Inverter

# Servo-Inverter i700

**5 to 64 A**

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# Servo-Inverter i700

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## Product key

E70A C M S E 005 4 S A 1 ET R

**Design**
C – Control cabinet inverter

**Type**
M – Single axis or double axis
P – Supply module

**Version**
S – Standard

**Mounting type**
E – Installation
D – Push–trough technique
C – Cold plate technique

**Max. short-time output current**
005 – 5.0 A
010 – 10.0 A
020 – 20.0 A
032 – 32.0 A
048 – 48.0 A
064 – 64.0 A

**Voltage class**
4 – 400/480 V, 3/PE AC

**Ambient conditions**
S – Standard
V – Rough

**Drive-based safety**
A – With drive-based safety (STO)

**Motor outputs**
1 – Single axis
2 – Double axis

**Communication**
ET – EtherCAT

**Encoder input**
R – Resolver
E – Encoder/Absolute value encoder





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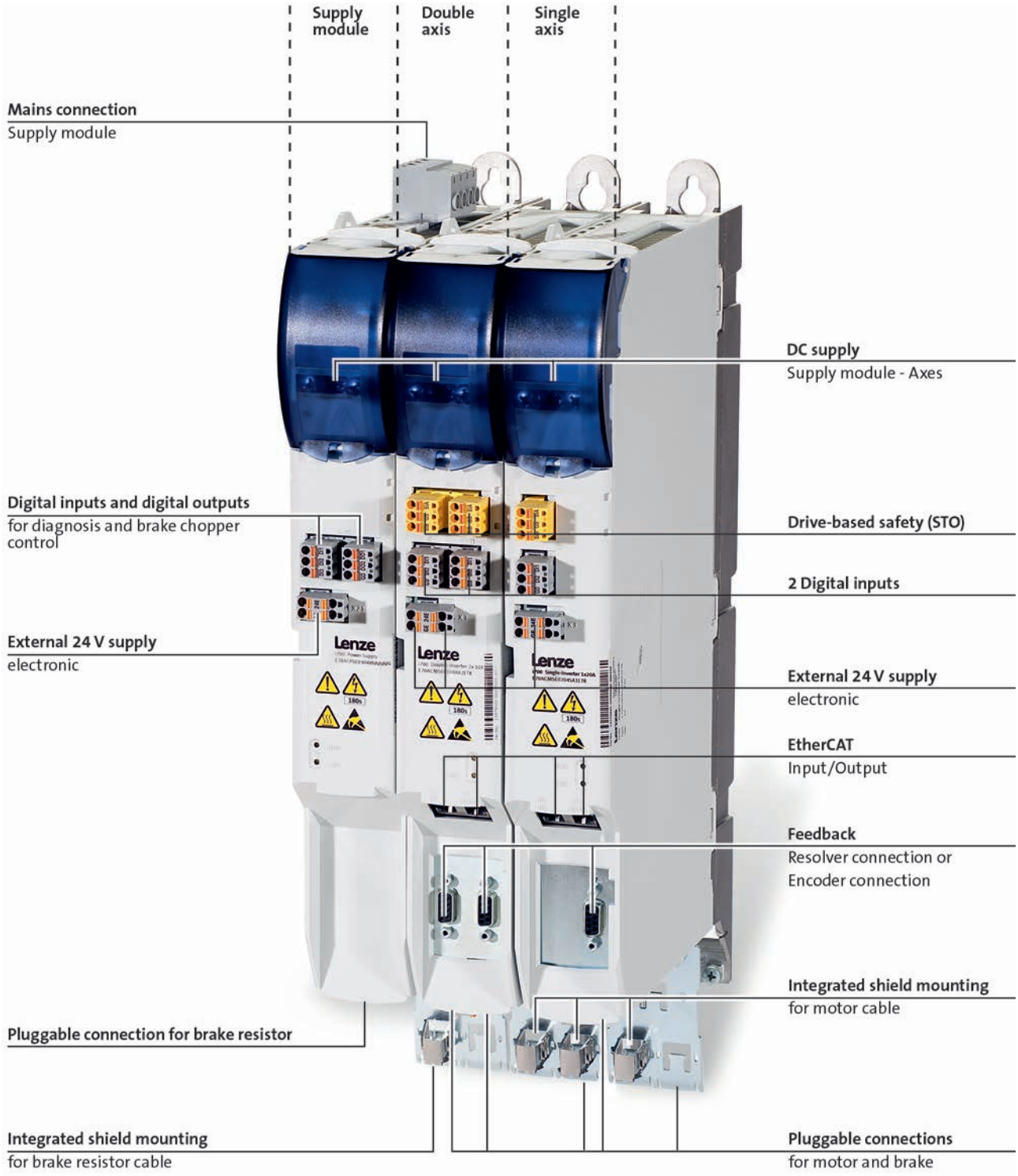
## Equipment





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## List of abbreviations

| | | |
|---|---|---|
| b | [mm] | Dimensions |
| $C_{th}$ | [KWs] | Thermal capacity |
| $f_{ch}$ | [kHz] | Rated switching frequency |
| h | [mm] | Dimensions |
| $I_{N, out}$ | [A] | Rated output current |
| $I_{N, AC}$ | [A] | Rated mains current |
| m | [kg] | Mass |
| $n_{max}$ | [r/min] | Max. speed |
| P | [kW] | Typical motor power |
| $P_V$ | [kW] | Power loss |
| $P_N$ | [kW] | Rated power |
| $R_N$ | [Ω] | Rated resistance |
| t | [mm] | Dimensions |
| $U_{AC}$ | [V] | Mains voltage |
| $U_{DC}$ | [V] | DC supply |
| $U_{N, AC}$ | [V] | Rated voltage |
| $U_{out}$ | [V] | Max. output voltage |

| | |
|---|---|
| ASM | Asynchronous motor |
| DIAG | Slot for diagnostic adapter |
| DIN | Deutsches Institut für Normung e.V. |
| EN | European standard |
| EN 60529 | Degrees of protection provided by enclosures (IP code) |
| EN 60721-3 | Classification of environmental conditions; Part 3: Classes of environmental parameters and their limit values |
| EN 61800-3 | Electrical variable speed drives Part 3: EMC requirements including special test methods |
| IEC | International Electrotechnical Commission |
| IEC 61508 | Functional safety of electrical/electronic/programmable electronic safety-related systems |
| IM | International Mounting Code |
| IP | International Protection Code |
| MCI | Slot for communication module (module communication interface) |
| NEMA | National Electrical Manufacturers Association |
| UL | Underwriters Laboratory Listed Product |
| UR | Underwriters Laboratory Recognized Product |
| VDE | Verband deutscher Elektrotechniker (Association of German Electrical Engineers) |





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## Generation Easy for multi-axis applications

The innovative Servo-Inverter i700 for central motion control is characterised by its compact and highly flexible design. Dual axes keep the drive size to a minimum, dynamic motor control makes it suitable for use in a wide range of applications. Drive integration, commissioning and maintenance have been substantially simplified thanks to its installation concept and easy engineering.

Highlights:
- Easy to use: from installation to service
- Compact: both in size and connection system
- Flexible: motor control for synchronous and asynchronous motors
- High performance, e. g. with real-time EtherCAT® bus system

**i700 – in use**

Powerful central motion control of demanding machine tasks is best achieved with our Controller-based Automation. The Servo-Inverter i700 for multiaxis application can drive all centrally controlled motors in your machine module – from three-phase AC motor to servo motor.

i700 features:
- Multi-axis system
- Single and double axes
- Power supply modules
- DC-bus connection via busbar system
- Pluggable connection system
- Automatic parameter/firmware download via the control system
- Motor control:
  -Servo with field weakening and torque pre-control
  -V/f control for standard asynchronous motors without encoder
- Scalable safety functions
- 3 cooling methods: standard panel-mount, cold plate technique, push-through technique

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## Functions and features

The Servo-Inverter i700 can be directly implemented into the Controller-based Automation applications via the integrated EtherCAT® interface. The interaction of the different Lenze controllers provide for a high number of sophisticated Lenze Motion applications.

The speed and position control modes are directly executed in the servo inverter which ensures very short cycle times (0.25 ms). The selection of the right control mode for the application is determined via the application in the Controller. The "Controller-based Automation" chapter summarises which controller optimally solves the individual applications together with the i700.

| **Mode** | |
|---|---|
| | Servo-Inverter i700 |
| **Conrol types, motor control** | |
| Field-oriented servo control (SC) | For synchronous servo motors, asynchronous servo motors and three-phase asynchronous motors |
| V/f control (VFCplus) | For three-phase AC motors and asynchronous servo motor (linear or square-law) |
| **Basic functions** | |
| | Brake management for brake control with low rate of wear<br>PID controller |
| Operating modes to CiA 402 | Velocity mode (VL) - non-cyclic velocity setpoint<br>Cyclic synchronous position (csp) - cyclic position setpoint<br>Cyclic synchronous velocity (csv) - cyclic velocity setpoint<br>Cyclic synchronous torque (cst) - cyclic torque setpoint |
| **Overload behaviour** | |
| | 200% maximum current (with regard to 4kHz rated current) |
| **Functions with FAST Application Software** | |
| | Comprehensive library of function and technology modules e.g. for positioning, cam functions, electrical shaft etc. |
| **Monitoring and protective measures** | |
| | Overload<br>Short circuit<br>Earth fault<br>Overvoltage<br>Undervoltage<br>DC-bus voltage<br>Motor phase failure<br>Overcurrent<br>I² x t-Motor monitoring<br>Overtemperature<br>Motor overtemperature<br>Brake chopper, brake resistance<br>Motor stalling |
| **Diagnostics** | |
| | Axis modules: Error codes to CiA 402<br>Power supply modules: Status message via 2 digital outputs<br>Oscilloscope functions |
| Status display | 2 LEDs |
| **Braking operation** | |
| Brake chopper | Integrated in power supply module |
| Brake resistor | External |
| **Mounting conditions** | |
| Mounting type | Installation<br>Cold plate technique<br>Push-through technique |
| Mounting place | In the control cabinet |
| Mounting position | Vertical |
| Free spaces | At the top: minimum 90 mm<br>Side–by–side mounting without any clearance<br>At the bottom: minimum 70 mm |





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## Operating modes

### Overcurrent operation

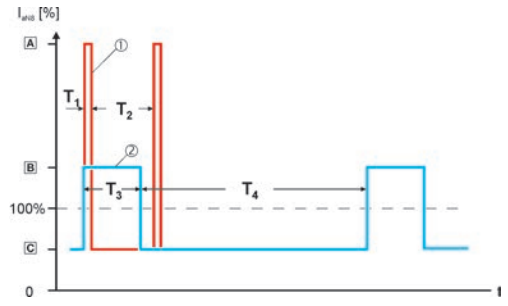
#### Axis modules and power supply modules

Power supply modules and axis modules can be operated with higher currents beyond the rated current if this overcurrent is only active for a limited operating time. Within the efficiency cycles, the overcurrent can flow for a certain period of time if afterwards an accordingly long recovery phase takes place afterwards. Two efficiency cycles of 15 s [1] in red and 180 s [2] in blue are defined.

- 15-s cycle
  - 3 s ($T_1$) load period with peak current [A] (200 %)
  - 12 s ($T_2$) recovery time with limited current [C] (75 %)
- 180-s cycle
  - 60 s ($T_3$) load period with peak current [B] (150 %)
  - 120 s ($T_4$) recovery time with limited current [C] (75 %)

A load period with peak current must be followed by a recovery time. In the recovery time, the current must not exceed the given value.

**Overcurrent operation**




► From a maximum device current of 32 A, the following restriction applies:
With field frequencies lower than 5 Hz, the cycle time of the short time behaviour is reduced from 15 s to 3 s.





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## Dimensioning of a multi-axis system

Drive dimensioning of multi-axis systems with Servo-Inverters i700 can be easily carried out using the DSD (Drive Solution Designer) engineering tool. This tool can be downloaded from the Lenze homepage. It considers various, frequently recurring applications, the ambient conditions and the entire mechatronic system and their operating mode as for instance coordinated or uncoordinated multi-axis operation with energy exchange in the DC-bus system. It provides comprehensible dimensioning protocols and an Energy Performance Certificate for the axes and for the multi-axis system. The Energy Performance Cer-tificate clearly displays the energy efficiency of all drive components under the given operation modes and provides potential for energy optimisations for entire plants.

**Functions and features**

| | |
|---|---|
| **Mode** | |
| | Engineering Tool DSD |
| **Applications** | |
| | Comprehensive applications as for instance linear and rotating drives, positioning-, wheel, hoist and synchronous drives, winders, pumps, fans, ... |
| **Components** | |
| | Inverter<br>Motors (brake, feedback)<br>Geared motors<br>Power supply modules |
| **Check of components and drive system** | |
| | Monitoring functions of the inverters<br>Maximum limits of the components<br>Product data in the applications<br>Consideration and check of the entire drive system<br>Limit loads (electrical/mechanical)<br>M-n characteristic fields and system checks<br>Possible combinations of the drive components<br>Losses and energy efficiency |
| **Optimisation and evaluation** | |
| | Energy consumption of the components and of the application<br>Energy exchange in multi-axis applications<br>Representation of working points, e.g. as characteristic |
| **Presentation of the result** | |
| | Evaluation of the dimensioning<br>Representation of energy consumption<br>Logging of dimensioning<br>Creating CAD data |
| **Basic functions** | |
| | Metric and imperial unit systems<br>Intuitive interfaces with simple dialogs<br>Comprehensive online help with physical basics and overviews<br>Fast and easy drive dimensioning and product configuration<br>Editor for the motion sequence<br>Creating alternative solutions with comparison operations |





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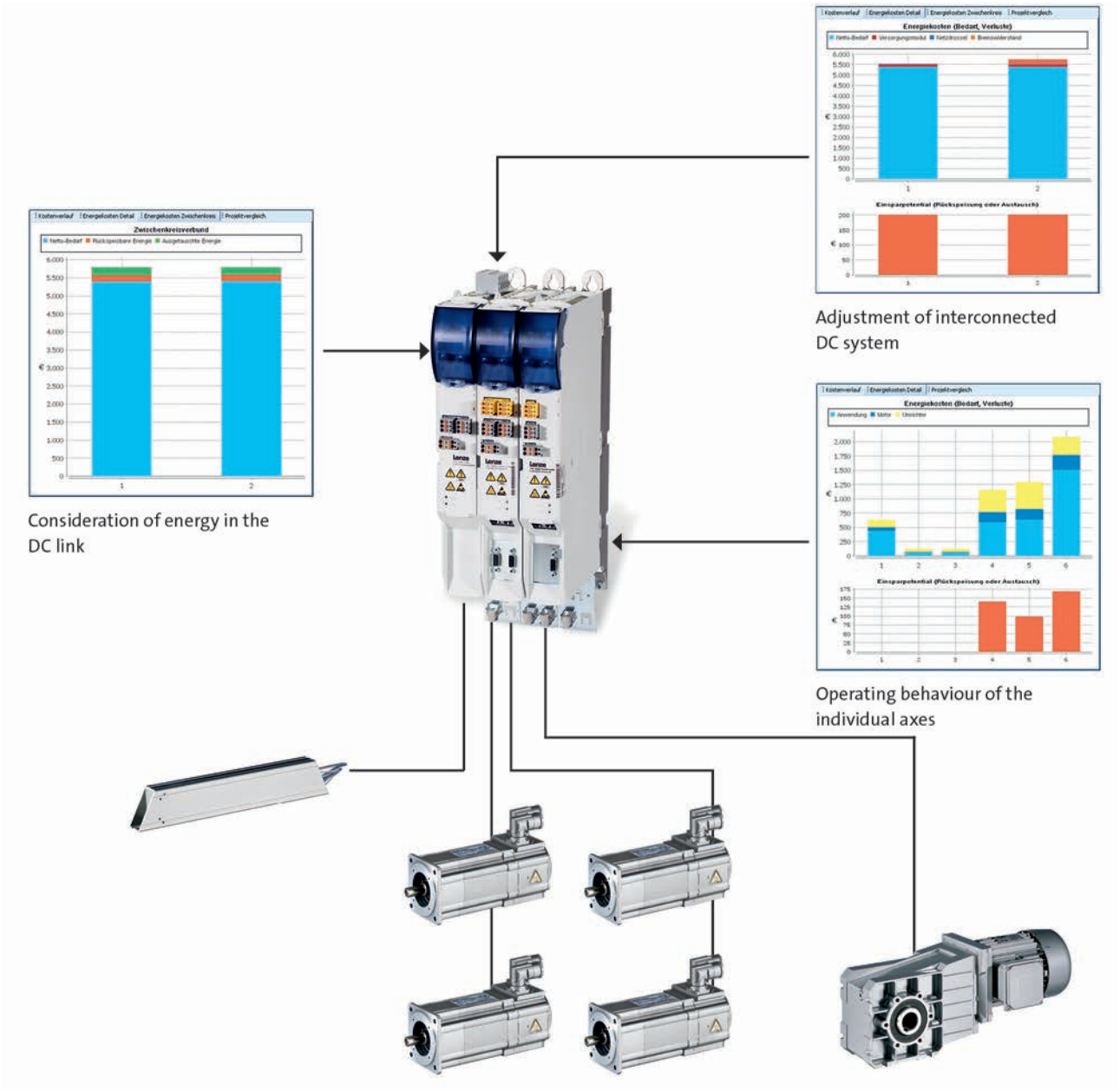
## Dimensioning of a multi-axis system





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## Standards and operating conditions

| Mode | | | |
|---|---|---|---|
| Product | | | Servo-Inverter i700 |
| **Conformity** | | | |
| CE | | | Low-Voltage Directive |
| | | | 2006/95/EC |
| EAC | | | TP TC 004/2011 (TR CU 004/2011)<br>TP TC 020/2011 (TR CU 020/2011) |
| **Approval** | | | |
| UL 508C | | | Power Conversion Equipment (file no. E132659) |
| CSA | | | CSA 22.2 No. 14 |
| **Certification** | | | |
| | | | RoHs |
| **Enclosure** | | | |
| EN 60529 | | | IP20 |
| NEMA 250 | | | Type 1 |
| **Climatic conditions** | | | |
| Storage (EN 60721-3-1) | | | 1K3 (temperature: -25 °C ... +60 °C) |
| Storage (EN 60721-3-1) > 6 months | | | 1K3 (temperature: -25 °C ... +40 °C) |
| Transport (EN 60721-3-2) | | | 2K3 (temperature: -25 °C ... +70 °C) |
| Operation (EN 60721-3-3) | | | 3K3 (temperature: -10°C ... +55°C) |
| Current derating at over 40°C | | | 2.5 % / K |
| **Site altitude** | | | |
| Amsl | $H_{max}$ | [m] | 4000 |
| Current derating at over 1000 m | | [%/1000 m] | 5 |
| **Vibration resistance** | | | |
| Transport (EN 60721-3-2) | | | 2M2 |
| Operation (EN 61800-5-1) | | | 10 Hz ≤ f ≤ 57 Hz: ±0.075 mm amplitude,<br>57 Hz ≤ f ≤ 150 Hz: 1.0 g |
| Operation (Germanischer Lloyd) | | | 5 Hz ≤ f ≤ 13.2 Hz: ± 1 mm amplitude<br>13.2 Hz ≤ f ≤ 100 Hz: 0.7 g |

| Mode | |
|---|---|
| Product | Servo-Inverter i700 |
| **Supply form** | |
| | Systems with earthed star point (TN and TT systems)<br>Systems with high-resistance or isolated star point (IT systems) |
| **Mains switching** | |
| | Cyclic mains switching of 5 times in 5 minutes is permissible without restrictions. |
| **Noise emission** | |
| EN 61800-3 | Cable-guided disturbance:<br>According to category C1 with special measures<br>According to category C2 with standard accessories<br>According to category C3 without additional measures |
| **Insulation resistance** | |
| EN 61800-5-1 | Overvoltage category III<br>Above 2000 m amsl overvoltage category II |
| **Degree of pollution** | |
| EN 61800-5-1 | 2 |
| **Shock current** | |
| EN 61800-5-1 | > 3.5 mA AC, > 10 mA DC |
| **Protective insulation of control circuits** | |
| EN 61800-5-1 | Safe mains isolation: double/reinforced insulation |





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## Rated data for single axes

| | | | | | |
|---|---|---|---|---|---|
| **Max. short-time output current** | | | | | |
| | $I_{max, out}$ | [A] | 5.0 | 10.0 | 20.0 |
| **Product key** | | | | | |
| | | | E70ACMS□0054SA1ET□ | E70ACMS□0104SA1ET□ | E70ACMS□0204SA1ET□ |
| **DC supply** | | | | | |
| | $U_{DC}$ | [V] | DC 260 V -0 % ... 775 V +0 % | | |
| **Typical motor power** | | | | | |
| 4-pole asynchronous motor | P | [kW] | 0.75 | 1.50 | 4.00 |
| **Rated output current** | | | | | |
| | $I_{N, out}$ | [A] | 2.5 | 5.0 | 10.0 |
| **Rated switching frequency** | | | | | |
| | $f_{ch}$ | [kHz] | 4 | | |
| **Output current** | | | | | |
| 4 kHz | $I_{out}$ | [A] | 2.5 | 5.0 | 10.0 |
| 8 kHz | $I_{out}$ | [A] | 2.5 | 5.0 | 10.0 |
| 16 kHz | $I_{out}$ | [A] | 1.5 | 3.0 | 6.0 |
| **Power loss** | | | | | |
| | $P_V$ | [kW] | 0.050 | 0.080 | 0.13 |

4.5

### Dimensions and weights

#### Standard installation design

| **Dimensions** | | | |
|---|---|---|---|
| Height | h | [mm] | 350 |
| Height, including fastening | h | [mm] | 410 |
| Width | b | [mm] | 50 |
| Depth | t | [mm] | 261 |
| **Mass** | | | |
| | m | [kg] | 2.7 |



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## Rated data for single axes

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **Max. short-time output current** | | | | | |
| | $I_{max, out}$ | [A] | 32.0 | 48.0 | 64.0 |
| **Product key** | | | | | |
| | | | E70ACMS□0324SA1ET□ | E70ACMS□0484SA1ET□ | E70ACMS□0644SA1ET□ |
| **DC supply** | | | | | |
| | $U_{DC}$ | [V] | DC 260 V -0 % ... 775 V +0 % | | |
| **Typical motor power** | | | | | |
| 4-pole asynchronous motor | P | [kW] | 7.50 | 11.0 | 15.0 |
| **Rated output current** | | | | | |
| | $I_{N, out}$ | [A] | 16.0 | 24.0 | 32.0 |
| **Rated switching frequency** | | | | | |
| | $f_{ch}$ | [kHz] | 4 | | |
| **Output current** | | | | | |
| 4 kHz | $I_{out}$ | [A] | 16.0 | 24.0 | 32.0 |
| 8 kHz | $I_{out}$ | [A] | 12.8 | 19.2 | 25.6 |
| 16 kHz | $I_{out}$ | [A] | 9.6 | 14.4 | 19.2 |
| **Power loss** | | | | | |
| | $P_V$ | [kW] | 0.21 | 0.29 | 0.39 |



### Dimensions and weights

#### Standard installation design

| | | | |
|---|---|---|---|
| **Dimensions** | | | |
| Height | h | [mm] | 350 |
| Height, including fastening | h | [mm] | 410 |
| Width | b | [mm] | 100 |
| Depth | t | [mm] | 261 |
| **Mass** | | | |
| | m | [kg] | 5.2 |



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## Rated data for double axes

| | | | | |
|---|---|---|---|---|
| | | | | |
| **Max. short-time output current** | | | | |
| | $I_{max, out}$ | [A] | 5.0 | 10.0 |
| **Product key** | | | | |
| | | | E70ACMS□0054SA2ET□ | E70ACMS□0104SA2ET□ |
| **DC supply** | | | | |
| | $U_{DC}$ | [V] | DC 260 V -0 % ... 775 V +0 % | |
| **Typical motor power** | | | | |
| 4-pole asynchronous motor | P | [kW] | 0.75 | 1.50 |
| **Rated output current** | | | | |
| | $I_{N, out}$ | [A] | 2.5 | 5.0 |
| **Rated switching frequency** | | | | |
| | $f_{ch}$ | [kHz] | 4 | |
| **Output current** | | | | |
| 4 kHz | $I_{out}$ | [A] | 2.5 | 5.0 |
| 8 kHz | $I_{out}$ | [A] | 2.5 | 5.0 |
| 16 kHz | $I_{out}$ | [A] | 1.5 | 3.0 |
| **Power loss** | | | | |
| | $P_V$ | [kW] | 0.090 | 0.14 |

4.5

### Dimensions and weights

#### Standard installation design

| | | | |
|---|---|---|---|
| **Dimensions** | | | |
| Height | h | [mm] | 350 |
| Height, including fastening | h | [mm] | 410 |
| Width | b | [mm] | 50 |
| Depth | t | [mm] | 261 |
| **Mass** | | | |
| | m | [kg] | 2.9 |



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## Rated data for double axes

| | | | | |
|---|---|---|---|---|
| | | | | |
| **Max. short-time output current** | | | | |
| | $I_{max, out}$ | [A] | 20.0 | 32.0 |
| **Product key** | | | | |
| | | | E70ACMS□0204SA2ET□ | E70ACMS□0324SA2ET□ |
| **DC supply** | | | | |
| | $U_{DC}$ | [V] | DC 260 V -0 % ... 775 V +0 % | |
| **Typical motor power** | | | | |
| 4-pole asynchronous motor | P | [kW] | 4.00 | 7.50 |
| **Rated output current** | | | | |
| | $I_{N, out}$ | [A] | 10.0 | 16.0 |
| **Rated switching frequency** | | | | |
| | $f_{ch}$ | [kHz] | 4 | |
| **Output current** | | | | |
| 4 kHz | $I_{out}$ | [A] | 10.0 | 16.0 |
| 8 kHz | $I_{out}$ | [A] | 10.0 | 12.8 |
| 16 kHz | $I_{out}$ | [A] | 6.0 | 9.6 |
| **Power loss** | | | | |
| | $P_V$ | [kW] | 0.26 | 0.37 |



### Dimensions and weights

#### Standard installation design

| | | | | |
|---|---|---|---|---|
| **Dimensions** | | | | |
| Height | h | [mm] | 350 | 350 |
| Width | b | [mm] | 100 | 100 |
| Depth | t | [mm] | 261 | 261 |
| **Mass** | | | | |
| | m | [kg] | 5.2 | 5.2 |



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## Rated data for power supply modules

► The data is valid for operation at 3/PE AC 400 V.

| | | | | |
|---|---|---|---|---|
| **Product key** | | | | |
| Power supply module | | | E70ACPS□0304S | E70ACPS□0604S |
| **Rated power** | | | | |
| With mains filter/mains choke | $P_N$ | [kW] | 15.4 | 30.9 |
| Without mains filter/mains choke | $P_N$ | [kW] | 10.3 | 20.6 |
| **Max. short-term output power** | | | | |
| | $P_{max, 2}$ | [kW] | 20.6 | 41.2 |
| **Mains voltage range** | | | | |
| | $U_{AC}$ | [V] | 3/PE AC 320 V -0% ... 528 V +0%, 45 Hz -0% ... 65 Hz +0% | |
| **Rated mains current** | | | | |
| | $I_{N, AC}$ | [A] | 24.5 | 49.0 |
| **Rated DC-bus current** | | | | |
| | $I_{N, DC}$ | [A] | 30.0 | 60.0 |
| **Max. DC-bus current** | | | | |
| | $I_{max}$ | [A] | 45.0 | 90.0 |
| **Power loss** | | | | |
| | $P_V$ | [kW] | 0.060 | 0.11 |

4.5

### Brake chopper rated data

| | | | | |
|---|---|---|---|---|
| **Rated power, Brake chopper** | | | | |
| | $P_N$ | [kW] | 4.1 | 10.1 |
| **Max. output power, Brake chopper** | | | | |
| | $P_{max, 1}$ | [kW] | 26.8 | 65.5 |
| **Running time** | | | | |
| | $t_{on}$ | [s] | 15.0 | |
| **Recovery time** | | | | |
| | $t_{re}$ | [s] | 82.0 | |
| **Min. brake resistance** | | | | |
| | $R_{min}$ | [Ω] | 22.0 | 9.0 |

### Dimensions and weights

#### Standard installation design

| | | | | |
|---|---|---|---|---|
| **Dimensions** | | | | |
| Height | h | [mm] | 350 | |
| Height, including fastening | h | [mm] | 410 | |
| Width | b | [mm] | 50 | 100 |
| Depth | t | [mm] | 261 | |
| **Mass** | | | | |
| | m | [kg] | 2.8 | 5.8 |


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## "Cold plate" design

Inverters in cold-plate design dissipate some of their waste heat (heat loss) via a cooler adapted to the application. For this purpose, the inverters are provided with a planed cooling plate which is connected to a separate cooler in a thermally conductive way. Using the cold plate technology, the main part of the heat energy can be transferred directly to the external cooling units.

**The use of cold-plate technology is advantageous for the following application cases:**

- Minimising the expense of cooling the control cabinet. Here, the main part of the power loss is directly transferred to a cooling unit outside of the control cabinet, e.g. convection cooler or water cooler.
- Heavily polluted ambient air or control cabinets with a high degree of protection which do not allow for a use of a forced air cooling of the control cabinets.
- Low mounting depth in the control cabinet.

**Requirements for the cooler**

When cold-plate technology is used, the following basic conditions must be considered:

- Good thermal connection to the external cooling unit, i.e. the implementation of the heat transfer resistance (Rth) according to the power loss.
- The contact surface must at least be as big as the cooling plate of the inverter.
- The planarity of the contact surface must not exceed 0.05 mm.
- The contact surface of the external coolers and cooling plate must be connected by means of the intended screwed connection.
- The maximum temperature of the cooling plate of the inverter ((75 °C) must not be exceeded.

**Single axes**

| Product key | Power to be dissipated | Thermal resistance |
|---|---|---|
| Inverter | | |
| | $P_V$ | $R_{th}$ |
| | [W] | [K/W] |
| E70ACMS□0054SA1ET□ | 25.0 | ≤ 1.6 |
| E70ACMS□0104SA1ET□ | 50.0 | ≤ 0.8 |
| E70ACMS□0204SA1ET□ | 95.0 | ≤ 0.45 |
| E70ACMS□0324SA1ET□ | 140 | ≤ 0.25 |
| E70ACMS□0484SA1ET□ | 215 | ≤ 0.2 |
| E70ACMS□0644SA1ET□ | 290 | ≤ 0.15 |

**Double axes**

| Product key | Power to be dissipated | Thermal resistance |
|---|---|---|
| Inverter | | |
| | $P_V$ | $R_{th}$ |
| | [W] | [K/W] |
| E70ACMS□0054SA2ET□ | 50.0 | ≤ 0.8 |
| E70ACMS□0104SA2ET□ | 95.0 | ≤ 0.45 |
| E70ACMS□0204SA2ET□ | 185 | ≤ 0.2 |
| E70ACMS□0324SA2ET□ | 275 | ≤ 0.15 |

**Power supply modules**

| Product key | Power to be dissipated | Thermal resistance |
|---|---|---|
| Power supply module | | |
| | $P_V$ | $R_{th}$ |
| | [W] | [K/W] |
| E70ACPS□0304S | 45.0 | ≤ 0.95 |
| E70ACPS□0604S | 85.0 | ≤ 0.45 |



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## "Cold plate" design

### Dimensions and weights

#### Single axes

| Product key | | | E70ACMS□0054SA1ET□ | E70ACMS□0104SA1ET□ | E70ACMS□0204SA1ET□ |
|---|---|---|---|---|---|
| **Dimensions** | | | | | |
| Height, including fastening | h | [mm] | 410 | | |
| Width | b | [mm] | 50 | | |
| Depth | t | [mm] | 221 | | |
| **Mass** | | | | | |
| | m | [kg] | 2.3 | | |

| Product key | | | E70ACMS□0324SA1ET□ | E70ACMS□0484SA1ET□ | E70ACMS□0644SA1ET□ |
|---|---|---|---|---|---|
| **Dimensions** | | | | | |
| Height, including fastening | h | [mm] | 410 | | |
| Width | b | [mm] | 100 | | |
| Depth | t | [mm] | 221 | | |
| **Mass** | | | | | |
| | m | [kg] | 5.3 | | |



#### Double axes

| Product key | | | E70ACMS□0054SA2ET□ | E70ACMS□0104SA2ET□ | E70ACMS□0204SA2ET□ | E70ACMS□0324SA2ET□ |
|---|---|---|---|---|---|---|
| **Dimensions** | | | | | | |
| Height, including fastening | h | [mm] | 410 | | | |
| Width | b | [mm] | 50 | | 100 | |
| Depth | t | [mm] | 221 | | | |
| **Mass** | | | | | | |
| | m | [kg] | 2.5 | | 5.3 | |

#### Power supply modules

| Product key | | | E70ACPS□0304S | E70ACPS□0604S |
|---|---|---|---|---|
| **Dimensions** | | | | |
| Height, including fastening | h | [mm] | 410 | |
| Width | b | [mm] | 50 | 100 |
| Depth | t | [mm] | 221 | |
| **Mass** | | | | |
| | m | [kg] | 2.6 | 5.6 |



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## Push-through technique design

The inverters in push-through design reduce the waste heat in the control cabinet.
The inverter is mounted in the control cabinet so that the heatsink on the inverter is outside the control cabinet. Thus, the entire waste heat can be dissipated outside the control cabinet via convection or forced air cooling for almost all device performances.

**Using the push-through technology is advantageous in the following application cases:**

- Minimising the expense for control cabinet cooling. For this purpose, the main part of the power loss is directly transferred to the ambience outside the control cabinet,e.g. convection cooling.
- In case of control cabinets with a high degree of protection > IP54 by using separate mounting and cooling areas.
- Low mounting depth in the control cabinet.



**Single axes**

| Product key | Power to be dissipated |
|---|---|
| Inverter | |
| | $P_V$ |
| | [W] |
| E70ACMS□0054SA1ET□ | 25.0 |
| E70ACMS□0104SA1ET□ | 50.0 |
| E70ACMS□0204SA1ET□ | 95.0 |
| E70ACMS□0324SA1ET□ | 140 |
| E70ACMS□0484SA1ET□ | 215 |
| E70ACMS□0644SA1ET□ | 290 |

**Double axes**

| Product key | Power to be dissipated |
|---|---|
| Inverter | |
| | $P_V$ |
| | [W] |
| E70ACMS□0054SA2ET□ | 50.0 |
| E70ACMS□0104SA2ET□ | 95.0 |
| E70ACMS□0204SA2ET□ | 185 |
| E70ACMS□0324SA2ET□ | 275 |

**Power supply modules**

| Product key | Power to be dissipated |
|---|---|
| Power supply module | |
| | $P_V$ |
| | [W] |
| E70ACPS□0304S | 45.0 |
| E70ACPS□0604S | 85.0 |



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## Push-through technique design

### Dimensions and weights

#### Single axes

| Product key | | | E70ACMS□0054SA1ET□ | E70ACMS□0104SA1ET□ | E70ACMS□0204SA1ET□ |
|---|---|---|---|---|---|
| **Dimensions** | | | | | |
| Height, including fastening | h | [mm] | 410 | | |
| Width | b | [mm] | 50 | | |
| Depth (in control cabinet) | t | [mm] | 221 | | |
| **Mass** | | | | | |
| | m | [kg] | 3.0 | | |

| Product key | | | E70ACMS□0324SA1ET□ | E70ACMS□0484SA1ET□ | E70ACMS□0644SA1ET□ |
|---|---|---|---|---|---|
| **Dimensions** | | | | | |
| Height, including fastening | h | [mm] | 410 | | |
| Width | b | [mm] | 100 | | |
| Depth (in control cabinet) | t | [mm] | 221 | | |
| **Mass** | | | | | |
| | m | [kg] | 7.1 | | |



#### Double axes

| Product key | | | E70ACMS□0054SA2ET□ | E70ACMS□0104SA2ET□ | E70ACMS□0204SA2ET□ | E70ACMS□0324SA2ET□ |
|---|---|---|---|---|---|---|
| **Dimensions** | | | | | | |
| Height, including fastening | h | [mm] | 410 | | | |
| Width | b | [mm] | 50 | | 100 | |
| Depth | t | [mm] | 261 | | | |
| **Mass** | | | | | | |
| | m | [kg] | 3.2 | | 7.1 | |

#### Power supply modules

| Product key | | | E70ACPS□0304S | E70ACPS□0604S |
|---|---|---|---|---|
| **Dimensions** | | | | |
| Height, including fastening | h | [mm] | 410 | |
| Width | b | [mm] | 50 | 100 |
| Depth (in control cabinet) | t | [mm] | 221 | |
| **Mass** | | | | |
| | m | [kg] | 2.8 | 5.8 |



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## Mains connection

Interference voltage categories according to the European standard EN 61800-3 are divided into category C1, C2 and the category C3.

Category C1
- Describes the use in public networks.

Category C2
- Describes the use of devices intended for industrial purposes in areas also comprising residential areas.

Category C3
- Describes the use of devices intended for industrial purposes only.

26 - The interference voltage categories achievable due to the filter measures are shown in conjunction with the motor cables.

With an upstream mains choke or mains filter, the maximum continuous power of the power supply modules can be used since the effective current will be reduced.
If no filter or an RFI filter is used, the permissible continuous power (rated power) of the power supply module is reduced.
The mains choke and the RFI filter can also be combined without any restrictions.

35 - Mains chokes, RFI filters, Mains filters

### Mains fuses and cable cross-sections

- ► The mains fuse and cable cross-section specifications are for a mains connection of 3AC 400 V or 3AC 480 V.
- ► Class gG/gl fuses or class gRL semiconductor fuses.
- ► The cable cross-sections apply to PVC-insulated copper cables.
- ► Use for installation with UL-approved cables, fuses and brackets.



| Rated power | Mains voltage | Product key | Circuit breaker | Fuse | | Mains connection |
|---|---|---|---|---|---|---|
| | | Power supply module | | EN 60204-1 | UL [1] | Cross-section (with mains choke) |
| $P_N$ | $U_{AC}$ | | I | I | I | q |
| [kW] | [V] | | [A] | [A] | [A] | [mm2] |
| 15.4 | 3 AC 320 ... 528 | E70ACPS□0304S | C40 | 40 | | 10.0 |
| 30.9 | | E70ACPS□0604S | C63 | 63 | | 16.0 |

[1] In preparation.



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## Motor connection

- ► Electric strength of the motor cable: 1 kV as per VDE 250-1.
- ► Keep motor cables as short as possible, as this has a positive effect on the drive behaviour.
- ► Maximum motor cable length 50 m per axis.
- ► With group drives (multiple motors on one inverter), the resulting cable length is the key factor. This can be calculated using the hardware manual.

**Motor cable lengths and interference voltage categories**

When using the i700 system, use external filters to comply with the EMC Directives.

Category C1
- With special measures; please contact your Lenze sales office.

Category C2
- With RFI filters, 6 axes with 50 m motor cable each
- With mains filters, 10 axes with 50 m motor cable each

Category C3
- Without external measures, 4 axes with 50 m motor cable each
- With mains choke, 10 axes with 50 m motor cable each

4.5

35 - Mains chokes, RFI filters, Mains filters



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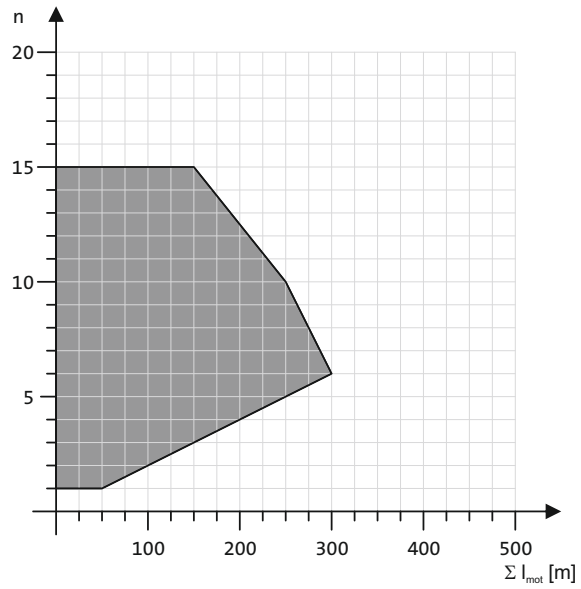
## Motor connection

The following diagrams show the possible number of axes and the possible sum of motor cable lengths to ensure compliance with interference suppression according to category .

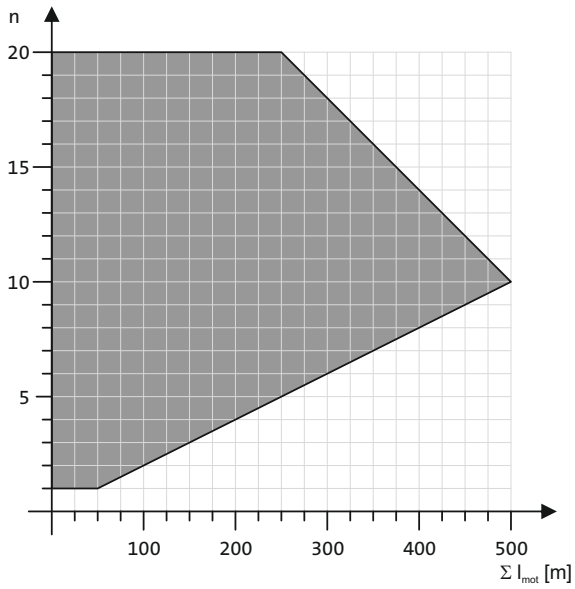
► Number of axes (n) / sum of the motor cable length (l)

**Category C2**

**With RFI filters**

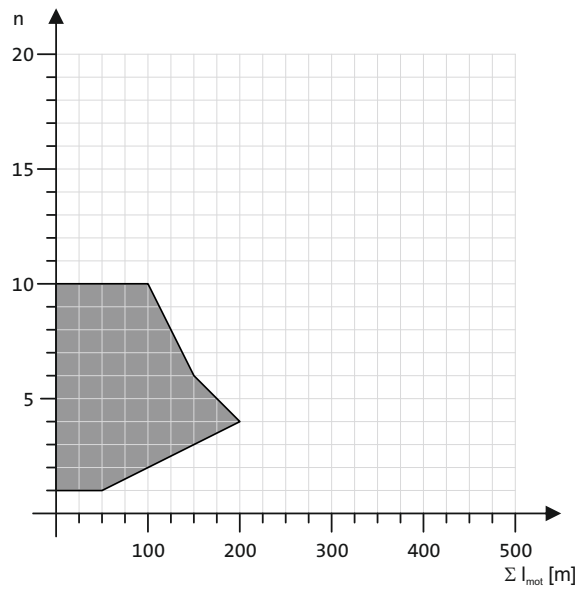



**With mains filters**

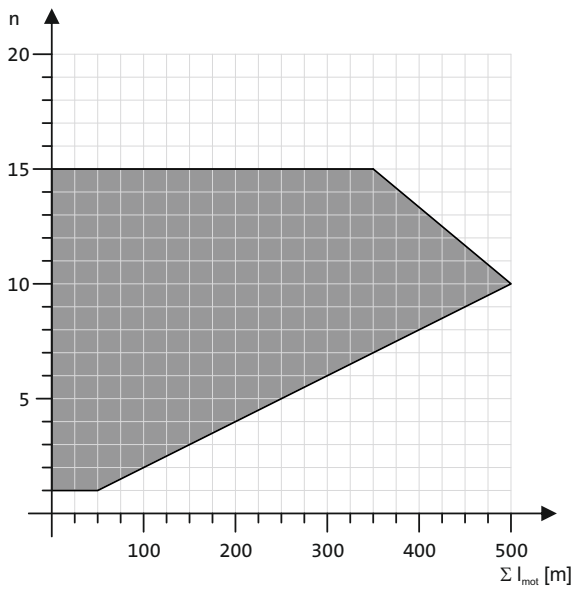



**Category C3**

**Without external measures**




**With mains chokes**





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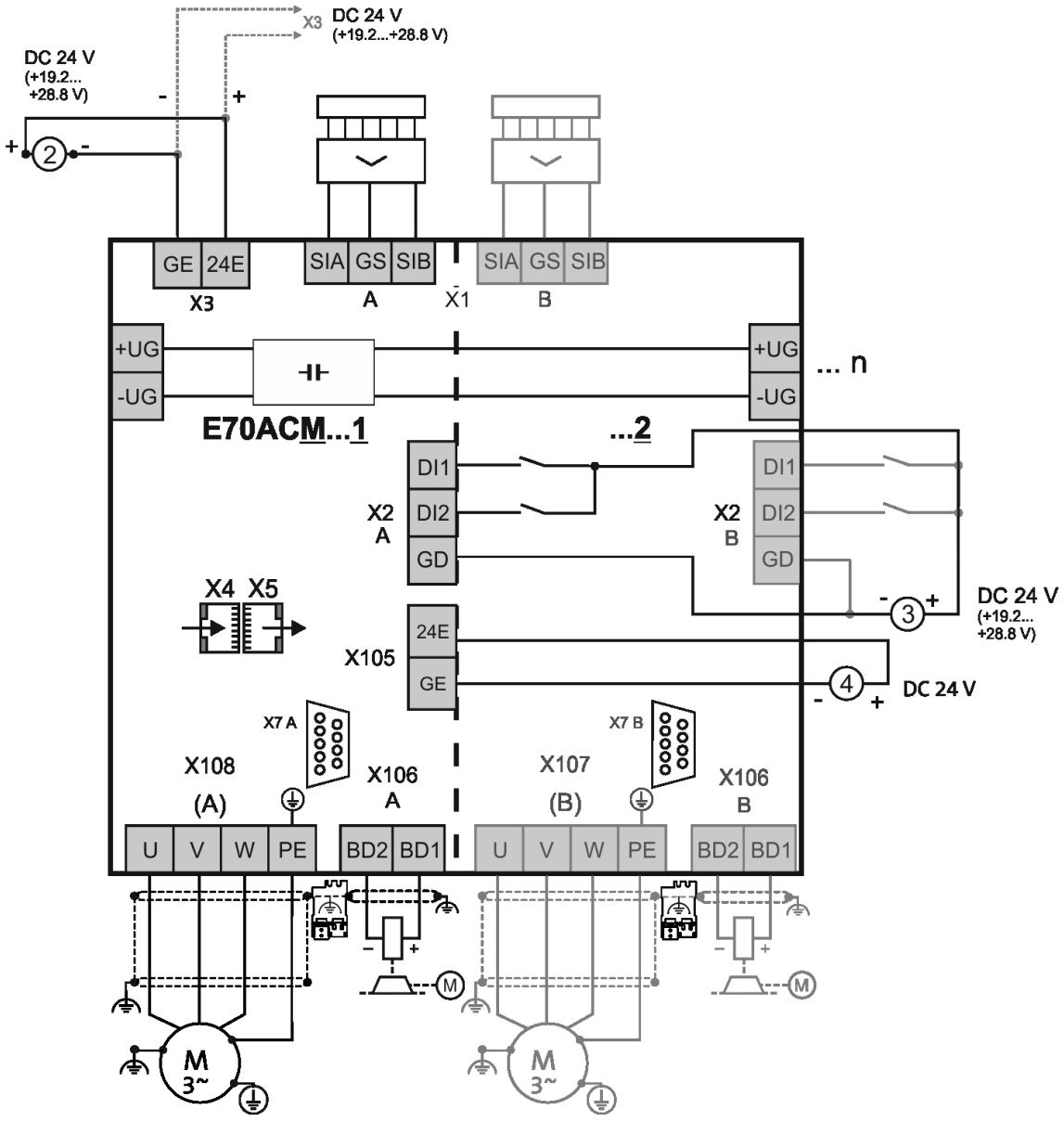
## Connection diagrams

**Servo-Inverter i700 wiring example, axis modules**




[2] 24 supply for control electronics
[3] 24 V supply for digital inputs
[4] 24 V supply for motor holding brake(s)



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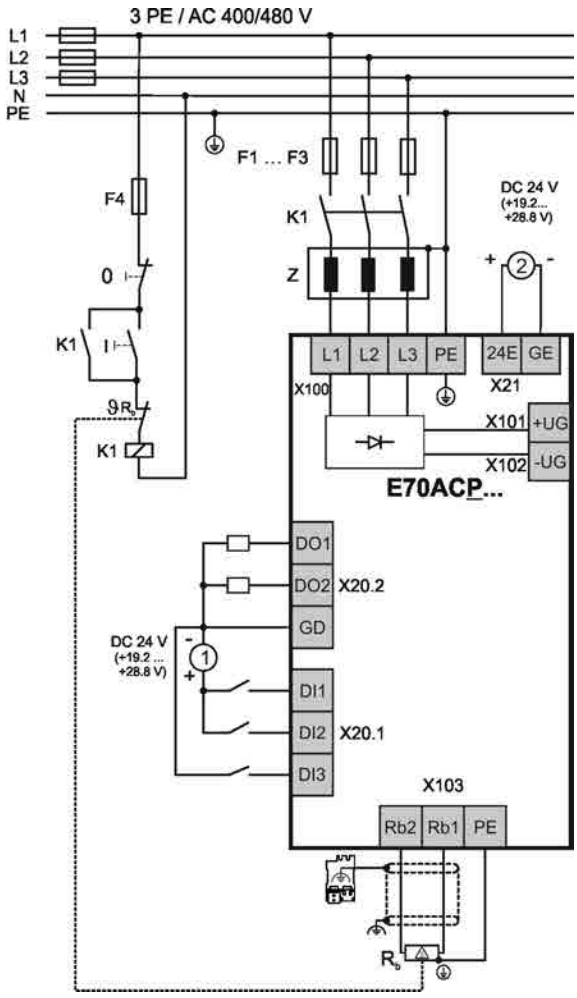
## Connection diagrams

**Servo-Inverter i700 wiring example, power supply modules**




[1] 24 V supply for digital inputs
[2] 24 V supply for control electronics





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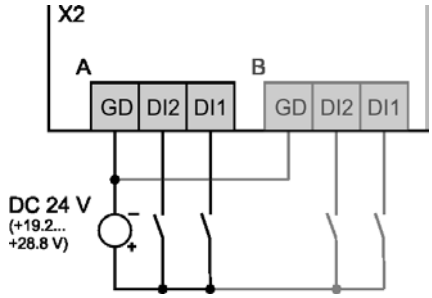
## Control connections

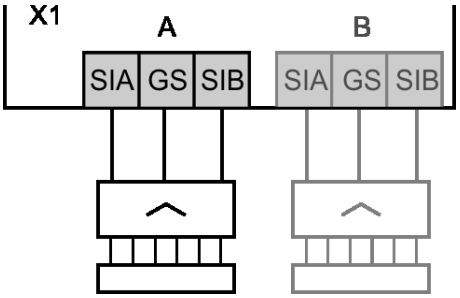
| Mode | |
|---|---|
| | Servo-Inverter i700 |
| **Digital inputs** | |
| Number | 2 |
| Touch-probe-capable | 2 with time and position stamp |
| Switching level | PLC (IEC 61131-2) |
| Max. input current | 8 mA |
| **External DC supply** | |
| Rated voltage | 24 V in accordance with IEC 61131-2 |
| Voltage range | 19.2 ... 28.8 V, max. residual ripple ± 5% |
| **Interfaces** | |
| EtherCAT | 2 (in/out) |
| Safety engineering | Safe torque off (STO)<br>2 channel design |
| **Drive interface** | |
| Resolver input | Sub-D, 9-pin |
| Encoder input | Sub-D, 15-pin<br>SinCos absolute value encoder single-turn (with zero pulse) or multi-turn (Hiperface®) |
| Motor brake | 24V holding brake per axis can be directly controlled |

4.5

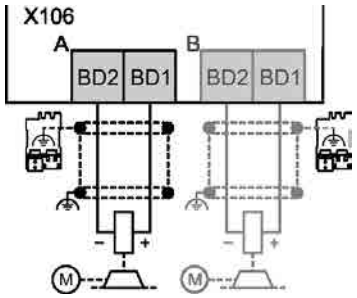
**Connection of digital inputs**




**Safety engineering connection**




**Motor brake connection**



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## Control connections

### External 24 V supply

The control electronics of the Servo-Inverter i700 has to be supplied with an external 24-V supply. For this purpose, Lenze provides power supply units. The following table shows the corresponding current consumptions of the devices.

38 - 24 V power supply unit

#### Single axes

| Max. short-time output current | Product key | External DC supply |
|---|---|---|
| | | Current |
| $I_{max, out}$ | | |
| [A] | | |
| 5.0 | E70ACMS□0054SA1ET□ | 1.0 A |
| 10.0 | E70ACMS□0104SA1ET□ | |
| 20.0 | E70ACMS□0204SA1ET□ | |
| 32.0 | E70ACMS□0324SA1ET□ | 2.0 A |
| 48.0 | E70ACMS□0484SA1ET□ | |
| 64.0 | E70ACMS□0644SA1ET□ | |



#### Double axes

| Max. short-time output current | Product key | External DC supply |
|---|---|---|
| | | Current |
| $I_{max, out}$ | | |
| [A] | | |
| 5.0 | E70ACMS□0054SA2ET□ | 1.0 A |
| 10.0 | E70ACMS□0104SA2ET□ | |
| 20.0 | E70ACMS□0204SA2ET□ | 2.0 A |
| 32.0 | E70ACMS□0324SA2ET□ | |



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## Safety system (STO)

By default, the Servo-Inverter i700 are available with the "safe torque off, STO" safety function. This helps reduce the control system costs, save space in the control cabinet and keep wiring to a minimum. The safety engineering is certified according to EN ISO 13849-1 (Cat. 4, PL e), EN 61508/EN 62061 (SIL 3). A "safe stop 1, SS1" can be implemented easily using a safety switching device.

The product key of the inverter has an "**A**".
as the 14th character. For example, a servo inverter 5A, built-in unit with safety engineering would be: E70ACMSE0054S**A**ETR

**Double axis with connections for safety engineering**





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## EtherCAT® communication

EtherCAT enables the Servo-Inverter i700 to be controlled with digital control signals via the EtherCAT® bus system. It is integrated in the Servo-Inverter i700. It can be seen in the product key at the positions 16 and 17: E70ACM□□□□4SA□**ET**□.

The advantages of the system are:
- quick and very powerful bus system
- ideally suited for Controller-based Automation solutions
- easy system integration since a wide range of sensors and actuator is available on the market.
- the basic features of a servo drive are available in the axes according to the device profile and can be easily used via the EtherCAT®.

| Mode | Features |
|---|---|
| Communication | |
| EtherCAT [1)] | • CANopen over EtherCAT (CoE)<br>• Distributed clock<br>• 2 RJ45 connections with LEDs for link and activity |

1) EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

**Technical data**

| | | | |
|---|---|---|---|
| **Product key** | | | |
| | | | E70ACM□□□□4SAxET□ |
| **Communication** | | | |
| Medium | | | CAT5e S/FTP according to ISO/ICE11801 (2002) |
| Communication profile | | | CoE (CANopen over EtherCAT) |
| **Baud rate** | | | |
| | b | [MBit/s] | 100 |
| **Node** | | | |
| | | | Slave |
| **Network topology** | | | |
| | | | Line (internal ring) |
| **Number of logical process data channels** | | | |
| | | | 1 |
| **Process data words (PCD)** | | | |
| 16 Bit | | | 1 ... 32 |
| **Number of bus nodes** | | | |
| | | | Max. 65535 |
| **Max. cable length** | | | |
| between two nodes | $l_{max}$ | [m] | 100 |
| **Rated voltage** | | | |
| | $U_{N, DC}$ | [V] | 24.0 |





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## Brake resistors for power supply modules

The assignment of brake resistors to the power supply modules is shown in the following tables.

**Brake resistor 27 ohms**

| Product key | | Rated resistance | Rated power | Thermal capacity | Dimensions | Mass |
|---|---|---|---|---|---|---|
| Power supply module | Brake resistor | | | | | |
| | | $R_N$ | $P_N$ | $C_{th}$ | h x b x t | m |
| | | [Ω] | [kW] | [KWs] | [mm] | [kg] |
| E70ACPS□0304S | ERBP027R200W | 27.0 | 0.20 | 30.0 | 320 x 41 x 122 | 1.0 |
| | ERBS027R600W | | 0.60 | 90.0 | 550 x 110 x 105 | 3.1 |
| | ERBS027R01K2 | | 1.20 | 180 | 1020 x 110 x 105 | 5.6 |
| E70ACPS□0604S | ERBG012R01K9 | 12.0 | 1.90 | 285 | 486 x 236 x 302 | 13.0 |
| | ERBG012R05K2 | | 5.20 | 750 | 486 x 426 x 302 | 28.0 |



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## Mains chokes for power supply modules

A mains choke is an inductive resistor which is connected in the mains cable of the power supply module. The use of a mains choke provides the following advantages:

- **Fewer effects on the mains:**
  The wave form of the mains current is a close approximation to a sine wave.
- **Reduction in the effective mains current:**
  Reduction of mains, cable and fuse loads
- **Current balancing of power supply modules connected in parallel**

Mains chokes can be used without restrictions in conjunction with RFI filters.

**Mains choke**

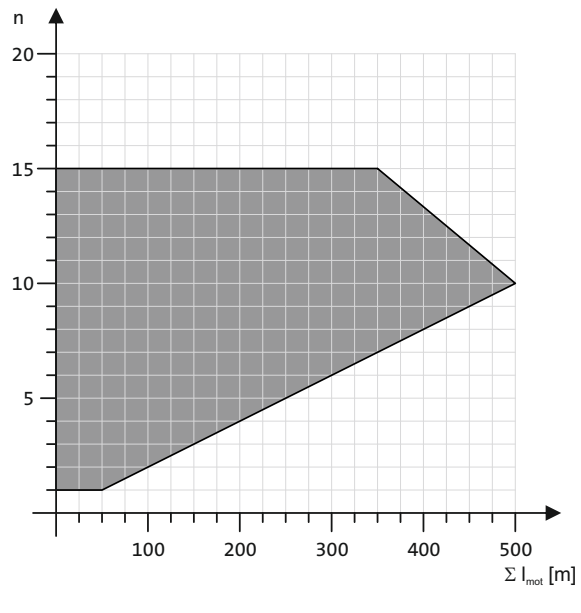
**Please note:**
The use of a mains choke slightly reduces the mains voltage at the input of the power supply module – the typical voltage drop across the mains choke at the rated values is around 5%.
The selection of the correct mains chokes for the power supply modules depends on the number of connected axes. For this purpose, different mains chokes are available. For the following efficiencies of the power supply modules, we have dimensioned model mains chokes:

- Power supply modules for 30 A operation with rated data
- Power supply modules for 60 A operation with rated data

| Product key | | Output power | Rated current | Dimensions | Mass |
|---|---|---|---|---|---|
| Power supply module | Mains choke | at 400 V | | | |
| | | $P_{out}$ | $I_N$ | h x b x t | m |
| | | [kW] | [A] | [mm] | [kg] |
| E70ACPS□0304S | EZAELN3025B122 | 15.4 | 25.0 | 110 x 155 x 167 | 5.8 |
| E70ACPS□0604S | EZAELN3050B591 | 30.9 | 50.0 | 112 x 185 x 208 | 8.4 |

The following diagram shows the possible number of axes and the possible sum of motor cable lengths to ensure compliance with interference suppression according to category C3.

**Number of axes (n) / sum of the motor cable length (l)**



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## Interference suppression of power supply modules

### RFI filters

RFI filters are primarily capacitive accessory components which can be connected directly upstream from the power supply modules. This measure enables compliance with the corresponding conducted noise emission requirements according to EN 61800-3.

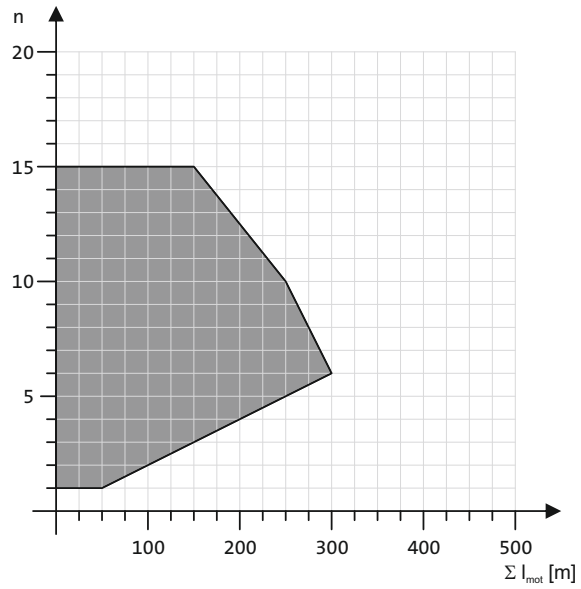
**RFI filter, can be mounted beside the power supply module**



| Product key | | Output power | Rated current | Power loss | Max. cable length | Dimensions | Mass |
|---|---|---|---|---|---|---|---|
| Power supply module | RFI filter | at 400 V | | | Reference group C2 | | |
| | | $P_{out}$ | $I_N$ | $P_V$ | $l_{max}$ | h x b x t | m |
| | | [kW] | [A] | [kW] | [m] | [mm] | [kg] |
| E70ACPS□0304S | E94AZRP0084 | 3.60 | 8.00 | 0.020 | 6 axes of 50 m each | 485 x 60 x 261 | 4.2 |
| | E94AZRP0294 | 10.3 | 29.0 | 0.050 | | | 4.5 |
| E70ACPS□0604S | E94AZRP0824 | 20.6 | 82.0 | 0.080 | | 490 x 209 x 272 | 18.5 |

The following diagram shows the possible number of axes and the possible sum of motor cable lengths to ensure compliance with interference suppression according to category C2.

**Number of axes (n) / sum of the motor cable length (l)**



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## Interference suppression of power supply modules

### Mains filters

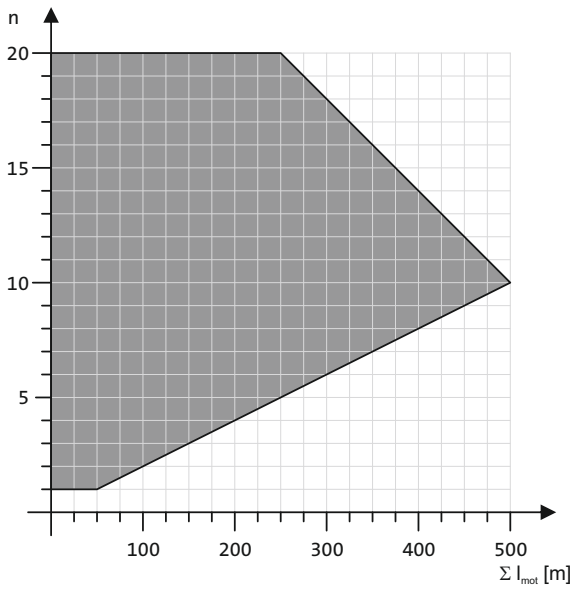
A mains filter is a combination of mains choke and RFI filter in one housing. It reduces the conducted interference emission into the mains in order that the conducted interference voltage is reduced to the area permissible according EN61800-3.
This results in the following advantages:

- Fewer effects on the mains:
  The wave form of the mains current is a close approximation to a sine wave.
- Reduction in the effective mains current:
  Reduction of mains, cable and fuse loads
- Current balancing when power supply modules are connected in parallel

| Product key | | Output power | Rated current | Voltage drop | Max. cable length | Dimensions | Mass |
|---|---|---|---|---|---|---|---|
| Power supply module | Mains filter | at 400 V | | | Reference group C2 | | |
| | | $P_{out}$ | $I_N$ | U | $I_{max}$ | h x b x t | m |
| | | [kW] | [A] | [V] | [m] | [mm] | [kg] |
| E70ACPS□0304S | E94AZMP0084 | 4.90 | 8.00 | 10.0 | 10 axes of 50 m each | 485 x 90 x 261 | 8.6 |
| | E94AZMP0294 | 15.4 | 29.0 | 7.3 | | 485 x 120 x 261 | 16.5 |
| E70ACPS□0604S | E94AZMP0824 | 30.6 | 82.0 | 6.4 | | 490 x 270 x 272 | 29.0 |

The following diagram shows the possible number of axes and the possible sum of motor cable lengths to ensure compliance with interference suppression according to category C2.

**Number of axes (n) / sum of the motor cable length (l)**



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## 24 V power supply unit

The control electronics of the axis and power supply modules must be supplied by external 24-V power supply units. For this purpose, various power supply units are available. The power supply units can be supplied with AC voltage and DC voltage from the DC bus of the drive system. This ensures a continuous supply of the electronics in case of mains failure to ensure a controlled braking process.

Electrical isolation
The i700 components have a "save separation" between mains and electronic potential according to IEC 61131–2. For maintaining this feature, the successive power supply units can be used with SELV (Safety Extra Low Voltage) or PELF (Protective Extra Low Voltage).

**24 V power supply unit**

| **Product key** | | | EZV1200-000 | EZV2400-000 | EZV4800-000 | EZV1200-001 | EZV2400-001 | EZV4800-001 |
|---|---|---|---|---|---|---|---|---|
| **Rated voltage** | | | | | | | | |
| AC | $U_{N, AC}$ | [V] | 230 | | | 400 | | |
| **Input voltage** | | | | | | | | |
| | $U_{in}$ | [V] | AC 85 ... 264<br>DC 90 ...350 | | | AC 320 ... 575<br>DC 450 ...800 | | |
| **Rated mains current** | | | | | | | | |
| | $I_{N, AC}$ | [A] | 0.8 | 1.2 | 2.3 | 0.3 | 0.6 | 1.0 |
| **Output voltage** | | | | | | | | |
| | $U_{out}$ | [V] | DC 22.5 ...28.5 | | | | | |
| **Rated output current** | | | | | | | | |
| | $I_{N, out}$ | [A] | 5.0 | 10.0 | 20.0 | 5.0 | 10.0 | 20.0 |
| **Dimensions** | | | | | | | | |
| Height | h | [mm] | 130 | | | | | |
| Width | b | [mm] | 55 | 85 | 157 | 73 | 85 | 160 |
| Depth | t | [mm] | 125 | | | | | |
| **Mass** | | | | | | | | |
| | m | [kg] | 0.8 | 1.2 | 2.5 | 1.0 | 1.1 | 1.9 |

4.5

## Installation sets for Servo-Inverter i700

The installation sets include:
- All plug-in terminals
- Shield sheets plus shield terminals
- EtherCAT® cable (100 mm) for connecting the next axis

| Mode | Features | Product key |
|---|---|---|
| Installation set for single axes | • For axes 5 to 20 A | E70AZEVK001 |
| | • For axes 32 to 64 A | E70AZEVK003 |
| Installation set for double axes | • For axes 5 to 10 A | E70AZEVK002 |
| | • For axes 20 to 32 A | E70AZEVK004 |
| Installation set for power supply modules | • For power supply module 30 A | E70AZEVK005 |
| | • For power supply module 60 A | E70AZEVK006 |
| | • For parallel connection | E70AZEVK007 |



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