

## ServoOne CM

ServoOne CM

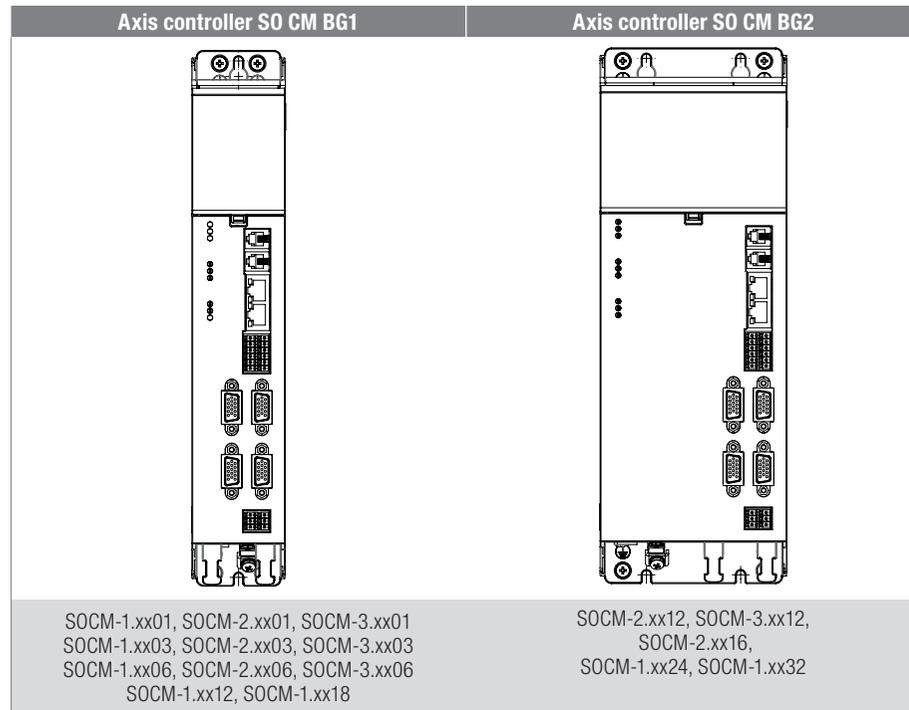
Operation Manual

### Axis controller SO CM BG1+2

Compact multi-axis system ServoOne CM



## Overview, axis controller SO CM BG1+2



## Operation Manual Axis Controller SO CM BG1+2 Compact multi-axis system ServoOne CM

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The German version is the original of this documentation.

## 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 is based on the latest information available to us.

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

Information and specifications may be subject to change at any time. Please obtain information on the latest version at [www.keba-lti.com](http://www.keba-lti.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 PDF format.

## 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 Industrial Automation Germany GmbH:

- 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.
- The user must read and understand the documentation on the 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 document we use the following pictograms:



### NOTE

Useful information for the user.



Reference to other documents.

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

## 1.4 Disclaimer

Following the documentation on the devices from KEBA Industrial Automation Germany GmbH is a prerequisite:

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

KEBA Industrial Automation Germany GmbH 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](http://www.keba-lti.com) → **Service** → **Downloads**

## 1.6 Order code

The article designation provides information on the related variant of the axis controller supplied.

	SO	CM	-	3	.	0	0	1	2	.	1	1	0	0	.	0
ServoOne CM																
Axes				1: Single-axis controller 2: Double-axis controller 3: Triple-axis controller												
Supply				0: DC (from SO CM-P)												
Cooling				0: Wall mounting (with heat sink) 1: Cold plate (without heat sink)												
Rated current				01: 1.5 A 03: 3 A 06: 6 A 12: 12 A 16: 16 A 18: 18 A 24: 24 A 32: 32 A												
Encoder interface				1: Standard 2: Hiperface DSL® (one-cable solution) + standard 3: Hiperface DSL® (one-cable solution)												
Safety function				1: SD0 (STO and SBC) standard 2: SDC (encoder version SinCos + HDSSL®) 3: SDC (encoder version SinCos + EnDat2.2)* 4: SDC (encoder version resolver + HDSSL®)* 5: SDC (encoder version resolver + EnDat2.2)*												
Extras				0: None 1: Assemblies coated												
Model				0, C, D: KEBA												
Version index																

\* In preparation

## 1.7 Rating plate

On the rating plate for the device you will find the serial number, from which you can identify the date of manufacture based on the following key.

SO CM-3.0012.1000.0 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)
 Industrial Automation Germany GmbH 35633 Lahnau Gewerbestraße 5-9	A: Revision state e.g.: F	
SO CM-3.0012.1000.0 In: 325V DC - 678V DC 36A DC Out: 3 x (0-480V 3ph 0-400 Hz 12A)		
Multiple rated equipment. See instruction manual Year: 2019  SN: JJWWSXXXXT		

Figure 1.1 Hardware rating plate, SO CM axis controller BG1+2 (example)

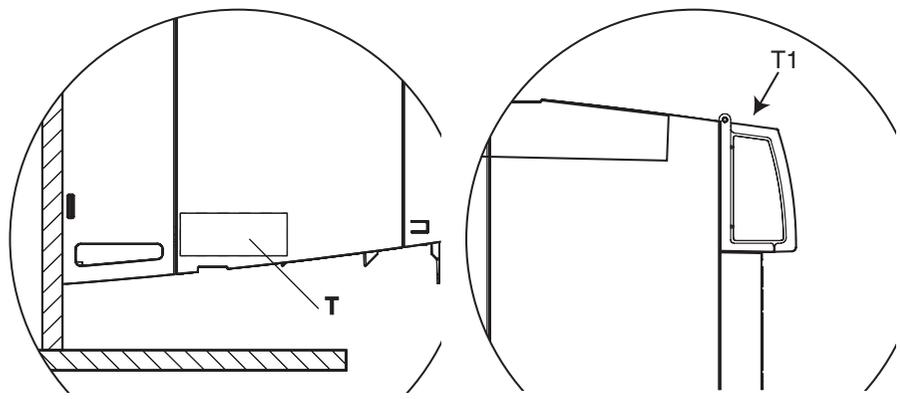


Figure 1.2 Position of rating plate (T)

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 axis controllers BG1+2 are described in this operation manual. You will find information on other components of the SO CM multi-axis system in the related operation manuals.

### Allocation of number of axes, rated current and sizes

Axis controller with ...	Cooling	Size 1 (BG 1)						Size 2 (BG 2)				Size 3 + 4
		Rated current $I_{rated, eff}$ [A]						Rated current $I_{rated, eff}$ [A]				
1 axis	Air	1.5	3	6	12	18	-	-	24	32	See Operation Manual 1800.200B.x	
2 axes	Air	2 x 1.5	2 x 3	2 x 6	-	-	2 x 12	2 x 16	-	-		
3 axes	Air	3 x 1.5	3 x 3	3 x 6	-	-	3 x 12	-	-	-		

## 1.9 Scope of supply

The scope of supply includes:

- ServoOne CM axis controller
- Pre-assembled data cables for cross-communication and EtherCAT
- PE connector
- Pre-assembled busbar elements for 24 V control supply and for DC link connection
- Product DVD with booklet

## 1.10 Disposal

Follow the current 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.de](mailto:helpline@keba.de)

Telephone: +49 6441 966-180

Internet: [www.keba-lti.com](http://www.keba-lti.com)

**NOTE:**

You will find detailed information about our services on our web site [www.keba-lti.com](http://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

The device is only allowed to be installed and placed in operation 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  $\geq 50$  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

<b>DANGER!</b>	<b>Risk of injury due to electrical power!</b>
	<ul style="list-style-type: none"> <li>• <b>Carelessness will result in serious injuries or death.</b></li> </ul> Follow safety instructions and warnings in this document and on the device.
<b>WARNING!</b>	<b>Risk of injury due to electrical power!</b>
	<ul style="list-style-type: none"> <li>• <b>Carelessness may result in serious injuries or death.</b></li> </ul> Follow safety instructions and warnings in this document and on the device.
<b>CAUTION!</b>	<b>Risk of injury or damage to the device due to incorrect operation!</b>
	<ul style="list-style-type: none"> <li>• <b>Carelessness may result in minor injuries or damage.</b></li> </ul> Follow safety instructions and warnings in this document and on the device.
<b>WARNING!</b>	<b>Risk of injury due to hot surfaces and components!</b>
	<ul style="list-style-type: none"> <li>• <b>Carelessness may result in serious burns.</b></li> </ul> Electronic components may become hot during operation! Follow safety instructions and warnings in this document and on the device!
<b>CAUTION!</b>	<b>Damage due to electrostatic discharge!</b>
	<ul style="list-style-type: none"> <li>• <b>Electrostatic discharge can destroy components.</b></li> </ul> Do not touch electronic components or contacts! Follow safety instructions and warnings in this document and on the device!
<b>DANGER!</b>	<b>Risk of injury due to rotating parts on the motor!</b>
	<ul style="list-style-type: none"> <li>• <b>Carelessness will result in serious injuries or death.</b></li> </ul> 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 axis controllers conform to the **Machinery Directive 2006/42/EC**

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 intended operation incl. all accessories such as mains filters and mains chokes 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 Industrial Automation Germany GmbH 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 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 and EN ISO 13849-1.

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 60204-1:2006) 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" - STO)

## 2.7 Relevant laws, standards and directives applied

For information on the laws, standards and directives applied by KEBA Industrial Automation Germany GmbH, 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.



**NOTE:**

Due to possible output frequencies >600 Hz, the axis controllers fall under the fallen Dual Use Regulation (EU) no. 1382/2014 dated 22 October 2014 item 3A225; export authorisation is therefore required for non-EU countries. Please note the information in the delivery documents.

## 2.8 Declaration of conformity

According to Machinery Directive 2006/42/EC:

		<b>EU-Konformitätserklärung MRL</b> <i>EU Declaration of Conformity</i>
<small>Automation by innovation.</small>		
<b>Der Hersteller</b> <i>The manufacturer</i>	KEBA Industrial Automation Germany GmbH Gewerbestraße 5 - 9 35633 Lahnau Deutschland	
erklärt in alleiniger Verantwortung hiermit, dass die folgenden Produkte <i>declares under sole responsibility that the following products</i>		
<b>Produktbezeichnung:</b> <i>Product designation:</i>	Servo Antriebsregler ServoOne CM   BG 1 + BG 2 + BG 3 Servo Drive ServoOne CM   Size 1 + Size 2 + Size 3	
<b>Produkttypen:</b> <i>Product types:</i>	ServoOne CM Sicherheitsausführung SDC & SD0 ServoOne CM Functional Safety SDC & SD0 SO CM-1.0xxx.xAxx.2, SO CM-2.0xxx.xAxx.2, SO CM-3.0xxx.xAxx.2 A = 1 (SD0), 2 (SDC)	
<b>ab Seriennummer:</b> <i>from serial number:</i>	200100001 200100001	
den Sicherheitsbestimmungen der nachstehenden EU-Richtlinie entsprechen: <i>comply with the essential requirements of the following EU Directive:</i>		
2006/42/EG <i>2006/42/EC</i>	Maschinenrichtlinie <i>Machinery-Directive</i>	
und dass folgende angeführten Normen angewandt wurden: <i>and that the following standards have been applied:</i>		
EN ISO 13849-1:2015 EN 61800-5-2:2016 EN 61800-5-1:2007	EN 62061:2015 EN 61800-3:2004 + A1:2012 IEC 61508 Teil / parts 1 bis / to 7:2010	
<b>EG-Baumusterprüfung / EC type examination</b>		
<b>Benannte Stelle / Notified body:</b>	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln 0035	
<b>Kennnummer / Identification-No.:</b>	01/205/5574.00/17	
<b>EG Baumusterprüfung Bescheinigung Nr.:</b>	01/205/5574.00/17	
<b>EC type examination Certificate-No.:</b>	01/205/5574.00/17	
Unterzeichnet für und im Namen von KEBA Industrial Automation Germany GmbH. <i>Signed for and on behalf of KEBA Industrial Automation Germany GmbH.</i>		
<b>Unterschrift / signature</b>		
<b>Name / name:</b>	Dr. Josef Wiesing	Alexander Lehmann
<b>Stellung:</b>	Geschäftsführer	Dokumentationsbeauftragter
<b>Position:</b>	Managing Director	Responsible for documentation
<b>Datum / date:</b>	05.02.2020	05.02.2020
<b>Adresse / address:</b>	Gewerbestraße 5-9	Gewerbestraße 5-9
<b>Ort / place:</b>	35633 Lahnau	35633 Lahnau
<b>Land / country:</b>	Deutschland	Deutschland
Die deutschsprachige Version dieses Dokumentes ist die Originalversion, alle anderssprachigen Versionen wurden aus dem Original-Text übersetzt. <i>The German-language version of this document is the original version, all other language versions have been translated from the original text.</i>		
<b>Dokument:</b>	1400.0DK.5-01	
FB 0108 EU-Konformitätserklärung MRL 2020/01 J		
<small>Seite / Page 1 / 1</small>		

## 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 axis controllers must not be installed in areas where they 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 the 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 axis controller in the axis group it is imperative the Operation Manuals for the other devices (supply unit, controller, etc.) are also followed.

#### 3.1.1 Order and arrangement

The following basic guidelines apply to the arrangement and installation of the axis controller or supply unit:

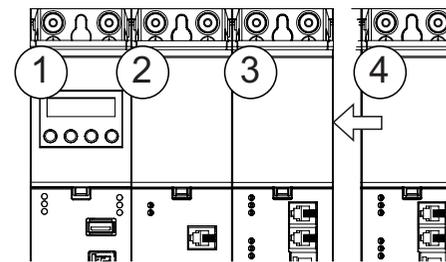
#### Butt mounting and alignment

- 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 supply and power supply to the axis controllers (SO CM) and the controller (MO CM) is provided with the aid of the DC link and 24 VDC busbars from the supply unit (SO CM-P) and is possible without additional compensation measures in relation to the device depth, with the same cooling concept.
- 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 (corresponds to maximum 24 axes) can be connected and operated on one supply unit (BG1 or BG2).



- 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



#### NOTE:

In the overall axis group, a DC link capacitance of  $\geq 100 \mu\text{F}/\text{kW}$  (for  $3 \times 400 \text{ V}$ ) or  $\geq 170 \mu\text{F}/\text{kW}$  (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, see Table A.1 and Table A.2.

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

## 3.2 Mounting clearances

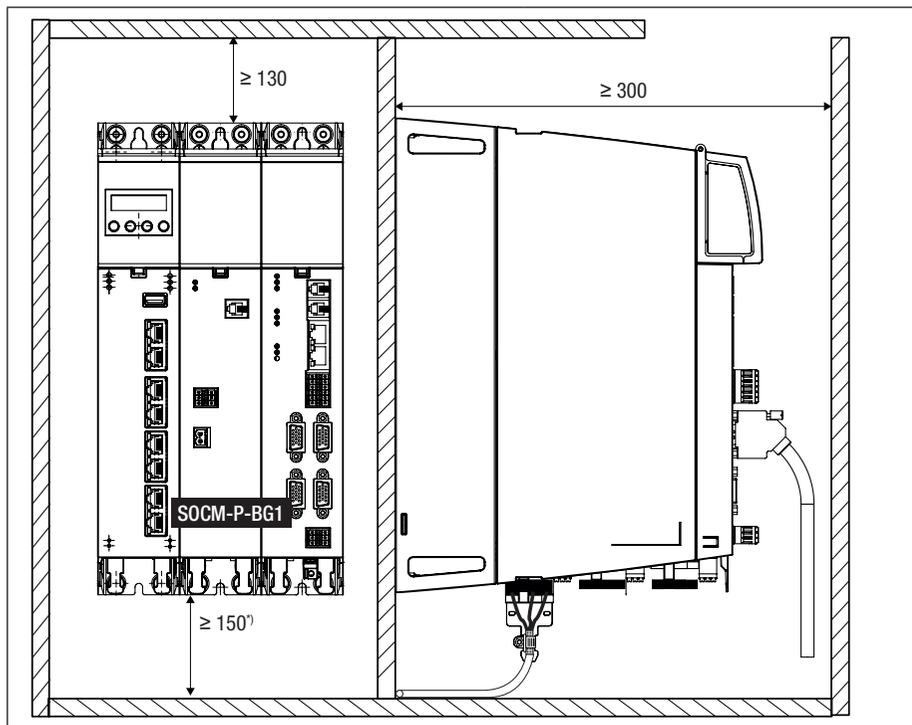


Figure 3.2 Mounting clearances SystemOne CM

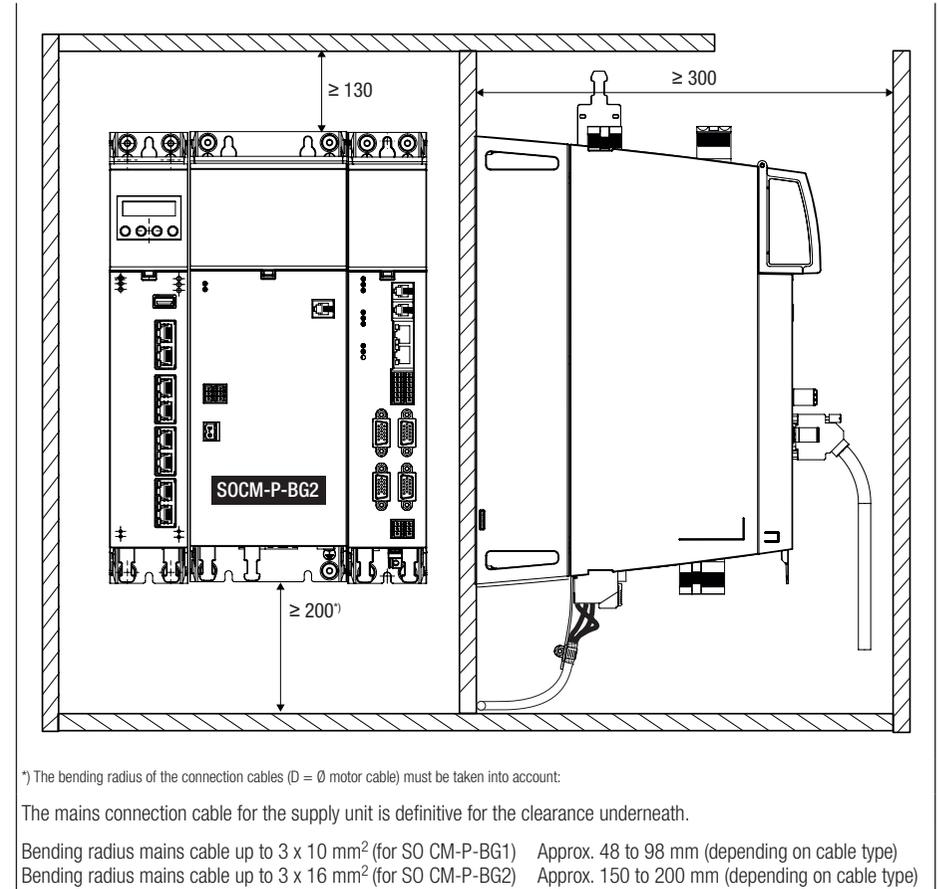


Figure 3.2 Mounting clearances SystemOne CM

<b>CAUTION!</b>	<b>Damage to the device due to incorrect installation conditions!</b>
	<p><b>The device may suffer irreparable damage if the conditions are not met.</b></p> <ul style="list-style-type: none"> <li>The minimum clearances stated in Figure 3.2 apply to all devices (MotionOne CM, ServoOne CM-P and ServoOne CM).</li> <li>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.</li> </ul>

### 3.3 Cooling the devices

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

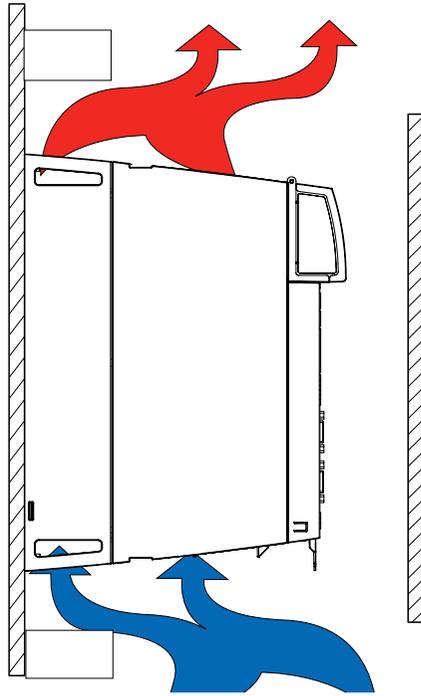


Figure 3.3 Cooling air flows unhindered through the device

### 3.4 Installation of the devices for wall mounting

Step	Action	Comment
1.	Arrange the devices 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 multi-axis group in a line along the top edge of the devices.	This action is necessary to be able to couple the DC link using the 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, Figure 3.4 and Figure 3.5
3.	Install the axis controllers vertically and butt mounted with the supply unit in a row on the backing plate.	The contact surface must be bare metal and conductive.
You will find the next steps for the electrical installation in chapter 4.		

## 3.4.1 Dimensions, wall mounting model

ServoOne CM	BG1	BG2
	SOCM-1.xx01	
	SOCM-2.xx01	
	SOCM-3.xx01	SOCM-2.xx12
	SOCM-1.xx03	SOCM-3.xx12
	SOCM-2.xx03	
	SOCM-3.xx03	
	SOCM-1.xx06	SOCM-2.xx16
	SOCM-2.xx06	SOCM-1.xx24
	SOCM-3.xx06	SOCM-1.xx32
	SOCM-1.xx12	
	SOCM-1.xx18	
Weight approx.	2.7 kg	4.5 kg
H (height)		310
H1		299
H2		6
B (width)	55	110
T (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

For sketch see Figure 3.4 and Figure 3.5

All dimensions in mm

Table 3.1 Dimensions and mounting clearances for wall mounting

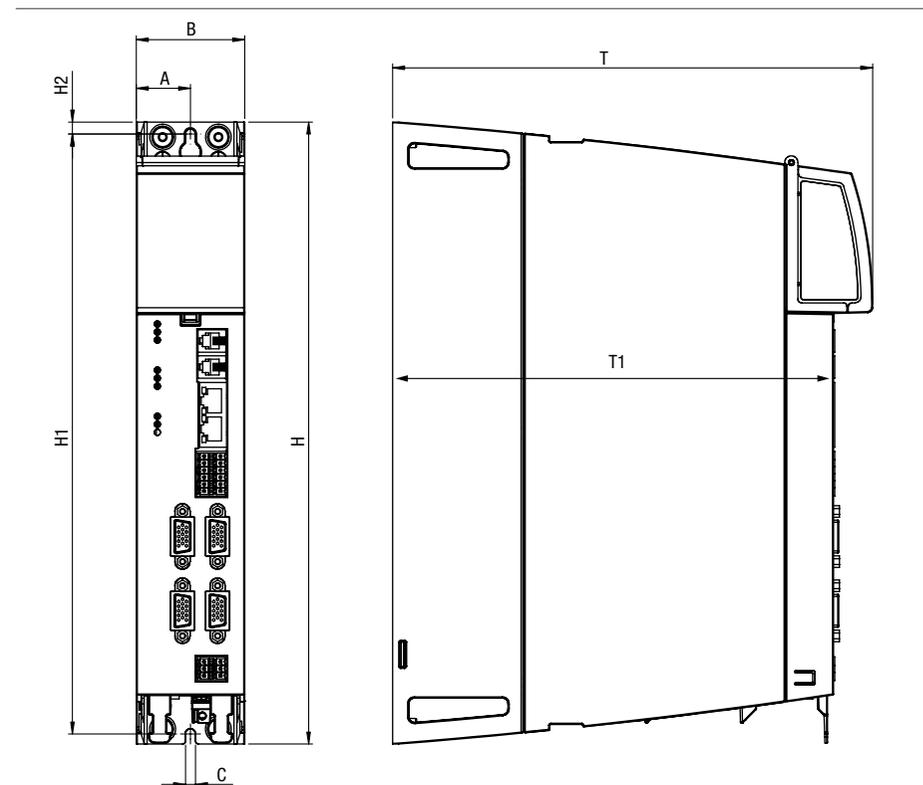


Figure 3.4 Dimensional drawing, ServoOne CM axis controller BG1  
(for dimensions see Table 3.1)

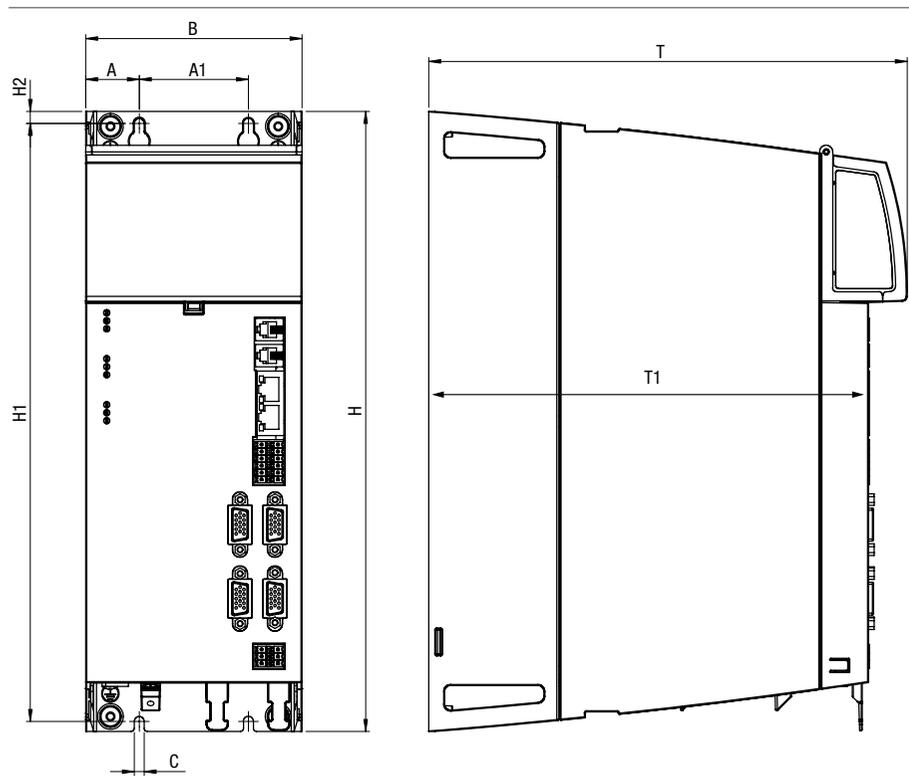


Figure 3.5 Dimensional drawing, ServoOne CM axis controller BG2  
(for dimensions see Table 3.2)

## 3.5 Installation of the devices for cold plate

Step	Action	Comment
1.	<p>Arrange the devices on the backing plate as per Figure 3.1.</p> <p>Please 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 3.2.</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 3.2, Figure 3.6 and Figure 3.7.</p>
3.	<p>The thermally conductive film is already bonded to the rear wall of the cold plate devices.</p> <p>Install the devices vertically and butt mounted in a row on the cooler. 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>
<p>You will find the next steps for the electrical installation in chapter 4.</p>		

## 3.5.1 Dimensions, cold plate model

ServoOne CM	BG1	BG2
	SOCM-1.x101	
	SOCM-2.x101	SOCM-2.x112
	SOCM-3.x101	SOCM-3.x112
	SOCM-1.x103	
	SOCM-2.x103	SOCM-2.x116
	SOCM-3.x103	
	SOCM-1.x106	SOCM-1.x124
	SOCM-2.x106	
	SOCM-3.x106	SOCM-1.x132
	SOCM-1.x112	
	SOCM-1.x118	
Weight approx.	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
A1	-	55
C		5
Side clearance	Direct butt mounting	
Screws	2 x M4	4 x M4

For sketch see Figure 3.6 and Figure 3.7

All dimensions in mm

Table 3.2 Dimensions, cold plate

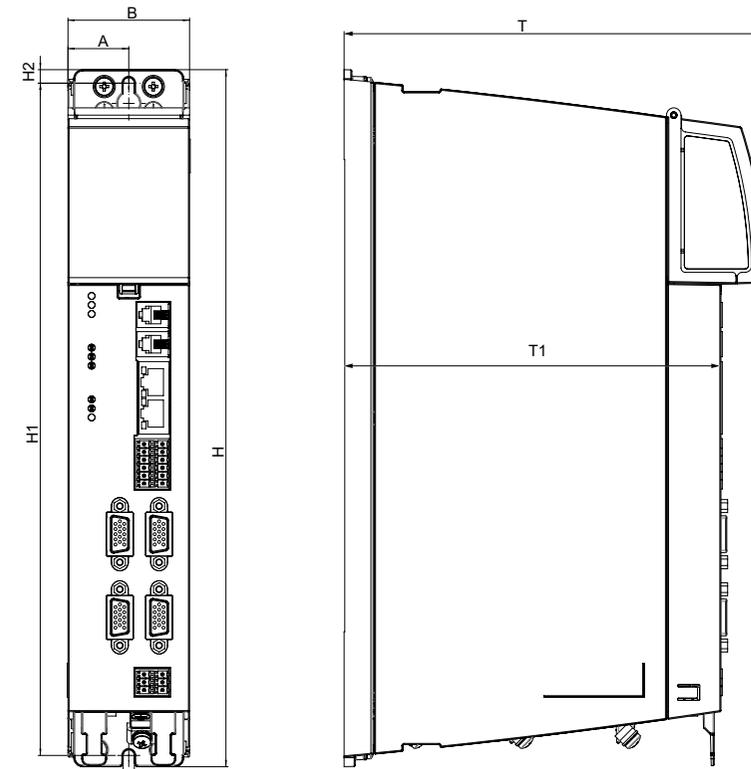


Figure 3.6 Dimensional drawing, ServoOne CM axis controller BG1 cold plate (for dimensions see Table 3.2)

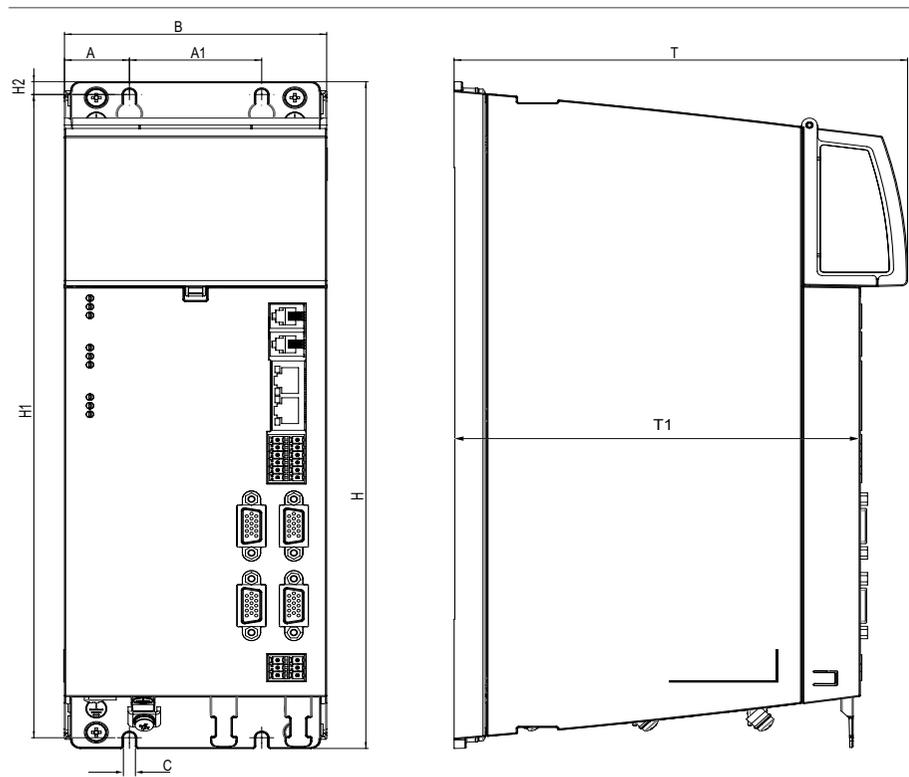


Figure 3.7 Dimensional drawing, ServoOne CM axis controller BG2 cold plate  
(for dimensions see Table 3.2)

### 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.

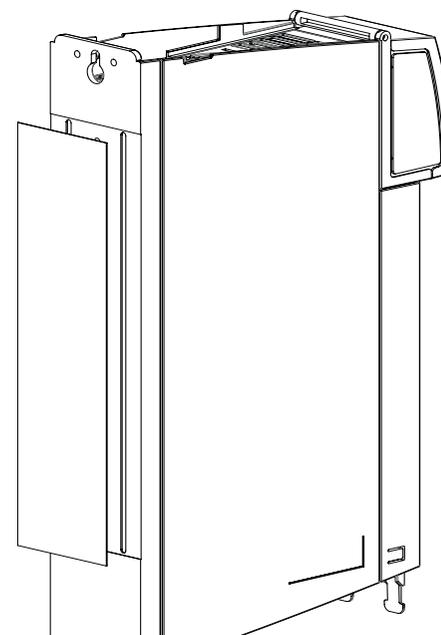


Figure 3.8 Rear wall with film ServoOne CM axis controller BG1 (cold plate)

<b>CAUTION!</b>	<b>Damage to the device due to incorrect mounting!</b>
	<p><b>If this instruction is not followed, the device will overheat due to the poor thermal transfer. The device would fail as a result.</b></p> <ul style="list-style-type: none"> <li>• Please ensure that there is no dirt between the cooler and the rear wall of the device during mounting.</li> </ul>

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).

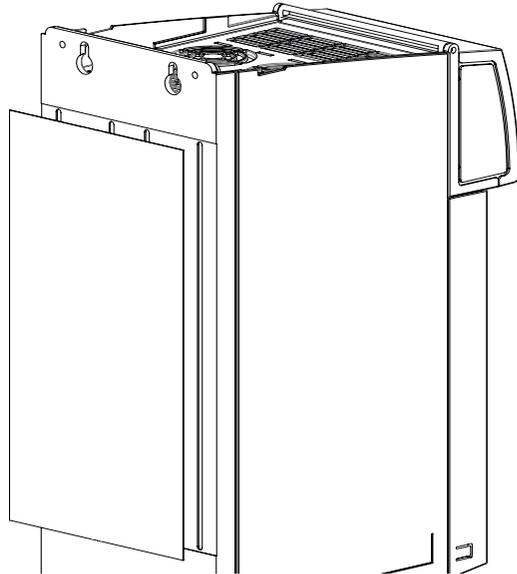


Figure 3.9 Rear wall with film ServoOne CM axis controller BG2 (cold plate)

### 3.5.3 Sizing the cooler

	ServoOne CM BG1	ServoOne CM 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 cooling plate device	85 °C	
Surface of 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 variant

## 3.6 Dimensions of the system

SystemOne CM Automation Complete (example safety control, supply unit and two axis controllers BG1)



Depth: 241 mm

Figure 3.10 ServoOne CM Automation Complete (includes all components)

SystemOne CM Motion plus Safety (example controller, supply unit and two axis controllers BG1)



Depth: 241 mm

Figure 3.11 ServoOne CM Motion plus Safety (with MotionOne CMS without MotionOne CM)

ServoOne CM Motion (example supply unit with two axis controllers BG1)



Depth: 241 mm

Figure 3.12 ServoOne CM Motion 6 axes (without MotionOne CM and SafetyOne CM)

ServoOne CM Motion (example supply unit with one axis controller BG1)



Depth: 241 mm

Figure 3.13 ServoOne CM Motion 3 axes (without MotionOne CM and SafetyOne CM)

## 4 Electrical installation

### 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

<b>DANGER!</b>	<b>Risk of injury due to electrical power!</b>
	<p><b>Carelessness will result in serious injuries or death.</b></p> <ul style="list-style-type: none"><li>• 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 <math>\geq 50</math> V may still be present (capacitor charge). The discharging time depends on the size and the number of axis controllers connected to the multi-axis system. So check that electrical power is not present!</li><li>• 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.</li><li>• Pay attention to warning sign on the device (see front of device).</li><li>• 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.</li></ul>



**NOTE:**

On installing the axis controller in a ServoOne CM multi-axis automation system it is imperative the Operation Manuals for the other devices (controller, supply unit) are also followed.

### 4.2 Effective EMC installation

#### Compliance with the EMC product standard

Commissioning, i.e. starting up intended operation, 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 wires in 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 Industrial Automation Germany GmbH, as all EMC tests have been undertaken successfully with these cables.



**NOTE:**

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

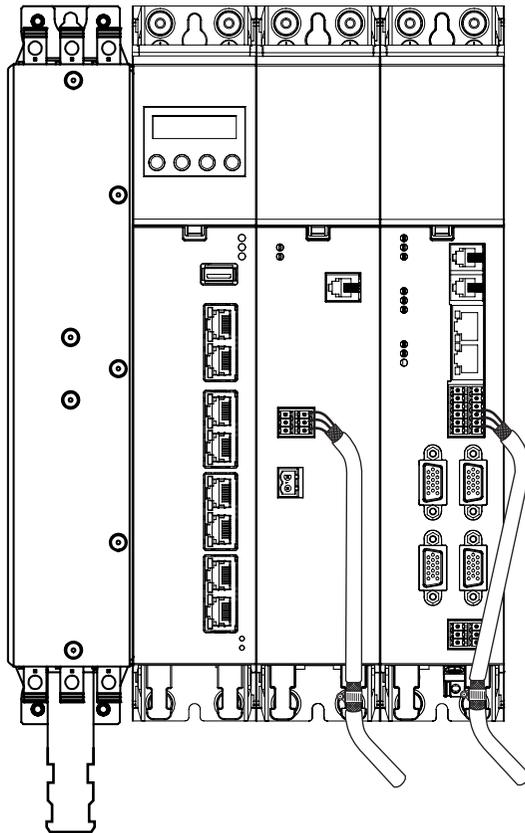


Figure 4.1 Example shield connection, control connections

**NOTE:**

We recommend the usage of the 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.

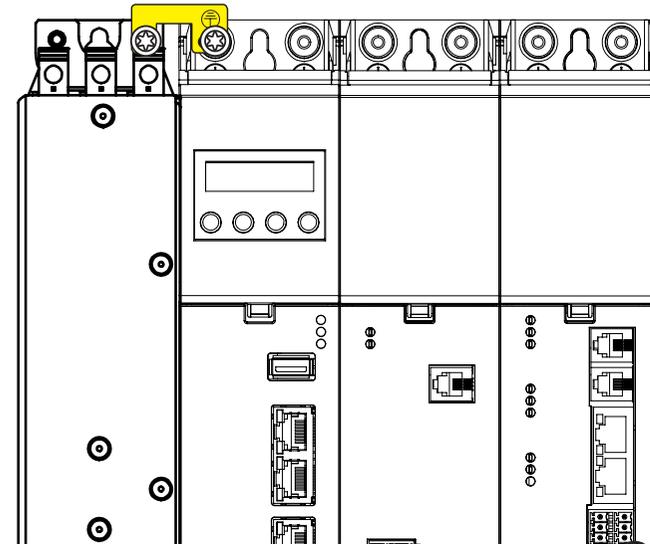


Figure 4.2 Cu strap for improvement of EMC

**Earthing measures**

- The devices are to be fastened to a conductive, earthed backing plate. Earthing measures according to EN 61800-5-1 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 Helpline. See "1.11 Support".

## 4.3 Overview of the connections

In the following you will find the layouts of the ServoOne CM single-axis, double-axis and triple-axis controllers with the corresponding positions of connectors and terminals. For improved clarity we have added an abbreviation (X...) to the designation of the connectors and terminals.

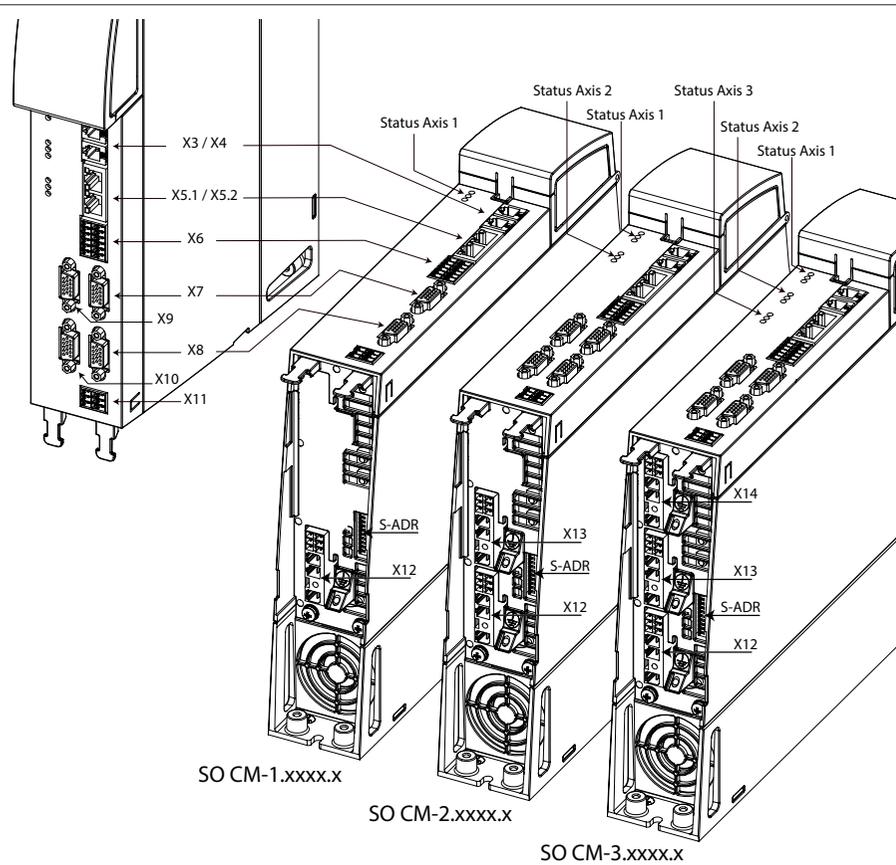


Figure 4.3 Layout, ServoOne CM axis controller

Abbreviation	Designation	Details
Via busbars	24 V control supply	See 4.6.1 on page 37
	DC link supply (DC-Link +/-)	See 4.6.2 on page 38
X3	Cross-communication input	See 4.10 on page 46
X4	Cross-communication output	
X5.1	EtherCAT IN, field bus input	Can also be used as EtherNet interface for PC with DriveManager 5.
X5.2	EtherCAT OUT, field bus output	See 4.11 on page 47
X6	Digital inputs (programmable)	See 4.7.1 on page 39
X7	Encoder interface	See Table 4.2 ff
X8	Encoder interface	
X9	Encoder interface	
X10	Encoder interface	
X11	Digital inputs (safety function)	See 4.7.2 on page 40
S-ADR	DIL switch bank for the configuration of the SDO functionality	See Model description SDO (ID no.: 1400.402B.x)
X12	Power connection motor 1	With integrated connections for motor brake and temperature monitoring. See section 4.8.1
X13	Power connection motor 2	
X14	Power connection motor 3	
SOCM-1.xxxx	ServoOne CM single-axis controller	
SOCM-2.xxxx	ServoOne CM double-axis controller	
SOCM-3.xxxx	ServoOne CM triple-axis controller	

Table 4.1 Key to layout, ServoOne CM axis controller

## 4.3.1 Single-axis controller

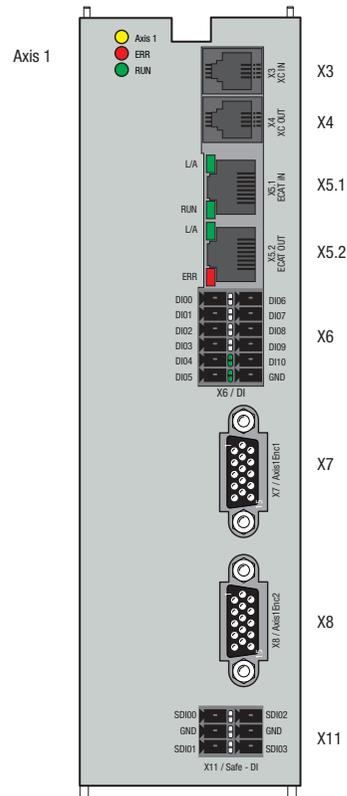


Figure 4.4 Layout, single-axis controller

Abbreviation	Designation	Details
X3	Cross-communication input	Connections for cross-communication. <b>Caution:</b> Only for system-internal usage/communication
X4	Cross-communication output	
X5.1	EtherCAT IN, field bus input	Can also be used as Ethernet interface for PC with DriveManager 5.
X5.2	EtherCAT OUT, field bus output	
X6	Digital inputs	
X7	Encoder connection 1 (axis 1)	Enc1 (multi-encoder interface)
X8	Additional encoder connection (axis 1)	Enc2 (single encoder interface)
X9	Does not exist	Are only used for double-axis and triple-axis controllers.
X10	Does not exist	
X11	Digital inputs, safety function	
Axis 1	LED yellow	Status, axis 1 For details see 6.1
ERR	LED red	
RUN	LED green	

Table 4.2 Key Connection diagram for single-axis controller

Single-axis controller, encoder **axis 1**

Fig.	X7 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver
	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>
	4	R+	Data +		SL+	-
	5	R-	Data -		SL-	-
	6	B-		REFSIN	-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )	
	8	GND				-
	9	-	-	-	-	R2 (resolver excit. -)
	10	-	-	-	-	R1 (resolver excit. +)
	11	B+		+SIN	-	S2 / SIN+ (B+)
	12	nc / Temp+ <sup>1) 2)</sup>				
	13	nc / Temp- <sup>1) 2)</sup>				
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

Fig.	X8 pin	SinCos and TTL	Resolver <sup>6)</sup>
	1	A-	
	2	A+	
	3	+5 V <sup>3)</sup>	
	4	R+	
	5	R-	
	6	B-	
	7	(10 V / 110 mA <sup>4) 7)</sup> )	
	8	GND	
	9	-	
	10	-	
	11	B+	
	12	nc / Temp+ <sup>1) 2)</sup>	
	13	nc / Temp- <sup>1) 2)</sup>	
	14	-	
	15	-	

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08

2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.

3) Typ. 5.15 V, max. 5.25 V, 250 mA max.

4) Alternative power supply for certain encoder types

5) Possible from firmware release 2.10-03

6) Additional resolver connection to **X8** on all devices from revision state "F", from firmware 2.10-03. Only one resolver per axis!

7) From revision state "F"

Table 4.3 Pin assignment, connector X7 (Enc1) single-axis controller

Table 4.4 Pin assignment, connector X8 (Enc2) single-axis controller

## 4.3.2 Double-axis controller

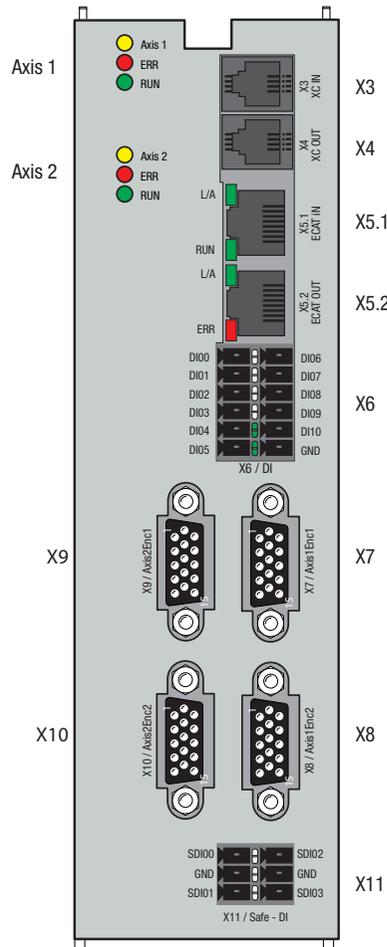


Figure 4.5 Layout, double-axis controller

Abbreviation	Designation	Details
X3	Cross-communication input	Connections for cross-communication. <b>Caution:</b> Only for system-internal usage/communication
X4	Cross-communication output	
X5.1	EtherCAT IN, field bus input	Can also be used as Ethernet interface for PC with DriveManager 5.
X5.2	EtherCAT OUT, field bus output	
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	
ERR	LED red	Status, axis 1 For details see 6.1
RUN	LED green	
Axis 2	LED yellow	
ERR	LED red	Status, axis 2 For details see 6.1
RUN	LED green	

Table 4.5 Key to connection diagram for double-axis controller

## Double-axis controller, encoder **axis 1**

Fig.	X7 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver
 X7 / Axis1 Enc1	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA		(10 V / 110 mA <sup>4)</sup> )
	8			GND		-
	9	-	-	-	-	R2 (resolver excit. -)
	10	-	-	-	-	R1 (resolver excit. +)
	11	B+		+SIN	-	S2 / SIN+ (B+)
	12			nc / Temp+ <sup>1) 2)</sup>		
	13			nc / Temp- <sup>1) 2)</sup>		
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

Fig.	X8 pin	SinCos and TTL	Resolver <sup>6)</sup>
 X8 / Axis1 Enc2	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN-(B-)
	7		(10 V / 110 mA <sup>4) 7)</sup> )
	8	GND	-
	9	-	R2 (resolver excit. -)
	10	-	R1 (resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12		nc / Temp+ <sup>1) 2)</sup>
	13		nc / Temp- <sup>1) 2)</sup>
	14	-	-
	15	-	-

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08

2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.

3) Typ. 5.15 V, max. 5.25 V, 250 mA max.

4) Alternative power supply for certain encoder types

5) Possible from firmware release 2.10-03

6) Additional resolver connection to **X8** on all devices from revision state "F", from firmware 2.10-03. Only one resolver per axis!

7) From revision state "F"

Table 4.6 Pin assignment, connector X7 (Enc1) double-axis controller axis 1

Table 4.7 Pin assignment, connector X8 (Enc2) double-axis controller axis 1

## Double-axis controller, encoder **axis 2**

Fig.	X9 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver
	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA		(10 V / 110 mA <sup>4)</sup> )
	8			GND		-
	9	-	-	-	-	R2 (resolver excit. -)
	10	-	-	-	-	R1 (resolver excit. +)
	11	B+		+SIN	-	S2 / SIN+ (B+)
	12			nc / Temp+ <sup>1) 2)</sup>		
	13			nc / Temp- <sup>1) 2)</sup>		
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

Fig.	X10 pin	SinCos and TTL	Resolver <sup>6)</sup>
	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN-(B-)
	7	(10 V / 110 mA <sup>4)</sup> )	(10 V / 110 mA <sup>4) 7)</sup> )
	8	GND	-
	9	-	R2 (resolver excit. -)
	10	-	R1 (resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12		nc / Temp+ <sup>1) 2)</sup>
	13		nc / Temp- <sup>1) 2)</sup>
	14	-	-
	15	-	-

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08

2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.

3) Typ. 5.15 V, max. 5.25 V, 250 mA max.

4) Alternative power supply for certain encoder types

5) Possible from firmware release 2.10-03

6) Additional resolver connection to **X10** on all devices from revision state "F", from firmware 2.10-03. Only one resolver per axis!

7) From revision state "F"

Table 4.8 Pin assignment, connector X9 (Enc1) double-axis controller axis 2

Table 4.9 Pin assignment, connector X10 (Enc2) double-axis controller axis 2

### 4.3.3 Triple-axis controller

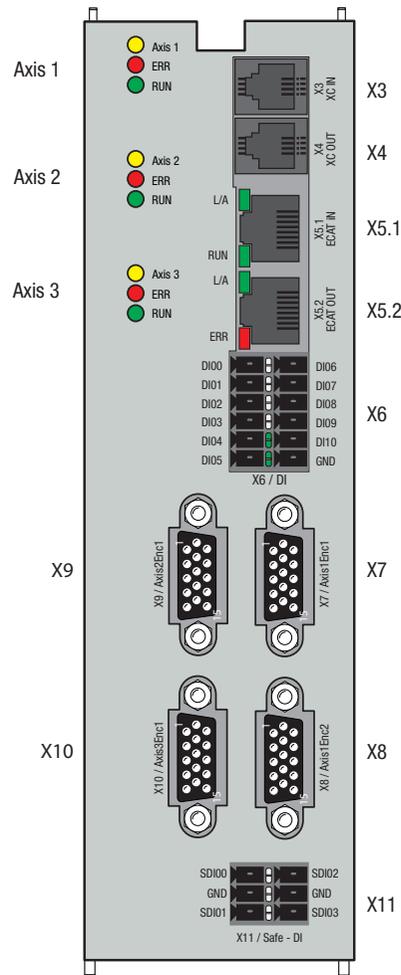


Figure 4.6 Layout, triple-axis controller

Abbreviation	Designation	Details
X3	Cross-communication input	Connections for cross-communication.
X4	Cross-communication output	<b>Caution:</b> Only for system-internal usage/communication
X5.1	EtherCAT IN, field bus input	Can also be used as Ethernet interface for PC with DriveManager 5.
X5.2	EtherCAT OUT, field bus output	
X6	9 digital and 2 fast control inputs	Programmable, per axis three inputs and 2 touch probe 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	Encoder connection 1 (axis 3)	Enc1 (multi-encoder interface)
X11	Digital inputs, safety function	
Axis 1	LED yellow	
ERR	LED red	Status, axis 1 For details see 6.1
RUN	LED green	
Axis 2	LED yellow	
ERR	LED red	Status, axis 2 For details see 6.1
RUN	LED green	
Axis 3	LED yellow	
ERR	LED red	Status, axis 3 For details see 6.1
RUN	LED green	

Table 4.10 Key to connection diagram for triple-axis controller

## Triple-axis controller, encoder axis 1

Fig.	X7 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver
	1	A-		REFCOS	-	S3 / COS- (A-)
	2	A+		+COS	-	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>		(+5 V <sup>3)4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3)4)</sup>
	4	R+		Data +	SL+	-
	5	R-		Data -	SL-	-
	6	B-		REFSIN	-	S4 / SIN-(B-)
	7		(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )
	8			GND		-
	9	-	-	-	-	R2 (resolver excit. -)
	10	-	-	-	-	R1 (resolver excit. +)
	11	B+		+SIN	-	S2 / SIN+ (B+)
	12			nc / Temp+ <sup>1)2)</sup>		
	13			nc / Temp- <sup>1)2)</sup>		
	14	-	CLK+	-	MA+	-
	15	-	CLK-	-	MA-	-

Fig.	X8 pin	SinCos and TTL	Resolver <sup>6)</sup>
	1	A-	S3 / COS- (A-)
	2	A+	S1 / COS+ (A+)
	3	+5 V <sup>3)</sup>	(+5 V <sup>3)4)</sup>
	4	R+	-
	5	R-	-
	6	B-	S4 / SIN-(B-)
	7		(10 V / 110 mA <sup>4)7)</sup> )
	8	GND	-
	9	-	R2 (resolver excit. -)
	10	-	R1 (resolver excit. +)
	11	B+	S2 / SIN+ (B+)
	12		nc / Temp+ <sup>1)2)</sup>
	13		nc / Temp- <sup>1)2)</sup>
	14	-	-
	15	-	-

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08

2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.

3) Typ. 5.15 V, max. 5.25 V, 250 mA max.

4) Alternative power supply for certain encoder types

5) Possible from firmware release 2.10-03

6) Additional resolver connection to **X8** on all devices from revision state "F", from firmware 2.10-03. Only one resolver per axis!

7) From revision state "F"

Table 4.11 Pin assignment, connector X7 (Enc1) triple-axis controller axis 1

Table 4.12 Pin assignment, connector X8 (Enc2) triple-axis controller axis 1

Triple-axis controller, encoder **axis 2**

Fig.	X9 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver	
	1	A-		REFCOS	-	S3 / COS- (A-)	
	2	A+		+COS	-	S1 / COS+ (A+)	
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>	
	4	R+	Data +		SL+	-	
	5	R-	Data -		SL-	-	
	6	B-		REFSIN	-	S4 / SIN-(B-)	
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )		
	8	GND					-
	9	-	-	-	-	R2 (resolver excit. -)	
	10	-	-	-	-	R1 (resolver excit. +)	
	11	B+		+SIN	-	S2 / SIN+ (B+)	
	12	nc / Temp+ <sup>1) 2)</sup>					
	13	nc / Temp- <sup>1) 2)</sup>					
	14	-	CLK+	-	MA+	-	
	15	-	CLK-	-	MA-	-	

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08  
 2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.  
 3) Typ. 5.15 V, max. 5.25 V, 250 mA max.  
 4) Alternative power supply for certain encoder types  
 5) Possible from firmware release 2.10-03

Table 4.13 Pin assignment, connector X9 (Enc1) triple-axis controller axis 2

Triple-axis controller, encoder **axis 3**

Fig.	X10 pin	SinCos and TTL	EnDat / SSI	Hiperface	BISS <sup>5)</sup>	Resolver	
	1	A-		REFCOS	-	S3 / COS- (A-)	
	2	A+		+COS	-	S1 / COS+ (A+)	
	3	+5 V <sup>3)</sup>		(+5 V <sup>3) 4)</sup>	+5 V <sup>3)</sup>	(+5 V <sup>3) 4)</sup>	
	4	R+	Data +		SL+	-	
	5	R-	Data -		SL-	-	
	6	B-		REFSIN	-	S4 / SIN-(B-)	
	7	(10 V / 110 mA <sup>4)</sup> )		10 V / 110 mA	(10 V / 110 mA <sup>4)</sup> )		
	8	GND					-
	9	-	-	-	-	R2 (resolver excit. -)	
	10	-	-	-	-	R1 (resolver excit. +)	
	11	B+		+SIN	-	S2 / SIN+ (B+)	
	12	nc / Temp+ <sup>1) 2)</sup>					
	13	nc / Temp- <sup>1) 2)</sup>					
	14	-	CLK+	-	MA+	-	
	15	-	CLK-	-	MA-	-	

1) Pin has no function on all devices up to revision state "F" / Motor temperature sensor on all devices from revision state "F", from firmware 2.20-08  
 2) The motor temperature sensor must, in relation to the motor winding if connected to the encoder connector, be provided with reinforced insulation as per DIN EN 61800-5-1.  
 3) Typ. 5.15 V, max. 5.25 V, 250 mA max.  
 4) Alternative power supply for certain encoder types  
 5) Possible from firmware release 2.10-03

Table 4.14 Pin assignment, connector X10 (Enc1) triple-axis controller axis 3

## 4.4 Protective earth conductor connection

Step	Action	Comment
1.	Connect together the PE connections on the supply unit, the axis controllers and the controller <b>in series</b> . Make a connection from one of the devices to the PE rail (main earth) in the switch cabinet (see "Figure 4.7 Protective earth conductor connection on the ServoOne CM system").	Each device in the axis group must be earthed!
2.	Connect the protective earth conductor connections on all other components, such as mains filter *) , mains choke *) etc. in a <b>star topology</b> to the PE rail (main earth) in the switch cabinet.	*) Components are only required for the ServoOne CM-P supply unit.

### 4.4.1 PE connection in accordance with DIN EN 61800-5-1

The leakage current is > 3.5 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 $10 \text{ mm}^2$ (Cu)
$16 \text{ mm}^2 < Q \leq 35 \text{ mm}^2$	$16 \text{ mm}^2$
$Q > 35 \text{ mm}^2$	$Q/2$
$Q < 10 \text{ mm}^2$	Q x 2 PE lay doubled (see Figure 4.8) or lay a copper wire with at least $10 \text{ mm}^2$ (Cu)

Table 4.15 Protective earth conductor cross-section

	<b>CAUTION!</b> Risk of injury due to incorrect wiring!
	<b>Carelessness may result in injuries.</b> 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.

### 4.4.2 Connection principle

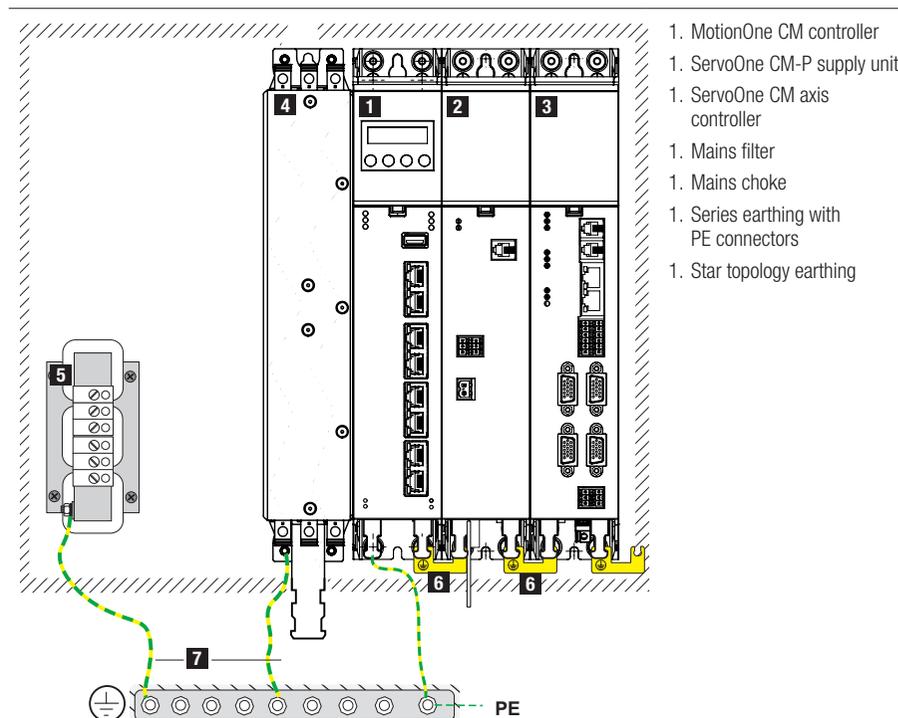


Figure 4.7 Protective earth conductor connection on the ServoOne CM system

**NOTE:** The minimum cross-section of the protective earth conductor must comply with the local safety requirements for protective earth conductors for equipment with high leakage current.

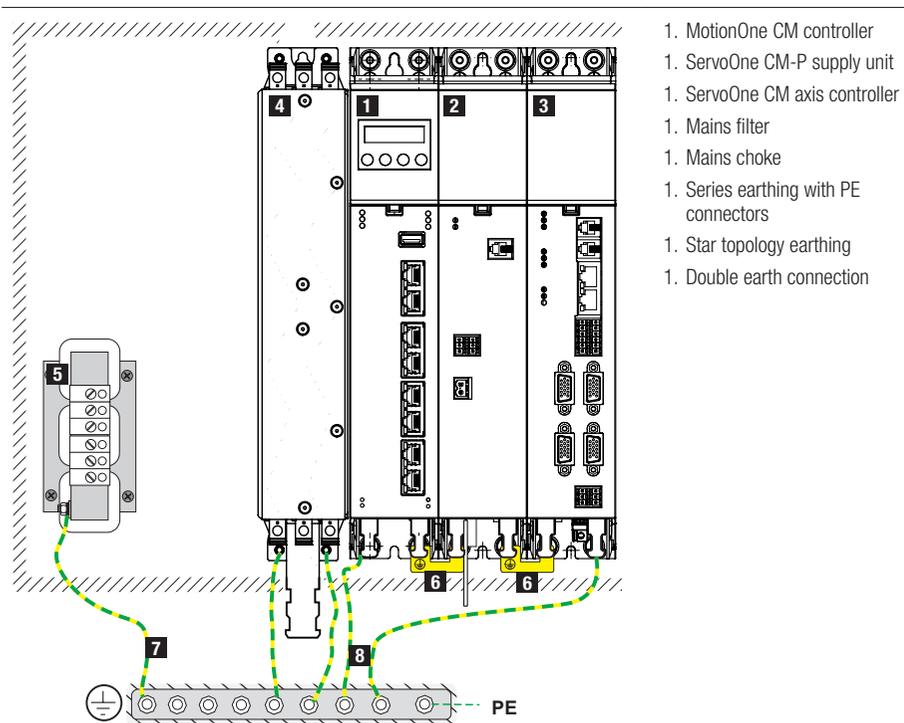


Figure 4.8 Protective earth conductor connection with double PE conductors

<b>CAUTION!</b>	<b>Risk of injury due to incorrect wiring!</b>
	<p><b>Carelessness may result in injuries.</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>

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 4.18

## 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 aspect provides reliable protection against electric shock.

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

The overview opposite shows the potential references for the individual connections in detail. This concept also delivers better operational safety and reliability of the axis controllers.

Axis controller connections (12)	Description	Potential	Abbreviation
Busbars 24 V DC	Control section supply voltage	Protective extra low voltage circuit <sup>3)</sup>	PELV
Busbars DC link	DC link supply voltage	Low voltage <sup>1)</sup>	ZK
X3 / X4	Cross-communication	Protective extra low voltage circuit <sup>3)</sup>	PELV
X5.1 / X5.2	EtherCAT IN/OUT field bus connection	Protective extra low voltage circuit <sup>3)</sup>	PELV
X6 / DI	Digital control inputs	Protective extra low voltage circuit <sup>3)</sup>	PELV
X11 / Safe - DI	Safe digital inputs	Protective extra low voltage circuit <sup>3)</sup>	PELV
X7 / X8 / X9 / X10	Encoder connections	Protective extra low voltage circuit <sup>3)</sup>	PELV
BRK - X12/X13/X14	Motor holding brake connection	Protective extra low voltage circuit <sup>3)</sup>	PELV
9 Motor - X12/X13/X14	Connection of motor temperature sensor	Extra low voltage with basic insulation <sup>2)</sup>	BI
U/V/W - X12/X13/X14	Connection of motor phases	Low voltage <sup>1)</sup>	ZK

1) Low voltage  $\leq 1000$  V AC or  $\leq 1500$  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 4.16 Key to the overview "Electrical isolation concept"

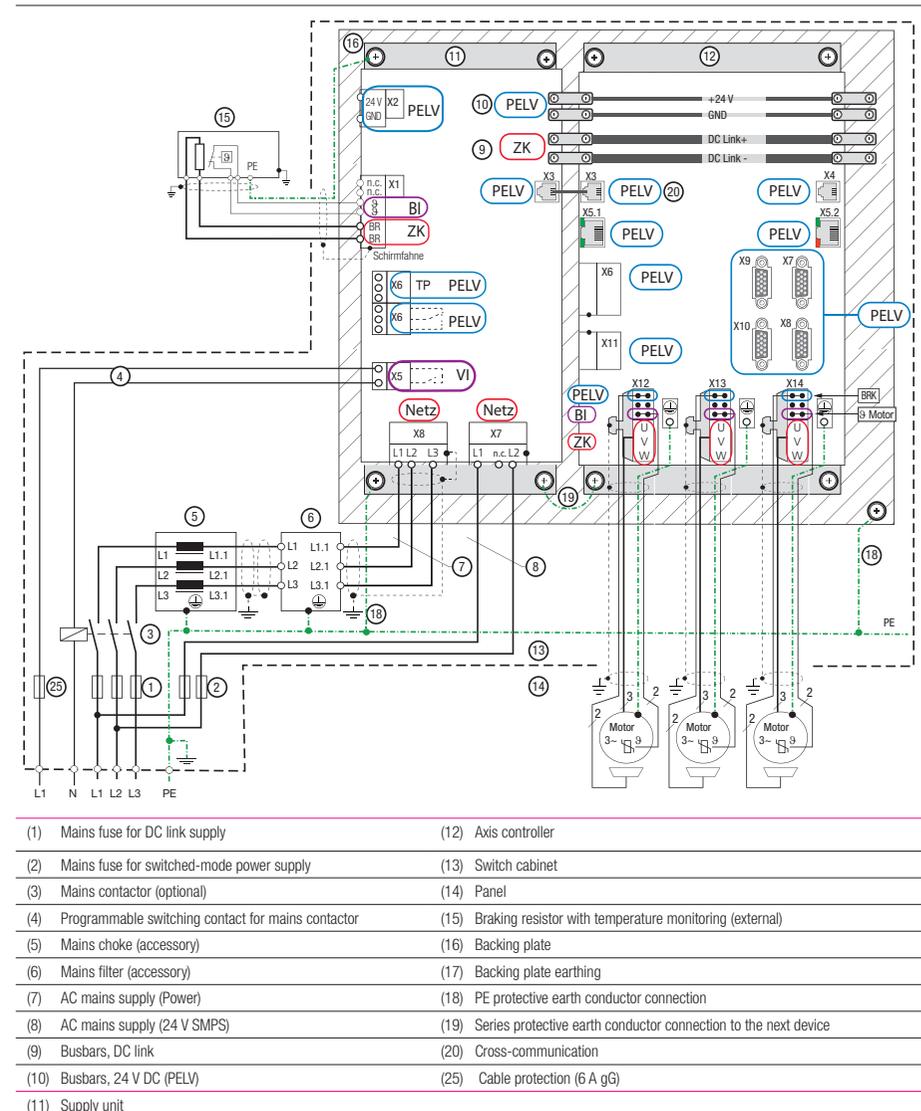


Figure 4.9 Electrical isolation concept with key



## 4.6.2 DC link supply

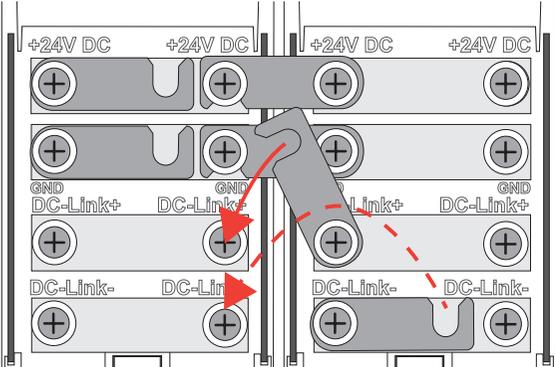
Figure	Specification
<p>ServoOne CM-P supply unit</p> 	<p>ServoOne CM axis controller</p> <ul style="list-style-type: none"> <li>• ServoOne CM axis controller</li> <li>• DC link voltage 565/678 V DC</li> <li>• Depends on the mains power supply to the ServoOne CM-P supply unit (400 V/ 480 V)</li> <li>•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

Figure 4.11 Busbars for the DC link supply

## 4.6.3 Overview of busbars in the group

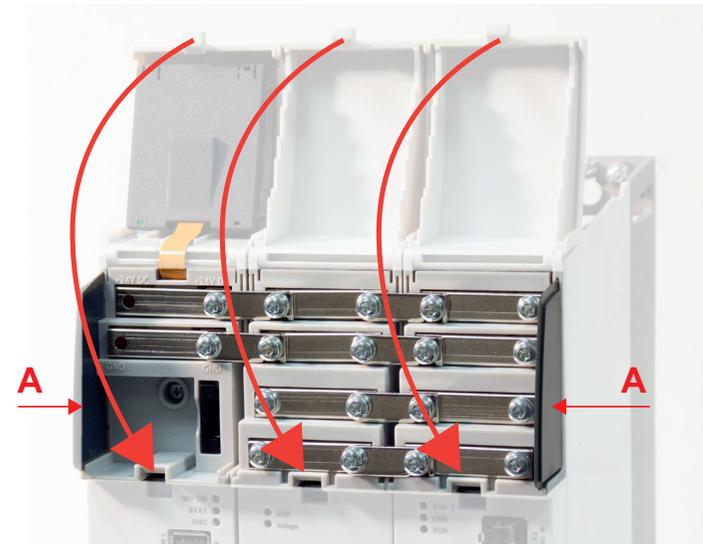


Figure 4.12 Cover on the busbars

	<p><b>Warning!</b></p>
	<p><b>Risk of injury due to electrical power!</b></p> <p><b>Carelessness may result in serious injuries or death.</b></p> <ul style="list-style-type: none"> <li>• 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.</li> </ul>

## 4.7 Control connections

Step	Action	Comment
1.	Connect connection X3 on supply unit to connection X3 on the first axis controller. Then connect connection X4 on the first axis controller to X3 on the next axis controller, etc.	Cross-communication see section 4.10
2.	Establish a connection between the EtherCAT interface X5.1 on the first axis controller and the MOCM controller or another compatible controller.	For EtherCAT interface specification, see section 4.11
3.	Connect all other axis controllers to the first axis controller via the EtherCAT interfaces X5.1 and X5.2	For EtherCAT interface specification, see section 4.11
4.	As necessary, wire the control outputs to X6 using shielded wires. Ground the cable shields over a wide area at both ends.	See section 4.7.1
5.	If you want to use the safety function STO and/or STB, wire the safe control outputs to X11 using shielded wires. Ground the cable shields over a wide area at both ends.	See section 4.7.2
6.	Check all connections again!	

### 4.7.1 Digital inputs on X6 (standard functions)

The digital inputs are provided for axis-related tasks, e.g. limit switches. They can be programmed individually via the EtherCAT bus system. The inputs DI09 and DI10 are suitable for touch probe applications due to their fast signal processing. In addition, the standard digital input DI08 can be used for touch probe tasks. Each servocontroller axis supports two touch probe inputs, with a fixed allocation to the inputs (see table 3.16). The axis assignment can also be programmed via the EtherCAT bus system.

Figure	Allocation	Des.	Type	Function
<p>I/O terminal X6/DI</p> <p>DI00 DI06 DI01 DI07 DI02 DI08 DI03 DI09 DI04 DI10 DI05 GND X6 / DI</p>	Axis 1	DI00	Standard dig. input	See device help, ServoOne CM ▶ subject area "Digital inputs"
		DI01	Standard dig. input	
		DI02	Standard dig. input	
		DI09	Fast dig. input	Touch probe
		DI10	Fast dig. input	Touch probe
	Axis 2	DI03	Standard dig. input	See device help, ServoOne CM ▶ subject area "Digital inputs"
		DI04	Standard dig. input	
		DI05	Standard dig. input	
		DI08	Standard dig. input	Touch probe
		DI10	Fast dig. input	Touch probe
	Axis 3	DI06	Standard dig. input	See device help, ServoOne CM ▶ subject area "Digital inputs"
		DI07	Standard dig. input	
		DI08	Standard dig. input	
		DI08	Standard dig. input	Touch probe
		DI09	Fast dig. input	Touch probe
	GND	DGND	Reference ground	

Table 4.17 Allocation of the control inputs (example triple-axis controller)

Des.	Term.	Specification	Electrical isolation
DI00	X6/DI	<b>Standard dig. inputs:</b> - $U_{inmax} = +24\text{ V DC } +20\%$ - $I_{max}$ at 24 V = 10 mA typ. - Switching level low/high: $\leq 5\text{ V} \geq 18\text{ V}$ - Frequency range $\leq 500\text{ Hz}$ - Sampling cycle: 1 ms  Optionally the dig. input DI08 can also be used as a touch probe input.	Yes
DI01			
DI02			
DI03			
DI04			
DI05			
DI06			
DI07			
DI08	X6/DI	<b>Touch probe:</b> Input for touch probe for quickly saving process data (e.g. actual position). - $U_{inmax} = +24\text{ V DC } +20\%$ - $I_{max}$ at 24 V = 10 mA typ. - Switching level low/high: $\leq 5\text{ V} \geq 18\text{ V}$ The internal signal delay due to the hardware propagation times is compensated by the software. There are the following inaccuracies: <b>DI08</b> - Inaccuracy pos. edge change +/- 0.75 $\mu\text{s}$ - Inaccuracy neg. edge change +/- 5.5 $\mu\text{s}$ <b>DI09 and DI10</b> - The inaccuracies are negligible.	Yes
DI09			
DI10			

Table 4.18 Specification of the control connections



**NOTE:** You will find detailed information on setting the parameters for the control inputs in the ServoOne CM device help in the subject area "Digital inputs" (ID. no.: 1400.209B.X).

## 4.7.2 Digital inputs on X11 (safe digital inputs)

Figure	X11/	Type	Function
	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	Reference ground	GND
	GND	Reference ground	GND



**NOTE:** You will find the specification for the inputs SDIxx and further details on the SD0 function in connection with the bank of DIL switches S-ADR in the document "Model Description SD0" ID no.: 1400.402B.x-xx

Table 4.19 Allocation of the control inputs X11/Safe-DI

### Specification for the terminals

The control terminal X6 is realised using a 2-layer 2 x 6 pole plug-in terminal with 3.5 mm spacing from Phoenix-Contact.

- Type: MCDN 1.5/6-G1-3.5

The safety terminal X11 is implemented using a 2-layer 2 x 3 pole plug-in terminal with 3.5 mm spacing from Phoenix-Contact.

- Type: MCDN 1.5/3-G1-3.5

CAUTION!	Damage to the device due to incorrect wiring!
	<p><b>If high currents flow via the ground terminals, high-impedance isolation from the device ground is possible. This can result in the malfunction of the drive.</b></p> <ul style="list-style-type: none"> <li>• Avoid currents circulating in the wiring.</li> </ul>

## 4.8 Motor connection

Step	Action	Comment
1.	Specify the cable cross-section dependent on the maximum current and ambient temperature.	Select cable cross-section as per local and country-specific regulations and conditions.
2.	Connect the shielded motor cable to terminals X12/13/14/ U, V, W and connect the motor to earth at $\oplus$ .	Connect the shield at both ends to reduce interference emissions. Fasten shield connection plate for the motor connection X12/13/14 using <b>both</b> screws.
3.	Wire the temperature sensor (if fitted) to X12/13/14 using separate shielded cables and activate the temperature evaluation using DriveManager 5.	Connect the shield at both ends to reduce interference emissions.
4.	If fitted, connect the motor holding brake to X12/13/14 -1, 2.	See Figure 4.13



### NOTE:

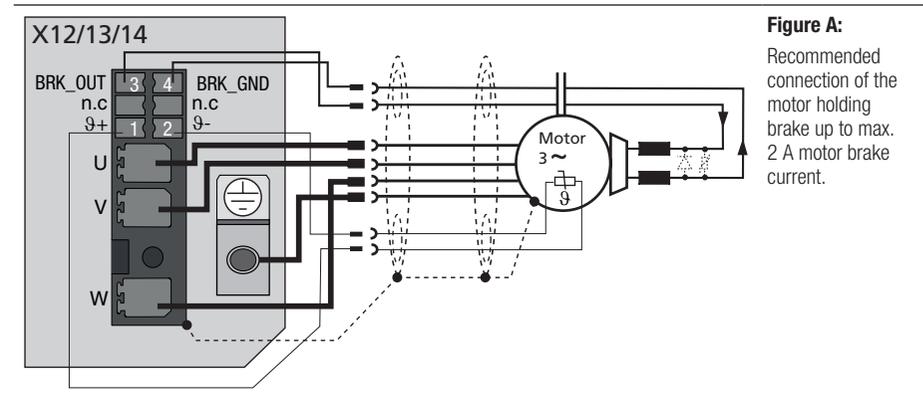
If you use motors that permit the connection of the motor temperature sensor to the motor terminals "9+; 9- " on the axis controller or, alternatively, the motor temperature sensor is to be connected via the encoder connection (see Table 4.6 to Table 4.9), this information is to be stated expressly with the motor order.

CAUTION!	Pay attention to required insulation on the motor temperature sensor.
	<p><b>Errors may result in injuries or damage to the device.</b></p> <ul style="list-style-type: none"> <li>The motor temperature sensor must be provided with at least basic insulation in relation to the motor winding if connected in motor connector X12 - X14.</li> <li>If connected in the encoder connector X7 - X10, the motor temperature sensor must be designed with reinforced insulation as per EN 61800-5-1.</li> </ul>

CAUTION!	Damage to the system due to uncontrolled coasting down of the motor!
	<p><b>If there is a short circuit or earth fault in the motor cable, the power stage is disabled and an error message is output. The motor coasts down in an uncontrolled manner.</b></p> <ul style="list-style-type: none"> <li>Ensure the drive is brought safely to a standstill.</li> </ul>

### 4.8.1 Motor connection diagram

All motor cables must be shielded. To connect the servomotors please use a pre-assembled motor cable from KEBA. The cables available are listed in the appendix A.7. Equivalent shielded cables must be used for the connection of motors from other manufacturers.

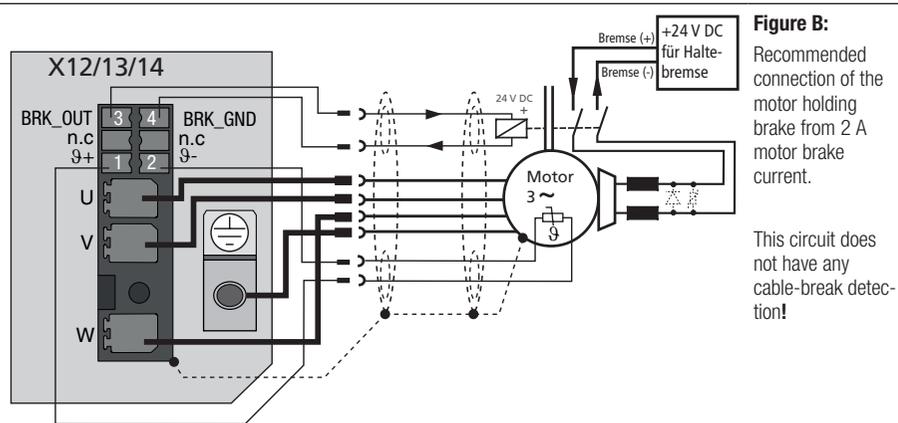


**Figure A:**

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

The temperature sensor connection is shown in the version with "standard encoder interface".

Figure 4.13 Connection of a servomotor with motor holding brake



The temperature sensor connection is shown in the version with "standard encoder interface".

Figure 4.13 Connection of a servomotor with motor holding brake

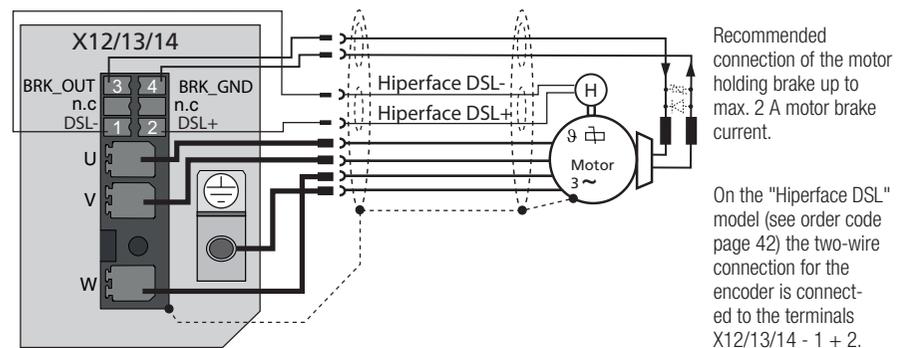


Figure 4.14 Connection of a servomotor with Hiperface DSL encoder system

<b>CAUTION!</b>	<b>Damage to the device due to incorrect insulation of the motor winding!</b>
	<p><b>Carelessness can cause damage to the motor/device</b></p> <ul style="list-style-type: none"> <li>The motor temperature sensor must, in relation to the motor winding, if connected to X12/13/14 -1, 2 be provided with <b>basic insulation</b> as per EN 61800-5-1.</li> </ul>

## 4.8.2 Motor holding brake monitoring output

The motor brake output (BRK\_Out and BRK-GND) is continuously monitored independently of the usage SBC.

The monitoring uses shutdown pulses that are sent with a maximum time window of 7.5 ms (depending on the load) and a minimum time window of 1.5 ms.



**NOTE:**

Due to this brief shutdown, the "Time window exceeded" error may be triggered with high-impedance loads.

### 4.8.3 Specification for motor connections

The connections X12/X13/X14 are provided for up to three motors with motor temperature monitoring and motor holding brake. The necessary motor connectors are to be ordered separately as a connector set depending on the number of motors to be used.

X12 X13 X14	Function	Specification	Figure
2 (9- / DSL+) / 1 (9+ / DSL-)	<ul style="list-style-type: none"> <li>Connection for motor temperature sensor</li> <li>Or Hiperface DSL</li> </ul>	Cross-section <ul style="list-style-type: none"> <li>0.25 - 1.0 mm<sup>2</sup></li> <li>AWG 26-16</li> <li>I<sub>N</sub> = 10 A</li> </ul>	
3 (BRK_OUT) / 4 (BRK_GND)	<ul style="list-style-type: none"> <li>Motor holding brake connection</li> <li>I<sub>BR</sub> = 2 A max.</li> </ul>		
U / V / W	<ul style="list-style-type: none"> <li>Connection of motor phases</li> </ul>	Cross-section *) <ul style="list-style-type: none"> <li>6 mm<sup>2</sup> max.</li> </ul>	
	<ul style="list-style-type: none"> <li>Connection of motor PE</li> </ul>	M4 screw with serrated washer for ring lug	
(S)	<ul style="list-style-type: none"> <li>Cable shield connection</li> </ul>		

\*) Cross-section that can be connected, not including ferrules.

Table 4.20 Specification for motor connections X12/X13/X14

Connector set (optional)	Suitable for	Article no.
Connector set includes, along with the motor connectors for X12/X13/X14, also the connectors for the controller connections X6 and X11.	Single-axis controller	1411.600.0
	Double-axis controller	1412.600.0
	Triple-axis controller	1413.600.0

### 4.8.4 Switching in the motor cable

<b>CAUTION!</b>	<b>Damage to the device due to switching in the motor cable!</b>
	<b>Carelessness can cause damage to the device</b> <ul style="list-style-type: none"> <li>Switching in the motor cable must take place with the power switched off and the power stage disabled, as otherwise problems such as burned contactor contacts or power stage damage may occur.</li> </ul>

The safety function STO is available to interrupt the supply of power to the servomotor, see page 65.

### 4.8.5 Electronic overload protection for the motor

The motor protection function, as a thermal memory, acquires the motor frequency, the motor current and other parameters described in the device help (1400.209B.X). Depending on these factors and the motor rated motor current, the electronic motor protection triggers the protection function if there is an overload.

The thermal memory is retained while the motor is at standstill if the device is switched on.

The devices do not retain the thermal memory if switched off, i.e. the electronic motor overload protection is reset by switching off and on again the power supply.

The electronic motor overload protection can be increased by using a motor temperature sensor.

## 4.9 Encoder connections

All encoder connections are located on the front of the device. For terminal assignment, see chapter 4.3.1 to 4.3.3.

### 4.9.1 Encoder connections

To connect the LSH/LST/LSN and LSP synchronous motors please use the pre-assembled motor and encoder cable from KEBA, see Appendix A8.

### 4.9.2 Allocation of motor/encoder cable to the drive controller

Compare the rating plates of the components. Make absolutely certain you are using the correct components according to variant A, B, C or D!

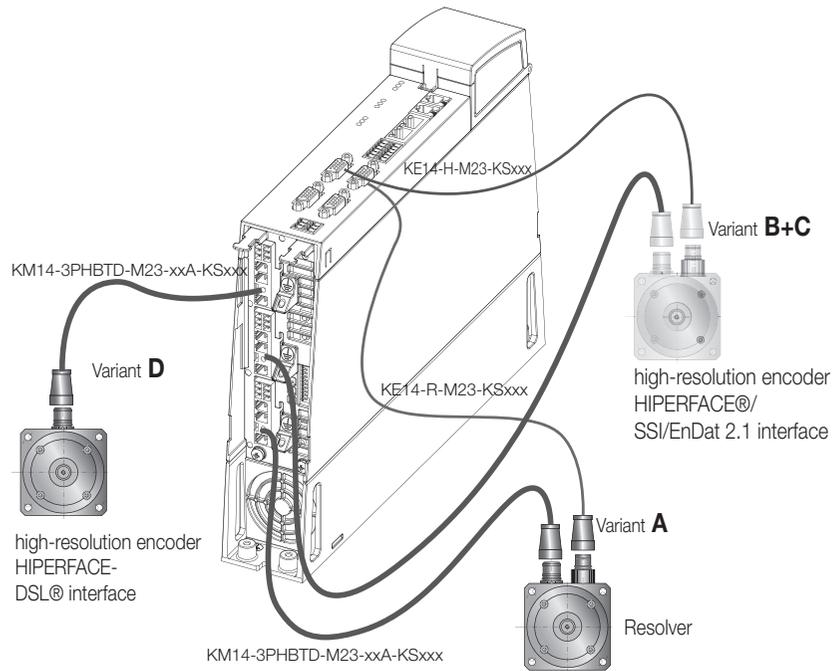


Figure 4.15 Allocation of motor/encoder (as an example a triple-axis controller is shown)

	Servomotor (with encoder installed)	Encoder cable*)	Motor cable*)
<b>For LSH/LST/LSN and LSP servomotor</b>			
Variant A	With resolver 1 pole pair e.g. LSx-074-2-30-320/T1,1R With resolver 3 pole pair e.g. LSx-074-2-30-320/T1,3R With resolver 5 pole pair e.g. LSx-074-2-30-320/T1,5R	KE14-R-M23-KSxxx KE14-R-117-KSxxx	KM14-3PHBTD-117-5A-KSxxx KM14-3PHBTD-117-10A-KSxxx KM14-3PHBTD-117-16A-KSxxx
Variant B	Singleturn absolute value encoder with Hiperface® interface e.g. LSx-074-2-30-320/T1,G6.1S Multiturn absolute value encoder with Hiperface® interface e.g. LSx-074-2-30-320/T1,G6.xM	KE14-H-M23-KSxxx KE14-H-117-KSxxx	KM14-3PHBTD-M23-5A-KSxxx KM14-3PHBTD-M23-10A-KSxxx KM14-3PHBTD-M23-16A-KSxxx KM14-3PHBTD-M23-24A-KSxxx
Variant C	Single/multiturn absolute value encoder with SSI interface e.g. LSN-074-2-30-320/T1,G3/G5 Single/multiturn absolute value encoder with EnDat2.1 interface e.g. LSN-074-2-30-320/T1,G12.xS/M	KE14-E-M23-KSxxx	KM14-3PHBTD-M40-35A-KSxxx
<b>For LSP servomotor</b>			
Variant D	Single/multiturn absolute value encoder with Hiperface DSL interface e.g. LSP-074-2-30-320/T1, D2S/M or LSP-074-2-30-320/T1, H2S/M	Hiperface DSL One-cable solution	KM14-3PHBTD-M23-5A-KSxxx KM14-3PHBTD-M23-10A-KSxxx KM14-3PHBTD-M23-16A-KSxxx KM14-3PHBTD-117-5A-KSxxx KM14-3PHBTD-117-10A-KSxxx KM14-3PHBTD-117-16A-KSxxx

\*) For details see "A.7.1 Motor and encoder cables (extract)" on page 77.

Table 4.21 Variants of motors, encoder types and encoder cables



**NOTE:**

Do not cut the encoder cable, for example to route the signals via terminals in the switch cabinet. The knurled screws on the D-Sub connector housing must be tightly locked!

### 4.9.3 Connection for high-resolution encoders

The interfaces X7, X9 and X10 make it possible to evaluate the encoder types listed in the following, depending on the model, as single-axis, double-axis or triple-axis controller.

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

Table 4.22 Suitable encoder types on X7/X9/X10

**NOTE:** The usage of encoders not included in the range supplied by KEBA requires special approval from KEBA Industrial Automation Germany GmbH. The maximum signal input frequency is 500 kHz. Encoders with a voltage supply of 5 V ±5 % must use the power supply on pin 3 (max. 5.25 V).

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

- Always used shielded cables. Connect the shield at both ends.
- Connect the differential track signals A/B, R or CLK, DATA using twisted pair cable cores.
- Do not cut the encoder cable, for example to route the signals via terminals in the switch cabinet.



**NOTE:** The encoder supply on X7, X8, X9 and X10 is short-circuit proof for both 5 V and 10 V operation. The controller remains in operation enabling the generation of a corresponding error message on evaluating the encoder signals.

## 4.9.4 Connection for additional encoder (X8 and X10)

The interfaces X8 and X10 enable evaluation of the following encoder types.

Fig.	Function
	<b>SinCos encoder with zero pulse</b> e.g. Heidenhain ERN1381, ROD486
	<b>TTL encoder</b>
	<b>Resolver</b> From revision state "F". Only one resolver per axis!

Table 4.23 Suitable encoder types on X8 and X10

- The usage of encoders not included in the range supplied by KEBA requires special approval from KEBA Industrial Automation Germany GmbH.
- The maximum signal input frequency is 500 kHz.
- Encoders with a voltage supply of 5 V ±5% must use the supply on pin X8/pin 3 (max. 5.25 V).



**NOTE:**

The encoder supply is short-circuit proof for 5 V operation. The controller remains in operation enabling the generation of a corresponding error message on evaluating the encoder signals.

## 4.10 Specification for cross-communication

Des.	Term.	Specification	Figure
XC IN cross-communi- cation input	X3	<ul style="list-style-type: none"> <li>• Connection via RJ10 connector</li> </ul>	
XC OUT cross-communi- cation output	X4	<ul style="list-style-type: none"> <li>• Internal RS485 network</li> </ul>	

Table 4.24 Cross-communication



**NOTE:**

The connections X3/X4 are used only for internal communication between the supply unit and the axis controllers. These connections must be made before commissioning, otherwise there will be an error message.

Connection example:



Figure 4.16 Connection example cross-communication

## 4.11 Specification EtherCAT®

The EtherCAT® field bus interface X5.1 is typically used for the connection of the MotionOne CM controller or another EtherCAT®-compliant controller with EtherCAT master.

It can also be used as a service and diagnostics interface. However, it is then only suitable for the connection of a PC for commissioning, service and diagnostics using the software DriveManager 5 (if you have any questions on this topic, please contact us).



### NOTE:

EtherCAT® is defined in IEC 61158 and IEC 61784. You will find general information on EtherCAT® at [www.ethercat.org](http://www.ethercat.org)

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

Technical specification:

- Transfer rate 10/100 Mbits/s BASE-T
- Transmission profile IEEE 802.3-compliant

Des.	Term.	Specification	Figure
ECAT IN EtherCAT® input	X5.1	Connection via RJ45 connector	
ECAT OUT EtherCAT® output	X5.2		
LEDs Ethernet ports			
L/A	Green	Port0 Link / Activity	
RUN	Green	Device / EtherCAT RUN	
L/A	Green	Port1 Link / Activity	
ERR	Red	Device / EtherCAT ERROR	

Table 4.25 EtherCAT ports

For a shielded connection up to a length of  $\leq 20$  m, the following tested cable or an equivalent cable must be used:

- Cat. 5e patch cable, S/STP 4x2x0.14 mm<sup>2</sup>, twisted pair and shielded data cable with characteristic impedance  $R_w = 100 \Omega \pm 15\%$



### NOTE:

For cable lengths  $\geq 20$  m, special installation cables with larger cross-sections are to be used.

Connection example



Figure 4.17 EtherCAT® connection (example)

## Connection example supply unit / axis controller

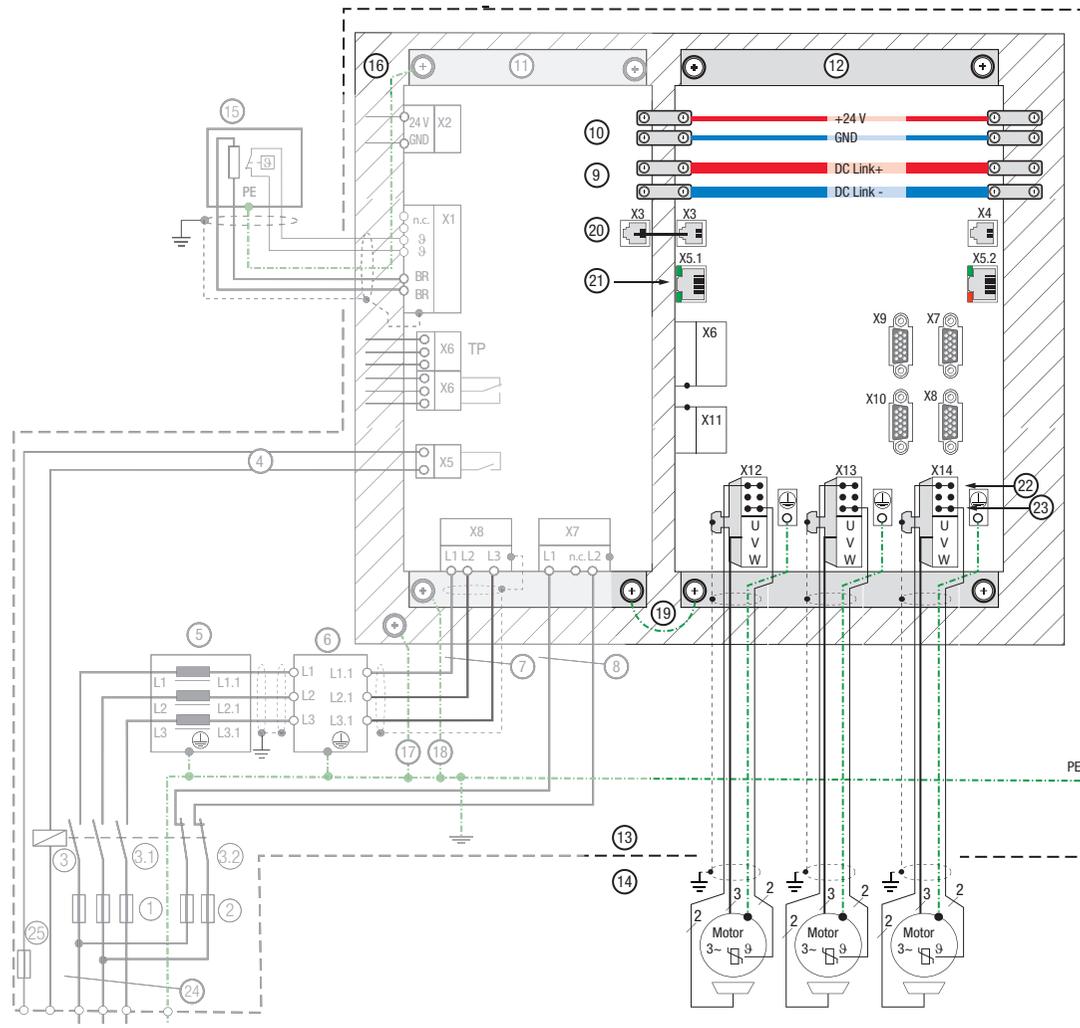


Figure 4.18 Connection example (schematic depiction)

## Key to connection example

	Designation
(1) (2) (3) (4) (5) (6) (7) (8)	See Operation Manual SO CM-P supply unit
(9)	Busbars, DC link
(10)	Busbars, 24 V DC (PELV)
(11)	Supply unit (SO CM-P)
(12)	Axis controller (SO CM)
(13)	Switch cabinet
(14)	Field
(15)	See Operation Manual SO CM-P supply unit
(16)	Backing plate
(17)	See Operation Manual SO CM-P supply unit
(18)	PE - protective earth conductor connection
(19)	Series protective earth conductor connection to the next device
(20)	Cross-communication
(21)	EtherCAT ports
(22)	Motor holding brake connection
(23)	Motor temperature monitoring connection

Table 4.26 Key to connection example



### NOTE:

A maximum of 8 axis controllers (corresponds to maximum 24 axes) can be connected and operated on one supply unit (BG1 or BG2).



### NOTE:

In the overall axis group, a DC link capacitance of  $\geq 100 \mu\text{F}/\text{kW}$  (for 3 x 400 V) or  $170 \mu\text{F}/\text{kW}$  (for 3 x 230 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, see Table A.1 and Table A.2.

# 5 Commissioning

The chapter Commissioning is divided into the subject area "Checking the motor-encoder combination connected" and "Connecting the ServoOne CM system to a field bus".

<b>Caution!</b>	<b>Damage to your system/machine due to errors in the operation (axis controller) of the motor and moving parts due to unclear operating states and/or product data!</b>
	Commissioning is not allowed to be undertaken: <ul style="list-style-type: none"><li>• If connections, product data or operating states are unclear or incorrect</li><li>• If system safety and monitoring devices are damaged or not in operation.</li></ul>

## 5.1 Preliminary comment

For the initial configuration and testing of the axis group on completion of the wiring for the axis group (supply unit, axis controller, motors and encoders), the PC with DriveManager 5 can be connected directly to each individual axis controller (peer-to-peer) via Ethernet. The drive axes can also be operated in the group via TCP/IP by setting the IP address in the axis controller.

### 5.1.1 Connections for communication

Every axis controller has two connections for establishing an EtherCAT network: X5.1 ECAT IN and X5.2 ECAT OUT. Here connection X5.1 ECAT IN is the input and connection X5.2 ECAT OUT the output. On the last axis controller in the axis group the output ECAT OUT remains open.

The supply unit does not have any connections with RJ-45 sockets. It is supplied indirectly with data via the first axis controller in the axis group via the connection X3 XC OUT on the supply unit and connection X4 XC IN on the axis controller.

The connections X5.1 can also be switched to the service and diagnostics mode. They then act as TCP/IP connections. A PC with DriveManager 5 installed can connect to the axis group. In this way it is possible to undertake initial configuration and tests on the complete axis group (supply unit, axis controller, motors and encoders). This is possible in the EtherCAT group via the Ethernet over EtherCAT function or in the service and diagnostics mode by directly connecting the service PC to the connection X5.1 ECAT IN on the first axis controller.

The cable assignment (1:1 or cross-over) is detected automatically.

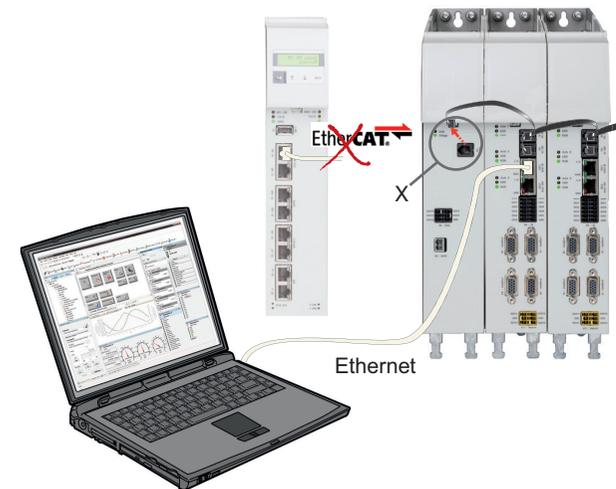


Figure 5.1 PC (with DriveManager 5) - axis controller connection

### 5.1.2 EtherCAT® integration

In an EtherCAT® network, real-time data (PDO) and service data (SDO) are exchanged between the controller and the drives. If Ethernet data (TCP/IP) are also to be sent in an EtherCAT® network, the EtherCAT® master must support the function Ethernet-over-EtherCAT® (EoE) to be able to tunnel Ethernet data to the axis controllers.

## 5.1.3 Service/diagnostics mode from firmware state 1.60 to 2.20



**NOTE:**

The function described in the following is available on ServoOne CM axis controllers from firmware version V1.60. The service and diagnostics mode is activated for all axes in the axis group.

### Activation of the service diagnostics mode

The service/diagnostics mode is signalled by interrupting the cross-communication between the supply unit and first axis (disconnection of the cross-communication cable to the supply unit) during the power-up process for the axis group, see Figure 5.1 detail X.

The axis controllers cannot be placed in operation without this connection, i.e. power cannot be applied. The system is always placed in the service/diagnostics mode by this action.

The interface (X5.1) is switched over on powering up for the first time after interrupting the cross-communication; this situation is signalled by the yellow LEDs (Axis 1, Axis 2, Axis 3) flashing quickly. The process can take a few seconds depending on the number of axes. It is imperative you wait until the last axis controller is flashing quickly (see Table 6.1) before switching off the axis group.

Powering up again the system activates the "2-Port Switched Ethernet Mode" in all axis controllers in an axis group (max. 9 devices/slaves incl. supply unit).



**NOTE:**

Two power on/off cycles are therefore required to switch over the interface to the service/diagnostics mode.

The IP addresses of the first axis controller after the supply unit defines the base IP address (192.168.39.10). The addresses of the other axis controllers are incremented based on this IP.

Depending on the number of axes, the yellow LEDs Axis 1, Axis 2, Axis 3 flash every approx. 0.8 s while the service/diagnostics mode is active. The EtherCAT RUN LED also flickers, see arrow (state indication = flickering).

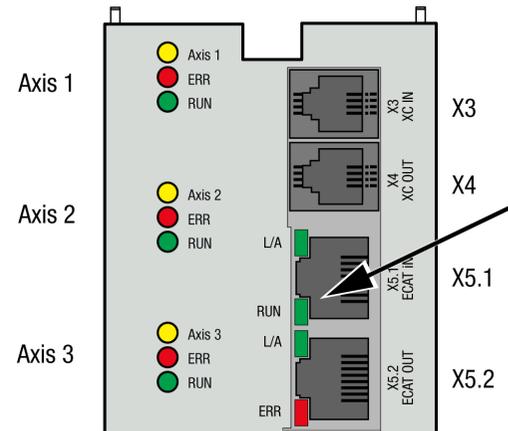


Figure 5.2 LEDs in the service/diagnostics mode

### 5.1.4 Service/diagnostics mode from firmware state 2.20-02



**NOTE:**

The function described in the following is available on ServoOne CM axis controllers from firmware version V2.20. The service and diagnostics mode is activated for all axes in the axis group.

#### Activation of the service diagnostics mode

The Ethernet interfaces "X5.1 ECAT IN" and "X5.2 ECAT OUT" on the ServoOne CM are in the EtherCAT® operating mode by default after switching on for the first time.

So that via this interface with the aid of a PC with DriveManager 5 installed it is possible to establish a connection to the axis controllers also without control, the EtherCAT® interfaces in the axis controllers must be switched to the service and diagnostics mode.

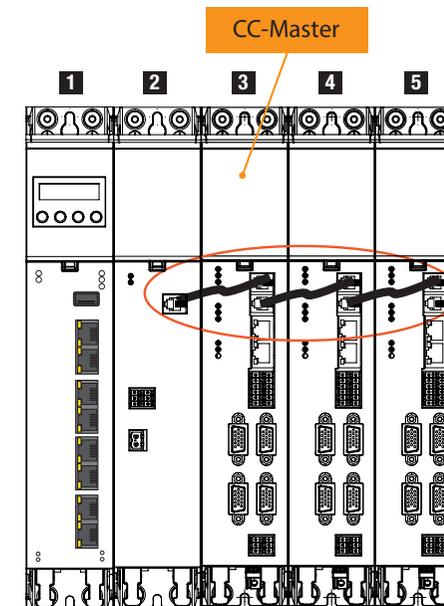
Take the following steps to switch over the EtherCAT® :

1. Identify first axis controller after the supply unit.



**NOTE:**

It is necessary to identify the first axis controller (cross-communication master) on the right side of the power supply within the cross-communication to activate the service and diagnostics mode.



Axis group with controller and supply unit. Maximum number of cross-communication users: 8

1: Controller    2: Supply unit    3 to 5: Axis controller

Figure 5.3 Cross-Communication (CC)

2. Switch off system.
3. The next time after switching on up to three yellow LEDs on the first axis controller illuminate briefly, depending on the number of axes, and are then illuminated continuously for approx. 4 seconds after approx. 14 seconds. This process is repeated during each switch-on process. Only exception: after a firmware update, the upstream supply unit may also be updated during the restart in certain circumstances. As a consequence, the start process may be delayed once by approx. 2 minutes. The loading of the firmware for the supply unit is indicated by the flashing (0.5 s/0.5 s) of the two LED on the supply unit.
4. If the connector for the cross-communication (first axis controller - X3 XCIN) is disconnected within 4 seconds and connected again, the interface is placed in the service and diagnostics mode the next time it is switched on. The activation of the interface switchover is indicated by fast flashing (0.1 s/0.1 s) on all axis controllers connected via the cross-communication.

5. Switch system off and on again. All axis controllers operate in the service and diagnostics mode (standard Ethernet). This situation is indicated by slow flashing of the yellow LEDs (0.8 s/0.8 s). IP, subnet mask and gateway are only configured in the first axis controller and incremented or applied in downstream devices that are also connected via cross-communication.
6. The devices also remain in this mode after a restart. Only if the service and diagnostics mode is terminated as described in the section "Exiting the service and diagnostics mode", is the EtherCAT operating mode again always active.



**NOTE:**

Interface switchover and the activation of new IP configuration settings are only active after a restart. As soon as an axis controller in the group has detected a change to the current configuration, the fast flashing (0.1 s/ 0.1 s) yellow LED indicates that a restart is required; this statement also applies to the termination of the service and diagnostics mode (see also section "Terminating the service and diagnostics mode" on page 22). A stable operating state is only achieved once none of the yellow LEDs in the axis group is flashing quickly (0.1 s/0.1 s)!

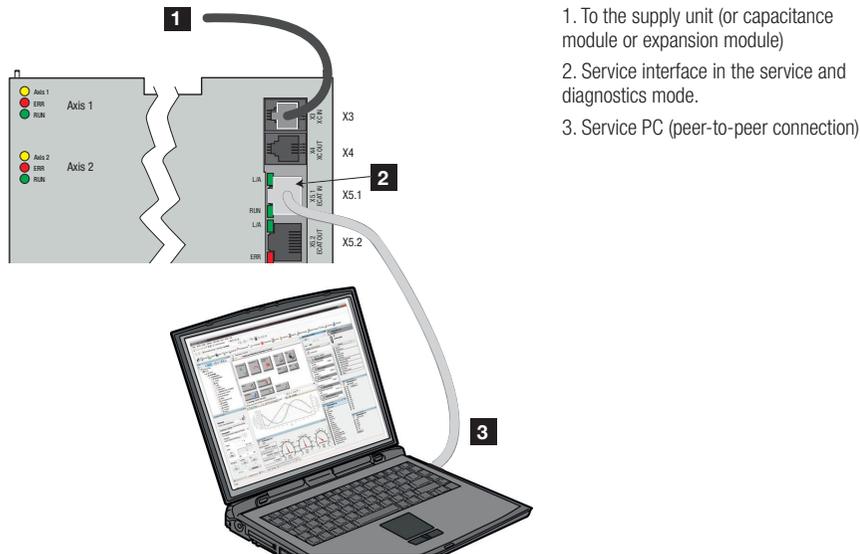


Figure 5.4 LEDs in the service/diagnostics mode (double-axis controller)



**NOTE:**

While the cross-communication to the supply unit is interrupted, power cannot be applied to the axis controllers!

## 5.1.5 Exiting the service/diagnostics mode

After the conclusion of the commissioning, the service and diagnostics mode must be left again. The Ethernet interface is switched back to the EtherCAT® operating mode.

Take the following steps:

- In DriveManager select: Project -> All devices -> Exit service/diagnostics mode after mains off/on.

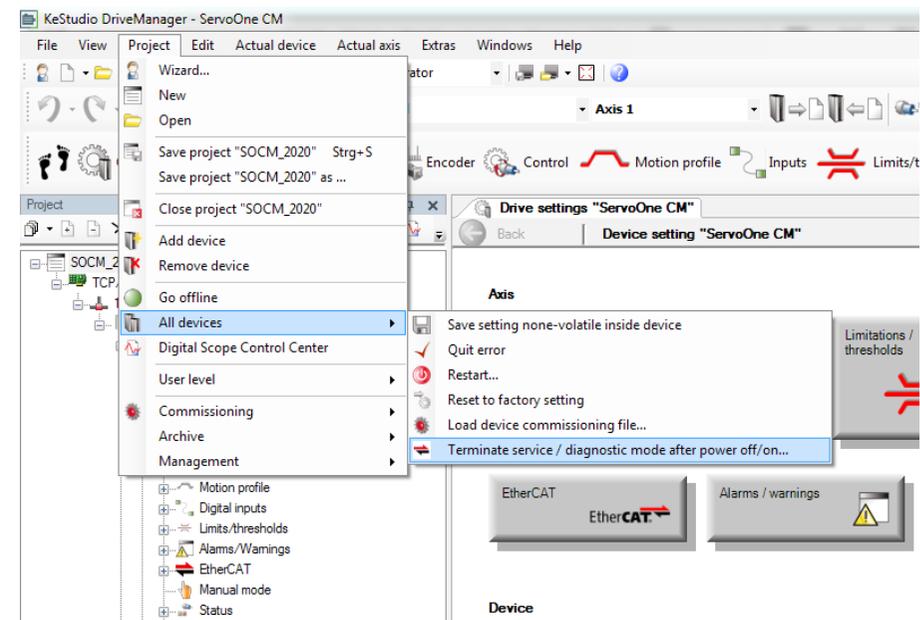


Figure 5.5 Exiting service/diagnostics mode



**NOTE:**

To check the axes affected by the switchover, all are shown again in the following dialog box. Here it is possible to exclude an axis from the switchover for further configuration.

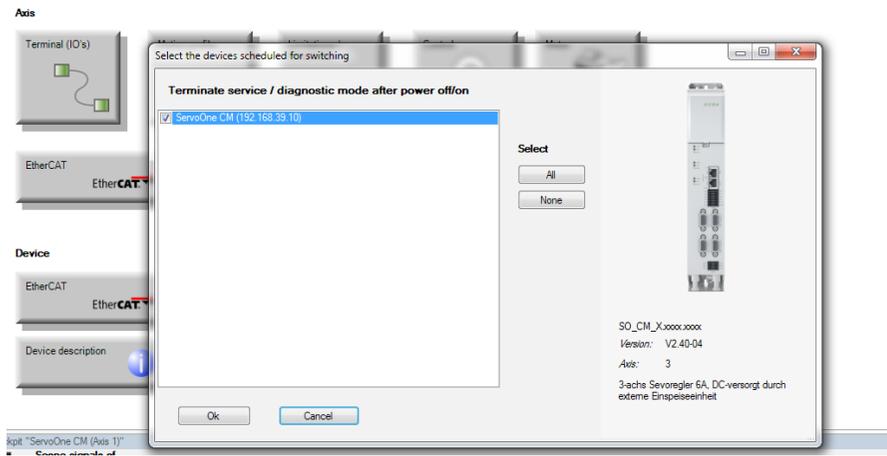


Figure 5.6 Selection of the axes affected by the switchover

The interface switchover selected is again signalled by the yellow LEDs flashing quickly on the next power-up.

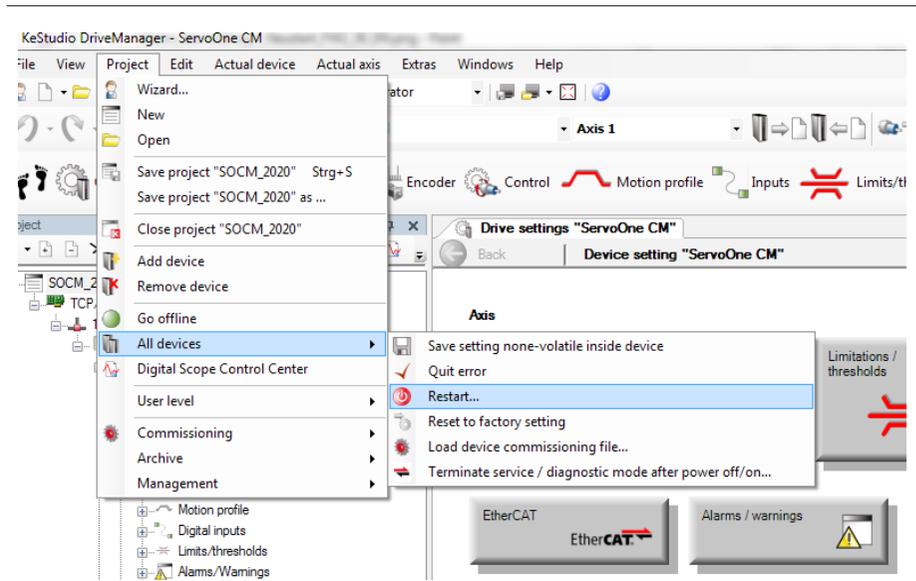


Figure 5.7 Restart after switchover selected

Restarting the drive system starts the interface controller directly with EtherCAT functionality. The yellow LEDs are switched off, the behaviour of the RUN LED is compliant with EtherCAT.

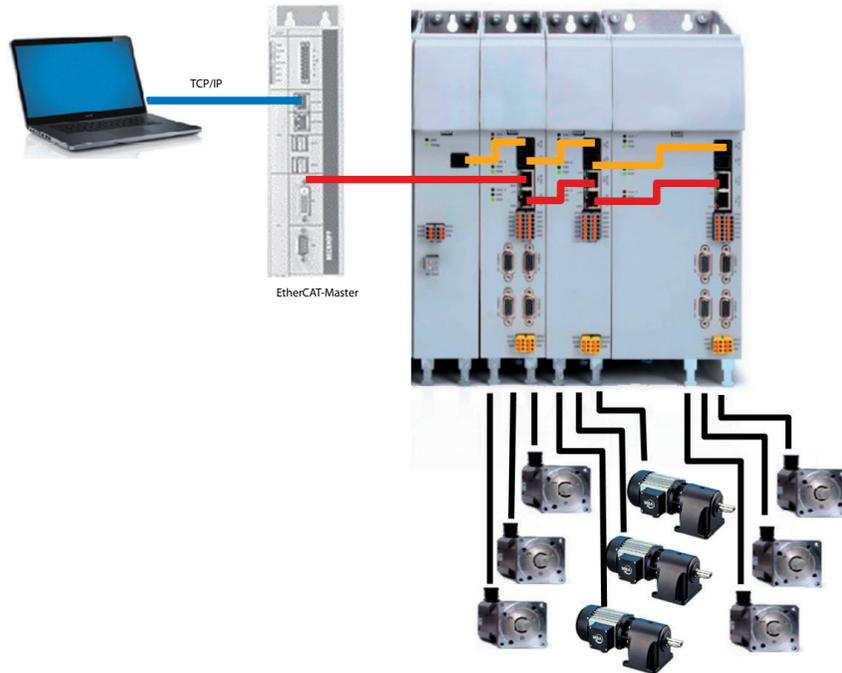


Figure 5.8 EtherCAT mode



**NOTE:**

On delivery the ServoOne CM axis controllers have the default IP address: 192.168.39.5

## 5.2 Initial commissioning of the axis controller

Once the ServoOne CM has been installed as described in chapter 3 and wired with all required voltage supplies and external components as described in chapter 4, initial commissioning can be performed in the following sequence:

Step	Action	Comment
1.	Install and start PC software	See installation manual DriveManager 5
2.	Connect PC to axis controller (Ethernet)	See section 5.1.1
3.	Commissioning	See section 5.3.1
4.	Control drive using DriveManager 5	See section 5.3.2

<b>CAUTION!</b>	<b>Damage to your system/machine due to uncontrolled or inappropriate commissioning.</b>
	<p><b>Carelessness may result in damage to your system/machine.</b></p> <ul style="list-style-type: none"> <li>It is imperative attention is paid to the limitations of the movement range. You are responsible for a safe process. KEBA Industrial Automation Germany GmbH will not assume liability for any damage that occurs.</li> </ul>



**NOTE:**

Details in relation to "STO" (Safe Torque Off) do not need to be taken into account for initial commissioning. You will find all information on the "STO" function in the document "Model Description SDO" (ID. no. 1400.402B.x).

## 5.3 Axis controller supply voltage

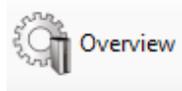
Only supply the axis controller with 24 V DC without supplying the power section (switch on mains supply for the switched-mode power supply on terminal X7 of the supply unit). In this way the axis controller has the control voltage required for communication. The communication between PC and axis controller can only be set up after the drive controller has completed its initialisation. If the PC does not recognise the axis controller connected, please check the driver and the settings for the TCP/IP connection.



### NOTE:

The IP address used must be in the range 192.168.39.x.

### 5.3.1 Commissioning



You will find all the necessary configuration settings for the SO-CM-P supply unit and the SO-CM axis controller on the "Overview" tab.

Settings for the supply unit (see also ServoOne CM-P Supply Unit Operation Manual ID no. 1400.201B.x).

DriveManager	Function
	Pre-setting for the supply unit: <ul style="list-style-type: none"> <li>• Selection of the voltage supply</li> <li>• Selection of a braking resistor</li> </ul>

Settings for the individual axes as follows:

DriveManager	Function
	Set clock frequency for the power stage.
	Motor configuration: <ol style="list-style-type: none"> <li>1. Load data set or start identification / calculation</li> <li>2. Set motor protection</li> <li>3. Configure motor brake parameters</li> <li>4. Undertake motor phase test</li> </ol>
	Encoder configuration: <ol style="list-style-type: none"> <li>1. Load data set or set manually</li> <li>2. Select encoder</li> <li>3. Select encoder channel</li> </ol>
	Save settings in the device



### NOTE:

If KEBA servomotors of type LSN, LSP or LST are used, the necessary motor and encoder data sets can be loaded directly from DriveManager 5.



### NOTE:

You will find a detailed description of DriveManager 5 and its configuration in the DriveManager help.

## 5.3.2 Controlling drive using DriveManager 5

For this part of the commissioning it is necessary to switch on the AC mains supply (SO CM-P supply unit power supply). Check whether the power stage is enabled. The drive should be tested without the coupled mechanism.

DriveManager	Function
	Overview of all axes and their status
	<p>Device status</p> <p>Check the error history</p> <p>Status indication for axis 1</p> <p>Status message for axis 1</p> <p>Status message for axis 2</p> <p>Status of the power stage</p> <p>Status of the brake</p>

DriveManager	Function
	Open manual mode window
	<p>Select operation mode - Initially U/F (open loop)</p> <p>Motor acceleration</p> <p>Motor with low speed</p> <p>Start motor and check required and actual speed in Cockpit (U/F operation)</p> <p>Start motor control</p> <p>Manual mode activated</p>

**NOTE:** You will find further information in relation to "Controlling a drive using DriveManager 5" and the manual operation window in the ServoOne CM device help (ID no.: 1400.209B.x).

<b>DANGER!</b>	<b>Risk of injury due to rotating parts on the motor!</b>
	<p><b>Carelessness may result in serious injuries or death.</b></p> <p>Before commissioning motors with feather keys in the shaft end, these keys must be reliably secured against throwing out, if this is not already prevented by drive elements such as belt pulleys, couplings or similar.</p>

<b>CAUTION!</b>	<b>Damage to the motor due to incorrect operation during motor test run!</b>
	<p><b>Carelessness can result in significant damage to the motor or machine.</b></p> <ul style="list-style-type: none"> <li>• It is imperative the safety instructions and warnings from chapter 2 are followed during commissioning. Please note that you yourself are responsible for safe operation.</li> <li>• Before you start commissioning it must be ensured that the machine will not be damaged by the test! Pay particular attention to the limitations of the positioning range.</li> <li>• Certain motors are <b>only</b> intended for operation on the drive controller. Direct connection to the mains supply can cause irreparable damage to the motor.</li> <li>• The motor surfaces may become extremely hot. No temperature sensitive parts may touch or be fastened to these areas, appropriate measures to prevent touching must be taken wherever necessary.</li> <li>• The temperature sensor installed must be connected to the terminals of the temperature monitoring system for the drive controller also during the test run to avoid overheating of the motor.</li> <li>• The motor holding brake (if installed) should be checked for correct function before commissioning the motor. Motor holding brakes are only designed for a limited number of emergency braking operations. Use as a service brake is not allowed.</li> </ul>

### 5.3.3 Serial commissioning

Saving the data:

DriveManager screen	Function
	Data set for an individual axis
	Data set for the complete device
	Data set for an axis group

A saved data set can be transferred to other ServoOne CM axis controllers using DriveManager 5. With the aid of the data set for an axis group, several devices including the software can be placed in operation. You will find details in the help system in DriveManager 5.

## 5.4 Standard operation on the MotionOne CM controller

For standard operation a MotionOne controller is connected to the "ECAT in" field bus interface on the first axis controller in the group as the EtherCAT master.



Figure 5.9 Connection of EtherCAT master with axis controller

The DriveManager 5 service and diagnostics communication is via EtherCAT using tunnelling in this case. For this purpose the EtherCAT master must support the EoE (Ethernet-over EtherCAT) function as per the profile ...

- ETG1000\_5\_S\_R\_V1i0i2\_EcatALServices and
- ETG1000\_6\_S\_R\_V1i0i2\_EcatALProtocols

...

In addition, as the communication master, the controller takes on the task of routing Ethernet protocols between the bus users.

### 5.4.1 Configuration of the MotionOne CM controller

You will find details on the configuration of the MotionOne CM control in the online help for the MotionCenter LX.

### 5.4.2 Configuration of a controller from another manufacturer

In the following example typical configurations in the Beckhoff TwinCAT 3 for the usage of the services mentioned above are shown. The information shown can vary between the different controller manufacturers.

Step 1: Activation of the EoE service on the EtherCAT master

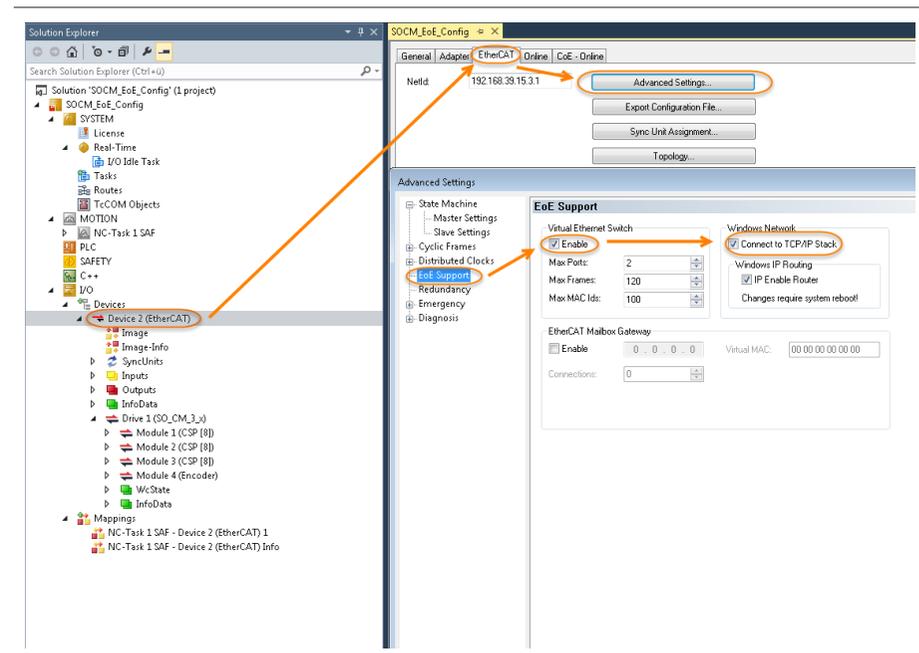


Figure 5.10 Advanced EtherCAT master settings

## Step 2: Assignment of the virtual IP address for the EtherCAT slave

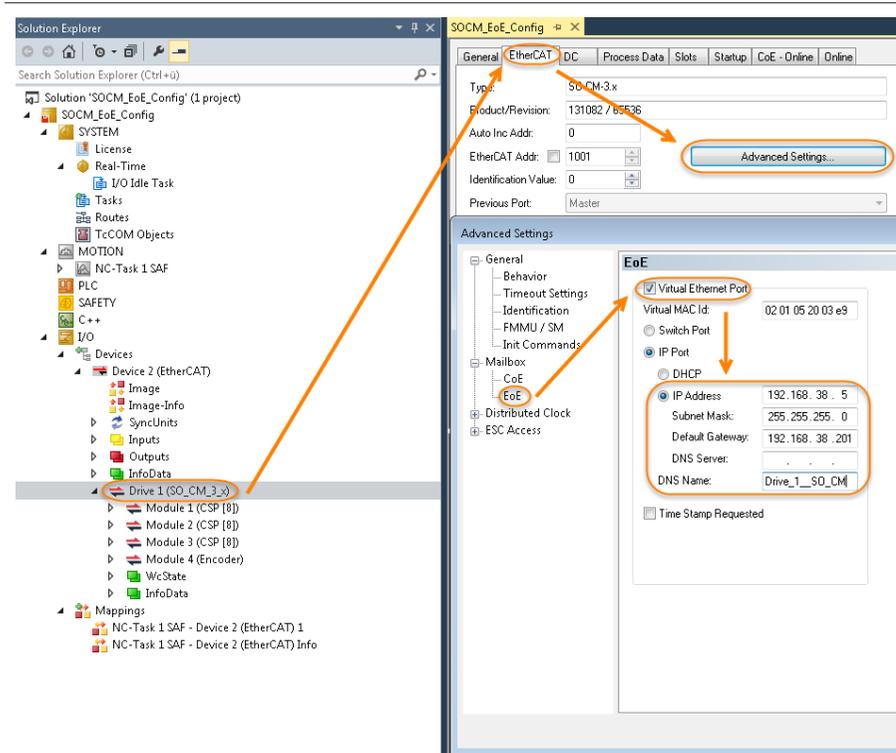


Figure 5.11 Assigning the virtual IP address for the EtherCAT slave

## Step 3: Establishment of communication with DriveManager 5

The virtual IP address configured in the previous step is to be used for the EoE communication.



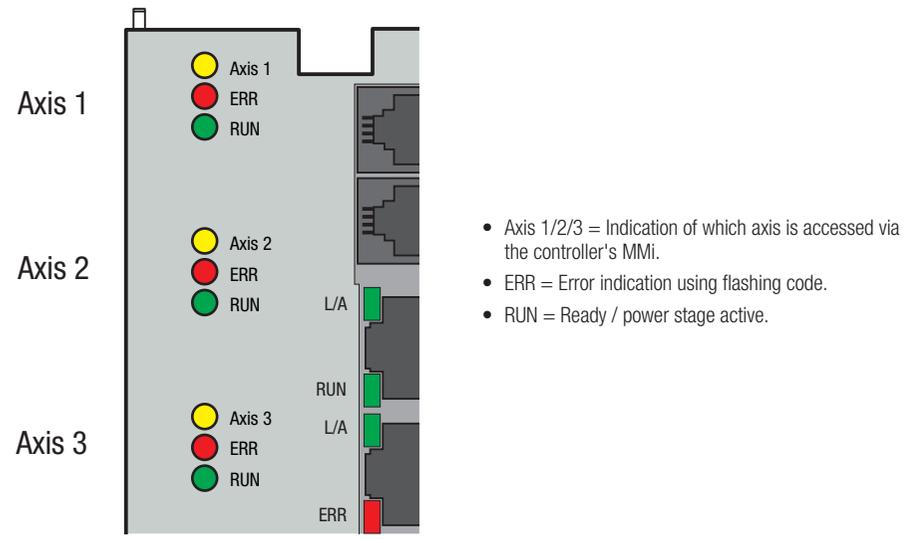
Figure 5.12 Establishing communication with DriveManager 5



# 6 Diagnostics

## 6.1 Status LEDs

Depending on the design of the axis controller (single-axis controller, double-axis controller, triple-axis controller) up to 3 times 3 LEDs are provided as status indicators. The LEDs are on the front of the device and are assigned to axis 1 to axis 3 from top to bottom. The significance of the LEDs is the same for each axis and is as follows:



- Axis 1/2/3 = Indication of which axis is accessed via the controller's MMi.
- ERR = Error indication using flashing code.
- RUN = Ready / power stage active.

Figure 6.1 Status LEDs

### 6.1.1 Flashing code

The Axis 1/2/3 LEDs (yellow) only have a defined function during a software update.

LED yellow Axis 1/2/3	LED red long (0.8 s)	LED green		Axis status
		long (0.8 s)	short (0.4 s)	
●	●	●	-	Reset / starting or loading firmware update
-	-	-	-	Self-initialisation on device startup (Initialisation)
-	○	* 1 x	* 1 x	Not ready to switch on
-	○	* 2 x	* 2 x	Switch on disabled
-	○	* 3 x	* 3 x	Axis ready to switch on
-	○	* 4 x	* 4 x	Axis switched on
-	○	●	* 5 x	Operation enabled
-	○	* 6 x	* 6 x	Quick stop
-	* Error code	* 7 x	* 7 x	Fault reaction active
-	* Error code	* 8 x	* 8 x	Fault
● <sup>1)</sup>	-	-	-	PtP Ethernet connection in the service and diagnostics mode via the EtherCAT interface

Green LED long = Motor in the normal mode  
Green LED short = Motor in the simulation mode

Yellow LED Axis 1/2/3 Status: on = (Reset/Starting)

1) Yellow LED Axis 1/2/3 Status: flickering = Axis interface X5.1 will be switched over after next power on

flashing = Axis interface is working in Ethernet mode - RUN LED RJ45 is flickering

off = Axis interface is working in EtherCAT mode

● = LED illuminated

○ = LED off

\* = LED flashing

Table 6.1 LED messages for the service/ diagnostics mode

## 6.2 Status and error indication in DriveManager 5

Click the "Device status" button in the header for the DM5 to open the "Device status" window.

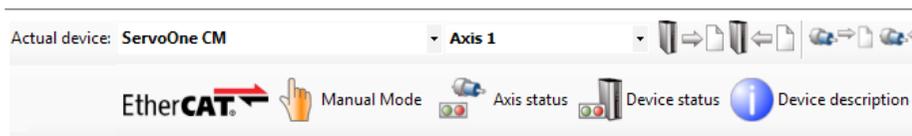


Figure 6.2 "Device status" button in the header

Use the "Error history..." button to retrieve information on the last 20 errors that have occurred.

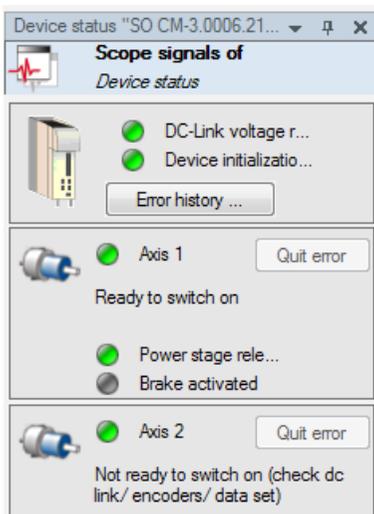
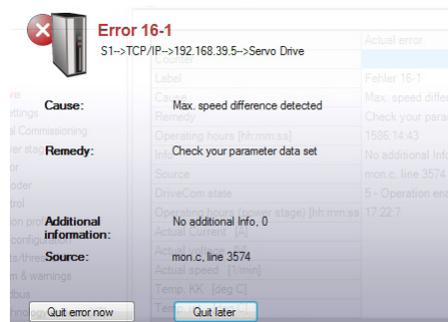


Figure 6.3 "Device status" window

On the occurrence of an error, a "pop-up" window appears immediately with more detailed information on the actual error.



**Note:**

In the event of error messages that require additional support from service, additional system information can be displayed using the (>>) button.

On sending enquiries by e-mail please attach this screenshot with its additional information.

Figure 6.4 Error message

On the "Alarms & Warnings" menu (parameter 100) you will find detailed information on all errors and warnings that have occurred.

1. In the tree in the "Project" window, click "Alarms & Warnings".
2. In the new window that opens you will find the history for the errors and warnings.



**NOTE:**

You will find further information on parameter 100 in the program help for DriveManager 5.

Error source	Axis 1	Axis 1	Axis 1
Counter	6	0	1
Label	Error 8-90	Error 8-182	Error 25-1
Cause	Encoder #1 lost connection	Encoder #3 Hiperface DSL error	Motor temperature reached TMax value
Remedy	Please check encoder wiring	Please check encoder wiring	Let motor cool down. If temperature is not plausible check cables.
Time of error occurrence	0 years : 0 days : 0 hours : 0 minutes : 3 seconds	0 years : 0 days : 0 hours : 0 minutes : 3 seconds	Tuesday, 20. June 2017 11:36:18
EtherCAT system time	0	0	0
Info	Drive processor #0, 0	Error on HDSL Init, 0	Motor temperature too high, 13313886
Source	unknown, line 509	ENC_HDSL.c, line 746	MON.c, line 2018
DriveCom state	Start	Start	Not ready to switch on
Operating hours (power stage) [hh:mm:ss]	34847	34847	34145
Actual Current [A]	0	0	0.00255312
Actual voltage [V]	28.20511	48.2772	539.089
Actual speed [SPEED]	0	0	5.49493E-38
Temp. heat sink modul 1 [°C]	0	26.7632	27.3356
Temp. heat sink modul 2 [°C]	0	26.4803	27.1751
Temp. heat sink modul 3 [°C]	0	26.411	27.0154
Temp. interior [°C]	2	2	41

Figure 6.5 Error history, error information mask



## 7 Safety design variants

### 7.1 Function SDO

The model SDO contains the safety functions STO (Safe Torque Off) and SBC (Safe Brake Control). It is operated via safe digital inputs on the axis controller's control board.



**NOTE:**

New control board, from revision state "F", with additional encoder connection functionality and modified safety error handling.

**From revision state "F", firmware  $\geq$  1.40-16 is imperative.**



**NOTE:**

You will find all further information on the "STO" and "SBC" functions in the document "Model Description SDO" (ID no. 1400.402B.x).

### 7.2 Function of SDC model

The SDC model provides an integrated safety control with encoder version.

The safety control in the device version SDC of the ServoOne CM axis controller is certified according to the requirements of EN ISO 13849-1 "PL e / cat 4" and EN 61508 / EN 62061 "SIL CL 3".



**NOTE:**

You will find all further information in the document "Model Description SDC" (ID no. 1400.206B.x).



# A Appendix

## A.1 Technical data, ServoOne CM axis controller (1.5 A to 6.0 A)

ServoOne CM axis controller	Unit	SOCM-1. xx01 (BG1)	SOCM-2. xx01 (BG1)	SOCM-3. xx01 (BG1)	SOCM-1. xx03 (BG1)	SOCM-2. xx03 (BG1)	SOCM-3. xx03 (BG1)	SOCM-1. xx06 (BG1)	SOCM-2. xx06 (BG1)	SOCM-3. xx06 (BG1)
<b>Axis controller</b>										
Number of axes		1	2	3	1	2	3	1	2	3
Rated current *	A <sub>eff</sub>	1 x 1.5	2 x 1.5	3 x 1.5	1 x 3.0	2 x 3.0	3 x 3.0	1 x 6.0	2 x 6.0	3 x 6.0
Maximum current for 10 s *	A <sub>eff</sub>	1 x 3.0	2 x 3.0	3 x 3.0	1 x 6.0	2 x 6.0	3 x 6.0	1 x 12.0	2 x 12.0	3 x 12.0
Maximum current for 500 ms *	A <sub>eff</sub>	1 x 4.5	2 x 4.5	3 x 4.5	1 x 9.0	2 x 9.0	3 x 9.0	1 x 18.0	2 x 18.0	3 x 18.0
<b>Control section</b>										
Control voltage	V DC	24 ± 20 %								
Max. switch-on current at the 24 V power supply unit, per device	A	1.8 at 24 V and 2.2 at 18 V / 1 s								
Control voltage for motor holding brake with cable length < 50 m	V DC	≥ 22.8 (24 V -5 %)								
Maximum power motor holding brake	W	48 max.	2 x 48 max.	3 x 48 max.	48 max.	2 x 48 max.	3 x 48 max.	48 max.	2 x 48 max.	3 x 48 max.
<b>DC link</b>										
Capacitance in the DC link	µF	165								
Permissible rated power @ 3 x 230 V AC	kW	0.220	0.430	0.650	0.430	0.860	1.300	0.860	1.700	1.700
Permissible rated power @ 3 x 400/480 V AC	kW	0.375	0.750	1.125	0.750	1.500	2.250	1.500	3.000	3.000
<b>Power section</b>										
Permissible switching frequencies	kHz	2 / 4 / 8 / 12 / 16								
Rate of rise of voltage on the output with 10 m motor cable (10 %-90 %)	kV / µs	3 ...8								
Output frequency range	Hz	0 ... 400 to max. 1600								
Power dissipation @ (400 V/ 4 kHz/ I <sub>rated</sub> ) in the interior	W	61	69	78	64	76	88	68	84	100
Power dissipation @ (400 V/ 4 kHz/ P <sub>rated</sub> ) via heat sink	W	12	24	26	24	48	72	40	80	120
*) @ At 4 kHz, 400 V AC supply via supply unit, for other currents see following pages										

Table A.1 Technical data, SO CM axis controller (1.5 A to 6.0 A)

## A.1.1 Control section current data, axis controller (1.5 A to 6.0 A)

ServoOne CM axis controller	Unit	SOCM-1. xx01 (BG1)	SOCM-2. xx01 (BG1)	SOCM-3. xx01 (BG1)	SOCM-1. xx03 (BG1)	SOCM-2. xx03 (BG1)	SOCM-3.x x03 (BG1)	SOCM-1. xx06 (BG1)	SOCM-2. xx06 (BG1)	SOCM-3.x x06 (BG1)
<b>Control section</b>										
Power consumption with power stage (without motor holding brake) air cooling / cold plate	W	26/17	34/24	41/31	26/17	34/24	41/31	26/17	34/24	41/31
Typical current consumption, axis controller air-cooled without encoder	A	0.9	1.1	1.3	0.9	1.1	1.3	0.9	1.1	1.3
Typical current consumption, axis controller cold plate without encoder	A	0.5	0.7	0.9	0.5	0.7	0.9	0.5	0.7	0.9
Typical current consumption, encoder SinCos/TTL/EnDat/SSI/resolver <sup>1)</sup>	A	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
Typical current consumption, encoder channel 4 SinCos/TTL <sup>1)</sup>	A	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1
Typical current consumption, encoder Hiperface/Hiperface DSL <sup>1)</sup>	A	0.3	0.5	0.7	0.3	0.5	0.7	0.3	0.5	0.7
Typical total current consumption, axis controller with air cooling	A	1.1	1.4	1.7	1.1	1.4	1.7	1.1	1.4	1.7
Typical total current consumption, axis controller with cold plate	A	0.7	1.0	1.3	0.7	1.0	1.3	0.7	1.0	1.3
1) Current consumption can vary depending on encoder type										

Table A.2 Control section current data, axis controller 1.5 A to 6.0 A

A.1.2 Power section current data, axis controller (1.5 A to 6.0 A)

	U <sub>Mains</sub>	F <sub>s</sub>	Unit/ size	SOCM-1.xx01	SOCM-2.xx01	SOCM-3.xx01	SOCM-1.xx03	SOCM-2.xx03	SOCM-3.xx03	SOCM-1.xx06	SOCM-2.xx06	SOCM-3.xx06
				BG1								
Rated current	230 V/ 400 V	2 kHz	A	1.5	2 x 1.5	3 x 1.5	3	2 x 3	3 x 3	6	2 x 6	3 x 6
Maximum current for 10 s			A	3	2 x 3	3 x 3	6	2 x 6	3 x 6	12	2 x 12	3 x 12
Maximum current for 500 ms			A	4.5	2 x 4.5	3 x 4.5	9	2 x 9	3 x 9	18	2 x 18	3 x 18
Maximum current for F <sub>M</sub> = 0 Hz			A	3.7	2 x 3.7	3 x 3.7	7.35	2 x 7.35	3 x 7.35	14.7	2 x 14.7	3 x 14.7
Rated current	230 V/ 400 V	4 kHz	A	1.5	2 x 1.5	3 x 1.5	3	2 x 3	3 x 3	6	2 x 6	3 x 6
Maximum current for 10 s			A	3	2 x 3	3 x 3	6	2 x 6	3 x 6	12	2 x 12	3 x 12
Maximum current for 500 ms			A	4.5	2 x 4.5	3 x 4.5	9	2 x 9	3 x 9	18	2 x 18	3 x 18
Maximum current for F <sub>M</sub> = 0 Hz			A	3.1	2 x 3.1	3 x 3.1	6.15	2 x 6.15	3 x 6.15	12.3	2 x 12.3	3 x 12.3
Rated current	230 V/ 400 V	8 kHz	A	1.5	2 x 1.5	3 x 1.5	3	2 x 3	3 x 3	6	2 x 6	3 x 6
Maximum current for 10 s			A	3	2 x 3	3 x 3	6	2 x 6	3 x 6	12	2 x 12	3 x 12
Maximum current for 500 ms			A	3.2	2 x 3.2	3 x 3.2	6.25	2 x 6.25	3 x 6.25	12.5	2 x 12.5	3 x 12.5
Maximum current for F <sub>M</sub> = 0 Hz			A	2.0	2 x 2.0	3 x 2.0	4.0	2 x 4.0	3 x 4.0	8	2 x 8	3 x 8
Rated current	230 V/ 400 V	12 kHz	A	1.0	2 x 1.0	3 x 1.0	2	2 x 2	3 x 2	4	2 x 4	3 x 4
Maximum current for 10 s			A	2	2 x 2	3 x 2	4	2 x 4	3 x 4	8	2 x 8	3 x 8
Maximum current for 500 ms			A	2.5	2 x 2.5	3 x 2.5	4.85	2 x 4.85	3 x 4.85	9.7	2 x 9.7	3 x 9.7
Maximum current for F <sub>M</sub> = 0 Hz			A	1.6	2 x 1.6	3 x 1.6	3.1	2 x 3.1	3 x 3.1	6.2	2 x 6.2	3 x 6.2
Rated current	230 V/ 400 V	16 kHz	A	0.8	2 x 0.8	3 x 0.8	1.45	2 x 1.45	3 x 1.45	2.9	2 x 2.9	3 x 2.9
Maximum current for 10 s			A	1.6	2 x 1.6	3 x 1.6	2.9	2 x 2.9	3 x 2.9	5.8	2 x 5.8	3 x 5.8
Maximum current for 500 ms			A	1.9	2 x 1.9	3 x 1.9	3.8	2 x 3.8	3 x 3.8	7.6	2 x 7.6	3 x 7.6
Maximum current for F <sub>M</sub> = 0 Hz			A	1.2	2 x 1.2	3 x 1.2	2.4	2 x 2.4	3 x 2.4	4.8	2 x 4.8	3 x 4.8

**Remarks:** Current data per axis in the axis controller 230/400/480 V AC refer to the supply voltage for the supply unit.

Table A.3 Power section current data, axis controller (1.5 A to 6.0 A)

	$U_{\text{Mains}}$	$F_s$	Unit/ size	SOCM-1.xx01 BG1	SOCM-2.xx01 BG1	SOCM-3.xx01 BG1	SOCM-1.xx03 BG1	SOCM-2.xx03 BG1	SOCM-3.xx03 BG1	SOCM-1.xx06 BG1	SOCM-2.xx06 BG1	SOCM-3.xx06 BG1
Rated current	480 V	2 kHz	A	1.5	2 x 1.5	3 x 1.5	3	2 x 3	3 x 3	6	2 x 6	3 x 6
Maximum current for 10 s			A	3	2 x 3	3 x 3	6	2 x 6	3 x 6	12	2 x 12	3 x 12
Maximum current for 500 ms			A	4.5	2 x 4.5	3 x 4.5	9.0	2 x 9.0	3 x 9.0	18	2 x 18	3 x 18
Maximum current for $F_M = 0$ Hz			A	3.1	2 x 3.1	3 x 3.1	6.2	2 x 6.2	3 x 6.2	12.4	2 x 12.4	3 x 12.4
Rated current	480 V	4 kHz	A	1.5	2 x 1.5	3 x 1.5	3	2 x 3	3 x 3	6	2 x 6	3 x 6
Maximum current for 10 s			A	3	2 x 3	3 x 3	6	2 x 6	3 x 6	12	2 x 12	3 x 12
Maximum current for 500 ms			A	4.0	2 x 4.0	3 x 4.0	8.0	2 x 8.0	3 x 8.0	16	2 x 16	3 x 16
Maximum current for $F_M = 0$ Hz			A	2.6	2 x 2.6	3 x 2.6	5.1	2 x 5.1	3 x 5.1	10.2	2 x 10.2	3 x 10.2
Rated current	480 V	8 kHz	A	1.3	2 x 1.3	3 x 1.3	2.6	2 x 2.6	3 x 2.6	5.2	2 x 5.2	3 x 5.2
Maximum current for 10 s			A	2.6	2 x 2.6	3 x 2.6	5.2	2 x 5.2	3 x 5.2	10.4	2 x 10.4	3 x 10.4
Maximum current for 500 ms			A	2.6	2 x 2.6	3 x 2.6	5.2	2 x 5.2	3 x 5.2	10.4	2 x 10.4	3 x 10.4
Maximum current for $F_M = 0$ Hz			A	1.7	2 x 1.7	3 x 1.7	3.3	2 x 3.3	3 x 3.3	6.6	2 x 6.6	3 x 6.6
Rated current	480 V	12 kHz	A	0.7	2 x 0.7	3 x 0.7	1.35	2 x 1.35	3 x 1.35	2.7	2 x 2.7	3 x 2.7
Maximum current for 10 s			A	1.4	2 x 1.4	3 x 1.4	2.7	2 x 2.7	3 x 2.7	5.4	2 x 5.4	3 x 5.4
Maximum current for 500 ms			A	1.8	2 x 1.8	3 x 1.8	3.6	2 x 3.6	3 x 3.6	7.2	2 x 7.2	3 x 7.2
Maximum current for $F_M = 0$ Hz			A	1.2	2 x 1.2	3 x 1.2	2.31	2 x 2.31	3 x 2.31	4.6	2 x 4.6	3 x 4.6
Rated current	480 V	16 kHz	A	0.3	2 x 0.3	3 x 0.3	0.6	2 x 0.6	3 x 0.6	1.2	2 x 1.2	3 x 1.2
Maximum current for 10 s			A	0.6	2 x 0.6	3 x 0.6	1.2	2 x 1.2	3 x 1.2	2.4	2 x 2.4	3 x 2.4
Maximum current for 500 ms			A	1.4	2 x 1.4	3 x 1.4	2.75	2 x 2.75	3 x 2.75	5.5	2 x 5.5	3 x 5.5
Maximum current for $F_M = 0$ Hz			A	0.9	2 x 0.9	3 x 0.9	1.75	2 x 1.75	3 x 1.75	3.5	2 x 3.5	3 x 3.5

**Remarks:** Current data per axis in the axis controller 230/400/480 V AC refer to the supply voltage for the supply unit.

Table A.3 Power section current data, axis controller (1.5 A to 6.0 A)

## A.2 Technical data, ServoOne CM axis controller (12 A to 32 A)

ServoOne CM axis controller	Unit/ size	SOCM-1. xx12 (BG1)	SOCM-1. xx18 (BG1)	SOCM-2. xx12 (BG2)	SOCM-3. xx12 (BG2)	SOCM-2. xx16 (BG2)	SOCM-1. xx24 (BG2)	SOCM-1. xx32 (BG2)
<b>Axis controller</b>								
Number of axes		1	1	2	3	2	1	1
Rated current *	A <sub>eff</sub>	1 x 12	1 x 18	2 x 12	3 x 12	2 x 16	1 x 24	1 x 32
Maximum current for 10 s *	A <sub>eff</sub>	1 x 24	1 x 36 **	2 x 24	3 x 24	2 x 32 **	1 x 48	1 x 64 ***
Maximum current for 500 ms *	A <sub>eff</sub>	1 x 36	1 x 48	2 x 36	3 x 36	2 x 40	1 x 67	1 x 100
<b>Control section</b>								
Control voltage	V DC	24 ± 20 %						
Maximum switch-on current on 24 V supply, per device/pulse duration	A	1.8 at 24 V and 2.2 at 18 V / 1 s						
Control voltage for motor holding brake, cable length < 50 m	V DC	≥ 22.8 (24 V -5 %)						
Maximum power motor holding brake	W	48	48	2 x 48	3 x 48	2 x 48	48	48
<b>DC link</b>								
Capacitance in the DC link	µF	275			405		675	
Permissible rated power @ 3 x 230 V AC	kW	1.700	2.600	3.500	3.500	3.500	3.500	4.600
Permissible rated power @ 3 x 400/480 V AC	kW	3.000	4.500	6.000	6.000	6.000	6.000	8.000
<b>Power section</b>								
Permissible switching frequencies	kHz	2 / 4 / 8 / 12 / 16 kHz						
Rate of rise of voltage on the output with 10 m motor cable (10 %-90 %)	kV / µs	3 ... 8						
Output frequency range	Hz	0 ... 400 to max. 1600						
Power dissipation @ (400 V/ 4 kHz/ I <sub>rated</sub> ) in the interior	W	95	102	118	141	129	103	112
Power dissipation @ (400 V/ 4 kHz/ P <sub>rated</sub> ) via heat sink	W	88	120	175	262	233	176	240
*) @ At 4 kHz, 400 V AC supply via supply unit, for other currents see following pages    **) Overcurrent for 2 s    ***) Overcurrent for 1.5 s								

Table A.4 Technical data, SO CM axis controller (12 A to 32 A)

## A.2.1 Control section current data, axis controller (12 A to 32 A)

ServoOne CM axis controller	Unit/ size	SOCM-1. xx12 (BG1)	SOCM-1. xx18 (BG1)	SOCM-2. xx12 (BG2)	SOCM-3. xx12 (BG2)	SOCM-2. xx16 (BG2)	SOCM-1. xx24 (BG2)	SOCM-1. xx32 (BG2)
<b>Control section</b>								
Typ. power consumption with power stage (without motor holding brake) air cooling / cold plate	W	26/17	26/17	43/26	50/34	43/26	36/26	36/26
Typical current consumption, axis controller air-cooled without encoder	A	0.9	0.9	1.5	1.7	1.5	1.3	1.3
Typical current consumption, axis controller cold plate without encoder	A	0.5	0.5	0.8	1.0	0.8	0.9	0.9
Typical current consumption, encoder SinCos/TTL/EnDat/SSI/resolver <sup>1)</sup>	A	0.1	0.1	0.2	0.3	0.2	0.1	0.1
Typical current consumption, encoder channel 4 SinCos/TTL <sup>1)</sup>	A	0.1	0.1	0.2	0.1	0.2	0.1	0.1
Typical current consumption, encoder Hiperface/Hiperface DSL <sup>1)</sup>	A	0.3	0.3	0.5	0.7	0.5	0.3	0.3
Typ. total current consumption, axis controller with air cooling	A	1.1	1.1	1.8	2.1	1.8	1.5	1.5
Typ. total current consumption, axis controller with cold plate	A	0.7	0.7	1.1	1.4	1.1	1.1	1.1

<sup>1)</sup> Current consumption can vary depending on encoder type

Table A.5 Control section current data, axis controller (12 A to 32 A)

## A.2.2 Power section current data, axis controller (12 A to 32 A)

	U <sub>Mains</sub>	F <sub>s</sub>	Unit/ size	SOCM-1.xx12 BG1	SOCM-1.xx18 BG1	SOCM-2.xx12 BG2	SOCM-3.xx12 BG2	SOCM-2.xx16 BG2	SOCM-1.xx24 BG2	SOCM-1.xx32 BG2
Rated current	230 V/ 400 V	2 kHz	A	12	18	2 x 12	3 x 12	2 x 16	24	32
Maximum current for 10 s			A	24	36 <sup>3)</sup>	2 x 24	3 x 24	2 x 32 <sup>3)</sup>	48	64 <sup>2)</sup>
Maximum current for 500 ms			A	36	48	2 x 36	3 x 36	2 x 40	72	100
Maximum current for F <sub>M</sub> = 0 Hz			A	25	37.5	2 x 36	3 x 36	2 x 36	53.9	64
Rated current	230 V/ 400 V	4 kHz	A	12	18	2 x 12	3 x 12	2 x 16	24	32
Maximum current for 10 s			A	24	36 <sup>3)</sup>	2 x 24	3 x 24	2 x 32 <sup>3)</sup>	48	64 <sup>2)</sup>
Maximum current for 500 ms			A	36	48	2 x 36	3 x 36	2 x 40	66.8	100
Maximum current for F <sub>M</sub> = 0 Hz			A	21	31.4	2 x 29.5	3 x 29.5	2 x 29.5	39.2	64
Rated current	230 V/ 400 V	8 kHz	A	10.7	16	2 x 10	3 x 10	2 x 15.4	20	31
Maximum current for 10 s			A	21.4	32 <sup>3)</sup>	2 x 20	3 x 20	2 x 29.3 <sup>3)</sup>	45.7	62 <sup>2)</sup>
Maximum current for 500 ms			A	21.4	32	2 x 29.3	3 x 29.3	2 x 29.3	45.7	74.8
Maximum current for F <sub>M</sub> = 0 Hz			A	13.5	20.3	2 x 20.2	3 x 20.2	2 x 20.2	26.8	51.4
Rated current	230 V/ 400 V	12 kHz	A	8.3	12.4	2 x 6.4	3 x 6.4	2 x 10.5	12.5	22.5
Maximum current for 10 s			A	16.6	24.8 <sup>3)</sup>	2 x 12.8	3 x 12.8	2 x 19.9 <sup>3)</sup>	31.1	50.8 <sup>2)</sup>
Maximum current for 500 ms			A	16.6	24.8	2 x 19.9	3 x 19.9	2 x 19.9	31.1	50.8
Maximum current for F <sub>M</sub> = 0 Hz			A	10.5	15.8	2 x 13.7	3 x 13.7	2 x 13.7	18.2	35
Rated current	230 V/ 400 V	16 kHz	A	6.5	9.6	2 x 5.1	3 x 5.1	2 x 7.7	9.9	17
Maximum current for 10 s			A	13	19.3 <sup>3)</sup>	2 x 10.2	3 x 10.2	2 x 14.7 <sup>3)</sup>	22.9	37.4 <sup>2)</sup>
Maximum current for 500 ms			A	13	19.3	2 x 14.7	3 x 14.7	2 x 14.7	22.9	37.4
Maximum current for F <sub>M</sub> = 0 Hz			A	8.2	12.3	2 x 10.1	3 x 10.1	2 x 10.1	13.4	25.7

**Remarks:** Current data per axis in the axis controller 400/480 V AC refer to the supply voltage for the supply unit.  
 2) Maximum current for 1.5 s 3) Maximum current for 2 s

Table A.6 Power section current data, axis controller (6 A to 32 A)

	$U_{\text{Mains}}$	$F_s$	Unit/ size	SOCM-1.xx12 BG1	SOCM-1.xx18 BG1	SOCM-2.xx12 BG2	SOCM-3.xx12 BG2	SOCM-2.xx16 BG2	SOCM-1.xx24 BG2	SOCM-1.xx32 BG2
Rated current	480 V	2 kHz	A	12	18	2 x 12	3 x 12	2 x 16	24	32
Maximum current for 10 s			A	24	36 <sup>3)</sup>	2 x 24	3 x 24	2 x 32 <sup>3)</sup>	48	64 <sup>2)</sup>
Maximum current for 500 ms			A	36	48	2 x 36	3 x 36	2 x 40	72	100
Maximum current for $F_M = 0$ Hz			A	21	31.5	2 x 36	3 x 36	2 x 36	52.5	64
Rated current	480 V	4 kHz	A	12	18	2 x 12	3 x 12	2 x 16	24	32
Maximum current for 10 s			A	24	36 <sup>3)</sup>	2 x 24	3 x 24	2 x 32 <sup>3)</sup>	48	64 <sup>2)</sup>
Maximum current for 500 ms			A	27.2	40.8	2 x 36	3 x 36	2 x 36	59	90.70
Maximum current for $F_M = 0$ Hz			A	17.3	26	2 x 26	3 x 26	2 x 26	34.6	62.4
Rated current	480 V	8 kHz	A	8.8	13.2	2 x 8.7	3 x 8.7	2 x 11.0	17.1	28.5
Maximum current for 10 s			A	17.6	26.4 <sup>3)</sup>	2 x 17.4	3 x 17.4	2 x 21 <sup>3)</sup>	32.6	53.3 <sup>2)</sup>
Maximum current for 500 ms			A	17.6	26.4	2 x 20.9	3 x 20.9	2 x 20.9	32.6	53.3 <sup>2)</sup>
Maximum current for $F_M = 0$ Hz			A	11.2	16.8	2 x 14.4	3 x 14.4	2 x 14.4	19.1	36.7
Rated current	480 V	12 kHz	A	6.2	9.2	2 x 5.2	3 x 5.2	2 x 8.2	10.1	18.5
Maximum current for 10 s			A	12.4	18.4 <sup>3)</sup>	2 x 10.4	3 x 10.4	2 x 15.5 <sup>3)</sup>	24.1	39.5 <sup>2)</sup>
Maximum current for 500 ms			A	12.4	18.4	2 x 15.5	3 x 15.5	2 x 15.5	24.1	39.5 <sup>2)</sup>
Maximum current for $F_M = 0$ Hz			A	15.1	11.7	2 x 10.7	3 x 10.7	2 x 10.7	14.2	27.2
Rated current	480 V	16 kHz	A	4.7	7	2 x 4	3 x 4	2 x 6.3	8.2	13.7
Maximum current for 10 s			A	9.4	14 <sup>3)</sup>	2 x 8	3 x 8	2 x 10.4 <sup>3)</sup>	19.3	31.6 <sup>2)</sup>
Maximum current for 500 ms			A	9.4	14	2 x 12.4	3 x 12.4	2 x 12.4	19.3	31.6 <sup>2)</sup>
Maximum current for $F_M = 0$ Hz			A	6.0	8.9	2 x 8.5	3 x 8.5	2 x 8.5	11.3	21.7

**Remarks:** Current data per axis in the axis controller 400/480 V AC refer to the supply voltage for the supply unit.  
 2) Maximum current for 1.5 s 3) Maximum current for 2 s

Table A.6 Power section current data, axis controller (6 A to 32 A)

## A.3 Ambient conditions

Ambient conditions	ServoOne CM axis controller
Protection	Device: IP20 - exception terminals: IP10 (protection against touching with 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 A.7 Ambient conditions, ServoOne CM axis controller

Climatic conditions		ServoOne CM axis controller
In transit	As per EN 61800-2, IEC 60721-3-2 class 2K3 <sup>1)</sup>	
	Temperature	-25 °C to +70 °C
	Relative atmospheric humidity	95% at max. +40 °C
In storage	As per EN 61800-2, IEC 60721-3-1 classes 1K3 and 1K4 <sup>2)</sup>	
	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 <sup>3)</sup>	
	Temperature	5 °C to +40 °C (4, 8, 16 kHz), to 55 °C with power reduction
	Relative atmospheric humidity	5 to 85 % without condensation

1) The absolute humidity is limited to max. 60 g/m<sup>3</sup>. 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/m<sup>3</sup>. 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/m<sup>3</sup>. That means that the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.

Table A.8 Climatic conditions ServoOne CM axis controller



### NOTE:

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

Mechanical conditions		ServoOne CM axis controller	
Vibration limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Frequency [Hz]	Amplitude [mm]	Acceleration [m/s <sup>2</sup> ]
	2 ≤ f < 9	3.5	Not applicable
	9 ≤ f < 200	Not applicable	10
	200 ≤ f < 500	Not applicable	15
Shock limit in transit	As per EN 61800-2, IEC 60721-3-2 class 2M1		
	Drop height of packed device max. 0.25 m		
Vibration limits for the system <sup>1)</sup>	As per EN 61800-2, IEC 60721-3-3 class 3M1		
	Frequency [Hz]	Amplitude [mm]	Acceleration [m/s <sup>2</sup> ]
	2 ≤ f < 9	0.3	Not applicable
	9 ≤ f < 200	Not applicable	1

1) The devices must not be installed in areas where they are exposed to continuous vibration.

Table A.9 Mechanical conditions, ServoOne CM axis controller

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



### NOTE:

The devices are only designed for stationary use.

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

If an axis controller is operated outside the specified maximum ambient temperature ( $T_{unom}$ ), the output power must be reduced as a function of the higher ambient temperature. This so-called **temperature derating** is used to protect parts in the device against overheating.



### NOTE:

If the output power is not reduced despite an elevated ambient temperature, the power stage will shut down due to overtemperature.

Device	Operation without derating up to $T_{unom}$	Operation with derating up to $T_{umax}$	Derating for $T_{unom} < T_u < T_{umax}$
SOCM-1.xx01	40 °C	50 °C	Reduction of the output power by 3.4% per 1 °C
SOCM-2.xx01	40 °C	50 °C	
SOCM-3.xx01	40 °C	50 °C	
SOCM-1.xx03	40 °C	50 °C	
SOCM-2.xx03	40 °C	50 °C	
SOCM-3.xx03	40 °C	50 °C	
SOCM-1.xx06	40 °C	50 °C	
SOCM-2.xx06	40 °C	50 °C	
SOCM-3.xx06	40 °C	50 °C	
SOCM-1.xx12	40 °C	55 °C	
SOCM-1.xx18	40 °C	55 °C	
SOCM-2.xx12	40 °C	55 °C	2.0 % per 1 °C
SOCM-3.xx12	40 °C	55 °C	
SOCM-2.xx16	40 °C	55 °C	2.6 % per 1 °C
SOCM-1.xx24	40 °C	55 °C	2.3 % per 1 °C
SOCM-1.xx32	40 °C	55 °C	3.0 % per 1 °C



### NOTE:

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

## A.5 Certifications

### A.5.1 CE certification

The ServoOne CM axis controllers conform to the requirements of the Low Voltage Directive 2006/95/EC and the product standard EN 61800-5-1.

The ServoOne CM axis controllers therefore conform to the requirements for installation in a machine or plant in the context of the Machinery Directive 2006/42/EC.

The servocontrollers are 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 UL 61800-5-1 for the ServoOne CM axis controllers in the document "UL-Certification" ID no.: 0927.21B.x.

### A.5.3 Load on the mains due to harmonics

(Note on EN 61000-3-2:2006)

The devices in the ServoOne CM system are "professional equipment" in the context of EN 61000 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 LSH/LST/LSN and LSP with
- Encoders of type resolver, hiperface© multiturn and hiperface© singleturn (other encoder types in preparation)
- Pre-assembled motor cable
- Pre-assembled encoder cable
- Data cables - for field bus and cross-communication
- Connector sets, PE connection plate
- PC user software - e.g. DriveManager 5
- 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 Connection system

### A.7.1 Motor and encoder cables (extract)

We offer pre-assembled cables in various lengths for the connection of KEBA servomotors (product ranges LSH, LST and LSN) to the ServoOne CM axis controllers. Here we provide only an extract of the cables available.



#### NOTE:

You will find comprehensive information as well as all the details on motor and encoder cables in the System Cables Order Catalogue ID no.: 0966.24B.X-xx.

### Resolver cable KE14-R-M23-KSxx

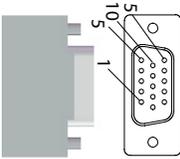
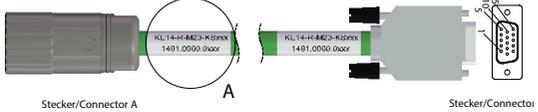
Sketch of connector B	Pin assignment	Key	Cross-section [mm <sup>2</sup> ]
 <p>Stecker/Connect</p>	2	COS + (S1)	0.25
	1	COS – (S3)	0.25
	11	SIN + (S2)	0.25
	6	SIN – (S4)	0.25
	10	REF + (R1)	0.25
	9	REF – (R2)	0.25
	n.c.	Thermo +	0.25
	n.c.	Thermo –	0.25
	Housing	Outer shield	
	 <p>Stecker/Connector A</p> <p>Stecker/Connector B</p> <p>KE14-R-M23-KSxxx 1491.0000.0xxx</p>		

Table A.10 Connections resolver cable (KE14-R-M23-KSxxx) controller end


**NOTE:**

At the motor end the encoder cable is equipped with a special connector (connector A M23) to suit the KEBA servomotors (type LSH, LST, LSN). You will find more information in the servomotor order catalogues.

Technical data	KE14-R-M23-KSxxx <sup>1)</sup>
Cable length	1 m to max. 30 m
Number of cores	4 x 2 (cable)
Temperature range, state with movement	-20 °C to +80 °C
Temperature range, state without movement	-40 °C to +80 °C
Protection	Inserted IP 66/67
Rated voltage	Signal 160 V AC/DC max.
Rated current	Signal 7 A max.
Pollution degree	3, as per EN 61984 para. 6.19.2.2
Overvoltage category	III, as per EN 61984 para. 6.19.2.2
Maximum installation altitude	2000 m max., as per EN 61984 para. 6.19.2.2
RoHS compliant	Yes
Oil resistance outer material	HD 22.10 Annex A, DIN EN 60811-2-1
Flame-retardant	As per IEC 60332-1-2, UL 758 cable flame test
Halogen-free	Yes
Silicone-free	Yes
CFC-free	Yes
Capable for energy chains	Yes
Bending radius	Fixed laying 5 x D Multiple movement 10 x D
Diameter D	7.4 mm (26 mm connector A)
Approval	UL 758 (AWM) style 21223 (sheath) and style 10492 (core)
Weight	0.071 kg/m

<sup>1)</sup> The cable length can be selected as required in 1-metre steps, e.g. ...KS001 = 1 m, ...KS025 = 25 m

Table A.11 Technical data, resolver cable

## Hiperface cable KE14-H-M23-KSxxx

Sketch of connector B	Pin assignment	Key	Cross-section [mm <sup>2</sup> ]
<p>Stecker/Connector B</p>	2	cos +	0.25
	1	REFCOS	0.25
	11	SIN +	0.25
	6	REFSIN	0.25
	8	GND	0.5
	7	Us 7 - 12 V	0.5
	4	DATA +	0.25
	5	DATA -	0.25
	n.c.	Thermo +	0.25
	n.c.	Thermo -	0.25
	Housing	Shielding	

Sketch of cable
<p>Stecker/Connector A</p> <p>Stecker/Connector B</p> <p>KE14-H-M23-KSxxx 1491.1000.0xxxx</p> <p>A (2:1)</p>

Table A.12 Connections Hiperface (KE14-H-M23-KSxxx) controller end


**NOTE:**

At the motor end the encoder cable is equipped with a special connector (connector A M23) to suit the KEBA servomotors (type LSH, LST, LSN). You will find more information in the servomotor order catalogues.

Technical data	KE14-H-M23-KSxxx <sup>1)</sup>	
Cable length	1 m to max. 30 m	
Number of cores	10 (cable)	
Temperature range, state with movement	-20 °C to +80 °C	
Temperature range, state without movement	-40 °C to +80 °C	
Protection	Inserted IP 66/67	
Rated voltage	Signal	125 V AC/DC max.
Rated current	Signal	7 A max.
Pollution degree	3, as per EN 61984 para. 6.19.2.2	
Overvoltage category	III, as per EN 61984 para. 6.19.2.2	
Maximum installation altitude	2000 m max., as per EN 61984 para. 6.19.2.2	
RoHS compliant	Yes	
Oil resistance outer material	HD 22.10 Annex A, DIN EN 60811-2-1	
Flame-retardant	As per IEC 60332-1-2, UL 758 cable flame test	
Halogen-free	Yes	
Silicone-free	Yes	
CFC-free	Yes	
Capable for energy chains	Yes	
Bending radius	Fixed laying	5 x D
	Multiple movement	7 x D
Diameter D	11.6 mm (26 mm connector A)	
Approval	UL 758 (AWM) style 21223 (sheath) and style 10492 (core)	
Weight	0.071 kg/m	
1) The cable length can be selected as required in 1-metre steps, e.g. ...KS001 = 1 m, ...KS025 = 25 m		

Table A.13 Technical data, Hiperface

### Motor cable KM14-3PHBTD-I17-xxA-KSxxx (with Hiperface DSL)

Connection controller end	Des. cable core	Key	Colour
	1	Phase U	black
	2	Phase V	black
	3	Phase W	black
	PE	Protective earth conductor	yellow/green
	DSL/Temp.	Hiperface DSL +/Temp.+	blue
	DSL/Temp.	Hiperface DSL -/Temp.-	white
	5	Brake +	black
	6	Brake -	black
	Earth	Outer shield	copper

Table A.14 Connections, motor cable KM14-3PHBTD-I17-xxA-KSxxx



**NOTE:**

At the motor end the motor cable is equipped with a special connector (connector A = I17) to suit the KEBA servomotors (type LSN, LST, LSH and LSP). You will find more information in the servomotor order catalogues.

Technical data		KM14-3PHBTD-I17-(xxA)*-KSxxx <sup>1)</sup>
Cable length		1 m to max. 30 m
Number of cores		8
Temperature range, state with movement		-20 °C to +80 °C
Temperature range, state without movement		-40 °C to +80 °C
Protection		Inserted IP 66/67
(I17) Rated voltage	Signal	63 V AC/DC max.
	Power	630 V AC/DC max.
(I17) Rated current	Signal	3.6 A max.
	Power	14 A max.
Pollution degree		3, as per EN 61984 para. 6.19.2.2
Overvoltage category		III, as per EN 61984 para. 6.19.2.2
Maximum installation altitude		2000 m max., as per EN 61984 para. 6.19.2.2
RoHS compliant		Yes
Oil resistance outer material		HD 22.10 Annex A, DIN EN 60811-2-1
Flame-retardant		As per IEC 60332-1-2, UL 758 cable flame test
Halogen-free		Yes
Silicone-free		Yes
CFC-free		Yes
Capable for energy chains		Yes
Bending radius	Fixed laying	5 x D
	Multiple movement	7 x D
Motor cable diameter D (for 5/10/16 A)*		9.3/11.6/12.7 mm (18.7 mm connector A)
Approval		UL 758 (AWM) style 21223 (sheath) and style 10492 (core)
Weight		0.215 kg/m

1) The cable length can be selected as required in 1-metre steps, e.g. ... KS001 = 1 m, ... KS025 = 25 m

Table A.15 Technical data, motor cable KM14-2PHBTD-I17-xxA-KSxxx

## KM14-3PHBTD-M23-xxA-KSxxx

Connection controller end	Des.cable core	Key	Colour
	1	Phase U	black
	2	Phase V	black
	3	Phase W	black
	PE	Protective earth conductor	yellow/green
	DSL/Temp.	Hiperface DSL +/- Temp.+	blue
	DSL/Temp.	Hiperface DSL -/ Temp.-	white
	5	Brake +	black
	6	Brake -	black
Earth	Outer shield	copper	

Table A.16 Connections, motor cable KM14-3PHBTD-M23-xxA-KSxxx


**NOTE:**

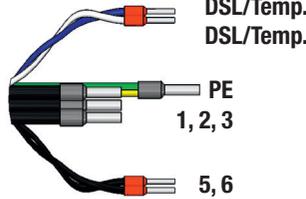
At the motor end the motor cable is equipped with a special connector (connector A = M23) to suit the KEBA servomotors (type LSN, LST, LSH and LSP). You will find more information in the servomotor order catalogues.

Technical data		KM14-3PHBTD-M23-(xxA)*-KSxxx <sup>1)</sup>
Cable length		1 m to max. 30 m
Number of cores		8
Temperature range, state with movement		-20 °C to 80 °C
Temperature range, state without movement		-40 °C to +80 °C
Protection		Inserted IP 66/67
(17) Rated voltage	Signal	63 V AC/DC max.
	Power	630 V AC/DC max.
(17) Rated current	Signal	7.0 A max.
	Power	30 A max.
Pollution degree		3, as per EN 61984 para. 6.19.2.2
Overvoltage category		III, as per EN 61984 para. 6.19.2.2
Maximum installation altitude		2000 m max., as per EN 61984 para. 6.19.2.2
RoHS compliant		Yes
Oil resistance outer material		HD 22.10 Annex A, DIN EN 60811 -2-1
Flame-retardant		As per IEC 60332-1-2, UL 758 cable flame test
Halogen-free		Yes
Silicone-free		Yes
CFC-free		Yes
Capable for energy chains		Yes
Bending radius	Fixed laying	5 x D
	Multiple movement	7 x D
Motor cable diameter D (for 5/10/16/24 A)*		9.3/11.6/12.7/13.9 mm (26 mm connector A)
Approval		UL 758 (AWM) style 21223 (sheath) and style 10492 (core)
Weight		0.215 kg/m

1) The cable length can be selected as required in 1-metre steps, e.g. ... KS001 = 1 m, ... KS025 = 25 m

Table A.17 Technical data, motor cable KM14-3PHBTD-M23-xxA-KSxxx

### KM14-3PHBTD-M40-xxA-KSxxx

Connection controller end	Des.cable core	Key	Colour
	1	Phase U	black
	2	Phase V	black
	3	Phase W	black
	PE	Protective earth conductor	yellow/green
	DSL/Temp.	Hiperface DSL +/ Temp.+	blue
	DSL/Temp.	Hiperface DSL -/ Temp.-	white
	5	Brake +	black
	6	Brake -	black
Earth	Outer shield	copper	

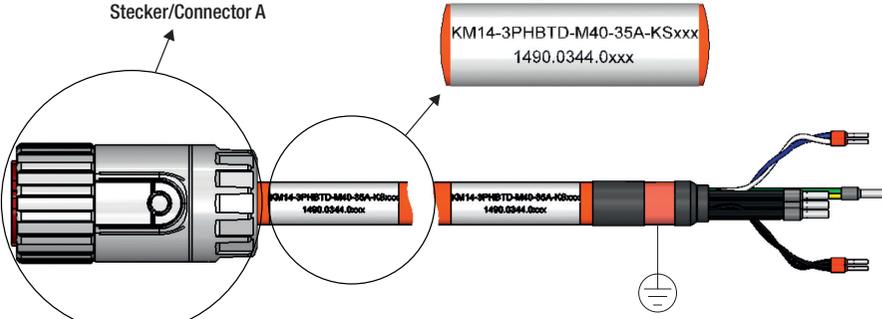
  


Table A.18 Connections, motor cable KM14-3PHBTD-M23-xxA-KSxxx



#### NOTE:

At the motor end the motor cable is equipped with a special connector (connector A = M40) to suit the KEBA servomotors (type LSN, LST, LSH and LSP). You will find more information in the servomotor order catalogues.

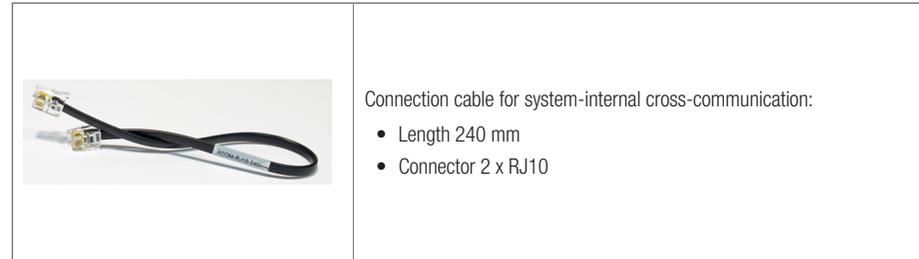
Technical data		KM14-3PHBTD-M40-(xxA)*-KSxxx <sup>1)</sup>
Cable length		1 m to max. 30 m
Number of cores		8
Temperature range, state with movement		-20 °C to 80 °C
Temperature range, state without movement		-40 °C to +80 °C
Protection		Inserted IP 66/67
(I17) Rated voltage	Signal	63 V AC/DC max.
	Power	630 V AC/DC max.
(I17) Rated current	Signal	7 A max.
	Power	75 A max.
Pollution degree		3, as per EN 61984 para. 6.19.2.2
Overvoltage category		III, as per EN 61984 para. 6.19.2.2
Maximum installation altitude		2000 m max., as per EN 61984 para. 6.19.2.2
RoHS compliant		Yes
Oil resistance outer material		HD 22.10 Annex A, DIN EN 60811-2-1
Flame-retardant		As per IEC 60332-1-2, UL 758 cable flame test
Halogen-free		Yes
Silicone-free		Yes
CFC-free		Yes
Capable for energy chains		Yes
Bending radius	Fixed laying	5 x D
	Multiple movement	7 x D
Motor cable diameter D (for 35 A)*		15.9 mm (46 mm connector A)
Approval		UL 758 (AWM) style 21223 (sheath) and style 10492 (core)
Weight		0.42 kg/m

1) The cable length can be selected as required in 1-metre steps, e.g. ... KS001 = 1 m, ... KS025 = 25 m

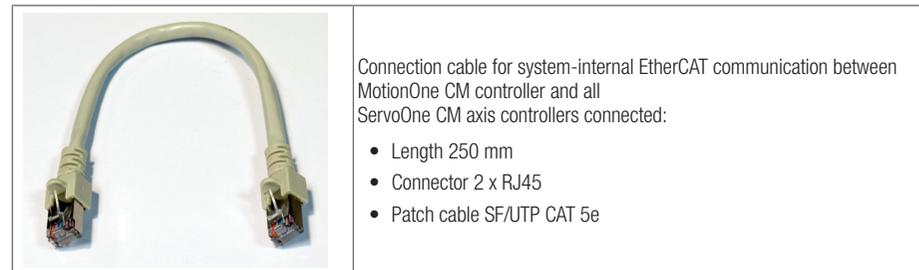
Table A.19 Technical data, motor cable KM14-3PHBTD-M23-xxA-KSxxx

## A.7.2 Connection cables for communication

Both cables are included in the scope of supply.



Type: XCOM



Type: ECAT

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