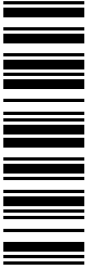


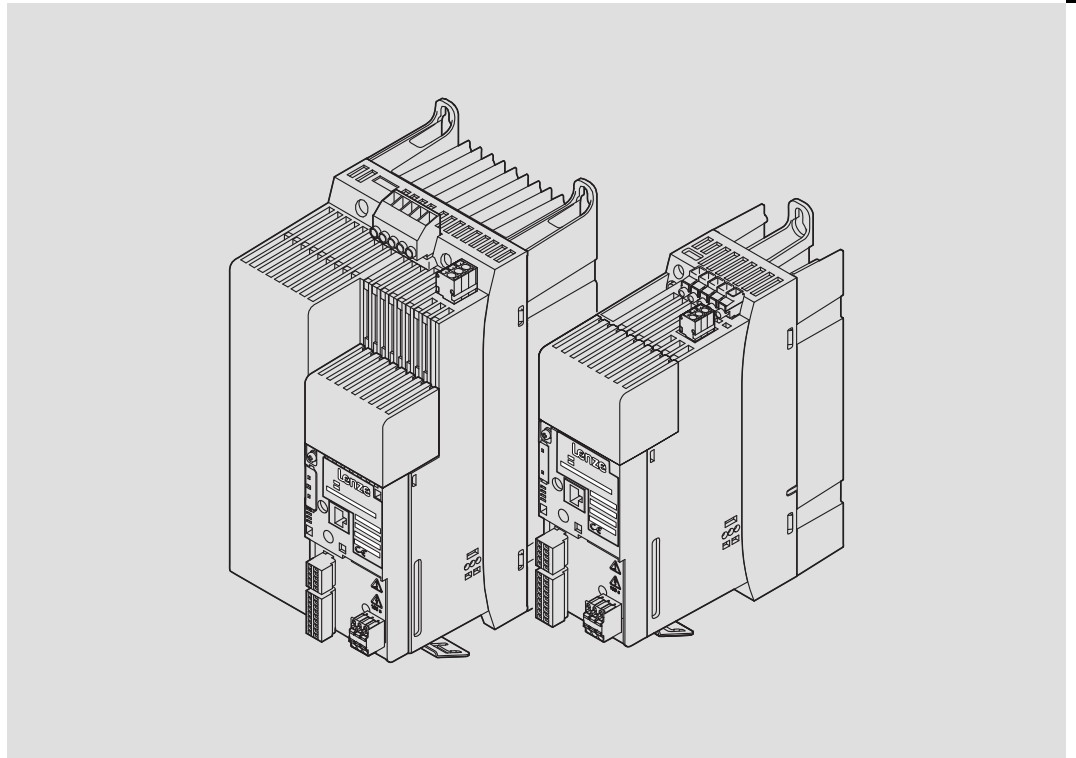
# L-force *Drives*



Translation **Hardware Manual**

## 8400

0.25 ... 45 kW



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

**Frequency inverter 8400**



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## 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 under [www.lenze.com](http://www.lenze.com)

## 1.1 Document history

| Material number | Version |         |      | Description                                                                                                                                          |
|-----------------|---------|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13481094        | 10.0    | 01/2015 | TD15 | complemented: Conformity EAC<br>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<br>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)<br>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                                                                                                                                        |



## 1.2 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.<br>For instance: 1234.56 |
|-------------------|-------|-----------------------------------------------------------------|

### Warnings

|             |                                                                                   |                             |
|-------------|-----------------------------------------------------------------------------------|-----------------------------|
| UL warnings |  | Given in English and French |
| UR warnings |  |                             |

### Text

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

### Icons

|                         |                                                                                   |                                                                                                                                                                                                    |
|-------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Page reference          |  | Reference to another page with additional information<br>For instance:  16 = see page 16                          |
| Documentation reference |  | Reference to another documentation with additional information<br>For example:  EDKxxx = see documentation EDKxxx |

### 1.3 Terms and abbreviations used

| Term            | Meaning                                                                                                                                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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> |
| Abbreviation    | Meaning                                                                                                                                                                                                                                             |
| 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<br>Former designation: safe standstill                                                                                                                                                                                              |

## 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><br>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><br>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><br>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                 |
| <b>Reference to another documentation</b> |                                                |

#### 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-authorised 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 (e.g. VBG 4).

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

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 lowvoltage machines, ensure a dry, dustfree and lowvibration ( $v_{\text{eff}} \leq 0.2 \text{ mm/s}$ ) 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 bolt 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 productspecific 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.

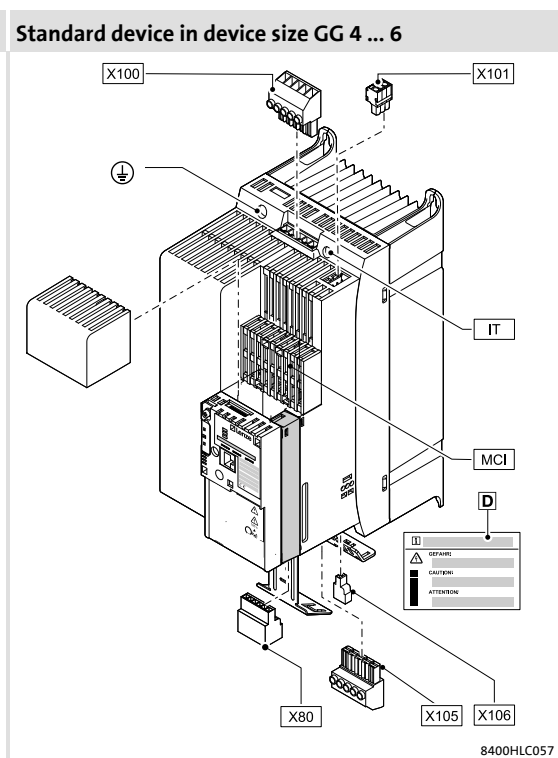
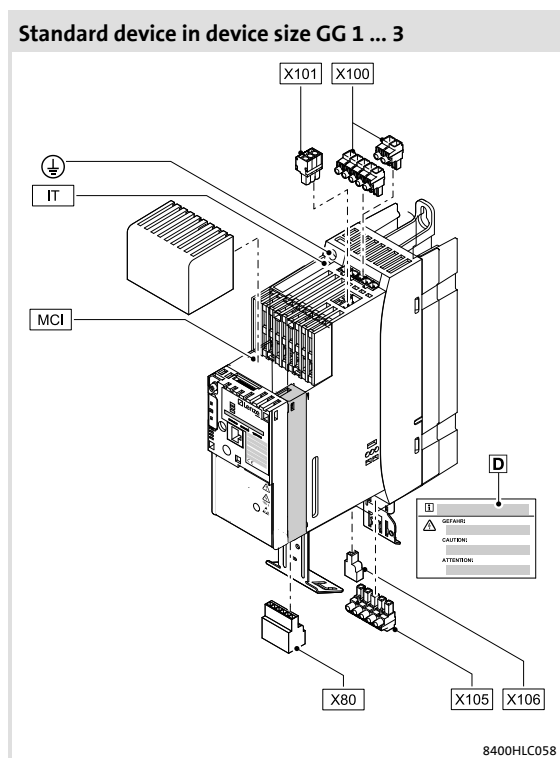
## 3 Product description

### 3.1 Device features

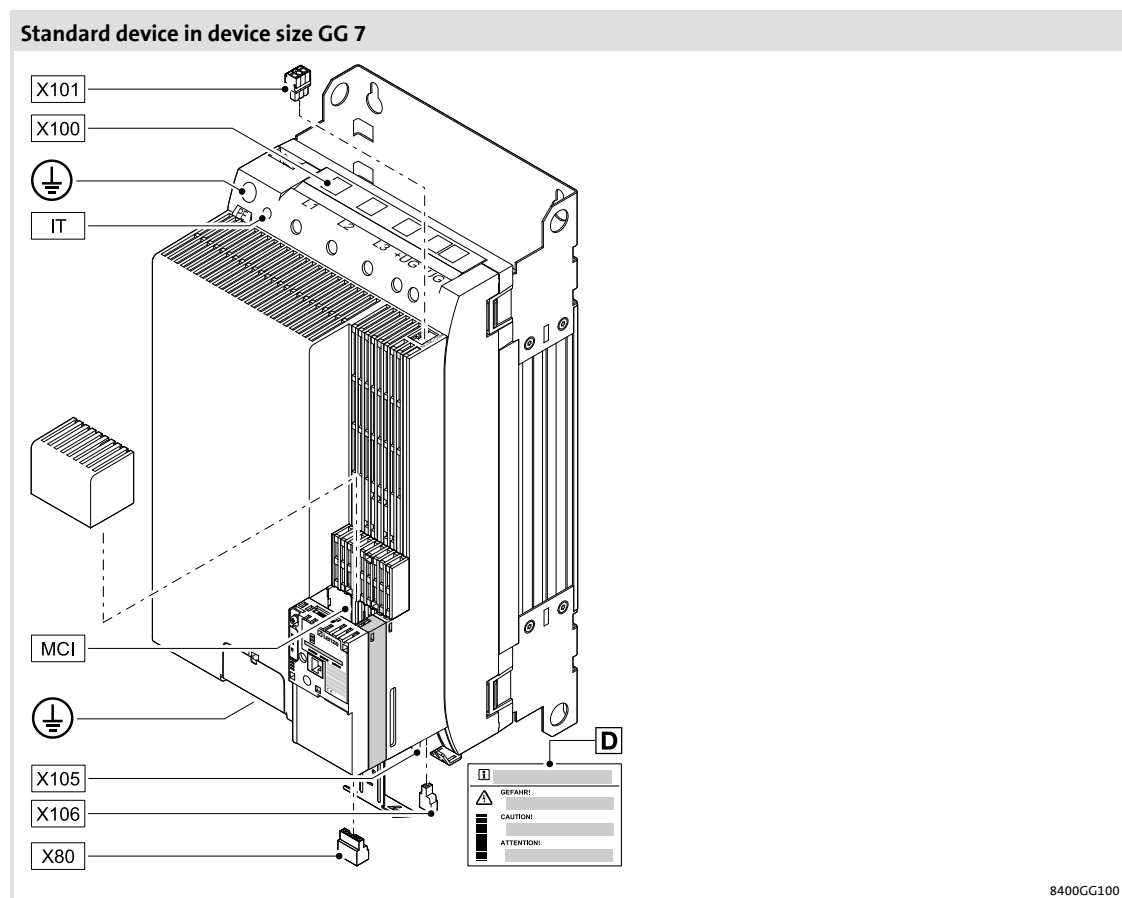
| Features                                                                                                         | Version         |                    |                    |
|------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|--------------------|
|                                                                                                                  | 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<br>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 | -               | ✓                  | ✓                  |

#### 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 |



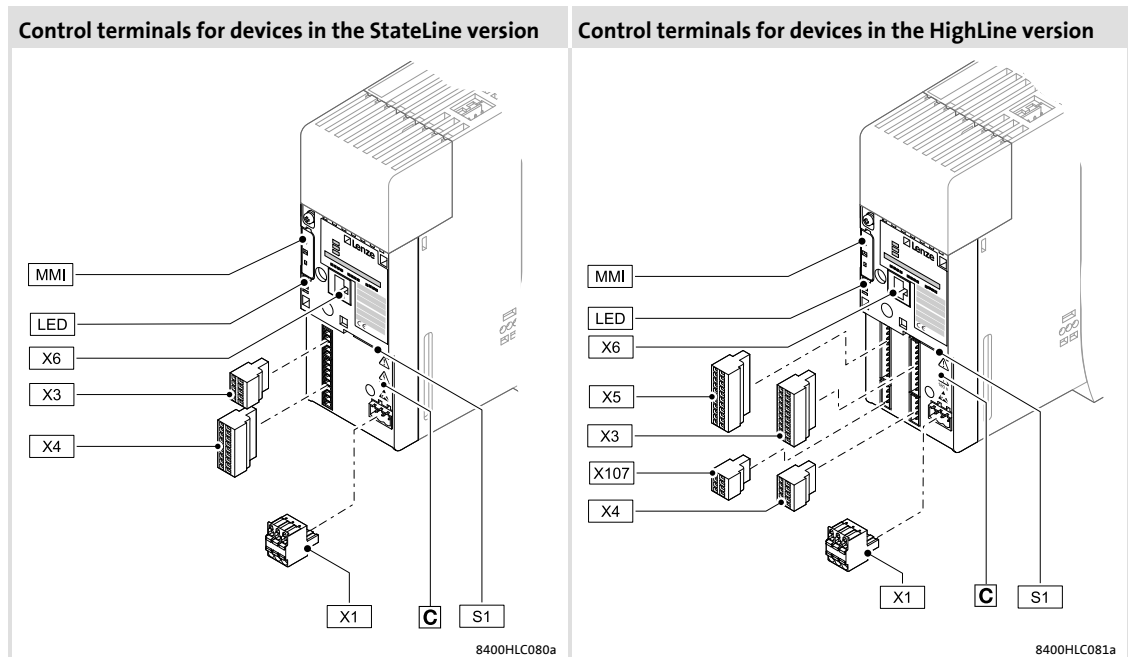
| Connection |                                                                                                                                  | Information |       |
|------------|----------------------------------------------------------------------------------------------------------------------------------|-------------|-------|
| Pos.       | Description                                                                                                                      | 230 V       | 400 V |
| X80        | Terminal strip for the integrated safety unit                                                                                    | 📖 272       |       |
| X100       | Mains/DC-bus voltage (for 400 V devices)<br>– For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable. | 📖 184       | 📖 194 |
| X101       | Relay output                                                                                                                     | 📖 221       |       |
| X105       | Motor/external brake resistor<br>– For devices in device size 6 (18.5 ... 22 kW) the terminal strip is not pluggable.            | 📖 188       | 📖 198 |
| X106       | Motor temperature monitoring                                                                                                     | 📖 187       | 📖 199 |
| IT         | Contact screw for interference suppression (on the supply side/on the motor side)                                                | 📖 185       | 📖 196 |
| MCI        | Slot for communication module (Module Communication Interface)                                                                   | 📖 296       |       |
| ⓘ          | Sticker with warning                                                                                                             | -           |       |



| Connection |                                                                                                                                 | Information |       |
|------------|---------------------------------------------------------------------------------------------------------------------------------|-------------|-------|
| Pos.       | Description                                                                                                                     | 230 V       | 400 V |
| X80        | Terminal strip for the integrated safety unit                                                                                   | -           | 272   |
| X100       | Mains/DC-bus voltage (for 400 V devices)<br>– For devices of device size 7 (30 ... 45 kW) this terminal strip is not pluggable. | -           | 204   |
| X101       | Relay output                                                                                                                    | -           | 221   |
| X105       | Motor/external brake resistor<br>– For devices of device size 7 (30 ... 45 kW) this terminal strip is not pluggable.            | -           | 208   |
| X106       | Motor temperature monitoring                                                                                                    | -           | 209   |
| IT         | Contact screw for interference suppression (on the supply side/on the motor side)                                               | -           | 206   |
| MCI        | Slot for communication module (Module Communication Interface)                                                                  | -           | 296   |
| D          | Sticker with warning                                                                                                            | -           |       |

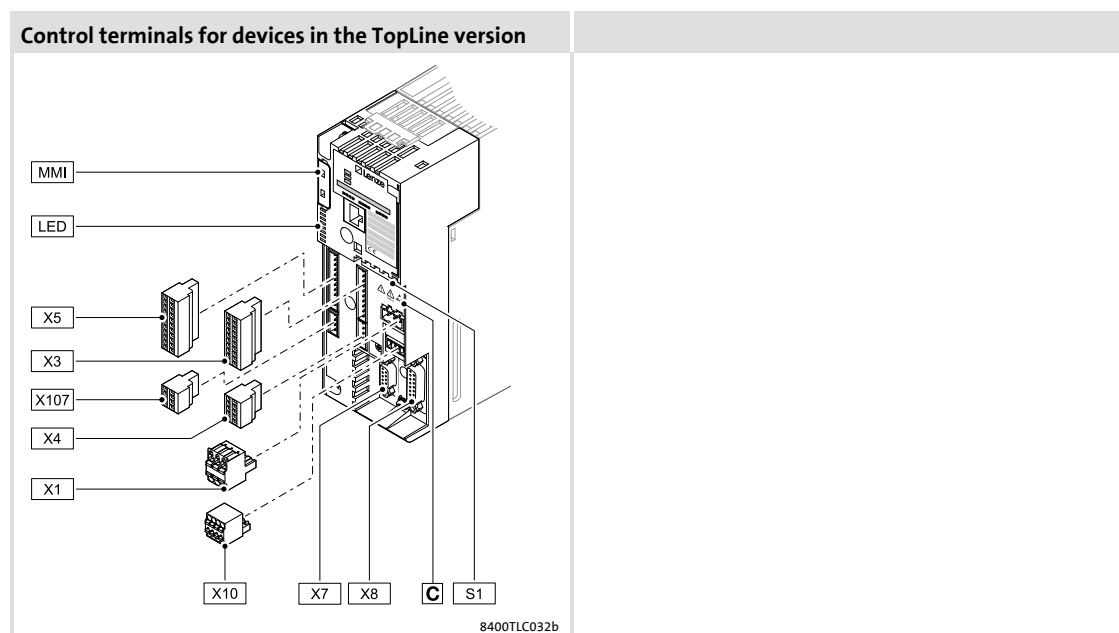
3.3

Overview of control terminals



| Connection |                                                                                   |                              | Information |            |
|------------|-----------------------------------------------------------------------------------|------------------------------|-------------|------------|
| Pos.       | Description                                                                       |                              | Stateline C | HighLine C |
| X1         | CANopen connection                                                                |                              | 215         |            |
| S1         | CANopen settings                                                                  |                              |             |            |
| X3         | Analog inputs/outputs; 10V reference voltage                                      |                              | 225         | 232        |
| X4         | Digital inputs; controller enable                                                 |                              | 236         | -          |
|            | 24 V supply of the control electronics                                            |                              |             |            |
|            | Digital outputs                                                                   |                              |             | 236        |
|            | 24 V voltage output                                                               |                              |             |            |
| X5         | Digital inputs; controller enable                                                 |                              | -           | 235        |
|            | External 24V supply of the control electronics; internal 24V supply fused via PTC |                              |             |            |
| X6 (DIAG)  | Diagnostic interface                                                              |                              | 223         |            |
| X107       | 24 V brake supply;                                                                |                              | -           | 238        |
|            | + BD1                                                                             | Connection for DC brake coil |             |            |
|            | - BD2                                                                             |                              |             |            |
| MMI        | Slot for memory module (Memory Module Interface)                                  |                              | 295         |            |

|  | 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.                                                               |



| Connection |                                                                                      | Information |
|------------|--------------------------------------------------------------------------------------|-------------|
| Pos.       | Description                                                                          | TopLine C   |
| X1         | CANopen connection                                                                   | 215         |
| S1         | CANopen settings                                                                     |             |
|            | Settings for CANopen terminating resistor and axis bus                               |             |
| X3         | Analog inputs / outputs; 10 V reference voltage                                      | 232         |
| X4         | Digital inputs; controller enable                                                    | -           |
|            | 24 V supply of the control electronics                                               |             |
|            | Digital outputs                                                                      |             |
|            | 24 V voltage output                                                                  |             |
| X5         | Digital inputs; controller enable                                                    | 235         |
|            | External 24 V supply of the control electronics; internal 24 V supply, fused via PTC |             |
| X6 (DIAG)  | Diagnostic interface                                                                 | 223         |
| X7         | Resolver                                                                             | 239         |
| X8         | Encoder                                                                              | 240         |
| X10        | Axis bus                                                                             | 241         |
| X107       | 24 V brake supply                                                                    | 238         |
|            | + BD1                                                                                |             |
|            | - BD2                                                                                |             |
| MMI        | Slot for memory module (Memory Module Interface)                                     | 295         |

| 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).

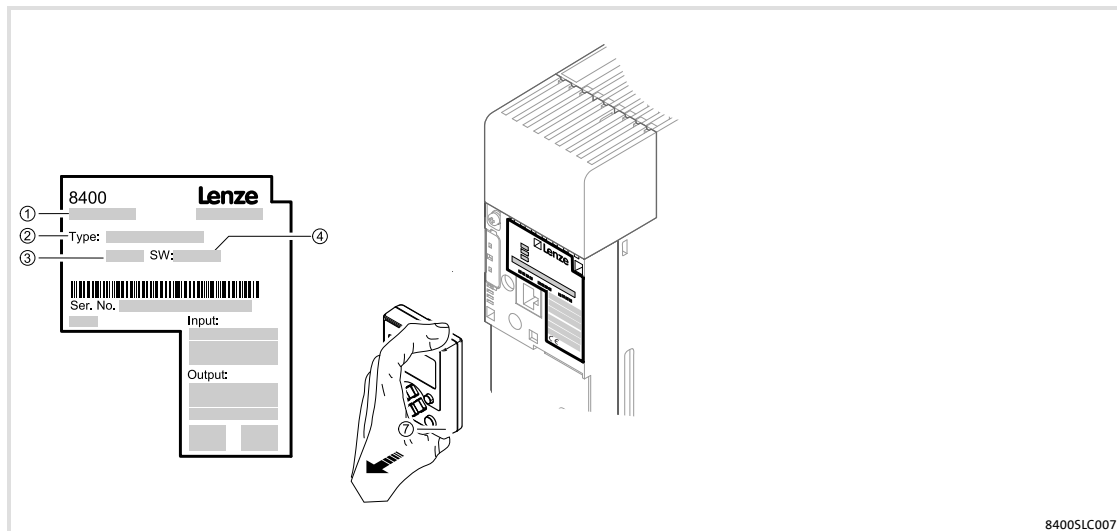


Fig. 3-1 Contents and position of the nameplate

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

## 3.5

## Product key

|                                                                                                                                                                    | E84 | A | V | xx | x | xxx | x | x | x | x |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|----|---|-----|---|---|---|---|
| <b>Product range</b><br>Inverter Drives 8400                                                                                                                       |     |   |   |    |   |     |   |   |   |   |
| <b>Version</b><br>A = 1. version                                                                                                                                   |     |   |   |    |   |     |   |   |   |   |
| <b>Inverter type</b><br>V = vector-controlled inverter                                                                                                             |     |   |   |    |   |     |   |   |   |   |
| <b>Version</b><br>SC = StateLine C<br>HC = HighLine C<br>TC = TopLine C                                                                                            |     |   |   |    |   |     |   |   |   |   |
| <b>Mounting type</b><br>E = installation<br>D = push-through technique<br>C = cold plate technology                                                                |     |   |   |    |   |     |   |   |   |   |
| <b>Power e.g.</b><br>251 = $25 \times 10^1 \text{ W} = 0.25 \text{ kW}$<br>222 = $22 \times 10^2 \text{ W} = 2.2 \text{ kW}$                                       |     |   |   |    |   |     |   |   |   |   |
| <b>Voltage class</b><br>2 = 230/240 V, 1/N/PE AC (0.25 ... 2.2 kW)<br>4 = 400/500 V, 3/PE AC (0.37 ... 45 kW)                                                      |     |   |   |    |   |     |   |   |   |   |
| <b>Ambient conditions</b><br>S = standard industrial environment IE33 according to IEC 60721-3-3 standard<br>V = rough environment (coated printed circuit boards) |     |   |   |    |   |     |   |   |   |   |
| <b>Safety system</b><br>X = without safety system<br>B = with integrated safety system "Safe torque off (STO)"                                                     |     |   |   |    |   |     |   |   |   |   |
| <b>Special design</b><br>0 = without (standard)<br>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<br>(TR CU 004/2011) | About the safety of low voltage equipment           | Eurasian conformity<br>TR CU: Technical<br>Regulations of Customs<br>Union |
|     | TP TC 020/2011<br>(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 10.9</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  185                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 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<br>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<br>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)<br>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)<br>Operation at 2/4 kHz, +45 ... +55 °C:<br>Reduce rated output current by 2.5 %/°C<br><br>Operation at 8/16 kHz, +40 ... +55 °C:<br>Reduce rated output current by 2.5 %/°C                                                                                                                                                                                                                                                                                                 |
| Site altitude                                      |                    | 0 ... 4000 m amsl<br>1000 ... 4000 m amsl:<br>Reduce rated output current by 5 %/1000 m<br>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><br>200 ... 500 Hz: acceleration resistant up to 15 m/s <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                               |
| Operation                                          | Germanischer Lloyd | 5 ... 13.2 Hz: Amplitude ±1 mm<br>13.2 ... 100 Hz: acceleration resistant up to 0.7 g                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                    | EN 61800-5-1       | 10 ... 57 Hz: amplitude 0.075 mm<br>57 ... 150 Hz: acceleration resistant up to 10 m/s <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                               |

| 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 | $U_0/U = 0.6/1.0 \text{ kV}$<br>( $U_0$ = r.m.s. value external - conductor/PE,<br>$U$ = r.m.s. value - external conductor/external conductor) |
|                                       | UL         | $U \geq 600 \text{ V}$<br>( $U$ = r.m.s. value external conductor/external conductor)                                                          |

### Motor cable lengths without considering EMC limit values

| U <sub>rated</sub><br>[V] | P <sub>rated</sub><br>[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", 11.3 and 11.4.

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

| U <sub>rated</sub><br>[V] | P <sub>rated</sub><br>[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><br>[V] | P <sub>rated</sub><br>[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.

| <b>EMC</b>                                                        |                               |                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Interference emission</b>                                      |                               |                                                                                                                                                                                                                                                                                                                                             |
| cable-guided                                                      | EN 61800-3                    | Up to a shielded motor cable length of 25 m: Category C2<br>With interference suppression: Category C1                                                                                                                                                                                                                                      |
| Radiation                                                         |                               | Category C2                                                                                                                                                                                                                                                                                                                                 |
| <b>Immunity to interference (acc. to EN 61800-3 requirements)</b> |                               |                                                                                                                                                                                                                                                                                                                                             |
| Electrostatic discharge (ESD)                                     | EN 61000-4-2                  | Air discharge: 8 kV,<br>Contact discharge to housing: 4 kV                                                                                                                                                                                                                                                                                  |
| <b>High frequency</b>                                             |                               |                                                                                                                                                                                                                                                                                                                                             |
| 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)                                                                                                                                                                                                                                                                                                  |
| <b>Burst</b>                                                      |                               |                                                                                                                                                                                                                                                                                                                                             |
| 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                                                                                                                                                                                                                                                                                                                                  |
| <b>Surge (surge voltage)</b>                                      |                               |                                                                                                                                                                                                                                                                                                                                             |
| Power connections                                                 | EN 61000-4-5                  | 1.2/50 µs,<br>1 kV phase-phase, 2 kV phase-PE                                                                                                                                                                                                                                                                                               |
| Control terminals                                                 | EN 61000-4-5                  | 1.2/50 µs, 1 kV                                                                                                                                                                                                                                                                                                                             |
| Operation on public supply systems                                | EN 61000-3-2<br>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<br>0.5 ... 1 kW: With active filter<br>> 1 kW at a mains current of ≤ 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.<br>The requirement for the short-circuit power ratio $RSCE \geq 120$ has to be met.<br>RSCE is the short-circuit power ratio at the connection point of the machine/plant to the public network. |
|                                                                   |                               |                                                                                                                                                                                                                                                                                                                                             |

**Open and closed loop control****Open and closed loop control processes**

|                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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>                                         |

**Switching frequency**

|                                                                                    |
|------------------------------------------------------------------------------------|
| 2 kHz, 4 kHz, 8 kHz, 16 kHz,<br>Optionally noise optimised or power-loss optimised |
|------------------------------------------------------------------------------------|

**Torque behaviour**

|                       |               |                                                                                                                                           |
|-----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 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.<br>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 dimensionings of motor and controller, the values may also differ.

**Sensorless vector control (speed)**

|                          |                             |                                   |
|--------------------------|-----------------------------|-----------------------------------|
| 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                     |                                   |

**Output frequency**

|                         |                                                                    |  |
|-------------------------|--------------------------------------------------------------------|--|
| Range                   | -1000 Hz ... +1000 Hz                                              |  |
| Absolute resolution     | 0.02 Hz                                                            |  |
| Standardised resolution | Parameter data: 0.01 %, process data: 0.006 % (= 2 <sup>14</sup> ) |  |

**Digital setpoint selection**

|          |         |
|----------|---------|
| Accuracy | ±0.01 % |
|----------|---------|

**Analog setpoint selection**

|          |        |                          |
|----------|--------|--------------------------|
| Accuracy | ±0.5 % | Based on the final value |
|----------|--------|--------------------------|



## 4.2 Rated data

### 4.2.1 Overview

#### Input data

| Basis of the data |                                   |                                         |                             |  |  |
|-------------------|-----------------------------------|-----------------------------------------|-----------------------------|--|--|
| Mains             | Voltage<br>$U_{\text{Rated}}$ [V] | Voltage range<br>$U_{\text{Rated}}$ [V] | Frequency range<br>$f$ [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<br>[V] | Frequency<br>[Hz] | Rated current [A]                      |                                        | Number of<br>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             | 36.0/31.0                              | 27.0/23.3                              | 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<br>[V] | Frequency<br>[Hz] | Rated current [A] |                | Number of<br>phases |
|-----------------|----------------|-------------------|-------------------|----------------|---------------------|
|                 |                |                   | up to +45 °C ①    | up to +55 °C ① |                     |
| E84AVxxx2512    | 0 - 230        | 0 - 1000          | 1.7               | 1.3            | 3                   |
| E84AVxxx3712    | 0 - 230        | 0 - 1000          | 2.4               | 1.8            | 3                   |
| E84AVxxx5512    | 0 - 230        | 0 - 1000          | 3.0               | 2.3            | 3                   |
| E84AVxxx7512    | 0 - 230        | 0 - 1000          | 4.0               | 3.0            | 3                   |
| E84AVxxx1122    | 0 - 230        | 0 - 1000          | 5.5               | 4.1            | 3                   |
| E84AVxxx1522    | 0 - 230        | 0 - 1000          | 7.0               | 5.3            | 3                   |
| E84AVxxx2222    | 0 - 230        | 0 - 1000          | 9.5               | 7.1            | 3                   |
| E84AVxxx3714    | 0 - 400/500    | 0 - 1000          | 1.3/1.0           | 1.0/0.8        | 3                   |
| E84AVxxx5514    | 0 - 400/500    | 0 - 1000          | 1.8/1.4           | 1.4/1.0        | 3                   |
| E84AVxxx7514    | 0 - 400/500    | 0 - 1000          | 2.4/1.9           | 1.8/1.4        | 3                   |
| E84AVxxx1124    | 0 - 400/500    | 0 - 1000          | 3.2/2.6           | 2.4/2.0        | 3                   |
| E84AVxxx1524    | 0 - 400/500    | 0 - 1000          | 3.9/3.1           | 2.9/2.3        | 3                   |
| E84AVxxx2224    | 0 - 400/500    | 0 - 1000          | 5.6/4.5           | 4.2/3.4        | 3                   |
| E84AVxxx3024xx5 | 0 - 400/500    | 0 - 1000          | 7.3/5.8           | 5.5/4.4        | 3                   |
| E84AVxxx3024xx0 | 0 - 400/500    | 0 - 1000          | 7.3/5.8           | 5.5/4.4        | 3                   |
| E84AVxxx4024    | 0 - 400/500    | 0 - 1000          | 9.5/7.6           | 7.1/5.7        | 3                   |
| E84AVxxx5524    | 0 - 400/500    | 0 - 1000          | 13/10.4           | 9.8/7.8        | 3                   |
| E84AVxxx7524    | 0 - 400/500    | 0 - 1000          | 16.5/13.2         | 12.4/9.9       | 3                   |
| E84AVxxx1134    | 0 - 400/500    | 0 - 1000          | 23.5/18.8         | 17.6/14.1      | 3                   |
| E84AVxxx1534    | 0 - 400/500    | 0 - 1000          | 32.0/25.6         | 24.0/19.2      | 3                   |
| E84AVxxx1834    | 0 - 400/500    | 0 - 1000          | 40.0/34.0         | 29.3/25.1      | 3                   |
| E84AVxxx2234    | 0 - 400/500    | 0 - 1000          | 47.0/40.4         | 35.3/30.3      | 3                   |
| E84AVxxx3034    | 0 - 400/500    | 0 - 1000          | 61.0/52.0         | 45.8/39.0      | 3                   |
| E84AVxxx3734    | 0 - 400/500    | 0 - 1000          | 76.0/65.0         | 57.0/48.8      | 3                   |
| E84AVxxx4534    | 0 - 400/500    | 0 - 1000          | 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 $I_{\text{rated}}$ | when controller is inhibited |
| E84AVxxx2512    | 45                                                          | 20                           |
| E84AVxxx3712    | 50                                                          |                              |
| E84AVxxx5512    | 60                                                          |                              |
| E84AVxxx7512    | 75                                                          |                              |
| E84AVxxx1122    | 95                                                          |                              |
| E84AVxxx1522    | 110                                                         |                              |
| E84AVxxx2222    | 140                                                         |                              |
| E84AVxxx3714    | 50                                                          |                              |
| E84AVxxx5514    | 65                                                          |                              |
| E84AVxxx7514    | 80                                                          |                              |
| E84AVxxx1124    | 95                                                          |                              |
| E84AVxxx1524    | 105                                                         |                              |
| E84AVxxx2224    | 135                                                         |                              |
| E84AVxxx3024xx5 | 165                                                         |                              |
| E84AVxxx3024xx0 | 165                                                         | 25                           |
| E84AVxxx4024    | 205                                                         |                              |
| E84AVxxx5524    | 275                                                         |                              |
| E84AVxxx7524    | 320                                                         | 30                           |
| E84AVxxx1134    | 435                                                         | 35                           |
| E84AVxxx1534    | 470                                                         |                              |
| E84AVxxx1834    | 540                                                         | 40                           |
| E84AVxxx2234    | 640                                                         |                              |
| E84AVxxx3034    | 840                                                         | 30                           |
| E84AVxxx3734    | 980                                                         |                              |
| E84AVxxx4534    | 1300                                                        |                              |

## 4.2.2 Operation at rated mains voltage 230 V

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

| Type         | Mains current at $I_{\text{aN}}$                    |                                                        | Apparent output power            | Motor power                        |
|--------------|-----------------------------------------------------|--------------------------------------------------------|----------------------------------|------------------------------------|
|              | with external<br>mains choke<br>$I_{\text{LR}}$ [A] | without external<br>mains choke<br>$I_{\text{LR}}$ [A] | U, V, W<br>$S_{\text{aR}}$ [kVA] | 4 pol. ASM<br>$P_{\text{aR}}$ [kW] |
| 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               |                   |
|              | $I_{\text{rated}2}$                        | $I_{\text{aM}2}$ | $I_{\text{rated}4}$ | $I_{\text{aM}4}$ | $I_{\text{rated}8}$ | $I_{\text{aM}8}$ | $I_{\text{rated}16}$ | $I_{\text{aM}16}$ |
| 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              |

$I_{\text{aNx}}$

$I_{\text{aMx}}$

Switching  
frequency

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

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  $V_{\text{BRmax}}$ : 380 V, adjustable

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

$R_{\text{Bmin}}$

$I_{\text{BRmax}}$

$P_{\text{BRmax}}$

$I_{\text{BRd}}$

$P_{\text{Bd}}$

$t_z$

$t_{\text{on}}$

$t_z - t_{\text{on}}$

$t_{\text{fp}}$

Minimum brake resistance, nominal value  $\pm 10\%$

Peak current

Peak braking power

Continuous current RMS - important for the dimensioning of the cables

Continuous braking power

Cycle time, periodic load change with running time and recovery time

Running time

Recovery time

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>   |
|                                                     | ①                                                  | ②  | L1, N - laying system |     |                    | ③                                          | L1, N |                    |
|                                                     |                                                    |    | B2                    | C   | F                  |                                            |       |                    |
|                                                     |                                                    |    | [A]                   | [A] | [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    |                    |

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, two loaded cores. Smaller cable cross-sections are not permissible for technical reasons.

2) 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.

3) 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>   |
|                                                  | ①                                                  | ②  | L1, N - laying system |     |                    | ③                                          | L1, N |                    |
|                                                  |                                                    |    | B2                    | C   | F                  |                                            |       |                    |
|                                                  |                                                    |    | [A]                   | [A] | [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

## 4.2.3

## Operation at rated mains voltage 400 V

| Basis of the data |                                   |                                         |                             |
|-------------------|-----------------------------------|-----------------------------------------|-----------------------------|
| Mains             | Voltage<br>$U_{\text{Rated}}$ [V] | Voltage range<br>$U_{\text{Rated}}$ [V] | Frequency range<br>$f$ [Hz] |
| 3/PE AC           | 400                               | 320 - 0 % ... 440 + 0 %                 | 45 - 0 % ... 65 + 0 %       |

| Type                       | Mains current at $I_{\text{aN}}$                    |                                                        | Apparent output power            | Motor power                        |
|----------------------------|-----------------------------------------------------|--------------------------------------------------------|----------------------------------|------------------------------------|
|                            | with external<br>mains choke<br>$I_{\text{LR}}$ [A] | without external<br>mains choke<br>$I_{\text{LR}}$ [A] | U, V, W<br>$S_{\text{aR}}$ [kVA] | 4 pol. ASM<br>$P_{\text{aR}}$ [kW] |
| 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                                |
| E84AVxxx3024xx5            | 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                   |                |
| E84AVxxx2224    | No                   | EZAELN3006B492 |
| 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<br>$U_{DC}$ [V] | Voltage range<br>$U_{DC}$ [V] | Frequency range<br>$f$ [Hz] |
| 2/PE DC           | 565                     | 455 - 0 % ... 620 + 0 %       | -                           |

| Type            | Input current at $I_{aN}$<br>$I_{DC}$ [A] | Output power<br>$U, V, W$<br>$S_{ar}$ [kVA] | Motor power<br>4.pol. ASM<br>$P_{ar}$ [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                                        |
| E84AVxxx3024xx5 | 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            | $R_{Bmin}$<br>[Ω] | $I_{BRmax}$<br>[A] | $P_{BRmax}$<br>[kW] | $I_{BRd}$<br>[A] | $P_{Bd}$<br>[kW] | $t_z$<br>[s] | $t_{on}$<br>[s] | $t_{fp}$<br>[s] |
|-----------------|-------------------|--------------------|---------------------|------------------|------------------|--------------|-----------------|-----------------|
| E84AVxxx3714    | 390               | 1.9                | 1.3                 | 1.9              | 1.3              | -            | ∞               | -               |
| E84AVxxx5514    | 390               | 1.9                | 1.3                 | 1.9              | 1.3              | -            | ∞               | -               |
| E84AVxxx7514    | 390               | 1.9                | 1.3                 | 1.9              | 1.3              | -            | ∞               | -               |
| E84AVxxx1124    | 180               | 4.0                | 2.9                 | 4.0              | 2.9              | -            | ∞               | -               |
| E84AVxxx1524    | 180               | 4.0                | 2.9                 | 4.0              | 2.9              | -            | ∞               | -               |
| E84AVxxx2224    | 150               | 4.8                | 3.5                 | 4.8              | 3.5              | -            | ∞               | -               |
| E84AVxxx3024xx5 | 82                | 8.8                | 6.4                 | 8.8              | 6.4              | -            | ∞               | -               |
| E84AVxxx3024xx0 | 82                | 8.8                | 6.4                 | 8.8              | 6.4              | -            | ∞               | -               |
| E84AVxxx4024    | 47                | 15.4               | 11.2                | 13.0             | 9.4              | -            | ∞               | -               |
| E84AVxxx5524    | 47                | 15.4               | 11.2                | 13.0             | 9.4              | -            | ∞               | -               |
| E84AVxxx7524    | 27                | 26.9               | 19.5                | 26.9             | 19.5             | -            | ∞               | -               |
| E84AVxxx1134    | 27                | 26.9               | 19.5                | 26.9             | 19.5             | -            | ∞               | -               |
| E84AVxxx1534    | 18                | 40.3               | 29.2                | 40.3             | 29.2             | -            | ∞               | -               |
| E84AVxxx1834    | 15                | 48.3               | 35.0                | 48.3             | 35.0             | -            | ∞               | -               |
| E84AVxxx2234    | 15                | 48.3               | 35.0                | 48.3             | 35.0             | -            | ∞               | -               |
| E84AVxxx3034    | 7.5               | 96.7               | 70.1                | 96.7             | 70.1             | -            | ∞               | -               |
| E84AVxxx3734    | 7.5               | 96.7               | 70.1                | 96.7             | 70.1             | -            | ∞               | -               |
| E84AVxxx4534    | 7.5               | 96.7               | 70.1                | 96.7             | 70.1             | -            | ∞               | -               |

|                |                                                                                 |
|----------------|---------------------------------------------------------------------------------|
| $R_{Bmin}$     | 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:

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

|               |                                                                                            |
|---------------|--------------------------------------------------------------------------------------------|
| $R_B$         | 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><br>[mA] |
|                                                     | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                     | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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         |                          |
| E84AVxxx3024xx5                                     | 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 1) |     |                            |       |       | Installation according to UL 2) |            | FI 3)    |
|                                                  | ①                                       | ②   | L1, L2, L3 - Laying system |       |       | ③                               | L1, L2, L3 |          |
|                                                  |                                         |     | B2                         | C     | F     |                                 |            |          |
|                                                  | [A]                                     | [A] | [mm²]                      | [mm²] | [mm²] | [A]                             | [AWG]      | [mA]     |
| E84AVxxx3714                                     | C 6                                     | 6   | 1.0                        | -     | -     | 6                               | 18         | ≥ 30 3)  |
| 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 3)  |
| 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 3) |
| E84AVxxx3024xx0                                  | C 10                                    | 10  | 1.5                        | -     | -     | 15                              | 14         | ≥ 300 3) |
| 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 3) |
| 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 3) |
| E84AVxxx2234                                     | C 63                                    | 63  | 25                         | 16    | -     | 50                              | 6          |          |
| E84AVxxx3034                                     | C 80                                    | 80  | -                          | 16    | -     | 70                              | 4          |          |
| E84AVxxx3734                                     | C100                                    | 100 | -                          | 25    | -     | 80                              | 4          | ≥ 300 3) |
| E84AVxxx4534                                     | C125                                    | 125 | -                          | 50    | -     | 100                             | 3          |          |

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<br>$U_{\text{Rated}}$ [V] | Voltage range<br>$U_{\text{Rated}}$ [V] | Frequency range<br>$f$ [Hz] |
| 3/PE AC           | 500                               | 400 - 0 % ... 550 + 0 %                 | 45 - 0 % ... 65 + 0 %       |

| Type                       | Mains current at $I_{\text{aN}}$                    |                                                        | Apparent output power            | Motor power                        |
|----------------------------|-----------------------------------------------------|--------------------------------------------------------|----------------------------------|------------------------------------|
|                            | with external<br>mains choke<br>$I_{\text{LR}}$ [A] | without external<br>mains choke<br>$I_{\text{LR}}$ [A] | U, V, W<br>$S_{\text{aR}}$ [kVA] | 4 pol. ASM<br>$P_{\text{aR}}$ [kW] |
| 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                                |
| E84AVxxx3024xx5            | 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<br>$U_{DC}$ [V] | Voltage range<br>$U_{DC}$ [V] | Frequency range<br>$f$ [Hz] |
| 2/PE DC           | 705                     | 565 - 0 % ... 775 + 0 %       | -                           |

| Type            | Input current at $I_{aN}$<br>$I_{DC}$ [A] | Output power<br>$U, V, W$<br>$S_{ar}$ [kVA] | Motor power<br>4.pol. ASM<br>$P_{ar}$ [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                                        |
| E84AVxxx3024xx5 | 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         |            |
|                 | $I_{arated2}$                              | $I_{aM2}$ | $I_{arated4}$ | $I_{aM4}$ | $I_{arated8}$ | $I_{aM8}$ | $I_{arated16}$ | $I_{aM16}$ |
| 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       |

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

Switching frequency

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

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            | $R_{Bmin}$<br>[Ω] | $I_{BRmax}$<br>[A] | $P_{BRmax}$<br>[kW] | $I_{BRd}$<br>[A] | $P_{Bd}$<br>[kW] | $t_z$<br>[s] | $t_{on}$<br>[s] | $t_{fp}$<br>[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              | -            | ∞               | -               |
| E84AVxxx3024xx5 | 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 $\pm 10\%$                              |
| $I_{BRmax}$    | 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:

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

|               |                                                                                            |
|---------------|--------------------------------------------------------------------------------------------|
| $R_B$         | 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>    |
|                                                     | ①                                                  | ②   | L1, L2, L3 - Laying system |                    |                    | ③                                          | L1, L2, L3 |                     |
|                                                     |                                                    |     | B2                         | C                  | F                  |                                            |            |                     |
|                                                     | [A]                                                | [A] | [mm <sup>2</sup> ]         | [mm <sup>2</sup> ] | [mm <sup>2</sup> ] | [A]                                        | [AWG]      | [mA]                |
| 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         |                     |
| E84AVxxx3024xx5                                     | 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><br>[mA] |
|                                                  | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                  | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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                         | -                       | -                       | 40                                         | 8          | ≥ 300 <sup>3)</sup>      |
| E84AVxxx2234                                     | C 63                                               | 63  | 25                         | -                       | -                       | 50                                         | 6          |                          |
| E84AVxxx3034                                     | C80                                                | 80  | -                          | 16                      | -                       | 70                                         | 4          |                          |
| 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<br>$U_{Lrated}$ [V] | Voltage range<br>$U_{Lrated}$ [V] | Frequency range<br>$f$ [Hz] |
|-----------|-----------------------------|-----------------------------------|-----------------------------|
| 1/N/PE AC | 230                         | 180 - 0 % ... 264 + 0 %           | 45 - 0 % ... 65 + 0 %       |

| Type         | Mains current at $I_{aN}$                        |                                                     | Apparent output power<br><br>$U, V, W$<br>$S_{aR}$ [kVA] | Motor power<br><br>4 pol. ASM<br>$P_{aR}$ [kW] |
|--------------|--------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|------------------------------------------------|
|              | with external<br>mains choke<br><br>$I_{LR}$ [A] | without external<br>mains choke<br><br>$I_{LR}$ [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 <sub>rated2</sub>                        | I <sub>aM2</sub> | I <sub>rated4</sub> | I <sub>aM4</sub> | I <sub>rated8</sub> | I <sub>aM8</sub> | I <sub>rated16</sub> | I <sub>aM16</sub> |
| 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><br>[mA] |
|                                                     | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                     | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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><br>[mA] |
|                                                  | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                  | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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         |                          |
| E84AVxxx7512                                     | C 10                                               | 10  | 1.5                        | -                       | -                       | 15                                         | 14         | ≥ 30 <sup>3)</sup>       |
| E84AVxxx1122                                     | C 16                                               | 16  | 2.5                        | -                       | -                       | 20                                         | 12         |                          |
| E84AVxxx1522                                     | C 16                                               | 16  | 2.5                        | -                       | -                       | 25                                         | 10         |                          |
| E84AVxxx2222                                     | -                                                  | -   | -                          | -                       | -                       | 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, three loaded cores.

<sup>2)</sup> 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.

<sup>3)</sup> 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<br>$U_{\text{Rated}}$ [V] | Voltage range<br>$U_{\text{Rated}}$ [V] | Frequency range<br>$f$ [Hz] |
|---------|-----------------------------------|-----------------------------------------|-----------------------------|
| 3/PE AC | 400                               | 320 - 0 % ... 440 + 0 %                 | 45 - 0 % ... 65 + 0 %       |

| Type                       | Mains current at $I_{aN}$                    |                                                 | Apparent output power<br>U, V, W<br>$S_{aR}$ [kVA] | Motor power<br>4 pol. ASM<br>$P_{aR}$ [kW] |
|----------------------------|----------------------------------------------|-------------------------------------------------|----------------------------------------------------|--------------------------------------------|
|                            | with external<br>mains choke<br>$I_{LR}$ [A] | without external<br>mains choke<br>$I_{LR}$ [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                                        |
| E84AVxxx3024xx5            | 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               |                   |
|                 | $I_{\text{rated}2}$                        | $I_{\text{aM}2}$ | $I_{\text{rated}4}$ | $I_{\text{aM}4}$ | $I_{\text{rated}8}$ | $I_{\text{aM}8}$ | $I_{\text{rated}16}$ | $I_{\text{aM}16}$ |
| 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            | -                   | -                | -                    | -                 |

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

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

Switching frequency

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

 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><br>[mA] |
|                                                     | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                     | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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                                        | -                                                  | -   | -                          | -                       | -                       | -                                          | -          | -                        |
| E84AVxxx3024xx5                                     | -                                                  | -   | -                          | -                       | -                       | -                                          | -          | -                        |
| 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>    |
|                                                  | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                     |
|                                                  | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[mm <sup>2</sup> ] | [A]                                        | [AWG]      | [mA]                |
| 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         | ≥ 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                                     | -                                                  | -   | -                          | -                       | -                       | -                                          | -          | -                   |
| 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

## 4.2.7

## 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<br>$U_{\text{Rated}}$ [V] | Voltage range<br>$U_{\text{Rated}}$ [V] | Frequency range<br>$f$ [Hz] |
|---------|-----------------------------------|-----------------------------------------|-----------------------------|
| 3/PE AC | 500                               | 400 - 0 % ... 550 + 0 %                 | 45 - 0 % ... 65 + 0 %       |

| Type                       | Mains current at $I_{aN}$    |                                 | Apparent output power<br>U, V, W<br>$S_{aR}$ [kVA] | Motor power<br>4 pol. ASM<br>$P_{aR}$ [kW] |
|----------------------------|------------------------------|---------------------------------|----------------------------------------------------|--------------------------------------------|
|                            | with external<br>mains choke | without external<br>mains choke |                                                    |                                            |
|                            | $I_{LR}$ [A]                 | $I_{LR}$ [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                                        |
| E84AVxxx3024xx5            | 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               |                   |
|                 | $I_{\text{rated}2}$                        | $I_{\text{aM}2}$ | $I_{\text{rated}4}$ | $I_{\text{aM}4}$ | $I_{\text{rated}8}$ | $I_{\text{aM}8}$ | $I_{\text{rated}16}$ | $I_{\text{aM}16}$ |
| 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            | -                   | -                | -                    | -                 |

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

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

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).

Switching  
frequency



## 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><br>[mA] |
|                                                     | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                     | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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                                        | -                                                  | -   | -                          | -                       | -                       | -                                          | -          | -                        |
| E84AVxxx3024xx5                                     | -                                                  | -   | -                          | -                       | -                       | -                                          | -          | -                        |
| 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><br>[mA] |
|                                                  | ①                                                  | ②   | L1, L2, L3 - Laying system |                         |                         | ③                                          | L1, L2, L3 |                          |
|                                                  | [A]                                                | [A] | B2<br>[mm <sup>2</sup> ]   | C<br>[mm <sup>2</sup> ] | F<br>[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                                     | -                                                  | -   | -                          | -                       | -                       | -                                          | -          |                          |
| 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"

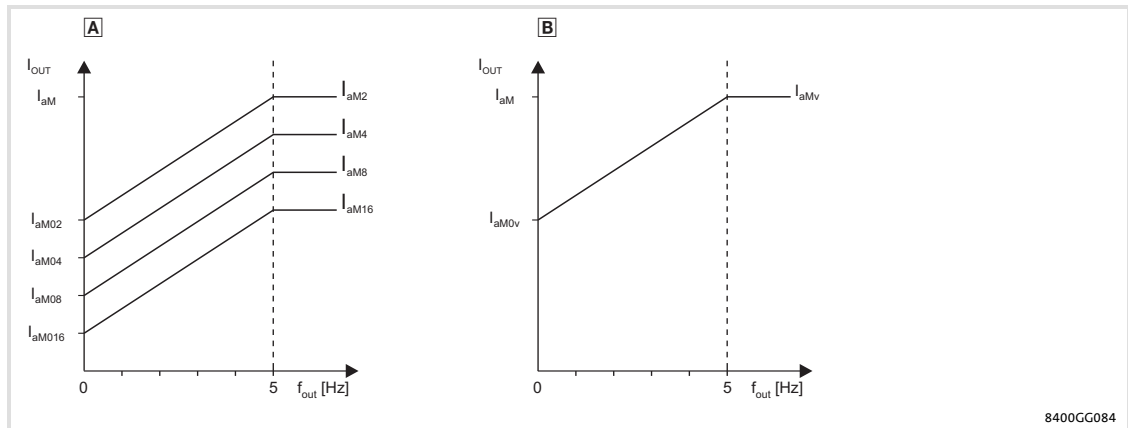


Fig. 4-1 Current derating characteristics

- 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 |           |
|--------------|-----------------------------------------------------------------------------|-----------|
|              | $U_{Lr} = 230V$                                                             |           |
|              | $I_{aM0v}$                                                                  | $I_{aMv}$ |
| 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 |           |
|-----------------|-----------------------------------------------------------------------------|-----------|
|                 | $U_{Lr} = 400V/U_{Lr} = 500V$                                               |           |
|                 | $I_{aM0v}$                                                                  | $I_{aMv}$ |
| 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      |
| E84AVxxx3024xx5 | 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:

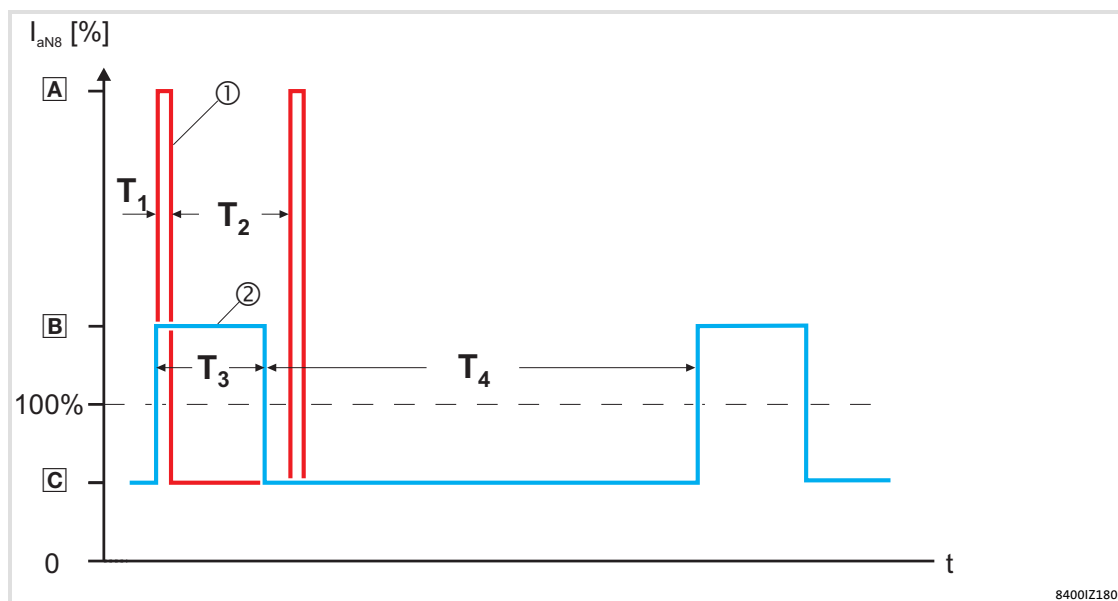


Fig. 4-2 Overcurrent capacity in 230/400 V operation at 45° C

- ① Pulse load (15 s cycle)  
**A** Peak current  
**C** 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)  
**B** Peak current  
**C** 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 |          |
|-----------------------------------------|-----------|----------|-----------|----------|-----------|----------|------------|----------|
|                                         | <b>A</b>  | <b>C</b> | <b>A</b>  | <b>C</b> | <b>A</b>  | <b>C</b> | <b>A</b>   | <b>C</b> |
| 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 |          |
|-----------------------------------------|-----------|----------|-----------|----------|-----------|----------|------------|----------|
|                                         | <b>B</b>  | <b>C</b> | <b>B</b>  | <b>C</b> | <b>B</b>  | <b>C</b> | <b>B</b>   | <b>C</b> |
| I <sub>amax</sub> /I <sub>aN8</sub> [%] | 150       | 75       | 150       | 75       | 150       | 75       | 100        | 50       |



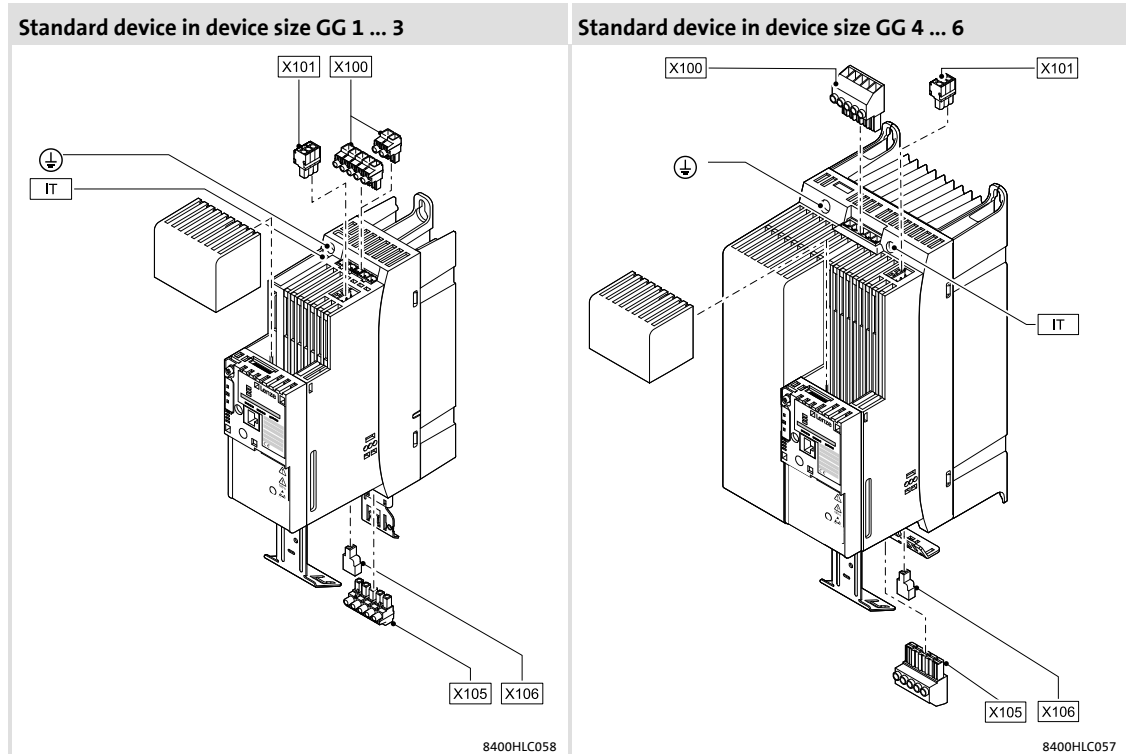
### Tip!

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

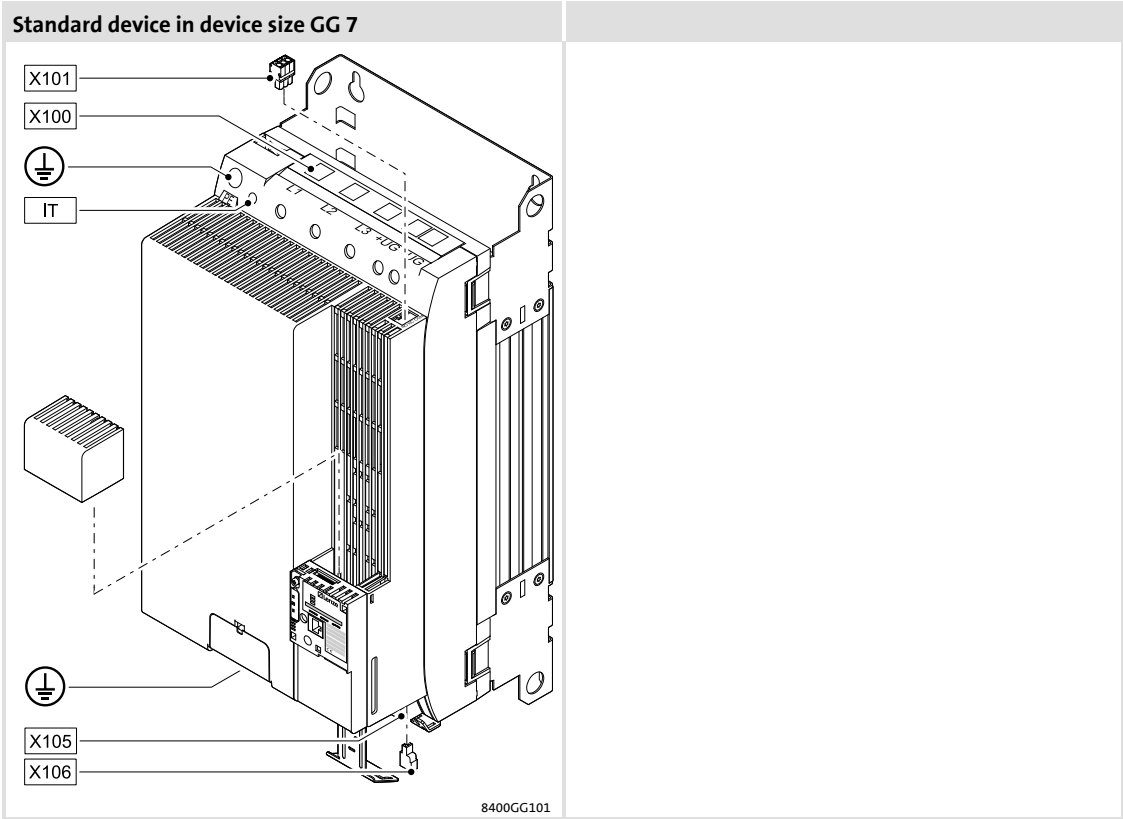


## 4.5 Terminal description

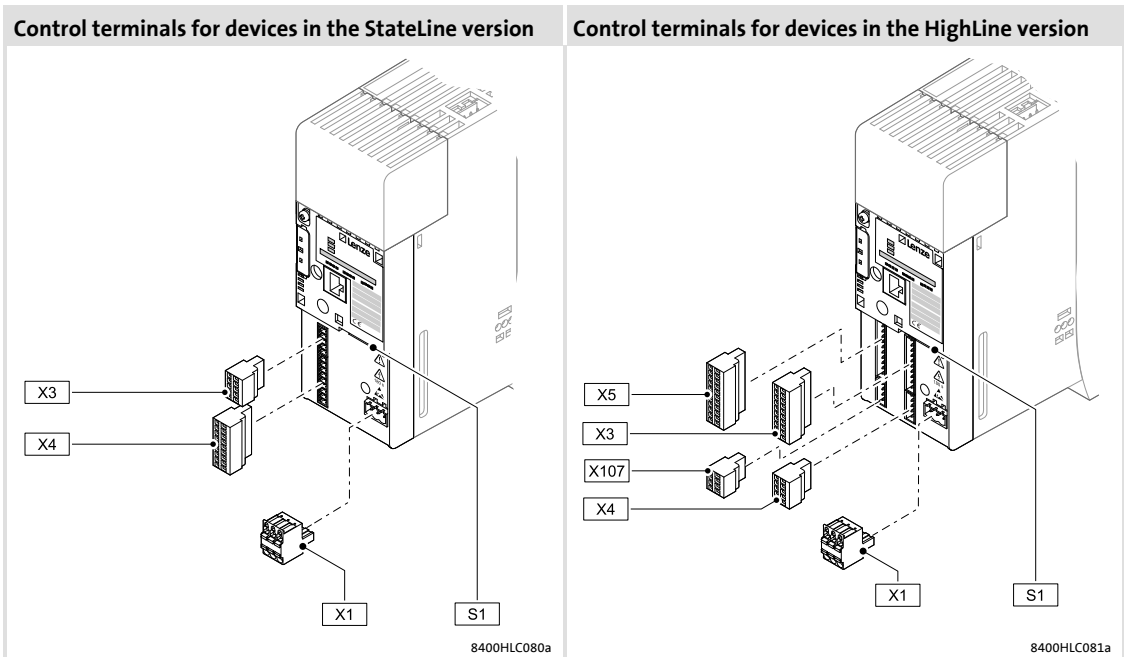
### 4.5.1 Overview



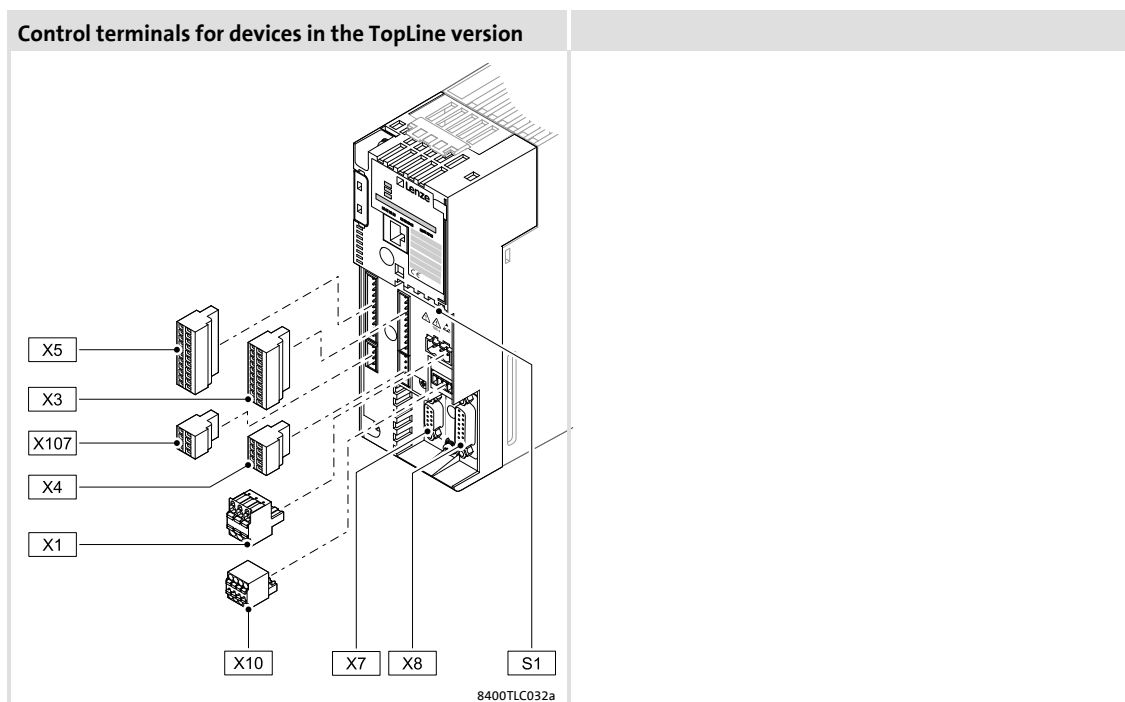
| Connection |                                                                                                                                 |        |
|------------|---------------------------------------------------------------------------------------------------------------------------------|--------|
| Pos.       | Description                                                                                                                     | Number |
| X100       | Mains/DC-bus voltage (for 400V devices)<br>– 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<br>– 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<br>– non-pluggable.                                          | 1      |
| X101       | Relay output                                                                      | 1      |
| X105       | Motor/external brake resistor<br>– 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        |
|            | 10 V reference voltage                 | 1           | 1          |
| X4         | Digital inputs                         | 4           | -          |
|            | Digital outputs                        | 1           | 3          |
|            | Controller enable                      | 1           | -          |
|            | 24 V supply of the control electronics | 1           | -          |
|            | 24 V voltage output                    | 1           | 1          |
| X5         | Digital inputs                         | -           | 7          |
|            | Controller enable                      | -           | 1          |
|            | 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       |
|            | 10 V reference voltage                 | 1         |
| X4         | 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<br>– 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<br>19.2 ... 28.8 V<br>Residual ripple max. $\pm 5\%$<br>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<br>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 $< 2.5\text{ V}$<br>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                                       | $\pm 10\text{ V}$                                                                      |
|           | Input resistance                            | $> 80\text{ k}\Omega$                                                                  |
|           | Input voltage in case of open circuit       | Display "0" ( $U < 0.2\text{ V}$ , absolute)                                           |
|           | Sampling frequency                          | 1 kHz (1 ms)                                                                           |
|           | Accuracy                                    | $\pm 0.1\text{ V}$                                                                     |
|           | Electric strength of external voltage       | $\pm 15\text{ V}$ , permanent                                                          |
|           | A/D converter                               | Resolution 10 bits + sign<br>Error 1 digit $\approx 0.1\%$ relating to the final value |
| X3/A1I    | Input                                       | 0 ... +20 mA<br>4 ... +20 mA, fail-safe                                                |
|           |                                             | Parameterisable                                                                        |
|           | Input resistance                            | 215 $\Omega$                                                                           |
|           | Input current in case of open circuit       | Display "0" ( $I < 0.1\text{ mA}$ )                                                    |
|           | Sampling frequency                          | 1 kHz (1 ms)                                                                           |
|           | Accuracy                                    | $\pm 0.1\text{ mA}$                                                                    |
|           | Electric strength of external voltage       | $\pm 7\text{ V}$ , permanent                                                           |
| X3/GA     | A/D converter                               | 10 bit resolution<br>Error 1 digit $\approx 0.1\%$ relating to the final value         |
|           | 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 $\mu\text{F}$                          |
|           | Voltage - 0 V                               | Display "0" ( $U < 0.1\text{ V}$ , absolute) |
|           | Output voltage at reset                     | $< 0.5\text{ V}$                             |
|           | 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                                   | $\pm 0.5\text{ V}$                           |
|           | Capacitive load                             | max 1 $\mu\text{F}$                          |
|           | Short-circuit strength                      | Unlimited period                             |
|           | Electric strength of external voltage       | Not guaranteed                               |
| X3/GA     | Permissible current loading                 | 10 mA                                        |
|           | 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 kΩ (2.5 kΩ ... 6 kΩ)                                                                        |
|             | Electric strength of external voltage        | Up to ±30 V, permanent                                                                          |
|             | Isolation                                    | 157                                                                                             |
|             | Level                                        | LOW < +5V<br>HIGH > +15V                                                                        |
|             | Cycle time                                   | 1 ms, can be changed by software filtering                                                      |
| X4/GIO      | 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<br>Integrated polarity reversal protection diode for switching inductive loads |
|           | Isolation                                    | 157                                                                                        |
|           | Level                                        | LOW < +5 V<br>High > +15 V                                                                 |
|           | Time-dependent behaviour                     | LOW - HIGH / HIGH - LOW<br>Max. 250 μs                                                     |
|           | 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<br>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 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<br>19.2 ... 28.8 V<br>Residual ripple max. $\pm 5\%$<br>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<br>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<br>19.2 ... 28.8 V<br>Residual ripple max. $\pm 5\%$<br>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 $< 2.5\text{ V}$<br>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<br>Error 1 digit ≙ 0.1 % relating to the final value |                 |
| X3/A1I, A2I | Input                                       | 0 ... +20 mA                                                                   | Parameterisable |
|             |                                             | 4 ... +20 mA, fail-safe                                                        |                 |
|             | 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<br>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                       | Parameterisable |  |
|             |                                             | 4 ... 20 mA, fail-safe            |                 |  |
|             | 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                    |                 |  |
|             | Permissible current loading                 | 10 mA                             |                 |  |
| 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<br>or<br>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<br>or<br>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<br>HIGH > +15V                                                                         |
|                  | Cycle time                                   | 1 ms, can be changed by software filtering                                                       |
|                  | Isolation                                    |  157            |
| 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 (  80) | In accordance with IEC61131-2, type 1, max. 50 mA                                       |
|                  | External-voltage protected                                                                                                                                                                   | Up to +30 V                                                                             |
|                  | Isolation                                                                                                                                                                                    |  157 |
|                  | Level                                                                                                                                                                                        | LOW < +5 V<br>High > +15 V                                                              |
|                  | Time-dependent behaviour                                                                                                                                                                     | LOW - HIGH / HIGH - LOW<br>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<br>AC 250 V, 3 A<br>DC 24 V, 2 A                                                                                                                                                                         |
|           | NC                                                                                                                                                                                                                                                                                                                                       | NC contact (normally closed)<br>DC 240 V, 0.16 A                                                                                                                                                                              |
|           | NO                                                                                                                                                                                                                                                                                                                                       | NO contact (normally open)<br><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<br>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<br>19.2 ... 28.8 V<br>Residual ripple max. $\pm 5\%$<br>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 $\mu\text{F}$                                                                                       |
| X107/BD1<br>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 (157)                                                                                |
|                      | Level                                                                                                                                                                                                                                                                                               | LOW < +5 V<br>High > +15 V                                                                            |
|                      | Time-dependent behaviour                                                                                                                                                                                                                                                                            | LOW - HIGH / HIGH - LOW<br>Max. 500 $\mu\text{s}$                                                     |
|                      | 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" (80). 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<br>Cable lengths: See CAN on board                       |
|            | Baud rate                                        | from version 12.00: 800 kbit/s, constant<br>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 |                                                                                    |

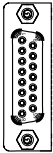
## 4.8.2 Multi-encoder connection

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/<br>General | Cable length (system cable is recommended)      | Max. 150 m                                                  |
|                | Encoder types                                   | TTL<br>SinCos 1V <sub>SS</sub>                              |
|                | Protocols                                       | Hiperface<br>SSI                                            |
|                | Number of increments                            | 1 ... 16384                                                 |
|                | Input frequency                                 | max. 500 kHz                                                |
|                | Scanning speed/position                         | TTL: 4 kHz (250 µs cycle)<br>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<br>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<br>Freely defined characteristic    |

| X8                                                                                | Pin | Description     |                   |                                | EYF002...<br>cable<br>SSI | EYDxxxxAxxxxS10S09<br>cable |           |
|-----------------------------------------------------------------------------------|-----|-----------------|-------------------|--------------------------------|---------------------------|-----------------------------|-----------|
|                                                                                   |     | TTL             | 1 V <sub>SS</sub> | 1 V <sub>SS</sub><br>Hiperface |                           | 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         |
|                                                                                   | 15  | n. c.           | n. c.             | n. c.                          | Clock -                   | -                           | $\bar{Z}$ |

9400SSP000X8

### 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             | U <sub>r</sub>  | Voltage setting [V] in C00421 for cable length [m] |         |         |         |         |          |          |
|---------------------|-----------------|----------------------------------------------------|---------|---------|---------|---------|----------|----------|
| Product key         | [V]             | 0 - 10                                             | 10 - 30 | 30 - 50 | 50 - 70 | 70 - 90 | 90 - 100 | 100 -150 |
| TTL                 |                 |                                                    |         |         |         |         |          |          |
| IG2048-5V-T         | 5 ±5%           | 5.0                                                | 5.0     | 5.1     | 5.1     | 5.2     | 5.2      | 5.3      |
| IG4096-5V-T         |                 |                                                    |         |         |         |         |          |          |
| IK2048-5V-T         |                 |                                                    |         |         |         |         |          |          |
| IK4096-5V-T         |                 |                                                    |         |         |         |         |          |          |
| Sin/cos             |                 |                                                    |         |         |         |         |          |          |
| IG1024-5V-V         | 5 ±5%           | 5.0                                                | 5.0     | 5.1     | 5.1     | 5.2     | 5.2      | 5.3      |
| IG2048-5V-S         |                 |                                                    |         |         |         |         |          |          |
| Sin/cos (Hiperface) |                 |                                                    |         |         |         |         |          |          |
| AM1024-8V-H         | 8<br>(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                                   |                            | $Z_{RO} = (R_{RO} + j X_{RO}) = 90.9 \text{ Ohms (max.)}$<br>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: $V = 7.07 \text{ V}$<br>Peak value: $\hat{u} = 10 \text{ V}$                                                                                                                                                                                                           |
|                                             | Maximum excitation current | R.m.s. value: $I = 77.78 \text{ mA}$<br>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**

### **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

**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.

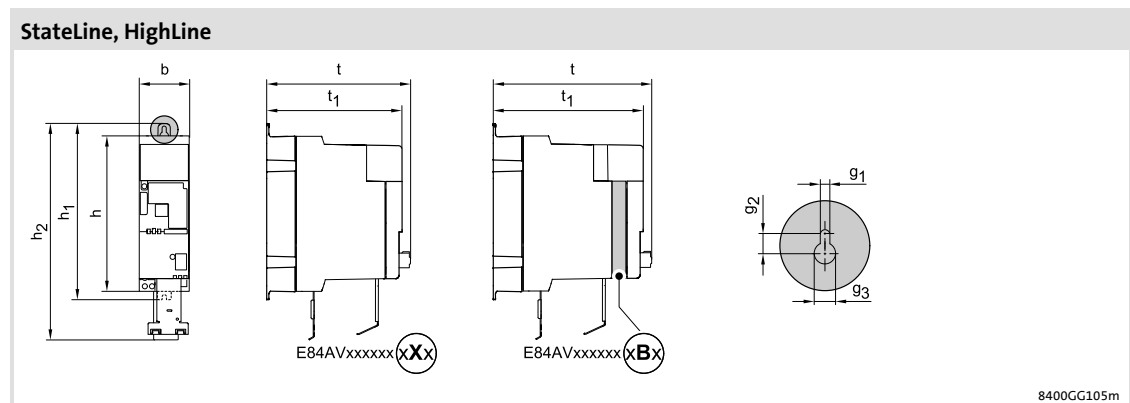


Fig. 5-1 Device dimensions

|                 | [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 |      |    |     |                |                |                |                |                |                |
| E84AVxxE3712xBx | 0.37 | 165  | 70 | 219 | 194            | 235            | 206            | 6              | 11             | 12             |
| E84AVxxE3714xBx | 0.37 |      |    |     |                |                |                |                |                |                |
| E84AVxxE551xxBx | 0.55 |      |    |     |                |                |                |                |                |                |
| E84AVxxE751xxBx | 0.75 | 215  | 70 | 219 | 244            | 285            | 206            | 6              | 11             | 12             |
| E84AVxxE112xxBx | 1.1  |      |    |     |                |                |                |                |                |                |
| E84AVxxE152xxBx | 1.5  |      |    |     |                |                |                |                |                |                |
| E84AVxxE222xxBx | 2.2  | 270  | 70 | 219 | 304            | 340            | 206            | 6              | 11             | 12             |
| E84AVxxE3024xB5 | 3.0  |      |    |     |                |                |                |                |                |                |

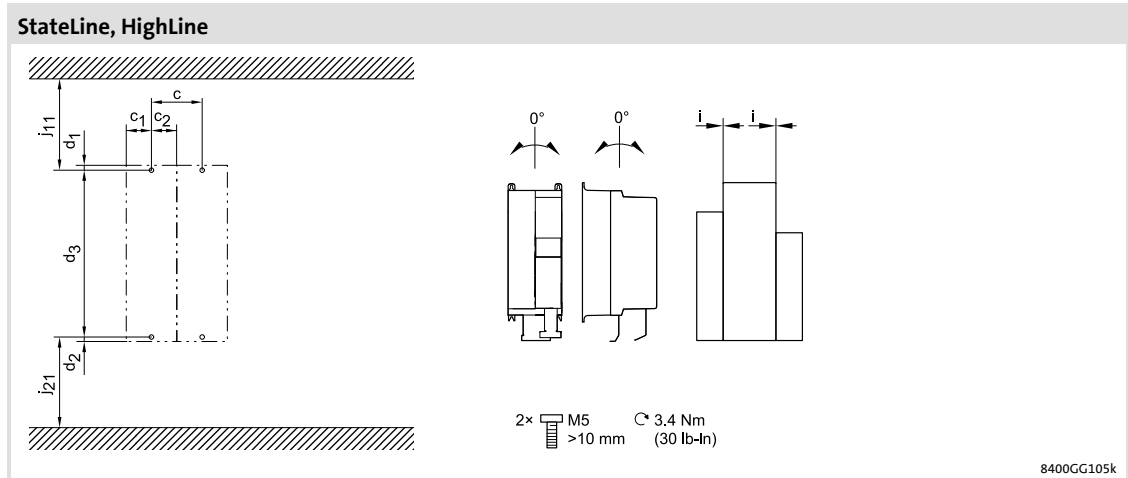


Fig. 5-2 Dimensions for mounting

|                 |      | 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]                                                                                |
| 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  |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVxxE3024xB5 | 3.0  |                |                |                |    |                |                |   |                 |                 |                                                                                     |

## Mechanical installation

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

Assembly without filter in "standard" technique

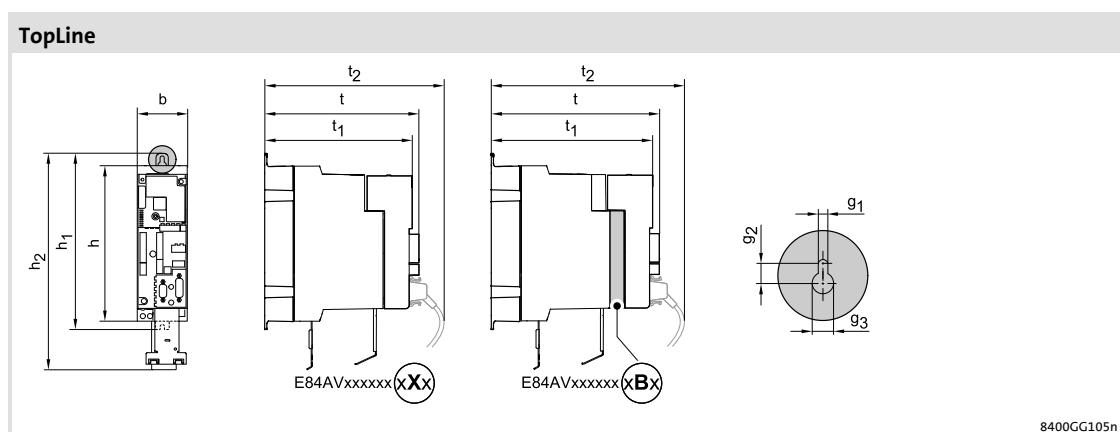


Fig. 5-3 Device dimensions

|                 |      | 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  |      |    |     |                |                |                |                |                |                |                |
| E84AVTCE3024xB5 | 3.0  |      |    |     |                |                |                |                |                |                |                |

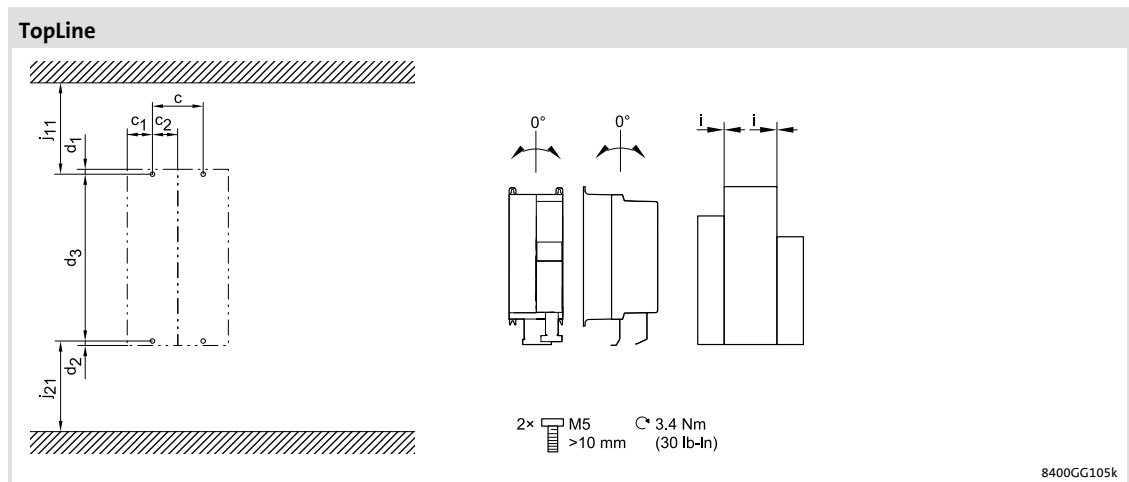


Fig. 5-4 Dimensions for mounting

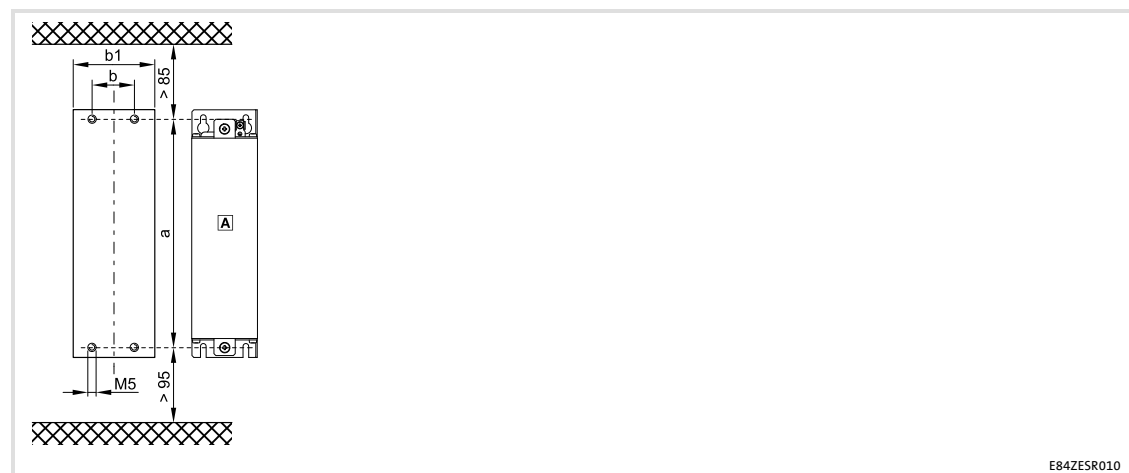
|                 |      | d <sub>1</sub> | d <sub>2</sub> | d <sub>3</sub> | c  | c <sub>1</sub> | c <sub>2</sub> | i | j <sub>11</sub> | j <sub>21</sub> |  |
|-----------------|------|----------------|----------------|----------------|----|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [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 | 9              | 5              | 230            | 70 | 35             | 35             | 0 | > 95            | > 95            | 2.1                                                                                 |
| E84AVTCE371xxBx | 0.37 |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVTCE551xxBx | 0.55 |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVTCE751xxBx | 0.75 |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVTCE112xxBx | 1.1  | 8              | 10             | 285            | 70 | 35             | 35             | 0 | > 95            | > 95            | 2.4                                                                                 |
| E84AVTCE152xxBx | 1.5  |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVTCE222xxBx | 2.2  |                |                |                |    |                |                |   |                 |                 |                                                                                     |
| E84AVTCE3024xB5 | 3.0  |                |                |                |    |                |                |   |                 |                 |                                                                                     |

**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            | SD             | RFI filter     |                |
|                 |                | LD             | LL             |
| E84AVxxx2512    | E84AZE5R3712SD | E84AZE5R3712LD | E84AZE5R3712LL |
| E84AVxxx3712    |                |                |                |
| E84AVxxx5512    | E84AZE5R7512SD | E84AZE5R7512LD | E84AZE5R7512LL |
| E84AVxxx7512    |                |                |                |
| E84AVxxx1122    | E84AZE5R2222SD | E84AZE5R2222LD | E84AZE5R2222LL |
| E84AVxxx1522    |                |                |                |
| E84AVxxx2222    |                |                |                |
| E84AVxxx3714    | E84AZE5R7514SD | E84AZE5R7514LD | -              |
| E84AVxxx5514    |                |                |                |
| E84AVxxx7514    |                |                |                |
| E84AVxxx1124    | E84AZE5R2224SD | E84AZE5R2224LD | -              |
| E84AVxxx1524    |                |                |                |
| E84AVxxx2224    |                |                |                |
| E84AVxxx3024xxS | E84AZE5R3024SD | E84AZE5R3024LD | -              |



E84ZE5R010

**A** Footprint filter

|                | a    | b  | b1 |
|----------------|------|----|----|
|                | [mm] |    |    |
| E84AZE5R3712xx | 190  | 45 | 70 |
| E84AZE5R7512xx | 240  |    |    |
| E84AZE5R7514xx | 240  |    |    |
| E84AZE5R2222xx | 295  | 45 | 70 |
| E84AZE5R2224xx |      |    |    |
| E84AZE5R3024xx |      |    |    |

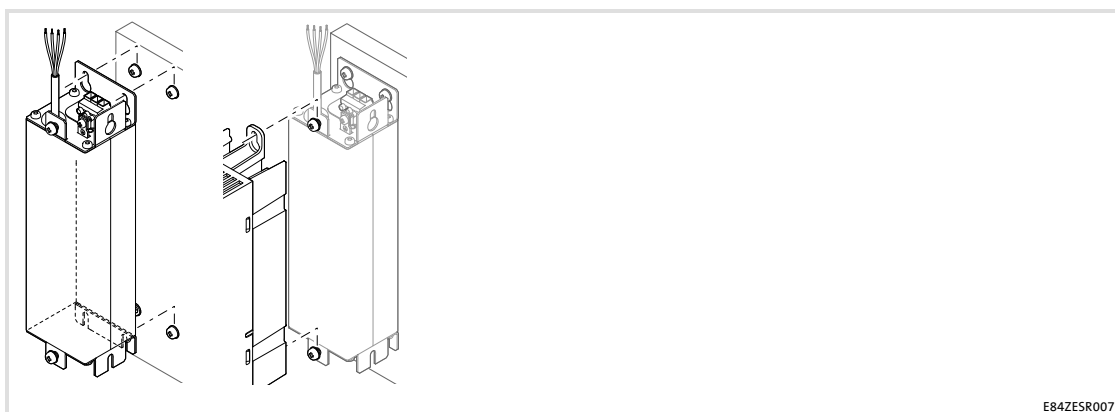


Fig. 5-5 Assembly with footprint filter

Proceed as follows for installation:

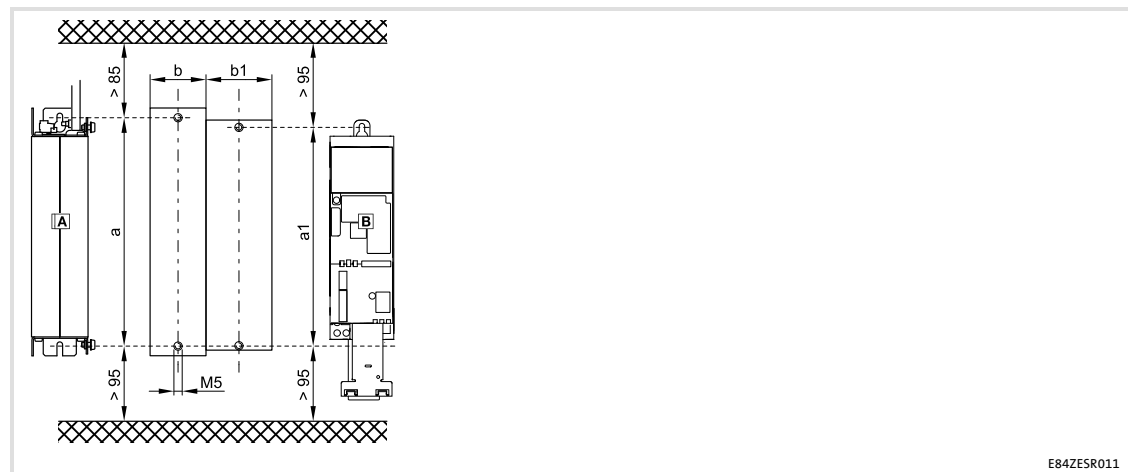
1. Prepare M5 threaded holes on the mounting plate and equip them with screws and washers.
  - Use four M5 screw and washer assemblies or M5 hexagon socket screws with washers.
  - Do not yet tighten the screws.
2. Mount the filter onto the prepared mounting plate.
  - Only tighten the screws hand-tight.
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)

**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            | SD             | RFI filter<br>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   | -              |



A Side-by-side filter  
B Standard device

|                | a    | a1  | b  | b1 |
|----------------|------|-----|----|----|
|                | [mm] |     |    |    |
| E84AZEsr3712xx | 190  | 180 | 60 | 70 |
| E84AZEsr7512xx | 240  | 230 |    |    |
| E84AZEsr7514xx | 240  | 230 |    |    |
| E84AZEsr2222xx | 295  | 285 | 60 | 70 |
| E84AZEsr2224xx | 295  | 285 |    |    |
| E84AZEsr3024xx | 295  | 285 |    |    |



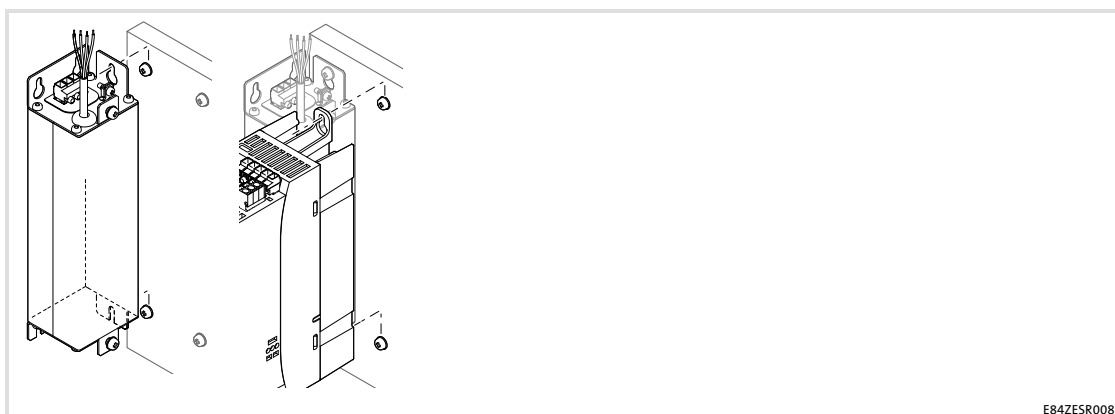


Fig. 5-6 Assembly with side-mounted filter

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)

**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.

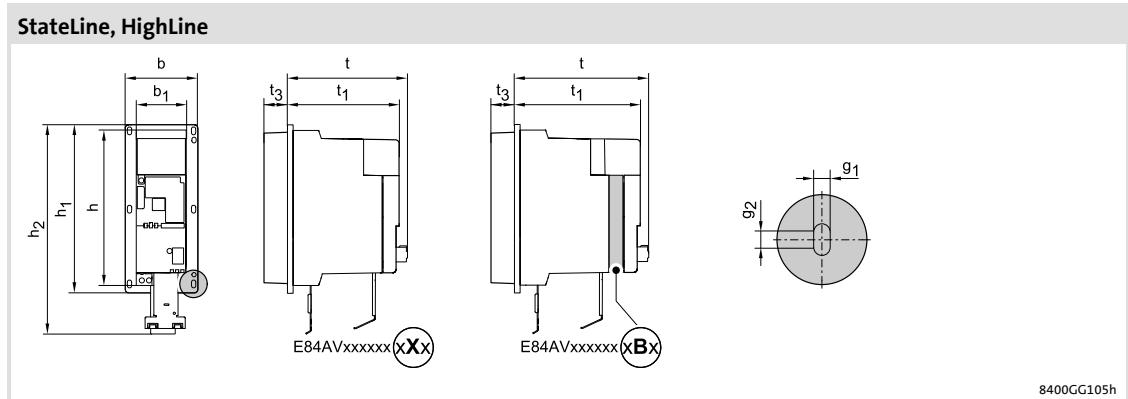


Fig. 5-7 Device dimensions

|                  | [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] |     |     |                |                |                |                |                |                |                |
| E84AVxxD2512xxXx | 0.25 | 165  | 102 | 185 | 186            | 226            | 70             | 172            | 14             | 6              | 5              |
| E84AVxxD3712xxXx | 0.37 |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD3714xxXx | 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  |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD2512xxBx | 0.25 |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD3712xxBx | 0.37 | 165  | 102 | 205 | 186            | 226            | 70             | 192            | 14             | 6              | 5              |
| E84AVxxD3714xxBx | 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)

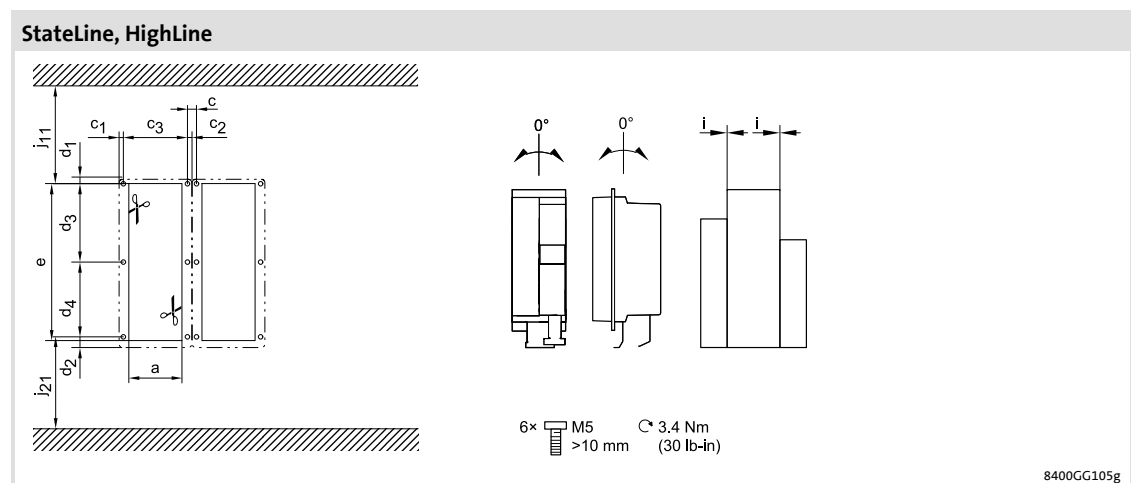


Fig. 5-8 Dimensions for mounting

|                 |      | 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]                                                                                |
| E84AVxxD2512xXx | 0.25 | 75   | 170 | 10             | 10             | 85             | 80             | 12 | 6              | 6              | 90             | 0 | > 95            | > 95            | 1.4                                                                                 |
| E84AVxxD3712xXx | 0.37 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD3714xXx | 0.37 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD551xxXx | 0.55 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD751xxXx | 0.75 | 75   | 221 | 8.5            | 12.5           | 110            | 105            | 12 | 6              | 6              | 90             | 0 | > 95            | > 95            | 1.9                                                                                 |
| E84AVxxD112xxXx | 1.1  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD152xxXx | 1.5  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| 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 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD551xxBx | 0.55 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD751xxBx | 0.75 | 75   | 221 | 8.5            | 12.5           | 110            | 105            | 12 | 6              | 6              | 90             | 0 | > 95            | > 95            | 2.0                                                                                 |
| E84AVxxD112xxBx | 1.1  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD152xxBx | 1.5  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD222xxBx | 2.2  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD2512xBx | 0.25 | 109  | 274 | 12.5           | 12.5           | 135            | 135            | 12 | 6              | 6              | 125            | 0 | > 95            | > 95            | 3.6                                                                                 |
| E84AVxxD3712xBx | 0.37 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD3714xBx | 0.37 |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| 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  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD222xxBx | 2.2  |      |     |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |

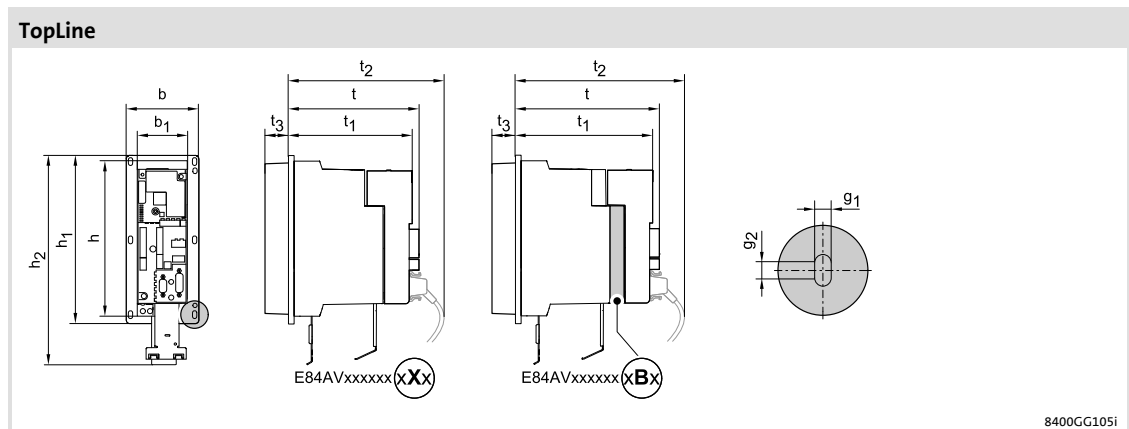


Fig. 5-9 Device dimensions

|                 |      | 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 | 215  | 102 | 199 | 236            | 276            | 70             | 186            | 226            | 36             | 6              | 5              |
| E84AVTCD371xxBx | 0.37 |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD551xxBx | 0.55 |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD751xxBx | 0.75 |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD112xxBx | 1.1  | 270  | 137 | 199 | 295            | 335            | 70             | 186            | 226            | 60             | 6              | 5              |
| E84AVTCD152xxBx | 1.5  |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD222xxBx | 2.2  |      |     |     |                |                |                |                |                |                |                |                |

## Mechanical installation

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

Assembly in push-through technique (thermal separation)

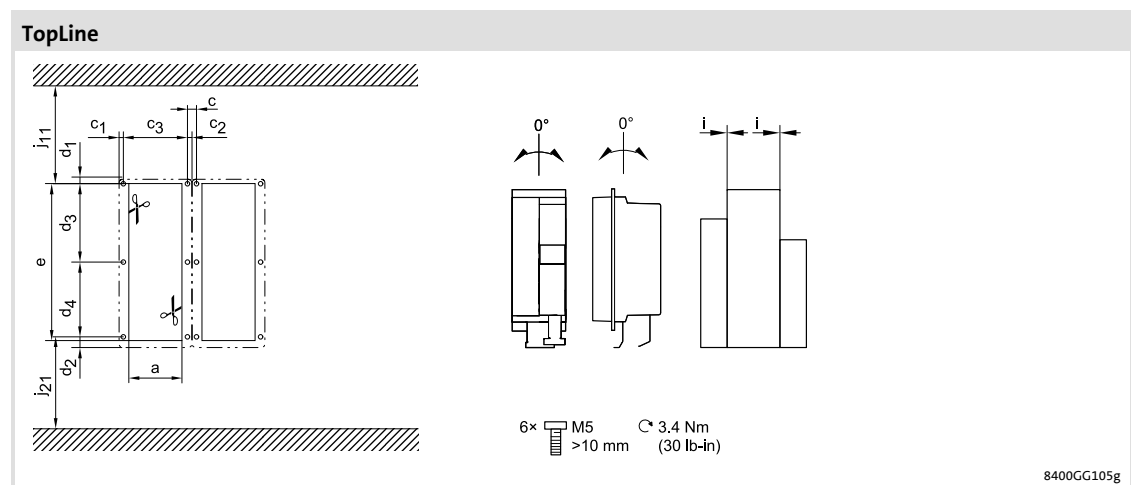


Fig. 5-10 Dimensions for mounting

|                 |      | 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 µm, 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                     | ≤ 1.5              |
| E84AVxxC3712    | 20                     | ≤ 1.5              |
| E84AVxxC5512    | 30                     | ≤ 1.0              |
| E84AVxxC7512    | 40                     | ≤ 1.0              |
| E84AVxxC1122    | 60                     | ≤ 0.6              |
| E84AVxxC1522    | 75                     | ≤ 0.5              |
| E84AVxxC2222    | 100                    | ≤ 0.4              |
| E84AVxxC3714    | 25                     | ≤ 1.5              |
| E84AVxxC5514    | 35                     | ≤ 1.0              |
| E84AVxxC7514    | 50                     | ≤ 0.8              |
| E84AVxxC1124    | 60                     | ≤ 0.6              |
| E84AVxxC1524    | 70                     | ≤ 0.5              |
| E84AVxxC2224    | 100                    | ≤ 0.4              |
| E84AVxxC3024xxS | 100                    | ≤ 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.

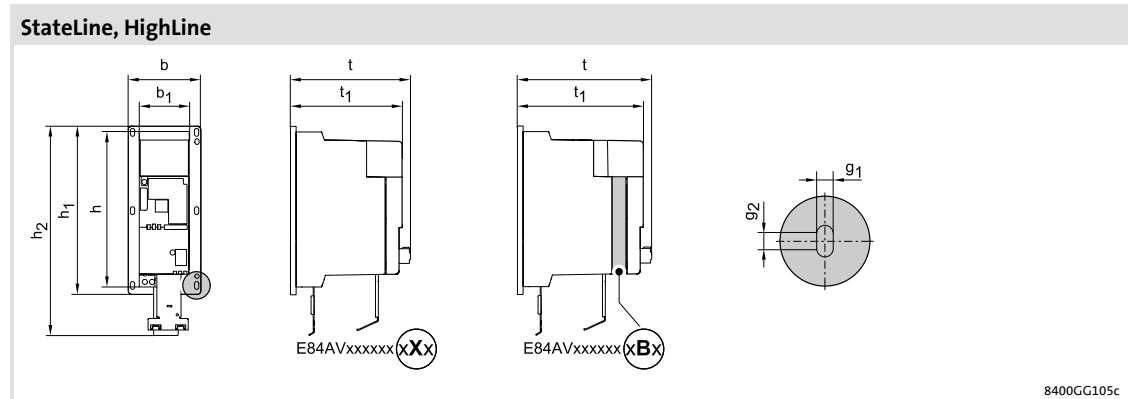


Fig. 5-11 Device dimensions

|                  | [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] |     |     |                |                |                |                |                |                |
| E84AVxxC2512xxX0 | 0.25 | 165  | 102 | 185 | 186            | 226            | 70             | 172            | 6              | 5              |
| E84AVxxC3712xxX0 | 0.37 |      |     |     |                |                |                |                |                |                |
| E84AVxxC3714xxX0 | 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  |      |     |     |                |                |                |                |                |                |
| E84AVxxC2512xxB0 | 0.25 |      |     |     |                |                |                |                |                |                |
| E84AVxxC3712xxB0 | 0.37 | 165  | 102 | 205 | 186            | 226            | 70             | 192            | 6              | 5              |
| E84AVxxC3714xxB0 | 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              |



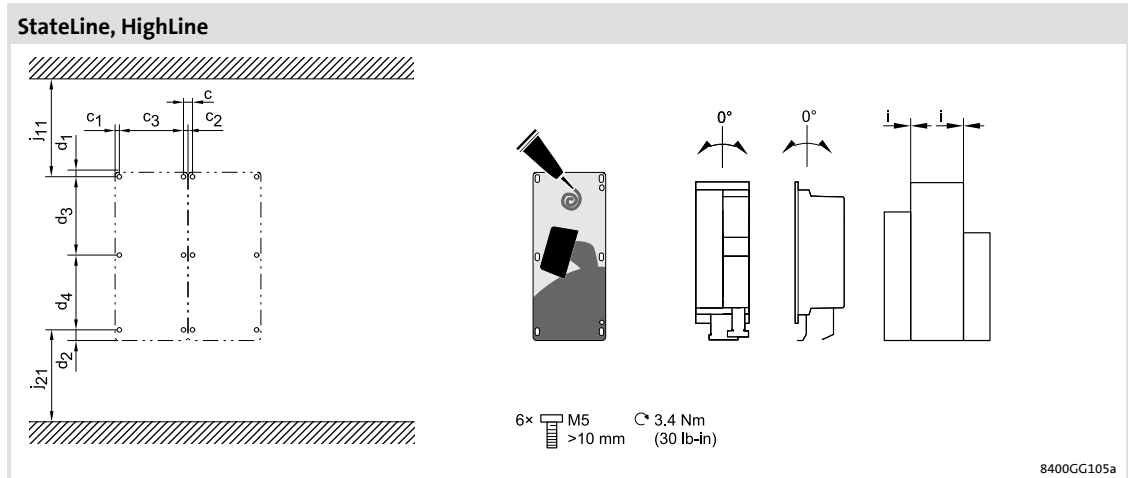


Fig. 5-12 Dimensions for mounting

|                 |      | 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]                                                                                |
| 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  | 12.5           | 12.5           | 135            | 135            | 12 | 6              | 6              | 125            | 0 | > 95            | > 95            | 2.0                                                                                 |
| E84AVxxC152xxX0 | 1.5  |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| 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  | 12.5           | 12.5           | 135            | 135            | 12 | 6              | 6              | 125            | 0 | > 95            | > 95            | 2.1                                                                                 |
| E84AVxxC152xxB0 | 1.5  |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC222xxB0 | 2.2  |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |

## Mechanical installation

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

Mounting in "cold plate" technique

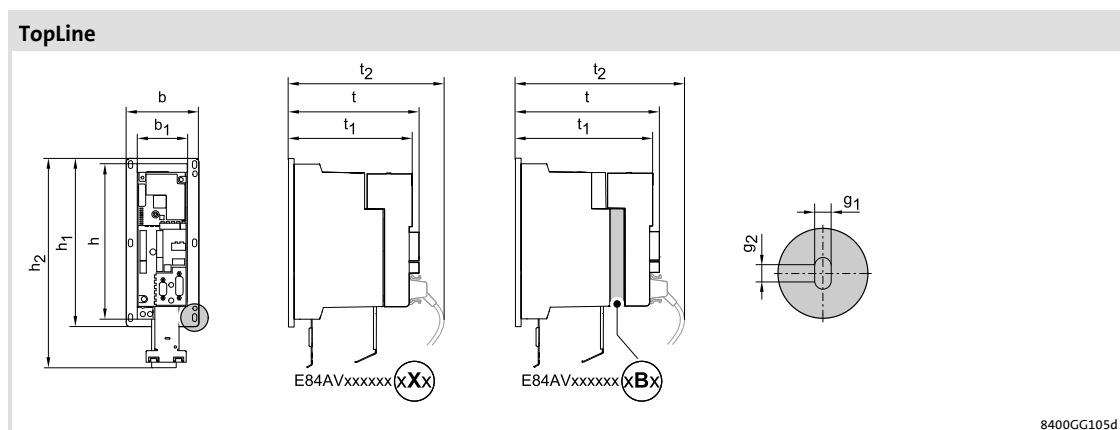


Fig. 5-13 Device dimensions

|                 | [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  | 270  | 137 | 178 | 295            | 335            | 70             | 165            | 205            | 6              | 5              |
| E84AVTCC551xxB0 | 0.55 |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC751xxB0 | 0.75 |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC112xxB0 | 1.1  |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC152xxB0 | 1.5  | 270  | 137 | 198 | 295            | 335            | 70             | 185            | 225            | 6              | 5              |
| E84AVTCC222xxB0 | 2.2  |      |     |     |                |                |                |                |                |                |                |

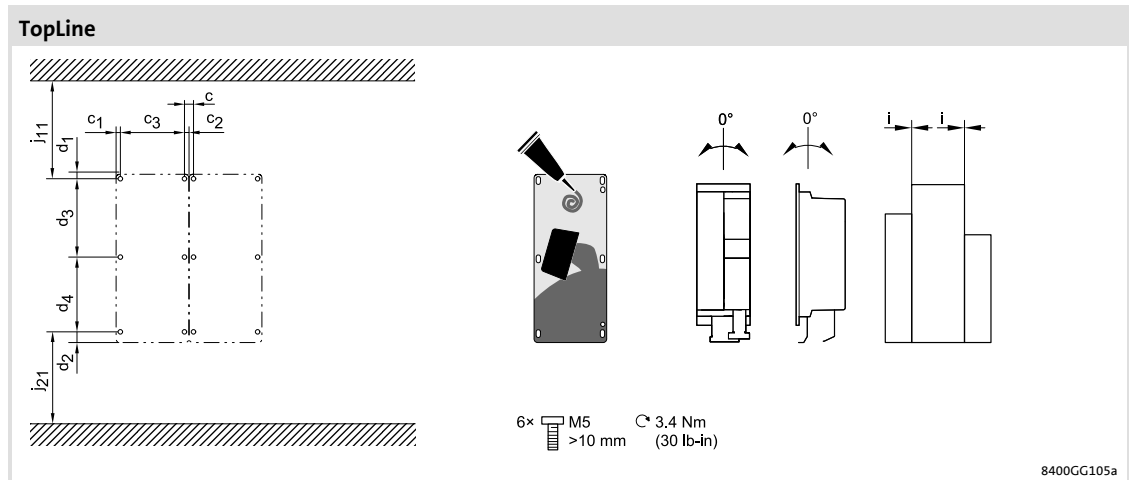


Fig. 5-14 Dimensions for mounting

|                 |      | 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  |                |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |

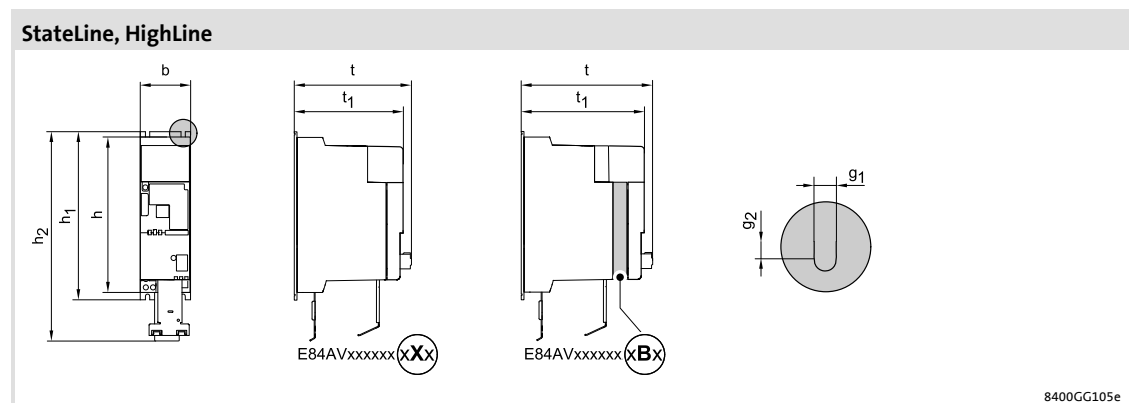
**"Slim"**

Fig. 5-15 Device dimensions

|                 |      | h    | b  | t   | h <sub>1</sub> | h <sub>2</sub> | t <sub>1</sub> | g <sub>1</sub> | g <sub>2</sub> |
|-----------------|------|------|----|-----|----------------|----------------|----------------|----------------|----------------|
|                 | [kW] | [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  | 270  | 70 | 163 | 295            | 335            | 150            | 6              | 5              |
| E84AVxxC3024xXS | 3.0  |      |    |     |                |                |                |                |                |
| E84AVxxC3714xB5 | 0.37 |      |    |     |                |                |                |                |                |
| E84AVxxC551xxB5 | 0.55 |      |    |     |                |                |                |                |                |
| E84AVxxC751xxB5 | 0.75 |      |    |     |                |                |                |                |                |
| E84AVxxC112xxB5 | 1.1  | 270  | 70 | 183 | 295            | 335            | 170            | 6              | 5              |
| E84AVxxC152xxB5 | 1.5  |      |    |     |                |                |                |                |                |
| E84AVxxC222xxB5 | 2.2  |      |    |     |                |                |                |                |                |
| E84AVxxC3024xB5 | 3.0  |      |    |     |                |                |                |                |                |

## "Slim"

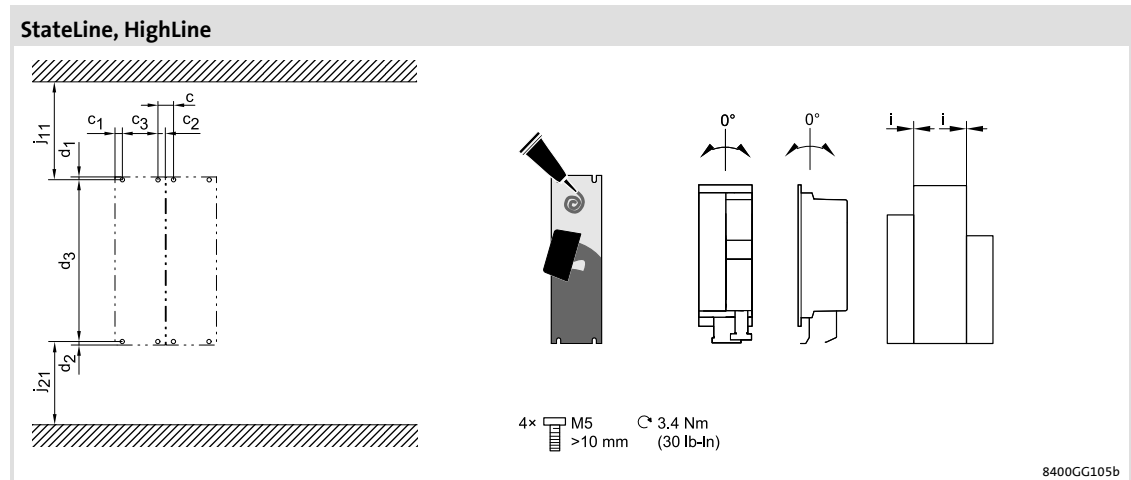


Fig. 5-16 Dimensions for mounting

|                 |      | 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]                                                                                |
| 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  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC3714xB5 | 0.37 | 4              | 4              | 228            | 20 | 10             | 10             | 50             | 0 | > 95            | > 95            | 1.6                                                                                 |
| E84AVxxC551xxB5 | 0.55 |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC751xxB5 | 0.75 |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC112xxB5 | 1.1  | 5              | 5              | 285            | 20 | 10             | 10             | 50             | 0 | > 95            | > 95            | 2.1                                                                                 |
| E84AVxxC152xxB5 | 1.5  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC222xxB5 | 2.2  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC3024xB5 | 3.0  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |

## Mechanical installation

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

Mounting in "cold plate" technique

### "Slim"

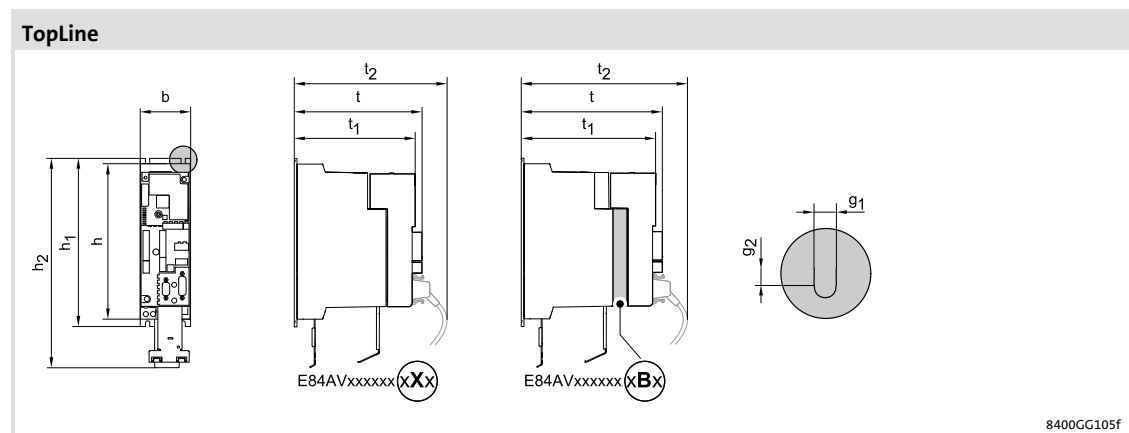


Fig. 5-17 Device dimensions

|                 |      | 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> |
|-----------------|------|------|----|-----|----------------|----------------|----------------|----------------|----------------|----------------|
|                 | [kW] | [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  |      |    |     |                |                |                |                |                |                |
| E84AVTCC2512xBS | 0.25 | 215  | 70 | 198 | 236            | 276            | 185            | 225            | 6              | 5              |
| E84AVTCC371xxBS | 0.37 |      |    |     |                |                |                |                |                |                |
| E84AVTCC551xxBS | 0.55 |      |    |     |                |                |                |                |                |                |
| E84AVTCC751xxBS | 0.75 |      |    |     |                |                |                |                |                |                |
| E84AVTCC112xxBS | 1.1  | 270  | 70 | 198 | 295            | 335            | 185            | 225            | 6              | 5              |
| E84AVTCC152xxBS | 1.5  |      |    |     |                |                |                |                |                |                |
| E84AVTCC222xxBS | 2.2  |      |    |     |                |                |                |                |                |                |
| E84AVTCC3024xBS | 3.0  |      |    |     |                |                |                |                |                |                |

## "Slim"

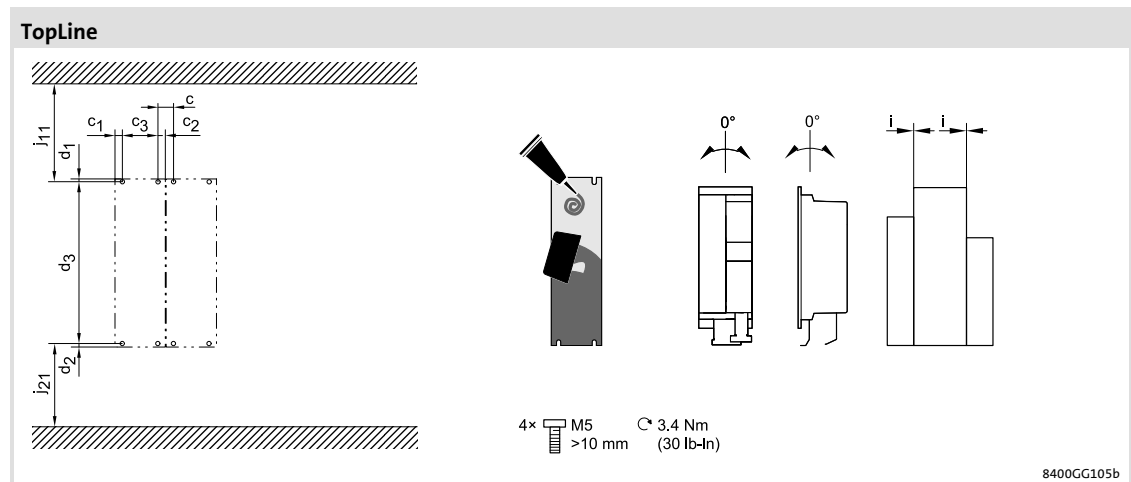


Fig. 5-18 Dimensions for mounting

|                 |      | 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 | 4              | 4              | 228            | 20 | 10             | 10             | 50             | 0 | > 95            | > 95            | 1.8                                                                                 |
| E84AVTCC371xxBS | 0.37 |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVTCC551xxBS | 0.55 |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVTCC751xxBS | 0.75 |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVTCC112xxBS | 1.1  | 5              | 5              | 285            | 20 | 10             | 10             | 50             | 0 | > 95            | > 95            | 2.3                                                                                 |
| E84AVTCC152xxBS | 1.5  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| 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.



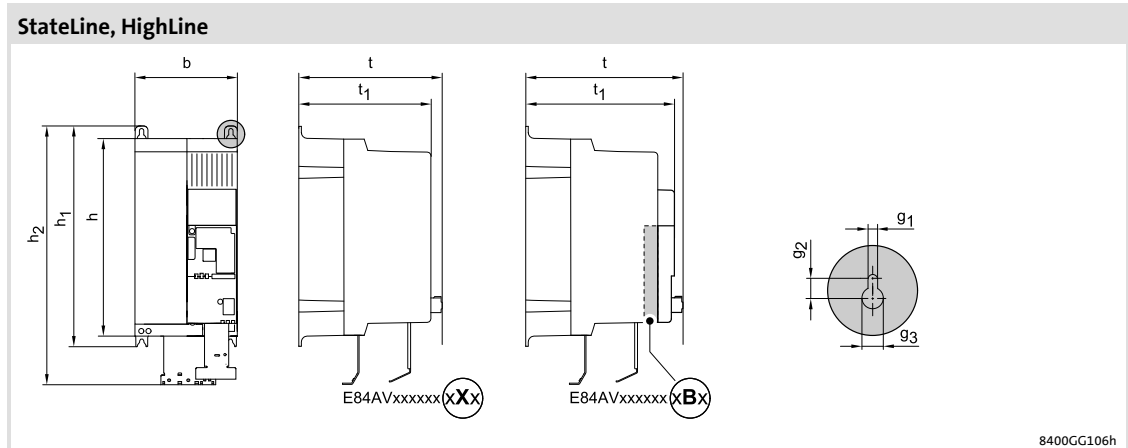


Fig. 5-19 Device dimensions

|                 | [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  |      |     |     |                |                |                |                |                |                |
| E84AVxxE1134xXX | 11   | 325  | 140 | 199 | 359            | 416            | 186            | 6              | 11             | 12             |
| E84AVxxE1534xXX | 15   |      |     |     |                |                |                |                |                |                |
| E84AVxxE1834xXX | 18.5 |      |     |     |                |                |                |                |                |                |
| E84AVxxE2234xXX | 22   | 350  | 205 | 250 | 359            | 430            | 237            | 7              | 10             | 13             |
| 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             |
|                 |      |      |     |     |                |                |                |                |                |                |

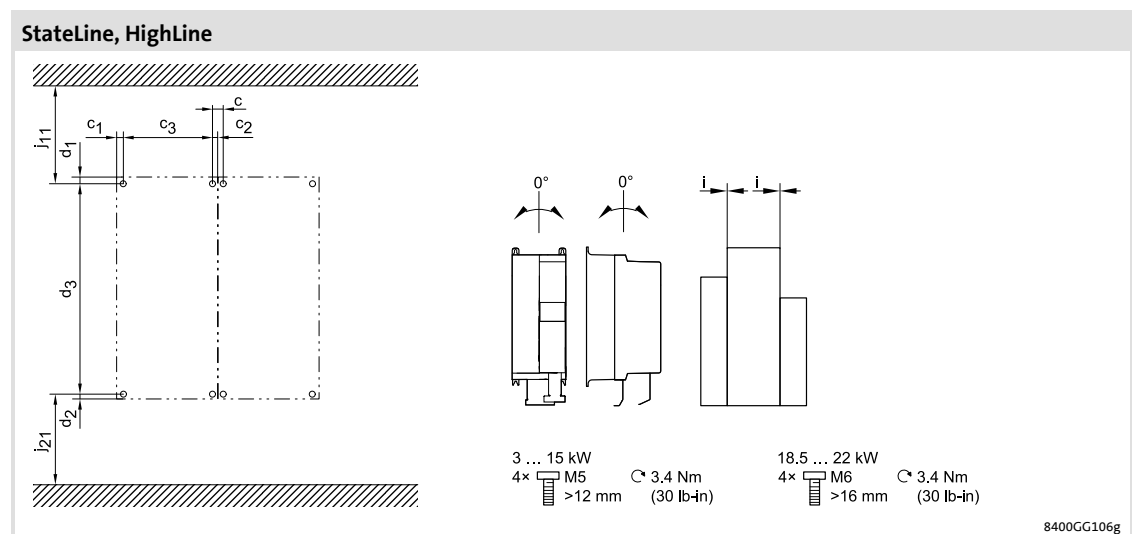


Fig. 5-20 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|----------------|----------------|----------------|----|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 |      | [mm]           |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE3024xXx | 3    | 9              | 9              | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 4.4                                                                                 |
| E84AVxxE4024xXx | 4    |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE5524xXx | 5.5  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE7524xXx | 7.5  | 10             | 9              | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 5.8                                                                                 |
| E84AVxxE1134xXx | 11   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE1534xXx | 15   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE1834xXx | 18.5 | 11             | 8              | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            | 12.0                                                                                |
| E84AVxxE2234xXx | 22   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE3024xBx | 3    | 9              | 9              | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 4.5                                                                                 |
| E84AVxxE4024xBx | 4    |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE5524xBx | 5.5  |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE7524xBx | 7.5  | 10             | 9              | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 5.9                                                                                 |
| E84AVxxE1134xBx | 11   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE1534xBx | 15   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxE1834xBx | 18.5 | 11             | 8              | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            | 12.1                                                                                |
| E84AVxxE2234xBx | 22   |                |                |                |    |                |                |                |   |                 |                 |                                                                                     |

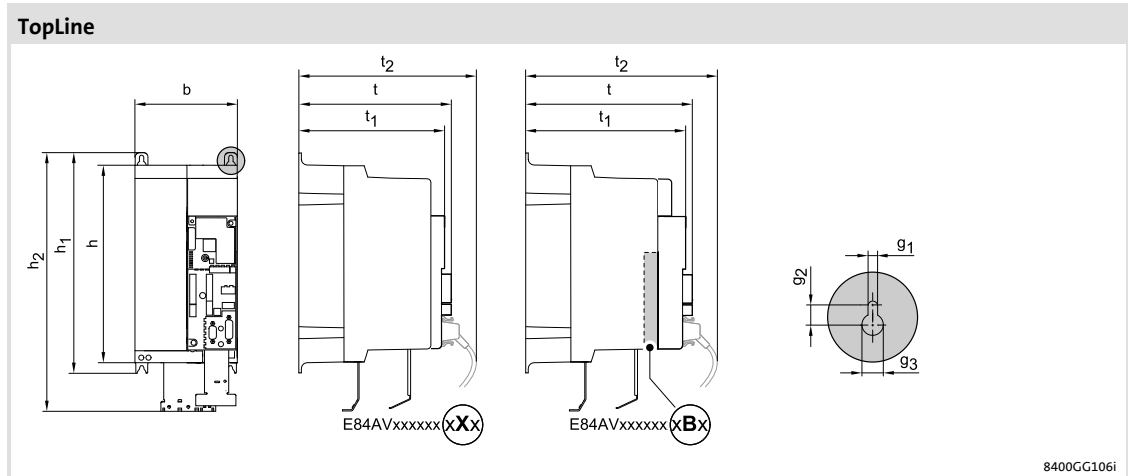


Fig. 5-21 Device dimensions

|                 |      | 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] |     |     |                |                |                |                |                |                |                |
| E84AVTCE3024xXx | 3    | 270  | 140 | 214 | 303            | 360            | 201            | 240            | 6              | 11             | 12             |
| E84AVTCE4024xXx | 4    |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE5524xXx | 5.5  |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE7524xXx | 7.5  |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE1134xXx | 11   | 325  | 140 | 214 | 359            | 416            | 201            | 240            | 6              | 11             | 12             |
| E84AVTCE1534xXx | 15   |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE1834xXx | 18.5 |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE2234xXx | 22   | 350  | 205 | 265 | 359            | 430            | 252            | 291            | 7              | 10             | 13             |
| 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 |      |     |     |                |                |                |                |                |                |                |
| E84AVTCE2234xBx | 22   | 350  | 205 | 285 | 359            | 430            | 272            | 311            | 7              | 10             | 13             |

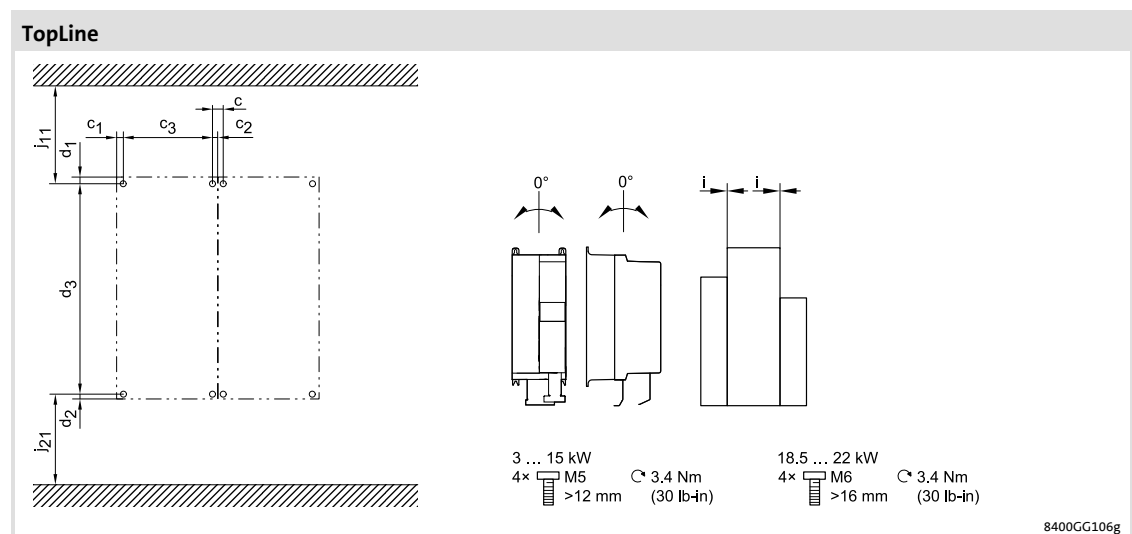


Fig. 5-22 Dimensions for mounting

|                 |      | 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]                                                                                |
| E84AVTCE3024xXx | 3    | 9              | 9              | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 4.6                                                                                 |
| E84AVTCE4024xXx | 4    |                |                | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE5524xXx | 5.5  |                |                | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE7524xXx | 7.5  | 10             | 9              | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 6.0                                                                                 |
| E84AVTCE1134xXx | 11   |                |                | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE1534xXx | 15   |                |                | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE1834xXx | 18.5 | 11             | 8              | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            | 12.2                                                                                |
| E84AVTCE2234xXx | 22   |                |                | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE3024xBx | 3    | 9              | 9              | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 4.7                                                                                 |
| E84AVTCE4024xBx | 4    |                |                | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE5524xBx | 5.5  |                |                | 285            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE7524xBx | 7.5  | 10             | 9              | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            | 6.1                                                                                 |
| E84AVTCE1134xBx | 11   |                |                | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE1534xBx | 15   |                |                | 340            | 20 | 10             | 10             | 120            | 0 | > 95            | > 95            |                                                                                     |
| E84AVTCE1834xBx | 18.5 | 11             | 8              | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            | 12.3                                                                                |
| E84AVTCE2234xBx | 22   |                |                | 340            | 25 | 12.5           | 12.5           | 180            | 0 | > 95            | > 95            |                                                                                     |

## 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..

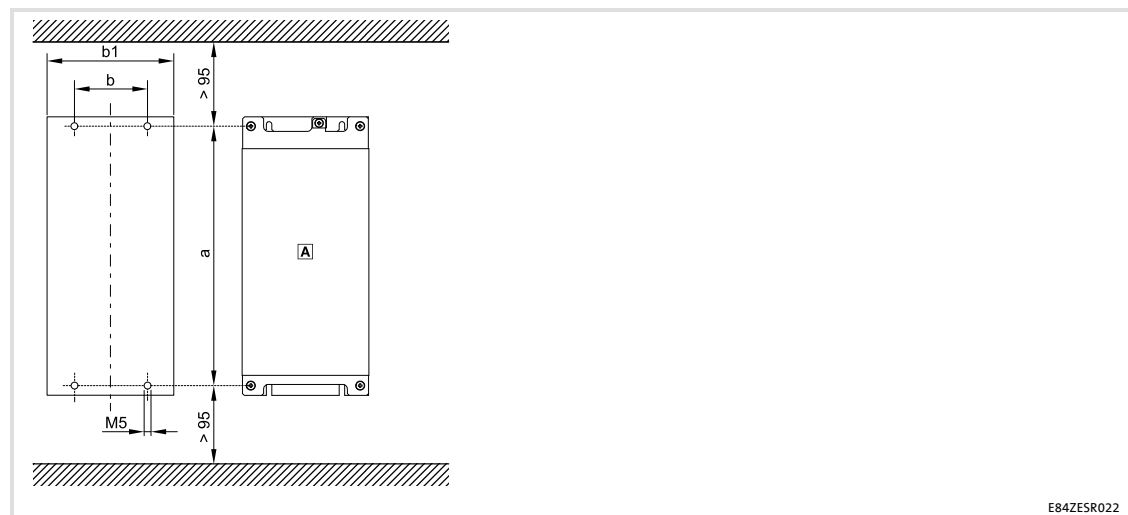


### Tip!

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            | SD              | RFI filter<br>LD | LL |
| E84AVxxx3024xx0 | E84AZE5SR5524SD | E84AZE5SR5524LD  | -  |
| E84AVxxx4024    |                 |                  |    |
| E84AVxxx5524    |                 |                  |    |
| E84AVxxx7524    | E84AZE5SR1534SD | E84AZE5SR1534LD  | -  |
| E84AVxxx1134    |                 |                  |    |
| E84AVxxx1534    |                 |                  |    |
| E84AVxxx1834    | -               | E84AZE5SR1834LD  | -  |
| E84AVxxx2234    | -               | E84AZE5SM2234LD  | -  |

1) Mains filter (mains choke with RFI filter)



E84ZE5R022

A Footprint filter

| Type            | a    | b   | b1  |
|-----------------|------|-----|-----|
|                 | [mm] |     |     |
| E84AZE5SR5524xx | 285  | 80  | 140 |
| E84AZE5SR1534xx | 340  | 80  | 140 |
| E84AZE5SR1834xx | 415  | 160 | 205 |
| E84AZE5SM2234xx | 415  | 160 | 205 |

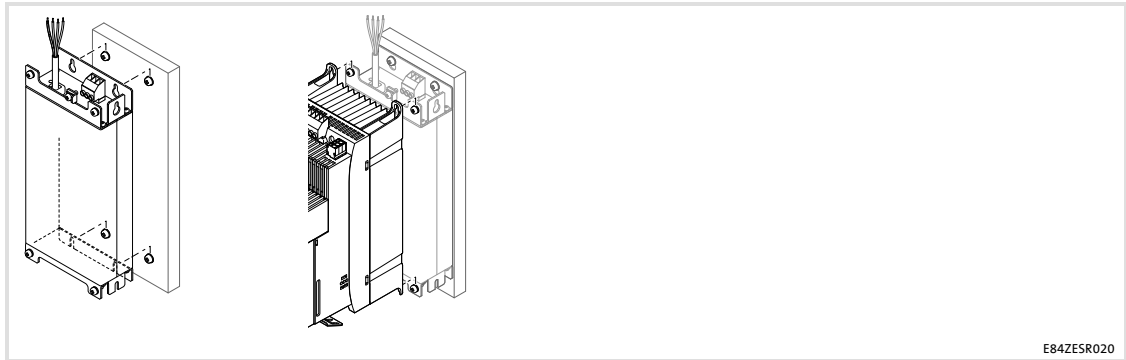


Fig. 5-23 Assembly with footprint filter

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..

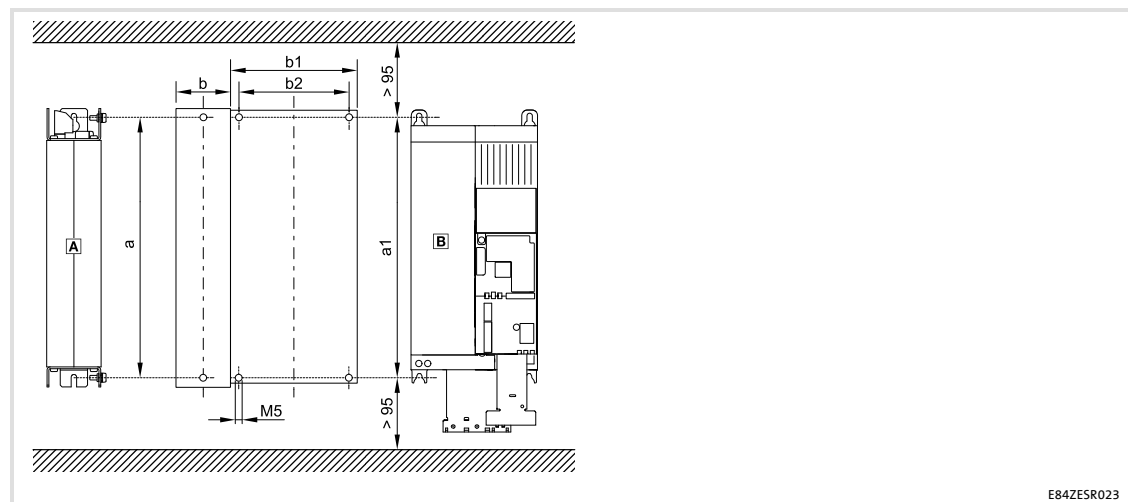


### Tip!

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            | SD             | RFI filter<br>LD | LL |
| E84AVxxx3024xx0 | E84AZESR5524SD | E84AZESR5524LD   | -  |
| E84AVxxx4024    |                |                  |    |
| E84AVxxx5524    |                |                  |    |
| E84AVxxx7524    | E84AZESR1534SD | E84AZESR1534LD   | -  |
| E84AVxxx1134    |                |                  |    |
| E84AVxxx1534    |                |                  |    |
| E84AVxxx1834    | -              | E84AZESR1834LD   | -  |
| E84AVxxx2234    | -              | E84AZESM2234LD   | -  |

1) Mains filter (mains choke with RFI filter)



E84ZESR023

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

| Type           | a<br>[mm] | a1<br>[mm] | b<br>[mm] | b1<br>[mm] | b2<br>[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        |

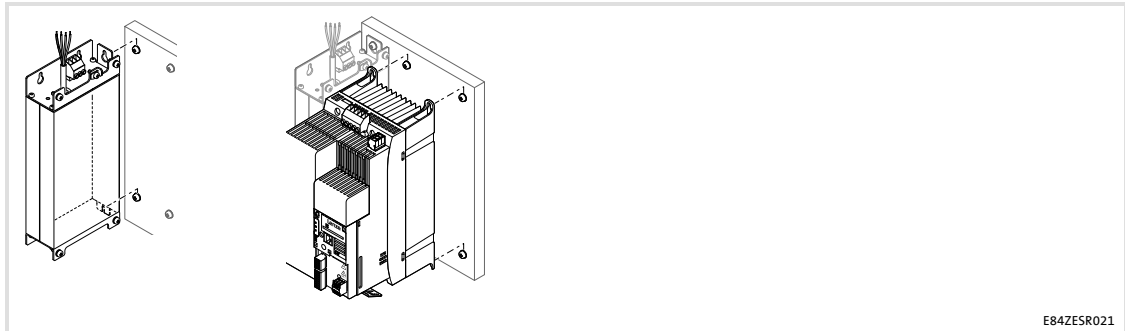


Fig. 5-24 Assembly with side-mounted filter

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.

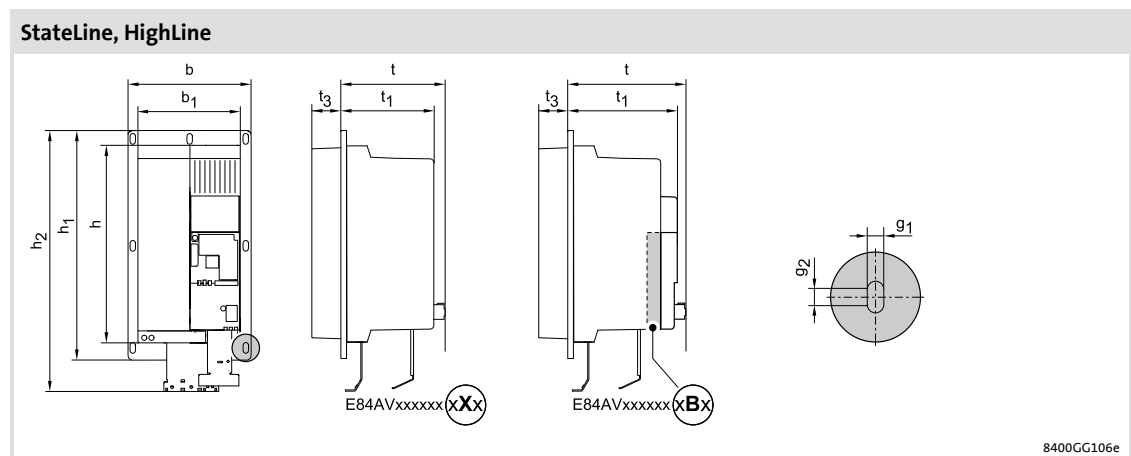


Fig. 5-25 Device dimensions

|                 |      | 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] |     |     |                |                |                |                |                |                |                |
| E84AVxxD3024xXx | 3    |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD4024xXx | 4    | 270  | 174 | 141 | 318            | 366            | 140            | 128            | 64             | 6              | 5              |
| E84AVxxD5524xXx | 5.5  |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD3024xBx | 3    |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD4024xBx | 4    | 270  | 174 | 161 | 318            | 366            | 140            | 148            | 64             | 6              | 5              |
| E84AVxxD5524xBx | 5.5  |      |     |     |                |                |                |                |                |                |                |

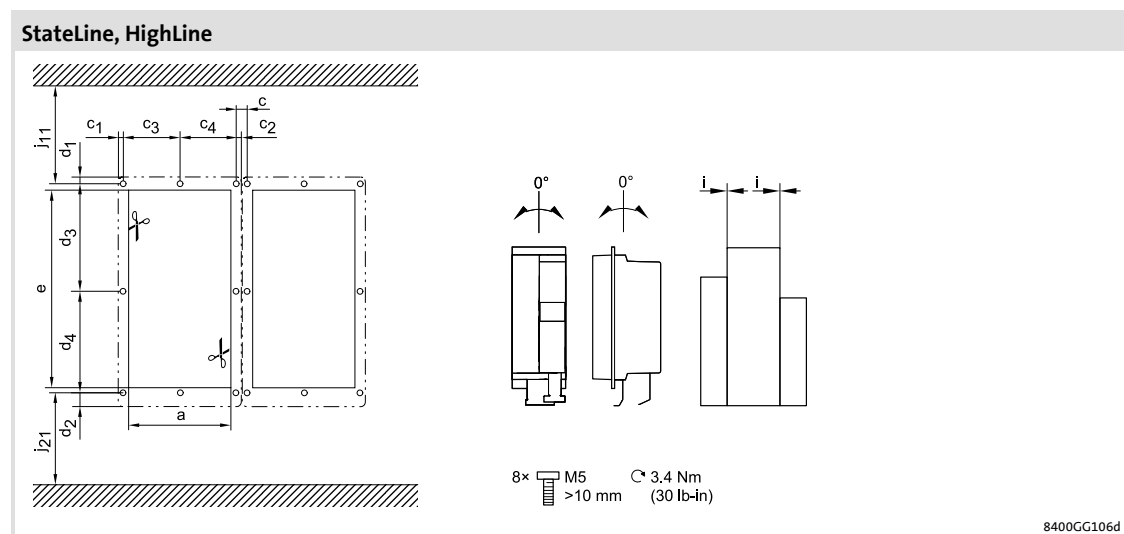


Fig. 5-26 Dimensions for mounting

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

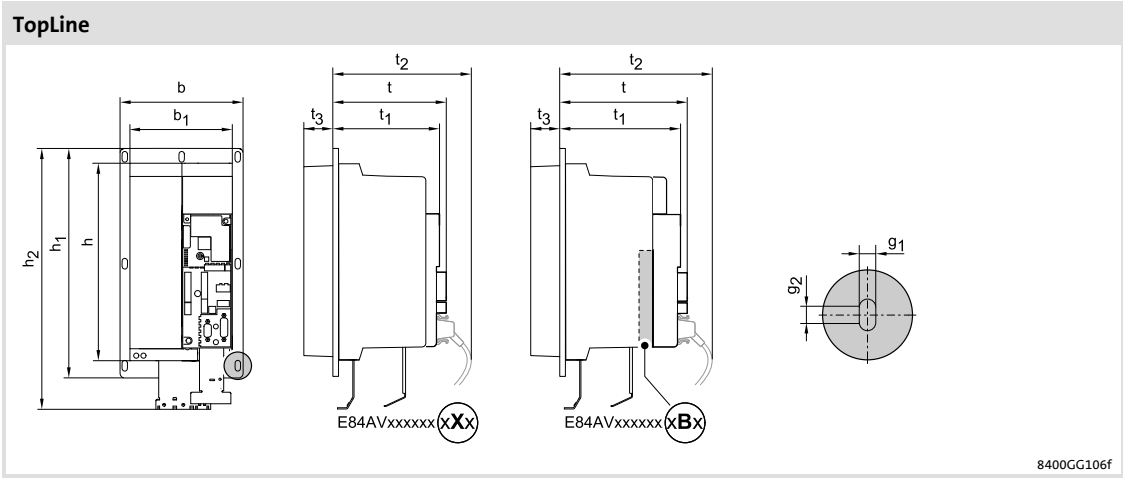


Fig. 5-27 Device dimensions

|                 | [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    | 270  | 174 | 156 | 318            | 366            | 140            | 143            | 182            | 64             | 6              | 5              |
| E84AVTCD4024xXx | 4    |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD5524xXx | 5.5  |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD3024xBx | 3    | 270  | 174 | 176 | 318            | 366            | 140            | 163            | 202            | 64             | 6              | 5              |
| E84AVTCD4024xBx | 4    |      |     |     |                |                |                |                |                |                |                |                |
| E84AVTCD5524xBx | 5.5  |      |     |     |                |                |                |                |                |                |                |                |

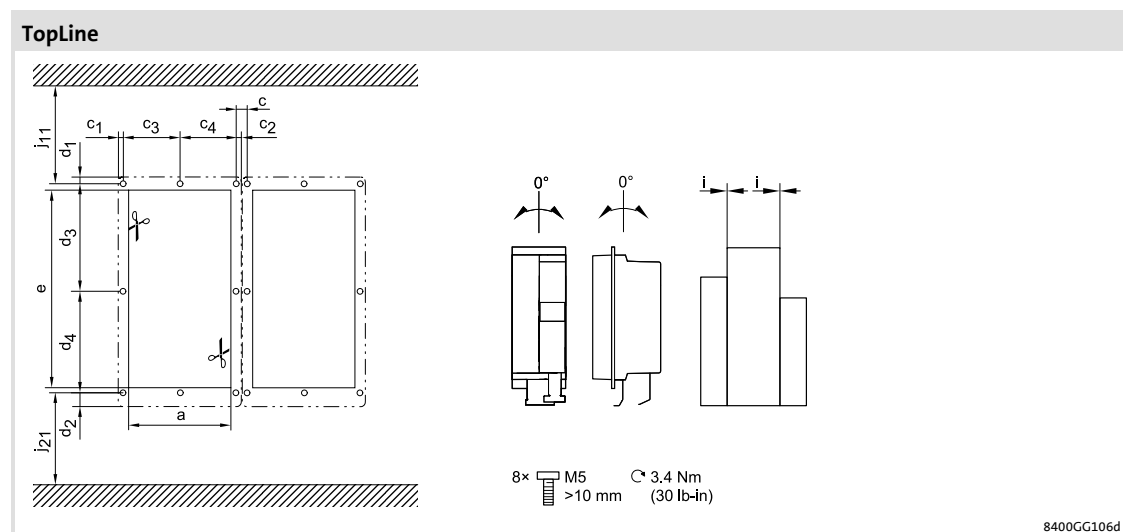


Fig. 5-28 Dimensions for mounting

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

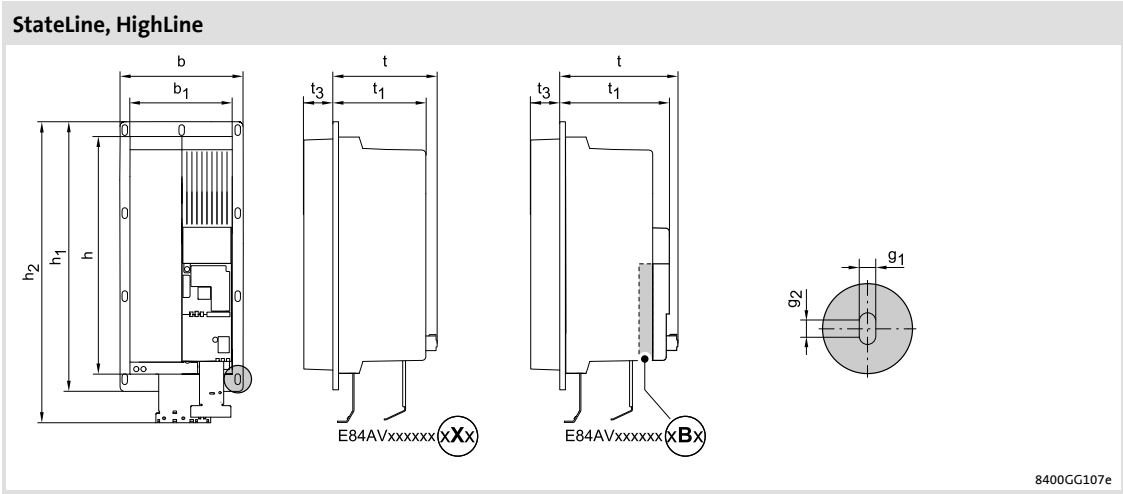


Fig. 5-29 Device dimensions

|                 |      | 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> |
|-----------------|------|------|-----|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                 |      | [mm] |     |     |                |                |                |                |                |                |                |
|                 | [kW] |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD7524xXx | 7.5  | 325  | 174 | 141 | 378            | 426            | 140            | 128            | 64             | 6              | 5              |
| E84AVxxD1134xXx | 11   |      |     | 161 | 378            | 426            | 140            | 148            | 64             | 6              | 5              |
| E84AVxxD1534xXx | 15   |      |     |     |                |                |                |                |                |                |                |
| E84AVxxD7524xBx | 7.5  | 325  | 174 | 161 | 378            | 426            | 140            | 148            | 64             | 6              | 5              |
| E84AVxxD1134xBx | 11   |      |     | 161 | 378            | 426            | 140            | 148            | 64             | 6              | 5              |
| E84AVxxD1534xBx | 15   |      |     |     |                |                |                |                |                |                |                |

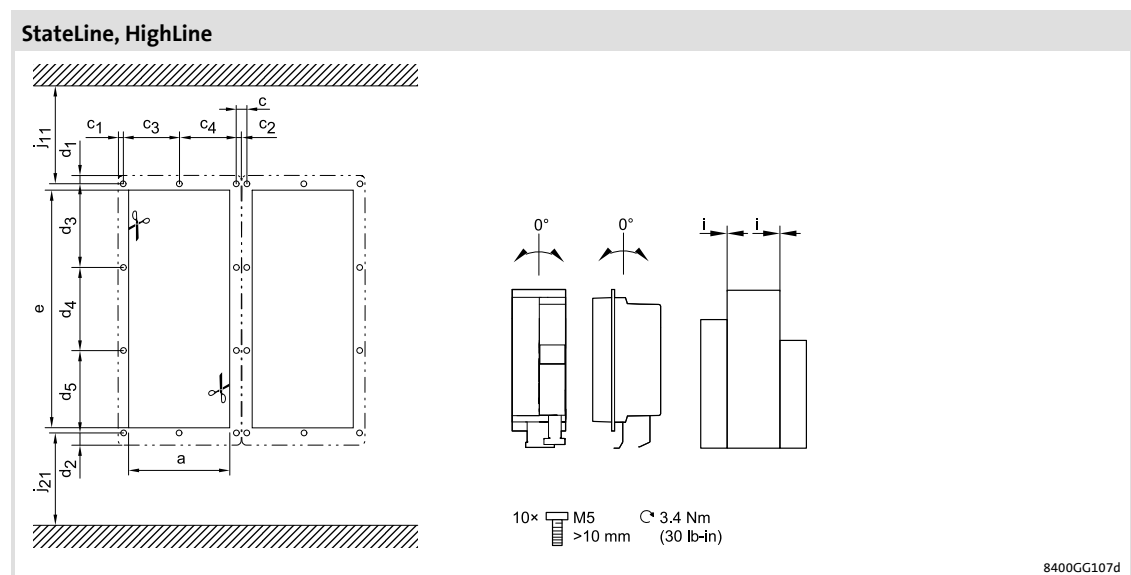


Fig. 5-30 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|------------|------------|----------------|----------------|----------------|----------------|----------------|----|----------------|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [kW] | [mm]       |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 | [kg]                                                                                |
| E84AVxxD7524xXx | 7.5  | 145<br>± 1 | 330<br>± 1 | 9              | 9              | 120            | 120            | 120            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 6.2                                                                                 |
| E84AVxxD1134xXx | 11   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD1534xXx | 15   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD7524xBx | 7.5  | 145<br>± 1 | 330<br>± 1 | 9              | 9              | 120            | 120            | 120            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 6.3                                                                                 |
| E84AVxxD1134xBx | 11   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxD1534xBx | 15   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |

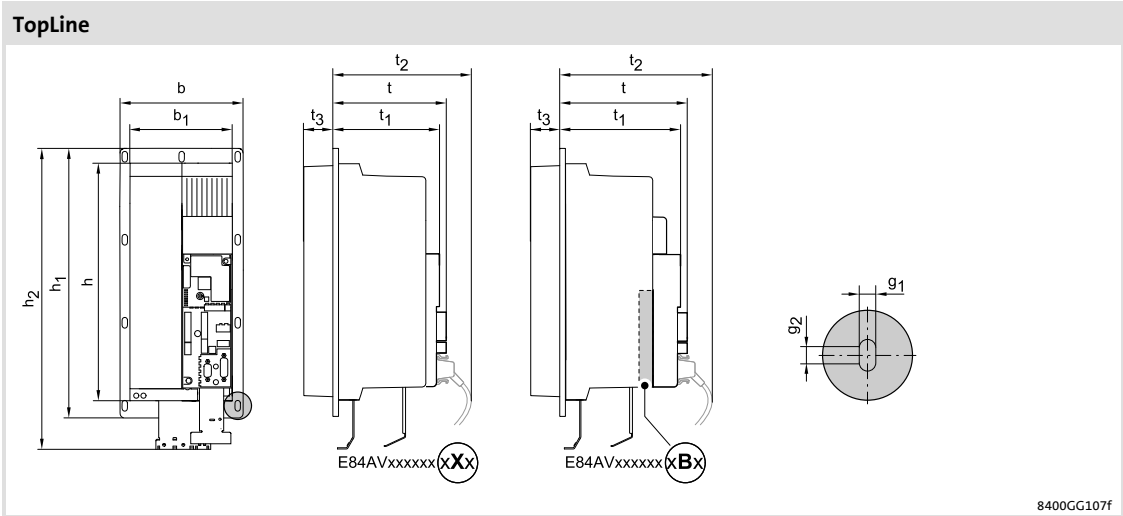


Fig. 5-31 Device dimensions

|                 |      | 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] |     |     |                |                |                |                |                |                |                |                |  |  |
| 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   |      |     |     |                |                |                |                |                |                |                |                |  |  |

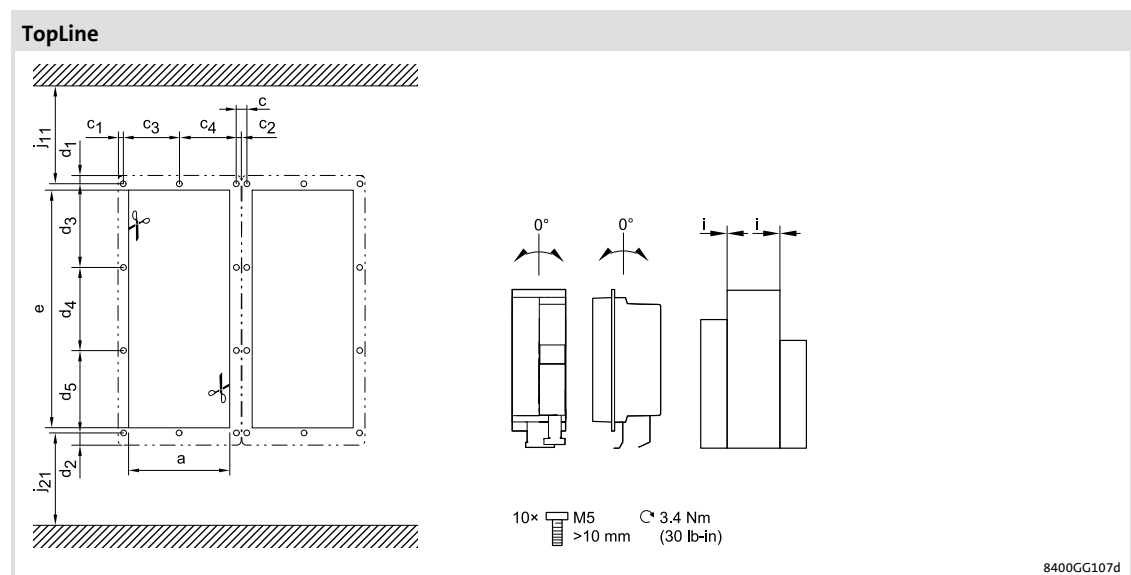


Fig. 5-32 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|------------|------------|----------------|----------------|----------------|----------------|----------------|----|----------------|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [kW] | [mm]       |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 | [kg]                                                                                |
| E84AVTCD7524xXx | 7.5  | 145<br>± 1 | 330<br>± 1 | 9              | 9              | 120            | 120            | 120            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 6.4                                                                                 |
| E84AVTCD1134xXx | 11   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVTCD1534xXx | 15   |            |            |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVTCD7524xBx | 7.5  | 145<br>± 1 | 330<br>± 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 µm, 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                    | ≤ 0.33             |
| E84AVxxC4024    | 155                    | ≤ 0.25             |
| E84AVxxC5524    | 215                    | ≤ 0.18             |
| E84AVxxC7524    | 250                    | ≤ 0.15             |
| E84AVxxC1134    | 355                    | ≤ 0.11             |
| E84AVxxC1534    | 390                    | ≤ 0.10             |
| E84AVxxC1834    | 460                    | ≤ 0.057            |
| E84AVxxC2234    | 540                    | ≤ 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.

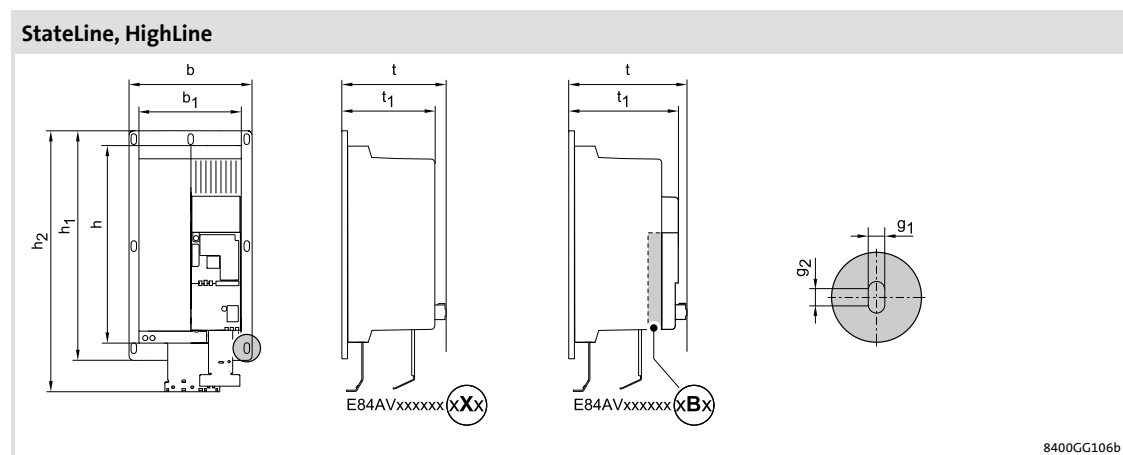


Fig. 5-33 Device dimensions

|                 | [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  |      |     |     |                |                |                |                |                |                |

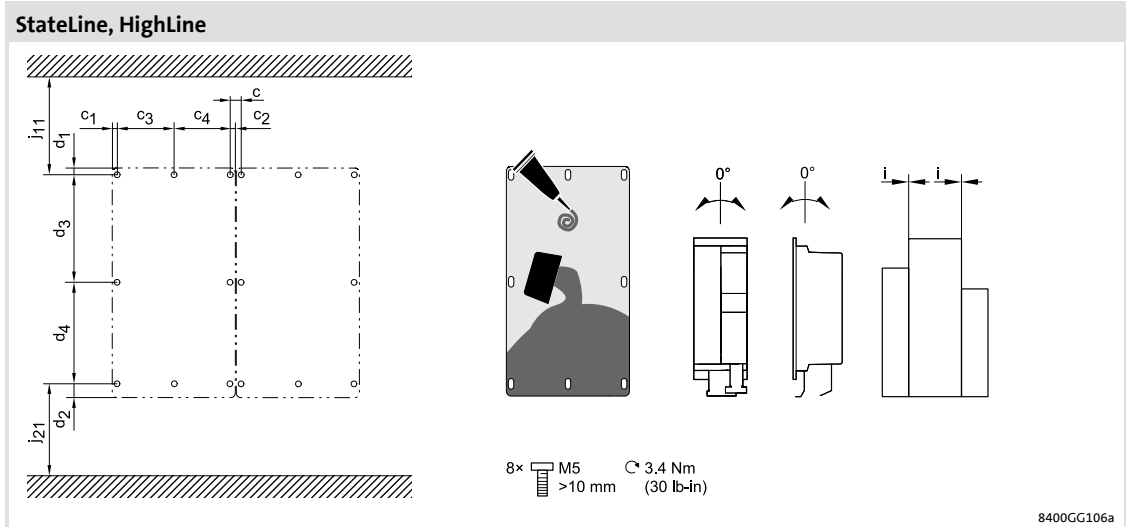


Fig. 5-34 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|----------------|----------------|----------------|----------------|----|----------------|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [kW] | [mm]           |                |                |                |    |                |                |                |                |   |                 |                 | [kg]                                                                                |
| E84AVxxC3024xX0 | 3    | 9              | 9              | 150            | 150            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 2.7                                                                                 |
| E84AVxxC4024xXx | 4    |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC5524xXx | 5.5  |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC3024xB0 | 3    | 9              | 9              | 150            | 150            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 2.8                                                                                 |
| E84AVxxC4024xBx | 4    |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC5524xBx | 5.5  |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |

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

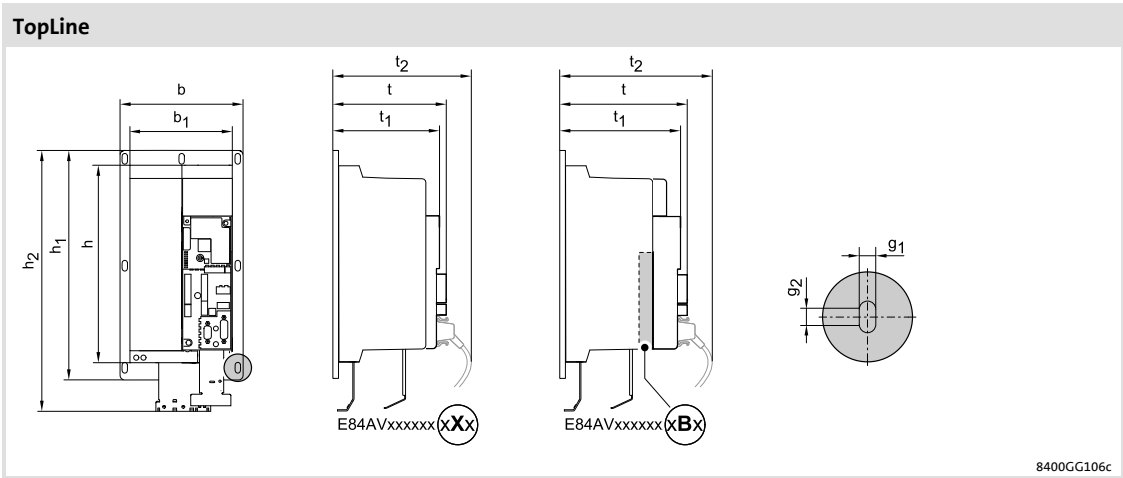


Fig. 5-35 Device dimensions

|                 | [kW] | h    | b   | t   | h <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] |     |     |                |                |                |                |                |                |                |
| E84AVTCC3024xX0 | 3    | 270  | 174 | 156 | 318            | 366            | 140            | 143            | 182            | 6              | 5              |
| E84AVTCC4024xXx | 4    |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC5524xXx | 5.5  |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC3024xB0 | 3    | 270  | 174 | 176 | 318            | 366            | 140            | 163            | 202            | 6              | 5              |
| E84AVTCC4024xBx | 4    |      |     |     |                |                |                |                |                |                |                |
| E84AVTCC5524xBx | 5.5  |      |     |     |                |                |                |                |                |                |                |

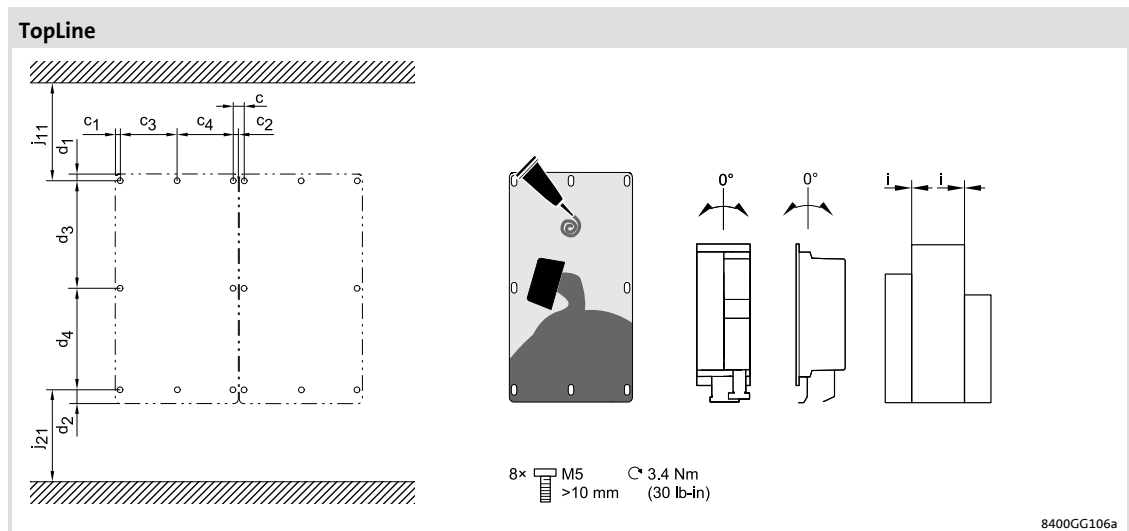


Fig. 5-36 Dimensions for mounting

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

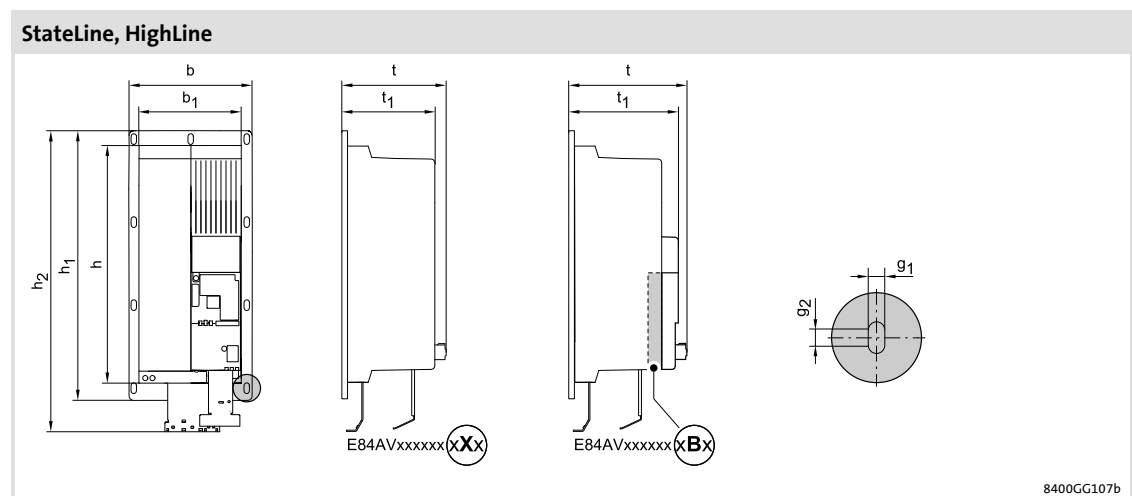


Fig. 5-37 Device dimensions

|                 |      | 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              |

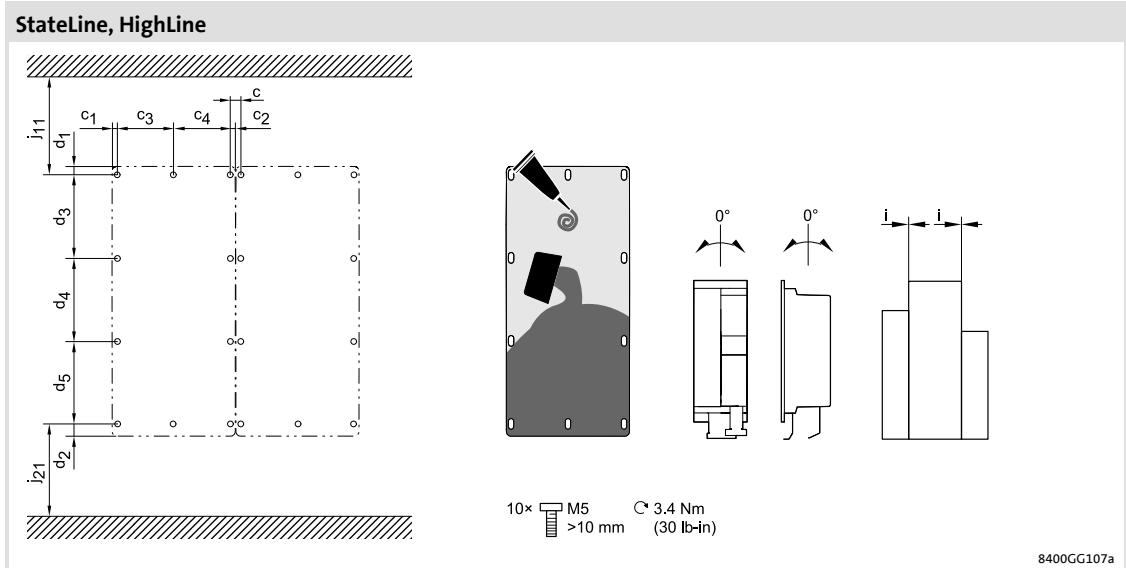


Fig. 5-38 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|----------------|----------------|----------------|----------------|----------------|----|----------------|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [kW] | [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  | 9              | 9              | 120            | 120            | 120            | 15 | 7              | 7              | 80             | 80             | 0 | > 95            | > 95            | 3.7                                                                                 |
| E84AVxxC1134xBx | 11   |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC1534xBx | 15   |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |
| E84AVxxC1834xBx | 18.5 | 8.5            | 8.5            | 130            | 130            | 130            | 15 | 5.5            | 5.5            | 110            | 110            | 0 | > 95            | > 95            | 9.4                                                                                 |
| E84AVxxC2234xBx | 22   |                |                |                |                |                |    |                |                |                |                |   |                 |                 |                                                                                     |

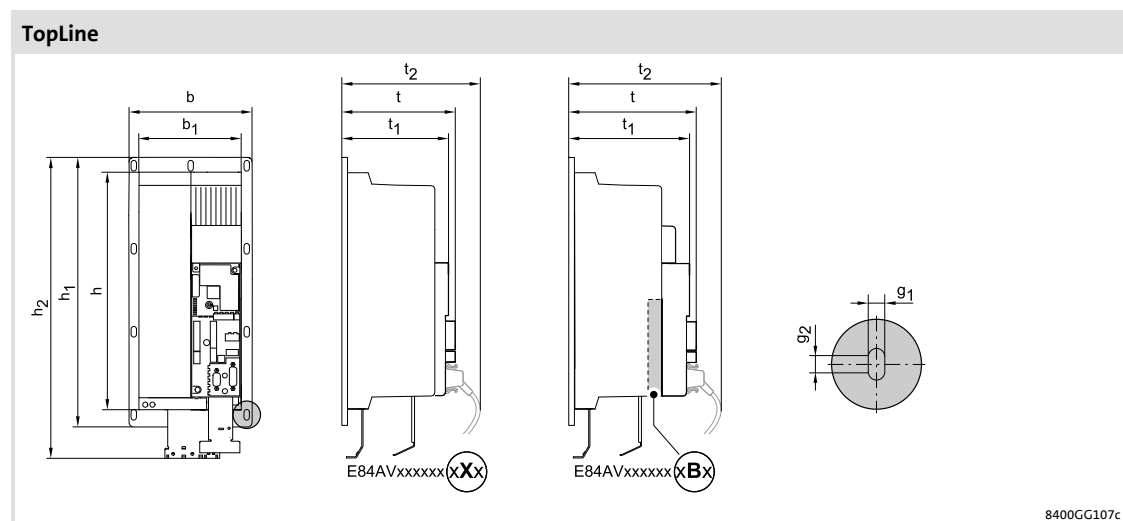


Fig. 5-39 Device dimensions

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



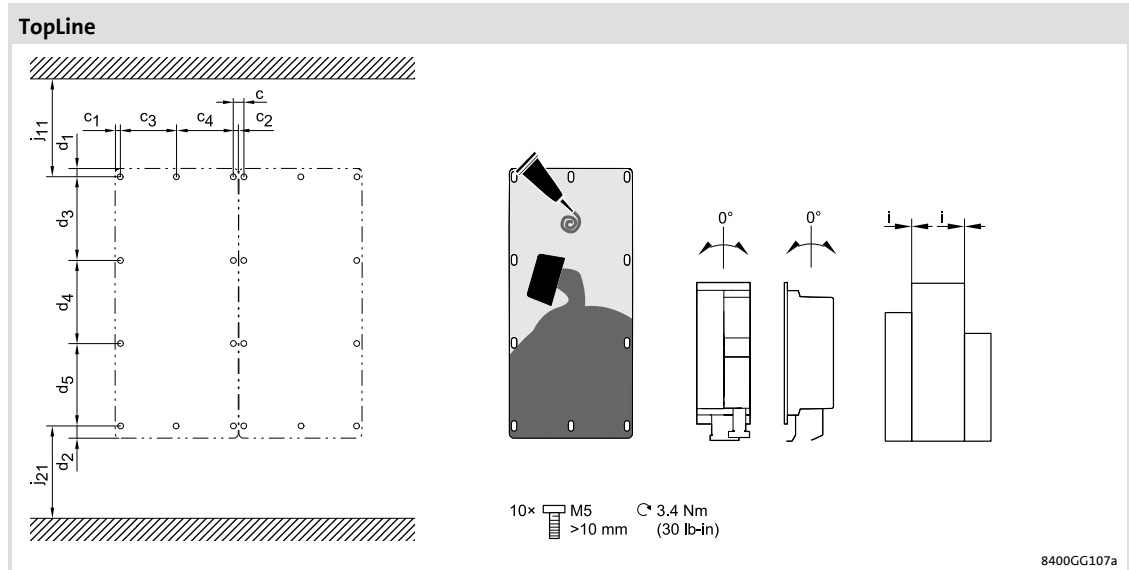


Fig. 5-40 Dimensions for mounting

|                 |      | 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> |  |
|-----------------|------|----------------|----------------|----------------|----------------|----------------|----|----------------|----------------|----------------|----------------|---|-----------------|-----------------|-------------------------------------------------------------------------------------|
|                 | [kW] | [mm]           |                |                |                |                |    |                |                |                |                |   |                 |                 | [kg]                                                                                |
| 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.

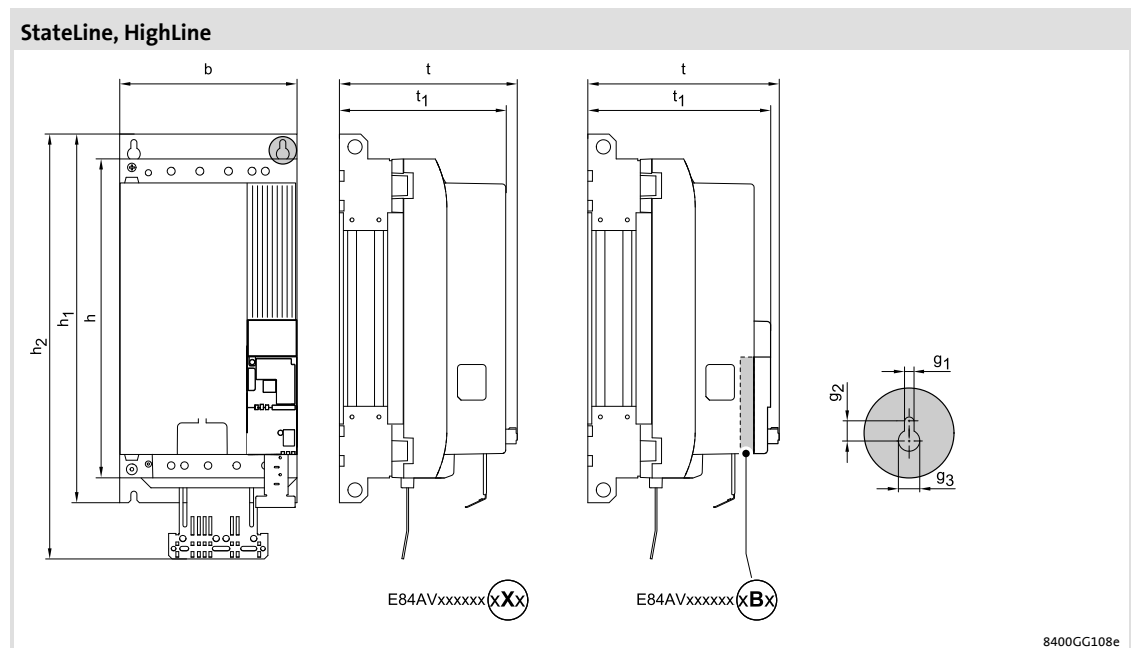


Fig. 5-41 Device dimensions

|                 |      | 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> |
|-----------------|------|------|-----|-----|----------------|----------------|----------------|----------------|----------------|----------------|
|                 | [kW] | [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

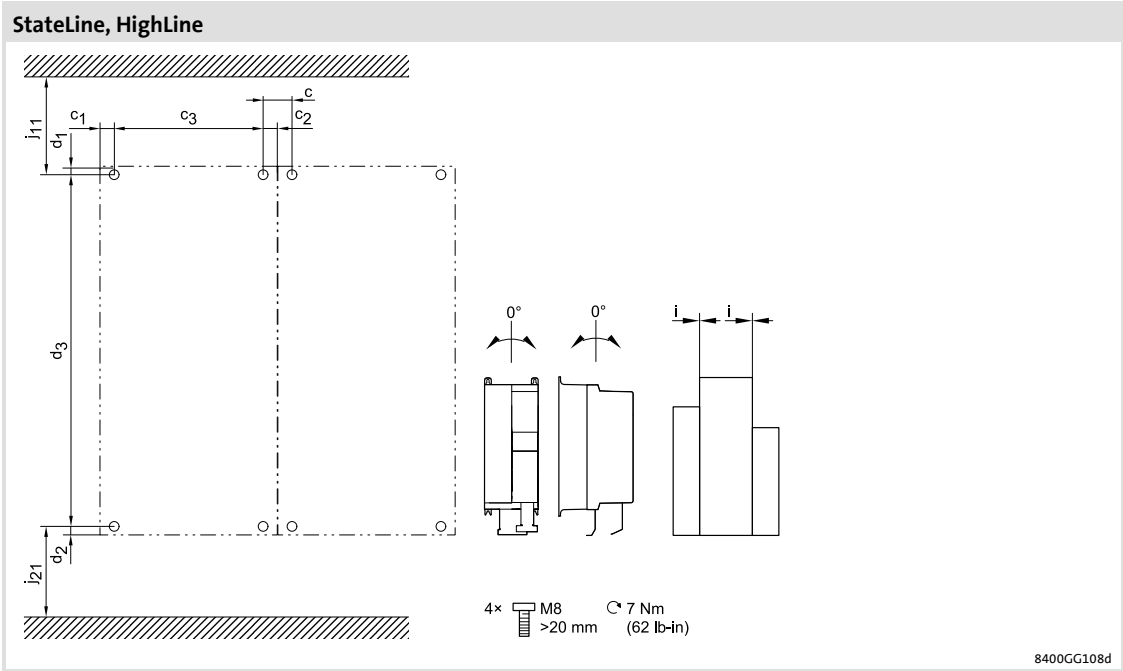


Fig. 5-42 Dimensions for mounting

|                 | [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> |  |
|-----------------|------|----------------|----------------|----------------|----|----------------|----------------|----------------|---|-----------------|-----------------|---------------------------------------------------------------------------------------|
|                 |      | [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   |                |                |                |    |                |                |                |   |                 |                 |                                                                                       |

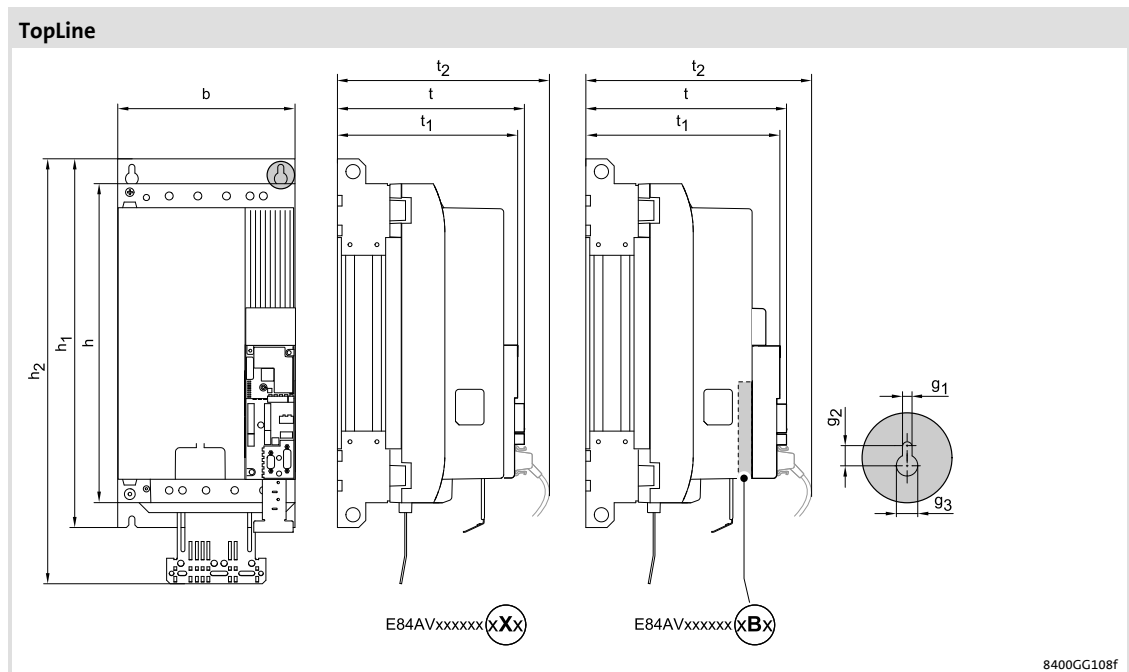


Fig. 5-43 Device dimensions

|                 |      | $h$  | $b$ | $t$ | $h_1$ | $h_2$ | $t_1$ | $t_2$ | $g_1$ | $g_2$ | $g_3$ |
|-----------------|------|------|-----|-----|-------|-------|-------|-------|-------|-------|-------|
|                 | [kW] | [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

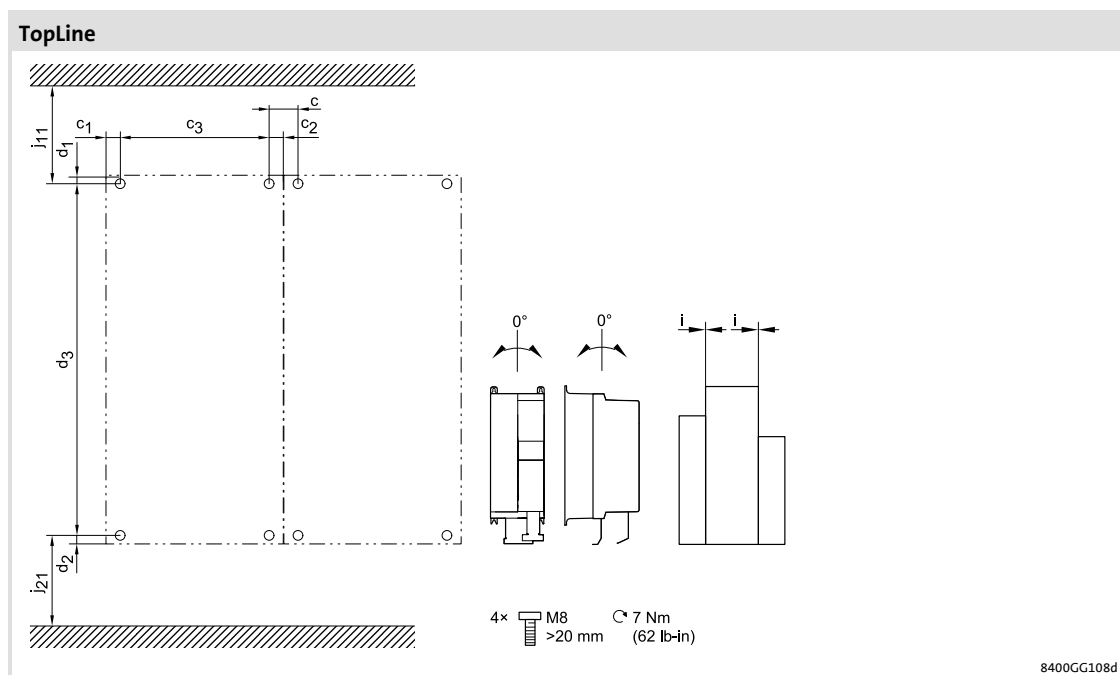


Fig. 5-44 Dimensions for mounting

|                 |      | 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!**

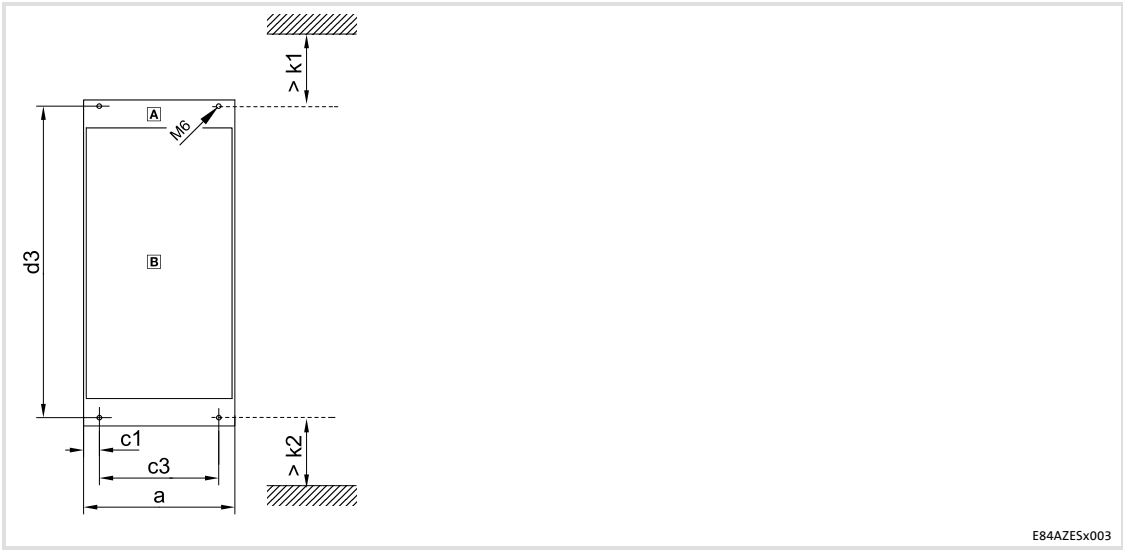
The scope of supply of the filter comprises mounting instructions. They describe technical data and information on mechanical and electrical mounting of this accessory part.

**Assignment of filter – controller**

| Controller<br>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

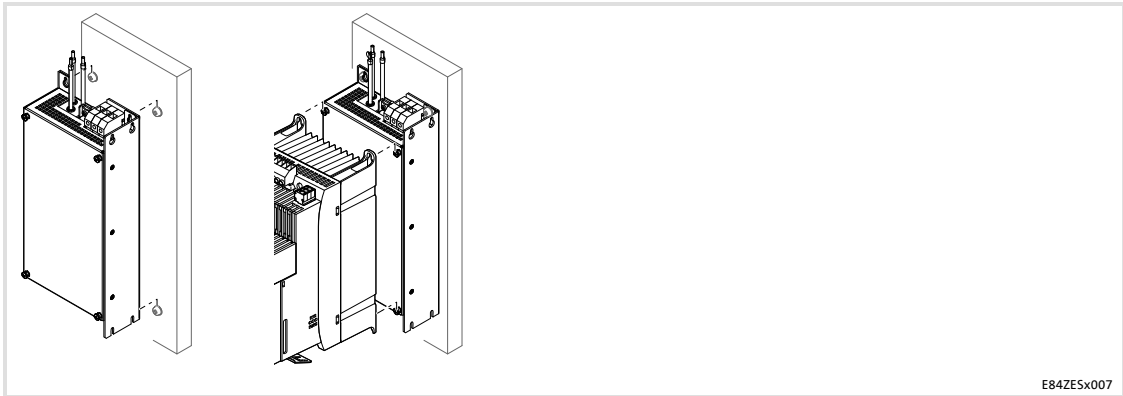
**Mechanical installation**  
Standard devices in a power range of 30 ... 45 kW  
Filter mounting in "standard" technique



**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     |      |      |      |      |      |      |
| E84AZESM4534LDN001 |      |      |      |      |      |      |





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)

## Filter mounting variant

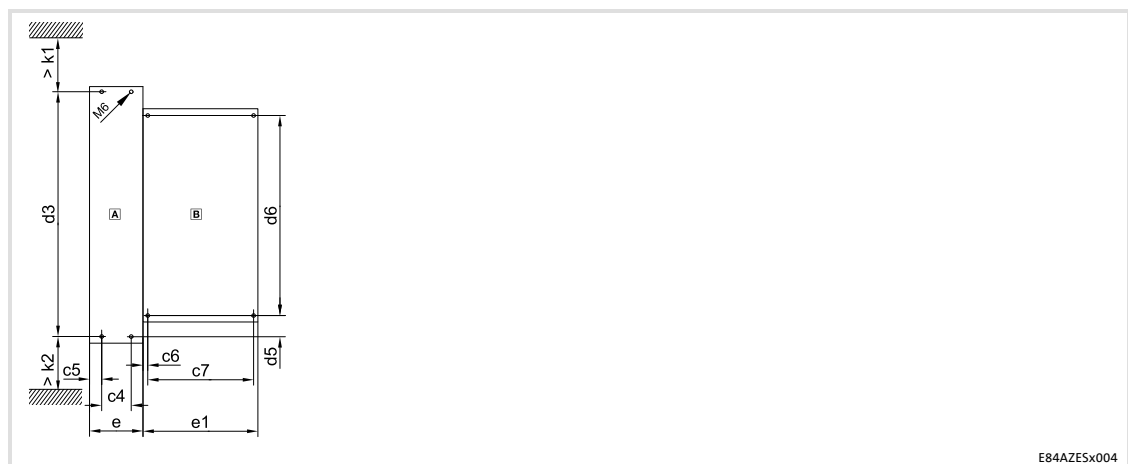
The mounting location and material must ensure a durable mechanical connection.

- 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.

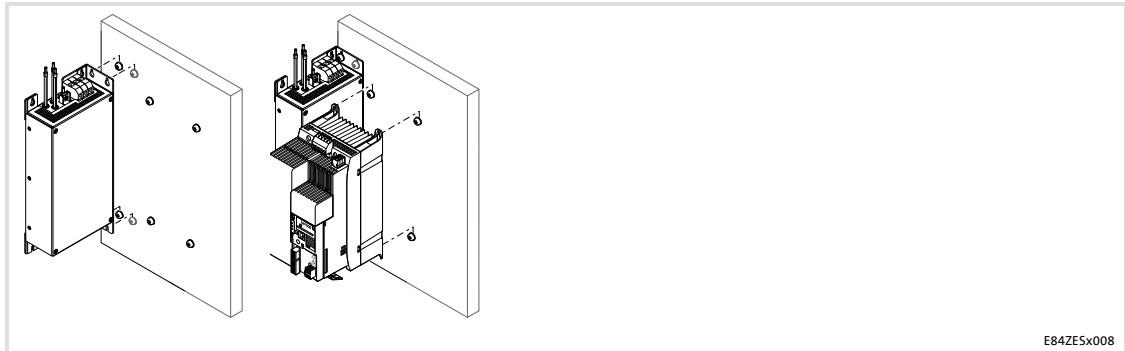


E84AZESx004

- 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 µm, the heat transmission is approx. 0.007 K/W.

|              | Power to be dissipated | Thermal resistance |
|--------------|------------------------|--------------------|
| Type         | $P_v$ [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.

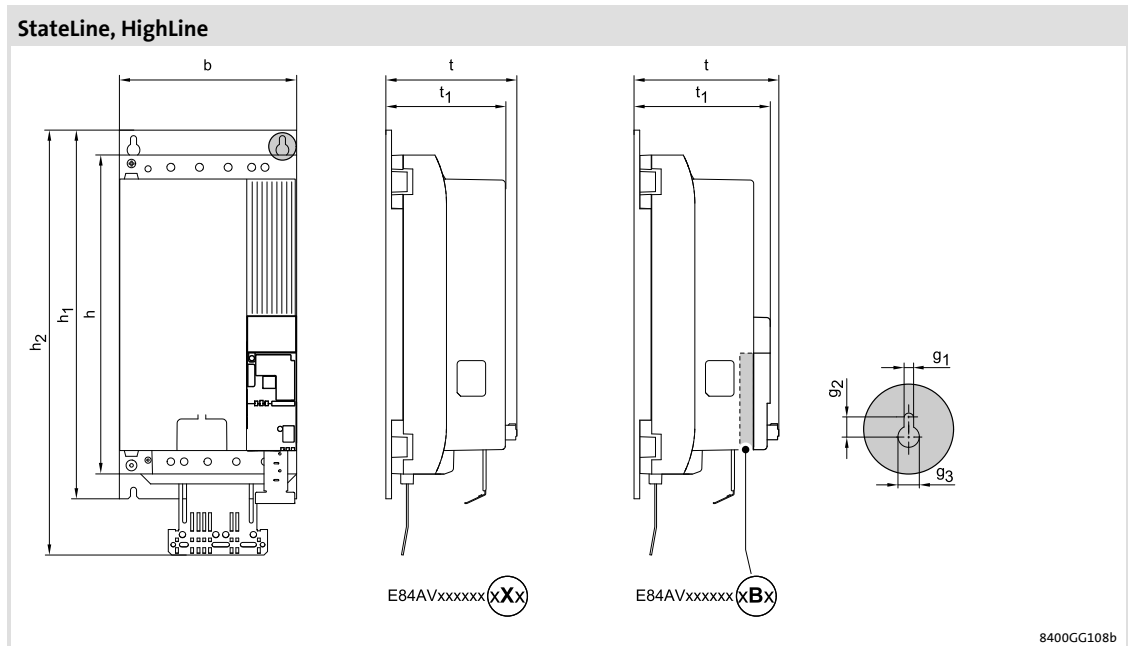


Fig. 5-45 Device dimensions

|                 |    | 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 |      |     | 204 | 520            | 636            | 191            | 8.5            | 16             | 18             |  |  |  |  |  |  |
| E84AVxxC4534xXx | 45 |      |     |     |                |                |                |                |                |                |  |  |  |  |  |  |
| E84AVxxC3034xBx | 30 | 450  | 250 | 204 |                |                |                |                |                |                |  |  |  |  |  |  |
| E84AVxxC3734xBx | 37 |      |     |     |                |                |                |                |                |                |  |  |  |  |  |  |
| E84AVxxC4534xBx | 45 |      |     |     |                |                |                |                |                |                |  |  |  |  |  |  |

**Mechanical installation**  
Standard devices in a power range of 30 ... 45 kW  
Mounting in "cold plate" technique

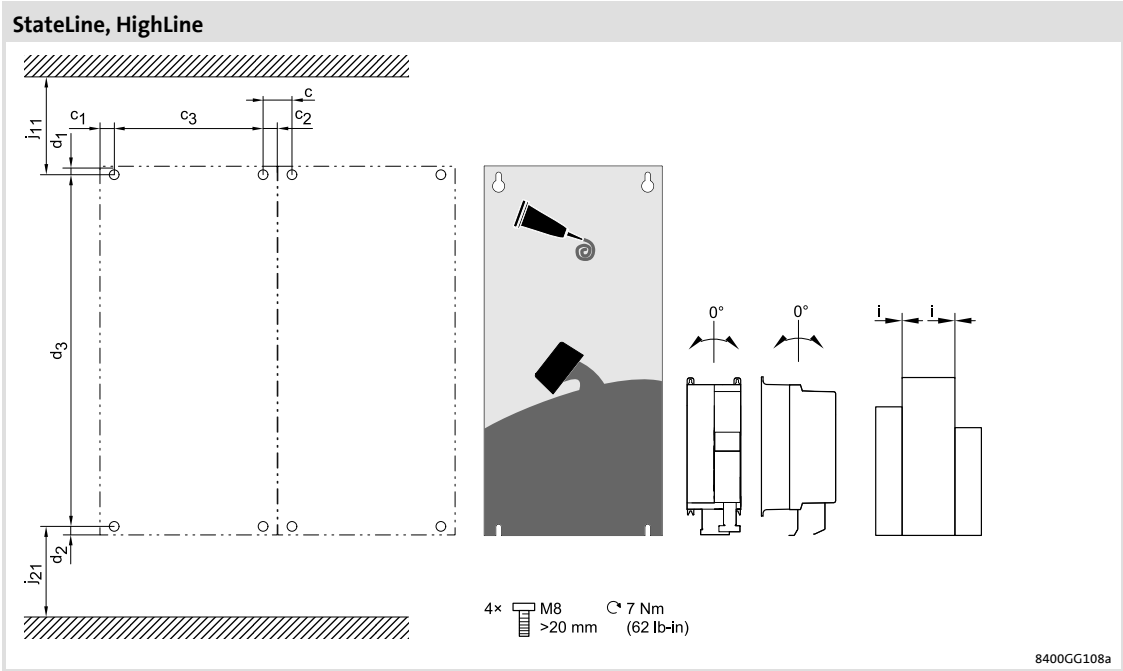


Fig. 5-46 Dimensions for mounting

|                 |      | 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   |                |                |                |    |                |                |                |   |                 |                 |                                                                                       |

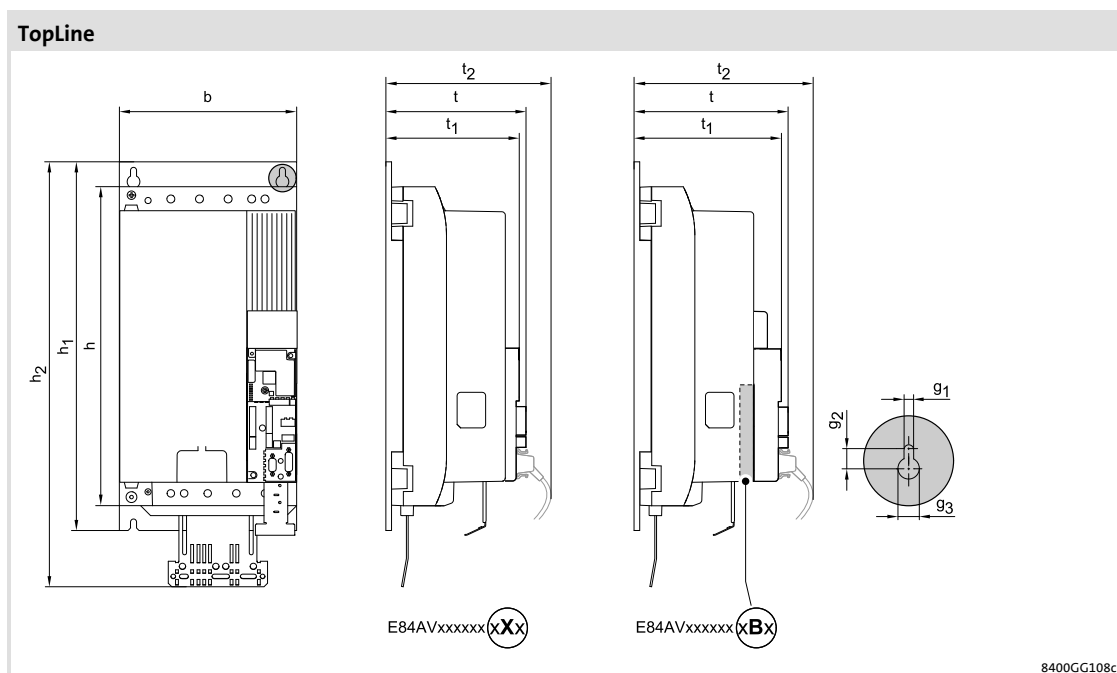


Fig. 5-47 Device dimensions

|                 |      | 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] |     |     |                |                |                |                |                |                |                |
| 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   |      |     |     |                |                |                |                |                |                |                |

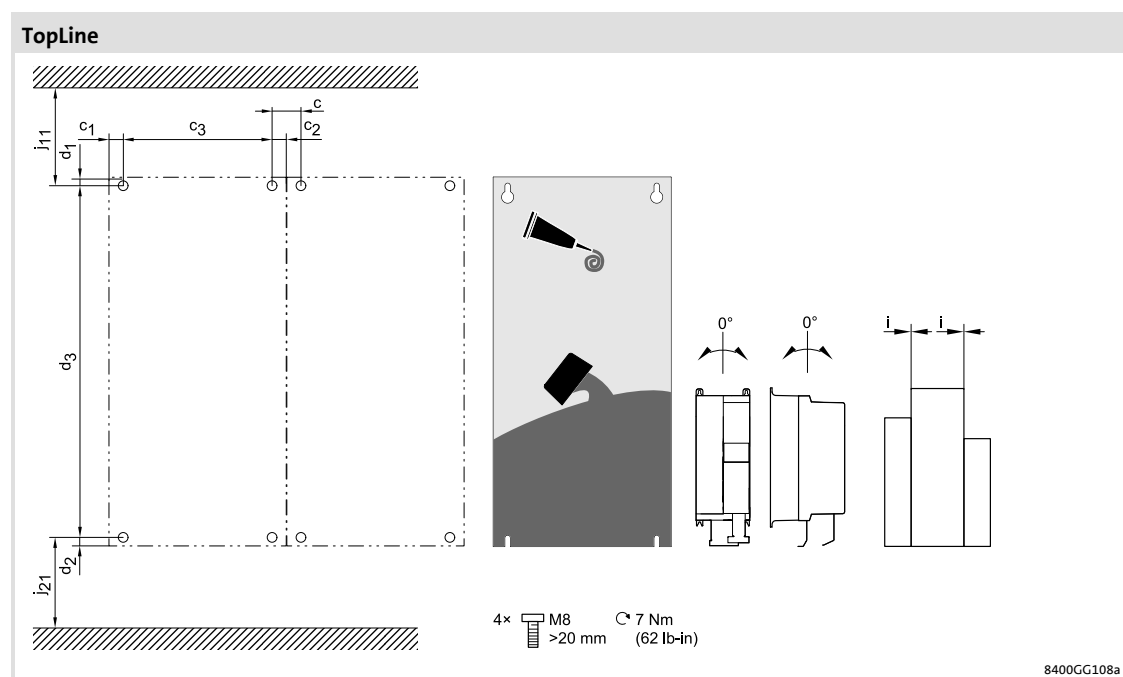


Fig. 5-48 Dimensions for mounting

|                 |      | 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  $> 3.5 \text{ mA AC}$  or  $> 10 \text{ mA DC}$ .

##### **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  $\geq 10 \text{ mm}^2$  or PE conductor must be connected twice)

**Stop!****No device protection if the mains voltage is too high**

The mains input is not internally fused.

**Possible consequences:**

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

**Protective measures:**

- Observe the maximally permissible mains voltage.
- Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

**Stop!****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.

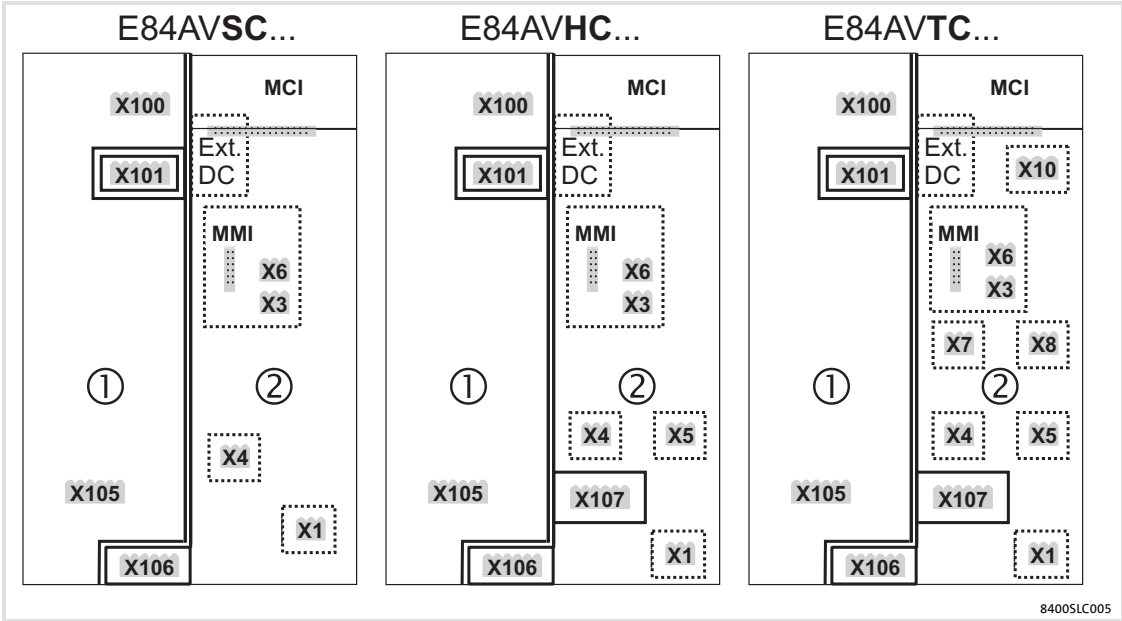
**Danger!**

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.



**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<br>Protection against accidental contact is guaranteed without any further measures. |

| Range        | Connection                      | Name                 | Explanation                                                                                                                                                                                             |
|--------------|---------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power<br>①   | X100                            | Mains                | Protective separation towards X101, X106 and all control terminals                                                                                                                                      |
|              |                                 | DC bus               |                                                                                                                                                                                                         |
|              | X105                            | Motor                | Protective separation towards X100, X105 and all control terminals                                                                                                                                      |
|              |                                 | Brake resistor       |                                                                                                                                                                                                         |
|              | X101                            | Relay contact        | Protective separation towards X100, X105 and all control terminals                                                                                                                                      |
|              | X106                            | Motor temperature    | Protective separation towards X100, X105 and X101<br>Isolation by basic insulation towards all control terminals<br>Degree of insulation of thermal contact, PTC, or cable can influence the isolation. |
| Control<br>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<br>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<sup>2</sup>t 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  $\nabla$  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  $\nabla$  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.



**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.

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 11.2 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.

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                  |
| E84AVxxx3024xx5 | 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 11.2 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. (📖 11.11)
- ▶ 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

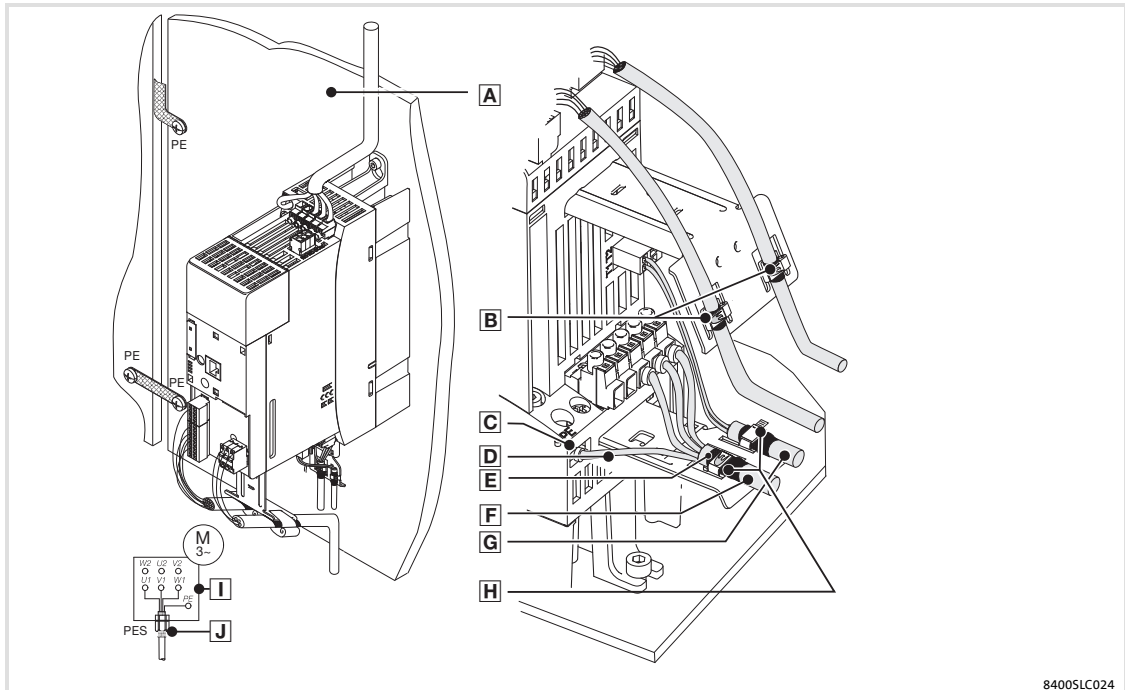


Fig. 6-2 Wiring in compliance with EMC standards

- 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.

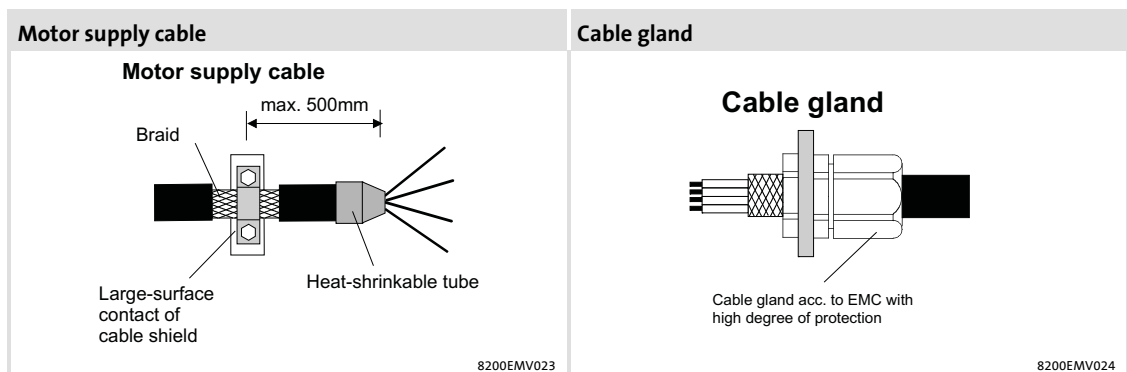


Fig. 6-3 Shielding of the motor cable

**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).

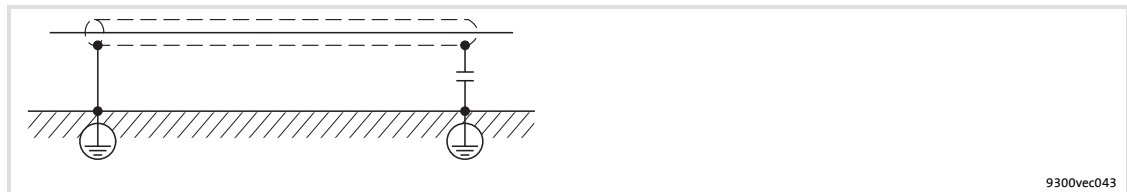


Fig. 6-4 Shielding of long, analog control cables

### 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.

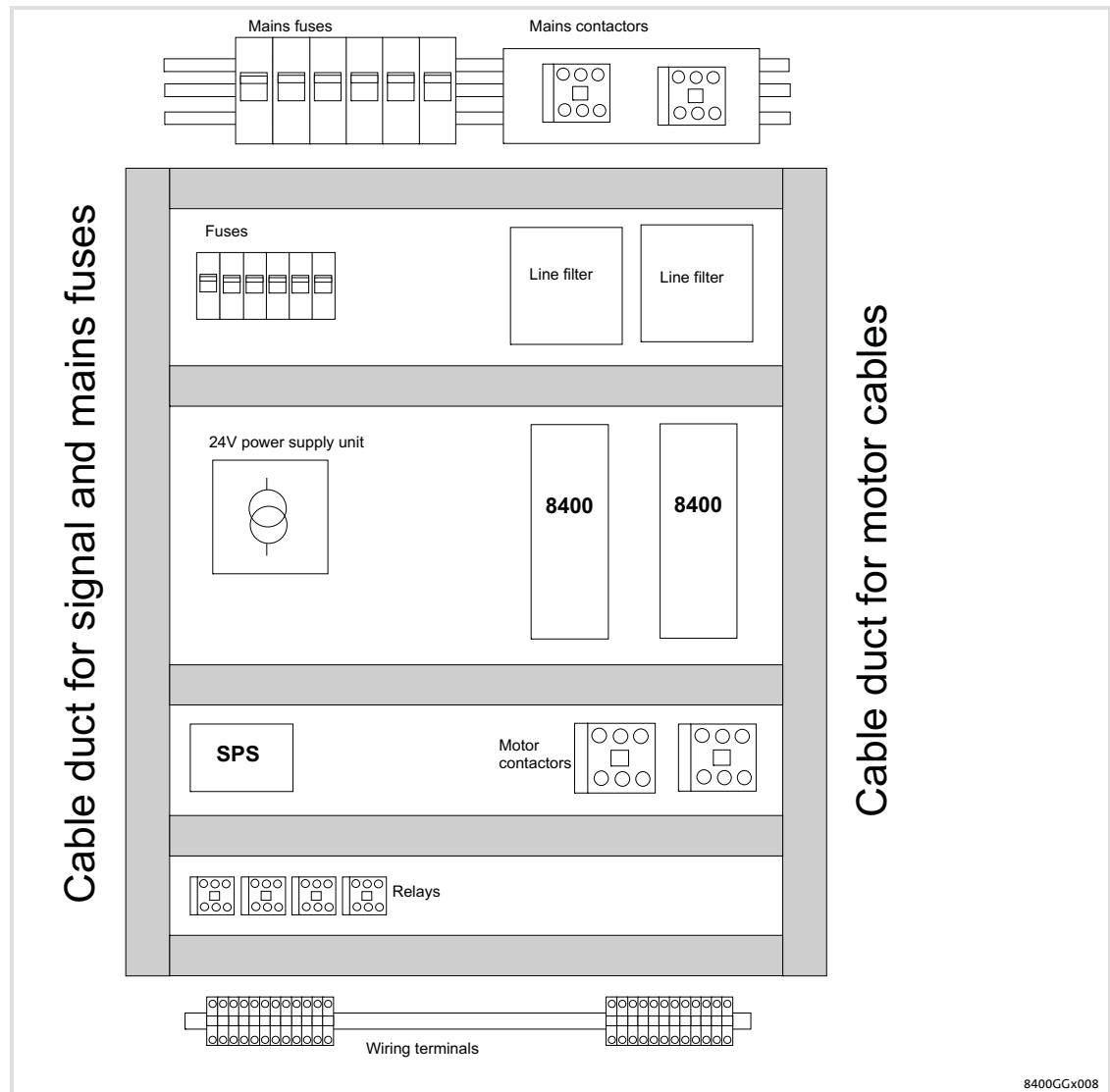


Fig. 6-5 Cable routing in the control cabinet

### 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.

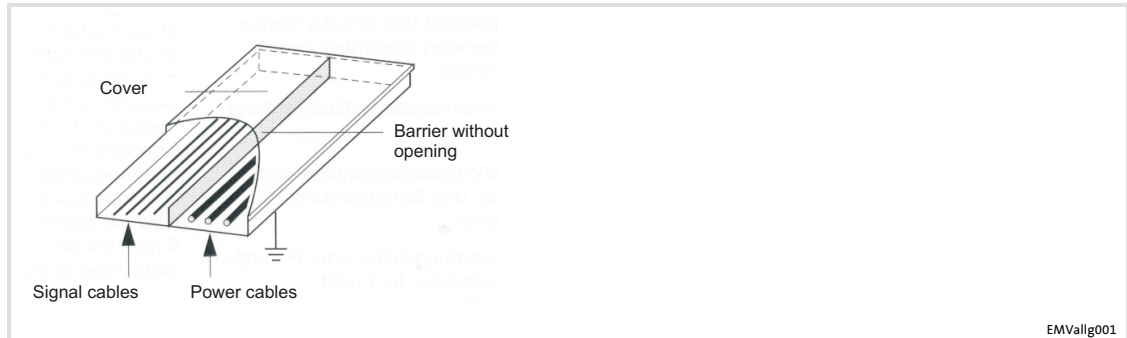


Fig. 6-6 Cable routing in the cable duct with barrier

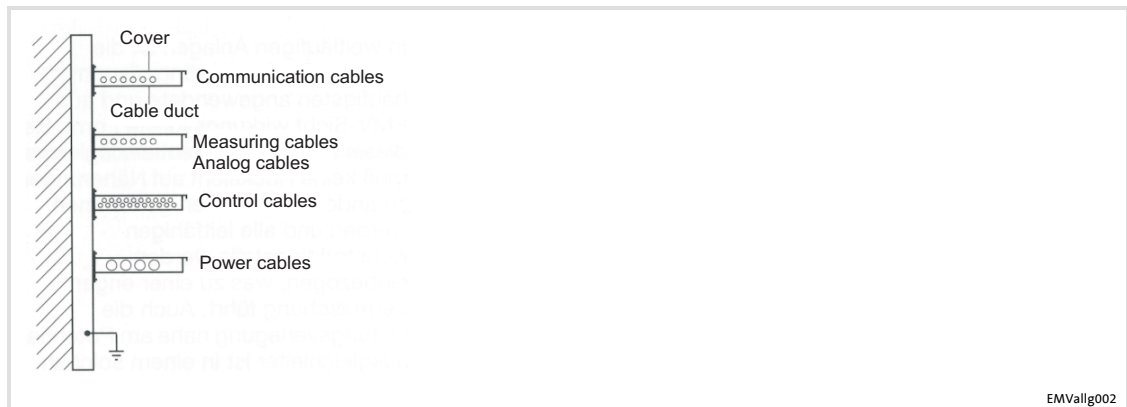


Fig. 6-7 Cable routing in separated cable ducts

**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: (📖 171)



## 6.2.7 Detecting and eliminating EMC interferences

| Fault                                                                                | Cause                                                                                               | Remedy                                                                                                                                                                  |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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

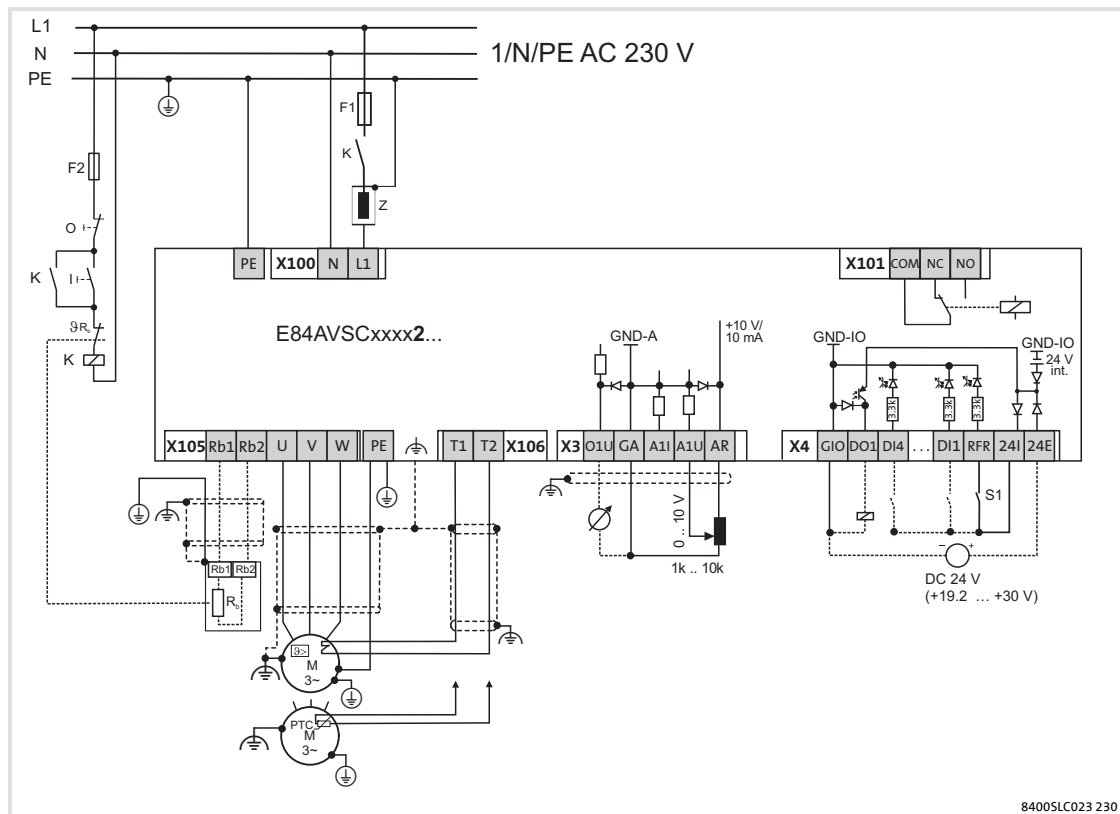


Fig. 6-8 Wiring for controllers in StateLine C design with 230-V mains connection

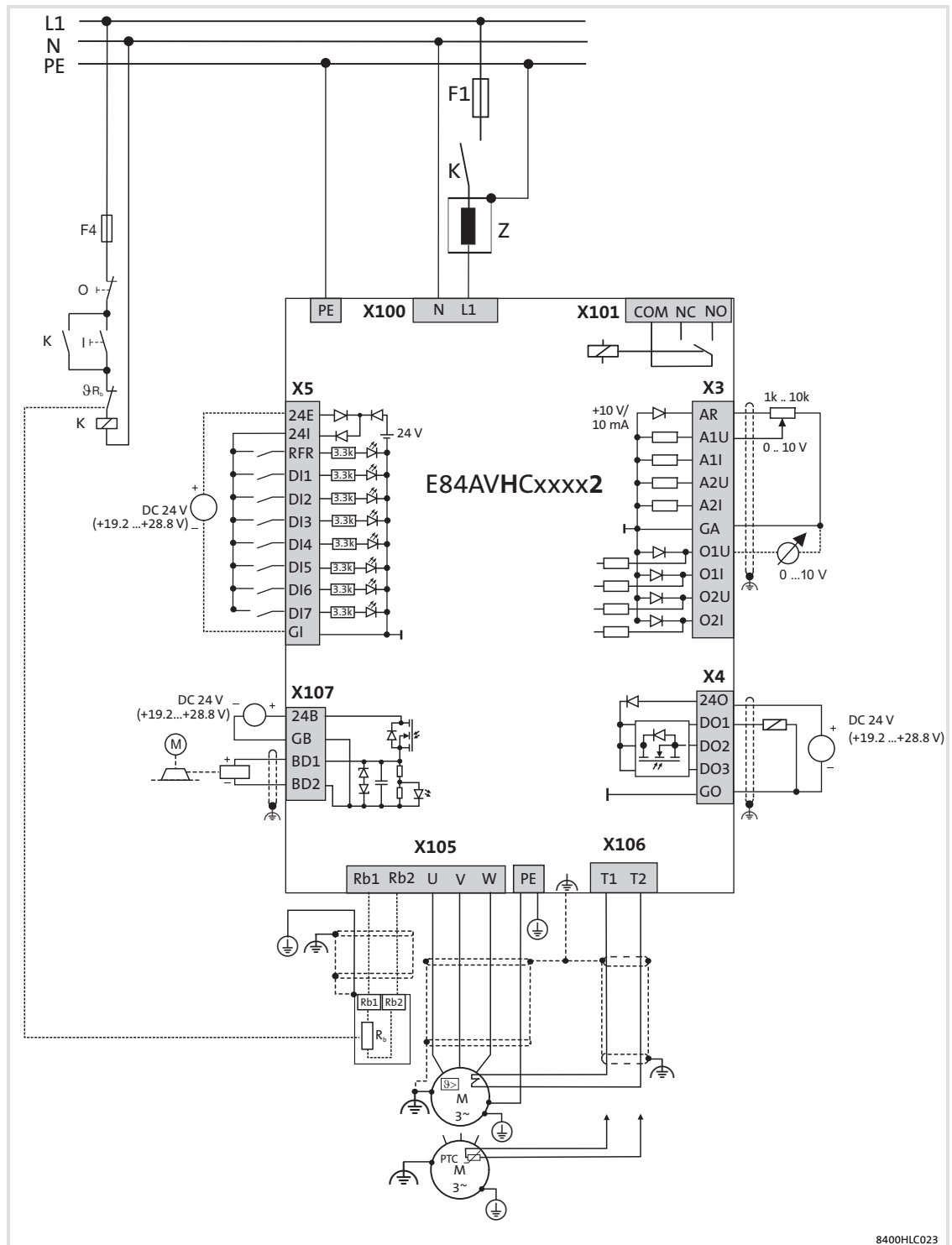


Fig. 6-9 Wiring for controllers in HighLine C design with 230-V mains connection

8400HLC023

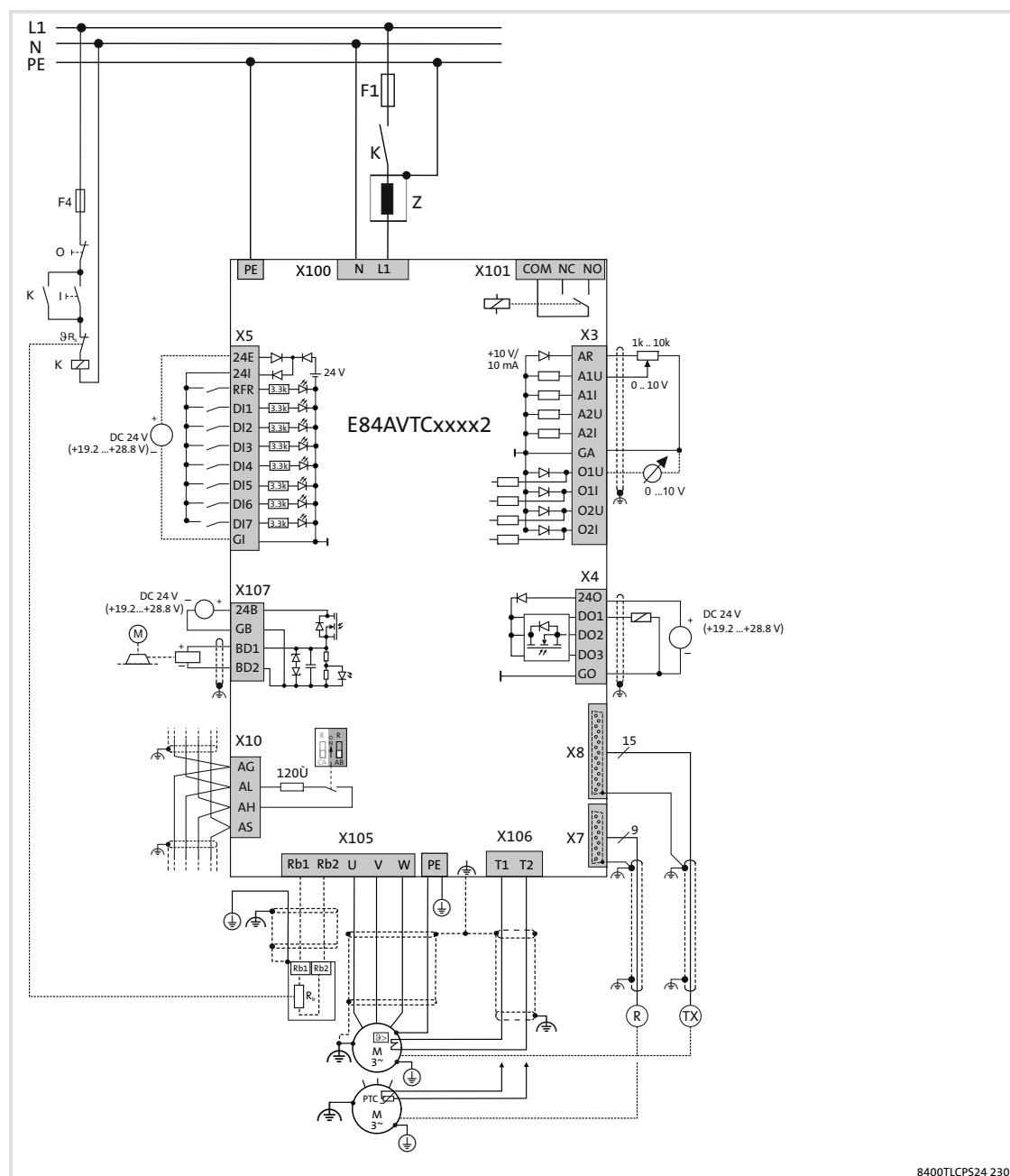


Fig. 6-10 Wiring for controllers in TopLine C design with 230-V mains connection

## 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.

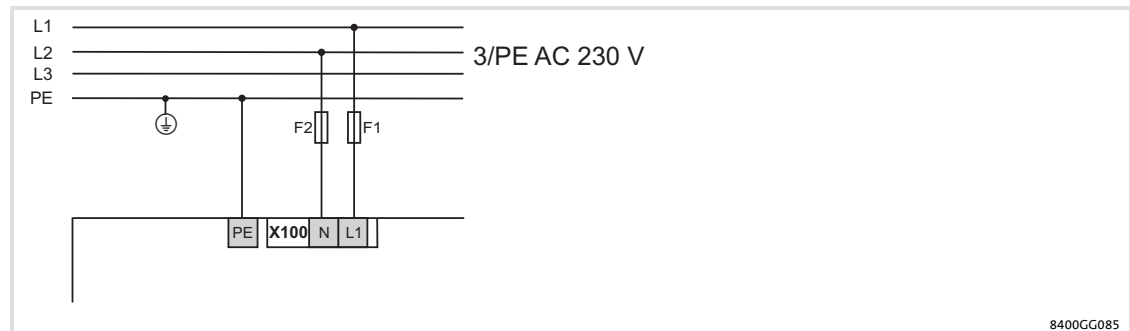


Fig. 6-11 Supplied by a three-phase 230V mains



### 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.

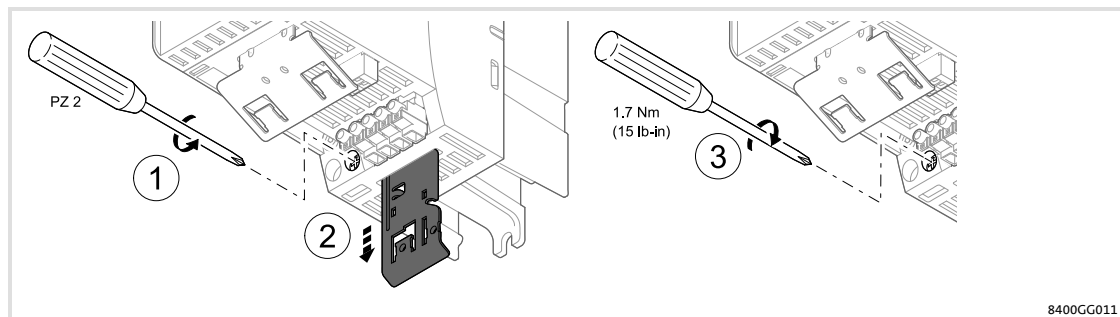
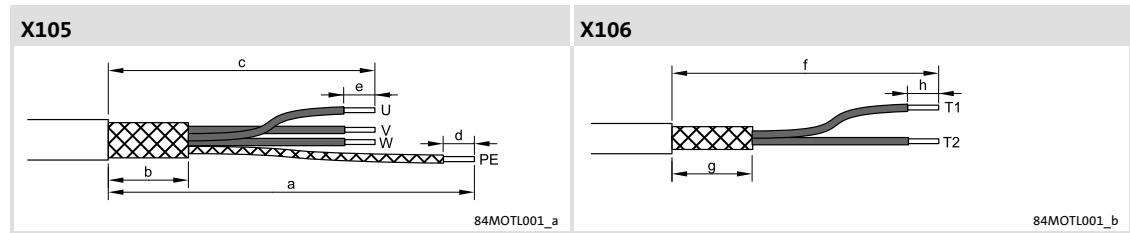


Fig. 6-12 Locate shield sheet in position

## 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:

1. Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
2. Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
3. Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
4. Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
5. 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. (178).

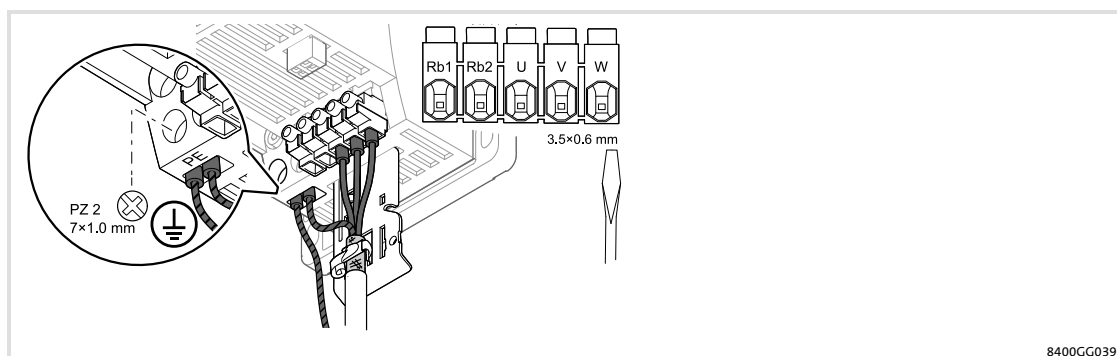
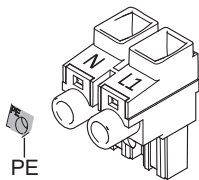


Fig. 6-13 Connection of controllers with device sizes 1 ... 3 to protective earth

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

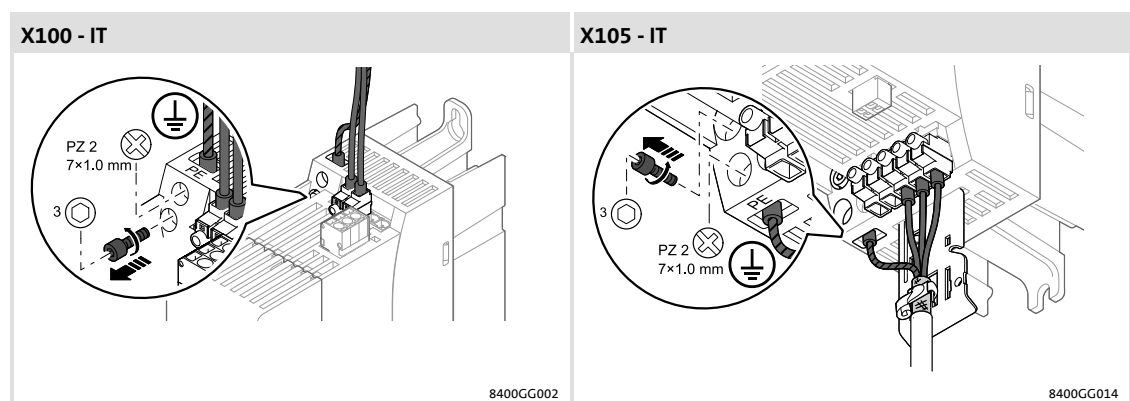
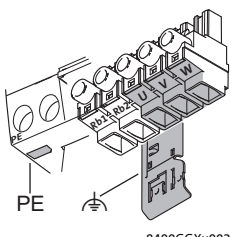


Fig. 6-14 Removal of the contact screws for device sizes 1 ... 3 (on the supply side and on the motor side)

## Motor connection

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

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

### Motor temperature monitoring



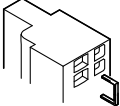
#### Note!

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                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | T1<br>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).<br>Lenze setting: activated, error message<br>Setting in C00585 |
| 8400GG016b                                                                        |           |                                                                                                                                                                                                                               |

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

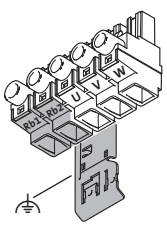


#### Tip!

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                                                   |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|
| <br>8400GGXx002b | Rb1, Rb2                                                                          | Brake resistor                                                |
|                                                                                                   |  | Functional earth<br>HF-shield termination by connection to PE |

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



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

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

### 6.4.1 Example circuits

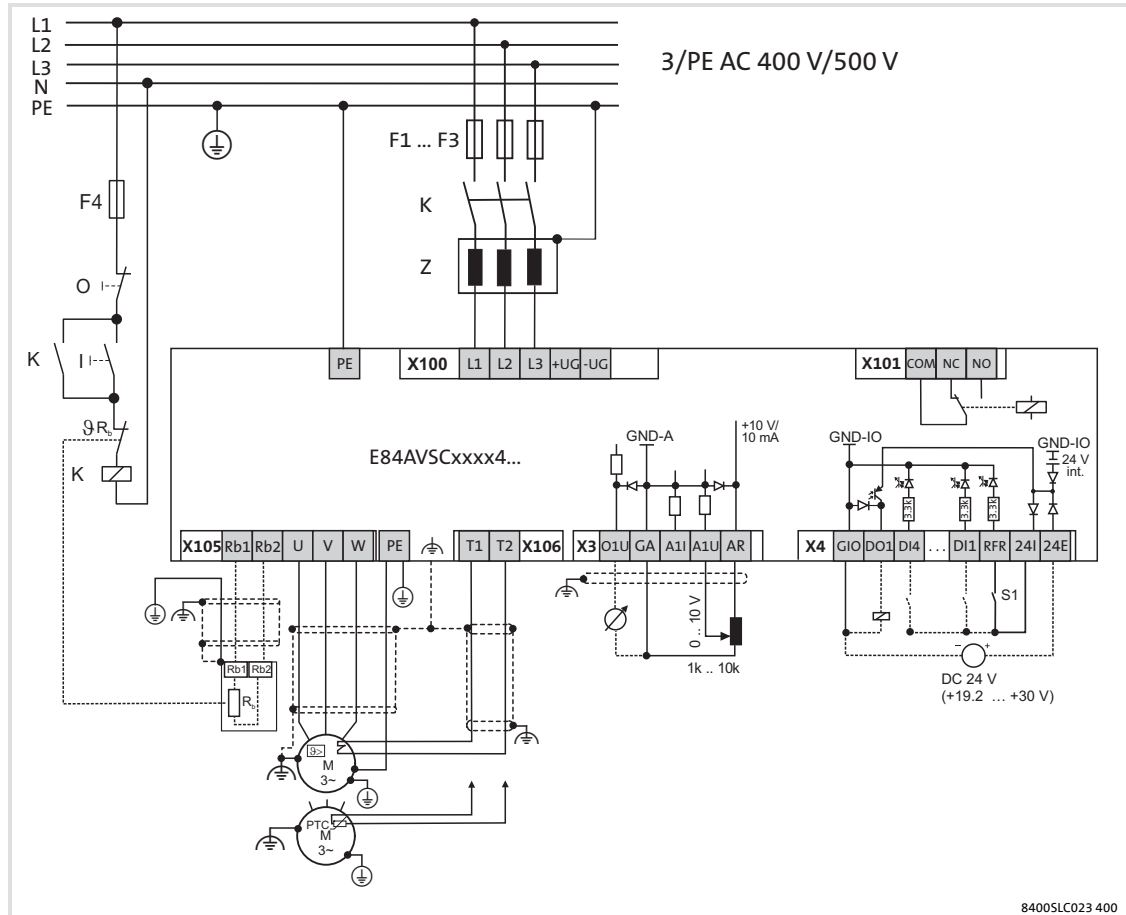
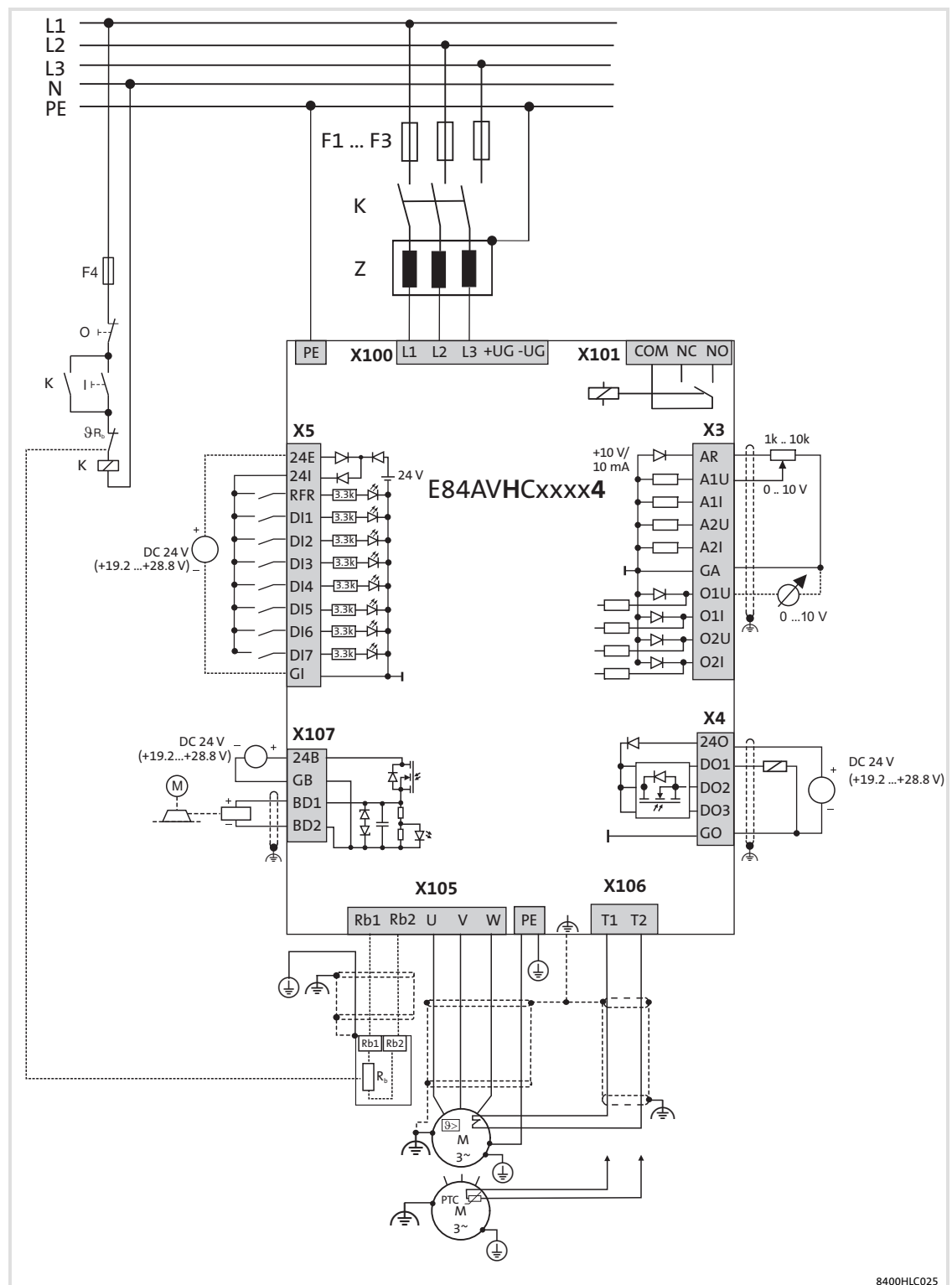


Fig. 6-15 Wiring for controllers in StateLine C design with 400-V/500-V mains connection



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

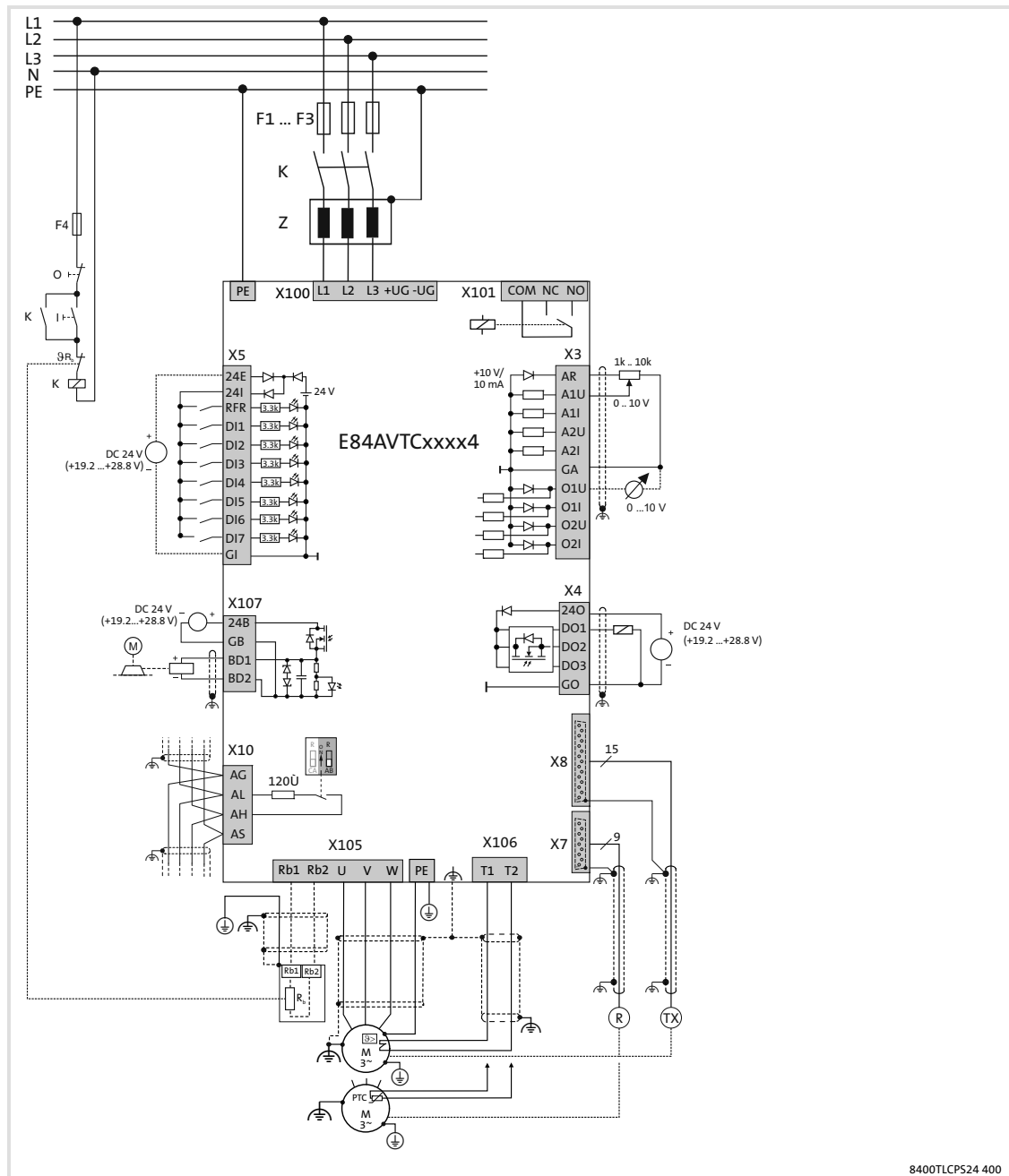


Fig. 6-17 Wiring for controllers in TopLine C design with 400-V/500-V mains connection

**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.

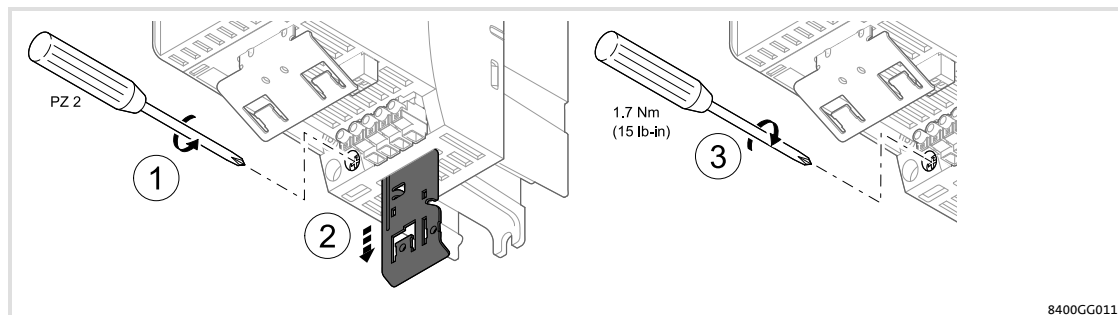
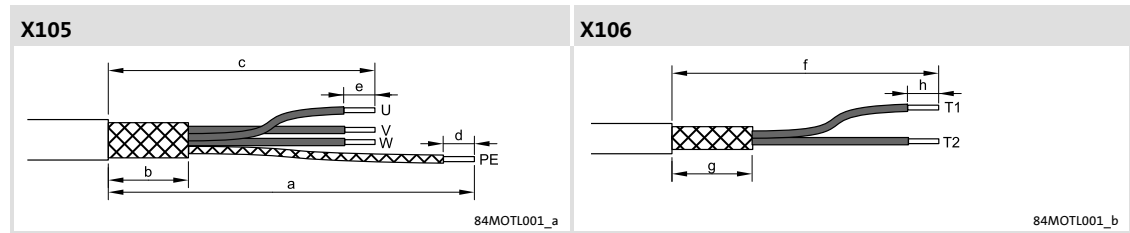


Fig. 6-18 Locate shield sheet in position



## Strip cables



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

### How to proceed:

1. Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
2. Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
3. Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
4. Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
5. 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. (189).

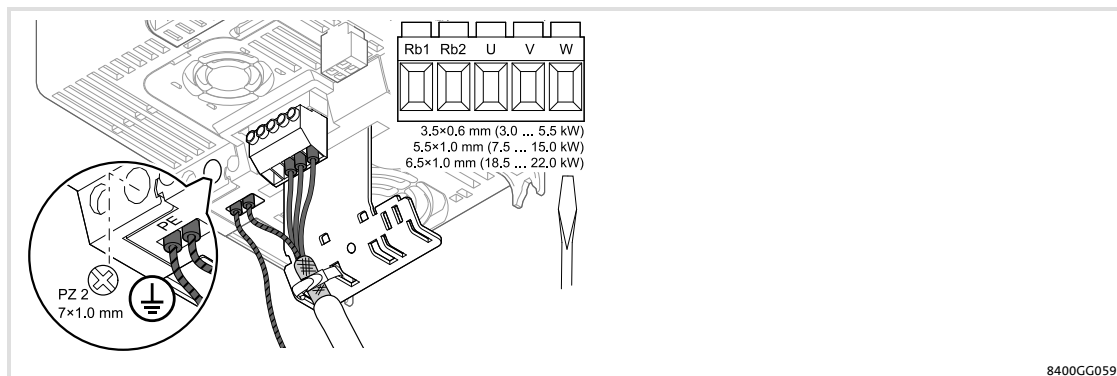
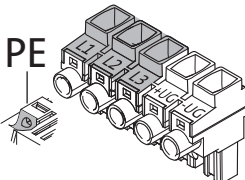


Fig. 6-19 Connecting controllers of device size 4 ... 6 to protective earth

### Mains connection

| Terminal X100                                                                       | Labelling      | Description                               |
|-------------------------------------------------------------------------------------|----------------|-------------------------------------------|
|  | L1<br>L2<br>L3 | Connection of the mains phases L1, L2, L3 |
|                                                                                     | PE             | Connection for the PE conductor           |

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

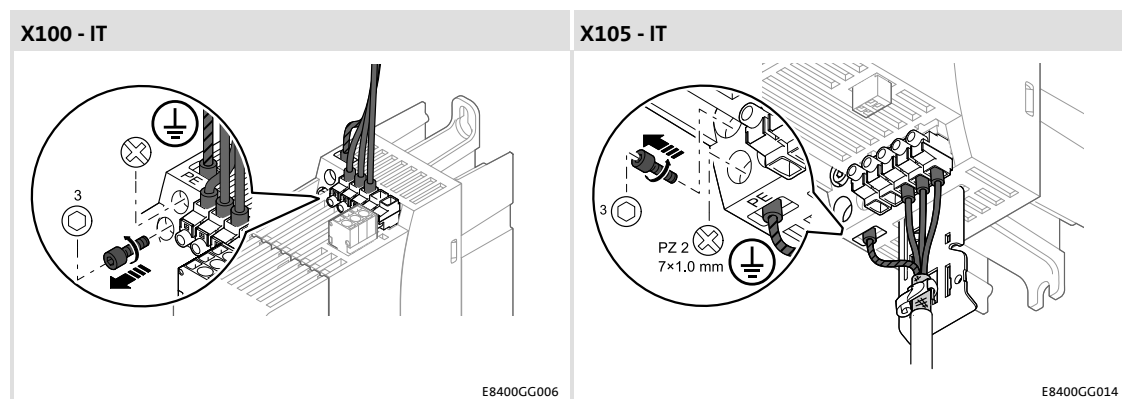


Fig. 6-20 Removal of the contact screws for device sizes 1 ... 3 (on the supply side and on the motor side)

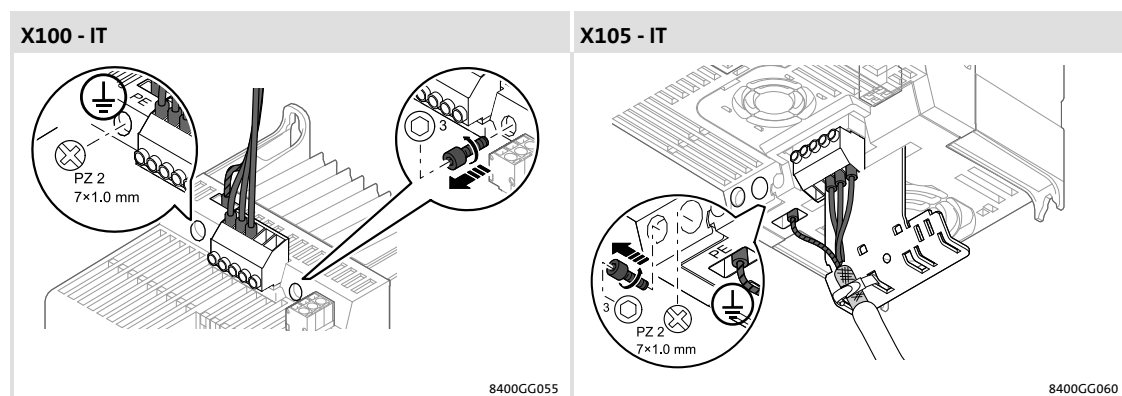
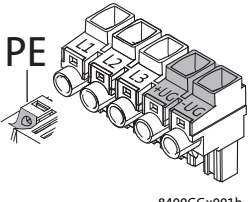


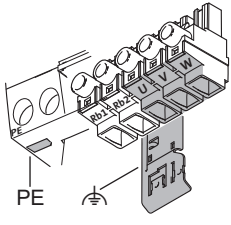
Fig. 6-21 Removal of the contact screws for device sizes 4 ... 6 (on the supply side and on the motor side)

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

| Terminal X100                                                                     | Labelling  | Description                                  |
|-----------------------------------------------------------------------------------|------------|----------------------------------------------|
|  | +UG<br>-UG | Alternative connection of the DC-bus voltage |
|                                                                                   | PE         | Connection for the PE conductor              |

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

## Motor connection

| Terminal X105                                                                                     | Labelling                                                                         | Description                                                   |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|
| <br>8400GGXx002b | U, V, W                                                                           | Motor                                                         |
|                                                                                                   | PE                                                                                | PE conductor                                                  |
|                                                                                                   |  | Functional earth<br>HF-shield termination by connection to PE |

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

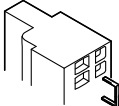
## Motor temperature monitoring

**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                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><br>8400GG016b | T1        | 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).<br>Lenze setting: activated, error message<br>Setting in C00585 |
|                                                                                                     | T2        |                                                                                                                                                                                                                               |

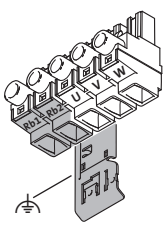
| Terminal data |                         |           |                   |         |                                                                                       |
|---------------|-------------------------|-----------|-------------------|---------|---------------------------------------------------------------------------------------|
|               | Conductor cross-section |           | Tightening torque |         |  |
|               | [mm²]                   | [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                                                   |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|
| <br>8400GGXx002b | Rb1, Rb2                                                                          | Brake resistor                                                |
|                                                                                                   |  | Functional earth<br>HF-shield termination by connection to PE |

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



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



**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 ( 189).

**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.

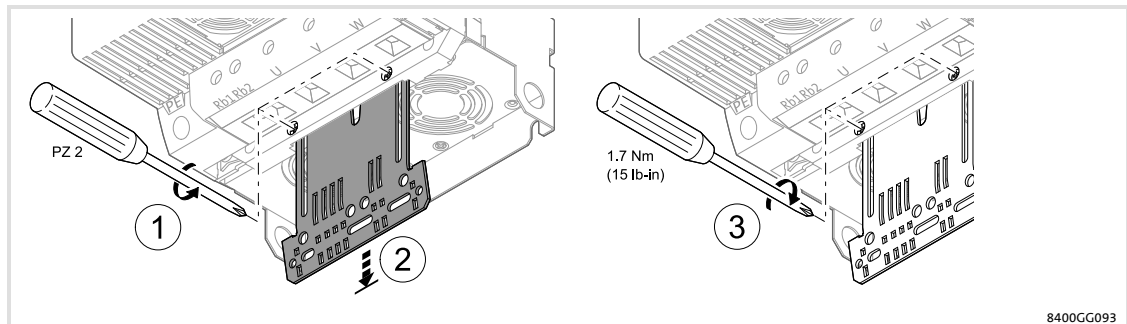
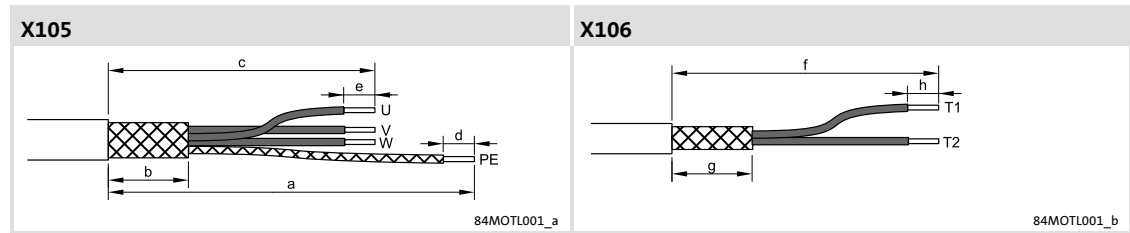


Fig. 6-22 Locate shield sheet in position

## Strip cables



|                                              | U, V, W |      |      |                      |                 | PE   |      |                        |                 | T1, T2 |      |      |                          |
|----------------------------------------------|---------|------|------|----------------------|-----------------|------|------|------------------------|-----------------|--------|------|------|--------------------------|
|                                              | b       | c    | e    |                      |                 | a    | d    |                        |                 | f      | g    | h    |                          |
|                                              | [mm]    | [mm] | [mm] | [mm²]<br>[AWG]       | [Nm]<br>[lb-in] | [mm] | [mm] | [mm²]<br>[AWG]         | [Nm]<br>[lb-in] | [mm]   | [mm] | [mm] | [mm²]<br>[AWG]           |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534 | 40      | 190  | 24   | 16 ... 50<br>6 ... 0 | 4.0<br>35       | 250  | 16   | 2.5 ... 25<br>12 ... 2 | 4.0<br>35       | 240    | 40   | 10   | 0.2 ... 1.5<br>24 ... 16 |

### How to proceed:

1. Strip motor cable and cable for motor temperature monitoring according to specified dimensions.
2. Fold back the shield of the motor cable and motor temperature cable over the cable sheath. Keep unshielded ends short.
3. Fix shield on the cable sheath (e.g. using a heat-shrinkable tube).
4. Fasten wire end ferrule to PE cable.
  - The other cables may be wired without using wire end ferrules.
5. 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. (📖 201).

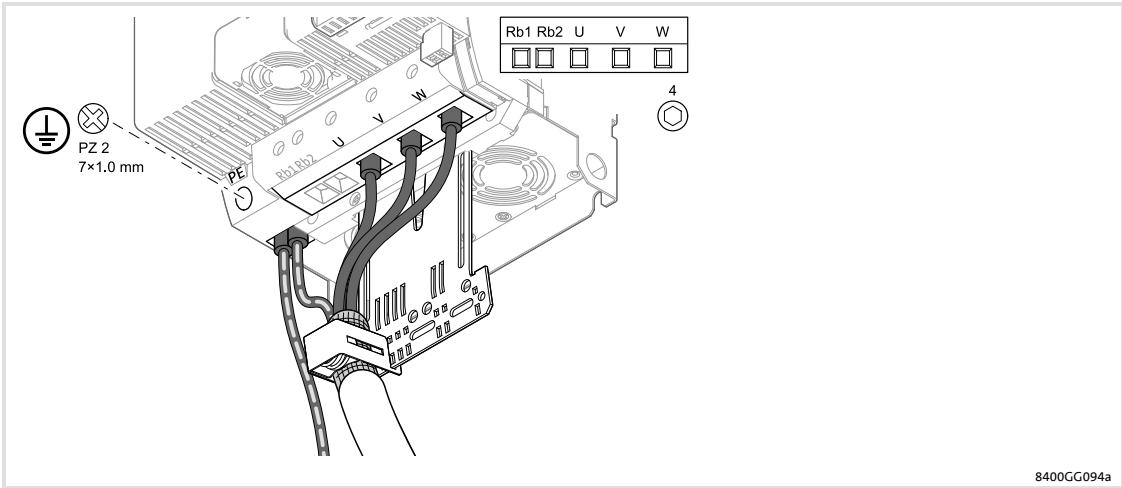
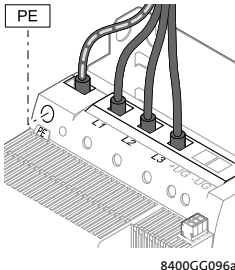


Fig. 6-23      Controller connection of device size GG7 to protective earth

**Mains connection**

| Terminal X100                                                                       | Labelling      | Description                               |
|-------------------------------------------------------------------------------------|----------------|-------------------------------------------|
|  | L1<br>L2<br>L3 | Connection of the mains phases L1, L2, L3 |
|                                                                                     | PE             | Connection for the PE conductor           |

|                                              | Terminal data                                          |                                      |                                                                                     | PE                                                     |                                      |                                                                                       |
|----------------------------------------------|--------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------|
|                                              | Conductor cross-section<br>[mm <sup>2</sup> ]<br>[AWG] | Tightening torque<br>[Nm]<br>[lb-in] |  | Conductor cross-section<br>[mm <sup>2</sup> ]<br>[AWG] | Tightening torque<br>[Nm]<br>[lb-in] |  |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534 | 16 ... 50<br>6 ... 0                                   | 4.0<br>35                            | Inbus<br>SW 4                                                                       | 2.5 ... 25<br>12 ... 2                                 | 4.0<br>35                            | PZ 2<br>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. 6-14).



### 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).

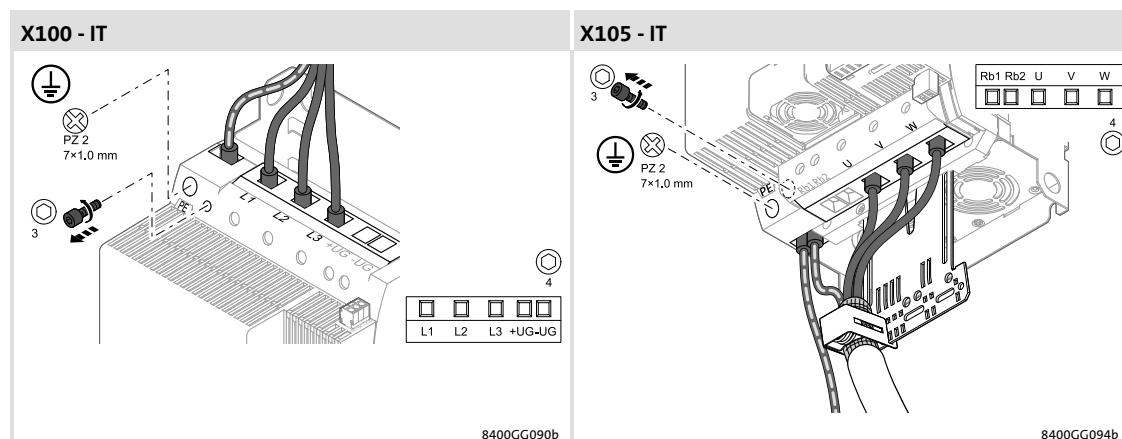
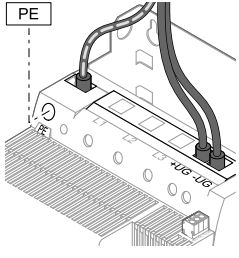


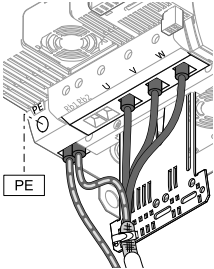
Fig. 6-24 Removal of the contact screws for device size GG7 (on the supply side and on the motor side)

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

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

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

## Motor connection

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

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



### Motor temperature monitoring



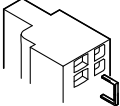
#### Note!

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                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>8400GG016b | T1<br>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).<br>Lenze setting: activated, error message<br>Setting in C00585 |

| Terminal data |                         |           |                   |         |                                                                                       |
|---------------|-------------------------|-----------|-------------------|---------|---------------------------------------------------------------------------------------|
|               | Conductor cross-section |           | Tightening torque |         |  |
|               | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |                                                                                       |
| E84AVxxxxxxx  | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | 2.5 x 0.4                                                                             |

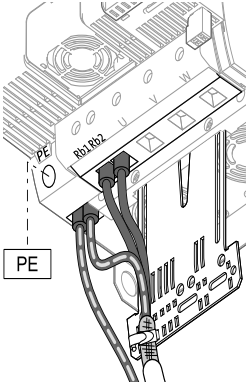


#### Tip!

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                                                   |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | Rb1, Rb2                                                                          | Brake resistor                                                |
|                                                                                   |  | Functional earth<br>HF-shield termination by connection to PE |

|                                              | Terminal data                             |                                      |                                                                                   | PE                                        |                                      |                                                                                     |
|----------------------------------------------|-------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------|
|                                              | Conductor cross-section<br>[mm²]<br>[AWG] | Tightening torque<br>[Nm]<br>[lb-in] |  | Conductor cross-section<br>[mm²]<br>[AWG] | Tightening torque<br>[Nm]<br>[lb-in] |  |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534 | 16 ... 50<br>6 ... 0                      | 4.0<br>35                            | Inbus<br>SW 4                                                                     | 2.5 ... 25<br>12 ... 2                    | 4.0<br>35                            | PZ 2<br>7 x 1                                                                       |



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.

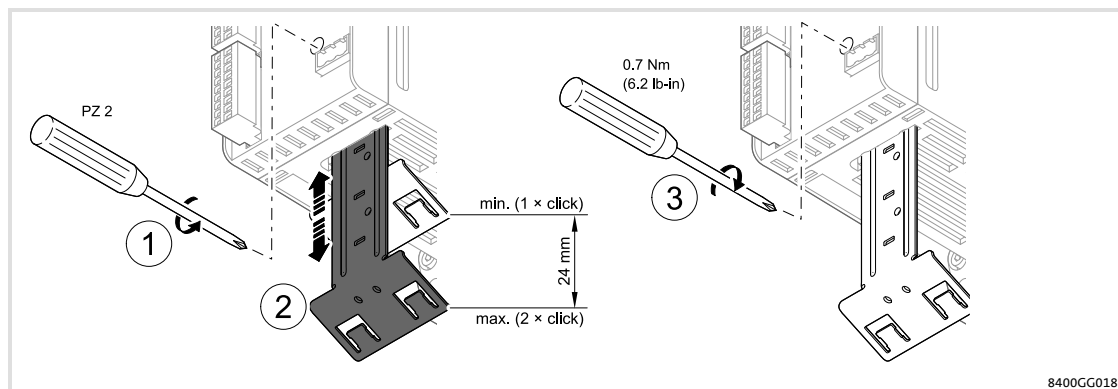
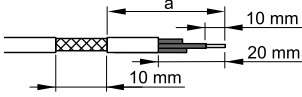
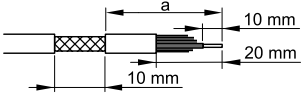
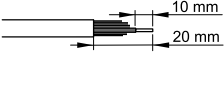


Fig. 6-25 Locate shield sheet in position

### 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.

| X1                                                                                | X3, X107                                                                           | X4, X5                                                                              |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |
| 84MOTL001_e                                                                       | 84MOTL001_d                                                                        | 84MOTL001_f                                                                         |

#### ► StateLine: stripping dimensions

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

#### ► HighLine: stripping dimensions

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

#### ► TopLine: Stripping lengths

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

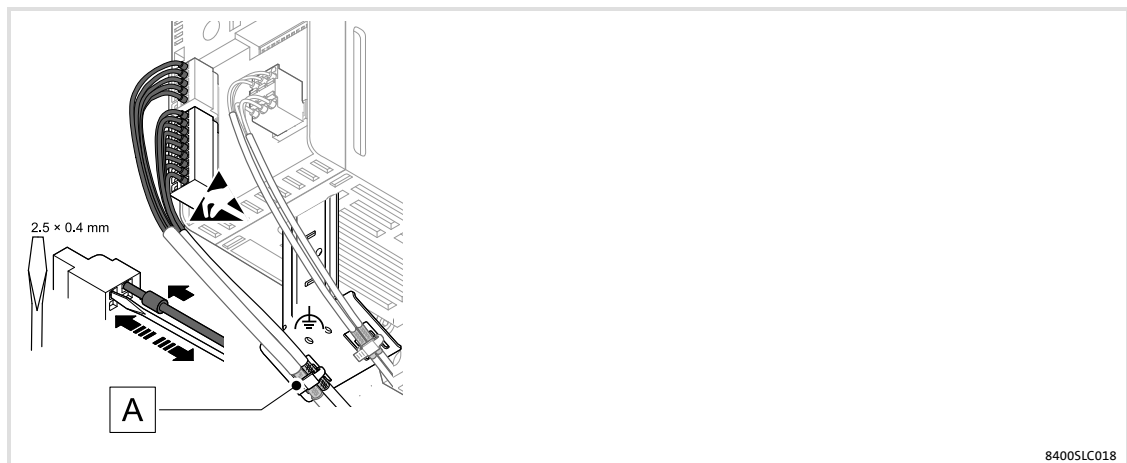


Fig. 6-26 Shielding and connecting control cables

## 6.6.2 System bus connection (CANopen)

### Basic structure of the CAN network

Every segment of the CAN network must be terminated by resistors ( $120\ \Omega$ ) 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.

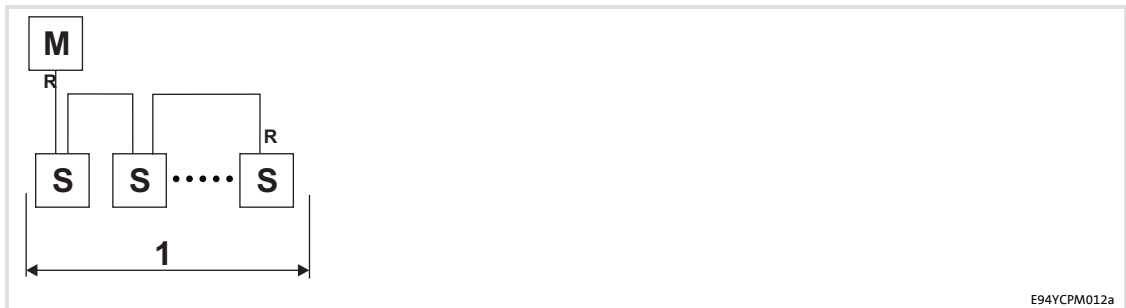


Fig. 6-27 Example: CAN network with one segment

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

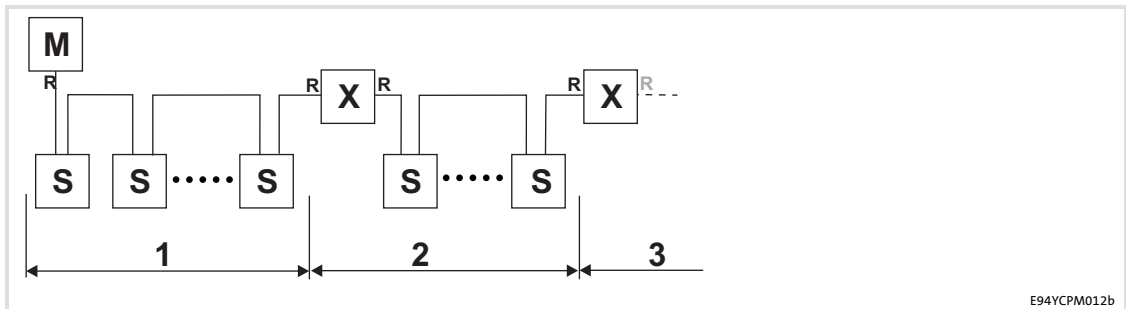


Fig. 6-28 Example: CAN network with repeater

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

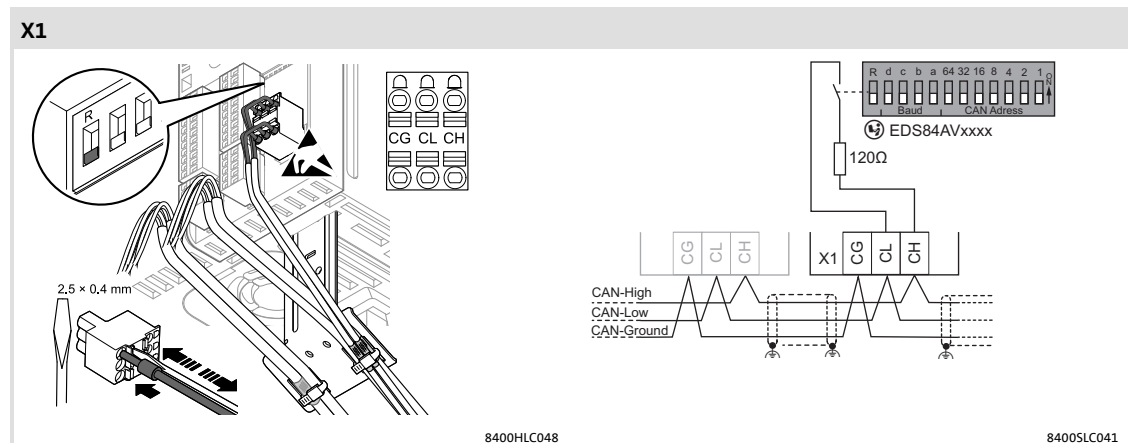


Fig. 6-29 CANopen connection



# TopLine

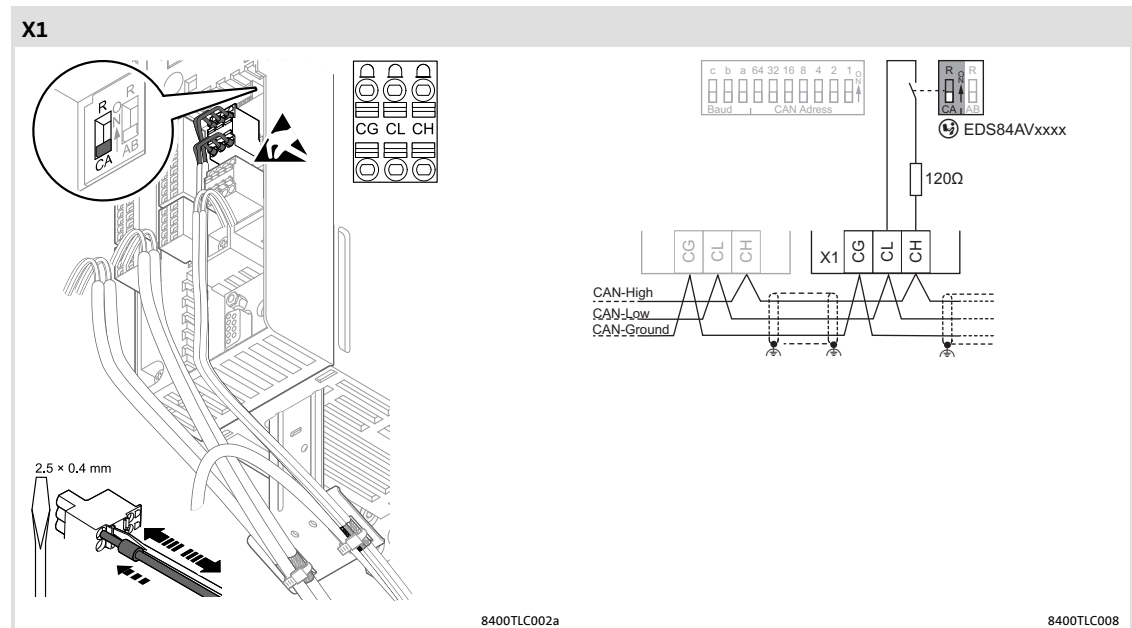


Fig. 6-30 CANopen connection

## 6.6.2.2 Structure of the CAN network

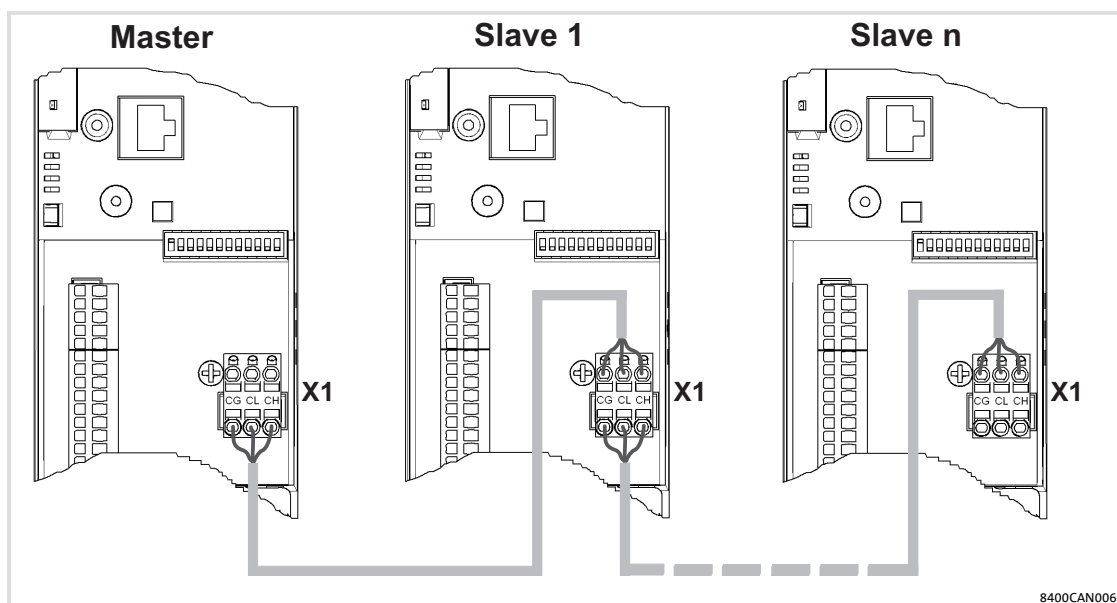


Fig. 6-31 Wiring of system bus (CAN)

## 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 (219).
- ▶ 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 ☐ 216) |
| • 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

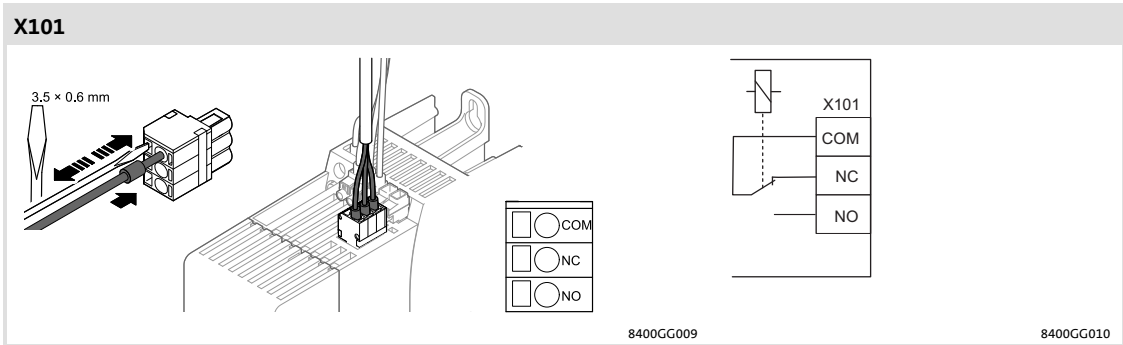


Fig. 6-32 Wiring of the relay outputs

| Labelling | Description                                                                                          |                                                                                                               |
|-----------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| COM       | Central contact of relay                                                                             | AC 250 V, 3 A<br>DC 24V, 2A                                                                                   |
| NC        | Relay output NC (normally closed)<br>Position is displayed via TRIP software message (Lenze setting) | DC 240 V, 0.16 A<br>● According to UL508C:<br>– 3 A, 250 V AC (general purpose)<br>– 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 |         |  |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |                                                                                       |
| flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | 3.5 x 0.6                                                                             |
| with wire end ferrule |                         |           |                   |         |                                                                                       |

**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                                                                                      |
|-------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------|
| <br>8400HLC009 | DIAG      | Diagnostic interface for connection of a keypad or USB diagnostic adapter for online diagnostics |

6

Electrical installation

StateLine C control terminals

External supply voltage 24 V

6.7

StateLine C control terminals

6.7.1

External supply voltage 24 V

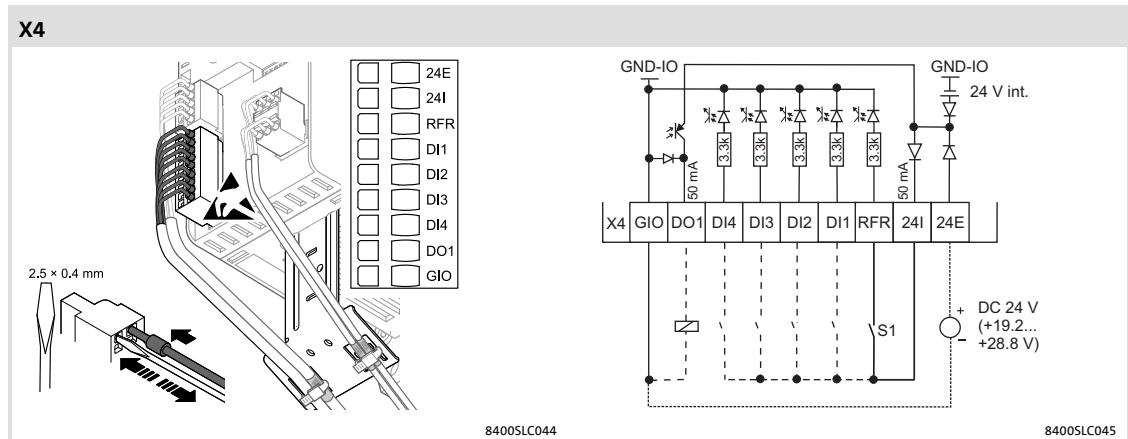


Fig. 6-33 Connection to an external supply voltage

| 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

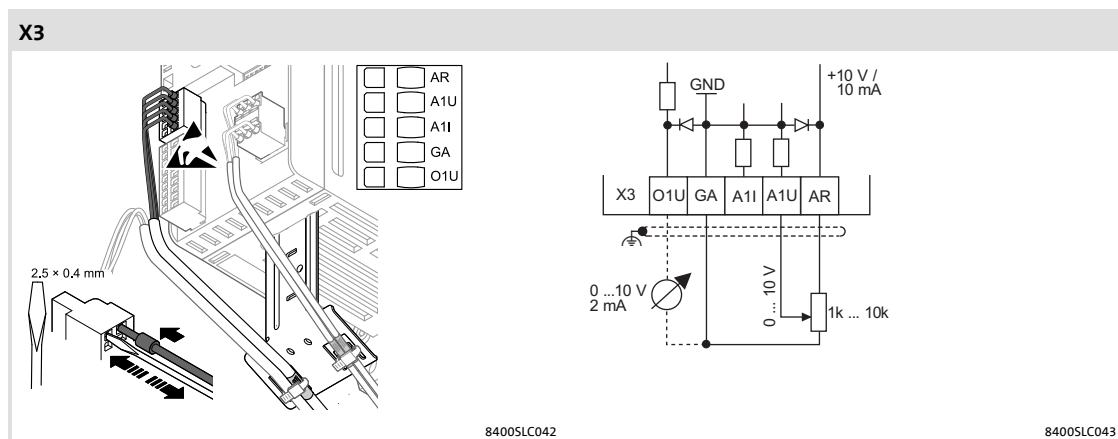


Fig. 6-34 Connection of the analog inputs and outputs

| Labelling  | Description                                     |
|------------|-------------------------------------------------|
| Controller | Reference voltage 10 V                          |
| A1U        | ±10V (78)                                       |
| A1I        | Analog input 1<br>0 ...+20 mA/+4 ...+20 mA (78) |
| GA         | GND analog signals                              |
| O1U        | Analog output 1<br>0 ... +10 V (78)             |

| 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

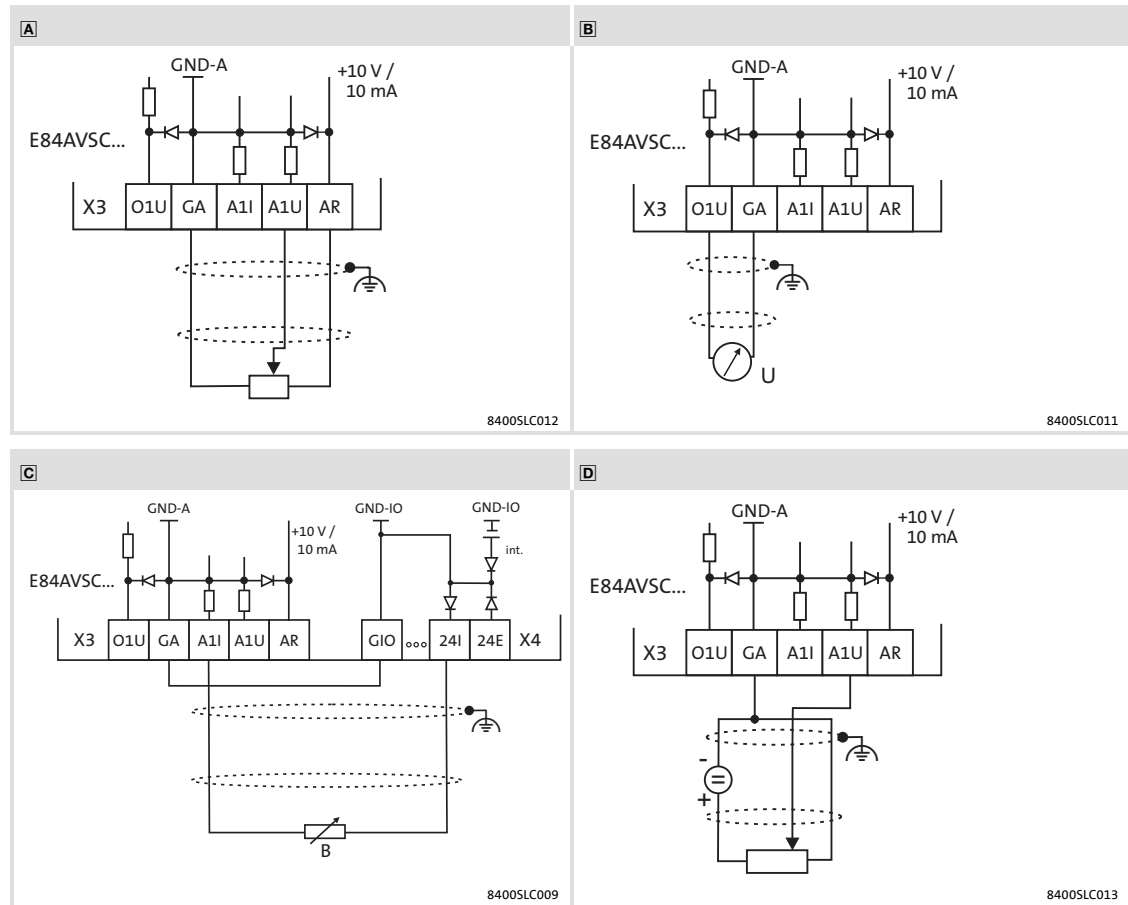


Fig. 6-35 Wiring examples of the analog inputs and outputs

- 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

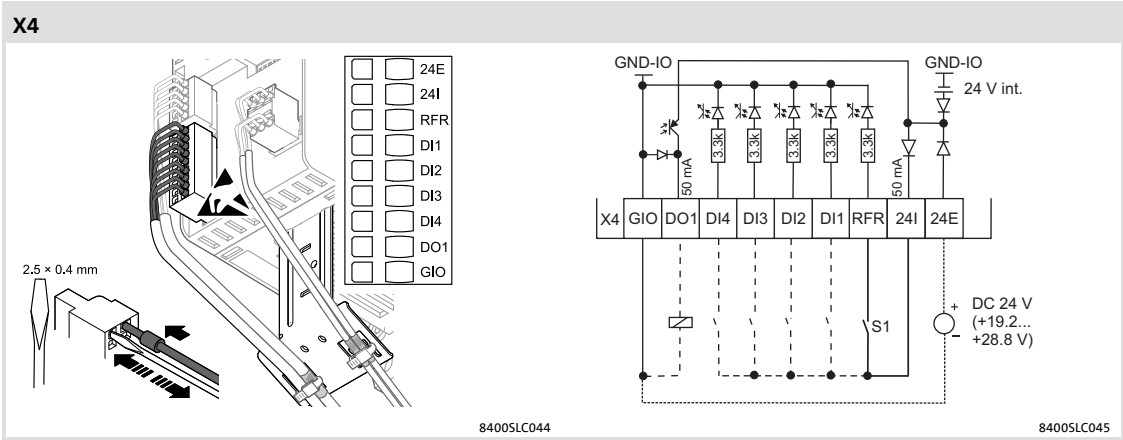


Fig. 6-36 Connection of the digital inputs and outputs

| Labelling | Description                                           |                                                                                      |         |
|-----------|-------------------------------------------------------|--------------------------------------------------------------------------------------|---------|
| RFR       | Controller enable/controller inhibit, always required |                                                                                      |         |
| DI1       | Digital input 1                                       | 79<br>IEC61131-2, type 1 or two-track frequency input, for HTL encoding 0 ... 10 kHz | track A |
| DI2       | Digital input 2                                       |                                                                                      | track B |
| DI3       | Digital input 3                                       | 79                                                                                   |         |
| DI4       | Digital input 4                                       |                                                                                      |         |
| DO1       | Digital output 1                                      | 79                                                                                   |         |
| GIO       | GND digital signals                                   |                                                                                      |         |

| Terminal data         |                         |           |                   |         |                                                                                       |
|-----------------------|-------------------------|-----------|-------------------|---------|---------------------------------------------------------------------------------------|
|                       | Conductor cross-section |           | Tightening torque |         |  |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |                                                                                       |
| Flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | -                                                                                     |
| With wire end ferrule |                         |           |                   |         |                                                                                       |

### Example circuit

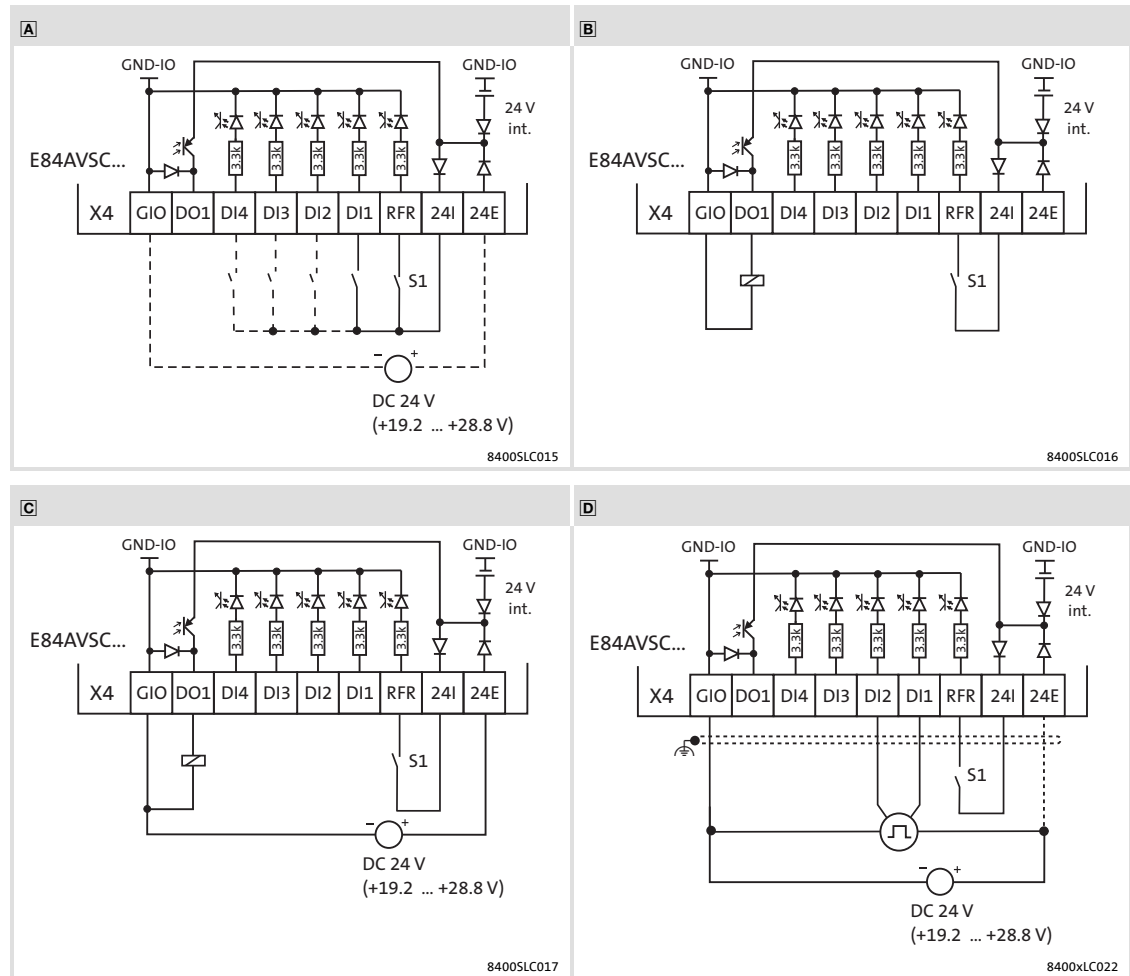


Fig. 6-37 Wiring examples of the digital inputs and outputs

- 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**

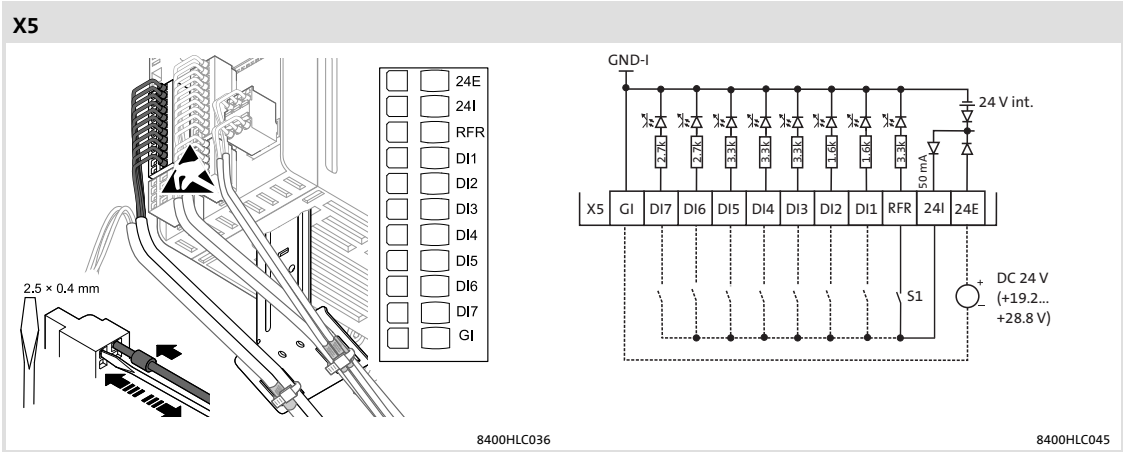


Fig. 6-38 Connection to an external supply voltage

| 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 |         |  |
|                       | [mm²]                                                                                                                                                                                                   | [AWG]                                             | [Nm]              | [lb-in] |                                                                                       |
| Flexible              | 0.2 ... 1.5                                                                                                                                                                                             | 24 ... 16                                         | -                 | -       | -                                                                                     |
| With wire end ferrule |                                                                                                                                                                                                         |                                                   |                   |         |                                                                                       |

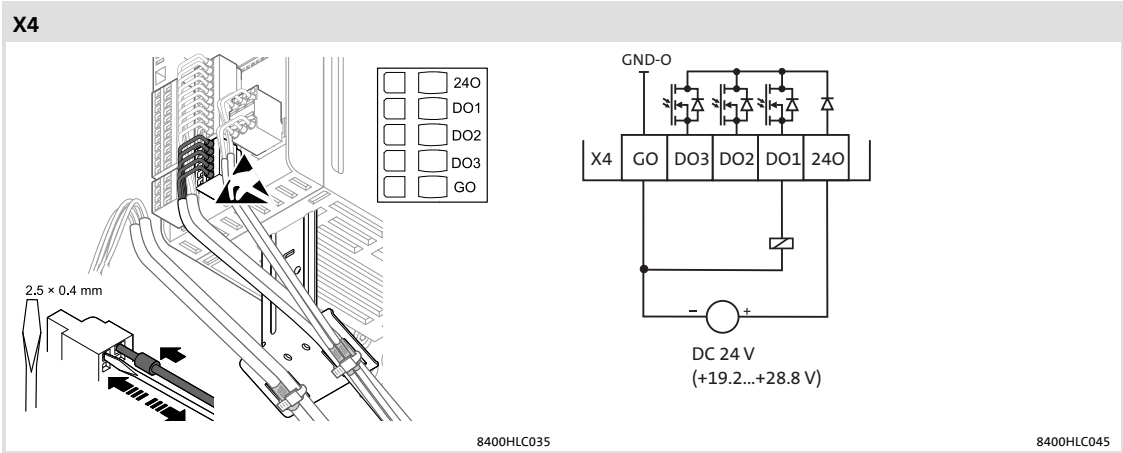


Fig. 6-39 Connection to an external supply voltage

| 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 |         |   |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |   |
| Flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | - |
| With wire end ferrule |                         |           |                   |         |   |

6.8.2 Analog inputs and outputs

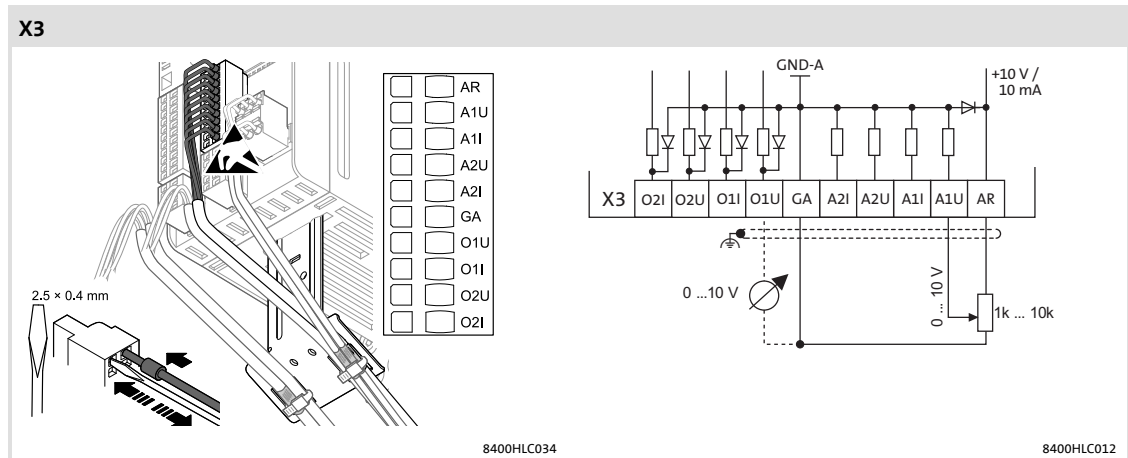


Fig. 6-40 Connection of the analog inputs and outputs

| Labelling  | Description             |                          |                                                                                          |
|------------|-------------------------|--------------------------|------------------------------------------------------------------------------------------|
| Controller | Reference voltage 10 V  |                          |                                                                                          |
| A1U        | Analog voltage input 1  | ± 10 V                   |  81   |
| A1I        | Analog current input 1  | 0 ...+20 mA/+4 ...+20 mA |                                                                                          |
| A2U        | Analog voltage input 2  | ± 10 V                   |                                                                                          |
| A2I        | Analog current input 2  | 0 ...+20 mA/+4 ...+20 mA |                                                                                          |
| GA         | GND analog signals      |                          |                                                                                          |
| O1U        | Analog voltage output 1 | 0 ... +10V               |  81 |
| O1I        | Analog current output 1 | 0 ...+20 mA/+4 ...+20 mA |                                                                                          |
| O2U        | Analog voltage output 2 | 0 ... +10V               |                                                                                          |
| O2I        | Analog current output 2 | 0 ...+20 mA/+4 ...+20 mA |                                                                                          |

| Terminal data         |                         |           |                   |         |                                                                                       |
|-----------------------|-------------------------|-----------|-------------------|---------|---------------------------------------------------------------------------------------|
|                       | Conductor cross-section |           | Tightening torque |         |  |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |                                                                                       |
| Flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | -                                                                                     |
| With wire end ferrule |                         |           |                   |         |                                                                                       |



### Example circuit

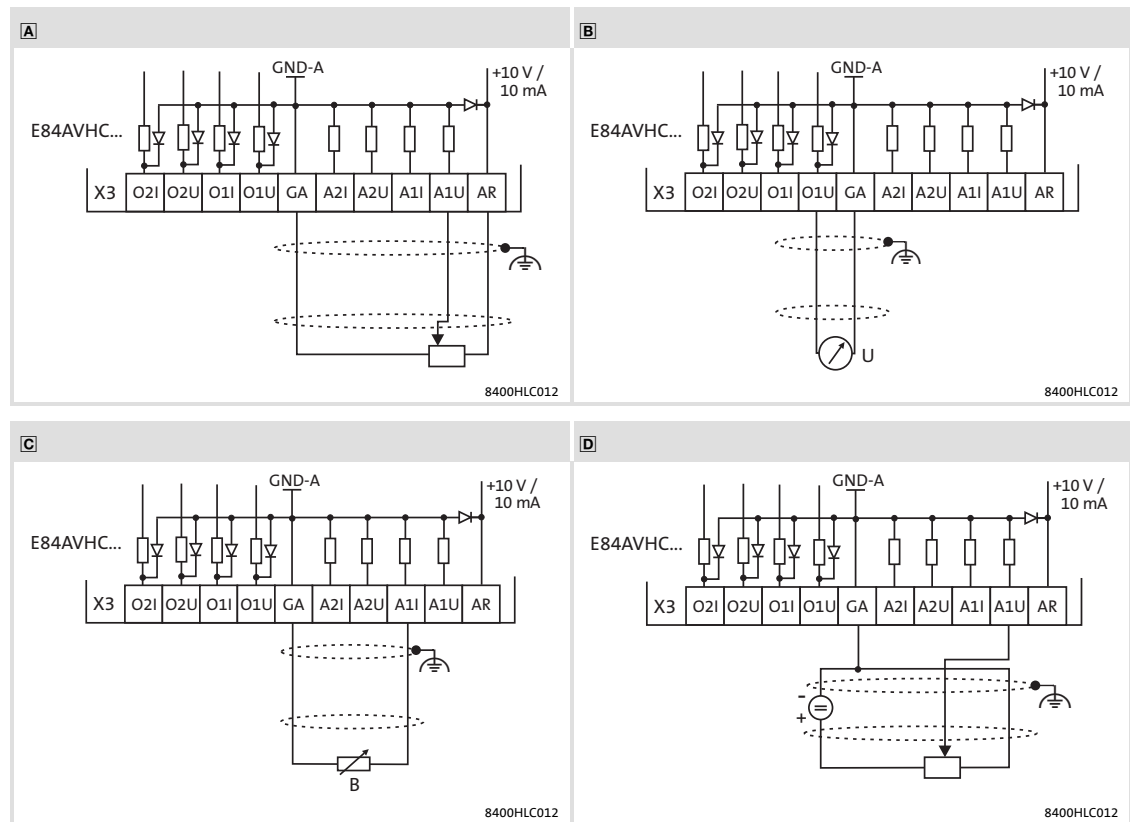


Fig. 6-41 Wiring examples of the analog inputs and outputs

- 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

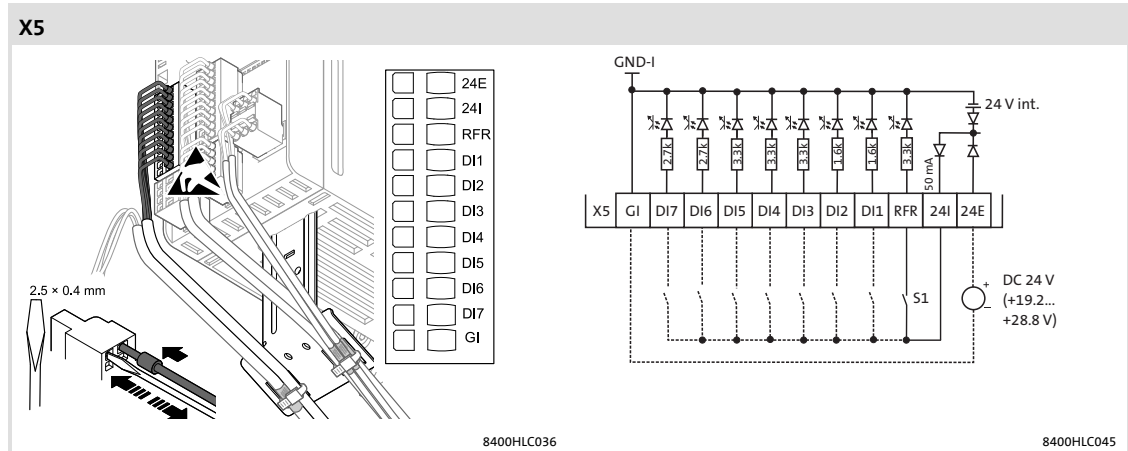


Fig. 6-42 Connection of the digital inputs

| Labelling | Description                                           |
|-----------|-------------------------------------------------------|
| RFR       | Controller enable/controller inhibit, always required |
| DI1       | Digital input 1                                       |
| DI2       | Digital input 2                                       |
| DI3       | Digital input 3                                       |
| DI4       | Digital input 4                                       |
| DI5       | Digital input 5                                       |
| DI6       | Digital input 6                                       |
| DI7       | Digital input 7                                       |
| G1        | 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 |                         |           |                   |         |   |

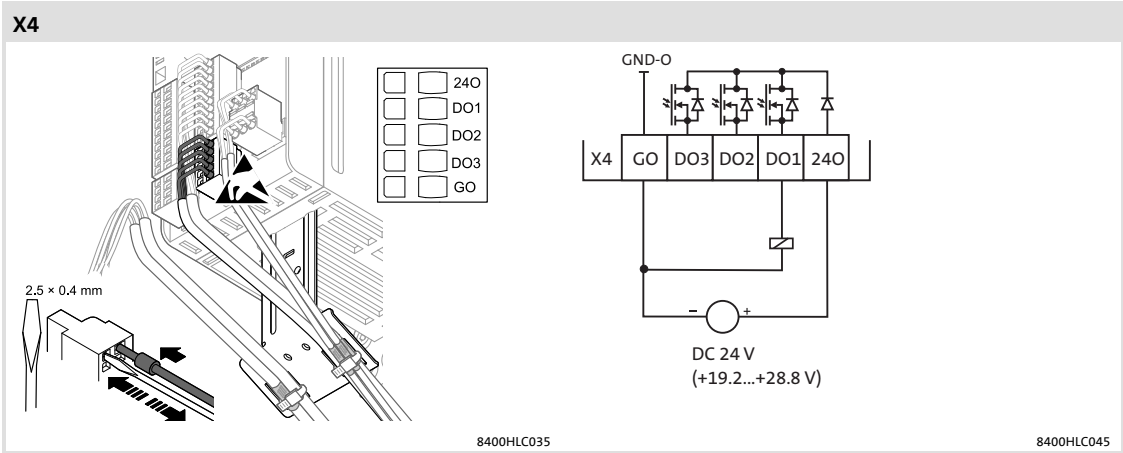


Fig. 6-43 Connection of the digital outputs

| Labelling | Description                  |                                                |
|-----------|------------------------------|------------------------------------------------|
| 240       | external 24 V supply voltage | required for the supply of the digital outputs |
| DO1       | Digital output 1             | 82<br>IEC61131-2, type 1                       |
| DO2       | Digital output 2             |                                                |
| DO3       | Digital output 3             |                                                |
| GO        | GND digital outputs          |                                                |

| Terminal data         |                         |           |                   |         |   |
|-----------------------|-------------------------|-----------|-------------------|---------|---|
|                       | Conductor cross-section |           | Tightening torque |         |   |
|                       | [mm²]                   | [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.

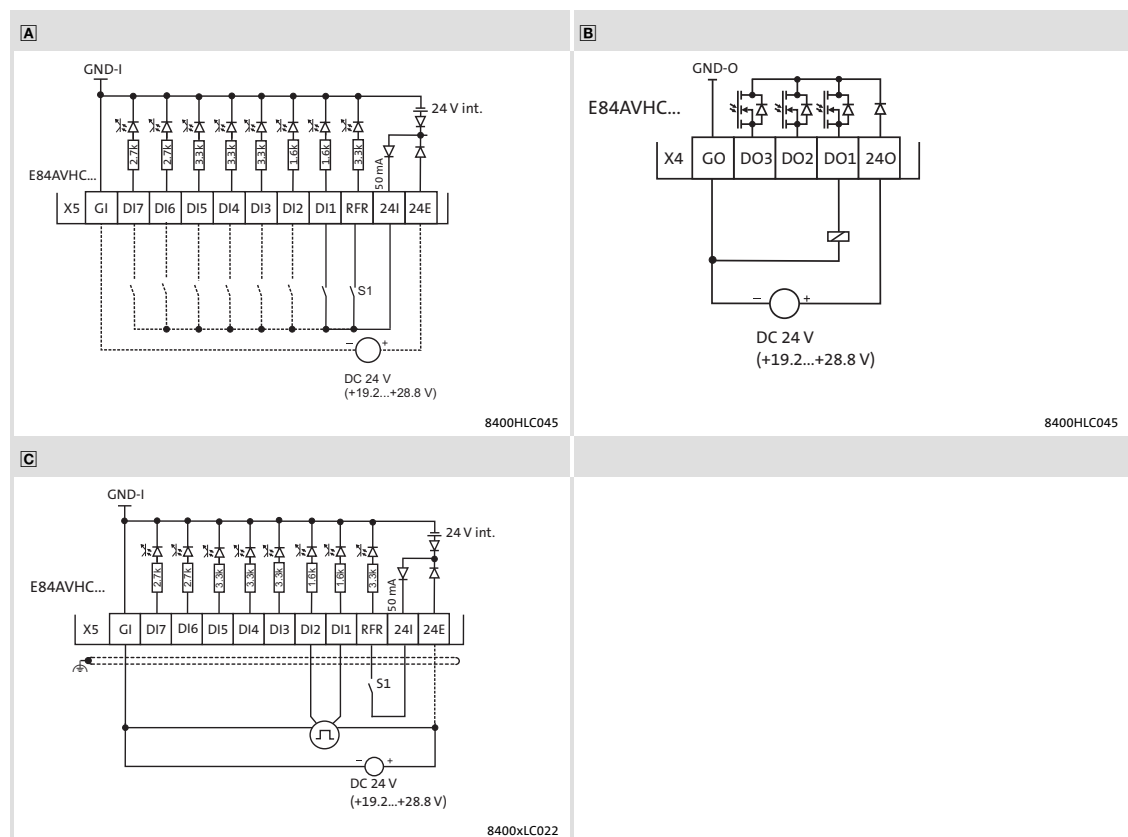


Fig. 6-44 Wiring examples of the digital inputs and outputs

- 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

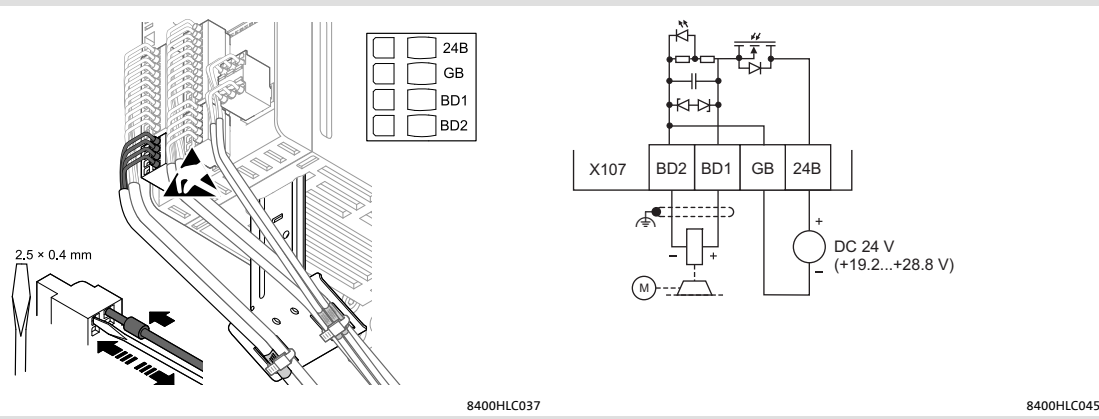
6.8.4 Motor holding brake connection



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.

X107



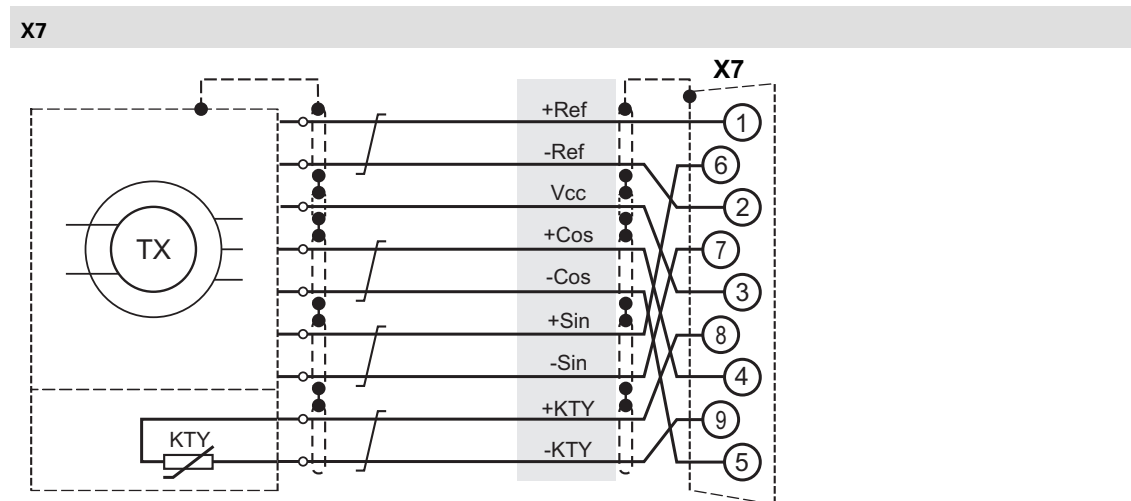
| Labelling | Description                                                                                                |                                                                     |
|-----------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 24B       | Connection for external 24 V supply voltage of the motor holding brake<br><b>Observe correct polarity!</b> | DC 19.2 ... 28.8 V, IEC 61131-2<br>SELV/PELV<br>Example circuit 260 |
| 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)                                                     |                                                                     |

| Terminal data         |                         |           |                   |         |   |
|-----------------------|-------------------------|-----------|-------------------|---------|---|
|                       | Conductor cross-section |           | Tightening torque |         |   |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |   |
| Flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | - |
| With wire end ferrule |                         |           |                   |         |   |

## 6.9 TopLine C control terminals

Devices of the TopLine C version have identical connections as described under "HighLine C control terminals" (📖 230). The additional control terminals of the TopLine C version are described in the following.

### 6.9.1 Resolver connection



6.9.2

Encoder connection

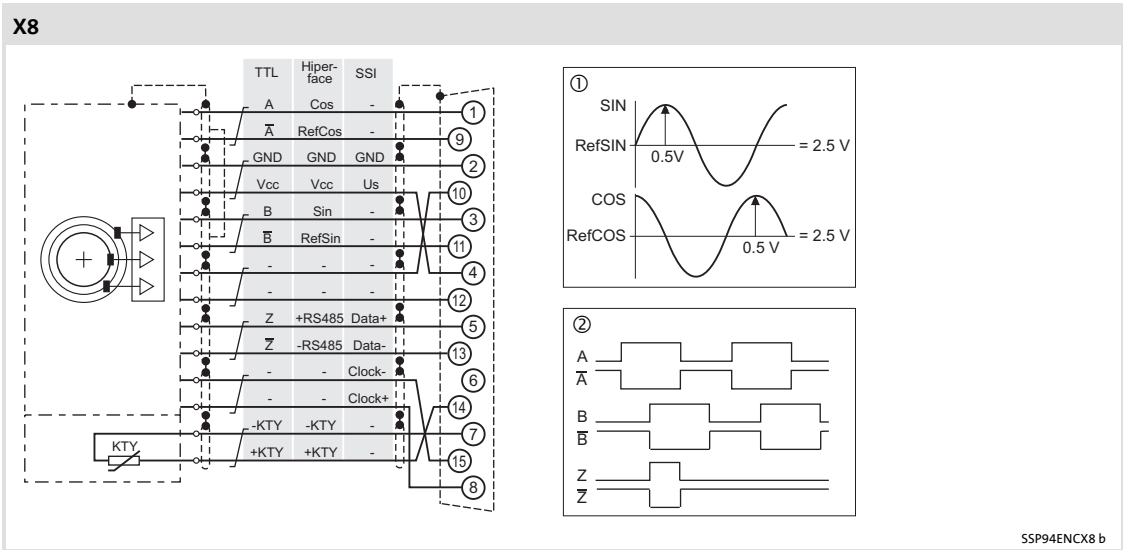


Fig. 6-46

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

| Terminal data         |                         |           |                   |         |   |
|-----------------------|-------------------------|-----------|-------------------|---------|---|
|                       | Conductor cross-section |           | Tightening torque |         |   |
|                       | [mm²]                   | [AWG]     | [Nm]              | [lb-in] |   |
| Flexible              | 0.2 ... 1.5             | 24 ... 16 | -                 | -       | - |
| With wire end ferrule |                         |           |                   |         |   |



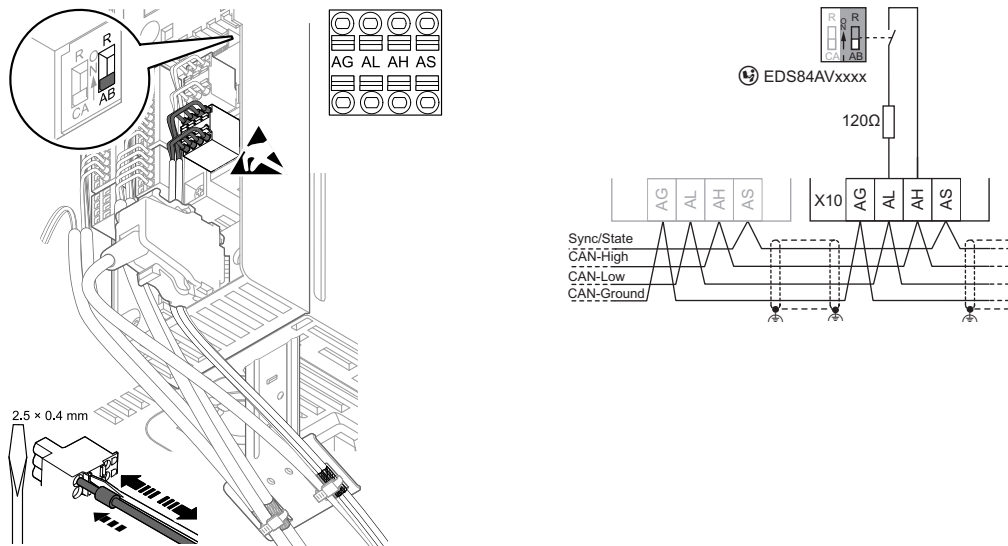
### 6.9.3 Axis bus



#### 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.

#### X10



8400TLC002o

8400TLC009

#### 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<br>Cable lengths: See CAN on board                       |
|            | Baud rate                                        | from version 12.00: 800 kbit/s, constant<br>up to version 2.xx: 500 kbps, constant |
|            | Terminating resistor                             | 120 $\Omega$ , 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 (📖 169)
  - ▶ Use of a power choke at the mains connection

## 7 Commissioning



### Note!

- ▶ Please observe the general safety instructions (📖 12).
- ▶ Please observe the notes regarding residual hazards (📖 18).

### 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  $I^2xt$  (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 $\sqrt{3}$ /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  $2.0 I_{N(motor)}$ .
- ▶ 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  $f = 3$  Hz (C00058).
- ▶ For noise reduction
  - Set code C00018 to the value "3" (switching frequency 16 kHz $_{sin var}$ ).
- ▶ 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 (📖 247), i.e. the X400 keypad is used as setpoint source
- ▶ Terminal control (📖 249), 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 |     |     |     |     |     |     |     |     |                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><b>X4</b><table><tr><td>GI0</td><td>DO1</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td><td>RFR</td><td>24I</td><td>24E</td></tr></table></div> <div></div> | GI0        | DO1         | DI4 | DI3 | DI2 | DI1 | RFR | 24I | 24E | RFR | <ul style="list-style-type: none"><li>● Controller enable</li></ul> RFR = High <ul style="list-style-type: none"><li>● Reset error</li></ul> High → Low (edge-controlled) |
| GI0                                                                                                                                                                                                                                                   | DO1        | DI4         | DI3 | DI2 | DI1 | RFR | 24I | 24E |     |     |                                                                                                                                                                           |

###### – HighLine/TopLine

| Digital inputs at terminal X5                                                                                                                                                         | Assignment | Information |     |     |     |     |     |     |     |     |     |     |                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>X5</div> <table><tr><td>GI</td><td>DI7</td><td>DI6</td><td>DI5</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td><td>RFR</td><td>24I</td><td>24E</td></tr></table> <div></div> | GI         | DI7         | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | RFR | 24I | 24E | RFR | <ul style="list-style-type: none"><li>Controller enable</li></ul> RFR = High <ul style="list-style-type: none"><li>Reset error</li></ul> High → Low (edge-controlled) |
| GI                                                                                                                                                                                    | DI7        | DI6         | DI5 | DI4 | DI3 | DI2 | DI1 | RFR | 24I | 24E |     |     |                                                                                                                                                                       |

##### 3. Load Lenze setting to controller



#### Note!

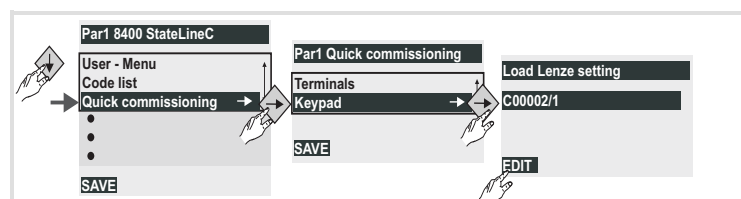
The application "actuating drive speed" is implemented with the Lenze setting.



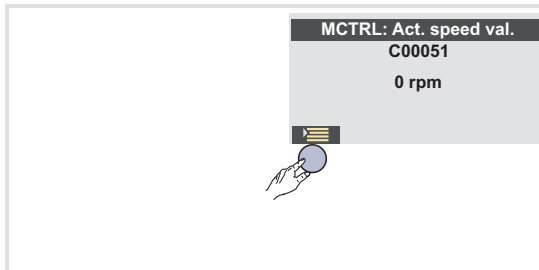
After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established.

The connection has been established when the code C00051 appears in the display.

- Then press the left function key.

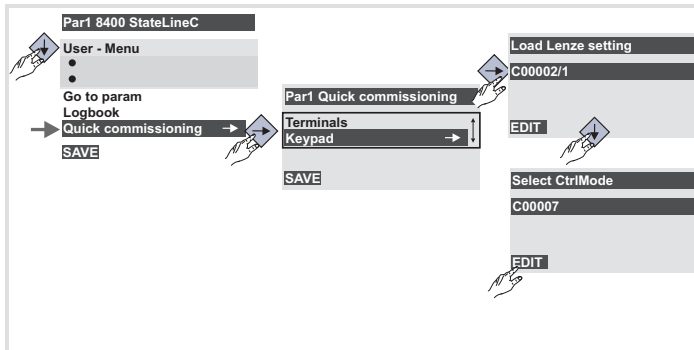


- Starting from "User menu" scroll down with button to "Quick commissioning" menu
- Click right button.
- Select "Keypad" menu.
- Click right button.
- Code 00002/1:
  - Parameterise with left "Edit" function key
  - Select value "1" -> On/Start and confirm with right "OK" function key.



- 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:<br>-199.99 % .... 0 (of C00011)                                     |
|        | C00051 | -       | CW rotation:<br>0 .... +199.99 % (of C00011)<br><br>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

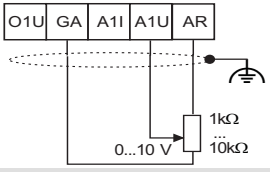
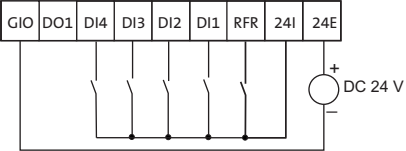
### Commissioning steps

#### 1. Wiring of power terminals

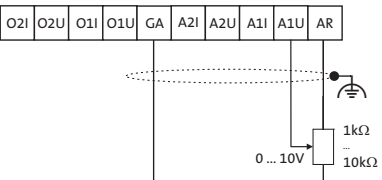
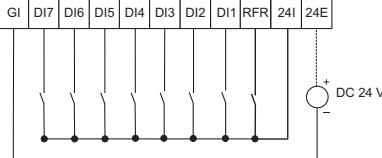
Make use of the Mounting Instructions supplied with the frequency inverter to wire the power terminals according to the requirements of your device.

#### 2. Wiring of control terminals.

##### – StateLine

| Analog inputs at X3                                                                | Assignment | Terminal control                                                                                                                   |
|------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------|
|   | A1U        | Setpoint selection<br>10 V (=100 %):<br>1500 min <sup>-1</sup> (with 4-pole motor)                                                 |
| Wiring of the digital inputs at X4                                                 | Assignment | Terminal control                                                                                                                   |
|  | 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<br>10 V (=100 %):<br>1500 min <sup>-1</sup> (with 4-pole motor)                                                 |
| Wiring of the digital inputs at X5                                                  | Assignment | Terminal control                                                                                                                   |
|  | 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!

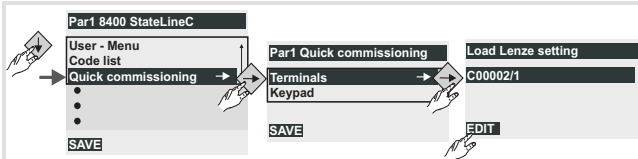
The application "actuating drive speed" is implemented with the Lenze setting.



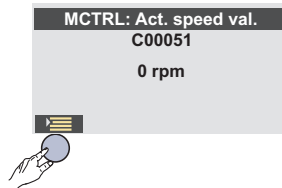
After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established.

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.

- 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).
- 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 ( 267)
- Save the settings with **SAVE** in the keypad.

## **8 Braking operation**

### **8.1 Braking operation without additional measures**

#### **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         | $R_{Bmin}$<br>[Ω] | $I_{BRmax}$<br>[A] | $P_{BRmax}$<br>[kW] | $I_{BRd}$<br>[A] | $P_{Bd}$<br>[kW] | $t_z$<br>[s] | $t_{on}$<br>[s] | $t_{fp}$<br>[s] |
|--------------|-------------------|--------------------|---------------------|------------------|------------------|--------------|-----------------|-----------------|
| E84AVxxx2512 | 180               | 2.1                | 0.8                 | 1.6              | 0.6              | -            | ∞               | -               |
| E84AVxxx3712 | 180               | 2.1                | 0.8                 | 1.6              | 0.6              | -            | ∞               | -               |
| E84AVxxx5512 | 100               | 3.8                | 1.4                 | 2.8              | 1.1              | -            | ∞               | -               |
| E84AVxxx7512 | 100               | 3.8                | 1.4                 | 2.8              | 1.1              | -            | ∞               | -               |
| E84AVxxx1122 | 33                | 11.5               | 4.4                 | 8.6              | 3.3              | -            | ∞               | -               |
| E84AVxxx1522 | 33                | 11.5               | 4.4                 | 8.6              | 3.3              | -            | ∞               | -               |
| E84AVxxx2222 | 33                | 11.5               | 4.4                 | 8.6              | 3.3              | -            | ∞               | -               |

|                |                                                                                 |
|----------------|---------------------------------------------------------------------------------|
| $R_{Bmin}$     | 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 |

## 8.2.2 Operation at rated mains voltage 400 V

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

| Type            | $R_{Bmin}$<br>[ $\Omega$ ] | $I_{BRmax}$<br>[A] | $P_{BRmax}$<br>[kW] | $I_{BRd}$<br>[A] | $P_{Bd}$<br>[kW] | $t_z$<br>[s] | $t_{on}$<br>[s] | $t_{fp}$<br>[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              | -            | $\infty$        | -               |
| E84AVxxx3024xx5 | 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             | -            | $\infty$        | -               |

 $R_{Bmin}$  $I_{BRmax}$  $P_{BRmax}$  $I_{BRd}$  $P_{Bd}$  $t_z$  $t_{on}$  $t_z - t_{on}$  $t_{fp}$ Minimum brake resistance, nominal value  $\pm 10\%$ 

Peak current

Peak braking power

Continuous current RMS - important for the dimensioning of the cables

Continuous braking power

Cycle time, periodic load change with running time and recovery time

Running time

Recovery time

Maximum running time without initial load and compliance with the recovery time

## Braking operation

Braking operation with external brake resistor

Operation at a rated mains voltage of 500 V

### 8.2.3

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

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

| Type            | $R_{Bmin}$<br>[Ω] | $I_{BRmax}$<br>[A] | $P_{BRmax}$<br>[kW] | $I_{BRd}$<br>[A] | $P_{Bd}$<br>[kW] | $t_z$<br>[s] | $t_{on}$<br>[s] | $t_{fp}$<br>[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             | -            | ∞               | -               |

$R_{Bmin}$

$I_{BRmax}$

$P_{BRmax}$

$I_{BRd}$

$P_{Bd}$

$t_z$

$t_{on}$

$t_z - t_{on}$

$t_{fp}$

Minimum brake resistance, nominal value  $\pm 10\%$

Peak current

Peak braking power

Continuous current RMS - important for the dimensioning of the cables

Continuous braking power

Cycle time, periodic load change with running time and recovery time

Running time

Recovery time

Maximum running time without initial load and compliance with the recovery time

### 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<br>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<br>(e.g. unwinder)                               |
| Passive load            | Can stop independent of the drive<br>(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)<br>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

8

| Product key                                  |                | Rated data - brake resistor |                           |                                                    |
|----------------------------------------------|----------------|-----------------------------|---------------------------|----------------------------------------------------|
| Controller                                   | Brake resistor | Resistor<br>R [ $\Omega$ ]  | Continuous power<br>P [W] | Heat quantity<br>Q <sub>B</sub> [kW <sub>s</sub> ] |
| E84AVxxx2512<br>E84AVxxx3712                 | ERBM180R050W   | 180                         | 50                        | 7.5                                                |
| E84AVxxx5512<br>E84AVxxx7512                 | ERBM100R100W   | 100                         | 100                       | 15                                                 |
| E84AVxxx1122<br>E84AVxxx1522                 | ERBP033R200W   | 33                          | 200                       | 30                                                 |
| E84AVxxx2222                                 | ERBP033R300W   |                             | 300                       | 45                                                 |
| E84AVxxx3714<br>E84AVxxx5514                 | ERBM390R100W   | 390                         | 100                       | 15                                                 |
| E84AVxxx7514                                 | ERBM390R100W   |                             |                           |                                                    |
| E84AVxxx1124<br>E84AVxxx1524                 | ERBP180R200W   | 180                         | 200                       | 30                                                 |
| E84AVxxx2224                                 | ERBP180R300W   |                             | 300                       | 45                                                 |
| E84AVxxx3024xxS                              | ERBP082R200W   | 82                          | 200                       | 30                                                 |
|                                              | ERBS082R780W   | 82                          | 780                       | 117                                                |
| E84AVxxx3024xx0                              | ERBP082R200W   | 82                          | 200                       | 30                                                 |
|                                              | ERBS082R780W   | 82                          | 780                       | 117                                                |
| E84AVxxx4024<br>E84AVxxx5524                 | ERBS047R400W   | 47                          | 400                       | 60                                                 |
|                                              | ERBS047R800W   |                             | 800                       | 120                                                |
| E84AVxxx7524<br>E84AVxxx1134                 | 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<br>E84AVxxx2234                 | ERBS015R800W   | 15                          | 800                       | 120                                                |
|                                              | ERBS015R01K2   |                             | 1200                      | 180                                                |
|                                              | ERBS015R02K4   |                             | 2400                      | 420                                                |
|                                              | ERBG015R06K2   |                             | 6200                      | 930                                                |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534 | ERBG075D01K9   | 7.5                         | 1900                      | 285                                                |

## 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.

### Wiring principle

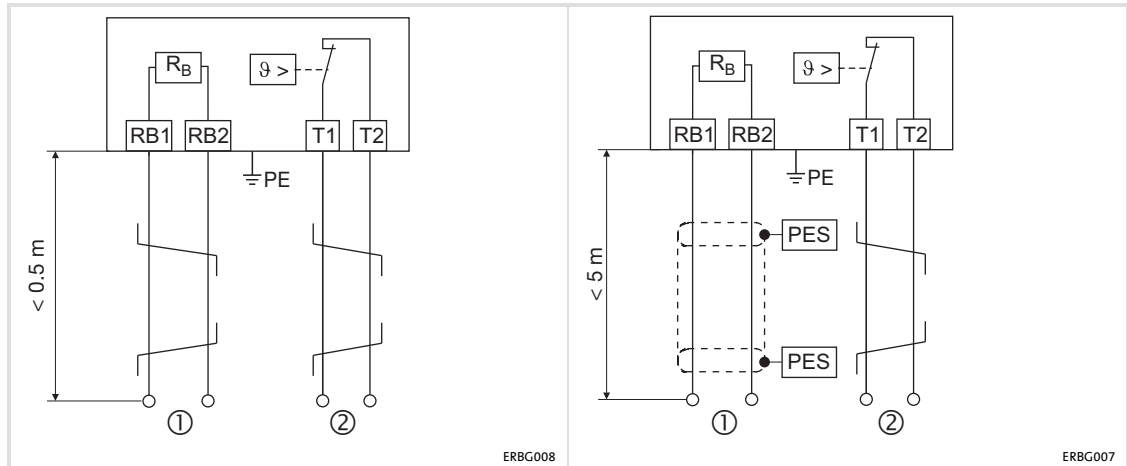


Fig. 8-1 Wiring of a brake resistor to the controller

|          |                                                                                                                                              |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br>(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.

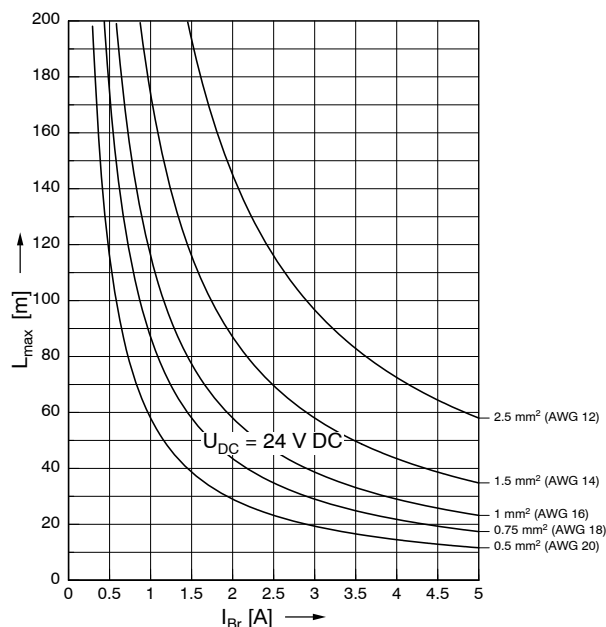
Observe additional notes in the documentation of the standard device!

**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**

E94AZHY004

$L_{max}$  Maximum brake cable length in [m]  
 $I_{Br}$  Brake current in [A]  
 $U_{DC}$  Supply voltage of the motor brake control

## 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<br>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><br>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 ... 0.61 A                                 |
| <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><br>AWG 16                     |

► Integrated brake control for devices of the HighLine/TopLine version

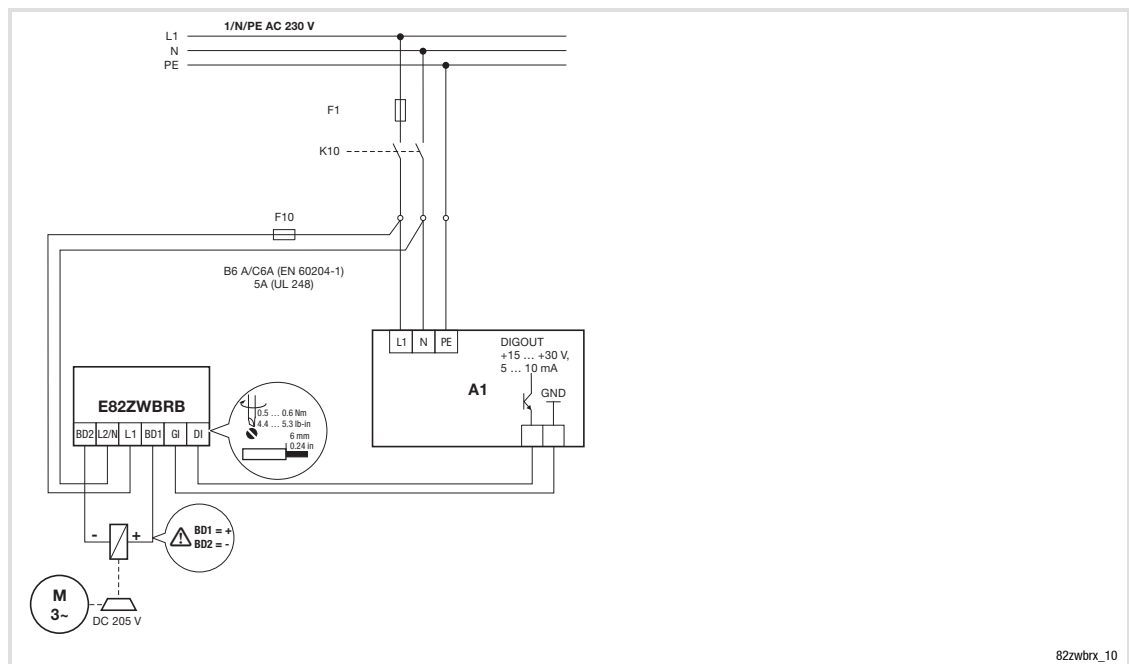
| Range                                     | Values                                                                                                                        |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Input voltage                             | DC 24 V in accordance with IEC 61131-2<br>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><br>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

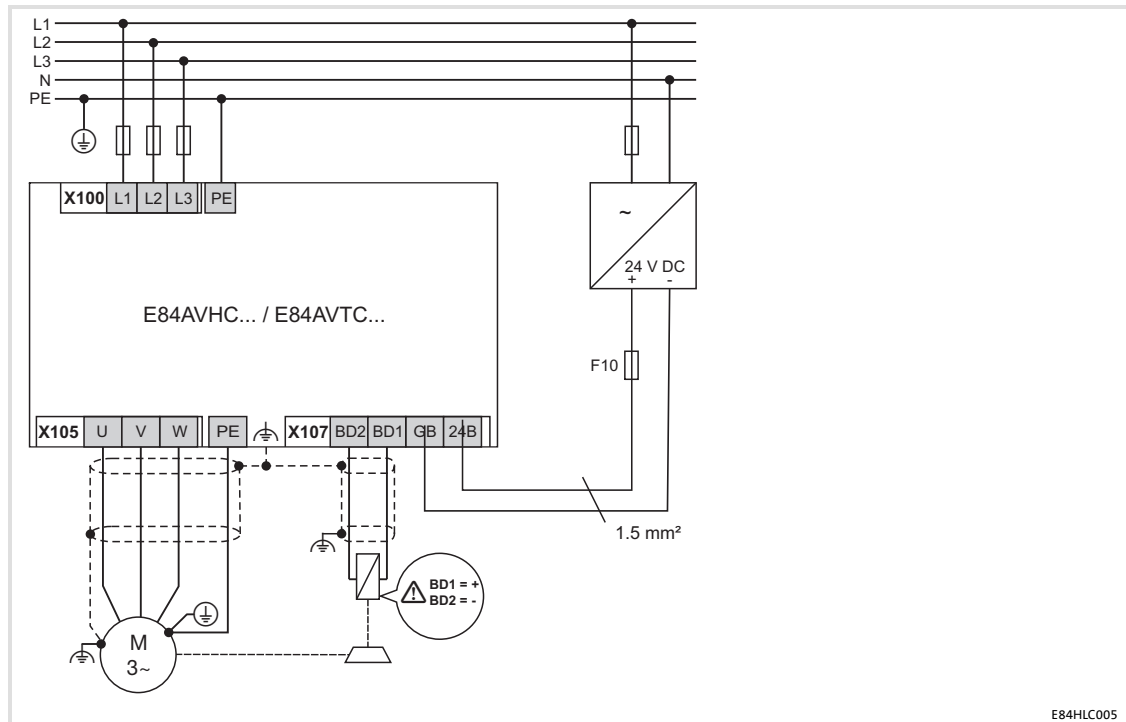


82zwbrx\_10

## Braking operation

Operation with spring-applied brake  
Wiring

### ► 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.



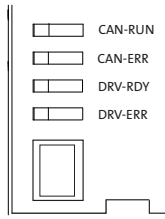
## 9 Diagnostics

### 9.1 Display of operating data, diagnostics

#### 9.1.1 Status display via controller LEDs

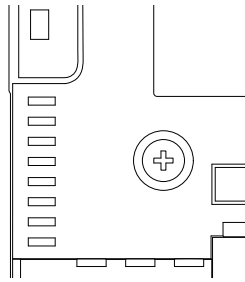
##### StateLine, HighLine

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                                        |
|-----------------------------------------------------------------------------------|-----------|--------|----------------------------------------------------|
|  | 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.

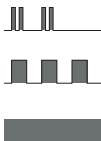
| LED                                                                                 | Labelling | Colour    | Description                                        |
|-------------------------------------------------------------------------------------|-----------|-----------|----------------------------------------------------|
|  | 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<br>(green)                                                              | DRIVE ERROR<br>(red)                                                                | Status                     | Description                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OFF                                                                                 | OFF                                                                                 | → "Init" state             | <b>Initialisation is active</b>                                                                                                                                                                |
|    | OFF                                                                                 | → "MotorIdent" state       | <b>Motor data identification</b><br>– 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><br>– This is the controller's state directly after the initialisation has been completed.                                                                      |
|    | OFF                                                                                 | → "SwitchedOn" state       | <b>Device is switched on</b><br>– 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><br>– In this device state, the motor follows the setpoint defined in the application.                                                                                         |
|  |  | → "Warning" status display | <b>Operation/warning is active</b><br>– 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><br>– 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><br>– 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><br>– 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><br>– This device state will be active if a system fault occurs.                                                                                                  |

### 9.1.2 Drive diagnostics via keypad

Important operating parameters are measured by the controller. They can be displayed with the keypad or PC.

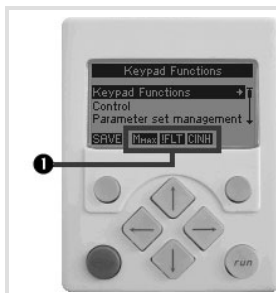
Some operating data can be calibrated to be displayed or selected directly with the unit of the process quantity (e.g. pressure, temperature, speed).



#### 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.                                       |                                  |
| <b>STP</b>              | 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>I<sub>max</sub></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>IS<sub>FLT</sub></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> xt)               |
| 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                |

**10 Safety engineering****10.1 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.



## 10.2 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  $180^\circ/\text{number of pole pairs}$  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.

**10.2.1 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.

**10.2.2 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.

### 10.2.3 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).

**10.3 Acceptance****10.3.1 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

**10.3.2 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.

## **10.4 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

## 10.5 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).

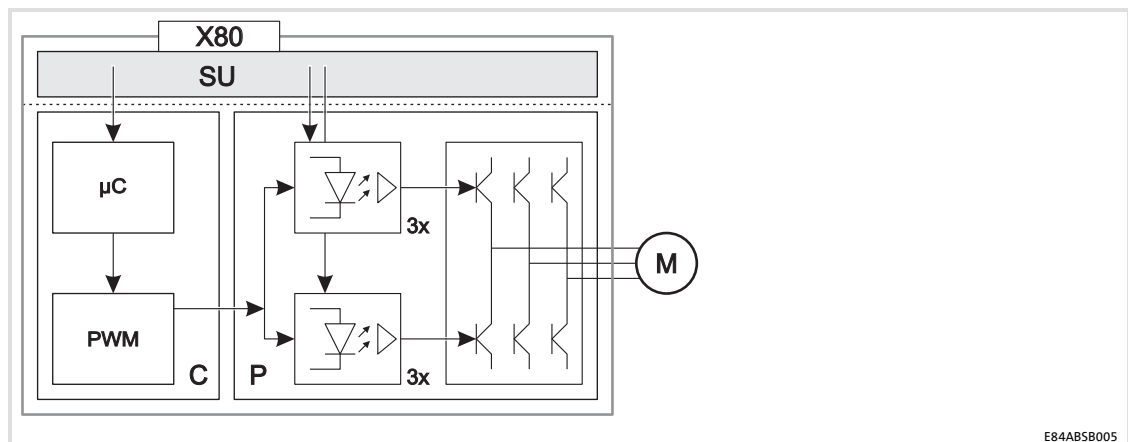


Fig. 10-1 Operating principle of safety unit

|     |                                                             |
|-----|-------------------------------------------------------------|
| 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

## 10.6 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.



**10.7      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      |      | $U_{240} - 1 \text{ V}$ |      |
| 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<br>(depends on the controller: Size 1 - 3)                                      | ms     |      | 6                       |      |
|              | Switch-off time<br>(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      |      | $U_{240} - 1 \text{ V}$ |      |
| 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 | Controller                   |        |
|----------------------|-----|-------------------|------------------------------|--------|
| SIA                  | SIB | DO1/DO            | 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.

## 10.8 Electrical installation

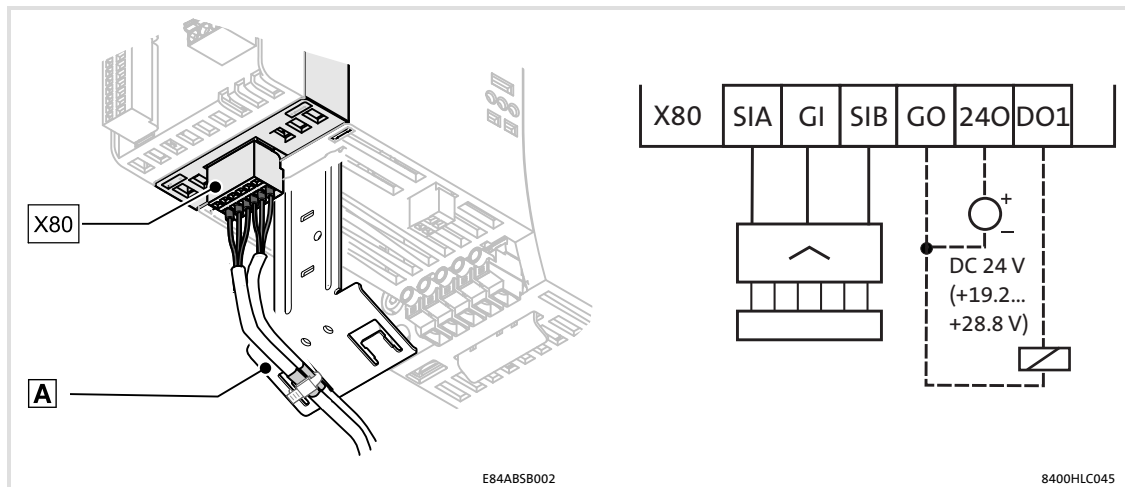


Fig. 10-2 Block diagram - safe torque off (STO)

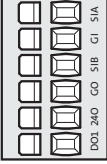
|              |                                              |
|--------------|----------------------------------------------|
| X80          | Pluggable terminal strip for the safety unit |
| SIA, SIB, GI | Connections for shutdown paths               |
| 240, DO1, GO | Feedback connections                         |
| A            | Shield connection                            |



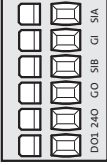
### Note!

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                                                                                 |
|-------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <br>E84AB5B003 | SIA       | Safe input, channel A                            | SIA: $I_{typ} = 100 \text{ mA}$                                                                 |
|                                                                                                 | GI        | GND potential for SIA/SIB                        | LOW: $-3 \dots 5 \text{ V}$ ,<br>HIGH: $15 \dots 30 \text{ V}$                                  |
|                                                                                                 | SIB       | Safe input, channel B                            | SIB: $I_{typ} = 28 \text{ mA}$<br>Supply through safely separated power supply unit (SELV/PELV) |
|                                                                                                 | GO        | GND potential feedback                           | 24 V, max. 0.7 A<br>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                                                |
|--------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------|----------------------------------------------------------------|
| <br>E84AB5B003 | SIA       | Safe input, channel A                            | SIA, SIB: $I_{typ} = 12 \text{ mA}$                            |
|                                                                                                  | GI        | GND potential for SIA/SIB                        | LOW: $-3 \dots 5 \text{ V}$ ,<br>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<br>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 |                   |         |

## **10.9 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.

## 11 Accessories (overview)



### Note!

You can find additional information on the accessories in the catalogue to this product series.

### 11.1 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 EMF2173IBxxx/EMF2177IB
- ▶ 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



## 11.2 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<br>Type/Cat. No. | L<br>[mH] | I <sub>N</sub><br>[A] | U <sub>N</sub><br>[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                  | 600                   |
| 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<br>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 |

### 11.3 RFI filter/mains filter

| Basis of the data |              |                         |                 |
|-------------------|--------------|-------------------------|-----------------|
|                   | Voltage      | Voltage range           | Frequency range |
| Mains             | $V_{LN}$ [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<br>[V] | Frequency<br>[Hz] | Current                 |                         | Number of<br>phases |
|--------------------|----------------|-------------------|-------------------------|-------------------------|---------------------|
|                    |                |                   | ① max. +45<br>°C<br>[A] | ① max. +55<br>°C<br>[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,<br>additional mains choke of type ELN3 is not required) |

## For operation with rated power

| Assignment      |                |                  |                |
|-----------------|----------------|------------------|----------------|
| Type            | SD             | RFI filter<br>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    |                |                  |                |
| E84AVxxx3024xx5 | 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         | SD                               | RFI filter<br>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)

## 11.4 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               | 1.2        | 25.5   |
| E84AVxxx2234    | EZS3-061A200      |                |                       | 1.0        | 33.5   |
| E84AVxxx3034    | EZS3-072A200      |                |                       | 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<br>E84AVxxx3024xx0 | EZS3-017A200      | 0 ... 550 V AC | 4                     | 3.1        | 8.5    |
| E84AVxxx4024                       |                   |                |                       |            |        |
| E84AVxxx5524                       | EZS3-024A200      | 0 ... 550 V AC | 4                     | 2.5        | 14.5   |
| 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   |

## 11.5

## External brake resistors

| Product key                                  |                | Rated data - brake resistor |                           |                                                    |
|----------------------------------------------|----------------|-----------------------------|---------------------------|----------------------------------------------------|
| Controller                                   | Brake resistor | Resistor<br>R [Ω]           | Continuous power<br>P [W] | Heat quantity<br>Q <sub>B</sub> [kW <sub>s</sub> ] |
| 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   |                             | 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<br>E84AVxxx1134                 | 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<br>E84AVxxx2234                 | ERBS015R800W   | 15                          | 800                       | 120                                                |
|                                              | ERBS015R01K2   |                             | 1200                      | 180                                                |
|                                              | ERBS015R02K4   |                             | 2400                      | 420                                                |
|                                              | ERBG015R06K2   |                             | 6200                      | 930                                                |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534 | ERBG075D01K9   | 7.5                         | 1900                      | 285                                                |

## 11.6 Memory module

### 11.6.1 E84AYM10S

Name: Memory module (for StateLine/HighLine version)

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.

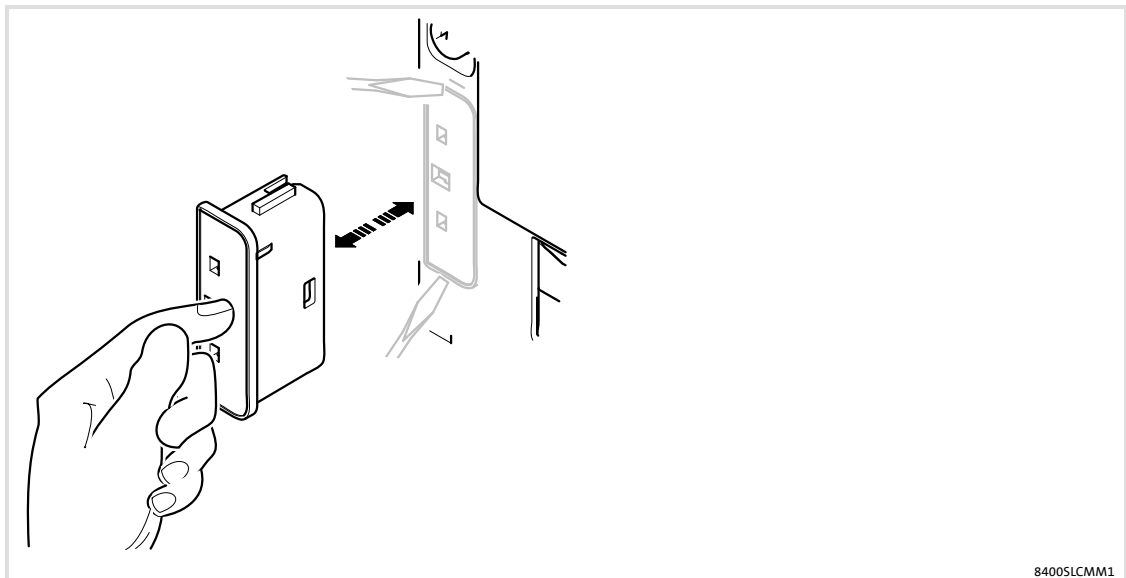
In order to remove the memory module, use a suitable screwdriver to lever the module out at the upper and lower groove. In order to plug in the module, insert it into the slot and push it with light pressure until end position is reached.



#### 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.



84005LCMM1

## 11.7

## 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<br>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>



**11.8 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

## 11.9 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<br>(1/N/PE AC) | 0.8          | 24<br>(22.5 ... 28.5) | 5            |
| EZV2400-000 |                    | 1.2          |                       | 10           |
| EZV4800-000 |                    | 2.3          |                       | 20           |
| EZV1200-001 | 400<br>(3/PE AC)   | 0.3          |                       | 5            |
| EZV2400-001 |                    | 0.6          |                       | 10           |
| EZV4800-001 |                    | 1.0          |                       | 20           |

### 11.10 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 |                 |                 |                 |                 |                 |
|-----------------------------------------------------------------|--------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Type                                                            | Mains<br>X100                        | Motor<br>X105   | Relay<br>X101   | PTC<br>X106     |                 |                 |
| E84AVxxx2512<br>E84AVxxx3712<br>E84AVxxx5512<br>E84AVxxx7512    | E84AZEVS001X100                      | E84AZEVS010X105 | E84AZEVS020X101 | E84AZEVS030X106 |                 |                 |
| E84AVxxx1122<br>E84AVxxx1522<br>E84AVxxx2222                    | E84AZEVS002X100                      |                 |                 |                 |                 |                 |
| E84AVxxx3714<br>E84AVxxx5514<br>E84AVxxx7514                    | E84AZEVS003X100                      |                 |                 |                 |                 |                 |
| E84AVxxx1124<br>E84AVxxx1524<br>E84AVxxx2224<br>E84AVxxx3024xxS |                                      |                 |                 |                 |                 |                 |
| E84AVxxx3024xx0<br>E84AVxxx4024<br>E84AVxxx5524                 |                                      |                 |                 |                 | E84AZEVS004X100 | E84AZEVS011X105 |
| E84AVxxx7524<br>E84AVxxx1134<br>E84AVxxx1534                    |                                      |                 |                 |                 | E84AZEVS005X100 | E84AZEVS012X105 |
| E84AVxxx1834<br>E84AVxxx2234                                    | -                                    |                 |                 |                 | -               |                 |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534                    | -                                    |                 |                 |                 | -               |                 |

| Assignment                                   | Replacement terminals for connection |                                    |                                    |                      |
|----------------------------------------------|--------------------------------------|------------------------------------|------------------------------------|----------------------|
| Type                                         | CAN<br>X1                            | Analog I/O<br>X3                   | Digital Out<br>X4                  | Digital In<br>X5     |
| E84AVSCxxxxx<br>E84AVHCxxxxx<br>E84AVTCxxxxx | E84AZEVS040X001                      | E84AZEVS050X003<br>E84AZEVS060X003 | E84AZEVS050X004<br>E84AZEVS060X004 | -<br>E84AZEVS060X005 |

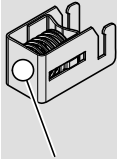
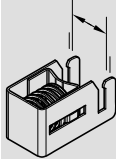
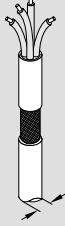
| Assignment                                   | Replacement terminals for connection |                      |  |  |
|----------------------------------------------|--------------------------------------|----------------------|--|--|
| Type                                         | Axis bus<br>X10                      | Brake<br>X107        |  |  |
| E84AVSCxxxxx<br>E84AVHCxxxxx<br>E84AVTCxxxxx | -<br>-<br>E84AZEVS060X010            | -<br>E84AZEVS060X107 |  |  |

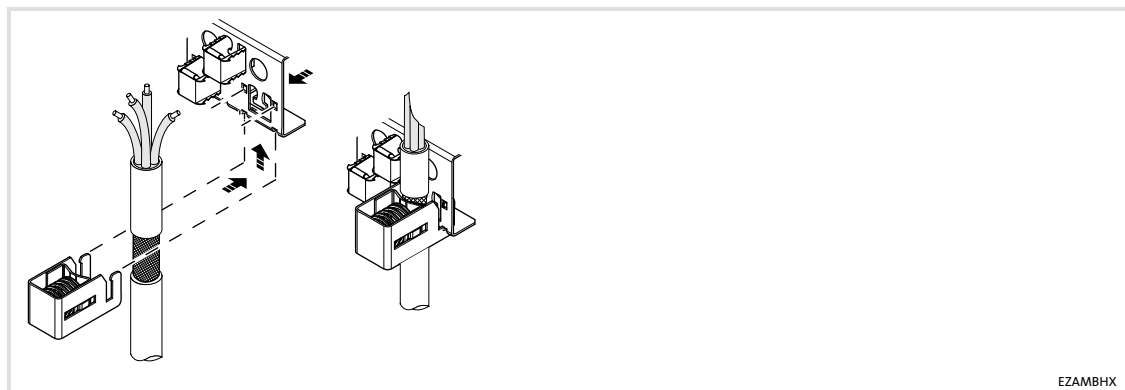
| Assignment      | Replacement terminals for connection |  |  |  |
|-----------------|--------------------------------------|--|--|--|
| Type            | Safety<br>X80                        |  |  |  |
| E84AVxxxxxxxSBx | E84AZEVS070X080                      |  |  |  |
| E84AVxxxxxxxVBx |                                      |  |  |  |

**11.11 EMC accessories**

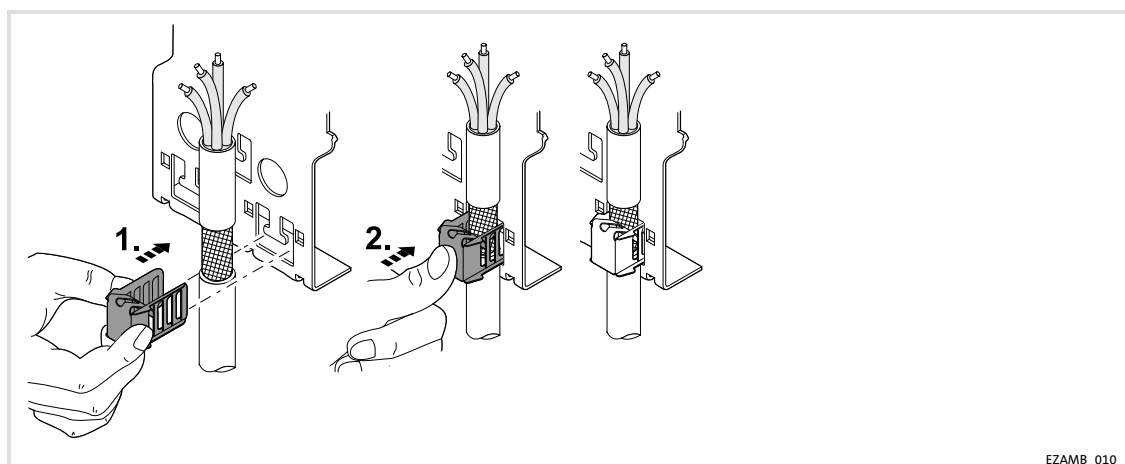
Matched accessories are available for an easy EMC-compliant installation and optimum shield connection. Select available accessories from the list below, depending on the device. Each packaging unit includes 10 or 50 pieces.

| Assignment                                                      |             | Shield sheet for                       |                         |
|-----------------------------------------------------------------|-------------|----------------------------------------|-------------------------|
| Type                                                            | Device size | Motor connection                       | Control terminals       |
| E84AVxxx2512<br>E84AVxxx3712                                    | GG1         | EZAMBHXM006<br>EZAMBHXM007<br>EZAMBKBM | EZAMBHXM007<br>EZAMBKBM |
| E84AVxxx551x<br>E84AVxxx751x<br>E84AVxxx3714                    | GG2         |                                        |                         |
| E84AVxxx112x<br>E84AVxxx152x<br>E84AVxxx222x<br>E84AVxxx3024xx5 | GG3         |                                        |                         |
| E84AVxxx3024xx0<br>E84AVxxx4024<br>E84AVxxx5524                 | GG4         | EZAMBHXM003<br>EZAMBHXM004             |                         |
| E84AVxxx7524<br>E84AVxxx1134<br>E84AVxxx1534                    | GG5         |                                        |                         |
| E84AVxxx1834<br>E84AVxxx2234                                    | GG6         |                                        |                         |
| E84AVxxx3034<br>E84AVxxx3734<br>E84AVxxx4534                    | GG7         | EZAMBHXM004<br>EZAMBHXM005             |                         |

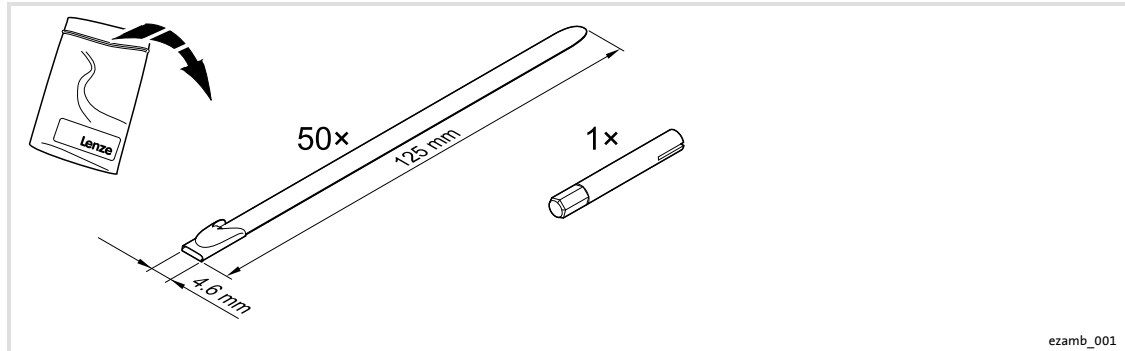
|                               |  |  |  |  |
|-------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                               |                                                                                   |                                                                                   | [mm]                                                                                |                                                                                     |
| EZAMBHXM006<br>(< E94AZIS003) | 2                                                                                 | 18                                                                                | 20                                                                                  | 4 ... 15                                                                            |
| EZAMBHXM003<br>(< E94AZIS007) | 3                                                                                 | 19                                                                                | 30                                                                                  | 10 ... 20                                                                           |
| EZAMBHXM004<br>(< E94AZIS024) | 4                                                                                 | 27                                                                                | 30                                                                                  | 15 ... 28                                                                           |
| EZAMBHXM005                   | 5                                                                                 | 37                                                                                | 35                                                                                  | 20 ... 37                                                                           |



|             |  |  |
|-------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| EZAMBHXM007 | 20 mm                                                                               | 4 ... 10 mm                                                                           |



|          |                                                                                   |                                                                                     |
|----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |  |  |
| EZAMBKBM | > 10 mm                                                                           | 8 ... 30 mm                                                                         |



**11.12****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.



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