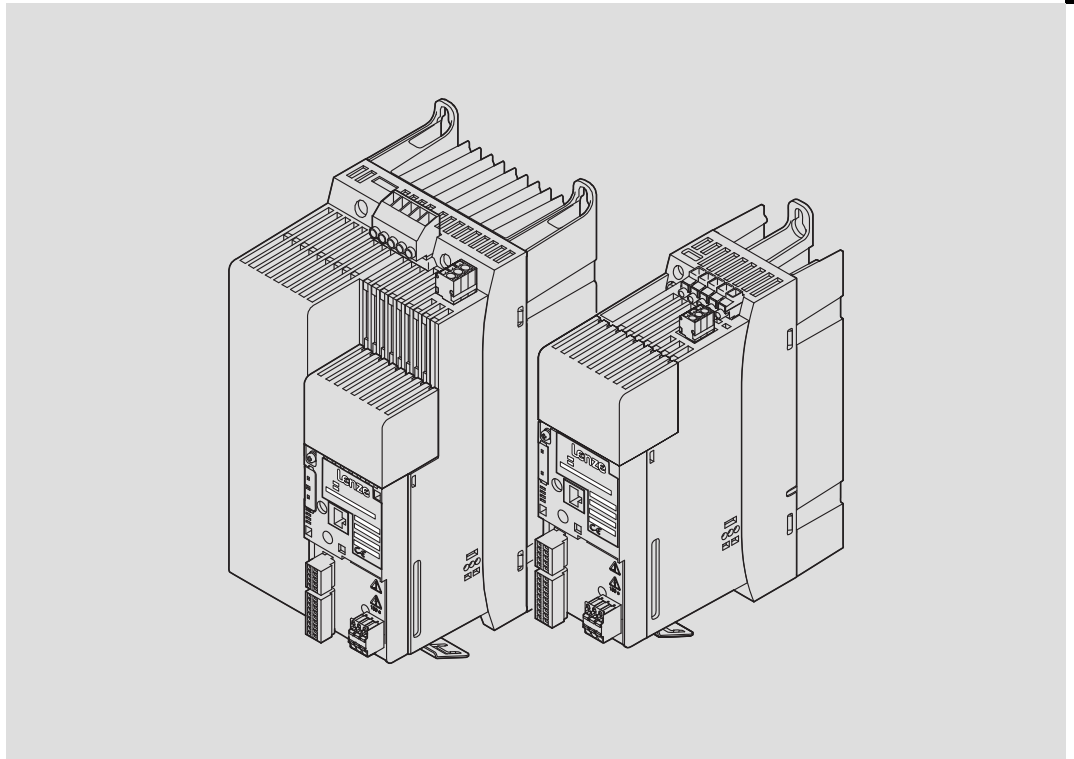


# L-force *Drives*



Translation **Hardware Manual**

## 8400 0.25 ... 45 kW



**E84Axxxx StateLine C/HighLine C/TopLine C**

**Frequency inverter 8400**



<b>1</b>	<b>About this documentation</b> .....	<b>8</b>
1.1	Document history .....	9
1.2	Conventions used .....	10
1.3	Terms and abbreviations used .....	11
1.4	Notes used .....	12
<b>2</b>	<b>Safety instructions</b> .....	<b>13</b>
2.1	General safety and application notes for Lenze controllers .....	13
2.2	General safety and application instructions for Lenze motors .....	16
2.3	Residual hazards .....	19
<b>3</b>	<b>Product description</b> .....	<b>20</b>
3.1	Device features .....	20
3.2	Overview of standard devices .....	22
3.3	Overview of control terminals .....	25
3.4	Identification .....	27
3.5	Product key .....	28
<b>4</b>	<b>Technical data</b> .....	<b>29</b>
4.1	General data and operating conditions .....	29
4.2	Rated data .....	35
4.2.1	Overview .....	35
4.2.2	Operation at rated mains voltage 230 V .....	38
4.2.3	Operation at rated mains voltage 400 V .....	42
4.2.4	Operation at a rated mains voltage of 500 V .....	49
4.2.5	Operation with increased power at a 230 V mains .....	56
4.2.6	Operation with increased power at a 400 V mains .....	59
4.2.7	Operation with increased power at a 500 V mains .....	64
4.3	Current characteristics .....	69
4.4	Overcurrent operation .....	73
4.5	Terminal description .....	75
4.5.1	Overview .....	75
4.6	StateLine C control terminals .....	79
4.6.1	External supply voltage 24 V .....	79
4.6.2	Analog inputs .....	80
4.6.3	Analog outputs .....	80
4.6.4	Digital inputs .....	81
4.6.5	Digital outputs .....	81
4.6.6	Connection of relay output .....	81

4.7	HighLine C control terminals .....	82
4.7.1	External supply voltage 24 V .....	82
4.7.2	Analog inputs .....	83
4.7.3	Analog outputs .....	83
4.7.4	Digital inputs .....	84
4.7.5	Digital outputs .....	84
4.7.6	Connection of relay output .....	84
4.7.7	Motor holding brake connection .....	85
4.8	TopLine C control terminals .....	86
4.8.1	Axis bus .....	86
4.8.2	Multi-encoder connection .....	87
4.8.3	Resolver connection .....	89
<b>5</b>	<b>Mechanical installation .....</b>	<b>90</b>
5.1	Important notes .....	90
5.2	Standard devices in a power range of 0.25 ... 3 kW .....	91
5.2.1	Assembly in built-in technique (standard) .....	91
5.2.2	Assembly in push-through technique (thermal separation) .....	100
5.2.3	Mounting in "cold plate" technique .....	105
5.3	Standard devices in the power range 3 ... 22 kW .....	114
5.3.1	Assembly in built-in technique (standard) .....	114
5.3.2	Assembly in push-through technique (thermal separation) .....	123
5.3.3	Mounting in "cold plate" technique .....	131
5.4	Standard devices in a power range of 30 ... 45 kW .....	140
5.4.1	Assembly in built-in technique (standard) .....	140
5.4.2	Mounting in "cold plate" technique .....	150
<b>6</b>	<b>Electrical installation .....</b>	<b>155</b>
6.1	Important notes .....	155
6.1.1	Electrical isolation .....	159
6.1.2	Device protection .....	160
6.1.3	Maximum motor cable length .....	161
6.1.4	Motor protection .....	161
6.1.5	Interaction with compensation equipment .....	161
6.1.6	Safety instructions for the installation according to UL or UR .....	1
6.1.7	Safety instructions for the installation according to UL or UR .....	1

6.2	Installation according to EMC (installation of a CE-typical drive system) .....	5
6.2.1	Shielding .....	5
6.2.2	Mains connection, DC supply .....	7
6.2.3	Motor cable .....	8
6.2.4	Control cables .....	9
6.2.5	Installation in the control cabinet .....	10
6.2.6	Wiring outside of the control cabinet .....	12
6.2.7	Detecting and eliminating EMC interferences .....	14
6.3	Devices in the power range 0.25 ... 2.2 kW (1/N/PE AC 230 V) .....	15
6.3.1	Example circuits .....	15
6.3.2	Terminal assignment of the power connections .....	19
6.4	Devices in the power range 0.37 ... 22 kW (3/PE AC 400 V) .....	26
6.4.1	Example circuits .....	26
6.4.2	Terminal assignment of the power connections .....	29
6.5	Devices in a power range of 30 ... 45 kW (3/PE AC 400 V) .....	38
6.5.1	Example circuits .....	38
6.5.2	Terminal assignment of the power connections .....	39
6.6	Common control terminals .....	48
6.6.1	Important notes .....	48
6.6.2	System bus connection (CANopen) .....	52
6.6.3	Connection of relay output .....	58
6.6.4	Diagnostics .....	60
6.7	StateLine C control terminals .....	61
6.7.1	External supply voltage 24 V .....	61
6.7.2	Analog inputs and outputs .....	62
6.7.3	Digital inputs and outputs .....	65
6.8	HighLine C control terminals .....	67
6.8.1	External supply voltage 24 V .....	67
6.8.2	Analog inputs and outputs .....	69
6.8.3	Digital inputs and outputs .....	72
6.8.4	Motor holding brake connection .....	75
6.9	TopLine C control terminals .....	76
6.9.1	Resolver connection .....	76
6.9.2	Encoder connection .....	77
6.9.3	Axis bus .....	78
<b>7</b>	<b>Commissioning .....</b>	<b>80</b>
7.1	Before switching on .....	80
7.2	Quick commissioning .....	83
7.2.1	Keypad control .....	84
7.2.2	Terminal control .....	86

<b>8</b>	<b>Braking operation</b> .....	<b>88</b>
8.1	Braking operation without additional measures .....	88
8.2	Braking operation with external brake resistor .....	89
8.2.1	Operation at rated mains voltage 230 V .....	89
8.2.2	Operation at rated mains voltage 400 V .....	90
8.2.3	Operation at a rated mains voltage of 500 V .....	91
8.2.4	Selection of the brake resistors .....	92
8.2.5	Rating for Lenze brake resistors .....	93
8.2.6	Wiring of brake resistor .....	95
8.3	Operation with spring-applied brake .....	97
8.3.1	Introduction .....	97
8.3.2	Rated data .....	99
8.3.3	Wiring .....	101
<b>9</b>	<b>DC-bus operation</b> .....	<b>104</b>
9.1	Advantages of DC-bus operation .....	104
9.2	Conditions for trouble-free DC-bus operation .....	104
<b>10</b>	<b>Diagnostics</b> .....	<b>105</b>
10.1	Display of operating data, diagnostics .....	105
10.1.1	Status display via controller LEDs .....	105
10.1.2	Drive diagnostics via keypad .....	108
<b>11</b>	<b>Safety engineering</b> .....	<b>110</b>
11.1	Introduction .....	110
11.2	Important notes .....	111
11.2.1	Hazard and risk analysis .....	112
11.2.2	Standards .....	112
11.2.3	Mission time .....	113
11.3	Acceptance .....	114
11.3.1	Description .....	114
11.3.2	Periodic inspections .....	114
11.4	Basics for safety sensors .....	115
11.5	Operating mode .....	116
11.6	Hardware revision .....	118
11.7	Technical data .....	119
11.8	Electrical installation .....	123
11.9	Certification .....	125
<b>12</b>	<b>Accessories (overview)</b> .....	<b>126</b>
12.1	Overview .....	126
12.2	Mains chokes .....	127

12.3	RFI filter/mains filter .....	129
12.4	Sinusoidal filters .....	131
12.5	External brake resistors .....	132
12.6	Memory module .....	133
12.6.1	E84AYM10S .....	133
12.7	Communication modules .....	134
12.8	Keypad .....	135
12.9	Power supply units .....	136
12.10	Terminals (replacement) .....	137
12.11	EMC accessories .....	139
12.12	Accessories for applications with digital frequency .....	142
<b>13</b>	<b>Appendix .....</b>	<b>143</b>
13.1	Total index .....	143

# 1 About this documentation

## 1 About this documentation

### Contents

The hardware manual provides the complete information on the application as directed of the 8400 controllers of the StateLine C, HighLine C, and TopLine C versions.

### Validity

Type	Type designation	from hardware version	from software version
8400 StateLine C	E84AVSCxxxxx	VA	01.00
8400 HighLine C	E84AVHCxxxxx	VA	01.00
8400 TopLine C	E84AVTCxxxxx	VA	01.00

### Target group

This Hardware Manual is intended for all persons who design, install, commission, and adjust controllers of the 8400 Inverter Drives product range.



### Tip!

Information and tools concerning the Lenze products can be found in the download area at [www.lenze.com](http://www.lenze.com)



## 1.1 Document history

Material number	Version			Description
13564879	11.0	05/2019	TD15	Error corrections Change: Output frequency adapted to the dual-use regulation, 1000 Hz -> 599 Hz Supplement: DC-bus operation
13481094	10.0	01/2015	TD14	Complemented: Conformity EAC Corrected: Error, data according to UL
13457188	9.1	03/2014	TD14	Information on safety engineering: HW revision 2A
13418876	9.0	12/2012	TD15	Error corrections
13394172	8.1	11/2011	TD14	Changed dimension sheets Error corrections
13385308	7.1	08/2011	TD14	Error corrections
13353079	7.0	11/2010	TD03	Added: <ul style="list-style-type: none"> <li>● Devices of size 7 (30 ... 45 kW)</li> <li>● Devices of the TopLine version</li> </ul> Error corrections
13321942	6.0	12/2009	TD03	Supplemented by devices of device size 6 (18.5 ... 22kW) Error corrections
13296844	5.0	04/2009	TD03	Supplemented by push-through and cold plate technique for devices of device size 5
13277975	4.0	11/2008	TD03	Supplemented by devices of device size 5 (7 ... 15kW)
13261567	3.0	07/2008	TD03	Supplemented by devices in the HighLine version
13255657	2.1	06/2008	TD03	Supplements to the chapter "Electrical installation"
13252301	2.0	04/2008	TD03	Complete revision
13234980	1.0	10/2007	TD15	First edition

# 1 About this documentation

## Conventions used

### 1.2 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

#### Spelling of numbers

Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
-------------------	-------	---





#### Warnings

UL warnings		Given in English and French
UR warnings		

#### Text

Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
--------------	-----	--

#### Icons

Page reference		Reference to another page with additional information For instance:  16 = see page 16
Documentation reference		Reference to another documentation with additional information For example:  EDKxxx = see documentation EDKxxx

### 1.3 Terms and abbreviations used

<b>Term</b>	<b>Meaning</b>
Device size	Used as generic term for a group of devices which have the same dimensions (depth, height and width) but different power ratings.
Standard device	Used as generic term when actions and features are described which are very similar or the same for different versions or device sizes, e.g. <ul style="list-style-type: none"><li>• mechanical installation or</li><li>• power terminals</li></ul>
<b>Abbreviation</b>	<b>Meaning</b>
Cat.	Category according to EN ISO 13849-1
OSSD	Output Signal Switching Device, tested signal output
PWM	Pulse width modulation
SIL	Safety Integrity Level according to IEC 61508
SU	Safety Unit
OFF state	Signal status of the safety sensors when safety sensors are activated or respond
ON state	Signal status of the safety sensors during normal operation
STO	Safe Torque Off Former designation: safe standstill

# 1 About this documentation

Notes used

## 1.4 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
 <b>Danger!</b>	<b>Danger of personal injury through dangerous electrical voltage.</b> Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Danger!</b>	<b>Danger of personal injury through a general source of danger.</b> Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Stop!</b>	<b>Danger of property damage.</b> 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
 <b>Note!</b>	Important note to ensure troublefree operation
 <b>Tip!</b>	Useful tip for simple handling
	Reference to another documentation

### Special safety instructions and application notes

Pictograph and signal word	Meaning
 <b>Warnings!</b>	<b>Safety note or application note for the operation according to UL or CSA requirements.</b>
 <b>Warnings!</b>	The measures are required to meet the requirements according to UL or CSA.

## 2 Safety instructions

### 2.1 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 assets:

- ▶ 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 this 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 Drives GmbH does not accept any liability for the suitability of the procedures and circuit proposals described.
- ▶ Depending on their degree of protection, some parts of the Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their accessory components can be live, moving and rotating during operation. Surfaces can be hot.
  - Non-authorized removal of the required cover, inappropriate use, incorrect installation or operation, creates 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 2006/42/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 electrostatic 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.

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.

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation. The controllers must be installed in housings (e.g. control cabinets) to meet the limit values for radio interferences valid at the site of installation. The housings must enable an EMC-compliant installation. Observe in particular that e.g. the control cabinet doors have a circumferential metal connection to the housing. Reduce housing openings and cutouts to a minimum.

Lenze controllers may cause a DC current in the PE conductor. If a residual current device (RCD) is used for protection against direct or indirect contact for a controller with three-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the controller. If the controller has a single-phase supply, a residual current device (RCD) of type A is also permissible. Apart from using a residual current device (RCD), other protective measures can be taken as well, e.g. electrical isolation by double or reinforced insulation or isolation from the supply system by means of 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 terminals 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.

### Safety functions

Certain controller versions support safety functions (e.g. "Safe torque off", formerly "Safe standstill") according to the requirements of the EC Directive 2006/42/EC (Machinery Directive). The notes on the integrated safety system provided in this documentation must be observed.

### Maintenance and servicing

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

### Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

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

**2.2 General safety and application instructions for Lenze motors**

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

**General**

Low-voltage machines have dangerous, live and rotating parts as well as possibly hot surfaces.

Synchronous machines induce voltages at open terminals during operation.

All operations serving transport, connection, commissioning and maintenance are to be carried out by skilled, responsible technical personnel (observe EN 50110-1 (VDE 0105-1) and IEC 60364). Improper handling can cause severe injuries or damages.

Lowvoltage 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**

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

Lowvoltage 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).

Lowvoltage 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 Aside 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 lowvoltage 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, dustfree and low-vibration ( $v_{\text{eff}} \leq 0.2 \text{ mm/s}$ ) environment (bearing damage while being stored).



### Installation

Ensure an even surface, solid foot/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 halfkey balanced. The clutch must be halfkey 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 lowvoltage 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 600341; IEC 34 (VDE 05301) voltage  $\pm 5\%$ , frequency  $\pm 2\%$ , 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 connectors must be bolted tightly (tostop).

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

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 insulation resistance. In case of values  $\leq 1 \text{ k}\Omega$  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 lowvoltage 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  $I > I_{\text{rated}}$  after a few seconds of operation, especially at the risk of blocking.

Vibrational severities  $v_{\text{eff}} \leq 3.5 \text{ mm/s}$  ( $P_{\text{rated}} \leq 15 \text{ kW}$ ) or  $4.5 \text{ mm/s}$  ( $P_{\text{rated}} > 15 \text{ kW}$ ) 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 lowvoltage machine.

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

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

Regrease bearings with relubricating devices while the lowvoltage 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 nondrive 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!!**

## 2.3 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

- ▶ Connect/disconnect all pluggable terminals only in deenergised condition!
- ▶ Detach the controllers from the installation, e.g. from the rear panel of the control cabinet, only in deenergised condition!

### 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.
- ▶ Switch **contactors in the motor cable** only if the controller is inhibited.  
When switching contactors in the motor cable while the controller is enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.

### Parameter set transfer

- ▶ During the parameter set transfer, control terminals of the controllers can adopt undefined states!
  - Therefore, it is absolutely necessary to remove control terminal X4 (digital input signals for devices of the StateLine C version) or control terminal X5 (digital input signals for devices of the HighLine C/TopLine C version). This ensures that the controller is inhibited and all control terminals have the firmly defined "LOW" status.

### 3 Product description

#### Device features

### 3 Product description

#### 3.1 Device features

Features	Version		
	StateLine C	HighLine C	TopLine C
Power range from 250 W to 45 kW	✓	✓	✓
Communication and diagnostic interfaces	✓	✓	✓
Integrated interference suppression acc. to EN 61800-3	✓	✓	✓
Integrated DC-bus connection for devices with 400 V mains connection	✓	✓	✓
Flying restart circuit	✓	✓	✓
Integrated brake management	✓	✓	✓
Integrated brake chopper	✓	✓	✓
Optionally: Integrated safety system "Safe torque off (STO)"	✓	✓	✓
Operating modes:			
VFCplus: V/f open loop control, linear and quadratic	✓	✓	✓
VFCplus: Freely definable characteristic	✓	✓	✓
VFCplus eco: Energy-efficient V/f characteristic	-	✓	✓
SLVC: Sensorless vector control (torque / speed)	✓	✓	✓
VFCplus: V/f closed loop control for speed-controlled applications	✓	✓	✓
SC: Servo control ASM (torque / speed)	-	✓	✓
SC: Servo control PSM (torque / speed)	-	✓	✓
SL PSM: Sensorless synchronous control (torque / speed)	-	✓	✓
S-shaped ramps for almost jerk-free acceleration and deceleration	✓	✓	✓
200 % overload current (3 s)	✓	✓	✓
IT system usability	✓	✓	✓
Protection against restart for cyclic mains switching	✓	✓	✓
CANopen baud rate	Up to 1000 kbps	Up to 1000 kbps	Up to 1000 kbps
Speed feedback			
Incremental HTL encoder Evaluation: Single-track / two-track	10 kHz	10 kHz and 200 kHz	10 kHz and 200 kHz
Incremental TTL encoder	-	-	✓
SSI	-	-	✓
1 V <sub>SS</sub> sin/cos encoder	-	-	✓
1 V <sub>SS</sub> sin/cos absolute value encoder (Hiperface)	-	-	✓
Applications			
Actuating drive	✓	✓	✓
Table positioning	-	✓	✓
Switch-off positioning	✓	✓	✓
Touch probe	-	✓	✓
Axis bus	-	-	✓
Digital frequency coupling	-	-	✓
Digital 2.5 A output with integrated spark suppressor, e.g. for the direct control of a 24 V motor holding brake	-	✓	✓

**Supplementary information with regard to export control**

By limiting the maximum output frequency to  $\pm 599$  Hz, the devices are not subject to the export restrictions of the "EC-Dual-Use Regulation" - EC 428/2009. This applies to devices supplied from the middle of the year 2015.

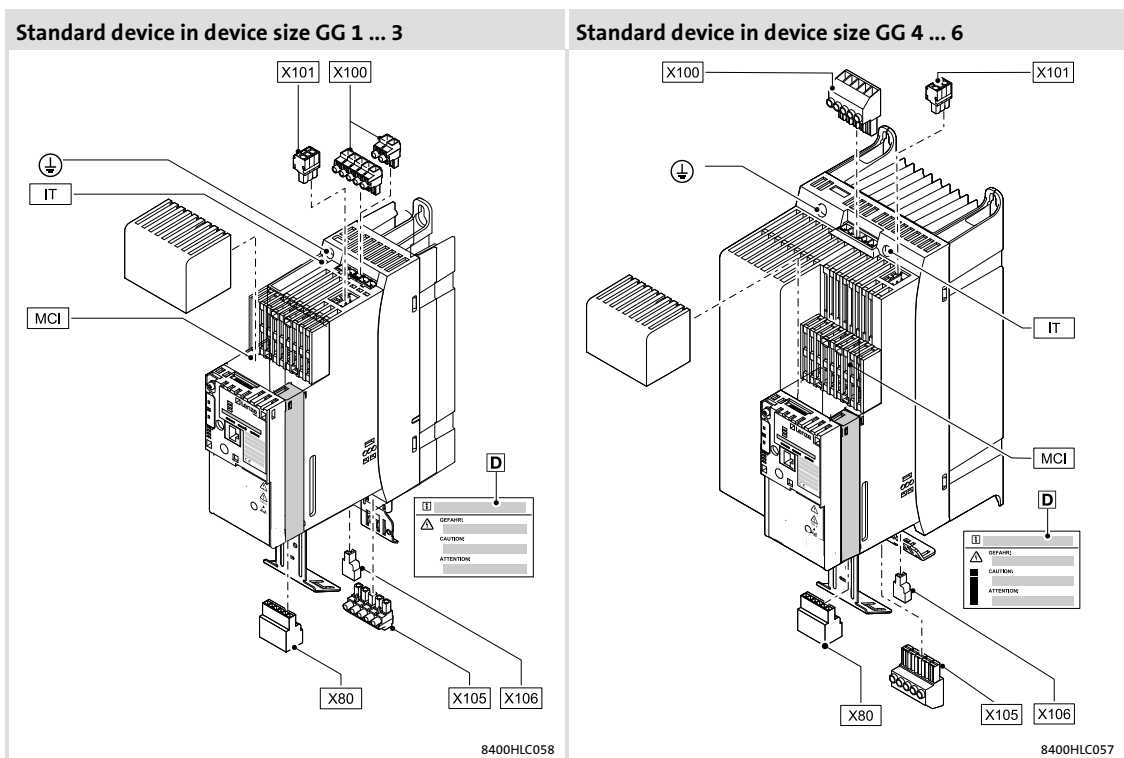
The maximum possible output frequency is specified on the nameplate. The technical data have been adapted with the hardware manual V11.0 release.

For certain applications, devices with the previous maximum output frequency of  $\pm 1000$  Hz may be supplied. If necessary, get in touch with your Lenze contact person.

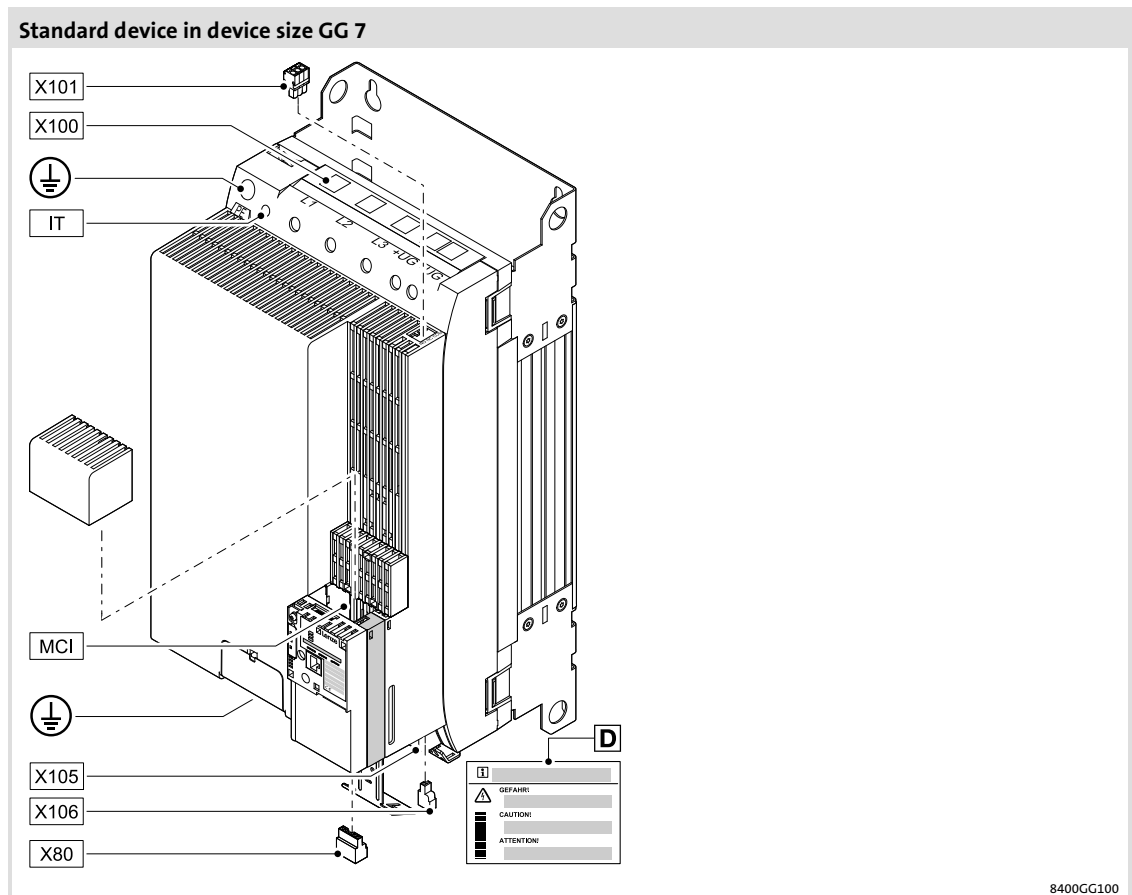
### 3.2 Overview of standard devices

#### Allocation of the device sizes

Device size	Power range [kW]
GG 1	0.25 ... 0.37
GG 2	0.55 ... 0.75
GG 3	1.1 ... 3.0
GG 4	3.0 ... 5.5
GG 5	7.5 ... 15.0
GG 6	18.5 ... 22.0
GG 7	30.0 ... 45.0



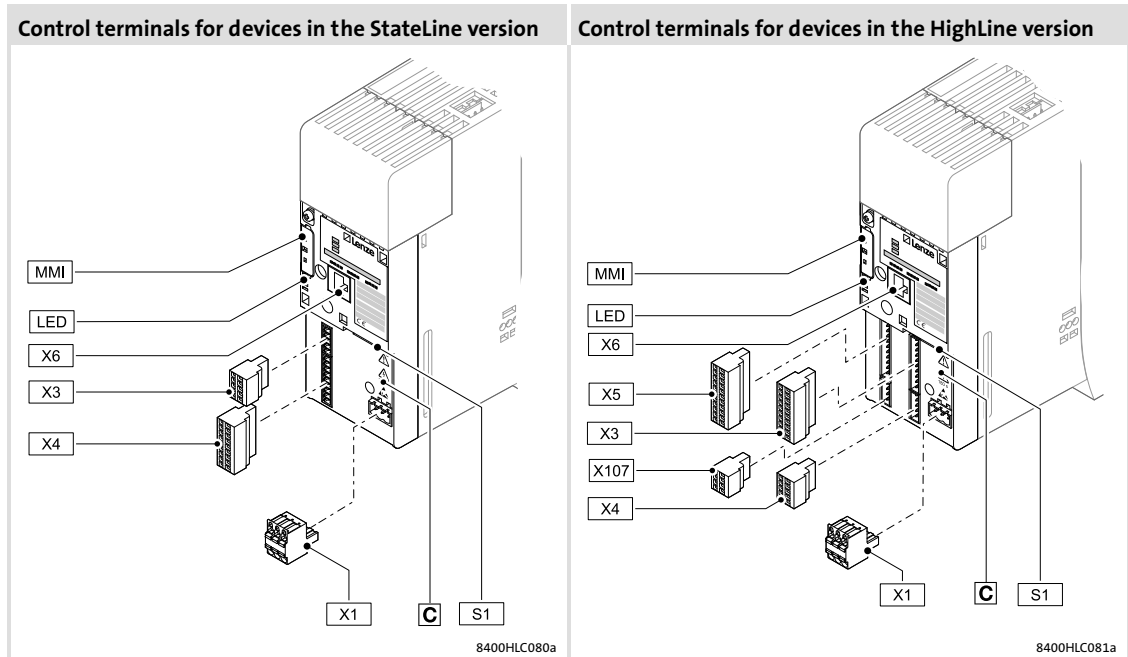
Connection		Information	
Pos.	Description	230 V	400 V
X80	Terminal strip for the integrated safety unit	📖 110	
X100	Mains/DC-bus voltage (for 400 V devices) – For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable.	📖 21	📖 31
X101	Relay output	📖 58	
X105	Motor/external brake resistor – For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable.	📖 25	📖 35
X106	Motor temperature monitoring	📖 24	📖 36
IT	Contact screw for interference suppression (on the supply side/on the motor side)	📖 22	📖 33
MCI	Slot for communication module (Module Communication Interface)	📖 134	
Ⓜ	Sticker with warning	-	



Connection		Information	
		230 V	400 V
X80	Terminal strip for the integrated safety unit	-	110
X100	Mains/DC-bus voltage (for 400 V devices) – For devices of device size 7 (30 ... 45 kW) this terminal strip is not pluggable.	-	41
X101	Relay output	-	58
X105	Motor/external brake resistor – For devices of device size 7 (30 ... 45 kW) this terminal strip is not pluggable.	-	45
X106	Motor temperature monitoring	-	46
IT	Contact screw for interference suppression (on the supply side/on the motor side)	-	43
MCI	Slot for communication module (Module Communication Interface)	-	134
D	Sticker with warning	-	-



3.3 Overview of control terminals

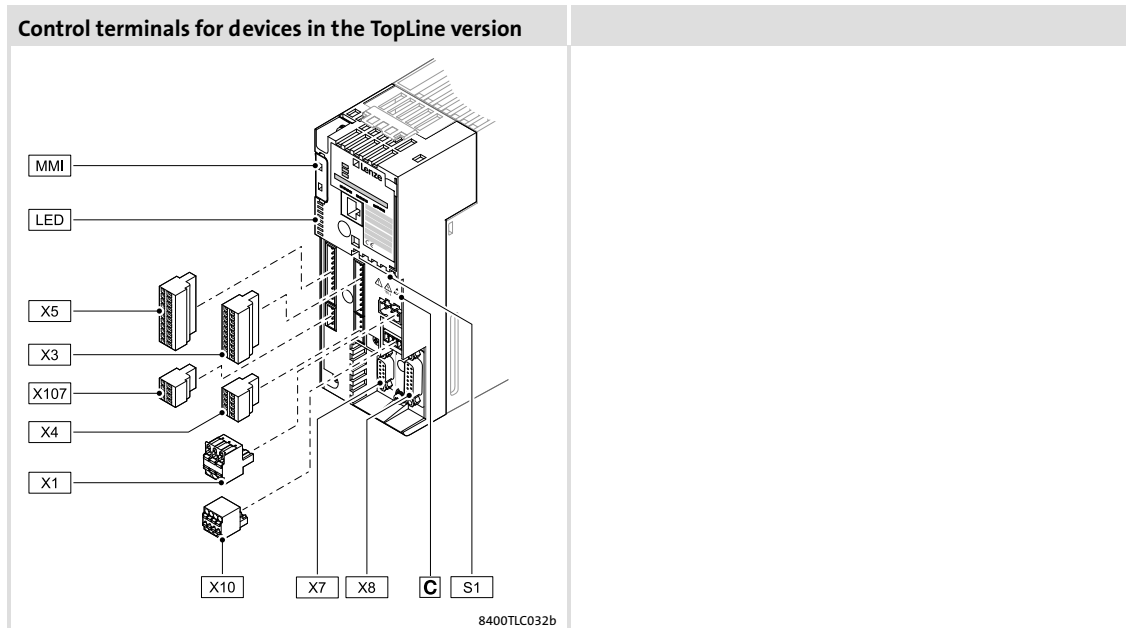


Connection		Information	
Pos.	Description	StateLine C	HighLine C
X1	CANopen connection	📖 52	
S1	CANopen settings		
X3	Analog inputs/outputs; 10V reference voltage	📖 62	📖 69
X4	Digital inputs; controller enable	📖 73	-
	24 V supply of the control electronics		📖 73
	Digital outputs		
X5	24 V voltage output		
	Digital inputs; controller enable		📖 72
X6 (DIAG)	External 24V supply of the control electronics; internal 24V supply fused via PTC	-	
X6 (DIAG)	Diagnostic interface	📖 60	
X107	24 V brake supply;	-	📖 75
	+ BD1 - BD2		
MMI	Slot for memory module (Memory Module Interface)	📖 133	

Icon	Description
	<b>Long discharge time:</b> All power terminals remain live for a few minutes after mains disconnection! The duration is given under the warning symbol on the device.
	<b>High leakage current:</b> Carry out fixed installation and PE connection according to EN 61800-5-1!
	<b>Electrostatic sensitive devices:</b> Before working on the device, the personnel must be free of electrostatic charge!
	<b>Hot surface:</b> Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

## Product description

### Overview of control terminals



Connection		Information	
Pos.	Description	TopLine C	
X1	CANopen connection		
S1	CANopen settings	52	
	Settings for CANopen terminating resistor and axis bus		
X3	Analog inputs / outputs; 10 V reference voltage	69	
X4	Digital inputs; controller enable		
	24 V supply of the control electronics		
	Digital outputs	73	
	24 V voltage output	73	
X5	Digital inputs; controller enable		
	External 24 V supply of the control electronics; internal 24 V supply, fused via PTC	72	
X6 (DIAG)	Diagnostic interface	60	
X7	Resolver	76	
X8	Encoder	77	
X10	Axis bus	78	
X107	24 V brake supply		
	+ BD1	Connection for DC brake coil	75
	- BD2		
MMI	Slot for memory module (Memory Module Interface)	133	

Icon	Description
	<b>Long discharge time:</b> All power terminals remain live for a few minutes after mains disconnection! The duration is given under the warning symbol on the device.
	<b>High leakage current:</b> Carry out fixed installation and PE connection according to EN 61800-5-1!
	<b>Electrostatic sensitive devices:</b> Before working on the device, the personnel must be free of electrostatic charge!
	<b>Hot surface:</b> Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

### 3.4 Identification

The type data used in this manual refer to the nameplate which is placed at the front of the controller (Fig. 3-1).

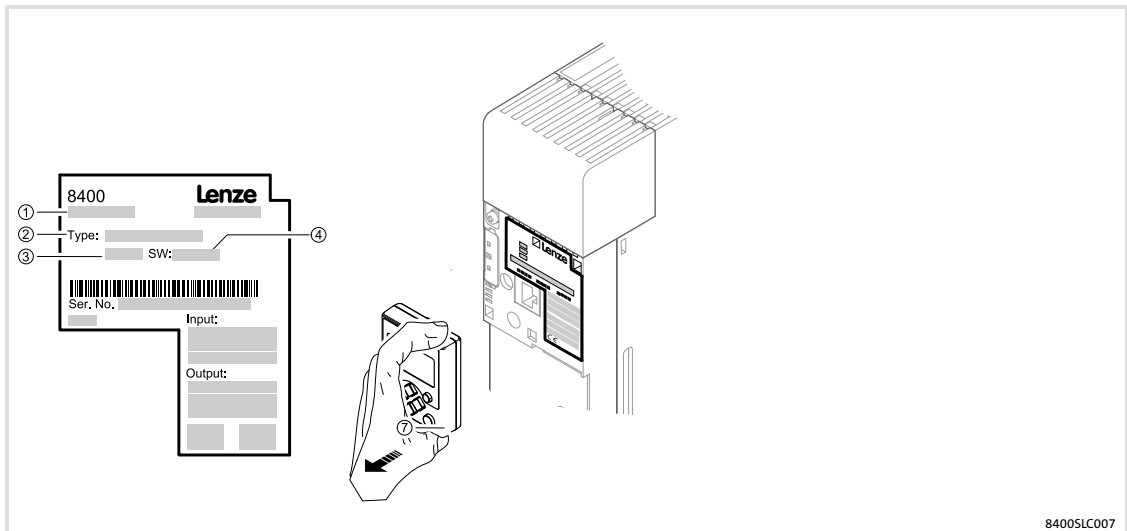


Fig. 3-1 Contents and position of the nameplate

- |   |                  |
|---|------------------|
| ① | Device version   |
| ② | Product key      |
| ③ | Rated power      |
| ④ | Software version |

84005LC007

## 3.5


## Product key

	E84	A	V	xx	x	xxx	x	x	x	x
<b>Product range</b> Inverter Drives 8400										
<b>Version</b> A = 1. version										
<b>Inverter type</b> V = vector-controlled inverter										
<b>Version</b> SC = StateLine C HC = HighLine C TC = TopLine C										
<b>Mounting type</b> E = installation D = push-through technique C = cold plate technology										
<b>Power e.g.</b> 251 = $25 \times 10^1 \text{ W} = 0.25 \text{ kW}$ 222 = $22 \times 10^2 \text{ W} = 2.2 \text{ kW}$										
<b>Voltage class</b> 2 = 230/240 V, 1/N/PE AC (0.25 ... 2.2 kW) 4 = 400/500 V, 3/PE AC (0.37 ... 45 kW)										
<b>Ambient conditions</b> S = standard industrial environment IE33 according to IEC 60721-3-3 standard V = rough environment (coated printed circuit boards)										
<b>Safety system</b> X = without safety system B = with integrated safety system "Safe torque off (STO)"										
<b>Special design</b> 0 = without (standard) S = reduced device dimension - "Slim"										

The nameplate serves to identify delivered products by nameplate data. The product catalogue provides information on the possible configuration to order the products.

## 4 Technical data

### 4.1 General data and operating conditions

Conformity and approval			
Conformity			
CE	2006/95/EC	Low-Voltage Directive	
EAC	TP TC 004/2011 (TR CU 004/2011)	About the safety of low voltage equipment	Eurasian conformity TR CU: Technical Regulations of Customs Union
	TP TC 020/2011 (TR CU 020/2011)	Electromagnetic compatibility of technical products	
Approval			
UL	UL 508C	<ul style="list-style-type: none"> <li>• Device size 1 ... 7 (0.25 ... 45 kW)</li> <li>• Certification of the integrated safety system: see chapter 11.9</li> </ul>	
CSA	CSA 22.2 No. 14	<ul style="list-style-type: none"> <li>• Device size 1 ... 7 (0.25 ... 45 kW)</li> <li>• only when using an external mains choke or a module for reducing transients, compare chapter 6.1.6</li> </ul>	
Protection of persons and device protection			
Type of protection	EN 60529	IP 20  22	Specification <ul style="list-style-type: none"> <li>• applies to the fully assembled state ready for use</li> <li>• does not apply to the wire range of the terminals</li> </ul>
	NEMA 250	Protection against accidental contact acc. to type 1	
Insulation resistance	EN 61800-5-1	Overvoltage category III Above 2000 m amsl: Overvoltage category II	
Control circuit isolation	EN 61800-5-1	Safe mains isolation via double / reinforced insulation for star-point earthed mains with a rated voltage for external conductors / star point of up to 300 V.	
Short-circuit strength Earth-fault strength	EN 61800-5-1	Motor connection: Limited, i.e. an internal protective device responds, the controller is inhibited (Error acknowledgement is required) Control terminals: Without limitation	
Protective measures against		<ul style="list-style-type: none"> <li>• Short circuit</li> <li>• Earth fault (Earth fault strength depends on the operating status)</li> <li>• Overvoltage</li> <li>• Motor stalling</li> <li>• Motor overtemperature (PTC or thermal contact, I<sup>2</sup>t-monitoring)</li> </ul>	
Leakage current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe regulations and safety instructions!
Mains switching		<ul style="list-style-type: none"> <li>• Mains switching 3 times in 9 minutes (without restrictions)</li> <li>• More frequent mains switching, e.g. during setting-up operation, does not harm the controller.                             <ul style="list-style-type: none"> <li>– Devices of up to 22 kW are protected against overload. A monitoring issues the "Su03" message. The message must be acknowledged via mains switching. Before you switch on again: Let the device cool down!</li> <li>– Devices from 30 kW are protected by the dimensioning of the load circuit. Monitoring is not carried out.</li> </ul> </li> </ul>	
Starting current		≤ 2 x I <sub>rated</sub>	

Supply conditions		
AC mains operation		Direct connection
Power systems		
TT		Operation permitted without restrictions
TN		
With earthed phase	EN 61800-5-1	Operation permitted if additional measures are taken: <ul style="list-style-type: none"> <li>• Overvoltage reduction to overvoltage category II required. If protection against accidental contact is required for the control terminals, external measures must be taken.</li> <li>• The measures described for IT systems must be taken.</li> </ul> Operation is <b>not</b> permissible: <ul style="list-style-type: none"> <li>• With integrated safety system, e.g. E84AVxxxxxxxBx</li> </ul>
IT		Observe instructions regarding special measures.
DC-bus operation		Direct connection possible for devices with 400 V mains connection.
Motors		Only use motors suitable for inverter operation. Lenze L-force motors comply with the requirements.

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) Operation at 2/4 kHz, +45 ... +55 °C: Reduce rated output current by 2.5 %/°C  Operation at 8/16 kHz, +40 ... +55 °C: Reduce rated output current by 2.5 %/°C
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: Reduce rated output current by 5 %/1000 m 2000 ... 4000 m amsl: overvoltage category II
Pollution	EN 61800-5-1	Degree of pollution 2
Vibration resistance (9.81 m/s <sup>2</sup> = 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 <sup>2</sup> 200 ... 500 Hz: acceleration resistant up to 15 m/s <sup>2</sup>
Operation	Germanischer Lloyd	5 ... 13.2 Hz: Amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g
		EN 61800-5-1

Requirements on the motor cable		
Capacitance per unit length		
$\leq 2.5 \text{ mm}^2/\text{AWG 14}$		$C_{\text{Core/core}}/C_{\text{Core/shield}} < 75/150 \text{ pF/m}$
$\geq 4 \text{ mm}^2/\text{AWG 12}$		$C_{\text{Core/core}}/C_{\text{Core/shield}} < 150/300 \text{ pF/m}$
Electric strength		
	VDE 0250-1	$U_0/U \geq 0.6/1.0 \text{ kV}$ ( $U_0$ = r.m.s. value external - conductor/PE, $U$ = r.m.s. value - external conductor/external conductor)
	UL	$U \geq 600 \text{ V}$ ( $U$ = r.m.s. value external conductor/external conductor)

### Motor cable lengths without considering EMC limit values

U <sub>rated</sub> [V]	P <sub>rated</sub> [kW]	Maximum length of the shielded motor cable [m] <sup>1)</sup>		
		after switching frequencies		
		4 kHz <sup>2)</sup>	8 kHz	16 kHz
230	0.25 ... 2.2	50	50	50
400	0.37 ... 2.2	50	50	25
500	0.37 ... 2.2	50	25	15
400/500	3 ... 15	50	50	50
400/500	18.5 ... 45	100	100	100

<sup>1)</sup> If EMC conditions must be complied with, the permissible cable lengths may be shorter.

<sup>2)</sup> Up to an ambient temperature of 40 °C, the motor cable may be 50 m longer.

### Motor cable lengths with interference suppression

- Device-dependent assignments of the filter are described in the chapter "Accessories", 12.3 and 12.4.

#### Compliance with category C2 (industry), cable-guided

U <sub>rated</sub> [V]	P <sub>rated</sub> [kW]	Maximum length of the shielded motor cable [m]								
		After interference suppression and possible earth-leakage circuit breaker								
		with integrated filter, FI			with SD filter, FI			with LD filter, FI		
		30 mA	300 mA	without	30 mA	300 mA	without	30 mA	300 mA	without
230	0.25 ... 2.2	25	25	25	25	50	50	-	50	100 <sup>3)</sup>
400/500	0.37 ... 2.2	25	25	25	25 <sup>3)</sup>	50 <sup>3)</sup>	50 <sup>3)</sup>	-	50 <sup>3)</sup>	100 <sup>3)</sup>
400/500	3.0 ... 15	-	25	25	25	50	50	-	50	100 <sup>3)</sup>
400/500	18.5 ... 45	-	25	25	-	-	-	-	50	100

<sup>3)</sup> Comply with switching frequency-dependent restrictions according to "motor cable lengths without considering EMC limit values" table

#### Compliance with category C1 (residential areas, public systems), cable-guided

U <sub>rated</sub> [V]	P <sub>rated</sub> [kW]	Maximum length of the shielded motor cable [m]								
		After interference suppression and possible earth-leakage circuit breaker								
		with LL filter <sup>4)</sup> , FI			with SD filter, FI			with LD filter, FI		
		30 mA	300 mA	without	30 mA	300 mA	without	30 mA	300 mA	without
230	0.25 ... 2.2	5	5	5	25	25	25	-	50	50
400/500	0.37 ... 2.2	-	-	-	25 <sup>3)</sup>	25 <sup>3)</sup>	25 <sup>3)</sup>	-	50 <sup>3)</sup>	50 <sup>3)</sup>
400/500	3.0 ... 15	-	-	-	25	25	25	-	50	50
400/500	18.5 ... 45	-	-	-	-	-	-	-	50	50

<sup>3)</sup> Comply with switching frequency-dependent restrictions according to "motor cable lengths without considering EMC limit values" table

<sup>4)</sup> If LL filters are used, the ≤ fault current is 3.5 mA and no fixed installation is required.



EMC		
Interference emission		
cable-guided	EN 61800-3	Up to a shielded motor cable length of 25 m: Category C2 With interference suppression: Category C1
Radiation		Category C2
Immunity to interference (acc. to EN 61800-3 requirements)		
Electrostatic discharge (ESD)	EN 61000-4-2	Air discharge: 8 kV, Contact discharge to housing: 4 kV
High frequency		
cable-guided	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)
Burst		
Power connections and interfaces	EN 61000-4-4	2 kV/5 kHz
Signal interfaces	EN 61000-4-4	1 kV/5 kHz
Control terminals	EN 61000-4-4	2 kV/5 kHz
Surge (surge voltage)		
Power connections	EN 61000-4-5	1.2/50 $\mu$ s, 1 kV phase-phase, 2 kV phase-PE
Control terminals	EN 61000-4-5	1.2/50 $\mu$ s, 1 kV
Operation on public supply systems	EN 61000-3-2 EN 61000-3-12	The devices are intended for the use in industrial environments. If they are used on public systems, measures must be taken to limit the radio interference to be expected. The machine / system manufacturer is responsible for compliance with the machine / system requirements!
	EN 61000-3-2	< 0.5 kW: With mains choke 0.5 ... 1 kW: With active filter > 1 kW at a mains current of $\leq$ 16 A: No limit values for harmonic currents
	EN 61000-3-12	Mains current > 16 A: in combination with an assigned mains choke or mains filter, in case of dimensioning for operation with rated power. The requirement for the short-circuit power ratio $RSCE \geq 120$ has to be met. RSCE is the short-circuit power ratio at the connection point of the machine/plant to the public network.

Open and closed loop control		
<b>Open and closed loop control processes</b>		
	V/f characteristic control (VFCplus) <ul style="list-style-type: none"> <li>• Operation of asynchronous machines with a linear load torque characteristic</li> <li>• Operation of asynchronous machines with a quadratic load torque characteristic</li> </ul>	
	V/f control (VFCplus + encoder) <ul style="list-style-type: none"> <li>• V/f characteristic control VFCplus with additional speed feedback</li> </ul>	
	Energy-saving V/f characteristic control (VFCplusEco) <ul style="list-style-type: none"> <li>• Reduction of the power loss in the partial load operational range</li> </ul>	
	Sensorless vector control (SLVC) <ul style="list-style-type: none"> <li>• Encoderless control of asynchronous machines</li> </ul>	
	Sensorless vector control (SLPSM) <ul style="list-style-type: none"> <li>• Encoderless control of synchronous machines</li> </ul>	
	Servo control (SC) <ul style="list-style-type: none"> <li>• Dynamic control of asynchronous machines in all quadrants</li> <li>• Dynamic control of synchronous machines in all quadrants</li> </ul>	
<b>Switching frequency</b>		
	2 kHz, 4 kHz, 8 kHz, 16 kHz, Optionally noise optimised or power-loss optimised	
<b>Torque behaviour</b>		
Setting range SC ASM	1 : 20 ... 50	Valid for power- / current-adapted motor and correct parameterisation.
Setting range SC PMSM	1 : 20 ... 40	Valid for power- / current-adapted motor and correct parameterisation.
Setting range SLVC	1 : 10 ... 20	Valid for power- / current-adapted motor and correct parameterisation.
Setting range SLPSM	1 : 10 ... 20	Valid for power- / current-adapted motor and correct parameterisation. Information exclusively refers to controlled operational range.
Note: The setting range depends on the accuracy of the nameplate data and the equivalent circuit diagram data of the motor. Depending on the data quality, the above-stated setting ranges may differ. In the case of special motors or strong differences in the dimensioning of motor and controller, the values may also differ.		
<b>Sensorless vector control (speed)</b>		
Minimum output frequency	0.5 Hz (0 ... $M_{rated}$ )	
Setting range	1 : 10	Based on 50 Hz and $M_{rated}$
Accuracy	±0.5 %	In a setting range of 3 ... 50 Hz
Smooth running	±0.1 Hz	
<b>Output frequency</b>		
Range	-599 Hz ... +599 Hz	
Absolute resolution	0.02 Hz	
Standardised resolution	Parameter data: 0.01 %, process data: 0.006 % (= 2 <sup>14</sup> )	
<b>Digital setpoint selection</b>		
Accuracy	±0.01 %	
<b>Analog setpoint selection</b>		
Accuracy	±0.5 %	Based on the final value

## 4.2 Rated data

### 4.2.1 Overview

#### Input data

Basis of the data					
Mains	Voltage $U_{\text{Rated}}$ [V]	Voltage range $U_{\text{Rated}}$ [V]	Frequency range $f$ [Hz]		
1/N/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %		
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %		
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %		

	Voltage [V]	Frequency [Hz]	Rated current [A]		Number of phases
			up to +45 °C ①	up to +55 °C ①	
E84AVxxx2512	230	50/60	3.4	2.6	1
E84AVxxx3712	230	50/60	5.0	3.8	1
E84AVxxx5512	230	50/60	5.3	4.0	1
E84AVxxx7512	230	50/60	8.0	6.0	1
E84AVxxx1122	230	50/60	12.0	9.0	1
E84AVxxx1522	230	50/60	13.7	10.3	1
E84AVxxx2222	230	50/60	21.8	16.4	1
E84AVxxx3714	400/500	50/60	1.8/1.4	1.4/1.1	3
E84AVxxx5514	400/500	50/60	2.5/2.0	2.0/1.7	3
E84AVxxx7514	400/500	50/60	3.6/2.6	2.7/2.2	3
E84AVxxx1124	400/500	50/60	4.4/3.6	3.3/2.7	3
E84AVxxx1524	400/500	50/60	5.5/4.4	4.1/3.3	3
E84AVxxx2224	400/500	50/60	7.3/5.8	5.5/4.4	3
E84AVxxx3024xx5	400/500	50/60	9.8/7.8	7.4/5.9	3
E84AVxxx3024xx0	400/500	50/60	9.8/7.8	7.4/5.9	3
E84AVxxx4024	400/500	50/60	13.1/10.5	9.8/7.8	3
E84AVxxx5524	400/500	50/60	18/14.4	13.5/10.8	3
E84AVxxx7524	400/500	50/60	20.0/16.0	15.0/12.0	3
E84AVxxx1134	400/500	50/60	29.0/23.2	21.7/17.4	3
E84AVxxx1534	400/500	50/60	29.0 <sup>1)</sup> /23.2 <sup>1)</sup>	21.4 <sup>1)</sup> /17.4 <sup>1)</sup>	3
E84AVxxx1834	400/500	50/60	50.4/43.4	37.8/32.6	3
E84AVxxx2234	400/500	50/60	42.0 <sup>1)</sup> /36.1 <sup>1)</sup>	31.5 <sup>1)</sup> /27.1 <sup>1)</sup>	3
E84AVxxx3034	400/500	50/60	55.0 <sup>1)</sup> /46.9 <sup>1)</sup>	41.3 <sup>1)</sup> /35.2 <sup>1)</sup>	3
E84AVxxx3734	400/500	50/60	68.0 <sup>1)</sup> /58.2 <sup>1)</sup>	51.0 <sup>1)</sup> /43.7 <sup>1)</sup>	3
E84AVxxx4534	400/500	50/60	80.0 <sup>1)</sup> /69.2 <sup>1)</sup>	60.0 <sup>1)</sup> /51.9 <sup>1)</sup>	3

① Ambient temperature in the control cabinet, switching frequency 2 and 4 kHz, operation without mains choke  
<sup>1)</sup> only with external mains choke

## Output data

	Voltage [V]	Frequency [Hz]	Rated current [A]		Number of phases
			up to +45 °C ①	up to +55 °C ①	
E84AVxxx2512	0 - 230	0 - 599	1.7	1.3	3
E84AVxxx3712	0 - 230	0 - 599	2.4	1.8	3
E84AVxxx5512	0 - 230	0 - 599	3.0	2.3	3
E84AVxxx7512	0 - 230	0 - 599	4.0	3.0	3
E84AVxxx1122	0 - 230	0 - 599	5.5	4.1	3
E84AVxxx1522	0 - 230	0 - 599	7.0	5.3	3
E84AVxxx2222	0 - 230	0 - 599	9.5	7.1	3
E84AVxxx3714	0 - 400/500	0 - 599	1.3/1.0	1.0/0.8	3
E84AVxxx5514	0 - 400/500	0 - 599	1.8/1.4	1.4/1.0	3
E84AVxxx7514	0 - 400/500	0 - 599	2.4/1.9	1.8/1.4	3
E84AVxxx1124	0 - 400/500	0 - 599	3.2/2.6	2.4/2.0	3
E84AVxxx1524	0 - 400/500	0 - 599	3.9/3.1	2.9/2.3	3
E84AVxxx2224	0 - 400/500	0 - 599	5.6/4.5	4.2/3.4	3
E84AVxxx3024xx5	0 - 400/500	0 - 599	7.3/5.8	5.5/4.4	3
E84AVxxx3024xx0	0 - 400/500	0 - 599	7.3/5.8	5.5/4.4	3
E84AVxxx4024	0 - 400/500	0 - 599	9.5/7.6	7.1/5.7	3
E84AVxxx5524	0 - 400/500	0 - 599	13/10.4	9.8/7.8	3
E84AVxxx7524	0 - 400/500	0 - 599	16.5/13.2	12.4/9.9	3
E84AVxxx1134	0 - 400/500	0 - 599	23.5/18.8	17.6/14.1	3
E84AVxxx1534	0 - 400/500	0 - 599	32.0/25.6	24.0/19.2	3
E84AVxxx1834	0 - 400/500	0 - 599	40.0/34.0	29.3/25.1	3
E84AVxxx2234	0 - 400/500	0 - 599	47.0/40.4	35.3/30.3	3
E84AVxxx3034	0 - 400/500	0 - 599	61.0/52.0	45.8/39.0	3
E84AVxxx3734	0 - 400/500	0 - 599	76.0/65.0	57.0/48.8	3
E84AVxxx4534	0 - 400/500	0 - 599	89.0/77.0	66.8/57.8	3

① Ambient temperature in the control cabinet, switching frequency 2 and 4 kHz, operation without mains choke

**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]	
	when operating with rated output current $I_{arated}$	when controller is inhibited
E84AVxxx2512	45	
E84AVxxx3712	50	
E84AVxxx5512	60	
E84AVxxx7512	75	
E84AVxxx1122	95	
E84AVxxx1522	110	
E84AVxxx2222	140	
E84AVxxx3714	50	20
E84AVxxx5514	65	
E84AVxxx7514	80	
E84AVxxx1124	95	
E84AVxxx1524	105	
E84AVxxx2224	135	
E84AVxxx3024xx5	165	
E84AVxxx3024xx0	165	
E84AVxxx4024	205	25
E84AVxxx5524	275	
E84AVxxx7524	320	30
E84AVxxx1134	435	
E84AVxxx1534	470	35
E84AVxxx1834	540	
E84AVxxx2234	640	40
E84AVxxx3034	840	
E84AVxxx3734	980	30
E84AVxxx4534	1300	

## 4.2.2 Operation at rated mains voltage 230 V

Basis of the data			
Mains	Voltage $U_{\text{Rated}}$ [V]	Voltage range $U_{\text{Rated}}$ [V]	Frequency range $f$ [Hz]
1/N/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %

Type	Mains current at $I_{\text{aN}}$		Apparent output power  U, V, W $S_{\text{aR}}$ [kVA]	Motor power  4 pol. ASM $P_{\text{aR}}$ [kW]
	with external mains choke  $I_{\text{LR}}$ [A]	without external mains choke  $I_{\text{LR}}$ [A]		
E84AVxxx2512	3.0	3.4	0.6	0.25
E84AVxxx3712	4.2	5.0	0.9	0.37
E84AVxxx5512	5.0	5.3	1.1	0.55
E84AVxxx7512	7.0	8.0	1.4	0.75
E84AVxxx1122	9.9	12.0	2.0	1.1
E84AVxxx1522	11.4	13.7	2.5	1.5
E84AVxxx2222	16.4	21.8	3.4	2.2

## Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx2512	No	ELN1-0900H005
E84AVxxx3712	No	
E84AVxxx5512	No	ELN1-0500H009
E84AVxxx7512	No	
E84AVxxx1122	No	ELN1-0250H018
E84AVxxx1522	No	
E84AVxxx2222	No	

### Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{arated2}$	$I_{aM2}$	$I_{arated4}$	$I_{aM4}$	$I_{arated8}$	$I_{aM8}$	$I_{arated16}$	$I_{aM16}$
E84AVxxx2512	1.7	3.4	1.7	3.4	1.7	3.4	1.1	2.8
E84AVxxx3712	2.4	4.8	2.4	4.8	2.4	4.8	1.6	4.0
E84AVxxx5512	3.0	6.0	3.0	6.0	3.0	6.0	2.0	5.0
E84AVxxx7512	4.0	8.0	4.0	8.0	4.0	8.0	2.7	6.6
E84AVxxx1122	5.5	11.0	5.5	11.0	5.5	11.0	3.7	9.1
E84AVxxx1522	7.0	14.0	7.0	14.0	7.0	14.0	4.7	11.6
E84AVxxx2222	9.5	19.0	9.5	19.0	9.5	19.0	6.3	15.7

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting "x kHz fixed/..." in C00018

Switching frequency

If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.

In the setting "x kHz var./..." in C00018 the switching frequency is reduced depending on the output current.

Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

### Rated data for internal brake chopper

Switching threshold  $V_{BRmax}$ : 380 V, adjustable

Type	$R_{Bmin}$ [ $\Omega$ ]	$I_{BRmax}$ [A]	$P_{BRmax}$ [kW]	$I_{BRd}$ [A]	$P_{Bd}$ [kW]	$t_z$ [s]	$t_{on}$ [s]	$t_{fp}$ [s]
E84AVxxx2512	180	2.1	0.8	1.6	0.6	-	$\infty$	-
E84AVxxx3712	180	2.1	0.8	1.6	0.6	-	$\infty$	-
E84AVxxx5512	100	3.8	1.4	2.8	1.1	-	$\infty$	-
E84AVxxx7512	100	3.8	1.4	2.8	1.1	-	$\infty$	-
E84AVxxx1122	33	11.5	4.4	8.6	3.3	-	$\infty$	-
E84AVxxx1522	33	11.5	4.4	8.6	3.3	-	$\infty$	-
E84AVxxx2222	33	11.5	4.4	8.6	3.3	-	$\infty$	-

$R_{Bmin}$  Minimum brake resistance, nominal value  $\pm 10\%$

$I_{BRmax}$  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

## Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	① [A]	② [A]	L1, N - laying system			③ [A]	L1, N [AWG]	
			B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]			
E84AVxxx2512	C 6	6	1	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx3712	C 6	6	1	-	-	10	16	
E84AVxxx5512	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx7512	C 10	10	1.5	-	-	15	14	
E84AVxxx1122	C16	16	2.5	-	-	20	12	≥ 30 <sup>3)</sup>
E84AVxxx1522	C 20	20	4.0	-	-	25	10	
E84AVxxx2222	C 25	25	6.0	-	-	30	10	

<sup>1)</sup> These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4).

The cable-cross sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45 °C, no bundling of cables or cores, two loaded cores. Smaller cable cross-sections are not permissible for technical reasons.

<sup>2)</sup> Use UL-approved cable, fuses, and fuse holders only.

UL fuse: voltage ≥ 240 V, tripping characteristic for example "H", "K5" or "CC".

The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C. Smaller cable cross-sections are not permissible for technical reasons.

<sup>3)</sup> Pulse-current sensitive or universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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 with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	① [A]	② [A]	L1, N - laying system			③ [A]	L1, N [AWG]	
			B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]			
E84AVxxx2512	C 6	6	1	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx3712	C 6	6	1	-	-	10	16	
E84AVxxx5512	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx7512	C 10	10	1.5	-	-	15	14	
E84AVxxx1122	C 16	16	2.5	-	-	20	12	≥ 30 <sup>3)</sup>
E84AVxxx1522	C 16	16	2.5	-	-	25	10	
E84AVxxx2222	C 20	20	4.0	-	-	30	10	

<sup>1)</sup> These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4).

The cable-cross sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45 °C, no bundling of cables or cores, two loaded cores. Smaller cable cross-sections are not permissible for technical reasons.

<sup>2)</sup> Use UL-approved cable, fuses, and fuse holders only.

UL fuse: voltage ≥ 240 V, tripping characteristic for example "H", "K5" or "CC".

The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C. Smaller cable cross-sections are not permissible for technical reasons.

<sup>3)</sup> Pulse-current sensitive or universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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

## 4

### Technical data

Rated data

Operation at rated mains voltage 400 V

#### 4.2.3 Operation at rated mains voltage 400 V

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

Type	Mains current at $I_{aN}$		Apparent output power  U, V, W $S_{aR}$ [kVA]	Motor power  4 pol. ASM $P_{aR}$ [kW]
	with external mains choke  $I_{LR}$ [A]	without external mains choke  $I_{LR}$ [A]		
E84AVxxx3714	1.4	1.8	0.8	0.37
E84AVxxx5514	2.0	2.5	1.1	0.55
E84AVxxx7514	2.5	3.6	1.5	0.75
E84AVxxx1124	3.2	4.4	2.0	1.1
E84AVxxx1524	3.9	5.5	2.4	1.5
E84AVxxx2224	5.1	7.3	3.5	2.2
E84AVxxx3024xxS	7.0	9.8	4.6	3.0
E84AVxxx3024xx0	7.0	9.8	4.6	3.0
E84AVxxx4024	8.8	13.1	5.9	4.0
E84AVxxx5524	12.0	18	8.1	5.5
E84AVxxx7524	15.0	20.0	10.3	7.5
E84AVxxx1134	21.0	29.0	14.7	11.0
E84AVxxx1534 <sup>1)</sup>	29.0	-	20.0	15.0
E84AVxxx1834	36.0	50.4	24.9	18.5
E84AVxxx2234 <sup>1)</sup>	42.0	-	29.3	22.0
E84AVxxx3034 <sup>1)</sup>	55.0	-	38.0	30.0
E84AVxxx3734 <sup>1)</sup>	68.0	-	47.4	37.0
E84AVxxx4534 <sup>1)</sup>	80.0	-	55.5	45.0

<sup>1)</sup> only with external mains choke

### Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx3714	No	EZAELN3002B153
E84AVxxx5514	No	EZAELN3004B742
E84AVxxx7514	No	
E84AVxxx1124	No	
E84AVxxx1524	No	EZAELN3006B492
E84AVxxx2224	No	
E84AVxxx3024xx5	No	EZAELN3008B372
E84AVxxx3024xx0	No	EZAELN3008B372
E84AVxxx4024	No	EZAELN3010B292
E84AVxxx5524	No	EZAELN3016B182
E84AVxxx7524	No	EZAELN3020B152
E84AVxxx1134	No	EZAELN3025B122
E84AVxxx1534	Yes	EZAELN3035B841
E84AVxxx1834	No	EZAELN3045B651
E84AVxxx2234	Yes	EZAELN3050B591
E84AVxxx3034	Yes	EZAELN3063B471
E84AVxxx3734	Yes	EZAELN3080B371
E84AVxxx4534	Yes	EZAELN3090B331

## Alternative DC supply

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 %	-

Type	Input current at $I_{aN}$ $I_{DC}$ [A]	Output power $U, V, W$ $S_{ar}$ [kVA]	Motor power 4.pol. ASM $P_{ar}$ [kW]
E84AVxxx3714	2.2	0.8	0.37
E84AVxxx5514	3.1	1.1	0.55
E84AVxxx7514	4.4	1.5	0.75
E84AVxxx1124	5.4	2.0	1.1
E84AVxxx1524	6.7	2.4	1.5
E84AVxxx2224	8.9	3.5	2.2
E84AVxxx3024xxS	12.0	4.6	3.0
E84AVxxx3024xx0	12.0	4.6	3.0
E84AVxxx4024	16.0	5.9	4.0
E84AVxxx5524	22.0	8.1	5.5
E84AVxxx7524	24.5	10.3	7.5
E84AVxxx1134	35.5	14.7	11.0
E84AVxxx1534	35.5	20.0	15.0
E84AVxxx1834	44.1	24.9	18.5
E84AVxxx2234	51.4	29.3	22.0
E84AVxxx3034	67.4	38.0	30.0
E84AVxxx3734	83.3	47.4	37.0
E84AVxxx4534	98.0	55.5	45.0

Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{arated2}$	$I_{aM2}$	$I_{arated4}$	$I_{aM4}$	$I_{arated8}$	$I_{aM8}$	$I_{arated16}$	$I_{aM16}$
E84AVxxx3714	1.3	2.6	1.3	2.6	1.3	2.6	0.9	2.1
E84AVxxx5514	1.8	3.6	1.8	3.6	1.8	3.6	1.2	3.0
E84AVxxx7514	2.4	4.8	2.4	4.8	2.4	4.8	1.6	4.0
E84AVxxx1124	3.2	6.4	3.2	6.4	3.2	6.4	2.1	5.3
E84AVxxx1524	3.9	7.8	3.9	7.8	3.9	7.8	2.6	6.4
E84AVxxx2224	5.6	11.2	5.6	11.2	5.6	11.2	3.7	9.2
E84AVxxx3024xxS	7.3	14.6	7.3	14.6	7.3	14.6	4.9	9.5
E84AVxxx3024xx0	7.3	14.6	7.3	14.6	7.3	14.6	4.9	9.5
E84AVxxx4024	9.5	19.0	9.5	19.0	9.5	17.1	6.3	9.5
E84AVxxx5524	13.0	26.0	13.0	26.0	13.0	19.5	8.7	11.7
E84AVxxx7524	16.5	33.0	16.5	33.0	16.5	26.4	11.0	16.5
E84AVxxx1134	23.5	47.0	23.5	47.0	23.5	32.9	15.7	21.2
E84AVxxx1534	32.0	64.0	32.0	57.1	32.0	43.2	21.3	27.2
E84AVxxx1834	40.0	78.0	40.0	78.0	40.0	72.2	27.0	48.8
E84AVxxx2234	47.0	89.3	47.0	89.3	47.0	75.2	31.3	49.4
E84AVxxx3034	61.0	112.1	61.0	89.3	61.0	75.2	41.0	53.1
E84AVxxx3734	76.0	136.8	76.0	115.2	76.0	97.2	51.0	72.0
E84AVxxx4534	89.0	169.1	89.0	146.9	89.0	120.2	60.0	84.6

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting "x kHz fixed/..." in C00018

Switching frequency

If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.  
In the setting "x kHz var./..." in C00018 the switching frequency is reduced depending on the output current.  
Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

## Rated data for internal brake chopper

Switching threshold  $V_{BRmax}$ : 725 V, adjustable

Type	$R_{Bmin}$ [ $\Omega$ ]	$I_{BRmax}$ [A]	$P_{BRmax}$ [kW]	$I_{BRd}$ [A]	$P_{Bd}$ [kW]	$t_z$ [s]	$t_{on}$ [s]	$t_{fp}$ [s]
E84AVxxx3714	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx5514	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx7514	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx1124	180	4.0	2.9	4.0	2.9	-	$\infty$	-
E84AVxxx1524	180	4.0	2.9	4.0	2.9	-	$\infty$	-
E84AVxxx2224	150	4.8	3.5	4.8	3.5	-	$\infty$	-
E84AVxxx3024xxS	82	8.8	6.4	8.8	6.4	-	$\infty$	-
E84AVxxx3024xx0	82	8.8	6.4	8.8	6.4	-	$\infty$	-
E84AVxxx4024	47	15.4	11.2	13.0	9.4	-	$\infty$	-
E84AVxxx5524	47	15.4	11.2	13.0	9.4	-	$\infty$	-
E84AVxxx7524	27	26.9	19.5	26.9	19.5	-	$\infty$	-
E84AVxxx1134	27	26.9	19.5	26.9	19.5	-	$\infty$	-
E84AVxxx1534	18	40.3	29.2	40.3	29.2	-	$\infty$	-
E84AVxxx1834	15	48.3	35.0	48.3	35.0	-	$\infty$	-
E84AVxxx2234	15	48.3	35.0	48.3	35.0	-	$\infty$	-
E84AVxxx3034	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-
E84AVxxx3734	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-
E84AVxxx4534	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-

$R_{Bmin}$	Minimum brake resistance, nominal value $\pm 10\%$
$I_{BRmax}$	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 brake chopper operation according to cUL/CSA

Brake chopper operation according to cUL/CSA is ensured if the running time  $t_{on}$  is not higher than 30% compared to the cycle time  $t_z$ .

The condition is fulfilled if the continuous braking power  $P_d$  is not higher than 30% compared to the peak braking power  $P_{BRmax}^*$  made possible through the resistor  $R_B$  used:

$$\frac{t_{on}}{t_z} \leq 0.3 \quad ; \quad \frac{P_d}{P_{BRmax}^*} \leq 0.3 \quad ; \quad P_{BRmax}^* = \frac{U_{BRmax}^2}{R_B}$$

$R_B$	Brake resistor used (nameplate data)
$V_{BRmax}$	Switching threshold of the inverter (725 V at $V_{LN} = 400$ V, 790 V at $V_{Lr} = 500$ V)
$V_{Lr}$	Rated mains voltage
$P_{BRmax}^*$	Peak braking power of the resistor used
$P_d$	Continuous braking power of the load to be braked (dependent on the application)
$t_{on}$	Running time
$t_z$	Cycle time ("duty cycle")

Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx5514	C 6	6	1.0	-	-	6	18	
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx1524	C 10	10	1.5	-	-	10	16	
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xxS	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	
E84AVxxx5524	C 25	25	4	-	-	20	12	
E84AVxxx7524	C 32	32	10	-	-	25	10	≥ 300 <sup>3)</sup>
E84AVxxx1134	C 32	32	10	-	-	40	8	
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	C80	80	25	16	-	60	6	≥ 300 <sup>3)</sup>
E84AVxxx2234	-	-	-	-	-	-	-	-
E84AVxxx3034	-	-	-	-	-	-	-	-
E84AVxxx3734	-	-	-	-	-	-	-	-
E84AVxxx4534	-	-	-	-	-	-	-	-

- 1) These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45 °C, no bundling of cables or cores, three loaded cores.
- 2) Use UL-approved cables, fuses and fuse holders only.  
UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C.
- 3) Universal-current sensitive earth-leakage circuit breaker, short-time delay  
If cables are longer than 50 m, the protective 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 with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx5514	C 6	6	1.0	-	-	6	18	
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 6	6	1.0	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx1524	C 6	6	1.0	-	-	10	16	
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xx5	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	
E84AVxxx5524	C 20	20	4	-	-	20	12	
E84AVxxx7524	C 20	20	4	2.5	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx1134	C 32	32	10	10	-	30	10	
E84AVxxx1534	C 32	32	10	10	-	40	8	
E84AVxxx1834	C 50	50	16	10	-	40	8	≥ 300 <sup>3)</sup>
E84AVxxx2234	C 63	63	25	16	-	50	6	≥ 300 <sup>3)</sup>
E84AVxxx3034	C 80	80	-	16	-	70	4	
E84AVxxx3734	C100	100	-	25	-	80	4	
E84AVxxx4534	C125	125	-	50	-	100	3	≥ 300 <sup>3)</sup>

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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



#### 4.2.4 Operation at a rated mains voltage of 500 V

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

Type	Mains current at $I_{aN}$		Apparent output power U, V, W $S_{aR}$ [kVA]	Motor power 4 pol. ASM $P_{aR}$ [kW]
	with external mains choke $I_{LR}$ [A]	without external mains choke $I_{LR}$ [A]		
E84AVxxx3714	1.1	1.4	0.8	0.37
E84AVxxx5514	1.4	2.0	1.1	0.55
E84AVxxx7514	2.0	2.6	1.5	0.75
E84AVxxx1124	2.6	3.6	2.0	1.1
E84AVxxx1524	3.1	4.4	2.4	1.5
E84AVxxx2224	4.1	5.8	3.5	2.2
E84AVxxx3024xxS	5.6	7.8	4.5	3.0
E84AVxxx3024xx0	5.6	7.8	4.5	3.0
E84AVxxx4024	7.0	10.5	5.9	4.0
E84AVxxx5524	9.6	14.4	8.1	5.5
E84AVxxx7524	12.0	16.0	10.3	7.5
E84AVxxx1134	16.8	23.2	14.7	11.0
E84AVxxx1534 <sup>1)</sup>	23.2	-	20.0	15.0
E84AVxxx1834	31.0	43.4	26.1	18.5
E84AVxxx2234 <sup>1)</sup>	36.1	-	31.5	22.0
E84AVxxx3034 <sup>1)</sup>	46.9	-	40.5	30.0
E84AVxxx3734 <sup>1)</sup>	58.2	-	50.7	37.0
E84AVxxx4534 <sup>1)</sup>	69.2	-	60.0	45.0

<sup>1)</sup> only with external mains choke

## Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx3714	No	EZAELN3002B153
E84AVxxx5514	No	EZAELN3004B742
E84AVxxx7514	No	
E84AVxxx1124	No	
E84AVxxx1524	No	EZAELN3006B492
E84AVxxx2224	No	
E84AVxxx3024xx5	No	EZAELN3008B372
E84AVxxx3024xx0	No	EZAELN3008B372
E84AVxxx4024	No	EZAELN3010B292
E84AVxxx5524	No	EZAELN3016B182
E84AVxxx7524	No	EZAELN3020B152
E84AVxxx1134	No	EZAELN3025B122
E84AVxxx1534	Yes	EZAELN3035B841
E84AVxxx1834	No	EZAELN3045B651
E84AVxxx2234	Yes	EZAELN3050B591
E84AVxxx3034	Yes	EZAELN3063B471
E84AVxxx3734	Yes	EZAELN3080B371
E84AVxxx4534	Yes	EZAELN3090B331

Alternative DC supply

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 %	-

Type	Input current at $I_{aN}$ $I_{DC}$ [A]	Output power $U, V, W$ $S_{ar}$ [kVA]	Motor power 4.pol. ASM $P_{ar}$ [kW]
E84AVxxx3714	1.7	0.8	0.37
E84AVxxx5514	2.4	1.1	0.55
E84AVxxx7514	3.2	1.5	0.75
E84AVxxx1124	4.4	2.0	1.1
E84AVxxx1524	5.4	2.4	1.5
E84AVxxx2224	7.1	3.5	2.2
E84AVxxx3024xxS	9.6	4.5	3.0
E84AVxxx3024xx0	9.6	4.5	3.0
E84AVxxx4024	12.9	5.9	4.0
E84AVxxx5524	17.6	8.1	5.5
E84AVxxx7524	19.6	10.3	7.5
E84AVxxx1134	28.4	14.7	11.0
E84AVxxx1534	28.4	20.0	15.0
E84AVxxx1834	38.0	26.1	18.5
E84AVxxx2234	44.2	31.5	22.0
E84AVxxx3034	57.4	40.5	30.0
E84AVxxx3734	71.3	50.7	37.0
E84AVxxx4534	84.8	60.0	45.0

## Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{\text{arated2}}$	$I_{\text{aM2}}$	$I_{\text{arated4}}$	$I_{\text{aM4}}$	$I_{\text{arated8}}$	$I_{\text{aM8}}$	$I_{\text{arated16}}$	$I_{\text{aM16}}$
E84AVxxx3714	1.0	2.6	1.0	2.6	1.0	2.4	0.7	1.7
E84AVxxx5514	1.4	3.6	1.4	3.6	1.4	3.3	0.9	2.3
E84AVxxx7514	1.9	4.8	1.9	4.8	1.9	4.4	1.3	3.1
E84AVxxx1124	2.6	6.4	2.6	6.4	2.6	5.9	1.7	4.1
E84AVxxx1524	3.1	7.8	3.1	7.2	3.1	7.2	2.1	5.0
E84AVxxx2224	4.5	11.2	4.5	11.2	4.5	10.4	3.0	7.2
E84AVxxx3024xxS	5.8	14.6	5.8	13.5	5.8	13.5	3.9	7.4
E84AVxxx3024xx0	5.8	14.6	5.8	13.5	5.8	13.5	3.9	7.4
E84AVxxx4024	7.6	19.0	7.6	17.6	7.6	13.4	5.1	7.3
E84AVxxx5524	10.4	26.0	10.4	24.1	10.4	15.2	6.9	9.0
E84AVxxx7524	13.2	33.0	13.2	30.5	13.2	20.6	8.8	12.7
E84AVxxx1134	18.8	47.0	18.8	43.5	18.8	25.6	12.5	16.2
E84AVxxx1534	25.6	64.0	25.6	49.0	25.6	33.6	17.1	20.8
E84AVxxx1834	34.0	78.0	34.0	78.0	34.0	61.2	23.0	41.1
E84AVxxx2234	40.0	89.3	40.0	89.3	40.0	63.7	27.0	41.5
E84AVxxx3034	52.0	112.1	52.0	89.3	52.0	63.7	35.0	44.4
E84AVxxx3734	65.0	136.8	65.0	97.6	65.0	82.1	43.0	60.4
E84AVxxx4534	77.0	169.1	77.0	124.4	77.0	101.5	51.0	70.8

$I_{\text{aNx}}$   
 $I_{\text{aMx}}$

Rated value of continuous output current

Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{\text{aMx}}$  and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting "x kHz fixed/..." in C00018

Switching frequency

If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.

In the setting "x kHz var./..." in C00018 the switching frequency is reduced depending on the output current.

Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

**Rated data for internal brake chopper**

Switching threshold  $V_{BRmax}$ : 790 V, adjustable

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]
E84AVxxx3714	390	2.0	1.6	2.0	1.6	-	∞	-
E84AVxxx5514	390	2.0	1.6	2.0	1.6	-	∞	-
E84AVxxx7514	390	2.0	1.6	2.0	1.6	-	∞	-
E84AVxxx1124	180	4.4	3.5	4.4	3.5	-	∞	-
E84AVxxx1524	180	4.4	3.5	4.4	3.5	-	∞	-
E84AVxxx2224	150	5.3	4.2	5.3	4.2	-	∞	-
E84AVxxx3024xxS	82	9.6	7.6	9.6	7.6	-	∞	-
E84AVxxx3024xx0	82	9.6	7.6	9.6	7.6	-	∞	-
E84AVxxx4024	47	16.8	13.3	13.0	10.3	-	∞	-
E84AVxxx5524	47	16.8	13.3	13.0	10.3	-	∞	-
E84AVxxx7524	27	29.3	23.1	29.3	23.1	-	∞	-
E84AVxxx1134	27	29.3	23.1	29.3	23.1	-	∞	-
E84AVxxx1534	18	43.9	34.7	43.9	34.7	-	∞	-
E84AVxxx1834	15	52.7	41.6	52.7	41.6	-	∞	-
E84AVxxx2234	15	52.7	41.6	52.7	41.6	-	∞	-
E84AVxxx3034	7.5	105.3	83.2	105.3	83.2	-	∞	-
E84AVxxx3734	7.5	105.3	83.2	105.3	83.2	-	∞	-
E84AVxxx4534	7.5	105.3	83.2	105.3	83.2	-	∞	-

$R_{Bmin}$	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 brake chopper operation according to cUL/CSA**

Brake chopper operation according to cUL/CSA is ensured if the running time  $t_{on}$  is not higher than 30% compared to the cycle time  $t_z$ .

The condition is fulfilled if the continuous braking power  $P_d$  is not higher than 30% compared to the peak braking power  $P^*_{BRmax}$  made possible through the resistor  $R_B$  used:

$$\frac{t_{on}}{t_z} \leq 0.3 \quad ; \quad \frac{P_d}{P^*_{BRmax}} \leq 0.3 \quad ; \quad P^*_{BRmax} = \frac{U_{BRmax}^2}{R_B}$$

$R_B$	Brake resistor used (nameplate data)
$V_{BRmax}$	Switching threshold of the inverter (725 V at $V_{LN} = 400$ V, 790 V at $V_{Lr} = 500$ V)
$V_{Lr}$	Rated mains voltage
$P^*_{BRmax}$	Peak braking power of the resistor used
$P_d$	Continuous braking power of the load to be braked (dependent on the application)
$t_{on}$	Running time
$t_z$	Cycle time ("duty cycle")

## Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx5514	C 6	6	1.0	-	-	6	18	
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx1524	C 10	10	1.5	-	-	10	16	
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xxS	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	
E84AVxxx5524	C 25	25	4	-	-	20	12	
E84AVxxx7524	C 32	32	10	-	-	25	10	≥ 300 <sup>3)</sup>
E84AVxxx1134	C 32	32	10	-	-	40	8	
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	C80	80	25	16	-	60	6	≥ 300 <sup>3)</sup>
E84AVxxx2234	-	-	-	-	-	-	-	-
E84AVxxx3034	-	-	-	-	-	-	-	-
E84AVxxx3734	-	-	-	-	-	-	-	-
E84AVxxx4534	-	-	-	-	-	-	-	-

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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 with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	
E84AVxxx5514	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 6	6	1.0	-	-	10	16	
E84AVxxx1524	C 6	6	1.0	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xx5	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 10	10	1.5	-	-	15	14	
E84AVxxx4024	C 16	16	2.5	-	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx5524	C 20	20	4	-	-	20	12	
E84AVxxx7524	C 20	20	4	2.5	-	20	12	
E84AVxxx1134	C 32	32	10	10	-	30	10	≥ 300 <sup>3)</sup>
E84AVxxx1534	C 32	32	10	10	-	40	8	
E84AVxxx1834	C 50	50	16	-	-	40	8	≥ 300 <sup>3)</sup>
E84AVxxx2234	C 63	63	25	-	-	50	6	
E84AVxxx3034	C80	80	-	16	-	70	4	≥ 300 <sup>3)</sup>
E84AVxxx3734	C100	100		25	-	80	4	≥ 300 <sup>3)</sup>
E84AVxxx4534	C125	125		50	-	100	3	≥ 300 <sup>3)</sup>

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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

## 4.2.5 Operation with increased power at a 230 V mains

With an increased continuous power, the inverter can be connected to a next higher and more powerful motor. The overload capacity according to operation with rated data continues to exist. The drive of units with quadratic load characteristic as provided by pumps or fans are typical applications.

**Note!**

Operation with increased power is only permitted ...

- ▶ With the rated data provided for the controller.
- ▶ In the stated mains voltage range.
- ▶ At switching frequencies of 2 kHz and 4 kHz.
- ▶ At a max. ambient temperature of 40 °C.
- ▶ With the stated installation types.
- ▶ With the fuses, cable cross-sections, mains chokes and filters required for this type of operation.
- ▶ After parameterisation acc. to specification (cp. software manual EDS84AV...)

**Basis of the data**

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range f [Hz]
1/N/PE AC	230	180 - 0 % ... 264 + 0 %	45 - 0 % ... 65 + 0 %

Type	Mains current at $I_{aN}$		Apparent output power U, V, W $S_{aR}$ [kVA]	Motor power 4 pol. ASM $P_{aR}$ [kW]
	with external mains choke $I_{LR}$ [A]	without external mains choke $I_{LR}$ [A]		
E84AVxxx2512	3.6	4.1	0.8	0.37
E84AVxxx3712	5.0	-	1.0	0.55
E84AVxxx5512	6.0	6.4	1.3	0.75
E84AVxxx7512	8.4	-	1.7	1.1
E84AVxxx1122	11.9	14.4	2.4	1.5
E84AVxxx1522	13.7	-	3.0	2.2
E84AVxxx2222	-	-	-	-



### Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx2512	no	ELN1-0900H005
E84AVxxx3712	yes	ELN1-0900H005
E84AVxxx5512	no	ELN1-0500H009
E84AVxxx7512	yes	ELN1-0500H009
E84AVxxx1122	no	ELN1-0250H018
E84AVxxx1522	yes	ELN1-0250H018
E84AVxxx2222	-	-

### Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{\text{arated}2}$	$I_{\text{aM}2}$	$I_{\text{arated}4}$	$I_{\text{aM}4}$	$I_{\text{arated}8}$	$I_{\text{aM}8}$	$I_{\text{arated}16}$	$I_{\text{aM}16}$
E84AVxxx2512	2.1	3.4	2.1	3.4	-	-	-	-
E84AVxxx3712	2.9	4.8	2.9	4.8	-	-	-	-
E84AVxxx5512	3.6	6.0	3.6	6.0	-	-	-	-
E84AVxxx7512	4.8	8.0	4.8	8.0	-	-	-	-
E84AVxxx1122	6.8	11.0	6.8	11.0	-	-	-	-
E84AVxxx1522	8.4	14.0	8.4	14.0	-	-	-	-
E84AVxxx2222	-	-	-	-	-	-	-	-

## Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx2512	C 6	6	1	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx3712	-	-	-	-	-	10	16	-
E84AVxxx5512	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx7512	-	-	-	-	-	15	14	-
E84AVxxx1122	C 16	16	2.5	-	-	20	12	≥ 30 <sup>3)</sup>
E84AVxxx1522	-	-	-	-	-	25	10	-
E84AVxxx2222	-	-	-	-	-	30	10	-

Operation with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx2512	C 6	6	1	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx3712	C 6	6	1	-	-	10	16	
E84AVxxx5512	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx7512	C 10	10	1.5	-	-	15	14	
E84AVxxx1122	C 16	16	2.5	-	-	20	12	≥ 30 <sup>3)</sup>
E84AVxxx1522	C 16	16	2.5	-	-	25	10	
E84AVxxx2222	-	-	-	-	-	30	10	-

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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

### 4.2.6 Operation with increased power at a 400 V mains

With an increased continuous power, the inverter can be connected to a next higher and more powerful motor. The overload capacity according to operation with rated data continues to exist. The drive of units with quadratic load characteristic as provided by pumps or fans are typical applications.



**Note!**

Operation with increased power is only permitted ...

- ▶ With the rated data provided for the controller.
- ▶ In the stated mains voltage range.
- ▶ At switching frequencies of 2 kHz and 4 kHz.
- ▶ At a max. ambient temperature of 40 °C.
- ▶ With the stated installation types.
- ▶ With the fuses, cable cross-sections, mains chokes and filters required for this type of operation.
- ▶ After parameterisation acc. to specification (cp. software manual EDS84AV...)

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

Type	Mains current at $I_{aN}$		Apparent output power U, V, W $S_{aR}$ [kVA]	Motor power 4 pol. ASM $P_{aR}$ [kW]
	with external mains choke $I_{LR}$ [A]	without external mains choke $I_{LR}$ [A]		
E84AVxxx3714	1.7	2.2	1.0	0.55
E84AVxxx5514	2.4	2.9	1.4	0.75
E84AVxxx7514	2.9	-	1.8	1.1
E84AVxxx1124	3.8	5.3	2.4	1.5
E84AVxxx1524	4.7	6.6	3.0	2.2
E84AVxxx2224	6.1	-	4.2	3.0
E84AVxxx3024xxS	8.4	-	5.5	4.0
E84AVxxx3024xx0	8.4	11.8	5.5	4.0
E84AVxxx4024	10.6	15.7	7.2	5.5
E84AVxxx5524	18.0	-	9.7	7.5
E84AVxxx7524	21.0	28	13.1	11
E84AVxxx1134	29.0	-	17.6	15
E84AVxxx1534 <sup>1)</sup>	-	-	-	-
E84AVxxx1834	42.2	-	29.2	22
E84AVxxx2234 <sup>1)</sup>	50.8	-	35.2	30
E84AVxxx3034 <sup>1)</sup>	66.0	-	45.6	37
E84AVxxx3734 <sup>1)</sup>	81.6	-	56.9	45
E84AVxxx4534 <sup>1)</sup>	96.0	-	66.6	55

<sup>1)</sup> only with external mains choke

## Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx3714	No	EZAELN3002B153
E84AVxxx5514	No	EZAELN3004B742
E84AVxxx7514	Yes	
E84AVxxx1124	No	
E84AVxxx1524	No	EZAELN3006B492
E84AVxxx2224	Yes	EZAELN3008B372
E84AVxxx3024xx5	Yes	EZAELN3010B292
E84AVxxx3024xx0	No	EZAELN3010B292
E84AVxxx4024	No	EZAELN3016B182
E84AVxxx5524	Yes	EZAELN3020B152
E84AVxxx7524	No	EZAELN3025B122
E84AVxxx1134	Yes	EZAELN3030B982
E84AVxxx1534	-	-
E84AVxxx1834	Yes	EZAELN3045B651
E84AVxxx2234	Yes	EZAELN3063B471
E84AVxxx3034	Yes	EZAELN3080B371
E84AVxxx3734	Yes	EZAELN3090B331
E84AVxxx4534	Yes	EZAELN3100B301

### Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{arated2}$	$I_{aM2}$	$I_{arated4}$	$I_{aM4}$	$I_{arated8}$	$I_{aM8}$	$I_{arated16}$	$I_{aM16}$
E84AVxxx3714	1.6	2.6	1.6	2.6	-	-	-	-
E84AVxxx5514	2.2	3.6	2.2	3.6	-	-	-	-
E84AVxxx7514	2.9	4.8	2.9	4.8	-	-	-	-
E84AVxxx1124	3.8	6.4	3.8	6.4	-	-	-	-
E84AVxxx1524	4.8	7.8	4.8	7.8	-	-	-	-
E84AVxxx2224	6.7	11.2	6.7	11.2	-	-	-	-
E84AVxxx3024xxS	8.8	14.6	8.8	14.6	-	-	-	-
E84AVxxx3024xx0	8.8	14.6	8.8	14.6	-	-	-	-
E84AVxxx4024	11.5	19.0	11.5	19.0	-	-	-	-
E84AVxxx5524	15.6	26.0	15.6	26.0	-	-	-	-
E84AVxxx7524	21.0	33.0	21.0	33.0	-	-	-	-
E84AVxxx1134	28.2	47.0	28.2	47.0	-	-	-	-
E84AVxxx1534	38.4	64.0	38.4	62.4	-	-	-	-
E84AVxxx1834	46.8	78.0	46.8	78.0	-	-	-	-
E84AVxxx2234	56.4	89.3	56.4	89.3	-	-	-	-
E84AVxxx3034	73.2	112.1	73.2	89.3	-	-	-	-
E84AVxxx3734	91.2	136.8	91.2	115.2	-	-	-	-
E84AVxxx4534	107.0	169.1	107.0	146.9	-	-	-	-

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)  

- Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting "x kHz fixed/..." in C00018

Switching frequency

If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.  
In the setting "x kHz var./..." in C00018 the switching frequency is reduced depending on the output current.  
Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

## Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx5514	C 6	6	1.0	-	-	6	18	
E84AVxxx7514	-	-	-	-	-	-	-	-
E84AVxxx1124	C10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx1524	C 10	10	1.5	-	-	10	16	
E84AVxxx2224	-	-	-	-	-	-	-	-
E84AVxxx3024xxS	-	-	-	-	-	-	-	-
E84AVxxx3024xx0	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx5524	-	-	-	-	-	-	-	-
E84AVxxx7524	C 32	32	10	-	-	25	10	≥ 300 <sup>3)</sup>
E84AVxxx1134	-	-	-	-	-	-	-	-
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	-	-	-	-	-	-	-	-
E84AVxxx2234	-	-	-	-	-	-	-	-
E84AVxxx3034	-	-	-	-	-	-	-	-
E84AVxxx3734	-	-	-	-	-	-	-	-
E84AVxxx4534	-	-	-	-	-	-	-	-

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

2) Use UL-approved cables, fuses and fuse holders only.  
UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay  
If cables are longer than 50 m, the protective 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 with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	① [A]	② [A]	L1, L2, L3 - Laying system			③ [A]	L1, L2, L3 [AWG]	
			B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]			
E84AVxxx3714	C 6	6	1.0	-	-	6	18	
E84AVxxx5514	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 6	6	1.0	-	-	10	16	
E84AVxxx1524	C 6	6	1.0	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xx5	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx5524	C 20	20	4	-	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx7524	C 20	20	4	2.5	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx1134	C 32	32	10	10	-	30	10	≥ 300 <sup>3)</sup>
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	C 50	50	16	-	-	60	6	≥ 300 <sup>3)</sup>
E84AVxxx2234	C 63	63	25	-	-	60	6	≥ 300 <sup>3)</sup>
E84AVxxx3034	C100	100	-	25	-	80	4	≥ 300 <sup>3)</sup>
E84AVxxx3734	C125	125	-	50	-	100	3	≥ 300 <sup>3)</sup>
E84AVxxx4534	C125	125	-	50	-	125	1	≥ 300 <sup>3)</sup>

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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

## 4.2.7 Operation with increased power at a 500 V mains

With an increased continuous power, the inverter can be connected to a next higher and more powerful motor. The overload capacity according to operation with rated data continues to exist. The drive of units with quadratic load characteristic as provided by pumps or fans are typical applications.

**Note!**

Operation with increased power is only permitted ...

- ▶ With the rated data provided for the controller.
- ▶ In the stated mains voltage range.
- ▶ At switching frequencies of 2 kHz and 4 kHz.
- ▶ At a max. ambient temperature of 40 °C.
- ▶ With the stated installation types.
- ▶ With the fuses, cable cross-sections, mains chokes and filters required for this type of operation.
- ▶ After parameterisation acc. to specification (cp. software manual EDS84AV...)

**Basis of the data**

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %

Type	Mains current at $I_{aN}$		Apparent output power U, V, W $S_{aR}$ [kVA]	Motor power 4 pol. ASM $P_{aR}$ [kW]
	with external mains choke $I_{LR}$ [A]	without external mains choke $I_{LR}$ [A]		
E84AVxxx3714	1.3	1.7	1.0	0.55
E84AVxxx5514	1.7	2.4	1.4	0.75
E84AVxxx7514	2.4	-	1.8	1.1
E84AVxxx1124	3.1	4.3	2.4	1.5
E84AVxxx1524	3.7	5.3	3.0	2.2
E84AVxxx2224	4.9	-	4.2	3.0
E84AVxxx3024xxS	6.7	-	5.5	4.0
E84AVxxx3024xx0	6.7	9.4	5.5	4.0
E84AVxxx4024	8.4	12.6	7.2	5.5
E84AVxxx5524	14.4	-	9.7	7.5
E84AVxxx7524	16.8	22.4	13.3	11
E84AVxxx1134	20.1	-	17.6	15
E84AVxxx1534	-	-	-	-
E84AVxxx1834	33.7	-	31.3	22
E84AVxxx2234 <sup>1)</sup>	40.6	-	37.8	30
E84AVxxx3034 <sup>1)</sup>	56.3	-	45.7	37
E84AVxxx3734 <sup>1)</sup>	69.8	-	56.9	45
E84AVxxx4534 <sup>1)</sup>	83.0	-	66.6	55

<sup>1)</sup> only with external mains choke



### Assignment of external mains chokes

Assignment		
Type	Mains choke required	Mains choke
E84AVxxx3714	No	EZAELN3002B153
E84AVxxx5514	No	EZAELN3004B742
E84AVxxx7514	Yes	
E84AVxxx1124	No	
E84AVxxx1524	No	EZAELN3006B492
E84AVxxx2224	Yes	EZAELN3008B372
E84AVxxx3024xx5	Yes	EZAELN3010B292
E84AVxxx3024xx0	No	EZAELN3010B292
E84AVxxx4024	No	EZAELN3016B182
E84AVxxx5524	Yes	EZAELN3020B152
E84AVxxx7524	No	EZAELN3025B122
E84AVxxx1134	Yes	EZAELN3030B982
E84AVxxx1534	-	-
E84AVxxx1834	Yes	EZAELN3045B651
E84AVxxx2234	Yes	EZAELN3063B471
E84AVxxx3034	Yes	EZAELN3080B371
E84AVxxx3734	Yes	EZAELN3090B331
E84AVxxx4534	Yes	EZAELN3100B301

## Switching frequency-dependent output currents

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{\text{arated}2}$	$I_{\text{aM}2}$	$I_{\text{arated}4}$	$I_{\text{aM}4}$	$I_{\text{arated}8}$	$I_{\text{aM}8}$	$I_{\text{arated}16}$	$I_{\text{aM}16}$
E84AVxxx3714	1.2	2.6	1.2	2.6	-	-	-	-
E84AVxxx5514	1.7	3.6	1.7	3.6	-	-	-	-
E84AVxxx7514	2.3	4.8	2.3	4.8	-	-	-	-
E84AVxxx1124	3.1	6.4	3.1	6.4	-	-	-	-
E84AVxxx1524	3.8	7.8	3.8	7.2	-	-	-	-
E84AVxxx2224	5.4	11.2	5.4	11.2	-	-	-	-
E84AVxxx3024xxS	7.0	14.6	7.0	13.5	-	-	-	-
E84AVxxx3024xx0	7.0	14.6	7.0	13.5	-	-	-	-
E84AVxxx4024	9.1	19.0	9.1	17.6	-	-	-	-
E84AVxxx5524	12.5	26.0	12.5	24.1	-	-	-	-
E84AVxxx7524	17.0	33.0	17.0	30.5	-	-	-	-
E84AVxxx1134	22.6	47.0	22.6	43.5	-	-	-	-
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	40.2	78.0	40.2	78.0	-	-	-	-
E84AVxxx2234	48.5	89.3	48.5	89.3	-	-	-	-
E84AVxxx3034	58.6	112.1	58.6	89.3	-	-	-	-
E84AVxxx3734	73.0	136.8	73.0	97.6	-	-	-	-
E84AVxxx4534	85.4	169.1	85.4	124.4	-	-	-	-

$I_{\text{aN}x}$   
 $I_{\text{aM}x}$

Rated value of continuous output current  
Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{\text{aM}x}$  and recovery time of 12 s according to the tables under chapter 4.4

- Can be obtained in the setting "x kHz fixed/..." in C00018

Switching frequency

If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.

In the setting "x kHz var./..." in C00018 the switching frequency is reduced depending on the output current.

Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx5514	C 6	6	1.0	-	-	6	18	
E84AVxxx7514	-	-	-	-	-	-	-	-
E84AVxxx1124	C 10	10	1.5	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx1524	C10	10	1.5	-	-	10	16	
E84AVxxx2224	-	-	-	-	-	-	-	-
E84AVxxx3024xxS	-	-	-	-	-	-	-	-
E84AVxxx3024xx0	C 16	16	2.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx4024	C 16	16	2.5	-	-	20	12	
E84AVxxx5524	-	-	-	-	-	-	-	-
E84AVxxx7524	C 32	32	10	-	-	25	10	≥ 300 <sup>3)</sup>
E84AVxxx1134	-	-	-	-	-	-	-	-
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	-	-	-	-	-	-	-	-
E84AVxxx2234	-	-	-	-	-	-	-	-
E84AVxxx3034	-	-	-	-	-	-	-	-
E84AVxxx3734	-	-	-	-	-	-	-	-
E84AVxxx4534	-	-	-	-	-	-	-	-

- 1) These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45 °C, no bundling of cables or cores, three loaded cores.
  - 2) Use UL-approved cables, fuses and fuse holders only.  
UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C.
  - 3) Universal-current sensitive earth-leakage circuit breaker, short-time delay  
If cables are longer than 50 m, the protective 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 with external mains choke/mains filter								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
E84AVxxx3714	C 6	6	1.0	-	-	6	18	
E84AVxxx5514	C 6	6	1.0	-	-	6	18	≥ 30 <sup>3)</sup>
E84AVxxx7514	C 6	6	1.0	-	-	6	18	
E84AVxxx1124	C 6	6	1.0	-	-	10	16	
E84AVxxx1524	C 6	6	1.0	-	-	10	16	≥ 30 <sup>3)</sup>
E84AVxxx2224	C 10	10	1.5	-	-	10	16	
E84AVxxx3024xx5	C 10	10	1.5	-	-	15	14	≥ 300 <sup>3)</sup>
E84AVxxx3024xx0	C 10	10	1.5	-	-	15	14	
E84AVxxx4024	C 16	16	2.5	-	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx5524	C 20	20	4	-	-	20	12	
E84AVxxx7524	C 20	20	4	2.5	-	20	12	≥ 300 <sup>3)</sup>
E84AVxxx1134	C 32	32	10	10	-	30	10	
E84AVxxx1534	-	-	-	-	-	-	-	-
E84AVxxx1834	C 50	50	16	-	-	60	6	≥ 300 <sup>3)</sup>
E84AVxxx2234	C 63	63	25	-	-	60	6	
E84AVxxx3034	C100	100	-	25	-	80	4	
E84AVxxx3734	C125	125	-	50	-	100	3	≥ 300 <sup>3)</sup>
E84AVxxx4534	C125	125	-	50	-	125	1	

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

2) Use UL-approved cables, fuses and fuse holders only.

UL fuse: voltage ≥ 500 V, tripping characteristic for example "H", "K5" or "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45 °C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay

If cables are longer than 50 m, the protective 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

### 4.3 Current characteristics

The controller limits its maximally possible motor current under the following operating conditions ("current derating"):

- ▶ If the maximum heatsink temperature is exceeded
  - In this case, the controller switches independently from switching frequency mode of 16 kHz to 8 kHz and from 8 kHz to 4 kHz (but not from 4 kHz to 2 kHz). This function can be deactivated via C00144.  
When the heatsink temperature continues to rise, the inverter output will be inhibited and the error message "Trip" occurs. This also occurs when the switching frequency reduction is deactivated.
- ▶ In case of output frequencies  $f_{out} < |5 \text{ Hz}|$
- ▶ As a function of the switching frequency modes "fixed" or "variable"

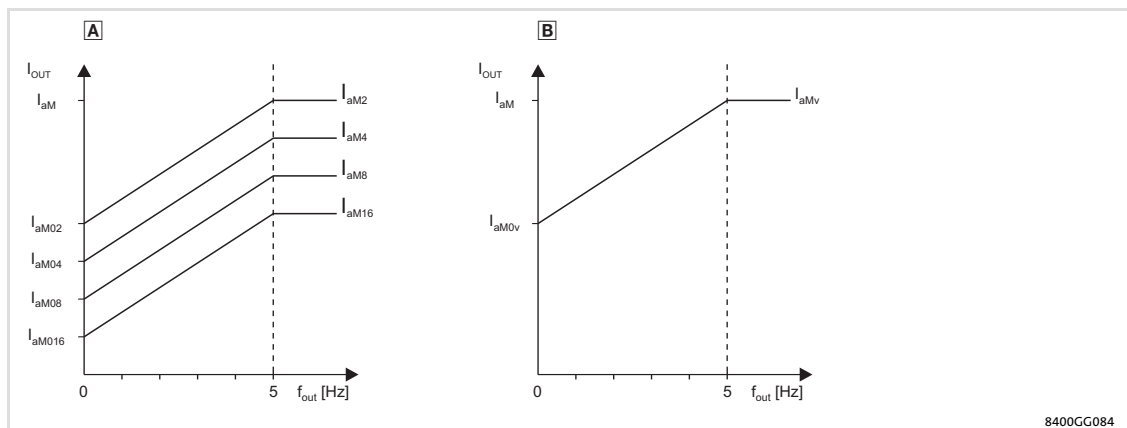


Fig. 4-1 Current derating characteristics

- A** Derating curve depending on the fixed switching frequency
- B** Derating curve depending on the variable switching frequency

$I_{out}$	Output current
$I_{aM}$	Maximum output current (overload current)
$I_{aMx}$	Maximum output current (overload current) at different switching frequencies: 2kHz, 4kHz, 8kHz and 16kHz
$I_{aM0x}$	Maximum output current (overload current) at $f_{out} = 0\text{Hz}$ and different switching frequencies: 2kHz, 4kHz, 8kHz, 16kHz
$I_{aMv}$	Maximum output current (overload current) at a variable switching frequency
$I_{aM0v}$	Maximum output current (overload current) at $f_{out} = 0\text{Hz}$ and a variable switching frequency
$f_{out}$	Field frequency at the output U, V, W

The maximum output currents depending on the mains voltage and the switching frequency modes are shown in the following tables.

Type	Maximum output currents [A] <sup>1)</sup> at a fixed switching frequency and $U_{LN} = 230V$							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{aM02}$	$I_{aM2}$	$I_{aM04}$	$I_{aM4}$	$I_{aM08}$	$I_{aM8}$	$I_{aM016}$	$I_{aM16}$
E84AVxxx2512	3.4	3.4	3.4	3.4	3.0	3.4	2.3	2.8
E84AVxxx3712	4.8	4.8	4.8	4.8	4.2	4.8	3.2	4.0
E84AVxxx5512	6.0	6.0	6.0	6.0	4.1	6.0	2.9	5.0
E84AVxxx7512	8.0	8.0	8.0	8.0	5.4	8.0	3.8	6.6
E84AVxxx1122	8.3	11.0	8.3	11.0	7.4	11.0	4.1	9.1
E84AVxxx1522	10.5	14.0	10.5	14.0	9.5	14.0	5.3	11.6
E84AVxxx2222	14.3	19.0	14.3	19.0	12.8	19.0	7.1	15.7

Type	Maximum output currents [A] <sup>1)</sup> at a fixed switching frequency and $U_{LN} = 400V$							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{aM02}$	$I_{aM2}$	$I_{aM04}$	$I_{aM4}$	$I_{aM08}$	$I_{aM8}$	$I_{aM016}$	$I_{aM16}$
E84AVxxx3714	2.6	2.6	2.6	2.6	1.5	2.6	1.0	2.1
E84AVxxx5514	3.6	3.6	3.6	3.6	2.1	3.6	1.4	3.0
E84AVxxx7514	4.8	4.8	4.8	4.8	2.8	4.8	1.8	4.0
E84AVxxx1124	4.8	6.4	4.8	6.4	3.4	6.4	2.1	5.3
E84AVxxx1524	5.9	7.8	5.9	7.8	4.1	7.8	2.5	6.4
E84AVxxx2224	8.4	11.2	8.4	11.2	5.9	11.2	3.6	9.2
E84AVxxx3024xxS	11.0	14.6	11.0	14.6	9.5	14.6	5.5	9.5
E84AVxxx3024xx0	11.0	14.6	11.0	14.6	9.5	14.6	5.5	9.5
E84AVxxx4024	14.3	19.0	13.8	19.0	9.5	17.1	5.7	9.5
E84AVxxx5524	19.5	26.0	16.9	26.0	11.7	19.5	6.5	11.7
E84AVxxx7524	24.8	33.0	24.8	33.0	16.5	26.4	9.9	16.5
E84AVxxx1134	35.3	47.0	31.7	47.0	21.2	32.9	12.9	21.2
E84AVxxx1534	48.0	64.0	44.8	62.4	30.4	43.2	17.6	27.2
E84AVxxx1834	58.5	78.0	58.5	78.0	48.8	72.2	29.3	48.8
E84AVxxx2234	70.5	89.3	68.2	89.3	49.4	75.2	30.6	49.4
E84AVxxx3034	82.6	112.1	67.9	88.5	53.1	73.8	38.4	53.1
E84AVxxx3734	108.0	136.8	93.6	115.2	79.2	97.2	54.0	72.0
E84AVxxx4534	133.5	169.1	124.6	146.9	97.9	120.2	66.8	84.6

Type	Maximum output currents [A] <sup>1)</sup> at a fixed switching frequency and $U_{LN} = 500V$							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{aM02}$	$I_{aM2}$	$I_{aM04}$	$I_{aM4}$	$I_{aM08}$	$I_{aM8}$	$I_{aM016}$	$I_{aM16}$
E84AVxxx3714	2.6	2.6	2.4	2.6	1.2	2.4	0.7	1.7
E84AVxxx5514	3.6	3.6	3.3	3.6	1.6	3.3	1.0	2.3
E84AVxxx7514	4.8	4.8	4.4	4.8	2.1	4.4	1.4	3.1
E84AVxxx1124	4.8	6.4	4.8	6.4	2.6	5.9	1.6	4.1
E84AVxxx1524	5.9	7.8	5.9	7.2	3.2	7.2	1.9	5.0
E84AVxxx2224	8.4	11.2	8.4	11.2	4.5	10.4	2.7	7.2
E84AVxxx3024xxS	11.0	14.6	10.6	13.5	7.4	13.5	4.2	7.4
E84AVxxx3024xx0	11.0	14.6	10.6	13.5	7.4	13.5	4.2	7.4
E84AVxxx4024	14.3	19.0	10.7	17.6	7.3	13.4	4.3	7.3
E84AVxxx5524	19.5	26.0	13.1	24.1	9.0	15.2	4.8	9.0
E84AVxxx7524	24.8	33.0	19.3	30.5	12.7	20.6	7.4	12.7
E84AVxxx1134	35.3	47.0	24.7	43.5	16.2	25.6	9.6	16.2
E84AVxxx1534	48.0	64.0	34.9	49.0	23.4	33.6	13.1	20.8
E84AVxxx1834	58.5	78.0	56.2	78.0	41.1	61.2	24.3	41.1
E84AVxxx2234	70.5	89.3	57.6	89.3	41.5	63.7	25.3	41.5
E84AVxxx3034	82.6	112.1	57.1	74.9	44.4	62.2	31.7	44.4
E84AVxxx3734	108.0	136.8	79.0	97.6	66.6	82.1	44.9	60.4
E84AVxxx4534	133.5	169.1	105.3	124.4	82.3	101.5	55.5	70.8

<sup>1)</sup> The shown values apply to the operation with ambient temperatures of up to +45°C for 2/4kHz and up to +40°C for 8/16kHz. For ambient temperatures between +40/45°C and +55°C, a derating from 2.5 %/K to the given values must be observed.

Type	Maximum output currents [A] <sup>1)</sup> at a variable switching frequency	
	U <sub>Lr</sub> = 230V	
	I <sub>aM0v</sub>	I <sub>aMv</sub>
E84AVxxx2512	3.4	3.4
E84AVxxx3712	4.8	4.8
E84AVxxx5512	6.0	6.0
E84AVxxx7512	8.0	8.0
E84AVxxx1122	8.3	11.0
E84AVxxx1522	10.5	14.0
E84AVxxx2222	14.3	19.0

Type	Maximum output currents [A] <sup>1)</sup> at a variable switching frequency	
	U <sub>Lr</sub> = 400V/U <sub>Lr</sub> = 500V	
	I <sub>aM0v</sub>	I <sub>aMv</sub>
E84AVxxx3714	2.6	2.6
E84AVxxx5514	3.6	3.6
E84AVxxx7514	4.8	4.8
E84AVxxx1124	4.8	6.4
E84AVxxx1524	5.9	7.8
E84AVxxx2224	8.4	11.2
E84AVxxx3024xxS	11.0	14.6
E84AVxxx3024xx0	11.0	14.6
E84AVxxx4024	14.3	19.0
E84AVxxx5524	19.5	26.0
E84AVxxx7524	24.8	33.0
E84AVxxx1134	35.3	47.0
E84AVxxx1534	48.0	64.0
E84AVxxx1834	58.5	78.0
E84AVxxx2234	70.5	89.3
E84AVxxx3034	88.5	112.1
E84AVxxx3734	108.0	136.8
E84AVxxx4534	133.5	169.1

<sup>1)</sup> The shown values apply to the operation with ambient temperatures of up to +45°C for 2/4kHz and up to +40°C for 8/16kHz. For ambient temperatures between +40/45°C and +55°C, a derating from 2.5 %/K to the given values must be observed.



#### 4.4 Overcurrent operation

The controllers can be driven at higher amperages beyond the rated current if the duration of this overcurrent operation is time limited. Two utilisation cycles with a duration of 15 s and 180 s are defined. Within these utilisation cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place. For both utilisation cycles, a moving average is determined separately.

Monitoring of the device utilisation ( $I \times t$ ) activates the set error response (trip or warning if one of the two utilisation values exceeds the limit of 100 %. The current device utilisation ( $I \times t$ ) is displayed under parameter C00064/x:

- ▶ C00064/1: Total value of the device utilisation
- ▶ C00064/2: Pulse utilisation in 15-s cycle
- ▶ C00064/3: Permanent utilisation in 180-s cycle

Type of utilisation	Utilisation cycle	Monitoring function	
		Condition	Code
Pulse utilisation	15 s	$I_{aNx} > 160 \%$	<ul style="list-style-type: none"> <li>● Display in C00064/2</li> <li>● Display of the maximum value in C00064/1</li> </ul>
Permanent utilisation	180 s	The monitoring function is permanently active.	<ul style="list-style-type: none"> <li>● Display in C00064/3</li> <li>● Display of the maximum value in C00064/1</li> </ul>

The curves of typical load functions and the simulation of the "Ixt" function are shown in the following illustration:

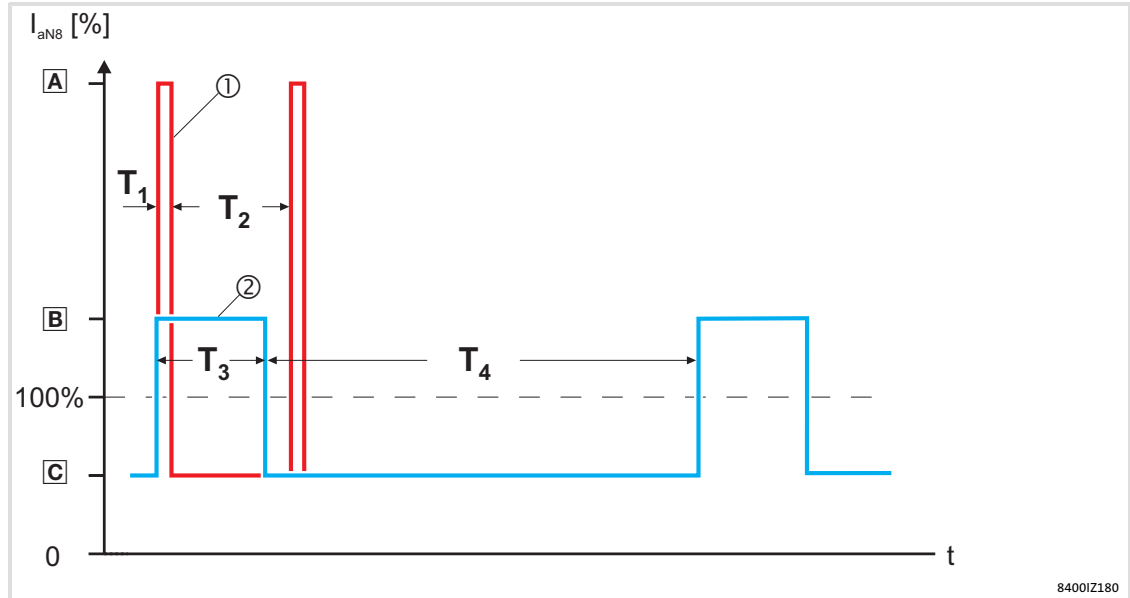


Fig. 4-2 Overcurrent capacity in 230/400 V operation at 45° C

- ① Pulse load (15 s cycle)
- Ⓐ Peak current
- Ⓒ Unloading current
- T<sub>1</sub> Peak current period
- T<sub>2</sub> Unloading current period

Calculation equation:  

$$\frac{A \cdot T_1 + C \cdot T_2}{T_1 + T_2} \leq 100\%$$

- ② Permanent load (180 s cycle)
- Ⓑ Peak current
- Ⓒ Unloading current
- T<sub>3</sub> Peak current period
- T<sub>4</sub> Unloading current period
- I<sub>aNx</sub> Rated value of continuous output current

Calculation equation:  

$$\frac{B \cdot T_3 + C \cdot T_4}{T_3 + T_4} \leq 100\%$$

15-s cycle ①	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	Ⓐ	Ⓒ	Ⓐ	Ⓒ	Ⓐ	Ⓒ	Ⓐ	Ⓒ
I <sub>amax</sub> /I <sub>aN8</sub> [%]	200	75	200	75	200	75	133	50

180-s cycle ②	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	Ⓑ	Ⓒ	Ⓑ	Ⓒ	Ⓑ	Ⓒ	Ⓑ	Ⓒ
I <sub>amax</sub> /I <sub>aN8</sub> [%]	150	75	150	75	150	75	100	50

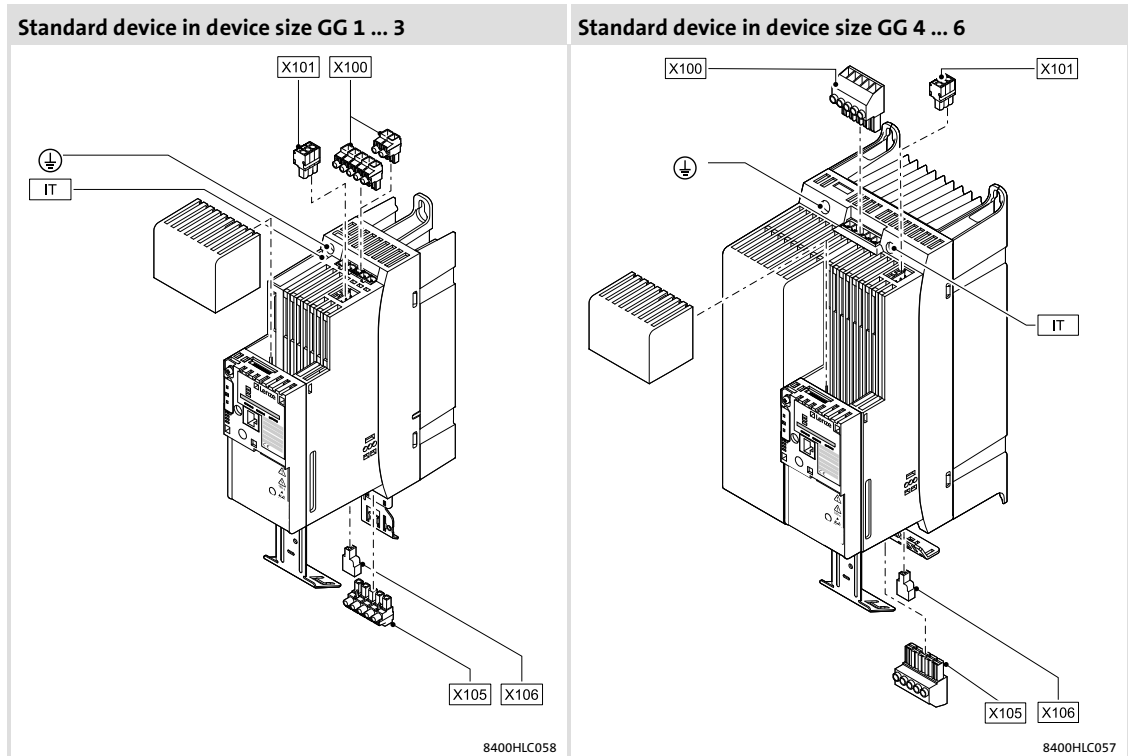


**Tip!**

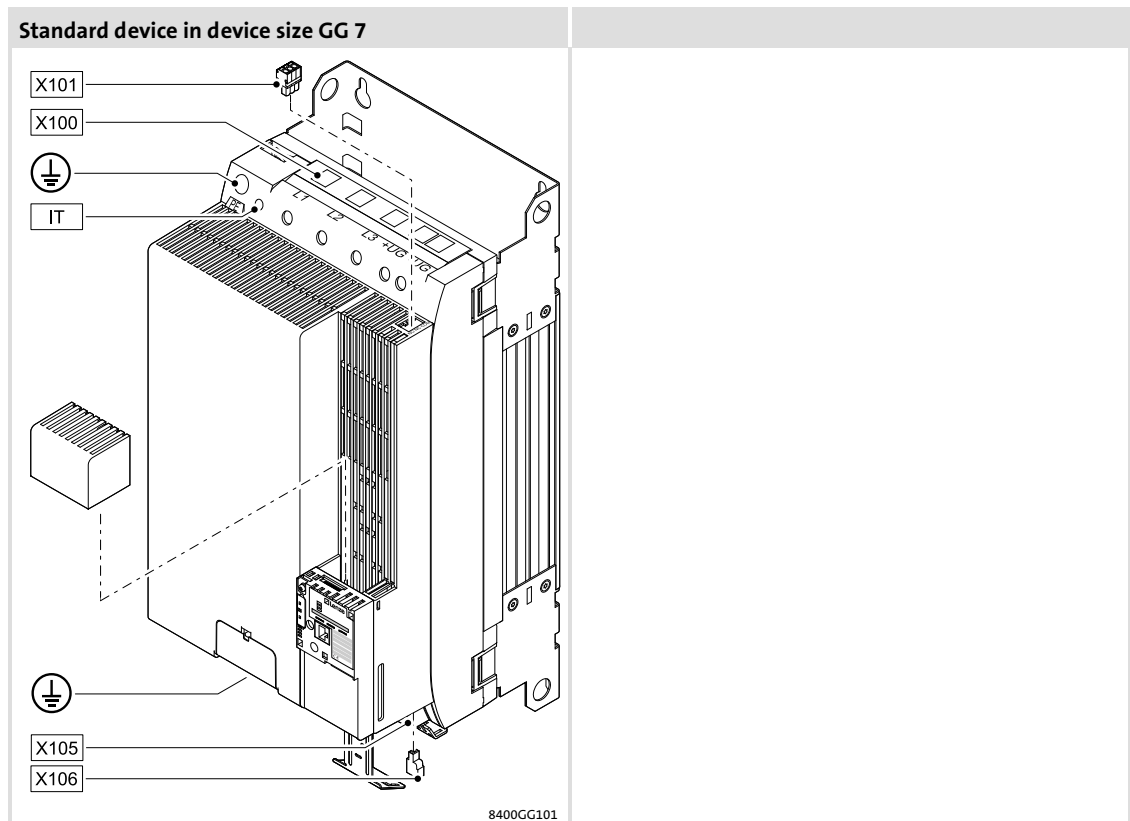
For calculations of application-specific cycles please contact your Lenze contact person.

## 4.5 Terminal description

### 4.5.1 Overview

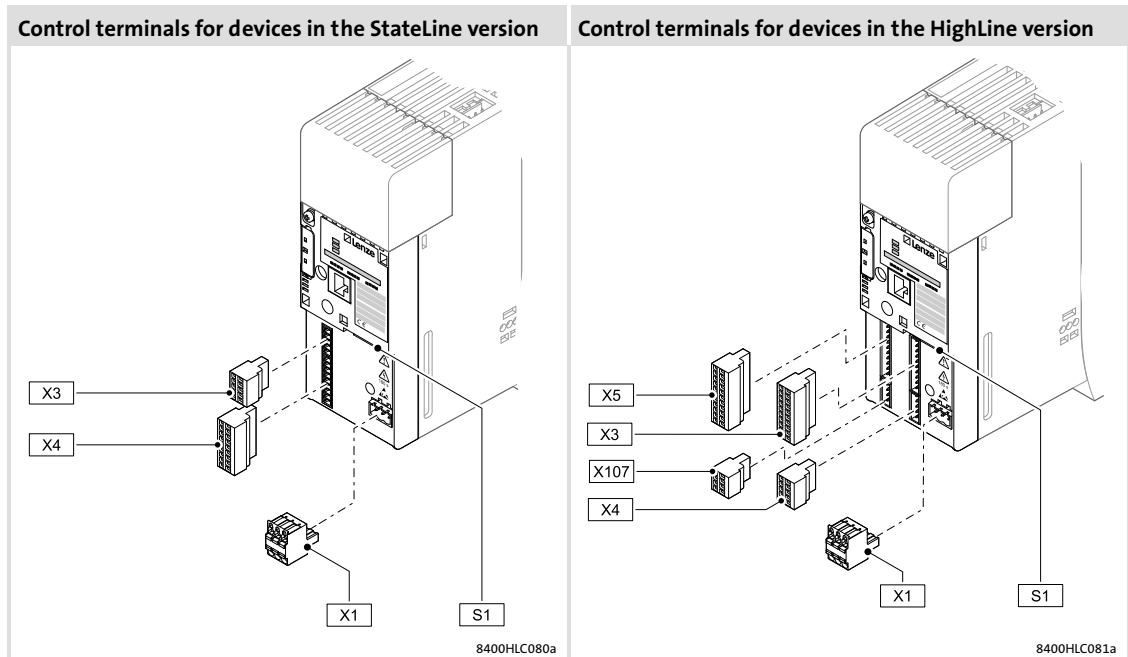


Connection		
Pos.	Description	Number
X100	Mains/DC-bus voltage (for 400V devices) – For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable.	1
X101	Relay output	1
X105	Motor/external brake resistor – For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable.	1
X106	Motor temperature monitoring	1
⊕	PE conductor (on the supply side/on the motor side)	2
IT	Contact screw for interference suppression (on the supply side/on the motor side)	2

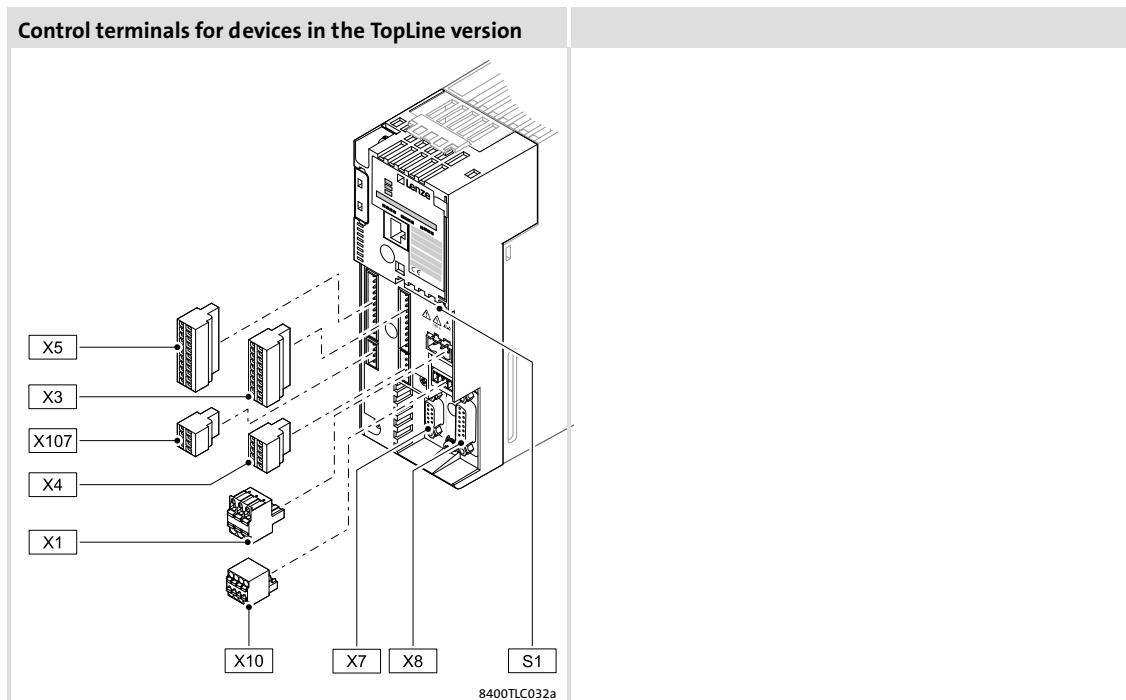


#### Connection

Pos.	Description	Number
X100	Mains/DC-bus voltage – non-pluggable.	1
X101	Relay output	1
X105	Motor/external brake resistor – non-pluggable.	1
X106	Motor temperature monitoring	1
⊕	PE conductor (on the supply side/on the motor side)	2
IT	Contact screw for interference suppression (on the supply side/on the motor side)	2



Connection		Number	
Pos.	Description	StateLine C	HighLine C
X1	System bus (CANopen)	1	1
S1	System bus settings (CANopen)	1	1
X3	Analog inputs (voltage/current)	1/1	2/2
	Analog outputs (voltage/current)	1/-	2/2
X4	10 V reference voltage	1	1
	Digital inputs	4	-
	Digital outputs	1	3
	Controller enable	1	-
X5	24 V supply of the control electronics	1	-
	24 V voltage output	1	1
	Digital inputs	-	7
	Controller enable	-	1
X107	24 V supply of the control electronics	-	1
	24 V internal supply	-	1
X107	Motor holding brake	-	1



Connection		Number
Pos.	Description	TopLine C
X1	System bus (CANopen)	1
S1	System bus settings (CANopen)	1
X3	Analog inputs (voltage/current)	2/2
	Analog outputs (voltage/current)	2/2
X4	10 V reference voltage	1
	Digital outputs	3
	24 V voltage output	1
X5	Digital inputs	7
	Controller enable	1
	24 V supply of the control electronics	1
	24 V internal supply	1
X6	Diagnostics	1
X7	Resolver (D-Sub 9-pole)	1
X8	Multi encoder (D-Sub 15-pole)	1
X10	Axis bus	1
	– Sync/State – CAN	
X107	Motor holding brake	1

## 4.6 StateLine C control terminals

### 4.6.1 External supply voltage 24 V

Labelling	Feature	Rated value
X4/24E	Connection for external 24 V supply voltage by a safely separated power supply unit (required for mains-independent supply of the control electronics and the communication module)	24 V in accordance with IEC 61131-2 19.2 ... 28.8 V Residual ripple max. $\pm 5\%$ SELV/PELV
	Suppression of voltage pulses	Suppressor diode 36 V, bidirectional
	Polarity reversal protection	When polarity is reversed: no function and no destruction
	Current consumption	Approx. 0.6 A during operation Max. 1.5 A starting current for 100 ms
	Capacity to be charged	1000 $\mu\text{F}$
X4/GIO	GND, reference potential for digital signals	

Labelling	Feature	Rated value
X4/24I	24 V voltage output to connect digital inputs via potential-free contacts	External supply at 24E: voltage drop $< 2.5\text{ V}$ Internal supply: DC 18 ... 28 V
	Max. output current	50 mA
	Electric strength of external voltage	+30 V
	Excess current release	Automatically resettable
X4/GIO	GND, reference potential for digital signals	

## 4.6.2 Analog inputs

Labelling	Feature	Rated value
X3/A1U	Input	$\pm 10$ V
	Input resistance	$> 80$ k $\Omega$
	Input voltage in case of open circuit	Display "0" (U < 0.2 V, absolute)
	Sampling frequency	1 kHz (1 ms)
	Accuracy	$\pm 0.1$ V
	Electric strength of external voltage	$\pm 15$ V, permanent
	A/D converter	Resolution 10 bits + sign Error 1 digit $\approx 0.1$ % relating to the final value
X3/A1I	Input	0 ... +20 mA 4 ... +20 mA, fail-safe
		Parameterisable
	Input resistance	215 $\Omega$
	Input current in case of open circuit	Display "0" (I < 0.1 mA)
	Sampling frequency	1 kHz (1 ms)
	Accuracy	$\pm 0.1$ mA
	Electric strength of external voltage	$\pm 7$ V, permanent
A/D converter	10 bit resolution Error 1 digit $\approx 0.1$ % relating to the final value	
X3/GA	GND, reference potential for analog signals	

## 4.6.3 Analog outputs

Labelling	Features	Rated value
X3/O1U	Output voltage	0 ... 10 V
	Output current	2 mA
	Capacitive load	max 1 $\mu$ F
	Voltage - 0 V	Display "0" (U < 0.1 V, absolute)
	Output voltage at reset	< 0.5 V
	Accuracy	$\pm 2$ % relating to the final value
	Short-circuit strength	Unlimited period
	Electric strength of external voltage	Not guaranteed
X3/AR	Reference 10 V	10.5 V
	Tolerance	$\pm 0.5$ V
	Capacitive load	max 1 $\mu$ F
	Short-circuit strength	Unlimited period
	Electric strength of external voltage	Not guaranteed
	Permissible current loading	10 mA
X3/GA	GND, reference potential for analog signals	



#### 4.6.4 Digital inputs

Labelling	Features	Rated value
X4/DI1, DI2	Digital input 1/2	In accordance with IEC61131-2, type 1 or two-track frequency input for HTL encoder 0 ... 10 kHz
X4/DI3, DI4	Digital input 3/4	In accordance with IEC61131-2, type 1
X4/RFR	Controller inhibit	In accordance with IEC61131-2, type 1
	Input resistance	3.3 k $\Omega$ (2.5 k $\Omega$ ... 6 k $\Omega$ )
	Electric strength of external voltage	Up to $\pm 30$ V, permanent
	Isolation	159
	Level	LOW < +5V HIGH > +15V
X4/GIO	Cycle time	1 ms, can be changed by software filtering
	GND, reference potential for digital signals	

#### 4.6.5 Digital outputs

Labelling	Features	Rated value
X4/DO1	Digital output	In accordance with IEC61131-2, type 1, max. 50 mA
	External-voltage protected	Up to +30 V Integrated polarity reversal protection diode for switching inductive loads
	Isolation	159
	Level	LOW < +5 V High > +15 V
	Time-dependent behaviour	LOW - HIGH / HIGH - LOW Max. 250 $\mu$ s
	Overload behaviour	Reduced voltage or periodical switch-off/on
	Reset and switch-on behaviour	Outputs are switched off (LOW)
	Cycle time	1 ms
X4/GIO	GND, reference potential for digital signals	

#### 4.6.6 Connection of relay output

Labelling	Description/features	Rated value
X101	In the Lenze setting, the relay switches if the controller changes to the "Fault" device status. Observe the notes provided in the corresponding software manual if you would like to implement parameters other than envisaged in the Lenze setting. Use a corresponding suppressor circuit in case of an inductive or capacitive load!	
COM	Relay centre contact	AC 250 V, 3 A DC 24 V, 2 A
NC	NC contact (normally closed)	DC 240 V, 0.16 A
NO	NO contact (normally open)	<ul style="list-style-type: none"> <li>● According to UL508C:                             <ul style="list-style-type: none"> <li>– 3 A, 250 V AC (general purpose)</li> <li>– 2 A, 24 V DC (resistive)</li> </ul> </li> </ul>

## 4

### Technical data

HighLine C control terminals  
External supply voltage 24 V

#### 4.7

#### HighLine C control terminals

##### 4.7.1

##### External supply voltage 24 V

Labelling	Feature	Rated value
X5/24E	Connection for external 24 V supply voltage by a safely separated power supply unit (required for mains-independent supply of the control electronics and the communication module)	24 V in accordance with IEC 61131-2 19.2 ... 28.8 V Residual ripple max. $\pm 5\%$ SELV/PELV
	Suppression of voltage pulses	Suppressor diode 36 V, bidirectional
	Polarity reversal protection	When polarity is reversed: no function and no destruction
	Current consumption	Approx. 0.6 A during operation Max. 1.5 A starting current for 100 ms
	Capacity to be charged	1000 $\mu\text{F}$
X5/GI	GND, reference potential for digital signals	

Labelling	Feature	Rated value
X4/24O	Connection for external 24 V supply voltage by a safely separated Power supply unit (required for the supply of the digital outputs)	24 V in accordance with IEC 61131-2 19.2 ... 28.8 V Residual ripple max. $\pm 5\%$ SELV/PELV
	Suppression of voltage pulses	Suppressor diode 36 V, bidirectional
	Polarity reversal protection	When polarity is reversed: no function and no destruction
	Current consumption	Approx. 0.15 A if all digital outputs are loaded with rated current
X4/GO	GND, reference potential for digital signals	

Labelling	Feature	Rated value
X5/24I	24 V voltage output for connection of the digital inputs via potential-free contacts	External supply at 24E: voltage drop $< 2.5\text{ V}$ Internal supply: DC 18 ... 28 V
	Max. output current	50 mA
	Electric strength of external voltage	+30 V
	Excess current release	Automatically resettable
X5/GI	GND, reference potential for digital signals	


### 4.7.2 Analog inputs

Labelling	Feature	Rated value	
X3/A1U, A2U	Input	± 10 V	
	Input resistance	> 80 kΩ	
	Input voltage in case of open circuit	Display "0" (U < 0.2 V, absolute)	
	Sampling frequency	1 kHz (1 ms)	
	Accuracy	± 0.1 V	
	Electric strength of external voltage	± 15 V, permanent	
	A/D converter	Resolution 10 bits + sign Error 1 digit ≙ 0.1 % relating to the final value	
X3/A1I, A2I	Input	0 ... +20 mA 4 ... +20 mA, fail-safe	Parameterisable
	Input resistance	215 Ω	
	Input current in case of open circuit	Display "0" (I < 0.1 mA)	
	Sampling frequency	1 kHz (1 ms)	
	Accuracy	± 0.1 mA	
	Electric strength of external voltage	± 7 V, permanent	
	A/D converter	10 bit resolution Error 1 digit ≙ 0.1 % relating to the final value	
X3/GA	GND, reference potential for analog signals		



### 4.7.3 Analog outputs

Labelling	Features	Rated value	
X3/O1U, O2U	Output voltage	0 ... 10 V	
	Output current	2 mA	
	Capacitive load	max 1 μF	
	Voltage - 0 V	Display "0" (U < 0.1 V, absolute)	
	Output voltage at reset	< 0.5 V	
	Accuracy	± 2 % relating to the final value	
	Short-circuit strength	Unlimited period	
	Electric strength of external voltage	Not guaranteed	
X3/O1I, O2I	Output current	0 ... 20 mA 4 ... 20 mA, fail-safe	Parameterisable
	Output voltage	0 ... 10 V	
	Current for output 0 mA	I < 0.1 mA abs.	
	Output current in the case of reset	< 1 mA	
	Accuracy	± 2 % relating to the final value	
	Short-circuit strength	Unlimited period	
	External voltage protection	Not guaranteed	
X3/AR	Reference 10 V	10.5 V	
	Tolerance	±0.5 V	
	Capacitive load	max 1 μF	
	Short-circuit strength	Unlimited period	
	Electric strength of external voltage	Not guaranteed	
X3/GA	GND, reference potential for analog signals		

## 4.7.4 Digital inputs

Labelling	Features	Rated value
X5/DI1, DI2	Digital input 1/2	according to IEC61131-2, type 1 or two-track frequency input for HTL encoder 0 ... 200 kHz
X5/DI3, DI4, DI5	Digital input 3/4/5	according to IEC61131-2, type 1
X5/DI6, DI7	Digital input 6/7	according to IEC61131-2, type 1 or two-track frequency input for HTL encoder 0 ... 10 kHz
X5/RFR	Controller inhibit	according to IEC61131-2, type 1
	Input resistance	3.3 k $\Omega$ (2.5 k $\Omega$ ... 6 k $\Omega$ )
	Electric strength of external voltage	Up to $\pm$ 30 V, permanent
	Level	LOW < +5V HIGH > +15V
	Cycle time	1 ms, can be changed by software filtering
	Isolation	 159
X5/GI	GND, reference potential for digital signals	

## 4.7.5 Digital outputs

Labelling	Features	Rated value
X4/DO1, DO2, DO3	Digital output 1/2/3 - for operation of the digital outputs an external voltage source is required (  82)	In accordance with IEC61131-2, type 1, max. 50 mA
	External-voltage protected	Up to +30 V
	Isolation	 159
	Level	LOW < +5 V High > +15 V
	Time-dependent behaviour	LOW - HIGH / HIGH - LOW Max. 250 $\mu$ s
	Overload behaviour	Reduced voltage or periodical switch-off/on
	Reset and switch-on behaviour	Outputs are switched off (LOW)
	Cycle time	1 ms
X4/GO	GND, reference potential for digital signals	

## 4.7.6 Connection of relay output

Labelling	Description/features	Rated value	
X101	In the Lenze setting, the relay switches if the controller changes to the "Fault" device status. Observe the notes provided in the corresponding software manual if you would like to implement parameters other than envisaged in the Lenze setting. Use a corresponding suppressor circuit in case of an inductive or capacitive load!		
	COM	Relay centre contact	AC 250 V, 3 A DC 24 V, 2 A
	NC	NC contact (normally closed)	DC 240 V, 0.16 A
	NO	NO contact (normally open)	<ul style="list-style-type: none"> <li>• According to UL508C:               <ul style="list-style-type: none"> <li>– 3 A, 250 V AC (general purpose)</li> <li>– 2 A, 24 V DC (resistive)</li> </ul> </li> </ul>

### 4.7.7 Motor holding brake connection

Labelling	Feature	Rated value
X107/24B X107/GB	Connection for external 24 V supply voltage by a safely separated power supply unit (required for the supply of the brake output)	24 V in accordance with IEC 61131-2 19.2 ... 28.8 V Residual ripple max. $\pm 5\%$ SELV/PELV
	Suppression of voltage pulses	Suppressor diode 36 V, bidirectional
	Polarity reversal protection	No
	Rated current	2.5 A DC
	Capacity to be charged	1 $\mu$ F
X107/BD1 X107/BD2	<ul style="list-style-type: none"> <li>• 24 V voltage output for connecting a motor holding brake via potential-free contacts</li> <li>• The brake output can also be used as a potential-free, digital output that can exceed a certain current value, e.g. for switching a relay or valve.</li> </ul>	
	Max. output current	2.5 A
	Max. voltage drop in the high state	< 3 V for rated current
	Breaking energy	Max. 5 Ws
	Isolation	Basic insulation (I 159)
	Level	LOW < +5 V High > +15 V
	Time-dependent behaviour	LOW - HIGH / HIGH - LOW Max. 500 $\mu$ s
	Behaviour during overload	Reduced voltage or periodic switch-off/on
	Reset and switch-on behaviour	Outputs are switched off
	Cycle time	1 ms
Operating frequency	Max. 6/min for max. breaking energy	

## 4.8 TopLine C control terminals

Devices of the TopLine C version have identical connections as described under "HighLine C control terminals" (82). The additional control terminals of the TopLine C version are described in the following.

## 4.8.1 Axis bus

**Note!**

This connection is not supported in versions below 8400 TopLine, SW version 02.00. This connection must not be wired in these lower versions.

The axis bus connection serves to implement two functionalities:

- ▶ Synchronisation via state bus
- ▶ CAN synchronisation

**I/O axis 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.

Labelling	Feature	Rated value
X10/AS	I/O axis bus connection	TTL level: 5 V
X10/AG	GND, reference potential: I/O axis bus	

**Data transfer axis bus**

Labelling	Feature	Rated value
X10/AH, AL	Data transfer axis bus connection	Acc. to CAN specification Cable lengths: See CAN on board
	Baud rate	from version 12.00: 800 kbit/s, constant up to version 2.xx: 500 kbps, constant
	Terminating resistor	120 Ω, switching via DIP switch
X10/AG	GND, reference potential: Data transfer axis bus	

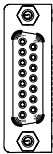
### 4.8.2 Multi-encoder connection

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

In order to avoid interference injections, only use shielded motor and encoder cables when using an encoder.

- ▶ Absolute and incremental encoders are supported:
  - TTL encoders 5 V (incremental)
  - SinCos encoders 1 V<sub>SS</sub> (incremental)
  - SinCos absolute value encoders 1 V<sub>SS</sub> with Hiperface protocol
  - SSI absolute value encoders with Stegmann protocol
- ▶ Improved detection of low speeds with TTL encoders by additional time measuring technique.
- ▶ SinCos absolute value encoders are read out serially during initialisation (connection of the supply voltage). Then the SinCos signals are evaluated.
- ▶ Open-circuit monitoring:
  - In the case of SinCos encoders by comparison of the SinCos signals with the sine-wave form (radius monitoring)
  - In the case of TTL encoders by monitoring of the mean value and the amplitudes
  - Not with SSI encoders
- ▶ The following is not supported:
  - HTL encoders -  
they are not connected via the multi-encoder input, but via the digital inputs of the controller.
  - Motors with an installed ENP and KTY -  
for these motors, correct temperature evaluation and motor protection are not possible with 8400.

Labelling	Feature	Rated value
X8/ General	Cable length (system cable is recommended)	Max. 150 m
	Encoder types	TTL SinCos 1V <sub>SS</sub>
	Protocols	Hiperface SSI
	Number of increments	1 ... 16384
	Input frequency	max. 500 kHz
	Scanning speed/position	TTL: 4 kHz (250 μs cycle) SSI: max. 4 kHz (250 μs cycle)
X8/4, 2	Supply voltage V <sub>CC</sub> /GND for encoder	5 ... 12 V
	max. output/current	up to 45 °C: 3 W/600 mA 45 ... 55 °C: 1.6 W/320 mA
	max. capacitive switch-on load	450 μF
X8/12, 10	n. c.	-
X8/14, 7	+KTY, -KTY	Type K: TY 83-110, TY84 Freely defined characteristic

X8	Pin	Description					
		EYF001... cable			EYF002... cable	EYDxxxxAxxxxS10S09 cable	
		TTL	1 V <sub>SS</sub>	1 V <sub>SS</sub> Hiperface	SSI	DFin	DFOut
	1	A	A	COS	n. c.	A	-
	2	GND	GND	GND	GND	GND	-
	3	B	B	Sin	n. c.	B	-
	4	V <sub>CC</sub>	V <sub>CC</sub>	V <sub>CC</sub>	U <sub>S</sub>	V <sub>CC</sub>	-
	5	Z	Z	+RS485	Data +	Z	-
	6	n. c.	n. c.	n. c.	n. c.	n. c.	-
	7	-KTY	-KTY	-KTY	n. c.	-	$\bar{A}$
	8	n. c.	n. c.	n. c.	Clock +	-	Z
	9	/A	/A	Ref COS	n. c.	$\bar{A}$	-
	10	n. c.	n. c.	n. c.	n. c.	-	$\bar{B}$
	11	/B	/B	Ref SIN	n. c.	$\bar{B}$	-
	12	n. c.	n. c.	n. c.	n. c.	-	B
	13	/Z	/Z	-RS485	Data -	$\bar{Z}$	-
	14	+KTY	+KTY	+KTY	n. c.	-	A
	9400SSP000X8	15	n. c.	n. c.	n. c.	Clock -	-

### Setting the supply voltage

The supply voltage of the encoder must be adjusted depending on the cable length.

This value is adjusted via the "Encoder voltage" parameter, C00421.

Encoder Product key	U <sub>r</sub> [V]	Voltage setting [V] in C00421 for cable length [m]						
		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)								
AM1024-8V-H	8 (7 ... 12)	8.0						

Tab. 4-1

V<sub>r</sub> Rated voltage of the encoder

The values provided in Tab. 4-1 apply if Lenze system cables are used at typical ambient temperatures.

Different cables, cable cross-sections, or extreme ambient temperatures may require adaptation after another metrological measurement process.

Encoders (e.g. laser-based length measuring systems) must be externally supplied if their supply must be increased.



### 4.8.3 Resolver connection

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

To avoid interference injection, only use shielded motor and encoder cables if an encoder is used.

You can connect and operate:

- ▶ Resolvers
  - Parameterisation of the number of pole pairs in C00925
  - Lenze setting: Number of pole pairs = 1.
- ▶ Multipole resolvers with a number of resolver pole pairs  $\geq 2$
- ▶ Resolvers of other manufacturers

Please ensure compliance with the technical limiting values of the resolver:

Description	Rated value	
Cable length (system cable is recommended)	Max. 150 m	
Number of resolver pole pairs	1 ... n	
Carrier frequency of the excitation voltage	4 kHz	
Impedance	$Z_{RO} = (R_{RO} + j X_{RO}) = 90.9 \text{ Ohms (max.)}$ When a resolver with a lower rotor impedance ( $Z_{RO}$ ) is connected, the integrated overload protection limits the excitation current which impairs the signal quality and may distort the determined actual values.	
<b>X7 /</b>		
Pin 1, 2	+REF, -REF	
	Excitation voltage	R.m.s. value: $V = 7.07 \text{ V}$ Peak value: $\hat{u} = 10 \text{ V}$
	Maximum excitation current	R.m.s. value: $I = 77.78 \text{ mA}$ Peak value: $\hat{I} = 110 \text{ mA}$
Pin 4, 5	+COS, -COS	
Pin 6, 7	+SIN, -SIN	
Pin 8, 9	+KTY, -KTY	Type: KTY 83-110, KTY 84, adjustable

## 5 Mechanical installation

Important notes

## 5 Mechanical installation

### 5.1 Important notes



#### **Danger!**

Sticker with warning note must be displayed prominently and close to the device!



#### **Note!**

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

- ▶ If the cooling air is polluted (lint, (conductive) dust, soot, aggressive gases), take adequate countermeasures, as e.g.:
  - Separate air guide
  - Installation of filters
  - Regular cleaning of the filters
- ▶ Possible mounting position:
  - Vertical on the mounting plate (mains connections at the top, motor connection at the bottom)
- ▶ Maintain the specified free spaces above and below the controller to other installations!
  - Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  - You can install several controllers of the 8400 L-force Inverter Drives product range next to each other without any clearance in the control cabinet.
- ▶ The mounting plate of the control cabinet must be electrically conductive.
- ▶ In case of continuous vibrations or shocks use vibration dampers.

**5.2 Standard devices in a power range of 0.25 ... 3 kW****5.2.1 Assembly in built-in technique (standard)**

You can choose between three variants for mounting the "built-in unit" version of the controllers:

- ▶ Assembly without filter
  - in "standard" technique
- ▶ Assembly with filter:
  - in "standard" technique (footprint filter)
  - in mounting variant (side-mounted filter)

The following filters can be used for the controllers:

- ▶ on the supply side
  - RFI filters

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW  
 Assembly without filter in "standard" technique

### Assembly without filter in "standard" technique

For mounting, use two screws M5 x >10 mm. The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended.

How to proceed:

1. Prepare the fixing holes on the mounting surface.
2. Screw the controller directly to the mounting surface.

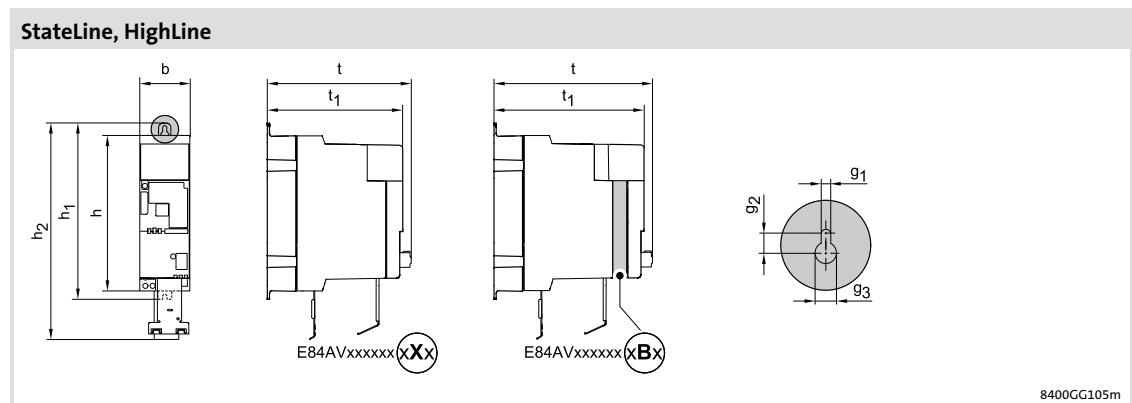


Fig. 5-1 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]								
E84AVxxE2512xXx	0.25	165	70	199	194	235	186	6	11	12
E84AVxxE3712xXx	0.37									
E84AVxxE3714xXx	0.37									
E84AVxxE551xxXx	0.55	215	70	199	244	285	186	6	11	12
E84AVxxE751xxXx	0.75									
E84AVxxE112xxXx	1.1									
E84AVxxE152xxXx	1.5	270	70	199	304	340	186	6	11	12
E84AVxxE222xxXx	2.2									
E84AVxxE3024xXS	3.0									
E84AVxxE2512xBx	0.25	165	70	219	194	235	206	6	11	12
E84AVxxE3712xBx	0.37									
E84AVxxE3714xBx	0.37									
E84AVxxE551xxBx	0.55	215	70	219	244	285	206	6	11	12
E84AVxxE751xxBx	0.75									
E84AVxxE112xxBx	1.1									
E84AVxxE152xxBx	1.5	270	70	219	304	340	206	6	11	12
E84AVxxE222xxBx	2.2									
E84AVxxE3024xBs	3.0									

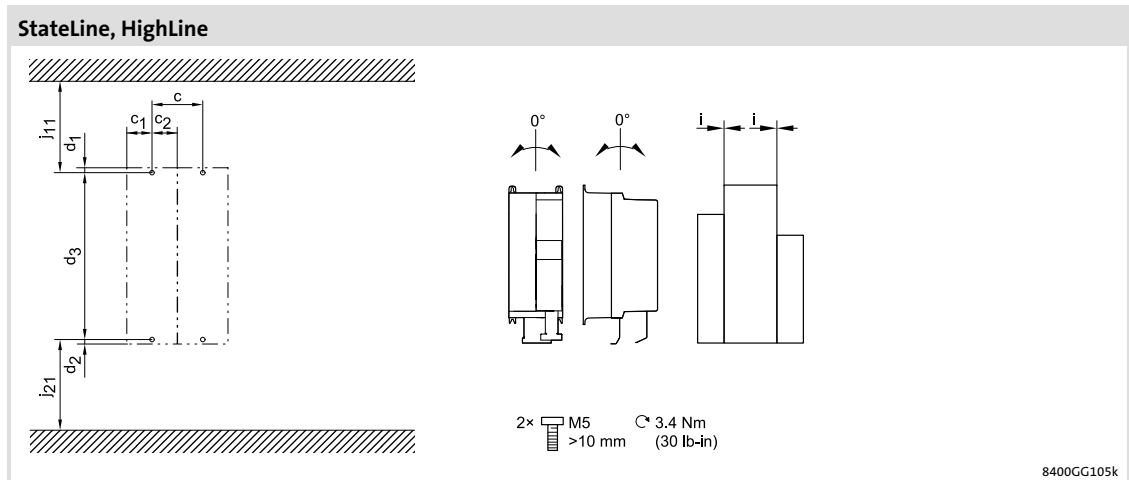



Fig. 5-2 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]									[kg]
E84AVxxE2512xXx	0.25	9	5	180	70	35	35	0	> 95	> 95	1.3
E84AVxxE3712xXx	0.37										
E84AVxxE3714xXx	0.37										
E84AVxxE551xxXx	0.55	9	5	230	70	35	35	0	> 95	> 95	1.8
E84AVxxE751xxXx	0.75										
E84AVxxE112xxXx	1.1										
E84AVxxE152xxXx	1.5	8	10	285	70	35	35	0	> 95	> 95	2.1
E84AVxxE222xxXx	2.2										
E84AVxxE3024xXS	3.0										
E84AVxxE2512xBx	0.25	9	5	180	70	35	35	0	> 95	> 95	1.4
E84AVxxE3712xBx	0.37										
E84AVxxE3714xBx	0.37										
E84AVxxE551xxBx	0.55	9	5	230	70	35	35	0	> 95	> 95	1.9
E84AVxxE751xxBx	0.75										
E84AVxxE112xxBx	1.1										
E84AVxxE152xxBx	1.5	8	10	285	70	35	35	0	> 95	> 95	2.2
E84AVxxE222xxBx	2.2										
E84AVxxE3024xBS	3.0										

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW  
 Assembly without filter in "standard" technique

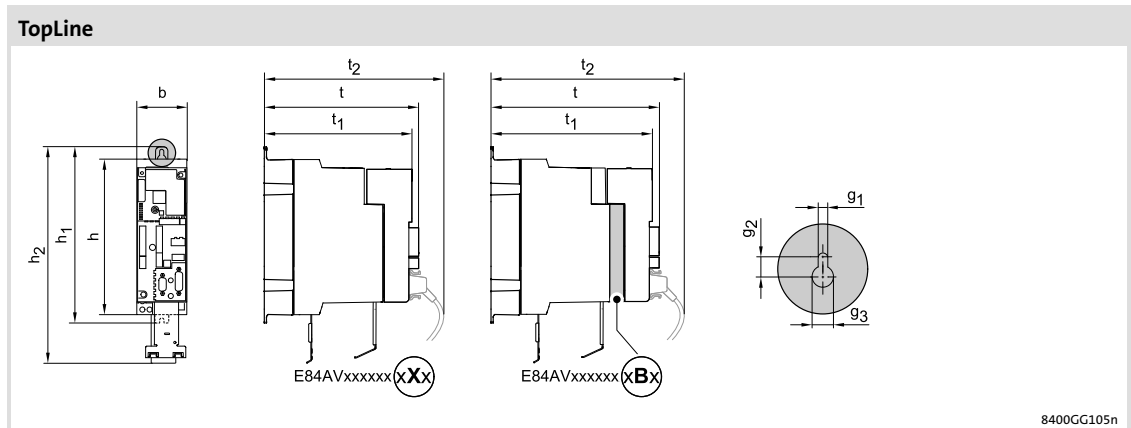


Fig. 5-3 Device dimensions

		h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
	[kW]	[mm]									
E84AVTCE2512xXx	0.25	215	70	214	244	285	201	240	6	11	12
E84AVTCE371xxXx	0.37										
E84AVTCE551xxXx	0.55										
E84AVTCE751xxXx	0.75										
E84AVTCE112xxXx	1.1	270	70	214	304	340	201	240	6	11	12
E84AVTCE152xxXx	1.5										
E84AVTCE222xxXx	2.2										
E84AVTCE3024xXS	3.0										
E84AVTCE2512xBx	0.25	215	70	234	244	285	221	260	6	11	12
E84AVTCE371xxBx	0.37										
E84AVTCE551xxBx	0.55										
E84AVTCE751xxBx	0.75										
E84AVTCE112xxBx	1.1	270	70	234	304	340	221	260	6	11	12
E84AVTCE152xxBx	1.5										
E84AVTCE222xxBx	2.2										
E84AVTCE3024xBs	3.0										

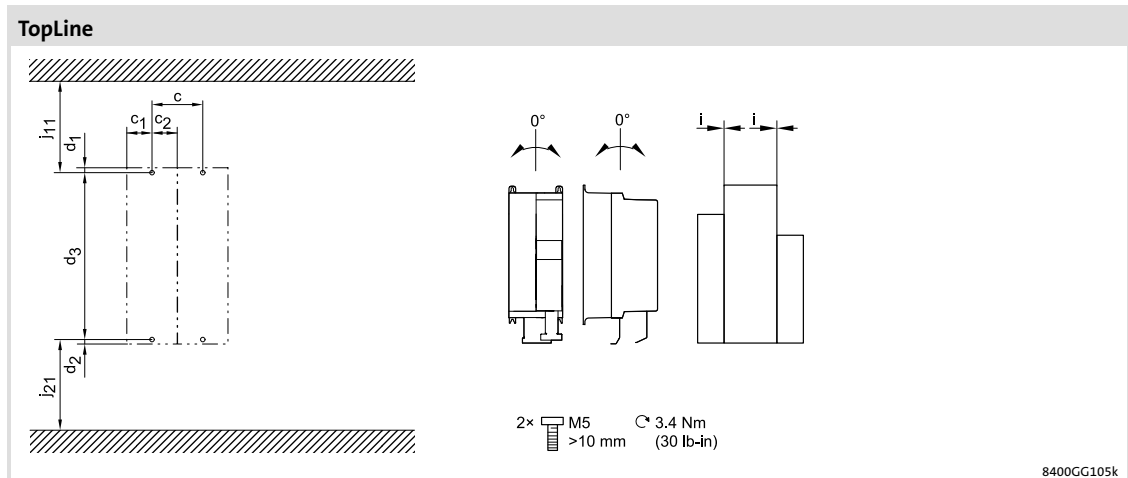



Fig. 5-4 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]									[kg]
E84AVTCE2512xXx	0.25	9	5	230	70	35	35	0	> 95	> 95	2.0
E84AVTCE371xxXx	0.37										
E84AVTCE551xxXx	0.55										
E84AVTCE751xxXx	0.75										
E84AVTCE112xxXx	1.1	8	10	285	70	35	35	0	> 95	> 95	2.3
E84AVTCE152xxXx	1.5										
E84AVTCE222xxXx	2.2										
E84AVTCE3024xXS	3.0										
E84AVTCE2512xBx	0.25										
E84AVTCE371xxBx	0.37	9	5	230	70	35	35	0	> 95	> 95	2.1
E84AVTCE551xxBx	0.55										
E84AVTCE751xxBx	0.75										
E84AVTCE112xxBx	1.1										
E84AVTCE152xxBx	1.5	8	10	285	70	35	35	0	> 95	> 95	2.4
E84AVTCE222xxBx	2.2										
E84AVTCE3024xBs	3.0										

## Mechanical installation

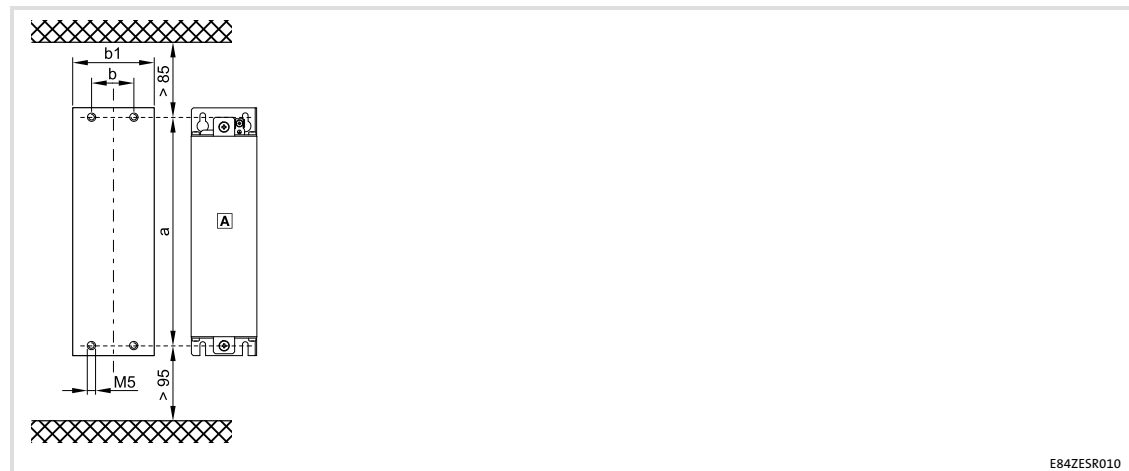
Standard devices in a power range of 0.25 ... 3 kW  
Filter mounting in "standard" technique

### Filter mounting in "standard" technique

For mounting, use two screws M5 x >10 mm. The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended.

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx2512	E84AZESR3712SD	E84AZESR3712LD	E84AZESR3712LL
E84AVxxx3712			
E84AVxxx5512	E84AZESR7512SD	E84AZESR7512LD	E84AZESR7512LL
E84AVxxx7512			
E84AVxxx1122	E84AZESR2222SD	E84AZESR2222LD	E84AZESR2222LL
E84AVxxx1522			
E84AVxxx2222			
E84AVxxx3714	E84AZESR7514SD	E84AZESR7514LD	-
E84AVxxx5514			
E84AVxxx7514			
E84AVxxx1124	E84AZESR2224SD	E84AZESR2224LD	-
E84AVxxx1524			
E84AVxxx2224			
E84AVxxx3024xxS	E84AZESR3024SD	E84AZESR3024LD	-



E84ZESR010

Ⓐ Footprint filter

	a	b	b1
	[mm]		
E84AZESR3712xx	190	45	70
E84AZESR7512xx	240		
E84AZESR7514xx	240		
E84AZESR2222xx	295	45	70
E84AZESR2224xx			
E84AZESR3024xx			



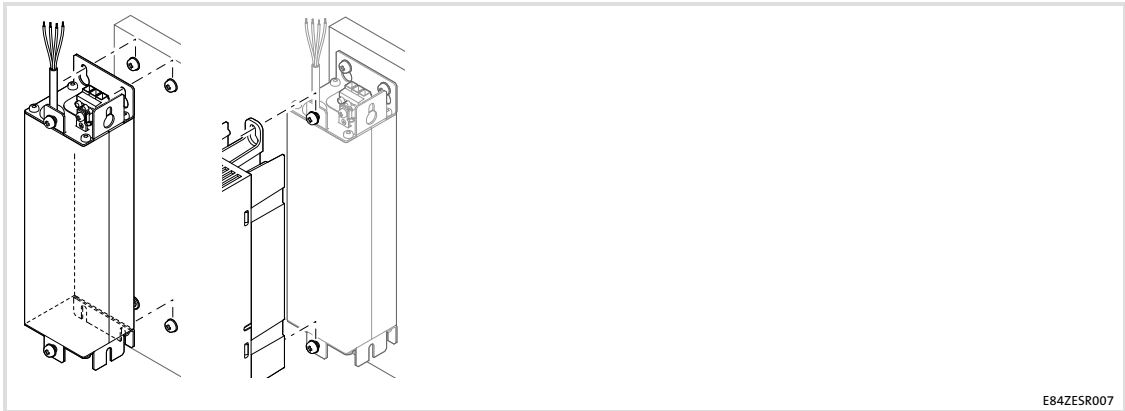


Fig. 5-5 Assembly with footprint filter

Proceed as follows for installation:

1. Prepare M5 threaded holes on the mounting plate and equip them with screws and washers.
  - Use four M5 screw and washer assemblies or M5 hexagon socket screws with washers.
  - Do not yet tighten the screws.
2. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
3. Loosen the two screw and washer assemblies to fix the standard device on the filter.
  - Two M5 × 14 mm screw and washer assemblies.
4. Mount the standard device onto the filter and tighten the screws.
  - Observe the instructions in the documentation for the standard device.
  - Tightening torque: 3.4 Nm (30 lb-in)
5. If necessary, preassemble additional units.
6. Align all units.
7. Screw all units onto the mounting plate.
  - Tightening torque: 3.4 Nm (30 lb-in)

## Mechanical installation

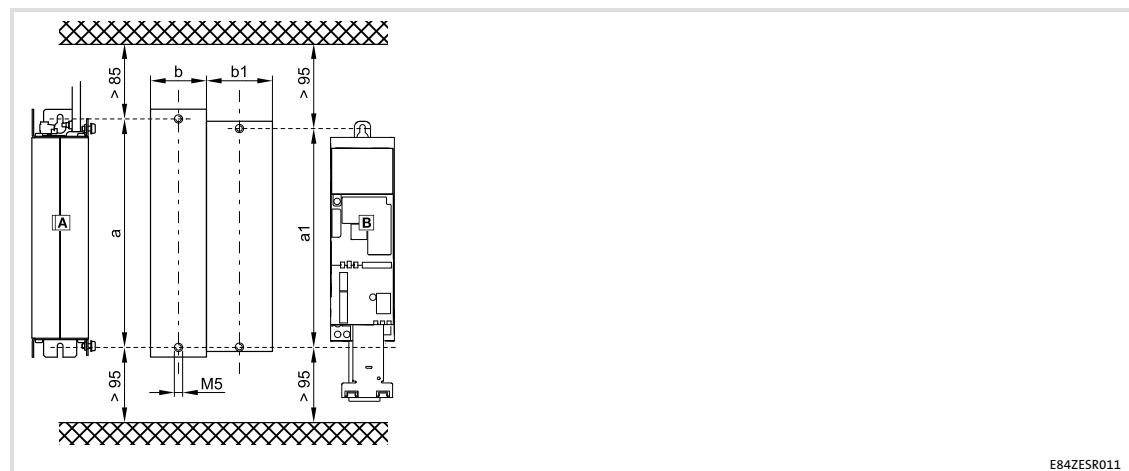
Standard devices in a power range of 0.25 ... 3 kW  
Filter mounting variant

### Filter mounting variant

For mounting, use two screws M5 x >10 mm. The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended.

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx2512	E84AZESR3712SD	E84AZESR3712LD	E84AZESR3712LL
E84AVxxx3712			
E84AVxxx5512	E84AZESR7512SD	E84AZESR7512LD	E84AZESR7512LL
E84AVxxx7512			
E84AVxxx1122	E84AZESR2222SD	E84AZESR2222LD	E84AZESR2222LL
E84AVxxx1522			
E84AVxxx2222			
E84AVxxx3714	E84AZESR7514SD	E84AZESR7514LD	-
E84AVxxx5514			
E84AVxxx7514			
E84AVxxx1124	E84AZESR2224SD	E84AZESR2224LD	-
E84AVxxx1524			
E84AVxxx2224			
E84AVxxx3024xxS	E84AZESR3024SD	E84AZESR3024LD	-



E84ZESR011

- Ⓐ Side-by-side filter
- Ⓑ Standard device

	a	a1	b	b1
	[mm]			
E84AZESR3712xx	190	180	60	70
E84AZESR7512xx	240	230		
E84AZESR7514xx				
E84AZESR2222xx	295	285		
E84AZESR2224xx				
E84AZESR3024xx				

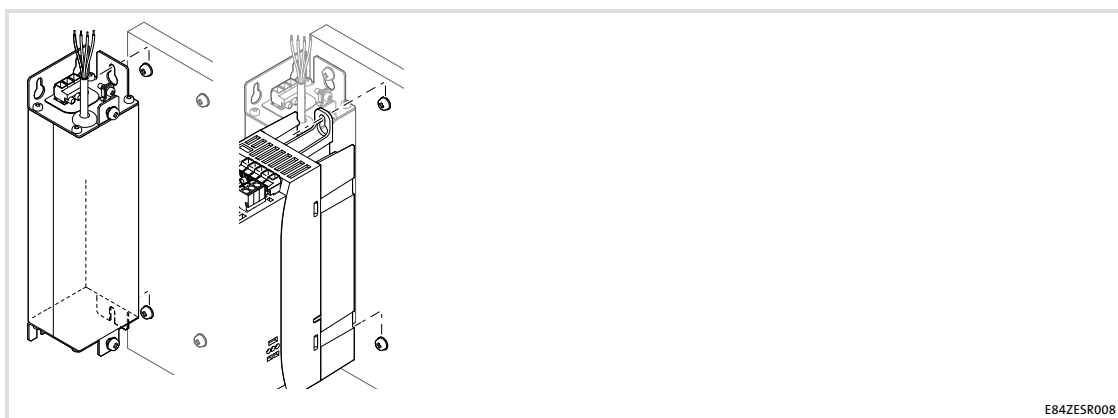


Fig. 5-6 Assembly with side-mounted filter

Proceed as follows for installation:

1. Prepare M5 threaded holes on the mounting plate and equip them with screws and washers.
  - Two M5 screw and washer assemblies or M5 hexagon socket screws with washers for the filter.
  - Two M5 screw and washer assemblies or M5 hexagon socket screws with washers for the standard device.
  - Do not yet tighten the screws.
2. Remove the screw and washer assemblies from the filter to fix the standard device.
3. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
4. Mount the standard device onto the prepared mounting plate.
  - Observe the instructions in the documentation for the standard device.
  - Only tighten the screws hand-tight.
5. If necessary, preassemble additional units.
6. Align all units.
7. Screw all units onto the mounting plate.
  - Tightening torque: 3.4 Nm (30 lb-in)

Standard devices in a power range of 0.25 ... 3 kW

Assembly in push-through technique (thermal separation)

### 5.2.2 Assembly in push-through technique (thermal separation)

The E84AVxxD... controllers are designed for mounting in push-through design. The scope of supply includes all parts required for mounting.

#### Installation steps

How to proceed:

1. Prepare mounting cutout and mounting holes (threaded holes M5 recommended).
2. Insert the 8400 frequency inverter into the mounting cutout.
3. Tighten with 6 screw and washer assemblies M5 x 10 (cross screw connection recommended).
4. Seal the screws to ensure the IP54 enclosure or UL type 12.

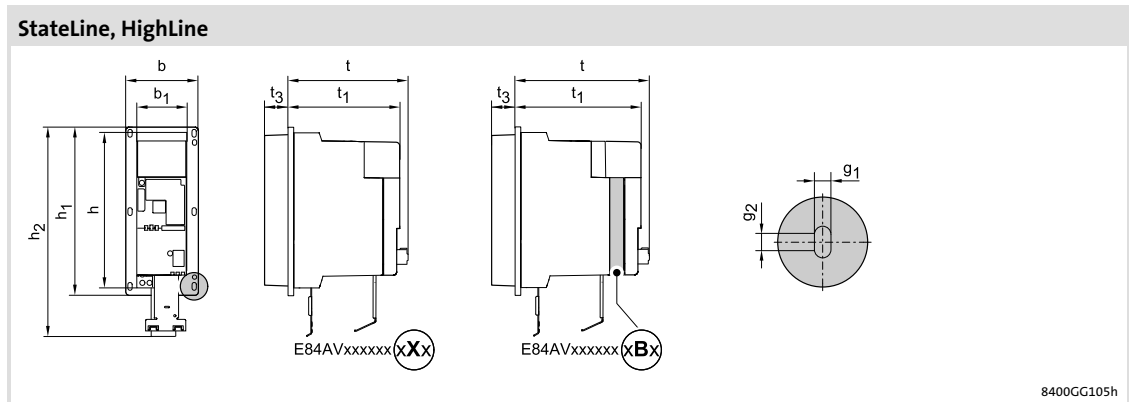


Fig. 5-7 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]									
E84AVxxD2512xXx	0.25	165	102	185	186	226	70	172	14	6	5
E84AVxxD3712xXx	0.37										
E84AVxxD3714xXx	0.37										
E84AVxxD551xxXx	0.55	215	102	163	236	276	70	150	36	6	5
E84AVxxD751xxXx	0.75										
E84AVxxD112xxXx	1.1										
E84AVxxD152xxXx	1.5	270	137	163	295	335	70	150	60	6	5
E84AVxxD222xxXx	2.2										
E84AVxxD2512xBx	0.25										
E84AVxxD3712xBx	0.37	165	102	205	186	226	70	192	14	6	5
E84AVxxD3714xBx	0.37										
E84AVxxD551xxBx	0.55										
E84AVxxD751xxBx	0.75	215	102	183	236	276	70	170	36	6	5
E84AVxxD112xxBx	1.1										
E84AVxxD152xxBx	1.5										
E84AVxxD222xxBx	2.2	270	137	183	295	335	70	170	60	6	5

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW

Assembly in push-through technique (thermal separation)

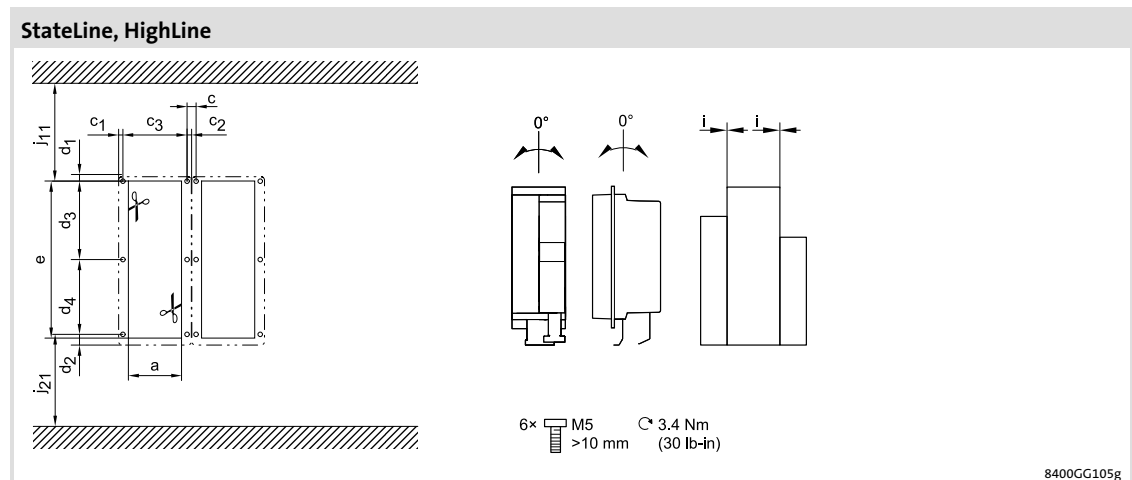



Fig. 5-8 Dimensions for mounting

	[kW]	a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]													[kg]
E84AVxxD2512xXx	0.25	75	170	10	10	85	80	12	6	6	90	0	> 95	> 95	1.4
E84AVxxD3712xXx	0.37														
E84AVxxD3714xXx	0.37	75	221	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	1.9
E84AVxxD551xxXx	0.55														
E84AVxxD751xxXx	0.75	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.5
E84AVxxD112xxXx	1.1														
E84AVxxD152xxXx	1.5	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.5
E84AVxxD222xxXx	2.2														
E84AVxxD2512xBx	0.25	75	170	10	10	85	80	12	6	6	90	0	> 95	> 95	1.5
E84AVxxD3712xBx	0.37														
E84AVxxD3714xBx	0.37	75	221	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	2.0
E84AVxxD551xxBx	0.55														
E84AVxxD751xxBx	0.75	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.6
E84AVxxD112xxBx	1.1														
E84AVxxD152xxBx	1.5	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.6
E84AVxxD222xxBx	2.2														

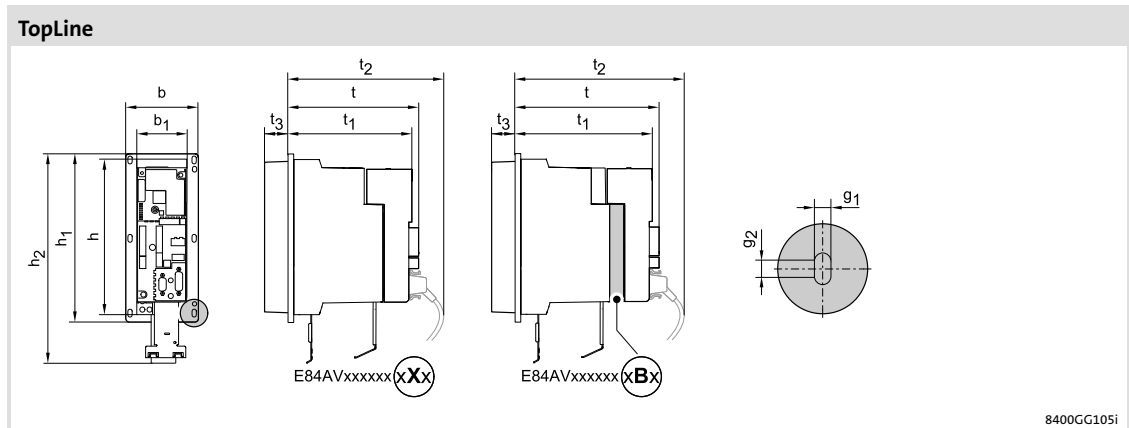


Fig. 5-9 Device dimensions

		h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
	[kW]	[mm]										
E84AVTCD2512xXx	0.25	215	102	179	236	276	70	166	206	36	6	5
E84AVTCD371xxXx	0.37											
E84AVTCD551xxXx	0.55											
E84AVTCD751xxXx	0.75											
E84AVTCD112xxXx	1.1	270	137	179	295	335	70	166	206	60	6	5
E84AVTCD152xxXx	1.5											
E84AVTCD222xxXx	2.2											
E84AVTCD2512xBx	0.25											
E84AVTCD371xxBx	0.37	215	102	199	236	276	70	186	226	36	6	5
E84AVTCD551xxBx	0.55											
E84AVTCD751xxBx	0.75											
E84AVTCD112xxBx	1.1											
E84AVTCD152xxBx	1.5	270	137	199	295	335	70	186	226	60	6	5
E84AVTCD222xxBx	2.2											

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW

Assembly in push-through technique (thermal separation)

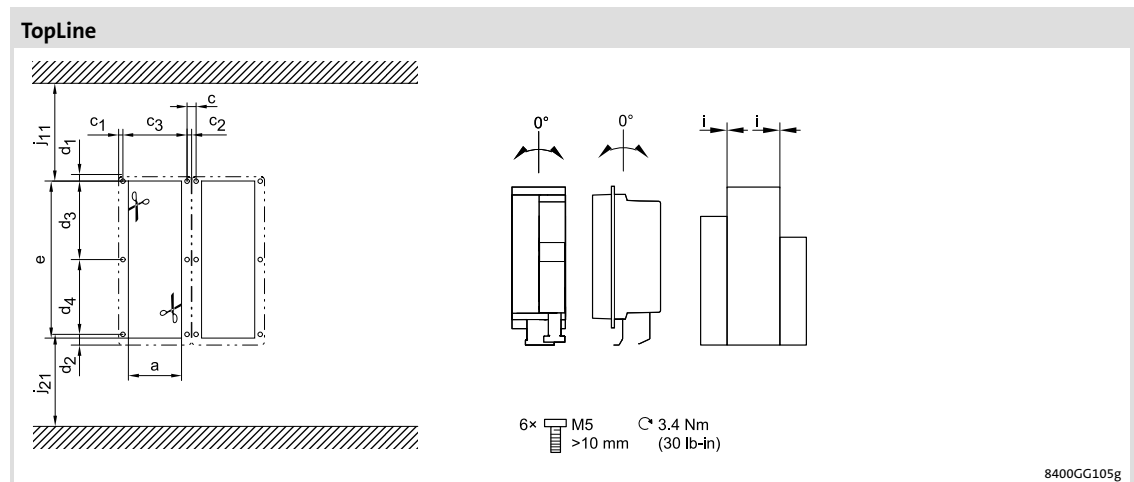



Fig. 5-10 Dimensions for mounting

		a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]													[kg]
E84AVTCD2512xXx	0.25	75	221	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	2.1
E84AVTCD371xxXx	0.37														
E84AVTCD551xxXx	0.55														
E84AVTCD751xxXx	0.75														
E84AVTCD112xxXx	1.1	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.7
E84AVTCD152xxXx	1.5														
E84AVTCD222xxXx	2.2														
E84AVTCD2512xBx	0.25	75	221	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	2.2
E84AVTCD371xxBx	0.37														
E84AVTCD551xxBx	0.55														
E84AVTCD751xxBx	0.75														
E84AVTCD112xxBx	1.1	109	274	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	3.8
E84AVTCD152xxBx	1.5														
E84AVTCD222xxBx	2.2														



### 5.2.3 Mounting in "cold plate" technique

The E84AVxxC... controllers are designed for assembly on coolers (e.g. collective coolers) in "cold-plate" technique.

#### Requirements for collective coolers

A good thermal connection to the cooler is important for the trouble-free operation of the controller:

- ▶ The contact area between the collective cooler and the controller
  - must be at least as big as the cooling plate of the controller.
  - must be smooth, the maximum deviation must not exceed 0.05 mm.
- ▶ The collective cooler must be connected to the controller with all required screwed joints.
- ▶ The thermal resistance  $R_{th}$  must be observed, see table.  
The values in the table apply to the operation of the controllers under rated conditions.  
The values include the heat transmission between the cooler and the device.  
With a standard heat conducting paste and a film thickness of 50  $\mu\text{m}$ , the heat transmission is approx.
  - 0.03 K/W for controllers up to 5.5 kW
  - 0.02 K/W for controllers up to 15 kW
  - 0.01 K/W for controllers up to 22 kW.

	Power to be dissipated	Thermal resistance
Type	$P_v$ [W]	$R_{th}$ [K/W]
E84AVxxC2512	15	$\leq 1.5$
E84AVxxC3712	20	$\leq 1.5$
E84AVxxC5512	30	$\leq 1.0$
E84AVxxC7512	40	$\leq 1.0$
E84AVxxC1122	60	$\leq 0.6$
E84AVxxC1522	75	$\leq 0.5$
E84AVxxC2222	100	$\leq 0.4$
E84AVxxC3714	25	$\leq 1.5$
E84AVxxC5514	35	$\leq 1.0$
E84AVxxC7514	50	$\leq 0.8$
E84AVxxC1124	60	$\leq 0.6$
E84AVxxC1524	70	$\leq 0.5$
E84AVxxC2224	100	$\leq 0.4$
E84AVxxC3024xxS	100	$\leq 0.4$

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW  
Mounting in "cold plate" technique

### Ambient conditions

- ▶ The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- ▶ Temperature at the cooling plate of the drive controller: max. 75 °C.



### Note!

Apply standard heat-conducting paste or heat-conducting foil onto cooler and cooling plate before you bolt the controller onto the cooler.

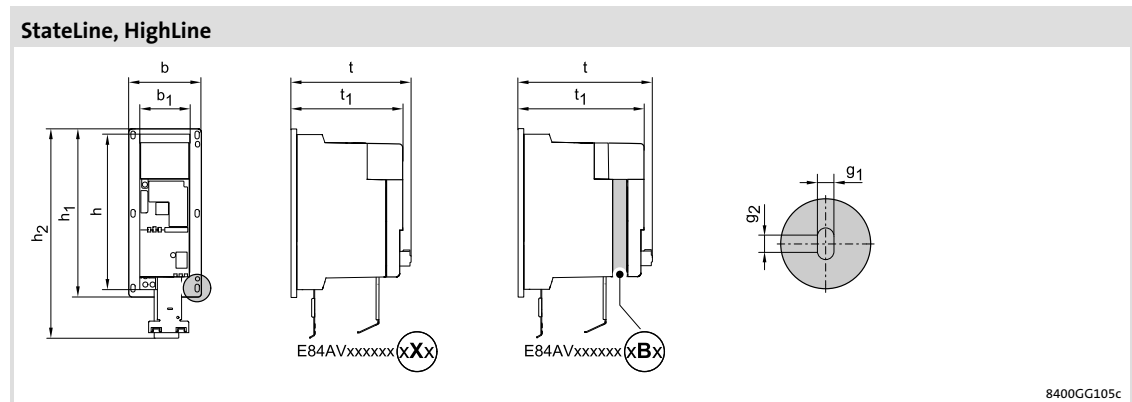


Fig. 5-11 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]								
E84AVxxC2512xX0	0.25	165	102	185	186	226	70	172	6	5
E84AVxxC3712xX0	0.37									
E84AVxxC3714xX0	0.37									
E84AVxxC551xxX0	0.55	215	102	163	236	276	70	150	6	5
E84AVxxC751xxX0	0.75									
E84AVxxC112xxX0	1.1									
E84AVxxC152xxX0	1.5	270	137	163	295	335	70	150	6	5
E84AVxxC222xxX0	2.2									
E84AVxxC2512xB0	0.25									
E84AVxxC3712xB0	0.37	165	102	205	186	226	70	192	6	5
E84AVxxC3714xB0	0.37									
E84AVxxC551xxB0	0.55									
E84AVxxC751xxB0	0.75	215	102	183	236	276	70	170	6	5
E84AVxxC112xxB0	1.1									
E84AVxxC152xxB0	1.5									
E84AVxxC222xxB0	2.2	270	137	183	295	335	70	170	6	5

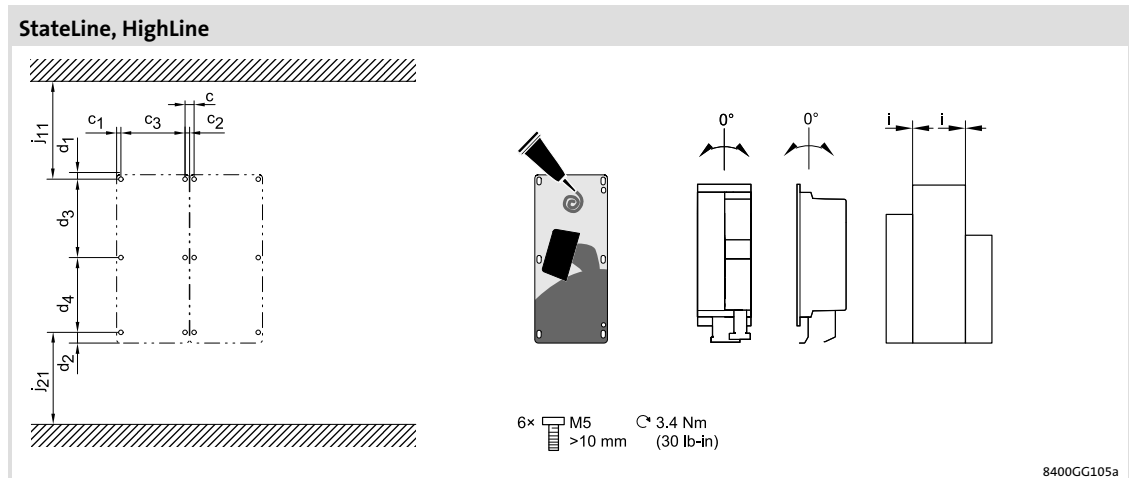


Fig. 5-12 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]											
E84AVxxC2512xX0	0.25	10	10	85	80	12	6	6	90	0	> 95	> 95	1.3
E84AVxxC3712xX0	0.37												
E84AVxxC3714xX0	0.37												
E84AVxxC551xxX0	0.55	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	1.5
E84AVxxC751xxX0	0.75												
E84AVxxC112xxX0	1.1												
E84AVxxC152xxX0	1.5	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	2.0
E84AVxxC222xxX0	2.2												
E84AVxxC2512xB0	0.25	10	10	85	80	12	6	6	90	0	> 95	> 95	1.4
E84AVxxC3712xB0	0.37												
E84AVxxC3714xB0	0.37												
E84AVxxC551xxB0	0.55	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	1.6
E84AVxxC751xxB0	0.75												
E84AVxxC112xxB0	1.1												
E84AVxxC152xxB0	1.5	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	2.1
E84AVxxC222xxB0	2.2												

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW

Mounting in "cold plate" technique

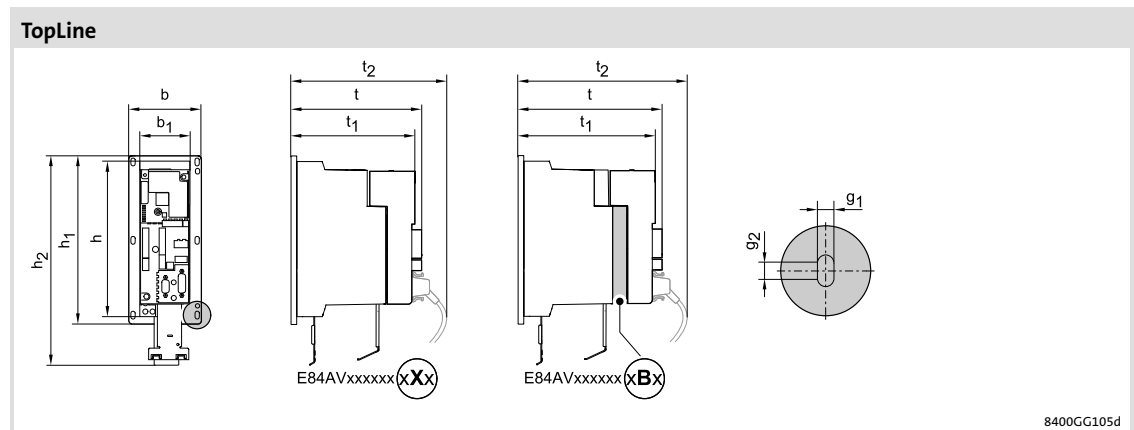


Fig. 5-13 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]									
E84AVTCC551xxX0	0.55	215	102	178	236	276	70	165	205	6	5
E84AVTCC751xxX0	0.75										
E84AVTCC112xxX0	1.1										
E84AVTCC152xxX0	1.5										
E84AVTCC222xxX0	2.2										
E84AVTCC551xxB0	0.55	270	137	178	295	335	70	185	225	6	5
E84AVTCC751xxB0	0.75										
E84AVTCC112xxB0	1.1										
E84AVTCC152xxB0	1.5										
E84AVTCC222xxB0	2.2										

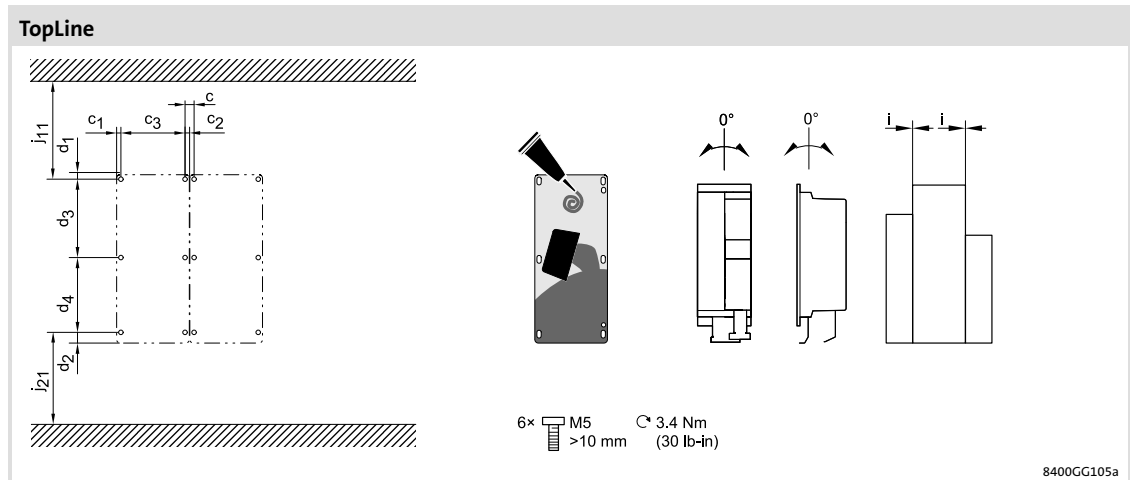



Fig. 5-14 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]											[kg]
E84AVTCC551xxX0	0.55	8.5	12.5	110	105	12	6	6	90	0	> 95	> 95	1.7
E84AVTCC751xxX0	0.75												
E84AVTCC112xxX0	1.1												
E84AVTCC152xxX0	1.5												
E84AVTCC222xxX0	2.2	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	2.2
E84AVTCC551xxB0	0.55												
E84AVTCC751xxB0	0.75												
E84AVTCC112xxB0	1.1												
E84AVTCC152xxB0	1.5	12.5	12.5	135	135	12	6	6	125	0	> 95	> 95	2.3
E84AVTCC222xxB0	2.2												

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW

Mounting in "cold plate" technique

### "Slim"

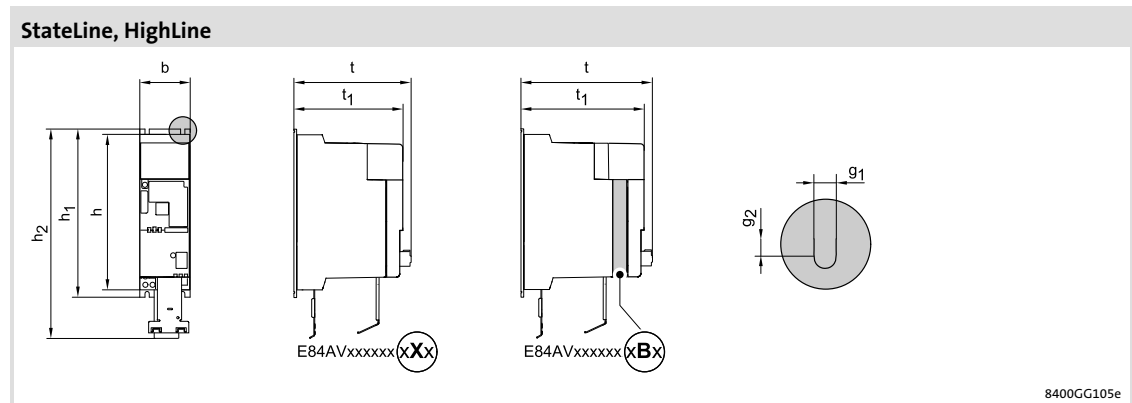


Fig. 5-15 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]							
E84AVxxC3714xXS	0.37	215	70	163	236	276	150	6	5
E84AVxxC551xxXS	0.55								
E84AVxxC751xxXS	0.75								
E84AVxxC112xxXS	1.1								
E84AVxxC152xxXS	1.5								
E84AVxxC222xxXS	2.2								
E84AVxxC3024xXS	3.0	270	70	163	295	335	150	6	5
E84AVxxC3714xB	0.37								
E84AVxxC551xxB	0.55								
E84AVxxC751xxB	0.75								
E84AVxxC112xxB	1.1								
E84AVxxC152xxB	1.5								
E84AVxxC222xxB	2.2	270	70	183	295	335	170	6	5
E84AVxxC3024xB	3.0								

## "Slim"

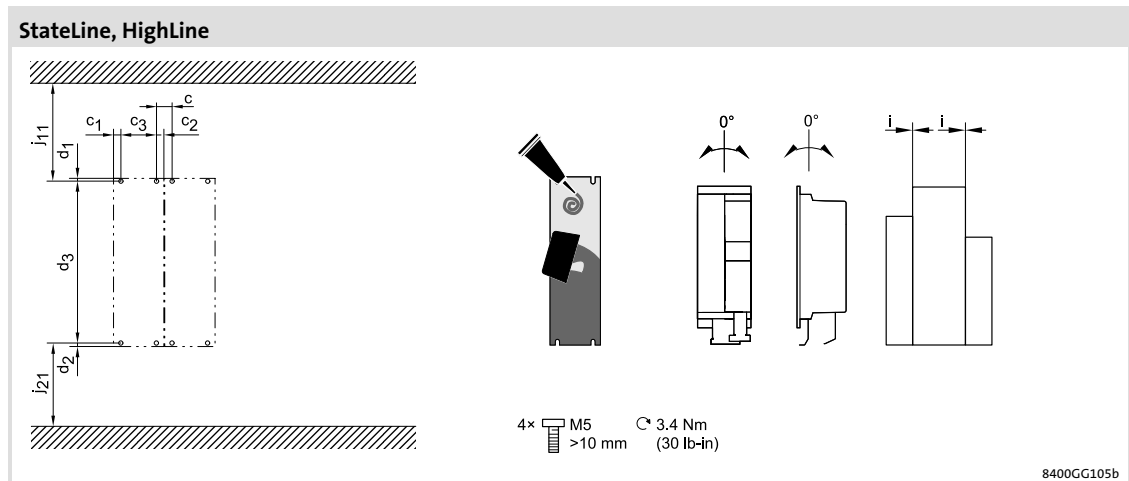


Fig. 5-16 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]										
E84AVxxC3714xXS	0.37	4	4	228	20	10	10	50	0	> 95	> 95	1.5
E84AVxxC551xxXS	0.55											
E84AVxxC751xxXS	0.75											
E84AVxxC112xxXS	1.1	5	5	285	20	10	10	50	0	> 95	> 95	2.0
E84AVxxC152xxXS	1.5											
E84AVxxC222xxXS	2.2											
E84AVxxC3024xXS	3.0											
E84AVxxC3714xBS	0.37											
E84AVxxC551xxBS	0.55	4	4	228	20	10	10	50	0	> 95	> 95	1.6
E84AVxxC751xxBS	0.75											
E84AVxxC112xxBS	1.1											
E84AVxxC152xxBS	1.5	5	5	285	20	10	10	50	0	> 95	> 95	2.1
E84AVxxC222xxBS	2.2											
E84AVxxC3024xBS	3.0											

## Mechanical installation

Standard devices in a power range of 0.25 ... 3 kW

Mounting in "cold plate" technique

### "Slim"

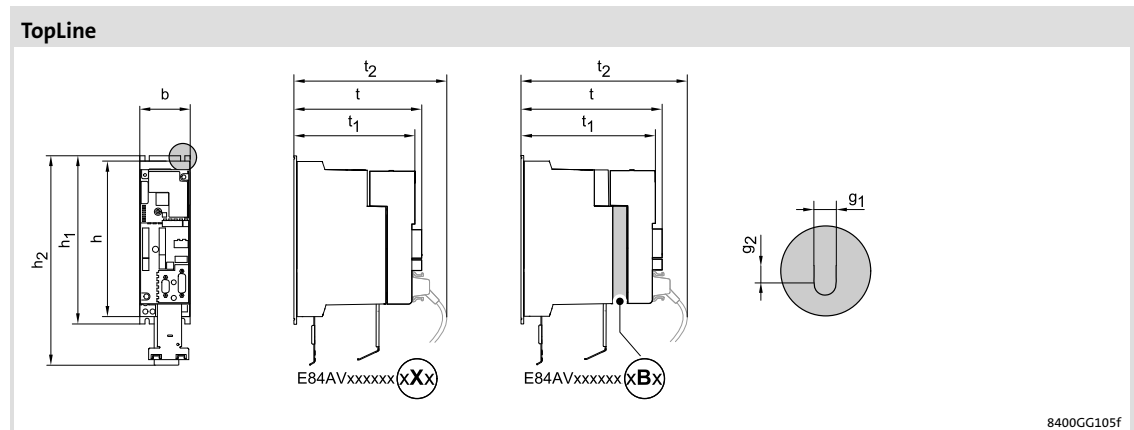


Fig. 5-17 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]								
E84AVTCC2512xXS	0.25	215	70	178	236	276	165	205	6	5
E84AVTCC371xxXS	0.37									
E84AVTCC551xxXS	0.55									
E84AVTCC751xxXS	0.75									
E84AVTCC112xxXS	1.1	270	70	178	295	335	165	205	6	5
E84AVTCC152xxXS	1.5									
E84AVTCC222xxXS	2.2									
E84AVTCC3024xXS	3.0									
E84AVTCC2512xB	0.25	215	70	198	236	276	185	225	6	5
E84AVTCC371xxB	0.37									
E84AVTCC551xxB	0.55									
E84AVTCC751xxB	0.75									
E84AVTCC112xxB	1.1	270	70	198	295	335	185	225	6	5
E84AVTCC152xxB	1.5									
E84AVTCC222xxB	2.2									
E84AVTCC3024xB	3.0									



"Slim"

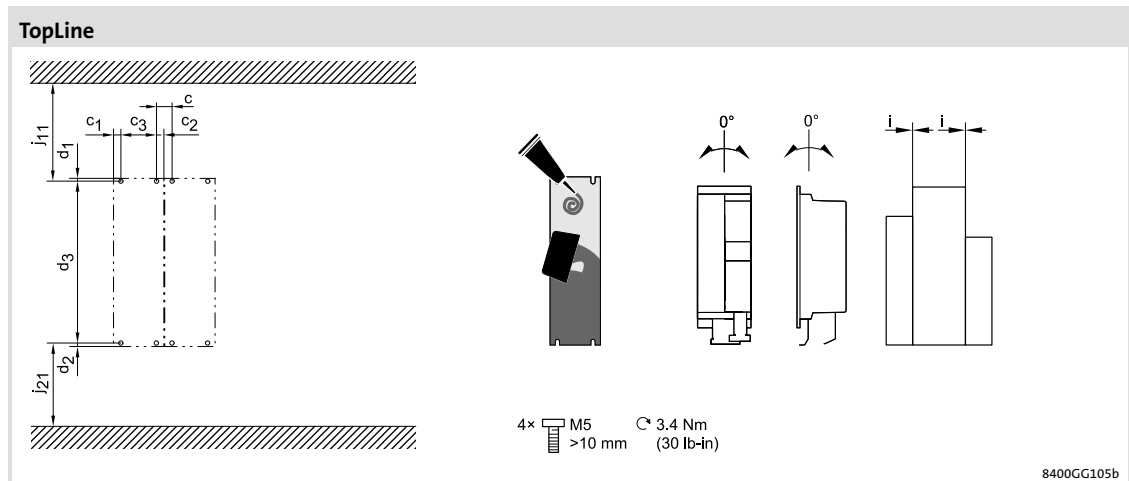



Fig. 5-18 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]										[kg]
E84AVTCC2512xXS	0.25	4	4	228	20	10	10	50	0	> 95	> 95	1.7
E84AVTCC371xxXS	0.37											
E84AVTCC551xxXS	0.55											
E84AVTCC751xxXS	0.75											
E84AVTCC112xxXS	1.1	5	5	285	20	10	10	50	0	> 95	> 95	2.2
E84AVTCC152xxXS	1.5											
E84AVTCC222xxXS	2.2											
E84AVTCC3024xXS	3.0											
E84AVTCC2512xBS	0.25											
E84AVTCC371xxBS	0.37	4	4	228	20	10	10	50	0	> 95	> 95	1.8
E84AVTCC551xxBS	0.55											
E84AVTCC751xxBS	0.75											
E84AVTCC112xxBS	1.1											
E84AVTCC152xxBS	1.5	5	5	285	20	10	10	50	0	> 95	> 95	2.3
E84AVTCC222xxBS	2.2											
E84AVTCC3024xBS	3.0											

**5.3 Standard devices in the power range 3 ... 22 kW****5.3.1 Assembly in built-in technique (standard)**

You can choose between three variants for mounting the "built-in unit" version of the controllers:

- ▶ Assembly without filter
  - in "standard" technique
- ▶ Assembly with filter:
  - in "standard" technique (footprint filter)
  - in mounting variant (side-mounted filter)

The following filters can be used for the controllers:

- ▶ on the supply side
  - RFI filters

**Assembly without filter in "standard" technique**

Mounting requires four screws

- ▶ M5 x 12 mm (for devices in the power range 3 kW ... 15 kW) or
- ▶ M6 x 16 mm (for devices in the power range 18.5 kW ... 22 kW).

Screw and washer assemblies or hexagon socket screws with washers are recommended.

The mounting location and material must ensure a durable mechanical connection.

How to proceed:

1. Prepare the fixing holes on the mounting surface.
2. Screw the controller directly to the mounting surface.

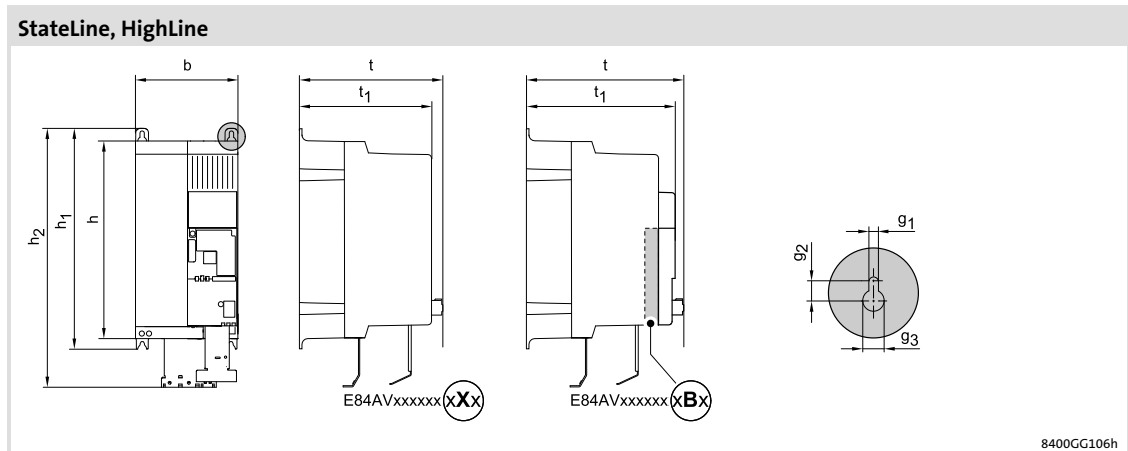


Fig. 5-19 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]								
E84AVxxE3024xXx	3	270	140	199	303	360	186	6	11	12
E84AVxxE4024xXx	4									
E84AVxxE5524xXx	5.5									
E84AVxxE7524xXx	7.5	325	140	199	359	416	186	6	11	12
E84AVxxE1134xXx	11									
E84AVxxE1534xXx	15									
E84AVxxE1834xXx	18.5	350	205	250	359	430	237	7	10	13
E84AVxxE2234xXx	22									
E84AVxxE3024xBx	3									
E84AVxxE4024xBx	4	270	140	219	303	360	206	6	11	12
E84AVxxE5524xBx	5.5									
E84AVxxE7524xBx	7.5									
E84AVxxE1134xBx	11	325	140	219	359	416	206	6	11	12
E84AVxxE1534xBx	15									
E84AVxxE1834xBx	18.5									
E84AVxxE2234xBx	22	350	205	270	359	430	257	7	10	13

## Mechanical installation

Standard devices in the power range 3 ... 22 kW  
 Assembly without filter in "standard" technique

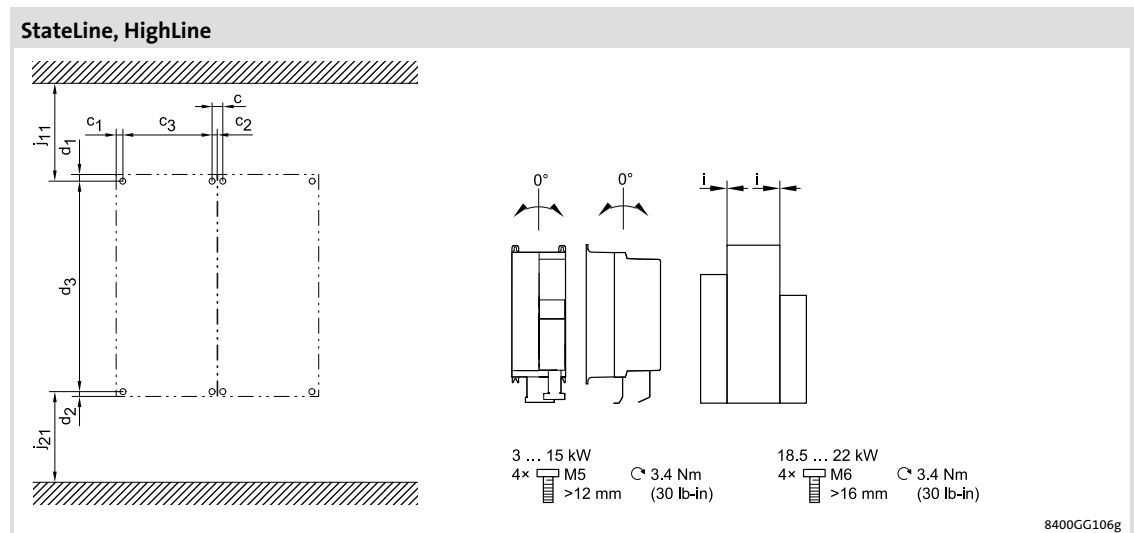



Fig. 5-20 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	 [kg]
		[mm]										
E84AVxxE3024xXx	3	9	9	285	20	10	10	120	0	> 95	> 95	4.4
E84AVxxE4024xXx	4											
E84AVxxE5524xXx	5.5											
E84AVxxE7524xXx	7.5											
E84AVxxE1134xXx	11	10	9	340	20	10	10	120	0	> 95	> 95	5.8
E84AVxxE1534xXx	15											
E84AVxxE1834xXx	18.5											
E84AVxxE2234xXx	22	11	8	340	25	12.5	12.5	180	0	> 95	> 95	12.0
E84AVxxE3024xBx	3											
E84AVxxE4024xBx	4	9	9	285	20	10	10	120	0	> 95	> 95	4.5
E84AVxxE5524xBx	5.5											
E84AVxxE7524xBx	7.5											
E84AVxxE1134xBx	11											
E84AVxxE1534xBx	15	10	9	340	20	10	10	120	0	> 95	> 95	5.9
E84AVxxE1834xBx	18.5											
E84AVxxE2234xBx	22											
E84AVxxE1834xBx	18.5	11	8	340	25	12.5	12.5	180	0	> 95	> 95	12.1
E84AVxxE2234xBx	22											

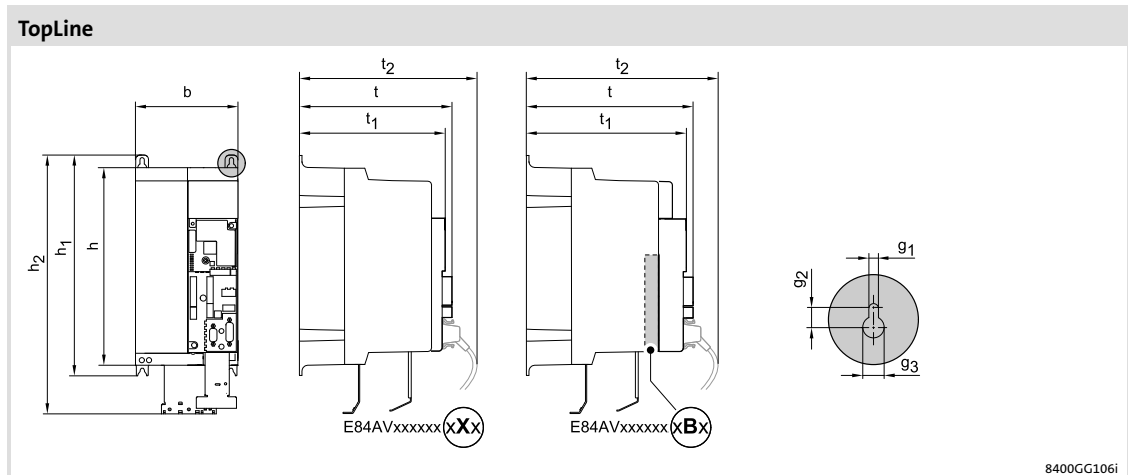


Fig. 5-21 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]									
E84AVTCE3024xXx	3										
E84AVTCE4024xXx	4	270	140	214	303	360	201	240	6	11	12
E84AVTCE5524xXx	5.5										
E84AVTCE7524xXx	7.5										
E84AVTCE1134xXx	11	325	140	214	359	416	201	240	6	11	12
E84AVTCE1534xXx	15										
E84AVTCE1834xXx	18.5	350	205	265	359	430	252	291	7	10	13
E84AVTCE2234xXx	22										
E84AVTCE3024xBx	3										
E84AVTCE4024xBx	4	270	140	234	303	360	221	260	6	11	12
E84AVTCE5524xBx	5.5										
E84AVTCE7524xBx	7.5										
E84AVTCE1134xBx	11	325	140	234	359	416	221	260	6	11	12
E84AVTCE1534xBx	15										
E84AVTCE1834xBx	18.5	350	205	285	359	430	272	311	7	10	13
E84AVTCE2234xBx	22										

## Mechanical installation

Standard devices in the power range 3 ... 22 kW  
 Assembly without filter in "standard" technique

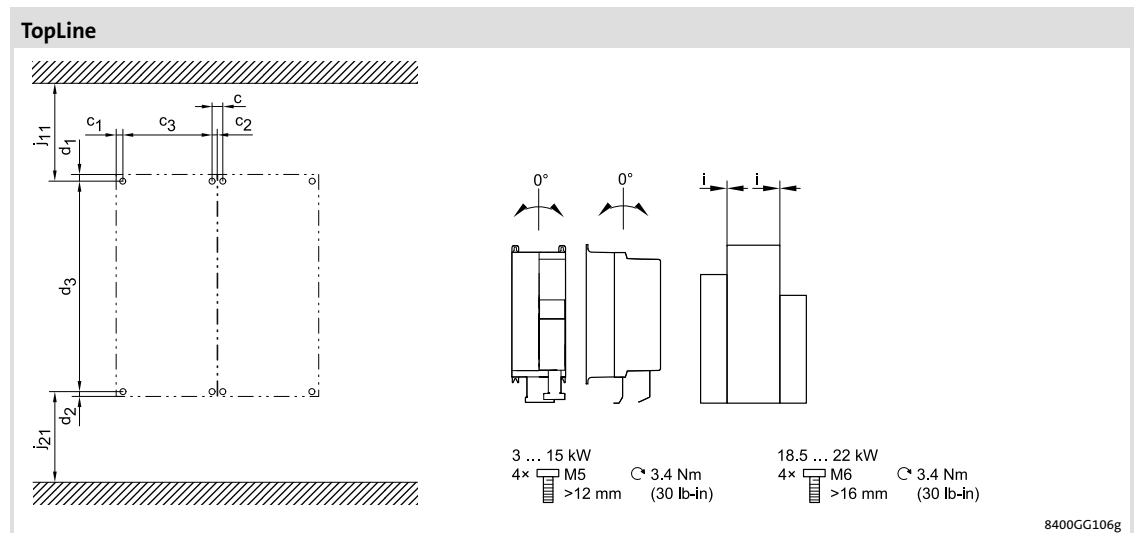


Fig. 5-22 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]										
E84AVTCE3024xXx	3	9	9	285	20	10	10	120	0	> 95	> 95	4.6
E84AVTCE4024xXx	4											
E84AVTCE5524xXx	5.5											
E84AVTCE7524xXx	7.5	10	9	340	20	10	10	120	0	> 95	> 95	6.0
E84AVTCE1134xXx	11											
E84AVTCE1534xXx	15											
E84AVTCE1834xXx	18.5	11	8	340	25	12.5	12.5	180	0	> 95	> 95	12.2
E84AVTCE2234xXx	22											
E84AVTCE3024xBx	3	9	9	285	20	10	10	120	0	> 95	> 95	4.7
E84AVTCE4024xBx	4											
E84AVTCE5524xBx	5.5											
E84AVTCE7524xBx	7.5	10	9	340	20	10	10	120	0	> 95	> 95	6.1
E84AVTCE1134xBx	11											
E84AVTCE1534xBx	15											
E84AVTCE1834xBx	18.5	11	8	340	25	12.5	12.5	180	0	> 95	> 95	12.3
E84AVTCE2234xBx	22											

## Filter mounting in "standard" technique

The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended..

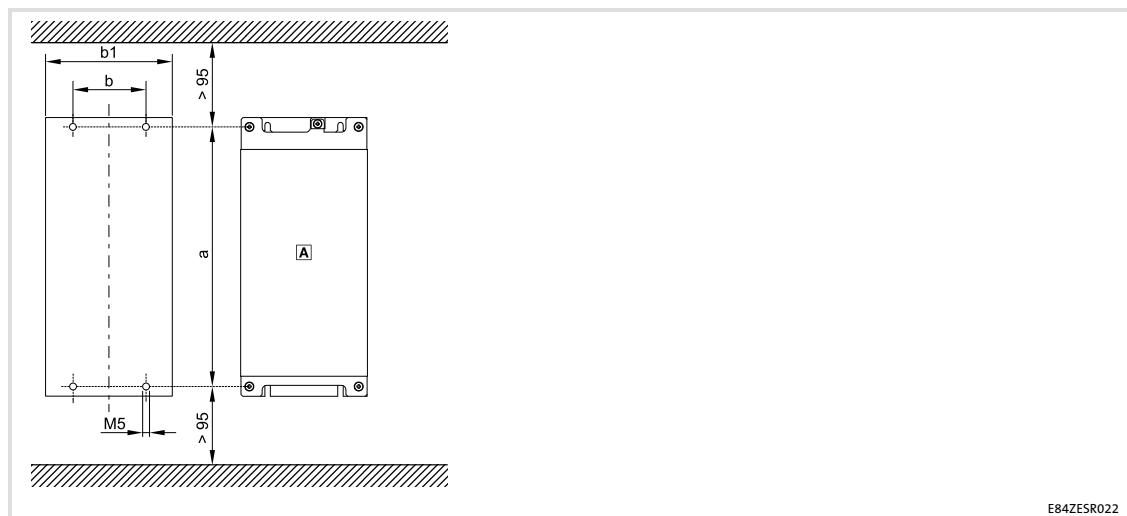


### Tip!

The scope of supply of the filter comprises mounting instructions. They describe technical data and information on mechanical and electrical mounting of this accessory part.

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx3024xx0	E84AZESR5524SD	E84AZESR5524LD	-
E84AVxxx4024			
E84AVxxx5524			
E84AVxxx7524	E84AZESR1534SD	E84AZESR1534LD	-
E84AVxxx1134			
E84AVxxx1534			
E84AVxxx1834	-	E84AZESR1834LD	-
E84AVxxx2234	-	E84AZESM2234LD	-

1) Mains filter (mains choke with RFI filter)



E84ZESR022

**A** Footprint filter

Type	a	b	b1
	[mm]		
E84AZESR5524xx	285	80	140
E84AZESR1534xx	340	80	140
E84AZESR1834xx	415	160	205
E84AZESM2234xx	415	160	205

## Mechanical installation

Standard devices in the power range 3 ... 22 kW  
Filter mounting in "standard" technique

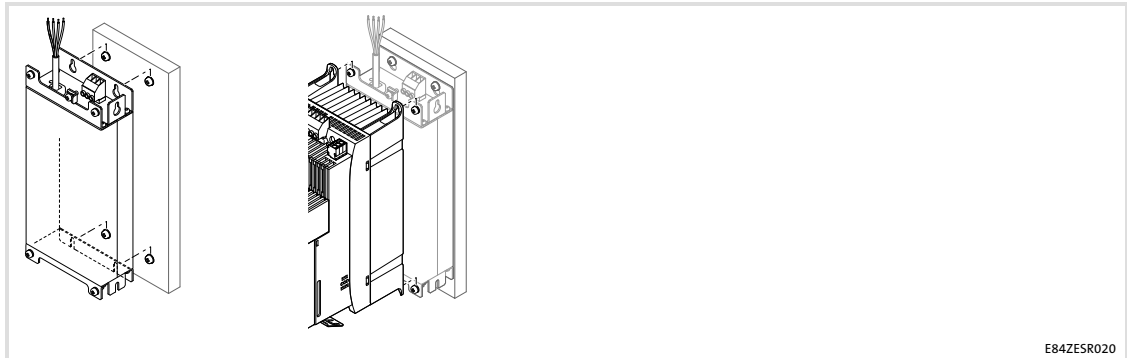


Fig. 5-23 Assembly with footprint filter

Proceed as follows for installation:

1. Prepare M5 threaded holes on the mounting plate and equip them with screws and washers.
  - Use four M5 screw and washer assemblies or M5 hexagon socket screws with washers.
  - Do not yet tighten the screws.
2. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
3. Loosen the two screw and washer assemblies to fix the standard device on the filter.
  - Two M5 × 14 mm screw and washer assemblies.
4. Mount the standard device onto the filter and tighten the screws.
  - Observe the instructions in the documentation for the standard device.
  - Tightening torque: 3.4 Nm (30 lb-in)
5. If necessary, preassemble additional units.
6. Align all units.
7. Screw all units onto the mounting plate.
  - Tightening torque: 3.4 Nm (30 lb-in)



## Filter mounting variant

The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended..

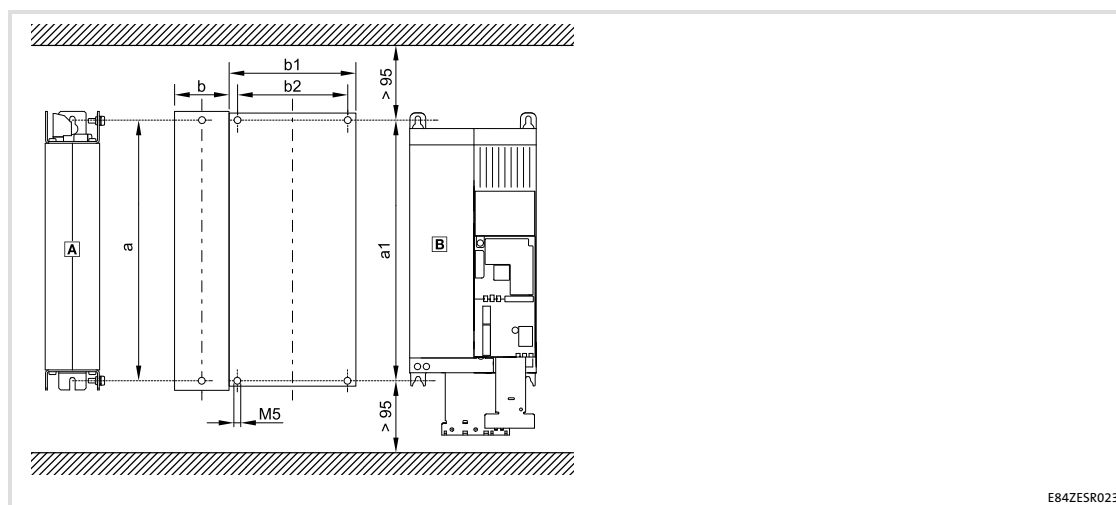


### Tip!

The scope of supply of the filter comprises mounting instructions. They describe technical data and information on mechanical and electrical mounting of this accessory part.

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx3024xx0	E84AZESR5524SD	E84AZESR5524LD	-
E84AVxxx4024			
E84AVxxx5524			
E84AVxxx7524	E84AZESR1534SD	E84AZESR1534LD	-
E84AVxxx1134			
E84AVxxx1534			
E84AVxxx1834	-	E84AZESR1834LD	-
E84AVxxx2234	-	E84AZESM2234LD	-

1) Mains filter (mains choke with RFI filter)



- Ⓐ Side-by-side filter
- Ⓑ Standard device

Type	a	a1	b	b1	b2
	[mm]	[mm]	[mm]	[mm]	[mm]
E84AZESR5524xx	285	285	60	140	120
E84AZESR1534xx	340	340	60	140	120
E84AZESM1834xx	415	340	90	205	180
E84AZESM2234xx	415	340	90	205	180

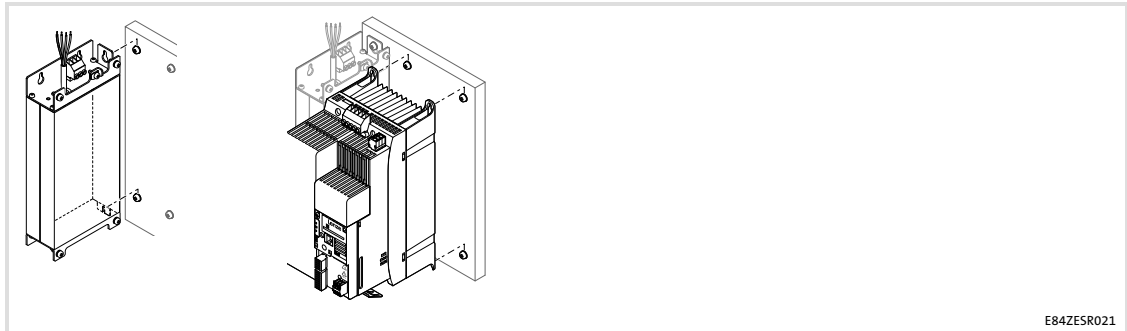


Fig. 5-24 Assembly with side-mounted filter

E84ZESR021

Proceed as follows for installation:

1. Prepare M5 threaded holes on the mounting plate and equip them with screws and washers.
  - Two M5 screw and washer assemblies or M5 hexagon socket screws with washers for the filter.
  - Two M5 screw and washer assemblies or M5 hexagon socket screws with washers for the standard device.
  - Do not yet tighten the screws.
2. Remove the screw and washer assemblies from the filter to fix the standard device.
3. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
4. Mount the standard device onto the prepared mounting plate.
  - Observe the instructions in the documentation for the standard device.
  - Only tighten the screws hand-tight.
5. If necessary, preassemble additional units.
6. Align all units.
7. Screw all units onto the mounting plate.
  - Tightening torque: 3.4 Nm (30 lb-in)

5.3.2 Assembly in push-through technique (thermal separation)

The E84AVxxD... controllers are designed for mounting in push-through design. The scope of supply includes all parts required for mounting.

Installation steps

How to proceed:

1. Prepare mounting cutout and mounting holes (threaded holes M5 recommended).
2. Insert the 8400 frequency inverter into the mounting cutout.
3. Tighten with 6 screw and washer assemblies M5 x 10 (cross screw connection recommended).
4. Seal the screws to ensure the IP54 enclosure or UL type 12.

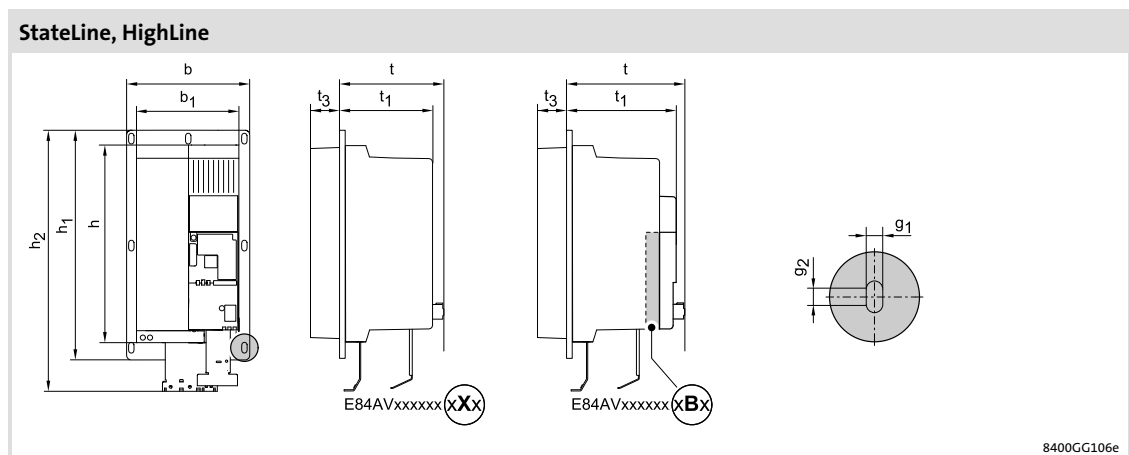


Fig. 5-25 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]									
E84AVxxD3024xXx	3	270	174	141	318	366	140	128	64	6	5
E84AVxxD4024xXx	4										
E84AVxxD5524xXx	5.5										
E84AVxxD3024xBx	3	270	174	161	318	366	140	148	64	6	5
E84AVxxD4024xBx	4										
E84AVxxD5524xBx	5.5										

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Assembly in push-through technique (thermal separation)

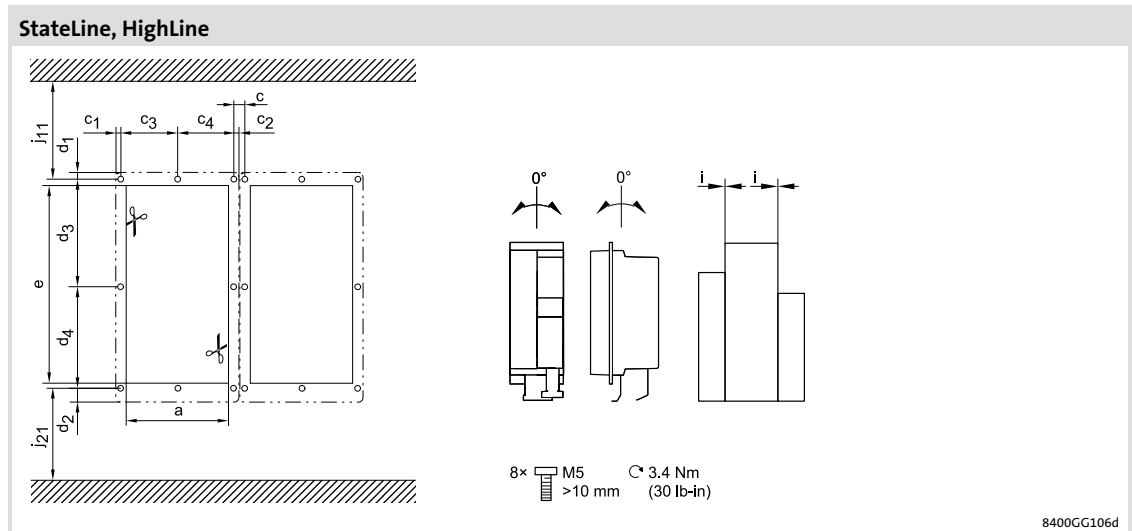



Fig. 5-26 Dimensions for mounting

	[kW]	a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]														[kg]
E84AVxxD3024xXx	3															
E84AVxxD4024xXx	4	145 ± 1	277 ± 1	9	9	150	150	15	7	7	80	80	0	> 95	> 95	4.9
E84AVxxD5524xXx	5.5															
E84AVxxD3024xBx	3															
E84AVxxD4024xBx	4	145 ± 1	277 ± 1	9	9	150	150	15	7	7	80	80	0	> 95	> 95	5.0
E84AVxxD5524xBx	5.5															

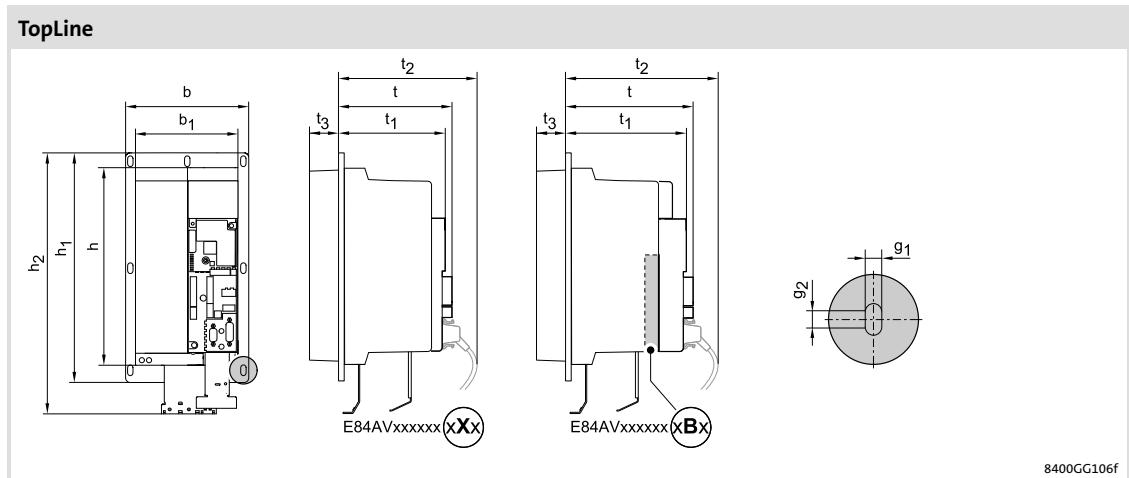


Fig. 5-27 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]										
E84AVTCD3024xXx	3											
E84AVTCD4024xXx	4	270	174	156	318	366	140	143	182	64	6	5
E84AVTCD5524xXx	5.5											
E84AVTCD3024xBx	3											
E84AVTCD4024xBx	4	270	174	176	318	366	140	163	202	64	6	5
E84AVTCD5524xBx	5.5											

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Assembly in push-through technique (thermal separation)

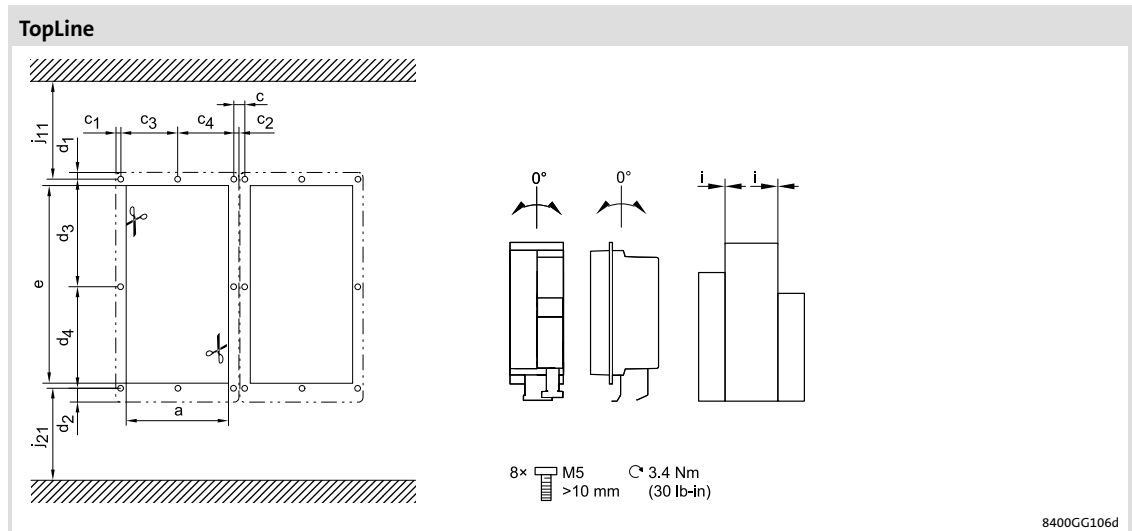



Fig. 5-28 Dimensions for mounting

	[kW]	a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]														[kg]
E84AVTCD3024xXx	3															
E84AVTCD4024xXx	4	145	277	9	9	150	150	15	7	7	80	80	0	> 95	> 95	5.1
E84AVTCD5524xXx	5.5															
E84AVTCD3024xBx	3															
E84AVTCD4024xBx	4	145	277	9	9	150	150	15	7	7	80	80	0	> 95	> 95	5.2
E84AVTCD5524xBx	5.5															

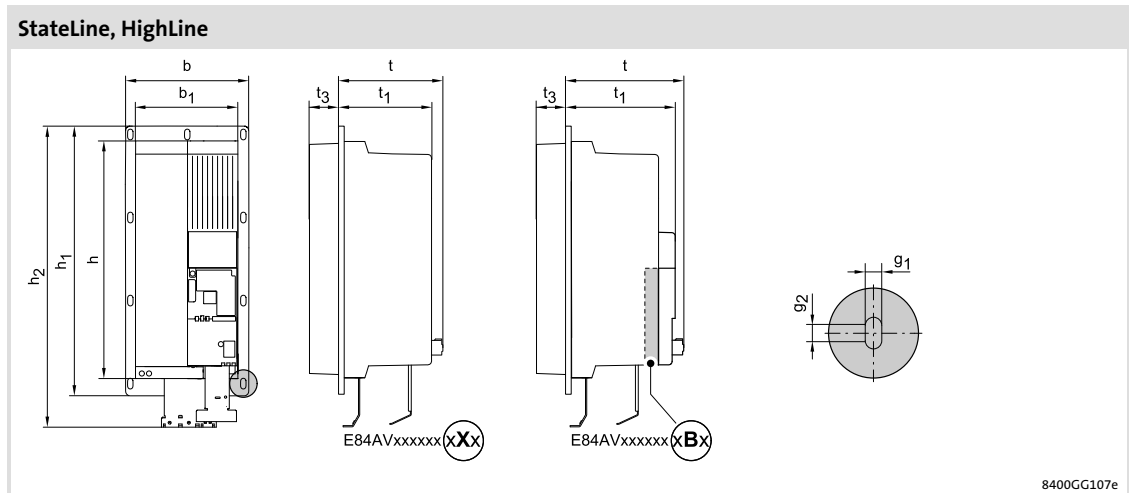


Fig. 5-29 Device dimensions

		h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
[kW]		[mm]									
E84AVxxD7524xXx	7.5	325	174	141	378	426	140	128	64	6	5
E84AVxxD1134xXx	11										
E84AVxxD1534xXx	15										
E84AVxxD7524xBx	7.5	325	174	161	378	426	140	148	64	6	5
E84AVxxD1134xBx	11										
E84AVxxD1534xBx	15										

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Assembly in push-through technique (thermal separation)

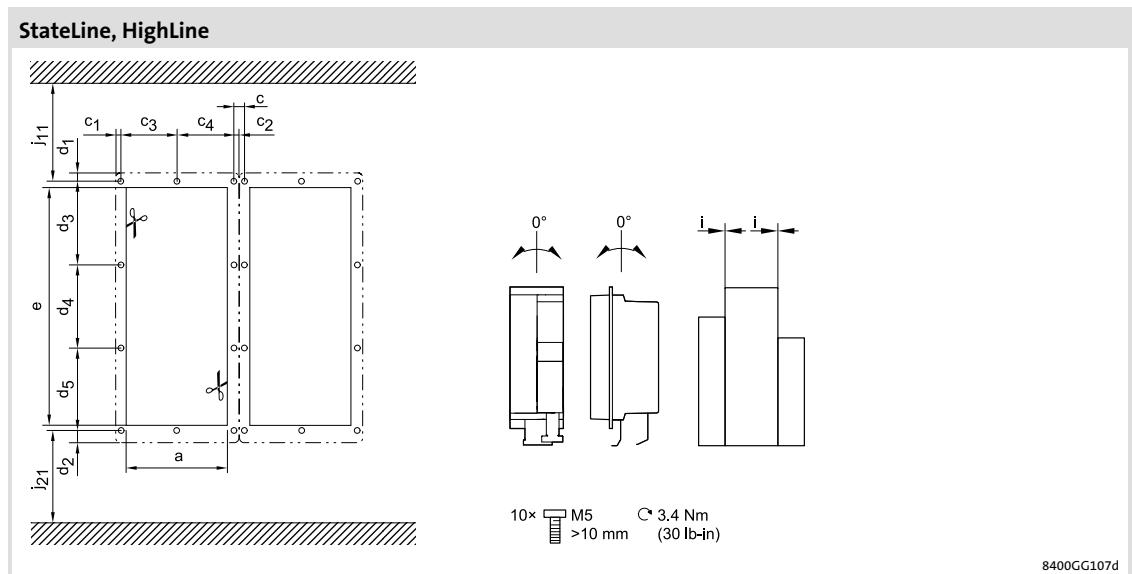



Fig. 5-30 Dimensions for mounting

	[kW]	a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]														[kg]	
E84AVxxD7524xXx	7.5	145 ± 1	338 ± 1	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	6.2
E84AVxxD1134xXx	11																
E84AVxxD1534xXx	15																
E84AVxxD7524xBx	7.5	145 ± 1	338 ± 1	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	6.3
E84AVxxD1134xBx	11																
E84AVxxD1534xBx	15																



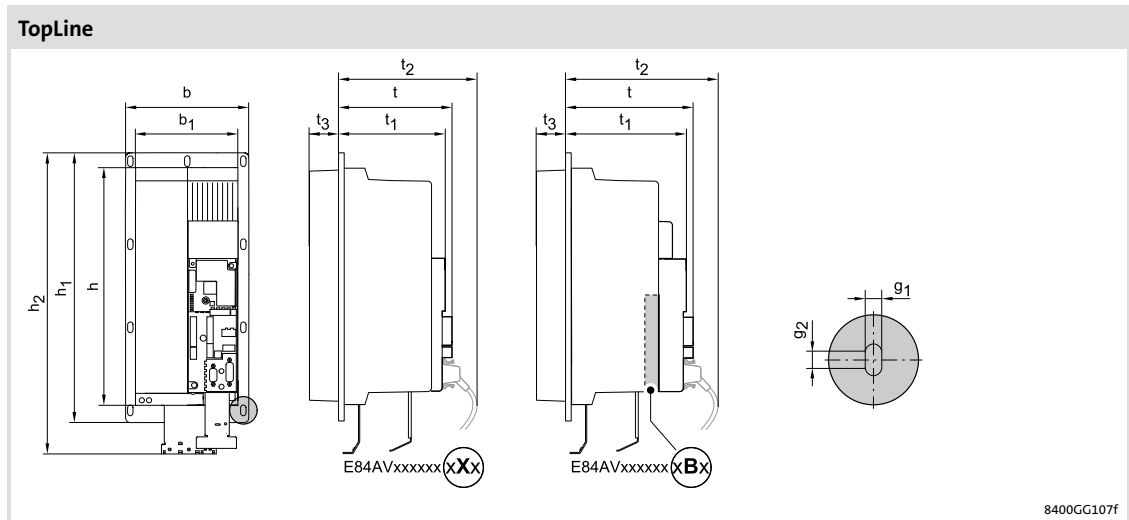


Fig. 5-31 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]										
E84AVTCD7524xXx	7.5	325	174	156	378	426	140	143	182	64	6	5
E84AVTCD1134xXx	11											
E84AVTCD1534xXx	15											
E84AVTCD7524xBx	7.5	325	174	176	378	426	140	163	202	64	6	5
E84AVTCD1134xBx	11											
E84AVTCD1534xBx	15											

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Assembly in push-through technique (thermal separation)

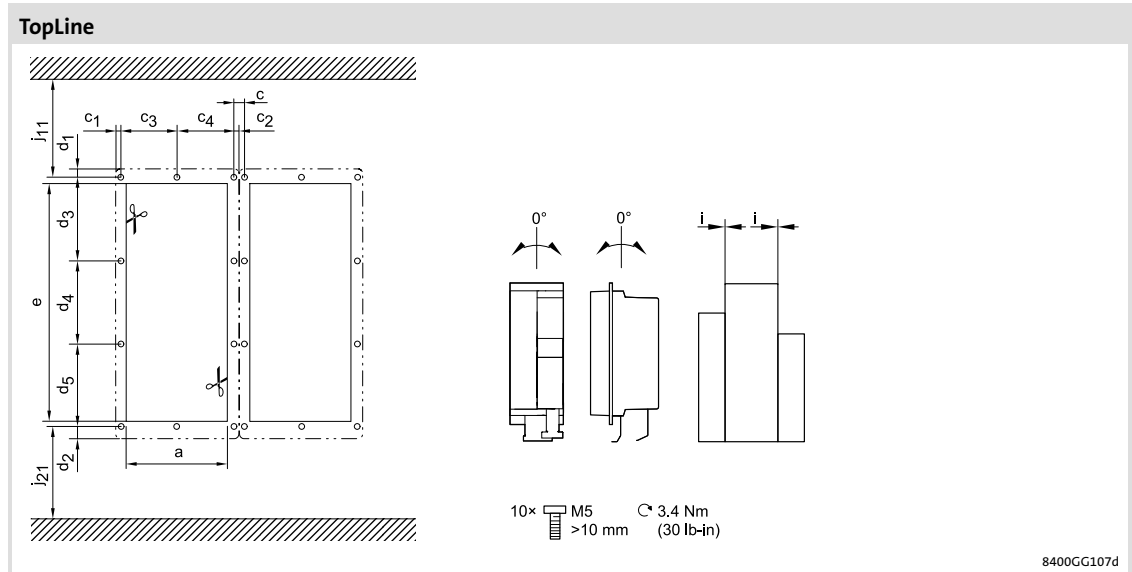



Fig. 5-32 Dimensions for mounting

	[kW]	a	e	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]														[kg]	
E84AVTCD7524xXx	7.5	145 ± 1	338 ± 1	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	6.4
E84AVTCD1134xXx	11																
E84AVTCD1534xXx	15																
E84AVTCD7524xBx	7.5	145 ± 1	338 ± 1	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	6.5
E84AVTCD1134xBx	11																
E84AVTCD1534xBx	15																

### 5.3.3 Mounting in "cold plate" technique

The E84AVxxC... controllers are designed for assembly on coolers (e.g. collective coolers) in "cold-plate" technique.

#### Requirements for collective coolers

A good thermal connection to the cooler is important for the trouble-free operation of the controller:

- ▶ The contact area between the collective cooler and the controller
  - must be at least as big as the cooling plate of the controller.
  - must be smooth, the maximum deviation must not exceed 0.05 mm.
- ▶ The collective cooler must be connected to the controller with all required screwed joints.
- ▶ The thermal resistance  $R_{th}$  must be observed, see table.  
The values in the table apply to the operation of the controllers under rated conditions.  
The values include the heat transmission between the cooler and the device.  
With a standard heat conducting paste and a film thickness of 50  $\mu\text{m}$ , the heat transmission is approx.
  - 0.03 K/W for controllers up to 5.5 kW
  - 0.02 K/W for controllers up to 15 kW
  - 0.01 K/W for controllers up to 22 kW.

	Power to be dissipated	Thermal resistance
Type	$P_v$ [W]	$R_{th}$ [K/W]
E84AVxxC3024xx0	115	$\leq 0.33$
E84AVxxC4024	155	$\leq 0.25$
E84AVxxC5524	215	$\leq 0.18$
E84AVxxC7524	250	$\leq 0.15$
E84AVxxC1134	355	$\leq 0.11$
E84AVxxC1534	390	$\leq 0.10$
E84AVxxC1834	460	$\leq 0.057$
E84AVxxC2234	540	$\leq 0.057$

#### Ambient conditions

- ▶ The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- ▶ Temperature at the cooling plate of the drive controller: max. 75 °C.



#### Note!

Apply standard heat-conducting paste or heat-conducting foil onto cooler and cooling plate before you bolt the controller onto the cooler.

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Mounting in "cold plate" technique

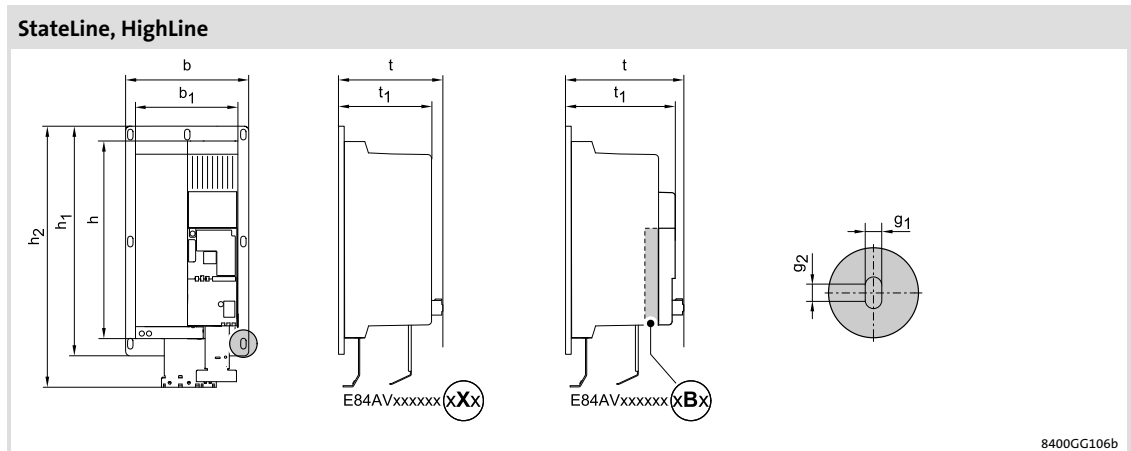


Fig. 5-33 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]								
E84AVxxC3024xX0	3	270	174	141	318	366	140	128	6	5
E84AVxxC4024xXx	4									
E84AVxxC5524xXx	5.5									
E84AVxxC3024xB0	3	270	174	161	318	366	140	148	6	5
E84AVxxC4024xBx	4									
E84AVxxC5524xBx	5.5									

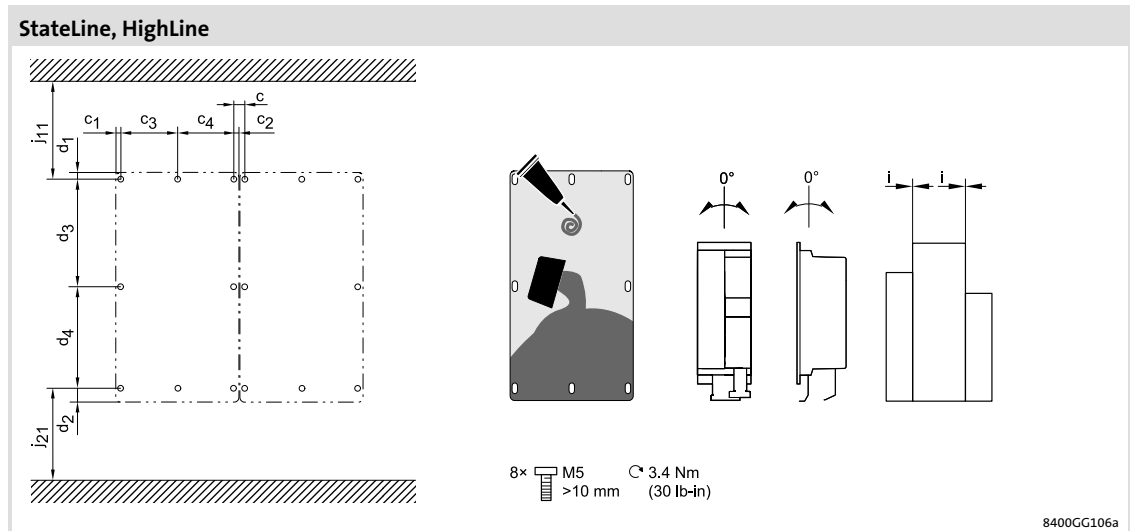


Fig. 5-34 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]												
E84AVxxC3024xX0	3													
E84AVxxC4024xXx	4	9	9	150	150	15	7	7	80	80	0	> 95	> 95	2.7
E84AVxxC5524xXx	5.5													
E84AVxxC3024xB0	3													
E84AVxxC4024xBx	4	9	9	150	150	15	7	7	80	80	0	> 95	> 95	2.8
E84AVxxC5524xBx	5.5													

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Mounting in "cold plate" technique

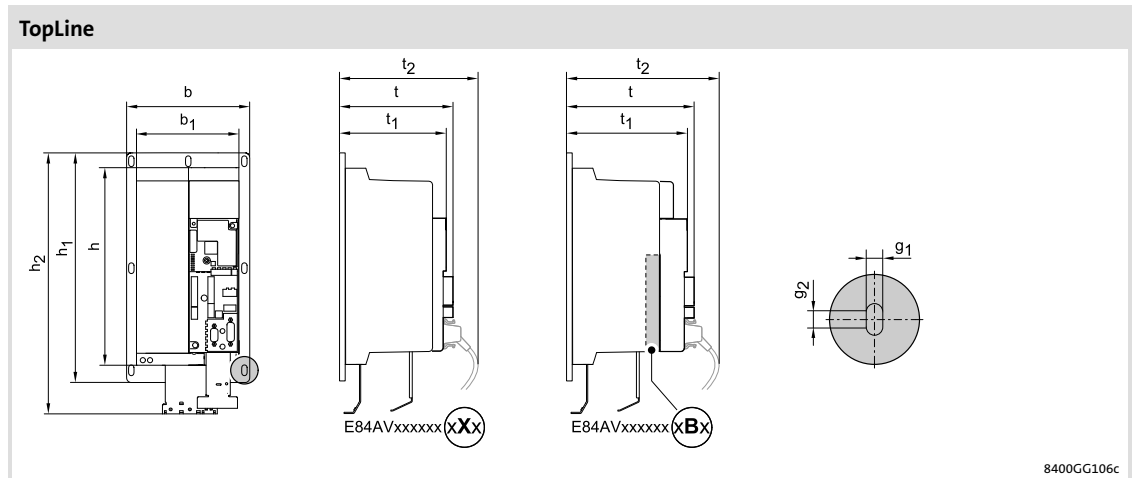


Fig. 5-35 Device dimensions

	[kW]	h	b	t	$h_1$	$h_2$	$b_1$	$t_1$	$t_2$	$g_1$	$g_2$
		[mm]									
E84AVTCC3024xX0	3										
E84AVTCC4024xXx	4	270	174	156	318	366	140	143	182	6	5
E84AVTCC5524xXx	5.5										
E84AVTCC3024xB0	3										
E84AVTCC4024xBx	4	270	174	176	318	366	140	163	202	6	5
E84AVTCC5524xBx	5.5										

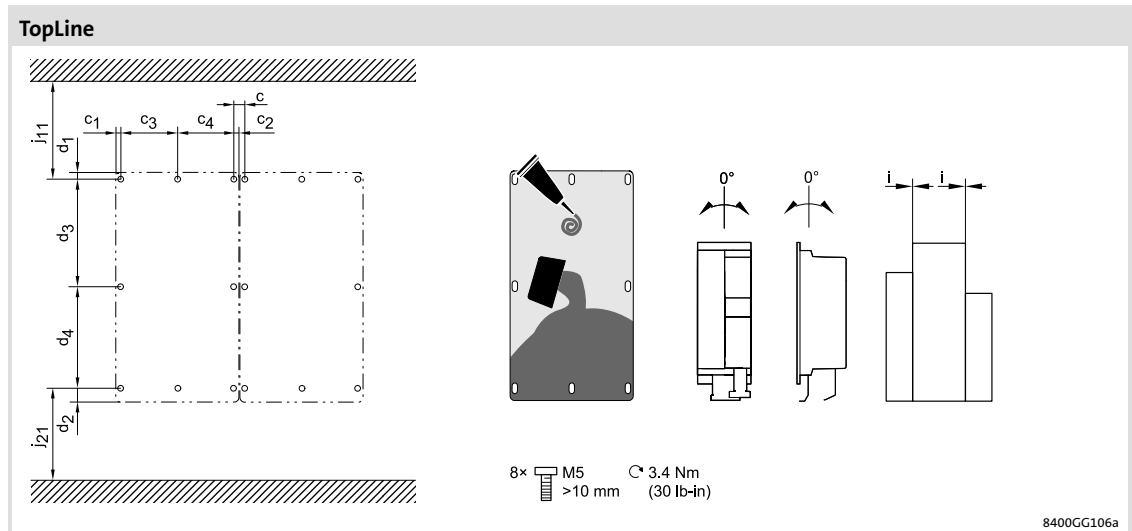


Fig. 5-36 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]												
E84AVTCC3024xX0	3													
E84AVTCC4024xXx	4	9	9	150	150	15	7	7	80	80	0	> 95	> 95	2.9
E84AVTCC5524xXx	5.5													
E84AVTCC3024xB0	3													
E84AVTCC4024xBx	4	9	9	150	150	15	7	7	80	80	0	> 95	> 95	3.0
E84AVTCC5524xBx	5.5													

## Mechanical installation

Standard devices in the power range 3 ... 22 kW  
Mounting in "cold plate" technique

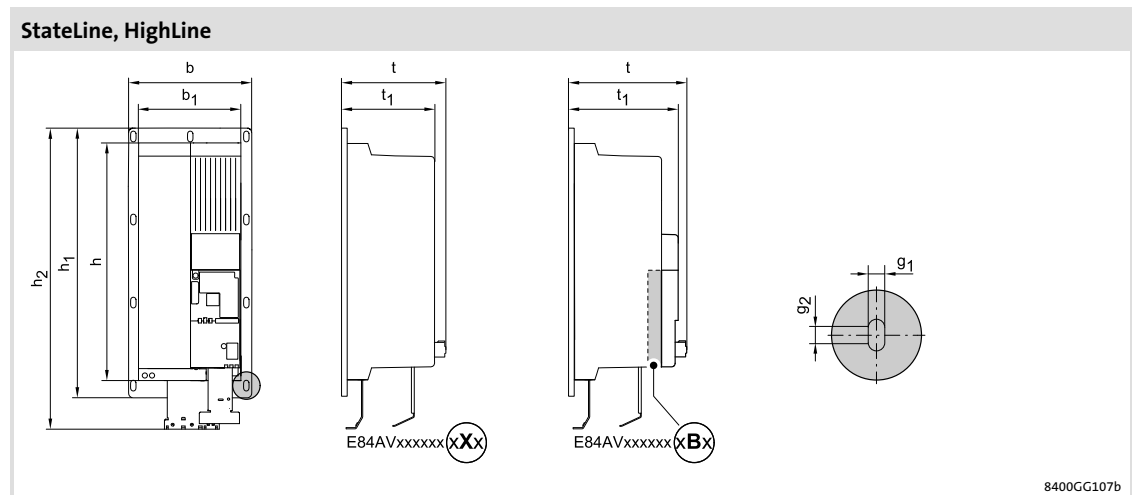


Fig. 5-37 Device dimensions

		h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>
	[kW]	[mm]								
E84AVxxC7524xXx	7.5	325	174	141	378	426	140	128	6	5
E84AVxxC1134xXx	11									
E84AVxxC1534xXx	15									
E84AVxxC1834xXx	18.5	350	231	164	407	458	205	151	6	7
E84AVxxC2234xXx	22									
E84AVxxC7524xBx	7.5									
E84AVxxC1134xBx	11	325	174	161	378	426	140	148	6	5
E84AVxxC1534xBx	15									
E84AVxxC1834xBx	18.5									
E84AVxxC2234xBx	22	350	231	184	407	458	205	171	6	7



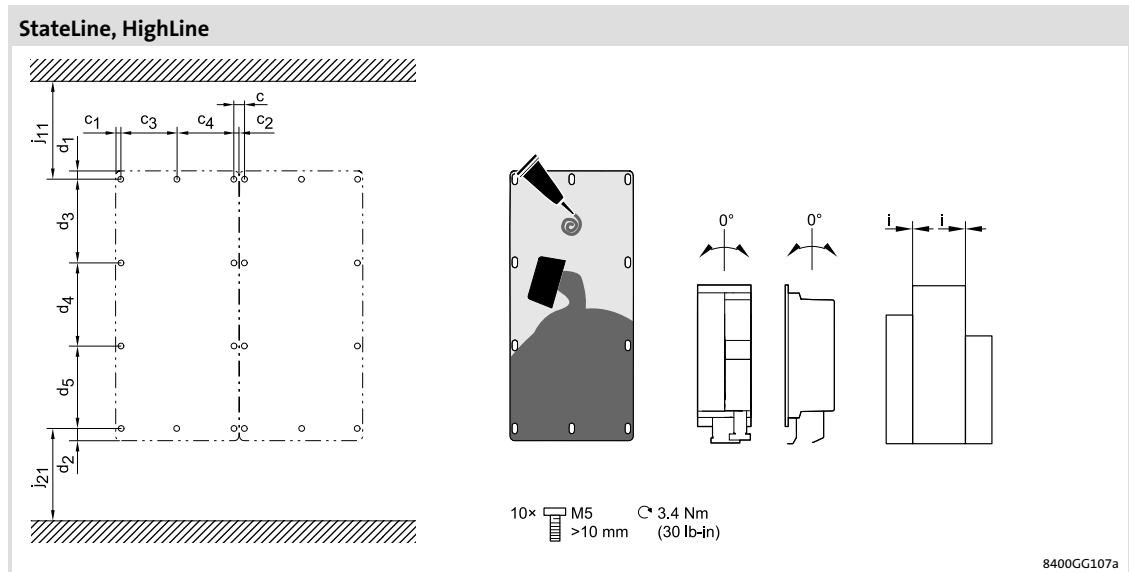



Fig. 5-38 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
		[mm]													[kg]
E84AVxxC7524xXx	7.5	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	3.6
E84AVxxC1134xXx	11														
E84AVxxC1534xXx	15														
E84AVxxC1834xXx	18.5	8.5	8.5	130	130	130	15	5.5	5.5	110	110	0	> 95	> 95	9.3
E84AVxxC2234xXx	22														
E84AVxxC7524xBx	7.5														
E84AVxxC1134xBx	11	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	3.7
E84AVxxC1534xBx	15														
E84AVxxC1834xBx	18.5														
E84AVxxC2234xBx	22	8.5	8.5	130	130	130	15	5.5	5.5	110	110	0	> 95	> 95	9.4

## Mechanical installation

Standard devices in the power range 3 ... 22 kW

Mounting in "cold plate" technique

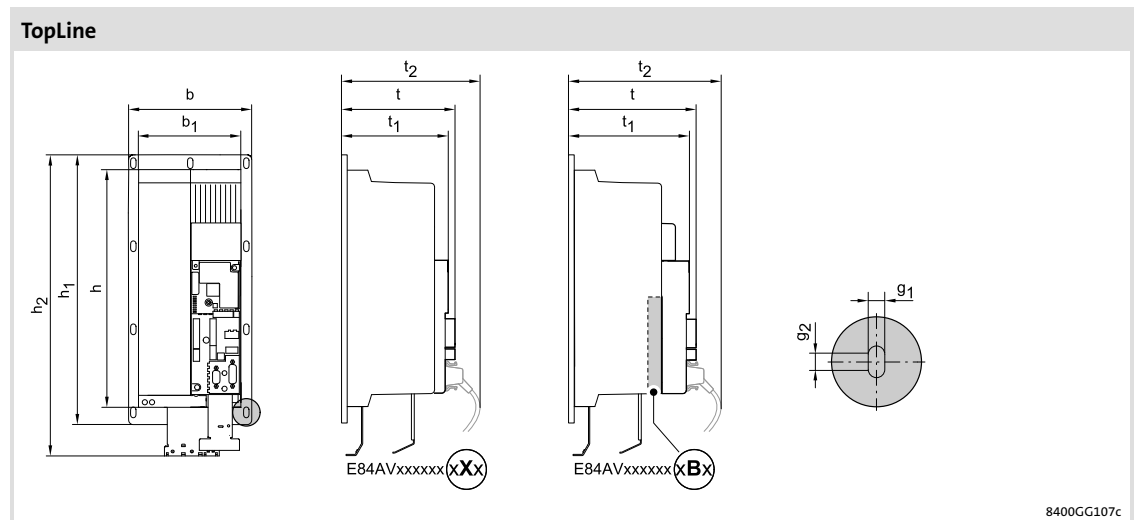


Fig. 5-39 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	b <sub>1</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>
		[mm]									
E84AVTCC7524xXx	7.5	325	174	156	378	426	140	143	182	6	5
E84AVTCC1134xXx	11										
E84AVTCC1534xXx	15										
E84AVTCC1834xXx	18.5	350	231	179	407	458	205	166	205	6	7
E84AVTCC2234xXx	22										
E84AVTCC7524xBx	7.5	325	174	176	378	426	140	163	202	6	5
E84AVTCC1134xBx	11										
E84AVTCC1534xBx	15										
E84AVTCC1834xBx	18.5	350	231	199	407	458	205	186	225	6	7
E84AVTCC2234xBx	22										

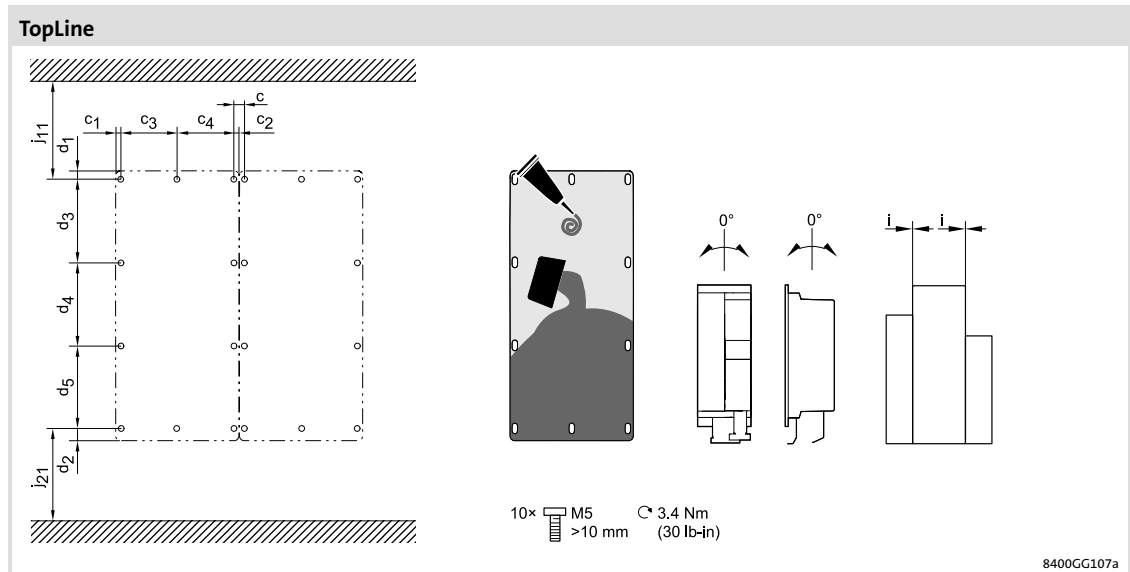


Fig. 5-40 Dimensions for mounting

	[kW]	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	i	j <sub>11</sub>	j <sub>21</sub>	[kg]
		[mm]													
E84AVTCC7524xXx	7.5	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	3.8
E84AVTCC1134xXx	11														
E84AVTCC1534xXx	15														
E84AVTCC1834xXx	18.5	8.5	8.5	130	130	130	15	5.5	5.5	110	110	0	> 95	> 95	9.5
E84AVTCC2234xXx	22														
E84AVTCC7524xBx	7.5	9	9	120	120	120	15	7	7	80	80	0	> 95	> 95	3.9
E84AVTCC1134xBx	11														
E84AVTCC1534xBx	15														
E84AVTCC1834xBx	18.5	8.5	8.5	130	130	130	15	5.5	5.5	110	110	0	> 95	> 95	9.6
E84AVTCC2234xBx	22														

**5.4 Standard devices in a power range of 30 ... 45 kW****5.4.1 Assembly in built-in technique (standard)**

You can choose between three variants for mounting the "built-in unit" version of the controllers:

- ▶ Assembly without filter
  - in "standard" technique
- ▶ Assembly with filter:
  - in "standard" technique (footprint filter)
  - in mounting variant (side-mounted filter)

The following filters can be used for the controllers:

- ▶ on the supply side
  - RFI filters

**Assembly without filter in "standard" technique**

For mounting, use four screws M8 x >16 mm. The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended..

How to proceed:

1. Prepare the fixing holes on the mounting surface.
2. Screw the controller directly to the mounting surface.

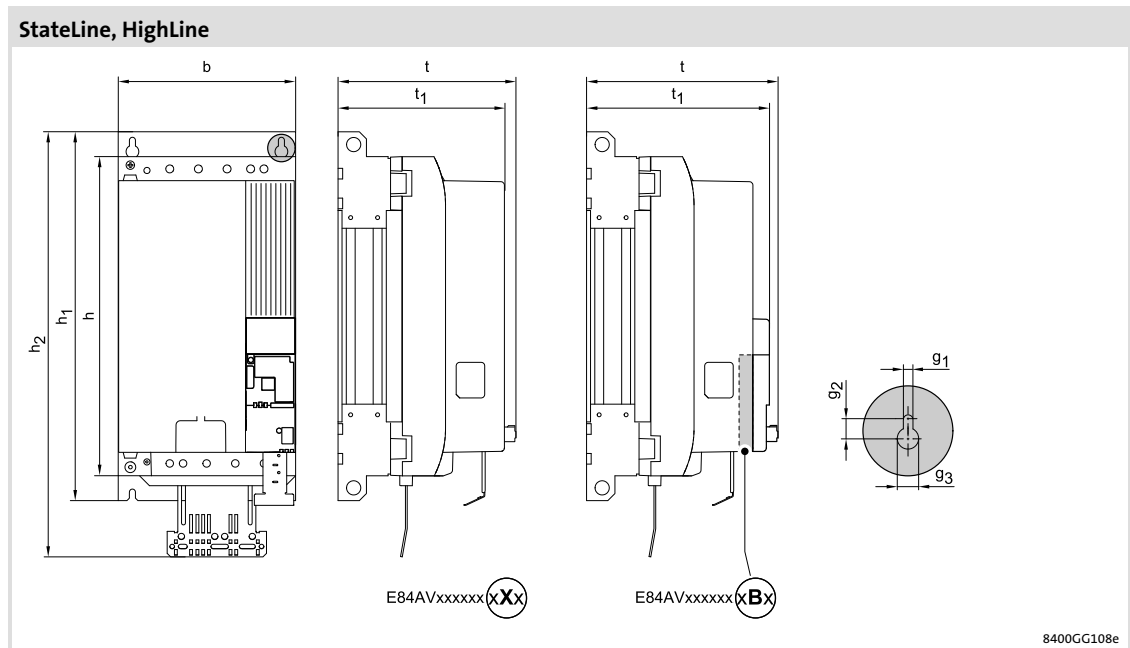


Fig. 5-41 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]								
E84AVxxE3034xXx	30	450	250	250	520	636	237	8.5	16	18
E84AVxxE3734xXx	37									
E84AVxxE4534xXx	45									
E84AVxxE3034xBx	30	450	250	270	520	636	257	8.5	16	18
E84AVxxE3734xBx	37									
E84AVxxE4534xBx	45									

## Mechanical installation

Standard devices in a power range of 30 ... 45 kW  
 Assembly without filter in "standard" technique

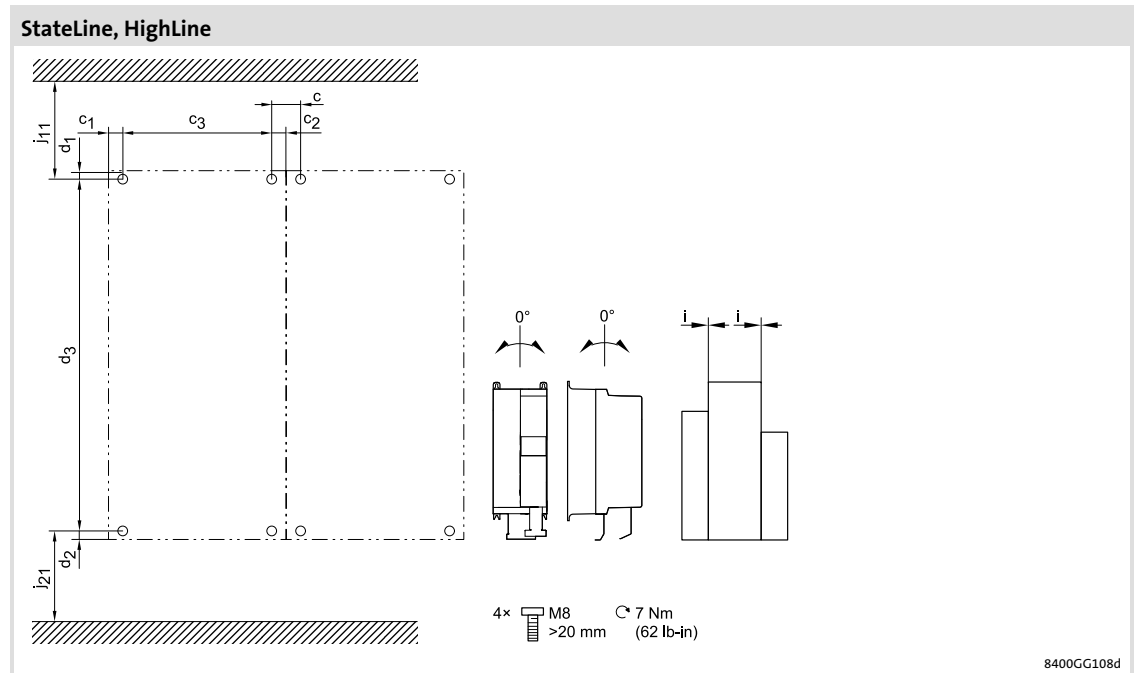



Fig. 5-42 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]										[kg]
E84AVxxE3034xXx	30	8	12	500	40	20	20	210	0	> 95	> 120	17.2
E84AVxxE3734xXx	37											
E84AVxxE4534xXx	45											
E84AVxxE3034xBx	30	8	12	500	40	20	20	210	0	> 95	> 120	17.3
E84AVxxE3734xBx	37											
E84AVxxE4534xBx	45											

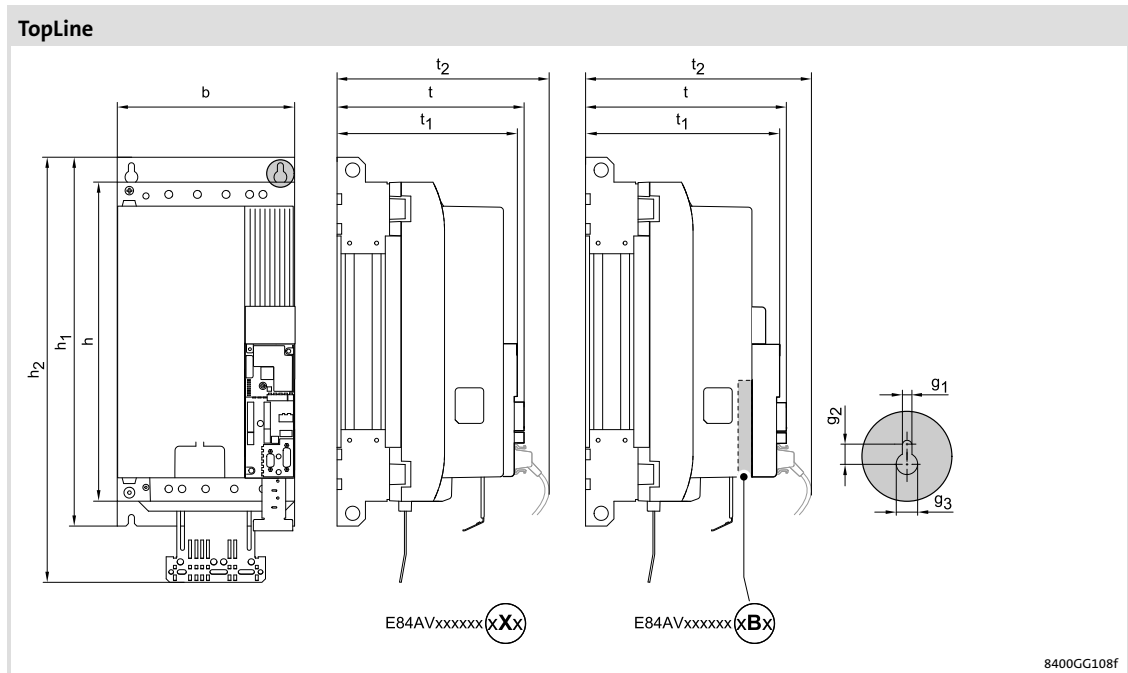


Fig. 5-43 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]									
E84AVTCE3034xXx	30	450	250	265	520	636	252	291	8.5	16	18
E84AVTCE3734xXx	37										
E84AVTCE4534xXx	45										
E84AVTCE3034xBx	30	450	250	285	520	636	272	311	8.5	16	18
E84AVTCE3734xBx	37										
E84AVTCE4534xBx	45										

## Mechanical installation

Standard devices in a power range of 30 ... 45 kW  
 Assembly without filter in "standard" technique

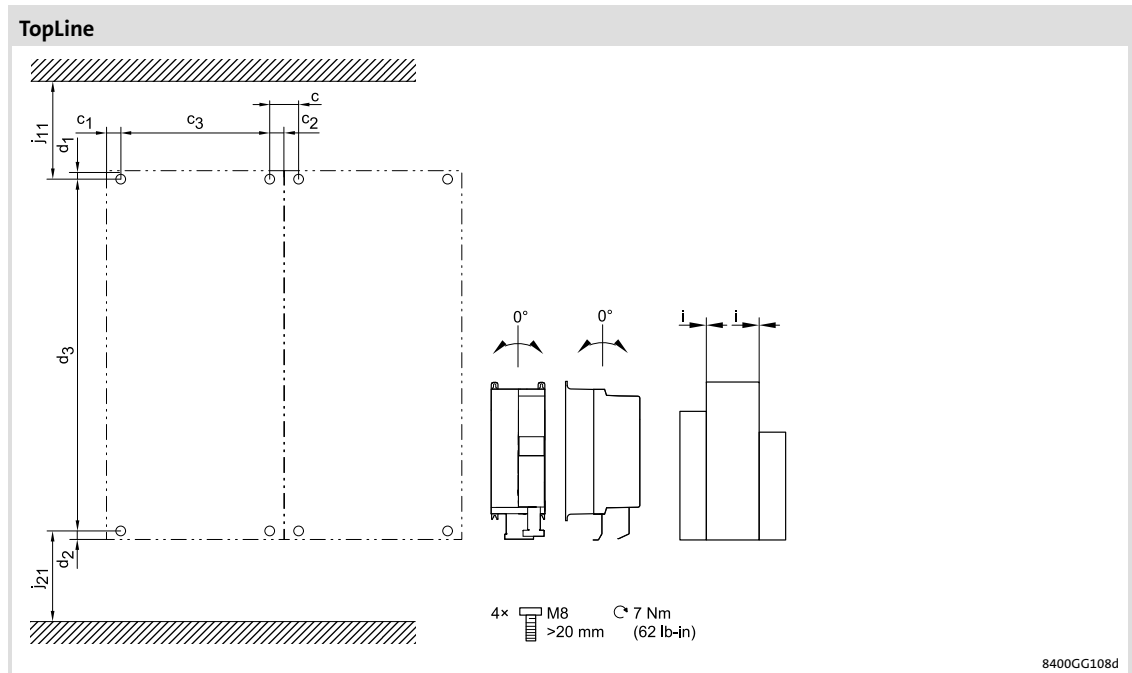



Fig. 5-44 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]										[kg]
E84AVTCE3034xXx	30	8	12	500	40	20	20	210	0	> 95	> 120	17.4
E84AVTCE3734xXx	37											
E84AVTCE4534xXx	45											
E84AVTCE3034xBx	30	8	12	500	40	20	20	210	0	> 95	> 120	17.5
E84AVTCE3734xBx	37											
E84AVTCE4534xBx	45											



## Filter mounting in "standard" technique

The mounting location and material must ensure a durable mechanical connection.

- ▶ Screw and washer assemblies or hexagon socket screws with washers are recommended..



### Tip!

The scope of supply of the filter comprises mounting instructions. They describe technical data and information on mechanical and electrical mounting of this accessory part.

## Assignment of filter – controller

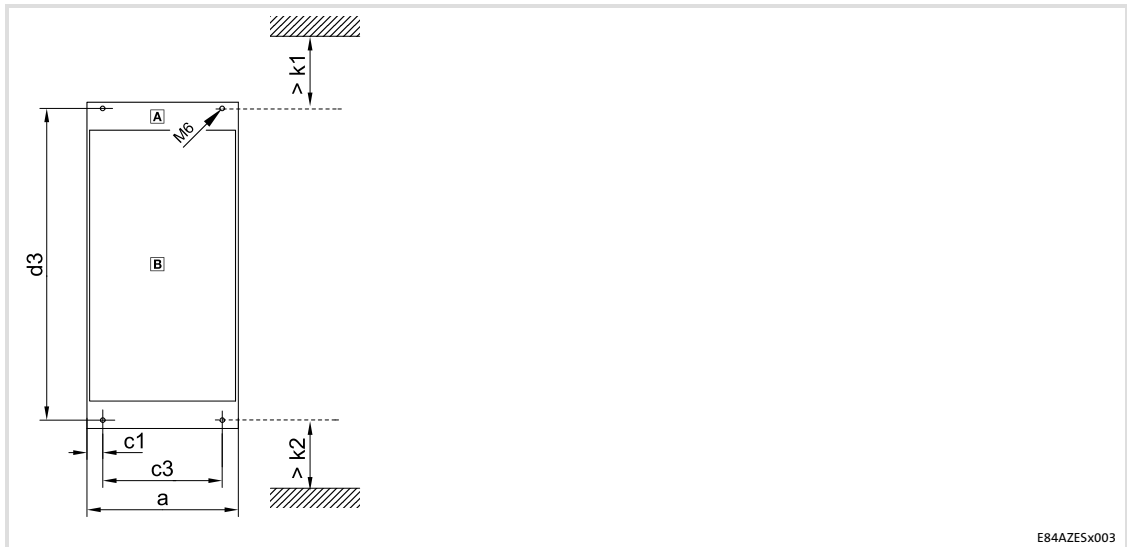
Controller E84AVxxE...	RFI filter E84AZESM...			
	3034LD	3734LD	4534LD	4534LD001
3034	x	x <sup>1)</sup>		
3734		x	x <sup>1)</sup>	
4534			x	x <sup>1)</sup>

<sup>1)</sup> For operation with increased power

# 5

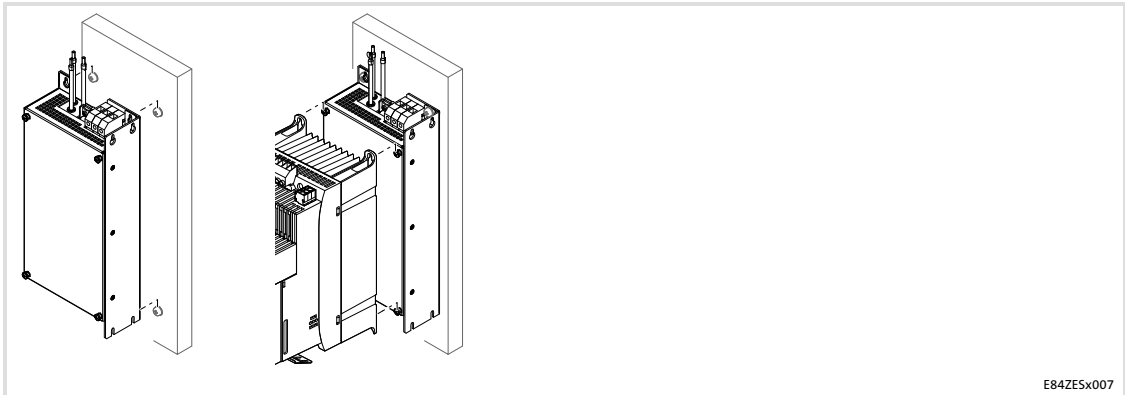
## Mechanical installation

Standard devices in a power range of 30 ... 45 kW  
 Filter mounting in "standard" technique



- A Side-by-side filter
- B Standard device

	a	c1	c3	d3	k1	k2
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
E84AZESM3034LD	250	20	210	570	55	60
E84AZESM3734LD						
E84AZESM4534LD						
E84AZESM4534LDNO 01						



E84ZESx007

Proceed as follows for installation:

1. Prepare threaded holes on the mounting plate.
2. Equip threaded holes with screws and washers.
  - Use 4 screw and washer assemblies or hexagon socket screws with washers.
  - Do not fully tighten the screws.
3. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
4. Mount the standard device onto the filter.
  - Use 4 screw and washer assemblies or hexagon socket screws with washers.
5. If required, pre-assemble further units.
6. Adjust all units.
7. Screw all units onto the mounting plate.
  - Starting torque: 7 Nm (62 lb-in)

## Mechanical installation

Standard devices in a power range of 30 ... 45 kW  
Filter mounting variant

### Filter mounting variant

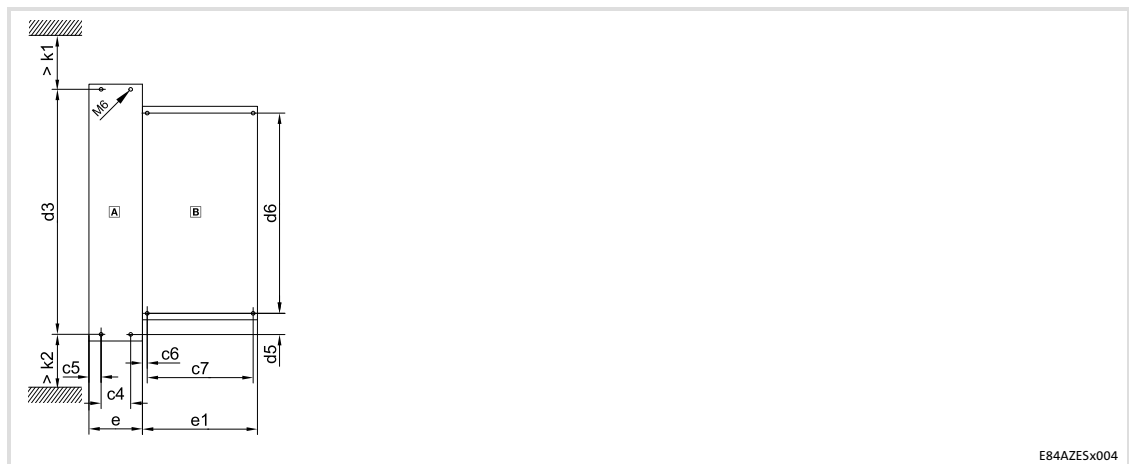
The mounting location and material must ensure a durable mechanical connection.

- Screw and washer assemblies or hexagon socket screws with washers are recommended..



### Tip!

The scope of supply of the filter comprises mounting instructions. They describe technical data and information on mechanical and electrical mounting of this accessory part.

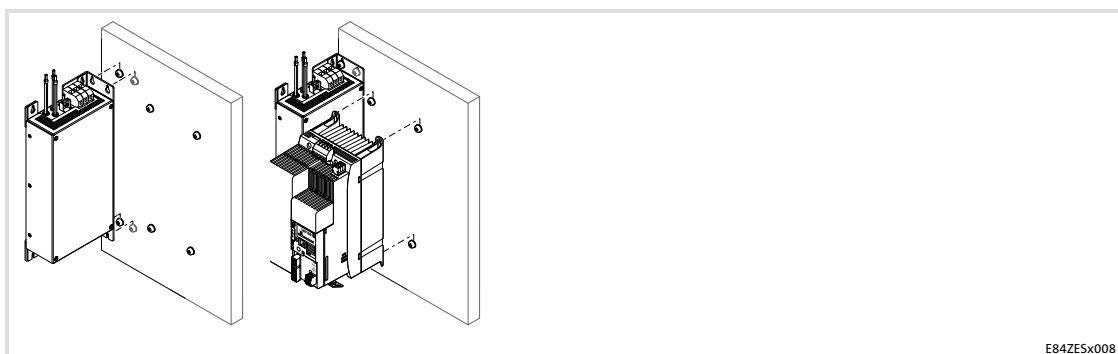


E84AZESx004

- ▣ A Side-by-side filter
- ▣ B Standard device

	c4	c5	c6	c7	d3	d5	d6
	[mm]						
E84AZESM3034LD	65	20	20	210	570	37	495
E84AZESM3734LD							
E84AZESM4534LD							
E84AZESM4534LDN001							

	e	e1	k1	k2
	[mm]			
E84AZESM3034LD	105	210	55	60
E84AZESM3734LD				
E84AZESM4534LD				
E84AZESM4534LDN001				



Proceed as follows for installation:

1. Prepare threaded holes on the mounting plate.
2. Equip threaded holes with screws and washers.
  - Use 8 screw and washer assemblies or hexagon socket screws with washers.
  - Do not fully tighten the screws.
3. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
4. Mount the standard device onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
5. If required, pre-assemble further units.
6. Adjust all units.
7. Screw all units onto the mounting plate.

**5.4.2 Mounting in "cold plate" technique**

The E84AVxxC... controllers are designed for assembly on coolers (e.g. collective coolers) in "cold-plate" technique.

**Requirements for collective coolers**

A good thermal connection to the cooler is important for the trouble-free operation of the controller:

- ▶ The contact area between the collective cooler and the controller
  - must be at least as big as the cooling plate of the controller.
  - must be smooth, the maximum deviation must not exceed 0.05 mm.
- ▶ The collective cooler must be connected to the controller with all required screwed joints.
- ▶ The thermal resistance  $R_{th}$  must be observed, see table.  
 The values in the table apply to the operation of the controllers under rated conditions.  
 The values include the heat transmission between the cooler and the device.  
 With a standard heat conducting paste and a film thickness of 50  $\mu\text{m}$ , the heat transmission is approx. 0.007 K/W.

Type	Power to be dissipated	Thermal resistance
	$P_v$ [W]	$R_{th}$ [K/W]
E84AVxxC3034	720	$\leq 0.053$
E84AVxxC3734	810	$\leq 0.047$
E84AVxxC4534	1080	$\leq 0.035$

**Ambient conditions**

- ▶ The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.
- ▶ Temperature at the cooling plate of the drive controller: max. 75 °C.

**Note!**

Apply standard heat-conducting paste or heat-conducting foil onto cooler and cooling plate before you bolt the controller onto the cooler.

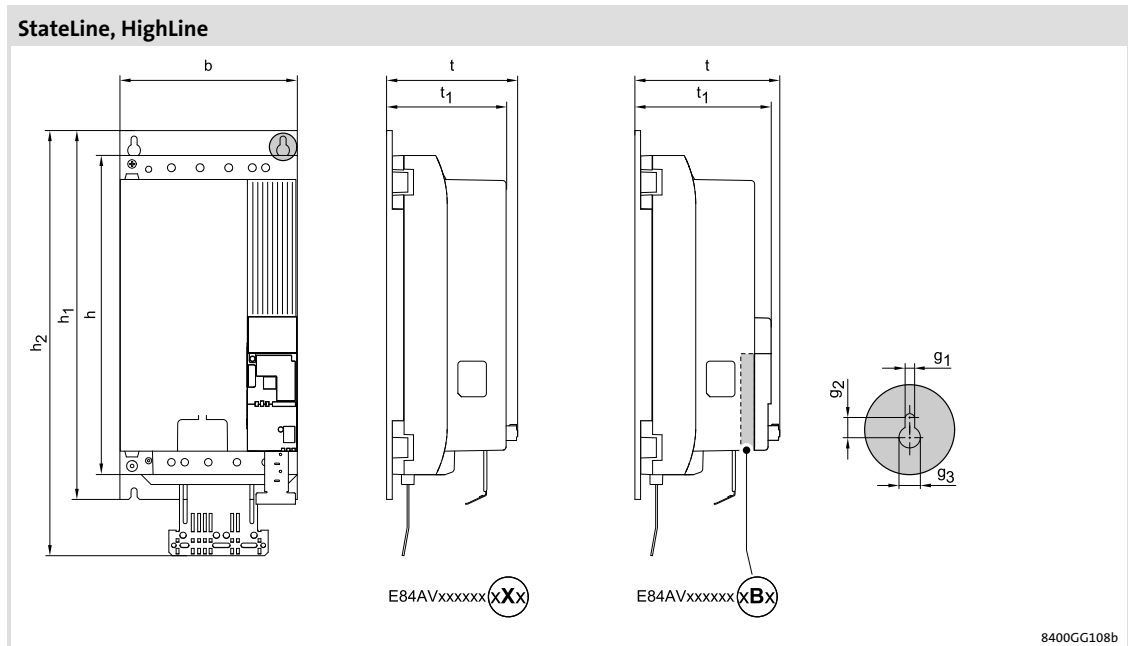


Fig. 5-45 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]								
E84AVxxC3034xXx	30	450	250	184	520	636	171	8.5	16	18
E84AVxxC3734xXx	37									
E84AVxxC4534xXx	45									
E84AVxxC3034xBx	30	450	250	204	520	636	191	8.5	16	18
E84AVxxC3734xBx	37									
E84AVxxC4534xBx	45									

## Mechanical installation

Standard devices in a power range of 30 ... 45 kW

Mounting in "cold plate" technique

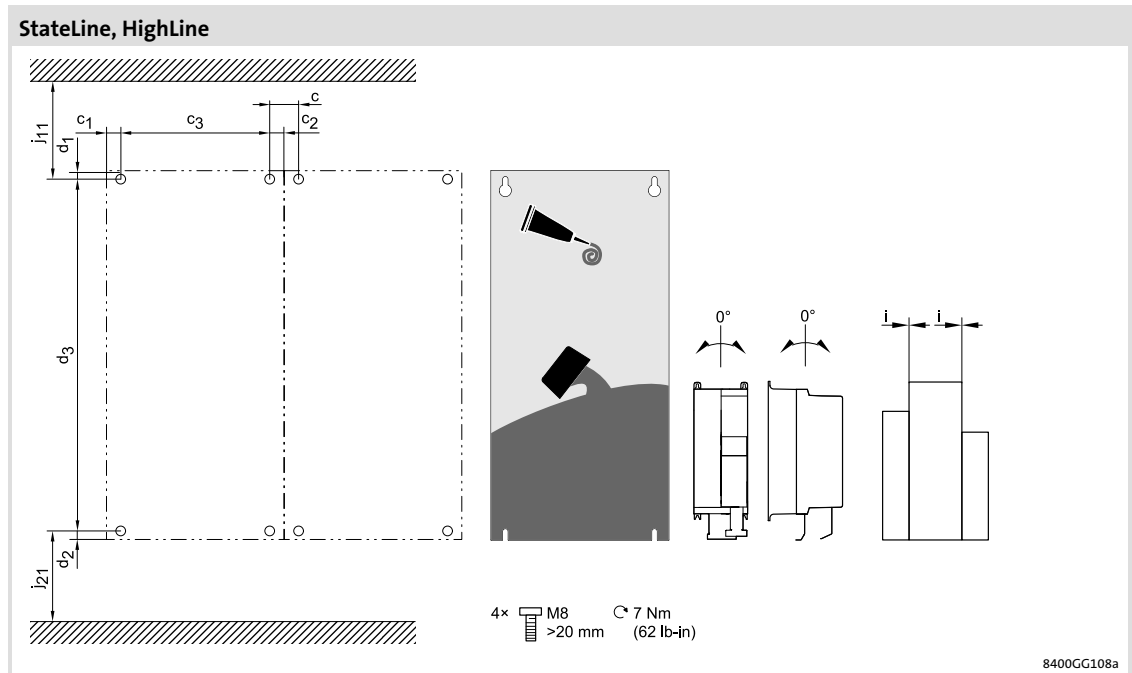



Fig. 5-46 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]										[kg]
E84AVxxC3034xXx	30	8	12	500	40	20	20	210	0	> 95	> 120	16.7
E84AVxxC3734xXx	37											
E84AVxxC4534xXx	45											
E84AVxxC3034xBx	30	8	12	500	40	20	20	210	0	> 95	> 120	16.8
E84AVxxC3734xBx	37											
E84AVxxC4534xBx	45											



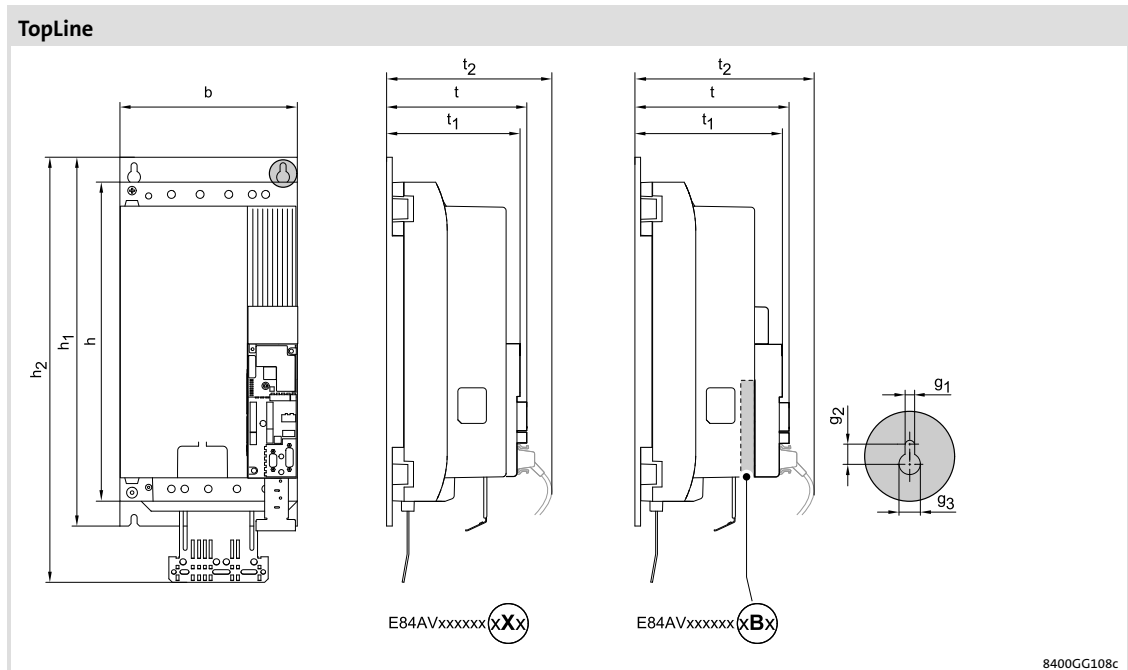


Fig. 5-47 Device dimensions

	[kW]	h	b	t	h <sub>1</sub>	h <sub>2</sub>	t <sub>1</sub>	t <sub>2</sub>	g <sub>1</sub>	g <sub>2</sub>	g <sub>3</sub>
		[mm]									
E84AVTCC3034xXx	30	450	250	199	520	636	186	225	8.5	16	18
E84AVTCC3734xXx	37										
E84AVTCC4534xXx	45										
E84AVTCC3034xBx	30	450	250	219	520	636	206	245	8.5	16	18
E84AVTCC3734xBx	37										
E84AVTCC4534xBx	45										

## Mechanical installation

Standard devices in a power range of 30 ... 45 kW

Mounting in "cold plate" technique

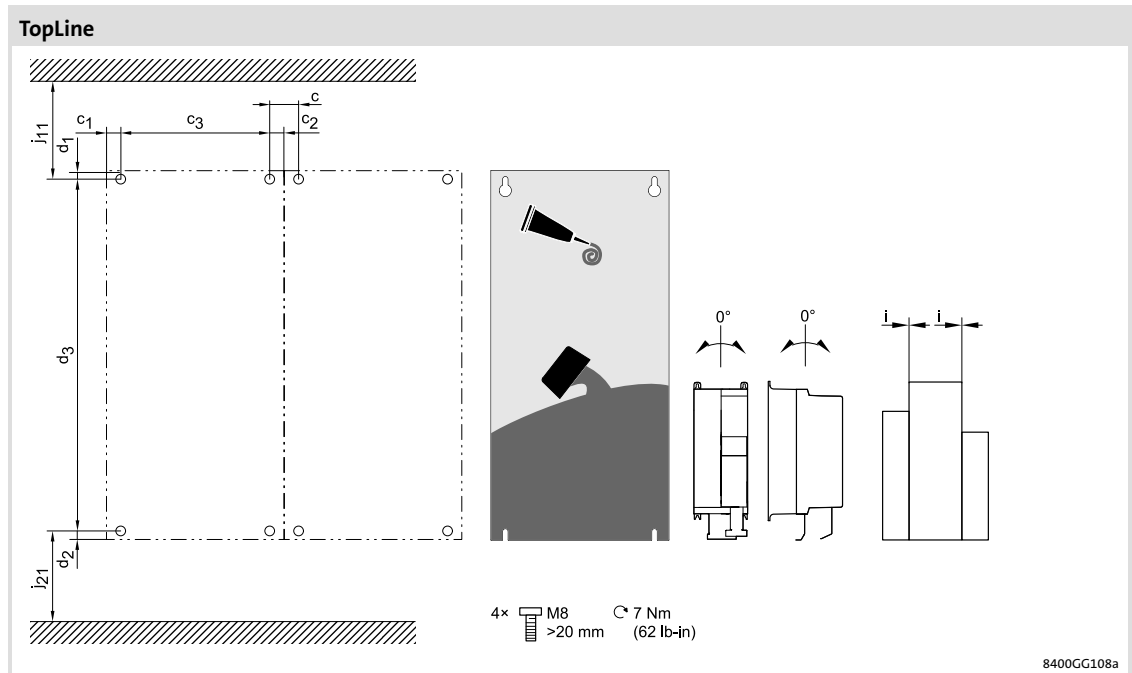



Fig. 5-48 Dimensions for mounting

		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	i	j <sub>11</sub>	j <sub>21</sub>	
	[kW]	[mm]										[kg]
E84AVTCC3034xXx	30	8	12	500	40	20	20	210	0	> 95	> 120	16.9
E84AVTCC3734xXx	37											
E84AVTCC4534xXx	45											
E84AVTCC3034xBx	30	8	12	500	40	20	20	210	0	> 95	> 120	17.0
E84AVTCC3734xBx	37											
E84AVTCC4534xBx	45											

## 6 Electrical installation

### 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  $\geq 10$  mm<sup>2</sup> 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!****Overvoltage at devices with 230-V mains connection**

An impermissible overvoltage may occur if the central supply of the N conductor is interrupted if the devices are connected to a TN three-phase system.

**Possible consequences:**

- ▶ Destruction of the device

**Protective measures:**

- ▶ Provide for the use of isolating transformers.

**Stop!**

The product contains electrostatic sensitive devices.

Before working in the connection area, the personnel must be free of electrostatic charge.

**Stop!****Pluggable terminal strips or plug connections**

Plugging or removing the terminal strips or plug connections during operation may cause high voltages and arcing.

**Possible consequences:**

- ▶ Damage of the devices

**Protective measures:**

- ▶ Switch off device.
- ▶ Only plug or remove the terminal strips or plug connections in deenergised status.



### Stop!

#### Use of RFI filters in IT systems

The controllers must not be operated with mains filters and RFI filters from Lenze because these filters contain components connected to PE.

#### Possible consequences:

- ▶ The filters may be destroyed when an earth fault occurs.
- ▶ Monitoring of the IT system may be triggered.

#### Protective measures:

- ▶ Do not use RFI filters from Lenze in IT systems.
- ▶ Before using the controller in IT systems, remove the two contact screws for interference suppression (on the supply side and on the motor side).



### Stop!

#### Overvoltage at components:

In case of an earth fault in IT systems, intolerable overvoltages may occur in the plant.

#### Possible consequences:

Destruction of the device.

#### Protective measures:

Before using the controller in the IT system, remove the contact screws on the supply side and the motor side. (📖 Fig. 6-14).



### Note!

Switching on the controller motor side is permissible for safety shutdown (emergency stop) and for operation of several motor on the controller (only in V/f operating mode!).

Please observe the following:

- ▶ When switching with the controller enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.
- ▶ The switching elements on the motor side must be dimensioned in accordance with the maximum occurring load.

**Danger!**

Operation of the controller on a phase earthed mains with a rated mains voltage of  $\geq 400$  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.

### 6.1.1 Electrical isolation

The protective insulation of the "8400 Inverter Drives" controllers is implemented according to EN 61800-5-1. The following illustration shows the insulation concept.

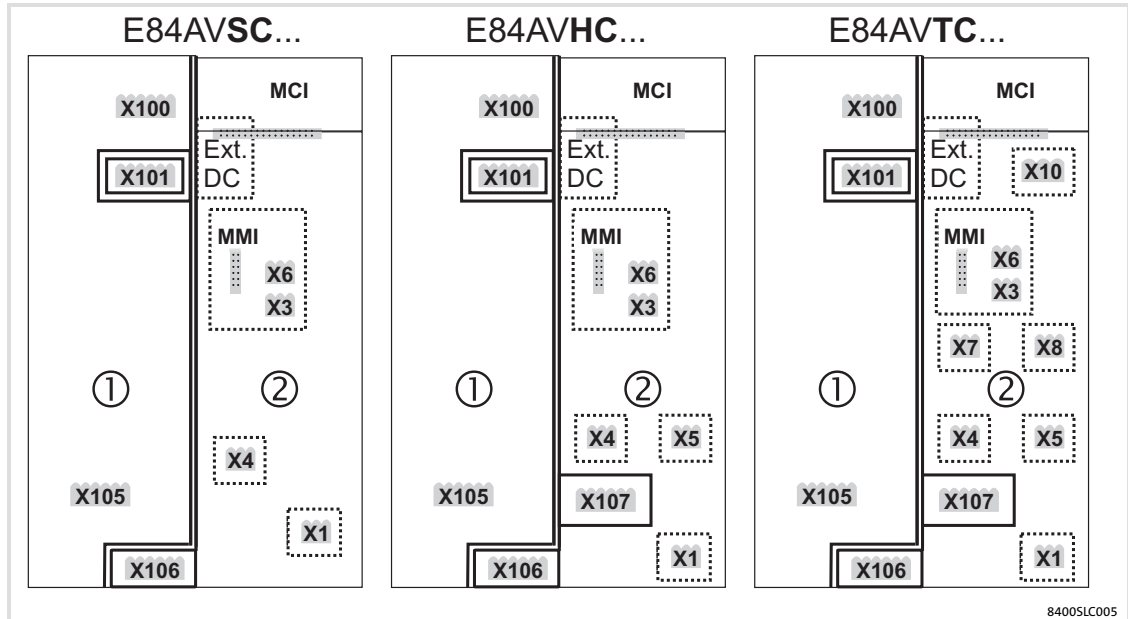


Fig. 6-1 Electrical isolation between power terminals, control terminals and housing



#### Note!

##### Ensure trouble-free operation

Execute the wiring in such a way that the potential islands remain separated.



#### Note!

If the terminal X106 is used, e.g. to connect an external PTC thermistor or a thermal contact, ensure at least one basic insulation to the motor or mains potential to not restrict the protective separation of the control terminals.



#### Note!

If terminal X107 is used for connecting a motor holding brake, at least one basic insulation to the motor or mains potential has to be provided, so that the protective separation of the control terminals is not limited.

#### Legend

⋮	Isolation by functional insulation
	Isolation by basic insulation
	Safe isolation by double or reinforced insulation Protection against accidental contact is guaranteed without any further measures.

Range	Connection	Name	Explanation
Power ①	X100	Mains	Protective separation towards X101, X106 and all control terminals
		DC bus	
	X105	Motor	
		Brake resistor	
	X101	Relay contact	
X106	Motor temperature	Protective separation towards X100, X105 and X101 Isolation by basic insulation towards all control terminals Degree of insulation of thermal contact, PTC, or cable can influence the isolation.	
Control ②	X1	System bus (CANopen)	Isolation by functional insulation towards other control terminals
	X3	Analog IO	
	X4	Digital IO	
		24 V external supply	The degree of insulation of the voltage source influences the degree of insulation of the controller.
	X5	Digital inputs	Isolation by functional insulation towards other control terminals
		24 V external supply	The degree of insulation of the voltage source influences the degree of insulation of the controller.
	X6	Diagnostics	Isolation by functional insulation towards other control terminals
	X107	24 V brake supply	Isolation by basic insulation towards other control terminals
	MCI	Communication	Isolation by functional insulation towards other control terminals
MMI	Memory		
Control ②	additional connections TopLine:		Isolation by functional insulation towards other control terminals
	X7	Resolver	
	X8	Encoder	
	X10	Axis bus	

### 6.1.2 Device protection

- ▶ In case of condensation, do not connect the controller to the mains voltage before the moisture has evaporated completely.
- ▶ The controller must be protected by external fuses.
- ▶ Provide unused control inputs and outputs with terminal strips.



### 6.1.3 Maximum motor cable length

- ▶ Ensure that the motor cable is as short as possible to have a positive effect on the drive behaviour.
- ▶ In group drives (multiple motors on one controller), the resulting cable length  $l_{res}$  is the crucial factor:

$l_{res} [m] = (l_1 + l_2 + l_3 \dots + l_i) \cdot \sqrt{i}$	$l_x$ Length of the individual motor cable
	$l_{res}$ Resulting length of the motor cable
	$i$ Number of individual motor cables

- ▶ The "technical data" (chap. 4.1) provided for the motor cable length must be observed.

### 6.1.4 Motor protection

- ▶ Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the  $I^2xt$  monitoring.
- ▶ Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min.  $\hat{u} = 1.5 \text{ kV}$ , min.  $du/dt = 5 \text{ kV}/\mu\text{s}$
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

### 6.1.5 Interaction with compensation equipment

- ▶ Controllers only consume very little reactive power of the fundamental wave from the AC supply mains. Therefore, a compensation is not required.
- ▶ If the controllers are connected to a supply system with compensation equipment, this equipment must comprise chokes.
  - For this, contact the supplier of the compensation equipment.

**6.1.6 Safety instructions for the installation according to  $U_L$  or  $U_R$** **Original - English****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.
- ▶ Branch circuit protection (240 V devices)  
Suitable for use on a circuit capable of delivering not more than:
  - 5000 rms symmetrical amperes, 240 V maximum (240 V devices).
  - 200k rms symmetrical amperes, 240 V maximum when protected by CC, J, T or R class fuses.
  - 50k rms symmetrical amperes, 240 V maximum when protected by a circuit breaker having an interrupting rating not less than 50k rms symmetrical amperes, 240 V maximum.
- ▶ Branch circuit protection (400 V/500 V devices, 0.37 ... 22 kW)  
Suitable for use on a circuit capable of delivering not more than:
  - 5000 rms symmetrical amperes, 400 V/500 V maximum.
  - 200k rms symmetrical amperes, 500 V maximum when protected by CC, J, T or R class fuses.
  - 50k rms symmetrical amperes, 500 V maximum when protected by a circuit breaker having an interrupting rating not less than 50k rms symmetrical amperes, 480 V/277 V  $\surd$  maximum.
- ▶ Branch circuit protection (400 V/500 V devices, 30 ... 45 kW)  
Suitable for use on a circuit capable of delivering not more than:
  - 10k rms symmetrical amperes, 500 V maximum, when protected by CC, J or T class fuses.
  - 200k rms symmetrical amperes, 500 V maximum when protected by CC, J or T class fuses.
- ▶ Branch circuit short circuit protection with fuses in accordance with UL248 or circuit breaker, 400 V/480 V  $\surd$  maximum, in accordance with UL489.  
Voltage of the fuses or circuit breakers must at least be suitable with the input voltage of the drive. The specific fuse/circuit breaker sizes and classes for each inverter are shown in the table below.

Safety instructions for the installation according to  $U_L$  or  $U_R$



### Warnings!

- ▶ Control card protection:
  - 24 V DC class 2 supply or external fuse for 24 V DC supply voltage of control terminal X107.
  - Rated 4 A DC fuse UL248-14.
  - Functional Safety is evaluated according to standards listed in section "Safety engineering".
- ▶ The device is provided with internal overload protection. For information on the protection level of the internal overload protection for a motor load, see the corresponding Software Manual or Online Help under the topic "Motor load monitoring ( $I^2xt$ )". This function has to be activated; i. e. the reaction must be changed from "Warning" (factory setting) to "Fault".
- ▶ For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Manual or Online Help.



### Warnings!

- ▶ The device shall be installed in a pollution degree 2 macro-environment.
- ▶ Maximum surrounding air temperature: 55 °C.
- ▶ Use 75 °C copper wire only, except for control circuits.



### Warnings!

- ▶ Safety card protection:
  - 24 V DC class 2 supply or external fuse for 24 V DC supply voltage of control terminal X80.
  - Rated 4 A DC fuse UL248-14.
  - Functional Safety is not evaluated by UL.

Safety instructions for the installation according to  $U_L$  or  $U_R$ 

The values of the fuses used may be equal to or fall below the values in the following table:

Type	Branch circuit protection		
	Fuse [A]		Circuit breaker [A]
	with mains choke	without mains choke	
E84AVxxx2512	6	6	15
E84AVxxx3712	10	10	15
E84AVxxx5512	10	10	15
E84AVxxx7512	15	15	15
E84AVxxx1122	20	20	20
E84AVxxx1522	25	25	25
E84AVxxx2222	30	30	30
E84AVxxx3714	6	6	15
E84AVxxx5514	6	6	15
E84AVxxx7514	6	6	15
E84AVxxx1124	10	10	15
E84AVxxx1524	10	10	15
E84AVxxx2224	10	10	15
E84AVxxx3024xxS	15	15	15
E84AVxxx3024xx0	15	15	15
E84AVxxx4024	20	20	20
E84AVxxx5524	20	20	20
E84AVxxx7524	20	25	25
E84AVxxx1134	30	40	40
E84AVxxx1534	50	-	50
E84AVxxx1834	60	60	-
E84AVxxx2234	60	-	-
E84AVxxx3034	80	-	-
E84AVxxx3734	100	-	-
E84AVxxx4534	125	-	-

**Warnings!**

For CSA Certification drives are intended to be used with Chokes - UL Recognized (XPTQ2/8, FOKY2/8) or CSA Certified (XPTQ2, FOKY2), File Number E103521 or E198787, mounted on the line side of the devices. The chokes are listed in chapter 4.2 Rated Data and chapter 12.2 Accessories. Alternatively - For Canadian Certification drives are intended to be used as follows:

**Transient surge suppression for 240 V models**

shall be installed on the line side of this equipment and shall have met the requirements of CSA C22.2 No. 8.

It shall be suitable for overvoltage category III.

It shall be rated

- phase to ground: 240 V,
- phase to phase: 240 V.

It shall provide protection for a rated impulse withstand voltage peak of

- line to line: 2.5 kV.

**Transient surge suppression for 400/500 V models**

shall be installed on the line side of this equipment and shall have met the requirements of CSA C22.2 No. 8.

It shall be suitable for overvoltage category III.

It shall be rated

- phase to ground: 500 V,
- phase to phase: 500 V.

It shall provide protection for a rated impulse withstand voltage peak of

- line to line: 2.5 kV.

**6.1.7 Safety instructions for the installation according to  $U_L$  or  $U_R$** 

Original - French

**Avertissement !**

- ▶ La protection statique intégrée n'offre pas la même protection qu'un disjoncteur. Une protection par disjoncteur externe doit être fournie, conformément aux indications du fabricant, au National Electrical Code et aux autres dispositions applicables.
- ▶ Protection par disjoncteur (appareils 240 V)  
Convient aux circuits non susceptibles de délivrer plus de :
  - 5000 ampères symétriques eff., maximum 240 V (appareils 240 V).
  - 200k ampères symétriques eff., maximum 240 V, avec protection par des fusibles CC de calibre J, T ou R.
  - 50k ampères symétriques eff., maximum 240 V, avec protection par disjoncteur à pouvoir de coupure nominal d'au moins 50k ampères symétriques eff., maximum 240 V.
- ▶ Protection par disjoncteur (appareils 400 V/500 V, 0,37 ... 22 kW)  
Convient aux circuits non susceptibles de délivrer plus de :
  - 5000 ampères symétriques eff., maximum 400 V/500 V.
  - 200k ampères symétriques eff., maximum 500 V, avec protection par des fusibles CC de calibre J, T ou R.
  - 50k ampères symétriques eff., maximum 500 V, avec protection par disjoncteur à pouvoir de coupure nominal d'au moins 50k ampères symétriques eff., maximum 480 V/277 V √.
- ▶ Protection par disjoncteur (appareils 400 V/500 V, 30 ... 45 kW)  
Convient aux circuits non susceptibles de délivrer plus de :
  - 10k ampères symétriques eff., maximum 500 V, avec protection par des fusibles CC de calibre J ou T.
  - 200k ampères symétriques eff., maximum 500 V, avec protection par des fusibles CC de calibre J ou T.
- ▶ Protéger le circuit de dérivation contre les court-circuits à l'aide de fusibles (norme UL248) ou d'un disjoncteur, maximum 400 V/480 V √ (norme UL489).

La tension des fusibles doit être adaptée à la tension d'entrée de l'entraînement (exigence minimale). Se reporter au tableau ci-après pour connaître le dimensionnement spécifique des fusibles/disjoncteurs et les classes agréés pour chaque variateur.

**Avertissement !**

- ▶ Protection de la carte de commande :
  - Fusible externe pour tension d'alimentation 24 V CC du bornier de commande X107.
  - Fusible CC 4 A UL248-14 (tension assignée).
  - La sécurité fonctionnelle n'est pas évaluée suivant les normes énumérées à la section "Système de sécurité".
- ▶ L'équipement est doté d'un dispositif de protection intégré contre les surcharges. Pour obtenir des informations sur le niveau de protection offert par la protection intégrée contre les surcharges du moteur, se reporter au manuel du logiciel ou à l'aide en ligne correspondante, rubrique "Surveillance de la charge du moteur ( $I^2xt$ )". Cette fonction doit être activée. En d'autres termes, la réaction doit être modifiée de "Avertissement" (réglage usine) à "Défaut".
- ▶ Pour obtenir des informations sur les caractéristiques assignées et sur le raccordement correct du dispositif de protection thermique (uniquement pour raccordement à des moteurs dotés d'une protection thermique intégrée), se reporter au manuel correspondant ou à l'aide en ligne.

**Avertissement !**

- ▶ L'équipement est destiné à être installé dans un macro-environnement caractérisé par le degré de pollution 2.
- ▶ Température ambiante maximale : 55 °C.
- ▶ Utiliser exclusivement des conducteurs en cuivre 75 °C, sauf pour la partie commande.

**Avertissement !**

- ▶ Protection de la carte de sécurité :
  - Fusible externe pour tension d'alimentation 24 V CC du bornier de commande X80.
  - Fusible CC 4 A UL248-14 (tension assignée).
  - La sécurité fonctionnelle n'est pas évaluée dans le cadre de l'homologation UL.

Safety instructions for the installation according to  $U_L$  or  $U_R$ 

Les valeurs des fusibles utilisés doivent être inférieures ou égales aux valeurs indiquées dans le tableau suivant :

Type	Branch circuit protection		
	Fuse [A]		Circuit breaker [A]
	with mains choke	without mains choke	
E84AVxxx2512	6	6	15
E84AVxxx3712	10	10	15
E84AVxxx5512	10	10	15
E84AVxxx7512	15	15	15
E84AVxxx1122	20	20	20
E84AVxxx1522	25	25	25
E84AVxxx2222	30	30	30
E84AVxxx3714	6	6	15
E84AVxxx5514	6	6	15
E84AVxxx7514	6	6	15
E84AVxxx1124	10	10	15
E84AVxxx1524	10	10	15
E84AVxxx2224	10	10	15
E84AVxxx3024xxS	15	15	15
E84AVxxx3024xx0	15	15	15
E84AVxxx4024	20	20	20
E84AVxxx5524	20	20	20
E84AVxxx7524	20	25	25
E84AVxxx1134	30	40	40
E84AVxxx1534	50	-	50
E84AVxxx1834	60	60	-
E84AVxxx2234	60	-	-
E84AVxxx3034	80	-	-
E84AVxxx3734	100	-	-
E84AVxxx4534	125	-	-



**Avertissement !**

Pour obtenir la certification CSA, les entraînements doivent être destinés à une utilisation avec des selfs homologuées UL (XPTQ2/8, FOKY2/8) ou certifiées CSA (XPTQ2, FOKY2), n° de dossier E103521 ou E198787, montées côté alimentation des équipements.

Ces selfs sont répertoriées sous les 4.2 Caractéristiques assignées ainsi qu'au chapitre 12.2 Accessoires.

Sinon - Pour les lecteurs de certification canadiens sont destinés à être utilisés comme suit:

**Les dispositif de suppression des tensions transitoires** pour modèles à 240 V doit être installé côté alimentation de l'équipement et répondre aux exigences de la norme CSA C22.2 n° 8.

Il doit être compatible avec la catégorie de surtension III.

Il doit en outre offrir les caractéristiques assignées suivantes :

- de la phase à la terre : 240 V
- de phase à phase: 240 V

Le dispositif doit fournir une protection contre le pic de tension de choc assigné

- de ligne à ligne : 2,5 kV.

**Les dispositif de suppression des tensions transitoires** pour modèles à 400/500 V

doit être installé côté alimentation de l'équipement et répondre aux exigences de la norme CSA C22.2 n° 8.

Il doit être compatible avec la catégorie de surtension III.

Il doit en outre offrir les caractéristiques assignées suivantes :

- de la phase à la terre : 500 V
- de phase à phase: 500 V

Le dispositif doit fournir une protection contre le pic de tension de choc assigné

- de ligne à ligne : 2,5 kV.

## 6.2 Installation according to EMC (installation of a CE-typical drive system)

### Design of the cables

- ▶ 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 cables used must comply with the approvals required for the location (e.g. UL).

### 6.2.1 Shielding

#### Requirements

- ▶ 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
- ▶ Feedback systems
- ▶ Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- ▶ Motor temperature monitoring
- ▶ Analog signals (inputs and outputs; single-sided shield connection to the controller)
- ▶ System bus (CANopen)

The following connections need not be shielded:

- ▶ 24-V supply
- ▶ Digital signals (inputs and outputs).
  - We recommend to use shielded cables for a cable length from approximately 5 m on or in environments with strong interferences.

#### Connection system

- ▶ Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp. (📖 12.11)
- ▶ Connect the shield directly to the corresponding device shield sheet.
  - If required, additionally connect the shield to the conductive and earthed mounting plate in the control cabinet.
  - If required, additionally connect the shield to the cable clamp rail.

## Realisation

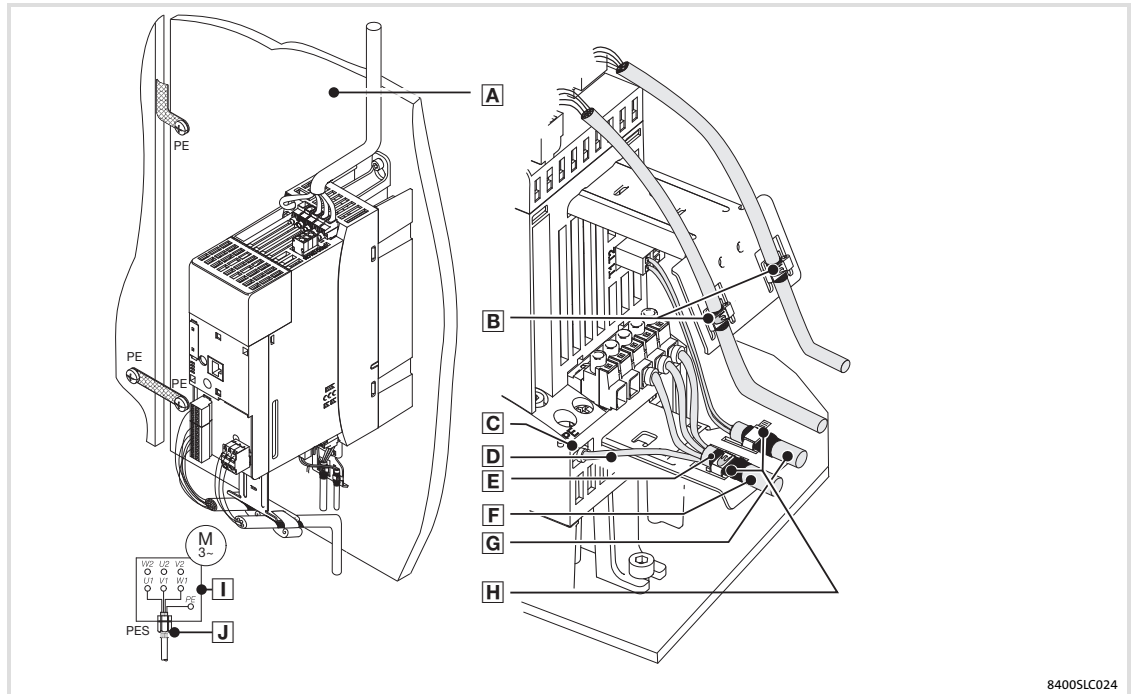


Fig. 6-2 Wiring in compliance with EMC standards

- A** Mounting plate with electrically conductive surface
- B** Control cables, connect shielding to the upper shield sheet (PES) with a surface as large as possible
- C** Terminal for motor PE
- D** PE of the motor cable
- E** Shield of the motor cable
- F** Shielded motor cable, low-capacitance  
(Core/core  $1.5 \text{ mm}^2 \leq 75 \text{ pF/m}$ ; from  $2.5 \text{ mm}^2 \leq 100 \text{ pF/m}$ ; core/shield  $\leq 150 \text{ pF/m}$ )
- G** Shielded PTC cable or thermal contact cable (preferentially installed separately)
- H** Connect cable shields to the lower shield sheet (PES) with a large surface. Preferentially use metal cable binders from the accessories.
- I** Star or delta connection as indicated on the motor nameplate
- J** EMC cable gland (not included in the scope of supply)

**6.2.2 Mains connection, DC supply**

- ▶ Controllers, mains chokes, or mains filters may only be connected to the mains via unshielded single cores or unshielded cables.
- ▶ When a mains filter or RFI filter is used, shield the cable between mains filter or RFI filter and controller if its length exceeds 300 mm. Unshielded cores must be twisted.
- ▶ In DC-bus operation or DC supply, use shielded cables.
- ▶ The cable cross-section must be dimensioned for the assigned fusing (observe national and regional regulations).

## 6.2.3

## Motor cable

- ▶ Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- ▶ The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- ▶ Shield the cable for motor temperature monitoring (PTC or thermal contact) and install it separately from the motor cable.
  - In Lenze system cables, the cable for brake control is integrated into the motor cable. If this cable is not required for brake control, it can also be used to connect the motor temperature monitoring up to a length of 50 m.
- ▶ Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp.
- ▶ Connect the shield directly to the corresponding device shield sheet.
  - If required, additionally connect the shield to the conductive and earthed mounting plate in the control cabinet.
- ▶ The motor cable is optimally installed if
  - it is separated from mains cables and control cables,
  - it only crosses mains cables and control cables at right angles,
  - it is not interrupted.
- ▶ If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  - The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  - Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  - Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.
- ▶ Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  - Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

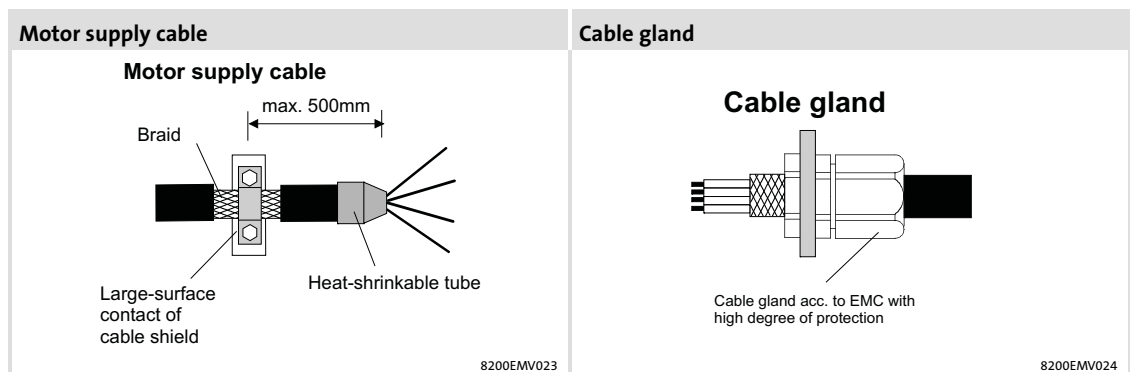


Fig. 6-3 Shielding of the motor cable

#### 6.2.4 Control cables

- ▶ Control cables must be shielded to minimise interference injections.
- ▶ For lengths of approx. 5 m and more, use only shielded cables for analog and digital inputs and outputs. Under 5 m, unshielded but twisted cables may be used.
- ▶ Connect the shield correctly:
  - The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
- ▶ To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

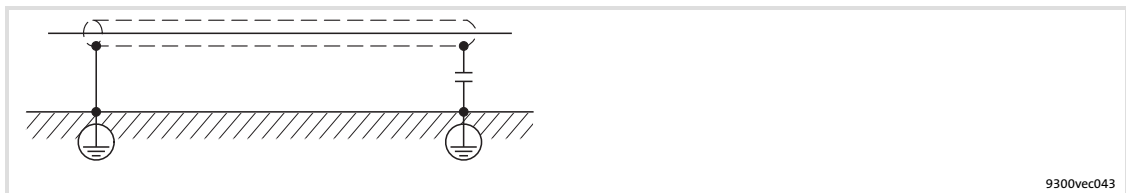


Fig. 6-4 Shielding of long, analog control cables

9300vec043

**6.2.5 Installation in the control cabinet****Mounting plate requirements**

- ▶ Only use mounting plates with conductive surfaces (zinc-coated or V2A-steel).
- ▶ Painted mounting plates are not suitable even if the paint is removed from the contact surfaces.
- ▶ If several mounting plates are used, ensure a large-surface connection between the mounting plates (e.g. by using earthing strips).

**Mounting of the components**

- ▶ Connect the controller and RFI filter to the grounded mounting plate with a surface as large as possible.
- ▶ No DIN rail mounting!

**Optimum cable routing**

- ▶ The motor cable is optimally installed if
  - it is separated from mains cables and control cables,
  - it crosses mains cables and control cables at right angles.
- ▶ Always install cables close to the mounting plate (reference potential), as freely suspended cables act like aerials.
- ▶ Lead the cables to the terminals in a straight line (avoid tangles of cables).
- ▶ Use separated cable channels for motor cables and control cables. Do not mix up different cable types in one cable channel.
- ▶ Minimise coupling capacities and coupling inductances by avoiding unnecessary cable lengths and reserve loops.
- ▶ Short-circuit unused cores to the reference potential.
- ▶ Install the positive and negative wires for DC 24 V close to each other over the entire length to avoid loops.

**Earth connections**

- ▶ Connect all components (drive controllers, chokes, filters) to a central earthing point (PE rail).
- ▶ Set up a star-shape earthing system.
- ▶ Comply with the corresponding minimum cable cross-sections.

**Continuation of cable routing**

Separation of the "hot" motor cable from the control, signal, and mains cables:

- ▶ Never install motor and signal cables in parallel and only cross at right angles
- ▶ The cables of a 24 V power supply unit (plus and minus cable) must be installed closely together over their entire length in order that no loops may occur.

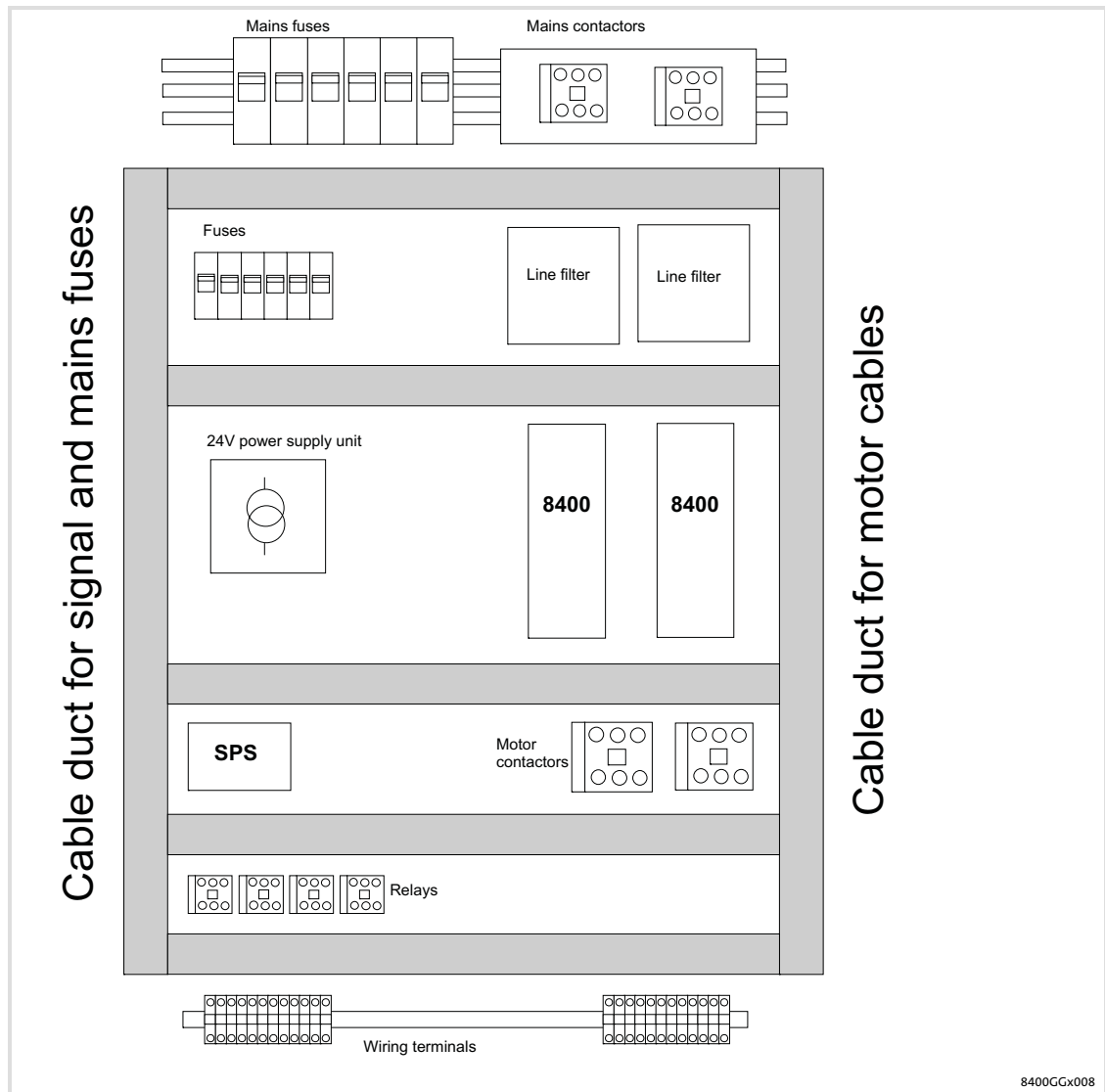


Fig. 6-5 Cable routing in the control cabinet



**6.2.6 Wiring outside of the control cabinet**

Notes for cable routing outside the control cabinet:

- ▶ The longer the cables the greater the space between the cables must be.
- ▶ If cables for different signal types are routed in parallel, the interferences can be minimized by means of a metal barrier or separated cable ducts.

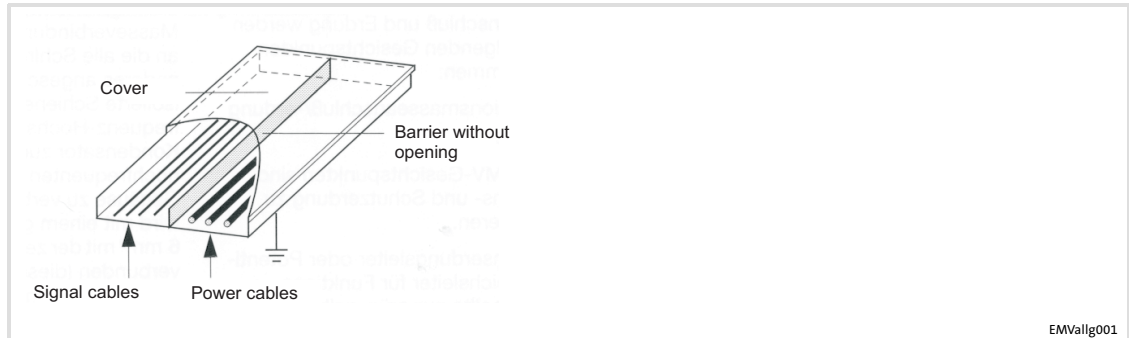


Fig. 6-6 Cable routing in the cable duct with barrier

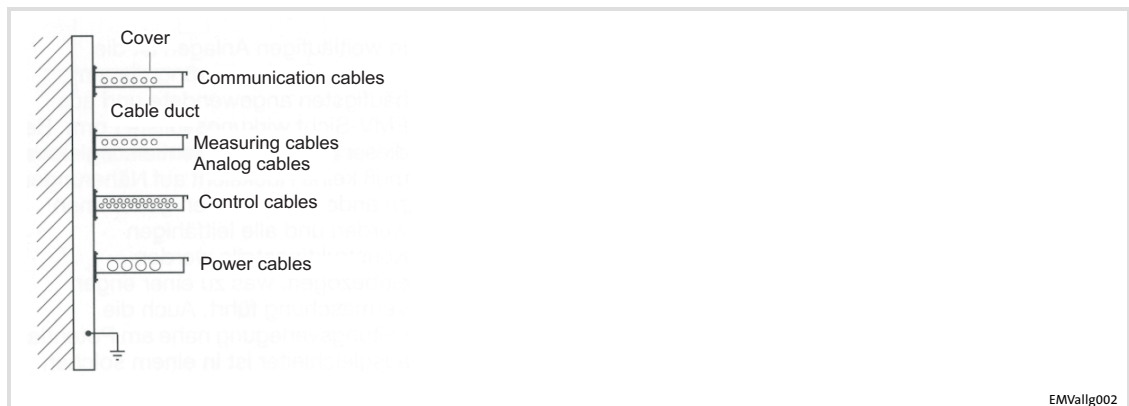


Fig. 6-7 Cable routing in separated cable ducts

**Wiring on the mains side**

- ▶ It is possible to connect the controller, mains choke or RFI filter to the mains via single cores or unshielded cables.
- ▶ The cable cross-section must be rated for the assigned fuse protection (VDE 0160).

**Wiring on the motor side****Stop!**

The motor cable is highly susceptible to interference. Therefore you will achieve an optimum wiring on the motor side if you

- ▶ exclusively use shielded and low-capacitance motor cables.
- ▶ do **not** integrate any further cable into the motor cable (e.g. for blowers etc.).
- ▶ shield the supply cable for temperature monitoring of the motor (PTC or thermostat) and install it separately from the motor cable.

Special conditions allow you to integrate the supply cable for temperature monitoring of the motor into the motor cable: (📖 8)

**6.2.7 Detecting and eliminating EMC interferences**

<b>Fault</b>	<b>Cause</b>	<b>Remedy</b>
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	<ul style="list-style-type: none"> <li>● Separate components from other component part with a minimum distance of 100 mm</li> <li>● Use motor choke/motor filter</li> </ul>
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm
Conducted interference level is exceeded on the supply side	Terminal strips for the motor cable are directly located next to the mains terminals	Spatially separate the terminal strips for the motor cable from main terminals and other control terminals with a minimum distance of 100 mm
	Mounting plate varnished	Optimise PE connection: <ul style="list-style-type: none"> <li>● Remove varnish</li> <li>● Use zinc-coated mounting plate</li> </ul>
	HF short circuit	Check cable routing

6.3 Devices in the power range 0.25 ... 2.2 kW (1/N/PE AC 230 V)

6.3.1 Example circuits

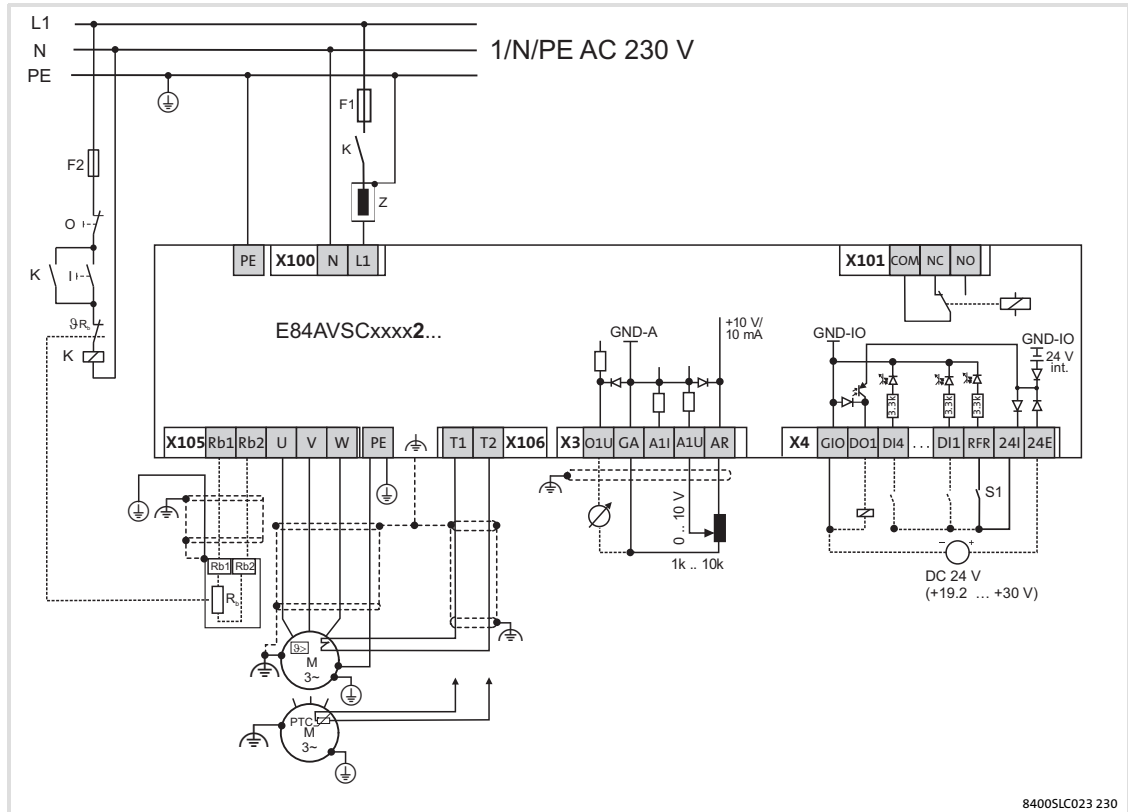


Fig. 6-8 Wiring for controllers in StatLine C design with 230-V mains connection

8400SLC023 230

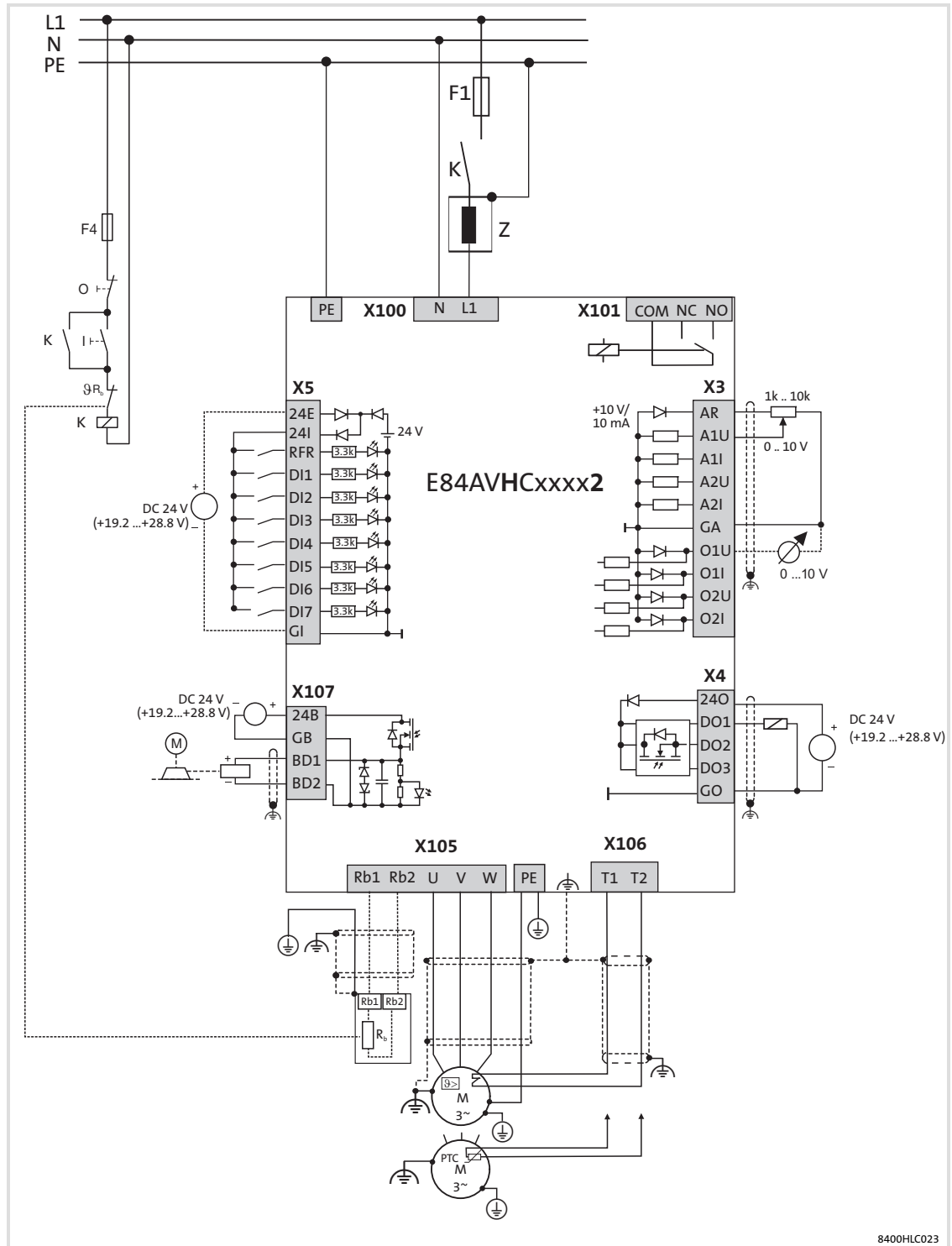


Fig. 6-9 Wiring for controllers in HighLine C design with 230-V mains connection

8400HLC023

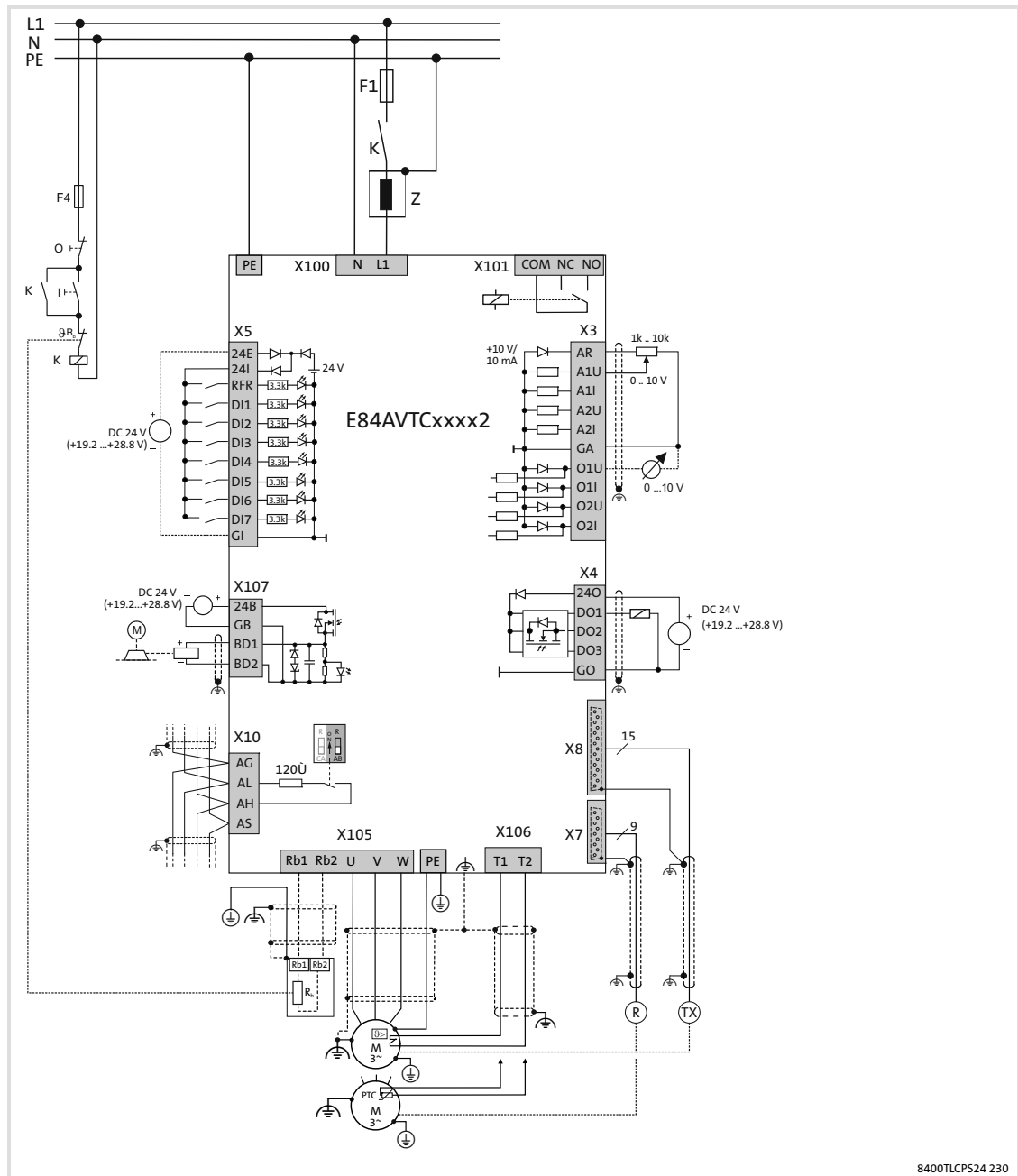


Fig. 6-10 Wiring for controllers in TopLine C design with 230-V mains connection

## Operation with rated power at the 230V mains, 3/PE

**Stop!****Destruction of the device**

Devices with a 230V mains connection must not be connected to a three-phase 400V mains.

**Possible consequences:**

- ▶ The device will be destroyed

**Protective measures:**

- ▶ Check the voltage between the phase conductors L1 and L2. It must not exceed 230/240V.

The devices in the power range of 0.25kW to 2.2kW can also be connected to a three-phase 230V mains. In this case, the following conditions must be observed:

- ▶ Both mains phases L1 and L2 must be fused.
- ▶ If the drive controller is connected to the mains via a contactor or similar, both mains phases L1 and L2 must be switched via the contactor.

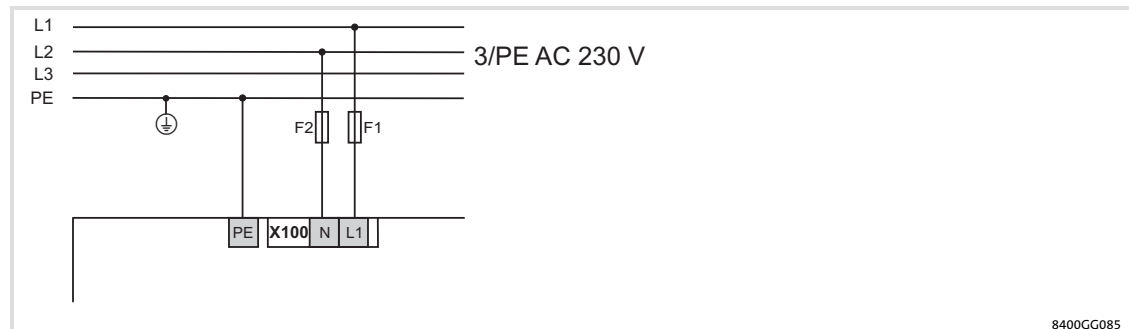


Fig. 6-11 Supplied by a three-phase 230V mains

**Note!**

The discharge current against ground is higher than when supplied via a one-phase 230V mains. If necessary, the application of a safety switch with a higher fault current must be observed.

### 6.3.2 Terminal assignment of the power connections

#### Preparing the cable installation

To connect the shield of the motor cable, use the shield lug of the rear shield sheet. Position the shield sheet as follows:

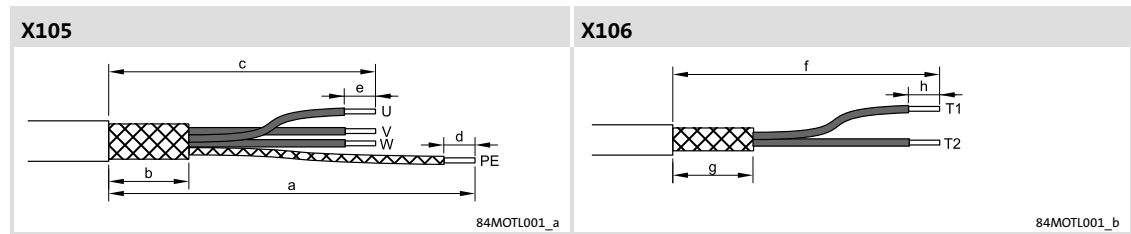
1. Release the holding screw of the shield sheet.
2. Bring the shield sheet into the lock-in position.
3. Tighten the holding screw to lock the shield sheet.



Fig. 6-12 Locate shield sheet in position



## Strip cables



	U, V, W			PE		T1, T2		
	b	c	e	a	d	f	g	h
	[mm]			[mm]		[mm]		
E84AVxxx2512	25	65	7	90	9	95	25	10
E84AVxxx3712								
E84AVxxx5512	30	65	7	90	9	95	30	10
E84AVxxx7512								
E84AVxxx1122	30	65	7	90	9	95	30	10
E84AVxxx1522								
E84AVxxx2222								

## How to proceed:

- Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
- Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
- Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
- Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
- Connect the shields separately to the shield sheet using (metal) cable ties or shield clamps.
  - left: motor cable
  - right: cable of motor temperature monitoring
  - For strain relief of the cables, measures are required.

## Connecting the controller to protective earth

Using the PE connection on the motor side the controller and the motor cable can be connected to protective earth. Additional protective earthing of the controller can be carried out via this connection in order to comply with the requirements regarding the operation of devices with an increased discharge current to PE.

How to proceed:

1. Observe the above-mentioned steps regarding stripping and shielding.
2. Connect a second cable to the PE connection and earth it. (📖 15).

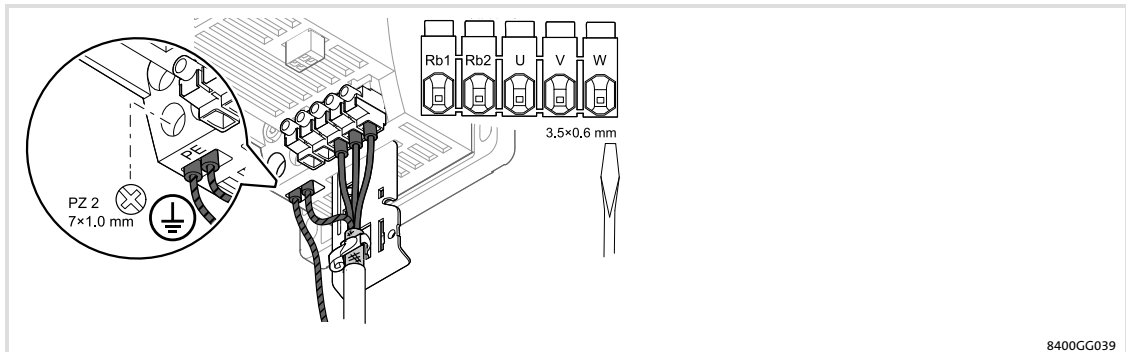


Fig. 6-13 Connection of controllers with device sizes 1 ... 3 to protective earth

## Mains connection

Terminal X100	Labelling	Description
	L1	Mains phase L
	n	Neutral conductor
	PE	PE conductor on the supply side

8400GG1001b

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx2512 E84AVxxx3712 E84AVxxx5512 E84AVxxx7512	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx1122 E84AVxxx1522 E84AVxxx2222	1 ... 6 18 ... 10	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1

## IT system

**Danger!**

- ▶ The contact screws have to be removed when controllers are used in IT operation or when external filters of E84AZESRxxxxLL or E84AZESRxxxxSD type are used.
- ▶ When both contact screws for interference suppression are removed, the enclosure for inverters E84AV ... will be reduced from IP 20 to IP 10.
- ▶ Please also observe further notes in the hardware manual and in mounting instructions of the inverters and filters.

**Tip!**

You can increase the degree of protection to IP 20 again by screwing plastic bolts made of polyamide into the open threaded holes. The thickness of the bolt head including the washer must be greater than 3.2mm, as for example in case of cheese head screws with internal hexagon (similar to DIN EN ISO 4762)

According to the relevant EMC product standard EN 61800-3 there are no limit values for noise emission in the high-frequency range. Therefore, the technical data for EMC do not apply.

Before using the controller in the IT system, remove both contact screws for interference suppression:

- Two hexagon socket screws M4 x 16 mm with washers.
- Insert for Allen key: 3mm

The tightening torque of the contact screws for connecting the drive to other networks is 1 Nm (8 lb-in).

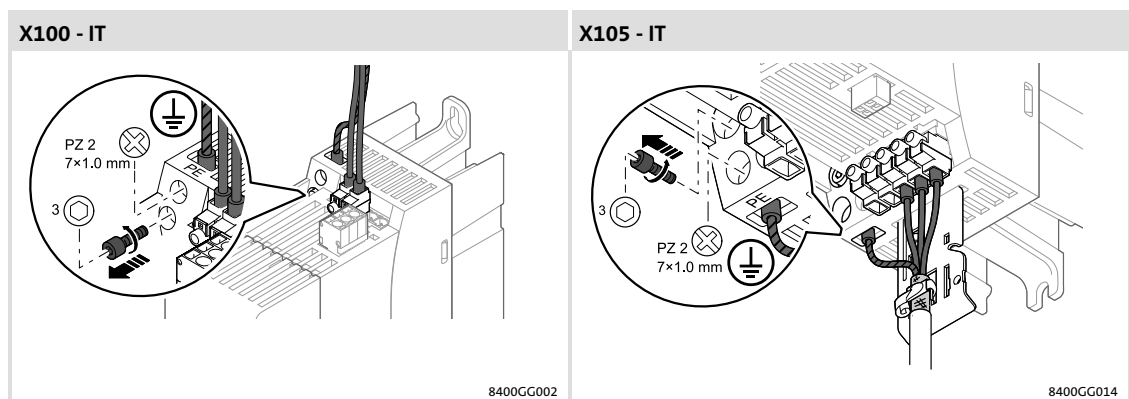
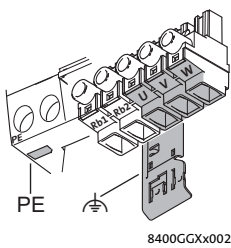





Fig. 6-14 Removal of the contact screws for device sizes 1 ... 3 (on the supply side and on the motor side)

## Motor connection

Terminal X105	Labelling	Description
	U, V, W	Motor
	PE	PE conductor
		Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx2512	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx3712						
E84AVxxx5512						
E84AVxxx7512						
E84AVxxx1122						
E84AVxxx1522						
E84AVxxx2222						

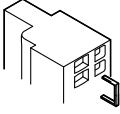
## Motor temperature monitoring


**Note!**

In the Lenze setting, motor temperature monitoring is activated! In the delivery status, there is a wire jumper between the terminals X106/T1 and X106/T2. Before connecting a thermal sensor, remove the wire jumper.

**Note!**

If the terminal X106 is used, e.g. to connect an external PTC thermistor or a thermal contact, ensure at least one basic insulation to the motor or mains potential to not restrict the protective separation of the control terminals.

Terminal X106	Labelling	Description
 8400GG016b	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance acc. to EN 60947-8 for type-A tripping units) or thermostat (NC contact). Lenze setting: activated, error message Setting in C00585

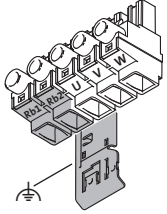

	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
E84AVxxx2512 E84AVxxx3712 E84AVxxx5512 E84AVxxx7512 E84AVxxx1122 E84AVxxx1522 E84AVxxx2222	0.2 ... 1.5	24 ... 16	-	-	2.5 x 0.4



**Tip!**

For an easy removal of the wire jumper:

1. Cut the wire jumper with side-cutting pliers.
2. Overcome the spring pressure of the terminal with a screwdriver.
3. Remove both wire ends individually.

Connection of external brake resistor

Terminal X105	Labelling	Description
 <p>8400GGx002b</p>	Rb1, Rb2	Brake resistor
		Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx2512 E84AVxxx3712 E84AVxxx5512 E84AVxxx7512 E84AVxxx1122 E84AVxxx1522 E84AVxxx2222	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1



Please read the information on how to install and connect the brake resistor in the corresponding mounting instructions.

# 6

## Electrical installation

Devices in the power range 0.37 ... 22 kW (3/PE AC 400 V)

Example circuits

### 6.4

Devices in the power range 0.37 ... 22 kW (3/PE AC 400 V)

#### 6.4.1

Example circuits

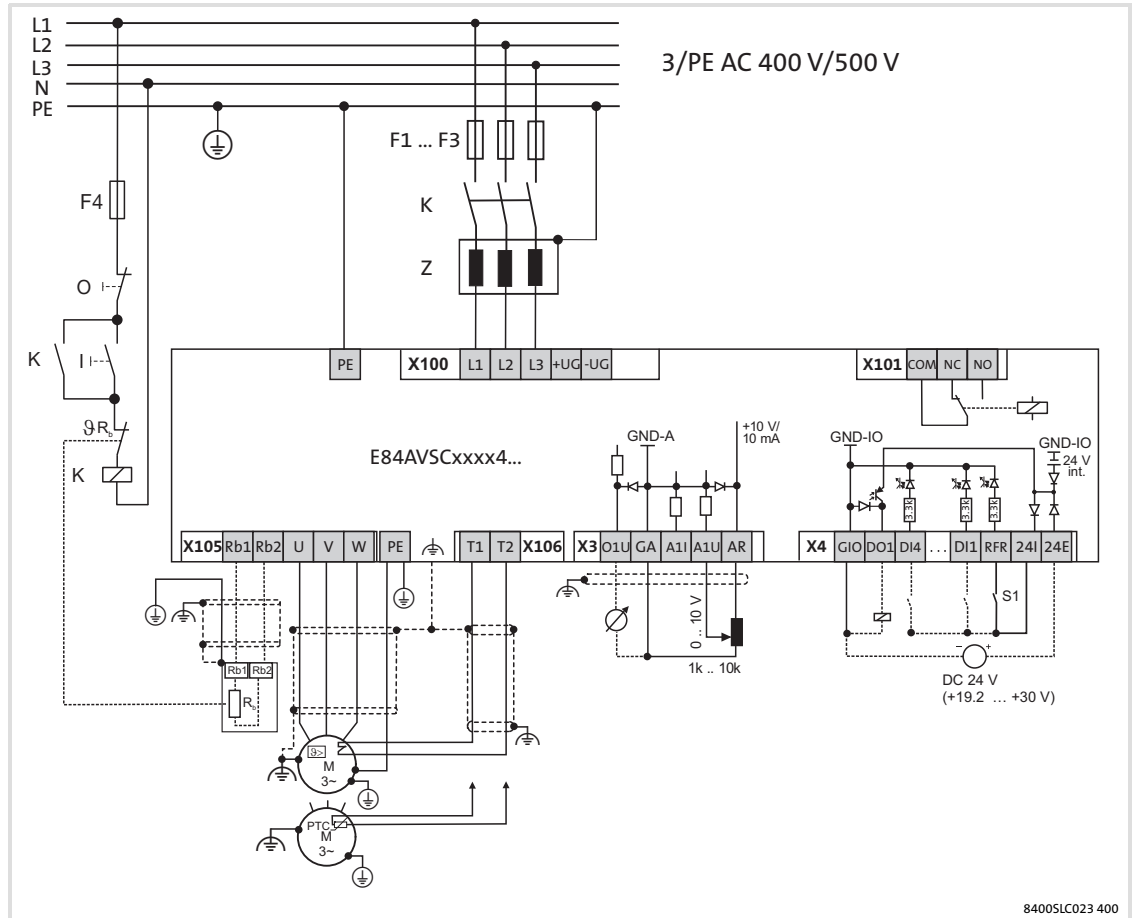


Fig. 6-15 Wiring for controllers in StatLine C design with 400-V/500-V mains connection

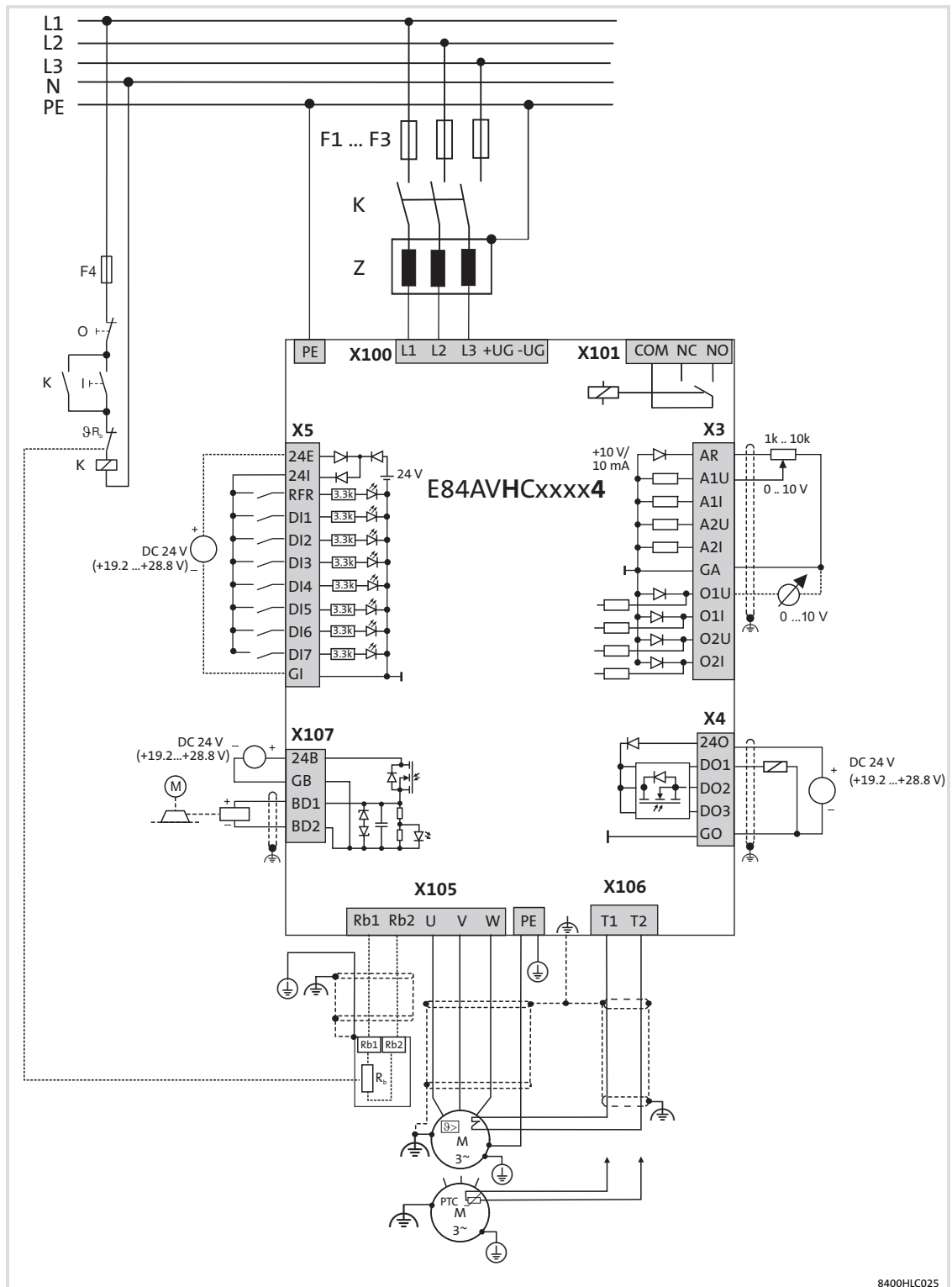
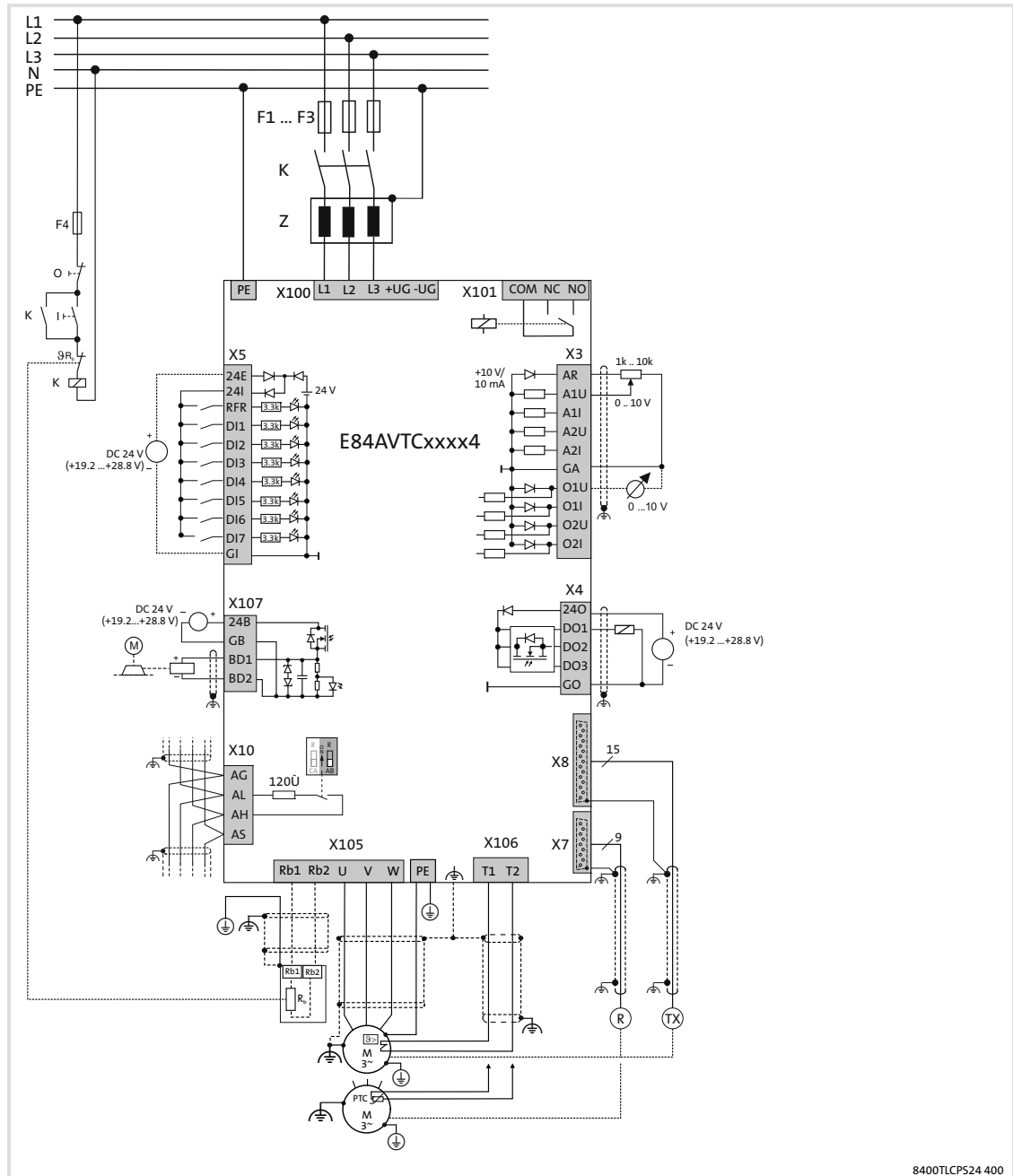


Fig. 6-16 Wiring for controllers in HighLine C design with 400-V/500-V mains connection





8400TLCPS24 400

Fig. 6-17 Wiring for controllers in TopLine C design with 400-V/500-V mains connection

## 6.4.2 Terminal assignment of the power connections

### Preparing the cable installation

To connect the shield of the motor cable, use the shield lug of the rear shield sheet. Position the shield sheet as follows:

1. Release the holding screw of the shield sheet.
2. Bring the shield sheet into the lock-in position.
3. Tighten the holding screw to lock the shield sheet.

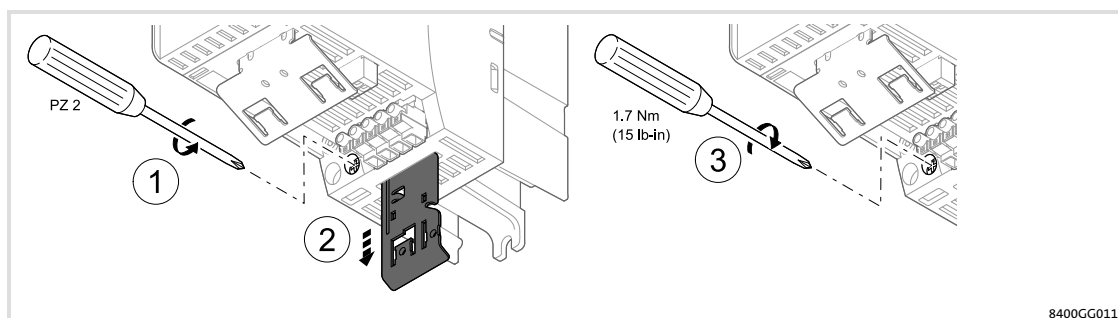
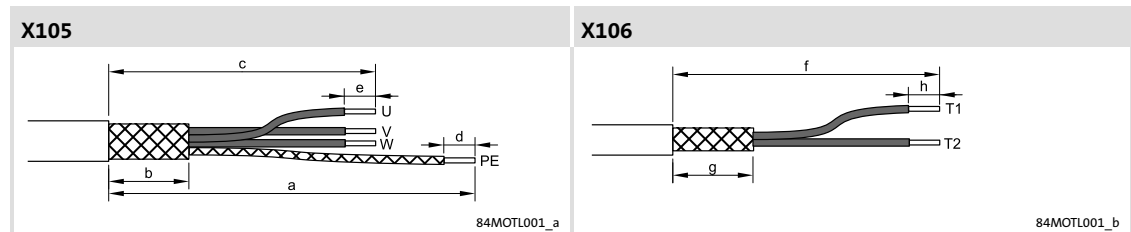


Fig. 6-18 Locate shield sheet in position

## Strip cables



	U, V, W			PE		T1, T2		
	b	c	e	a	d	f	g	h
	[mm]			[mm]		[mm]		
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514 E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xxS	30	65	7	90	9	95	30	10
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	25	70	12 ... 14	125	12 ... 14	105	25	10
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	25	80	14	120	14	115	25	10
E84AVxxx1834 E84AVxxx2234	30	110	16	195	16	160	30	10

## How to proceed:

- Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
- Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
- Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
- Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
- Connect the shields separately to the shield sheet using (metal) cable ties or shield clamps.
  - left: motor cable
  - right: cable of motor temperature monitoring
  - For strain relief of the cables, measures are required.

### Connecting the controller to protective earth

Using the PE connection on the motor side the controller and the motor cable can be connected to protective earth. Additional protective earthing of the controller can be carried out via this connection in order to comply with the requirements regarding the operation of devices with an increased discharge current to PE.

How to proceed:

1. Observe the above-mentioned steps regarding stripping and shielding.
2. Connect a second cable to the PE connection and earth it. (📖 26).

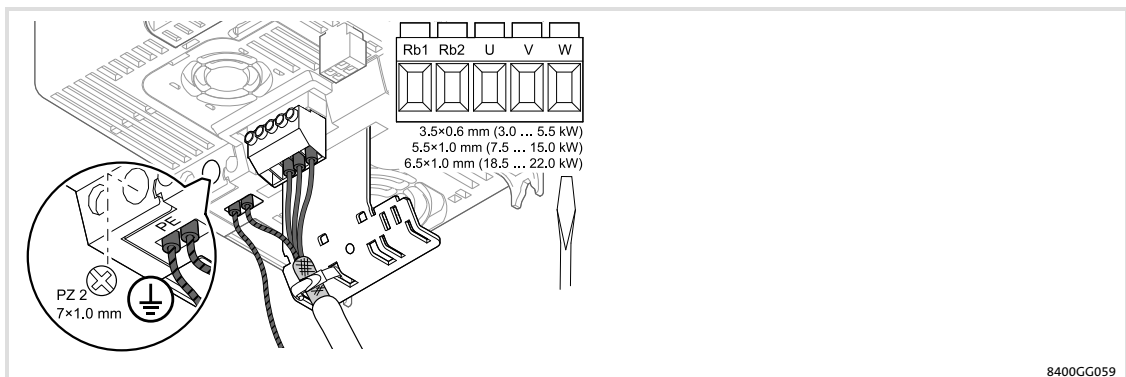


Fig. 6-19 Connecting controllers of device size 4 ... 6 to protective earth

### Mains connection

Terminal X100	Labelling	Description
<p>8400GGx001b</p>	L1 L2 L3	Connection of the mains phases L1, L2, L3
	PE	Connection for the PE conductor

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514 E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xxS	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	1 ... 6 18 ... 10	0.5 4.4	3.5 x 0.6	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	1 ... 16 18 ... 6	1.2 10.6	5.5 x 1	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx1834 E84AVxxx2234	1.5 ... 25 16 ... 2	3.5 31	6.5 x 1	2.5 ... 25 12 ... 2	4.0 35	PZ 2 7 x 1

**IT system****Danger!**

- ▶ The contact screws have to be removed when controllers are used in IT operation or when external filters of E84AZESRxxxxLL or E84AZESRxxxxSD type are used.
- ▶ When both contact screws for interference suppression are removed, the enclosure for inverters E84AV ... will be reduced from IP 20 to IP 10.
- ▶ Please also observe further notes in the hardware manual and in mounting instructions of the inverters and filters.

**Stop!****Overvoltage at components:**

In case of an earth fault in IT systems, intolerable overvoltages may occur in the plant.

**Possible consequences:**

Destruction of the device.

**Protective measures:**

Before using the controller in the IT system, remove the contact screws on the supply side and the motor side. (📖 Fig. 6-20).

**Tip!**

You can increase the degree of protection to IP 20 again by screwing plastic bolts made of polyamide into the open threaded holes. The thickness of the bolt head including the washer must be greater than 3.2mm, as for example in case of cheese head screws with internal hexagon (similar to DIN EN ISO 4762)

According to the relevant EMC product standard EN 61800-3 there are no limit values for noise emission in the high-frequency range. Therefore, the technical data for EMC do not apply.

Before using the controller in the IT system, remove both contact screws for interference suppression:

- Two hexagon socket screws M4 x 16 mm with washers.
- Insert for Allen key: 3mm

The tightening torque of the contact screws for connecting the drive to other networks is 1 Nm (8 lb-in).

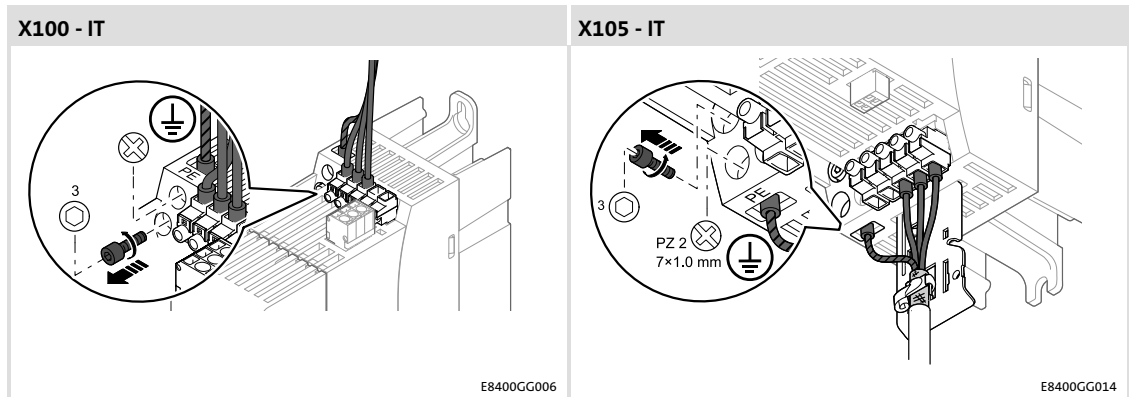


Fig. 6-20 Removal of the contact screws for device sizes 1 ... 3 (on the supply side and on the motor side)

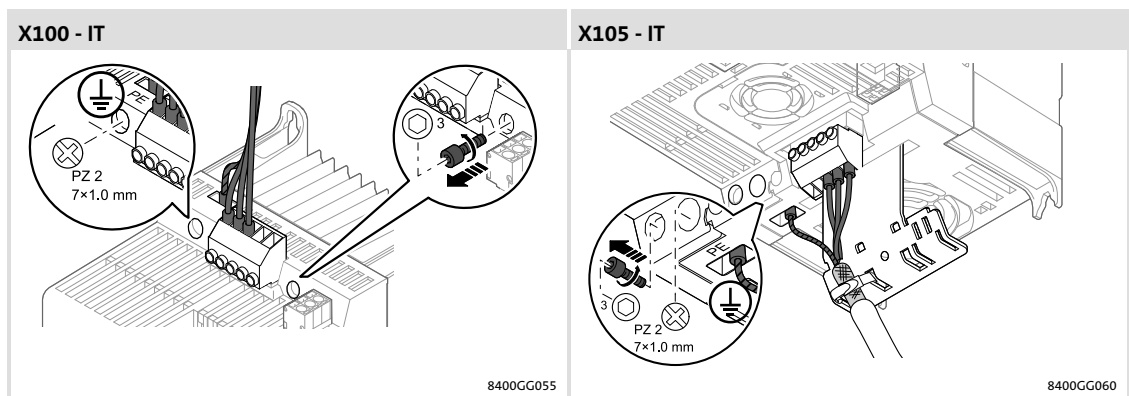
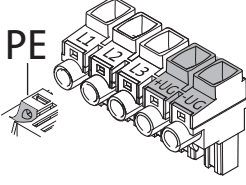




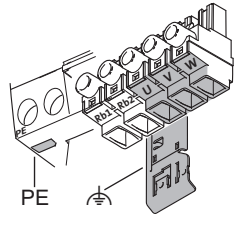

Fig. 6-21 Removal of the contact screws for device sizes 4 ... 6 (on the supply side and on the motor side)



Connection to the DC bus (+U<sub>G</sub>, -U<sub>G</sub>)

Terminal X100	Labelling	Description
 8400GGx001b	+UG -UG	Alternative connection of the DC-bus voltage
	PE	Connection for the PE conductor

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514 E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xxS	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	1 ... 6 18 ... 10	0.5 4.4	3.5 x 0.6	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	1 ... 16 18 ... 6	1.2 10.6	5.5 x 1	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx1834 E84AVxxx2234	1.5 ... 25 16 ... 2	3.5 31	6.5 x 1	2.5 ... 25 12 ... 2	4.0 35	PZ 2 7 x 1

Motor connection

Terminal X105	Labelling	Description
 <p>8400GGx002b</p>	U, V, W	Motor
	PE	PE conductor
		Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514 E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xxS	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	1 ... 6 18 ... 10	0.5 4.4	3.5 x 0.6	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	1 ... 16 18 ... 6	1.2 10.6	5.5 x 1	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx1834 E84AVxxx2234	1.5 ... 25 16 ... 2	3.5 31	6.5 x 1	2.5 ... 25 12 ... 2	4.0 35	PZ 2 7 x 1



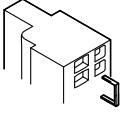

## Motor temperature monitoring

**Note!**

In the Lenze setting, motor temperature monitoring is activated! In the delivery status, there is a wire jumper between the terminals X106/T1 and X106/T2. Before connecting a thermal sensor, remove the wire jumper.

**Note!**

If the terminal X106 is used, e.g. to connect an external PTC thermistor or a thermal contact, ensure at least one basic insulation to the motor or mains potential to not restrict the protective separation of the control terminals.

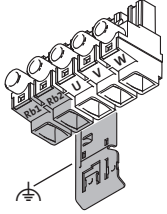

Terminal X106	Labelling	Description			
 8400GG016b	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance acc. to EN 60947-8 for type-A tripping units) or thermostat (NC contact). Lenze setting: activated, error message Setting in C00585			
Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
E84AVxxxxxxx	0.2 ... 1.5	24 ... 16	-	-	2.5 x 0.4



**Tip!**

For an easy removal of the wire jumper:

1. Cut the wire jumper with side-cutting pliers.
2. Overcome the spring pressure of the terminal with a screwdriver.
3. Remove both wire ends individually.

### Connection of external brake resistor

Terminal X105	Labelling	Description
 <small>8400GGx002b</small>	Rb1, Rb2	Brake resistor
		Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514 E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xx5	1 ... 2.5 18 ... 12	0.5 4.4	3.5 x 0.6	1 ... 6 18 ... 10	1.7 15	PZ 2 7 x 1
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	1 ... 6 18 ... 10	0.5 4.4	3.5 x 0.6	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	1 ... 16 18 ... 6	1.2 10.6	5.5 x 1	2.5 ... 16 12 ... 6	3.4 30	PZ 2 7 x 1
E84AVxxx1834 E84AVxxx2234	1.5 ... 25 16 ... 2	3.5 31	6.5 x 1	2.5 ... 25 12 ... 2	4.0 35	PZ 2 7 x 1



Please read the information on how to install and connect the brake resistor in the corresponding mounting instructions.


## 6

### Electrical installation

Devices in a power range of 30 ... 45 kW (3/PE AC 400 V)  
Example circuits

#### 6.5 Devices in a power range of 30 ... 45 kW (3/PE AC 400 V)

##### 6.5.1 Example circuits

Use the example circuits provided in the previous chapter ( 26).

## 6.5.2 Terminal assignment of the power connections

### Preparing the cable installation

To connect the shield of the motor cable, use the shield lug of the rear shield sheet. Position the shield sheet as follows:

1. Release the holding screw of the shield sheet.
2. Bring the shield sheet into the lock-in position.
3. Tighten the holding screw to lock the shield sheet.

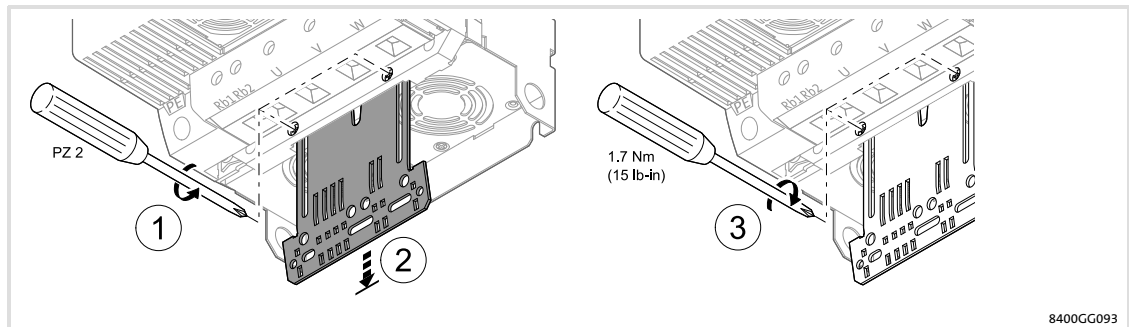
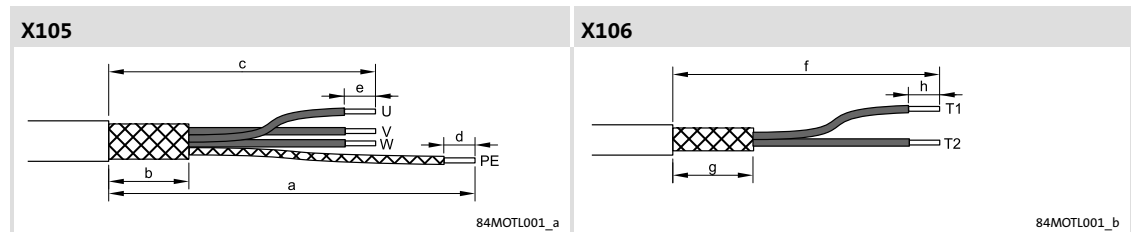


Fig. 6-22 Locate shield sheet in position

## Strip cables



	U, V, W					PE				T1, T2			
	b	c	e			a	d			f	g	h	
	[mm]	[mm]	[mm]	[mm <sup>2</sup> ] [AWG]	[Nm] [l <sup>b</sup> -in]	[mm]	[mm]	[mm <sup>2</sup> ] [AWG]	[Nm] [l <sup>b</sup> -in]	[mm]	[mm]	[mm]	[mm <sup>2</sup> ] [AWG]
E84AVxxx3034													
E84AVxxx3734	40	190	24	16 ... 50	4.0	250	16	2.5 ... 25	4.0	240	40	10	0.2 ... 1.5
E84AVxxx4534				6 ... 0	35			12 ... 2	35				24 ... 16

## How to proceed:

- Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
- Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
- Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
- Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
- Connect the shields separately to the shield sheet using (metal) cable ties or shield clamps.
  - left: motor cable
  - right: cable of motor temperature monitoring
  - For strain relief of the cables, measures are required.

**Connecting the controller to protective earth**

Using the PE connection on the motor side the controller and the motor cable can be connected to protective earth. Additional protective earthing of the controller can be carried out via this connection in order to comply with the requirements regarding the operation of devices with an increased discharge current to PE.

How to proceed:

1. Observe the above-mentioned steps regarding stripping and shielding.
2. Connect a second cable to the PE connection and earth it. (📖 38).

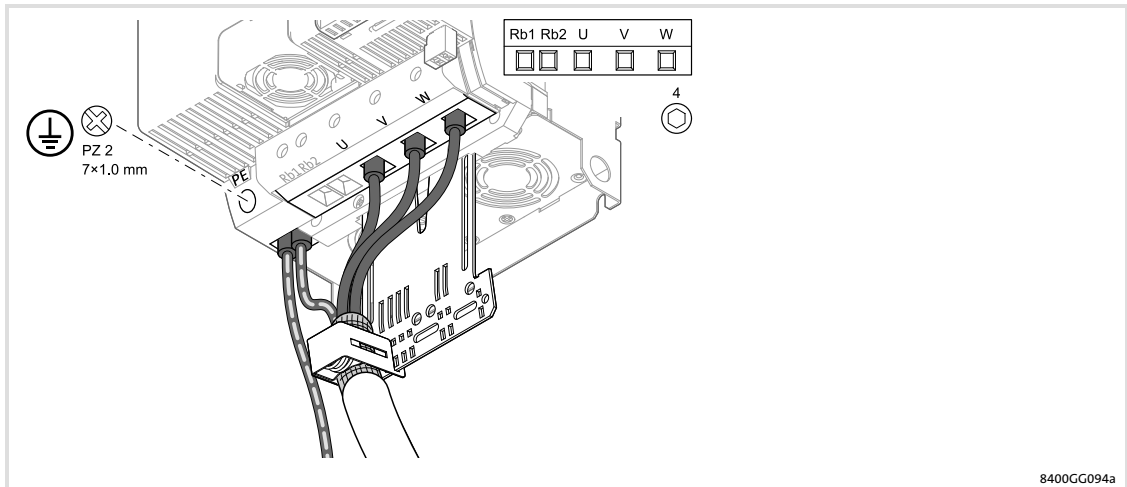


Fig. 6-23 Controller connection of device size GG7 to protective earth

**Mains connection**

Terminal X100	Labelling	Description
	L1 L2 L3	Connection of the mains phases L1, L2, L3
	PE	Connection for the PE conductor

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3034	16 ... 50	4.0	Inbus	2.5 ... 25	4.0	PZ 2
E84AVxxx3734						
E84AVxxx4534						

**IT system****Danger!**

- ▶ The contact screws have to be removed when controllers are used in IT operation or when external filters of E84AZESRxxxxLL or E84AZESRxxxxSD type are used.
- ▶ When both contact screws for interference suppression are removed, the enclosure for inverters E84AV ... will be reduced from IP 20 to IP 10.
- ▶ Please also observe further notes in the hardware manual and in mounting instructions of the inverters and filters.

**Stop!****Overvoltage at components:**

In case of an earth fault in IT systems, intolerable overvoltages may occur in the plant.

**Possible consequences:**

Destruction of the device.

**Protective measures:**

Before using the controller in the IT system, remove the contact screws on the supply side and the motor side. (📖 Fig. 6-14).

**Tip!**

You can increase the degree of protection to IP 20 again by screwing plastic bolts made of polyamide into the open threaded holes. The thickness of the bolt head including the washer must be greater than 3.2mm, as for example in case of cheese head screws with internal hexagon (similar to DIN EN ISO 4762)

According to the relevant EMC product standard EN 61800-3 there are no limit values for noise emission in the high-frequency range. Therefore, the technical data for EMC do not apply.

Before using the controller in the IT system, remove both contact screws for interference suppression:

- Two hexagon socket screws M4 x 16 mm with washers.
- Insert for Allen key: 3mm

The tightening torque of the contact screws for connecting the drive to other networks is 1 Nm (8 lb-in).

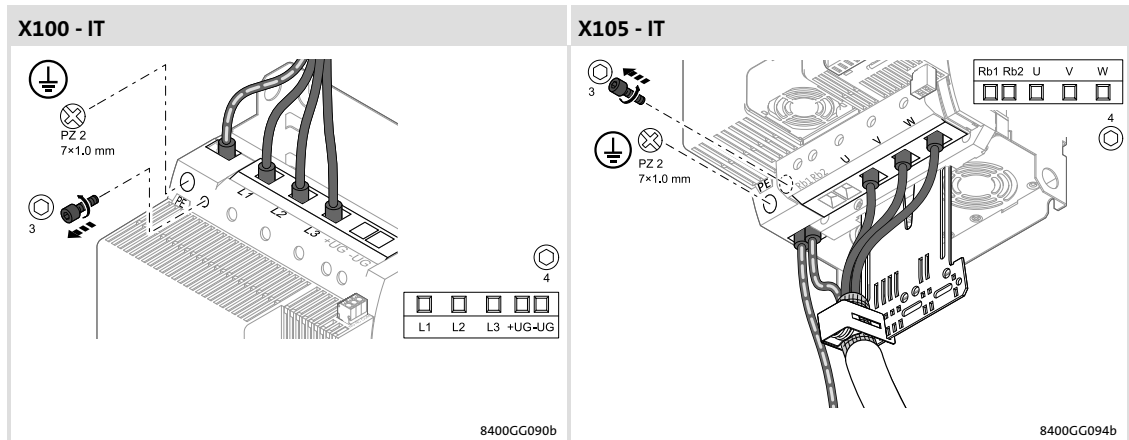


Fig. 6-24 Removal of the contact screws for device size GG7 (on the supply side and on the motor side)

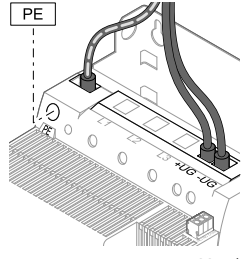




## Electrical installation

Devices in a power range of 30 ... 45 kW (3/PE AC 400 V)

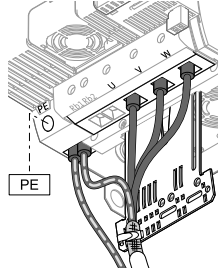

Terminal assignment of the power connections



### Connection to the DC bus (+U<sub>G</sub>, -U<sub>G</sub>)

Terminal X100	Labelling	Description
 <p>8400GG096b</p>	+UG -UG	Alternative connection of the DC-bus voltage
	PE	Connection for the PE conductor

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3034	16 ... 50 6 ... 0	4.0 35	Inbus SW 4	2.5 ... 25	4.0 35	PZ 2 7 x 1
E84AVxxx3734				12 ... 2		
E84AVxxx4534						

Motor connection

Terminal X105	Labelling	Description
 <p>8400GG097a</p>	U, V, W	Motor
	PE	PE conductor
		Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3034	16 ... 50	4.0	Inbus	2.5 ... 25	4.0	PZ 2
E84AVxxx3734	6 ... 0	35	SW 4	12 ... 2	35	7 x 1
E84AVxxx4534						

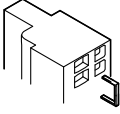
## Motor temperature monitoring


**Note!**

In the Lenze setting, motor temperature monitoring is activated! In the delivery status, there is a wire jumper between the terminals X106/T1 and X106/T2. Before connecting a thermal sensor, remove the wire jumper.

**Note!**

If the terminal X106 is used, e.g. to connect an external PTC thermistor or a thermal contact, ensure at least one basic insulation to the motor or mains potential to not restrict the protective separation of the control terminals.

Terminal X106	Labelling	Description
 8400GG016b	T1 T2	Motor temperature monitoring with PTC element (type-A sensor, switching performance acc. to EN 60947-8 for type-A tripping units) or thermostat (NC contact). Lenze setting: activated, error message Setting in C00585

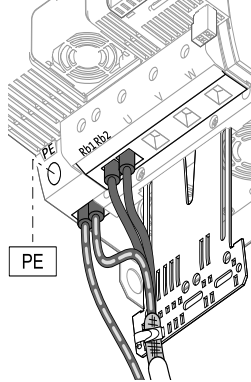

Terminal data	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
E84AVxxxxxxx	0.2 ... 1.5	24 ... 16	-	-	2.5 x 0.4



**Tip!**

For an easy removal of the wire jumper:

1. Cut the wire jumper with side-cutting pliers.
2. Overcome the spring pressure of the terminal with a screwdriver.
3. Remove both wire ends individually.

## Connection of external brake resistor

Terminal X105	Labelling	Description
 <p>8400GG097b</p>	Rb1, Rb2	Brake resistor
		 Functional earth HF-shield termination by connection to PE

	Terminal data			PE		
	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]		Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
E84AVxxx3034	16 ... 50 6 ... 0	4.0 35	Inbus SW 4	2.5 ... 25	4.0 35	PZ 2 7 x 1
E84AVxxx3734				12 ... 2		
E84AVxxx4534						



Please read the information on how to install and connect the brake resistor in the corresponding mounting instructions.

**6.6 Common control terminals****6.6.1 Important notes****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.

**Note!**

If the terminal X106 is used, e.g. to connect an external PTC thermistor or a thermal contact, ensure at least one basic insulation to the motor or mains potential to not restrict the protective separation of the control terminals.

**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.

These terminals must be shielded:

- ▶ Feedback systems
- ▶ Analog signals (inputs and outputs; single-sided shield connection to the controller)
- ▶ System bus (CANopen)

**Note!**

Always ensure shielded wiring for edge-controlled digital input signals (quick inputs or touch probe).

The following connections need not be shielded:

- ▶ 24-V supply
- ▶ Digital signals (inputs and outputs).
  - We recommend to use shielded cables for a cable length from approximately 5 m on or in environments with strong interferences.

### Preparing the cable installation

The shields of the control cables are connected to the left shield lug of the front shield sheet. For this, proceed as shown in the illustration.

1. Release the holding screw of the shield sheet.
2. Bring the shield sheet into one of the two possible lock-in positions.
3. Tighten the holding screw to lock the shield sheet.

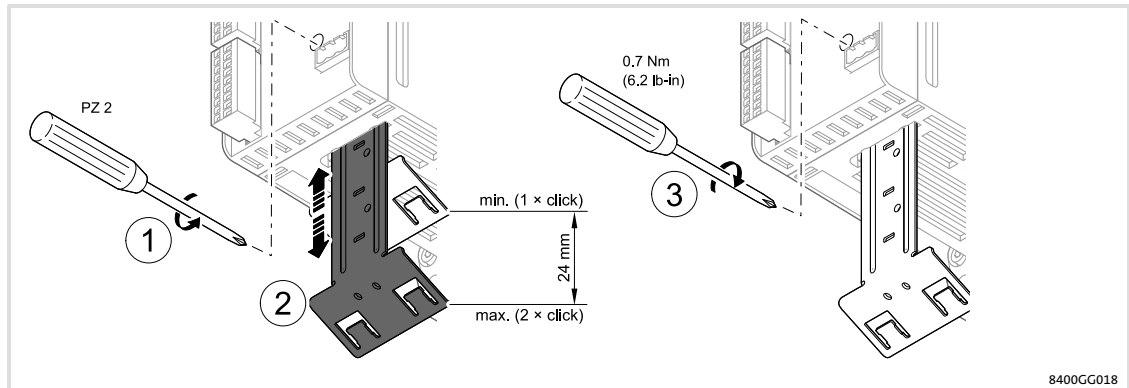
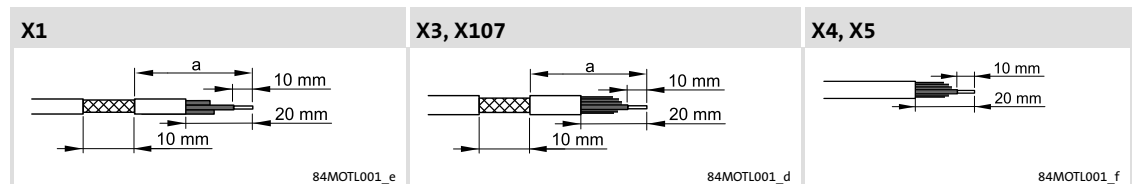


Fig. 6-25 Locate shield sheet in position

### Strip cables

According to the selected lock-in position of the shield sheet, strip the control cables. For this, strip the cable ends and the cable sheath at the shield lug.

The following table shows the stripping length for the control cables depending on the selected lock-in position of the shield sheet.



#### ► StateLine: stripping dimensions

X1			X3			X4
min.	max.		min.	max.		
a [mm]	a [mm]	[mm <sup>2</sup> ] [AWG]	a [mm]	a [mm]	[mm <sup>2</sup> ] [AWG]	[mm <sup>2</sup> ] [AWG]
110	135	0.2 ... 1.5 24 ... 16	150	175	0.2 ... 1.5 24 ... 16	0.2 ... 1.5 24 ... 16

#### ► HighLine: stripping dimensions

X1			X3			X4, X5		X107	
min.	max.		min.	max.			min.	max.	
a [mm]	a [mm]	[mm <sup>2</sup> ] [AWG]	a [mm]	a [mm]	[mm <sup>2</sup> ] [AWG]	[mm <sup>2</sup> ] [AWG]	a [mm]	a [mm]	[mm <sup>2</sup> ] [AWG]
110	135	0.2 ... 1.5 24 ... 16	150	175	0.2 ... 1.5 24 ... 16	0.2 ... 1.5 24 ... 16	115	140	0.2 ... 1.5 24 ... 16

#### ► TopLine: Stripping lengths

X1			X3/X5			X4/X107				
	min.		max.		min.		max.			
a	a				a	a				
[mm]	[mm]	[mm <sup>2</sup> ] [AWG]			[mm]	[mm]	[mm <sup>2</sup> ] [AWG]	[mm <sup>2</sup> ] [AWG]		
110	135	0.2 ... 1.5 24 ... 16			150	175	0.2 ... 1.5 24 ... 16	115	140	0.2 ... 1.5 24 ... 16



#### Note!

Devices including safety engineering have an increased stripping length "a":

- by 10 mm when the shield sheet is pulled out to its minimum length
- by 15 mm when the shield sheet is pulled out to its maximum length

### Shield and connect cables

The uncovered cable shield at the left shield lug of the stripped control cables must be connected **A** using a (metal) cable tie for high conductivity.

As shown in the illustration, the cable ends (if required, provided with wire end ferrule) must be inserted into the corresponding spring terminals with a suitable screwdriver (for max. width, see illustration).

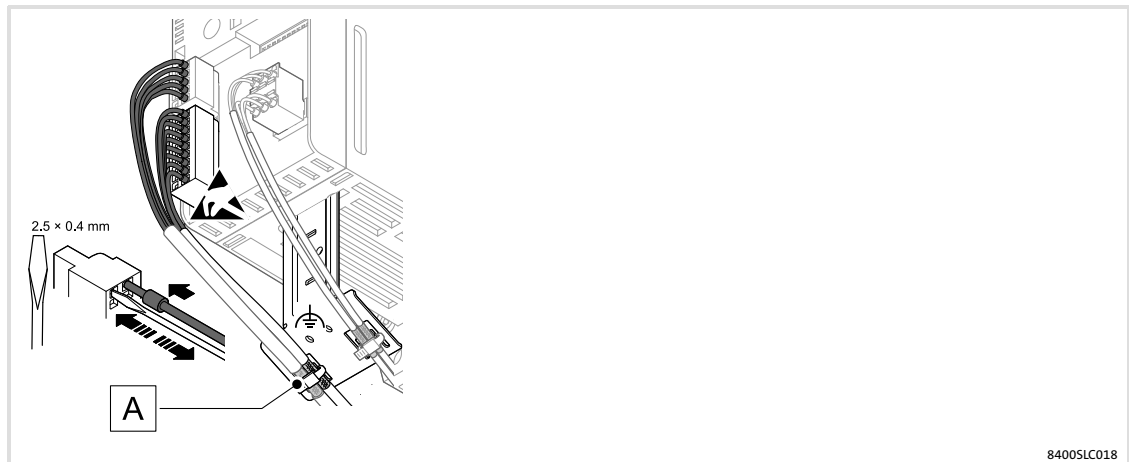


Fig. 6-26 Shielding and connecting control cables

84005LC018



6.6.2 System bus connection (CANopen)

Basic structure of the CAN network

Every segment of the CAN network must be terminated by resistors (120 Ω) between CAN Low and CAN High. The 8400 controller has one integrated bus terminating resistor each which can be activated via DIP switch.

The bus terminations of the system bus (CAN) are labelled by "R" in every one of the examples below.

If a CAN network has only one segment, the master (M) with integrated bus termination marks the start, and the last node (S) marks the bus termination.

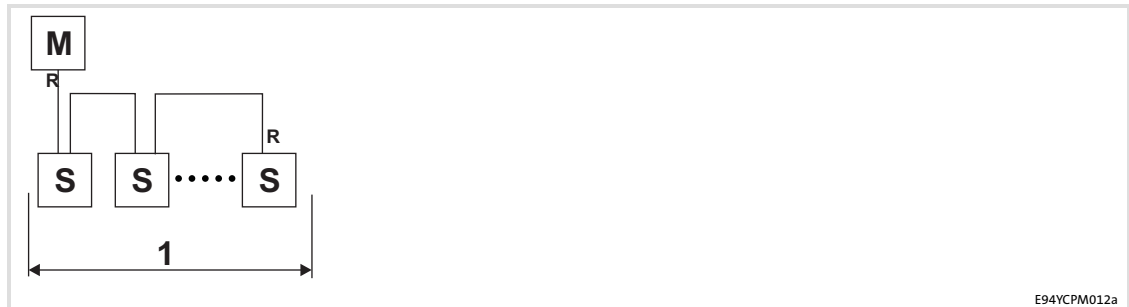


Fig. 6-27 Example: CAN network with one segment

A CAN network with multiple segments includes repeaters (X) for coupling the segments. The repeaters are equipped with integrated bus terminations.

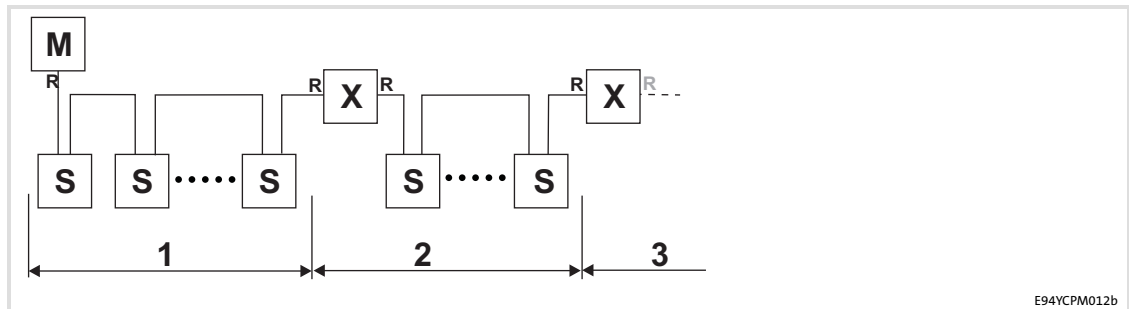



Fig. 6-28 Example: CAN network with repeater

If no repeater is used at the end of the segment, the bus terminating resistor on the last node must be activated.

**6.6.2.1 Wire CAN plug connector (X1) and ensure bus termination.**

- ▶ Wire CAN plug connector (X1).
  - Only install shielded bus cables to avoid interference injection.
  - Fix the bus cable connected to plug connector X1 to the shield sheet of the controller.
- ▶ Ensure bus termination.
  - Only required if the controller is the first or the last node of the CAN bus.
  - Activate the bus termination vis DIP switch "R".

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

**Specification of the bus 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 <sup>2</sup> (AWG22)
Cable length 301 ... 1000 m	≤ 40 mΩ/m / 0.5 mm <sup>2</sup> (AWG20)
Signal propagation delay	≤ 5 ns/m

**StateLine, HighLine**

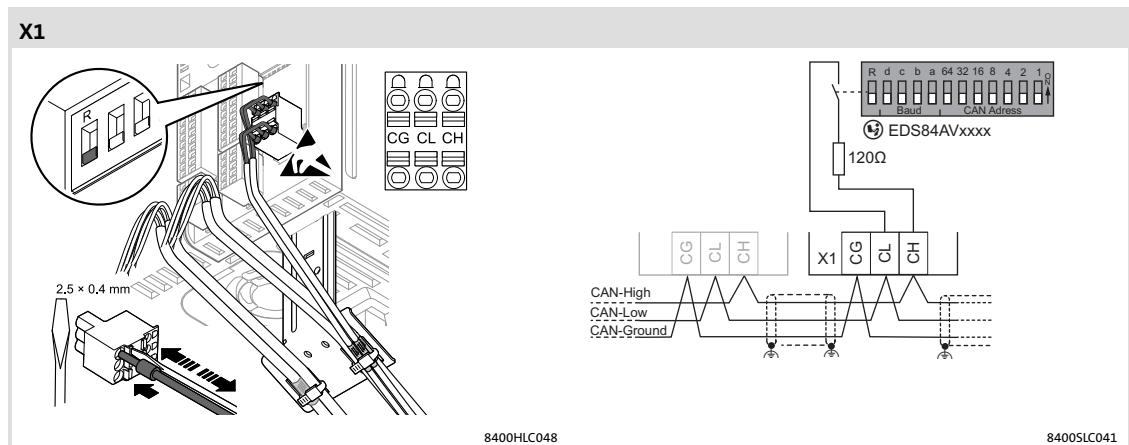


Fig. 6-29 CANopen connection

**TopLine**

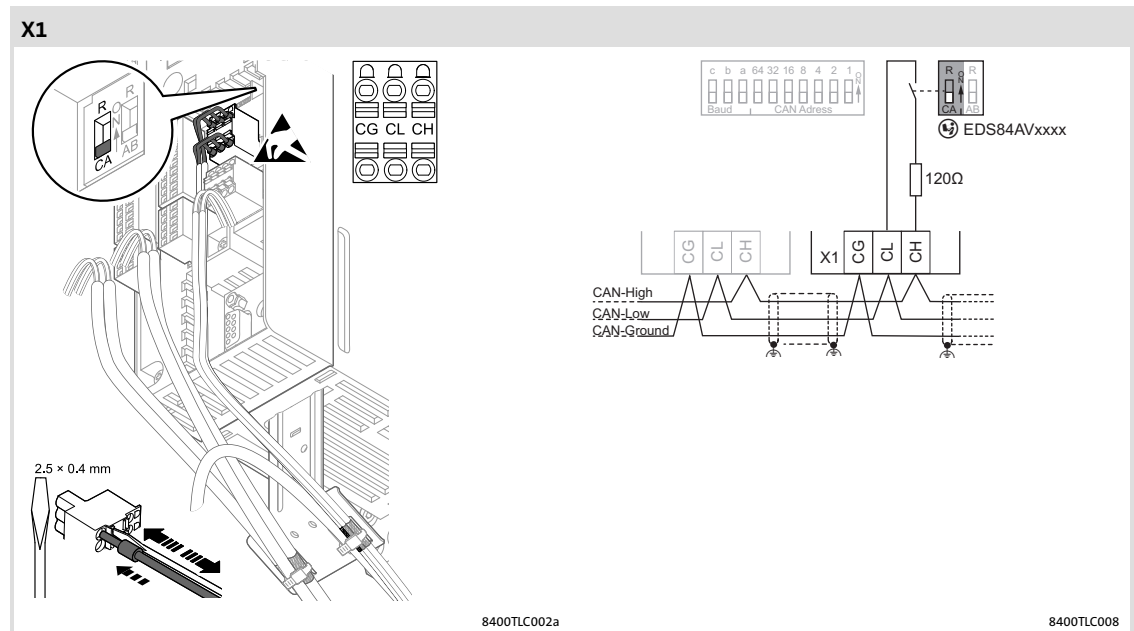


Fig. 6-30 CANopen connection

### 6.6.2.2 Structure of the CAN network

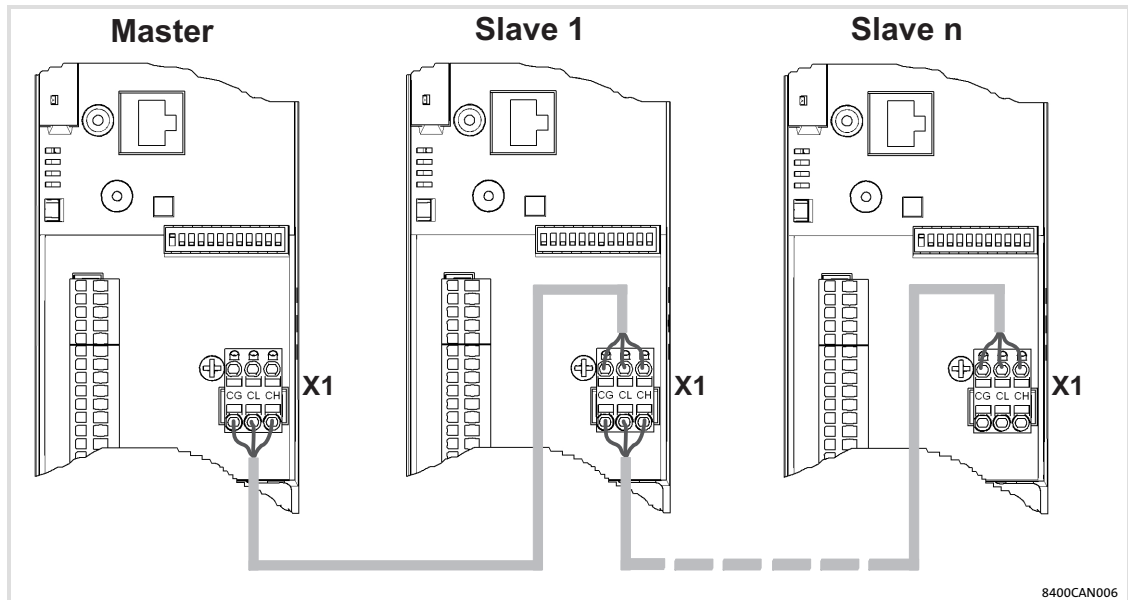


Fig. 6-31 Wiring of system bus (CAN)

### Bus cable length



#### Note!

- ▶ The permissible cable lengths must be observed.
- ▶ Please observe the reduction of the total cable length due to the signal delay of the repeater, see example below (56).
- ▶ During mixed operation, multiple nodes are operated on one mains.
- ▶ If the respective total cable lengths of the nodes differ at the same baud rate, the lower value must be used for the determination of the max. cable length.

### Total cable length

1. Check whether the total cable length is complied with.

The total cable length is determined by the baud rate:

Baud rate [kbps]	Max. bus length [m]
10 (not supported at the moment)	8075
20	4013
50	1575
125	600
250	275
500	113
800 (HighLine and TopLine, StateLine from FW V11.0)	38
1000 (HighLine and TopLine, StateLine from FW V11.0)	13

Tab. 6-1 Total cable length

### Segment cable length

2. Check whether the segment cable length is complied with.

The segment cable length is determined by the used cable cross-section and the number of nodes. If no repeaters are used, the segment cable length corresponds to the total cable length.


Maximum number of nodes per segment	Cable cross-section			
	0.25 mm <sup>2</sup>	0.5 mm <sup>2</sup>	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 6-2 Segment cable length

3. Comparison of the two determined values.

If the value determined from Tab. 6-2 is lower than the total cable length to be implemented from Tab. 6-1, repeaters must be used. Repeater divide the total cable length into segments.

### Example: Selection help

Selections	
• Cable cross-section:	0.5 mm <sup>2</sup> (acc. to cable specification  53)
• Number of nodes:	63
• Repeater:	Lenze repeater, type 2176 (cable reduction: 30 m)

For a max. number of nodes (63), the following cable lengths / numbers of repeaters must be complied with according to selection:

Baud rate [kbps]	10	20	50	125	250	500	800	1000
Max. cable length [m]	8075	4013	1575	600	275	113	38	13
Segment cable length [m]	270	270	270	270	270	113	38	13
Number of repeaters	30	15	6	2	1	-	-	-

### Check the use of repeaters



#### Note!

The use of another repeater is recommended as

► Service interface

**Advantage:** Trouble-free connection to running bus operation is possible.

► Calibration interface

**Advantage:** The calibration / programming unit remains electrically isolated.

Selections	
• Baud rate:	125 kbps
• Cable cross-section:	0.5 mm <sup>2</sup>
• Number of nodes:	28
• Cable length:	450 m

Test steps	Cable length	See
1. Total cable length at 125 kbps:	600 m	From Tab. 6-1
2. Segment cable length for 28 nodes and a cable cross-section of 0.5 mm <sup>2</sup> :	360 m	From Tab. 6-2
3. Comparison: The value in point 2 is lower than the cable length of 450 m which must be implemented.		

## Result

- ▶ Use of repeaters
  - Without the use of repeaters, a cable length of 450 m cannot be implemented. After 360 m (point 2), a repeater must be used.
  - The Lenze repeater, type 2176 is used (cable reduction: 30 m).
- ▶ Calculation of the max. cable length:
  - First segment: 360 m
  - Second segment: 360 m (acc. to Tab. 6-1) *minus* 30 m (cable reduction if a repeater is used)
  - Max. cable length that can be implemented if a repeater is used: 690 m.

Hence, the selected cable length can be implemented.

### 6.6.3 Connection of relay output

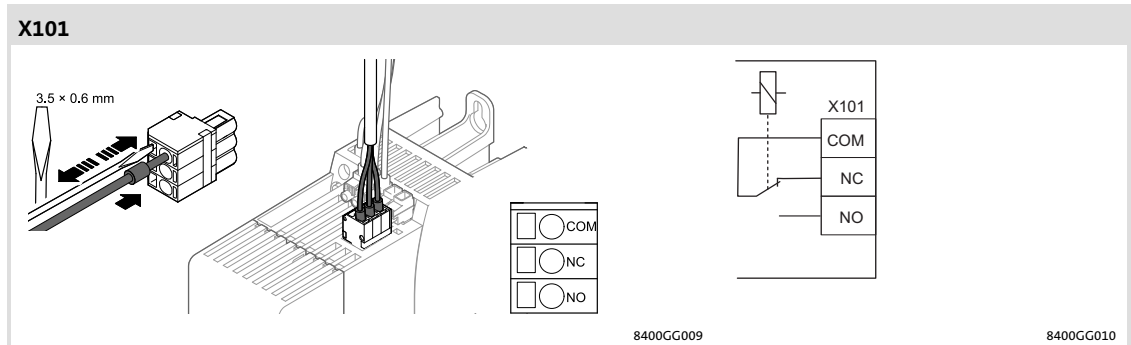



Fig. 6-32 Wiring of the relay outputs

Labelling	Description	
COM	Central contact of relay	AC 250 V, 3 A DC 24V, 2A
NC	Relay output NC (normally closed) Position is displayed via TRIP software message (Lenze setting)	DC 240 V, 0.16 A ● According to UL508C: – 3 A, 250 V AC (general purpose) – 2 A, 24 V DC (resistive)
NO	Relay output NO (normally open)	– 0.16 A, 240 V DC (general purpose)

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
flexible with wire end ferrule	0.2 ... 1.5	24 ... 16	-	-	3.5 x 0.6

**Note!**

- ▶ Switching of control signals:
  - Use shielded cables
  - HF-shield termination by PE connection
  - The minimum load for a correct through-connection of the relay contacts is 10 V DC and 10 mA. Both values must be exceeded at the same time.
- ▶ Use shielded cables for switching the control signals and establish the HF-shield termination through a PE connection.
- ▶ For the switching operation of mains potentials, shielded cables are sufficient.
- ▶ To protect the relay contacts, use a corresponding suppressor circuit in case of an inductive or capacitive load!
- ▶ The service life of the relay depends on the load type (ohmic, inductive, or capacitive) and the height of capacity to be switched.

**Note!**

The following notes are described in detail in the software manual "Parameter setting" in the section "I/O terminals", "Relay output":

- ▶ Use code C00118 to define the relay switching status.
- ▶ The minimum period for a valid HIGH or LOW signal to control the relay can be defined via the codes C00423/3 and C00423/4.



**6.6.4 Diagnostics**

The following can be optionally connected to the X6 diagnostic interface:


- ▶ E94AZCUSdiagnostic USB adapter
- ▶ EZAEBK1001 keypad
- ▶ EZAEBK2001 diagnosis terminal

In combination with the Lenze PC software »Engineer«, the diagnostic adapter serves to make comprehensive settings via dialogs, e.g. for initial commissioning.

The keypad serves to check or change individual settings. It is directly plugged onto the controller.

Using the keypad, the controller can be parameterised with regard to basic settings in a quick commissioning menu.

The diagnosis terminal combines the keypad with a housing and a connecting cable. The diagnosis terminal can also be used for installation, e.g. into a control cabinet door.

Socket X6	Labelling	Description
 <small>8400HLC009</small>	DIAG	Diagnostic interface for connection of a keypad or USB diagnostic adapter for online diagnostics

## 6.7 StateLine C control terminals

### 6.7.1 External supply voltage 24 V

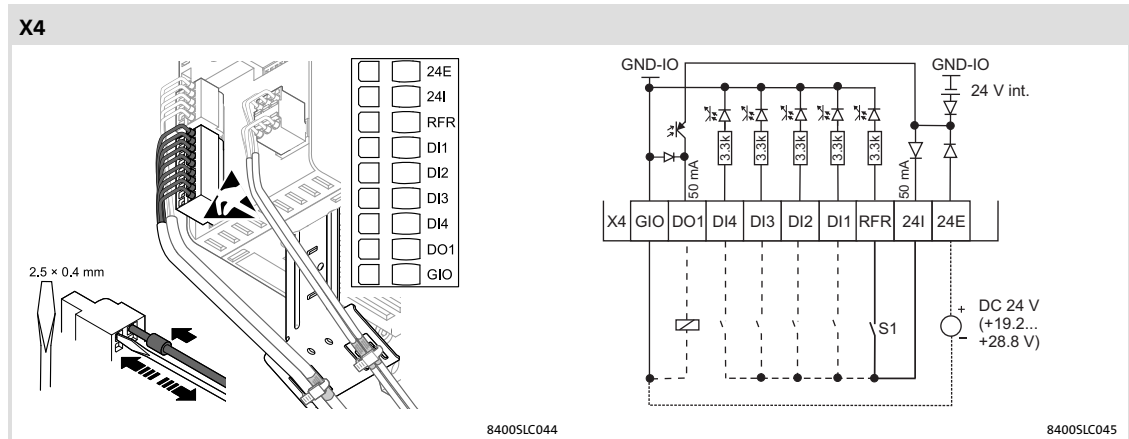



Fig. 6-33 Connection to an external supply voltage

Labelling	Description
24E	Connection for an external 24 V supply by a safely separated power supply unit (SELV/PELV), IEC 61131-2 (required for mains-independent supply of the control electronics and the communication module)
24I	Output 24 V, max. 50 mA for connection of the digital inputs via potential-free contacts
GIO	GND-IO Ground reference potential for the digital inputs and outputs

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

**6.7.2 Analog inputs and outputs**

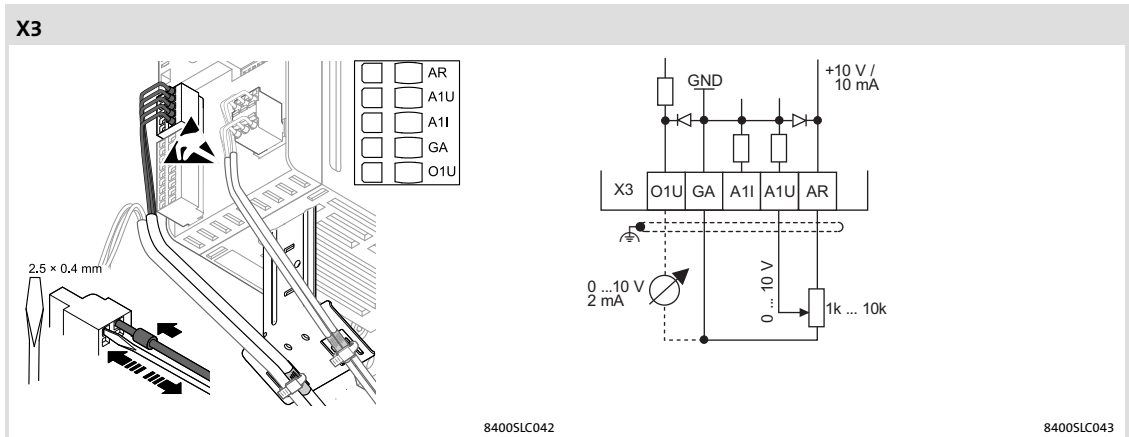



Fig. 6-34 Connection of the analog inputs and outputs

Labelling	Description	
Controller	Reference voltage 10 V	
A1U		±10V (□ 80)
A1I	Analog input 1	0 ...+20 mA/+4 ...+20 mA (□ 80)
GA	GND analog signals	
O1U	Analog output 1	0 ... +10 V (□ 80)

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

Example circuit

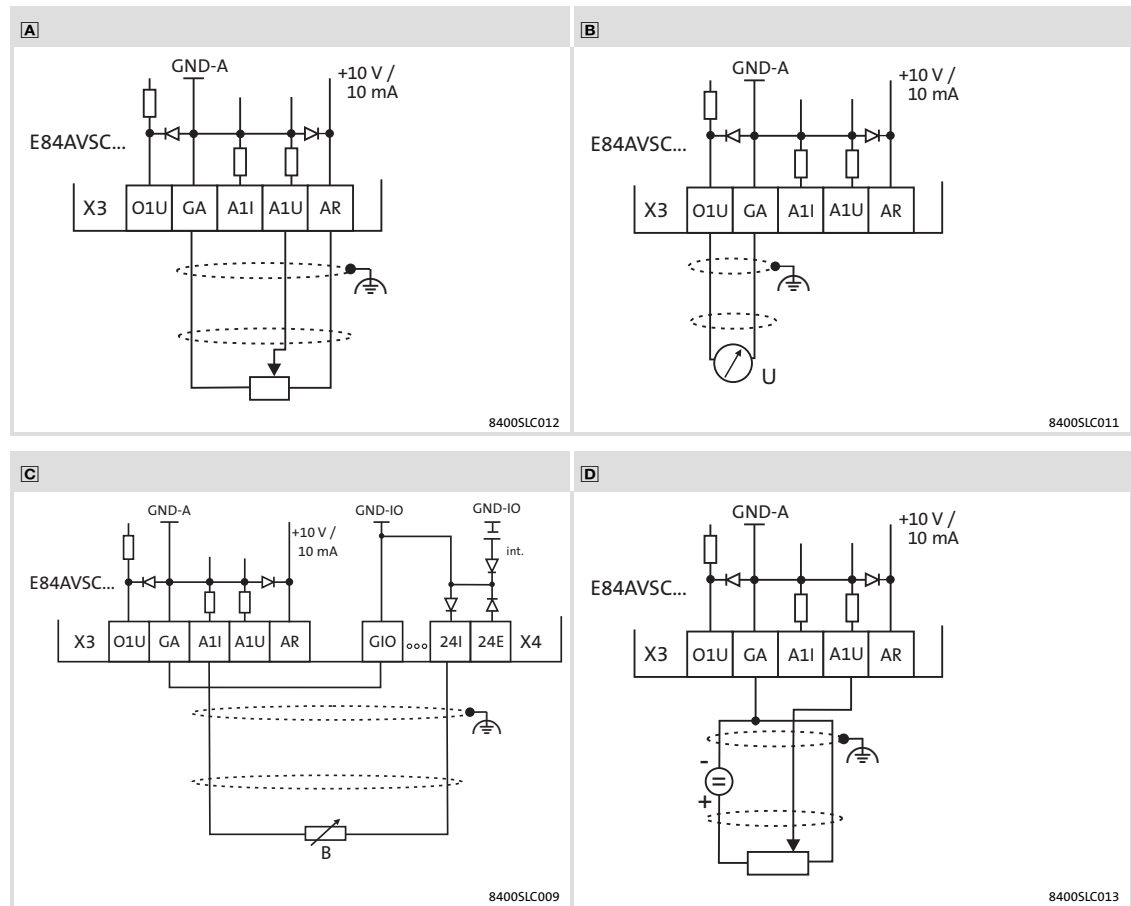


Fig. 6-35 Wiring examples of the analog inputs and outputs

- A** Potentiometer with internal controller supply
- B** Terminal assignment of the analog output signal, e.g. by a measuring instrument
- C** External master current selection based on a sensor signal 0 - 20 mA. If GA and GIO are electrically connected, the digital cables have to be shielded as well.
- D** Potentiometer with external supply
- X3 Terminal for the analog inputs and outputs
- X4 Terminal for the digital inputs and outputs
- GA GND-A Ground reference potential for the analog inputs and outputs
- GIO GND-IO Ground reference potential for the digital inputs and outputs
- ⏏ EMC shield connection
- U Measuring device
- B Measuring transducer



6.7.3 Digital inputs and outputs

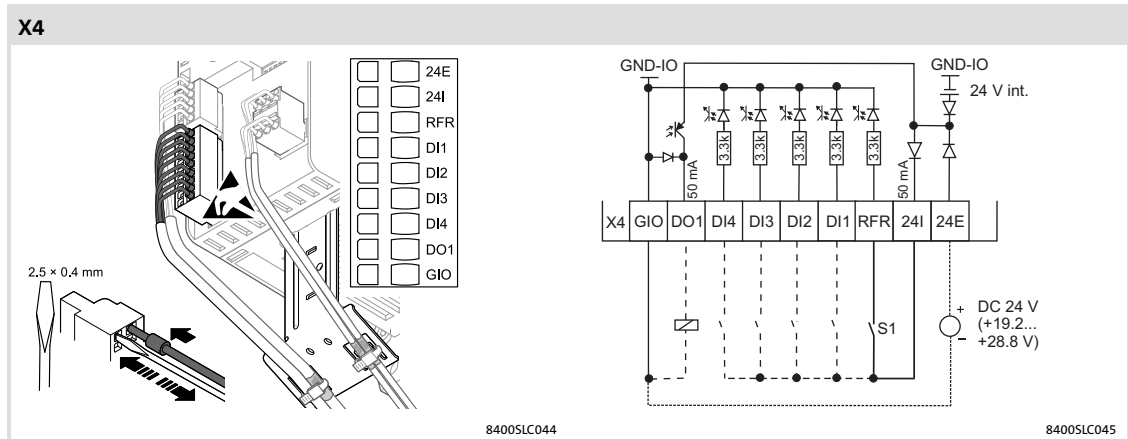


Fig. 6-36 Connection of the digital inputs and outputs

Labelling	Description		
RFR	Controller enable/controller inhibit, always required		
DI1	Digital input 1	81	track A
DI2	Digital input 2	IEC61131-2, type 1 or two-track frequency input, for HTL encoding 0 ... 10 kHz	track B
DI3	Digital input 3	81	
DI4	Digital input 4	81	
DO1	Digital output 1	81	
GIO	GND digital signals		

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

#### Example circuit

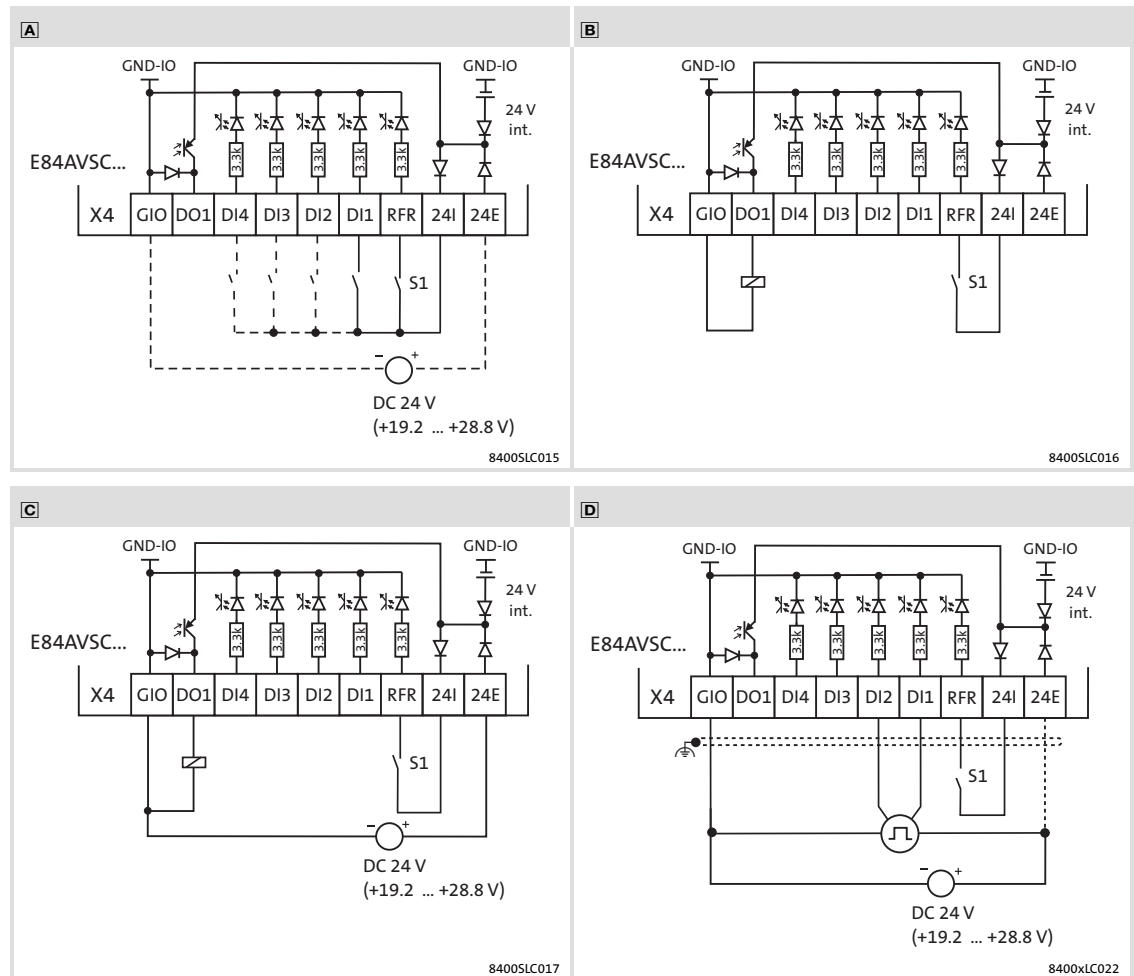


Fig. 6-37 Wiring examples of the digital inputs and outputs

- A** Wiring with one (or several) digital input (here: DI1), e.g. a PLC; optional: external 24 V supply
  - B** Digital control (relay, valve, ...) with internal 24 V supply
  - C** Digital control (relay, valve, ...) with external 24 V supply
  - D** Connection of an HTL incremental encoder with a maximum input frequency of 10 kHz
    - DI1 track A
    - DI2 track B
- RFR Input for controller enable; wiring is always required.  
 GIO GND-IO Ground reference potential for the digital inputs and outputs  
 X4 Terminal for the digital inputs and outputs

## 6.8 HighLine C control terminals

### 6.8.1 External supply voltage 24 V

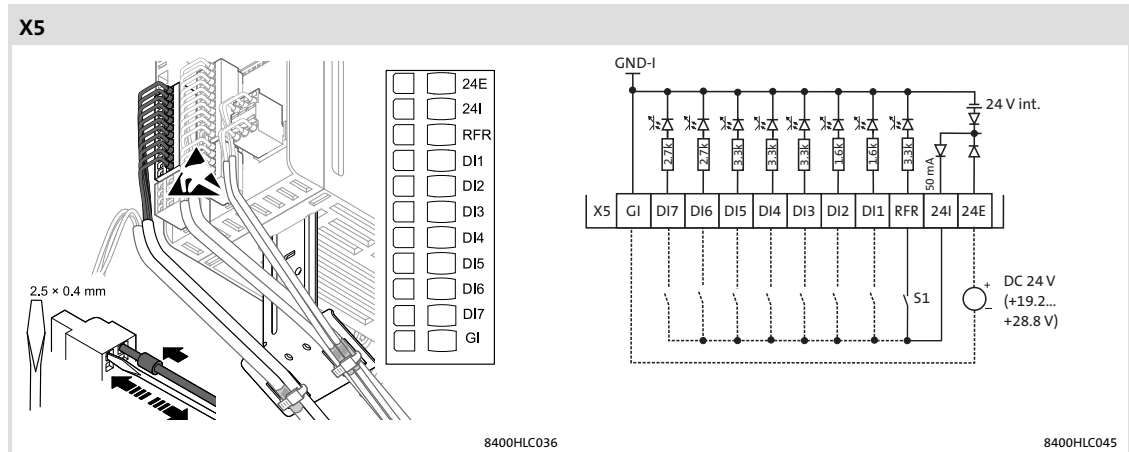



Fig. 6-38 Connection to an external supply voltage

Labelling	Description
24E	Connection for an external 24 V supply by a safely separated power supply unit (SELV/PELV), IEC 61131-2 (required for mains-independent supply of the control electronics and the communication module)
24I	Output 24 V, max. 50 mA for connection of digital inputs via potential-free contacts
GI	GND-I Ground reference potential for the digital inputs

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					



**Electrical installation**  
 HighLine C control terminals  
 External supply voltage 24 V

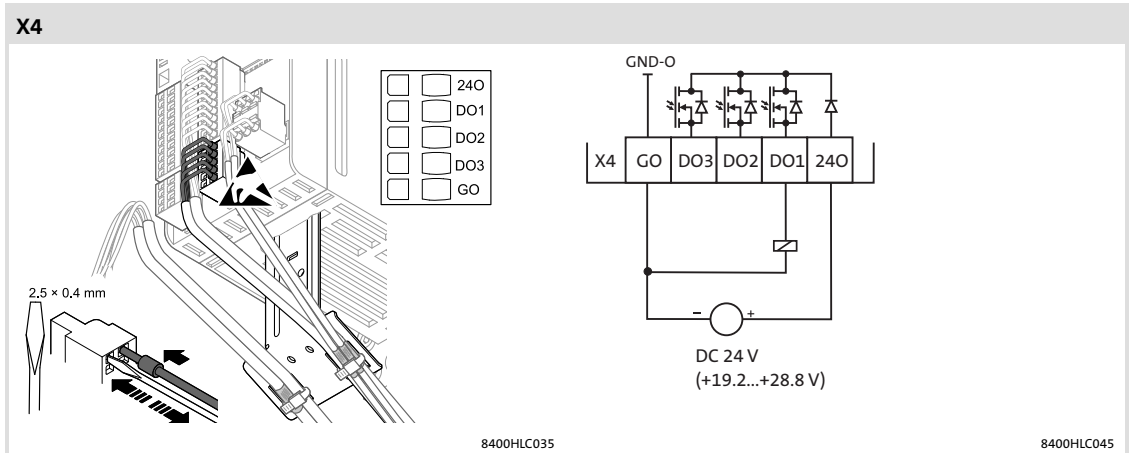



Fig. 6-39 Connection to an external supply voltage

Labelling	Description
240	Connection for an external 24 V supply by a safely separated power supply unit (SELV/PELV), IEC 61131-2 (required for the supply of the digital outputs)
GO	GND-O Ground reference potential for the digital outputs

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

6.8.2 Analog inputs and outputs

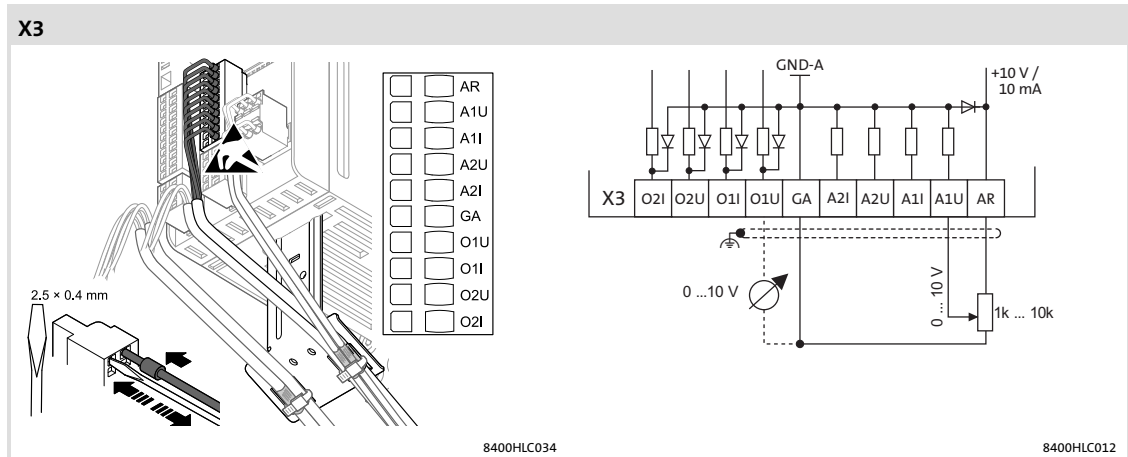



Fig. 6-40 Connection of the analog inputs and outputs

Labelling	Description		
Controller	Reference voltage 10 V		
A1U	Analog voltage input 1	$\pm 10 \text{ V}$	83
A1I	Analog current input 1	$0 \dots +20 \text{ mA} / +4 \dots +20 \text{ mA}$	
A2U	Analog voltage input 2	$\pm 10 \text{ V}$	
A2I	Analog current input 2	$0 \dots +20 \text{ mA} / +4 \dots +20 \text{ mA}$	
GA	GND analog signals		
O1U	Analog voltage output 1	$0 \dots +10 \text{ V}$	83
O1I	Analog current output 1	$0 \dots +20 \text{ mA} / +4 \dots +20 \text{ mA}$	
O2U	Analog voltage output 2	$0 \dots +10 \text{ V}$	
O2I	Analog current output 2	$0 \dots +20 \text{ mA} / +4 \dots +20 \text{ mA}$	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

#### Example circuit

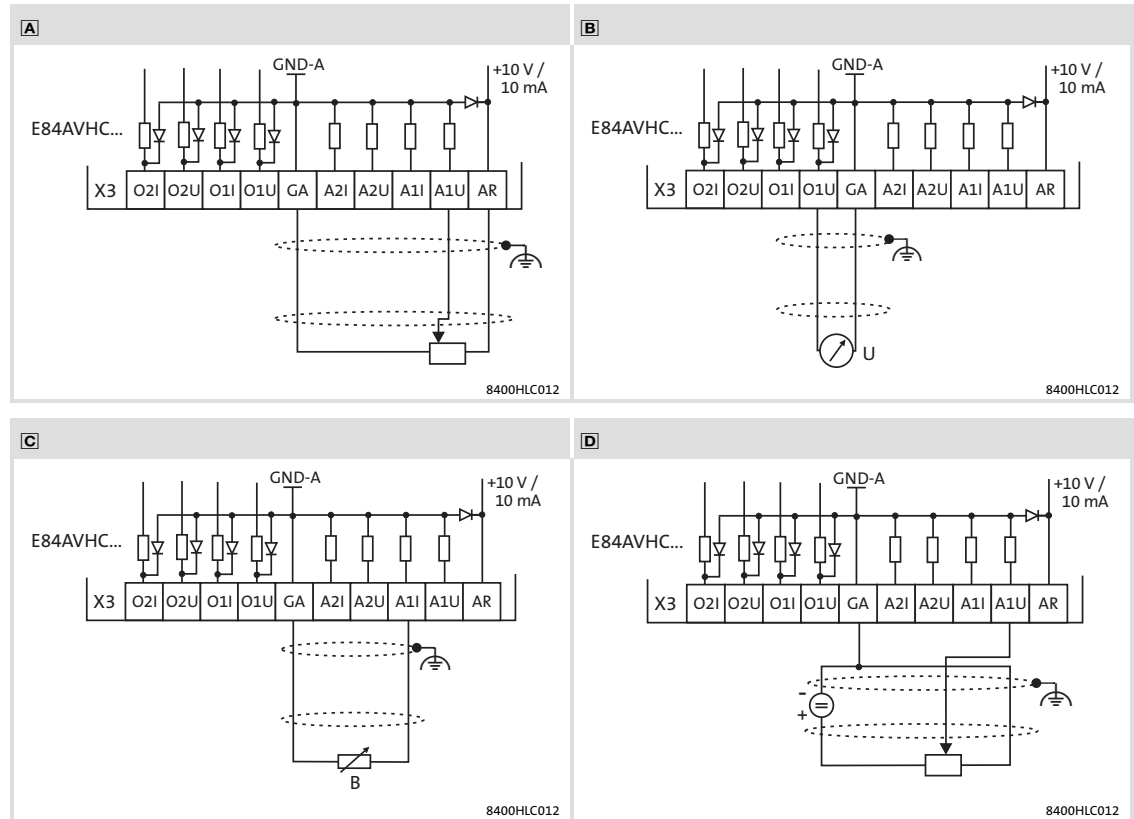


Fig. 6-41 Wiring examples of the analog inputs and outputs

- A** Potentiometer with internal controller supply
- B** Terminal assignment of the analog output signal, e.g. by a measuring instrument
- C** External master current selection based on a sensor signal 0-20 mA.
- D** Potentiometer with external supply
- X3 Terminal for the analog inputs and outputs
- GA GND-A Ground reference potential for the analog inputs and outputs
- ⏏ EMC shield connection
- U Measuring device



**6.8.3 Digital inputs and outputs**

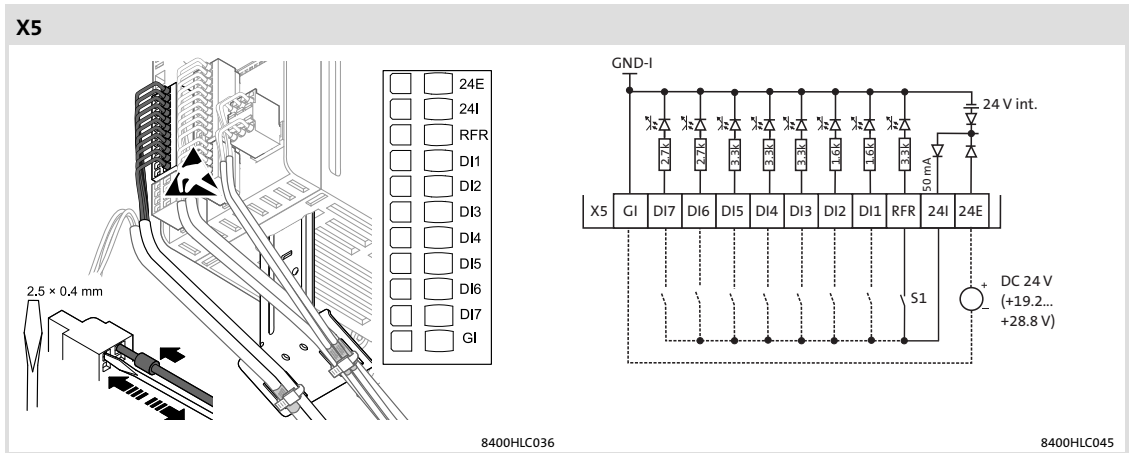



Fig. 6-42 Connection of the digital inputs

Labelling	Description	
RFR	Controller enable/controller inhibit, always required	
DI1	Digital input 1	IEC61131-2, type 1 or two-track frequency input, for HTL encoder 0 ... 200 kHz track A
DI2	Digital input 2	
DI3	Digital input 3	IEC61131-2, type 1 track A
DI4	Digital input 4	
DI5	Digital input 5	IEC61131-2, type 1
DI6	Digital input 6	IEC61131-2, type 1 or
DI7	Digital input 7	two-track frequency input for HTL encoder 0 ... 10 kHz
GI	GND digital inputs	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

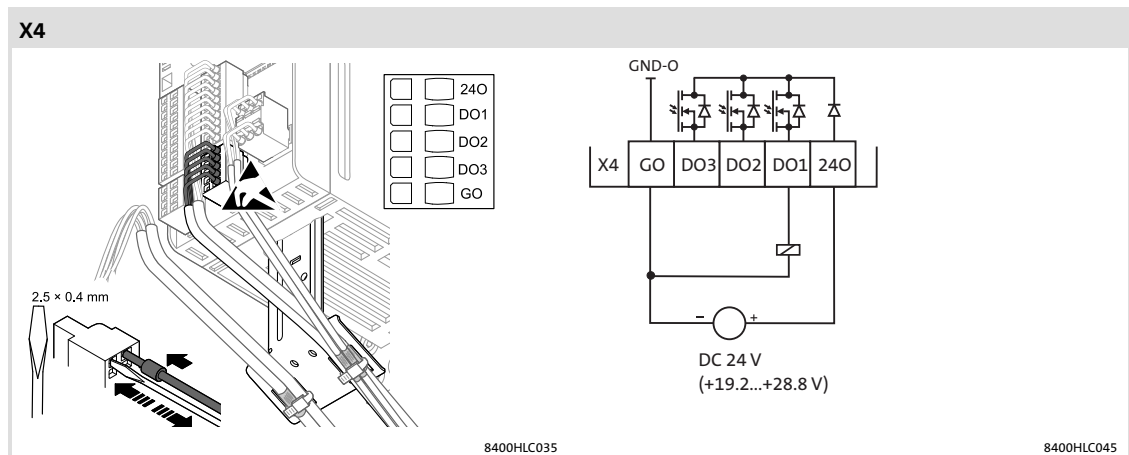



Fig. 6-43 Connection of the digital outputs

Labelling	Description
240	external 24 V supply voltage required for the supply of the digital outputs
DO1	Digital output 1
DO2	Digital output 2
DO3	Digital output 3
GO	GND digital outputs

84  
IEC61131-2, type 1

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

#### Example circuit



#### 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.

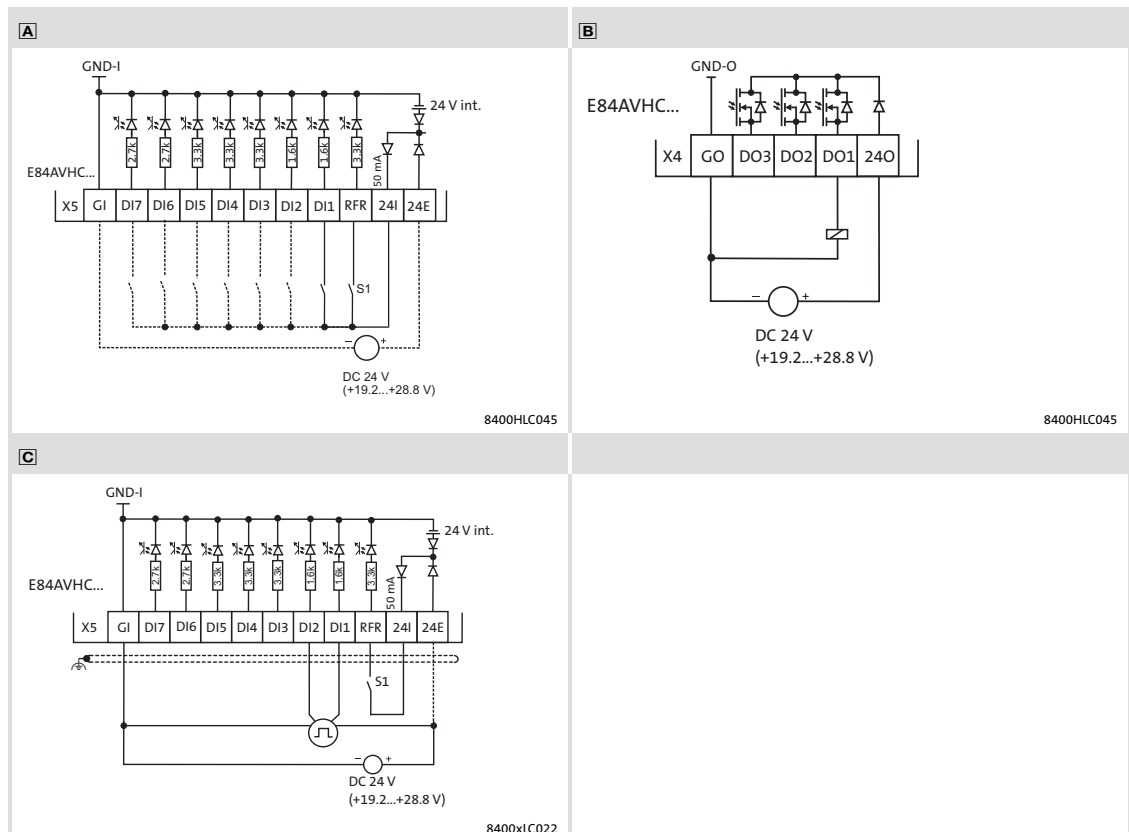


Fig. 6-44 Wiring examples of the digital inputs and outputs

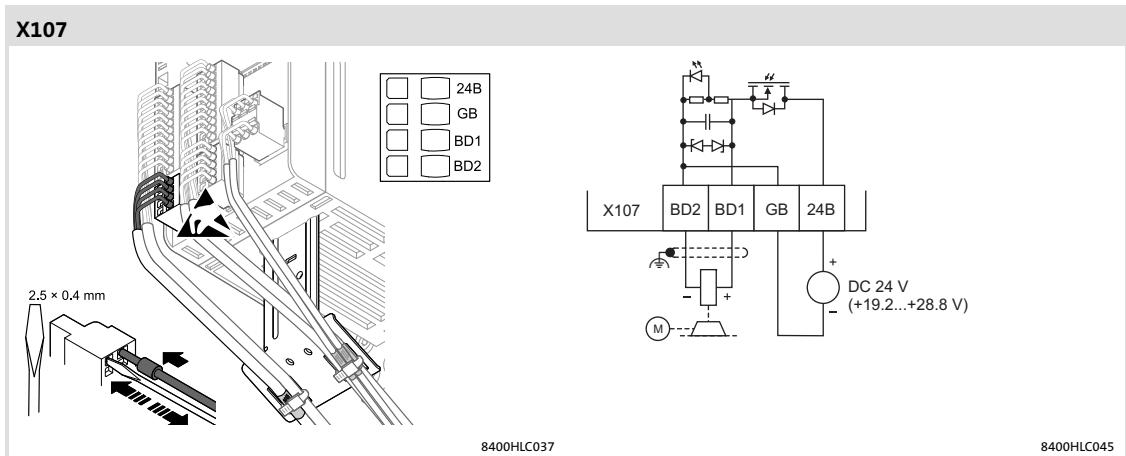
- A** Wiring with one (or several) digital input (here: DI1), e.g. a PLC; optional: external 24 V supply
- B** Digital control (relay, valve, ...) with external 24 V supply
- C** Connection of an HTL incremental encoder with a maximum input frequency of 200 kHz
  - DI1 track A
  - DI2 track B
- X4 Terminal for the digital outputs
- X5 Terminal for the digital inputs
- GI GND-I Ground reference potential for the digital inputs
- GO GND-O Ground reference potential for the digital outputs

6.8.4 Motor holding brake connection



**Note!**

If terminal X107 is used for connecting a motor holding brake, at least one basic insulation to the motor or mains potential has to be provided, so that the protective separation of the control terminals is not limited.



Labelling	Description	
24B	Connection for external 24 V supply voltage of the motor holding brake <b>Observe correct polarity!</b>	DC 19.2 ... 28.8 V, IEC 61131-2 SELV/PELV Example circuit 97
GB	GND connection for external supply	
BD1	Pos. connection of the motor holding brake (Lenze: WH)	
BD2	Neg. connection of the motor holding brake (Lenze: BN)	

	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					



# 6 Electrical installation

## TopLine C control terminals

### Resolver connection

## 6.9 TopLine C control terminals

Devices of the TopLine C version have identical connections as described under "HighLine C control terminals" (📖 67). The additional control terminals of the TopLine C version are described in the following.

### 6.9.1 Resolver connection

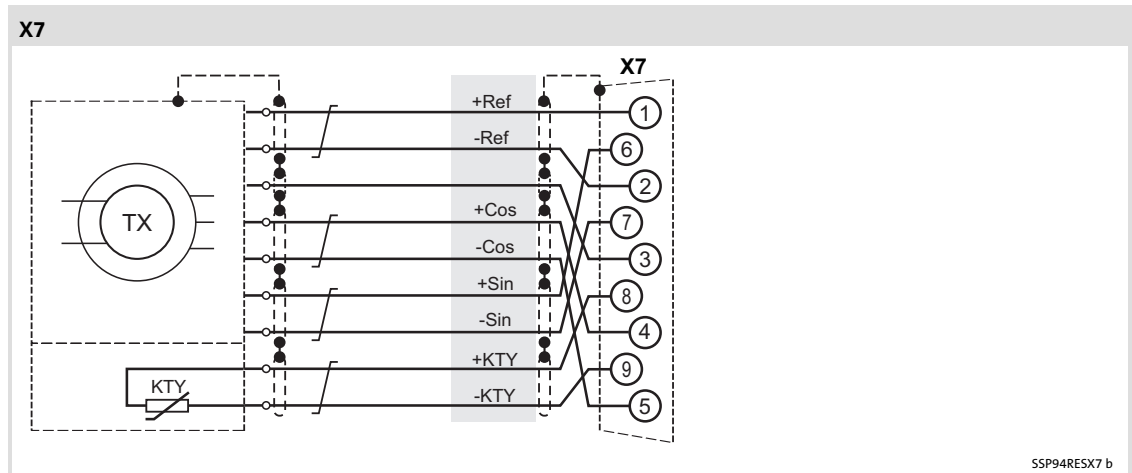



Fig. 6-45 Wiring principle

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

6.9.2 Encoder connection

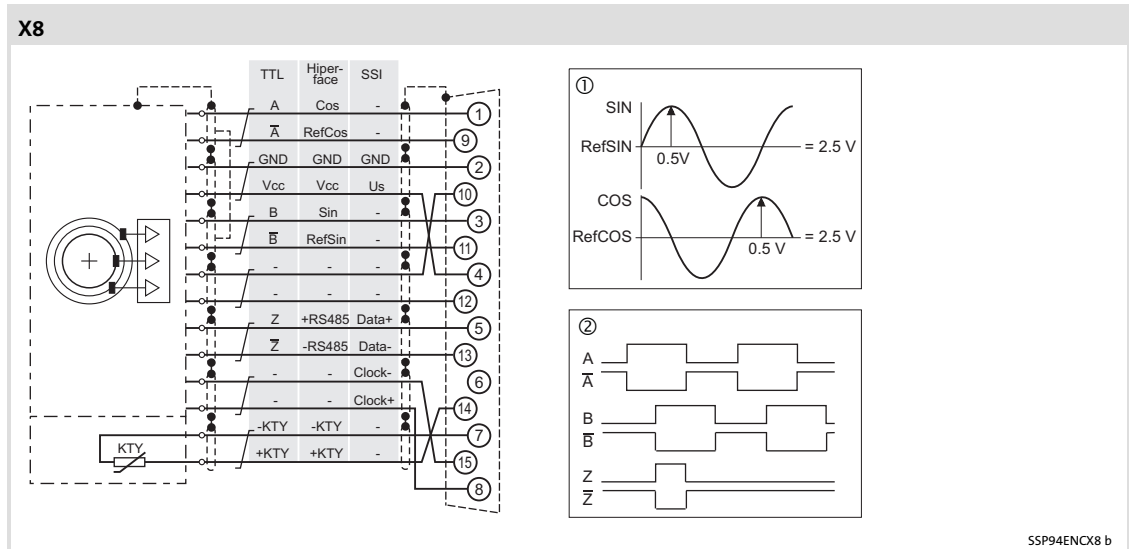



Fig. 6-46 Wiring principle  
① Signals of a sin/cos encoder  
② Signals with CW rotation

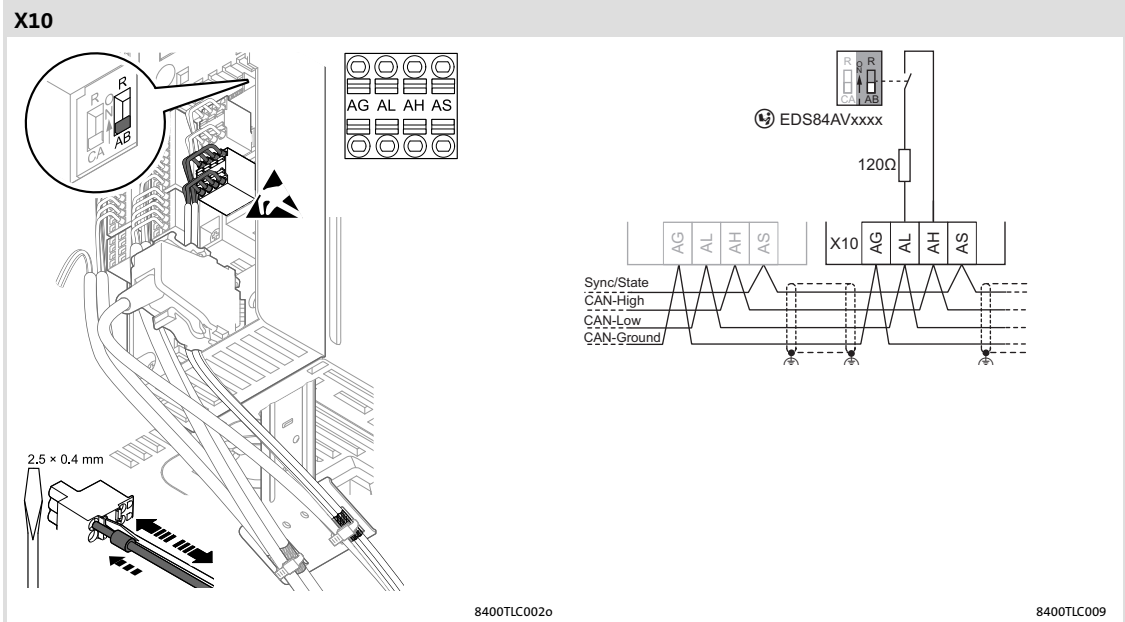
Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

6.9.3 Axis bus



**Note!**

This connection is not supported in versions below 8400 TopLine, SW version 02.00. This connection must not be wired in these lower versions.



Terminal data					
	Conductor cross-section		Tightening torque		
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]	
Flexible	0.2 ... 1.5	24 ... 16	-	-	-
With wire end ferrule					

**I/O axis bus**

Labelling	Feature	Rated value
X10/AS	I/O axis bus connection	TTL level: 5 V
X10/AG	GND, reference potential: I/O axis bus	

**Data transfer axis bus**

Labelling	Feature	Rated value
X10/AH, AL	Data transfer axis bus connection	Acc. to CAN specification Cable lengths: See CAN on board
	Baud rate	from version 12.00: 800 kbit/s, constant up to version 2.xx: 500 kbps, constant
	Terminating resistor	120 Ω, switching via DIP switch
X10/AG	GND, reference potential: Data transfer axis bus	



**Note!**

Trouble-free operation of the axis bus is only possible if the following requirements are met:

- ▶ Use CAN cables in accordance with ISO 11898
- ▶ Apply cable shields to both ends of the shield connections (functional earth)

In particular for longer cables, in the case of installation over several control cabinets, or in difficult EMC environments, further measures are required:

- ▶ Establish equipotential bonding between the places of installation (📖 6)
- ▶ Use of a power choke at the mains connection

## 7 Commissioning



### Note!

- ▶ Please observe the general safety instructions (📖 13).
- ▶ Please observe the notes regarding residual hazards (📖 19).

### 7.1 Before switching on



### Note!

- ▶ Comply with the respective switch-on sequence.
- ▶ In case of trouble during commissioning, the following supports you:
  - The "Diagnostics" chapter
  - The online help in the »Engineer«
  - The software manual of the prevailing device version

**In order to avoid injury to persons or damage to material assets, check ...**

**... before switching on the mains voltage:**

- ▶ Check the wiring for completeness, short-circuit and earth fault
- ▶ The "emergency switching off" function of the entire plant
- ▶ The motor circuit configuration (star/delta) must be adapted to the output voltage of the controller
- ▶ The in-phase connection of the motor
- ▶ The direction of rotation of the incremental encoder (if available)

**...the setting of the most important drive parameters before controller enable to ensure the following:**

- ▶ The V/f rated frequency is adapted to the motor circuit configuration!
- ▶ The drive parameters relevant for your application are set correctly!
- ▶ The configuration of the analog and digital inputs and outputs are adapted to the wiring!

### **Selection of the appropriate commissioning tool**

There are two ways to commission the 8400 frequency inverter:

- ▶ Commissioning using the keypad (or diagnosis terminal)
  - For simple drive tasks such as quick commissioning of the 'Speed closed-loop control' standard application
- ▶ Commissioning using the »Engineer«
  - For rather demanding drive tasks such as 'Table positioning' of the HighLine version
  - Supported by online help and accompanying software documentation (software manual)



#### **Tip!**

Use the »Engineer« to carry out extensive parameter setting and configuration. The online help which is available for each device and the accompanying software documentation will assist you.

The L-force keypad can be used for quick commissioning and checking individual parameters on the controller.

### Notes for motor operation



#### Danger!

- ▶ For thermal reasons, continuous operation of self-ventilated motors at low field frequency and rated motor current is not permissible. If required, activate a motor temperature monitoring with C00585
  - motor temperature monitoring with I<sup>2</sup>xt (see software manual)
  - motor temperature monitoring with motor PTC (see software manual).
- ▶ Select 87-Hz operation under code C00015 if an asynchronous motor in delta connection (nameplate data: 400 V $\Upsilon$ /230 V $\Delta$ ) is to be operated on a frequency inverter for a supply voltage of 400 V.



#### Tip!

In the Lenze setting, the "linear V/f characteristic" operating mode is set as motor control. The parameter settings are preset so that if the frequency inverter and the 50 Hz asynchronous machine match in terms of power, the controller is ready for operation without any further need for parameterisation and the motor operates satisfactorily.

Recommendations for the following application cases

- ▶ If the frequency inverter and the motor differ strongly in terms of power
  - Set code C00022 ( $I_{\max}$  limit in motor mode) to  $2.0 I_{N(\text{motor})}$ .
- ▶ If a high starting torque is required
  - When the motor is idling, set the code C00016 ( $V_{\min}$  boost) so that a rated motor current flows with a field frequency  $f = 3 \text{ Hz}$  (C00058).
- ▶ For noise reduction
  - Set code C00018 to the value "3" (switching frequency  $16 \text{ kHz}_{\text{sin var}}$ ).
- ▶ If a high torque without feedback is to be available at low speeds, we recommend the "vector control" mode.

## 7.2 Quick commissioning

### Target

For test and demonstration purposes, the load-free motor shall be rotated in best time with an amount of wiring as little as possible and few settings.

### Keypad or setpoint potentiometer

For this simple application, you can choose between two drive control options:

- ▶ Keypad control (📖 84), i.e. the X400 keypad is used as setpoint source
- ▶ Terminal control (📖 86), i.e. a setpoint potentiometer connected to the controller terminals is used as setpoint source

### Diagnostics

In addition to the keypad, also use the LEDs on the front of the controller for drive diagnostics:

- ▶ Two LEDs indicate the device status (DRIVE READY and DRIVE ERROR)
- ▶ Two LEDs indicate the bus status (CAN-RUN and CAN-ERROR)

The LEDs for the bus status are less important during quick commissioning.



### Tip!

The handling of the keypad X401 or the diagnosis terminal X401 is described in the operating instructions. The instructions are supplied with the keypad and are also included in electronic form on the product CD "L-force Inverter Drives 8400".



**7.2.1 Keypad control**

**Commissioning steps**

1. Wiring of power terminals

Consult the "Electrical installation" chapter or the mounting instructions to wire the power connections according to the requirements of your device.

2. Wiring of control terminals.

– StateLine

Digital inputs at terminal X4	Assignment	Information
	RFR	<ul style="list-style-type: none"> <li>• Controller enable</li> <li>RFR = High</li> <li>• Reset error</li> <li>High → Low (edge-controlled)</li> </ul>

– HighLine/TopLine

Digital inputs at terminal X5	Assignment	Information
	RFR	<ul style="list-style-type: none"> <li>• Controller enable</li> <li>RFR = High</li> <li>• Reset error</li> <li>High → Low (edge-controlled)</li> </ul>

3. Load Lenze setting to controller



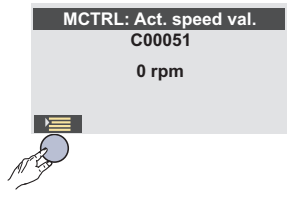
**Note!**

The application "actuating drive speed" is implemented with the Lenze setting.

After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established. The connection has been established when the code C00051 appears in the display.

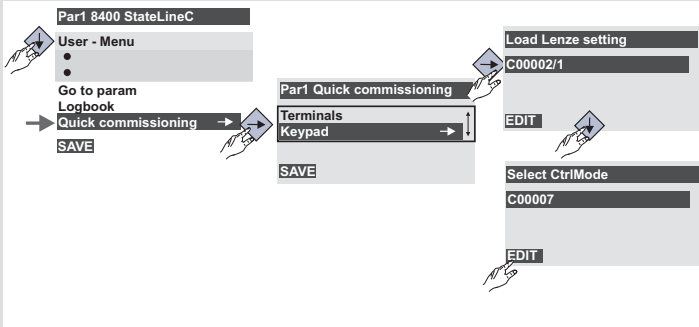
- Then press the left function key.

- Starting from "User menu" scroll down with button to "Quick commissioning" menu
- Click right button.
- Select "Keypad" menu.
- Click right button.
- Code 00002/1:
  - Parameterise with left "Edit" function key
  - Select value "1" - -> On/Start and confirm with right "OK" function key.



- When the Lenze setting is loaded, the display goes off for a short time.
- When the display goes on again, the main menu appears.
  - The main menu settings can be defined by the user using codes C00465 ... C00469.
- Press the left function key to go to the user menu.

### 4. Set keypad control



Continue as with commissioning step ►3. Load Lenze setting to controller:

- "Quick commissioning" menu
- Keypad
- Load Lenze setting

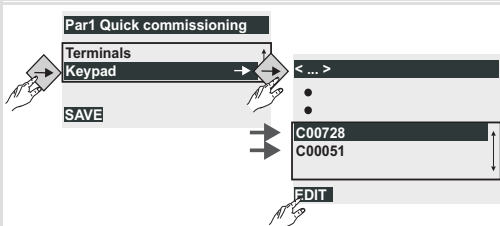
Use the "down" navigation key to go to code C00007 for selecting the control mode:

- Select parameter code 00007 and parameterise with "Edit"
- Select value "20" -> Keypad and confirm with "OK".

### 5. Enable controller:

- StateLine: Set terminal X4/RFR to HIGH potential (reference: X4/24I).
- HighLine/TopLine: Set terminal X5/RFR to HIGH potential (reference: X5/24I).

### 6. Vary the motor speed with the keypad or by defining different fixed setpoints:

Keypad	Code	Subcode	Motor speed
	C00728	3	CCW rotation: -199.99 % .... 0 (of C00011)
			CW rotation: 0 .... +199.99 % (of C00011)
	C00051	-	Display of actual speed value

### ► Please observe:

- the actual speed value: C00051

### 7. Save the settings with **SAVE** in the keypad.

#### 7.2.2 Terminal control

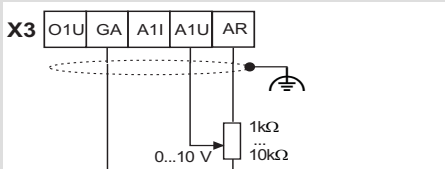
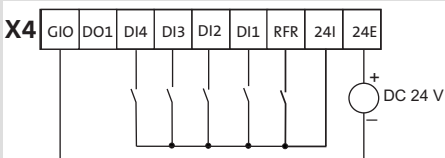
##### Commissioning steps

##### 1. Wiring of power terminals

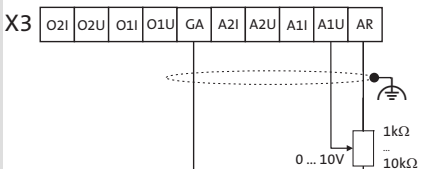
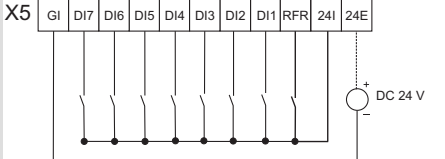
Make use of the Mounting Instructions supplied with the frequency inverter to wire the power terminals according to the requirements of your device.

##### 2. Wiring of control terminals.

– StateLine

Analog inputs at X3	Assignment	Terminal control
	A1U	Setpoint selection 10 V (=100 %): 1500 min <sup>-1</sup> (with 4-pole motor)
<b>Wiring of the digital inputs at X4</b>	RFR	<ul style="list-style-type: none"> <li>Controller enable: RFR = High</li> <li>Reset error: High → Low (edge-controlled)</li> </ul>
	DI1	Fixed frequency 1 ... fixed frequency 3, see table below
	DI2	
	DI3	DCB
DI1 ... DI4: all active = High	DI4	Direction of rotation left/right (CCW/CW)

– HighLine/TopLine

Analog inputs at X3	Assignment	Terminal control
	A1U	Setpoint selection 10 V (=100 %): 1500 min <sup>-1</sup> (with 4-pole motor)
<b>Wiring of the digital inputs at X5</b>	RFR	<ul style="list-style-type: none"> <li>Controller enable: RFR = High</li> <li>Reset error: High → Low (edge-controlled)</li> </ul>
	DI1	Fixed frequency 1 ... fixed frequency 3, see table below
	DI2	
	DI3	DCB
DI1 ... DI4: all active = High	DI4	Direction of rotation left/right (CCW/CW)

- If you can be sure that the frequency inverter is in the default state (Lenze setting), you can skip the following step. If not, establish the Lenze setting of the frequency inverter. We recommend to use the keypad for this.



**Note!**

The application "actuating drive speed" is implemented with the Lenze setting.

After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established. The connection has been established when the code C00051 appears in the display.

- Then press the left function key.

- Starting from "User menu" scroll down with button to "Quick commissioning" menu
- Click right button.
- Select "Keypad" menu.
- Click right button.
- Code 00002/1:
  - Parameterise with left "Edit" function key

- When the Lenze setting is loaded, the display goes off for a short time.
- When the display goes on again, the main menu appears.
  - The main menu settings can be defined by the user using codes C00465 ... C00469.
- Press the left function key to go to the user menu.

4. Enable controller:
  - StateLine: Set terminal X4/RFR to HIGH potential (reference: X4/GIO).
  - HighLine/TopLine: Set terminal X5/RFR to HIGH potential (reference: X5/GI).
5. Vary the motor speed with the potentiometer or by defining different fixed setpoints:

DI2	DI1	Motor speed
0	0	Setpoint by potentiometer
0	1	40 % of C00011 (reference speed)
1	0	60 % of C00011 (reference speed)
1	1	80 % of C00011 (reference speed)

- ▶ Please observe
    - the actual speed value: C00051
    - the front LEDs (105)
6. Save the settings with **SAVE** in the keypad.

**DC injection brake DCB**

To decelerate small masses, the "DC injection brake DCB" function can be parameterised. DC-injection braking enables a quick deceleration of the drive to standstill without the need for an external brake resistor.

- ▶ Code C00036 can be used to select the braking current.
- ▶ The maximum braking torque to be realised by the DC braking current amounts to approx. 20 ... 30 % of the rated motor torque. It is lower compared to braking action in generator mode with external brake resistor.
- ▶ Automatic DC-injection braking (Auto-DCB) improves the starting performance of the motor when the operation mode without speed feedback is used.

Further information on the relevant parameters can be obtained from the software manual.

## 8.2 Braking operation with external brake resistor

To decelerate greater moments of inertia or with a longer operation in generator mode an external brake resistor is required. It converts braking energy into heat.

The brake resistor is connected if the DC-bus voltage exceeds the switching threshold. This prevents the controller from setting pulse inhibit through the "Overvoltage" fault and the drive from coasting. The external brake resistor serves to control the braking process at any time.

The brake chopper integrated in the controller connects the external brake resistor.

- ▶ Adapt the switching threshold to the mains voltage (C00173/C00714, see software manual).



### Note!

DC-bus system without the use of a regenerative module:

- ▶ Up to and including software version V02.xx.xx, only an internal brake chopper can be used in the DC-bus system to dissipate the regenerative energy.
- ▶ Starting from software version V12.00.00, all internal brake choppers can be used in the DC-bus system to dissipate regenerative energy ("master-slave operation").

More information can be found in the "Braking operation/brake energy management" chapter of the reference manual.

### 8.2.1 Operation at rated mains voltage 230 V

Switching threshold  $V_{BRmax}$ : 380 V, adjustable

Type	$R_{Bmin}$ [ $\Omega$ ]	$I_{BRmax}$ [A]	$P_{BRmax}$ [kW]	$I_{BRd}$ [A]	$P_{Bd}$ [kW]	$t_z$ [s]	$t_{on}$ [s]	$t_{fp}$ [s]
E84AVxxx2512	180	2.1	0.8	1.6	0.6	-	$\infty$	-
E84AVxxx3712	180	2.1	0.8	1.6	0.6	-	$\infty$	-
E84AVxxx5512	100	3.8	1.4	2.8	1.1	-	$\infty$	-
E84AVxxx7512	100	3.8	1.4	2.8	1.1	-	$\infty$	-
E84AVxxx1122	33	11.5	4.4	8.6	3.3	-	$\infty$	-
E84AVxxx1522	33	11.5	4.4	8.6	3.3	-	$\infty$	-
E84AVxxx2222	33	11.5	4.4	8.6	3.3	-	$\infty$	-

$R_{Bmin}$	Minimum brake resistance, nominal value $\pm 10\%$
$I_{BRmax}$	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

## Braking operation

Braking operation with external brake resistor  
Operation at rated mains voltage 400 V

### 8.2.2 Operation at rated mains voltage 400 V

Switching threshold  $V_{BRmax}$ : 725 V, adjustable

Type	$R_{Bmin}$ [ $\Omega$ ]	$I_{BRmax}$ [A]	$P_{BRmax}$ [kW]	$I_{BRd}$ [A]	$P_{Bd}$ [kW]	$t_z$ [s]	$t_{on}$ [s]	$t_{fp}$ [s]
E84AVxxx3714	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx5514	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx7514	390	1.9	1.3	1.9	1.3	-	$\infty$	-
E84AVxxx1124	180	4.0	2.9	4.0	2.9	-	$\infty$	-
E84AVxxx1524	180	4.0	2.9	4.0	2.9	-	$\infty$	-
E84AVxxx2224	150	4.8	3.5	4.8	3.5	-	$\infty$	-
E84AVxxx3024xxS	82	8.8	6.4	8.8	6.4	-	$\infty$	-
E84AVxxx3024xx0	82	8.8	6.4	8.8	6.4	-	$\infty$	-
E84AVxxx4024	47	15.4	11.2	13.0	9.4	-	$\infty$	-
E84AVxxx5524	47	15.4	11.2	13.0	9.4	-	$\infty$	-
E84AVxxx7524	27	26.9	19.5	26.9	19.5	-	$\infty$	-
E84AVxxx1134	27	26.9	19.5	26.9	19.5	-	$\infty$	-
E84AVxxx1534	18	40.3	29.2	40.3	29.2	-	$\infty$	-
E84AVxxx1834	15	48.3	35.0	48.3	35.0	-	$\infty$	-
E84AVxxx2234	15	48.3	35.0	48.3	35.0	-	$\infty$	-
E84AVxxx3034	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-
E84AVxxx3734	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-
E84AVxxx4534	7.5	96.7	70.1	96.7	70.1	-	$\infty$	-

$R_{Bmin}$	Minimum brake resistance, nominal value $\pm 10\%$
$I_{BRmax}$	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

## 8.2.3 Operation at a rated mains voltage of 500 V

Switching threshold  $V_{BRmax}$ : 790 V, adjustable

Type	$R_{Bmin}$ [ $\Omega$ ]	$I_{BRmax}$ [A]	$P_{BRmax}$ [kW]	$I_{BRd}$ [A]	$P_{Bd}$ [kW]	$t_z$ [s]	$t_{on}$ [s]	$t_{fp}$ [s]
E84AVxxx3714	390	2.0	1.6	2.0	1.6	-	$\infty$	-
E84AVxxx5514	390	2.0	1.6	2.0	1.6	-	$\infty$	-
E84AVxxx7514	390	2.0	1.6	2.0	1.6	-	$\infty$	-
E84AVxxx1124	180	4.4	3.5	4.4	3.5	-	$\infty$	-
E84AVxxx1524	180	4.4	3.5	4.4	3.5	-	$\infty$	-
E84AVxxx2224	150	5.3	4.2	5.3	4.2	-	$\infty$	-
E84AVxxx3024xxS	82	9.6	7.6	9.6	7.6	-	$\infty$	-
E84AVxxx3024xx0	82	9.6	7.6	9.6	7.6	-	$\infty$	-
E84AVxxx4024	47	16.8	13.3	13.0	10.3	-	$\infty$	-
E84AVxxx5524	47	16.8	13.3	13.0	10.3	-	$\infty$	-
E84AVxxx7524	27	29.3	23.1	29.3	23.1	-	$\infty$	-
E84AVxxx1134	27	29.3	23.1	29.3	23.1	-	$\infty$	-
E84AVxxx1534	18	43.9	34.7	43.9	34.7	-	$\infty$	-
E84AVxxx1834	15	52.7	41.6	52.7	41.6	-	$\infty$	-
E84AVxxx2234	15	52.7	41.6	52.7	41.6	-	$\infty$	-
E84AVxxx3034	7.5	105.3	83.2	105.3	83.2	-	$\infty$	-
E84AVxxx3734	7.5	105.3	83.2	105.3	83.2	-	$\infty$	-
E84AVxxx4534	7.5	105.3	83.2	105.3	83.2	-	$\infty$	-

$R_{Bmin}$	Minimum brake resistance, nominal value $\pm 10\%$
$I_{BRmax}$	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



## Braking operation

Braking operation with external brake resistor  
Selection of the brake resistors

### 8.2.4 Selection of the brake resistors

The recommended Lenze brake resistors are adapted to the corresponding controller (with regard to 150 % of regenerative power). They are suitable for most of the applications.

For special applications, e.g. centrifuges, the brake resistor must meet the following criteria:

Brake resistor Criterion	Application	
	With active load	With passive load
Continuous braking power [W]	$\geq P_{\max} \cdot \eta_e \cdot \eta_m \cdot \frac{t_1}{t_{\text{zykl}}}$	$\geq \frac{P_{\max} \cdot \eta_e \cdot \eta_m}{2} \cdot \frac{t_1}{t_{\text{zykl}}}$
Heat quantity [Ws]	$\geq P_{\max} \cdot \eta_e \cdot \eta_m \cdot t_1$	$\geq \frac{P_{\max} \cdot \eta_e \cdot \eta_m}{2} \cdot t_1$
Resistance [ $\Omega$ ]	$R_{\min} \leq R \leq \frac{U_{\text{DC}}^2}{P_{\max} \cdot \eta_e \cdot \eta_m}$	

Active load	Can start to move independent of the drive (e.g. unwinder)
Passive load	Can stop independent of the drive (e.g. horizontal travelling drives, centrifuges, fans)
$V_{\text{DC}}$ [V]	Brake chopper switching threshold from C0174
$P_{\max}$ [W]	Maximum occurring braking power determined by the application
$\eta_e$	Electrical efficiency (controller + motor) Guide value: 0.54 (0.25 kW) ... 0.85 (11 kW)
$\eta_m$	Mechanical efficiency (gearbox, machine)
$t_1$ [s]	Braking time
$t_{\text{cycl}}$ [s]	Cycle time = time between two successive braking processes (= $t_1$ + dead time)
$R_{\min}$ [ $\Omega$ ]	Minimum permissible brake resistance (see rated data of the integrated brake chopper)

**8.2.5 Rating for Lenze brake resistors**

To decelerate greater moments of inertia or with a longer operation in generator mode an external brake resistor is required. It converts braking energy into heat.

The brake resistors (IP20) recommended in the table are designed to tolerate a regenerative power of approx. 1.5 times the normal value. The cycle time of the brake resistors is 150s and includes a braking time of max. 15s and a recovery time (pause) of min. 135s.

- ▶ The brake resistors are equipped with a thermostat (potential-free NC contact, switching capacity: AC 250V, 0.5A).
- ▶ To increase the power, brake resistors can be connected in parallel or in series.
  - The resistance for the controller must not fall below the lowest permissible value.
  - The thermostat of several brake resistors at a controller must always be connected in series.

## Braking operation

Braking operation with external brake resistor  
Rating for Lenze brake resistors

Product key		Rated data - brake resistor		
Controller	Brake resistor	Resistor R [ $\Omega$ ]	Continuous power P [W]	Heat quantity Q <sub>B</sub> [kWs]
E84AVxxx2512	ERBM180R050W	180	50	7.5
E84AVxxx3712				
E84AVxxx5512	ERBM100R100W	100	100	15
E84AVxxx7512				
E84AVxxx1122	ERBP033R200W	33	200	30
E84AVxxx1522	ERBP033R200W			
E84AVxxx2222	ERBP033R300W		300	45
E84AVxxx3714	ERBM390R100W	390	100	15
E84AVxxx5514	ERBM390R100W			
E84AVxxx7514				
E84AVxxx1124	ERBP180R200W	180	200	30
E84AVxxx1524	ERBP180R200W			
E84AVxxx2224	ERBP180R300W		300	45
E84AVxxx3024xxS	ERBP082R200W	82	200	30
	ERBS082R780W	82	780	117
E84AVxxx3024xx0	ERBP082R200W	82	200	30
	ERBS082R780W	82	780	117
E84AVxxx4024	ERBS047R400W	47	400	60
E84AVxxx5524	ERBS047R800W		800	120
E84AVxxx7524	ERBP027R200W	27	200	30
	ERBS027R600W		600	90
	ERBS027R01K2		1200	180
E84AVxxx1534	ERBS018R800W	18	800	120
	ERBS018R01K4		1400	210
	ERBS018R02K8		2800	420
	ERBD020R03K0RB	20	3000	450
E84AVxxx1834	ERBS015R800W	15	800	120
	ERBS015R01K2		1200	180
	ERBS015R02K4		2400	420
	ERBG015R06K2		6200	930
E84AVxxx3034	ERBG075D01K9	7.5	1900	285
E84AVxxx3734				
E84AVxxx4534				

## 8.2.6 Wiring of brake resistor

**Danger!****Hazardous electrical voltage**

During operation of the standard device and **up to 3 minutes after power-off** hazardous electrical voltages may occur at the terminals of the brake resistor.

**Possible consequences:**

- ▶ Death or severe injuries when touching the terminals.

**Protective measures:**

- ▶ Disconnect the standard device from the mains before working on the brake resistor.
- ▶ Check all power terminals for isolation from supply.
- ▶ Select the mounting location so that the operating conditions mentioned in the mounting instructions for the brake resistor are permanently guaranteed.

**Danger!****Hot surface**

The brake resistor may get very hot. (For temperatures see the mounting instructions for the brake resistor.)

**Possible consequences:**

- ▶ Severe burns when touching the brake resistor.
- ▶ Fire or smouldering fire if flammable material is placed near the brake resistor or may get to it.

**Protective measures:**

- ▶ Before working on the brake resistor, check its surface temperature.
- ▶ Select the mounting location so that the operating conditions mentioned in the mounting instructions for the brake resistor are permanently guaranteed.
- ▶ Protect the mounting location through fire prevention.

Protect the brake resistor and controller against destruction caused by overload:

- ▶ Establish a safety shutdown using the thermostat of the brake resistor to disconnect the controller from the mains.

Connecting cable version

- ▶ up to 0.5 m: twisted and unshielded
- ▶ from 0.5 to 5 m: shielded
  - Use shielded cables to meet the EMC requirements.

## Braking operation

### Braking operation with external brake resistor Wiring of brake resistor

#### Wiring principle

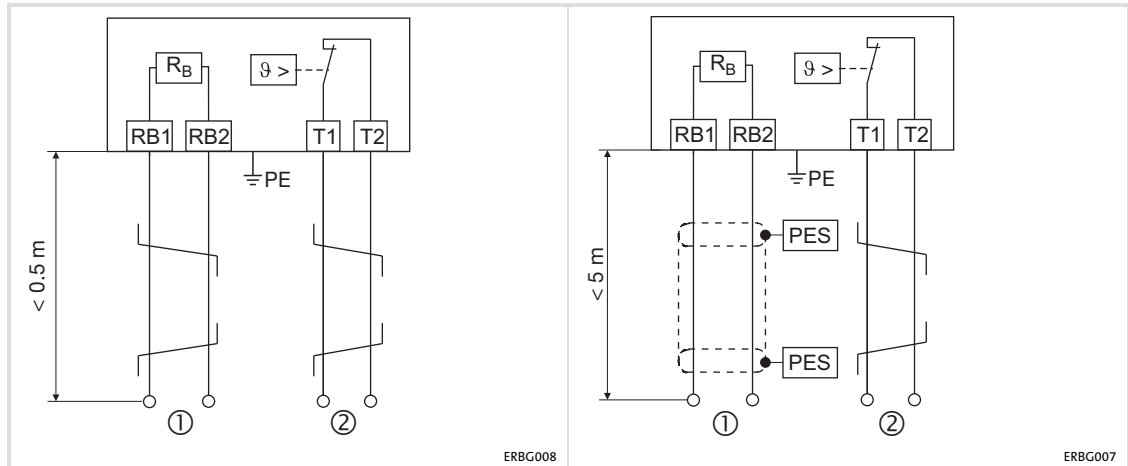


Fig. 8-1 Wiring of a brake resistor to the controller

PES	HF-shield termination by PE connection via shield clamp
Rb1, Rb2	Terminals of the brake resistor
①	Supply cable to the controller
T1, T2	Terminals temperature monitoring of the brake resistor (thermal contact/NC contact)
②	Supply cable for evaluation of temperature monitoring (to be integrated e.g. into the latch circuit of the mains contactor of the supply)

## 8.3 Operation with spring-applied brake

### 8.3.1 Introduction

Lenze three-phase AC motors and G-motion geared motors can be equipped with spring-applied brakes (motor holding brakes). An external motor brake control module is required for switching and as a DC supply of the spring-applied brakes.

The suitable motor brake control module is selected according to the rated data of the spring-applied brakes.

Controllers in the HighLine C/TopLine C version offer an integrated control for brakes with 24 V connection and a braking current of up to 2.5 A.

#### Switching the brake

For controllers of the StateLine C, HighLine C, and TopLine C versions, the switching operation of the brake can be controlled:

- ▶ Via an external control contact (e.g. PLC)
- ▶ Via a brake switch which is connected to one of the digital outputs of the controller. The digital output must be parameterised accordingly.

For controllers of the HighLine C and TopLine C version, the switching operation of the brake can be controlled additionally:

- ▶ Via an integrated brake control

The software manual contains further information on the parameterisation and the integrated brake management.



#### Stop!

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

Only motor holding brakes which comply with the permissible data mentioned in the Technical Data may be connected to the integrated brake control. (If necessary, the holding brake must be controlled without a brake control via a digital output and a coupling relay.)

If the permissible values mentioned in the Technical Data are not observed:

- ▶ the brake control may be destroyed.
- ▶ a safe operation of the motor holding brake is not ensured.

Observe additional notes in the documentation of the standard device!

## Braking operation

Operation with spring-applied brake  
Introduction



### Stop!

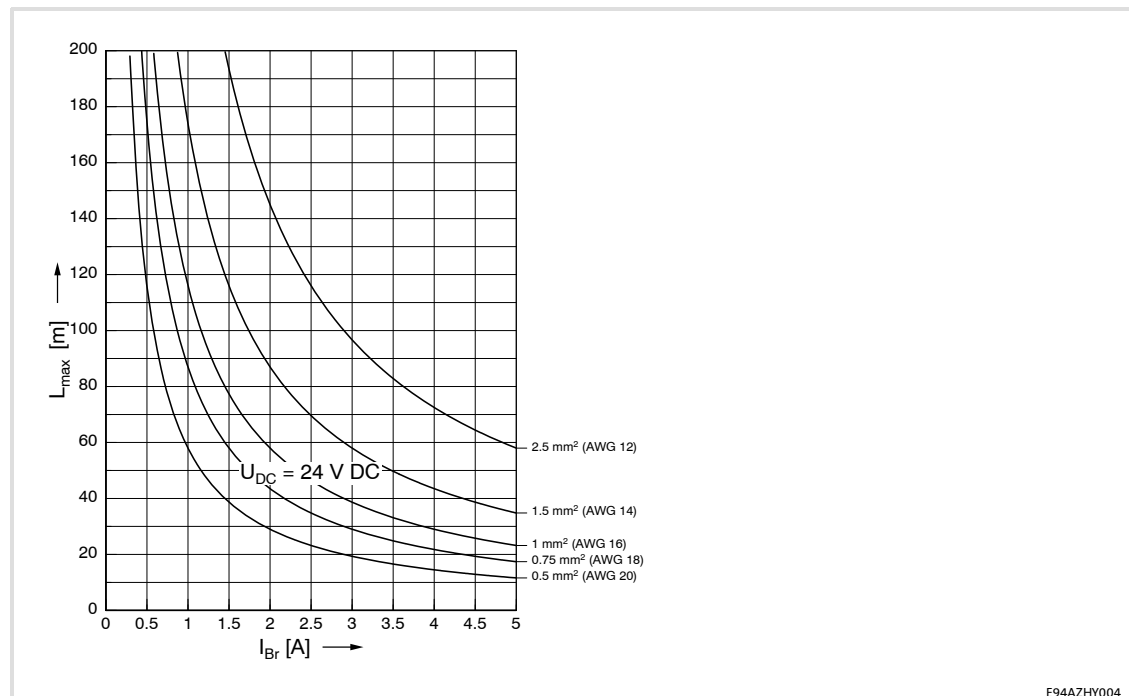
#### Requirements with regard to the brake cable (connection BD1/BD2):

- ▶ 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).
- ▶ In the case of a permanent magnet holding brake, observe the correct polarity of the brake cable.
  - If the terminals are inverted, the brake does not release. As the motor is running against the closed brake, the brake can be destroyed.
- ▶ Apply the shield to PE on both sides.

#### Requirements with regard to the supply voltage $U_{DC}$ (connection +/-):

- ▶ Always supply the motor brake control with a separate 24 V supply.
  - A common supply of the motor brake control and the controller control card is not permissible, as otherwise the basic insulation between the two components is reduced.
- ▶ Set  $U_{DC}$  so that the operating voltage of the brake is within the permissible range and the maximum supply voltage of the motor brake control is not exceeded.

### Cable length



$L_{max}$  Maximum brake cable length in [m]  
 $I_{BR}$  Brake current in [A]  
 $U_{DC}$  Supply voltage of the motor brake control

E94AZHY004

### 8.3.2 Rated data

► E82ZWBRB brake switch

Range	Values
<b>Input voltage</b>	1/N/PE AC 230 V (AC 180 ... 264 V), 45 ... 65 Hz 2/PE AC 230 V (AC 180 ... 264 V), 45 ... 65 Hz
<b>Input current</b>	AC 0.1 ... 0.54 A
<b>Output voltage</b>	DC 205 V      at AC 230 V mains voltage
<b>Maximum brake current</b>	DC 0.41 A      Installation in 8200 motec DC 0.54 A      Installation in control cabinet
<b>Control input</b>	
Control voltage	DC 24 V, PLC-level HIGH      DC +15 ... 30 V LOW      DC 0 ... +3 V
Control current	5 ... 10 mA
Protective function	Protected against polarity reversal until DC 60 V
<b>Maximally connectable cable cross-section</b>	1.5 mm <sup>2</sup> AWG 16

► E82ZWBRE brake switch

Range	Values
<b>Input voltage</b>	3/PE AC 400 V (AC 320 ... 550 V), 45 ... 65 Hz
<b>Input current</b>	AC 0.1 ... 0.61A
<b>Output voltage</b>	DC 180 V      at AC 400 V mains voltage DC 225 V      at AC 500 V mains voltage
<b>Maximum brake current</b>	
(pilot duty)	DC 0.47 A      Installation in 8200 motec DC 0.61 A      Installation in control cabinet
<b>Control input</b>	
Control voltage	DC 24 V, PLC-level HIGH      DC +15 ... 30V LOW      DC 0 ... +3 V
Control current	5 ... 10 mA
Protective function	Protected against polarity reversal until DC 60 V
Min. permissible switch-off time	t <sub>off</sub> >20ms
<b>Maximally connectable cable cross-section</b>	1.5 mm <sup>2</sup> AWG 16



## Braking operation

Operation with spring-applied brake

Rated data

### ► Integrated brake control for devices of the HighLine/TopLine version

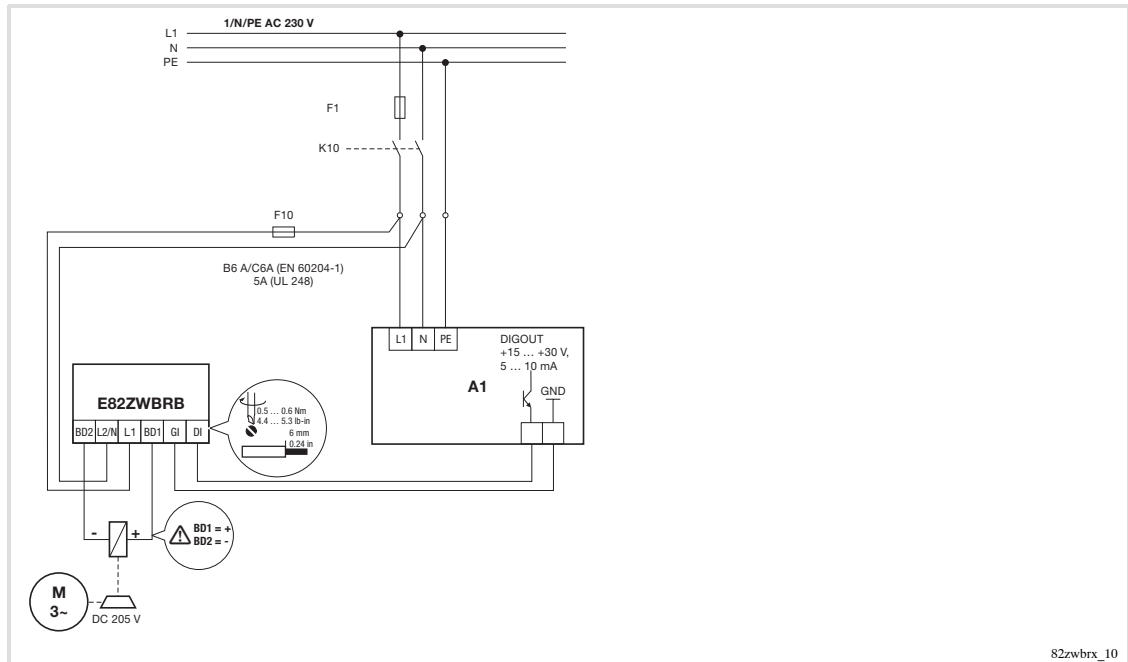
Range	Values
Input voltage	DC 24 V in accordance with IEC 61131-2 19.2 ... 28.8 V
Input current	DC 0.1 ... 2.6 A
Output voltage	DC 24 V
Maximum brake current	DC 2.5 A
Internal control	Information on internal brake control is provided in the software manual for the Inverter Drives 8400 HighLine C / TopLine C.
Maximally connectable cable cross-section	1.5 mm <sup>2</sup> AWG 16



Further technical data regarding the brake control can be found in chapter 4.7.7.

8.3.3 Wiring

► E82ZWRB brake switch



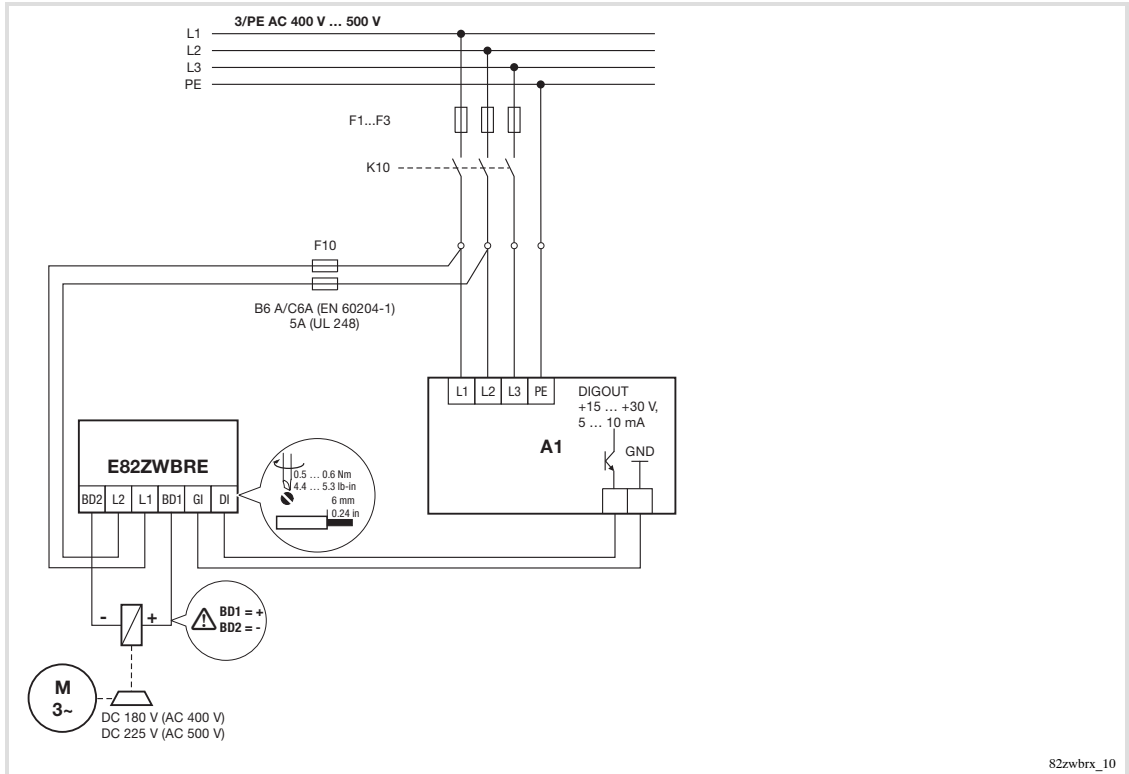
A1 Lenze controller with digital output  
F10 Additional cable protection

# Braking operation

## Operation with spring-applied brake

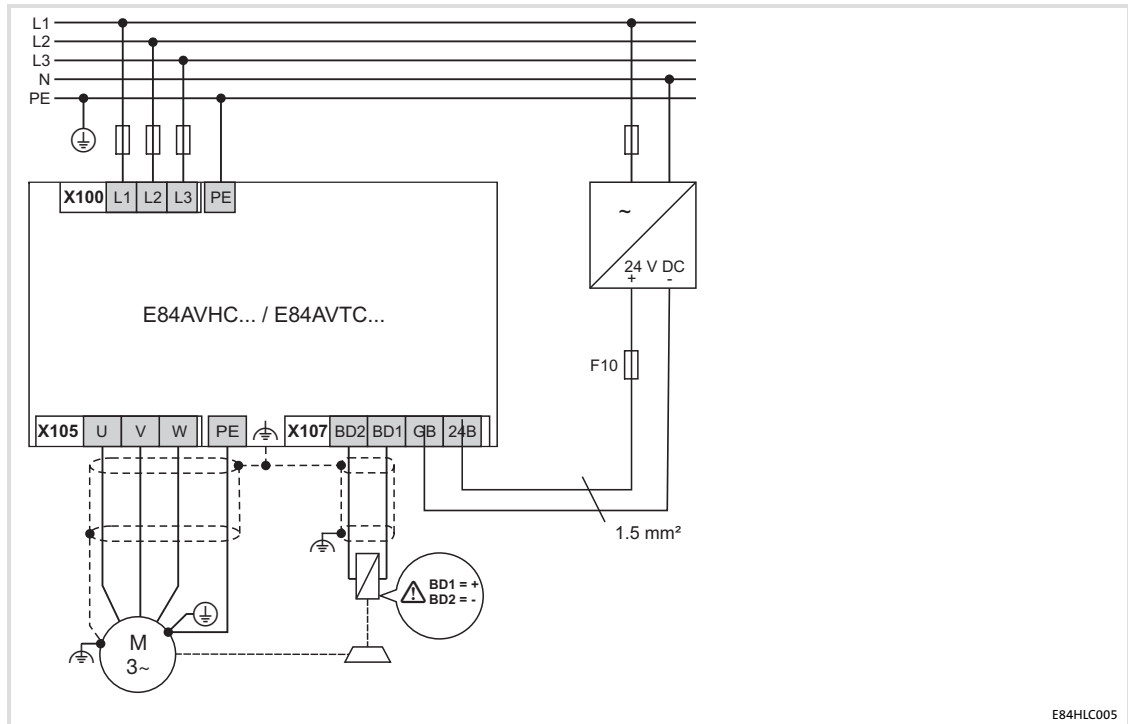
### Wiring

► E82ZWBRE brake switch



A1 Lenze controller with digital output  
F10 Additional cable protection

► Integrated brake control for devices of the HighLine/TopLine version



E84AVxC...  
F10

Controller of the HighLine or TopLine version  
Cable protection in secondary circuit.

**Observe the standards for cable protection and the safety instructions for the installation according to UL or UR when dimensioning the fuse!**  
HF-shield termination by large surface connection to PE.



## **9 DC-bus operation**

### **9.1 Advantages of DC-bus operation**

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 power supply modules or supply controllers can be dimensioned with a lower DC supply power, if necessary.

### **9.2 Conditions for trouble-free DC-bus operation**

- ▶ Only controllers with identical mains voltage/DC bus voltage ranges can be operated in a DC-bus connection:
  - Set mains voltage and brake chopper threshold to the same values in all axis controllers.
- ▶ For decentralised supply (multiple mains supply):
  - Operate all input modules only with the mains chokes specified!
- ▶ In order to ensure correct dimensioning of the mains chokes, please get in touch with your Lenze contact partner.
- ▶ Fuses and cable cross-sections must be dimensioned in compliance with the locally applicable regulations.

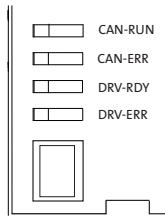
## 10 Diagnostics

### 10.1 Display of operating data, diagnostics

#### 10.1.1 Status display via controller LEDs

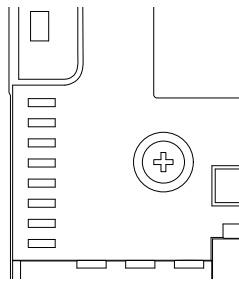
##### StateLine, HighLine

During operation, the operating status of the controller is indicated by four light-emitting diodes. These are located at the front of the device. The upper two LEDs indicate the current status of the CAN bus connection and the lower two LEDs indicate the status of the controller.

LED	Labelling	Colour	Description
 8400SLC026	CAN-RUN	green	CAN-BUS o.k.
	CAN-ERR	red	CAN-BUS error
	DRV RDY	green	Controller is ready for operation
	DRV ERR	red	Error in the controller or through the application






##### TopLine

During operation, the operating status of the controller is indicated by eight light-emitting diodes. These are located at the front of the device. Two LEDs indicate the current status of the CAN bus connection and another two indicate the controller status. One LED indicates the axis bus status. Another three LEDs can be parameterised for display purposes of the application.















LED	Labelling	Colour	Description
 8400TLC033	CAN-RUN	green	CAN-BUS o.k.
	CAN-ERR	red	CAN-BUS error
	DRV RDY	green	Controller is ready for operation
	DRV ERR	red	Error in the controller or through the application
	Axis bus	green	-
	User1	green/red	-
	User2	red	-
	User3	green	-

**Legend**

The symbols used for indicating the LED states have the following meaning:

	LED flashes once approx. every 3 seconds (slow flash)
	LED flashes once approx. every 1.25 seconds (flash)
	LED flashes twice approx. every 1.25 seconds (double flash)
	LED blinks every second
	LED is permanently on

The LEDs "DRIVE READY" and "DRIVE ERROR" can blink in different ways depending on the device states which are explained in the following. This permits an easy device diagnostics without additional tools.

DRIVE READY (green)	DRIVE ERROR (red)	Status	Description
OFF	OFF	→ "Init" state	<b>Initialisation is active</b>
	OFF	→ "MotorIdent" state	<b>Motor data identification</b> – The "MotorIdent" device state can only be reached by the "SwitchON" device state and jumps back to that state after the action is completed.
	OFF	→ "SafeTorqueOff" state	<b>This state is only possible in relation with a connected safety module and an existing power section supply!</b>
	OFF	→ "ReadyToSwitchOn" state	<b>Device is ready to start</b> – This is the controller's state directly after the initialisation has been completed.
	OFF	→ "SwitchedOn" state	<b>Device is switched on</b> – This is the controller's device state if the DC bus voltage is applied and the controller is still inhibited by the user (controller inhibit).
	OFF	→ "OperationEnabled" state	<b>Operation</b> – In this device state, the motor follows the setpoint defined in the application.
  		→ "Warning" status display	<b>Operation/warning is active</b> – This display may occur in all device states if a monitoring mode responds the error response "Warning" or "Warning locked" has been parameterised for.
		→ "TroubleQSP" state	<b>TroubleQSP is active</b> – This device state will be active as soon as a monitoring mode responds, the error response "TroubleQSP" has been parameterised for.
OFF		→ "Trouble" state	<b>Message is active</b> – This device state will be active as soon as a monitoring mode responds, the error response "Message" has been parameterised for.
OFF		→ "Fault" state	<b>Fault is active</b> – This device state will be active as soon as a monitoring mode responds, the error response "Fault" has been parameterised for.
OFF		→ "SystemFail" state	<b>System fault is active</b> – This device state will be active if a system fault occurs.



## 10.1.2 Drive diagnostics via keypad

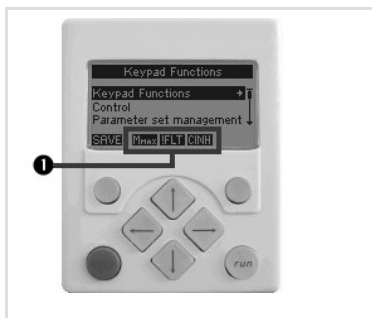
Important operating parameters are measured by the controller. They can be displayed with the keypad or PC.

Some operating data can be calibrated to be displayed or selected directly with the unit of the process quantity (e.g. pressure, temperature, speed).

**Note!**

The calibration always affects all specified codes simultaneously.

## Display of the controller status on the keypad



– If the keypad at the front of the controller is connected to the diagnostic interface X6, the area ① of the LCD displays the controller status via different symbols.

Icon	Meaning	Note
<b>RDY</b>	Controller is switched on.	→ "SwitchedON" state
<b>RUN</b>	Controller is enabled.	
□	Application in the controller is stopped.	
<b>QSP</b>	Quick stop is active.	
<b>CINH</b>	Controller is inhibited.	The power outputs are inhibited.
<b>OFF</b>	Controller is ready to start	→ "ReadyToSwitchOn" state
<b>Mmax</b>	Speed controller 1 in the limitation	The drive is torque-controlled.
<b>Imax</b>	The set current limit is exceeded in motor or generator mode	
<b>IMP</b>	Pulse inhibit is active	The power outputs are inhibited.
<b>ISFLT</b>	System fault is active	
<b>IFLT</b>	Fault	→ "Fault" state
<b>ITRB</b>	Trouble	→ "Trouble" state
<b>ITQSP</b>	TroubleQSP	→ "TroubleQSP" state
<b>WRN</b>	Warning is active	→ "Warning" status display

## Display parameters

The parameters listed in the following table serve to get information on current statuses and actual values of the controller for diagnostic purposes, e.g. with the keypad, via a bus system or using the »Engineer« (when an online connection has been established to the controller)

- In the »Engineer« parameter list and in the keypad, these parameters are classified in the **Diagnostics** category.
- A detailed description of these parameters can be found in the software manual of the prevailing device version.

Parameter	Display
C00183	Device state
C00168	Error number
C00051	Actual speed value
C00052	Motor voltage
C00054	Motor current
C00057/1	Maximum torque
C00057/2	Torque at maximum current
C00059	Motor - number of pole pairs
C00061	Heatsink temperature
C00062	Temp. inside the controller
C00063	Motor temperature
C00064	Device utilisation (I x t) over the last 180 seconds
C00065	Ext. 24-V voltage
C00066	Thermal motor load (I <sup>2</sup> x t)
C00178	Time the controller was enabled (elapsed-time meter)
C00179	Time the mains was switched on (power-on time meter)

### Identification data

The parameters listed in the following table which are classified in the »Engineer« parameter list and the keypad in the category **Identification→Controller** serve to display the identification data of the controller.

Parameter	Display
C00099	Firmware version
C00200	Firmware product type
C00201	Firmware compilation date
C00203/1 ... 9	HW product types
C00204/1 ... 9	HW serial numbers
C00205/1 ... 6	HW descriptions
C00206/1 ... 6	HW manufacturing data
C00208/1 ... 6	HW manufacturer
C00209/1 ... 6	HW countries of origin
C00210/1 ... 6	HW version

## 11 Safety engineering

### Introduction

## 11 Safety engineering

### 11.1 Introduction

With increasing automation, protection of persons against hazardous movements is becoming more important. Functional safety describes the measures needed by means of electrical or electronic equipment to reduce or remove danger caused by failures.

During normal operation, safety equipment prevents people accessing hazardous areas. In certain operating modes, e.g. set-up mode, work needs to be carried out in hazardous areas. In these situations the machine operator must be protected by integrated drive and control measures.

Drive-based safety provides the conditions in the controls and drives to optimise the safety functions. Planning and installation expenditure is reduced. In comparison to the use of standard safety engineering, drive-based safety increases machine functionality and availability.

#### **Drive-based safety with Inverter Drives 8400**

The controllers of the 8400 series are available with drive-based safety "safe torque off (STO)".

Drive-based safety can be used for the protection of persons working on machines.

The safety system provides the safe inputs. If the STO safety function is requested, the safety system directly causes the torqueless status according to EN 60204-1.

## 11.2 Important notes

### Application as directed

The controllers of the 8400 series that are equipped with drive-based safety must not be modified by the user. This concerns the unauthorised exchange or removal of the drive-based safety.



#### **Danger!**

##### **Danger to life through improper installation**

Improper installation of safety engineering systems can cause an uncontrolled starting action of the drives.

##### **Possible consequences:**

- ▶ Death or severe injuries

##### **Protective measures:**

- ▶ Safety engineering systems may only be installed and commissioned by qualified and skilled personnel.
- ▶ All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of EN ISO 13849-1 and EN ISO 138492. This includes i.a.:
  - Switches, relays with at least IP54 enclosure.
  - Control cabinet with at least IP54 enclosure.
  - Please refer to EN ISO 13849-1 and EN ISO 138492 for all further requirements.
- ▶ It is essential to use insulated wire end ferrules for wiring.
- ▶ All safety relevant cables outside the control cabinet must be protected, e.g. by means of a cable duct:
  - Ensure that no short circuits can occur.
  - For further measures see EN ISO 138492.
- ▶ If an external force acts upon the drive axes, additional brakes are required. Please observe that hanging loads are subject to the force of gravity!



#### **Danger!**

When the "safe torque off" (STO) function is used, an "emergency switching-off" according to EN 60204 is not possible without additional measures. There is no electrical isolation, no service switch or repair switch between motor and controller!

"Emergency switching-off" requires an electrical isolation, e.g. by a central mains contactor!

**During operation**

After the installation is completed, the operator must check the wiring of the safety function.

The functional test must be repeated at regular intervals. The time intervals to be selected depend on the application, the entire system and the corresponding risk analysis. The inspection interval should not exceed one year.

**Residual hazards**

In case of a short-circuit of two power transistors a residual movement of the motor of up to  $180^\circ$ /number of pole pairs may occur! (Example: 4-pole motor  $\Rightarrow$  residual movement max.  $180^\circ/2 = 90^\circ$ )

This residual movement must be considered in the risk analysis, e.g. safe torque off for main spindle drives.

**11.2.1 Hazard and risk analysis**

This documentation can only accentuate the need for hazard analysis. The user of the integrated safety system must read up on standards and the legal situation:

Before the launch of a machine, the manufacturer of the machine must conduct a hazard analysis according to Machinery Directive 2006/42/EC to determine the hazards associated with the application of the machine. The Machinery Directive refers to three basic principles for the highest possible level of safety:

- ▶ Hazard elimination / minimisation by the construction itself.
- ▶ Required protective measures must be taken against hazards which cannot be eliminated.
- ▶ Existing residual hazards must be documented and the user must be informed of them.

Detailed information on the hazard analysis procedure is provided in the DIN EN ISO 12100:2013-08 - "Safety of machinery - General principles for design, risk assessment and risk reduction". The results of the hazard analysis determine the category for safety-related control systems according to EN ISO 13849-1. Safety-oriented parts of the machine control must be compliant.

**11.2.2 Standards**

Safety regulations are confirmed by laws and other governmental guidelines and measures and the prevailing opinion among experts, e.g. by technical regulations.

The regulations and rules to be applied must be observed in accordance with the application.

### 11.2.3 Mission time

The *mission time* of the used component has to be observed and complied with. After the mission time of a component has expired, the component has to be taken out of service and replaced. Continued operation is not permitted!

The specified mission time starts at the date of manufacture. The date manufacture is permanently stored in the component and can be read out via the parameter C00206/6 (see also chapter Diagnostics, identification data).

For the STO safety function of the 8400 device series, no special examination is specified. Therefore, the mission time cannot be reset via an examination.

The proof test interval is the period after which a *proof test* to reveal undetected faults must be performed.

The proof test is a periodic examination to reveal hidden hazardous failures in a safety-related system so that - if necessary - a repair can bring the system back to an "as new" state or restore it as close as under practical considerations possible to this state (see DIN EN 61508-4).

## 11 Safety engineering

Acceptance  
Description

### 11.3 Acceptance

#### 11.3.1 Description

The machine manufacturer must check and prove the operability of the safety functions used.

##### Inspector

The machine manufacturer must authorise a person with expertise and knowledge of the safety functions to carry out the test.

##### Test report

The test result of every safety function must be documented and signed by the inspector.



##### Note!

If parameters of the safety functions are changed, the inspector must repeat the test and record the results in the test report.

##### Scope of test

A complete test comprises the following:

- ▶ Documenting the plant including the safety functions:
  - Creating an overview screen of the plant
  - Describing the plant
  - Describing the safety equipment
  - Documenting the safety functions used
- ▶ Checking the function of the safety functions used:
  - "Safe torque off" function, STO
- ▶ Preparing the test report:
  - Documenting the functional test
  - Checking the parameters
  - Signing the test report
- ▶ Preparing the appendix with test records:
  - Protocols from the plant
  - External recording

#### 11.3.2 Periodic inspections

The correct sequence of the safety-oriented functions must be checked in periodic inspections. The risk analysis or applicable regulations determine the time distances between the tests. The inspection interval should not exceed one year.

## **11.4 Basics for safety sensors**

The components used must comply with the control category required for the application.

### **Passive sensors**

Passive sensors are two-channel switching elements with contacts. The connecting cables and the sensor function must be monitored.

The contacts must switch simultaneously (equivalently). Nevertheless, safety functions will be activated as soon as at least one channel is switched.

The switches must be wired according to the closed-circuit principle.

Examples of passive sensors:

- ▶ Door contact switch
- ▶ Emergency stop control units

### **Active sensors**

Active sensors are units with 2-channel semiconductor outputs (OSSD outputs). With the integrated safety system of this device series, test pulses  $< 1$  ms for monitoring the outputs and cables are permissible. The maximally permissible connection capacity of the outputs is to be observed. Active sensors are wired directly to the terminals of the integrated safety system. Monitoring for cross or short circuits must be carried out by the active sensor.

P/M-switching sensors switch the positive and negative cable or the signal and ground wire of a sensor signal.

The outputs must switch simultaneously (equivalently). Nevertheless, safety functions will be activated as soon as at least one channel is switched. Active triggering of only one channel indicates faulty sensors or impermissible wiring.

Examples of active sensors:

- ▶ Lightgrid
- ▶ Laser scanner
- ▶ Control systems



11.5 Operating mode

With the integrated safety system, product key: ...B..., the following safety function can be used:

- ▶ Safe Torque Off (STO)

If requested, the safe disconnection of the drive is achieved through:

- ▶ Directly connected active sensors
- ▶ Passive sensors connected to a safety switching device

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 4 according to EN ISO 13849-1.



**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).

The transmission of the pulse width modulation is safely switched (off) by the safety unit. After this, the power drivers do not generate a rotating field. The motor is safely switched to torqueless operation (STO).

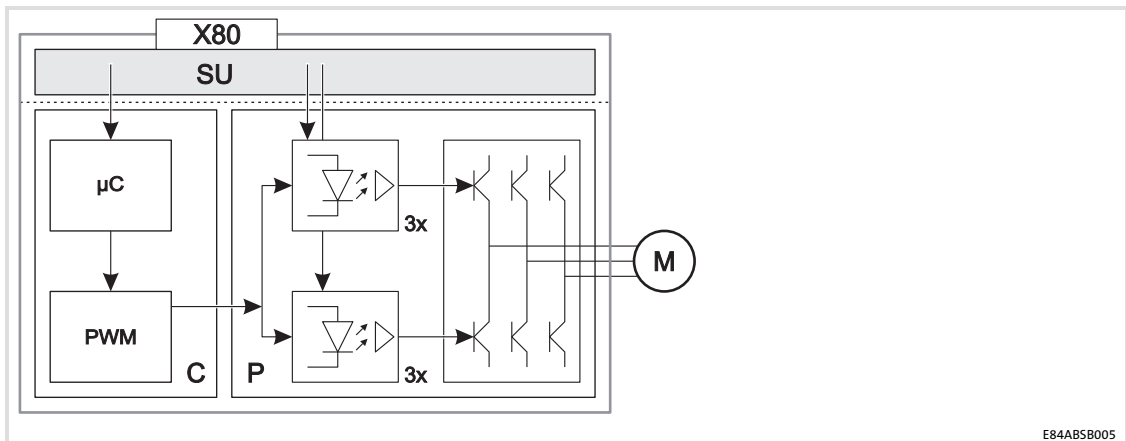


Fig. 11-1 Operating principle of safety unit

SU	Safety unit
X80	Control terminals of safety unit (pluggable terminal strip)
C	Control section
µC	Microcontroller
PWM	Pulse width modulation
P	Power section
M	Motor

### **Safety status**

When the controller is disconnected from the safety system, the standard device signals the "Safe torque off" (STO), "safe torque off" status as follows:

- ▶ Extended status word: C00155 bit 10 = 1
- ▶ Device status: C00137 = 10
- ▶ Process signal: LS\_DriveInterface:bSafeTorqueOff = TRUE

### 11.6 Hardware revision

The integrated safety of the 8400 controllers is implemented with two hardware versions.

The previous hardware ...

- ▶ has no labelling (up to "1B").
- ▶ has to be assigned to the data with the reference to **HW revision: up to 1B.**

The revised hardware ...

- ▶ Is clearly labelled on the side with a sticker, e.g. "HW: 2A".
- ▶ has to be assigned to the data with the reference to **HW revision: from 2A.**
- ▶ is functionally compatible with the previous hardware.
- ▶ comes with changed technical data.
- ▶ Revision 2A has a slightly lower PFH value (compared to the revision up to 1B). Hence, the hardware requires approx. 0.9 % of the maximum PFH value of the total safety chain. For all the other components of the safety chain, only 99.1 % (instead of 100 % so far) of the PFH value is available. Although the PFH value given here is negligible, we recommend a check of the executed calculation of the safety chain and, if required, a correction of the safety-related parameters.

**11.7**      **Technical data**

**Supply**

The inputs and outputs are isolated and designed for a low-voltage supply through a safely separated power supply unit (SELV/PELV) of 24 V DC. P/N switching input signals and test pulses  $\leq 1$  ms are permissible.

Active sensors are directly wired to the X80 terminal strip.

Passive sensors are wired to the X80 terminal strip via a switching device. The switching device must comply with the required control category of the application.

There is no monitoring for short circuits.

### HW revision: Up to 1B - detailed features of the inputs and outputs of the safety system

Terminal	Specification	[Unit]	Min.	Typ.	Max.
SIA, SIB	Low signal	V	-3	0	5
	High signal	V	15	24	30
	Input capacitance at switch-off	nF		4	
	Input delay (tolerated test pulse)	ms			1
	Switch-off time (depending on the controller)	ms	2.5	4	
	Running time	ms		3	
SIA	Input current	mA		100	170
	Input capacitance at switch-on, reduced	μF		20	
SIB	Input current	mA		28	35
	Input capacitance at switch-on, reduced	μF		5	
GI	Ground for SIA/SIB				
240, GO	Supply voltage $U_{240}$ for the output DO1 by a safely separated power supply unit (SELV/PELV)	V	18	24	30
DO1	Low signal	V			0.8
	High signal	V		$U_{240} - 1$ V	
240, GO, DO1	Output current	A			0.7

The function of the safety unit meets the requirements of the following standards:

- ▶ Category 4 and PL e according to EN ISO 13849-1
  - To comply with category 4, the external wiring and the cable monitoring must meet the requirements of category 4.
  - Ensure that short circuits cannot occur in the external wiring.
- ▶ SIL 3 according to IEC 61508
  - The safety unit does not contribute to the probability of failure on demand (PFD) and probability of failure per hour (PFH) of IEC 61508.

**HW revision: From 2A - detailed features of the inputs and outputs of the safety system**

Terminal	Specification	[Unit]	Min.	Typ.	Max.
SIA, SIB	Low signal	V	-3	0	5
	High signal	V	15	24	30
	Input capacitance at switch-off	nF		3	
	Switch-off time (depends on the controller: Size 1 - 3)	ms		6	
	Switch-off time (depends on the controller: From size 4)	ms		4	
	Running time	ms		1	
	Input current	mA	2		15
	Input capacitance at switch-on	nF		100	
	Input delay (tolerated test pulse)	ms			1
	Test pulses permissible at intervals of	ms	10		
	GI	Ground for SIA/SIB			
When the polarity is reversed: No function, no destruction					
240, GO	Supply voltage $U_{240}$ for the output DO1 by a safely separated power supply unit (SELV/PELV)	V	18	24	30
DO1	Low signal	V			0.8
	High signal	V		$U_{240} - 1$ V	
240, GO, DO1	Output current	A			0.7

**Safety-related parameters acc.to IEC 61508-1 to -7 and IEC 62061**

Specification	Value	Comment
Safety Integrity Level	SIL 3	
PFH [1/h]	9.05 E-10	0.9 % of SIL 3
PFD	7.92 E-5	7.9 % of SIL 3 after T = 20 years
Proof test interval	20 years	Mission time

**Safety-related parameters acc. to EN ISO 13849-1**

Specification	Value	Comment
Performance Level	e	
Category	4	
MTTF <sub>d</sub>	High	68619 years
Diagnostic coverage DC	High	99 %

## Truth table

Safe input / channel		Signalling output DO1/DO	Controller	
SIA	SIB		Description of device status	Enable
0	0	1	"Safe torque off" activated	0
0	1	0		0
1	0	0		0
1	1	0	Drive active	1

## Restriction of use

The operation of an integrated safety system is **not** permissible in earthed phase mains.

11.8 Electrical installation

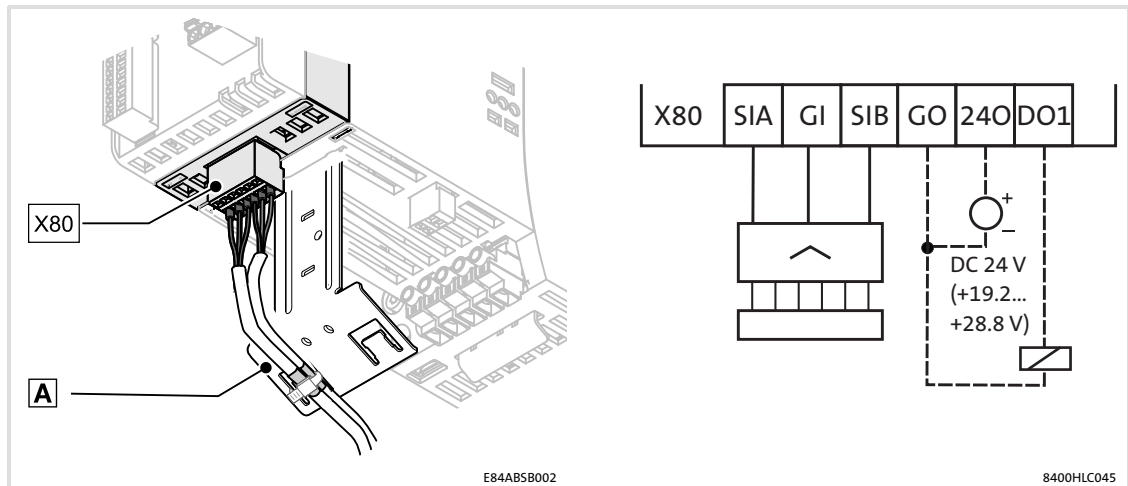


Fig. 11-2 Block diagram - safe torque off (STO)

- |              |  |
|--------------|--|
| X80          | Pluggable terminal strip for the safety unit |
| SIA, SIB, GI | Connections for shutdown paths               |
| 240, DO1, GO | Feedback connections                         |
| A            | Shield connection                            |

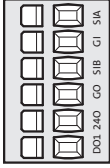


**Note!**

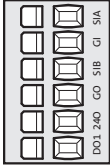
For trouble-free operation of the safety unit, connect the supply cables to the shield sheet (strain relief).



### HW revision: Up to 1B

X80	Labelling	Description	Electrical data
 E84ABS8003	SIA	Safe input, channel A	SIA: $I_{typ} = 100 \text{ mA}$
	GI	GND potential for SIA/SIB	LOW: $-3 \dots 5 \text{ V}$ , HIGH: $15 \dots 30 \text{ V}$
	SIB	Safe input, channel B	SIB: $I_{typ} = 28 \text{ mA}$ Supply through safely separated power supply unit (SELV/PELV)
	GO	GND potential feedback	24 V, max. 0.7 A short-circuit-proof
	24O	24 V voltage supply feedback	LOW-active
	DO1	Non-safe signalling output: "Safe pulse inhibit"	Supply through safely separated power supply unit (SELV/PELV)

### HW revision: From 2A

X80	Labelling	Description	Electrical data
 E84ABS8003	SIA	Safe input, channel A	SIA, SIB: $I_{typ} = 12 \text{ mA}$
	GI	GND potential for SIA/SIB	LOW: $-3 \dots 5 \text{ V}$ , HIGH: $15 \dots 30 \text{ V}$
	SIB	Safe input, channel B	Supply through safely separated power supply unit (SELV/PELV)
	GO	GND potential feedback	24 V, max. 0.7 A short-circuit-proof
	24O	24 V voltage supply feedback	LOW-active
	DO1	Non-safe signalling output: "Safe pulse inhibit"	Supply through safely separated power supply unit (SELV/PELV)

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm <sup>2</sup> ]	[AWG]	[Nm]	[lb-in]
Rigid	0.14 ... 1.5	26 ... 16	Spring terminal	
With wire end ferrule	0.25 ... 0.5	24 ... 20		

## 11.9 Certification

The certification of drive-based safety in the controllers of the 8400 series is based on the following test fundamentals:

- ▶ EN ISO 13849-1  
Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- ▶ EN ISO 13849-2  
Safety of machinery - Safety-related parts of control systems - Part 2: Validation
- ▶ EN 60204-1  
Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- ▶ IEC 61508, Part 1-7  
Functional safety of electrical/electronic/programmable electronic safety-related systems
- ▶ EN 61800-3  
Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
- ▶ EN 61800-5-1  
Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
- ▶ EN 61800-5-2  
Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
- ▶ EN 62061  
Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems



Declarations of conformity and certificates can be found on the internet at: <http://www.Lenze.com> and on the product CD.

## 12 Accessories (overview)



### Note!

You can find additional information on the accessories in the catalogue to this product series.

### 12.1 Overview

Matching accessories for L-force Inverter Drives 8400:

- ▶ Communication modules
  - PROFIBUS E84AYCPM
  - EtherCAT E84AYCET
  - PROFINET E84AYCER
  - INTEBUS E84AYCIB
  - Ethernet POWERLINK E84AYCEC
  - EtherNet/IP E84AYCEO
- ▶ Memory module E84AYM10S
- ▶ USB diagnostic adapter E94AZCUS
  - Connecting cables EWL007x
- ▶ PC system bus adapter EMF21731Bxxx/EMF21771B
- ▶ EZAEBK1001 keypad
- ▶ EZAEBK2001diagnosis terminal
- ▶ RFI filter E84AZESRxxxxxx
- ▶ Brake resistors ERBMxxxRxxxW/ERBPxxxRxxxW/ERBSxxxRxxxW
- ▶ Brake switches E82ZWBRx
- ▶ 24-V power supply units EZVxx00-00x
- ▶ Shield mounting kit (metal cable ties) EZAMBKBM
- ▶ Shield mounting (clips) EZAMBHXM00x
- ▶ Replacement terminals for pluggable terminals
- ▶ Master frequency module EZAeva001/EZAeva002

## 12.2 Mains chokes

Within the scope of the product maintenance, the assignment of the inverters/mains chokes has been revised. Thus, a uniform assignment is available for all inverters. Thus, the selection of the correct components is easier.

As a migration help for assigning the old and new mains chokes, further information has been provided in the "Product change of mains chokes" document.

### Technical data

	UL/CSA Type/Cat. No.	L [mH]	I <sub>N</sub> [A]	U <sub>N</sub> [V]
ELN1-0900H005	EI 66/34.7	9.0	5.0	600
ELN1-0500H009	EI 66/34.7	5.0	9.0	
ELN1-0250H018	EI 96/35.7	2.5	18	
EZAELN3002B153	3UI 39/14	15.0	2.0	
EZAELN3004B742	3UI 48/17	7.40	4.0	
EZAELN3006B492	3UI 48/26	4.90	6.0	
EZAELN3008B372	3UI 60/21	3.70	8.0	
EZAELN3010B292	3UI 60/21	2.90	10.0	
EZAELN3016B182	3UI 60/31	1.80	16.0	
EZAELN3020B152	3UI 75/26	1.50	20.0	
EZAELN3025B122	3UI 75/41	1.18	25.0	
EZAELN3030B982	3UI 75/41	0.98	30.0	
EZAELN3035B841	3UI 75/41	0.84	35.0	600
EZAELN3045B651	3UI 90/41	0.65	45.0	
EZAELN3050B591	3UI 90/41	0.59	50.0	
EZAELN3063B471	3UI 90/51	0.47	63.0	
EZAELN3080B371	3UI 105/45	0.37	80.0	
EZAELN3090B331	3UI 114/40	0.33	90.0	
EZAELN3100B301	3UI 114/64	0.30	100	

## Assignment

Assignment Type	Mains choke			
	For operation with rated power		For operation with increased power	
	Required	Type	Required	Type
E84AVxxx2512	No	ELN1-0900H005	No	ELN1-0900H005
E84AVxxx3712	No		Yes	
E84AVxxx5512	No	ELN1-0500H009	No	ELN1-0500H009
E84AVxxx7512	No		Yes	
E84AVxxx1122	No	ELN1-0250H018	No	ELN1-0250H018
E84AVxxx1522	No		Yes	
E84AVxxx2222	No		-	
E84AVxxx3714	No	EZAELN3002B153	No	EZAELN3002B153
E84AVxxx5514	No	EZAELN3004B742	No	EZAELN3004B742
E84AVxxx7514	No	EZAELN3004B742	Yes	EZAELN3004B742
E84AVxxx1124	No	EZAELN3004B742	No	EZAELN3004B742
E84AVxxx1524	No	EZAELN3006B492	No	EZAELN3006B492
E84AVxxx2224	No	EZAELN3006B492	Yes	EZAELN3008B372
E84AVxxx3024xx5	No	EZAELN3008B372	Yes	EZAELN3010B292
E84AVxxx3024xx0	No	EZAELN3008B372	No	EZAELN3010B292
E84AVxxx4024	No	EZAELN3010B292	No	EZAELN3016B182
E84AVxxx5524	No	EZAELN3016B182	Yes	EZAELN3020B152
E84AVxxx7524	No	EZAELN3020B152	No	EZAELN3025B122
E84AVxxx1134	No	EZAELN3025B122	Yes	EZAELN3030B982
E84AVxxx1534	Yes	EZAELN3035B841	-	-
E84AVxxx1834	No	EZAELN3045B651	Yes	EZAELN3045B651
E84AVxxx2234	Yes	EZAELN3050B591	Yes	EZAELN3063B471
E84AVxxx3034	Yes	EZAELN3063B471	Yes	EZAELN3080B371
E84AVxxx3734	Yes	EZAELN3080B371	Yes	EZAELN3090B331
E84AVxxx4534	Yes	EZAELN3090B331	Yes	EZAELN3100B301

12.3 RFI filter/mains filter

Basis of the data			
Mains	Voltage	Voltage range	Frequency range
	$V_{LN}$ [V]	$V_{LN}$ [V]	f [Hz]
1/PE AC	230	180 - 0 % ... 264 + 0 %	45 ... 65
3/PE AC	400/500	320 - 0 % ... 550 + 0 %	45 ... 65

Type	Voltage [V]	Frequency [Hz]	Current		Number of phases
			① max. +45 °C [A]	① max. +55 °C [A]	
E84AZESR3712xx	230	50/60	5.0	3.5	1
E84AZESR7512xx	230	50/60	9.0	6.5	1
E84AZESR2222xx	230	50/60	22	16.5	1
E84AZESR7514xx	400	50/60	3.3	2.4	3
E84AZESR2224xx	400	50/60	7.3	5.4	3
E84AZESR3024xx	400	50/60	9.8	5.4	3
E84AZESR5524xx	400	50/60	18	13.5	3
E84AZESR1534xx	400	50/60	29	21.8	3
E84AZESR1834LD	400	50/60	50.4	37.8	3
E84AZESM2234LD	400	50/60	42.0	31.8	3
E84AZESM2234LDN001	400	50/60	50.8	38.1	3
E84AZESM3034LD	400	50/60	55.0	41.3	3
E84AZESM3734LD	400	50/60	68.0	51.0	3
E84AZESM4534LD	400	50/60	80.0	60.0	3
E84AZESM4534LDN001	400	50/60	96.0	72.0	3

① Temperature in the control cabinet

E84AZESR ... RFI filter  
 E84AZESM... Mains filter (RFI filter with mains choke,  
 additional mains choke of type ELN3 is not required)

## For operation with rated power

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx2512	E84AZESR3712SD	E84AZESR3712LD	E84AZESR3712LL
E84AVxxx3712			
E84AVxxx5512	E84AZESR7512SD	E84AZESR7512LD	E84AZESR7512LL
E84AVxxx7512			
E84AVxxx1122	E84AZESR2222SD	E84AZESR2222LD	E84AZESR2222LL
E84AVxxx1522			
E84AVxxx2222			
E84AVxxx3714	E84AZESR7514SD	E84AZESR7514LD	-
E84AVxxx5514			
E84AVxxx7514			
E84AVxxx1124	E84AZESR2224SD	E84AZESR2224LD	-
E84AVxxx1524			
E84AVxxx2224			
E84AVxxx3024xxS	E84AZESR3024SD	E84AZESR3024LD	-
E84AVxxx3024xx0	E84AZESR5524SD	E84AZESR5524LD	-
E84AVxxx4024			
E84AVxxx5524			
E84AVxxx7524	E84AZESR1534SD	E84AZESR1534LD	-
E84AVxxx1134			
E84AVxxx1534			
E84AVxxx1834	-	E84AZESR1834LD	-
E84AVxxx2234	-	E84AZESM2234LD	-
E84AVxxx3034	-	E84AZESM3034LD	-
E84AVxxx3734	-	E84AZESM3734LD	-
E84AVxxx4534	-	E84AZESM4534LD	-

## For operation with increased power

Assignment			
Type	RFI filter		
	SD	LD	LL
E84AVxxx2512	See "Operation with rated power"		
...			
E84AVxxx1534			
E84AVxxx1834	-	E84AZESM2234LD	-
E84AVxxx2234	-	E84AZESM2234LDN001	-
E84AVxxx3034	-	E84AZESM3734LD	-
E84AVxxx3734	-	E84AZESM4534LD	-
E84AVxxx4534	-	E84AZESM4534LDN001	-

E84AZESR ...  
E84AZESM...

RFI filter  
Mains filter (RFI filter with mains choke,  
additional mains choke of type ELN3 is not required)

12.4 Sinusoidal filters

For operation with rated power

Controller	Sinusoidal filter	Voltage range	Switching frequency	Inductance	Mass
		U [V]	f <sub>ch</sub> [kHz]	L [mH]	m [kg]
E84AVxxx3714	EZS3-004A200	0 ... 550 V AC	4 ... 8	11.0	4.0
E84AVxxx5514					
E84AVxxx7514					
E84AVxxx1124					
E84AVxxx1524	EZS3-010A200	0 ... 550 V AC	4 ... 8	5.1	5.5
E84AVxxx2224					
E84AVxxx3024xxS					
E84AVxxx3024xx0					
E84AVxxx4024	EZS3-017A200	0 ... 550 V AC	4 ... 8	3.1	8.5
E84AVxxx5524					
E84AVxxx7524	EZS3-024A200	0 ... 550 V AC	4 ... 8	2.5	14.5
E84AVxxx1134	EZS3-032A200			2.0	19.0
E84AVxxx1534	EZS3-037A200			1.7	21.0
E84AVxxx1834	EZS3-048A200			0 ... 550 V AC	4 ... 8
E84AVxxx2234	EZS3-061A200	1.0	33.5		
E84AVxxx3034	EZS3-072A200	0 ... 550 V AC	4 ... 8	0.95	37.0
E84AVxxx3734	EZS3-090A200	0 ... 550 V AC	4 ... 8	0.8	53.5
E84AVxxx4534	EZS3-115A200			0.7	66.0

For operation with increased power

Controller	Sinusoidal filter	Voltage range	Switching frequency	Inductance	Mass
		U [V]	f <sub>ch</sub> [kHz]	L [mH]	m [kg]
E84AVxxx3714	EZS3-010A200	0 ... 550 V AC	4	5.1	5.5
E84AVxxx5514					
E84AVxxx7514					
E84AVxxx1124					
E84AVxxx1524					
E84AVxxx2224					
E84AVxxx3024xxS	EZS3-017A200	0 ... 550 V AC	4	3.1	8.5
E84AVxxx3024xx0					
E84AVxxx4024	EZS3-024A200	0 ... 550 V AC	4	2.5	14.5
E84AVxxx5524					
E84AVxxx7524	EZS3-024A200	0 ... 550 V AC	4	2.5	14.5
E84AVxxx1134	EZS3-037A200	0 ... 550 V AC	4	1.7	21.0
E84AVxxx1534	-	-	-	-	-
E84AVxxx1834	EZS3-061A200	0 ... 550 V AC	4	1.0	33.5
E84AVxxx2234					
E84AVxxx3034	EZS3-072A200	0 ... 550 V AC	4	0.95	37.0
E84AVxxx3734	EZS3-090A200	0 ... 550 V AC	4	0.8	53.5
E84AVxxx4534	EZS3-115A200			0.7	66.0



## 12.5 External brake resistors

Product key		Rated data - brake resistor		
Controller	Brake resistor	Resistor R [ $\Omega$ ]	Continuous power P [W]	Heat quantity Q <sub>B</sub> [kWs]
E84AVxxx2512	ERBM180R050W	180	50	7.5
E84AVxxx3712				
E84AVxxx5512	ERBM100R100W	100	100	15
E84AVxxx7512				
E84AVxxx1122	ERBP033R200W	33	200	30
E84AVxxx1522	ERBP033R200W		300	45
E84AVxxx2222	ERBP033R300W			
E84AVxxx3714	ERBM390R100W	390	100	15
E84AVxxx5514	ERBM390R100W			
E84AVxxx7514				
E84AVxxx1124	ERBP180R200W	180	200	30
E84AVxxx1524	ERBP180R200W		300	45
E84AVxxx2224	ERBP180R300W			
E84AVxxx3024xx5	ERBP082R200W	82	200	30
	ERBS082R780W	82	780	117
E84AVxxx3024xx0	ERBP082R200W	82	200	30
	ERBS082R780W	82	780	117
E84AVxxx4024	ERBS047R400W	47	400	60
E84AVxxx5524	ERBS047R800W		800	120
E84AVxxx7524	ERBP027R200W	27	200	30
	ERBS027R600W		600	90
	E84AVxxx1134		ERBS027R01K2	1200
E84AVxxx1534	ERBS018R800W	18	800	120
	ERBS018R01K4		1400	210
	ERBS018R02K8		2800	420
	ERBD020R03K0RB	20	3000	450
E84AVxxx1834	ERBS015R800W	15	800	120
	ERBS015R01K2		1200	180
	ERBS015R02K4		2400	420
	ERBG015R06K2		6200	930
E84AVxxx3034	ERBG075D01K9	7.5	1900	285
E84AVxxx3734				
E84AVxxx4534				

## 12.6 Memory module

### 12.6.1 E84AYM10S

Name: Memory module

Type designation: E84AYM10S (/M = 5 pcs/VPE)

Slot: MMI

The parameters of the controller are stored in the memory module.

The pluggable memory module enables a quick parameter set transfer to an identical controller. Possible reasons for a parameter set transfer are:

- ▶ Duplication of similar applications in a series of identical drives.
- ▶ Restorage of an application after device replacement.

The required steps for a parameter set transfer are described in the software manual.

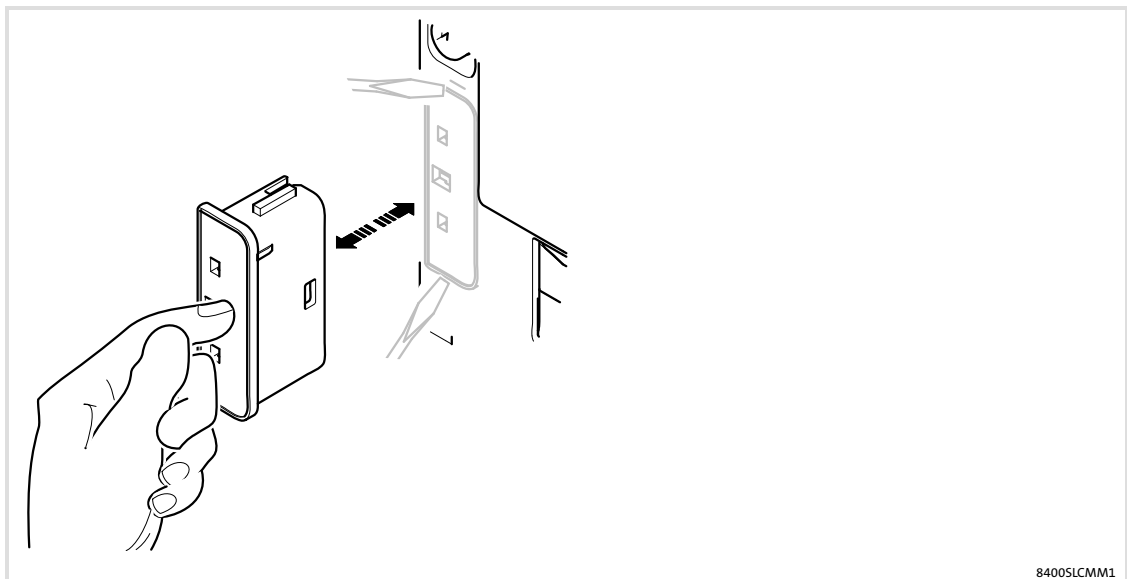
In order to remove the memory module, use a suitable screwdriver to lever the module out at the upper and lower groove. In order to plug in the module, insert it into the slot and push it with light pressure until end position is reached.



#### 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.



### 12.7 Communication modules

The communication modules for the Inverter Drives 8400 serve to link the control system and the Inverter Drives 8400 controllers. The table below contains an overview of the available communication modules and their features.

Communication modules for Inverter Drives 8400					
Feature	PROFIBUS	PROFINET	EtherCAT	POWERLINK	INTERBUS
Type designation	E84AYCPM	E84AYCER	E84AYCET	E84AYCEC	E84AYCIB
Communication profile	PROFIBUS-DP	PROFINET	EtherCAT	Ethernet POWERLINK	INTERBUS
Node type	Slave	Slave	Slave	Slave	Slave
Slot	MCI	MCI	MCI	MCI	MCI
StateLine C	✓	✓	✓	✓	✓
HighLine C	✓	✓	✓	✓	✓
TopLine C	✓	✓	✓	✓	✓
Status display	5 LEDs	9 LEDs	9 LEDs	9 LEDs	5 LEDs
Address switch	✓	-	-	✓	-
Connection	Sub-D	2 x RJ45	2 x RJ45	2 x RJ45	2 x Sub-D
External voltage supply	-	24 V <sub>DC</sub>	24 V <sub>DC</sub>	24 V <sub>DC</sub>	24 V <sub>DC</sub>
Bus electrically isolated	✓	✓	✓	✓	✓



#### Communication manuals

Further information on the communication modules is provided in the respective communication manuals.

The PDF files are provided on the Internet in the download area at <http://www.Lenze.com>

## 12.8 Keypad

The X400 keypad allows you to easily carry out local parameter setting and diagnostics. The data can be quickly accessed via structured menus and a plain text display. The keypad is plugged into the X6 diagnostic interface (DIAG) at the front of the controller.

**Name: Keypad X400**

Type designation: EZAEBK1001

Slot: X6 (DIAG)

**Features**

- ▶ Menu-driven diagnostics and parameter setting
- ▶ Backlighting graphic display for representing information
- ▶ 4 navigation keys, 2 context-sensitive keys
- ▶ Adjustable RUN/STOP function
- ▶ Hot-plug capable
- ▶ Enclosure IP20
- ▶ Suitable for Inverter Drives 8400 StateLine C, HighLine C, and TopLine C

**Name: Hand terminal**

Type designation: EZAEBK200x

Slot: X6 (DIAG)

**Features**

- ▶ See keypad
- ▶ Robust housing
- ▶ Suitable for installation into the control cabinet door
- ▶ 2.5 m connecting cable, exchangeable
- ▶ Enclosure IP65 is possible for installation into the control cabinet

## 12 Accessories (overview)

### Power supply units

#### 12.9 Power supply units

External power supply units are available for supplying the control electronic with an external 24-V supply, if required.

Advantages of an external supply: Parameter setting and diagnostics of the controller with a deenergised mains input.

Type	Mains		Secondary	
	$V_{LN}$ [V]	$I_{LN}$ [A]	$V_{DC}$ [V]	$I_{DC}$ [A]
EZV1200-000	230 (1/N/PE AC)	0.8	24 (22.5 ... 28.5)	5
EZV2400-000		1.2		10
EZV4800-000		2.3		20
EZV1200-001	400 (3/PE AC)	0.3		5
EZV2400-001		0.6		10
EZV4800-001		1.0		20

12.10 Terminals (replacement)

If required, the pluggable terminals are separately available, e.g. to replace lost or damaged terminals. Determine the type designation of the terminals for each connection as follows, depending on the device and version. Each packaging unit includes 5 terminals.

Assignment	Replacement terminals for connection				
	Mains X100	Motor X105	Relay X101	PTC X106	
E84AVxxx2512 E84AVxxx3712	E84AZEVS001X100	E84AZEVS010X105	E84AZEVS020X101	E84AZEVS030X106	
E84AVxxx5512 E84AVxxx7512					
E84AVxxx1122 E84AVxxx1522 E84AVxxx2222	E84AZEVS002X100				
E84AVxxx3714 E84AVxxx5514 E84AVxxx7514	E84AZEVS003X100				
E84AVxxx1124 E84AVxxx1524 E84AVxxx2224 E84AVxxx3024xxS					
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524					E84AZEVS004X100
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	E84AZEVS005X100				E84AZEVS011X105
E84AVxxx1834 E84AVxxx2234	-				-
E84AVxxx3034 E84AVxxx3734 E84AVxxx4534	-				-

Assignment	Replacement terminals for connection			
	CAN X1	Analog I/O X3	Digital Out X4	Digital In X5
E84AVSCxxxxx	E84AZEVS040X001	E84AZEVS050X003	E84AZEVS050X004	-
E84AVHCxxxxx		E84AZEVS060X003	E84AZEVS060X004	E84AZEVS060X005
E84AVTCxxxxx				

Assignment	Replacement terminals for connection			
	Axis bus X10	Brake X107		
E84AVSCxxxxx	-	-		
E84AVHCxxxxx	-	E84AZEVS060X107		
E84AVTCxxxxx	E84AZEVS060X010			

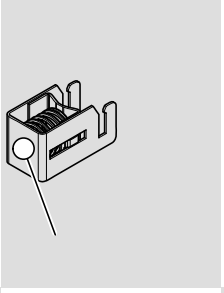
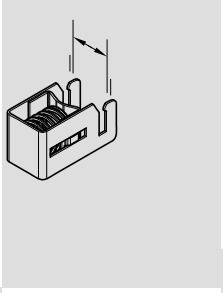
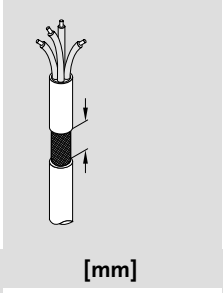
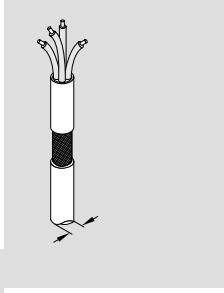
Assignment	Replacement terminals for connection			
Type	Safety X80			
E84AVxxxxxxxSBx	E84AZEVS070X080			
E84AVxxxxxxxVBx				

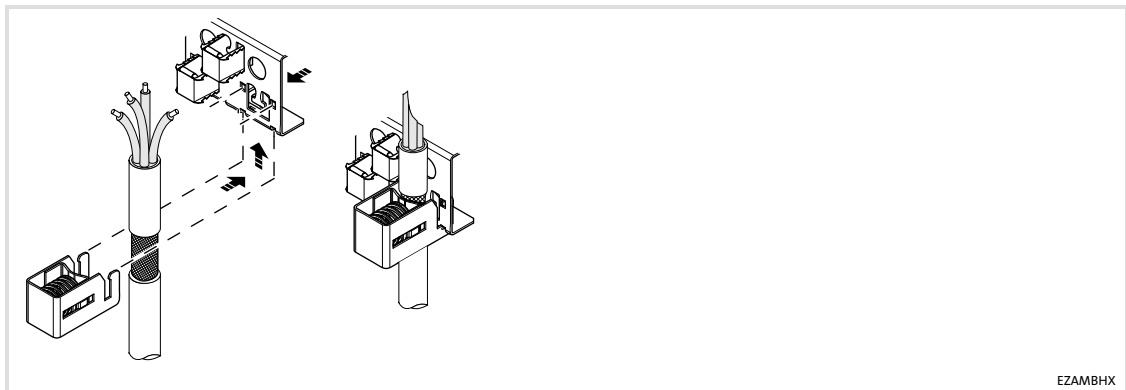
12.11 EMC accessories

Matched accessories are available for an easy EMC-compliant installation and optimum shield connection. Select available accessories from the list below, depending on the device. Each packaging unit includes 10 or 50 pieces.

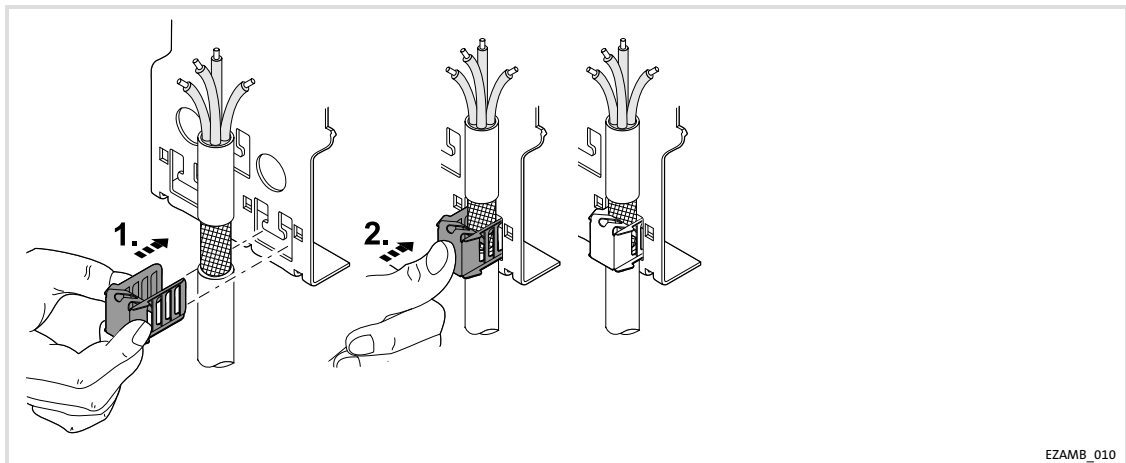
Assignment		Shield sheet for	
Type	Device size	Motor connection	Control terminals
E84AVxxx2512 E84AVxxx3712	GG1		
E84AVxxx551x E84AVxxx751x E84AVxxx3714	GG2	EZAMBHXM006 EZAMBHXM007 EZAMBKBM	
E84AVxxx112x E84AVxxx152x E84AVxxx222x E84AVxxx3024xx5	GG3		
E84AVxxx3024xx0 E84AVxxx4024 E84AVxxx5524	GG4	EZAMBHXM003 EZAMBHXM004	EZAMBHXM007 EZAMBKBM
E84AVxxx7524 E84AVxxx1134 E84AVxxx1534	GG5		
E84AVxxx1834 E84AVxxx2234	GG6	EZAMBHXM003 EZAMBHXM004 EZAMBHXM005	
E84AVxxx3034 E84AVxxx3734 E84AVxxx4534	GG7	EZAMBHXM004 EZAMBHXM005	

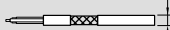


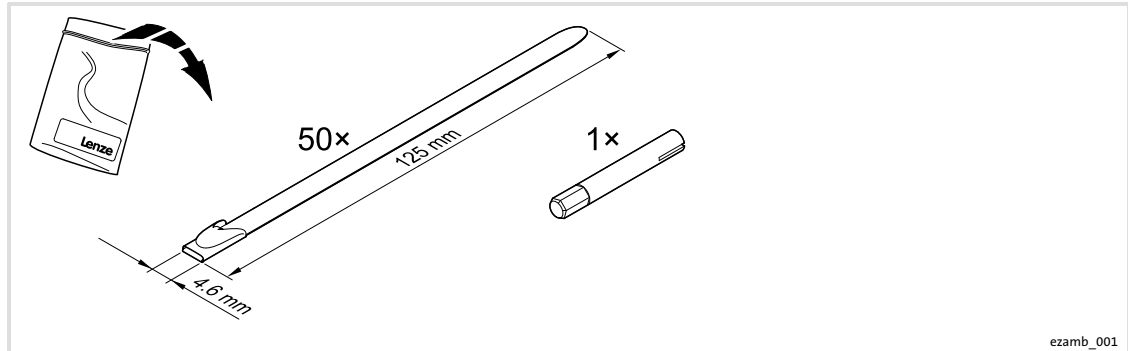
			
EZAMBHXM006 (< E94AZIS003)	2	18	20
EZAMBHXM003 (< E94AZIS007)	3	19	30
EZAMBHXM004 (< E94AZIS024)	4	27	30
EZAMBHXM005	5	37	35



	
EZAMBHXM007	20 mm
	4 ... 10 mm



		
EZAMBKBM	> 10 mm	8 ... 30 mm



**12.12 Accessories for applications with digital frequency**

For synchronising synchronous drives via digital frequency (8400 TopLine, encoder connection X8), the following accessories can be used:

- ▶ Digital frequency distributor EZA-EVA001 (master/slave rail structure)
- ▶ Digital frequency distributor EZA-EVA002 (master/slave cascade structure)
- ▶ Digital frequency cables EYD0021AxxxxS10S09 (with 8400 device series)
- ▶ Digital frequency cables EYD0017Axxxx... (with further device series)

For more information, please get in touch with your Lenze contact person.

## 13 Appendix

### 13.1 Total index

#### A

##### Accessories, 126

- External brake resistor, 89

##### Analog inputs, 80, 83

##### Analog inputs and outputs, 62, 69

##### Analog outputs, 80, 83

##### Application as directed, 111

##### Application, as directed, 111

##### Assembly

- standard installation, 91, 114, 140
- standard technique, 92, 114, 141

##### Axis bus

- CAN, 86, 78
- Sync/State, 86, 78

#### B

##### Baud rate, System bus (CAN). *Siehe* Baud rate

##### Brake resistor, 93

- Selection, 92
- Wiring, 95

##### Braking, 88

##### Braking operation, 88

- DC injection brake DCB, 88
- With external brake resistor, 89
- without additional measures, 88

##### Bus cable length, 55

#### C

##### Cable

- For control connections, 9
- for the motor connection, 8

##### Cable cross-section, 56

##### Cable specification, 53

##### Cables

- cross-sections, 40, 47, 54, 58, 62, 67
- fuses, 40, 47, 54, 58, 62, 67

##### "Cold Plate", requirements for the cooler, 105, 131, 150

##### Commissioning, 80

- analog inputs and outputs, 62, 69
- before initial switch-on, 80

##### Commissioning steps, 84, 86

##### Communication modules, 134

##### Compensation equipment, Interaction with, 161

##### Configuration, Display functions, 105

##### Contactors, in the motor cable, 19

##### Control cable, 9

##### Control terminals, 79, 82, 48, 61, 67

- TopLine C, 86, 76

#### D

##### DC bus, connection to the, 34, 44

##### DC supply, 7

##### DC-bus operation, 30, 104

- Conditions, 104
- Several drives, 104

##### Definition of notes used, 12

##### Definitions, Terms, 11

##### Device protection, 19, 48, 133

##### Diagnostics, 60, 105

##### Digital inputs, 81, 84, 65, 72

- StateLine C, connection of an HTL incremental encoder, 66, 74

##### Digital outputs, 81, 84, 65, 72

##### Display

- Operating status, 105
- operating status, 105

##### Display functions, 105

##### Disposal, 15

##### Drive behaviour, Influence of the motor cable length, 161

#### E

##### Electrical installation, 155, 123

##### EMC

- Accessories, 139
- what to do in case of interferences, 14

**EN 61000-3-2, 33**

**Encoder, 77**

## F

**Fuses, 40, 47, 54, 58, 62, 67**

- operation with rated power, 400 V (UL), 40, 41, 47, 48, 54, 55, 58, 62, 63, 67, 68

## H

**Harmonic currents, Limitation acc. to EN 61000-3-2, 33**

**Hazard analysis, 112**

## I

**Identification, 27**

**Immunity to interference, 33**

**Installation**

- electrical, 123  
 - Mechanical, Cold plate technique, 105, 131, 150  
 - mechanical  
   filter with standard technology, 96, 119, 145  
   mounting variant, 98, 121, 148  
   standard technique, 92, 114, 141

**Installation, electrical, 155**

**Installation, mechanical, 90**

**Interaction with compensation equipment, 161**

**Interference emission, 33**

**Interferences, eliminating EMC interferences, 14**

**IT system, 22, 32, 42**

## K

**Keypad, 135**

## L

**LED display, 105**

**Legal regulations, 111**

**Light-emitting diodes, 105**

## M

**Mains choke, assignment to standard device, 38, 43, 50, 57, 60, 65**

**Mains chokes, 127**

**Mains connection, 7**

**Mains current**

- with external mains choke, 38, 42, 49, 56, 59, 64  
 - without external mains choke, 38, 42, 49, 56, 59, 64

**Mains filter, 129**

**Mechanical installation, 90**

- "cold plate" technology, requirements for the cooler, 105, 131, 150

- Cold plate technique, 105, 131, 150

**Memory module, 133**

- E84AYM10S, 133

**Mission time, 113**

**Motor cable, 8**

- capacitance per unit length, 31

- contactors in the, 19

- Influence of the length, 161

- requirements, 31

**Motor connection, 23**

**Motor end, switching on the, 19**

**Motor power, typical, 38, 42, 49, 56, 59, 64**

**Motor protection, 19**

**Mounting, mounting variant, 98, 121, 148**

**mounting, filter with standard technology, 96, 119, 145**

**Multi-encoder, 87**

## N

**Nameplate, 27**

**Notes, definition, 12**

## O

**Operating status**

- Display, 105

- display, 105

**Operation, Overcurrent, 73**

**Output currents, Switching frequency-dependent, 39, 45, 52, 57, 61, 66**

**Output power, 38, 42, 49, 56, 59, 64**

**output voltage, reduced, 36**

**output voltage, 36**

**Overspeeds, 19**

**Overview**

- Accessories, 126

- control terminals, 25

- standard devices, 22

- terminals, 75

## P

**Parameter set transfer, 19**

**Product description, 20**

**Proof test interval, 113**

Protection of persons, 19

## Q

**Quick commissioning**

- with keypad control, 84
- with terminal control, 86

## R

**Rated data, 99**

- Operation with increased power
  - 230 V mains, 56
  - 400 V mains, 59
  - 500 V mains, 64

**Rating, Brake resistors, 93**

**Replacement, Terminals, 137**

**Requirements, motor cable, 31**

**Residual hazards, 19, 112**

**Resolver, 89, 76**

**RFI filter, 129**

**Risk analysis, 112**

## S

**Safety, safety engineering, 110**

**Safety engineering, 110**

- Certification, 125

**Safety functions, safety instructions, during operation, 112**

**Safety instructions, 13**

- definition, 12
- during operation, 112
- layout, 12

**Sensors, basics, 115**

**Shield and connect cables, 51**

**Specification of the bus cable, 53**

**State bus, Axis bus, 86, 78**

**Strip cables, 20, 30, 40, 50**

**Supply voltage, 24 V external, 79, 82, 61, 67**

**Switch-on, check before initial switch-on, 80**

**Switching on the motor side, 19**

**System bus (CAN), Baud rate, 55, 56**

**System bus (CANopen), 52**

## T

**Technical data, 29, 119**

- Operation with increased power
  - 230 V mains, 56
  - 400 V mains, 59
  - 500 V mains, 64

**Terminals, 75**

**Terms, definitions, 11**

**Total index, 143**

**Type code, finding, 27**

## V

**Validity, documentation, 8**

## W

**Wiring**

- Brake resistor, 95
- in the control cabinet, 10
- outside of the control cabinet, 12



© 05/2019

Lenze Drives GmbH  
Postfach 10 13 52, 31763 Hameln  
Breslauer Straße 3, 32699 Extertal  
GERMANY  
HR Lemgo B 6478



+49 5154 82-0



+49 5154 82-2800



sales.de@lenze.com



www.lenze.com

Service

Lenze Service GmbH  
Breslauer Straße 3, D-32699 Extertal

Germany



008000 2446877 (24 h helpline)



+49 5154 82-1112



service.de@lenze.com

EDS84ASC552 ■ 13564879 ■ EN ■ 11.0 ■ TD15

10 9 8 7 6 5 4 3 2 1