

# Operating Manual

(Translation of the original German Operating Manual)

PacDrive

Servo Amplifier MC-4

07.2013



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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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# 1 About this manual

## 1.1 Introduction

Read and understand the material contained in this manual before you work on the PacDrive Servo Amplifier for the first time. Take particular note of the safety information (see 2.3 Residual risks). As described in section 2.2, only those persons who meet the "Selection and qualification of employees" are allowed to work on the PacDrive Servo Amplifier.

A copy of this manual must be available for personnel who work on the PacDrive Servo Amplifier.

This manual is supposed to help you use the capabilities of the PacDrive Servo Amplifier safely and properly.

Follow the instructions within this manual to:

- avoid risks
- reduce repair costs and downtime of the PacDrive Servo Amplifier
- increase the service life of the PacDrive Servo Amplifier,
- increase reliability of the PacDrive Servo Amplifier.

## 1.2 Symbols, designator and display format of safety messages

### Important Information

**NOTE** The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to warn the user of potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

### **DANGER**

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

### **WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.




### **CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

### **NOTICE**

**NOTICE**, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in equipment damage.

The following symbols and designators are used in this document:

Symbol/Character	Meaning
	<b>Information Symbol:</b> After this symbol, you will find important information and useful tips on using the components.
	<b>Marker:</b> After this symbol, you will find references for further information.
▪	<b>Prerequisite symbol:</b> This symbol indicates a prerequisite you have to fulfill before you start to implement an instruction.
✕	<b>Problem symbol:</b> This symbol is followed by a description of the problem and an instruction how to solve the problem.
►	<b>Activity symbol:</b> After this symbol, you will find an instruction. Follow the instructions in sequence from top to bottom.
✓	<b>Result symbol:</b> The text after this symbol contains the result of an action.
(1), (2), (3)	<b>Image numbers</b> in the text always refer to the image numbers in the <b>referenced</b> figure.
	<b>Orientation aid:</b> Information serving as an orientation aid regarding the section's contents follows this symbol.
<b>bold</b>	If the descriptive text contains <b>keywords</b> , such as parameters, they are highlighted in bold.
<code>lBuffSelect</code>	<b>Program code</b> is written using a different font.

## 2 Safety information



This section contains information regarding working with the PacDrive Servo Amplifier. Qualified personnel working on the PacDrive Servo Amplifier must read and observe this information. The servo amplifier is conform to recognized technical safety regulations.

### 2.1 Proper use

The PacDrive Servo Amplifier is must only be installed in a closed electrical equipment (for example, control cabinet). The closed electrical equipment must be lockable by using a key or tool.

**Provide for protective measures** Before installing the device, provide for appropriate protective devices in compliance with local and national standards. Do not commission components without suitable protective devices. After installation, commissioning, or repair, test the protective devices used.

Perform a risk evaluation concerning the specific use before operating the product and take appropriate security measures.

If circumstances occur that affect the safety or cause changes to the operating behavior of the of the PacDrive Servo Amplifier, then immediately shut down the the PacDrive Servo Amplifier and contact your Schneider Electric contact person.

**Use original-equipment only** Use only the accessories and mounting parts specified in the documentation and no third-party devices or components that have not been expressly approved by Schneider Electric. Do not change the PacDrive Servo Amplifier inappropriately.

The components must not be used in the following environments:

**Forbidden environments**

- In hazardous (explosive) atmospheres
- In mobile, movable or floating systems
- In life support systems
- In domestic appliances
- underground

**Installation and operating conditions** Only use the components in accordance with the installation and operating conditions described in this documentation. The operating conditions at the installation location must be inspected and maintained in accordance with the required technical data (performance data and ambient conditions). Commissioning is prohibited until the usable machine or system in which the PacDrive Servo Amplifier is installed meets all requirements of EC guidelines 2006/42/EC (machinery directive).

In addition, the following standards, directives and regulations are to be observed:

- EN ISO 13849-1 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- EN 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- EN ISO 12100-1 - Safety of machines - Basic terms, general principles for design - Part 1: Basic terminology, methodology
- EN ISO 12100-2 - Safety of machines - Basic terms, general principles of design - Part 2: Technical guidelines
- EN 50178 - Electronic equipment for use in power installations
- EN 61800-3 Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

- The generally applicable local and national safety and accident prevention regulations.
- The rules and regulations on accident prevention and environmental protection that apply in the country where the product is used.

## 2.2 Qualification of Personnel

**Target audience for this manual** Electrical equipment must be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

**Qualified person** A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

The qualified personnel must be able to detect possible hazards that may arise from parameterization, changing parameter values and generally from mechanical, electrical or electronic equipment. The qualified personnel must be familiar with the standards, provisions and regulations for the prevention of industrial accidents, which they must observe when working on the drive system.

**Inverter Enable function** Qualified personnel that work with the Inverter Enable function must be trained according to the complexity of the machines and the requirements of the EN954-1 (Category 3). The training must include the production process and the relation between Inverter Enable function and machine.



Qualification guidelines are available in the following publication: Safety, Competency and Commitment: Competency Guidelines for Safety-Related System Practitioners. IEEE Publications, ISBN 0 85296 787 X, 1999.

## 2.3 Residual risks



Health risks arising from the PacDrive Servo Amplifier have been reduced. However a residual risk remains, since the PacDrive Servo Amplifier works with electrical voltage and electrical currents.

If activities involve residual risks, a safety message is made at the appropriate points. This includes potential hazard(s) that may arise, their possible consequences, and describes preventive measures to avoid the hazard(s). The following types of warnings concerning residual risks which cannot be assigned to a specific handling. The structure of a warning instruction is identical to that of a safety label.

### 2.3.1 Electrical parts

#### **DANGER**

##### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Operate electrical components only with a connected protective conductor.
- After the installation, verify the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the unit is switched on.
- Provide protection against indirect contact (EN 50178).
- Disconnect/plug in Plug-in connectors of the cables and plug-in terminals on the device only when the system is disconnected from the power supply.
- Isolate the unused conductors on both ends of the motor cable because AC voltages in the motor cable can couple to unused conductors.

**Failure to follow these instructions will result in death or serious injury.**

### 2.3.2 Assembly and handling

#### **DANGER**

##### **HAZARD OF ELECTRIC SHOCK CAUSED BY HIGH TOUCH VOLTAGE**

- Connect devices with a leakage current of 3.5 mAac or more through a fixed connection to the power supply network.
- In addition, implement one of the measures according to EN 50178:1997, Section 5.3.2.1.

**Failure to follow these instructions will result in death or serious injury.**

## **WARNING**

### **CRUSHING, SHEARING, CUTTING AND HITTING DURING HANDLING**

- Observe the general construction and safety regulations for handling and assembly.
- Use suitable mounting and transport equipment correctly and use special tools if necessary.
- Prevent clamping and crushing by taking appropriate precautions.
- Cover edges and angles to protect against cutting damage.
- Wear suitable protective clothing (e.g. safety goggles, safety boots, protective gloves) if necessary.

**Failure to follow these instructions can result in death or serious injury.**

### **2.3.3 Hot surfaces**

## **CAUTION**

### **HOT SURFACES OVER 70°C / 158°F**

- Wait until the surface temperature has cooled to allow safe contact.
- Wear protective gloves.
- Attach protective cover or touch guard

**Failure to follow these instructions can result in injury.**

### **2.3.4 Magnetic and electromagnetic fields**

## **WARNING**

### **MAGNETIC AND ELECTROMAGNETIC FIELDS**

- Do not allow personnel with pacemakers or similar sensitive implants to work in the immediate vicinity of live conductors and motor permanent magnets.

**Failure to follow these instructions can result in death or serious injury.**

## 2.3.5 Hazardous movements

There can be different causes of hazardous movements:

- Missing or incorrect homing of the drive
- Wiring or cabling errors
- Errors in the application program
- Potential component errors
- Potential error in the measured value and signal transmitter



Provide for personal safety by primary equipment monitoring or measures. Do not rely only on the internal monitoring of the drive components. Adapt the monitoring or other arrangements and measures to the specific conditions of the installation in accordance with a risk and error analysis carried out by the system manufacturer.

### DANGER

#### MISSING PROTECTIVE DEVICE OR INCORRECT PROTECTION

- Prevent entry to a hazard area, for example with protective fencing, mesh guards, protective coverings, or light barriers.
- Dimension the protective devices properly and do not remove them.
- Do not carry out any changes that can invalidate the protection device.
- Before accessing the drives or entering the hazard area, bring the drives to a stop.
- Protect existing work stations and operating terminals against unauthorized operation.
- Position EMERGENCY STOP switches so that they are easily accessible and can be quickly reached.
- Check the functionality of EMERGENCY STOP equipment before start-up and during maintenance periods.
- Prevent unintentional start-up by disconnecting the power connection of the drive using the EMERGENCY STOP circuit or using an appropriate lock-out tag-out sequence.
- Check the system and installation before the initial start-up for possible glitches in all general purposes.
- Avoid operating high-frequency, remote control, and radio devices close to the system electronics and their feed lines. If necessary, perform a special EMC check of the system.

**Failure to follow these instructions will result in death or serious injury.**

### 2.3.6 PELV circuits

The signal voltage and the control voltage of the devices are  $< 30 \text{ Vdc}$  and have to be designed as PELV circuits. In this range the specification as PELV system, according to IEC 60364-4-41 contains a protective measure against direct and indirect contact with dangerous voltage through a implemented safe separation in the system/machine of the primary and the secondary side. We recommend to design the system/machine with a safe separation (PELV Protective-Extra-Low-Voltage).

## DANGER

### HAZARD OF ELECTRIC SHOCK BY INADEQUATE PROTECTIVE SEPARATION

- Only connect devices, electrical components or lines to the signal voltage connectors of these components that feature a sufficient, protective separation from the connected circuits in accordance with the standards (EN 50178: 1999 - Electronic equipment for use in power installations - Section 5.2.14.2).

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Achieve a safe separation in the entire process of the electric circuit.
- ▶ To protect from direct contact, always cover connections and contacts which guide FELV (Functional Extra Low Voltage) voltages.
- ▶ Avoid using FELV current circuits for safety reasons.
- ▶ Design the cover or device connection so that it can only be removed by using a tool.
- ▶ The protection measures have to be followed on all connected devices.

### 3 System overview

The control system consists of several single components, depending on its application.

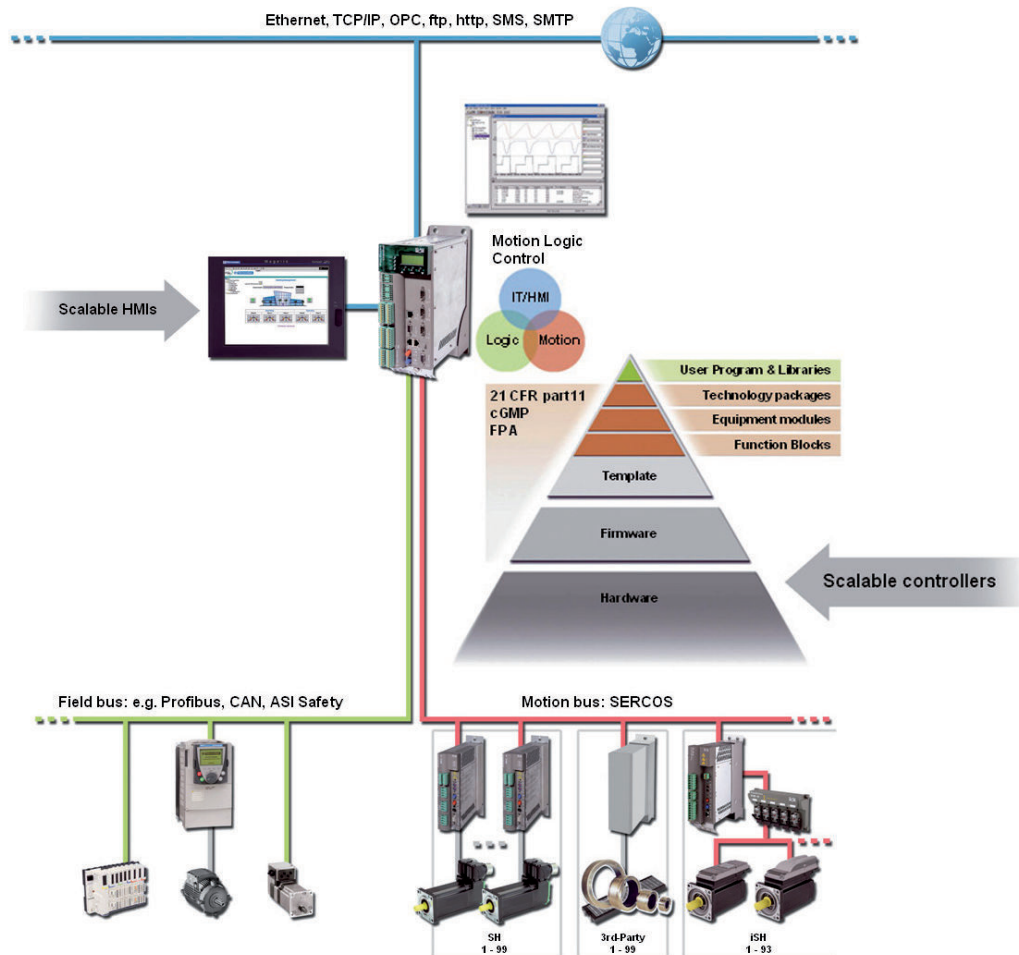


Figure 3-1: PacDrive System overview

#### 3.1 PacDrive Controller Family



The PacDrive Controller, microprocessor-based control hardware with the VxWorks real-time operating system, centrally implements the PLC and motion functions. A PacDrive Controller synchronizes, coordinates, and creates the motion functions for maximum

- 2 drives for the PacDrive Controller C200 A2
- 8 drives for the PacDrive Controller C200
- 8 drives for the PacDrive Controller C400 A8
- 16 drives for the PacDrive Controller C400
- 99 drives for the PacDrive Controller C600

of a food and packaging machine.

## 3.2 PacDrive MC-4 Servo Amplifier



The digital Servo Amplifier MC-4 features compact, closed, wall-mountable construction as well as state of the art technology. For the innovative MC-4, the power supply unit, the power stage and the software servo regulator for an axis are housed in a space-saving housing. Because it communicates with the PacDrive Controller exclusively via fiber optic cable, it is also suitable for peripheral layout. It does not require a user program, processes single or multi-turn encoders, and configures itself using the electronic nameplate in the SH motor.

The highlights:

- wide voltage range
- Integrated power supply unit
- Max. 34.5/69 kVA output
- Automatic motor detection
- Minimal design
- Safety input inverter enable (according to EN ISO 13849-1)
- 250 % overload
- Integrated sercos interface

## 3.3 PacDrive Servo Motor



The servo motors meet rigorous requirements of dynamics and precision. Five flange sizes with different torque outputs offer the right drive solution for application.

**high dynamic AC servo motors** Because of the low inertia and a high overload capability, the motor SH3 fulfills the requirements concerning the accuracy, dynamics and efficiency.

The SH3 motors are available in five different flange sizes:

- SH3-055
- SH3-070
- SH3-100
- SH3-140
- SH3-205

The highlights:

- Developed for high dynamics and precision
- Single tooth winding
- compact size
- high power density
- Low internal moment of inertia
- high overload capability
- Low detent torque

### 3.4 Type code

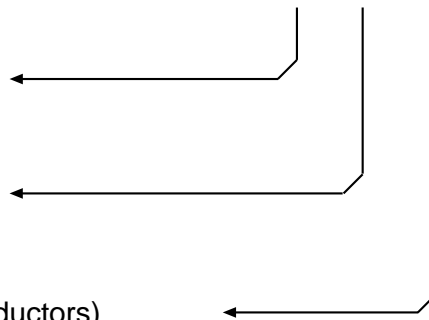
#### Product ID code

**MC-4 / 11 / 10 / 400**

**HW-Variant**  
11

**Rated current**  
z.B. 03 = 3 A

**Rated Voltage**  
230 = 230 V  
400 = 400 V (3 external conductors)



### 3.5 Nameplate descriptions

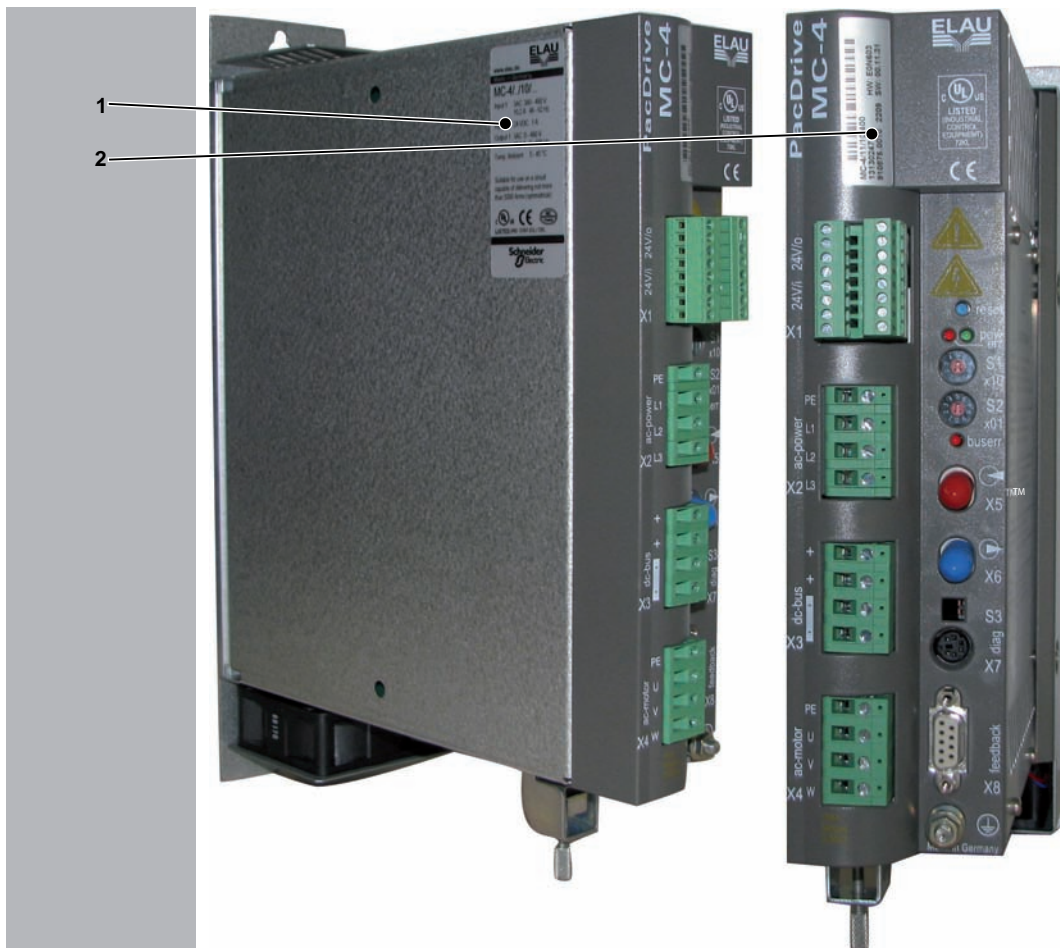


Figure 3-2: Nameplates on the PacDrive MC-4

1	Technical nameplate
2	Logistic nameplate



Figure 3-3: Logistic nameplate of a PacDrive MC-4

Label	Meaning
MC-4	Device type, see type code
13130247	Item no.
897773.0010 4808	Serial number
HW	Hardware version
SW	Software version

Table 3-1: Explanation of the nameplate

**To execute a firmware update, proceed as follows:**

- For MC-4 with bootloader version  $\geq 3.30$ , the firmware must be updated using the sercos Firmware Assistant V2.1 or higher.



The sercos Firmware Assistant from V2.1 is part of the "EPAS-4 Automation Tool-kit" or the "PacDrive Service CD".

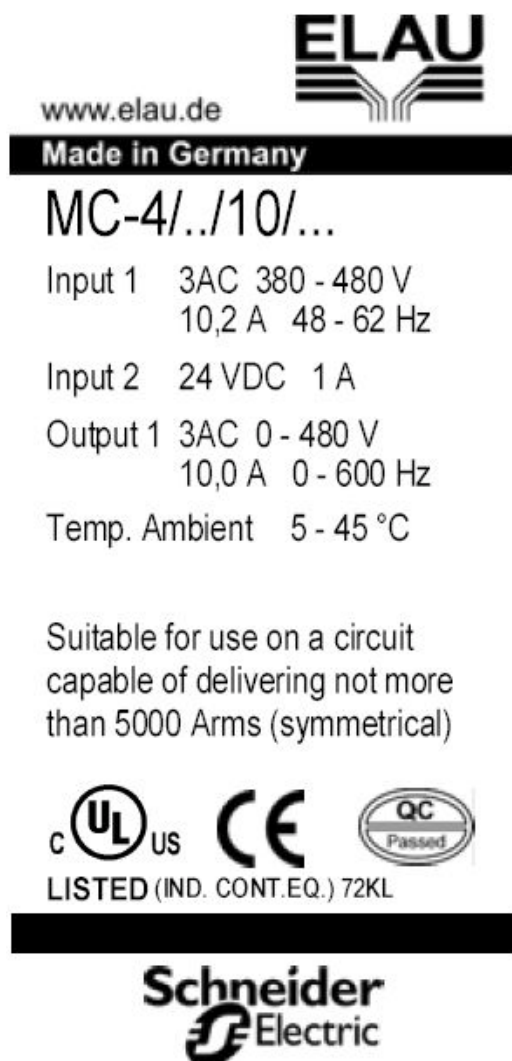


Figure 3-4: Technical nameplate of a PacDrive MC-4

Label	Meaning
MC-4	Device type, see type code
Input 1	Rated voltage and rated current of the power supply
Input 2	Rated voltage and rated current of the electronics
Output 1	Rated voltage and rated current of the power supply
Ambient temp.	Permitted ambient temperature
CE	CE mark
cULus (symbol)	UL certification for the US and Canada

Table 3-2: Explanation of the nameplate

## 4 Indicators and control elements

The PacDrive System supports the user by means of its diagnostic system which contains a powerful message logger in which additional diagnostic information is recorded

### How to use the diagnostic system:

- ▶ Read out diagnostic messages using the EPAS-4 Automation Toolkit or PD Diagnostics.
- ▶ If applicable, read out diagnostic messages on the control panel of the machine.
- ▶ Then contact the machine manufacturer.



Detailed information on diagnostic is available in the Online Help of the EPAS-4 Automation Toolkit or the PD Diagnostics tool.

### 4.1 Example of a diagnostic message

The diagnostic message 121 "Braking resistor temperature too high" is displayed.

Meaning of diagnostic message:

- Class 2 error
- Diagnostic code 121

The meaning of the diagnostic code is explained more thoroughly in the online help section of the EPAS-4 Automation Toolkit.

#### 121 Braking resistor Temperature Too High

Diagnostic class (Standard): 2

Reaction: B

The braking resistor is overloaded.

- The drive sizing is incorrect.
- ▶ Check drive sizing.
- Potential hardware error detected: The braking resistor or triggering is not operating properly.
- ▶ Contact the Schneider Electric customer service.

## 4.2 Displays and operating elements on the MC-4 servo amplifier

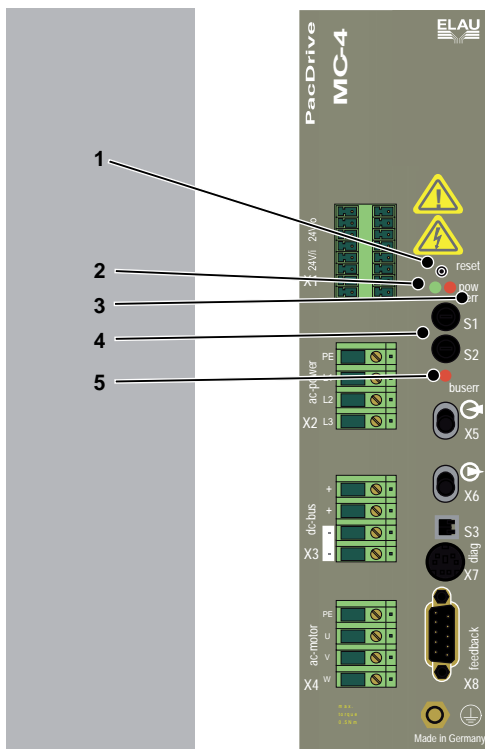


Figure 4-1: Diagnosis LEDs of the MC-4 servo amplifier

1	reset button
2	pow LED (control voltage display)
3	err LED (error display)
4	S1/S2 (Address setting for the sercos bus)
5	bus err LED (sercos bus error display)

### 4.2.1 pow LED



State	Meaning
OFF	The control voltage (24 Vdc) is missing or too low.
ON (green)	Normal operation

Table 4-1: pow LED (control voltage display)

### 4.2.2 err LED



State	Meaning
OFF	Normal operation
slow flashing (1/4 Hz) (red) from V00.20xx	sercos error
slow flashing (1/2 Hz) (red) from V00.16xx	sercos error
quick flashing (2Hz) (red)	A potential general error has been detected.
ON (red)	A non repairable error has been detected.

Table 4-2: err LED (error display)

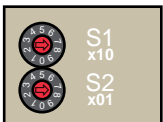
### 4.2.3 bus err LED



State	Meaning
OFF	Normal operation
ON / flashing (red)	Detected communication error. <b>Possible Causes:</b> <ul style="list-style-type: none"> <li>Fiber-optic connection problem</li> <li>The transmitting power is too low or too high</li> <li>Broken cable</li> </ul>

Table 4-3: bus err LED (sercos bus error display)

### 4.2.4 S1/S2 Rotary switch for sercos address



Switch	Meaning
S1	Tens position of the sercos address
S2	Digits position of the sercos address

Table 4-4: S1/S2 address setting with rotary switch

### 4.2.5 S3 switch



- DIL switch S3 at the front plate for setting the transmitter intensity of the fibre-optic light source.

### 4.2.6 reset button



- Press the reset button to restart the servo amplifier.

## 4.3 Displays and operating elements on the BM-4 Braking resistor Module

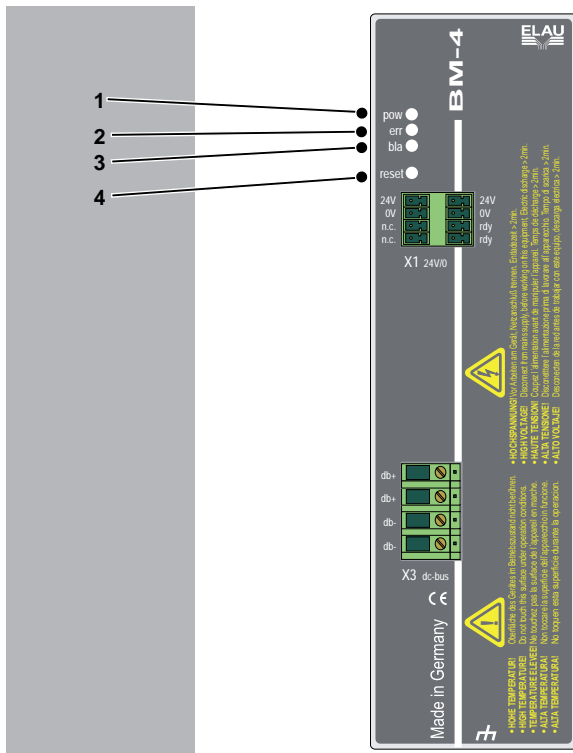


Figure 4-2: Diagnostic LEDs of the BM-4 Braking resistor Module

1	pow LED (control voltage display)
2	err LED (error display)
3	bla LED (braking resistor active)
4	reset button

### 4.3.1 pow LED



The pow LED indicates the state of the control voltage.

State	Meaning
OFF	The control voltage (24 Vdc) is missing or too low.
ON	Normal operation; control voltage in normal range

Table 4-5: pow LED (control voltage display)

### 4.3.2 err LED



The err LED indicates errors.

State	Meaning
OFF	Normal operation, no error detected
Flashes slowly (ON: 500 ms / OFF: 2000 ms)	Braking resistor I <sup>2</sup> t at the limit
Flashes fast (ON: 500 ms / OFF: 500 ms)	<ul style="list-style-type: none"> <li>- Intermediate circuit voltage too high</li> <li>- supply voltage too low</li> <li>- Temperature too high (no reset necessary; device is ready to operate again after cooling)</li> </ul>
ON	Braking resistor error detected

Table 4-6: err LED (error display)

### 4.3.3 bla LED



State	Meaning
OFF	PacDrive BM-4 not active
ON	PacDrive BM-4 active

Table 4-7: bla LED

### 4.3.4 reset button



**Reset button**

Pressing the "reset" button only restarts the MC-4. Any other PacDrive Controllers that may be connected have their own reset button.

## 5 Installation and maintenance

For warranty reasons, we recommend that you employ Schneider Electric personnel for initial start-up. The Schneider Electric personnel

- will check the equipment,
  - determine the optimal configuration
  - and instruct the operating staff.
- Proceed with care during the following steps and take all precautions described in order to help to avoid the following points:
- Injuries and material damage
  - Incorrect installation and programming of components
  - the incorrect operation of components
  - The use of non-authorized cables or modified components

### 5.1 Commissioning

#### DANGER

##### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Operate electrical components only with a connected protective conductor.
- After the installation, verify the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the unit is switched on.
- Provide protection against indirect contact (EN 50178).
- Disconnect/plug in Plug-in connectors of the cables and plug-in terminals on the device only when the system is disconnected from the power supply.
- Isolate the unused conductors on both ends of the motor cable because AC voltages in the motor cable can couple to unused conductors.

**Failure to follow these instructions will result in death or serious injury.**

#### 5.1.1 Preparing commissioning

*ESD protection*

- Check safety circuits for proper function, if applicable.
- Observe the following instructions for ESD protection in order to avoid any damage due to electrostatic discharge:

#### NOTICE

##### ELECTROSTATIC DISCHARGE

- Do not touch any of the electrical connections.
- Prevent electrostatic charges; e.g., by wearing appropriate clothing.
- Remove existing static charge by touching a grounded, metallic surface, like for example, a grounded housing.

**Failure to follow these instructions can result in equipment damage.**

**Unpacking** How to unpack the device:

- ▶ Remove packaging.
- ▶ Dispose of the packaging material in accordance with the relevant local regulations.

**Verifying** How to check the device:

- ▶ Verify that the delivery is complete.
- ▶ Verify if the device is in working condition.

 <b>WARNING</b>
<p><b>DAMAGED OR MODIFIED DRIVE SYSTEMS</b></p> <ul style="list-style-type: none"> <li>Do not mount or commission damaged drive systems.</li> <li>Do not modify the drive systems.</li> <li>Send back inoperative devices.</li> </ul> <p><b>Failure to follow these instructions can result in death or serious injury.</b></p>



- ▶ Check data against type plates.
- ▶ Observe requirements for the installation location.
- ▶ Observe requirements for the degree of protection and the EMC rules.

## 5.1.2

**Cabling of the servo amplifier**

 <b>DANGER</b>
<p><b>HAZARD OF ELECTRIC SHOCK CAUSED BY HIGH TOUCH VOLTAGE</b></p> <ul style="list-style-type: none"> <li>Connect devices as of 3.5 mA AC or more via a fixed connection with the power supply network.</li> <li>In addition, implement one of the measures according to DIN EN 50178, in order to provide the required protection against electrical shock by indirect contact.</li> </ul> <p><b>Failure to follow these instructions will result in death or serious injury.</b></p>

**Grounding**

- ▶ Connect devices, beginning with the ground conductor.
- ▶ Check if the terminals are fastened securely and the necessary cable cross sections are correct.
- ▶ Use the ring cable lug for M5 ( $d = 5.3 \text{ mm}^2 / 0.21 \text{ in.}$ ) to connect MC-4 1.5-22 A and BM-4 (cross section  $10 \text{ mm}^2 / 0.39 \text{ in.}$ ) with the ground bolt.
- ▶ Use the ring cable lug for M6 ( $d = 6.4 \text{ mm}^2 / 0.25 \text{ in.}$ ) to connect MC-4 50 A (cross section  $5.3 \text{ mm}^2 / 0.21 \text{ in.}$ ) with the ground bolt.
- ▶ Check that shielding is completely correct.
- ▶ Eliminate the possibility of short circuits and interruptions.
- ▶ Check the continuity of the protective conductor system.
- ▶ Use an appropriate tool to assign an unambiguous, two-digit sercos address (00 ... 99) for the sercos slave in the loop on the front of the MC-4 (S1/S2).

- Set the transmitter intensity of the fiber-optic light source on the PacDrive by means of the DIL switch (S3) on the front plate of the MC-4 according to the cable length to the next participant.





Cable length [m] / [ft]	Curr_P_Gain	switch position
0.1 ... 1 / 0.33 ... 3.28	1	
1.1 ... 20 / 3.61 ... 65.62	2	
20.1 ... 40 / 65.94 ... 131.32	3	
40.1 ... 50 / 131.56 ... 164.04	4	

Table 5-1: S3 fiber-optic cable intensity with respective cable length

- Protecting**
- According to UL508C, an overtemperature detection of the motor by the drive module is not intended.  
Thus, connect the temperature sensor of the motor to the connection X1 of the MC-4 servo amplifier.
- Control voltage**
- Check the power supply voltage and control voltage.
  - Connect external 24 Vdc control voltage.
  - Check the control voltage ( $\geq 24$  Vdc) so that the fans work with the necessary power until the specified ambient temperatures are reached.

## NOTICE

### OVERHEATING BECAUSE OF TOO HIGH AMBIENT TEMPERATURES

- For ambient temperatures  $> 45$  °C /  $113$  °F, ensure that there is additional recirculation of the cooling air in the control cabinet (external fan).

**Failure to follow these instructions can result in equipment damage.**



For further information on this (see 6.1 Ambient conditions).

- ✓ PacDrive Servo Amplifier initializes and the LEDs show the following condition:
  - pow: ON
  - err: FLASHES
  - buserr: ON



- Check thermal contact of motor or PTC (posistor sensor).  
For more information see the operating instructions for the motors connected.

### 5.1.3 Completion of commissioning

- ▶ Check safety functions such as the EMERGENCY STOP switch.
- ▶ Ensure that the supply voltage matches the rated voltage of the servo amplifier.

## NOTICE

### SUPPLY VOLTAGE TOO HIGH

- Only connect mains voltage if the supply voltage matches the rated voltage of the servo amplifier.

**Failure to follow these instructions can result in equipment damage.**

#### This is how to connect the mains voltage:

- ▶ Activate EMERGENCY STOP switch.
- ▶ Check with a suitable measuring instrument that it is off-circuit.
- ▶ Connect mains voltage.
- ▶ Check status displays for proper function.
- ▶ Release EMERGENCY STOP switch and activate ON switch.

#### This is how to move the axis:

- ▶ When moving the axis for the first time, use a reliable, tested application program which covers the following motions / functions: checking
  - the correct direction of rotation of the axis,
  - the correct setting of the limit switches and
  - the braking distance in both directions.



From the electronic nameplate of the motor, the servo amplifier automatically determines the motor and the corresponding motor data when the 24 Vdc control voltage is connected.

#### This is how to transmit the configuration and the program:

- ▶ Transfer project with the EPAS-4 automation toolkit to the PacDrive controller.

## ! WARNING

### HAZARDOUS MOVEMENTS

- Ensure that no persons are in the danger zone.
- Remove all tools, loose parts and other working aids not belonging to the axis/machine/system from the area of movement.
- Engaged the engine only after the function test has been successfully performed.

**Failure to follow these instructions can result in death or serious injury.**

### 5.1.4 Performing the function test

- ▶ Verify devices and wiring again.
- ▶ If you haven't already done so, connect the mains voltage.
- ▶ Carry out function test using a checklist for axis/machine/system functions.
- ▶ Resume system operation according to the operating manual (from the machine manufacturer and servo amplifier).

## 5.2 Electromagnetic compatibility, EMC

### WARNING

#### RISK OF ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

- Use proper EMC shielding techniques to help prevent unexpected device operation.

**Failure to follow these instructions can result in death or serious injury.**

**Enclosure layout** The prerequisite for compliance with the specified limit values is an EMC compatible layout. Comply with the following specifications:

EMC measures	Target
Use galvanized or chromium-plated sub plates, bond metallic parts across large surface areas, remove paint layer from contact surfaces.	Good conductivity by surface area contact
Ground enclosure, door and sub plates by using grounding strips or grounding cables with a cross-section of 10 mm <sup>2</sup> (AWG 6).	Reduce emission.
Supplement switch devices such as contactors, relays or magnetic valves with interference suppression combinations or spark suppressor elements (e.g. diodes, varistors, RC elements).	Reduces mutual interference
Fit power and control components separately.	Reduces mutual interference

**Shielded cables**

EMC measures	Target
Place cable shields on the surface, use cable clamps and grounding strips.	Reduce emission.
At the control cabinet outfeed, connect the shield of all shielded cables via cable clamps to the sub plate across large surface areas.	Reduce emission.
Ground shields of digital signal cables on both sides across large surface areas or through conducting connector housings.	Reduce interference action on signal cables, reduce emissions.
Ground shield of analog signal cables directly on the device (signal input), insulate the shield at the other cable end or ground the same through a capacitor, such as 10 nF.	Reduce grounding loops by low frequency interferences.
Use only shielded motor supply cables with a copper braid and at least 85% cover, ground shield on both sides across a large surface area.	Specifically discharge interference currents, reduce emissions.

**Cable routing**

EMC measures	Target
Do not route fieldbus cables and signal cables together with cabling for direct and alternating voltages above 60 V in the same cable duct (fieldbus cables can be routed together with signal cables and analog cables in the same duct). Recommendation: Routing in separated cable cuts with a distance of at least 20 cm (7.84 in.).	Reduces mutual interference
Keep the cables as short as possible. Do not install any unnecessary cable loops, short cable routing from a central grounding point in the control cabinet to the external grounding connection.	Reduce capacitive and inductive interference couplings.
Insert a potential equalization for: <ul style="list-style-type: none"> <li>• large surface installation</li> <li>• different voltage infeeds</li> <li>• networking across buildings</li> </ul>	Reduce current on cable shield, reduce emissions.
Use fine wire potential equalization conductor.	Discharging of high frequency interference currents.
If motor and machine are not connected in a conducting fashion, e.g. due to an insulated flange or a connection not across a full surface, the motor must be grounded via a grounding cable > 10 mm <sup>2</sup> (AWG 6) or a grounding strip.	Reduce emissions, increase interference resistance.
Use twisted pair for 24 Vdc signals.	Reduce interference action on signal cables, reduce emissions.

**Voltage supply**

EMC measures	Target
Operate product on mains with a grounded neutral.	Enable the effect of the integrated mains filter.
Protection circuit if there is a risk of overvoltage.	Reduce risk of damage due to overvoltages.

**Motor and encoder cables**

From an EMC point of view, motor supply cables and encoder cables are particularly critical. Only use pre-configured cables, or cables with the prescribed properties, and comply with the following EMC measures.

EMC measures	Target
Do not install switching elements in motor cables or encoder cables.	Reduces interference.
Route motor cable with a distance of at least 20 cm (7.84 in.) to the signal cables or insert shield plates between the motor supply cable and the signal cable.	Reduces mutual interference
For long cabling, use potential equalization cables.	Reduce current on cable shield.
Route motor supply cables and encoder cables without any separation point. <sup>1)</sup>	Reduces emission.
<sup>1)</sup> If a cable must be cut through for installation purposes, the cables must be connected at the point of separation by means of screen connections and metal housing.	

**Additional measures for improving the EMC** Depending on the respective application, the following measures may lead to a EMC compatible layout:

EMC measures	Target
Upstream connection of line chokes	Reduction of the harmonic network oscillations, extension of the service life of the product.
Upstream connection of external integrated mains filters	Improvement of the EMC limit values.
Special EMC-suitable layout, e.g. within an enclosed control cabinet complete with 15 dB attenuation of the interferences emitted	Improvement of the EMC limit values.

## 5.3 Maintenance, repair, cleaning

- ▶ Observe the following instructions before carrying out maintenance on Device:

### How to de-energize the system:

- ▶ Set main switch to "OFF Position".
- ▶ Prevent main switch from being switched back on.
- ▶ After switching off, wait 15 minutes so that the DC bus can discharge.

## DANGER

### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside equipment.

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Check the DC bus with a measuring instrument to make sure that it is de-energized (< 42,4 Vdc).

### Help in case of an unforeseen issue:

- ✗ DC bus does not discharge completely.
  - ▶ Do not repair or operate component.
  - ▶ Contact the Schneider Electric Customer Service.

### 5.3.1 Repair

**In case of repair proceed as follows :**

- ▶ Contact the Schneider Electric Customer Service.
- ▶ Observe the following instructions for ESD protection in order to avoid any damage due to electrostatic discharge:

<b>NOTICE</b>
<p><b>ELECTROSTATIC DISCHARGE</b></p> <ul style="list-style-type: none"> <li>• Do not touch any of the electrical connections.</li> <li>• Prevent electrostatic charges; e.g., by wearing appropriate clothing.</li> <li>• Remove existing static charge by touching a grounded, metallic surface, like for example, a grounded housing.</li> </ul> <p><b>Failure to follow these instructions can result in equipment damage.</b></p>

### 5.3.2 Cleaning

**How to clean the PacDrive Servo Amplifier:**

- ▶ De-energize PacDrive Servo Amplifier.
- ▶ Remove PacDrive Servo Amplifier.



It is not possible to test in advance all materials of the Schneider Electric product range that are used at the moment and in the future for compatibility with the cleaning agents available on the market.

<b>NOTICE</b>
<p><b>DAMAGE CAUSED BY CLEANING AGENTS</b></p> <ul style="list-style-type: none"> <li>• Before using a cleaning agent, carry out a compatibility test in relation to the cleaning agent and the component affected.</li> <li>• Do not use alkaline detergent as the polycarbonate can lose its stability if you come into contact with it.</li> <li>• Do not use any chloride-containing cleaning agents as these corrode the stainless steel and in particular the welds, and thus reduce the strength of the mechanics.</li> </ul> <p><b>Failure to follow these instructions can result in equipment damage.</b></p>



For more information on the material properties of your component (see 6.3 Mechanical and electrical data).

- ▶ Then blow out PacDrive Servo Amplifier with dry pressurized air (max. 1 bar / 14.5 PSI).

## 5.4 Spare part inventory

- ▶ Keep a stock of the most important components to make certain the equipment is functioning and ready for operation at all times.
- ▶ Only exchange devices with the same hardware configuration.
- ▶ Indicate the following information on the spare part order:

Item name:	e.g. PacDrive MC-4/11/10/400
Item no.:	e.g. 13130247
Hardware code:	e.g. HW: D0H503
Software version:	e.g. SW: 00.12.31



This information can be found on the nameplate.

## 5.5 Device-, parts- or cable exchange

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Operate electrical components only with a connected protective conductor.
- After the installation, verify the fixed connection of the protective conductor to all electrical devices to ensure that connection complies with the connection diagram.
- Before enabling the device, safely cover the live components to prevent contact.
- Do not touch the electrical connection points of the components when the unit is switched on.
- Provide protection against indirect contact (EN 50178).
- Disconnect/plug in Plug-in connectors of the cables and plug-in terminals on the device only when the system is disconnected from the power supply.
- Isolate the unused conductors on both ends of the motor cable because AC voltages in the motor cable can couple to unused conductors.

**Failure to follow these instructions will result in death or serious injury.**

### 5.5.1 Device replacement

### CAUTION

#### HOT SURFACES OVER 70°C / 158°F

- Wait until the surface temperature has cooled to allow safe contact.
- Wear protective gloves.
- Attach protective cover or touch guard

**Failure to follow these instructions can result in injury.**

**How to de-energize the system:**

- ▶ Set main switch to "OFF Position".
- ▶ Prevent main switch from being switched back on.
- ▶ After switching off, wait 15 minutes so that the DC bus can discharge.

## ! DANGER

### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside equipment.

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Check the DC bus with a measuring instrument to make sure that it is de-energized ( $< 42,4 \text{ Vdc}$ ).

**Help in case of an unforeseen issue:**

- ✕ DC bus does not discharge completely.
  - ▶ Do not repair or operate component.
  - ▶ Contact the Schneider Electric Customer Service.

## NOTICE

### IMPROPER REPLACEMENT / COMMISSIONING

- Do not open Servo Drives for commissioning or replacement.

**Failure to follow these instructions can result in equipment damage.**

- ▶ When exchanging the of the servo amplifier, in addition to the following instructions, the specifications of the manufacturer have to be observed also.
- ▶ Disconnect cables of the MC-4.
- ▶ Remove the screws from the top and bottom of the housing.
- ▶ Remove the MC-4 and exchange the complete unit.
- ▶ Install New MC-4 and tighten screws.
- ▶ Connect the MC-4 according to the circuit diagram of the machine.

## ! DANGER

### INCORRECT ASSIGNMENT OF NEW CABLES

- If you are not using prefabricated cables, make certain that the configuration of the new cables matches the connection diagram of the machine manufacturer.

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Following replacement of the PacDrive Servo Amplifier proceed as for the initial start-up.

## 5.5.2 Cable replacement

### How to de-energize the system:

- ▶ Set main switch to "OFF Position".
- ▶ Prevent main switch from being switched back on.
- ▶ After switching off, wait 15 minutes so that the DC bus can discharge.

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside equipment.

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Check the DC bus with a measuring instrument to make sure that it is de-energized ( $< 42,4 \text{ Vdc}$ ).

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#### Help in case of an unforeseen issue:

- ✗ DC bus does not discharge completely.
    - ▶ Do not repair or operate component.
    - ▶ Contact the Schneider Electric Customer Service.
- 

### Proceed as follows for cable replacement:

### DANGER

#### LOSS OF THE INVERTER ENABLE FUNCTION

- Test the proper functioning of the Inverter Enable after every device replacement and every change of the wiring.

**Failure to follow these instructions will result in death or serious injury.**

- ▶ Exchange the cable according to the machine manufacturer's specifications.

## 6 Technical data

### 6.1 Ambient conditions

Procedure	Parameter	Value	Basis
Operation	Class	3K3	IEC/EN 60721-3-3
	Degree of protection housing	IP 20	
	Degree of protection installation site	IP 54, if safety circuit with InverterEnable is used	
	Isolation class	Pollution degree 2	
	Ambient temperature	+5 °C ... +45 °C / 41 °F ... 113°F	
	Ambient temperature in the case of power reduction	+5 °C ... +55 °C / 41 °F ... 131 °F (-2% per K for $I_{NC}$ and $I_{SC}$ )	
	Condensation	Prohibited	
	Icing	Prohibited	
	other liquid	Prohibited	
	Relative humidity	5% ... 85%	
Transport	Class	2K3	IEC/EN 60721-3-2
	Isolation class	Pollution degree 2	
	Ambient temperature	-25 °C ... +70 °C / -13 °F ... +158°F	
	Condensation	Prohibited	
	Icing	Prohibited	
	other liquid	Prohibited	
	Relative humidity	5% ... 85%	
Long-term storage in transport packaging	Class	1K4	IEC/EN 60721-3-1
	Isolation class	Pollution degree 2	
	Ambient temperature	-25 °C ... +55 °C / -13 °F ... 131°F	
	Condensation	Prohibited	
	Icing	Prohibited	
	other liquid	Prohibited	
	Relative humidity	5% ... 85%	

Table 6-1: Ambient conditions for control cabinet devices

### 6.2 Standards and regulations

Declarations	MC-4 1.5 A / 3 A / 5 A / 10 A / 22 A	CE
	MC-4 50 A	CE
	BM-4	CE
Certifications	MC-4 1.5 A / 3 A / 5 A / 10 A / 22 A	cULus
	BM-4	cULus

Table 6-2: Declarations and certifications MC-4 Servo amplifier

## 6.3 Mechanical and electrical data

Firmware version	supported rated speed of the connected motor
≤ V00.22.XX	≤ 6000 rpm
> V00.22.XX	≤ 12,000 rpm

### 6.3.1 MC-4 / 1.5 A Servo Amplifier

Category	Parameter	Value
Product configuration	Item name	MC-4 / 11 / 01 / 400 V
	Order number	13 13 02 44
Power supply	Rated supply voltage	Min. 3 380 Vac (-10 %) Max. 3 480 Vac (+10 %)
	Supply frequency	48 ... 62 Hz
	Control voltage / -current	24 Vdc (-15 % / +25 %) / 1 A
DC circuit	DC_Bus Voltage	530 ... 680 Vdc
	Capacitance	165 µF
	U <sub>Bleeder</sub> ON	820 Vdc
	U <sub>Bleeder</sub> OFF	800 Vdc
	Overvoltage	860 Vdc
	Braking resistor resistor	120 ohm
	Braking resistor-continuous power	50 W
	Braking resistor-peak power	5 kW
Motor connection	Rated current 8 kHz (I <sub>NC</sub> )	1.5 Aeff
	Peak current 1 s (I <sub>SC</sub> )	3.75 Aeff
	Rated power	1.1 kVA
Power loss	Electronics power supply	approx. 12 W
	Braking resistor (internal)	0 ... 50 W (depending on the application)
	Power unit	approx. 15 W / A
Inputs	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
Outputs	Relay-outputs	20 ... 30 Vdc / 2 A
Dimensions	Dimensions packaging	DxWxH (mm) / (in.): 320x100x400 / 12.6x3.9x15.7
Weight	Weight (with packaging)	3.1 kg (4.0 kg) / 6.8 lbs (8.8 lbs)
Ventilation		Natural convection
Overvoltage category		K III, T2 (DIN VDE 0110)
Overvoltage protection		Class 1 (DIN VDE 0160)
Radio interference level		Class A EN 55011 / EN 61800 - 3

Table 6-3: Technical Data MC-4 / 1.5 A Servo Amplifier



Only use the PacDrive MC-4 / 1.5 A from firmware version V00.22.XX and only in connection with SH Motor 055. If you are using a motor with a deviation in performance, then the diagnostic message „138 impermissible motor“ will appear.

### 6.3.2 MC-4 / 3 A Servo Amplifier

Category	Parameter	Value
<b>Product configuration</b>	Item name	MC-4 / 11 / 03 / 400 V
	Order number	13 13 02 45
<b>Power supply</b>	Rated supply voltage	Min. 3 380 Vac (-10 %) Max. 3 480 Vac (+10 %)
	Supply frequency	48 ... 62 Hz
	Control voltage / -current	24 Vdc (-15 % / +25 %) / 1 A
<b>DC circuit</b>	DC_Bus Voltage	530 ... 680 Vdc
	Capacitance	165 $\mu$ F
	U <sub>Bleeder</sub> ON	820 Vdc
	U <sub>Bleeder</sub> OFF	800 Vdc
	Overvoltage	860 Vdc
	Braking resistor resistor	120 ohm
	Braking resistor-continuous power	50 W
	Braking resistor-peak power	5 kW
<b>Motor connection</b>	Rated current 8 kHz (I <sub>NC</sub> )	3 A <sub>eff</sub>
	Peak current 1 s (I <sub>SC</sub> )	7.5 A <sub>eff</sub>
	Rated power	2.1 kVA
<b>Power loss</b>	Electronics power supply	approx. 12 W
	Braking resistor (internal)	0 ... 50 W (depending on the application)
	Power unit	approx. 15 W / A
<b>Inputs</b>	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
<b>Outputs</b>	Relay-outputs	20 ... 30 Vdc / 2 A
<b>Dimensions</b>	Dimensions packaging	DxWxH (mm) / (in.): 320x100x400 / 12.6x3.9x15.7
<b>Weight</b>	Weight (with packaging)	3.1 kg (4.0 kg) / 6.8 lbs (8.8 lbs)
<b>Ventilation</b>		Natural convection
<b>Overvoltage category</b>		K III, T2 (DIN VDE 0110)
<b>Overvoltage protection</b>		Class 1 (DIN VDE 0160)
<b>Radio interference level</b>		Class A EN 55011 / EN 61800 - 3

Table 6-4: Technical Data MC-4 / 03 A Servo Amplifier

### 6.3.3 MC-4 / 5 A Servo Amplifier

Category	Parameter	Value
<b>Product configuration</b>	Item name	MC-4 / 11 / 05 / 230 V
	Order number	13 13 02 46
<b>Power supply</b>	Rated supply voltage	Min. 3 / 1 220 Vac (-10 %) Max. 3 / 1 240 Vac (+10 %)
	Supply frequency	48 ... 62 Hz
	Control voltage / -current	24 Vdc (-15 % / +25 %) / 1 A
<b>DC circuit</b>	DC_Bus Voltage	260 ... 370 Vdc
	Capacitance	660 µF
	U <sub>Bleeder</sub> ON	410 Vdc
	U <sub>Bleeder</sub> OFF	400 Vdc
	Overvoltage	430 Vdc
	Braking resistor resistor	33 ohm
	Braking resistor-continuous power	50 W
	Braking resistor-peak power	5 kW
<b>Motor connection</b>	Rated current 8 kHz	5 A <sub>eff</sub>
	Peak current 1 s	12.5 A <sub>eff</sub>
	Rated power	1.9 kVA
<b>Power loss</b>	Electronics power supply	approx. 12 W
	Braking resistor (internal)	0 ... 50 W (depending on the application)
	Power unit	approx. 15 W / A
<b>Inputs</b>	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
<b>Outputs</b>	Relay-outputs	20 ... 30 Vdc / 2 A
<b>Dimensions</b>	Dimensions packaging	DxWxH (mm) / (in.): 320x100x400 / 12.6x3.9x15.7
<b>Weight</b>	Weight (with packaging)	3.1 kg (4.0 kg) / 6.8 lbs (8.8 lbs)
<b>Ventilation</b>		Natural convection
<b>Overvoltage category</b>		K III, T2 (DIN VDE 0110)
<b>Overvoltage protection</b>		Class 1 (DIN VDE 0160)
<b>Radio interference level</b>		Class A EN 55011 / EN 61800 - 3

Table 6-5: Technical Data MC-4 / 05 A Servo Amplifier

### 6.3.4 MC-4 / 10 A Servo Amplifier

Category	Parameter	Value
<b>Product configuration</b>	Item name	MC-4 / 11 / 10 / 400 V
	Order number	13 13 02 47
<b>Power supply</b>	Rated supply voltage	Min. 3 380 Vac (-10 %) Max. 3 480 Vac (+10 %)
	Supply frequency	48 ... 62 Hz
	Control voltage / -current	24 Vdc (-15 % / +25 %) / 1 A
<b>DC circuit</b>	DC_Bus Voltage	530 ... 680 Vdc
	Capacitance	330 $\mu$ F
	U <sub>Bleeder</sub> ON	820 Vdc
	U <sub>Bleeder</sub> OFF	800 Vdc
	Overvoltage	860 Vdc
	Braking resistor resistor	60 ohm
	Braking resistor-continuous power	100 W
	Braking resistor-peak power	10 kW
<b>Motor connection</b>	Rated current 8 kHz (I <sub>NC</sub> )	10 Aeff
	Peak current 1 s (I <sub>SC</sub> )	25 Aeff
	Rated power	6.9 kVA
<b>Power loss</b>	Electronics power supply	approx. 12 W
	Braking resistor (internal)	0 ... 100 W (depending on the application)
	Power unit	approx. 15 W / A
<b>Inputs</b>	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
<b>Dimensions</b>	Dimensions packaging	DxWxH (mm) / (in.): 320x100x400 / 12.6x3.9x15.7
<b>Weight</b>	Weight (with packaging)	3.1 kg (4.0 kg) / 6.8 lbs (8.8 lbs)
<b>Ventilation</b>	Fan	internal, temperature-controlled, (switching on threshold = 55 °C / 131 °F)
<b>Overvoltage category</b>		K III, T2 (DIN VDE 0110)
<b>Overvoltage protection</b>		Class 1 (DIN VDE 0160)
<b>Radio interference level</b>		Class A EN 55011 / EN 61800 - 3

Table 6-6: Technical Data MC-4 / 10 A Servo Amplifier

### 6.3.5 MC-4 / 22 A Servo Amplifier

Category	Parameter	Value
<b>Product configuration</b>	Item name	MC-4 / 11 / 22 / 400 V
	Order number	13 13 02 54
<b>Power supply</b>	Rated supply voltage	Min. 3 380 Vac (-10 %) Max. 3 480 Vac (+10 %)
	Supply frequency ( $I_{NC}$ )	48 ... 62 Hz
	Control voltage / -current ( $I_{SC}$ )	24 Vdc (-15 % / +25 %) / 1 A
<b>DC circuit</b>	DC_Bus Voltage	530 Vdc ... 680 Vdc
	Capacitance	705 $\mu$ F
	$U_{Bleeder}$ ON	820 Vdc
	$U_{Bleeder}$ OFF	800 Vdc
	Overvoltage	860 Vdc
	Braking resistor resistor	42 ohm
	Braking resistor-continuous power	150 W
	Braking resistor-peak power	15 kW
<b>Motor connection</b>	Rated current 8 kHz	22 Aeff
	Peak current 1 s	55 Aeff
	Rated power	15.2 kVA
<b>Power loss</b>	Electronics power supply	approx. 12 W
	Braking resistor (internal)	0 ... 150 W (depending on the application)
	Power unit	approx. 15 W / A
<b>Inputs</b>	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
<b>Outputs</b>	Relay-outputs	20 ... 30 Vdc / 2 A
<b>Dimensions</b>	Dimensions packaging	DxWxH (mm) / (in.): 310x160x400 / 12.2x6.3x15.7
<b>Weight</b>	Weight (with packaging)	6.3 kg (7.0 kg) / 13.9 lbs (15.4 lbs)
<b>Ventilation</b>	Fan	internal, temperature-controlled, (switching on threshold = 55 °C / 131 °F)
<b>Overvoltage category</b>		K III, T2 (DIN VDE 0110)
<b>Overvoltage protection</b>		Class 1 (DIN VDE 0160)
<b>Radio interference level</b>		Class A EN 55011 / EN 61800 - 3

Table 6-7: Technical Data MC-4 / 22 A Servo Amplifier

### 6.3.6 MC-4 / 50 A Servo Amplifier

- Use an external mains filter to comply with EMC directives.

## WARNING

### LOSS OF TECHNICAL SAFETY FUNCTIONS

- Use the PacDrive MC-4 / 50 A only with the original firmware of the delivery condition.
- Only use the PacDrive MC-4 / 50 A with firmware version V00.11.XX or higher.
- If the firmware must be replaced, only use versions  $\geq$  V00.11.XX.

Failure to follow these instructions can result in death or serious injury.

Category	Parameter	Value
Product configuration	Item name	MC-4 / 11 / 50 / 400 V
	Order number	13 13 02 56
Power supply	Rated supply voltage	Min. 3 380 Vac (-10 %) Max. 3 480 Vac (+10 %)
	Supply frequency	48 ... 62 Hz
	Control voltage / -current	24 Vdc (-15 % / +25 %) / 1 A
DC circuit	DC_Bus Voltage	530 Vdc ... 680 Vdc
	Capacitance	1400 $\mu$ F
	U <sub>Bleeder</sub> ON	820 Vdc
	U <sub>Bleeder</sub> OFF	800 Vdc
	Overvoltage	860 Vdc
	Braking resistor resistor	18 ohm
	Braking resistor-continuous power	approx. 600 W at 45 °C / 113 °F ambient temperature
	Braking resistor-peak power	35 kW
Motor connection	Rated current 8 kHz (I <sub>NC</sub> )	50 Aeff
	Peak current 1 s (I <sub>SC</sub> )	125 Aeff
	Rated power	34.6 kVA
Power loss	Electronics power supply	approx. 55 W
	Braking resistor (internal)	0 ... 600 W (depending on the application)
	Power unit	approx. 15 W / A
inputs	Input voltage / -current	20 ... 30 Vdc / 5 mA
	ie-input	20 ... 30 Vdc / 30 mA
	Input filter	[5 ms]
Outputs	Relay-outputs	20 ... 30 Vdc / 2 A
Dimensions	Dimensions packaging	DxWxH (mm) / (in.): 310x350x450 / 12.2x13.8x17.7
Weight	Weight (with packaging)	16.5kg (19.0 kg) / 36.4 lbs (41.9 lbs)
Ventilation	Fan	internal, temperature-controlled, (switching on threshold = 55 °C / 131 °F)
Overvoltage category		K III, T2 (DIN VDE 0110)
Overvoltage protection		Class 1 (DIN VDE 0160)

Category	Parameter	Value
Radio interference level		Class A EN 55011 / EN 61800 - 3

Table 6-8: Technical Data MC-4 / 50 A Servo Amplifier

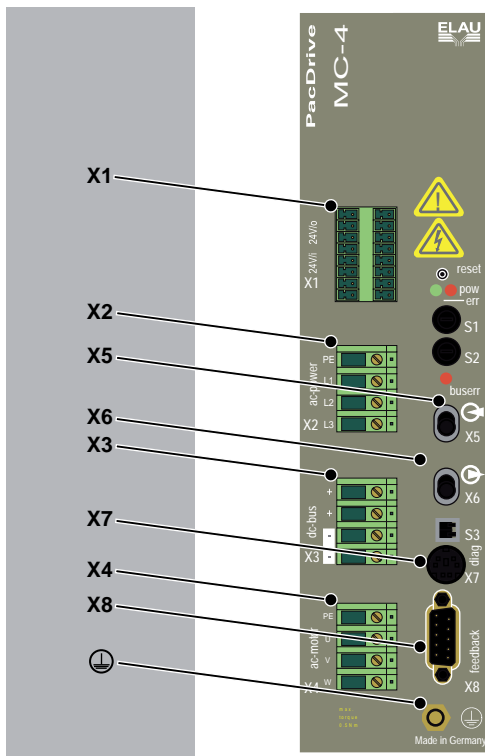
### 6.3.7 BM-4 Braking resistor module

-	Parameter	Value
<b>Product configuration</b>	Item name	Braking resistor module BM-4
	Order number	13 27 00 13
<b>Power supply</b>	Supply voltage	24 Vdc (-15 / +25 %), 0.5 A
<b>Braking resistor thresholds</b>	- $U_{\text{Bleeder}}$ ON	790 ... 820 Vdc in 10 V increments
	- $U_{\text{Bleeder}}$ OFF	20 V below $U_{\text{Bleeder}}$ ON
<b>Power ratings</b>	Resistance	18 ohm
	Permanent power	800 W
	Peak power	45 kW
<b>Outputs</b>	Relay-outputs	20 ... 30 Vdc / 2 A
<b>Dimensions</b>	Dimensions packaging	DxWxH (mm) / (in.): 320x100x400 / 12.6x3.9x15.8
<b>Weight</b>	-	2.5 kg / 5.5 lbs
<b>Overvoltage category</b>	-	K III, T2 (DIN VDE 0110)
<b>Overvoltage protection</b>	-	Class 1 (DIN VDE 0160)
<b>Radio interference level</b>	-	Class A EN 55011 / EN 61800 - 3

Table 6-9: Technical data of the Braking resistor Module BM-4

## 6.4 Electrical connections

### 6.4.1 Connection overview MC-4 Servo Amplifier

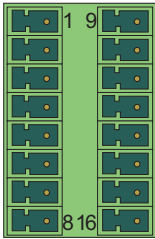


Connection	Meaning	max. terminal cross section [mm²]/ [AWG]		Tightening torque [Nm / lbf in]
X1	Control voltage	1.5	28 - 16	0.2 - 0.25 / 1.77 - 2.21
X2	Mains connection	2.5 (MC-4/ 1.5..10 A)	24 - 12	0.4 - 0.5 / 3.54 - 4.43
		4 (MC-4/ 22 A)	22 - 10	0.5 - 0.6 / 4.43 - 5.31
		16 (MC-4/ 50 A)	20 - 4	2.0 - 2.3 / 17.70 - 20.36
X3	DC circuit	2.5 (MC-4/ 1.5..10 A)	24 - 12	0.4 - 0.5 / 3.54 - 4.43
		4 (MC-4/ 22 A)	22 - 10	0.5 - 0.6 / 4.43 - 5.31
		16 (MC-4/ 50 A)	20 - 4	2.0 - 2.3 / 17.70 - 20.36
X4	Motor connection	2.5 (MC-4/ 1.5..10 A)	24 - 12	0.4 - 0.5 / 3.54 - 4.43
		4 (MC-4/ 22 A)	22 - 10	0.5 - 0.6 / 4.43 - 5.31
		16 (MC-4/ 50 A)	20 - 4	2.0 - 2.3 / 17.70 - 20.36
X5	sercos LWL IN	-	-	0.8 / 7.08
X6	sercos LWL OUT	-	-	0.8 / 7.08
X7	Diagnostics	0.25	-	-
X8	Encoder Connection	0.25	-	-
	Ground conductor connection (flexible)	10 (1.5 A - 22 A)	-	-
		16 (50 A)	-	-
-	Shield guard motor supply cable	For routing motor connection cables with a cross section of maximally 1.5 mm² / 15 AWG.		

Table 6-10: Connection overview MC-4 servo amplifier

## 6.4.2 MC-4 Servo Amplifier / 1.5 A

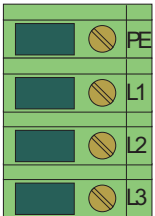
### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	0 V	Supply voltage	
3	iei	Inverter Enable	20 ... 30 Vdc / 30 mA
4	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
5	θ (5)	PTC Motortemp.	-
6	θ (6)	PTC Motortemp.	-
7	bi+	Supply holding brake	+24 Vdc
8	bi-	Supply holding brake	0 Vdc
9	24 V	Bridged with pin 1	-
10	0 V	Bridged with pin 2	-
11	ieo	inverter enable output	20 ... 30 Vdc / 2 A
12	ieo	inverter enable output	20 ... 30 Vdc / 2 A
13	rdy	Ready contact	20 ... 30 Vdc / 2 A
14	rdy	Ready contact	20 ... 30 Vdc / 2 A
15	bo+ (8)	Holding brake connection	+24 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-11: Electrical connections MC-4 (1.5 ... 10 A) / X1

### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	-
2	L1	Phase L1	3 380 ... 480 Vac
3	L2	Phase L2	3 380 ... 480 Vac
4	L3	Phase L3	3 380 ... 480 Vac

Table 6-12: Electrical connections MC-4 (1.5 ... 10 A) / X2



The permissible permanent current of the X2 power terminal is 24 A. The voltage range of the MC-4 / 5 A with three-phase or single-phase infeed is 220 ... 240 Vac. In the case of single-phase infeed, connect L to L1 and N to L2. L3 must remain unused.

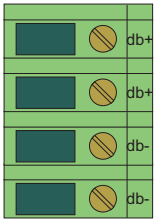
## NOTICE

### NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

**Failure to follow these instructions can result in equipment damage.**

## X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-13: Electrical connections MC-4 (1.5 ... 10 A) / X3



The permissible permanent current of the X3 power terminal is 24 A.

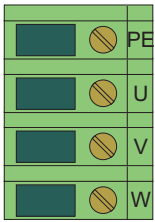
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

Failure to follow these instructions can result in equipment damage.

## X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	U	Phase U	3 0 ... 480 Vac
3	V	Phase V	3 0 ... 480 Vac
4	W	Phase W	3 0 ... 480 Vac

Table 6-14: Electrical connections MC-4 (1.5 ... 10 A) / X4



The permissible permanent current of the X4 power terminal is 24 A.

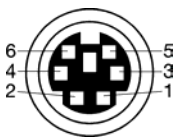
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

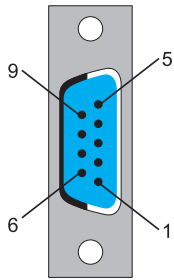
Failure to follow these instructions can result in equipment damage.

## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-15: Electrical connections MC-4 / X7

**X8 - Motor encoder (SinCos)**

Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-16: Electrical connections MC-4 / X8

## NOTICE

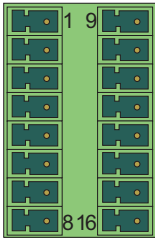
### REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

**Failure to follow these instructions can result in equipment damage.**

### 6.4.3 MC-4 Servo Amplifier / 3 A

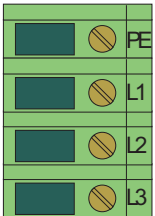
#### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	0 V	Supply voltage	
3	iei	Inverter Enable	20 ... 30 Vdc / 30 mA
4	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
5	θ (5)	PTC Motortemp.	-
6	θ (6)	PTC Motortemp.	-
7	bi+	Supply holding brake	+24 Vdc
8	bi-	Supply holding brake	0 Vdc
9	24 V	Bridged with pin 1	-
10	0 V	Bridged with pin 2	-
11	ieo	inverter enable output	20 ... 30 Vdc / 2 A
12	ieo	inverter enable output	20 ... 30 Vdc / 2 A
13	rdy	Ready contact	20 ... 30 Vdc / 2 A
14	rdy	Ready contact	20 ... 30 Vdc / 2 A
15	bo+ (8)	Holding brake connection	+24 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-17: Electrical connections MC-4 (1.5 ... 10 A) / X1

#### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	L1	Phase L1	3/1 220 ... 240 Vac
3	L2	Phase L2	3/1 220 ... 240 Vac
4	L3	Phase L3	3/1 220 ... 240 Vac

Table 6-18: Electrical connections MC-4 (1.5 ... 10 A) / X2



The permissible permanent current of the X2 power terminal is 24 A. The voltage range of the MC-4 / 5 A with three-phase or single-phase infeed is 220 ... 240 Vac. In the case of single-phase infeed, connect L to L1 and N to L2. L3 must remain unused.

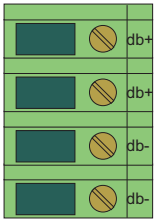
## NOTICE

### NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

Failure to follow these instructions can result in equipment damage.

## X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-19: Electrical connections MC-4 (1.5 ... 10 A) / X3



The permissible permanent current of the X3 power terminal is 24 A.

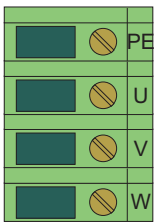
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

Failure to follow these instructions can result in equipment damage.

## X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	U	Phase U	3 0 ... 480 Vac
3	V	Phase V	3 0 ... 480 Vac
4	W	Phase W	3 0 ... 480 Vac

Table 6-20: Electrical connections MC-4 (1.5 ... 10 A) / X4



The permissible permanent current of the X4 power terminal is 24 A.

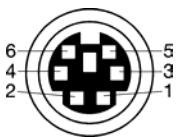
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

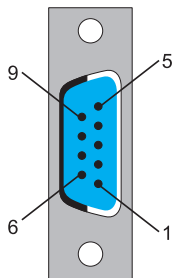
Failure to follow these instructions can result in equipment damage.

## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-21: Electrical connections MC-4 / X7

**X8 - Motor encoder (SinCos)**

Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-22: Electrical connections MC-4 / X8

## NOTICE

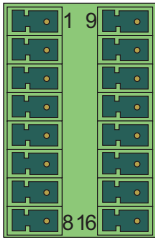
### REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

**Failure to follow these instructions can result in equipment damage.**

## 6.4.4 MC-4 Servo Amplifier / 5 A

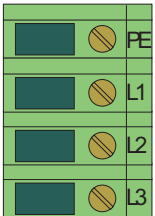
### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	0 V	Supply voltage	
3	iei	Inverter Enable	20 ... 30 Vdc / 30 mA
4	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
5	θ (5)	PTC Motortemp.	-
6	θ (6)	PTC Motortemp.	-
7	bi+	Supply holding brake	+24 Vdc
8	bi-	Supply holding brake	0 Vdc
9	24 V	Bridged with pin 1	-
10	0 V	Bridged with pin 2	-
11	ieo	inverter enable output	20 ... 30 Vdc / 2 A
12	ieo	inverter enable output	20 ... 30 Vdc / 2 A
13	rdy	Ready contact	20 ... 30 Vdc / 2 A
14	rdy	Ready contact	20 ... 30 Vdc / 2 A
15	bo+ (8)	Holding brake connection	+24 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-23: Electrical connections MC-4 (1.5 ... 10 A) / X1

### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	-
2	L1	Phase L1	3 380 ... 480 Vac
3	L2	Phase L2	3 380 ... 480 Vac
4	L3	Phase L3	3 380 ... 480 Vac

Table 6-24: Electrical connections MC-4 (1.5 ... 10 A) / X2



The permissible permanent current of the X2 power terminal is 24 A. The voltage range of the MC-4 / 5 A with three-phase or single-phase infeed is 220 ... 240 Vac. In the case of single-phase infeed, connect L to L1 and N to L2. L3 must remain unused.

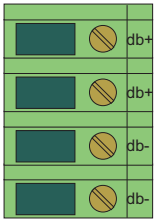
## NOTICE

### NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

**Failure to follow these instructions can result in equipment damage.**

## X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-25: Electrical connections MC-4 (1.5 ... 10 A) / X3



The permissible permanent current of the X3 power terminal is 24 A.

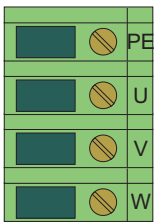
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

Failure to follow these instructions can result in equipment damage.

## X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	U	Phase U	3 0 ... 480 Vac
3	V	Phase V	3 0 ... 480 Vac
4	W	Phase W	3 0 ... 480 Vac

Table 6-26: Electrical connections MC-4 (1.5 ... 10 A) / X4



The permissible permanent current of the X4 power terminal is 24 A.

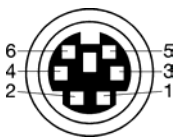
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

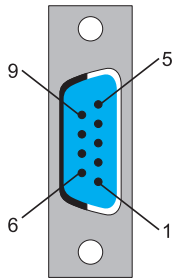
Failure to follow these instructions can result in equipment damage.

## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-27: Electrical connections MC-4 / X7

**X8 - Motor encoder (SinCos)**

Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-28: Electrical connections MC-4 / X8

## NOTICE

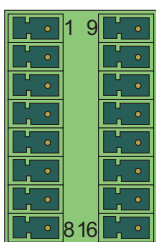
### REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

**Failure to follow these instructions can result in equipment damage.**

## 6.4.5 MC-4 Servo Amplifier / 10 A

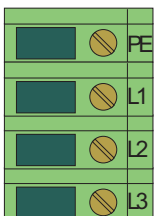
### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	0 V	Supply voltage	
3	iei	Inverter Enable	20 ... 30 Vdc / 30 mA
4	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
5	θ (5)	PTC Motortemp.	-
6	θ (6)	PTC Motortemp.	-
7	bi+	Supply holding brake	+24 Vdc
8	bi-	Supply holding brake	0 Vdc
9	24 V	Bridged with pin 1	-
10	0 V	Bridged with pin 2	-
11	ieo	inverter enable output	20 ... 30 Vdc / 2 A
12	ieo	inverter enable output	20 ... 30 Vdc / 2 A
13	rdy	Ready contact	20 ... 30 Vdc / 2 A
14	rdy	Ready contact	20 ... 30 Vdc / 2 A
15	bo+ (8)	Holding brake connection	+24 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-29: Electrical connections MC-4 (1.5 ... 10 A) / X1

### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	-
2	L1	Phase L1	3 380 ... 480 Vac
3	L2	Phase L2	3 380 ... 480 Vac
4	L3	Phase L3	3 380 ... 480 Vac

Table 6-30: Electrical connections MC-4 (1.5 ... 10 A) / X2



The permissible permanent current of the X2 power terminal is 24 A. The voltage range of the MC-4 / 5 A with three-phase or single-phase infeed is 220 ... 240 Vac. In the case of single-phase infeed, connect L to L1 and N to L2. L3 must remain unused.

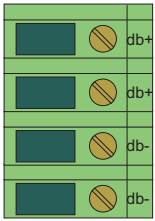
## NOTICE

### NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

**Failure to follow these instructions can result in equipment damage.**

## X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-31: Electrical connections MC-4 (1.5 ... 10 A) / X3



The permissible permanent current of the X3 power terminal is 24 A.

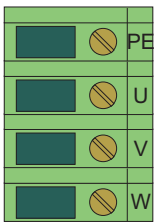
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

Failure to follow these instructions can result in equipment damage.

## X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	U	Phase U	3 0 ... 480 Vac
3	V	Phase V	3 0 ... 480 Vac
4	W	Phase W	3 0 ... 480 Vac

Table 6-32: Electrical connections MC-4 (1.5 ... 10 A) / X4



The permissible permanent current of the X4 power terminal is 24 A.

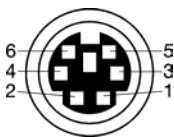
## NOTICE

## NO RELIABLE CONTACT

- Use conductor sleeves without a plastic collar with a length of at least 12 mm or conductor sleeves with a plastic collar and a metal socket length of at least 12 mm.

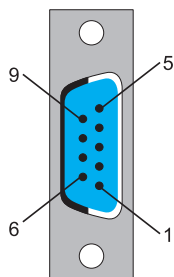
Failure to follow these instructions can result in equipment damage.

## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-33: Electrical connections MC-4 / X7

**X8 - Motor encoder (SinCos)**

Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-34: Electrical connections MC-4 / X8

## NOTICE

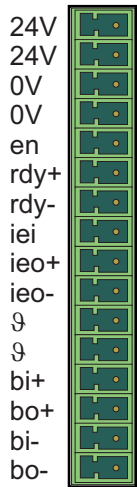
### REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

**Failure to follow these instructions can result in equipment damage.**

## 6.4.6 MC-4 Servo Amplifier / 22 A

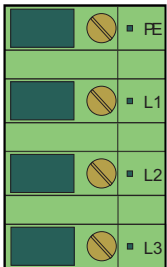
### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	24 V	Bridged with pin 1	-
3	0 V	Supply voltage	-
4	0 V	Bridged with pin 3	-
5	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
6	rdy+	Ready contact	20...30 Vdc / 2 A
7	rdy -	Ready contact	20...30 Vdc / 2 A
8	iei	Inverter Enable	20...30 Vdc / 30 mA
9	ieo+	inverter enable output	20...30 Vdc / 2 A
10	ieo-	inverter enable output	20...30 Vdc / 2 A
11	(5)	PTC Motortemp.	-
12	(6)	PTC Motortemp.	-
13	bi+	Supply holding brake	+24 Vdc
14	bo+ (8)	Holding brake connection	+24 Vdc
15	bi-	Supply holding brake	0 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-35: Electrical connections MC-4 (22 A, 50 A) / X1

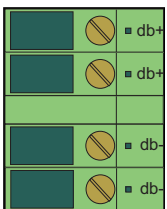
### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	L1	Phase L1	3 380 ... 480 Vac
3	L2	Phase L2	3 380 ... 480 Vac
4	L3	Phase L3	3 380 ... 480 Vac

Table 6-36: Electrical connections MC-4 / X2

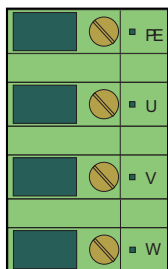
### X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-37: Electrical connections MC-4 / X3

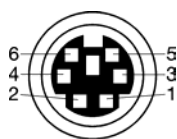
## X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	U (1)	Phase U	3 0 ... 480 Vac
3	V (2)	Phase V	3 0 ... 480 Vac
4	W (3)	Phase W	3 0 ... 480 Vac

Table 6-38: Electrical connections MC-4 / X4

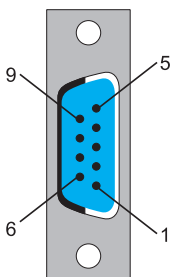
## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-39: Electrical connections MC-4 / X7

## X8 - Motor encoder (SinCos)



Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-40: Electrical connections MC-4 / X8

## NOTICE

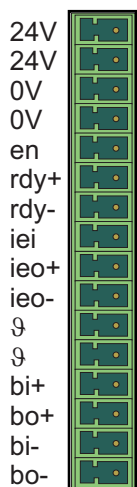
## REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

Failure to follow these instructions can result in equipment damage.

## 6.4.7 MC-4 Servo Amplifier / 50 A

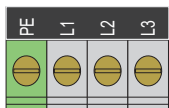
### X1 - Control voltage



Pin	Designation	Meaning	Range
1	24 V	Supply voltage	-15 % / +25 %
2	24 V	Bridged with pin 1	-
3	0 V	Supply voltage	-
4	0 V	Bridged with pin 3	-
5	en	Enable	24 Vdc (corresponds to IEC61131-2 type I)
6	rdy+	Ready contact	20...30 Vdc / 2 A
7	rdy -	Ready contact	20...30 Vdc / 2 A
8	iei	Inverter Enable	20...30 Vdc / 30 mA
9	ieo+	inverter enable output	20...30 Vdc / 2 A
10	ieo-	inverter enable output	20...30 Vdc / 2 A
11	(5)	PTC Motortemp.	-
12	(6)	PTC Motortemp.	-
13	bi+	Supply holding brake	+24 Vdc
14	bo+ (8)	Holding brake connection	+24 Vdc
15	bi-	Supply holding brake	0 Vdc
16	bo- (7)	Holding brake connection	0 Vdc

Table 6-41: Electrical connections MC-4 (22 A, 50 A) / X1

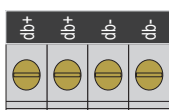
### X2 - Mains connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	L1	Phase L1	3 380 ... 480 Vac
3	L2	Phase L2	3 380 ... 480 Vac
4	L3	Phase L3	3 380 ... 480 Vac

Table 6-42: Electrical connections MC-4 (50 A) / X2

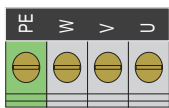
### X3 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	0 ... 860 Vdc
2	db +	DC bus voltage +	0 ... 860 Vdc
3	db -	DC bus voltage -	0 ... 860 Vdc
4	db -	DC bus voltage -	0 ... 860 Vdc

Table 6-43: Electrical connections MC-4 (50 A) / X3

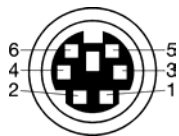
### X4 - motor connection



Pin	Designation	Meaning	Range
1	PE	Protective ground conductor connection	
2	W (3)	Phase W	3 0 ... 480 Vac
3	V (2)	Phase V	3 0 ... 480 Vac
4	U (1)	Phase U	3 0 ... 480 Vac

Table 6-44: Electrical connections MC-4 (50 A) / X4

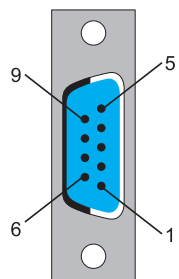
## X7 - Diagnosis



Pin	Designation	Meaning	Range
1	PRO_SEL		
2	RxD	Receive Data	
3	TxD	Transmit Data	
4	GND	Signal Ground	
5	RS232_SEL		
6	VCC		

Table 6-45: Electrical connections MC-4 / X7

## X8 - Motor encoder (SinCos)



Pin	Designation	Meaning
1	REFSIN	Reference signal sine
2	SIN	Sinusoidal trace
3	REFCOS	Reference Signal Cosinus
4	COS	Cosine track
5	+12 V	Supply voltage
6	RS485	Parameter channel -
7	RS485	Parameter channel +
8	SC_SEL	Encoder plugged (bridge to GND)
9	GND	Supply voltage

Table 6-46: Electrical connections MC-4 / X8

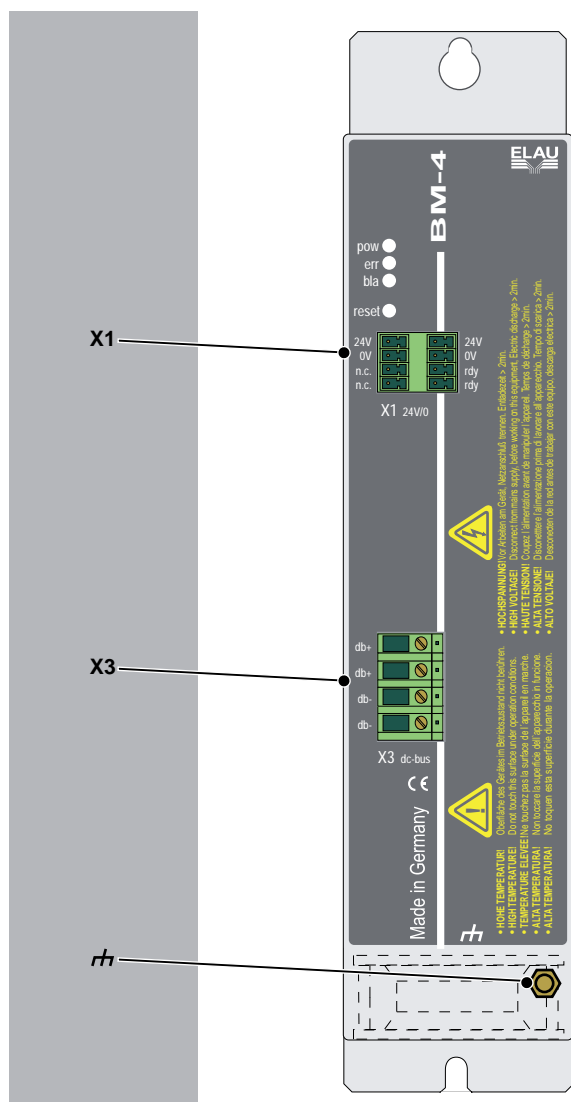
## NOTICE

## REMOVAL OF LIVE SINCOS ENCODER PLUG

- SinCos encoder plug only to be withdrawn or connected when in an off-circuit condition.

Failure to follow these instructions can result in equipment damage.

### 6.4.8 BM4 braking resistor module connection overview

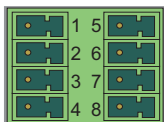


Connection	Meaning	max. terminal cross-section [mm <sup>2</sup> ] / [AWG]		Tightening torque [Nm] / [lbf in]
X1	Control voltage	1.5	28-16	0.2-0,25 / 1.77-2.21
X3	DC circuit	2.5	24-12	0.4-0,5 / 3.54-4.43
rh	Protective ground conductor connec- tion	10	-	-

Table 6-47: Connection overview BM-4 Braking resistor Module

## 6.4.9 Braking resistor module BM-4

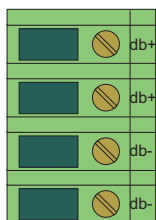
### X1 - Power supply / Watch Dog



Pin	Designation	Meaning	Range
1	+24 Vdc	Supply voltage	-15 % / +25 %
2	0 Vdc	Supply voltage	
3		Reserved	
4		Reserved	
5	+24 Vdc	Supply voltage	-15 % / +25 %
6	0 Vdc	Supply voltage	
7	rdy	Ready	
8	rdy	Ready	

Table 6-48: Electrical connections BM-4 / X1

### X2 - DC bus



Pin	Designation	Meaning	Range
1	db +	DC bus voltage +	530 ... 860 Vdc
2	db +	DC bus voltage +	530 ... 860 Vdc
3	db -	DC bus voltage -	530 ... 860 Vdc
4	db -	DC bus voltage -	530 ... 860 Vdc

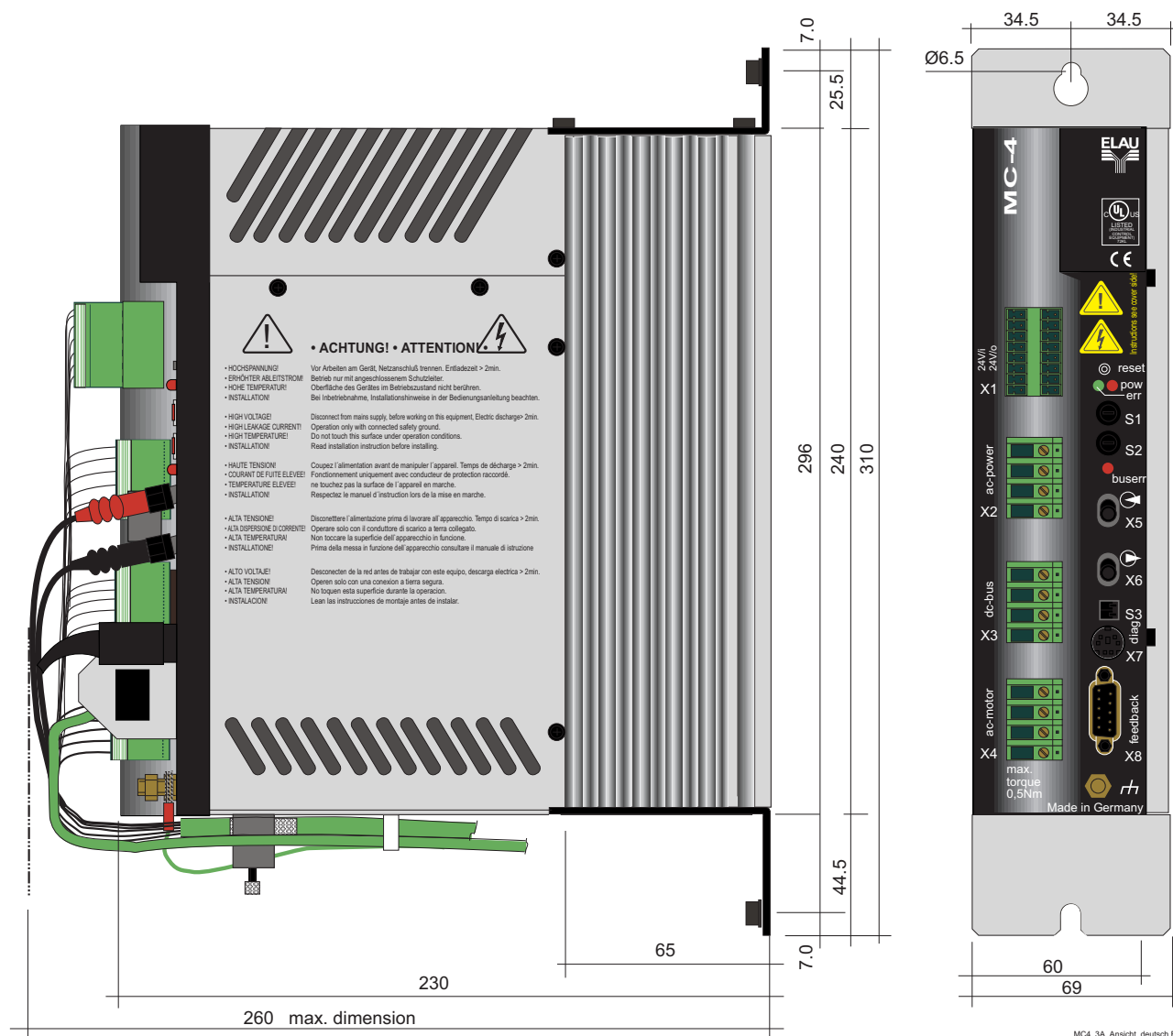
Table 6-49: Electrical connections BM-4 / X2

## 6.5 Dimensions



For a table to convert the mm dimension specifications (see 7.7.1 Length).

### 6.5.1 MC-4 / 1.5 A and 3 A servo amplifier



MC4\_3A\_Ansicht\_deutsch.FH8

Figure 6-1: Dimensions of the PacDrive MC-4 / 1.5 A and 3 A

### 6.5.2 MC-4 / 5 A Servo Amplifier

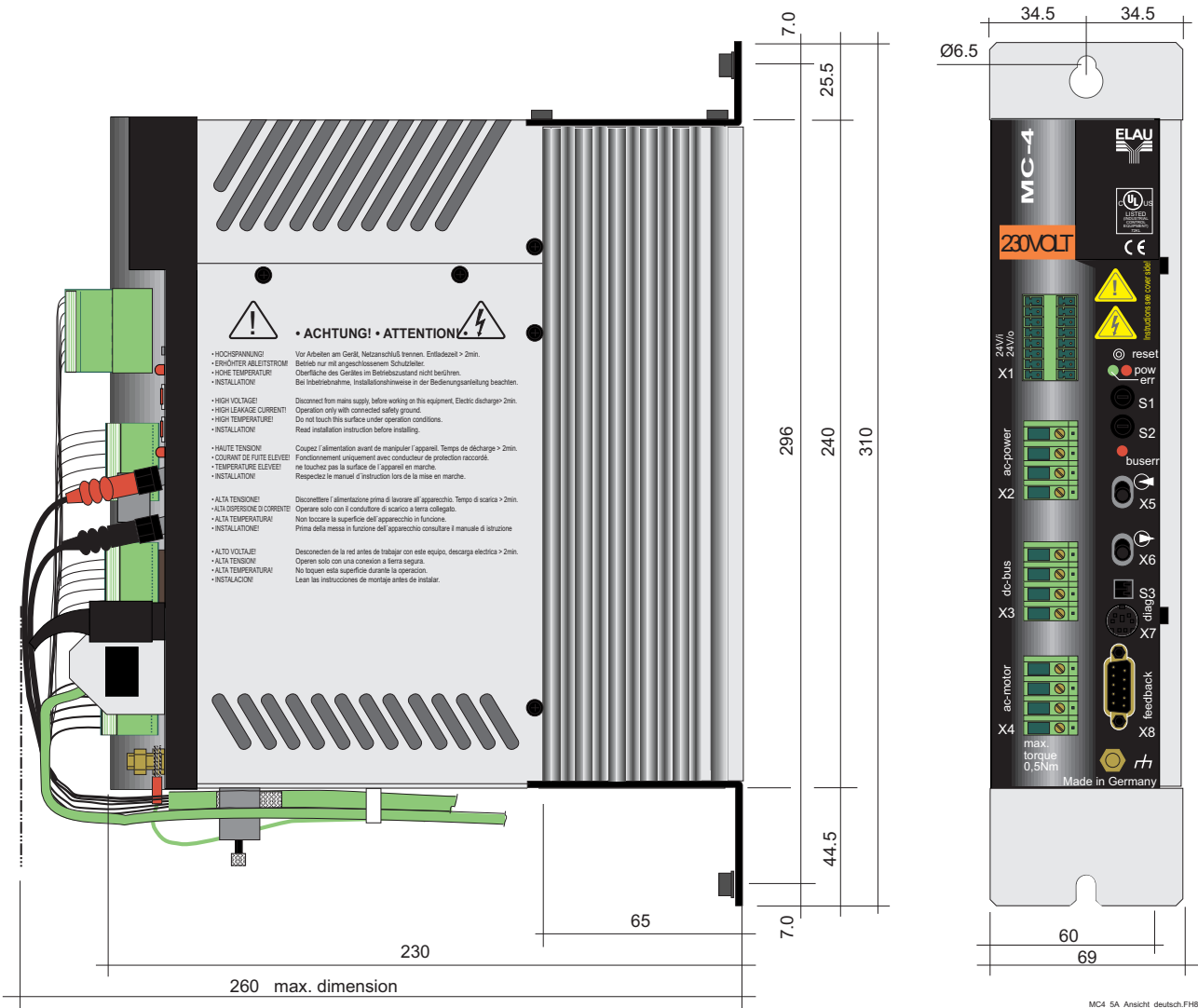


Figure 6-2: Dimensions of the PacDrive MC-4 / 5 A

### 6.5.3 MC-4 / 10 A Servo Amplifier

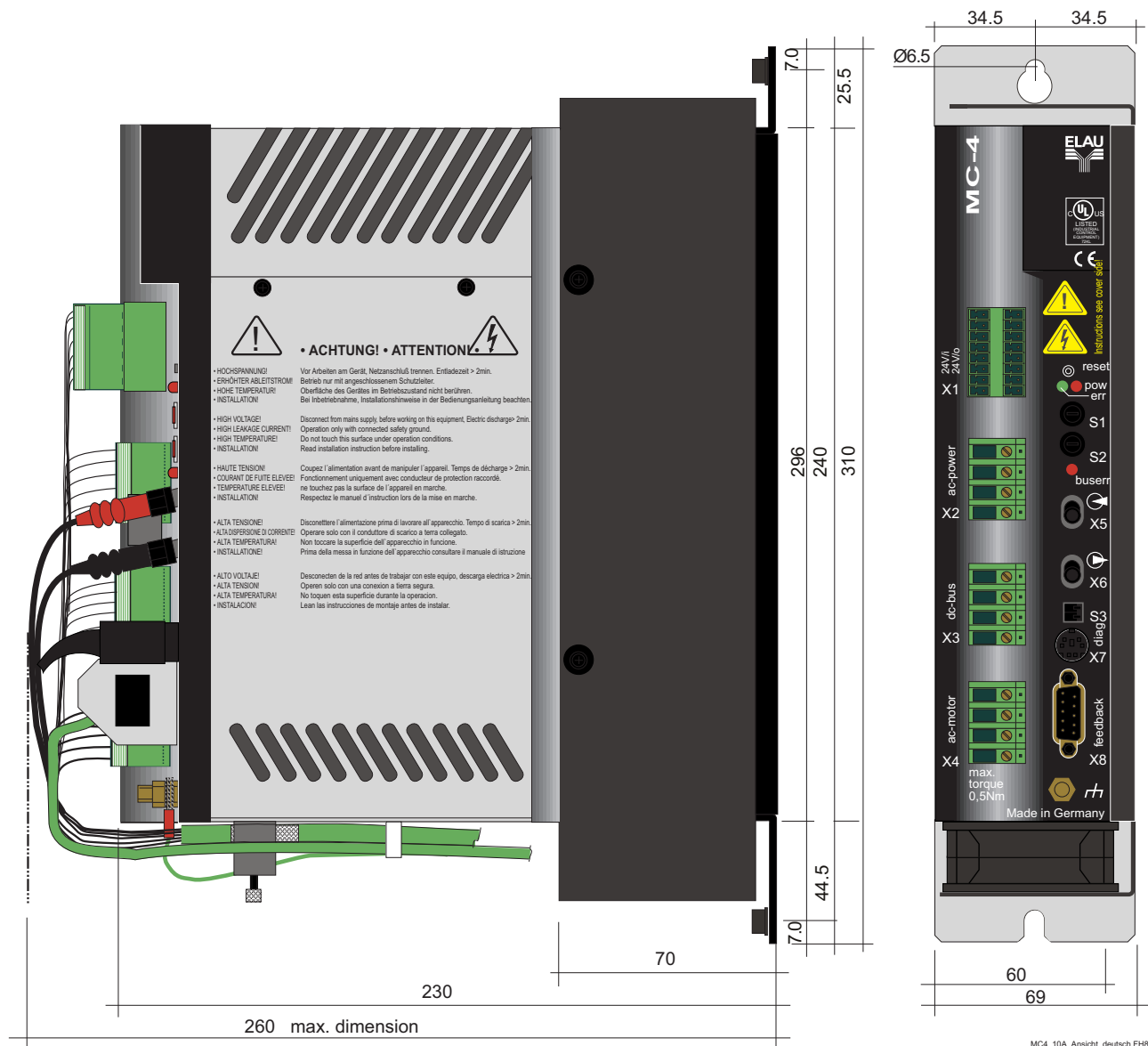


Figure 6-3: Dimensions of the PacDrive MC-4 / 10 A

### 6.5.4 MC-4 / 22 A Servo Amplifier

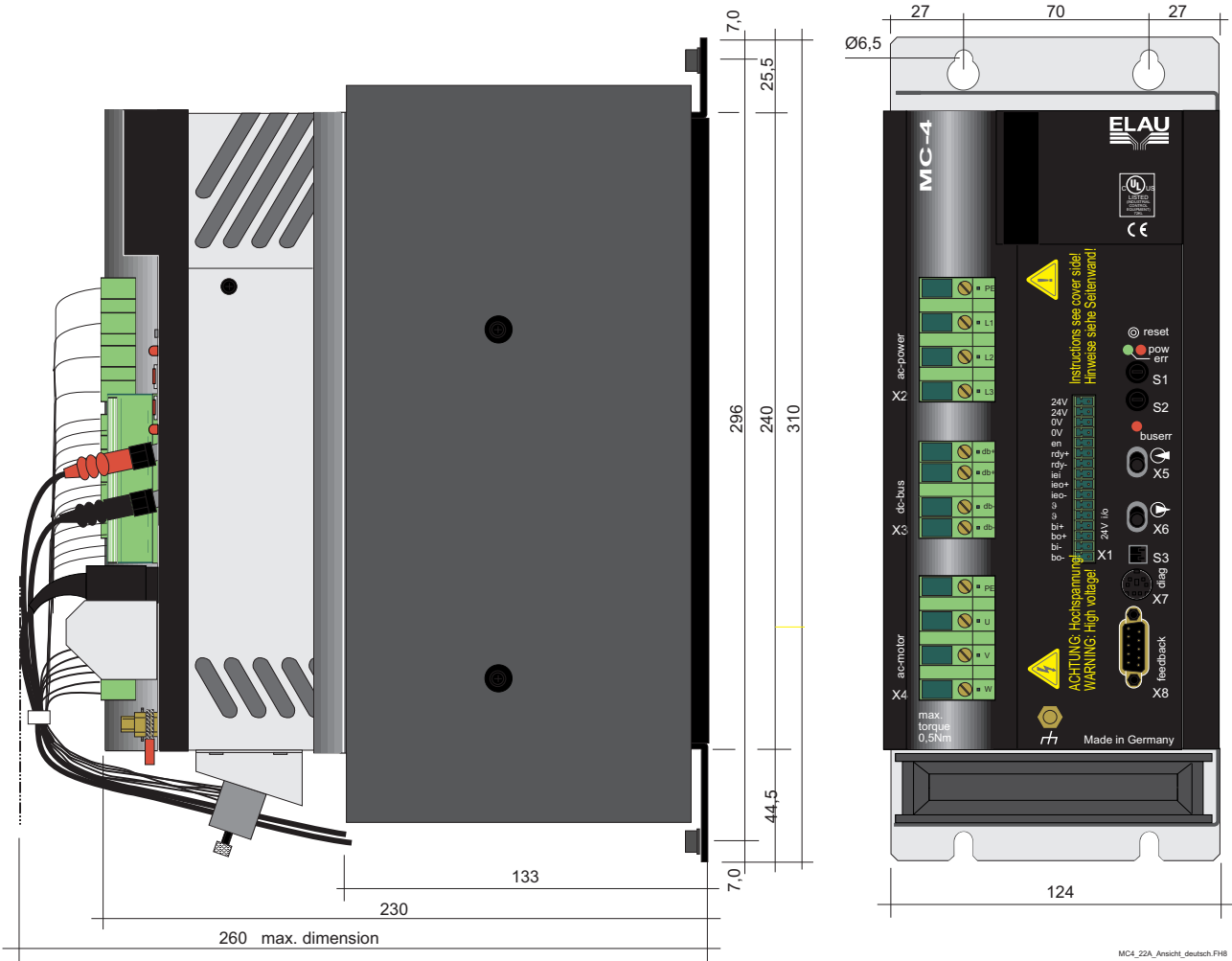


Figure 6-4: Dimensions of the PacDrive MC-4 / 22 A

## 6.5.5 MC-4 / 50 A Servo Amplifier

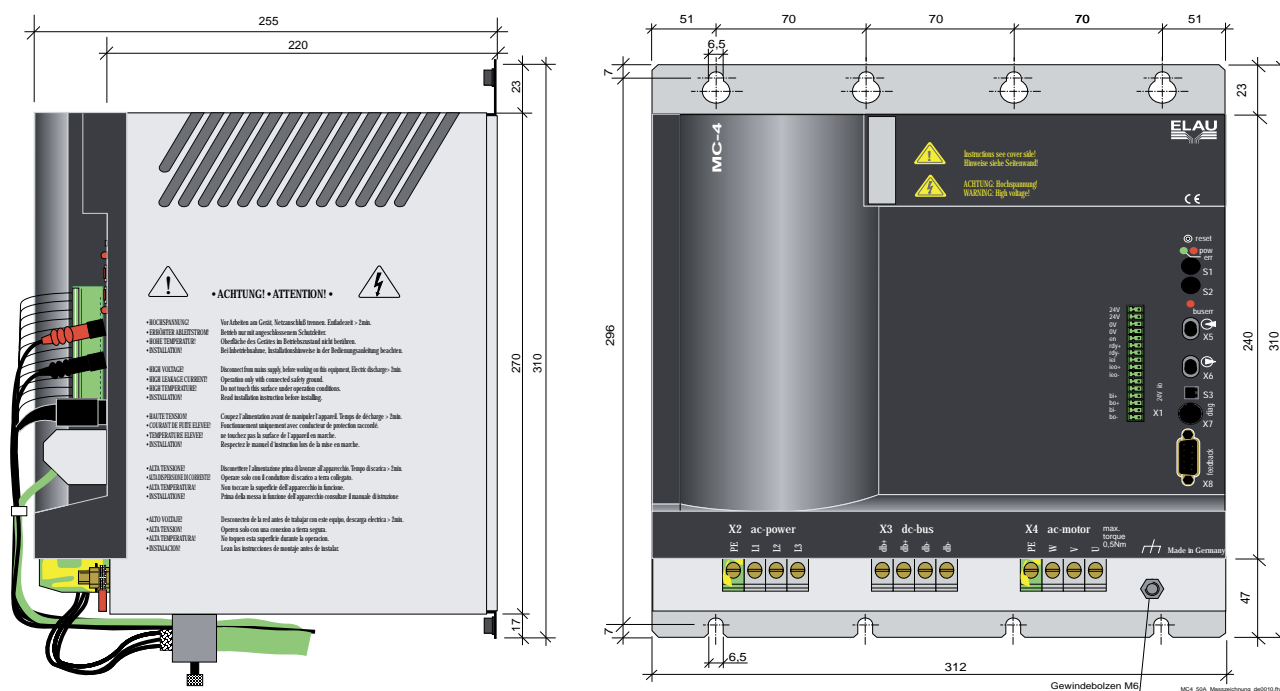


Figure 6-5: Dimensions of the PacDrive MC-4 / 50 A

## 6.5.6 Mains filter

### FI 07876 / 8A

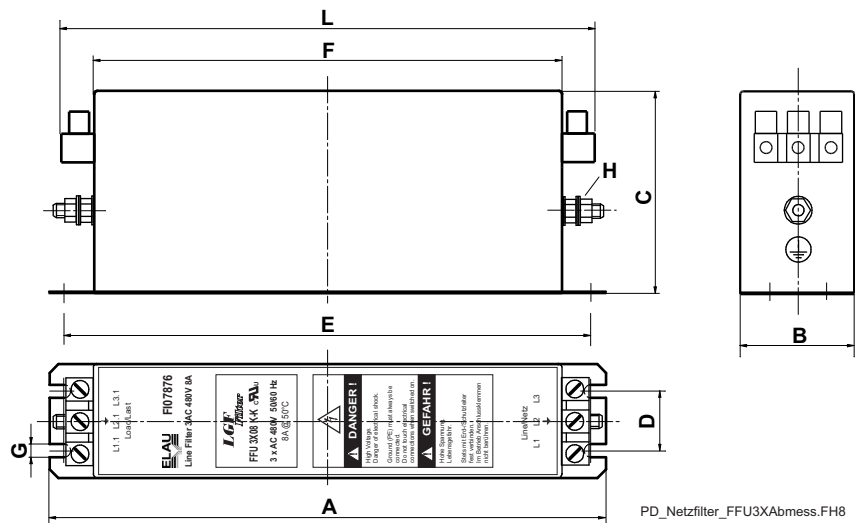


Figure 6-6: Dimensions of mains filter

Item name (Order no.)	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H	L [mm]
FFU 3X08 K-K (FI07876)	190	40	70	20	180	160	5.4	M5	185
FFU 3X30 K-K (FI07877)	270	50	85	30	255	240	5.4	M5	265
FFU 3X55 K-K (FI07878)	250	85	90	60	235	220	5.4	M5	258

Table 6-50: Legend in [mm]

## 6.5.7 Line chokes

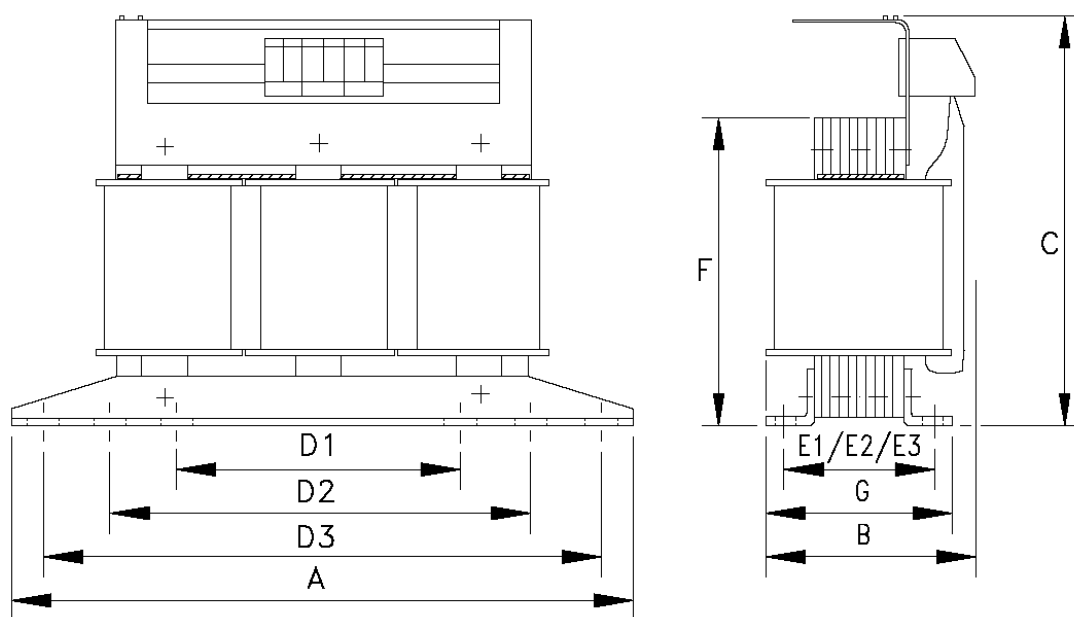


Figure 6-7: 10 A and 25 A line chokes NKD 10 / 2.93 and NKD 25 / 1.17

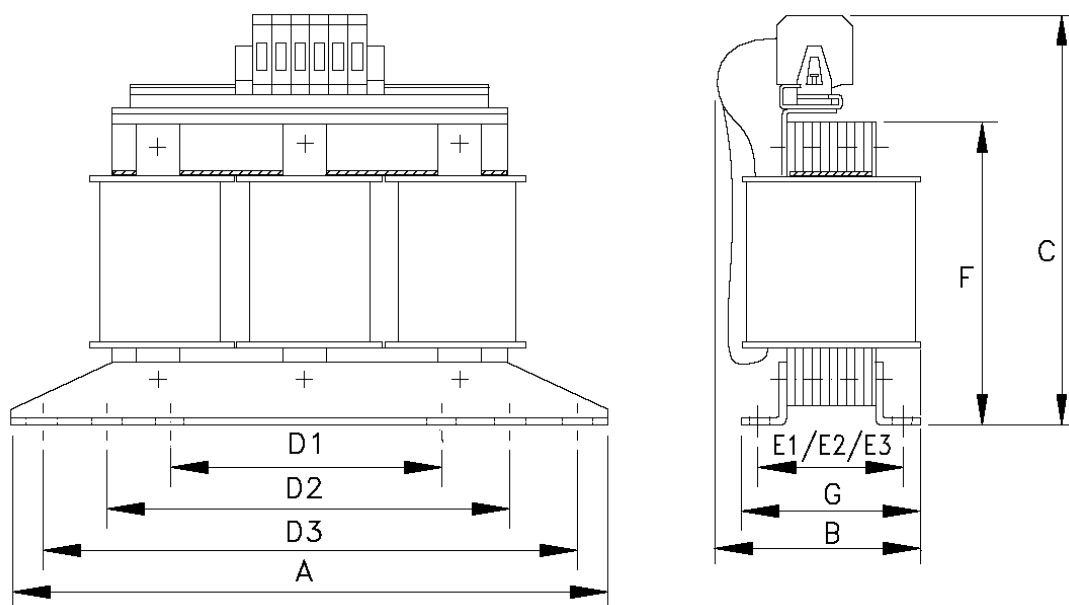


Figure 6-8: 50 A line choke NKD 50 / 0.59

Item name (Order no.)	A	B	C	D 1	D2	D3	E1	E2	E3	F	G
NKD 10 / 2.93	148	76	151	90	100	136	39	45	49	110	69
NKD 25 / 1.17	178	106	175	113	130	166	64.5	71.5	69.5	133	89.5
NKD 50 / 0.59	267	115	265	176	180	249	71	98	79	200	115

Table 6-51: Legend in [mm]

### 6.5.8 BM-4 Braking resistor module

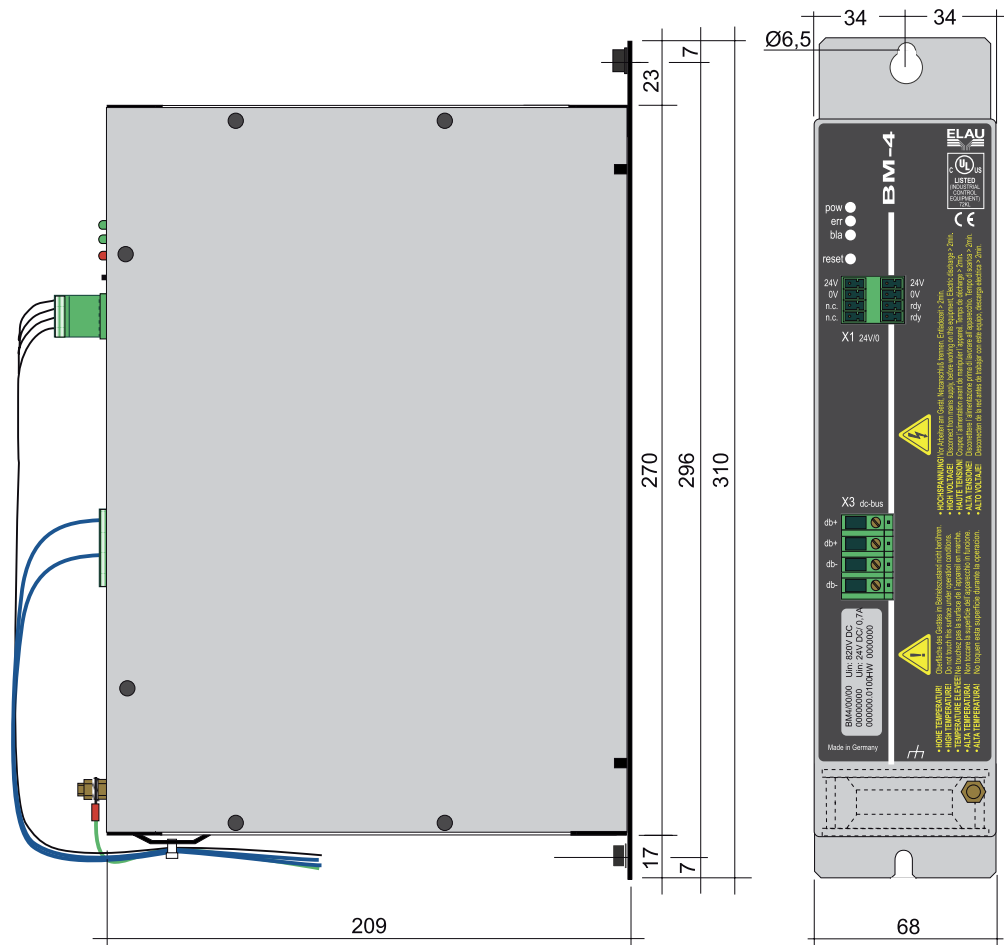


Figure 6-9: Dimensions BM-4 braking resistor module

## 7 Appendix

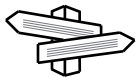
### 7.1 Contact addresses

#### Schneider Electric Automation GmbH

Schneiderplatz 1  
97828 Marktheidenfeld, Germany  
Phone: +49 (0) 9391 / 606 - 0  
Fax: +49 (0) 9391 / 606 - 4000  
Email: [info-marktheidenfeld@schneider-electric.com](mailto:info-marktheidenfeld@schneider-electric.com)  
Internet: [www.schneider-electric.com](http://www.schneider-electric.com)

#### Machine Solution Service

Schneiderplatz 1  
97828 Marktheidenfeld, Germany  
Phone: +49 (0) 9391 / 606 - 3265  
Fax: +49 (0) 9391 / 606 - 3340  
Email: [automation.support.de@schneider-electric.com](mailto:automation.support.de@schneider-electric.com)  
Internet: [www.schneider-electric.com](http://www.schneider-electric.com)

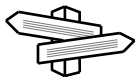


See the homepage for additional contact addresses:  
[www.schneider-electric.com](http://www.schneider-electric.com)

### 7.2 Product training courses

Schneider Electric offers a number of product training courses.

Our training instructors will help you take advantage of the extensive possibilities offered by the system.



See the homepage ([www.schneider-electric.com](http://www.schneider-electric.com)) for further information and our current seminar schedule.

## 7.3 EC declaration of conformity

### EC DECLARATION OF CONFORMITY (Original)

Document number / Month.Year: HRB7495300\_00 / 02.2013



**We:** Schneider Electric Industries SA  
35, rue Joseph Monier  
92506 Rueil Malmaison  
France

Hereby declare that the products

<b>Trademark:</b>	Schneider Electric
<b>Product, Type, Function:</b>	MC-4 Drives
<b>Models:</b>	VDM
<b>Serial number:</b>	YYZZXXXXXX (YY: Year, 22=2012, 23=2013; ZZ: Supplier Code; XXXXXX:Continuous number)

Reference	Description
VDM01D10zzxx	SERVODRIVE MC 4, 400V, 10 25A
VDM01D22zzxx	SERVODRIVE MC 4, 400V, 22 55A
VDM01D50zzxx	SERVODRIVE MC 4, 400V, 50 125A
VDM01U15zzxx	SERVODRIVE MC 4, 400V, 1,5 3,75A
VDM01U30zzxx	SERVODRIVE MC 4, 400V, 3 7,5A
VDM01U50zzxx	SERVODRIVE MC 4, 230V, 5 12,5A
VDM02D10zzxx	SERVODRIVE MC 4, 400V, 10 25A
VDM02D22zzxx	SERVODRIVE MC 4, 400V, 22 55A
VDM02U15zzxx	SERVODRIVE MC 4, 400V, 1,5 3,75A
VDM02U30zzxx	SERVODRIVE MC 4, 400V, 3 7,5A

z are letters, x are numbers for different variations

are in conformity with the requirements of the following directives and conformity was checked in accordance with the following standards:

Directive	Harmonized Standard
<b>DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL</b> of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	<b>EN 61800-3:2004 + A1:2012</b> Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods (IEC 61800-3:2004 + A1:2011)
<b>DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL</b> of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)  Applying article 12(3)a)	<b>EN ISO 13849-1/2:2008</b> Safety of machinery - Safety-related parts of control systems  <b>EN 61800-5-2:2007</b> Adjustable speed electrical power drive systems - Part 5-2: Safety requirements – Functional  <b>EN 62061:2005</b> Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

and also the standard **EN 61800-5-1:2007**: Adjustable speed electrical power drive systems – Part 5-1: Safety requirements - Electrical, thermal and energy.

It is important that the component is subject to correct installation, maintenance and use conforming to its intended purpose, to the applicable regulations and standards, to the supplier's instructions, user manual and to the accepted rules of the art.

Person in charge of documentation:

**Eric Barry, Schneider Electric Automation GmbH, Schneiderplatz 1, 97828 Marktheidenfeld, Germany**

First year of affixing CE Marking: 2001

France -Rueil Malmaison, February 2013

i.A. Peter Spitzfaden  
Machine Solution Certification Manager

## 7.4 Electrical tests

The following tests are performed in the production for the PacDrive MC-4 servo amplifier:

- DIN EN 50178:1997 - Equipment of high-current electrical systems
  - DIN EN 60204-1: 2006 - Electrical equipment of machines
1. End-to-end connection of grounding conductor in accordance with DIN EN 60204-1 **(30 A)**
  2. Voltage tests DIN EN 50178:1997 Section 9.4.5.2.2 Level and type of testing voltage **(2500 Vdc)**
  3. Insulation resistance test DIN EN 50178:1997 Section 9.4.5.4 Testing of insulation resistance in high-current electrical systems **(500 Vdc)**



Insulation testing and voltage testing are carried out with direct current in the PacDrive MC-4. The devices have internal bypass capacitors against PE. Retesting is thus not necessary.



However, should circumstances arise which make additional testing necessary, conduct the testing of the PacDrive MC-4 with direct current or direct voltage. As per the DIN EN 50178:1997 standard, the insulation resistance test and voltage testings can also be carried out with direct voltage.



If you perform tests with alternating current or alternating voltage (50 / 60 Hz) on connected PacDrive MC-4 devices, a diagnostic message on the testing device appears. This is why you have to disconnect all MC-4 devices while testing entire systems or machines with alternating current or voltage.

## 7.5 Hardware/software compatibility list

FW family	HW code			
	small Bxxxxx	Bxxxxx	Cxxxxx	Exxxxx
V05	V00.05.xx	V00.05.20 and higher	V00.05.22 and higher	V00.05.31 and higher
V07	V00.07.xx	V00.07.20 and higher	V00.07.22 and higher	V00.07.31 and higher
V10	V00.10.xx	V00.10.20 and higher	V00.10.22 and higher	V00.10.31 and higher
V11	V00.11.xx	V00.11.20 and higher	V00.11.22 and higher	V00.11.31 and higher
V12	V00.12.xx	V00.12.01 and higher	V00.12.02 and higher	V00.12.31 and higher
V15	V00.15.xx	V00.15.xx	V00.15.xx	from V00.15.31
V16	V00.16.xx	V00.16.xx	V00.16.xx	V00.16.xx
V20	V00.20.xx	V00.20.xx	V00.20.xx	V00.20.xx
...	...	...	...	...

Table 7-1: PacDrive MC-4 hardware and software compatibility

## 7.6 Changes

### 01 / 2001

- MC-4 / 50 / 400 new
- Mains filter HLD 110-500/55 new

### 08 / 2004

- New series of mains filter added
- Layout of document revised
- Product names and terms adapted

### 05 / 2005

- New chapter entitled Line Chokes added

### 12 / 2005

- MC-4 / 1.5 A added

### 04 / 2007

- Various motor supply cables added

### 12 / 2008

- Revision of the chapter entitled "Technical Data"
- Revision of the chapter entitled "Installation and Maintenance"
- Adaptation of document layout
- Adaptation of the corporate design

### 07 / 2009

- Revisions of the safety messages
- Improvement of the mechanical and electrical data
- Improvement of the electrical connections

### 10 / 2010

- Revising the whole documentation

### 11 / 2012

- Note about overtemperature detection added

### 07 / 2013

- Revision of EC declaration of conformity

## 7.7 Units and conversion tables

### 7.7.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

### 7.7.2 Mass

	lb	oz	slug	0.22 kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* 1.942559*10 <sup>-3</sup>	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ 1.942559*10 <sup>-3</sup>	-	* 14.5939	* 14593.9
0.22 kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

### 7.7.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* 9.807*10 <sup>-3</sup>
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ 100*10 <sup>3</sup>
N	/ 4.448222	/ 0.27801	/ 9.807*10 <sup>-3</sup>	* 100*10 <sup>3</sup>	-

### 7.7.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

### 7.7.5 Rotation

	min <sup>-1</sup> (rpm)	rad/s	deg./s
min <sup>-1</sup> (rpm)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

## 7.7.6 Torque

	lb•in	lb•ft	oz•in	Nm	kp•m	kp•cm	dyne•cm
lb•in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* 1.129*10 <sup>6</sup>
lb•ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* 13.558*10 <sup>6</sup>
oz•in	/ 16	/ 192	-	* 7.0616*10 <sup>-3</sup>	* 720.07*10 <sup>-6</sup>	* 72.007*10 <sup>-3</sup>	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ 7.0616*10 <sup>-3</sup>	-	* 0.101972	* 10.1972	* 10*10 <sup>6</sup>
kp•m	/ 0.011521	/ 0.138255	/ 720.07*10 <sup>-6</sup>	/ 0.101972	-	* 100	* 98.066*10 <sup>6</sup>
kp•cm	/ 1.1521	/ 13.8255	/ 72.007*10 <sup>-3</sup>	/ 10.1972	/ 100	-	* 0.9806*10 <sup>6</sup>
dyne•cm	/ 1.129*10 <sup>6</sup>	/ 13.558*10 <sup>6</sup>	/ 70615.5	/ 10*10 <sup>6</sup>	/ 98.066*10 <sup>6</sup>	/ 0.9806*10 <sup>6</sup>	-

## 7.7.7 Moment of inertia

	lb•in <sup>2</sup>	lb•ft <sup>2</sup>	kg•m <sup>2</sup>	kg•cm <sup>2</sup>	kg•cm <sup>2</sup> •s <sup>2</sup>	oz•in <sup>2</sup>
lb•in <sup>2</sup>	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb•ft <sup>2</sup>	* 144	-	/3	*0.30479	*30.479	*304.79
kg•m <sup>2</sup>	* 3417.16	/ 0.04214	-	*0.9144	*91.44	*914.4
kg•cm <sup>2</sup>	* 0.341716	/ 421.4	/0.9144	-	*100	*1000
kg•cm <sup>2</sup> •s <sup>2</sup>	* 335.109	/ 0.429711	/91.44	/100	-	*10
oz•in <sup>2</sup>	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

## 7.7.8 Temperature

	°F	max	K
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
max	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

## 7.7.9 Conductor cross-section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm <sup>2</sup>	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm <sup>2</sup>	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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