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# Inverter

Inverter i510 Cabinet 0.25 ... 2.2 kW



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## About Lenze

### The 5 phases

#### **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**

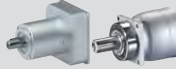
Productivity, reliability and new performance peaks on a daily basis these are our key success factors for your machine. After delivery, we offer you cleverly devised service concepts to ensure continued safe operation. The primary focus here is on technical support, based on the excellent application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



## Portfolio overview

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.

**As easy as that.**

| Controlling and visualising events | Automating and visualising machine modules                                          | Automating and visualising machines                                                   |
|------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Logic Control                      | Machine module-Control                                                              | Machine Control                                                                       |
| Visualisation                      |    |    |
| Controllers                        |    |                                                                                       |
|                                    |                                                                                     |                                                                                       |
| Time and event-controlled motion   | Speed and torque-controlled motion                                                  | Position-controlled single-axis and multi-axis motion                                 |
| Mains operation                    | Inverter operation                                                                  | Servo inverter operation                                                              |
| Inverters                          |  |  |
| Motors                             |  |   |
| Gearboxes                          |  |  |



## Inverter overview

### Comparison of i500

| Inverter                           | i510                                                                                                                             |                                            |                                          | i550                                                                                                                                                                                                                                                                                                                                                                          |                                            |                                          |                                          |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------|------------------------------------------|
|                                    |                                                 |                                            |                                          |                                                                                                                                                                                                                                                                                            |                                            |                                          |                                          |
| Application area                   | Pumps and fans, conveyor, travelling, winding, forming, tool and hoist drives                                                    |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Electrical supply system           | 1/N/PE<br>AC 170 ... 264 V<br>45 ... 65 Hz                                                                                       | 1/3/PE<br>AC 170 ... 264 V<br>45 ... 65 Hz | 3/PE<br>AC 340 ... 528 V<br>45 ... 65 Hz | 1/N/PE<br>AC 170 ... 264 V<br>45 ... 65 Hz                                                                                                                                                                                                                                                                                                                                    | 1/3/PE<br>AC 170 ... 264 V<br>45 ... 65 Hz | 3/PE<br>AC 170 ... 264 V<br>45 ... 65 Hz | 3/PE<br>AC 340 ... 528 V<br>45 ... 65 Hz |
| Motor power                        | 0.25 ... 2.2 kW                                                                                                                  | 0.25 ... 2.2 kW                            | 0.37 ... 2.2 kW                          | 0.25 ... 2.2 kW                                                                                                                                                                                                                                                                                                                                                               | 0.25 ... 2.2 kW                            | 4.0 ... 5.5 kW                           | 0.37 ... 75 kW                           |
| Inverter output current            | 1.7 ... 9.6 A                                                                                                                    | 1.7 ... 9.6 A                              | 1.3 ... 5.6 A                            | 1.7 ... 9.6 A                                                                                                                                                                                                                                                                                                                                                                 | 1.7 ... 9.6 A                              | 16.5 ... 23 A                            | 1.3 ... 150 A                            |
| Inverter efficiency class          | IE2 according to EN 50598-2                                                                                                      |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Max. inverter output current       | 150 % at an overload time of 60 s<br>200 % at an overload time of 3 s                                                            |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| RFI filters                        | Integrated                                                                                                                       | not integrated                             | Integrated                               | Integrated                                                                                                                                                                                                                                                                                                                                                                    | not integrated                             | Integrated                               | Integrated                               |
| Dissipation of regenerative energy | -                                                                                                                                | -                                          | -                                        | Brake resistor                                                                                                                                                                                                                                                                                                                                                                | Brake resistor                             | Brake resistor                           | Brake resistor<br>DC-bus connection      |
| Inverter version                   | Control cabinet                                                                                                                  |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Degree of protection               | IP20 according to EN 60529                                                                                                       |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Inverter mounting type             | Installation, easy mounting via keyhole suspension                                                                               |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Control connections and networks   | Basic I/Os<br><br>5 digital inputs - 1 digital output<br>2 analog inputs - 1 analog output<br><br>Modbus or CANopen (switchable) |                                            |                                          | Standard-I/O<br><br>5 digital inputs - 1 digital output<br>2 analog inputs - 1 analog output<br>HTL incremental encoder via 2 digital inputs<br><br>Modbus<br>CANopen<br>EtherCAT<br>EtherNet/IP<br>PROFIBUS<br>PROFINET<br><br>Application I/O<br>7 digital inputs - 2 digital outputs<br>2 analog inputs - 2 analog outputs<br>HTL incremental encoder via 2 digital inputs |                                            |                                          |                                          |
| More connections                   | Relay                                                                                                                            |                                            |                                          | Relay<br><br>Connection for PTC or thermal contact<br>External 24 V supply                                                                                                                                                                                                                                                                                                    |                                            |                                          |                                          |
| Functional safety                  | Without                                                                                                                          |                                            |                                          | STO (Safe torque off)                                                                                                                                                                                                                                                                                                                                                         |                                            |                                          |                                          |
| Approvals                          | CE, RoHS2, UL (for USA and Canada), EAC                                                                                          |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |
| Interference suppression           | Residential areas C1, industrial premises C2                                                                                     |                                            |                                          |                                                                                                                                                                                                                                                                                                                                                                               |                                            |                                          |                                          |



| Function                                                | Inverter |      | Available as of firmware version |      |      |
|---------------------------------------------------------|----------|------|----------------------------------|------|------|
|                                                         | i510     | i550 | V1.1                             | V2.1 | V3.0 |
| Motor control                                           |          |      |                                  |      |      |
| V/f characteristic control linear/square-law (VFC plus) | •        | •    | •                                |      |      |
| V/f characteristic control Midpoint                     | •        | •    |                                  |      | •    |
| Sensorless vector control (SLVC)                        | •        | •    | •                                |      |      |
| Energy saving function (VFCeco)                         | •        | •    |                                  | •    |      |
| Servo control for asynchronous motors                   |          | •    |                                  | •    |      |
| Torque mode                                             | •        | •    |                                  |      | •    |
| Motor functions                                         |          |      |                                  |      |      |
| Flying restart circuit                                  | •        | •    | •                                |      |      |
| Slip compensation                                       | •        | •    | •                                |      |      |
| DC braking                                              | •        | •    | •                                |      |      |
| Oscillation damping                                     | •        | •    | •                                |      |      |
| Skip frequencies                                        | •        | •    | •                                |      |      |
| Automatic identification of the motor data              | •        | •    |                                  | •    |      |
| Brake energy management                                 | •        | •    | •                                |      |      |
| Holding brake control                                   | •        | •    |                                  | •    |      |
| Rotational Energy Ride Through (RERT)                   | •        | •    |                                  | •    |      |
| Speed feedback (HTL encoder)                            |          | •    |                                  | •    |      |
| Application functions                                   |          |      |                                  |      |      |
| Process controller                                      | •        | •    | •                                |      |      |
| Parameter change-over                                   | •        | •    | •                                |      |      |
| S-shaped ramps for smooth acceleration                  | •        | •    | •                                |      |      |
| Motor potentiometer                                     | •        | •    | •                                |      |      |
| Flexible I/O configuration                              | •        | •    | •                                |      |      |
| Access protection                                       | •        | •    | •                                |      |      |
| Automatic restart                                       | •        | •    | •                                |      |      |
| Sequencer                                               | •        | •    |                                  |      | •    |
| Position counter                                        |          | •    |                                  |      | •    |
| Monitoring                                              |          |      |                                  |      |      |
| Short circuit, earth fault                              | •        | •    | •                                |      |      |
| Device overload monitoring (I x t)                      | •        | •    | •                                |      |      |
| Motor overload monitoring (I <sup>2</sup> x t)          | •        | •    | •                                |      |      |
| Mains phase failure, motor phase failure                | •        | •    | •                                |      |      |
| Stalling protection                                     | •        | •    | •                                |      |      |
| Motor current limit                                     | •        | •    | •                                |      |      |
| Maximum torque                                          | •        | •    | •                                |      |      |
| Ultimate motor current                                  | •        | •    | •                                |      |      |
| Motor speed monitoring                                  | •        | •    | •                                |      |      |
| Load loss detection                                     | •        | •    | •                                |      |      |
| Motor temperature monitoring                            |          | •    | •                                |      |      |
| Diagnostics                                             |          |      |                                  |      |      |
| Error history buffer, logbook                           | •        | •    | •                                |      |      |
| LED status display                                      | •        | •    | •                                |      |      |
| Network                                                 |          |      |                                  |      |      |
| CANopen                                                 | •        | •    | •                                |      |      |
| Modbus                                                  | •        | •    | •                                |      |      |
| PROFIBUS                                                |          | •    | •                                |      |      |
| EtherCAT                                                |          | •    |                                  | •    |      |
| EtherNet/IP                                             |          | •    |                                  | •    |      |
| PROFINET                                                |          | •    |                                  | •    |      |
| Functional safety (optional)                            |          |      |                                  |      |      |
| STO (Safe torque off)                                   |          | •    | •                                |      |      |

# About this document

## Document description



## About this document

### Document description

This document is aimed at all persons who want to project inverters with the described products.

The data and information compiled here serve to support you in dimensioning and selecting and preparing the electrical and mechanical installation. You will receive information on product extensions and accessories.

### More information

For certain tasks, more information is available in additional documents.

| Document                                   | Contents/topics                                                                                                                                     |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Commissioning document                     | Setting and parameterising the inverters                                                                                                            |
| Mounting Instructions                      | Basic information for the mechanical and electrical installation <ul style="list-style-type: none"><li>• Is supplied with each component.</li></ul> |
| "Functional safety" configuration document | Information on this (optional) function                                                                                                             |



Information and tools with regard to the Lenze products can be found on the Internet:  
<http://www.lenze.com> → Download





## Notations and conventions

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

| Numbers |                         |                                                                                   |                                                                                                                                                                                                |
|---------|-------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Decimal separator       | Point                                                                             | In general, the decimal point is used.<br>Example: 1 234.56                                                                                                                                    |
| Warning |                         |                                                                                   |                                                                                                                                                                                                |
|         | UL warning              | UL                                                                                | Are used in English and French.                                                                                                                                                                |
|         | UR warning              | UR                                                                                |                                                                                                                                                                                                |
| Text    |                         |                                                                                   |                                                                                                                                                                                                |
|         | Programs                | » «                                                                               | Software<br>Example: »Engineer«, »EASY Starter«                                                                                                                                                |
| Icons   |                         |                                                                                   |                                                                                                                                                                                                |
|         | Page reference          |  | Reference to another page with additional information<br>Example:  16 = see page 16                           |
|         | Documentation reference |  | Reference to another documentation with additional information<br>Example:  EDKxxx = see documentation EDKxxx |

## Layout of the safety instructions

### DANGER!

This note refers to an imminent danger which, if not avoided, may result in death or serious injury.

### WARNING!

This note refers to a danger which, if not avoided, may result in death or serious injury.

### CAUTION!

This note refers to a danger which, if not avoided, may result in minor or moderate injury.

### NOTICE

This note refers to a danger which, if not avoided, may result in damage to material assets.

# Project planning

Procedure of an inverter configuration process  
Dimensioning



## Project planning

### Procedure of an inverter configuration process

#### Dimensioning

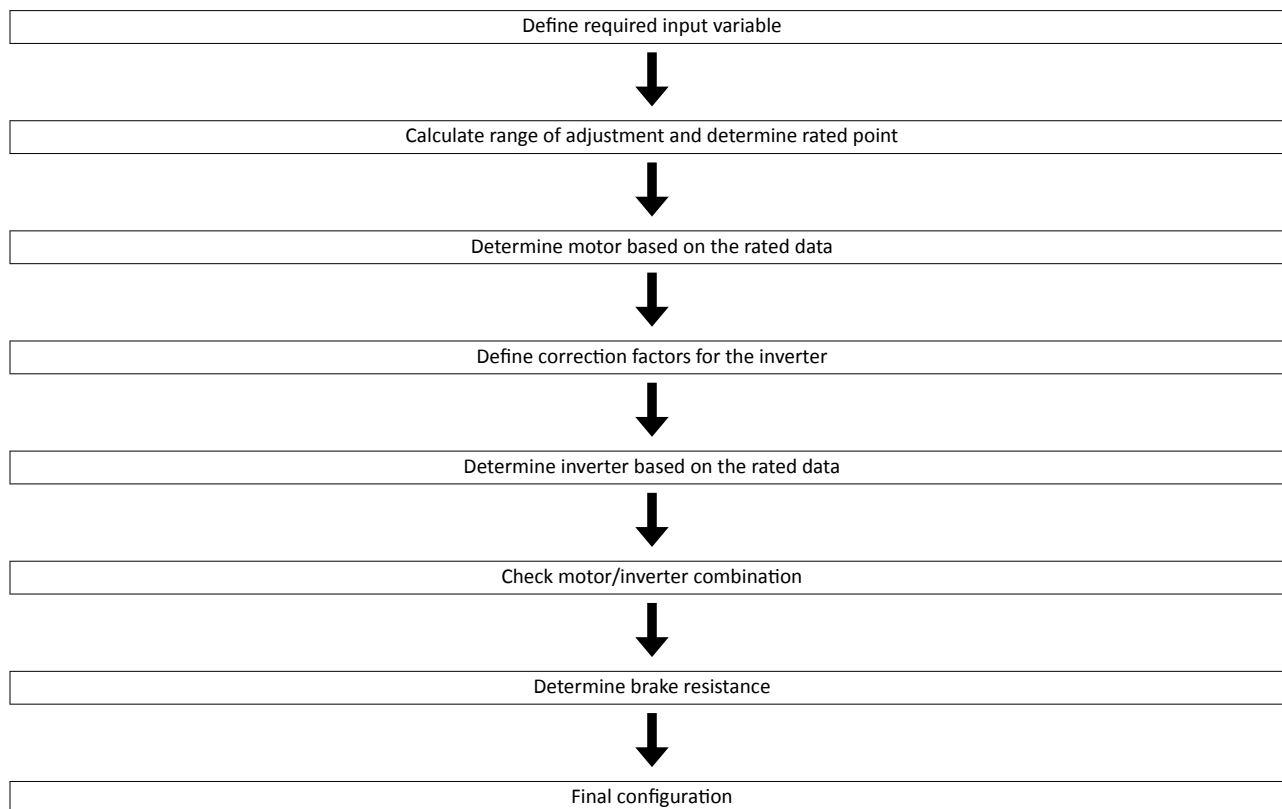
##### 3 methods for dimensioning

**Fast:** Selection of the inverter based on the motor data of a 4-pole asynchronous motor.

**Detailed:** In order to optimise the selection of the inverter and all drive components, it is worth to execute the detailed system dimensioning based on the physical requirements of the application. For this purpose, Lenze provides the «Drive Solution Designer» (DSD) design program.

**Manual:** The following chapter guides you step by step to the selection of a drive system.

#### Workflow of a configuration process



#### Define required input variables

|                                    |             |     |          |
|------------------------------------|-------------|-----|----------|
| Operating mode                     |             |     | S1 or S6 |
| Max. load torque                   | $M_{L,max}$ | Nm  |          |
| Max. load speed                    | $n_{L,max}$ | rpm |          |
| Min. load speed                    | $n_{L,min}$ | rpm |          |
| Site altitude                      | H           | m   |          |
| Temperature in the control cabinet | $T_U$       | °C  |          |

#### Calculate range of adjustment and determine rated point

|               | Calculation                       |
|---------------|-----------------------------------|
| Setting range | $V = \frac{n_{L,max}}{n_{L,min}}$ |



# Project planning

## Procedure of an inverter configuration process

### Dimensioning

|                                             | Setting range                                                                | Rated point              |
|---------------------------------------------|------------------------------------------------------------------------------|--------------------------|
| Motor with integral fan                     | $\leq 2.50$ (20 - 50 Hz)<br>$\leq 4.35$ (20 - 87Hz)<br>$\leq 6$ (20 - 120Hz) | 50 Hz<br>87 Hz<br>120 Hz |
| Motor with blower                           | $\leq 10.0$ (5 - 50 Hz)                                                      | 50 Hz                    |
| Motor with integral fan<br>(reduced torque) | $\leq 17.4$ (5 - 87Hz)<br>$\leq 24$ (5 - 120Hz)                              | 87 Hz<br>120 Hz          |

#### Determine motor based on the rated data

|                   |             |     | Check                                                            |
|-------------------|-------------|-----|------------------------------------------------------------------|
| Rated torque      |             |     |                                                                  |
| Operating mode S1 | $M_{rated}$ | Nm  | $M_N \geq \frac{M_{L,max}}{T_{H,Mot} \times T_{U,Mot}}$          |
| Operating mode S6 | $M_{rated}$ | Nm  | $M_N \geq \frac{M_{L,max}}{2 \times T_{H,Mot} \times T_{U,Mot}}$ |
| Rated speed       | $n_{rated}$ | rpm | $n_{rated} \geq n_{L,max}$<br><br>$\frac{n_n}{V} \leq n_{L,min}$ |

|                                         |                |     | Note                   |
|-----------------------------------------|----------------|-----|------------------------|
| Rated torque                            | $M_{rated}$    | Nm  | → Rated motor data     |
| Rated speed                             | $n_{rated}$    | rpm |                        |
| Rated point at                          |                | Hz  |                        |
| Power factor                            | $\cos \varphi$ |     | → Rated motor data     |
| Rated current                           | $I_{N,MOT}$    | A   |                        |
| Rated power                             | $P_{rated}$    | kW  |                        |
| Correction factor - site altitude       | $T_{H,MOT}$    |     | → Technical motor data |
| Correction factor - ambient temperature | $T_{U,MOT}$    |     |                        |
| Select motor                            |                |     |                        |

#### Correction factors for the inverter

| Site altitude Amsl | H   |             |             |             |             |
|--------------------|-----|-------------|-------------|-------------|-------------|
|                    | [m] | $\leq 1000$ | $\leq 2000$ | $\leq 3000$ | $\leq 4000$ |
| $k_{H,INV}$        |     | 1.00        | 0.95        | 0.90        | 0.85        |

| Temperature in the control cabinet | $T_U$        |           |           |           |           |
|------------------------------------|--------------|-----------|-----------|-----------|-----------|
|                                    | [°C]         | $\leq 40$ | $\leq 45$ | $\leq 50$ | $\leq 55$ |
| Switching frequency                |              |           |           |           |           |
| 2 or 4 kHz                         | $k_{TU,INV}$ | 1.00      | 1.00      | 0.875     | 0.750     |
| 8 or 16 kHz                        |              | 1.00      | 0.875     | 0.750     | 0.625     |

#### Determine inverter based on the rated data

|                                   |           |   | Check                                                               |
|-----------------------------------|-----------|---|---------------------------------------------------------------------|
| Output current                    |           |   |                                                                     |
| Continuous operation              | $I_{out}$ | A | $I_{out} \geq I_{N,Mot} / (k_{H,INV} \times k_{TU,INV})$            |
| Overcurrent operation cycle 15 s  | $I_{out}$ | A | $I_{out} \geq I_{N,Mot} \times 2 / (k_{H,INV} \times k_{TU,INV})$   |
| Overcurrent operation cycle 180 s | $I_{out}$ | A | $I_{out} \geq I_{N,Mot} \times 1.5 / (k_{H,INV} \times k_{TU,INV})$ |

#### Check motor/inverter combination

|              |   |    | Calculation                                                                                                      |
|--------------|---|----|------------------------------------------------------------------------------------------------------------------|
| Motor torque | M | Nm | $M = \sqrt{\left(\frac{I_{out,INV}}{I_{N,MOT}}\right)^2 - (1 - \cos \varphi^2)} \times \frac{M_N}{\cos \varphi}$ |

# Project planning

Procedure of an inverter configuration process  
Dimensioning



|                                   |  | Check                          |
|-----------------------------------|--|--------------------------------|
| Overload capacity of the inverter |  | $\frac{M_{L,max}}{M} \leq 1.5$ |

## Braking operation without additional measures

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

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

## Braking operation with external brake resistor

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

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

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

## Determine brake resistance

|                  |             |          | Application                                                           |                                                                                 |
|------------------|-------------|----------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|
|                  |             |          | With active load                                                      | With passive load                                                               |
| Rated power      | $P_{rated}$ | kW       | $P_N \geq P_{max} \times \eta_e \times \eta_m \times \frac{t_1}{t_2}$ | $P_N \geq \frac{P_{max} \times \eta_e \times \eta_m}{2} \times \frac{t_1}{t_2}$ |
| Thermal capacity | $C_{th}$    | kWs      | $C_{th} \geq P_{max} \times \eta_e \times \eta_m \times t_1$          | $C_{th} \geq \frac{P_{max} \times \eta_e \times \eta_m}{2} \times t_1$          |
| Rated resistance | $R_{rated}$ | $\Omega$ | $R_N \geq \frac{U_{DC}^2}{P_{max} \times \eta_e \times \eta_m}$       |                                                                                 |

|               |                                                                                          |
|---------------|------------------------------------------------------------------------------------------|
| Active load   | Can start to move independent of the drive (e.g. unwinder)                               |
| Passive load  | Can stop independent of the drive (e.g. horizontal travelling drives, centrifuges, fans) |
| $U_{DC}$ [V]  | Switching threshold - brake chopper                                                      |
| $P_{max}$ [W] | Maximum occurring braking power                                                          |
| $\eta_e$      | Electrical efficiency                                                                    |
| $\eta_m$      | Mechanical efficiency                                                                    |
| $t_1$ [s]     | Braking time                                                                             |
| $t_2$ [s]     | Cycle time = time between two successive braking processes ( $t_1$ + dead time)          |

## Final configuration

Product extensions and accessories can be found here:

- [Product extensions](#) 55
- [Accessories](#) 62



## Project planning

Procedure of an inverter configuration process  
Operation in motor and generator mode

---

### Operation in motor and generator mode

The energy analysis differs between operation in motor mode and generator mode.

During operation in motor mode, the energy flows from the supplying mains via the inverter to the motor which converts electrical energy into mechanical energy (e. g. for lifting a load).

During operation in generator mode, the energy flows back from the motor to the inverter. The motor converts the mechanical energy into electrical energy - it acts as a generator (e. g. when lowering a load).

The drive brakes the load in a controlled manner.

The energy recovery causes a rise in the DC-bus voltage. If this voltage exceeds an upper limit, the output stage of the inverter will be blocked to prevent the device from being destroyed.

The drive coasts until the DC-bus voltage reaches the permissible value range again.

In order that the excessive energy can be dissipated, a brake resistor or a regenerative module is required.

# Project planning

Procedure of an inverter configuration process  
Overcurrent operation



## Overcurrent operation

The inverters can be driven at higher amperages beyond the rated current if the duration of this overcurrent operation is time limited.

Two utilisation cycles of 15 s and 180 s are defined. Within these utilisation cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place.

### Cycle 15 s

During this operation, the inverter may be loaded for 3 s with up to 200 % of the rated current if afterwards a recovery time of 12 s with max. 75 % of the rated current is observed. A cycle corresponds to 15 s.

### Cycle 180 s

During this operation, the inverter may be loaded for 60 s with up to 150 % of the rated current if afterwards a recovery time of 120 s with max. 75 % of the rated current is observed. A cycle corresponds to 180 s.

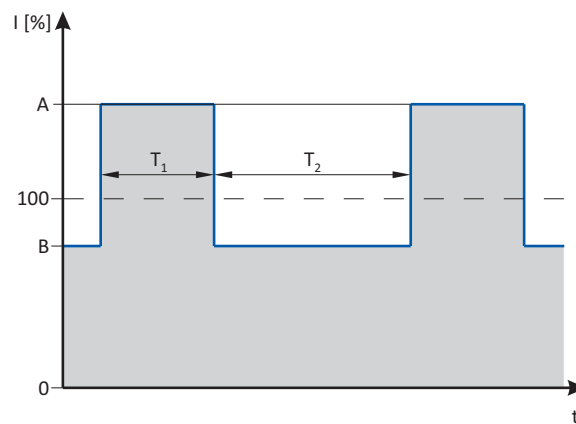
The monitoring of the device utilisation (Ixt) causes the set error response if one of the two utilisation values exceeds the threshold of 100 %.



The maximum output currents correspond to the switching frequencies and the overload behaviour of the inverters are given in the rated data.

In case of rotating frequencies < 10 Hz, the time-related overload behaviour may be reduced.

The graphics shows a cycle. The basic conditions given in the table (graphics field highlighted in grey) have to be complied with in order that the inverter will not be overloaded. Both cycles can be combined with each other.



|             | Max. output current | Max. overload time | Max. output current during the recovery time | Min. recovery time |
|-------------|---------------------|--------------------|----------------------------------------------|--------------------|
|             | A                   | T <sub>1</sub>     | B                                            | T <sub>2</sub>     |
|             | %                   | s                  | %                                            | s                  |
| Cycle 15 s  | 200                 | 3                  | 75                                           | 12                 |
| Cycle 180 s | 150                 | 60                 | 75                                           | 120                |



---

## Safety instructions

Disregarding the following basic safety measures and safety information may lead to severe personal injury and damage to property!

Please observe the specific safety information in the other sections!

### Application as directed

- The product must only be operated under the operating conditions prescribed in this documentation.
- The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive.
- The product is not a machine in terms of 2006/42/EC: Machinery Directive.
- Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EC Directive 2006/42/EC: Machinery Directive; observe EN 60204-1.
- Commissioning or starting the operation as directed is only allowed when there is compliance with the EMC Directive 2014/30/EU.
- The harmonised standard EN 61800-5-1 is used for the inverters.
- The product is not a household appliance, but is only designed as component for commercial or professional use in terms of EN 61000-3-2.
- The product can be used according to the technical data if drive systems have to comply with categories according to EN 61800-3.

In residential areas, the product may cause EMC interferences. The operator is responsible for taking interference suppression measures.

# Project planning

Safety instructions  
Handling



## Handling

### Transport, storage

Observe the notes regarding transport, storage and correct handling. 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 and contacts. Inverters contain electrostatically sensitive components which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since thereby your health could be endangered!

### Installation

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

The inverters have to be installed and cooled according to the regulations given in the corresponding documentation. Observe the climatic conditions according to the technical data. The ambient air must not exceed the degree of pollution 2 according to EN 61800-5-1.

### Electrical connection

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

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

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-marked inverters. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation. The inverters 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.

Inverters 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 an inverter with three-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the inverter. If the inverter 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 inverters must be equipped with additional monitoring and protection devices according to the valid safety regulations.

After the inverter 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 inverter.

All protection covers and doors must be shut during operation.

You may adapt the inverters to your application by parameter setting within the limits available. For this, observe the notes in the documentation.

### Safety functions

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

### Maintenance and servicing

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





---

### Disposal

In accordance with the current provisions, inverters and accessories have to be disposed of by means of professional recycling. Inverters contain recyclable raw material such as metal, plastics and electronic components.

### Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to property!

### Protection of persons

Before working on the inverter, check if no voltage is applied to the power terminals.

- Depending on the device, the power terminals X105 remain live for up to 3 ... 20 minutes.
- The power terminals X100 and X105 remain live even when the motor is stopped.

### Motor protection

With some settings of the inverter, the connected motor can be overheated.

- E. g. by longer operation of self-ventilated motors at low speed.
- E. g. by longer operation of the DC-injection brake.

### Protection of the machine/system

Drives can reach dangerous overspeeds.

- E. g. by setting high output frequencies in connection with motors and machines not suitable for this purpose.
- The inverters do not provide protection against such operating conditions. For this purpose, use additional components.

Switch contactors in the motor cable only if the controller is inhibited.

- Switching while the inverter is enabled is only permissible if no monitoring functions are activated.

### Motor

If there is a short circuit of two power transistors, a residual movement of up to  $180^\circ$ /number of pole pairs can occur at the motor! (For 4-pole motor: residual movement max.  $180^\circ/2 = 90^\circ$ ).

### Parameter set transfer

During the parameter set transfer, control terminals of the inverters can adopt undefined states.

- Thus, the control terminal of the digital input signals have to be removed before the transfer.
- This ensures that the inverter is inhibited. The control terminals are in a defined state.

# Project planning

Control cabinet structure  
Arrangement of components



## Control cabinet structure

### Control cabinet requirements

- Protection against electromagnetic interferences
- Compliance with the ambient conditions of the installed components

### Mounting plate requirements

- The mounting plate must be electrically conductive.
  - Use zinc-coated mounting plates or mounting plates made of V2A.
  - Varnished mounting plates are unsuitable, even if the varnish is removed from the contact surfaces.
- When using several mounting plates, make a conductive connection over a large surface (e. g. using grounding strips).

### Arrangement of components

- Division into power and control areas

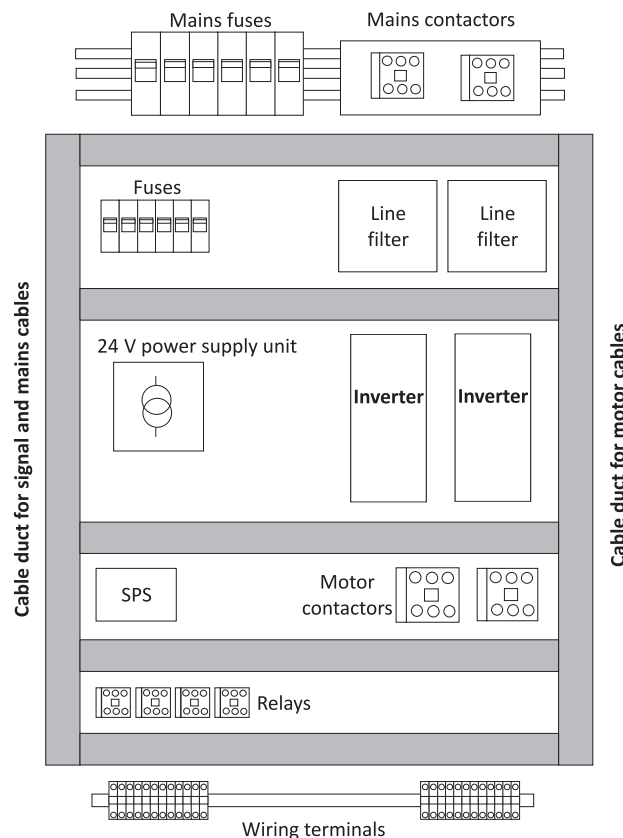


Fig. 1: Example for the ideal arrangement of components in the control cabinet



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#### Cables

##### Requirements

- The cables used must correspond to the requirements at the location (e. g. EN 60204–1, UL).
- The cable cross-section must be dimensioned for the assigned fusing. Observe national and regional regulations.
- You must observe the regulations for minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.

##### Installation inside the control cabinet

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

##### Installation outside the control cabinet

- In the case of greater cable lengths, a greater cable distance between the cables is required.
- In the case of parallel routing (cable trays) of cables with different types of signals, the degree of interference can be minimised by using a metallic cable separator or isolated cable ducts.

#### Earthing concept

- Set up the earthing system with a star topology.
- Connect all components (inverters, filters, chokes) to a central earthing point (PE rail).
- Comply with the corresponding minimum cross-sections of the cables.
- When using several mounting plates, make a conductive connection over a large surface (e. g. using grounding strips).

# Project planning

Control cabinet structure  
EMC-compliant installation



## EMC-compliant installation

Structure of a CE-typical drive system

The drive system (frequency inverter and drive) corresponds to 2014/30/EU: EMC Directive if it is installed according to the specifications of the CE-typical drive system.

The structure in the control cabinet must support the EMC-compliant installation with shielded cables.

- Please use highly conductive shield connections.
- Connect the housing with shielding effect to the grounded mounting plate with a surface as large as possible, e. g. of inverters and RFI filters.
- Use central earthing points.

Matching accessories makes effective shielding easier.

- Shield sheets
- Shield clips/shield clamps
- Metallic cable ties

## Mains connection, DC supply

- Inverters, mains chokes, or mains filters may only be connected to the mains via unshielded single cores or unshielded cables.
- When a line filter is used, shield the cable between mains filter or RFI filter and inverter if its length exceeds 300 mm. Unshielded cores must be twisted.
- In DC-bus operation or DC supply, use shielded cables.
  - Only certain inverters are provided with this connection facility.

## Voltages for the DC-bus operation

| Voltage on the motor side<br>$V_{AC}$ | DC supply<br>$V_{DC}$ | Voltage range<br>$V_{DC}$ |      |
|---------------------------------------|-----------------------|---------------------------|------|
| 400                                   | 565                   | 480 - 0 % ... 622 + 0 %   | 2/PE |
| 480                                   | 675                   | 577 - 0 % ... 747 + 0 %   |      |



## Motor cable

- Only use low-capacitance and shielded motor cables with braid made of tinned or nickel-plated copper.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
  - Shields made of steel braids are not suitable.
- Shield the cable for motor temperature monitoring (PTC or thermal contact) and install it separately from the motor cable.
  - In Lenze system cables, the cable for brake control is integrated into the motor cable. If this cable is not required for brake control, it can also be used to connect the motor temperature monitoring up to a length of 50 m.
  - Only certain inverters are provided with this connection facility.
- Connect the shield with a large surface and fix it with metal cable binders or conductive clamp. The following is suitable for the connection of the shield:
  - The mounting plate
  - A central grounding rail
  - A shield sheet, optional where necessary
- This is optimal:
  - The motor cable is separated from the mains cables and control cables.
  - The motor cable only crosses mains cables and control cables at right angles.
  - The motor cable is not interrupted.
- If the motor cable must be opened all the same (e. g. by chokes, contactors, or terminals):
  - The unshielded cable ends must not be longer than 100 mm (depending on the cable cross-section).
  - Install chokes, contactors, terminals etc. spatially separated from other components (with a minimum 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.

## Control cables

- Install the cables so that no induction-sensitive loops arise.
- Distance of shield connections of control cables to shield connections of motor cables and DC cables:
  - At least 50 mm
- Control cables for analog signals:
  - Must always be shielded
  - Connect the shield on one side of the inverter
- Control cables for digital signals:

|        | Cable length      |                           |                                            |
|--------|-------------------|---------------------------|--------------------------------------------|
|        | < ca. 5 m         | ca. 5 m ... ca. 30 m      | > ca. 30 m                                 |
| Design | unshielded option | unshielded twisted option | always shielded<br>connected on both sides |

## Network cables

- Cables and wiring must comply with the specifications and requirements of the used network.
  - Ensures the reliable operation of the network in typical systems.



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# Inverter

Inverter i510 Cabinet 0.25 ... 2.2 kW

## Inhalt

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## Product information

### Product description

i500 is the new inverter series - a streamlined design, scalable functionality and exceptional user-friendliness.

i500 is a high-quality inverter that already conforms to future standard in accordance with the EN 50598-2 efficiency classes (IE). Overall, this provides a reliable and future-proof drive for a wide range of machine applications.



### The i510

This chapter provides the complete scope of the inverter i510. This version is suitable for simple applications in inverter-operated drives. Basically, the device has the following features:

- All typical motor control types of modern inverters.
- Stroke and continuous operation of the motor according to common operating modes.
- Networking options via CANopen/Modbus.
- Extensively integrated functions.

### Highlights

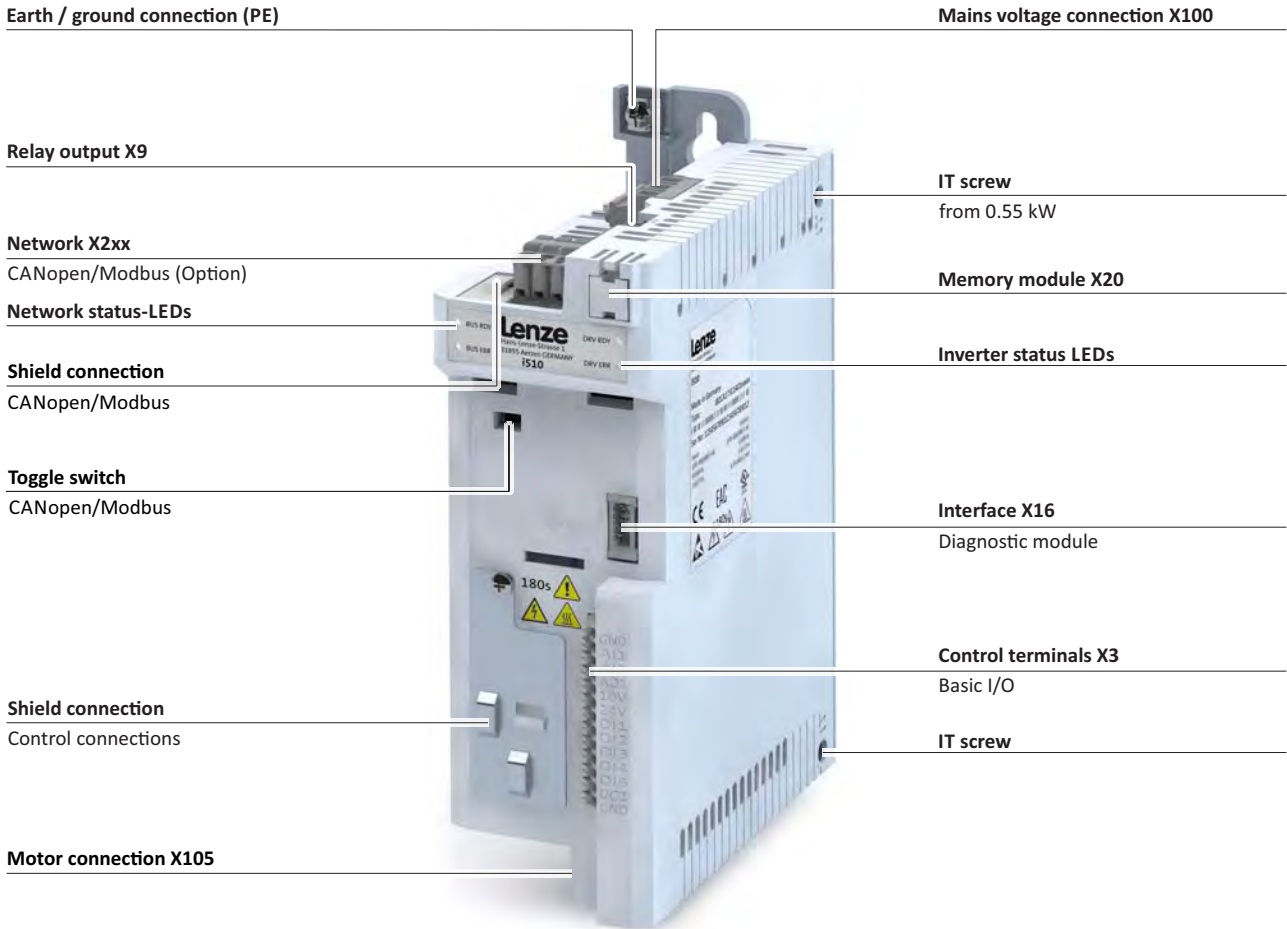
- Compact size
  - Only 60 mm wide and 130 mm deep
- Can be directly connected without external cooling
- Innovative interaction options enable better set-up times than ever.

### Application ranges

- Pumps and fans
- Conveying and travelling drives
- Forming and tool drives



Equipment



Terminal designations X... see connection plans

Position and meaning of the nameplates

Complete inverter



|   |                                        |
|---|----------------------------------------|
| ① | Technical data                         |
| ② | Type and serial number of the inverter |



## Product information

The modular system  
The concept

### The modular system

#### The concept

The inverter i510 is a compact device unit consisting of control unit and power unit.

The i510 is always delivered as a complete inverter.

2 versions are available:

- Without network.
- With CANopen/Modbus, switchable.

#### Kompletter Inverter



### Topologies / network



CANopen® is a communication protocol based on CAN.  
CANopen® is a registered community trademark of the CAN user organisation CiA® (CAN in Automation e. V.).  
The EDS device description files for CANopen can be found here:  
<http://www.lenze.com/application-knowledge-base/artikel/200413930/0/>



The Modbus protocol is an open communication protocol based on a client/server architecture and developed for the communication with programmable logic controllers.  
The further development is carried out by the international user organisation Modbus Organization, USA.

More information on the supported networks can be found at <http://www.lenze.com>

# Product information

The modular system  
Ways of commissioning



## Ways of commissioning

- Keypad

If it's only a matter of setting a few key parameters such as acceleration and deceleration time, this can be done quickly on the keypad.



- Smart-Keypad-App for Android

The intuitive smartphone app enables adjustment to a simple application such as a conveyor belt.



- »EASY Starter«

If functions such as the holding brake control or sequencer need to be set, it's best to use the »EASY Starter« engineering tool.





## Functions

### Overview

The inverters i510 are adjusted to simple applications regarding their functionality.

| Functions                                               |                                           |
|---------------------------------------------------------|-------------------------------------------|
| Motor control                                           | Monitoring                                |
| V/f characteristic control linear/square-law (VFC plus) | Short circuit                             |
| Sensorless vector control (SLVC)                        | earth fault                               |
| Energy saving function (VFCeco)                         | Device overload monitoring ( $i^*t$ )     |
| Torque mode                                             | Motor overload monitoring ( $i^2*t$ )     |
|                                                         | Mains phase failure                       |
|                                                         | Stalling protection                       |
| Motor functions                                         | Motor current limit                       |
| Flying restart circuit                                  | Maximum torque                            |
| Slip compensation                                       | Ultimate motor current                    |
| DC braking                                              | Motor speed monitoring                    |
| Oscillation damping                                     | Load loss detection                       |
| Skip frequencies                                        |                                           |
| Automatic identification of the motor data              |                                           |
| Brake energy management                                 |                                           |
| Holding brake control                                   | Diagnostics                               |
| Voltage add – function                                  | Error history buffer                      |
| Rotational Energy Ride Through (RERT)                   | Logbook                                   |
|                                                         | LED status display                        |
| Application functions                                   | Keypad language selection German, English |
| Process controller                                      |                                           |
| Process controller - idle state and rinse function      | Network                                   |
| Freely assignable favourite menu                        | CANopen                                   |
| Parameter change-over                                   | Modbus                                    |
| S-shaped ramps for smooth acceleration                  |                                           |
| Motor potentiometer                                     |                                           |
| Flexible I/O configuration                              |                                           |
| Access protection                                       |                                           |
| Automatic restart                                       |                                           |
| OEM parameter set                                       |                                           |
| Sequencer                                               |                                           |

### Motor control types

The following table contains the possible control types with Lenze motors.

| Motors                | V/f characteristic control<br>VFCplus | Sensorless vector control<br>SLVC | ASM servo control<br>SC ASM |
|-----------------------|---------------------------------------|-----------------------------------|-----------------------------|
| Three-phase AC motors |                                       |                                   |                             |
| MD                    | •                                     | •                                 |                             |
| MF                    | •                                     | •                                 |                             |
| mH                    | •                                     | •                                 |                             |
| m500                  | •                                     | •                                 |                             |

# Product information

Features  
Motor setting range



## Features

### Motor setting range

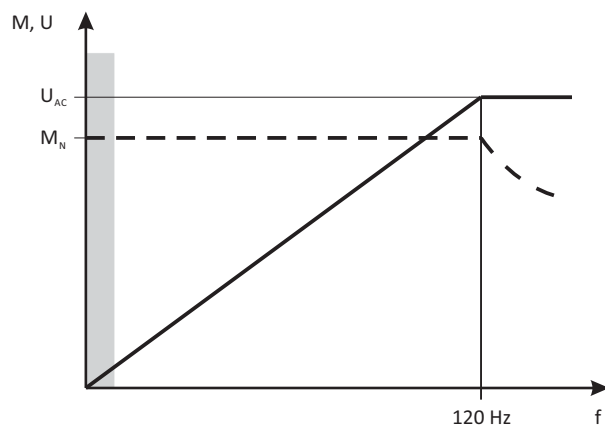
#### Rated point 120 Hz



Only possible with Lenze MF motors.

The rated motor torque is available up to 120 Hz.  
Compared to the 50-Hz operation, the setting range increases by 2.5 times.  
It is quite simply not possible for a drive to be operated any more efficiently in a machine.

#### V/f at 120 Hz

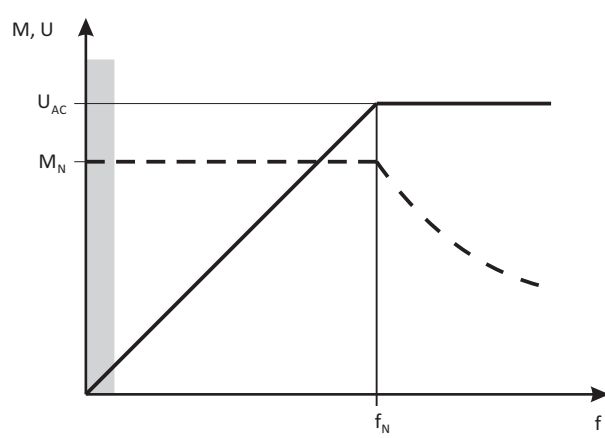


|   |           |             |               |
|---|-----------|-------------|---------------|
| V | Voltage   | $U_{AC}$    | Mains voltage |
| M | Torque    | $M_{rated}$ | Rated torque  |
| f | Frequency |             |               |

#### Rated point 87 Hz

The rated motor torque is available up to 87 Hz.  
Compared to the 50-Hz operation, the setting range increases by 1.74 times.  
For this purpose, a motor with 230/400 V in star connection is driven by a 400-V inverter.  
The inverter must be dimensioned for a rated motor current of 230 V.

#### V/f at 87 Hz

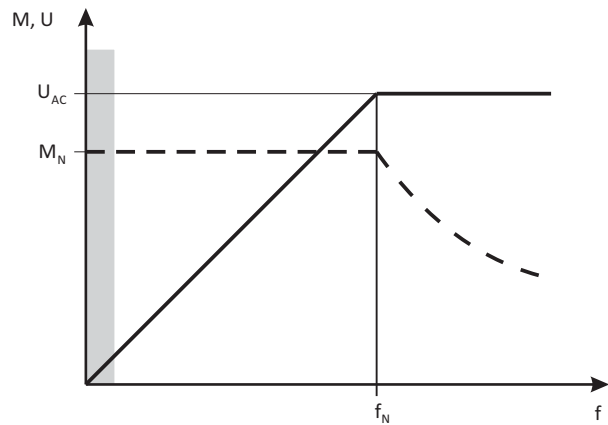




|   |           |             |                 |
|---|-----------|-------------|-----------------|
| V | Voltage   | $U_{AC}$    | Mains voltage   |
| M | Torque    | $M_{rated}$ | Rated torque    |
| f | Frequency | $f_{rated}$ | Rated frequency |

**Rated point 50 Hz**  
The rated motor torque is available up to 50 Hz.

**V/f at 50 Hz**



|   |           |             |                 |
|---|-----------|-------------|-----------------|
| V | Voltage   | $U_{AC}$    | Mains voltage   |
| M | Torque    | $M_{rated}$ | Rated torque    |
| f | Frequency | $f_{rated}$ | Rated frequency |

# Product information

The name of the product



## The name of the product

When the technical data of the different versions were listed, the product name was entered because it is easier to read than the individual type code of the product. The product name is also used for the accessories. The assignment of product name and order code can be found in the Order chapter.

The product name contains the power in kW, mains voltage class 230 V/ 400 V and the number of phases.

The 1/3-phase inverters are marked at the end with "-2".

"C" marks the "Cabinet" version = inverter for the installation into the control cabinet.

| Inverter series | Design | Rated power | Rated mains voltage | Number of phases | Inverter product name |
|-----------------|--------|-------------|---------------------|------------------|-----------------------|
|                 |        | kW          | V                   |                  |                       |
| i510            | C      | 0.25        | 230                 | 1                | i510-C0.25/230-1      |
|                 |        | 0.37        |                     |                  | i510-C0.37/230-1      |
|                 |        | 0.55        |                     |                  | i510-C0.55/230-1      |
|                 |        | 0.75        |                     |                  | i510-C0.75/230-1      |
|                 |        | 1.1         |                     |                  | i510-C1.1/230-1       |
|                 |        | 1.5         |                     |                  | i510-C1.5/230-1       |
|                 |        | 2.2         |                     |                  | i510-C2.2/230-1       |
|                 |        | 0.25        | 230/240             | 1/3              | i510-C0.25/230-2      |
|                 |        | 0.37        |                     |                  | i510-C0.37/230-2      |
|                 |        | 0.55        |                     |                  | i510-C0.55/230-2      |
|                 |        | 0.75        |                     |                  | i510-C0.75/230-2      |
|                 |        | 1.1         |                     |                  | i510-C1.1/230-2       |
|                 |        | 1.5         |                     |                  | i510-C1.5/230-2       |
|                 |        | 2.2         |                     |                  | i510-C2.2/230-2       |
|                 |        | 0.37        | 400/480             | 3                | i510-C0.37/400-3      |
|                 |        | 0.55        |                     |                  | i510-C0.55/400-3      |
|                 |        | 0.75        |                     |                  | i510-C0.75/400-3      |
|                 |        | 1.1         |                     |                  | i510-C1.1/400-3       |
|                 |        | 1.5         |                     |                  | i510-C1.5/400-3       |
|                 |        | 2.2         |                     |                  | i510-C2.2/400-3       |





## Technical data

### Standards and operating conditions

#### Conformities/approvals

|              |                |                                                                                             |
|--------------|----------------|---------------------------------------------------------------------------------------------|
| Conformities |                |                                                                                             |
| CE           | 2014/35/EU     | Low-Voltage Directive                                                                       |
|              | 2014/30/EU     | EMC Directive (reference: CE-typical drive system)                                          |
| EAC          | TR TC 004/2011 | Eurasian conformity: safety of low voltage equipment                                        |
|              | TP TC 020/2011 | Eurasian conformity: electromagnetic compatibility of technical means                       |
| RoHS 2       | 2011/65/EU     | Restrictions for the use of specific hazardous materials in electric and electronic devices |
| Approvals    |                |                                                                                             |
| UL           | UL 61800-5-1   | for USA and Canada (requirements of the CSA 22.2 No. 274)                                   |

#### Protection of persons and device protection

|                                                      |              |                                                      |
|------------------------------------------------------|--------------|------------------------------------------------------|
| Degree of protection                                 |              |                                                      |
| IP20                                                 | EN 60529     |                                                      |
| Type 1                                               | NEMA 250     | Protection against contact                           |
| Open type                                            |              | only in UL-approved systems                          |
| Insulation resistance                                |              |                                                      |
| Overvoltage category III                             | EN 61800-5-1 | 0 ... 2000 m a.m.s.l.                                |
| Overvoltage category II                              |              | above 2000 m a.m.s.l.                                |
| Control circuit isolation                            |              |                                                      |
| Safe mains isolation by double/reinforced insulation | EN 61800-5-1 |                                                      |
| Protective measures against                          |              |                                                      |
| Short circuit                                        |              |                                                      |
| earth fault                                          |              | Earth fault strength depends on the operating status |
| overvoltage                                          |              |                                                      |
| Motor stalling                                       |              |                                                      |
| Motor overtemperature                                |              | I <sup>2</sup> xt monitoring                         |
| Leakage current                                      |              |                                                      |
| > 3.5 mA AC, > 10 mA DC                              | EN 61800-5-1 | Observe regulations and safety instructions!         |
| Cyclic mains switching                               |              |                                                      |
| 3 times per minute                                   |              | Without restrictions                                 |
| Starting current                                     |              |                                                      |
| ≤ 3 x rated mains current                            |              |                                                      |

#### EMC data

|                                                                                                                     |               |                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------|
| Actuation on public supply systems                                                                                  |               |                                                                                                              |
| Implement measures to limit the radio interference to be expected:                                                  |               | The machine or plant manufacturer is responsible for compliance with the requirements for the machine/plant! |
| < 1 kW: with mains choke                                                                                            | EN 61000-3-2  |                                                                                                              |
| > 1 kW at mains current ≤ 16 A: without additional measures                                                         |               |                                                                                                              |
| Mains current > 16 A: with mains choke or mains filter, with dimensioning for rated power. Rsce ≥ 120 is to be met. | EN 61000-3-12 | RSCE: short-circuit power ratio at the connection point of the machine/plant to the public network.          |
| Noise emission                                                                                                      |               |                                                                                                              |
| Category C2                                                                                                         | EN 61800-3    | Type-dependent, for motor cable lengths see rated data                                                       |
| Noise immunity                                                                                                      |               |                                                                                                              |
| Meets requirement in compliance with                                                                                | EN 61800-3    |                                                                                                              |

# Technical data

Standards and operating conditions  
Motor connection



## Motor connection

| Requirements to the shielded motor cable |    |                                                        |
|------------------------------------------|----|--------------------------------------------------------|
| Capacitance per unit length              | UL |                                                        |
| C-core-core/C-core-shield < 75/150 pF/m  |    | ≤ 2.5 mm <sup>2</sup> / AWG 14                         |
| C-core-core/C-core-shield < 150/300 pF/m |    | ≥ 4 mm <sup>2</sup> / AWG 12                           |
| Electric strength                        |    |                                                        |
| U <sub>0</sub> /U = 0.6/1.0 kV           |    | U = r.m.s. value external conductor/external conductor |
|                                          |    | U <sub>0</sub> = r.m.s. value external conductor to PE |
| U ≥ 600 V                                |    | U = r.m.s. value external conductor/external conductor |

## Environmental conditions

| Energy efficiency                  |                    |                                                                                                         |
|------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------|
| Class IE2                          | EN 50598-2         | Reference: Lenze setting (switching frequency 8 kHz variable)                                           |
| Climate                            |                    |                                                                                                         |
| 1K3 (-25 ... +60 °C)               | EN 60721-3-1       | Storage                                                                                                 |
| 2K3 (-25 ... +70 °C)               | EN 60721-3-2       | Transport                                                                                               |
| 3K3 (-10 ... +55 °C)               | EN 60721-3-3       | operation                                                                                               |
|                                    |                    | Operation at a switching frequency of 2 or 4 kHz: above +45°C, reduce rated output current by 2.5 %/°C  |
|                                    |                    | Operation at a switching frequency of 8 or 16 kHz: above +40°C, reduce rated output current by 2.5 %/°C |
| Site altitude                      |                    |                                                                                                         |
| 0 ... 1000 m a.m.s.l.              |                    |                                                                                                         |
| 1000 ... 4000 m a.m.s.l.           |                    | Reduce rated output current by 5 %/1000 m                                                               |
| Pollution                          |                    |                                                                                                         |
| Degree of pollution 2              | EN 61800-5-1       |                                                                                                         |
| Vibration resistance               |                    |                                                                                                         |
| Transport                          |                    |                                                                                                         |
| 2M2 (sine, shock)                  | EN 60721-3-2       |                                                                                                         |
| operation                          |                    |                                                                                                         |
| Amplitude 1 mm                     | Germanischer Lloyd | 5 ... 13.2 Hz                                                                                           |
| Acceleration resistant up to 0.7 g |                    | 13.2 ... 100 Hz                                                                                         |
| Amplitude 0.075 mm                 | EN 61800-5-1       | 10 ... 57 Hz                                                                                            |
| Acceleration resistant up to 1 g   |                    | 57 ... 150 Hz                                                                                           |

## Electrical supply conditions

The connection to different supply forms enables a worldwide application of the inverters.

The following is supported:

- [1-phase mains connection 230/240 V](#) 35
- [1/3-phase mains connection 230/240 V](#) 39
- [3-phase mains connection 400 V](#) 44
- [3-phase mains connection 480 V](#) 48

| Permissible mains systems |  |                                                     |
|---------------------------|--|-----------------------------------------------------|
| TT                        |  | Voltage to earth/ground: max. 300 V                 |
| TN                        |  |                                                     |
| IT                        |  | Apply the measures described for IT systems!        |
|                           |  | IT systems are not relevant for UL-approved systems |



## 1-phase mains connection 230/240 V

### Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

| Inverter                                     |           | i510-C0.25/230-1                           | i510-C0.37/230-1 | i510-C0.55/230-1 | i510-C0.75/230-1 |
|----------------------------------------------|-----------|--------------------------------------------|------------------|------------------|------------------|
| <b>Rated power</b>                           | <b>kW</b> | <b>0.25</b>                                | <b>0.37</b>      | <b>0.55</b>      | <b>0.75</b>      |
| Mains voltage range                          |           | 1/N/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz |                  |                  |                  |
| Rated mains current                          |           |                                            |                  |                  |                  |
| without mains choke                          | A         | 4                                          | 5.7              | 7.6              | 10               |
| with mains choke                             | A         | 3.6                                        | 4.8              | 7.1              | 8.8              |
| Apparent output power                        | kVA       | 0.6                                        | 0.9              | 1.2              | 1.6              |
| Output current                               |           |                                            |                  |                  |                  |
| 2 kHz                                        | A         | -                                          | -                | 3.2              | 4.2              |
| 4 kHz                                        | A         | 1.7                                        | 2.4              | 3.2              | 4.2              |
| 8 kHz                                        | A         | 1.7                                        | 2.4              | 3.2              | 4.2              |
| 16 kHz                                       | A         | 1.1                                        | 1.6              | 2.1              | 2.8              |
| Power loss                                   |           |                                            |                  |                  |                  |
| 4 kHz                                        | W         | 15                                         | 18               | 23               | 29               |
| 8 kHz                                        | W         | 15                                         | 20               | 25               | 33               |
| at controller inhibit                        | W         | 6                                          | 6                | 6                | 6                |
| Overcurrent cycle 180 s                      |           |                                            |                  |                  |                  |
| Max. output current                          | A         | 2.6                                        | 3.6              | 4.8              | 6.3              |
| Overload time                                | s         | 60                                         | 60               | 60               | 60               |
| Recovery time                                | s         | 120                                        | 120              | 120              | 120              |
| Max. output current during the recovery time | A         | 1.3                                        | 1.8              | 2.4              | 3.2              |
| Overcurrent cycle 15 s                       |           |                                            |                  |                  |                  |
| Max. output current                          | A         | 3.4                                        | 4.8              | 6.4              | 8.4              |
| Overload time                                | s         | 3                                          | 3                | 3                | 3                |
| Recovery time                                | s         | 12                                         | 12               | 12               | 12               |
| Max. output current during the recovery time | A         | 1.3                                        | 1.8              | 2.4              | 3.2              |
| Max. motor cable length shielded             |           |                                            |                  |                  |                  |
| without EMC category                         | m         | 50                                         |                  |                  |                  |
| Category C2                                  | m         | 15                                         |                  | 20               |                  |
| Weight                                       | kg        | 0.75                                       |                  | 0.95             |                  |

# Technical data

1-phase mains connection 230/240 V

Rated data



| Inverter                                     |     | i510-C1.1/230-1                            | i510-C1.5/230-1 | i510-C2.2/230-1 |
|----------------------------------------------|-----|--------------------------------------------|-----------------|-----------------|
| Rated power                                  | kW  | 1.1                                        | 1.5             | 2.2             |
| Mains voltage range                          |     | 1/N/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz |                 |                 |
| Rated mains current                          |     |                                            |                 |                 |
| without mains choke                          | A   | 14.3                                       | 16.7            | 22.5            |
| with mains choke                             | A   | 11.9                                       | 13.9            | 16.9            |
| Apparent output power                        | kVA | 2.2                                        | 2.6             | 3.6             |
| Output current                               |     |                                            |                 |                 |
| 2 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 4 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 8 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 16 kHz                                       | A   | 4                                          | 4.7             | 6.4             |
| Power loss                                   |     |                                            |                 |                 |
| 4 kHz                                        | W   | 37                                         | 43              | 60              |
| 8 kHz                                        | W   | 42                                         | 50              | 70              |
| at controller inhibit                        | W   | 6                                          | 6               | 6               |
| Overcurrent cycle 180 s                      |     |                                            |                 |                 |
| Max. output current                          | A   | 9                                          | 10.5            | 14.4            |
| Overload time                                | s   | 60                                         | 60              | 60              |
| Recovery time                                | s   | 120                                        | 120             | 120             |
| Max. output current during the recovery time | A   | 4.5                                        | 5.3             | 7.2             |
| Overcurrent cycle 15 s                       |     |                                            |                 |                 |
| Max. output current                          | A   | 12                                         | 14              | 19.2            |
| Overload time                                | s   | 3                                          | 3               | 3               |
| Recovery time                                | s   | 12                                         | 12              | 12              |
| Max. output current during the recovery time | A   | 4.5                                        | 5.3             | 7.2             |
| Max. motor cable length shielded             |     |                                            |                 |                 |
| without EMC category                         | m   | 50                                         |                 |                 |
| Category C2                                  | m   | 20                                         |                 |                 |
| Weight                                       | kg  | 1.35                                       |                 |                 |



# Technical data

## 1-phase mains connection 230/240 V

### Fusing and terminal data

#### Fusing and terminal data

| Inverter                              |                 | i510-C0.25/230-1         | i510-C0.37/230-1 | i510-C0.55/230-1 | i510-C0.75/230-1 |
|---------------------------------------|-----------------|--------------------------|------------------|------------------|------------------|
| Cable installation in compliance with |                 | EN 60204-1               |                  |                  |                  |
| Laying system                         |                 | B2                       |                  |                  |                  |
| operation                             |                 | without mains choke      |                  |                  |                  |
| Fuse                                  |                 |                          |                  |                  |                  |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Circuit breaker                       |                 |                          |                  |                  |                  |
| Characteristics                       |                 | B                        |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| operation                             |                 | with mains choke         |                  |                  |                  |
| Fuse                                  |                 |                          |                  |                  |                  |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Circuit breaker                       |                 |                          |                  |                  |                  |
| Characteristics                       |                 | B                        |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Earth-leakage circuit breaker         |                 |                          |                  |                  |                  |
| 1-phase mains connection              |                 | ≥ 30 mA, type A or B     |                  |                  |                  |
| Mains connection                      |                 |                          |                  |                  |                  |
| Connection                            |                 | X100                     |                  |                  |                  |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                  |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                  |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                  |
| Stripping length                      | mm              | 8                        |                  |                  |                  |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                  |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                  |
| Motor connection                      |                 |                          |                  |                  |                  |
| Connection                            |                 | X105                     |                  |                  |                  |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                  |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                  |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                  |
| Stripping length                      | mm              | 8                        |                  |                  |                  |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                  |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                  |

# Technical data

1-phase mains connection 230/240 V  
Fusing and terminal data



| Inverter                              |                 | i510-C1.1/230-1          | i510-C1.5/230-1 | i510-C2.2/230-1 |
|---------------------------------------|-----------------|--------------------------|-----------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                 |                 |
| Laying system                         |                 | B2                       |                 |                 |
| operation                             |                 | without mains choke      |                 |                 |
| Fuse                                  |                 |                          |                 |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Circuit breaker                       |                 |                          |                 |                 |
| Characteristics                       |                 | B                        |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| operation                             |                 | with mains choke         |                 |                 |
| Fuse                                  |                 |                          |                 |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Circuit breaker                       |                 |                          |                 |                 |
| Characteristics                       |                 | B                        |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Earth-leakage circuit breaker         |                 |                          |                 |                 |
| 1-phase mains connection              |                 | ≥ 30 mA, type A or B     |                 |                 |
| Mains connection                      |                 |                          |                 |                 |
| Connection                            |                 | X100                     |                 |                 |
| Connection type                       |                 | pluggable screw terminal |                 |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 6                        |                 |                 |
| Stripping length                      | mm              | 8                        |                 |                 |
| Tightening torque                     | Nm              | 0.7                      |                 |                 |
| Required tool                         |                 | 0.6 x 3.5                |                 |                 |
| Motor connection                      |                 |                          |                 |                 |
| Connection                            |                 | X105                     |                 |                 |
| Connection type                       |                 | pluggable screw terminal |                 |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |                 |
| Stripping length                      | mm              | 8                        |                 |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |                 |



## Technical data

1/3-phase mains connection 230/240 V  
Fusing and terminal data

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### 1/3-phase mains connection 230/240 V



EMC filters are **not integrated** in inverters for this mains connection.

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# Technical data

1/3-phase mains connection 230/240 V

Rated data



## Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

| Inverter                                     |           | i510-C0.25/230-2                           | i510-C0.37/230-2 | i510-C0.55/230-2 | i510-C0.75/230-2 |
|----------------------------------------------|-----------|--------------------------------------------|------------------|------------------|------------------|
| <b>Rated power</b>                           | <b>kW</b> | <b>0.25</b>                                | <b>0.37</b>      | <b>0.55</b>      | <b>0.75</b>      |
| Mains voltage range                          |           | 1/N/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz |                  |                  |                  |
| Rated mains current                          |           |                                            |                  |                  |                  |
| without mains choke                          | A         | 4                                          | 5.7              | 7.6              | 10               |
| with mains choke                             | A         | 3.6                                        | 4.8              | 7.1              | 8.8              |
| Mains voltage range                          |           | 3/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz   |                  |                  |                  |
| Rated mains current                          |           |                                            |                  |                  |                  |
| without mains choke                          | A         | 2.6                                        | 3.9              | 4.8              | 6.4              |
| with mains choke                             | A         | 2                                          | 3                | 3.8              | 5.1              |
| Apparent output power                        | kVA       | 0.6                                        | 0.9              | 1.2              | 1.6              |
| Output current                               |           |                                            |                  |                  |                  |
| 2 kHz                                        | A         | -                                          | -                | 3.2              | 4.2              |
| 4 kHz                                        | A         | 1.7                                        | 2.4              | 3.2              | 4.2              |
| 8 kHz                                        | A         | 1.7                                        | 2.4              | 3.2              | 4.2              |
| 16 kHz                                       | A         | 1.1                                        | 1.6              | 2.1              | 2.8              |
| Power loss                                   |           |                                            |                  |                  |                  |
| 4 kHz                                        | W         | 15                                         | 18               | 23               | 29               |
| 8 kHz                                        | W         | 15                                         | 20               | 25               | 33               |
| at controller inhibit                        | W         | 6                                          | 6                | 6                | 6                |
| Overcurrent cycle 180 s                      |           |                                            |                  |                  |                  |
| Max. output current                          | A         | 2.6                                        | 3.6              | 4.8              | 6.3              |
| Overload time                                | s         | 60                                         | 60               | 60               | 60               |
| Recovery time                                | s         | 120                                        | 120              | 120              | 120              |
| Max. output current during the recovery time | A         | 1.3                                        | 1.8              | 2.4              | 3.2              |
| Overcurrent cycle 15 s                       |           |                                            |                  |                  |                  |
| Max. output current                          | A         | 3.4                                        | 4.8              | 6.4              | 8.4              |
| Overload time                                | s         | 3                                          | 3                | 3                | 3                |
| Recovery time                                | s         | 12                                         | 12               | 12               | 12               |
| Max. output current during the recovery time | A         | 1.3                                        | 1.8              | 2.4              | 3.2              |
| Max. motor cable length shielded             |           |                                            |                  |                  |                  |
| without EMC category                         | m         | 50                                         |                  |                  |                  |
| Weight                                       | kg        | 0.75                                       |                  | 0.95             |                  |





# Technical data

1/3-phase mains connection 230/240 V  
Rated data

| Inverter                                     |     | i510-C1.1/230-2                            | i510-C1.5/230-2 | i510-C2.2/230-2 |
|----------------------------------------------|-----|--------------------------------------------|-----------------|-----------------|
| Rated power                                  | kW  | 1.1                                        | 1.5             | 2.2             |
| Mains voltage range                          |     | 1/N/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz |                 |                 |
| Rated mains current                          |     |                                            |                 |                 |
| without mains choke                          | A   | 14.3                                       | 16.7            | 22.5            |
| with mains choke                             | A   | 11.9                                       | 13.9            | 16.9            |
| Mains voltage range                          |     | 3/PE AC 170 V ... 264 V, 45 Hz ... 65 Hz   |                 |                 |
| Rated mains current                          |     |                                            |                 |                 |
| without mains choke                          | A   | 7.8                                        | 9.5             | 13.6            |
| with mains choke                             | A   | 5.6                                        | 6.8             | 9.8             |
| Apparent output power                        | kVA | 2.2                                        | 2.6             | 3.6             |
| Output current                               |     |                                            |                 |                 |
| 2 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 4 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 8 kHz                                        | A   | 6                                          | 7               | 9.6             |
| 16 kHz                                       | A   | 4                                          | 4.7             | 6.4             |
| Power loss                                   |     |                                            |                 |                 |
| 4 kHz                                        | W   | 37                                         | 43              | 60              |
| 8 kHz                                        | W   | 42                                         | 50              | 70              |
| at controller inhibit                        | W   | 6                                          | 6               | 6               |
| Overcurrent cycle 180 s                      |     |                                            |                 |                 |
| Max. output current                          | A   | 9                                          | 10.5            | 14.4            |
| Overload time                                | s   | 60                                         | 60              | 60              |
| Recovery time                                | s   | 120                                        | 120             | 120             |
| Max. output current during the recovery time | A   | 4.5                                        | 5.3             | 7.2             |
| Overcurrent cycle 15 s                       |     |                                            |                 |                 |
| Max. output current                          | A   | 12                                         | 14              | 19.2            |
| Overload time                                | s   | 3                                          | 3               | 3               |
| Recovery time                                | s   | 12                                         | 12              | 12              |
| Max. output current during the recovery time | A   | 4.5                                        | 5.3             | 7.2             |
| Max. motor cable length shielded             |     |                                            |                 |                 |
| without EMC category                         | m   | 50                                         |                 |                 |
| Weight                                       | kg  | 1.35                                       |                 |                 |

# Technical data

1/3-phase mains connection 230/240 V

Fusing and terminal data



## Fusing and terminal data

| Inverter                              |                 | i510-C0.25/230-2         | i510-C0.37/230-2 | i510-C0.55/230-2 | i510-C0.75/230-2 |
|---------------------------------------|-----------------|--------------------------|------------------|------------------|------------------|
| Cable installation in compliance with |                 | EN 60204-1               |                  |                  |                  |
| Laying system                         |                 | B2                       |                  |                  |                  |
| operation                             |                 | without mains choke      |                  |                  |                  |
| Fuse                                  |                 |                          |                  |                  |                  |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Circuit breaker                       |                 |                          |                  |                  |                  |
| Characteristics                       |                 | B                        |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| operation                             |                 | with mains choke         |                  |                  |                  |
| Fuse                                  |                 |                          |                  |                  |                  |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Circuit breaker                       |                 |                          |                  |                  |                  |
| Characteristics                       |                 | B                        |                  |                  |                  |
| Max. rated current                    | A               | 10                       | 10               | 16               | 16               |
| Earth-leakage circuit breaker         |                 |                          |                  |                  |                  |
| 1-phase mains connection              |                 | ≥ 30 mA, type A or B     |                  |                  |                  |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                  |                  |                  |
| Mains connection                      |                 |                          |                  |                  |                  |
| Connection                            |                 | X100                     |                  |                  |                  |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                  |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                  |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                  |
| Stripping length                      | mm              | 8                        |                  |                  |                  |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                  |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                  |
| Motor connection                      |                 |                          |                  |                  |                  |
| Connection                            |                 | X105                     |                  |                  |                  |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                  |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                  |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                  |
| Stripping length                      | mm              | 8                        |                  |                  |                  |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                  |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                  |



# Technical data

## 1/3-phase mains connection 230/240 V

### Fusing and terminal data

| Inverter                              |                 | i510-C1.1/230-2          | i510-C1.5/230-2 | i510-C2.2/230-2 |
|---------------------------------------|-----------------|--------------------------|-----------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                 |                 |
| Laying system                         |                 | B2                       |                 |                 |
| operation                             |                 | without mains choke      |                 |                 |
| Fuse                                  |                 |                          |                 |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Circuit breaker                       |                 |                          |                 |                 |
| Characteristics                       |                 | B                        |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| operation                             |                 | with mains choke         |                 |                 |
| Fuse                                  |                 |                          |                 |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Circuit breaker                       |                 |                          |                 |                 |
| Characteristics                       |                 | B                        |                 |                 |
| Max. rated current                    | A               | 25                       | 25              | 25              |
| Earth-leakage circuit breaker         |                 |                          |                 |                 |
| 1-phase mains connection              |                 | ≥ 30 mA, type A or B     |                 |                 |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                 |                 |
| Mains connection                      |                 |                          |                 |                 |
| Connection                            |                 | X100                     |                 |                 |
| Connection type                       |                 | pluggable screw terminal |                 |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 6                        |                 |                 |
| Stripping length                      | mm              | 8                        |                 |                 |
| Tightening torque                     | Nm              | 0.7                      |                 |                 |
| Required tool                         |                 | 0.6 x 3.5                |                 |                 |
| Motor connection                      |                 |                          |                 |                 |
| Connection                            |                 | X105                     |                 |                 |
| Connection type                       |                 | pluggable screw terminal |                 |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |                 |
| Stripping length                      | mm              | 8                        |                 |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |                 |

# Technical data

3-phase mains connection 400 V

Rated data



## 3-phase mains connection 400 V

### Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

| Inverter                                     |           | i510-C0.37/400-3                         | i510-C0.55/400-3 | i510-C0.75/400-3 | i510-C1.1/400-3 |
|----------------------------------------------|-----------|------------------------------------------|------------------|------------------|-----------------|
| <b>Rated power</b>                           | <b>kW</b> | <b>0.37</b>                              | <b>0.55</b>      | <b>0.75</b>      | <b>1.1</b>      |
| Mains voltage range                          |           | 3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz |                  |                  |                 |
| Rated mains current                          |           |                                          |                  |                  |                 |
| without mains choke                          | A         | 1.8                                      | 2.5              | 3.3              | 4.4             |
| with mains choke                             | A         | 1.4                                      | 2                | 2.6              | 3               |
| Apparent output power                        | kVA       | 0.9                                      | 1.2              | 1.6              | 2.2             |
| Output current                               |           |                                          |                  |                  |                 |
| 2 kHz                                        | A         | -                                        | 1.8              | 2.4              | 3.2             |
| 4 kHz                                        | A         | 1.3                                      | 1.8              | 2.4              | 3.2             |
| 8 kHz                                        | A         | 1.3                                      | 1.8              | 2.4              | 3.2             |
| 16 kHz                                       | A         | 0.9                                      | 1.2              | 1.6              | 2.1             |
| Power loss                                   |           |                                          |                  |                  |                 |
| 4 kHz                                        | W         | 20                                       | 25               | 32               | 40              |
| 8 kHz                                        | W         | 24                                       | 31               | 40               | 51              |
| at controller inhibit                        | W         | 6                                        | 6                | 6                | 6               |
| Overcurrent cycle 180 s                      |           |                                          |                  |                  |                 |
| Max. output current                          | A         | 2                                        | 2.7              | 3.6              | 4.8             |
| Overload time                                | s         | 60                                       | 60               | 60               | 60              |
| Recovery time                                | s         | 120                                      | 120              | 120              | 120             |
| Max. output current during the recovery time | A         | 1                                        | 1.4              | 1.8              | 2.4             |
| Overcurrent cycle 15 s                       |           |                                          |                  |                  |                 |
| Max. output current                          | A         | 2.6                                      | 3.6              | 4.8              | 6.4             |
| Overload time                                | s         | 3                                        | 3                | 3                | 3               |
| Recovery time                                | s         | 12                                       | 12               | 12               | 12              |
| Max. output current during the recovery time | A         | 1                                        | 1.4              | 1.8              | 2.4             |
| Max. motor cable length shielded             |           |                                          |                  |                  |                 |
| without EMC category                         | m         | 15                                       | 50               |                  |                 |
| Category C2                                  | m         | 15                                       |                  |                  | 20              |
| Weight                                       | kg        | 0.75                                     | 0.95             |                  | 1.35            |



# Technical data

3-phase mains connection 400 V  
Rated data

| Inverter                                     |     | i510-C1.5/400-3                          | i510-C2.2/400-3 |
|----------------------------------------------|-----|------------------------------------------|-----------------|
| Rated power                                  | kW  | 1.5                                      | 2.2             |
| Mains voltage range                          |     | 3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz |                 |
| Rated mains current                          |     |                                          |                 |
| without mains choke                          | A   | 5.4                                      | 7.8             |
| with mains choke                             | A   | 3.7                                      | 5.3             |
| Apparent output power                        | kVA | 2.6                                      | 3.6             |
| Output current                               |     |                                          |                 |
| 2 kHz                                        | A   | 3.9                                      | 5.6             |
| 4 kHz                                        | A   | 3.9                                      | 5.6             |
| 8 kHz                                        | A   | 3.9                                      | 5.6             |
| 16 kHz                                       | A   | 2.6                                      | 3.7             |
| Power loss                                   |     |                                          |                 |
| 4 kHz                                        | W   | 48                                       | 66              |
| 8 kHz                                        | W   | 61                                       | 85              |
| at controller inhibit                        | W   | 6                                        | 6               |
| Overcurrent cycle 180 s                      |     |                                          |                 |
| Max. output current                          | A   | 5.9                                      | 8.4             |
| Overload time                                | s   | 60                                       | 60              |
| Recovery time                                | s   | 120                                      | 120             |
| Max. output current during the recovery time | A   | 2.9                                      | 4.2             |
| Overcurrent cycle 15 s                       |     |                                          |                 |
| Max. output current                          | A   | 7.8                                      | 11.2            |
| Overload time                                | s   | 3                                        | 3               |
| Recovery time                                | s   | 12                                       | 12              |
| Max. output current during the recovery time | A   | 2.9                                      | 4.2             |
| Max. motor cable length shielded             |     |                                          |                 |
| without EMC category                         | m   | 50                                       |                 |
| Category C2                                  | m   | 20                                       |                 |
| Weight                                       | kg  | 1.35                                     |                 |

# Technical data

3-phase mains connection 400 V

Fusing and terminal data



## Fusing and terminal data

| Inverter                              |                 | i510-C0.37/400-3         | i510-C0.55/400-3 | i510-C0.75/400-3 | i510-C1.1/400-3 |
|---------------------------------------|-----------------|--------------------------|------------------|------------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                  |                  |                 |
| Laying system                         |                 | B2                       |                  |                  |                 |
| operation                             |                 | without mains choke      |                  |                  |                 |
| Fuse                                  |                 |                          |                  |                  |                 |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Circuit breaker                       |                 |                          |                  |                  |                 |
| Characteristics                       |                 | B                        |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| operation                             |                 | with mains choke         |                  |                  |                 |
| Fuse                                  |                 |                          |                  |                  |                 |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Circuit breaker                       |                 |                          |                  |                  |                 |
| Characteristics                       |                 | B                        |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Earth-leakage circuit breaker         |                 |                          |                  |                  |                 |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                  |                  |                 |
| Mains connection                      |                 |                          |                  |                  |                 |
| Connection                            |                 | X100                     |                  |                  |                 |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                 |
| Stripping length                      | mm              | 8                        |                  |                  |                 |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                 |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                 |
| Motor connection                      |                 |                          |                  |                  |                 |
| Connection                            |                 | X105                     |                  |                  |                 |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                 |
| Stripping length                      | mm              | 8                        |                  |                  |                 |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                 |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                 |



# Technical data

## 3-phase mains connection 400 V

### Fusing and terminal data

| Inverter                              |                 | i510-C1.5/400-3          | i510-C2.2/400-3 |
|---------------------------------------|-----------------|--------------------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                 |
| Laying system                         |                 | B2                       |                 |
| operation                             |                 | without mains choke      |                 |
| Fuse                                  |                 |                          |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Circuit breaker                       |                 |                          |                 |
| Characteristics                       |                 | B                        |                 |
| Max. rated current                    | A               | 16                       | 16              |
| operation                             |                 | with mains choke         |                 |
| Fuse                                  |                 |                          |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Circuit breaker                       |                 |                          |                 |
| Characteristics                       |                 | B                        |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Earth-leakage circuit breaker         |                 |                          |                 |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                 |
| Mains connection                      |                 |                          |                 |
| Connection                            |                 | X100                     |                 |
| Connection type                       |                 | pluggable screw terminal |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |
| Stripping length                      | mm              | 8                        |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |
| Motor connection                      |                 |                          |                 |
| Connection                            |                 | X105                     |                 |
| Connection type                       |                 | pluggable screw terminal |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |
| Stripping length                      | mm              | 8                        |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |

# Technical data

3-phase mains connection 480 V

Rated data



## 3-phase mains connection 480 V

### Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

| Inverter                                     |           | i510-C0.37/400-3                         | i510-C0.55/400-3 | i510-C0.75/400-3 | i510-C1.1/400-3 |
|----------------------------------------------|-----------|------------------------------------------|------------------|------------------|-----------------|
| <b>Rated power</b>                           | <b>kW</b> | <b>0.37</b>                              | <b>0.55</b>      | <b>0.75</b>      | <b>1.1</b>      |
| Mains voltage range                          |           | 3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz |                  |                  |                 |
| Rated mains current                          |           |                                          |                  |                  |                 |
| without mains choke                          | A         | 1.5                                      | 2.1              | 2.8              | 3.7             |
| with mains choke                             | A         | 1.2                                      | 1.7              | 2.2              | 2.5             |
| Apparent output power                        | kVA       | 0.9                                      | 1.2              | 1.6              | 2.2             |
| Output current                               |           |                                          |                  |                  |                 |
| 2 kHz                                        | A         | -                                        | 1.6              | 2.1              | 3               |
| 4 kHz                                        | A         | 1.1                                      | 1.6              | 2.1              | 3               |
| 8 kHz                                        | A         | 1.1                                      | 1.6              | 2.1              | 3               |
| 16 kHz                                       | A         | 0.7                                      | 1.1              | 1.4              | 2               |
| Power loss                                   |           |                                          |                  |                  |                 |
| 4 kHz                                        | W         | 20                                       | 25               | 32               | 40              |
| 8 kHz                                        | W         | 24                                       | 31               | 40               | 51              |
| at controller inhibit                        | W         | 6                                        | 6                | 6                | 6               |
| Overcurrent cycle 180 s                      |           |                                          |                  |                  |                 |
| Max. output current                          | A         | 1.7                                      | 2.4              | 3.2              | 4.5             |
| Overload time                                | s         | 60                                       | 60               | 60               | 60              |
| Recovery time                                | s         | 120                                      | 120              | 120              | 120             |
| Max. output current during the recovery time | A         | 0.8                                      | 1.2              | 1.6              | 2.3             |
| Overcurrent cycle 15 s                       |           |                                          |                  |                  |                 |
| Max. output current                          | A         | 2.2                                      | 3.2              | 4.2              | 6               |
| Overload time                                | s         | 3                                        | 3                | 3                | 3               |
| Recovery time                                | s         | 12                                       | 12               | 12               | 12              |
| Max. output current during the recovery time | A         | 0.8                                      | 1.2              | 1.6              | 2.3             |
| Max. motor cable length shielded             |           |                                          |                  |                  |                 |
| without EMC category                         | m         | 15                                       | 50               |                  |                 |
| Category C2                                  | m         | 15                                       |                  |                  | 20              |
| Weight                                       | kg        | 0.75                                     | 0.95             |                  | 1.35            |





## Technical data

3-phase mains connection 480 V  
Rated data

| Inverter                                     |     | i510-C1.5/400-3                          | i510-C2.2/400-3 |
|----------------------------------------------|-----|------------------------------------------|-----------------|
| Rated power                                  | kW  | 1.5                                      | 2.2             |
| Mains voltage range                          |     | 3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz |                 |
| Rated mains current                          |     |                                          |                 |
| without mains choke                          | A   | 4.5                                      | 6.5             |
| with mains choke                             | A   | 3.1                                      | 4.4             |
| Apparent output power                        | kVA | 2.6                                      | 3.6             |
| Output current                               |     |                                          |                 |
| 2 kHz                                        | A   | 3.5                                      | 4.8             |
| 4 kHz                                        | A   | 3.5                                      | 4.8             |
| 8 kHz                                        | A   | 3.5                                      | 4.8             |
| 16 kHz                                       | A   | 2.3                                      | 3.2             |
| Power loss                                   |     |                                          |                 |
| 4 kHz                                        | W   | 48                                       | 66              |
| 8 kHz                                        | W   | 61                                       | 85              |
| at controller inhibit                        | W   | 6                                        | 6               |
| Overcurrent cycle 180 s                      |     |                                          |                 |
| Max. output current                          | A   | 5.3                                      | 7.2             |
| Overload time                                | s   | 60                                       | 60              |
| Recovery time                                | s   | 120                                      | 120             |
| Max. output current during the recovery time | A   | 2.6                                      | 3.6             |
| Overcurrent cycle 15 s                       |     |                                          |                 |
| Max. output current                          | A   | 7                                        | 9.6             |
| Overload time                                | s   | 3                                        | 3               |
| Recovery time                                | s   | 12                                       | 12              |
| Max. output current during the recovery time | A   | 2.6                                      | 3.6             |
| Max. motor cable length shielded             |     |                                          |                 |
| without EMC category                         | m   | 50                                       |                 |
| Category C2                                  | m   | 20                                       |                 |
| Weight                                       | kg  | 1.35                                     |                 |

# Technical data

3-phase mains connection 480 V

Fusing and terminal data



## Fusing and terminal data

| Inverter                              |                 | i510-C0.37/400-3         | i510-C0.55/400-3 | i510-C0.75/400-3 | i510-C1.1/400-3 |
|---------------------------------------|-----------------|--------------------------|------------------|------------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                  |                  |                 |
| Laying system                         |                 | B2                       |                  |                  |                 |
| operation                             |                 | without mains choke      |                  |                  |                 |
| Fuse                                  |                 |                          |                  |                  |                 |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Circuit breaker                       |                 |                          |                  |                  |                 |
| Characteristics                       |                 | B                        |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| operation                             |                 | with mains choke         |                  |                  |                 |
| Fuse                                  |                 |                          |                  |                  |                 |
| Characteristics                       |                 | gG/gL or gRL             |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Circuit breaker                       |                 |                          |                  |                  |                 |
| Characteristics                       |                 | B                        |                  |                  |                 |
| Max. rated current                    | A               | 10                       | 10               | 10               | 16              |
| Earth-leakage circuit breaker         |                 |                          |                  |                  |                 |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                  |                  |                 |
| Mains connection                      |                 |                          |                  |                  |                 |
| Connection                            |                 | X100                     |                  |                  |                 |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                 |
| Stripping length                      | mm              | 8                        |                  |                  |                 |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                 |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                 |
| Motor connection                      |                 |                          |                  |                  |                 |
| Connection                            |                 | X105                     |                  |                  |                 |
| Connection type                       |                 | pluggable screw terminal |                  |                  |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                  |                  |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                  |                  |                 |
| Stripping length                      | mm              | 8                        |                  |                  |                 |
| Tightening torque                     | Nm              | 0.5                      |                  |                  |                 |
| Required tool                         |                 | 0.5 x 3.0                |                  |                  |                 |



# Technical data

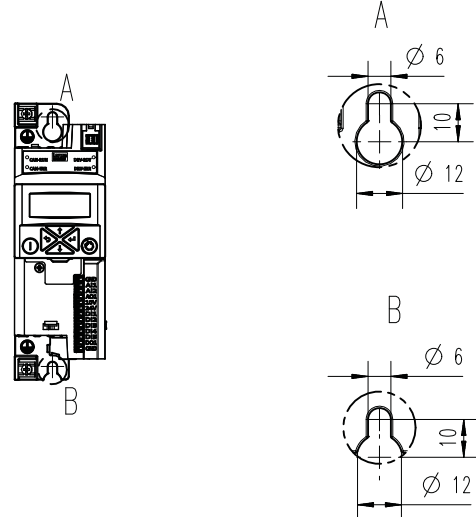
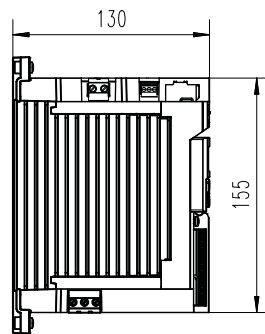
## 3-phase mains connection 480 V

### Fusing and terminal data

| Inverter                              |                 | i510-C1.5/400-3          | i510-C2.2/400-3 |
|---------------------------------------|-----------------|--------------------------|-----------------|
| Cable installation in compliance with |                 | EN 60204-1               |                 |
| Laying system                         |                 | B2                       |                 |
| operation                             |                 | without mains choke      |                 |
| Fuse                                  |                 |                          |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Circuit breaker                       |                 |                          |                 |
| Characteristics                       |                 | B                        |                 |
| Max. rated current                    | A               | 16                       | 16              |
| operation                             |                 | with mains choke         |                 |
| Fuse                                  |                 |                          |                 |
| Characteristics                       |                 | gG/gL or gRL             |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Circuit breaker                       |                 |                          |                 |
| Characteristics                       |                 | B                        |                 |
| Max. rated current                    | A               | 16                       | 16              |
| Earth-leakage circuit breaker         |                 |                          |                 |
| 3-phase mains connection              |                 | ≥ 30 mA, type B          |                 |
| Mains connection                      |                 |                          |                 |
| Connection                            |                 | X100                     |                 |
| Connection type                       |                 | pluggable screw terminal |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |
| Stripping length                      | mm              | 8                        |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |
| Motor connection                      |                 |                          |                 |
| Connection                            |                 | X105                     |                 |
| Connection type                       |                 | pluggable screw terminal |                 |
| Min. cable cross-section              | mm <sup>2</sup> | 1                        |                 |
| Max. cable cross-section              | mm <sup>2</sup> | 2.5                      |                 |
| Stripping length                      | mm              | 8                        |                 |
| Tightening torque                     | Nm              | 0.5                      |                 |
| Required tool                         |                 | 0.5 x 3.0                |                 |

Dimensions  
0.25 kW ... 0.37 kW

Dimensions  
0.25 kW ... 0.37 kW





# Technical data

Dimensions  
0.55 kW ... 0.75 kW

## 0.55 kW ... 0.75 kW

The dimensions in mm apply to:

0.55 kW

i510-C0.55/230-1

i510-C0.55/230-2

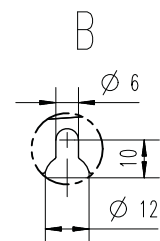
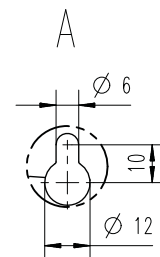
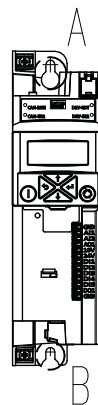
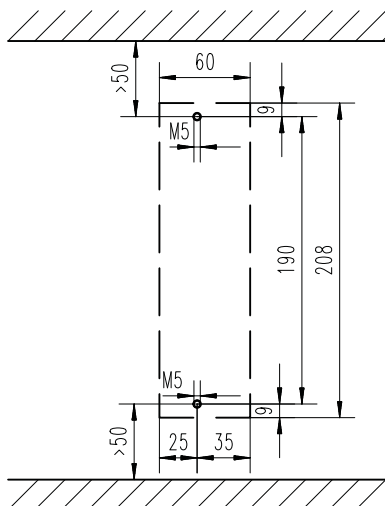
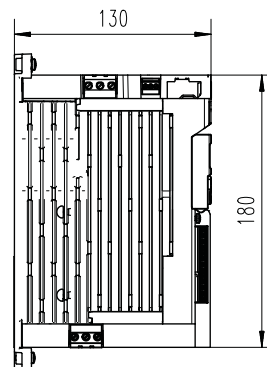
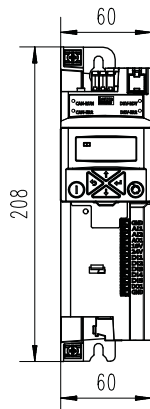
i510-C0.55/400-3

0.75 kW

i510-C0.75/230-1

i510-C0.75/230-2

i510-C0.75/400-3



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# Technical data

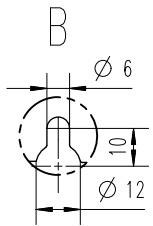
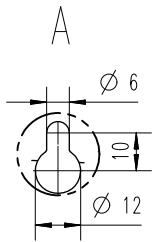
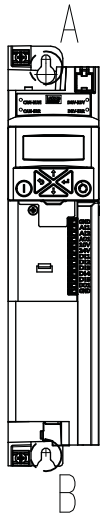
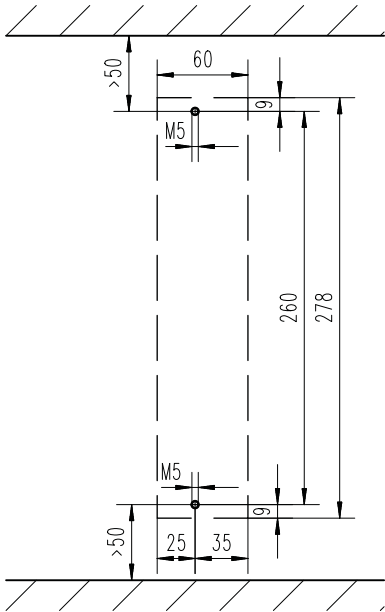
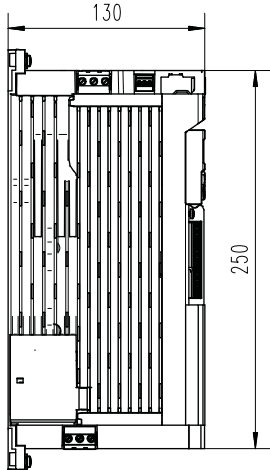
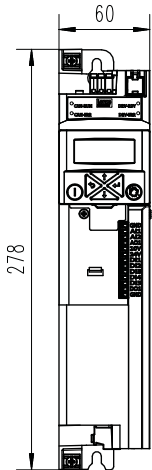
Dimensions  
1.1 kW ... 2.2 kW



## 1.1 kW ... 2.2 kW

The dimensions in mm apply to:

| 1.1 kW          | 1.5 kW          | 2.2 kW          |
|-----------------|-----------------|-----------------|
| i510-C1.1/230-1 | i510-C1.5/230-1 | i510-C2.2/230-1 |
| i510-C1.1/230-2 | i510-C1.5/230-2 | i510-C2.2/230-2 |
| i510-C1.1/400-3 | i510-C1.5/400-3 | i510-C2.2/400-3 |



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## Product extensions

### Overview

The inverters can be easily integrated into the machine. The scalable product extensions serve to flexibly match the required functions to your application.

The integrated standard product extension for the inverter i510 is the control unit with basic I/O.

As the control unit cannot be extended, the inverter i510 is available in two versions:

- With CANopen/Modbus, switchable.
- Without network.

In order to provide a largely uniform documentation, all information and data of the control unit with basic I/O are contained here in the product extension chapter.



Inverter  
without network



Inverter  
with CANopen and Modbus

# Product extensions

I/O extensions  
Basic I/Os

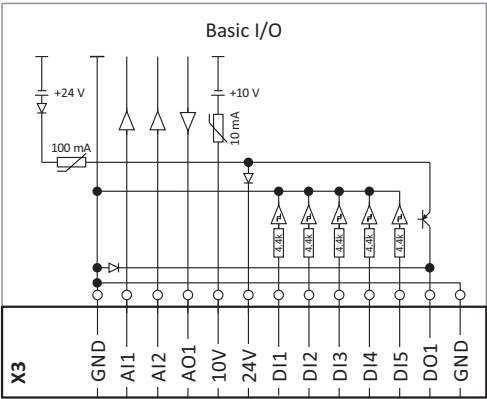


## I/O extensions

### Basic I/Os

The basic I/O provides the inverter analog and digital inputs and outputs and is designed for simple applications.

The basic I/O can be purchased with or without the CANopen and Modbus networks. A switch can be used to select between the two networks.



|                     |                                      |                                                                                                |
|---------------------|--------------------------------------|------------------------------------------------------------------------------------------------|
| Digital inputs      | Terminal X3: DI1, DI2, DI3, DI4, DI5 | HIGH active                                                                                    |
| Digital outputs     | Terminal X3: DO1                     |                                                                                                |
| Analog inputs       | Terminal X3: AI1, AI2                | AI1: Can be optionally used as voltage or current input.<br>AI2: Can be used as voltage input. |
| Analog output       | Terminal X3: AO1                     | Can be optionally used as voltage or current output.                                           |
| 10-V output         | Terminal X3: 10V                     | Reference voltage or setpoint potentiometer                                                    |
| 24-V output         | Terminal X3: 24V                     |                                                                                                |
| Reference potential | Terminal X3: GND                     |                                                                                                |
| Connection system   | Pluggable spring terminal            |                                                                                                |





## Product extensions

I/O extensions  
Data of control connections

### Data of control connections

#### Digital inputs

|                                       |    |       |                                      |
|---------------------------------------|----|-------|--------------------------------------|
| Switching type                        |    | PNP   |                                      |
| PNP switching level                   |    |       |                                      |
| LOW                                   | V  | < +5  | IEC 61131-2, type 1                  |
| HIGH                                  | V  | > +15 |                                      |
| Input resistance                      | kΩ | 4.6   |                                      |
| Cycle time                            | ms | 1     | can be changed by software filtering |
| Electric strength of external voltage | V  | ± 30  |                                      |

|                      |     |                         |                    |
|----------------------|-----|-------------------------|--------------------|
| Encoder input        |     |                         |                    |
| Type                 |     | Incremental HTL encoder |                    |
| Two-track connection |     | X3/DI3<br>X3/DI4        | Track A<br>Track B |
| Frequency range      | kHz | 0 ... 100               |                    |

#### Digital outputs

|                                       |    |                                                                |                               |
|---------------------------------------|----|----------------------------------------------------------------|-------------------------------|
| Switching level                       |    |                                                                |                               |
| LOW                                   | V  | < +5                                                           | IEC 61131-2, type 1           |
| HIGH                                  | V  | > +15                                                          |                               |
| max. output current                   | mA | 100                                                            | Total current for DO1 and 24V |
| Cycle time                            | ms | 1                                                              |                               |
| Short-circuit strength                |    | Unlimited period                                               |                               |
| Electric strength of external voltage | V  | ± 30                                                           |                               |
| Polarity reversal protection          |    | Integrated freewheeling diode for switching the inductive load |                               |
| Overload behaviour                    |    | Reduced voltage or periodic switch-off/on                      |                               |
| Reset or switch-on behaviour          |    | Output is switched off                                         | LOW                           |

#### Analog inputs

|                                       |     |                      |                        |
|---------------------------------------|-----|----------------------|------------------------|
| Cycle time                            | ms  | 1                    |                        |
| Resolution of A/D converter           | Bit | 12                   |                        |
| Operation as voltage input            |     |                      |                        |
| Connection designation                |     | X3/AI1, X3/AI2       |                        |
| Input voltage DC                      | V   | 0 ... 10             |                        |
| Input resistance                      | kΩ  | 70                   |                        |
| Accuracy                              | mV  | ± 50                 | Typical                |
| Input voltage in case of open circuit | V   | - 0.2 ... 0.2        | Display "0"            |
| Electric strength of external voltage | V   | ± 24                 |                        |
| Operation as current input            |     |                      |                        |
| Connection designation                |     | X3/AI1               |                        |
| Input current                         | mA  | 0 ... 20<br>4 ... 20 | open-circuit monitored |
| Accuracy                              | mA  | ± 0.1                | Typical                |
| Input current in case of open circuit | mA  | < 0.1                | Display "0"            |
| Input resistance                      | Ω   | < 250                |                        |
| Electric strength of external voltage | V   | ± 24                 |                        |

# Product extensions

I/O extensions

Data of control connections



## Analog outputs

|                                       |     |                  |                        |
|---------------------------------------|-----|------------------|------------------------|
| Short-circuit strength                |     | Unlimited period |                        |
| Electric strength of external voltage | V   | + 24V            |                        |
| Operation as voltage output           |     |                  |                        |
| Resolution of D/A converter           | Bit | 12               |                        |
| Output voltage DC                     | V   | 0 ... 10         |                        |
| max. output current                   | mA  | 5                |                        |
| Max. capacitive load                  | μF  | 1                |                        |
| Accuracy                              | mV  | ± 100            | Typical                |
| Operation as current output           |     |                  |                        |
| Output current                        | mA  | 0 ... 20         |                        |
|                                       |     | 4 ... 20         | open-circuit monitored |
| Accuracy                              | mA  | ± 0.3            | Typical                |

## 10-V output

|                                       |    |                                                           |  |
|---------------------------------------|----|-----------------------------------------------------------|--|
| Use                                   |    | Primarily for the supply of a potentiometer (1 ... 10 kΩ) |  |
| Output voltage DC                     |    |                                                           |  |
| Typical                               | V  | 10                                                        |  |
| Accuracy                              | mV | ± 100                                                     |  |
| Max. output current                   | mA | 10                                                        |  |
| Max. capacitive load                  | μF | 1                                                         |  |
| Short-circuit strength                |    | Unlimited period                                          |  |
| Electric strength of external voltage | V  | + 24                                                      |  |

## 24-V output

|                                       |    |                                            |                                 |
|---------------------------------------|----|--------------------------------------------|---------------------------------|
| Use                                   |    | Primarily for the supply of digital inputs |                                 |
| Output voltage DC                     |    |                                            |                                 |
| Typical                               | V  | 24                                         |                                 |
| Area                                  | V  | 16 ... 28                                  |                                 |
| max. output current                   | mA | 100                                        | Total current for DO... and 24V |
| Short-circuit strength                |    | Unlimited period                           |                                 |
| Electric strength of external voltage | V  | + 30                                       |                                 |
| Excess current release                |    | Automatically resettable                   |                                 |

| Terminal description     |                 | Control terminals |
|--------------------------|-----------------|-------------------|
| Connection               |                 | X3                |
| Connection type          |                 | Spring terminal   |
| Min. cable cross-section | mm <sup>2</sup> | 0.5               |
| Max. cable cross-section | mm <sup>2</sup> | 1.5               |
| Stripping length         | mm              | 9                 |
| Tightening torque        | Nm              | -                 |
| Required tool            |                 | 0.4 x 2.5         |



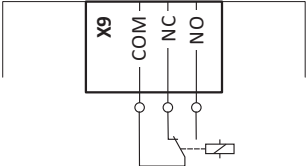
## More control connections

### Relay output



Relay is not suitable for direct switching of a electromechanical holding brake!  
Use a corresponding suppressor circuit in case of an inductive or capacitive load!

|                                     |          |    |                  |                                                                                            |
|-------------------------------------|----------|----|------------------|--------------------------------------------------------------------------------------------|
| Connection                          |          |    | Terminal X9: COM | Centre contact (common)                                                                    |
|                                     |          |    | Terminal X9: NC  | Normally-closed contact                                                                    |
|                                     |          |    | Terminal X9: NO  | Normally-open contact                                                                      |
| Minimum DC contact load             |          |    |                  |                                                                                            |
|                                     | Voltage  | V  | 10               | A correct switching of the relay contacts needs both values to be exceeded simultaneously. |
|                                     | Current  | mA | 10               |                                                                                            |
| Switching voltage/switching current |          |    |                  |                                                                                            |
| Maximum                             | AC 240 V | A  | 3                | According to UL: General Purpose                                                           |
|                                     | DC 24 V  | A  | 2                | According to UL: Resistive                                                                 |
|                                     | DC 240 V | A  | 0.16             |                                                                                            |



| Terminal description     |                 | Relay output             |
|--------------------------|-----------------|--------------------------|
| Connection               |                 | X9                       |
| Connection type          |                 | pluggable screw terminal |
| Min. cable cross-section | mm <sup>2</sup> | 0.5                      |
| Max. cable cross-section | mm <sup>2</sup> | 1.5                      |
| Stripping length         | mm              | 6                        |
| Tightening torque        | Nm              | 0.2                      |
| Required tool            |                 | 0.4 x 2.5                |

# Product extensions

Networks  
CANopen/Modbus



## Networks

The integrated standard product extension for the inverter i510 is the control unit with basic I/O.

As the control unit cannot be extended, the inverter i510 is available in two versions:

- With CANopen/Modbus, switchable.
- Without network.

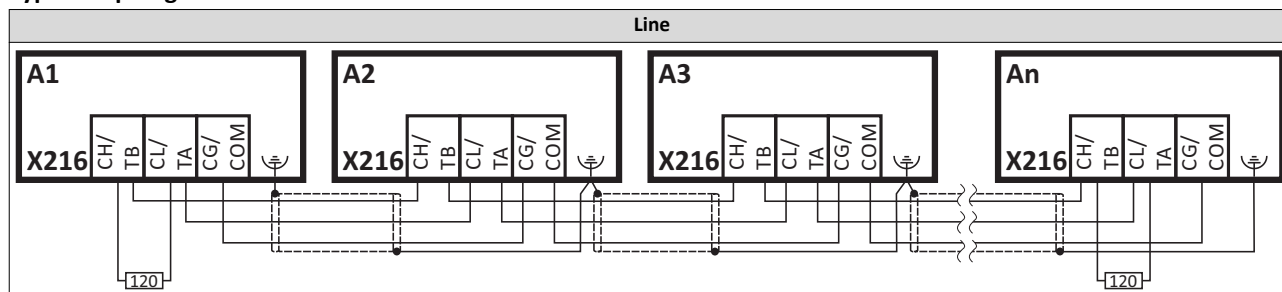
In order to provide a largely uniform documentation, all information and data of the control unit with basic I/O are contained here in the product extension chapter.

## CANopen/Modbus

| General information                                                             |  |                             |                                                                                                                          |  |
|---------------------------------------------------------------------------------|--|-----------------------------|--------------------------------------------------------------------------------------------------------------------------|--|
| Design                                                                          |  | Inverter version            | <ul style="list-style-type: none"><li>• No retrofitting possible.</li><li>• Integrated in the complete device.</li></ul> |  |
| Mains-dependent voltage supply of the control electronics and optional fieldbus |  | internally via the inverter |                                                                                                                          |  |
| Mains-independent voltage supply                                                |  | not possible                |                                                                                                                          |  |

| Bus-related information             |  |                                                 |                                                |                          |
|-------------------------------------|--|-------------------------------------------------|------------------------------------------------|--------------------------|
| Name                                |  | CANopen DS301 V4.02                             | Modbus RTU                                     | Selection via DIP switch |
| Use                                 |  | Connection of the inverter to a CANopen network | Connection of the inverter to a Modbus network |                          |
| Connection system                   |  | pluggable double spring terminal                |                                                |                          |
| Status display                      |  | 2 LEDs                                          |                                                |                          |
| Connection designation              |  | X216: CH/TB, CL/TA, CG/COM                      |                                                |                          |
| integrated bus terminating resistor |  | No                                              |                                                | External wiring required |

## Typical topologies



| Terminal description     |                 | CANopen/Modbus            |
|--------------------------|-----------------|---------------------------|
| Connection               |                 | X216                      |
| Connection type          |                 | pluggable spring terminal |
| Min. cable cross-section | mm <sup>2</sup> | 0.5                       |
| Max. cable cross-section | mm <sup>2</sup> | 2.5                       |
| Stripping length         | mm              | 10                        |
| Tightening torque        | Nm              | -                         |
| Required tool            |                 | 0.4 x 2.5                 |



## CANopen

CANopen is an internationally approved communication protocol which is designed for commercial and industrial automation applications. High data transfer rates in connection with efficient data formatting provide for the coordination of motion control devices in multi-axis applications.

| Technical data                      |      |                                              |                                             |
|-------------------------------------|------|----------------------------------------------|---------------------------------------------|
| Bus terminating resistor            | Ω    | 120                                          | Terminated on both sides                    |
| integrated bus terminating resistor |      | No                                           | External wiring required                    |
| Network topology                    |      |                                              |                                             |
| Without repeater                    |      | Line                                         |                                             |
| With repeater                       |      | Line or tree                                 |                                             |
| Station                             |      |                                              |                                             |
| Type                                |      | Slave                                        |                                             |
| Max. number without repeater        |      | 127                                          | per bus segment, incl. host system          |
| Address                             |      | 1 ... 127                                    | Adjustable via code or DIP switch           |
| Baud rate                           | kbps | 20, 50, 125, 250, 500, 800 or 1000           | Adjustable via code or DIP switch           |
| Max. bus length                     | m    | 2500, 1000, 500, 250, 100, 50 or 25          | Total cable length depends on the baud rate |
| Max. cable length between two nodes |      | not limited, the max. bus length is decisive |                                             |
| Process data                        |      |                                              |                                             |
| Transmit PDOs                       |      | 3 TPDOs with 1 ... 8 bytes (adjustable)      |                                             |
| Receive PDOs                        |      | 3 RPDOs with 1 ... 8 bytes (adjustable)      |                                             |
| Transmission mode for TPDOs         |      |                                              |                                             |
| With change of data                 |      | Yes                                          |                                             |
| Time-controlled, multiple of        | ms   | 10                                           |                                             |
| After reception                     |      | 1 ... 240 sync telegrams                     |                                             |
| Parameter data                      |      |                                              |                                             |
| SDO channels                        |      | Max. 2 servers                               |                                             |

## Modbus

Modbus is an internationally approved, asynchronous, serial communication protocol, designed for commercial and industrial automation applications.

| Technical data                      |      |                                              |                                                                                                                                   |
|-------------------------------------|------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Communication profile               |      | Modbus RTU                                   |                                                                                                                                   |
| Bus terminating resistor            | Ω    | 120                                          | Terminated on both sides                                                                                                          |
| integrated bus terminating resistor |      | No                                           | External wiring required                                                                                                          |
| Network topology                    |      |                                              |                                                                                                                                   |
| Without repeater                    |      | Line                                         |                                                                                                                                   |
| Station                             |      |                                              |                                                                                                                                   |
| Type                                |      | Slave                                        |                                                                                                                                   |
| Max. number without repeater        |      | 32                                           | per bus segment, incl. host system                                                                                                |
| Max. number with repeater           |      | 90                                           |                                                                                                                                   |
| Address                             |      | 1 ... 247                                    | Adjustable via code or DIP switch                                                                                                 |
| Baud rate                           | kbps | 4.8 ... 115                                  | Adjustable via code or DIP switch, alternatively automatic detection via DIP switch can be activated                              |
| Max. cable length                   | m    | 12 ... 600                                   | Per bus segment, depending on the baud rate and the used cable type                                                               |
| Max. cable length between two nodes |      | not limited, the max. bus length is decisive |                                                                                                                                   |
| Data channel                        |      |                                              |                                                                                                                                   |
| SDO channels                        |      | Max. 2 servers, with 1 ... 8 bytes           | Supported functions:<br>Read Holding Registers<br>Preset Single Register<br>Preset Multiple Registers<br>Read/Write 4 x registers |

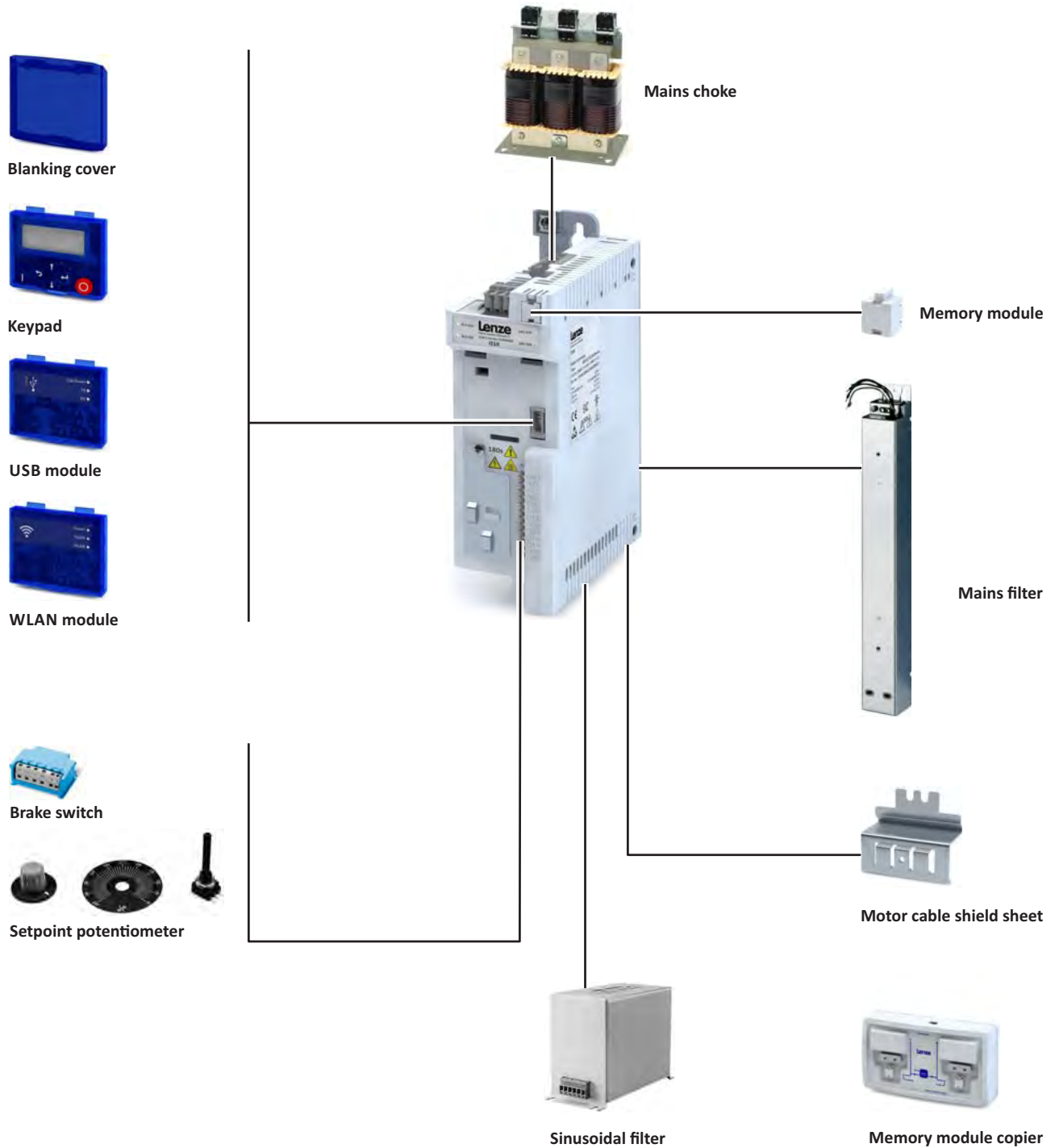


## Accessories

### Overview

A package of accessories optimally matched to the inverter is available for your applications.

Moreover, the pluggable modules make commissioning and diagnostics easier.





## Operation and diagnostics

### Keypad

Parameter setting and diagnostics

Thanks to the intuitive operating structure, the navigation keys allow a quick and easy access to the most important parameters, either to configure functions or to query current values. Parameters and actual values are indicated on the easy-to-read display.



| Keypad         |                                                  |
|----------------|--------------------------------------------------|
| Order code     | Design                                           |
| I5MADK0000000S | 7-digit LED display<br>Display in German/English |

### USB module

Interface to the PC

The USB 2.0-connecting cable is used to connect the inverter with a PC with the »EASY Starter« Lenze Engineering Tool. The »EASY Starter« serves to configure the inverter via graphical interfaces. They create diagnostics with trend functions or monitor parameter values.

Parameterising without supplying the inverter with voltage: If you connect the inverter directly to the PC without a hub, in many cases the USB interface of the PC is sufficient for the voltage supply.



| USB module     |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Order code     | Version                                                                                       |
| I5MADU0000000S | Parameter setting without voltage supply of the inverter<br>USB 2.0 connecting cable required |

| Connecting cable |        |                                                   |
|------------------|--------|---------------------------------------------------|
| Order code       | Length | Version                                           |
| EWL0085/S        | 3 m    | USB 2.0-connecting cable (A plug to micro-B plug) |
| EWL0086/S        | 5 m    |                                                   |

# Accessories

Operation and diagnostics  
WLAN module



## WLAN module

The wireless interface

Wireless communication with the inverter.

- via a PC with the Lenze «EASY Starter» Engineering Tool or
- via the Lenze Smart keypad app for Android smartphones.

The app is recommended for adapting easy applications. The clearly arranged user interface of the app guides you intuitively and safely through all the menus. Operation corresponds to keypad operation.



The Lenze Smart keypad app can be found in the Google Play Store.



## WARNING!

- ▶ This product contains FCC ID: QQQWF121/IC: 5123A-BGTWF121
- ▶ To comply with FCC and Industry Canada RF radiation exposure limits for general population, the transmitter with its antenna must be installed such that a minimum separation distance of 20 cm is maintained between the radiator (antenna) and all persons at all times.
- ▶ This product must not be collocated or operated in conjunction with any other antenna or transmitter.
- ▶ -----
- ▶ Le produit contient un module transmetteur certifié FCC ID: QQQWF121/IC: 5123A-BGTWF121
- ▶ Afin de se conformer aux réglementations de la FCC et d'Industry Canada relatives aux limites d'exposition aux rayonnements RF pour le grand public, le transmetteur et son antenne doivent être installés de sorte qu'une distance minimale de 20 cm soit constamment maintenue entre le radiateur (antenne) et toute personne.
- ▶ Le produit ne doit pas être utilisé en combinaison avec d'autres antennes ou transmetteurs.





| LED status displays   |                      |              |                                                  |
|-----------------------|----------------------|--------------|--------------------------------------------------|
| LED 1                 | LED 2                | LED 3        | Meaning                                          |
| Power (green)         | TX/RX (yellow)       | WLAN (green) |                                                  |
| Supply voltage status | Communication status | WLAN status  |                                                  |
| OFF                   | OFF                  | OFF          | No voltage                                       |
| ON                    | ON                   | ON           | Self-test (approx. 1 s)                          |
| ON                    | OFF                  | OFF          | Ready for operation<br>No active WLAN connection |
| ON                    | Flashing             | ON           | Communication active                             |
| ON                    | OFF                  | Blinking     | Client Mode<br>Waiting for connection            |
| Blinking              | OFF                  | OFF          | Trouble                                          |

| Additional conformities and approvals |                                |                          |
|---------------------------------------|--------------------------------|--------------------------|
| CE                                    | R&TTE/RED                      | EN 301489-1 V1.9.2:2011  |
|                                       |                                | EN 301489-17 V2.2.1:2012 |
|                                       |                                | EN 300328 V1.8.1:2012-06 |
| FCC                                   | Part 15.107/15.109<br>ICES-003 |                          |

| Connection data (default setting) |                                      |
|-----------------------------------|--------------------------------------|
| IP address                        | 192.168.178.1                        |
| SSID                              | <Product type>_<10-digit identifier> |
| Password                          | password                             |

| WLAN module    |                                                                        |
|----------------|------------------------------------------------------------------------|
| Order code     | Design                                                                 |
| I5MADW00000005 | Range in open space: 100 m, conditions on site may restrict the range. |

## Blanking cover

Protection and optics

The blanking cover protects the terminals and provides for uniform optics if no other module is plugged on.



| Blanking cover |                                           |       |
|----------------|-------------------------------------------|-------|
| Order code     | Version                                   | VPE   |
|                |                                           | Piece |
| I5ZAA0000M     | Protection against dust<br>Uniform optics | 4     |

# Accessories

Operation and diagnostics  
Setpoint potentiometer



## Setpoint potentiometer

For the external selection of an analog setpoint.

The setpoint selection (e.g. motor speed) can be manually set via the external potentiometer.

The setpoint potentiometer is connected to the analog input terminals of the inverter.

The position is displayed on the scale via the rotary knob.

The components have to be ordered separately.



| Setpoint potentiometer |               |                                   |
|------------------------|---------------|-----------------------------------|
| Order code             | Name          | Version                           |
| ERPD0010K0001W         | Potentiometer | 10 k $\Omega$ /1 W                |
| ERZ0001                | Rotary knob   | Diameter 36 mm                    |
| ERZ0002                | Scale         | Scale 0 ... 100 %, Diameter 62 mm |

## Memory modules

For standard set-up, Lenze offers its customers multipacked, unwritten memory modules (EPM). Together with the EPM copier, the EPMs can be duplicated at any place.

A memory module is included in the scope of supply of the inverter.



| Memory module  |                                                                  |       |
|----------------|------------------------------------------------------------------|-------|
| Order code     | Version                                                          | VPE   |
|                |                                                                  | Piece |
| IOMAPA0000000M | Easily pluggable<br>Duplicate data set with memory module copier | 12    |

## Memory module copier

For duplicating data on memory modules for a faster standard set-up.

The memory module copier is a copying system for all memory modules from Lenze. With the help of simple optical user guidance, the data of a module is copied quickly and reliably to another memory module.



| Memory module copier |                                    |
|----------------------|------------------------------------|
| Order code           | Version                            |
| EZAEDE1001           | Data set copier for memory modules |



## Accessories

Mains chokes  
1-phase mains connection 230/240 V

### Mains chokes

Mains chokes reduce the effects of the inverter on the supplying mains.

The switching operations in the inverter cause high-frequency interferences that will be transmitted unfiltered to the supplying mains. Mains chokes smooth the steep and pulse-like curves coming from the Inverter and make them more sinusoidal. Moreover, the effective mains current is reduced and thus energy is saved.

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

Please note that the use of a mains choke reduces the mains voltage at the input of the inverter. The typical voltage drop across the mains choke is around 4 % at its rated point.



#### 1-phase mains connection 230/240 V

| Inverter         | Mains choke   |                  |               |            |
|------------------|---------------|------------------|---------------|------------|
|                  | Order code    | Number of phases | Rated current | Inductance |
|                  |               |                  | A             | mH         |
| i510-C0.25/230-1 | ELN1-0900H005 | 1                | 5             | 9          |
| i510-C0.37/230-1 |               |                  |               |            |
| i510-C0.55/230-1 | ELN1-0500H009 |                  | 9             | 5          |
| i510-C0.75/230-1 |               |                  |               |            |
| i510-C1.1/230-1  | ELN1-0250H018 |                  | 18            | 2.5        |
| i510-C1.5/230-1  |               |                  |               |            |
| i510-C2.2/230-1  |               |                  |               |            |

#### 1/3-phase mains connection 230/240 V

| Inverter         | Mains choke    |                  |               |            |
|------------------|----------------|------------------|---------------|------------|
|                  | Order code     | Number of phases | Rated current | Inductance |
|                  |                |                  | A             | mH         |
| i510-C0.25/230-2 | ELN1-0900H005  | 1                | 5             | 9          |
|                  | EZAELN3002B153 | 3                | 2             | 14.7       |
| i510-C0.37/230-2 | ELN1-0900H005  | 1                | 5             | 9          |
|                  | EZAELN3004B742 | 3                | 4             | 7.35       |
| i510-C0.55/230-2 | ELN1-0500H009  | 1                | 9             | 5          |
|                  | EZAELN3004B742 | 3                | 4             | 7.35       |
| i510-C0.75/230-2 | ELN1-0500H009  | 1                | 9             | 5          |
|                  | EZAELN3006B492 | 3                | 6             | 4.9        |
| i510-C1.1/230-2  | ELN1-0250H018  | 1                | 18            | 2.5        |
|                  | EZAELN3006B492 | 3                | 6             | 4.9        |
| i510-C1.5/230-2  | ELN1-0250H018  | 1                | 18            | 2.5        |
|                  | EZAELN3008B372 | 3                | 8             | 3.68       |
| i510-C2.2/230-2  | ELN1-0250H018  | 1                | 18            | 2.5        |
|                  | EZAELN3010B292 | 3                | 10            | 2.94       |

# Accessories

Mains chokes

3-phase mains connection 400 V



## 3-phase mains connection 400 V

| Inverter         | Mains choke    |                  |               |            |
|------------------|----------------|------------------|---------------|------------|
|                  | Order code     | Number of phases | Rated current | Inductance |
|                  |                |                  | A             | mH         |
| i510-C0.37/400-3 | EZAELN3002B203 | 3                | 1.5           | 19.6       |
| i510-C0.55/400-3 | EZAELN3002B153 |                  | 2             | 14.7       |
| i510-C0.75/400-3 | EZAELN3004B742 |                  | 4             | 7.35       |
| i510-C1.1/400-3  |                |                  |               |            |
| i510-C1.5/400-3  |                |                  |               |            |
| i510-C2.2/400-3  | EZAELN3006B492 |                  | 6             | 4.9        |

## 3-phase mains connection 480 V

| Inverter         | Mains choke    |                  |               |            |
|------------------|----------------|------------------|---------------|------------|
|                  | Order code     | Number of phases | Rated current | Inductance |
|                  |                |                  | A             | mH         |
| i510-C0.37/400-3 | EZAELN3002B203 | 3                | 1.5           | 19.6       |
| i510-C0.55/400-3 | EZAELN3002B153 |                  | 2             | 14.7       |
| i510-C0.75/400-3 | EZAELN3004B742 |                  | 4             | 7.35       |
| i510-C1.1/400-3  |                |                  |               |            |
| i510-C1.5/400-3  |                |                  |               |            |
| i510-C2.2/400-3  | EZAELN3006B492 |                  | 6             | 4.9        |



---

### RFI filters / Mains filters

RFI and mains filters are used to ensure compliance with the EMC requirements of European Standard EN 61800-3. This standard defines the EMC requirements for electrical drive system in various categories.

#### Definition of the environments

(EN 61800-3)

##### First environment

The first environment comprises residential buildings or locations that are directly connected to a low-voltage system for supplying residential areas.

##### Second environment

The second environment comprises facilities or locations that are not directly connected to a low-voltage system for supplying residential areas.

##### Category C1

Category C1 defines the requirements for drive systems that are intended for the use in the first environment at a rated voltage lower than 1000 V.

The limit values of the EN 61800-3 comply with EN 55011 class B.

##### Category C2

Category C2 defines the requirements for permanently installed drive systems that are intended for the use in the first environment at a rated voltage lower than 1000 V. Installation and commissioning must only be carried out by qualified personnel with EMC knowledge.

The limit values of the EN 61800-3 comply with EN 55011 class A group 1.

##### Category C3

Category C3 defines the requirements for drive systems that are exclusively intended for the use in the second environment at a rated voltage lower than 1000 V.

The limit values of the EN 61800-3 comply with EN 55011 class A group 2.



When working with stricter line-bound noise emission requirements which cannot be met using the radio interference suppression measures integrated in the inverter, external filters can be used. The filters can be installed below or next to the inverter.

If necessary, the internal filters have to be deactivated when external filters are used. For this purpose, remove the IT screws of the inverters.

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# Accessories

RFI filters / Mains filters



## Comparison of integrated and external RFI filters

| RFI filters             | Filter types               |                          |                          |                                           |
|-------------------------|----------------------------|--------------------------|--------------------------|-------------------------------------------|
|                         | Integrated in the inverter | External                 |                          |                                           |
|                         |                            | Low Leakage              | Short Distance           | Long Distance                             |
| Use                     | In standard applications.  | In mobile systems.       | With short cable length. | At switching frequencies 4 kHz and 8 kHz. |
| Optimisation            | Easy use.                  | For low leakage current. | For low leakage current. | For long motor cable.                     |
| Reduces noise emissions | Cable-guided and radiated  | Cable-guided             | Cable-guided             | Cable-guided                              |

| Mains connection                           |                               |    | 1-phase, 230 V                       |                                      |                                                       |
|--------------------------------------------|-------------------------------|----|--------------------------------------|--------------------------------------|-------------------------------------------------------|
| Inverter                                   |                               |    | i510-C0.25/230-1<br>i510-C0.37/230-1 | i510-C0.55/230-1<br>i510-C0.75/230-1 | i510-C1.1/230-1<br>i510-C1.5/230-1<br>i510-C2.2/230-1 |
| With integrated RFI filter                 |                               |    |                                      |                                      |                                                       |
| Without EMC category<br>Thermal limitation | Shielded motor cable length   | m  | 50                                   | 50                                   | 50                                                    |
|                                            | Unshielded motor cable length | m  | 100                                  | 100                                  | 200                                                   |
| With integrated RFI filter                 |                               |    |                                      |                                      |                                                       |
| Category C1                                | Shielded motor cable length   | m  | -                                    | -                                    | -                                                     |
| Category C2                                |                               | m  | 15                                   | 20                                   | 20                                                    |
|                                            | Earth-leakage circuit breaker | mA | 30                                   | 30                                   | 30                                                    |
| RFI filter Low Leakage                     |                               |    |                                      |                                      |                                                       |
| Category C1                                | Shielded motor cable length   | m  | 5                                    | 5                                    | 5                                                     |
|                                            | Earth-leakage circuit breaker | mA | 10                                   | 10                                   | 10                                                    |
| RFI filter Short Distance                  |                               |    |                                      |                                      |                                                       |
| Category C1                                | Shielded motor cable length   | m  | 25                                   | 25                                   | 25                                                    |
| Category C2                                |                               | m  | 50                                   | 50                                   | 50                                                    |
|                                            | Earth-leakage circuit breaker | mA | 30                                   | 30                                   | 30                                                    |
| RFI filter Long Distance                   |                               |    |                                      |                                      |                                                       |
| Category C1                                | Shielded motor cable length   | m  | 50                                   | 50                                   | 50                                                    |
| Category C2                                |                               | m  | 50                                   | 50                                   | 50                                                    |
|                                            | Earth-leakage circuit breaker | mA | 300                                  | 300                                  | 300                                                   |



## Accessories

RFI filters / Mains filters

| Mains connection           |                               |    | 3-phase, 400 V   |                                      |                                                       |
|----------------------------|-------------------------------|----|------------------|--------------------------------------|-------------------------------------------------------|
| Inverter                   |                               |    | i510-C0.37/400-3 | i510-C0.55/400-3<br>i510-C0.75/400-3 | i510-C1.1/400-3<br>i510-C1.5/400-3<br>i510-C2.2/400-3 |
| With integrated RFI filter |                               |    |                  |                                      |                                                       |
| Without EMC category       | Shielded motor cable length   | m  | 15               | 50                                   | 50                                                    |
| Thermal limitation         | Unshielded motor cable length | m  | 30               | 100                                  | 200                                                   |
| With integrated RFI filter |                               |    |                  |                                      |                                                       |
| Category C1                | Shielded motor cable length   | m  | -                | -                                    | -                                                     |
| Category C2                |                               | m  | 15               | 15                                   | 20                                                    |
|                            | Earth-leakage circuit breaker | mA | 30               | 30                                   | 30                                                    |
| RFI filter Low Leakage     |                               |    |                  |                                      |                                                       |
| Category C1                | Shielded motor cable length   | m  | -                | -                                    | -                                                     |
|                            | Earth-leakage circuit breaker | mA | -                | -                                    | -                                                     |
| RFI filter Short Distance  |                               |    |                  |                                      |                                                       |
| Category C1                | Shielded motor cable length   | m  | 15               | 25                                   | 25                                                    |
| Category C2                |                               | m  | 15               | 50                                   | 50                                                    |
|                            | Earth-leakage circuit breaker | mA | 30               | 30                                   | 30                                                    |
| RFI filter Long Distance   |                               |    |                  |                                      |                                                       |
| Category C1                | Shielded motor cable length   | m  | 15               | 50                                   | 50                                                    |
| Category C2                |                               | m  | 15               | 50                                   | 50                                                    |
|                            | Earth-leakage circuit breaker | mA | 300              | 300                                  | 300                                                   |

### Low Leakage

| Inverter         | RFI filters        |               |
|------------------|--------------------|---------------|
|                  | Order code         | Rated current |
|                  |                    | A             |
| i510-C0.25/230-1 | IOFAE175B100L0000S | 9             |
| i510-C0.37/230-1 |                    |               |
| i510-C0.55/230-1 |                    |               |
| i510-C0.75/230-1 |                    |               |
| i510-C1.1/230-1  | IOFAE222B100L0000S | 21.8          |
| i510-C1.5/230-1  |                    |               |
| i510-C2.2/230-1  |                    |               |



## Short Distance

| Inverter         | RFI filters        |               |
|------------------|--------------------|---------------|
|                  | Order code         | Rated current |
|                  |                    | A             |
| i510-C0.25/230-1 | IOFAE175B100S0000S | 9             |
| i510-C0.37/230-1 |                    |               |
| i510-C0.55/230-1 |                    |               |
| i510-C0.75/230-1 |                    |               |
| i510-C1.1/230-1  | IOFAE222B100S0000S | 21.8          |
| i510-C1.5/230-1  |                    |               |
| i510-C2.2/230-1  |                    |               |
| i510-C0.37/400-3 | IOFAE175F100S0000S | 3.3           |
| i510-C0.55/400-3 |                    |               |
| i510-C0.75/400-3 |                    |               |
| i510-C1.1/400-3  | IOFAE222F100S0000S | 7.3           |
| i510-C1.5/400-3  |                    |               |
| i510-C2.2/400-3  |                    |               |

## Long Distance

| Inverter         | RFI filters        |               |
|------------------|--------------------|---------------|
|                  | Order code         | Rated current |
|                  |                    | A             |
| i510-C0.25/230-1 | IOFAE175B100D0000S | 9.0           |
| i510-C0.37/230-1 |                    |               |
| i510-C0.55/230-1 |                    |               |
| i510-C0.75/230-1 |                    |               |
| i510-C1.1/230-1  | IOFAE222B100D0000S | 21.8          |
| i510-C1.5/230-1  |                    |               |
| i510-C2.2/230-1  |                    |               |
| i510-C0.37/400-3 | IOFAE175F100D0000S | 3.3           |
| i510-C0.55/400-3 |                    |               |
| i510-C0.75/400-3 |                    |               |
| i510-C1.1/400-3  | IOFAE222F100D0000S | 7.3           |
| i510-C1.5/400-3  |                    |               |
| i510-C2.2/400-3  |                    |               |





### Sine filter

A sinusoidal filter in the motor cable limits the rate of voltage rise and the capacitive charge/discharge currents that occur during inverter operation.



Only use a sinusoidal filter with standard asynchronous motors 0 to 550 V.

Operation only with V/f or square-law V/f characteristic control.

Set the switching frequency permanently to the specified value.

Limit the output frequency of the inverter to the given value.



| Inverter         |                     | Sine filter  |                  |                       |  |
|------------------|---------------------|--------------|------------------|-----------------------|--|
|                  | Switching frequency | Order code   | Rated inductance | Max. output frequency |  |
|                  | kHz                 |              | mH               | Hz                    |  |
| i510-C0.37/400-3 | 4<br>8              | EZS3-004A200 | 11.0             | 150                   |  |
| i510-C0.55/400-3 |                     |              |                  |                       |  |
| i510-C0.75/400-3 |                     |              |                  |                       |  |
| i510-C1.1/400-3  |                     |              |                  |                       |  |
| i510-C1.5/400-3  |                     | EZS3-010A200 | 5.10             |                       |  |
| i510-C2.2/400-3  |                     |              |                  |                       |  |

### Brake switches

For switching an electromechanical brake.

The brake switch consists of a rectifier and an electronic circuit breaker.

It is mounted on the control cabinet plate by means of two screws. Control is performed using a digital output on the inverter.



| Brake switches     |   | Half-wave rectifiers                         | Bridge rectifiers    |
|--------------------|---|----------------------------------------------|----------------------|
| Order code         |   | E82ZWBRE                                     | E82ZWBRB             |
| Input voltage      | V | AC 320 - 550                                 | AC 180 - 317         |
| Output voltage     | V | DC 180 (with AC 400)<br>DC 225 (with AC 500) | DC 205 (with AC 230) |
| Max. brake current | A | 0.61                                         | 0.54                 |

# Accessories

Mounting  
Shield mounting kit



## Mounting

### Shield mounting kit

#### Motor cable

If the shielding of the motor cable is centrally connected to an earthing bus in the control cabinet, no shielding is required.

For a direct connection of the shielding of the motor cable to the inverter, the optionally available accessories can be used consisting of shield sheet and fixing clips or wire clamps.



| Inverter         | Shield mounting kit |                                           |
|------------------|---------------------|-------------------------------------------|
|                  | Order code          | VPE                                       |
|                  |                     | Piece                                     |
| i510-C0.25/230-1 | EZAMBHXM014         | 5x motor shield sheet<br>10x fixing clips |
| i510-C0.25/230-2 |                     |                                           |
| i510-C0.37/230-1 |                     |                                           |
| i510-C0.37/230-2 |                     |                                           |
| i510-C0.55/230-1 |                     |                                           |
| i510-C0.55/230-2 |                     |                                           |
| i510-C0.75/230-1 |                     |                                           |
| i510-C0.75/230-2 |                     |                                           |
| i510-C1.1/230-1  |                     |                                           |
| i510-C1.1/230-2  |                     |                                           |
| i510-C1.5/230-1  |                     |                                           |
| i510-C1.5/230-2  |                     |                                           |
| i510-C2.2/230-1  |                     |                                           |
| i510-C2.2/230-2  |                     |                                           |
| i510-C0.37/400-3 |                     |                                           |
| i510-C0.55/400-3 |                     |                                           |
| i510-C0.75/400-3 |                     |                                           |
| i510-C1.1/400-3  |                     |                                           |
| i510-C1.5/400-3  |                     |                                           |
| i510-C2.2/400-3  |                     |                                           |



## Accessories

Mounting  
Terminal strips

### Terminal strips

For connecting the inverter, the connections are equipped with pluggable terminal strips. Pluggable terminal strips are available separately for service purposes or if cable harnesses need to be physically separated.

| Inverter         | Terminal strips<br>Mains connection X100 |       | Terminal strips<br>Motor connection X105 |       |
|------------------|------------------------------------------|-------|------------------------------------------|-------|
|                  | Order code                               | VPE   | Order code                               | VPE   |
|                  |                                          | Piece |                                          | Piece |
| i510-C0.25/230-1 | EZA EVE032                               | 10    | EZA EVE038                               | 10    |
| i510-C0.37/230-1 |                                          |       |                                          |       |
| i510-C0.55/230-1 |                                          |       |                                          |       |
| i510-C0.75/230-1 |                                          |       |                                          |       |
| i510-C1.1/230-1  | EZA EVE033                               | 10    |                                          |       |
| i510-C1.5/230-1  |                                          |       |                                          |       |
| i510-C2.2/230-1  |                                          |       |                                          |       |
| i510-C0.25/230-2 | EZA EVE034                               | 10    |                                          |       |
| i510-C0.37/230-2 |                                          |       |                                          |       |
| i510-C0.55/230-2 |                                          |       |                                          |       |
| i510-C0.75/230-2 |                                          |       |                                          |       |
| i510-C1.1/230-2  | EZA EVE035                               | 10    |                                          |       |
| i510-C1.5/230-2  |                                          |       |                                          |       |
| i510-C2.2/230-2  |                                          |       |                                          |       |
| i510-C0.37/400-3 | EZA EVE036                               | 10    |                                          |       |
| i510-C0.55/400-3 |                                          |       |                                          |       |
| i510-C0.75/400-3 |                                          |       |                                          |       |
| i510-C1.1/400-3  |                                          |       |                                          |       |
| i510-C1.5/400-3  |                                          |       |                                          |       |
| i510-C2.2/400-3  |                                          |       |                                          |       |

| Terminal strips | Order code | VPE   |
|-----------------|------------|-------|
|                 |            | Piece |
| Relay X9        | EZA EVE030 | 10    |

| Terminal strips       | Order code | VPE   |
|-----------------------|------------|-------|
|                       |            | Piece |
| CANopen / Modbus X216 | EZA EVE042 | 10    |



## Mounting/ installation

More data and information for the mechanical and electrical installation can be found here:

- [Control cabinet structure](#) 18
- [EMC-compliant installation](#) 20
- [Standards and operating conditions](#) 33
- [Dimensions](#) 52



The scope of supply of the inverter comprises mounting instructions. They describe technical data and information on mechanical and electrical installation.

### Mounting position

- Vertical alignment - all mains connections are at the top and the motor connections at the bottom.

### Free spaces

- Maintain the specified free spaces above and below to the other installations.

### Mechanical installation

- The mounting location and material must ensure a durable mechanical connection.
- Do not mount onto DIN rails!
- In case of continuous vibrations or shocks use vibration dampers.

### How to mount the inverters onto the mounting plate

1. Prepare mounting plate with corresponding threaded holes and equip them with screws and, if required, washers.
  - a) Use screw and washer assemblies or hexagon socket screws with washers.
  - b) Do not yet tighten the screws.
2. Mount the inverter on the prepared mounting plate via keyhole suspension.
3. Only tighten the screws hand-tight.
4. If required, pre-assemble further units.
5. Adjust the units.
6. Screw the units onto the mounting plate.

The inverters are ready for wiring.

### Measures for cooling during operation

- Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
- If the cooling air is polluted (fluff, (conductive) dust, soot, aggressive gases), take adequate countermeasures.
  - Install filters.
  - Arrange for regular cleaning of the filters.
- If required, implement a separate air guide.

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

M5 x  $\geq 10$  mm for devices up to and including 2.2 kW



## Detecting and eliminating EMC interferences

| Trouble                                                                              | Cause                                                                                                           | Remedy                                                                                                                                                                        |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interferences of analog setpoints of your own or other devices and measuring systems | Unshielded motor cable has been used                                                                            | Use shielded motor cable                                                                                                                                                      |
|                                                                                      | Shield contact is not extensive enough                                                                          | Carry out optimal shielding as specified                                                                                                                                      |
|                                                                                      | Shield of the motor cable is interrupted, e. g. by terminal strips, switches etc.                               | <ul style="list-style-type: none"> <li>Separate components from other component parts with a minimum distance of 100 mm</li> <li>Use motor chokes or motor filters</li> </ul> |
|                                                                                      | Additional unshielded cables inside the motor cable have been installed, 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 mains terminals and other control terminals with a minimum distance of 100 mm                                 |
|                                                                                      | Mounting plate varnished                                                                                        | Optimise PE connection: <ul style="list-style-type: none"> <li>Remove varnish</li> <li>Use zinc-coated mounting plate</li> </ul>                                              |
|                                                                                      | HF short circuit                                                                                                | Check cable routing                                                                                                                                                           |

A good shield connection at the transitions of the different areas reduce possible interferences caused by problems with the EMC.

### Example of an EMC-compliant cable gland

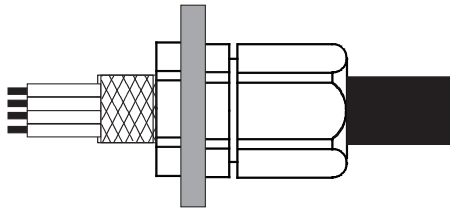


Fig. 2: EMC cable gland with a high degree of protection

# Mounting/ installation

Electrical installation  
Important notes



## Electrical installation

### Important notes

#### **DANGER!**

Dangerous electrical voltage

Depending on the device, all power connections may be live up to 3 minutes after switching off the supply.

Possible consequences: Death or severe injuries when touching the power terminals.

- ▶ Wait for at least 3 minutes before you start working on the power terminals.
- ▶ Make sure that all power terminals are deenergised.

#### **DANGER!**

Dangerous electrical voltage

The leakage current against earth (PE) is  $> 3.5 \text{ mA AC}$  or  $> 10 \text{ mA DC}$ .

Possible consequences: Death or severe injuries when touching the device in the event of an error.

- ▶ Implement the measures required in EN 61800-5-1, especially:
- ▶ Fixed installation
- ▶ The PE connection must comply with the standards (PE conductor diameter  $\geq 10 \text{ mm}^2$  or use a double PE conductor)

#### **NOTICE**

No device protection against too high mains voltage

The mains input is not fused internally.

Possible consequences: Destruction of the device at too high mains voltage.

- ▶ Please observe the maximum permissible mains voltage.
- ▶ Fuse the device professionally on the supply side against mains fluctuations and voltage peaks.

#### **DANGER!**

Use of the inverter on a phase earthed mains with a rated mains voltage  $\geq 400 \text{ V}$

The protection against accidental contact is not ensured without external measures.

- ▶ If protection against accidental contact according to EN 61800-5-1 is required for the control terminals of the inverters and the connections of the plugged device modules, ...
- ▶ an additional basic insulation has to be provided.
- ▶ the components to be connected have to come with a second basic insulation.



## **i NOTICE**

Overvoltage at devices with 230-V mains connection

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

Possible consequences: Destruction of the device

- Provide for the use of isolating transformers.

## **i NOTICE**

The product contains electrostatic sensitive devices.

Possible consequences: Destruction of the device

- Before working in the connection area, the staff must ensure to be free of electrostatic charge.

## **i NOTICE**

Pluggable terminal strips or plug connections

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

Possible consequences: Damage of the devices

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

## **i NOTICE**

Use of mains filters and RFI filters in IT systems

Mains filters and RFI filters from Lenze contain components that are interconnected against PE.

Possible consequences: The filters may be destroyed when an earth fault occurs.

Possible consequences: Monitoring of the IT system may be triggered.

- Do not use mains filters and RFI filters from Lenze in IT systems.
- Before using the inverter in the IT system, remove the IT screws.

## **i NOTICE**

Overvoltage at components

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

Possible consequences: Destruction of the device.

- Before using the inverter in the IT system, the contact screws must be removed.
- Positions and number of the contact screws depend on the device.



Ensure a trouble-free operation:

Carry out the total wiring so that the separation of the separate potential areas is preserved.

# Mounting/ installation

Electrical installation  
Important notes



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When implementing machines and systems for the use in the UL/CSA scope, you have to observe especially issued notes.

These notes and further information on the UL/CSA subject are summarised in separated documents.

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You have to install the devices into housings (e. g. control cabinets) to comply with valid regulations.

Stickers with warning notes must be displayed prominently and close to the device.

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## Mains connection

The following should be considered for the mains connection of inverters:

Single inverters are either directly connected to the **AC system** or via upstream filters. RFI filters are already integrated in many inverters. Depending on the requirements, mains chokes or mains filters can be used.

Inverter groups are connected to the **DC system** with the DC bus. For this purpose, the inverters have to be provided with a connection for the DC bus, e. g. terminals +UG/-UG.

This enables the energy exchange in phases with operation in generator and motor mode of several drives in the network.

The DC system can be provided by power supply modules (AC/DC converters) or inverters with a power reserve.

The technical data informs about the possible applications in the given groups. In the dimensioning, data and further notes have to be observed.

# Mounting/ installation

Electrical installation  
Mains connection



## 1-phase mains connection 230/240 V

### Connection plan

The wiring diagram is valid for I5xAExxxB inverters.

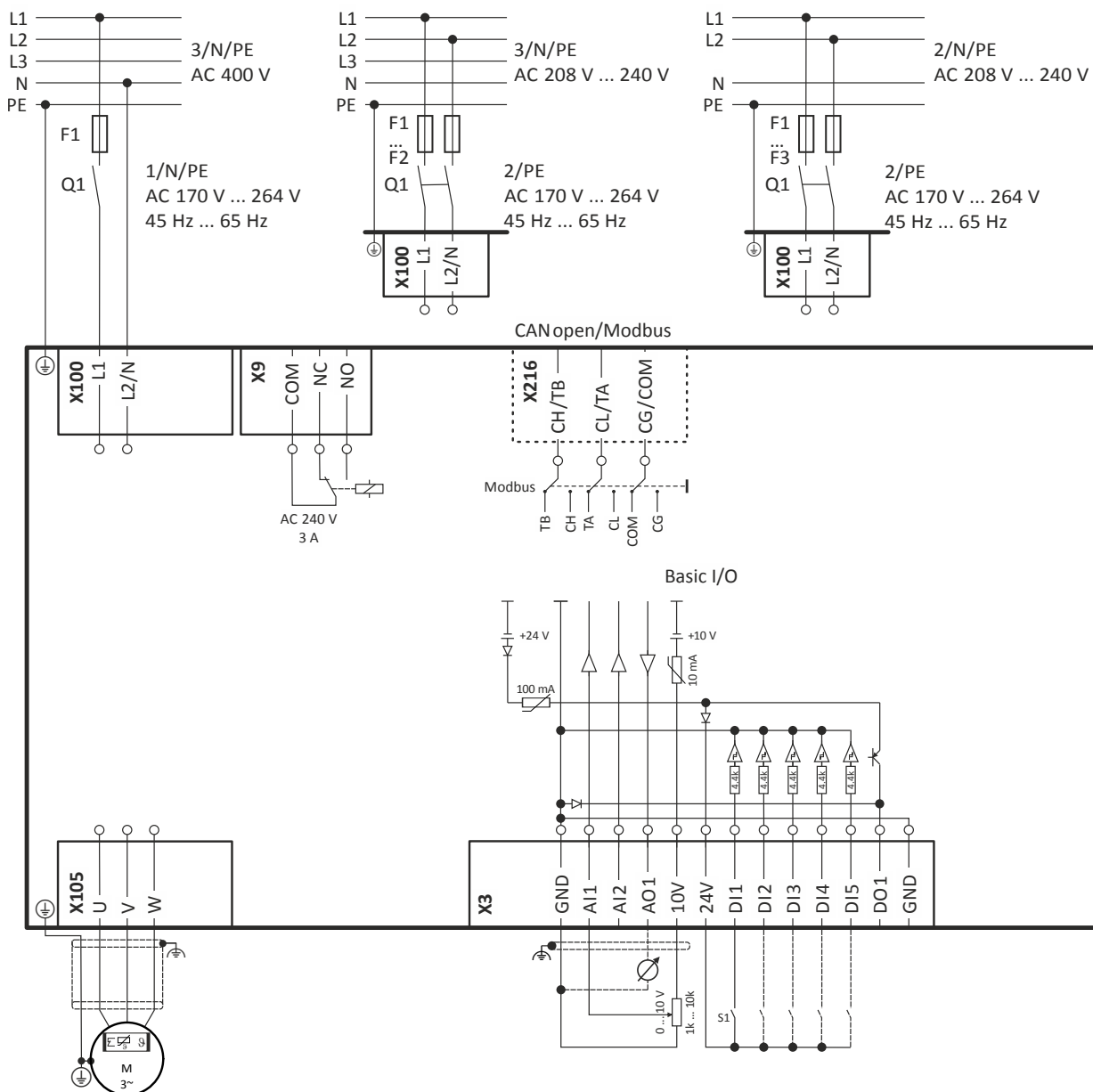


Fig. 3: Wiring example

S1 Run/Stop  
Fx Fuses

Q1 Mains contactor  
--- Dashed line = options



# Mounting/ installation

Electrical installation  
Mains connection

## 1/3-phase mains connection 230/240 V

### Connection plan

The wiring diagram is valid for I5xAExxxD inverters.

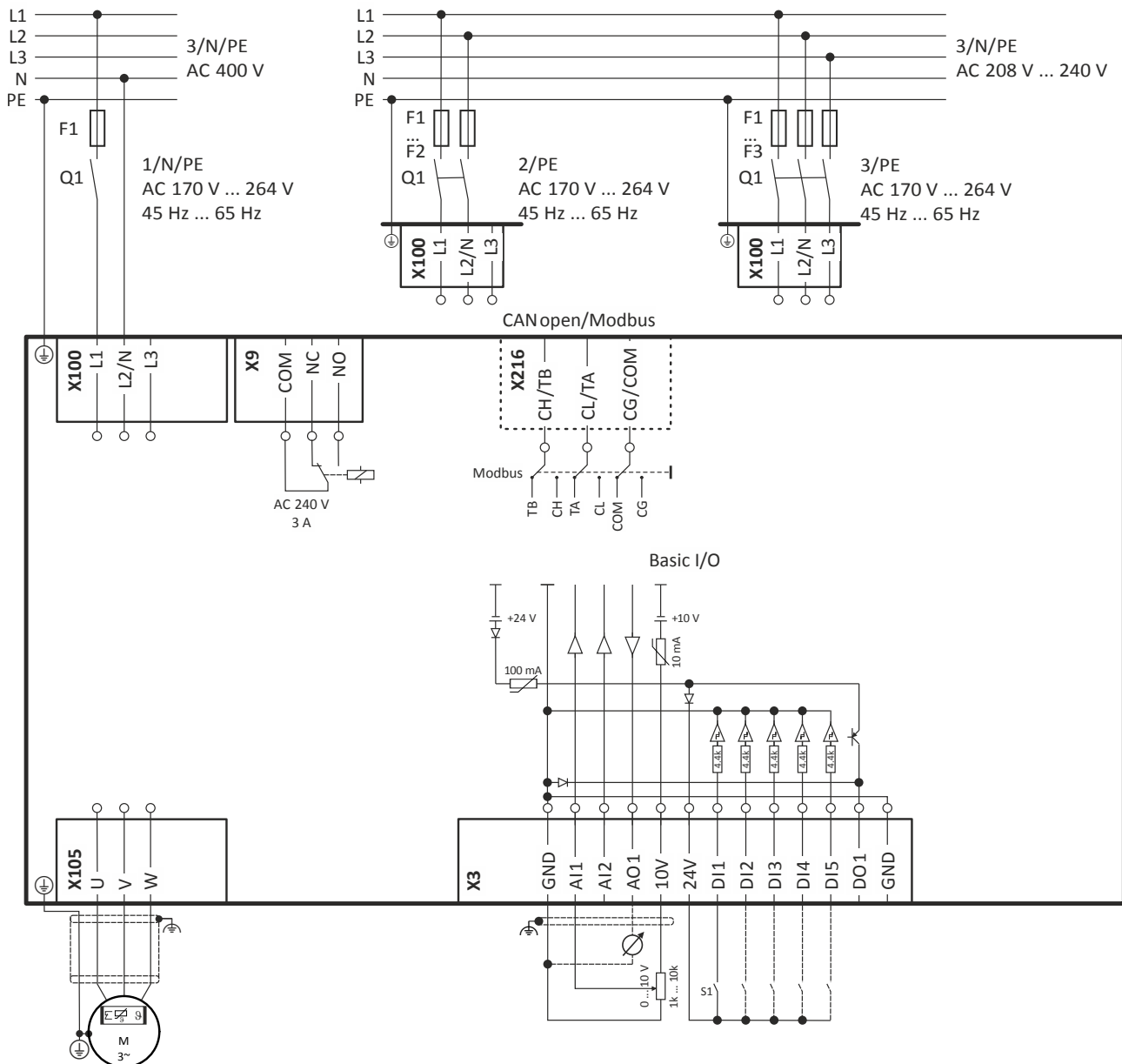


Fig. 4: Wiring example

S1 Run/Stop  
Fx Fuses

Q1 Mains contactor  
--- Dashed line = options

# Mounting/ installation

Electrical installation  
Mains connection



## 3-phase mains connection 400 V

### Connection plan

The wiring diagram is valid for I5xAExxxF inverters.

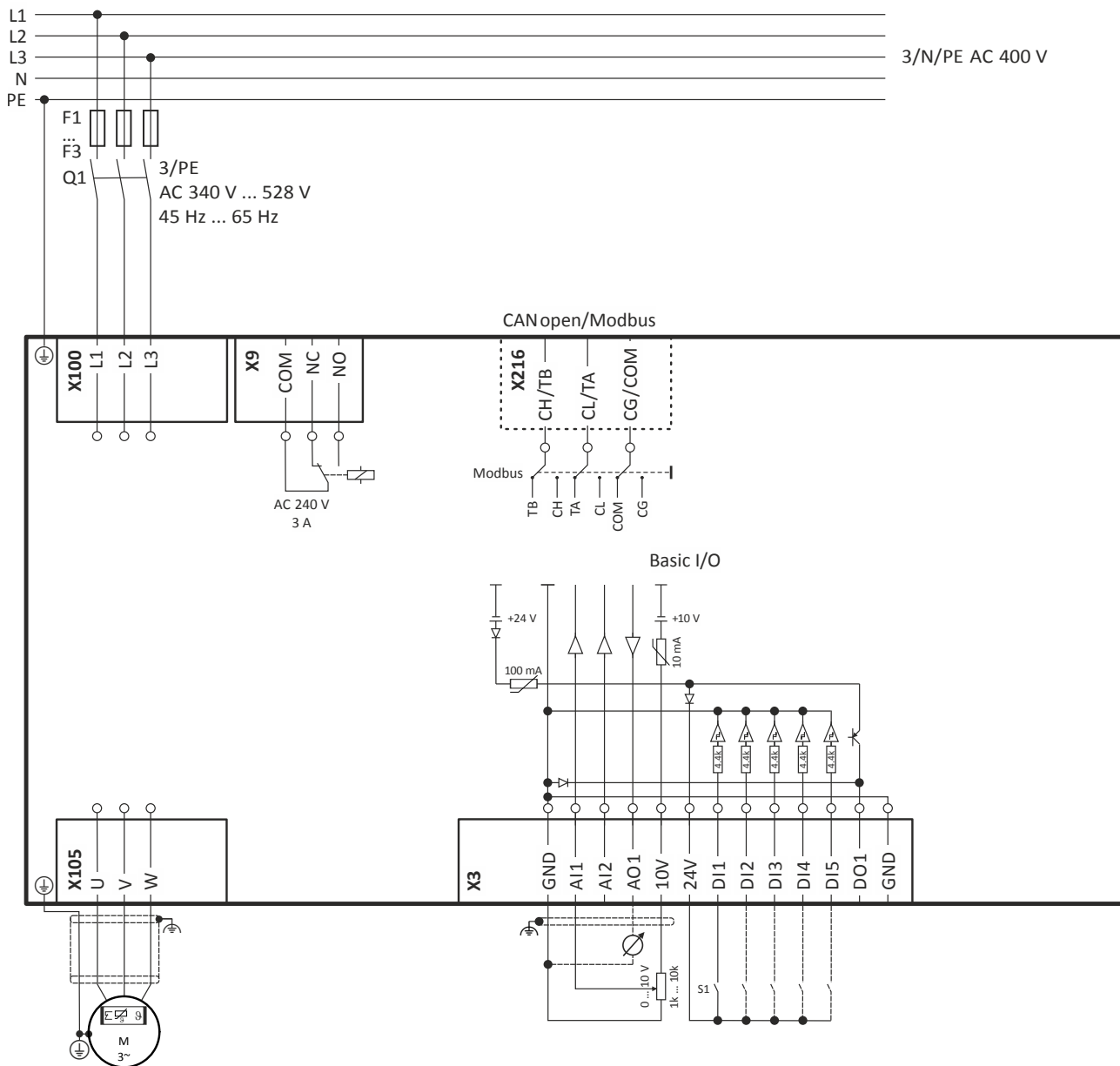


Fig. 5: Wiring example

S1 Run/Stop  
Fx Fuses

Q1 Mains contactor  
--- Dashed line = options



# Mounting/ installation

Electrical installation  
Mains connection

## 3-phase mains connection 480 V

### Connection plan

The wiring diagram is valid for I5xAExxxF inverters.

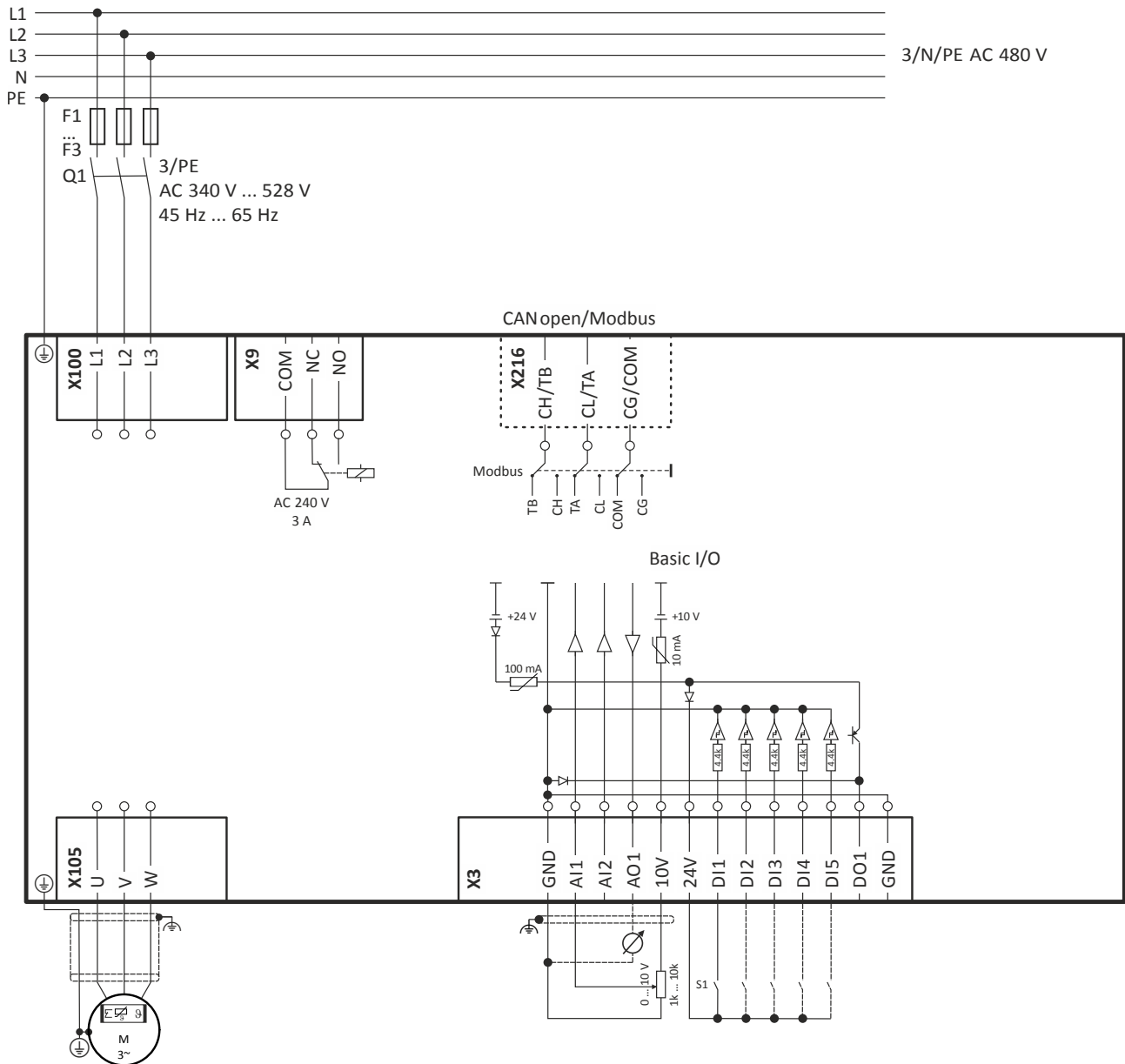


Fig. 6: Wiring example

S1 Run/Stop  
Fx Fuses

Q1 Mains contactor  
--- Dashed line = options



## Motor connection

A good shield connection and short cable lengths reduce possible interferences caused by problems with the EMC.

### Example for preparing the EMC-compliant wiring or the motor cable

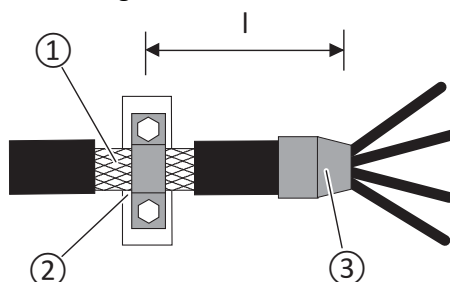


Fig. 7: Shield connection

- |                                         |                        |
|-----------------------------------------|------------------------|
| ① Braid                                 | ③ Heat-shrinkable tube |
| ② large surface contacting of the braid | l maximally 500 mm     |

## Switching in the motor cable



Switching on the motor side of the inverter is permissible:

For safety shutdown (emergency stop).

In case several motors are driven by one inverter (only in V/f operating mode).

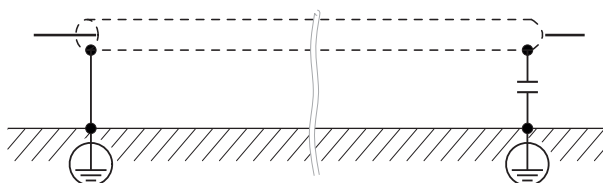
Please note the following:

The switching elements on the motor side must be dimensioned for with the maximum occurring load.

## Control connections



In order to achieve an optimum shielding effect (in case of very long cables, with high interference), one shield end of analog input and output cables can be connected to PE potential via a capacitor (e. g. 10 nF/250 V).





## Purchase order

### Notes on ordering

The inverters are supplied as complete devices. A control unit with basic I/O is integrated.

As the control unit cannot be extended, the inverter i510 is available in two versions:

- With CANopen/Modbus, switchable.
- Without network.

#### Kompletter Inverter



# Purchase order

Order code



## Order code

### Delivery as complete inverter

Order data: Order code of the complete device.

### Order example

| Description of the component                             | Order code         |
|----------------------------------------------------------|--------------------|
| Complete inverter                                        | i51AE175F10010001S |
| 3-phase mains connection 400 V                           |                    |
| Power 0.75 kW (i510-C0.75/400-3)                         |                    |
| Without safety engineering (not available for i510)      |                    |
| Default setting of parameters: EU region (50-Hz systems) |                    |
| Basic I/O with CANopen/Modbus                            |                    |

### Inverter i510

| Power                                                    |      | Inverter         | Order code |
|----------------------------------------------------------|------|------------------|------------|
| kW                                                       | HP   |                  |            |
| 1-phase mains connection 230 V                           |      |                  |            |
| 0.25                                                     | 0.33 | i510-C0.25/230-1 | i51AE125B1 |
| 0.37                                                     | 0.5  | i510-C0.37/230-1 | i51AE137B1 |
| 0.55                                                     | 0.75 | i510-C0.55/230-1 | i51AE155B1 |
| 0.75                                                     | 1    | i510-C0.75/230-1 | i51AE175B1 |
| 1.1                                                      | 1.5  | i510-C1.1/230-1  | i51AE211B1 |
| 1.5                                                      | 2    | i510-C1.5/230-1  | i51AE215B1 |
| 2.2                                                      | 3    | i510-C2.2/230-1  | i51AE222B1 |
| 1/3-phase mains connection 230 V                         |      |                  |            |
| 0.25                                                     | 0.33 | i510-C0.25/230-2 | i51AE125D1 |
| 0.37                                                     | 0.5  | i510-C0.37/230-2 | i51AE137D1 |
| 0.55                                                     | 0.75 | i510-C0.55/230-2 | i51AE155D1 |
| 0.75                                                     | 1    | i510-C0.75/230-2 | i51AE175D1 |
| 1.1                                                      | 1.5  | i510-C1.1/230-2  | i51AE211D1 |
| 1.5                                                      | 2    | i510-C1.5/230-2  | i51AE215D1 |
| 2.2                                                      | 3    | i510-C2.2/230-2  | i51AE222D1 |
| 3-phase mains connection 400 V                           |      |                  |            |
| 0.37                                                     | 0.5  | i510-C0.37/400-3 | i51AE137F1 |
| 0.55                                                     | 0.75 | i510-C0.55/400-3 | i51AE155F1 |
| 0.75                                                     | 1    | i510-C0.75/400-3 | i51AE175F1 |
| 1.1                                                      | 1.5  | i510-C1.1/400-3  | i51AE211F1 |
| 1.5                                                      | 2    | i510-C1.5/400-3  | i51AE215F1 |
| 2.2                                                      | 3    | i510-C2.2/400-3  | i51AE222F1 |
| Delivery status                                          |      |                  |            |
| Default setting of parameters: EU region (50-Hz systems) |      |                  | 0          |
| Default setting of parameters: US region (60-Hz systems) |      |                  | 1          |
| Control unit type                                        |      |                  |            |
| Basic I/O without network                                |      |                  | 000S       |
| Basic I/O with CANopen/Modbus                            |      |                  | 001S       |





## Appendix

### Good to know

#### Approvals/directives

|                                       |                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CCC                                   | China Compulsory Certification<br>documents the compliance with the legal product safety requirements of the PR of China - GB standards.                                                                                                                                                                                                      |
| c <sub>CSA</sub> <sub>US</sub>        | CSA certificate, tested according to US and Canada standards                                                                                                                                                                                                                                                                                  |
| CE                                    | Communauté Européenne<br>documents the declaration of the manufacturer that EC Directives are complied with.                                                                                                                                                                                                                                  |
| CEL                                   | China Energy Label<br>documents the compliance with the legal energy efficiency requirements for motors, tested according to PR of China standards                                                                                                                                                                                            |
| CSA                                   | Canadian Standards Association<br>CSA certificate, tested according to Canada standards                                                                                                                                                                                                                                                       |
| UL <sup>Energy</sup> <sub>US CA</sub> | Energy Verified Certificate<br>Determining the energy efficiency according to CSA C390 for products within the scope of energy efficiency requirements in the USA and Canada                                                                                                                                                                  |
| c <sub>UL</sub> <sub>US</sub>         | UL certificate<br>for products, tested according to US and Canada standards                                                                                                                                                                                                                                                                   |
| c <sub>UR</sub> <sub>US</sub>         | UL certificate<br>for components, tested according to US and Canada standards                                                                                                                                                                                                                                                                 |
| EAC                                   | Customs union Russia / Belarus / Kazakhstan certificate<br>documents the declaration of the manufacturer that the specifications for the Eurasian conformity (EAC) required for placing electronic and electromechanical products on the market of the entire territory of the Customs Union (Russia, Belarus, Kazakhstan) are complied with. |
| UL                                    | Underwriters Laboratory Listed Product                                                                                                                                                                                                                                                                                                        |
| UR                                    | UL certificate<br>for components, tested according to US standards                                                                                                                                                                                                                                                                            |

# Appendix

Good to know

Operating modes of the motor



## Operating modes of the motor

Operating modes S1 ... S10 as specified by EN 60034-1 describe the basic stress of an electrical machine.

In continuous operation a motor reaches its permissible temperature limit if it outputs the rated power dimensioned for continuous operation. However, if the motor is only subjected to load for a short time, the power output by the motor may be greater without the motor reaching its permissible temperature limit. This behaviour is referred to as overload capacity.

Depending on the duration of the load and the resulting temperature rise, the required motor can be selected reduced by the overload capacity.

### The most important operating modes

| Continuous operation S1                                                                                                                                                                                                                                                                                                                                                           | Short-time operation S2                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.</p>                                                                                                                                                                                                                              | <p>Operation with constant load; however, the motor does not reach the thermal steady state. During the following standstill, the motor winding cools down to the ambient temperature again. The increase in power depends on the load duration.</p>                                                                                                                                                                                     |
| Intermittent operation S3                                                                                                                                                                                                                                                                                                                                                         | Non-intermittent periodic operation S6                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>Sequence of identical duty cycles comprising operation with a constant load and subsequent standstill. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/downtime ratio.</p> | <p>Sequence of identical duty cycles comprising operation with a constant load and subsequent no-load operation. The motor cools down during the no-load phase. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/idle time ratio.</p> |

P Power  
t Time  
 $t_L$  Idle time  
 $\theta$  Temperature

$P_V$  Power loss  
 $t_B$  Load period  
 $t_S$  Cycle duration



## Motor control types

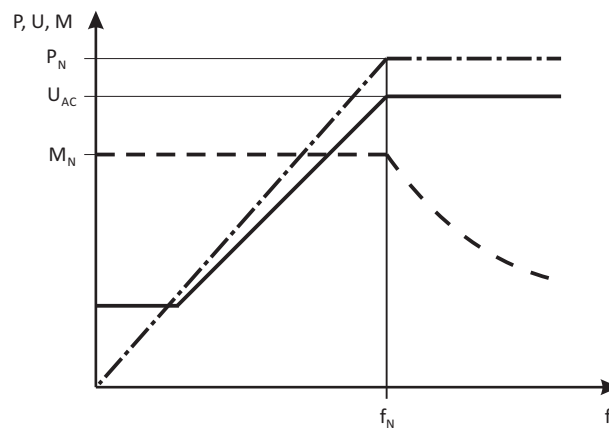
The inverter provides various motor control types.

### Linear V/f characteristic control

The output voltage is increased proportionately to the output frequency.

In case of low output frequencies, the motor voltage can be increased to ensure a minimum current for the breakaway torque. In the field weakening range, the output voltage of the inverter is constant (mains voltage) and the frequency can be further increased depending on the load. The maximum torque of the motor is reduced squarely to the frequency increase. the maximum output power of the motor being constant.

Application areas are for instance: Single drives with constant load.



P Power  
V Voltage  
M Torque  
f Frequency

$M_{rated}$  Rated torque  
 $f_{rated}$  Rated frequency  
 $M_{rated}$  Rated torque  
 $f_{rated}$  Rated frequency

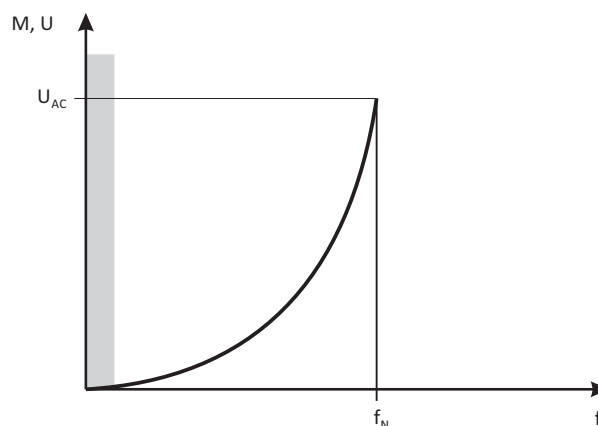
### Square-law V/f characteristic control

The output voltage is increased squarely to the output frequency.

In case of low output frequencies, the motor voltage can be increased to ensure a minimum current for the breakaway torque. In the field weakening range, the output voltage of the inverter is constant (mains voltage) and the frequency can be further increased depending on the load. The maximum torque of the motor is reduced squarely to the frequency increase. the maximum output power of the motor being constant.

Application areas are for instance:

- Pumps
- Fans
- Fan

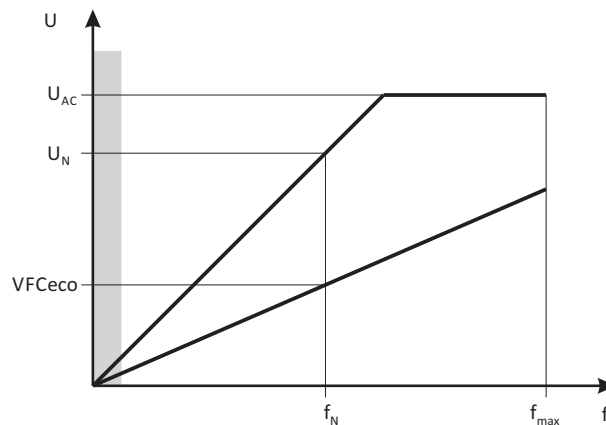




|   |           |             |                 |
|---|-----------|-------------|-----------------|
| V | Voltage   | $U_{AC}$    | Mains voltage   |
| f | Frequency | $f_{rated}$ | Rated frequency |
| M | Torque    |             |                 |

## VFCeco

The VFCeco mode has a special effect in the partial load operational range. Usually, three-phase AC motors are supplied there with a higher magnetising current than required by the operating conditions. The VFCeco mode reduces the losses in the partial load operational range so that savings up to 30 % are possible.



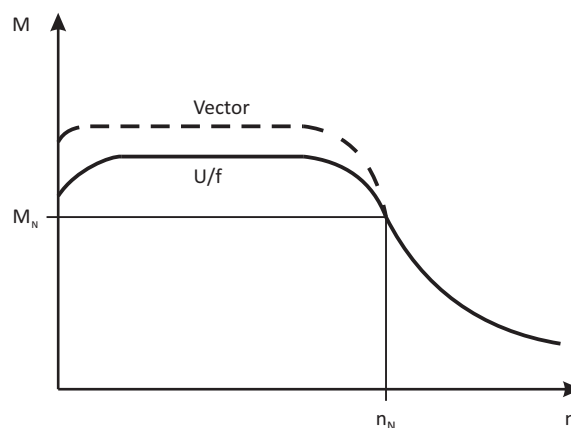
|             |               |             |                 |
|-------------|---------------|-------------|-----------------|
| V           | Voltage       | f           | Frequency       |
| $U_{AC}$    | Mains voltage | $f_{rated}$ | Rated frequency |
| $U_{rated}$ | Rated voltage | $f_{max}$   | Max. frequency  |

## Sensorless vector control (SLVC)

In vector control, an inverted voltage model is used for calculation. The parameters are detected via a parameter identification. The inverter determines the angle between current and voltage. This imposes a current on the motor".

Compared to the V/f characteristic control, the vector control serves to achieve improved drive characteristics thanks to:

- higher torque throughout the entire speed range
- higher speed accuracy and higher concentricity factor
- higher efficiency



|   |        |             |              |
|---|--------|-------------|--------------|
| M | Torque | $M_{rated}$ | Rated torque |
| n | Speed  | $n_{rated}$ | Rated speed  |

Application areas are for instance:

- Single drives with changing loads



- Single drives with high starting duty
- Sensorless speed control of three-phase AC motors

## Switching frequencies

On an inverter, the term "switching frequency" is understood to mean the frequency with which the input and outputs of the output module (inverter) are switched. On an inverter, the switching frequency can generally be set to values between 2 and 16 kHz, whereby the selection is based on the respective power output

As switching the modules cause heat losses, the inverter can provide higher output currents at low switching frequencies than at high frequencies. Additionally, it is distinguished between the operation at a permanently set switching frequency and a variably set switching frequency. Here, the switching frequency is automatically reduced as a function of the device utilisation.

At a higher switching frequency, the noise generation is less.

| Features              | Versions                                                                                                                                                 |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Switching frequencies | <ul style="list-style-type: none"> <li>• 2 kHz</li> <li>• 4 kHz</li> <li>• 8 kHz</li> <li>• 16 kHz</li> <li>• variable (automatic adjustment)</li> </ul> |

## Enclosures

The degree of protection indicates the suitability of a motor for specific ambient conditions with regard to humidity as well as the protection against contact and the ingress of foreign particles. The degrees of protection are classified by EN 60529.

The first code number after the code letters IP indicates the protection against the ingress of foreign particles and dust. The second code number refers to the protection against the ingress of humidity.

| Code number 1 | Degree of protection                                                                                         | Code number 2 | Degree of protection                                                                                          |
|---------------|--------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------|
| 0             | No protection                                                                                                | 0             | No protection                                                                                                 |
| 1             | Protection against the ingress of foreign particles $d > 50$ mm. No protection in case of deliberate access. | 1             | Protection against vertically dripping water (dripping water).                                                |
| 2             | Protection against medium-sized foreign particles, $d > 12$ mm, keeping away fingers or similar.             | 2             | Protection against diagonally falling water (dripping water), $15^\circ$ compared to normal service position. |
| 3             | Protection against small foreign particles $d > 2.5$ mm. Keeping away tools, wires or similar.               | 3             | Protection against spraying water, up to $60^\circ$ to the vertical                                           |
| 4             | Protection against granular foreign particles, $d > 1$ mm, keeping away tools, wire or similar.              | 4             | Protection against spraying water from all directions.                                                        |
| 5             | Protection against dust deposits (dust-protected), complete protection against contact.                      | 5             | Protection against water jets from all directions.                                                            |
| 6             | Protection against the ingress of dust (dust-proof), complete protection against contact.                    | 6             | Protection against choppy seas or heavy water jets (flood protection).                                        |

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