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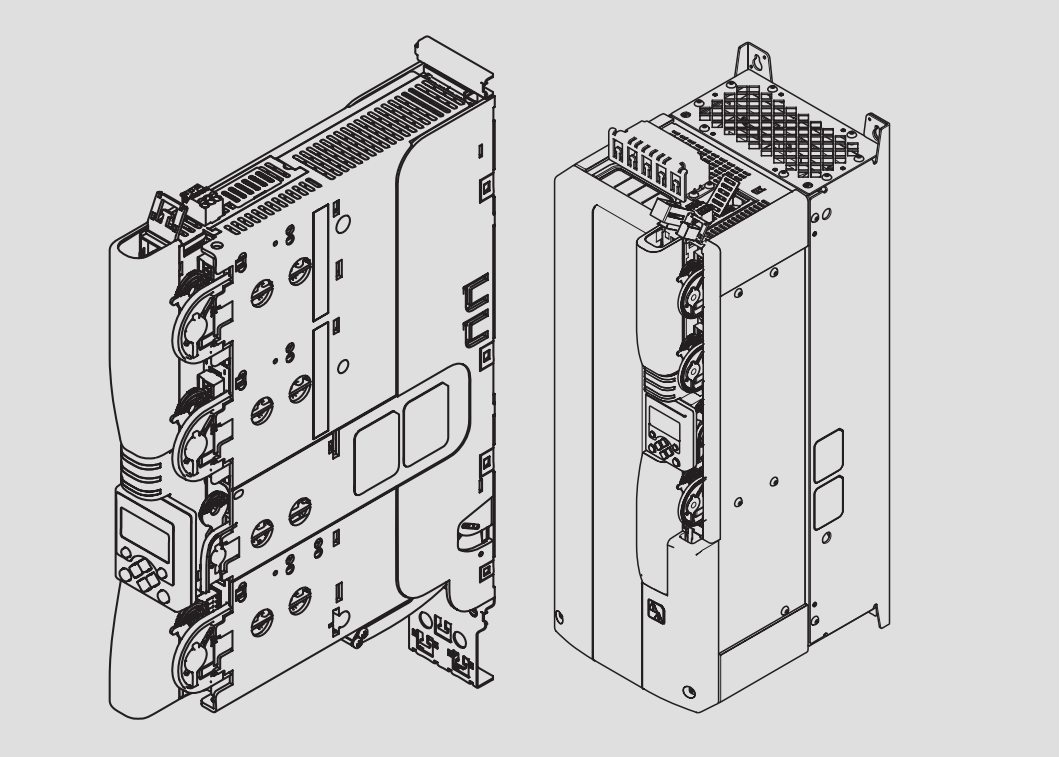
L-force *Drives*

Hardware Manual

9400



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Servo Drives 9400

Lenze

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1.1 The 9400 Servo Drives product range

1.1.1 The system

9400 Servo Drives range is the product family with the components required for an intelligent servo drive system in automation. The product range comprises

- servo drive controllers
- I/O components
- software
- accessories
- motors
- gearboxes
- DC-supply modules

1.1.2 Features

The Servo Drives 9400 feature:

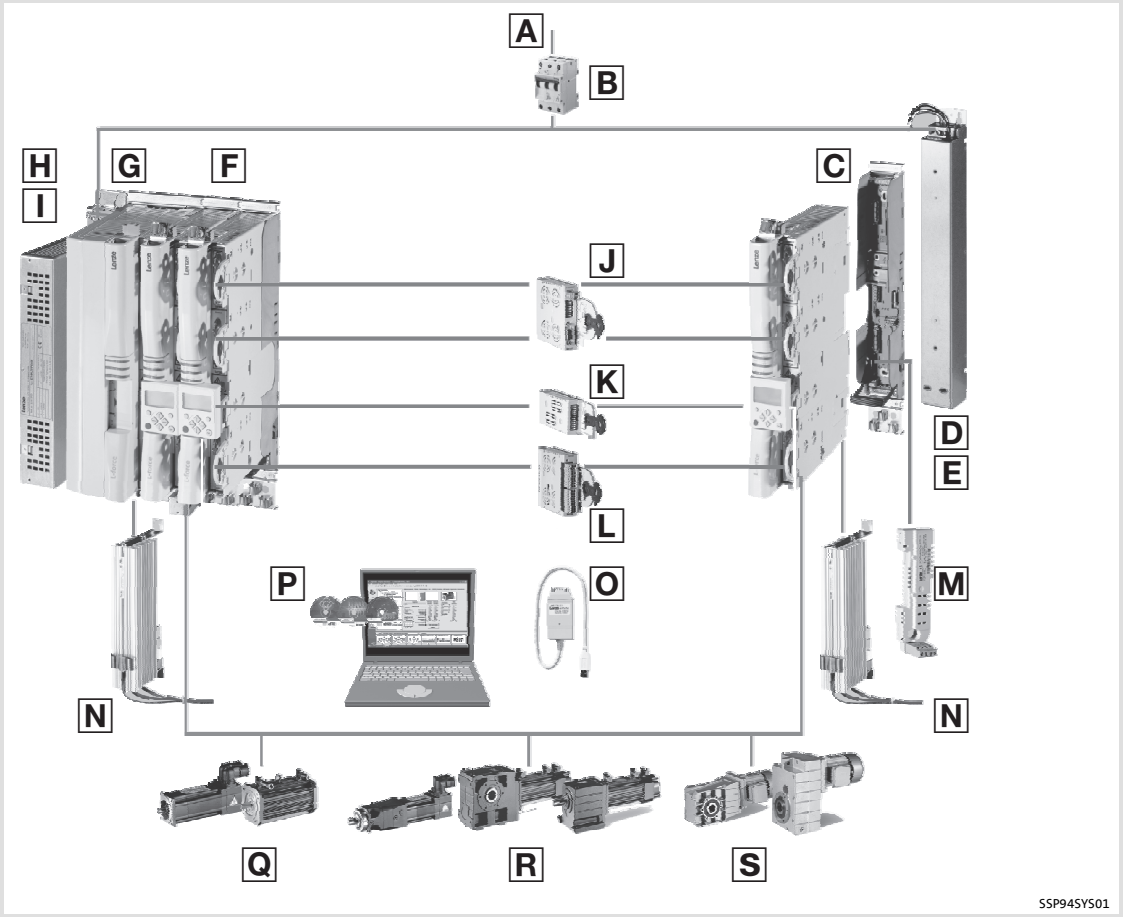
- compact design
- wide power range
- innovative installation concept
- intelligent technology functions
- high control precision
- scalable safety technology

1.1.3 System overview

The following figure shows the most important components for the implementation of a drive system with the Servo Drives 9400 product range.

On the way from the mains connection to the motor, you can see the basic principle of a drive system on the left path. On the right path, the basic principle of a single-axis drive is described.

In accordance with the requirements of your drive solution, your drive system can be equipped or extended with specially adapted components.



A Mains voltage 3/PE AC 180 ... 550 V ±0 % or 3/PE AC 380 ... 550 V ±0 %
(depending on the device size/device power)
B Mains fusing (not contained in the delivery programme)
C Single Drives 9400 📖 37
and corresponding installation backplanes
D Mains filter for Single Drives 9400 📖 495
E RFI filter for Single Drives 9400 📖 518
F Multi Drives 9400 📖 155
and corresponding installation backplanes
G Power supply modules 9400
📖 213, 📖 261
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H Mains filter for power supply modules 9400 📖 227
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Equipment for all axis modules (device-dependent options):
J Communication modules and extension modules 📖 346
K Memory modules 📖 396
L Safety modules 📖 403
M Motor holding brake control modules 📖 419
N Brake resistors 📖 560
O Diagnostic adapters 📖 467
P L-force Engineer (software)
Q Servo motors (motor catalogue)
R Geared servo motors (")
S Standard geared motors (")
Motor cables/system cables
(manual "System cables")

1.2 About this Hardware Manual

1.2.1 Information provided by the Hardware Manual

Target group

This Hardware Manual is intended for all persons who install, commission, and adjust 9400 servo controllers.

Together with the catalog it forms the basis of project planning for the manufacturers of machines and plants.

Contents

This Hardware Manual is meant as an addition to the Mounting Instructions included in the scope of supply:

- The features and functions are described in detail.
- It provides detailed information on additional ranges of application.

How to find information

Each chapter forms a complete unit and informs you about an individual subject:

- You therefore only have to read the chapter containing the information you need.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and Manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Availability

This Hardware Manual is designed as a loose-leaf collection and available as a PDF file on the Internet. At the bottom of each page you can see the version and publication date.

Tip!

Documentation and software updates for further Lenze products can be found on the Internet in the ”Services & Downloads” area under

http://www.Lenze.com

1.2.2 Products to which the Hardware Manual applies

Power modules

①										
E94	x	x	x	E	xxx	x	x	xx	xx	xx

Type / product range

9400 Servo Drives

Version

A = 1.
N = not relevant

Design

S = single-axis controller (Single Drive)
M = multi-axis controller (Multi Drive)
P = power supply module
R = regenerative power supply module

Variant

H = HighLine
N = not relevant
P = PLC

Mechanical version

E = installation

Rated current (rounded)

e.g.
007 = 7 A
024 = 23.5 A
...

Voltage class

2 = 230 V ~ / 300 V =
4 = 400 V ~ / 540 V =

Safety module

A ... D

Memory module

11 ... 44

Extension module 1

xx

Extension module 2

xx

Extension modules

			①		
E94	x	Y	x	xx	

Type / product range

9400 Servo Drives

Generation

A = 1.
N = not relevant

Identification

Y = module

Module group

C = communication
I = I/O
F = feedback
M = memory
A = safety

Module identification

CA = CANopen

DN = DeviceNet

EN = Ethernet

EP = Ethernet Powerlink

ET = EtherCAT

PM = PROFIBUS MC

LF = digital frequency

1x = MM1x0memory module

2x = MM2x0memory module

3x = MM3x0memory module

4x = MM4x0memory module

x1 = MMx10 memory module with MC StateLevellicence

x2 = MMx20 memory module with MC HighLevellicence

x3 = MMx30 memory module with MC TopLevellicence

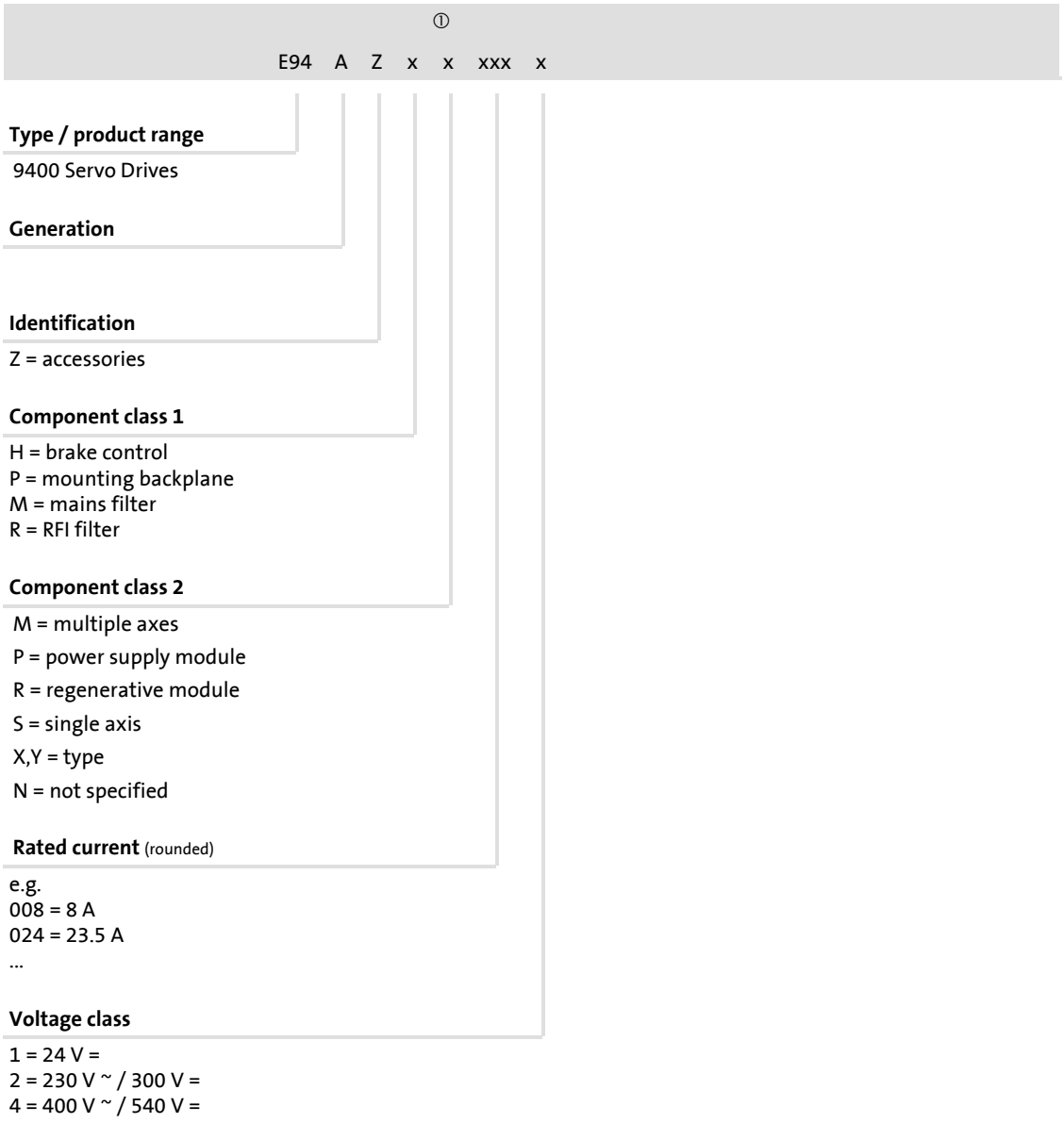
x4 = MMx40 memory module with PLClicence

A = SM0 safety module

B = SM100 safety module

E = SM301safety module

Power-related accessories



Power-independent accessories

	①			
E94	A	Z	x	xxx

Type / product range

9400 Servo Drives

Generation

Identification

Z = accessories

Accessory group

J = mechanical components, other
S = software
K = keypad
N = not specified

Module identification

1.3 Legal regulations

Labelling

Lenze drive controllers are clearly labelled and defined by the contents of the nameplate.

Manufacturer

Lenze Automation GmbH, Hans-Lenze-Str. 1, D-31855 Aerzen

CE conformity

Complies with the ”Low voltage” EC Directive

Application as directed

The following applies to 9400 servo controllers and the accessories:

- They must only be operated under the operating conditions described in this Hardware Manual.
- They are components for open and closed loop control of control variable speed drives with asynchronous standard motors, asynchronous servo motors, PM synchronous servo motors.
- They are components for installation into a machine.
- They are components used for assembly together with other components to form a machine.
- They comply with the protection requirements of the ”Low Voltage” EC Directive.
- They are not machines for the purposes of the ”EC ”Machinery” Directive.
- They are not to be used as household appliances but for industrial purposes only.

The following applies to drives with 9400 servo controllers:

- They comply with the EC ”Electromagnetic Compatibility” Directive if they are installed according to the guidelines of CE-typical drive systems.
- They can be used for operation at public and non-public mains.
- They can be used in industrial premises as well as residential and commercial premises.
- The user is responsible for the compliance of his application with the EC Directives.

Any other use shall be deemed inappropriate!

Liability

The information, data, and notes in this Hardware Manual met the state of the art at the time of printing. Claims referring to drive systems which have already been supplied cannot be derived from the information, illustrations, and descriptions given in this Manual.

The specifications, processes, and circuitry described in this Hardware Manual are for guidance only and must be adapted to your own application. Lenze does not take any responsibility for the suitability of the process and circuit proposals.

The specifications in this Hardware Manual describe the product features without guaranteeing them.

Lenze does not accept any liability for damage and failures caused by:

- Disregarding the Hardware Manual
- Unauthorised modifications to the controller
- Operating errors
- Improper working on and with the controller

Warranty

See Terms of sale and delivery.

Warranty claims must be made to your Lenze representative immediately after detecting the deficiency or fault.

The warranty is void in all cases where liability claims cannot be made.

2 Guide

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2.1 Terms and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
Axis, drive	Lenze controller combined with a motor or geared motor and other Lenze drive components
Basic insulation	Insulation for the basic protection against dangerous shock currents
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxxx/y	Subcode y of code Cxxxx (e.g. C0410/3 = subcode 3 of code C0410)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung
Double insulation	Basic insulation and additional insulation
EMC	Electromagnetic compatibility
EN	European standard
f_{max} [Hz]	Maximum frequency
Functional insulation	Insulation for perfect operation
I_{LN} [A]	Rated mains current
I_{aN} [A]	Rated output current
I_{aM} [A]	Maximum output current
IEC	International Electrotechnical Commission
IP	International Protection Code
I_{PE} [mA]	Discharge current
L [mH]	Inductance
M_N [Nm]	Rated torque
NEMA	National Electrical Manufacturers Association
P_N [kW]	Rated motor power
P_V [W]	Inverter power loss
P_{DC} [kW]	Power on the DC voltage side
R [Ω]	Resistance
Reinforced insulation	Standardised insulating system, equivalent protection to double insulation
S_N [kVA]	Apparent output power of controller

UL	Underwriters Laboratories
U_{DC} [V]	DC voltage
U_{LN} [V]	Rated mains voltage
U_{M} [V]	Output voltage / voltage on the motor terminals
VDE	Verband deutscher Elektrotechniker
Xk/y	Terminal y on terminal strip Xk (e.g. X3/28 = terminal 28 on terminal strip X3)

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3 Safety instructions

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3.1 General safety and application notes for Lenze controllers

(in accordance with Low-Voltage Directive 2006/95/EC)

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from Lenze.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - According to the basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
  - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
  - The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the particular applications. Lenze Automation GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and the accessory components can include live and rotating parts - depending on their type of protection - during operation. Surfaces can be hot.
  - Non-authorised removal of the required cover, inappropriate use, incorrect installation or operation create the risk of severe injury to persons or damage to material assets.
  - For more information, please see the documentation.
- High amounts of energy are produced in the controller. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

Application as directed

Controllers are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.

When controllers are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 98/37/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

The controllers meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonised standard EN 61800-5-1 applies to the controllers.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Warning: Controllers are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

Transport, storage

Please observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

Installation

The controllers must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

Controllers contain electrostatically sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live controllers, observe the applicable national regulations for the prevention of accidents (e.g. VBG 4).

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

The documentation contains information on the installation according to EMC (shielding, earthing, arrangement of filters, and installation of the cables). Also observe this information with regard to drive controllers labelled with CE marking. The manufacturer of the system or machine is responsible for the compliance of the limit values required in connection with EMC legislation. In order to observe the limit values for radio interference emissions effective at the installation site, you have to mount the drive controllers into housings (e. g. control cabinets). The housings have to enable an EMC-compliant structure. Particularly observe that, for instance, control cabinet doors preferably are metallically connected to the housing in a circumferential manner. Reduce openings or apertures through the housing to a minimum.

Lenze controllers can cause a DC current in the PE conductor. If a residual current device (RCD) is used for the protection in the case of direct or indirect contact on a three-phase supplied controller, only one residual current device of type B is permissible on the current supply side of the controller. If the controller is supplied with one phase, also a residual current device (RCD) of type A may be used. Apart from the use of a residual current device (RCD) also other protective measures can be used, like for instance isolation from the environment by double or reinforced insulation or isolation from the supply system by a transformer.

Operation

If necessary, systems including controllers must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The controllers can be adapted to your application. Please observe the corresponding information given in the documentation.

After the controller has been disconnected from the supply voltage, all live components and power connections must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.

All protection covers and doors must be shut during operation.

Notes for UL-approved systems with integrated controllers: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

Safety functions

Special controller variants support safety functions (e.g. ”safe torque off”, formerly ”safe standstill”) according to the requirements of appendix I No. 1.2.7 of the EC Directive ”Machinery” 98/37/EC, EN 954-1 category 3 and EN 1037. Strictly observe the notes on the safety functions given in the documentation on the respective variants.

Maintenance and servicing

The controllers do not require any maintenance if the prescribed operating conditions are observed.

Disposal

Recycle metals and plastics. Dispose of printed circuit board assemblies according to the state of the art.

The product-specific safety and application notes given in these instructions must be observed!

3.2 General safety and application instructions for Lenze motors

(According to: Low-Voltage Directive 2006/95/EC)

General

Low-voltage machines have hazardous live and rotating parts and possibly also hot surfaces.

Synchronous machines induce voltages at open terminals during operation.

All operations concerning transport, connections, commissioning and maintenance must be carried out by qualified, skilled personnel (EN 50110-1 (VDE 0105-100) and IEC 60364 must be observed). Inappropriate use creates the risk of severe injury to persons and damage to material assets.

Low-voltage machines may only be operated under the conditions that are indicated in the section ”Application as directed”.

The conditions at the place of installation must comply with the data given on the nameplate and in the documentation.

Application as directed

Low-voltage machines are intended for commercial installations. They comply with the harmonised standards of the series EN 60034 (VDE 0530). Their use in potentially explosive atmospheres is prohibited unless they are expressly intended for such use (follow additional instructions).

Low-voltage machines are components for installation into machines as defined in the Machinery Directive 2006/42/EC. Commissioning is prohibited until the conformity of the end product with this directive has been established (follow i.a. EN 60204-1)

Low-voltage machines with IP23 protection or less are only intended for outdoor use when applying special protective features.

The integrated brakes must not be used as safety brakes. It cannot be ruled out that factors which cannot be influenced, such as oil ingress due to a defective A-side shaft seal, cause a brake torque reduction.

Transport, storage

Damages must be reported immediately upon receipt to the forwarder; if required, commissioning must be excluded. Tighten screwed-in ring bolts before transport. They are designed for the weight of the low-voltage machines, do not apply extra loads. If necessary, use suitable and adequately dimensioned means of transport (e. g. rope guides).

Remove transport locking devices before commissioning. Reuse them for further transport. When storing low-voltage machines, ensure a dry, dust-free and low-vibration ($v_{eff} \leq 0.2$ mm/s) environment (damages while being stored).

Installation

Ensure an even surface, solid foot and flange mounting and exact alignment if a direct clutch is connected. Avoid resonances with the rotational frequency and double mains frequency which may be caused by the assembly. Turn rotor by hand, listen for unusual slipping noises. Check the direction of rotation when the clutch is not active (observe section "Electrical connection").

Use appropriate means to mount or remove belt pulleys and clutches (heating) and cover them with a touch guard. Avoid impermissible belt tensions.

The machines are half-key balanced. The clutch must be half-key balanced, too. The visible jutting out part of the key must be removed.

If required, provide pipe connections. Designs with shaft end at bottom must be protected with a cover which prevents the ingress of foreign particles into the fan. Free circulation of the cooling air must be ensured. The exhaust air - also the exhaust air of other machines next to the drive system - must not be taken in immediately.

Electrical connection

All operations must only be carried out by qualified and skilled personnel on the low-voltage machine at standstill and deenergised and provided with a safe guard to prevent an unintentional restart.This also applies to auxiliary circuits (e. g. brake, encoder, blower).

Check safe isolation from supply!

If the tolerances specified in EN 60034-1; IEC 34 (VDE 0530-1) - voltage ±5 %, frequency ±2 %, waveform, symmetry - are exceeded, more heat will be generated and the electromagnetic compatibility will be affected.

Observe the data on the nameplate, operating notes, and the connection diagram in the terminal box.

The connection must ensure a continuous and safe electrical supply (no loose wire ends); use appropriate cable terminals. The connection to the PE conductor must be safe. The plug-in connector must be bolt tightly (to stop).

The clearances between blank, live parts and to earth must not fall below 8 mm at $U_r \leq 550$ V, 10 mm at $U_r \leq 725$ V, 14 mm at $U_r \leq 1000$ V.

The terminal box must be free of foreign particles, dirt and moisture. All unused cable entries and the box itself must be sealed against dust and water.

Commissioning and operation

Before commissioning after longer storage periods, measure the insulation resistance. In case of values ≤ 1 kΩ per volt of rated voltage, dry winding.

For trial run without output elements, lock the featherkey. Do not deactivate the protective devices, not even in a trial run.

Check the correct operation of the brake before commissioning low-voltage machines with brakes.

Integrated thermal detectors do not provide full protection for the machine. If necessary, limit the maximum current. Parameterise the controller so that the motor will be switched off with $I > I_r$ after a few seconds of operation. especially at the risk of blocking.

Vibrational severities $v_{eff} \leq 3.5$ mm/s ($P_r \leq 15$ kW) or 4.5 mm/s ($P_r > 15$ kW) are acceptable if the clutch is activated.

If deviations from normal operation occur, e.g. increased temperatures, noises, vibrations, find the cause and, if required, contact the manufacturer. In case of doubt, switch off the low-voltage machine.

If the machine is exposed to dirt, clean the air channels regularly.

Shaft sealing rings and roller bearings have a limited service life.

Regrease bearings with relubricating devices while the low-voltage machine is running. Only use the grease recommended by the manufacturer. If the grease drain holes are sealed with a plug, (IP54 drive end; IP23 drive and non-drive end), remove plug before commissioning. Seal bore holes with grease. Replace prelubricated bearings (2Z bearing) after approx. 10,000 h - 20,000 h, at the latest however after 3 - 4 years.

The product-specific safety and application notes given in these instructions must be observed!

3.3 Residual hazards

Protection of persons

- Before working on the controller, check that no voltage is applied to the power terminals, because
  - depending on the controller - the power terminals U, V, W, +UG, -UG, Rb1 and Rb2 carry hazardous voltages for up to 3 to 20 minutes after mains disconnection.
  - the power terminals L1, L2, L3; U, V, W, +UG, -UG, Rb1 and Rb2 carry hazardous voltages when the motor is stopped.

Device protection

- Plug on or pull off all pluggable terminals only in deenergised condition!
- Detach the controllers only in deenergised conditions from their installation backplanes or the back panel of the control cabinet!
- **Cyclic** switching on and off of the mains voltage can overload and destroy the input current limitation of the controller:
  - Cyclic mains switching of 5-times in 5 minutes is permissible without restrictions.

Motor protection

- Depending on the controller settings, the connected motor can be overheated by:
  - For instance, longer DC-braking operations.
  - Longer operation of self-ventilated motors at low speed.

Protection of the machine/system

- Drives can reach dangerous overspeeds (e.g. setting of high output frequencies in connection with motors and machines unsuitable for such conditions):
  - The controllers do not offer any protection against such operating conditions. Use additional components for this purpose.

3.4 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions

Structure of safety instructions:

Danger!

(characterises the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

4 Single-axis controllers

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4.1 Device features

- Space-saving installation by compact design
- Innovative installation concept
- Power range: 370 W to 400 kW
- Pluggable and uniform connection for control cables over the complete power range
- Direct AC mains connection for ”Single Drive” design
- DC busbar integrated or can be retrofit
  (for devices up to 24 A/11 kW)
- Integrated brake chopper
- Direct connection of resolver or encoder feedback
  – Easy connection via predesigned system cable (accessories)
- Integrated phase controller for drift-free standstill
- Field-oriented control for asynchronous and synchronous motors
- Digital synchronisation system via bus system or
  digital frequency (extension module required)
- User configuration for control functions and input/output signals
  – Comprehensive library with function blocks
  – High flexibility with regard to the adaptation of the internal control structure to the drive task
- Extension interfaces for
  – Communication
  – Controller functionality
  – Safety engineering
- System bus (CANopen) for
  – servo inverter connection
  – input and output terminal extensions
  – connecting keypad and display units (HMI)

4.2 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-voltage directive	
Approval			
UL	UL 508C	Power Conversion Equipment, File No. 132659	
GOST-R	51321.1-2000 51321.3-99	No. POCC DE.AN30.B08815	

Protection of persons and devices			
Enclosure	EN 60529	IP 20	Not in the wire range of the terminals on the motor side
	NEMA 250	Protection against contact in accordance with type 1	
Insulation resistance	EN 61800-5-1	Overvoltage category III Reduction from 2000 m amsl onwards: Overvoltage category II	
Insulation of control circuits	EN 61800-5-1	Safe mains isolation by double/reinforced insulation for mains with neutral earthing with a rated voltage for the external conductor/star point up to 300 V.	
Short-circuit strength	EN 61800-5-1	Motor connection: with restrictions, error acknowledgement required Control connections: without restrictions	
Motor - protective measures against		• Short circuit • Earth fault • Overvoltage • Motor stalling • Motor overtemperature (PTC or thermal contact, I^2t monitoring)	
Discharge current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe regulations and safety instructions!
Cyclic mains switching		Cyclic mains switching of 5 times in 5 minutes is permissible without restrictions.	

Design			
Housing			
Carrier housing	Device sizes 1, 2 and 3	Glass-fiber reinforced plastic	
Carrier housing	Device sizes as of 6	Metal	
Dimensions		see "Mechanical installation"	
Weight		see "Mechanical installation"	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical	
Mounting clearances			
Above/below		≥ 80 mm / ≥ 120 mm	Observe the device-related notes on mounting.
To the sides		Side-by-side mounting without any clearance	

”Single Drive” **supply conditions**		
AC-mains operation		Direct connection
DC-bus operation		Direct connection via terminals or busbars(can be retrofitted) For more information, please see the chapter DC-bus operation.
Power systems		
TT		Operation permitted without restrictions.
TN		
With grounded phase		Operation with additional measures permitted: ● Overvoltage must be reduced to overvoltage category II according to EN 61800-5-1. ● Measures described for IT systems must be applied.
IT		Additional device-internal measure required (see (”Earthing of internal EMC filters”, 📖 103)
Motors	EN 60034	Only use motors suitable for inverter operation. Insulation resistance: max. û ≥ 1.5 kV, max. du/dt ≥ 5 kV/µs

Operating conditions

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s^2 = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

General electrical data

Motor cable requirements		
Capacitance per unit length		
≤ 2.5 mm²/AWG 14		$C_{Core/core}/C_{Core/shield}$ < 75/150 pF/m
≥ 4 mm²/AWG 12		$C_{Core/core}/C_{Core/shield}$ < 150/300 pF/m
Electric strength		
	VDE 0250-1	$U_0/U_=$ 0.6/1.0 kV (U_0 = r.m.s. value of external conductor to PE, U = r.m.s. value of external conductor to external conductor)
	UL	U ≥ 600 V (U = r.m.s. value of external conductor to external conductor)

Maximum motor and feedback cable lengths
(for shielded motor cable with rated mains voltage)

Type	Device size	[m]
E94AMxE0024 E94AMxE0034 E94AMxE0044	1	50
E94ASxE0024 E94ASxE0034		
E94AMxE0074 E94AMxE0094	2	100
E94ASxE0044 E94ASxE0074		
E94AMxE0134 E94AMxE0174 E94AMxE0244	3	100
E94AMxE0324	3	100
E94ASxE0134 E94ASxE0174 E94ASxE0244	3	100
E94ASxE0324 E94ASxE0474 E94ASxE0594	6	100
E94ASxE0864 E94ASxE1044	7	100
E94ASxE1454	8S	150
E94ASxE1724 E94ASxE2024	8	150
E94ASxE2454 E94ASxE2924 E94ASxE3664	9	150
E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	10	150

If EMC conditions must be met, the permissible cable lengths can be reduced.

Tab. 4-1

Type	Max. shielded motor cable lengths for compliance with EMC protection requirement C1/C2		
	with RFI filter	with mains filter	without filter
E94ASxE0024 E94ASxE0034	E94AZRS0044 -/50 m	E94AZMS0034 25 m/50 m	-/10 m
E94ASxE0044 E94ASxE0074	E94AZRS0104 -/50 m	E94AZMS0094 25 m/100 m	-/10 m
E94ASxE0134 E94ASxE0174	E94AZRS0294 -/50 m	E94AZMS0184 25 m/100 m	-/10 m
E94ASxE0244		E94AZMS0314 25 m/100 m	-/10 m
E94ASxE0324 E94ASxE0474 E94ASxE0594	E94AZRS0544 50 m/100 m	-	-/50 m
E94ASxE0864 E94ASxE1044	E94AZRS0954 50 m/100 m	-	-/50 m
E94ASxE1454	-	-	-/150 m
E94ASxE1724 E94ASxE2024			
E94ASxE2454 E94ASxE2924 E94ASxE3664			
E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954			

Tab. 4-2

EMC limit value class for conducted noise emission in TN/TT systems:
C2 to EN 61800-3 corresponds to class A to EN 55011
C1 to EN 61800-3 corresponds to class B to EN 55011

Longer motor cables can be achieved when line filters are used in combination with sinusoidal filters. Further conditions to be observed:

- V/f control mode
- Switching frequency is permanently set (C00018)

Motor cable lengths when sinusoidal filters and line filters are used

Type	Compliance with the EMC protection requirement C2				
	RFI filter	Mains filter	Sinusoidal filter	shielded unshielded	Switching frequency
E94ASxE0024	-	E94AZMS0034	EZS3-004A200	100 m 300 m	4 kHz or 8 kHz
E94ASxE0034					
E94ASxE0044	-	E94AZMS0094	EZS3-010A200		
E94ASxE0074					
E94ASxE0134	-	E94AZMS0184	EZS3-024A200		
E94ASxE0174					
E94ASxE0244	-	E94AZMS0314	EZS3-037A200		
E94ASxE0324	E94AZRS0544	-	EZS3-048A200	150 m 300 m	4 kHz or 8 kHz
E94ASxE0474			EZS3-061A200		
E94ASxE0594			EZS3-072A200		
E94ASxE0864	E94AZRS0954	-	EZS3-115A200	150 m 300 m	2 kHz or 4 kHz
E94ASxE1044			EZS3-150A200		
E94ASxE1454	-	-	EZS3-180A200	150 m - m	2 kHz or 4 kHz
E94ASxE1724	-	-	EZS3-250A200		
E94ASxE2024	-	-	EZS3-250A200		
E94ASxE2454	-	-	EZS3-350A200		
E94ASxE2924	-	-	EZS3-350A200		
E94ASxE3664	-	-	EZS3-480A200		
E94ASxE4604	-	-	EZS3-350A200 (2 in parallel)		
E94ASxE5724	-	-	EZS3-480A200 (2 in parallel)		
E94ASxE6354	-	-	EZS3-480A200 (2 in parallel)		
E94ASxE6954	-	-	EZS3-350A200 (3 in parallel)		

Tab. 4-3

EMC limit value class for conducted noise emission in TN/TT systems:
C2 to EN 61800-3 corresponds to class A to EN 55011

EMC		
Operation on public supply systems	EN 61800-3	The controllers are designed for use in an industrial environment. Operation on public networks requires measures to be taken for limiting the expected emission of radio interferences.
Noise emission, in cables		
Design ”Single Drive”	EN 61800-3	see Tab. 4-2 EMC protection requirements
Design ”Multi Drive”		Depending on the filter at the central DC supply module.
Noise immunity (to EN 61800-3)		
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV with air discharge, 4 kV with contact discharge against housing
Radio frequency		
Cable-guided	EN 61000-4-6	150 kHz ... 80 MHz, 10 V 80 % AM (1 kHz)
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz)
Burst		
Power terminals and interfaces	EN 61000-4-4	2 kV/5 kHz
Signal interfaces	EN 61000-4-4	1 kV/5 kHz
Control connections	EN 61000-4-4	2 kV/5 kHz
Surge (surge voltage)		
Power terminals	EN 61000-4-5	1.2/50 µs, 1 kV phase/phase, 2 kV phase/PE

Protective insulation

Danger!

Operation of the controller on a phase earthed mains with a rated mains voltage of ≥ 400 V:

- ► The protection against accidental contact is not ensured without external measures.
- ► If protection against accidental contact acc. to EN 61800-5-1 is required for the control terminals of the controller and the terminals for the plugged-in device modules,
  - – an additional basic insulation must be available.
  - – the components to be connected must have the second basic insulation.

Danger!

Dangerous electrical voltage

When one common voltage source is used for control voltages in separate potential areas, the protective insulation between the separate potential areas is deactivated.

Possible consequences:

- ► The specified protective insulations are not complied with.

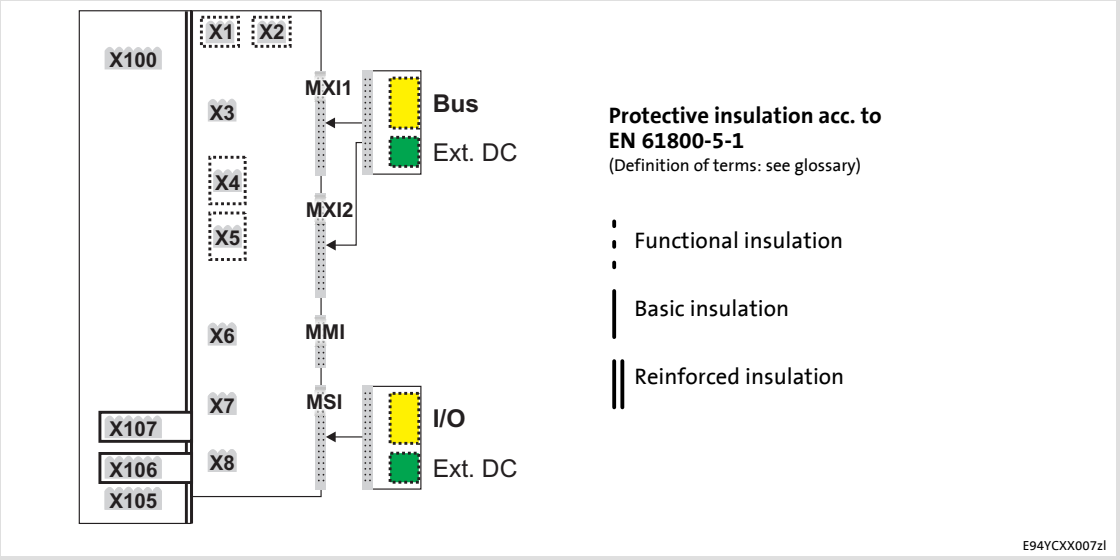
Protective measures:

- ► Use independent voltage sources.

The available protective insulation within the controller of the ” 9400 Servo Drives” series in accordance with EN 61800-5-1 is implemented with a rated voltage for the external conductor/star point of up to 300 V for mains with neutral earthing.

The following graphic representation

- ► shows the arrangement of the terminal strips and the separate potential areas of the controller.
- ► serves to determine the relevant protective insulation between two terminals in differently insulated separate potential areas.



Terminal strip	Terminal
X100	• L1, L2, L3 (only single drive) • +UG, -UG
X105	• U, V, W • Rb1, Rb2 (only single drive)
X106	Motor PTC
X107	Control of motor holding brake

Terminal strip	Terminal
X1	CAN on board 9400
X2	• State bus • 24 V (ext.)
X3	Analog input/output
X4	Digital outputs
X5	Digital inputs
X6	Diagnostics
X7	Resolver
X8	Encoder
MXI1, MXI2	Extension module
MMI	Memory module
MSI	Safety module

Example

Which type of protective insulation is used between the bus terminal of the device module in slot MXI1 or MXI2 and the mains terminal X100?

The separate potential area with the better protective insulation is decisive.

- ► The separate potential area of the device module bus terminal is ”functionally insulated”.
- ► The separate potential area of the mains terminal has a ”reinforced insulation”.

Result: The insulation between the mains terminal X100 and the bus terminal is of the ”reinforced insulation” type.

4.3 Rated data (devices for 400/500V mains)

The E94ASxExxx**4** devices can be used in the voltage range of 180 V ... 550 V AC.

Note!

To ensure a faultless operation of the devices the code C00173 must be set according to the mains voltage connected.

Emergency operation

Operation of the E94ASxxxx4 devices with an emergency voltage supply at +UG, -UG, is possible from $U_{DC} \geq 260$ V. The settings in C00173 and C00174 are to be adapted accordingly.

Operation of the E94AMxxxx4 devices with an emergency voltage supply at +UG, -UG, is possible with $U_{DC} \leq 260$ V. The settings in C00173 and C00174 are to be adapted accordingly. A 24-V supply at X2 is required.

4.3.1 Overview

Input data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94ASxE0024	230/400/500	50/60	2.1/2.1/1.8	1.6/1.6/1.4	3
E94ASxE0034	230/400/500	50/60	3.5/3.5/3.1	2.6/2.6/2.3	3
E94ASxE0044	230/400/500	50/60	5.5/5.5/4.8	4.1/4.1/3.6	3
E94ASxE0074	230/400/500	50/60	9.9/9.9/8.6	7.4/7.4/6.5	3
E94ASxE0134	230/400/500	50/60	16.8/16.8/14.7	12.6/12.6/11.0	3
E94ASxE0174	230/400/500	50/60	21.0/21.0/18.3	15.8/15.8/13.8	3
E94ASxE0244	230/400/500	50/60	29.0/29.0/25.4	21.8/21.8/19.1	3
E94ASxE0324	230/400/500	50/60	29.0/29.0/26.0	22.0/22.0/20.0	3
E94ASxE0474	230/400/500	50/60	43.0/43.0/39.0	32.0/32.0/29.0	3
E94ASxE0594	230/400/500	50/60	54.0/54.0/47.0	40.5/40.5/35.3	3
E94ASxE0864	230/400/500	50/60	79.0/79.0/70.0	59.0/59.0/52.0	3
E94ASxE1044	230/400/500	50/60	95.0/95.0/84.0	71.0/71.0/63.0	3
E94ASxE1454	400/500	50/60	140/140	126/126	3
E94ASxE1724	400/500	50/60	166/166	149/149	3
E94ASxE2024	400/500	50/60	195/195	176/176	3
E94ASxE2454	400/500	50/60	237/237	213/213	3
E94ASxE2924	400/500	50/60	280/280	252/252	3
E94ASxE3664	400/500	50/60	354/354	319/319	3
E94ASxE4604	400/500	50/60	444/444	400/400	3
E94ASxE5724	400/500	50/60	553/553	498/498	3
E94ASxE6354	400/500	50/60	614/614	553/553	3
E94ASxE6954	400/500	50/60	672/672	605/605	3

① Temperature in the control cabinet

Output data

Type	Voltage [V]	Frequency [1] [Hz]	Current [A] max. +45 °C ①	Current [A] max. +55 °C ①	Number of phases
E94ASxE0024	0 - 230/400/500	0 - 480	1.5/1.5/1.3	1.1/1.1/1.0	3
E94ASxE0034	0 - 230/400/500	0 - 480	2.5/2.5/2.2	1.9/1.9/1.7	3
E94ASxE0044	0 - 230/400/500	0 - 480	4/4/3.5	3/3/2.6	3
E94ASxE0074	0 - 230/400/500	0 - 480	7/7/6.1	5.3/5.3/4.6	3
E94ASxE0134	0 - 230/400/500	0 - 480	13/13/11.4	9.8/9.8/8.6	3
E94ASxE0174	0 - 230/400/500	0 - 480	16.5/16.5/14.4	12.4/12.4/10.8	3
E94ASxE0244	0 - 230/400/500	0 - 480	23.5/23.5/20.6	17.6/17.6/15.5	3
E94ASxE0324	0 - 230/400/500	0 - 599	32.0/32.0/28.0	24.0/24.0/21.0	3
E94ASxE0474	0 - 230/400/500	0 - 599	47.0/47.0/41.0	35.3/35.3/30.8	3
E94ASxE0594	0 - 230/400/500	0 - 599	59.0/59.0/51.6	44.3/44.3/38.7	3
E94ASxE0864	0 - 230/400/500	0 - 599	86.0/86.0/75.3	64.5/64.5/56.4	3
E94ASxE1044	0 - 230/400/500	0 - 599	104/104/91.0	78.0/78.0/68.3	3
E94ASxE1454	0 - 400/500	0 - 599	145/145	131/131	3
E94ASxE1724	0 - 400/500	0 - 599	172/172	155/155	3
E94ASxE2024	0 - 400/500	0 - 599	202/202	182/182	3
E94ASxE2454	0 - 400/500	0 - 599	245/245	221/221	3
E94ASxE2924	0 - 400/500	0 - 599	292/292	263/263	3
E94ASxE3664	0 - 400/500	0 - 599	366/366	329/329	3
E94ASxE4604	0 - 400/500	0 - 599	460/460	414/414	3
E94ASxE5724	0 - 400/500	0 - 599	572/572	515/515	3
E94ASxE6354	0 - 400/500	0 - 599	635/635	572/572	3
E94ASxE6954	0 - 400/500	0 - 599	695/695	626/626	3

① Temperature in the control cabinet

1) The limitation to 599 Hz does not apply to the "servo control" modes (see C00006 = 1 or 2). Generally applies: the output frequency is limited to 1/8 of the selected chopper frequency (see C00018).

Note!

The indicated output voltage will not be reached under certain operating conditions.

- ► Output power in the maximum range
- ► High switching frequencies
- ► Use of mains filters or mains chokes
- ► Mains supply with high impedance (U_k > 5 %)

Power losses

Type	Power loss P_V [W]			
	U_{Lr} = 230 V	U_{Lr} = 400 V	U_{Lr} = 500 V	**when controller is inhibited**
E94ASxE0024	70	90	105	40
E94ASxE0034	85	105	125	
E94ASxE0044	100	130	150	
E94ASxE0074	125	160	190	
E94ASxE0134	200	260	300	
E94ASxE0174	240	300	350	
E94ASxE0244	310	400	460	
E94ASxE0324	750	750	750	75
E94ASxE0474	1050	1050	1050	
E94ASxE0594	1100	1100	1100	
E94ASxE0864	1500	1500	1500	100
E94ASxE1044	1800	1800	1800	
E94ASxE1454	-	2100	2100	50
E94ASxE1724	-	2200	2200	50
E94ASxE2024	-	2600	2600	
E94ASxE2454	-	3300	3300	50
E94ASxE2924	-	4100	4100	
E94ASxE3664	-	4900	4900	
E94ASxE4604	-	6200	6200	100
E94ASxE5724	-	7200	7200	
E94ASxE6354	-	7700	7700	
E94ASxE6954	-	8700	8700	

4.3.2 Operation at rated mains voltage 230 V

Device size 1 ... 6

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %
2/PE DC	325	260 - 0 % ... 370 + 0 %	-

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE0024	1.5	2.1	0.5	0.18	0.25
E94ASxE0034	2.5	3.5	0.9	0.37	0.5
E94ASxE0044	3.9	5.5	1.4	0.75	1
E94ASxE0074	7.0	9.9	2.5	1.5	2
E94ASxE0134	12.0	16.8	4.7	3	4
E94ASxE0174	15.0	21.0	5.9	4	5.5
E94ASxE0244	20.5	29.0	8.4	5.5	7.5
E94ASxE0324	-	29.0	11.5	7.5	10
E94ASxE0474	-	43.0	16.9	11	15
E94ASxE0594	-	54.0	21.2	15	20

Device size 7

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE0864	-	79.0	30.8	22	29
E94ASxE1044	-	95.0	37.3	30	40

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94ASxE0024	1.9 [3]	6.0	1.9 [3]	6.0	**1.5**	4.8	1.1
E94ASxE0034	3.1 [3]	10.0	3.1 [3]	10.0	**2.5**	8.0	1.9
E94ASxE0044	5.0 [3]	16.0	5.0 [3]	16.0	**4.0**	12.8	3.0
E94ASxE0074	8.8 [3]	21.0	8.8 [3]	21.0	**7.0**	16.8	5.3
E94ASxE0134	16.3 [3]	39.0	16.3 [3]	39.0	**13.0**	31.2	9.8
E94ASxE0174	20.6 [3]	49.5	20.6 [3]	49.5	**16.5**	39.6	12.4
E94ASxE0244	29.4 [3]	58.8	29.4 [3]	58.8	**23.5**	47.0	17.6
E94ASxE0324	38.4	76.8	38.4	76.8	**32.0**	64.0	16.8
E94ASxE0474	47.0	94.0	**47.0**	94.0	41.0	82.0	21.5
E94ASxE0594	59.0	118	**59.0**	118	41.0	82.0	21.5
E94ASxE0864	86.0	172	**86.0**	172	73.0	146	38.3
E94ASxE1044	104	208	**104**	208	78.0	156	40.9

I_{aN2} Rated value of permanent output current at a frequency of ≥ 0 Hz

I_{aM2} Maximum output current (overload current) at frequency ≥ 0 Hz
- Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}

I_{aN4}, I_{aN8}, I_{aN16} Rated value of continuous output current at a frequency of ≥ 5 Hz
(reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)

I_{aM4}, I_{aM8} Maximum output current (overload current) at frequency ≥ 5 Hz
(reduce to 0.66 * I_{aMx} for 0 ... 5 Hz)
- Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx}
- Can be achieved using the setting "x kHz fixed" in C00018

bold Nominal value I_{aN}

[3] Operation with permanent currents > I_{aN8} requires an external mains choke.

Rated data for internal brake chopper

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ASxE0024	47	8.3	3.2	3.7	0.64	5	0.7	1.1
E94ASxE0034	47	8.3	3.2	3.7	0.64	5	0.7	1.1
E94ASxE0044	27	14.4	5.6	5.9	0.95	5	0.6	1.0
E94ASxE0074	27	14.4	5.6	6.9	1.3	5	0.8	1.0
E94ASxE0134	18	21.7	8.5	10.6	2.0	5	0.8	1.2
E94ASxE0174	9	43.3	16.9	20.3	3.7	5	0.7	1.1
E94ASxE0244	9	43.3	16.9	24.5	5.4	5	1.1	1.6
E94ASxE0324	9	43.3	16.9	28.5	7.3	600	260	600
E94ASxE0474	7.5	52.0	20.3	37.9	10.8	600	320	600
E94ASxE0594	7.5	52.0	20.3	44.2	14.7	600	430	600
E94ASxE0864	3.8	102.6	40.0	75.5	21.6	600	320	600
E94ASxE1044	3.8	102.6	40.0	83.5	26.4	600	400	600

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

Note on the brake chopper data

The brake chopper can output the peak braking power maximally for the specified time t_{on} within a cycle time t_Z.

The brake chopper can output the peak braking power from unloaded states once for the time t_{fp}, e. g. after mains connection or after a recovery time of > 5 x t_Z.

If the times are exceeded, the brake chopper is clocked so that only the continuous braking power is output. This serves to the protection of the brake chopper, however, it does not protect the brake resistor. The brake resistor connected can be protected separately by parameterisation (C00129 ... C00133) or a thermal contact.

Further information can be found in the software manual.

4.3.3 Operation at rated mains voltage 400 V

Device size 1 ... 6

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %
2/PE DC	565	455 - 0 % ... 620 + 0 %	-

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE0024	1.5	2.1	0.9	0.37	0.5
E94ASxE0034	2.5	3.5	1.6	0.75	1
E94ASxE0044	3.9	5.5	2.5	1.5	2
E94ASxE0074	7.0	9.9	4.4	3	4
E94ASxE0134	12.0	16.8	8.1	5.5	7.5
E94ASxE0174	15.0	21.0	10.3	7.5	11
E94ASxE0244	20.5	29.0	14.7	11	15
E94ASxE0324	-	29.0	20.0	15	20
E94ASxE0474	-	43.0	29.3	22	29
E94ASxE0594	-	54.0	36.8	30	40

Device size 7

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE0864	-	79.0	53.6	45	60
E94ASxE1044	-	95.0	64.8	55	73

Device size 8S ... 10

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	400	340 - 0 % ... 440 + 0 %	48 - 0 % ... 65 + 0 %

	Mains current at I_{aN}		**Output power**	**Motor power (typical)**	
	with external mains choke	without external mains choke	U, V, W	4 pol. ASM	
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE1454	-	140	90	75	100
E94ASxE1724	-	166	107	90	125
E94ASxE2024	-	195	126	105	140
E94ASxE2454	-	237	153	130	170
E94ASxE2924	-	280	182	150	205
E94ASxE3664	-	354	228	190	255
E94ASxE4604	-	444	287	240	320
E94ASxE5724	-	553	357	300	400
E94ASxE6354	-	614	396	335	445
E94ASxE6954	-	672	433	370	495

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94ASxE0024	1.9 [3]	6.0	1.9 [3]	6.0	**1.5**	4.8	1.1
E94ASxE0034	3.1 [3]	10.0	3.1 [3]	10.0	**2.5**	8.0	1.9
E94ASxE0044	5.0 [3]	16.0	5.0 [3]	16.0	**4.0**	12.8	3.0
E94ASxE0074	8.8 [3]	21.0	8.8 [3]	21.0	**7.0**	16.8	5.3
E94ASxE0134	16.3 [3]	39.0	16.3 [3]	39.0	**13.0**	31.2	9.8
E94ASxE0174	20.6 [3]	49.5	20.6 [3]	49.5	**16.5**	39.6	12.4
E94ASxE0244	29.4 [3]	58.8	29.4 [3]	58.8	**23.5**	47.0	17.6
E94ASxE0324	38.4	76.8	38.4	76.8	**32.0**	56.0	16.8
E94ASxE0474	47.0	94.0	**47.0**	94.0	41.0	82.0	21.5
E94ASxE0594	59.0	118	**59.0**	118	41.0	82.0	21.5
E94ASxE0864	86.0	172	**86.0**	172	73.0	146	38.3
E94ASxE1044	104	208	**104**	208	78.0	156	40.9
E94ASxE1454	145	261	**145**	261	102	184	-
E94ASxE1724	172	310	**172**	310	120	216	-
E94ASxE2024	202	364	**202**	364	131	236	-
E94ASxE2454	**245**	441	209	376	160	288	-
E94ASxE2924	**292**	526	250	450	191	344	-
E94ASxE3664	**366**	659	313	563	240	432	-
E94ASxE4604	**460**	828	368	662	260	468	-
E94ASxE5724	**572**	1030	458	824	286	515	-
E94ASxE6354	**635**	1143	508	914	318	572	-
E94ASxE6954	**695**	1251	556	1001	348	626	-

I_{aN2} Rated value of permanent output current at a frequency of ≥ 0 Hz

I_{aM2} Maximum output current (overload current) at frequency ≥ 0 Hz

E94ASxE0024 ... E94ASxE1044:
- Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}

E94ASxE1454 ... E94ASxE6954:
- Periodic load change of 10 s with I_{aM2} and recovery time of 50 s with 75 % I_{aN2}

I_{aN4}, I_{aN8}, I_{aN16} Rated value of continuous output current at a frequency of ≥ 5 Hz

(reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)

I_{aM4}, I_{aM8} Maximum output current (overload current) at frequency ≥ 5 Hz

(reduce to 0.66 * I_{aMx} for 0 ... 5 Hz)
- Can be achieved using the setting "x kHz fixed" in C00018

E94ASxE0024 ... E94ASxE1044:
- Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx}

E94ASxE1454 ... E94ASxE6954:
- Periodic load change of 10 s with I_{aM2} and recovery time of 50 s with 75 % I_{aN2}

bold Nominal value I_{aN}

[3] Operation with permanent currents > I_{aN8} requires an external mains choke.

Operation with increased continuous power

If required, operation with increased continuous power can be activated for specific controllers at the switching frequency 2 kHz. This operating mode can only be performed under the following conditions:

- Controllers of the types E94ASxE1454 ... E94ASxE6954, (device size 8S ... 10).
- The controllers require the versions SW: 04.00 and HW: 1C.
  – "Mode 1" is possible from SW: 03.00 and HW: 1C.
- For "Mode 2" the mains voltage is ≤ 440 V.
- The maximum permissible ambient temperature inside the control cabinet is ≤ 40 °C.
- The maximum output current in C00022 is to be reduced according to the following data for I_{aMhc}.
- Operation with increased continuous power has to be activated in C01199 with "Mode 1" or "Mode 2".
  – For activation controller inhibit has to be set.

The currents deviating from the standard can be gathered from the following tables.

Note!

The "activated" setting in C01199 is reset to "deactivated" automatically (without error message) if the above-mentioned conditions are not (no longer) met.

- This, for instance, is also the case if the memory module is plugged into a controller of device size 1 ... 6 (device replacement).

For the selection ”Mode 1“:

Type	Output currents [A] at switching frequency 2 kHz			
	I_{aN2}	I_{aNhc}	I_{aMhc}	I_{aMre}
E94ASxE1454	145	160	218	145
E94ASxE1724	172	195	258	180
E94ASxE2024	202	240	303	226
E94ASxE2454	245	302	368	275
E94ASxE2924	292	361	438	330
E94ASxE3664	366	443	549	415
E94ASxE4604	460	550	690	522
E94ASxE5724	572	610	858	550
E94ASxE6354	635	678	953	610
E94ASxE6954	695	730	1043	653

I_{aN2} Rated value of continuous output current at a frequency of ≥ 0 Hz (standard operation)

I_{aNhc} Increased continuous output current at a frequency of ≥ 0 Hz

I_{aMhc} Maximum output current (overload current)
- Periodic load change of 10 s with I_{aMhc} and recovery time of 50 s with I_{aMre}

I_{aMre} Maximum output current during the recovery time of 50 s

Sinusoidal filter assignments changed for this operating mode:

Motor cable lengths when sinusoidal filters and line filters are used				
	Compliance with the EMC protection requirement C2			
Type	Setting C01199	Sinusoidal filter	shielded unshielded	Switching frequency
E94ASxE2924	”Mode 1”	**EZS3-480A200**	150 m - m	2 kHz or 4 kHz

For the selection ”Mode 2“:

Type	Output currents [A] at switching frequency 2 kHz			
	I_{aN2}	I_{aNhc}	I_{aMhc}	I_{aMre}
E94ASxE1454	145	177	195	168
E94ASxE1724	172	212	233	201
E94ASxE2024	202	260	286	247
E94ASxE2454	245	315	347	299
E94ASxE2924	292	395	434	375
E94ASxE3664	366	480	528	456
E94ASxE4604	460	600	660	570
E94ASxE5724	572	658	724	625
E94ASxE6354	635	745	820	708
E94ASxE6954	695	800	880	760

I_{aN2} Rated value of continuous output current at a frequency of ≥ 0 Hz (standard operation)

I_{aNhc} Increased continuous output current at a frequency of ≥ 0 Hz

I_{aMhc} Maximum output current (overload current)
- Periodic load change of 60 s with I_{aMhc} and recovery time of 120 s with I_{aMre}

I_{aMre} Maximum output current during the recovery time

Sinusoidal filter assignments changed for this operating mode:

Motor cable lengths when sinusoidal filters and line filters are used				
	Compliance with the EMC protection requirement C2			
Type	Setting C01199	Sinusoidal filter	shielded unshielded	Switching frequency
E94ASxE2024	”Mode 2”	**EZS3-350A200**	150 m - m	2 kHz or 4 kHz
E94ASxE2924		**EZS3-480A200**		
E94ASxE4604		**EZS3-480A200** (2 in parallel)		

Rated data for internal brake chopper

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ASxE0024	82	8.8	6.4	3.9	1.3	5	0.7	1.1
E94ASxE0034	82	8.8	6.4	3.9	1.3	5	0.7	1.1
E94ASxE0044	47	15.4	11.2	6.3	1.9	5	0.6	1.0
E94ASxE0074	47	15.4	11.2	7.4	2.6	5	0.8	1.0
E94ASxE0134	27	26.9	19.5	13.2	4.7	5	0.8	1.2
E94ASxE0174	18	40.3	29.2	18.9	6.4	5	0.7	1.1
E94ASxE0244	18	40.3	29.2	22.8	9.3	5	1.1	1.6
E94ASxE0324	18	40.3	29.2	26.5	12.6	600	260	600
E94ASxE0474	15	48.3	35.0	35.2	18.6	600	320	600
E94ASxE0594	15	48.3	35.0	41.0	25.3	600	430	600
E94ASxE0864	7.5	96.7	70.1	71.1	37.9	600	320	600
E94ASxE1044	7.5	96.7	70.1	78.7	46.3	600	400	600
E94ASxE1454	5.0	145	105	79	31.5	600	60	62
E94ASxE1724	4.3	169	122	93	36.7	600	60	62
E94ASxE2024	3.5	207	150	113	45.1	600	60	62
E94ASxE2454	2.8	259	188	142	56.3	600	60	62
E94ASxE2924	2.3	315	229	173	68.6	600	60	62
E94ASxE3664	1.8	414	300	227	90.1	600	60	62
E94ASxE4604	1.4	518	375	266	99	300	30	33
E94ASxE5724	1.2	604	438	287	99	300	28	32
E94ASxE6354	1.1	659	478	300	99	300	25	29
E94ASxE6954	1.1	659	478	300	99	300	25	29

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

Note on the brake chopper data

The brake chopper can output the peak braking power maximally for the specified time t_{on} within a cycle time t_Z.

The brake chopper can output the peak braking power from unloaded states once for the time t_{fp}, e. g. after mains connection or after a recovery time of > 5 x t_Z.

If the times are exceeded, the brake chopper is clocked so that only the continuous braking power is output. This serves to the protection of the brake chopper, however, it does not protect the brake resistor. The brake resistor connected can be protected separately by parameterisation (C00129 ... C00133) or a thermal contact.

Further information can be found in the software manual.

4.3.4 Operation at rated mains voltage 500 V

Device size 1 ... 6

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %
2/PE DC	705	565 - 0 % ... 775 + 0 %	-

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE0024	1.3	1.8	1.0	0.37	0.5
E94ASxE0034	2.2	3.1	1.7	0.75	1
E94ASxE0044	3.4	4.8	2.7	1.5	2
E94ASxE0074	6.1	8.7	4.8	3	4
E94ASxE0134	10.5	14.7	8.9	5.5	7.5
E94ASxE0174	13.1	18.4	11.3	7.5	10
E94ASxE0244	17.9	25.4	16.0	11	15
E94ASxE0324	-	26.0	21.8	15	20
E94ASxE0474	-	37.6	32.1	22	29
E94ASxE0594	-	47.0	40.2	30	40

Device size 7

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %

	Mains current at I_{aN}		**Output power** U, V, W	**Motor power (typical)** 4 pol. ASM	
	with external mains choke	without external mains choke			
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94AsxE0864	-	70.0	58.6	45	60
E94ASxE1044	-	84.0	70.9	55	73

Device size 8S ... 10

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	48 - 0 % ... 65 + 0 %

	Mains current at I_{aN}		**Output power**	**Motor power (typical)**	
	with external mains choke	without external mains choke	U, V, W	4 pol. ASM	
Type	I_{LN} [A]	I_{LN} [A]	S_{aN} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94ASxE1454	-	140	113	95	130
E94ASxE1724	-	166	134	110	150
E94ASxE2024	-	195	157	130	180
E94ASxE2454	-	237	191	160	215
E94ASxE2924	-	280	228	190	255
E94ASxE3664	-	354	285	235	320
E94ASxE4604	-	444	359	300	405
E94ASxE5724	-	553	446	375	510
E94ASxE6354	-	614	495	420	570
E94ASxE6954	-	672	542	460	625

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94ASxE0024	1.9 [3]	6.0	1.9 [3]	6.0	1.3	4.2	1.0
E94ASxE0034	3.1 [3]	10.0	3.1 [3]	10.0	2.2	7.0	1.6
E94ASxE0044	5.0 [3]	16.0	5.0 [3]	16.0	3.5	11.2	2.6
E94ASxE0074	8.8 [3]	21.0	8.8 [3]	21.0	6.1	14.7	4.6
E94ASxE0134	16.3 [3]	39.0	16.3 [3]	39.0	11.4	27.3	8.5
E94ASxE0174	20.6 [3]	49.5	20.6 [3]	49.5	14.4	34.7	10.8
E94ASxE0244	29.4 [3]	58.8	29.4 [3]	58.8	20.6	41.1	15.4 [4]
E94ASxE0324	38.4	76.8	33.6	67.2	28.0	64.0	16.8
E94ASxE0474	47.0	94.0	41.1	82.2	35.8	71.6	21.5
E94ASxE0594	59.0	118	51.6	103	35.9	71.8	21.5
E94ASxE0864	86.0	172	75.3	150	63.9	127	38.3
E94ASxE1044	104	208	91.0	182	68.3	136	40.9
E94ASxE1454	145	261	**145**	261	89	161	-
E94ASxE1724	172	310	**172**	310	105	189	-
E94ASxE2024	202	364	**202**	364	115	206	-
E94ASxE2454	**245**	441	209	376	140	252	-
E94ASxE2924	**292**	526	250	450	167	301	-
E94ASxE3664	**366**	659	313	563	210	378	-
E94ASxE4604	**460**	828	368	662	228	410	-
E94ASxE5724	**572**	1030	458	824	250	450	-
E94ASxE6354	**635**	1143	508	914	278	500	-
E94ASxE6954	**695**	1251	556	1001	305	549	-

I_{aN2} Rated value of permanent output current at a frequency of ≥ 0 Hz

I_{aM2} Maximum output current (overload current) at frequency ≥ 0 Hz

E94ASxE0024 ... E94ASxE1044:
- Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}

E94ASxE1454 ... E94ASxE6954:
- Periodic load change of 10 s with I_{aM2} and recovery time of 50 s with 75 % I_{aN2}

I_{aN4}, I_{aN8}, I_{aN16} Rated value of continuous output current at a frequency of ≥ 5 Hz

(reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)

I_{aM4}, I_{aM8} Maximum output current (overload current) at frequency ≥ 5 Hz

(reduce to 0.66 * I_{aMx} for 0 ... 5 Hz)
- Can be achieved using the setting "x kHz fixed" in C00018

E94ASxE0024 ... E94ASxE1044:
- Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx}

E94ASxE1454 ... E94ASxE6954:
- Periodic load change of 10 s with I_{aM2} and recovery time of 50 s with 75 % I_{aN2}

bold Nominal value I_{aN}

[3] Operation with permanent currents > I_{aN8} requires an external mains choke.

[4] Temperature inside the control cabinet = +35 ... +55 °C: 2.5 %/K current derating

Operation with increased continuous power

If required, operation with increased continuous power can be activated for specific controllers at the switching frequency 2 kHz. This operating mode can only be performed under the following conditions:

- Controllers of the types E94ASxE1454 ... E94ASxE6954, (device size 8S ... 10).
- The controllers require the versions SW: 04.00 and HW: 1C.
  – "Mode 1" is possible from SW: 03.00 and HW: 1C.
- The maximum permissible ambient temperature inside the control cabinet is ≤ 40 °C.
- The maximum output current in C00022 is to be reduced according to the following data for I_{aMhc}.
- Operation with increased continuous power has to be activated in C01199 with "Mode 1".
  – For activation controller inhibit has to be set.

The currents deviating from the standard can be gathered from the following tables.

Note!

The "activated" setting in C01199 is reset to "deactivated" automatically (without error message) if the above-mentioned conditions are not (no longer) met.

- This, for instance, is also the case if the memory module is plugged into a controller of device size 1 ... 6 (device replacement).

For the selection ”Mode 1“:

Type	Output currents [A] at switching frequency 2 kHz			
	I_{aN2}	I_{aNhc}	I_{aMhc}	I_{aMre}
E94ASxE1454	145	160	218	145
E94ASxE1724	172	195	258	180
E94ASxE2024	202	240	303	226
E94ASxE2454	245	302	368	275
E94ASxE2924	292	361	438	330
E94ASxE3664	366	443	549	415
E94ASxE4604	460	550	690	522
E94ASxE5724	572	610	858	550
E94ASxE6354	635	678	953	610
E94ASxE6954	695	730	1043	653

I_{aN2} Rated value of continuous output current at a frequency of ≥ 0 Hz (standard operation)

I_{aNhc} Increased continuous output current at a frequency of ≥ 0 Hz

I_{aMhc} Maximum output current (overload current)
- Periodic load change of 10 s with I_{aMhc} and recovery time of 50 s with I_{aMre}

I_{aMre} Maximum output current during the recovery time of 50 s

Sinusoidal filter assignments changed for this operating mode:

Motor cable lengths when sinusoidal filters and line filters are used				
	Compliance with the EMC protection requirement C2			
Type	Setting C01199	Sinusoidal filter	shielded unshielded	Switching frequency
E94ASxE2924	”Mode 1”	**EZS3-480A200**	150 m - m	2 kHz or 4 kHz

The selection ”Mode 2“ is only permissible for mains voltages ≤ 440 V.

Rated data for internal brake chopper

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ASxE0024	82	9.6	7.6	4.3	1.5	5	0.7	1.1
E94ASxE0034	82	9.6	7.6	4.3	1.5	5	0.7	1.1
E94ASxE0044	47	16.8	13.3	6.9	2.3	5	0.6	1.0
E94ASxE0074	47	16.8	13.3	8.1	3.1	5	0.8	1.0
E94ASxE0134	27	29.3	23.1	14.4	5.5	5	0.8	1.2
E94ASxE0174	18	43.9	34.7	20.6	7.6	5	0.7	1.1
E94ASxE0244	18	43.9	34.7	24.8	11.1	5	1.1	1.6
E94ASxE0324	18.0	43.9	34.7	28.9	15.0	600	260	600
E94ASxE0474	15.0	52.7	41.6	38.4	22.0	600	320	600
E94ASxE0594	15.0	52.7	41.6	44.8	30.0	600	430	600
E94ASxE0864	7.5	105.3	83.2	77.5	45.0	600	320	600
E94ASxE1044	7.5	105.3	83.2	85.7	55.0	600	400	600
E94ASxE1454	5.0	158	125	87	37.4	600	60	62
E94ASxE1724	4.3	184	145	101	43.5	600	60	62
E94ASxE2024	3.5	226	178	124	53.5	600	60	62
E94ASxE2454	2.8	282	223	154	66.9	600	60	62
E94ASxE2924	2.3	343	271	188	81.4	600	60	62
E94ASxE3664	1.8	451	357	247	107	600	60	62
E94ASxE4604	1.4	564	446	289	117	300	30	33
E94ASxE5724	1.2	658	520	312	117	300	28	32
E94ASxE6354	1.1	718	567	327	117	300	25	29
E94ASxE6954	1.1	718	567	327	117	300	25	29

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

Note on the brake chopper data

The brake chopper can output the peak braking power maximally for the specified time t_{on} within a cycle time t_Z.

The brake chopper can output the peak braking power from unloaded states once for the time t_{fp}, e. g. after mains connection or after a recovery time of > 5 x t_Z.

If the times are exceeded, the brake chopper is clocked so that only the continuous braking power is output. This serves to the protection of the brake chopper, however, it does not protect the brake resistor. The brake resistor connected can be protected separately by parameterisation (C00129 ... C00133) or a thermal contact.

Further information can be found in the software manual.

4.3.5 Fuses and cable cross-sections

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230 ... 500	180 - 0 % ... 550 + 0 %	45 ... 65

Operation with external mains choke/mains filter								
Type	Installation according to EN 60204-1 [1]					Installation according to UL [2]		FI [3]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E94ASxE0024	C10	-	1,5	1,5	-	10	16	≥ 300
E94ASxE0034	C10	-	1.5	1.5	-	10	16	≥ 300
E94ASxE0044	C10	-	1.5	1.5	-	10	16	≥ 300
E94ASxE0074	C16	-	2.5	2.5	-	15	14	≥ 300
E94ASxE0134	C20	-	2.5	2.5	-	20	12	≥ 300
E94ASxE0174	C25	-	4	4	-	25	10	≥ 300
E94ASxE0244	C32	-	10	6	-	40	8	≥ 300

1) The details are recommendations. Other designs/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: the use of PVC-insulated copper cables, conductor temperature < 70°C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) UL approved cables only, fuses and fuse holders must be used.
UL fuse: voltage 500 ... 600 V

3) Universal-current sensitive earth-leakage circuit breaker
If several devices or cable lengths > 50 m are used, the circuit breaker may respond, depending on the cable type and switching frequency.

① Circuit breaker

② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category

③ Fuse

Observe national and regional regulations

Operation without external mains choke/mains filter

Type	Installation according to EN 60204-1 [1]					Installation according to UL [2]		FI [3]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E94ASxE0024	C10	-	1,5	1,5	-	10	18	≥ 300
E94ASxE0034	C10	-	1.5	1.5	-	10	18	≥ 300
E94ASxE0044	C10	-	1.5	1.5	-	10	18	≥ 300
E94ASxE0074	C16	-	2.5	2.5	-	15	16	≥ 300
E94ASxE0134	C20	-	2.5	2.5	-	20	12	≥ 300
E94ASxE0174	C25	-	4	4	-	25	10	≥ 300
E94ASxE0244	C40	-	10	6	-	40	8	≥ 300
E94ASxE0324 [4]	-	40	10	6	-	40	8	≥ 300
E94ASxE0474 [4]	-	63	16	10	-	60	4	≥ 300
E94ASxE0594 [4]	-	80	25	25	-	80	2	≥ 300
E94ASxE0864 [4]	-	100	50	35	-	100	1	≥ 300
E94ASxE1044 [4]	-	125	70	50	-	125	0	≥ 300
E94ASxE1454 [4]	-	200	-	-	70	250	000	≥ 300
E94ASxE1724 [4]	-	250	-	-	95	300	350 mcm	≥ 300
E94ASxE2024 [4]	-	315	-	-	150	350	500 mcm	≥ 300
E94ASxE2454 [4]	-	350	-	-	150	2 x 200	0000	≥ 300
E94ASxE2924 [4]	-	400	-	-	185	2 x 250	2 x 250 mcm	≥ 300
E94ASxE3664 [4]	-	500	-	-	240	2 x 300	2 x 350 mcm	≥ 300
E94ASxE4604 [4]	-	2 x 350	-	-	150	2 x 350	500 mcm	≥ 300
E94ASxE5724 [4]	-	2 x 400	-	-	185	2 x 400	600 mcm	≥ 300
E94ASxE6354 [4]	-	2 x 450	-	-	240	2 x 400	600 mcm	≥ 300
E94ASxE6954 [4]	-	2 x 500	-	-	240	2 x 400	600 mcm	≥ 300

1) The details are recommendations. Other designs/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: the use of PVC-insulated copper cables, conductor temperature < 70°C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) UL approved cables only, fuses and fuse holders must be used.
UL fuse: voltage 500 ... 600 V

3) Universal-current sensitive earth-leakage circuit breaker
If several devices or cable lengths > 50 m are used, the circuit breaker may respond, depending on the cable type and switching frequency.

4) Device with integrated mains choke

① Circuit breaker

② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category

③ Fuse

Observe national and regional regulations

4.3.6 Overcurrent operation

The controllers are designed for two overcurrent modes:

- 5-s-cycle ①
  - 0.5 s load period with peak current A
  - 4.5 s recovery time with limited current B
- 3-min cycle ②
  - 1 min load period with peak current C
  - 2 min recovery time with limited current D

A load period must be followed by a recovery time. During the recovery time the current must not exceed the value given.

The values given refer to the rated output current I_{aN8}.

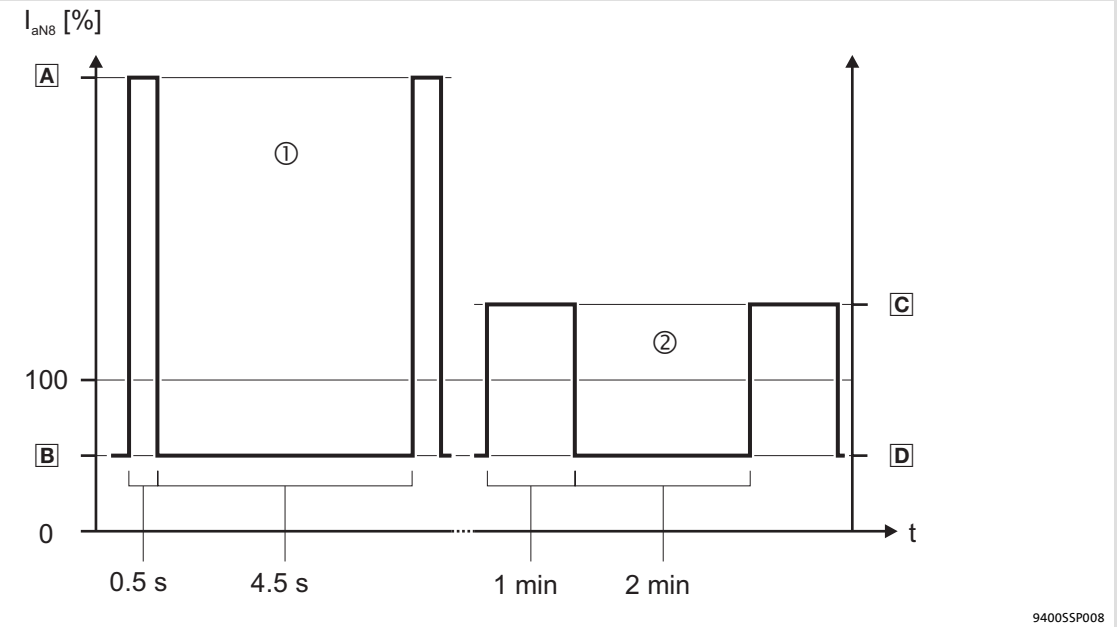


Fig. 4-1 Overcurrent capacity at 45° C

A Peak current for 0.5 s
B Max. current in the recovery time for 4.5 s
C Peak current for 1 min
D Max. current in the recovery time for 2 min

① 5-s cycle

② 3-min cycle

230 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94ASxE0024	6.0	1.4	6.0	1.4	4.8	1.1	-	-
E94ASxE0034	10.0	2.3	10.0	2.3	8.0	1.9	-	-
E94ASxE0044	16.0	3.8	16.0	3.8	12.8	3.0	-	-
E94ASxE0074	21.0	6.6	21.0	6.6	16.8	5.3	-	-
E94ASxE0134	39.0	12.2	39.0	12.2	31.2	9.8	-	-
E94ASxE0174	49.5	15.5	49.5	15.5	39.6	12.4	-	-
E94ASxE0244	58.8	22.0	58.8	22.0	47.0	17.6	-	-
E94ASxE0324	76.8	28.8	76.8	28.8	64.0	24.0	-	-
E94ASxE0474	94.0	35.3	94.0	35.3	81.8	30.6	-	-
E94ASxE0594	118	44.3	118	44.3	82.0	30.7	-	-
E94ASxE0864	172	64.5	172	64.5	146	55.0	-	-
E94ASxE1044	208	78.0	208	78.0	156	58.2	-	-
E94ASxE1454	261	109	261	109	196	81.2	-	-
E94ASxE1724	310	129	310	129	232	96.3	-	-
E94ASxE2024	364	152	364	152	273	113	-	-
E94ASxE2454	441	184	377	157	289	120	-	-
E94ASxE2924	526	219	450	187	345	143	-	-
E94ASxE3664	659	275	564	234	432	179	-	-
E94ASxE4604	828	345	662	276	469	193	-	-
E94ASxE5724	1030	429	824	343	515	217	-	-
E94ASxE6354	1143	476	914	381	572	241	-	-
E94ASxE6954	1251	521	1001	417	626	264	-	-

230 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94ASxE0024	2.8	1.4	2.8	1.4	2.3	1.1	-	-
E94ASxE0034	4.7	2.4	4.7	2.4	3.8	1.9	-	-
E94ASxE0044	7.5	3.8	7.5	3.8	6.0	3.0	-	-
E94ASxE0074	13.2	6.6	13.2	6.6	10.5	5.3	-	-
E94ASxE0134	24.4	12.2	24.4	12.2	19.5	9.8	-	-
E94ASxE0174	31.0	15.5	31.0	15.5	24.8	12.4	-	-
E94ASxE0244	44.2	22.1	44.2	22.1	35.3	17.6	-	-
E94ASxE0324	57.6	28.8	57.6	28.8	48.0	24.0	-	-
E94ASxE0474	70.5	35.3	70.5	35.3	61.6	30.6	-	-
E94ASxE0594	88.5	44.3	88.5	44.3	61.4	30.7	-	-
E94ASxE0864	129	64.5	129	64.5	109	55.0	-	-
E94ASxE1044	156	78.0	156	78.0	118	58.2	-	-
E94ASxE1454	218	109	218	109	164	81.2	-	-
E94ASxE1724	258	129	258	129	194	96.3	-	-
E94ASxE2024	303	152	303	152	228	113	-	-
E94ASxE2454	368	184	314	157	240	120	-	-
E94ASxE2924	438	219	374	187	286	143	-	-
E94ASxE3664	549	275	468	234	359	179	-	-
E94ASxE4604	690	345	552	276	391	193	-	-
E94ASxE5724	858	429	686	343	429	217	-	-
E94ASxE6354	953	476	762	381	476	241	-	-
E94ASxE6954	1043	521	834	417	521	264	-	-

400 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94ASxE0024	6.0	1.4	6.0	1.4	4.8	1.1	-	-
E94ASxE0034	10.0	2.3	10.0	2.3	8.0	1.9	-	-
E94ASxE0044	16.0	3.8	16.0	3.8	12.8	3.0	-	-
E94ASxE0074	21.0	6.6	21.0	6.6	16.8	5.3	-	-
E94ASxE0134	39.0	12.2	39.0	12.2	31.2	9.8	-	-
E94ASxE0174	49.5	15.5	49.5	15.5	39.6	12.4	-	-
E94ASxE0244	58.8	22.0	58.8	22.0	47.0	17.6	-	-
E94ASxE0324	76.8	28.8	76.8	28.8	64.0	24.0	-	-
E94ASxE0474	94.0	35.3	94.0	35.3	81.8	30.6	-	-
E94ASxE0594	118	44.3	118	44.3	82.0	30.7	-	-
E94ASxE0864	172	64.5	172	64.5	146	55.0	-	-
E94ASxE1044	208	78.0	208	78.0	156	58.2	-	-
E94ASxE1454	261	109	261	109	196	81.2	-	-
E94ASxE1724	310	129	310	129	232	96.3	-	-
E94ASxE2024	364	152	364	152	273	113	-	-
E94ASxE2454	441	184	377	157	289	120	-	-
E94ASxE2924	526	219	450	187	345	143	-	-
E94ASxE3664	659	275	564	234	432	179	-	-
E94ASxE4604	828	345	662	276	469	193	-	-
E94ASxE5724	1030	429	824	343	515	217	-	-
E94ASxE6354	1143	476	914	381	572	241	-	-
E94ASxE6954	1251	521	1001	417	626	264	-	-

400 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94ASxE0024	2.8	1.4	2.8	1.4	2.3	1.1	-	-
E94ASxE0034	4.7	2.4	4.7	2.4	3.8	1.9	-	-
E94ASxE0044	7.5	3.8	7.5	3.8	6.0	3.0	-	-
E94ASxE0074	13.2	6.6	13.2	6.6	10.5	5.3	-	-
E94ASxE0134	24.4	12.2	24.4	12.2	19.5	9.8	-	-
E94ASxE0174	31.0	15.5	31.0	15.5	24.8	12.4	-	-
E94ASxE0244	44.2	22.1	44.2	22.1	35.3	17.6	-	-
E94ASxE0324	57.6	28.8	57.6	28.8	48.0	24.0	-	-
E94ASxE0474	70.5	35.3	70.5	35.3	61.6	30.6	-	-
E94ASxE0594	88.5	44.3	88.5	44.3	61.4	30.7	-	-
E94ASxE0864	129	64.5	129	64.5	109	55.0	-	-
E94ASxE1044	156	78.0	156	78.0	118	58.2	-	-
E94ASxE1454	218	109	218	109	164	81.2	-	-
E94ASxE1724	258	129	258	129	194	96.3	-	-
E94ASxE2024	303	152	303	152	228	113	-	-
E94ASxE2454	368	184	314	157	240	120	-	-
E94ASxE2924	438	219	374	187	286	143	-	-
E94ASxE3664	549	275	468	234	359	179	-	-
E94ASxE4604	690	345	552	276	391	193	-	-
E94ASxE5724	858	429	686	343	429	217	-	-
E94ASxE6354	953	476	762	381	476	241	-	-
E94ASxE6954	1043	521	834	417	521	264	-	-

500 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94ASxE0024	6.0	1.4	6.0	1.4	4.2	1.0	-	-
E94ASxE0034	10.0	2.3	10.0	2.3	7.0	1.6	-	-
E94ASxE0044	16.0	3.8	16.0	3.8	11.2	2.6	-	-
E94ASxE0074	21.0	6.6	21.0	6.6	14.7	4.6	-	-
E94ASxE0134	39.0	12.2	39.0	12.2	27.3	8.5	-	-
E94ASxE0174	49.5	15.5	49.5	15.5	34.7	10.8	-	-
E94ASxE0244	58.8	22.0	58.8	22.0	41.1	15.4	-	-
E94ASxE0324	76.8	28.8	76.8	28.8	56.0	21.0	-	-
E94ASxE0474	94.0	35.3	94.0	35.3	71.6	26.7	-	-
E94ASxE0594	118	44.3	118	44.3	71.8	26.8	-	-
E94ASxE0864	172	64.5	172	64.5	128	48.2	-	-
E94ASxE1044	208	78.0	208	78.0	137	51.0	-	-
E94ASxE1454	261	109	261	109	196	81.2	-	-
E94ASxE1724	310	129	310	129	232	96.3	-	-
E94ASxE2024	364	152	364	152	273	113	-	-
E94ASxE2454	441	184	377	157	289	120	-	-
E94ASxE2924	526	219	450	187	345	143	-	-
E94ASxE3664	659	275	564	234	432	179	-	-
E94ASxE4604	828	345	662	276	469	193	-	-
E94ASxE5724	1030	429	824	343	515	217	-	-
E94ASxE6354	1143	476	914	381	572	241	-	-
E94ASxE6954	1251	521	1001	417	626	264	-	-

500 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94ASxE0024	2.8	1.4	2.8	1.4	2.0	1.0	-	-
E94ASxE0034	4.7	2.4	4.7	2.4	3.3	1.6	-	-
E94ASxE0044	7.5	3.8	7.5	3.8	5.3	2.6	-	-
E94ASxE0074	13.2	6.6	13.2	6.6	9.2	4.6	-	-
E94ASxE0134	24.4	12.2	24.4	12.2	17.1	8.5	-	-
E94ASxE0174	31.0	15.5	31.0	15.5	21.7	10.8	-	-
E94ASxE0244	44.2	22.1	44.2	22.1	30.8	15.4	-	-
E94ASxE0324	57.6	28.8	57.6	28.8	42.0	21.0	-	-
E94ASxE0474	70.5	35.3	70.5	35.3	53.9	26.7	-	-
E94ASxE0594	88.5	44.3	88.5	44.3	53.7	26.8	-	-
E94ASxE0864	129	64.5	129	64.5	96	48.2	-	-
E94ASxE1044	156	78.0	156	78.0	103	51.0	-	-
E94ASxE1454	218	109	218	109	164	81.2	-	-
E94ASxE1724	258	129	258	129	194	96.3	-	-
E94ASxE2024	303	152	303	152	228	113	-	-
E94ASxE2454	368	184	314	157	240	120	-	-
E94ASxE2924	438	219	374	187	286	143	-	-
E94ASxE3664	549	275	468	234	359	179	-	-
E94ASxE4604	690	345	552	276	391	193	-	-
E94ASxE5724	858	429	686	343	429	217	-	-
E94ASxE6354	953	476	762	381	476	241	-	-
E94ASxE6954	1043	521	834	417	521	264	-	-

4.3.7 Current-time diagrams

In addition to the data for overcurrent operation within the 5-s cycle or 3-min cycle, here you are provided with information on the dimensioning of application-oriented cycles.

By means of the following information you determine permissible load periods with overcurrents and required recovery times with limited currents. If the currents and times determined are observed, the Ixt monitoring function for the protection of the devices will not respond.

Characteristics

The following characteristics (”Current-time diagrams”) describe the device utilisation via amperage and the duration of current flow.
The left part of the diagram (negative time data) represents the overload phase, while the right part of the diagram (positive time data) shows the relieving phase.
Devices with an identical Ixt behaviour are combined within a diagram. A second diagram enlarges a cutout area to improve the clearness of display.

Requirements

- Switching frequency

  The curves shown always refer to the variable rated switching frequency (f_{chopp}) at which the rated device current is permissible permanently. As this rated switching frequencies are different for the individual devices, they are specified with the diagrams. This means that the switching frequency is reduced automatically during the overload phase. During the recovery phase the switching frequency set is maintained.

- Mains voltage

  In the diagrams a mains voltage of U_N = 400 V was assumed. Where applicable, a current derating depending on the mains voltage may be necessary for the devices, depending on the switching frequency that is reached. This means that the currents are weighted differently in the Ixt monitoring. The devices for which a derating is required can be gathered from the ”Rated values” section. The continuous currents specified there then are the 100% values which are required for working with the diagrams.

- Ambient temperature

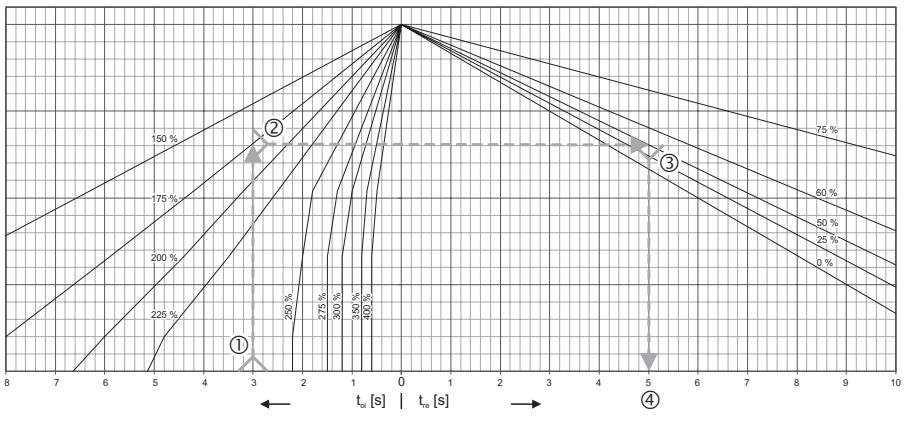
  The ambient temperature may be maximally T_{Amb} < 45 °C. In the case of higher ambient temperatures the reduced continuous currents have to be taken into consideration.

- Output frequency

  In the diagrams an output frequency (= field frequency) f_{out} > 5 Hz has been assumed. In the case of smaller output frequencies (f_{out} = 0 ... 5 Hz), a different switching frequency results in a different device utilisation due to a different continuous current. When the diagrams were created, this device behaviour was not taken into consideration.
  If a fixed switching frequency f > 4 kHz is selected, the reduction of the permissible continuous current has to be considered (100 % = reduced continuous current) for smaller output frequencies (f_{out} = 0 ... 5 Hz).

Application example

- Drive task
  - A current I_{ol} = 4.0 A is required for a time t_{ol} = 3 s.
  - During the recovery phase there is a current I_{re} = 1.0 A.
  - During the overload phase a switching frequency of 4 kHz is accepted.
  - The switching frequency during the recovery phase is to be 8 kHz.
  - The mains voltage is 400 V.
  - The times with output frequencies under 5 Hz are insignificant.
- Problem
  - How long does the recovery phase t_{re} have to be when the E94AxxE0034 controller is used?
- The currents required are based on the rated device current:
  - I_{ol} = 4.0 A/2.5 A = 160 % - selected characteristic: 175 %
  - I_{re} = 1.0A/2.5 A = 40 % - selected characteristic: 50 %
  - Because of the short overcurrent time t_{ol} = 3 s, the cutout diagram of the E94AxxE0034 device is taken into consideration.
  - The switching frequency f_{chopp} = 8 kHz, var does not have to be considered separately.
- Procedure within the diagram
  - ① Starting from the time axis at t_{ol} = 3 s, a perpendicular line is drawn to the selected characteristic at 175 % (corresponds to the minimum required current I_{ol}).
  - ② Draw a straight line from the point of intersection horizontally to the right to the selected characteristic, the recovery phase, at 50 %.
  - ③ Draw a perpendicular line from the point of intersection back to the time axis.
  - ④ Read the minimum required duration of recovery on the time axis.



- Result in the example
  - The duration of recovery has to be at least t_{re} = 5 s!

Guide

Type	Diagram
E94AxxE0024	Page 78 Fig. 4-2/ Fig. 4-3
E94AxxE0034	
E94AxxE0044	
E94AxxE0074	Page 79 Fig. 4-4/ Fig. 4-5
E94AxxE0134	
E94AxxE0174	
E94AxxE0244	
E94AMxE0324	
E94ASxE0324	Page 80 Fig. 4-6/ Fig. 4-7
E94AxxE0474	Page 81 Fig. 4-8/ Fig. 4-9
E94AxxE0594	
E94AxxE0864	Page 82 Fig. 4-10/ Fig. 4-11
E94AxxE1044	
E94AxxE1454	Page 83 Fig. 4-12/ Fig. 4-13
E94AxxE1724	
E94AxxE2024	
E94AxxE2454	
E94AxxE2924	
E94AxxE3664	
E94AxxE4604	
E94AxxE5724	
E94AxxE6354	
E94AxxE6954	

E94AxxE0024 ... E94AxxE0044

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0024	400	1.5	8 kHz var
E94AxxE0034		2.5	
E94AxxE0044		4.0	

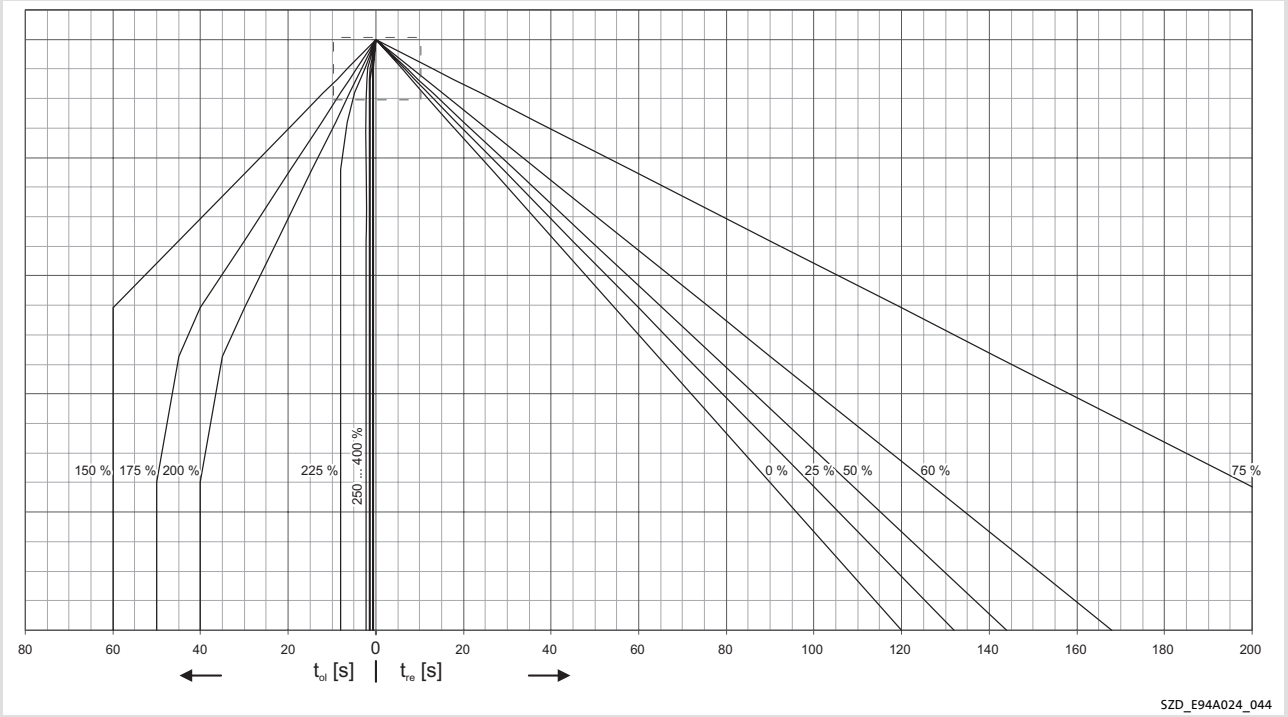


Fig. 4-2 Diagram for E94AxxE0024 and E94AxxE0044

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

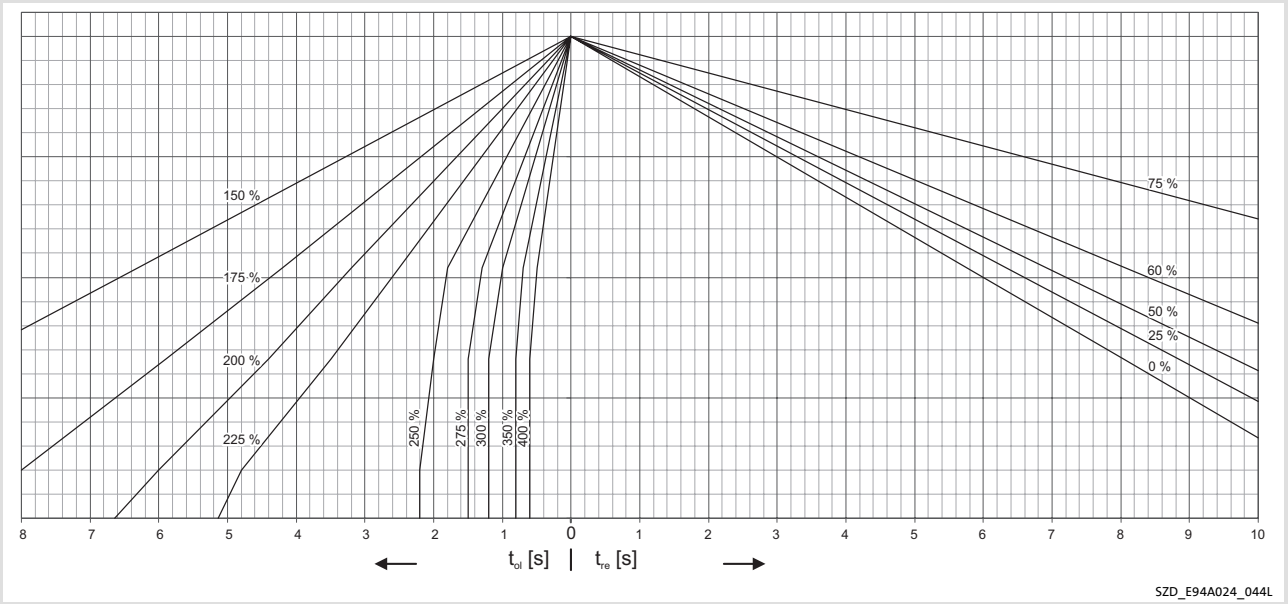


Fig. 4-3 Area cutout for E94AxxE0024 and E94AxxE0044

E94AxxE0074 ... E94AxxE0244 E94AMxE0324

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0074	400	7.0	8 kHz var
E94AMxE0094		9.3	8 kHz var
E94AxxE0134		13.0	8 kHz var
E94AxxE0174		16.5	
E94AxxE0244		23.5	
E94AMxE0324		32.0	8 kHz var

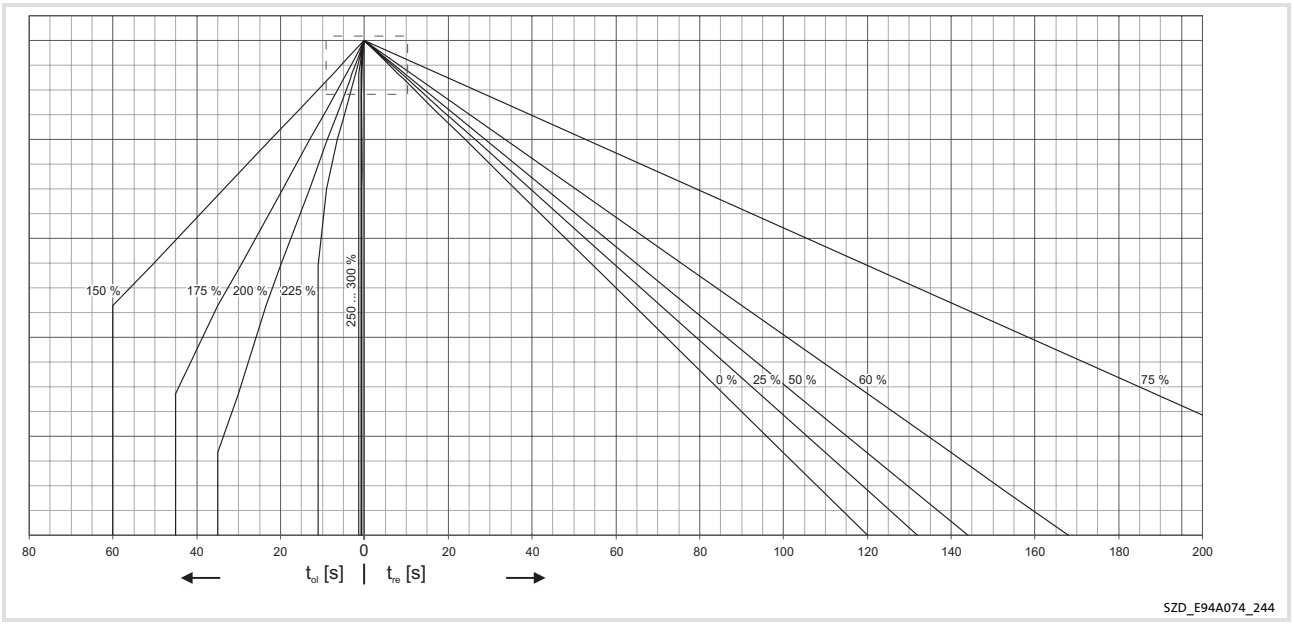


Fig. 4-4 Diagram for E94AxxE0074 ... E94AxxE0244, E94AMxE0324

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

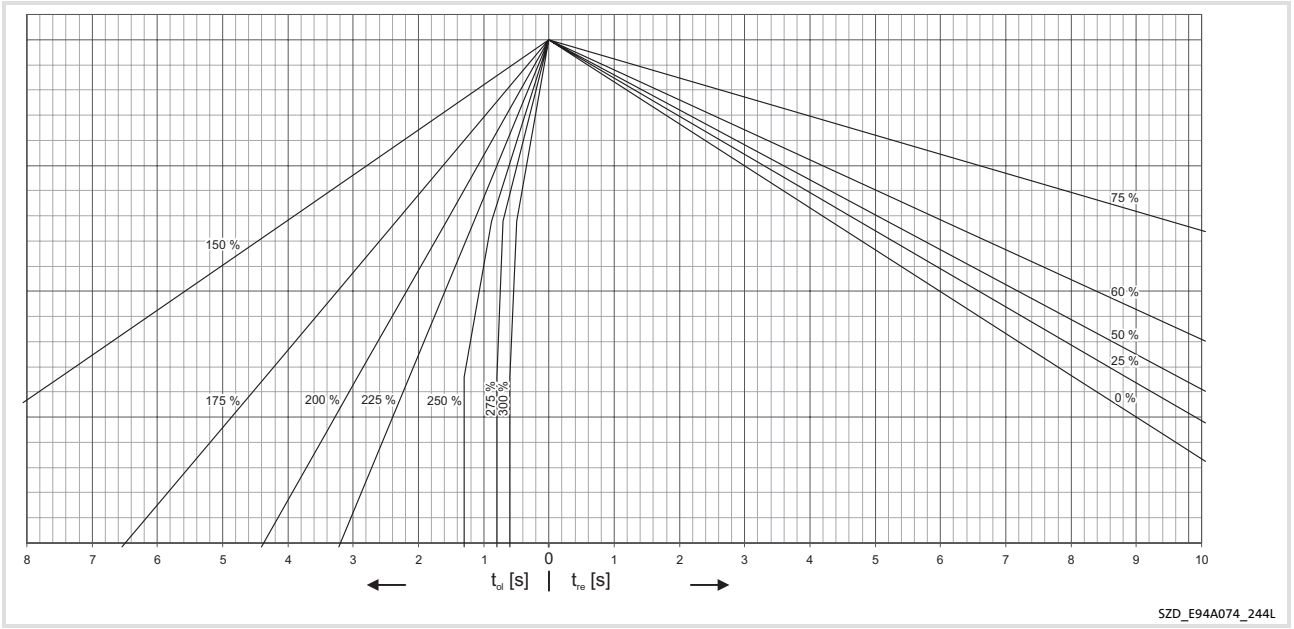


Fig. 4-5 Area cutout for E94AxxE0074 ... E94AxxE0244, E94AMxE0324

E94AxxE0324

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0324	400	32.0	4 kHz var

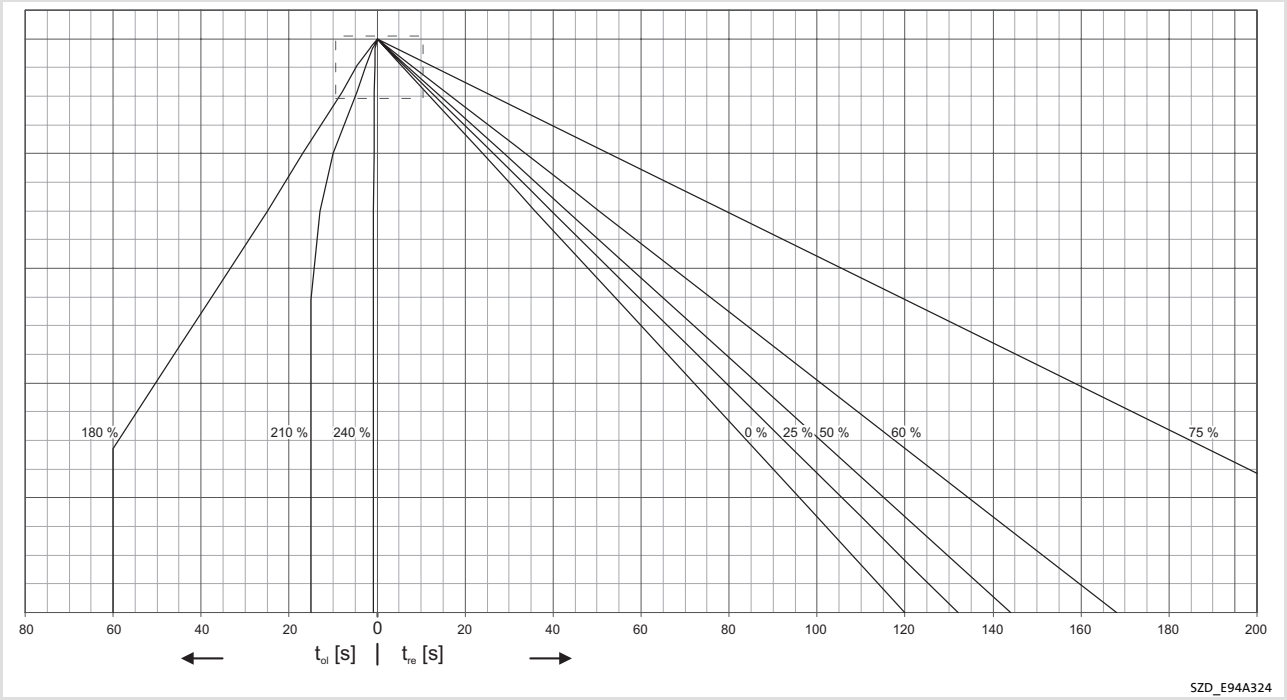


Fig. 4-6 Diagram for E94AxxE0324

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

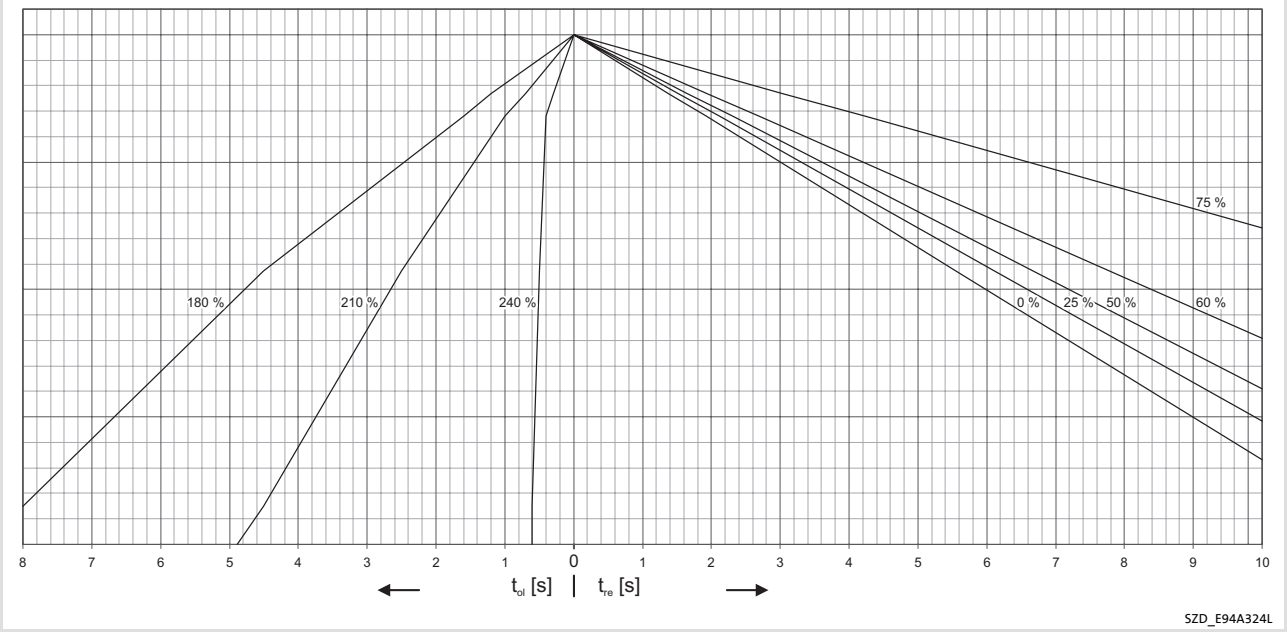


Fig. 4-7 Area cutout for E94AxxE0324

E94AxxE0474 and E94AxxE0594

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0474	400	47.0	4 kHz var
E94AxxE0594		59.0	

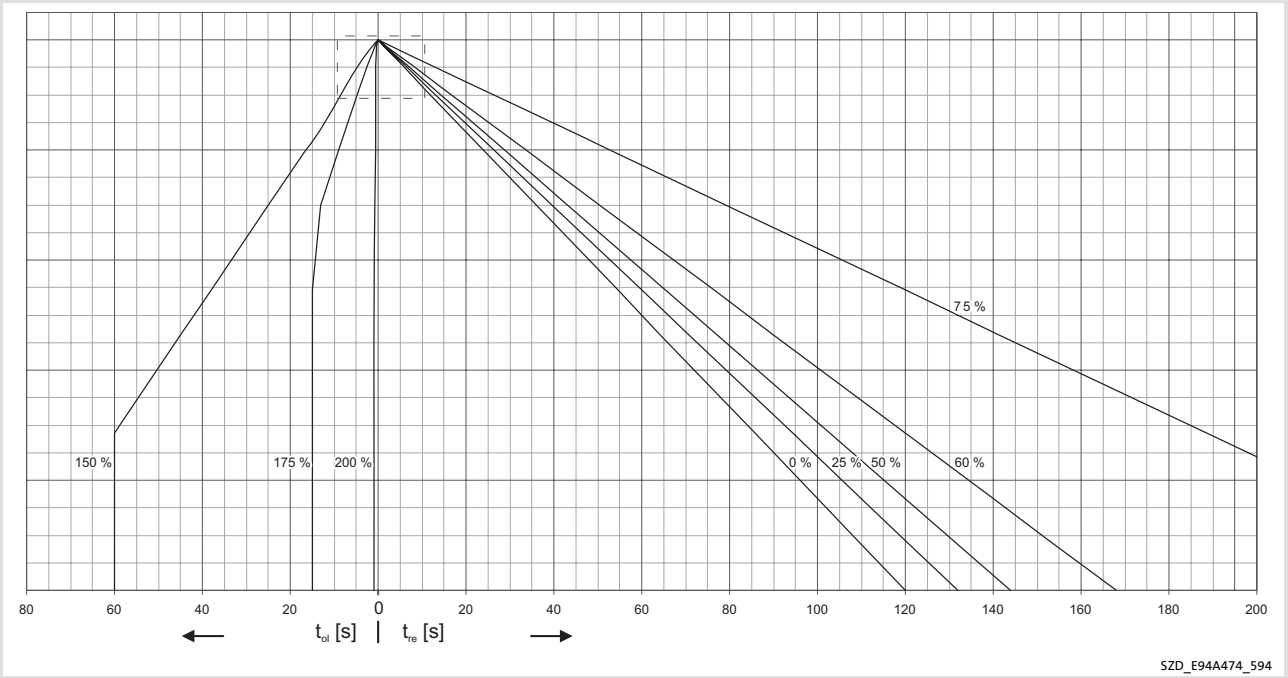


Fig. 4-8 Diagram for E94AxxE0474 and E94AxxE0594

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

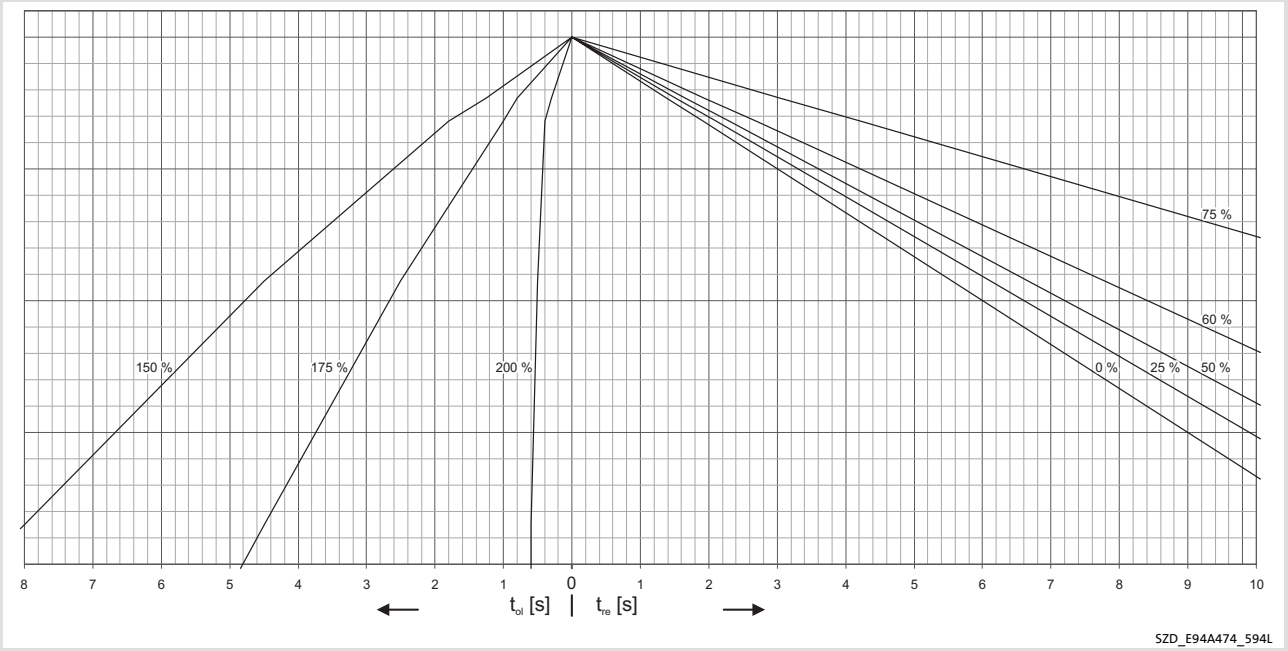


Fig. 4-9 Area cutout for E94AxxE0474 and E94AxxE0594

E94AxxE0864 and E94AxxE1044

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0864	400	86.0	4 kHz var
E94AxxE1044		104	

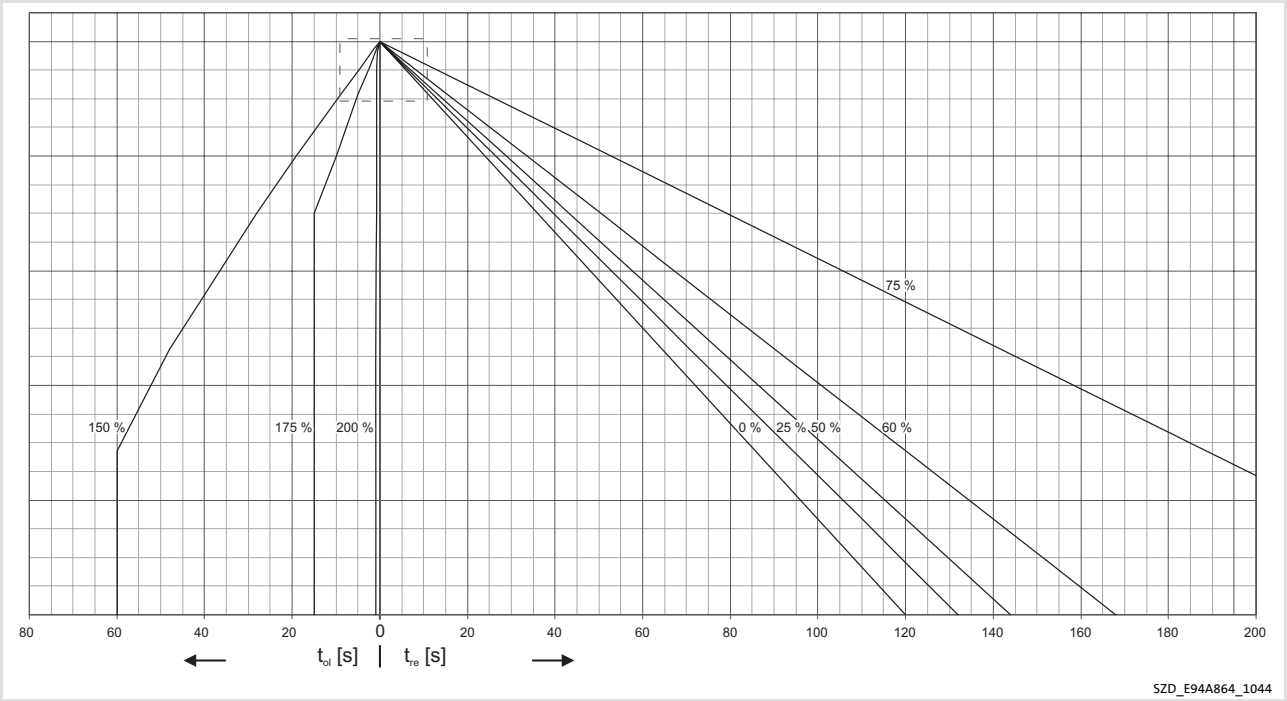


Fig. 4-10 Diagram for E94AxxE0864 and E94AxxE1044

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

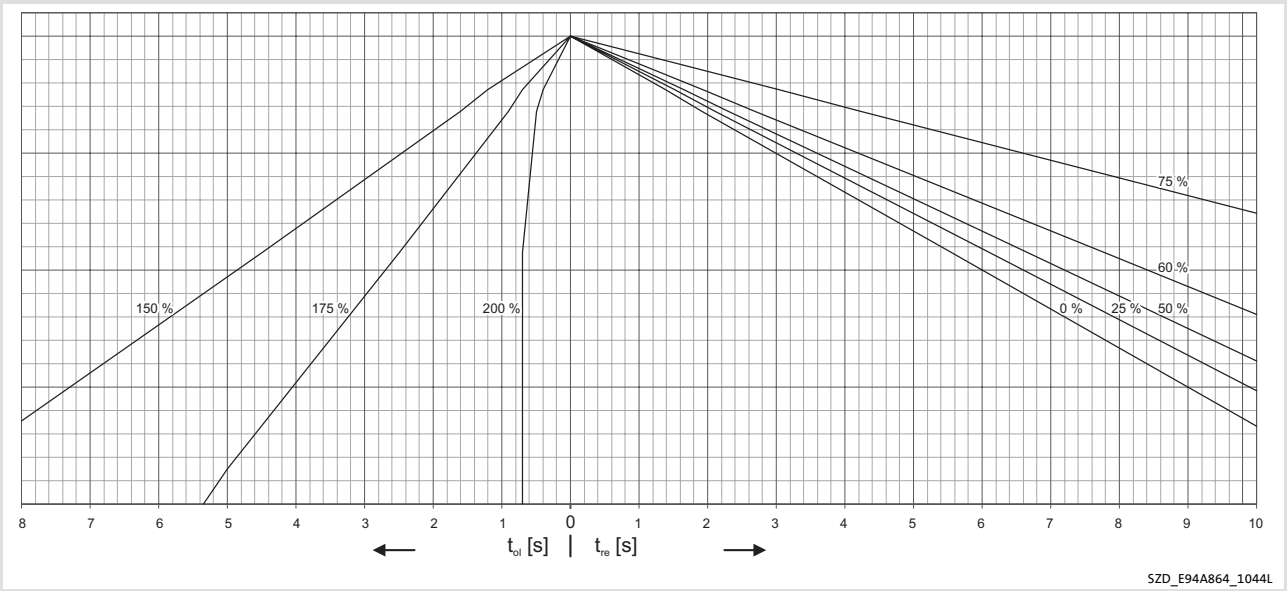


Fig. 4-11 Area cutout for E94AxxE0864 and E94AxxE1044

E94AxxE1454 ... E94AxxE6954

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE1454	400	145	4 kHz var
E94AxxE1724		172	
E94AxxE2024		202	
E94AxxE2454	400	245	2 kHz var
E94AxxE2924		292	
E94AxxE3664		366	
E94AxxE4604		460	
E94AxxE5724		572	
E94AxxE6354		635	
E94AxxE6954		695	

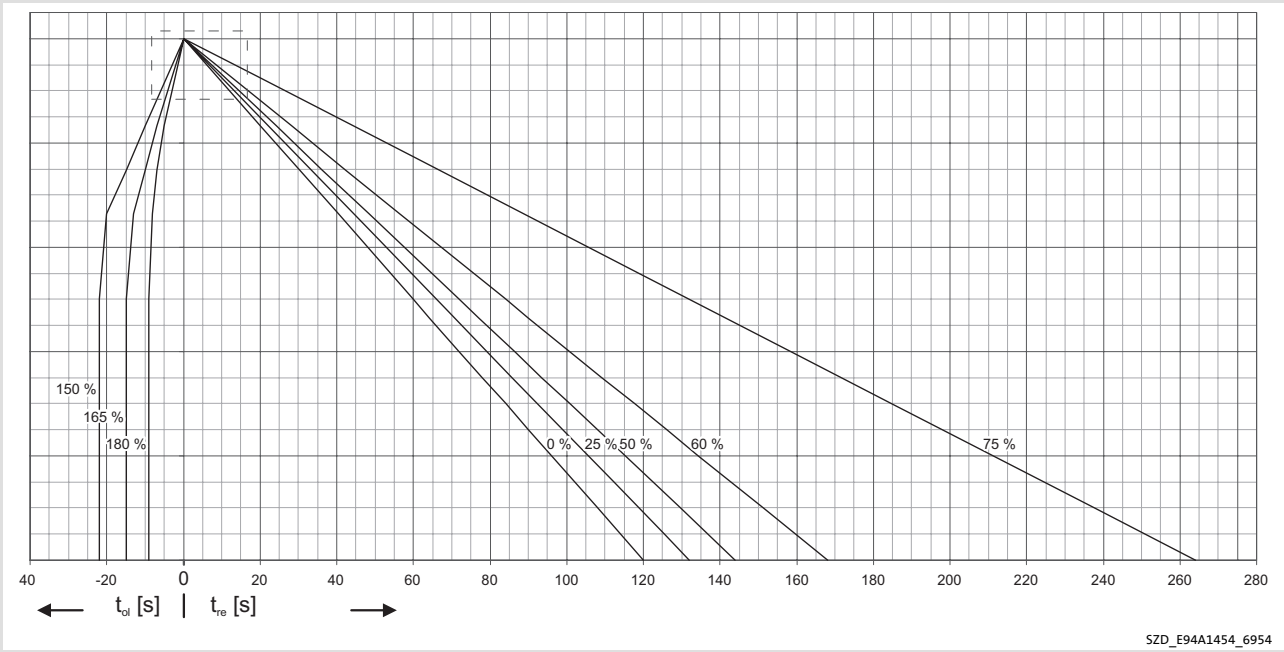


Fig. 4-12 Diagram for E94AxxE1454 ... E94AxxE6954

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

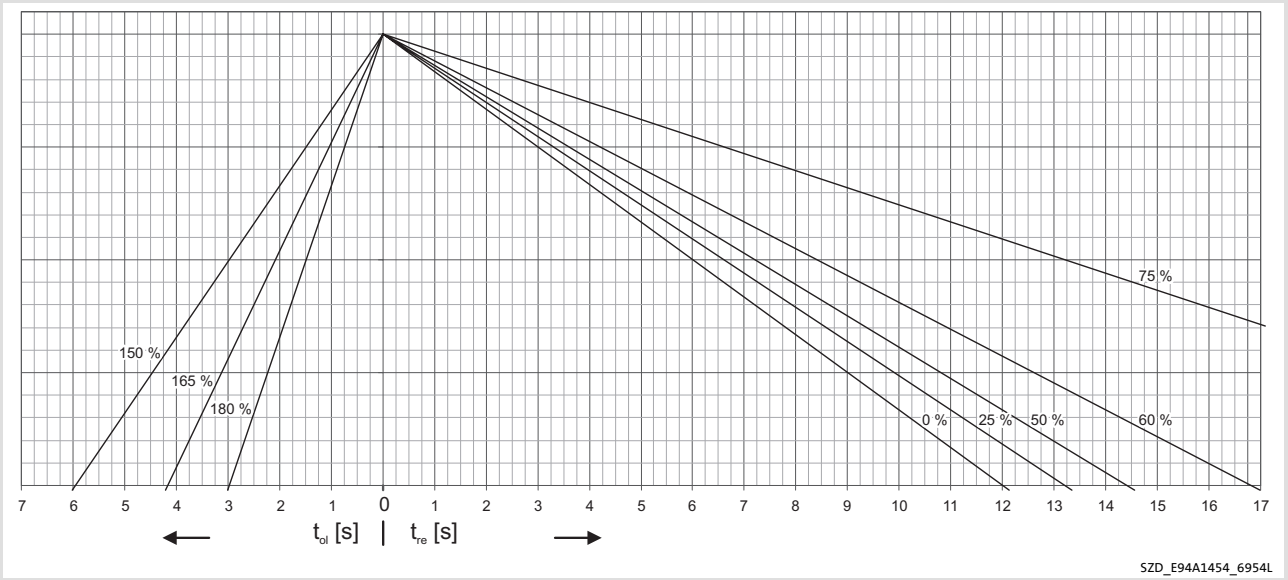
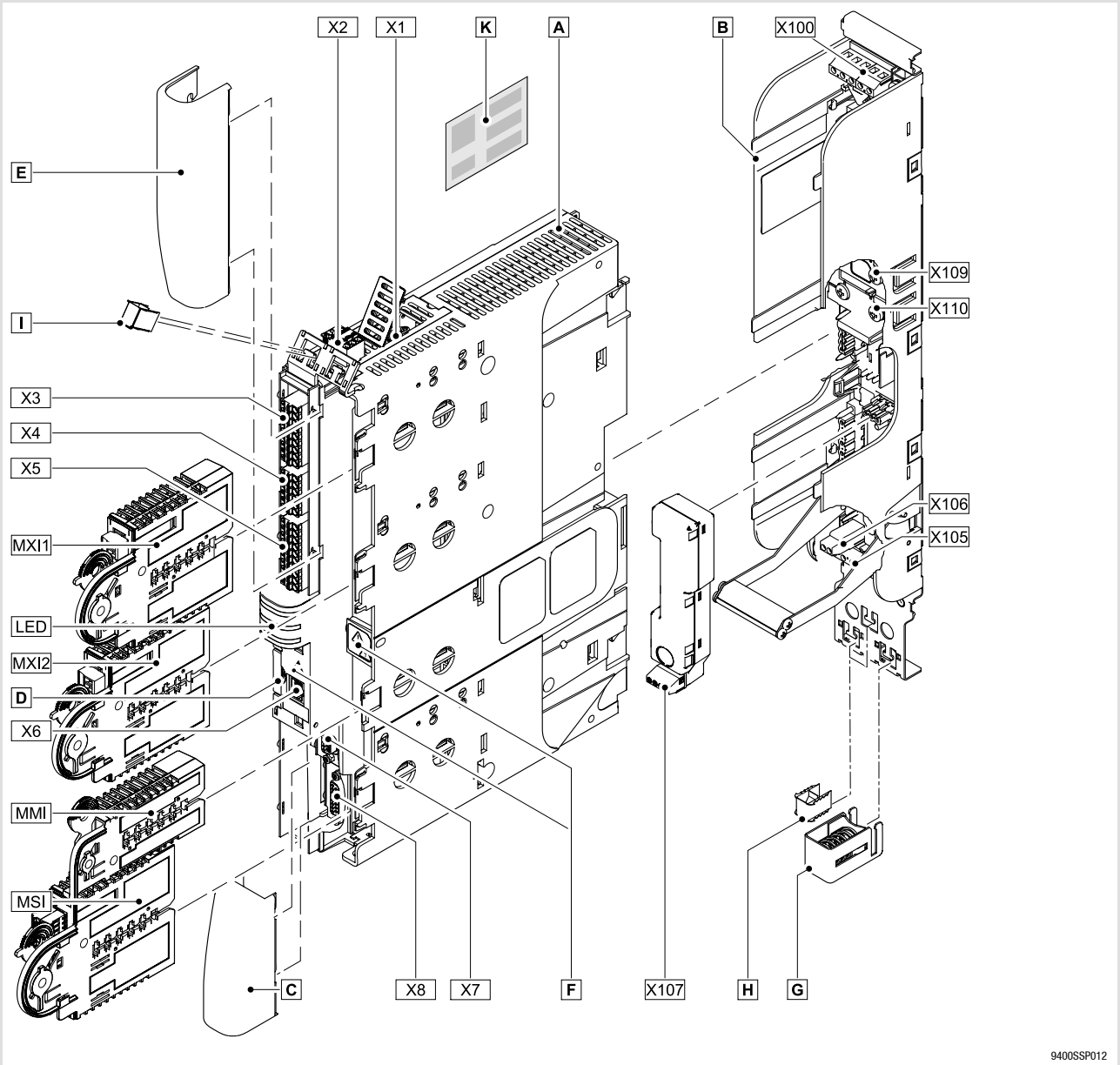


Fig. 4-13 Area cutout for E94AxxE1454 ... E94AxxE6954

4.4 Device description

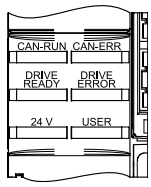
This page remains blank to give you a clearly arranged overview of the following subject on the next double page.

4.4.1 Devices in the range 2 ... 24 A (0.37 ... 11 kW)



Standard device A	
Pos.	**Description**
MXI1	Module receptacle for extension 1, e.g. communication
MXI2	Module receptacle for extension 2, e.g. communication
MMI	Module receptacle for memory modules
MSI	Module receptacle for safety equipment
X1	System bus (CAN), under the cover
X2	24 V supply and statebus
X3	Analog inputs and analog outputs
X4	Digital outputs
X5	Digital inputs
X6	Diagnostics
X7	Resolver
X8	Encoder
C	Lower cover
D	Retractable nameplate
E	Upper cover
I	EMC clip
K	Prominent warning label close to the device!

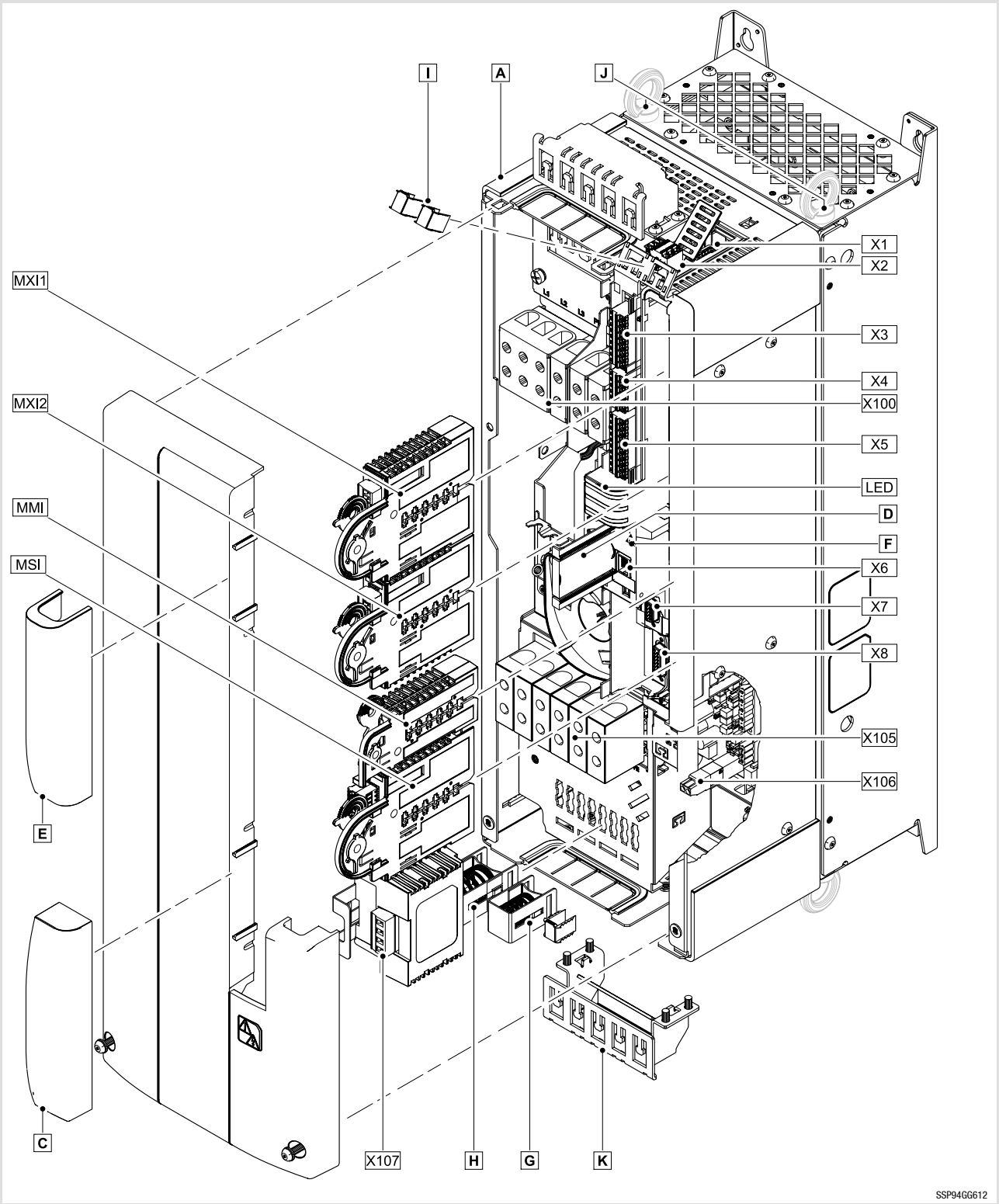
The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED01	CAN-RUN	green	CAN bus ok
	CAN-ERR	red	CAN bus error
	DRIVE READY	green	Standard device is ready for operation
	DRIVE ERROR	red	Error in the standard device or application-induced
	24 V	green	24 V supply voltage ok
	USER	yellow	Message parameterised by the application

Pos.	Symbol	Description
F		**Long discharge time**: All power terminals carry hazardous voltages for at least 3 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, personnel must ensure that they are free of electrostatic charge!

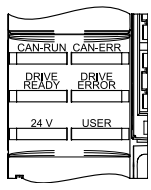
Installation backplane B	
Pos.	**Description**
X100	Mains / DC-bus voltage
X105	Motor / external brake resistor
X106	Motor temperature monitoring
X107	Control of motor holding brake
X109	DC busbar +
X110	DC busbar -
G	EMC wire clamp (for device sizes II + III), replaces 1 x H
H	EMC shield clamp

4.4.2 Devices in the range 32 ... 104 A (15 ... 55 kW)



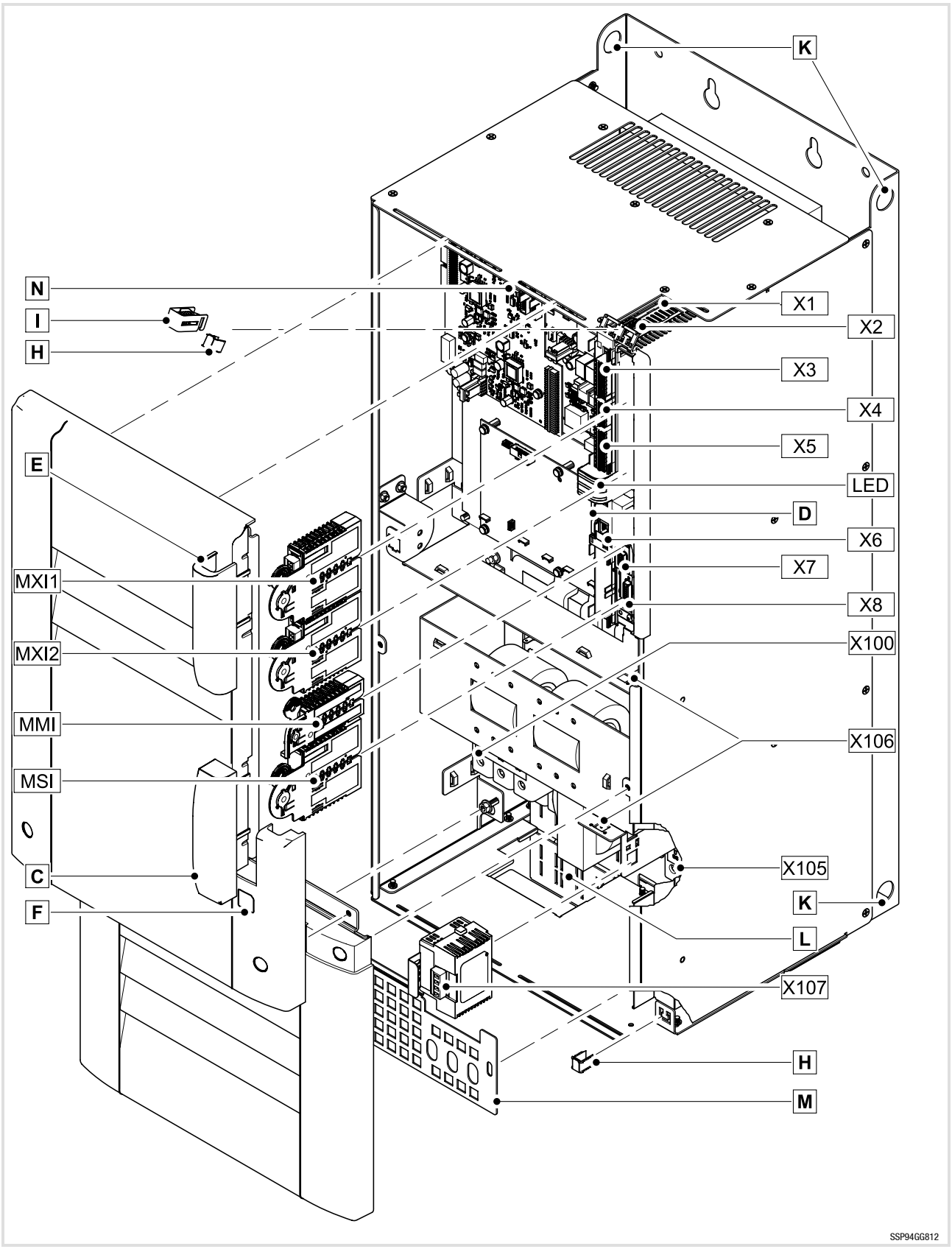
Standard device [A]	
Pos.	**Description**
MXI1	Module receptacle for extension 1, e.g. communication
MXI2	Module receptacle for extension 2, e.g. communication
MMI	Module receptacle for memory modules
MSI	Module receptacle for safety equipment
X1	System bus (CAN), under the cover
X2	24 V supply and statebus
X3	Analog inputs and analog outputs
X4	Digital outputs
X5	Digital inputs
X6	Diagnostics
X7	Resolver
X8	Encoder
[C]	Lower cover
[D]	Retractable nameplate
[E]	Upper cover
[I]	EMC clip
[K]	Prominent warning label close to the device!
X100	Mains / DC-bus voltage
X105	Motor / external brake resistor
X106	Motor temperature monitoring
X107	Control of motor holding brake
[G] [H]	EMC wire clamp Device size 6: ∅ 10 ... 20 mm and ∅ 15 ... 28 mm Device size 7: ∅ 15 ... 28 mm and ∅ 20 ... 37 mm
[J]	Internal thread for M6 eye bolt (not included in the scope of supply)
[K]	Strain relief and lifting aid, removable

The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED01	CAN-RUN	green	CAN bus ok
	CAN-ERR	red	CAN bus error
	DRIVE READY	green	Standard device is ready for operation
	DRIVE ERROR	red	Error in the standard device or application-induced
	24 V	green	24 V supply voltage ok
	USER	yellow	Message parameterised by the application

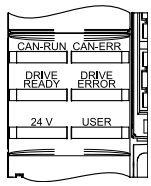
Pos.	Symbol	Description
[F]		**Long discharge time**: All power terminals carry hazardous voltages for at least 3 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, personnel must ensure that they are free of electrostatic charge!

4.4.3 Devices in the range 145 ... 695 A (75 ... 370 kW)



Pos.	Description
MXI1	Module receptacle for extension 1, e.g. communication
MXI2	Module receptacle for extension 2, e.g. communication
MMI	Module receptacle for memory modules
MSI	Module receptacle for safety equipment
X1	System bus (CAN), under the cover
X2	24-V supply / Statebus
X3	Analog inputs / analog outputs
X4	Digital outputs
X5	Digital inputs
X6	Diagnostics (with diagnostic adapter or keypad)
X7	Resolver
X8	Encoder
C	Lower cover
D	Retractable nameplate
E	Upper cover
I	EMC wire clamp
X100	Mains / DC-bus voltage
X105	Motor / external brake resistor
X106	Motor temperature monitoring (position depends on the device size)
X107	Control of motor holding brake
H	EMC shield clamp
K	Holes for transport and assembly guides
L	Shield connection/strain relief (device sizes: 8S, 8 and 9)
M	Barrier between mains input and other power terminals (device sizes: 8S, 8 and 9)
N	Switch for operation in IT systems

The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED01	CAN-RUN	green	CAN bus ok
	CAN-ERR	red	CAN bus error
	DRIVE READY	green	Standard device is ready for operation
	DRIVE ERROR	red	Error in the standard device or application-induced
	24 V	green	24 V supply voltage ok
	USER	yellow	Message parameterised by the application

Pos.	Symbol	Description
F		**Long discharge time**: All power terminals carry hazardous voltages for at least 20 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, the personnel must remove any electrostatic charges using suitable measures!

4.5 Mechanical installation

4.5.1 Important notes

Note!

The devices must be installed in housings (e.g. control cabinets) to meet applicable regulations.

4.5.2 Devices in the range 2 ... 24 A (0.37 ... 11 kW)

Proceed as follows for the installation:

1. Prepare M5 threaded holes on the mounting plate according to the mounting grid.
2. When using footprint filters: Screw installation backplane and footprint filter together.
   – Use screw and washer assemblies M5 x 20 mm or hexagon socket screws M5 x 20 mm with washers.
   – Tightening torque: 3.4 Nm (30 lb-in)
3. Screw the installation backplane or footprint filter with installation backplane onto the mounting plate. Do not yet tighten the screws.
   – Use M5 screw and washer assemblies or M5 hexagon socket screws with washers.
   – The screw joint in the installation backplane may jut out no more than 7 mm.
4. Repeat steps 2 and 3 with further installation backplanes which are mounted side by side.
5. Align all installation backplanes.
6. Screw all installation backplanes/footprint filters onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

Mounting grid

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices, and the device sizes 1, 2, ... n can thus be mounted directly adjacent to each other.

Note!

- ► M5 screw and washer assemblies or hexagon socket screws with washers are permitted.
- ► Tightening torque: 3.4 Nm / 30 lb-in.
- ► In the installation backplane, the screwed connection may not jut out more than 7 mm.

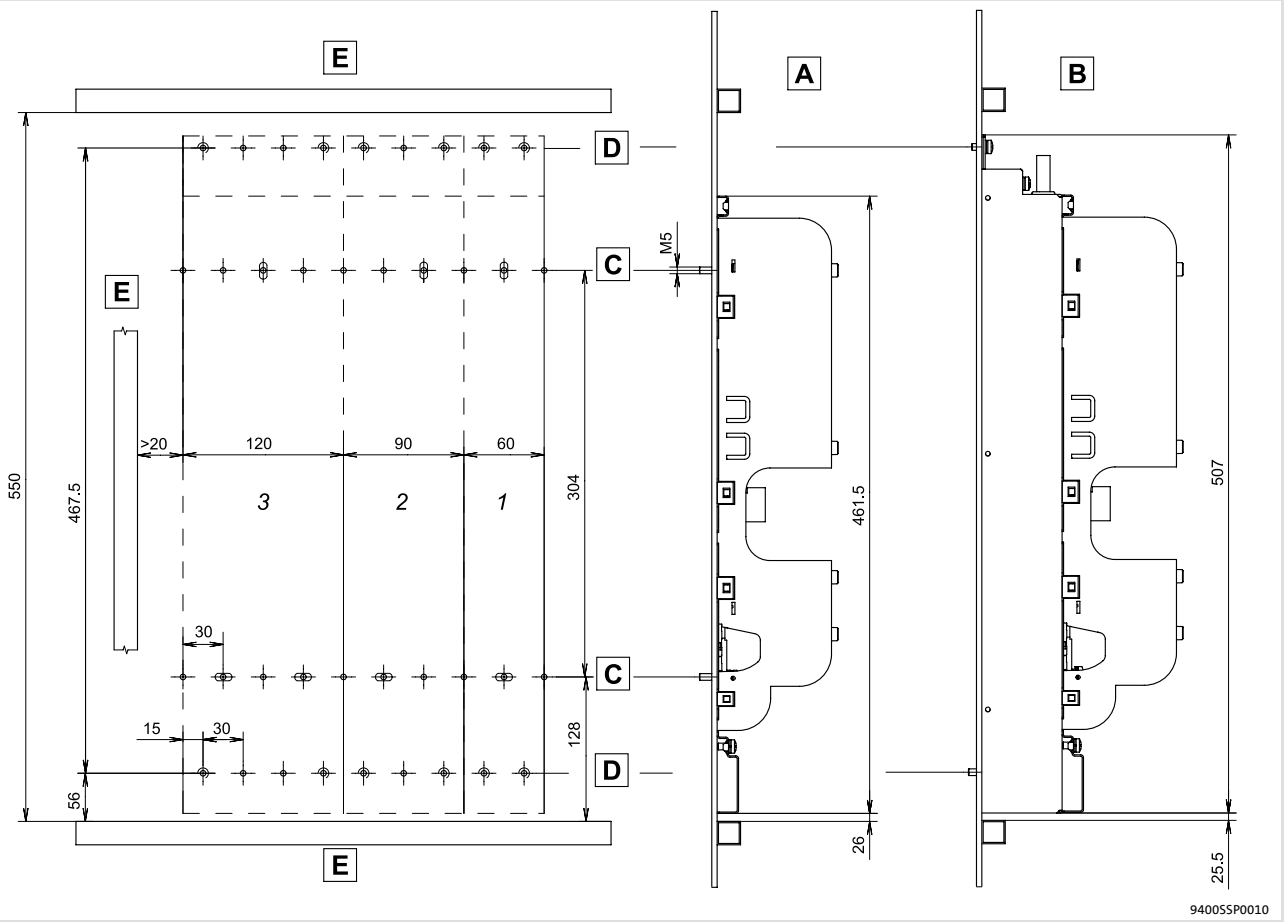


Fig. 4-14 Mounting grid for installation backplane and filter of device sizes 1 ... 3

- A Installation backplane without footprint filter (mains or RFI filter)
- B Installation backplane with footprint filter
- C Grid hole pattern for installation backplane (M5 threaded holes)
- D Grid hole pattern for footprint filter (M5 threaded holes)
- E Cable duct
- 1 ... 3 Device size, mounting holes used

Standard device with installation backplane

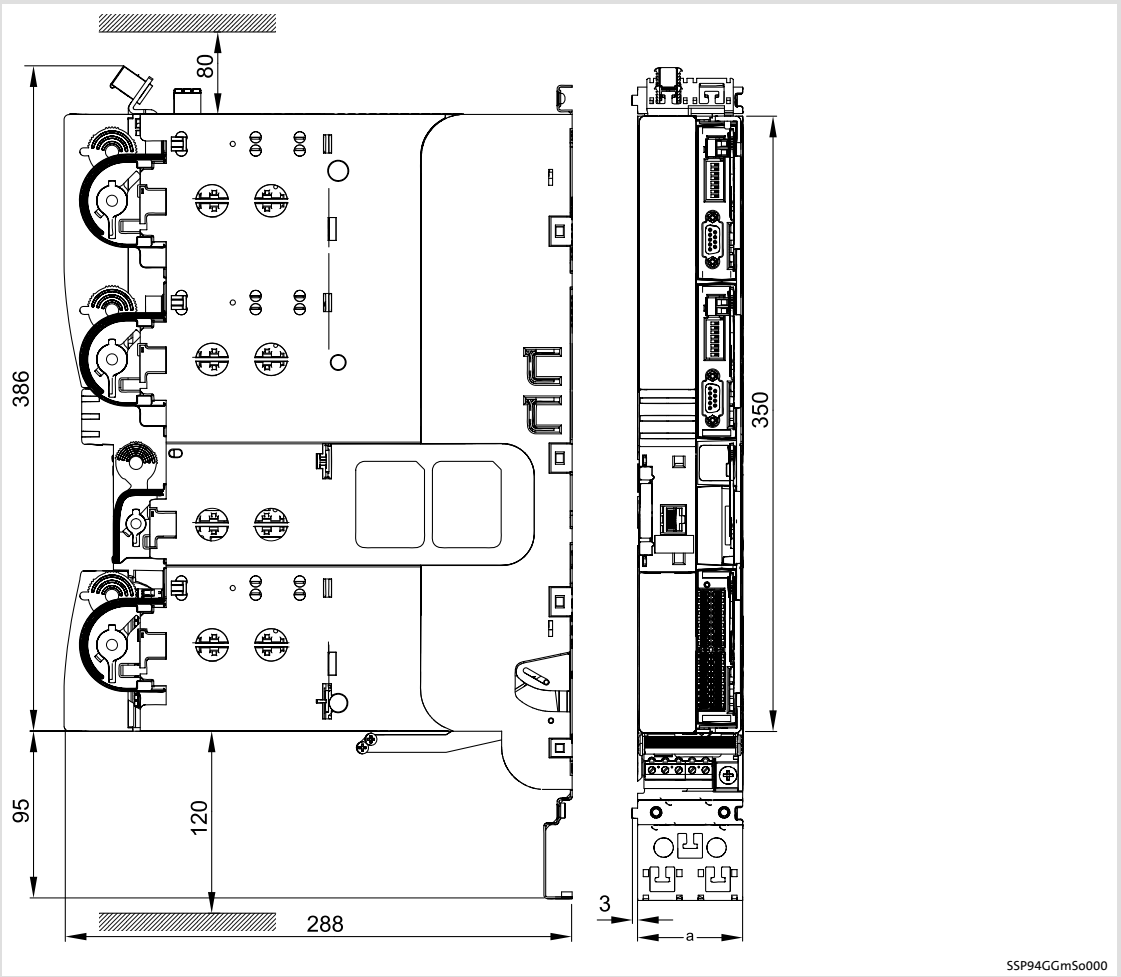


Fig. 4-15 Dimensions [mm]

Type	Dimensions [mm] a	Weight [kg]	Device size
E94ASxE0024	60	4.0	1
E94ASxE0034			
E94ASxE0044	90	5.3	2
E94ASxE0074			
E94ASxE0134	120	8.1	3
E94ASxE0174			
E94ASxE0244			

4.5.3 Devices in the range 32 ... 104 A (15 ... 55 kW)

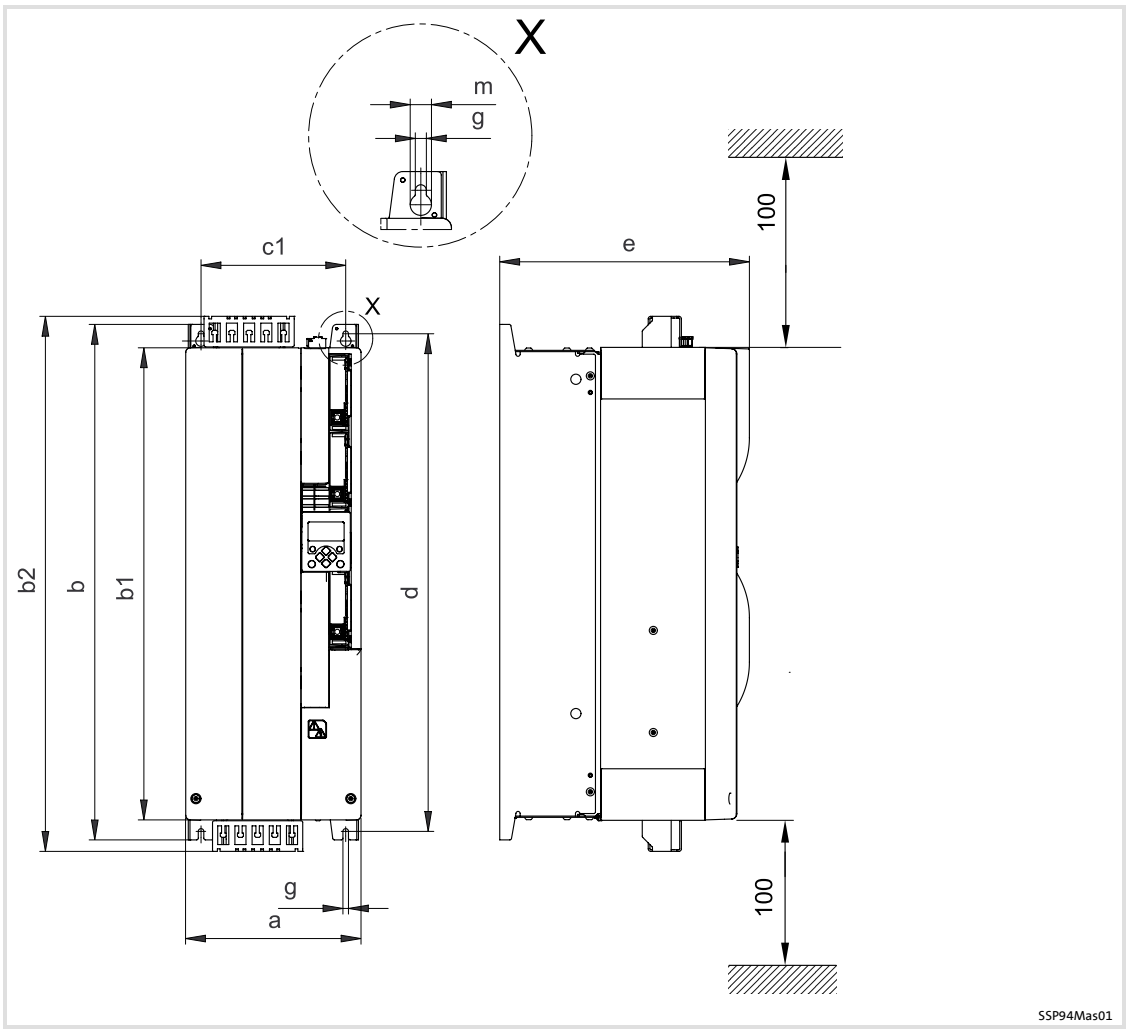


Fig. 4-16 Dimensions [mm]

Type	Dimensions [mm]									Weight [kg]	Device size
	a	b	b1	b2	e	c1	d	g	m		
E94ASxE0324	206	606	556	630	294	170	585	6.5	12.5	26.5	6
E94ASxE0474											
E94ASxE0594											
E94ASxE0864	266	706	655	729	370	230	685			42	7
E94ASxE1044											

4.5.4 Devices in the range 145 ... 366 A (75 ... 200 kW)

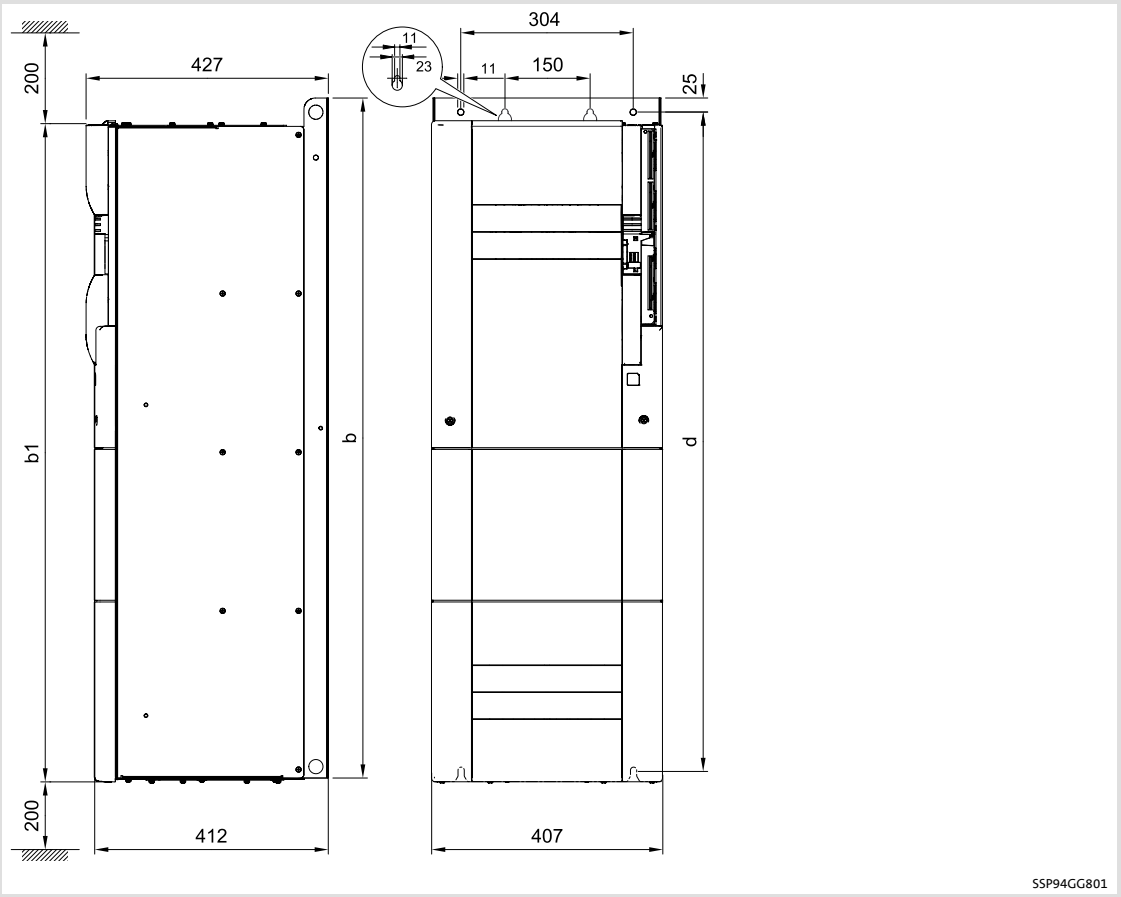


Fig. 4-17 Dimensions [mm]

Type	Dimensions [mm]			Weight	Device size
	b	b1	d	[kg]	
E94ASxE1454	930	897	885	95	8S
E94ASxE1724	1199	1166	1154	107	8
E94ASxE2024				109	
E94ASxE2454	1580	1546	1535	132	9
E94ASxE2924				132	
E94ASxE3664				161	

4.5.5 Devices in the range 460 ... 695 A (250 ... 400 kW)

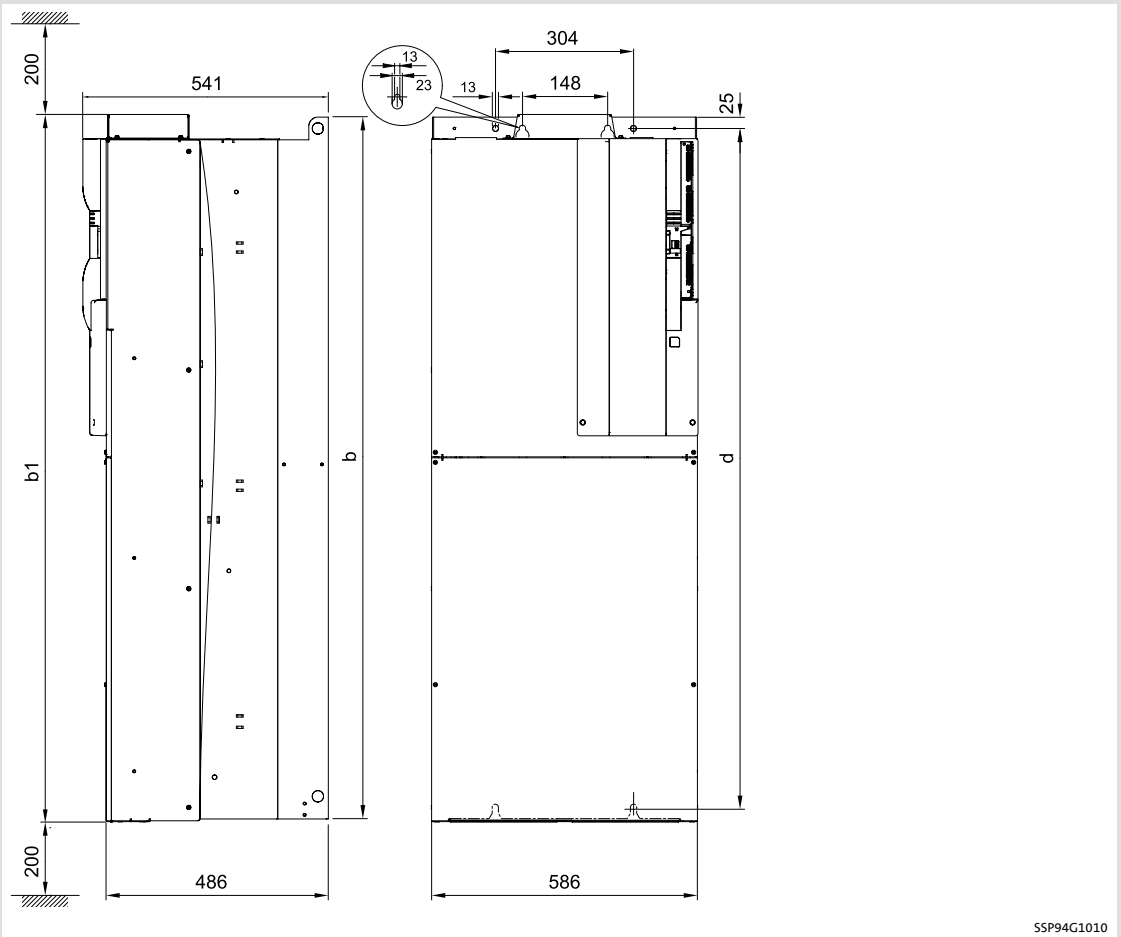


Fig. 4-18 Dimensions [mm]

Type	Dimensions [mm] b	b1	d	Weight [kg]	Device size
E94ASxE4604	1547	1559	1502	266	10
E94ASxE5724				278	
E94ASxE6354				300	
E94ASxE6954				321	

4.6 Wiring

4.6.1 Important notes

Danger!

Hazardous electrical voltage

Depending on the device, all power connections remain live up to 3 minutes after the mains has been switched off.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Wait for at least 3 minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
  – Fixed installation
  – PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

Stop!

Overvoltage on components:

On IT systems an earth fault in the installation can cause impermissible overvoltages.

Possible consequences:

Destruction of the device.

Protective measures:

If the devices are operated on IT systems, the internal connection of the filters to the protective earth in the installation backplane has to be disconnected (📖 103).

Note!

Switching operations on the motor side of the controller are permitted for safety switch-off (emergency off).

Please observe:

- ► When the controller is enabled, switching operations may lead to a response of the controller monitoring functions.
- ► The switching elements on the motor side must be rated for DC voltages with U_{DCmax} = 800 V.

4.6.2 Safety notes for the installation according to U_L or U_R

Device size 1 ... 3

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 500 V max.
- Voltage of the fuses must at least be suitable with the input voltage of the drive.
- The integral solid state protection does not provide branch circuit protection and that branch circuit protection has to be provided externally in accordance with manufacturers instructions, the National Electrical Code and any additional codes.
- For information on the protection level of the internal overload protection for a motor load, see the corresponding Application Manuals or Software Helps.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Application Manuals or Software Helps.
- Maximum surrounding air temperature: 55 °C.
- Use 60/75 °C copper wire only, except for control circuits.
- Control card protection:
  External fuse for 24 Vdc supply voltage of control terminal X2. Rated 4 A DC fuse UL248-14.

	Branch circuit/short circuit protection with fuses in accordance with UL248
Type	Fuse [A]
E94ASxE0024	10
E94ASxE0034	10
E94ASxE0044	10
E94ASxE0074	15
E94ASxE0134	20
E94ASxE0174	25
E94ASxE0244	40

Device size 6 and 7

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 500 V max.
- Voltage of the fuses must at least be suitable with the input voltage of the drive.
- The integral solid state protection does not provide branch circuit protection and that branch circuit protection has to be provided externally in accordance with manufacturers instructions, the National Electrical Code and any additional codes.
- For information on the protection level of the internal overload protection for a motor load, see the corresponding Application Manuals or Software Helps.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Application Manuals or Software Helps.
- Maximum surrounding air temperature: 55 °C.
- E94ASxE0324 ... E94ASxE0594:
  Use 60/75 °C copper wire only, except for control circuits.
- E94ASxE0864 ... E94ASxE1044:
  Use 75 °C copper wire only, except for control circuits.
- Control card protection:
  External fuse for 24 Vdc supply voltage of control terminal X2. Rated 4 A DC fuse UL248-14.

	Branch circuit/short circuit protection with fuses in accordance with UL248
Type	Fuse [A]
E94ASxE0324	60
E94ASxE0474	60
E94ASxE0594	80
E94ASxE0864	100
E94ASxE1044	125

Device size 8S ... 10

Warnings!

- ► Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 100000 rms symmetrical amperes, 500 V max., when protected by the specified fuses (📖 Tab. 4-4).
- ► Voltage of the fuses must at least be suitable with the input voltage of the drive.
- ► The integral solid state protection does not provide branch circuit protection and that branch circuit protection has to be provided externally in accordance with manufacturers instructions, the National Electrical Code and any additional codes.
- ► For information on the protection level of the internal overload protection for a motor load, see the corresponding Application Manuals or Software Helps.
- ► For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Application Manuals or Software Helps.
- ► Maximum surrounding air temperature: 55 °C with derating.
- ► Use 75 °C copper wire only, except for control circuits.
- ► Control card protection:
  External fuse for 24 Vdc supply voltage of control terminal X2. Rated 4 A DC fuse UL248-14.

Branch circuit protection (UL Guide No. JHFR2)

	Bussmann		Alternate type	
Type	Fuse rating	Type	Ferraz-Shawmut	SIBA
E94ASxE1454	250 A, 700 V	170M3016	2061032.250	6.6URD30D08A0250
E94ASxE1724	315 A, 700 V	170M3017	2061032.315	6.6URD30D08A0315
E94ASxE2024	350 A, 700 V	170M3018	2061032.350	6.6URD30D08A0350
E94ASxE2454	400 A, 700 V	170M4012	2061032.400	6.6URD30D08A0400
E94ASxE2924	500 A, 700 V	170M4014	2061032.500	6.6URD30D08A0500
E94ASxE3664	630 A, 700 V	170M4016	206xx32.600	A50-P600
E94ASxE4604	700 A, 700 V	170M4017	2061032.700	6.6URD31D08A0700
E94ASxE5724	900 A, 700 V	170M6013	2063032.900	6.6URD33D08A0900
E94ASxE6354	900 A, 700 V	170M6013	2063032.900	6.6URD33D08A0900
E94ASxE6954	900 A, 700 V	170M6013	2063032.900	6.6URD33D08A0900

Tab. 4-4

- ► 100 kA SCCR with above fuses. (Short Circuit Current Rating)
- ► Ferraz-Schawmut A50QS fuses may be substituted for A50-P fuses.
- ► 170M fuses from Bussmann shown use -/80 visual indicator. -TN80 Type T, -/110 or TN/110 Type T indicater fuses of the same size and amperage may be substituted.

4.6.3 Earthing of internal EMC filters

Device-internal EMC filters have been implemented to reduce interference emission. These EMC filters are connected to protective earth to discharge interference currents.

Under certain conditions the EMC filters must be disconnected from:

- Operation in an IT system
  The devices are protected from damages or destruction due to incompatible overvoltages in the case of an error (earth fault).
- DC-bus operation
- Operation with power supply modules or regenerative power supply modules
- Operating multiple devices with a common filter
  The EMC properties can only be reached by carrying out the described measures.
  The triggering behaviour of applicable earth-leakage circuit breakers remains undisturbed.

Overview of the measures

The measures can be carried out easily. They are prepared device-dependently, and their mounting and wiring are described.

Device	Measure
Controller	
With installation backplane (GG1 ... GG3)	Plug/unplug the plastic cap
Without installation backplane (GG6 ... GG7)	Change the screwed connection
Without installation backplane (GG8S ... GG10)	Activate the switch
Power supply modules	
With installation backplane (GG1 und GG3)	Plug/unplug the plastic cap
Without installation backplane (GG4 ... GG5)	---
Regenerative power supply module	
With installation backplane (GG3)	Plug/unplug the plastic cap
Suitable mains filter	Change the screwed connection

Device size 1 ... 3

Proceed as follows to disconnect the internal connection between the filters and PE:

1. Remove IT insulating cap from the parking position ① in the installation backplane.
   – For this apply a screwdriver on the right or left and lever off the insulating cap.
   – Optionally the insulating cap can be carefully removed using an appropriate pliers.
2. Attach IT insulating cap to the earthing jumper ② until it clicks into place.

Fig. 4-19 Plugging the IT insulating cap onto the earthing jumper

Device size 6 and 7

Proceed as follows to disconnect the internal connection between the filters and PE:

1. Find the screw over terminals X100 (+UG/-UG) in the position ”TT-TN” (📖 Fig. 4-20).
2. Unscrew the screw and screw it in again at position ”IT”.
   – Tightening torque: 3.4 Nm (30 lb-in)

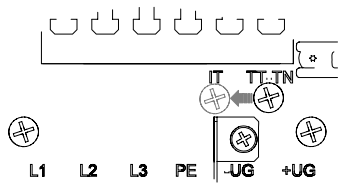
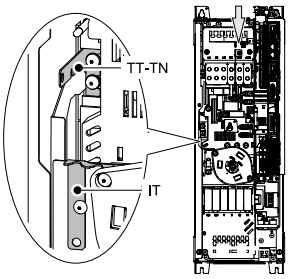


Fig. 4-20

3. Find the metal strap on the left of the device (📖 Fig. 4-21).
4. Unbolt the screws to remove the metal strap.
5. Unbolt the screw at position ”IT” and insert the metal strap.
6. Tighten all screws.
   – Tightening torque: 3.4 Nm (30 lb-in)

Device size 6



Device size 7

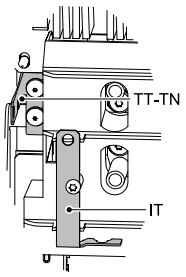


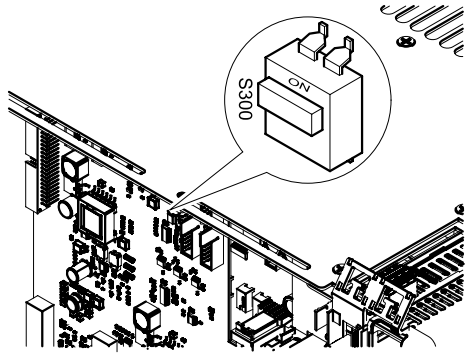
Fig. 4-21

After this, the device is suitable for operation in IT systems.

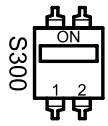
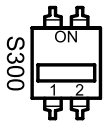
Device size 8S ... 10

How to separate the internal connection of filters to the protective earth:

1. Remove the upper housing cover.
2. The S300 switch can be found on the Interface card. The Interface card is located in the top of the device.
   – ON position: Standard operation at earthed-neutral systems (Lenze).
   – OFF position: Operation at IT systems.
3. Push the S300 switch into the OFF position.



94ITSW8001

ON - Standard	OFF - IT
	
IF-Card-SW	IF-Card-SW

4.6.4 Devices in the range 2 ... 24 A (0.37 ... 11 kW)

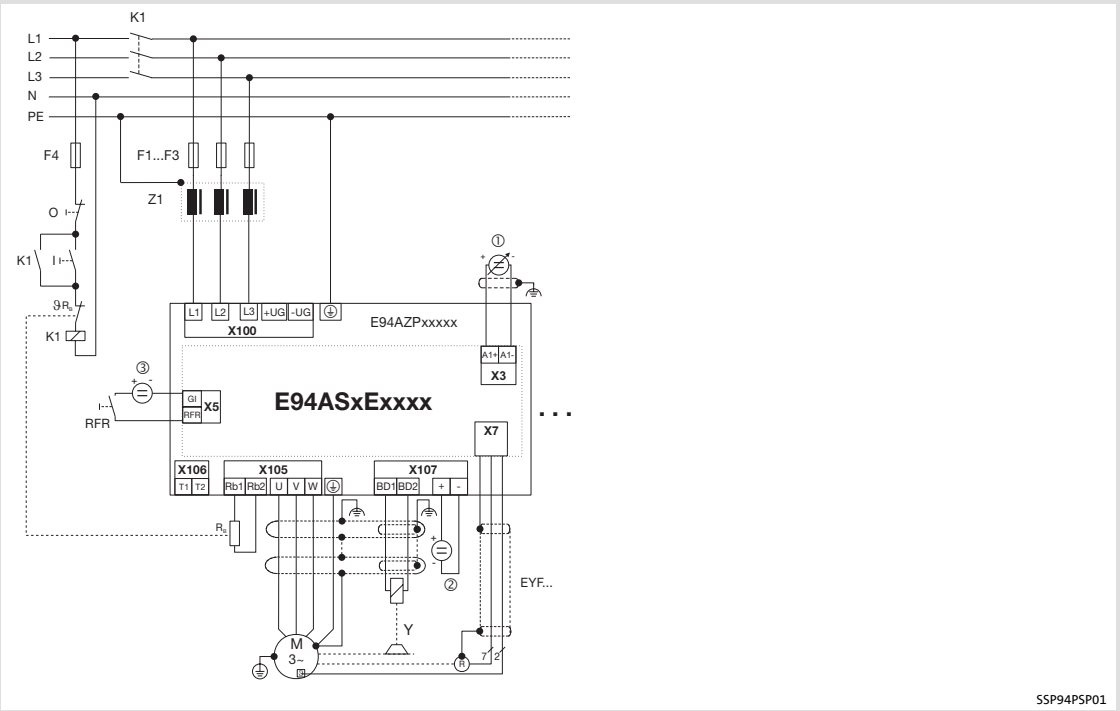


Fig. 4-22 Basic circuit diagram of the drive system

E94ASxExxxx	9400 Single Drive servo axis module
E94AZPxxxxx	Installation backplane
F1 ... F4	Fuses
Z1	Mains filter/RFI filter (optional)
⏚	HF shield termination through large-surface connection to functional earth
EYF...	System cable for resolver feedback
RFR	Controller enable
K1	Mains contactor
R	Resolver
RB	Brake resistor
Y	Motor holding brake (connected to optional motor brake control)
①	Speed setpoint selection via analog input 1 (-10 ... 0 ... +10 V)
②	Voltage source for the motor holding brake
③	24-V voltage source for the digital inputs according to IEC 61131-2

Tip!

Complete the wiring of the installation backplane before plugging in the standard device. The upper terminals of the installation backplane cannot be connected with a plugged-in standard device.

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

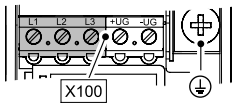
Use system cables or shielded cables for these connections:

- Motor
- Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- Motor temperature monitoring
- External brake resistor (Mounting Instructions of the brake resistor)

The following connections need not be shielded:

- Mains
- DC bus

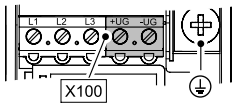
Mains

Terminal X100 (left part)	Labelling	Description
 SSP940X100	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1+2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with wire end ferrule	16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

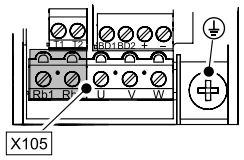
DC bus

Terminal X100 (right part)	Labelling	Description
 SSP940X100	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series).

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1+2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with wire end ferrule	16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

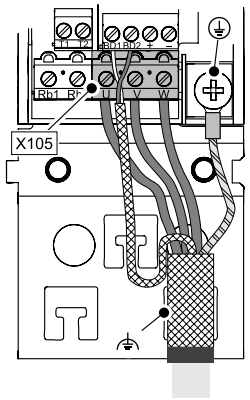
External brake resistor

Terminal X105 (left part)	Labelling	Description
 SSP94LX105	Rb1 Rb2	External brake resistor
	⏚	Connection for the PE conductor with M5 ring cable lug.

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1+2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with wire end ferrule	16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

Motor

Terminal X105 (right part)	Labelling	Description
 SSP940X105	U V W	Connection of the motor phases
	⏚	Functional earth Connect the shields of the motor phases and of the optional motor brake control separately and with a surface as large as possible to the shield sheet. Use EMC wire clamp or EMC shield clamp for fixing.
	⏚	Connection for the PE conductor on the motor side with M5 ring cable lug

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1+2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with wire end ferrule	16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

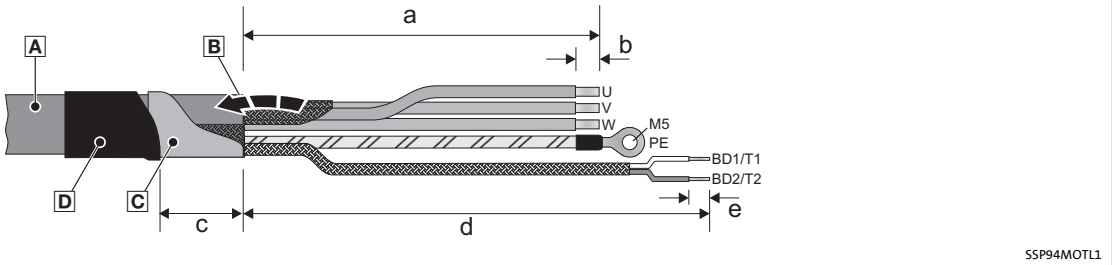
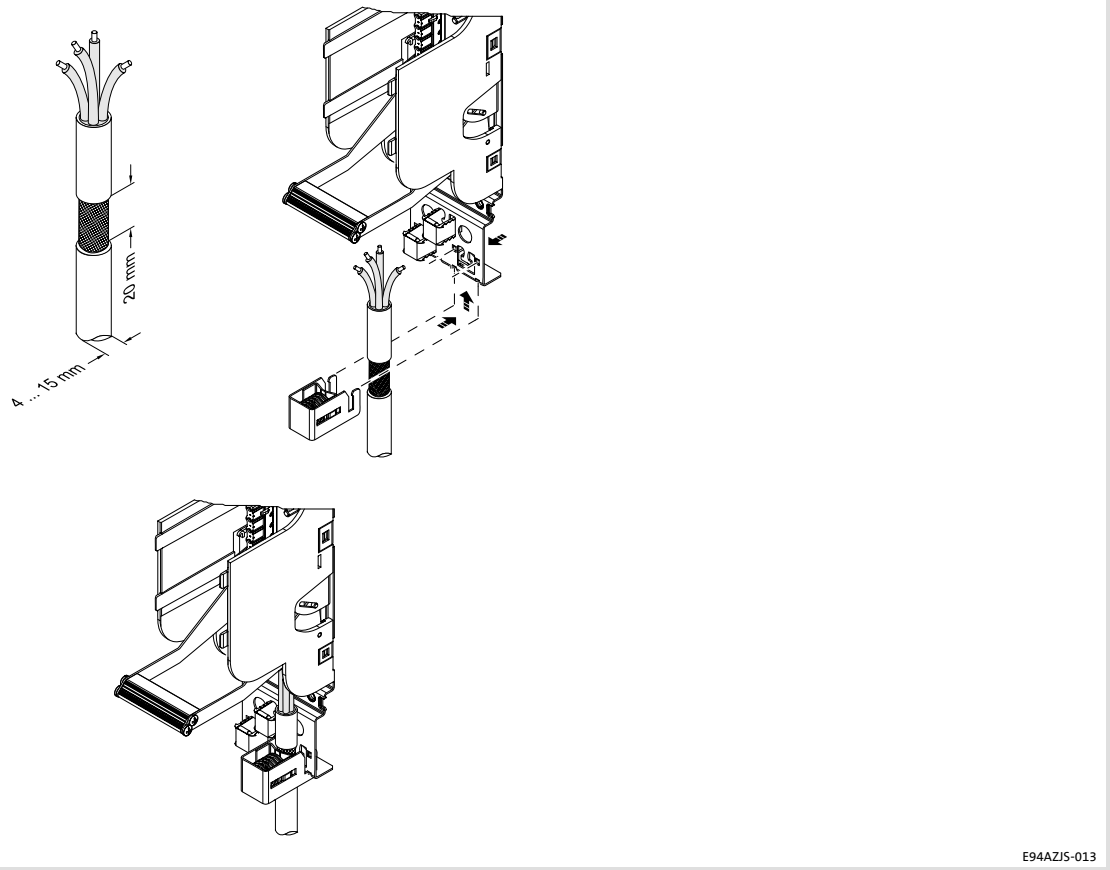


Fig. 4-23 Stripping lengths of the motor cable

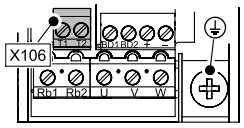
Type	Dimensions [mm]				
	a	b	c	d	e
Device size 1	80	8	25	150	8
Device size 2	90	8	30	160	8
Device size 3	100	10	30	170	8

How to proceed:

1. Strip the motor cable [A] according to dimensions given.
2. Fold back the shield of the motor cable [B] over the cable sheath.
3. Stabilise the shield with self-adhesive conductive foil [C] (recommendation).
4. Fix the shield and conductive foil with heat-shrinkable tube [D] on the cable sheath.
5. Fasten cable lugs or wire end ferrules.
6. Connect the shields separately to the shield sheet using shield clamps (no strain relief).



Motor temperature monitoring

Terminal X106	Labelling	Description
 SSP940X106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0

Motor brake control (optional)

Note!

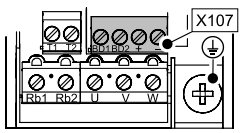
When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

For information on the E94AZHX0051 motor holding brake control module optionally contained in the installation backplane, please see the chapter Accessories starting on page 420.

Terminal X107	Labelling	Description
 SSP940X107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHX0051: 24 V DC, max. 2.5 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0

Stripping length or contact length: 8 mm

Stop!

The motor brake control includes an electronic switch which can control a 24 V motor holding brake.

The motor brake control may only be connected with motor holding brakes which correspond to the permissible data mentioned in the technical data. (If required, the holding brake without motor brake control must be controlled via a digital output and a coupling relay).

If the permissible data mentioned in the technical data are not complied with:

► the motor brake control can be destroyed.

► a safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements concerning the brake cable (connection BD1/BD2):

► The brake cables must be shielded if they are incorporated in the motor cable.
  – Operation with unshielded brake cables can destroy the motor brake control.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

► Connect the shield on both sides of PE.

Requirements concerning the supply voltage U_{DC} (connection +/-):

► The motor brake control must always be supplied with a separate 24 V supply.
  – A common supply of the motor brake control and the control card of the controller is not permissible since otherwise the double insulation between both components would be reduced.

► Set U_{DC} so that the operating voltage of the brake is within the admissible range and the maximum supply voltage of the motor brake control will not be exceeded.

Installation of the standard device

After the wiring of the installation backplane has been fully completed, install the standard device. Then continue with the wiring of the control terminals.

How to proceed:

1. Insert the device into the installation backplane without twisting it until resistance is felt.
2. Press the device into the installation backplane until it audibly snaps into place. The locking clip moves downwards and back into the locking position.
3. The end position is reached when the locking clip can be pressed against the device. Now the device is locked.

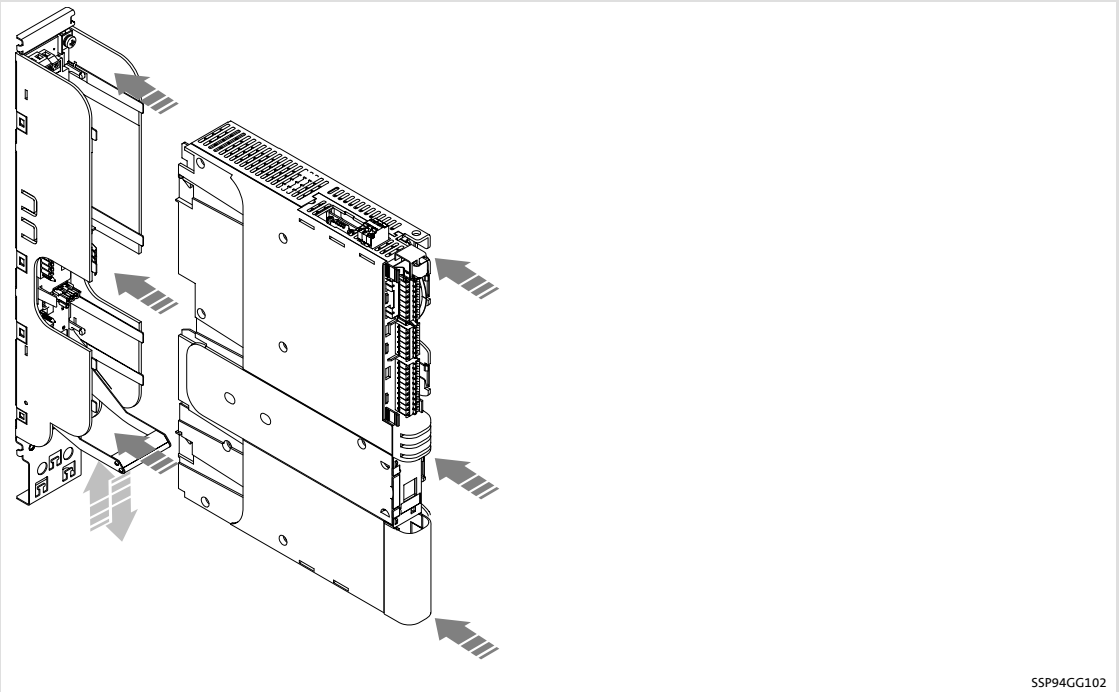


Fig. 4-24 Installation of the device

Proceed as follows to remove the device:

1. Disconnect already wired connectors at the device.
2. Push the locking clip downwards to release the device and disengage it from the contacts.
3. Pull the device completely out of the installation backplane and remove it. The locking clip moves back into the locking position.

4.6.5 Devices in the range 32 ... 104 A (15 ... 55 kW)

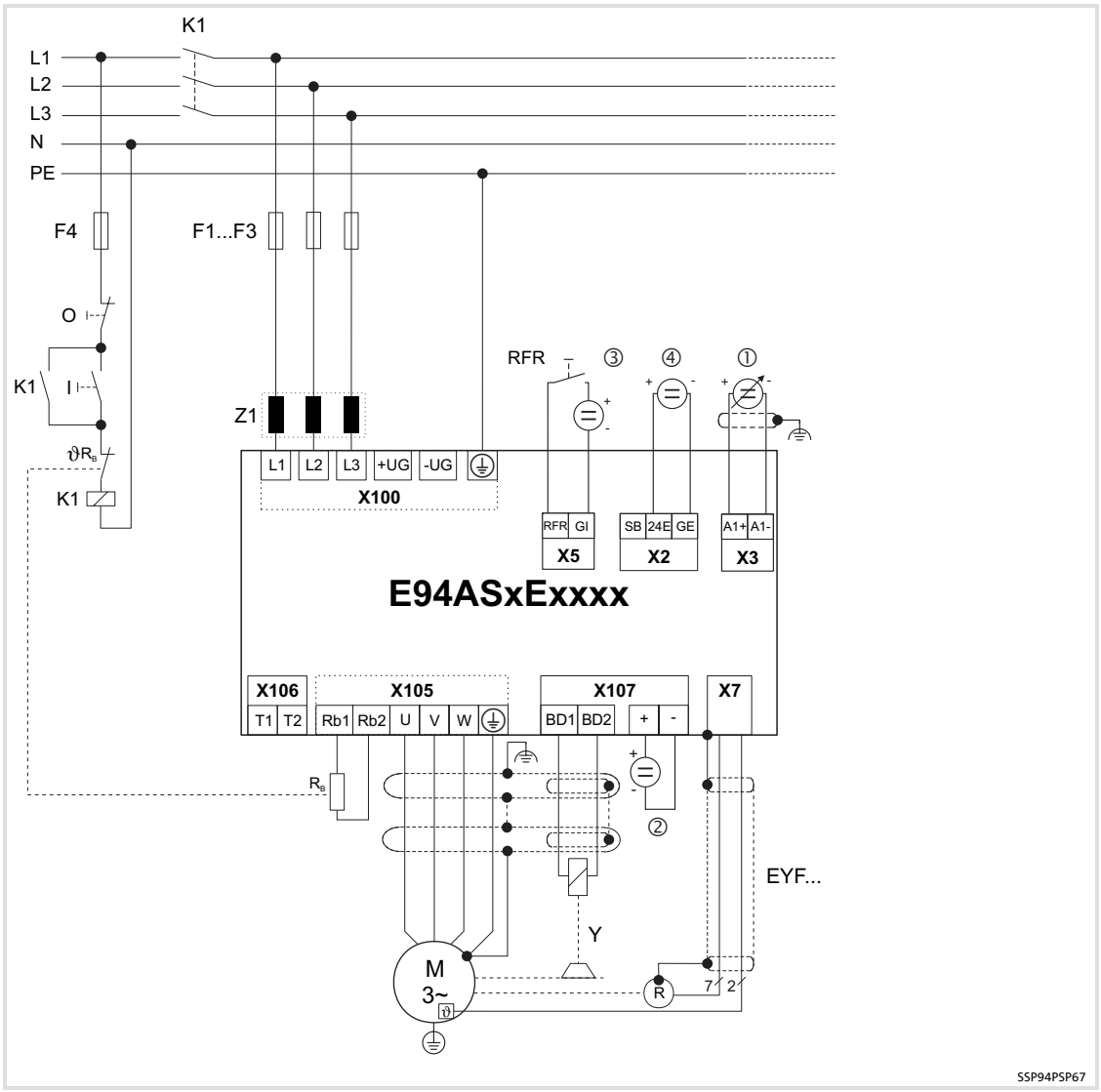


Fig. 4-25 Basic circuit diagram of the drive system

E94ASxExxxx	Servo axis module 9400 Single
F1 ... F4	Fuses
Z1	Toroidal core, effective in the high-frequency range 30 ... 60 MHz
⏚	HF-shield termination through large-surface connection to functional earth
EYF...	System cable - resolver feedback
RFR	Controller enable
K1	Mains contactor
R	Resolver
RB	Brake resistor
Y	Motor holding brake (an optimum motor brake control)
①	Speed setpoint selection via analog input 1 (-10 ... 0 ... +10 V)
②	Voltage source for the motor holding brake
③	24-V voltage source for digital inputs according to IEC 61131-2
④	24-V voltage source for the control electronics

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

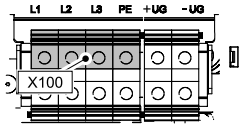
Use system cables or shielded cables for these connections:

- Motor
- Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- Motor temperature monitoring
- External brake resistor (Mounting Instructions of the brake resistor)

The following connections need not be shielded:

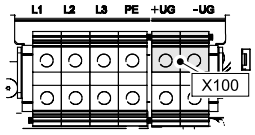
- Mains
- DC bus

Mains

Terminal X100 (left part)	Labelling	Description
 SSP94X6100	L1 L2 L3	Connection of the mains phases L1, L2, L3
	PE	Connection for the PE conductor on the supply side

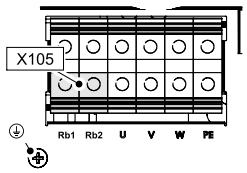
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 6: Flexible With wire end ferrule	50	0	10	88.5	Hexagon socket 5
Device size 7: Flexible With wire end ferrule	95	000	14	124	Hexagon socket 5

DC bus

Terminal X100 (right part)	Labelling	Description
 SSP94X6100	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series).

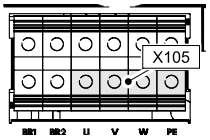
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 6: Flexible With wire end ferrule	50	0	10	88.5	Hexagon socket 5
Device size 7: Flexible With wire end ferrule	95	000	14	124	Hexagon socket 5

External brake resistor

Terminal X105 (left part)	Labelling	Description
 SSP94X6105	Rb1 Rb2 ⏚	External brake resistor Connection for the PE conductor with M5 ring cable lug

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 6: Flexible With wire end ferrule	50	0	10	88.5	Hexagon socket 5
Device size 7: Flexible With wire end ferrule	95	000	14	124	Hexagon socket 5

Motor

Terminal X105 (right part)	Labelling	Description
 SSP94X6105	U V W PE	Motor phases Connection for the motor-side PE conductor

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 6: Flexible With wire end ferrule	50	0	10	88.5	Hexagon socket 5
Device size 7: Flexible With wire end ferrule	95	000	14	124	Hexagon socket 5

Motor temperature monitoring

Terminal X106	Labelling	Description
SSP94X6106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data

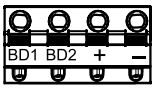
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Motor brake control (optional)

Note!

When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Terminal X107	Labelling	Description
 SSP94X6107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHx0101: 24 V DC, max. 5.0 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Stripping length or contact length: 8 mm

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

4.6.6 Devices in the range 145 ... 695 A (75 ... 370 kW)

Device size 8S

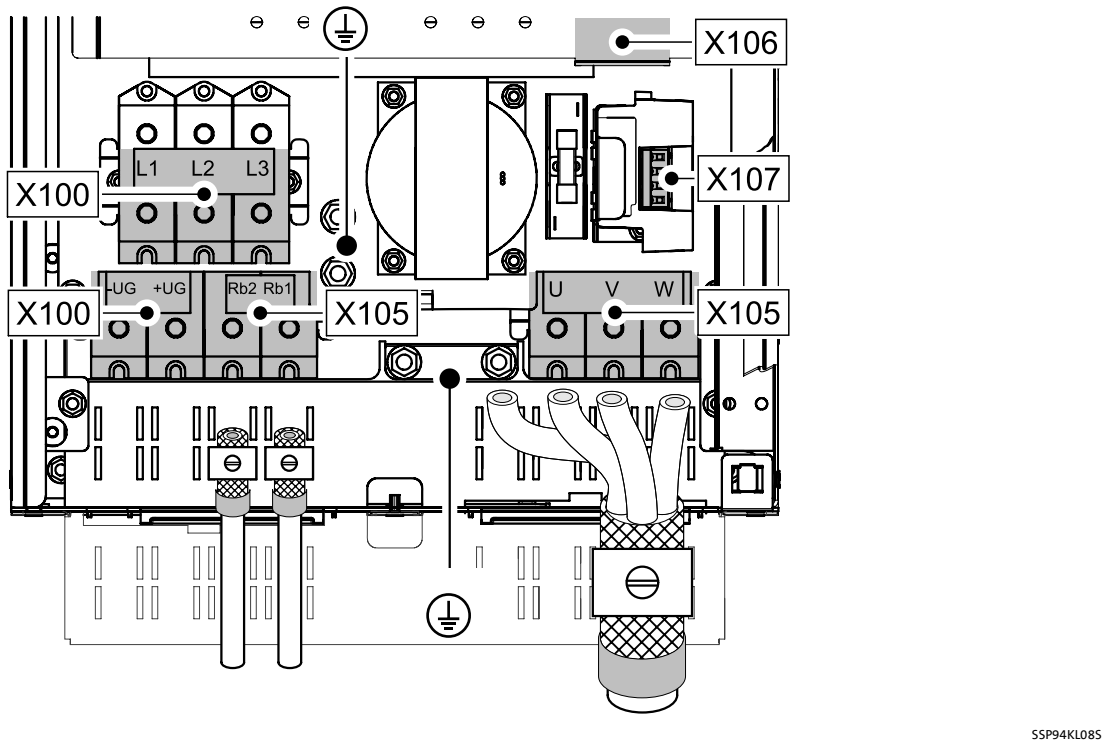


Fig. 4-26 Arrangement of the power connections

Tip!

The barrier between mains input and power terminals can be dismounted to have more free space for wiring.

Motor

Terminal X105	Marking	Description
SSP94KL0X8	U V W	Motor phases
	⏚	Connection for the PE conductor on the motor side with M8 ring cable lug

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8S: Flexible With wire end ferrule	95	000	14	124	Inbus 5
M8 ring cable lug	95	000	9.5	84	WAF 13

External brake resistor

Terminal X105	Labelling	Description
	Rb1 Rb2	Connection of external brake resistor
	⏚	Connection for the PE conductor with M8 ring cable lug.

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8S: Flexible With wire end ferrule	95	000	14	124	Inbus 5

DC bus

Terminal X100	Labelling	Description
	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series).

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8S: Flexible With wire end ferrule	95	000	14	124	Inbus 5

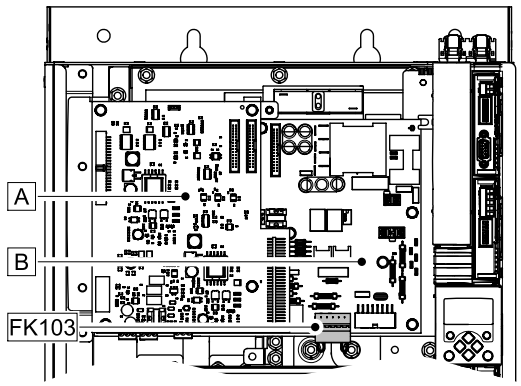
Tip!

Now mount the barrier between mains input and power terminals, if had been removed to have more free space for wiring.

Operation with DC supply

For operation with DC supply, the internal fans must be connected via the internal terminal FK103 to the 400/500 V AC mains voltage.

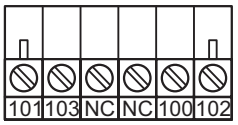
When opening the upper housing cover, you will find the pluggable terminal FK103 at the top in the device on the switched-mode power supply card.



94SSPGG852

A	Interface card
B	Switched-mode power supply card
FK103	Fan voltage terminal

Remove the cable bridges of the terminal. Then, connect the mains voltage to FK103.101/100.

FK103	Labelling	Description	
 SSP94FK103	101	Fan L1	by default bridged
	103	Mains phase (internal)	
	NC	not assigned	
	NC		
	100	Fan L2	by default bridged
	102	Mains phase (internal)	

Terminal data	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5
With wire end ferrule					

Rated values - internal fan, AC 400 V				
Gg	Type	I [A]	P [W]	
8S	E94ASxE1454	0.3	120	
8	E94ASxE1724 E94ASxE2024	1.2	480	
9	E94ASxE2454 E94ASxE2924 E94ASxE3664	1.2	480	
10	E94ASxE4604	1.2	480	
	E94ASxE5724 E94ASxE6354 E94ASxE6954	2.8	1120	

Mains

Terminal X100	Marking	Description
SSP94KL0X8	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the PE conductor on the supply side with M8 ring cable lug

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8S: Flexible With wire end ferrule	95	000	14	124	Inbus 5
M8 ring cable lug	95	000	9.5	84	WAF 13

Motor temperature monitoring

Terminal X106	Labelling	Description
SSP94X6106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data

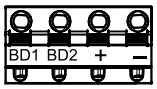
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Motor brake control (optional)

Note!

When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Terminal X107	Labelling	Description
 SSP94X6107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHx0101: 24 V DC, max. 5.0 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Stripping length or contact length: 8 mm

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

Device sizes 8 and 9

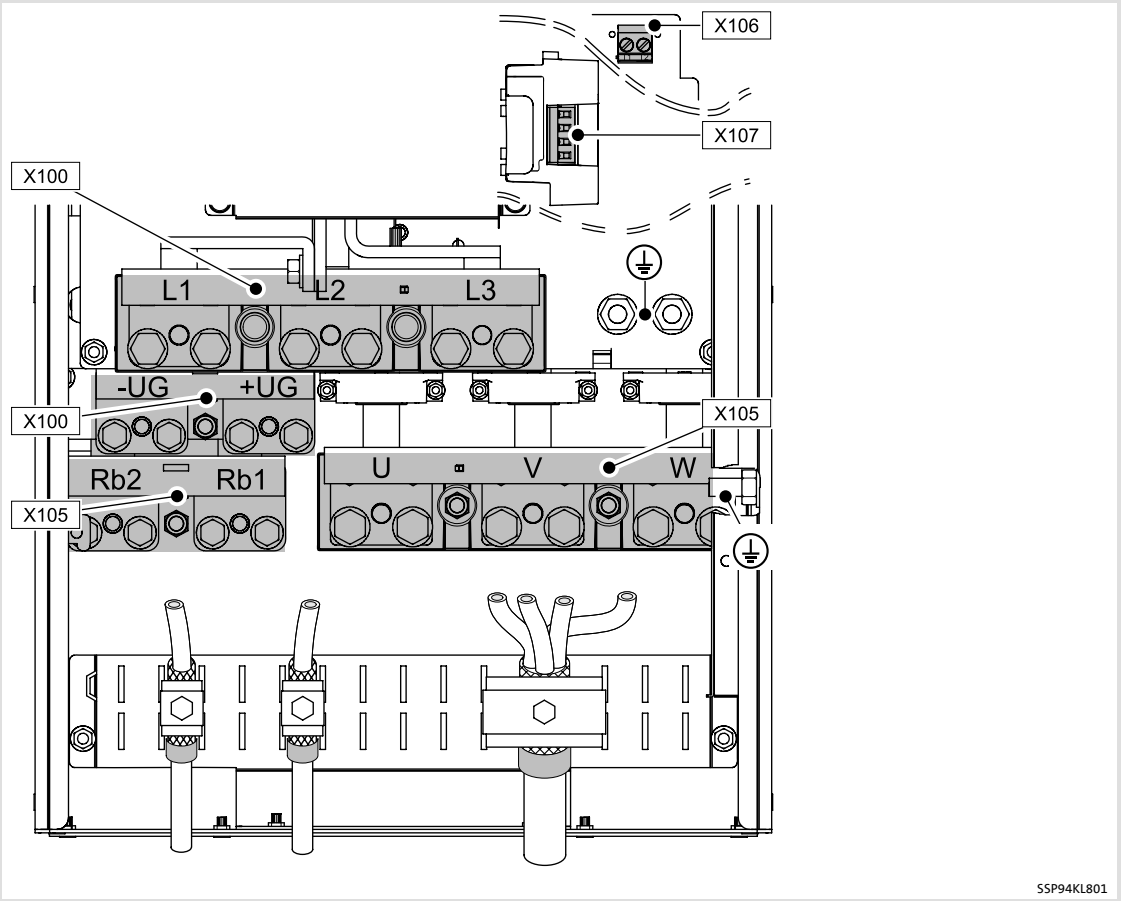


Fig. 4-27 Arrangement of the power connections

Tip!

The barrier between mains input and power terminals can be dismounted to have more free space for wiring.

Motor

Terminal X105	Marking	Description
Connection with ring cable lug for M10	U V W	Connection of the motor phases
SSP94KL801	⏚	Connection for the PE conductor on the motor side

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8: E94ASxE1724 E94ASxE2024	2 x 240	2 x 500 mcm	19	168	WAF 16
Device size 9: E94ASxE2454 E94ASxE2924 E94ASxE3664					

External brake resistor

Terminal X105	Labelling	Description
Connection with ring cable lug for M8	Rb1 Rb2	Connection of external brake resistor
SSP94KL801	⏚	Connection for the PE conductor

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8: E94ASxE1724 E94ASxE2024	2 x 240	2 x 500 mcm	9.5	84	WAF 13
Device size 9: E94ASxE2454 E94ASxE2924 E94ASxE3664					

DC bus

Terminal X100	Marking	Description
Connection with ring cable lug for M8 SSP94KL801	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series).

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8: E94ASxE1724 E94ASxE2024	2 x 240	2 x 500 mcm	9.5	84	WAF 13
Device size 9: E94ASxE2454 E94ASxE2924 E94ASxE3664					

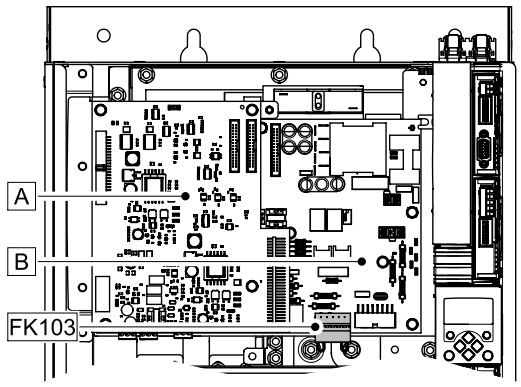
Tip!

Now mount the barrier between mains input and power terminals, if had been removed to have more free space for wiring.

Operation with DC supply

For operation with DC supply, the internal fans must be connected via the internal terminal FK103 to the 400/500 V AC mains voltage.

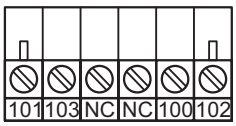
When opening the upper housing cover, you will find the pluggable terminal FK103 at the top in the device on the switched-mode power supply card.



94SSPGG852

A	Interface card
B	Switched-mode power supply card
FK103	Fan voltage terminal

Remove the cable bridges of the terminal. Then, connect the mains voltage to FK103.101/100.

FK103	Labelling	Description	
 SSP94FK103	101	Fan L1	by default bridged
	103	Mains phase (internal)	
	NC	not assigned	
	NC		
	100	Fan L2	by default bridged
	102	Mains phase (internal)	

Terminal data	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5
With wire end ferrule					

Rated values - internal fan, AC 400 V				
Gg	**Type**	**I [A]**	**P [W]**	
8S	E94ASxE1454	0.3	120	
8	E94ASxE1724 E94ASxE2024	1.2	480	
9	E94ASxE2454 E94ASxE2924 E94ASxE3664	1.2	480	
10	E94ASxE4604	1.2	480	
	E94ASxE5724 E94ASxE6354 E94ASxE6954	2.8	1120	

Mains

Terminal X100	Marking	Description
Connection with ring cable lug for M10	L1 L2 L3	Connection of the mains phases
SSP94KL801	⏚	Connection for the PE conductor on the supply side

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 8: E94ASxE1724 E94ASxE2024	2 x 240	2 x 500 mcm	19	168	WAF 16
Device size 9: E94ASxE2454 E94ASxE2924 E94ASxE3664					

Motor temperature monitoring

Terminal X106	Labelling	Description
SSP94X6106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data

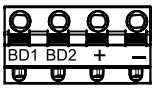
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Motor brake control (optional)

Note!

When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Terminal X107	Labelling	Description
 SSP94X6107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHx0101: 24 V DC, max. 5.0 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Stripping length or contact length: 8 mm

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

Device size 10

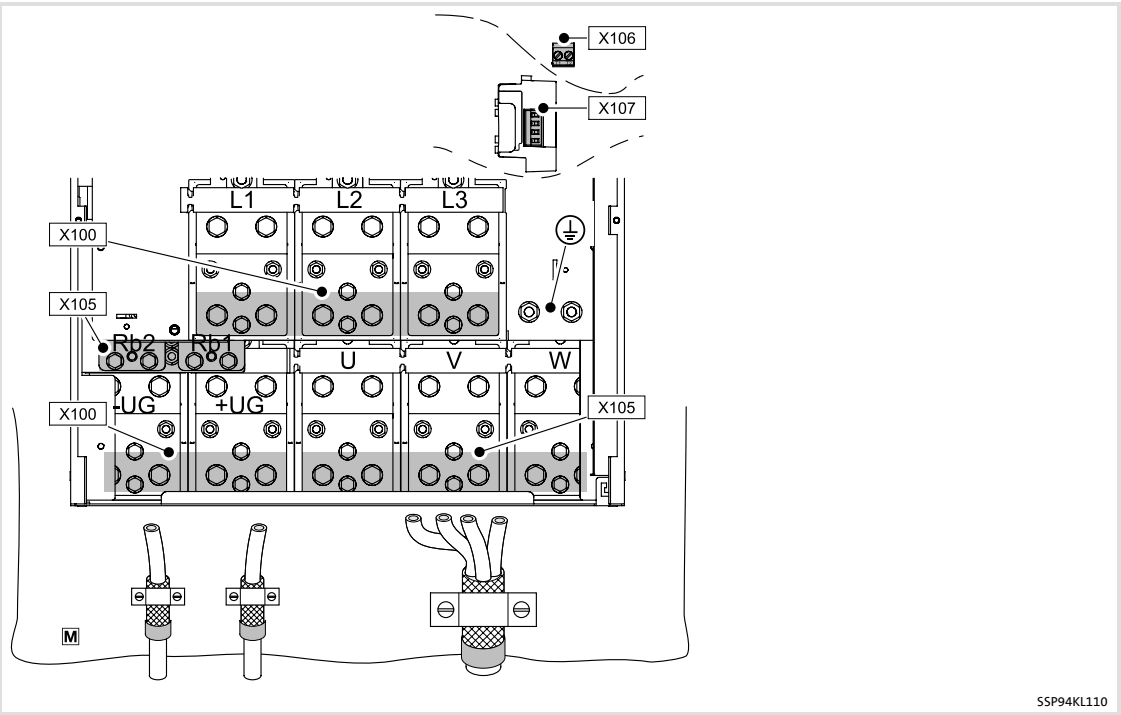


Fig. 4-28 Arrangement of the power connections

M Mounting plate
The shield of singles cores and multi-core cables must be connected to the mounting plate M of the control cabinet.

Motor

Terminal X105	Marking	Description
Connection with ring cable lug for M10	U V W	Connection of the motor phases
SSP94KL801	⏚	Connection for the PE conductor on the motor side

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 10: E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	2 x 400 3 x 150	2 x 750 mcm 3 x 350 mcm	19	168	WAF 16

External brake resistor

Terminal X105	Labelling	Description
Connection with ring cable lug for M8	Rb1 Rb2	Connection of external brake resistor
SSP94KL801	⏚	Connection for the PE conductor

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 10: E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	2 x 70	2 x 00	19	168	13

DC bus

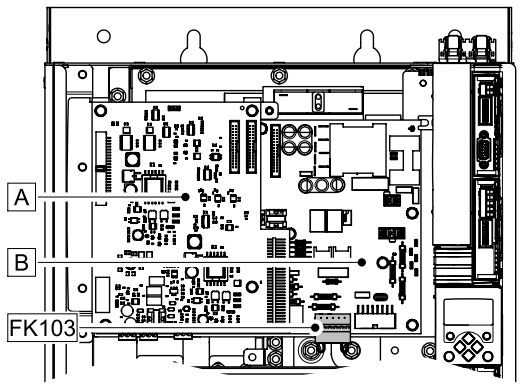
Terminal X100	Labelling	Description
Connection with ring cable lug for M10	+Ug -Ug	Alternative option for DC-bus voltage connection (compatible to 9300 series).

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 10: E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	2 x 400 3 x 150	2 x 750 mcm 3 x 350 mcm	19	168	WAF 16

Operation with DC supply

For operation with DC supply, the internal fans must be connected via the internal terminal FK103 to the 400/500 V AC mains voltage.

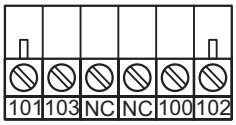
When opening the upper housing cover, you will find the pluggable terminal FK103 at the top in the device on the switched-mode power supply card.



94SSPGG852

A	Interface card
B	Switched-mode power supply card
FK103	Fan voltage terminal

Remove the cable bridges of the terminal. Then, connect the mains voltage to FK103.101/100.

FK103	Labelling	Description	
 SSP94FK103	101	Fan L1	by default bridged
	103	Mains phase (internal)	
	NC	not assigned	
	NC		
	100	Fan L2	by default bridged
	102	Mains phase (internal)	

Terminal data	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5
With wire end ferrule					

Rated values - internal fan, AC 400 V				
Gg	**Type**	**I [A]**	**P [W]**	
8S	E94ASxE1454	0.3	120	
8	E94ASxE1724 E94ASxE2024	1.2	480	
9	E94ASxE2454 E94ASxE2924 E94ASxE3664	1.2	480	
10	E94ASxE4604	1.2	480	
	E94ASxE5724 E94ASxE6354 E94ASxE6954	2.8	1120	

Mains

Terminal X100	Marking	Description
Connection with ring cable lug for M10	L1 L2 L3	Connection of the mains phases
SSP94KL801	⏚	Connection for the PE conductor on the supply side

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 10: E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	2 x 400 3 x 150	2 x 750 mcm 3 x 350 mcm	19	168	WAF 16

Motor temperature monitoring

Terminal X106	Labelling	Description
SSP94X6106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data

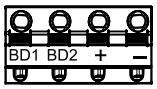
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Motor brake control (optional)

Note!

When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Terminal X107	Labelling	Description
 SSP94X6107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHx0101: 24 V DC, max. 5.0 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	Slot 0.6 x 3.5

Stripping length or contact length: 8 mm

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

4.7 Control terminals

Danger!

Hazardous electrical voltage

Depending on the device, all power connections remain live up to 3 minutes after the mains has been switched off.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Wait for at least 3 minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- Analog signals (inputs and outputs)
- System bus CAN
- Resolver
- Encoder

The following connections need not be shielded:

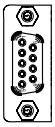
- 24 V supply
- Digital signals (inputs and outputs)

Tip!

Parameter setting and configuration can be carried out using the L-force »Engineer«. For this purpose the Online Help and the Software Manual for the standard device will guide you.

System bus CAN on board

The controller features an integrated CANopen system bus interface to exchange process data and parameter values between different nodes and to connect further modules as e.g. distributed terminals, operator and input devices (”HMIs”) and external control units. Further information can be obtained from the Communication Manual.

Terminal X1	Labelling	Description
 9400SSP000X1	Pin 2	CAN-LOW
	Pin 3	CAN-GND
	Pin 7	CAN-HIGH
	(Housing)	CAN-Shield

24 V supply

The supply voltage for the control electronics should be fed by a mains-independent 24 V source. Thus, the control functions remain active even after power is removed.
As an option, the controller can generate the supply voltage for the control electronics from the DC-bus voltage. Then, the control functions will not be active when power is removed.

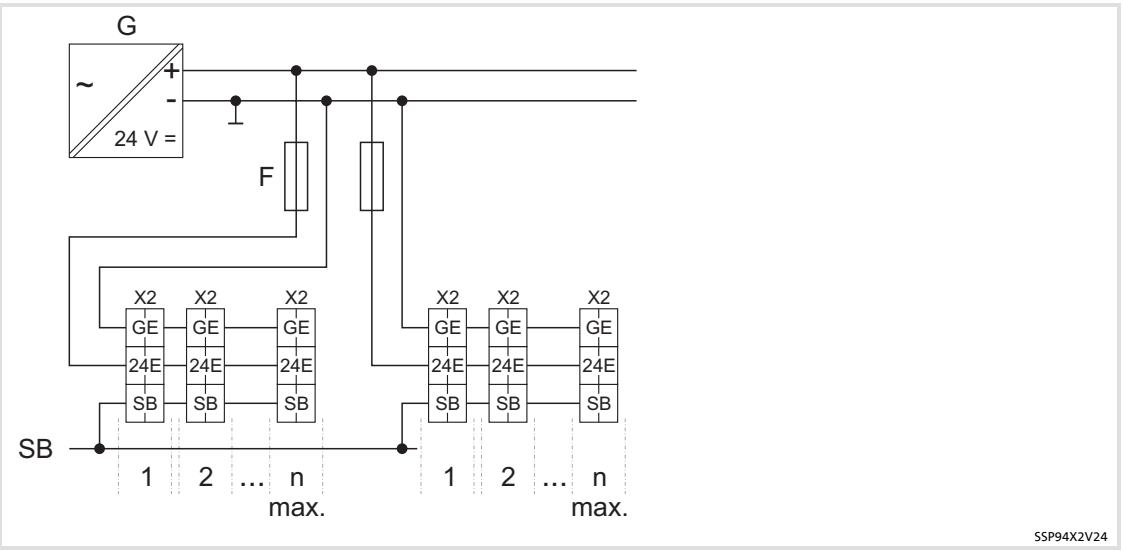


Fig. 4-29 Wiring principle

g	24 V external supply (e.g. EZV...)
F	Fuse
X2	Terminal for 24 V and state bus
GE/24E/SB	Labelling on the terminal
SB	State bus
1 ... n	E94A... device number during loop-through connection

Terminal X2	Labelling	Description
	GE	GND external supply
	24E	24 V external supply via a safely separated power supply unit (SELV/PELV) (only required for mains-independent supply of the control electronics)
9400SSP000X2	SB	State bus in/out (reference GE)

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Electrical data		
24 V	Rated voltage	24 V According to IEC 61131-2
	Voltage range	19.2 ... 28.8 V Residual ripple max. ± 5 %
	Current consumption	Approx. 1.2 A during operation Max. 3 A starting current for 100 ms
	Fuse	Circuit breaker with tripping characteristic B or C, Standard blade-type fuses
	Looping through	Max. 12 devices with 2.5 mm² Fusing: 16/15 A
		Max. 8 devices with 1.5 mm² Fusing: 10/10 A
	Connectable cross-cuttings	See terminal data

State bus

The state bus is a bus system exclusively designed for Lenze controllers via which up to 20 controllers can be connected and which serves to simulate a ”release cord” function. The state is controlled via the system module SFBDigitalOutput.

- The state bus knows the states ”OK” and ”fault”.
- The state bus is multi-master-compliant, i.e. each node connected to the state bus can set the state bus to ”fault” by changing to LOW level.
- In the ”fault” status, all nodes activate their programmed response, e.g. synchronised braking of the drive system.

Stop!

Do not connect an external voltage to the state bus, otherwise the function will be disturbed.

Electrical data		
State bus	Rated voltage	24 V According to IEC 61131-2
	Switching level	According to IEC 61131-2
	LOW	0 V ... +5 V
	HIGH	+15 V ... +30 V
	Looping through	Max. 20 devices DC-bus operation with 9300 devices is possible.
	Connectable cross-cuttings	See terminal data

Analog inputs, analog outputs

The controller features two analog inputs which are able to detect differential voltage signals in the range ±10 V, e.g. an analog speed setpoint selection or the voltage signal of an external sensor (temperature, pressure, etc.).

► The analog signal 1 can also detect a current setpoint.

The controller features two analog outputs, which can output internal analog signals as voltage signals, e.g. for the control of analog indicating instruments or as a setpoint for slave drives.

Electrical data		
Analog input 1 Analog input 2	Level:	-10 ... +10 V
	Resolution:	11 bits + sign
	Scaling:	±10 V ≡ $\pm 2^{30}$
	Conversion rate:	1 kHz
Analog input 1 as current input (A1R and A1- bridged)	Level:	-20 ... +20 mA
	Resolution:	10 bits + sign
	Scaling:	For C00034 = ”1” -20 ... -4 mA ≡-2^{30} ... 0 +4 ... +20 mA ≡0 ... $+2^{30}$
		For C00034 = ”2” ±20 mA ≡ ±2^{30}
	Conversion rate:	1 kHz
	Open-circuit monitoring:	Configurable
Analog output 1 Analog output 2	Level:	-10 ... +10 V (max. 2 mA)
	Resolution:	11 bits + sign
	Scaling:	±10 V ≡ $\pm 2^{30}$
	Conversion rate:	1 kHz

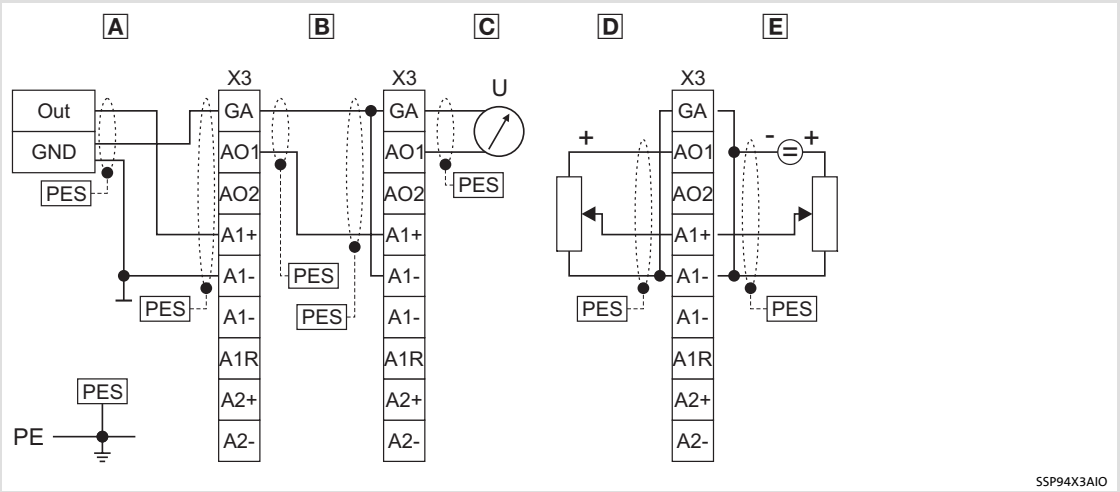


Fig. 4-30 Wiring principle

A	Wiring of an external analog signal
B	Wiring with a slave drive
C	Wiring with a measuring device
D	Potentiometer supplied by analog output 1
E	Potentiometer with external supply
Out	Analog output signal, e.g. of a control
GND	Earth reference potential
X3	Terminal for the analog inputs and outputs
PES	EMC shield connection
PE	Protective earth
U	Measuring device

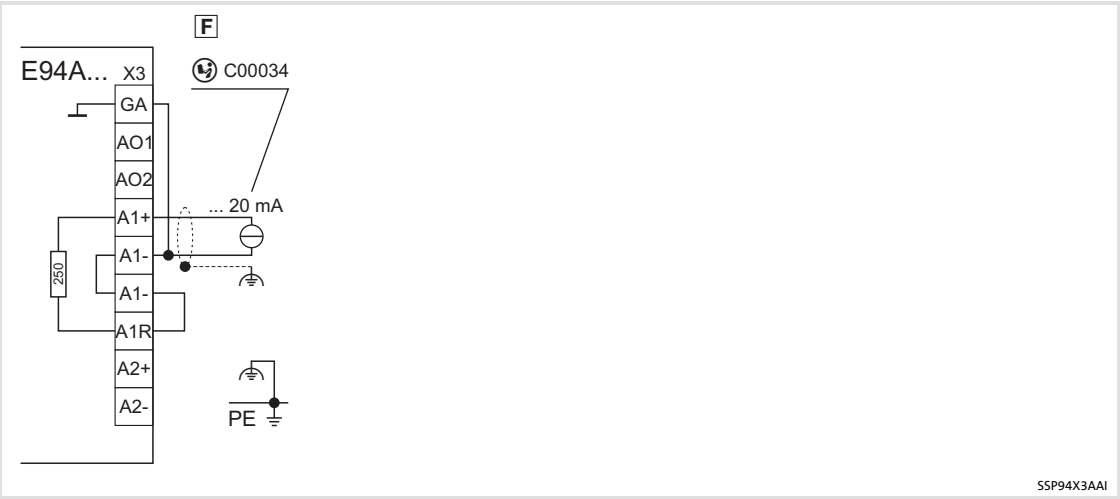
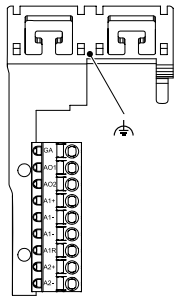


Fig. 4-31 Wiring principle of current input

F	Wiring of a current signal
X3	Terminal for the analog inputs and outputs
	Read information on the input configuration (software manual)
	Functional earth
PE	Protective earth

Terminal X3	Labelling	Description
 SSP94000X3	GA	GND analog signals
	AO1	Analog output 1
	AO2	Analog output 2
	A1+	Analog input 1 +
	A1-	Analog input 1 -
	A1-	Analog input 1 -
	A1R	Terminating resistor for ±20mA
	A2+	Analog input 2 +
	A2-	Analog input 2 -
	⏚	Shield connection: Fix the shield with EMC wire clamp.

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Note!

If the control terminals are completely wired, we recommend to use a cable cross-section of max. 0.75 mm² to save space. The mechanical cover can then be attached.

Digital outputs

The controller features four freely configurable digital outputs.

Electrical data			
24O GO	24 V external voltage source, optional		according to IEC 61131-2 SELV/PELV
	Current consumption		Max. 300 mA
DO1 ... DO4 GO	Switching level		according to IEC 61131-2
		LOW	0 V ... +5 V
		HIGH	+15 V ... +30 V
	Output current		Max. 50 mA
	Load		> 480 Ω at 24 V

Note!

For stable digital output states, in particular during the starting phase of the controller, you must use an external 24V supply for the digital outputs.

Note!

Digital inputs and digital outputs have separated reference potentials (GI and GO). If you interconnect inputs and outputs, the reference potentials are connected as well by an external bridge.

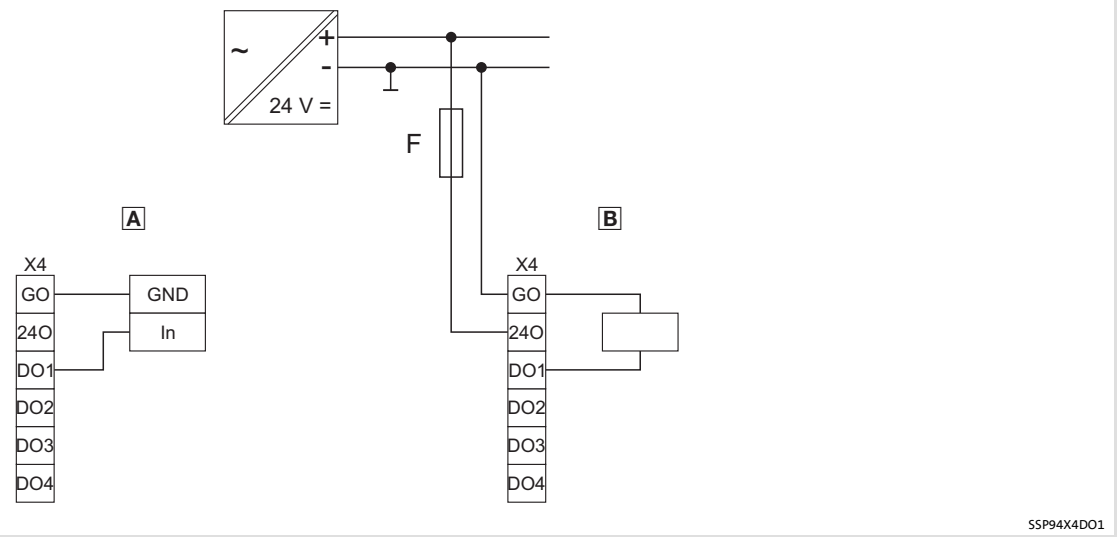
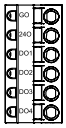


Fig. 4-32 Wiring principle

A	Wiring with a digital input, e.g. a PLC
B	Digital control (relay, valve, ...) with an external 24-V supply
X4	Terminal for the digital outputs
In	Digital input, e.g. of a control
GND	Earth reference potential
F	Fuse

Terminal X4	Labelling	Description
	GO	GND digital out
	24O	24-V digital out
	DO1	Digital output 1
	DO2	Digital output 2
	DO3	Digital output 3
9400SSP000X4	DO4	Digital output 4

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Digital inputs

The controller is provided with freely configurable digital inputs which can be used for touch probe measurement (edge-controlled event).

The control input RFR for controller enable is firmly connected with the device control. It must be wired to enable the controller with a HIGH signal.

Electrical data		
24O (external voltage source, optional)	Rated voltage	24 V According to IEC 61131-2
	Current consumption	Max. 50 mA
RFR DI1 ... DI8	Switching level	According to IEC 61131-2
	LOW	0 V ... +5 V
	HIGH	+15 V ... +30 V
	Input current	Max. 8 mA

Note!

Digital inputs and digital outputs have separated reference potentials (GI and GO). If you interconnect inputs and outputs, the reference potentials are connected as well by an external bridge.

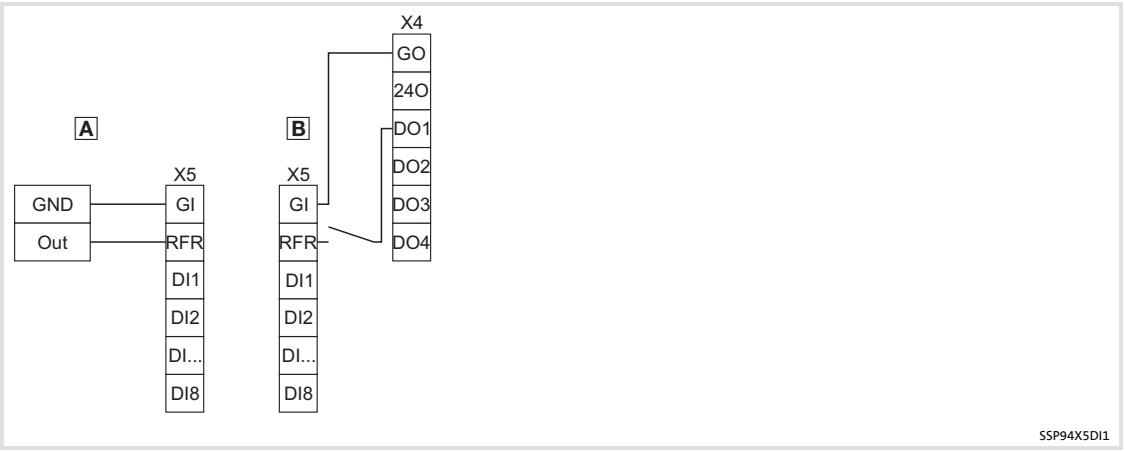
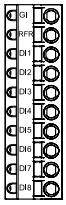


Fig. 4-33 Wiring principle

A	Wiring of an external digital signal, e.g. a PLC
B	Wiring with a slave drive
X4	Terminal for the digital outputs
X5	Terminal for the digital inputs
Out	digital output signal, e.g. of a control
GND	Earth reference potential

Terminal X5	Labelling	Description
 9400SSP000X5	GI	GND digital in
	RFR	Controller enable
	DI1	Digital input 1
	DI2	Digital input 2
	DI3	Digital input 3
	DI4	Digital input 4
	DI5	Digital input 5
	DI6	Digital input 6
	DI7	Digital input 7
	DI8	Digital input 8

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Diagnostics/keypad

The following can be connected to this interface:

► USB diagnostic adapter E94AZCUS

or

► Keypad E94AZKAE.

The diagnostic adapter and a computer with the Lenze software »Engineer« serve to carry out comprehensive settings, e.g. for initial commissioning.

The keypad enables experienced users to check or change individual settings.

Terminal X6	Labelling	Description
9400SSP000X6		Internal interface, RJ69 socket, for keypad or diagnostic adapter

Resolver

Resolvers are connected to X7 (9-pole Sub-D socket).

The use of third-party resolvers is permissible. For this purpose the number of pole pairs of the resolver in C00080 must be adapted to the resolver used. When the stator coils are excited with 4 kHz, the apparent impedance of the connected resolver must not fall below 65 Ohm. When lower impedances are connected, the overload protection integrated in the resolver output limits the output current and can falsify the resolver evaluation.

Resolvers are operated in reverse mode:

- Supply to the sine and cosine track,
- Both signals are controlled in a way that the current flow on the reference track is reduced to zero.

Electrical data		
General	Cable length (system cable recommended)	Max. 150 m
V_{CC}	Supply voltage	5 V
	Maximum output current	110 mA
+REF, -REF	Input frequency	Max. 250 kHz
+COS, -COS +SIN, -SIN	Excitation voltage	10 V_{SS}
	Carrier frequency	4 kHz, fix
+KTY, -KTY	Type	KTY 83-110

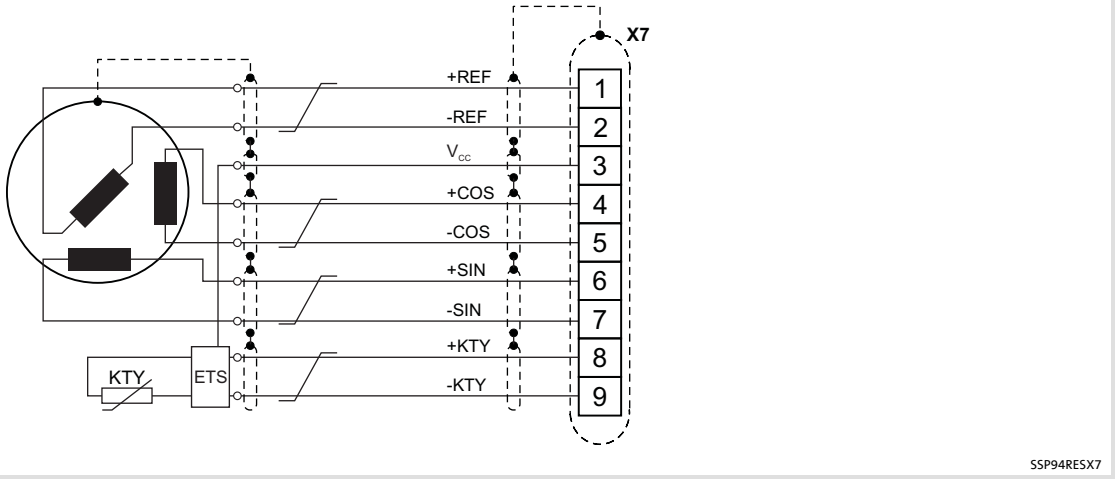


Fig. 4-34 Wiring principle

Terminal X7	Labelling	Description
	1	+REF
	2	-REF
	3	V_{CC}
	4	+COS
	5	-COS
	6	+SIN
	7	-SIN
	8	+KTY
9400SSP000X7	9	-KTY

Encoder

Encoders are connected to X8 (15-pole Sub-D socket).

- Absolute and incremental encoders are supported:
  - TTL encoder 5 V (incremental)
  - Sin/cos encoder 1 V_{ss} (incremental)
  - Sin/cos absolute value encoder 1 V_{ss} with Hiperface protocol
  - Sin/cos absolute value encoder 1 V_{ss} with EnDat protocol (2.1)
  - SSI load encoder with Stegmann protocol (as of 9400 with firmware 05.00)
- Improved determination of low speeds with TTL encoders through additional time measuring method.
- SinCos absolute value encoders are serially read during initialisation (power-on). After this, the sin/cos signals are evaluated.
- Open-circuit monitoring:
  - for sin/cos encoders by comparing the sin/cos signals with the sine shape (radius monitoring)
  - for TTL encoders by means of mean value and amplitude monitoring
  - not with SSI encoders
- The following encoders are not supported:
  - HTL encoders

Electrical data			
General	Cable length (system cable recommended)		Max. 150 m
	Encoder types		TTL 1 V_{SS}
	Protocols		Hiperface EnDat 2.1 SSI-Stegmann
	Number of increments		1 ... 16384
	Input frequency		Max. 250 kHz
VCC (GND)	Supply voltage		5 V ... 12 V
	Current, max.	9 V	330 mA
		12 V	250 mA
+Sense, -Sense	Measuring lead for readjusting V_{CC}		
+KTY, -KTY	Type		KTY 83-110

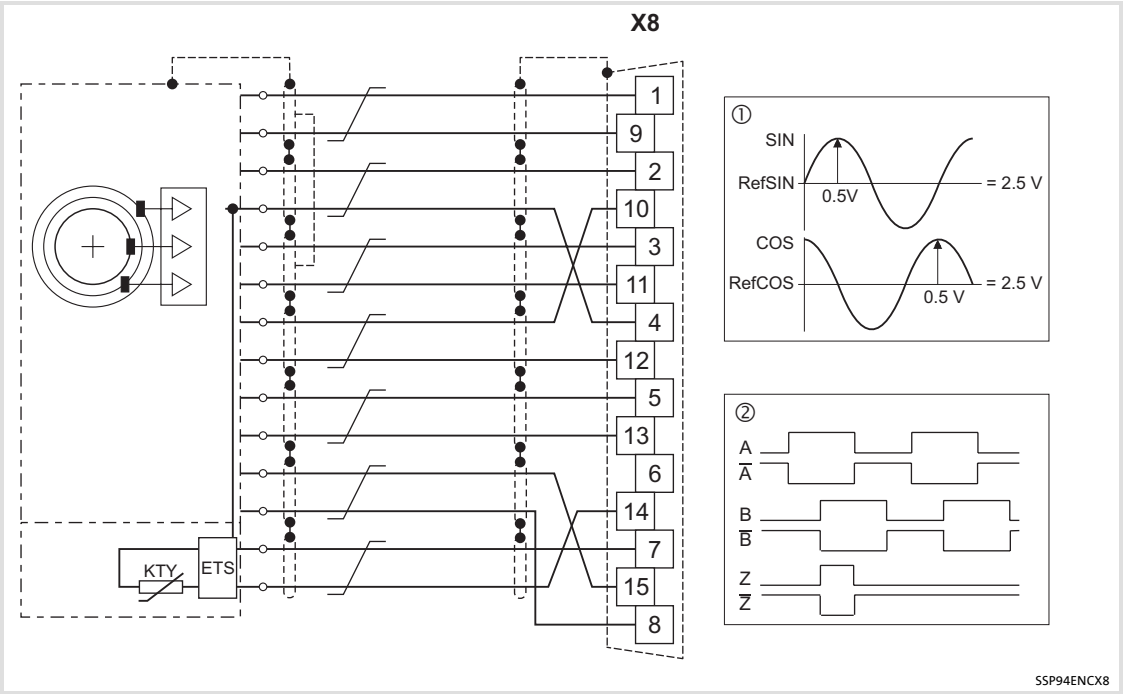
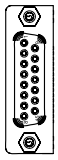


Fig. 4-35 Wiring principle

① Signals of a sin/cos encoder
② Signals with CW rotation

Terminal X8	Labelling	Description				
		Cable EYF001...			EYF002...	-
		TTL	1 V_{SS}	1 V_{SS} Hiperface	1 V_{SS} EnDat 2.1	SSI
	1	A	A	COS	A	-
	2	GND	GND	GND	GND	GND
	3	B	B	Sin	B	-
	4	V_{CC}	V_{CC}	V_{CC}	V_{CC}	U_S
	5	Z	Z	+RS485	Data (Z)	Data +
	6	n. c.	n. c.	n. c.	n. c.	n. c.
	7	-KTY	-KTY	-KTY	-KTY	-
	8	-	-	-	Clock	Clock +
	9	/A	/A	Ref COS	/A	-
	10	-	-	-	-Sense	-
	11	/B	/B	Ref SIN	/B	-
	12	-	-	-	+Sense	-
	13	/Z	/Z	-RS485	/Data (/Z)	Data -
	14	+KTY	+KTY	+KTY	+KTY	-
9400SSP000X8	15	-	-	-	/Clock	Clock -

Setting the supply voltage

The supply voltage of the encoder must be adapted to the cable length.

For this purpose, use the ”Encoder voltage” parameter, C00421.

Encoder	U_r	Voltage setting [V] in C00421 for cable length [m]						
Product key	[V]	0 - 10	10 - 30	30 - 50	50 - 70	70 - 90	90 - 100	100 -150
TTL								
IG2048-5V-T	5 ±5%	5.0	5.0	5.1	5.1	5.2	5.2	5.3
IG4096-5V-T								
IK2048-5V-T								
IK4096-5V-T								
Sin/cos								
IG1024-5V-V	5 ±5%	5.0	5.0	5.1	5.1	5.2	5.2	5.3
IG2048-5V-S								
Sin/cos (Hiperface)								
AS1024-8V-H	8 (7 ... 12)	8.0						
AM1024-8V-H								
Sin/cos (Endat)								
AM32-5V-E	5 ±5%	5.0						
AS2048-5V-E								
AM2048-5V-E								

Tab. 4-5

U_r Rated encoder voltage

The values listed in Tab. 4-5 are valid for the use of Lenze system cables at typical ambient temperatures.

Other cables, other cable cross-sections, or extreme ambient temperatures may require adaptations determined by means of measurements.

For a higher encoder supply power, e.g. for laser-based length measuring systems, an external encoder supply must be provided.

5 Multi-axis controllers

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5.1 Device features

- You can choose between three options for direct DC-bus voltage supply:
  - using a power supply module or ”Single Drive” axis module via the integrated DC busbar
  - using a DC input module via the integrated DC busbar
  - via terminals +UG and -UG
- Space-saving installation by compact design
- Innovative installation concept
- Power range: 370 W to 15 kW
- Pluggable and uniform connection for control cables over the complete power range
- Integrated DC busbar and DC fuse
- Direct connection of resolver and/or encoder feedback
  - Easy connection via predesigned system cables (accessories)
- Integrated phase controller for drift-free standstill
- Field-oriented control for asynchronous and synchronous motors
- Digital synchronisation system via bus system or digital frequency (extension module required)
- User configuration for control functions and input/output signals
  - Comprehensive library with function blocks
  - High flexibility with regard to the adaptation of the internal control structure to the drive task
- Extension interfaces for
  - communication
  - controller functionality
  - safety engineering
- System bus (CANopen) for
  - servo inverter connection
  - input and output terminal extensions
  - connecting keypad and display units (HMI)
- Emergency operation with reduced mains voltage possible
  - Control of motor holding brake possible

5.2 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-voltage directive	
Approval			
UL	UL 508C	Power Conversion Equipment, File No. 132659	
GOST-R	51321.1-2000 51321.3-99	No. POCC DE.AN30.B08815	

Protection of persons and devices			
Enclosure	EN 60529	IP 20	Not in the wire range of the terminals on the motor side
	NEMA 250	Protection against contact in accordance with type 1	
Insulation resistance	EN 61800-5-1	Overvoltage category III Reduction from 2000 m amsl onwards: Overvoltage category II	
Insulation of control circuits	EN 61800-5-1	Safe mains isolation by double/reinforced insulation for mains with neutral earthing with a rated voltage for the external conductor/star point up to 300 V.	
Short-circuit strength	EN 61800-5-1	Motor connection: with restrictions, error acknowledgement required Control connections: without restrictions	
Motor - protective measures against		• Short circuit • Earth fault • Overvoltage • Motor stalling • Motor overtemperature (PTC or thermal contact, I^2t monitoring)	
Discharge current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe regulations and safety instructions!
Cyclic mains switching		Cyclic mains switching of 5 times in 5 minutes is permissible without restrictions.	

Design			
Housing			
Carrier housing	Device sizes 1, 2 and 3	Glass-fiber reinforced plastic	
Dimensions		see "Mechanical installation"	
Weight		see "Mechanical installation"	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical	
Mounting clearances			
Above/below		≥ 80 mm / ≥ 120 mm	Observe the device-related notes on mounting.
To the sides		Side-by-side mounting without any clearance	

”Multi Drive” **supply conditions**		
AC-mains operation		No direct connection, DC supply module or ”Single Drive” network required
DC-bus operation		Direct connection via terminals or busbars For more information, please see the chapter DC-bus operation.
Power systems		
TT		Operation permitted without restrictions.
TN		
With grounded phase		Operation with additional measures permitted: ● Protection of persons according to EN 61800-5-1 requires the supplementary insulation of the control cables. ● Measures described for IT systems must be applied.
IT		Additional device-internal measure required (see (”Earthing of internal EMC filters”, 📖 186)
Motors	EN 60034	Only use motors suitable for inverter operation. Insulation resistance: min. û ≥1.5 kV, min. du/dt ≥5 kV/µs

Operating conditions

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

General electrical data

Motor cable requirements		
Capacitance per unit length		
≤ 2.5 mm²/AWG 14		$C_{Core/core}/C_{Core/shield}$ < 75/150 pF/m
≥ 4 mm²/AWG 12		$C_{Core/core}/C_{Core/shield}$ < 150/300 pF/m
Electric strength		
	VDE 0250-1	$U_0/U_=$ 0.6/1.0 kV (U_0 = r.m.s. value of external conductor to PE, U = r.m.s. value of external conductor to external conductor)
	UL	U ≥ 600 V (U = r.m.s. value of external conductor to external conductor)

Maximum motor and feedback cable lengths
(for shielded motor cable with rated mains voltage)

Type	Device size	[m]
E94AMxE0024 E94AMxE0034 E94AMxE0044	1	50
E94ASxE0024 E94ASxE0034		
E94AMxE0074 E94AMxE0094	2	100
E94ASxE0044 E94ASxE0074		
E94AMxE0134 E94AMxE0174 E94AMxE0244	3	100
E94AMxE0324	3	100
E94ASxE0134 E94ASxE0174 E94ASxE0244	3	100
E94ASxE0324 E94ASxE0474 E94ASxE0594	6	100
E94ASxE0864 E94ASxE1044	7	100
E94ASxE1454	8S	150
E94ASxE1724 E94ASxE2024	8	150
E94ASxE2454 E94ASxE2924 E94ASxE3664	9	150
E94ASxE4604 E94ASxE5724 E94ASxE6354 E94ASxE6954	10	150

If EMC conditions must be met, the permissible cable lengths can be reduced.

Tab. 5-1

EMC		
Operation on public supply systems	EN 61800-3	The controllers are designed for use in an industrial environment. Operation on public networks requires measures to be taken for limiting the expected emission of radio interferences.
Noise emission, in cables		
Design ”Single Drive”	EN 61800-3	see Tab. 4-2 EMC protection requirements
Design ”Multi Drive”		Depending on the filter at the central DC supply module.
Noise immunity (to EN 61800-3)		
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV with air discharge, 4 kV with contact discharge against housing
Radio frequency		
Cable-guided	EN 61000-4-6	150 kHz ... 80 MHz, 10 V 80 % AM (1 kHz)
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz)
Burst		
Power terminals and interfaces	EN 61000-4-4	2 kV/5 kHz
Signal interfaces	EN 61000-4-4	1 kV/5 kHz
Control connections	EN 61000-4-4	2 kV/5 kHz
Surge (surge voltage)		
Power terminals	EN 61000-4-5	1.2/50 µs, 1 kV phase/phase, 2 kV phase/PE

Protective insulation

Danger!

Operation of the controller on a phase earthed mains with a rated mains voltage of ≥ 400 V:

- ► The protection against accidental contact is not ensured without external measures.
- ► If protection against accidental contact acc. to EN 61800-5-1 is required for the control terminals of the controller and the terminals for the plugged-in device modules,
  - – an additional basic insulation must be available.
  - – the components to be connected must have the second basic insulation.

Danger!

Dangerous electrical voltage

When one common voltage source is used for control voltages in separate potential areas, the protective insulation between the separate potential areas is deactivated.

Possible consequences:

- ► The specified protective insulations are not complied with.

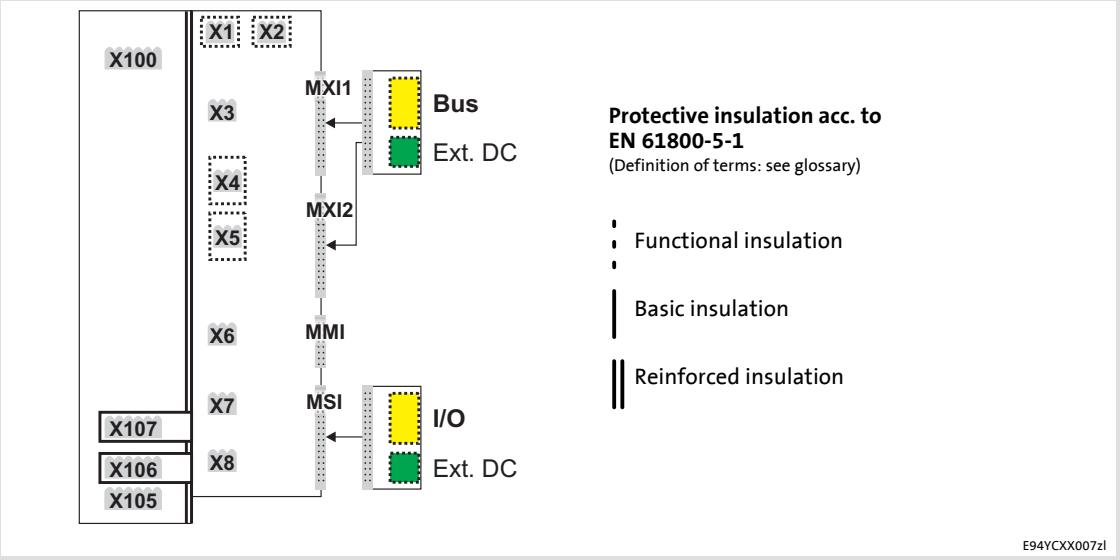
Protective measures:

- ► Use independent voltage sources.

The available protective insulation within the controller of the ” 9400 Servo Drives” series in accordance with EN 61800-5-1 is implemented with a rated voltage for the external conductor/star point of up to 300 V for mains with neutral earthing.

The following graphic representation

- ► shows the arrangement of the terminal strips and the separate potential areas of the controller.
- ► serves to determine the relevant protective insulation between two terminals in differently insulated separate potential areas.



Terminal strip	Terminal
X100	• L1, L2, L3 (only single drive) • +UG, -UG
X105	• U, V, W • Rb1, Rb2 (only single drive)
X106	Motor PTC
X107	Control of motor holding brake

Terminal strip	Terminal
X1	CAN on board 9400
X2	• State bus • 24 V (ext.)
X3	Analog input/output
X4	Digital outputs
X5	Digital inputs
X6	Diagnostics
X7	Resolver
X8	Encoder
MXI1, MXI2	Extension module
MMI	Memory module
MSI	Safety module

Example

Which type of protective insulation is used between the bus terminal of the device module in slot MXI1 or MXI2 and the mains terminal X100?

The separate potential area with the better protective insulation is decisive.

- ► The separate potential area of the device module bus terminal is ”functionally insulated”.
- ► The separate potential area of the mains terminal has a ”reinforced insulation”.

Result: The insulation between the mains terminal X100 and the bus terminal is of the ”reinforced insulation” type.

5.3 Rated data

The E94A**M**xExxx**4** devices can be used in the voltage range of 260 ... 775 V DC.

Note!

To ensure a faultless operation of the devices the code C00173 must be set according to the mains voltage connected.

Emergency operation

Operation of the E94ASxxxx4 devices with an emergency voltage supply at +UG, -UG, is possible from $U_{DC} \geq 260$ V. The settings in C00173 and C00174 are to be adapted accordingly.

Operation of the E94AMxxxx4 devices with an emergency voltage supply at +UG, -UG, is possible with $U_{DC} \leq 260$ V. The settings in C00173 and C00174 are to be adapted accordingly. A 24-V supply at X2 is required.

5.3.1 Overview

Input data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AMxE0024	325/565/705	0 (DC)	2.6/2.6/2.3	2.0/2.0/1.7	2
E94AMxE0034	325/565/705	0 (DC)	4.3/4.3/3.8	3.2/3.2/2.9	2
E94AMxE0044	325/565/705	0 (DC)	6.7/6.7/5.9	5.0/5.0/4.4	2
E94AMxE0074	325/565/705	0 (DC)	12.1/12.1/10.6	9.1/9.1/8.0	2
E94AMxE0094	325/565/705	0 (DC)	15.4/15.4/13.5	11.6/11.6/10.1	2
E94AMxE0134	325/565/705	0 (DC)	20.6/20.6/18.0	15.5/15.5/13.5	2
E94AMxE0174	325/565/705	0 (DC)	25.7/25.7/22.5	19.3/19.3/16.9	2
E94AMxE0244	325/565/705	0 (DC)	35.5/35.5/31.1	26.3/26.3/23.3	2
E94AMxE0324	325/565/705	0 (DC)	48.0/48.0/38.9	36.0/36.0/29.1	2

① Temperature in the control cabinet

Output data

Type	Voltage [V]	Frequency [1] [Hz]	Current [A] max. +45 °C ①	Current [A] max. +55 °C ①	Number of phases
E94AMxE0024	0 - 230/400/500	0 - 599	1.5/1.5/1.3	1.1/1.1/1.0	3
E94AMxE0034	0 - 230/400/500	0 - 599	2.5/2.5/2.2	1.9/1.9/1.7	3
E94AMxE0044	0 - 230/400/500	0 - 599	4/4/3.5	3/3/2.6	3
E94AMxE0074	0 - 230/400/500	0 - 599	7/7/6.1	5.3/5.3/4.6	3
E94AMxE0094	0 - 230/400/500	0 - 599	9.3/9.3/8.2	7.0/7.0/6.2	3
E94AMxE0134	0 - 230/400/500	0 - 599	13/13/11.4	9.8/9.8/8.6	3
E94AMxE0174	0 - 230/400/500	0 - 599	16.5/16.5/14.4	12.4/12.4/10.8	3
E94AMxE0244	0 - 230/400/500	0 - 599	23.5/23.5/20.6	17.6/17.6/15.5	3
E94AMxE0324	0 - 230/400/500	0 - 599	32.0/32.0/25.9	24.0/24.0/19.4	3

① Temperature in the control cabinet

1) The limitation to 599 Hz does not apply to the "servo control" modes (see C00006 = 1 or 2). Generally applies: the output frequency is limited to 1/8 of the selected chopper frequency (see C00018).

Type	Power loss P_V [W] U_{Lr} = 230 V	U_{Lr} = 400 V	U_{Lr} = 500 V	when controller is inhibited
E94AMxE0024	65	80	95	40
E94AMxE0034	75	95	110	
E94AMxE0044	90	120	130	
E94AMxE0074	105	145	170	
E94AMxE0094	130	170	205	
E94AMxE0134	160	215	255	
E94AMxE0174	185	255	300	
E94AMxE0244	235	320	385	
E94AMxE0324	290	405	490	

5.3.2 Devices for 400/500V-mains

5.3.2.1 Operation on 230 V_{AC} mains

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-

	Input current at I_{aN8} (without external mains choke)	Output power 8 kHz, U, V, W	Motor power (typical) 8 kHz, 4 pol. ASM	
Type	I_{DC} [A]	S_{aN8} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94AMxE0024	2.6	0.6	0.18	0.25
E94AMxE0034	4.3	1.0	0.37	0.5
E94AMxE0044	6.7	1.6	0.75	1
E94AMxE0074	12.1	2.8	1.5	2
E94AMxE0094	15.4	3.7	2.2	3
E94AMxE0134	20.6	5.2	3	4
E94AMxE0174	25.7	6.6	4	5.5
E94AMxE0244	35.5	9.4	5	7.5

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94AMxE0024	1.9	6.0	1.9	6.0	**1.5**	4.8	1.1
E94AMxE0034	3.1	10.0	3.1	10.0	**2.5**	8.0	1.9
E94AMxE0044	5.0	16.0	5.0	16.0	**4.0**	12.8	3.0
E94AMxE0074	8.8	21.0	8.8	21.0	**7.0**	16.8	5.3
E94AMxE0094	11.7	28.0	11.7	28.0	**9.3**	22.4	7.0
E94AMxE0134	16.3	39.0	16.3	39.0	**13.0**	31.2	9.8
E94AMxE0174	20.6	49.5	20.6	49.5	**16.5**	39.6	12.4
E94AMxE0244	29.4	70.5	29.4	70.5	**23.5**	47.0	17.6

I_{aN2}	Rated value of permanent output current at a frequency of ≥ 0 Hz
I_{aM2}	Maximum output current (overload current) at frequency ≥ 0 Hz ● Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}
I_{aN4}, I_{aN8}, I_{aN16}	Rated value of continuous output current at a frequency of ≥ 5 Hz (reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)
I_{aM4}, I_{aM8}	Maximum output current (overload current) at frequency ≥ 5 Hz (reduce to 0.66 * I_{aMx} for 0 ... 5 Hz) ● Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx} ● Can be achieved using the setting "x kHz fixed" in C00018
bold	Nominal value I_{aN}

5.3.2.2 Operation on 400 V_{AC} mains

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	565	455 - 0 % ... 620 + 0 %	-

	Input current at I_{aN8} (without external mains choke)	Output power 8 kHz, U, V, W	Motor power (typical) 8 kHz, 4 pol. ASM	
Type	I_{DC} [A]	S_{aN8} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94AMxE0024	2.6	1.0	0.37	0.5
E94AMxE0034	4.3	1.7	0.75	1
E94AMxE0044	6.7	2.8	1.5	2
E94AMxE0074	12.1	4.8	3	4
E94AMxE0094	15.4	6.5	4	5
E94AMxE0134	20.6	9.0	5.5	7.5
E94AMxE0174	25.7	11.4	7.5	11
E94AMxE0244	35.5	16.3	11	15

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94AMxE0024	1.9	6.0	1.9	6.0	**1.5**	4.8	1.1
E94AMxE0034	3.1	10.0	3.1	10.0	**2.5**	8.0	1.9
E94AMxE0044	5.0	16.0	5.0	16.0	**4.0**	12.8	3.0
E94AMxE0074	8.8	21.0	8.8	21.0	**7.0**	16.8	5.3
E94AMxE0094	11.7	28.0	11.7	28.0	**9.3**	22.4	7.0
E94AMxE0134	16.3	39.0	16.3	39.0	**13.0**	31.2	9.8
E94AMxE0174	20.6	49.5	20.6	49.5	**16.5**	39.6	12.4
E94AMxE0244	29.4	70.5	29.4	70.5	**23.5**	56.4	17.6

I_{aN2} Rated value of permanent output current at a frequency of ≥ 0 Hz

I_{aM2} Maximum output current (overload current) at frequency ≥ 0 Hz
- Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}

I_{aN4}, I_{aN8}, I_{aN16} Rated value of continuous output current at a frequency of ≥ 5 Hz (reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)

I_{aM4}, I_{aM8} Maximum output current (overload current) at frequency ≥ 5 Hz (reduce to 0.66 * I_{aMx} for 0 ... 5 Hz)
- Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx}
- Can be achieved using the setting "x kHz fixed" in C00018

bold Nominal value I_{aN}

5.3.2.3 Operation on 500 V_{AC} mains

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	705	565 - 0 % ... 775 + 0 %	-

	Input current at I_{aN8} (without external mains choke)	Output power 8 kHz, U, V, W	Motor power (typical) 8 kHz, 4 pol. ASM	
Type	I_{DC} [A]	S_{aN8} [kVA]	P_{aN} [kW]	P_{aN} [hp]
E94AMxE0024	2.3	1.1	0.37	0.5
E94AMxE0034	3.8	1.9	0.75	1
E94AMxE0044	5.9	3.0	1.5	2
E94AMxE0074	10.6	5.3	3	4
E94AMxE0094	13.5	7.1	4	5
E94AMxE0134	18.0	9.8	5.5	7.5
E94AMxE0174	22.5	12.5	7.5	10
E94AMxE0244	31.1	17.8	11	15

	Output currents [A] at switching frequency						
	2 kHz		4 kHz		8 kHz		16 kHz [4]
Type	I_{aN2}	I_{aM2}	I_{aN4}	I_{aM4}	I_{aN8}	I_{aM8}	I_{aN16}
E94AMxE0024	1.9	6.0	1.9	6.0	**1.3**	4.2	1.0
E94AMxE0034	3.1	10.0	3.1	10.0	**2.2**	7.0	1.7
E94AMxE0044	5.0	16.0	5.0	16.0	**3.5**	11.2	2.6
E94AMxE0074	8.8	21.0	8.8	21.0	**6.1**	14.7	4.6
E94AMxE0094	11.7	28.0	11.7	28.0	**8.2**	19.6	6.1
E94AMxE0134	16.3	39.0	16.3	39.0	**11.4**	27.3	8.6
E94AMxE0174	20.6	49.5	20.6	49.5	**14.4**	34.7	10.9
E94AMxE0244	29.4	70.5	29.4	70.5	**20.6**	49.4	15.4

I_{aN2} Rated value of permanent output current at a frequency of ≥ 0 Hz

I_{aM2} Maximum output current (overload current) at frequency ≥ 0 Hz
- Periodic load change of 0.5 s with I_{aM2} and recovery time of 4.5 s with 75 % I_{aN2}

I_{aN4}, I_{aN8}, I_{aN16} Rated value of continuous output current at a frequency of ≥ 5 Hz (reduce to 0.66 * I_{aNx} for 0 ... 5 Hz)

I_{aM4}, I_{aM8} Maximum output current (overload current) at frequency ≥ 5 Hz (reduce to 0.66 * I_{aMx} for 0 ... 5 Hz)
- Periodic load change of 0.5 s with I_{aMx} and recovery time of 4.5 s with 75 % I_{aNx}
- Can be achieved using the setting "x kHz fixed" in C00018

bold Nominal value I_{aN}

5.3.2.4 Fuses and cable cross-sections

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC (alternativ)	325 ... 705	260 - 0 % ... 775 + 0 %	0

When the integrated DC busbar is used, wiring is not required. The mounting backplane already includes an integrated fuse.

When terminals +UG/-UG are used, dimension the cables and fuses as described in the chapter DC-bus operation.

5.3.3 Overcurrent operation

The controllers are designed for two overcurrent modes:

- 5-s-cycle ①
  - 0.5 s load period with peak current A
  - 4.5 s recovery time with limited current B
- 3-min cycle ②
  - 1 min load period with peak current C
  - 2 min recovery time with limited current D

A load period must be followed by a recovery time. During the recovery time the current must not exceed the value given.

The values given refer to the rated output current I_{aN8}.

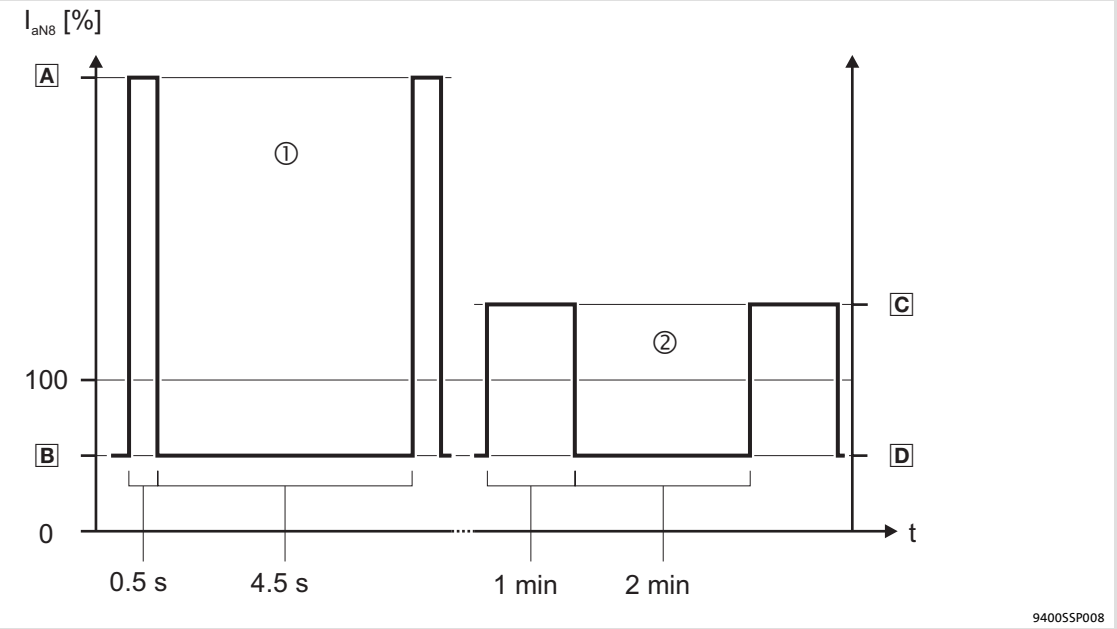


Fig. 5-1 Overcurrent capacity at 45° C

A Peak current for 0.5 s
B Max. current in the recovery time for 4.5 s
C Peak current for 1 min
D Max. current in the recovery time for 2 min

① 5-s cycle
② 3-min cycle

230 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94AMxE0024	6.0	1.4	6.0	1.4	4.8	1.1	-	-
E94AMxE0034	10.0	2.3	10.0	2.3	8.0	1.9	-	-
E94AMxE0044	16.0	3.8	16.0	3.8	12.8	3.0	-	-
E94AMxE0074	21.0	6.6	21.0	6.6	16.8	5.3	-	-
E94AMxE0094	27.9	8.7	27.9	8.7	22.3	7.0	-	-
E94AMxE0134	39.0	12.2	39.0	12.2	31.2	9.8	-	-
E94AMxE0174	49.5	15.5	49.5	15.5	39.6	12.4	-	-
E94AMxE0244	70.5	22.0	70.5	22.0	47.0	17.6	-	-
E94AMxE0324	76.8	30.0	76.8	30.0	76.8	24.0	-	-

230 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94AMxE0024	2.8	1.4	2.8	1.4	2.3	1.1	-	-
E94AMxE0034	4.7	2.4	4.7	2.4	3.8	1.9	-	-
E94AMxE0044	7.5	3.8	7.5	3.8	6.0	3.0	-	-
E94AMxE0074	13.2	6.6	13.2	6.6	10.5	5.3	-	-
E94AMxE0094	17.5	8.7	17.5	8.7	14.0	7.0	-	-
E94AMxE0134	24.4	12.2	24.4	12.2	19.5	9.8	-	-
E94AMxE0174	31.0	15.5	31.0	15.5	24.8	12.4	-	-
E94AMxE0244	44.2	22.1	44.2	22.1	35.3	17.6	-	-
E94AMxE0324	60.0	30.0	60.0	30.0	48.0	24.0	-	-

400 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94AMxE0024	6.0	1.4	6.0	1.4	4.8	1.1	-	-
E94AMxE0034	10.0	2.3	10.0	2.3	8.0	1.9	-	-
E94AMxE0044	16.0	3.8	16.0	3.8	12.8	3.0	-	-
E94AMxE0074	21.0	6.6	21.0	6.6	16.8	5.3	-	-
E94AMxE0094	27.9	8.7	27.9	8.7	22.3	7.0	-	-
E94AMxE0134	39.0	12.2	39.0	12.2	31.2	9.8	-	-
E94AMxE0174	49.5	15.5	49.5	15.5	39.6	12.4	-	-
E94AMxE0244	70.5	22.0	70.5	22.0	47.0	17.6	-	-
E94AMxE0324	76.8	30.0	76.8	30.0	76.8	24.0	-	-

400 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94AMxE0024	2.8	1.4	2.8	1.4	2.3	1.1	-	-
E94AMxE0034	4.7	2.4	4.7	2.4	3.8	1.9	-	-
E94AMxE0044	7.5	3.8	7.5	3.8	6.0	3.0	-	-
E94AMxE0074	13.2	6.6	13.2	6.6	10.5	5.3	-	-
E94AMxE0094	17.5	8.7	17.5	8.7	14.0	7.0	-	-
E94AMxE0134	24.4	12.2	24.4	12.2	19.5	9.8	-	-
E94AMxE0174	31.0	15.5	31.0	15.5	24.8	12.4	-	-
E94AMxE0244	44.2	22.1	44.2	22.1	35.3	17.6	-	-
E94AMxE0324	60.0	30.0	60.0	30.0	48.0	24.0	-	-

500 V

Type	I [A] in a cycle of 5 seconds ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E94AMxE0024	6.0	1.4	6.0	1.4	4.2	1.0	-	-
E94AMxE0034	10.0	2.3	10.0	2.3	7.0	1.6	-	-
E94AMxE0044	16.0	3.8	16.0	3.8	11.2	2.6	-	-
E94AMxE0074	21.0	6.6	21.0	6.6	14.7	4.6	-	-
E94AMxE0094	27.9	8.7	27.9	8.7	19.5	6.1	-	-
E94AMxE0134	39.0	12.2	39.0	12.2	27.3	8.5	-	-
E94AMxE0174	49.5	15.5	49.5	15.5	34.7	10.8	-	-
E94AMxE0244	70.5	22.0	70.5	22.0	41.1	15.4	-	-
E94AMxE0324	76.8	30.0	76.8	30.0	62.2	19.4	-	-

500 V

Type	I [A] in a cycle of 3 minutes ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E94AMxE0024	2.8	1.4	2.8	1.4	2.0	1.0	-	-
E94AMxE0034	4.7	2.4	4.7	2.4	3.3	1.6	-	-
E94AMxE0044	7.5	3.8	7.5	3.8	5.3	2.6	-	-
E94AMxE0074	13.2	6.6	13.2	6.6	9.2	4.6	-	-
E94AMxE0094	17.5	8.7	17.5	8.7	12.2	6.1	-	-
E94AMxE0134	24.4	12.2	24.4	12.2	17.1	8.5	-	-
E94AMxE0174	31.0	15.5	31.0	15.5	21.7	10.8	-	-
E94AMxE0244	44.2	22.1	44.2	22.1	30.8	15.4	-	-
E94AMxE0324	60.0	30.0	60.0	30.0	38.9	19.4	-	-

5.3.4 Current-time diagrams

In addition to the data for overcurrent operation within the 5-s cycle or 3-min cycle, here you are provided with information on the dimensioning of application-oriented cycles.

By means of the following information you determine permissible load periods with overcurrents and required recovery times with limited currents. If the currents and times determined are observed, the Ixt monitoring function for the protection of the devices will not respond.

Characteristics

The following characteristics (”Current-time diagrams”) describe the device utilisation via amperage and the duration of current flow.
The left part of the diagram (negative time data) represents the overload phase, while the right part of the diagram (positive time data) shows the relieving phase.
Devices with an identical Ixt behaviour are combined within a diagram. A second diagram enlarges a cutout area to improve the clearness of display.

Requirements

- Switching frequency

  The curves shown always refer to the variable rated switching frequency (f_{chopp}) at which the rated device current is permissible permanently. As this rated switching frequencies are different for the individual devices, they are specified with the diagrams. This means that the switching frequency is reduced automatically during the overload phase. During the recovery phase the switching frequency set is maintained.

- Mains voltage

  In the diagrams a mains voltage of U_N = 400 V was assumed. Where applicable, a current derating depending on the mains voltage may be necessary for the devices, depending on the switching frequency that is reached. This means that the currents are weighted differently in the Ixt monitoring. The devices for which a derating is required can be gathered from the ”Rated values” section. The continuous currents specified there then are the 100% values which are required for working with the diagrams.

- Ambient temperature

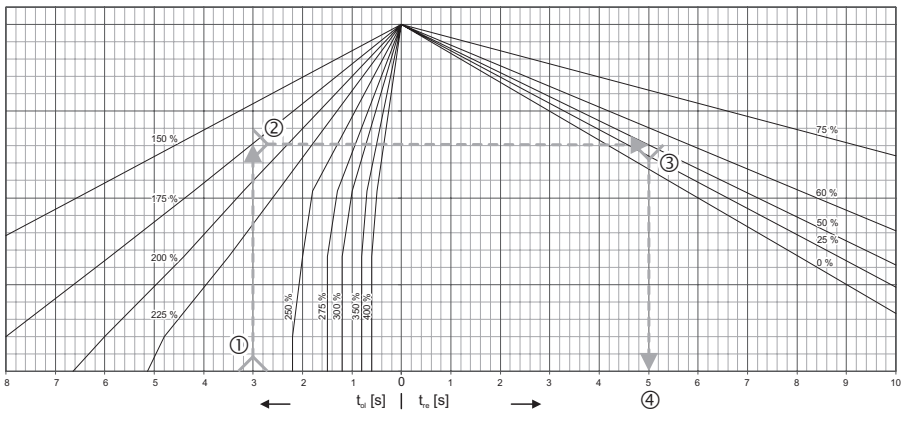
  The ambient temperature may be maximally T_{Amb} < 45 °C. In the case of higher ambient temperatures the reduced continuous currents have to be taken into consideration.

- Output frequency

  In the diagrams an output frequency (= field frequency) f_{out} > 5 Hz has been assumed. In the case of smaller output frequencies (f_{out} = 0 ... 5 Hz), a different switching frequency results in a different device utilisation due to a different continuous current. When the diagrams were created, this device behaviour was not taken into consideration.
  If a fixed switching frequency f > 4 kHz is selected, the reduction of the permissible continuous current has to be considered (100 % = reduced continuous current) for smaller output frequencies (f_{out} = 0 ... 5 Hz).

Application example

- Drive task
  - A current I_{ol} = 4.0 A is required for a time t_{ol} = 3 s.
  - During the recovery phase there is a current I_{re} = 1.0 A.
  - During the overload phase a switching frequency of 4 kHz is accepted.
  - The switching frequency during the recovery phase is to be 8 kHz.
  - The mains voltage is 400 V.
  - The times with output frequencies under 5 Hz are insignificant.
- Problem
  - How long does the recovery phase t_{re} have to be when the E94AxxE0034 controller is used?
- The currents required are based on the rated device current:
  - I_{ol} = 4.0 A/2.5 A = 160 % - selected characteristic: 175 %
  - I_{re} = 1.0A/2.5 A = 40 % - selected characteristic: 50 %
  - Because of the short overcurrent time t_{ol} = 3 s, the cutout diagram of the E94AxxE0034 device is taken into consideration.
  - The switching frequency f_{chopp} = 8 kHz, var does not have to be considered separately.
- Procedure within the diagram
  - ① Starting from the time axis at t_{ol} = 3 s, a perpendicular line is drawn to the selected characteristic at 175 % (corresponds to the minimum required current I_{ol}).
  - ② Draw a straight line from the point of intersection horizontally to the right to the selected characteristic, the recovery phase, at 50 %.
  - ③ Draw a perpendicular line from the point of intersection back to the time axis.
  - ④ Read the minimum required duration of recovery on the time axis.



- Result in the example
  - The duration of recovery has to be at least t_{re} = 5 s!

Guide

Type	Diagram
E94AxxE0024	Page 176 Fig. 5-2/ Fig. 5-3
E94AxxE0034	
E94AxxE0044	
E94AxxE0074	Page 177 Fig. 5-4/ Fig. 5-5
E94AxxE0134	
E94AxxE0174	
E94AxxE0244	
E94AMxE0324	

E94AxxE0024 ... E94AxxE0044

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0024	400	1.5	8 kHz var
E94AxxE0034		2.5	
E94AxxE0044		4.0	

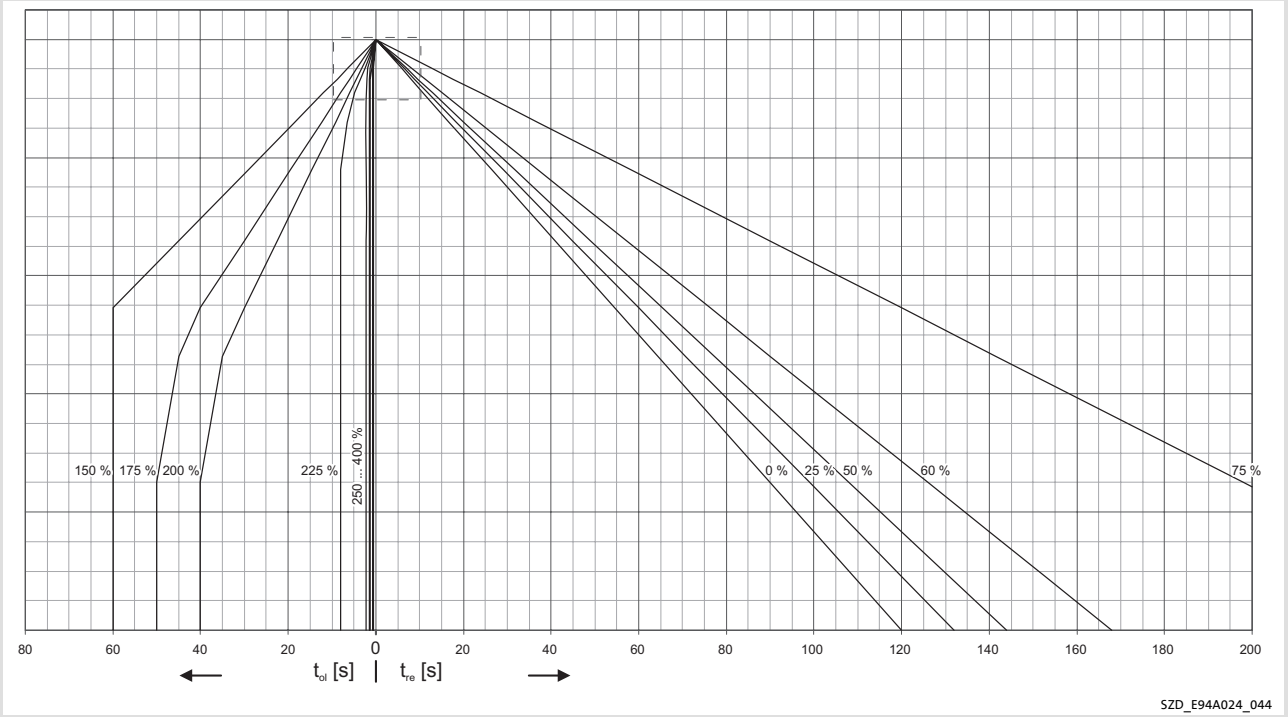


Fig. 5-2 Diagram for E94AxxE0024 and E94AxxE0044

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

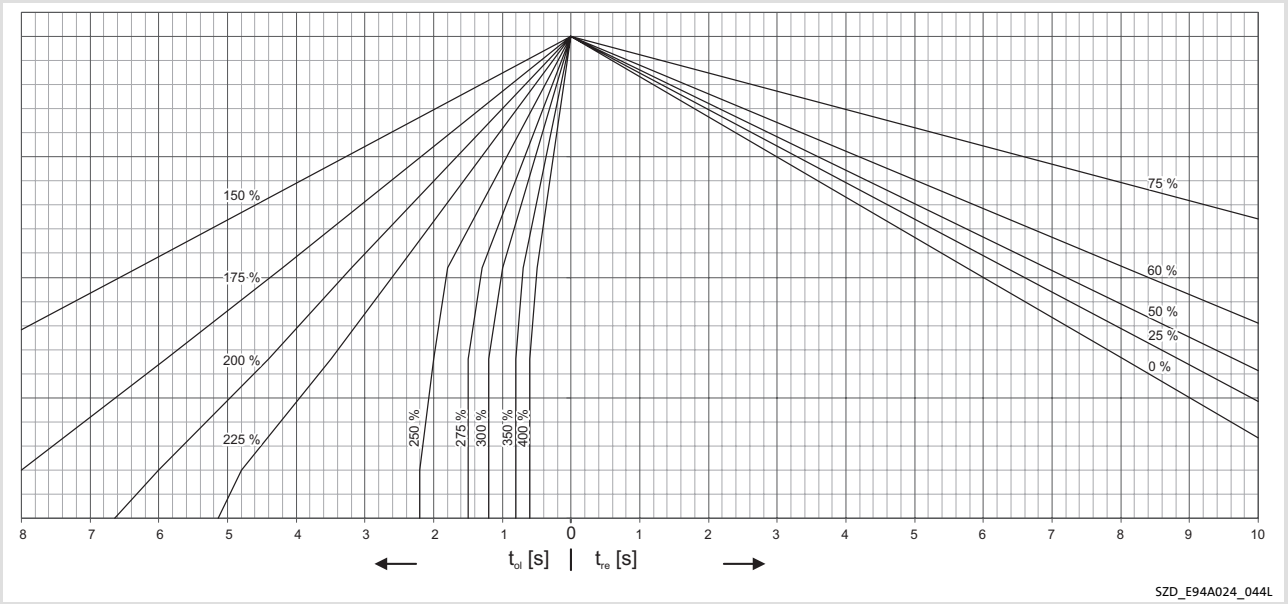


Fig. 5-3 Area cutout for E94AxxE0024 and E94AxxE0044

E94AxxE0074 ... E94AxxE0244 E94AMxE0324

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94AxxE0074	400	7.0	8 kHz var
E94AMxE0094		9.3	8 kHz var
E94AxxE0134		13.0	8 kHz var
E94AxxE0174		16.5	
E94AxxE0244		23.5	
E94AMxE0324		32.0	8 kHz var

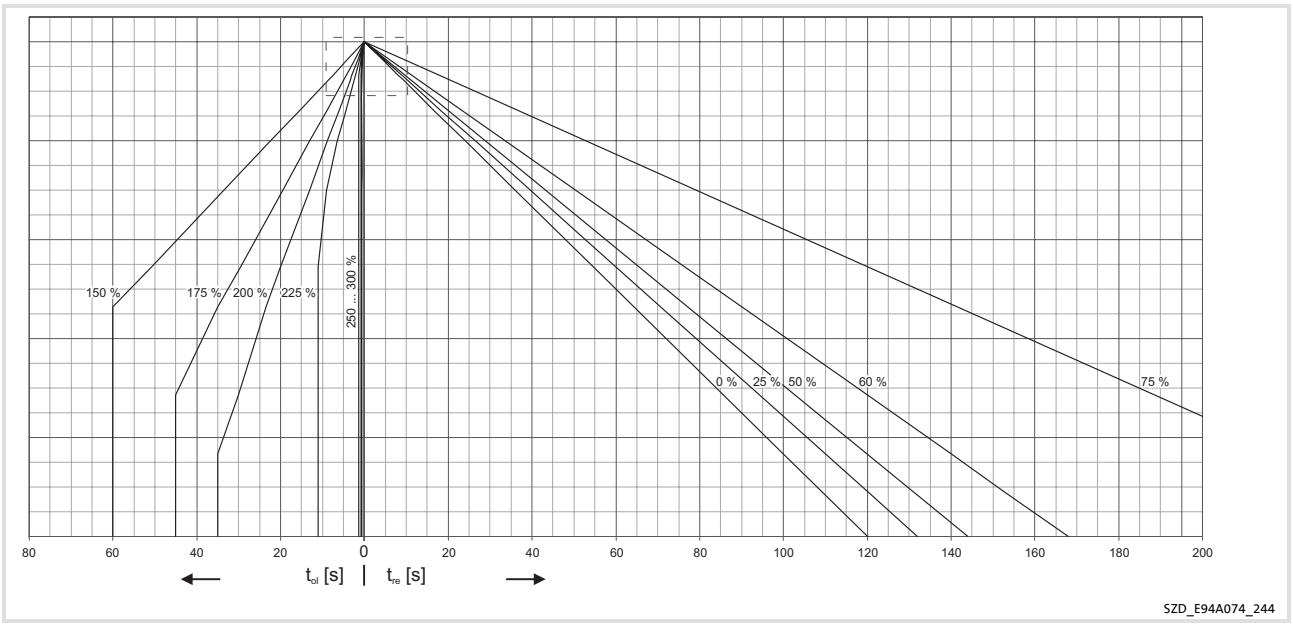


Fig. 5-4 Diagram for E94AxxE0074 ... E94AxxE0244, E94AMxE0324

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

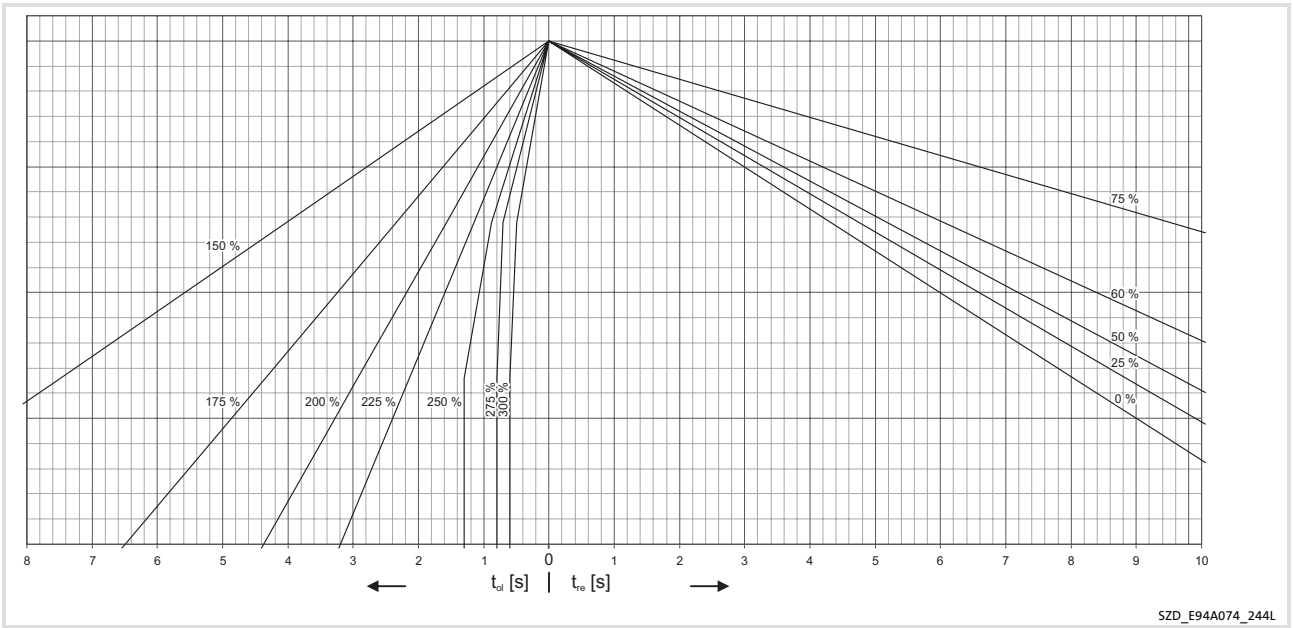


Fig. 5-5 Area cutout for E94AxxE0074 ... E94AxxE0244, E94AMxE0324

5.4 Mechanical installation

5.4.1 Important notes

Note!

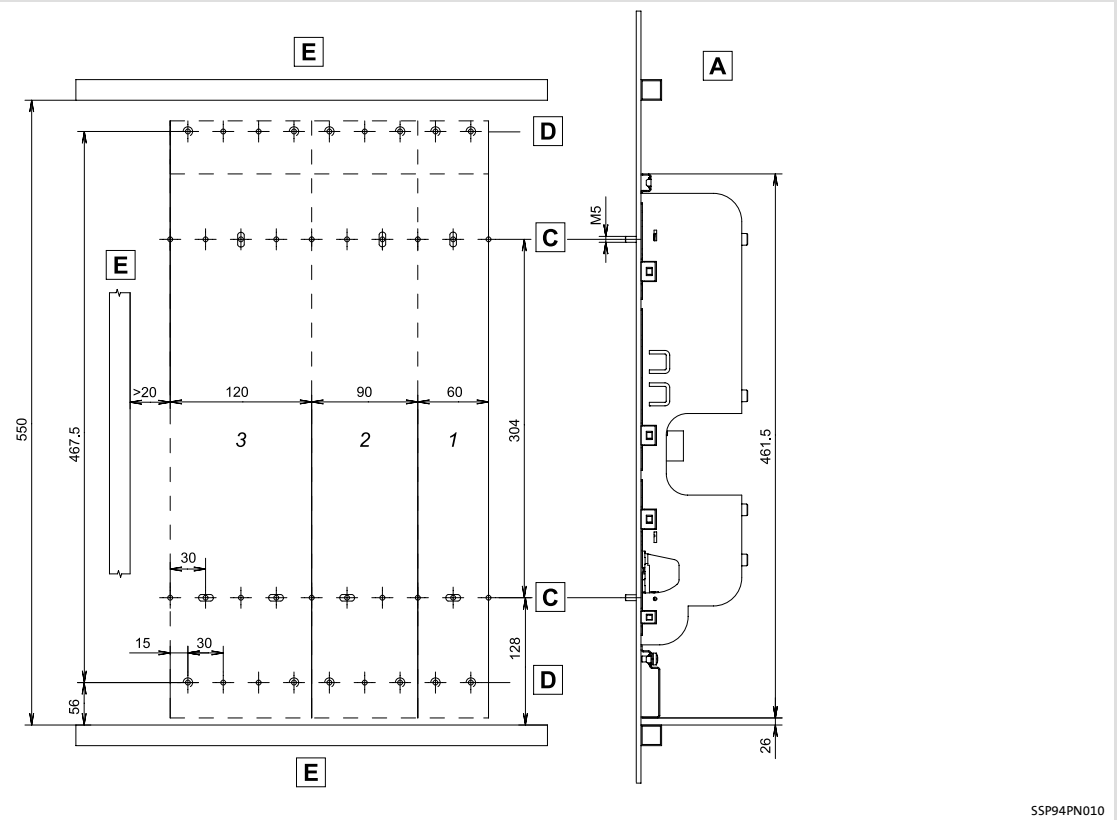
The devices must be installed in housings (e.g. control cabinets) to meet applicable regulations.

Mounting grid

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices, and the device sizes 1, 2, ... n can thus be mounted directly adjacent to each other.

Note!

- ► M5 screw and washer assemblies or hexagon socket screws with washers are permitted.
- ► Tightening torque: 3.4 Nm / 30 lb-in.
- ► In the installation backplane, the screwed connection may not jut out more than 7 mm.



A Mounting with backplane for attaching the power supply module
C Grid hole pattern for installation backplane
D Grid hole pattern for other device sizes or built-on/footprint filters (only Single Drive)
E Cable duct
1
... Device size, mounting holes used
3

Arrangement of the devices

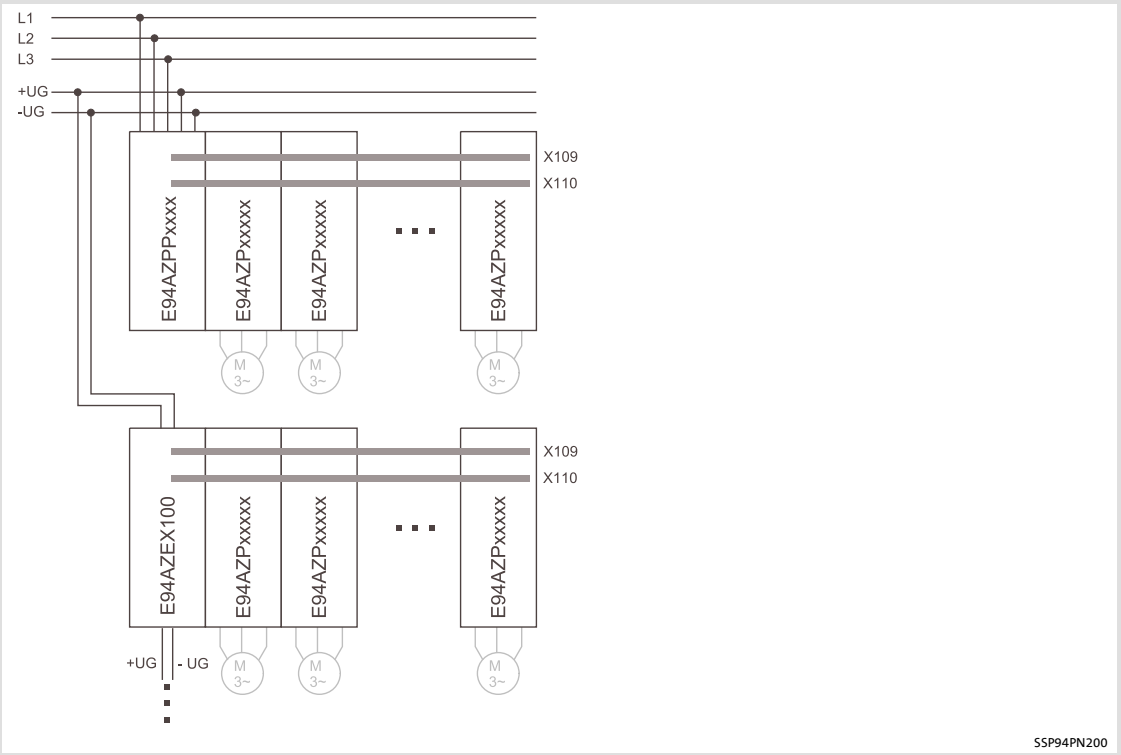


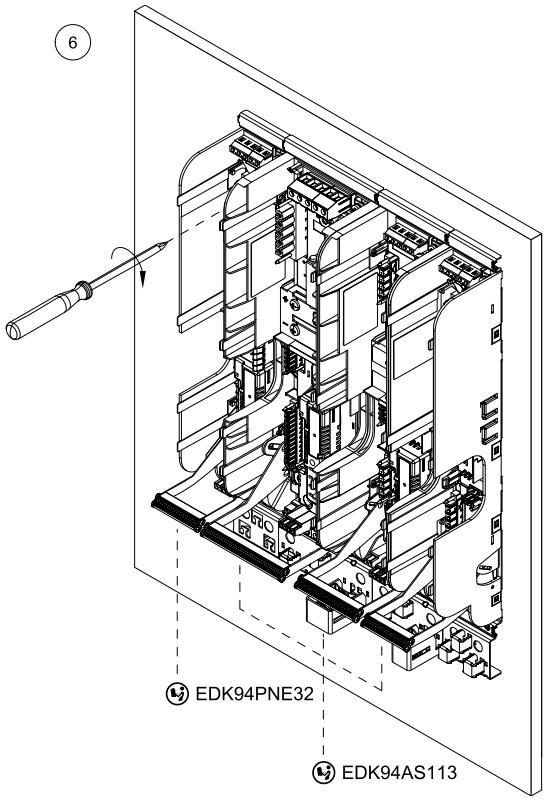
Fig. 5-6 Arrangement concept

Note!

Axis modules E94AMxE0324 and installation backplane E94AZPM0324 can only be connected directly to each other! A use with another device or installation backplane of size 3 is not permissible and is prevented through a plug protection.

Please consider this when planning drive systems where the devices are mounted side by side.

Installation steps



5.4.2 Devices in the range 2 ... 32 A (0.37 ... 15 kW)

Standard device with installation backplane

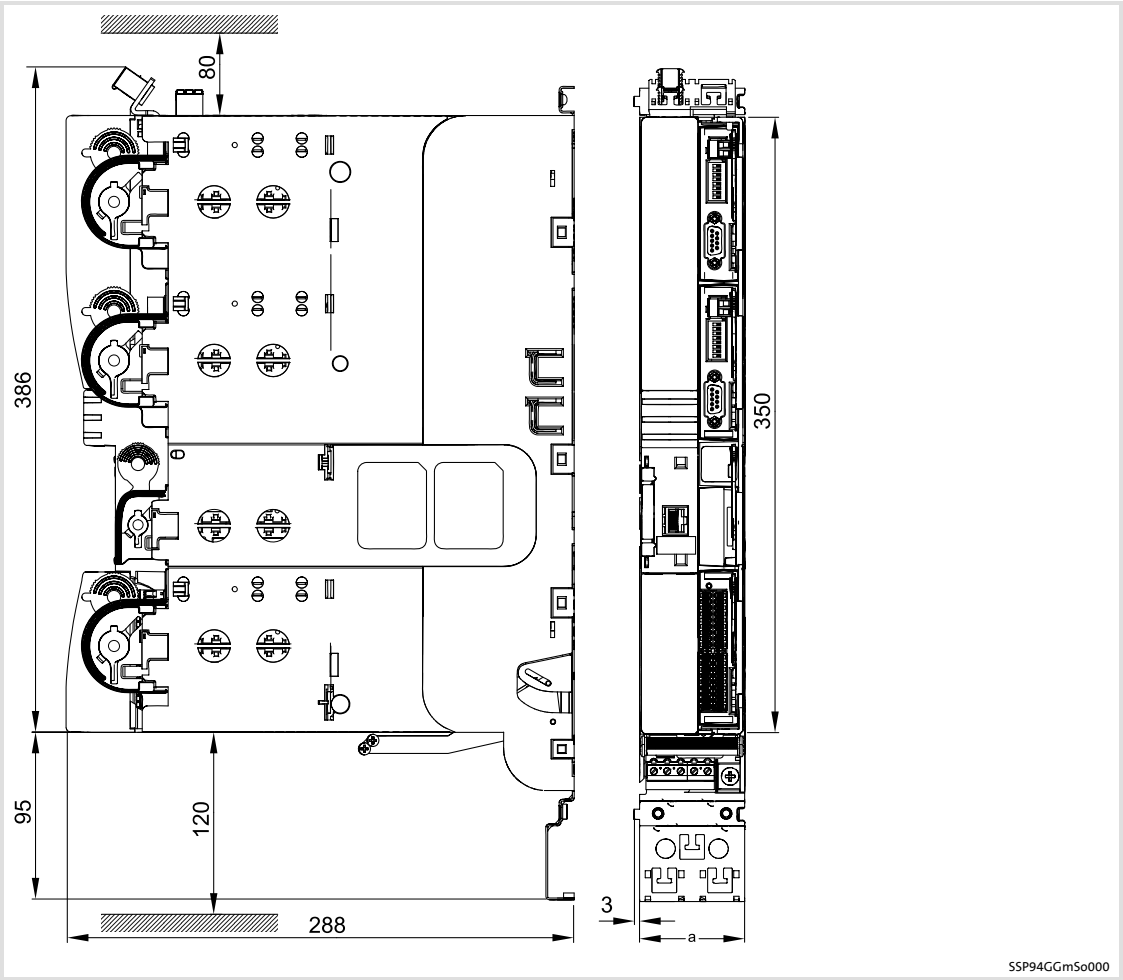


Fig. 5-7 Dimensions [mm]

Type	Dimensions a [mm]	Mass [kg]
E94AMxE0024	60	4.0
E94AMxE0034		
E94AMxE0044		
E94AMxE0074	90	5.3
E94AMxE0094		
E94AMxE0134	120	8.1
E94AMxE0174		
E94AMxE0244		
E94AMxE0324	120	8.5

5.5 Wiring

5.5.1 Important notes

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

Note!

Switching operations on the motor side of the controller are permitted for safety switch-off (emergency off).

Please observe:

► When the controller is enabled, switching operations may lead to a response of the controller monitoring functions.

► The switching elements on the motor side must be rated for DC voltages with U_{DCmax} = 800 V.

5.5.2 Safety notes for the installation according to U_L or U_R

Warnings!

- The integral solid state protection does not provide branch circuit protection and that branch circuit protection has to be provided externally in accordance with manufacturers instructions, the National Electrical Code and any additional codes.
- For information on the protection level of the internal overload protection for a motor load, see the corresponding Application Manuals or Software Helps.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Application Manuals or Software Helps.
- Maximum surrounding air temperature: 55 °C.
- Use 60/75 °C copper wire only, except for control circuits.
- Control card protection:

  External fuse for 24 Vdc supply voltage of control terminal X2. Rated 4 A DC fuse UL248-14.

5.5.3 Earthing of internal EMC filters

Device-internal EMC filters have been implemented to reduce interference emission. These EMC filters are connected to protective earth to discharge interference currents.

Under certain conditions the EMC filters must be disconnected from:

- Operation in an IT system
  The devices are protected from damages or destruction due to incompatible overvoltages in the case of an error (earth fault).
- DC-bus operation
- Operation with power supply modules or regenerative power supply modules
- Operating multiple devices with a common filter
  The EMC properties can only be reached by carrying out the described measures.
  The triggering behaviour of applicable earth-leakage circuit breakers remains undisturbed.

Overview of the measures

The measures can be carried out easily. They are prepared device-dependently, and their mounting and wiring are described.

Device	Measure
Controller	
With installation backplane (GG1 ... GG3)	Plug/unplug the plastic cap
Without installation backplane (GG6 ... GG7)	Change the screwed connection
Without installation backplane (GG8S ... GG10)	Activate the switch
Power supply modules	
With installation backplane (GG1 und GG3)	Plug/unplug the plastic cap
Without installation backplane (GG4 ... GG5)	---
Regenerative power supply module	
With installation backplane (GG3)	Plug/unplug the plastic cap
Suitable mains filter	Change the screwed connection

Implementing the measures

Proceed as follows to disconnect the internal connection between the filters and PE:

1. Remove IT insulating cap from the parking position ① in the installation backplane.
   – For this apply a screwdriver on the right or left and lever off the insulating cap.
   – Optionally the insulating cap can be carefully removed using an appropriate pliers.
2. Attach IT insulating cap to the earthing jumper ② until it clicks into place.

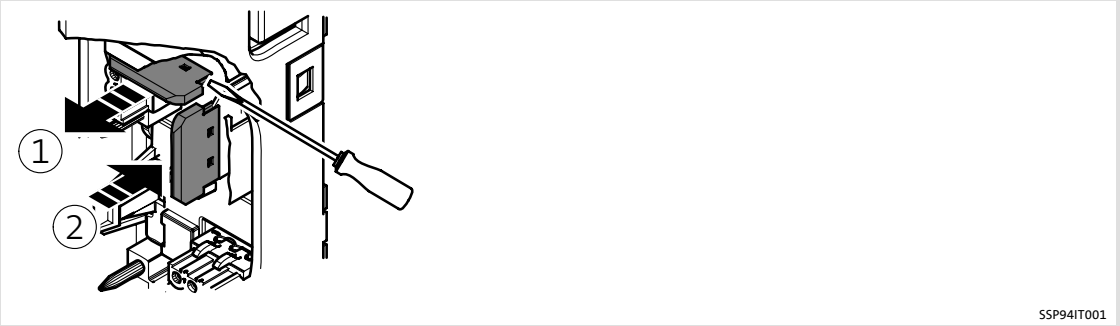


Fig. 5-8 Plugging the IT insulating cap onto the earthing jumper

5.5.4 Devices in the range 2 ... 32 A (0.37 ... 15 kW)

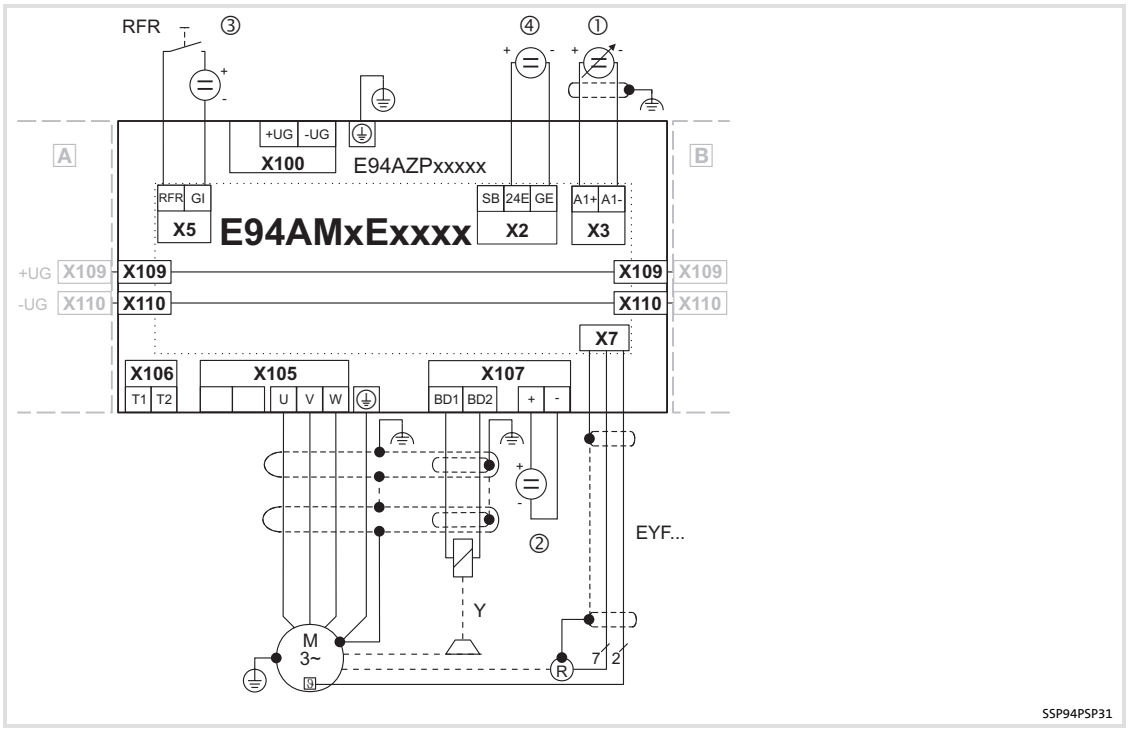


Fig. 5-9 Basic circuit diagram of the drive system

E94AMxExxxx	9400 Multi Drive servo axis module
E94AZPxxxxx	Installation backplane
A	DC power supply module or DC feeding point or axis module
B	Next axis module
⏚	HF shield termination through large-surface connection to functional earth
EYF...	System cable for resolver feedback
RFR	Controller enable
R	Resolver
Y	Motor holding brake (connected to optional motor brake control)
①	Speed setpoint selection via analog input 1 (-10 ... 0 ... +10 V)
②	Voltage source for the motor holding brake
③	24-V voltage source for the digital inputs according to IEC 61131-2
④	24-V voltage source for control electronics according to IEC 61131-2

Tip!

Complete the wiring of the installation backplane before plugging in the standard device. The upper terminals of the installation backplane cannot be connected with a plugged-in standard device.

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- Motor
- Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- Motor temperature monitoring

The following connections need not be shielded:

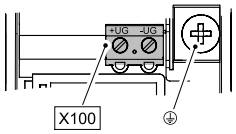
- DC bus

DC bus

Use the integrated DC busbars (X109 and X110) to connect the DC bus. The mounting backplane of the multi-axis controllers is already equipped with a fuse.
The busbar mounting set (accessories) can also be used to integrate single-axis controllers into a drive network. The busbar mounting set for single-axis controllers also contains the fuse required for the mounting backplane.

The DC bus is supplied via a DC supply module or a DC-feeding point which always have to be located on the left-hand side.

Compatible with the 9300 series, the DC-bus voltage can also be supplied via terminals +UG/-UG (X100, right part) for all devices.

Terminal X100 (right part)	Labelling	Description
 SSP942X100	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series).

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1 + 2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with/without wire end ferrule	10/16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

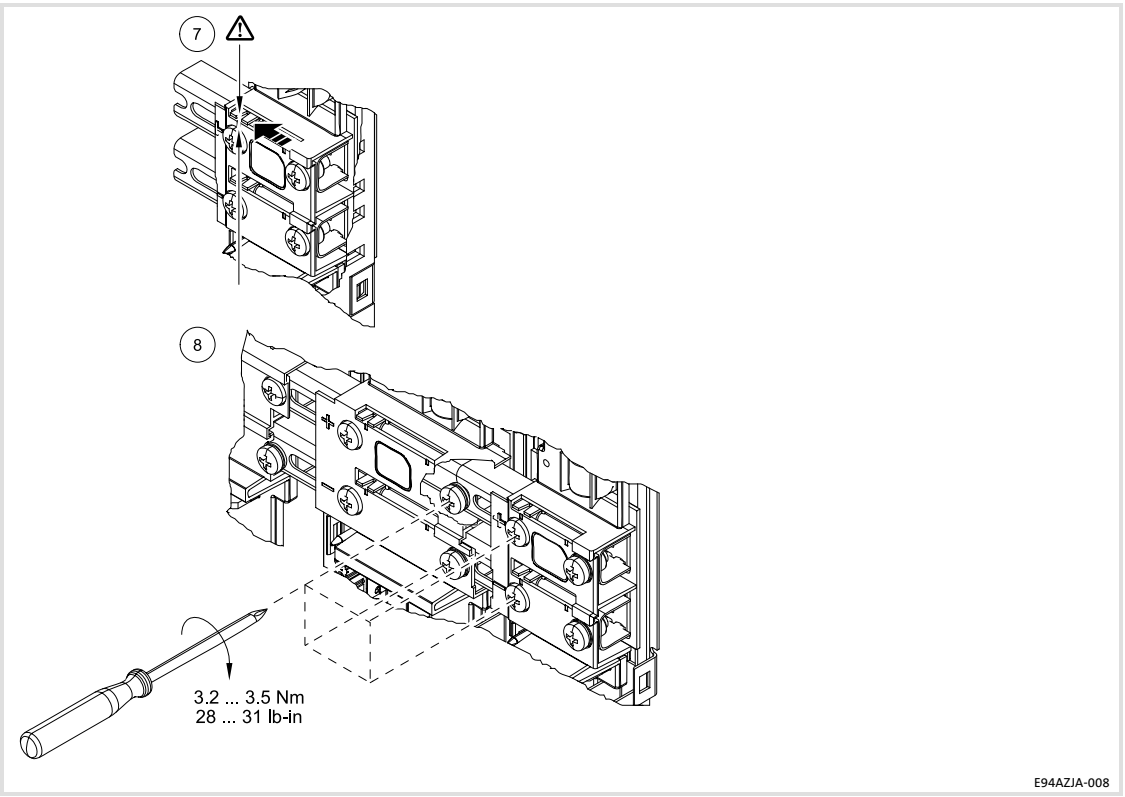
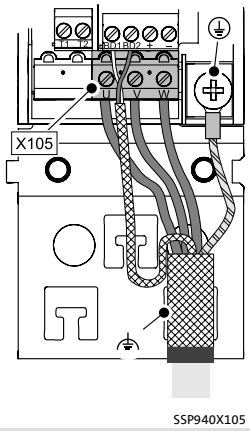


Fig. 5-10 Example: connecting busbars to DC power supply module

Proceed as follows to connect the busbars:

1. If devices of the interconnected system have already been in operation:
   – Ensure that the power supply system is switched off by checking the voltage at the supply terminals.
   – If necessary, switch off the power supply and wait at least 3 minutes.
2. Loosen the busbar screws but do not remove them completely.
3. Push the busbars as far as possible to the left towards the adjacent busbar.
   – Ensure that there is good contact to the adjacent busbar.
4. Tighten the busbar screws.
   – Tightening torque: 3.2 ... 3.5 Nm (28 ... 31 lb-in).
5. Screw all components onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

Motor

Terminal X105 (right part)	Labelling	Description
 SSP940X105	U V W	Connection of the motor phases
	⏚	Functional earth Connect the shields of the motor phases and of the optional motor brake control separately and with a surface as large as possible to the shield sheet. Use EMC wire clamp or EMC shield clamp for fixing.
	⏚	Connection for the PE conductor on the motor side with M5 ring cable lug

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1 + 2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with/without wire end ferrule	10/16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

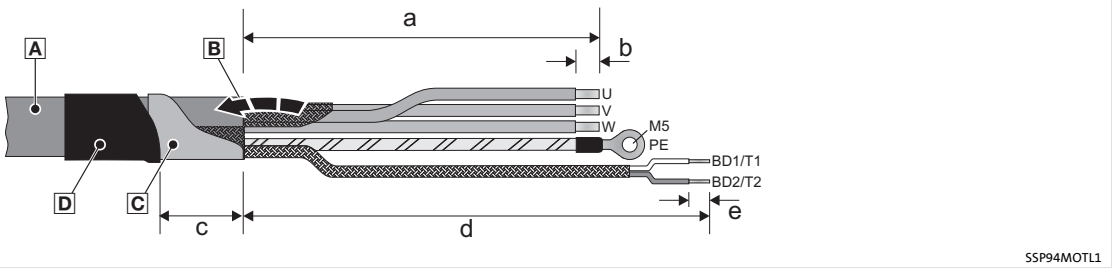
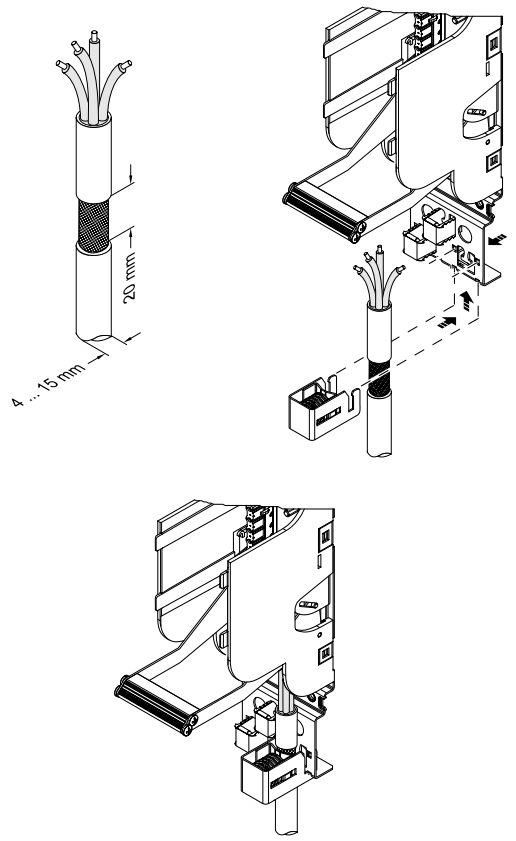


Fig. 5-11 Stripping lengths of the motor cable

Type	Dimensions [mm]				
	a	b	c	d	e
Device size 1	80	8	25	150	8
Device size 2	90	8	30	160	8
Device size 3	100	10	30	170	8

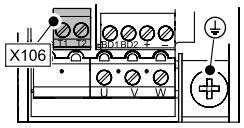
How to proceed:

1. Strip the motor cable [A] according to dimensions given.
2. Fold back the shield of the motor cable [B] over the cable sheath.
3. Stabilise the shield with self-adhesive conductive foil [C] (recommendation).
4. Fix the shield and conductive foil with heat-shrinkable tube [D] on the cable sheath.
5. Fasten cable lugs or wire end ferrules.
6. Connect the shields separately to the shield sheet using shield clamps (no strain relief).



E94AZJS-013

Motor temperature monitoring

Terminal X106	Labelling	Description
 SSP940X106	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance according to EN 60947-8 for type-A tripping units) or thermostat (NC contact).

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0

Motor brake control (optional)

Note!

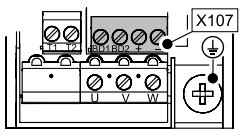
When the 24 V supply voltages (at X2) are applied and a motor holding brake is available, the devices respond as follows:

- ► SingleDrive without mains or DC-bus voltage: The motor holding brake **cannot** be released.
- ► MultiDrive without DC-bus voltage: The motor holding brake can be released.

Tip!

For detailed information on the motor holding brake control modules, please see the chapter Accessories (📖 419).

For information on the E94AZHX0051 motor holding brake control module optionally contained in the installation backplane, please see the chapter Accessories starting on page 420.

Terminal X107	Labelling	Description
 SSP940X107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHX0051: 24 V DC, max. 2.5 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Flexible With wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0

Stripping length or contact length: 8 mm

Stop!

The motor brake control includes an electronic switch which can control a 24 V motor holding brake.

The motor brake control may only be connected with motor holding brakes which correspond to the permissible data mentioned in the technical data. (If required, the holding brake without motor brake control must be controlled via a digital output and a coupling relay).

If the permissible data mentioned in the technical data are not complied with:

► the motor brake control can be destroyed.

► a safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements concerning the brake cable (connection BD1/BD2):

► The brake cables must be shielded if they are incorporated in the motor cable.
  – Operation with unshielded brake cables can destroy the motor brake control.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

► Connect the shield on both sides of PE.

Requirements concerning the supply voltage U_{DC} (connection +/-):

► The motor brake control must always be supplied with a separate 24 V supply.
  – A common supply of the motor brake control and the control card of the controller is not permissible since otherwise the double insulation between both components would be reduced.

► Set U_{DC} so that the operating voltage of the brake is within the admissible range and the maximum supply voltage of the motor brake control will not be exceeded.

5.6 Installation of the standard device

How to proceed:

1. Insert the device into the installation backplane without twisting it until resistance is felt.
2. Press the device into the installation backplane until it audibly snaps into place. The locking clip moves downwards and back into the locking position.
3. The end position is reached when the locking clip can be pressed against the device. Now the device is locked.

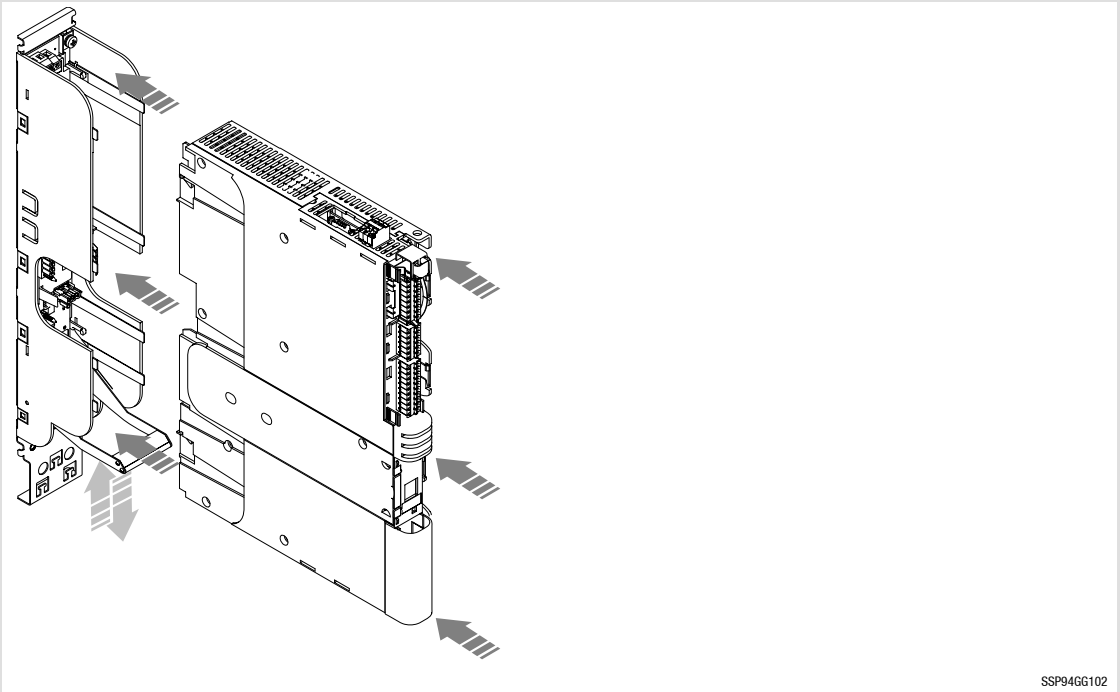


Fig. 5-12 Installation of the device

Proceed as follows to remove the device:

1. Disconnect already wired connectors at the device.
2. Push the locking clip downwards to release the device and disengage it from the contacts.
3. Pull the device completely out of the installation backplane and remove it. The locking clip moves back into the locking position.

5.7 Control terminals

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- Analog signals (inputs and outputs)
- System bus CAN
- Resolver
- Encoder

The following connections need not be shielded:

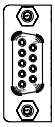
- 24 V supply
- Digital signals (inputs and outputs)

Tip!

Parameter setting and configuration can be carried out using the L-force »Engineer«. For this purpose the Online Help and the Software Manual for the standard device will guide you.

System bus CAN on board

The controller features an integrated CANopen system bus interface to exchange process data and parameter values between different nodes and to connect further modules as e.g. distributed terminals, operator and input devices (”HMIs”) and external control units. Further information can be obtained from the Communication Manual.

Terminal X1	Labelling	Description
 9400SSP000X1	Pin 2	CAN-LOW
	Pin 3	CAN-GND
	Pin 7	CAN-HIGH
	(Housing)	CAN-Shield

24 V supply

The controller of the ”MultiDrive” version requires a 24-V supply voltage for the control electronics. This serves to maintain the control functions, even if the DC bus is not loaded.

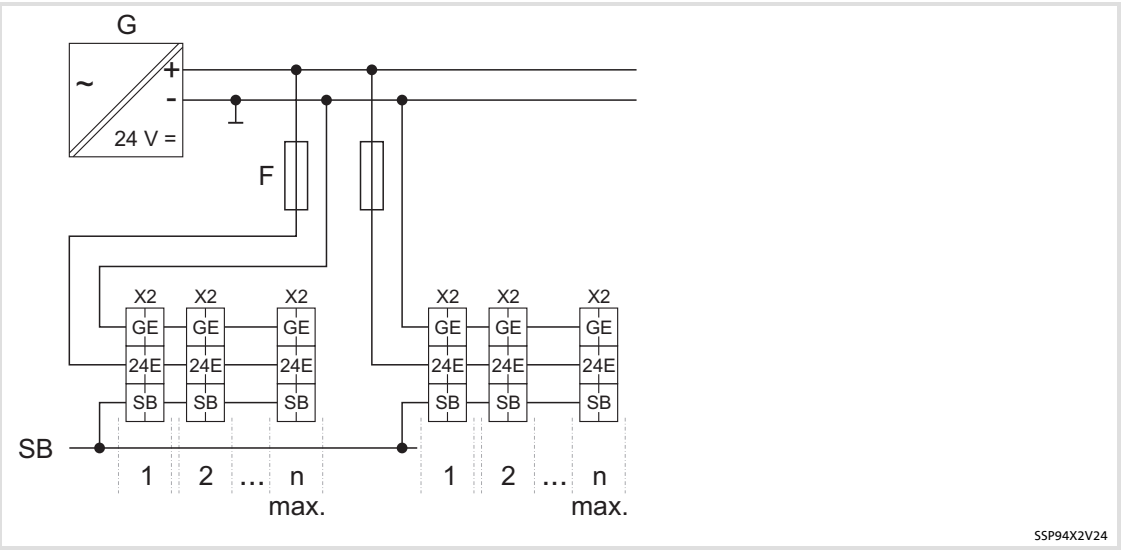


Fig. 5-13 Wiring principle

g	24 V external supply (e.g. EZV...)
F	Fuse
X2	Terminal for 24 V and state bus
GE/24E/SB	Labelling on the terminal
SB	State bus
1 ... n	E94A... device number during loop-through connection

Terminal X2	Labelling	Description
9400SSP000X2	GE	GND external supply
	24E	24 V external supply via a safely separated power supply unit (SELV/PELV)
	SB	State bus in/out (reference GE)

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Electrical data		
24 V	Rated voltage	24 V According to IEC 61131-2
	Voltage range	19.2 ... 28.8 V Residual ripple max. ± 5 %
	Current consumption	Continuous operation: 2.4 A Switch-on: 4 A for 100 ms Controller enable: 4 A for 300 ms
	Fuse	Circuit breaker with tripping characteristic B or C, Standard blade-type fuses
	Looping through	Max. 7 devices with 2.5 mm² Fusing: 16/15 A
		Max. 4 devices with 1.5 mm² Fusing: 10/10 A
	Connectable cross-cuttings	See terminal data

Warnings!

Up to hardware version 1x, take the following tino consideration:
In UL-approved systems the fuse of the 24 V supply must not exceed 4 A.

State bus

The state bus is a bus system exclusively designed for Lenze controllers via which up to 20 controllers can be connected and which serves to simulate a ”release cord” function. The state is controlled via the system module SFBDigitalOutput.

- The state bus knows the states ”OK” and ”fault”.
- The state bus is multi-master-compliant, i.e. each node connected to the state bus can set the state bus to ”fault” by changing to LOW level.
- In the ”fault” status, all nodes activate their programmed response, e.g. synchronised braking of the drive system.

Stop!

Do not connect an external voltage to the state bus, otherwise the function will be disturbed.

Electrical data		
State bus	Rated voltage	24 V According to IEC 61131-2
	Switching level	According to IEC 61131-2
	LOW	0 V ... +5 V
	HIGH	+15 V ... +30 V
	Looping through	Max. 20 devices DC-bus operation with 9300 devices is possible.
	Connectable cross-cuttings	See terminal data

Analog inputs, analog outputs

The controller features two analog inputs which are able to detect differential voltage signals in the range ±10 V, e.g. an analog speed setpoint selection or the voltage signal of an external sensor (temperature, pressure, etc.).

► The analog signal 1 can also detect a current setpoint.

The controller features two analog outputs, which can output internal analog signals as voltage signals, e.g. for the control of analog indicating instruments or as a setpoint for slave drives.

Electrical data		
Analog input 1 Analog input 2	Level:	-10 ... +10 V
	Resolution:	11 bits + sign
	Scaling:	±10 V ≡ $\pm 2^{30}$
	Conversion rate:	1 kHz
Analog input 1 as current input (A1R and A1- bridged)	Level:	-20 ... +20 mA
	Resolution:	10 bits + sign
	Scaling:	For C00034 = ”1” -20 ... -4 mA ≡-2^{30} ... 0 +4 ... +20 mA ≡0 ... $+2^{30}$
		For C00034 = ”2” ±20 mA ≡ $\pm 2^{30}$
	Conversion rate:	1 kHz
	Open-circuit monitoring:	Configurable
Analog output 1 Analog output 2	Level:	-10 ... +10 V (max. 2 mA)
	Resolution:	11 bits + sign
	Scaling:	±10 V ≡ $\pm 2^{30}$
	Conversion rate:	1 kHz

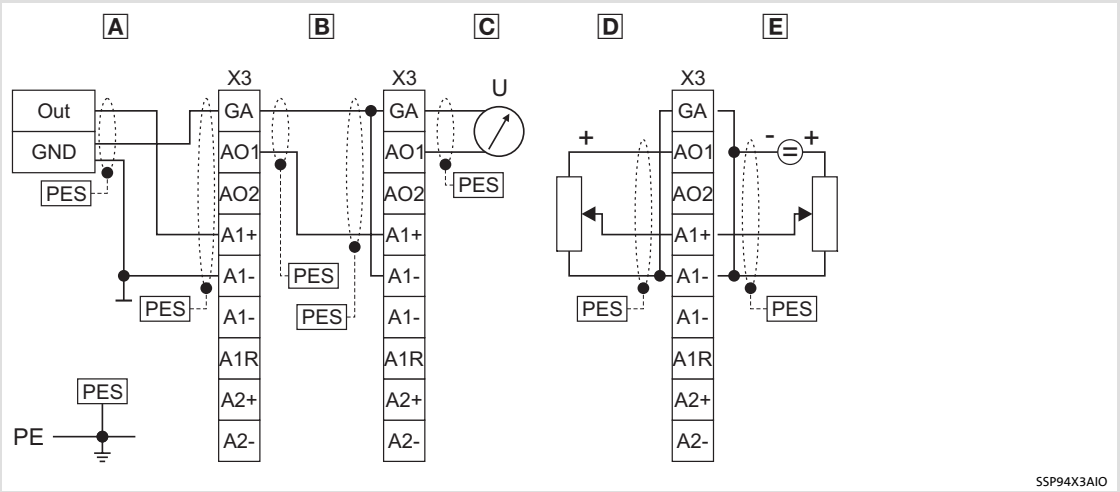


Fig. 5-14 Wiring principle

A	Wiring of an external analog signal
B	Wiring with a slave drive
C	Wiring with a measuring device
D	Potentiometer supplied by analog output 1
E	Potentiometer with external supply
Out	Analog output signal, e.g. of a control
GND	Earth reference potential
X3	Terminal for the analog inputs and outputs
PES	EMC shield connection
PE	Protective earth
U	Measuring device

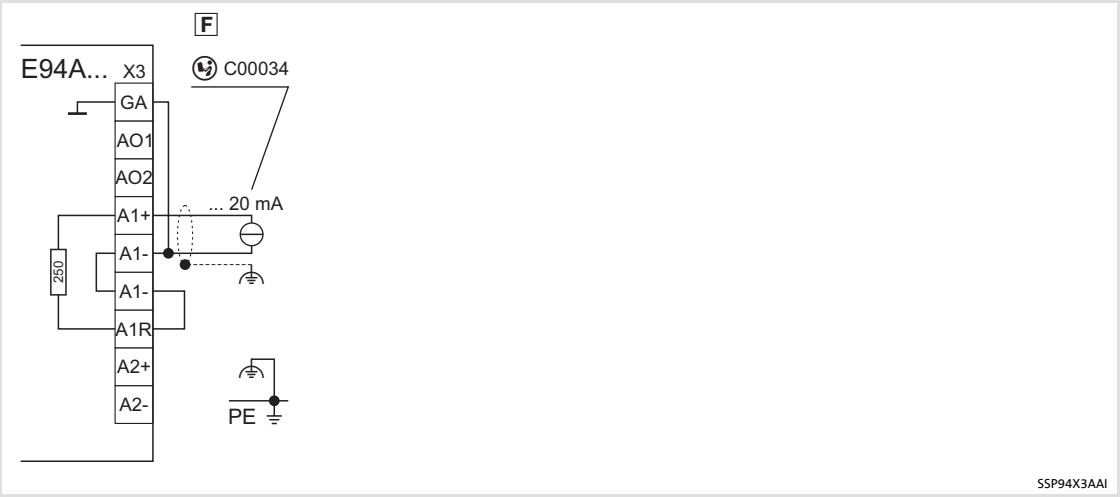
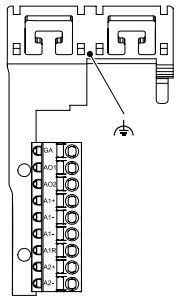


Fig. 5-15 Wiring principle of current input

- F Wiring of a current signal
- X3 Terminal for the analog inputs and outputs
- Read information on the input configuration (software manual)
- Functional earth
- PE Protective earth

Terminal X3	Labelling	Description
 SSP94000X3	GA	GND analog signals
	AO1	Analog output 1
	AO2	Analog output 2
	A1+	Analog input 1 +
	A1-	Analog input 1 -
	A1-	Analog input 1 -
	A1R	Terminating resistor for ±20mA
	A2+	Analog input 2 +
	A2-	Analog input 2 -
	⏚	Shield connection: Fix the shield with EMC wire clamp.

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Note!

If the control terminals are completely wired, we recommend to use a cable cross-section of max. 0.75 mm² to save space. The mechanical cover can then be attached.

Digital outputs

The controller features four freely configurable digital outputs.

Electrical data			
24O GO	24 V external voltage source, optional		according to IEC 61131-2 SELV/PELV
	Current consumption		Max. 300 mA
DO1 ... DO4 GO	Switching level		according to IEC 61131-2
		LOW	0 V ... +5 V
		HIGH	+15 V ... +30 V
	Output current		Max. 50 mA
	Load		> 480 Ω at 24 V

Note!

For stable digital output states, in particular during the starting phase of the controller, you must use an external 24V supply for the digital outputs.

Note!

Digital inputs and digital outputs have separated reference potentials (GI and GO). If you interconnect inputs and outputs, the reference potentials are connected as well by an external bridge.

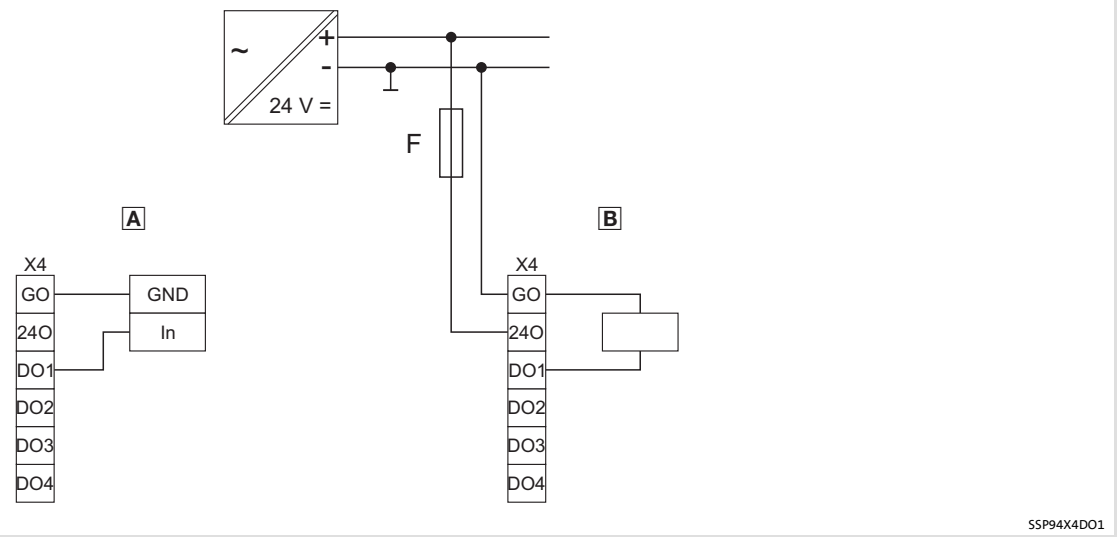
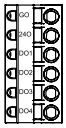


Fig. 5-16 Wiring principle

A	Wiring with a digital input, e.g. a PLC
B	Digital control (relay, valve, ...) with an external 24-V supply
X4	Terminal for the digital outputs
In	Digital input, e.g. of a control
GND	Earth reference potential
F	Fuse

Terminal X4	Labelling	Description
	GO	GND digital out
	24O	24-V digital out
	DO1	Digital output 1
	DO2	Digital output 2
	DO3	Digital output 3
9400SSP000X4	DO4	Digital output 4

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Digital inputs

The controller is provided with freely configurable digital inputs which can be used for touch probe measurement (edge-controlled event).

The control input RFR for controller enable is firmly connected with the device control. It must be wired to enable the controller with a HIGH signal.

Electrical data		
24O (external voltage source, optional)	Rated voltage	24 V According to IEC 61131-2
	Current consumption	Max. 50 mA
RFR DI1 ... DI8	Switching level	According to IEC 61131-2
	LOW	0 V ... +5 V
	HIGH	+15 V ... +30 V
	Input current	Max. 8 mA

Note!

Digital inputs and digital outputs have separated reference potentials (GI and GO). If you interconnect inputs and outputs, the reference potentials are connected as well by an external bridge.

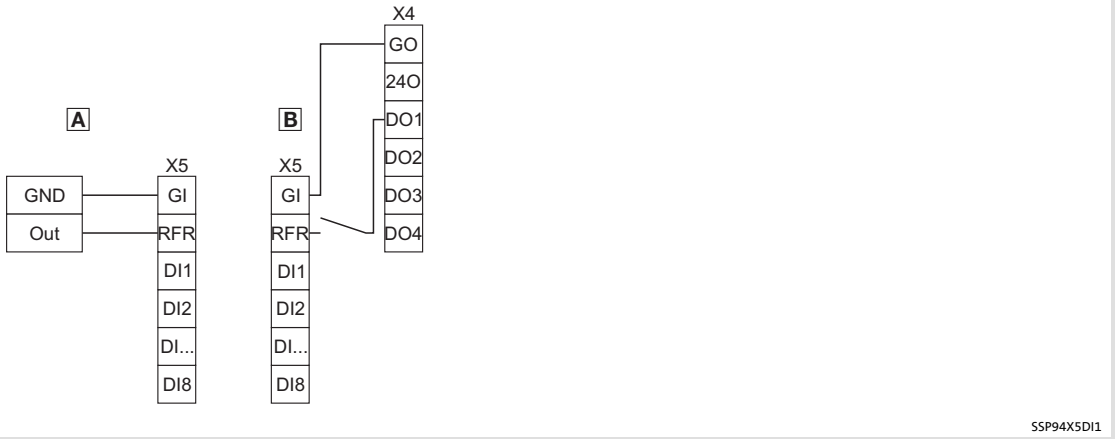
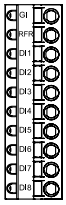


Fig. 5-17 Wiring principle

A	Wiring of an external digital signal, e.g. a PLC
B	Wiring with a slave drive
X4	Terminal for the digital outputs
X5	Terminal for the digital inputs
Out	digital output signal, e.g. of a control
GND	Earth reference potential

Terminal X5	Labelling	Description
 9400SSP000X5	GI	GND digital in
	RFR	Controller enable
	DI1	Digital input 1
	DI2	Digital input 2
	DI3	Digital input 3
	DI4	Digital input 4
	DI5	Digital input 5
	DI6	Digital input 6
	DI7	Digital input 7
	DI8	Digital input 8

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Diagnostics/keypad

The following can be connected to this interface:

► USB diagnostic adapter E94AZCUS

or

► Keypad E94AZKAE.

The diagnostic adapter and a computer with the Lenze software »Engineer« serve to carry out comprehensive settings, e.g. for initial commissioning.

The keypad enables experienced users to check or change individual settings.

Terminal X6	Labelling	Description
9400SSP000X6		Internal interface, RJ69 socket, for keypad or diagnostic adapter

Resolver

Resolvers are connected to X7 (9-pole Sub-D socket).

The use of third-party resolvers is permissible. For this purpose the number of pole pairs of the resolver in C00080 must be adapted to the resolver used. When the stator coils are excited with 4 kHz, the apparent impedance of the connected resolver must not fall below 65 Ohm. When lower impedances are connected, the overload protection integrated in the resolver output limits the output current and can falsify the resolver evaluation.

Resolvers are operated in reverse mode:

- Supply to the sine and cosine track,
- Both signals are controlled in a way that the current flow on the reference track is reduced to zero.

Electrical data		
General	Cable length (system cable recommended)	Max. 150 m
V_{CC}	Supply voltage	5 V
	Maximum output current	110 mA
+REF, -REF	Input frequency	Max. 250 kHz
+COS, -COS +SIN, -SIN	Excitation voltage	10 V_{SS}
	Carrier frequency	4 kHz, fix
+KTY, -KTY	Type	KTY 83-110

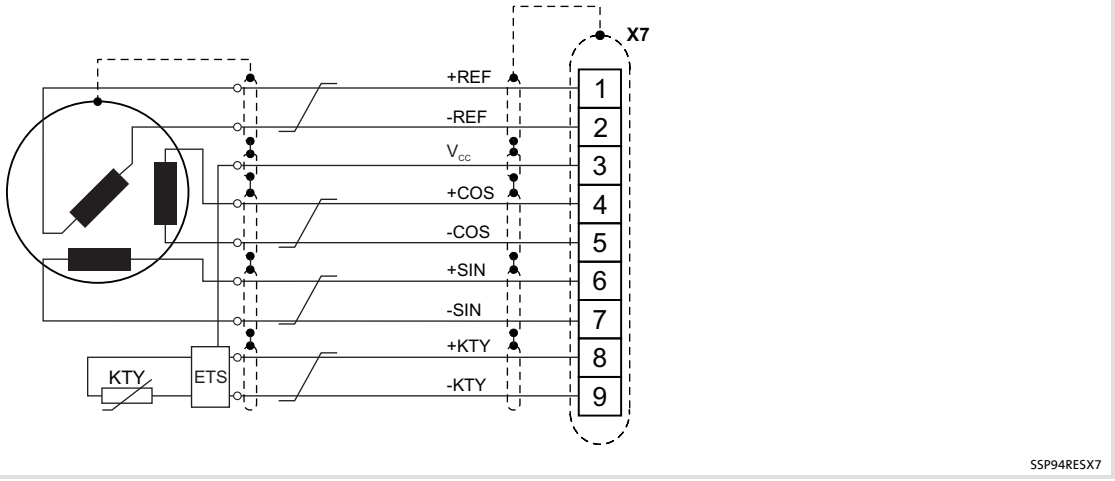


Fig. 5-18 Wiring principle

Terminal X7	Labelling	Description
	1	+REF
	2	-REF
	3	V_{CC}
	4	+COS
	5	-COS
	6	+SIN
	7	-SIN
	8	+KTY
9400SSP000X7	9	-KTY

Encoder

Encoders are connected to X8 (15-pole Sub-D socket).

- Absolute and incremental encoders are supported:
  - TTL encoder 5 V (incremental)
  - Sin/cos encoder 1 V_{ss} (incremental)
  - Sin/cos absolute value encoder 1 V_{ss} with Hiperface protocol
  - Sin/cos absolute value encoder 1 V_{ss} with EnDat protocol (2.1)
  - SSI load encoder with Stegmann protocol (as of 9400 with firmware 05.00)
- Improved determination of low speeds with TTL encoders through additional time measuring method.
- SinCos absolute value encoders are serially read during initialisation (power-on). After this, the sin/cos signals are evaluated.
- Open-circuit monitoring:
  - for sin/cos encoders by comparing the sin/cos signals with the sine shape (radius monitoring)
  - for TTL encoders by means of mean value and amplitude monitoring
  - not with SSI encoders
- The following encoders are not supported:
  - HTL encoders

Electrical data			
General	Cable length (system cable recommended)		Max. 150 m
	Encoder types		TTL 1 V_{SS}
	Protocols		Hiperface EnDat 2.1 SSI-Stegmann
	Number of increments		1 ... 16384
	Input frequency		Max. 250 kHz
VCC (GND)	Supply voltage		5 V ... 12 V
	Current, max.	9 V	330 mA
		12 V	250 mA
+Sense, -Sense	Measuring lead for readjusting V_{CC}		
+KTY, -KTY	Type		KTY 83-110

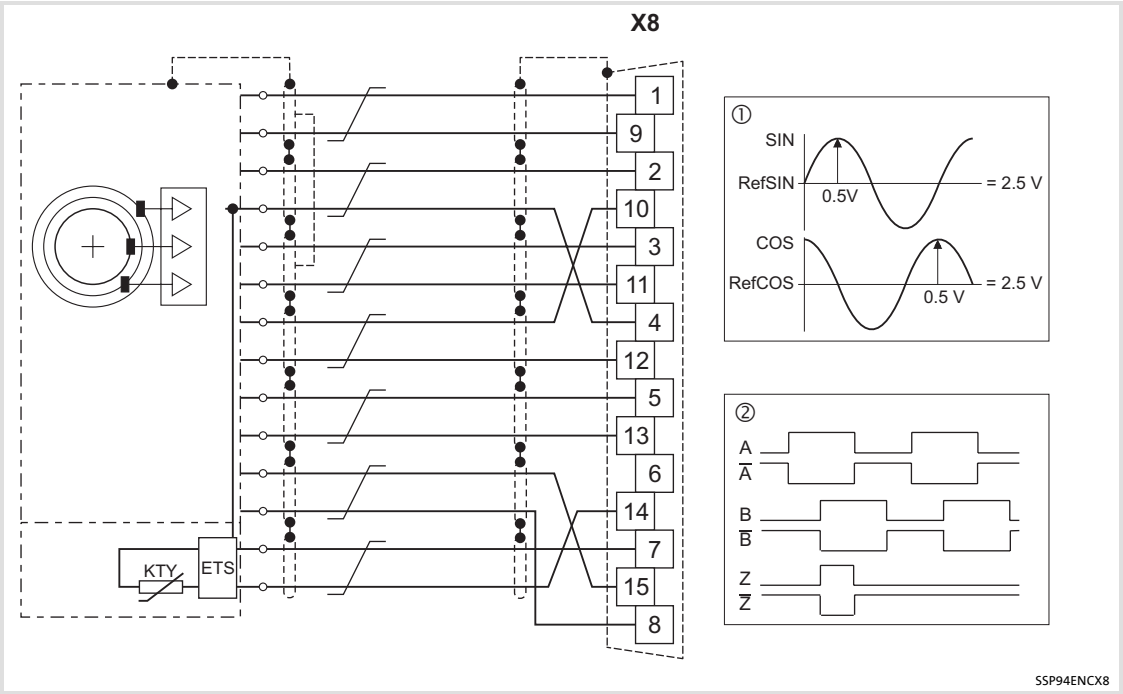


Fig. 5-19 Wiring principle

① Signals of a sin/cos encoder
② Signals with CW rotation

Terminal X8	Labelling	Description				
		Cable EYF001...			EYF002...	-
		TTL	1 V_{SS}	1 V_{SS} Hiperface	1 V_{SS} EnDat 2.1	SSI
	1	A	A	COS	A	-
	2	GND	GND	GND	GND	GND
	3	B	B	Sin	B	-
	4	V_{CC}	V_{CC}	V_{CC}	V_{CC}	U_S
	5	Z	Z	+RS485	Data (Z)	Data +
	6	n. c.	n. c.	n. c.	n. c.	n. c.
	7	-KTY	-KTY	-KTY	-KTY	-
	8	-	-	-	Clock	Clock +
	9	/A	/A	Ref COS	/A	-
	10	-	-	-	-Sense	-
	11	/B	/B	Ref SIN	/B	-
	12	-	-	-	+Sense	-
	13	/Z	/Z	-RS485	/Data (/Z)	Data -
	14	+KTY	+KTY	+KTY	+KTY	-
9400SSP000X8	15	-	-	-	/Clock	Clock -

Setting the supply voltage

The supply voltage of the encoder must be adapted to the cable length.

For this purpose, use the ”Encoder voltage” parameter, C00421.

Encoder	U_r	Voltage setting [V] in C00421 for cable length [m]						
Product key	[V]	0 - 10	10 - 30	30 - 50	50 - 70	70 - 90	90 - 100	100 -150
TTL								
IG2048-5V-T	5 ±5%	5.0	5.0	5.1	5.1	5.2	5.2	5.3
IG4096-5V-T								
IK2048-5V-T								
IK4096-5V-T								
Sin/cos								
IG1024-5V-V	5 ±5%	5.0	5.0	5.1	5.1	5.2	5.2	5.3
IG2048-5V-S								
Sin/cos (Hiperface)								
AS1024-8V-H	8 (7 ... 12)	8.0						
AM1024-8V-H								
Sin/cos (Endat)								
AM32-5V-E	5 ±5%	5.0						
AS2048-5V-E								
AM2048-5V-E								

Tab. 5-2

U_r Rated encoder voltage

The values listed in Tab. 5-2 are valid for the use of Lenze system cables at typical ambient temperatures.

Other cables, other cable cross-sections, or extreme ambient temperatures may require adaptations determined by means of measurements.

For a higher encoder supply power, e.g. for laser-based length measuring systems, an external encoder supply must be provided.

6 Power supply module

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6.1 Device features

The most important device features at a glance:

- power supply modules supply the DC buses of several controllers of a drive system with energy.
- power supply modules are the central AC mains connection in a DC-bus operation.
- power supply modules have an internal brake chopper and a terminal for a brake resistor.
- power supply modules of the 9400 series have a busbar port for the easy connection and side-by-side mounting of the 9400 controllers up to 100 A. Ports for higher currents or compatible device series are available.
- Power supply modules generally supply controllers of the ”Multi Drive” version. However, also controllers of the ”Single Drive” version can be implemented in a DC-bus operation if the data and notes in the ”DC-bus operation” chapter are observed.
- Power supply modules are designed as multi-range voltage units (230/400/480/500 V).
- Four types of power supply modules are available:
  - **E94APNE0104**,
    Rated current: 10 A,
    Device size: 1,
    Version: compact standard device with installation backplane
  - **E94APNE0364**,
    Rated current: 36 A,
    Device size: 3,
    Version: compact standard device with installation backplane
  - **E94APNE1004**,
    Rated current: 100 A,
    Device size: 4,
    Version: compact total device
  - **E94APNE2454**,
    Rated current: 245 A,
    Device size: 5,
    Version: compact total device
- Power supply modules are assigned to specially designed mains filters and RFI filters.
- Power supply modules and filters can be mounted in the mounting grid of the 9400 series.

6.2 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approval			
UL	UL 508C	Industrial Control Equipment Listed (File No. E132659) for USA	
Mains data			
Mains types	With earthed Y point	Unrestricted use	
	IT systems	Unrestricted use Observe instructions about special measures concerning the connected axis controllers (📖 245)!	
Noise emission	EN 61800-3	Conducted: cannot be specified because dependent on the conditions present in the interconnected system	
		Radiation: category C3	
Noise immunity (according to requirements of EN 61800-3)			
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV for air discharge, 4 kV for contact discharge to housing	
Radio frequency			
Conducted	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80% AM (1kHz)	
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80% AM (1kHz)	
Protection of persons and device protection			
Enclosure	EN 60529	IP 20	Not in the wire range of the terminals on the motor side
	NEMA 250	Protection against contact to type 1	
Insulation resistance	EN 61800-5-1	Overvoltage category III Derating at and above 2000 m AMSL: overvoltage category II	
Isolation of control circuits	EN 61800-5-1	Safe mains isolation through double/reinforced insulation.	
Short-circuit strength	EN 61800-5-1	DC-bus connection: not short-circuit-proof Brake resistor connection: full Control connections: full	
Discharge current	EN 61800-5-1	> 3.5 mA	Observe regulations and safety instructions!
Cyclic mains switching		Cyclic mains switching of five times in five minutes is fully permissible.	
Design			
Housing			
Carrier housing	Device sizes 1 and 3	Glass-fiber reinforced plastic	
Carrier housing	Device sizes 4 and 5	Metal	
Dimensions		see "Mechanical installation"	
Weight		see "Mechanical installation"	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical	
Mounting clearances			
Above/below		≥ 80 mm / ≥ 120 mm	Observe the device-related notes on mounting.
To the sides		Side-by-side mounting without any clearance	

Connection conditions for DC power supply module		
AC mains operation		Direct connection
DC-bus operation		Direct connection of axis modules via terminals or busbar system More information can be found in the Hardware Manual, chapter ”DC-bus operation”.

Operating conditions

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s^2 = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

6.3 Rated data (devices for 400/500V mains)

General data

Type	Power loss P_V [W]	
	Total (when operating with I_{aN})	Constant (control electronics only)
E94APNE0104	55	5
E94APNE0364	110	5
E94APNE1004	230	7
E94APNE2454	550	7

Assignment of filters to standard devices

DC-power supply module	Mains filter (corresponds to ”long distance”)	RFI filter (corresponds to ”short distance”)
E94APNE0104	E94AZMP0084	E94AZRP0084
E94APNE0364	E94AZMP0294	E94AZRP0294
E94APNE1004	E94AZMP0824	E94AZRP0824
E94APNE2454	E94AZMP2004	E94AZRP2004

6.3.1 Operation at rated mains voltage 230 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %

Input data

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	230	50/60	8	6	3
E94APNE0364	230	50/60	29	21.8	3
E94APNE1004	230	50/60	82	61	3
E94APNE2454	230	50/60	200	150	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94APNE0104	230	3.2
E94APNE0364	230	11.5
E94APNE1004	230	32.6
E94APNE2454	230	79.6

Output data

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	325	0 (DC)	10	7.5	2
E94APNE0364	325	0 (DC)	36	27	2
E94APNE1004	325	0 (DC)	100	75	2
E94APNE2454	325	0 (DC)	245	184	2

① Temperature in the control cabinet

Type	Output current and output power					
	100 %		5-s cycle		3-min cycle	
	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94APNE0104	10	2.1	40	8.4	15	3.2
E94APNE0104 + E94AZMP0084	10	2.8	40	11.2	15	4.2
E94APNE0364	36	7.5	108	22.5	54	11.3
E94APNE0364 + E94AZMP0294	36	10.1	108	30.3	54	15.5
E94APNE1004	100	20.8	200	62.4	150	31.2
E94APNE1004 + E94AZMP0824	100	27.9	200	83.7	150	41.9
E94APNE2454	245	51	368	153	368	76.5
E94APNE2454 + E94AZMP2004	245	68.5	368	206	368	103

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94APNE0104	18.0	21.7	8.5	7.9	1.1	4.3	0.5	0.5
E94APNE0364	6.0	65.0	25.4	29.1	5.1	3.0	0.5	0.5
E94APNE1004	2.5	156	60.8	62.7	9.8	3.6	0.5	0.5
E94APNE2454	1.4	279	109	112	17.5	3.6	0.5	0.5

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

6.3.2 Operation at rated mains voltage 400 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %

Input data

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	400	50/60	8	6	3
E94APNE0364	400	50/60	29	21.8	3
E94APNE1004	400	50/60	82	61	3
E94APNE2454	400	50/60	200	150	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94APNE0104	400	5.5
E94APNE0364	400	20.1
E94APNE1004	400	56.7
E94APNE2454	400	138

Output data

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	565	455 - 0 % ... 620 + 0 %	-

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	565	0 (DC)	10	7.5	2
E94APNE0364	565	0 (DC)	36	27	2
E94APNE1004	565	0 (DC)	100	75	2
E94APNE2454	565	0 (DC)	245	184	2

① Temperature in the control cabinet

Type	Output current and output power					
	100 %		5-s cycle		3-min cycle	
	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94APNE0104	10	3.6	40	14.4	15	5.4
E94APNE0104 + E94AZMP0084	10	4.9	40	19.6	15	7.4
E94APNE0364	36	13.0	108	39.0	54	19.5
E94APNE0364 + E94AZMP0294	36	17.5	108	52.5	54	26.3
E94APNE1004	100	36.2	200	109	150	54.3
E94APNE1004 + E94AZMP0824	100	48.6	200	146	150	72.9
E94APNE2454	245	88.6	368	266	368	133
E94APNE2454 + E94AZMP2004	245	119	368	357	368	179

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94APNE0104	27.0	26.9	19.5	9.7	2.6	4.3	0.5	0.5
E94APNE0364	12.0	60.4	43.8	27.0	8.7	3.0	0.5	0.5
E94APNE1004	5.0	145	105	58.2	17.0	3.6	0.5	0.5
E94APNE2454	2.8	259	188	104	30.3	3.6	0.5	0.5

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

6.3.3 Operation at a rated mains voltage of 500 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %

Input data

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	500	50/60	8	6	3
E94APNE0364	500	50/60	29	21.8	3
E94APNE1004	500	50/60	82	61	3
E94APNE2454	500	50/60	200	150	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94APNE0104	500	6.9
E94APNE0364	500	25.1
E94APNE1004	500	70.9
E94APNE2454	500	173

Output data

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	705	565 - 0 % ... 775 + 0 %	-

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94APNE0104	705	0 (DC)	10	7.5	2
E94APNE0364	705	0 (DC)	36	27	2
E94APNE1004	705	0 (DC)	100	75	2
E94APNE2454	705	0 (DC)	245	184	2

① Temperature in the control cabinet

Type	Output current and output power					
	100 %		5-s cycle		3-min cycle	
	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94APNE0104	10	4.5	40	18.0	15	6.8
E94APNE0104 + E94AZMP0084	10	6.1	40	24.4	15	9.2
E94APNE0364	36	16.3	108	48.9	54	24.5
E94APNE0364 + E94AZMP0294	36	21.9	108	65.7	54	32.9
E94APNE1004	100	45.2	200	136	150	67.8
E94APNE100 + E94AZMP0824	100	60.8	200	182	150	91.2
E94APNE2454	245	111	368	333	368	167
E94APNE2454 + E94AZMP2004	245	149	368	447	368	224

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94APNE0104	27.0	29.3	23.1	10.6	3.0	4.3	0.5	0.5
E94APNE0364	12.0	65.8	52.0	29.4	10.4	3.0	0.5	0.5
E94APNE1004	5.0	158	125	63.5	20.1	3.6	0.5	0.5
E94APNE2454	2.8	282	223	113	36.0	3.6	0.5	0.5

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

6.3.4 Fuses and cable cross-sections

Basis of the data			
Mains	**Voltage**	**Voltage range**	**Frequency range**
	U_{LN} [V]	U_{LN} [V]	f [Hz]
3/PE AC	230 ... 500	180 - 0 % ... 550 + 0 %	45 ... 65

Operation with external mains choke/mains filter								
Type	Installation according to EN 60204-1 [1]					Installation according to UL [2]		FI [3]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E94APNE0104	C16	-	2,5		2,5	15	14	≥ 300
E94APNE0364	C40	-	10		10	40	8	≥ 300
E94APNE1004	-	125	-		50 F: 50	100	1/0	≥ 300
E94APNE2454	-	315	-		F: 150 (2 x 70)	250	250 mcm (2 x 1/0)	≥ 300

1) The details are recommendations. Other designs/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: the use of PVC-insulated copper cables, conductor temperature < 70°C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.
2) UL approved cables only, fuses and fuse holders must be used.
UL fuse: voltage 500 ... 600 V
3) Universal-current sensitive earth-leakage circuit breaker
If several devices or cable lengths > 50 m are used, the circuit breaker may respond, depending on the cable type and switching frequency.
4) Device with integrated mains choke
① Circuit breaker
② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category
③ Fuse
Observe national and regional regulations

Operation without external mains choke/mains filter

Type	Installation according to EN 60204-1 [1]					Installation according to UL [2]		FI [3]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E94APNE0104	C16	-	2,5	2,5		15	14	≥ 300
E94APNE0364	C40	-	10	10		40	8	≥ 300
E94APNE1004	-	125	-	50 F: 50		100	1/0	≥ 300
E94APNE2454	-	315	-	F: 150 (2 x 70)		250	250 mcm (2 x 1/0)	≥ 300

1) The details are recommendations. Other designs/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: the use of PVC-insulated copper cables, conductor temperature < 70°C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.
2) UL approved cables only, fuses and fuse holders must be used.
UL fuse: voltage 500 ... 600 V
3) Universal-current sensitive earth-leakage circuit breaker
If several devices or cable lengths > 50 m are used, the circuit breaker may respond, depending on the cable type and switching frequency.
4) Device with integrated mains choke
① Circuit breaker
② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category
③ Fuse
Observe national and regional regulations

6.3.5 Mains filters for power supply modules

When using the mains filters assigned, conditions must be observed for compliance with EMC class C2:

- The measures for the use on IT systems must be applied to all axis modules in the interconnection (separation of internal filter components from PE, (📖 331)).
- The maximum sum total of all motor cable lengths (Σl_{mot}) for the filter used must be observed.

Motor cable lengths in the interconnection

The assigned filters are designed for Σl_{mot}
(E94AZRPxxx4: 60 m (= 6 x 10 m), E94AZMPxxx4: 500 m (= 10 x 50 m)).

For a different number of axis modules, Σl_{mot} can be determined from the following diagrams.

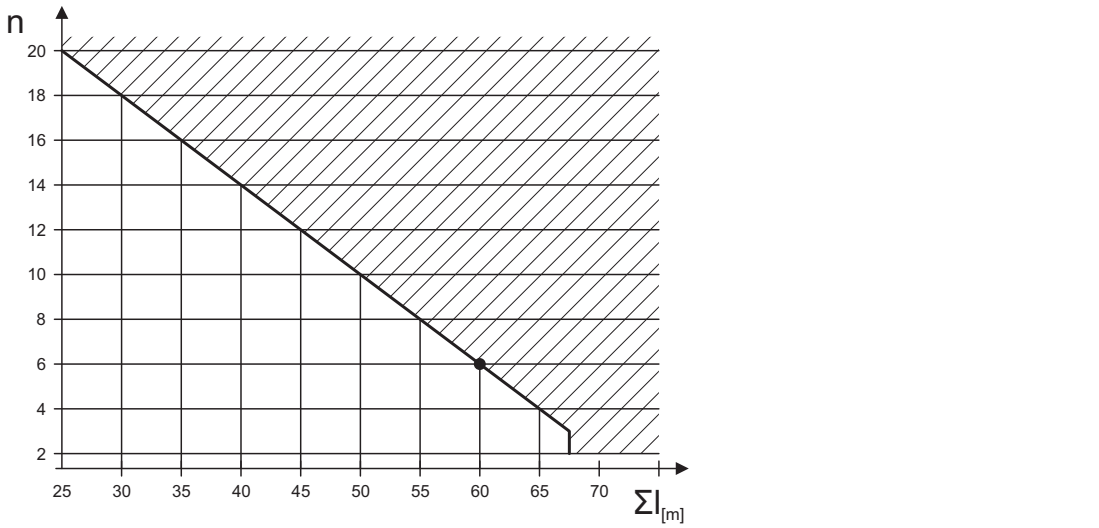


Fig. 6-1 Filter E94AZMR...SDB (short distance): Sum total of motor cable lengths as a function of the number of axis modules

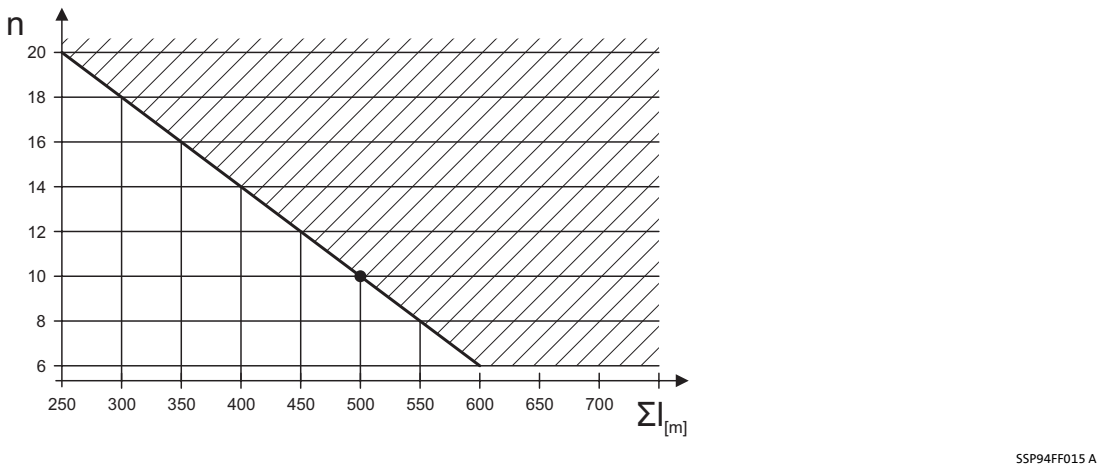


Fig. 6-2 Filter E94AZMR...LDB (long distance): Sum total of motor cable lengths as a function of the number of axis modules

With different motor cable lengths, per axis at least 25 % of the longest cable must be considered when calculating the total motor cable length.

Example: 1	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1	6	0.25 * 20 = 5	6
2 ... 4	3 * 10		3 * 10
5	20	⇦	20
Total	56	max. permissible for 5 axes: ∑< 60	**56**
		EMC class C2 will be complied with.	☑

Example: 2	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 4	4 * 5	0.25 * 40 = 10	4 * 10
5	40	⇦	20
Total	60	max. permissible for 5 axes: ∑< 60	**80**
		EMC class C2 will not be complied with.	☒

Other interference factors

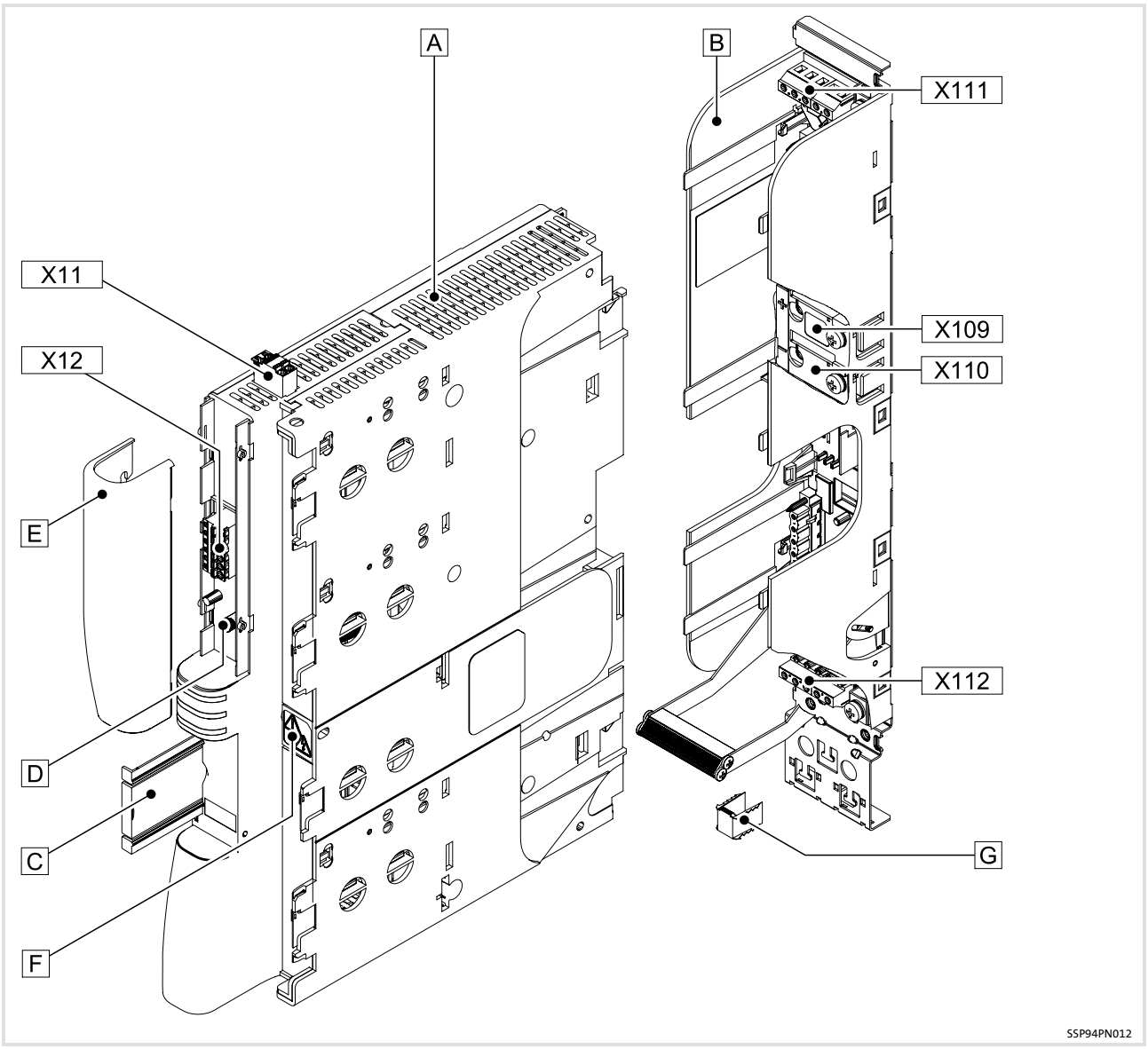
Compliance of EMC class C2 may also be interfered with by other factors:

- ► Distribution of axis modules over several control cabinets
- ► No use of Lenze system cables or cables with the same specifications
- ► Poor connection of motor cable shields
- ► Motor cable interruptions
- ► Other interference sources (e.g. switched-mode power supplies)
- ► Synchronous switching of limit switches

6.4 Device description

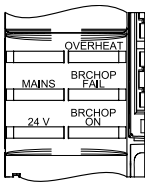
This page remains blank to give you a clearly arranged overview of the following subject on the next double page.

6.4.1 Devices in the range 10 ... 36 A (4 ... 18 kW)



Standard device A	
Pos.	**Description**
X11	24 V supply
X12	4 digital outputs
	1 digital input
C	Nameplate, retractable
D	Setting of mains voltage/brake chopper threshold
E	Upper cap

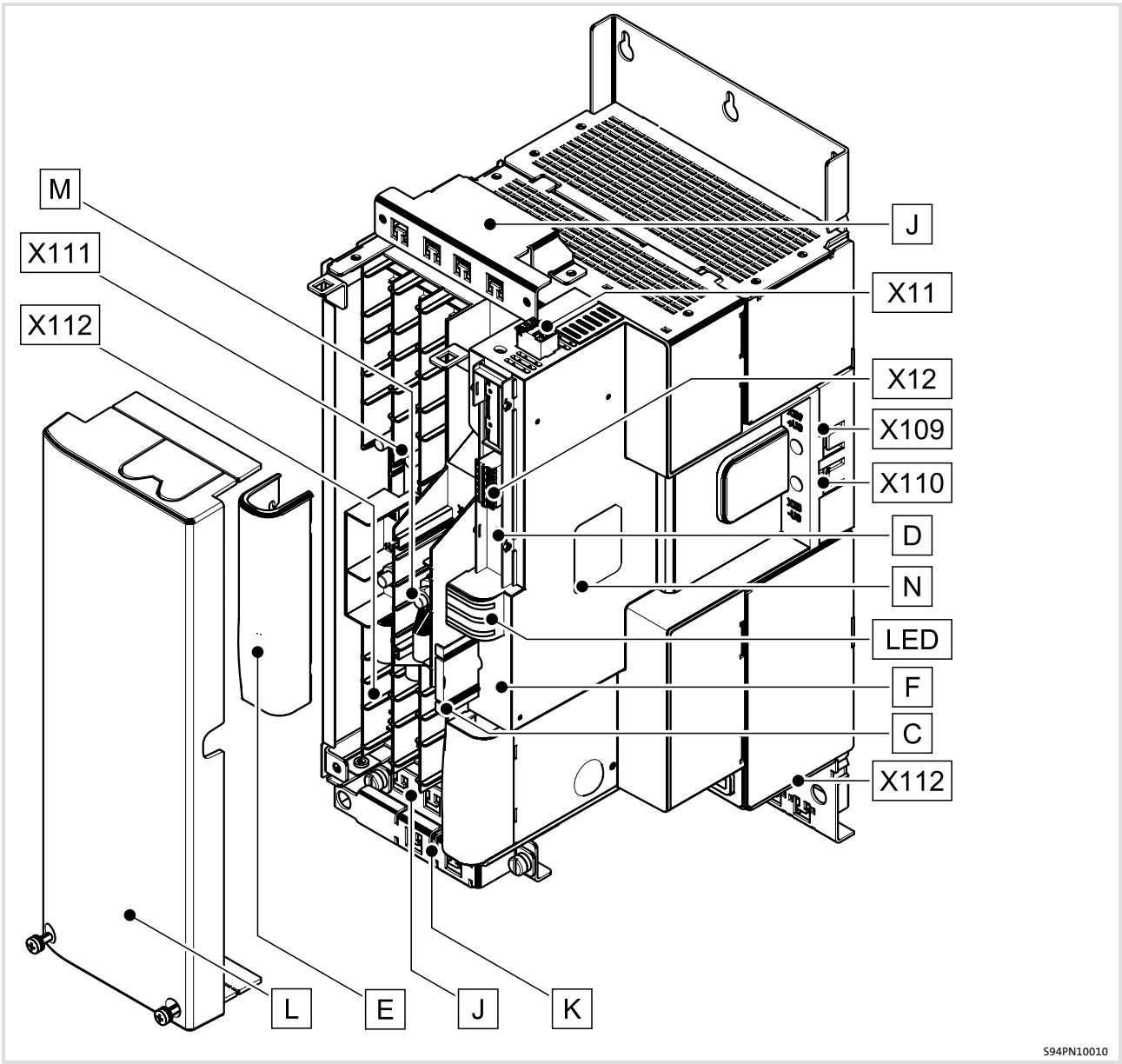
The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED21	-	-	-
	OVERHEAT	Red	Overtemperature
	MAINS	Green	Mains voltage OK
	BRCHOP FAIL	Red	Short circuit on brake chopper
	24 V	Green	24 V supply voltage OK
	BRCHOP ON	Yellow	Brake chopper active

Pos.	Symbol	Description
F		**Long discharge time**: All power terminals carry hazardous voltages for at least 3 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, personnel must ensure that they are free of electrostatic charge!

Installation backplane B		
Pos.	**Description**	
X111	Mains (supply from above, e.g. from top filters)	
	DC-bus voltage (compatible with 9300 series)	
X112	Mains (supply from below, e.g. from built-on filter)	
	External brake resistor	
X109	DC-bus busbar +	Direct connection of 9400 axis modules, device sizes 1 ... 3
X110	DC busbar -	
G	EMC shield clamp	

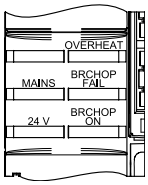
6.4.2 Devices in the range 100 ... 245 A (48 ... 119 kW)



Pos.	Description
X11	External 24 V supply
X12	4 digital outputs
	1 digital input
C	Nameplate, retractable
D	Setting of mains voltage/brake chopper threshold
E	Upper cap
J	Cable fixation for L1 ... L3, ⏚, also serves as a lifting aid, at the top and bottom, can be removed
K	Cable fixation for +UG/-UG, can be mounted at the top and bottom
L	Module front with removable cable opening covers
M	Cable connection +UG/-UG (also specified as part of X111 or X112)
N	Nameplate 2

Pos.	Description (connections)	
X111	Mains (supply from above, e.g. through top-mounted filter)	For cables being routed upwards
	DC-bus voltage (compatible to 9300 series)	
X112	Mains (supply from below, e.g. through side-mounted filter)	For cables being routed downwards
	External brake resistor	
	DC bus	
X109	DC busbar +	Direct connection of 9400 series axis modules, device size 1 ... 3
X110	DC busbar -	

The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED21	-	-	-
	OVERHEAT	Red	Overtemperature
	MAINS	Green	Mains voltage OK
	BRCHOP FAIL	Red	Short circuit on brake chopper
	24 V	Green	24 V supply voltage OK
	BRCHOP ON	Yellow	Brake chopper active

Pos.	Symbol	Description
F		**Long discharge time**: All power terminals carry hazardous voltages for at least 3 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, personnel must ensure that they are free of electrostatic charge!

6.5 Mechanical installation

6.5.1 Important notes

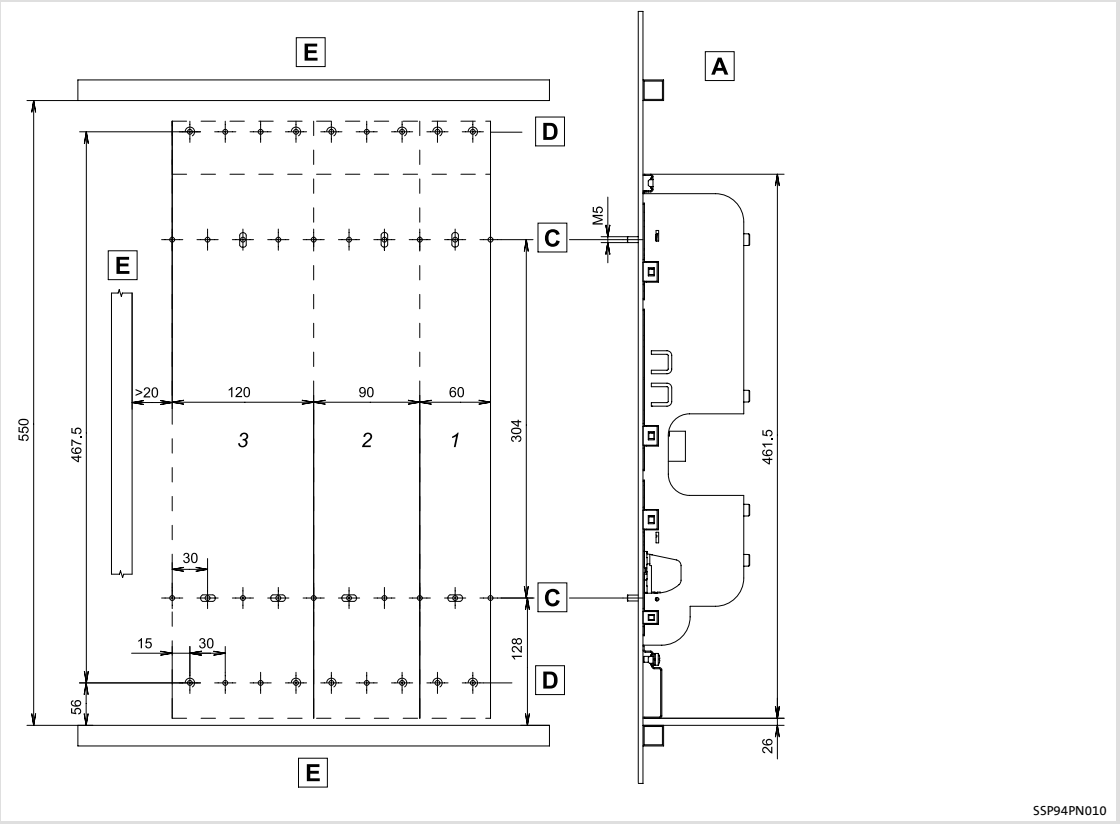
Note!

The devices must be installed in housings (e.g. control cabinets) to meet applicable regulations.

6.5.2 Devices in the range 10 ... 36 A (4 ... 18 kW)

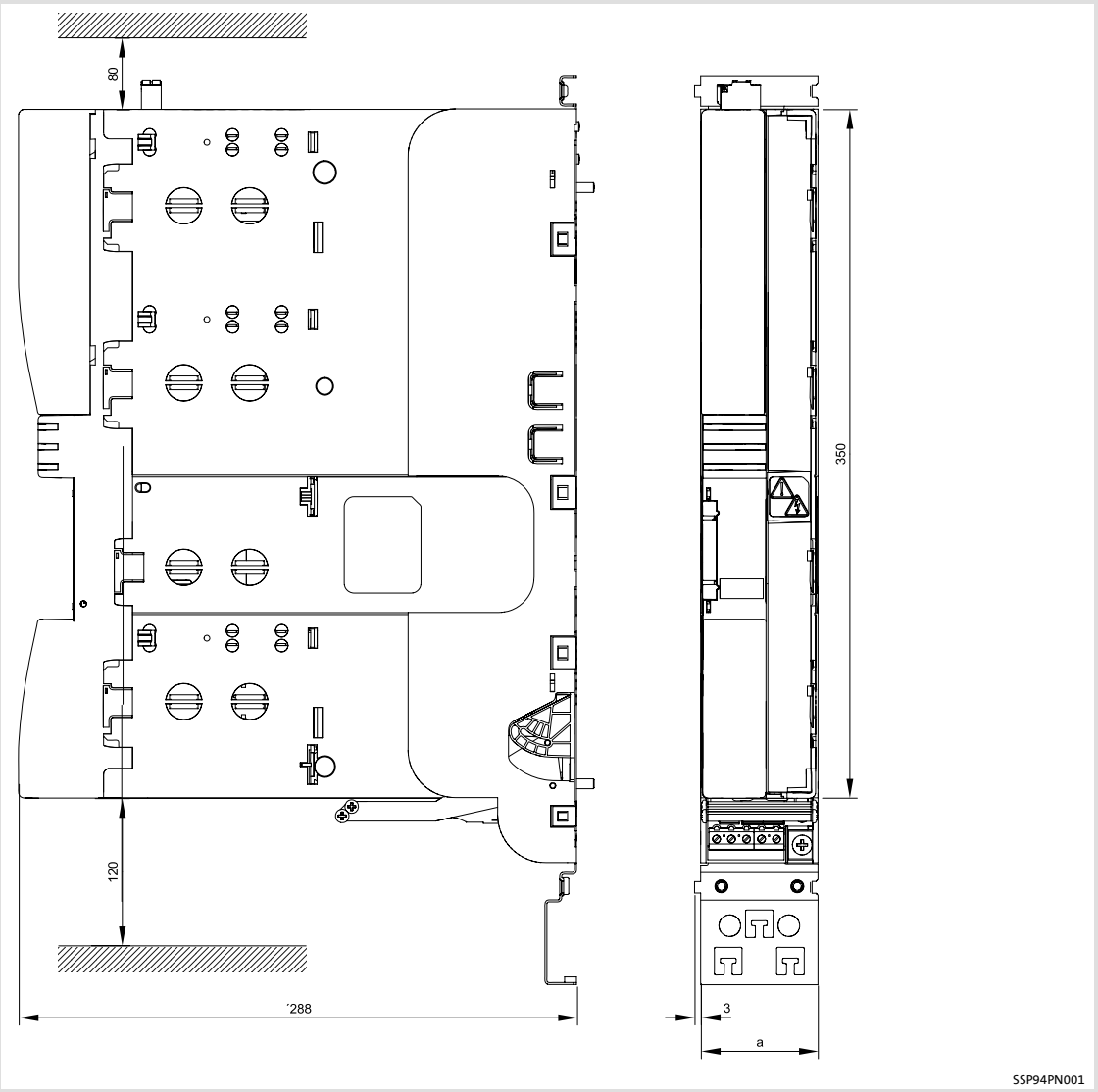
Mounting grid

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices, and the device sizes 1, 2, ... n can thus be mounted directly adjacent to each other.



A Mounting with backplane for attaching the power supply module
C Grid hole pattern for installation backplane
D Grid hole pattern for other device sizes or built-on/footprint filters (only Single Drive)
E Cable duct
1 ... 3 Device size, mounting holes used

Standard device with installation backplane



Type		Dimensions a	Weight
Power supply module	**Installation backplane**	[mm]	[kg]
E94APNE0104	E94AZPP0104	60	2.6
E94APNE0364	E94AZPP0364	120	5.3

Arrangement of the devices

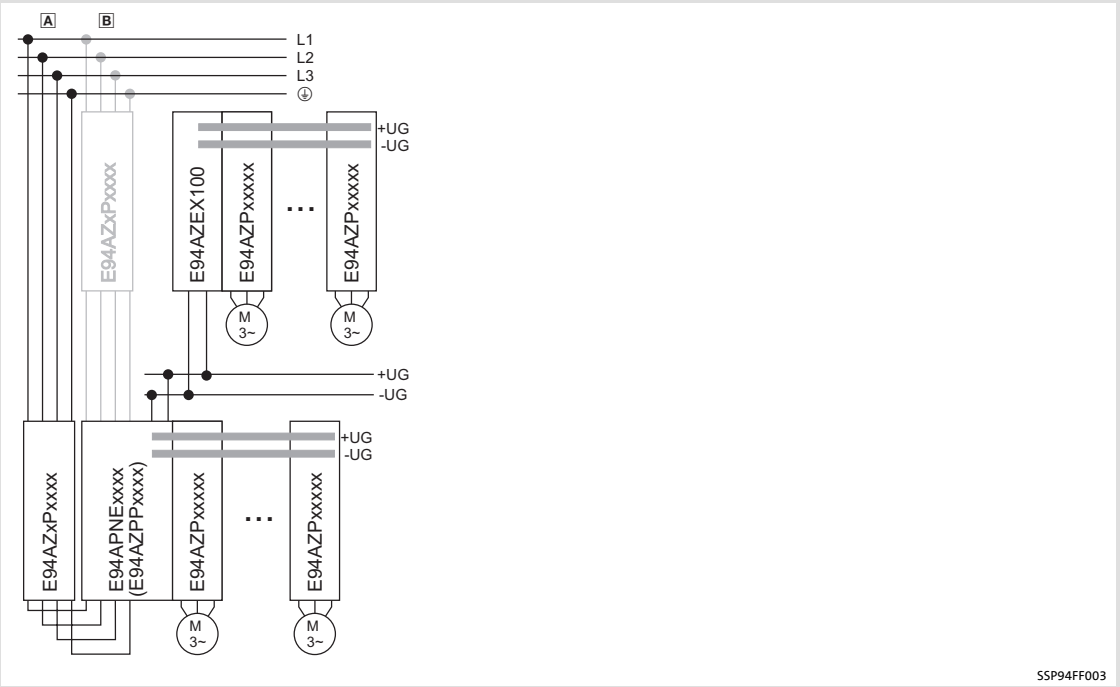


Fig. 6-3 Arrangement concept

A	Standard mounting: side mounting
B	Mounting variant: top mounting
E94AZxPxxxx	Filter
E94APNExxxx	9400 DC power supply module
	(up to 36 A/18 kW with E94AZPPxxxx installation backplane)
E94AZEX100	DC input module
E94AZPxxxxx	Installation backplane for 9400 axis module

A DC-bus connection has to be planned and dimensioned taking the technical data into account.

How to arrange the devices via the DC busbars for operation in the DC-bus connection:

- ► Arrange the devices in a row from left to right.
- ► Install the supplying device on the left:
  - – DC power supply module (in a first row),
  - – DC input module (in the following rows).
- ► Install the multi drive axis controllers to the right from the highest to the lowest power (recommendation).
- ► For increasing the braking power also single drive axis controllers can be integrated. For this purpose these axis controllers have to be equipped with the optional busbar mounting set (E94AZJAxxx).

Note!

If the first axis module is not connected to the DC busbar, the cable between power supply module and axis module must not be longer than 5 m.

Installation steps

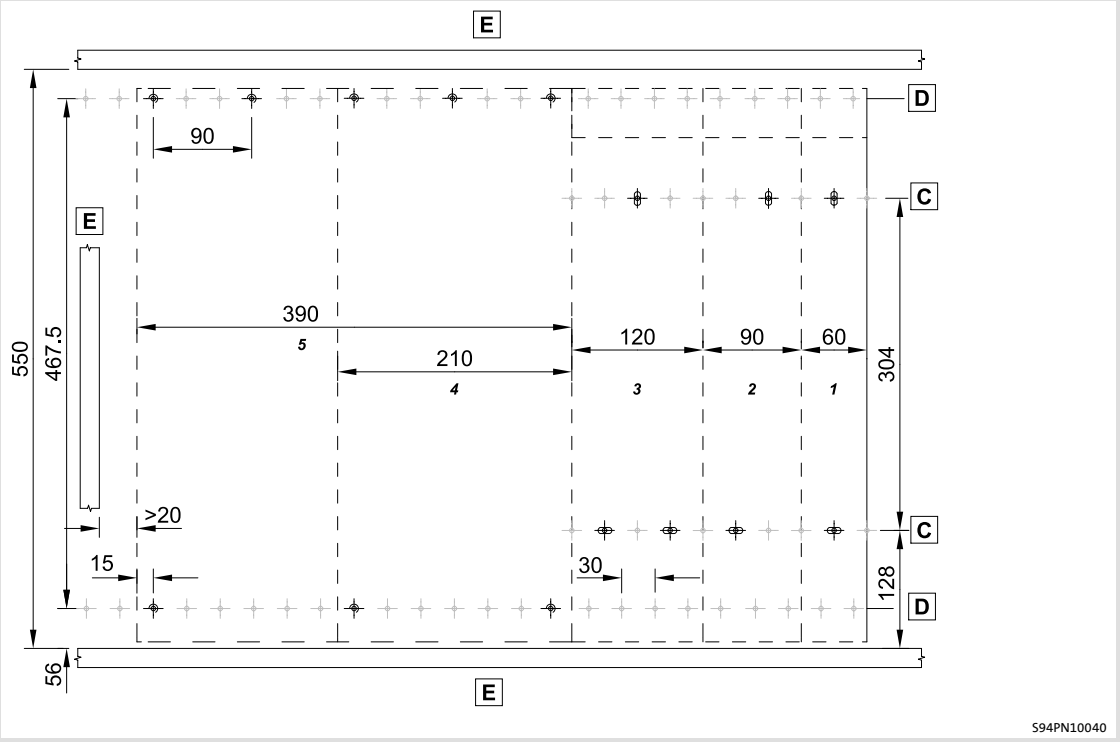
Proceed as follows for the installation:

1. Prepare M5 threaded holes on the mounting plate according to the mounting grid.
2. Screw the installation backplane onto the mounting plate. Do not yet tighten the screws.
   – Use M5 screw and washer assemblies or M5 hexagon socket screws with washers.
   – The screw joint in the installation backplane may not jut out more than 7 mm.
3. Repeat step 2 for other installation backplanes, which can be mounted directly adjacent to one another.
4. Align all installation backplanes.
5. If busbars are used: connect the busbars.
6. Tightly screw all installation backplanes onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

6.5.3 Devices in the range 100 ... 245 A (48 ... 119 kW)

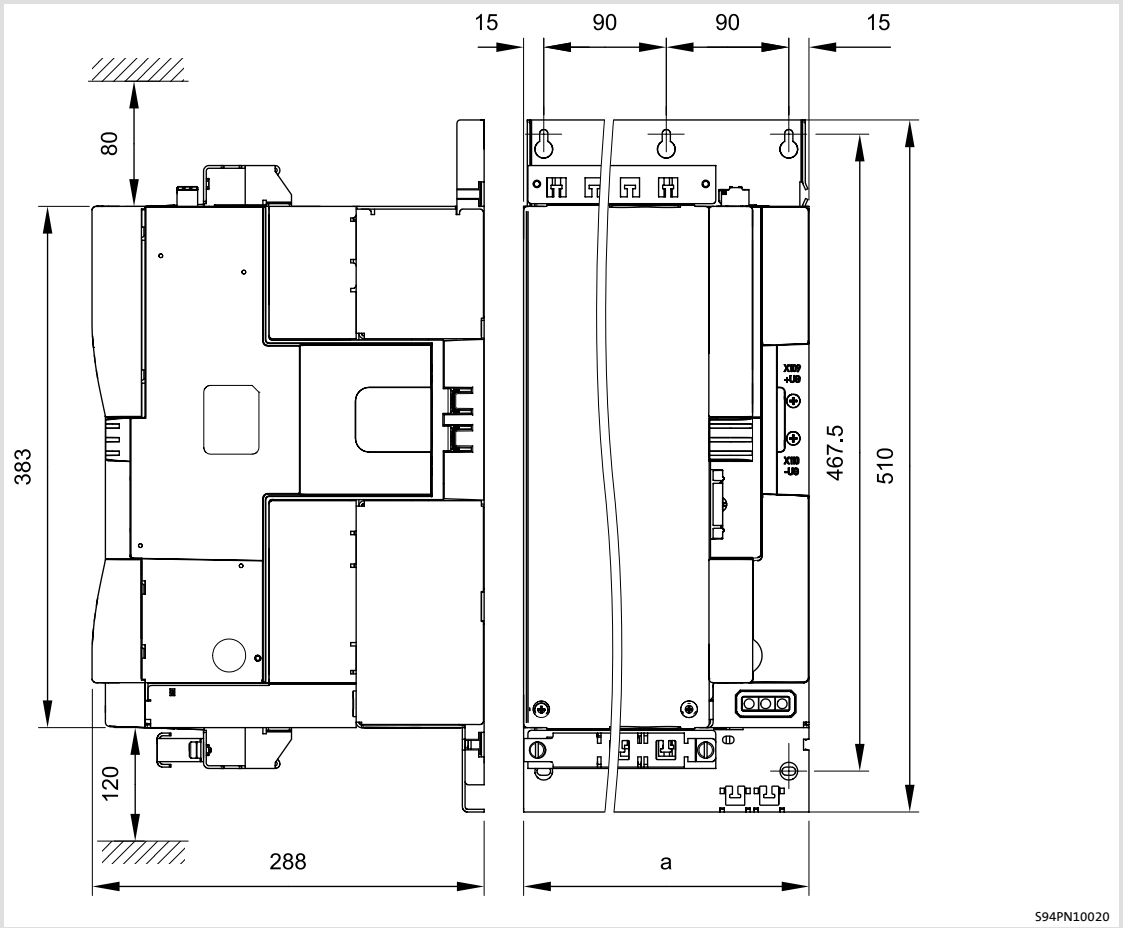
Mounting grid

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices, and the device sizes 1, 2, ... n can thus be mounted directly adjacent to each other.



C Grid hole pattern for installation backplane
D Grid hole pattern for other device sizes or filters mounted below or beside the device (only for Single Drive)
E Cable duct
1 ... *5* Device size, mounting holes used

Dimensions



Type Power supply module	Dimension a [mm]	Mass [kg]	Device size
E94APNE1004	210	13.5	4
E94APNE2454	390	28.5	5

Arrangement of the devices

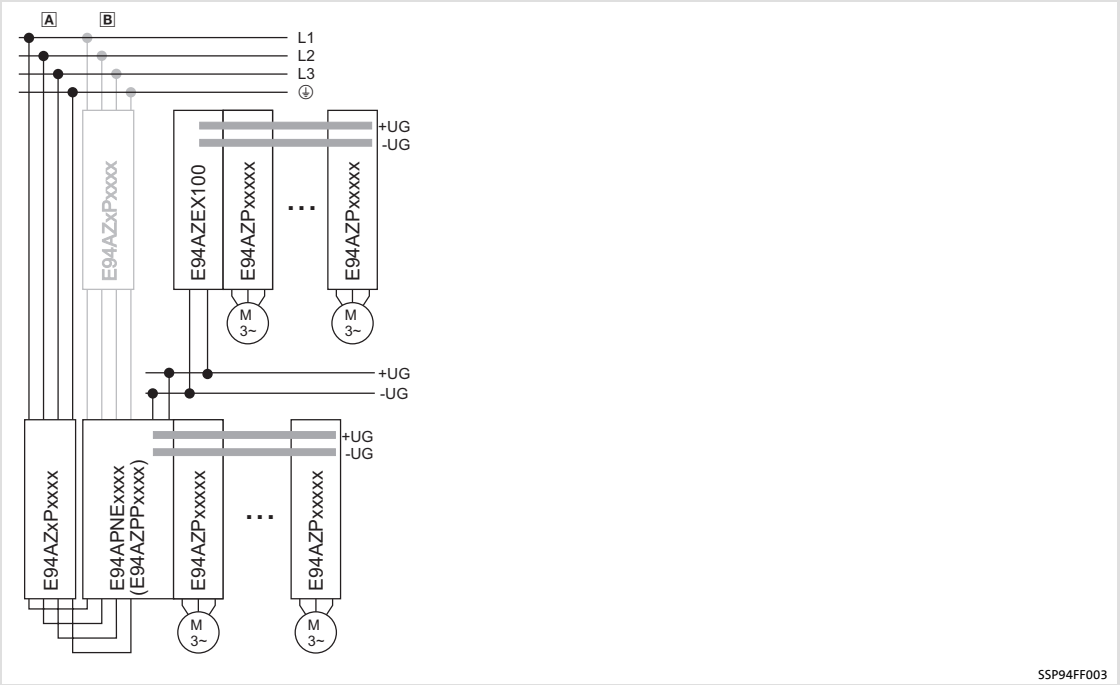


Fig. 6-4 Arrangement concept

A	Standard mounting: side mounting
B	Mounting variant: top mounting
E94AZxPxxxx	Filter
E94APNExxxx	9400 DC power supply module (up to 36 A/18 kW with E94AZPPxxxx installation backplane)
E94AZEX100	DC input module
E94AZPxxxxx	Installation backplane for 9400 axis module

A DC-bus connection has to be planned and dimensioned taking the technical data into account.

How to arrange the devices via the DC busbars for operation in the DC-bus connection:

- ► Arrange the devices in a row from left to right.
- ► Install the supplying device on the left:
  – DC power supply module (in a first row),
  – DC input module (in the following rows).
- ► Install the multi drive axis controllers to the right from the highest to the lowest power (recommendation).
- ► For increasing the braking power also single drive axis controllers can be integrated. For this purpose these axis controllers have to be equipped with the optional busbar mounting set (E94AZJAxxx).

Installation steps

Proceed as follows for the installation:

1. Prepare M5 threaded holes on the mounting plate according to the mounting grid.
   – Always use all mounting points specified.
2. Screw the device onto the mounting plate. Do not yet tighten the screws.
   – Use M5 screw and washer assemblies or M5 hexagon socket screws with washers.
3. Repeat step 2 for installation backplanes, which can be mounted directly adjacent to one another.
4. Align all devices and installation backplanes.
5. If busbars are used: connect the busbars.
6. Tightly screw all devices and installation backplanes onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

6.6 Wiring

6.6.1 Important notes

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
– Fixed installation
– PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

6.6.2 Safety notes for the installation according to U_L or U_R

E94APNE0104/E94APNE0364

Warnings!

- ► Maximum surrounding air temperature: 55 °C.
- ► For use in a pollution degree 2 environment.
- ► Branch circuit protection:

  Suitable for use on a circuit capable of delivering not more than 5000 rms symetrical amperes, 500 V max.
- ► Voltage of the fuses must at least be suitable with the input voltage of the drive.
- ► Use 60/75 °C copper wire only, except for control circuits.

	Branch circuit protection
Type	Fuse [A]
E94APNE0104	15
E94APNE0364	40

E94APNE1004/E94APNE2454

Warnings!

- ► Maximum surrounding air temperature: 55 °C.
- ► For use in a pollution degree 2 environment.
- ► Branch circuit protection:

  Suitable for use on a circuit capable of delivering not more than 18000 rms symetrical amperes, 500 V max., when protected by H or K5 fuses.
- ► Voltage of the fuses must at least be suitable with the input voltage of the drive.
- ► E94APNE1004: Use 60/75 °C copper wire only, except for control circuits.
- ► E94APNE2454: Use 75 °C copper wire only, except for control circuits.

	Branch circuit protection
Type	Fuse [A]
E94APNE1004	100
E94APNE2454	250

6.6.3 Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- External brake resistor (Mounting Instructions of the brake resistor)

The following connections need not be shielded:

- Mains

6.6.4 Earthing of internal EMC filters

Device-internal EMC filters have been implemented to reduce interference emission. These EMC filters are connected to protective earth to discharge interference currents.

Under certain conditions the EMC filters must be disconnected from:

- Operation in an IT system
  The devices are protected from damages or destruction due to incompatible overvoltages in the case of an error (earth fault).
- DC-bus operation
- Operation with power supply modules or regenerative power supply modules
- Operating multiple devices with a common filter
  The EMC properties can only be reached by carrying out the described measures.
  The triggering behaviour of applicable earth-leakage circuit breakers remains undisturbed.

Overview of the measures

The measures can be carried out easily. They are prepared device-dependently, and their mounting and wiring are described.

Device	Measure
Controller	
With installation backplane (GG1 ... GG3)	Plug/unplug the plastic cap
Without installation backplane (GG6 ... GG7)	Change the screwed connection
Without installation backplane (GG8S ... GG10)	Activate the switch
Power supply modules	
With installation backplane (GG1 und GG3)	Plug/unplug the plastic cap
Without installation backplane (GG4 ... GG5)	---
Regenerative power supply module	
With installation backplane (GG3)	Plug/unplug the plastic cap
Suitable mains filter	Change the screwed connection

Implementing the measures

Proceed as follows to disconnect the internal connection between the filters and PE:

1. Remove IT insulating cap from the parking position ① in the installation backplane.
   – For this apply a screwdriver on the right or left and lever off the insulating cap.
   – Optionally the insulating cap can be carefully removed using an appropriate pliers.
2. Attach IT insulating cap to the earthing jumper ② until it clicks into place.

Fig. 6-5 Plugging the IT insulating cap onto the earthing jumper

6.6.5 Devices in the range 10 ... 36 A (4 ... 18 kW)

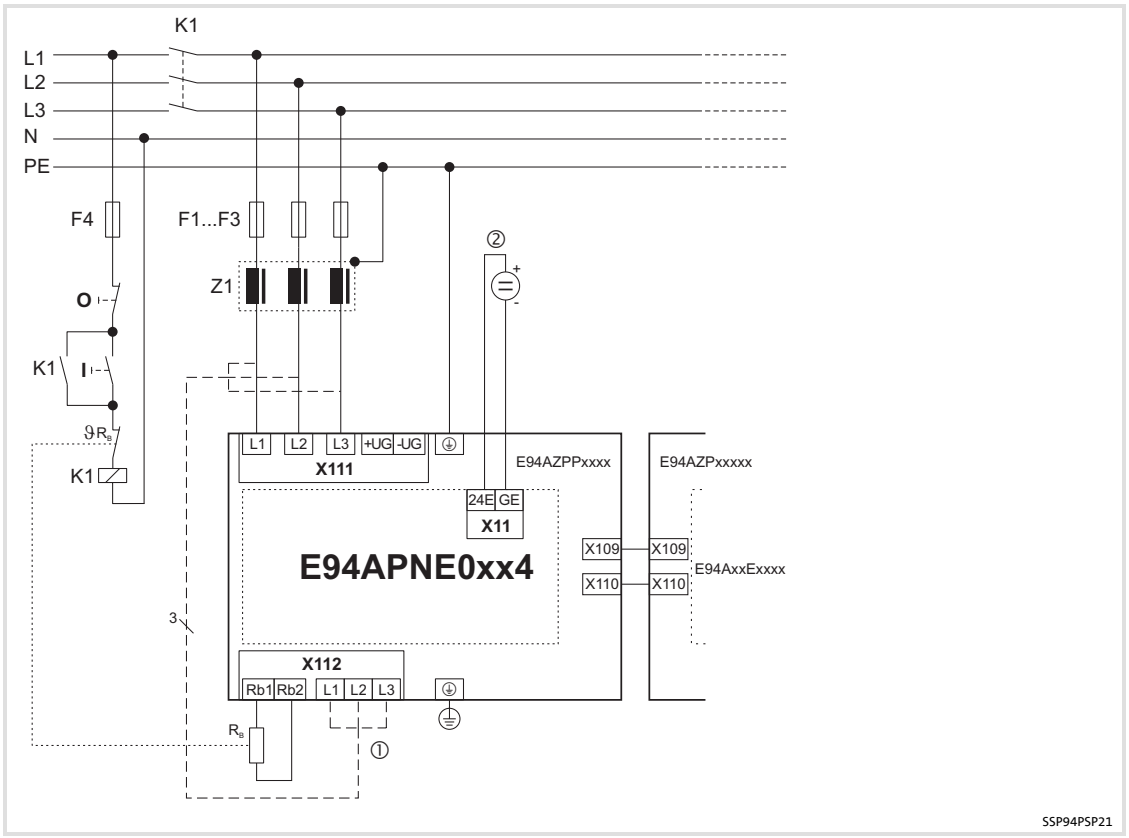


Fig. 6-6 Example circuit for installation backplane and DC power supply module

E94APNExxx4	9400 DC power supply module
E94AZPxxxxx	Installation backplane
E94AxxExxxx	9400 axis module
E94AZEX100	DC input module
F1 ... Fx	Fuses
Z1	Mains filter/RFI filter (optional)
K1	Mains contactor
RB	Brake resistor
①	Alternative: mains connection at the bottom
②	24 V supply voltage for control electronics according to IEC 61131-2

Tip!

Complete the wiring of the installation backplane before plugging in the standard device. The upper terminals of the installation backplane cannot be connected with a plugged-in standard device.

6.6.6 Connecting busbars

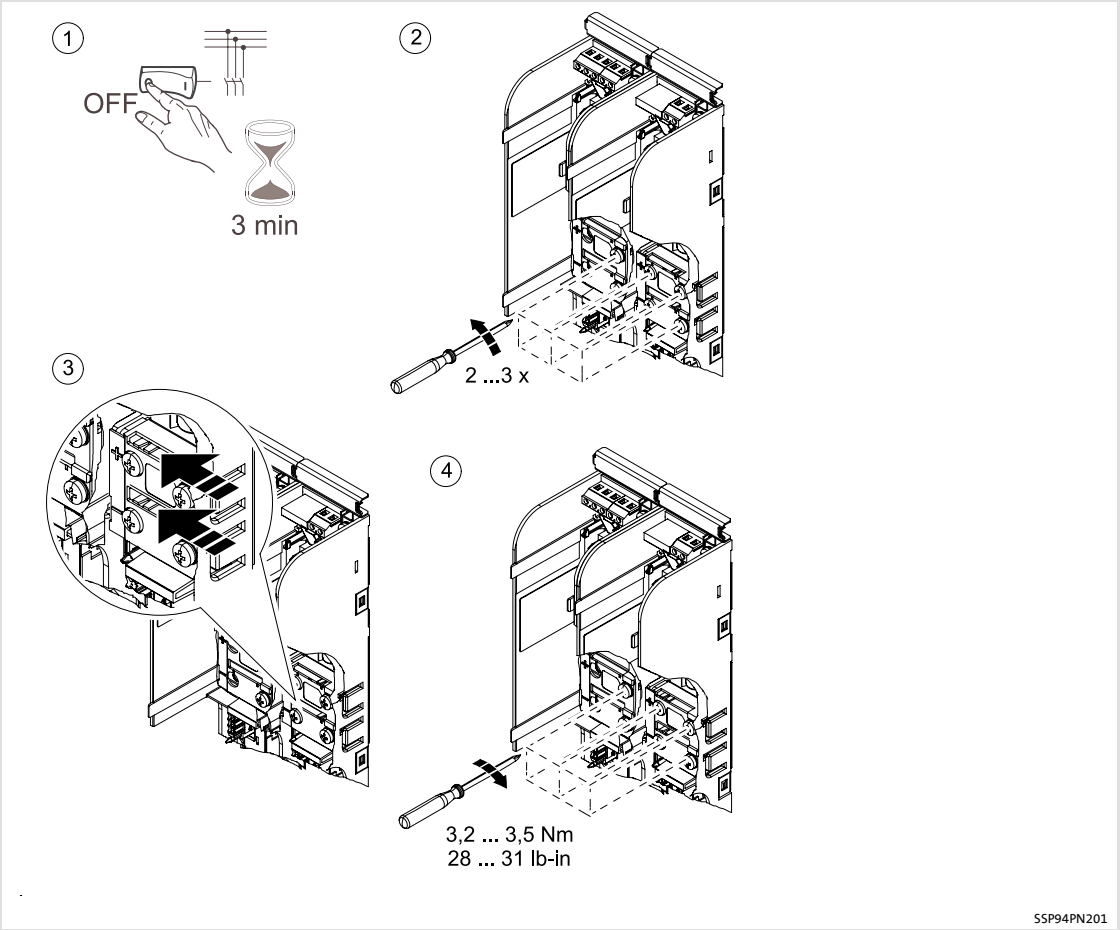


Fig. 6-7 Example: connecting busbars to DC power supply module

Proceed as follows to connect the busbars:

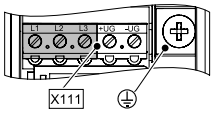
1. If devices of the interconnected system have already been in operation:
   – Ensure that the power supply system is switched off by checking the voltage at the supply terminals.
   – If necessary, switch off the power supply and wait at least 3 minutes.
2. Loosen the busbar screws but do not remove them completely.
3. Push the busbars as far as possible to the left towards the adjacent busbar.
   – Ensure that there is good contact to the adjacent busbar.
4. Tighten the busbar screws.
   – Tightening torque: 3.2 ... 3.5 Nm (28 ... 31 lb-in).
5. Screw all components onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

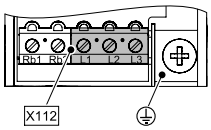
6.6.7 Terminal assignment

Tip!

Complete the wiring of the installation backplane before plugging in the standard device. The upper terminals of the installation backplane cannot be connected with a plugged-in standard device.

Mains

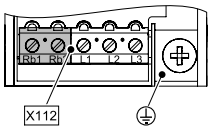
Terminal X111 (left part)	Labelling	Description
 SSP940X111	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

Terminal X112 (right part)	Labelling	Description
 SSP940X112	L1 L2 L3	Alternative connection at the bottom: mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

Terminal data

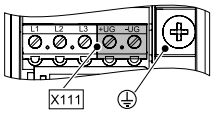
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1 + 2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with/without wire end ferrule	10/16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

External brake resistor

Terminal X112 (left part)	Labelling	Description
 SSP940X112	Rb1 Rb2	External brake resistor

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1 + 2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with/without wire end ferrule	10/16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

DC bus

Terminal X111 (right part)	Labelling	Description
 SSP940X111	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series) E94ARNE0244: maximum current I_{dc} = 50 A

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device sizes 1 + 2: flexible with wire end ferrule	2.5	12	0.5 ... 0.6	4.5 ... 6.2	PZ0
Device size 3: flexible with/without wire end ferrule	10/16	6	1.2 ... 1.5	10.6 ... 13.3	PH1

6.6.8 Devices in the range 100 ... 245 A (48 ... 119 kW)

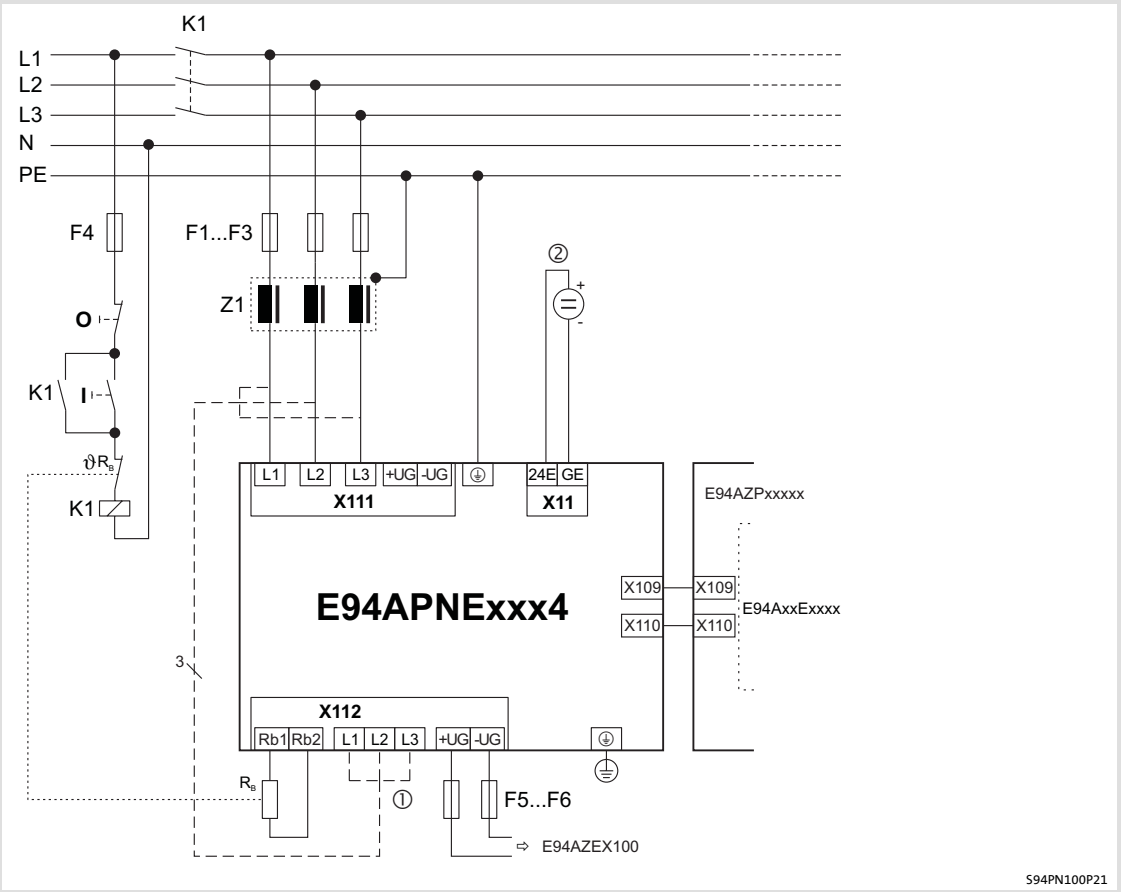


Fig. 6-8 Connection concept

E94APNExxx4	9400 DC power supply module
E94AZPxxxxx	Installation backplane
E94AxxExxxx	9400 axis module
E94AZEX100	DC input module
F1 ... Fx	Fuses
Z1	Mains filter/RFI filter (optional)
K1	Mains contactor
RB	Brake resistor
①	Alternative: mains connection at the bottom
②	24 V supply voltage for control electronics according to IEC 61131-2

6.6.9 Connecting busbars

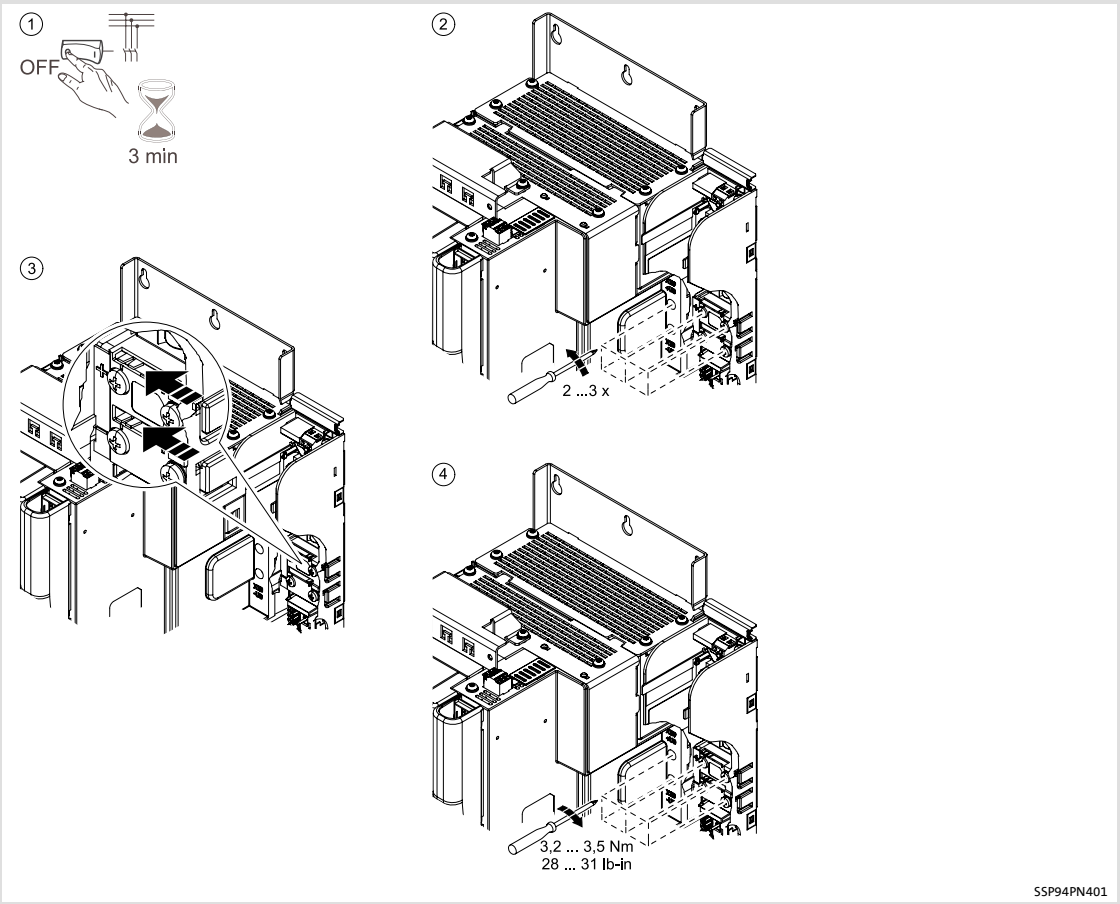


Fig. 6-9 Example: connecting busbars to DC power supply module

Proceed as follows to connect the busbars:

1. If devices of the interconnected system have already been in operation:
   – Ensure that the power supply system is switched off by checking the voltage at the supply terminals.
   – If necessary, switch off the power supply and wait at least 3 minutes.
2. Loosen the busbar screws but do not remove them completely.
3. Push the busbars as far as possible to the left towards the adjacent busbar.
   – Ensure that there is good contact to the adjacent busbar.
4. Tighten the busbar screws.
   – Tightening torque: 3.2 ... 3.5 Nm (28 ... 31 lb-in).
5. Screw all components onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

6.6.10 Terminal assignment

The wiring area of the power terminals is designed for the cables being routed upwards and/or downwards. Usually the AC mains cables come from above. When filters are used, the connection cables are fed from below (for filters mounted beside the module) or from above (for filters mounted above the module). The protection against contact in the cover can be removed accordingly.

To improve the cable handling, the cable cross-section can also be divided onto two cables.

The ring cable lugs used must not exceed the dimensions specified here.

- E94APNE1004 (device size 4, connection M8): max. cable lug width 20 mm
- E94APNE2454 (device size 5, connection M10): max. cable lug width 33 mm

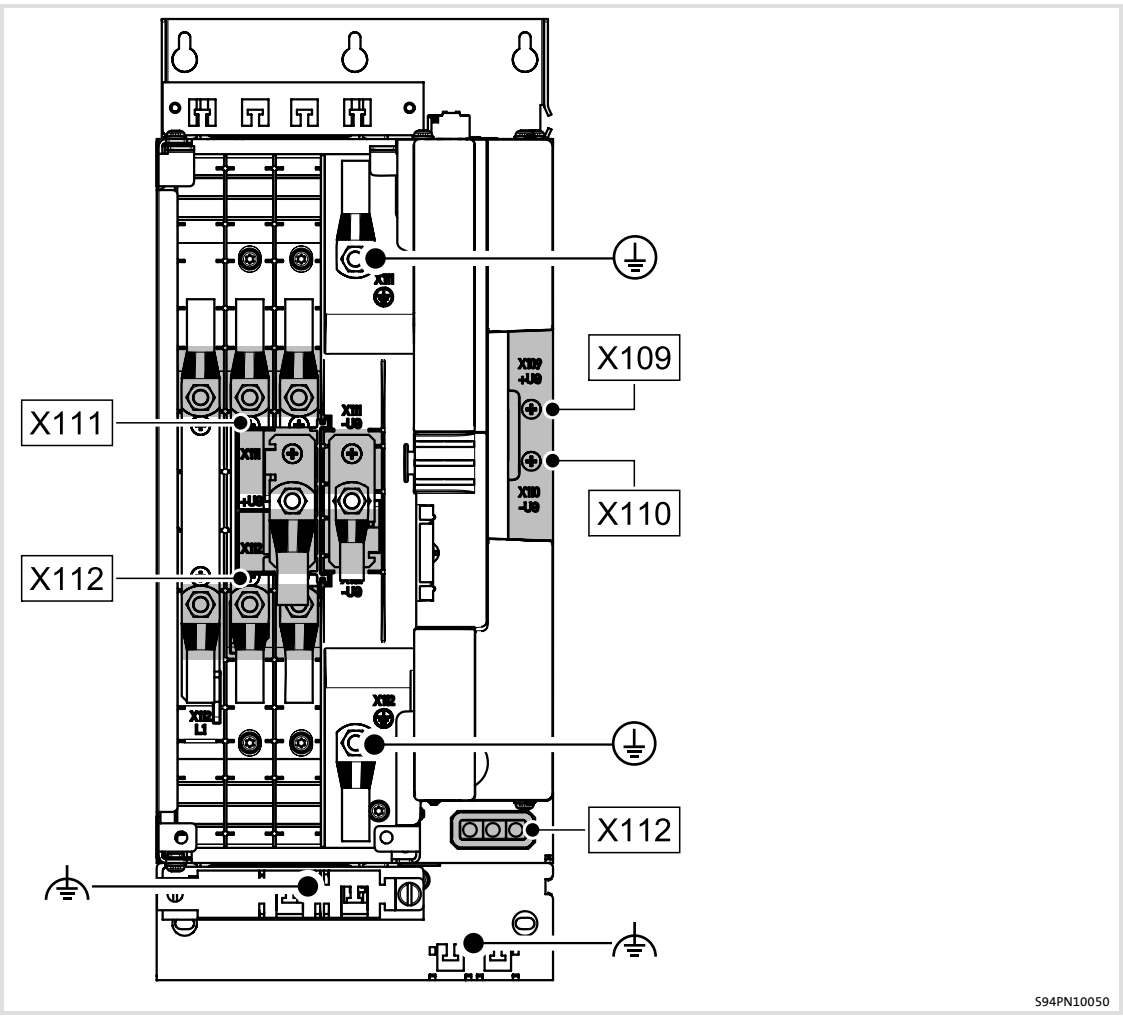


Fig. 6-10 Arrangement of the power connections

Mains

Terminal X111	Labelling	Description
🕮 Fig. 6-10	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor

Terminal X112	Labelling	Description
🕮 Fig. 6-10	L1 L2 L3	Alternative connection at the bottom: mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 4: Connection with ring cable lug M8	50 (2 x 25)	1/0 -	8	71	SW13
Device size 5: Connection with ring cable lug M10	120 (2 x 50)	4/0 (2 x 1/0)	15	133	SW15

DC bus

Terminal X111	Labelling	Description
🕮 Fig. 6-10	+UG -UG	Connection of DC-bus voltage Cables routed upwards

Terminal X112	Labelling	Description
🕮 Fig. 6-10	+UG -UG	Connection of DC-bus voltage Cables routed downwards

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 4: Connection with ring cable lug M8	70 (2 x 35)	2/0 -	8	71	SW13
Device size 5: Connection with ring cable lug M10	150 (2 x 70)	300 mcm (2 x 2/0)	15	133	SW15

External brake resistor

Terminal X112	Labelling	Description
🕮 Fig. 6-10	Rb1 Rb2	External brake resistor

Terminal data

	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 4: flexible with wire end ferrule	16	4	2.5 ... 3.0	22.2 ... 26.6	6 x 2
Device size 5: flexible with wire end ferrule	35	1	3.2 ... 3.7	28.4 ... 32.8	6 x 2

6.7 Control terminals

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

The following connections need not be shielded:

- 24 V supply
- Digital signals (inputs and outputs)

24 V supply

The devices can only function correctly when the 24-V supply is switched on!

E94APNE0104 and E94APNE0364:

Terminal X11	Labelling	Description
SSP9400X11	GE	GND external supply
	24E	24 V external supply through safely separated power supply unit (SELV/PELV) IEC 61131-2, 19.2 ... 28.8 V, residual ripple max. ±5 % Current during operation: 450 mA Starting current: 4 A for 100 ms

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Stripping length / contact length: 10 mm

E94APNE1004 and E94APNE2454:

Terminal X11	Labelling	Description
9400SSP000X2	GE	GND external supply
	24E	24 V external supply through safely separated power supply unit (SELV/PELV) IEC 61131-2, 19.2 ... 28.8 V, residual ripple max. ±5 % Current during operation: 1.4 A Starting current: 4 A for 100 ms
	SB	Reserved

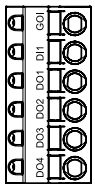
Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Stripping length / contact length: 10 mm

State bus

Power supply modules are not designed as nodes on the state bus of the controller.

Digital inputs, digital outputs

Terminal X12	Labelling	Description
 SSP9400X12	GOI	GND digital out/in
	DI1	External control of the brake chopper; its only purpose is to synchronise the brake choppers if a second power supply module is used.
	DO1	Mains OK
	DO2	Brake chopper active
	DO3	Short circuit in brake chopper
	DO4	Heatsink overtemperature

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Stripping length / contact length: 10 mm

Synchronisation

The device-internal brake chopper operates automatically and independently even if the control inputs are not wired.

Depending on the selected mains voltage, the brake resistor is connected if the DC-bus voltage is exceeded (e.g. due to excessive braking energy).

If the brake choppers of power supply modules in a DC-bus connection need to be synchronised, proceed as follows:

1. The 24-V supply of the control card (X11) must be independent of the mains voltage at the mains connection and switched on.
2. All power supply modules of the DC-bus connection must have the same brake chopper threshold (according to the mains).
3. The DO2 (X12) digital output of the master power supply module needs to be wired to the DI1 (X12) digital input of every other power supply module of the DC-bus connection. The GOI connections (X12) of all power supply modules of the DC-bus connection must be interconnected.

6.8 Final works

Danger!

Dangerous voltage!

Depending on the device, the DC-bus voltage is still charged for approx. 3 ... 20 min after switching off the mains voltage.

- ► The state of charge is not indicated!
- ► On synchronous motors self-discharge only starts after a possible feedback operation has been completed.
- ► Discharging the DC bus in a controlled manner via the brake chopper/brake resistor requires the external 24 V supply (🕮 digital input DI1).

Possible consequences:

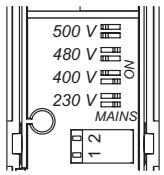
- ► Death or severe injuries when touching the terminals.

Protective measures:

- ► Before starting work on the system check that it is deenergised.
- ► Wait at least 3 minutes after switching off the mains voltage.
- ► Only remove deenergised standard devices from the installation backplanes and do not touch any terminals.

How to proceed:

- ► Adjust the setting for the mains voltage/brake chopper threshold to the mains

Setting of mains voltage/brake chopper threshold			2
Pos. D	U_{LN} [V]	U_{BRmax} [V]	1
	500	790	OFF OFF
	480	765	ON OFF
	400	725	OFF ON
	230	390	ON ON

- ► Switch on the 24 V supply
- ► Check the operating status by means of the LED display

If you want to continue commissioning:

- ► Switch on the mains

7 Regenerative power supply modules

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7.1 Device features

The most important device features at a glance:

- Regenerative power supply modules supply the DC buses of several controllers of a drive system with energy.
- Regenerative power supply modules feed braking energy back to the AC mains.
- Regenerative power supply modules with the assigned mains filter are the central AC mains connection within DC-bus operation.
- Regenerative power supply modules have an internal brake chopper and a terminal for a brake resistor.
- Regenerative power supply modules of the 9400 series are equipped with a busbar connection (max. 100 A) for the simple connection and side-by-side mounting of the 9400 controllers.
- Regenerative power supply modules generally supply controllers of the ”Multi Drive” version. However, also controllers of the ”Single Drive” version can be implemented in a DC-bus operation if the data and notes in the ”DC-bus operation” chapter are observed.
  - Required accessories (📖 313)
  - Set-up for operation on IT systems (📖 331)
- Regenerative power supply modules are designed as multi-range voltage units (230/400/480/500 V).
- There are two types of regenerative power supply modules:
  - **E94ARNE0134**,
    rated current: in motor mode 26 A, in generator mode 13 A,
    device size: 3,
    Design: compact basic device with installation backplane
  - **E94ARNE0244**,
    rated current: in motor mode 47 A, in generator mode 23.5 A,
    device size: 3,
    Design: compact basic device with installation backplane
- Regenerative power supply modules are assigned to specifically designed mains filters and can only be operated with them.
- Regenerative power supply modules and filters can be mounted in the mounting grid of the 9400 series.
- Regenerative power supply modules allow parallel supply. Your Lenze contact will be pleased to help you with the dimensioning.

7.2 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/95/EG	Low-Voltage Directive	
Approval			
UL	UL 508C	In preparation: Industrial Control Equipment, File No. 132659	

Mains data			
Mains types	With earthed Y point	Unrestricted use	The measures described for IT systems must be observed and carried out in all systems (TN, TT and IT) and for all interconnected modules (📖 294)!
	IT systems	Unrestricted use	
Noise emission	EN 61800-3	With E94AZMR0xx4**S**DB mains filter: 6 x 10 m, C2 With E94AZMR0xx4**L**DB mains filter: 10 x 50 m, C2	
		Radiation: category C3	
Noise immunity (according to requirements of EN 61800-3)			
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV for air discharge, 4 kV for contact discharge to housing	
Radio frequency			
Conducted	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80% AM (1kHz)	
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80% AM (1kHz)	

Protection of persons and device protection			
Enclosure	EN 60529	IP 20	Not in the wire range of the terminals on the motor side
	NEMA 250	Protection against contact to type 1	
Insulation resistance	EN 61800-5-1	Overvoltage category III Derating at and above 2000 m AMSL: overvoltage category II	
Isolation of control circuits	EN 61800-5-1	Safe mains isolation through double/reinforced insulation.	
Short-circuit strength	EN 61800-5-1	DC-bus connection: not short-circuit-proof Brake resistor connection: full Control connections: full	
Discharge current	EN 61800-5-1	> 3.5 mA	Observe regulations and safety instructions!
Cyclic mains switching		Cyclic mains switching of five times in five minutes is fully permissible.	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical	
Mounting clearances			
Above/below		≥ 80 mm / ≥ 120 mm	Observe the device-related notes on mounting.
To the sides		Side-by-side mounting without any clearance	

Supply conditions for the regenerative power supply module		
AC mains operation		Connection at the assigned mains filter
DC-bus operation		Direct connection of the axis modules via terminals or busbar systems See the chapter on DC-bus operation in the Hardware Manual for further information.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s^2 = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

7.3 Rated data (devices for 400/500V mains)

Note!

The operation of the regenerative power supply modules is only permissible with an assigned mains filter.

Assignment of filters to standard devices

Mains filter	Regenerative power supply module		Device size
	Standard device	Installation backplane	
E94AZMR0264SDB E94AZMR0264LDB	E94ARNE0134	E94AZPP0364	GG3
E94AZMR0474SDB E94AZMR0474LDB	E94ARNE0244		

E94AZMR0xx**SD**B -> "**s**hort **d**istance" E94AZMR0xx**LD**B -> "**l**ong **d**istance"

General data

Type	Power loss P_V [W]	
	Total (when operating with I_{aN})	Constant (control electronics only)
E94ARNE0134	150	40
E94ARNE0244	230	40

	Power loss	Inductance	Regenerative inductance	Voltage drop
	P_V [W]	L [mH]	L_{gen} [mH]	ΔU [V]
E94AZMR0264SDB	65	0.77 ±10 %	0.84 ±10 %	6.3
E94AZMR0264LDB	72			
E94AZMR0474SDB	85	0.42 ±10 %	1.54 ±10 %	6.2
E94AZMR0474LDB	101			

7.3.1 Operation at rated mains voltage 230 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65

Input data (on the supply side)

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94ARNE0134					
In motor mode	230	50/60	26	19.5	3
In generator mode	230	50/60	13	9.8	3
E94ARNE0244					
In motor mode	230	50/60	47	35	3
In generator mode	230	50/60	23.5	17.6	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94ARNE0134		
In motor mode	230	10.3
In generator mode	230	5.2
E94ARNE0244		
In motor mode	230	18.7
In generator mode	230	9.4

Output data (on the DC side)

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-

	Voltage [V]	Frequency [Hz]	Current [A]		Number of phases
			max. +45 °C ①	max. +55 °C ①	
E94ARNE0134					
In motor mode	325	0 (DC)	32	24	2
In generator mode	345	0 (DC)	16	12	2
E94ARNE0244					
In motor mode	325	0 (DC)	57	43	2
In generator mode	345	0 (DC)	28.5	21.4	2

① Temperature in the control cabinet

	Output current and output power					
	100 %		5-s cycle		3-min cycle	
Type	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94ARNE0134						
In motor mode	32	8.6	96	25.8	48	12.9
In generator mode	16	4.3	48	12.9	24	6.4
E94ARNE0244						
In motor mode	57	15.6	171	46.6	86	23.3
In generator mode	28.5	7.8	87	23.3	44	11.6

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Switching threshold U_{BRmax}: 345 V

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ARNE0134	18.0	19.2	6.6	9.4	1.6	150	15	15
E94ARNE0244	9.0	38.3	13.2	21.7	4.2	150	15	15

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

7.3.2 Operation at rated mains voltage 400 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65

Input data (on the supply side)

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94ARNE0134					
In motor mode	400	50/60	26	19.5	3
In generator mode	400	50/60	13	9.8	3
E94ARNE0244					
In motor mode	400	50/60	47	35	3
In generator mode	400	50/60	23.5	17.6	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94ARNE0134		
In motor mode	400	18.0
In generator mode	400	9.0
E94ARNE0244		
In motor mode	400	32.5
In generator mode	400	16.3

Output data (on the DC side)

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	565	455 - 0 % ... 620 + 0 %	-

	Voltage [V]	Frequency [Hz]	Current [A]		Number of phases
			max. +45 °C ①	max. +55 °C ①	
E94ARNE0134					
In motor mode	565	0 (DC)	32	24	2
In generator mode	565	0 (DC)	16	12	2
E94ARNE0244					
In motor mode	565	0 (DC)	57	43	2
In generator mode	565	0 (DC)	28.5	21.4	2

① Temperature in the control cabinet

	Output current and output power					
	100 %		5-s cycle		3-min cycle	
Type	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94ARNE0134						
In motor mode	32	15	96	44.9	48	22.4
In generator mode	16	7.5	48	22.4	24	11.2
E94ARNE0244						
In motor mode	57	27	171	81.1	86	40.5
In generator mode	28.5	13.5	87	40.5	44	20.2

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Switching threshold U_{BRmax}: 586 V

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ARNE0134	27.0	21.7	12.7	10.6	3.0	150	15	15
E94ARNE0244	18.0	32.6	19.1	18.4	6.1	150	15	15

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

7.3.3 Operation at a rated mains voltage of 500 V

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

Input data (on the supply side)

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94ARNE0134					
In motor mode	500	50/60	26	19.5	3
In generator mode	500	50/60	13	9.8	3
E94ARNE0244					
In motor mode	500	50/60	47	35	3
In generator mode	500	50/60	23.5	17.6	3

① Temperature in the control cabinet

Type	Voltage [V]	Continuous input power S_L [kVA]
E94ARNE0134		
In motor mode	500	22.5
In generator mode	500	11.2
E94ARNE0244		
In motor mode	500	40.7
In generator mode	500	20.3

Output data (on the DC side)

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	705	565 - 0 % ... 775 + 0 %	-

	Voltage [V]	Frequency [Hz]	Current [A]		Number of phases
			max. +45 °C ①	max. +55 °C ①	
E94ARNE0134					
In motor mode	705	0 (DC)	32	24	2
In generator mode	705	0 (DC)	16	12	2
E94ARNE0244					
In motor mode	705	0 (DC)	57	43	2
In generator mode	705	0 (DC)	28.5	21.4	2

① Temperature in the control cabinet

	Output current and output power					
	100 %		5-s cycle		3-min cycle	
Type	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]	I_{DC} [A]	P_{DC} [kW]
E94ARNE0134						
In motor mode	32	18.6	96	56.1	48	28
In generator mode	16	9.3	48	28.0	24	14
E94ARNE0244						
In motor mode	57	33.8	171	101.4	86	50.7
In generator mode	28.5	16.9	87	50.6	44	25.3

100 %	Permanent rated values
5-s cycle	Cycle for the second-range (0.5 s overload/4.5 s recovery time with 75 % of the permanent rated value)
3-min cycle	Cycle for the minute-range (60 s overload/120 s recovery time with 75 % of the permanent rated value)

Internal brake chopper data

Switching threshold U_{BRmax}: 727 V

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
E94ARNE0134	27.0	26.9	19.6	13.2	4.7	150	15	15
E94ARNE0244	18.0	40.4	29.4	22.9	9.4	150	15	15

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time

7.3.4 Regenerative feedback with brake chopper

Operation in motor mode

The regenerative power supply modules provide the energy for the DC bus from which the axis controllers are supplied. If the peak voltage of the mains is higher than the peak voltage of the DC bus, a current flows from the mains via the DC-bus into the DC-bus connection.

Operation in generator mode

When drives are decelerated, the excessive energy is fed into the DC bus via the controllers. The DC-bus voltage rises.

Regenerative feedback

If the DC-bus voltage exceeds the peak value of the mains voltage, the regenerative feedback is activated.

Up to the maximum regenerative power P_{Mmax}, the controller can dissipate the energy into the mains. If the regenerative energy and, accordingly, the DC-bus voltage continues to rise, the ”Clamp mode” device protection is activated. This leads to an overvoltage switch-off.

In this way, the devices are protected, but the drives coast to standstill.

Regenerative feedback with brake chopper

It is possible to use the integrated brake chopper to avoid the ”Clamp mode”. For this, connect the brake resistor recommended as additional component.

With regenerative powers of $P_{gen} > P_{Bron}$, the brake chopper starts to dissipate part of the energy via the brake resistor. The following formula applies: $P_{gen} = P_{Mgen} + P_{Br}$.

The following diagram shows how the regenerative power is divided between the mains and the brake resistor.

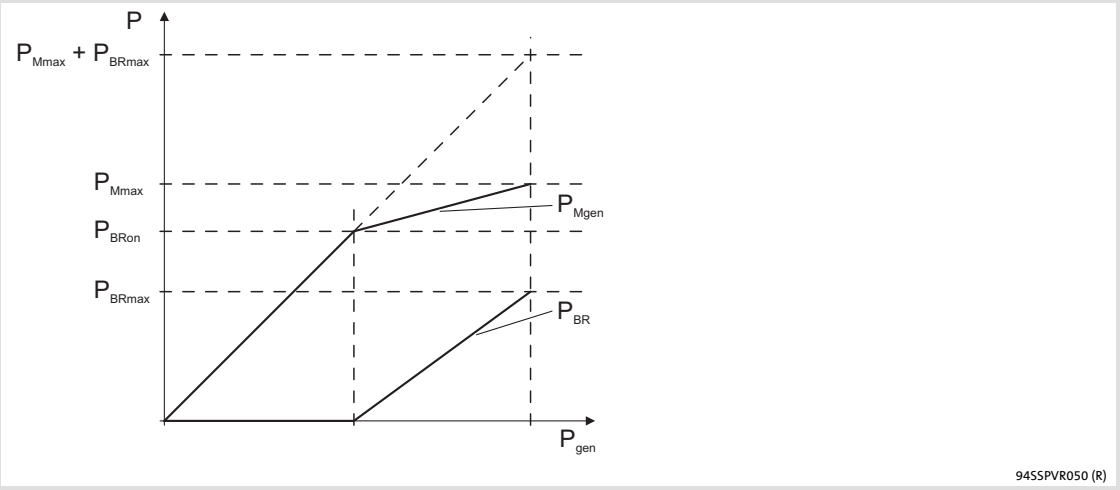


Fig. 7-1 Power regeneration - power characteristics for deceleration in the limit range (legend: Fig. 7-2)

Example: Deceleration with power recovery and brake chopper
The following diagram shows the time characteristics of the speed and the corresponding power. Regenerative powers (into the DC bus connection) are shown as negative values. This energy must be dissipated by the regenerative power supply module to the supply system. In the example, the regenerative power is that high that a brake chopper is required.

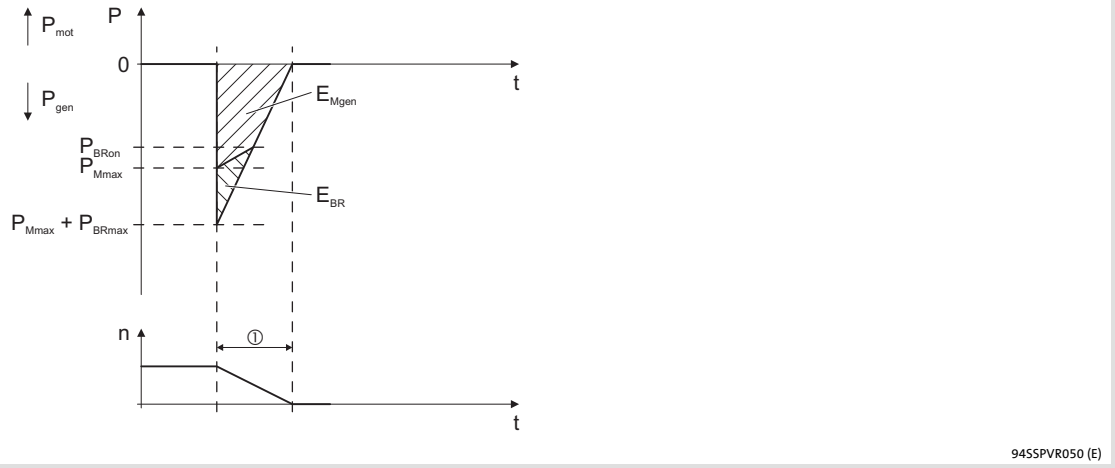


Fig. 7-2 Power regeneration - energy characteristics for deceleration in the limit range

P	Power (general)
t	Time axis
n	Speed
P_{mot}	Power in motor mode
P_{gen}	Regenerative power
P_{Mgen}	Regenerative power into mains
P_{Mmax}	max. regenerative power into mains (= cycle 1, P_{DC})
P_{BR}	Power loss via brake resistor
P_{BRmax}	max. power loss via brake resistor
P_{Bron}	Switch-on position of brake chopper
E_{Mgen}	Regenerative energy into mains
E_{BR}	Energy loss via brake resistor
①	Braking

The hatched area E_{Mgen} shows the energy dissipated to the supply system. The hatched area E_{Br} shows the power loss in the brake resistor. With cyclic processes, the power loss must be referred to the cycle time t (mean time between two deceleration processes) to obtain the mean power loss (=continuous power) of the brake resistor: $P_{BrAV} = E_{Br} / t$. The mean power loss is important for the dimensioning of the brake resistor. Mains voltage tolerances and resistance value changes due to the tolerance and the temperature rise must be considered.

Type	U_r [V]	$P_{DC\,(100\,\%)}$ [kW]	P_{Mmax} [kW]	P_{BRmax} [kW]	$P_{Mmax} + P_{BRmax}$ [kW]	P_{Bron} [kW]	U_{BRmax} [V]
E94ARNE0134	230	4.3	12.9	6.6	19.5	9.9	345
E94ARNE0244		7.8	23.3	13.2	36.5	17.9	
E94ARNE0134	400	7.5	22.4	12.7	35.1	17.2	586
E94ARNE0244		13.5	40.5	19.1	59.6	31.0	
E94ARNE0134	500	9.3	28.0	19.6	47.6	19.6	727
E94ARNE0244		16.9	50.6	29.4	80.0	35.4	

7.3.5 Fuses and cable cross-sections

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230 ... 500	180 - 0 % ... 550 + 0 %	45 ... 65

Operation with external mains choke/mains filter								
Type	Installation according to EN 60204-1 [1]					Installation according to UL [2]		FI [3]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E94AZMR0264xDB E94ARNE0134	C32	-	10	6	-	30	10	-
E94AZMR0474xDB E94ARNE0244	-	80	25	16	-	60	6	-

1) The details are recommendations. Other designs/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: the use of PVC-insulated copper cables, conductor temperature < 70°C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) UL approved cables only, fuses and fuse holders must be used.
UL fuse: voltage 500 ... 600 V

3) Universal-current sensitive earth-leakage circuit breaker
If several devices or cable lengths > 50 m are used, the circuit breaker may respond, depending on the cable type and switching frequency.

① Circuit breaker

② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category

③ Fuse

Observe national and regional regulations

7.3.6 Current-time diagrams

In addition to the data for overcurrent operation within the 5-s cycle or 3-min cycle, here you are provided with information on the dimensioning of application-oriented cycles.

By means of the following information you determine permissible load periods with overcurrents and required recovery times with limited currents. If the currents and times determined are observed, the Ixt monitoring function for the protection of the devices will not respond.

Characteristics

The following characteristics (”Current-time diagrams”) describe the device utilisation via amperage and the duration of current flow.
The left part of the diagram (negative time data) represents the overload phase, while the right part of the diagram (positive time data) shows the relieving phase.
Devices with an identical Ixt behaviour are combined within a diagram. A second diagram enlarges a cutout area to improve the clearness of display.

Requirements

- Switching frequency

  The curves shown always refer to the variable rated switching frequency (f_{chopp}) at which the rated device current is permissible permanently. As this rated switching frequencies are different for the individual devices, they are specified with the diagrams. This means that the switching frequency is reduced automatically during the overload phase. During the recovery phase the switching frequency set is maintained.

- Mains voltage

  In the diagrams a mains voltage of U_N = 400 V was assumed. Where applicable, a current derating depending on the mains voltage may be necessary for the devices, depending on the switching frequency that is reached. This means that the currents are weighted differently in the Ixt monitoring. The devices for which a derating is required can be gathered from the ”Rated values” section. The continuous currents specified there then are the 100% values which are required for working with the diagrams.

- Ambient temperature

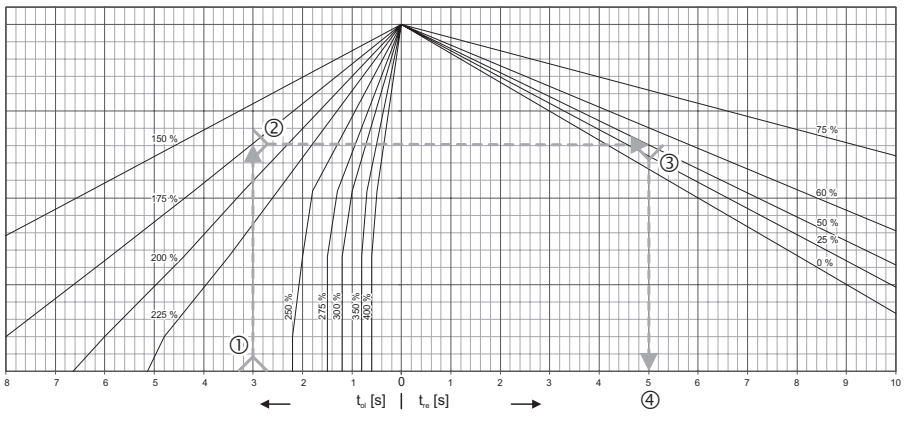
  The ambient temperature may be maximally T_{Amb} < 45 °C. In the case of higher ambient temperatures the reduced continuous currents have to be taken into consideration.

- Output frequency

  In the diagrams an output frequency (= field frequency) f_{out} > 5 Hz has been assumed. In the case of smaller output frequencies (f_{out} = 0 ... 5 Hz), a different switching frequency results in a different device utilisation due to a different continuous current. When the diagrams were created, this device behaviour was not taken into consideration.
  If a fixed switching frequency f > 4 kHz is selected, the reduction of the permissible continuous current has to be considered (100 % = reduced continuous current) for smaller output frequencies (f_{out} = 0 ... 5 Hz).

Application example

- Drive task
  - A current I_{ol} = 4.0 A is required for a time t_{ol} = 3 s.
  - During the recovery phase there is a current I_{re} = 1.0 A.
  - During the overload phase a switching frequency of 4 kHz is accepted.
  - The switching frequency during the recovery phase is to be 8 kHz.
  - The mains voltage is 400 V.
  - The times with output frequencies under 5 Hz are insignificant.
- Problem
  - How long does the recovery phase t_{re} have to be when the E94AxxE0034 controller is used?
- The currents required are based on the rated device current:
  - I_{ol} = 4.0 A/2.5 A = 160 % - selected characteristic: 175 %
  - I_{re} = 1.0A/2.5 A = 40 % - selected characteristic: 50 %
  - Because of the short overcurrent time t_{ol} = 3 s, the cutout diagram of the E94AxxE0034 device is taken into consideration.
  - The switching frequency f_{chopp} = 8 kHz, var does not have to be considered separately.
- Procedure within the diagram
  - ① Starting from the time axis at t_{ol} = 3 s, a perpendicular line is drawn to the selected characteristic at 175 % (corresponds to the minimum required current I_{ol}).
  - ② Draw a straight line from the point of intersection horizontally to the right to the selected characteristic, the recovery phase, at 50 %.
  - ③ Draw a perpendicular line from the point of intersection back to the time axis.
  - ④ Read the minimum required duration of recovery on the time axis.



- Result in the example
  - The duration of recovery has to be at least t_{re} = 5 s!

Guide

Type	Diagram
E94AxxE0024	Page 78 Fig. 4-2/ Fig. 4-3
E94AxxE0034	
E94AxxE0044	
E94AxxE0074	Page 278 Fig. 7-3/ Fig. 7-4
E94AxxE0134	
E94AxxE0174	
E94AxxE0244	
E94AMxE0324	

E94ARNE0134 and E94ARNE0244

Type	U_r	100 %	f_{chopp}
	[V]	[A]	[Setting]
E94ARNE0134	400	13.0	8 kHz var
E94ARNE0244		23.5	

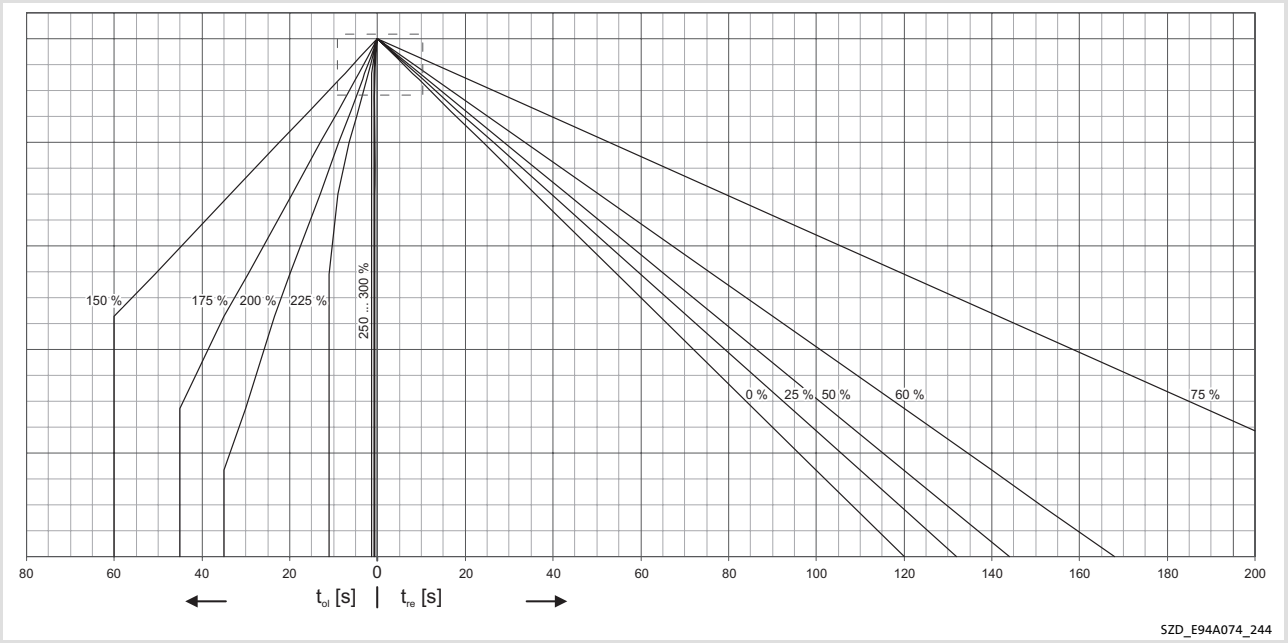


Fig. 7-3 Diagram for E94ARNE0134 and E94ARNE0244

t_{ol} Duration of the load phase
t_{re} Duration of the recovery phase

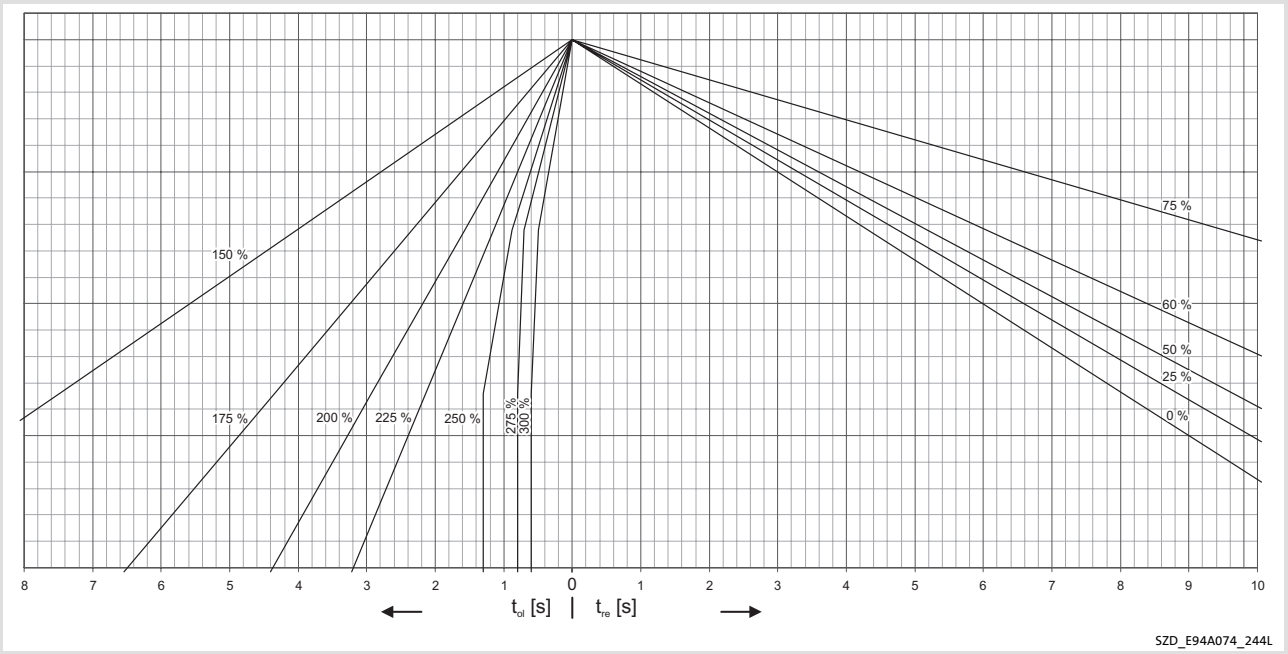


Fig. 7-4 Area cutout for E94ARNE0134 and E94ARNE0244

7.3.7 Mains filters for regenerative power supply modules

When using the mains filters assigned, conditions must be observed for compliance with EMC class C2:

- The measures for the use on IT systems must be applied to all axis modules in the interconnection (separation of internal filter components from PE, (📖 331)).
- The maximum sum total of all motor cable lengths ($\Sigma\, l_{mot}$) for the filter used must be observed.

Motor cable lengths in the interconnection

The assigned filters are designed for $\Sigma\, l_{mot}$
(E94AZMR...SDB: 60 m (= 6 x 10 m), E94AZMR...LDB: 500 m (= 10 x 50 m)).

For a different number of axis modules, $\Sigma\, l_{mot}$ can be determined from the following diagrams.

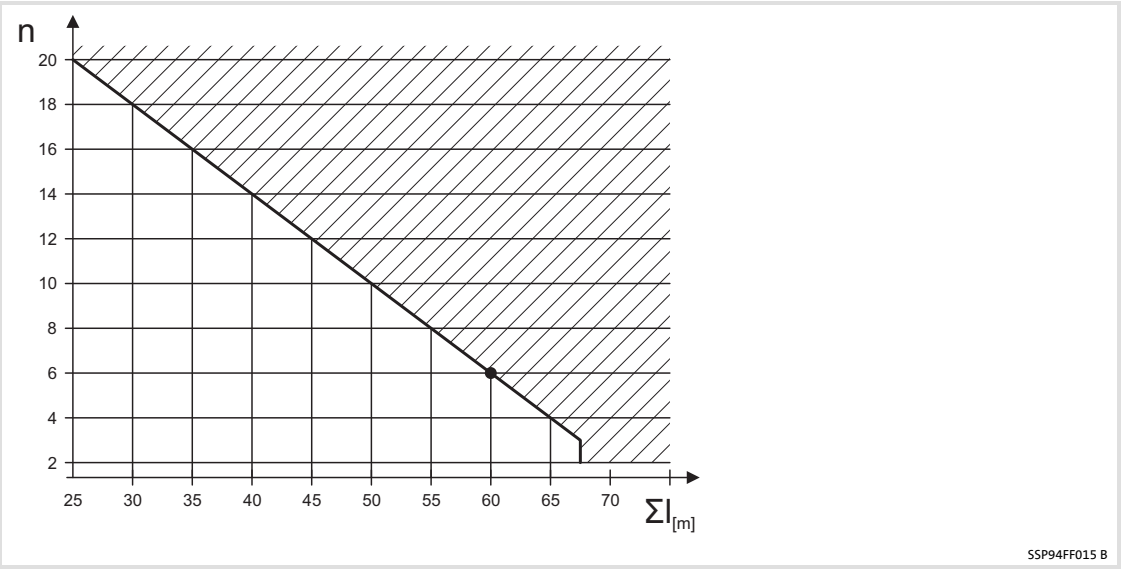


Fig. 7-5 Filter E94AZMR...SDB (short distance): Sum total of motor cable lengths as a function of the number of axis modules

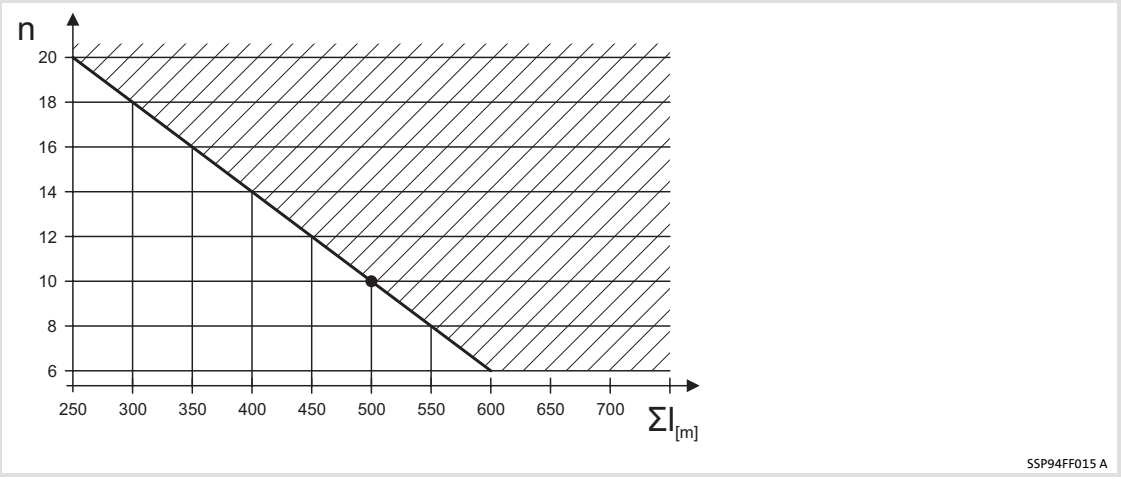


Fig. 7-6 Filter E94AZMR...LDB (long distance): Sum total of motor cable lengths as a function of the number of axis modules

With different motor cable lengths, per axis at least 25 % of the longest cable must be considered when calculating the total motor cable length.

Example: 1	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1	6	0.25 * 20 = 5	6
2 ... 4	3 * 10		3 * 10
5	20	⇦	20
Total	56	max. permissible for 5 axes: ∑< 60	**56**
		EMC class C2 will be complied with.	☑

Example: 2	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 4	4 * 5	0.25 * 40 = 10	4 * 10
5	40	⇦	20
Total	60	max. permissible for 5 axes: ∑< 60	**80**
		EMC class C2 will not be complied with.	☒

Example: 3	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 3	3 * 100	⇦	3 * 100
4	50	0.25 * 100 = 25	50
5 ... 10	6 * 15		6 * 25
Total	410	max. permissible for 10 axes: ∑ < 500	**500**
		EMC class C2 will be complied with.	☑

Example: 4	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 4	4 * 100	⇦	4 * 100
5 ... 10	6 * 15	0.25 * 100 = 25	6 * 25
Total	490	max. permissible for 10 axes: ∑ < 500	**550**
		EMC class C2 will not be complied with.	☒

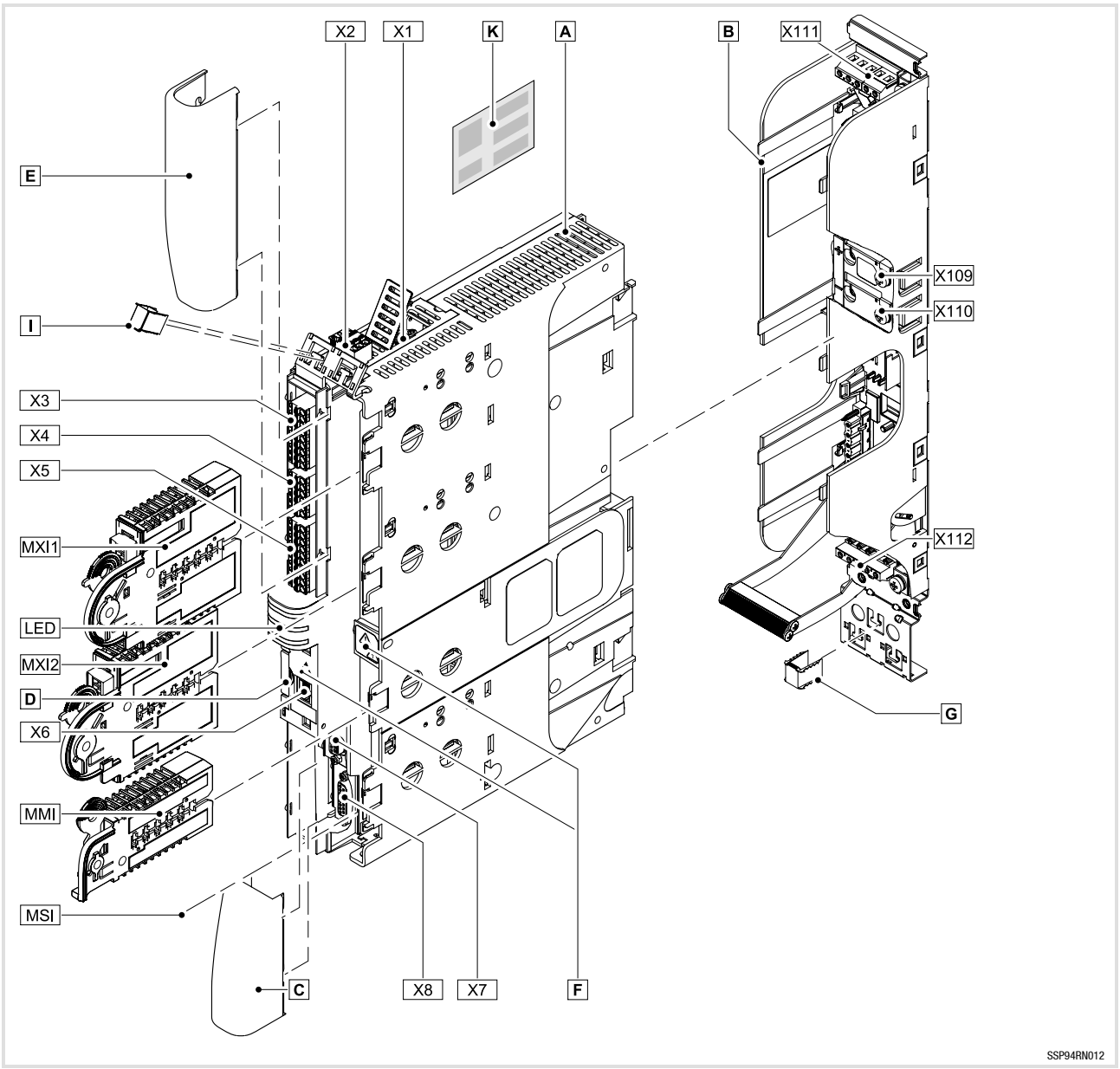
Other interference factors

Compliance of EMC class C2 may also be interfered with by other factors:

- Distribution of axis modules over several control cabinets
- No use of Lenze system cables or cables with the same specifications
- Poor connection of motor cable shields
- Motor cable interruptions
- Other interference sources (e.g. switched-mode power supplies)
- Synchronous switching of limit switches

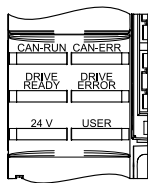
7.4 Device description

Standard device



Standard device [A]		Design
Pos.	Description	VR module
MXI1	Expansion slot 1, e.g. for communication	☑
MXI2	Expansion slot 2, e.g. for communication	☑
MMI	Storage module slot	☑
MSI	Reserved	☐
X1	System bus (CAN), under the cover	☑
X2	24 V supply and statebus	☑
X3	Analog inputs and analog outputs	2/2
X4	Digital outputs	4
X5	Digital inputs	8
X6	Diagnostics	☑
X7	Reserved (resolver)	☐
X8	Control signals for mains filter (encoder)	☑
[C]	Lower cover	☑
[D]	Retractable nameplate	☑
[E]	Upper cover	☑
[K]	Prominent warning label close to the device!	☑

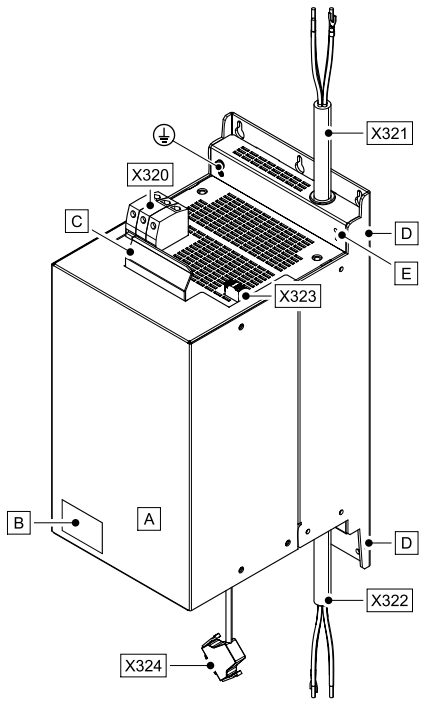
The LED display enables fast indication of several operating states.

LED	Labelling	Colour	Description
 SSP94LED01	CAN-RUN	green	CAN bus ok
	CAN-ERR	red	CAN bus error
	DRIVE READY	green	Standard device is ready for operation
	DRIVE ERROR	red	Error in the standard device or application-induced
	24 V	green	24 V supply voltage ok
	USER	yellow	Message parameterised by the application

Pos.	Symbol	Description
[F]		**Long discharge time**: All power terminals carry hazardous voltages for at least 3 minutes after mains disconnection!
		High discharge current: Fixed installation and PE connection to EN 61800-5-1 required!
		Electrostatic sensitive devices: Before working on the device, personnel must ensure that they are free of electrostatic charge!

Installation backplane [B]		Design
Pos.	Description	VR module
X111	Mains supply via mains filter/DC-bus voltage	☑
X112	Mains supply and mains power recovery via mains filter/external brake resistor	☑
X109	DC busbar +	☑
X110	DC busbar -	
[G]	EMC shield clamp	☑

Mains filter



Pos.	Description
A	Mains filter
	Mounting Instructions
Pos.	**Description**
B	Nameplate
C	Lifting aid
D	Mounting aid for mounting base
E	Parking position of the IT screw
⏚	PE terminal
X320	Terminal L1 ... L3
X321	Connecting cable L1.1 ... L3.1
X322	Connecting cable L1.2 ... L3.2
X323	Terminal for 24-V supply voltage (use safely separated power supply unit (SELV/PELV), in accordance with IEC 61131-2)
X324	Mains filter control signal

7.5 Mechanical installation

7.5.1 Important notes

Note!

The devices must be installed in housings (e.g. control cabinets) to meet applicable regulations.

Stop!

Heavy device weight

The device is very heavy and must be lifted for the mounting.

Possible consequences:

- ► Injury to persons, particularly backache when lifting and holding the device, respectively
- ► Injury to persons and damage to material assets due to the device falling down

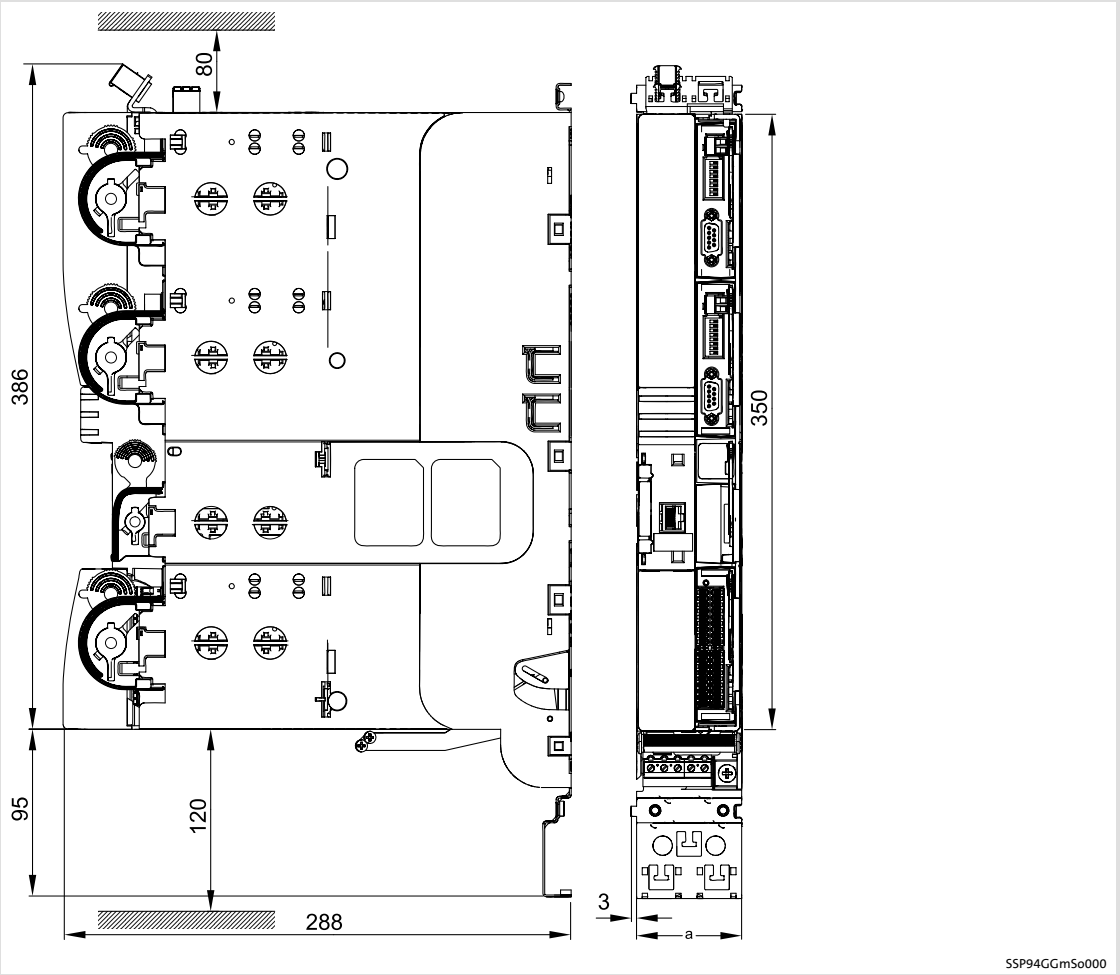
Protective measures:

- ► The device must only be carried with a load bearing system such as an indoor crane permitted for the device weight
- ► Before the transport, the hoist, the load bearing system and lifting accessories must be checked for sufficient payload and faultless status
- ► Do not remove the hoist and the lifting accessories until the device lies safe on a stable surface or is finally mounted.

- ► The mounting location must always fulfill the operating conditions specified in the Technical data. (📖 263). If necessary, take additional measures.
- ► The mounting plate of the control cabinet must be:
  – electrically conductive
  – free of lacquer
- ► The mechanical connections must always be ensured.
- ► The described EMC properties are provided if the following conditions are complied with:
  – The devices are mounted according to the arrangement concept described.
  – The prepared cables are used and remain unchanged.

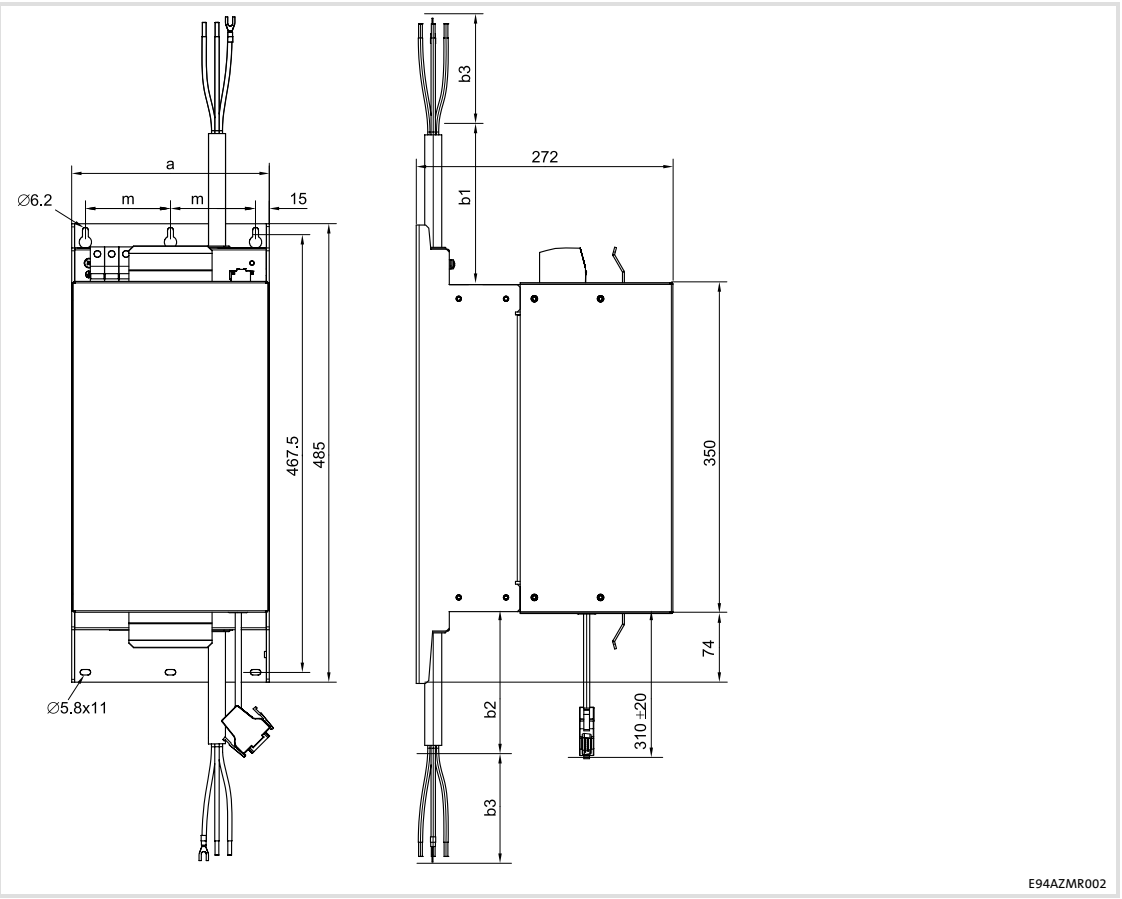
7.5.2 Dimensions

Standard device with installation backplane



Regenerative power supply module		a	
Standard device	Installation backplane	[mm]	[kg]
E94ARNE0134 E94ARNE0244	E94AZPP0364	120	8.1

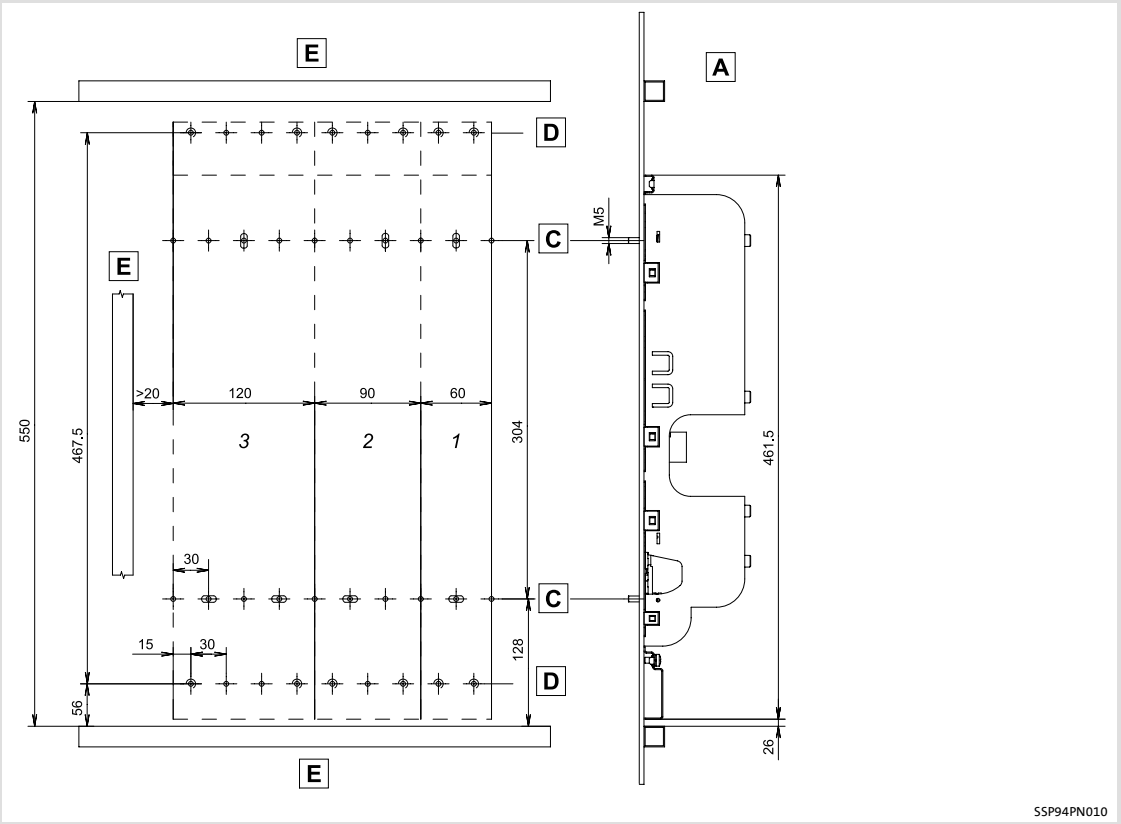
Mains filter



	a	m	b1	b2	b3	
	[mm]					[kg]
E94AZRM0264SDB	149	60	240 ±5	260 ±5	100 ±5	25
E94AZRM0264LDB						26
E94AZRM0474SDB	209	90	250 ±5	270 ±5	110 ±5	36
E94AZRM0474LDB						37

Mounting grid

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices, and the device sizes 1, 2, ... n can thus be mounted directly adjacent to each other.



A Mounting with backplane for attaching the power supply module
C Grid hole pattern for installation backplane
D Grid hole pattern for other device sizes or built-on/footprint filters (only Single Drive)
E Cable duct
1 … 3 Device size, mounting holes used

7.5.3 Arrangement of the devices

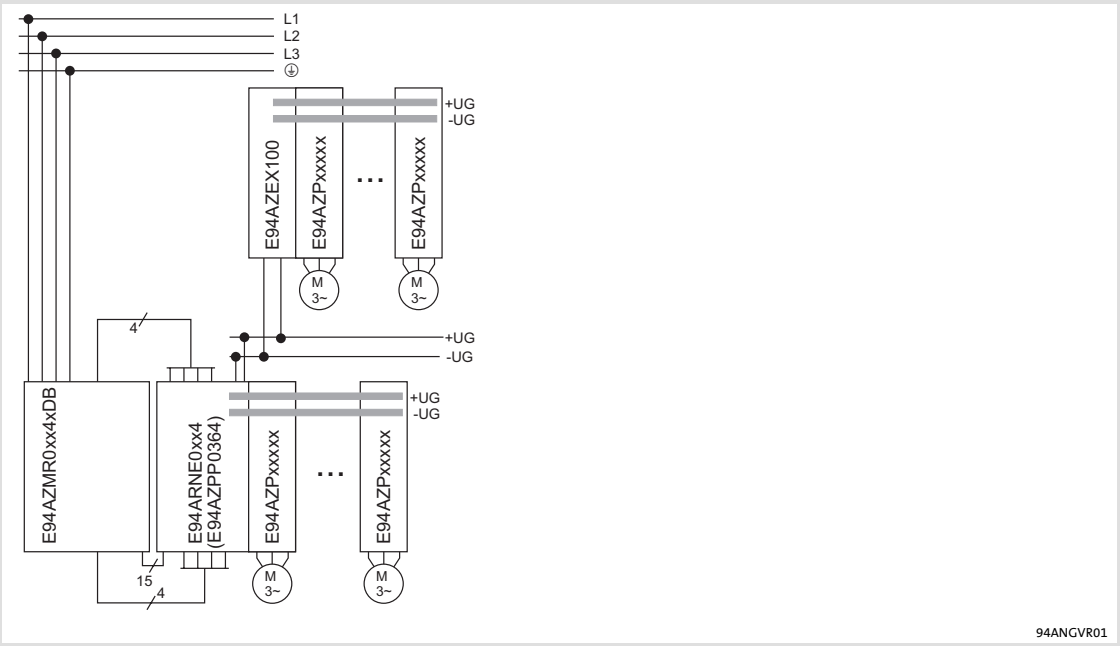


Fig. 7-7 Arrangement concept

E94AZMR0xx4xDB	Mains filter
E94ARNE0xx4	Regenerative power supply module (with E94AZPP0364 installation backplane)
E94AZEX100	DC-input module
E94AZPxxxxx	installation backplane for 9400 axis module
+UG/-UG	DC bus

A DC-bus connection with regenerative power supply module has to be planned and dimensioned taking the technical data into account.

How to arrange the devices for operation in the DC-bus connection via the DC busbars:

- ► Arrange the devices in a row from left to right.
- ► Install the supplying device on the left:
  - – Regenerative power supply module with assigned mains filter (in a first row),
  - – Input module (in the following rows).
- ► Install the multi drive axis controllers to the right from the highest to the lowest power (recommendation).
- ► For increasing the braking power also single drive axis controllers can be integrated. For this purpose, these axis controllers have to be equipped with the optional busbar mounting set (E94AZJAxxx). In order to carry out multi-supply applications, consult Lenze.

7.5.4 Mounting steps

Proceed as follows for the installation:

1. Prepare M5 threaded holes on the mounting plate according to the mounting grid.
2. Screw the installation backplane onto the mounting plate. Do not yet tighten the screws.
   – Use M5 screw and washer assemblies or M5 hexagon socket screws with washers.
   – The screw joint in the installation backplane may not jut out more than 7 mm.
3. Repeat step 2 for other installation backplanes, which can be mounted directly adjacent to one another.
4. Align all installation backplanes.
5. If busbars are used: connect the busbars.
6. Tightly screw all installation backplanes onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

Tip!

Before plugging the standard device into the installation backplane, read the chapters ”Disconnect internal PE connection” (📖 294) and ”Connecting busbars” (📖 296).

7.6 Wiring

7.6.1 Important notes

- Installation must
  - always be in accordance with the operating conditions specified in the Technical data (📖 263).
  - be carried out to EN 60204-1.
- Please observe the following when selecting the cable type:
  - The cables used must comply with the approvals required for the application (e. g. VDE, UL etc.).
  - Fuses and cable cross-sections must be dimensioned in accordance with the specifications in the documentation for the basic device.
- The described EMC properties are provided if the following conditions are complied with:
  - The devices are mounted according to the arrangement concept described.
  - The prepared cables are used and remain unchanged.

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

- Death or severe injuries when touching the power terminals.

Protective measures:

- Switch off the power supply and wait for at least three minutes before working on the power terminals.
- Make sure that all power terminals are deenergised.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

- Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

- Implement the actions required in the EN 61800-5-1. Especially:
  - Fixed installation
  - PE connection must conform to standards (PE conductor diameter ≥ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

► Destruction of the device if the mains voltage is too high.

Protective measures:

► Observe the maximally permissible mains voltage.

► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

Stop!

Overtemperature

The mains filter may become hot if permissible limit values are exceeded during operation.

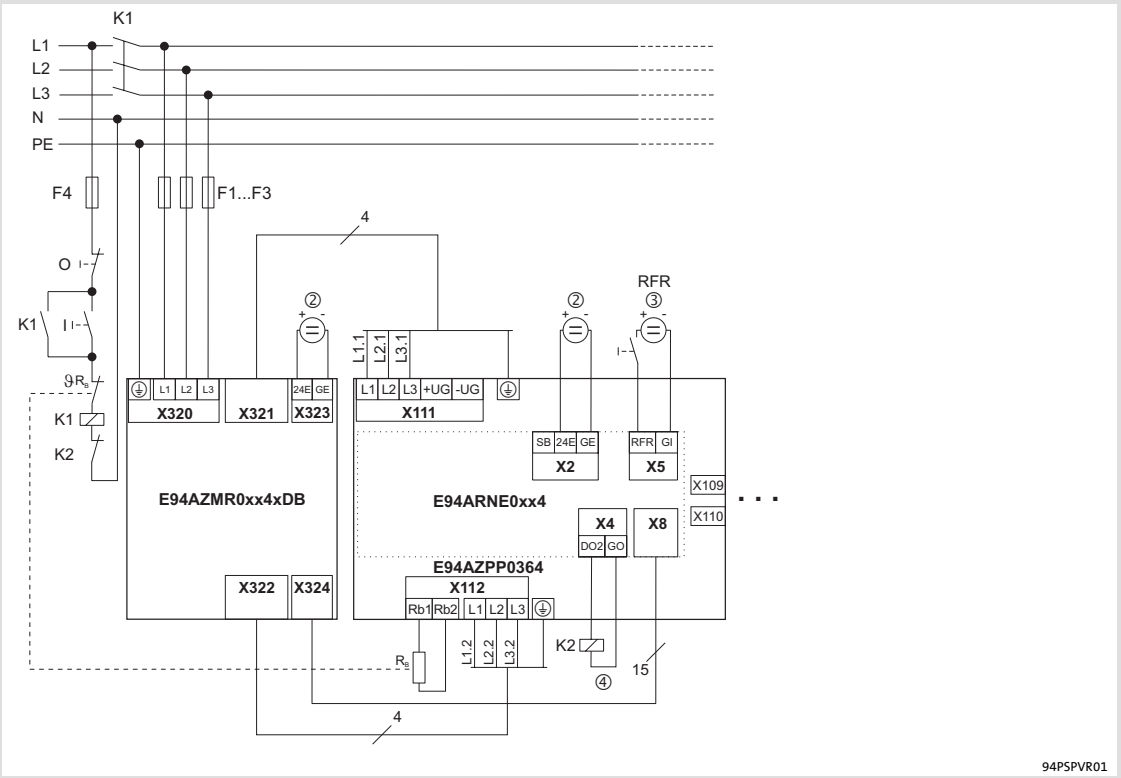
Possible consequences:

► The device may be damaged or destroyed.

Protective measures:

► Wire the overtemperature disconnection with the digital DO2 output according to circuit proposal.

7.6.2 Connection plan



E94ARNE0xx4	Regenerative power supply module
E94AZPP0364	Installation backplane for the regenerative power supply module
E94AZMR0...	Mains filter
F1 ... F4	Fuses
RFR	Controller enable (only for regenerative feedback)
K1	Mains contactor
RB	Brake resistor
②	24 V voltage source for the control electronics (safely separated power supply unit (SELV/PELV) according to IEC 61131-2)
③	24 V voltage source for the digital inputs according to IEC 61131-2
④	From FW 02.00: Overtemperature disconnection DO2 load: max. 50 mA

7.6.3 Earthing of internal EMC filters

Device-internal EMC filters have been implemented to reduce interference emission. These EMC filters are connected to protective earth to discharge interference currents.

Under certain conditions the EMC filters must be disconnected from:

- Operation in an IT system
  The devices are protected from damages or destruction due to incompatible overvoltages in the case of an error (earth fault).
- DC-bus operation
- Operation with power supply modules or regenerative power supply modules
- Operating multiple devices with a common filter
  The EMC properties can only be reached by carrying out the described measures.
  The triggering behaviour of applicable earth-leakage circuit breakers remains undisturbed.

Overview of the measures

The measures can be carried out easily. They are prepared device-dependently, and their mounting and wiring are described.

Device	Measure
Controller	
With installation backplane (GG1 ... GG3)	Plug/unplug the plastic cap
Without installation backplane (GG6 ... GG7)	Change the screwed connection
Without installation backplane (GG8S ... GG10)	Activate the switch
Power supply modules	
With installation backplane (GG1 und GG3)	Plug/unplug the plastic cap
Without installation backplane (GG4 ... GG5)	---
Regenerative power supply module	
With installation backplane (GG3)	Plug/unplug the plastic cap
Suitable mains filter	Change the screwed connection

Implementing the measures

Proceed as follows to disconnect the internal connection between the filters and PE:

1. Remove IT insulating cap from the parking position ① in the installation backplane.
   – For this apply a screwdriver on the right or left and lever off the insulating cap.
   – Optionally the insulating cap can be carefully removed using an appropriate pliers.
2. Attach IT insulating cap to the earthing jumper ② until it clicks into place.

Fig. 7-8 Plugging the IT insulating cap onto the earthing jumper

7.6.4 Connecting busbars

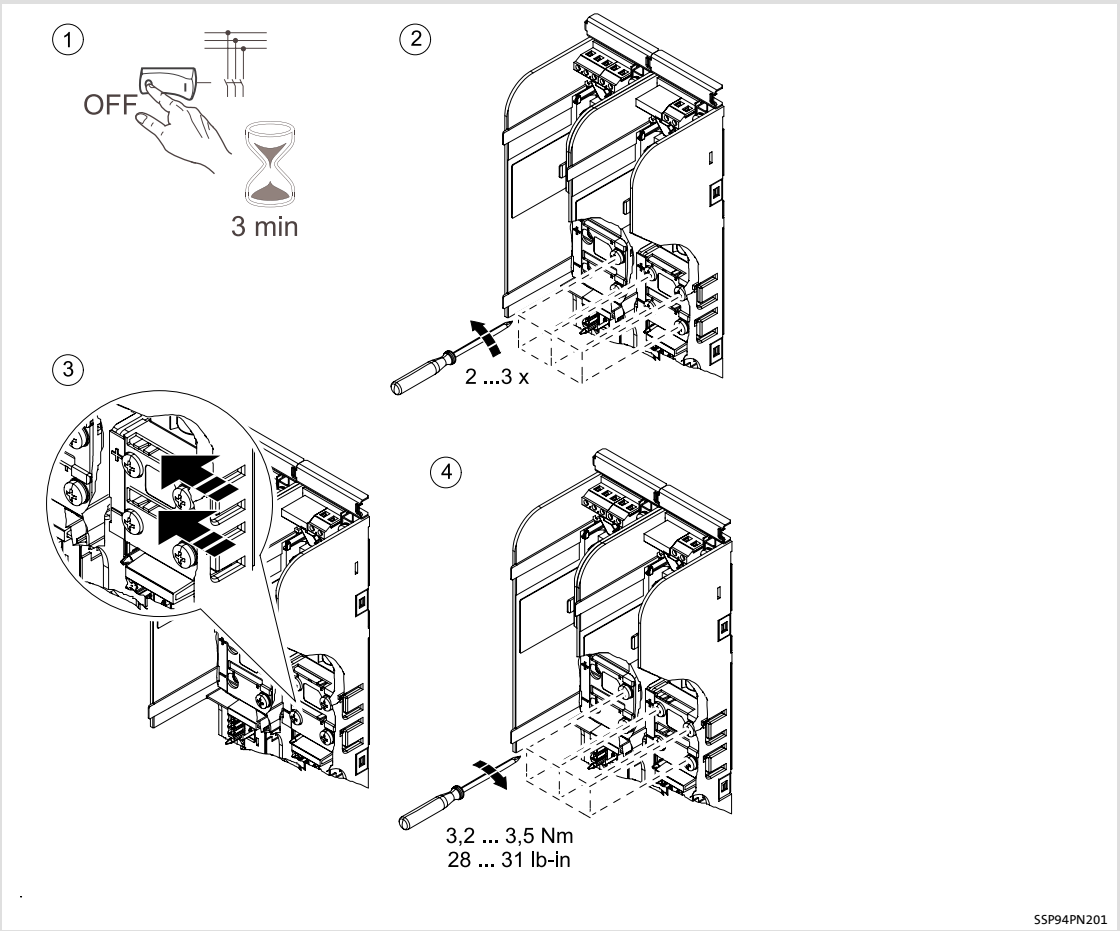


Fig. 7-9 Example: connecting busbars to DC power supply module

Proceed as follows to connect the busbars:

1. If devices of the interconnected system have already been in operation:
   – Ensure that the power supply system is switched off by checking the voltage at the supply terminals.
   – If necessary, switch off the power supply and wait at least 3 minutes.
2. Loosen the busbar screws but do not remove them completely.
3. Push the busbars as far as possible to the left towards the adjacent busbar.
   – Ensure that there is good contact to the adjacent busbar.
4. Tighten the busbar screws.
   – Tightening torque: 3.2 ... 3.5 Nm (28 ... 31 lb-in).
5. Screw all components onto the mounting plate.
   – Tightening torque: 3.4 Nm (30 lb-in).

7.6.5 Design of the cables

- The cables used must comply with the approvals required for the location (e.g. UL).
- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

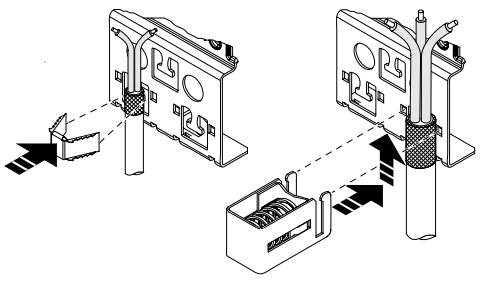
Use system cables or shielded cables for these connections:

- External brake resistor (Mounting Instructions of the brake resistor)
- Analog signals (inputs and outputs)
- CAN system bus
- Resolver
- System connection for synchronisation

The following connections need not be shielded:

- Mains
- DC bus
- 24 V supply
- Digital signals (inputs and outputs)

7.6.6 How to connect the shield



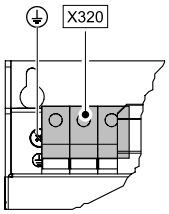
E94AZPS004

7.6.7 Terminal assignment

Tip!

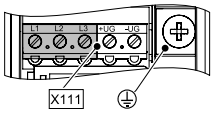
Complete the wiring of the installation backplane before plugging in the standard device. The upper terminals of the installation backplane cannot be connected with a plugged-in standard device.

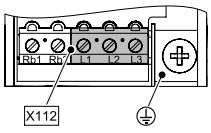
Mains

Terminal X320	Labelling	Description
 SSP94NF406	L1 L2 L3	Connection of the L1, L2, L3 mains phases
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZMR0264xDB	10	6	1.2 ... 1.5	10.6 ... 13.3	1.0 x 4.0
E94AZMR0474xDB	25	2	2.5	22.1	1.0 x 6.5

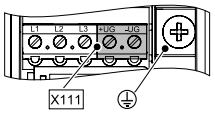
PE connection data				
	Ø	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZMR0264xDB	M5	3	26.5	PH2
E94AZMR0474xDB				

Terminal X111 (left part)	Labelling	Description
 SSP940X111	L1 L2 L3	Connection of the mains phases E94APNE0xx4/E94AZxPxxx4: L1, L2, L3 E94ARNE0xx4/E94AZMR0xx4xDB: L1.1, L2.1, L3.1
	⏚	Terminal for the supply-side PE conductor with M5 ring cable lug

Terminal X112 (right part)	Labelling	Description
 SSP940X112	L1 L2 L3	Connection of the mains phases E94APNE0xx4/E94AZxPxxx4: alternatively at the bottom L1, L2, L3 E94ARNE0xx4/E94AZMR0xx4xDB: L1.2, L2.2, L3.2
	⏚	Terminal for the supply-side PE conductor with M5 ring cable lug

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 3: Flexible With wire end ferrule	10	6	1.2 ... 1.5	10.6 ... 13.3	PH1

DC bus

Terminal X111 (right part)	Labelling	Description
 SSP940X111	+UG -UG	Alternative option for DC-bus voltage connection (compatible to 9300 series) E94ARNE0244: maximum current I_{dc} = 50 A

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 3: Flexible With wire end ferrule	10	6	1.2 ... 1.5	10.6 ... 13.3	PH1

External brake resistor

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
Device size 3: Flexible With wire end ferrule	10	6	1.2 ... 1.5	10.6 ... 13.3	PH1

7.6.8 Wiring of control connections

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Stop!

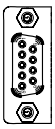
The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Tip!

Parameter setting and configuration can be carried out using the L-force »Engineer«. For this purpose the Online Help and the Software Manual for the standard device will guide you.

System bus CAN on board

Terminal X1	Labelling	Description
 9400SSP000X1	Pin 2	CAN-LOW
	Pin 3	CAN-GND
	Pin 7	CAN-HIGH
	(Housing)	CAN-Shield

24 V supply

Terminal X323	Labelling	Description
SSP9400X11	GE	GND external supply
	24E	24 V external supply through safely separated power supply unit (SELV/PELV) IEC 61131-2, 22.8 ... 28.8 V, residual ripple max. ±5 % Current during operation: 450 mA Starting current: max. 4 A for 100 ms

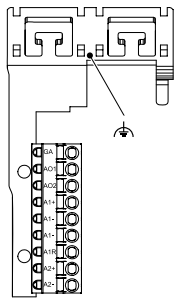
Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Stripping length / contact length: 10 mm

Terminal X2	Labelling	Description
9400SSP000X2	GE	GND external supply
	24E	24 V external supply via a safely separated power supply unit (SELV/PELV)
	SB	State bus in/out (reference GE)

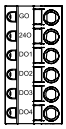
Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Analog inputs, analog outputs

Terminal X3	Labelling	Description
 SSP94000X3	GA	GND analog signals
	AO1	Analog output 1
	AO2	Analog output 2
	A1+	Analog input 1 +
	A1-	Analog input 1 -
	A1-	Analog input 1 -
	A1R	Terminating resistor ±20mA
	A2+	Analog input 2 +
	A2-	Analog input 2 -
	⏚	Shield connection: Fix the shield with EMC wire clamp.

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Digital outputs

Terminal X4	Labelling	Description
	GO	GND digital out
	24O	24-V digital out
	DO1	Digital output 1
	DO2	Digital output 2
	DO3	Digital output 3
9400SSP000X4	DO4	Digital output 4

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Digital inputs

Terminal X5	Labelling	Description
	GI	GND digital in
	RFR	Controller enable
	DI1	Digital input 1
	DI2	Digital input 2
	DI3	Digital input 3
	DI4	Digital input 4
	DI5	Digital input 5
	DI6	Digital input 6
	DI7	Digital input 7
9400SSP000X5	DI8	Digital input 8

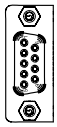
Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

Diagnostics/keypad

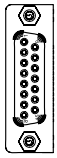
Terminal X6	Labelling	Description
9400SSP000X6		Internal interface, RJ69 socket, for keypad or diagnostic adapter

Resolver

(without function)

Terminal X7	Labelling	Description
	1	+REF
	2	-REF
	3	V_{CC}
	4	+COS
	5	-COS
	6	+SIN
	7	-SIN
	8	+KTY
9400SSP000X7	9	-KTY

System connection for synchronisation

X8terminal	Labelling	Description
	1	Must only be used in conjunctionwith the E94AZMR0xx4xDB mains filter, X324
	...	
9400SSP000X8	15	

The equipment of the device with modules depends on the device variant or on the application. A short description of the different device modules follows. More detailed information is given in the corresponding documentation.

7.6.9 Communication modules

Use these modules in slot ☑ MXI1 or ☑MXI2 ☐MMI ☐MSI.

The regenerative power supply modules support communication modules of the following bus systems:

- Ethernet (E94AYCEN)
- PROFIBUS (E94AYCPM)
- CAN (E94AYCCA)
- DeviceNet (E94AYCDN)
- PROFINET (E94AYCER)
- EtherCAT (E94AYCET)

The communication modules can be used in slot MXI1 or MXI2.

– It is possible to operate two bus systems at the same time.
– Simultaneous bus system operation in MXI1 and MXI2 is not permitted.

7.6.10 Memory modules

Use these modules in slot ☐ MXI1 ☐MXI2 ☑MMI ☐MSI.

MM220

Equipment MM220:

- 1 MB flash memory
- System bus address switch (CAN)

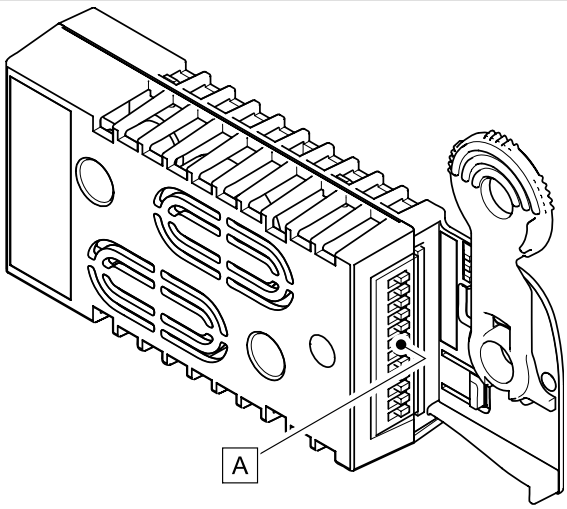


Fig. 7-10 Memory module with DIP switch (as of order designation E94AYM22)

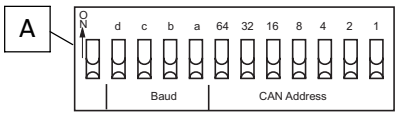


Fig. 7-11 Arrangement and labelling of the DIP switches

For the DIP switches that are placed at the front

- the node address (labelling ”1” ... ”64”) and
- baud rate (labelling ”a” ... ”d”)

can be set.

Note!

If all address switches adopt the ”OFF” position when the basic device is switched on, the configurations of codes C00350 (nodes address) and C00351 (baud rate) apply.

Switch the voltage supply of the basic device off and then on again to activate altered settings.

Setting the node address

The node address of the drive is calculated from the sum of all address switches in the ”ON” position.

Setting the baud rate

d	c	b	a	Baud rate
OFF	ON	ON	OFF	10 kbit/s
OFF	ON	OFF	ON	20 kbit/s
OFF	OFF	ON	ON	50 kbit/s
OFF	OFF	ON	OFF	125 kBit/s
OFF	OFF	OFF	ON	250 kbit/s
OFF	OFF	OFF	OFF	500 kbit/s
ON	ON	ON	OFF	800 kbit/s
OFF	ON	OFF	OFF	1000 kbit/s
OFF	ON	ON	ON	Auto baud

7.6.11 Safety modules

If the regenerative power supply module is used, safety functions are **not** available. However, the SM0 module in the MSI slot is mandatory for the operation of the regenerative power supply module.

7.7 Final works

7.7.1 Initial commissioning on 400 V mains voltage

After the installation has been carried out according to the Mounting Instructions, the regenerative power supply module can be operated on a mains voltage of 400 V.

The regenerative feedback is activated via the digital input RFR.

How to proceed:

1. Switch on 24 V supply voltages.
   – for the mains filter
   – for the regenerative power supply module (optional)
2. Switch on 400 V mains voltage.
3. Activate/deactivate regenerative feedback via the digital input RFR.

7.7.2 Initial commissioning on 230 V or 500 V mains voltage

For operation on a mains voltage of 230 V or 500 V, first the mains voltage within the regenerative power supply module has to be set. The setting is effected in C00173 and can be carried out using a keypad or the Lenze PC software »Engineer«.

For commissioning you require:

► An EZAEBKx00xkeypad,

or

► A computer with Windows® operating system (XP or 2000)

► The Lenze PC software »Engineer«

► A connection to the regenerative power supply module via an interface, e. g.
   – Diagnostic interface X6 with USB diagnostic adapter
   – CAN system bus
   – Communication modules in the expansion slots M1/M2

► The software manual for the technology application used

► The communication manual (KHB) for the network of the automation platform

► Switch on 24 V supply voltages:
   – for the mains filter
   – for the regenerative power supply module

After the setting has been carried out according to the mains voltage available:

1. Switch on mains voltage.
2. Activate/deactivate regenerative feedback via the digital input RFR.

7.7.3 Further settings

Follow the instructions of the software and/or read the documentation for the parameterisation of the regenerative power supply module.

8 DC-bus operation

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8.1 Introduction

8.1.1 Terminology and abbreviations used

- DC bus

  The energy store in the controller or supply module from which the controller modulates the AC voltage for the motor. The DC buses of several controllers can be networked.

- DC bus

  Electrical connection of the DC connections of several controllers via cable or busbar.

- DC-voltage level

  DC-voltage level in the DC bus

- Power supply module

  Module with AC mains connection used to supply the DC bus of a drive system with DC voltage.

- Regenerative power supply module

  Power supply module with additional power regeneration into the AC mains

- Multi-axis controllers (Multi Drive)

  Controllers for connection to a DC bus. Multi-axis controllers have no AC mains connection and no brake chopper.

- Single-axis controllers (Single Drive)

  Controllers for connection to an AC mains or a DC bus. Single-axis controllers have an integrated brake chopper.

- Brake chopper

  Switching element in the controller used to dissipate excess energy in the DC bus via a brake resistor.

- Brake resistor

  High-performance resistor used to convert excess energy in the DC-bus into heat.

- Braking operation

  Motor operation in generator mode with energy feedback from the motor to the controller.

8.1.2 Comparison single-axis controllers / multi-axis controllers

As controllers of the ”Servo Drives 9400” series, the ”Single Drive, E94A**S**…” are available in the power range up to 695 A (370 kW) and the ”Multi Drive, E94A**M**…” are available up to 32 A (15 kW).

The single-axis controllers (”Single Drive”) are designed for connection to AC mains (3/PE AC). They are equipped with mains rectifiers, mains filters and brake choppers.

The multi-axis controllers (”Multi Drive”) are exclusively designed for connection to DC mains (2/PE DC). They are equipped with DC busbars for easy assembly. In DC-bus connections, power supply modules are used that contain mains rectifiers and brake choppers. Mains filters must be specially dimensioned for each DC-bus.

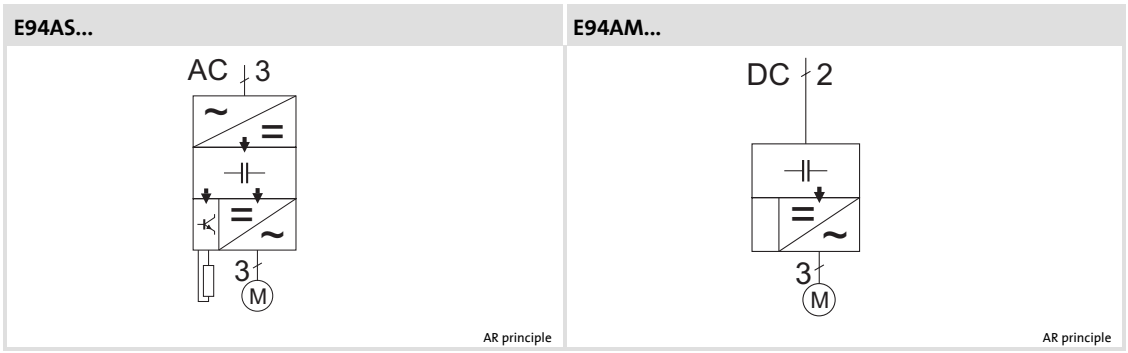


Fig. 8-1 Single Drive/Multi Drive

8.1.3 Advantages of a drive system

When several controllers are operated in a DC-bus connection (DC bus), this offers the following advantages:

- Energy exchange between controllers in generator-mode (braking) and motor-mode operation.
- The energy exchange reduces the supply power from the AC mains.
- DC-supply modules or feeding single-axis controllers can be dimensioned with a lower rated power.
- The energy exchange reduces the braking losses in generator-mode operation.

Advantages for installation:

- Only one AC-mains connection (e.g. at the DC-supply module).
- Reduced wiring costs.

8.1.4 General information on the accessories

Fuses in the DC bus

For device protection, multi-axis controllers up to 11 kW are equipped with a fuse in the installation backplane. The fuse is only integrated into the current path if the busbar system (X109) is used.

When operated in a DC-bus connection, single-axis controllers can be retrofit with a fuse in the installation backplane for device protection (see busbar mounting set).

When the alternative terminal connections are used for DC-bus wiring, external fuses must be integrated into both current paths (+UG/-UG).

Busbar mounting set

With the busbar mounting set (E94AZJA0xx) you can connect a single-axis controller via a busbar to a DC bus, e.g. to provide additional brake power. The busbar mounting set also includes the corresponding fuse.

DC-feeding point

With the DC-input module (E94AZEX100) you can establish the electrical connection between the DC cables and the busbar. Multi-row or distributed arrangements are possible.

Filters

RFI filters and mains filters are available for the devices connected to the AC mains (supply modules or single-axis controllers).

Depending on the application, additional filters may be required for compliance with the EMC regulations. When dimensioning the filters, please consider:

- Motor cable lengths
- Number of axis controllers
- Motor powers

8.2 Conditions for trouble-free DC-bus operation

8.2.1 Voltages

Controllers can only be operated in a DC-bus connection, if the rated mains voltage/the rated DC-bus voltage is the same. All brake choppers in the DC-bus system must have the same thresholds.

8.2.2 Number of feeding points

The 9400 servo drives series has been designed for drive systems with a central AC mains feeding point. For this you can use DC supply modules of different power categories.

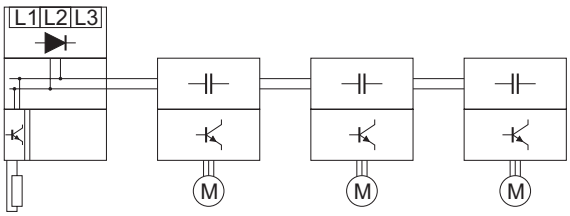
Several AC mains feeding points are only permitted in drive systems with two single-axis controllers of the same power category with inverse operation in motor and generator mode. Your Lenze representative will be pleased to inform you about further possible supply concepts.

8.2.3 Other conditions

- The entire DC power P_{DC} must be provided by the feeding point (DC-supply module or "Single Drive" controller).
- The controllers in the DC bus may only start operation when the DC bus has been completely loaded. I.e. controller enable may only be set after "State bus OK" (see terminal X2).
- Up to a total current of 100 A, devices up to 24 A (device sizes 1 ... 3) can be operated via the integrated DC busbar. Maximum busbar overload for 60 s: 150 % * I_r, followed by a relief phase of 120 s: 75 % * I_r.
- The DC bus must at no time be overloaded through the required maximum total power. For this, a time/performance diagram has to be created and considered (see Basic dimensioning).
- The cable protection measures described for the DC-bus operation must be observed.

8.3 DC-bus variants

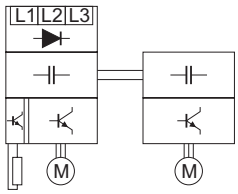
8.3.1 Supply from a supply module



A DC supply module with direct AC mains connection supplies energy into the DC bus of several controllers. The DC supply module is equipped with an integrated brake chopper to which you can connect a brake resistor.

Possible combinations	
Components to be used	**Components not to be used**
For supply	
Power supply modules	
E94APNExxx4 (10 ... 245 A)	-
Regenerative power supply modules	
E94ARNE0xx4 + E94AZMR0xx4xDB (13 ... 24 A)	-
As DC-bus component	
Multi-axis controllers	
E94AMxExxx4 (2 ... 24 A)	-
Single-axis controllers	
E94ASxE0024 ... E94ASxE0594 (2 ... 59 A or device sizes 1 ... 6)	E94ASxE0864 ... E94ASxE6954 (86 ... 695 A or device sizes 7 ... 10)

8.3.2 Supply from controllers



A single-axis controller with direct AC mains connection supplies energy into the DC bus of other controllers. The single-axis controller is equipped with an integrated brake chopper to which you can connect a brake resistor.

Possible combinations	
Components to be used	**Components not to be used**
For supply	
Single-axis controllers	
E94ASxE0024 ... E94ASxE0594 (2 ... 59 A or device sizes 1 ... 6)	E94ASxE0864 ... E94ASxE6954 (86 ... 695 A or device sizes 7 ... 10) → Possible to a certain degree when considering Application Reports.
As DC-bus component	
Multi-axis controllers	
E94AMxExxx4 (2 ... 24 A)	-
Single-axis controllers	
E94ASxE0024 ... E94ASxE0594 (2 ... 59 A or device sizes 1 ... 6)	E94ASxE0864 ... E94ASxE6954 (86 ... 695 A or device sizes 7 ... 10)

8.4 Rated data

8.4.1 General data

The total current of the nominal input currents I_{DC} to be provided by the power supply module or one or several single-axis controllers must be determined. The DC cables must be dimensioned in accordance with the total current.

The number of devices in a drive system can be limited by the DC-bus capacity and the charging current ($I_{charging,\ permissible} > \Sigma(I_{charging\ at}\ U_r)$).

Additional data						
	Input current	DC-bus capacity	Charging resistor	$I_{charging}$ at U_{Lr}		permissible
Type	I_{DC} at I_{ar} [A]	[µF]	[Ω]	400 V [A]	500 V [A]	[A]
Power supply modules						
E94APNE0104	-	-	-	-	-	90
E94APNE0364	-	-	-	-	-	154
E94APNE1004	-	-	-	-	-	278
E94APNE2454	-	-	-	-	-	520
Regenerative power supply modules						
E94ARNE0134	20.6	495	100	5.7	7.1	154
E94ARNE0244	35.5	990	50	11.3	14.1	154
Multi Drives						
E94AMxE0024	2.6	165	100	5.7	7.1	-
E94AMxE0034	4.3	165	100	5.7	7.1	-
E94AMxE0044	6.7	330	100	5.7	7.1	-
E94AMxE0074	12.1	330	100	5.7	7.1	-
E94AMxE0094	15.4	495	50	11.3	14.1	-
E94AMxE0134	20.6	495	100	5.7	7.1	-
E94AMxE0174	25.7	825	50	11.3	14.1	-
E94AMxE0244	35.5	990	50	11.3	14.1	-
E94AMxE0324	48.0	1320	50	11.3	14.1	-

Additional data						
	Input current	DC-bus capacity	Charging resistor	$I_{charging}$ at U_{Lr}		permissible
Type	I_{DC} at I_{ar} [A]	[µF]	[Ω]	400 V [A]	500 V [A]	[A]
Single Drives						
E94ASxE0024	2.6	165	100	5.7	7.1	20.4
E94ASxE0034	4.3	165	100	5.7	7.1	20.4
E94ASxE0044	6.7	330	100	5.7	7.1	49.0
E94ASxE0074	12.1	330	100	5.7	7.1	49.0
E94ASxE0134	20.6	495	100	5.7	7.1	154
E94ASxE0174	25.7	825	50	11.3	14.1	154
E94ASxE0244	35.5	990	50	11.3	14.1	154
E94ASxE0324	35.5	2200	27	21.0	26.2	154
E94ASxE0474	52.6	2200	27	21.0	26.2	154
E94ASxE0594	66.1	2200	27	21.0	26.2	154
E94ASxE0864 [1)]	96.8	3300	68	8.3	10.4	358
E94ASxE1044 [1)]	116	3300	68	8.3	10.4	358
E94ASxE1454 [1)]	171	7050	32	17.7	22.1	356
E94ASxE1724 [1)]	203	7050	32	17.7	22.1	423
E94ASxE2024 [1)]	239	7050	32	17.7	22.1	496
E94ASxE2454 [1)]	290	7050	32	17.7	22.1	603
E94ASxE2924 [1)]	343	9040	32	17.7	22.1	713
E94ASxE3664 [1)]	434	11750	32	17.7	22.1	901
E94ASxE4604 [1)]	544	14100	32	17.7	22.1	1130
E94ASxE5724 [1)]	677	18800	32	17.7	22.1	1408
E94ASxE6354 [1)]	752	18800	32	17.7	22.1	1563
E94ASxE6954 [1)]	823	18800	32	17.7	22.1	1711

Tab. 8-1

DCbus = DC bus

$I_{charging}$ = charging current

1) Devices may not be used as direct DC bus devices on the DC-bus level because the charging current is not limited.

8.4.2 DC-supply power

The parameters relevant for the selection of a supply unit with a suitable supply power (even in the overload range) are listed in the below table:

U_{Lr}	Rated AC voltage
Cycle 1	Cycle for the second-range
Cycle 2	Cycle for the minute-range
$P_{DC\ 100\%}$	Permanent power of DC-voltage level
P_{ol}	Power supply during overload time
t_{ol}	Overload time
P_{re}	Power supply during unloading time
t_{re}	Relief time

Any other cycles are calculated with the following formula:

$$\frac{(P_{ol} \cdot t_{ol}) + (P_{re} \cdot t_{re})}{t_{ol} + t_{re}} \leq P_{DC\ 100\%}$$

Cycles other than the above cycles must not exceed the specified power and time values, i.e. the values must be used as maximum values.

The values depend on the rated AC voltage U_{Lr}.

230 V

Supply power U_{Lr} = 230 V		Cycle 1		Cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E94APNE0104	2.1	8.4 · 0.5	1.6 · 4.5	3.2 · 60	1.6 · 120
E94APNE0104 + E94AZMP0084	2.8	11.2 · 0.5	2.1 · 4.5	4.2 · 60	2.1 · 120
E94APNE0364	7.5	22.5 · 0.5	5.6 · 4.5	11.3 · 60	5.6 · 120
E94APNE0364 + E94AZMP0294	10.1	30.3 · 0.5	7.6 · 4.5	15.5 · 60	7.6 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	8.6	25.8 · 0.5	6.5 · 4.5	12.9 · 60	6.5 · 120
E94ARNE0244 + E94AZMR0474xDB	15.6	46.6 · 0.5	11.7 · 4.5	23.3 · 60	11.7 · 120
Single Drives					
E94ASxE0024 + E94AZMS0034	1.0	4.0 · 0.5	0.8 · 4.5	1.8 · 60	0.8 · 120
E94ASxE0034 + E94AZMS0034	1.0	4.0 · 0.5	0.8 · 4.5	1.8 · 60	0.8 · 120
E94ASxE0044 + E94AZMS0094	1.6	6.4 · 0.5	1.2 · 4.5	3.0 · 60	1.2 · 120
E94ASxE0074 + E94AZMS0094	2.7	10.8 · 0.5	2.0 · 4.5	4.1 · 60	2.0 · 120
E94ASxE0134 + E94AZMS0314	5.0	20.0 · 0.5	3.8 · 4.5	9.5 · 60	3.8 · 120
E94ASxE0174 + E94AZMS0314	6.3	25.2 · 0.5	4.7 · 4.5	9.5 · 60	4.7 · 120
E94ASxE0244 + E94AZMS0314	8.9	35.6 · 0.5	6.7 · 4.5	13.4 · 60	6.7 · 120
E94ASxE0324	15.8	63.2 · 0.5	11.9 · 4.5	23.7 · 60	11.9 · 120
E94ASxE0474	22.3	80.4 · 0.5	15.1 · 4.5	30.2 · 60	15.1 · 120
E94ASxE0594	22.3	80.4 · 0.5	15.1 · 4.5	30.2 · 60	15.1 · 120
E94ASxE0864	39.1	70.4 · 0.5	29.3 · 4.5	58.7 · 60	29.3 · 120
E94ASxE1044	39.1	70.4 · 0.5	29.3 · 4.5	58.7 · 60	29.3 · 120

Tab. 8-2

400 V

Power supply U_{Lr} = 400 V		Cycle 1		Cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E94APNE0104	3.6	14.4 · 0.5	2.7 · 4.5	5.4 · 60	2.7 · 120
E94APNE0104 + E94AZMP0084	4.9	19.6 · 0.5	3.7 · 4.5	7.4 · 60	3.7 · 120
E94APNE0364	13.0	39.0 · 0.5	9.8 · 4.5	19.5 · 60	9.8 · 120
E94APNE0364 + E94AZMP0294	17.5	52.5 · 0.5	13.1 · 4.5	26.3 · 60	13.1 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	15.0	44.9 · 0.5	11.3· 4.5	22.4 · 60	11.3 · 120
E94ARNE0244 + E94AZMR0474xDB	27.0	81.1 · 0.5	20.3· 4.5	40.5 · 60	20.3 · 120
Single Drives					
E94ASxE0024 + E94AZMS0034	2.0	8.0 · 0.5	1.3 · 4.5	3.0 · 60	1.3 · 120
E94ASxE0034 + E94AZMS0034	2.0	8.0 · 0.5	1.3 · 4.5	3.0 · 60	1.3 · 120
E94ASxE0044 + E94AZMS0094	3.2	12.8 · 0.5	2.0 · 4.5	4.8 · 60	2.0 · 120
E94ASxE0074 + E94AZMS0094	5.7	17.1 · 0.5	3.5 · 4.5	8.6 · 60	3.5 · 120
E94ASxE0134 + E94AZMS0314	10.5	31.5 · 0.5	6.3 · 4.5	15.8 · 60	6.3 · 120
E94ASxE0174 + E94AZMS0314	13.1	39.3 · 0.5	8.0 · 4.5	19.7 · 60	8.0 · 120
E94ASxE0244 + E94AZMS0314	18.7	46.8 · 0.5	11.4 · 4.5	28.1 · 60	11.4 · 120
E94ASxE0324	26.7	64.1 · 0.5	20.0 · 4.5	40.1 · 60	20.0 · 120
E94ASxE0474	37.9	76.8 · 0.5	25.7 · 4.5	56.9 · 60	25.7 · 120
E94ASxE0594	37.9	76.8 · 0.5	25.7 · 4.5	56.9 · 60	25.7 · 120
E94ASxE0864	66.6	133 · 0.5	50.0 · 4.5	100 · 60	50.0 · 120
E94ASxE1044	66.6	133 · 0.5	50.0 · 4.5	100 · 60	50.0 · 120
E94ASxE1454	92.0	166 · 10	69.0 · 30	138 · 60	69.0 · 120
E94ASxE1724	109	196 · 10	81.8 · 30	164 · 60	81.8 · 120
E94ASxE2024	129	232 · 10	96.8 · 30	194 · 60	96.8 · 120
E94ASxE2454	156	281 · 10	117 · 30	234 · 60	117 · 120
E94ASxE2924	186	345 · 10	140 · 30	279 · 60	140 · 120
E94ASxE3664	233	419 · 10	175 · 30	350 · 60	175 · 120
E94ASxE4604	293	527 · 10	220 · 30	440 · 60	220 · 120
E94ASxE5724	364	655 · 10	273 · 30	546 · 60	273 · 120
E94ASxE6354	404	727 · 10	303 · 30	606 · 60	303 · 120
E94ASxE6954	442	796 · 10	332 · 30	663 · 60	332 · 120

Tab. 8-3

500 V

Power supply U_{Lr} = 500 V		Cycle 1		Cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E94APNE0104	4.5	18.0 · 0.5	3.4 · 4.5	6.8 · 60	3.4 · 120
E94APNE0104 + E94AZMP0084	6.1	24.4 · 0.5	4.6 · 4.5	9.2 · 60	4.6 · 120
E94APNE0364	16.3	48.9 · 0.5	12.2 · 4.5	24.5 · 60	12.2 · 120
E94APNE0364 + E94AZMP0294	21.9	65.7 · 0.5	16.4 · 4.5	32.9 · 60	16.4 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	18.6	56.1 · 0.5	14.0 · 4.5	28.0 · 60	14.0 · 120
E94ARNE0244 + E94AZMR0474xDB	33.8	101.4 · 0.5	25.4 · 4.5	50.7 · 60	25.4 · 120
Single Drive					
E94ASxE0024 + E94AZMS0034	2.5	10.0 · 0.5	1.4 · 4.5	3.8 · 60	1.4 · 120
E94ASxE0034 + E94AZMS0034	2.5	10.0 · 0.5	1.4 · 4.5	3.8 · 60	1.4 · 120
E94ASxE0044 + E94AZMS0094	4.1	16.4 · 0.5	2.2 · 4.5	6.2 · 60	2.2 · 120
E94ASxE0074 + E94AZMS0094	7.1	21.3 · 0.5	3.8 · 4.5	10.7 · 60	3.8 · 120
E94ASxE0134 + E94AZMS0314	13.0	39.0 · 0.5	6.9 · 4.5	19.5 · 60	6.9 · 120
E94ASxE0174 + E94AZMS0314	16.5	49.5 · 0.5	8.7 · 4.5	24.8 · 60	8.7 · 120
E94ASxE0244 + E94AZMS0314	23.4	58.5 · 0.5	12.5 · 4.5	35.1 · 60	12.5 · 120
E94ASxE0324	29.1	69.8 · 0.5	21.8 · 4.5	43.7 · 60	21.8 · 120
E94ASxE0474	41.3	82.6 · 0.5	31.0 · 4.5	62.0 · 60	31.9 · 120
E94ASxE0594	41.3	82.6 · 0.5	31.0 · 4.5	62.0 · 60	31.9 · 120
E94ASxE0864	72.7	145 · 0.5	54.5 · 4.5	109 · 60	54.5 · 120
E94ASxE1044	72.7	145 · 0.5	54.5 · 4.5	109 · 60	54.5 · 120
E94ASxE1454	115	207 · 10	86.3 · 30	173 · 60	86.3 · 120
E94ASxE1724	136	245 · 10	102 · 30	204 · 60	102 · 120
E94ASxE2024	160	288 · 10	120 · 30	240 · 60	120 · 120
E94ASxE2454	194	349 · 10	146 · 30	291 · 60	146 · 120
E94ASxE2924	232	418 · 10	174 · 30	348 · 60	174 · 120
E94ASxE3664	290	522 · 10	218 · 30	435 · 60	218 · 120
E94ASxE4604	365	657 · 10	274 · 30	548 · 60	274 · 120
E94ASxE5724	453	815 · 10	340 · 30	680 · 60	340 · 120
E94ASxE6354	503	905 · 10	377 · 30	755 · 60	377 · 120
E94ASxE6954	551	992 · 10	413 · 30	827 · 60	413 · 120

Tab. 8-4

8.4.3 DC-power requirements

Use the below tables to determine the power requirements of the devices used in the DC bus and the device-dependent power loss for the rated mains voltage U_{Lr}.

Power requirements P_{ar} [W] with rated current			
Type	U_{Lr} = 230 V	U_{Lr} = 400 V	U_{Lr} = 500 V
Multi Drives			
E94AMxE0024	500	900	1000
E94AMxE0034	900	1600	1700
E94AMxE0044	1400	2500	2700
E94AMxE0074	2500	4400	4800
E94AMxE0094	3300	5800	6400
E94AMxE0134	4700	8100	8900
E94AMxE0174	5900	10300	11200
E94AMxE0244	8400	14700	16100
E94AMxE0324	11500	20000	20200
Single Drives			
E94ASxE0024	500	900	1000
E94ASxE0034	900	1600	1700
E94ASxE0044	1400	2500	2700
E94ASxE0074	2500	4400	4800
E94ASxE0134	4700	8100	8900
E94ASxE0174	5900	10300	11200
E94ASxE0244	8400	14700	16100
E94ASxE0324	11500	20000	21800
E94ASxE0474	16900	29300	32000
E94ASxE0594	19000	33100	40200
E94ASxE0864	30800	53600	58700
E94ASxE1044	37300	64800	70900
E94ASxE1454	-	90000	113000
E94ASxE1724	-	107000	134000
E94ASxE2024	-	126000	157000
E94ASxE2454	-	153000	191000
E94ASxE2924	-	182000	228000
E94ASxE3664	-	228000	285000
E94ASxE4604	-	287000	359000
E94ASxE5724	-	357000	446000
E94ASxE6354	-	396000	495000
E94ASxE6954	-	433000	542000

Tab. 8-5

Type	Power loss P_V [W]			
	U_{Lr} = 230 V	U_{Lr} = 400 V	U_{Lr} = 500 V	**when controller is inhibited**
Multi Drives				
E94AMxE0024	65	80	95	40
E94AMxE0034	75	95	110	
E94AMxE0044	90	120	130	
E94AMxE0074	105	145	170	
E94AMxE0094	130	170	205	
E94AMxE0134	160	215	255	
E94AMxE0174	185	255	300	
E94AMxE0244	235	320	385	
E94AMxE0324	290	405	490	
Single Drives				
E94ASxE0024	70	90	105	40
E94ASxE0034	85	105	125	
E94ASxE0044	100	130	150	
E94ASxE0074	125	160	190	
E94ASxE0134	200	260	300	
E94ASxE0174	240	300	350	
E94ASxE0244	310	400	460	
E94ASxE0324	750	750	750	75
E94ASxE0474	1050	1050	1050	
E94ASxE0594	1100	1100	1100	
E94ASxE0864	1500	1500	1500	100
E94ASxE1044	1800	1800	1800	
E94ASxE1454	-	2100	2100	50
E94ASxE1724	-	2200	2200	50
E94ASxE2024	-	2600	2600	
E94ASxE2454	-	3300	3300	50
E94ASxE2924	-	4100	4100	
E94ASxE3664	-	4900	4900	
E94ASxE4604	-	6200	6200	100
E94ASxE5724	-	7200	7200	
E94ASxE6354	-	7700	7700	
E94ASxE6954	-	8700	8700	

8.4.4 DC fuses

When using the busbar system (X109/X110), fuse the busbar system in the installation backplane to protect the DC-bus connection. The DC-bus connection is protected against damage through a DC earth fault or short circuit in a device.

Controller (with installation backplane)/DC fuse assignment				
Type	Rated value [A]	Type (SIBA)	Size [mm] or size	Number per backplane
Multi Drives				
E94AMxE0024 E94AMxE0034 E94AMxE0044	16	EFSAR0016ARHN	14 x 51	1
E94AMxE0074 E94AMxE0094	40	EFSAR0040ARHN	14 x 51	
E94AMxE0134 E94AMxE0174 E94AMxE0244 E94AMxE0324	100	EFSAR0100ARHN	NH00 (screwable)	
Single Drives (can be retrofitted with E94AZJA0xx busbar mounting set))				
E94ASxE0024 E94ASxE0034	16	EFSAR0016ARHN	14 x 51	1
E94ASxE0044 E94ASxE0074	40	EFSAR0040ARHN	14 x 51	
E94ASxE0134 E94ASxE0174 E94ASxE0244	100	EFSAR0100ARHN	NH00 (screwable)	

Tab. 8-6

Fuse the individual +UG/-UG cables to protect the DC-bus connection. The DC-bus connection is protected against damage through a DC earth fault or short circuit in a device.

Controller/DC fuse assignment

Type	Rated value [A]	Type (SIBA)	Size [mm] or size	Number per +UG/-UG
Multi Drives				
E94AMxE0024 E94AMxE0034 E94AMxE0044	20	EFSGR0200AYHz	14 x 51	1
		EFSGR0200AYIz	22 x 58	
E94AMxE0074 E94AMxE0094	32	EFSGR0320AYHz	14 x 51	
		EFSGR0320AYIz	22 x 58	
E94AMxE0134 E94AMxE0174	63	EFSGR0630AYIz	22 x 58	
E94AMxE0244 E94AMxE0324	100	EFSGR1000AYIz	22 x 58	
Single Drives				
E94ASxE0024 E94ASxE0034	16	EFSGR0200AYHz	14 x 51	1
		EFSGR0200AYIz	22 x 58	
E94ASxE0044 E94ASxE0074	32	EFSGR0320AYHz	14 x 51	
		EFSGR0320AYIz	22 x 58	
E94ASxE0134 E94ASxE0174	63	EFSGR0630AYIz	22 x 58	
E94ASxE0244 E94ASxE0324 E94ASxE0474	100	EFSGR1000AYIz	22 x 58	
		EFSGR1000ANVN	NH1	
E94ASxE0594 E94ASxE0864	200	EFSGR2000ANVN	NH1	
E94ASxE1044	250	EFSGR2500ANWN	NH2	
E94ASxE1454	350	EFSGR3500ANWN	NH2	
E94ASxE1724 E94ASxE2024	400	EFSGR4000ANWN	NH2	
E94ASxE2454	500	EFSGR5000ANWN	NH2	
E94ASxE2924	350	EFSGR3500ANWN	NH2	2 (in parallel)
E94ASxE3664	400	EFSGR4000ANWN	NH2	
E94ASxE4604	500	EFSGR5000ANWN	NH2	
E94ASxE5724	400	EFSGR4000ANWN	NH2	3 (in parallel)
E94ASxE6354	500	EFSGR5000ANWN	NH2	
E94ASxE6954				

Tab. 8-7

z K = indicator, N = no indicator

Fuse size	Fuse holder	
	2-pole	Single-pole
14 x 51	EFH20005	EFH10005
22 x 58	EFH20007	EFH10004
NH1, NH2	Use standard fuse holders	

Tab. 8-8

If fuses have tripped in case of an error, fuses connected upstream of other devices may have been damaged before. If so, we recommend to replace them.

Warnings!

For installation to UL, select approved fuses with the same tripping characteristic and a suitable voltage class.

8.5 Basic dimensioning

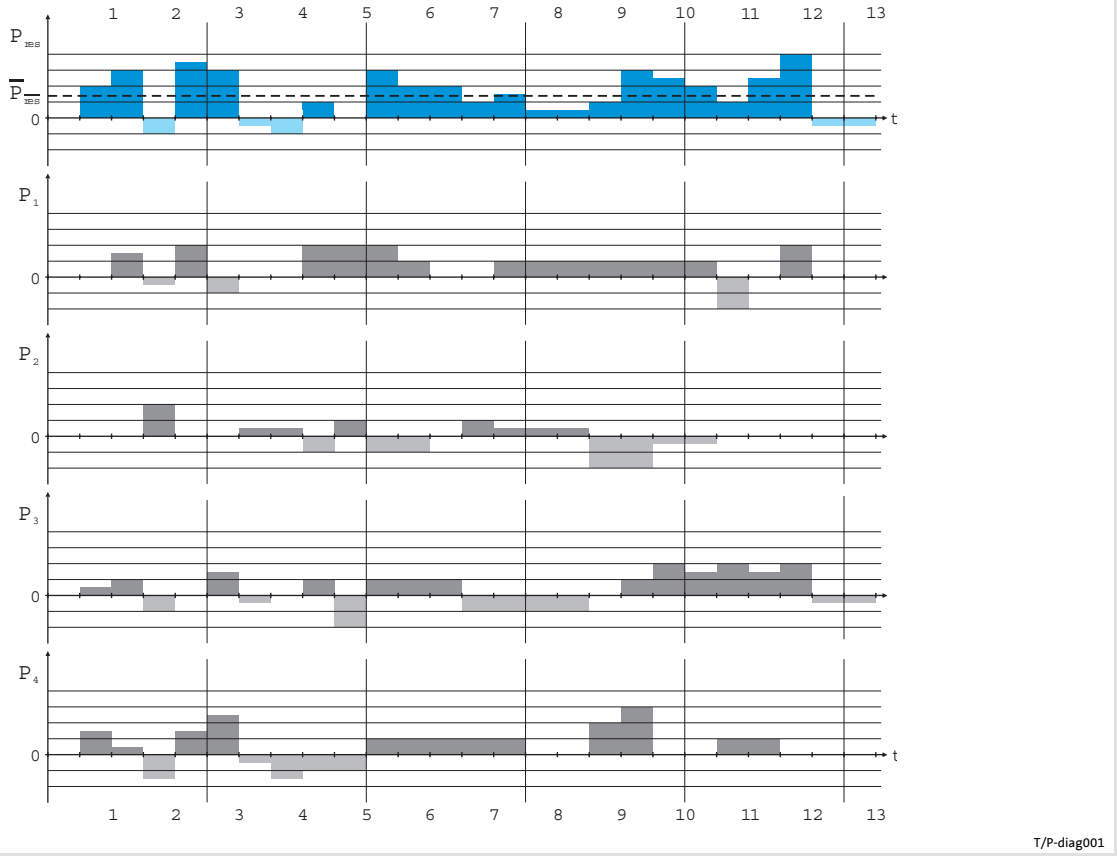
8.5.1 General information

The Drive Solution Designer (DSD) PC software helps you to dimension your drive network.

For expert advice, you may also contact your Lenze sales representative when dimensioning your application.

Time/performance diagram

For determining the performance of your drive network, create a time/performance diagram for all axes for a complete machine cycle. The power requirements of the drive network are calculated by adding the individual performances occurring at the same time. Positive results show the AC requirements for the dimensioning of the power supply units. Negative results show the brake power to be dissipated via brake choppers at the brake resistor.



Tab. 8-9 Example time/performance diagram

$P_1 \ldots P_4$	Individual performances of axes 1 ... 4
$\underline{P_{total}}$	Addition of the individual performances
$\overline{P_{total}}$	Average of the individual performances

Use the time/performance diagram to optimise the DC-bus performance of all axes for a complete machine cycle.

Utilisation factor

Please consider the utilisation factors when determining $P_{DCtotal}$. Reduce the power requirements if the rated power is not fully used.

Simultaneity factor

Please consider the simultaneity factor when determining $P_{DCtotal}$. Reduce the power requirements if the drives do not run simultaneously or in opposite direction (braking).

Braking

After determining the brake power $P_{BRtotal}$, ensure that the brake power can be provided by the brake choppers and brake resistors in the DC bus.

Other conditions

The power supply unit must be able to provide the required power (arithmetic mean).

The overload requirements must be within the permissible range:

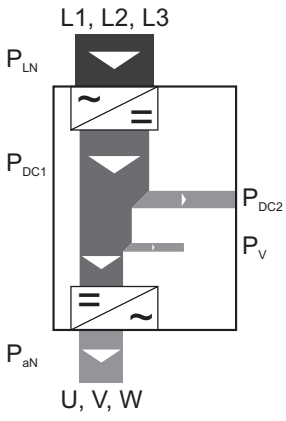
(📖 8.4.2)

- 3-min cycle (1 min overload with 150 %/2 min recovery time with 75 %)
- 5-s cycle (0.5 s overload and 4.5 s recovery time with 75 %)

For detailed information on the overload capacity, please see the Technical data.

8.5.2 Power distribution of controllers

In a DC-bus operation, the power from the AC mains is stored in the DC bus and consumed by several controllers. Drive groups with non-synchronous power consumption, partial load or excess energy from braking operations are suitable for establishing a DC-bus connection.



Power distribution

L1, L2, L3	Mains connection (3/PE AC)
P_{Lr}	Input mains power
P_{DC1}	Total DC-bus power
P_{DC2}	DC-bus power available for the DC bus
P_{loss}	Power loss
P_{ar}	Output power
U, V, W	Motor connection

8.5.3 Motor efficiency

For determining the power requirements, you have to consider the shaft power P_{shaft} and the motor efficiency. The motor efficiency can be found under the motor data.

8.5.4 Power loss of devices

When determining the power requirements, the power loss of the devices must be considered (📖 Tab. 8-5).

8.5.5 Determining the power requirements

For determining the power requirements of the drive system you need to know the rated power of the motors and their efficiency as well as the power losses of the controllers. The power requirements are calculated with the following formula:

$$P_{DCtotal} = \sum_{i=1}^{n} \left\{ \frac{\left(P_{shaft}\right)_i}{\eta_i} + \left(P_{loss}\right)_i \right\}$$

$P_{DCtotal}$	Total power required by the drive system
P_{shaft}	Rated power of a connected motor
P_{loss}	Power loss of a controller
η	Motor efficiency
I	Index variable for device identification
n	Number of devices in the drive system

The supply unit must be able to supply the calculated power requirements.

For application examples, please see 8.7 .

8.5.6 Determining the regenerative power requirements

Power regeneration into the AC mains is presently not yet possible with the 9400 servo drives series. Use the regenerative power for the dimensioning of the brake chopper(s) and the brake resistor.

8.5.7 Cable protection

In case of interferences, the cables have to be adequately protected (8.4.4).

Please consider the following when dimensioning the DC bus for a plant or machine:

- Mains fuses can be used to protect the DC cables if the wiring is designed for 122 % of the rated fuse current. Otherwise, the cable protection for the DC cables must be specially determined.
- Select the fuses for the currents resulting from power $P_{DC100\%}$. Please observe the standards and regulations applicable for the particular location and application.
- Fuse the DC-supply modules according to the Technical data on the AC mains side.
- The DC outputs of the supply modules need not be fused if all connected controllers are fused in accordance with the specifications.
- ”Multi Drive” controllers are default equipped with a fuse in the installation backplane. The fuse is only effective if the DC busbar is used. In this case, a single pole fusing against short-circuit is sufficient.
- ”Single Drive” controllers can be retrofit with a fuse in the mounting backplane. The fuse will only be effective if the DC busbar is used. In this case, a single-pole fusing against short-circuit is sufficient.
  For retrofitting, use the E94AZJA0xx busbar mounting set.
- If the DC bus is wired via the terminals +UG/-UG, always select a 2-pole cable protection.

8.5.8 Filters

The following filters can be used for the DC-supply modules.

Mains filter		DC power supply module	
Type	Device size	Type	Device size
E94AZMP0084	2	E94APNE0104	1
E94AZMP0294	3	E94APNE0364	3
E94AZMP0824	4	E94APNE1004	4
E94AZMP2004	5	E94APNE2454	5

The mains filters are designed for the following conditions:

- 10 interconnected devices,
- each with a 50 m motor cable,
- EMC category C2.

RFI filter		DC power supply module	
Type	Device size	Type	Device size
E94AZRP0084	1	E94APNE0104	1
E94AZRP0294	1	E94APNE0364	3
E94AZRP0824	4	E94APNE1004	4
E94AZRP2004	4	E94APNE2454	5

The RFI filters are designed for the following conditions:

- 6 interconnected devices,
- each with a 10 m motor cable,
- EMC category C2.

In applications with a different number of interconnected devices or different motor cable lengths, the filters may have to be specially dimensioned.

Note!

To observe EMC category C2, measures must be carried out on the device-internal EMC filters of the drive components in the network system. The measures for the individual devices are described in the chapter ”Wiring”, section ”Earthing of internal EMC filters”.

When using the mains filters assigned, conditions must be observed for compliance with EMC class C2:

- The measures for the use on IT systems must be applied to all axis modules in the interconnection (separation of internal filter components from PE).
- The maximum sum total of all motor cable lengths ($\Sigma\, l_{mot}$) for the filter used must be observed.

Motor cable lengths in the interconnection

The assigned filters are designed for $\Sigma\ l_{mot}$ for 6 axis modules (E94AZRP...: 60 m (= 6 x 10 m), E94AZMP...: 600 m (= 6 x 100 m)).

For a different number of axis modules, $\Sigma\ l_{mot}$ can be determined from the following diagrams.

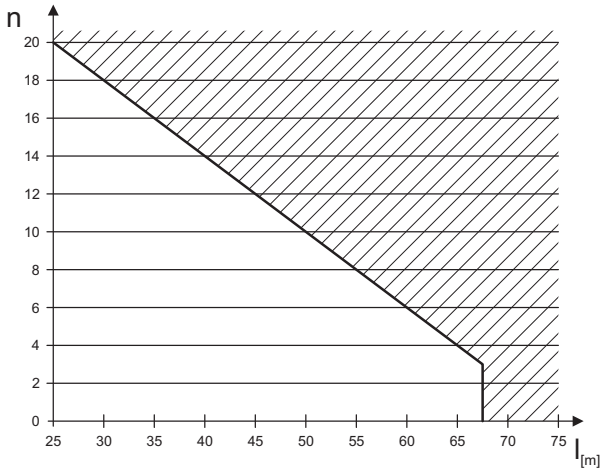


Fig. 8-2 Filter E94AZRP...: Sum total of motor cable lengths as a function of the number of axis modules

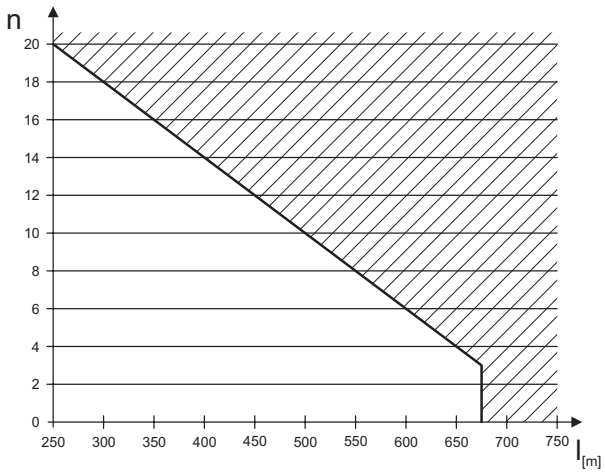


Fig. 8-3 Filter E94AZMP...: Sum total of motor cable lengths as a function of the number of axis modules

Other interference factors

Compliance of EMC class C2 may also be interfered with by other factors:

- Distribution of axis modules over several control cabinets
- No use of Lenze system cables or cables with the same specifications
- Poor connection of motor cable shields
- Motor cable interruptions
- Other interference sources (e.g. switched-mode power supplies)
- Synchronous switching of limit switches

With different motor cable lengths, per axis at least 25 % of the longest cable must be considered when calculating the total motor cable length.

Example: 1	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1	6	0.25 * 20 = 5	6
2 ... 4	3 * 10		3 * 10
5	20	⇦	20
Total	56	max. permissible for 5 axes: ∑< 60	**56**
		EMC class C2 will be complied with.	☑

Example: 2	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 4	4 * 5	0.25 * 40 = 10	4 * 10
5	40	⇦	20
Total	60	max. permissible for 5 axes: ∑< 60	**80**
		EMC class C2 will not be complied with.	☒

Example: 3	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 3	3 * 100	⇦ 0.25 * 100 = 25	3 * 100
4	50		50
5 ... 10	6 * 15		6 * 25
Total	410	max. permissible for 10 axes: ∑ < 500	**500**
		EMC class C2 will be complied with.	☑

Example: 4	Motor cable length l_{mot} [m]		
Axis	**Actual value**	**min. 25 % of the longest cable**	**To be considered**
1 ... 4	4 * 100	⇦	4 * 100
5 ... 10	6 * 15	0.25 * 100 = 25	6 * 25
Total	490	max. permissible for 10 axes: ∑ < 500	**550**
		EMC class C2 will not be complied with.	☒

8.5.9 Cables

Select the cable cross-sections for the currents resulting from power $P_{DC100\%}$. Please observe the standards and regulations applicable for the particular location and application.

8.6 Braking operation in a drive system

8.6.1 Basic considerations

If the regenerative power of a drive exceeds the storage capacity of the DC bus, the excessive energy must be consumed or dissipated. Target of the DC bus is to use the excessive energy for other axes.

Check for all DC-bus operations if the brake power provided by the brake choppers is high enough for the maximum regenerative power that may occur. If necessary, controllers with an integrated brake chopper (single-axis controller instead of a multi-axis controller) must be integrated into the drive system to increase the brake power.

If several brake choppers are used, the following conditions must be met:

- The thresholds of the brake choppers must be the same for all controllers.
- The brake choppers of several controllers are independent of each other. The brake choppers are protected by changing the duty cycle or switching them off temporarily. They are automatically switched on again.
- The limiting monitorings must be considered when dimensioning the continuous brake power for the DC bus:
  – Brake chopper monitoring
  – Brake resistor monitoring
- The temperature monitoring of the brake resistors must lead to power-off, otherwise the brake resistors or devices may be destroyed.
- The peak brake power can be used for 0.5 s in 5-s cycles.

8.7 Application examples

8.7.1 Example 1 - supply module with multi-axis controllers

Assumptions:

- 400 V, 3 AC/PE
- 7 axes in 2 power categories
- no particular dynamic performance requirements

The following motors (Mx) are selected:

Index	Motor type	Rated power [kW]	Efficiency	Rated current [A]
M1 ... M5	MCS14H15	2.5	0.92	6.6
M6 ... M7	MCS09F38	1.2	0.90	2.5

For the above motor data, the following controllers (Gx) are selected:

Index	Controller	Rated power [kW]	Typical motor power [kW]	Power loss P_l [kW]	Rated current [A]
G1 ... G5	E94AMxE0074	4.8	3.0	0.19	7.0
G6 ... G7	E94AMxE0034	1.7	0.75	0.12	2.5

The power required by the drive system is determined with the below formula (📖 8.5.5):

$P_{DCtotal}$ = 5 * (2.5 kW / 0.92 + 0.19 kW) + 2 * (1.2 kW / 0.90 + 0.12 kW)

$P_{DCtotal}$ = 17.4 kW

The calculated power requirement is used to select the supply module:

Index	Supply module (+ mains filter)	Rated power ($P_{DC100\%}$) [kW]
V1	E94APNE0364 + E94AZMP0294	17.5

Note: Only the supply module with mains filter reaches the required power.

Checking the power efficiency:

With 17.5 kW > 17.4 kW, $P_{DC100\%} > P_{DCtotal}$.

Select cables and fuses in accordance with the Technical data.

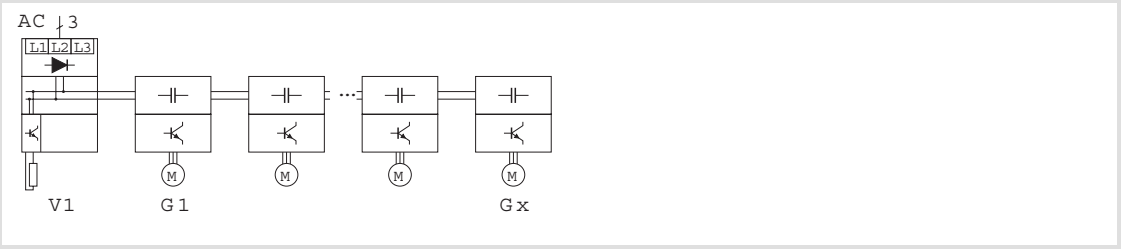


Fig. 8-4 Basic circuit diagram

8.7.2 Example 2 - single-axis controller with multi axes

Assumptions:

- 400 V, 3 AC/PE
- 4 axes in 3 power categories
- no particular dynamic performance requirements

The following motors (Mx) are selected:

Index	Motor type	Rated power [kW]	Efficiency	Rated current [A]
M1	MCS19P30	10.0	0.93	19
M2	MCS14H15	2.5	0.92	6.6
M3 ... M4	MCS09F38	1.2	0.90	2.5

For the above motor data, the following controllers (Gx) are selected:

Index	Controller	Rated power [kW]	Typical motor power [kW]	Power loss P_l [kW]	Rated current [A]
G1	E94ASxE0244	16.3	11.0	0.50	23.5
G2	E94AMxE0074	4.8	3.0	0.19	7.0
G3 ... G4	E94AMxE0034	1.7	0.75	0.12	2.5

The power required by the drive system is determined with the below formula (📖 8.5.5):

$P_{DCtotal} = (10\ kW / 0.93 + 0.50\ kW) + (2.5\ kW / 0.92 + 0.19\ kW) + 2 * (1.2\ kW / 0.90 + 0.12\ kW)$

$P_{DCtotal} = 17.1\ kW$

The calculated power requirement is used to select the single-axis controller with mains choke:

Index	Controller (+ mains choke)	Rated power ($P_{DC100\%}$) [kW]
(G1)	E94ASxE0244 + E94AZMS0314	18.8

Note: Only the controller with mains choke reaches the required power.

Checking the power efficiency:

With 18.8 kW > 17.1 kW, $P_{DC100\%} > P_{DCtotal}$.

Select cables and fuses in accordance with the Technical data.

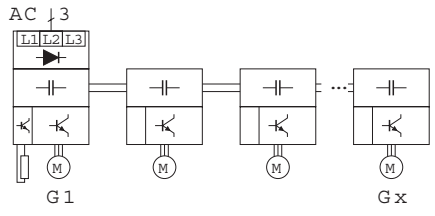


Fig. 8-5 Basic circuit diagram

9 Accessories (overview)

Note!

You can find additional information on the accessories in the catalogue to this product series.

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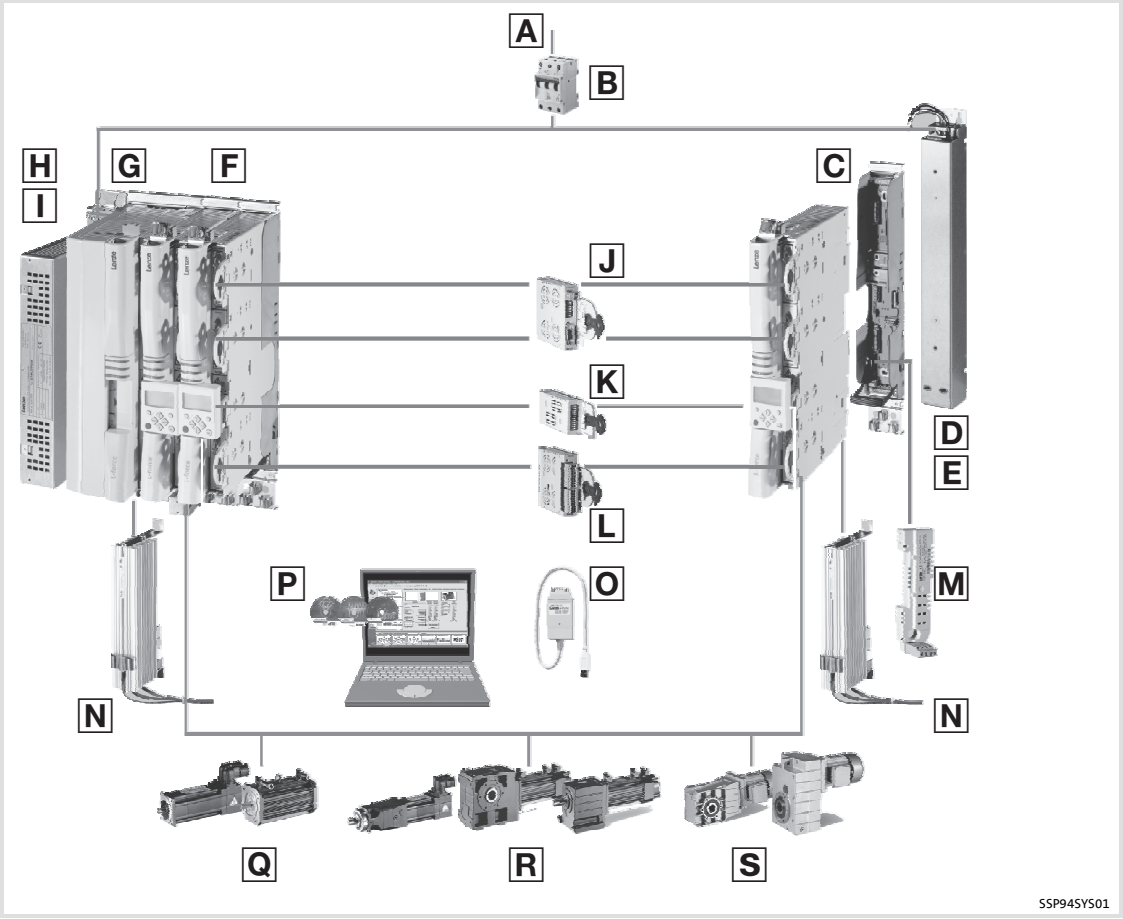
9.1 Overview

9.1.1 System overview

The following figure shows the most important components for the implementation of a drive system with the Servo Drives 9400 product range.

On the way from the mains connection to the motor, you can see the basic principle of a drive system on the left path. On the right path, the basic principle of a single-axis drive is described.

In accordance with the requirements of your drive solution, your drive system can be equipped or extended with specially adapted components.



A Mains voltage 3/PE AC 180 ... 550 V ±0 % or 3/PE AC 380 ... 550 V ±0 %
(depending on the device size/device power)
B Mains fusing (not contained in the delivery programme)
C Single Drives 9400 📖 37
and corresponding installation backplanes
D Mains filter for Single Drives 9400 📖 495
E RFI filter for Single Drives 9400 📖 518
F Multi Drives 9400 📖 155
and corresponding installation backplanes
G Power supply modules 9400
📖 213, 📖 261
(for DC bus installations with Multi Drives 9400)
H Mains filter for power supply modules 9400 📖 501
I RFI filter for power supply modules 9400 📖 527

Equipment for all axis modules (device-dependent options):
J Communication modules and extension modules 📖 346
K Memory modules 📖 396
L Safety modules 📖 403
M Motor holding brake control modules 📖 419
N Brake resistors 📖 560
O Diagnostic adapters 📖 467
P L-force Engineer (software)
Q Servo motors (motor catalogue)
R Geared servo motors (")
S Standard geared motors (")
Motor cables/system cables
(manual "System cables")

9.1.2 Assignment of accessories

With the accessories available, the standard devices of the controllers of the Servo Drives 9400 series are directly equipped with functions, interfaces, etc. required for specific drive solutions.

The following overview shows the accessories assigned to the controllers and power supply modules.

Accessories	Single Drive			Multi Drive	Power supply modules		VR modules	
Field	Device size GG			GG	GG		GG	
Designation	1 ... 3	6 ... 7	8S ... 10	1 ... 3	1 & 3	4 & 5	1 & 3	Page
Device modules								
Communication modules								from 346
Ethernet	+	+	+	+	---	---	+	
EtherCAT	+	+	+	+	---	---	+	
PROFIBUS	+	+	+	+	---	---	+	
PROFINET	+	+	+	+	---	---	+	
CAN	+	+	+	+	---	---	+	
DeviceNet	+	+	+	+	---	---	+	
Function modules								from 390
Digital frequency	+	+	+	+	---	---	---	
Cover module	+	+	+	+	---	---	+	
Memory modules 1)								from 396
MM20x	+	+	+	+	---	---	---	
MM220	---	---	---	---	---	---	+	
MM330	+	+	+	+	---	---	---	
(MM4xx in preparation)	+	+	+	+	---	---	---	
Safety modules 1)								from 403
SM0	+	+	+	+	---	---	+	
SM100	+	+	+	+	---	---	---	
SM301	+	+	+	+	---	---	---	
Motor holding brake control modules								from 419
28 V intern. installation backplane	+	---	---	+	---	---	---	
28 V intern. device	---	+	+	---	---	---	---	
180 V extern. (installation backplane)	+	-	-	+	---	---	---	
180 V intern. device	---	+	+		---	---	---	
205 V extern. (installation backplane)	+	-	-	+	---	---	---	
205 V intern. device	---	+	+	+	---	---	---	
Filters								
Mains filters								from 495
E94AZMSxxxx	+	+	---	---	---	---	---	
E94AZMPxxxx	---	---	---	---	+	+	---	
E94AZMRxxxxSDB	---	---	---	---	---	---	+	
E94AZMRxxxxLDB	---	---	---	---	---	---	+	
RFI filters								from 518
E94AZRSxxxx	+	+	---	---	---	---	---	

Accessories	Single Drive			Multi Drive	Power supply modules		VR modules	
Field	Device size GG			GG	GG		GG	
Designation	1 ... 3	6 ... 7	8S ... 10	1 ... 3	1 & 3	4 & 5	1 & 3	Page
E94AZRPxxxx	---	---	---	---	+	+	---	
Sinusoidal filters								from 538
EZS3-xxxA200	+	+	-	-	---	---	---	
Installation accessories								
EMC kit								from 557
E94A...	+	+	+	+	+	+	+	
Busbar mounting sets								from 488
E94AZJA003	+	---	---	^	---	---	---	
E94AZJA007	+	---	---	^	---	---	---	
E94AZJA024	+	---	---	^	---	---	---	
Input module								from 481
E94AZEX100	+	o	o	+	+	+	+	
Brake resistors								from 560
ERBxxxxxRxxxW	+	+	+	---	+	+	+	
Diagnostics								from 467
PC connection								
E94ACUS USB adapter	+	+	+	+	---	---	+	
Keypad								
E94AZKAE keypad	+	+	+	+	---	---	+	
E94AZKHT hand-held terminal	+	+	+	+	---	---	+	
24 V DC power supply units								from 574
EZV1200-000	+	+	+	+	+	+	+	
EZV2400-000	+	+	+	+	+	+	+	
EZV4800-000	+	+	+	+	+	+	+	
EZV1200-001	+	+	+	+	+	+	+	
EZV2400-001	+	+	+	+	+	+	+	
EZV4800-001	+	+	+	+	+	+	+	
DC fuses								
EFSARxxxxARHN EFSGRxxxxAYxz	+	---	---	+	---	---	---	
EFSGRXXXXANVN	---	+	---	---	---	---	---	
EFSGRXXXXANWN	---	---	+	---	---	---	---	
System cables								
see manual "System cables"	+	+	+	+	+	+	+	

1)	Component from this range is absolutely necessary
+	Can be used without restrictions
o	Can be used with restrictions
-	Can be used, but check alternative
^	Already included
---	No use

9.2 Type-specific accessories

Accessories for L-force 9400:

- Device modules - for different functional areas

  Communication
  – Ethernet (📖 349)
    Ethernet E94AYCEN
    Ethernet POWERLINK master E94AYCEP
    Ethernet POWERLINK slave E94AYCEC
    EtherCAT E94AYCET
    ETHERNET Powerlink hub
  – DeviceNet E94AYCDN
  – PROFIBUS E94AYCPM
  – PROFINET E94AYCER
  – CANopen E94AYCCA (📖 386)

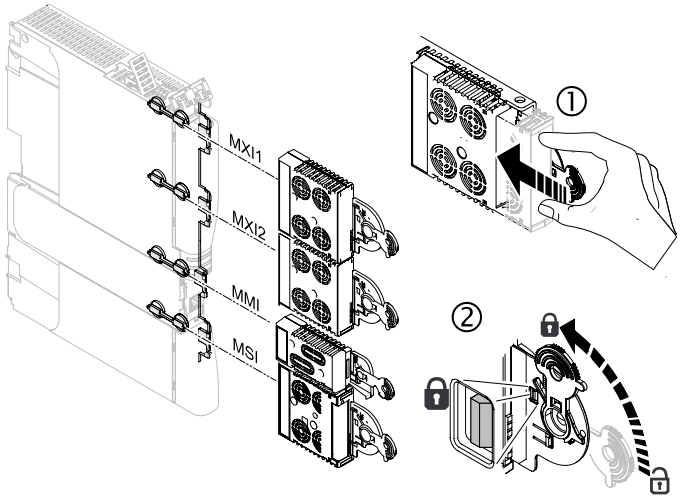
  Extension
  – Digital frequency E94AYFLF

  Memory
  – MM100 E94AYM100 (minimum equipment)
  – MM200 E94AYM200
  – MM300 E94AYM300
  – MM400 E94AYM400

  Safety
  – SM0 E94AYAA (minimum equipment, if no safety functions are required)
  – SM100 E94AYAB
  – SM301 E94AYAE
- Keypad E94AKZAE
- USB diagnostic adapter E94AZCUS
- DC-feeding point E94AZEX100
- Mains filter E94AZ...
- RFI filters
- Sinusoidal filters
- Brake resistors
- Prefabricated, ready-for-use system cables
- Motors with electronic nameplate (ENP)
- Gearboxes with reduced backlash
- Motor brake control module
- Busbar mounting sets (for retrofitting single-axis controllers for DC-bus operation)

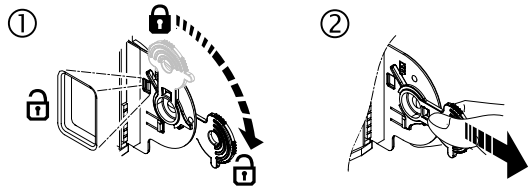
9.3 Communication modules

Mounting



E94YCXX001G

Dismounting



E94AYCXX001H

Safety instructions

Danger!

Inappropriate handling of the communication module and the standard device can cause serious personal injury and material damage.

Observe the safety instructions and residual hazards described in the documentation for the standard device.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

The communication module contains electronic components that may be damaged or destroyed through electrostatic discharge.

Take appropriate measures to protect the components before touching the communication module.

9.3.1 Possible device module combinations

Communication and extension modules can be used to adapt the Servo Drives 9400 to the machine requirements. For this, the HighLine version is equipped with module slots MXI1 and MXI2.

The following possible combinations are permissible:

	MXI1								
MXI2	E94AYFLF	E94AYCCA	E94AYCDN	E94AYCET	E94AYCEN	E94AYCEP	E94AYCEC	E94AYCPM	E94AYCER
E94AYFLF	-	☑	☑	☑	☑	☑	☑	☑	☑
E94AYCCA	☑	-	-	☑	☑	☑	☑	☑	☑
E94AYCDN	☑	-	-	-	☑	☑	☑	☑	☑
E94AYCET	☑	☑	-	-	☑	-	-	-	☑
E94AYCEN	☑	☑	☑	☑	-	☑	☑	☑	☑
E94AYCEP	☑	☑	☑	-	☑	-	-	☑	☑
E94AYCEC	☑	☑	☑	-	☑	-	-	-	-
E94AYCPM [1)]	☑	☑	☑	-	☑	☑	-	-	☑
E94AYCER [1)]	☑	☑	☑	☑	☑	☑	-	☑	-

☑ Permissible
- Not possible
1) PROFIsafe can only be used in MXI1

9.3.2 Ethernet interface

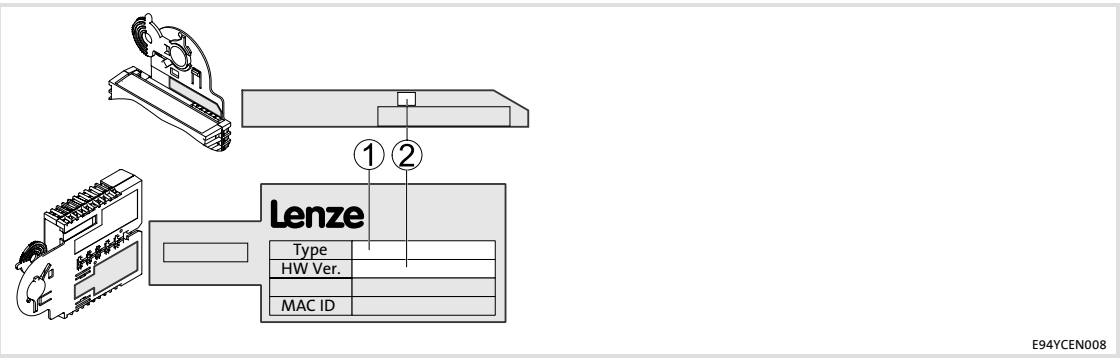
9.3.2.1 Ethernet

For detailed information, please see the Ethernet communication manual.

Quick introduction:

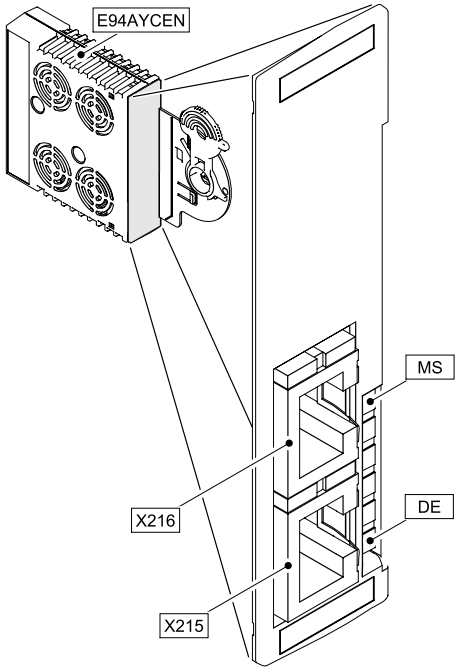
Type designation: E94AYCEN

Identification



	①					②
Type code	**E94**	**A**	**Y**	**C**	**EN**	**Vx**
Product series						
Device generation						
Module identification: extension module						
Module type: communication module						
Ethernet						
Hardware version						

Scope of supply



E94YCEN001A

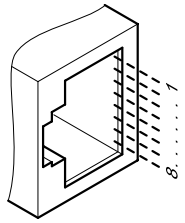
Connections

Pos.	Description
X215	Ethernet connections Design: RJ45 socket to IEC 60603-7
X216	

Displays

LED			
Pos.	Colour	Condition	Description
MS	green	on	The communication module is supplied with voltage.
DE	red	on	The communication module is not accepted by the standard device (see notes provided in the instructions for the standard device).
LEDs at connection X215/X216:			
-	yellow	On / blinking	Data is being exchanged via Ethernet.
-	green	on	Ethernet connection is available.

Ethernet connection

RJ45 socket	PIN	Signal
 E94AYCXX004C	1	Tx +
	2	Tx -
	3	Rx +
	4	-
	5	-
	6	Rx -
	7	-
	8	-

Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

9.3.2.2 Ethernet POWERLINK

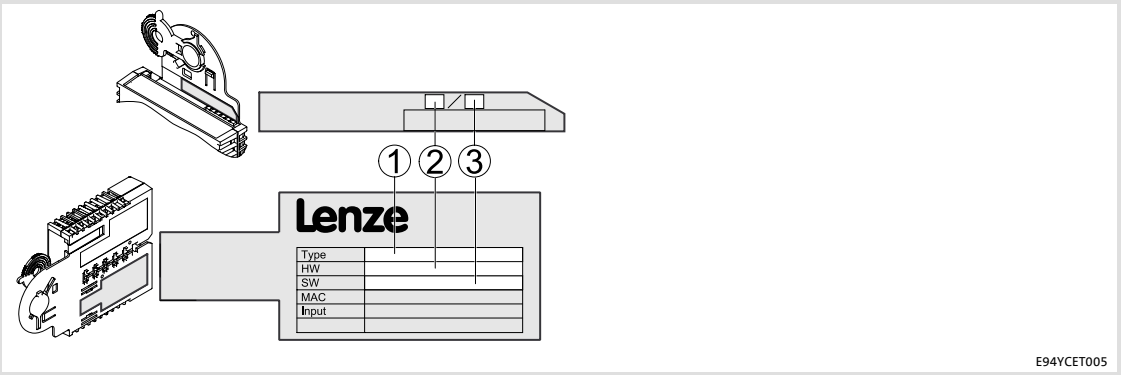
Ethernet Powerlink

For detailed information, please see the Ethernet communication manual.

Quick introduction:

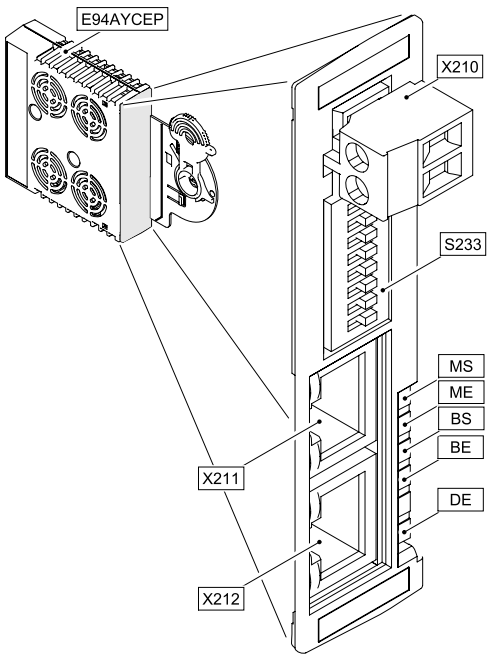
Type designation: E94AYCEP

Identification



	①					②	③
	E94	**A**	**Y**	**C**	**EP**	**VA**	**0.50**
Product series							
Version							
Module identification: extension module							
Module type: communication module							
ETHERNET Powerlink							
Hardware version							
Software version							

Scope of supply



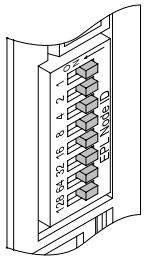
Connections

Pos.	Description
X210	Connection to the external supply of the communication module Design: plug connector with screw connection, 2-pole
X211	Connection for ETHERNET Powerlink Design: RJ45 socket in accordance with IEC 60603-7, with integrated LEDs
X212	

Displays

LED			
Pos.	**Colour**	**Condition**	**Description**
MS	Green	Blinking	Communication module is supplied with voltage, but has no connection to the standard device (standard device is either switched off, in the initialisation phase, or not available).
		On	Communication module is supplied with voltage and has a connection to the standard device.
ME	Red	On	There is an error in the area of the communication module.
BS	Green	The LED functions are controlled by the NMT state machine.	
		Off	EPL network is not active (LED off) EPL status: NMT_GS_OFF, NMT_GS_INITIALISATION, NMT_CS_NOT_ACTIVE / NMT_MS_NOT_ACTIVE
			EPL network in the initialisation phase. (LED flashes once within a second) EPL status: NMT_CS_PREOPERATIONAL_1 / NMT_MS_PREOPERATIONAL_1
			EPL in the initialisation phase with cyclic traffic. (LED flashes twice within a second) EPL status: NMT_CS_PREOPERATIONAL_2 / NMT_MS_PREOPERATIONAL_2
			EPL node waits for the starting signal. (LED flashes three times within a second) EPL status: NMT_CS_READY_TO_OPERATE / NMT_MS_READY_TO_OPERATE
			EPL node has not found any EPL master and is in the "BASIC-Ethernet" operating mode. (LED is blinking at a frequency of 10 Hz) EPL status: NMT_CS_BASIC_ETHERNET
			EPL node in the "Stopped" status. Waiting for disconnection. (LED is blinking at a frequency of 2.5 Hz) EPL status: NMT_CS_STOPPED
			EPL node in the operating phase (LED is on continuously) EPL status: NMT_CS_OPERATIONAL / NMT_MS_OPERATIONAL
BE	Red	Off	There is no error.
		On	There is an error.
DE	Red	On	The communication module is not accepted by the standard device (see notes given in the documentation on the standard device).
Signalling at the terminals X211 or X212:			
-	Red	On	Ethernet collision is available.
-	Green	On	Ethernet connection is available.
		Blinking	Ethernet connection with active data communication

DIP switch



E94YCEP001D

Pos.	Description
S233	Node addressing: The node address results from the sum of all switches being set to "ON". ● Example: Switches 32, 8, 4 = ON → address = 44 ● E94AYCEP address as master: 240 ● E94AYCEP address as slave: 1 ... 100 with E94AYCEP as master 1 ... 239 with another master

Note!

The Lenze setting of all switches is OFF.

Observe the information on how to set the node address in the ETHERNET Powerlink Communication Manual.

External voltage supply

Supply the communication module via the connection X210 by means of a separate supply voltage.

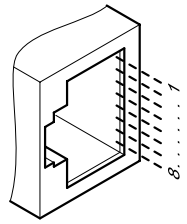
Designation	Explanation
+	External voltage supply U = 24 V DC (20.4 V - 0 % ... 28.8 V + 0 %) I = 140 mA
-	Reference potential for external voltage supply

For greater distances between the control cabinets, use a power supply unit in each control cabinet.

Screw terminal data

Area	Values	
Electrical connection	Plug connector with screw connection	
Possible connections	rigid:	
		1.5 mm^2 (AWG 16)
	flexible:	
		without wire end ferrule 1.5 mm^2 (AWG 16)
		with wire end ferrule, without plastic sleeve 1.5 mm^2 (AWG 16)
		with wire end ferrule, with plastic sleeve 1.5 mm^2 (AWG 16)
Tightening torque	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	
Stripping length	6 mm	

Ethernet connection

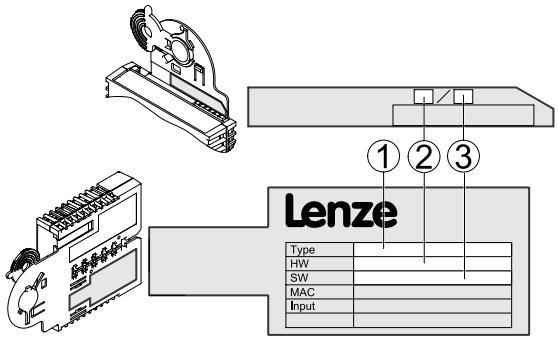
RJ45 socket	PIN	Signal
 E94AYCXX004C	1	Tx +
	2	Tx -
	3	Rx +
	4	-
	5	-
	6	Rx -
	7	-
	8	-

Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

9.3.2.3 Ethernet POWERLINK slave

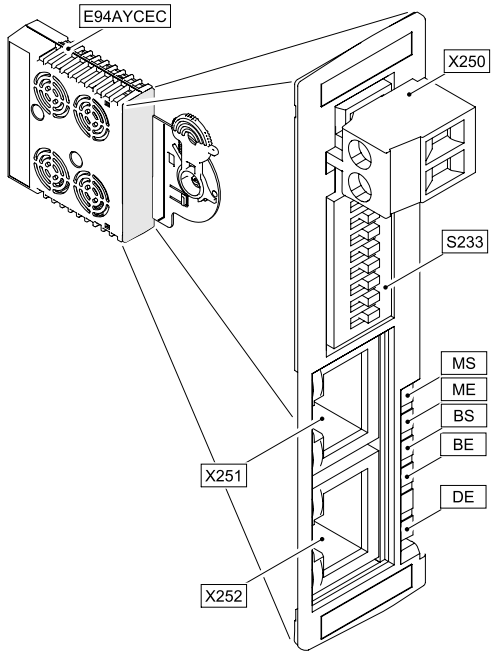
Identification



E94YCET005

	①				②	③
	E94	**A**	**Y**	**C**	**EC**	**VC**	**1.0**
Product series							
Version							
Module identification: extension module							
Module type: communication module							
ETHERNET Powerlink (CN)							
Hardware version							
Software version							

Scope of supply



E94YCEC001A

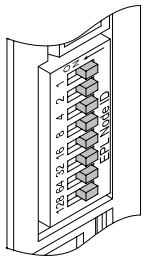
Connections

Pos.	Description
X250	Connection to the external supply of the communication module Design: plug connector with screw connection, 2-pole
X251	Connection for ETHERNET Powerlink
X252	Design: RJ45 socket in accordance with IEC 60603-7, with integrated LEDs

Displays

LED			
Pos.	Colour	Condition	Description
MS	Green	Blinking	Communication module is supplied with voltage, but has no connection to the standard device (standard device is either switched off, in the initialisation phase, or not available).
		On	Communication module is supplied with voltage and has a connection to the standard device.
ME	Red	On	There is an error in the area of the communication module.
BS	Green	The LED functions are controlled by the NMT state machine.	
		Off	EPL network is not active (LED off) EPL status: NMT_GS_OFF, NMT_GS_INITIALISATION, NMT_CS_NOT_ACTIVE / NMT_MS_NOT_ACTIVE
			EPL network in the initialisation phase. (LED flashes once within a second) EPL status: NMT_CS_PREOPERATIONAL_1 / NMT_MS_PREOPERATIONAL_1
			EPL in the initialisation phase with cyclic traffic. (LED flashes twice within a second) EPL status: NMT_CS_PREOPERATIONAL_2 / NMT_MS_PREOPERATIONAL_2
			EPL node waits for the starting signal. (LED flashes three times within a second) EPL status: NMT_CS_READY_TO_OPERATE / NMT_MS_READY_TO_OPERATE
			EPL node has not found any EPL master and is in the "BASIC-Ethernet" operating mode. (LED is blinking at a frequency of 10 Hz) EPL status: NMT_CS_BASIC_ETHERNET
			EPL node in the "Stopped" status. Waiting for disconnection. (LED is blinking at a frequency of 2.5 Hz) EPL status: NMT_CS_STOPPED
			EPL node in the operating phase (LED is on continuously) EPL status: NMT_CS_OPERATIONAL / NMT_MS_OPERATIONAL
BE	Red	Off	There is no error.
		On	There is an error.
DE	Red	On	The communication module is not accepted by the standard device (see notes given in the documentation on the standard device).
Signalling at the terminals X211 or X212:			
-	Red	On	Ethernet collision is available.
-	Green	On	Ethernet connection is available.
		Blinking	Ethernet connection with active data communication

DIP switch



E94YCEP001D

Pos.	Description
S233	Node addressing: The node address results from the sum of all switches being set to "ON". ● Example: Switches 32, 8, 4 = ON → address = 44 ● Address area: 1 ... 100 1 ... 100 with E94AYCEP as master 1 ... 239 with another master

Note!

The Lenze setting of all switches is OFF.

Observe the information on how to set the node address in the ETHERNET Powerlink Communication Manual.

External voltage supply

Supply the communication module via the connection X210 by means of a separate supply voltage.

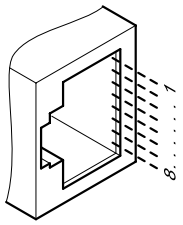
Designation	Explanation
+	External voltage supply U = 24 V DC (20.4 V - 0 % ... 28.8 V + 0 %) I = 140 mA
-	Reference potential for external voltage supply

For greater distances between the control cabinets, use a power supply unit in each control cabinet.

Screw terminal data

Area	Values	
Electrical connection	Plug connector with screw connection	
Possible connections	rigid:	
		1.5 mm² (AWG 16)
	flexible:	
		without wire end ferrule 1.5 mm² (AWG 16)
		with wire end ferrule, without plastic sleeve 1.5 mm² (AWG 16)
		with wire end ferrule, with plastic sleeve 1.5 mm² (AWG 16)
Tightening torque	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	
Stripping length	6 mm	

Ethernet connection

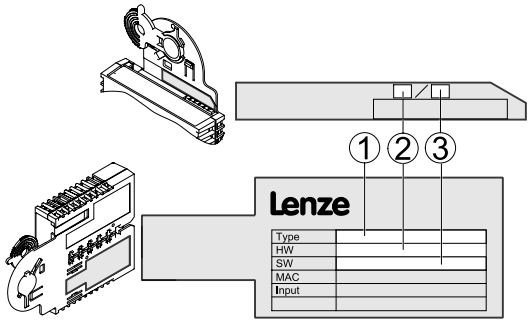
RJ45 socket	PIN	Signal
 E94AYCXX004C	1	Tx +
	2	Tx -
	3	Rx +
	4	-
	5	-
	6	Rx -
	7	-
	8	-

Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

9.3.2.4 EtherCAT

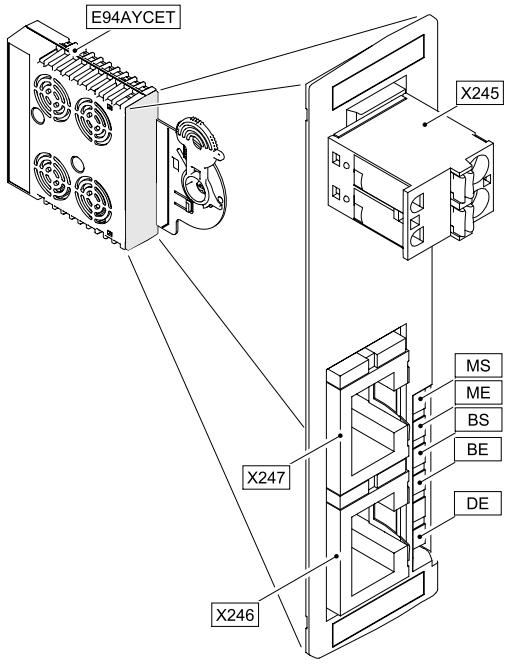
Identification



E94AYCET005

	①				②	③
	E94	**A**	**Y**	**C**	**ET**	**VE**	**02.00**
Product range							
Version							
Module ID: extension module							
Module type: communication module							
EtherCAT							
Hardware version							
Software version							

Scope of supply



E94AYCET001B

Connections

Pos.	Description
X245	Connection for the external supply of the communication module Design: Plug connector with spring connection, 2-pole
X246	EtherCAT input (IN) Design: RJ45 socket according to IEC 60603-7
X247	EtherCAT output (OUT) Design: RJ45 socket according to IEC 60603-7

Displays

LED			
Pos.	Colour	Condition	Description
MS	green	blinking	The communication module is supplied with voltage but has no connection to the standard device (standard device is either switched off, in the initialisation phase, or not available).
		on	The communication module is being supplied with voltage and is connected to the standard device.
ME	red	on	A communication module error has occurred.
BS	green	off	The communication module is in the ”Init” status (initialisation phase).
		blinking (2.5 Hz)	The communication module is in the ”Pre-Operational” status.
		blinking (1.0 Hz)	The communication module is in the ”Safe-Operational” status.
		flickering	The communication module is booting and has not yet reached the ”Init” status (initialisation phase).
		on	The communication module is in the ”Operational” status.
BE	red	blinking	Bus error/trouble is active (e.g. the Ethernet cable is unplugged). The LED is blinking in parallel to the BS LED.
DE	red	on	The communication module is not accepted by the standard device or the standard device is not active. (See notes provided in the documentation for the standard device.)
Signalling at connection X246/X247:			
-	Red	On / blinking	The EtherCAT connection is disrupted or not available.
-	Green	On / blinking	● The EtherCAT connection is available. ● The data communication of the EtherCAT connection is active.

External voltage supply

Note!

Always use a separate power supply unit in every control cabinet and safely separate it according to EN 61800-5-1 (”SELV”/”PELV”) in the case of external voltage supply and larger distances between the control cabinets.

The external voltage supply of the communication module is required if EtherCAT communication is to remain intact in case the supply of the standard device fails.

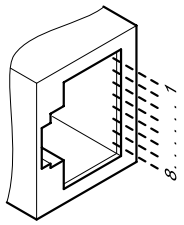
Supply the communication module via the 2-pole plug connector (X245) with a separate supply voltage.

Designation	Description
+	External voltage supply U = 24 V DC (20.4 V - 0 % ... 28.8 V + 0 %) I = 130 mA
-	Reference potential for external voltage supply

Terminal data

Field	Values	
Electrical connection	2-pin plug connector with spring connection	
Possible connections	rigid:	
		1.5 mm² (AWG 16)
	flexible:	
		without wire end ferrule 1.5 mm² (AWG 16)
		with wire end ferrule, without plastic sleeve 1.5 mm² (AWG 16)
		with wire end ferrule, with plastic sleeve 1.5 mm² (AWG 16)
Stripping length	9 mm	

EtherCAT connection



E94AYCET004C

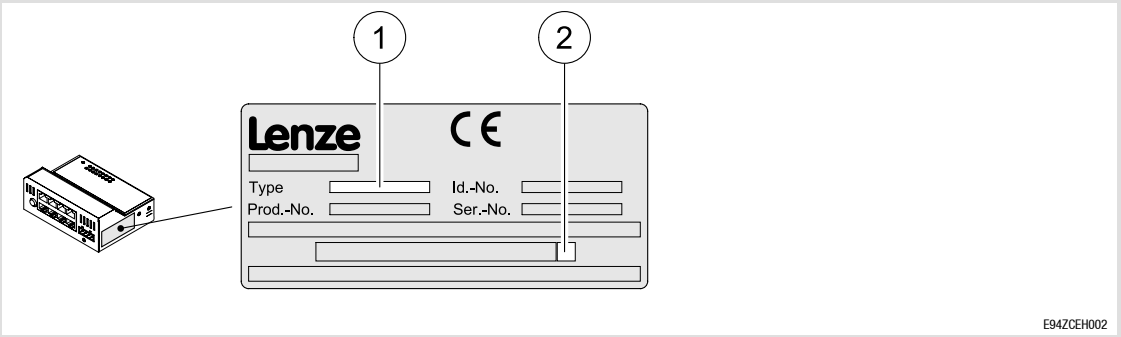
Pin	Signal
1	Tx +
2	Tx -
3	Rx +
4	-
5	-
6	Rx -
7	-
8	-

Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

9.3.2.5 Ethernet POWERLINK hub

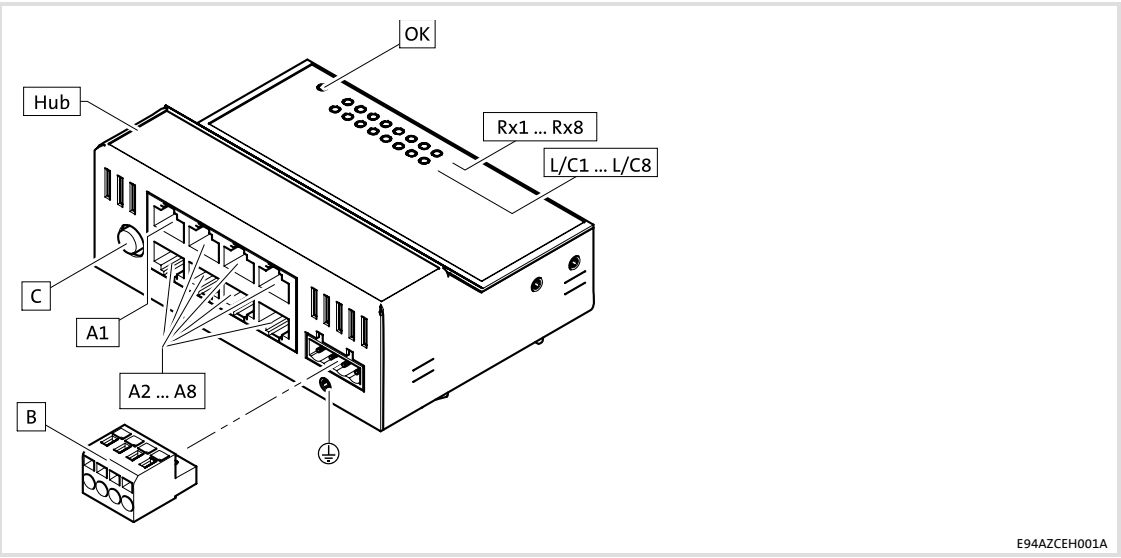
Identification



①					②
E94	A	Z	C	EH	1A

- Product series
- Generation
- Accessories
- External accessories
- ETHERNET Powerlink hub
- Hardware version

Scope of supply

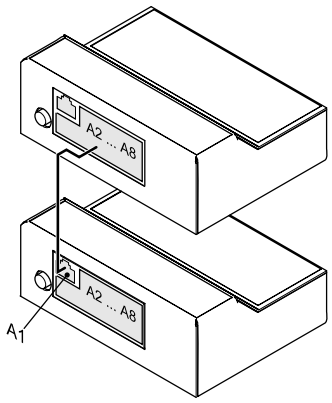


Pos.	Description
-	ETHERNET Powerlink hub
-	Mounting Instructions

Connections

Pos.	Connection	Description
A1, A2 ... A8	Ethernet	RJ45 socket to EN 50173
B	DC voltage supply	Plug connector with spring connection, 4-pole
⏚	PE	M3 thread

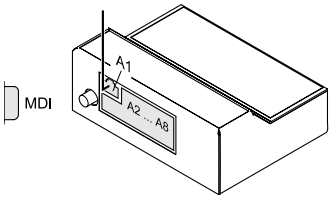
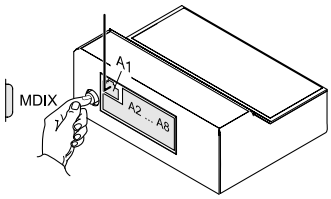
Use the uplink port A1 to cascade the hubs:



E94AZCEH003

The hubs can be connected using a patch or a crossover cable.

Use the MDI / MDIX switch to select the uplink mode as shown in the following figure:

Patch cable	Crossover cable
	

E94YCEH005

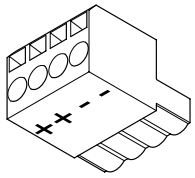
Switch

Pos.	Element	Explanation
C	Pushbutton switch	Activates Rx/Tx crossing for connection A1: ● ON: MDIX ● OFF: MDI

Displays

LED			
Pos.	Colour	Condition	Description
OK	Yellow	On	Device is supplied with voltage.
Rx1 ... Rx8	Yellow	On	**Activity** Connections A1 ... A8 send or receive data.
		Blinking	
L/C1 ... L/C8	Green	On	**Link** Connections A1 ... A8 are connected to the Ethernet network.
	Red	On	**Collision** Connection between connections A1 ... A8 and the Ethernet network is inhibited due to collision.

External voltage supply



E94AZCEH001C

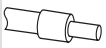
Stop!

The double plug connector terminals are used to conduct the voltage supply. The total current resulting from the series connection of several devices must not exceed $I_{max.}$ = 10 A per terminal.

Plug connector connection:

Plug connector	Explanation
+	Voltage supply U = 24 V DC (20.4 V - 0 % ... 28.8 V + 0 %) I = 210 mA
-	Reference potential for voltage supply

Screw terminal data

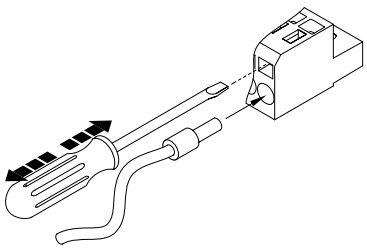
Terminal data		
Electrical connection	Plug connector with spring connection	
Possible connections		rigid: 2.5 mm² (AWG 12)
		flexible:
		without wire end ferrule 2.5 mm² (AWG 12)
		with wire end ferrule, without plastic sleeve 2.5 mm² (AWG 12)
		with wire end ferrule, with plastic sleeve 2.5 mm² (AWG 12)
Stripping length	10 mm	

Use of pluggable terminal strips

Stop!

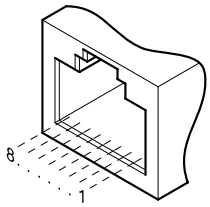
To avoid damage to pluggable terminal strips and contacts:
Wire pluggable terminal strips prior to connection!

Use of the pluggable terminal strip with spring connection



E94YCEH007B

Ethernet connection



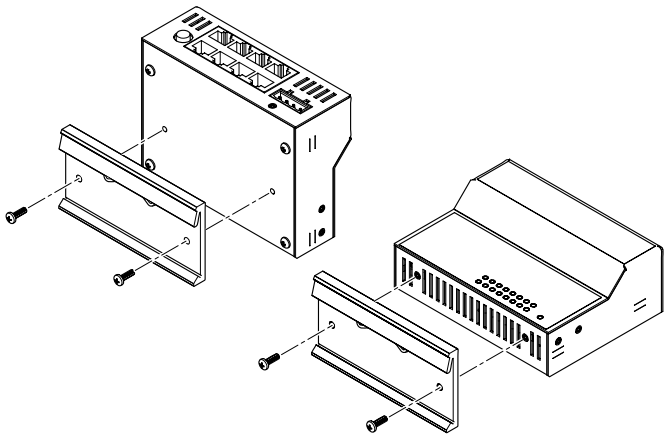
E94ZCEH004

PIN	Pin assignment for port 1 (connection A1)		Pin assignment for ports 2 - 8 (connections A2 ... A8)
	MDI (not crossed)	MDIX (crossed)	
1	Tx +	Rx +	Rx +
2	Tx -	Rx -	Rx -
3	Rx +	Tx +	Tx +
4	-	-	-
5	-	-	-
6	Rx -	Tx -	Tx -
7	-	-	-
8	-	-	-

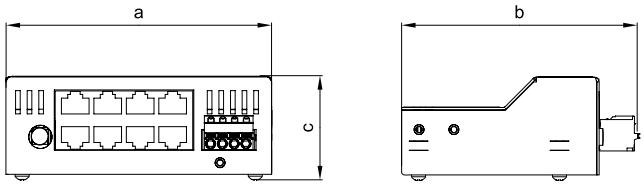
Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

Mounting



Dimensions



a	114 mm
b	102 mm
c	44 mm

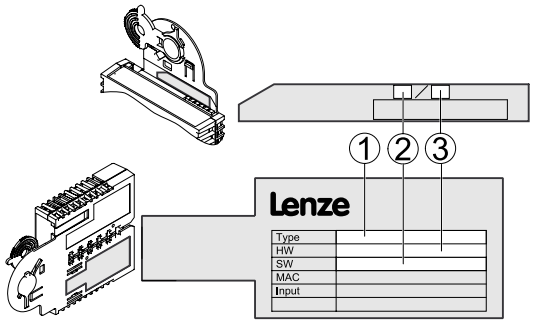
9.3.3 DeviceNet

For detailed information, please see the DeviceNet communication manual.

Quick introduction:

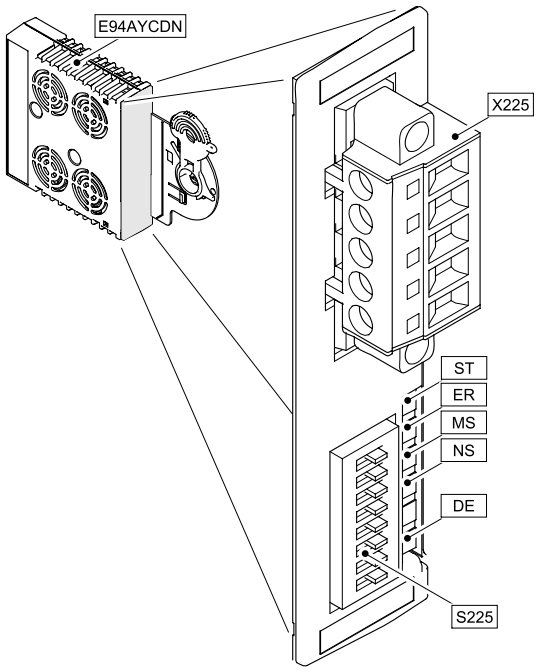
Type designation: E94AYCDN

Identification



	①					②	③
	E94	**A**	**Y**	**C**	**DN**	**VA**	**1.00**
Product range							
Device generation							
Module identification: extension module							
Module type: Communication module							
DeviceNet							
Hardware version							
Software version							

Scope of supply



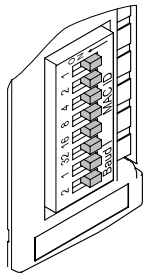
Connections

X225	Connection to DeviceNet with external voltage supply of the communication module Design: Plug connector with screw connection, 5-pole

Displays

Pos.	Colour / status		Description
ST	green is on		The communication module is supplied with voltage and has a connection to the basic device.
	green is blinking		The communication module is supplied with voltage but is not connected to the standard device (standard device is switched off, being initialised, or not available).
ER	red is on		An error has occurred on the communication module.
MS	**green**	**red**	
	off	off	The communication module is not supplied with voltage.
	off	on	The communication module is defective and must be replaced.
	off	blinking	The error in the communication module can be removed.
	on	off	The communication module works properly.
	blinking	off	The communication module has not been completely configured yet or configuration is faulty.
	blinking	blinking	The communication module is in self-test mode.
NS	**green**	**red**	
	off	off	The communication module is not supplied with voltage via DeviceNet or the ”Duplicate MAC ID” test has not been completed yet.
	off	on	The communication module cannot access the bus (e.g. ”Duplicate MAC ID”, bus off, invalid baud rate etc.).
	off	blinking	The error in the communication module can be removed.
	on	off	The communication module works properly and has established a connection to the scanner.
	blinking	off	The communication module ... ● works properly; ● has completed the ”Duplicate MAC ID” test; ● has not yet been integrated by the scanner.
	blinking	blinking	The communication module ... ● is in error status; ● has received and accepted a telegram for identifying the faulty devices (”Identify Communication Faulted Request”).
DE	red is on		The communication module is not accepted by the standard device (see notes given in the documentation of the standard device).

DIP switch



E94YCDN001D

Pos.	Switch positions								
	Baud rate			Node address (MAC ID)					
	2	1	kbps	32	16	8	4	2	1
S225	OFF	OFF	125	The station address results from the sum of the binary valencies of the switches 1 ... 32. ● Example: station address 44 → switches 32, 8, 4 = ON (32 + 8 + 4 = 44) ● The Lenze setting of all switches is OFF.					
	OFF	**ON**	250						
	ON	OFF	500						
	ON	ON	No function						

Note!

Please observe the information about the setting of the DIP switches given in the "Commissioning" and "Appendix" chapters of the E94AYCDN communication manual (DeviceNet).

Bus cable length

Depending on the baud rate and the cable type used (thick cable/thin cable), the following bus cable lengths are possible:

Baud rate [kbps]	Bus cable lengths [m]	
	Thick cable	Thin cable
125	500	100
250	250	
500	100	

If both thick and thin cable types are used, the maximum cable lengths can be defined according to the baud rates as follows:

Baud rate [kbps]	Max. bus cable length
125	500 m = L_{thick} + 5 L_{thin}
250	250 m = L_{thick} + 2.5 L_{thin}
500	100 m = L_{thick} + L_{thin}

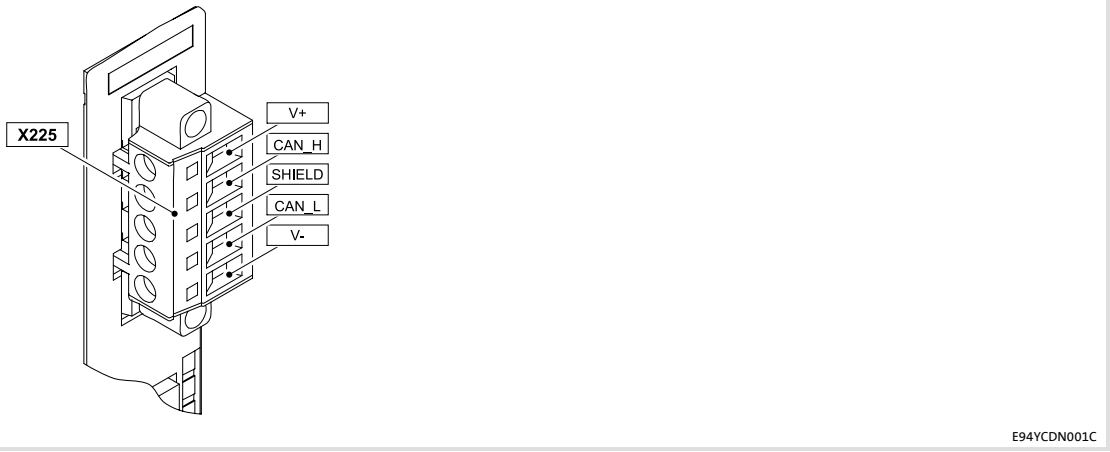
L_{thick}: thick cable length

L_{thin} : thin cable length

Note!

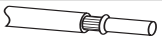
Select a baud rate in dependency of the data volume, cycle time and number of nodes just high enough to suit your application.

Terminal data



The bus of the communication module is connected via the 5-pole plug connector with double screw connection (X225).

Designation	Cable colour	Description
V+	red	External voltage supply ● U = 24 V DC ● I_{max} = 170 mA
CAN_H	white	Data line / input for bus terminating resistor (120 Ω)
SHIELD		Shielding
CAN_L	blue	Data line / input for bus terminating resistor (120 Ω)
V-	black	Reference potential for external voltage supply

Type	Values	
Electrical connection	Plug connector with double screw connection	
Possible connections	rigid:	
		2.5 mm² (AWG 14)
	flexible:	
		without wire end ferrule 2.5 mm² (AWG 14)
		with wire end ferrule, without plastic sleeve 2.5 mm² (AWG 14)
		with wire end ferrule, with plastic sleeve 2.5 mm² (AWG 14)
Starting torque	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	
Stripping length	7 mm	

External voltage supply

Note!

The communication module must be supplied externally via the DeviceNet cable!

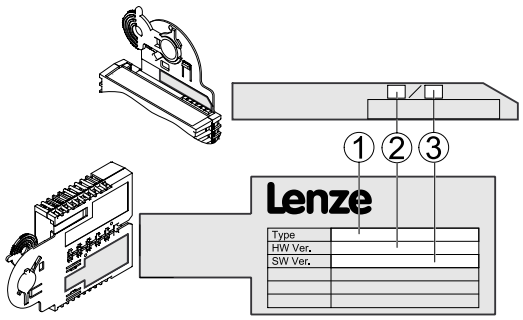
9.3.4 PROFIBUS

For detailed information, please see the Ethernet communication manual.

Quick introduction:

Type designation: E94AYCPM

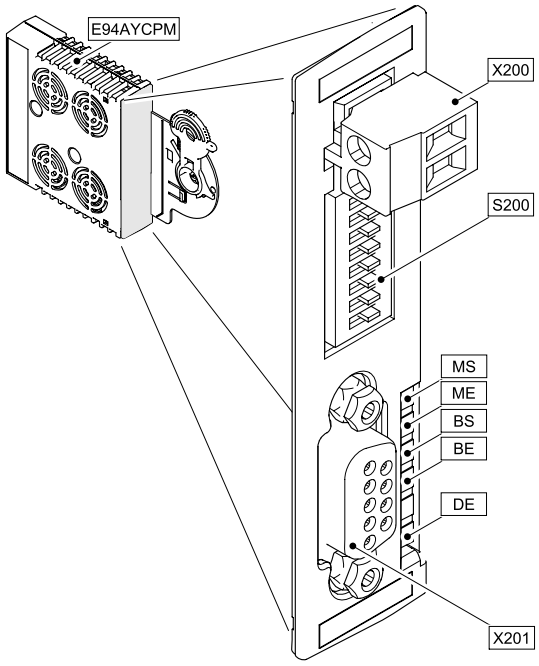
Identification



E94YCPM005

	①					②	③
	E94	**A**	**Y**	**C**	**PM**	**1A**	**01.00**
Product series							
Version							
Module identification: extension module							
Module type: communication module							
PROFIBUS							
Hardware version							
Software version							

Scope of supply



Connections

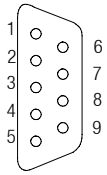
Pos.	Description
X200	External supply of the communication module Design: Plug connector with screw connection, 2-pole
X201	Connection for PROFIBUS Design: Sub-D socket, 9-pole

Displays

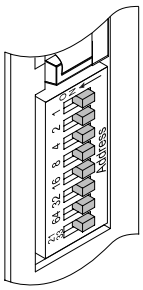
LED			
Pos.	Colour	Condition	Description
MS	Green	On	Communication module is supplied with voltage and connected to the standard device.
		Blinking	Communication module is supplied with voltage, but has no connection to the standard device (standard device is switched off, initialising or not present).
ME	Red	On	An error has occurred on the communication module.
BS	Green	Blinking	Communication via the communication module has been established. The PROFIBUS is active.
BE	Red	On	Bus monitoring has been triggered.
DE	Red	On	The communication module is not accepted by the standard device. ● See notes given in the instructions for the standard device.

Assignment of the Sub-D socket

Connection of PROFIBUS to 9-pin Sub-D socket (X201):

View	Pin	Designation	Explanation
	1	free	-
	2	free	-
	3	RxD/TxD-P	Data line B (received data/transmitted data plus)
	4	RTS	Request To Send (received data/transmitted data, no differential signal)
	5	M5V2	Data ground (ground to 5V)
	6	P5V2	5 V DC / 30 mA (bus termination)
	7	free	-
	8	RxD/TxD-N	Data line A (received data/transmitted data minus)
	9	free	-

DIP switch



E94YCPM001D

Pos.	Description
S200	**Switches 1 ... 64:** bus station addressing The station address results from the sum of all switches in "ON" position. ● Example: switches 32, 8, 4 = ON → address = 44 ● Address range: 1 ... 126 **Switch 2133:** establishing compatibility with the communication module EMF2133IB

Note!

The Lenze setting of all switches is OFF.

Please observe the information provided in the PROFIBUS Communication Manual about the setting of the station address and the EMF2133IB compatibility.

External voltage supply

Note!

Always use a separate power supply unit in every control cabinet and safely separate it according to EN 61800-5-1 (”SELV”/”PELV”) in the case of external voltage supply and larger distances between the control cabinets.

The external voltage supply of the communication module is required if communication via the bus system is to continue in the event of a power supply failure of the standard device.

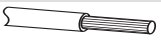
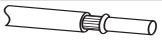
- The external voltage supply of the communication module is required if communication is to continue when the power supply of the standard device fails.
- Access to parameters of a standard device disconnected from the mains is not possible.
- The external voltage supply is effected via the 2-pole plug connector.

Connection of the 2-pin plug connector (X200):

Designation	Explanation
+	U = 24 V DC (20.4 V - 0 % ... 28.8 V + 0 %) I = 130 mA
-	Reference potential for external voltage supply

Connect the communication module to the bus system according to the description (📖 380).

Terminal data

Area	Values	
Electrical connection	Plug connector with screw connection	
Possible connections	rigid:	
		1.5 mm² (AWG 16)
	flexible:	
		without wire end ferrule 1.5 mm² (AWG 16)
		with wire end ferrule, without plastic sleeve 1.5 mm² (AWG 16)
		with wire end ferrule, with plastic sleeve 1.5 mm² (AWG 16)
Tightening torque	0.5 ... 0.6 Nm (4.4 ... 5.3 lb-in)	
Stripping length	6 mm	

Wiring of the PROFIBUS

Observe the notes and wiring regulations given in the documentation for the control system.

- ► Install a bus terminating resistor only at the first and last physical bus station.
  - – The bus terminating resistor is integrated into the bus connector and can be activated via a switch.
  - – The bus terminator is fed by the bus station. When the communication module is provided with an external power supply, (📖 379) the bus terminator can be fed independently from the power supply of the standard device.
- ► Check/activate the bus terminating resistors.
- ► Use the bus connector to connect the PROFIBUS with the controller.
- ► Only use cables which correspond to the listed specifications (📖 381).

Note!

- ► The bus terminator must always be supplied. Otherwise, the bus can get unstable.
- ► If you want to disconnect individual bus stations, ensure that the bus terminators at the first and last physical bus station remain active.
- ► The bus terminator is no longer active if
  - – the connector has been pulled out e.g. in the event of service.
  - – the module supply has been switched off.

For further notes on the PROFIBUS network, please refer to the PROFIBUS Communication Manual.

Specification of the transmission cable

Please follow the specifications of the PROFIBUS user organisation (PNO) for signal cables:

Area	Values
Specific resistance	135 ... 165 Ω/km, (f = 3 ... 20 MHz)
Capacitance per unit length	≤ 30 nF/km
Loop resistance	< 110 Ω/km
Core diameter	> 0.64 mm
Core cross-section	> 0.34 mm^2
Cores	Double twisted, insulated and shielded

Baud rate / length of bus cable

Baud rate [kbps]	Length [m]
9.6 ... 93.75	1200
187.5	1000
500	400
1500	200
3000 ... 12000	100

Tip!

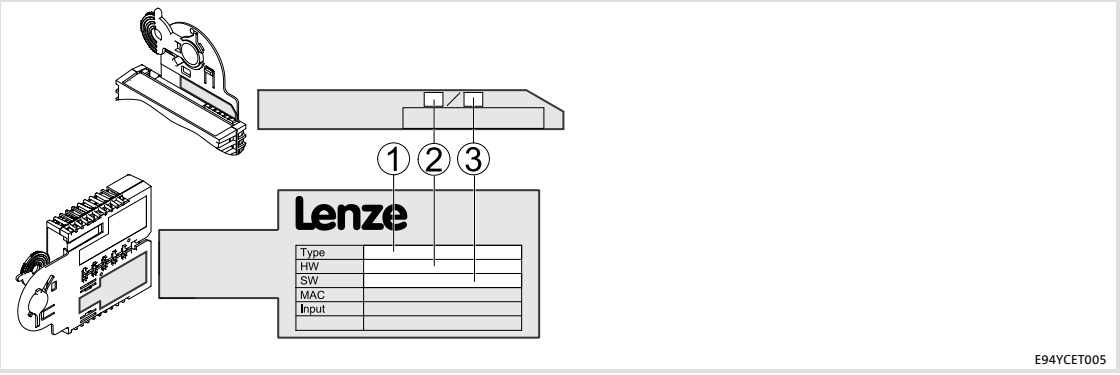
For high baud rates we recommend to consider the application of optical fibres.

Advantages of optical fibres:

- ► Electromagnetic interferences on the transmission path remain ineffective.
- ► Bus lengths of several kilometres are also possible with higher baud rates. The bus length is
  - – independent of the baud rate.
  - – dependent on the optical fibre used.

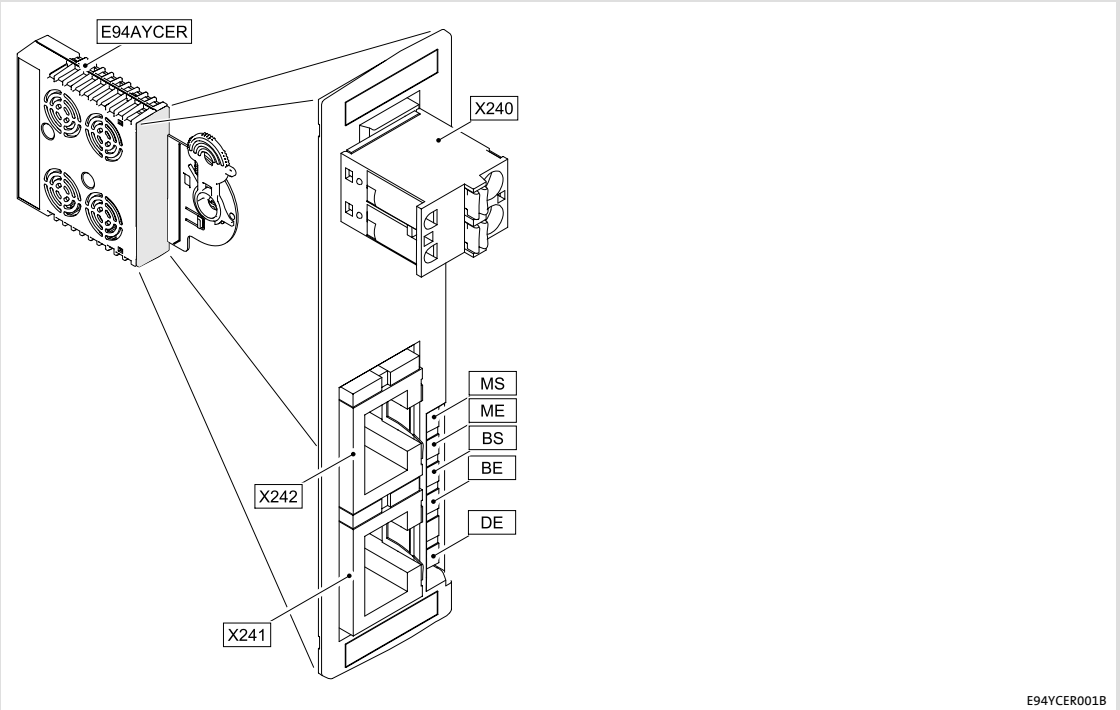
9.3.5 PROFINET

Identification



	①				②	③
	E94	**A**	**Y**	**C**	**ER**	**VE**	**1.20**
Product series							
Version							
Module identification: extension module							
Module type: communication module							
PROFINET							
Hardware version							
Software version							

Scope of supply



Connections

Pos.	Description
X240	Connection for the external supply of the communication module Design: Plug connector with spring connection, 2-pole
X241	PROFINET connections Design: RJ45 socket according to IEC 60603-7
X242	

Displays

LED			
Pos.	Colour	Condition	Description
MS	Green	Blinking	The communication module is supplied with voltage but has no connection to the basic device (basic device is either switched off, in the initialisation phase, or not available).
		On	The communication module is supplied with voltage and has a connection to the basic device.
ME	Red	On	There is an error in the area of the communication module.
BS	Green	Off	The PROFINET module is not active at the fieldbus.
		Blinking	The PROFINET module is in the ”Data_Exchange” state.
BE	Red	On	Bus error/trouble is active, e.g. the Ethernet cable is unplugged. (The LED is blinking in parallel to the BS LED.)
DE	Red	On	The communication module is not accepted by the basic device (see notes in the instructions for the basic device)or the standard device is not active.
Signalling on the connection X241/X242:			
-	yellow	on/blinking	Data is exchanged via PROFINET.
-	Green	On	PROFINET connection is available.

External voltage supply

Note!

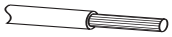
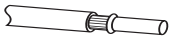
Always use a separate power supply unit in every control cabinet and safely separate it according to EN 61800-5-1 (”SELV”/”PELV”) in the case of external voltage supply and larger distances between the control cabinets.

The external voltage supply of the communication module is required if PROFINET communication is to remain intact in case the supply of the standard device fails.

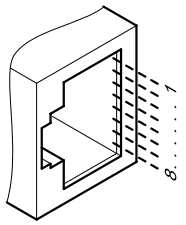
If required, feed the communication module with a separate supply voltage via the 2-pin plug connector (X240).

Designation	Explanation
+	External voltage supply U = 24 V DC (20.4 ... 28.8 V) I = 140 mA
-	Reference potential for external voltage supply

Terminal data

Field	Values	
Electrical connection	2-pin plug connector with spring connection	
Possible connections	rigid:	
		1.5 mm² (AWG 16)
	flexible:	
		without wire end ferrule 1.5 mm² (AWG 16)
		with wire end ferrule, without plastic sleeve 1.5 mm² (AWG 16)
		with wire end ferrule, with plastic sleeve 1.5 mm² (AWG 16)
Stripping length	9 mm	

Ethernet connection



E94AYCET004C

Pin	Signal
1	Tx +
2	Tx -
3	Rx +
4	-
5	-
6	Rx -
7	-
8	-

Note!

Plug/remove the Ethernet cable plug *vertically* into/from the socket to make sure that the RJ45 socket will not be damaged.

9.3.6 CAN port

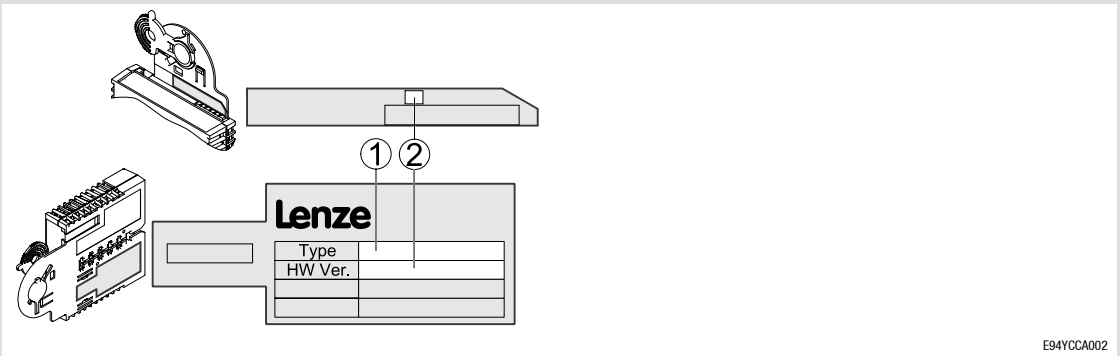
CANopen

For detailed information, please see the CAN communication manual.

Quick introduction:

Type designation: E94AYCCA

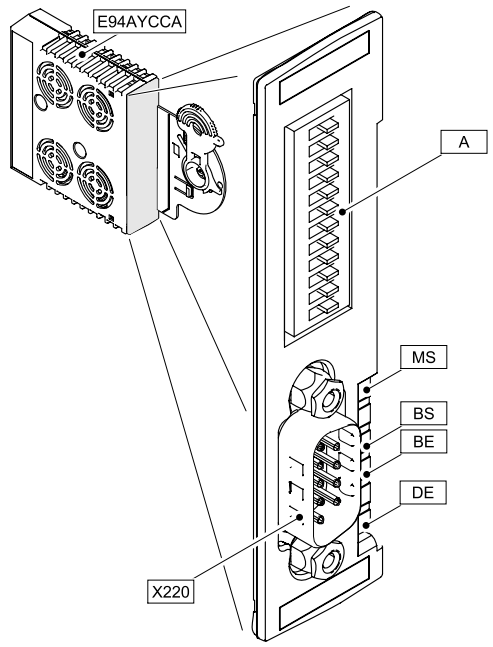
Identification



	①				②
	E94	A	Y	C	CA	VA

- Product series
- Device generation
- Module identification: extension module
- Module type: communication module
- CANopen
- Hardware version

Scope of supply



E94YCCA001B

Connections

Pos.	Description
X220	Connection for CAN Design: Sub-D plug connector, 9-pin

Displays

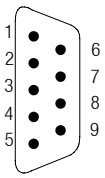
Pos.	Colour	Status	Description
MS	Green	On	Communication module is supplied with voltage.
DE	Red	On	The communication module is not accepted by the basic device (see notes in the Instructions for the basic device)
BS	Green	see table 📖 389; "Signalling according to DR303-3"	CANopen status ("**Z**")
BE	Red		CANopen error ("**F**")

DIP switch

Pos.	Description
A	Addressing of the bus node

Assignment of the Sub-D plug connector

Connection of the CAN to the 9-pin Sub-D plug connector, pos. ”X220”:

View	Pin	Designation	Explanation
	1	-	
	2	CAN_L	Signal core CAN
	3	CAN_GND	Ground CAN
	4	-	
	5	-	
	6	-	
	7	CAN_H	Signal core CAN
	8	-	
	9	-	
	Housing	CAN_Shield	Shield (connected to the housing)

Specification of the transmission cable

We recommend the use of CAN cables in accordance with ISO 11898-2:

CAN cable in accordance with ISO 11898-2	
Cable type	Paired with shielding
Impedance	120 Ω (95 ... 140 Ω)
Cable resistance/cross-section	
Cable length ≤ 300 m	≤ 70 mΩ/m / 0.25 ... 0.34 mm^2 (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm^2 (AWG20)
Signal propagation delay	≤ 5 ns/m

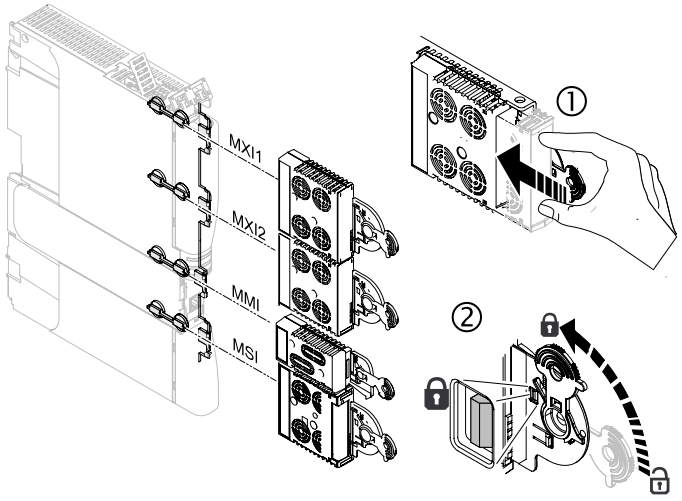
Signalling

Status display (LED)	Explanation
Connection status to the bus with the following signalling:	
off green red	No connection to the master CANopen status ("**S**") CANopen fault ("**F**")
Constant red	**F**: bus off
Flickering	Automatic detection of the baud rate is active
Green blinking every 0.2 s	**S**: pre-operational, **F**: none
Green blinking every 0.2 s Red blinking 1 x, 1 s OFF	**S**: pre-operational, **F**: warning limit reached
Green blinking every 0.2 s Red blinking 2 x, 1 s OFF	**S**: pre-operational, **F**: node guard event
Constant green	**Z**: operational, **F**: no errors
Constant green Red blinking 1 x, 1 s OFF	**Z**: operational, error: warning limit reached
Constant green Red blinking 2 x, 1 s OFF	**Z**: operational, **F**: node guarding event
Constant green Red blinking 3 x, 1 s OFF	**Z**: operational, **F**: sync message error
Green blinking every 1 s	**Z**: stopped, **F**: no errors
Green blinking every 1 s Red blinking 1 x, 1 s OFF	**S**: stopped, **F**: warning limit reached
Green blinking every 1 s Red blinking 2 x, 1 s OFF	**S**: stopped, **F**: node guard event

Tab. 9-1 Signalling according to DR303-3

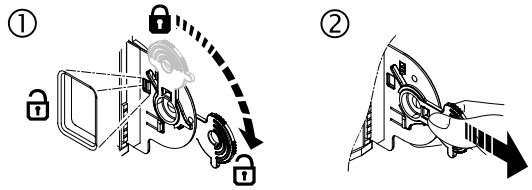
9.4 Function modules

Mounting



E94YCXX001G

Dismounting



E94AYCXX001H

Safety instructions

Danger!

Improper use of the module and the standard device may cause serious injury and property damage.

Observe the chapters ”Safety instructions” and ”Residual hazards” contained in the instructions for the standard device.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

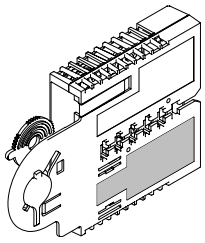
Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

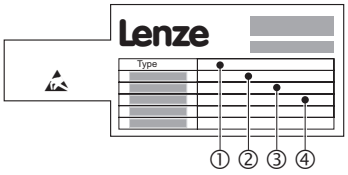
Before mounting/dismounting, switch off the supply voltage to prevent electronic modules from damage.

9.4.1 Digital frequency

Identification



E94YCEI003C



E94AYXX001

	①				②	③	④
	E94	A	Y	F	xx	xx	xx	nn

Product series
Device generation
Module identification: extension module
Module type: feedback module
Design
LF = master frequency
Hardware version

Application range

This module may be used in conjunction with basic devices of the 9400 product series as of nameplate designation

• Type	E94AxxExxxx
• HW version	VB
• SW version	04.01

Stop!

Malfunctions

If E94AxHExxx4 standard devices, firmware (SW) up to and including 04.00.21.00, are used, the output signals of the digital frequency module can be faulty.

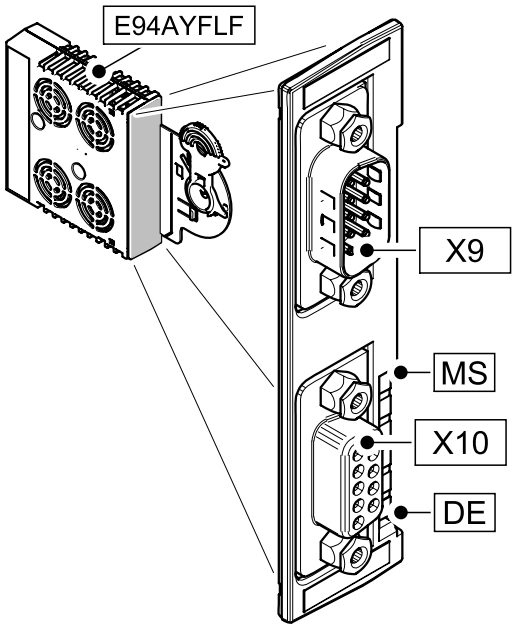
Possible consequences:

► Damage to machines through unexpected movements of slave drives.

Protective measures:

► Only use digital frequency modules together with E94AxHExxx4 standard devices of firmware (SW) 04.01.00.00 or higher. The firmware version is indicated in parameter C00099 and on the nameplate.
Example: C00099 = 04.01.00.00 or SW nameplate data: 04.01

Scope of supply



E94AYFLF004

Elements on the front

Pos.	Description
X9	Input for digital frequency, 9-pole Sub-D plug
X10	Output for digital frequency, 9-pole Sub-D socket

Displays

Pos.	Colour	Condition	Description
MS	Green	ON	The module is supplied with voltage.
DE	Red	ON	The module is not accepted by the standard device (see notes given in the documentation for the standard device).

Rated data

Note!

Only one module per basic device may be used, either in module receptacle MXI1 or MXI2.

Stop!

The output voltages on X9/4 and on X10/4 may only be charged at a total of max. 150 mA.

If the output voltage on X9/4 is used, no digital input signal may be applied to X9/8. In this case, the cable serves as a sensor lead. In case of a connection error, the components connected to X9 are damaged.

Functions on X9

- Input for encoder signals with TTL level
- Voltage supply +5 V for encoder
- Sensor lead (sense) at regulated voltage supply (Lenze setting)
  - max. control range of the voltage drop on the cable: 4 V (corresponds to 5 ... 9 V output voltage on X9/4)
- Digital input signal (only with regard to unused or external voltage supply)

Functions on X10

- Output for encoder signals with TTL level, directly or simulated
- Voltage supply +5 V
- Digital output signal

Assignment of the Sub-D plug connector

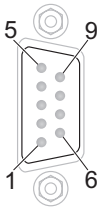
Stop!

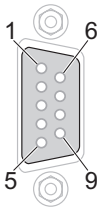
The output voltages on X9/4 and on X10/4 may not be interconnected. This applies to both the wiring of several modules and to the wiring of one module (e. g. for purposes of simulation).

Use system cables not connecting pin 4 for this applications only.

Tip!

We recommend the use of Lenze system cables. For this purpose, please read the documentation for the basic device.

X9	Pin	Designation	Explanation
 SUBD09010	1	B	TTL input signal by encoder or encoder simulation
	2	$\overline{A}$	
	3	A	
	4	+5 V	Regulated voltage supply for encoder (pin 8 = sense must be used, max. control range 5 ... 9 V)
	5	GND	-
	6	$\overline{Z}$	TTL input signal by encoder or encoder simulation
	7	Z	
	8	● **S** ● Lc ● E	The function of this cable has to be set in the basic device: ● **Sense** (sensor lead for voltage regulation, **Lenze setting**) ● Lamp control ● Enable
	9	$\overline{B}$	TTL input signal by encoder or encoder simulation

X10	Pin	Designation	Explanation
 SUBD09010	1	B	TTL output signal from encoder or encoder simulation
	2	$\overline{A}$	
	3	A	
	4	+5 V	V_{CC} ±6 %
	5	GND	-
	6	$\overline{Z}$	TTL output signal from encoder or encoder simulation
	7	Z	
	8	Enable	Digital output signal
	9	$\overline{B}$	TTL output signal from encoder or encoder simulation

9.5 Memory modules

Use these modules in slot ☐ MXI1 ☐MXI2 ☑MMI ☐MSI.

Safety instructions

Stop!

The ⚠ symbol visible at the front indicates the presence of electronic components which can be damaged or destroyed by electrostatic discharge.

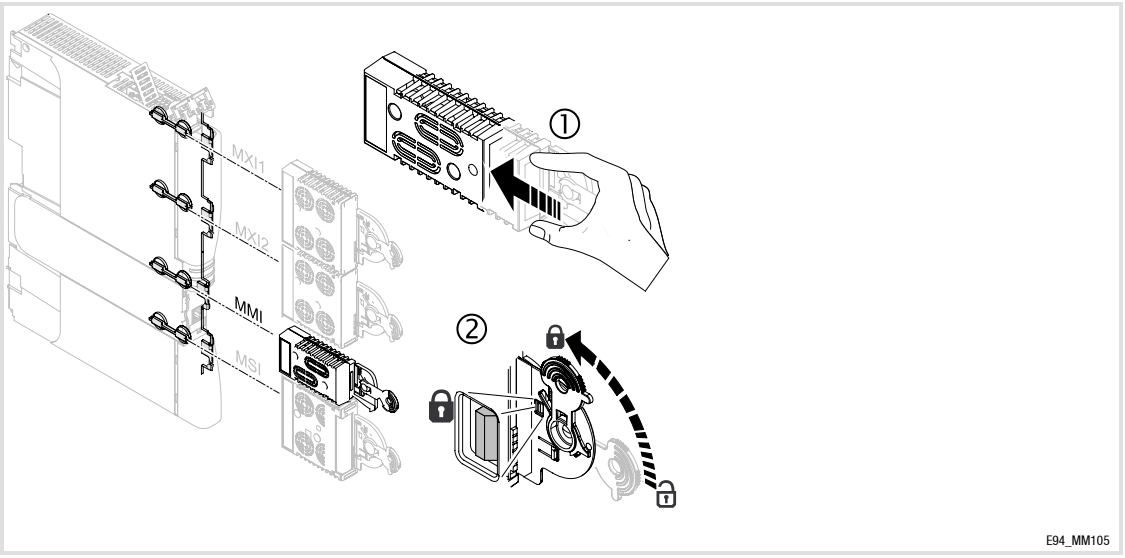
Take appropriate measures to protect these components before touching the module!

Stop!

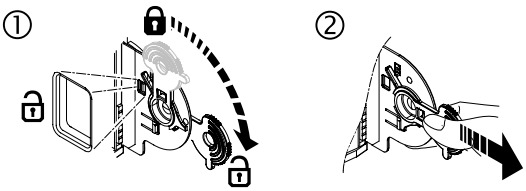
Before mounting/dismounting, switch off the supply voltage to prevent electronic modules from damage.

Mounting

Position the memory module in the MMI module receptacle:



Dismounting



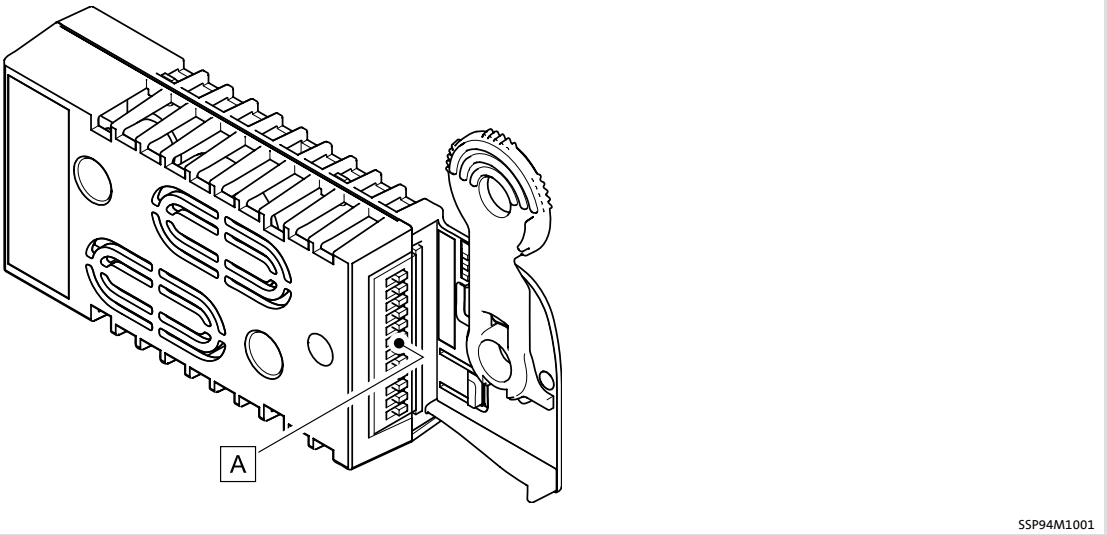


Fig. 9-1 Memory module with DIP switch (as of order designation E94AYM22)

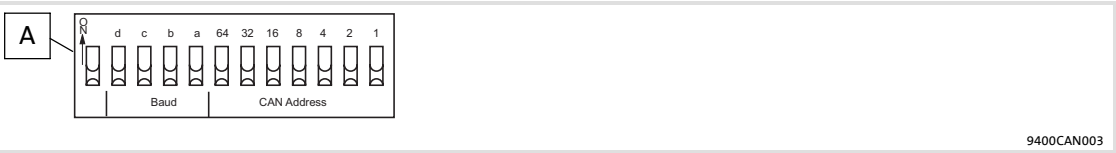


Fig. 9-2 Arrangement and labelling of the DIP switches

For the DIP switches that are placed at the front

- the node address (labelling ”1” ... ”64”) and
- baud rate (labelling ”a” ... ”d”)

can be set.

Note!

If all address switches adopt the ”OFF” position when the basic device is switched on, the configurations of codes C00350 (nodes address) and C00351 (baud rate) apply.

Switch the voltage supply of the basic device off and then on again to activate altered settings.

Setting the node address

The node address of the drive is calculated from the sum of all address switches in the ”ON” position.

Setting the baud rate

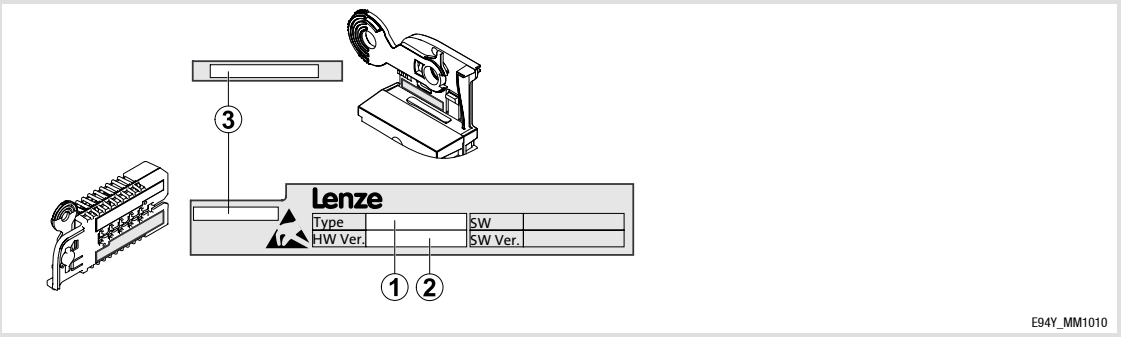
d	c	b	a	Baud rate
OFF	ON	ON	OFF	10 kbit/s
OFF	ON	OFF	ON	20 kbit/s
OFF	OFF	ON	ON	50 kbit/s
OFF	OFF	ON	OFF	125 kBit/s
OFF	OFF	OFF	ON	250 kbit/s
OFF	OFF	OFF	OFF	500 kbit/s
ON	ON	ON	OFF	800 kbit/s
OFF	ON	OFF	OFF	1000 kbit/s
OFF	ON	ON	ON	Auto baud

► E94AYM22 (MM220) memory modules as of version VA

Scope of supply

Pos.	Description
	MM220 memory module with front panel DIP switch (position ”A”) for setting the address and baud rate, order designation E94AYM22
	Mounting Instructions

Identification



Designation ③: **MM220**

①					②
E94	**A**	**Y**	**M**	**22**	**VA**

Product series

Device generation

Module identification: extension module

Module type: memory module

Design:
- 2 MB Flash
- DIP switch

License: Motion Control HighLevel

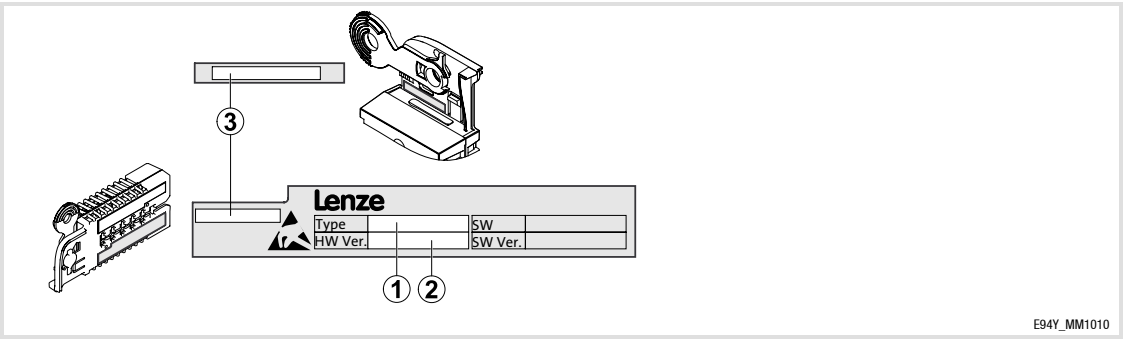
Hardware version

► E94AYM33 (MM330) memory modules as of version VA

Scope of supply

Pos.	Description
	MM330 memory module with front panel DIP switch (position ”A”) for setting the address and baud rate, order designation: E94AYM33
	Mounting Instructions

Identification



Designation ③: **MM330**

①					②
E94	**A**	**Y**	**M**	**33**	**VA**

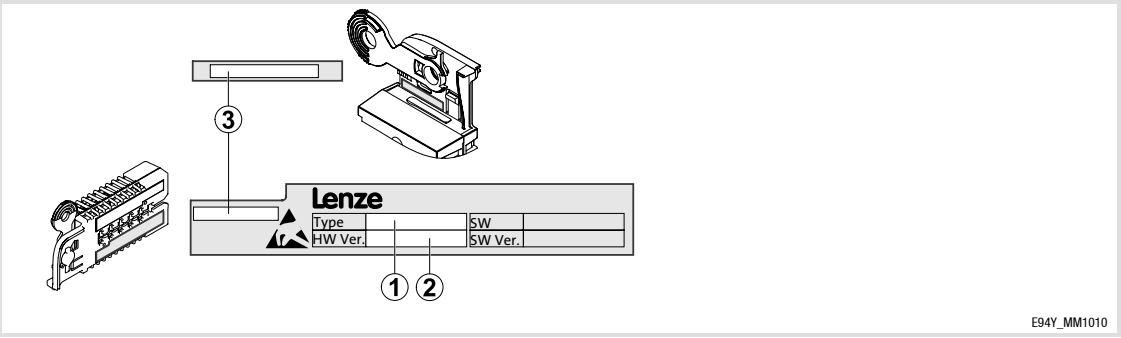
- Product series
- Device generation
- Module identification: extension module
- Module type: memory module
- Design:
  - 4 MB Flash
  - DIP switch
  License: Motion Control TopLevel
- Hardware version

► E94AYM34 (MM340) memory modules as of version VA

Scope of supply

Pos.	Description
	MM340 memory module with front panel DIP switch (position ”A”) for setting the address and baud rate, order designation: E94AYM34
	Mounting Instructions

Identification



Designation ③: **MM340**

①					②
E94	**A**	**Y**	**M**	**34**	**VA**

Product series

Device generation

Module identification: extension module

Module type: memory module

Design:
- 4 MB Flash
- DIP switch

License: PLC

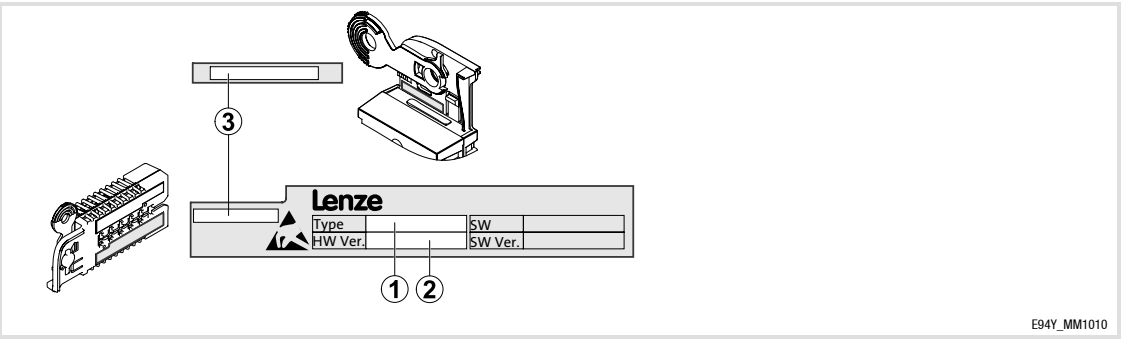
Hardware version

► E94AYM43 (MM430) memory modules as of version VA

Scope of supply

Pos.	Description
	MM430 memory module with front panel DIP switch (position ”A”) for setting the address and baud rate, order designation: E94AYM43
	Mounting Instructions

Identification



Designation ③: **MM430**

①					②
E94	**A**	**Y**	**M**	**43**	**VA**

Product series

Device generation

Module identification: extension module

Module type: memory module

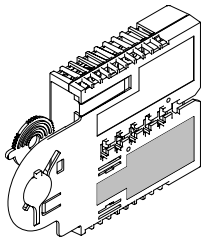
Design:
- 8 MB Flash
- 128 kB retain memory
- DIP switch
- Real-time clock

License: Motion Control TopLevel

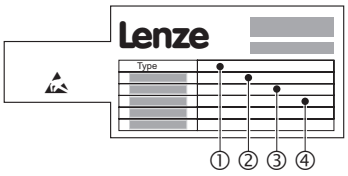
Hardware version

9.6 Safety modules

Identification



E94YCEI003C



E94AYXX001

①					②	③	④
E94	A	Y	A	x	xx	xx	nn

Product series

Version

Module identification: Device module

Module type: Safety module

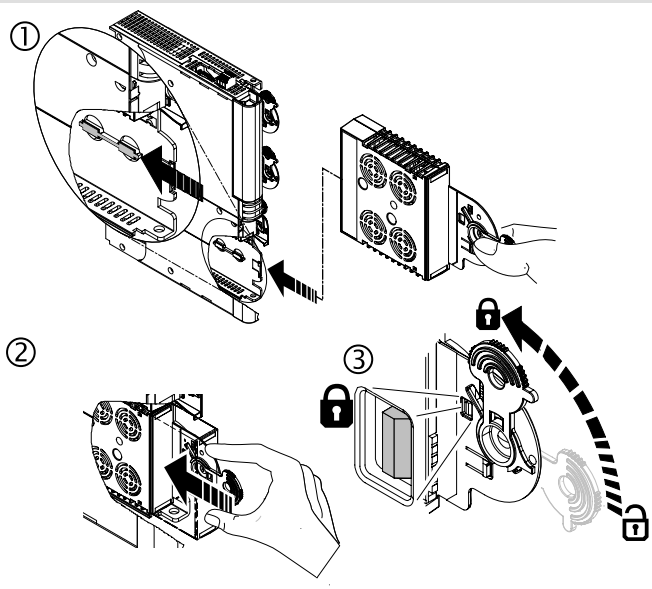
Design
A = SM0
B = SM100
E = SM301

Hardware version

Software version (SM301 only)

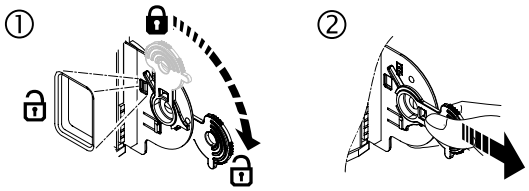
Serial number

Mounting



E94AYAX001

Dismounting



E94AYCXX001H

Safety instructions

Danger!

Improper use of the module and the standard device may cause serious injury and property damage.

Observe the chapters ”Safety instructions” and ”Residual hazards” contained in the instructions for the standard device.

Stop!

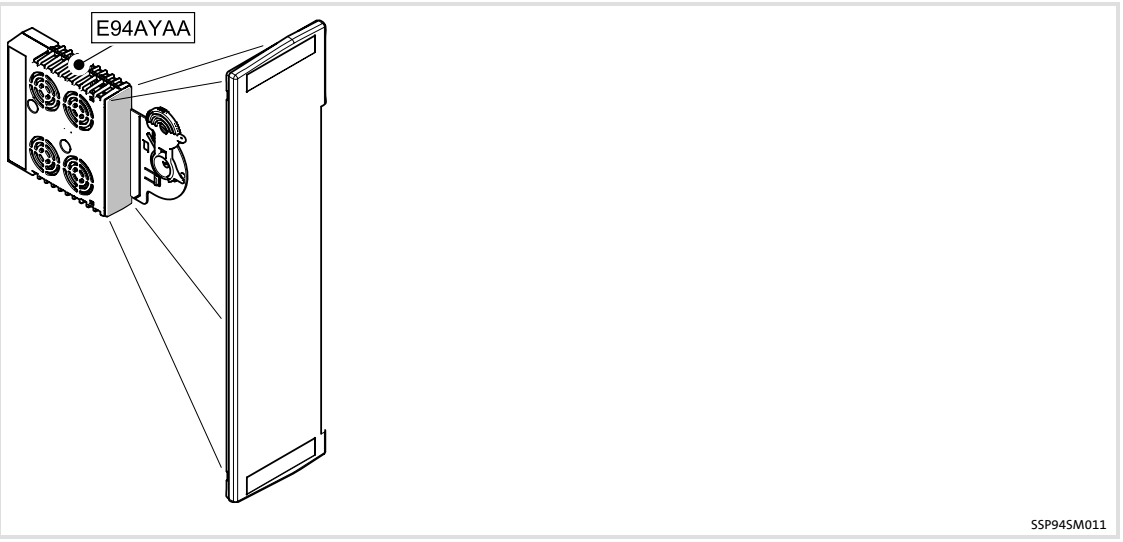
Mounting/dismounting must be carried out when the supply voltage is switched off to protect the electronic components against damage.

Only use safety modules in the module slot for safety modules (MSI).

Note!

The entry in code C00214 must correspond to the type of the plugged-on safety module. Otherwise, the controller will report the following error: ”Safety module: Incompatible to setting in C00214”.

9.6.1 SM0



Scope of supply

Pos.	Description
	SM0 safety module, type E94AYAA
	Mounting Instructions

Elements on the front

Pos.	Description
-	There are no elements.

Technical data

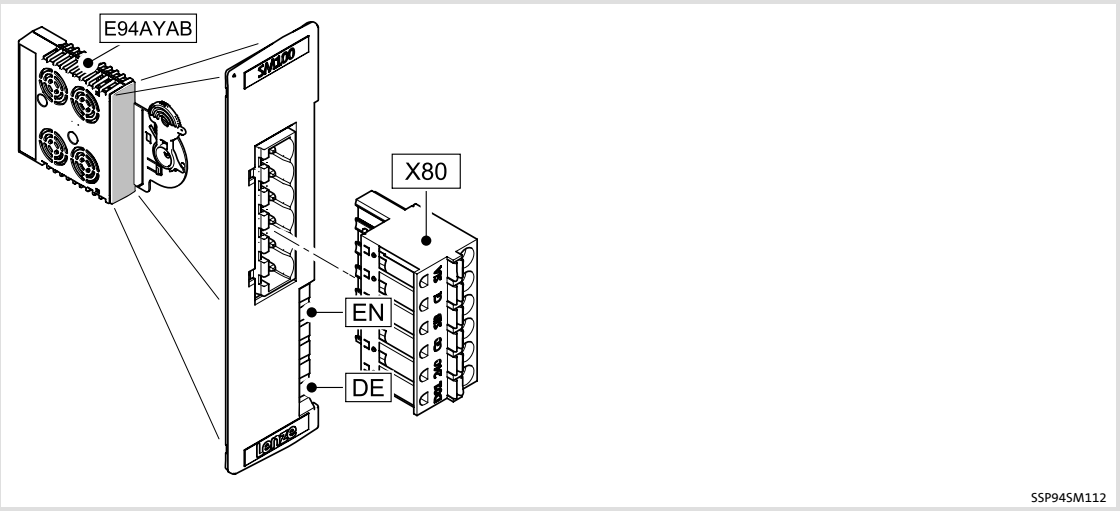
Function

- There are **no** safety functions available.
- This module is required to operate the controller without safetyfunctions.

Note!

If safety functions are required, replace this module by a module with safety functions (e.g. SM100, SM301).

9.6.2 SM100



Scope of supply

Pos.	Description
	SM100 safety module, type E94AYAB
	Mounting Instructions

Elements on the front

Pos.	Description
X80	Pluggable terminal strip for input and output signals

Displays

Pos.	Colour	Condition	Description
EN	Yellow	On	Controller enabled
		Off	Non-safe display "Safe pulse inhibit"
DE	Red	On	The module is not accepted by the standard device (see notes given in the documentation for the standard device).

Application range

This accessory component may only be used in conjunction with

► E94AxxExxxx axis module

as of nameplate data

	HW	SW
E94AxxExxxx	VA	1.10

Safety instructions

Danger!

If the request for the safety function is cancelled, the drive will restart automatically.

You must provide external measures which ensure that the drive only restarts after a confirmation (EN 60204).

Danger!

Unexpected motor rotation possible

In the event of a short-circuit between two power transistors, a residual movement of the motor of up to 180 °/number of pole pairs may occur! (Example.: 4-pole motor ⇒ residual movement max. 180 °/2 = 90 °)

Possible consequences:

► People may be injured by the machine movements (unexpected start-up).

Protective measures:

► The residual movement must be considered in the risk analysis, e.g. safe torque off for main spindle drives.

Warnings!

► Maximum surrounding air temperature: 55 °C.

► External fuse for 24 Vdc supply voltage. Rated 4 A DC fuse UL248-14.

Technical data

Function

► Safe torque off
(previously: safe standstill, protection against unexpected start-up)

Rated data input (sensor)

Type	Voltage U_N [V]	Current I_{max} [A]
E94AYAB - SM100	24	0.9

Rated data output (feedback)

Type	Voltage U_N [V]	Current I_{max} [A]
E94AYAB - SM100	24	0.7

Block diagram

SM100	Safety module
SIA, SIB, GI	Two-channel sensor signal connections, supply through safely separated power supply unit (SELV/PELV)
	(old labelling up to HW version VB: SI1, SI2, GI)
24O, DO1, GO	Non-safe feedback connections, supply through safely separated power supply unit (SELV/PELV)
µC	Microcontroller
PWM	Pulse width modulation

Connection data

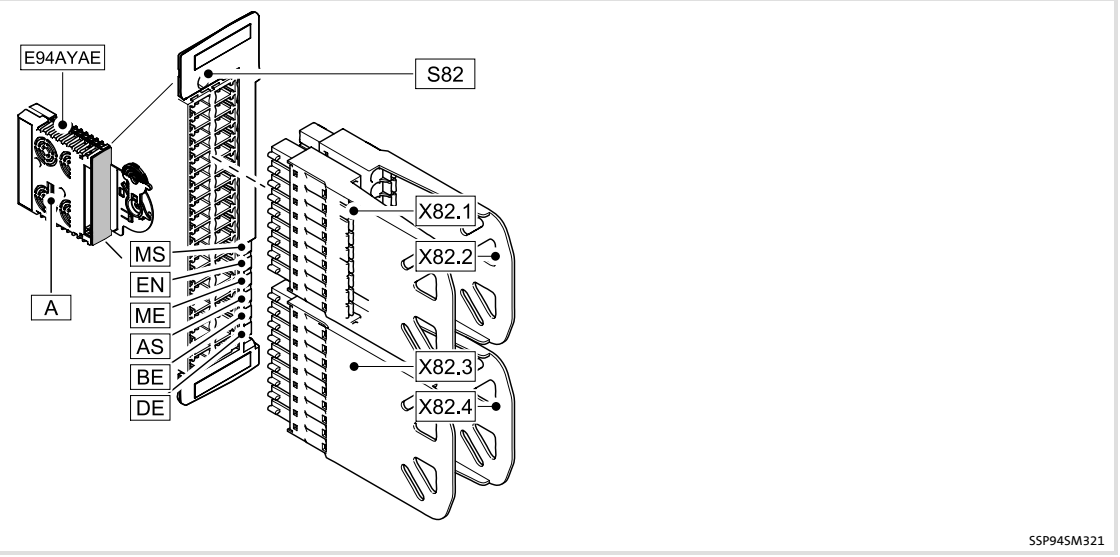
X80	Marking	Description	Electrical data
SSP9400X80	SIA	Input first shutdown path	SIA: I_{typ} = 160 mA
	GI	GND potential for SIA/SIB	LOW: -3 ... 5 V, HIGH: 15 ... 30 V,
	SIB	Input second shutdown path	SIB: I_{typ} = 28 mA Supply through safely separated power supply unit (SELV/PELV)
	GO	GND potential feedback	24 V, max. 0.7 A, short-circuit-proof, LOW-active, Supply through safely separated power supply unit (SELV/PELV)
	24O	24 V supply feedback	
	DO1	Non-safe signalling output: "Safe pulse inhibit"	

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Rigid	0.2 ... 2.5	24 ... 12	Spring terminal	
Wire end ferrule, insulated	0.2 ... 1.5	24 ... 16		
Twin wire end ferrule	0.5 ... 1.0	20 ... 18		

Stripping length / contact length: 10 mm

Information for the exchange of modules of different hardware versions		
up to HW: VB	from HW: VC	Comment
SI1	SIA	The exchange of the spring terminal is required!
GI	GI	
SI2	SIB	
GO	GO	
24O	24O	
DO1	DO1	

9.6.3 SM301



Scope of supply

Pos.	Description
	SM301 safety module, type E94AYAE
	Mounting Instructions

Elements on the front

Pos.	Description
A	Safety address switch (in the left part of the housing)
S82	Module switch for parameter set adoption from the memory module
X82.1	Plug-in terminal strips for input and output signals
X82.2	
X82.3	
X82.4	

Displays

Pos.	Colour	State	Description
MS (Module State)	Green	On	Drive-based safety has initialised without a fault.
		Blinking	Drive-based safety has initialised without a fault. Internal communication to the standard device is not possible.
		Flashing	Drive-based safety is in service status. For exiting, parameterise the drive-based safety.
		Off	Drive-based safety is not initialised. Acknowledgement is not possible.
EN (Enable)	Yellow	On	Controller enabled
		Off	Non-safe display "STO"
ME (Module Error)	Red	On	System error
		Blinking	Trouble
		Flashing	Warning
		Off	Error-free operation
AS (Acknowledge Stop)	Yellow	On	Request of an acknowledgement for the restart or the parameter set adoption
		Blinking	SS1/STO active
		Flashing	SS2/SOS active
		Off	No stop function active
BE (Bus Error)	Red	On	Safety bus error: ● Communication is not possible. ● Acknowledgement is possible.
		Blinking	Safety bus error: no valid configuration.
		Off	Safety bus: error-free operation.
DE (Drive Error)	Red	On	Drive-based safety is not accepted by the standard device (see notes in the instructions for the standard device).
		Off	Drive-based safety is correctly recognised by the standard device.

Blinking: on/off every 0.5 s Flashing: on/off every 0.1/0.9 s

Application range

This module may be used in conjunction with standard devices of the 9400 product series as of nameplate inscription

Type	HW	SW
E94ASxExxxx	VA	01.49
E94AMxExxxx	VA	01.49

This module may be used together with the PROFIBUS communication module with the nameplate designation as of

Type	HW	SW
E94AYCPM	VB	01.xx

Safety instructions

Danger!

When the request for the safety function is deactivated, the drive can restart automatically. The behaviour can be set via the parameter ”Restart behaviour” (C15300/1/2).

In the case of an automatic restart, you must provide external measures which ensure that the drive only restarts after an acknowledgement (EN 60204).

Danger!

Danger to life through improper installation

Improper installation of the safety engineering systems can cause an uncontrolled restart of the drives.

Possible consequences:

► Death or severe injuries

Protective measures:

Total cable length between X82 and the connected components (e.g. sensors, devices, etc.) > 3 m:

► It is essential to shield the cable installed between X82 and the connected components:
  – Connect the shield at least to the shield support of the installation backplane.
  – If possible, connect the shield to the connected component as well.

Total cable length between X82 and the connected components (e.g. sensors, devices, etc.) < 3 m:

► Unshielded wiring is permitted.

Warnings!

► Maximum surrounding air temperature: 55 °C.

► External fuse for 24 Vdc supply voltage. Rated 4 A DC fuse UL248-14.

Technical data

The module and the safe output must be supplied with 24 V from safely separated power supply units. To maintain electrical isolations, separate voltage supplies are required.

Detailed features of the 24-V supply					
Terminal	Specification	[Unit]	min.	typ.	max.
+, -	Supply voltage of the module via a safely separated power supply unit (SELV/PELV)	[V]	19.2	24	30
	Input current	[mA]			350
24O, GO	Supply voltage of the safe output via a safely separated power supply unit (SELV/PELV)	[V]	18	24	30
	Input current	[mA]			1100

Functions

- Safe torque off (STO)
  (formerly: Safe standstill, protection against unexpected start-up)
- Safe stop 1 (SS1)
- Safe stop 2 (SS2) - see SOS
- Safe stop emergency (SSE)
- Safe operational stop (SOS) - in accordance with EN 61800-5-2: SOS is designed with speed monitoring
- Safe maximum speed (SMS)
- Safely limited speed 1 (SLS1)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)
- Safe speed monitor (SSM)
- Safe monitor (output)
- Connection of safety sensors
- Safe parameterisation
- Safety bus connection (PROFIsafe V1)

Additional functions from SM301 V1.1

- Safely limited speed 2 (SLS2)
- Safely limited speed 3 (SLS3)
- Safely limited speed 4 (SLS4)
- Safe cascading (CAS) via SD-In4/SD-Out1
- Safety bus connection (PROFIsafe V2)

Addressing

The safety address serves to clearly assign the safety modules of the SM301 type in systems with several drives. The address ”0” is not permissible.

Address switch

The safety address can be set in the left part of the housing by means of the DIP switch A. For setting the switch, use an appropriately small tool, e. g. a probe. The switch can only be set if the module is not connected to a standard device. Via the switch, addresses in the range of 0 ... 1023 can be set. Alterations by the switch with regard to the address are only activated when the 24-V supply is switched on. The address setting ”0” requires the setting by the address code.

DIP switch A	Labelling									
	1	2	3	4	5	6	7	8	9	0
Value of the address bit	1	2	4	8	16	32	64	128	256	512

Note!

In the SM301 safety module as of version VA 1.xx, the address 0 is replaced as follows:

- ► With the address saved in the safety module in the parameter ”Safety address” (C15111).
- ► If the address 0 canot be replaced, the module reports an error.

Block diagram

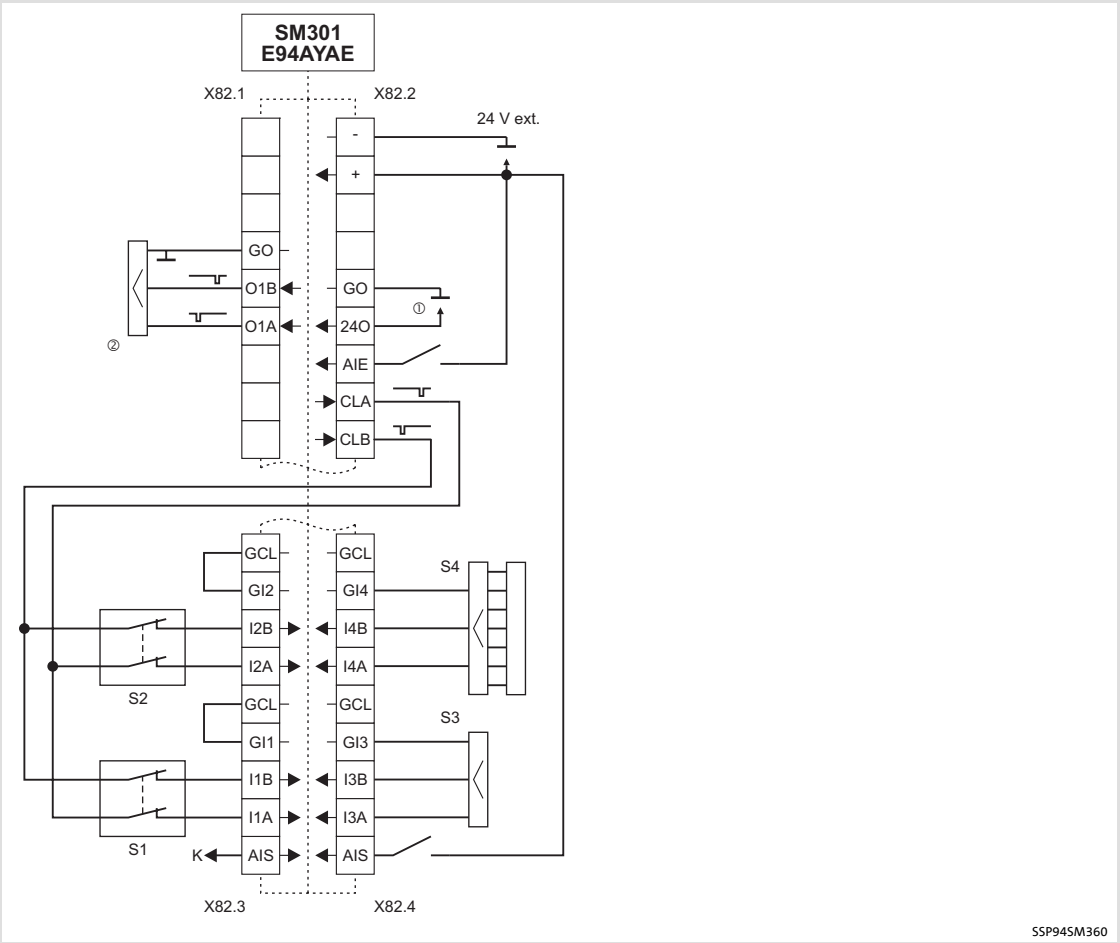


Fig. 9-3 Wiring example

E94AYAE	SM301 safety module
S1 S2	passive sensor with channel A and B
S3	higher-level safety control (active sensor)
S4	lightgrid (active sensor)
24 V ext.	24-V voltage supply of the module (SELV/PELV)
①	24-V voltage supply of the output (SELV/PELV)
②	safe output to higher-level safety control
K	to AIS of the next module

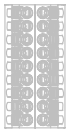
Connection data

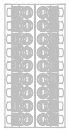
Note!

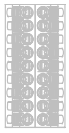
Provide for a sufficient strain relief, so that the terminals are not pulled from the plug connectors, in particular when you use rigid cables.

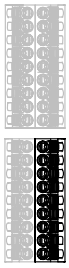
Cable cross-sections and tightening torques				
Type	**[mm²]**	**[Nm]**	**AWG**	**[lb-in]**
Wire end ferrule, insulated	0.25 ... 0.75	Spring terminal	24 ... 18	Spring terminal
Rigid	0.14 ... 1.5		26 ... 16	

Stripping length or contact length: 9 mm

X82.1	Labelling	Description
		This part of the terminal strip is not assigned.
	GO	GND SD-Out1
	O1B	Safe monitor SD-Out1, channel B
	O1A	Safe monitor SD-Out1, channel A
		This part of the terminal strip is not assigned.

X82.2	Labelling	Description
	-	GND external supply
	+	+24 V external supply via a safely separated power supply unit (SELV/PELV)
	GIR	This part of the terminal strip is reserved.
	RI1	
	GO	GND 24O
	24O	+24 V external supply for the safe monitor SD-Out1 (SELV/PELV)
	AIE	Error acknowledgement input (”Acknowledge In Error”)
	CLA	Clock output for passive sensors, channel A (Clock A)
	CLB	Clock output for passive sensors, channel B (Clock B)

X82.3	Labelling	Description
	GCL	GND clock output
	GI2	GND SD-In2
	I2B	Sensor input SD-In2, channel B
	I2A	Sensor input SD-In2, channel A
	GCL	GND clock output
	GI1	GND SD-In1
	I1B	Sensor input SD-In1, channel B
	I1A	Sensor input SD-In1, channel A
	AIS	Restart acknowledgement input (”Acknowledge In Stop”, 1-channel, bridged to X82.4/AIS)

X82.4	Labelling	Description
	GCL	GND clock output
	GI4	GND SD-In4
	I4B	Sensor input SD-In4, channel B
	I4A	Sensor input SD-In4, channel A
	GCL	GND clock output
	GI3	GND SD-In3
	I3B	Sensor input SD-In3, channel B
	I3A	Sensor input SD-In3, channel A
	AIS	Restart acknowledgement input (”Acknowledge In Stop”, 1-channel, bridged to X82.3/AIS)

9.7 Motor holding brake control modules

The motor brake control modules differ in the following features:

- Rated voltage
- Device size assignment
- Mounting

The table shows the module/controller assignments according to the features listed.

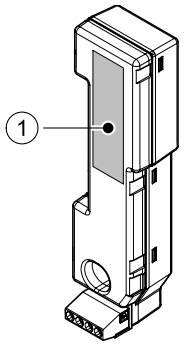
Axis module		Rated voltage of motor holding brake (control module)		
Type		24 V	230 V	180 V
E94AMxE0024 ... E94AMxE0244	GG1 ... GG3	E94AZHY0051 ① ③	E94AZHN0025 ④ ⑤	E94AZHN0026 ④ ⑤
E94ASxE0024 ... E94ASxE0244				
E94ASxE0324 ... E94ASxE3664	GG6 ... GG9	E94AZHY0101 ② ③	E94AZHY0025 ② ③	E94AZHY0026 ② ③

Tab. 9-2 Motor holding brake/control module assignment

GGx	Device size
①	integrated in the installation backplane, already used or retrofittable
②	integrated in the device, already used or retrofittable (recommended variant for the same rated voltage)
③	integrated control module (automatic brake operation can be activated)
④	external control (via digital output/digital input)
⑤	external mounting (DIN rail or mounting plate)

9.7.1 Motor holding brake control module E94AZHX0051

Identification

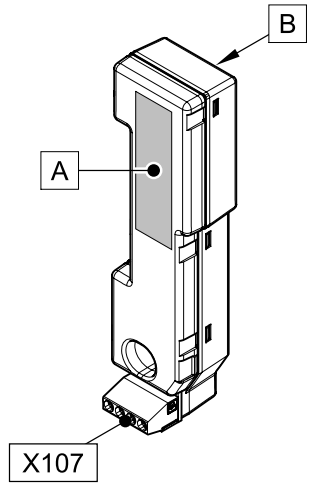


E94AZH002

Type code	①					
	E94	A	Z	H	x	005	1

Product series
Device generation
Accessories
Motor brake control type
Rated current
005 = 2.5 A
Voltage class
1 = 24 V

Scope of supply



E94AZH001

Pos.	Description
	Motor brake control E94AZHX0051
	Mounting Instructions

Elements of the motor brake control

Pos.	Description
A	Nameplate
B	Connection of the installation backplane
X107	Connection of supply and brake

Standards

Conformity	CE	Low-Voltage Directive
Approvals	UL (only for use with E94 series)	UL508, Industrial Control Equipment, Underwriter Laboratories (File No. E232497) for USA and Canada

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

General electrical data

Operating frequency	Max. 6/min
Operating times	Can be ignored compared to the delay time of the brake. See documentation of the brake.
Service life	> 10 millions of cycles
Protection against	
Overload	No
Short circuit of the terminals	Yes
Polarity reversal at the input	Yes
Insulation [1]	Double insulation (EN61800-5-1: V_{rated} = 300 V AC), Separation (UL: V_{rated} = 500 V AC)

[1] Brake connection against control card of the controller

Rated data

Type	Voltage U_{DC} [V]	Current I_{DC} [A]	Power P_{DC} [W]	Breaking energy E [Ws]
E94AZHX0051	18 ... 30	0.3 ... 2.5	max. 55	max. 5

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Stop!

The motor brake control includes an electronic switch which can control a 24 V motor holding brake.

The motor brake control may only be connected with motor holding brakes which correspond to the permissible data mentioned in the technical data. (If required, the holding brake without motor brake control must be controlled via a digital output and a coupling relay).

If the permissible data mentioned in the technical data are not complied with:

► the motor brake control can be destroyed.

► a safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements concerning the brake cable (connection BD1/BD2):

► The brake cables must be shielded if they are incorporated in the motor cable.
  – Operation with unshielded brake cables can destroy the motor brake control.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

► Connect the shield on both sides of PE.

Requirements concerning the supply voltage U_{DC} (connection +/-):

► The motor brake control must always be supplied with a separate 24 V supply.
  – A common supply of the motor brake control and the control card of the controller is not permissible since otherwise the double insulation between both components would be reduced.

► Set U_{DC} so that the operating voltage of the brake is within the admissible range and the maximum supply voltage of the motor brake control will not be exceeded.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Monitoring functions

Motor brake control module		
Brake status	**Module-internal monitoring**	**No monitoring**
Brake is not controlled (brake is applied)	• Supply voltage of brake – not available – not connected correctly	• Supply voltage – too high – too low – e.g. 18 V instead of 24 V • Brake current – too high – too low • Brake cable not connected correctly
Brake is controlled (brake is released)	• Short circuits – cable "+" or "-" – cable "BD1" or "BD2" • Open circuit – cable "+" or "-" – cable "BD1" or "BD2"	

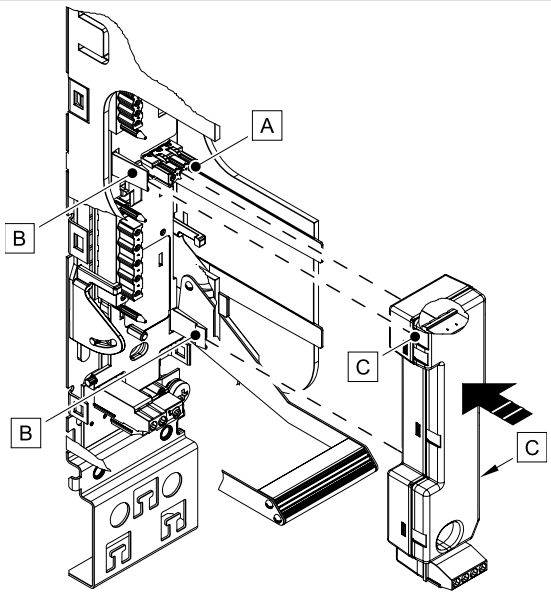
► SingleDrives E94AS...: monitoring active from $V_{DC\ bus}$ > 250 V

► MultiDrives E94AM...: monitoring active independently of $V_{DC\ bus}$

$V_{DC\ bus}$ = DC-bus voltage

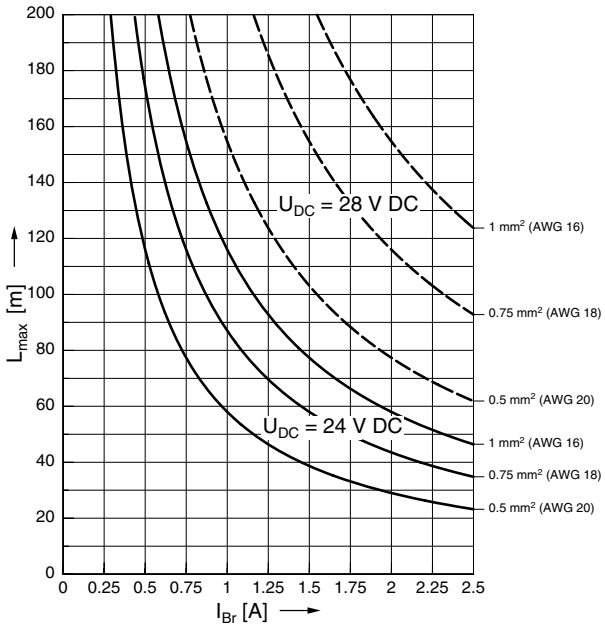
► Errors can be evaluated under code C02609/8.

Installation steps



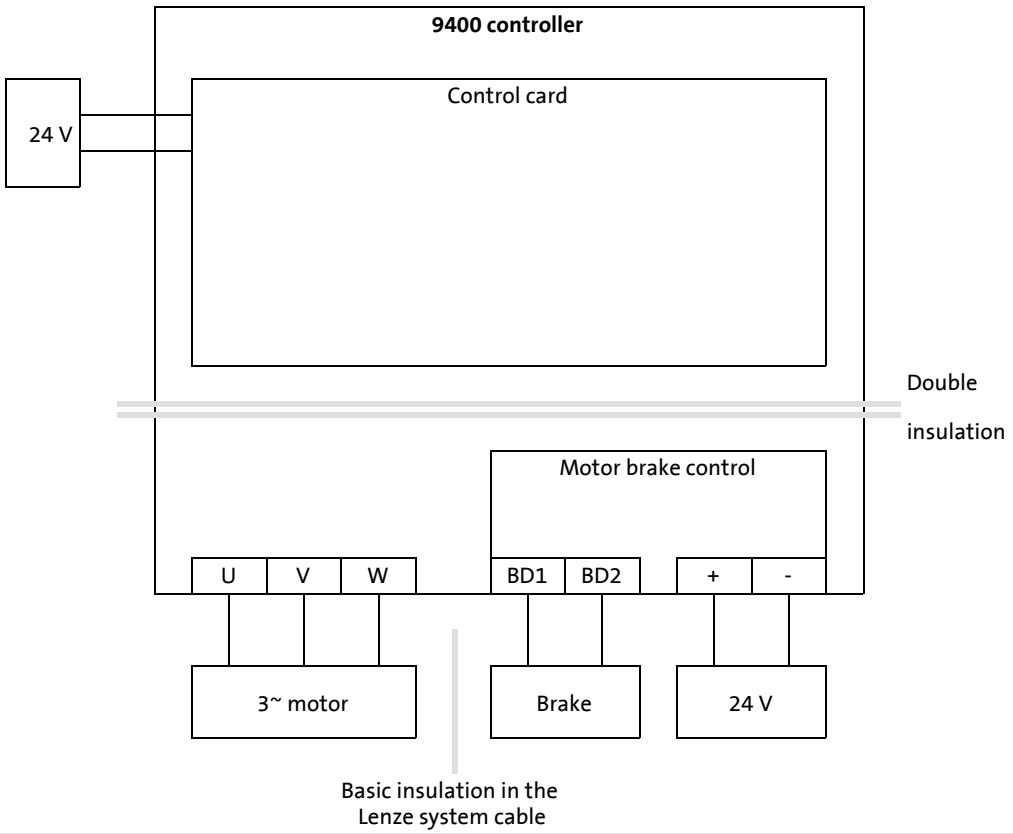
3. Insert the motor brake control into the terminal A of the installation backplane.
4. Ensure that both clips B snap in the slots C of the motor brake control.

Cable lengths

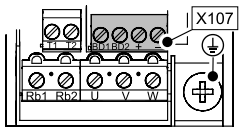


L_{max}	Maximum brake cable length in [m]
I_{BR}	Brake current in [A]
U_{DC}	Supply voltage of the motor brake control

Electrical isolation / protection against accidental contact



Terminal data

Terminal X107	Labelling	Description
 SSP940X107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHX0051: 24 V DC, max. 2.5 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Note!

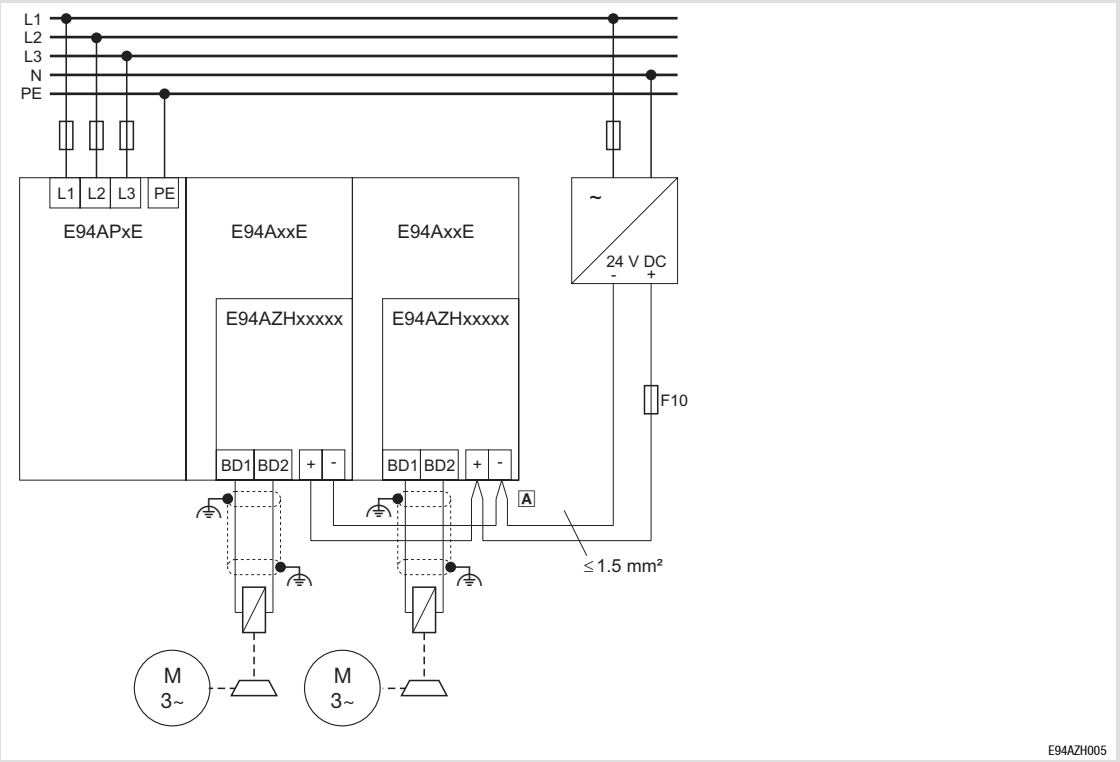
The supply terminals (+/-) are protected against polarity reversal.

The supply status can be reported to the basic device via the error channel. Further information can be obtained from the documentation of the basic device.

Terminal data	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Single core	0.25 ... 2.5	24 ... 12	0.5 ... 0.6	4.4 ... 5.3
2 conductors [1)]	0.25 ... 1.5	24 ... 16		

1) Two conductors of the same cross-section with a twin wire end ferrule

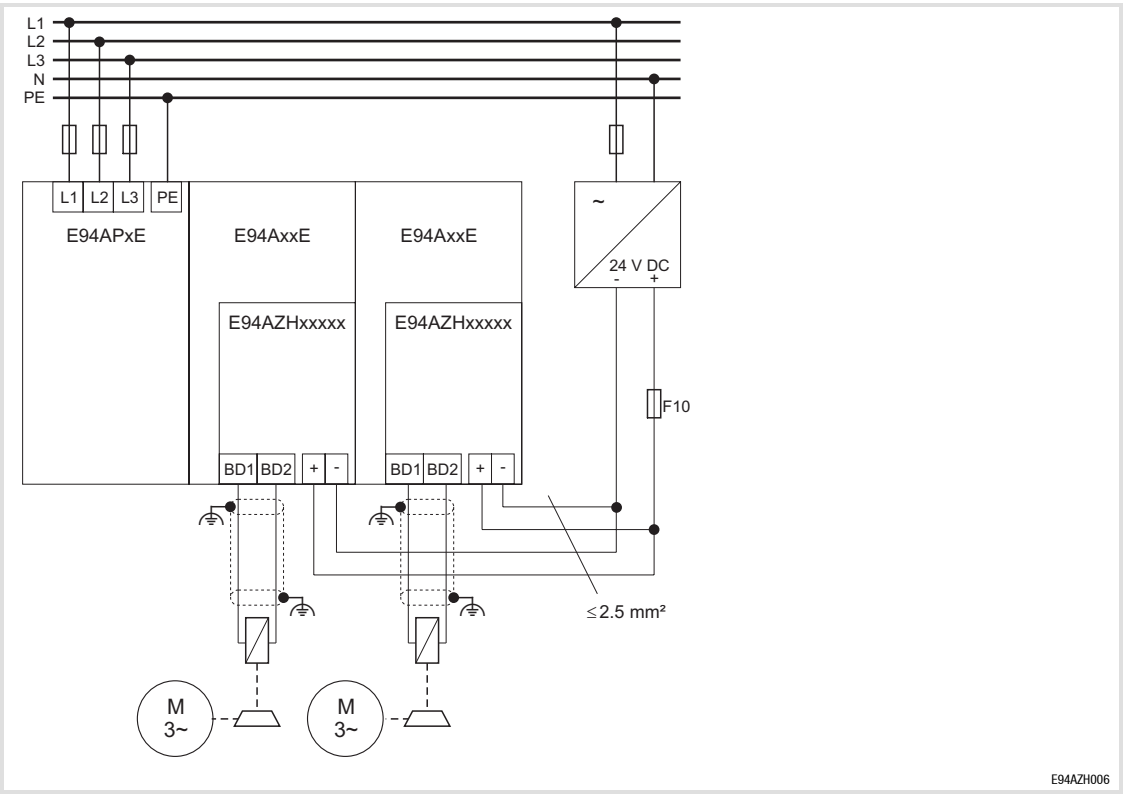
Connection plan



F10 Secondary cable protection. Observe the standards of the cable protection when selecting the fuse!

A Use twin wire end ferrules.

HF shield termination through large-surface PE connection

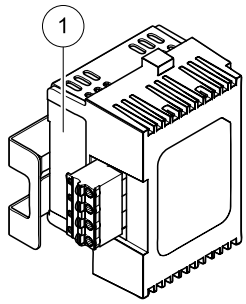


F10 Secondary cable protection. Observe the standards of the cable protection when selecting the fuse!

⏚ HF shield termination through large-surface PE connection

9.7.2 Motor holding brake control module E94AZHY0101

Identification

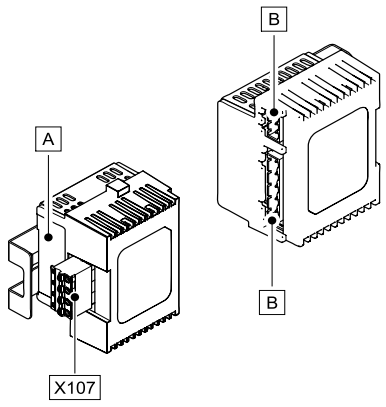


E94AZHY002

Type code	①					
	E94	A	Z	H	Y	xxx	x

Product series
Version
Accessories
Motor brake control type
Rated current
002 = 0.75 A
010 = 5.0 A
Voltage class
1 = 24 V DC
5 = 205 V DC
6 = 180 V DC

Scope of supply



E94AZHY001

Pos.	Description
	Motor brake control E94AZHY0101
	Mounting Instructions

Elements of the motor brake control

Pos.	Description
A	Nameplate
B	Connection of standard device
X107	Connection of supply and brake

Standards

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approval			
UR	UL 508C	Industrial Control Equipment Recognised (file no. E132659) for USA	

Protection of persons and equipment			
Enclosure	EN 60529	IP00	
Protective measures		Against short circuit	

EMC			
Noise emission	EN 61800-3	Conducted, category C2.	
Noise immunity	EN 61800-3	Burst on mains cable:	2 kV/5 kHz
		Burst on control cable:	2 kV/5 kHz
		Surge on mains cable:	1 kV (1.2 µs/50 µs; phase - phase)
			2 kV (1.2 µs/50 µs; phase - PE)

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

Rated data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0101	24	0 (DC)	0.3 ... 5	0.3 ... 5	2

① Temperature in the control cabinet

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0101	24	0 (DC)	0.3 ... 5	0.3 ... 5	2

① Temperature in the control cabinet

Area	Values
Input voltage	DC 24 V (18 ... 30 V)
Output voltage	Corresponds to input voltage
Brake current	0.3 ... 5 A
Switching capacity	Max. 110 W
Breaking energy	Max. 10 Ws
Cable protection	Recommendation: 7.5 A, tripping characteristic ”B” or ”C”
Control input	
Control voltage	Internal
Control current	
Protective function	
Maximum cable length	In the chapter ”Electrical installation” the dependency of the cable length on the brake current and the cable cross-section is described.
Operating frequency	Max. 6/min
Operating times	Can be ignored compared to the delay time of the brake. See documentation of the brake.
Service life	> 10 millions of cycles
Protection against	
Overload	No
Short circuit of the terminals	Yes
Polarity reversal at the input	Yes
Insulation [1]	Double insulation (EN61800-5-1: V_{rated} = 300 V AC), Separation (UL: V_{rated} = 500 V AC)

[1] Brake connection against control card of the controller

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Stop!

Requirements concerning the brake cable (connection BD1/BD2):

- ► The brake cables must be shielded if they are incorporated in the motor cable.
  - – Operation with unshielded brake cables can destroy the motor brake control.
  - – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).
- ► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  - – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.
- ► Connect the shield on both sides of PE.

Requirements concerning the supply voltage U_{DC} (connection +/-):

- ► The motor brake control must always be supplied with a separate 24 V supply.
  - – A common supply of the motor brake control and the control card of the controller is not permissible since otherwise the double insulation between both components would be reduced.
- ► Set U_{DC} so that the operating voltage of the brake is within the admissible range and the maximum supply voltage of the motor brake control will not be exceeded.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Monitoring functions

Motor brake control module		
Brake status	**Module-internal monitoring**	**No monitoring**
Brake is not controlled (brake is applied)	• Supply voltage of brake – not available – not connected correctly	• Supply voltage – too high – too low – e.g. 18 V instead of 24 V • Brake current – too high – too low • Brake cable not connected correctly
Brake is controlled (brake is released)	• Short circuits – cable "+" or "-" – cable "BD1" or "BD2" • Open circuit – cable "+" or "-" – cable "BD1" or "BD2"	

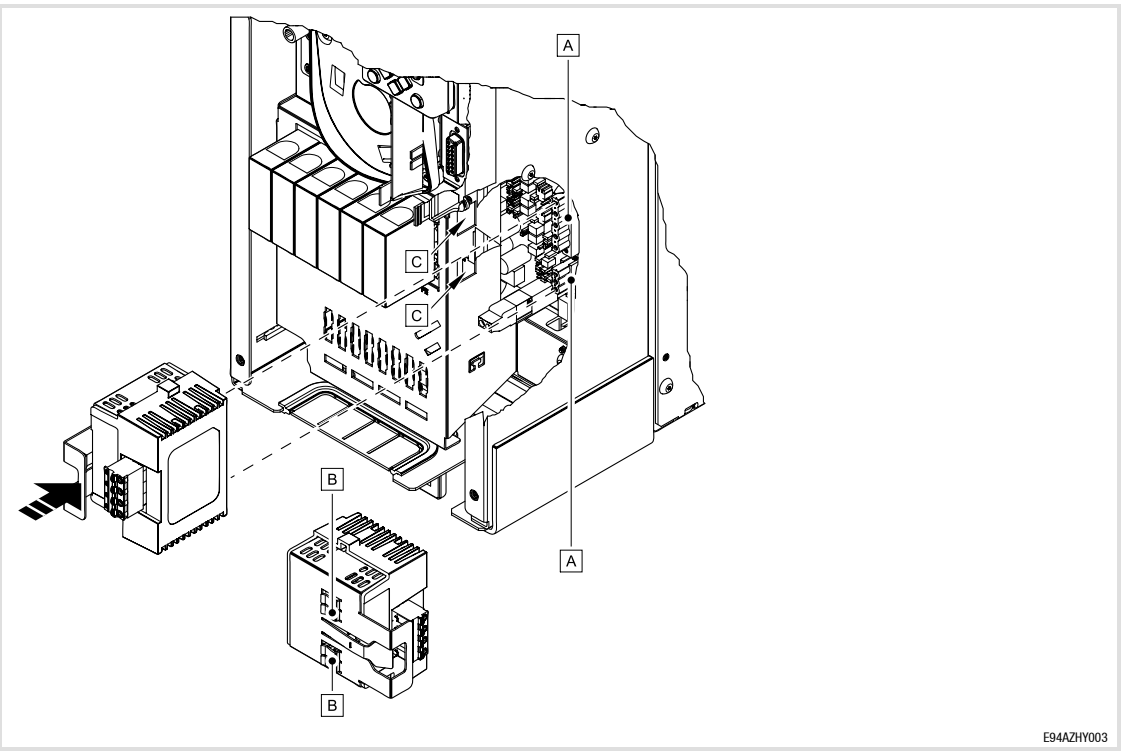
► SingleDrives E94AS...: monitoring active from $V_{DC\ bus}$ > 250 V

► MultiDrives E94AM...: monitoring active independently of $V_{DC\ bus}$

$V_{DC\ bus}$ = DC-bus voltage

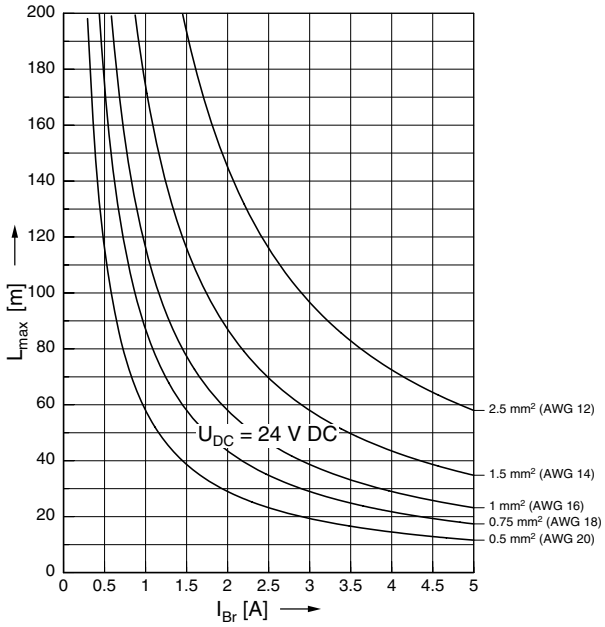
► Errors can be evaluated under code C02609/8.

Installation steps

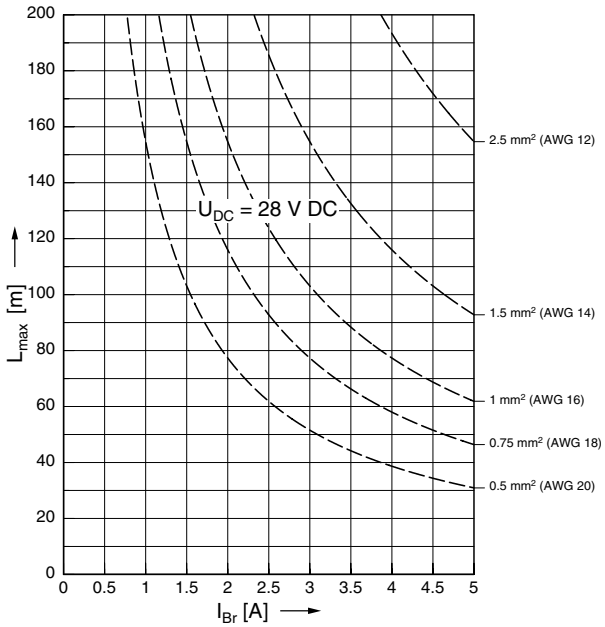


1. Plug the motor brake control module onto the terminals A of the standard device.
   – Ensure that both clips B snap into the slots C of the standard device!
2. Check that the motor brake control module is securely connected.

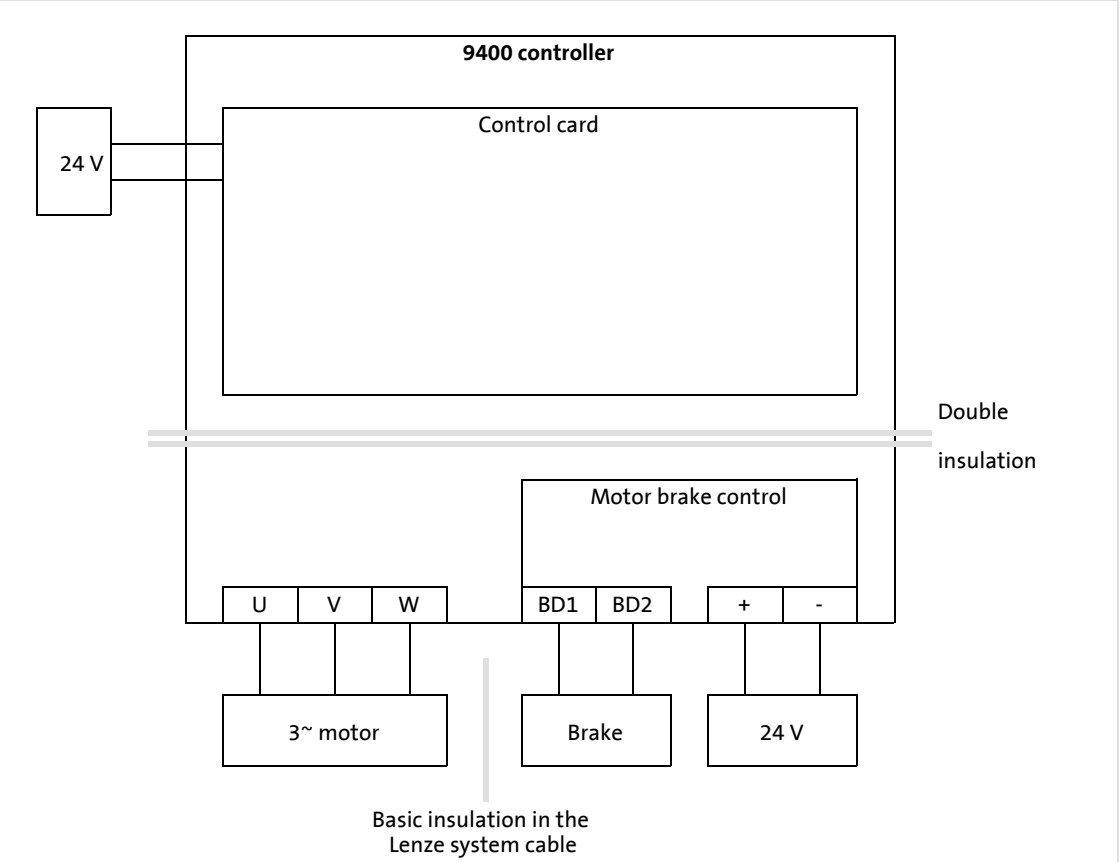
Cable lengths



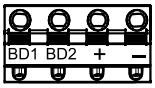
L_{max} Maximum brake cable length in [m]
I_{BR} Brake current in [A]
U_{DC} Supply voltage of the motor brake control



L_{max} Maximum brake cable length in [m]
I_{BR} Brake current in [A]
U_{DC} Supply voltage of the motor brake control



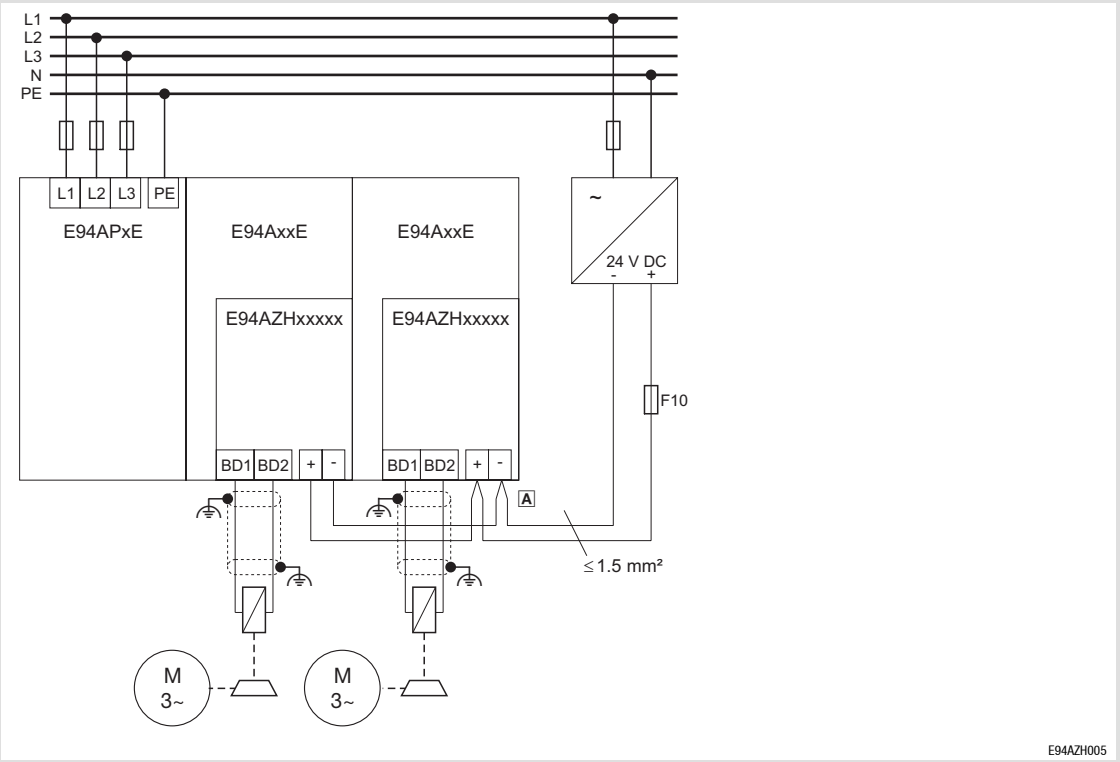
Terminal data

Terminal X107	Labelling	Description
 SSP94X6107	BD1 BD2	Connection of the motor holding brake + (Lenze: WH) - (Lenze: BN) E94AZHx0101: 24 V DC, max. 5.0 A Observe correct polarity!
	+ / -	Supply voltage for the motor holding brake (18 ... 30 V DC) Observe correct polarity!

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.5 ... 2.5	20 ... 12	Spring terminal	
With wire end ferrule				

Stripping length or contact length: 8 mm

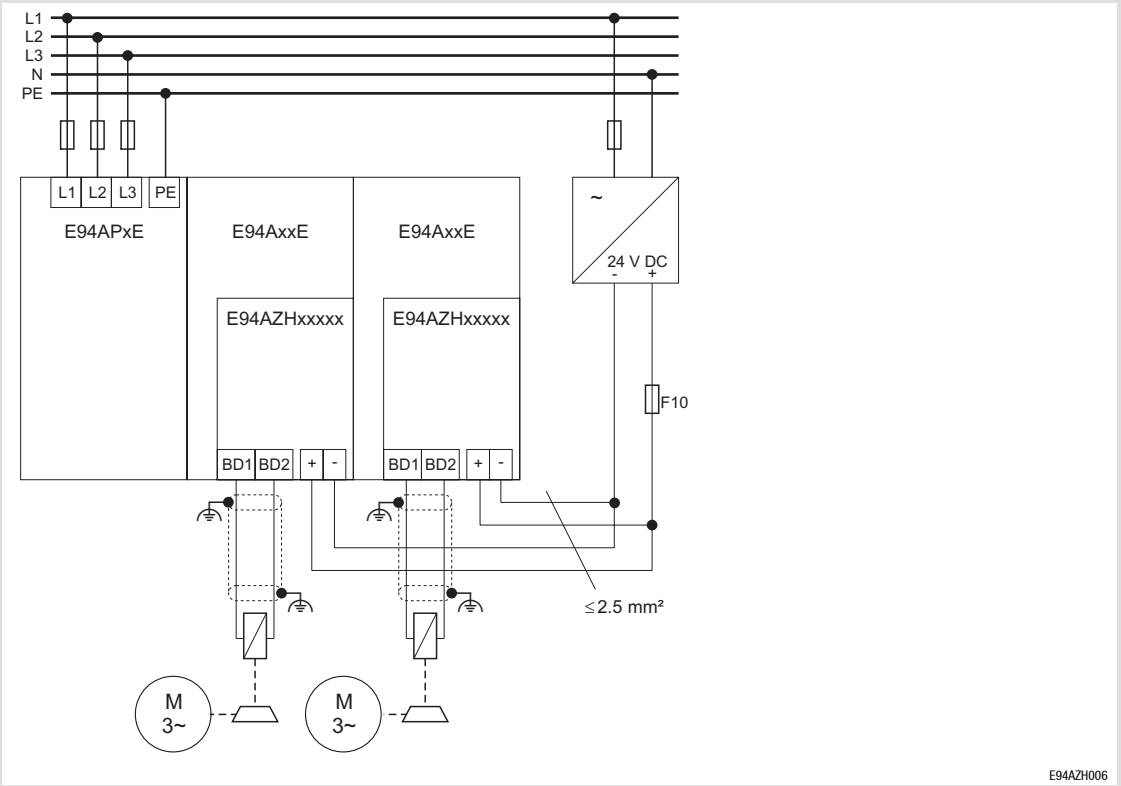
Connection plan



F10 Secondary cable protection. Observe the standards of the cable protection when selecting the fuse!

A Use twin wire end ferrules.

⏚ HF shield termination through large-surface PE connection

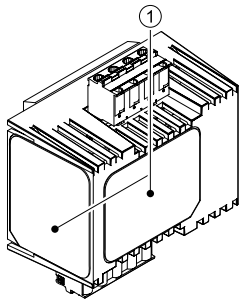


F10 Secondary cable protection. Observe the standards of the cable protection when selecting the fuse!

⏚ HF shield termination through large-surface PE connection

9.7.3 Motor holding brake control module E94AZHN0025

Identification



E94AZHN0025_003i

Type code	①						
	E94	A	Z	H	N	xxx	x

Product series

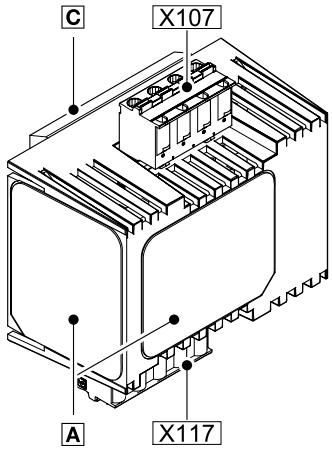
Accessories

Motor brake control type

Rated current
002 = 0.75 A

Voltage class
5 = 205 V DC
6 = 180 V DC

Scope of supply



E94AZHN0025_003

Pos.	Description
	Motor brake control E94AZHN0025
	Mounting Instructions
C	DIN rail adapter

Elements of the motor brake control

Pos.	Description
A	Nameplate
X117	Control connection
X107	Connection of supply and brake

Standards

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approval			
UR	UL 508C	Industrial Control Equipment Recognised (file no. E132659) for USA	

Protection of persons and equipment			
Enclosure	EN 60529	IP00	
Protective measures		Against short circuit	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertically	
Mounting clearances			
Above/below		≥ 25 mm	
To the sides		Side-by-side mounting without clearance	

EMC			
Noise emission	EN 61800-3	Conducted, category C2.	
Noise immunity	EN 61800-3	Burst on mains cable:	2 kV/5 kHz
		Burst on control cable:	2 kV/5 kHz
		Surge on mains cable:	1 kV (1.2 µs/50 µs; phase - phase)
			2 kV (1.2 µs/50 µs; phase - PE)

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

Rated data

	Voltage [V]	Frequency [Hz]	Current [A] max. +45 °C ①	Current [A] max. +55 °C ①	Number of phases
E94AZHN0025	230/290	50/60	0.75/0.75	0.54/0.54	1

① Temperature in the control cabinet

	Voltage [V]	Frequency [Hz]	Current [A] max. +45 °C ①	Current [A] max. +55 °C ①	Number of phases
E94AZHN0025	205/260	0 (DC)	0.75/0.75	0.54/0.54	1

① Temperature in the control cabinet

Area	Values	
Input voltage	AC 230 V (180 ... 317 V), 45 ... 65 Hz	
Output voltage	DC 205 V	With mains voltage of AC 230 V
Brake current	0.1 ... 0.75 A	
Cable protection	Recommendation: 5 A, tripping characteristic ”B” or ”C”	
Control input DI **Signalling output DO**		
Control voltage	DC 24 V, PLC level	
	HIGH LOW	DC +15 ... 30 V DC 0 ... +3 V
Control current		
Input	5 ... 10 mA	
Output	5 ... 50 mA	
Protective function	Protected against polarity reversal up to DC 60 V	
Max. connectable cable cross-section	2.5 mm² AWG 12	
Maximum cable length	150 m	

Permissible operating frequencies

Recommended brake Type	Power P [W]	Coil: Voltage DC 205 V L [H]	I [A] (20 °C)	Permissible operating frequency [1/min]
BFK457-06E BFK458-06E	20	76	0.10	60
BFK457-08E BFK458-08E	25	66	0.12	60
BFK457-10E BFK458-10E	30	85	0.15	60
BFK457-12E BFK458-12E	40	107	0.20	40
BFK457-14E BFK458-14E	50	102	0.24	30
BFK457-16E BFK458-16E	55	127	0.27	20
BFK457-18E BFK458-18E	85	100	0.41	10
BFK457-20E BFK458-20E	100	115	0.49	8
BFK457-25E BFK458-25E	110	134	0.54	6

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Danger!

Dangerous electrical voltage!

Dangerous electrical voltages may be applied to the connections of the brake switch.

Possible consequences:

► Death or severe injuries when touching the terminals.

Protective measures:

► Disconnect the standard device and the brake switch from the mains before carrying out any operations.

► Check that all power terminals are deenergised.

Stop!

The motor brake control includes an electronic switch which can control a motor holding brake.

The motor brake control module may only be connected to holding brakes which correspond to the permissible data specified in the technical data.

If the permissible values specified in the technical data are not complied with:

► The motor brake control module can be destroyed.

► A safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements on the brake cable (connection BD1/BD2):

► If the brake cable is part of the motor cable, it must be shielded.
  – An operation with unshielded brake cables can destroy the motor brake control module.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).
  – Connect the shield to PE on both sides.

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Warnings!

► Use H, K5 or CC fuses.

► Voltage of the fuses must at least be suitable with the input voltage.

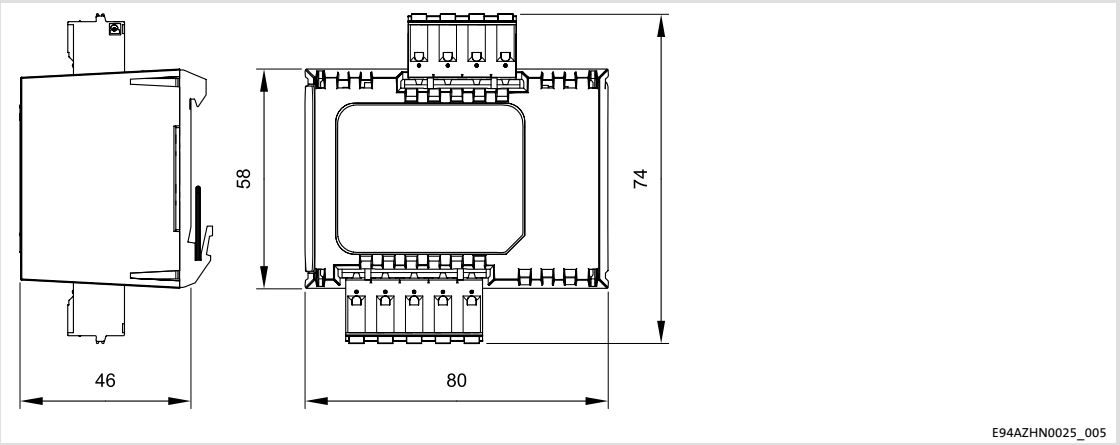
► Use 105 °C wire only.

► Maximum surrounding air temperature: 55 °C with derating.

► Load at ”Brake Output” is provided for ”dc pilot duty”.

► For use in a pollution degree 2 environment.

Dimensions



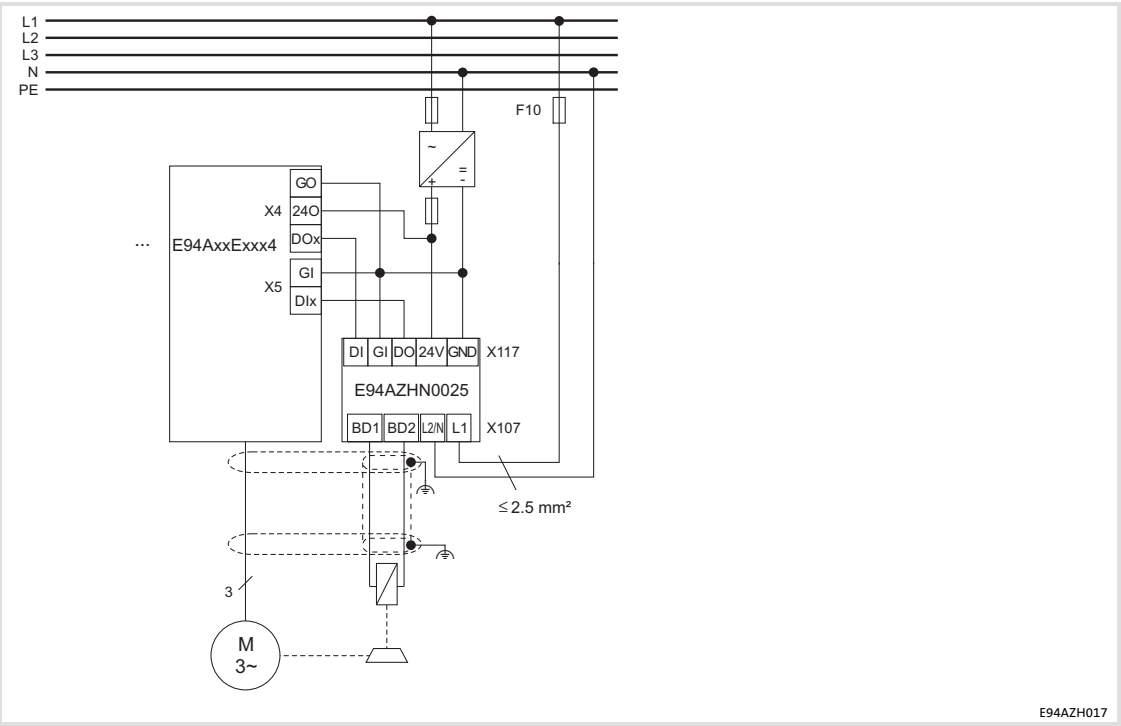
All dimensions in millimetres.

Installation steps

DIN rail mounting

1. Position the motor brake control module with the DIN rail adapter [C] at the bottom of the DIN rail.
2. Let the motor brake control module snap into the upper DIN rail edge against the resistance of the spring force.
3. Check that the motor brake control module is securely connected.

Connection plan



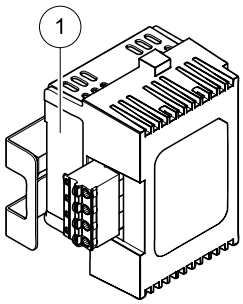
F10 Cable protection of the motor holding brake
Observe the cable protection standards for fuse dimensioning!

E94A.. Components of the 9400 series
.

⏚ HF shield termination through large-surface PE connection

9.7.4 Motor holding brake control module E94AZHY0025

Identification

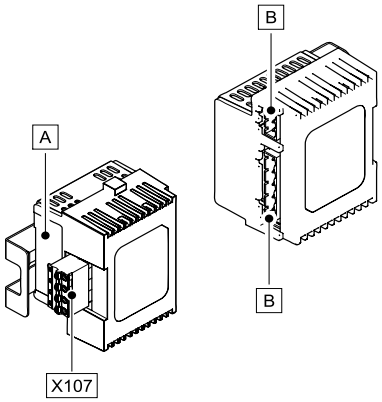


E94AZHY002

Type code	①						
	E94	A	Z	H	Y	xxx	x

Product series
Version
Accessories
Motor brake control type
Rated current
002 = 0.75 A
010 = 5.0 A
Voltage class
1 = 24 V DC
5 = 205 V DC
6 = 180 V DC

Scope of supply



E94AZHY001

Pos.	Description
	Motor brake control E94AZHY0025
	Mounting Instructions

Elements of the motor brake control

Pos.	Description
A	Nameplate
B	Connection of standard device
X107	Connection of supply and brake

Standards

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approval			
UR	UL 508C	Industrial Control Equipment Recognised (file no. E132659) for USA	

Protection of persons and equipment			
Enclosure	EN 60529	IP00	
Protective measures		Against short circuit	

EMC			
Noise emission	EN 61800-3	Conducted, category C2.	
Noise immunity	EN 61800-3	Burst on mains cable:	2 kV/5 kHz
		Burst on control cable:	2 kV/5 kHz
		Surge on mains cable:	1 kV (1.2 µs/50 µs; phase - phase)
			2 kV (1.2 µs/50 µs; phase - PE)

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s^2 = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

Rated data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0025	230/290	50/60	0.75/0.75	0.54/0.54	1

① Temperature in the control cabinet

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0025	205/260	0 (DC)	0.75/0.75	0.54/0.54	1

① Temperature in the control cabinet

Area	Values
Input voltage	AC 230 V (180 ... 317 V), 45 ... 65 Hz
Output voltage	DC 205 V With mains voltage of AC 230 V
Brake current	0.1 ... 0.75 A
Cable protection	Recommendation: 5 A, tripping characteristic ”B” or ”C”
Control input	
Control voltage	Internal
Control current	
Protective function	
Max. connectable cable cross-section	2.5 mm^2 AWG 12
Maximum cable length	150 m

Permissible operating frequencies

Recommended brake Type	Power P [W]	Coil: Voltage DC 205 V L [H]	Coil: Voltage DC 205 V I [A] (20 °C)	Permissible operating frequency [1/min]
BFK457-06E BFK458-06E	20	76	0.10	60
BFK457-08E BFK458-08E	25	66	0.12	60
BFK457-10E BFK458-10E	30	85	0.15	60
BFK457-12E BFK458-12E	40	107	0.20	40
BFK457-14E BFK458-14E	50	102	0.24	30
BFK457-16E BFK458-16E	55	127	0.27	20
BFK457-18E BFK458-18E	85	100	0.41	10
BFK457-20E BFK458-20E	100	115	0.49	8
BFK457-25E BFK458-25E	110	134	0.54	6

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Danger!

Dangerous electrical voltage!

Dangerous electrical voltages may be applied to the connections of the brake switch.

Possible consequences:

► Death or severe injuries when touching the terminals.

Protective measures:

► Disconnect the standard device and the brake switch from the mains before carrying out any operations.

► Check that all power terminals are deenergised.

Stop!

The motor brake control includes an electronic switch which can control a motor holding brake.

The motor brake control module may only be connected to holding brakes which correspond to the permissible data specified in the technical data.

If the permissible values specified in the technical data are not complied with:

► The motor brake control module can be destroyed.

► A safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements on the brake cable (connection BD1/BD2):

► If the brake cable is part of the motor cable, it must be shielded.
  – An operation with unshielded brake cables can destroy the motor brake control module.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).
  – Connect the shield to PE on both sides.

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Warnings!

► Use H, K5 or CC fuses.

► Voltage of the fuses must at least be suitable with the input voltage.

► Use 105 °C wire only.

► Maximum surrounding air temperature: 55 °C with derating.

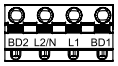
► Load at ”Brake Output” is provided for ”dc pilot duty”.

► For use in a pollution degree 2 environment.

Installation steps

1. Plug the motor brake control module onto the terminals A of the standard device.
   – Ensure that both clips B snap into the slots C of the standard device!
2. Check that the motor brake control module is securely connected.

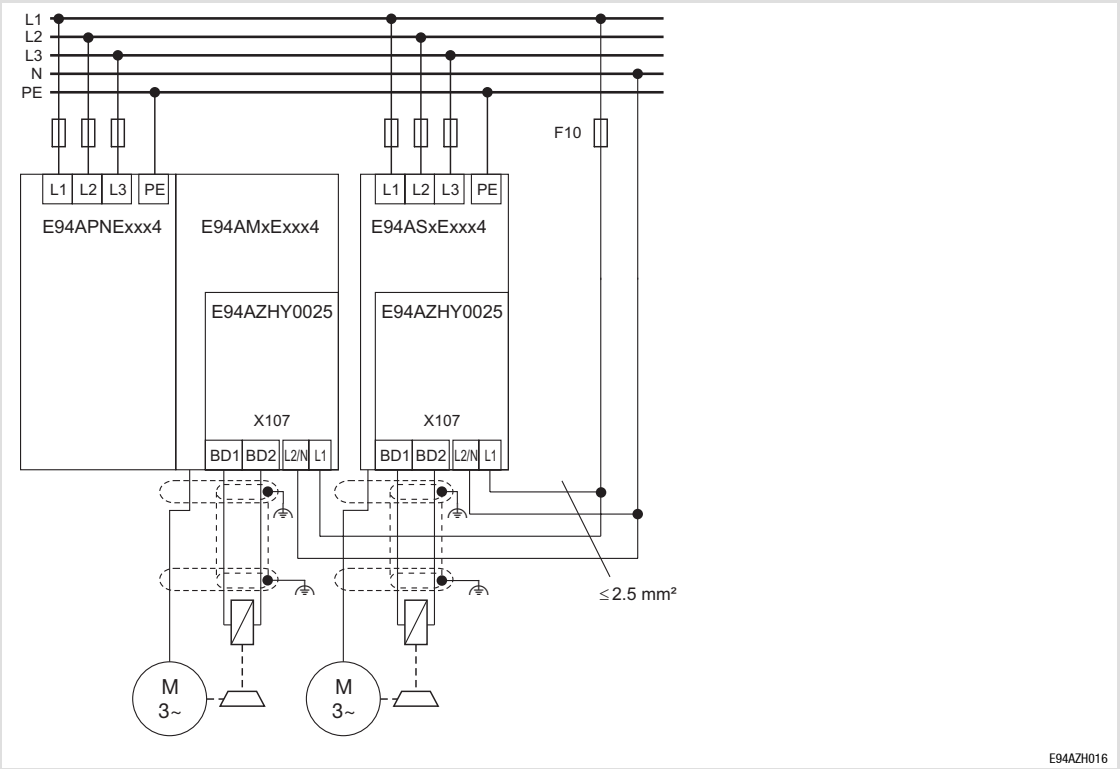
Terminal data

Terminal X107	Labelling	Description
 SSP94A6107	BD1 BD2	Connection of the motor holding brake: + (Lenze: WH) - (Lenze: BN) E94AZHY0025: 205 V DC, max. 0.75 A Ensure correct polarity!
	L1 L2/N	Supply voltage of the motor holding brake

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.5 ... 2.5	20 ... 12	Spring terminal	
With wire end ferrule				

Stripping length or contact length: 8 mm

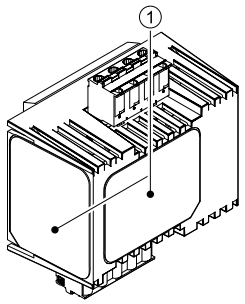
Connection plan



F10 Observe the cable protection standards for fuse dimensioning!
⏚ HF shield termination through large-surface PE connection

9.7.5 Motor holding brake control module E94AZHN0026

Identification



E94AZHN0025_003i

Type code	①						
	E94	A	Z	H	N	xxx	x

Product series

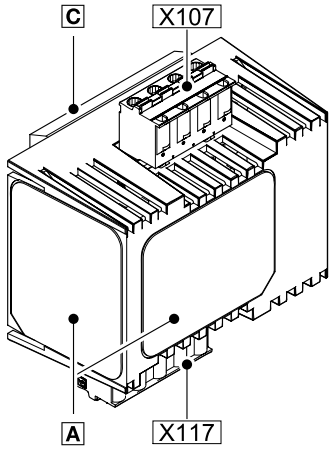
Accessories

Motor brake control type

Rated current
002 = 0.75 A

Voltage class
5 = 205 V DC
6 = 180 V DC

Scope of supply



E94AZHN0025_003

Pos.	Description
	Motor brake control E94AZHN0026
	Mounting Instructions
C	DIN rail adapter

Elements of the motor brake control

Pos.	Description
A	Nameplate
X117	Control connection
X107	Connection of supply and brake

Standards

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Approval			
UR	UL 508C	Industrial Control Equipment Recognised (file no. E132659) for USA	

Protection of persons and equipment			
Enclosure	EN 60529	IP00	
Protective measures		Against short circuit	

Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertically	
Mounting clearances			
Above/below		≥ 25 mm	
To the sides		Side-by-side mounting without clearance	

EMC			
Noise emission	EN 61800-3	Conducted, category C2.	
Noise immunity	EN 61800-3	Burst on mains cable:	2 kV/5 kHz
		Burst on control cable:	2 kV/5 kHz
		Surge on mains cable:	1 kV (1.2 µs/50 µs; phase - phase)
			2 kV (1.2 µs/50 µs; phase - PE)

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C)
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Pollution degree 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	EN 600068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 10 m/s²

Rated data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHN0026	400/500	50/60	0.75/0.75	0.61/0.61	1

① Temperature in the control cabinet

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHN0026	180/225	0 (DC)	0.75/0.75	0.61/0.61	1

① Temperature in the control cabinet

Area	Values	
Input voltage	AC 400 V (320 ... 550 V), 45 ... 65 Hz	
Output voltage	DC 180 V	With mains voltage of AC 400 V
Brake current	0.1 ... 0.61 A	
Cable protection	Recommendation: 5 A, tripping characteristic "B" or "C"	
Control input DI **Signalling output DO**		
Control voltage	DC 24 V, PLC level	
	HIGH LOW	DC +15 ... 30 V DC 0 ... +3 V
Control current		
Input	5 ... 10 mA	
Output	5 ... 50 mA	
Protective function	Protected against polarity reversal up to DC 60 V	
Max. connectable cable cross-section	2.5 mm² AWG 12	
Maximum cable length	150 m	

Permissible operating frequencies

Recommended brake Type	Power P [W]	Coil: Voltage DC 180 V L [H]	Coil: Voltage DC 180 V I [A] (20 °C)	Permissible operating frequency [rpm]
BFK457-06E BFK458-06E	20	60	0.11	60
BFK457-08E BFK458-08E	25	50	0.14	60
BFK457-10E BFK458-10E	30	69	0.17	60
BFK457-12E BFK458-12E	40	81	0.22	40
BFK457-14E BFK458-14E	50	78	0.28	30
BFK457-16E BFK458-16E	55	102	0.31	20
BFK457-18E BFK458-18E	85	77	0.47	10
BFK457-20E BFK458-20E	100	92	0.56	8
BFK457-25E BFK458-25E	110	102	0.61	6

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Danger!

Dangerous electrical voltage!

Dangerous electrical voltages may be applied to the connections of the brake switch.

Possible consequences:

► Death or severe injuries when touching the terminals.

Protective measures:

► Disconnect the standard device and the brake switch from the mains before carrying out any operations.

► Check that all power terminals are deenergised.

Stop!

The motor brake control includes an electronic switch which can control a motor holding brake.

The motor brake control module may only be connected to holding brakes which correspond to the permissible data specified in the technical data.

If the permissible values specified in the technical data are not complied with:

► The motor brake control module can be destroyed.

► A safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements on the brake cable (connection BD1/BD2):

► If the brake cable is part of the motor cable, it must be shielded.
  – An operation with unshielded brake cables can destroy the motor brake control module.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).
  – Connect the shield to PE on both sides.

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Warnings!

► Use H, K5 or CC fuses.

► Voltage of the fuses must at least be suitable with the input voltage.

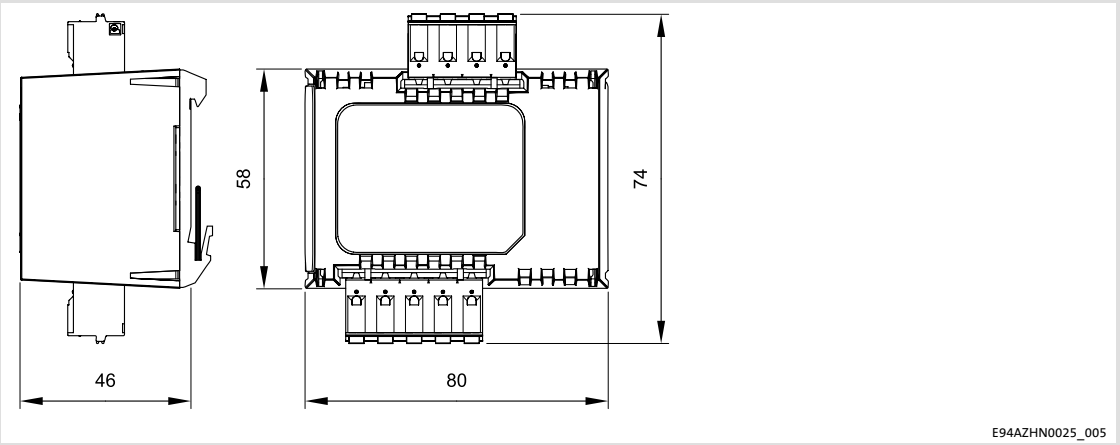
► Use 60/75 °C wire only.

► Maximum surrounding air temperature: 55 °C with derating.

► Load at ”Brake Output” is provided for ”dc pilot duty”.

► For use in a pollution degree 2 environment.

Dimensions



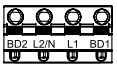
All dimensions in millimetres.

Installation steps

DIN rail mounting

1. Position the motor brake control module with the DIN rail adapter C at the bottom of the DIN rail.
2. Let the motor brake control module snap into the upper DIN rail edge against the resistance of the spring force.
3. Check that the motor brake control module is securely connected.

Connection of the motor holding brake

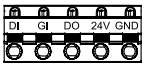
Terminal X107	Labelling	Description
 SSP94A6107	BD1 BD2	Connection of the motor holding brake: + (Lenze: WH) - (Lenze: BN) E94AZHN0026: 180 V DC, max. 0.75 A Ensure correct polarity!
	L1 L2/N	Supply voltage of the motor holding brake

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.5 ... 2.5	20 ... 12	Spring terminal	
With wire end ferrule				

Stripping length or contact length: 8 mm

Terminal data

Control connection

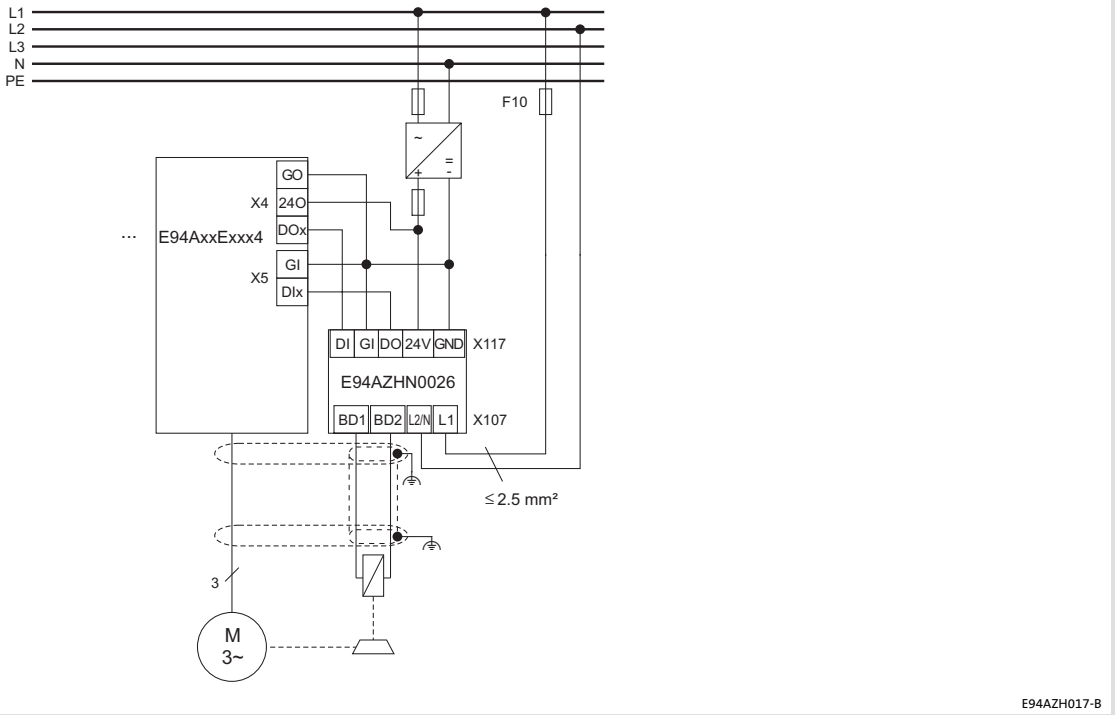
Terminal X117	Labelling	Description
 SSP94A6117	DI	Digital input
	GI	GND digital in
	DO	Signalling output
	24V	24-V supply by safely separated power supply unit (SELV/PELV)
	GND	GND digital out

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.5 ... 2.5	20 ... 12	Spring terminal	
With wire end ferrule				

Stripping length or contact length: 8 mm

Digital output DO	
State	Description
HIGH	No fault
LOW	Fault ● Supply voltage of the motor holding brake is missing ● Motor holding brake is not connected ● Brake cable is defective – Open circuit – Short circuit ● Supply voltage of the motor brake control is missing

Connection plan



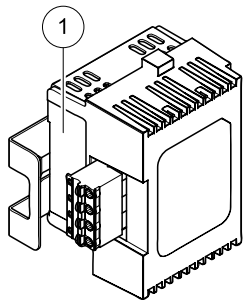
F10 Cable protection of the motor holding brake
Observe the cable protection standards for fuse dimensioning!

E94A.. Components of the 9400 series
.

⏚ HF shield termination through large-surface PE connection

9.7.6 Motor holding brake control module E94AZHY0026

Identification

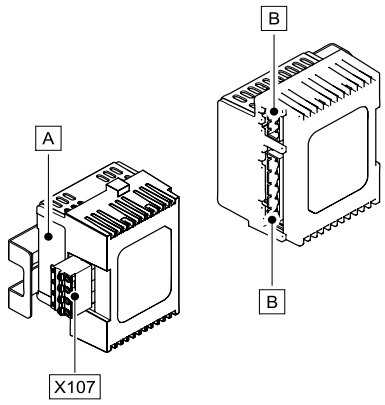


E94AZHY002

Type code	①					
	E94	A	Z	H	Y	xxx	x

Product series
Version
Accessories
Motor brake control type
Rated current
002 = 0.75 A
010 = 5.0 A
Voltage class
1 = 24 V DC
5 = 205 V DC
6 = 180 V DC

Scope of supply



E94AZHY001

Pos.	Description
	Motor brake control E94AZHY0026
	Mounting Instructions

Elements of the motor brake control

Pos.	Description
A	Nameplate
B	Connection of standard device
X107	Connection of supply and brake

Standards

Conformity and approval		
Conformity		
CE	2006/95/EC	Low-Voltage Directive
Approval		
UR	UL 508C	Industrial Control Equipment Recognised (file no. E132659) for USA

Protection of persons and equipment		
Enclosure	EN 60529	IP00
Protective measures		Against short circuit

EMC			
Noise emission	EN 61800-3	Conducted, category C2.	
Noise immunity	EN 61800-3	Burst on mains cable:	2 kV/5 kHz
		Burst on control cable:	2 kV/5 kHz
		Surge on mains cable:	1 kV (1.2 µs/50 µs; phase - phase)
			2 kV (1.2 µs/50 µs; phase - PE)

Operating conditions

The operating conditions correspond to the operating conditions for the standard device to which the DC-feeding point is connected.

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C)
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Pollution degree 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	EN 600068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 10 m/s²

Rated data

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0026	400/500	50/60	0.61/0.61	0.61/0.61	1

① Temperature in the control cabinet

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZHY0026	180/225	0 (DC)	0.61/0.61	0.61/0.61	1

① Temperature in the control cabinet

Area	Values
Input voltage	AC 400 V (320 ... 550 V), 45 ... 65 Hz
Output voltage	DC 180 V With mains voltage of AC 400 V
Brake current	0.1 ... 0.61 A
Cable protection	Recommendation: 5 A, tripping characteristic ”B” or ”C”
Control input	
Control voltage	Internal
Control current	
Protective function	
Max. connectable cable cross-section	2.5 mm^2 AWG 12
Maximum cable length	150 m

Permissible operating frequencies

Recommended brake Type	Power P [W]	Coil: Voltage DC 180 V L [H]	Coil: Voltage DC 180 V I [A] (20 °C)	Permissible operating frequency [rpm]
BFK457-06E BFK458-06E	20	60	0.11	60
BFK457-08E BFK458-08E	25	50	0.14	60
BFK457-10E BFK458-10E	30	69	0.17	60
BFK457-12E BFK458-12E	40	81	0.22	40
BFK457-14E BFK458-14E	50	78	0.28	30
BFK457-16E BFK458-16E	55	102	0.31	20
BFK457-18E BFK458-18E	85	77	0.47	10
BFK457-20E BFK458-20E	100	92	0.56	8
BFK457-25E BFK458-25E	110	102	0.61	6

Safety instructions

During installation the notes given in the documentation for the standard device must be observed!

Danger!

Dangerous electrical voltage!

Dangerous electrical voltages may be applied to the connections of the brake switch.

Possible consequences:

► Death or severe injuries when touching the terminals.

Protective measures:

► Disconnect the standard device and the brake switch from the mains before carrying out any operations.

► Check that all power terminals are deenergised.

Stop!

The motor brake control includes an electronic switch which can control a motor holding brake.

The motor brake control module may only be connected to holding brakes which correspond to the permissible data specified in the technical data.

If the permissible values specified in the technical data are not complied with:

► The motor brake control module can be destroyed.

► A safe operation of the motor holding brake cannot be guaranteed.

Further notes in the documentation of the standard device must be observed!

Stop!

Requirements on the brake cable (connection BD1/BD2):

► If the brake cable is part of the motor cable, it must be shielded.
  – An operation with unshielded brake cables can destroy the motor brake control module.
  – We recommend the use of Lenze system cables (motor cable with separately shielded additional cores).
  – Connect the shield to PE on both sides.

► When using a permanent magnet holding brake, ensure the correct polarity of the brake cable.
  – If the terminals are reversed, the brake does not release. Since the motor runs against the closed brake, the brake can be destroyed.

Note!

The supply status can be reported to the standard device via the error channel. For more information, please see the software manual or the online help (see description of C02609/8).

Warnings!

► Use H, K5 or CC fuses.

► Voltage of the fuses must at least be suitable with the input voltage.

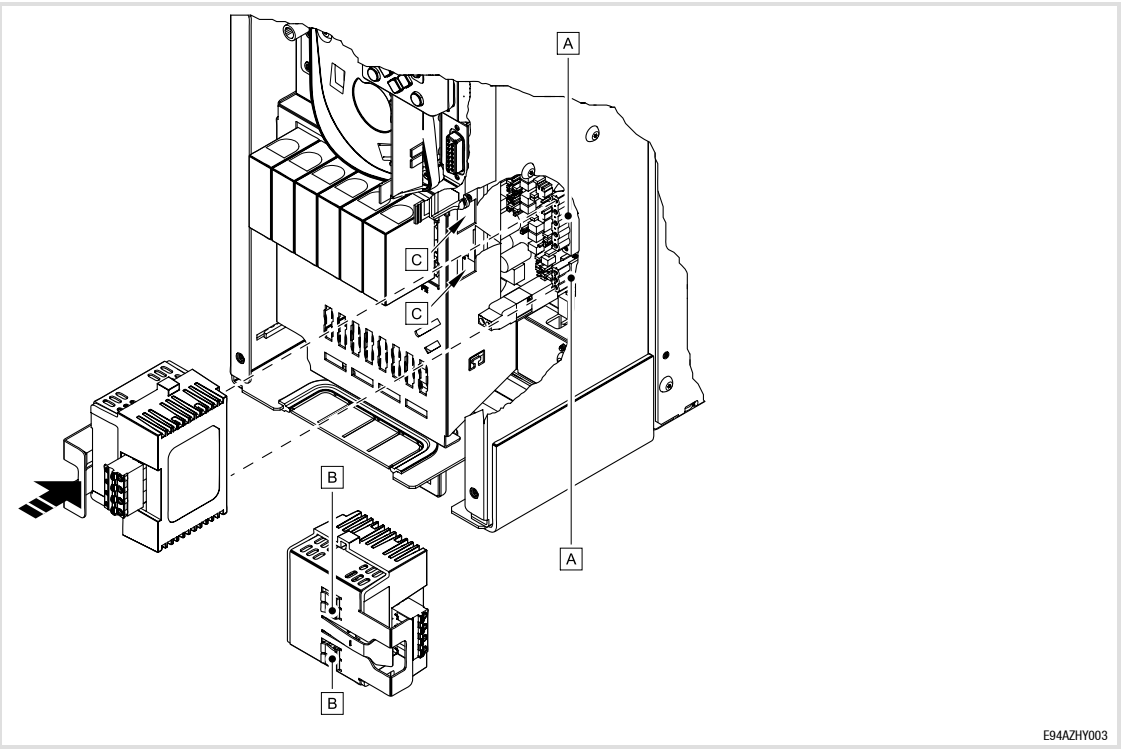
► Use 60/75 °C wire only.

► Maximum surrounding air temperature: 55 °C with derating.

► Load at ”Brake Output” is provided for ”dc pilot duty”.

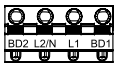
► For use in a pollution degree 2 environment.

Installation steps



1. Plug the motor brake control module onto the terminals A of the standard device.
   – Ensure that both clips B snap into the slots C of the standard device!
2. Check that the motor brake control module is securely connected.

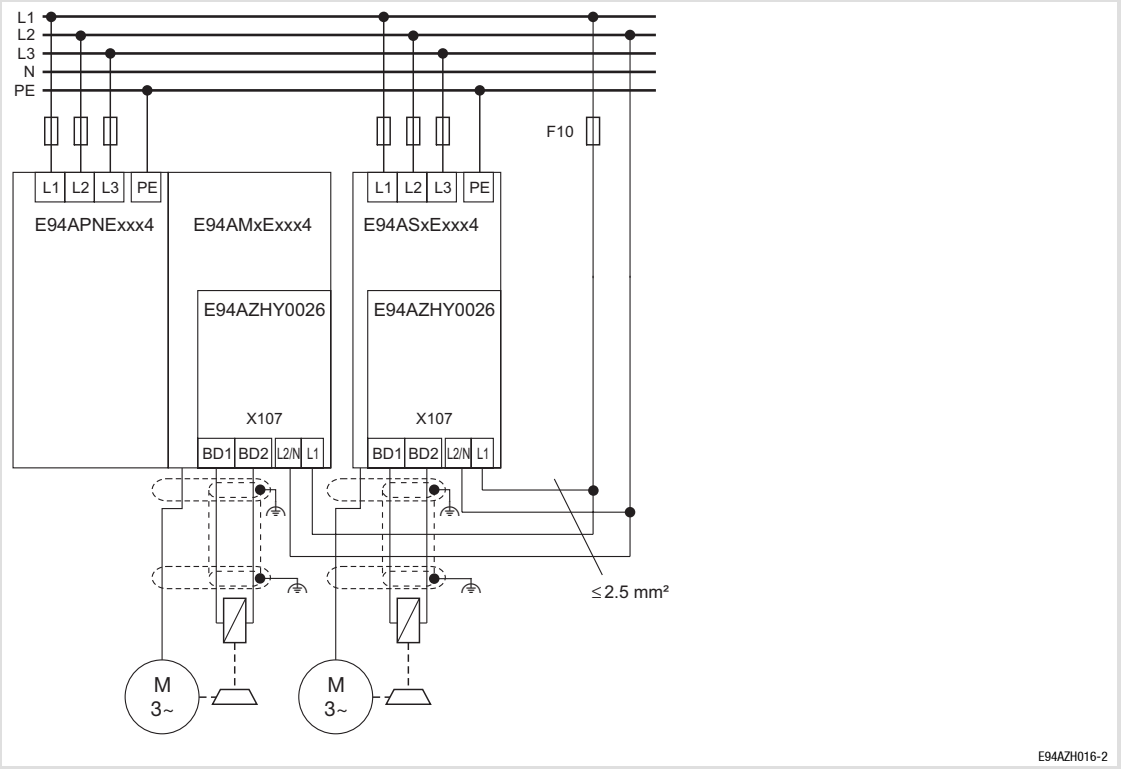
Terminal data

Terminal X107	Labelling	Description
 SSP94A6107	BD1 BD2	Connection of the motor holding brake: + (Lenze: WH) - (Lenze: BN) E94AZHY0026: 180 V DC, max. 0.61 A Ensure correct polarity!
	L1 L2/N	Supply voltage of the motor holding brake

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.5 ... 2.5	20 ... 12	Spring terminal	
With wire end ferrule				

Stripping length or contact length: 8 mm

Connection plan

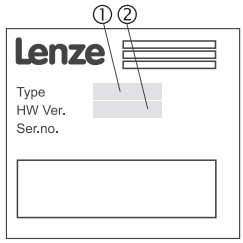


F10 Observe the cable protection standards for fuse dimensioning!
HF shield termination through large-surface PE connection

9.8 Accessories for diagnostics

9.8.1 USB diagnostic adapter

Identification

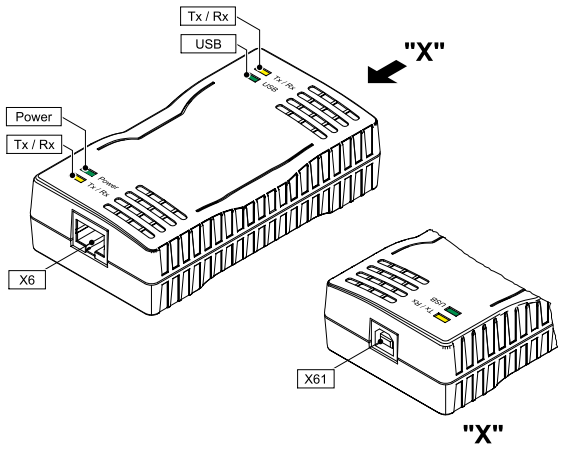


E94ZCUS003

	①					②
	E94	A	Z	C	US	VA

Product range
Version
Module identification: accessories
Module type: communication module
USB diagnostic adapter
Hardware version

Scope of supply



E894ZCUS001BA

Pos.	Description
	USB diagnostic adapter E94AZCUS
	USB cable
	Mounting Instructions

Connections

Pos.	Description
X61	USB connection
X6	Connection of the basic device (RJ69 socket)

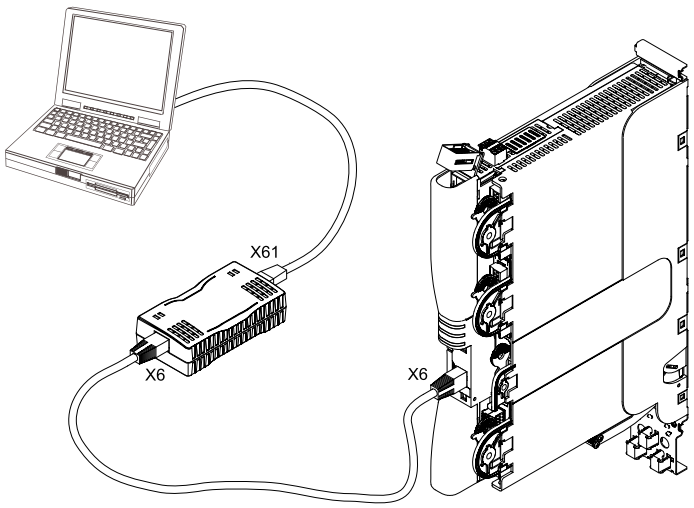
Displays

LED			
Pos.	Colour	Condition	Description
Power	Green	On	Diagnostic adapter is supplied with voltage by the basic device.
Tx / Rx	Yellow	Blinking	Basic device and PC communicate with each other via the diagnostic adapter.
USB	Green	On	Diagnostic adapter is connected to the PC and configured via USB.

Rated data

Field	Details
USB connection (X61)	Maximum current consumption: 100 mA

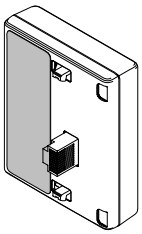
Installation steps



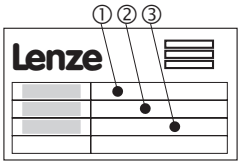
E94ZCUS002

9.8.2 Keypad

Identification



E94AZKAE036



E94AZKAE100

	①					②	③
	EZ	AE	B	K	100x	xx	xx

Product range: accessories

Design
AE = display unit

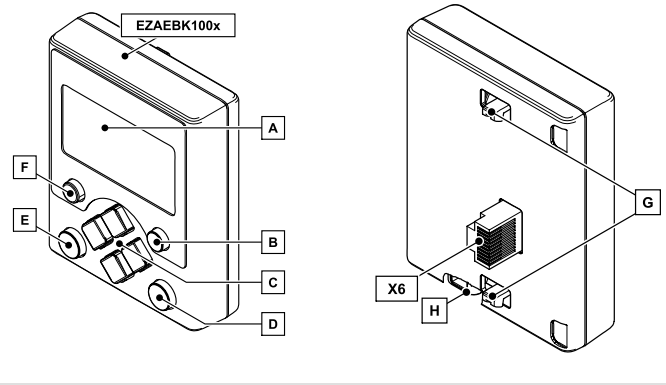
Version

Module type: keypad

Hardware version

Software version

Scope of supply



E94AZKAE025/035

Elements on the front

Pos.	Description
A	LCD display
B	Right function key
C	Navigation keys ⇧⇩⇦⇨
D	run key
E	stop key
F	Left function key

Elements on the back side

Pos.	Description
G	Lock hook
H	Release button
X6	RJ69 connector, connection on diagnostic interface (X6) on the basic device

Application range

The use of this module is permissible with basic devices as of nameplate designation:

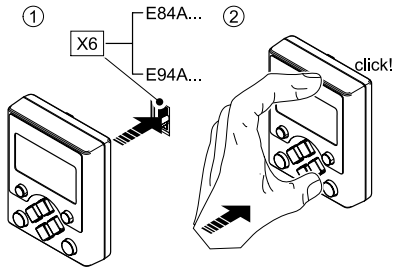
Product range	Type	HW Ver.	SW Ver.
Servo Drives 9400	E94AxxExxxx	VB	01.10
Inverter Drives 8400	E84AxxxExxxxxxxx	VA	00.07

General electrical data

Rated data

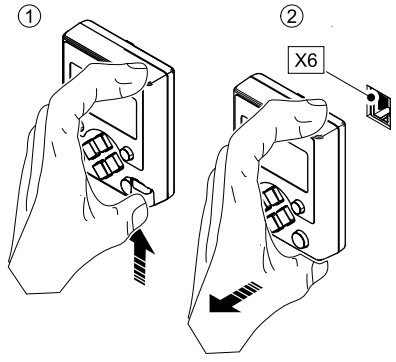
Field	Values	
Enclosure	IP20	
Ambient temperature	In operation:	-10 °C ... +55 °C
	Transport:	-25 °C ... +70 °C
	Storage:	-25 °C ... +55 °C
Climatic conditions	Class 3K3 in accordance with EN 50178 (without condensation, average relative humidity 85 %)	
Degree of pollution	EN 61800-5-1, degree of pollution 2	

Mounting



E94AZKAE055

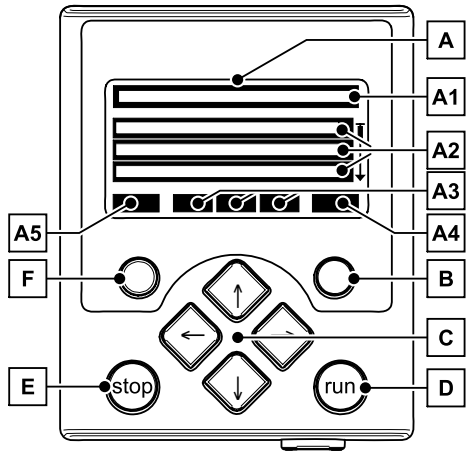
Dismounting



E94AZKAE060

Step-by-step commissioning

Commissioning step		Comment
1.	Connect keypad to the front side of the basic device on the diagnostic interface X6.	**You can also connect or remove the keypad during operation.**
2.	If the keypad is supplied with voltage, it carries out a short self test.	
3.	The keypad is ready for operation if it displays the main menu.	If you commission the keypad for the **first** time, you are requested to select the dialog language.
4.	You can now communicate with the basic device.	



E94AZKAE003

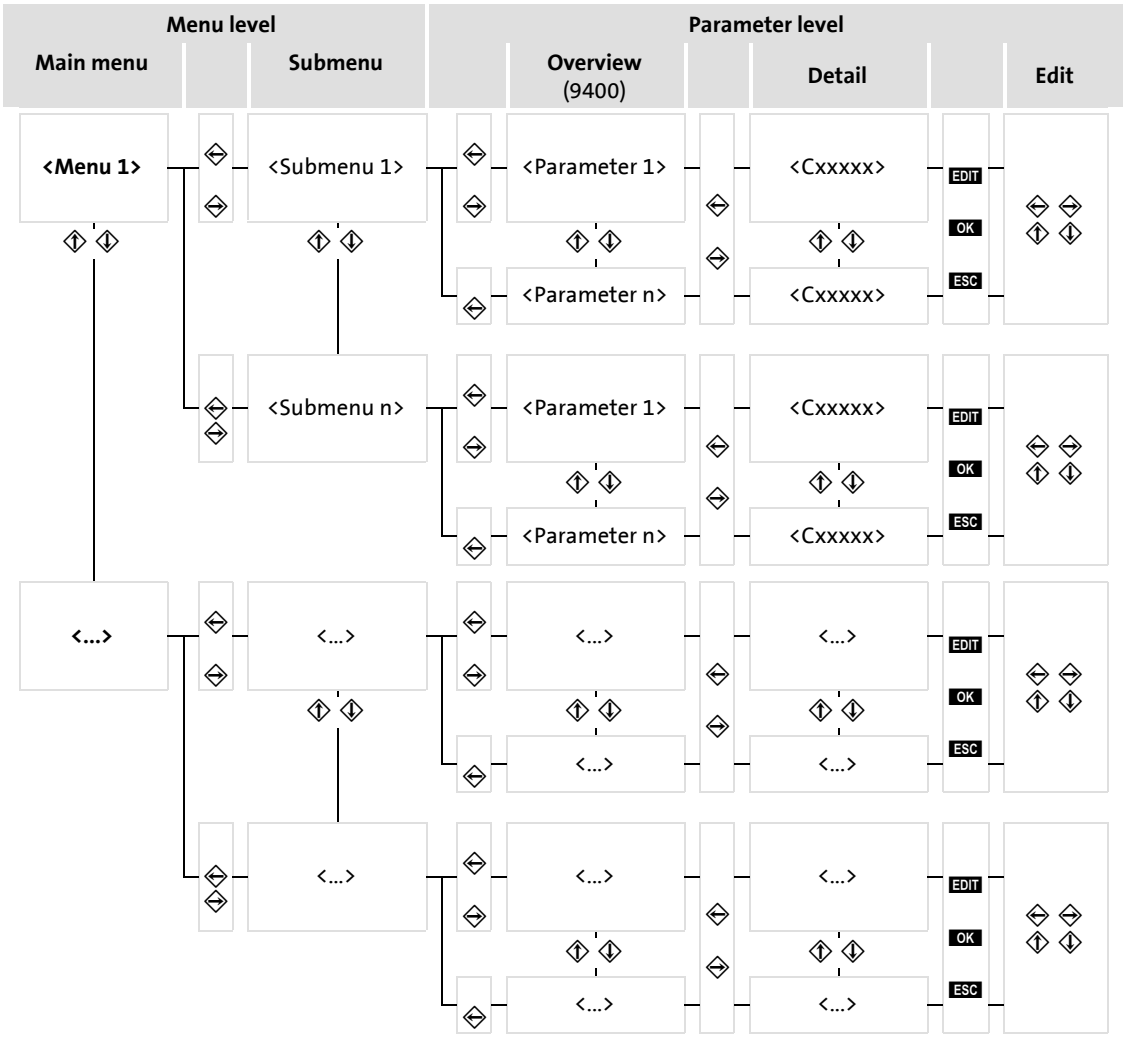
Display		Meaning	Comment
A	**LCD display**		
A1	**Headline**		
	<MMM>	Meaning of the menu	In the menu level only
	<PPP>	Meaning of the parameter	In the parameter level only
A2	**Triple-spaced display**		
	<M1> <M2> <...>	List of the menus available	In the menu level only
	<P1> <P2> <...>	List of the parameters available	In the parameter level only
	<xxx>	Setting of the selected parameter	

Display		Meaning	Comment
A3	**Status of the basic device**		
	RDY	The basic device is ready for operation.	
	RUN	The basic device is enabled.	
	STP	Application in the basic device is stopped.	
	QSP	Quick stop active	
	CINH	The basic device is inhibited.	The power outputs are inhibited.
	OFF	The basic device is ready to start.	
	Mmax	Speed controller 1 in the limitation	The drive is torque-controlled.
	Imax	Set current limit exceeded in motor or generator mode	
	IMP	Pulse inhibit active	The power outputs are inhibited.
	ISYST	System error active	
	IFLT	Error active	
	ITRB	Fault active	
	ITose	Quick stop by trouble active	
	WRN	Warning active	
A4	**Current function of the right function key**		
	OK	Confirm and accept changes	
	HELP	Call up help	Is only displayed if a detailed help is available.
	NEXT	Browse to the next page.	
A5	**Current function of the left function key**		
	▶☰	Back to the main menu	
	SAVE	Save parameter set in the drive non-volatilely.	
	EDIT	Alter parameter	
	ESC	Cancel action without accepting the change.	
	PREV	Browse to the previous page.	
	PLC!!	Parameter can only be altered if the application of the basic device is stopped.	
	CINH!!	Parameter can only be altered if the basic device is inhibited.	

Key		Function	Comment
B	○	Carry out the function indicated in the field A4.	
D	fun	Deactivate the function of the stop key. The LED in the stop key goes out.	
E	stop	Carry out the function selected in C00469 in the "Keypad" menu. The LED in the key is on.	Lenze setting: activate quick stop.
F	○	Carry out the function indicated in the field A5.	

Key		Function				
		Menu level		Parameter level		
		Main menu	Submenu	Overview (9400)	Detail	Editing mode
C	⇳	Select menu	Select submenu	Select parameter		Alter selected digit
	⇉	To the submenu	To the parameter level	To the detail view		Cursor to the right
	⇇		Back to the main menu	Back to the menu level	Back to the overview	Cursor to the left

Operation


Menu level
Parameter level
Main menu
Submenu
Overview (9400)
Detail
Edit
<Menu 1>
<Submenu 1>
<Parameter 1>
<Cxxxxx>
<Parameter n>
<Cxxxxx>
<Submenu n>
<Parameter 1>
<Cxxxxx>
<Parameter n>
<Cxxxxx>
<...>
<...>
<...>
<...>
<...>
<...>
<...>
<...>
EDIT
OK
ESC

In the main menu, you'll find the self-explanatory "Keypad" menu.

In the "Keypad" menu, you'll find parameters by means of which you can adapt the keypad to your needs:

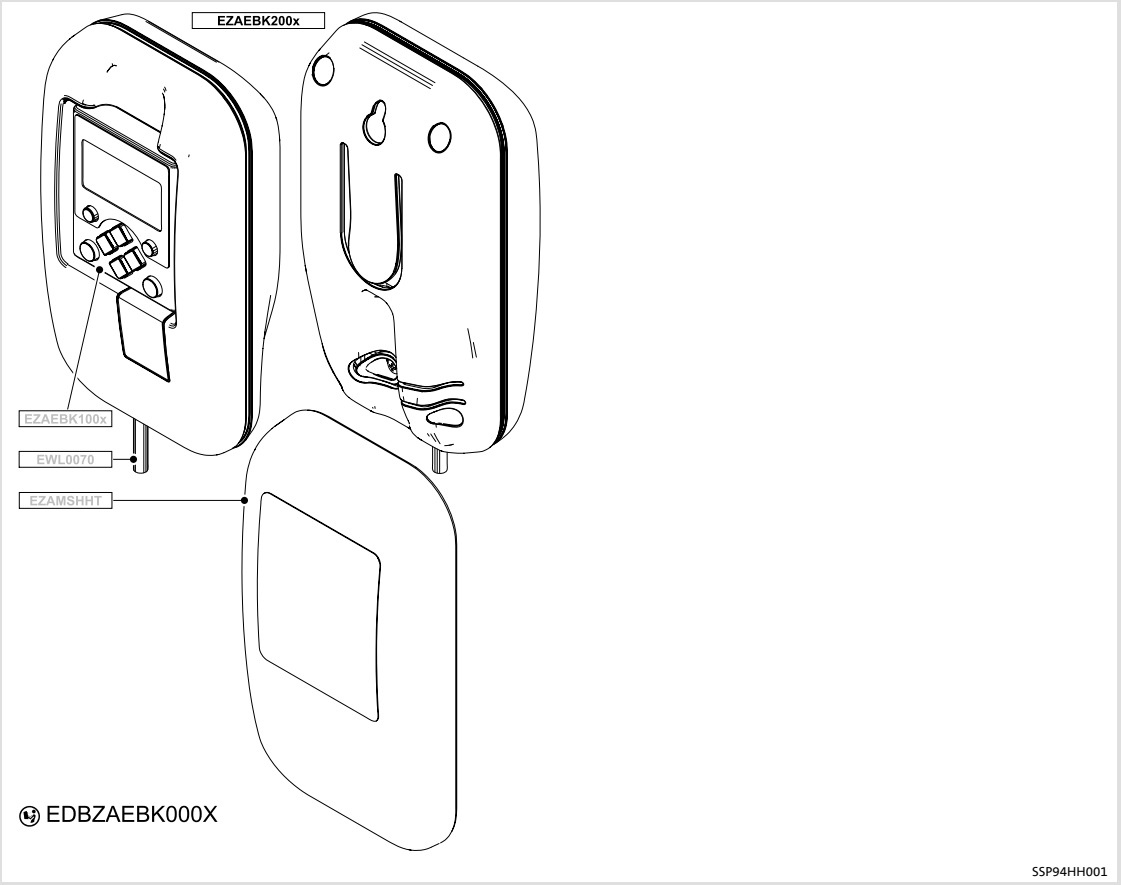
- Settings for the LCD display:
  - Duration and brightness of the background lighting
  - Contrast
- Starting values:
  - Display after the initialisation
  - Display of error messages
  - Representation of integers
- Function of the STOP key

In the "Keypad" menu, you can also call up status information on the keypad:

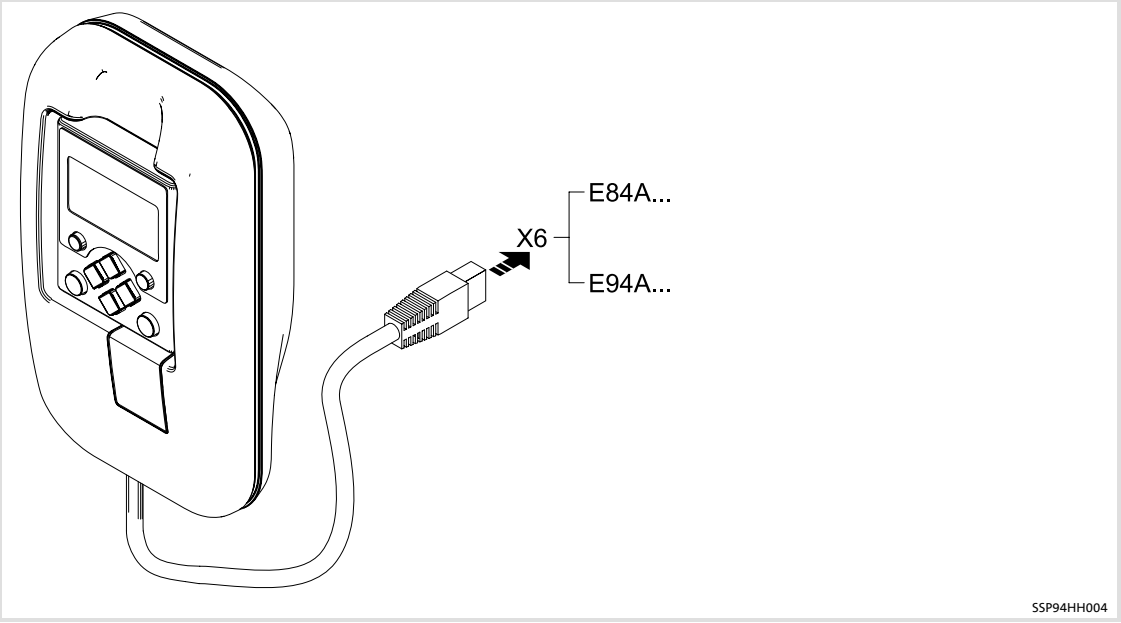
- Manufacturing data
- Hardware version and software version
- Serial number

9.8.3 Hand-held terminal

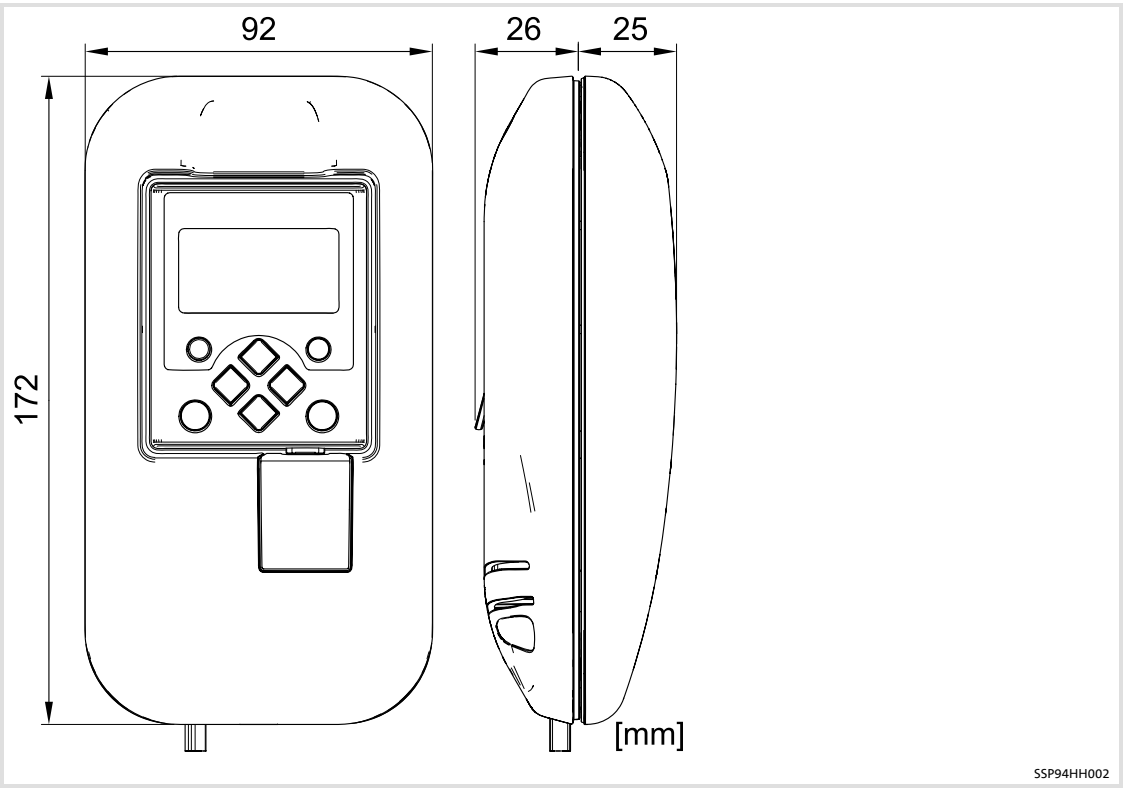
Scope of supply

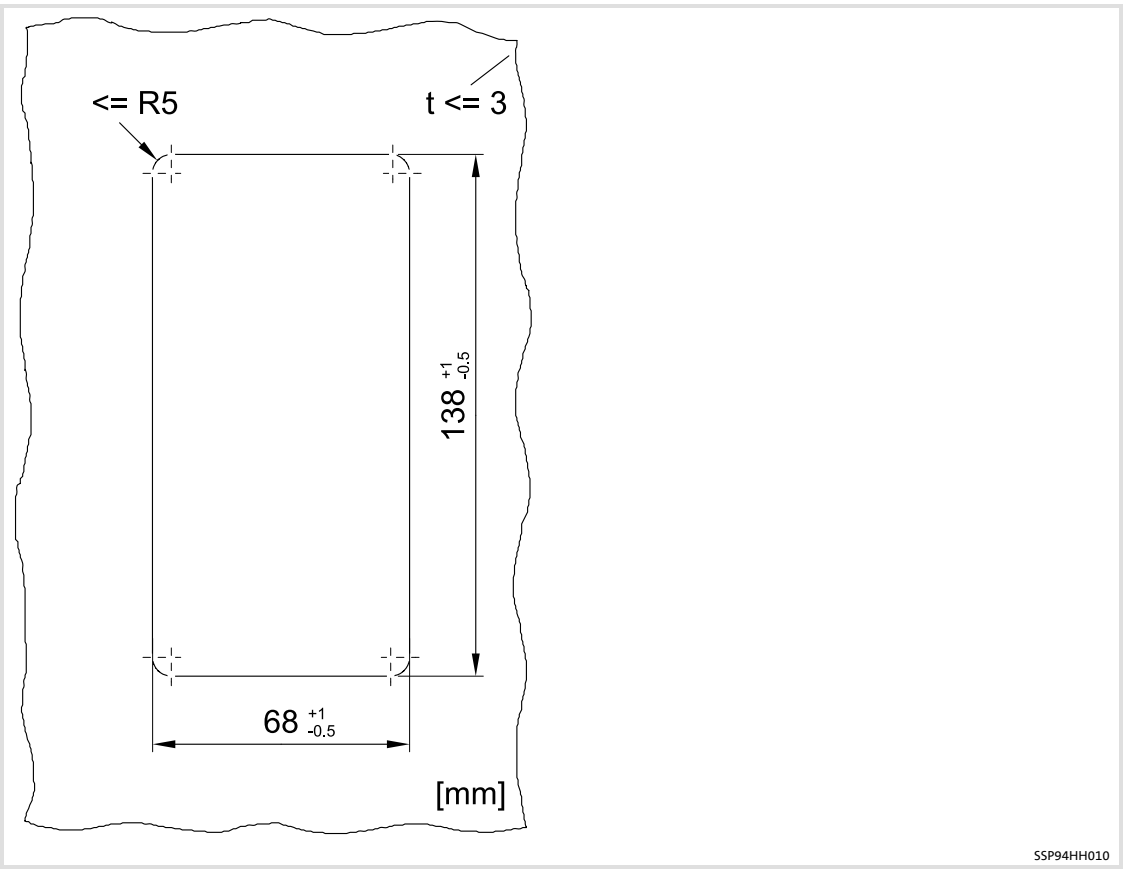


Connection

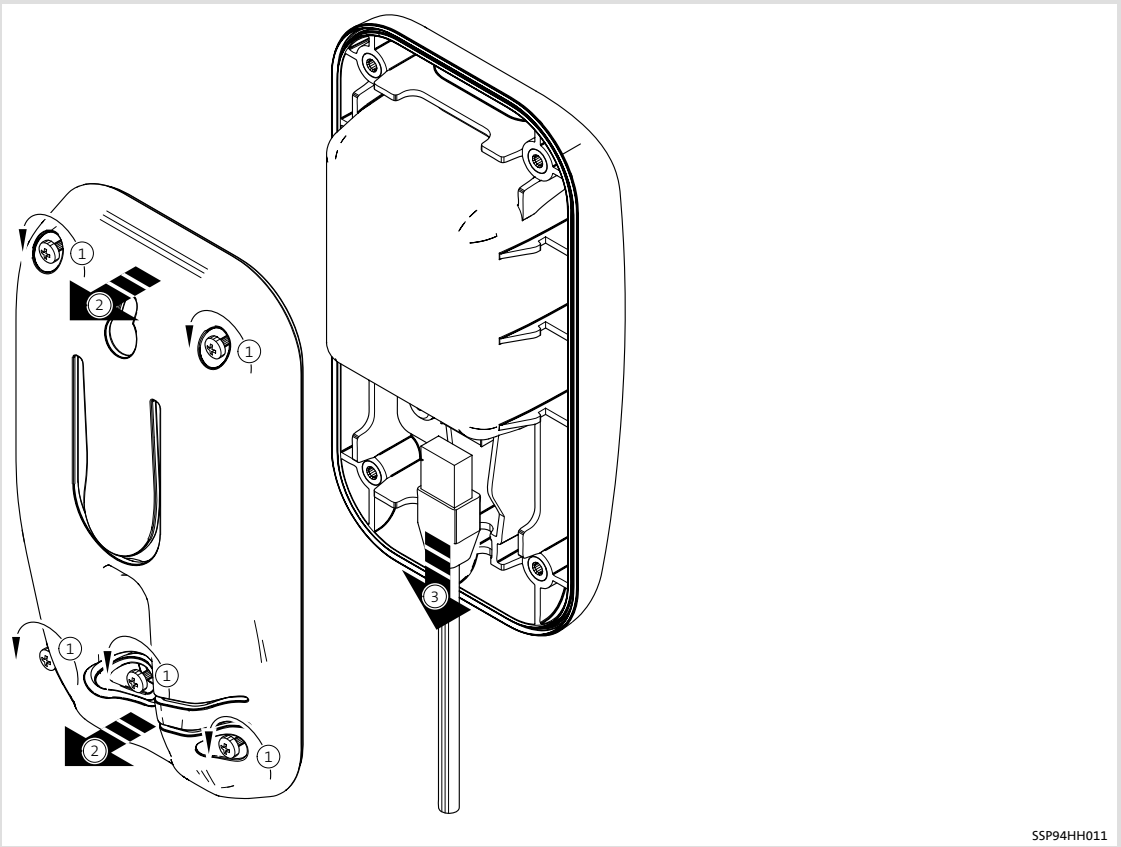


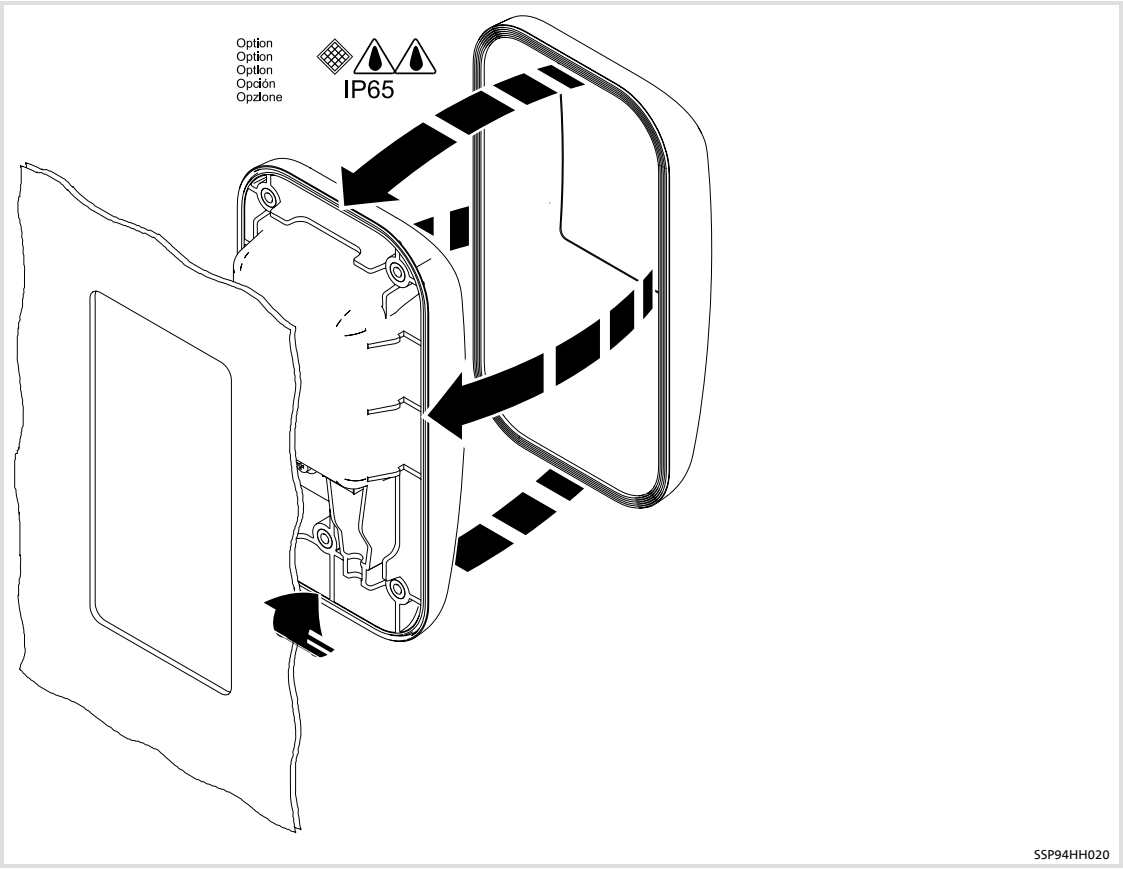
Dimensions

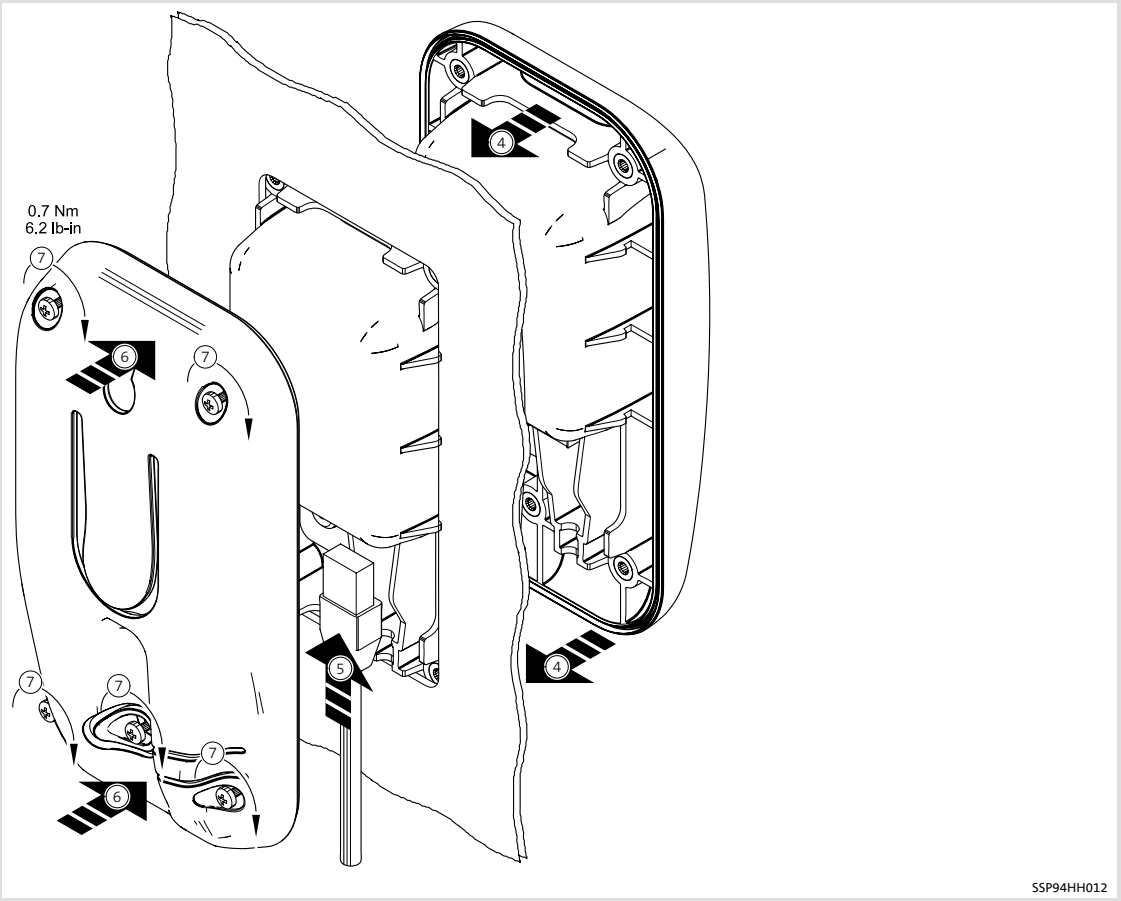




Installation steps



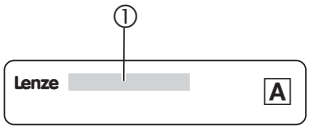

Option
Option
Option
Opción
Opzione
IP65
SSP94HH020


0.7 Nm
6.2 lb-in
4
4
5
6
6
7
7
7
7
7
SSP94HH012

9.9 Components for operation in the DC-bus connection

9.9.1 DC-feeding point

Identification



ERBMXXX011

Type code	①					
	E94	A	Z	E	X	100

Product range

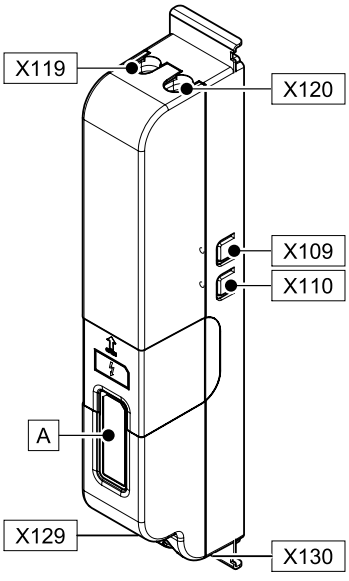
Device generation

Accessories

Type
E = input module

Rated current
100 = 100 A

Scope of supply



E94AZEX001

Pos.	Description
	DC input module
	Mounting Instructions

DC input module components

Pos.	Description
A	Nameplate
X109	+UG busbar input
X110	-UG busbar input
X119	+UG cable input
X120	-UG cable input
X129	+UG cable output
X130	-UG cable output

Standards

Conformity and approval		
Conformity		
CE	2006/95/EC	Low-voltage directive
Approval		
UL	UL 508C	Power Conversion Equipment, File No. 132659
GOST-R	51321.1-2000 51321.3-99	No. POCC DE.AN30.B08815

Protection		
Enclosure	EN 60529	IP 20
	NEMA 250	Protection against accidental contact acc. to type 1
Insulation resistance	EN 61800-5-1	Overvoltage category III Reduction from 2000 m: Overvoltage category II

Operating conditions

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: Device size 1 ... 7: 2.5 %/°C Device size 8S ... 10: 1 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s² = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s²
		200 ... 500 Hz: acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

Rated data

Basis of the data			
Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-
2/PE DC	565	455 - 0 % ... 620 + 0 %	-
2/PE DC	705	565 - 0 % ... 775 + 0 %	-

	Voltage	Frequency	Current [A]		Number of phases
	[V]	[Hz]	max. +45 °C ①	max. +55 °C ①	
E94AZEX100	325/565/705	0 (DC)	100/100/100	75/75/75	2

① Temperature in the control cabinet

Safety instructions

Danger!

Hazardous electrical voltage

During operation and **up to 3 minutes after power-off**, hazardous electrical voltages may occur at the DC input module connections.

Possible consequences:

► Death or serious injuries when touching the connections.

Protective measures:

► Disconnect all devices in the DC-bus connection from the mains before working on the input module.

► Check if no voltage is applied to the power terminals.

Warnings!

► Maximum surrounding air temperature: 55 °C

► Use 60/70 °C copper wires only.

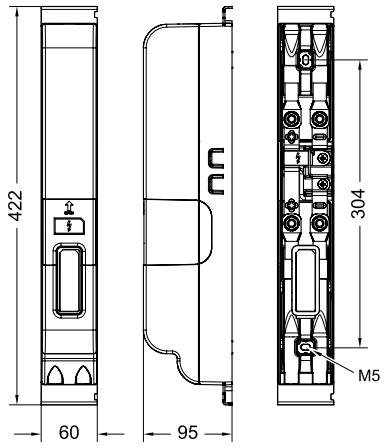
► Use appropriate listed (ZMVV) wire connectors and soldering lugs, suitable for current and voltage.

Note!

The place of installation and mounting material must ensure a permanent mechanical connection.

We recommend to keep to the hole patterns of the axis modules when fixing the DC input module. The hole spacing corresponds to device size I. For further information, please see the Mounting Instructions for the axis module installation backplane (EDK94ZPM113).

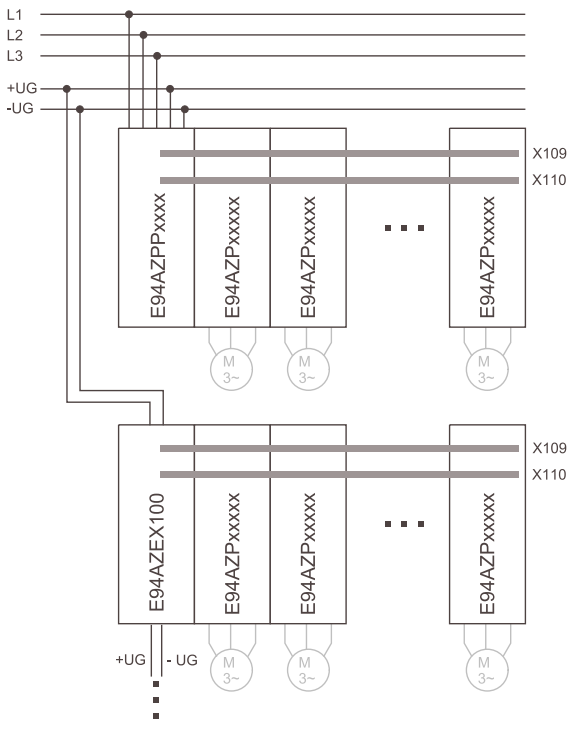
Dimensions



All dimensions in millimetres.

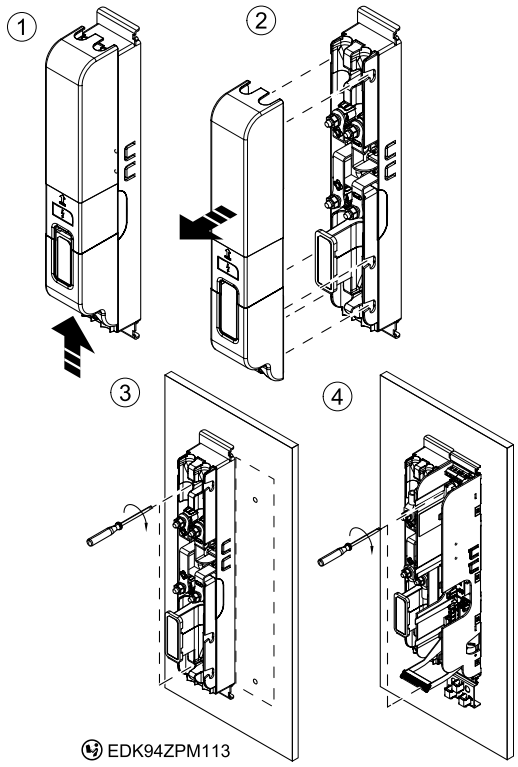
Type	Weight [kg]
E94AZEX100	0.9

Arrangement of the devices

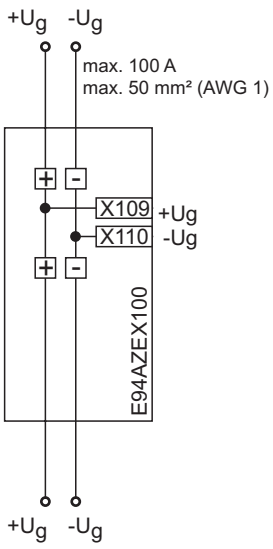


E94AZEX100	DC input module
E94AZPPxxxx	Installation backplane - 9400 DC power supply module
E94AZPxxxxx	Installation backplane - 9400 axis module

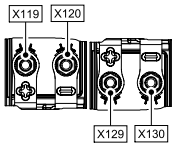
Installation steps



Electrical installation

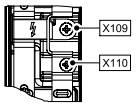


E94AZEX006

Terminal X119/X120/X129/X130	Labelling	Description
 E94AZEX007	*/-	Threaded bolt for connecting the input and output cables (+UG, -UG) with M8 ring cable lug

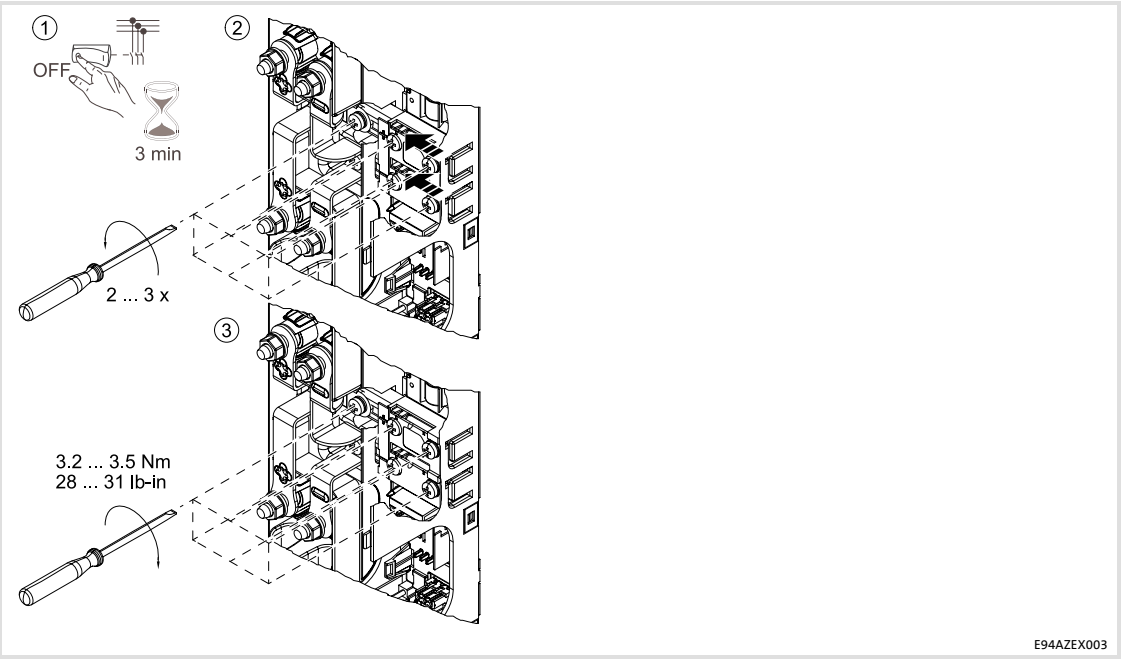
Terminal data

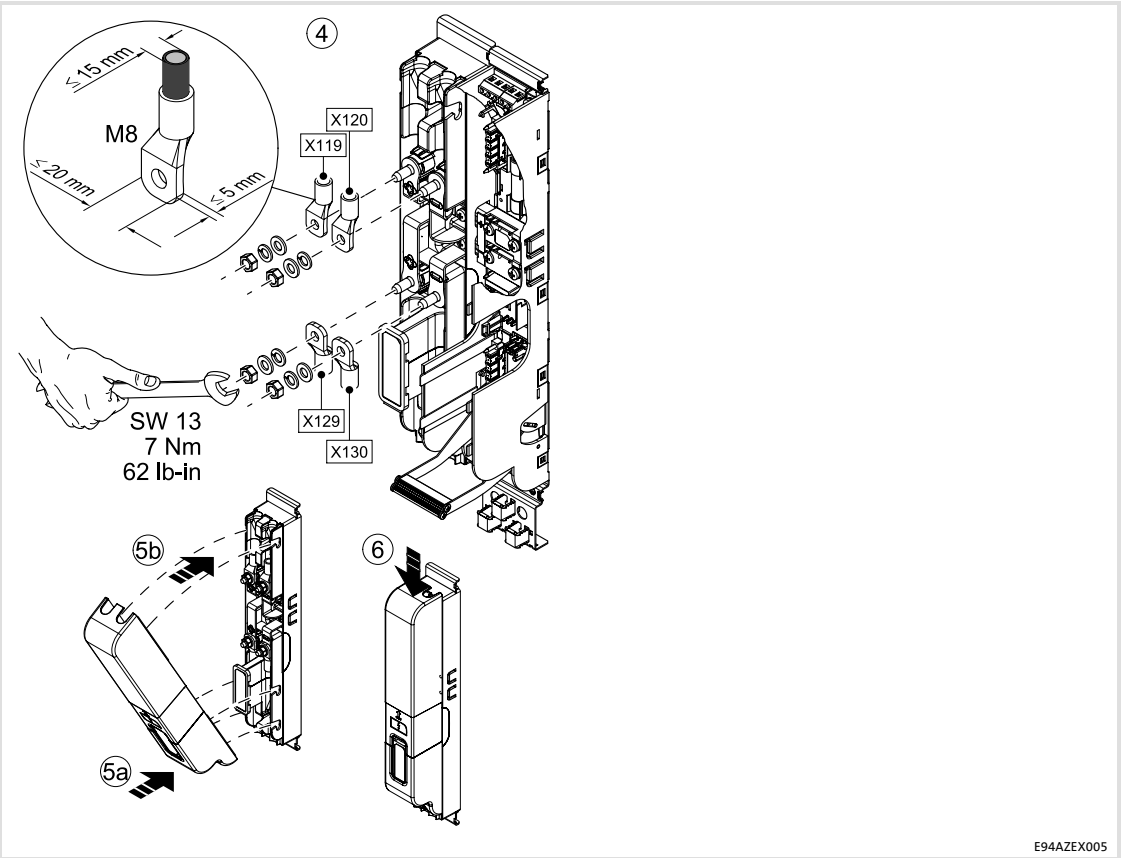
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZEX100	50	1	7	62	SW13

Terminal X109/X110	Labelling	Description
 E94AZEX008	*/-	Busbar connection (+UG, -UG)

Terminal data

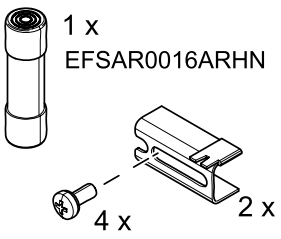
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZEX100	–	–	3.2 ... 3.5	28 ... 31	PH2


1
OFF
3 min
2
2 ... 3 x
3
3.2 ... 3.5 Nm
28 ... 31 lb-in
E94AZEX003


4
≤ 15 mm
M8
≤ 20 mm
≤ 5 mm
X120
X119
X129
X130
SW 13
7 Nm
62 lb-in
5b
5a
6
E94AZEX005

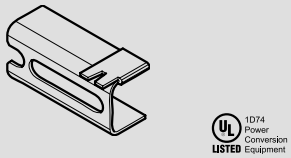
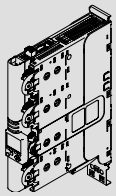
9.9.2 GG1 busbar mounting set

Scope of supply



E94AZJA-001

General electrical data

	
E94AZJA003	E94ASxE002x E94ASxE003x

Safety instructions

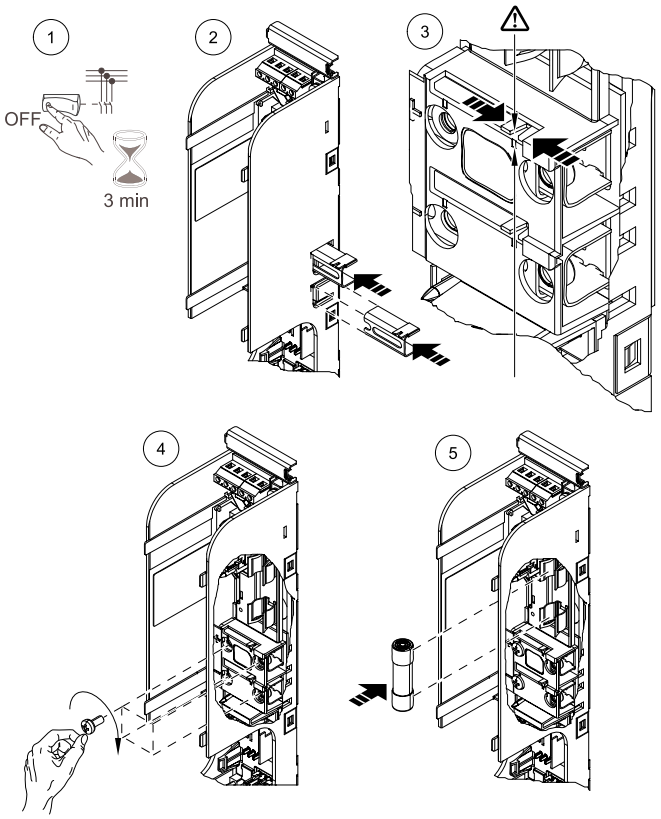
Please read these instructions and the documentation of the standard device before you start working!
Observe the safety instructions given therein!

Warnings!

The busbar mounting set needs to be installed in accordance with the Mounting Instructions of Lenze Power Conversion Equipment, E94 servo system.

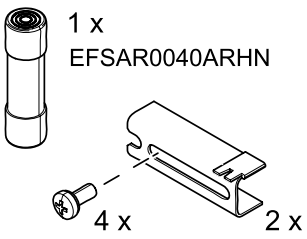
Risk of electrical shock - Disconnect power supply before you start working with the busbar mounting set.

Installation steps

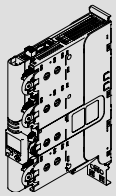


9.9.3 GG2 busbar mounting set

Scope of supply



General electrical data

	
E94AZJA007	E94ASxE004x E94ASxE007x

Safety instructions

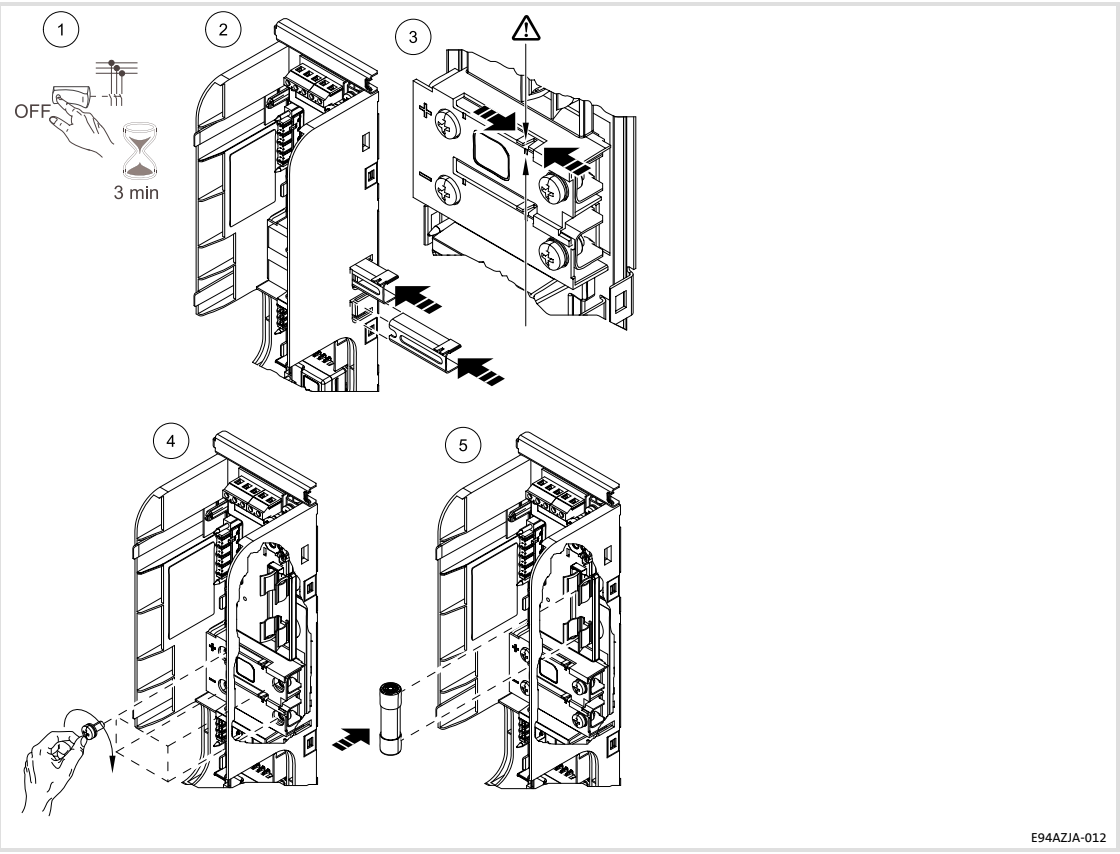
Please read these instructions and the documentation of the standard device before you start working!
Observe the safety instructions given therein!

Warnings!

The busbar mounting set needs to be installed in accordance with the Mounting Instructions of Lenze Power Conversion Equipment, E94 servo system.

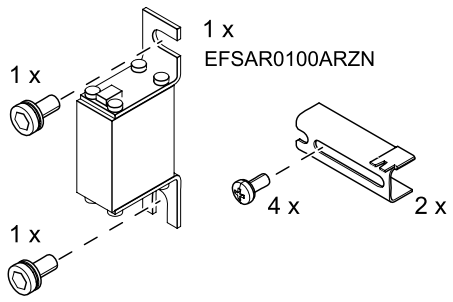
Risk of electrical shock - Disconnect power supply before you start working with the busbar mounting set.

Installation steps

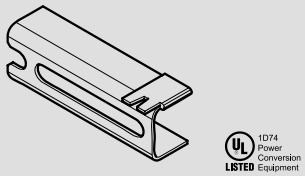
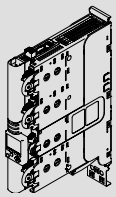


9.9.4 GG3 busbar mounting set

Scope of supply



General electrical data

	
E94AZJA024	E94ASxE013x E94ASxE017x E94ASxE024x

Safety instructions

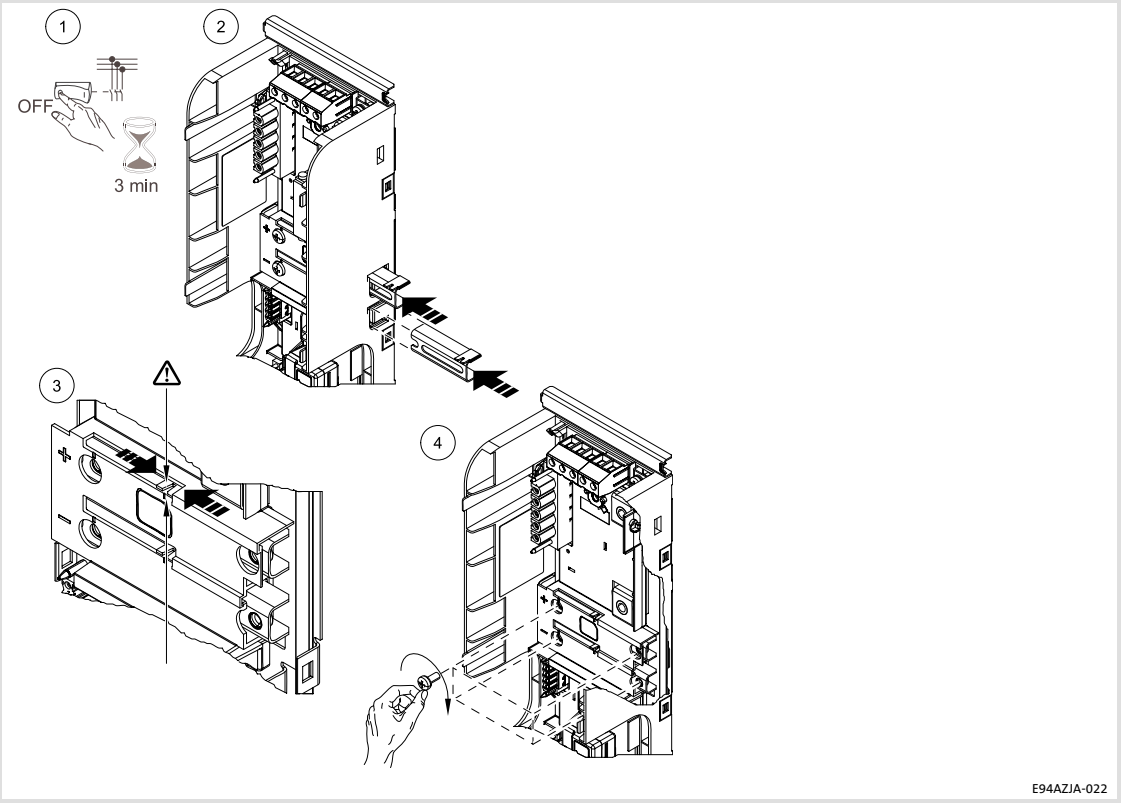
Please read these instructions and the documentation of the standard device before you start working!
Observe the safety instructions given therein!

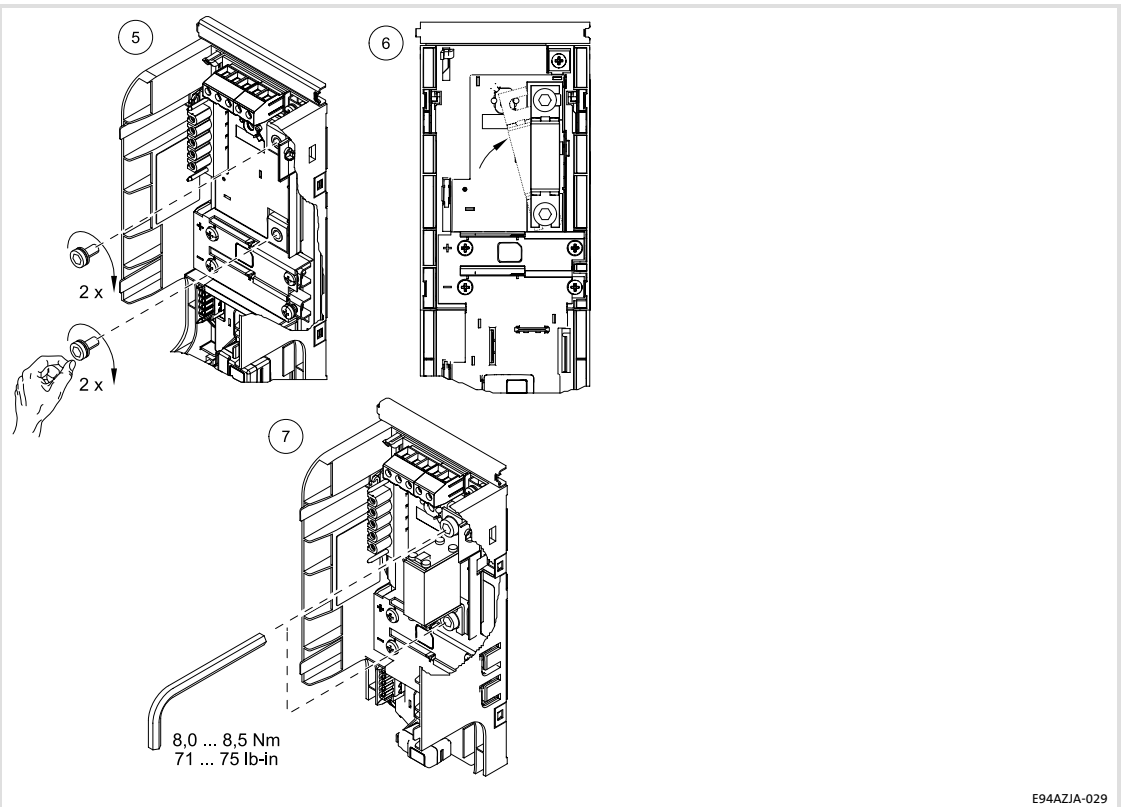
Warnings!

The busbar mounting set needs to be installed in accordance with the Mounting Instructions of Lenze Power Conversion Equipment, E94 servo system.

Risk of electrical shock - Disconnect power supply before you start working with the busbar mounting set.

Installation steps





9.10 Filters

Advantages through the use of filters:

- Compliance with EMC requirements
- Reduced current load
- Positive effects on the service life of the controller possible
  - Stable reliability
  - Reduced failure rate

Mains chokes:
Inductances for damping conducted harmonic interferences which may arise from reloading the DC bus and the switching frequency of the inverter.

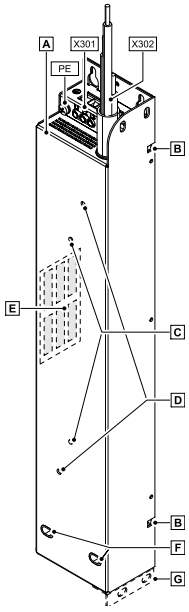
RFI filters:
RFI filters are capacitive accessories for compliance with the requirements acc. to EN 61800-3 for conducted interference emission. RFI filters can be directly connected upstream of the power supply modules. RFI filters are also called EMC filters.

Mains filters:
Mains filters reduce the conducted interference emission into the mains for compliance with the requirements acc. to EN 61800-3. Mains filters are a combination of mains choke and RFI filter in one housing.

A sinusoidal filter (LC filter) in the motor cable limits the rate of rise of voltage and the capacitive charge/discharge currents which occur during inverter operation. This enables considerably longer shielded motor cables and the service life of the motor is increased.

Accessories	Single Drive			Multi Drive	Power supply modules		VR modules	
Field	Device size GG			GG	GG		GG	
Designation	1 ... 3	6 ... 7	8S ... 10	1 ... 3	1 & 3	4 & 5	1 & 3	Page
Filters								
Mains filters								from 495
E94AZMSxxxx	+	+	---	---	---	---	---	
E94AZMPxxxx	---	---	---	---	+	+	---	
E94AZMRxxxxSDB	---	---	---	---	---	---	+	
E94AZMRxxxxLDB	---	---	---	---	---	---	+	
RFI filters								from 518
E94AZRSxxxx	+	+	---	---	---	---	---	
E94AZRPxxxx	---	---	---	---	+	+	---	
Sinusoidal filters								from 538
EZS3-xxxA200	+	+	-	-	---	---	---	

9.10.1 Mains filters for single-axis controllers

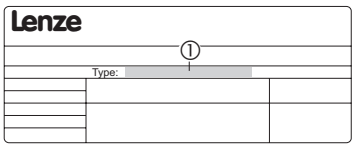


SSP94NF206

Elements on the filter

Pos.	Description
PE	PE connection (for M5 ring or fork-type cable lug)
X301	Mains terminal L1 ... L3
X302	Connection cable to controller, 4-core
B	Mounting aid for mounting base
C	Guide pins for mounting base
D	Mounting thread for mounting base
E	Nameplate
F	Fastening at the bottom
G	Angle bracket for "side-by-side" mounting variant, device sizes II and III

Identification



SSP94NF002

	①						
Type code	**E94**	**A**	**Z**	**M**	**S**	**xxx**	**x**
Product series							
Device generation							
Accessories							
Type of mains filter							
For 9400 SingleDrive							
Rated current [A]							
Voltage class 4 = 230 ... 400/500 V							

Assignment of filters to standard devices

Mains filter type	Single-axis controller type	Device size
E94AZMS0034	E94ASxE002x	1
	E94ASxE003x	
E94AZMS0094	E94ASxE004x	2
	E94ASxE007x	
E94AZMS0184	E94ASxE013x	3
	E94ASxE017x	
E94AZMS0314	E94ASxE024x	

General data

Conformity and approval			
Approval			
UR	UL508	Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada	
Mains data			
Mains types			
With grounded neutral (TT/TN systems)		Operation permitted without restrictions	
Other mains types		Observe instructions for special measures in the documentation for the basic device!	
Protection of persons and equipment			
Enclosure	EN 60529	IP20	Not in the wire range of the terminals
	NEMA 250	Protection against contact to type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Environmental conditions			
Climate			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m	
Pollution	EN 61800-5-1	Pollution degree 2	
Vibration resistance (9.81 m/s^2 = 1 g)			
Transport	IEC/EN 60721-3-2	2M2	
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm	
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2	
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2	
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g	
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm	
		57 ... 150 Hz: acceleration resistant up to 1 g	
Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical	
Free spaces Dimensions Weights		📖 499	

Rated data

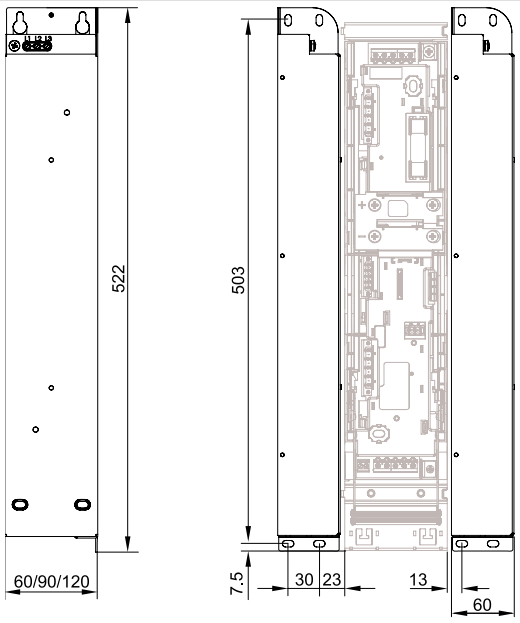
Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

	Voltage [V]	**Freq.** [Hz]	**Current [A]** ① max. +45° C	**Current [A]** ① max. +55° C	**Number of phases**
E94AZMS0034	230/400/500	50/60	3.2/3.2/3.2	2.0/2.0/2.0	3
E94AZMS0094	230/400/500	50/60	9.0/9.0/9.0	5.6/5.6/5.6	3
E94AZMS0184	230/400/500	50/60	18/18/18	11/11/11	3
E94AZMS0314	230/400/500	50/60	31/31/31	19/19/19	3

① Temperature in the control cabinet

	Power loss P_{loss} [W]	**Inductance** L [mH]	**Voltage drop** ΔU [V]
E94AZMS0034	15	10	10
E94AZMS0094	23	3.5	10
E94AZMS0184	38	1.1	7.4
E94AZMS0314	48	0.75	7.3

Dimensions



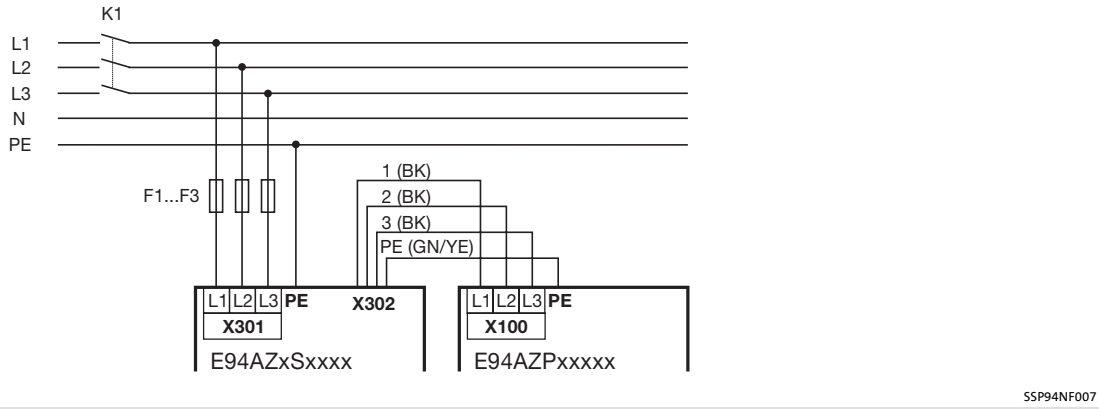
All dimensions in millimetres.

	Mass [kg]
E94AZMS0034	3.2
E94AZMS0094	5.2
E94AZMS0184	8.4
E94AZMS0314	8.8

Installation steps

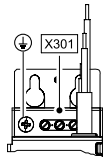
For information on this topic, please see the corresponding mounting instructions.

Connection plan



Terminal data

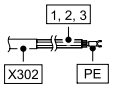
Mains

Terminal X301	Labelling	Description
 SSP94FF008	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

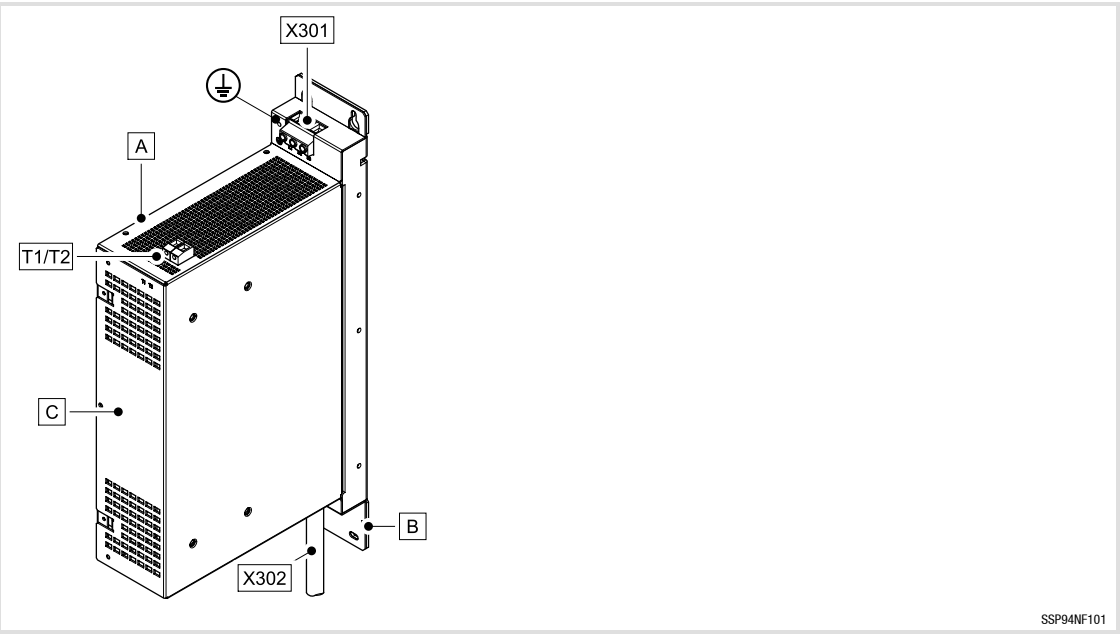
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZMS0034	2.5	14	0.5 ... 0.6	4.42 ... 5.31	PH1
E94AZMS0094	4	12			
E94AZMS0184	10	8	1.2 ... 1.5	10.6 ... 13.3	
E94AZMS0314					

PE connection data				
	⌀	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZMS0034	M5	3.0	26.5	SW 8
E94AZMS0094				
E94AZMS0184				
E94AZMS0314				

Standard device

Cable X302	Labelling	Description
 SSP94FF007	1 2 3	Filter output conductor (lead with wire end ferrule, colour BK)
	PE	Output-side PE conductor (lead with M5 fork-type cable lug, colour GN/YE)

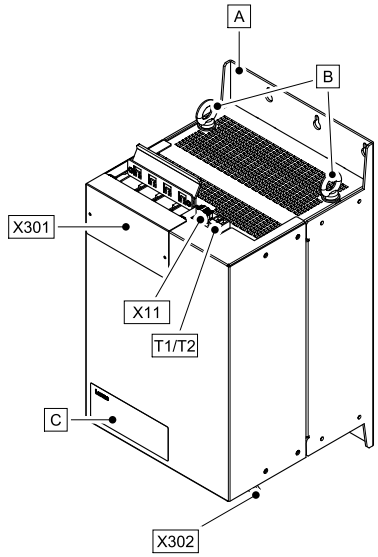
9.10.2 Mains filters for power supply modules



Pos.	Description
A	Mains filter E94AZMPxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
⏚	Connection of PE conductor
X301	Mains terminal L1 ... L3
X302	Connection cable to DC power supply module, four-core
T1/T2	Thermal contact terminal T1, T2
B	Mounting aid for installation backplane
C	Nameplate



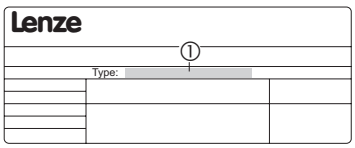
SSP94NF301

Pos.	Description
A	Mains filter E94AZMPxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
X301	Mains connection for L1 ... L3 and PE
X302	Connection cables to DC power supply module L1' ... L3' and PE
X11	Voltage supply for internal fan (24 V DC)
T1/T2	Thermal contact terminals T1, T2
B	Ring bolts
C	Nameplate

Identification



SSP94NF002

	①						
Type code	**E94**	**A**	**Z**	**M**	**P**	**xxx**	**x**
Product range							
Version							
Accessories							
Type: mains filter							
For 9400 power supply							
Rated current [A]							
Voltage class 4 = 230 ... 400/500 V							

General data

Conformity and approval			
Approval			
UR	UL508	Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada	
Mains data			
Mains types			
With grounded neutral (TT/TN systems)		Operation permitted without restrictions	
Other mains types		Observe instructions for special measures in the documentation for the basic device!	
Protection of persons and equipment			
Enclosure	EN 60529	IP20	Not in the wire range of the terminals
	NEMA 250	Protection against contact to type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Environmental conditions			
Climate			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m	
Pollution	EN 61800-5-1	Pollution degree 2	
Vibration resistance (9.81 m/s² = 1 g)			
Transport	IEC/EN 60721-3-2	2M2	
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm	
		10 ... 200 Hz: acceleration resistant up to 10 m/s²	
		200 ... 500 Hz: acceleration resistant up to 15 m/s²	
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g	
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm	
		57 ... 150 Hz: acceleration resistant up to 1 g	
Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertically	
Free space		The required free space results from the mounting position and the specifications of the standard device.	

Rated data

Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

	Voltage [V]	**Freq.** [Hz]	**Current [A]** ① max. +45° C	**Current [A]** ① max. +55° C	**Number of phases**
E94AZMP0084	230/400/500	50/60	8/8/8	6/6/6	3
E94AZMP0294	230/400/500	50/60	29/29/29	21.8/21.8/21.8	3
E94AZMP0824	230/400/500	50/60	82/82/82	61/61/61	3
E94AZMP2004	230/400/500	50/60	200/200/200	150/150/150	3

① Temperature in the control cabinet

	Power loss P_{loss} [W]	**Inductance** L [mH]	**Voltage drop** ΔU [V]
E94AZMP0084	50	3.9	9.8
E94AZMP0294	110	0.7	6.4
E94AZMP0824	200	0.25	6.4
E94AZMP2004	350	0.10	6.3

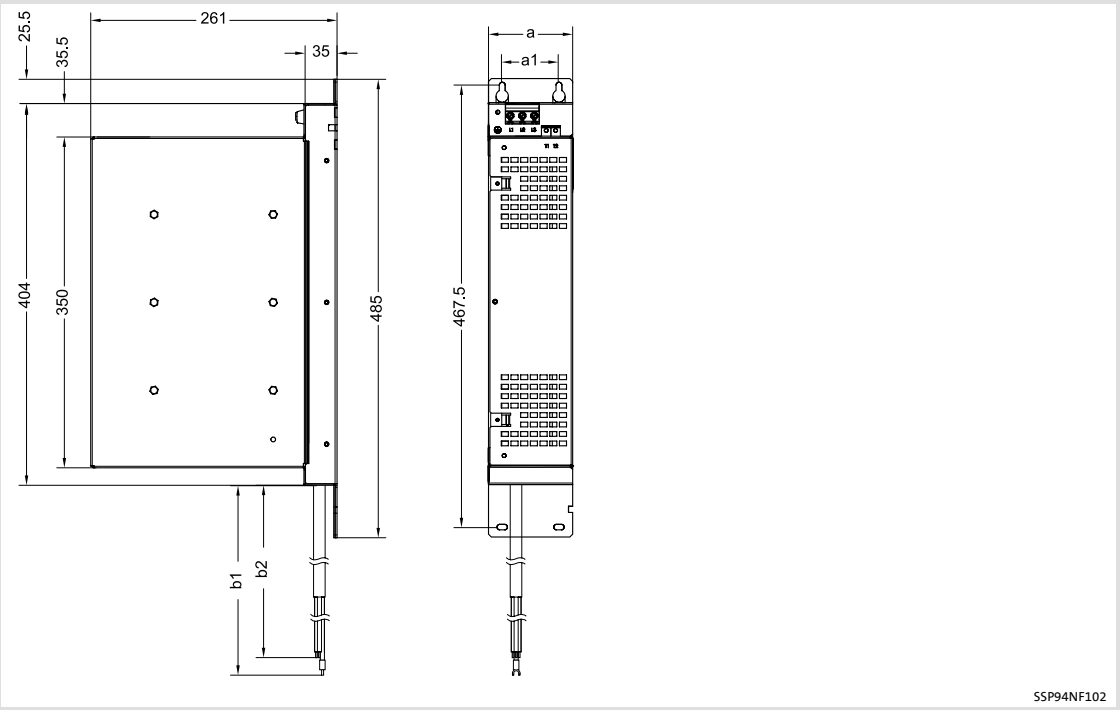
Thermal contact

	Design	**max. switching voltage** U_{Th} [V AC]	**max. switching current** I_{Th} [A]
E94AZMP0084	NC contact, 150 °C	250	2.5
E94AZMP0294			
E94AZMP0824	NC contact, 150 °C	250	2.5
E94AZMP2004			

Fan

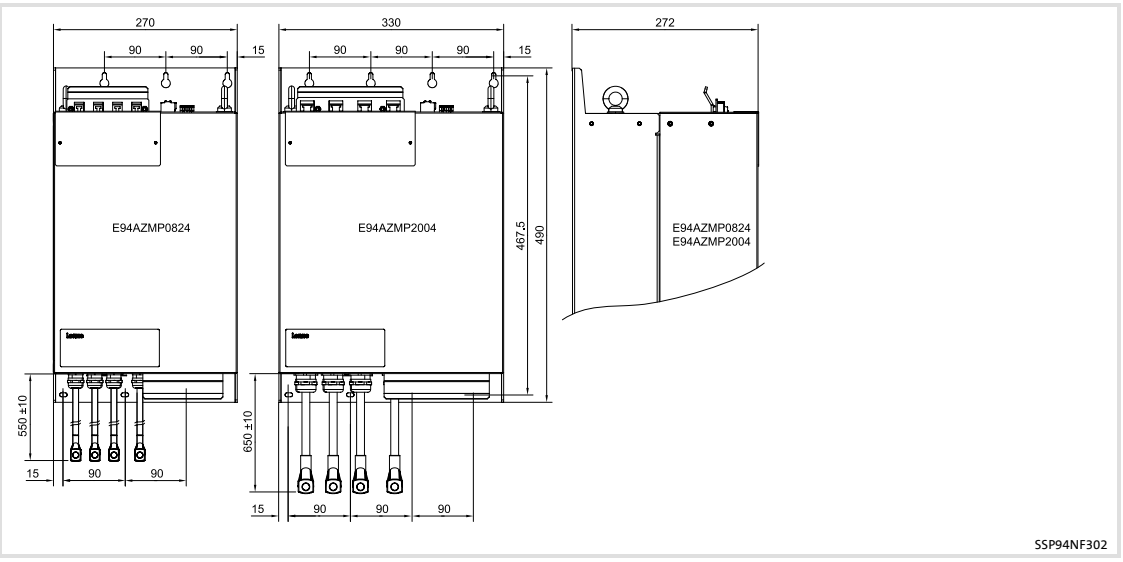
	Voltage [V DC]	**Current** [A]
E94AZMP0824	24	0.3
E94AZMP2004		

Dimensions



All dimensions in millimetres.

	a	a1	b1	b2	Mass
	[mm]				[kg]
E94AZMP0084	90	60	360 ±5	350 ±5	8.6
E94AZMP0294	120	90	460 ±5	450 ±5	16.0



All dimensions in millimetres.

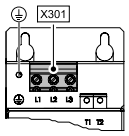
	Mass [kg]
E94AZMP0824	29.0
E94AZMP2004	51.5

Installation steps

For information on this topic, please see the corresponding mounting instructions.

Terminal data

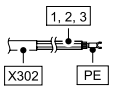
Mains

Terminal X301	Labelling	Description
 SSP94NF106	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

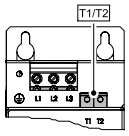
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxP0084 E94AZxP0294	10	6	1.2 ... 1.5	10.6 ... 13.3	PH1

PE connection data				
	Ø	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZxP0084 E94AZxP0294	M5	3	26.5	SW 8

Standard device

Cable X302	Labelling	Description
 SSP94FF007	1 2 3	Filter output conductor (lead with wire end ferrule, colour BK)
	PE	Output-side PE conductor (lead with M5 fork-type cable lug, colour GN/YE)

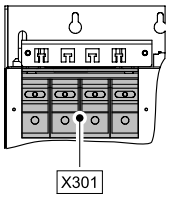
Thermal contact

Terminal T1/T2	Labelling	Description
 SSP94NF108	T1 T2	Thermal contact connection

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZMP0084 E94AZMP0294	4	10	0.6 ... 0.8	5.3 ... 7.1	PZ1

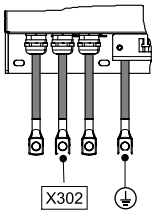
Terminal data

Mains

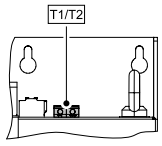
Terminal X301	Labelling	Description
 SSP94NF306	L1 L2 L3 PE	Connection of mains phases L1, L2, L3 and PE conductor

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxP0824 Connection with M8 ring cable lug	70 (2 x 70)	2/0	12	106	SW13
E94AZxP2004 Connection with M10 ring cable lug	150 (2 x 120)	250 mcm	20	177	SW15

Power supply module

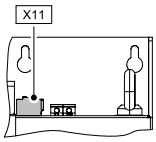
Cable X302	Labelling	Description
 SSP94NF307	L1' L2' L3'	Filter output conductor (lead with ring cable lug, colour BK)
		Output PE conductor (lead with ring cable lug, colour GN/YE)

Thermal contact

Terminal T1/T2	Labelling	Description
 SSP94NF308	T1 T2	Connection of thermal contact

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxP0824	4.0	10	0.6 ... 0.8	5.3 ... 7.1	PZ1
E94AZxP2004					

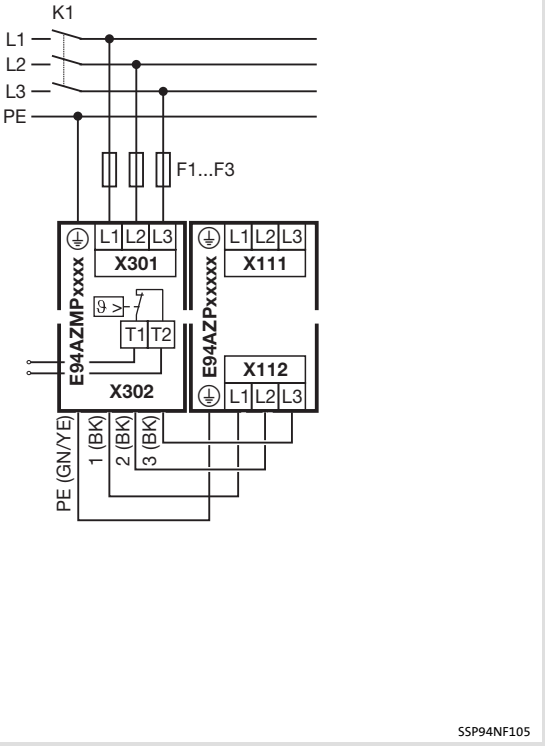
Fan

Terminal X11	Labelling	Description
 SSP94NF309	GE	GND External supply
	24E	24 V External supply through safely separated power supply unit (SELV/PELV)

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
E94AZMP0824	0.2 ... 2.5	24 ... 12	-	
E94AZMP2004				

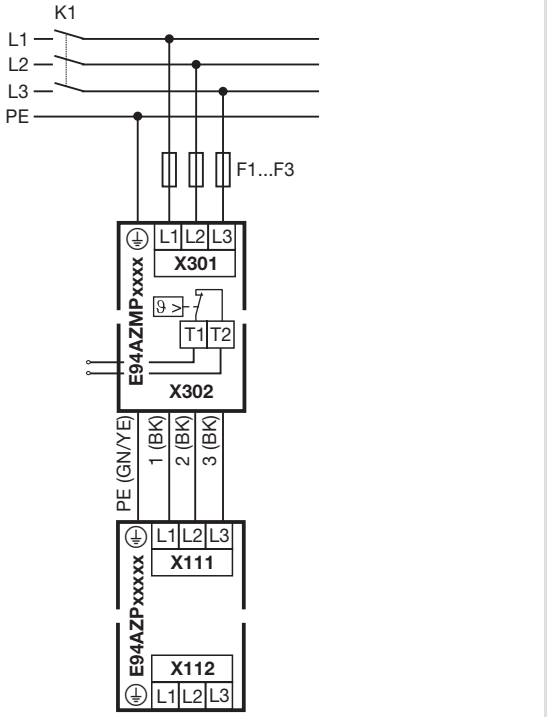
Connection plan

Standard mounting



SSP94NF105

Mounting variant



SSP94NF105

Fig. 9-4 Connection concept

E94AZMPxxxx	Mains filter
E94AZPxxxxx	Installation backplane for 9400 DC power supply module
F1 ... F3	Fuses
K1	Mains contactor

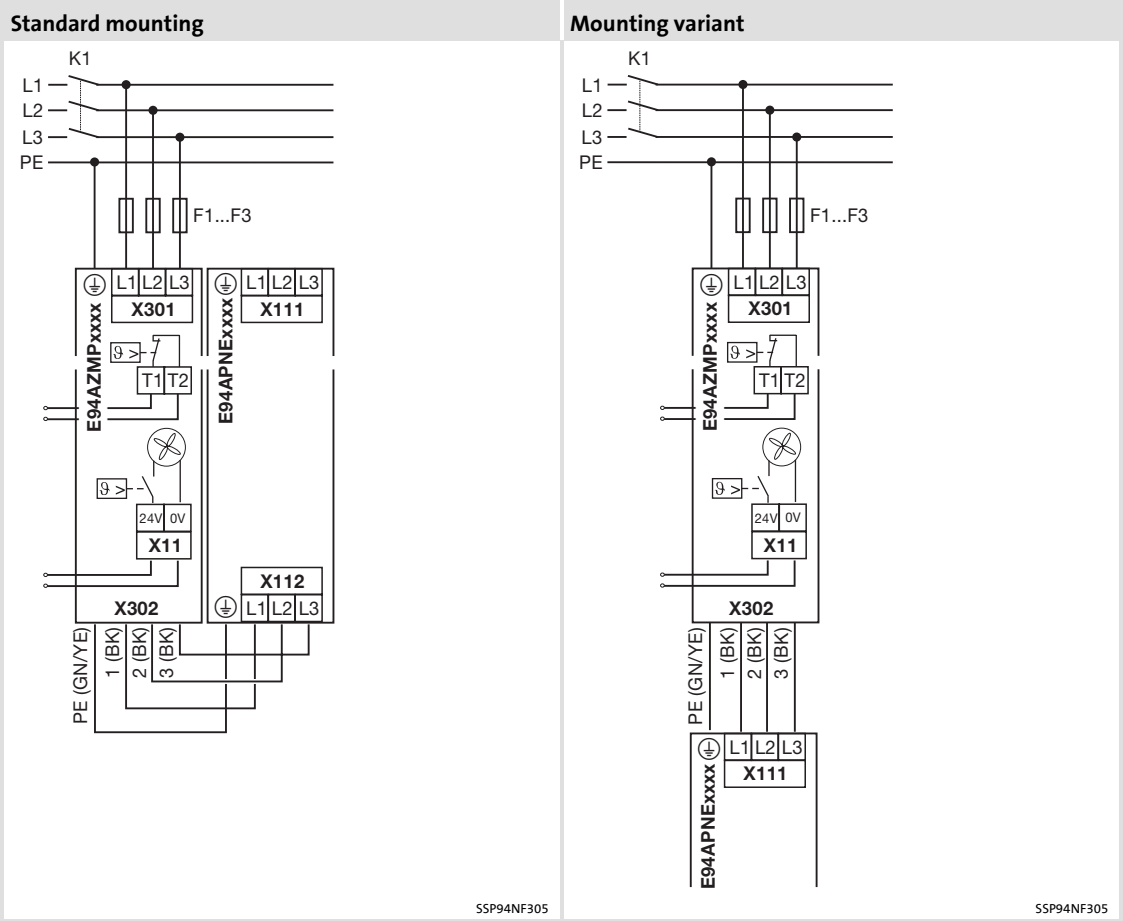
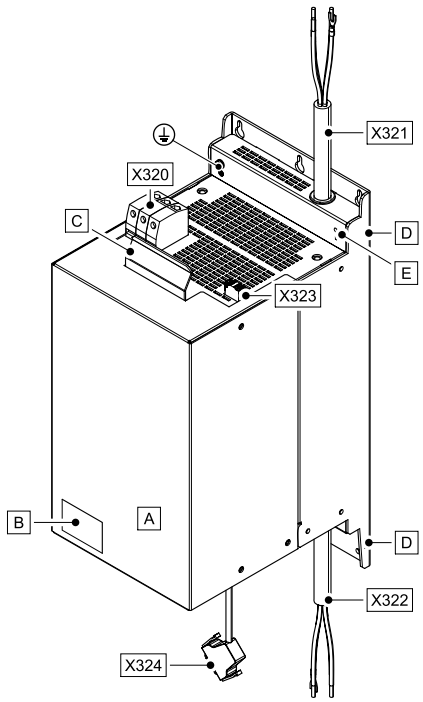


Fig. 9-5 Connection concept

E94AZMPxxxx	Mains filter
E94APNExxxx	9400 DC power supply module
F1 ... F3	Fuses
K1	Mains contactor

9.10.3 Mains filters for regenerative power supply modules

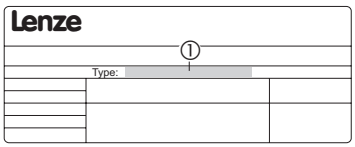


Pos.	Description
A	Mains filter
	Mounting Instructions

Elements on the filter

Pos.	Description
B	Nameplate
C	Lifting aid
D	Mounting aid for mounting base
E	Parking position of the IT screw
⏚	PE terminal
X320	Terminal L1 ... L3
X321	Connecting cable L1.1 ... L3.1
X322	Connecting cable L1.2 ... L3.2
X323	Terminal for 24-V supply voltage (use safely separated power supply unit (SELV/PELV), in accordance with IEC 61131-2)
X324	Mains filter control signal

Identification



SSP94NF002

Type code	①							
	E94	A	Z	MR	xxx	4	xx	B

Product range

Version

Accessories

Type mains filter for regenerative power supply module

Rated current [A]

Voltage class
4 = 230 ... 400/500 V

Design
SD = short-distance motor cables
LD = long-distance motor cables

Operating mode
B = block mode

General data

Mains data			
Mains types			
With grounded neutral (TT/TN systems)		Operation permitted without restrictions	
IT systems		Request specific measures from Lenze	

Protection of persons and equipment			
Enclosure	EN 60529	IP20	Not in the wire range of the terminals
	NEMA 250	Protection against contact to type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	

Environmental conditions		
Climate		
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: 2.5 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m
Pollution	EN 61800-5-1	Pollution degree 2
Vibration resistance (9.81 m/s^2 = 1 g)		
Transport	IEC/EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm
		57 ... 150 Hz: acceleration resistant up to 1 g

Mounting conditions		
Mounting place		In the control cabinet
Mounting position		Vertically
Free space		The required free space results from the mounting position and the specifications of the standard device.

Rated data

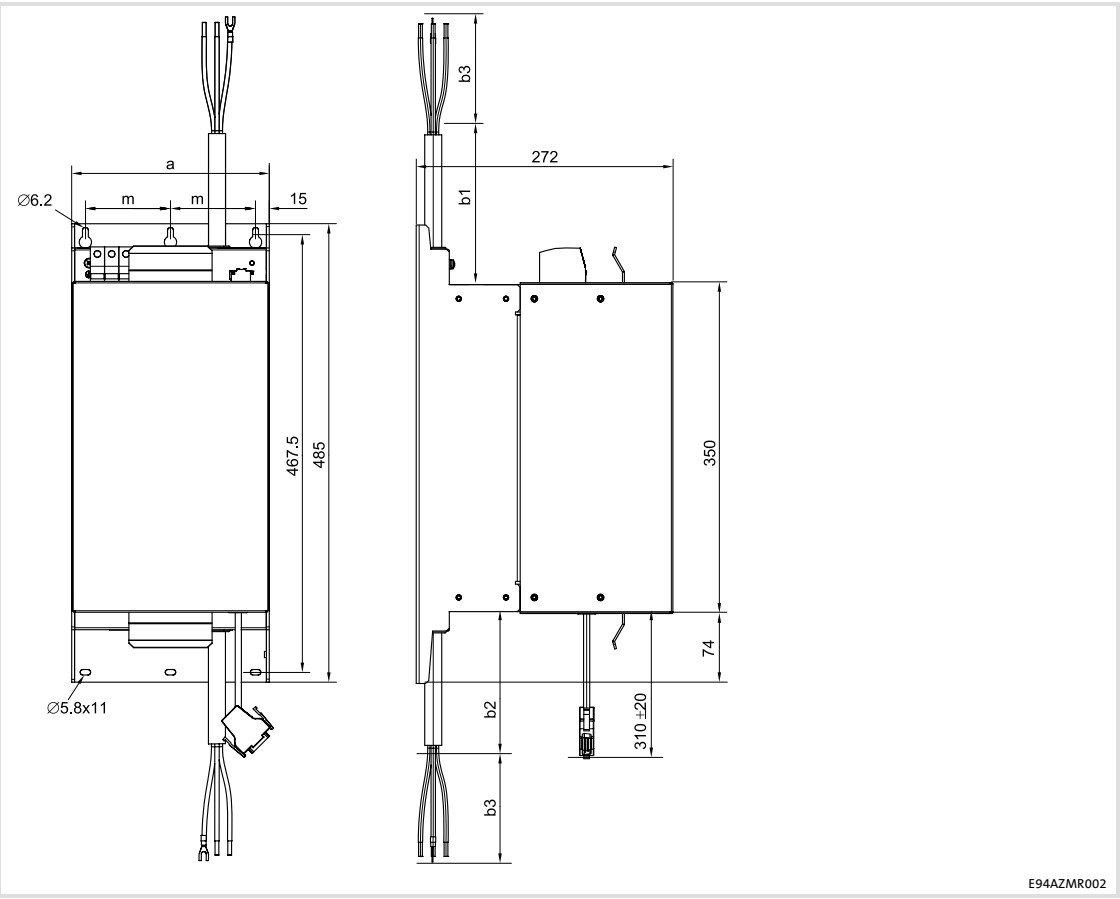
Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

	Voltage [V]	**Freq.** [Hz]	**Current [A]** ① max. +45° C	**Current [A]** ① max. +55° C	**Number of phases**
E94AZMR0264xDB	230/400/500	50/60	26/26/26	19/19/19	3
E94AZMR0474xDB	230/400/500	50/60	47/47/47	35/35/35	3

① Temperature in the control cabinet

	Power loss P_V [W]	**Inductance** L [mH]	**Regenerative inductance** L_{gen} [mH]	**Voltage drop** ΔU [V]
E94AZMR0264SDB	65	0.77 ±10 %	0.84 ±10 %	6.3
E94AZMR0264LDB	72			
E94AZMR0474SDB	85	0.42 ±10 %	1.54 ±10 %	6.2
E94AZMR0474LDB	101			

Dimensions



All dimensions in millimetres.

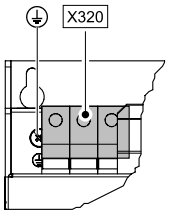
	a	m	b1	b2	b3	[kg]
	[mm]					
E94AZRM0264SDB	149	60	240 ±5	260 ±5	100 ±5	25
E94AZRM0264LDB						26
E94AZRM0474SDB	209	90	250 ±5	270 ±5	110 ±5	36
E94AZRM0474LDB						37

Installation steps

For information on this topic, please see the corresponding mounting instructions.

Terminal data

Mains

Terminal X320	Labelling	Description
 SSP94NF406	L1 L2 L3	Connection of the L1, L2, L3 mains phases
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZMR0264xDB	10	6	1.2 ... 1.5	10.6 ... 13.3	1.0 x 4.0
E94AZMR0474xDB	25	2	2.5	22.1	1.0 x 6.5

PE connection data				
	Ø	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZMR0264xDB	M5	3	26.5	PH2
E94AZMR0474xDB				

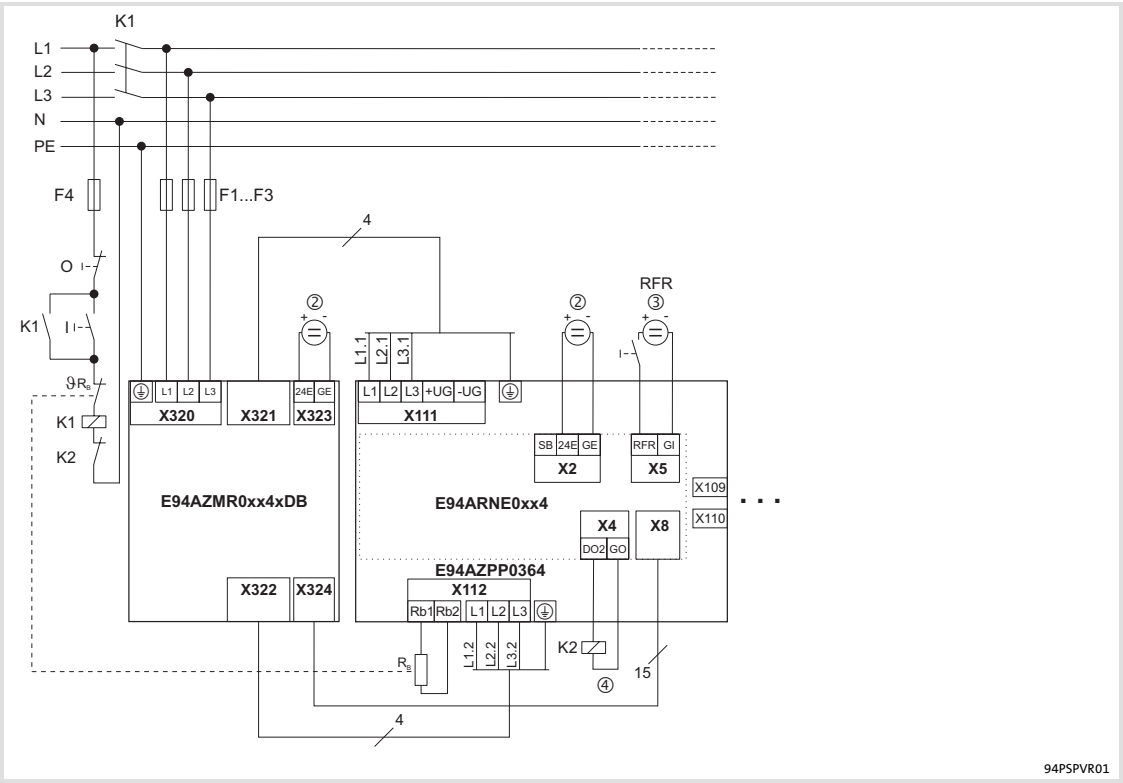
24 V supply

Terminal X323	Labelling	Description
SSP9400X11	GE	GND external supply
	24E	24 V external supply through safely separated power supply unit (SELV/PELV) IEC 61131-2, 22.8 ... 28.8 V, residual ripple max. ±5 % Current during operation: 450 mA Starting current: max. 4 A for 100 ms

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
Flexible	0.2 ... 2.5	24 ... 12	Spring terminal	
With wire end ferrule				

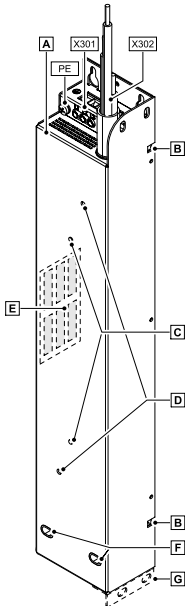
Stripping length / contact length: 10 mm

Connection plan



E94ARNE0xx4	Regenerative power supply module
E94AZPP0364	Installation backplane for the regenerative power supply module
E94AZMR0...	Mains filter
F1 ... F4	Fuses
RFR	Controller enable (only for regenerative feedback)
K1	Mains contactor
RB	Brake resistor
②	24 V voltage source for the control electronics (safely separated power supply unit (SELV/PELV) according to IEC 61131-2)
③	24 V voltage source for the digital inputs according to IEC 61131-2
④	From FW 02.00: Overtemperature disconnection DO2 load: max. 50 mA

9.10.4 RFI filters for single-axis controllers

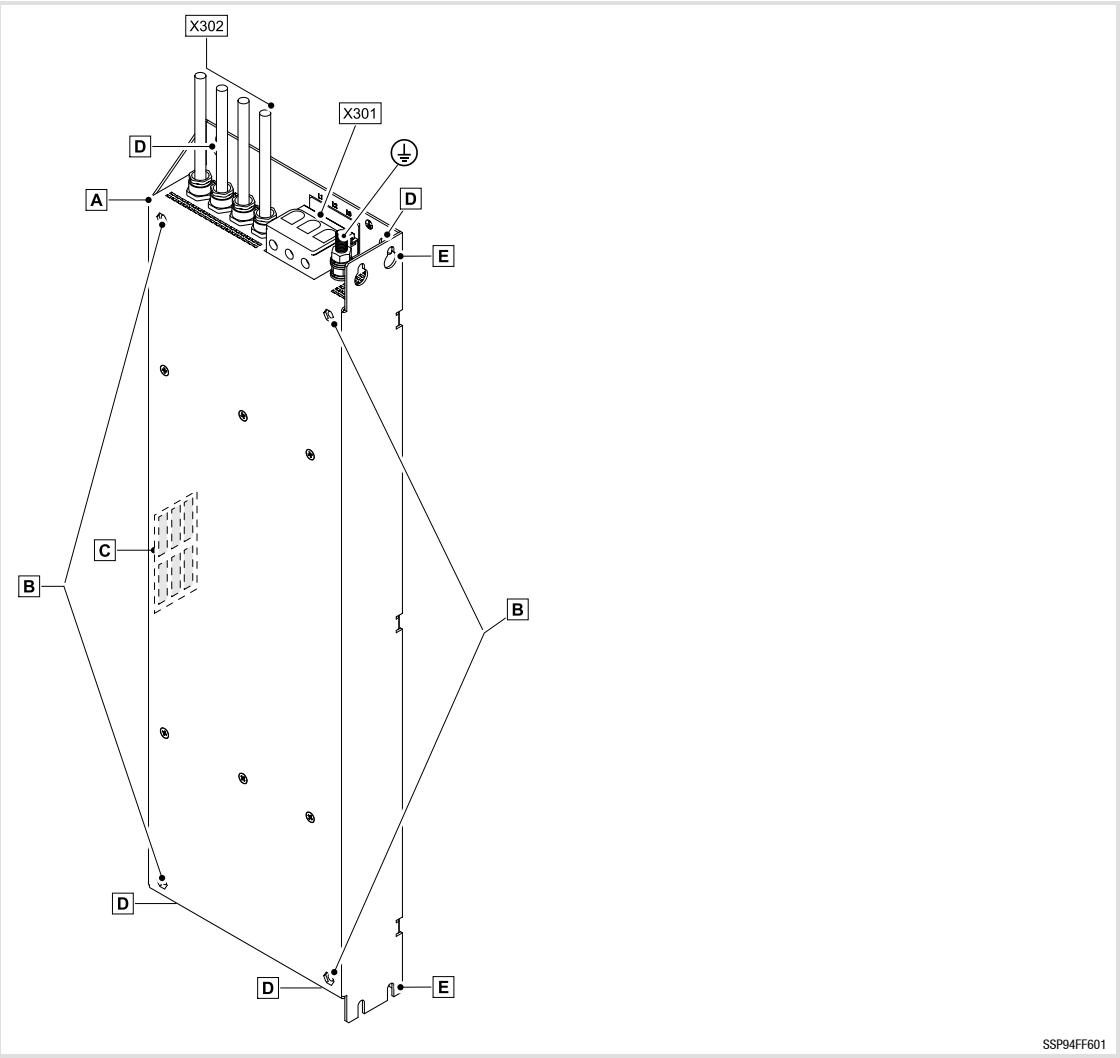


SSP94NF206

Pos.	Description
A	RFI filter E94AZRSxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
PE	PE connection (for M5 ring or fork-type cable lug)
X301	Mains terminal L1 ... L3
X302	Connection cable to controller, 4-core
B	Mounting aid for mounting base
C	Guide pins for mounting base
D	Mounting thread for mounting base
E	Nameplate
F	Fastening at the bottom
G	Angle bracket for ”side-by-side” mounting variant, device sizes II and III

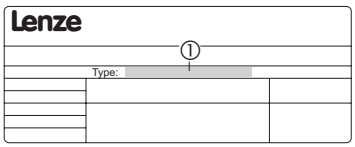


Pos.	Description
A	RFI filter E94AZRSxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
⏚	PE connection (for ring or fork-type cable lug M8)
X301	Mains terminal L1 ... L3
X302	Connection cable to controller, four-core
B	Fastening thread for standard device
C	Nameplate
D	Fixings for standard mounting (footprint mounting)
E	Fixings for mounting variant (side-by-side mounting)

Identification



SSP94NF002

	①						
Type code	**E94**	**A**	**Z**	**R**	**S**	**xxx**	**x**

Product range
Version
Accessories
Type: RFI filter
For 9400 SingleDrive
Rated current [A]
Voltage class
4 = 230 ... 400/500 V

General data

Conformity and approval			
Approval			
UR	UL508	Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada	
Mains data			
Mains types			
With grounded neutral (TT/TN systems)		Operation permitted without restrictions	
Other mains types		Observe instructions for special measures in the documentation for the basic device!	
Protection of persons and equipment			
Enclosure	EN 60529	IP20	Not in the wire range of the terminals
	NEMA 250	Protection against contact to type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Environmental conditions			
Climate			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m	
Pollution	EN 61800-5-1	Pollution degree 2	
Vibration resistance (9.81 m/s^2 = 1 g)			
Transport	IEC/EN 60721-3-2	2M2	
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm	
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2	
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2	
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g	
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm	
		57 ... 150 Hz: acceleration resistant up to 1 g	
Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertically	
Free space		The required free space results from the mounting position and the specifications of the standard device.	
Mounting position			
Standard		Footprint mounting; standard device is screwed on the filter	
Variant		Side-by-side mounting; filter is directly screwed to the left of the standard device (📖Mechanical installation)	

Rated data

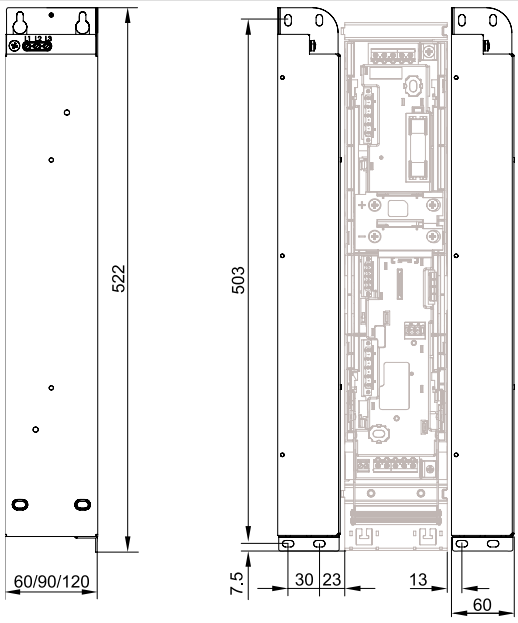
Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

	Voltage [V]	**Frequency** [Hz]	**Current [A]** max. +45 °C ①	**Current [A]** max. +55 °C ①	**Number of phases**
E94AZMS0044	230/400/500	50/60	3.5/3.5/3.5	2.2/2.2/2.2	3
E94AZMS0104	230/400/500	50/60	10/10/10	6.2/6.2/6.2	3
E94AZMS0294	230/400/500	50/60	29/29/29	18/18/18	3
E94AZRS0544	230/400/500	50/60	54.0/54.0/54.0	40.5/40.5/40.5	3
E94AZRS0954	230/400/500	50/60	95.0/95.0/95.0	71.0/71.0/71.0	3

① Temperature in the control cabinet

	Power loss P_{loss} [W]	**Inductance** L [mH]	**Voltage drop** ΔU [V]
E94AZMS0044	4	-	-
E94AZMS0104	8	-	-
E94AZMS0294	22	-	-
E94AZRS0544	50	–	–
E94AZRS0954	70	–	–

Dimensions



All dimensions in millimetres.

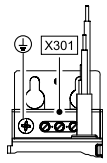
	Mass [kg]
E94AZMS0044	1.8
E94AZMS0104	2.3
E94AZMS0294	3.6

Installation steps

For information on this topic, please see the corresponding mounting instructions.

Terminal data

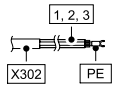
Mains

Terminal X301	Labelling	Description
 SSP94FF008	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

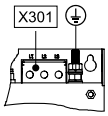
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZRS0044	2.5	14	0.5 ... 0.6	4.42 ... 5.31	PH1
E94AZRS0104	4	12			
E94AZRS0294	10	8	1.2 ... 1.5	10.6 ... 13.3	

PE connection data				
	⌀	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZRS0044	M5	3.0	26.5	SW 8
E94AZRS0104				
E94AZRS0294				

Standard device

Cable X302	Labelling	Description
 SSP94FF007	1 2 3	Filter output conductor (lead with wire end ferrule, colour BK)
	PE	Output-side PE conductor (lead with M5 fork-type cable lug, colour GN/YE)

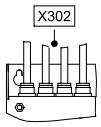
Mains

Terminal X301	Labelling	Description
 SSP94FF606	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with ring cable lug M8

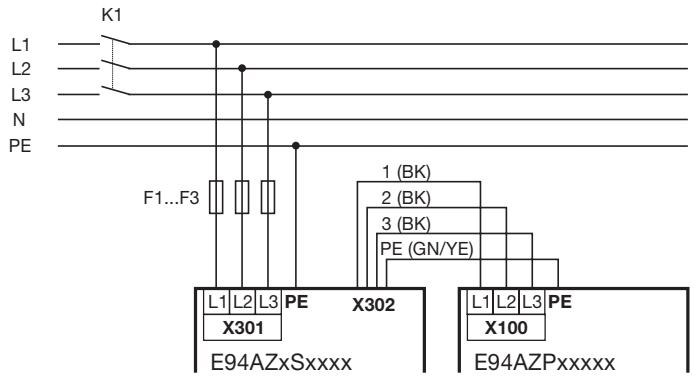
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxS0544	50	0	10	88.5	Hexagon socket 5
E94AZxS0954	95	000	14	124.0	

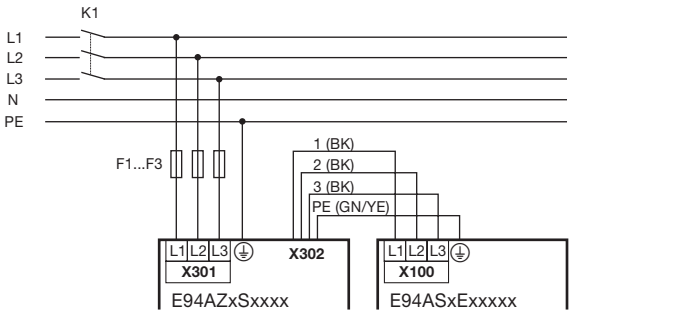
PE connection data				
	Ø	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZxS0544	M8	12	106	SW 13
E94AZxS0954				

Standard device

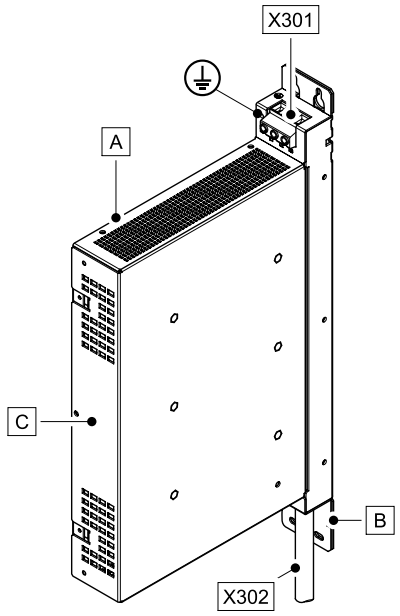
Cable X302	Labelling	Description
 SSP94FF607	1 2 3	Filter output conductor (lead with wire end ferrules, colour BK)
	PE	Output-side PE conductor (lead with wire end ferrule, colour GN/YE)

Connection plan





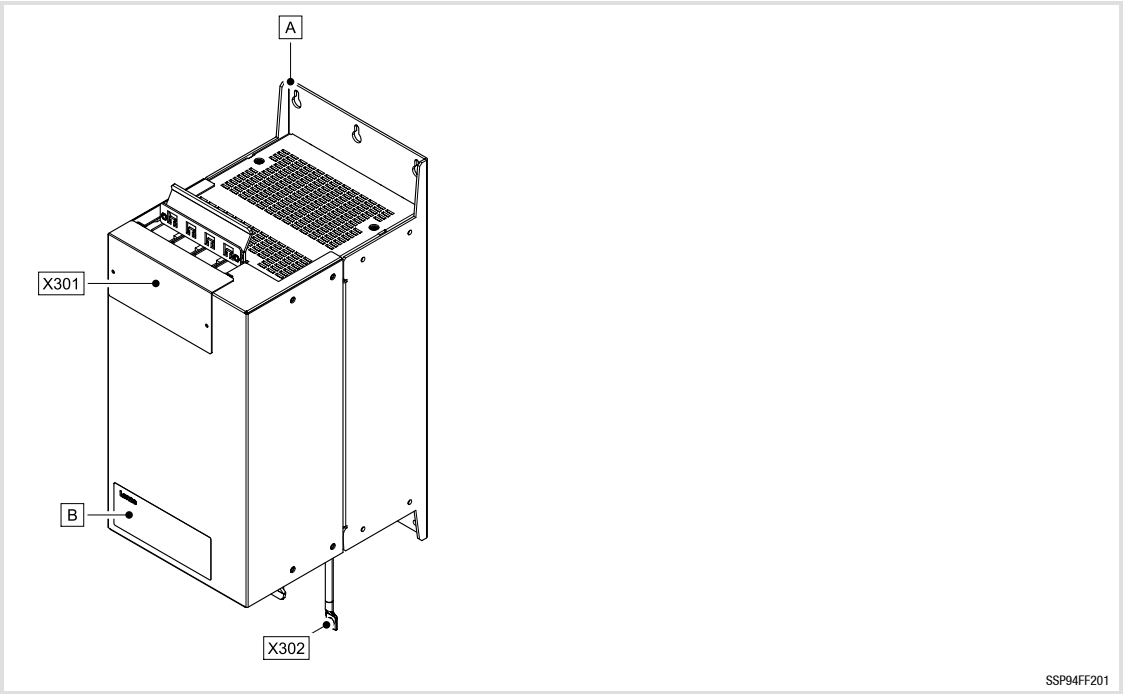
9.10.5 RFI filters for power supply modules



Pos.	Description
A	RFI filter E94AZRPxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
⏚	Connection of PE conductor
X301	Mains terminal L1 ... L3
X302	Connection cable to DC power supply module, four-core
B	Mounting aid for installation backplane
C	Nameplate

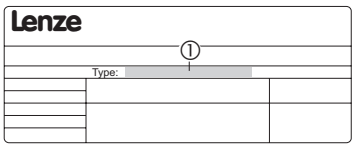


Pos.	Description
A	RFI filter E94AZRPxxxx
	Mounting Instructions

Elements on the filter

Pos.	Description
X301	Mains connection for L1 ... L3 and PE
X302	Connection cables to DC power supply module L1' ... L3' and PE
B	Nameplate

Identification



SSP94NF002

	①						
Type code	**E94**	**A**	**Z**	**R**	**P**	**xxx**	**x**
Product range							
Version							
Accessories							
Type: RFI filter							
For 9400 power supply							
Rated current [A]							
Voltage class 4 = 230 ... 400/500 V							

General data

Conformity and approval			
Approval			
UR	UL508	Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada	
Mains data			
Mains types			
With grounded neutral (TT/TN systems)		Operation permitted without restrictions	
Other mains types		Observe instructions for special measures in the documentation for the basic device!	
Protection of persons and equipment			
Enclosure	EN 60529	IP20	Not in the wire range of the terminals
	NEMA 250	Protection against contact to type 1	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Environmental conditions			
Climate			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +45 ... +55 °C: 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: current derating of 5 %/1000 m	
Pollution	EN 61800-5-1	Pollution degree 2	
Vibration resistance (9.81 m/s^2 = 1 g)			
Transport	IEC/EN 60721-3-2	2M2	
	EN 61800-2	2 ... 9 Hz: amplitude 3.5 mm	
		10 ... 200 Hz: acceleration resistant up to 10 m/s^2	
		200 ... 500 Hz: acceleration resistant up to 15 m/s^2	
Operation	Germanischer Lloyd	5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g	
	IEC/EN 60068-2-6	10 ... 57 Hz: amplitude 0.075 mm	
		57 ... 150 Hz: acceleration resistant up to 1 g	
Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertically	
Free space		The required free space results from the mounting position and the specifications of the standard device.	
Mounting position			
Standard		Footprint mounting; standard device is screwed on the filter	
Variant		Side-by-side mounting; filter is directly screwed to the left of the standard device (📖Mechanical installation)	

Rated data

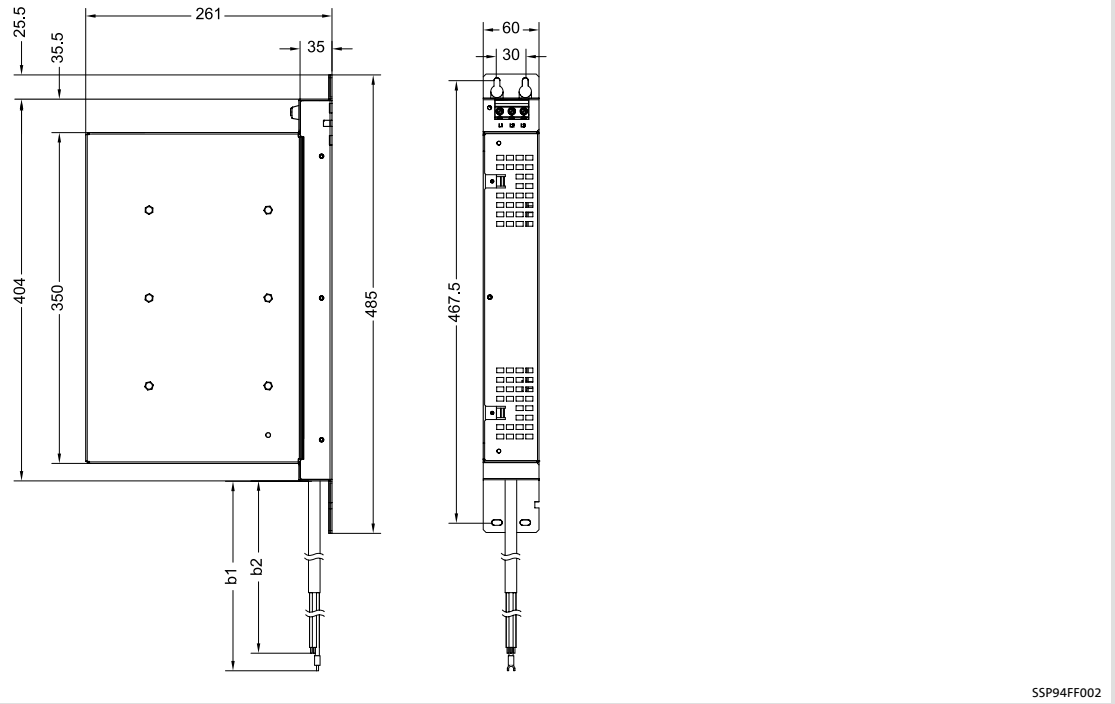
Basis of the data			
Mains	**Voltage** U_{LN} [V]	**Voltage range** U_{LN} [V]	**Frequency range** f [Hz]
3/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 ... 65
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 ... 65

	Voltage [V]	**Freq.** [Hz]	**Current [A]** ① max. +45° C	**Current [A]** ① max. +55° C	**Number of phases**
E94AZRP0084	230/400/500	50/60	8/8/8	6/6/6	3
E94AZRP0294	230/400/500	50/60	29/29/29	21.8/21.8/21.8	3
E94AZRP0824	230/400/500	50/60	82/82/82	61/61/61	3
E94AZRP2004	230/400/500	50/60	200/200/200	150/150/150	3

① Temperature in the control cabinet

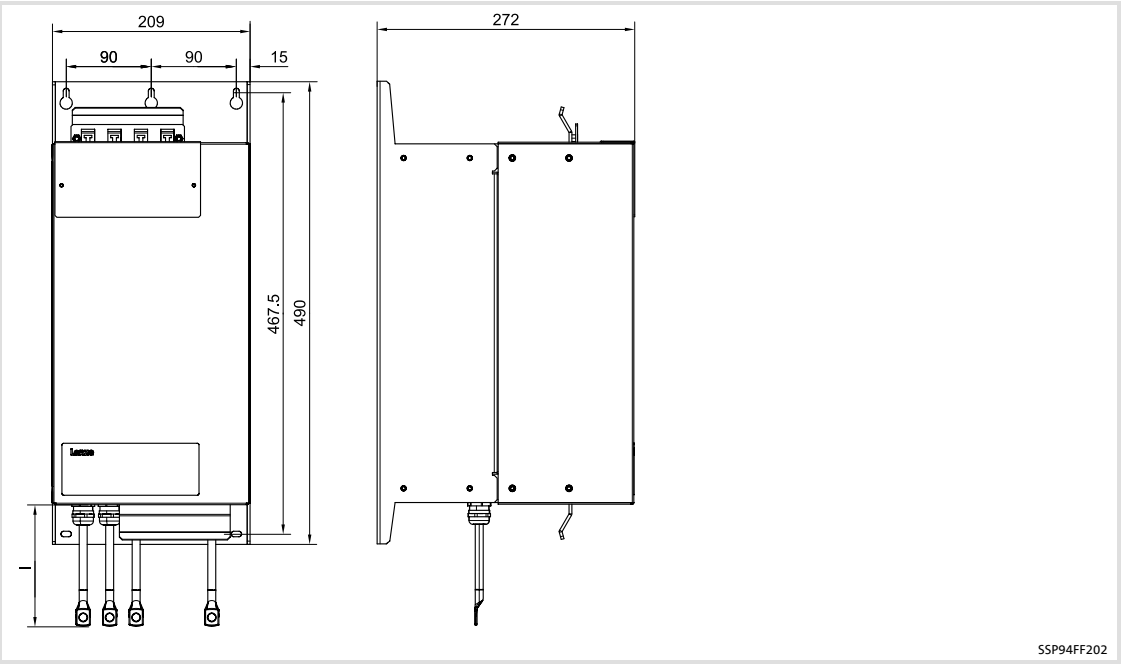
	Power loss P_{loss} [W]	**Inductance** L [mH]	**Voltage drop** ΔU [V]
E94AZRP0084	20	–	–
E94AZRP0294	50	–	–
E94AZRP0824	80	-	-
E94AZRP2004	150	-	-

Dimensions



All dimensions in millimetres.

	b1	b2	Mass
	[mm]		[kg]
E94AZRP0084	360 ±5	350 ±5	4.2
E94AZRP0294	430 ±5	420 ±5	4.5



All dimensions in millimetres.

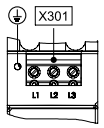
	Dimension l	Mass
	[mm]	[kg]
E94AZRP0824	500 ±10	18.5
E94AZRP2004	600 ±10	21.0

Installation steps

For information on this topic, please see the corresponding mounting instructions.

Terminal data

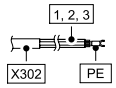
Mains

Terminal X301	Labelling	Description
 SSP94FF006	L1 L2 L3	Connection of the mains phases L1, L2, L3
	⏚	Connection for the supply-side PE conductor with M5 ring cable lug

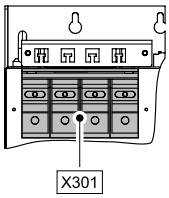
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxP0084	10	6	1.2 ... 1.5	10.6 ... 13.3	PH1
E94AZxP0294					

PE connection data				
	Ø	Starting torque		
	[mm]	[Nm]	[lb-in]	
E94AZxP0084	M5	3	26.5	SW 8
E94AZxP0294				

Standard device

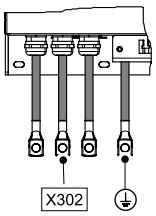
Cable X302	Labelling	Description
 SSP94FF007	1 2 3	Filter output conductor (lead with wire end ferrule, colour BK)
	PE	Output-side PE conductor (lead with M5 fork-type cable lug, colour GN/YE)

Mains

Terminal X301	Labelling	Description
 SSP94NF306	L1 L2 L3 PE	Connection of mains phases L1, L2, L3 and PE conductor

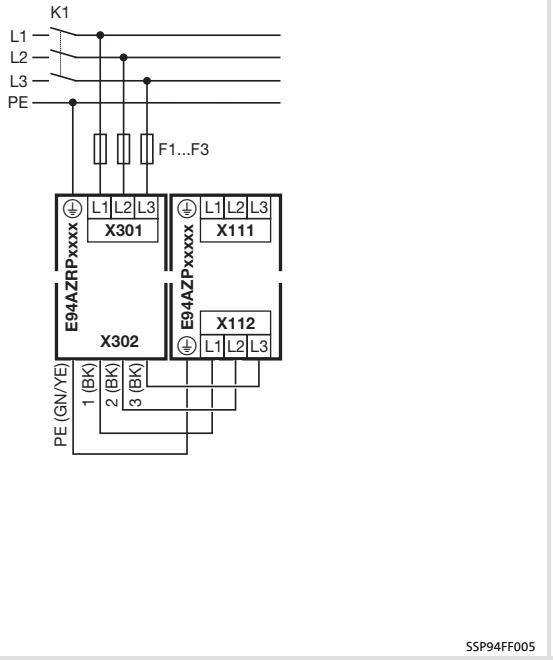
Terminal data					
	Max. conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
E94AZxP0824 Connection with M8 ring cable lug	70 (2 x 70)	2/0	12	106	SW13
E94AZxP2004 Connection with M10 ring cable lug	150 (2 x 120)	250 mcm	20	177	SW15

Power supply module

Cable X302	Labelling	Description
 SSP94NF307	L1' L2' L3'	Filter output conductor (lead with ring cable lug, colour BK)
		Output PE conductor (lead with ring cable lug, colour GN/YE)

Connection plan

Standard mounting



Mounting variant

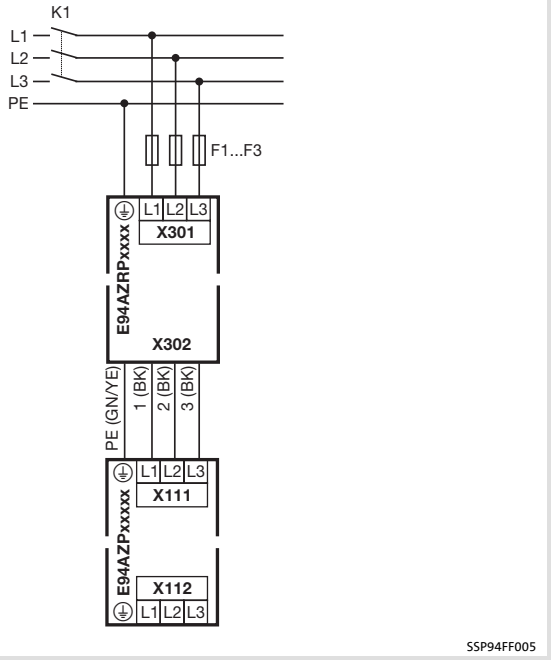


Fig. 9-6 Connection concept

E94AZRPxxxx	RFI filter
E94AZPxxxxx	Installation backplane for 9400 DC power supply module
F1 ... F3	Fuses
K1	Mains contactor

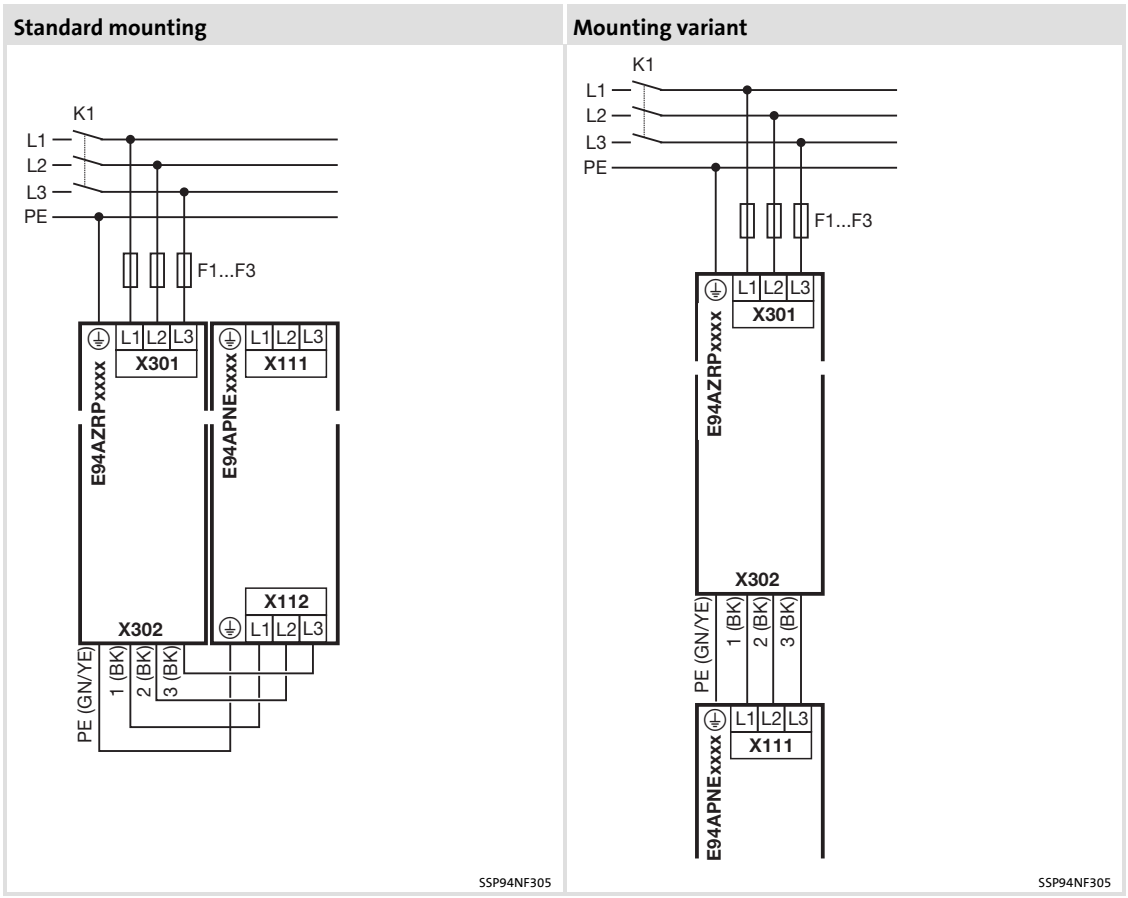
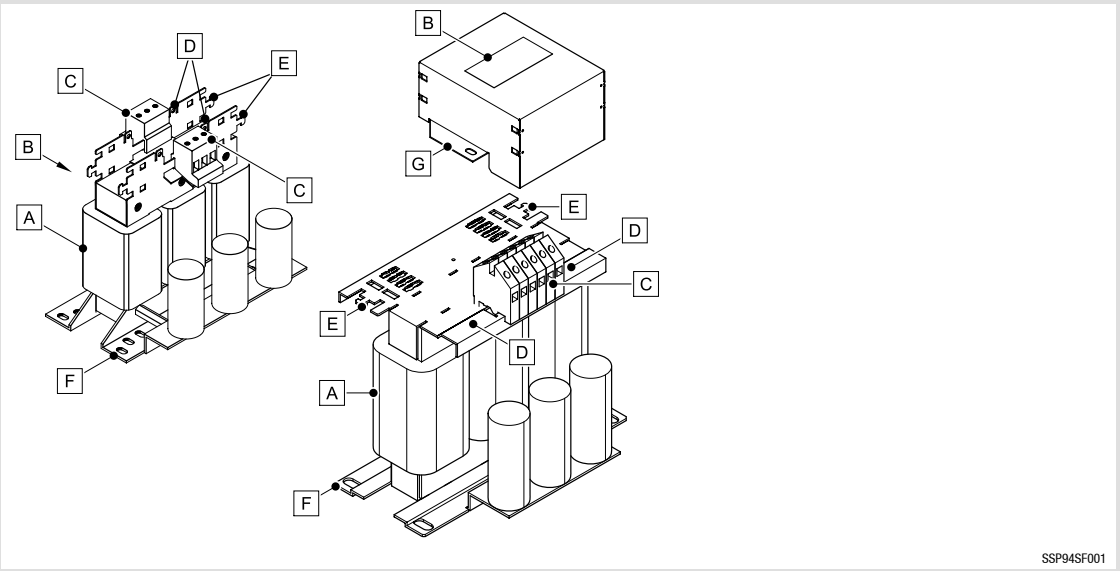


Fig. 9-7 Connection concept

E94AZRPxxxx	RFI filter
E94APNExxxx	9400 DC power supply module
F1 ... F3	Fuses
K1	Mains contactor

9.10.6 Sinusoidal filters 4 ... 16.5 A

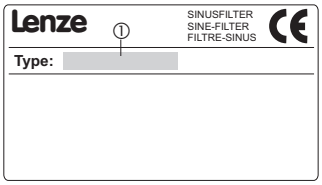


Pos.	Description
A	Sinusoidal filter EZS3-xxxA200
	Mounting Instructions

Elements on the filter

Pos.	Description
B	Nameplate
C	Terminals (input: 1U1, 1V1, 1W1 / output: 1U2, 1V2, 1W2)
D	PE connection
E	Shield connection
F	Fixing bracket
G	Terminal cover

Identification



SSP94SF002

	①						
Type code	**e**	**Z**	**S**	**3**	**-**	**xxxA**	**xxx**

Product series

Accessories

Filter type
S = sinusoidal filter

Phases
3 = 3 phases

Rated current [A] (rounded)

Variant

General data

Conformity	CE	Low-Voltage Directive
Approval	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada

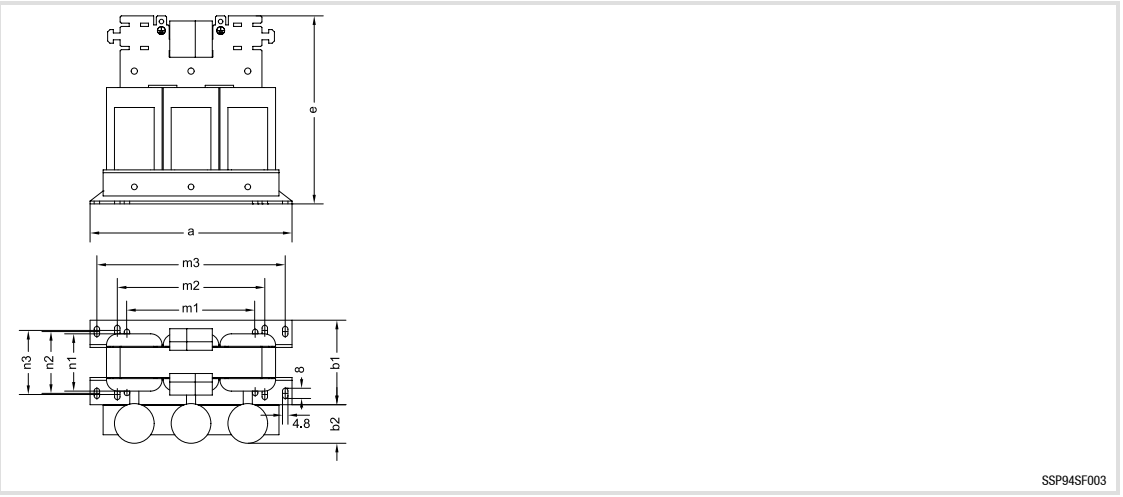
Climatic conditions	Class 3K3 according to EN 50178	Without condensation, average relative humidity 85 %
Permissible ambient operating temperature	-10 °C ... +55 °C Above 40 °C, the rated current I_N must be reduced by 2.5 %/°C	
Permissible installation height	0 ... 4000 m amsl Above 1000 m, the rated current I_N must be reduced by 5 %/1000 m	
Vibration resistance	Accelerational stability up to 1 g	EN50178, IEC61800-5-1 and Germanischer Lloyd, general conditions
Degree of protection	IP20 (protection against contact to NEMA 250 type 1)	
Mounting position	Vertical with fixing bracket below Depending on the weight, wall mounting is possible	
Connecting cables		
Drive controller ↔ filter	As short as possible, shielded	
Filter ↔ motor	Max. 200 m shielded or max. 300 m unshielded	

Rated data

Type	U [V]	f_{ch} [kHz]	I_N [A]	P_V [W]	L [mH]	m [kg]
EZS3-004A200	0 ... 550 V AC	4 ... 8	4.0	50	11.0	4.0
EZS3-010A200			10.0	80	5.1	5.5
EZS3-017A200			16.5	130	3.1	8.5
EZS3-024A200			23.5	160	2.5	14.5
EZS3-032A200			32.0	180	2.0	19.0
EZS3-037A200			37.0	190	1.7	21.0
EZS3-048A200			48.0	200	1.2	25.5
EZS3-061A200			61.0	230	1.0	33.5
EZS3-072A200			72.0	260	0.95	37.0
EZS3-090A200			90.0	300	0.8	53.0

U	Voltage range	PV	Power loss
f_{ch}	Switching frequency	L	Inductance
I_N	Rated current	M	Mass

Dimensions



Type	a	b1	b2	e	m1	m2	m3	n1	n2	n3
	[mm]									
EZS3-004A200	178	75	36	171	113	130	166	50	55	57
EZS3-010A200	178	90	36	171	113	130	166	65	70	72
EZS3-017A200	219	111	51	198	136	170	201	67	68	81

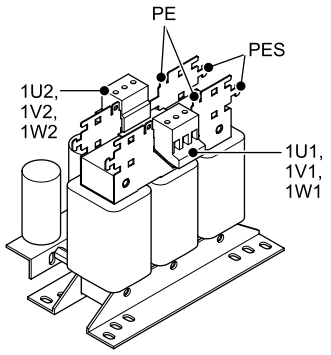
Installation steps

For information on this topic, please see the corresponding mounting instructions.

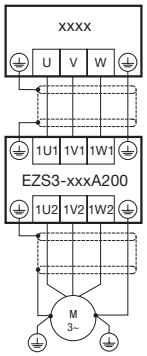
Terminal data

Sinusoidal filter	Terminal				PE screw		
	Connection cross-sections		Tightening torque		∅	Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]		[Nm]	[lb-in]
EZS3-004A200	0.2 ... 6	24 ... 10	0.6	5.3	M4	2	17.7
EZS3-010A200							
EZS3-017A200	0.5 ... 16	20 ... 6	1.5	13.3			
EZS3-024A200	2.5 ... 25	10 ... 6	2	17.7	M5	3	26.5
EZS3-032A200							
EZS3-037A200							
EZS3-048A200	2.5 ... 35	12 ... 2	3	26.5			
EZS3-061A200							
EZS3-072A200	16 ... 50	1/0 ... 6					
EZS3-090A200							

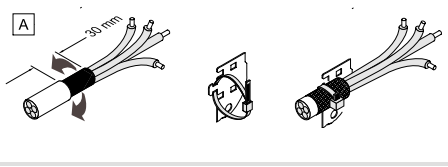
Connection plan



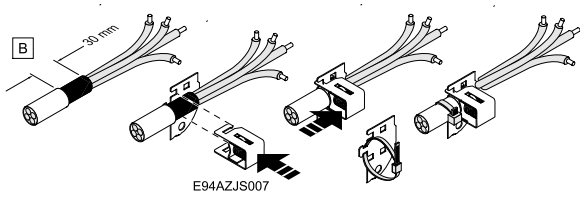
SSP94SF005



SSP94SF004

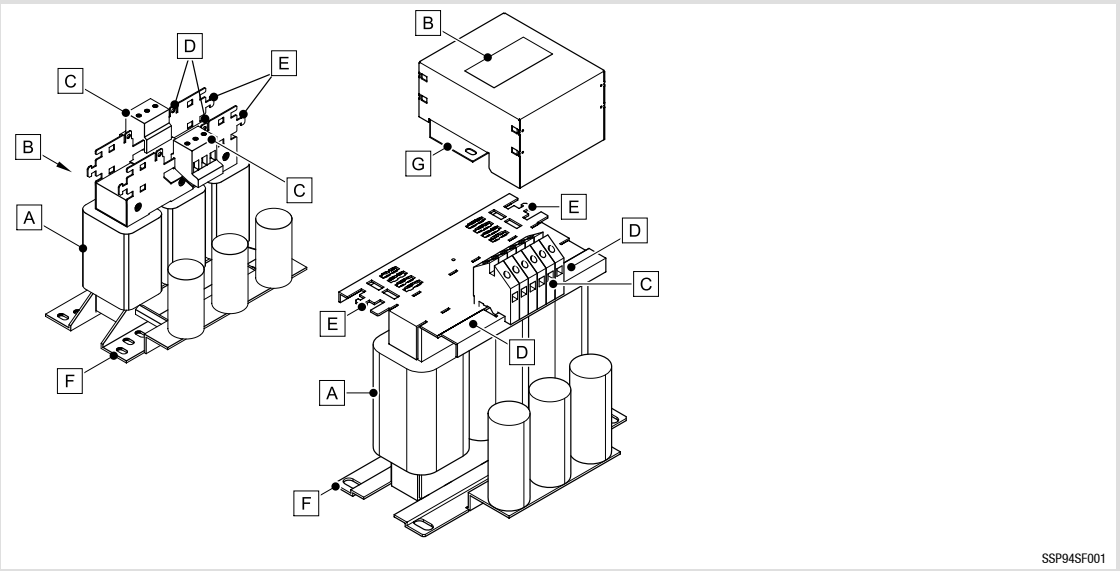


SSP94SF009



SSP94SF011

9.10.7 Sinusoidal filter 23.5 ... 90 A

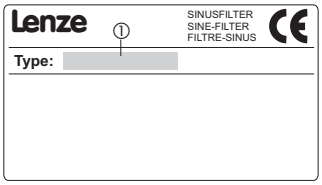


Pos.	Description
A	Sinusoidal filter EZS3-xxxA200
	Mounting Instructions

Elements on the filter

Pos.	Description
B	Nameplate
C	Terminals (input: 1U1, 1V1, 1W1 / output: 1U2, 1V2, 1W2)
D	PE connection
E	Shield connection
F	Fixing bracket
G	Terminal cover

Identification



SSP94SF002

	①						
Type code	**e**	**Z**	**S**	**3**	**-**	**xxxA**	**xxx**

Product series

Accessories

Filter type
S = sinusoidal filter

Phases
3 = 3 phases

Rated current [A] (rounded)

Variant

General data

Conformity	CE	Low-Voltage Directive
Approval	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada

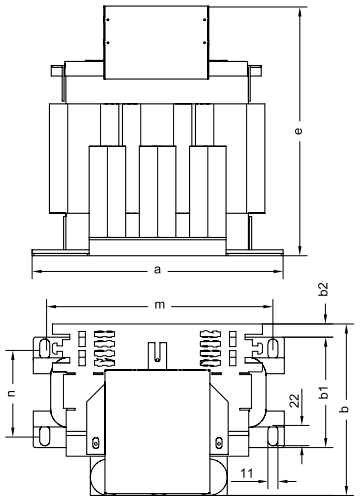
Climatic conditions	Class 3K3 according to EN 50178	Without condensation, average relative humidity 85 %
Permissible ambient operating temperature	-10 °C ... +55 °C Above 40 °C, the rated current I_N must be reduced by 2.5 %/°C	
Permissible installation height	0 ... 4000 m amsl Above 1000 m, the rated current I_N must be reduced by 5 %/1000 m	
Vibration resistance	Accelerational stability up to 1 g	EN50178, IEC61800-5-1 and Germanischer Lloyd, general conditions
Degree of protection	IP20 (protection against contact to NEMA 250 type 1)	
Mounting position	Vertical with fixing bracket below Depending on the weight, wall mounting is possible	
Connecting cables		
Drive controller ↔ filter	As short as possible, shielded	
Filter ↔ motor	Max. 200 m shielded or max. 300 m unshielded	

Rated data

Type	U [V]	f_{ch} [kHz]	I_N [A]	P_V [W]	L [mH]	m [kg]
EZS3-004A200	0 ... 550 V AC	4 ... 8	4.0	50	11.0	4.0
EZS3-010A200			10.0	80	5.1	5.5
EZS3-017A200			16.5	130	3.1	8.5
EZS3-024A200			23.5	160	2.5	14.5
EZS3-032A200			32.0	180	2.0	19.0
EZS3-037A200			37.0	190	1.7	21.0
EZS3-048A200			48.0	200	1.2	25.5
EZS3-061A200			61.0	230	1.0	33.5
EZS3-072A200			72.0	260	0.95	37.0
EZS3-090A200			90.0	300	0.8	53.0

U	Voltage range	PV	Power loss
f_{ch}	Switching frequency	L	Inductance
I_N	Rated current	M	Mass

Dimensions



SSP94SF006

Type	a	b	b1	b2	e	m	n
	[mm]						
EZS3-024A200	275	190	121	14	280	250	95
EZS3-032A200	275	200	131	14	280	250	105
EZS3-037A200	275	210	141	14	280	250	115
EZS3-048A200	275	245	151	14	290	250	125
EZS3-061A200	340	240	165	5	315	300	133
EZS3-072A200	340	265	176	5	325	300	145
EZS3-090A200	340	292	203	5	325	300	172

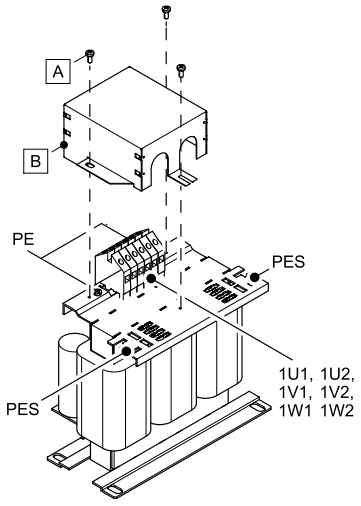
Installation steps

For information on this topic, please see the corresponding mounting instructions.

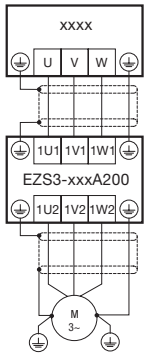
Terminal data

Sinusoidal filter	Terminal				PE screw		
	Connection cross-sections		Tightening torque		∅	Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]		[Nm]	[lb-in]
EZS3-004A200	0.2 ... 6	24 ... 10	0.6	5.3	M4	2	17.7
EZS3-010A200							
EZS3-017A200	0.5 ... 16	20 ... 6	1.5	13.3			
EZS3-024A200	2.5 ... 25	10 ... 6	2	17.7	M5	3	26.5
EZS3-032A200							
EZS3-037A200							
EZS3-048A200	2.5 ... 35	12 ... 2	3	26.5			
EZS3-061A200							
EZS3-072A200	16 ... 50	1/0 ... 6					
EZS3-090A200							

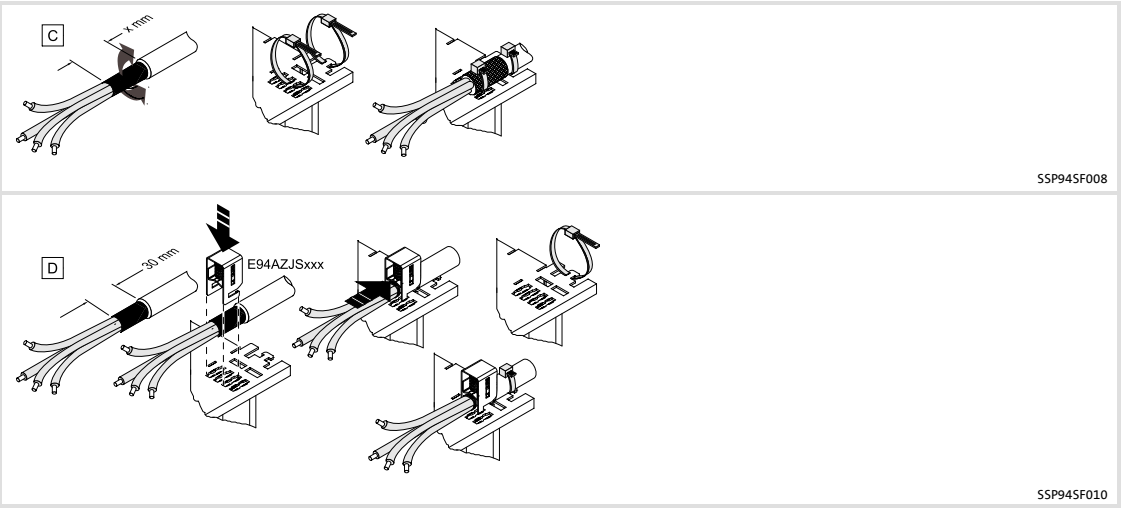
Connection plan



SSP94SF007

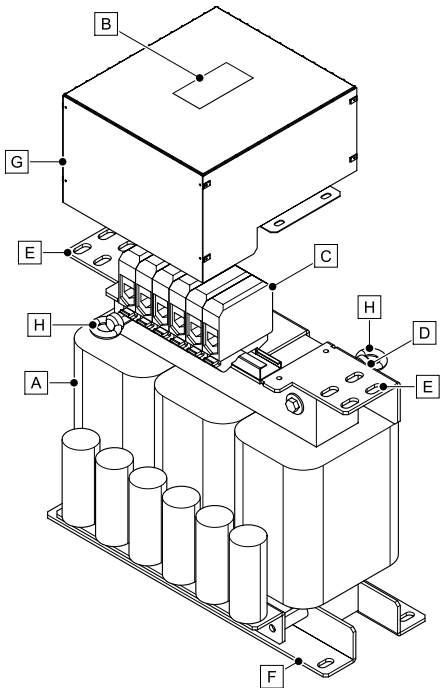


SSP94SF004



x Stripping length depends on the filter size

9.10.8 Sinusoidal filter 115 ... 150 A

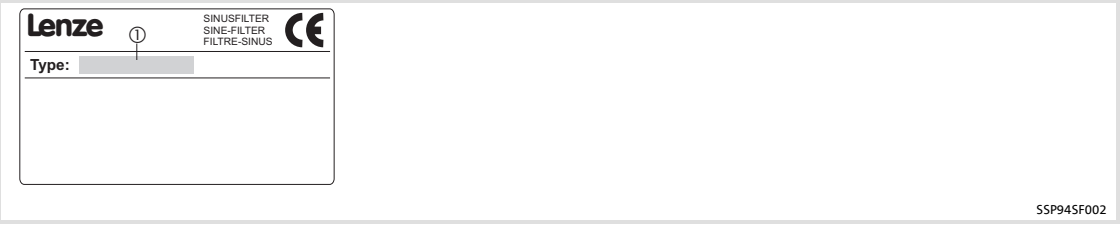


Pos.	Description
A	Sinusoidal filter EZS3-xxxA200
	Mounting Instructions

Elements on the filter

Pos.	Description
B	Nameplate
C	Terminals (input: 1U1, 1V1, 1W1 / output: 1U2, 1V2, 1W2)
D	PE connection
E	Shield connection
F	Fixing bracket
G	Terminal cover
H	Ring bolts

Identification



	①						
Type code	**e**	**Z**	**S**	**3**	**-**	**xxxA**	**xxx**

Product series

Accessories

Filter type
S = sinusoidal filter

Phases
3 = 3 phases

Rated current [A] (rounded)

Variant

General data

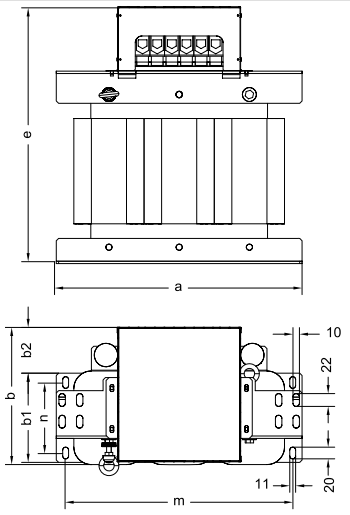
Conformity	CE	Low-Voltage Directive
Approval	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File-No. E219022) for USA and Canada

Rated data

Type	U [V]	f_{ch} [kHz]	I_r [A]	P_V [W]	L [mH]	m [kg]
EZS3-115A200	0 ... 550 V AC	2 ... 4	115	360	0.7	66
EZS3-150A200			150	400	0.5	69

U	Voltage range	PV	Power loss
f_{ch}	Switching frequency	L	Inductance
I_r	Rated current	m	Mass

Dimensions



SSP94SF103

All dimensions in millimetres.

Type	a	b	b1	b2	e	m	n
	[mm]						[mm]
EZS3-115A200	420	235	153	78.5	444	388	121
EZS3-150A200	420	235	168	63.5	444	388	136

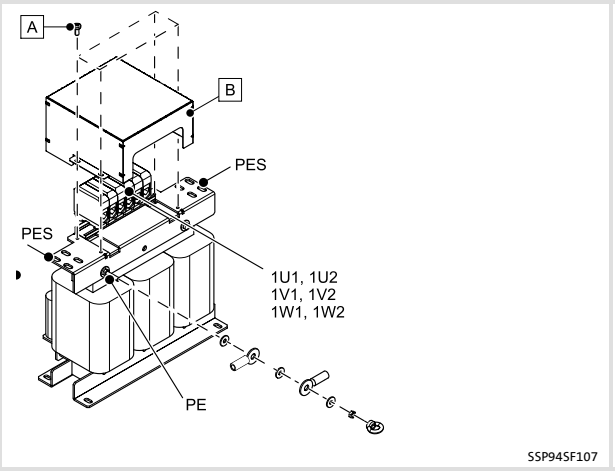
Installation steps

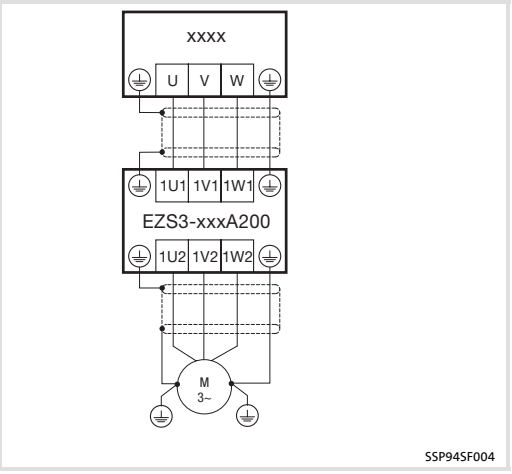
For information on this topic, please see the corresponding mounting instructions.

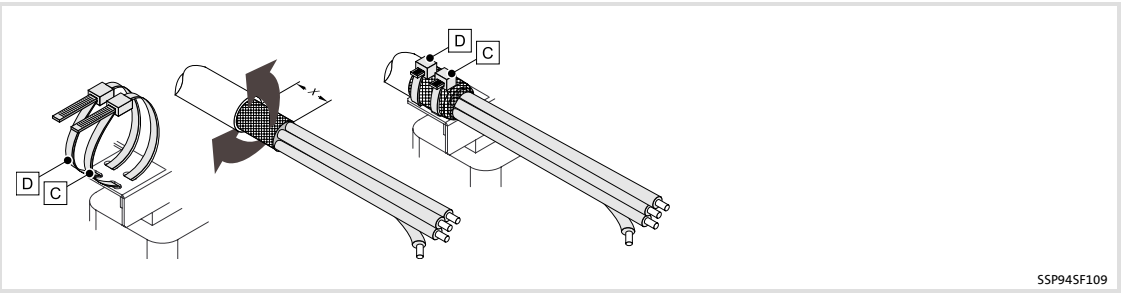
Terminal data

Sinusoidal filter	Terminal				PE screw		
	Connection cross-sections		Tightening torque		∅	Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]		[Nm]	[lb-in]
EZS3-115A200	35 ... 95	4/0 ... 2	6	53.1	M8	18	159.3
EZS3-150A200							

Connection plan

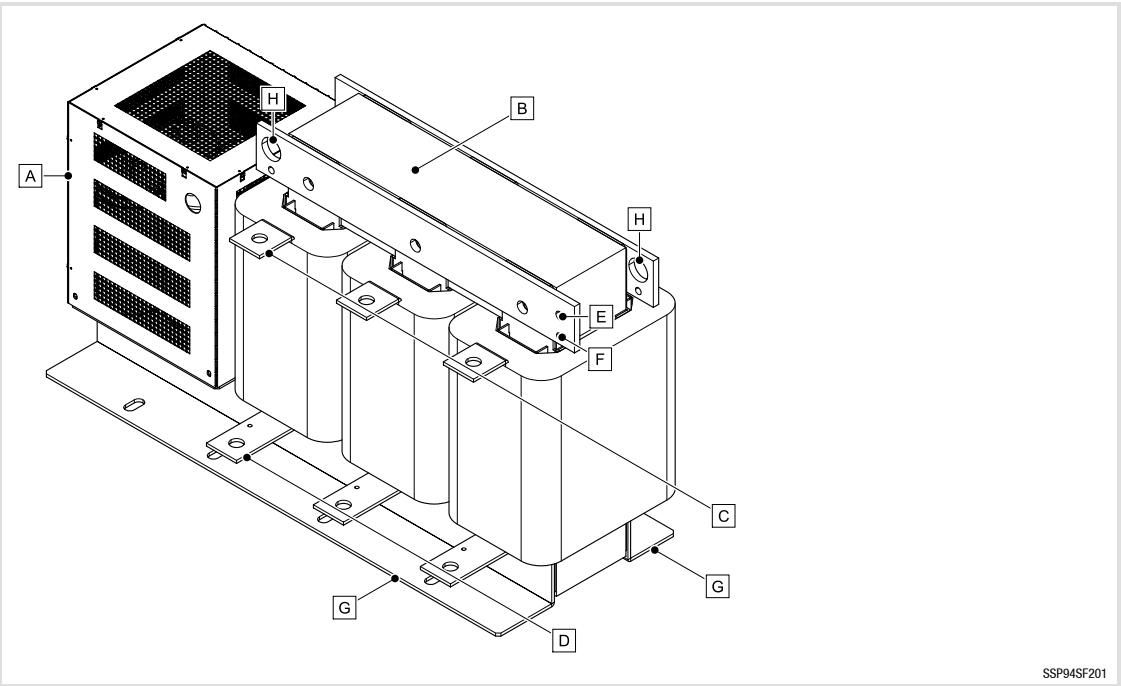






x Stripping length depends on the filter size

9.10.9 Sinusoidal filter 180 ... 480 A

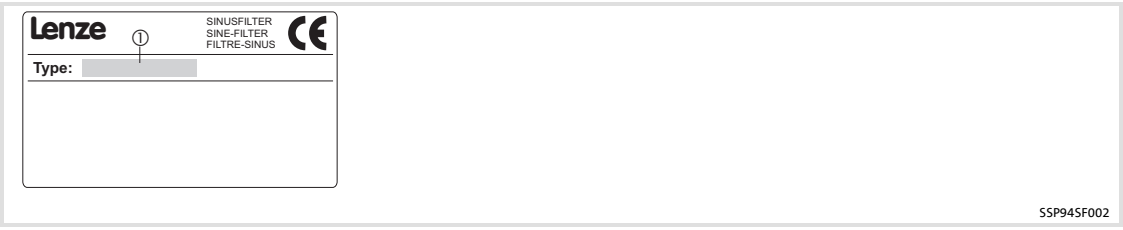


Pos.	Description
A	Sinusoidal filter EZS3-xxxA200
	Mounting Instructions

Elements on the filter

Pos.	Description
B	Nameplate
C	Connection 1U1, 1V1, 1W1 (inputs)
D	Connection 1U2, 1V2, 1W2 (outputs)
E	PE connection
F	Shield connection
G	Fixing bracket
H	Blocking point for lifting system

Identification



	①						
Type code	**e**	**Z**	**S**	**3**	**-**	**xxxA**	**xxx**

Product series

Accessories

Filter type
S = sinusoidal filter

Phases
3 = 3 phases

Rated current [A] (rounded)

Variant

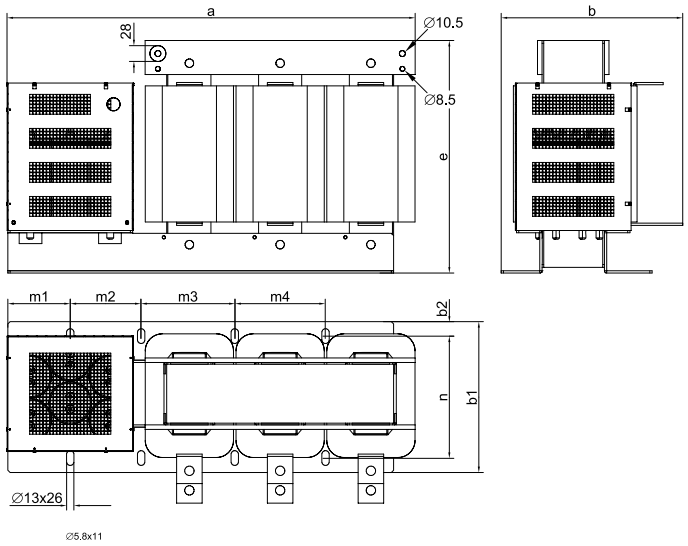
General data

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
Protection of persons and equipment			
Degree of protection	EN 60529	IP00	
Earth leakage current	IEC/EN 61800-5-1	> 3.5 mA	Observe stipulations and safety instructions!
Insulation resistance	IEC/EN 61800-5-1	< 2000 m site altitude: overvoltage category III	
		> 2000 m site altitude: overvoltage category II	
Environmental conditions			
Climate			
Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) Current derating at +40 ... +55 °C: 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: Current derating 5 %/1000 m	
Pollution	EN 61800-5-1	Degree of pollution 2	
Vibration resistance (9.81 m/s² = 1 g)			
Transport	IEC/EN 60721-3-2	2M2	
	EN 61800-2	2 ... 9 Hz: Amplitude 3.5 mm	
		10 ... 200 Hz: Acceleration resistant up to 10 m/s²	
		200 ... 500 Hz: Acceleration resistant up to 15 m/s²	
Operation	Germanischer Lloyd	5 ... 13.2 Hz: Amplitude ±1 mm 13.2 ... 100 Hz: Acceleration resistant up to 0.7 g	
	IEC/EN 60068-2-6	10 ... 57 Hz: Amplitude 0.075 mm	
		57 ... 150 Hz: Acceleration resistant up to 10 m/s²	
Mounting conditions			
Mounting place		In the control cabinet	
Mounting position		Vertical, fixing bracket below	
Free space		100 mm to the side and above	

Rated data

	Voltage	Current	Output frequency	Switching frequency	Power loss	Inductance
	U [V]	I_N [A]	f [Hz]	f_{ch} [kHz]	P_V [W]	L [mH]
EZS3-180A200	0 ... 550	180	0 ... 90	2 ... 4	580	0.40
EZS3-250A200		250			810	0.35
EZS3-350A200		350			1100	0.21
EZS3-480A200		480			1550	0.14

Dimensions



	a	b	b1	b2	e	m1	m2	m3	m4	n	
	[mm]										[kg]
EZS3-180A200	600	270	235	21	324	102.5	117.5	130	160	194.5	97
EZS3-250A200	665	330	290	23	373		122.5	145	140	238.5	152
EZS3-350A200	730	320	268	26	431	110	125	165	160	216.5	172
EZS3-480A200		370	318		426					266.5	244

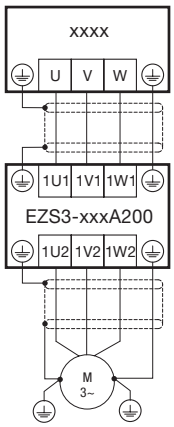
Installation steps

For information on this topic, please see the corresponding mounting instructions.

Terminal data

	1U1, 1V1, 1W1, 1U2, 1V2, 1W2 ∅	PE ∅	PES ∅
EZS3-180A200	M10	M10	M8
EZS3-250A200	M13		
EZS3-350A200	M16		
EZS3-480A200			

Connection plan



SSP94SF004

9.11 General accessories

9.11.1 Introduction

For information about further accessories, please see the ”Servo Drives 9400” catalogue.

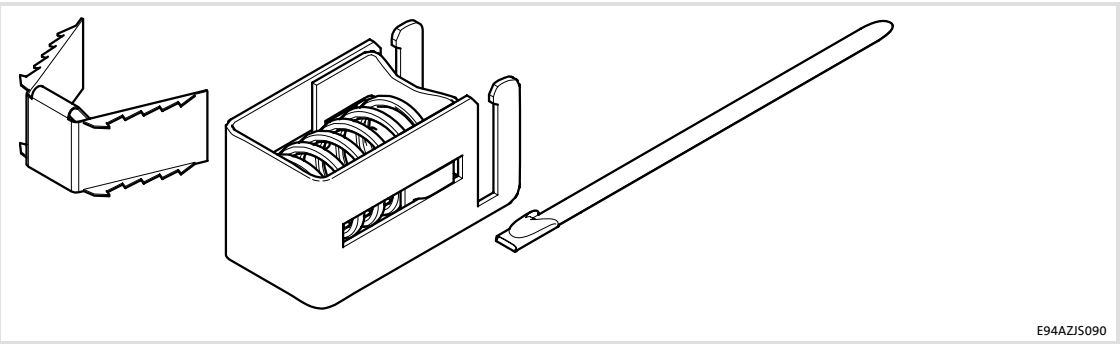
9.11.2 Shield mounting

Shield mounting kits facilitate the conductive connection of cable shields with a surface as large as possible. Good shield connections are an important part of wiring according to EMC guidelines. The shield connections on the devices are designed for different installations. If a recommended shield mounting cannot be implemented, e.g. because of thick cables, you can always choose an alternative. The alternative also ensures a good shield connection.

Always implement a strain relief in addition to the shield mounting, since strain relief is not possible with a shield mounting.

Possible installations of the shield connection:

- EMC clip (spring clip)
  – preferred for control cables or thin motor cables
- EMC wire clamp
  – preferred for motor cables, device-dependent sizes
- Cable tie, metallic
  – preferred for thick motor cables or several cables



Shield mounting and cable cross-section

Shield mountings contained in the scope of supply of the Servo Drives 9400:

Type			EMC clip (spring clip)	EMC wire clamp
Axis module	Installation backplane		EZA... (axis module/installation backplane)	(usability depends on installation backplane)
E94ASxE0024 E94ASxE0034	E94AZPS0034	GG1	2/1	0 x E94AZJS003 0 x E94AZJS007
E94AMxE0024 E94AMxE0034 E94AMxE0044	E94AZPM0044			
E94ASxE0044 E94ASxE0074	E94AZPS0074	GG2	2/0	0 x E94AZJS003 1 x E94AZJS007
E94AMxE0074 E94AMxE0094	E94AZPM0094			
E94ASxE0134 E94ASxE0174 E94ASxE0244	E94AZPS0244	GG3	2/0	1 x E94AZJS024
E94AMxE0134 E94AMxE0174 E94AMxE0244	E94AZPM0244			

Tab. 9-3 Shield mountings contained in the scope of supply

Shield mountings available as accessories:

Type	EMC clip	EMC wire clamp			Cable tie
Accessory set	EZA... (spring clip)	E94AZJS003 (C02)	E94AZJS007 (C03)	E94AZJS024 (C04)	EZAMBKBM (metallic)
E94A...	1	-	-	-	-
E94AZJS003	-	2	-	-	-
E94AZJS007	-	-	1	-	-
E94AZJS024	-	-	-	1	-
EZAMBKBM	-	-	-	-	50

Tab. 9-4 Shield mountings available as accessories

Permissible cable cross-sections (without cable sheath) of the shield mountings:

EMC clip	EMC wire clamp			Cable tie
EZA...??? (spring clip)	E94AZJS003 (C02)	E94AZJS007 (C03)	E94AZJS024 (C04)	EZAMBKBM (metallic)
[mm]	[mm]	[mm]	[mm]	[mm]
[*in*]	[*in*]	[*in*]	[*in*]	[*in*]
2 ... 11.6 *0.079 ... 0.456*	4 ... 15 *0.157 ... 0.59*	10 ... 20 *0.394 ... 0.787*	15 ... 28 *0.59 ... 1.1*	8 ... 30 *0.32 ... 1.18*

Tab. 9-5 Clamping range of shield mountings

Select the shield mounting according to the cable characteristics.

Lenze system cables		EMC clip	EMC wire clamp			Cable tie
a [mm²]	**d** [mm]	**EZA...** (spring clip)	**E94AZJS003** (C02)	**E94AZJS007** (C03)	**E94AZJS024** (C04)	**EZAMBKBM** (metallic)
standard, shielded						
1.0	10.3	•	•	•	-	•
1.5	11.6	•	•	•	-	•
2.5	13.2	-	•	•	-	•
4.0	14.5	-	•	•	•	•
6.0	16.5	-	-	•	•	•
10	19.6	-	-	•	•	•
suitable for trailing						
1.0	11.2	•	•	•	-	•
1.5	12.3	-	•	•	-	•
2.5	14.2	-	•	•	-	•
4.0	14.8	-	•	•	•	•
6.0	17.5	-	-	•	•	•
10	20.5	-	-	-	•	•

Tab. 9-6 Cable characteristics of Lenze system cables

a Single-core cross-sections of a Lenze system cable (motor)
Standard design or trailing cable

d Cross-section of Lenze system cable/cable shield

Tip!

If a shield mounting cannot be used because of thicker cables, in many cases, an alternative is possible.

Instead of the EMC clip you can e.g. use the EMC wire clamp E94AZJS003 or the metallic cable tie EZAMBKBM.

9.11.3 Brake resistors

Assignment of external brake resistors

Rated mains voltage: U_{Lr} = 400/500 V

For U_{Lr} = 230 V rated voltage, different assignments are applicable.

Note!

Max. permissible brake resistor connecting cable length for devices E94A...: ≤ 5 m

SingleDrive axis module	Brake resistor	Resistance R [Ω]	Continuous power P [W]	Quantity of heat Q_B [kWs]
E94ASxE0024 E94ASxE0034	ERBP082R200W	82	200	30
E94ASxE0044 E94ASxE0074	ERBP047R200W	47	200	30
	ERBS047R400W		400	60
	ERBS047R800W		800	120
E94ASxE0134	ERBP027R200W	27	200	30
	ERBS027R600W		600	90
	ERBS027R01K2		1200	180
E94ASxE0174	ERBP018R300W	18	300	30
	ERBS018R800W		800	120
	ERBS018R02K8		2800	180
E94ASxE0244	ERBP018R300W	18	300	30
	ERBS018R01K2		1200	180
	ERBS018R02K8		2800	420
E94ASxE0324	ERBS018R800W	18	800	120
	ERBS018R01K4		1400	210
	ERBG018R04K3		4300	645
E94ASxE0474	ERBS015R800W	15	800	1500
	ERBS015R02K4		2400	495
	ERBG015R06K2		6200	930
E94ASxE0594	ERBS015R01K2	15	1200	180
	ERBG015R03K3		3300	495
	ERBG015R10K0		10000	1500
E94ASxE0864 E94ASxE1044	ERBG075D01K9	7.5	1900	285
E94ASxE1454	ERBG005R02K6	5	2600	390
E94ASxE1724	ERBG043D03K0	4.3	3000	450
E94ASxE2024	ERBG035D03K3	3.5	3300	495
E94ASxE2454	ERBG028D04K1	2.8	4100	615
E94ASxE2924	ERBG023D05K6	2.3	5600	840
E94ASxE3664	ERBG035D03K3 [2)]	3.5	3300	495
E94ASxE4604	ERBG028D04K1 [2)]	2.8	4100	615
E94ASxE5724 E94ASxE6354 E94ASxE6954	ERBG023D05K6 [2)]	2.3	5600	840

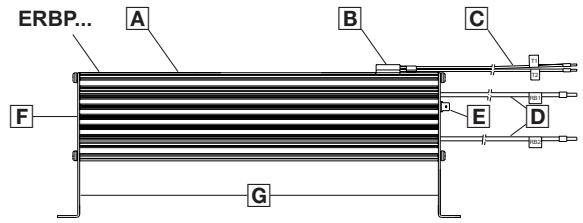
2) Zwei Widerstände parallel schalten.

Power supply module	Brake resistor	Resistance R [Ω]	Continuous power P [W]	Quantity of heat QB [kWs]
E94APNE0104	ERBP027R200W	27	200	30
	ERBS027R600W		600	90
	ERBS027R01K2		1200	180
E94APNE0364	ERBG012R01K9	12	1900	285
	ERBG012R05K2		5200	780
E94APNE1004	ERBG005R02K6	5	2600	390
E94APNE2454	ERBG028D04K1	2.8	4100	615

Regenerative power supply module	Brake resistor	Resistance R [Ω]	Continuous power P [W]	Quantity of heat Q_B [kWs]
E94ARNE0134	ERBP027R200W	27	200	30
	ERBS027R600W		600	90
	ERBS027R01K2		1200	180
E94ARNE0244	ERBP018R300W	18	300	30
	ERBS018R01K2		1200	180
	ERBS018R02K8		2800	420

Operating conditions

Climatic conditions	Class 3K3 to EN 50178	Without condensation, average relative humidity 85 %
Ambient temperature	-10 °C ... +55 °C Above 45 °C the permanent power P_d is to be reduced by 2.5 %/°C	
Installation height	0 ... 4000 m amsl Above 1000 m the permanent power P_d is to be reduced by 5 %/1000 m	
Mounting location	● The mounting location must comply with the device features mentioned in the chapter "General data". ● Flammable materials or substances must not be placed in the vicinity of the brake resistor. ● The heat generated by the brake resistor must be dissipated freely.	
Mounting position		
Standard	Vertically suspended with connecting cables at the bottom.	
Variant	Horizontally standing with fixing bracket at the bottom. The permanent power P_d is to be reduced by 30 %!	
Free spaces		
Standard	at the top > 200 mm, to the sides > 25 mm, at the bottom > 100 mm	
Variant	at the top > 200 mm, to the sides > 45 mm, at the bottom > 45 mm	
Design and project planning	● Mean value of regenerative power < permanent power P_d of brake resistor. ● Regenerative power during braking time < heat quantity Q_B of brake resistor. ● Braking time < 10 % of cycle time (braking time + dead time). ● Always connect the thermal contact and integrate it in a way into the system monitoring that the mains supply will be switched off when the basic device is overheated.	



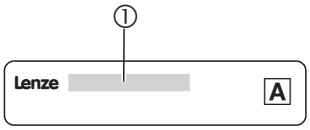
ERBP001

Pos.	Description
	Brake resistor
	Mounting Instructions

Brake resistor elements

Pos.	Description
A	Nameplate
B	Thermal contact
C	Connecting cable thermal contact
D	Connecting cable brake resistor
E	PE connection
F	Warning note
G	Fixing bracket

Identification



ERBMXXX011

	①		
Type code	**ERBx**	**xxxx**	**xxxx**
Product series			
Resistance R_B [Ω] e.g. 470R = 470 Ω 075D = 7.5 Ω			
Permanent power P_d [W] e.g. 120W = 120 W 01k2 = 1.2 kW			

General data

Conformity	CE	Low-Voltage Directive
Approvals	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File No. E232497) for USA and Canada
Degree of protection	IP21 (protection against contact to NEMA 250 type 1)	
Vibration resistance	Acceleration resistant up to 1 g	EN50178, IEC61800-5-1 and Germanischer Lloyd, general conditions
Surface temperature	In normal operation up to 300 °C In case of an error more than 300 °C	
Thermal contact		
Design	NC contact, 180 °C	
Switching capacity	250 V AC/4 A	

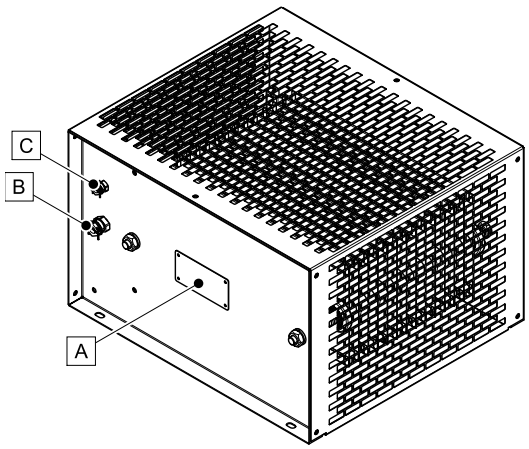
Rated data

	R_B [Ω]	P_d [W]	Q_B [kWs]	U_{max} [V_{DC}]	m [kg]
ERBP018R300W	18	300	30	800	1.4
ERBP027R200W	27	200	30		1.0
ERBP033R200W	33	200	30		1.0
ERBP033R300W		300	45		1.4
ERBP047R200W	47	200	30		1.0
ERBP082R200W	82	200	30		1.0
ERBP180R200W	180	200	30		1.0
ERBP180R300W		300	45		1.4

R_B	Resistance
P_d	Permanent power
Q_B	Heat quantity
V_{max}	Max. operating voltage
m	Mass

Installation steps

For information on this topic, please see the corresponding mounting instructions.



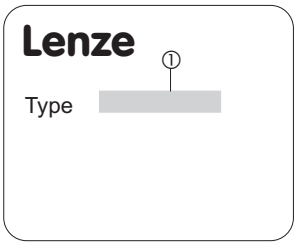
ERBG001

Pos.	Description
	Brake resistor
	Mounting Instructions

Brake resistor elements

Pos.	Description
A	Nameplate
B	Cable gland for brake resistor cable
C	Cable gland for thermal contact cable

Identification



ERBG002

	①		
Type code	**ERBx**	**xxxx**	**xxxx**
Product series			
Resistance R_B [Ω] e.g. 470R = 470 Ω 075D = 7.5 Ω			
Permanent power P_d [W] e.g. 120W = 120 W 01k2 = 1.2 kW			

General data

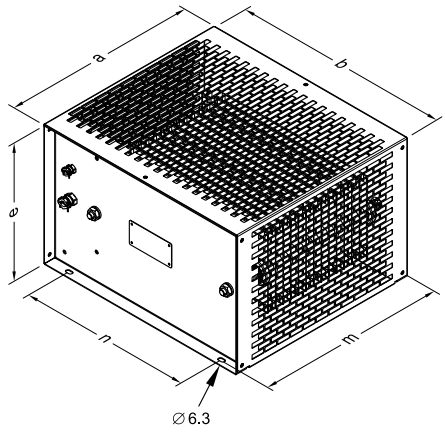
Conformity	CE	Low-Voltage Directive
Approvals	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File-No. E221095) for USA and Canada
Degree of protection	IP20 (protection against accidental contact according to NEMA 250 type 1)	
Vibration resistance	Acceleration resistant up to 0.7 g	EN50178, IEC61800-5-1 and Germanischer Lloyd, general conditions
Surface temperature		
Housing	in normal operation up to 250 °C in case of a fault more than 300 °C	
Elements	in normal operation up to 390 °C in case of a fault more than 680 °C	
Thermal contact		
Design	NC contact, 100 °C	
Switching capacity	250 V AC / 2.5A 110 V AC / 1.6 A	

Rated data

	R_B [Ω]	P_d [W]	Q_B [kWs]	U_{max} [V_{DC}]	m [kg]
ERBG023D05K6	2.3	5.6	840	1000	15.9
ERBG028D04K1	2.8	4.1	615		12.8
ERBG035D03K3	3.5	3.3	495		12.6
ERBG043D03K0	4.3	3.0	450		11.8
ERBG005R02K6	5.0	2.6	390		11.0
ERBG075D01K9	7.5	1.9	285		9.5
ERBG012R01K9	12.0				
ERBG012R05K2		5.2	780		15.1
ERBG015R03K3	15.0	3.3	495		12.6
ERBG015R06K2		6.2	930		17.0
ERBG015R10K0		10.0	1500		22.0
ERBG018R04K3	18.0	4.3	645		13.5

R_B	Resistance
P_d	Permanent power
Q_B	Heat quantity
V_{max}	Max. operating voltage
m	Mass

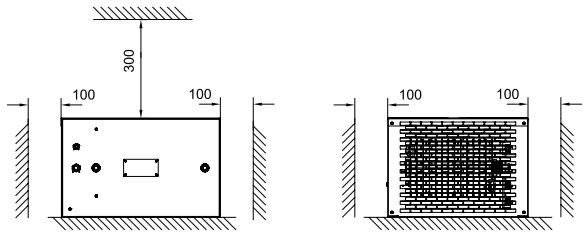
Dimensions



ERBG003

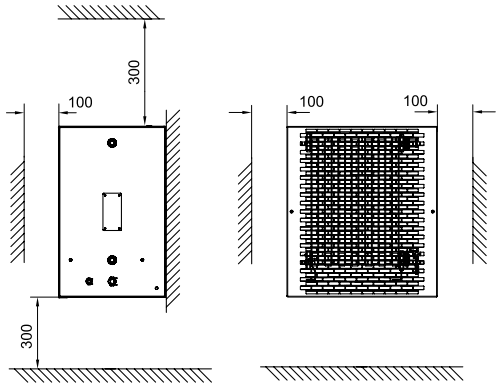
Type	a	b	e	m	n
			[mm]		
ERBG023D05K6	426	486	302	400	380
ERBG028D04K1	426			400	
ERBG035D03K3	326			300	
ERBG043D03K0	326			300	
ERBG005R02K6	326			300	
ERBG012R05K2	426			400	
ERBG015R03K3	326			300	
ERBG015R06K2	526			500	
ERBG015R10K0	736			710	
ERBG018R04K3	426			400	

Free spaces for standard mounting



All dimensions in millimetres.

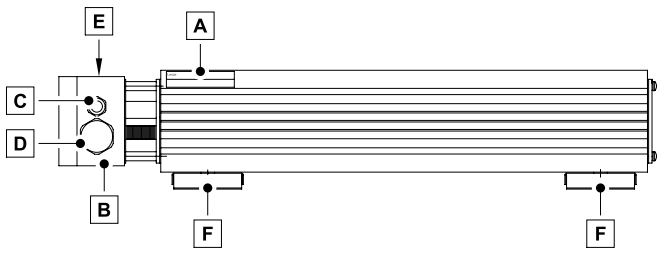
Free spaces for mounting variant



All dimensions in millimetres.

Installation steps

For information on this topic, please see the corresponding mounting instructions.



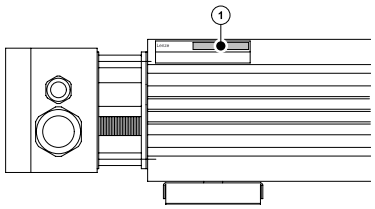
ERBS101

Pos.	Description
	Brake resistor
	Mounting Instructions

Brake resistor elements

Pos.	Description
A	Nameplate
B	Terminal box
C	Cable gland for thermal contact cable
D	Cable gland for brake resistor cable
E	Warning note
F	Fixing bracket

Identification



ERBS104

	①		
Type code	**ERBx**	**xxxx**	**xxxx**
Product series			
Resistance R_B [Ω] e.g. 470R = 470 Ω 075D = 7.5 Ω			
Permanent power P_d [W] e.g. 120W = 120 W 01k2 = 1.2 kW			

General data

Conformity	CE	Low-Voltage Directive
Approvals	UR	UL508, Industrial Control Equipment, Underwriter Laboratories (File No. E232497) for USA and Canada
Degree of protection	IP65 (NEMA 250 type 4)	
Vibration resistance	Acceleration resistant up to 1 g	EN50178, IEC61800-5-1 and Germanischer Lloyd, general conditions
Surface temperature	With normal operation up to 400 °C In case of an error more than 500 °C	
Thermal contact		
Design	NC contact, 230 °C	
Switching capacity	250 V AC / 5 A	

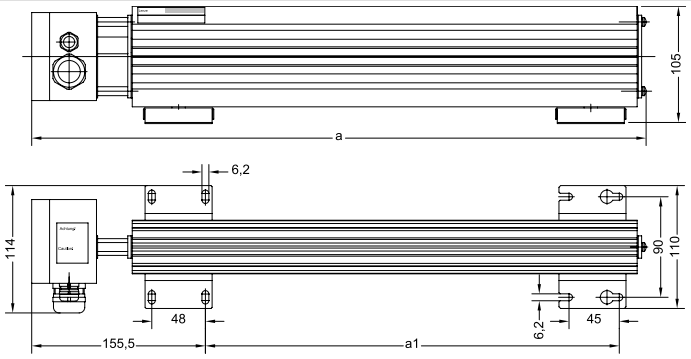
Rated data

	R_B [Ω]	P_d [W]	Q_B [kWs]	U_{max} [V_{DC}]	m [kg]
	R_B [Ω]	P_d [W]	C_B [kWs]	U_{max} [V_{DC}]	m [kg]
ERBS015R800W	15	800	120	800	4.0
ERBS015R01K2		1200	180		5.6
ERBS015R02K4		2400	420		10.0
ERBS018R800W	18	800	120		4.0
ERBS018R01K2		1200	180		5.6
ERBS018R01K4		1400	210		6.3
ERBS018R01K9		1900	285		8.7
ERBS018R02K8		2800	420		12.0
ERBS027R600W	27	600	90		3.1
ERBS027R01K2		1200	180		5.6
ERBS027R01K4		1400	210		6.3
ERBS047R400W	47	400	60		2.3
ERBS047R800W		800	120		4.0

R_B	Resistance
P_d	Permanent power
Q_B	Heat quantity
V_{max}	Max. operating voltage
m	Mass

Dimensions

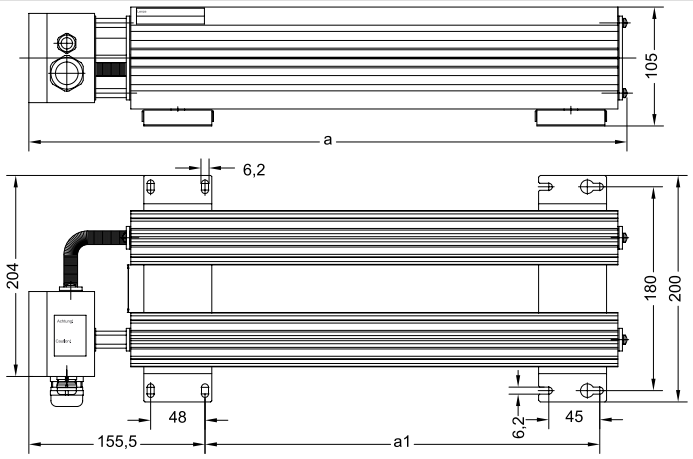
Design 1



All dimensions in millimetres.

Type	a	a1
	[mm]	
ERBS075D01K4	1110	931
ERBS012R600W	550	371
ERBS015R800W	710	531
ERBS015R01K2	1020	841
ERBS018R800W	710	531
ERBS018R01K2	1020	841
ERBS018R01K4	1110	931
ERBS027R600W	550	371
ERBS027R01K2	1020	841
ERBS027R01K4	1110	931
ERBS047R400W	400	221
ERBS047R800W	710	531

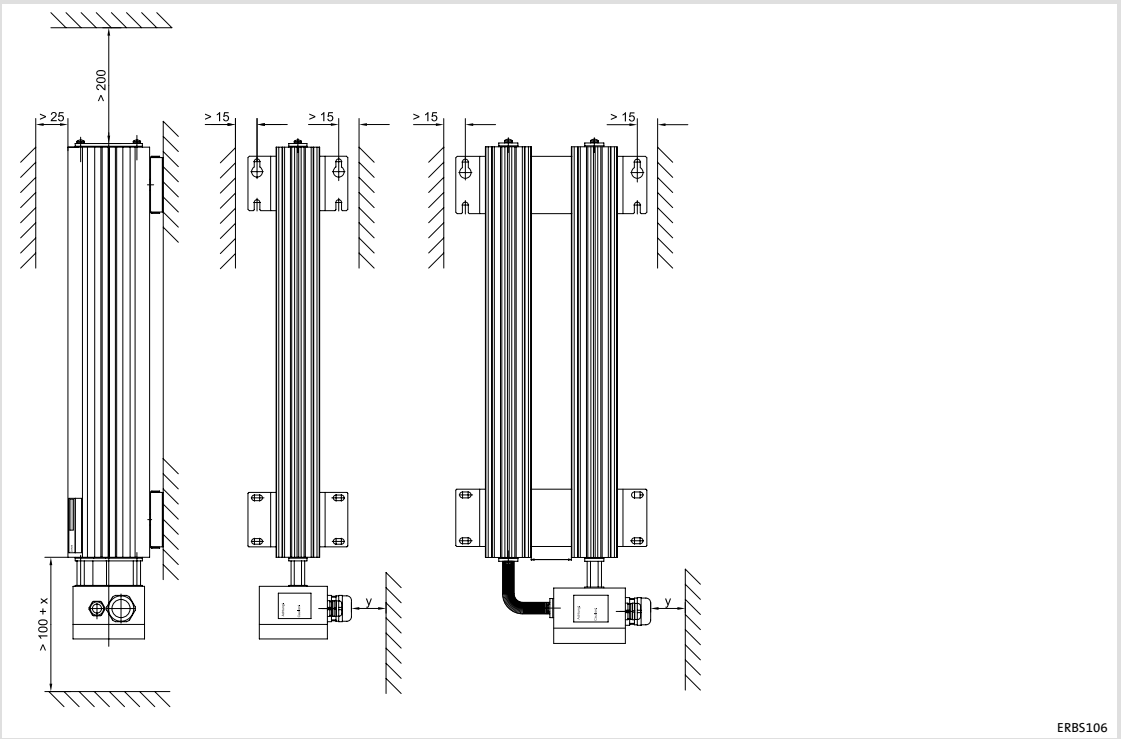
Design 2



All dimensions in millimetres.

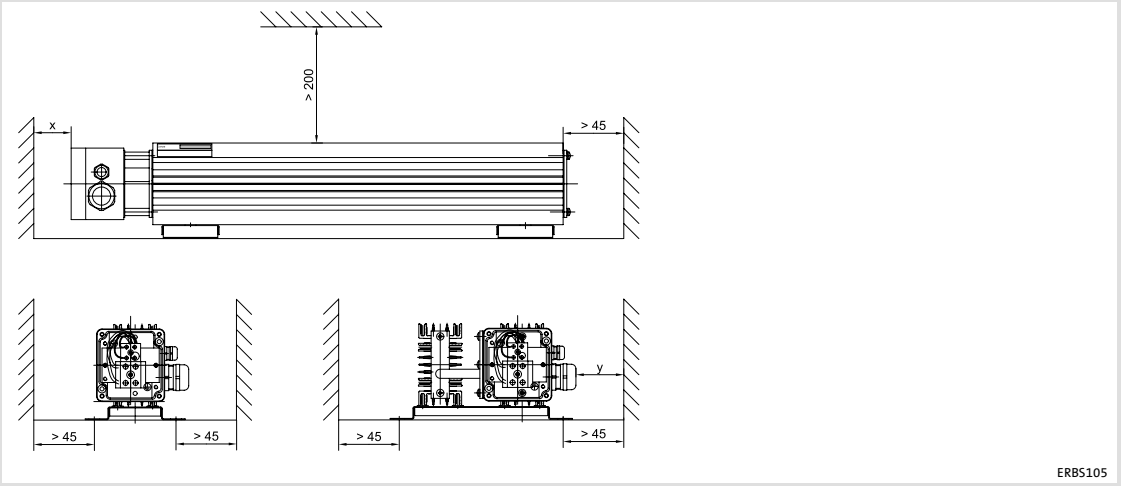
Type	a	a1
	[mm]	
ERBS075D01K9	825	646
ERBS012R02K0	865	686
ERBS015R02K4	1020	841
ERBS018R01K9	825	646
ERBS018R02K8	1110	931

Free spaces for standard mounting



x Wiring clearance
y Cable bending radius
All dimensions in millimetres

Free spaces for mounting variant

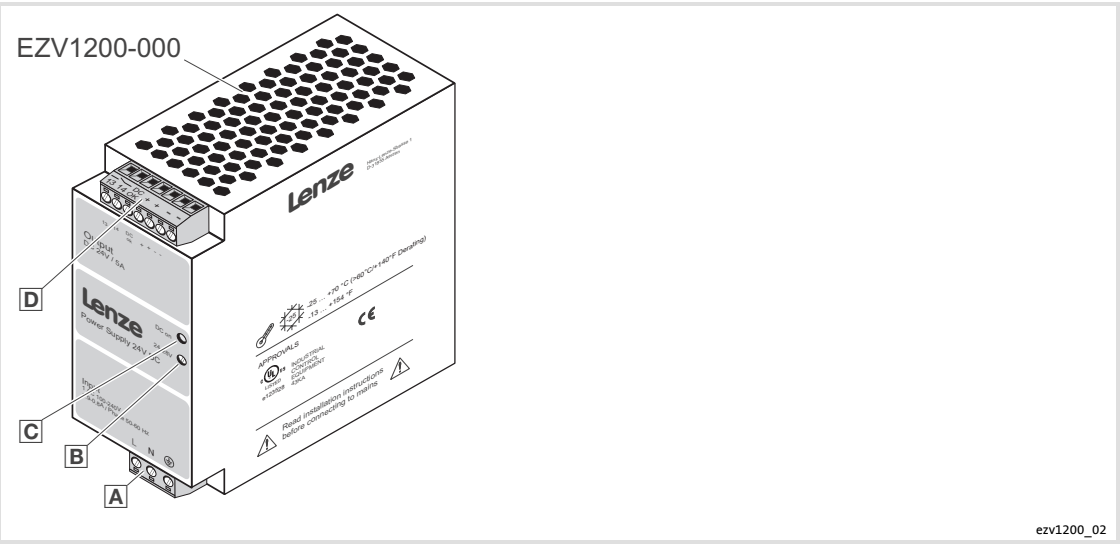


x Wiring clearance
y Cable bending radius
All dimensions in millimetres

Installation steps

For information on this topic, please see the corresponding mounting instructions.

9.11.4 Power supply unit

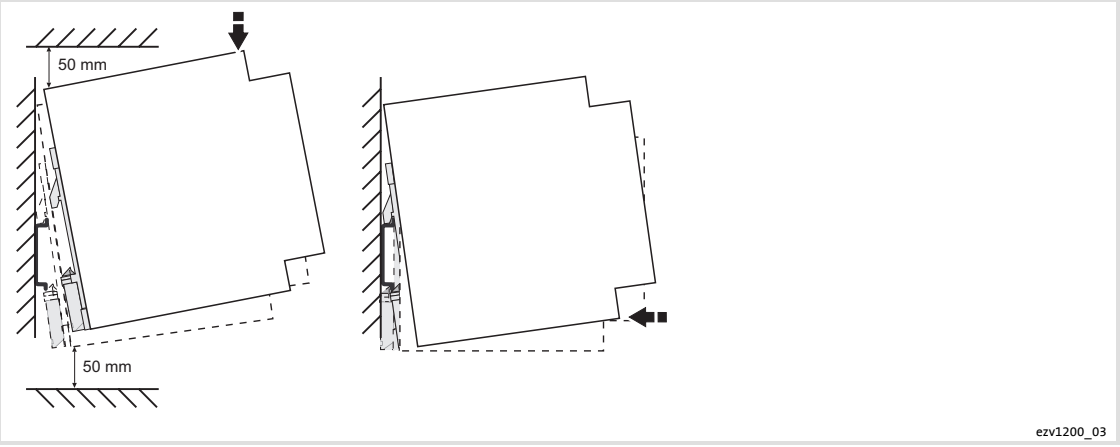


Elements

Legend for the illustration on the fold-out page

Pos.	Description
A	Input terminals
B	Potentiometer
C	Green LED
D	Output terminals

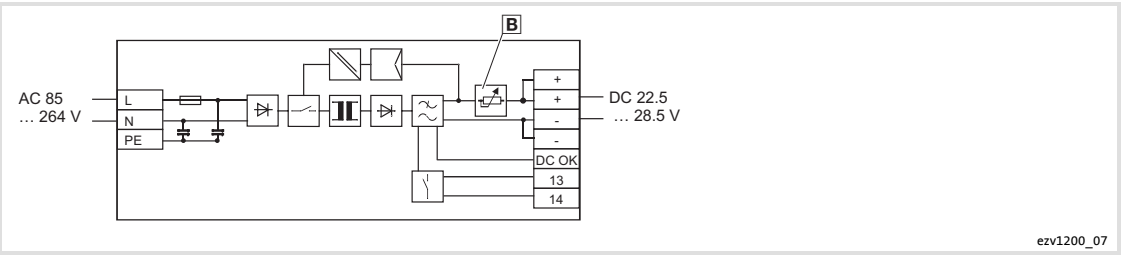
Mounting



Overview

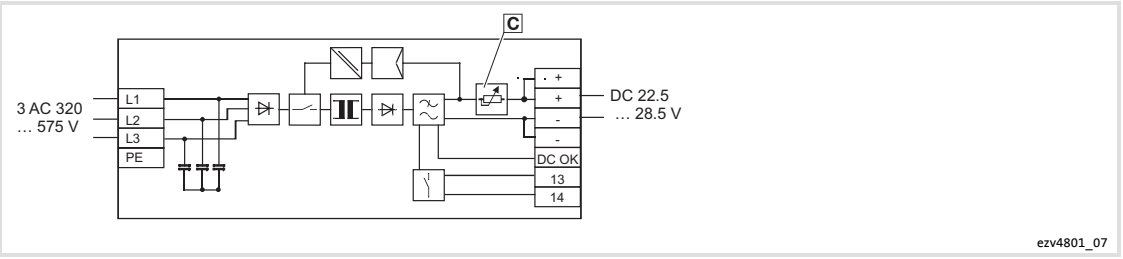
Power supply unit	Mains voltage V_{LN} [V]	Output voltage V_A [V]	Output current I_A [A]
EZV1200-000	1/N AC 230	DC 24	5
EZV1200-001	3 AC 400		
EZV2400-000	1/N AC 230		10
EZV2400-001	3 AC 400		
EZV4800-000	1/N AC 230		20
EZV4800-001	3 AC 400		

Connection plan



B Potentiometer

At DC OK: 24 V, max. 40 mA



C Potentiometer

At DC OK: 24 V, max. 40 mA

Terminal data

	Input terminals	Output terminals
Rigid terminal	0.2 … 2.5 mm² (AWG 24 … 12)	0.2 … 2.5 mm² (AWG 24 … 12)
Flexible terminal with wire end ferrule with plastic collar	0.2 … 2.5 mm² (AWG 24 … 12)	0.2 … 2.5 mm² (AWG 24 … 12)
Stripping length	7 mm	7 mm
Tightening torque	0.5 … 0.6 Nm (4.4 … 5.3 lb-in)	0.5 … 0.6 Nm (4.4 … 5.3 lb-in)

Function monitoring

The LED, the active DC OK switching output and a potential-free contact provide the function monitoring.

LED	DC OK switching output	Potential-free contact	Meaning	
			Output voltage	Description
ON	U = 24 V	closed	U_{output} > 0.9 U_{input}	Device is in operation, ● the output voltage U_{output} is higher than 90 % of the set voltage U_{input} ● the output current is in the permissible range
BLINKING	U = 0 V	open	U_{output} < 0.9 U_{input}	Device is in operation but ● error at the load ● current consumption is higher than I_{BOOST} ● output is short-circuited
OFF	U = 0 V	open	U_{output} = 0	Device is out of service because ● no mains voltage is applied ● the circuit-breaker is activated ● the device is defect

Standards

General data/operating conditions		
Conformity	CE	Low-Voltage Directive (2006/95/EC) EMC regulation (2004/108/EC)
Approval	UL508 Industrial Control equipment (file no. E123528)	
Vibration resistance	up to 30 g	to IEC 68-2-27
Climatic conditions	Class 3K3	to EN 60 721
Degree of pollution	2	to EN 50 178
Permissible temperature ranges		
Storage	-40 °C ... +85 °C	
Operation	-25 °C ... +70 °C	The output current must be reduced by 2.5 %/°C above a temperature of +60 °C
Humidity	< 95 %	at +25 °C, no condensation
Free spaces	> 50 mm	above/below

General electrical data		
Degree of protection	IP 20	
Class of protection	I	with PE connection
Leakage current to PE	< 3.5 mA	
MTBF	> 500 000 h	to IEC 1709 (SN 29 500)

Input data	
Turn-on time	< 1 s after applying the mains voltage
Transient surge voltage protection	varistor

Output data		
Rated output voltage U_N	DC 24 V / ± 1 %	
Setting range of the output voltage	DC 22.5 ... 28.5 V	
Start of unlimited capacitive loads	yes	
Residual ripple / switching peaks (20 MHz)	< 100 mV_{SS}	with rated values
Can be connected in parallel	to increase redundancy and power	
Resistance to return supply	DC 35 V	

Dimensioning

The control level of the Servo Drives 9400 series is supplied with 24 V DC. To meet the requirements of typical applications, the 24-V supply has been implemented in a way allowing internal or external supply. For some components, external supply is absolutely necessary.

- The additional current requirements for extensions and components added to the modular structure must be considered.
- A separate 24-V supply is implemented via the connection of the basic device to operate the control section independently of the power section.
  - Communication modules are internally supplied.
  - Separate and external supply is absolutely necessary for: safety units.
- The control section of Single Drive controllers can supply itself from the power section. In this case, there is no external current required for the components and their modules.
  - E.g. for controllers for single drives without communication or without requirements on their availability (special case)
- Multi Drive controllers and power supply modules always require an external 24-V supply.

Typical current requirement of the 24-V supply for basic devices and modules or components (*with example*):

Current requirement of 24-V supply					
Type	GG	Connection	I_{24V} [mA]	Quantity	Total [mA]
Power supply modules					
E94APNE0104	1	X11	450	*1*	*450*
E94APNE0364	3		450		
E94APNE1004	4		1400		
E94APNE2454	5		1400		
Regenerative power supply modules					
E94ARNE0134	1	X11	620		
E94ARNE0244	3		620		
Multi Drive					
E94AMxE0024 E94AMxE0034 E94AMxE0044	1	X2	1120	*5*	*5600*
E94AMxE0074 E94AMxE0094	2	X2	1220		
E94AMxE0134 E94AMxE0174 E94AMxE0244 E94AMxE0324	3	X2	1470		
Single Drive					
E94ASxE0024 ... E94ASxE0244	1 ... 3	X2	620		
E94ASxE0324 ... E94ASxE1044	6 ... 7	X2	660		
E94ASxE1454 ... E94ASxE6954	8 ... 10	X2	620		

Current requirement of 24-V supply					
Type	**GG**	**Connection**	**[mA]**		**[mA]**
Connections					
Keypad EZAEBK...		X6	50	*5*	*250*
Digital outputs		X4	70	*6*	*420*
Analog outputs		X3	10		
Memory modules (MMI)					
MMxxx E94AYM...		-	20	*5*	*100*
Feedback					
Encoder		X8	110		
Resolver		X7	20	*5*	*100*
Communication (MXI1/MXI2)					
PROFIBUS E94AYCPM		X200	130	*5*	*650*
PROFINET E94AYCER		X240	140		
DeviceNet E94AYCDN		X225	130		
Ethernet Powerlink E94AYCEP/E94AYCEC		X210/X250	140		
Safety system (MSI)					
SM0 E94AYAA		-	0	*2*	*0*
SM100 E94AYAB		X80	200	*3*	*600*
- digital output			max. 700	*5 x 10 %*	*350*
SM301 E94AYAD		X80.2	350		
- clock output			50		
- safe digital output		X80.1	500		
				Example values in italics	
Result: current requirement of 24-V supply					
				Sum total [mA]:	*8520*
				Sum total [A]:	*8.5*

Notes:

- The current requirement refers to the nominal voltage of 24 V. With a lower voltage, the current requirement increases linearly.
- The values are maximum values. If the real currents are known, this can be considered accordingly in the table.
- The typical current consumption is approx. 10 ... 20 % lower.
- When selecting the power supply unit, observe that there will flow a substantially higher current for a short time when switching on the power supply unit. Select power supply units that can supply this overcurrent and do not switch off.
- The indicated current is a continuous current. If consumers are connected, more current is required in the starting phase (e.g. device fans). Power supply units therefore must have dynamic reserves.

Note!

When several devices are switched on, a very high initial charging current is required. Power supply units without current limitation can be overloaded (fault).

Lenze power supply units are equipped with an internal starting current limitation. When several devices are switched on, there will not occur any fault.

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