figure 4.13). The DC link supply comes from an unregulated DC voltage and is connected to the axis controllers via the lower busbar (DC Link +/-).

Step	Action	Comment
1.	Make sure the supply unit is arranged in a line with all axis controllers and they are together in a row.	See installation instructions
2.	Use the busbar elements supplied for the control supply for the axis controllers. Connect together all (+24 V DC) connections and all (GND) connections.	The busbar elements are as long as the related device is wide.
3.	Use the busbar elements supplied for the DC link supply for the axis controllers. Connect together all (DC Link+) connections and all (DC Link-) connections.	The busbar elements are as long as the related device is wide.

CAUTION!

Damage to the drive system due to incorrect wiring!



Carelessness may result in damage to the device.

- Use the connection elements supplied (busbars) for the electrical coupling of the devices.
- Make sure that all connections have good contact and are sufficiently secure (2.1 Nm) that they cannot come loose.



NOTE!

On the usage of other connection elements (busbars), KEBA does provide any guarantee for stable, reliable operation.

4.12.1 24 V control supply

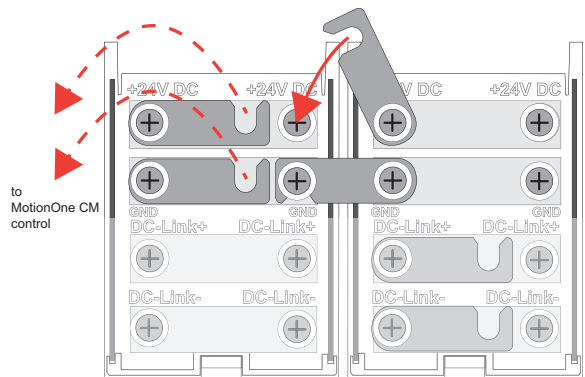
Figure		Specification
ServoOne CM-P supply unit	ServoOne CM axis controller	
		<ul style="list-style-type: none"> • $U_{St} = +24 \text{ V DC} \pm 20 \%$ stabilised and smoothed • Continuous output power of the switched-mode power supply (SMPS) max. 470 W • Internal polarity reversal protection • The power supply unit used must have safe isolation in relation to the mains as per EN 61800-5-1 • Tightening torque for the busbar fittings 2.1 Nm.

Figure 4.13 Busbars, 24 V control supply

4.12.2 DC link supply

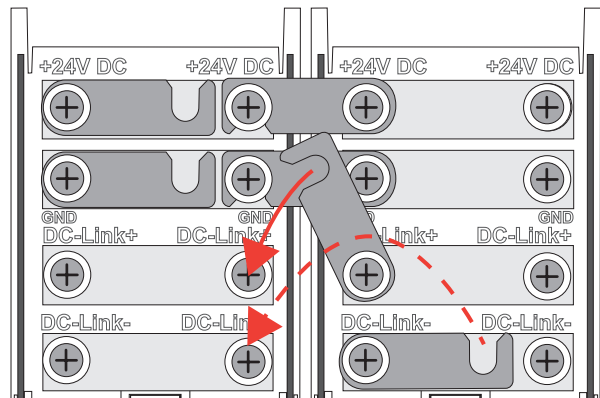
Figure		Specification
ServoOne CM-P supply unit	ServoOne CM axis controller	<ul style="list-style-type: none"> • ServoOne CM-P supply unit
		<ul style="list-style-type: none"> • DC link voltage 565/ 678 V DC • Depending on mains voltage (400 V / 480 V) • Tightening torque 2.1 Nm

Figure 4.14 DC link supply



NOTE:

The software for the supply unit must be set to the mains voltage connected. This action is necessary so that all switching thresholds (e.g. under/overvoltage, switching on the brake chopper etc.) are set correctly. Details can be found in the ServoOne CM device help.

4.12.3 Overview of busbars in the group

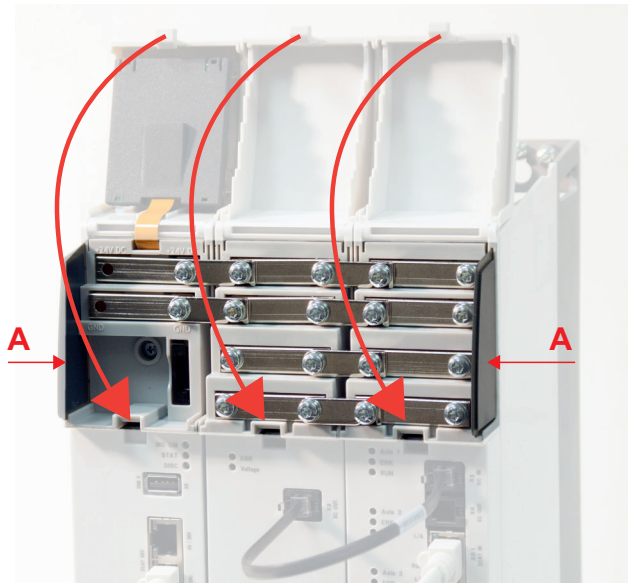


Figure 4.15 Cover on the busbars

WARNING!	Risk of injury due to electrical power!
	Carelessness may result in serious injuries or death. <ul style="list-style-type: none"> The multi-axis system is only allowed to be operated with the cover on the busbars closed! It is also important that the side covers (A) are fitted. Both provide protection against touching bare and live parts.

4.13 Control connections (front panel)

Step	Action	Comment
1.	Make a connection between the connection X3 on the supply unit and X3 on the first axis controller (cross-communication).	For this purpose use the cable supplied of type: XCOM See appendix
2.	If necessary wire the programmable relay contacts X5 and X6 as well as the test pulse outputs TP01 and TP02.	
3.	Check all connections again!	

Figure	Abbreviation	Designation
	LED red (ERR)	Supply unit error status (flashing code)
	LED green (Voltage)	Status mains supply available
	X3 / XC OUT	Cross-communication
	X5 / REL Output	Relay contact (R002)
	X6 / State	Relay contact (R001) Digital outputs (TP01, TP02)

Figure 4.16 Layout, supply unit front


4.13.1 Specification, cross-communication (X3)

Des.	Term.	Specification	Details
X3	XC Out	Cross-communication output (RJ10 connector), internal RS485 network for communication with axis controllers	See Operation Manual SO CM ID. no. 1400.200B.x-xx

**NOTE:**

Connections X3 are used only for internal communication between supply unit and axis controller.




4.13.2 Specification, relay contact REL Output (X5)

Des.	Term.	Specification	Details
X5	R002NO = normally open contact	R002CO  R002NO 	Relay contact for low-voltage circuit: $\leq 250 \text{ V AC}$ or $\leq 30 \text{ V DC}$, 1.5 A max. each, contact freely programmable Factory setting = Operation of main contactor

**NOTE:**

For switching inductive loads (e.g. auxiliary contactors) on X5, we recommend the usage of suppressors (AC-operated contactors) or free-wheeling diodes (DC-operated contactors) on their control coils.

4.13.3 Specification, connection "State" (X6)

Des.	Term.	Specification	Details
X6	R001NC = normally closed contact R001CO = changeover contact R001NO = normally open contact	R001NC  R001CO  R001NO 	Signal relay contact for PELV circuit: $\leq 25 \text{ V AC}$ or $\leq 30 \text{ V DC}$, 0.5 A max. each (only ohmic load), contact freely programmable Factory setting = Active on error
X6	TP00 = test pulse signal 00 TP01 = test pulse signal 01 GND = reference ground	Signal driver outputs for internal usage for short-circuit and cross-circuit checks on the wiring to the safe inputs on the axis controllers	See Model Description SD0 ID no. 1400.402B.x-xx

4.14 Commissioning

You will find a description of commissioning in the Operation Manual ServoOne CM Axis Controller chapter 4.

4.15 Connection examples, supply unit

The supply unit can be operated on supply systems with 3 x 230V, 3 x 400 V and 3 x 480 V. For connection examples, see next page.

**NOTE:**

A maximum of 8 axis controllers (this corresponds to maximum 24 axes) can be connected and operated on one ServoOne CM-P Supply Unit .

4.15.1 Connection example, supply unit 3 x 400 V

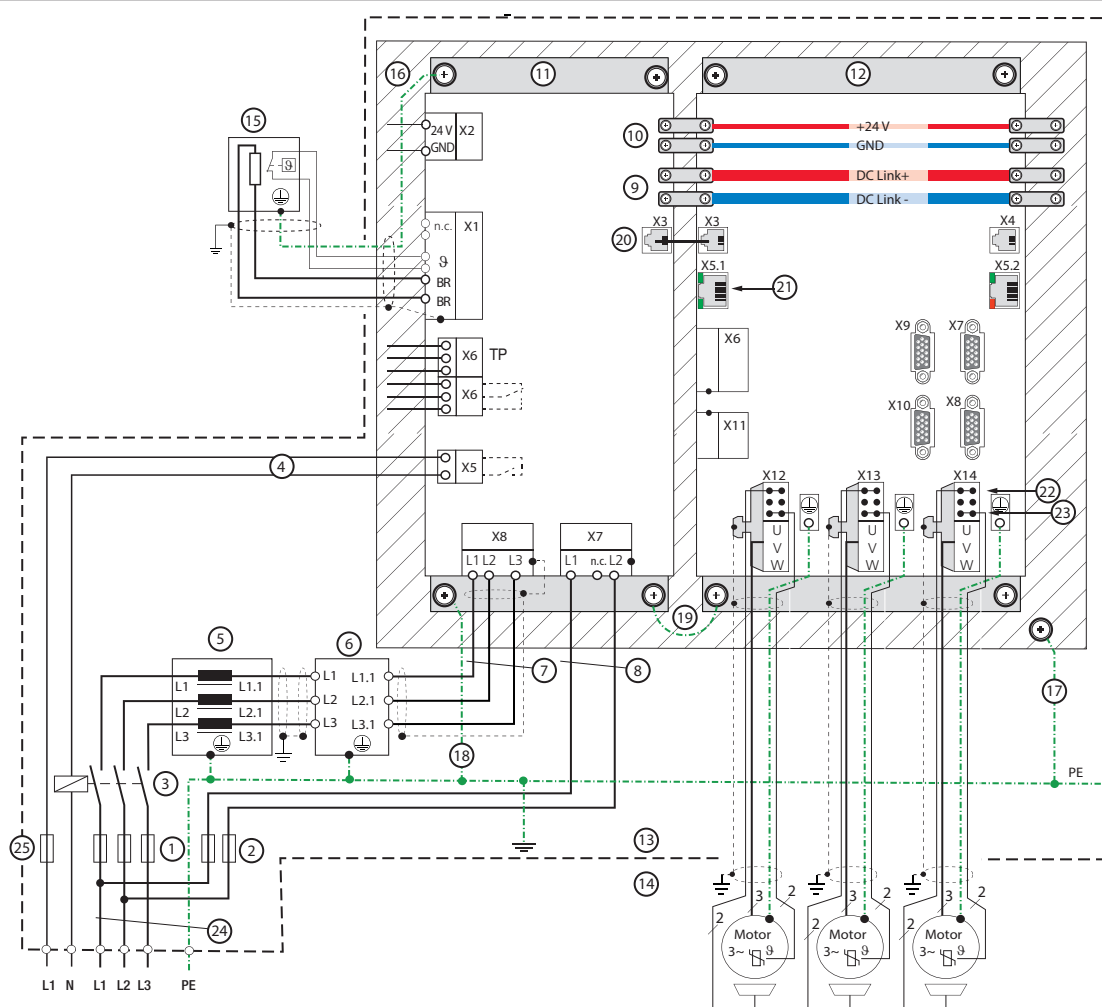


Figure 4.17 Connection example, (schematic depiction) 3 x 400 V

Key to connection example

Position	Designation
(1)	Mains fuses for DC link supply
(2)	Mains fuse for switched-mode power supply
(3)	Mains contactor with protection circuit (optional)
(4)	Programmable switching contact for mains contactor
(5)	Mains choke (accessory)
(6)	Mains filter (accessory)
(7)	AC mains connection (power supply)
(8)*	AC mains connection (24 V switched-mode power supply SMPS)
(9)	Busbars DC link
(10)	Busbars 24 V DC (PELV)
(11)	Supply unit (SO CMP)
(12) (21) (22) (23)	See Operation Manual Axis Controller (SO CM)
(13)	Switch cabinet
(14)	Field
(15)	External braking resistor with temperature monitoring
(16)	Backing plate
(17)	Backing plate earthing
(18)	PE - protective earth conductor connection
(19)	Series protective earth conductor connection to the next device
(20)	Cross-communication
(24)	Supply point, switch cabinet
(25)	Cable protection 6 A gG

* The SMPS must be connected on the mains side at the supply point (24).

Table 4.11 Key to connection example



NOTE:

The supply unit does not protect the upstream components (3, 5, 6) against thermal or electrical hazards. Corresponding protective measures are to be taken.

4.15.2 Connection example, supply unit 3 x 230 V

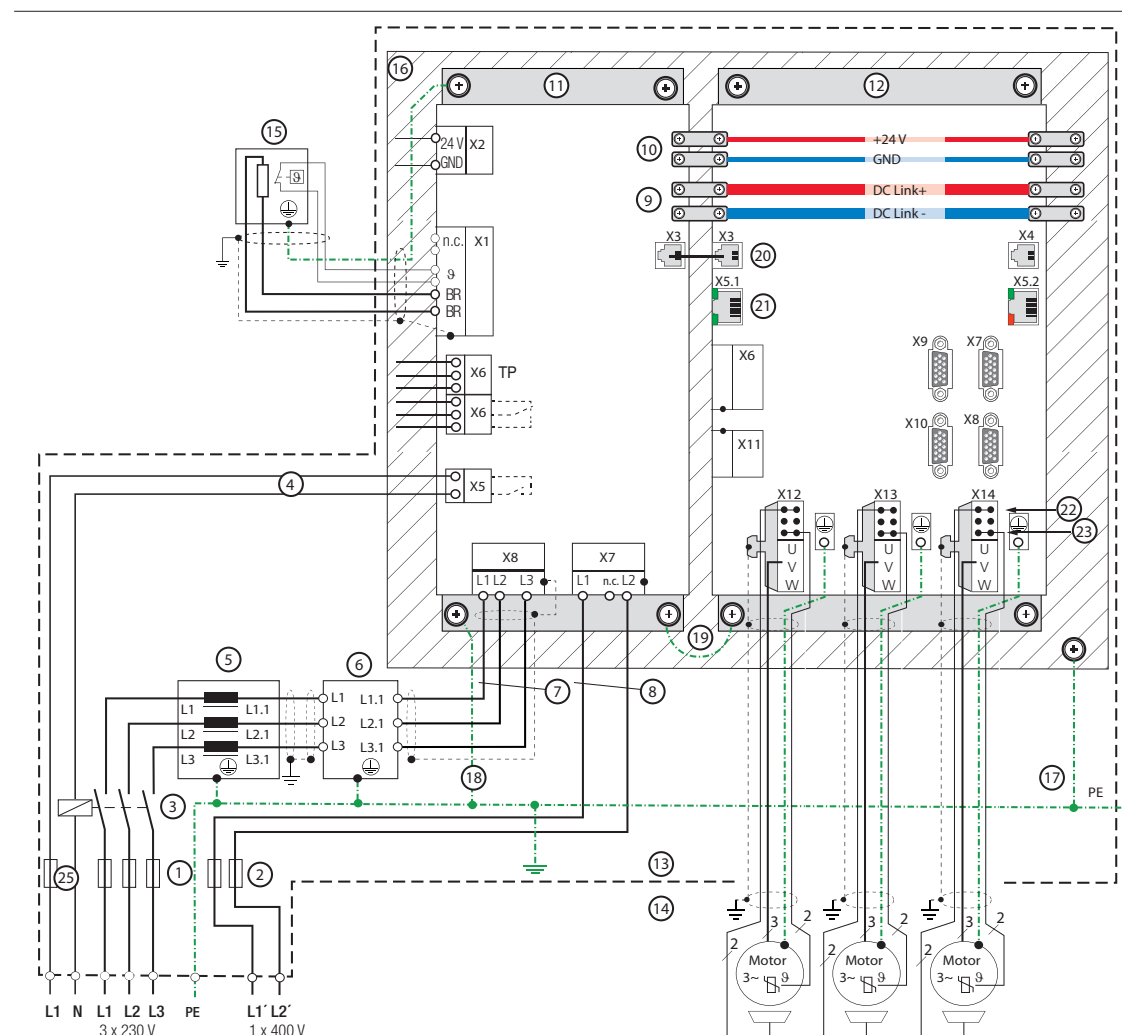


Figure 4.18 Connection example, (schematic depiction) 3 x 230 V

Key to connection example

	Designation
(1)	Mains fuses for DC link supply
(2)	Mains fuse for switched-mode power supply
(3)	Mains contactor with protection circuit (optional)
(4)	Programmable switching contact for mains contactor
(5)	Mains choke (accessory)
(6)	Mains filter (accessory)
(7)	AC mains connection (power supply)
(8)	AC mains connection (24 V switched-mode power supply)
(9)	Busbars DC link
(10)	Busbars 24 V DC (PELV)
(11)	Supply unit (SO CMP)
(12) (21) (22) (23)	See Operation Manual Axis Controller (SO CM)
(13)	Switch cabinet
(14)	Field
(15)	External braking resistor with temperature monitoring
(16)	Backing plate
(17)	Backing plate earthing
(18)	PE - protective earth conductor connection
(19)	Series protective earth conductor connection to the next device
(20)	Cross-communication
(25)	Cable protection 6 A gG

Table 4.12 Key to connection example

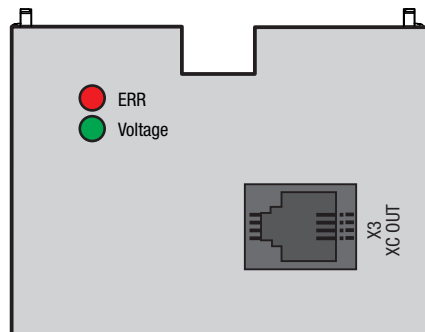


NOTE:

The supply unit does not protect the upstream components (3, 5, 6) against thermal or electrical hazards. Corresponding protective measures are to be taken.

5 Diagnostics

5.1 Status indication LED



LED red (ERR)	Supply unit error status (flashing code)
LED green (Voltage)	Status mains supply available

Figure 5.1 Significance of the status LEDs



NOTE:

You will find details on the LED messages in the ServoOne CM device help (ID. no.: 1400.209B.x)

Behaviour	Green LED Voltage (Operating indication)	Red LED ERR (Error indication)
Off	-	No error and no warning
Flashing slowly	Ready, the DC link is not connected to the system.	There is a warning, however the supply unit is ready.
Flashing quickly	Supply unit is in the pre-charging phase, can take a few seconds.	-
On	Supply unit is pre-charged and connected to the system.	There is an error, the DC link is disconnected from the system. Error message appears in the axis modules.

Table 5.1 Significance of the status LEDs, ServoOne CM-P Supply Unit

6 Design variants

6.1 24 V back-up on power failure

Applies to SO CM-P.xxxx.2xxx.x

6.1.1 Purpose of the function

The "24 V back-up on power failure" function is used to stop in a controlled manner the masses moved in a mechanical system (e.g. robot arm). For this purpose the DC link in the 24 V switched-mode power supply (24 V SMPS) is coupled to the DC links in the axis controllers (DC Link +/-). During braking of the drive axis, energy is generated that charges the DC links in the axis controllers. Using this additional energy the 24 V control supply can be maintained for longer.

6.1.2 Function description

Coupling takes place immediately after precharging. For trouble-free operation, the mains supply to the switched-mode power supply (X7) is then to be disconnected (see Figure, contact 3.2). For this purpose the parameter 270-0 in the firmware is to be set to the value "16".



NOTE:

The total power drawn from the internal 24 V power supply unit must not exceed $P_v = 240 \text{ W max.}$ for this operating case!

CAUTION!	DAMAGE TO THE DEVICE DUE TO ERROR IN THE WIRING!
	<ul style="list-style-type: none">• Carelessness may result in significant damage. <p>Operation of these devices with 3 x 230 V mains supply is not allowed for the "24 V back-up on power failure" variant.</p>

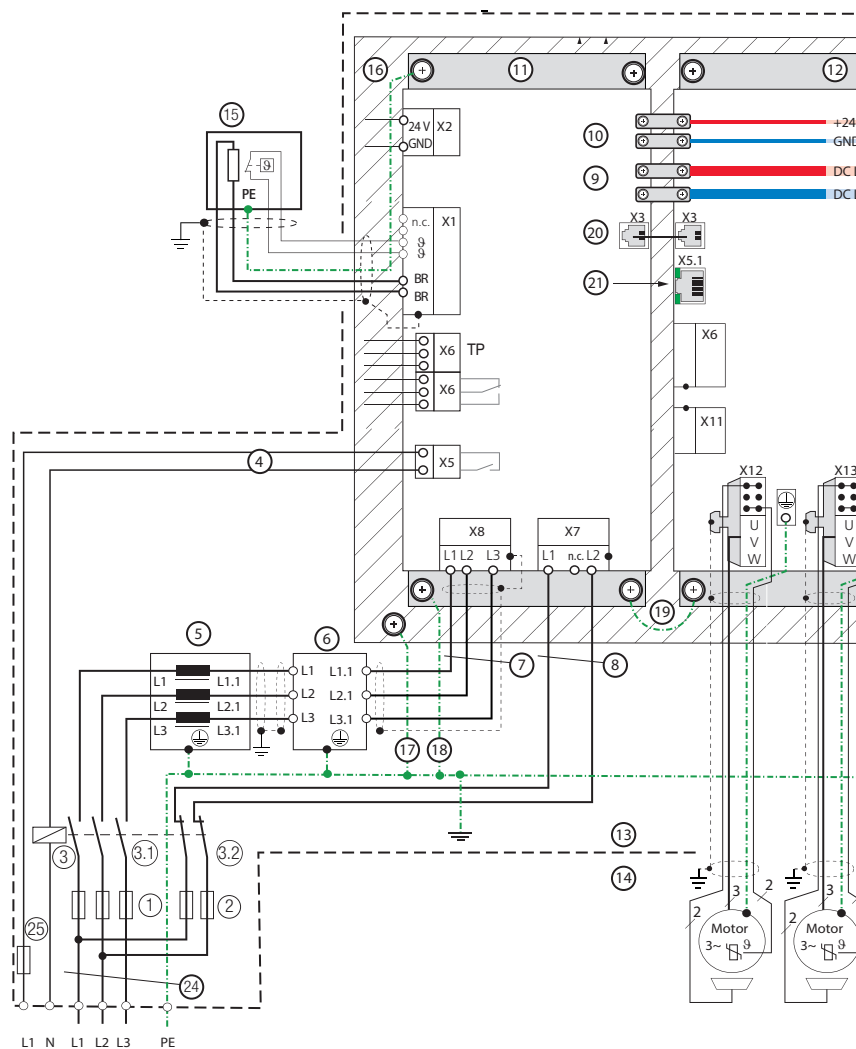


Figure 6.1 Connection example (schematic depiction). For key, see next page.

Key to connection example

	Designation
(1)	Mains fuses for DC link supply
(2)	Mains fuse for switched-mode power supply
(3.1)	Mains contactor normally open contact
(3.2)	Mains contactor normally closed contact for the disconnection of the SMPS supply
(4)	Programmable switching contact for mains contactor
(5)	Mains choke (accessory)
(6)	Mains filter (accessory)
(7)	AC mains connection (power supply)
(8)*	AC mains connection (24 V switched-mode power supply)
(9)	Busbars DC link
(10)	Busbars 24 V DC (PELV)
(11)	Supply unit (SO CM-P)
(12) (21) (22) (23)	See Operation Manual Axis Controller (SO CM)
(13)	Switch cabinet
(14)	Field
(15)	External braking resistor with temperature monitoring
(16)	Backing plate
(17)	Backing plate earthing
(18)	PE - protective earth conductor connection
(19)	Series protective earth conductor connection to the next device
(20)	Cross-communication
(24)	Supply point, switch cabinet
(25)	Cable protection 6 A gG

* The SMPS must be connected on the mains side at the supply point (24).

Table 6.1 Key to connection example



NOTE:

The supply unit does not protect the upstream components (3, 5, 6) against thermal or electrical hazards. Corresponding protective measures are to be taken.

6.1.3 Protective earth conductor connection with 24 V back-up on power failure

For these devices, the DC link in the 24 V switched-mode power supply (24 V SMPS) is coupled internally to the DC links in the axis controllers (DC Link +/-).

The DC link in the 24 V switched-mode power supply and the DC link in the axis controller are fused separately on the mains side.

Therefore the minimum current carrying capacity of the PE conductor, formed by the sum of the fuse rated currents for both mains connections, is also to be taken into account for the design of the cross-section. Furthermore, the minimum requirements for the devices not coupled as described in Section 4.4 apply.

6.2 Version with integrated braking resistor

Applies to SO CM-P.xxxx.11xx.x

6.2.1 Purpose of the design variant

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

The design variant described here is a low-cost option for braking drives with low masses without additional effort.

The integrated braking resistor also has the major advantage that no additional space for an external braking resistor is required.

However, the braking power is limited for thermal reasons. You will find the technical data for the BG1 in section A.1.1 and for the BG2 in section A.2.1

6.3 Version without 24 V switched-mode power supply


Applies to SO CM-P.xxxx.0xxx.x

6.3.1 Purpose of the variant

With this design variant you can supply the control section for the ServoOne CM system using an existing switched-mode power supply.

The external switched-mode power supply must meet the following minimum requirements:

- $U_v = 24 \text{ V} \pm 10 \%$, stabilised and smoothed (operating voltage)
- Output power as per selected supply unit and axis controller connected
- Internal polarity reversal protection
- The power supply unit used must have safe and reliable isolation in relation to the mains as per EN 50178 or EN 61800-5-1.
- The starting current for the control voltage can briefly reach 2-3 times the operating current.
- If other devices are supplied from this switched-mode power supply, the power figures must be correspondingly higher.

CAUTION!	DAMAGE TO THE DEVICE DUE TO ERROR IN THE WIRING!
	<ul style="list-style-type: none">• Carelessness may result in significant damage. The connection 24 V/GND on the supply unit is at earth potential (see PELV). By connecting, e.g. control cable shields other loads may be damaged. Please check connections first.

Current consumption, 24 V control supply (A)

Device	SOCM-P.0010	SOCM-P.0110	SOCM-P.0022	SOCM-P.0122
Cooling system	Wall mounting	Cold plate	Wall mounting	Cold plate
Current consumption, 24 V control supply	0.7 A	0.4 A	1.0 A	0.5 A

Table 6.2 Current consumption, 24 V control supply (A)

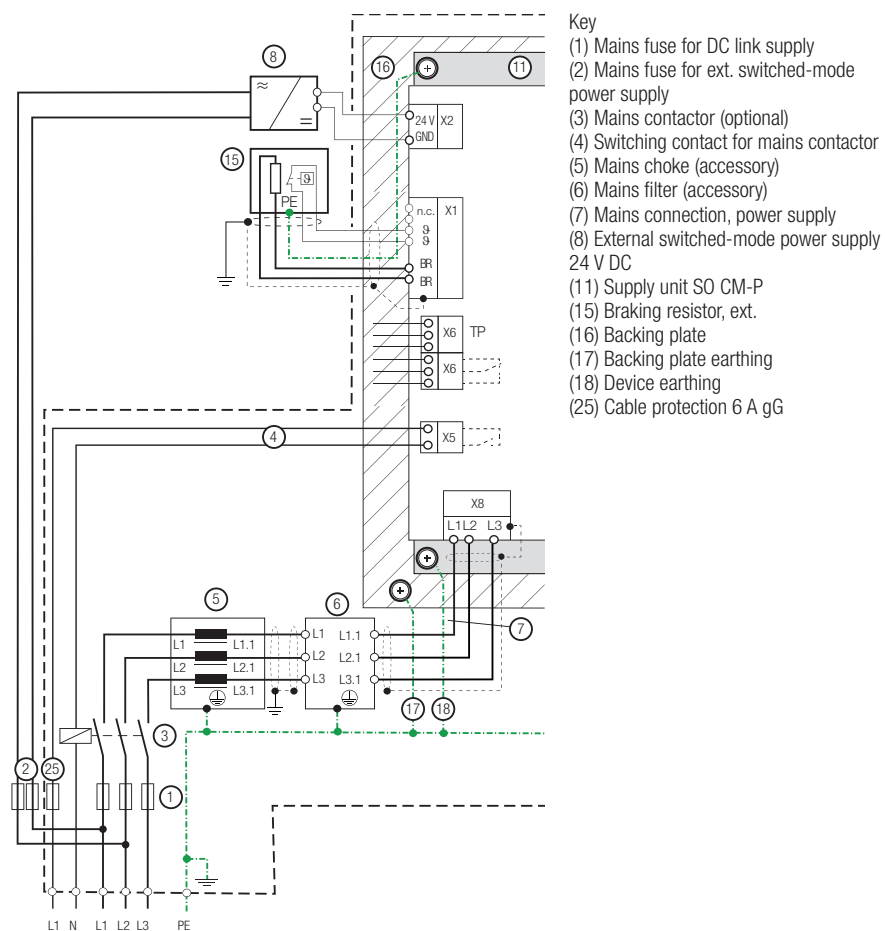



Figure 6.2 Connection example for SO CM-P.xxxx.0xxx.x

A Appendix

A.1 Technical data, supply unit BG1

Device	Unit	SOCM-P.0010 / SOCM-P.0110		
Input, mains side				
Mains voltage $U_N \pm 10\%$, 3 times	V AC	230	400	480
Continuous current $[A_{AC\ eff}]$, typical	A_{eff}	23	23	19
Peak current $[A_{AC}]$, typical	A_{eff}	46	46	38
Continuous power, typical (depending on mains impedance)	kVA	9	16	
Rectifier power dissipation, typical	W	50		
Asymmetry of the mains voltage		$\pm 3\%$ max.		
Frequency		50-60 Hz $\pm 10\%$		
Max. cable cross-section X12		1.5 ... 6 mm ² (fine-stranded cable with/without ferrules) mm ²		
DC link output				
DC link voltage typical *	V DC	325	565	678
Continuous current	A DC	18	18	15
Peak current 2 x I_N for 1 s mains choke not required	A DC	36	36	30
Continuous power P_N	kW	5.8	10	10
Peak power 2 x P_N for 1 s	kW	11.6	20	20
DC link capacitance only CM-P	μF	330		
Required total DC link capacitance for continuous power	μF	1000		
Max. permissible DC link capacitance SO CM + SO CM-P	μF	2000 (1670 + 330) max.		
Power dissipation P_{rated} in the interior	W	85		
* Load-dependent				

Table A.1 Technical data, ServoOne CM-P BG1

CAUTION!	DAMAGE TO THE DEVICE DUE TO OVERLOAD IN THE DC LINK!
	<ul style="list-style-type: none"> Carelessness may result in significant damage. The maximum overall capacitance of the multi-axis system DC link must not exceed the value stated.




NOTE:

In the overall axis group, a DC link capacitance of $\geq 100\ \mu\text{F/kW}$ (for $3 \times 400\ \text{V}$) or $\geq 170\ \mu\text{F/kW}$ (for $3 \times 230\ \text{V}$), referred to the highest rated power that occurs, must be provided. This capacitance is determined by adding together the capacitances of the individual devices. The root mean square of the active power for a load cycle is defined as the active power.

A.1.1 Technical data, brake chopper BG1

Device	Unit	SOCM-P.0010 / SOCM-P.0110		
Mains voltage	V AC	230	400	480
Brake chopper power electronics				
Brake chopper switching threshold	V	411	652	765
Overvoltage protection	V	446	687	800
Continuous braking power [kW]	kW	1.8	3	3
Peak braking power for maximum 0.5 s *)	kW	8	13	16
Maximum ohmic resistance of an externally installed braking resistor	Ω	60	90	90
Minimum ohmic resistance of an externally installed braking resistor	Ω	21	33	38
Supply unit with integrated braking resistor: (model SO CM-P.xxxx.11xx.x)				
Continuous braking power	W	75		
Peak braking power for maximum 0.5 s *)	kW	3		
Ohmic resistance of the integrated braking resistor	Ω	56		
*) After this time shutdown is initiated based on I² x t				


Table A.2 Brake chopper BG1

CAUTION!	DAMAGE TO THE DEVICE DUE TO CONNECTION OF AN EXT. BRAKING RESISTOR!
	<ul style="list-style-type: none"> Carelessness may result in significant damage. <p>Please note that no additional external braking resistor is allowed to be connected to the device model "with integrated braking resistor".</p>

A.2 Technical data, supply unit BG2

Device	Unit	SOCM-P.0022 / SOCM-P.0122		
Input, mains side				
Mains voltage $U_N \pm 10\%$, 3 times	V AC	230	400	480
Continuous current $[A_{AC\ eff}]$, typical	A	46	46	38
Peak current $[A_{AC}]$, typical	A	92	92	76
Continuous power, typical (depending on mains impedance)	kVA	18.5	32	
Rectifier power dissipation	W	110		
Asymmetry of the mains voltage		$\pm 3\%$ max.		
Frequency		50-60 Hz $\pm 10\%$		
Max. cable cross-section of the terminals X12		1.5 ... 16 mm ² (fine-stranded cable with/without ferrules)		
DC link output				
DC link voltage typical *	V DC	325	565	678
Continuous current	A DC	39	39	32
Peak current 2 x I_N for 1 s mains choke not required	A DC	78	78	64
Continuous power P_N	kW	12.5	22	
Peak power 2 x P_N for 1 s	kW	25	44	
DC link capacitance only CM-P	μF	840		
Required total DC link capacitance for continuous power	μF	2200		
Permissible DC link capacitance SOCM + CM-P	μF	4000 (3160 + 840) max.		
Power dissipation P_{rated} in the interior	W	130		
* Load-dependent				

Table A.3 Technical data, ServoOne CM-P BG2

CAUTION!	DAMAGE TO THE SUPPLY UNIT DUE TO OVERLOAD IN THE DC LINK!
	<ul style="list-style-type: none"> Carelessness may result in significant damage. <p>The maximum overall capacitance of the multi-axis system DC link must not exceed the value stated.</p>

**NOTE:**

In the overall axis group, a DC link capacitance of $\geq 100 \mu\text{F/kW}$ (for $3 \times 400 \text{ V}$) or $\geq 170 \mu\text{F/kW}$ (for $3 \times 230 \text{ V}$), referred to the highest rated power that occurs, must be provided. This capacitance is determined by adding together the capacitances of the individual devices. The root mean square of the active power for a load cycle is defined as the active power.

A.2.1 Technical data, brake chopper BG2

Device	Unit	SOCM-P.0022 / SOCM-P.0122		
Mains voltage	V AC	230	400	480
Brake chopper power electronics				
Brake chopper switching threshold	V	411	652	765
Overvoltage protection	V	446	687	800
Continuous braking power [kW]	kW	3.5	6	6
Peak braking power for maximum 0.5 s *)	kW	20	28	30
Maximum ohmic resistance of an externally connected braking resistor	Ω	50	90	90
Minimum ohmic resistance of an externally installed braking resistor	Ω	8	15	20
Supply unit "with integrated braking resistor" (version SO CM-P.xxxx.11xx.x)				
Continuous braking power [kW]	W	200		
Peak braking power for maximum 0.5 s *)	kW	6		
Ohmic resistance of the integrated braking resistor	Ω	28		

*) After this time shutdown is initiated based on $I^2 \times t$

Table A.4 Brake chopper BG2

CAUTION!**DAMAGE TO THE DEVICE DUE TO CONNECTION OF AN EXT. BRAKING RESISTOR!**

- Carelessness may result in significant damage.

Please note that no additional external braking resistor is allowed to be connected to the device model "with integrated braking resistor".

A.3 Ambient conditions

Ambient conditions	ServoOne CM-P supply unit
Protection	Device: IP20 - exception terminals: IP10 (protection against touching, back of hand)
Accident prevention regulations	As per the local regulations (in Germany e.g. BGV V3)
Installation altitude	Up to 1000 m above MSL, higher with power reduction (1% per 100 m, max. 2000 m above sea level)
Pollution degree	2
Type of mounting	Built-in unit, only for vertical mounting in a switch cabinet with min. IP4x protection, on using STO safety function min. IP54

Table E.5 Ambient conditions, ServoOne CM

Climatic conditions	ServoOne CM-P supply unit	
In transit	As per EN 61800-2, IEC 60721-3-2 class 2K3 ¹⁾	
	Temperature	-25 °C to +70 °C
	Relative atmospheric humidity	95 % at max. +55 °C

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

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

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

Table A.6 Climatic conditions, supply unit ServoOne CM-P

Climatic conditions		ServoOne CM-P supply unit
In storage	As per EN 61800-2, IEC 60721-3-1 classes 1K3 and 1K4 ²⁾	
	Temperature	-25 °C to +55 °C
	Relative atmospheric humidity	5 to 95 %
In operation	As per EN 61800-2, IEC 60721-3-3 class 3K3 ³⁾	
	Temperature Air cooling	5 °C to +40 °C
	Relative atmospheric humidity	5 to 85 % without condensation
<p>1) The absolute humidity is limited to max. 60 g/m³. This means, at 70 °C for example, that the relative atmospheric humidity may only be max. 40 %.</p> <p>2) The absolute humidity is limited to max. 29 g/m³. So the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.</p> <p>3) The absolute humidity is limited to max. 25 g/m³. That means that the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.</p>		

Table A.6 Climatic conditions, supply unit ServoOne CM-P

**NOTE:**


The climatic conditions apply to the device. For this reason they must also be met in the switch cabinet.

Mechanical conditions		ServoOne CM-P supply unit	
Vibration limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	Amplitude [mm]	Acceleration [m/s²]
	$2 \leq f < 9$	3.5	Not applicable
	$9 \leq f < 200$	Not applicable	10
	$200 \leq f < 500$	Not applicable	15
Shock limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Drop height of packed device max. 0.25 m		
1) <i>Note: The devices are only designed for stationary use.</i>			

Table A.7 Mechanical conditions, ServoOne CM-P

Mechanical conditions		ServoOne CM-P supply unit	
Vibration limits for the system ¹⁾	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	Amplitude [mm]	Acceleration [m/s²]
	2 ≤ f < 9	0.3	Not applicable
	9 ≤ f < 200	Not applicable	1
1) Note: The devices are only designed for stationary use.			

Table A.7 Mechanical conditions, ServoOne CM-P

CAUTION!	DAMAGE TO THE DEVICE DUE TO INCORRECT OPERATION!
	<p>Failure to observe the ambient conditions may result in damage.</p> <ul style="list-style-type: none"> No continuous vibration! The axis controllers must not be installed in areas where they would be permanently exposed to vibration. Switch cabinet min. IP54 for STO! as per EN ISO 13849-2 Observe cooling conditions!

**NOTE:**

The devices are only designed for stationary use.

A.4 Power reduction at $T_{unom} \geq 40\text{ °C}$

If the multi-axis system is operated outside the specified maximum ambient temperature (T_{unom}), the output power of the supply unit must be reduced as a function of the higher ambient temperature; this reduction will have an effect on the current in the DC link connections. This so-called temperature derating is used to protect parts in the device against overheating.

Device	Operation without derating up to T_{unom}	Operation with derating up to T_{umax}	Derating for $T_{unom} < T_u < T_{umax}$
SOCM-P.0010 / SOCM-P.0110 SOCM-P.0022 / SOCM-P.0122	40 °C	55 °C	Reduction of the output power by 3.0 % per 1 °C

Table E.8 Power reduction at $T_{UNOM} \geq 40\text{ °C}$



NOTE:

The derating is to be applied both to the rated currents and to the overload currents.

A.5 Certification

A.5.1 CE certification

The ServoOne CM-P supply unit conforms to the requirements of the Low Voltage Directive 2006/95/EC and the product standard EN 61800-5-1.

The ServoOne CM-P supply unit conforms to the requirements for installation in a machine or plant under the terms of the Machinery Directive 2006/42/EC.

The supply unit is accordingly CE marked. The CE marking on the rating plate indicates conformity with the above directives.

A.5.2 UL certification

You will find information on the certification according to UL61800-5-1 for the ServoOne CM-P supply unit in the document "UL-Certification" ID no.: 0927.21B.x.

A.5.3 Load on the mains due to harmonics (EN 61000-3-2:2006)

The devices in the ServoOne CM system are "professional equipment" in the context of EN61000 such that with a nominal connected load $\leq 1\text{ kW}$ (or $\leq 16\text{ A}$ per mains phase) they fall within the scope of the standard. On the direct connection of the supply unit $\leq 1\text{ kW}$ to the public low-voltage network, either measures to conform to the standard are to be taken or the responsible utility must grant approval for connection. If you should use our drive units as a component in your machine / system, then the scope of the standard is to be checked for the complete machine / system.

A.6 Accessories

We have supplemented the ServoOne CM system with comprehensive accessories. Important components are, e.g.:

- Synchronous servomotors from the product ranges LSN/LST and LSP with
 - Encoders of type resolver, hiperface® multiturn and hiperface® singleturn
- Pre-assembled motor cable
- Pre-assembled encoder cable
- DriveManager 5 PC user software
- Mains filter - reduces the cable-borne high-frequency interference from the drive controller (for use on the supply unit ServoOne CM-P)
- Mains choke - reduces the distortion (THD) in the system and prolongs the life of the axis controller (for usage on the ServoOne CM-P supply unit).
- Braking resistor - converts surplus regenerated energy into heat and in this way permits an even more dynamic movement process (for usage on the ServoOne CM-P supply unit).

A.7 Mains filters

The following tables provide an initial estimation of which mains filter will probably meet the EMC requirements for a given requirement. The selection is to be checked by the installer/operator. Under certain conditions it is possible to change to a smaller filter, or a larger filter must be used.

Step	Action	Comment
1.	Select the table that corresponds to the rated current for your application.	
2.	Add together the motor cable lengths for your application and go to the related column or the next larger column.	
3.	Select the corresponding environment for your application (residential C2 or industrial C3).	
4.	Select the maximum motor power stage clock frequency that occurs in your application.	
5.	Read off the article designation for the mains filter.	
6.	For systems with a larger number of axes or long motor cables, check the mains filter selected according to appendix A7.2.	
7.	Demonstrate compliance with EMC requirements by measurement.	

Example

The system on which the interference is to be suppressed consists of six axes each with a motor cable length of 4 m and is operated with an automatically switching clock frequency with a maximum of 8 kHz also in residential areas. The mains-side rated current is 18 A.

- Based on the rated current, the Table "Mains input current $I_{IN} \leq 25$ A" is to be selected.
- The sum of the motor cable lengths is $6 \times 4 \text{ m} = 24 \text{ m}$, the column "30" is to be selected.
- Residential environment = category C2
- Maximum clock frequency = 8 kHz
- The recommendation for the mains filter is EMC25.240-UR

For table see next page.

A.7.1 Overview of mains filters

Mains input current $I_{IN} \leq 25 \text{ A}$

Max. motor cable length [m]			20	30	40	50	60	70	80	90	100	120	140	240	300	600	
Category	C2	Clock frequency [kHz]	4	EMC25.120-UR	EMC25.240-UR					EMC25.600-UR		N/A					
			8	EMC25.120-UR	EMC25.240-UR				EMC25.600-UR		N/A						
			16	EMC25.240-UR				N/A									
	C3		4	EMC25.120-UR										EMC25.240-UR		EMC25.600-UR	
			8	EMC25.120-UR										EMC25.240-UR		EMC25.600-UR	
			16	EMC25.120-UR								N/A					

KEBA article designation	KEBA article no.
EMC25.120-UR	0996.2027
EMC25.240-UR	0996.2026
EMC25.600-UR	0996.2025

Table A.9 Selection, mains filter for SOCM-P.0010 / SOCM-P.0110

Mains input current $I_{IN} \leq 53 \text{ A}$

Max. motor cable length [m]				20	30	40	50	60	70	80	90	100	120	140	240	300	600	
Category	C2	Clock frequency [kHz]	4	EMC53.120-UR	EMC53.240-UR	EMC53.600-UR			N/A									
			8	EMC53.240-UR	EMC53.600-UR	N/A												
			16	EMC53.240-UR	EMC53.600-UR	N/A												
	C3		4	EMC53.120-UR											EMC53.240-UR		EMC53.600-UR	
			8	EMC53.120-UR											EMC53.240-UR		EMC53.600-UR	
			16	EMC53.120-UR										EMC53.240-UR			N/A	

KEBA article designation	KEBA article no.
EMC53.120-UR	0996.2024
EMC53.240-UR	0996.2023
EMC53.600-UR	0996.2022

Table A.10 Selection, mains filter for SOCM-P.0022 / SOCM-P.0122

A.7.2 Selection of the mains filter taking into account the cable and motor leakage capacitances

The effect of the mains filter is in general limited by the sum of all the leakage capacitances in the components connected to the SO CM. This parasitic capacitance is primarily determined by the motor cables connected. The capacitances in motors connected form a further factor that cannot be ignored.

Therefore, typical application scenarios were assumed for the development of the filters and the capacitances of KEBA motor cables and motors used as the basis to produce typical total capacitances for which the filters were designed. For KEBA components the following applies:

KEBA cables have a value of 0.47 nF/m

KEBA motors have a value less than or equal to 10 nF

For the 600 m filter variant, an application with 12 motors each with a cable length of 50 m is assumed for the design. With the above data, there is a total capacitance of $12 \times 10 \text{ nF} + 12 \times 50 \text{ m} \times 470 \text{ pF/m} = 402 \text{ nF}$. The total leakage capacitances for the other mains filters are found similarly.

Overview of the permissible leakage capacitances for the mains filters

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

Table E.11 Total leakage capacitances on mains filters

Detailed consideration is necessary in applications with a larger number of axes or long motor cables. Detailed consideration is also necessary if cables from other suppliers are used and these cables are not designed to have low capacitance, and if motors from other suppliers or special motors are used.

As the basis for the estimation of the permissible total cable length, use:

$$L_g = (C_x - C_m) / C_k$$

Key:

L_g = Sum of the cable length for all axes connected [m]

C_x = Permissible total leakage capacitance of the mains filter (see table) [nF]

C_m = Sum of the parasitic capacitances in all motors connected [nF]

C_k = Capacitance of the motor cable used in [nF/m]

Example:

The SO CM system features the possibility of operating up to 24 axes on one supply unit. Selected mains filter is in EMCxx.600.

Due to the capacitance contributed by the motors of 240 nF ($24 \times 10 \text{ nF}$), a total cable length of $L_g = (402 \text{ nF} - 240 \text{ nF}) / 0.47 \text{ nF/m} = 344 \text{ m}$ is permissible.

That is an average per axis of 14.3 m on a "600 m filter".

A.8 Mains choke

We recommend the usage of mains chokes to reduce the peak system currents and therefore also the distortion (THD) in the system and to prolong the life of the axis controller (for use on the ServoOne CM-P supply unit BG1+2).



NOTE:

For these devices, it is also to be ensured that the mains choke is installed on the mains side in front of the mains filter.

Use the following mains chokes for the ServoOne CM-P supply unit BG1+2

Device	Related mains choke
SO CM-P.0x10	LR34.20-UR
SO CM-P.0x22	LR34.44-UR

Table E.12 Total leakage capacitances on mains filters



NOTE:

If the rated power of the ServoOne CM-P supply unit BG1+2 is not utilised, smaller mains chokes to match the related mains input current can be used.

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