

Automation systems

Drive solutions

Controls

Inverter

Motors

Gearboxes

Engineering Tools

Automation systems: Controller-based Automation

Controls: Panel PC v800, Monitor v200, Controller 3200 C, Controller c300, Controller p500, Controller p300, I/O System 1000

Inverter: Servo-Inverter i700

Lenze

As easy as that.

Contents of the L-force catalogue

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Lenze makes many things easy for you.

With our motivated and committed approach, we work together with you to create the best possible solution and set your ideas in motion - whether you are looking to optimise an existing machine or develop a new one. We always strive to make things easy and seek perfection therein. This is anchored in our thinking, in our services and in every detail of our products. It's as easy as that!

1

Developing ideas

Are you looking to build the best machine possible and already have some initial ideas? Then get these down on paper together with us, starting with small innovative details and stretching all the way to completely new machines. Working together, we will develop an intelligent and sustainable concept that is perfectly aligned with your specific requirements.

2

Drafting concepts

We see welcome challenges in your machine tasks, supporting you with our comprehensive expertise and providing valuable impetus for your innovations. We take a holistic view of the individual motion and control functions here and draw up consistent, end-to-end drive and automation solutions for you - keeping everything as easy as possible and as extensive as necessary.

3

Implementing solutions

Our easy formula for satisfied customers is to establish an active partnership with fast decision making processes and an individually tailored offer. We have been using this principle to meet the ever more specialised customer requirements in the field of machine engineering for many years.

4

Manufacturing machines

Functional diversity in perfect harmony: as one of the few full-range providers in the market, we can provide you with precisely those products that you actually need for any machine task – no more and no less. Our L-force product portfolio, a consistent platform for implementing drive and automation tasks, is invaluable in this regard.

5

Ensuring productivity

Productivity, reliability and new performance peaks on a daily basis – these are our key success factors for your machine. After delivery, we offer you cleverly devised service concepts to ensure continued safe operation. The primary focus here is on technical support, based on the excellent application expertise of our highly-skilled and knowledgeable after-sales team.

A matter of principle: the right products for every application.

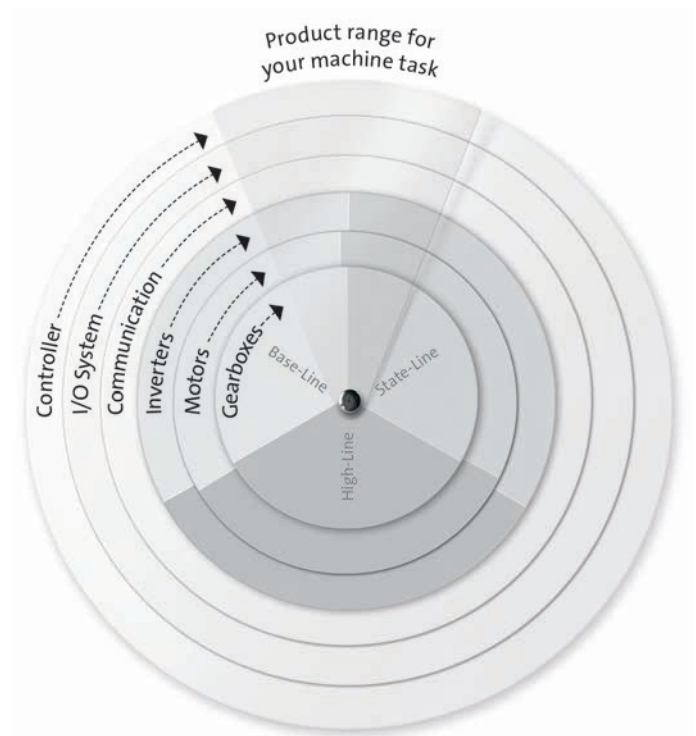
Lenze's extensive L-force product portfolio follows a very simple principle. The functions of our finely scaled products are assigned to the three lines Base-Line, State-Line or High-Line.

But what does this mean for you? It allows you to quickly recognise which products represent the best solution for your own specific requirements.

Powerful products with a major impact:

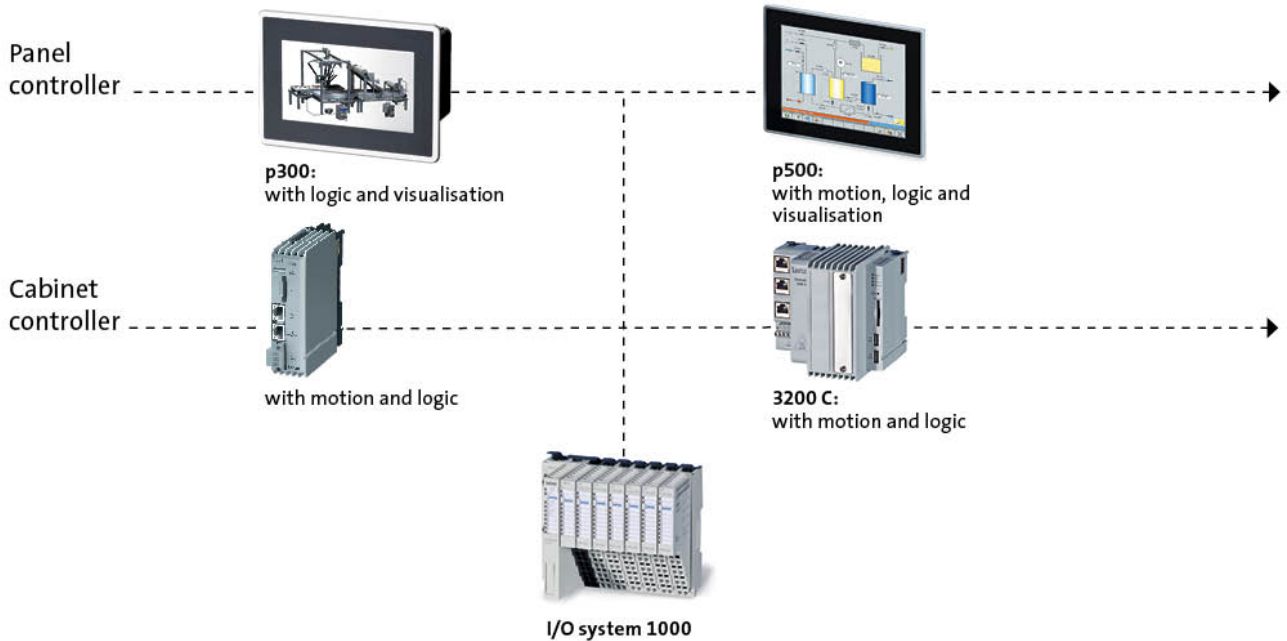
- Easy handling
- High quality and durability
- Reliable technologies in tune with the latest developments

Lenze products undergo the most stringent testing in our own laboratory. This allows us to ensure that you will receive consistently high quality and a long service life. In addition to this, five logistics centres ensure that the Lenze products you select are available for quick delivery anywhere across the globe. It's as easy as that!

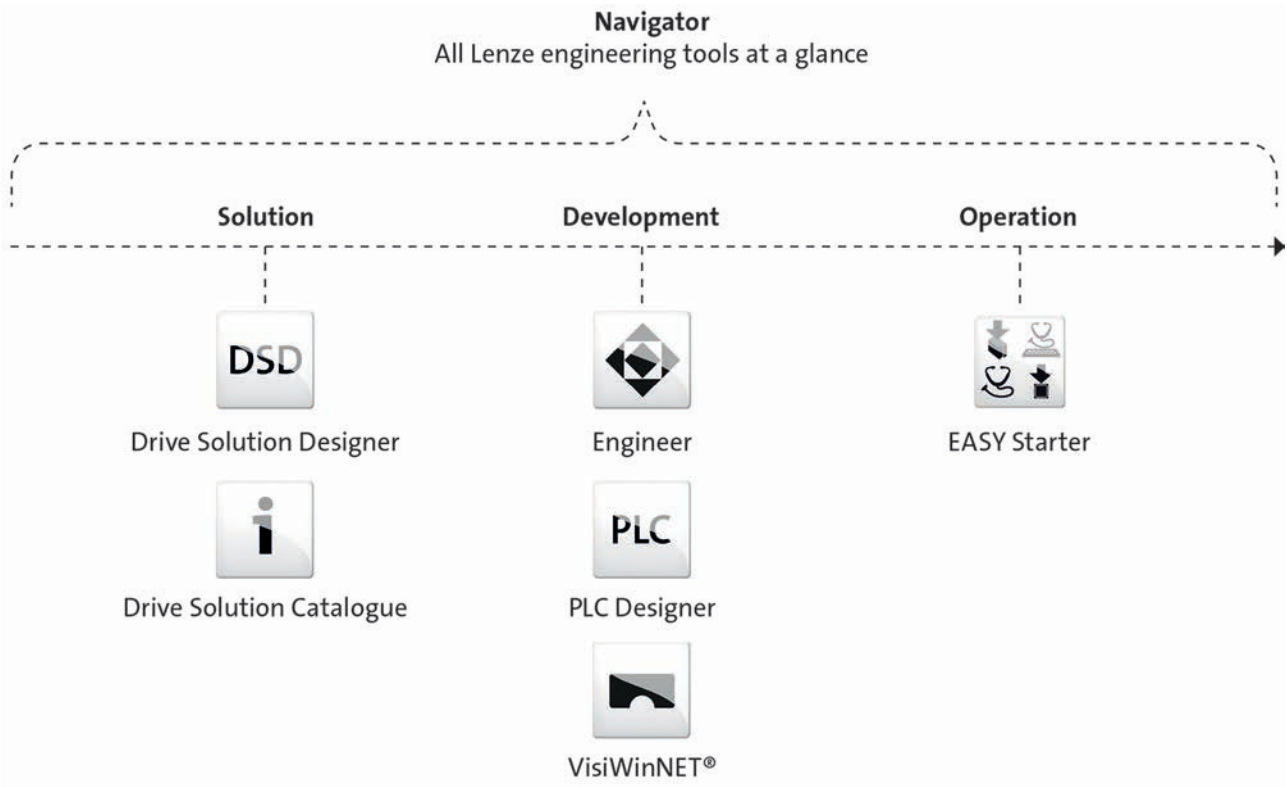


L-force product portfolio

Controls

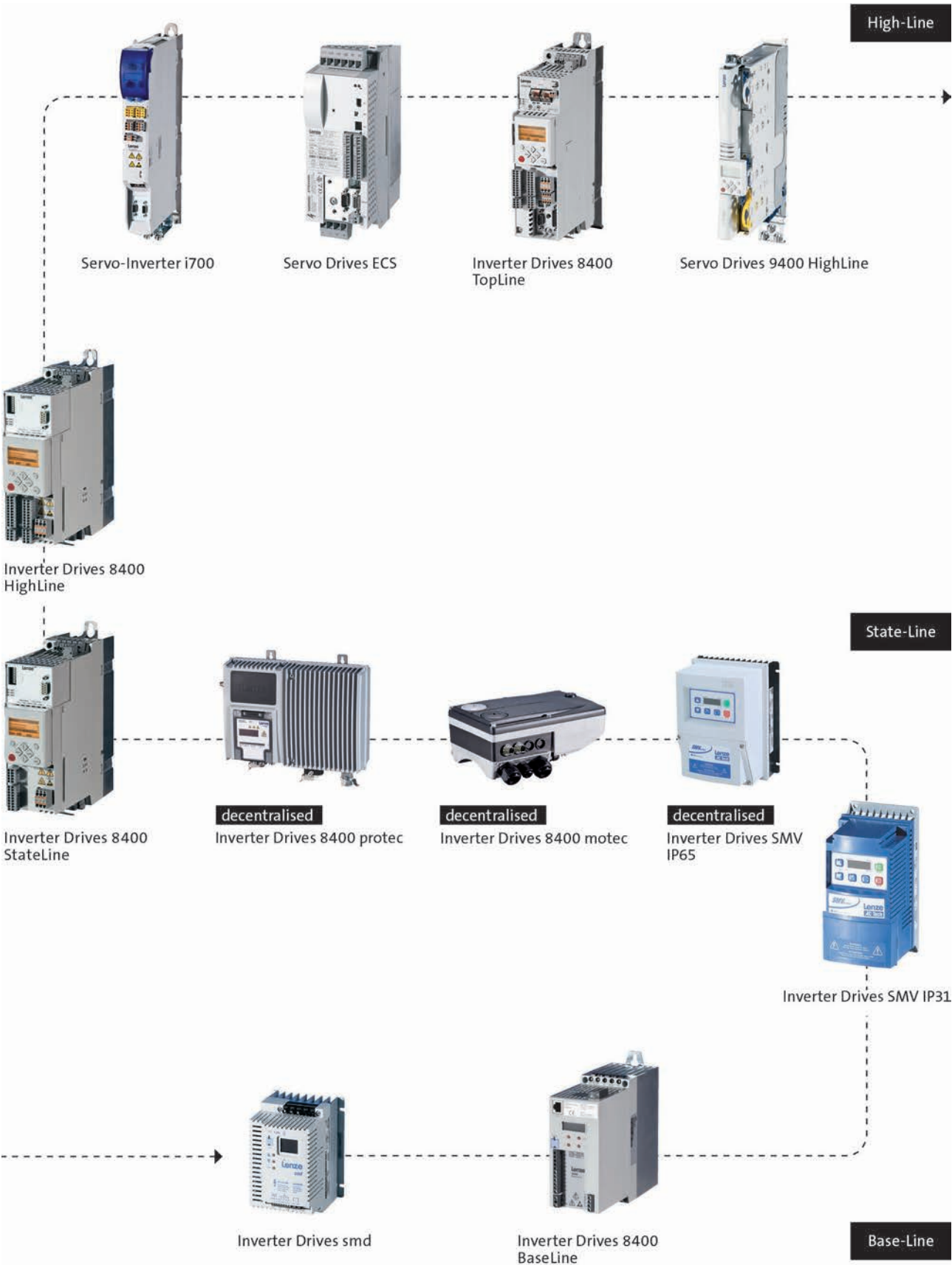


Engineering Tools



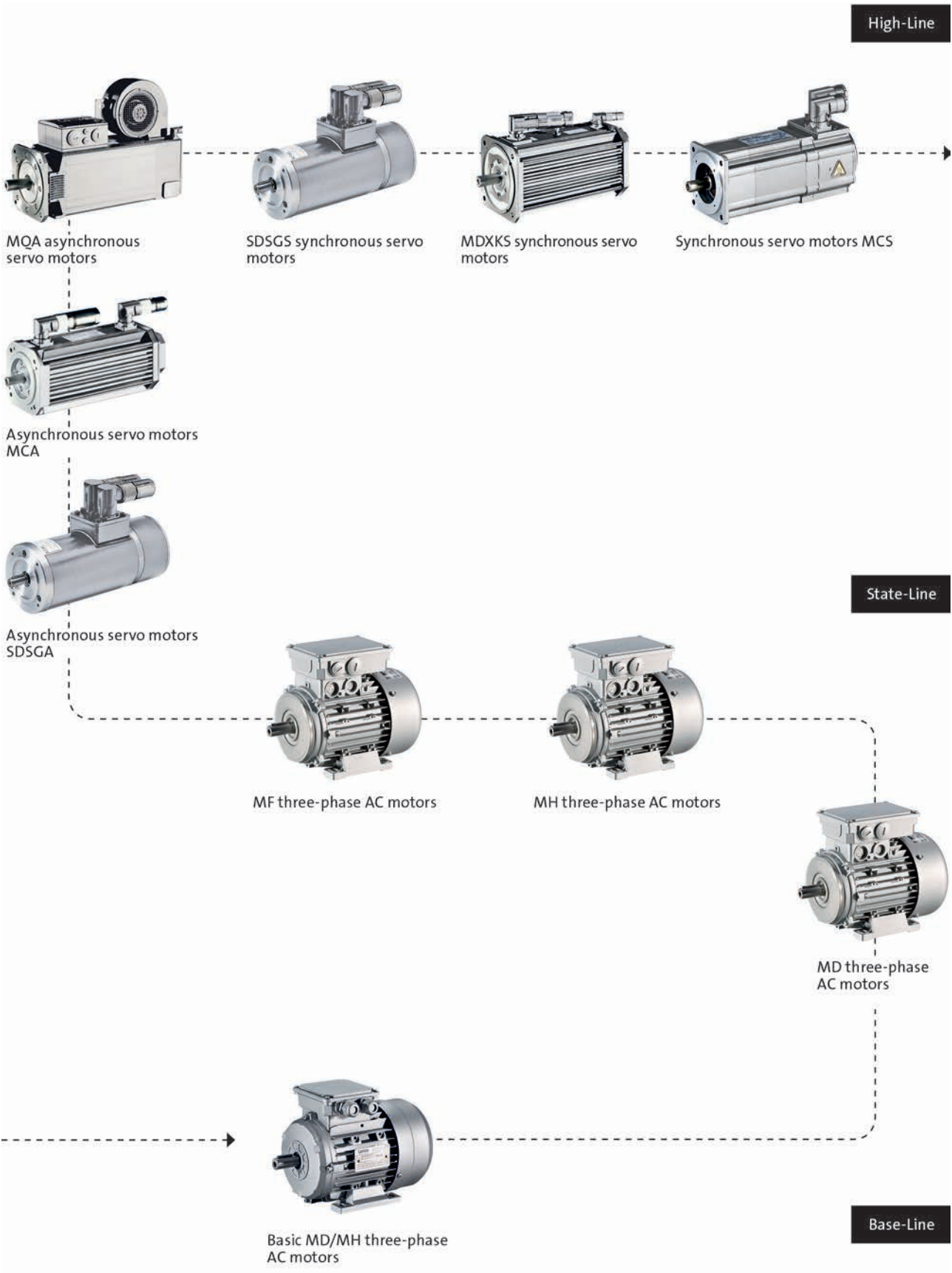
L-force product portfolio

Inverter



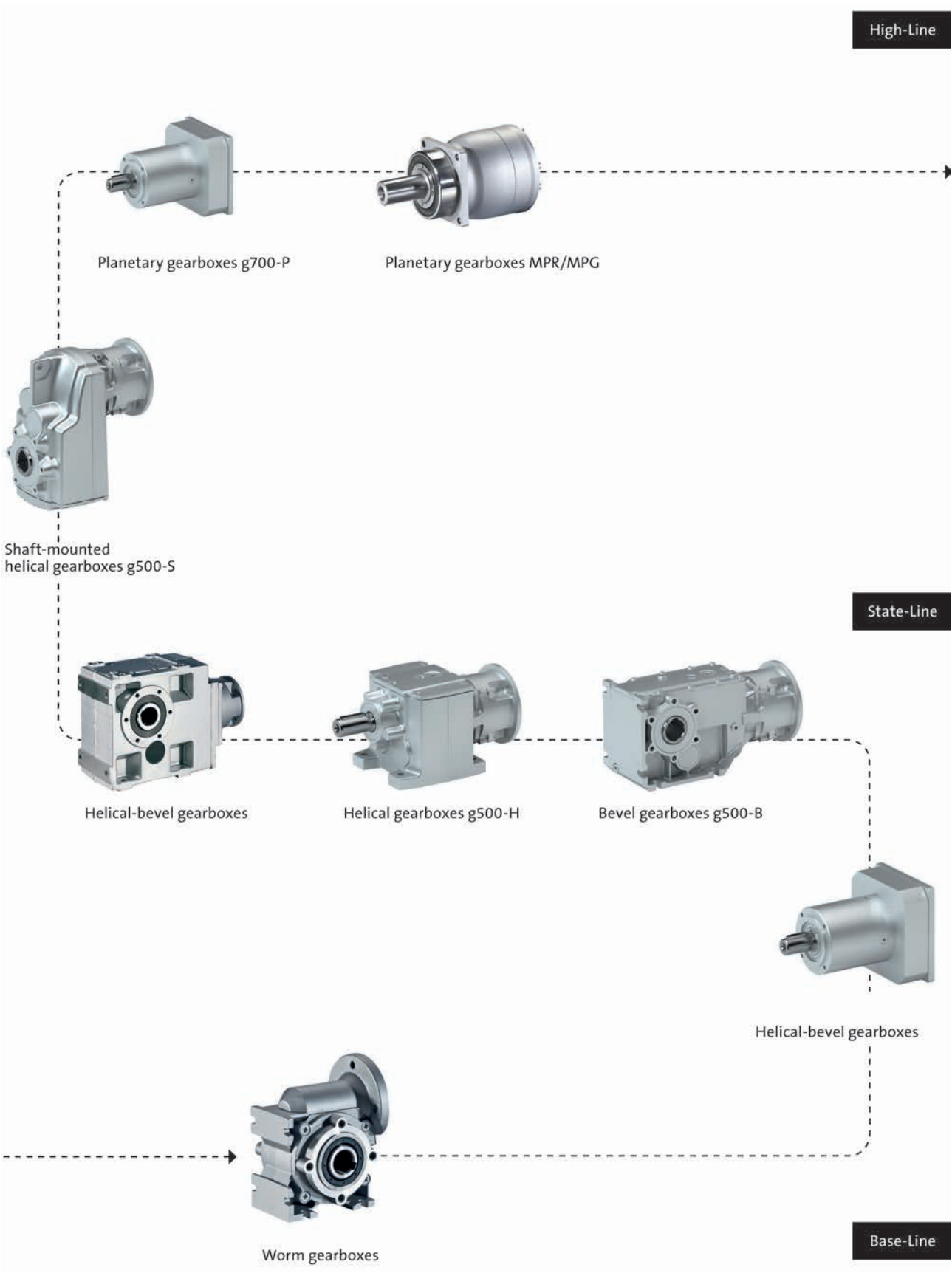
L-force product portfolio

Motors

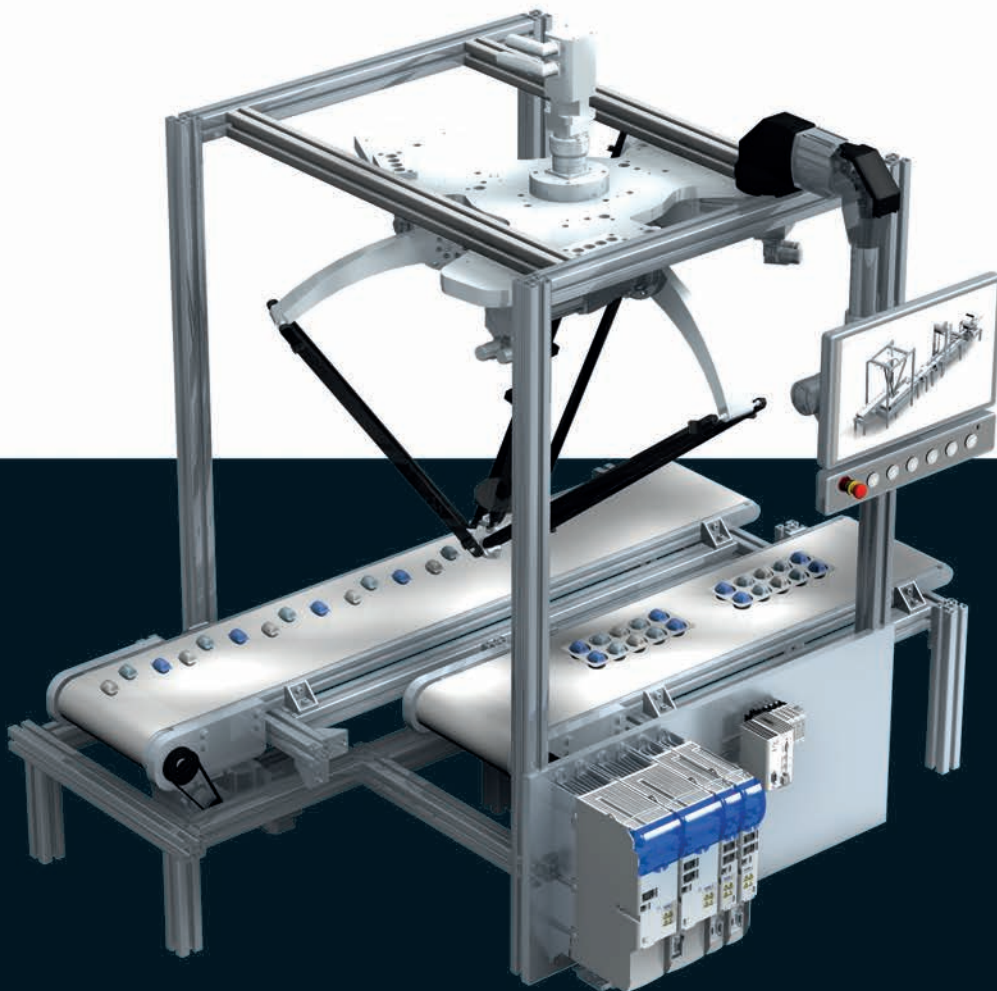


L-force product portfolio

Gearboxes



Controller-based Automation



Controller-based Automation

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Controller-based Automation

General information



1.1

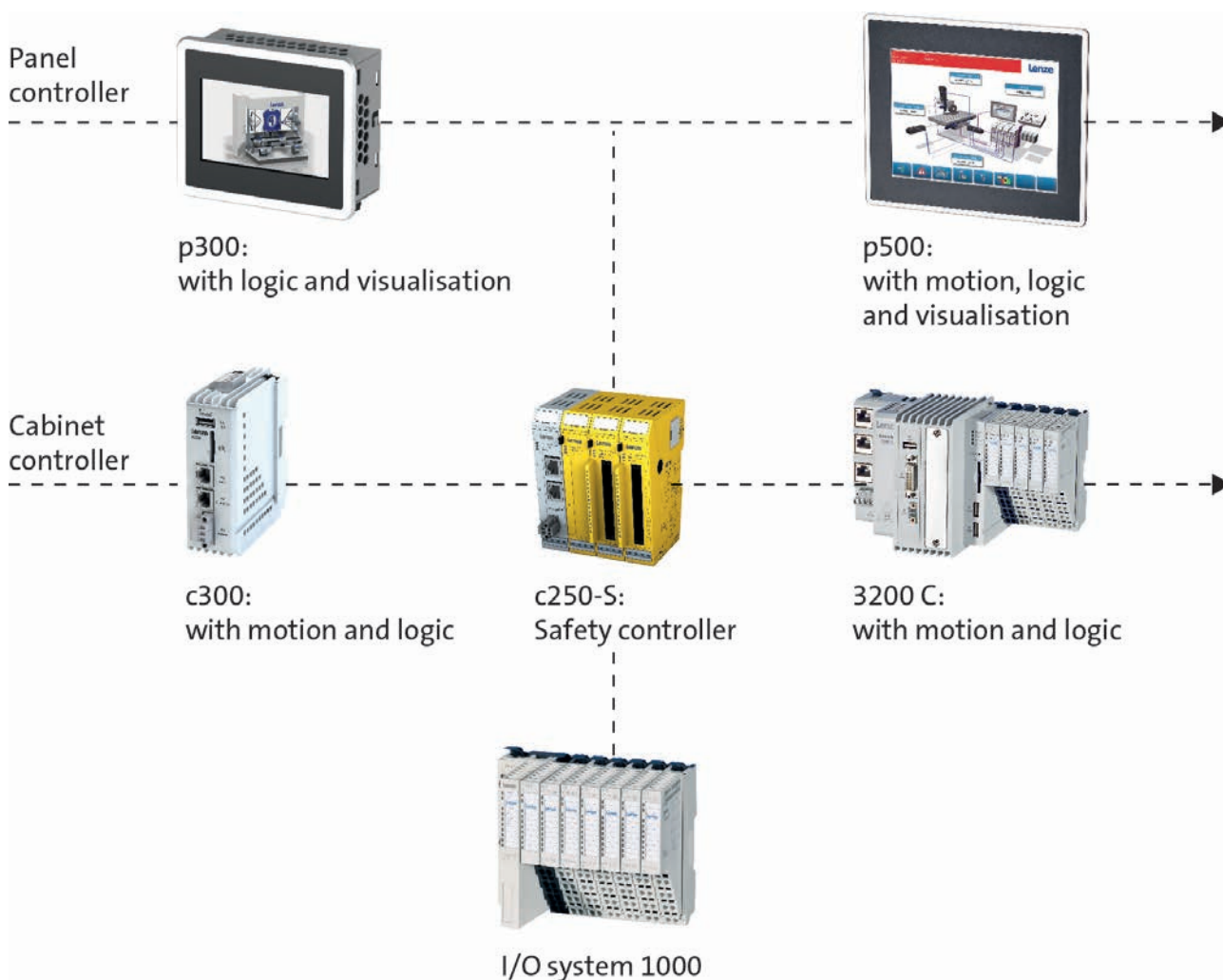
Automation with central motion control

Complex machines such as robots, packaging machines and handling systems require a powerful, uniform and end-to-end automation system with a central control system. This allows coordinated movement of many axes and is also capable of performing control functions for a linear process. For project engineers, the central architecture offers the additional advantage that only one control program has to be developed and managed. We call this Controller-based Automation for central motion control.

To address the increasing complexity of your automation tasks efficiently and cost-effectively, alongside a uniform, end-to-end automation system you also expect your automation supplier to provide you with advanced engineering tools and, if necessary, qualified support. Lenze offers you experienced experts in sales and support that can help you, whatever issues you are experiencing. No matter whether you are seeking support for project planning, dimensioning, selecting the right components or programming a mechatronic solution, we are here to help.

In Europe alone, customers have access to a network of over 100 highly-qualified application engineers with extensive expert knowledge and sector expertise. All-around service, training sessions and a helpline that can be accessed from anywhere in the world round off our portfolio of services.

Components in Lenze's Controller-based Automation system include the controllers, a wide range of inverters with matching standard three-phase AC motors, as well as synchronous servo motors and asynchronous servo motor, each of which can be combined with various types of gearboxes all the way up to decentralised I/O systems.

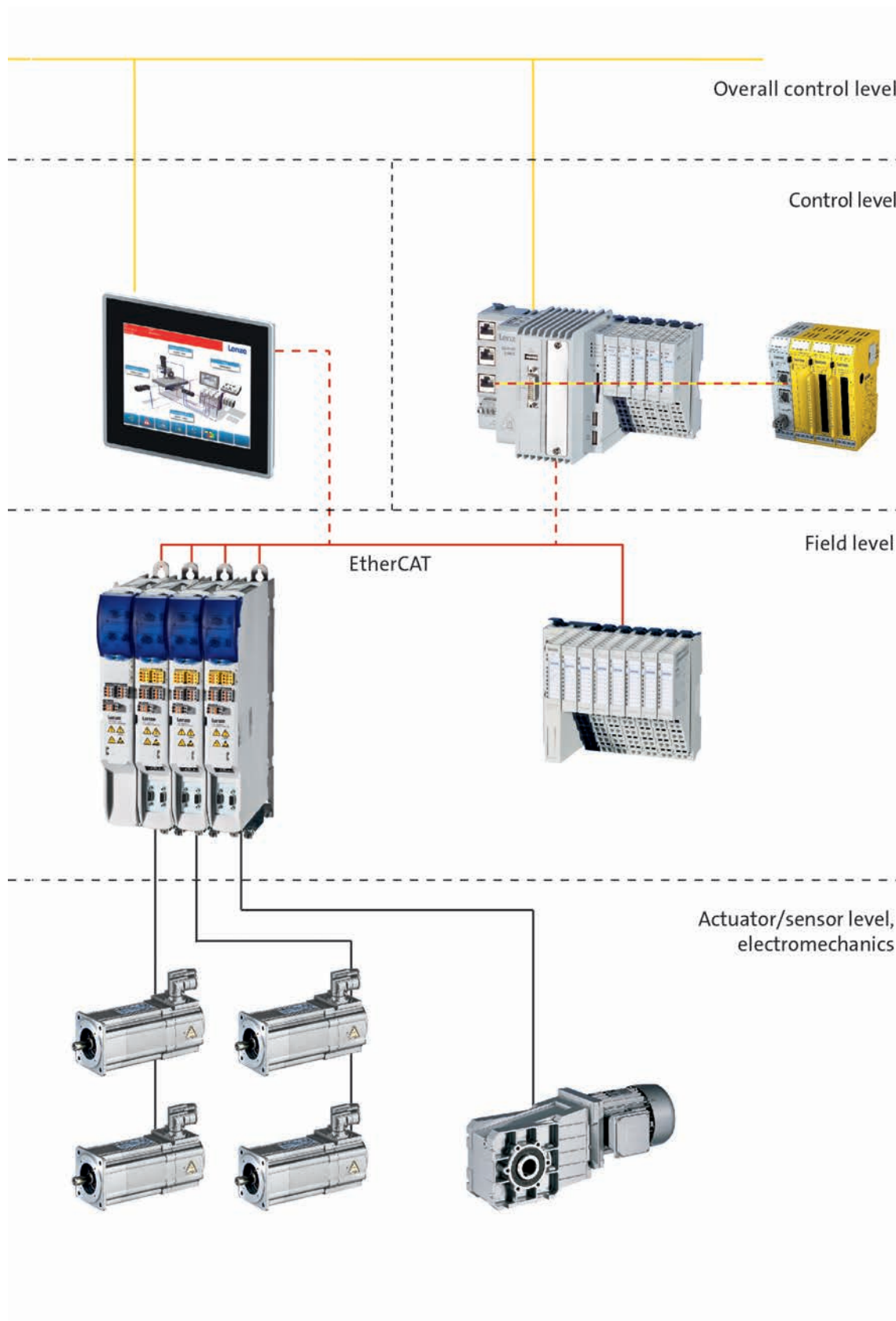


Controller-based Automation

General information



Automation with central motion control



1.1

Controller-based Automation

Topologies



General information

1.1

For Controller-based Automation, Lenze offers flexible solutions for system topologies. For self-sustaining solutions, simply rely on the bus systems used by Lenze such as the well-established CANopen or the fast, flexible EtherCAT.

In addition, Lenze offers easy integration into systems with higher-level controls or into existing systems.

The use of the Lenze Engineering tools can be provided for by any type of system bus. Each controller provides an additional Ethernet connection, enabling access of the Engineering tools to the controllers right down to the drives. Programming, commissioning, or diagnostics can therefore be carried out easily also in remote maintenance scenarios.

Controller	c300	p300	3200C	p500
Runtime				
FAST Runtime	●	●	●	●
FAST Motion	●		●	●
Visualisation		●	● 1)	●
Communication				
EtherCAT Master	Integrated	Integrated	Integrated	Integrated
CANopen	Integrated	Integrated	Option	Option
PROFIBUS Master			Option	
PROFIBUS Slave			Option	Option
PROFINET Device	Option	Option	Option	Option
Safety Controller				
c250-S	About EtherCAT Controller based Safety	About EtherCAT Controller based Safety	About EtherCAT Controller based Safety	About EtherCAT Controller based Safety

¹⁾ With monitor panel via DVI interface.

Controller-based Automation

Topologies

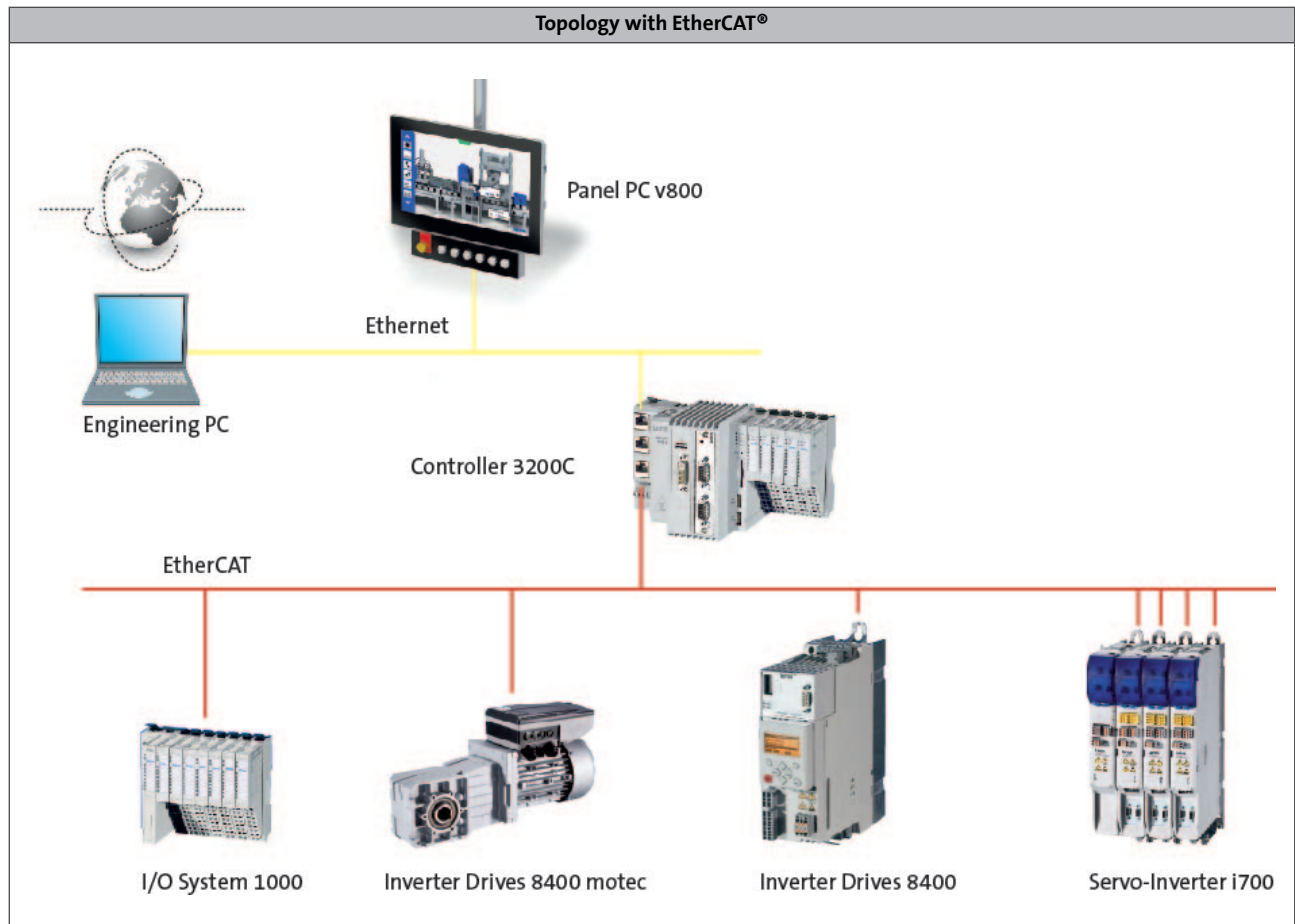


Standard topology with EtherCAT®

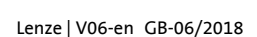
The Ethernet-based bus system EtherCAT® is the standard topology for Controller-based Automation applications and offers a large range of potential applications.



1.1



Hence in practice, a FAST module can, for instance, control the reduction in traversing speed while at the same time the safety controller within the system can monitor the safe maximum speed.



Controller-based Automation

Topologies

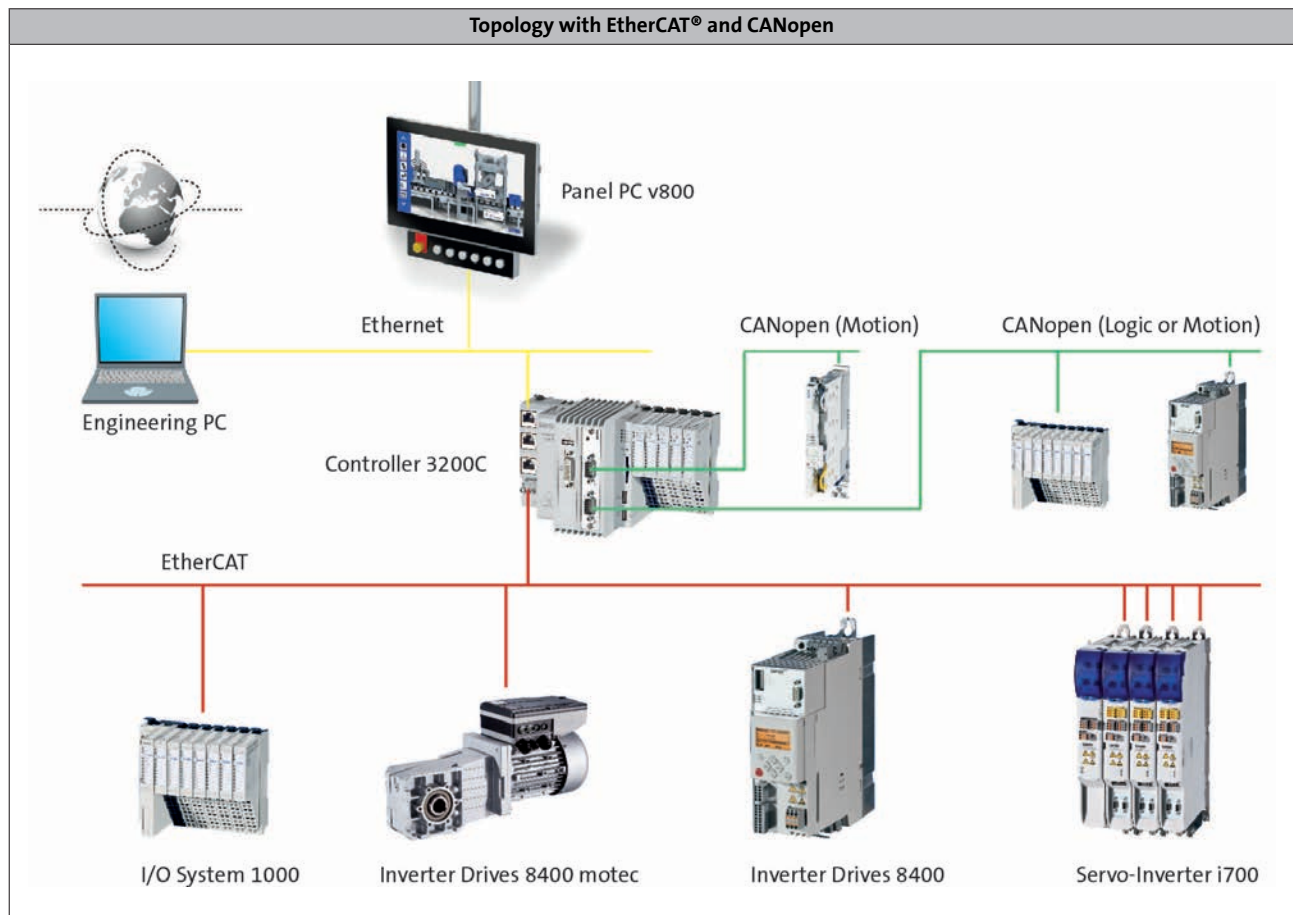


Advanced topology with CANopen

The tried-and-tested CAN bus comes as standard on many field devices. The controllers therefore allow CANopen to be used, some controllers even allow it in addition to the EtherCAT as a double master system. In this topology, a separation of motion and logic bus is recommended.

CANopen

1.1



Controller-based Automation

Topologies

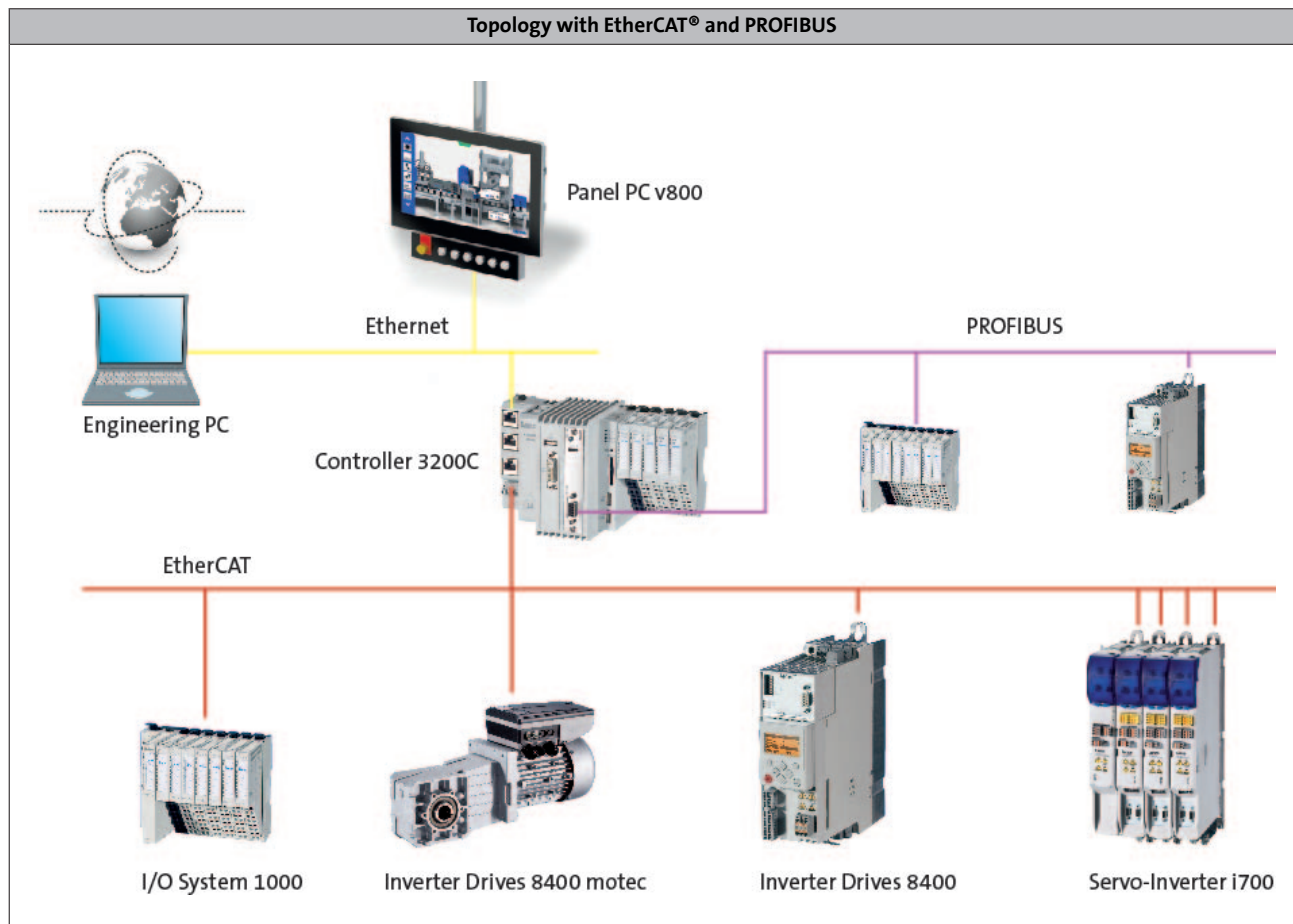


Advanced topology with PROFIBUS

PROFIBUS is the most widely used fieldbus in today's automation technology industry. The choice of available field devices is immense. The expansion of control technology to include PROFIBUS means that this diversity is now also available within FAST Runtime.



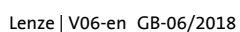
1.1



Extended topology with PROFINET



1.1





The basis

1.1

The runtime software in a Controller determines the type of functions to be executed. The runtime software is available in the "FAST Runtime" and "Visu" versions.

FAST Runtime

The "FAST Runtime" runtime software enables the Controller to execute a sequence control (PLC functionality according to IEC 61131-3).

Moreover, Lenze FAST features licenced, predefined and already tested standard software modules (FAST technology modules) for an easy development of a modular machine control. FAST Motion modules (based on "PLCopen motion control) can be used to individually extend the functionalities of the FAST technology modules. – With Lenze FAST you only pay the functionalities you really need!

The PLC programming is carried out with the »PLC Designer« engineering tool. The FAST technology modules and FAST Motion modules are contained in »PLC Designer« function libraries and can be easily integrated into the machine program.



FAST Application Software

The topic of software is becoming increasingly important in developing machines as mechanical engineers are focusing more attention on efficient processes for creating the applications they need.

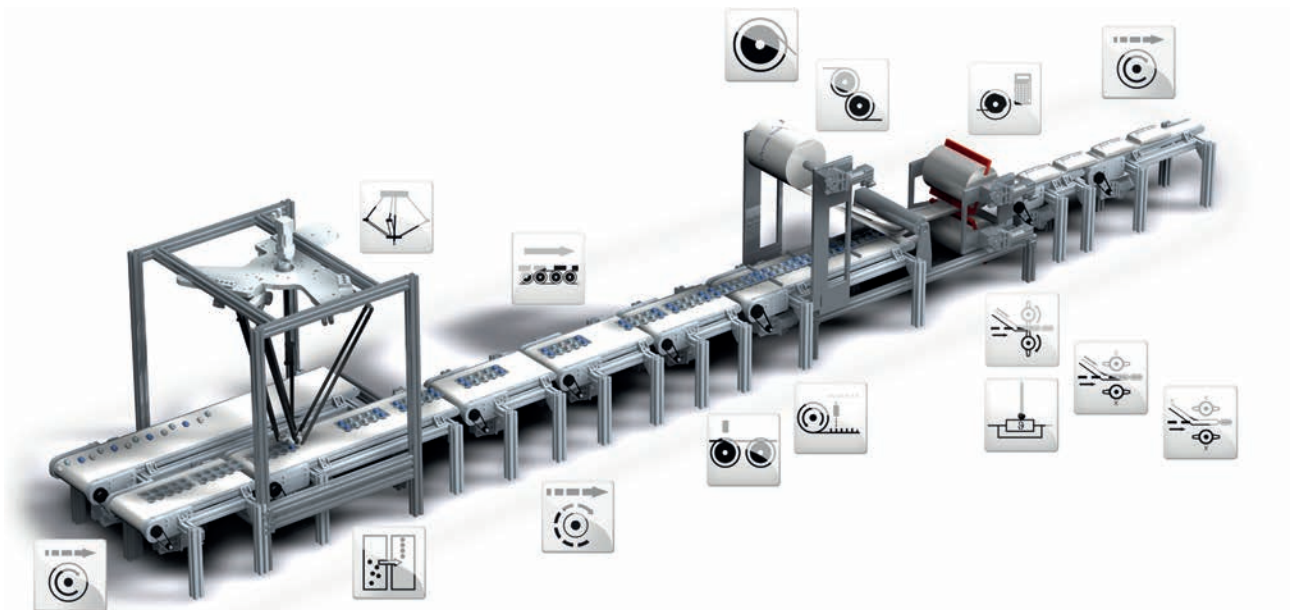
Lenze FAST (Feasibly Applicable Software Toolbox) provides Lenze standard software modules for easily developing a modular machine control.

For this purpose, the »PLC Designer« engineering tool with the "FAST Application Template" provides for an easy programming and commissioning as standardised software structure and with predefined technology modules. FAST Motion functions serve to implement individual extensions.

Highlights

- Up to 80 % of the software engineering for the motion control of the machine can be covered by standards.
- Considerable reduction of the development times for the basic drive functions
- Saved time can be invested in the further development of the special features of the machine.
- Predefined and tested software modules
- Structured programming
- Easier reuse and extension of programming segments
- Error reduction by tested software

1.1





FAST Application Template

The FAST Application Template is standardised by Lenze for a modularised and clear programming in the »PLC Designer«.

For a modular implementation of the mechatronic structure of an automation system, ready-made and reusable machine modules and module applications (e.g. a cross cutter) can be generated in the FAST Application Template.

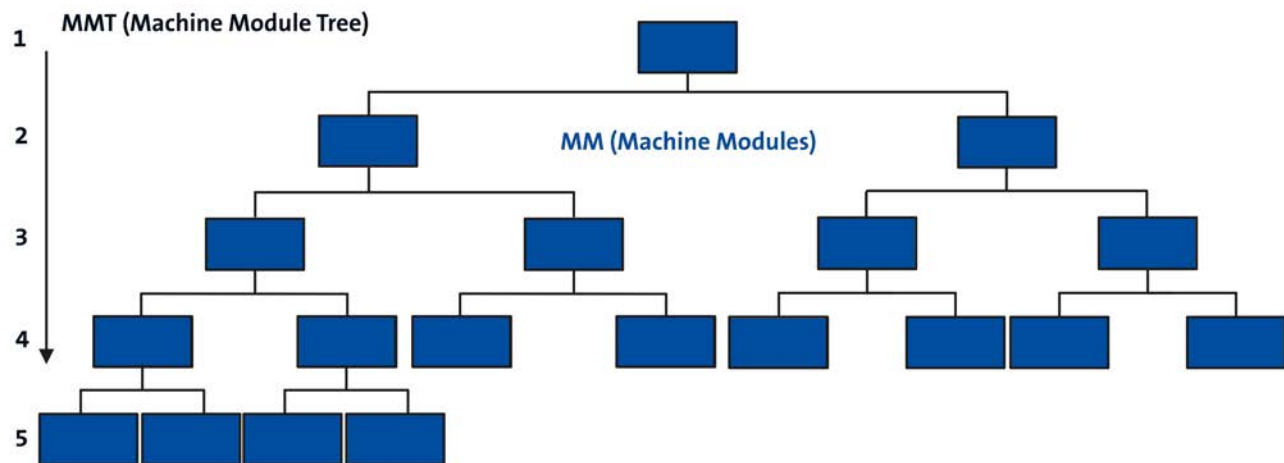
The FAST Application Template can be used via a library in the »PLC Designer« (from version 3.3). The library contains the structure and basic functionality of the FAST Application Template (as, for instance, state machine and error handling).

FAST Application Template elements

In order to map the automation system based on the FAST Application Template in the »PLC Designer«, the structure of the entire machine application has to be divided into machine modules. Each subfunction or drive function of the machine (e.g. "cross cutter" or "conveying belt") is mapped in one machine module.

A machine module always comes with at least one module application. Up to three module applications per machine module are possible.

The FAST Application Template supports two up to five hierarchy levels with up to 30 machine modules.



Example of a machine structure tree (MMT) with five levels

PackML standard

The FAST Application Template PackML standard is an extension that fulfils the requirements of the OMAC (Organization for Machine Automation and Control) user organisation for open and modular automation solutions for packaging machines according to the "PackML" standard.

Controller-based Automation

Application Software



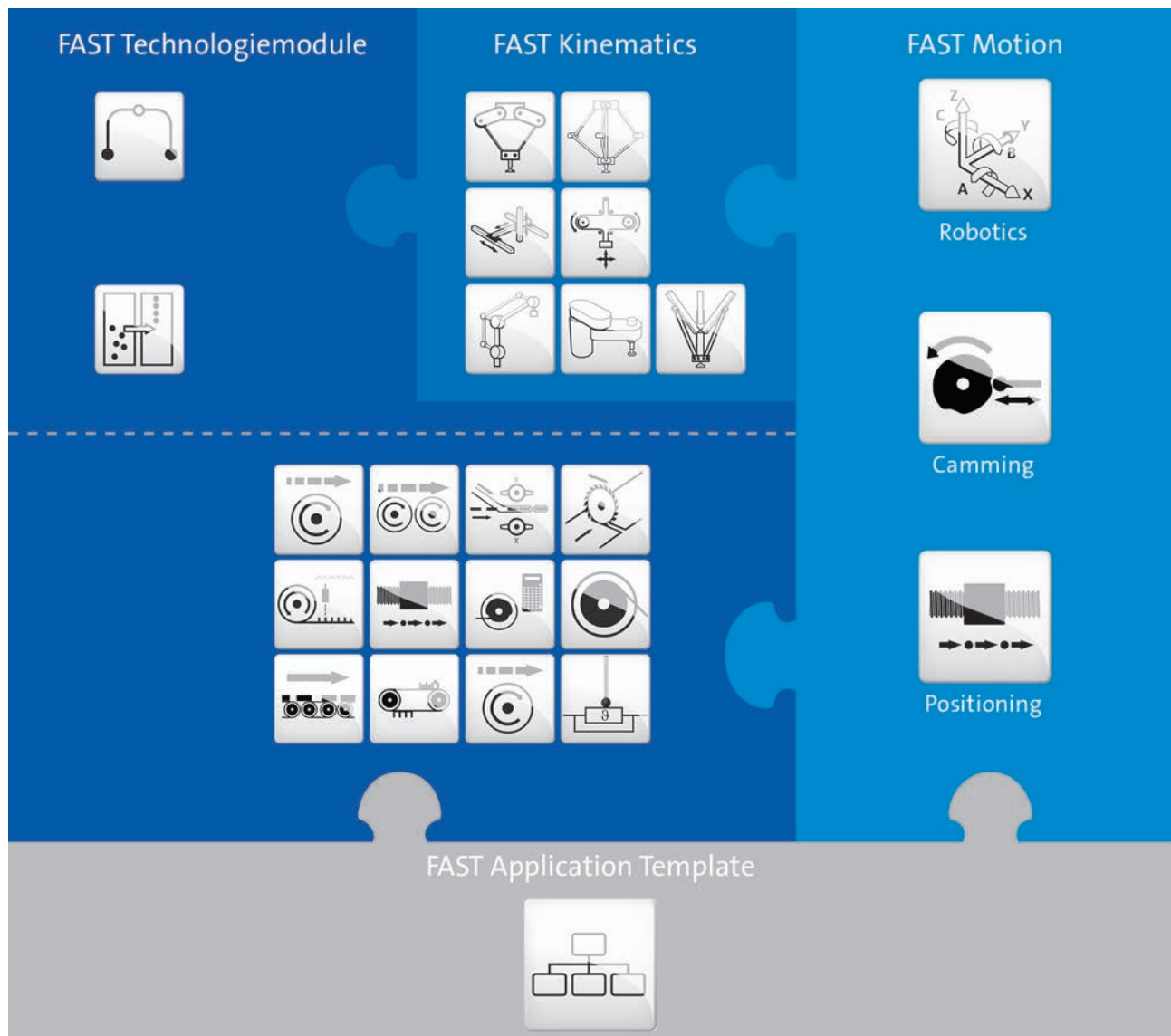
FAST technology modules

The predefined FAST technology modules serve to easily implement the desired machine functions.

The FAST technology modules are standardised software modules for a modular programming of the machine control. A FAST technology module features a complete and pre-tested drive function.

Integrated basic functions and an integrated visualisation provide for an easy commissioning and testing of the modules. The reusability of the modules increases the quality of the software and considerably reduces the time required for programming, commissioning and testing.

1.1



The FAST technology modules are contained in the »PLC Designer« as independent function blocks in a library. They use the standardised interfaces and can thus be easily integrated into the machine program, combined in any way and extended individually with FAST Motion functions.

Using the FAST technology modules requires a licencing via Application Credit, see controller accessories.

Controller-based Automation

Application Software



FAST technology modules

Each FAST technology module contains the basic functions manual jog, homing and positioning for the drives.

The following technology modules are available for applications with the motion control of a single drive axis:



Single drives

Technology module		Function
Virtual Master		Implementation of a virtual master axis in the machine
Basic Motion		Provides easy basic motion functions: Manual jog, homing, absolute and relative positioning, continuous travel
Electrical Shaft		Synchronisation and coupling of drives with precise speed and positioning.
Flex Cam		Implementation of one or several electric cams. Flexible management of curves created online and offline.
Cross Cutter		Synchronised movements of drives for cross-sealing and/or cross-cutting of products.
Register control		Implementation of a clock-synchronised drive for generating a register control with print mark detection.
Winder Dancer		Implementation of a winding drive with dancer position control and/or a winding drive with tensile force/speed control
Table Positioning		Positioning profiles for single axes with smoothing and touch probe positioning
Flying Saw		Cutting and processing of material while moving
Temperature Control		Control of the temperature of a system that is provided with a heating element and a thermal sensor.
Smart Track		Distribution of products via several conveying belts. An intelligent distribution results in optimum packaging of products.
Magic Track		The preparation of single products to package them in groups. Is implemented comfortably with the two-pass conveyor.



FAST technology modules



Coordinated multi-axes drives

1.1

Technology module		Function	Kinematics		Function
Pick&Place		Implementation of complex three-dimensional movements by means of profiles for up to four drives with different kinematics.	Portal		Universal Cartesian portal kinematics with 2, 3 and 4 degrees of freedom for Pick&Place with high load capacities and big workspaces
			Belt		Universally usable belt kinematics with 2 degrees of freedom *
			Delta 2		Parallel kinematics with 2 degrees of freedom * for highly dynamic Pick&Place tasks
			Delta 3		Parallel kinematics with 3 degrees of freedom * for highly dynamic Pick&Place tasks
			LinearDelta 3		Parallel kinematics with 3 degrees of freedom with linear axes for dynamic pick & place tasks.
			Scara		Universal serial Scara kinematics with 2 and 3 degrees of freedom
			Articulated P		Special form of an articulated arm kinematics with 4 degrees of freedom especially suitable for palletizing
Track Pick & Place		Implementation of gripper movements which, for instance, pick up workpieces from a conveying belt and place or position them onto another conveying belt			

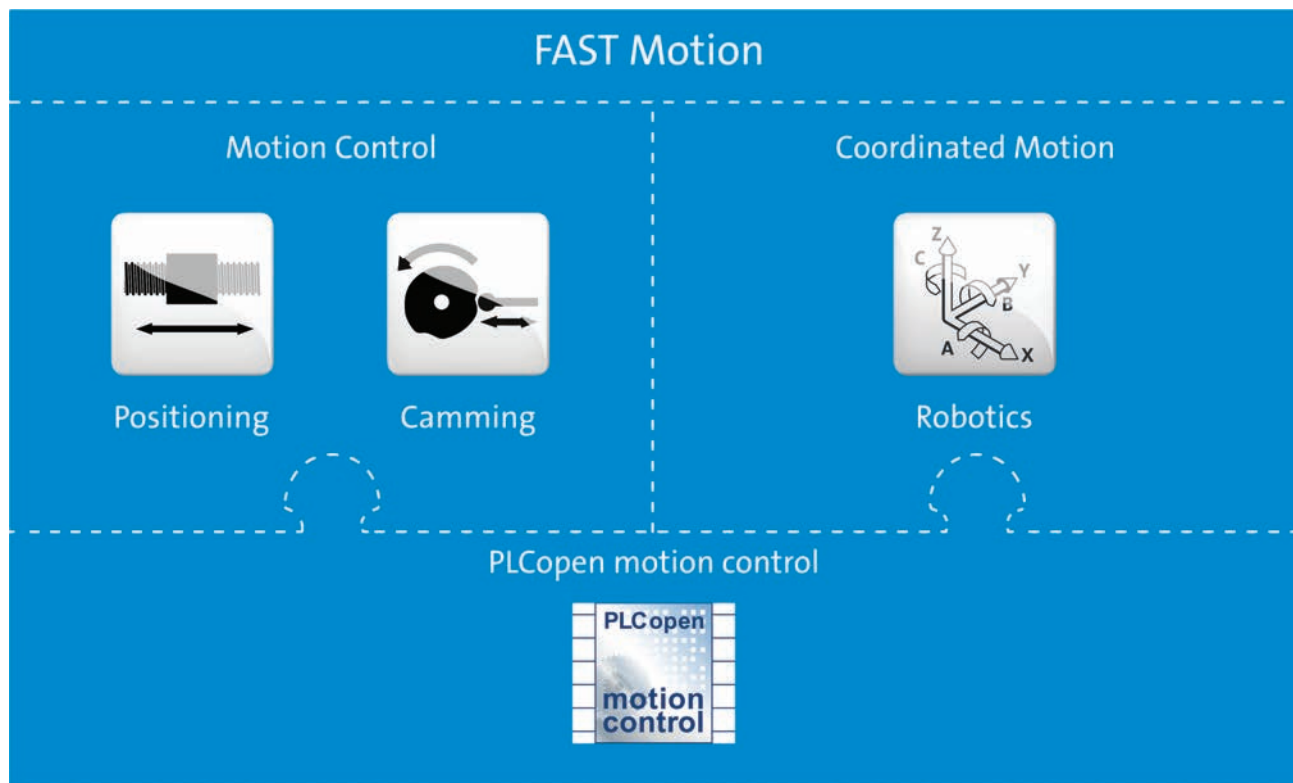
* Further degrees of freedom in preparation.



FAST Motion

FAST Motion provides full flexibility and scalability for machine programming and comprises optimised function blocks based on "PLCopen motion control":

- "Motion Control" modules (based on PLCopen Motion Control (formerly part 1+2) are optimised for the basic functions "positioning" and "cams" (synchronising).
- "Coordinated Motion" modules (based on PLCopen Coordinated Motion (part 4) are optimised for multi-axis coordinated three-dimensional movements – which can also be controlled via the FAST technology modules "Pick & Place".



If the functionalities of the FAST technology modules are not sufficient, they can be supplemented individually with FAST Motion modules. This serves to easily create the machine function with pre-planned standards. Thus, FAST frees up time for what really matters.

The »PLC Designer« contains the "Motion Control" module in two libraries and the "Coordinate Motion" modules in one library. Detailed information on the library functions and the functional range of the technology modules can be found in the online help of the PLC Designer.

Controller-based Automation

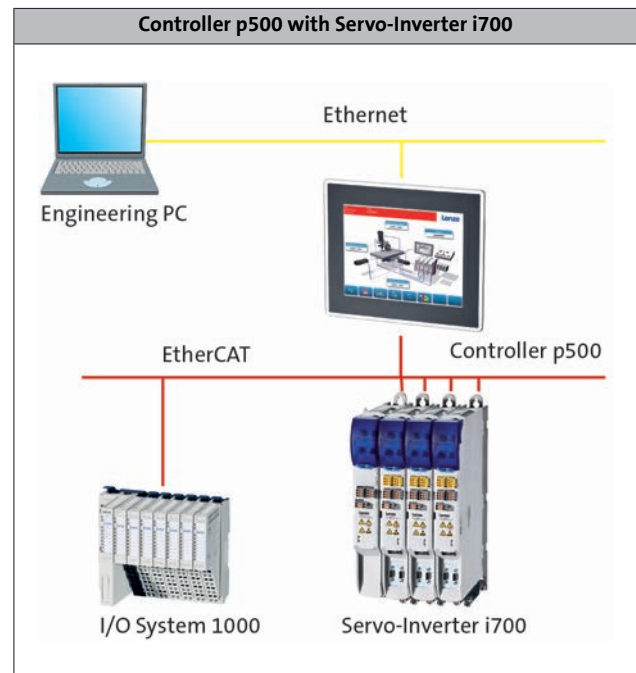
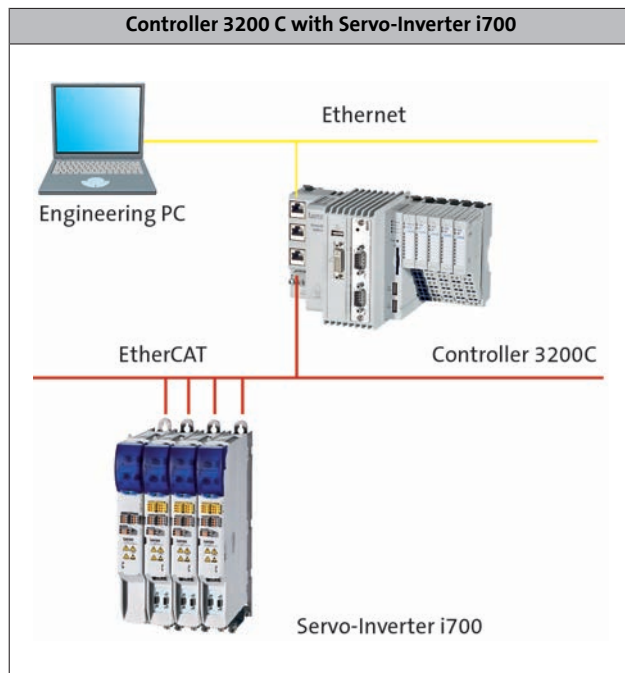
Application areas



Functions and features

Servo-Inverter i700

The Servo-Inverter i700 is implemented into the Controller-based Automation solution via the Ethernet-based EtherCAT® bus system. Thus, a large variety of technology applications can be adopted via the implemented controller. The »PLC Designer« engineering tool serves to program the FAST Motion functions.



For the different controllers, cycle times of the setpoint selection depend on the number of axes and the functionalities. The following table shows typical values for "Motion Control" (based on PLCopen Motion Control, formerly Part 1+2) and "Coordinated Motion" (based on PLCopen Coordinated Motion, Part 4).

Mode						
Controller			3221 C	3231 C	3251 C	p500
Min. cycle time PLCopen part 1,2: Motion Control						
1 - 4 axes	t	[ms]	1	1	1	1
8 axes	t	[ms]	2	1	1	1
12 axes	t	[ms]	2	2	1	2
16 axes	t	[ms]	2	2	2	2
32 axes	t	[ms]	4	3	3	4
64 axes	t	[ms]	8	6	5	6
Min. cycle time PLCopen part 4: Coordinated Motion						
4 axes	t	[ms]	1	1	1	1
8 axes	t	[ms]	2	2	1	2
16 axes	t	[ms]	3	3	2	3



Handling, commissioning and diagnostics

The Controller-based Automation solution can be easily commissioned and optimised with the PLC Designer and »EASY Starter« engineering tools.

The entire plant is commissioned via the Ethernet terminal of the Controller. By this means, the entire plant will be made available. When the plant is used for the first time, it can be subsequently optimised using the »EASY Starter«.

Drafting concepts

Defining automation solutions

Finding the right solution together

- Individual consulting service by the Lenze field service.
- Joint analysis and definition of the machine topology.
- Basic functions of the FAST modules as basis.
- Consistent automation and drive solution.

Implementing solutions

Machine development

PLC

Consistent engineering using the »PLC Designer«

- Control and drive application with only one tool.
- Creating an application easily using the FAST modules.
- All Lenze motor data is available.
- The oscilloscope function within the inverter supports the assessment and optimisation of the settings.

Manufacturing machines

Standard set-up



Commissioning via USB stick

- The prepared USB stick provides for the
 - transfer of the control software.
 - parameter setting and firmware download for connected field devices.
- The complete machine can be prepared, configured and parameterised in an automated fashion.
- Plug in USB stick, start machine, wait, finished.

Ensuring productivity

Servicing, diagnostics



Easy diagnostics - »EASY Starter«

- Support by the service technicians in commissioning and maintenance.
- Easy parameter setting and commissioning.
- Online diagnostics without the risk of an accidental application change.

Device exchange without tools

- Thanks to automated firmware and parameter download.
- The SD card of the Controller provides for an easier device exchange.
- Possible without any specific know how and software.
- No data of the machine gets lost.

Controls

Visualisation

Industrial PC v800
Monitor v200
VisiWinNET®



Visualisation

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Product key

v200 and v800, 2nd generation

	V80	G	B	S	J	0	7	5	0	H	4	R	XXXX	-0000G0000000
Device series														
V20 - Monitor														
V80 - Industrial PC														
Version														
S - Protec (industrial PC)														
D - Protec (monitor)														
P - Cabinet (industrial PC)														
M - Cabinet (monitor)														
Screen diagonal/resolution														
J - 43.9 cm (17.3")														
L - 61.0 cm (24")														
USB IP65 on rear (Protec only)														
0 - Without														
5 - 1x USB														
Processor type														
0 - Without (monitor)														
H - Mobile Intel Celeron 1.6 GHz														
K - Mobile Intel Core i5 1.9 (max.2.9) GHz														
Main memory														
0 - Without (monitor)														
6 - 4 GB (Celeron only)														
7 - 8 GB (i5 only)														
Mass storage														
0 - Without (monitor)														
R - Solid State Disk (SSD) 120GB														
Operating system														
0 - Without (monitor)														
9 - Windows Embedded Standard 7 P 64 Bit														
G - Windows 10 IoT Enterprise 2019 LTSC														

v200 and v800, 1st generation

	V80	G	A	P	G	0	7	0	0	G	6	R	XXXX	-0000G0000000
Device series														
V80 - Panel PC														
Version														
P - Cabinet (panel PC)														
Screen diagonal/resolution														
G - 33.8 cm (13.3")														
H - 39.1 cm (15.4")														
K - 54.6 cm (21.5")														
Processor type														
G - Intel® Celeron 1.5 GHz														
J - Intel® Core i5 2.7 (max. 3.3) GHz														
Main memory														
6 - 4 GB														
Mass storage														
R - Solid State Disk (SSD) 120GB														
Operating system														
9 - Windows Embedded Standard 7 P 64 Bit														
G - Windows 10 IoT Enterprise 2019 LTSC														

Visualisation

Features



Features

The v800 visualisations are compact and designed with a high degree of protection. The connections are protected and integrated into the housing.



3.1

v800-Protac front view with switch box



Rear view with support arm



Product information

Visualisation solutions with the industrial PC v800

Machine visualisations with the v800 industrial PCs can be easily scaled and realised in an optimal manner for the machine. The various screen diagonals and processor capacities are tailored to the requirements of modern machine control. As a stand-alone type (Protec) or embedded panel (Cabinet), they will fit into any machine concept. All devices are equipped with cutting-edge multi-touch glass sensors that can be operated even with gloves on and the operating program can be set up intuitively using the engineering software VisiwinNet.

3.1

The high-quality solution – v800-protec

An appealing, elegant device design with IP65 degree of protection and a shape that ensures ease of cleaning results in a product that offers simple elegance with maximum functionality and the best possible platform for demanding user interface concepts. A high degree of standardisation guarantees maximum availability and protection of software investments over a long period of time.

The highlights

- High-resolution full HD displays in 17.3" and 24.0"
- Maintenance-free thanks to no rotary components
- IPC type with low-power Intel Mobile processors
- Complies with hygienic design guidelines, no visible screws, IP65 degree of protection
- Individualisation via optional switch box

High-quality, integrated into machine housing – v800-Cabinet

The Cabinet version is intended for installation in machine housing. With the same technical specifications as the v800-Protec, this version is an equivalent alternative. The frameless design with narrow edge ensures a streamlined and visually appealing integration thanks to the circumferential seal on the multi-touch glass pane.

The highlights

- High-resolution full HD displays in 17.3" and 24.0"
- Maintenance-free thanks to no rotary components
- IPC type with low-power Intel Mobile processors
- Complies with hygienic design guidelines, no chamfering, front panel, IP65 degree of protection

The high-performance industrial PC – the v800-Cabinet

The devices in this range are ideal for applications that require even more power. The front panels meet the high demands regarding the degree of protection. The innovative cooling method comprising aluminium housing on the rear and durable fans guarantee optimal heat dissipation while ensuring maximum performance.

The highlights

- High-resolution displays in 13.3", 15.4" and 21.5"
- Solid-state disk
- IPC with high-performance industrial Intel processors
- Fan cooled for maximum performance, easily swappable
- Front panel IP65 degree of protection



Visualisation

General information



Product information

Visualisation solutions with monitor

The v200 monitors depict the visualisation created on the upstream IPC. All the required functions are transferred to the monitors and scaled to suit the features of the v800 industrial PC family. A visually uniform line from the industrial PC to the monitor enables uniform machine design. They are available both as embedded panel (Cabinet) or as stand-alone (Protec) versions. All devices are equipped with cutting-edge multi-touch glass sensors that can be operated even when wearing gloves.

The modern monitor – v200-Protec

An appealing, elegant device design with IP65 degree of protection and an easy-to-clean design results in sleek elegance with maximum functionality and the best possible platform for demanding user interface concepts. A high degree of standardisation guarantees maximum availability and protection of investments over a long period of time.

The highlights

- High-resolution full HD displays in 17.3" and 24.0"
- Standard HDMI or DisplayPort connection
- Optional mounting up to 100 m from control cabinet PC via integrable Extender
- Complies with hygienic design guidelines, no visible screws, IP65 degree of protection

Modern integrable monitor – v200-Cabinet

Designed for direct installation into machine housing, these devices offer an alternative platform as they have the same technical specifications and options as the v200-p series. The frameless design with narrow edge ensures a streamlined and visually appealing integration thanks to the circumferential seal on the multi-touch glass pane.

The highlights

- High-resolution full HD displays in 17.3" and 24.0"
- Standard HDMI or display port connection
- Optional installation up to 100 m from control cabinet PC via integrable Extender
- Complies with hygienic design guidelines, no chamfering, IP65 degree of protection on front panel





Standards and operating conditions

Type	Protec		Cabinet	
Conformity	CE			
RoHS	2011/65/EU [UKCA: S.I. 2012/3032]			
EN50581				
Degree of protection	IP65		IP65 on front	
			IP20 on rear	
Vibration resistance	3M4		3M5	
Vibration (IEC/EN 60721-3-3)	3M4		3M5	
Shock (IEC/EN 60721-3-3)	3M4		3M5	
Climatic conditions				
Storage (IEC/EN 60068-2-1)	-20 °C – 60 °C, 10% - 85% air humidity without condensation		-20 °C – 60 °C, 10% - 85% air humidity without condensation	
Transport (IEC/EN 60068-2-2)	-20 °C – 60 °C, 10% - 85% air humidity without condensation		-20 °C – 60 °C, 10% - 85% air humidity without condensation	
Operation (IEC/EN 60068-2-14)				
13.3 "			0 °C – 55 °C, 10% - 85% air humidity without condensation	
15.4 "			0 °C – 55 °C, 10% - 85% air humidity without condensation	
17 "	0 °C – 55 °C, 10% - 85% air humidity without condensation		0 °C – 55 °C, 10% - 85% air humidity without condensation	
21.5 "			5 °C – 45 °C, 10% - 85% air humidity without condensation	
24 "	0°C – 45°C, 10 % - 85 % air humidity without condensation		0°C – 45°C, 10 % - 85 % air humidity without condensation	
Site altitude				
Transport	< 12000 m amsl		< 12000 m amsl	
	< 3000 m amsl		< 3000 m amsl	
Degree of pollution				
IEC/EN 61131-2	2		2	

3.1



Rated data v800 and v200-Protec

								
Version			v800-P				v200-P	
Screen diagonal			43.9 cm (17.3")	61 cm (24")	43.9 cm (17.3")	61 cm (24")	43.9 cm (17.3")	61 cm (24")
Resolution		Pixel	1920 x 1080		1920 x 1080		1920 x 1080	
Touch			Capacitive glass surface, Multi-Touch		Capacitive glass surface, Multi-Touch		Capacitive glass surface, Multi-Touch	
Processor type			Intel® Celeron® Processor 2980U (2M Cache, 1.60 GHz)		Intel® Core™ i5-4300U Processor (3M Cache, 1.90 up to 2.90 GHz)			
Graphics processor			Intel® HD Graphics		Intel® HD Graphics 4400			
Operating system			Windows Embedded Standard 7 P 64 Bit		Windows Embedded Standard 7 P 64 Bit			
Storage medium								
Mass storage		[GB]	120 (2.5" SSD)		120 (2.5" SSD)			
Internal memory		[GB]	4		8			
Interfaces								
USB host 3.0/2.0 1x external access point			2 / 1		2 / 1		-	/2
USB Device 2.0			2		2		1	
Ethernet (10/100/1000 Mbit/s)			2		2			
HDMI / display port							1/1	
Rated voltage DC	U _{N, DC}	[V]	24 (+/- 20%)		24 (+/- 20%)		24 (+/- 20%)	
Max. current consumption (incl. USB)	I	[A]	3	4	3	4	2	2
Maximum starting current	I	[A]	4	4	4	4	3	3
Fusing of supply voltage	I	[A]	4 slow-blow	6 slow-blow	4 slow-blow	6 slow-blow	4 slow-blow	4 slow-blow
Weight	m	[kg]	4.8	7.7	4.8	7.7	4.6	7.5
Dimensions incl. switch box	Wx- HxD	[mm]	431x351x 216	578x436x 216	431x351x 216	578x436x 216	431x351x 216	578x436x 216
Dimensions without switch box	Wx- HxD	[mm]	431x261x 216	578x347x 216	431x261x 216	578x347x 216	431x261x 216	578x347x 216



Rated data v800 and v200-Cabinet, 2nd generation

								
Version			v800-C				v200-C	
Screen diagonal			43.9 cm (17.3")	61 cm (24")	43.9 cm (17.3")	61 cm (24")	43.9 cm (17.3")	61 cm (24")
Resolution		Pixel	1920 x 1080		1920 x 1080		1920 x 1080	
Touch			capacitive glass surface, Multi-Touch		capacitive glass surface, Multi-Touch		capacitive glass surface, Multi-Touch	
Processor type			Intel® Celeron® Processor 2980U (2M Cache, 1.60 GHz)		Intel® Core™ i5-4300U Processor (3M Cache, 1.90 up to 2.90 GHz)			
Graphics processor			Intel® HD Graphics		Intel® HD Graphics 4400			
Operating system			Windows Embedded Standard 7 P 64 Bit		Windows Embedded Standard 7 P 64 Bit			
Storage medium								
Mass storage		[GB]	120 (2.5" SSD)		120 (2.5" SSD)			
Internal memory		[GB]	4		8			
Interfaces								
USB host 3.0/2.0 1x external access point			2 / 1		2 / 1		-	/2
USB Device 2.0			2		2		1	
Ethernet (10/100/1000 Mbit/s)			2		2			
HDMI / DisplayPort							1/1	
Rated voltage DC	U _{N, DC}	[V]	24 (+/- 20%)		24 (+/- 20%)		24 (+/- 20%)	
Max. current consumption (incl. USB)	I	[A]	3	4	3	4	2	2
Maximum starting current	I	[A]	4	4	4	4	3	3
Fusing of supply voltage	I	[A]	4 slow-blow	6 slow-blow	4 slow-blow	6 slow-blow	4 slow-blow	4 slow-blow
Dimension	Wx- HxD	[mm]	433x263x 89	580x349x 89	433x263x 89	580x349x 89	433x263x 89	580x349x 89
Mounting depth	D	[mm]	79	79	79	79	62	62
Mounting cutout	WxH	[mm]	422x252	569x338	422x252	569x338	422x252	569x338



Rated data v800-Cabinet, 1st generation

								
Version			v800-C					
Screen diagonal			33.8 cm (13.3")	39.1 cm (15.4")	54.6 cm (21.5")	33.8 cm (13.3")	39.1 cm (15.4")	54.6 cm (21.5")
Resolution			1280 x 800	1280 x 800	1920 x 1080	1280 x 800	1280 x 800	1920 x 1080
Touch			capacitive glass surface, Multi-Touch			capacitive glass surface, Multi-Touch		
Processor type			Intel® Celeron® Processor 2002E (2M Cache, 1.50 GHz)			Intel® Core™ i5-4400E Processor (3M Cache, 2.70 up to 3.30 GHz)		
Graphics processor			Intel® HD Graphics			Intel® HD Graphics 4600		
Operating system			Windows® Embedded Standard 7 P 64 bit			Windows® Embedded Standard 7 P 64 bit		
Storage medium								
Mass storage		[GB]	120 (2.5" SSD)			120 (2.5" SSD)		
Internal memory		[GB]	4			8		
Interfaces								
COM (RS232)			1			1		
USB Device 2.0			2/2 on rear			2/2 on rear		
Ethernet (10/100/1000 Mbit/s)			3			3		
Rated voltage DC	U _{N, DC}	[V]	24 (+/- 20%)		24 (+/- 20%)		24 (+/- 20%)	
Max. current consumption (incl. USB)	I	[A]	3	4	3	4	3	4
Maximum starting current	I	[A]	8	8	8	8	8	8
Fusing of supply voltage	I	[A]	4 slow-blow	4 slow-blow	4 slow-blow	4 slow-blow	6 slow-blow	6 slow-blow
Weight	m	[kg]	3.6	4.9	8.6	3.6	4.9	8.6
Dimension	Wx- HxD	[mm]	353 x 261 x 63	426 x 261 x 66	567 x 369 x 66	353 x 261 x 63	426 x 261 x 66	567 x 369 x 66
Mounting depth	D	[mm]	51	54	54	51	54	54
Mounting cutout	WxH	[mm]	332 x 240	392 x 269	532 x 334	332x240	392 x 269	532 x 334



DBaseT Extender kit

The HDBaseT Extender can be optionally retrofitted to the monitors v200-C and v200 –P. This expansion in the form of a transmitter and receiver module enables digital image and USB 2.0 signals to be transferred up to 100 m via a network cable using the HDBaseT standard.

Transmission of DisplayPort / HDMI / DVI video and USB (2.0) signal

- Transmission length: max. 100 m
- Easy installation: plug and play, no software driver required
- Easy installation: TX module on DIN rail, RX module is inserted into module slot on the rear of the monitor

3.1

Version	Characteristics	Product key
HD BaseT Extender kit	HDBase-T transmitter (TX) • Control cabinet mounting via DIN rail • 1 x HD Base-T transmitter (TX) • 1 x DisplayPort > HDMI cable (100 cm) • 1 x USB host > USB slave cable (100 cm) • 1 x 24 VDC connector	EPCZEBE1
	HDBase-T receiver (RX) • Snap-in installation slot in monitor • 1 x HD Base-T receiver (RX) • 1 x HDMI > HDMI cable (25cm) • 1 x USB host > USB slave cable (10 cm) • 1 x 24 VDC supply cable (10 cm) • 1 x 24 VDC connector	

Transmission cable for HDBaseT Extender

The following CAT cables are recommended for operation:

- CAT6a cable, maximum cable length up to 80 m, 24AWG/27AWG, shielded
- CAT7 cable, maximum cable length up to 100 m, 24AWG, shielded

Transmission cable for v200 monitor

A Display Port (DP) or HDMI cable and USB cable can be used to connect the v200 monitors:

Version	Characteristics	Product key
DP/DP cable	• Length: 3 m for connection via DisplayPort	EWL0091
	• Length: 5 m for connection via DisplayPort	EWL0092
HDMI/HDMI cable	• Length: 3 m for video connection via HDMI	EWL0093
	• Length: 5 m for video connection via HDMI	EWL0094
USB (host/slave)	• Length: 3 m for touch and external devices on monitor	EWL0095
	• Length: 5 m for touch and external devices on monitor	EWL0096



T-Adapter

The support arm is required to mount the v800-Protec and v200-Protec on a standard 48 mm stainless steel tube. It has an integrated tilting device to tilt the display unit and can be rotated +/- 90° using the quick release clamping screw. This type is designed for use in support arm constructions with the IP65 degree of protection. The support arm adapter is supplied in series for hanging mounting but can be adapted for vertical mounting in just a few steps.



T-Adapter with switch box

The switch box is designed to expand the T-Adapter with standard 22 mm command elements. Like the console, the switch box has a screwless design. Thanks to easy removal of the front unit and by tearing the perforated installation opening, up to seven standard command elements (e.g. for 6 pushbuttons and 1x emergency-off switch) can be fitted. The labelling on the command elements can be individualised using slide-in strips.



3.1

Version	Characteristics	Product key
T-Adapter	• Mounting on 48 mm tube, either hanging or vertical	EPCZMP1
T-Adapter 17" with switch box	• Mounting on 48 mm tube, either hanging or vertical • 7x command elements • The switch box is prepared for the recording of standard 22.5-mm command elements. • Standard pushbuttons and switches can be installed. • The command elements are not included in the scope of supply.	EPCZEBT801-000
T-Adapter 24" with switch box	• Mounting on 48 mm tube, either hanging or vertical • 7x command elements • The switch box is prepared for the recording of standard 22.5-mm command elements. • Standard pushbuttons and switches can be installed. • The command elements are not included in the scope of supply.	EPCZEBT901-000
Tool for T-Adapter mounting	• Rotates the mounting tube 180°.	EPCZMB5



VisiWinNET® Smart

Machines are almost exclusively equipped with visual operating units. Creating a machine visualisation used to be a subtask of control programming, but today it has developed into a core autonomous discipline. Interfaces that were often technically overloaded and could only be operated by experts have given way to user-oriented visual machine operation and have therefore become an important sales argument. VisiWinNET® Smart is the ideal tool for this task.

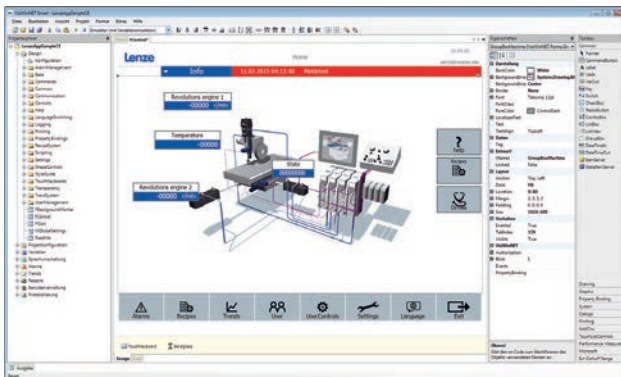
3.1

Advantages of visualisation software:

- **Intuitive project planning:**
the integrated development environment of VisiWinNET Smart offers all functions under one roof. The graphics designer for visualisation pages and all other editors and tools are grouped into a flexible, modern window layout with dockable elements that also enables the use of multiple monitors.
- **Intelligent data exchange**
Project data such as variables, texts or alarms can easily be exchanged with other programs. The transfer of variables directly from the control project goes hand-in-hand with easy exchange of data with Microsoft Excel using the Windows clipboard.
- **Parallel installation**
Various VisiWinNET versions can be installed alongside one another on one computer. New projects can always be developed using the latest version and older ones are supported.
- **Modern software architecture**
VisiWinNET® SMART comprises a development system with a full-graphics integrated development environment and a runtime licence scalable to the scope of the project. For the v800 industrial PCs, single user and client server solutions can be realised with the standard framework.
- **... and if you need a bit more:**
For tasks that go beyond the scope of VisiWinNET® Smart, it is possible to expand the software to suit your individual needs with the expert tools VisiWinNET® Professional. If you require this, please get in touch with your Lenze contact person. We would be happy to make you an offer for a solution that meets your needs.

VisiWinNET® Smart main components:

- Process communication for technical process monitoring
- Language options for international use
- Alarm management, data logging and trend recording for plant controlling
- Recipe management and user management



Visualisation

Visualisation software



VisiWinNET® Smart development system

The integrated development environment of VisiWinNET® SMART is offered in the form of single user and client/server applications for the creation of visualisations. Please specify the respective option when ordering the engineering software.

Version	Development system	Target system	Product key
VisiWinNET® SMART	• Single user licence • Operating system engineering software: Windows® 7, Windows® 8 • Licencing: USB dongle	• Single user licence Windows® 7, Windows® 8	7710120065
	• Single user licence • Operating system engineering software: Windows® 7, Windows® 8 • Licencing: USB dongle	• Client/Server Windows® 7, Windows® 8	7710130065
	• Upgrade	Single user licence on client/server	7710131065
VisiWinNET® Professional			On request

3.1

VisiWinNET® Runtime licences

To realise your machine visualisation developed with VisiWinNET® Smart, your Lenze industrial PC requires the respective VisiWinNet® Runtime. The number of power tags, i.e. the data that needs to be exchanged with the control system, should be selected depending on the scope of the project.
For data exchange in networked environments, the runtime system also has an additional OPC server interface. Via this interface, higher-level systems can access process variables within the visualisation application and exchange relevant data, making connections to e.g. an ERP system or data exchange between multiple machines easier.

Single user licences

Item description			Order code		
VisiWinNET® 250	250 power tags	Windows® 7, Windows® 8	7700	4430	025
VisiWinNET® 500	500 power tags	Windows® 7, Windows® 8	7700	4430	050
VisiWinNET® 1000	1000 power tags	Windows® 7, Windows® 8	7700	4430	100
VisiWinNET® 2000	2000 power tags	Windows® 7, Windows® 8	7700	4430	200
VisiWinNET® 4000	4000 power tags	Windows® 7, Windows® 8	7700	4430	400
VisiWinNET® 64000	64000 power tags	Windows® 7, Windows® 8	7700	4430	999
Licencing		USB dongle Licence file with mandatory hardware			5 6

Client/server licences

Item description			Order code		
VisiWinNET® 250	250 power tags	Windows® 7, Windows® 8	7700	4440	025
VisiWinNET® 500	500 power tags	Windows® 7, Windows® 8	7700	4440	050
VisiWinNET® 1000	1000 power tags	Windows® 7, Windows® 8	7700	4440	100
VisiWinNET® 2000	2000 power tags	Windows® 7, Windows® 8	7700	4440	200
VisiWinNET® 4000	4000 power tags	Windows® 7, Windows® 8	7700	4440	400
VisiWinNET® 64000	64000 power tags	Windows® 7, Windows® 8	7700	4440	999
VisiWinNET® Client	Operate and monitor (client)	Windows® 7, Windows® 8	7700	4440	001
VisiWinNET® Viewer	Monitor (viewer)	Windows® 7, Windows® 8	7700	4440	002
Licencing		USB dongle Licence file with mandatory hardware			5 6

Controller 3200 C



Controller 3200 C

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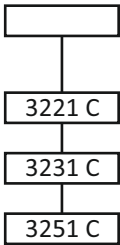
Controller 3200 C

General information

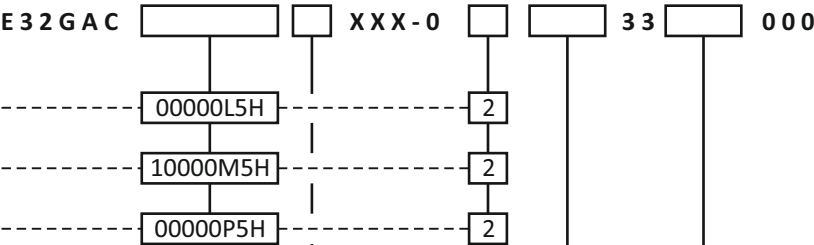


Product key

Product



Product key



Option interface MC 1

- 0 – No
- 5 – MC-PBM (PROFIBUS Master)
- 6 – MC-PBS (PROFIBUS Slave)
- 8 – MC-PND (PROFINET Device)
- 9 – MC-CAN2 (CANopen)

Application Credit

- | | |
|------------------------------|------------------------------|
| S1 - Application Credit 0 | AA - Application Credit 1200 |
| A0 - Application Credit 50 | AB - Application Credit 1500 |
| A1 - Application Credit 100 | AC - Application Credit 2000 |
| A2 - Application Credit 150 | AD - Application Credit 2500 |
| A3 - Application Credit 200 | AE - Application Credit 3000 |
| A4 - Application Credit 300 | AF - Application Credit 4000 |
| A5 - Application Credit 400 | |
| A6 - Application Credit 500 | |
| A7 - Application Credit 600 | |
| A8 - Application Credit 700 | |
| A9 - Application Credit 1000 | |

Runtime Software visualisation (3231 C only)

- 00 – Visu: without runtime
- 14 – Visu: VisiWinNET® Compact CE, 500 power tags



Controller 3221 C and 3251 C



Controller 3231 C

Controller 3200 C

General information



Equipment

USB 3

Touchscreen connection
(not with 3221 C, 3251 C)

LAN 1a

Ethernet 10/100 MBits/s
with integrated switch

LAN 1b

Ethernet 10/100 MBits/s
with integrated switch

EtherCAT

DVI-D

External monitor connection
(not with 3221 C, 3251 C)

Supply voltage

24V DC

Option interface

Bus system extensions

4 LEDs

Status display

Supply module

Supply for stacked I/O modules

I/O system 1000

Up to 64 modules
Analog and digital
inputs and outputs

SD card

Data memory for project data
Accessories: application credit

USB 1

Keyboard connection (optional)

USB 2

USB stick connection
for backup (optional)

3.3

Safety topology extension

Safety-Controller c250-Sx

Safety-bus coupler

Unlocking mechanism

Status-LEDs

Network Out

Network In

24-V-connection

Additional shield connection

Safety-I/O-Modul

E-Bus

(covered)

Status-LEDs

Terminal strip

IO-LEDs

Controller 3200 C

General information



Product information

The Controller 3200 C is the ideal platform for automation systems in the control cabinet. It is based on the Intel® processor Atom™, which makes it possible to implement a powerful computer architecture without force-cooling and other moving components even in the smallest of spaces. As a special touch it is possible to directly attach the I/O system 1000 without taking the detour via fieldbuses.

Variants

The Controller 3200 C comprises three versions. Together with our system modules, the variants 3221 C, 3231 C and 3251 C provide the basis for a powerful Motion controller – with and without an integrated visualisation! The controller version 3231 C is provided with an integrated DVI interface to which external monitors or monitor panels can be connected.



Integrated Ethernet switch

The integrated switch allows line topologies to be established using Ethernet without the need for a separate switch as an infrastructure component. In addition to this, a free interface provides allows a diagnostics device such as a service technician's laptop to be connected without having to access the bus physics.

I/O System 1000 as local I/Os

The extremely fast communication (48 Mbps) between the L-force Controller 3200 C and the I/O modules takes place via a proprietary, yet extremely efficient backplane bus. This allows individual and group access to the inputs and outputs and also enables precise synchronisation of the input modules, which attach a time stamp to the input signals with a resolution of 1µs and thereby ensure high-precision.

Safety topology with EtherCAT®

The Safety Controller c250-S clears the way for planning the complete drive and safety technology from one single source. The entire machine safety can be programmed with only one engineering tool, based on the PLCOpen standard - irrespective whether it is about "grey" or "yellow" control technology.

The deep integration of the functional safety into the automation system makes the engineering easier, improves the diagnostics options and reduces the number of interfaces and components. This saves time and money and finally increases the availability and flexibility of the machine.

Controller 3200 C

General information

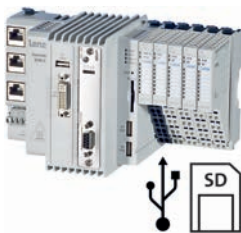


Product information



Logic (PLC), motion and visualisation in a single device

- Optimised for machine(modules) with central motion control
- Easy engineering thanks to central data storage



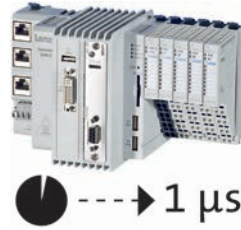
Easy to use

- Easy use of FAST via pluggable SD card with Application Credit for Motion Control or Coordinated Motion
- Automated standard set-up and data backup via USB stick
- Easy device replacement by means of the pluggable SD card with the corresponding Application Credit
- Diagnostics by implemented web server or EASY Starter



Communicative

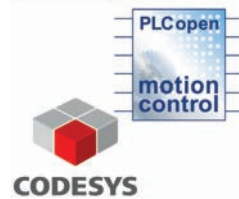
- EtherCAT® as a fast bus system directly on board (in preparation)
- CANopen on board
- Precisely tailored by modular extension option



High-precision control for optimum manufacturing results

- Touch probe-compatible inputs
- High-precision output control
- Highly deterministic backplane bus with precise 1 µs time stamp

IEC 61131-3



Prepared for the future thanks to compliance with industrial standards

- Programming in IEC61131-3
- Motion Control as per PLCopen
- PLC Designer based on CODESYS3



I/O system 1000 as local I/Os

- Permanent wiring due to separation of electronics and base module
- Fast diagnostics achieved thanks to clear labelling of the LEDs assigned to each channel
- Easy connection thanks to inclusion of printed circuit diagram
- Fully integrated shield connection without special shield terminals

Controller 3200 C

General information



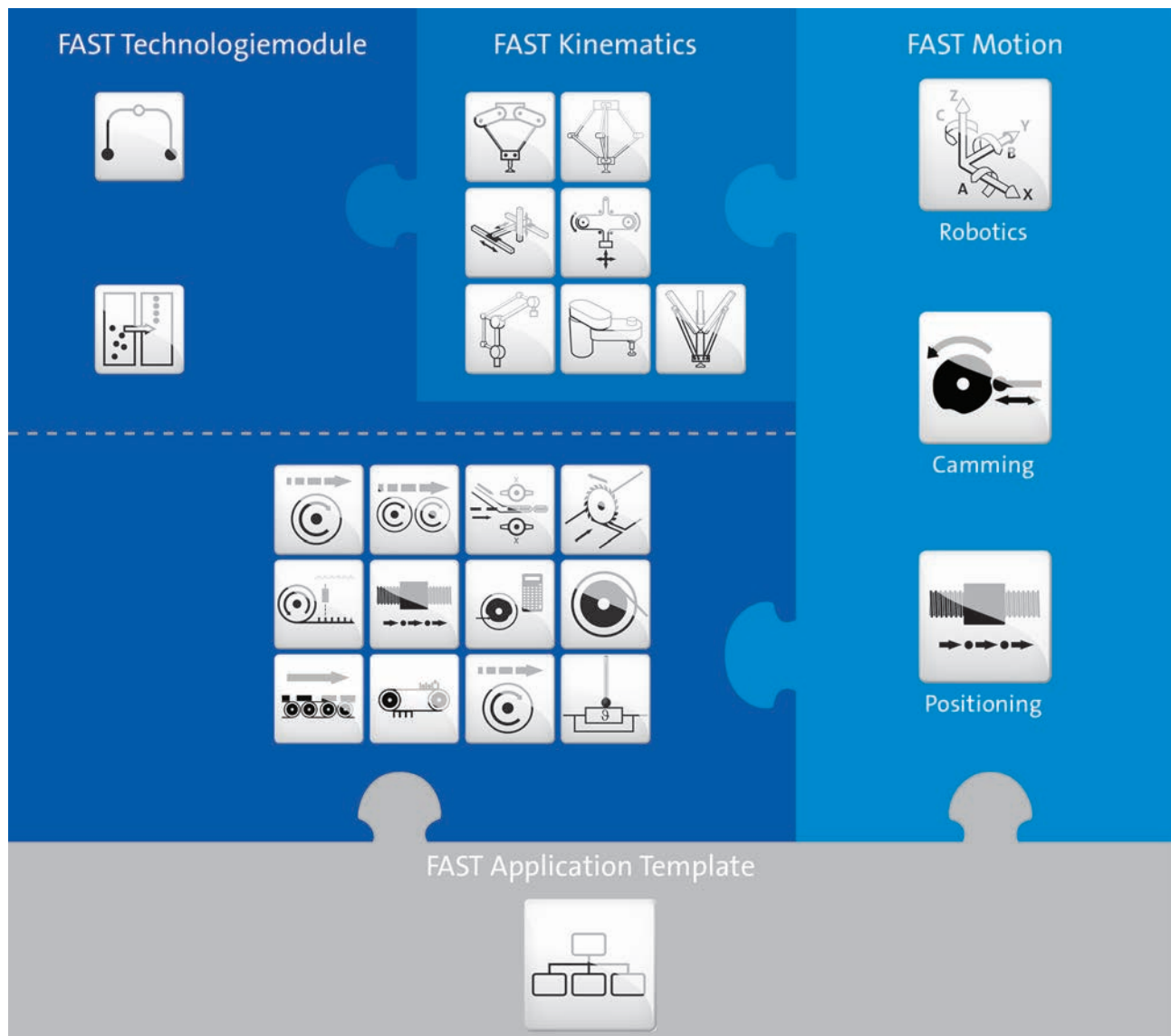
Lenze FAST

Lenze FAST (Feasibly Applicable Software Toolbox) provides Lenze standard software modules for easily developing a modular machine control.

For this purpose, the »PLC Designer« engineering tool with the "FAST Application Template" provides for an easy programming and commissioning as standardised software structure and with predefined technology modules.

FAST Motion functions serve to implement individual extensions. The »EASY Starter« can be used to subsequently optimise and diagnose the system.

3.3



FAST Application Template

The FAST Application Template is standardised by Lenze for a modularised and clear programming in the »PLC Designer«.

The FAST Application Template can be used via a library in the »PLC Designer«. The library contains the structure and basic functionality of the FAST Application Template (as, for instance, state machine and error handling).

Controller 3200 C

General information



Lenze FAST

FAST technology modules

The predefined FAST technology modules serve to easily implement the desired machine functions.

The FAST technology modules are standardised software modules for a modular programming of the machine control. A FAST technology module features a complete and pre-tested drive function. Integrated basic functions and an integrated visualisation provide for an easy commissioning and testing of the modules. The reusability of the modules increases the quality of the software and considerably reduces the time required for programming, commissioning and testing.

FAST Motion

FAST Motion provides full flexibility and scalability for machine programming and comprises optimised function blocks based on "PLCopen motion control":

- "Motion Control" modules (based on PLCopen Motion Control (formerly part 1+2) are optimised for the basic functions "positioning" and "cams" (synchronising).
- "Coordinated Motion" modules (based on PLCopen Coordinated Motion (part 4) are optimised for multi-axis coordinated three-dimensional movements – which can also be controlled via the FAST technology modules "Pick & Place".

The FAST technology modules are contained in the »PLC Designer« as independent function blocks in a library. They use the standardised interfaces and can thus be easily integrated into the machine program, combined in any way and extended individually with FAST Motion functions.

If the functionalities of the FAST technology modules are not sufficient, they can be adapted and extended individually using the FAST Motion modules. These modules are capable to program any number of functions.

The »PLC Designer« contains the "Motion Control" modules in two libraries and the "Coordinated Motion" modules in one library.

Controller 3200 C

Technical data



Standards and operating conditions

Mode					
Controller			3221 C	3231 C	3251 C
Conformity					
CE			EMC Directive		
			2014/30/EU [UKCA: S.I. 2016/1091]		
Approval					
UL 508C			Process Control Equipment (File-No. E236341)		
UL/CSA			CSA 22.2 No.142		
Enclosure					
EN 60529			IP20		
NEMA 250			Type 1		
Climatic conditions					
Storage (EN 60721-3-1)			1K3 (Temperature: -5 °C ... +45 °C)		
Transport (EN 60721-3-2)			2K3 (temperature: -25 °C ... +70 °C)		
Operation (EN 60721-3-3)			3K3 (temperature: 0 °C ... +55 °C) ¹⁾ 3K3 (temperature: 0 °C ... +50 °C) ²⁾	3K3 (temperature: 0 °C ... +50 °C) ¹⁾ 3K3 (temperature: 0 °C ... +45 °C) ²⁾	
Degree of pollution					
EN 61131-2			2		
Site altitude					
Amsl	H _{max}	[m]	3000		
Vibration resistance					
Vibration (EN 61131-2)			1 g		
Mechanical shock (EN 61131-2)			15 g		
Operation (Germanischer Lloyd)			5 Hz ≤ f ≤ 13.2 Hz: ± 1 mm amplitude 13.2 Hz ≤ f ≤ 100 Hz: 0.7 g		
Noise emission					
EN 61000-6-4			Industrial premises		
Noise immunity					
EN 61000-4-2			ESD: Severity 3		
EN 61000-4-6			150 kHz ... 80 MHz, 10 V/m 80 % AM (1 kHz)		
EN 61000-4-3			80 kHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz) 1.4 GHz ... 2.0 GHz, 3 V/m, 80 % AM (1kHz) 2.0 GHz ... 2.7 GHz, 1 V/m, 80 % AM (1kHz)		
EN 61000-4-4			Burst: Severity 3		

¹⁾ Horizontal mounting

²⁾ Vertical mounting

Controller 3200 C

Technical data



Rated data

					
Mode					
Controller			3221 C	3231 C	3251 C
Processor type					
Fanless			Intel® Atom™ 1.46 GHz	Intel® Atom™ 1.75 GHz	Intel® Atom™ 1.91 GHz
Storage medium					
SD card ¹⁾		[MB]	512		
Interfaces					
Ethernet (integrated switch)			2		
EtherCAT Master			1		
USB			2	3	2
DVI-D			1		
Option			Interface connection for CANopen (MC-CAN2) Interface connection for PROFIBUS Master (MC-PBM) Interface connection for PROFIBUS Slave (MC-PBS) Interface connection for PROFINET-Device (MC-PND) Interface connection for EtherNet (MC-ETH) Interface connection for RS232, 422, 485 (MC-ISI)		
Rated voltage					
DC	U _{N, DC}	[V]	24		
Max. current consumption					
With connected I/Os	I _{max}	[A]	1.00	1.20	
Without connected I/Os	I _{max}	[A]	0.60	0.80	
Operating system			Windows® CE 6.0		
Memory size					
Program memory		[MB]	512		
Data memory		[MB]	512		
Flags		[kB]	4		
Retain data		[kB]	60		
Main memory (RAM)		[GB]	2		
Min. internal flash memory		[GB]	4		
Runtime					
FAST Runtime			●		
Visualisation ²⁾				●	
Dimensions					
	h x b x t	[mm]	112 x 136 x 105		
Mass					
	m	[kg]	0.70		

¹⁾ 1 x SD card included in the scope of supply.

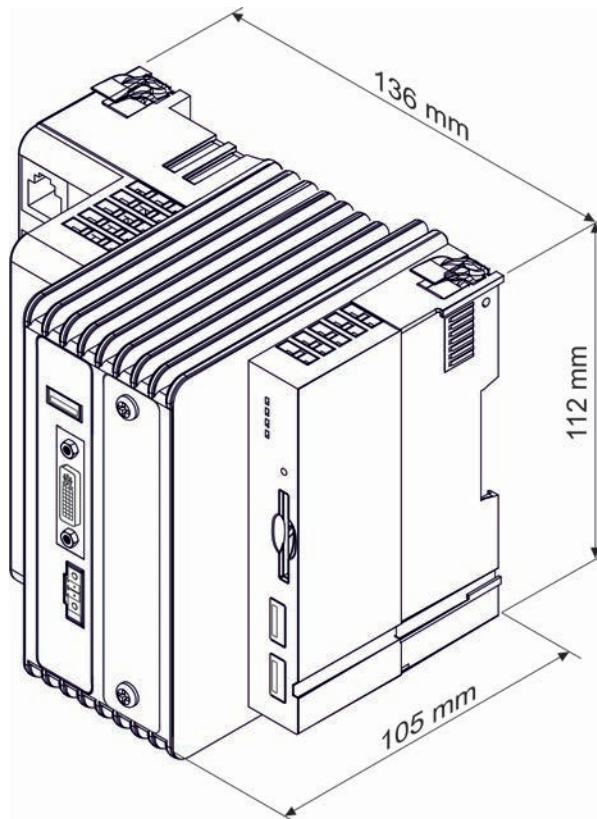
²⁾ Controller 3231 C with external monitor at the DVI-D interface. For operation, power tags are required.

Controller 3200 C

Technical data



Dimensions



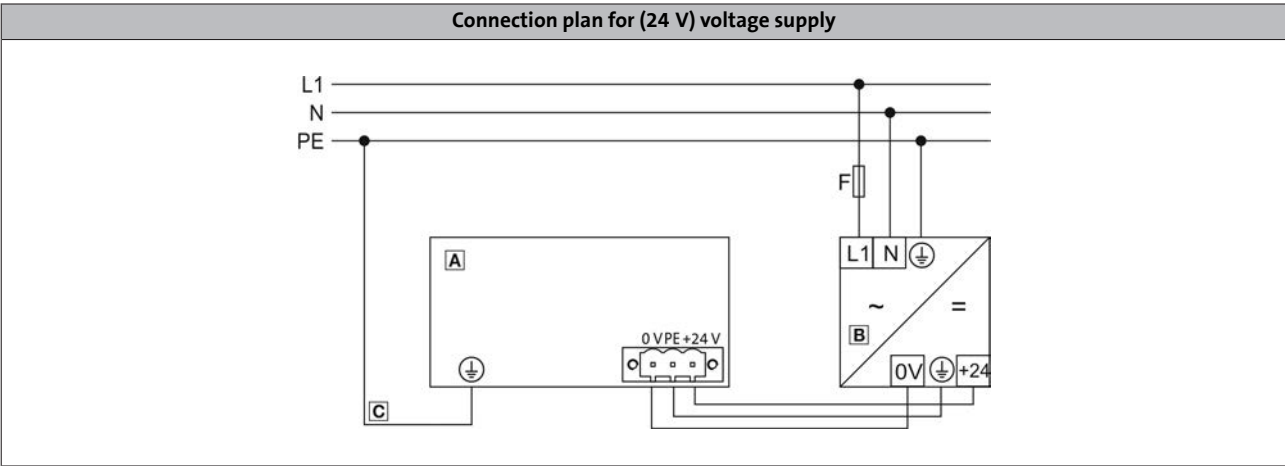
3.3

Controller 3200 C

Interfaces



Connection plan



Position	Meaning
A	Controller
B	Power supply unit
C	Protective earth connection on the supply side via DIN rail

Mains connection

	Connection	Connection type	Cable type
	DC supply (24 V)	3-pole Combicon socket	Cable with Combicon-plug (cable cross-section max. 2.5 mm²)

Controller 3200 C

Accessories



Safety Controller

Safety in the system does not begin with the drives first, but at the control level.

With the expansion of the controller software to include the Safety Controller c250-S a complete automation solution is provided for safety engineering and control and drive tasks. Topped with the safety I/O module, all the safety aspects in the machine module can be evaluated.
EtherCAT is used for data transfer.



3.3

Mode		Features	Product key
Safety Controller c250-S	-	• Compact Controller c250-S for easy mounting using the DIN rail • High-quality safety solution thanks to PL e/SIL 3	C25BAYSQ
Safety bus coupler	-	• Supported network: EtherCAT with safety-over EtherCAT (FSOE = Fail Safe over EtherCAT)	C25BAYCB
Safety I/O module	-	• Expansion of the Safety Controller with 4 safe inputs and 2 safe outputs	C25BAYA42

Safety Controller	
Functions	Implementation according to PLCopen, TC 5
Equivalence / antivalence test	SF_Equivalent SF_Antivalent
Operation mode selector	SF_ModeSelector
Emergency stop, emergency off	SF_EmergencyStop
Monitoring of electro-sensitive protective equipment (ESPE)	SF_ESPE (electro-sensitive protective equipment)
Guard monitoring	SF_GuardMonitoring
Guard monitoring with locking	SF_GuardLocking
Two-hand control	SF_TwoHandControlTypeII SF_TwoHandControlTypeIII
Muting	SF_MutingSeq SF_MutingPar SF_MutingPar_2Sensors
Cyclic test of ESPE	SF_TestableSafetySensor
Enable switch	SF_EnableSwitch
Controlling safety output with standard controller and safety controller	SF_OutControl
Monitoring of feedback loop	SF_EDM (external device monitoring)

Technical data	
Rated current	240 mA via E-bus connection
DC supply voltage	5 V via E-bus connection 24 V via safety bus coupler
Dimensions h x w x d	120 mm x 25 mm x 90 mm
Degree of protection	IP20

Controller 3200 C

Accessories



Application Credit

With Lenze FAST, technology modules are provided for Motion Control and Coordinated Motion. In order that these modules are used, the following Application Credit is required. If different technology modules are used, the demand for Application Credit must be added for all modules used.

Mode		Features	Product key
Application Credit		• Licence for use of FAST Application Software, 50 points	EPCZEMSD0L1005
		• Licence for use of FAST Application Software, 100 points	EPCZEMSD0L1010
		• Licence for use of FAST Application Software, 150 points	EPCZEMSD0L1015
		• Licence for use of FAST Application Software, 200 points	EPCZEMSD0L1020
		• Licence for use of FAST Application Software, 300 points	EPCZEMSD0L1030
		• Licence for use of FAST Application Software, 400 points	EPCZEMSD0L1040
		• Licence for use of FAST Application Software, 500 points	EPCZEMSD0L1050
		• Licence for use of FAST Application Software, 600 points	EPCZEMSD0L1060
		• Licence for use of FAST Application Software, 700 points	EPCZEMSD0L1070
		• Licence for use of FAST Application Software, 1000 points	EPCZEMSD0L1100
		• Licence for use of FAST Application Software, 1200 points	EPCZEMSD0L1120
		• Licence for use of FAST Application Software, 1500 points	EPCZEMSD0L1150
		• Licence for use of FAST Application Software, 2000 points	EPCZEMSD0L1200
		• Licence for use of FAST Application Software, 2500 points	EPCZEMSD0L1250
		• Licence for use of FAST Application Software, 3000 points	EPCZEMSD0L1300
		• Licence for use of FAST Application Software, 4000 points	EPCZEMSD0L1400

3.3

FAST technology modules



Single drives

Technology module		Function	Points for use
Virtual Master		Implementation of a virtual master axis in the machine	25
Basic Motion		Provides easy basic motion functions: Manual jog, homing, absolute and relative positioning, continuous travel	
Electrical Shaft		Synchronisation and coupling of drives with precise speed and positioning.	
Flex Cam		Implementation of one or several electric cams. Flexible management of curves created online and offline.	50
Cross Cutter		Synchronised movements of drives for cross-sealing and/or cross-cutting of products.	100



Application Credit

FAST technology modules

Technology module		Function	Points for use
Register control		Implementation of a clock-synchronised drive for generating a register control with print mark detection.	100
Winder Dancer		Implementation of a winding drive with dancer position control and/or a winding drive with tensile force/speed control	
Table Positioning		Positioning profiles for single axes with smoothing and touch probe positioning	50
Flying Saw		Cutting and processing of material while moving	100
Temperature Control		Control of the temperature of a system that is provided with a heating element and a thermal sensor.	50
Smart Track		Distribution of products via several conveying belts. An intelligent distribution results in optimum packaging of products.	
Magic Track		The preparation of single products to package them in groups. Is implemented comfortably with the two-pass conveyor.	

Controller 3200 C

Accessories



Application Credit

FAST technology modules



Coordinated multi-axes drives

3.3

Technology module		Function	Kinematics		Function	Points for use
Pick&Place		Implementation of complex three-dimensional movements by means of profiles for up to four drives with different kinematics.	Portal		Universal Cartesian portal kinematics with 2, 3 and 4 degrees of freedom for Pick&Place with high load capacities and big work-spaces	100
			Belt		Universally usable belt kinematics with 2 degrees of freedom *	
			Delta 2		Parallel kinematics with 2 degrees of freedom * for highly dynamic Pick&Place tasks	200
			Delta 3		Parallel kinematics with 3 degrees of freedom * for highly dynamic Pick&Place tasks	
			LinearDelta 3		Parallel kinematics with 3 degrees of freedom with linear axes for dynamic pick & place tasks.	
			Scara		Universal serial Scara kinematics with 2 and 3 degrees of freedom	
			Articulated P		Special form of an articulated arm kinematics with 4 degrees of freedom especially suitable for palletizing	
Track Pick & Place		Implementation of gripper movements which, for instance, pick up workpieces from a conveying belt and place or position them onto another conveying belt				300

FAST dimensioning

The FAST modules can be connected easily with the PLC Designer. Which module is to be selected, depends on the automation dimensioning of the machine. In order to define the correct Application Credit, the points of each module simply have to be added up. The required Application Credit is deducted each time a technology module is called.

Example 1:

- 1x Virtual Master (25 points)
- 1x Electrical Shaft (25 points)
- 2x Winder Dancer (200 points)
- 1x Cross Cutter (100 points)

Result: 350 points

Example 2:

- 1x Virtual Master (25 points)
- 1x Electrical Shaft (25 points)
- 2x Flex Cam (100 points)

Result: 150 points



Application Credit

FAST Motion

FAST Motion provides a scalable programming of function blocks based on "PLCopen Motion Control".
If you use the technology modules in the application, the basic functions of the FAST Motion are accessed both for single axes and for coordinated multi-axes systems.
If you do not want to use the technology modules for the motion control in your application, the application can, for instance, be implemented as well with your own program code on the basis of the FAST Motion.

3.3

Fast Motion		Function	Points for use
Motion Control		Positioning: FAST Motion basic functions for single-axis movements according to PLCopen Motion Control (formerly part 1) for positioning. This serves to freely program flexible positioning modes and further single-axis movements in IEC 61131.	150
		Camming: FAST Motion basic functions for synchronisation and cam movements according to PLCopen Motion Control (formerly part 2). This serves to freely program flexible axis synchronisations and cams for single axes in IEC 61131.	
Coordinated Motion		Robotics: FAST Motion basic functions for coordinated three-dimensional movements according to PLCopen Coordinated Motion Control (part 4). This serves to interpolate flexible axis groups as, for instance, robot kinematics in a multidimensional space. Programming is made in IEC 61131. Also contains "Positioning" and "Camming".	300

If you use FAST technology modules, the Application Credit already includes the required function of the FAST Motion. In this case, no additional points have to be considered for the use of the FAST Motion.

If you use the FAST Motion as a basic function for the motion control, the points according to the FAST Motion table apply.

Controller 3200 C

Accessories



SD card and USB flash drive

SD cards and USB flash drives are available for data storage and data backups.

- ▶ A SD card is part of the scope of supply of the controller.
- ▶ SD card without Application Credit.

Mode		Features	Product key
Application Credit 0		• 512 MB	EPCZEMSD0L0000
USB flash drive		• 4 GB	EPCZEMUS6

24 V power supply unit

An external power supply unit is also available as an alternative for powering the controller's control electronics.



24 V power supply unit

Rated data

Product key			
			EZV2400-000
Rated voltage			
AC	$U_{N, AC}$	[V]	230
Rated mains current			
	$I_{N, AC}$	[A]	1.20
Output voltage			
	U_{out}	[V]	DC 22.5 ...28.5
Rated current			
	I_N	[A]	10.0
Dimensions			
	$h \times b \times t$	[mm]	130 x 85 x 125
Mass			
	m	[kg]	1.24

Controller 3200 C

Accessories



CAN bus connector

The connector is used to connect the CAN to inverters which are provided with a Sub-D connection for the CAN bus. An integrated CAN terminating resistor can be switched on/off. Internal spring terminals make the use of special mounting tools superfluous. The switch setting can be read from two sides.

Mode		Features	Product key
CAN bus connector: Node		- Sub-D, 90° - Screw terminals	EPM-T950
CAN bus connector: Terminating		- Sub-D, 90° - Screw terminals - Integrated terminating resistor	EPM-T951
CAN bus connector: Straight		- Sub-D, 180° - Screw terminals - Switchable terminating resistor	EPM-T952
CAN bus connector: Switch		- Sub-D, 90° - Spring-loaded terminal - Switchable terminating resistor	EWZ0046

MC cards

In addition to the available standard interfaces, the Controllers can be optionally extended with further fieldbuses. This enables a very universal implementation into the machine control. These fieldbuses can be ordered or retrofitted as MC cards.

Mode	Features	Product key
MC card	• 2 x CAN interface (MC-CAN2)	EPCZEBKM9
	• 1 x PROFIBUS master (MC-PBM)	EPCZEBKM5
	• 1 x PROFIBUS slave (MC-PBS)	EPCZEBKM6
	• 1 x PROFINET device (MC-PND)	EPCZEBKM8
	• 1 x RS232, RS422, RS485 (MC-ISI)	EPCZEBKMD
	• 1 x EtherNet (MC-ETH)	EPCZEBKM1

Controller c300



Controller c300

Contents



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Accessories	Safety Controller	3.4 - 15
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Controller c300

General information



Product key

Product

c 3 0 0

Product key

C 3 0 G A C 0 0 0 0 0 F 3 G XXX - 0 2 S 3 0 0 0 0 0

Option interface MC 1

0 – No
8 – MC-PND (PROFINET Device)

Operating system

C – WEC7 Core

Runtime software control technology

3 – FAST Runtime

3.4



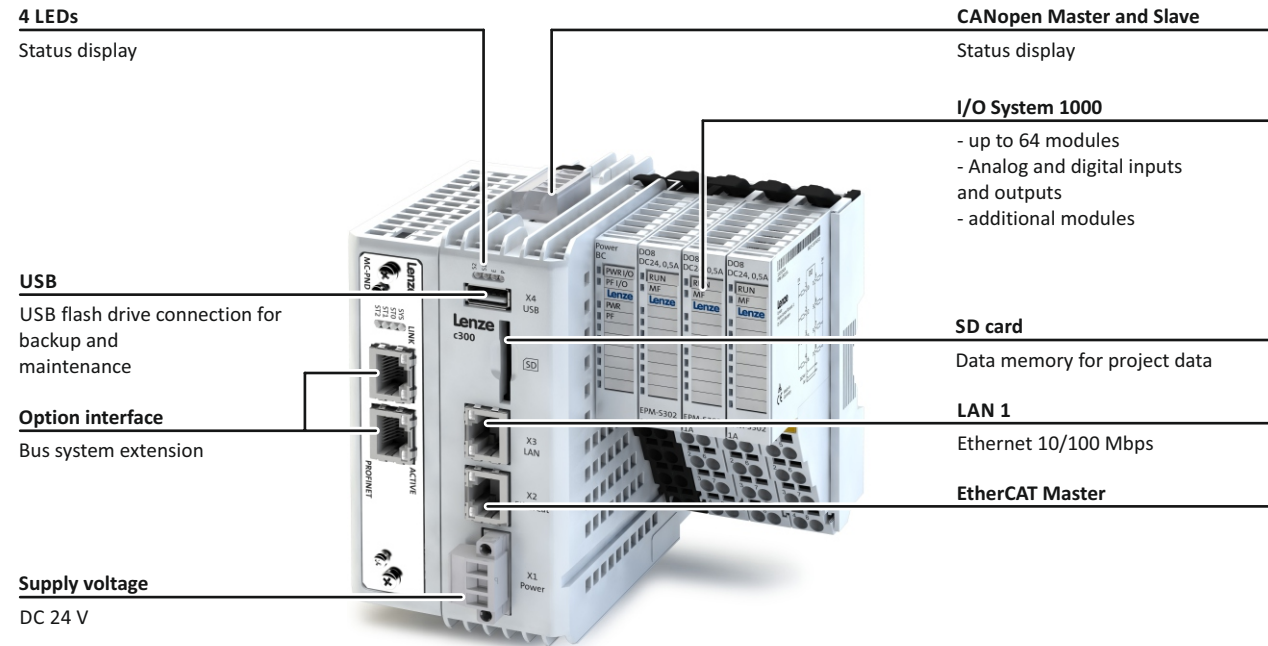
Controller c300

Controller c300

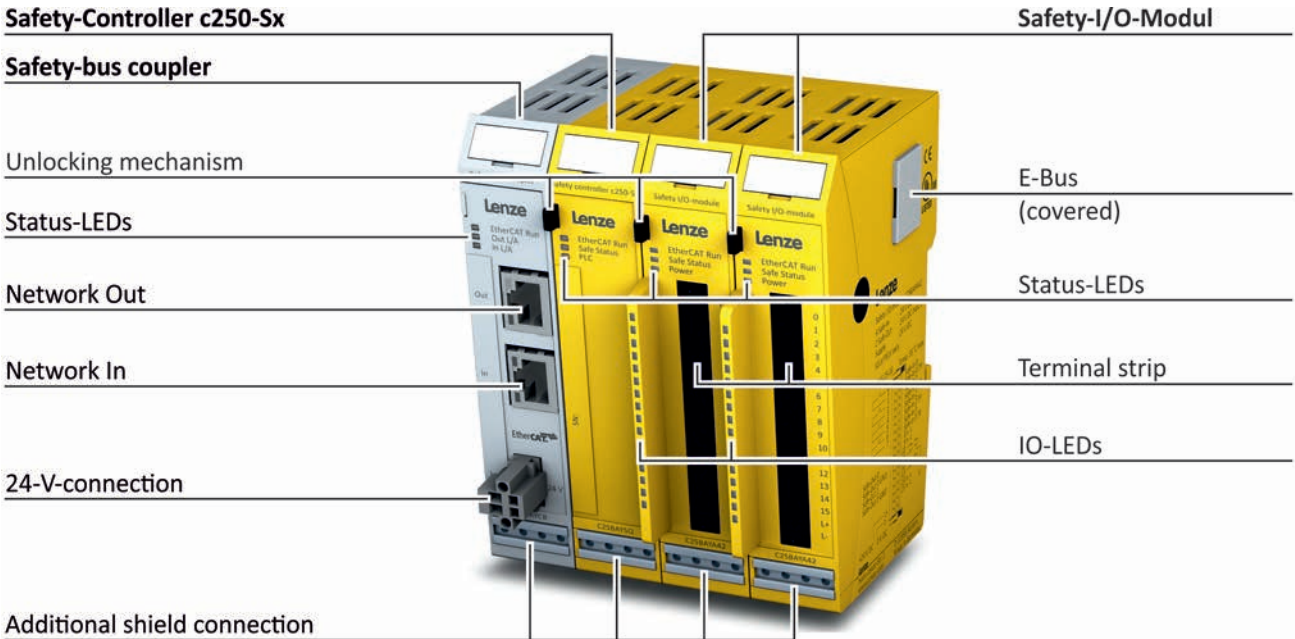
General information



Equipment



Safety topology extension



Controller c300

General information



Product information

Based on the 3200 C, the c300 fits seamlessly into our platform which is built on a consistently modern system architecture. The benefits: within the Controller-based Automation system, the precisely tailored Controller c300 takes responsibility for all of your control tasks. It focusses primarily on basic control (PLC) and motion tasks. Space-saving and intelligent at the same time.

Highlights

- Small control system with I/O modules which can be connected in series and integrated master interfaces for EtherCAT and CanOpen
- Easy standard set-up and data backup via USB flash drive
- Can be extended with communication interface PROFINET-Device)
- Future-proof due to compliance with industrial standards
- High system-availability
 - Integrated UPS solution
 - Easy device replacement thanks to replaceable memory card
- No maintenance required thanks to batteryless and fanless design

I/O system 1000 as local I/Os

At a speed of 48 Mbps, which is extremely fast, the c300 controller and the I/O modules communicate with each other via an extremely efficient backplane bus. Like this, it is possible to mount a great variety of configurations of the IO system directly on the controller in a flexible fashion. Precisely tailored to your application.

Safety topology with EtherCAT®

The Safety Controller c250-S clears the way for planning the complete drive and safety technology from one single source. The entire machine safety can be programmed with only one engineering tool, based on the PLCOpen standard - irrespective whether it is about "grey" or "yellow" control technology.

The deep integration of the functional safety into the automation system makes the engineering easier, improves the diagnostics options and reduces the number of interfaces and components.

This saves time and money and finally increases the availability and flexibility of the machine.



Controller c300

General information



Product information



Logic (PLC) and motion in a single device

- Optimised for machines/machine modules with central motion control
- Easy engineering thanks to central data storage



Easy to use

- Automated standard set-up and data backup via USB stick
- Easy device replacement by the pluggable SD card Application Credit 0
- Diagnostics via implemented web server or EASY Starter



Communicative

- EtherCAT® as a fast bus system directly on board (in preparation)
- CANopen on board
- Precisely tailored by modular extension option



High-precision control for optimum manufacturing results

- Touch probe-compatible inputs
- High-precision output control
- Highly deterministic backplane bus with precise 1 µs time stamp

IEC 61131-3



CODESYS

Prepared for the future thanks to compliance with industrial standards

- Programming in IEC61131-3
- Motion Control as per PLCopen
- PLC Designer based on CODESYS3



I/O system 1000 as local I/Os

- Permanent wiring due to separation of electronics and base module
- Fast diagnostics achieved thanks to clear labelling of the LEDs assigned to each channel
- Easy connection thanks to inclusion of printed circuit diagram
- Fully integrated shield connection without special shield terminals

Controller c300

General information

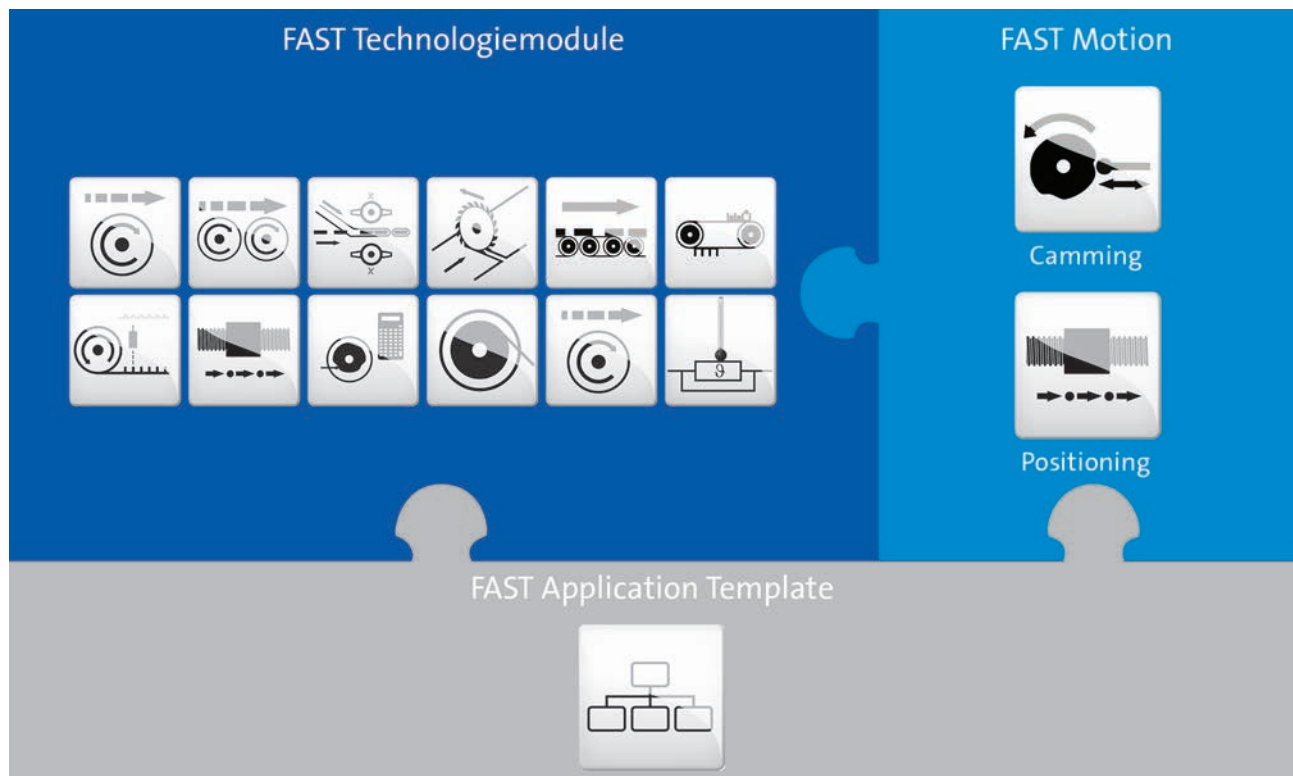


Lenze FAST

Lenze FAST (Feasibly Applicable Software Toolbox) provides Lenze standard software modules for easily developing a modular machine control.

For this purpose, the »PLC Designer« engineering tool with the "FAST Application Template" provides for an easy programming and commissioning as standardised software structure and with predefined technology modules.

FAST Motion functions serve to implement individual extensions. The »EASY Starter« can be used to subsequently optimise and diagnose the system.



FAST Application Template

The FAST Application Template is standardised by Lenze for a modularised and clear programming in the »PLC Designer«.

The FAST Application Template can be used via a library in the »PLC Designer«. The library contains the structure and basic functionality of the FAST Application Template (as, for instance, state machine and error handling).

Controller c300

General information



Lenze FAST

FAST technology modules

The predefined FAST technology modules serve to easily implement the desired machine functions.

The FAST technology modules are standardised software modules for a modular programming of the machine control. A FAST technology module features a complete and pre-tested drive function. Integrated basic functions and an integrated visualisation provide for an easy commissioning and testing of the modules. The reusability of the modules increases the quality of the software and considerably reduces the time required for programming, commissioning and testing.

FAST Motion

FAST Motion provides full flexibility and scalability for programming and comprises optimised function blocks based on "PLCopen motion control":

- "Motion Control" modules (based on PLCopen Motion Control (formerly part 1+2) are optimised for the basic functions "positioning" and "cams" (synchronising).

The FAST technology modules are contained in the »PLC Designer« as independent function blocks in a library. They use the standardised interfaces and can thus be easily integrated into the machine program, combined in any way and extended individually with FAST Motion functions.

If the functionalities of the FAST technology modules are not sufficient, they can be adapted and extended individually using the FAST Motion modules. These modules are capable to program any number of functions.

The »PLC Designer« contains the "Motion Control" modules in two libraries.

3.4

Controller c300

General information



Controller c300

Technical data



Standards and operating conditions

Mode			
Controller			c300
Conformity			
CE			EMC Directive
			2014/30/EU [UKCA: S.I. 2016/1091]
Approval			
UL 508C			Process Control Equipment (File-No. E236341)
UL/CSA			CSA C22.2 No. 61010-2-201 UL 61010-2-201
Degree of protection			
EN 60529			IP20
NEMA 250			
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (Temperature: -5 °C ... +45 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -25 °C ... +70 °C)
Operation (EN 60721-3-3)			3K3 (temperature: 0 °C ... +55 °C)
Degree of pollution			
EN 61131-2			2
Site altitude			
Amsl	H _{max}	[m]	2000
Vibration resistance			
Vibration (EN 61131-2)			1 g
Mechanical shock (EN 61131-2)			15 g
Noise emission			
EN 61000-6-4			Industrial premises
Noise immunity			
EN 61000-4-2			ESD: Severity 3
EN 61000-4-6			150 kHz ... 80 MHz, 10 V/m 80 % AM (1 kHz)
EN 61000-4-3			80 kHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz) 1.4 GHz ... 2.0 GHz, 3 V/m, 80 % AM (1kHz) 2.0 GHz ... 2.7 GHz, 1 V/m, 80 % AM (1kHz)
EN 61000-4-4			Burst: Severity 3

3.4

Controller c300

Technical data



Rated data

			
Mode			
Controller			c300
Processor type			
Fanless			ARM Cortex A8800
Storage medium			
SD card		[MB]	512
Interfaces			
Ethernet			1
EtherCAT Master			1
CANopen			1
USB			1
Rated voltage			
DC	$U_{N, DC}$	[V]	24
Max. current consumption			
With connected I/Os	I_{max}	[A]	0.70
Without connected I/Os	I_{max}	[A]	0.60
Operating system			
			Windows® Embedded Compact 7
Memory size			
Retain data		[kB]	128
Main memory (RAM)		[MB]	512
Min. internal flash memory		[GB]	2
Runtime			
FAST Runtime			•
Visualisation			•
Dimensions			
	h x b x t	[mm]	127 x 42 x 102
Mass			
	m	[kg]	0.33

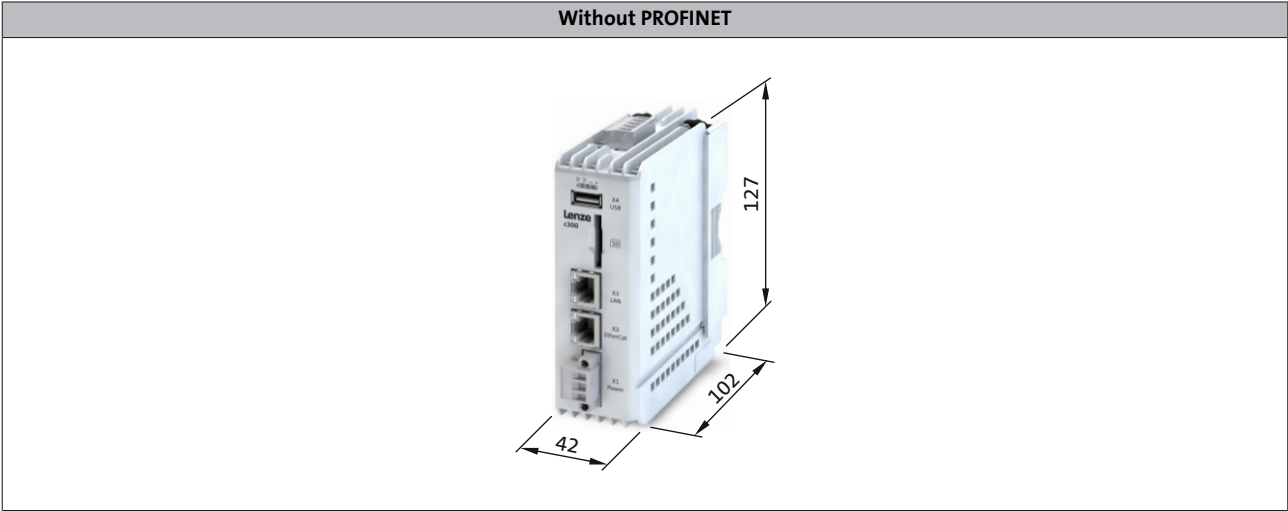
3.4

Controller c300

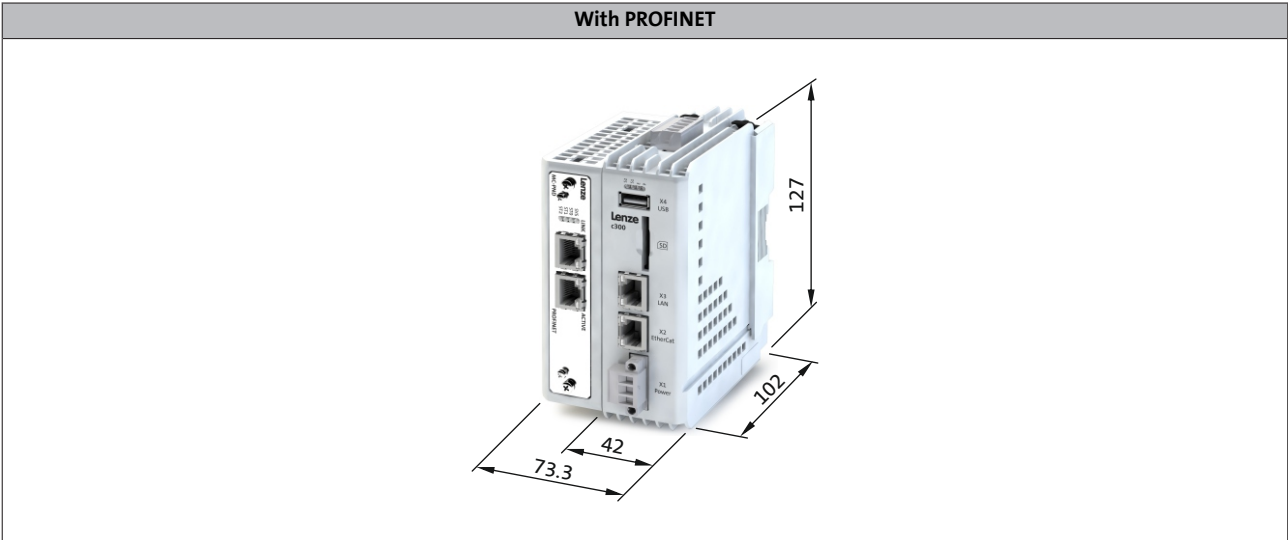
Technical data



Dimensions



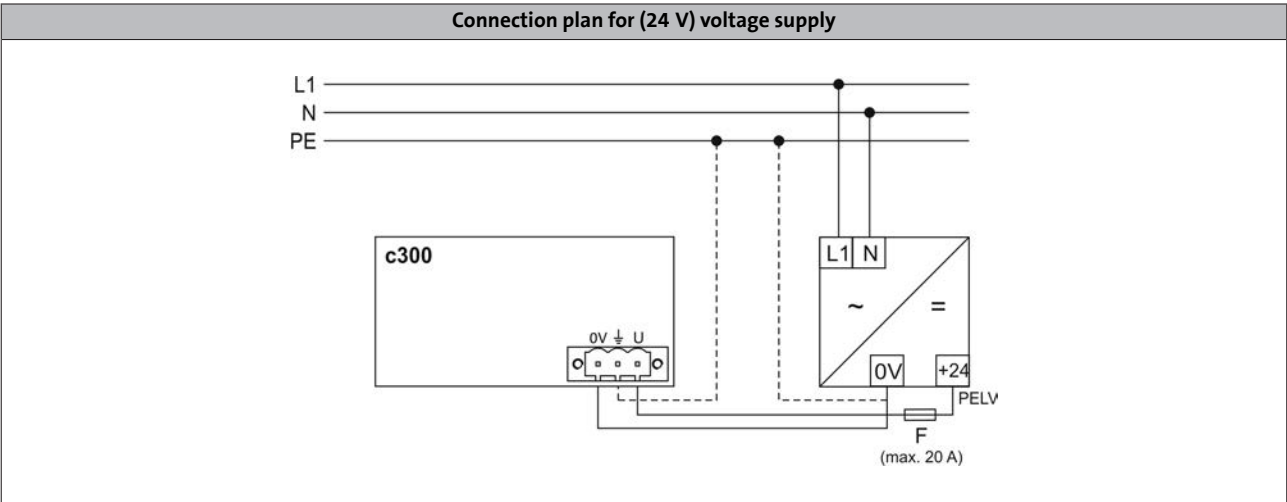
3.4



Dimensions [mm]



Connection plan



Mains connection

	Connection	Connection type	Cable type
	DC supply (24 V)	3-pole Combicon socket	Cable with Combicon-plug (cable cross-section max. 2.5 mm ²)

Controller c300

Accessories



Safety Controller

Safety in the system does not begin with the drives first, but at the control level.

With the expansion of the controller software to include the Safety Controller c250-S a complete automation solution is provided for safety engineering and control and drive tasks. Topped with the safety I/O module, all the safety aspects in the machine module can be evaluated.
EtherCAT is used for data transfer.



3.4

Mode		Features	Product key
Safety Controller c250-S	-	• Compact Controller c250-S for easy mounting using the DIN rail • High-quality safety solution thanks to PL e/SIL 3	C25BAYSQ
Safety bus coupler	-	• Supported network: EtherCAT with safety-over EtherCAT (FSOE = Fail Safe over EtherCAT)	C25BAYCB
Safety I/O module	-	• Expansion of the Safety Controller with 4 safe inputs and 2 safe outputs	C25BAYA42

Safety Controller	
Functions	Implementation according to PLCopen, TC 5
Equivalence / antivalence test	SF_Equivalent SF_Antivalent
Operation mode selector	SF_ModeSelector
Emergency stop, emergency off	SF_EmergencyStop
Monitoring of electro-sensitive protective equipment (ESPE)	SF_ESPE (electro-sensitive protective equipment)
Guard monitoring	SF_GuardMonitoring
Guard monitoring with locking	SF_GuardLocking
Two-hand control	SF_TwoHandControlTypeII SF_TwoHandControlTypeIII
Muting	SF_MutingSeq SF_MutingPar SF_MutingPar_2Sensors
Cyclic test of ESPE	SF_TestableSafetySensor
Enable switch	SF_EnableSwitch
Controlling safety output with standard controller and safety controller	SF_OutControl
Monitoring of feedback loop	SF_EDM (external device monitoring)

Technical data	
Rated current	240 mA via E-bus connection
DC supply voltage	5 V via E-bus connection 24 V via safety bus coupler
Dimensions h x w x d	120 mm x 25 mm x 90 mm
Degree of protection	IP20

Controller c300

Accessories



Application Credit

With Lenze FAST, technology modules for motion control are provided. In order that these modules are used, the following Application Credit is required. If different technology modules are used, the demand for Application Credit must be added for all modules used.

Mode		Features	Product key
Application Credit		• Licence for use of FAST Application Software, 50 points	EPCZEMSD0L1005
		• Licence for use of FAST Application Software, 100 points	EPCZEMSD0L1010
		• Licence for use of FAST Application Software, 150 points	EPCZEMSD0L1015
		• Licence for use of FAST Application Software, 200 points	EPCZEMSD0L1020
		• Licence for use of FAST Application Software, 300 points	EPCZEMSD0L1030
		• Licence for use of FAST Application Software, 400 points	EPCZEMSD0L1040
		• Licence for use of FAST Application Software, 500 points	EPCZEMSD0L1050
		• Licence for use of FAST Application Software, 600 points	EPCZEMSD0L1060
		• Licence for use of FAST Application Software, 700 points	EPCZEMSD0L1070
		• Licence for use of FAST Application Software, 1000 points	EPCZEMSD0L1100
		• Licence for use of FAST Application Software, 1200 points	EPCZEMSD0L1120
		• Licence for use of FAST Application Software, 1500 points	EPCZEMSD0L1150
		• Licence for use of FAST Application Software, 2000 points	EPCZEMSD0L1200
		• Licence for use of FAST Application Software, 2500 points	EPCZEMSD0L1250
		• Licence for use of FAST Application Software, 3000 points	EPCZEMSD0L1300
		• Licence for use of FAST Application Software, 4000 points	EPCZEMSD0L1400

FAST technology modules



Single drives

Technology module		Function	Points for use
Virtual Master		Implementation of a virtual master axis in the machine	25
Basic Motion		Provides easy basic motion functions: Manual jog, homing, absolute and relative positioning, continuous travel	
Electrical Shaft		Synchronisation and coupling of drives with precise speed and positioning.	
Flex Cam		Implementation of one or several electric cams. Flexible management of curves created online and offline.	50
Cross Cutter		Synchronised movements of drives for cross-sealing and/or cross-cutting of products.	100



Application Credit

FAST technology modules

Technology module		Function	Points for use
Register control		Implementation of a clock-synchronised drive for generating a register control with print mark detection.	100
Winder Dancer		Implementation of a winding drive with dancer position control and/or a winding drive with tensile force/speed control	
Table Positioning		Positioning profiles for single axes with smoothing and touch probe positioning	50
Flying Saw		Cutting and processing of material while moving	100
Temperature Control		Control of the temperature of a system that is provided with a heating element and a thermal sensor.	50
Smart Track		Distribution of products via several conveying belts. An intelligent distribution results in optimum packaging of products.	
Magic Track		The preparation of single products to package them in groups. Is implemented comfortably with the two-pass conveyor.	

3.4

FAST dimensioning

The FAST modules can be connected easily with the PLC Designer. Which module is to be selected, depends on the automation dimensioning of the machine. In order to define the correct Application Credit, the points of each module simply have to be added up. The required Application Credit is deducted each time a technology module is called.

Example 1:

- 1x Virtual Master (25 points)
- 1x Electrical Shaft (25 points)
- 2x Winder Dancer (200 points)
- 1x Cross Cutter (100 points)

Result: 350 points

Example 2:

- 1x Virtual Master (25 points)
- 1x Electrical Shaft (25 points)
- 2x Flex Cam (100 points)

Result: 150 points



Application Credit

FAST Motion

FAST Motion provides a scalable programming of function blocks based on "PLCopen Motion Control".
If you use the technology modules in the application, the basic functions of the FAST Motion are accessed both for single axes and for coordinated multi-axes systems.
If you do not want to use the technology modules for the motion control in your application, the application can, for instance, be implemented as well with your own program code on the basis of the FAST Motion.

3.4

Fast Motion		Function	Points for use
Motion Control		-	150

If you use FAST technology modules, the Application Credit already includes the required function of the FAST Motion. In this case, no additional points have to be considered for the use of the FAST Motion.

If you use the FAST Motion as a basic function for the motion control, the points according to the FAST Motion table apply.

Controller c300

Accessories



SD card and USB flash drive

SD cards and USB flash drives are available for data storage and data backups.

- ▶ A SD card is part of the scope of supply of the controller.
- ▶ SD card without Application Credit.

Mode		Features	Product key
Application Credit 0		• 512 MB	EPCZEMSD0L0000
USB flash drive		• 4 GB	EPCZEMUS6

24 V power supply unit

An external power supply unit is also available as an alternative for powering the controller's control electronics.



24 V power supply unit

Rated data

Product key			
			EZV2400-000
Rated voltage			
AC	$U_{N, AC}$	[V]	230
Rated mains current			
	$I_{N, AC}$	[A]	1.20
Output voltage			
	U_{out}	[V]	DC 22.5 ...28.5
Rated current			
	I_N	[A]	10.0
Dimensions			
	$h \times b \times t$	[mm]	130 x 85 x 125
Mass			
	m	[kg]	1.24

Controller c300

Accessories



Controller p500



Controller p500

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Controller p500

General information



Product key

Product

p 5 0 0

Product key

P 5 0 G A P 0 3 0 0 M5H X X X - 02 4 0 0 0

Display diagonal

9 – 17.8 cm (7 ")
4 – 26.4 cm (10.4 ")
6 – 38.1 cm (15 ")

Option interface MC 1

0 – No
6 – MC-PBS (PROFIBUS Slave)
8 – MC-PND (PROFINET Device)
9 – MC-CAN2 (CANopen)

Application Credit

S1 - Application Credit 0	AA - Application Credit 1200
A0 - Application Credit 50	AB - Application Credit 1500
A1 - Application Credit 100	AC - Application Credit 2000
A2 - Application Credit 150	AD - Application Credit 2500
A3 - Application Credit 200	AE - Application Credit 3000
A4 - Application Credit 300	AF - Application Credit 4000
A5 - Application Credit 400	
A6 - Application Credit 500	
A7 - Application Credit 600	
A8 - Application Credit 700	
A9 - Application Credit 1000	

Runtime software control technology

0 – No
3 – FAST Runtime

Power tags

15 - 1000 power tags
16 - 2000 power tags



Controller p500 - 17.8 cm (7")



Controller p500 - 26.4 cm (10.4")



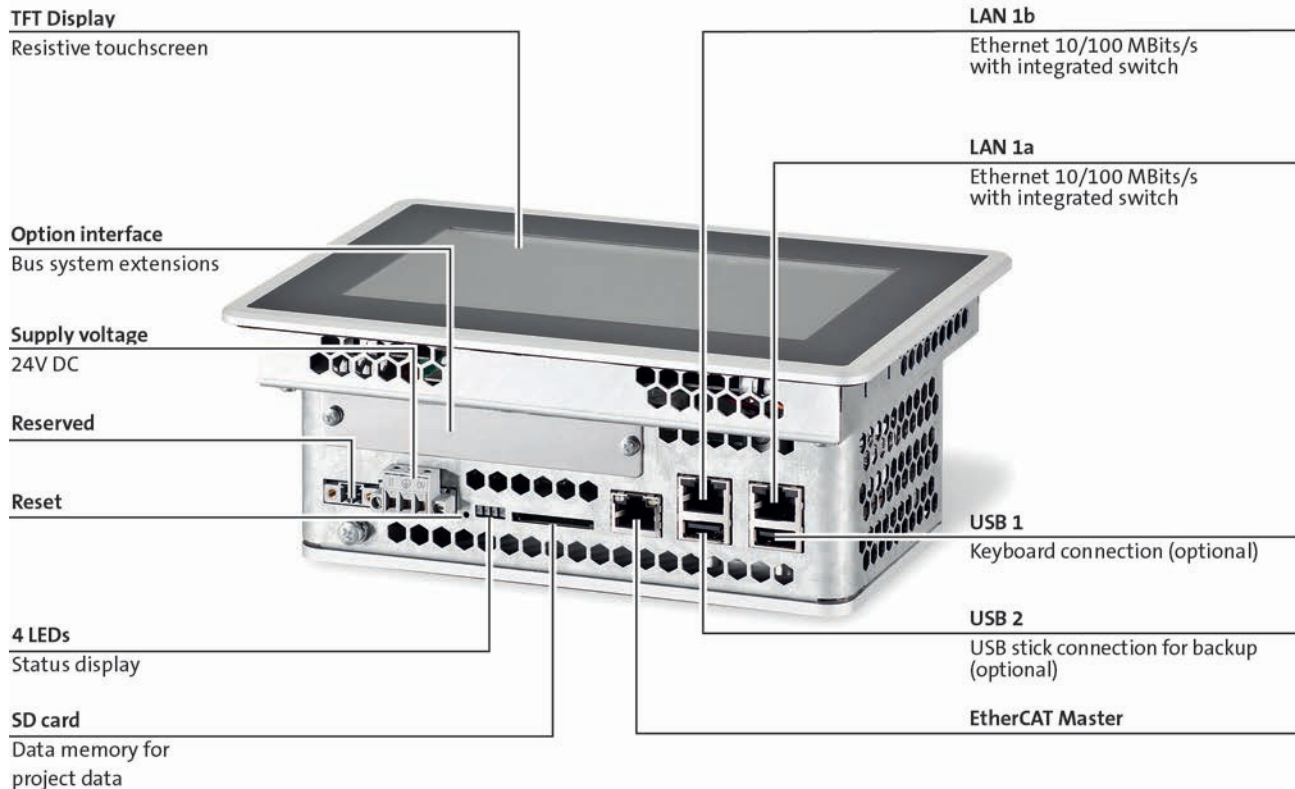
Controller p500 - 38.1 cm (15")

Controller p500

General information

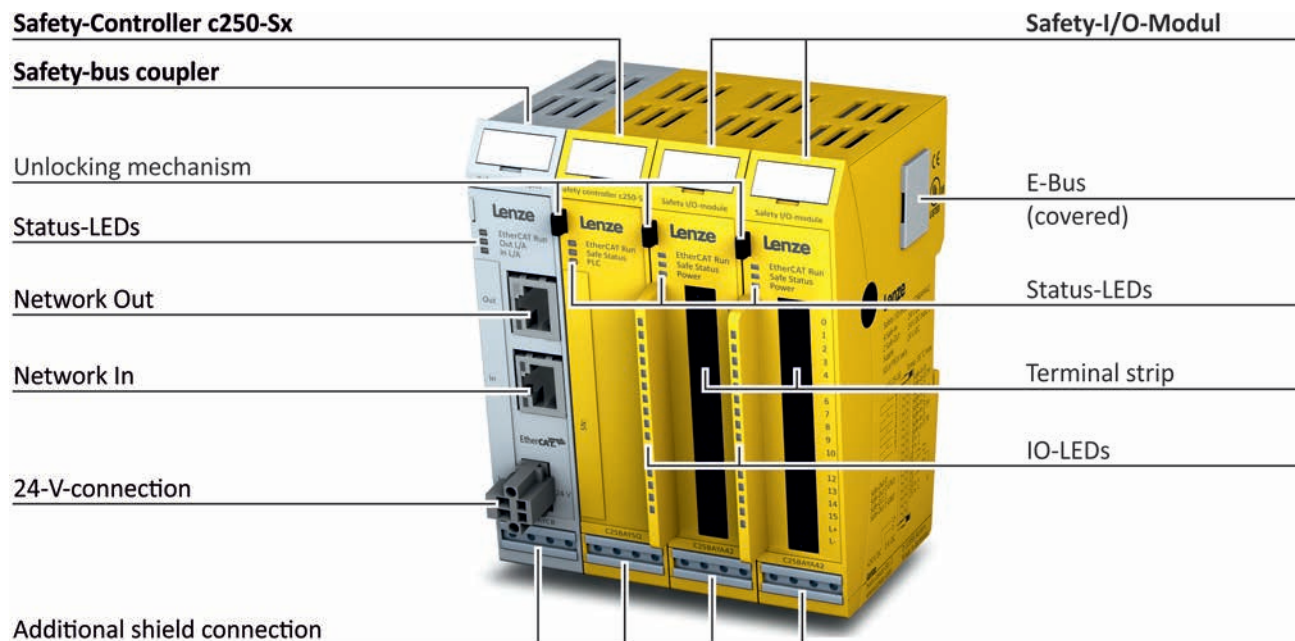


Equipment



3.5

Safety topology extension



Controller p500

General information



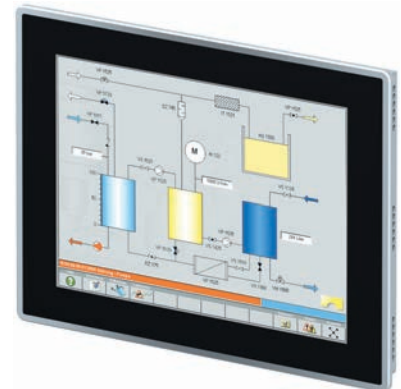
Product information

Control and visualisation combined in a compact unit.

We have taken yet another step towards creating an easier future with the p500 – a perfect combination of maintenance-free panel-mounted controller, logic (PLC), motion and visualisation in a single device. It is ideally suited for use as a control and visualisation system within Controller-based Automation systems, suiting applications with central motion control or as a visualisation device within a drive-based automation system.

Highlights

- Logic (PLC), motion and visualisation in a single device
- Machine-oriented and high-precision control for optimum manufacturing results
- Easy to use
- Prepared for the future thanks to compliance with industrial standards



Controller p500 - 38.1 cm (15")

Versions

The p500 device series encompasses 3 versions, which only differ in terms of their screen size. All other technical properties are absolutely identical.

Integrated Ethernet switch

The integrated switch allows line topologies to be established using Ethernet without the need for a separate switch as an infrastructure component. In addition to this, a free interface provides allows a diagnostics device such as a service technician's laptop to be connected without having to access the bus physics.

Safety topology with EtherCAT®

The Safety Controller c250-S clears the way for planning the complete drive and safety technology from one single source. The entire machine safety can be programmed with only one engineering tool, based on the PLCOpen standard - irrespective whether it is about "grey" or "yellow" control technology.

The deep integration of the functional safety into the automation system makes the engineering easier, improves the diagnostics options and reduces the number of interfaces and components. This saves time and money and finally increases the availability and flexibility of the machine.

Controller p500

General information



Product information



Logic (PLC), motion and visualisation in a single device

- Optimised for machine(modules) with central motion control
- Easy engineering thanks to central data storage



Easy to use

- Easy use of FAST via pluggable SD card with Application Credit for Motion Control or Coordinated Motion
- Automated standard set-up and data backup via USB stick
- Easy device replacement by means of the pluggable SD card with the corresponding Application Credit
- Diagnostics by implemented web server or EASY Starter

3.5



High degree of system availability

- Maintenance-free
- Fanless
- No battery

IEC 61131-3



CODESYS

Prepared for the future thanks to compliance with industrial standards

- Programming in IEC61131-3
- Motion Control as per PLCopen
- PLC Designer based on CODESYS3



Communicative

- EtherCAT® as a fast bus system directly on board (in preparation)
- CANopen on board
- Precisely tailored by modular extension option



Variable front panel concept

- Easy customizing of the front panels (foils, smart customising)

Controller p500

General information

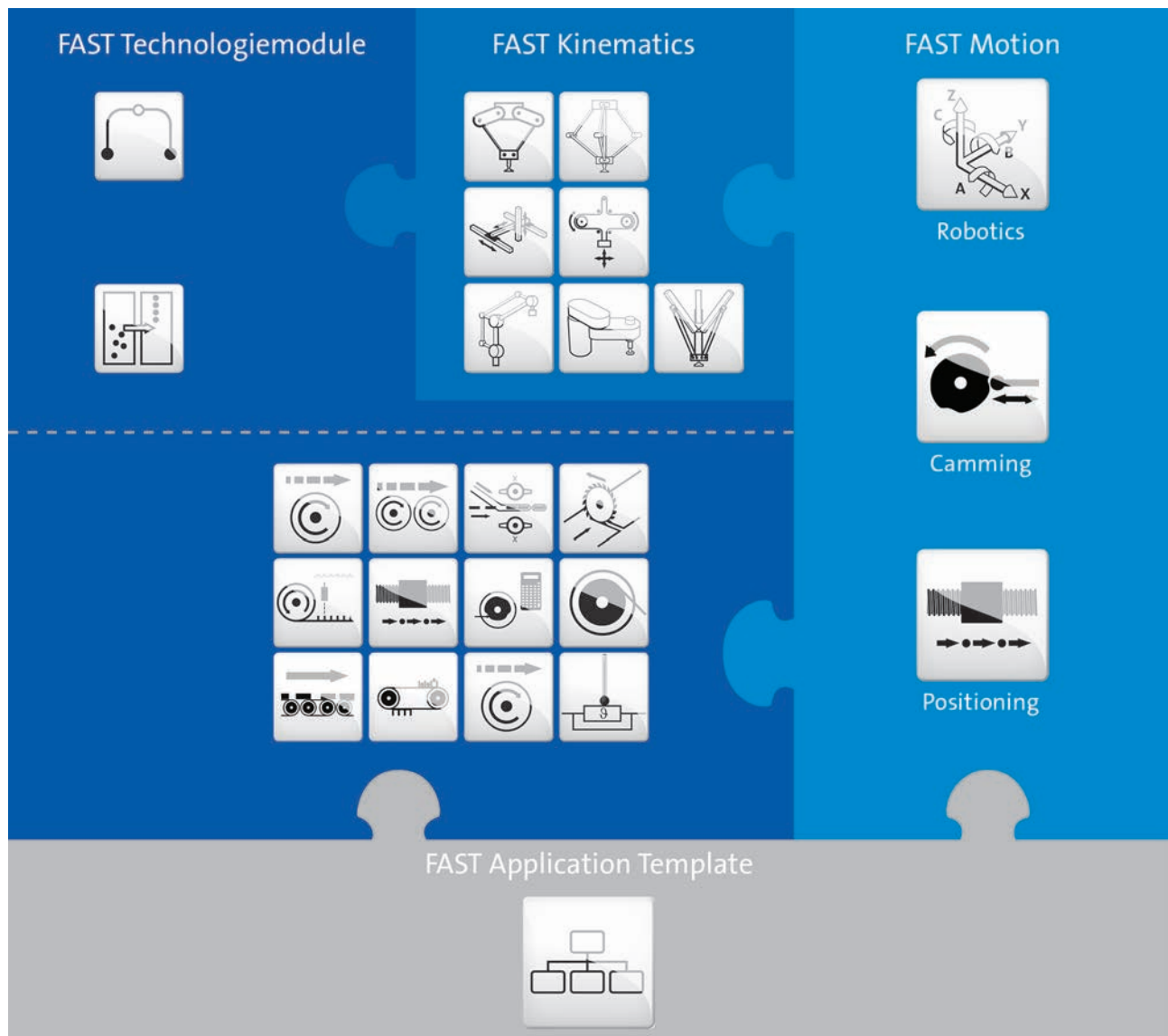


Lenze FAST

Lenze FAST (Feasibly Applicable Software Toolbox) provides Lenze standard software modules for easily developing a modular machine control.

FAST Motion functions serve to implement individual extensions. The »EASY Starter« can be used to subsequently optimise and diagnose the system.

For this purpose, the »PLC Designer« engineering tool with the "FAST Application Template" provides for an easy programming and commissioning as standardised software structure and with predefined technology modules.



FAST Application Template

The FAST Application Template is standardised by Lenze for a modularised and clear programming in the »PLC Designer«.

The FAST Application Template can be used via a library in the »PLC Designer«. The library contains the structure and basic functionality of the FAST Application Template (as, for instance, state machine and error handling).



Lenze FAST

FAST technology modules

The predefined FAST technology modules serve to easily implement the desired machine functions.

The FAST technology modules are standardised software modules for a modular programming of the machine control. A FAST technology module features a complete and pre-tested drive function. Integrated basic functions and an integrated visualisation provide for an easy commissioning and testing of the modules. The reusability of the modules increases the quality of the software and considerably reduces the time required for programming, commissioning and testing.

FAST Motion

FAST Motion provides full flexibility and scalability for machine programming and comprises optimised function blocks based on "PLCopen motion control":

- "Motion Control" modules (based on PLCopen Motion Control (formerly part 1+2) are optimised for the basic functions "positioning" and "cams" (synchronising).
- "Coordinated Motion" modules (based on PLCopen Coordinated Motion (part 4) are optimised for multi-axis coordinated three-dimensional movements – which can also be controlled via the FAST technology modules "Pick & Place".

The FAST technology modules are contained in the »PLC Designer« as independent function blocks in a library. They use the standardised interfaces and can thus be easily integrated into the machine program, combined in any way and extended individually with FAST Motion functions.

If the functionalities of the FAST technology modules are not sufficient, they can be adapted and extended individually using the FAST Motion modules. These modules are capable to program any number of functions.

The »PLC Designer« contains the "Motion Control" modules in two libraries and the "Coordinated Motion" modules in one library.

Controller p500

General information



3.5



Standards and operating conditions

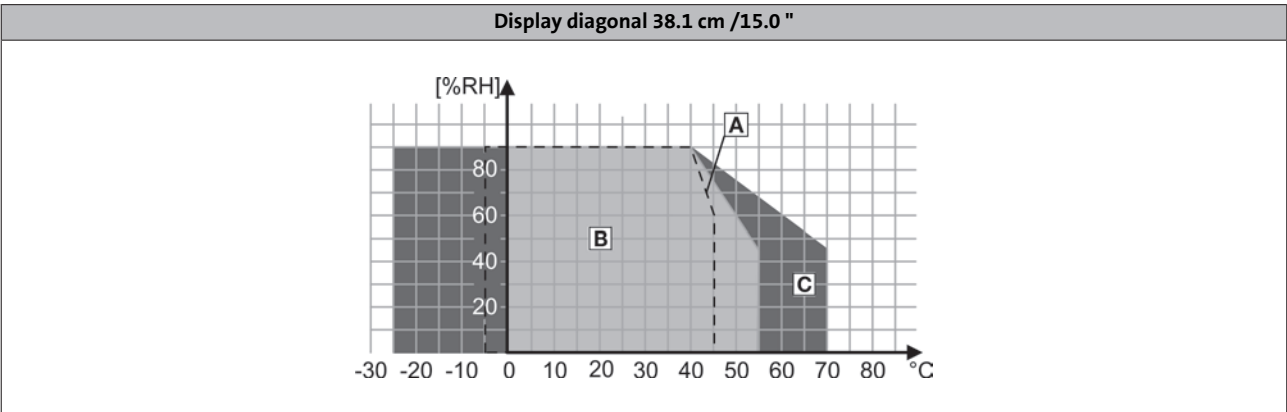
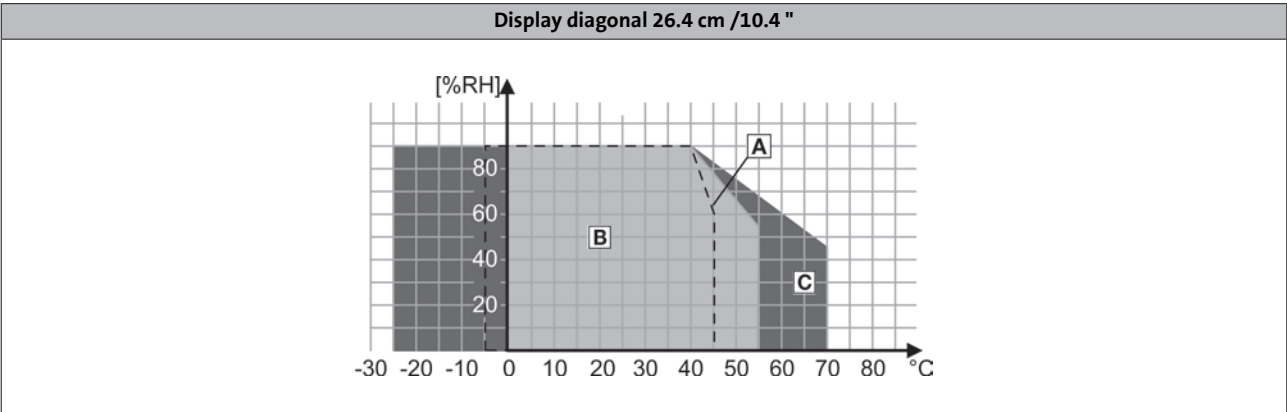
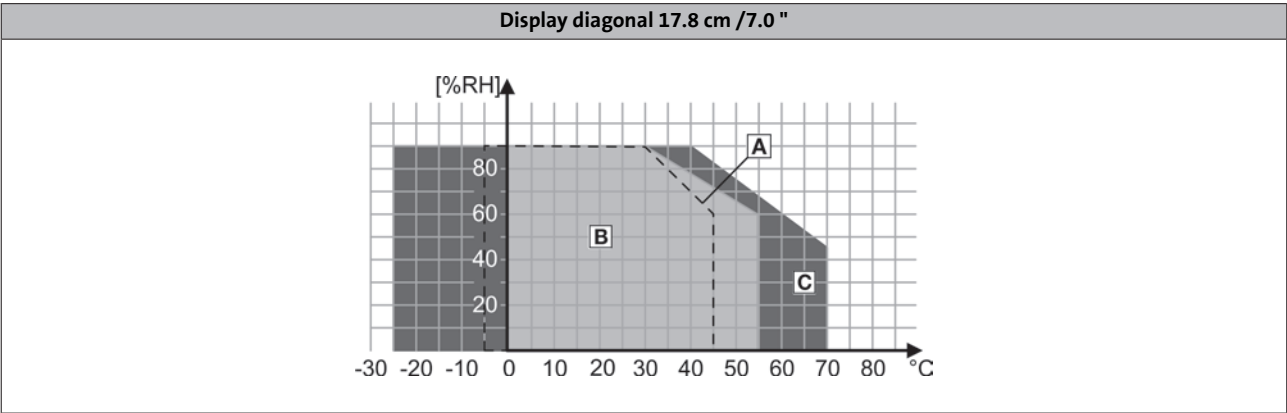
Mode			
Controller			p500
Conformity			
CE			EMC Directive
			2014/30/EU [UKCA: S.I. 2016/1091]
Approval			
UL 508C			Process Control Equipment (File-No. E236341)
UL/CSA			CSA 22.2 No.142
Degree of protection			
EN 60529			IP65 (front) IP20 (back)
NEMA 250			Type 1
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (Temperature: -5 °C ... +45 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -25 °C ... +70 °C)
Operation (EN 60721-3-3)			3K3 (temperature: 0 °C ... +55 °C)
Degree of pollution			
EN 61131-2			2
Site altitude			
Amsl	H _{max}	[m]	3000
Vibration resistance			
Vibration (EN 61131-2)			1 g
Mechanical shock (EN 61131-2)			15 g
Operation (Germanischer Lloyd)			5 Hz ≤ f ≤ 13.2 Hz: ± 1 mm amplitude
Noise emission			
EN 61000-6-4			Industrial premises
Noise immunity			
EN 61000-4-2			ESD: Severity 3
EN 61000-4-6			150 kHz ... 80 MHz, 10 V/m 80 % AM (1 kHz)
EN 61000-4-3			80 kHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz) 1.4 GHz ... 2.0 GHz, 3 V/m, 80 % AM (1kHz) 2.0 GHz ... 2.7 GHz, 1 V/m, 80 % AM (1kHz)
EN 61000-4-4			Burst: Severity 3



Standards and operating conditions

Relative humidity

3.5



- [A] Storage
- [B] Operation
- [C] Transport

Controller p500

Technical data



Rated data

						
Mode				p500		
Controller						
Display						
Screen diagonal			[cm]	17.8	26.4	38.1
			["]	7.0	10.4	15.0
Display				TFT		
Design				color		
Type				Graphics		
Number of colours				262144		
Resolution			[Pixel]	800 x 480	800 x 600	1024 x 768
Brightness			[cd/m²]	320	400	
Contrast				1 : 400	1 : 700	
Operator control						
Screen				Resistive touchscreen		
Processor type						
Fanless				Intel® Atom™ 1.75 GHz		
Storage medium						
SD card ¹⁾			[MB]	512		
Interfaces						
Ethernet (integrated switch)				2		
EtherCAT				1		
USB				2		
Option				Interface connection for CANopen (MC-CAN2) Interface connection for PROFIBUS Slave (MC-PBS) Interface connection for PROFINET-Device (MC-PND) Interface connection for EtherNet (MC-ETH) Interface connection for RS232, 422, 485 (MC-ISI)		
Supply voltage						
DC	U _{in}	± 25 %	[V]	24		
Max. current consumption						
	I _{max}		[A]	0.50 ²⁾ 1.20 ³⁾	0.60 ²⁾ 1.30 ³⁾	0.70 ²⁾ 1.50 ³⁾
Operating system						
				Windows® CE 6.0		

¹⁾ 1 x SD card included in the scope of supply.

²⁾ Without optional cards and USB load.

³⁾ 2x 500 mA USB 1+2, with MC-CAN2 module, 30 s max. after switching-on.

Controller p500

Technical data



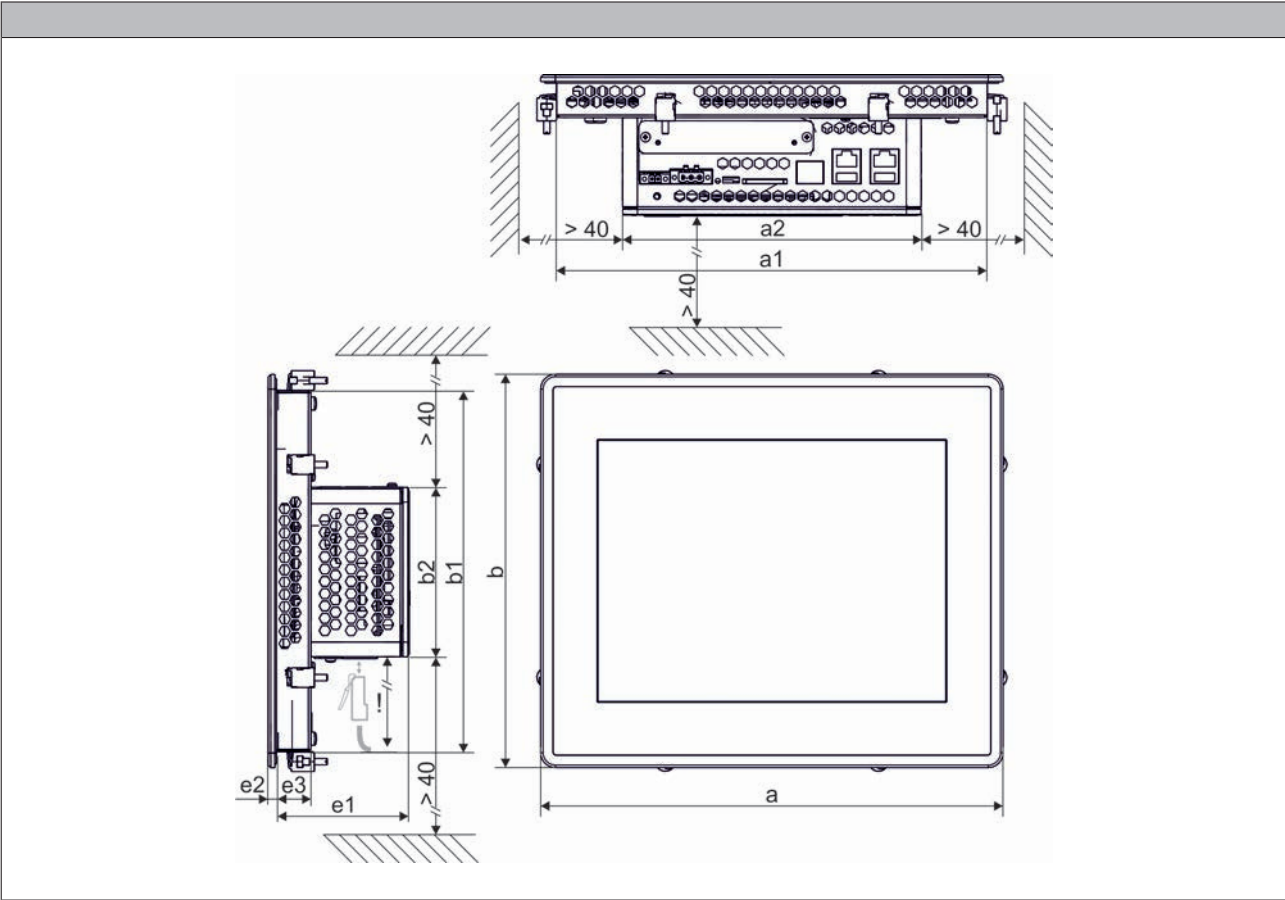
Rated data

					
Mode			p500		
Controller					
Display					
Screen diagonal		[cm]	17.8	26.4	38.1
		["]	7.0	10.4	15.0
Memory size					
Program memory		[MB]	512		
Data memory		[MB]	4000		
Flags		[kB]	4		
Retain data		[kB]	1024		
Max. number of persistently saved visualisation alarms			10000		
Main memory (RAM)		[GB]	2		
Min. internal flash memory		[GB]	4		
Runtime					
FAST Runtime ¹⁾			●		
Visualisation			●		
Dimensions					
	h x b x t	[mm]	155 x 210 x 86	240 x 282 x 86	310 x 390 x 93
Mass					
	m	[kg]	1.40	2.50	4.50

¹⁾ Optional



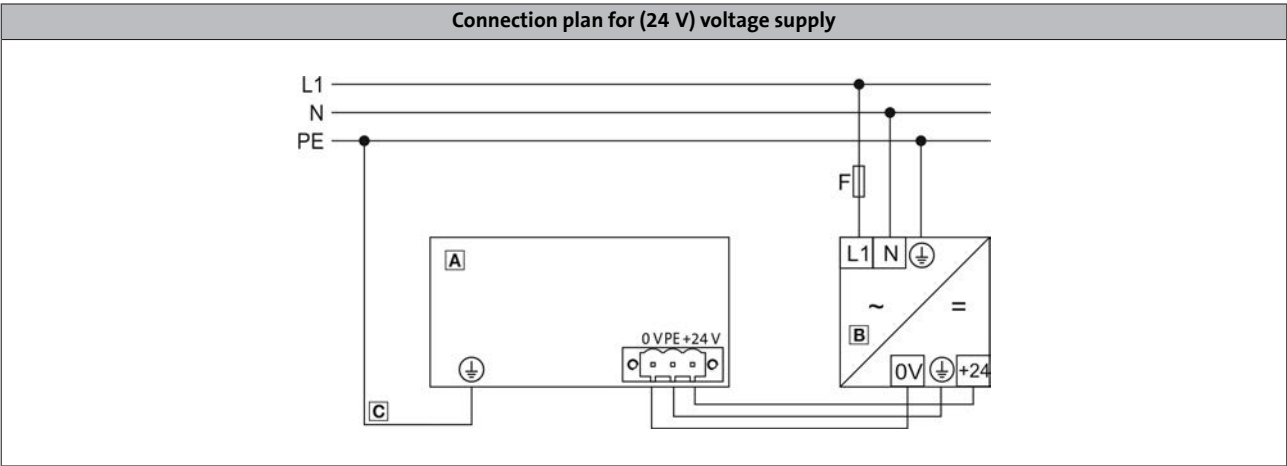
Dimensions



Display		Dimensions								
Screen diagonal										
		a	a ₁	a ₂	b	b ₁	b ₂	e ₁	e ₂	e ₃
[cm]	["]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
17.8	7.0	210	191	182	155	136	104	82.0	4.00	22.0
26.4	10.4	282	263	182	240	221	104	82.0	4.00	22.0
38.1	15.0	390	371	182	310	291	104	87.0	6.00	27.0



Connection plan



Position	Meaning
A	Controller
B	Power supply unit
C	Protective earth connection on the supply side (PE, internally bridged with GND)

Mains connection

	Connection	Connection type	Cable type
	DC supply (24 V)	3-pole Combicon socket	Cable with Combicon-plug (cable cross-section max. 2.5 mm²)
	PE connection	M4 (PH 2)	Separate earth conductor (1.2 ... 2.5 mm² with ring cable lug)



Safety Controller

Safety in the system does not begin with the drives first, but at the control level.

With the expansion of the controller software to include the Safety Controller c250-S a complete automation solution is provided for safety engineering and control and drive tasks. Topped with the safety I/O module, all the safety aspects in the machine module can be evaluated.

EtherCAT is used for data transfer.



Mode		Features	Product key
Safety Controller c250-S	-	- Compact Controller c250-S for easy mounting using the DIN rail - High-quality safety solution thanks to PL e/SIL 3	C25BAYSQ
Safety bus coupler	-	Supported network: EtherCAT with safety-over EtherCAT (FSOE = Fail Safe over EtherCAT)	C25BAYCB
Safety I/O module	-	Expansion of the Safety Controller with 4 safe inputs and 2 safe outputs	C25BAYA42

3.5

Safety Controller	
Functions	Implementation according to PLCopen, TC 5
Equivalence / antivalence test	SF_Equivalent SF_Antivalent
Operation mode selector	SF_ModeSelector
Emergency stop, emergency off	SF_EmergencyStop
Monitoring of electro-sensitive protective equipment (ESPE)	SF_ESPE (electro-sensitive protective equipment)
Guard monitoring	SF_GuardMonitoring
Guard monitoring with locking	SF_GuardLocking
Two-hand control	SF_TwoHandControlTypeII SF_TwoHandControlTypeIII
Muting	SF_MutingSeq SF_MutingPar SF_MutingPar_2Sensors
Cyclic test of ESPE	SF_TestableSafetySensor
Enable switch	SF_EnableSwitch
Controlling safety output with standard controller and safety controller	SF_OutControl
Monitoring of feedback loop	SF_EDM (external device monitoring)

Technical data	
Rated current	240 mA via E-bus connection
DC supply voltage	5 V via E-bus connection 24 V via safety bus coupler
Dimensions h x w x d	120 mm x 25 mm x 90 mm
Degree of protection	IP20

Controller p500

Accessories



Application Credit

With Lenze FAST, technology modules are provided for Motion Control and Coordinated Motion. In order that these modules are used, the following Application Credit is required.

If different technology modules are used, the demand for Application Credit must be added for all modules used.

Mode		Features	Product key
Application Credit		• Licence for use of FAST Application Software, 50 points	EPCZEMSD0L1005
		• Licence for use of FAST Application Software, 100 points	EPCZEMSD0L1010
		• Licence for use of FAST Application Software, 150 points	EPCZEMSD0L1015
		• Licence for use of FAST Application Software, 200 points	EPCZEMSD0L1020
		• Licence for use of FAST Application Software, 300 points	EPCZEMSD0L1030
		• Licence for use of FAST Application Software, 400 points	EPCZEMSD0L1040
		• Licence for use of FAST Application Software, 500 points	EPCZEMSD0L1050
		• Licence for use of FAST Application Software, 600 points	EPCZEMSD0L1060
		• Licence for use of FAST Application Software, 700 points	EPCZEMSD0L1070
		• Licence for use of FAST Application Software, 1000 points	EPCZEMSD0L1100
		• Licence for use of FAST Application Software, 1200 points	EPCZEMSD0L1120
		• Licence for use of FAST Application Software, 1500 points	EPCZEMSD0L1150
		• Licence for use of FAST Application Software, 2000 points	EPCZEMSD0L1200
		• Licence for use of FAST Application Software, 2500 points	EPCZEMSD0L1250
		• Licence for use of FAST Application Software, 3000 points	EPCZEMSD0L1300
		• Licence for use of FAST Application Software, 4000 points	EPCZEMSD0L1400

FAST technology modules



Single drives

Technology module		Function	Points for use
Virtual Master		Implementation of a virtual master axis in the machine	25
Basic Motion		Provides easy basic motion functions: Manual jog, homing, absolute and relative positioning, continuous travel	
Electrical Shaft		Synchronisation and coupling of drives with precise speed and positioning.	
Flex Cam		Implementation of one or several electric cams. Flexible management of curves created online and offline.	50
Cross Cutter		Synchronised movements of drives for cross-sealing and/or cross-cutting of products.	100



Application Credit

FAST technology modules

Technology module		Function	Points for use
Register control		Implementation of a clock-synchronised drive for generating a register control with print mark detection.	100
Winder Dancer		Implementation of a winding drive with dancer position control and/or a winding drive with tensile force/speed control	
Table Positioning		Positioning profiles for single axes with smoothing and touch probe positioning	50
Flying Saw		Cutting and processing of material while moving	100
Temperature Control		Control of the temperature of a system that is provided with a heating element and a thermal sensor.	50
Smart Track		Distribution of products via several conveying belts. An intelligent distribution results in optimum packaging of products.	
Magic Track		The preparation of single products to package them in groups. Is implemented comfortably with the two-pass conveyor.	



Application Credit

FAST technology modules



Coordinated multi-axes drives

Technology module		Function	Kinematics		Function	Points for use
Pick&Place		Implementation of complex three-dimensional movements by means of profiles for up to four drives with different kinematics.	Portal		Universal Cartesian portal kinematics with 2, 3 and 4 degrees of freedom for Pick&Place with high load capacities and big work-spaces	100
			Belt		Universally usable belt kinematics with 2 degrees of freedom *	
			Delta 2		Parallel kinematics with 2 degrees of freedom * for highly dynamic Pick&Place tasks	200
			Delta 3		Parallel kinematics with 3 degrees of freedom * for highly dynamic Pick&Place tasks	
			LinearDelta 3		Parallel kinematics with 3 degrees of freedom with linear axes for dynamic pick & place tasks.	
			Scara		Universal serial Scara kinematics with 2 and 3 degrees of freedom	
			Articulated P		Special form of an articulated arm kinematics with 4 degrees of freedom especially suitable for palletizing	
Track Pick & Place		Implementation of gripper movements which, for instance, pick up workpieces from a conveying belt and place or position them onto another conveying belt				300

FAST dimensioning

The FAST modules can be connected easily with the PLC Designer. Which module is to be selected, depends on the automation dimensioning of the machine. In order to define the correct Application Credit, the points of each module simply have to be added up. The required Application Credit is deducted each time a technology module is called.

Example 1:

- 1x Virtual Master (25 points)
 - 1x Electrical Shaft (25 points)
 - 2x Winder Dancer (200 points)
 - 1x Cross Cutter (100 points)
- Result: 350 points

Example 2:

- 1x Virtual Master (25 points)
 - 1x Electrical Shaft (25 points)
 - 2x Flex Cam (100 points)
- Result: 150 points



Application Credit

FAST Motion

FAST Motion provides a scalable programming of function blocks based on "PLCopen Motion Control".
If you use the technology modules in the application, the basic functions of the FAST Motion are accessed both for single axes and for coordinated multi-axes systems.
If you do not want to use the technology modules for the motion control in your application, the application can, for instance, be implemented as well with your own program code on the basis of the FAST Motion.

Fast Motion		Function	Points for use
Motion Control		-	150
			
Coordinated Motion			300

If you use FAST technology modules, the Application Credit already includes the required function of the FAST Motion. In this case, no additional points have to be considered for the use of the FAST Motion.

If you use the FAST Motion as a basic function for the motion control, the points according to the FAST Motion table apply.

Controller p500

Accessories



SD card and USB flash drive

SD cards and USB flash drives are available for data storage and data backups.

- ▶ A SD card is part of the scope of supply of the controller.
- ▶ SD card without Application Credit.

Mode		Features	Product key
Application Credit 0		• 512 MB	EPCZEMSD0L0000
USB flash drive		• 4 GB	EPCZEMUS6

3.5

24 V power supply unit

An external power supply unit is also available as an alternative for powering the controller's control electronics.



24 V power supply unit

Rated data

Product key			
			EZV2400-000
Rated voltage			
AC	$U_{N, AC}$	[V]	230
Rated mains current			
	$I_{N, AC}$	[A]	1.20
Output voltage			
	U_{out}	[V]	DC 22.5 ...28.5
Rated current			
	I_N	[A]	10.0
Dimensions			
	$h \times b \times t$	[mm]	130 x 85 x 125
Mass			
	m	[kg]	1.24



CAN bus connector

The connector is used to connect the CAN to inverters which are provided with a Sub-D connection for the CAN bus. An integrated CAN terminating resistor can be switched on/off. Internal spring terminals make the use of special mounting tools superfluous. The switch setting can be read from two sides.

Mode		Features	Product key
CAN bus connector: Node		- Sub-D, 90° - Screw terminals	EPM-T950
CAN bus connector: Terminating		- Sub-D, 90° - Screw terminals - Integrated terminating resistor	EPM-T951
CAN bus connector: Straight		- Sub-D, 180° - Screw terminals - Switchable terminating resistor	EPM-T952
CAN bus connector: Switch		- Sub-D, 90° - Spring-loaded terminal - Switchable terminating resistor	EWZ0046

3.5

Protection films

Mode		Features	Product key
10.9 cm (4.3")		Protection of the surface against chemicals and mechanical damages (Packaging unit: 2 pieces)	EPCZMFD8
17.8 cm (7")			EPCZMFD9
26.4 cm (10.4")			EPCZMFD4

MC cards

In addition to the available standard interfaces, the Controllers can be optionally extended with further fieldbuses. This enables a very universal implementation into the machine control. These fieldbuses can be ordered or retrofitted as MC cards.

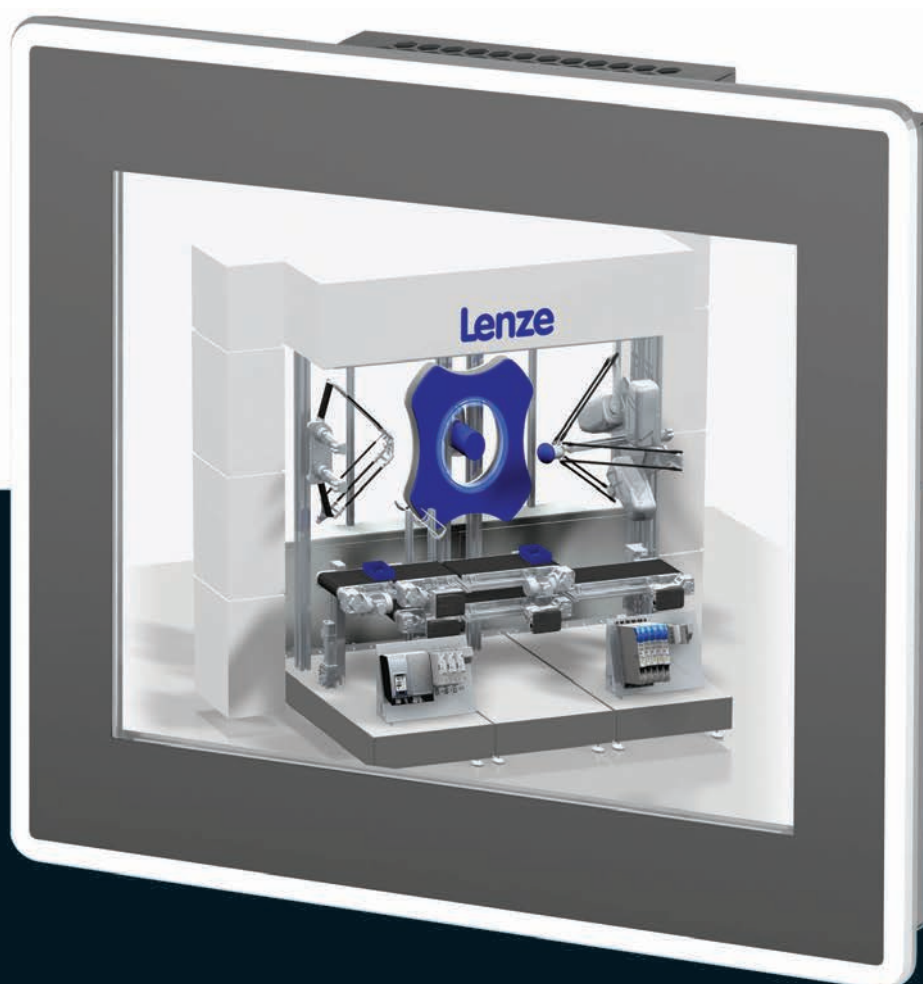
Mode	Features	Product key
MC card	• 2 x CAN interface (MC-CAN2)	EPCZEBKM9
	• 1 x PROFIBUS slave (MC-PBS)	EPCZEBKM6
	• 1 x PROFINET device (MC-PND)	EPCZEBKM8
	• 1 x RS232, RS422, RS485 (MC-ISI)	EPCZEBKMD
	• 1 x EtherNet (MC-ETH)	EPCZEBKM1

Controller p500

Accessories



Controller p300



Controller p300

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Controller p300

General information



Product key

Product

p 3 0 0

Product key

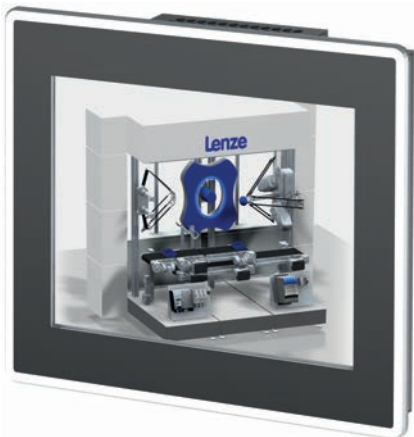
P 3 0 G A			0		0 0 F 3 G		X X X - 0 2 S 3			1		0 0 0
Type												
P - Panel Controller												
H - HMI												
Display diagonal												
8 - 10.9 cm (4.3 ")												
9 - 17.8 cm (7 ")												
4 - 26.4 cm (10.4 ")												
Type												
3 - Standard layout												
8 - Rear control cabinet installation												
Option interface MC 1												
0 - No												
8 - MC-PND (PROFINET Device)												
Operating system												
C - WEC7 Core												
D - WEC7 Prof												
Runtime software control technology												
0 - No												
3 - FAST Runtime												
Power tags												
4 - 500 power tags												
5 - 1000 power tags												



Controller p300 - 10.9 cm (4.3")



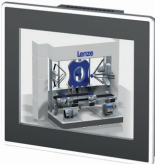
Controller p300 - 17.8 cm (7")



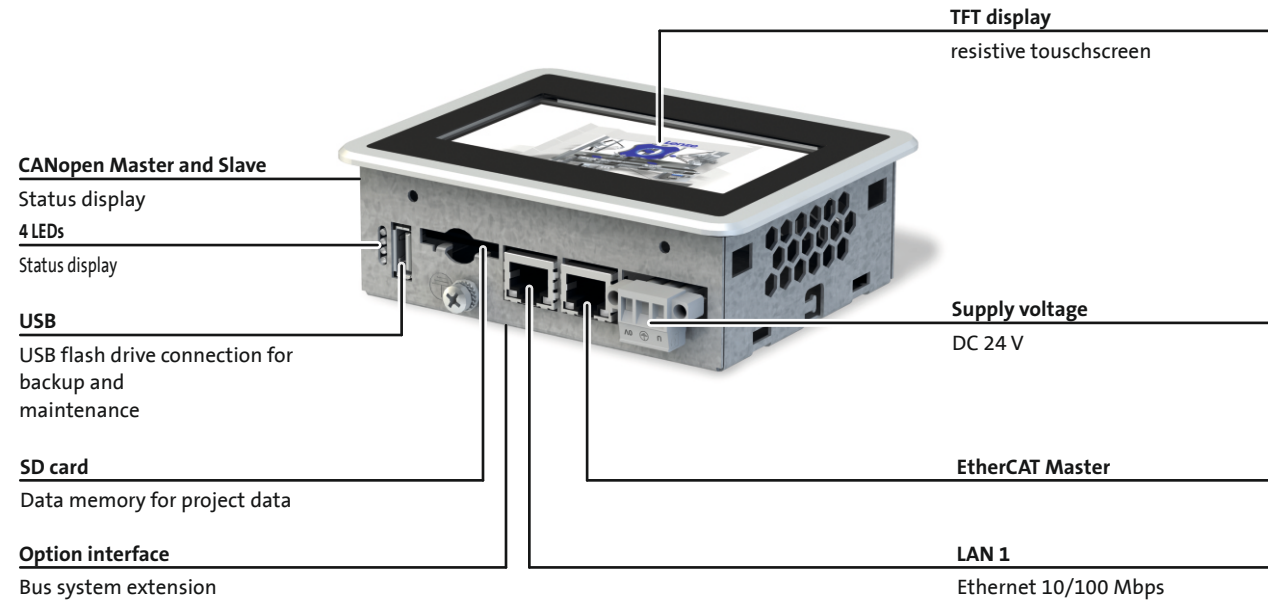
Controller p300 - 26.4 cm (10.4")

Controller p300

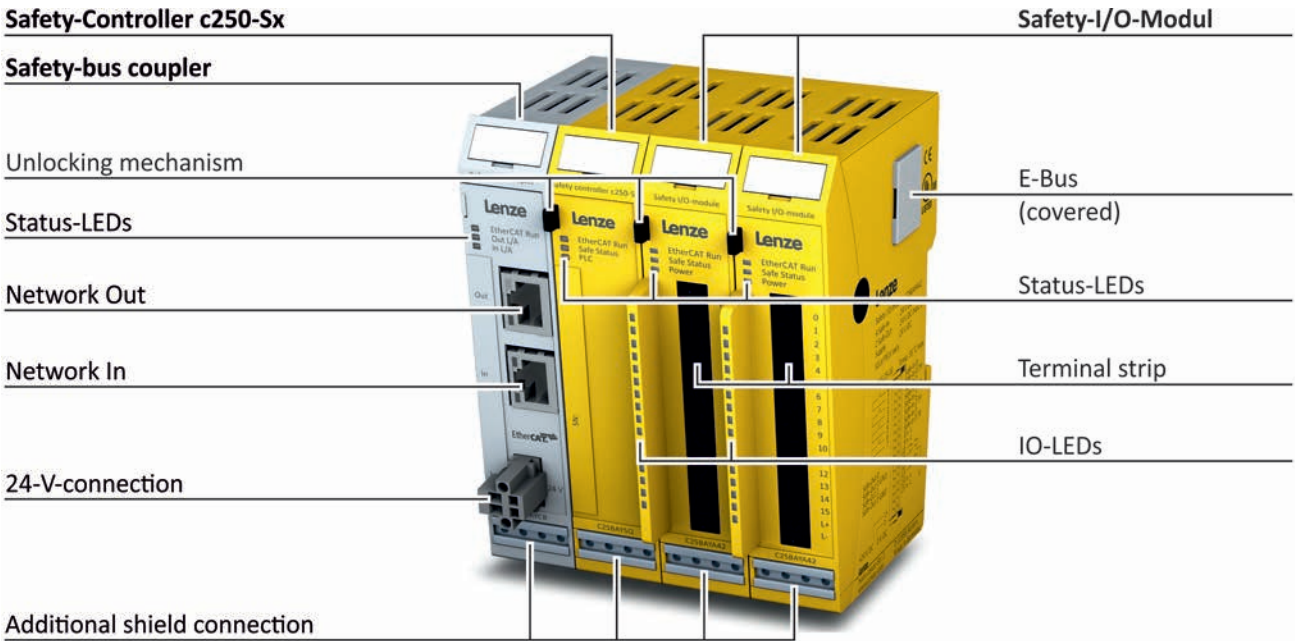
General information



Equipment

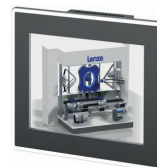


Safety topology extension



Controller p300

General information



Product information

So small, and yet so powerful!

Based on the p500 panel controller, the new p300 fits seamlessly into our platform which is built on a consistently modern system architecture.

It combines logic (PLC) and visualisation in a compact device and is ideally suited to machine applications which only require a low processing power. With the same system properties as its older brother (p500), its true strength lies in its visualisation capabilities when used as an HMI.

Highlights

- Robust industry-compliant Panel Controller available in sizes 10.9 cm (4.3"), 17.8 cm (7") and 26.4 cm (10.4")
- For basic to complex control and visualisation tasks
- Uniform engineering in all phases of the customer's machine development process
- High degree of system availability
 - Integrated UPS solution
 - Easy device replacement thanks to replaceable memory card
- No maintenance required thanks to batteryless and fanless design

Variants

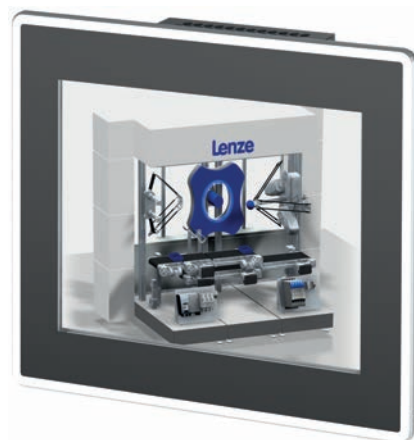
The p300 device series comprises 3 variants differing in the display size and therefore in the design and dimension of the front module. The panel controllers are available with screen diagonals of 10.9 cm (4.3"), 17.8 cm (7"), and 26.4 cm (10"). All technical properties of the controller unit are identical in this series.

Safety topology with EtherCAT®

The Safety Controller c250-S clears the way for planning the complete drive and safety technology from one single source. The entire machine safety can be programmed with only one engineering tool, based on the PLCOpen standard - irrespective whether it is about "grey" or "yellow" control technology.

The deep integration of the functional safety into the automation system makes the engineering easier, improves the diagnostics options and reduces the number of interfaces and components.

This saves time and money and finally increases the availability and flexibility of the machine.



Operator control and process monitoring functions — p300 as HMI

The strength of the p300 lies in visualisation tasks. With the integrated VisiWinNET® visualisation system and the optional logic control system, the devices are also cost-effective and powerful complete systems for operator control and process monitoring. Thanks to tried-and-tested standard interfaces, the devices offer a variety of options for communication with the Lenze system world as well as with master controls.

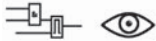
For an easy dialog between people and machines.

Controller p300

General information

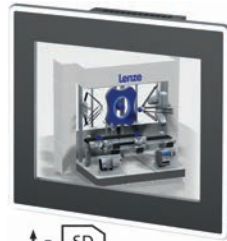


Product information



Logic (PLC) and visualisation in a single device

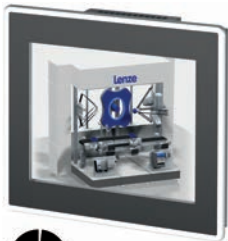
- Optimised for machines/modules with central motion control
- Easy engineering thanks to central data storage



Easy to use

- Automated standard set-up and data backup via USB stick
- Easy device replacement by the pluggable SD card Application Credit 0
- Diagnostics via implemented web server or EASY Starter

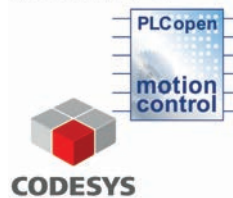
3.6



High degree of system availability

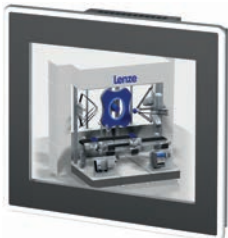
- Maintenance-free
- Fanless
- No battery

IEC 61131-3



Prepared for the future thanks to compliance with industrial standards

- Programming in IEC61131-3
- PLC Designer based on CODESYS 3



Communicative

- EtherCAT® as a fast bus system directly on board (in preparation)
- CANopen on board
- Precisely tailored by modular extension option

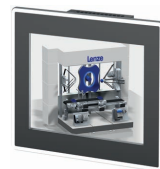


Variable front panel concept

- Easy customizing of the front panels (foils, smart customising)

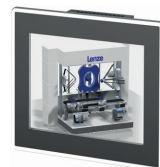
Controller p300

General information



Controller p300

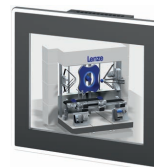
Technical data



Standards and operating conditions

Mode			p300		
Controller					
Display					
Screen diagonal	[cm]		10.9	17.8	26.4
	["]		4.3	7.0	10.4
Conformity			EMC Directive		
CE			2014/30/EU [UKCA: S.I. 2016/1091]		
Approval			Process Control Equipment (File-No. E236341)		
UL 508C			CSA C22.2 No. 61010-2-201		
UL/CSA			UL 61010-2-201		
Degree of protection			IP65 (front)		
EN 60529			IP20 (back)		
NEMA 250			Type 4		
Climatic conditions			1K3 (Temperature: -5 °C ... +45 °C)		
Storage (EN 60721-3-1)			2K3 (temperature: -25 °C ... +70 °C)		
Transport (EN 60721-3-2)			3K3 (temperature: 0 °C ... +50 °C)		
Operation (EN 60721-3-3)			3K3 (temperature: 0 °C ... +55 °C)		
Degree of pollution			2		
EN 61131-2					
Site altitude					
Amsl	H _{max}	[m]	2000	3000	
Vibration resistance			1 g		
Vibration (EN 61131-2)			15 g		
Mechanical shock (EN 61131-2)					
Noise emission			Industrial premises		
EN 61000-6-4					
Noise immunity			ESD: Severity 3		
EN 61000-4-2			150 kHz ... 80 MHz, 10 V/m 80 % AM (1 kHz)		
EN 61000-4-6			80 kHz ... 1000 MHz, 10 V/m 80 % AM (1 kHz)		
EN 61000-4-3			1.4 GHz ... 2.0 GHz, 3 V/m, 80 % AM (1kHz)		
			2.0 GHz ... 2.7 GHz, 1 V/m, 80 % AM (1kHz)		
EN 61000-4-4			Burst: Severity 3		

3.6

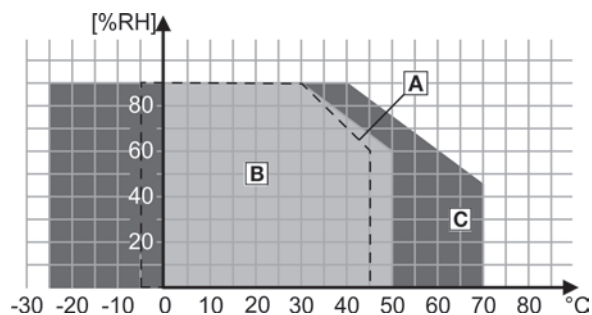


Standards and operating conditions

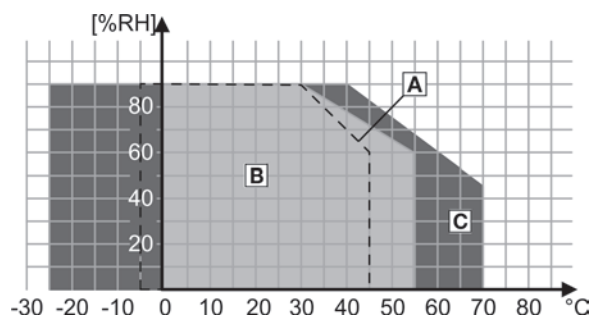
Relative humidity

3.6

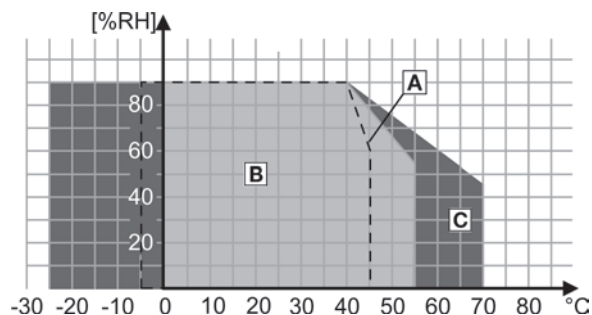
Display diagonal 10.9 cm / 4.3 "



Display diagonal 17.8 cm / 7.0 "



Display diagonal 26.4 cm / 10.4 "



- [A] Storage
- [B] Operation
- [C] Transport

Controller p300

Technical data



Rated data

						
Mode				p300		
Controller						
Display						
Screen diagonal			[cm]	10.9	17.8	26.4
			["]	4.3	7.0	10.4
Display				TFT		
Design				color		
Type				Graphics		
Number of colours				262144		
Resolution			[Pixel]	480 x 272	800 x 480	800 x 600
Brightness			[cd/m ²]	400	320	400
Contrast				1 : 400		1 : 700
Operator control						
Screen				Resistive touchscreen		
Processor type						
Fanless				ARM Cortex A8800		
Storage medium						
SD card			[MB]	512		
Interfaces						
Ethernet				1		
EtherCAT Master				1		
CANopen				1		
USB				1		
Option ¹⁾				Interface connection for PROFINET-Device (MC-PND)		
Supply voltage						
DC	U _{in}	± 25 %	[V]	24		
Max. current consumption						
	I _{max}		[A]	0.85	0.90	0.95
Operating system						
				Windows® Embedded Compact 7		

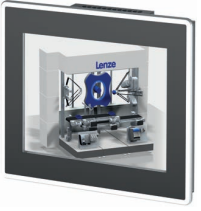
¹⁾ In preparation.

Controller p300

Technical data



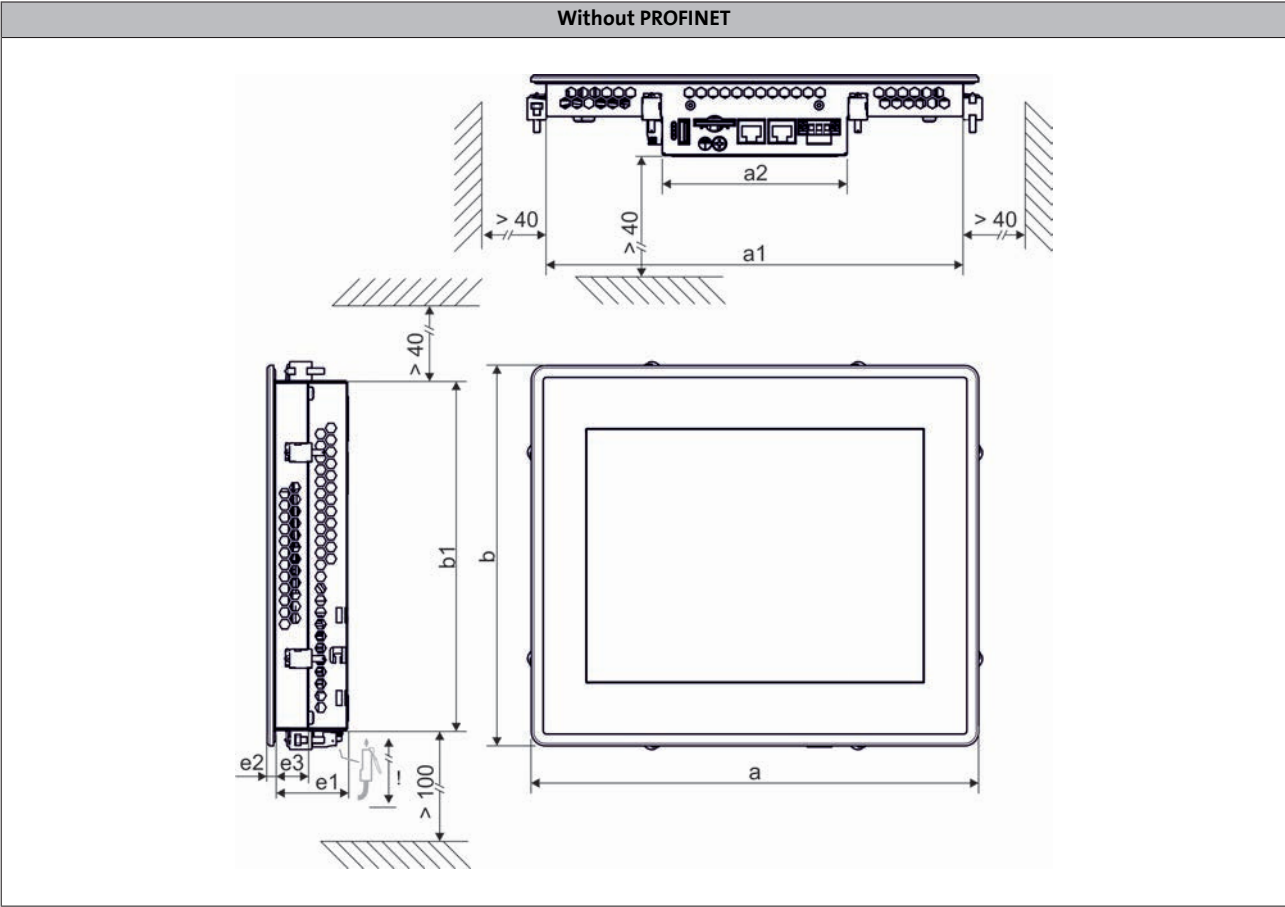
Rated data

					
Mode			p300		
Controller					
Display					
Screen diagonal		[cm]	10.9	17.8	26.4
		["]	4.3	7.0	10.4
Memory size					
Retain data		[kB]	128		
Main memory (RAM)		[MB]	512		
Min. internal flash memory		[GB]	2		
Runtime					
FAST Runtime ¹⁾			●		
Dimensions					
	h x b x t	[mm]	130 x 104 x 45	210 x 155 x 51	282 x 240 x 51
Mass					
	m	[kg]	0.53	1.10	2.10

¹⁾ Optional



Dimensions

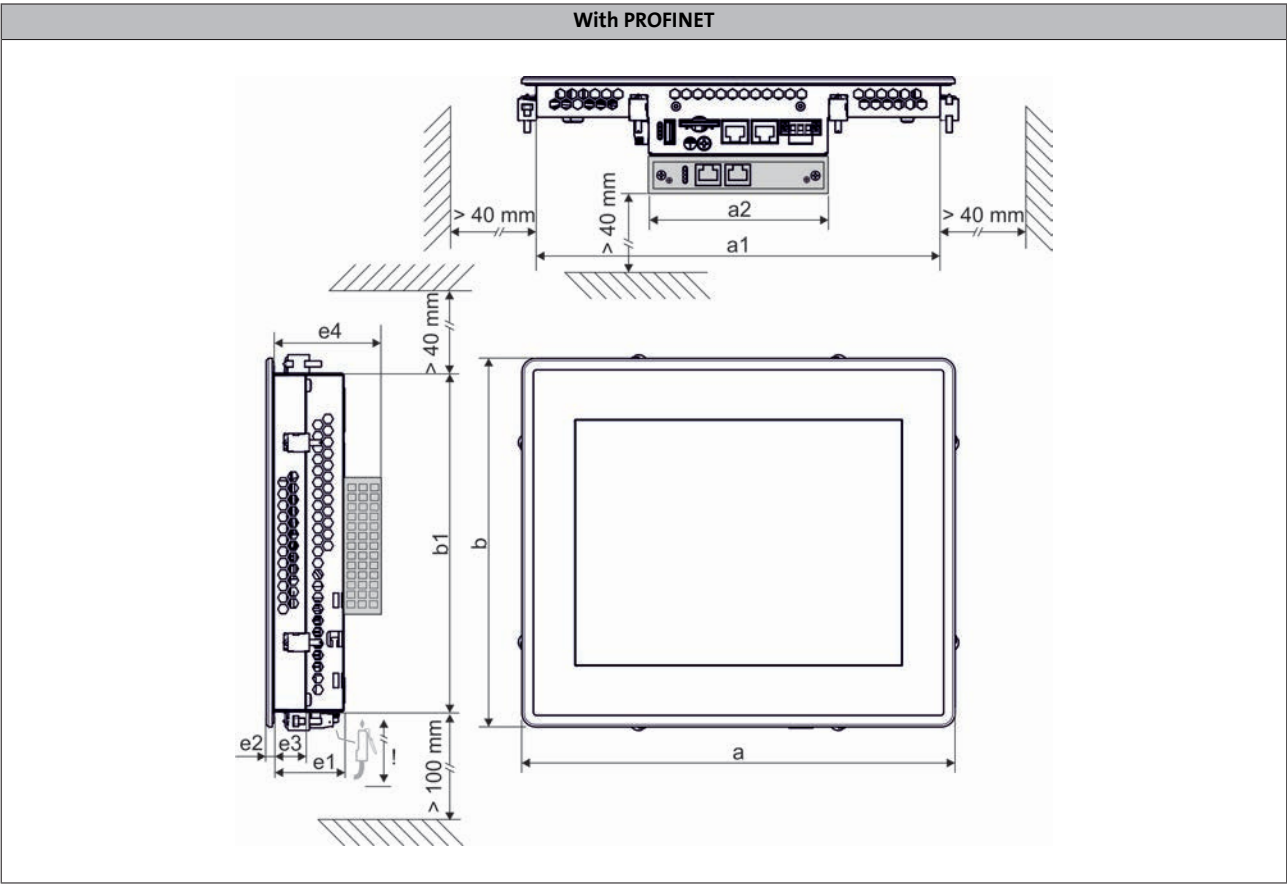


3.6

Display		Dimensions							
Screen diagonal									
		a	a ₁	a ₂	b	b ₁	e ₁	e ₂	e ₃
[cm]	["]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
10.9	4.3	130	117	117	104	91.0	42.0	3.00	
17.8	7.0	210	191	117	155	136	47.0	4.00	22.0
26.4	10.4	282	263	117	240	221	47.0	4.00	22.0



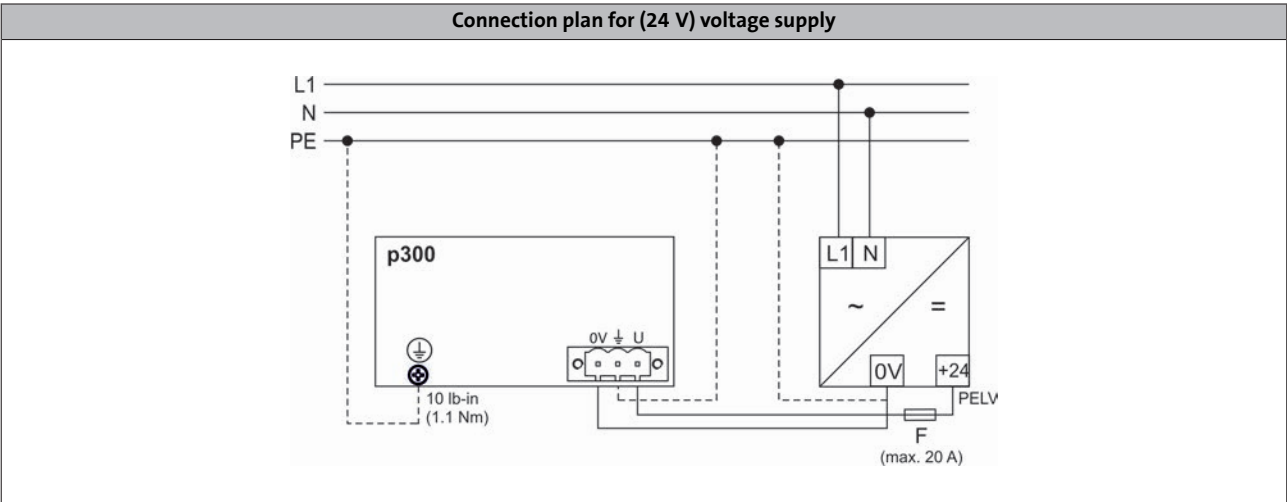
Dimensions



Display		Dimensions								
Screen diagonal										
		a	a ₁	a ₂	b	b ₁	e ₁	e ₂	e ₃	e ₄
[cm]	["]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
10.9	4.3	130	117	117	104	91.0	42.0	3.00		73.0
17.8	7.0	210	191	117	155	136	47.0	4.00	22.0	78.0
26.4	10.4	282	263	117	240	221	47.0	4.00	22.0	78.0

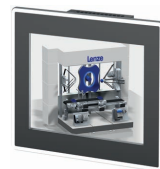


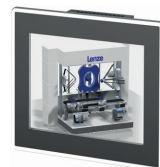
Connection plan



Mains connection

	Connection	Connection type	Cable type
	DC supply (24 V)	3-pole Combicon socket	Cable with Combicon-plug (cable cross-section max. 2.5 mm ²)
	PE connection	M4 (PH 2)	Separate earth conductor (1.2 ... 2.5 mm ² with ring cable lug)





Safety Controller

Safety in the system does not begin with the drives first, but at the control level.

With the expansion of the controller software to include the Safety Controller c250-S a complete automation solution is provided for safety engineering and control and drive tasks. Topped with the safety I/O module, all the safety aspects in the machine module can be evaluated.
EtherCAT is used for data transfer.



Mode		Features	Product key
Safety Controller c250-S	-	- Compact Controller c250-S for easy mounting using the DIN rail - High-quality safety solution thanks to PL e/SIL 3	C25BAYSQ
Safety bus coupler	-	Supported network: EtherCAT with safety-over EtherCAT (FSOE = Fail Safe over EtherCAT)	C25BAYCB
Safety I/O module	-	Expansion of the Safety Controller with 4 safe inputs and 2 safe outputs	C25BAYA42

3.6

Safety Controller	
Functions	Implementation according to PLCopen, TC 5
Equivalence / antivalence test	SF_Equivalent SF_Antivalent
Operation mode selector	SF_ModeSelector
Emergency stop, emergency off	SF_EmergencyStop
Monitoring of electro-sensitive protective equipment (ESPE)	SF_ESPE (electro-sensitive protective equipment)
Guard monitoring	SF_GuardMonitoring
Guard monitoring with locking	SF_GuardLocking
Two-hand control	SF_TwoHandControlTypeII SF_TwoHandControlTypeIII
Muting	SF_MutingSeq SF_MutingPar SF_MutingPar_2Sensors
Cyclic test of ESPE	SF_TestableSafetySensor
Enable switch	SF_EnableSwitch
Controlling safety output with standard controller and safety controller	SF_OutControl
Monitoring of feedback loop	SF_EDM (external device monitoring)

Technical data	
Rated current	240 mA via E-bus connection
DC supply voltage	5 V via E-bus connection 24 V via safety bus coupler
Dimensions h x w x d	120 mm x 25 mm x 90 mm
Degree of protection	IP20



SD card and USB flash drive

SD cards and USB flash drives are available for data storage and data backups.

- ▶ A SD card is part of the scope of supply of the controller.
- ▶ SD card without Application Credit.

Mode		Features	Product key
Application Credit 0		• 512 MB	EPCZEMSD0L0000
USB flash drive		• 4 GB	EPCZEMUS6

3.6

24 V power supply unit

An external power supply unit is also available as an alternative for powering the controller's control electronics.



24 V power supply unit

Rated data

Product key			
			EZV2400-000
Rated voltage			
AC	$U_{N, AC}$	[V]	230
Rated mains current			
	$I_{N, AC}$	[A]	1.20
Output voltage			
	U_{out}	[V]	DC 22.5 ...28.5
Rated current			
	I_N	[A]	10.0
Dimensions			
	$h \times b \times t$	[mm]	130 x 85 x 125
Mass			
	m	[kg]	1.24



CAN bus connector

The connector is used to connect the CAN to inverters which are provided with a Sub-D connection for the CAN bus. An integrated CAN terminating resistor can be switched on/off. Internal spring terminals make the use of special mounting tools superfluous. The switch setting can be read from two sides.

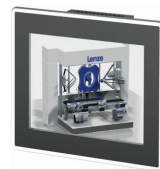
Mode		Features	Product key
CAN bus connector: Node		- Sub-D, 90° - Screw terminals	EPM-T950
CAN bus connector: Terminating		- Sub-D, 90° - Screw terminals - Integrated terminating resistor	EPM-T951
CAN bus connector: Straight		- Sub-D, 180° - Screw terminals - Switchable terminating resistor	EPM-T952
CAN bus connector: Switch		- Sub-D, 90° - Spring-loaded terminal - Switchable terminating resistor	EWZ0046

Protection films

Mode		Features	Product key
10.9 cm (4.3")		Protection of the surface against chemicals and mechanical damages (Packaging unit: 2 pieces)	EPCZMFD8
17.8 cm (7 ")			EPCZMFD9
26.4 cm (10.4 ")			EPCZMFD4

Controller p300

Accessories



I/O System 1000





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	Functions and features	3.7 - 6
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Technical data	General	3.7 - 10
	Standards and operating conditions	3.7 - 10
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	Rated data	3.7 - 11
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Accessories	Bracket for shield bus	3.7 - 39
	CAN bus connector	3.7 - 39
	Labelling strip	3.7 - 40

I/O System 1000

General information



Product information

Complies with the strictest requirements

The availability of Ethernet-based bus systems lays the foundations for new automation concepts in the field of machine and systems engineering — the performance limits of established bus systems are then eliminated.

The L-force I/O system 1000 offers highly deterministic control of input and output modules, which also includes importing touch probe inputs, such as those required for synchronised movements in clocked production processes. A minimum internal cycle time, in combination with a time stamp, ensures that the I/O system 1000 itself meets the strictest speed requirements here. As such, it is also suitable for use in realtime-based architectures.

At the very first glance, the system impresses with its slimline design, as well as its clearly structured labelling and diagnostics concept. The I/O modules, which offer space for 8 connections, require just 12.5 mm of space on the conventional DIN rail.



User-oriented connection technique

The "internals" of the I/O system are also user friendly down to the last detail: the I/O compound module, consisting of terminal block with backplane bus connection and electronics protected against polarity reversal, has a modular structure. This allows a defective electronic module to be changed when maintenance work needs to be performed without the wiring from the base module having to be disconnected. Service engineers know that this eliminates a common source of errors — incorrect wiring. The stepped design of the connection level also offers advantages, including tension spring connection technology and permanent wiring, which has proven itself on standard terminals for years. For the wiring itself, a simple screwdriver is sufficient. The simple and clear system of labelling and wiring for the new system also makes it a breeze to combine modules to create complete stations. The integrated backplane bus allows up to 64 modules to be connected in any desired sequence by simply plugging them in without the need for any wiring.

Compact structure

- Slimline design
- 8 connection points in a width of just 12.5 mm
- Tried-and-tested tension spring technology
- Stair-step shaped, space-saving wiring level
- Consistent separation of electronics and the wiring level
- Up to 64 modules can be connected
- Automatic connection via the backplane bus

Performance and robustness

- Gold-plated contacts guarantee a secure connection between the modules
- Fault-tolerant protocols secure maximum availability — even in the event of individual frame errors
- The large bandwidth of 48 MBits/s allows extremely fast response times without telegram overheads



Product information



Permanent wiring

- 2-part concept: base module and electronic module
- The electronics can be replaced during maintenance work without touching the wiring
- The item designation remains on the base module
- Codes prevent the incorrect module type from being connected



>Fast diagnostics

- Clearly structured labelling and diagnostics concept
- Bright LEDs are easy to see, even in poorly illuminated control cabinets
- One LED and one labelling field is clearly assigned to each channel



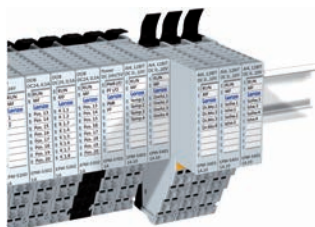
Easy connection

- Circuit diagram and connection plan printed directly on the module
- Side: detailed view
- Front: simplified view, also visible when the modules have been installed



Integrated shield connection

- Brackets are available as accessories for shield buses
- Direct installation of standard 10 x 3 busbars on the I/O station
- Shield connection possible with standard cable attachments and shield clamps



No tools required for installation

- Direct snap-in installation on the DIN rail
- Individual module or entire station can be fitted
- Complete blocks can subsequently be attached to the DIN rail
- The release levers remain open, allowing complete stations to be fitted and removed



Scalable supply concept

- The main supply is a fixed component of the bus coupler and supplies both the electronics and the I/O level
- Additional I/O supply available as an option, in the event that more than 10 A output current is required
- Additional I/O supply and electronic supply available as an option for extremely large station structures
- Each new I/O supply forms a separate potential area

I/O System 1000

General information



Functions and features

Bus coupler module

Mode	Product key
Bus coupler	
CANopen	EPM-S110
PROFIBUS	EPM-S120
EtherCAT	EPM-S130
PROFINET	EPM-S140
Modbus TCP/IP	EPM-S160

- Scope of supply: bus coupler module, including power supply module

Input and output modules

3.7

Mode		Product key
Digital I/O	Abbreviated designation	
Inputs	DI 2, DC 24 V	EPM-S200
	DI 4, DC 24 V	EPM-S201
	DI 8, DC 24 V	EPM-S202
	DI 4, DC 24 V	EPM-S203
	DI 2, 2 μ s, DC 24 V	EPM-S207
	DI 2, NPN, DC 24 V	EPM-S204
	DI 4, NPN, DC 24 V	EPM-S205
	DI 8, NPN, DC 24 V	EPM-S206
Outputs	DO 2, DC 24 V, 0.5 A	EPM-S300
	DO 4, DC 24 V, 0.5 A	EPM-S301
	DO 8, DC 24 V, 0.5 A	EPM-S302
	DO 2, DC 24 V, 2 A	EPM-S306
	DO 4, DC 24 V, 2 A	EPM-S309
	DO2, DC 24 V, 1 μ s	EPM-S310
	DO 2, NPN, DC 24 V, 0.5 A	EPM-S303
	DO 4, NPN, DC 24 V, 0.5 A	EPM-S304
	DO 8, NPN, DC 24 V, 0.5 A	EPM-S305
RELAY	Relay 2, AC 230 V, 3 A	EPM-S308

- Scope of supply: I/O compound module (base module + electronic module)



Functions and features

Input and output modules

Mode		Product key
Analog I/O	Abbreviated designation	
Inputs	AI 2, 12-bit, 0 to 10 V	EPM-S400
	AI 4, 12-bit, 0 to 10 V	EPM-S401
	AI 2, 12-bit, 0/4 to 20 mA	EPM-S402
	AI 4, 12-bit, 0/4 to 20 mA	EPM-S403
	AI 2, 16-bit, -10 V to 10 V	EPM-S406
	AI 2, 16-bit, 0/4 to 20 mA	EPM-S408
Outputs	AO 2, 12-bit, 0 to 10 V	EPM-S500
	AO 4, 12-bit, 0 to 10 V	EPM-S501
	AO 2, 12-bit, 0/4 to 20 mA	EPM-S502
	AO 4, 12-bit, 0/4 to 20 mA	EPM-S503

- Scope of supply: I/O compound module (base module + electronic module)

Function modules

Mode		Product key
Product	Abbreviated designation	
Temperature measurement	AI 4, 16-bit, resistor	EPM-S404
	AI 2, 16-bit, Thermo	EPM-S405
Counter	Counter 1, DC 24 V	EPM-S600
	Counter 2, DC 24 V	EPM-S601
	Counter 1, DC 5 V	EPM-S602
	Counter 2, DC 24 V	EPM-S603
Encoder evaluation	SSI	EPM-S604
Technology modules	PWM	EPM-S620
	RS -232	EPM-S640
	RS -422/485	EPM-S650

- Scope of supply: I/O compound module (base module + electronic module)

I/O System 1000

General information



Functions and features

Power supply modules

Mode		Product key
Product	Abbreviated designation	
Power supply modules	Power BC	EPM-S700
	Power DC 24 V	EPM-S701
	Power DC 24 V / 24 V	EPM-S702

- Scope of supply for EPM-S700: electronic module
Scope of supply for EPM-S701 to 702: I/O compound module
(base module + electronic module)

Potential distribution modules

Mode		Product key
Product	Abbreviated designation	
Potential distribution modules	Supply 8 x DC 24 V	EPM-S910
	Supply 8 x DC 0 V	EPM-S911
	Supply 4 x DC 24 V / 0 V	EPM-S912

3.7

I/O System 1000

General information



Compiling an I/O system

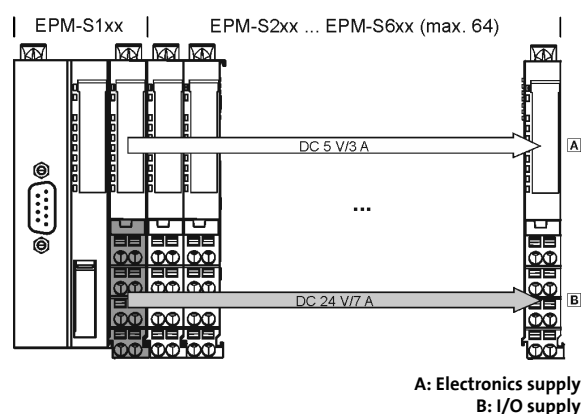
The I/O system 1000 can be used to create a very individual, tailored system for the most diverse of applications. A total of up to 64 I/O modules can be integrated.

Operation with bus coupler

The bus couplers are used to connect the I/O system to a control via a bus system, in which a 24V power supply module, the so-called main power supply, is integrated.

Properties of the power supply unit:

- 5V electronic supply of the bus coupler itself, as well as the connected modules.
Maximum output current 3 A
- 24V I/O supply for the inputs and outputs of the connected modules
Maximum output current 7 A (10 A if no UL-conformity is required in the field of deployment)



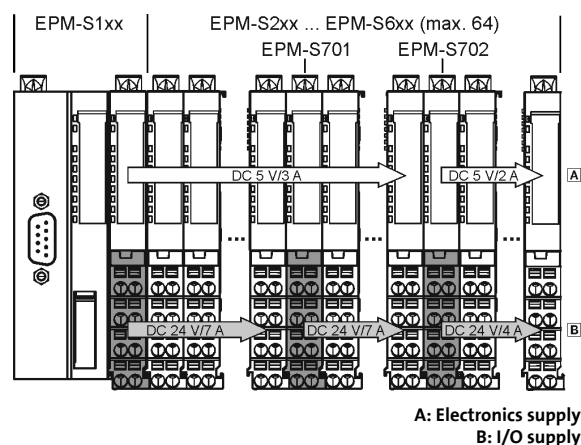
3.7

Extension with power supply modules

In comprehensive systems, operation with just the DC supply via the bus coupler is sometimes not enough. In cases such as these, the I/O system can be extended with additional power supply modules.

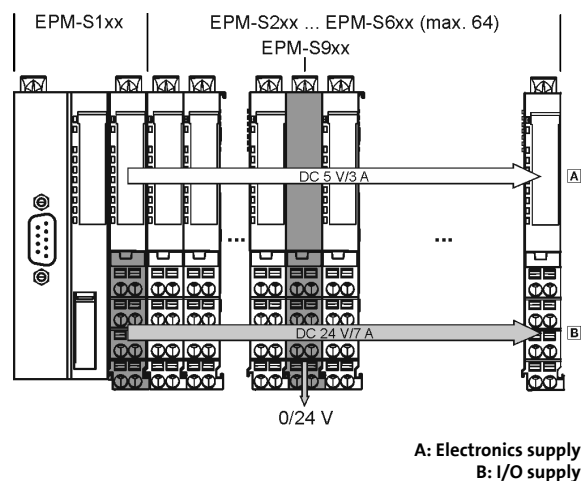
Depending on which supply is insufficient, there are two different modules available:

- Power supply module EPM-S701
Additional I/O supply (7 A)
- Power supply module EPM-S702
Additional electronics supply (2 A) and I/O supply (4 A)



External supply

The I/O system can also be used to supply 24V consumers. This is particularly useful when using active sensors which need to be connected using three-wire conductors. Power distribution modules EPM-S91□ which, depending on their design, provide 24 V and 0 V for connection of external sensor technology are available for this.





Standards and operating conditions

Conformity			Low-Voltage Directive	EMC Directive
CE			2014/35/EU [UKCA: S.I. 2016/1101]	2014/30/EU [UKCA: S.I. 2016/1091]
Approval			Programmable Controller (File-No. E343358)	
UL 508C			IP20	
Degree of protection			IP20	
EN 60529			Temperature: -25 °C ... +70 °C	
Climatic conditions			Temperature: -25 °C ... +70 °C	
Storage (EN 60068-2-14)			Temperature: 0 °C ... +60 °C	
Transport (EN 60068-14)				
Operation (EN 61131-2)				
Site altitude			3000	
Amsl	H _{max}	[m]		
Vibration resistance			1 g	
Vibration (EN 60068-2-6)			15 g	
Mechanical shock (EN 60068-2-27)				
Noise emission			Limit class A	
EN 61000-6-4			ESD: Severity 3	
Noise immunity			150 kHz ... 80 MHz, 10 V/m 80% AM (1 kHz)	
EN 61000-4-2			80 kHz ... 1000 MHz, 10 V/m 80% AM (1 kHz)	
EN 61000-4-6			Burst: Severity 3	
EN 61000-4-3			Surge: Severity 3	
EN 61000-4-4				
EN 61000-4-5				
Insulation resistance			Overvoltage category III	
IEC 61131-2			Above 2000 m amsl overvoltage category II	
Insulation voltage to reference earth/PE			500	
EN 61800-5-1	U _{AC}	[V]		
Electrical isolation			500 V between I/O supply, electronic supply and fieldbus	
Protective insulation of control circuits			Safe mains isolation: double/reinforced insulation	
EN 61800-5-1				

I/O System 1000

Technical data - Bus coupler



Rated data

					
Product key			EPM-S110	EPM-S120	EPM-S130
Mode			CANopen	PROFIBUS	EtherCAT
Rated voltage			24		
DC	U _{N, DC}	[V]			
Max. input current			0.95	0.90	0.95
	I _{in, max}	[A]			
Output current			3		
Backplane bus	I _{out}	[A]			
I/O supply	I _{out}	[A]	7 ¹⁾		
Output voltage			24		
I/O supply	U _{out}	[V]			
Max. number of I/O modules			64		
Diagnostics			Supply OK / fuse defective		
Voltage supply					
Bus diagnostics			RUN-LED as per CANopen Ready for operation System error	Ready for operation System error	
Fusing			Via power supply module		
Communication					
Communication profile			CANopen, DS301 V4.02	PROFIBUS-DP-V0 PROFIBUS-DP-V1	EtherCAT (CoE)
Node			Slave		
Baud rate					
	b		10 kbps ... 1 Mbps	9.6 kbps ... 12 Mbps	100 Mbps
Number of bus nodes			127	With repeaters: 125 Without repeaters: 32	Max. 65535
Number of PDOs			16 Rx / 16 Tx	244 bytes	4 kbytes
Device description file			EDS	GSE	XML (Modular Device Profile MDP)

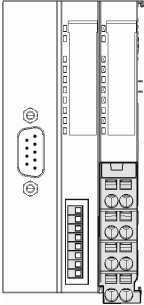
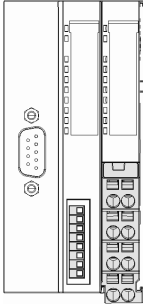
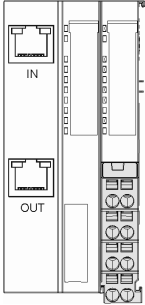
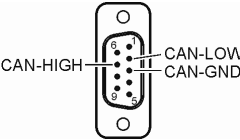
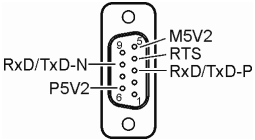
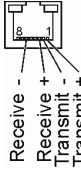
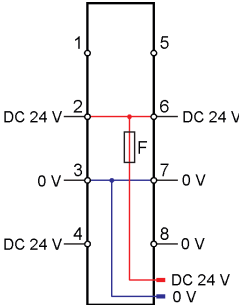
¹⁾ Can used up to 10 A without UL-approval.



Rated data

					
Product key			EPM-S110	EPM-S120	EPM-S130
Mode			CANopen	PROFIBUS	EtherCAT
Bus coupler					
Connection			Sub-D connection, 9-pin		RJ45, double
Dimensions			109 x 48 x 76.5		
	h x b x t	[mm]			
Mass			0.16		
	m	[kg]			

3.7

Product key	EPM-S110	EPM-S120	EPM-S130
			
			
			

I/O System 1000

Technical data - Bus coupler



Rated data

				
Product key			EPM-S140	EPM-S160
Mode				
Bus coupler			PROFINET	Modbus TCP/IP
Rated voltage				
DC	$U_{N, DC}$	[V]	24	
Max. input current				
	$I_{in, max}$	[A]	0.95	
Output current				
Backplane bus	I_{out}	[A]	3	
I/O supply	I_{out}	[A]	7 ¹⁾	
Output voltage				
I/O supply	U_{out}	[V]	24	
Max. number of I/O modules			64	
Diagnostics				
Voltage supply			Supply OK / fuse defective	
Bus diagnostics			Ready for operation System error	
Fusing				
			Via power supply module	
Communication				
Communication profile			PROFINET (RT/IRT)	Modbus TCP/IP
Node				
			Device	Slave
Baud rate				
	b		100 Mbps	
Number of bus nodes				
			255	
Number of PDOs				
			512 bytes	1 kbytes
Device description file				
			GSDML	

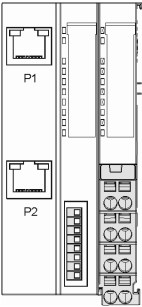
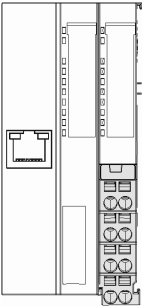
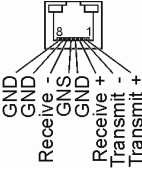
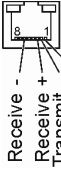
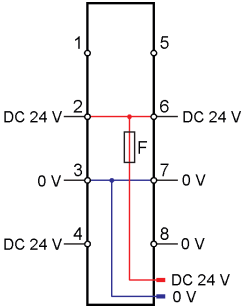
¹⁾ Can used up to 10 A without UL-approval.



Rated data

				
Product key			EPM-S140	EPM-S160
Mode			PROFINET	Modbus TCP/IP
Bus coupler			PROFINET	Modbus TCP/IP
Connection			RJ45, double	RJ45
Dimensions			109 x 48 x 76.5	
	h x b x t	[mm]		
Mass			0.16	
	m	[kg]		

3.7

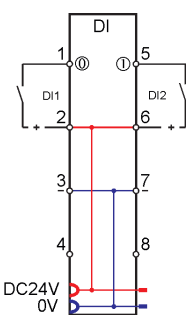
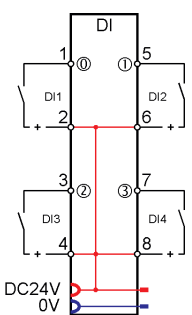
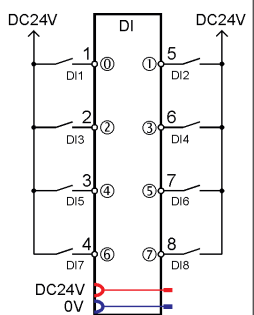
Product key	EPM-S140	EPM-S160
		
		
		



Rated data

► Positive switching

					
Product key			EPM-S200	EPM-S201	EPM-S202
Mode			DI 2, DC 24 V	DI 4, DC 24 V	DI 8, DC 24 V
Abbreviated designation			DI 2, DC 24 V	DI 4, DC 24 V	DI 8, DC 24 V
Digital inputs					
Number			2	4	8
Input filter delay time		[ms]	3		
Connection system			1-/2-/3-wire technology	1-/2-wire technology	1-wire technology
Input level			IEC 61121-2 type 1 "0": 0 ... 5 V "1": 15 ... 28.8 V		
Wiring			PNP		
Input current					
Backplane bus	I_{in}	[mA]	55		60
Rated voltage					
DC	$U_{N, DC}$	[V]	24		
Communication					
Width in the input process image			8 bits 2 bits with bus coupler EPM-S110	8 bits 4 bits with bus coupler EPM-S110	8 bits
Parameter data (PROFIBUS/PROFINET)					
Diagnostics					
Module status			Ready for operation / error		
Signal status			1 LED per channel		
Time stamp					
Dimensions					
	h x b x t	[mm]	109 x 12.5 x 76.5		
Mass					
	m	[kg]	0.060		

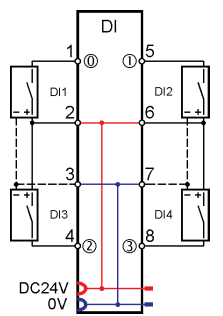
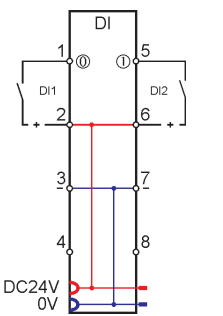
Product key	EPM-S200	EPM-S201	EPM-S202
			



Rated data

► Positive switching

				
Product key			EPM-S203	EPM-S207
Mode				
Abbreviated designation			DI 4, DC 24 V	DI 2, 2 µs, DC 24 V
Digital inputs				
Number			4	2
Input filter delay time			3	0.002 ... 3
Connection system			1-/2-/3-wire technology	
Input level			IEC 61121-2 type 1 "0": 0 ... 5 V "1": 15 ... 28.8 V	
Wiring			PNP	
Input current				
Backplane bus	I_{in}	[mA]	55	85
Rated voltage				
DC	$U_{N, DC}$	[V]	24	
Communication				
Width in the input process image			8 bits 4 bits with bus coupler EPM-S110	4 ... 60 bytes
Parameter data (PROFIBUS/PROFINET)				6 bytes
Diagnostics				
Module status			Ready for operation / error	
Signal status			1 LED per channel	
Time stamp				Yes
Dimensions				
	h x b x t	[mm]	109 x 12.5 x 76.5	
Mass				
	m	[kg]	0.060	

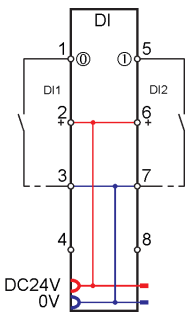
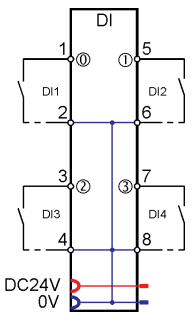
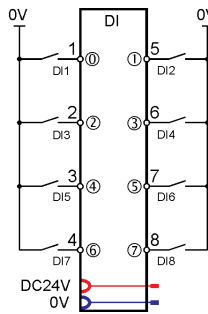
Product key		EPM-S203	EPM-S207
			



Rated data

► Negative switching

					
Product key			EPM-S204	EPM-S205	EPM-S206
Mode					
Abbreviated designation			DI 2, NPN, DC 24 V	DI 4, NPN, DC 24 V	DI 8, NPN, DC 24 V
Digital inputs					
Number			2	4	8
Input filter delay time		[ms]	3		
Connection system			1-/2-/3-wire technology	1-/2-wire technology	1-wire technology
Input level			IEC 61121-2 type 1 "0": 0 ... 5 V "1": 15 ... 28.8 V		
Wiring			NPN		
Input current					
Backplane bus	I_{in}	[mA]	60		65
Rated voltage					
DC	$U_{N, DC}$	[V]	24		
Communication					
Width in the input process image			8 bits 2 bits with bus coupler EPM-S110	8 bits 4 bits with bus coupler EPM-S110	8 bits
Diagnostics					
Module status			Ready for operation / error		
Signal status			1 LED per channel		
Time stamp					
Dimensions					
	h x b x t	[mm]	109 x 12.5 x 76.5		
Mass					
	m	[kg]	0.060		

Product key	EPM-S204	EPM-S205	EPM-S206
			



Rated data

► Positive switching

					
Product key			EPM-S300	EPM-S301	EPM-S302
Mode					
Abbreviated designation			DO 2, DC 24 V, 0.5 A	DO 4, DC 24 V, 0.5 A	DO 8, DC 24 V, 0.5 A
Digital outputs					
Number			2	4	8
Output filter delay time	T	[μs]	30 ... 175		
Connection system			1-/2-/3-wire technology	1-/2-wire technology	1-wire technology
Wiring			PNP		
Input current					
Backplane bus	I _{in}	[mA]	55		65
I/O supply	I _{in}	[mA]	5 ¹⁾	10 ¹⁾	15 ¹⁾
Output current					
per channel	I _{out}	[A]	0.50		
Rated voltage					
DC	U _{N, DC}	[V]	24		
Switching frequency					
Ohmic load	f _{ch}	[Hz]	1000		
Inductive load	f _{ch}	[Hz]	0.50		
Lamp load	f _{ch}	[Hz]	10.0		
Communication					
Width in the input process image					
Width in the output process image			8 bits 2 bits with bus coupler EPM-S110	8 bits 4 bits with bus coupler EPM-S110	8 bits
Parameter data (PROFIB- US/PROFINET)					

¹⁾ + load current.



Rated data

► Positive switching

Product key			EPM-S300	EPM-S301	EPM-S302
Mode			DO 2, DC 24 V, 0.5 A	DO 4, DC 24 V, 0.5 A	DO 8, DC 24 V, 0.5 A
Abbreviated designation			DO 2, DC 24 V, 0.5 A	DO 4, DC 24 V, 0.5 A	DO 8, DC 24 V, 0.5 A
Diagnostics			Ready for operation / error / overload		
Module status			1 LED per channel		
Signal status			Electronic		
Short-circuit strength			Electronic		
Dimensions			109 x 12.5 x 76.5		
	h x b x t	[mm]			
Mass			0.060		
	m	[kg]			

Product key	EPM-S300	EPM-S301	EPM-S302



Rated data

► Positive switching

					
Product key			EPM-S306	EPM-S309	EPM-S310
Mode			DO 2, DC 24 V, 2 A	DO 4, DC 24 V, 2 A	DO2, DC 24 V, 1 μs
Abbreviated designation			DO 2, DC 24 V, 2 A	DO 4, DC 24 V, 2 A	DO2, DC 24 V, 1 μs
Digital outputs					
Number			2	4	2
Output filter delay time	T	[μs]	30 ... 175		1
Connection system			1-/2-/3-wire technology	1-/2-wire technology	
Wiring			PNP		
Input current					
Backplane bus	I _{in}	[mA]	55		85
I/O supply	I _{in}	[mA]	5 ¹⁾	10 ¹⁾	14 ¹⁾
Output current					
per channel	I _{out}	[A]	2.00 ²⁾		0.50
Rated voltage					
DC	U _{N, DC}	[V]	24		
Switching frequency					
Ohmic load	f _{ch}	[Hz]	1 000		40 000
Inductive load	f _{ch}	[Hz]	0.50		40 000
Lamp load	f _{ch}	[Hz]	10.0		40 000
Communication					
Width in the input process image					4 bytes
Width in the output process image			8 bits 2 bits with bus coupler EPM-S110	8 bits 4 bits with bus coupler EPM-S110	4 ... 60 bytes
Parameter data (PROFIB-US/PROFINET)					2 bytes

¹⁾ + load current.

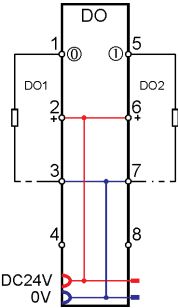
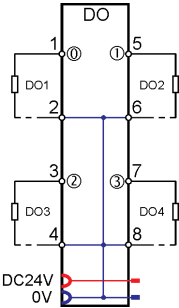
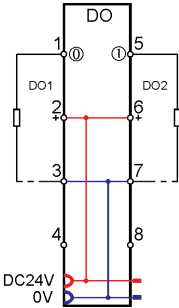
²⁾ On the EPM-S309, the max. total current is 4 A.



Rated data

► Positive switching

					
Product key			EPM-S306	EPM-S309	EPM-S310
Mode			DO 2, DC 24 V, 2 A	DO 4, DC 24 V, 2 A	DO2, DC 24 V, 1 µs
Abbreviated designation			DO 2, DC 24 V, 2 A	DO 4, DC 24 V, 2 A	DO2, DC 24 V, 1 µs
Diagnostics			Ready for operation / error / overload		
Module status			1 LED per channel		
Signal status			Electronic		
Short-circuit strength			Electronic		
Dimensions			109 x 12.5 x 76.5		
	h x b x t	[mm]			
Mass			0.060		
	m	[kg]			

Product key	EPM-S306	EPM-S309	EPM-S310
			



Rated data

► Negative switching

					
Product key			EPM-S303	EPM-S304	EPM-S305
Mode					
Abbreviated designation			DO 2, NPN, DC 24 V, 0.5 A	DO 4, NPN, DC 24 V, 0.5 A	DO 8, NPN, DC 24 V, 0.5 A
Digital outputs					
Number			2	4	8
Output filter delay time	T	[μs]	30 ... 175		
Connection system			1-/2-/3-wire technology	1-/2-wire technology	1-wire technology
Wiring			NPN		
Input current					
Backplane bus	I _{in}	[mA]	60	65	70
I/O supply	I _{in}	[mA]	3 ¹⁾	5 ¹⁾	10 ¹⁾
Output current					
per channel	I _{out}	[A]	0.50		
Rated voltage					
DC	U _{N, DC}	[V]	24		
Switching frequency					
Ohmic load	f _{ch}	[Hz]	1000		
Inductive load	f _{ch}	[Hz]	0.50		
Lamp load	f _{ch}	[Hz]	10.0		
Communication					
Width in the output process image			8 bits 2 bits with bus coupler EPM-S110	8 bits 4 bits with bus coupler EPM-S110	8 bits

¹⁾ + load current.



Rated data

► Negative switching

Product key			EPM-S303	EPM-S304	EPM-S305
Mode					
Abbreviated designation			DO 2, NPN, DC 24 V, 0.5 A	DO 4, NPN, DC 24 V, 0.5 A	DO 8, NPN, DC 24 V, 0.5 A
Diagnostics			Ready for operation / error / overload		
Module status			1 LED per channel		
Signal status			Electronic		
Short-circuit strength			Electronic		
Dimensions			109 x 12.5 x 76.5		
	h x b x t	[mm]			
Mass			0.060		
	m	[kg]			

Product key	EPM-S303	EPM-S304	EPM-S305

¹⁾ + load current.



Rated data

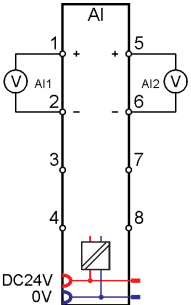
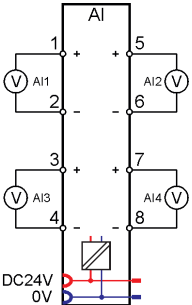
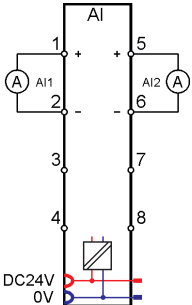
Product key			EPM-S308
Mode			Relay 2, AC 230 V, 3 A
Abbreviated designation			
Relay outputs			
Number			2
Contact			NO contact
Input current			
Backplane bus	I_{in}	[mA]	55
Rated voltage			
DC	$U_{N, DC}$	[V]	30
AC	$U_{N, AC}$	[V]	230
Output current			
per channel	I_{out}	[A]	3.00
Switching frequency			
Ohmic load	f_{ch}	[Hz]	100
Communication			
Width in the output process image			8 bits 2 bits with bus coupler EPM-S110
Diagnostics			
Module status			Ready for operation / error
Signal status			1 LED per channel
Dimensions			
	$h \times b \times t$	[mm]	109 x 12.5 x 76.5
Mass			
	m	[kg]	0.060

Product key	EPM-S308



Rated data

					
Product key			EPM-S400	EPM-S401	EPM-S402
Mode					
Abbreviated designation			AI 2, 12-bit, 0 to 10 V	AI 4, 12-bit, 0 to 10 V	AI 2, 12-bit, 0/4 to 20 mA
Analog inputs					
Number			2	4	2
Voltage	U_{DC}	[V]	0 ... 10		
Current	I	[mA]			0 ... 20 4 ... 20
Input filter limit frequency		[kHz]	1.00		
Resolution			12 bits		
Usage error limit		[%]	± 0.3		± 0.3 at 0 ... 20 mA ± 0.5 at 4 ... 20 mA
Basic error limit (at 25 °C)		[%]	± 0.2		± 0.2 at 0 ... 20 mA ± 0.3 at 4 ... 20 mA
A/D conversion time	T	[ms]	4 (all channels)	8 (all channels)	4 (all channels)
Input current					
Backplane bus	I_{in}	[mA]	70		
I/O supply	I_{in}	[mA]	15		
Rated voltage					
DC	$U_{N, DC}$	[V]			
Communication					
Width in the input process image			4 bytes	8 bytes	4 bytes
Parameter data (PROFIB-US/PROFINET)			6 bytes	8 bytes	6 bytes
Diagnostics					
Module status			Ready for operation / error		
Signal status			1 LED per channel		
Dimensions					
	$h \times b \times t$	[mm]	109 x 12.5 x 76.5		
Mass					
	m	[kg]	0.060		

Product key	EPM-S400	EPM-S401	EPM-S402
			



Rated data

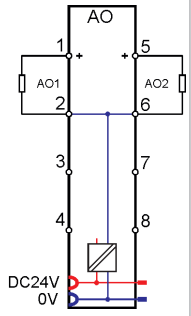
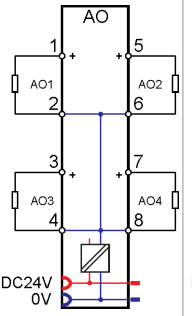
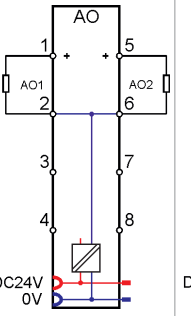
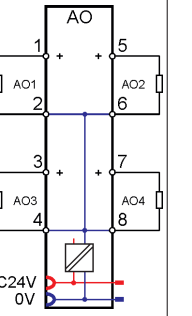
Product key			EPM-S403	EPM-S406	EPM-S408
Mode					
Abbreviated designation			AI 4, 12-bit, 0/4 to 20 mA	AI 2, 16-bit, -10 V to 10 V	AI 2, 16-bit, 0/4 to 20 mA
Analog inputs					
Number			4	2	
Voltage	U_{DC}	[V]		-10 ... 10	
Current	I	[mA]	0 ... 20 4 ... 20		0 ... 20 4 ... 20
Input filter limit frequency			1.00		
Resolution			12 bits	16 bits	
Usage error limit			± 0.3 at 0 ... 20 mA ± 0.5 at 4 ... 20 mA	± 0.2	
Basic error limit (at 25 °C)			± 0.2 at 0 ... 20 mA ± 0.3 at 4 ... 20 mA	± 0.1	
A/D conversion time	T	[ms]	8 (all channels)	0.24 (all channels)	
Input current					
Backplane bus	I_{in}	[mA]	70	60	
I/O supply	I_{in}	[mA]	15	20	15
Rated voltage					
DC	$U_{N, DC}$	[V]			
Communication					
Width in the input process image			8 bytes	4 bytes	
Parameter data (PROFIB-US/PROFINET)			8 bytes	20 bytes	
Diagnostics					
Module status			Ready for operation / error		
Signal status			1 LED per channel		
Dimensions					
	$h \times b \times t$	[mm]	109 x 12.5 x 76.5		
Mass					
	m	[kg]	0.060		

Product key			
	EPM-S403	EPM-S406	EPM-S408



Rated data

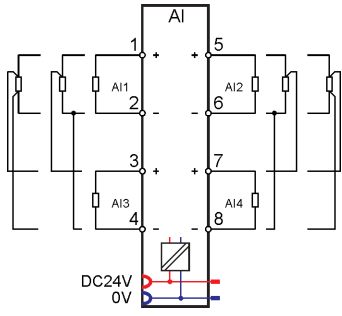
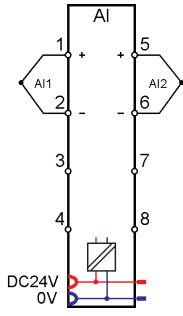
						
Product key			EPM-S500	EPM-S501	EPM-S502	EPM-S503
Mode			AO 2, 12-bit, 0 to 10 V	AO 4, 12-bit, 0 to 10 V	AO 2, 12-bit, 0/4 to 20 mA	AO 4, 12-bit, 0/4 to 20 mA
Abbreviated designation						
Analog outputs						
Number			2	4	2	4
Voltage	U _{DC}	[V]	0 ... 10			
Current	I	[mA]			0/4 ... 20	
Resolution			12 bits			
Usage error limit		[%]	± 0.3		± 0.4 at 0 ... 20 mA ± 0.5 at 4 ... 20 mA	
Basic error limit (at 25 °C)		[%]	± 0.2		± 0.2 at 0 ... 20 mA ± 0.3 at 4 ... 20 mA	
D/A conversion time	T	[ms]	2 (all channels)			
Input current						
Backplane bus	I _{in}	[mA]	80			
I/O supply	I _{in}	[mA]	35		55	95
Rated voltage						
DC	U _{N, DC}	[V]				
Communication						
Width in the input process image			4 bytes	8 bytes	4 bytes	8 bytes
Parameter data (PROFIB-US/PROFINET)			8 bytes	10 bytes	8 bytes	10 bytes
Diagnostics						
Module status			Ready for operation / error			
Signal status			1 LED per channel (overload, short circuit, parameter entry error)			
Dimensions						
	h x b x t	[mm]	109 x 12.5 x 76.5			
Mass						
	m	[kg]	0.060			

Product key		EPM-S500	EPM-S501	EPM-S502	EPM-S503
					



Rated data

				
Product key			EPM-S404	EPM-S405
Mode			AI 4, 16-bit, resistor	AI 2, 16-bit, Thermo
Abbreviated designation			AI 4, 16-bit, resistor	AI 2, 16-bit, Thermo
Analog inputs				
Number			4 / (2)	2
Voltage	U_{DC}	[V]		
Resolution			16 bits	
Usage error limit		[%]	± 0.4	
		[K]		$\geq \pm 1.5^{1)}$
Basic error limit (at 25 °C)		[%]	± 0.2	
		[K]		$\geq \pm 1.0^{1)}$
A/D conversion time	T	[ms]		4 ... 325 ²⁾
Connection system			2-wire technology (3-/4-wire technology)	
Input current				
Backplane bus	I_{in}	[mA]	75	
I/O supply	I_{in}	[mA]	30	
Temperature sensor				
			Resistor PT100, PT1000 NI100, NI1000 NI120	Thermocouple type: Thermocouple type: J, K, N, R, S, T, B, C, E, L
Communication				
Width in the input process image			8 bytes	4 bytes
Parameter data (PROFIB- US/PROFINET)			34 bytes	22 bytes
Diagnostics				
Module status			Ready for operation / error	
Signal status			1 LED per channel	
Dimensions				
	h x b x t	[mm]	109 x 12.5 x 76.5	
Mass				
	m	[kg]	0.060	

Product key			EPM-S404	EPM-S405
				

¹⁾ Dependent on the sensor and interference frequency suppression.

²⁾ Dependent on the configuration and filter settings.



Measuring range

Product key			EPM-S404	EPM-S405
Sensor measuring range				
PT100	T	[°C]	-200 ... 850	
PT1000	T	[°C]	-200 ... 850	
NI100	T	[°C]	-60 ... 250	
NI1000	T	[°C]	-60 ... 250	
Resistor	R	[Ω]	60/600/3000/6000	
Thermocouple type B	T	[°C]		0 ... 1820
Thermocouple type C	T	[°C]		0 ... 2315
Thermocouple type E	T	[°C]		-270 ... 1000
Thermocouple type J	T	[°C]		-210 ... 1200
Thermocouple type K	T	[°C]		-270 ... 1372
Thermocouple type L	T	[°C]		-200 ... 900
Thermocouple type N	T	[°C]		-270 ... 1300
Thermocouple type R	T	[°C]		-50 ... 1769
Thermocouple type S	T	[°C]		-50 ... 1769
Thermocouple type T	T	[°C]		-270 ... 400
Voltage	U _{DC}	[mV]		-80 ... 80



Rated data

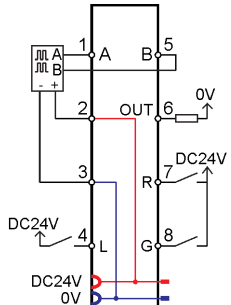
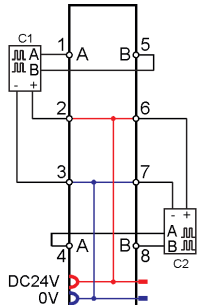
				
Product key			EPM-S600	EPM-S601
Mode			Counter 1, DC 24 V	Counter 2, DC 24 V
Abbreviated designation			Counter 1, DC 24 V	Counter 2, DC 24 V
Digital inputs				
Number			1	2
Input level			HTL	
Input filter limit frequency		[kHz]	100	
Counter width		[Bit]	32	
Counting frequency		[kHz]	400	
Digital outputs				
Number			1	
Input current				
Backplane bus	I_{in}	[mA]	75	
I/O supply	I_{in}	[mA]	20 ¹⁾	15 ¹⁾
Output current				
per channel	I_{out}	[A]	0.50	
Rated voltage				
DC	$U_{N, DC}$	[V]	24	
Communication				
Width in the input process image			12 bytes	
Width in the output process image			10 bytes	12 bytes
Parameter data (PROFIB-US/PROFINET)			21 bytes	42 bytes

¹⁾ + encoder power consumption.



Rated data

				
Product key			EPM-S600	EPM-S601
Mode				
Abbreviated designation			Counter 1, DC 24 V	Counter 2, DC 24 V
Diagnostics				
Module status			Ready for operation / error	
Signal status			1 LED per counter input 1 LED per control input 1 LED per output	
Counter function			Read, set Latch function	Read, set
Alarm function			Yes	
Control inputs			Latch, reset, gate	
Dimensions				
	h x b x t	[mm]	109 x 12.5 x 76.5	
Mass				
	m	[kg]	0.060	

Product key	EPM-S600	EPM-S601
		



Rated data

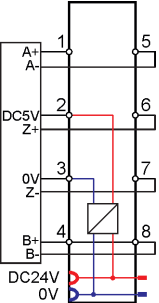
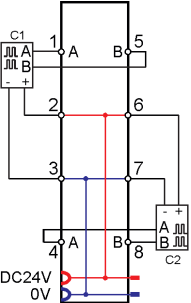
				
Product key			EPM-S602	EPM-S603
Mode			Counter 1, DC 5 V	Counter 2, DC 24 V
Abbreviated designation				
Digital inputs				
Number			1	2
Input level			TTL	HTL
Input filter limit frequency		[kHz]	500	100
Counter width		[Bit]	32	
Counting frequency		[kHz]	2000	400
Digital outputs				
Number				
Input current				
Backplane bus	I_{in}	[mA]	75	100
I/O supply	I_{in}	[mA]	20 ¹⁾	15 ¹⁾
Output current				
per channel	I_{out}	[A]		
Rated voltage				
DC	$U_{N, DC}$	[V]		
Communication				
Width in the input process image			8 bytes	12 bytes
Width in the output process image			10 bytes	4 bytes
Parameter data (PROFIB-US/PROFINET)			22 bytes	8 bytes

¹⁾ + encoder power consumption.



Rated data

				
Product key			EPM-S602	EPM-S603
Mode			Counter 1, DC 5 V	Counter 2, DC 24 V
Abbreviated designation			Counter 1, DC 5 V	Counter 2, DC 24 V
Diagnostics			Ready for operation / error	
Module status			1 LED per counter input	
Signal status			1 LED per control input	
			1 LED per output	
Counter function			Read, set	Read
Alarm function			Yes	
Control inputs			Reset	
Dimensions			109 x 12.5 x 76.5	
Mass	h x b x t	[mm]	109 x 12.5 x 76.5	
	m	[kg]	0.060	

Product key	EPM-S602	EPM-S603
		



Rated data

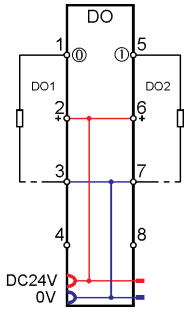
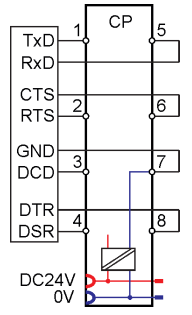
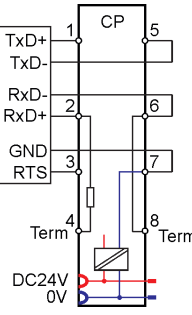
					
Product key			EPM-S620	EPM-S640	EPM-S650
Mode			PWM	RS -232	RS -422/485
Outputs					
Number			2		
Level				RS 232	RS 422 / 485
Delay time					
	T	[μs]	1		
Switching frequency					
	f _{ch}	[kHz]	20		
Input current					
Backplane bus	I _{in}	[mA]	85	100	
I/O supply	I _{in}	[mA]	15 ¹⁾	10 ¹⁾	
Output current					
per channel	I _{out}	[A]	0.50		
Rated voltage					
DC	U _{N, DC}	[V]	24		
Communication					
Hardware handshake				RTS/CTS	
Protocols				ASCII, STX/ETX, 3964 (R)	
Width in the input process image			4 bytes	max. 60 Byte	
Width in the output process image			12 bytes	max. 60 Byte	
Parameter data (PROFIB-US/PROFINET)			8 bytes	17 bytes	
Max. baud rate					
	b	[kBit/s]		115	

¹⁾ + load current.



Rated data

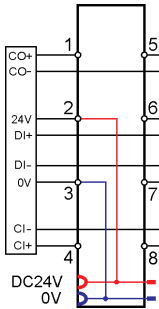
					
Product key			EPM-S620	EPM-S640	EPM-S650
Mode			PWM	RS -232	RS -422/485
Abbreviated designation			PWM	RS -232	RS -422/485
Diagnostics			Ready for operation / error		
Module status			1 LED per channel		
Signal status			1 TxD LED, 1 RxD LED		
Short-circuit strength			Electronic		
Dimensions			109 x 12.5 x 76.5		
Mass			0.060		
	h x b x t	[mm]			
	m	[kg]			

Product key	EPM-S620	EPM-S640	EPM-S650
			



Rated data

			
Product key			EPM-S604
Mode			SSI
Abbreviated designation			SSI
Inputs			
Number			1
Level			RS 422
Frequency	f_{in}	[kHz]	12 ... 6000
Input current			
Backplane bus	I_{in}	[mA]	70
I/O supply	I_{in}	[mA]	30
Rated voltage			
DC	$U_{N, DC}$	[V]	24
Communication			
Width in the input process image			6 bytes
Parameter data (PROFIB-US/PROFINET)			33 bytes
Diagnostics			
Module status			Ready for operation / error
Signal status			1 LED per encoder input
Evaluation function			3 comparisons, 2 limit values
Dimensions			
	$h \times b \times t$	[mm]	109 x 12.5 x 76.5
Mass			
	m	[kg]	0.060

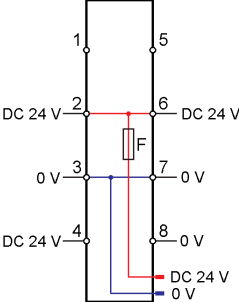
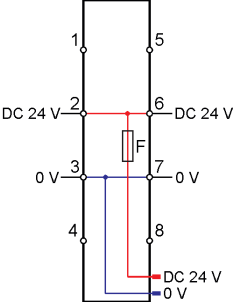
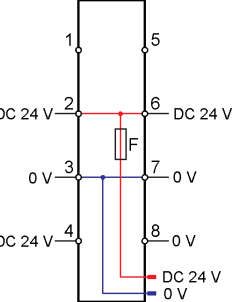
Product key	EPM-S604
	

3.7



Rated data

					
Product key			EPM-S700	EPM-S701	EPM-S702
Mode			Power BC	Power DC 24 V	Power DC 24 V / 24 V
Abbreviated designation			Power BC	Power DC 24 V	Power DC 24 V / 24 V
Rated voltage			24		
DC	U _{N, DC}	[V]	24		
Supply voltage			24		
Electronics	U _{in}	[V]	DC 24 (20.4 ... 28.8)		DC 24 (20.4 ... 28.8)
Output current			24		
Backplane bus	I _{out}	[A]	24		
I/O supply	I _{out}	[A]	7 ¹⁾		4
Electrical isolation			500 V between I/O supply, electronic supply and fieldbus	not connected to the I/O supply voltage of the modules to the left	not connected to the I/O supply voltage of the modules to the left 500 V between I/O supply and electronic supply
Diagnostics			Supply OK / fuse defective		
Voltage supply			Supply OK / fuse defective		
Fusing			Internal		
Polarity reversal protection			Present		
Dimensions			109 x 12.5 x 76.5		
	h x b x t	[mm]	56 x 12.5 x 62	109 x 12.5 x 76.5	
Mass			0.060		
	m	[kg]	0.030	0.060	

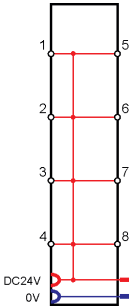
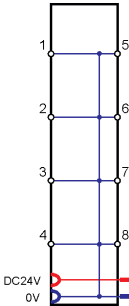
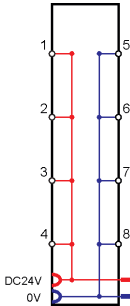
Product key	EPM-S700	EPM-S701	EPM-S702
			

¹⁾ Can used up to 10 A without UL-approval.



Rated data

					
Product key			EPM-S910	EPM-S911	EPM-S912
Mode			Supply 8 x DC 24 V	Supply 8 x DC 0 V	Supply 4 x DC 24 V / 0 V
Rated voltage					
DC	$U_{N, DC}$	[V]	24	0	0 24
Rated current			10.0		
	I_N	[A]			
Dimensions			109 x 12.5 x 53		
	h x b x t	[mm]			
Mass			0.050		
	m	[kg]			

Product key	EPM-S910	EPM-S911	EPM-S912
			



Bracket for shield bus

Standard 10 x 3 busbars can be connected directly to the I/O system using the bracket for shield buses. The shield connection with standard cable attachments and shield clamps can be used.

Mode		Features	Product key
Bracket for shield bus		Installation of standard metal rails for shield connections directly on the module (VPE 10 pieces)	EPM-S900

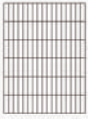
CAN bus connector

The connector is used to connect the CAN to inverters which are provided with a Sub-D connection for the CAN bus. An integrated CAN terminating resistor can be switched on/off. Internal spring terminals make the use of special mounting tools superfluous. The switch setting can be read from two sides.

Mode		Features	Product key
CAN bus connector: Node		- Sub-D, 90° - Screw terminals	EPM-T950
CAN bus connector: Terminating		- Sub-D, 90° - Screw terminals - Integrated terminating resistor	EPM-T951
CAN bus connector: Straight		- Sub-D, 180° - Screw terminals - Switchable terminating resistor	EPM-T952
CAN bus connector: Switch		- Sub-D, 90° - Spring-loaded terminal - Switchable terminating resistor	EWZ0046



Labelling strip

Mode		Features	Product key
Labelling strip		- DIN A4 white, precut - Material: PET (water and oil resistant) - Printing using a standard laser printer 102 labelling strips per sheet (VPE 10 sheets)	EPM-S990

Inverter

Servo-Inverter i700

5 to 64 A



Servo-Inverter i700

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		Installation material for i700 servo inverter	4.5 - 42

Servo-Inverter i700

General information



Product key

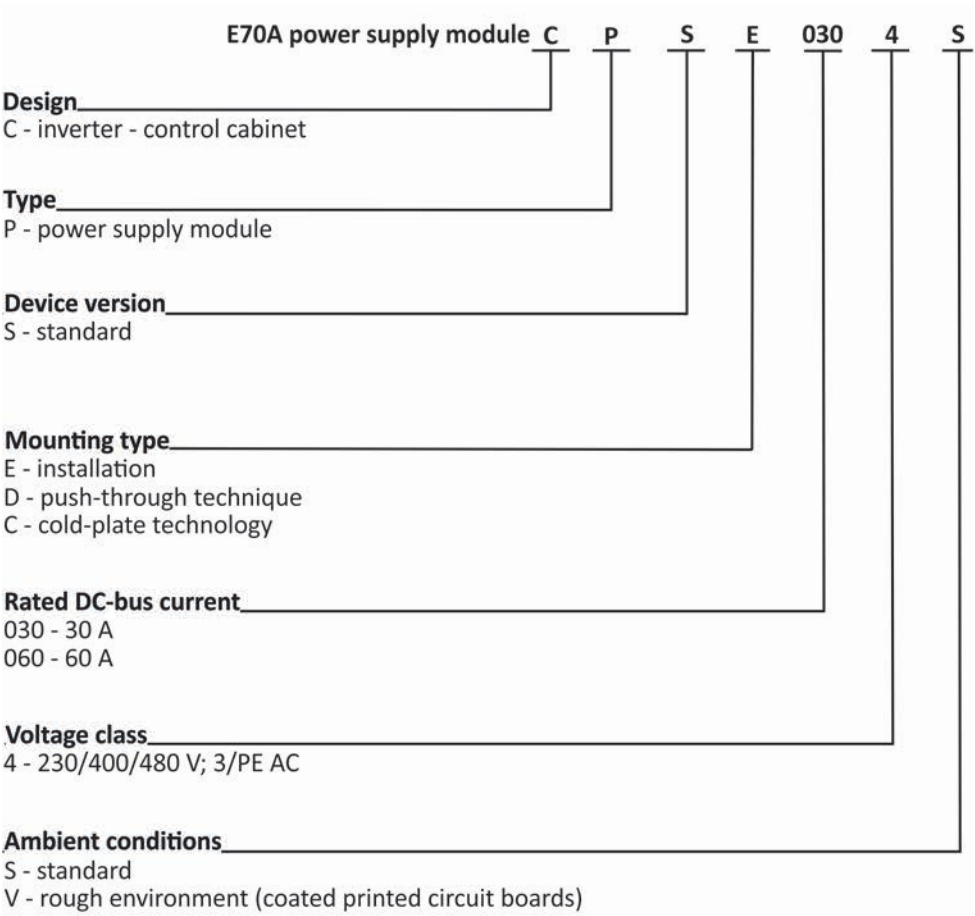
	Single/double axis E70A	C	M	S	E	005	4	S	A	1	ET	R
Design												
C - inverter - control cabinet												
Type												
M - single axis or double axis												
Device version												
D - 599 Hz												
S - up to 2000 Hz are possible												
Mounting type												
E - installation												
D - push-through technique												
C - cold-plate technology												
Max. short-time output current												
005 - 5 A												
010 - 10 A												
020 - 20 A												
032 - 32 A												
048 - 48 A												
064 - 64 A												
Voltage class												
4 - 230/400/480 V; 3/PE AC												
Ambient conditions												
S - standard												
V - rough environment (coated printed circuit boards)												
Safety engineering												
A - with Basic Safety (STO) function												
B - with Extended Safety function												
Motor outputs												
1 - single axis												
2 - double axis												
Communication												
ET - EtherCAT®												
Encoder input												
R - resolver												
E - encoder/absolute value encoder												

Servo-Inverter i700

General information



Product key



Servo-Inverter i700

General information

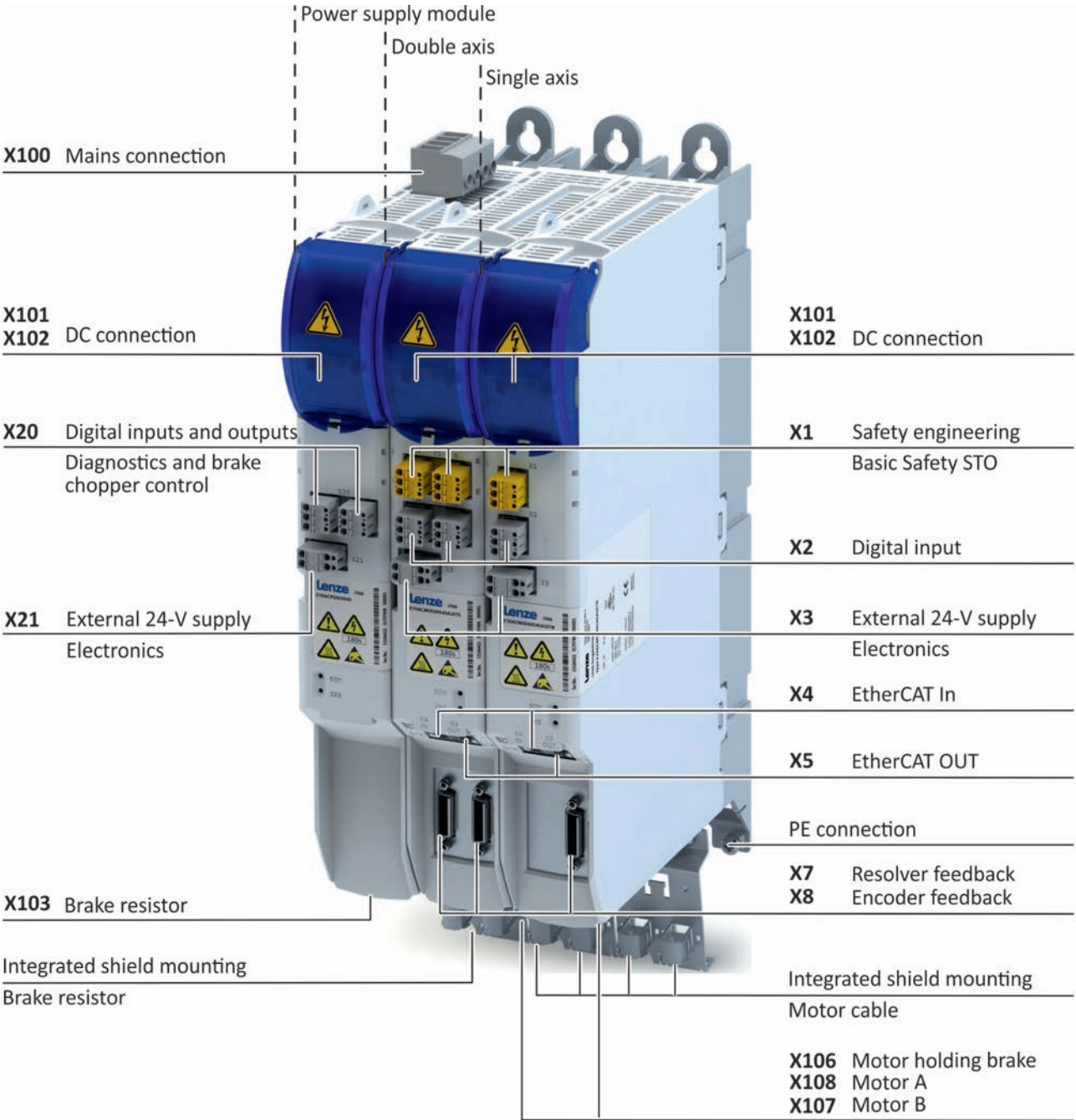


Servo-Inverter i700

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Equipment with Basic Safety STO



Servo-Inverter i700

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List of abbreviations

b	[mm]	Dimensions
C _{th}	[KW _s]	Thermal capacity
f _{ch}	[kHz]	Switching frequency
h	[mm]	Dimensions
H _{max}	[m]	Site altitude
I _{max}	[A]	Max. DC-bus current
I _{max, out}	[A]	Max. output current
I _{N, AC}	[A]	Rated mains current
I _{N, DC}	[A]	Rated DC-bus current
I _{N, out}	[A]	Rated output current
l _{max}	[m]	Max. cable length
m	[kg]	Mass
P	[kW]	Typical motor power
P _{max, 1}	[kW]	Max. output power
P _V	[kW]	Power loss
P _N	[kW]	Rated power
R _{min}	[Ω]	Min. brake resistance
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)

Servo-Inverter i700

General information



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

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Servo-Inverter i700

General information



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
Control 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 PID controller
Operating modes to CiA 402	Velocity mode (VL) - non-cyclic velocity setpoint Cyclic synchronous position (csp) - cyclic position setpoint Cyclic synchronous velocity (csv) - cyclic velocity setpoint 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 Short circuit Earth fault Overvoltage Undervoltage DC-bus voltage Motor phase failure Overcurrent I ² x t-Motor monitoring Overtemperature Motor overtemperature Brake chopper, brake resistance Motor stalling
Diagnostics	
	Axis modules: Error codes to CiA 402 Power supply modules: Status message via 2 digital outputs Oscilloscope functions
Status display	2 LEDs
Braking operation	
Brake chopper	Integrated in power supply module
Brake resistor	External
Mounting conditions	
Mounting type	Installation Cold plate technique (on request) Push-through technique (on request)
Mounting place	In the control cabinet
Mounting position	Vertical
Free spaces	At the top: minimum 90 mm Side-by-side mounting without any clearance At the bottom: minimum 70 mm



Operating modes

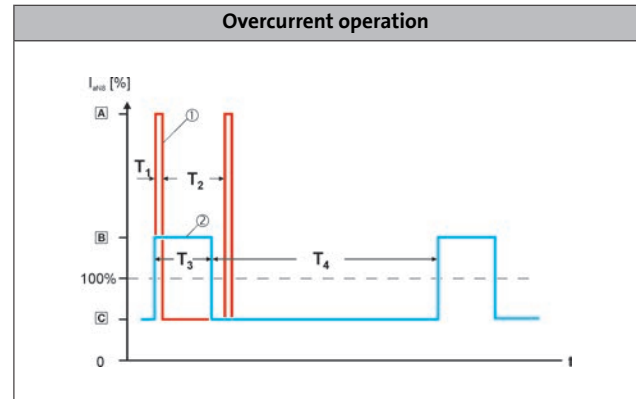
Overcurrent operation

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.



- 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.



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 (<http://www.lenze.com/download/software-downloads>). 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 Certificate 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

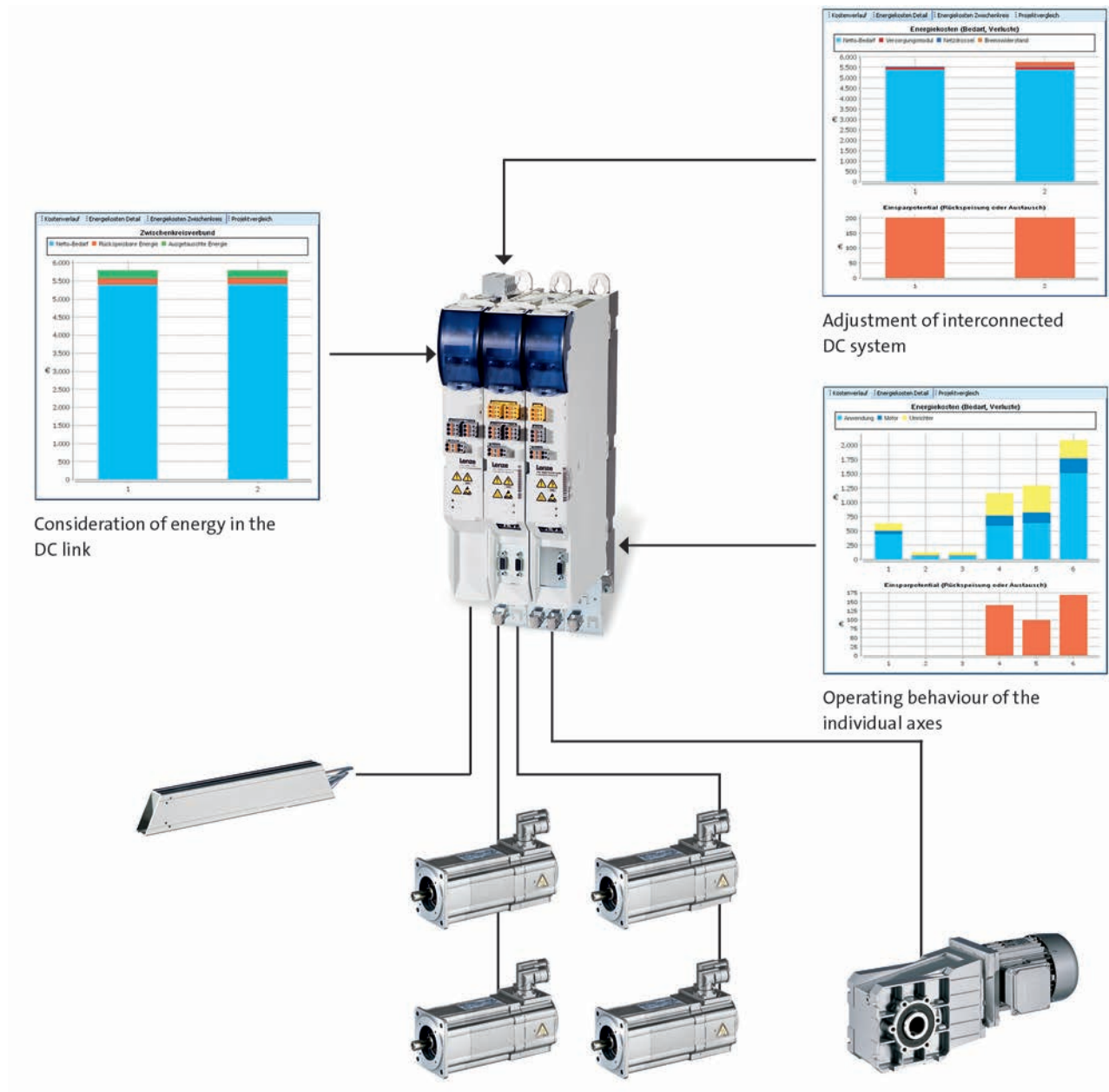
Mode	Engineering Tool DSD
Applications	Comprehensive applications as for instance linear and rotating drives, positioning-, wheel, hoist and synchronous drives, winders, pumps, fans, ...
Components	Inverter Motors (brake, feedback) Geared motors Power supply modules
Check of components and drive system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

Servo-Inverter i700

General information



Dimensioning of a multi-axis system



Servo-Inverter i700

General information



Servo-Inverter i700

Technical data



Standards and operating conditions

Mode			Servo-Inverter i700
Product			Servo-Inverter i700
Conformity			Low-Voltage Directive
CE			2014/35/EU [UKCA: S.I. 2016/1101]
Approval			Power Conversion Equipment (file no. E132659)
UL 508C			CSA 22.2 No. 14
CSA			RoHS
Certification			RoHS
Degree of protection			IP20
EN 60529			Type 1
NEMA 250			1K3 (temperature: -25 °C ... +60 °C)
Climatic conditions			1K3 (temperature: -25 °C ... +40 °C)
Storage (EN 60721-3-1)			2K3 (temperature: -25 °C ... +70 °C)
Storage (EN 60721-3-1) > 6 months			3K3 (temperature: -10 °C ... +55 °C)
Transport (EN 60721-3-2)			2.5 % / K
Operation (EN 60721-3-3)			2.5 % / K
Current derating at over 40 °C			2.5 % / K
Site altitude			4000
Amsl	H _{max}	[m]	4000
Current derating at over 1000 m		[%/1000 m]	5
Vibration resistance			2M2
Transport (EN 60721-3-2)			10 Hz ≤ f ≤ 57 Hz: ±0.075 mm amplitude, 57 Hz ≤ f ≤ 150 Hz: 1.0 g
Operation (EN 61800-5-1)			5 Hz ≤ f ≤ 13.2 Hz: ±1 mm amplitude 13.2 Hz ≤ f ≤ 100 Hz: 0.7 g
Operation (Germanischer Lloyd)			5 Hz ≤ f ≤ 13.2 Hz: ±1 mm amplitude 13.2 Hz ≤ f ≤ 100 Hz: 0.7 g

Mode		Servo-Inverter i700
Product		Servo-Inverter i700
Supply form		Systems with earthed star point (TN and TT systems) 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		Cable-guided disturbance: According to category C1 with special measures According to category C2 with standard accessories According to category C3 without additional measures
Insulation resistance		Overvoltage category III Above 2000 m amsl overvoltage category II
EN 61800-5-1		2
Degree of pollution		2
EN 61800-5-1		> 3.5 mA AC, > 10 mA DC
Shock current		> 3.5 mA AC, > 10 mA DC
EN 61800-5-1		> 3.5 mA AC, > 10 mA DC
Protective insulation of control circuits		Safe mains isolation: double/reinforced insulation
EN 61800-5-1		Safe mains isolation: double/reinforced insulation

Servo-Inverter i700

Technical data



Rated data for single axes

					
Max. short-time output current					
	$I_{\max, \text{out}}$	[A]	5.0	10.0	20.0
Product key			E70ACM□□0054□□1ET□	E70ACM□□0104□□1ET□	E70ACM□□0204□□1ET□
DC supply			DC 260 V -0 % ... 775 V +0 %		
	U_{DC}	[V]			
Typical motor power					
4-pole asynchronous motor	P	[kW]	0.75	1.50	4.00
Rated output current					
	$I_{\text{N, out}}$	[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	0.130

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

Servo-Inverter i700

Technical data



Rated data for single axes

					
Max. short-time output current					
	$I_{\max, \text{out}}$	[A]	32.0	48.0	64.0
Product key			E70ACM□□0324□□1ET□	E70ACM□□0484□□1ET□	E70ACM□□0644□□1ET□
DC supply			DC 260 V -0 % ... 775 V +0 %		
	U_{DC}	[V]			
Typical motor power					
4-pole asynchronous motor	P	[kW]	7.50	11.0	15.0
Rated output current					
	$I_{\text{N, out}}$	[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]	0.210	0.290	0.390

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

Servo-Inverter i700

Technical data



Rated data for double axes

				
Max. short-time output current				
	$I_{\max, \text{out}}$	[A]	5.0	10.0
Product key			E70ACM□□0054□□2ET□	E70ACM□□0104□□2ET□
DC supply			DC 260 V -0 % ... 775 V +0 %	
	U_{DC}	[V]		
Typical motor power				
4-pole asynchronous motor	P	[kW]	0.75	1.50
Rated output current				
	$I_{\text{N, out}}$	[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	0.140

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

Servo-Inverter i700

Technical data



Rated data for double axes

				
Max. short-time output current				
	$I_{\max, \text{out}}$	[A]	20.0	32.0
Product key			E70ACM□□0204□□2ET□	E70ACM□□0324□□2ET□
DC supply			DC 260 V -0 % ... 775 V +0 %	
	U_{DC}	[V]		
Typical motor power				
4-pole asynchronous motor	P	[kW]	4.00	7.50
Rated output current				
	$I_{\text{N, out}}$	[A]	10.0	16.0
Rated switching frequency			4	
	f_{ch}	[kHz]		
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]	0.260	0.370

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

Servo-Inverter i700

Technical data



Rated data for power supply modules

- Operation at 3/PE AC 230/400 and 480 V possible.
- The data is valid for operation at 3/PE AC 400 V.

				
Product key				
Power supply module			E70ACP000304	E70ACP000604
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 180 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	0.110

Brake chopper rated data

Rated power, Brake chopper				
	P_N	[kW]	5.0	10.1
Max. output power, Brake chopper				
	$P_{max, 1}$	[kW]	32.5	65.5
Running time				
	t_{on}	[s]	15.0	
Recovery time				
	t_{re}	[s]	82.0	
Min. brake resistance				
	R_{min}	[Ω]	18.0	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 (on request)

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 (R_{th}) 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
	P_V	R_{th}
	[W]	[K/W]
E70ACM□C0054□□1ET□	25.0	≤ 1.6
E70ACM□C0104□□1ET□	50.0	≤ 0.8
E70ACM□C0204□□1ET□	95.0	≤ 0.45
E70ACM□C0324□□1ET□	140	≤ 0.25
E70ACM□C0484□□1ET□	215	≤ 0.2
E70ACM□C0644□□1ET□	290	≤ 0.15

Double axes

Product key	Power to be dissipated	Thermal resistance
	P_V	R_{th}
	[W]	[K/W]
E70ACM□C0054□□2ET□	50.0	≤ 0.8
E70ACM□C0104□□2ET□	95.0	≤ 0.45
E70ACM□C0204□□2ET□	185	≤ 0.2
E70ACM□C0324□□2ET□	275	≤ 0.15

Power supply modules

Product key	Power to be dissipated	Thermal resistance
	P_V	R_{th}
	[W]	[K/W]
E70ACP□C0304□	45.0	≤ 0.95
E70ACP□C0604□	85.0	≤ 0.45

Servo-Inverter i700

Technical data



"Cold plate" design (on request)

Dimensions and weights

Single axes

Product key			E70ACM□C0054□□1ET□	E70ACM□C0104□□1ET□	E70ACM□C0204□□1ET□
Dimensions					
Height, including fastening	h	[mm]	410		
Width	b	[mm]	50		
Depth	t	[mm]	221		
Mass					
	m	[kg]	2.3		

Product key			E70ACM□C0324□□1ET□	E70ACM□C0484□□1ET□	E70ACM□C0644□□1ET□
Dimensions					
Height, including fastening	h	[mm]	410		
Width	b	[mm]	100		
Depth	t	[mm]	221		
Mass					
	m	[kg]	5.3		

Double axes

Product key			E70ACM□C0054□□2ET□ E70ACM□C0104□□2ET□		E70ACM□C0204□□2ET□ E70ACM□C0324□□2ET□
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			E70ACP□C0304□	E70ACP□C0604□
Dimensions				
Height, including fastening	h	[mm]	410	
Width	b	[mm]	50	100
Depth	t	[mm]	221	
Mass				
	m	[kg]	2.6	5.6

Servo-Inverter i700

Technical data



Push-through technique design (on request)

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
	P_V
	[W]
E70ACM□D0054□□1ET□	25.0
E70ACM□D0104□□1ET□	50.0
E70ACM□D0204□□1ET□	95.0
E70ACM□D0324□□1ET□	140
E70ACM□D0484□□1ET□	215
E70ACM□D0644□□1ET□	290

Double axes

Product key	Power to be dissipated
	P_V
	[W]
E70ACM□D0054□□2ET□	50.0
E70ACM□D0104□□2ET□	95.0
E70ACM□D0204□□2ET□	185
E70ACM□D0324□□2ET□	275

Power supply modules

Product key	Power to be dissipated
	P_V
	[W]
E70ACP□D0304□	45.0
E70ACP□D0604□	85.0

Servo-Inverter i700

Technical data



Push-through technique design (on request)

Dimensions and weights

Single axes

Product key			E70ACM□D0054□□1ET□	E70ACM□D0104□□1ET□	E70ACM□D0204□□1ET□
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			E70ACM□D0324□□1ET□	E70ACM□D0484□□1ET□	E70ACM□D0644□□1ET□
Dimensions					
Height, including fastening	h	[mm]	410		
Width	b	[mm]	100		
Depth (in control cabinet)	t	[mm]	221		
Mass					
	m	[kg]	7.1		

4.5

Double axes

Product key			E70ACM□D0054□□2ET□	E70ACM□D0104□□2ET□
Dimensions				
Height, including fastening	h	[mm]	410	
Width	b	[mm]	50	
Depth	t	[mm]	261	
Mass				
	m	[kg]	3.2	

Product key			E70ACM□D0204□□2ET□	E70ACM□D0324□□2ET□
Dimensions				
Height, including fastening	h	[mm]	410	
Width	b	[mm]	100	
Depth	t	[mm]	261	
Mass				
	m	[kg]	7.1	

Power supply modules

Product key			E70ACP□D0304□	E70ACP□D0604□
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

Servo-Inverter i700

Technical data





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.



28 - 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.



38 - Mains chokes, RFI filters, Mains filters

Mains fuses and cable cross-sections

- The mains fuse and cable cross-section specifications apply to a mains connection of 3AC 230/400/480 V.
- Class gG/gI 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.

Mains voltage	Product key	Circuit breaker	Fuse		Mains connection
			EN 60204-1	UL ¹⁾	
U _{AC}	Power supply module	I	I	I	Cross-section (with mains choke)
[V]		[A]	[A]	[A]	q
3 AC 180 ... 528	E70ACP□□0304□	C40	40		10.0
	E70ACP□□0604□	C63	63		16.0

¹⁾ In preparation.



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



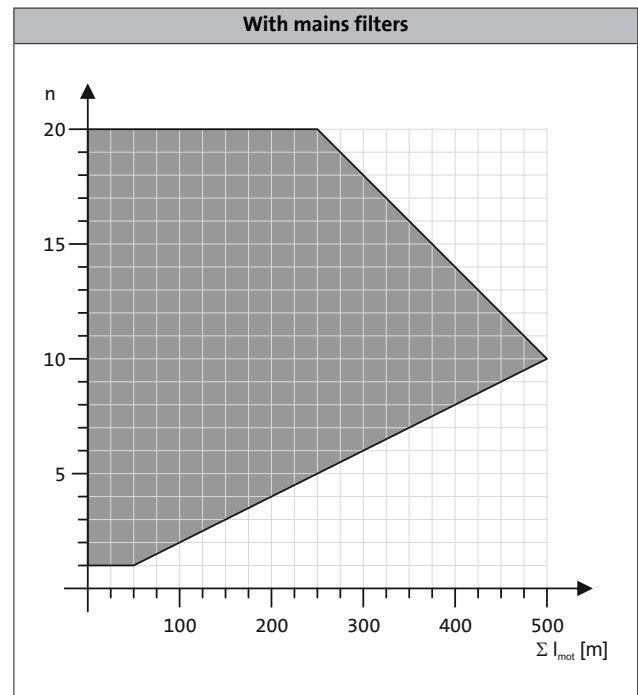
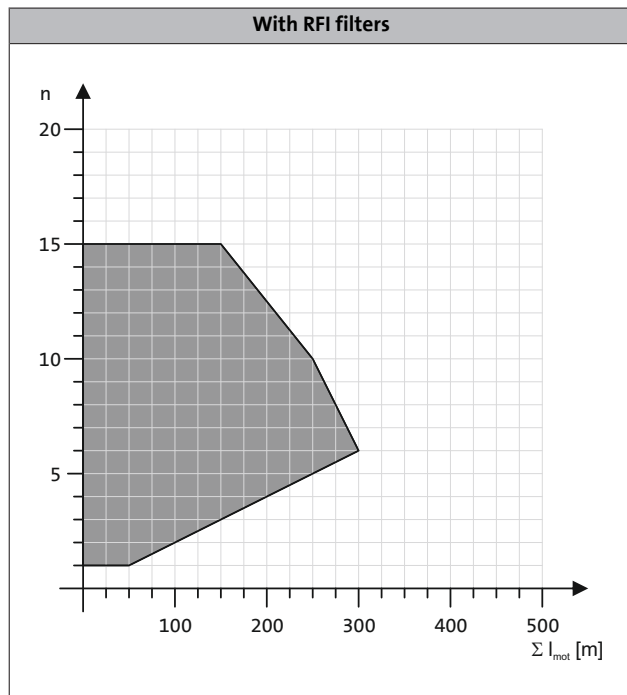


Motor connection

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 .

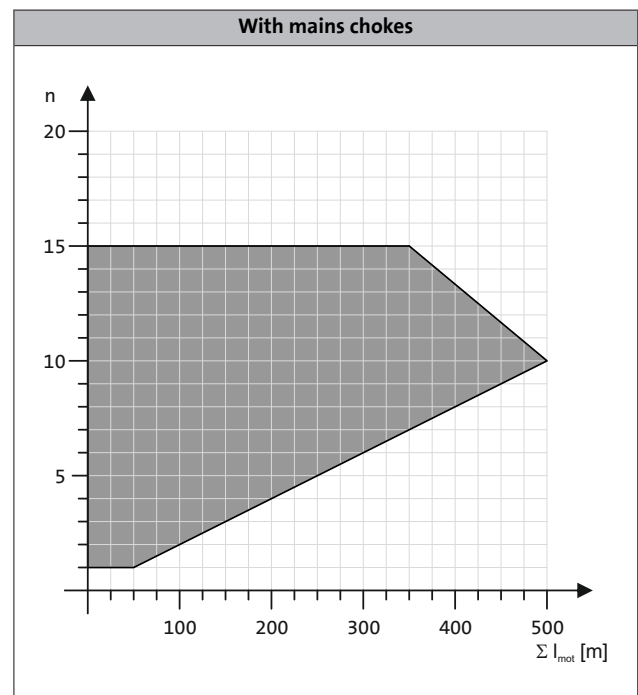
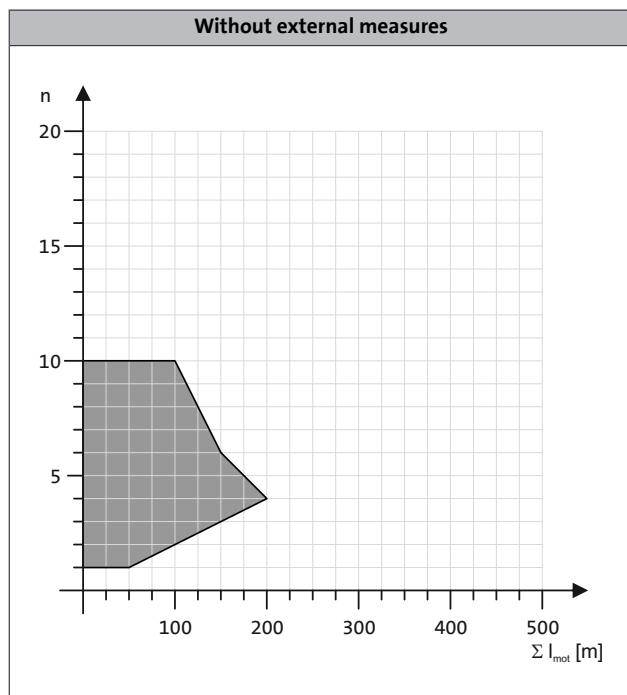
- Number of axes (n) / sum of the motor cable length (l)

Category C2



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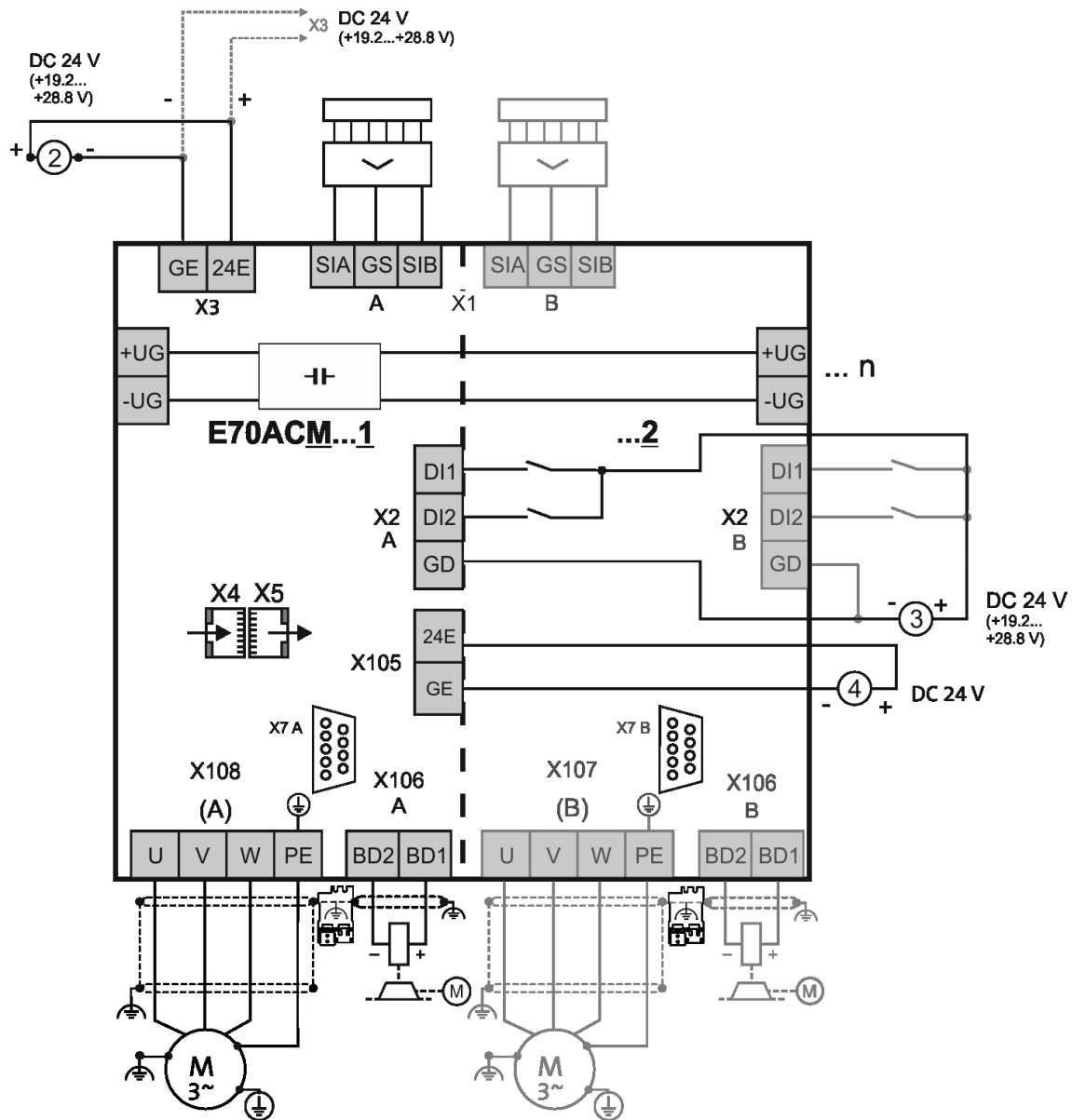
Category C3





Connection diagrams

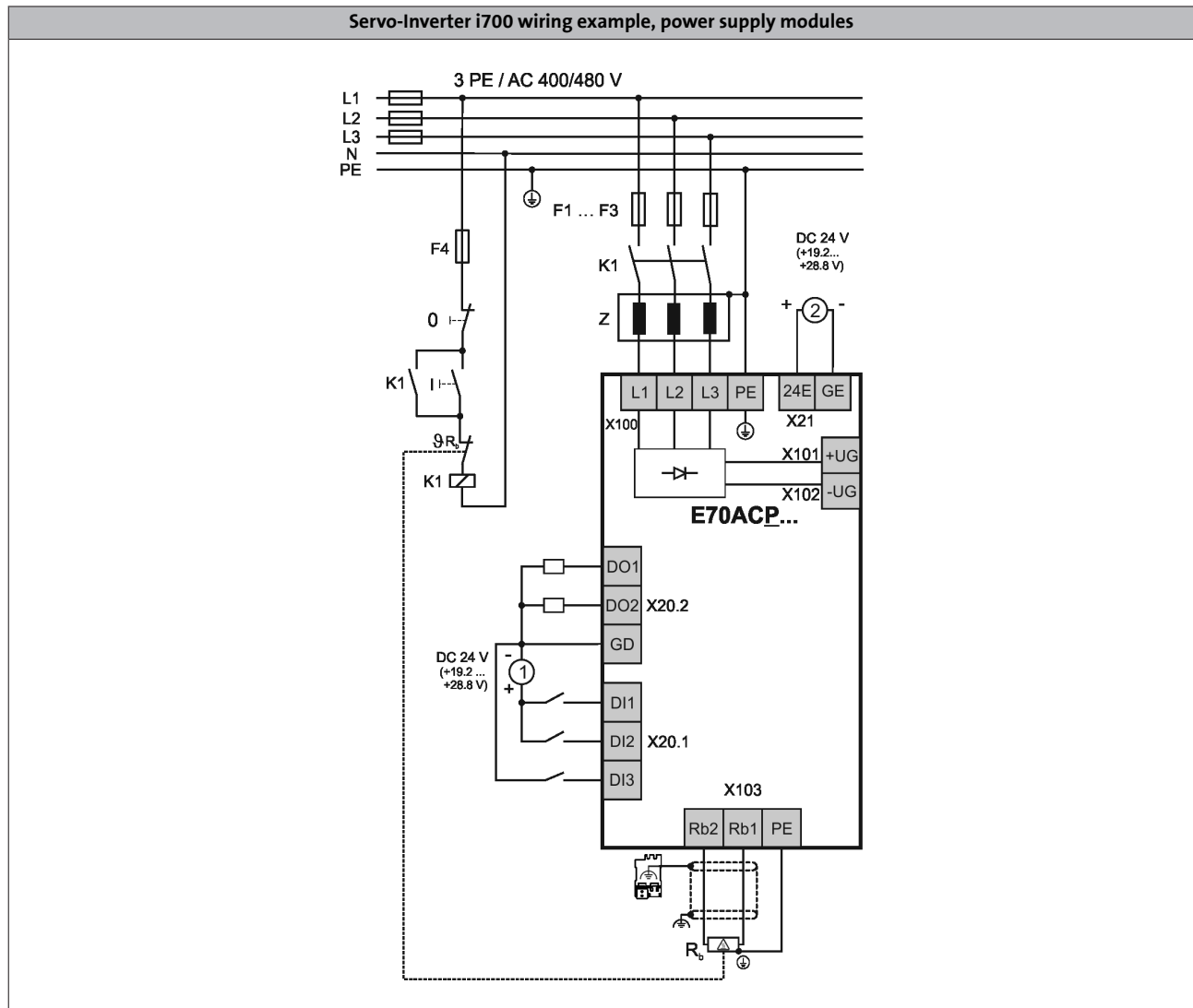
Wiring example for i700 servo inverter, axis modules, Basic Safety STO



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



Connection diagrams



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

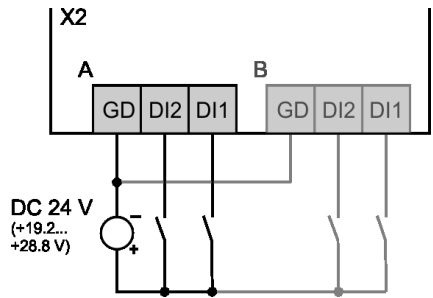


Control connections

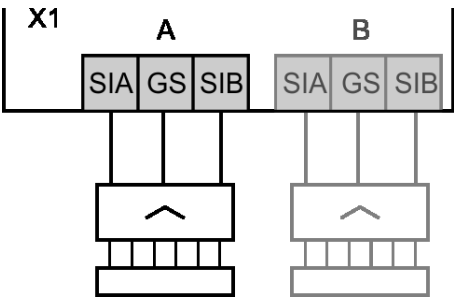
Mode	Servo-Inverter i700
Digital inputs	
Number	2
Touch-probe-capable	2 with time and position stamp
Switching level	PLC (IEC 61131-2)
Max. input current	8 mA
External DC supply	
Rated voltage	24 V in accordance with IEC 61131-2
Voltage range	19.2 ... 28.8 V, max. residual ripple $\pm 5\%$
Interfaces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

4.5

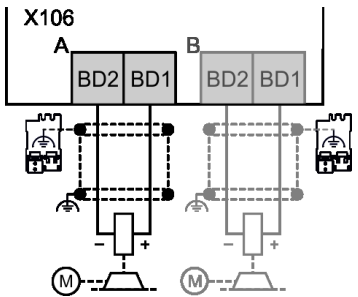
Connection of digital inputs



Connection of Basic Safety STO safety system



Motor brake connection





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.

  41 - 24 V power supply unit

Single axes

Max. short-time output current	Product key	External DC supply
		Current
$I_{\max, \text{out}}$		
[A]		
5.0	E70ACM□□0054□□1ET□	1.0 A
10.0	E70ACM□□0104□□1ET□	
20.0	E70ACM□□0204□□1ET□	
32.0	E70ACM□□0324□□1ET□	2.0 A
48.0	E70ACM□□0484□□1ET□	
64.0	E70ACM□□0644□□1ET□	

4.5

Double axes

Max. short-time output current	Product key	External DC supply
		Current
$I_{\max, \text{out}}$		
[A]		
5.0	E70ACM□□0054□□2ET□	1.0 A
10.0	E70ACM□□0104□□2ET□	
20.0	E70ACM□□0204□□2ET□	2.0 A
32.0	E70ACM□□0324□□2ET□	

Servo-Inverter i700

Interfaces



Safety engineering

Safety engineering has been certified acc. to EN ISO 13849-1 (cat. 4, PL e), EN 61508/EN 62061 (SIL 3).

Basic Safety STO

By default, the i700 servo inverters 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. 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 Basic Safety STO safety engineering would be: E70ACMSE0054SA1ETR



Double axis with connection for "Basic Safety STO" safety system



EtherCAT® communication

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

The advantages of the system are:

- fast and very powerful bus system
- ideally suited for Controller-based Automation solutions
- easy system integration since a wide range of sensors and actuators is available on the market.
- the basic features of a servo drive are available in the axes according to the CiA402 device profile and can be easily used via the EtherCAT®.

Mode	Features
Communication	
EtherCAT ¹⁾	• CANopen over EtherCAT (CoE) • Distributed clock • 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			
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	I _{max}	[m]	100
Rated voltage			
	U _{N, DC}	[V]	24.0

Servo-Inverter i700

Interfaces





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}	$h \times b \times t$	m
		[Ω]	[kW]	[KWs]	[mm]	[kg]
E70ACP□□0304□	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
E70ACP□□0604□	ERBG012R01K9	12.0	1.90	285	486 x 236 x 302	13.0
	ERBG012R05K2		5.20	750	486 x 426 x 302	28.0



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.

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

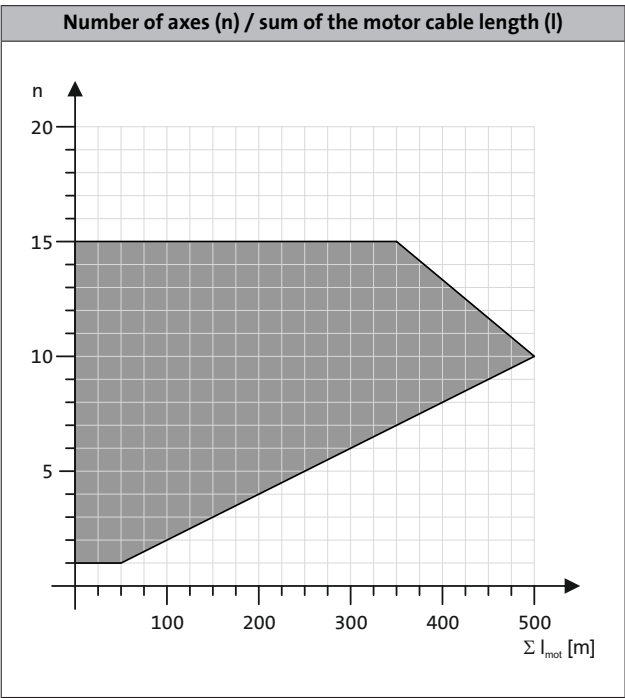


Mains choke

4.5

Product key		Output power	Rated current	Dimensions	Mass
Power supply module	Mains choke	at 400 V			
		P_{out}	I_N	$h \times b \times t$	m
		[kW]	[A]	[mm]	[kg]
E70ACP□□0304□	EZAELN3025B122	15.4	25.0	110 x 155 x 170	5.8
E70ACP□□0604□	EZAELN3050B591	30.9	50.0	112 x 185 x 210	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.





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.

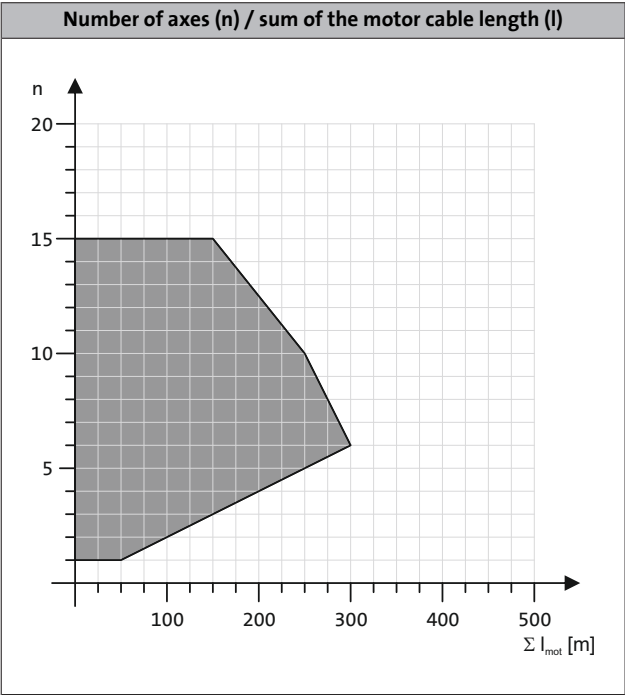


RFI filter, can be mounted beside the power supply module

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	I_{max}	$h \times b \times t$	m
		[kW]	[A]	[kW]	[m]	[mm]	[kg]
E70ACP□□0304□	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
E70ACP□□0604□	E94AZRP0824	20.6	82.0	0.080		490 x 209 x 272	18.5

4.5

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.





Interference suppression of power supply modules

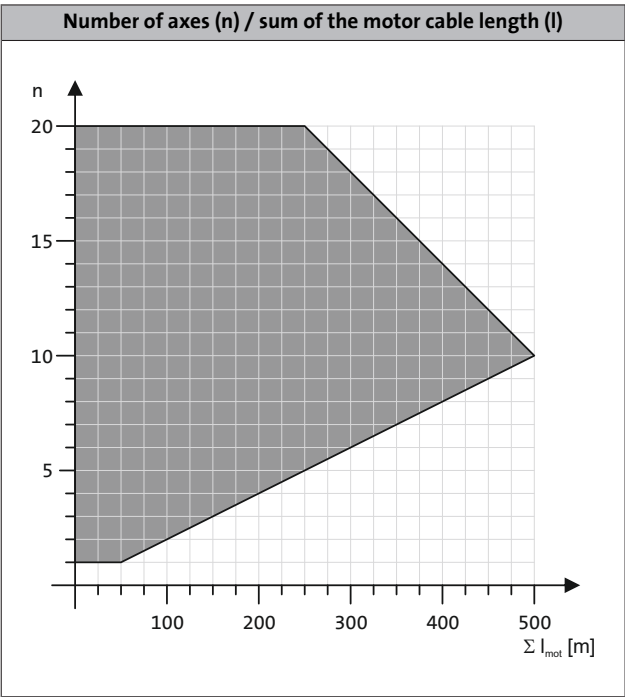
Mains filters

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}	$h \times b \times t$	m
		[kW]	[A]	[V]	[m]	[mm]	[kg]
E70ACP□□0304□	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
E70ACP□□0604□	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.



Servo-Inverter i700

Accessories



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 "safe 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 PELV (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 DC 90 ... 350			AC 320 ... 575 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
Infeed adapter i700 DC Terminal	• For extending the DC-bus connection, energy exchange	E70AZEVE001

Servo-Inverter i700

Accessories



Installation material for i700 servo inverter

- For customers who order large quantities.

Single axes 5 to 20 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
STO terminal	50	EZAEVE001/M
DigIN terminal	50	EZAEVE002/M
Terminal - external 24-V supply	50	EZAEVE003/M
Brake terminal	50	EZAEVE004/M
Motor terminal 2.5 mm ²	50	EZAEVE005/M
Shield plate BF1	25	EZAMBHXM008/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM006/M
EtherCAT® cable 100 mm (connection to the next axis)	10	EYC0000A0000X001/M

Single axes 32 to 64 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
STO terminal	50	EZAEVE001/M
DigIN terminal	50	EZAEVE002/M
Terminal - external 24-V supply	50	EZAEVE003/M
Brake terminal	50	EZAEVE004/M
Motor terminal 6.0 mm ²	25	EZAEVE006/M
Shield plate BF2	25	EZAMBHXM009/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM003/M
EtherCAT® cable 100 mm (connection to the next axis)	10	EYC0000A0000X001/M

Double axes 5 to 10 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
STO terminal	50	EZAEVE001/M
DigIN terminal	50	EZAEVE002/M
Terminal - external 24-V supply	50	EZAEVE003/M
Brake terminal	50	EZAEVE004/M
Motor terminal 2.5 mm ²	50	EZAEVE005/M
Shield plate BF1	25	EZAMBHXM008/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM006/M
EtherCAT® cable 100 mm (connection to the next axis)	10	EYC0000A0000X001/M

Servo-Inverter i700

Accessories



Installation material for i700 servo inverter

- For customers who order large quantities.

Double axes 20 to 32 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
STO terminal	50	EZAEVE001/M
DigIN terminal	50	EZAEVE002/M
Terminal - external 24-V supply	50	EZAEVE003/M
Brake terminal	50	EZAEVE004/M
Motor terminal 2.5 mm ²	50	EZAEVE005/M
Shield plate BF2	25	EZAMBHXM009/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM003/M
EtherCAT® cable 100 mm (connection to the next axis)	10	EYC0000A0000X001/M

Power supply module 30 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
Terminal - external 24-V supply	50	EZAEVE003/M
Mains terminal	50	EZAEVE008/M
DigIN terminal	50	EZAEVE009/M
DigOUT terminal	50	EZAEVE010/M
Brake resistor terminal	50	EZAEVE011/M
Shield plate BF1	25	EZAMBHXM008/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM006/M

Power supply module 60 A

Mode	Packaging	Product key
	VPE	
	[Stück]	
Terminal - external 24-V supply	50	EZAEVE003/M
Mains terminal	50	EZAEVE008/M
DigIN terminal	50	EZAEVE009/M
DigOUT terminal	50	EZAEVE010/M
Brake resistor terminal	50	EZAEVE011/M
Shield plate BF2	25	EZAMBHXM009/M
Fixing clip	20	EZAMBHXM007/M
Wire clamp	10	EZAMBHXM003/M

Servo-Inverter i700

Accessories

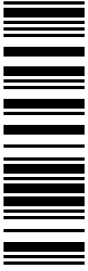


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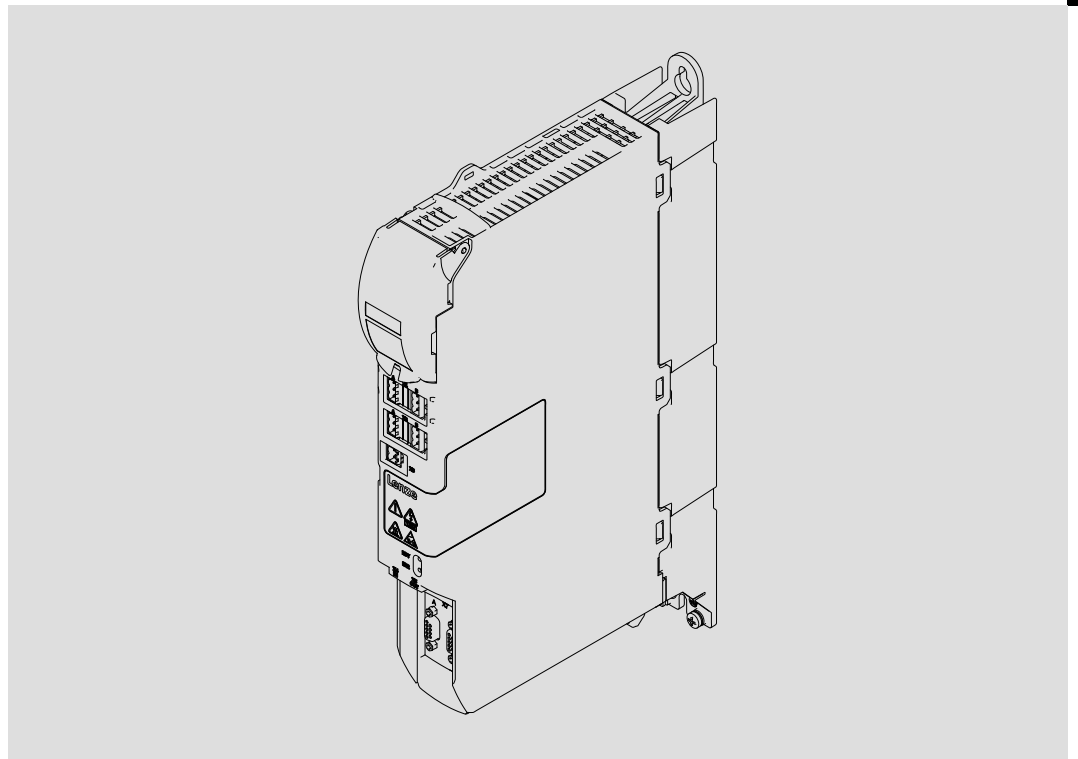
Lenze



Translation

Hardware Manual

i700



E70AC...

Servo-Inverter i700

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1 About this documentation

Contents

The hardware manual contains the complete information required for the application as directed of the i700 series controllers and components.



Tip!

Information and tools concerning the Lenze products can be found in the download area at
www.lenze.com

Validity

Type	Type designation	from hardware version	from software version
Power supply modules	E70ACPSE...	1x	-
Single axis modules	E70ACMxE...1...	1x	01.06
Double axis modules	E70ACMxE...2...	1x	01.06

Target group

This hardware manual is intended for all persons who dimension, install, commission, and adjust drives of the i700 product series.

1.1 Document history

Material number	Version			Description
13575533	6.1	02/2022	TD00	Complemented: Conformity UKCA Supplements to the versions "Cold Plate" and "push-through design" General corrections and supplements
13575533	6.0	05/2019	TD15	Data supplemented for operation on 230 V Supplement to parallel operation of supply modules
13528287	5.1	08/2018	TD15	General corrections and supplements: Data according to Dual-Use Regulation
13528287	5.0	05/2018	TD15	General corrections and supplements: "Extended Safety" version Data according to Dual-Use Regulation
13455352	4.0	05/2014	TD15	Supplements to the versions "Cold Plate" and "push-through design" UL notes in French
13445510	3.0	09/2013	TD15	General corrections and supplements New: UL approval
13432926	2.0	04/2013	TD15	General corrections New: encoder as sensor type
13412058	1.2	11/2012	TD15	1. Proof copy

1.2

Conventions used

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

Spelling of numbers

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

Warnings

UL warnings		Given in English and French
UR warnings		

Text

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

Icons

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

Parameter or object

Hexadecimal	0x1234	Refers to the parameter or object 1234
With colon	0x1234:5	Refers to the parameter or object 1234 with subindex 5

Parameter or object

Hexadecimal	0x1234	Refers to the parameter or object 1234
With colon	0x1234:5	Refers to the parameter or object 1234 with subindex 5

1.3 Terms and abbreviations used

General

Term	Description
Controllers Axis module Motor module	General designation for servo controllers and frequency inverters
Module	Electronic unit or device
Single axis module 1-axis module Single inverter	Controller for one motor / one drive axis
Double axis module 2-axis module Double inverter	Controller for two motors / two drive axes
Axis A Axis B	Designation of the first / second axis of double axis devices
Servo controller Servo inverter	Electronic controller for operating rotating field motors with variably adjustable speed and torque. "Servo" stands for especially dynamic drive characteristics.
i700, 9400, 9300	Lenze servo controller product series
Frequency inverter	Electronic controller for operating rotating field motors with variably adjustable speed and torque.
8400, 8200	Lenze frequency inverter product series
Power electronics	Rectification, DC bus and inverter
Control electronics	Open-loop control, closed-loop control, setpoint generation, monitoring
Power supply unit, Power supply module	Electronic rectifier unit with mains connection for supplying energy to the DC bus. In a DC-bus operation, the controllers are supplied via the DC bus.
DC-bus operation	Interconnection of several controllers and, if required, power supply modules on the DC-bus level
DC-bus level	Energy storage between rectification and DC-AC conversion, for one or more controllers

Term	Description
 EtherCAT	EtherCAT® is a real-time capable Ethernet system with a top performance. EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Term	Description
C_L	Loading capacity for the 24 V supply
f	Frequency or frequency range
f_{Ch}	Switching frequency
I_{aMx}	Max. output current
I_{aNdc}	Rated value of continuous output current of the power supply module
I_{aNx}	Rated value of continuous output current, frequency-dependent
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
I_{BRmax}	Peak current
I_{max_3}	Maximum short-time current after cycle time
I_{max_60}	Maximum short-time current after cycle time
I_{red_12}	Reduced current after cycle time (recovery phase)
I_{red_120}	Reduced current after cycle time (recovery phase)
I_{r4}	Rated value of continuous output current at 4 kHz
I_{r24}	Rated current for the 24 V supply
I_{max24}	Maximum current for the 24 V supply
P_{24}	Rated power for the 24 V supply
P_{Bd}	Continuous braking power
P_{loss}	Power loss
R_{Bmin}	Nominal value of minimum brake resistance
P_{BRmax}	Peak braking power
t_{fp}	Maximum running time without initial load and compliance with the recovery time
t_{on}	Running time
t_z	Cycle time, periodic load change with running time and recovery time
U_{Lrated}	Rated mains voltage, also voltage range
U_{DC}	Rated DC bus voltage, also voltage range

DC-bus operation

Term	Description
DC bus	The energy store in the controller or supply module from which the controller modulates the AC voltage for the motor. The DC buses of several controllers can be networked.
DC bus	Electrical connection of the DC connections of several controllers via cable or busbar.
DC-voltage level	DC-voltage level in the DC bus
Power supply module	Module with AC mains connection used to supply the DC bus of a drive system with DC voltage.
Regenerative power supply module	Power supply module with additional power regeneration into the AC mains
Multi-axis controllers (Multi Drive)	Controllers for connection to a DC bus. Multi-axis controllers have no AC mains connection and no brake chopper.
Single-axis controllers (Single Drive)	Controllers for connection to an AC mains or a DC bus. Single-axis controllers have an integrated brake chopper.
Brake chopper	Switching element in the controller used to dissipate excess energy in the DC bus via a brake resistor.
Brake resistor	High-performance resistor used to convert excess energy in the DC-bus into heat.
Braking operation	Motor operation in generator mode with energy feedback from the motor to the controller.

Integrated safety engineering

Term	Description
STO	Functional safety: <i>safe torque off</i>
Mission time	Restricted period of use of safety-related components
Proof test interval	Period after which an examination must be performed to reveal undetected errors.

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

Application notes

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

Special safety instructions and application notes

Pictograph and signal word	Meaning
Warnings!	Safety note or application note for the operation according to UL or CSA requirements.
Warnings!	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 inverters

For your personal safety

Disregarding the following basic safety measures may lead to severe personal injury 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.
 - IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC-Report 664 or DIN VDE 0110 and national regulations for the prevention of accidents must be observed.
 - According to the basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- ▶ Observe all specifications in this documentation.
 - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
 - The procedural notes and circuit details described in this documentation are only proposals. It's up to the user to check whether they can be transferred to the particular applications. Lenze SE does not accept any liability for the suitability of the procedures and circuit proposals described.
- ▶ According to their enclosure, Lenze controllers (frequency inverters, servo inverters, DC speed controllers) and their components can carry a voltage, or parts of the controllers can move or rotate during operation. Surfaces can be hot.
 - Non-authorized removal of the required cover, inappropriate use, incorrect installation or operation create the risk of severe injury to persons or damage to material assets.
 - For more information, please see the documentation.
- ▶ There is a high amount of energy within the controller. Therefore always wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard) when working on the controller when it is live.

Application as directed

Drive controllers are components designed for the installation in electrical systems or machinery. They must not be used as household appliances. They are intended exclusively for professional and commercial 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 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]; EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with 2014/30/EU: EMC Directive [UKCA: S.I. 2016/1091 - The Electromagnetic Compatibility Regulations 2016].

The inverters meet the requirements of 2014/35/EU: Low-Voltage Directive [UKCA: S.I. 2016/1101 - The Electrical Equipment (Safety) Regulations 2016]. The harmonised standard EN 61800-5-1 applies to the inverters.

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

The actuation of the inverters in specific areas in compliance with EN 61800-3 (EMC categories) possibly requires the use of filters.

Warning: in residential environments, this product may cause high-frequency interferences which may make the implementation of interference suppression measures 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 mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components or contacts.

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

Electrical connection

When working on live inverters, observe the applicable national regulations for the prevention of accidents.

Carry out the electrical installation according to the relevant regulations (e. g. cable cross-sections, fusing, connection to the PE conductor). Additional notes are included in 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). You are allowed to adapt the controllers 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.

Keep all protective covers and doors closed during operation.

Safety functions

Certain controller versions support safety functions (e.g. "Safe torque off", formerly "Safe standstill") according to the requirements of 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]. 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 conditions of operation are observed.

Waste disposal

Recycle metal and plastic materials. Assembled PCBs must be disposed of professionally.

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

2.2 General safety and application notes for Lenze motors

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.

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

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

Application as directed

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

Low-voltage machines are components for installation into machines as defined in 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]. Commissioning is prohibited until the conformity of the end product with this directive has been established (follow i. a. EN 60204-1).

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

The integrated brakes must not be used as safety brakes. It cannot be ruled out that factors which cannot be influenced, such as oil ingress due to a defective 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 low-voltage machines, do not apply extra loads. If necessary, use suitable and adequately dimensioned means of transport (e. g. rope guides).

Remove transport locking devices before commissioning. Reuse them for further transport. When storing low-voltage machines, ensure a dry, dust-free and low-vibration ($v_{\text{eff}} \leq 0.2 \text{ mm/s}$) 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 mm/s ($P_{\text{rated}} > 15 \text{ kW}$) are acceptable if the clutch is activated.

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

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

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

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

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

2.3**Residual hazards****Protection of persons**

- ▶ Before working on the controller, check whether all power terminals are deenergised because
 - depending on the controller - the power terminals U, V, W, +UG, -UG, Rb1, and Rb2 carry hazardous voltages for up to 3 to 30 minutes after power-off.
 - 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 (initialisation), no undefined states occur.
 - Additional measures for the protection of the device or for the prevention of unrequested and/or non-braking motor movements are not required.
- ▶ If no data for the initialisation are transmitted by the L-force Controller, the i700 servo inverter uses the "Lenze setting" for the parameters.

3 Product description

3.1 Device features

Features	Power supply modules	Single axis module	Double axis module
Central mains connection	✓	-	-
Can be connected in parallel	✓	-	-
Integrated brake chopper	✓	-	-
Direct side-by-side mounting	✓	✓	✓
Mechanical design			
Built-in unit	✓	✓	✓
Push-through technique	Devices available on request		
Cold plate	Devices available on request		
DC-bus wiring			
Integrated	✓	✓	✓
Option: via cable	✓	✓	✓
Terminals in separate accessory kits	✓	✓	✓
Communication			
EtherCAT®	-	✓	✓
Touch probe inputs	-	2	2 x 2
Suitable motors			
ASM	-	✓	✓
SM	-	✓	✓
Integrated motor holding brake control			
Automatically	-	✓	✓
Via the control system	-	✓	✓
Servo control feedback system (alternative)			
Resolver	-	✓	✓
SinCos encoder	-	✓	✓
Operating modes			
Velocity mode	-	✓	✓
Cyclic synchronous velocity mode	-	✓	✓
Cyclic synchronous position mode	-	✓	✓
Cyclic synchronous torque mode	-	✓	✓
Integrated safety system (STO)	-	✓	✓

Additional information on export control

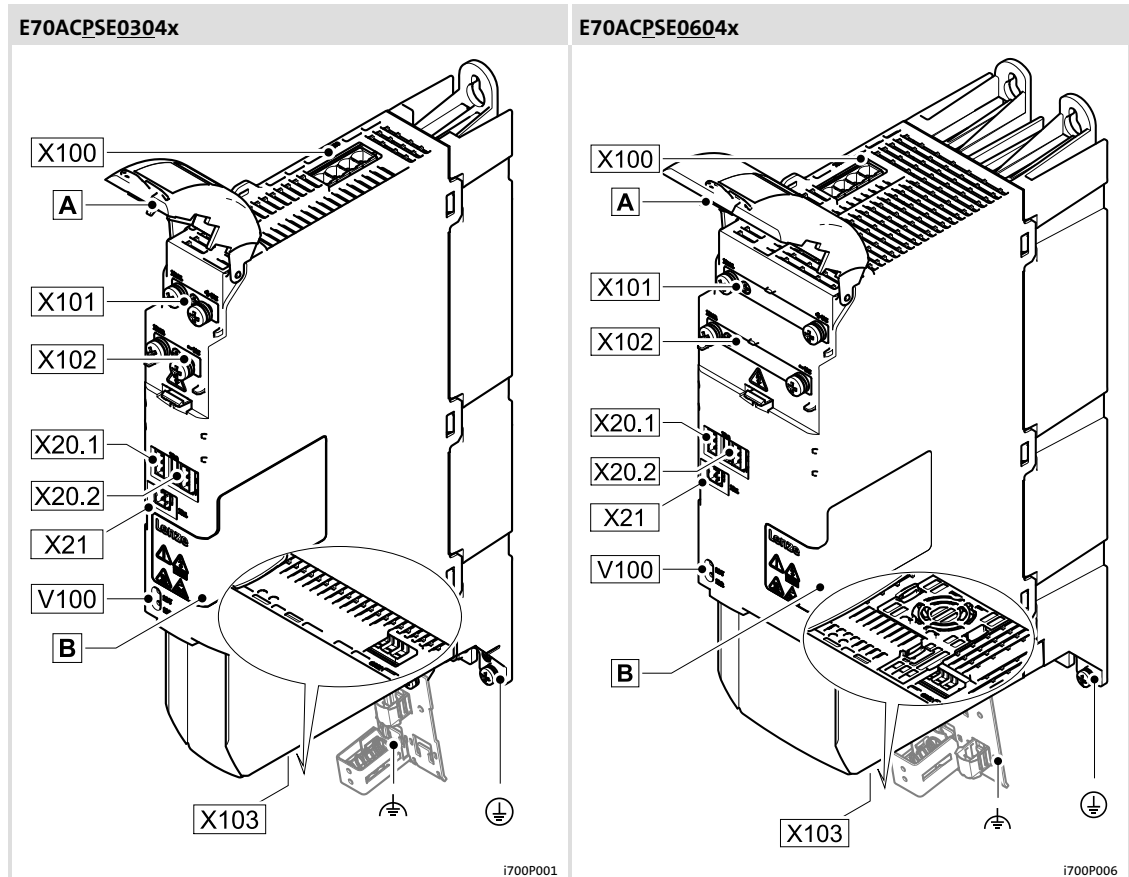
By limiting the maximum output frequency to 599 Hz, the devices are not subject to the export restrictions of the "EC-Dual-Use Regulation" - EC 428/2009.

This applies to devices with the product key E70ACMDxxxx4xxxxxx. The maximally possible output frequency is given on the nameplate.

Certain applications allow the devices E70ACMSxxxx4xxxxxx to be supplied with the previous maximum output frequency. If needed, get in touch with your Lenze contact person.

3.2 Overview of the devices

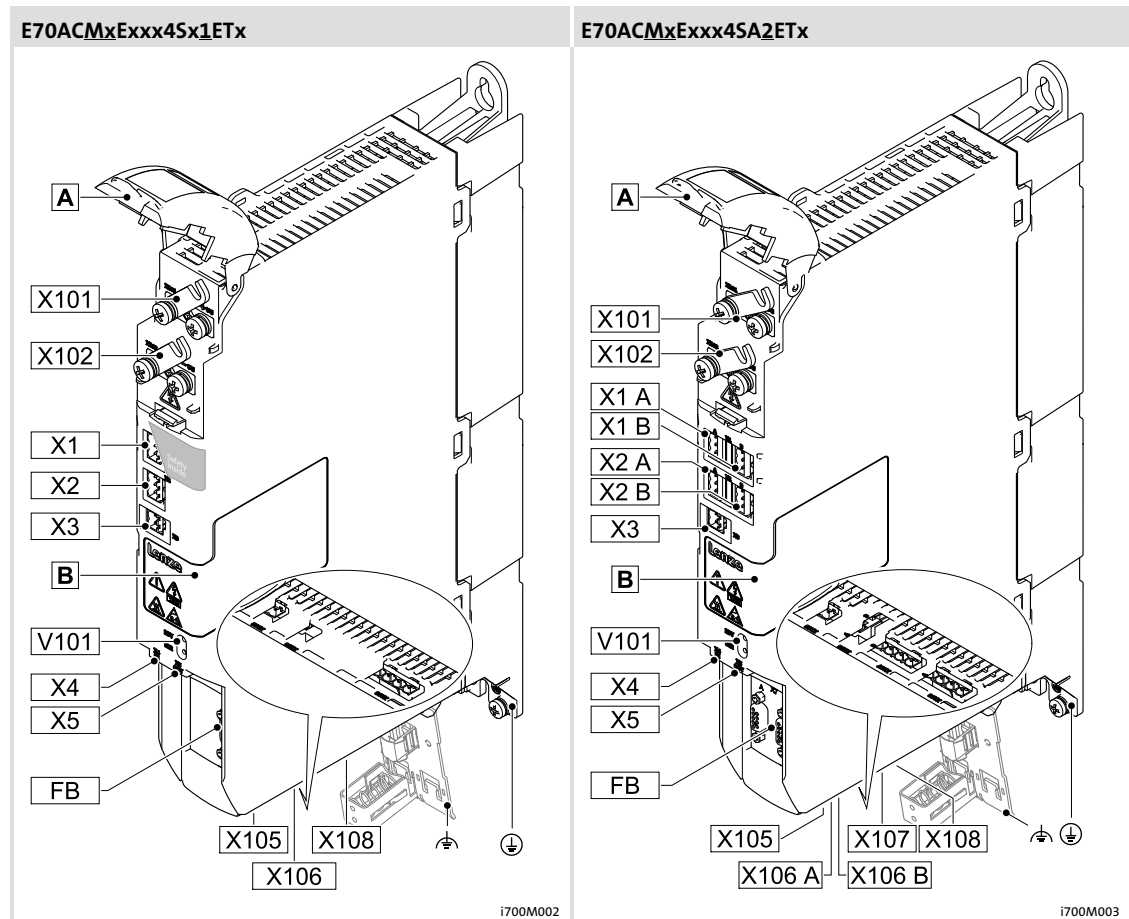
3.2.1 Supply modules



Connections and elements		Info
A	Hinged cover of DC-bus connections	52
B	Nameplate and warning symbols	25
X20.1	Digital inputs, digital outputs	50
X20.2		
X21	External 24-V supply	49
X100	Mains connection	51
X101	DC-bus UG+	52
X102	DC-bus UG-	
X103	Connection of brake resistor	53
V100	LED status display	129
	PE conductor	103
	Shield connection (functional earth)	103

3.2.2

Axis modules



Connections and elements		Info
A	Hinged cover of DC-bus connections	52
B	Nameplate and warning symbols	25
V101	LED status display	129
X1 A/B	Integrated safety system	130
X2 A/B	Touch probe	56
X3	External 24-V supply	57
X4	EtherCAT IN	58
X5	EtherCAT OUT	
FB	Servo control feedback system (alternative)	
	X7 A/B - Resolver (E70ACM...R)	60
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X101	DC-bus UG+	64
X102	DC-bus UG-	
X105	24-V supply of motor holding brake	65
X106 A/B	Motor holding brake	66
X107	Motor - axis B	67
X108	Motor - axis A	
⏚	PE conductor	103
⏚	Shield connection (functional earth)	103

3.3 Identification

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

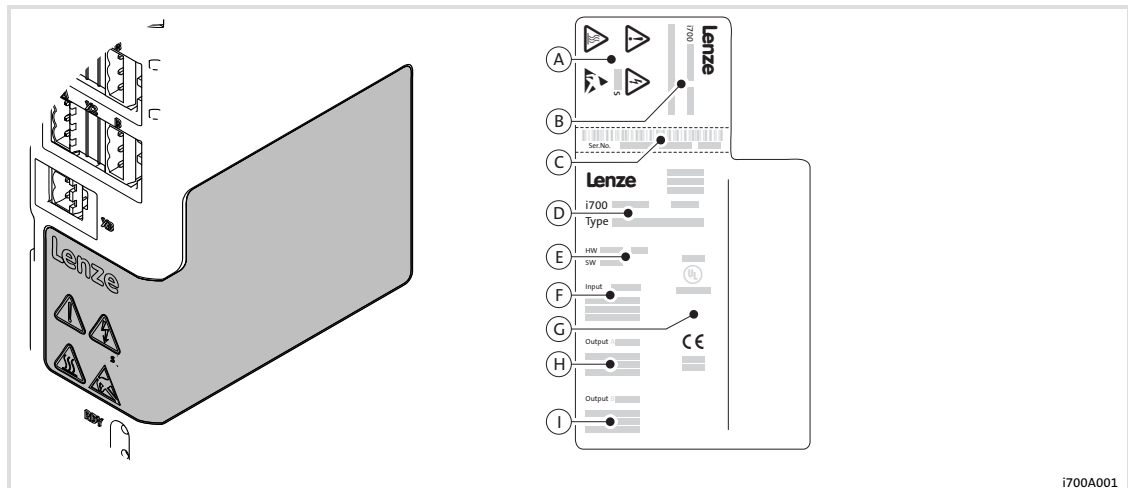


Fig. 3-1 Contents and position of the nameplate

A	Notes and warning symbols ☐
B	Product designation at the front
C	Serial number
D	Product designation at the side
E	Hardware and/or software version
F	Rated input power
G	Conformity and approval identification
H	Rated output power (power supply module or motor (A))
I	Rated output power (for 2-axis modules: motor B)

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

3.4

Product key

	1 ... 4	5	6	7	8	9 ... 11	12	13	14	15	16, 17	18
Power supply	E70A	C	P	S	x	xxx	4	x				
Servo inverter	E70A	C	M	x	x	xxx	4	x	x	x	xx	x
Product series Servo inverter i700												
Mounting type C = control cabinet												
Version M = axis module (servo inverter) P = power supply module												
Version D = < 599 Hz S = > 599 Hz or standard												
Mounting type E = built-in technique D = push-through technique C = cold plate technique												
Output current e.g. 005 = 5 A 060 = 60 A												
Voltage class 4 = 400/480 V, 3/PE AC												
Ambient conditions S = standard industrial environment IE33 according to IEC 60721-3-3 V = rough environment (coated printed circuit boards)												
Safety system A = with integrated safety engineering "Basic Safety - STO" B = with integrated safety engineering "Extended Safety"												
Number of axes 1 = single axis module (single inverter) 2 = double axis module (double inverter)												
Communication ET = EtherCAT®												
Type of encoder R = resolver E = SinCos encoder												

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



Tip!

Depending on the topic, the type designation parts important for the identification are underlined, e.g. E70ACMxD0054Sx1xxx.

4 Technical data

General data and operating conditions

4 Technical data

4.1 General data and operating conditions

Conformity and approval			
Conformity			
CE	2006/42/EC	Machinery Directive (only relevant for safety components)	
	2014/35/EU	Low-Voltage Directive	
	2014/30/EU	EMC Directive	
	2011/65/EU	RoHS Directive	
UKCA	S.I. 2008/1597	The Supply of Machinery (Safety) Regulations 2008 (only relevant for safety components)	
	S.I. 2016/1101	The Electrical Equipment (Safety) Regulations 2016	
	S.I. 2016/1091	The Electromagnetic Compatibility Regulations 2016	
	S.I. 2012/3032	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	
Approval			
cUL _{US}	UL 508C	E70ACxSE...	Industrial Control Equipment, Lenze File No. E132659
cUR _{US}	CSA 22.2 No. 14	E70ACxSC...	
		E70ACxSD...	

Protection of persons and devices			
Enclosure	EN 60529	IP 20	Specification • applies to the fully assembled state ready for use • does not apply to the wire range of the terminals
	UL	Protection against contact in accordance with Open Type	
		EN 60529	Mounting type "push-through technique", heatsink side: • IP54
Insulation resistance	EN 61800-5-1	< 2000 m amsl: overvoltage category III	
		> 2000 m amsl: overvoltage category II	
Insulation of control circuits	EN 61800-5-1	Safe mains isolation through double/reinforced insulation (☐ 87): • Touch probe inputs • Safety system inputs • Encoder feedback (☐ 59)	
Short-circuit strength	EN 61800-5-1	• Motor connection: limited, controller is inhibited, error acknowledgement is required • Brake control: limited, error acknowledgement is required • Control electronics and holding brake supply connections: not short-circuit-proof	
Protective measures integrated for		• Short circuit • Earth fault • Overvoltage • Motor overload (temperature detection via encoder, I²t monitoring)	
Contact current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe the regulations and safety instructions!
mains switching		Cyclic mains switching of 5 times in 5 minutes is permissible without restrictions.	
Starting current		≤ 2 × I _{rated}	
Discharge time of charge stored after mains disconnection		typically 5 min The duration is indicated by a warning symbol on the device.	

EMC

Operation in industrial environment	EN 61800-3	The devices are intended for use in an industrial environment. A drive system consisting of a power supply module and 6 axis modules (each with a motor cable length of 25m) complies with EMC class „C3“ without any external measures. When third party power supply modules, power supply modules connected in parallel or longer motor cable lengths are used, matching mains filters must be installed to comply with the EMC requirements.
		The compliance with the requirements for the machine/plant is the responsibility of the manufacturer of the machine or system!
Operation on public supply systems	EN 61800-3	When being used on public network, additional measures must be taken to limit the expected radio interference.
Noise emission		
Cable-guided	EN 61800-3	Depending on the filter at the central power supply module
Radiation	EN 61800-3	Single components of the i700 series: ● Category C3
Noise immunity (according to requirements of EN 61800-3)		
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV for air discharge to control cabinet, 4 kV for contact discharge to housing
Radio frequency		
Cable-guided	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80 % AM (1kHz)
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1kHz) 1.4 GHz ... 2 GHz, 3 V/m 80 % AM (1kHz) 2 GHz ... 2.7 GHz, 1 V/m 80 % AM (1kHz)
Burst		
Power terminals and interfaces	EN 61000-4-4	2 kV/5 kHz
Signal interfaces	EN 61000-4-4	1 kV/5 kHz
Control terminals	EN 61000-4-4	2 kV/5 kHz
Surge		
Power terminals	EN 61000-4-5	1.2/50 µs, 1 kV phase/phase, 2 kV phase/PE
Control terminals	EN 61000-4-5	1.2/50 µs, 1 kV

Environmental conditions

Climate

Storage	IEC/EN 60721-3-1	1K3 (-25 ... +60 °C)	< 6 months
		1K3 (-25 ... +40 °C)	> 6 months
Transport	IEC/EN 60721-3-2	2K3 (-25 ... +70 °C)	
Operation	IEC/EN 60721-3-3	3K3 (-10 ... +55 °C) For operation above +40 °C: ● Reduce rated output current by 2.5 %/°C	
Site altitude		0 ... 4000 m amsl 1000 ... 4000 m amsl: ● Reduce rated output current by 5 %/1000 m	
Pollution	EN 61800-5-1	Pollution degree 2	

Vibration resistance (9.81 m/s² = 1 g)

Transport	EN 60721-3-2	2M2 2 ... 9 Hz: amplitude 3.5 mm 10 ... 200 Hz: acceleration resistant up to 10 m/s ² 200 ... 500 Hz: acceleration resistant up to 15 m/s ²	
Operation	EN 61800-5-1	10 ... 57 Hz: amplitude 0.075 mm 57 ... 150 Hz: acceleration resistant up to 10 m/s ²	
	Germanischer Lloyd	general vibration stress characteristic 1 5 ... 13.2 Hz: amplitude ±1 mm 13.2 ... 100 Hz: acceleration resistant up to 0.7 g	

Supply conditions**Power supply modules**

AC mains connection		Direct connection to an AC system acc. to technical data
Power systems		
TT		With earthed neutral:
TN		Operation permitted without restrictions.
IT		When appropriate measures are taken on the power supply module, the operation in IT systems is permissible (□ 101). - Connect isolating transformer upstream - Separate internal EMC filters from earth connection
Operation on public supply systems	EN 61000-3-2	Measures for the limitation of harmonic currents at a total power on the mains > 1 kW:
		Operation without additional measures
	EN 61000-3-12	from a mains current > 16 A: - connect assigned mains choke upstream - Observe $R_{sce} \geq 350$
		R_{sce} : Ratio of short circuit power at the connection point of the machine/system to the public network
		The compliance with the requirements for the multi-axis grouping with power supply module and for the machine/plant is the responsibility of the manufacturer of the machine or plant.

Axis modules

DC system connection		Direct connection to a DC system acc. to technical data - E70ACP... power supply modules - Equivalent DC sources acc. to technical data
		DC voltage symmetrical to PE required. Earthing of +UG/-UG conductor will destroy the axis modules.
Motors		Only use motors suitable for inverter operation. L-force motors from Lenze meet the requirements.
Motor cable length		≤ 50 m
Encoder cable length		≤ 50 m

Requirements on the motor cable

Capacitance per unit length

≤ 2.5 mm ² /AWG 14	$C_{Core/core}/C_{Core/shield} < 75/150$ pF/m
≥ 4 mm ² /AWG 12	$C_{Core/core}/C_{Core/shield} < 150/300$ pF/m

Electric strength

VDE 0250-1	$U_0/U = 0.6/1.0$ kV (U_0 = r.m.s. value external - conductor/PE, U = r.m.s. value - external conductor/external conductor)
UL	$U \geq 600$ V (U = r.m.s. value external conductor/external conductor)

Mounting conditions

Mounting place		in the control cabinet
Mounting position		vertical
Clearance		
above/beneath		Comply with the device-relating mounting instructions.
at the side		Can be installed in a row without any clearance

4.2 Rated data

4.2.1 External supply voltage 24 V

The control electronics of the devices must be supplied from an external 24 V voltage source. In order to ensure that the control electronics will still work during mains failure (on the power side), the 24 V supply should be independent of this system, if possible, e.g. by means of a separate system, backup supply via battery, or DC supply.

The supply voltage terminal is designed to be wired from one device to another (loop-through connection). The number of devices to be supplied by loop-through is limited by the maximum current of the terminal.

Requirements for the 24 V voltage supply:

Electrical data		
Rated voltage	24 V	In accordance with IEC 61131-2
Voltage range	19.2 ... 28.8 V	
Residual ripple	Max. $\pm 5\%$	
Safe separation	SELV or PELV	
Looping through	Max. 16 A with 2.5 mm ² Max. 10 A with 1.5 mm ²	
Cable protection	Circuit breaker with tripping characteristic B or C Standard blade-type fuses	$\leq 20\text{ A}, \geq 30\text{ V}$

The 24 V voltage source must at least provide the total current of all devices supplied. The increased current $I_{\text{max}24}$ is required when the internal fans are connected. It may take up to 0.5 s until the fans have accelerated.
The 24 V voltage source must be able to also provide the required power in the case of undervoltage.

Current consumption of the devices from the 24 V voltage supply:

	I_{r24}	P_{24}	I_{max24}	C_L	Terminal
	[A]	[W]	[A]	[μF]	
E70ACPSx0304x	0.5	12	1.5	500	X21
E70ACPSx0604x	0.5	12	1.5		
E70ACMxx0054xx1xxx	0.5	12	1.0	3000	X3
E70ACMxx0104xx1xxx	0.6	14	1.0		
E70ACMxx0204xx1xxx	0.6	14	1.0		
E70ACMxx0324xx1xxx	1.0	24	2.0		
E70ACMxx0484xx1xxx	1.0	24	2.0		
E70ACMxx0644xx1xxx	1.2	29	2.0		
E70ACMxx0054xx2xxx	0.8	19	1.0		
E70ACMxx0104xx2xxx	0.8	19	1.0		
E70ACMxx0204xx2xxx	1.0	24	2.0		
E70ACMxx0324xx2xxx	1.4	34	2.0		

I_{r24}

Rated current of the device for 24 V supply

P_{24}

Rated power of the device for 24 V supply

I_{max24}

Maximum device current for the 24 V supply (during start-up of the internal fans, up to 0.5 s)

C_L

Charging capacity of the device for 24-V supply

4.2.2 Busbar system for the DC bus

The DC busbar system of the i700 device series is dimensioned for 120 A effective current (RMS). It responds to the arising thermal load with a time constant of approximately 5 minutes.

Using an upstream mains choke or mains filter (integrated mains choke) reduces the harmonic content of the mains current and the DC bus current. Hence, the permissible supply power P_{DC} is increased at 120 A RMS.

Permissible supply power P_{DC} (via the DC busbar system)			
	Mains voltage		
	230 V	400 V	480 V
i700 power supply module with mains choke/filter	$\leq 35.6 \text{ kW}$	$\leq 51 \text{ kW}$	$\leq 62 \text{ kW}$
i700 power supply module without mains choke/filter	$\leq 23.7 \text{ kW}$	$\leq 34 \text{ kW}$	$\leq 41 \text{ kW}$

The required supply power P_{DC} consists of the sum of the power requirement of the single controllers (see also from page 116).

In many cases, the rated power of the controllers P_{ar} and their power losses P_V can be added and be compared with the permissible P_{DC} .

The actual supply power P_a (mean value via 3 min) can be detected by using familiar travel profiles of the controllers and can be compared with the permissible P_{DC} .



Tip!

The limits of the system only have to be considered in a few applications.

If the compliance cannot be ensure with a simple test, the test can be carried out using the «Drive Solution Designer» PC software.

«DSD» completely maps the required tests for multi-axis systems. This provides for a simple dimensioning of the network. Moreover, an energy-optimised dimensioning of a multi-axis system is possible.

If you do not use «DSD» yet, refer to your Lenze contact.

4.2.3

Supply modules

Basics of the rated data

Mains	Voltage U_{Rated} [V]	Voltage range U_{Rated} [V]	Frequency range f [Hz]
3/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	480	432 - 0 % ... 528 + 0 %	45 - 0 % ... 65 + 0 %

Mains	Voltage U_{DC} [V]	Voltage range U_{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-
2/PE DC	565	455 - 0 % ... 620 + 0 %	-
2/PE DC	675	540 - 0 % ... 746 + 0 %	-

Input data

	Voltage [V]	Frequency [Hz]	current [A]		Number of phases
			up to +40 °C ①	up to +55 °C ①	
E70ACPSx0304x	230/400/480	50 ... 60	24.5/24.5/24.5	15.3/15.3/15.3	3
E70ACPSx0604x	230/400/480	50 ... 60	49.0/49.0/49.0	30.6/30.6/30.6	3

① Temperature in the control cabinet

Output data

	Voltage [V]	Frequency [Hz]	Continuous output current [A]		Number of phases	Continuous output power [kW] up to +40 °C ^①	
			up to +40 °C ^①	up to +55 °C ^①		Without Mains choke/filter	With Mains choke/filter
E70ACPSx0304x	325	DC	30.0	18.8	2	5.9	8.9
E70ACPSx0304x	565	DC	30.0	18.8	2	10.3	15.4
E70ACPSx0304x	675	DC	30.0	18.8	2	12.3	18.5
E70ACPSx0604x	325	DC	60.0	37.5	2	11.8	17.7
E70ACPSx0604x	565	DC	60.0	37.5	2	20.6	30.9
E70ACPSx0604x	675	DC	60.0	37.5	2	24.6	37.0

^① Temperature in the control cabinet

Chapter 4.3 contains data for overcurrent operation.

The i700 device series is designed for dynamic applications with several drives (DC-bus operation, (110)).

Usually an acceleration process is followed by a deceleration process, and the motor speeds rarely reach the rated motor speed. Even if a drive is operated at rated power (rated current, rated speed), there are other drives in the network requiring less power.

Therefore, in this case, a power supply module can be dimensioned much smaller than would be required by the total power of the axis controllers.

Power losses

	Power loss P _V [W]			
	U _{Lr} = 230 V	U _{Lr} = 400 V	U _{Lr} = 480 V	when controller is inhibited
E70ACPSx0304x	60	60	60	-
E70ACPSx0304x + EZAELN3025B122	80	80	80	-
E70ACPSx0604x	110	110	110	-
E70ACPSx0604x + EZAELN3050B591	160	160	160	-

Rated data for internal brake chopper

To be able to dissipate the excess energy produced during operation in generator mode, the power supply modules are equipped with an internal brake chopper/brake transistor. For this purpose, an external brake resistor corresponding with the technical data from the optional accessories must be connected to X103.

If the DC-bus voltage exceeds 765 V, the brake chopper connects the external brake resistor.

In order to increase the braking power, several power supply modules with a brake chopper and a brake resistor can be used in parallel. Additional information can be obtained from page 123.

Type	RBmin [Ω]	IBRmax [A]	PBRmax [kW]	IBRd [A]	PBd [kW]	t _z [s]	t _{on} [s]	t _{fp} [s]
E70ACPSx0304x	18	42.5	32.5	16.7	5.0	97	15	15
E70ACPSx0604x	9	85.0	65.5	33.4	10.1	97	15	15

R _{Bmin}	Minimum brake resistance, nominal value ±10 %
I _{BRmax}	Peak current
P _{BRmax}	Peak braking power
I _{BRd}	Continuous current RMS - important for the dimensioning of the cables
P _{Bd}	Continuous braking power
t _z	Cycle time, periodic load change with running time and recovery time
t _{on}	Running time
t _z - t _{on}	Recovery time
t _{fp}	Maximum running time without initial load and compliance with the recovery time

The trouble-free operation of power supply modules with an external brake resistor is only ensured if an axis module is installed in the immediate vicinity. Preferably by end-to-end mounting and use of the DC busbar system (X101/X102).

Fuses and cable cross-sections

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			①	③	L1, L2, L3	
	[A]	[A]	B2 [mm ²]	C [mm ²]	F [mm ²]	[A]	[A]	[AWG]	
E70ACPSx0304x	C40	40	10	6	-	40	40	8	≥ 300
E70ACPSx0604x	C63	63	16	10	-	-	60	6	≥ 300

¹⁾ The data are recommendations. Other designs/laying systems are possible (e.g. in accordance with 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 cable or core bundling, three loaded cores.

²⁾ Only use UL-approved cables, fuses, and fuse holders.

UL fuse: voltage ≥ 500 V, tripping characteristic "J", "T", or "G". 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 delayed, type B

In the case of cable lengths > 50m, depending on the cable type and the switching frequency, the circuit-breaker may respond.

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

Axis modules

Basics of the rated data

Mains	Voltage U _{DC} [V]	Voltage range U _{DC} [V]	Frequency range f [Hz]
2/PE DC	325	260 - 0 % ... 370 + 0 %	-
2/PE DC	565	455 - 0 % ... 620 + 0 %	-
2/PE DC	675	540 - 0 % ... 746 + 0 %	-

Input data

	Voltage [V]	Frequency [Hz]	current [A]		Number of phases
			up to +40 °C ①	up to +55 °C ①	
E70ACMxx0054xx1xxx	325/565/675	DC	5.0/5.0/4.9	3.1/3.1/3.1	2
E70ACMxx0104xx1xxx	325/565/675	DC	9.3/9.3/9.2	5.8/5.8/5.8	2
E70ACMxx0204xx1xxx	325/565/675	DC	18.7/18.7/18.5	11.7/11.7/11.6	2
E70ACMxx0324xx1xxx	325/565/675	DC	29.8/29.8/29.7	18.6/18.6/18.6	2
E70ACMxx0484xx1xxx	325/565/675	DC	44.6/44.6/44.5	27.9/27.9/27.9	2
E70ACMxx0644xx1xxx	325/565/675	DC	59.2/59.2/59.1	37.0/37.0/37.0	2
E70ACMxx0054xx2xxx	325/565/675	DC	9.3/9.3/9.2	5.8/5.8/5.8	2
E70ACMxx0104xx2xxx	325/565/675	DC	18.7/18.7/18.5	11.7/11.7/11.6	2
E70ACMxx0204xx2xxx	325/565/675	DC	37.0/37.0/36.9	23.1/23.1/23.0	2
E70ACMxx0324xx2xxx	325/565/675	DC	59.2/59.2/59.1	37.0/37.0/37.0	2

① Temperature in the control cabinet

Output data

The axis modules E70ACM... generate the output power at switching frequencies of 4, 8 and 16 kHz. The switching frequency of 2 kHz used of controllers of other device series is not used.

The rated switching frequency is preset with 4 kHz. In general, the rated current (I_{aM4}) and the maximum current (I_{aM4}) refer to the rated switching frequency.

8 and 16 kHz are parameterised as standard switching frequency. These are variable switching frequencies. If the permissible continuous current for these switching frequencies is exceeded, it is automatically switched back to the next lower switching frequency.

When the axis modules E70ACM... are used, the maximum output current (overload current) is only possible at a rated switching frequency of 4 kHz.

Dynamic load change cycles with recovery times are defined for the maximum output current. In the recovery time, the current has to be limited to 75 % of the rated current at 4 kHz. For certain axis modules, the use of load change cycles at output frequencies 0 ... 5 Hz is restricted.

Data for operation at a switching frequency of 4 kHz.

	Voltage [V]	Frequency ¹⁾ [Hz]	Continuous output current [A]		Number of phases
			up to +40 °C ^①	up to +55 °C ^①	
E70ACMxx0054xx1xxx	0 ... 230/400/480	0 ... 500	2.5/2.5/2.5	1.6/1.6/1.6	3
E70ACMxx0104xx1xxx	0 ... 230/400/480	0 ... 500	5.0/5.0/5.0	3.1/3.1/3.1	3
E70ACMxx0204xx1xxx	0 ... 230/400/480	0 ... 500	10.0/10.0/10.0	6.3/6.3/6.3	3
E70ACMxx0324xx1xxx	0 ... 230/400/480	0 ... 500	16.0/16.0/16.0	10.0/10.0/10.0	3
E70ACMxx0484xx1xxx	0 ... 230/400/480	0 ... 500	24.0/24.0/24.0	15.0/15.0/15.0	3
E70ACMxx0644xx1xxx	0 ... 230/400/480	0 ... 500	32.0/32.0/32.0	20.0/20.0/20.0	3
E70ACMxx0054xx2xxx	0 ... 230/400/480	0 ... 500	2 * 2.5/2.5/2.5	2 * 1.6/1.6/1.6	3
E70ACMxx0104xx2xxx	0 ... 230/400/480	0 ... 500	2 * 5.0/5.0/5.0	2 * 3.1/3.1/3.1	3
E70ACMxx0204xx2xxx	0 ... 230/400/480	0 ... 500	2 * 10.0/10.0/10.0	2 * 6.3/6.3/6.3	3
E70ACMxx0324xx2xxx	0 ... 230/400/480	0 ... 500	2 * 16.0/16.0/16.0	2 * 10.0/10.0/10.0	3

^① Temperature in the control cabinet

¹⁾ Table value valid at switching frequency = 4 kHz

E70ACMSxxxx4xxxxx:

At switching frequency = 8 kHz, the max. output frequency is 1000 Hz.

At switching frequency = 16 kHz, the max. output frequency is 2000 Hz.

E70ACMDxxxx4xxxxx:

The max. output frequency is limited to 599 Hz.

Testing of the axis modules via +UG, -UG is possible if $U_{DC} \geq 30$ V.

Provision of the 24-V supply at X21 (power supply module) / X3 (axis module) is required.

Switching frequency-dependent output currents

230 V

	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	I _{aN2}	I _{aM2}	I _{aN4}	I _{aM4}	I _{aN8}	I _{aM8}	I _{aN16}	I _{aM16}
E70ACMxx0054xx1xxx	-	-	2.5	5.0	2.5	5.0	1.5	3.0
E70ACMxx0104xx1xxx	-	-	5.0	10.0	5.0	10.0	3.0	6.0
E70ACMxx0204xx1xxx	-	-	10.0	20.0	10.0	20.0	6.0	12.0
E70ACMxx0324xx1xxx ¹⁾	-	-	16.0	32.0	12.8	25.6	9.6	19.2
E70ACMxx0484xx1xxx ¹⁾	-	-	24.0	48.0	19.2	38.4	14.4	28.8
E70ACMxx0644xx1xxx ¹⁾	-	-	32.0	64.0	25.6	51.2	19.2	38.4
E70ACMxx0054xx2xxx	-	-	2 * 2.5	2 * 5.0	2 * 2.5	2 * 5.0	2 * 1.5	2 * 3.0
E70ACMxx0104xx2xxx	-	-	2 * 5.0	2 * 10.0	2 * 5.0	2 * 10.0	2 * 3.0	2 * 6.0
E70ACMxx0204xx2xxx	-	-	2 * 10.0	2 * 20.0	2 * 10.0	2 * 20.0	2 * 6.0	2 * 12.0
E70ACMxx0324xx2xxx ¹⁾	-	-	2 * 16.0	2 * 32.0	2 * 12.8	2 * 25.6	2 * 9.6	2 * 19.2

400 V

	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	I _{aN2}	I _{aM2}	I _{aN4}	I _{aM4}	I _{aN8}	I _{aM8}	I _{aN16}	I _{aM16}
E70ACMxx0054xx1xxx	-	-	2.5	5.0	2.5	5.0	1.5	3.0
E70ACMxx0104xx1xxx	-	-	5.0	10.0	5.0	10.0	3.0	6.0
E70ACMxx0204xx1xxx	-	-	10.0	20.0	10.0	20.0	6.0	12.0
E70ACMxx0324xx1xxx ¹⁾	-	-	16.0	32.0	12.8	25.6	9.6	19.2
E70ACMxx0484xx1xxx ¹⁾	-	-	24.0	48.0	19.2	38.4	14.4	28.8
E70ACMxx0644xx1xxx ¹⁾	-	-	32.0	64.0	25.6	51.2	19.2	38.4
E70ACMxx0054xx2xxx	-	-	2 * 2.5	2 * 5.0	2 * 2.5	2 * 5.0	2 * 1.5	2 * 3.0
E70ACMxx0104xx2xxx	-	-	2 * 5.0	2 * 10.0	2 * 5.0	2 * 10.0	2 * 3.0	2 * 6.0
E70ACMxx0204xx2xxx	-	-	2 * 10.0	2 * 20.0	2 * 10.0	2 * 20.0	2 * 6.0	2 * 12.0
E70ACMxx0324xx2xxx ¹⁾	-	-	2 * 16.0	2 * 32.0	2 * 12.8	2 * 25.6	2 * 9.6	2 * 19.2

480 V

	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	I _{aN2}	I _{aM2}	I _{aN4}	I _{aM4}	I _{aN8}	I _{aM8}	I _{aN16}	I _{aM16}
E70ACMxx0054xx1xxx	-	-	2.5	5.0	2.5	5.0	1.5	3.0
E70ACMxx0104xx1xxx	-	-	5.0	10.0	5.0	10.0	2.4	4.8
E70ACMxx0204xx1xxx	-	-	10.0	20.0	10	20.0	4.8	9.6
E70ACMxx0324xx1xxx ¹⁾	-	-	16.0	32.0	12.8	25.6	7.7	15.4
E70ACMxx0484xx1xxx ¹⁾	-	-	24.0	48.0	19.2	38.4	11.5	23.0
E70ACMxx0644xx1xxx ¹⁾	-	-	32.0	64.0	25.6	51.2	15.4	30.8
E70ACMxx0054xx2xxx	-	-	2 * 2.5	2 * 5.0	2 * 2.5	2 * 5.0	2 * 1.5	2 * 3.0
E70ACMxx0104xx2xxx	-	-	2 * 5.0	2 * 10.0	2 * 5.0	2 * 10.0	2 * 2.4	2 * 4.8
E70ACMxx0204xx2xxx	-	-	2 * 10.0	2 * 20.0	2 * 10.0	2 * 20.0	2 * 4.8	2 * 9.6
E70ACMxx0324xx2xxx ¹⁾	-	-	2 * 16.0	2 * 32.0	2 * 12.8	2 * 25.6	2 * 7.7	2 * 15.4

I_{aNx}

bold

I_{aMx}

¹⁾

Rated value of continuous output current

Nominal value I_{aN}

Maximum output current (overload current,  45)

- dynamic load change cycle of 3 s with I_{aM4} and recovery time of 12 s with 75 % I_{aN4}

Restriction for output frequencies 0 ... 5 Hz

- dynamic load change cycle of 0.5 s with I_{aM4} and recovery time of 2 s with 75 % I_{aN4}

If the output currents specified for a switching frequency of 16 kHz and 8 kHz are exceeded, the switching frequency is automatically reduced to the next lower switching frequency.

Power losses

	Power loss P_V [W]			
	$U_{Lr} = 230\text{ V}$	$U_{Lr} = 400\text{ V}$	$U_{Lr} = 480\text{ V}$	when controller is inhibited
E70ACMxx0054xx1xxx	50	50	50	20
E70ACMxx0104xx1xxx	80	80	80	20
E70ACMxx0204xx1xxx	130	130	130	20
E70ACMxx0324xx1xxx	210	210	210	35
E70ACMxx0484xx1xxx	290	290	300	35
E70ACMxx0644xx1xxx	390	390	390	45
E70ACMxx0054xx2xxx	90	90	90	30
E70ACMxx0104xx2xxx	140	140	150	30
E70ACMxx0204xx2xxx	260	260	260	45
E70ACMxx0324xx2xxx	370	370	380	45

4.3 Overcurrent operation

Power supply modules and axis modules can be operated with currents exceeding the rated current if the time interval of this overcurrent operation is limited. Within the utilisation cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place. Two utilisation cycles with a duration of 15 s and 180 s are defined.

- ▶ 15-s cycle ①
 - 3 s load period with peak current I_A (200 %)
 - 12 s recovery time with limited current I_B (75 %)
- ▶ 180-s cycle ②
 - 60 s load period with peak current I_C (150 %)
 - 120 s recovery time with limited current I_D (75 %)

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

The values given refer to the rated output current.

- ▶ I_{rdc} for power supply modules
- ▶ I_{ar4} for axis modules

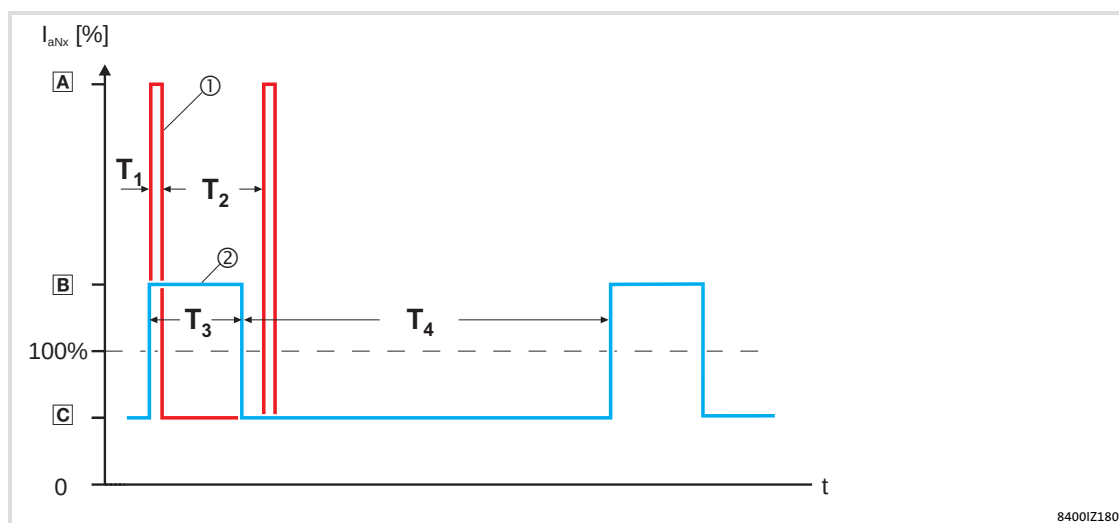


Fig. 4-1

Overcurrent capacity at 40° C

- ① Pulse utilisation (15 s cycle)
- A Peak current
- C Unloading current
- T₁ Peak current period
- T₂ Unloading current period
- ② Permanent load (180 s cycle)
- B Peak current
- C Unloading current
- T₃ Peak current period
- T₄ Unloading current period
- I_{aNx} Rated value of continuous output current



Tip!

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

4.3.1 Supply modules

Power supply modules	Short-time currents [A] acc. to cycle times				
	I _{rdc}	3 / 12 s		60 / 120 s	
		200% I _{max_3}	75% I _{red_12}	150% I _{max_60}	75% I _{red_120}
E70ACPSx0304x	30.0	60.0	19.8	45.0	22.5
E70ACPSx0604x	60.0	120	39.6	90.0	45.0

4.3.2 Axis modules

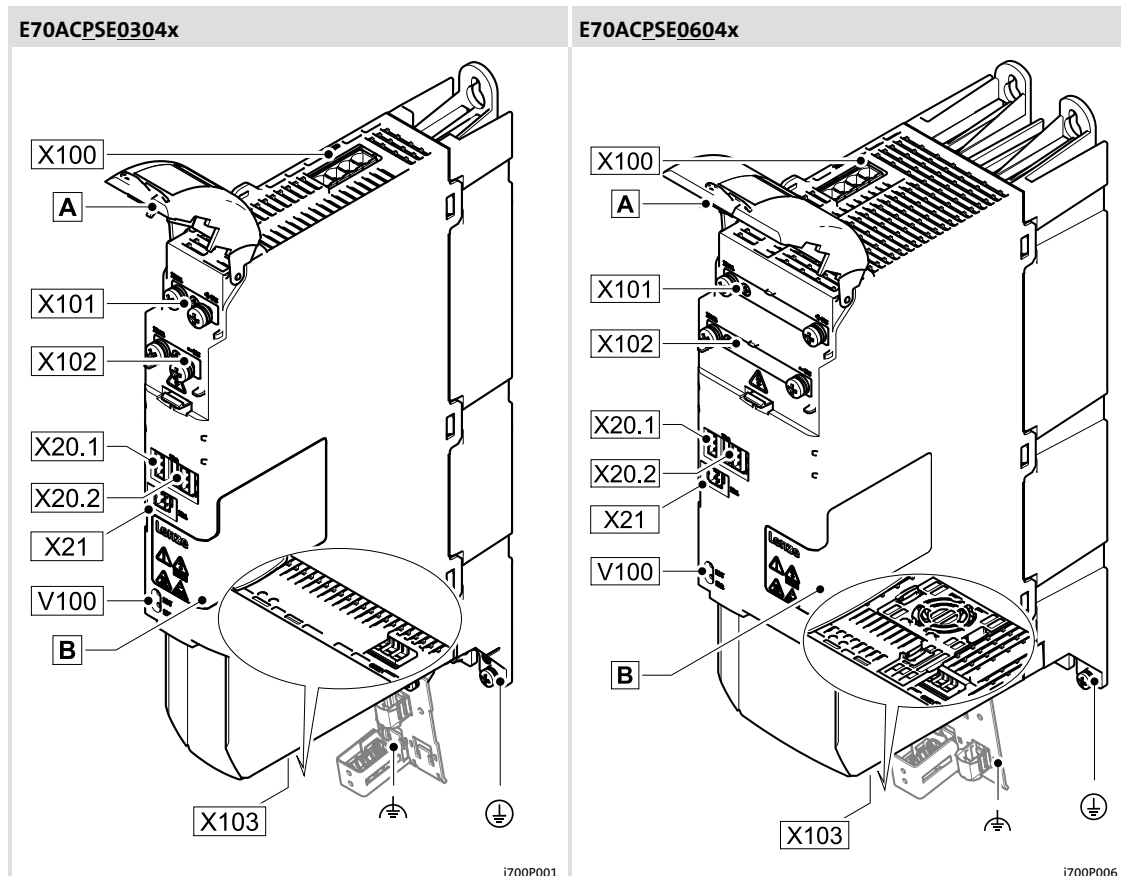
Axis modules	Short-time currents [A] at switching frequency of 4 kHz acc. to cycle times				
	I _{r4}	3 / 12 s		60 / 120 s	
		200% I _{max4_3}	75% I _{red4_12}	150% I _{max4_60}	75% I _{red4_120}
E70ACMxx0054xx1xxx	2.5	5.0	1.9	3.8	1.9
E70ACMxx0104xx1xxx	5.0	10.0	3.8	7.5	3.8
E70ACMxx0204xx1xxx	10.0	20.0	7.5	15.0	7.5
E70ACMxx0324xx1xxx	16.0	32.0	12.0	24.0	12.0
E70ACMxx0484xx1xxx	24.0	48.0	18.0	36.0	18.0
E70ACMxx0644xx1xxx	32.0	64.0	24.0	48.0	24.0
E70ACMxx0054xx2xxx	2 * 2.5	2 * 5.0	2 * 1.9	2 * 3.8	2 * 1.9
E70ACMxx0104xx2xxx	2 * 5.0	2 * 10.0	2 * 3.8	2 * 7.5	2 * 3.8
E70ACMxx0204xx2xxx	2 * 10.0	2 * 20.0	2 * 7.5	2 * 15.0	2 * 7.5
E70ACMxx0324xx2xxx	2 * 16.0	2 * 32.0	2 * 12.0	2 * 24.0	2 * 12.0

4.4

Terminal description

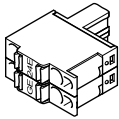
4.4.1

Supply modules



Connections and elements		Info
A	Hinged cover of DC-bus connections	52
B	Nameplate and warning symbols	25
X20.1	Digital inputs, digital outputs	50
X20.2		
X21	External 24-V supply	49
X100	Mains connection	51
X101	DC-bus UG+	52
X102	DC-bus UG-	
X103	Connection of brake resistor	53
V100	LED status display	129
	PE conductor	103
	Shield connection (functional earth)	103

External voltage supply

X21	Labelling	Description
 i700PX021	24E	24-V supply voltage of control electronics from a safely separated power supply unit (SELV/PELV)
	GE	Reference potential (GND)

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6

X21	Electrical data				
24E	Rated voltage	24 V	in accordance with IEC 61131-2		
GE	Voltage range	19.2 ... 28.8 V			
	Residual ripple	Max. ± 5 %			
	Current consumption	See technical data,  4.2.1			
	Polarity reversal protection	When polarity is reversed: no function and no destruction.			
	Cable protection	Circuit breaker with tripping characteristic B or C Standard blade-type fuses			

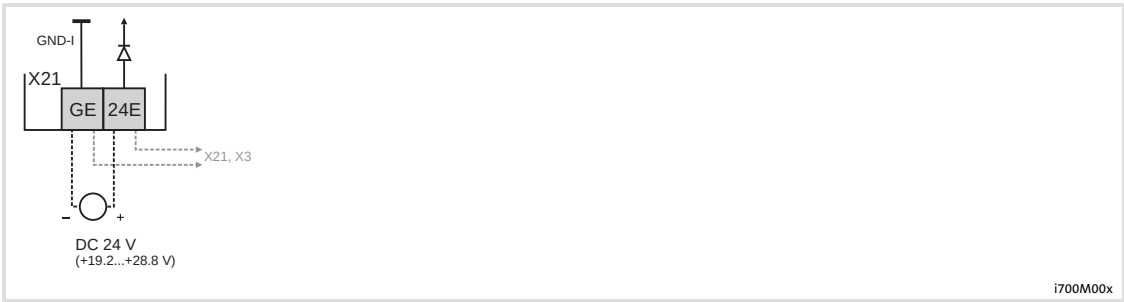


Fig. 1

Wiring of X21

X21

24E

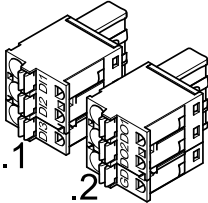
GE

Connection of the control electronics supply voltage at the power supply module, can be looped through to other power supply or axis modules

DC 24 V, acc. to IEC IEC 61131-2, SELV/PELV

Reference potential GND

Digital inputs, digital outputs

X20		Labelling	Description
	DI1	External brake chopper control	X20.1: digital inputs
	DI2	TRIP reset	
	DI3	SLAVE activation	
	DO1	Brake chopper status output	X20.2: digital outputs Diagnostic information:  128
	DO2	Error message	
	GD	Reference potential GND	For DI1, DI2, DI3, DO1, DO2

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6

X20 Electrical data			
	Rated voltage	24 V	in accordance with IEC 61131-2
	Voltage range	19.2 ... 28.8 V	
	Residual ripple	Max. ± 5 %	
DI1 DI2 DI3	Current consumption	Max. 8 mA	
	Polarity reversal protection	When polarity is reversed: no function and no destruction.	
DO1 DO2	Current	Max. 50 mA	
GD	Reference potential	0 V	

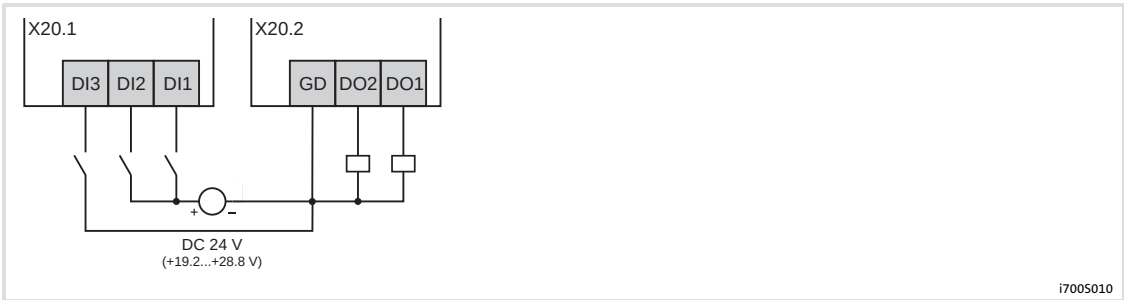


Fig. 2 Wiring of X20

- X20

.1

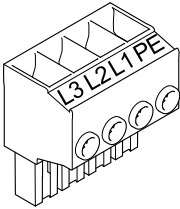
.2

DIx

DOx

GD
- Connection of digital inputs and outputs at the power supply module
Connector on the left-hand side
Connector on the right-hand side
Digital input
Digital output (e.g. for controlling relays)
Reference potential GND

Mains connection

X100	Labelling	Description
 i700P003	PE	Protective earth ⊕
	L1	Mains phases 3 PE / AC 400/480 V
	L2	
	L3	

Terminal data				
	Conductor cross-section		Tightening torque	
	[mm²]	[AWG]	[Nm]	[lb-in]
flexible	0.5 ... 16	22 ... 6	1.2 ... 1.5	10.6 ... 13.3
				5.5 x 1 

X100	Electrical data		
L1	Rated voltage	400/480 V	
L2			
L3	Voltage range	320 ... 528 V	
PE			

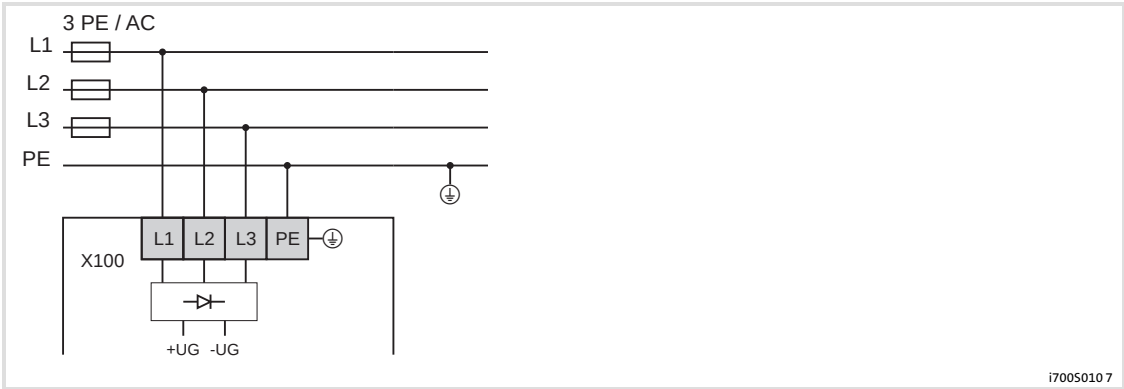


Fig. 3

Wiring of X100

X100

L1, L2, L3

PE

UG (+, -)

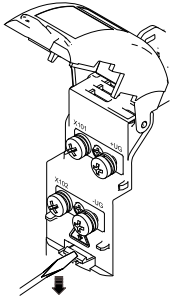
Mains voltage connection of power supply module

Mains phases 3 / AC

PE conductor, ⊕

DC bus

Connection to the DC bus (+U_G, -U_G)

X101/X102	Labelling	Description
	UG+	DC-bus voltage UG+
	UG-	DC-bus voltage UG-
		Open the protection cover only if the device is deenergised! To open the protection cover, press the lock between the clips of the cover down using a screwdriver and swivel the protection cover away from the device at the same time.

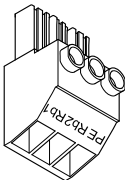
i700PX1012

Terminal data

	Conductor cross-section		Tightening torque		
	[mm ²]	[AWG]	[Nm]	[lb-in]	
Swivel hook	-	-	5.0	44.3	PH 3

X101 X102	Electrical data		
UG+ UG-	Rated voltage	565/675 V	
	Current	Up to 40 °C: 120 A 40 ... 55 °C: -2.5 %/K	
	Polarity reversal protection	For internal connection: not relevant	

Connection of external brake resistor

X103	Labelling	Description
 i700PX103	Rb1	Connection of brake resistor
	Rb2	
	PE	Protective earth ⊕

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.5 ... 6	22 ... 10	0.5 ... 0.6	4.4 ... 5.3	4.5 x 0.8

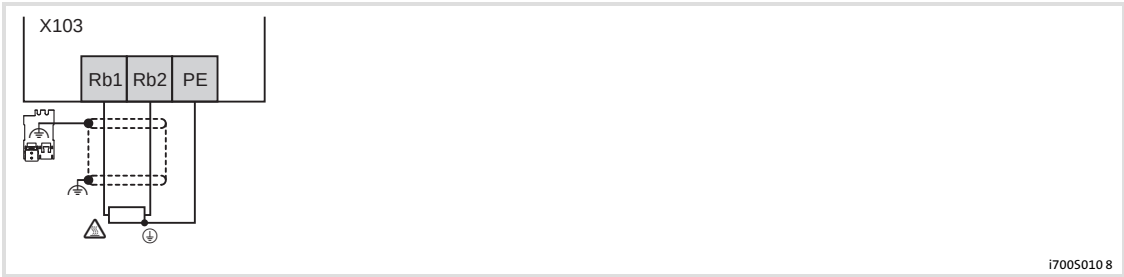


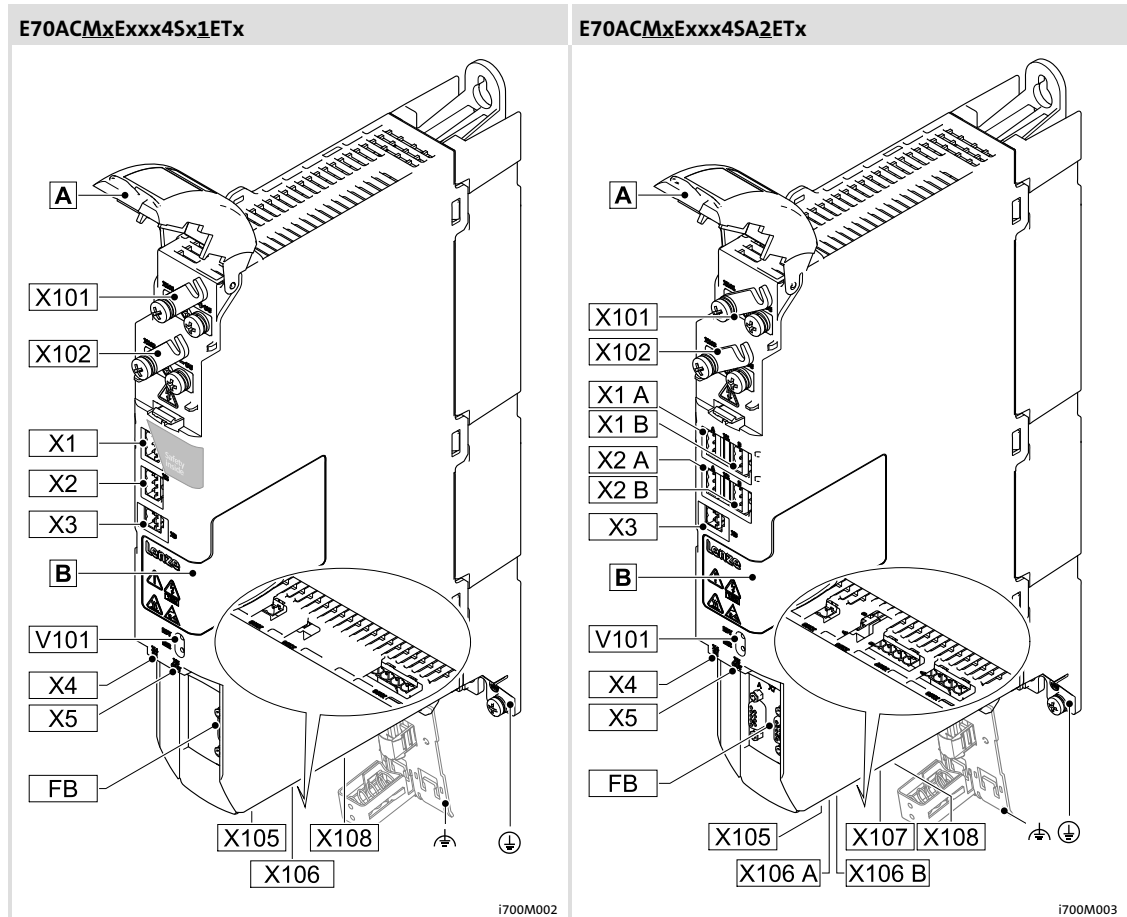
Fig. 4 Wiring of X103

X103	Connection of brake resistor
Rb1, Rb2	Brake resistor corresponding with rated data
	Functional earth ⊕, shield connection

The shielded cable for connection of a brake resistor is prepared in the same way as a motor cable (📘 67). The free length of the cores for Rb1/Rb2 is to be 160 mm (PE: + 10 mm).

4.4.2

Axis modules



Connections and elements		Info
A	Hinged cover of DC-bus connections	52
B	Nameplate and warning symbols	25
V101	LED status display	129
X1 A/B	Integrated safety system	130
X2 A/B	Touch probe	56
X3	External 24-V supply	57
X4	EtherCAT IN	58
X5	EtherCAT OUT	
FB	Servo control feedback system (alternative)	
	X7 A/B - Resolver (E70ACM...R)	60
	X8 A/B - Encoder (E70ACM...E)	62
X101	DC-bus UG+	64
X102	DC-bus UG-	
X105	24-V supply of motor holding brake	65
X106 A/B	Motor holding brake	66
X107	Motor - axis B	67
X108	Motor - axis A	
	PE conductor	103
	Shield connection (functional earth)	103

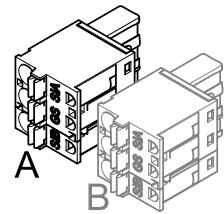
Integrated safety engineering



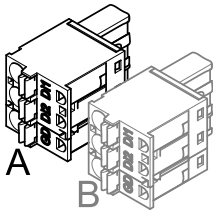
Information on how to use the integrated safety:

- ▶ general topics (📖 130)
- ▶ E70ACMxxxxx4xAxETx - **Basic Safety - STO**
 - Chapter "Safety engineering, Basic Safety - STO" (📖 137)
 - Chapter "Electrical installation" (📖 107)

E70ACMxxxxx4xAxETx - Basic Safety - STO

X1	Labelling	Description	
 i700P00x	SIA	Safe input, channel A	On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used. Independently of this, the two-channel safe input is always provided with the channels A and B.
	GS	Reference potential GND	
	SIB	Safe input, channel B	

Digital inputs

X2	Labelling	Description	
 i700P00x	DI1	Touch probe inputs	On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used.
	DI2		
	GD	Reference potential GND	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6

X2	Electrical data			
DI1	Rated voltage	24 V	in accordance with IEC 61131-2	
DI2	Voltage range	19.2 ... 28.8 V		
	Residual ripple	Max. ± 5 %		
	Current consumption	Max. 8 mA		
	Polarity reversal protection	When polarity is reversed: no function and no destruction.		
GD	Reference potential	0 V		

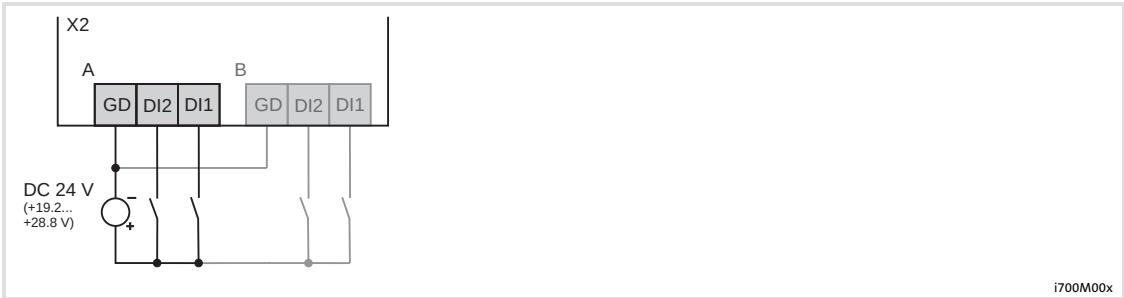
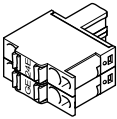


Fig. 5 Wiring of X2

X2	Connection of digital inputs of axis module
A	1-axis module
B	Additionally for 2-axis module
DIx	Digital input
GD	Reference potential GND

External voltage supply

X3	Labelling	Description
	24E	24-V supply voltage of control electronics from a safely separated power supply unit (SELV/PELV)
	GE	Reference potential (GND)

i700P00x

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6

X3	Electrical data			
24E	Rated voltage	24 V	in accordance with IEC 61131-2	
GE	Voltage range	19.2 ... 28.8 V		
	Residual ripple	Max. ± 5 %		
	Current consumption	See technical data,  4.2.1		
	Polarity reversal protection	When polarity is reversed: no function and no destruction.		
	Cable protection	Circuit breaker with tripping characteristic B or C Standard blade-type fuses		

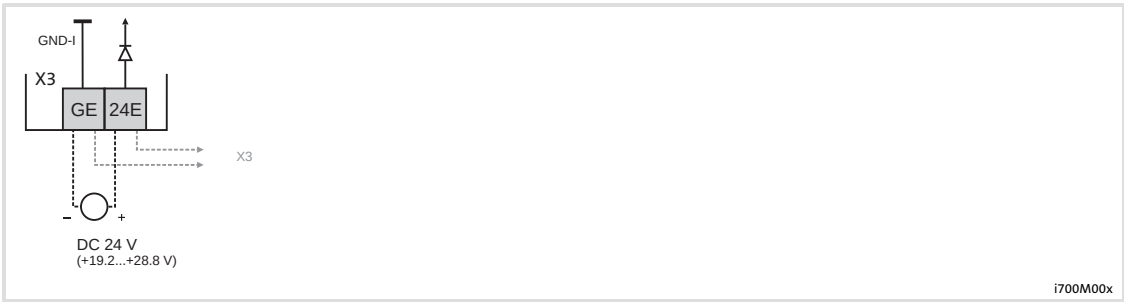
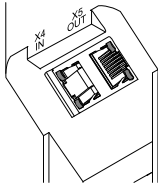


Fig. 6 Wiring of X3

X3	Supply voltage connection of axis module control electronics, can be looped through
24E	DC 24 V, acc. to IEC 61131-2, SELV/PELV
GE	Reference potential GND

EtherCAT®

X4/X5		Labelling	Description	
 i700AX045 a		IN	EtherCAT input	RJ45 socket with one LED status display for diagnostics
		OUT	EtherCAT output	RJ45 socket with two LED status displays for diagnostics
X4 X5	Electrical data			
	Acc. to EtherCAT Technology Group (ETG)			

Connection of feedback system

Over two hardware variants, the axis modules support the following feedback systems (motor encoders) for servo control:

- ▶ The E70ACM...R types support resolvers.
 - On the X7 connection (A/B), 9-pole Sub-D socket
- ▶ The E70ACM...E types support SinCos encoders
 - On the X8 connection (A/B), 15-pole Sub-D socket

In the case of double axis modules, the hardware variant is designed in the same way for both axes. Operation with different encoder types on one double axis module is not possible.

At the motor encoder terminal (X7/X8), a PTC sensor can also be connected and evaluated instead of a KTY sensor. A correct setting of the sensor type for motor temperature monitoring is required (see reference manual).

Ensure an electrically protective separation of the KTY or PTC sensors from the motor voltage potential:



Danger!

Hazardous electrical voltage

In the event of an error, control terminals can carry a hazardous electrical voltage due to unsuitable KTY or PTC sensors.

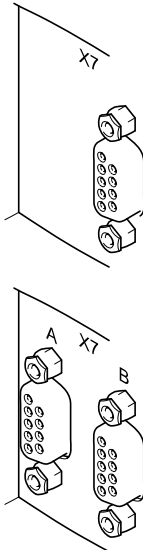
Possible consequences:

- ▶ Contact may result in fatal injuries.

Protective measures:

- ▶ Only connect motors with safely separated KTY or PTC sensors.

Resolver

X7	Pin	Description
	E70ACM...R	
	1	+REF
	2	-REF
	3	n. c.
	4	+COS
	5	-COS
	6	+SIN
	7	-SIN
	8	+KTY
	9	-KTY
		Shield connection at Sub-D housing

On single axis devices, this connection is located on the right-hand side below the labelling "X7".

On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used.

X7	Electrical data		
	General	Cable length (system cable is recommended)	Max. 50 m
3	n. c.		
1, 2	+REF, -REF	Input frequency	max. 250 kHz
4, 5	+COS, -COS	Excitation voltage	10 V _{SS}
6, 7	+SIN, -SIN	Carrier frequency	4 kHz, constant value
8, 9	+KTY, -KTY	Type	KTY 83-110, PT1000

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

The use of third-party resolvers is permissible. For this purpose, the number of pole pairs of the resolver saved in parameter 0x2C43 (0x3443) must be adapted to the used resolver. If the stator coils are excited with 4 kHz, the apparent impedance of the connected resolver must not fall below a value of 65 ohms. If smaller impedances are connected, the overload protection integrated in the resolver output limits the output current and can falsify the resolver evaluation.

Resolvers are operated in reverse mode:

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

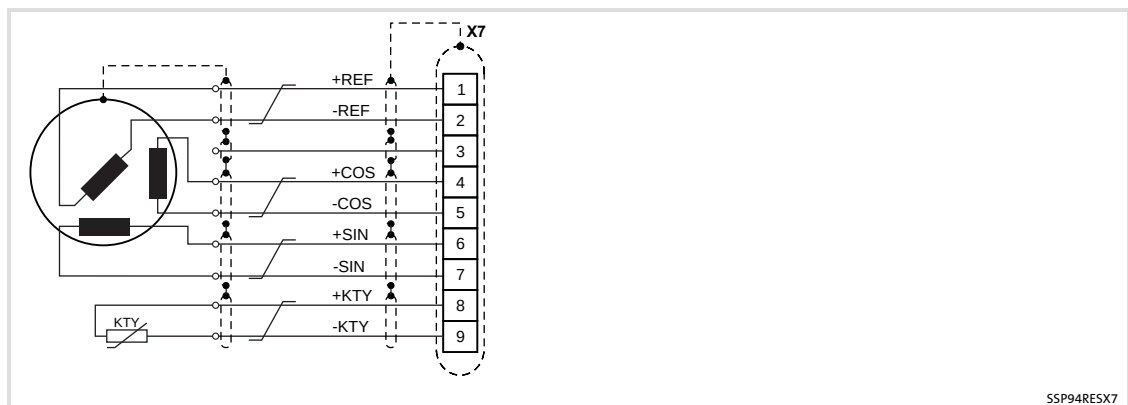
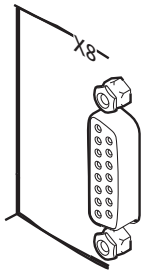
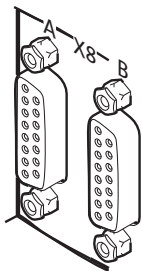


Fig. 4-2 Wiring principle

Encoder

X8	Pin	Description		
		EYF001... cable		
		1 V _{SS}	1 V _{SS} Hiperface	
	E70ACM...E			
	1	A	COS	On single axis devices, this connection is located on the right-hand side below the labelling "X8".
	2	GND	GND	
	3	B	Sin	
	4	V _{CC}	V _{CC}	
	5	Z	+RS485	
	6	n. c.	n. c.	
	7	-KTY	-KTY	
	8	n. c.	n. c.	
	9	/A	Ref COS	On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used.
	10	n. c.	n. c.	
	11	/B	Ref SIN	
	12	n. c.	n. c.	
	13	/Z	-RS485	
	14	+KTY	+KTY	
	15	n. c.	n. c.	
		Shield connection at Sub-D housing		

i700AX007 a b

Electrical data

General	Cable length (system cable is recommended)		Max. 50 m
	Encoder types		Sin/cos encoder, 1V _{SS}
	Protocols		Hiperface®
	Number of increments		1 ... 16383
	Input frequency		max. 250 kHz
VCC (GND)	Supply voltage		5 V ... 12 V
	Current, max.		9 V 12 V 250 mA
+KTY, -KTY	Type		KTY 83-110, PT1000

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

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

- ▶ Absolute and incremental encoders are supported:
 - Sin/cos encoders 1 V_{SS} (incremental)
 - SinCos absolute value encoder 1 V_{SS} with Hiperface® protocol
- ▶ Sin/cos absolute value encoders are read out by default during initialisation (switch-on of the supply voltage). Then, the sin/cos signals are evaluated.
- ▶ Open-circuit monitoring:
 - Sin/cos encoders: Comparison of the sin/cos signals and the sine-wave form (radius monitoring)

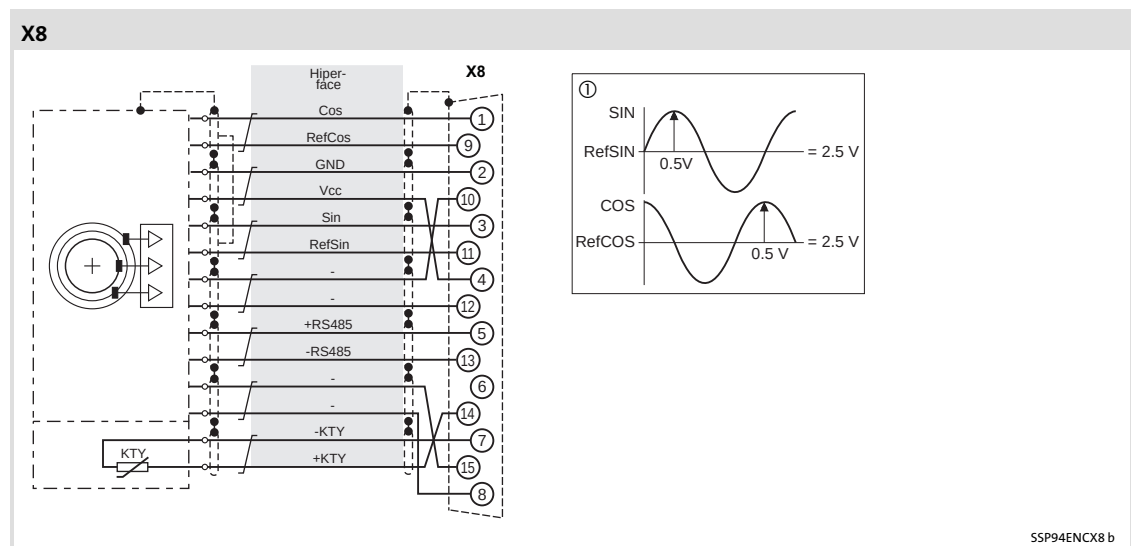
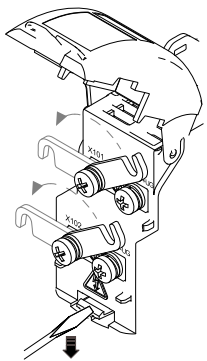


Fig. 4-3 Wiring principle

SSP94ENCX8 b

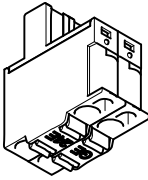
Connection to the DC bus (+U_G, -U_G)

X101/X102	Labelling	Description
 i7005X1012	UG+	DC-bus voltage UG+
	UG-	DC-bus voltage UG-
		Open the protection cover only if the device is deenergised! To open the protection cover, press the lock between the clips of the cover down using a screwdriver and swivel the protection cover upwards.

Terminal data					
	Conductor cross-section		Tightening torque		 PH 3
	[mm²]	[AWG]	[Nm]	[lb-in]	
Swivel hook	-	-	5.0	44.3	PH 3

X101 X102	Electrical data		
UG+ UG-	Rated voltage	565/675 V	
	Current	Up to 40 °C: 120 A 40 ... 55 °C: -2.5 %/K	
	Polarity reversal protection	For internal connection: not relevant	

Brake connection

X105	Labelling	Description	
 i700P00x	24E	24 V supply voltage for motor holding brakes	On double axis devices, there is one of these connections. The motor holding brakes of axis A and B are supplied.
	GE	Reference potential GND	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6 

X105	Electrical data		
24E GE	Rated voltage	24 V	The supply voltage of the motor holding brakes must be independent to ensure a safe isolation from the control electronics. A safely separated supply is not required.  87
	Voltage range	18 ... 30 V	
	Current consumption	Corresponding to the connected brake	
	Terminal current when looped through	With 1.5 mm²: max. 10 A With 2.5 mm²: max. 16 A	
	Polarity reversal protection	When the polarity is reversed: no function and no destruction.	
	Cable protection	Circuit breaker with tripping characteristic B or C Standard blade-type fuses	
			≤ 20 A, ≥ 30 V

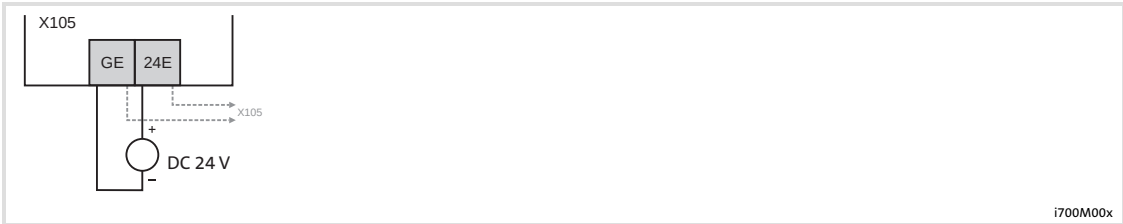
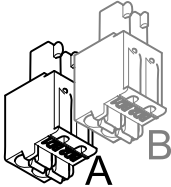


Fig. 7 Wiring of X105

X105
24E
GE

Supply voltage connection of motor holding brake, can be looped through
 24-V supply voltage for motor holding brakes
 Reference potential

X106	Labelling	Description	
	BD1	Motor holding brake (+)	On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used.
	BD2	(-)	

Terminal data

	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 1.5	24 ... 16	-	-	3.5 x 0.6

X106 Electrical data

BD1 BD2	Voltage	24 V	
	Voltage range	Depending on the external voltage source for controlling the brake(s)	
	Current consumption	Corresponding to the connected brake	
	Polarity reversal protection	Not relevant	

X106	Maximum switchable current for connected brakes
	[A]
E70ACMxx0054xx1xxx E70ACMxx0104xx1xxx E70ACMxx0204xx1xxx	1.5
E70ACMxx0054xx2xxx E70ACMxx0104xx2xxx E70ACMxx0204xx2xxx	2 x 1.5
E70ACMxx0324xx1xxx E70ACMxx0484xx1xxx E70ACMxx0644xx1xxx	2.5
E70ACMxx0324xx2xxx	2 x 2.5

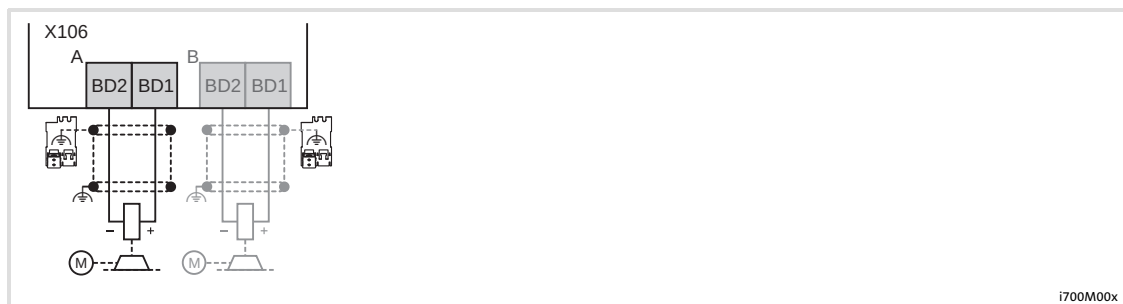


Fig. 8 Wiring of X106

X106

A, B

BD1, BD2



Connection of a motor holding brake

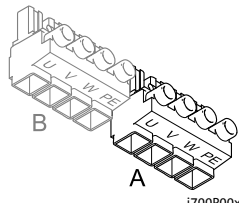
A: 1-axis module, B: additionally for 2-axis module

Coil voltage 24 V DC

(observe correct polarity for permanent magnet brakes)

Functional earth , shield connection

Motor connection

X107/108	Labelling	Description	
	V	Motor phases	On double axis devices, there are two of these connections. Assignment of the axes: ● Axis "A" = X108 ● Axis "B" = X107
	V		
	W		
	PE	Motor earthing ⚡	
		Shield connection at the shield sheet	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible for the devices E70ACMxx0054xx1xxx E70ACMxx0104xx1xxx E70ACMxx0204xx1xxx E70ACMxx0054xx2xxx E70ACMxx0104xx2xxx E70ACMxx0204xx2xxx E70ACMxx0324xx2xxx	0.2 ... 4	24 ... 12	0.5	4.4	3.5 x 0.6
flexible for the devices E70ACMxx0324xx1xxx E70ACMxx0484xx1xxx E70ACMxx0644xx1xxx	0.5 ... 16	22 ... 6	1.5	13.3	5.5 x 1

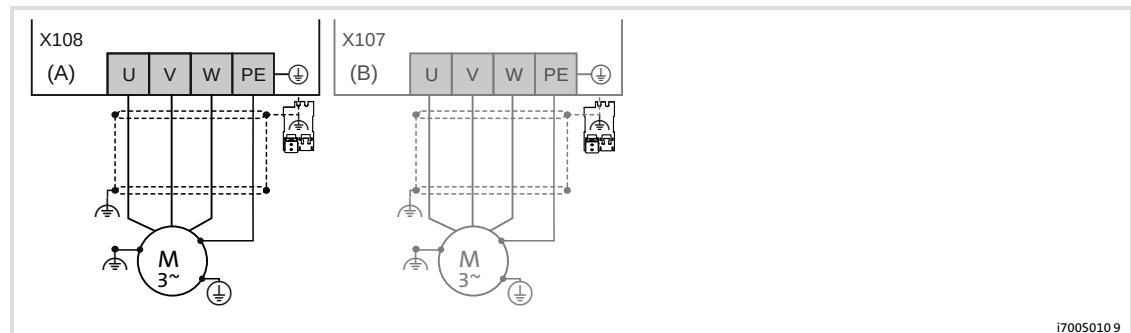


Fig. 9 Wiring of X107 or X108

X107, X108
A
B


Connection of motor|s
1-axis module: axis A
Additionally for 2-axis module: axis B
Functional earth , shield connection

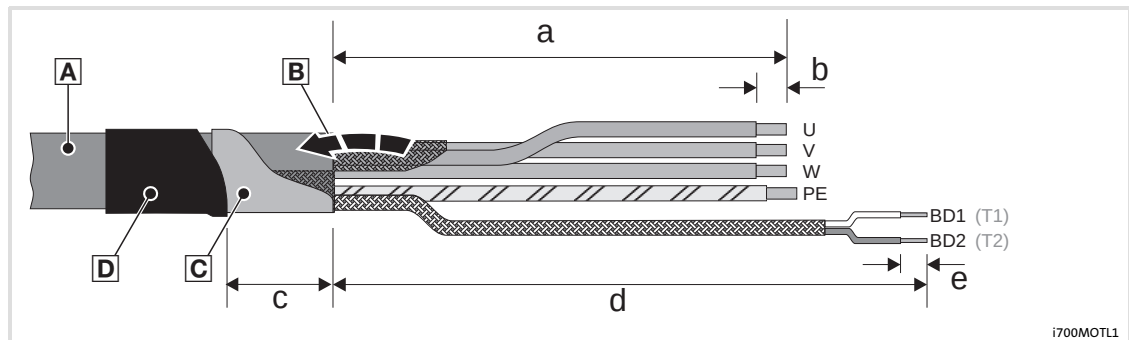


Fig. 4-4 Stripping lengths of the motor cable

	[mm]				
	a	b	c	d	e
E70ACMxxxxx4xx1xxx	180	8	40	210	8
E70ACMxxxxx4xx2xxx	180	8	40	210	8
E70ACMxx0324xx1xxx	180	8	40	210	8
E70ACMxx0484xx1xxx	180	8	40	210	8
E70ACMxx0644xx1xxx	180	8	40	210	8

How to proceed:

1. Strip motor cable **A** as specified.
2. Fold back the shield of the motor cable **B** over the cable sheath.
3. Stabilise the shield with self-adhesive conductive foil **C** (recommendation).
4. Fix the shield and conductive foil with heat-shrinkable tube **D** on the cable sheath.
5. The terminals are directly suitable for the utilisation of flexible conductors. Short circuits between the terminal connections are ruled out by the design if the specified stripping length is met.
 - Wire end ferrules can be used.
 - If insulated wire end ferrules are used, it must be ensured that the effective clamping length is not reduced by the plastic collar.
6. Apply the shields separately on the shield sheet using shield clamps (no strain relief).

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.

Summary of important notes on mechanical installation

- ▶ Mount the devices vertically ( 32)
 - DC-bus voltage connections (X101/102): at the top
 - Fan unit: at the bottom
- ▶ Observe mounting clearances ( 32):
 - If unimpeded ventilation of the modules is ensured, the connecting cables can be installed in the mounting clearances
 - The modules can be mounted side-by-side without any clearance
- ▶ Requirements for the mounting and supporting surface to ensure an EMC-compliant installation without the need for additional measures:
 - Electrically conductive
 - Free of lacquer and protected against corrosion or made of rust-proof metal
 - Completely flat and smooth surface
- ▶ In case of push-through installation (thermal separation), the heatsink protrudes through the mounting cutout of the mounting wall.
 - The design of the mounting wall must ensure the tightness towards the device surface.
 - Prevent the mounting wall from being bent or twisted.
- ▶ In order to comply with the permissible pollution degree of the ambient air, ( 31) provide additional measures:
 - Separate or filtered air flow against dust, fluff, grease, aggressive gas
 - Ensure regular cleaning
- ▶ Observe permissible ambient temperatures - also in the control cabinet ( 31).

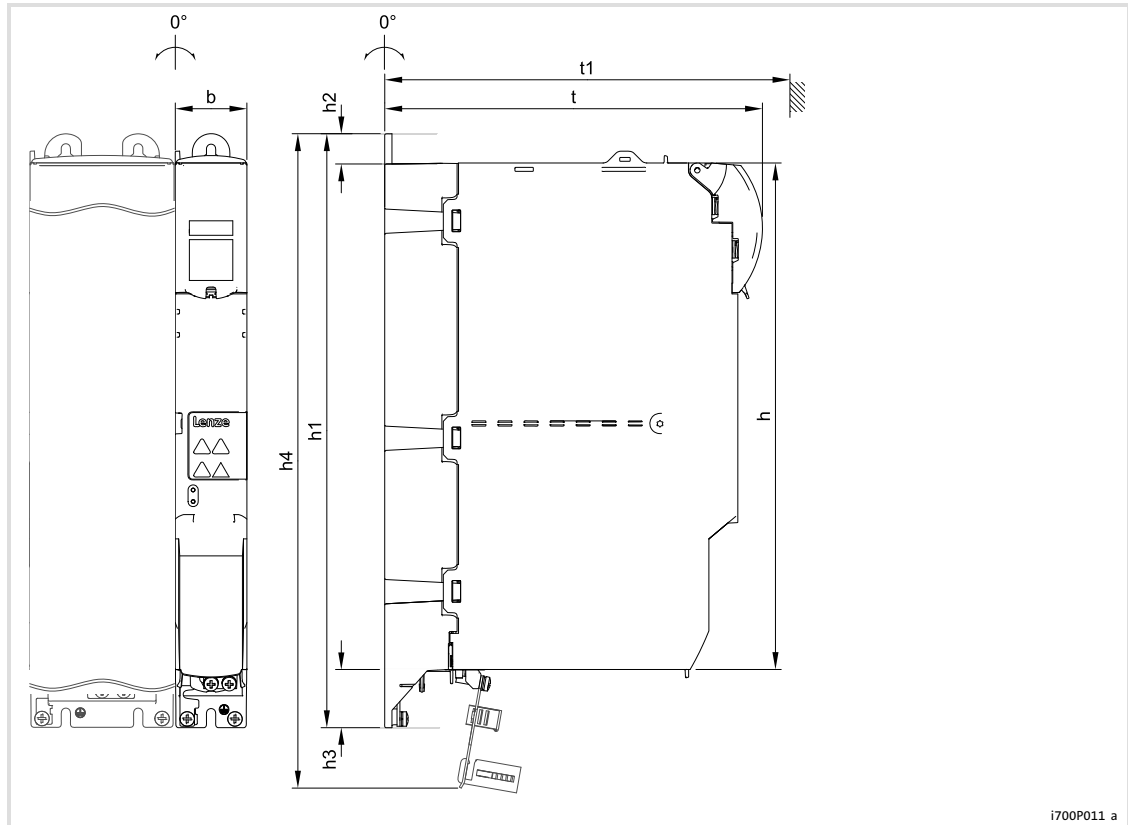
5.2 Devices with standard built-in design**5.2.1 Drilling the holes into the mounting plate****Mounting grid**

We recommend to provide the mounting plate with a grid pattern of M5 threaded holes for attaching the devices. This preparation enables easy attachment of the devices and the device sizes 1 (b = 50 mm) and 2 (b = 100 mm) can thus be mounted directly adjacent to each other.

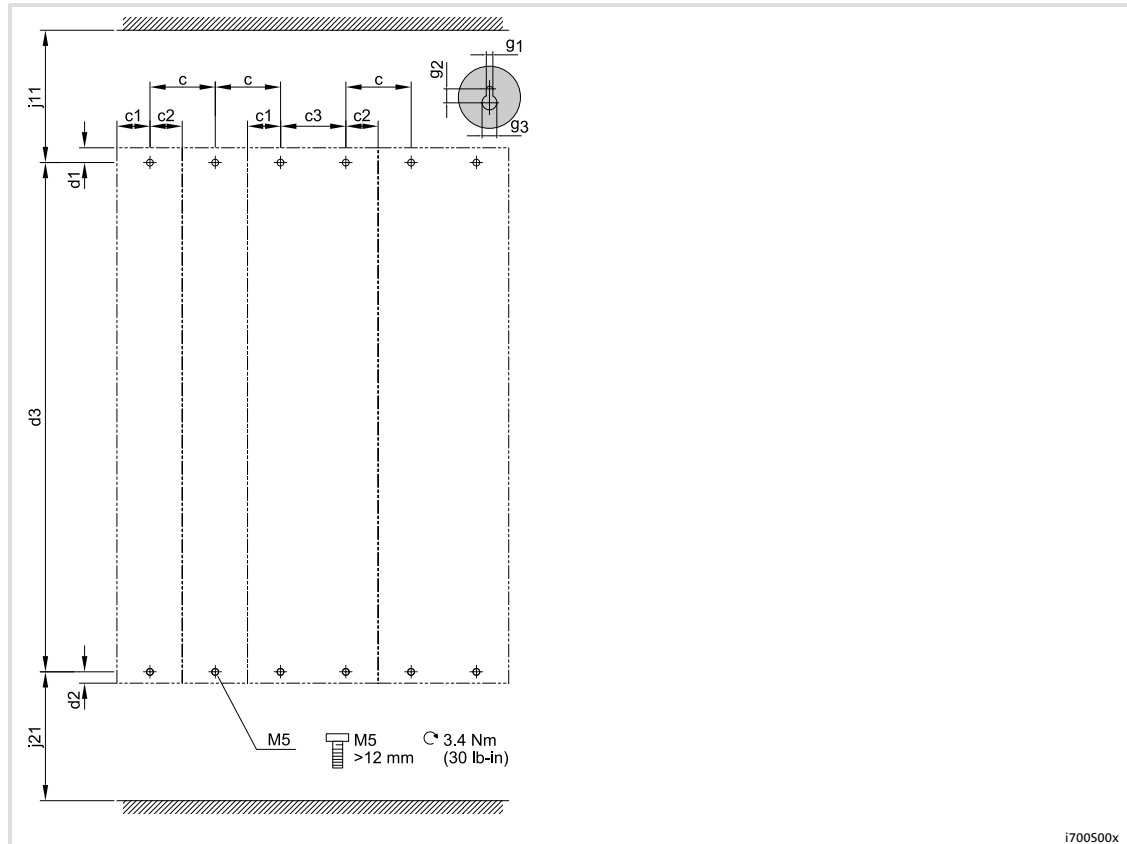
**Note!**

- ▶ M5 screw and washer assemblies or hexagon socket screws with washers are permitted.
- ▶ Tightening torque: 3.4 Nm / 30 lb-in.

5.2.2 Dimensions



		h	b	t	h1	h2	h3	h4	t1	t2	
	[A]	[mm]									[kg]
E70ACPSE0304x	30	350	50	261	410	20	40	452	275	-	2.5
E70ACPSE0604x	60	350	100	261							5.3
E70ACMxE0054xx1xxx	5	350	50	261	410	20	40	452	275	-	2.7
E70ACMxE0104xx1xxx	10										2.7
E70ACMxE0204xx1xxx	20										2.7
E70ACMxE0054xx2xxx	2 * 5										2.9
E70ACMxE0104xx2xxx	2 * 10	350	100	261	410	20	40	452	275	-	2.9
E70ACMxE0324xx1xxx	32										5.2
E70ACMxE0484xx1xxx	48										5.2
E70ACMxE0644xx1xxx	64										5.2
E70ACMxE0204xx2xxx	2 * 20	350	100	261	410	20	40	452	275	-	5.2
E70ACMxE0324xx2xxx	2 * 32										5.2

5.2.3**Mounting**

i700500x

		c	c1	c2	c3	d1	d2	d3	j11	j21	g1	g2	g3
	[A]	[mm]											
E70ACPSE0304x	30	50	25	25	-	10	10	390	70	90	6	10	15
E70ACMxE0054xx1xxx	5												
E70ACMxE0104xx1xxx	10												
E70ACMxE0204xx1xxx	20												
E70ACMxE0054xx2xxx	2*5												
E70ACMxE0104xx2xxx	2*10												
E70ACPSE0604x	60				50								
E70ACMxE0324xx1xxx	32												
E70ACMxE0484xx1xxx	48												
E70ACMxE0644xx1xxx	64												
E70ACMxE0204xx2xxx	2*20												
E70ACMxE0324xx2xxx	2*32												

5.3 Devices with "cold plate" design

Devices available on request

The E70ACxxCxxx4x... devices are designed for assembly on coolers (e.g. collective coolers) in "cold-plate" technique.

5.3.1 Safety instructions for the installation according to UL



Warnings!

- ▶ The device should be mounted in an overall enclosure with proper spacings being maintained.
- ▶ The terminals are suitable for factory and field wiring connection when the suitability of the intended mating connection has been determined.
- ▶ All Cold Plate devices E70ACPxC... and E70ACMxC... are intended to be mounted with adequate heat sink assemblies in the end use.
- ▶ In Order to determine the acceptability of these assemblies , a temperature test shall be considered in the end use. The temperature on the heat sinks shall not exceed the values listed in Tab. 5-1.



Avertissement !

- ▶ Les équipements doivent être montés dans un coffret de protection adapté en respectant les espaces minimums prescrits.
- ▶ Les terminaux sont adaptés à un câblage en usine et à pied d'œuvre à condition que les raccords de destination soient compatibles.
- ▶ Tous les appareils de type Cold Plate E70ACPxC... et E70ACMxC... sont destinés à être montés en combinaison avec un radiateur adapté en vue de l'application finale.
- ▶ Afin de déterminer l'admissibilité de ces combinaisons, procéder à un test de température dans le cadre de l'application finale. La température des radiateurs ne doit pas dépasser les valeurs figurant dans le tableau Tab. 5-1.

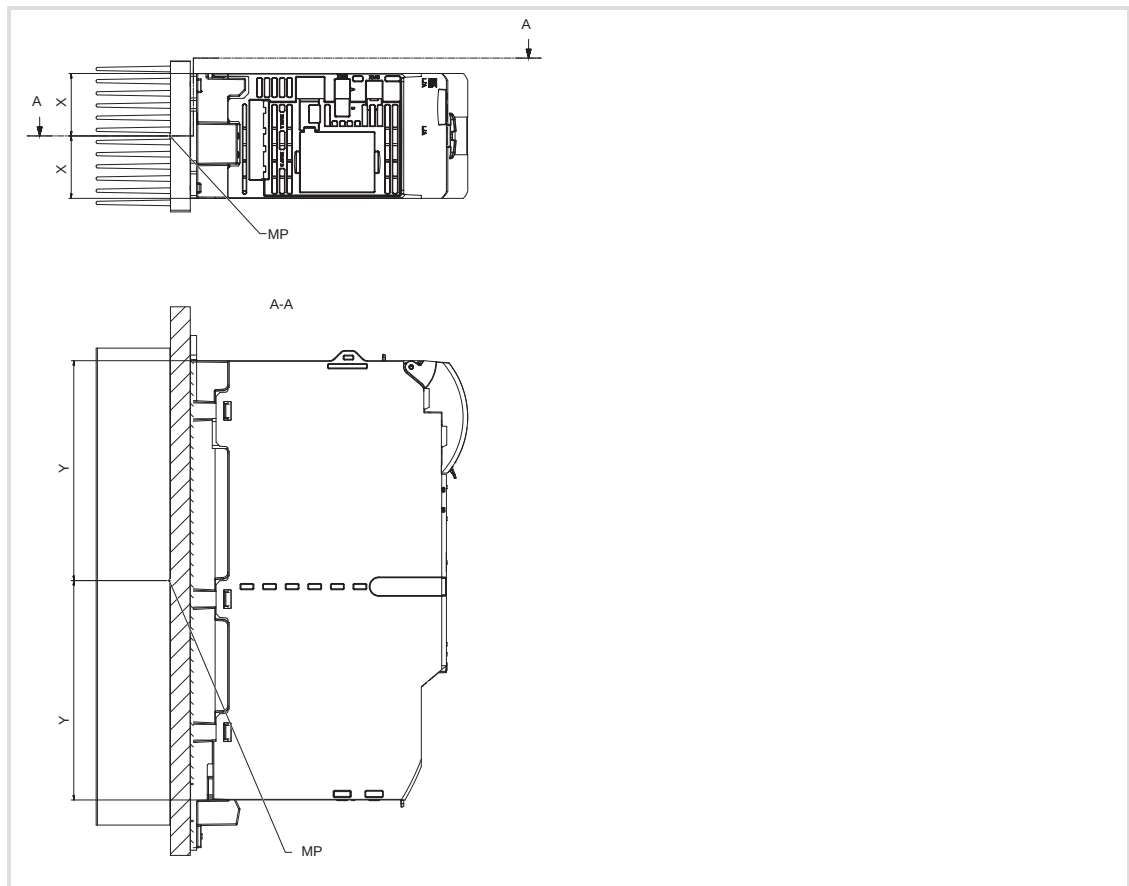
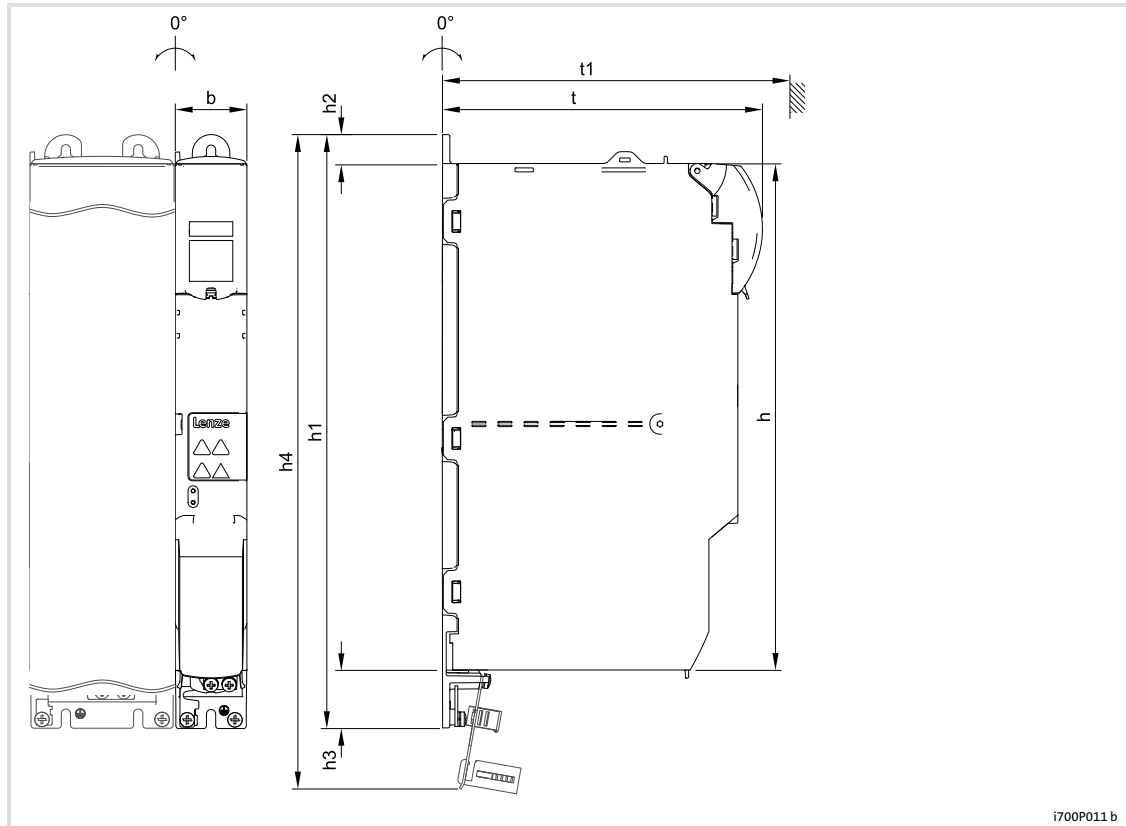


Fig. 5-1 Position of the measuring points (MP)

5.3.2 Dimensions



		h	b	t	h1	h2	h3	h4	t1	t2	
	[A]	[mm]									[kg]
E70ACPSC0304x	30	350	50	221	410	20	40	452	235	-	2.1
E70ACPSC0604x	60	350	100	221							5.4
E70ACMxC0054xx1xxx	5	350	50	221	410	20	40	452	235	-	2.3
E70ACMxC0104xx1xxx	10										2.3
E70ACMxC0204xx1xxx	20										2.3
E70ACMxC0054xx2xxx	2 * 5										2.5
E70ACMxC0104xx2xxx	2 * 10										2.5
E70ACMxC0324xx1xxx	32	350	100	221	410	20	40	452	235	-	5.3
E70ACMxC0484xx1xxx	48										5.3
E70ACMxC0644xx1xxx	64										5.3
E70ACMxC0204xx2xxx	2 * 20										5.3
E70ACMxC0324xx2xxx	2 * 32										5.3

5.3.3**Mounting****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 controller has to be connected to the collective cooler 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 already include the heat transmission between the cooler and the device with a standard heat conducting paste at a film thickness of approx. 50 µm.

	Power loss	Thermal resistance	T_{max}	Power loss (control cabinet)
Type	P_{V1} [W]	R_{th} [K/W]	[°C]	P_{V2} [W]
E70ACPSC0304x	45	≤ 1.11	85	15
E70ACMxC0054xx1xxx	25	≤ 2.00	85	25
E70ACMxC0104xx1xxx	50	≤ 1.00	85	30
E70ACMxC0204xx1xxx	95	≤ 0.53	85	35
E70ACMxC0054xx2xxx	50	≤ 1.00	85	40
E70ACMxC0104xx2xxx	95	≤ 0.53	85	55
E70ACPSC0604x	85	≤ 0.41	70	25
E70ACMxC0324xx1xxx	140	≤ 0.29	75	70
E70ACMxC0484xx1xxx	215	≤ 0.19	75	85
E70ACMxC0644xx1xxx	290	≤ 0.14	75	100
E70ACMxC0204xx2xxx	185	≤ 0.22	75	75
E70ACMxC0324xx2xxx	275	≤ 0.15	75	105

Tab. 5-1 Cold plate

 P_{V1}

separated power loss, to be dissipated via heatsink

 P_{V2}

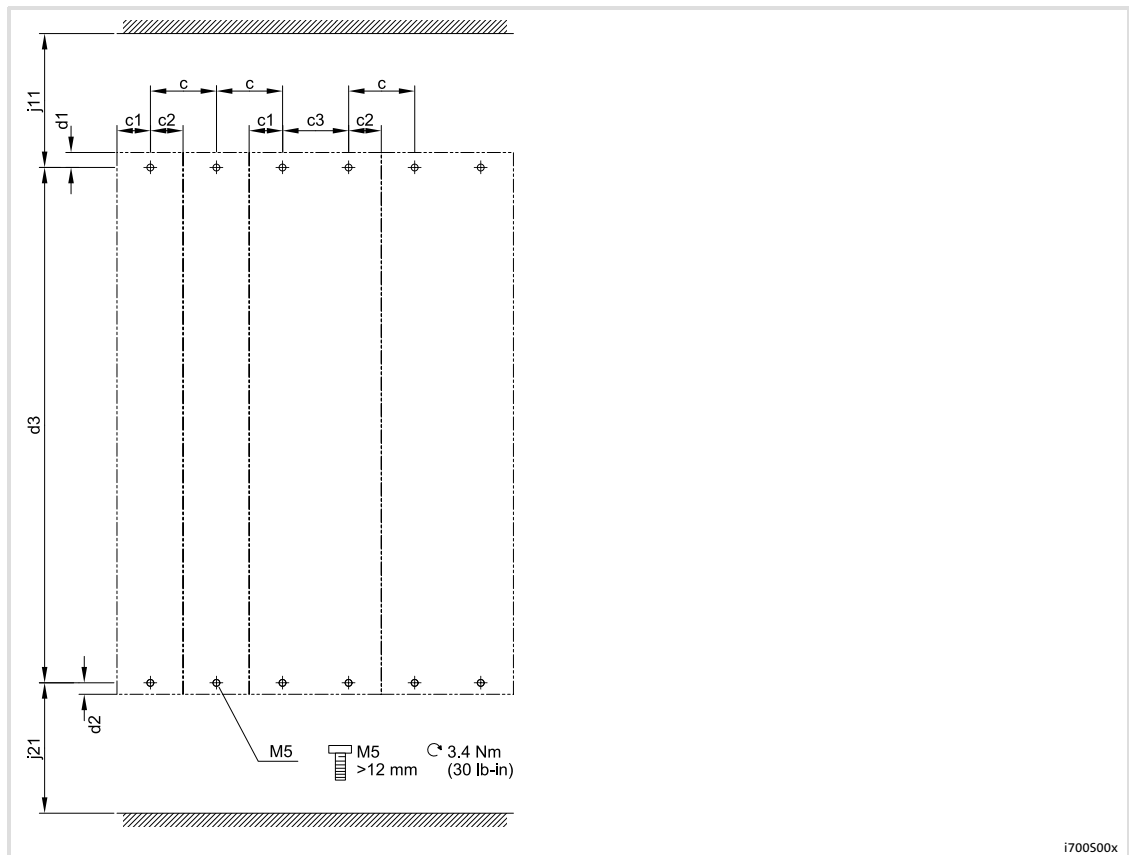
Power loss remaining in the control cabinet

Ambient conditions

- ▶ The rated data and the derating factors at increased temperature also apply to the ambient temperature of the drive controllers.

**Note!**

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



i700500x

		c	c1	c2	c3	d1	d2	d3	j11	j21					
	[A]	[mm]													
E70ACPSC0304x	30	50	25	25	-	10	10	390	90	70					
E70ACMxC0054xx1xxx	5														
E70ACMxC0104xx1xxx	10														
E70ACMxC0204xx1xxx	20														
E70ACMxC0054xx2xxx	2*5														
E70ACMxC0104xx2xxx	2*10														
E70ACPSC0604x	60				50										
E70ACMxC0324xx1xxx	32														
E70ACMxC0484xx1xxx	48														
E70ACMxC0644xx1xxx	64														
E70ACMxC0204xx2xxx	2*20														
E70ACMxC0324xx2xxx	2*32														

5.4 Devices with push-through design (thermal separation)

Devices available on request

5.4.1 Safety instructions for the installation according to UL

- ▶ The device version in "push-through design" is made for the installation in the control cabinet and achieves "Open Type" according to UL508C.
- ▶ If the cooling ribs are not inside the control cabinet but stick out of the control cabinet housing: Prevent direct contact with the cooling ribs.

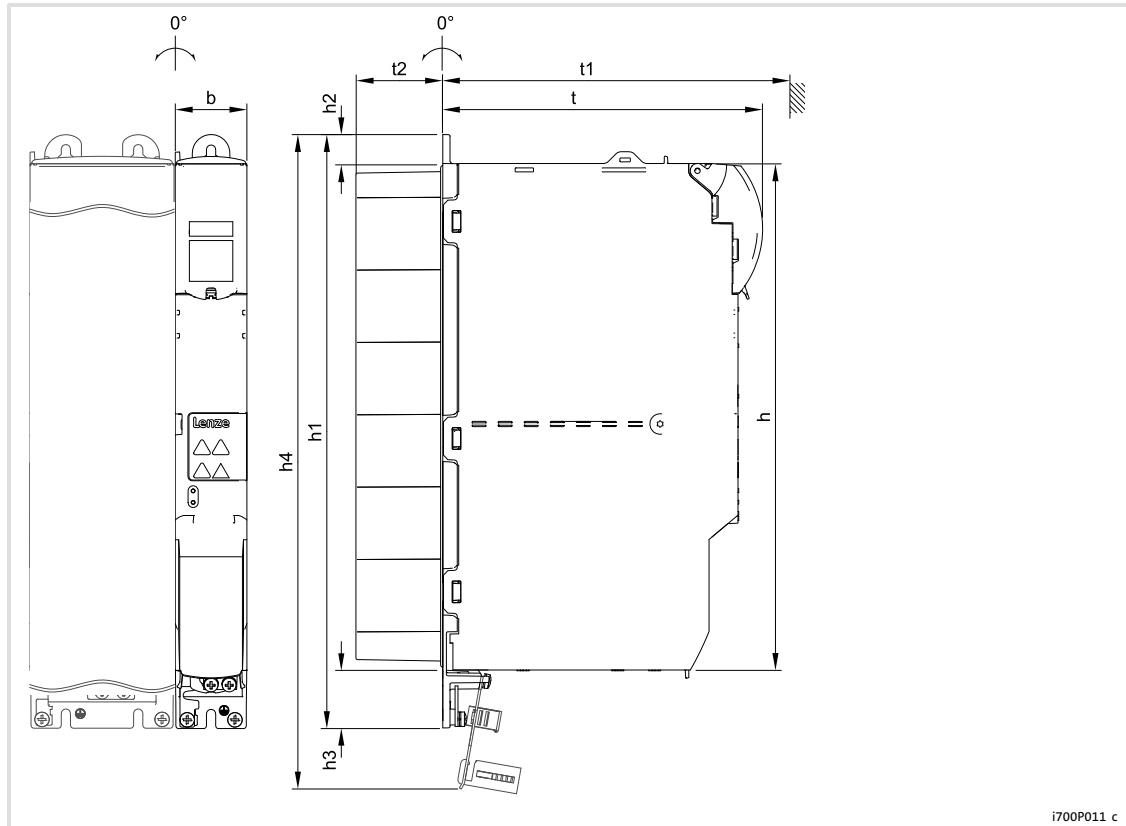
**Warnings!**

- ▶ The device should be mounted in an overall enclosure with proper spacings being maintained.
- ▶ The terminals are suitable for factory and field wiring connection when the suitability of the intended mating connection has been determined.
- ▶ Push-through devices E70ACPxD... and E70ACMxD..., which are intended to be used with external forced ventilation or natural convection.
- ▶ Forced ventilation:
 - Ratings at surrounding air temperature of max. 40 °C or with reduced ratings at max. 55 °C.
 - Only valid when provided with additional external forced cooling as specified in the hardware manual.
- ▶ Natural convection:
 - Reduced ratings at surrounding air temperature of max. 40 °C.
 - No external forced cooling is required.

**Avertissement !**

- ▶ Les équipements doivent être montés dans un coffret de protection adapté en respectant les espaces minimums prescrits.
- ▶ Les terminaux sont adaptés à un câblage en usine et à pied d'œuvre à condition que les raccords de destination soient compatibles.
- ▶ Relier les appareils de type E70ACPxD... et E70ACMxD..., destinés à être utilisés avec un système de ventilation forcée externe ou à convection naturelle.
- ▶ Ventilation forcée :
 - Caractéristiques assignées valables pour une température ambiante maximale de 40 °C ou de 55 °C avec des valeurs réduites.
 - Convient uniquement si associée à un système de refroidissement forcé externe, conformément aux spécifications contenues dans la documentation de l'équipement.
- ▶ Convection naturelle :
 - Valeurs assignées réduites valables pour une température ambiante maximale de 40 °C.
 - Système de refroidissement forcé externe non requis.

5.4.2 Dimensions



		h	b	t	h1	h2	h3	h4	t1	t2	
	[A]	[mm]									[kg]
E70ACPSD0304x	30	350	50	221	410	20	40	452	235	60	2.8
E70ACPSD0604x	60	350	100	221							7.3
E70ACMxD0054xx1xxx	5	350	50	221	410	20	40	452	235	60	3.0
E70ACMxD0104xx1xxx	10										3.0
E70ACMxD0204xx1xxx	20										3.0
E70ACMxD0054xx2xxx	2 * 5										3.2
E70ACMxD0104xx2xxx	2 * 10	350	100	221	410	20	40	452	235	60	3.2
E70ACMxD0324xx1xxx	32										7.1
E70ACMxD0484xx1xxx	48										7.1
E70ACMxD0644xx1xxx	64										7.1
E70ACMxD0204xx2xxx	2 * 20										7.1
E70ACMxD0324xx2xxx	2 * 32										7.1

5.4.3**Notes on mounting**

In case of compactly designed control cabinets, special attention has to be paid to the dissipation of the power loss.

The device version in push-through design (E70ACxxD...) serves to separate the heatsink losses from the other device losses and dissipate them from the control cabinet. This serves to reduce the temperature inside the control cabinet. The thermal load of all components is reduced and the reliability of the plant is improved.

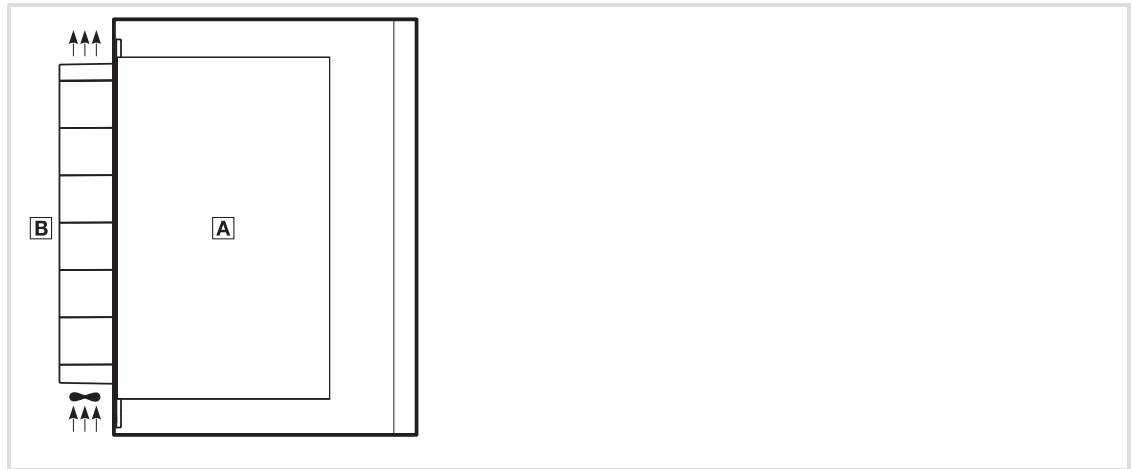


Fig. 5-2 Basic arrangement of the thermal separation using the push-through technique

- A** Controller in the control cabinet
- B** Heatsink separated from the control cabinet volume

All about cooling

A good cooling is achieved by a focussed air flow at the cooling ribs.

By measuring the air speed, the compliance with the required cooling should be checked. The measurement has to be executed at the points (MP) defined in the illustration for the heatsink cross-section.

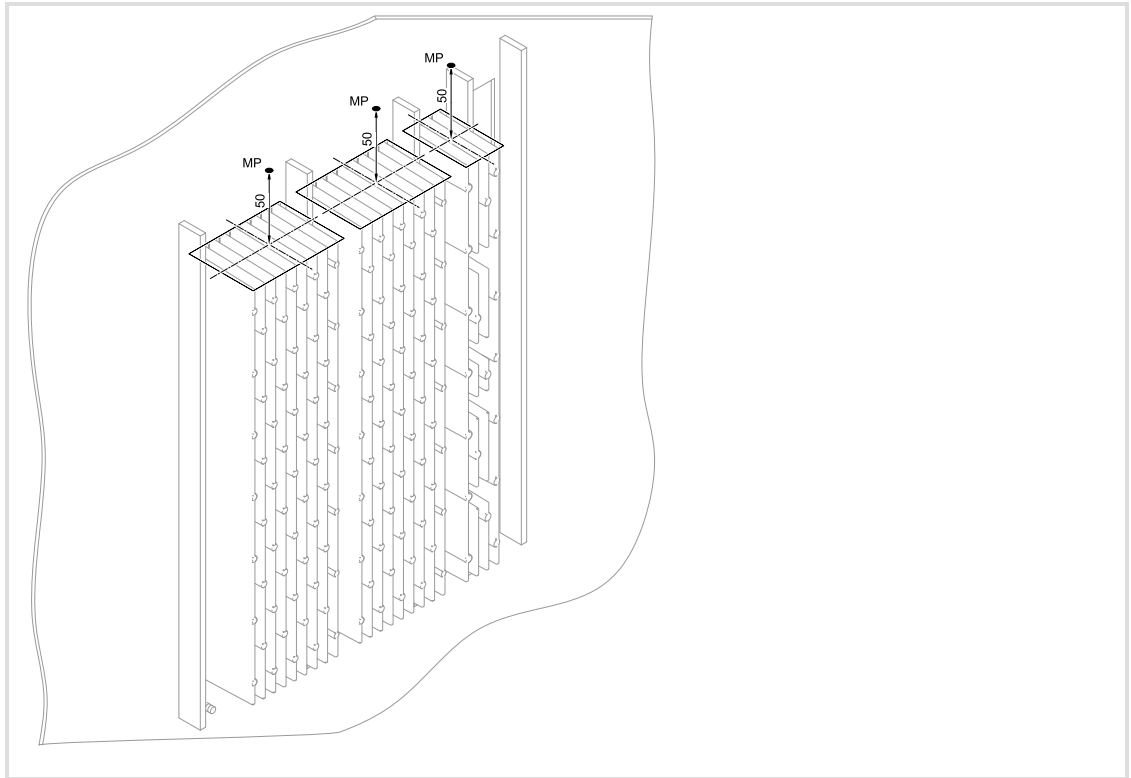


Fig. 5-3 Positions of the measuring points, centrally above the heatsink

If a single fan is to cool several devices, this fan has to provide the sum of all volume flows.



Tip!

An air channel serves to implement a protection against accidental contact towards the hot heatsink surface.

An air channel provides a sufficient air flow for each device.

Cooling by forced ventilation

Required:

- ▶ Forced ventilation by one or several fans.
- ▶ Air speed: 2.5 m/s at the MP measuring point
 - For fan dimensioning: Corresponds to a volume flow of 0.5 m³/min (17.6 CFM) per 50 mm device installation width.

Permissible:

- ▶ Operation with continuous output current $I_a = I_{rated}$.
- ▶ Operation according to rated data.
- ▶ Switching frequencies f_{ch} : 4 kHz, 8 kHz and 16 kHz

Cooling by means of natural convection

Required:

- ▶ Unhindered ventilation by means of natural convection (no fan required).
- ▶ Ambient temperature: $T_{amb} < 40\text{ °C}$

Permissible:

- ▶ Operation with reduced output current I_a according to Tab. 5-2.
- ▶ Switching frequencies $f_{ch} = 4\text{ kHz}$ and 8 kHz

Type	I_a [A]		
E70ACPxD0304x	25		
E70ACPxD0604x	50		

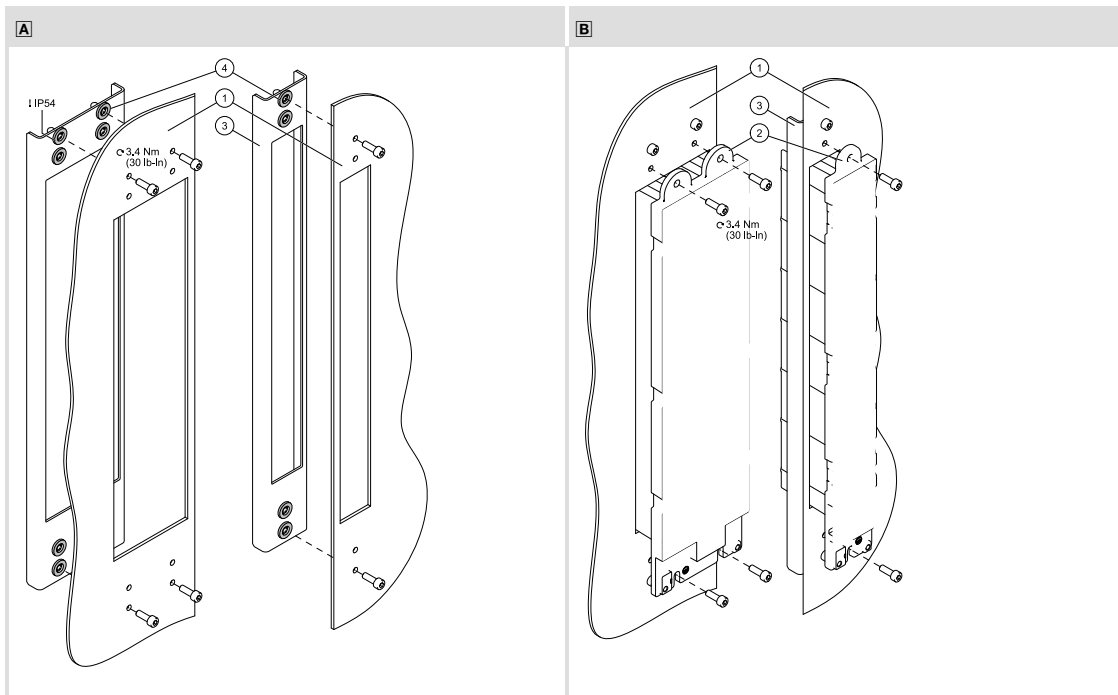
Type	I_a [A]		
	4 kHz	8 kHz	16 kHz
E70ACMxD0054xx1ETx	2.5	2.5	-
E70ACMxD0104xx1ETx	5.0	5.0	
E70ACMxD0204xx1ETx	6.0	6.0	
E70ACMxD0054xx2ETx	2 x 2.5	2 x 2.5	
E70ACMxD0104xx2ETx	Σ 5.0	Σ 5.0	
E70ACMxD0324xx1ETx	12.0	9.6	
E70ACMxD0484xx1ETx	14.0	11.2	
E70ACMxD0644xx1ETx	16.0	12.8	
E70ACMxD0204xx2ETx	Σ 10.0	Σ 10.0	
E70ACMxD0324xx2ETx	Σ 12.0	Σ 9.6	

Tab. 5-2 Permissible currents I_a in case of natural convection

Σ Sum of the output currents axis A and axis B

Suitable mounting place

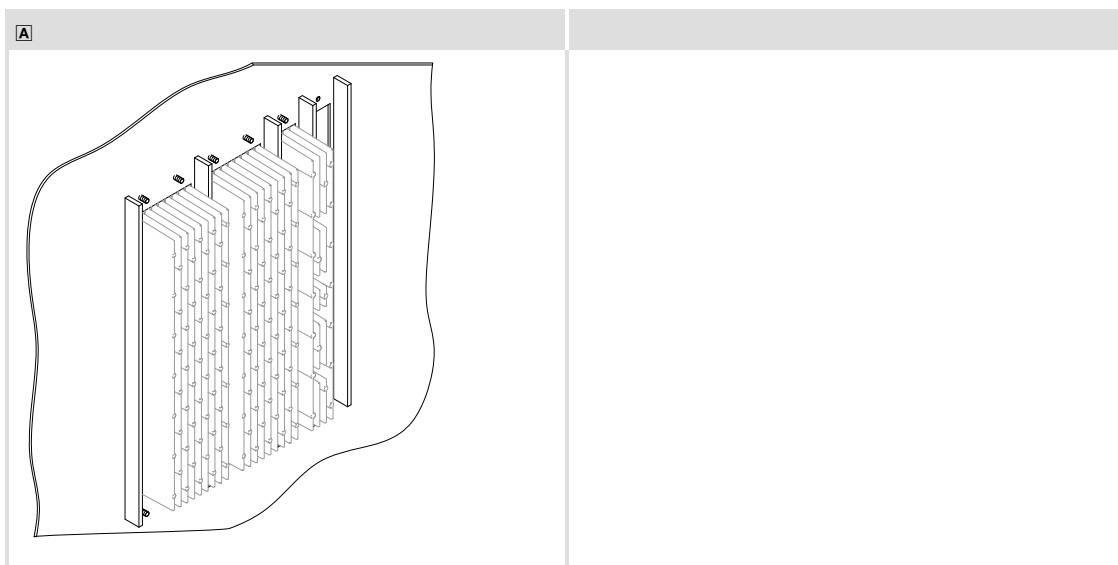
Providing a wide contact area and the integrated seal, the mounting area of the device complies with the requirements of the class of protection IP54. The mounting has to be carried out properly at a mounting position with sufficient rigidity. The "mounting frame" accessories serve to achieve the sufficient rigidity more easily.



Example for achieving rigidity of the mounting position with E70AZMBHM00x mounting frame

- A** Step 1: Mounting of the frames
- B** Step 2: Mounting of the devices

Bars attached on the sides of the mounting cutouts are an option to achieve the required rigidity.



A Example for achieving rigidity of the mounting position with bars

5.4.4**Mounting****Note!**

The installation must ensure the required tightness.

For this purpose, the mounting plate with the required cutouts must have a sufficient rigidity against the seal.

Overview of the mechanical requirements of the mounting position:

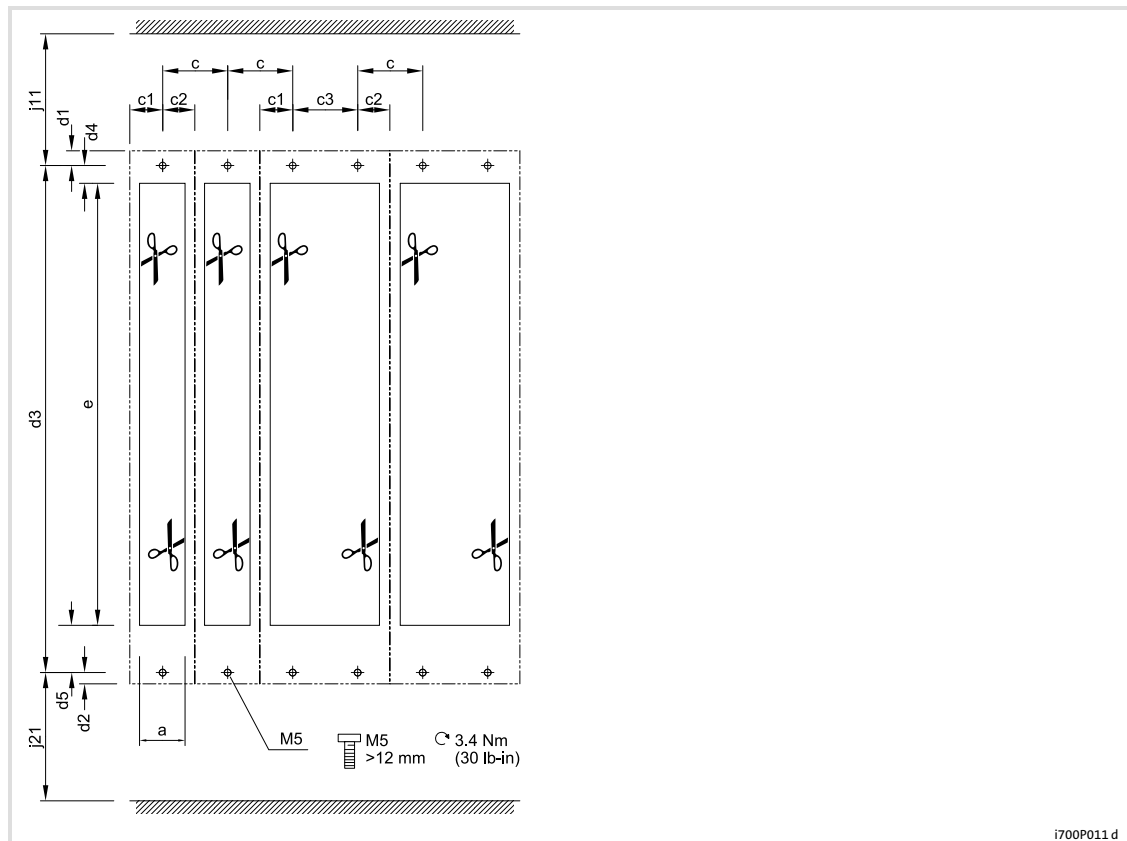
Requirements	
Cutouts	
Tolerance	± 0.5 mm
Corner radius R	1 ... 2 mm
Evenness to the seal	0.5 mm
Fixing holes	
Tolerance	± 0.25 mm
Seal	Use thread sealant
Bar reinforcement (suggestion)	
Flat material	5 * 20 * 400 mm

Type	Power loss	
	P _{V1} [W]	P _{V2} [W]
E70ACPSD0304x	60	20
E70ACMxD0054xx1xxx	30	20
E70ACMxD0104xx1xxx	50	30
E70ACMxD0204xx1xxx	100	30
E70ACMxD0054xx2xxx	60	30
E70ACMxD0104xx2xxx	100	50
E70ACPSD0604x	130	30
E70ACMxD0324xx1xxx	160	50
E70ACMxD0484xx1xxx	230	70
E70ACMxD0644xx1xxx	310	80
E70ACMxD0204xx2xxx	200	60
E70ACMxD0324xx2xxx	310	70

P_{V1}P_{V2}

separated power loss, to be dissipated via heatsink

Power loss remaining in the control cabinet



		a	e	c	c1	c2	c3	d1	d2	d3	d4	d5	j11	j21
	[A]	[mm]												
E70ACPSD0304x	30	35	340	50	25	25	-	10	10	390	15	35	90	70
E70ACMxD0054xx1xxx	5													
E70ACMxD0104xx1xxx	10													
E70ACMxD0204xx1xxx	20													
E70ACMxD0054xx2xxx	2*5													
E70ACMxD0104xx2xxx	2*10	85					50							
E70ACPSD0604x	60													
E70ACMxD0324xx1xxx	32													
E70ACMxD0484xx1xxx	48													
E70ACMxD0644xx1xxx	64													
E70ACMxD0204xx2xxx	2*20													
E70ACMxD0324xx2xxx	2*32													

6 **Electrical installation**

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.



Danger!

Dangerous voltage

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

Possible consequences:

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

Protective measures:

- Implement the actions required in the EN 61800-5-1. Especially:
 - Fixed installation
 - PE connection must conform to standards (PE conductor diameter $\geq 10 \text{ mm}^2$ or PE conductor must be connected twice)



Danger!

Hazardous electrical voltage

All power connections carry a hazardous electrical voltage for a longer time after mains disconnection. Observe the information regarding the discharge time on the device.

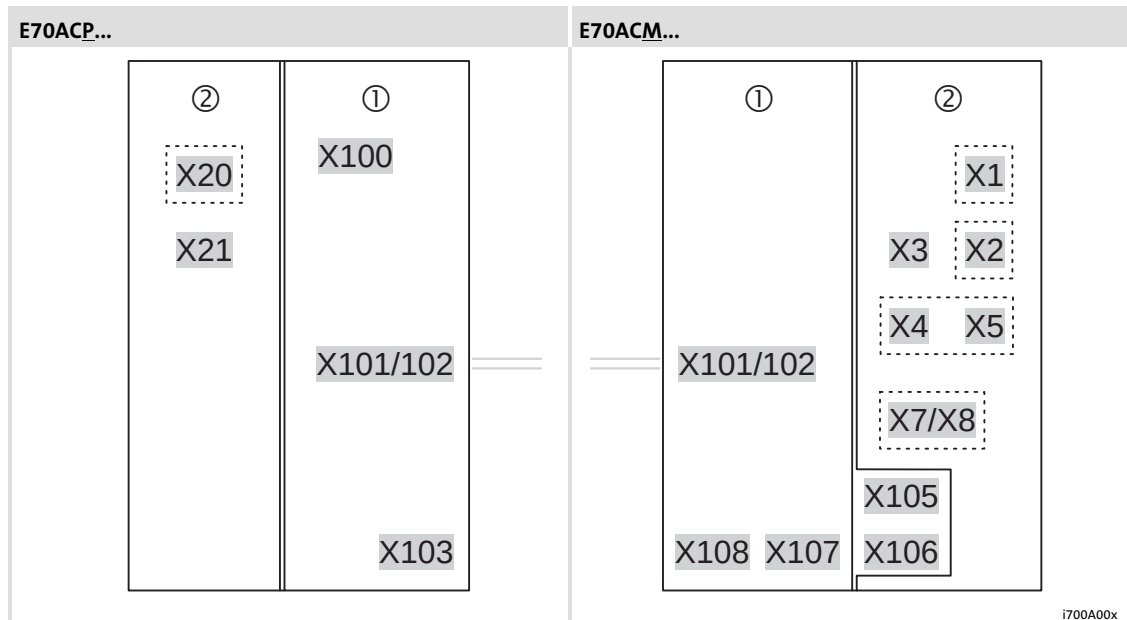
Possible consequences:

- Death or severe injuries when touching the power terminals.

Protective measures:

- Before working on the power connections, wait at least until the discharge time has passed (depending on the device, this may be up to 30 minutes).
- Make sure that all power terminals are deenergised.

6.1.1 Electrical isolation



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

E70ACP...	Power supply module	E70ACM...	Axis module
①	Power section	①	Power section
②	Control section	②	Control section
		X1	Safety system
X20	Digital inputs and outputs	X2	Digital inputs
X21	24-V voltage supply	X3	24-V voltage supply
X100	AC mains		
X101/102	DC bus +UG/-UG	X101/102	DC bus +UG/-UG
X103	Brake resistor		
		X4/X5	EtherCAT
		X7/X8	Resolver or encoder
		X105	24-V voltage supply of motor holding brake
		X106	Motor holding brake
		X107	Motor B
		X108	Motor A

6.1.2 Device protection

The trouble-free operation of power supply modules with an external brake resistor is only ensured if an axis module is installed in the immediate vicinity. Preferably by end-to-end mounting and use of the DC busbar system (X101/X102).

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

6.1.3**Motor protection**

- ▶ Extensive protection against overload by means of temperature monitoring:
 - with KTY or PTC sensors of the resolvers or encoders
 - with activated I^2t monitoring
 - Combination of the possible monitoring modes
- ▶ Only use motors which have a suitable insulation 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.

6.1.4**Interaction with compensation equipment**

- ▶ Drive control systems only consume very little fundamental reactive power from the supplying AC system. Therefore, compensation is not required.
- ▶ If the drive control systems are operated on supply systems by means of compensation equipment, the compensation equipment must include chokes.
 - For this purpose, please contact the supplier of the compensation equipment.

6.2 Safety instructions for the installation according to UL/CSA

Original - English



Warnings!

- ▶ Use 60/75 °C copper wire only, except for control circuits.
- ▶ Suitable for use in a surrounding air temperature of 40 °C, and additionally 55 °C when the derating rules are followed.
- ▶ Voltage of the fuses must at least be suitable for the input voltage of the drive.
- ▶ The opening of branch circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged.
- ▶ For E70ACPS0304x AC/DC power supply module only:
 - Suitable for use on a circuit capable of delivering not more than 100 k rms symmetrical amperes, 480 V max,
 - when protected by class J, T or G fuses or protected by a circuit breaker having an interrupting rating not less than 100 k rms symmetrical amperes, 480 V.
 - Use fuses or circuit breakers only.
- ▶ For E70ACPS0604x AC/DC power supply module only:
 - Suitable for use on a circuit capable of delivering not more than 100 k rms symmetrical amperes, 480 V max,
 - when protected by class J, T or G fuses.
 - Use fuses only.
- ▶ E70ACMxxxxx4x... DC/AC inverter units:
 - The integral solid state protection does not provide branch circuit protection. Branch circuit protection has to be provided externally in accordance with the National Electrical Code and any additional codes.
- ▶ E70ACMxxxxx4x... DC/AC inverter units, connected to an external DC power supply:
 - Overload protection: 125 % of rated FLA

**Warnings!****Conditions of acceptability:**

- ▶ The device should be mounted in an overall enclosure with proper spacings being maintained.
- ▶ The terminals are suitable for factory and field wiring connection when the suitability of the intended mating connection has been determined.
- ▶ The devices E70AC followed by one digit, followed by C, followed by suffixes are intended to be mounted with adequate heat sink assemblies. In order to determine the acceptability of these assemblies, the equipment shall be subjected to temperature tests.

Temperature tests are conducted with the following aluminum heat sinks:

- Units size 1: Heat sink size 410 mm by 50 mm by 80 mm.
 - Units size 2: Heat sink size 410 mm by 100 mm by 90 mm.
- ▶ The heat sinks of devices E70AC followed by one digit, followed by D, followed by suffixes are intended to be ventilated adequately. In order to determine the acceptability of these assemblies, the equipment shall be subjected to temperature tests.

Original - French

**Avertissement !**

- ▶ Utiliser exclusivement des conducteurs cuivre 60/75 °C, sauf pour la partie commande.
- ▶ Supporte une température ambiante de 40 °C ou 55 °C avec réduction de puissance.
- ▶ La tension des fusibles doit être adaptée à la tension d'entrée de l'entraînement.
- ▶ Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés.
- ▶ Module d'alimentation CA/CC E70ACPS0304x uniquement :
 - Convient aux circuits non susceptibles de délivrer plus de 100 k ampères symétriques eff., maximum 480 V,
 - avec protection par des fusibles de calibre J, T ou G ou par un disjoncteur à pouvoir de coupure nominal d'au moins 100 k ampères symétriques eff., maximum 480 V.
 - Utiliser exclusivement des fusibles ou des disjoncteurs.
- ▶ Module d'alimentation CA/CC E70ACPS0604x uniquement :
 - Convient aux circuits non susceptibles de délivrer plus de 100 k ampères symétriques eff., maximum 480 V,
 - avec protection par des fusibles de calibre J, T ou G.
 - Utiliser exclusivement des fusibles.
- ▶ Variateurs E70ACMxxxxx4x... CC/CA :
 - La protection statique intégrée n'offre pas la même protection qu'un disjoncteur. Une protection par disjoncteur externe doit être fournie, conformément au National Electrical Code et aux autres dispositions applicables.
- ▶ Variateurs CC/CA E70ACMxxxxx4x... reliés à une source d'alimentation CC externe :
 - Protection contre les surcharges : 125 % de l'intensité nominale à pleine charge

**Avertissement !****Conditions d'acceptabilité :**

- ▶ L'appareil doit être monté dans une enveloppe de protection en respectant les espacements minimums prescrits.
- ▶ Les bornes sont compatibles avec des raccordements extérieurs et en usine, l'adéquation du mode de raccordement envisagé devant être établie.
- ▶ Les appareils de type E70AC dont la référence est suivie d'un chiffre, de la lettre C et de suffixes doivent être dotés des radiateurs appropriés. Afin d'établir si ces entités remplissent les conditions d'acceptabilité, il convient de soumettre l'équipement à des tests de température.

Les tests de température sont menés sur les radiateurs en aluminium suivants :

- Dimensions module 1 : radiateur 410 mm x 50 mm x 80 mm.
 - Dimensions module 2 : radiateur 410 mm x 100 mm x 90 mm.
- ▶ Les radiateurs des appareils de type E70AC dont la référence est suivie d'un chiffre, de la lettre D et de suffixes doivent être ventilés de façon appropriée. Afin d'établir si ces entités remplissent les conditions d'acceptabilité, il convient de soumettre l'équipement à des tests de température.

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

Design of the cables

- ▶ The cross-section of the PE conductor must be dimensioned according to the relevant national regulations.
- ▶ The cables used must comply with the approvals required for the location (e.g. UL).

6.3.1 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)

The following connections need not be shielded:

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

Connection system

- ▶ Connect the shield with a large surface and fix it with metal cable binders or a conductive clamp. (📖 11.9)
- ▶ 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

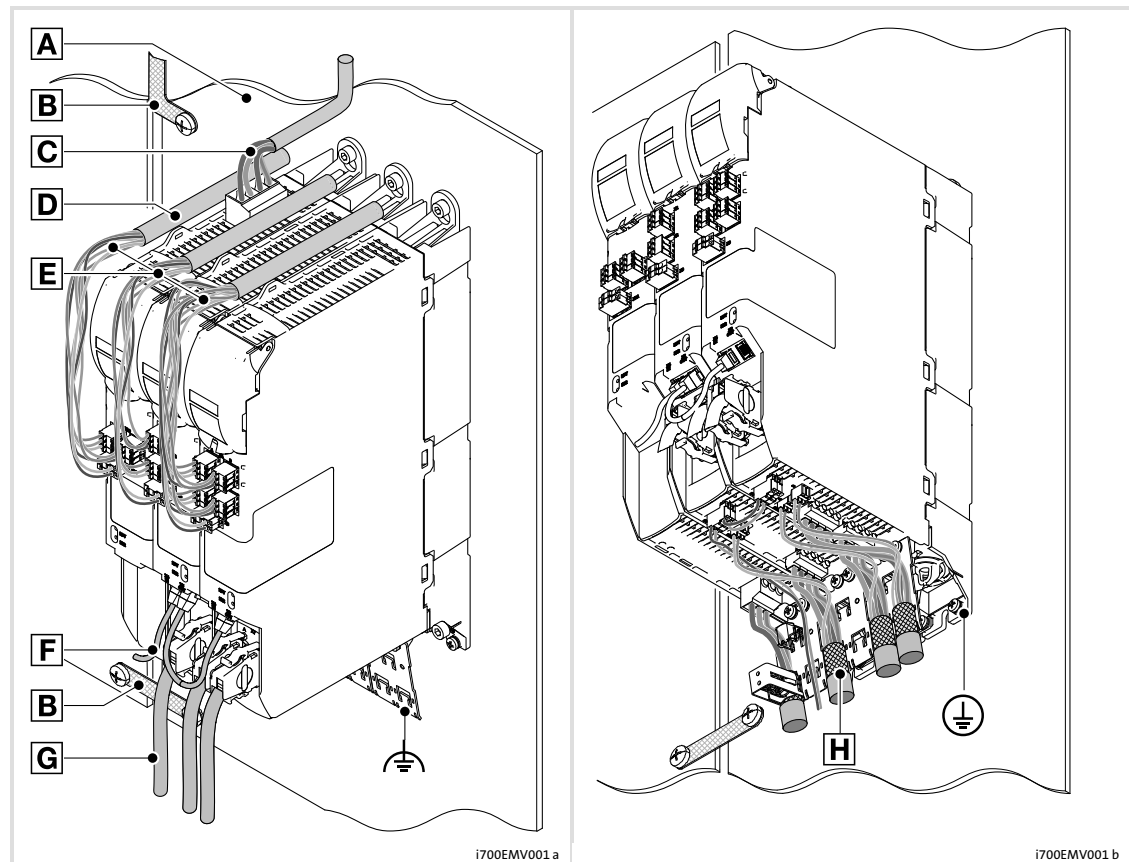


Fig. 6-1 Wiring in compliance with EMC standards

- A** Mounting plate with electrically conductive surface
- B** Earth connection of the control cabinet elements
- C** Mains connection, unshielded cable
- D** Bundling of cables in the conduit
- E** Control cables and supply voltage, unshielded
- F** System cables, EtherCAT® communication bus (scope of supply)
- G** System cable for feedback, servo control
- H** Integrated shield connection (functional earth) with shield clamp (scope of supply)
- H** Shielded cables of the motor, motor holding brake and brake resistor connections
 Motor cable, shielded, low-capacitance (see also technical data, page 32)
 $\leq 2.5 \text{ mm}^2$ (AWG 14): Core/core $\leq 75 \text{ pF/m}$; core/shield $\leq 150 \text{ pF/m}$
 $\geq 4.0 \text{ mm}^2$ (AWG 12): Core/core $\leq 150 \text{ pF/m}$; core/shield $\leq 300 \text{ pF/m}$
- ⊕** Integrated PE conductor connection

6.3.2 Mains connection, DC supply

- ▶ Power supply modules, mains chokes or mains filters may be connected to the mains via unshielded single cores or unshielded cables.
- ▶ Cables between mains filters/RFI filters and power supply modules:
 - Install twisted and with sufficient distance to adjacent cables.
 - If cables are routed together in a cable duct or if longer cable lengths are used, we recommend the use of shielded cables, e.g. between two control cabinets.
- ▶ The integrated DC busbars (X101/102) do not require EMC measures.
- ▶ Installation of cables for DC supply:
 - Up to a length of 300 mm, twisted unshielded cables can be used, e.g. between an upper and a lower installation row.
 - From a length of 300 mm onwards, we recommend the use of shielded cables, e.g. between two control cabinets.
- ▶ The cable cross-section must be dimensioned for the assigned fusing (observe national and regional regulations).

6.3.3**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).
- ▶ 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.

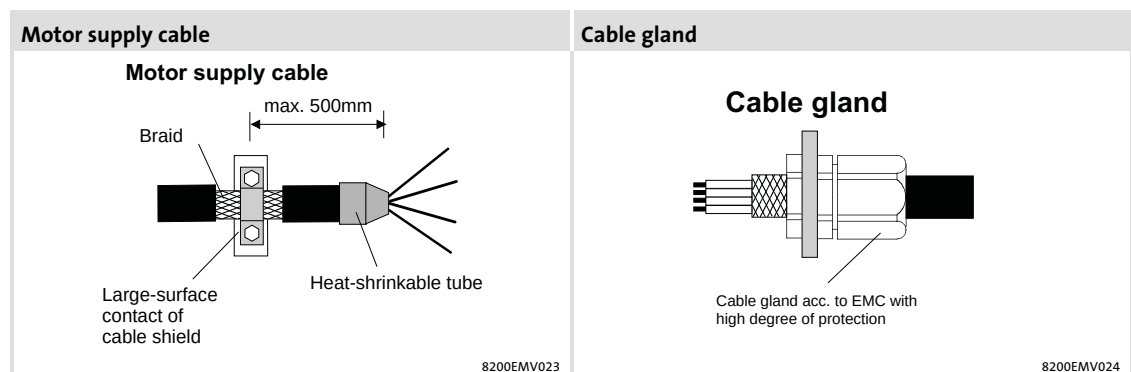


Fig. 6-2 Shielding of the motor cable

6.3.4 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

The trouble-free operation of power supply modules with an external brake resistor is only ensured if an axis module is installed in the immediate vicinity. Preferably by end-to-end mounting and use of the DC busbar system (X101/X102).

- ▶ 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.
- ▶ In order to comply with the limit values of conducted interference emission of fieldbus cables according to DIN EN 55022 class A, the shield of the fieldbus cable must be connected to the mounting plate over a large area before leaving the control cabinet.

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.

6.3.5 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.

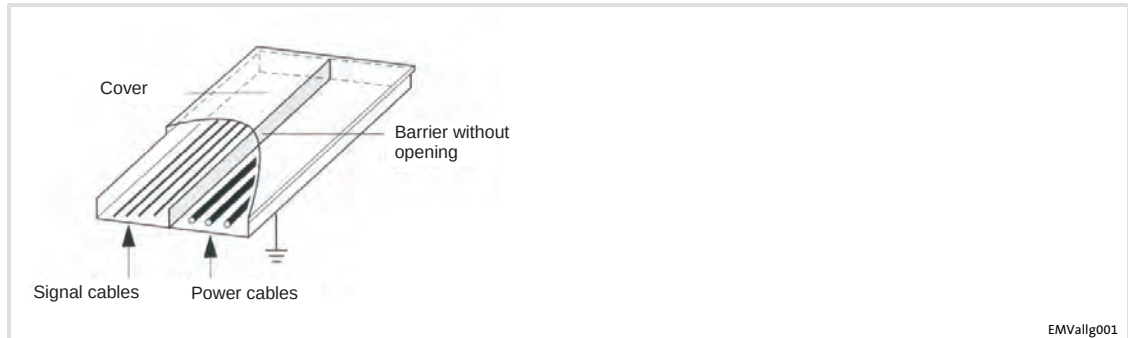


Fig. 6-3 Cable routing in the cable duct with barrier

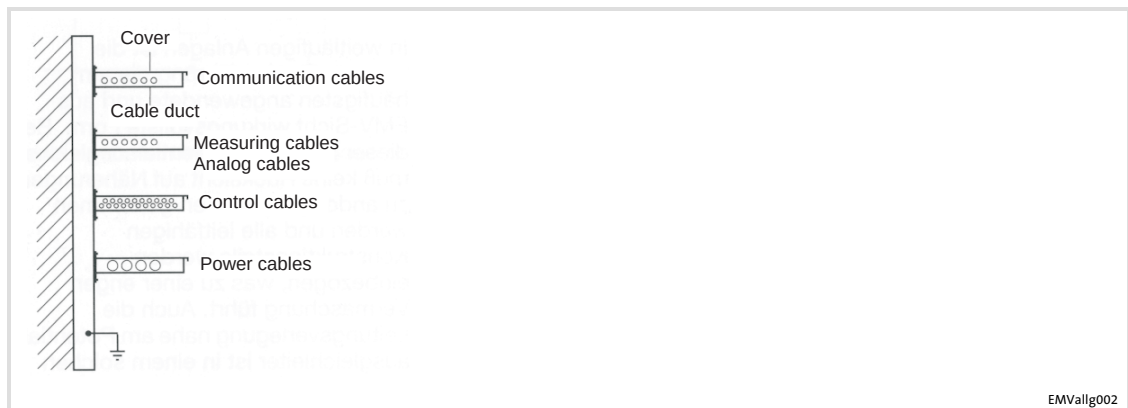


Fig. 6-4 Cable routing in separated cable ducts

Wiring on the motor side



Note!

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.

6.3.6 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.	• Separate components from other component part with a minimum distance of 100 mm • Use motor choke/motor filter
	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: • Remove varnish • Use zinc-coated mounting plate
	HF short circuit	Check cable routing

6.4 Measures when drive is used in IT systems

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

For the use in the IT system, the device-internal capacitors must be separated from PE, in order to protect the devices against damage or destruction by incompatible overvoltages in the event of an error (earth fault).

- The separation is carried out on the power supply modules by the removal of screws.

Overview of the measures

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

Device	Measure for operation in the IT system
Controllers	
E70ACM...	No measure
Power supply modules	
E70ACPSx0304x	Remove two screws (Fig. 6-5)
E70ACPSx0604x	Remove one screw (Fig. 6-5)
Regenerative power supply modules	
E94ARNE0xx4	According to the mounting instructions
Suitable mains filter	According to the mounting instructions

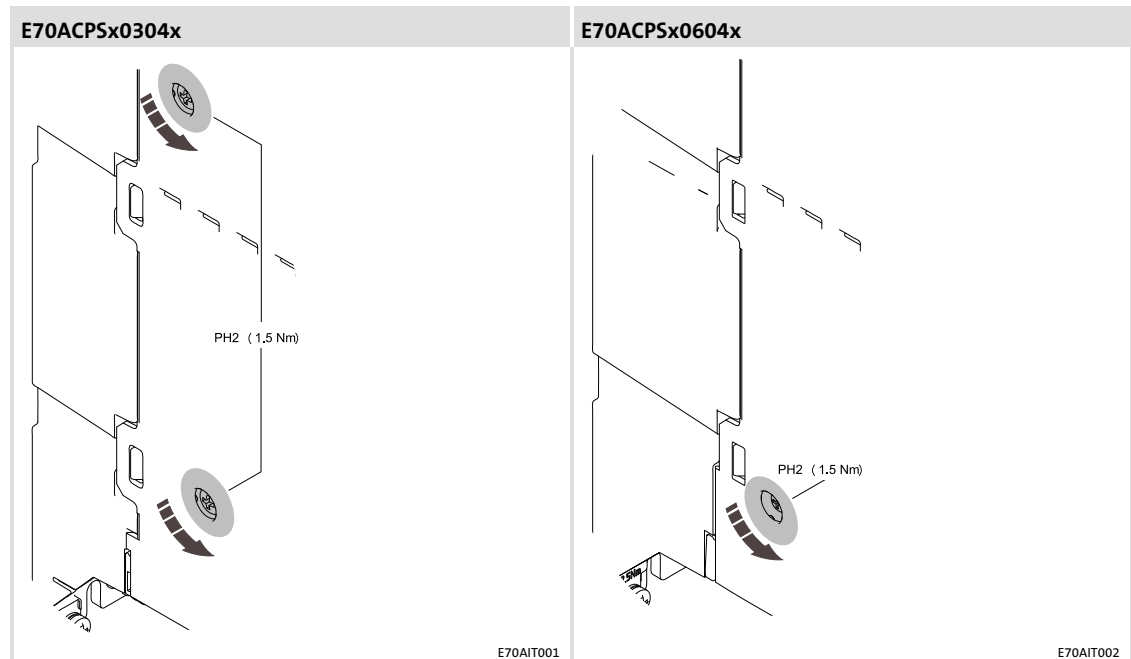


Fig. 6-5 Position of the screws to be removed

**Stop!****Only operate the controllers with the mains chokes assigned.**

Operation with mains filters or RFI filters by Lenze is not permitted, as these modules contain components that are interconnected against PE. By this the protective design of the IT system would be cancelled out. The components are destroyed in the case of an earth fault.

Protect the IT system against earth fault at the controller.

Due to physical conditions, an earth fault on the motor side at the controller can interfere with or damage other devices on the same IT system. Therefore appropriate measures have to be implemented, by means of which the earth fault is detected and which disconnect the controller from the mains.

Permissible supply forms and electrical supply conditions

Mains	Operation of the controllers	Comments
With an isolated star point (IT systems)	Possible, if the controller is protected in the event of an earth fault in the supplying mains: • appropriate earth fault detections are available and • the controller is immediately disconnected from the mains.	• An earth fault on the motor side with a switching frequency of 4 kHz or 8 kHz can cause a safety shutdown of the device. • An earth fault on the motor side at 16 kHz presents an impermissible load for the controller.

Installation of the CE-typical drive system

For the installation of drives on IT systems, the same conditions apply as for the installation on systems with an earthed neutral point.

According to the binding EMC product standard EN61800-3, no limit values are defined for IT systems for noise emission in the high-frequency range.

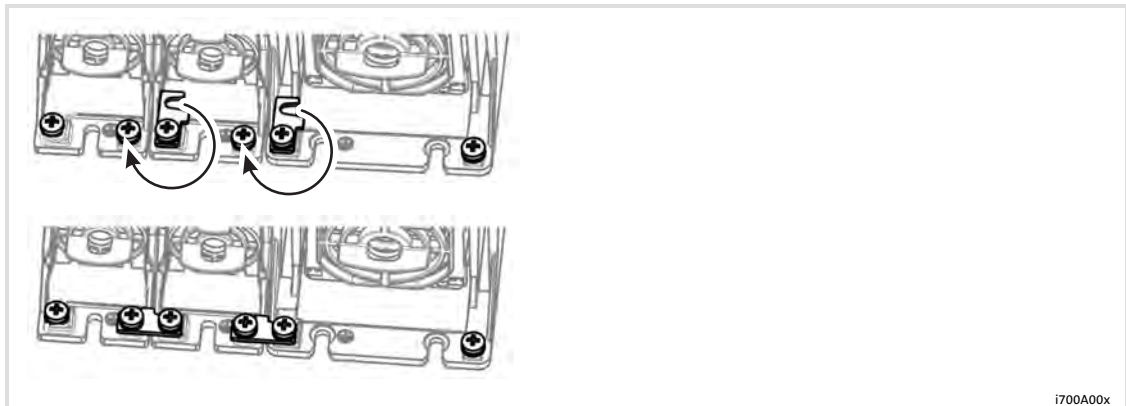
6.5 Preparations

When the mechanical installation has been completed, the electrical wiring starts with the creation of the integrated electrical connections:

6.5.1 Integrated PE conductor connection

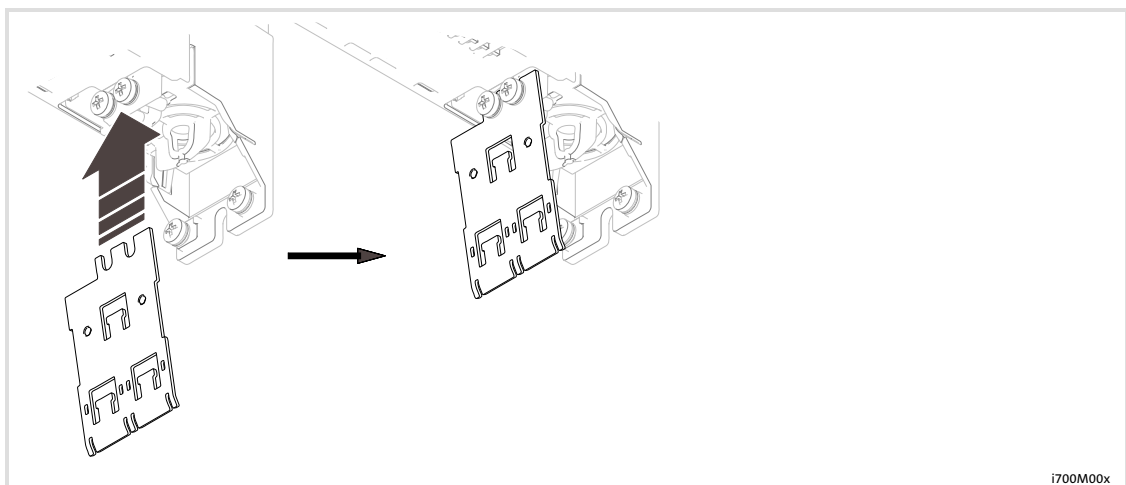
How to proceed:

- ▶ Use the swivel hook to establish the PE conductor connection of the devices.
 - Loosen the screws
 - Turn the swivel hook into the right position
 - Fasten the screws
- ▶ At the left and right device of an installation row, attach the PE connection twice conforming to standards.
- ▶ Then attach the shield connection sheet.



i700A00x

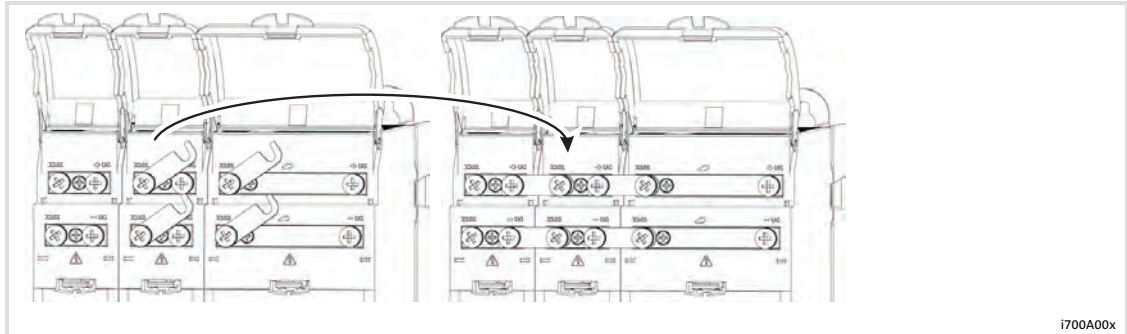
Terminal data					
	Conductor cross-section		Tightening torque		
	[mm ²]	[AWG]	[Nm]	[lb-in]	
Swivel hook ⊕	-	-	2.5	22.1	PH 2



i700M00x

6.5.2 Integrated DC bus connection

- Establish the DC bus connection from the power supply module up to the last axis module



Terminal data

	Conductor cross-section		Tightening torque		
	[mm ²]	[AWG]	[Nm]	[lb-in]	
Swivel hook	-	-	5.0	44.3	PH 3

6.6 Power supply modules

For all connections, the chapter "Technical data, connection description" provides the following detailed information:

- ▶ Rated data
- ▶ Assignment
- ▶ Circuit diagram for the electrical connection

Interconnections required for the power supply module:

Connections and elements		Info
X20.1	Digital inputs	
X20.2	Digital outputs	 50
X21	External 24-V supply	 49
X100	Mains connection	 51
X101	DC-bus voltage +UG	
X102	DC-bus voltage -UG	 52
X103	Connection of brake resistor	 53
	PE conductor	 103
	Shield connection (functional earth)	 103

The basic circuit diagram provides a complete overview of the wiring of the devices.

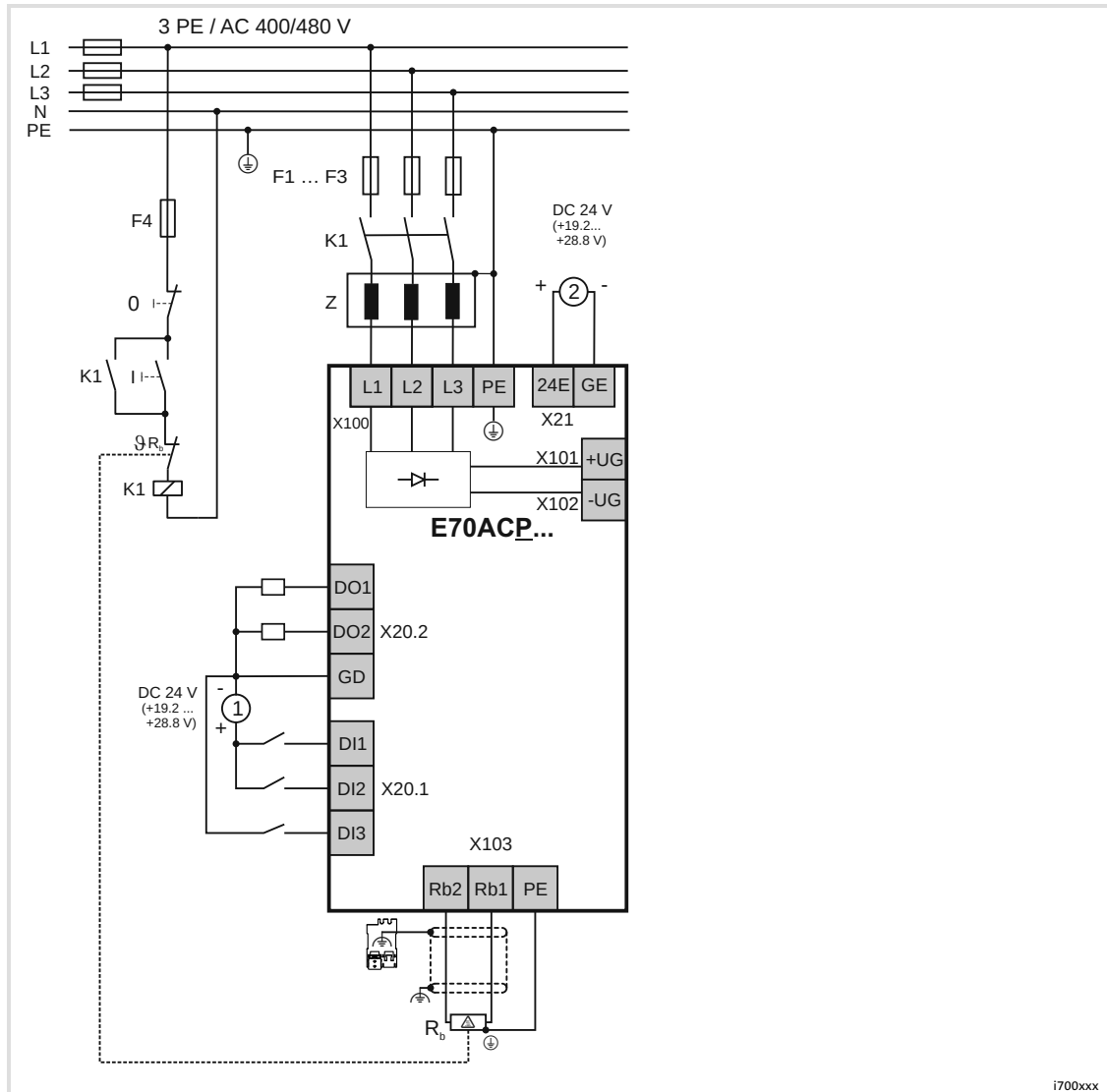


Fig. 10

Basic circuit diagram - power supply modules

E70ACP...

i700 power supply module

F...

Fuses

K

Mains contactor with latch circuit

Z

Filter

R_b

External brake resistor

①

24-V supply of digital inputs and outputs

②

24-V supply of control electronics

6.7 Axis modules

For all connections, the chapter "Technical data, connection description" provides the following detailed information:

- ▶ Rated data
- ▶ Assignment
- ▶ Circuit diagram for the electrical connection

Interconnections required for the axis module:

Connections and elements		Info
X1	Basic Safety - STO	 55  137
X2	Touch probe	 56
X3	External 24-V supply	 57
X4	EtherCAT IN	 58
X5	EtherCAT OUT	
Servo control feedback (alternative)		
	X7 - resolver	 60
	X8 - encoder	 62
X101	DC-bus voltage +UG	 64
X102	DC-bus voltage -UG	
X108	Motor A	 67
X107	Motor B	
X105	24-V supply of motor holding brake(s)	 65
X106	Motor holding brake	 66
	PE conductor	 103
	Shield connection (functional earth)	 103



Note!

If integrated safety is not to be used for an axis, the safe inputs SIA and SIB of the axis must be fixedly assigned with "HIGH" potential (24 V).

The wiring should not give the impression of connected safety sensors, or should be provided with adequate labelling.

The basic circuit diagram provides a complete overview of the wiring of the devices.

Single axis module

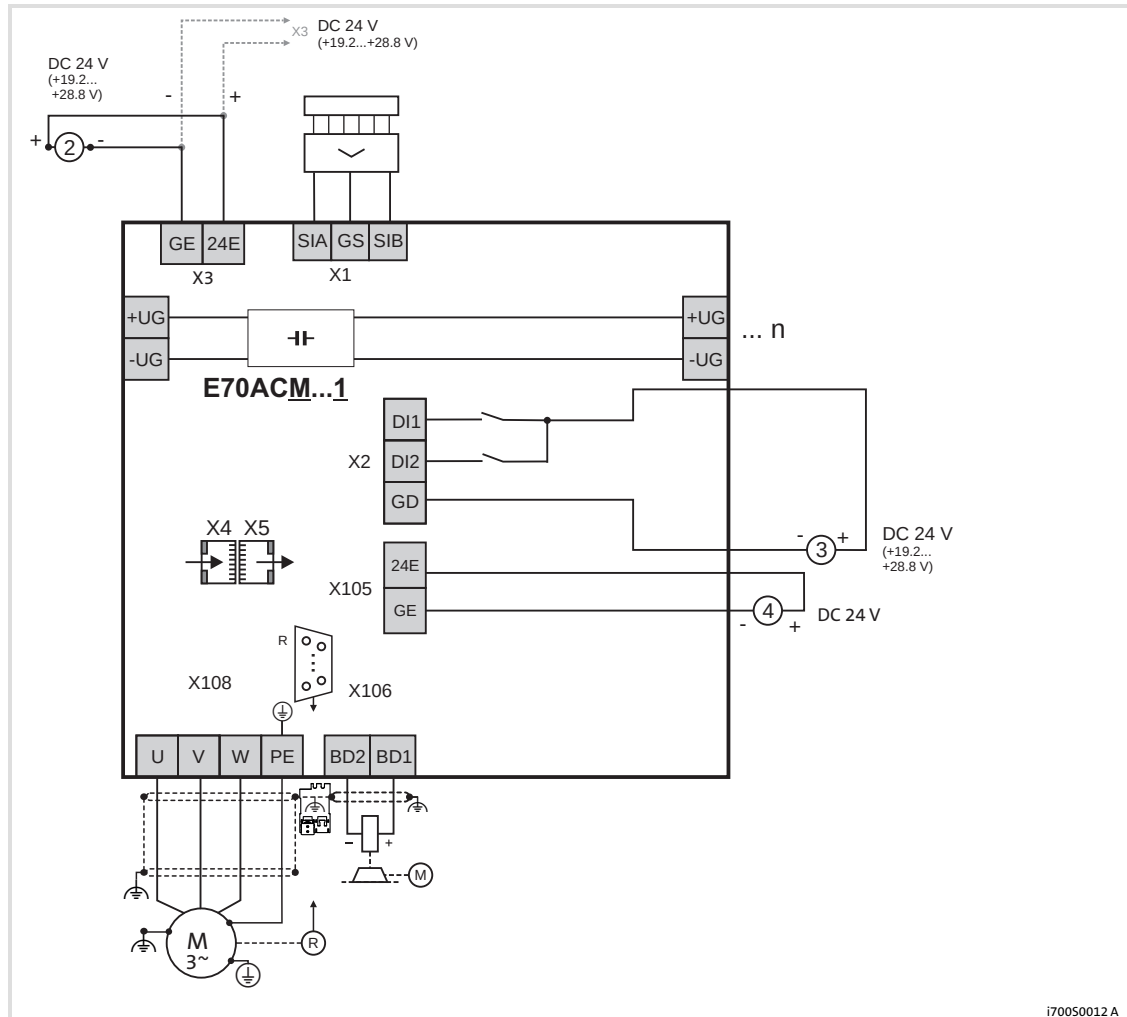


Fig. 11 Basic circuit diagram - axis modules

E70ACM...1

...n

②

③

④

R

i700 "single inverter" single axis module - motor A

Other i700 axis modules

24-V supply of control electronics

24-V supply of digital inputs

24-V supply of motor holding brake(s)

Servo control feedback (X7 = resolver or X8 = encoder)

Double axis module

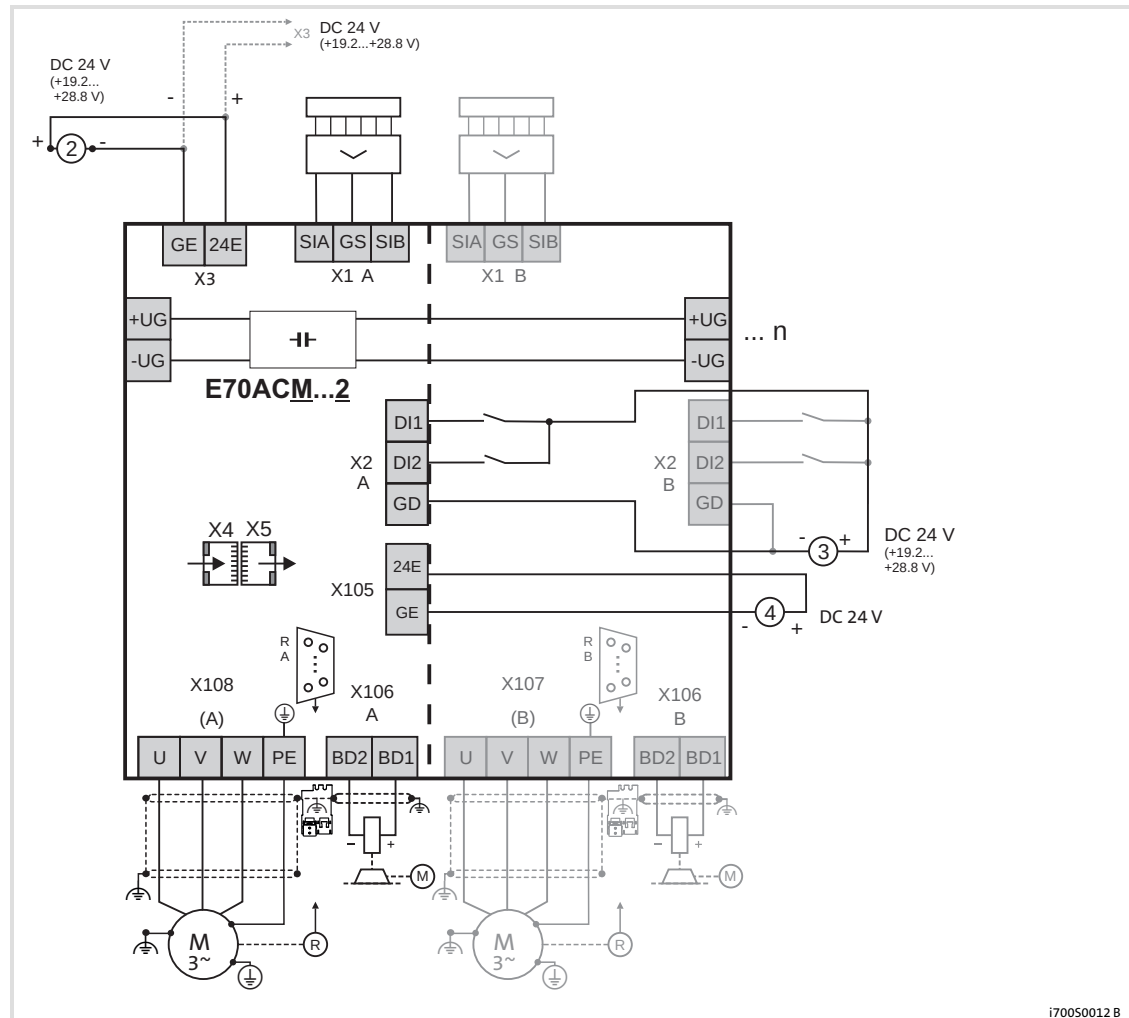


Fig. 12 Basic circuit diagram - axis modules

E70ACM...2	i700 double axis module "double inverter" - motor A and motor B
...n	Other i700 axis modules
②	24-V supply of control electronics
③	24-V supply of digital inputs
④	24-V supply of motor holding brake(s)
R	Servo control feedback (X7 = resolver or X8 = encoder)

7 DC-bus operation

7.1 Introduction

7.1.1 Terminology and abbreviations used

Explanations of special terms concerning DC-bus operation can be found in the chapter "About this documentation" under "Terminology and abbreviations used" (📖 10).

7.1.2 Advantages of a drive system

When several controllers are operated in a DC-bus connection (DC bus), this offers the following advantages:

- ▶ Energy exchange between controllers in generator-mode (braking) and motor-mode operation.
- ▶ The energy exchange reduces the supply power from the AC mains.
- ▶ DC-supply modules or feeding single-axis controllers can be dimensioned with a lower rated power.
- ▶ The energy exchange reduces the braking losses in generator-mode operation.

Advantages for installation:

- ▶ Only one AC-mains connection (e.g. at the DC-supply module).
- ▶ Reduced wiring costs.

7.2 Conditions for trouble-free DC-bus operation

7.2.1 Voltages

The DC-bus operation of controllers is only possible if the rated values of the mains voltage or DC-bus voltage are identical. The switching thresholds of all brake choppers in the interconnected system have to be set identically and the control has to be synchronised by master/slave interconnection.

7.2.2 Number of feeding points

The "i700 servo inverter" series has been designed for drive systems with a central AC mains feeding point. For this you can use DC supply modules of different power categories.

It is permissible to operate DC power supply modules in parallel in order to increase the supply or braking power. Using the assigned mains chokes ensures a distribution of the mains input current in accordance with the rated data.

The spacial arrangement of the DC power supply modules in the network can be selected freely according to the requirements.

Examples:

- ▶ Arrangement of DC power supply modules to the left and right of the axis interconnection for power increase P_{DC} and optimised current distribution in the busbar system
- ▶ Arrangement of DC power supply modules directly next to the axes with dominant punctual motor power or regenerative power.



Tip!

Your Lenze contact person will advise you on further possible supply concepts.

7.2.3**Other conditions**

- ▶ The entire DC power P_{DC} must be provided by the feeding point.
- ▶ The controllers of the interconnected system may only start operation when the DC bus has been charged completely.

**Stop!****Possible destruction of the DC charging circuit**

The 24 V supply of the drive controllers in the DC network is not switched on.

Possible consequences:

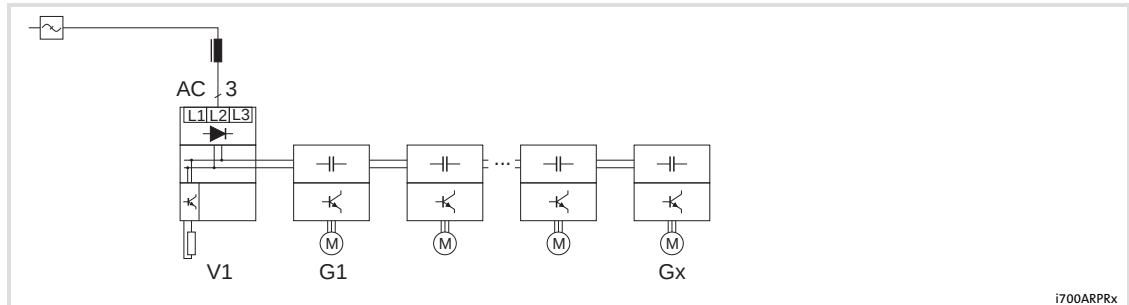
- ▶ Charging relay or charging hybrid can be destroyed.

Protective measures:

- ▶ Supply all drive controllers in the DC bus via a common and stable 24 V supply.
 - ▶ With split 24 V supply to several axes and split fuse protection:
 - If a fuse responds, shut down the entire drive train if possible to avoid cyclical voltage strokes in the DC bus.
-
- ▶ Up to a total current of 120 A, the controllers can be operated via the integrated DC-busbar.
 - Maximum overload of the busbar for 60 s: $150 \% \cdot I_{rated}$ with a subsequent 120 s recovery phase: $75 \% \cdot I_{rated}$.
 - ▶ The required DC power P_{DC} must be determined. In order to avoid temporary overloads, a time/power diagram must be created and taken into account (see basic dimensioning).

7.3 DC-bus variants

7.3.1 Supply with one power supply module



AC AC mains
V1 Power supply modules
G1 ... Gx Controller

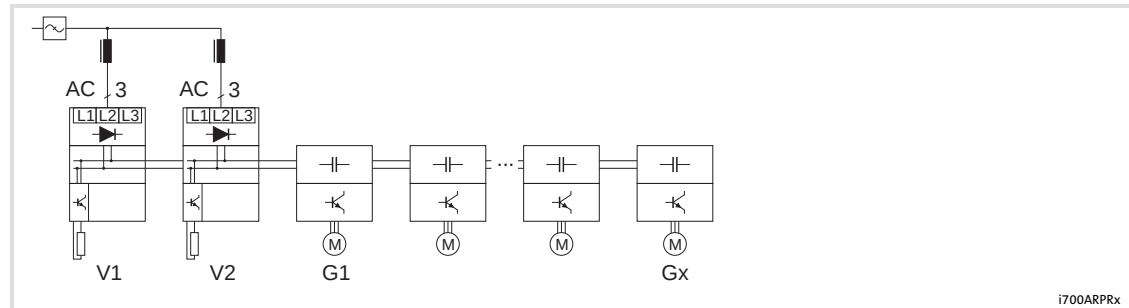
A DC supply module with direct AC mains connection supplies energy into the DC bus of several controllers. The DC supply module is equipped with an integrated brake chopper to which you can connect a brake resistor.

The table lists 9 typical combinations of the usable components.

Filter		Mains choke	Power supply module	DC-supply power	
RFI filter	Mains filter			P _{DC 100%} [kW]	
				400 V	480 V
E94AZRP0084	-	-	E70ACPSx0304x	3.4	4.1
E94AZRP0084	-	EZAELN3025B122	E70ACPSx0304x	5.1	6.2
E94AZRP0294	-	-	E70ACPSx0304x	10.3	12.3
E94AZRP0294	-	EZAELN3025B122	E70ACPSx0304x	15.4	18.5
-	E94AZMP0084	-	E70ACPSx0304x	5.1	6.2
-	E94AZMP0294	-	E70ACPSx0304x	15.4	18.5
E94AZRP0824	-	-	E70ACPSx0604x	20.6	24.7
E94AZRP0824	-	EZAELN3050B591	E70ACPSx0604x	30.9	37.0
-	E94AZMP0494	-	E70ACPSx0604x	30.9	37.0

7.3.2

Supply with power supply modules operated in parallel



AC
V1, V2
G1 ... Gx

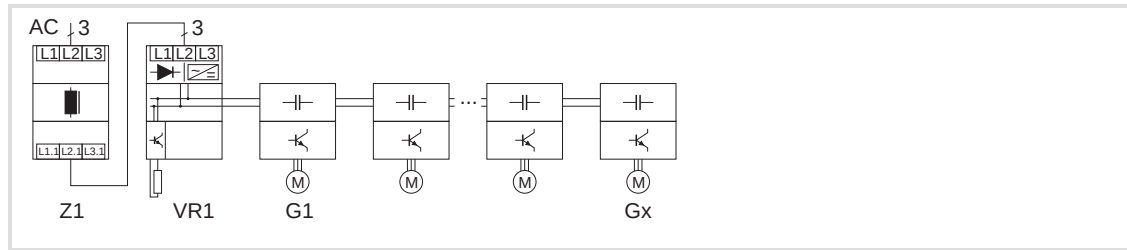
AC mains
Power supply modules
Controllers

Power supply modules can be operated in parallel in order to increase the DC supply power and/or the braking power.

For the central connection of power supply modules operated in parallel to the AC mains, the filters must be dimensioned as collective filters.

Components to be used	
i700 device series	Other device series
DC supply	
Power supply modules	
E70ACPSx0304x (30 A)	-
E70ACPSx0604x (60 A)	-
Mains chokes	
-	EZAELN3025B122 EZAELN3050B591
Filter	
RFI filters	
-	-
Mains filters	
-	E94AZMP0084 E94AZMP0294 E94AZMP0824
Interconnected device	
Controllers	
E70ACM...1... (single axis)	-
E70ACM...2... (double axis)	-

7.3.3 Supply with regenerative power supply module



AC AC mains
 Z1 Regenerative power supply filter
 VR1 Regenerative power supply module
 G1 ... Gx Controllers

If the regenerative energy produced by a drive system is to be fed back to the AC mains, a regenerative power supply module of the "Servo Drives 9400" device series can be used. A brake chopper, to which a brake resistor can be connected, is integrated.

Components to be used

i700 device series

Other device series

DC supply

Regenerative power supply modules

-

E94ARNE0xx4 + E94AZMR0xx4xDB (13 ... 24 A)

Filter

- assigned to the regenerative power supply module

Interconnected device

Controllers

E70ACM...1... (single axis)

-

E70ACM...2... (double axis)

-

7 DC-bus operation

Rated data

General data

7.4 Rated data

7.4.1 General data

The total current of the nominal input currents I_{DC} to be provided by the power supply module must be determined. If required, the DC cables must be dimensioned in accordance with the total current.

Additional data			
	Input current I_{DC} at I_{ar} [A]	DC-bus capacity [μF]	Charging resistor [Ω]
E70ACMxx0054xx1xxx	5.0	165	100
E70ACMxx0104xx1xxx	9.3	165	100
E70ACMxx0204xx1xxx	18.4	330	100
E70ACMxx0324xx1xxx	29.8	720	34
E70ACMxx0484xx1xxx	44.6	1080	34
E70ACMxx0644xx1xxx	59.5	1080	34
E70ACMxx0054xx2xxx	9.3	165	100
E70ACMxx0104xx2xxx	18.4	330	100
E70ACMxx0204xx2xxx	37.3	720	34
E70ACMxx0324xx2xxx	59.5	1080	34

Tab. 7-1

DCbus = DC bus

7.4.2 DC-supply power

The parameters relevant for the selection of a supply unit with a suitable supply power (even in the overload range) are listed in the below table:

U_{Lr}	Rated AC voltage
Cycle 1	Cycle for the second-range
Cycle 2	Cycle for the minute-range
$P_{DC\ 100\%}$	Permanent power of DC-voltage level
P_{ol}	Power supply during overload time
t_{ol}	Overload time
P_{re}	Power supply during unloading time
t_{re}	Relief time

Any other cycles are calculated with the following formula:

$$\frac{(P_{ol} \cdot t_{ol}) + (P_{re} \cdot t_{re})}{t_{ol} + t_{re}} \leq P_{DC\ 100\%}$$

Cycles other than the above cycles must not exceed the specified power and time values, i.e. the values must be used as maximum values.

The values depend on the rated AC voltage U_{Lr} .

230 V

Power supply $U_{Lr} = 230\text{ V}$		cycle 1		cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E70ACPSx0304x	5.9	11.8 · 3	3.9 · 12	8.9 · 60	4.4 · 120
E70ACPSx0304x + E94AZMP0084	2.9	5.8 · 3	1.9 · 12	4.4 · 60	2.2 · 120
E70ACPSx0304x + E94AZMP0294	8.9	17.7 · 3	5.9 · 12	13.3 · 60	6.7 · 120
E70ACPSx0604x	11.8	23.7 · 3	7.8 · 12	17.8 · 60	8.9 · 120
E70ACPSx0604x + E94AZMP0824	17.8	35.5 · 3	11.7 · 12	26.7 · 60	13.3 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	8.6	25.8 · 3	6.5 · 12	12.9 · 60	6.5 · 120
E94ARNE0244 + E94AZMR0474xDB	15.6	46.6 · 3	11.7 · 12	23.3 · 60	11.7 · 120

Tab. 7-2

400 V

Power supply $U_{Lr} = 400\text{ V}$		Cycle 1		Cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E70ACPSx0304x	10.3	20.6 · 3	6.8 · 12	15.5 · 60	7.7 · 120
E70ACPSx0304x + E94AZMP0084	5.1	10.3 · 3	3.4 · 12	7.7 · 60	3.9 · 120
E70ACPSx0304x + E94AZMP0294	15.4	30.8 · 3	10.2 · 12	23.1 · 60	11.6 · 120
E70ACPSx0604x	20.6	41.2 · 3	13.6 · 12	30.9 · 60	15.5 · 120
E70ACPSx0604x + E94AZMP0824	30.9	61.8 · 3	20.4 · 12	46.4 · 60	23.2 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	15.0	44.9 · 3	11.3 · 12	22.4 · 60	11.3 · 120
E94ARNE0244 + E94AZMR0474xDB	27.0	81.1 · 3	20.3 · 12	43 · 60	20.3 · 120

Tab. 7-3

480 V

Power supply $U_{Lr} = 480\text{ V}$		Cycle 1		Cycle 2	
Type	$P_{DC\ 100\%}$ [kW]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]	$P_{ol} \cdot t_{ol}$ [kW] · [s]	$P_{re} \cdot t_{re}$ [kW] · [s]
Supply modules (+ filter)					
E70ACPSx0304x	12.3	24.6 · 3	8.1 · 12	18.5 · 60	9.2 · 120
E70ACPSx0304x + E94AZMP0084	6.2	12.3 · 3	4.1 · 12	9.2 · 60	4.6 · 120
E70ACPSx0304x + E94AZMP0294	18.5	37.0 · 3	12.2 · 12	27.8 · 60	13.9 · 120
E70ACPSx0604x	24.7	49.4 · 3	16.3 · 12	37.1 · 60	18.5 · 120
E70ACPSx0604S + E94AZMP0824	37.0	74.0 · 3	24.4 · 12	55.5 · 60	27.8 · 120
Regenerative power supply modules + filters					
E94ARNE0134 + E94AZMR0264xDB	18.6	56.1 · 3	14.0 · 12	28.0 · 60	14.0 · 120
E94ARNE0244 + E94AZMR0474xDB	33.8	101.4 · 3	25.4 · 12	50.7 · 60	25.4 · 120

Tab. 7-4

7.4.3 DC-power requirements

Use the below tables to determine the power requirements of the devices used in the DC bus and the device-dependent power loss for the rated mains voltage U_{Lr} .

Power requirements P_{ar} [W] with rated current			
	$U_{Lr} = 230 \text{ V}$	$U_{Lr} = 400 \text{ V}$	$U_{Lr} = 480 \text{ V}$
E70ACMxx0054xx1xxx	1000	1700	2000
E70ACMxx0104xx1xxx	1900	3200	3800
E70ACMxx0204xx1xxx	3700	6300	7600
E70ACMxx0324xx1xxx	5900	10200	11200
E70ACMxx0484xx1xxx	8900	15300	18300
E70ACMxx0644xx1xxx	11900	20400	24300
E70ACMxx0054xx2xxx	1900	3200	3900
E70ACMxx0104xx2xxx	3000	6300	7600
E70ACMxx0204xx2xxx	7500	12800	15300
E70ACMxx0324xx2xxx	11800	20400	24400

Tab. 7-5

Consider the following criteria when using mains chokes:

- Mains chokes are always required if all interconnected devices are operated with rated current and speed.
- Mains chokes are not required if the power of the entire network is less than 50 % of the added continuous powers of all interconnected devices (= standard case).

$$\Sigma P_a \leq 0.5 \times \Sigma P_{aN}$$

ΣP_a

Sum of the average output power of the axes in the network
Medium mains power, depending on the "in motor mode/in generator mode" operating status, motor current, motor speed and device losses

ΣP_{ar}

Sum of the rated power of the axes in the network

- The use of mains chokes for complying with the EMC category C3 has to be assessed separately (124).

	Power loss P_V [W]			
	$U_{Lr} = 230 \text{ V}$	$U_{Lr} = 400 \text{ V}$	$U_{Lr} = 480 \text{ V}$	when controller is inhibited
E70ACMxx0054xx1xxx	50	50	50	20
E70ACMxx0104xx1xxx	80	80	80	20
E70ACMxx0204xx1xxx	130	130	130	20
E70ACMxx0324xx1xxx	210	210	210	35
E70ACMxx0484xx1xxx	290	290	300	35
E70ACMxx0644xx1xxx	390	390	390	45
E70ACMxx0054xx2xxx	90	90	90	30
E70ACMxx0104xx2xxx	140	140	150	30
E70ACMxx0204xx2xxx	260	260	260	45
E70ACMxx0324xx2xxx	370	370	380	45

7.5 Basic dimensioning

7.5.1 General information

The Drive Solution Designer (DSD) PC software helps you to dimension your drive network. For expert advice, you may also contact your Lenze sales representative when dimensioning your application.

Time/performance diagram

For determining the performance of your drive network, create a time/performance diagram for all axes for a complete machine cycle. The power requirements of the drive network are calculated by adding the individual performances occurring at the same time. Positive results show the AC requirements for the dimensioning of the power supply units. Negative results show the brake power to be dissipated via brake choppers at the brake resistor.

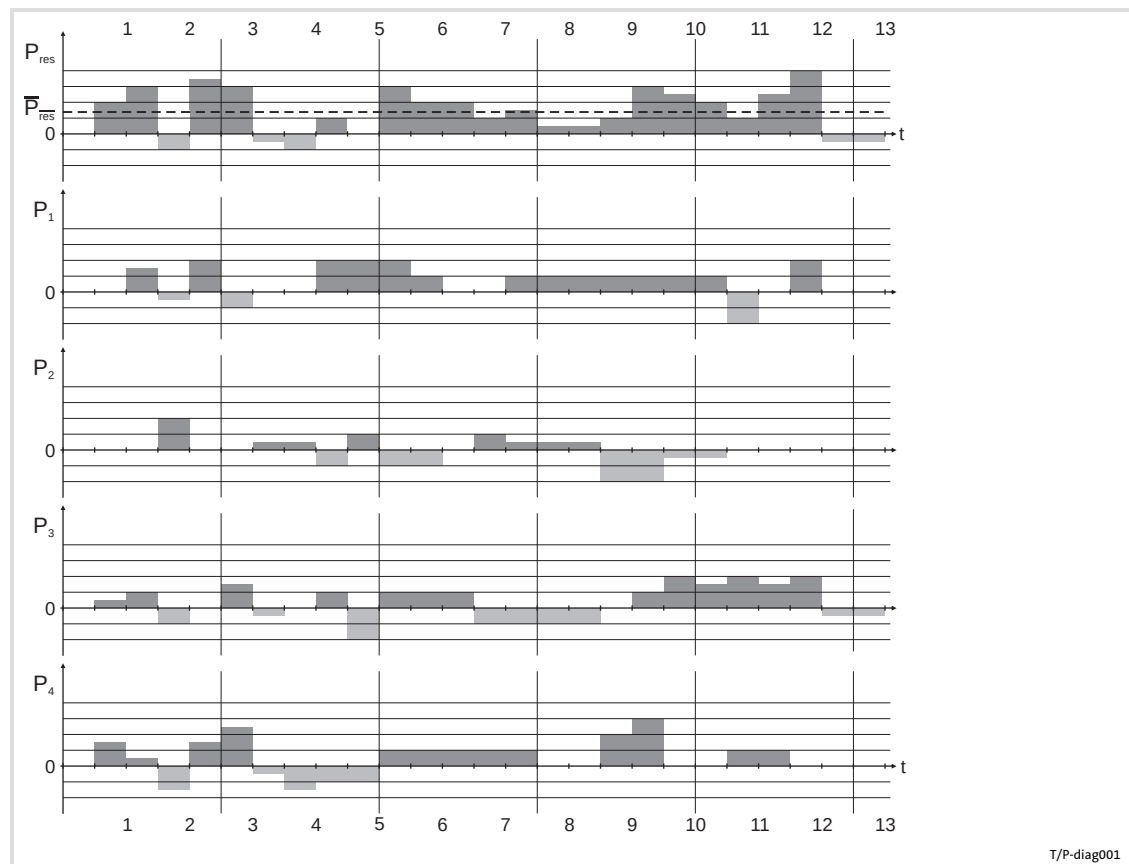


Fig. 7-1 Example time/performance diagram

$P_1 \dots P_4$	Individual performances of axes 1 ... 4
P_{total}	Addition of the individual performances
$\overline{P_{total}}$	Average of the individual performances

Use the time/performance diagram to optimise the DC-bus performance of all axes for a complete machine cycle.

Utilisation factor

Please consider the utilisation factors when determining $P_{DCtotal}$. Reduce the power requirements if the rated power is not fully used.

Simultaneity factor

Please consider the simultaneity factor when determining $P_{DCtotal}$. Reduce the power requirements if the drives do not run simultaneously or in opposite direction (braking).

Braking operation

After determining the brake power $P_{BRtotal}$, ensure that the brake power can be provided by the brake choppers and brake resistors in the DC bus.

Other conditions

The power supply unit must be able to provide the required power (arithmetic mean).

The overload requirements must be within the permissible range:

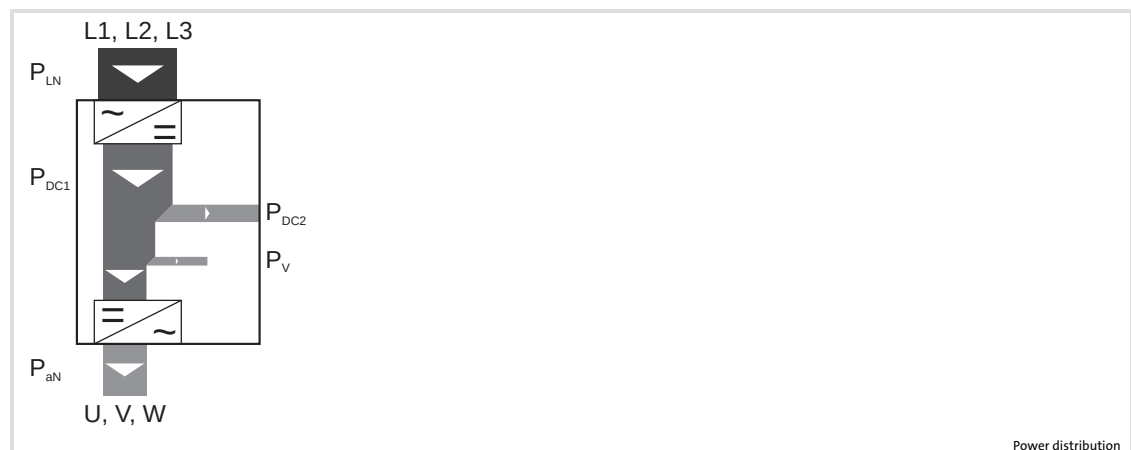
(7.4.2)

- ▶ 3-min cycle (1 min overload with 150 % and 2 min recovery time with 75 %)
- ▶ 15-s cycle (3 s overload with 200 % and 12 s recovery time with 75 %)

For detailed information on the overload capacity, please see the Technical data.

7.5.2 Power distribution of controllers

In a DC-bus operation, the power from the AC mains is stored in the DC bus and consumed by several controllers. Drive groups with non-synchronous power consumption, partial load or excess energy from braking operations are suitable for establishing a DC-bus connection.



L1, L2, L3	Mains connection (3/PE AC)
P_{Lr}	Input mains power
P_{DC1}	Total DC-bus power
P_{DC2}	DC-bus power available for the DC bus
P_{loss}	Power loss
P_{ar}	Output power
U, V, W	Motor connection

7.5.3 Motor efficiency

For determining the power requirements, you have to consider the shaft power P_{shaft} and the motor efficiency. The motor efficiency can be found under the motor data.

7.5.4 Power loss of devices

When determining the power requirements, the power loss of the devices must be considered (📖 Tab. 7-5).

7.5.5 Determining the power requirements

For determining the power requirements of the drive system you need to know the rated power of the motors and their efficiency as well as the power losses of the controllers. The power requirements are calculated with the following formula:

$$P_{DCtotal} = \sum_{i=1}^n \left\{ \frac{(P_{\text{shaft}})_i}{\eta_i} + (P_{\text{loss}})_i \right\}$$

$P_{DCtotal}$	Total power required by the drive system
P_{shaft}	Rated power of a connected motor
P_{loss}	Power loss of a controller
η	Motor efficiency
i	Index variable for device identification
n	Number of devices in the drive system

The supplying device must be able to provide the required power that is calculated.

7.5.6 Determining the regenerative power requirements

With the regenerative power supply modules of the "Servo Drives 9400" series, power regeneration into the AC mains is possible. Use the determined regenerative power for the dimensioning of the regenerative power supply module.

7.5.7 Cable protection

In case of interferences, the cables have to be adequately protected.

Please consider the following when dimensioning the DC bus for a plant or machine:

- ▶ Mains fuses can be used to protect the DC cables if the wiring is designed for 122 % of the rated fuse current. Otherwise, the cable protection for the DC cables must be specially determined.
- ▶ Select the fuses for the currents resulting from power $P_{DC100\%}$. Please observe the standards and regulations applicable for the particular location and application.
- ▶ Fuse the DC-supply modules according to the Technical data on the AC mains side.
- ▶ If the DC bus is wired via the terminals +UG/-UG, always select a 2-pole cable protection.

7.6 Braking operation in a drive system

7.6.1 Basic considerations

If the regenerative power of a drive exceeds the storage capacity of the DC bus, the excessive energy must be consumed or dissipated. Target of the DC bus is to use the excessive energy for other axes.

Check for all operating situations that may occur in the DC-bus interconnection whether the brake power provided by the brake choppers is high enough for the maximum regenerative power that may occur. If necessary, several power supply modules with an integrated brake chopper can be integrated into the drive system to increase the brake power (parallel connection).

If several brake choppers are used, the following conditions must be met:

- ▶ The limiting monitoring functionalities must be considered when dimensioning the continuous brake power for the DC bus:
 - Brake chopper monitoring
 - Brake resistor monitoring
- ▶ The temperature monitoring of the brake resistors must lead to power-off, otherwise the brake resistors or devices may be destroyed.
- ▶ The brake choppers are protected by changing the duty cycle or switching them off temporarily. They are automatically switched on again.
- ▶ One device must be defined as "master", and the other devices must be defined as "slaves", in order to provide for the simultaneous switching of all brake choppers, irrespective of tolerances. How to proceed:
 - For "Slave activation", apply digital input DI3 of each slave to GND potential (GD/0 V). By this, the device-internal brake chopper switching threshold of the slave is set to a value above the tolerance zone (790 V).
 - For control by the master, interconnect digital output DO1 of the master with DI1 of the slaves. Like this, the slaves will chop on request by the master, isochronously with the master (at 765 V).

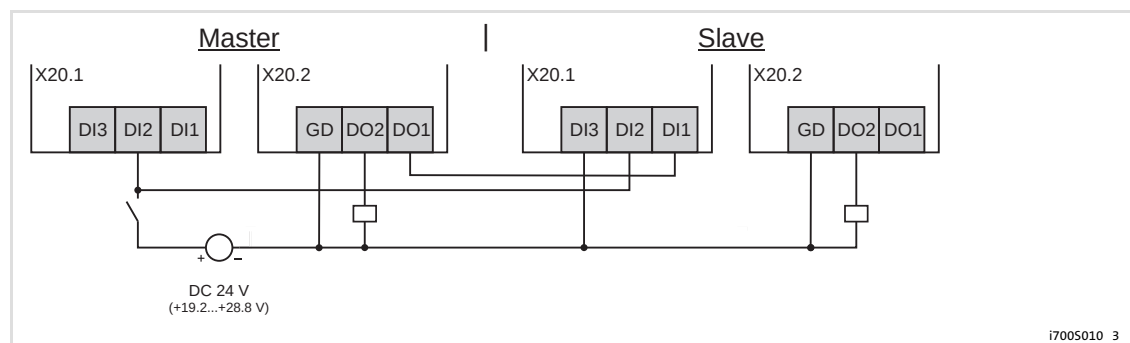


Fig. 13 Wiring of X20

X20	Connection of digital inputs and outputs at the power supply module
.1	Connector on the left-hand side
.2	Connector on the right-hand side
DIx	Digital input
DOx	Digital output (e.g. for controlling relays)
GD	Reference potential GND

7.7 EMC in DC-bus operation**7.7.1 Compliance with EMC category C3 (industrial premises)**

Applications for the "second environment" on industrial premises must comply with EMC category C3.

Observe the conditions for the compliance with EMC category C3:

- ▶ The permissible motor cable length is ≤ 50 m for each axis.
- ▶ The maximum sum of all motor cable lengths (Σl_{mot}) must be observed.
- ▶ Without a mains choke: 4 axes x 50 m = 200 m
 - Switching frequency: 4 & 8 kHz
- ▶ With the mains chokes assigned: 10 axes x 50 m = 500 m

If the number of axes deviates, Σl_{mot} can be determined from the following diagram.

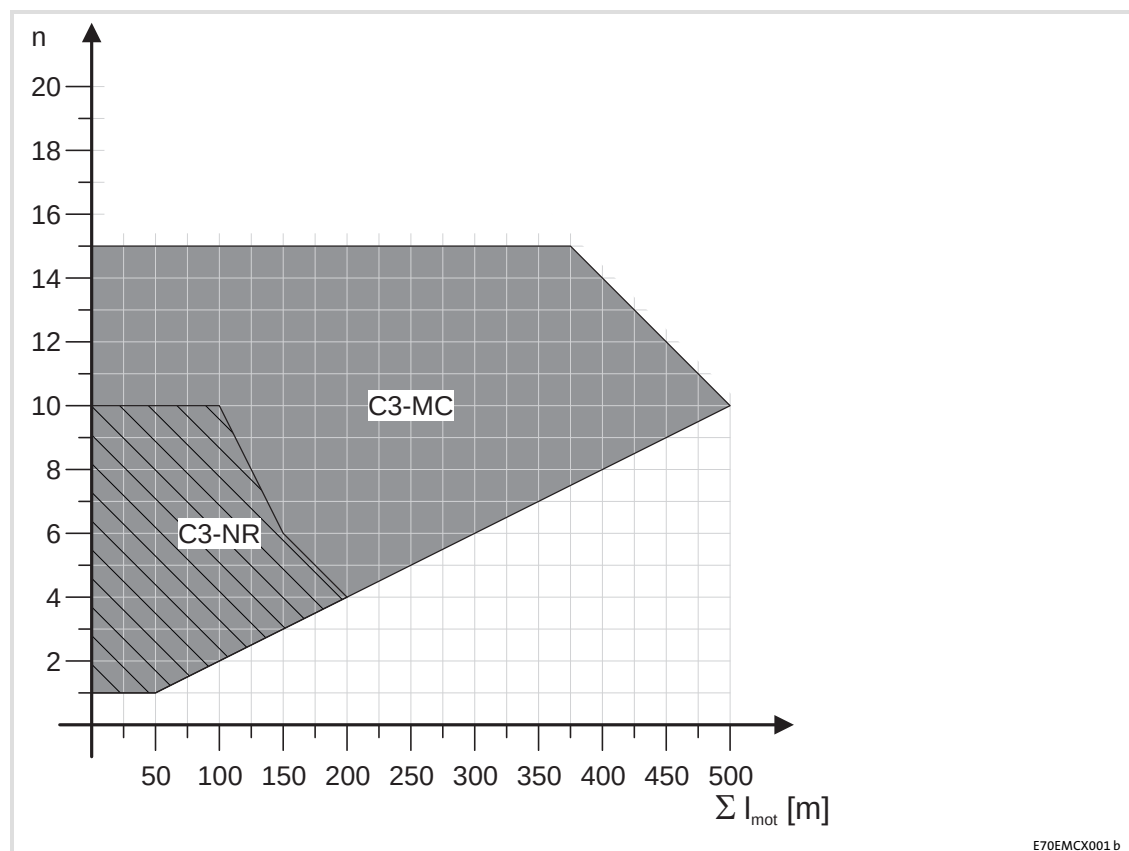


Fig. 7-2 Motor cable lengths for the compliance with category C3

n	Number of axes
Σl_{mot}	Sum of the motor cable lengths ...
C3-NR	without mains chokes, according to the number of axes, for switching frequency 4 & 8 kHz
C3-MC	with mains chokes, according to the number of axes

7.7.2 Compliance with EMC category C2 (residential areas)

Applications for the "first environment" in residential areas must comply with EMC category C2.

Observe the conditions for the compliance with EMC category C2:

- ▶ The permissible motor cable length is ≤ 50 m for each axis.
- ▶ The maximum sum of all motor cable lengths (Σl_{mot}) must be observed.
- ▶ Filters to be used:
 - RFI filter E94AZRP...: 6 axes x 50 m = 300 m
 - Mains filter E94AZMP...: 10 axes x 50 m = 500 m

If the number of axes deviates, Σl_{mot} can be determined from the following diagram.

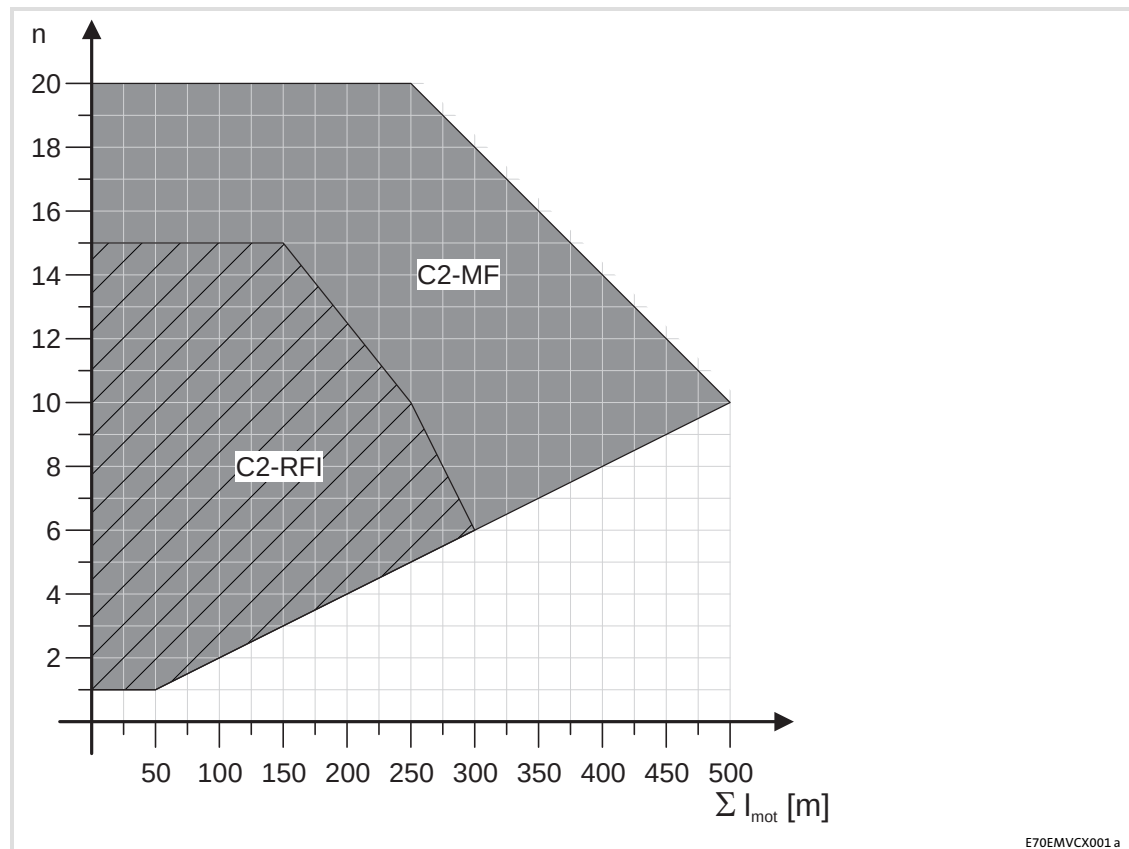


Fig. 7-3 Motor cable lengths for the compliance with category C2

n	Number of axes
Σl_{mot}	Sum of the motor cable lengths ...
C2-RFI	for E94AZRP... RFI filters, according to the number of axes
C2-MF	for E94AZMP... mains filters, according to the number of axes

7.7.3**Assignment of filters**

In order to comply with the EMC category C2, use filters adapted to the DC power supply modules. Install the filters E94AZ... with the outgoing cable to the top in order that this cable can be directly connected to the mains connection of the power supply module.

RFI filter	DC power supply module
E94AZRP0294	E70ACPSx0304x
E94AZRP0824	E70ACPSx0604x

The RFI filters are designed for the following conditions:

- ▶ 6 interconnected devices,
- ▶ each with a 50 m motor cable,

Mains filters	DC power supply module
E94AZMP0294	E70ACPSx0304x
E94AZMP0824	E70ACPSx0604x

The mains filters are designed for the following conditions:

- ▶ 10 interconnected devices,
- ▶ each with a 50 m motor cable,

In applications with a different number of interconnected devices or different motor cable lengths, the filters may have to be specially dimensioned.

**Note!**

To observe EMC category C2, measures must be carried out on the device-internal EMC filters of the drive components in the network system. The measures for the individual devices are described in the chapter "Wiring", section "Earthing of internal EMC filters".

Constellations with unfavourable or intensifying parasitic couplings

Compliance with EMC category C2 may also be interfered with by other circumstances:

- ▶ Distribution of the axis modules over several control cabinets without efficient HF equipotential bonding between the mounting plates
- ▶ No use of Lenze system cables or cables with the same specifications
- ▶ Poor connection of motor cable shields
- ▶ Motor cable interruptions
- ▶ Other interference sources (e.g. switched-mode power supplies)
- ▶ Isochronous switching of the inverter output stages

8 Commissioning



Note!

- ▶ Please observe the general safety instructions (📖 13).
- ▶ Please observe the notes regarding residual hazards (📖 20).

8.1 Before switching on

Prevent injury to persons and damage to property by checking the following before switching on the mains voltage.

Check

- ▶ the wiring for completeness.
- ▶ for the absence of short circuits and/or earth faults.
- ▶ for the correct covering of the DC-bus wiring.
- ▶ the "EMERGENCY OFF" function of the entire system.
- ▶ the motor circuit configuration (star/delta). It must be adapted to the output voltage of the controller.
- ▶ the in-phase connection of the motor (direction of rotation).
- ▶ whether the drive mechanically can be disconnected from the machine for commissioning.



Danger!

High hazard potential during commissioning

Incorrect settings can cause unexpected and dangerous movements of the motor and the equipment.

Possible consequences:

- ▶ Damage to material assets
- ▶ Injury to persons

Protective measures:

- ▶ Clear hazard area
- ▶ Observe safety instructions and safety distances

8.2 Quick commissioning

Quick commissioning is described in

- ▶ the "Controller-based automation, EtherCAT" communication manual,
– the chapter "Commissioning of i700 servo inverter".

9 **Diagnostics**

9.1 **Display of operating data, diagnostics**

9.1.1 **Supply modules**

The passive power supply modules can only be diagnosed via the terminal outputs on the device.

X20			
Signal	Name	Status	Description
DO1	Brake chopper status	LOW	Brake chopper not active or 24-V supply voltage off
		HIGH	Brake chopper active
DO2	Status message	LOW	• 24-V supply voltage is off • Fault: Heatsink overtemperature – no acknowledgement required • Fault: Brake IGBT overcurrent/short circuit – acknowledgement required:
		HIGH	24-V supply voltage ok, module ready for operation

Acknowledgement of the status messages of the power supply modules by means of:

- ▶ Applying of 24 V (HIGH) at input DI2.
- ▶ Short-time switch-off of the 24-V supply voltage
 - If the voltage supply cannot be switched off, terminal X21 can be unplugged instead.

If the status cannot be acknowledged, the "overtemperature" or "overcurrent/short circuit" fault persists.

9.1.2 **Axis modules**

To diagnose the axis modules, errors and warnings are mapped in "error codes" according to the CiA 301/402 standard. Additionally, a history is available enabling a central logbook to be set up in the control system. More detailed information can be found in the software manual or in the online help.

9.2 LED status displays

9.2.1 Supply modules

LED display of power supply module - V100			
Colour	Name	Status	Description
blue	RDY	off	24-V supply voltage off or ≤ 18 V
		is ON	24-V supply voltage ok, module ready for operation
red	ERR	off	Power supply module ready for operation
		is ON	Error/fault

9.2.2 Axis modules

LED display of axis module - V101			
Colour	Name	Status	Description
blue	RDY	off	24-V supply voltage off or ≤ 18 V
		is ON	24-V supply voltage ok, module ready for operation
		blinking	Axis module inhibited
		fast blinking	Optical device identification (simultaneously with red/ERR)
red	ERR	off	Axis module ready for operation - no error - axis A (and B)
		is ON	Error/fault - device
			Error/fault - axis A (or B)
		fast blinking	Optical device identification (simultaneously with blue/RDY)



i700AX045 b

LED display of axis module - X4/X5 EtherCAT IN/OUT		
Name	Status	Description
RUN	is ON	"Operational" status is active.
	flickering	"Bootstrap" status is active.
	blinking	"Pre-operational" status is active.
	blinking once (single flash)	"Safe-operational" status is active.
	off	Fieldbus communication is not active or is in the "Init" state.
L/A	is ON	Physical EtherCAT connection is available.
	flickering	Data are exchanged via EtherCAT.
	off	Physical EtherCAT-CAT connection is not available
①	-	This LED is used for internal diagnostic purposes.

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.

Integrated safety engineering**E70ACMxxxxx4xAxETx - Basic Safety - STO**

i700 controllers are available with drive-based safety.

The integrated safety system can be used for the protection of persons working on machines in accordance with the Machinery Directive.

The motion functions continue to be executed by the controller. The integrated safety system monitors the safe compliance with the limit values and provides the safe inputs. If monitored limit values are exceeded, the integrated safety system starts control functions directly in the controller according to EN 60204-1 to counteract possible errors.

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.

10.2 Important notes

Application as directed

The controllers that are equipped with safety engineering must not be modified by the user. This concerns the unauthorised exchange or removal of the safety engineering.



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 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008] 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 must be observed and complied with. When the mission time of a component has expired, the component must be taken out of service and replaced. Continued operation is not permitted!

The specified mission time starts at the date of manufacture. The date of manufacture is permanently stored in the component and can be read out via an object.

For the STO safety function of the i700 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 Certification

The certification of the safety system integrated in the controllers of the i700 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:
<https://www.Lenze.com> and on the product CD.

10.5 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

10.6 Basic Safety - STO

E70ACMxxxxx4xAxETx - Basic Safety - STO

10.6.1 Mode of operation

With the integrated safety system, product key: A, 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).

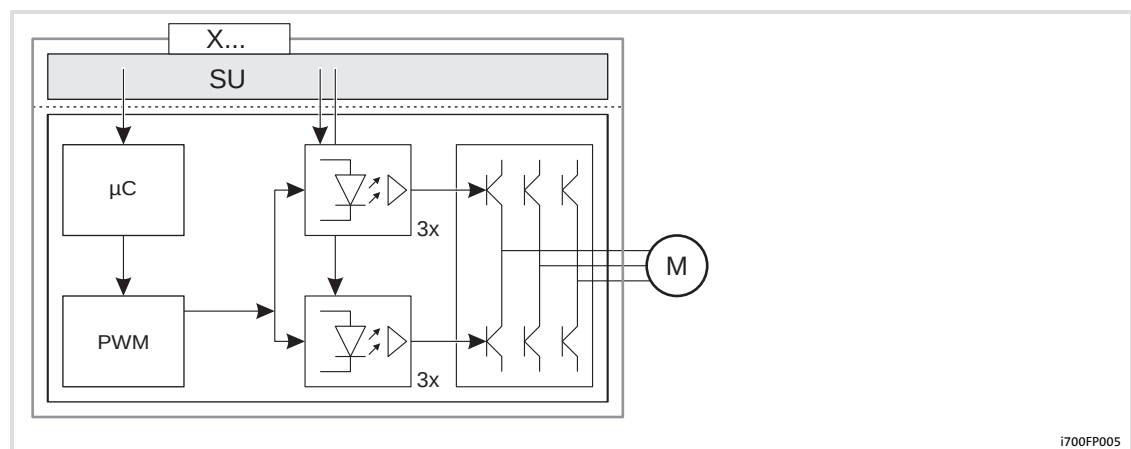


Fig. 10-1 Operating principle of safety unit

SU	Safety unit
X...	Control terminals of the safety unit
μC	Microcontroller
PWM	Pulse Width Modulation
M	Motor

Safety status

If the controller is switched off by the safety system, the "STO is not active" status in the status word changes from 1: HIGH to 0: LOW (object 0x6041/0x6841, bit 15).

10.6.2 Technical data

Supply

The inputs 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 ≤ 1 ms are permissible.

Active sensors are directly wired to the X1 terminal strip.

Passive sensors are wired to the X1 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.

Terminal X1	Specification	[Unit]	min.	typ.	max.
	The input channels comply with the IEC 61131-2 standard, type 1.				
SIA, SIB	Low signal	V	-3	0	5
	High signal	V	15	24	30
	Input capacitance at switch-off	nF		3	
	Input delay (tolerated test pulse)	ms			1
	Switch-off time	ms		5	
	Running time	ms		1	
	Input current	mA	2		15
	Input capacitance at switch-on	nF		100	
	Test pulses permissible at intervals of	ms	10		
	Polarity reversal protection	When polarity is reversed: no function and no destruction.			
GS	Ground for SIA/SIB				

Truth table

Safe input / channel		Controller	
SIA	SIB	Description of device status	Enable
0	0	"Safe torque off" activated	0
0	1		0
1	0		0
1	1	Drive active	1

Safety-related parameters acc.to IEC 61508-1 to -7 and IEC 62061

Specification	Value	Comment
Safety Integrity Level	SIL 3	
PFH [1/h]	7.79 E-10	0.78 % of SIL 3
PFD	6.82 E-5	6.8 % of SIL 3 after T = 20 years
Proof test interval	20 years	Mission time

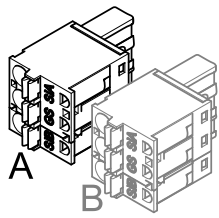
Safety-related parameters acc. to EN ISO 13849-1

Specification	Value	Comment
Performance Level	e	
Category	4	
MTTF _d	high	71285 years
Diagnostic coverage DC	high	99 %

Note on safety-related parameters

Source of failure rates	SN 29500	As far as values from the component manufacturers were not available
Average max. ambient temperature	40 °C	
General assumption that 50 % of the failures of a component are hazardous failures	$\lambda_d = 0.5 \lambda$, MTTF _d = 2 MTTF	As far as other information was not available

10.6.3 Electrical installation

X1	Labelling	Description	
	SIA	Safe input, channel A	On double axis devices, there are two of these connections. For the assignment to the axes, the designations "A" / "B" are used. Independently of this, the two-channel safe input is always provided with the channels A and B.
	GS	Reference potential GND	
	SIB	Safe input, channel B	

Terminal data					
	Conductor cross-section		Tightening torque		
	[mm²]	[AWG]	[Nm]	[lb-in]	
flexible	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6
Rigid	0.2 ... 2.5	24 ... 12	-	-	3.5 x 0.6

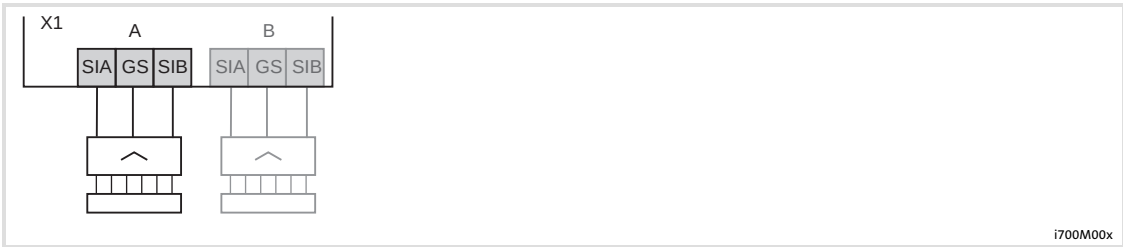


Fig. 14 Wiring of X1

X1	Connection of integrated safety system
A	1-axis module
B	Additionally for 2-axis module
SIA	Safety system input, channel A
SIB	Safety system input, channel B
GS	Reference potential GND



Note!

To avoid interchanging of the plug-in terminals - especially in the case of double axis devices -, the plug-in terminals can be provided with coding pins. Alternatively, we recommend to label the terminals clearly in order to enable the correct assignment of plugs and sockets.



Note!

If integrated safety is not to be used for an axis, the safe inputs SIA and SIB of the axis must be fixedly assigned with "HIGH" potential (24 V). The wiring should not give the impression of connected safety sensors, or should be provided with adequate labelling.

11 Accessories (overview)



Note!

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

11.1 Overview

Coordinated accessories for i700:

- ▶ Mains chokes
- ▶ RFI filters and mains filters
- ▶ Brake resistors
- ▶ 24-V power supply units
- ▶ Terminals for plug-in connections
- ▶ DC terminal
- ▶ Mounting frame for push-through technique
- ▶ EMC shield mounting kits

11.2

Mains chokes

Mains chokes:

Inductances for damping conducted harmonic interferences which may arise from reloading the DC bus and the switching frequency of the inverter.

Assignment of mains chokes

Mains choke	Power supply module
EZAELN3025B122	E70ACPSx0304x
EZAELN3050B591	E70ACPSx0604x

Technical data

	I_N [A]	L [mH]	P_V [W]
EZAELN3025B122	25	1.18	72.0
EZAELN3050B591	50	0.59	144

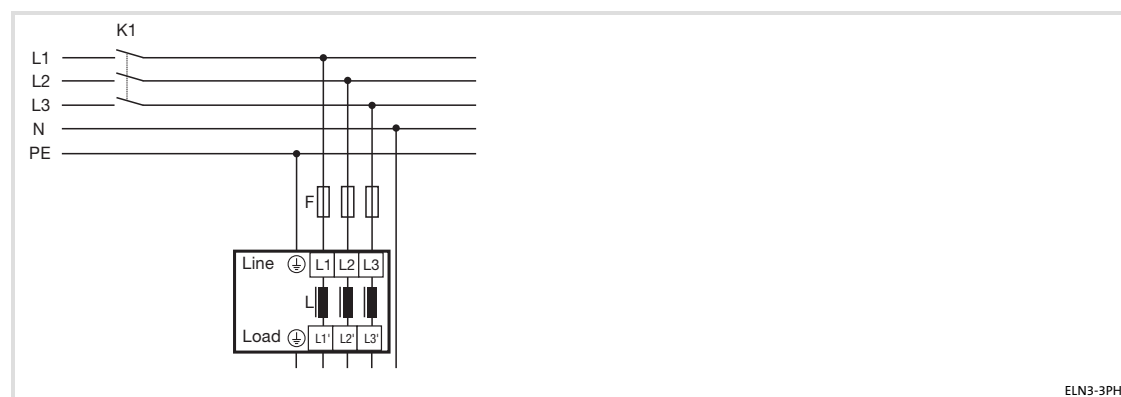


Fig. 11-1 Basic circuit diagram

Consider the following criteria when using mains chokes:

- Mains chokes are always required if all interconnected devices are operated with rated current and speed.
- Mains chokes are not required if the power of the entire network is less than 50 % of the added continuous powers of all interconnected devices (= standard case).
 $\Sigma P_a \leq 0.5 \times \Sigma P_{ar}$

ΣP_a	Sum of the average output power of the axes in the network Medium mains power, depending on the "in motor mode/in generator mode" operating status, motor current, motor speed and device losses
ΣP_{ar}	Sum of the rated power of the axes in the network
- The use of mains chokes for complying with the EMC category C3 has to be assessed separately (124).

Notwithstanding the above, consider the advantages when using mains chokes:

- ▶ Increase of the available mains power by approx. 50 %
- ▶ Reduction of the transient mains current at short-term power-off
- ▶ Reduction of the mains current to approx. 2/3 of the value without mains choke
This increases the service life of the DC bus capacitor considerably. Regarding the service life, the i700 devices are dimensioned for 40.000 h.

11.3 RFI filter/mains filter

Advantages by the use of filters:

- ▶ Compliance with EMC requirements
- ▶ Reduction of the current load
- ▶ Positive effects on the service life of the controllers possible
 - Strong reliability
 - Reduction of the failure rate
- ▶ Operation on 300 mA earth-leakage circuit breakers (type B) for device sizes 1 ... 3 (bis 24 A/11 kW) is enabled. For this purpose, observe the device number and motor cable lengths according to "Compliance with the EMC category C2 (residential areas)" (125)

Mains filters:

Mains filters reduce the conducted interference emission into the mains for compliance with the requirements acc. to EN 61800-3. Mains filters are a combination of mains choke and RFI filter in one housing.

	Voltage [V]	Freq. [Hz]	Current [A] ① max. +45° C	Current [A] ① max. +55° C	Number of phases
E94AZMP0084	400/480	50/60	8/8	6/6	3
E94AZMP0294	400/480	50/60	29/29	21.8/21.8	3
E94AZMP0494	400/480	50/60	49/49	36.8/36.8	3
E94AZMP0824	400/480	50/60	82/82	61/61	3
E94AZMP2004	400/480	50/60	200/200	150/150	3

① Temperature in the control cabinet

RFI filters:

RFI filters are capacitive accessories for compliance with the requirements acc. to EN 61800-3 for conducted interference emission. RFI filters can be directly connected upstream of the power supply modules. RFI filters are also called EMC filters.

	Voltage [V]	Freq. [Hz]	Current [A] ① max. +45° C	Current [A] ① max. +55° C	Number of phases
E94AZRP0084	400/480	50/60	8/8	6/6	3
E94AZRP0294	400/480	50/60	29/29	21.8/21.8	3
E94AZRP0824	400/480	50/60	82/82	61/61	3
E94AZRP2004	400/480	50/60	200/200	150/150	3

① Temperature in the control cabinet

11.4 External brake resistors

Power supply module	Brake resistor	Resistance R [Ω]	Continuous power P [W]	Quantity of heat QB [kW _s]
E70ACPSx0304x	ERBP027R200W	27	200	30
	ERBS027R600W	27	600	90
	ERBS027R01K2	27	1200	180
E70ACPSx0604x	2 ERBP018R300W	9	600	60
	ERBP018R300W	18	300	30
	ERBG012R01K9	12	1900	285
	ERBG012R05K2	12	5200	780

11.5 Power supply units

External power supply units are available for supplying the control electronic with an 24-V supply.

Type	Mains		Secondary	
	V _{LN} [V]	I _{LN} [A]	V _{DC} [V]	I _{DC} [A]
EZV1200-000	230 (1/N/PE AC)	0.8	24 (22.5 ... 28.5)	5
EZV2400-000		1.2		10
EZV4800-000		2.3		20
EZV1200-001	400 (3/PE AC)	0.3		5
EZV2400-001		0.6		10
EZV4800-001		1.0		20

EZVxxx-001, alternative V_{LN}: 450 ... 800 V, 2/PE DC, Ⓢ EDKZV1200

11.6 Terminals

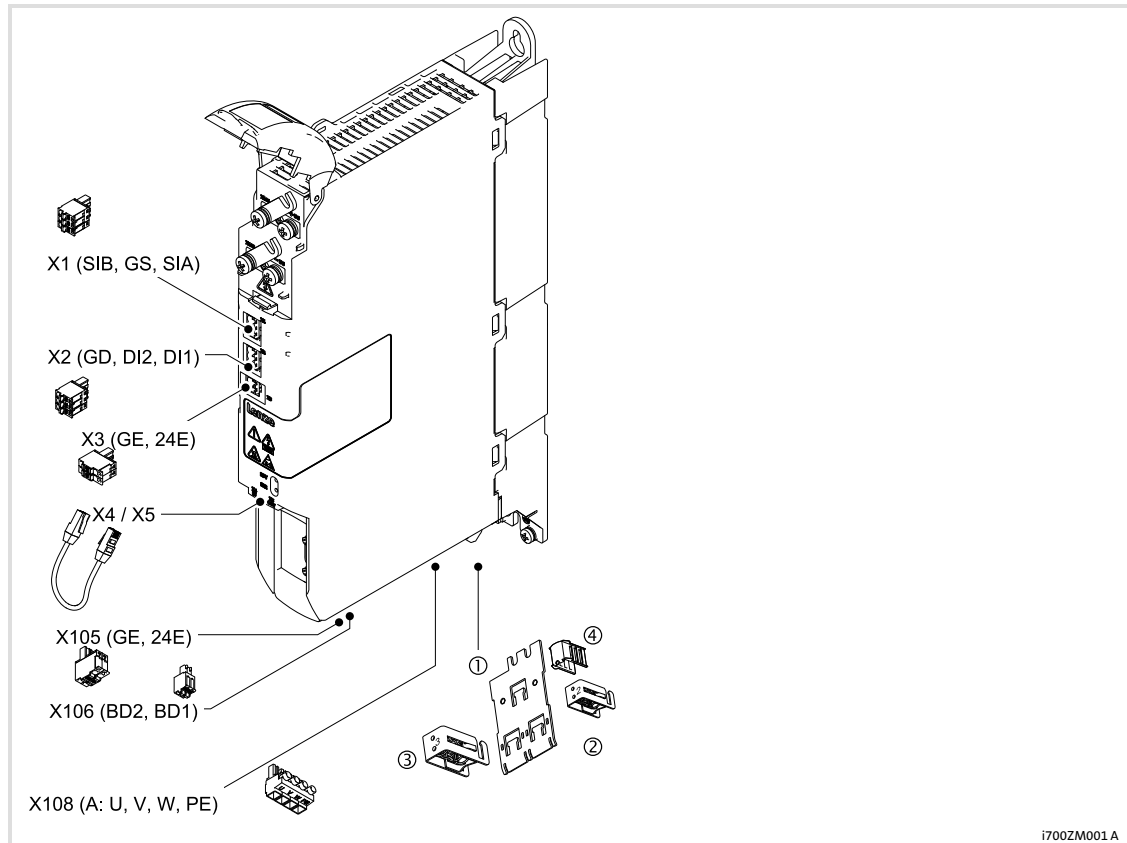
To the devices of the i700 servo inverter product series, coordinated terminal accessory kits are assigned. These kits must be ordered separately.

	Accessory kits	
E70ACMxx0054xA1xxx	E70AZEVK001	
E70ACMxx0104xA1xxx		
E70ACMxx0204xA1xxx		
E70ACMxx0324xA1xxx	E70AZEVK003	
E70ACMxx0484xA1xxx		
E70ACMxx0644xA1xxx		
E70ACMxx0054xA2xxx	E70AZEVK002	
E70ACMxx0104xA2xxx		
E70ACMxx0204xA2xxx	E70AZEVK004	
E70ACMxx0324xA2xxx		
E70ACPSx0304x	E70AZEVK005	E70AZEVK007 (for parallel connection)
E70ACPSx0604x	E70AZEVK006	

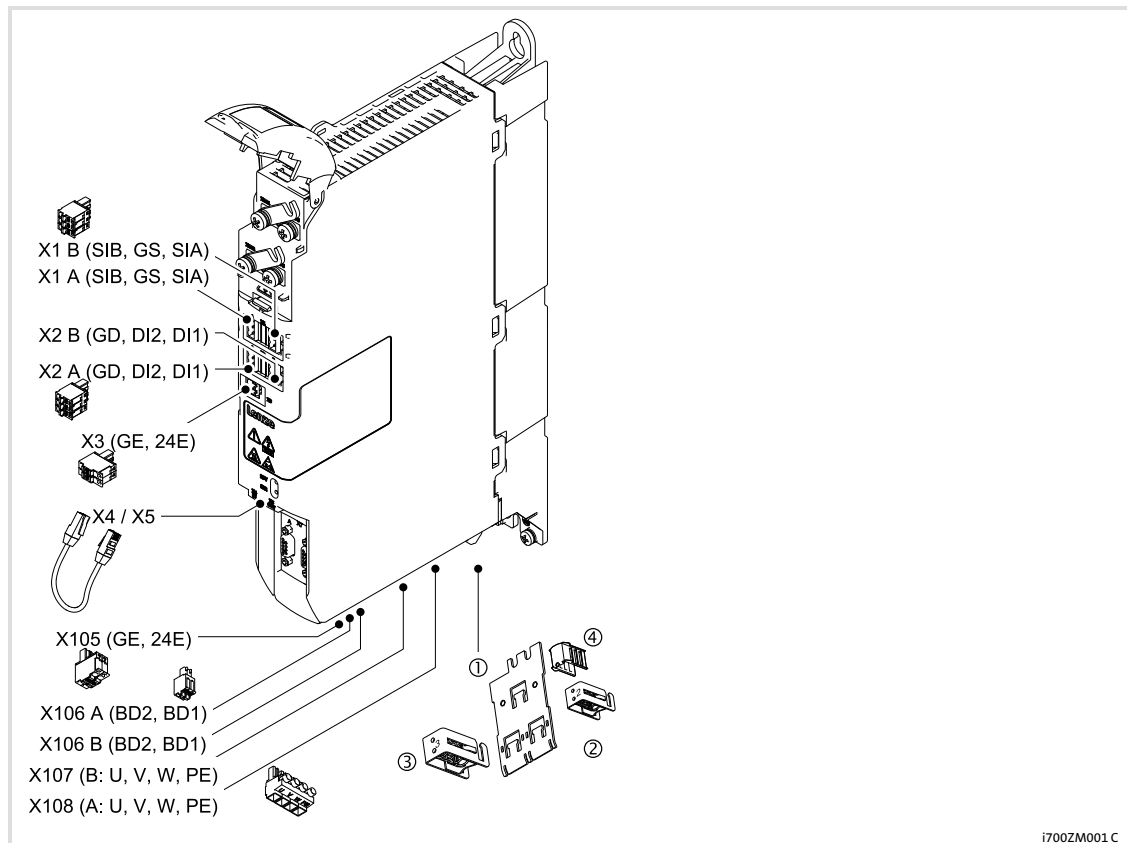
i		Kit E70AZEVK...			
		...001	...002	...003	...004
X1	SIB, GS, SIA	1 (A)	2 (A, B)	1 (A)	2 (A, B)
X2	GD, DI2, DI1	1 (A)	2 (A, B)	1 (A)	2 (A, B)
X3	GE, 24E	1	1	1	1
X4/X5	EtherCAT	1	1	1	1
X105	GE, 24E	1	1	1	1
X106	BD2, BD1	1 (A)	2 (A, B)	1 (A)	2 (A, B)
X108	U, V, W, PE	1 (A), 4 mm ²	1 (A), 4 mm ²	1 (A), 16 mm ²	1 (A), 4 mm ²
X107	U, V, W, PE	-	1 (B), 4 mm ²	-	1 (B), 4 mm ²
①	⚡	1 (↔ 50)	1 (↔ 50)	1 (↔ 100)	1 (↔ 100)
②	2	1	2		
③	3	-	-	1	2
④	-	1	1	1	1

i		Kit E70AZEVK...		
		...005	...006	...007
X100	L3, L2, L1, PE	1	1	-
X20 A	DI3, DI2, DI1	1 (A)	1 (A)	-
X20 B	GD, DO2, DO1	1 (B)	1 (B)	-
X21	GE, 24E	1	1	-
X103	PE, Rb2, Rb1	1	1	-
X101, X102	+UG, -UG	-	-	2
PE	⊕	-	-	1
①	↔	1 (↔ 50)	1 (↔ 100)	-
②	2	1	-	-
③	3	-	1	-
④	-	1	1	-

E70AZEVK001

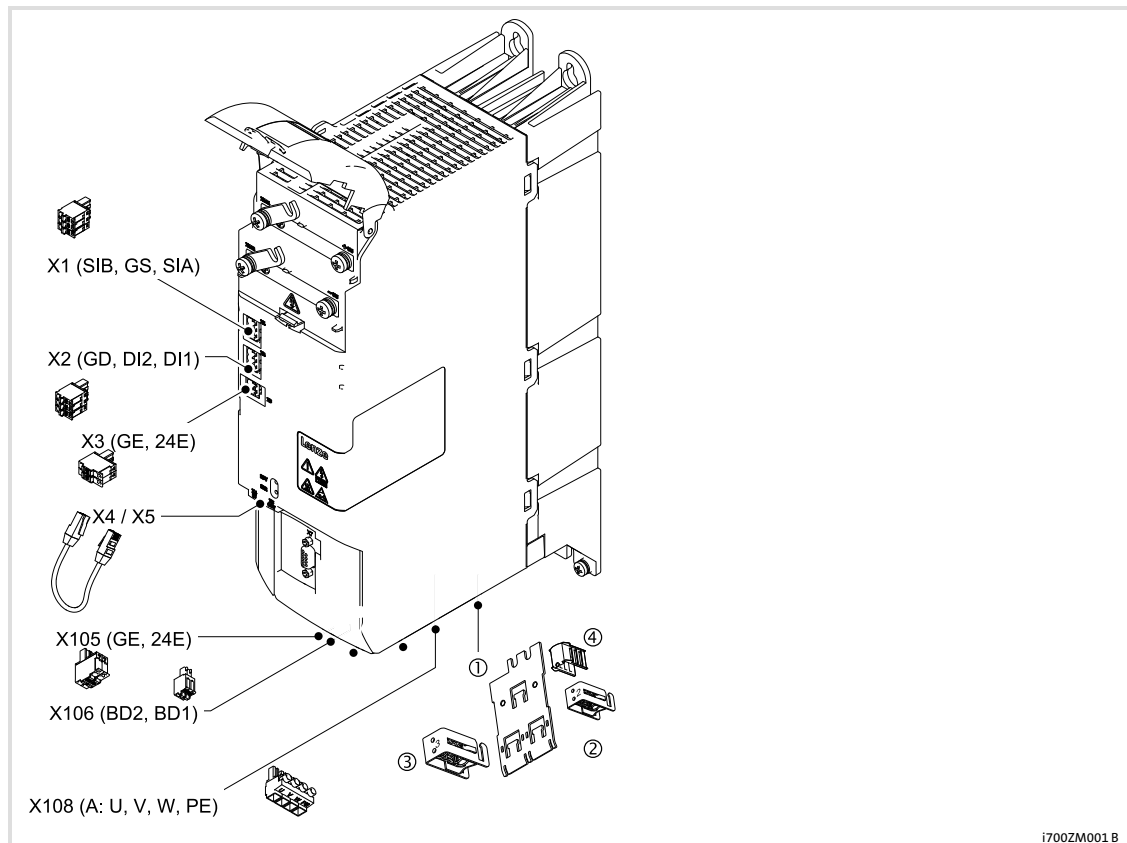


E70AZEVK002

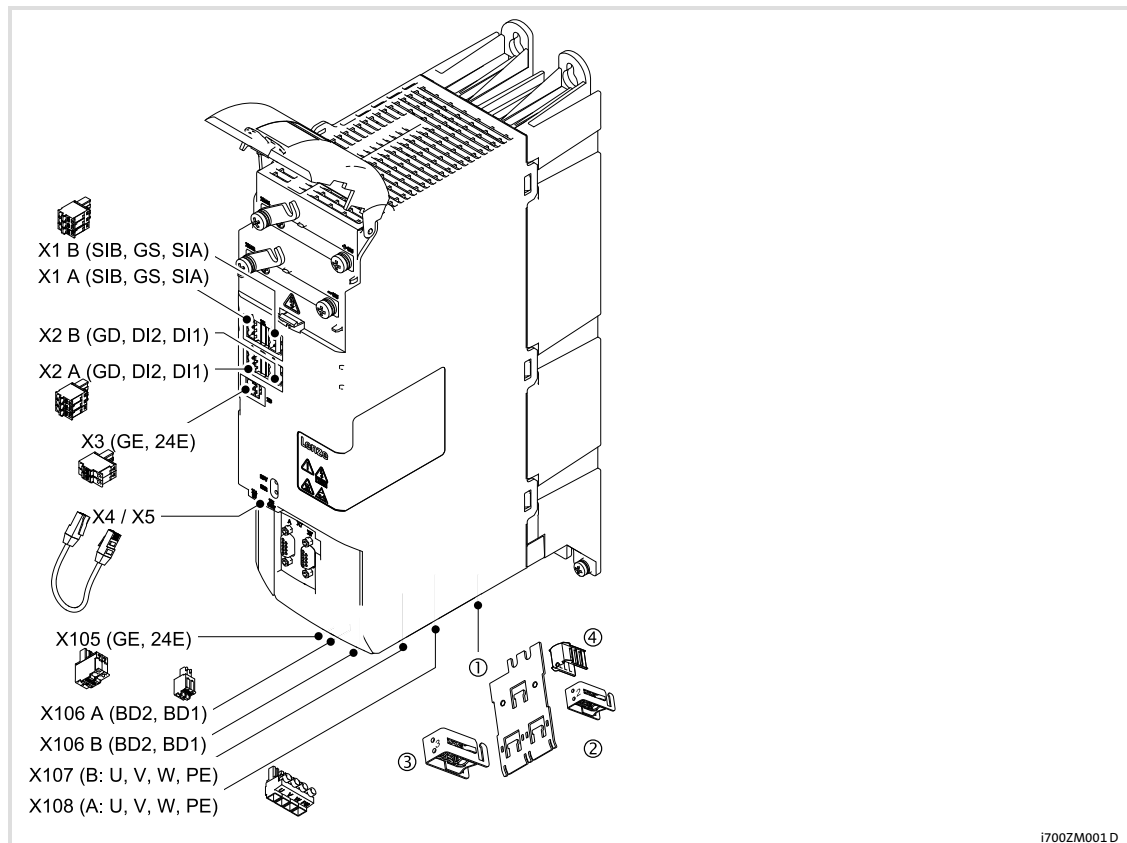


i7002M001.C

E70AZEVK003

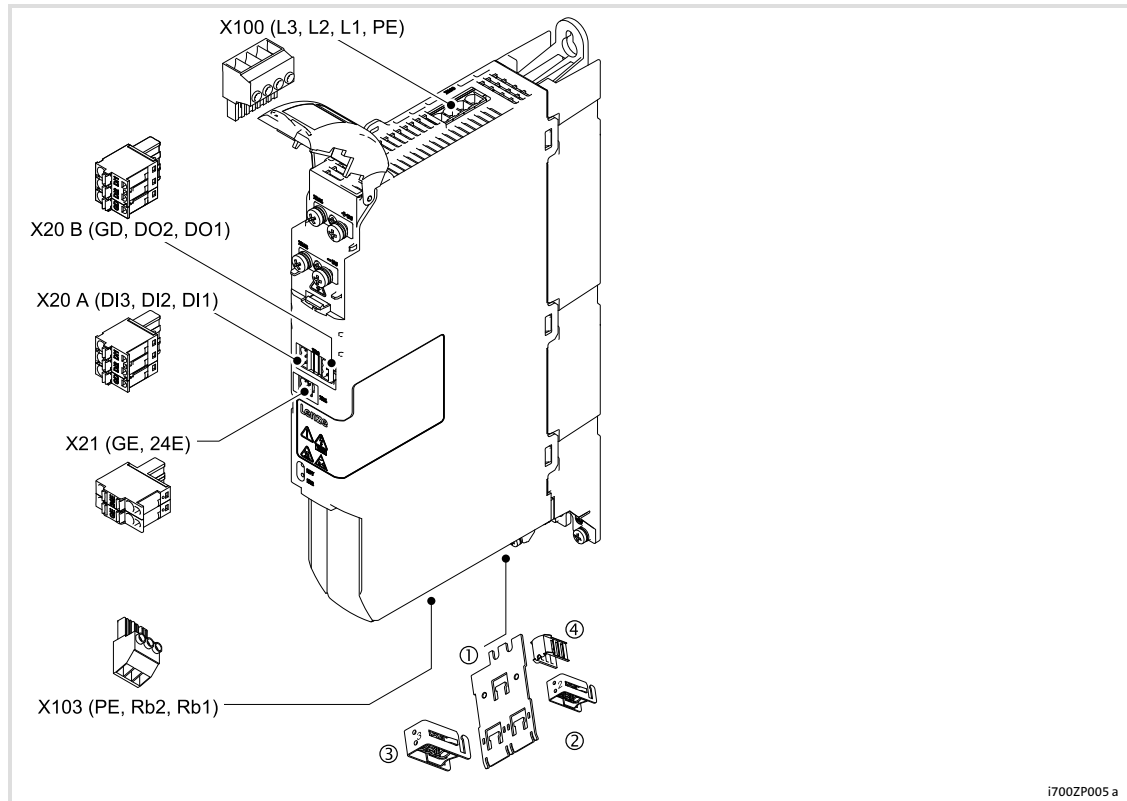


E70AZEVK004

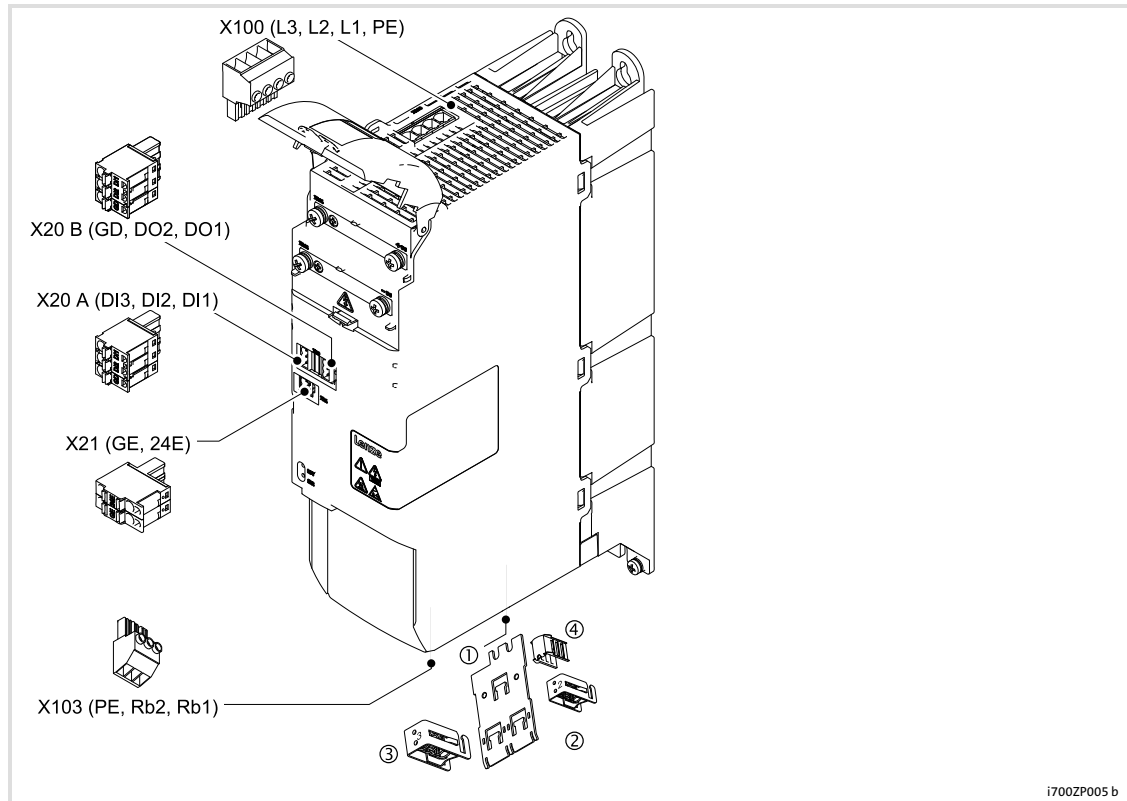


i7002M001.D

E70AZEVK005

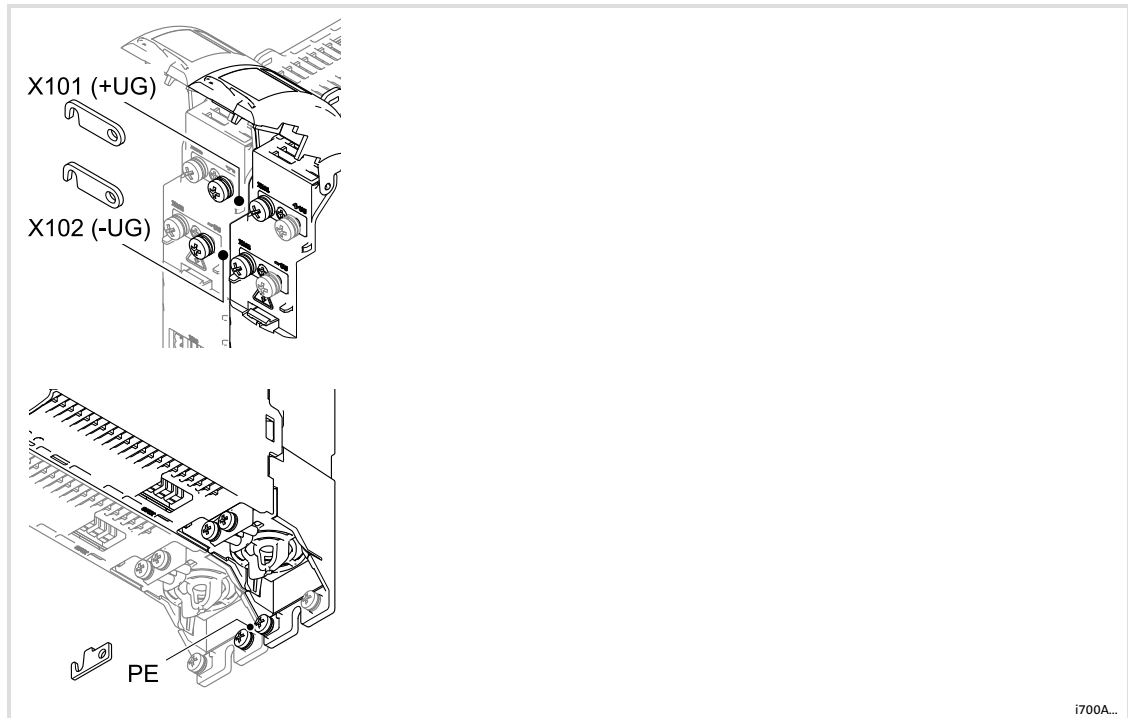


E70AZEVK006



E70AZEVK007

In order to wire the +UG and -UG connections, the "Power Supply Kit UG/PE", designation E70AZEVK007, is required. In addition to the connectors for UG, it also contains a connector for an optimum PE connection.



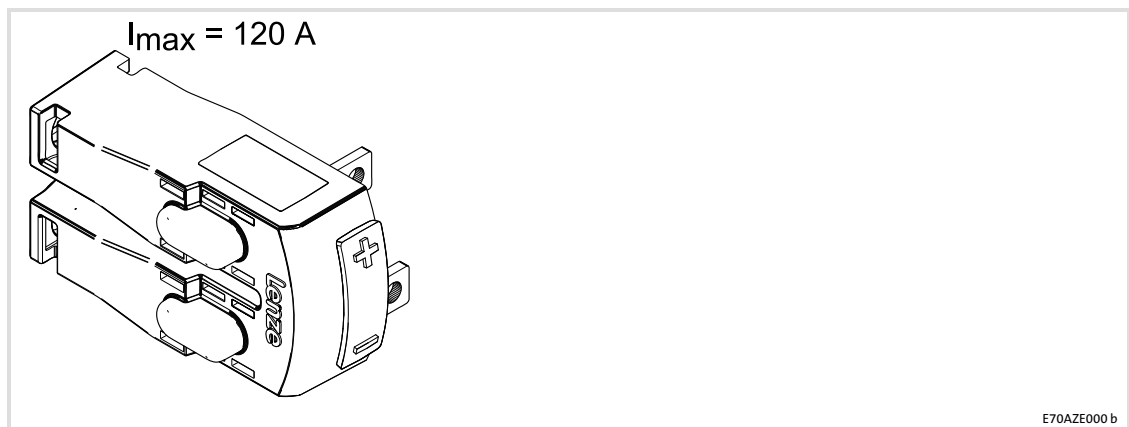
i700A...

11.7**Components for operation in the DC-bus connection**

The E70AZEVE001 DC terminal is adapted to the i700 series.

By means of the DC terminal, a connection to the busbar system of the DC bus can be established using a cable.

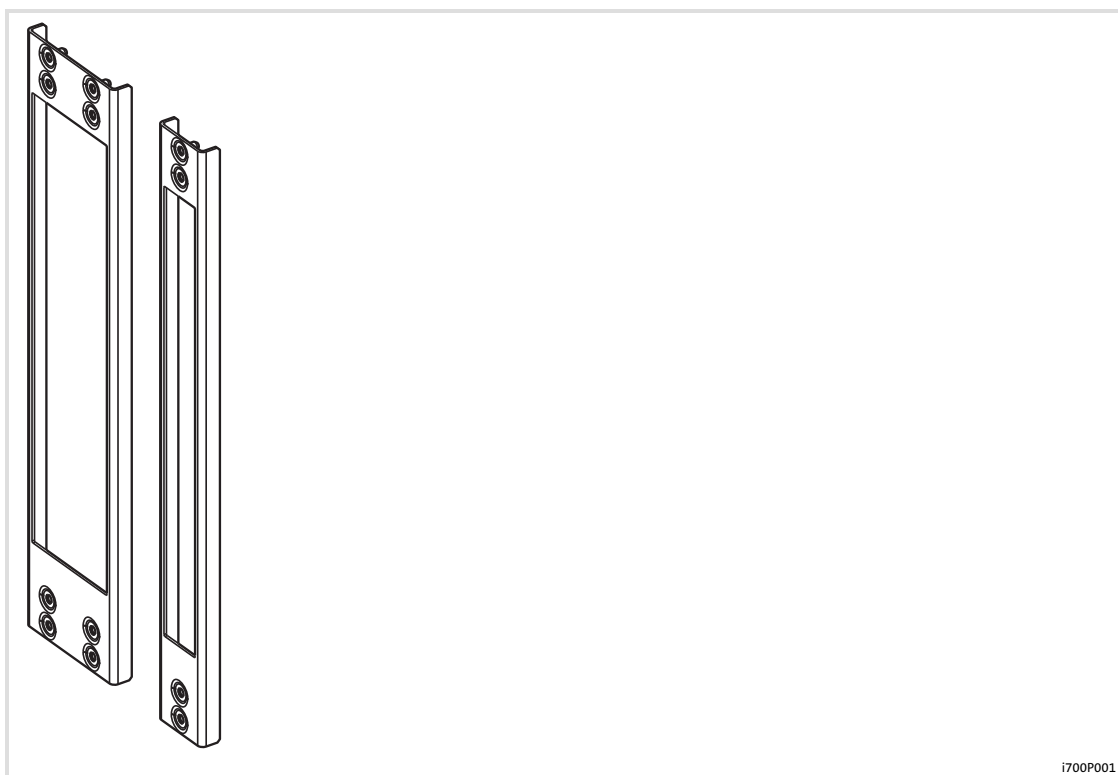
- ▶ Distribution of the installation to several rows, groups, or control cabinets.
- ▶ Energy exchange, e.g. with external DC-energy storage mechanisms.
- ▶ Provides for cable cross-sections $\leq 35 \text{ mm}^2$ or $2 \times \leq 25 \text{ mm}^2$.
- ▶ Ensures protection against contact.
- ▶ Mounting can be carried out on the left or right.



11.8 Installation material for the push-through technique

The E70AZMBHM00x mounting frames make it easier to stabilise and seal the cutouts when the push-through technique is applied.

- ▶ Threads for frames and devices are integrated.
- ▶ The frames can be mounted beforehand without the devices.
- ▶ E70AZMBHM001 for a width of 50 mm, VPE: 5 items
- ▶ E70AZMBHM002 for a width of 100 mm, VPE: 5 items



i700P001

11

Accessories (overview)

EMC accessories

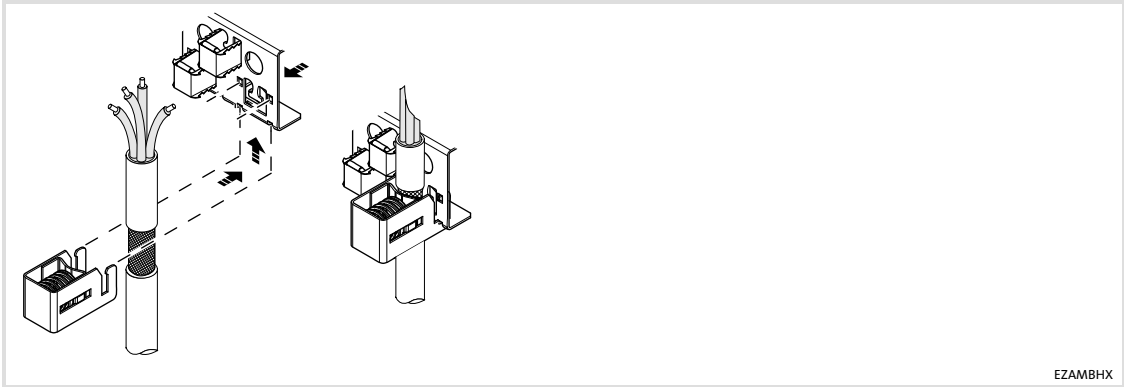
Shield mounting

11.9

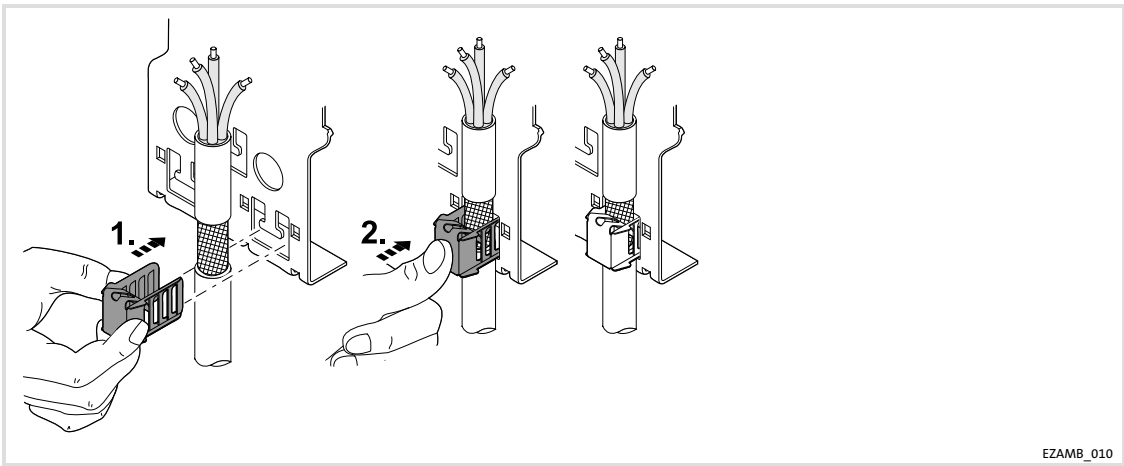
EMC accessories

11.9.1

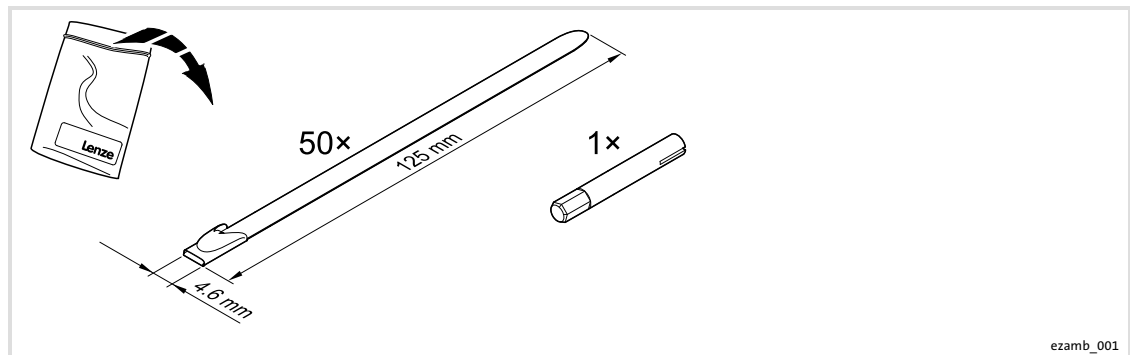
Shield mounting



			[mm]	
EZAMBHXM006 (< E94AZJS003)	2	18	20	4 ... 15
EZAMBHXM003 (< E94AZJS007)	3	19	30	10 ... 20
EZAMBHXM004 (< E94AZJS024)	4	27	30	15 ... 28
EZAMBHXM005	5	37	35	20 ... 37



EZAMBHXM007	20 mm	4 ... 10 mm



EZAMBKBM	 > 10 mm	 8 ... 30 mm
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12 **Appendix**

12.1 **Declarations of conformity**



2295108.08

EU-Konformitätserklärung

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

erklärt in alleiniger Verantwortung die Übereinstimmung der Produkte

Antriebsregler der Baureihen:

E70ACPSx 0304y E70ACMwx 0054y A1ETz
E70ACPSx 0604y E70ACMwx 0104y A1ETz
E70ACMwx 0204y A1ETz
E70ACPSC0604SBH001 E70ACMwx 0324y A1ETz
E70ACPSE0604SBH001 E70ACMwx 0484y A1ETz
E70ACMwx 0644y A1ETz

mit der
Niederspannungsrichtlinie
2014/35/EU

Angewandte harmonisierte Normen:

EN 61800-5-1:2007 + A1:2017

EMV- Richtlinie
2014/30/EU

Angewandte harmonisierte Normen:

EN 61800-3:2004 + A1:2012
EN IEC 61800-3:2018

RoHS Richtlinie
2011/65/EU

Verordnung
2015/863 + 2017/2102

Angewandte harmonisierte Normen:

EN IEC 63000:2018

Die Sicherheitshinweise der Betriebsanleitung sind zu beachten.

Die aufgeführten Produkte sind im Sinne der EMV- Richtlinie keine eigenständig betreibbare Produkte. Die Einhaltung der Richtlinie setzt den korrekten Einbau der Produkte, die Beachtung der spezifischen Installationshinweise und der Produktdokumentation voraus. Dies wurde an bestimmten Anlagenkonfigurationen nachgewiesen.

Die Produkte sind bestimmt zum Einbau in Maschinen. Die Inbetriebnahme ist solange untersagt bis festgestellt wurde, dass die Maschine, in welche diese Produkte eingebaut werden sollen, den Bestimmungen der o.g. EU-Richtlinie entsprechen.

Ort / Datum
Place / date

Aerzen 11.05.2021

Vorstand
Chief Technology Officer

Dipl.-Ing. Frank Maier

EU Declaration of Conformity

declares under sole responsibility compliance of the products

Controllers of the series:

E70ACMwx 0054y A2ETz
E70ACMwx 0104y A2ETz
E70ACMwx 0204y A2ETz
E70ACMwx 0324y A2ETz

with the
Low Voltage Directive
2014/35/EU

Applied harmonized standards:

EMC Directive
2014/30/EU

Applied harmonized standards:

RoHS Directive
2011/65/EU

Applied harmonized standards:

Commission Regulation
2015/863 + 2017/2102

The safety instructions of the manual are to be considered.

According to the EMC directive, the listed devices are not independently operable products. Compliance of the directive requires the correct installation of the product, the observance of specific installation notes and product documentation. This was tested on specific system configurations.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned EU Directive.

Dokumentationsverantwortlicher
Responsible for documentation

i.V. Torsten Pieper

Lenze

2294567.04

EU-Konformitätserklärung

EU Declaration of Conformity

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

erklärt in alleiniger Verantwortung die Übereinstimmung der
Produkte

declares under sole responsibility compliance of the products

i700

E70ACMxxxxxxxAXxxx (x=0-9/A-Z)

mit der

with the

Maschinenrichtlinie

2006/42/EG Anhang VIII und IX

Angewandte harmonisierte Normen:

Sicherer Halt Stopp Kategorie 0
Kategorie 4
Performance Level (PL):
PL e

EN 60204-1

EN ISO 13849-1

EN 61508 1-7

EN 62061

+AC +A1 +A2

EN 61800-5-2

EN 61800-5-1 +A1

Machinery Directive

2006/42/EC Annex VIII and IX

Applied harmonized standards:

Stop category 0

Category 4

Performance Level (PL):
PL e

:2018

:2015

:2010

:2010 :2013 :2015

:2017

:2007 :2017

Safe torque off

Sicherheitsfunktionen siehe
Betriebsanleitung. SIL 3

SIL 3 For safety functions see manual.



Konformitätsbewertung



Benannte Stelle

Zertifikate

Gültigkeit

EMV- Richtlinie

2014/30/EU

Angewandte harmonisierte Normen:

EN 61800-3:2004 + A1:2012

EN 61800-3:2018

Conformity assessment

notified body

Certificates

Date of expiry

TÜV Rheinland Industrie Service GmbH

Am Grauen Stein

51105 Köln / Germany

01/205/5250.02/19

2024-01

EMC Directive

2014/30/EU

Applied harmonized standards:

RoHS- Richtlinie

2011/65/EU

Angewandte harmonisierte Normen:

EN IEC 63000:2018

RoHS Directive

2011/65/EU

Applied harmonized standards:

Die Sicherheitshinweise der Betriebsanleitung sind zu beachten.

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Die Produkte sind bestimmt zum Einbau in Maschinen. Die
Inbetriebnahme ist solange untersagt bis festgestellt wurde, dass
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den Bestimmungen der o.g. EU-Richtlinie entsprechen.

These products are intended for installation in machines. Operation
is prohibited until it has been determined that the machines in
which these products are to be installed, conforms to the above
mentioned EU Directive.

Ort / Datum
Place / date

Aerzen 16.10.2020

Geschäftsführer
Managing Director

Dipl.-Ing. Frank Maier

Dokumentationsverantwortlicher
Responsible for documentation

i.V. T. Wedemeyer

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