Installation and operation manual

Solar inverter M88H_122 (CF), product version D

Europe United Kingdom

This manual applies to the following inverter models:

- **M88H_122 (with DC connections of Multi-Contact and String fuses, Delta part number RPI883M122000, Product Version D)**

with firmware versions:

DSP: 1.36 / RED: 1.03 / COM: 1.18 or higher

The Delta part number can be found on the type plate of the inverter. The Product Version is shown by the last letters of the serial number, which is also located on the type plate. The firmware versions are listed on the display in the **`Inverter Info.`** menu.

The Delta manuals undergo continuous revision in order to provide you with complete information regarding the installation and operation of our inverters. Therefore, before starting installation work, **always** consult www.solar-inverter.com to check whether a newer version of the Quick Installation Guide or of the comprehensive Installation and Operation Manual is available.

This manual is intended for installers.

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1. About This Manual

1.1 Purpose of This Manual

This manual is part of the inverter and supports the installation, commissioning and operation of the inverter.

Read this manual **before** working on the inverter.

Always follow the safety instructions and work instructions in this manual. This will ensure that the inverter can be safely installed, commissioned and operated.

Store this manual in a safe place in the vicinity of the inverter so that it is always quickly available when working on the inverter.

Delta Electronics is not responsible for damage resulting from failure to follow the safety and operating instructions set out in this manual.

1.2 Target audience of this manual

This manual is intended for installers who are trained and approved for the installation, commissioning and operation of solar inverters in mains-connected solar systems.

1.3 How to use this manual

The structure of this manual, in addition to the symbols and text markings used, is described in the section **1. About This Manual**. This latter means that the contents are marked according to their meaning. Thus operations, names of buttons and display texts can be recognized even by their specific formatting.

The section **2. Basic safety instructions** identifies the safety risks associated with using the inverter. You **must** read this section in order to ensure safe handling of the installation, maintenance and operation of the inverter.

The purposes for which the inverter may be used are described in the section **3. Intended purpose** This section also describes purposes for which the use of the inverter is not allowed, even though in some cases they are similar to the purposes for which the inverter may be used.

The section **4. Product overview** gives a brief description of the position and use of the most important components of the inverter. In section you will see for instance where the cables for the mains and the solar modules are connected.

The section **5. Planning the installation** describes the planning of the installation and contains information about effective preparations for installation of the inverter and avoiding delays in its installation. This includes where necessary descriptions of the operating behavior of the inverter. In this section you will learn for instance what you must consider in selecting, calculating and laying the cables.

The section **6. Installation** gives detailed step-by-step instructions. This section contains a description, for example, of how the sequence of work steps for connecting the cables is organized and how you can perform these steps directly. So that this proceeds smoothly, you must first read the section **4. Product overview** and **5. Planning the installation** to ensure you have prepared everything.

The section **7. Commissioning** describes exclusively the commissioning procedure on the display which starts automatically as soon as the inverter is supplied with power for the first time.

All other setting options are listed in the section **8. Settings**. This section describes only the settings that can be changed directly on the display. Setting options for performance by Delta Service Software are on the other hand not described.

The section **9. Measurements and statistics** describes how measured values and statistics can be called up on to the display, and what the information displayed means.

Possible faults for which the cause and measures for rectification are listed in the section **10. Error events and troubleshooting**. Follow the instructions without fail. Do not attempt yourself to remedy faults that are marked "Contact Delta Support".

Maintenance work that you can perform yourself are described in the section **11. Maintenance**. All other maintenance work may be performed only after consultation with Delta Customer Service.

Section **12. Replacing the inverter** guides you step-by-step through the work steps for the replacement of the complete inverter or of the power module.

If you wish to take the inverter out of operation and put it into storage, you will find all the necessary information for doing so in section **13. Decommissioning**.

A list of the most important technical data can be found in the **14. Technical data** section. If you require technical values over and above this, please contact Delta Customer Service.

1.4 Warning notices and warning symbols

This manual uses the following warning notices and symbols for describing potential dangers and the measures necessary for reducing these dangers.

Always follow the instructions in the warning notices.

Warning levels

DANGER

Indicates a dangerous situation that will **always** lead to death or severe injuries if not avoided.

WARNING

Indicates a dangerous situation that **can lead** to death or severe injuries if not avoided.

CAUTION

Indicates a dangerous situation that **can lead** to light or medium injuries if not avoided.

NOTICE

Indicates possible **material damage** that can be caused to other objects by the inverter.

A note provides information on efficient use of the inverter.

If necessary, the warning labels are also marked with warning symbols indicating the source of the danger.

High electrical voltages or currents

Hot surfaces

Heavy weight

General danger

1.5 Writing and labeling conventions

Some sections in this manual are specially labeled.

Labeling of work instructions

Work instructions that must be performed in a specific sequence are numbered accordingly. Numbered sequences of work steps must **always** be performed in the specified sequence.

1. First step
   → Where necessary, the result of the work step is described here. This is used for checking that the work step has been completed correctly.
2. Second step
3. Third step

☑ Work step is now finished.

If the work instructions consist of only a single step or the work steps can be performed in any desired sequence then the work steps are labeled as follows:

► Step
► Step

Labeling of inverter components

Buttons	ENT
Text on the inverter display	`Inverter info.`
LEDs	***ALARM*** LED

LED	Meaning
	LED stays on.
	LED flashes.
	LED is off.

2. Basic safety instructions

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter.

1. Turn the DC isolating switch to the ***0 (OFF)*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored. How you are to proceed thereby is described in the respective work instructions.
3. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock

Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Turn the DC isolating switch to the ***0 (OFF)*** position.
- ► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally. For details of how to do this, please consult the respective work instructions.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

- ► Remove the cover only when absolutely necessary.
- ► Do not remove the cover if water or dirt might enter the inverter.
- ► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

WARNING

Heavy weight

The inverter is very heavy.

- ► The inverter must be lifted and carried by at least 3 people or using appropriate lifting gear (e.g. block and tackle or crane).

- To comply with the IEC 62109-5.3.3 safety requirements and avoid injury or material damage, the inverter must be installed and operated in accordance with the safety and operating instructions set out in this manual. Delta Electronics is not responsible for damage resulting from failure to follow the safety and operating instructions set out in this manual.
- The inverter may be installed and commissioned only by installers who have been trained and certified for the installation and operation of mains-based solar inverters.
- All repair work on the inverter must be carried out by Delta Electronics. Otherwise, the warranty will be void.
- Warning instructions and warning symbols attached to the inverter by Delta Electronics must not be removed.
- The inverter has a high leakage current value. The grounding cable **must** be connected before commencing operation.
- Do not disconnect any cables while the inverter is under load due to risk of a fault arc.
- To prevent damage due to lightning strikes, follow the provisions that apply in your country.
- The surface of the inverter can get very hot during operation. Wear safety gloves when you touch the inverter (apart from at the display).
- Only equipment in accordance with SELV (EN 60950) may be connected to the RS485 interfaces.
- All connections must be sufficiently insulated in order to ensure the IP65 degree of protection. Unused connections must be closed using cover caps.

3. Intended purpose

The inverter may be used only for the specified intended purpose.

The intended purpose of the inverter is defined as follows:

- Use in stationary solar systems that are connected to the public mains. For conversion of the DC power that is generated by the solar modules of the solar system into AC power which is fed into the local power mains.
- Use in conformity with the power specifications and environmental conditions specified by the manufacturer.

The following uses are regarded as not for the intended purposes:

- Use in stand-alone mode, i.e. without a connection to the public mains. The inverter has functions for preventing operating in stand-alone mode.
- Use in mobile solar systems.

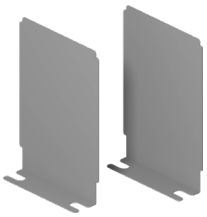
4. Product overview

4.1 Scope of supply

Part		Description	Part		Description
Inverter with wiring box	1		Mounting plate	1	
Cover caps	2	For closing the upper cable feed-throughs on the wiring box when the inverter part is disconnected. The cover caps are fitted to the mounting plate. 		1	
DC plug	18	Multi-Contact MC4-plug for DC + (32.0017P0001-UR for 4/6 mm²) 	M6 grounding screw	1	For grounding the inverter housing; with spring washer, washer and toothed lock washer; mounted on the inverter. 
	18	Multi-Contact MC4-plug for DC– (32.0016P0001-UR for 4/6 mm²) 	M6 mounting screw	4	For fastening the wiring box to the mounting plate; with spring washer and washer 
Cable gland for the AC connection	1	For feeding the AC cable into the junction box 	Quick installation guide and basic safety instructions	1	

4 Product overview

Scope of supply

Part		Description	Part		Description
Cable gland for the communication connection	1	For fastening the communication cable to the wiring box 	Screening plate for the air inlet	2	For covering the air inlets. Preventing the entry of small animals. 

Check the delivery for completeness and all components for damage before starting installation work.

Do not use any damaged components.

Keep the packaging.

4.2 Overview of components and connections

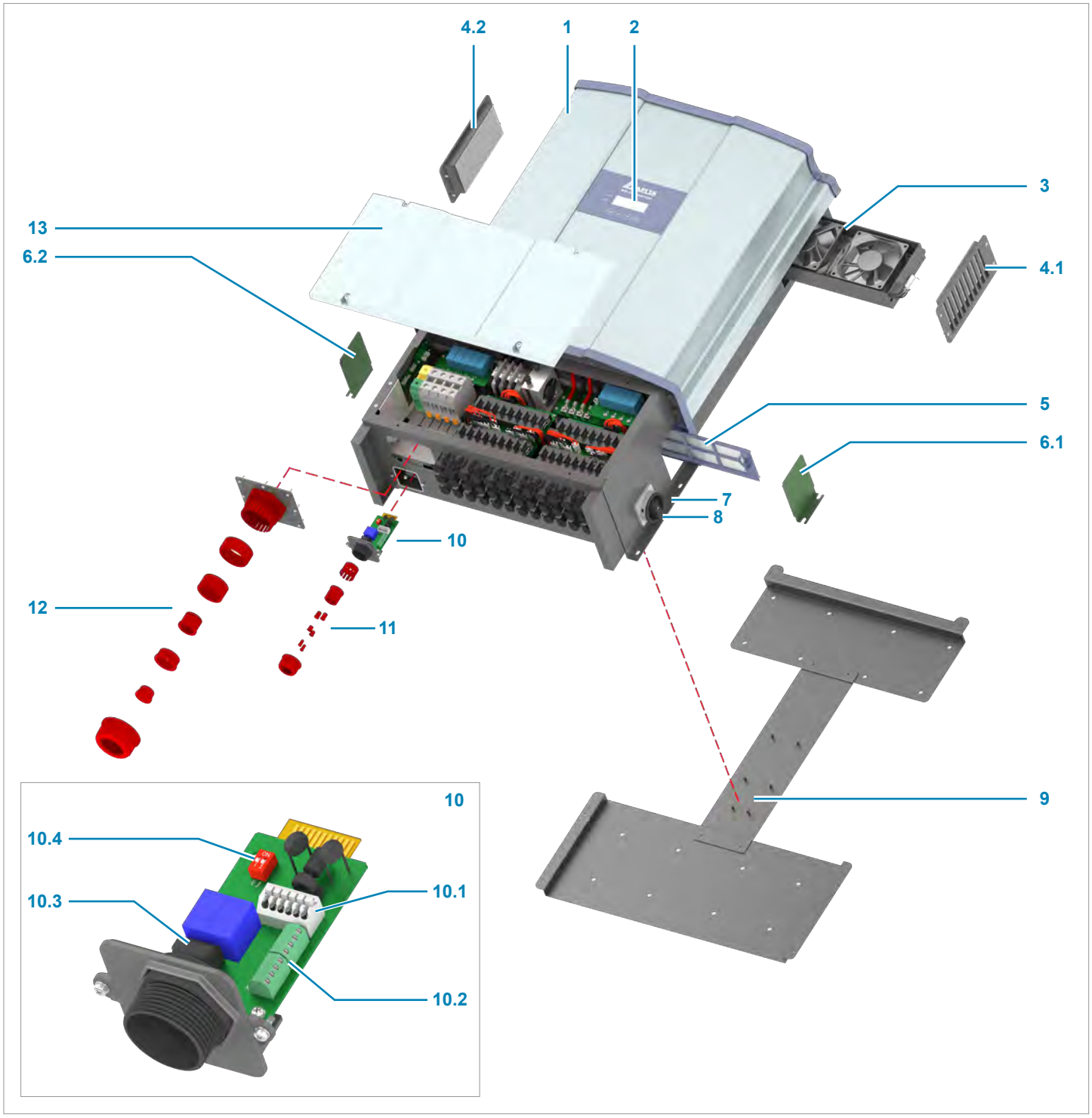


Fig. 4.1: Overview of components and connections

1 Power module
2 Display, buttons, and LED
3 Fan module
4 Filter for air outlet (2x)
5 Filter for air inlet
6 Cover panel for the air inlet (2x)
7 DC cable gland (2x)
8 Grounding connection
9 Mounting plate
10 Cable gland for the communication connection
11 Communication card
12 AC cable gland
13 Cover panel for the wiring box

11.1 RS485 connection
11.2 Digital inputs
11.3 Dry contacts
11.4 DIP switch for VCC and RS485 termination resistor

4 Product overview

Overview of components and connections

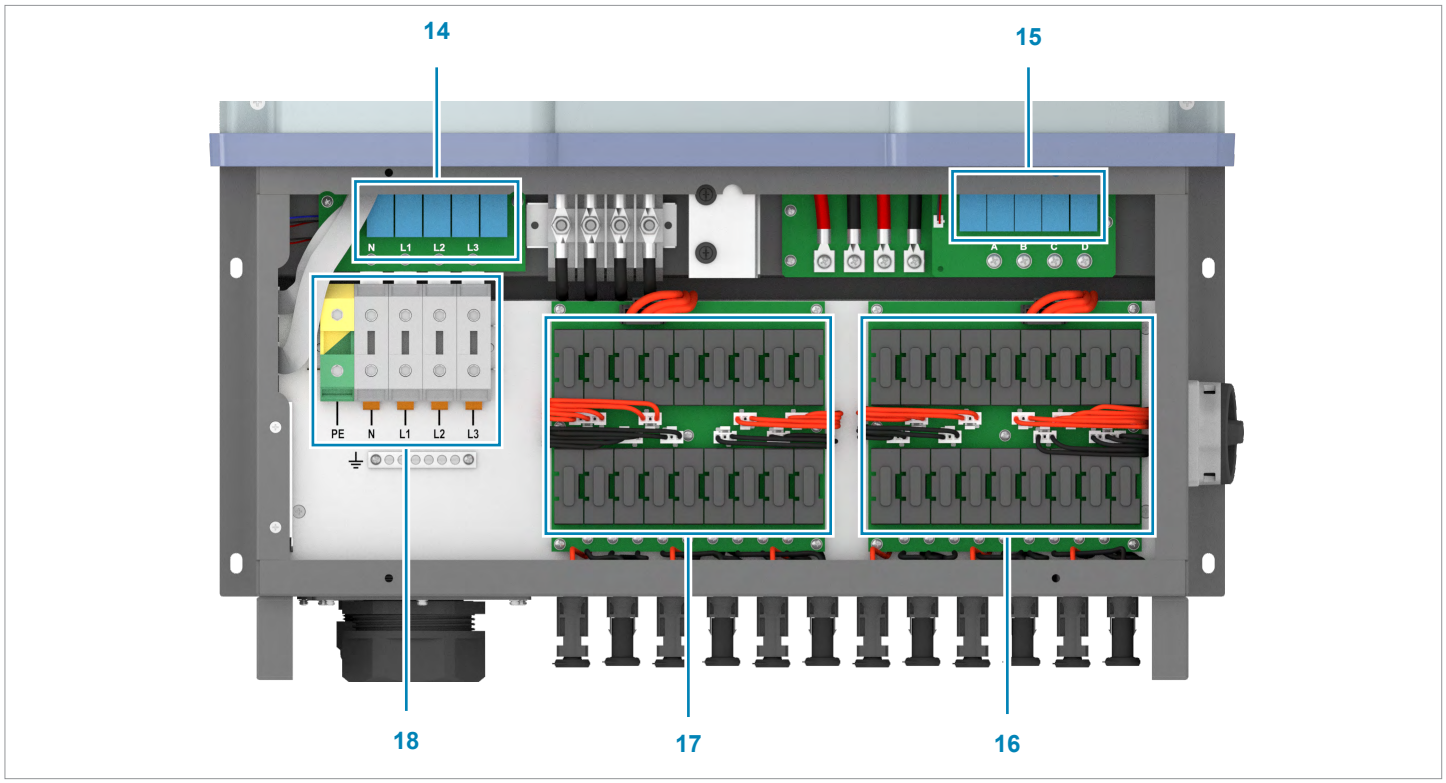


Fig. 4.2: Overview of components on the inside of the terminal box cover

14 AC surge protection devices
15 DC surge protection devices
16 DC1 string fuses
17 DC2 string fuses
18 AC terminal block

4.3 Display, buttons, status LEDs

Fig. 4.3: Overview of display, buttons, and status LEDs

Label	Designation	Use
Status LEDs		
GRID	Mains	Green LED; lights up when the inverter is supplying power to the mains.
ALARM	Alarm	Red LED; displays a warning, an error or a fault.
Buttons		
EXIT	Exit	Exit the current menu. Cancel the setting for a parameter. Changes are not applied.
▼	Down	Move downwards in the menu. Reduce the value of a configurable parameter.
▲	Up	Move upwards in the menu. Increase the value of a configurable parameter.
ENT	Enter	Select menu item. Open a configurable parameter for editing. Cancel the setting for a parameter. Changes are adopted.

4.4 DC-side components

4.4.1 DC connections

Fig. 4.4: Position of the DC connections

The solar modules are connected to the DC connections.
Plug type required:

- Multi-contact MC4 32.0017P0001-UR for DC+
- Multi-contact MC4 32.0016P0001-UR for DC–

18 pairs of DC plugs are supplied in the scope of delivery.

1.1.1 DC isolating switch

Fig. 4.5: Position of the DC isolating switch

*Fig. 4.6: DC isolating switch in the **0 (OFF)** position*

The inverter is **disconnected** from the solar modules when the DC isolating switch is in the ***0 (OFF)*** position.

*Fig. 4.7: DC isolating switch in the **1 (ON)** position*

The inverter is **connected** to the solar modules when the DC isolating switch is in the ***1 (ON)*** position.

4.4.2 String fuses

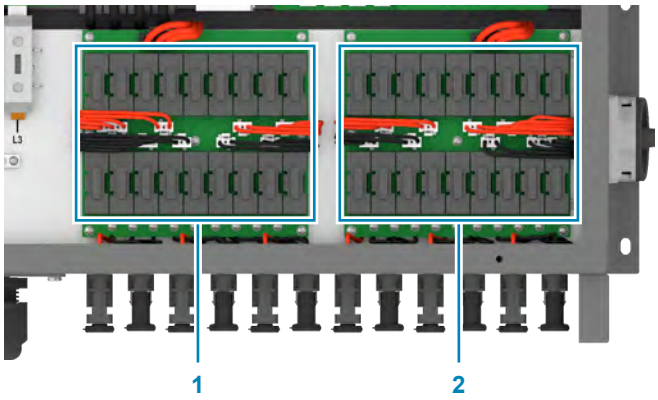


Fig. 4.8: Position of the string fuses

1 DC1 string fuses
2 DC2 string fuses

The inverter has string fuses on the DC side. The string fuses are located in the terminal box.

Fig. 4.9: Littlefuse string fuses are installed ex works

Type

Manufacturer	**Littelfuse**
Part number	0SPF015.T
Nominal current	15 A
Nominal voltage	1000 V

or

Manufacturer	**Hollyland**
Part number	10GPV15UO
Nominal current	15 A
Nominal voltage	1000 V

4.4.3 DC surge protection devices

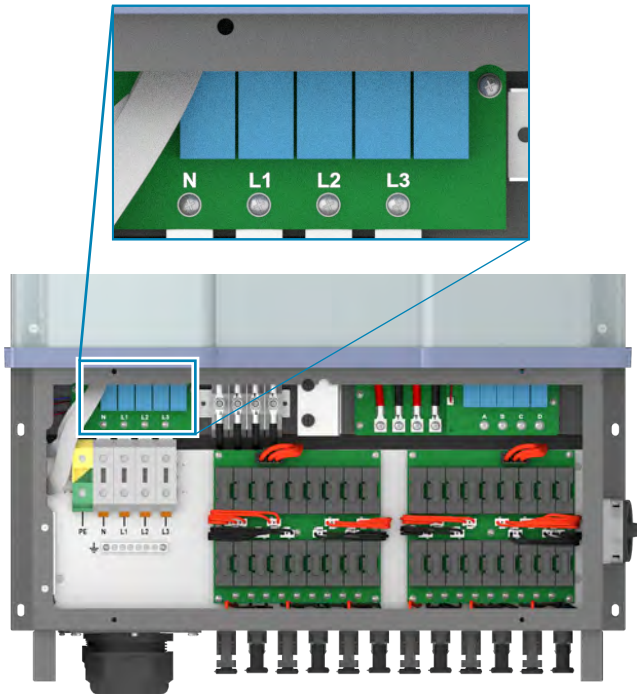


Fig. 4.10: Position of the DC surge protection devices

The inverter is equipped with exchangeable surge protection devices type 2 on the DC side. The surge protection devices protect the inverter from excessively high voltages. If a surge protection device is defective, the entire block will need to be replaced.

The surge protection devices are located in the terminal box.

Type

Type 2 OCM as per EN 50539-11	
Current I_n	10 kA (8/20 µs)
Current I_{max}	20 kA (8/20 µs)
Voltage U_P	1,175 V

4.5 AC-side components

4.5.1 AC cable feed-through

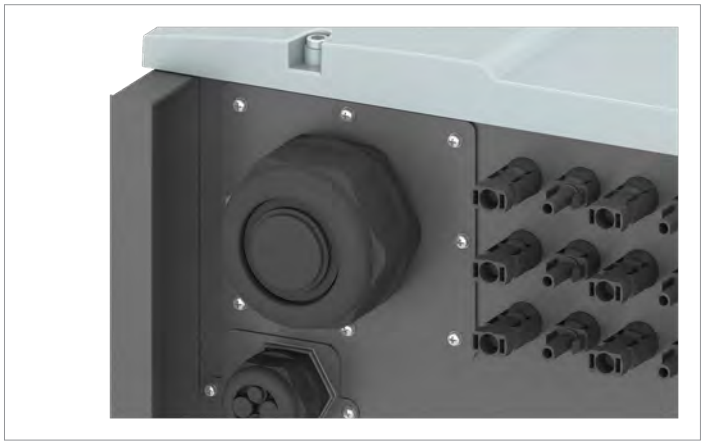


Fig. 4.11: Position of the AC cable feed-through

The inverter is connected to the public grid via the AC connection.

Technical specification for the AC cable feed-through

Min./max. Cable diameter	23.9 ... 51.3 mm

4.5.2 AC terminal block

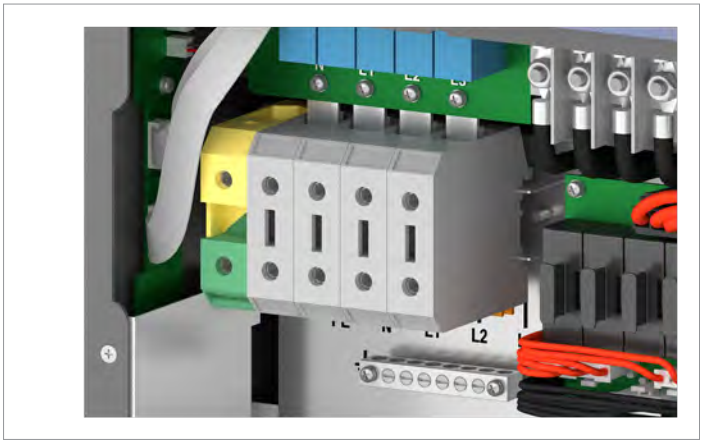


Fig. 4.12: Position of the AC terminal block

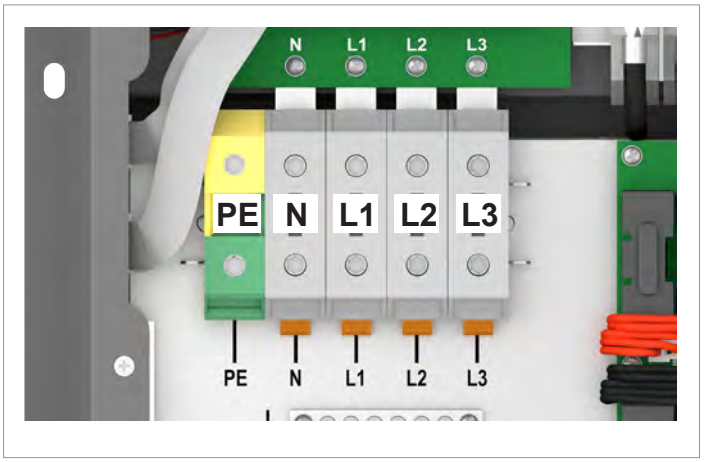


Fig. 4.13: Phase assignment at the AC terminal block

Technical specification for the AC terminal block

Nominal current	106 A
Min./max. Wire cross-section	
Without wire end sleeve	
• rigid cable (solid)	16 ... 95 mm²
• flexible cable	25 ... 70 mm²
with wire end sleeve	
• Flexible cable (wire end sleeve without plastic sleeve)	16 ... 70 mm²
• flexible cable (wire end sleeve with plastic sleeve)	16 ... 70 mm²
Recommended torque for terminal screws	8 Nm

Always observe the notes in “5.5.9 AC cable requirements”, p. 35 when selecting the AC cables.

4.5.3 AC surge protection devices

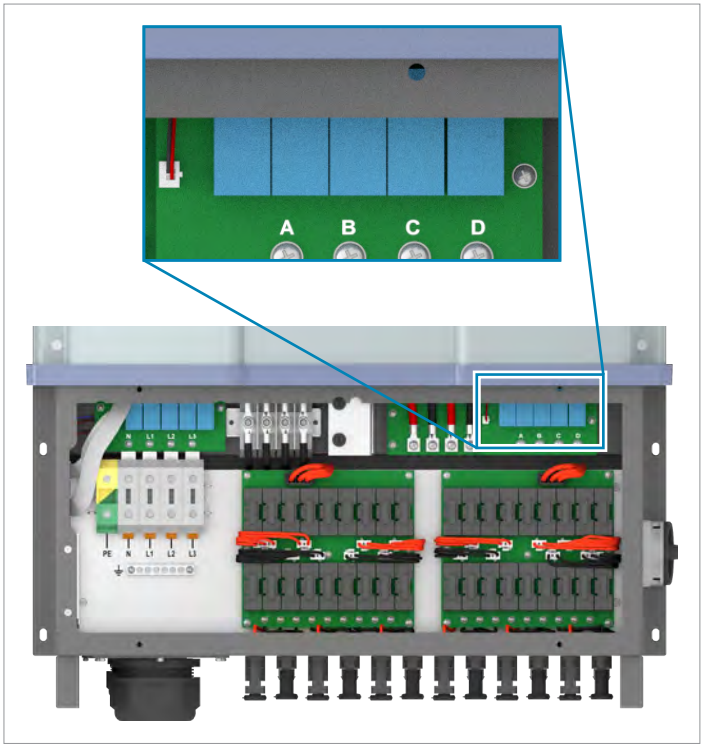


Fig. 4.14: Position of the AC surge protection devices

The inverter is equipped with exchangeable surge protection devices type 2 on the AC side. The surge protection devices protect the inverter from excessively high voltages. If a surge protection device is defective, the entire block will need to be replaced.

The surge protection devices are located in the terminal box.

Type	
Type 2 OCM as per EN 61643-11	
Rated current I_n	10 kA (8/20 µs)
Maximum current I_{max}	20 kA (8/20 µs)
Voltage U_P	895 V_{AC}

4.6 Communications connection

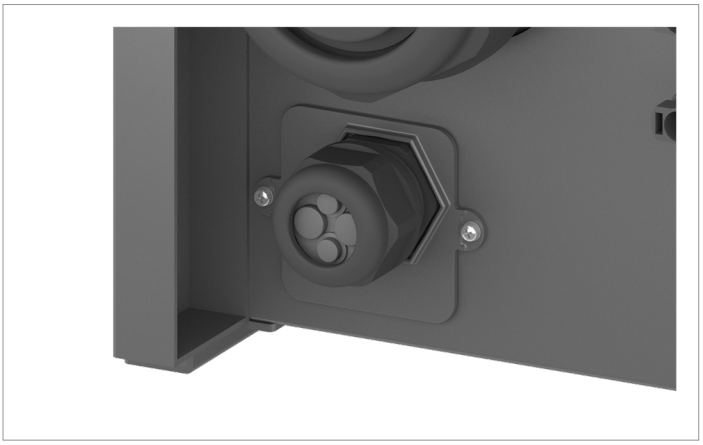


Fig. 4.15: Position of the communications connection

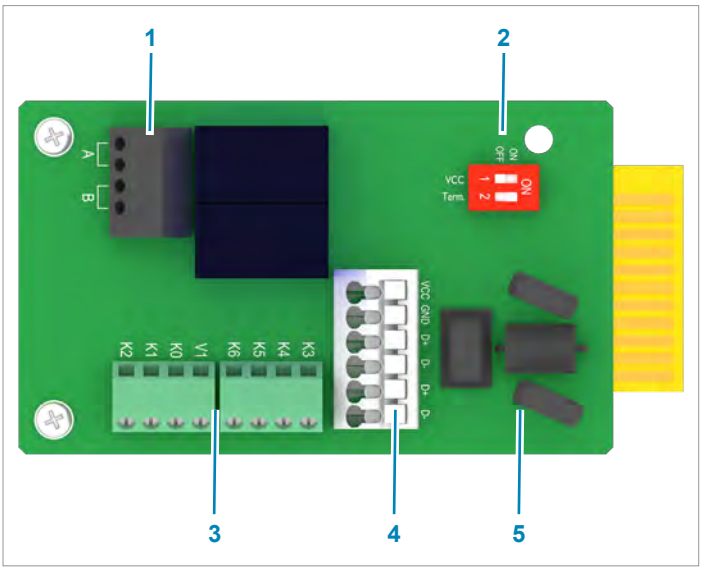


Fig. 4.16: Components of the communications card

1 Dry contacts (terminal block)
2 DIP switch for the RS485 termination resistor
3 Digital inputs and external power-off (terminal block)
4 RS485 and VCC (terminal block)
5 Protection against electromagnetic interference (EMI)

Available connections

Connection	Connection type
2x RS485 (DATA+ and DATA–)	Terminal block
1x VCC (12 V, 0,5 A)	Terminal block
6x digital inputs	Terminal block
2x dry contacts	Terminal block
1x external power-off (EPO)	Terminal block

4.7 Grounding connection

Fig. 4.17: Position of the grounding connection on the inverter

The inverter housing can be grounded via the grounding connection.

The M6 screw, spring washer, washer, and toothed lock washer are already mounted on the inverter**.**

4.8 Ventilation system

Fig. 4.18: Position of the air outlets and the fan block

There is one air outlet located at the top of each of the left and right sides. The fan block can be pulled out at the left and right sides.

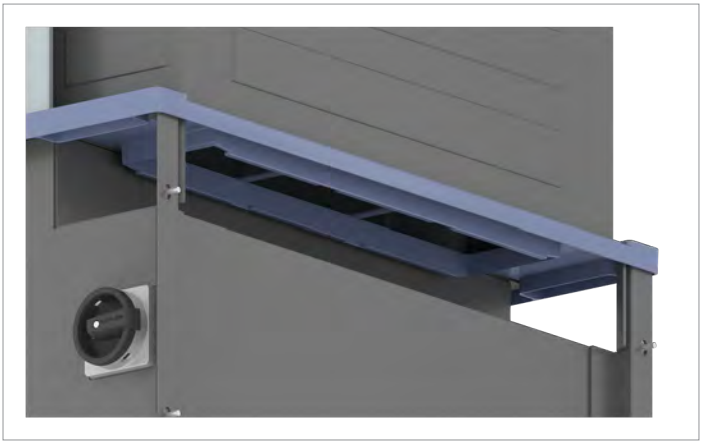
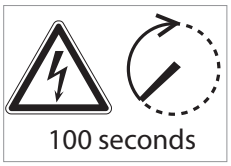


Fig. 4.19: Position of the air inlets

Ambient air is sucked into the air inlet by the fans, passed through the inverter for cooling and the heated air is then expelled to the environment via the air outlets.

4.9 Information on the type plate

Information on the type plate	Description
	This inverter does not contain a transformer.
	**Danger to life through electric shock** Potentially fatal voltage exists within the inverter during operation. This voltage persists even 100 seconds after disconnection of the all the voltage sources.
	Before working on the inverter, read the supplied manual and follow the instructions contained therein.
	The housing of the inverter must be grounded if this is required by local regulations.
	CE mark. By applying this mark, Delta declares that the inverter satisfies the provisions of the applicable EU directives.
	WEEE mark The inverter must not be disposed of as standard household waste, but in accordance with the applicable electronic waste disposal regulations of your country or region.
	This regulatory symbol does not apply to the EU because the noise level lies below the EU guidelines (see “14. Technical data”, p. 228).
Solar Inverter	This is a solar inverter.
Model: M88H_122	Delta model name
DC input	
200~1000 V DC	DC input voltage range
MPPT 600-800 V DC	MPP input voltage range for the rated DC power (symmetrical arrangement of the DC inputs)
1000 V DC max	Maximum DC input voltage
70 A*2 max	Maximum DC input current (70 A at DC1 and DC2 respectively)
Isc: 90A*2 max	Maximum DC short-circuit current I_{SC} (90 A at DC1 and DC2 respectively)
AC output	
230/400, 277/480 V AC	AC nominal voltage
3P3W or 3P4W	The inverter can be connected to 3-phase grids without neutral conductors (3P3W, 3 phases + PE) and 3-phase grids with neutral conductors (3P4W, 3 phases + N + PE).
50/60Hz	AC nominal frequency
106A max	Maximum AC current
cosφ 0.8 ind ~ 0.8 cap	Setting range of the displacement factor cos φ
400 V AC: 66 kW/66 kV A nom, 73 kW/73 kV A max	Rated active power/rated apparent power, maximum active power/maximum apparent power at AC rated voltage = 400 V_{AC}
480 V AC: 80 kW/80 kV A nom, 88 kW/88 kV A max	Rated active power/rated apparent power, maximum active power/maximum apparent power at AC rated voltage = 480 V_{AC}

4 Product overview

Information on the type plate

Information on the type plate	Description
Further information	
IP code: IP65 (electronics)	Protection class for the internal electronics as per EN 60529
Protective Class I	Safety class as per EN 61140
Over Voltage Category: AC: III / DC: III	AC and DC overvoltage category as per IEC 62109-1
Authorized representative Delta Electronics (Netherlands) B.V. Zandsteen 15, 2132 MZ Hoofdorpp The Netherlands	Authorized representative for this product in the EU: Delta Electronics (Netherlands) B.V. Zandsteen 15 2132 MZ Hoofddorp Netherlands

5. Planning the installation

This chapter describes only the **planning** of the installation work. The **execution** of the installation work and the associated dangers are described in the "Installation" chapter.

5.1 Installation location

5.1.1 Requirements for the wall and mounting system

- ► The inverter is very heavy. The wall and mounting system must be able to bear the heavy weight of the inverter.
- ► Always use the mounting plate supplied with the inverter.
- ► Use mounting materials (dowels, screws etc.) that are suitable for the wall or the mounting system, as well as the heavy weight of the inverter.
- ► Mount the inverter on a vibration-free wall to avoid disruptions.
- ► When using the inverter in residential areas or in buildings with animals, possible noise emissions can be disturbing. Therefore, carefully choose the place of installation.
- ► Mount the inverter on a fireproof wall.

5.1.2 Installation height

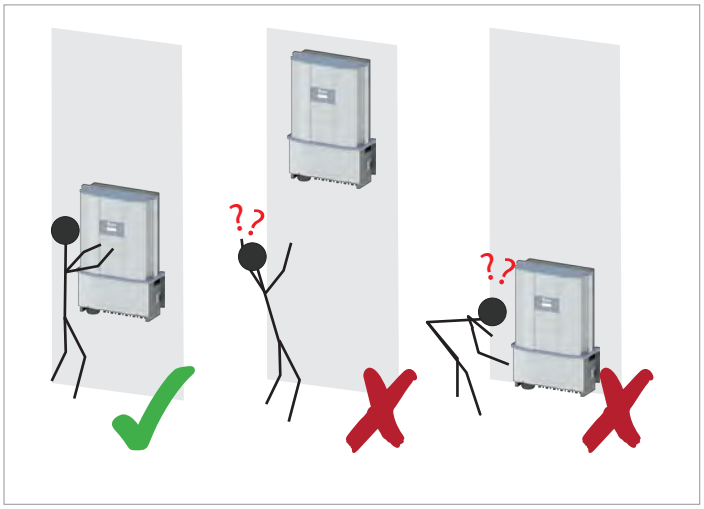


Fig. 5.20: Installation height - the display must be legible and accessible for operation

- ► Attach the inverter so that the information on the display can be read and the buttons can be operated without any problems.

5.1.3 Mounting alignment

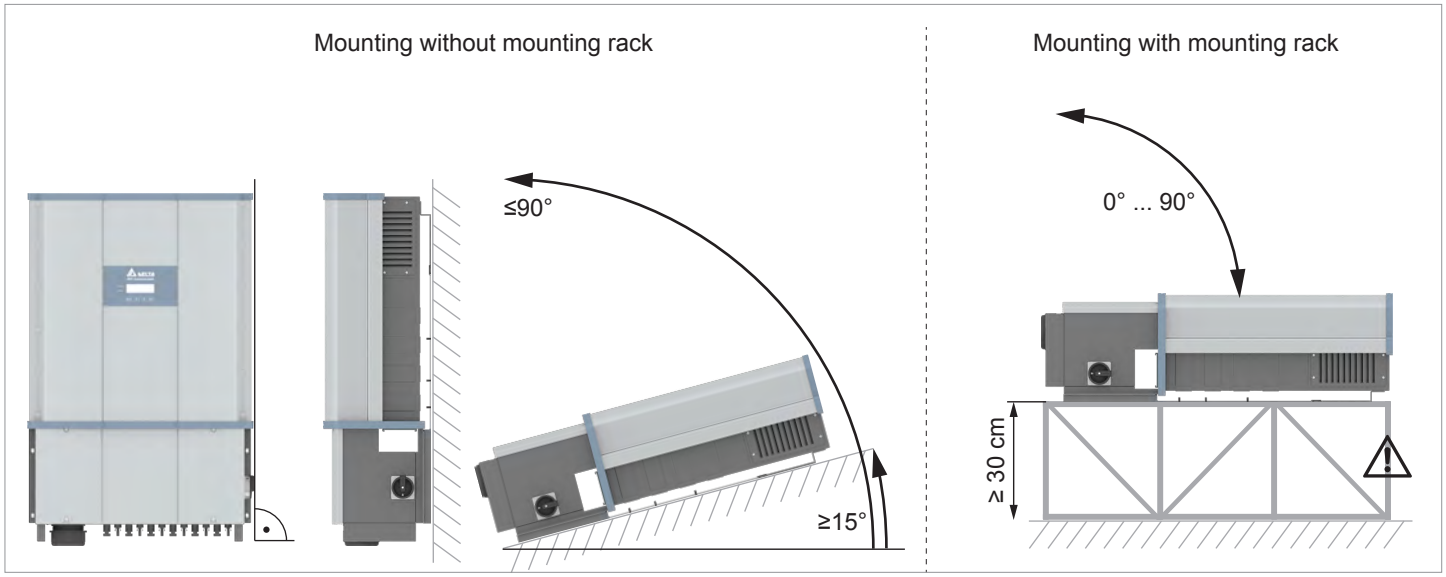


Fig. 5.21: Mounting alignment

► Mount the inverter exclusively in the installation positions shown in “Fig. 5.21: Mounting alignment”, page 24. No other installation positions are permitted.

5.1.4 Outdoor installations

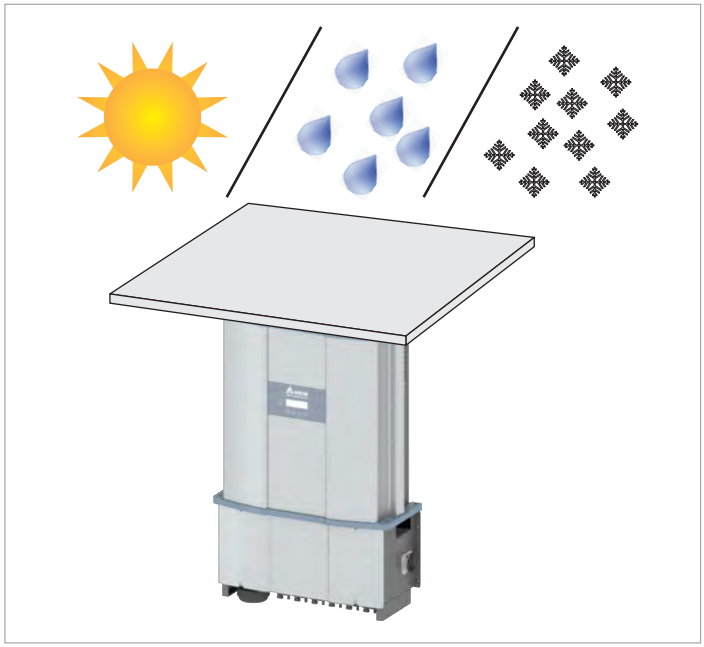


Fig. 5.22: For outdoor installations, protect the inverter against sun, rain and snow

► The inverter has a protection degree of IP65 and can be installed indoors and outdoors. Despite this, the inverter should be protected by a roof against direct solar irradiation, rain and snow. For example, the power of the inverter will be reduced if it is too heavily heated by solar radiation. This is normal operating behavior for the inverter and is necessary to protect the internal electronics.

5.2 Installation clearances and air circulation

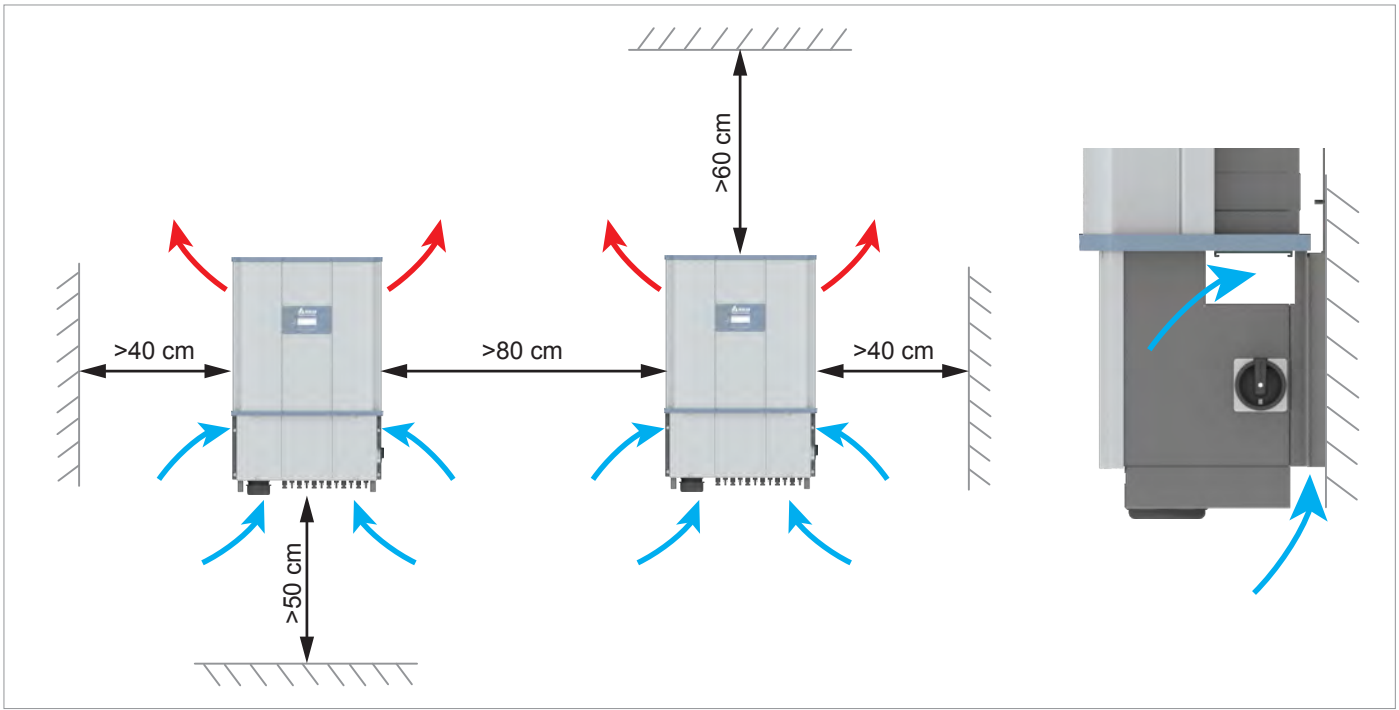


Fig. 5.23: Installation clearances and air circulation

- ► Ensure sufficient air circulation. Hot air must be able to dissipate upwards. Leave enough space around each inverter.
- ► Do not install inverters above one another so that they do not heat each other.
- ► Note the *Operating temperature range without derating* and the *Operating temperature range*. When the *Operating temperature range without derating* is exceeded, the inverter reduces the AC power fed into the mains grid. When the *Operating temperature range* is exceeded, the inverter stops feeding AC power into the mains. This is normal operating behavior for the inverter and is necessary to protect the internal electronics.
- ► In areas with many trees or fields, pollen can clog the air inlets and outlets, hindering the air flow.

5.3 Characteristic curves

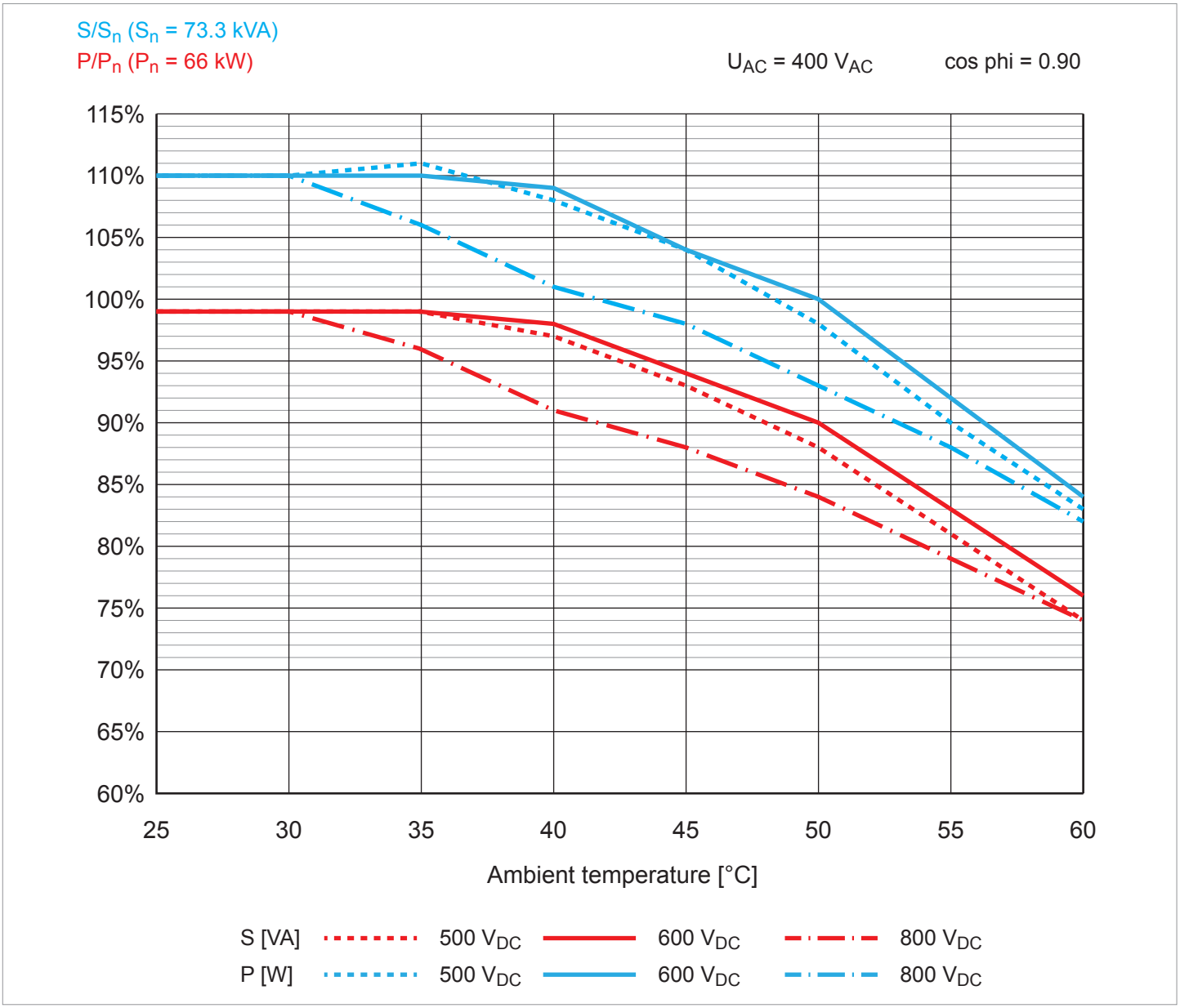


Fig. 5.24: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 0.90, AC voltage = 400 V"

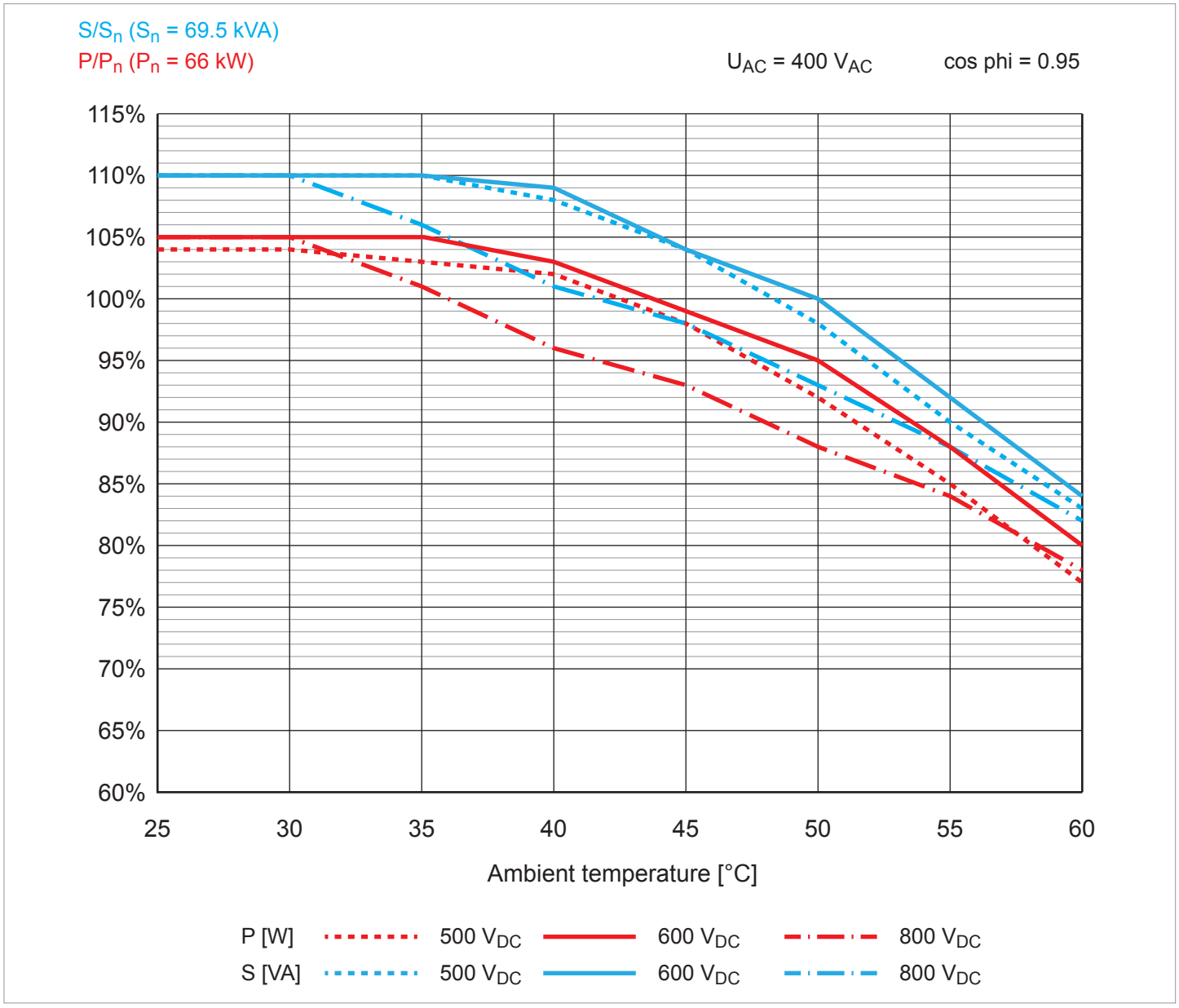


Fig. 5.25: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 0.95, AC voltage = 400 V"

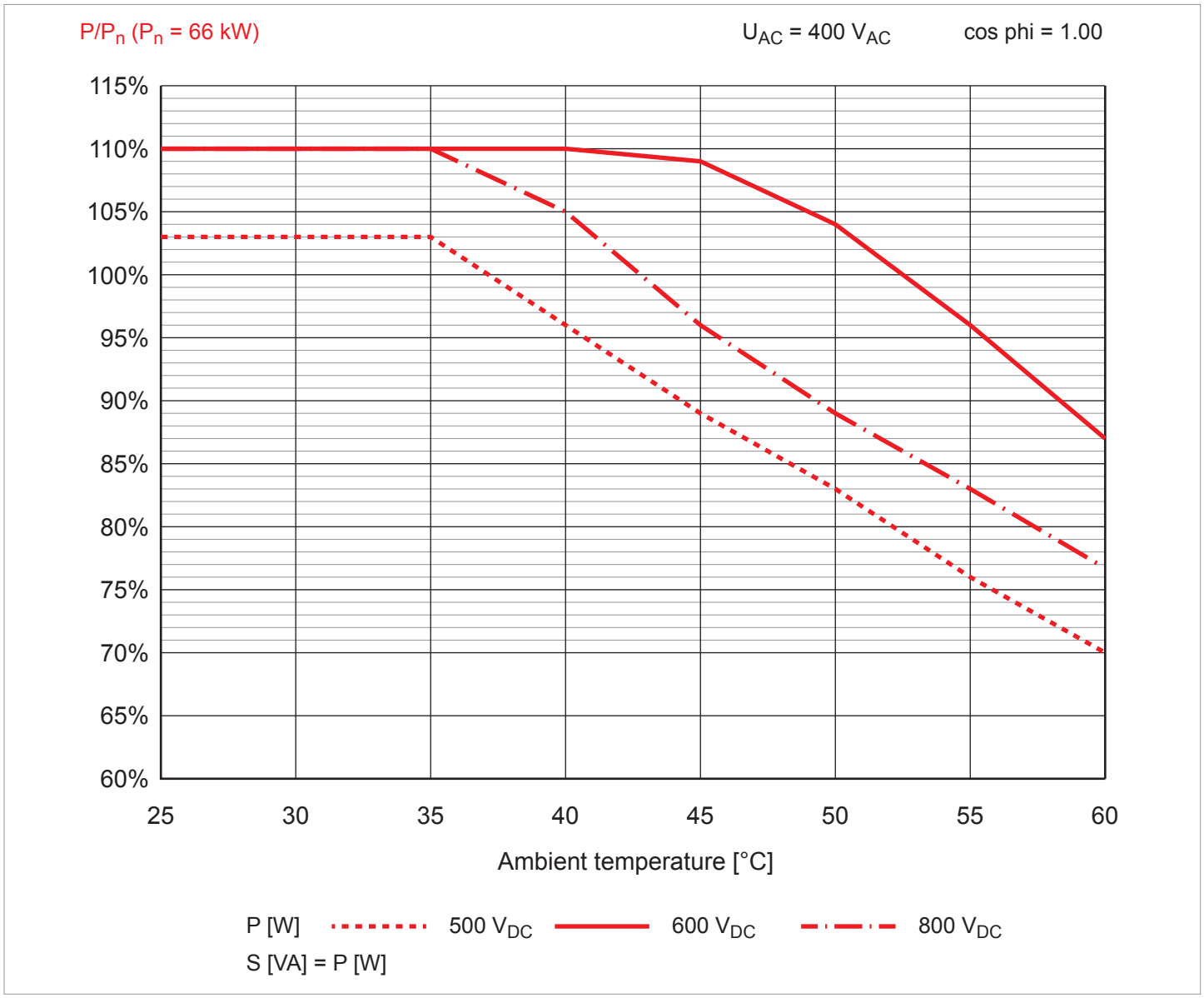


Fig. 5.26: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 1.0, AC voltage = 400 V"

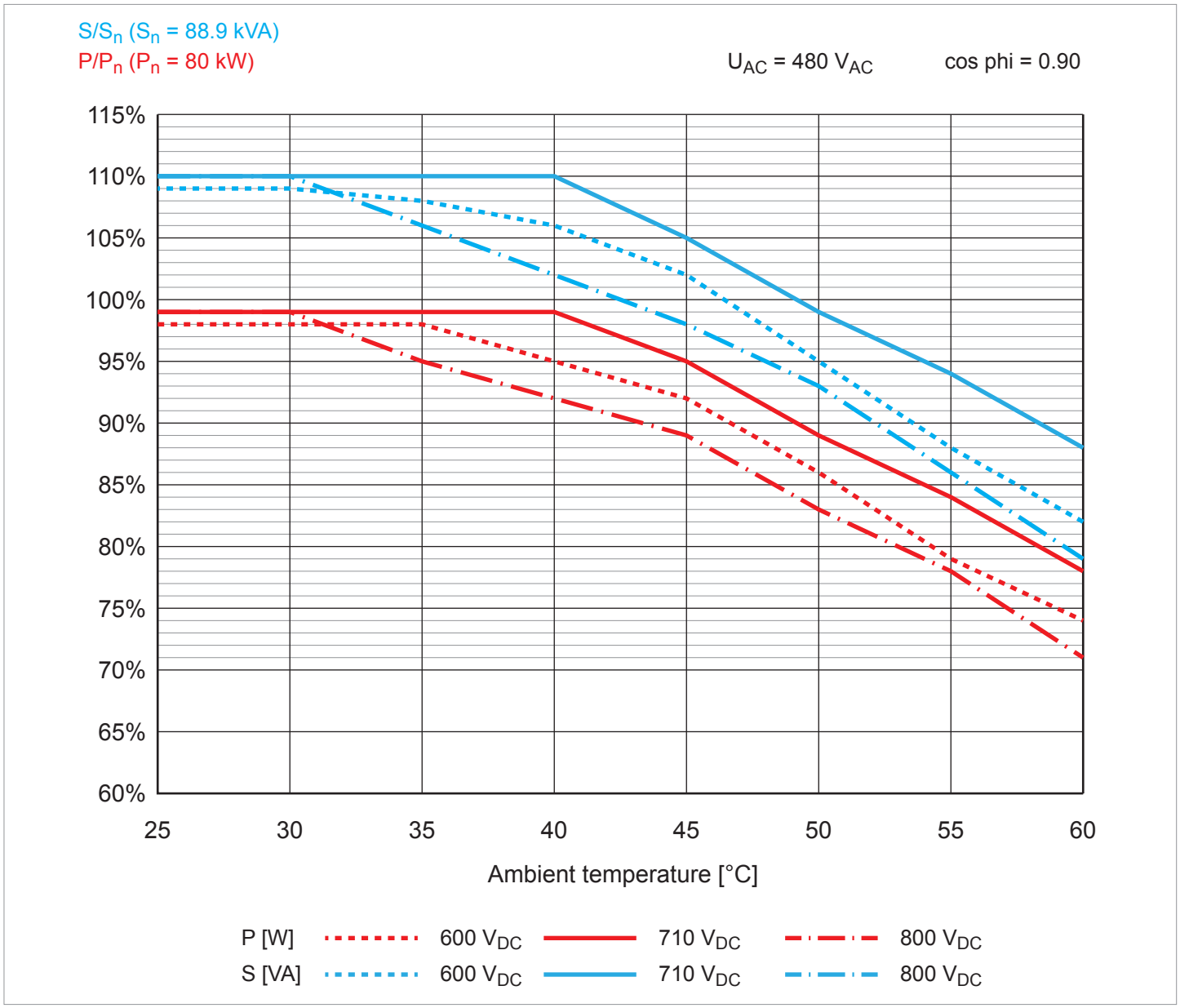


Fig. 5.27: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 0.90, AC voltage = 480 V"

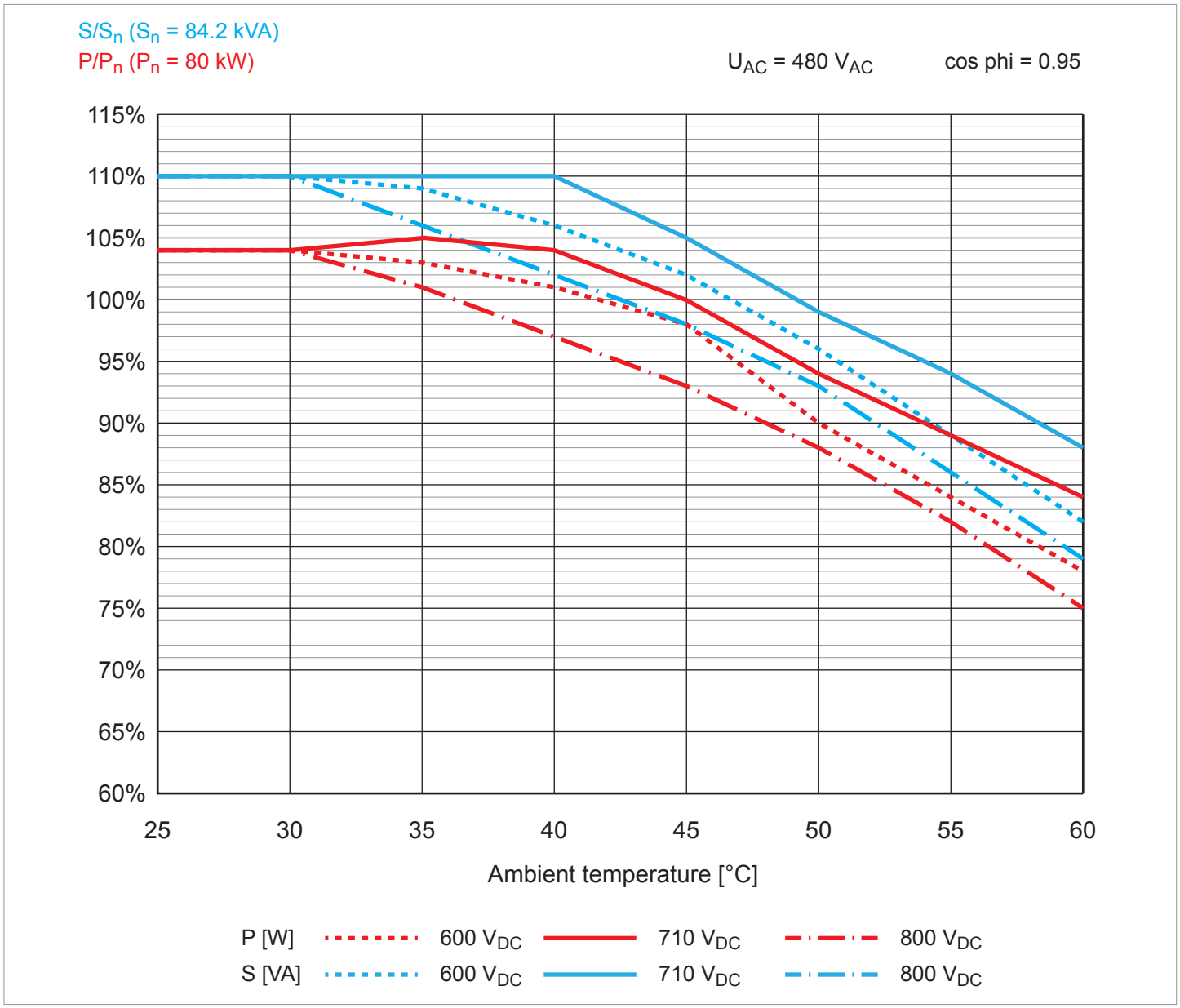


Fig. 5.28: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 0.95, AC voltage = 480 V"

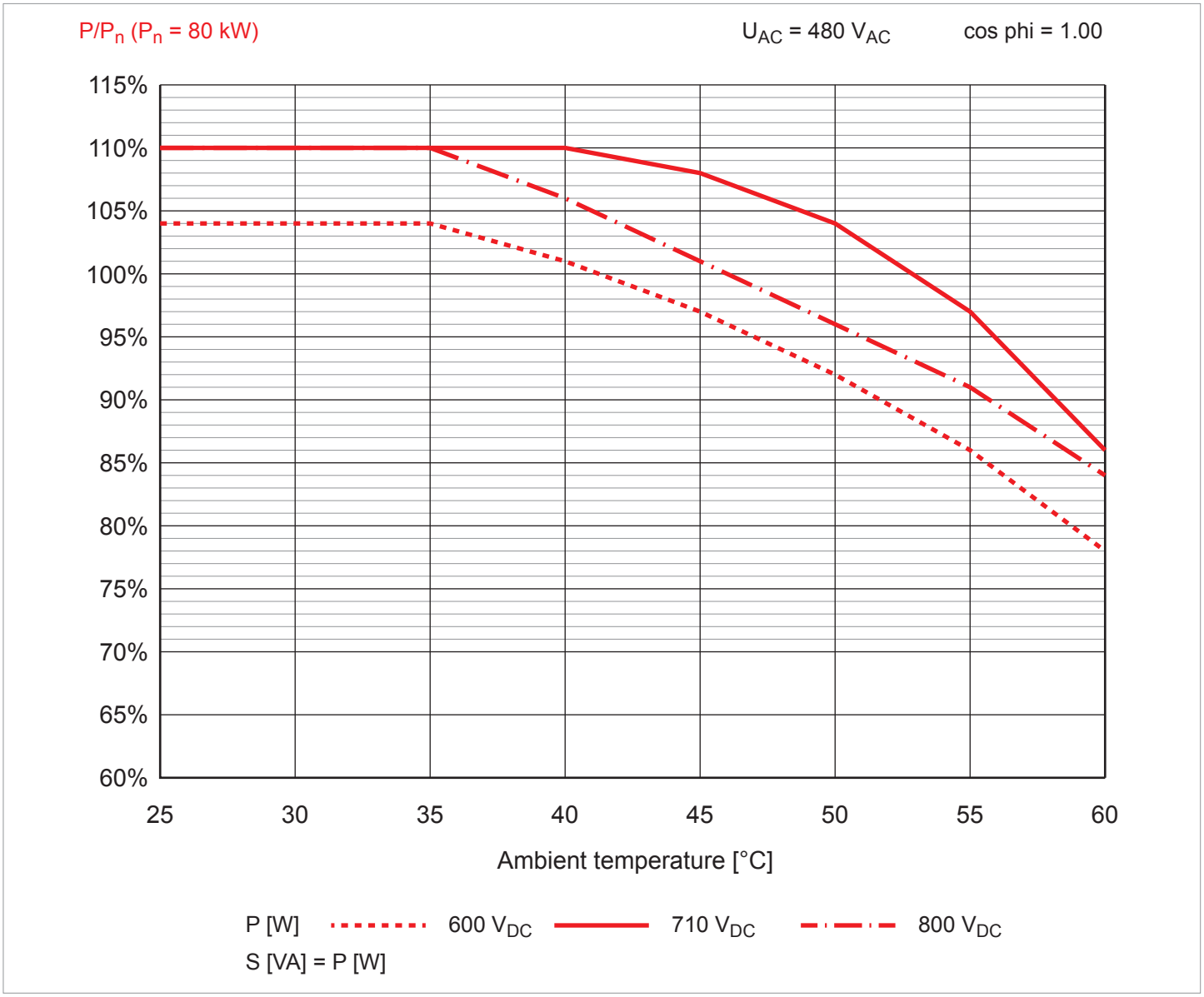


Fig. 5.29: Characteristic curve "Power derating depending on the ambient temperature, cos φ = 1.0, AC voltage = 480 V"

5.4 Dimensions

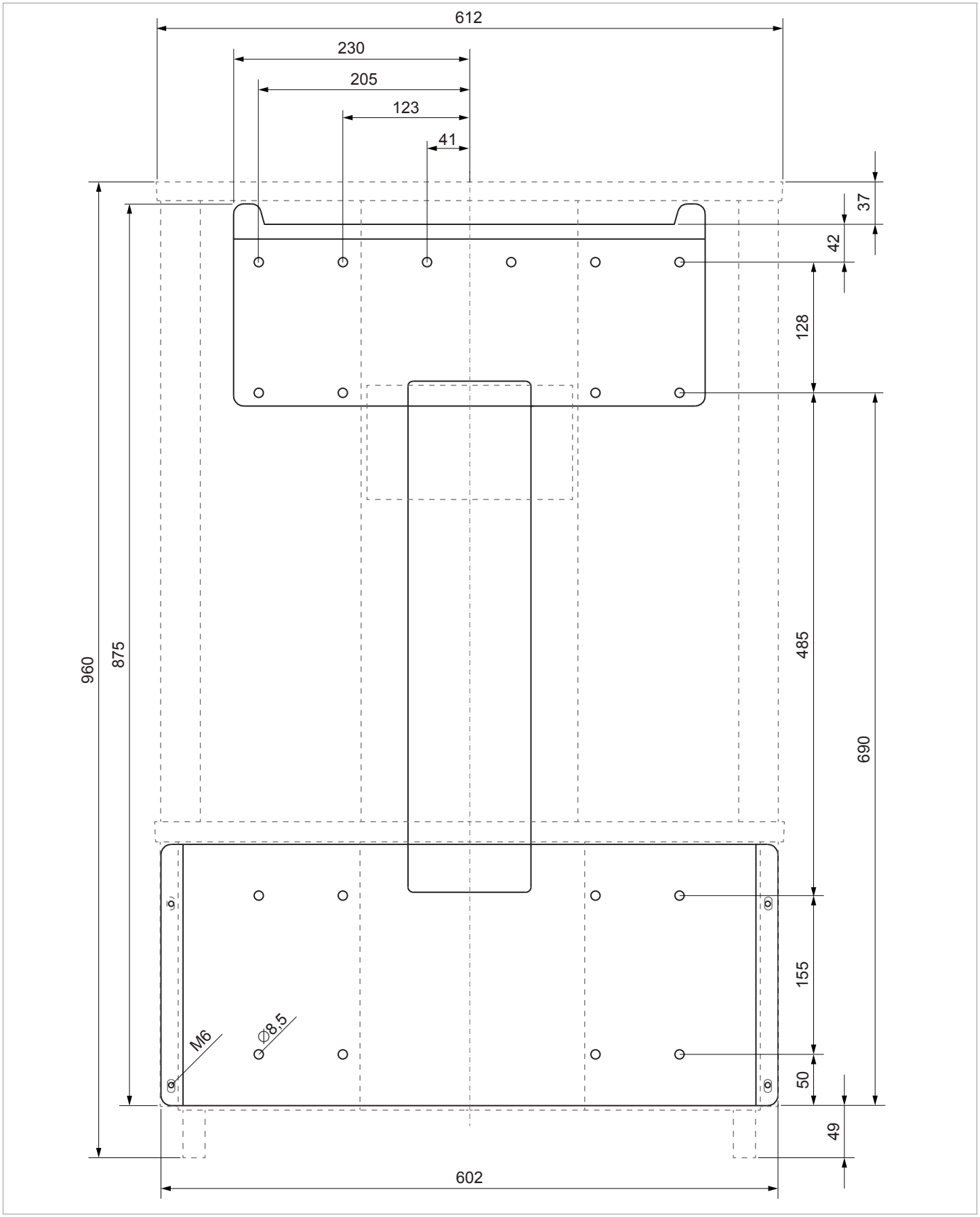


Fig. 5.30: Dimensions 1 (in mm)

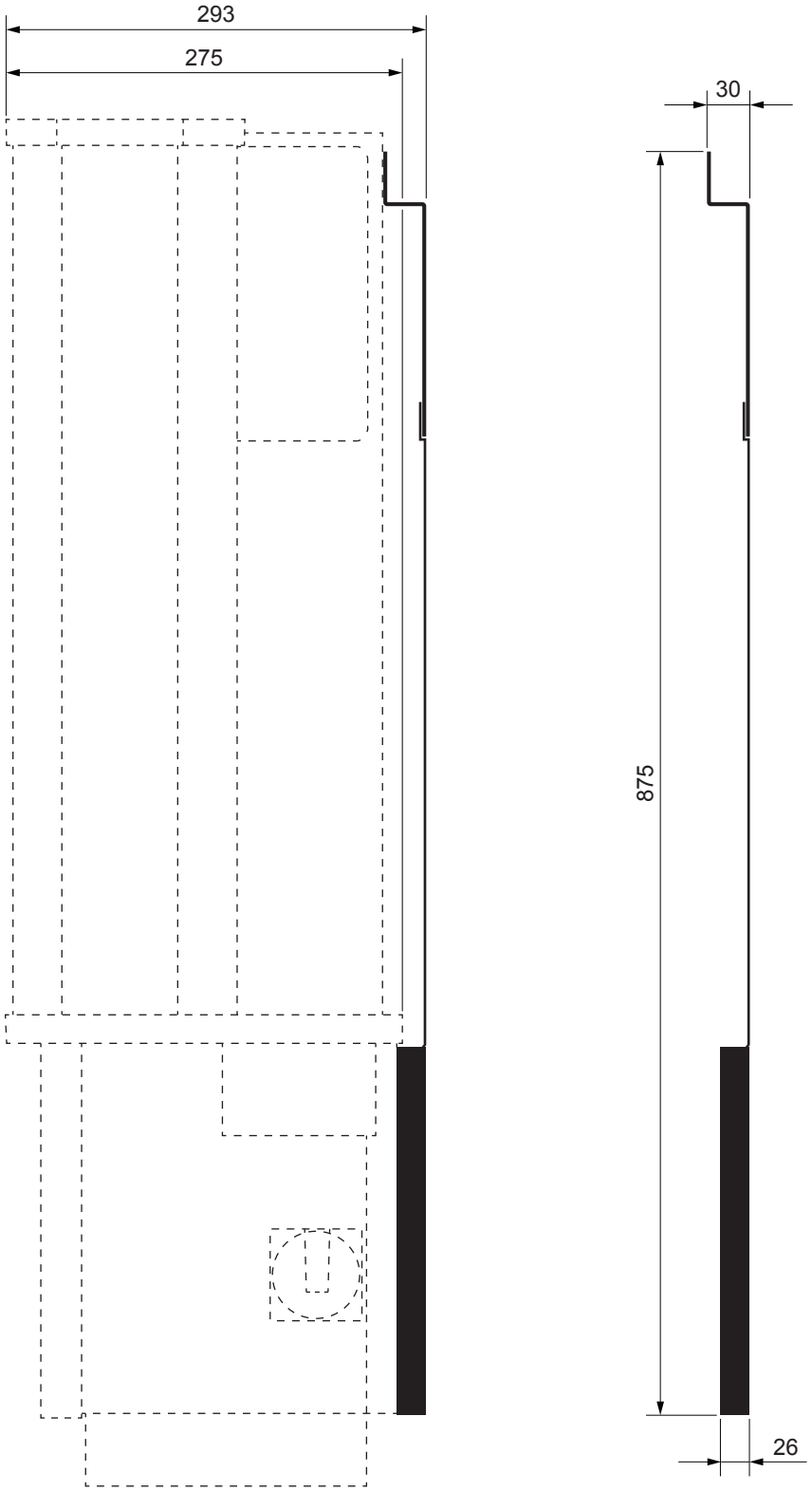


Fig. 5.31: Dimensions 2 (in mm)

5.5 AC connection (grid)

NOTICE

Ingress of moisture

If the fuse box cover is removed, the degree of protection is no longer IP65.

► Do not remove the cover unless the inverter is in a dry environment.

5.5.1 Important safety instructions

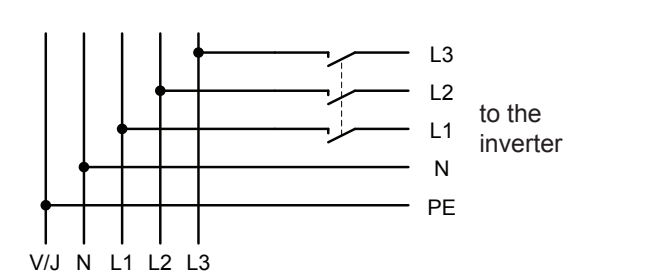
► Always follow the specific regulations of your country or region.

► Always follow the specific regulations of your energy provider.

► Install all the stipulated safety and protective devices (such as automatic circuit breakers and/or surge protection devices).

► Protect the inverter with a suitable upstream circuit breaker:

Upstream circuit breaker	125 A



► When selecting the protective devices for the mains cable to the transformer of the mains feed-in point, always take into account the impedance between the PE of the inverter and the system and/or operational ground of the distribution network. This applies in particular for TT and IT networks.

5.5.2 Residual current circuit breaker

Due to its design, the inverter cannot supply the mains with DC residual current. This means that the inverter meets the requirements of DIN VDE 0100-712.

Possible error events were assessed by Delta in accordance with the current installation standards. The assessments showed that no hazards arise from operating the inverter in combination with an upstream, type A residual current circuit breaker (FI circuit breaker, RCD). There is no need to use a type B residual current circuit breaker.

Minimum tripping current of the type A residual current circuit breaker	≥300 mA

The required tripping current of the residual current circuit breaker depends first and foremost on the quality of the solar modules, the size of the PV system, and the ambient conditions (e.g. humidity). The tripping current must not, however, be less than the specified minimum tripping current.

5.5.3 Integrated residual current monitoring unit

The integrated, universal current-sensitive residual current monitoring unit (RCMU) is certified in accordance with VDE 0126 1-1:2013-08 §6.6.2.

5.5.4 Integrated surge protection devices

► Surge protection devices are available from Delta.

5.5.5 Grounding the inverter

The inverter must be grounded via the PE conductor. To do this, connect the PE conductor of the AC cable to the AC plug pin provided for that purpose.

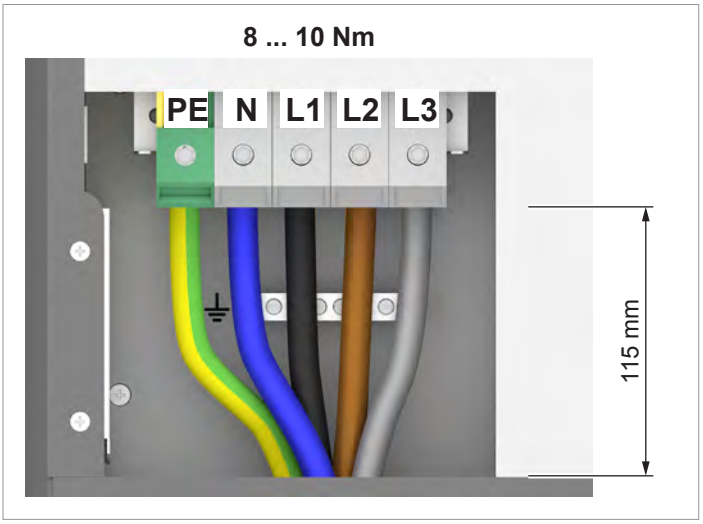
5.5.6 Permissible grounding systems

Grounding system	TN-S	TN-C	TN-C-S	TT	IT
Allowed	Yes	Yes	Yes	Yes	Yes

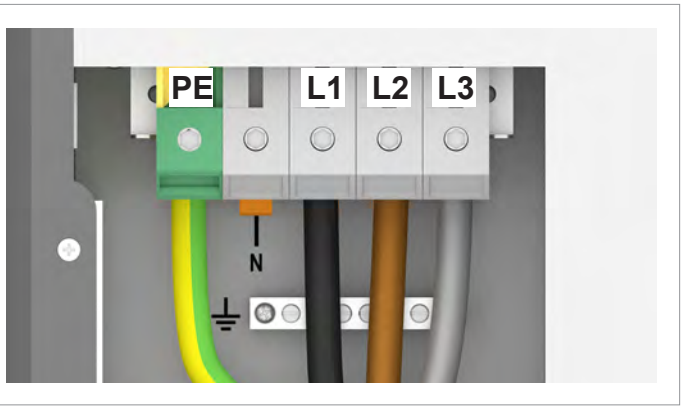
5.5.7 Requirements for the mains voltage

3P3W	Voltage range	3P4W	Voltage range
L1-L2	400 V_{AC} ± 30%	L1-N	230 V_{AC} ± 30%
L1-L3	400 V_{AC} ± 30%	L2-N	230 V_{AC} ± 30%
L2-L3	400 V_{AC} ± 30%	L3-N	230 V_{AC} ± 30%
L1-L2	480 V_{AC} ± 20%	L1-N	277 V_{AC} ± 20%
L1-L3	480 V_{AC} ± 20%	L2-N	277 V_{AC} ± 20%
L2-L3	480 V_{AC} ± 20%	L3-N	277 V_{AC} ± 20%

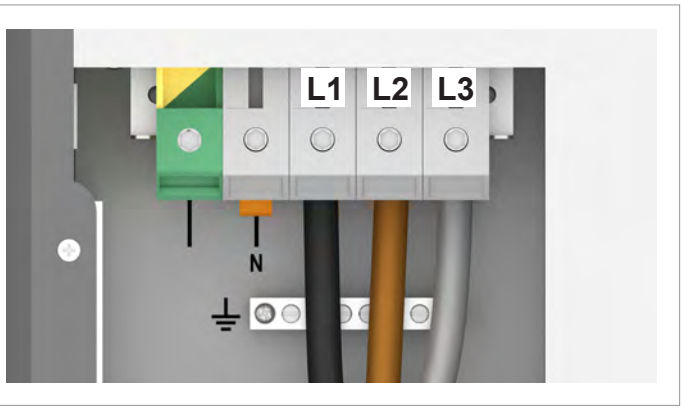
5.5.8 Wiring examples for the M88H_122 (CF)



Wiring example 1: With PE conductor, with neutral conductor



Wiring example 2: With PE conductor, without neutral conductor



Wiring example 3: Without PE conductor, without neutral conductor

5.5.9 AC cable requirements

NOTICE

Danger of a cable fire.
Bending and twisting causes damage to the inner structure of the conductor, which leads to punctiform increase in electrical resistance. This can result in an overheating of the conductor and destruction of the insulation.

► When bending and twisting cables or conductors, always comply with the manufacturer's instructions.

5.5.9.1 General information on the AC terminal block

The section describes the general technical characteristics of the AC terminal blocks. The special features which apply to the installation of the inverter are explained in the following sections.

The specifications in this section have been defined by Phoenix Contact. Check if the technical specifications have change before starting installation work, see www.phoenixcontact.com.

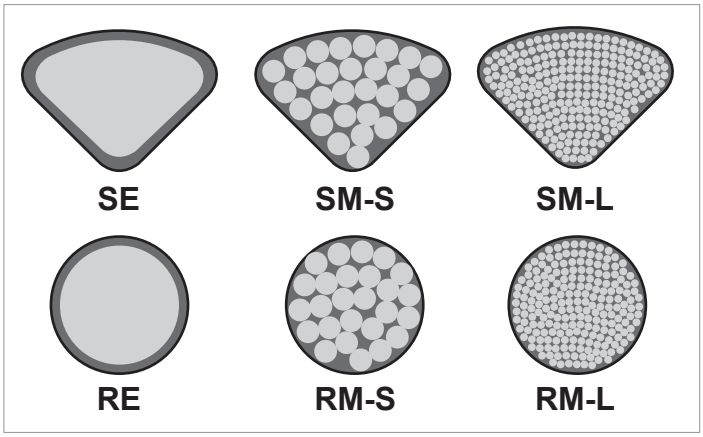
AC terminal block specifications

Designation	Phoenix Contact UKH 70
Connection type	Screws with hexagon socket head
Screw thread	M8
Rated current I_N	96 A
Rated voltage U_N	1000 V
Attaching the conductor	
Type of attachment	M8 screws with hexagon socket head
Tightening torque	8 ... 10 Nm

Specification for copper cable

Min./max. Wire cross-section	
Without wire end sleeve	
• rigid cable	16 ... 95 mm²
• flexible cable	25 ... 70 mm²
with wire end sleeve	
• Flexible cable (wire end sleeve without plastic sleeve)	16 ... 70 mm²
• flexible cable (wire end sleeve with plastic sleeve)	16 ... 70 mm²
Stripping length	24 mm

Specification for aluminum cable

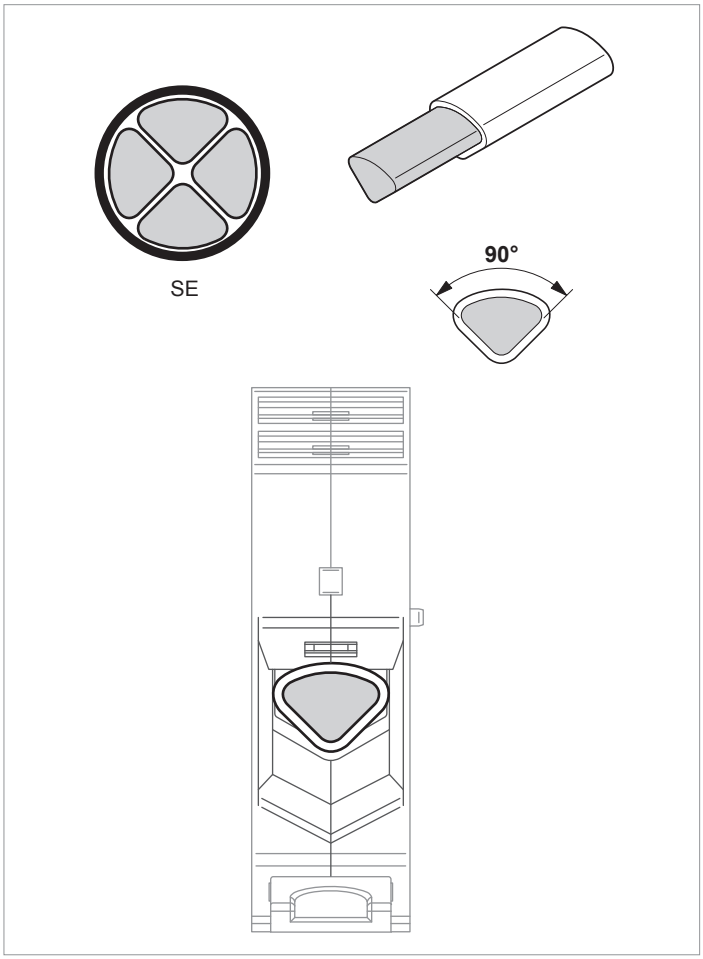


The most important cable types for aluminum cable

SE	**s**ector-shaped, **s**olid conductor
SM-S	**s**ector-shaped, **m**ulti-conductor, rigid wires
SM-L	**s**ector-shaped, **m**ulti-conductor, (stranded wires)
RE	**r**ound, **s**olid conductor
RM-S	**r**ound, **m**ulti-conductor, rigid wires
RM-L	**r**ound, **m**ulti-conductor, (stranded wires)

The terminals have been specially developed for direct connection of sector-shaped solid conductor (SE) aluminum cables:

Min./max. Conductor cross-section	50 / 70 mm²
Stripping length	24 mm



5.5.9.2 Special instructions for the use of aluminum cables

The instructions contained in this section refer specifically to the use of aluminum cables with this inverter. These instructions supplement the specifications of the manufacturer of the terminal blocks.

Handling aluminum conductors during installation work

The special properties of aluminum must be taken in to consideration when using aluminum:

- Aluminum "flows", i.e. it gives way under pressure.
- A thin non-conductive oxide layer forms within a few minutes on de-insulation, which increases the contact resistance between the conductor and clamping point.
- The specific conductivity and hence the current carrying capacity is approximately one third less than that of copper.

NOTICE

Extreme temperature rise at the clamping point

If the contact resistance between the aluminum conductor and clamping point is too high, the clamping point can become very hot and even catch fire in extreme cases.

To ensure a safe and reliable contact, **always** perform the following work steps:

- ► Use a conductor cross-section at least one number larger due to the lower current-carrying capacity.
- ► Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ► Connect the aluminum cables quickly.
- ► Mechanically clean the stripped end of the aluminum conductor (using for instance a knife blade to scrape off the oxide layer), then immediately dip the aluminum conductor into acid-fee and alkaline-free (= neutral) Vaseline and straight away insert it into the terminal block.
- ► Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.

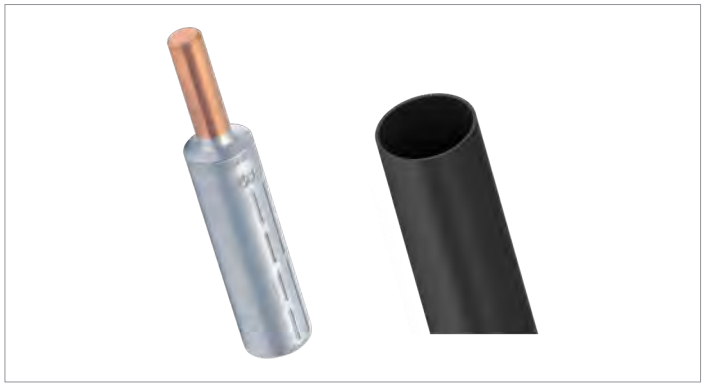
If other types of aluminum cables are used, Al-Cu crimped connectors (such as those available from Klauke, Elpress or Mecatraction) must be used, see “Instructions regarding selection and utilization of Al-Cu crimped connectors”, p. 36.

Instructions regarding selection and utilization of Al-Cu crimped connectors

Observe the following instructions when using aluminum cables with Al-Cu crimped connectors (such as those from Klauke, Elpress or Mecatraction) and heat-shrink sleeving.

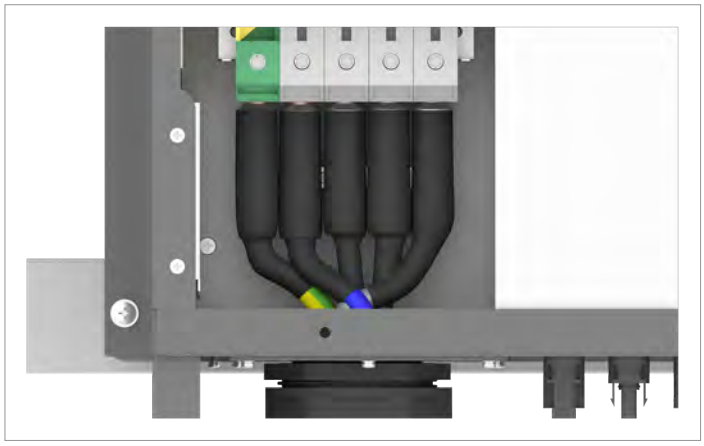
- ► Select crimp connectors suitable for the type of cable that is used.

► Comply with the installation instructions issued by the manufacturer of the crimp connectors.
► Secure the cables with an external strain relief element.



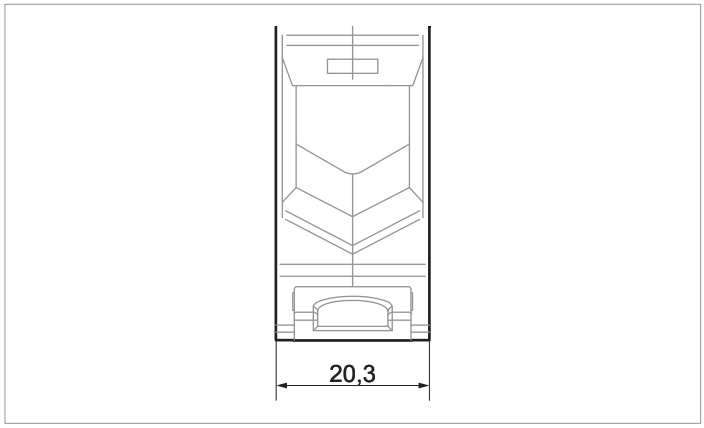
Additional Al-Cu crimped connectors and heat-shrink sleeving are required with non-sector-shaped aluminum cables

► Use original tools from the manufacturer of the crimp connectors for assembling the aluminum cables.



AC cabling using aluminum cables, crimp connectors and heat-shrink sleeving

- The external diameter of the crimped connectors including the heat-shrink sleeving must be smaller than the width of a clamping point on the terminal block.

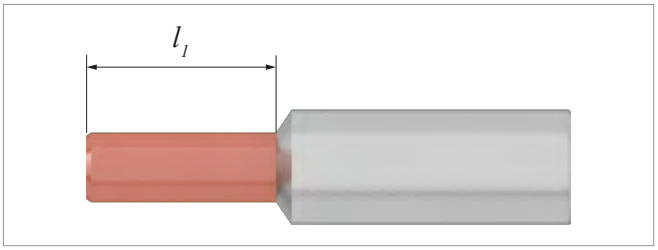


Width of a clamping point on the terminal block

- Pull the heat-shrink sleeving on so that the aluminum part of the crimped connector is completely covered.

Pull the heat-shrink sleeving over the complete aluminum part

- The length of the copper bolt on the Al-Cu crimped connector must be approximately equal to the stripping length specified for copper cable by the manufacturer of the terminal block (see “Specification for copper cable”, p. 35):



Type	Stripping length	l_1 Copper bolts
UKH 70	24 mm	≈ 24 mm

5.5.9.3 Laying of the AC cable

When bending and twisting cables or conductors, always comply with the manufacturer's instructions so as to avoid breakage of the conductors or the insulation.

Fig. 5.32: Recommended feeding of the AC cable

Fasten the cable with a strain relief element.

5.5.9.4 AC cable gland

The inverter has 1 AC cable gland with 1 cable feed-through.

Min./max. Cable diameter	23.9 ... 51.3 mm

Notes on calculating the cable cross-section

Consider the following factors when calculating the cable diameter:

- Cable material
- Temperature conditions
- Cable length
- Installation type
- Voltage drop
- Loss of power in the cable

Always follow the installation regulations for AC cables applicable in your country.

France: Follow the installation instructions of UTE 15-712-1. This standard contains the requirements for minimum cable diameters and for avoiding overheating due to high currents.

Germany: Follow the installation instructions of UTE VDE 0100-712. This standard contains the requirements for minimum cable diameters and for avoiding overheating due to high currents.

5.6 DC connection (solar modules)

NOTICE

Incorrectly dimensioned solar system.
An solar system of the wrong size may cause damage to the inverter.

► Always pay attention to the technical specifications of the inverter (input voltage range, maximum current and maximum input power) when calculating the number of solar modules.

NOTICE

Overheating of the DC connections.
Exceeding the maximum current can cause overheating of the DC connections and result in a fire.

► Always take into account the maximum current of the DC connections when planning the installation.

5.6.1 Symmetrical and asymmetrical configuration of the DC inputs

The inverter has a separate MPP tracker for each DC input (DC 1 and DC 2).

The two MPP trackers work independently, i.e. the optimum working point is set separately for DC 1 and DC 2. This allows the module strings connected to DC 1 and DC 2 to be aligned or dimensioned differently. A typical application example is a building with a gable roof where the parts of the roof are facing east and west.

Variant 1: Symmetrical design of the DC inputs

The total input power is evenly divided (50%/50%) between DC 1 and DC 2.

Variant 2: Asymmetrical design of the DC inputs

The maximum permissible total input power is divided between DC 1 and DC 2 within a range of 60%/40% to 40%/60%. A distribution of 55%/45% or 45%/55% is also possible, for example.

The percentages always relate to the instantaneous input power. In an east-west roof-mounted system, this allows installing 60% of the maximum input power on both roofs. This utilizes the effect that the solar modules on both roofs provide maximum power at different times of the day.

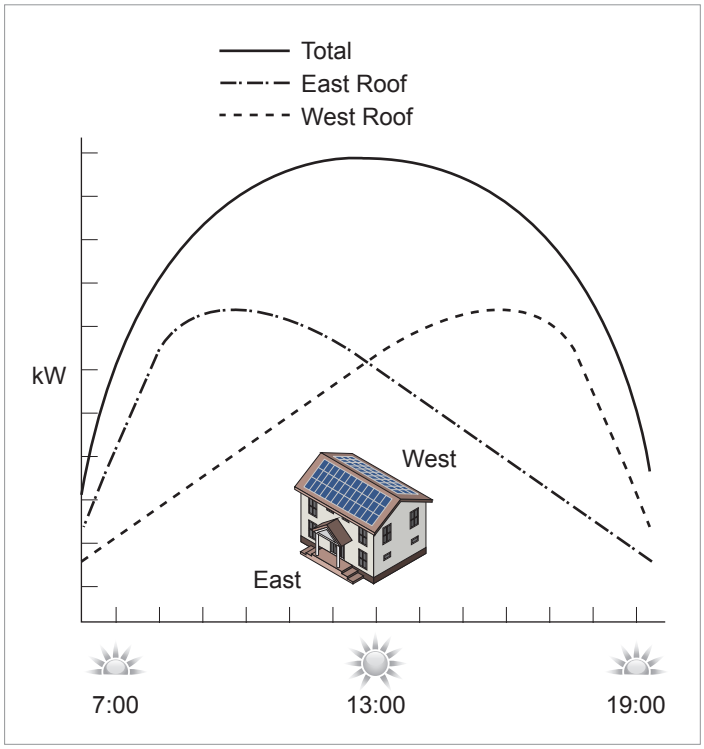
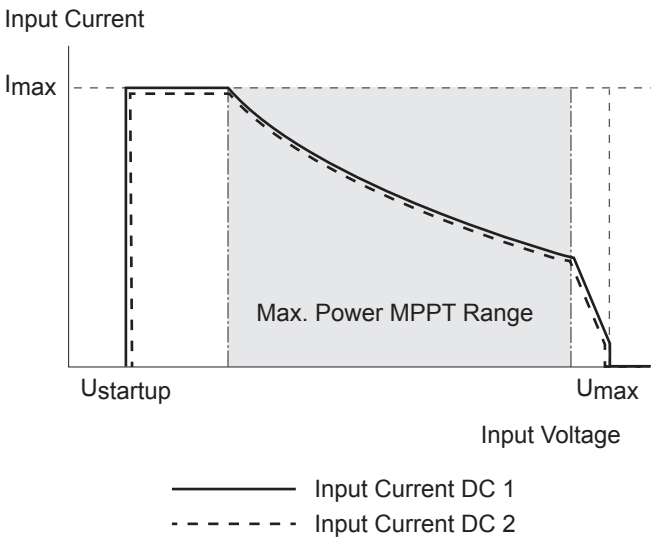


Fig. 5.33: Concept for a system with 2 MPP trackers and asymmetric load distribution across the DC inputs

Symmetrical design



Asymmetrical design

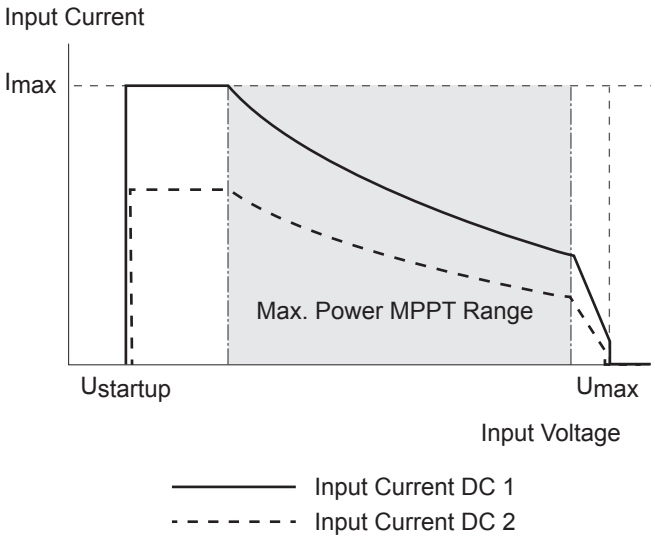


Fig. 5.34: I-U characteristic curves for symmetric and asymmetric configuration of the DC inputs (illustration of principle)

See “14. Technical data”, p. 228 for currents and voltages.

5.6.2 Separately connected and parallel-connected DC inputs

The inverter can be used with separate DC inputs or with DC inputs connected in parallel.

Separately connected DC inputs

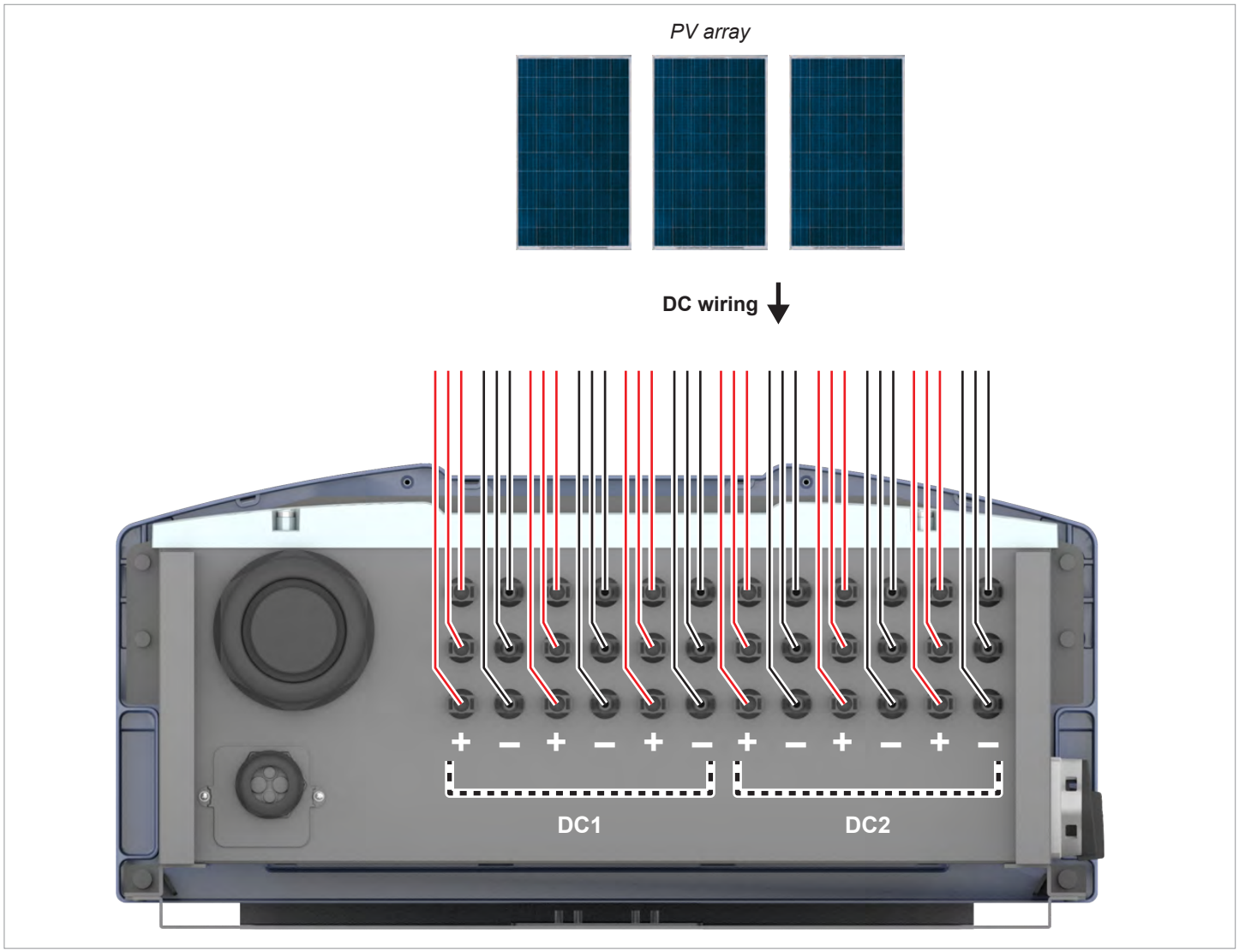


Fig. 5.35: Separately connected DC inputs

The module strings for DC1 and DC2 are connected separately. MPP tracker 1 regulates the module strings at DC1, MPP tracker 2 regulates the module strings at DC2.

This allows implementation of symmetric and asymmetric configurations at the DC inputs.

This DC cabling variant **cannot** be used with grounded solar modules.

Parallel-connected DC inputs

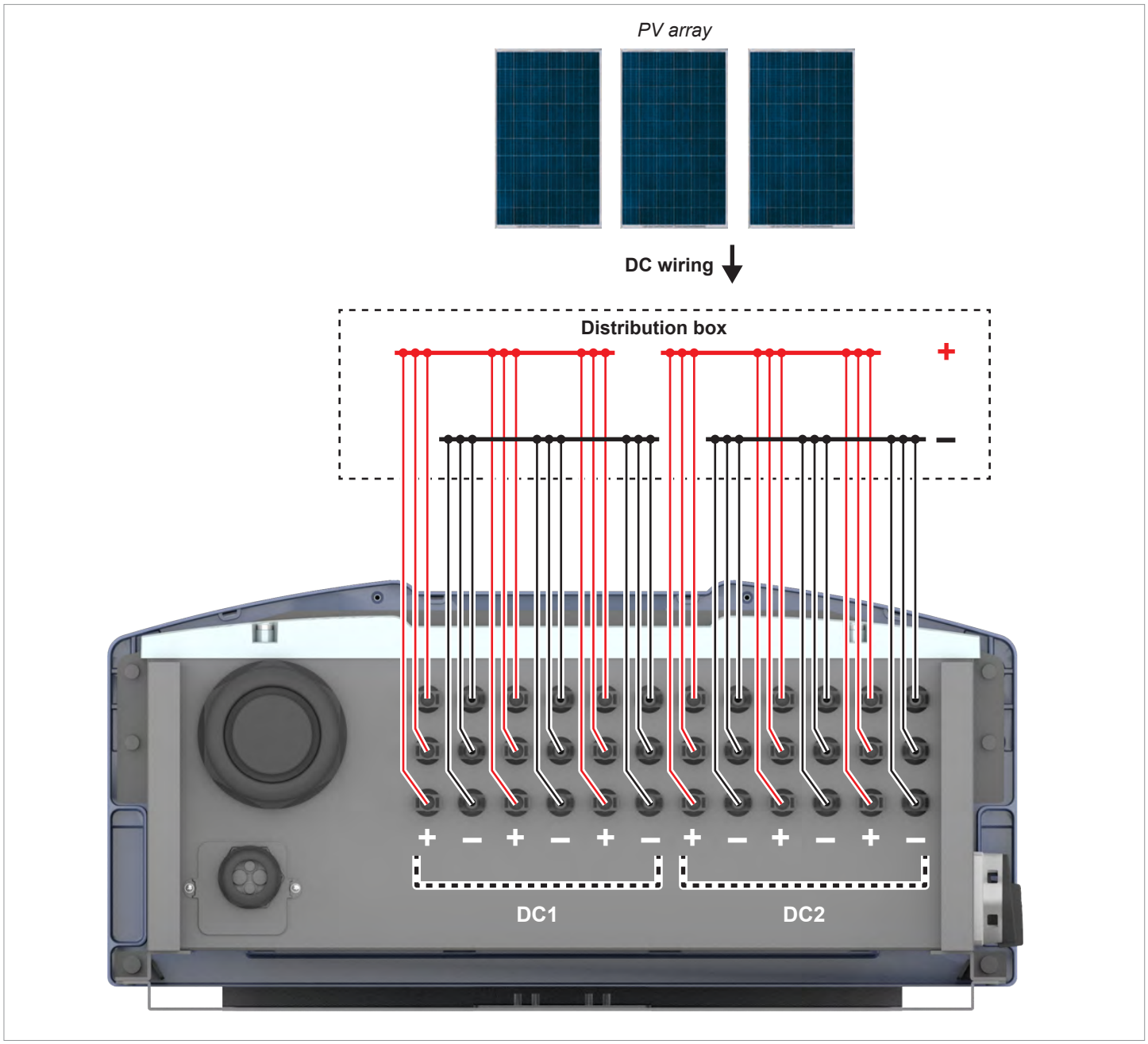


Fig. 5.36: Parallel-connected DC inputs

The module strings are combined at a distribution box and the DC cable is then connected to DC1 and DC2. MPP tracker 1 regulates all module strings, MPP tracker 2 is not used.

This allows implementation of symmetric configurations only at the DC inputs.

This DC cabling variant **is mandatory by law** for use with grounded solar modules.

5.6.3 Connection to solar modules that are not grounded

The DC inputs can be connected to the DC inputs separately or in parallel when using non-grounded solar modules.

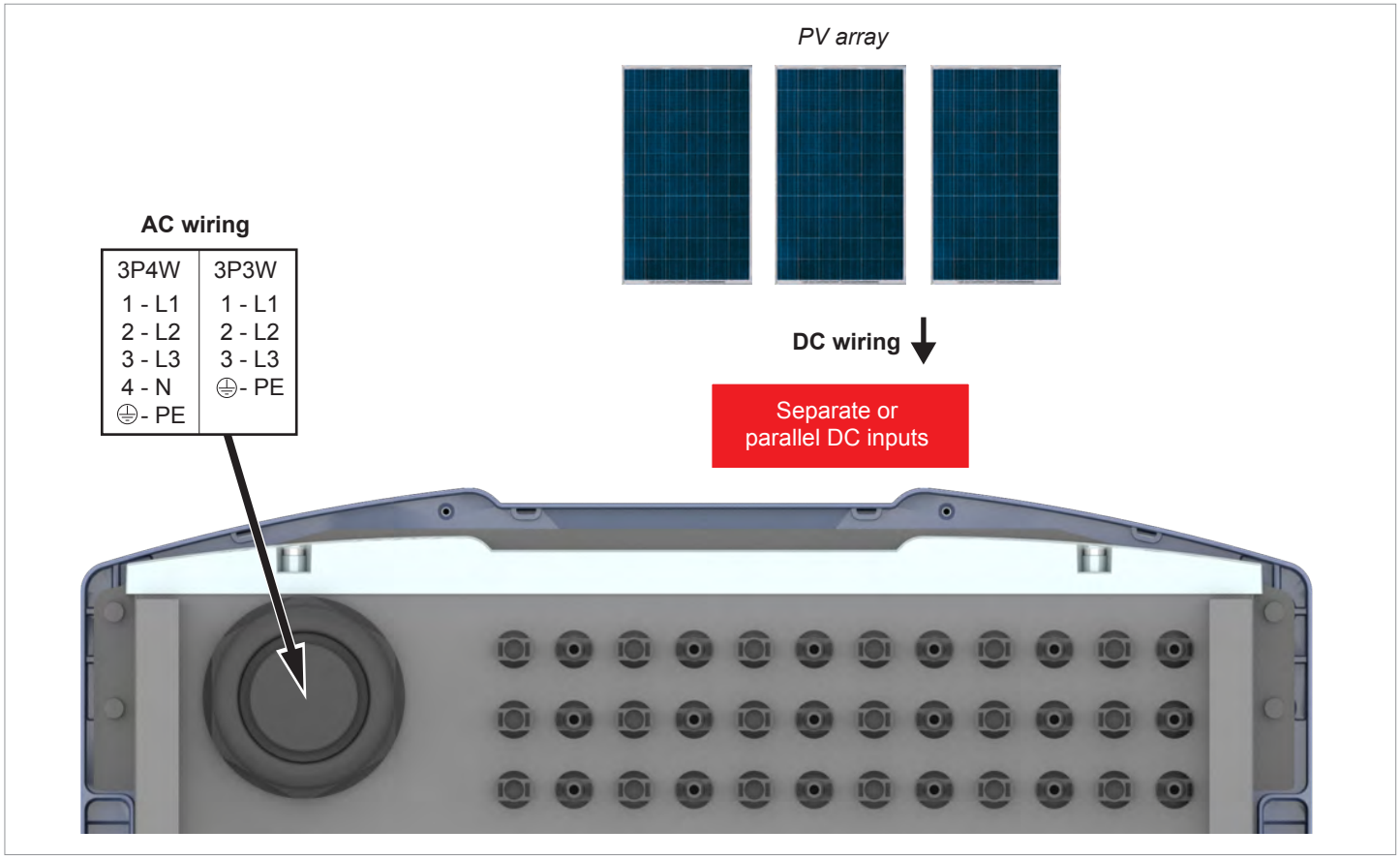


Fig. 5.37: System design when using non-grounded solar modules

5.6.4 Connecting grounded solar modules

The DC inputs must be connected in parallel when using grounded solar modules.

- ► An isolation transformer must be connected between the grid and the AC connection of the inverter.
- ► The insulation monitoring can be set on the inverter display after commissioning, see “8.3.2 Insulation”, p. 102.

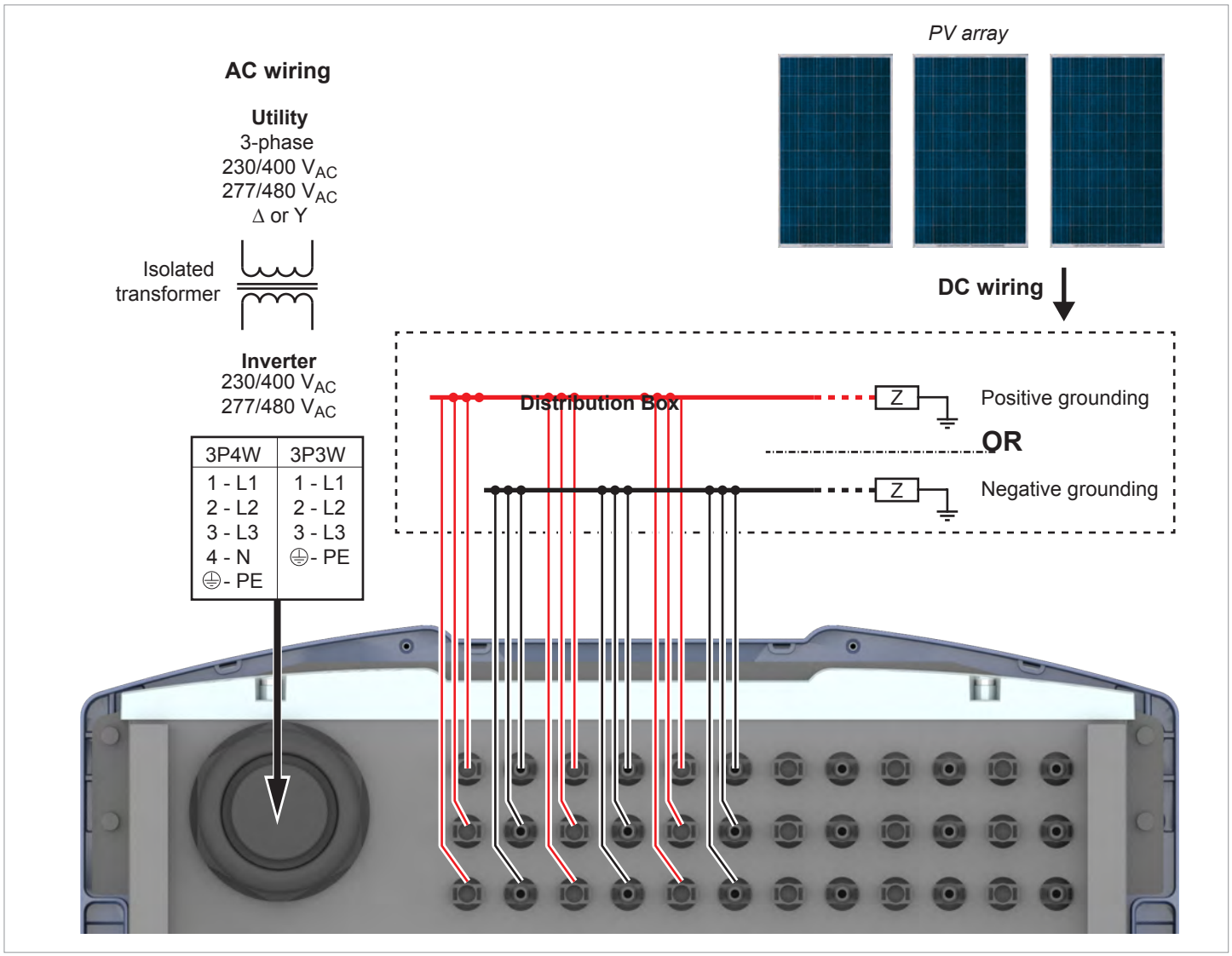


Fig. 5.38: System design when using grounded solar modules

5.6.5 Connecting the DC strings to the DC inputs

Check the polarity of the DC voltage before connecting the solar modules to the inverter.

The negative pole of the solar modules must be connected to DC–, the positive to DC+.

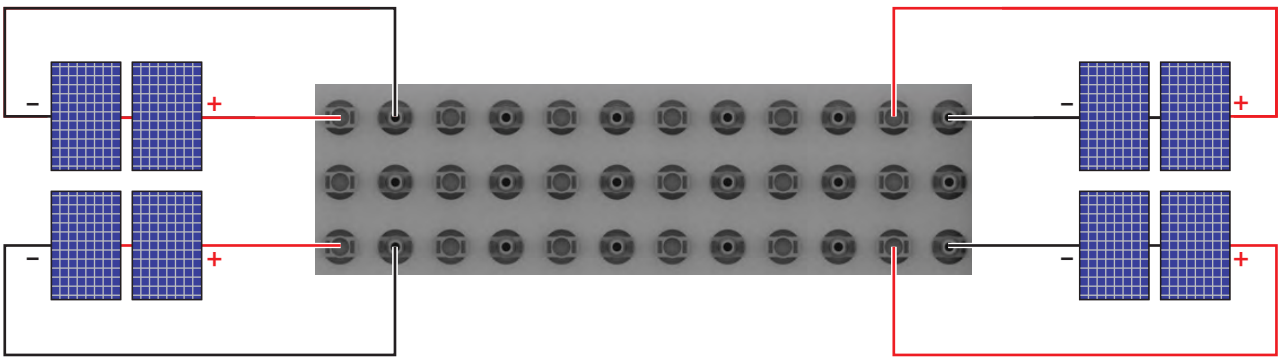


Fig. 5.39: Connecting a DC string to a DC connection

When selecting protective devices (such as fuses), always cater for the *maximum current rating* of the solar modules.

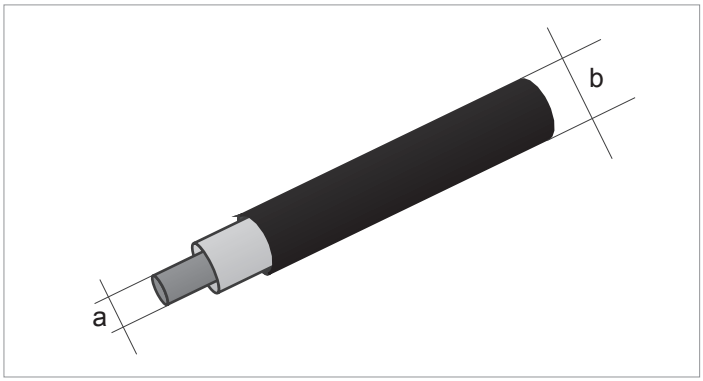
When selecting protective devices, always observe the local safety regulations.

1	When selecting protective devices (such as fuses), always cater for the *maximum current rating* of the solar modules.
2	When selecting protective devices, always observe the local safety regulations.

5.6.6 DC cable requirements

The DC plugs for all DC connections are supplied with the inverter.

If you want to order more or need a different size, see the information in the following table.



	DC connections on the inverter	DC plugs for DC cables
DC–		
DC+		

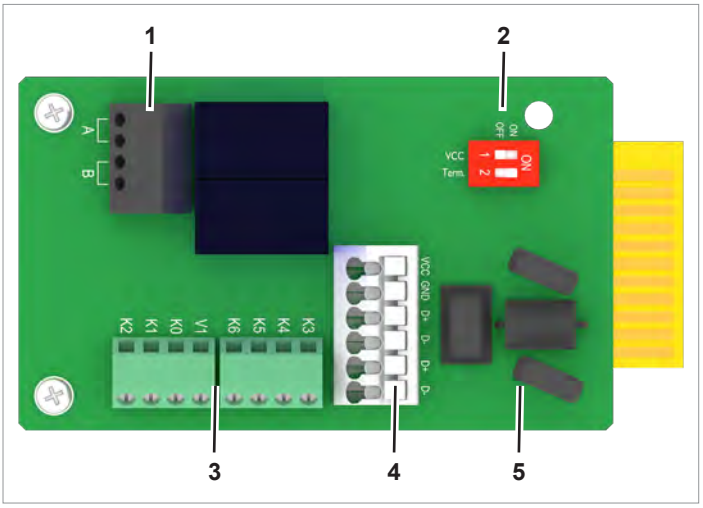
a	b	Multi-contact
mm²	mm	
4 / 6	3-6	32.0014P0001-UR
	5.5-9	32.0016P0001-UR [1]
10	5.5-9	32.0034P0001-UR
4 / 6	3-6	32.0015P0001-UR
	5.5-9	32.0017P0001-UR [1]
10	5.5-9	32.0035P0001-UR
4/6	3-6	32.0015P0001-UR
	5.5-9	32.0017P0001-UR

[1] Included in delivery

5.7 Communications connection

5.7.1 Overview

The connections for RS485, the digital inputs, the dry contacts and the external power-off (EPO) are all on the communication card. This means that the installation work can be combined.



1 2 x dry contacts (terminal box)
2 DIP switch for RS485 termination resistor and VCC
3 Digital inputs and external power-off (terminal block)
4 RS485 (terminal block)
5 Protection against electromagnetic interference (EMI)

5.7.2 Communications cable requirements

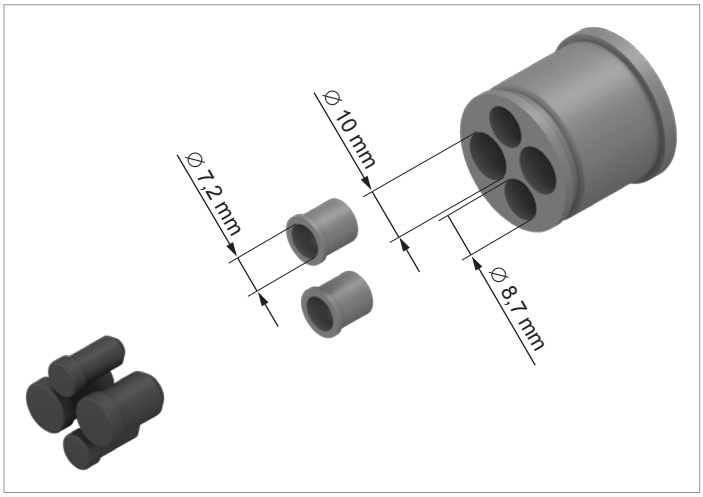
- Shielded twisted-pair cable (CAT5 or CAT6)
- Cable diameter: 7.2 / 8.7 / 10.0 mm
- Wire cross-section: 0.25 ... 1, 5 mm²

The communications cable is required for connection to the following units:

- Data logger
- External alarm unit
- Ripple control receiver
- External power-off

Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

5.7.3 Cable gland for the communication connection



The inverter has 1 cable gland for the communications cable with 2x2 cable feed-throughs.

5.7.4 Connecting a data logger

NOTICE

Unwanted currents.
Unwanted currents can flow when multiple inverters are connected via RS485.

- ► Do not use GND and VCC.
- ► If the cable shield is used for providing lightning protection then the housing of only one inverter in the RS485 chain should be grounded.

The inverter can be connected to a data logger via RS485, e.g. for monitoring the PV system or changing the inverter settings.

The SUNSPEC protocol with Modbus RTU is used for data transmission.

Multiple inverters can be connected in series to a data logger.

The following recommendations must be complied with to ensure a stable data connection.

The inverter can be connected to a data logger via RS485, e.g. for monitoring the PV system or changing the inverter settings.

Multiple inverters can be connected in series to a data logger.

Note the following recommendations for ensuring a stable data connection.

Connecting a single inverter to a data logger

- ► Switch on the RS485 termination resistor.
- ► Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

Connecting multiple inverters to a data logger

- ► Switch on the RS485 termination resistor at the last inverter in the chain.
- ► If the data logger does not have an integrated RS485 termination resistor then also switch on the RS485 termination resistor at the first inverter in the chain.
- ► Switch off the RS485 termination resistor at all other inverters in the chain.
- ► A different inverter ID must be set at each inverter. Otherwise the data logger cannot identify the individual inverters.
- ► Set the same RS485 Baud rate at all inverters.
- ► Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

5.7.5 Connecting an external alarm unit

The inverter has two multifunction relays allowing connection of an acoustic or visual alarm unit to each.

An event can be assigned to the dry contacts on the inverter display after commissioning (see “8.3.6 Dry contacts”, p. 117).

Event	Description
Disable	The function is disabled.
On Grid	The inverter is connected to the mains.
Fan Fail	The fans are defective.
Insulation	The insulation test has failed.
Alarm	An error event message, fault message or warning has been sent.
Error	An error event message has been sent.
Fault	A fault message has been sent.
Warning	A warning message has been sent.

The default setting for both relays is **Disable**.

5.7.6 Connecting a ripple control receiver

An external ripple control receiver can be connected to the digital inputs.

Pin assignments

Pin	Designation	Short circuit	Assigned action
1	V1	-	-
2	K0	V1 + K0	External power-off (EPO)
3	K1	V1 + K1	Maximum active power limited to 0%
4	K2	V1 + K2	Maximum active power limited to 30 %
5	K3	V1 + K3	Maximum active power limited to 60 %
6	K4	V1 + K4	Maximum active power limited to 100 %
7	K5	V1 + K5	Reserved
8	K6	V1 + K6	Reserved

5.7.7 External power-off

The inverter has a multifunction relay allowing an external shutdown of the inverter to be triggered.

Pin assignments

Pin	Designation	Short circuit	Assigned action
1	V1	-	-
2	K0	V1 + K0	External power-off (EPO)
3	K1	V1 + K1	Maximum active power limited to 0%
4	K2	V1 + K2	Maximum active power limited to 30%
5	K3	V1 + K3	Maximum active power limited to 60%
6	K4	V1 + K4	Maximum active power limited to 100%
7	K5	V1 + K5	Reserved
8	K6	V1 + K6	Reserved

After commissioning, the relays for the external power-off (EPO) can be defined on the display as having normally closed or normally open contacts, see XYZ.

5.7.8 Using external mains and system protection

1. The German standard VDE-AR-N 4105, Section 6.1, requires external mains and system protection with a coupling switch for PV system larger than 30 kVA.
2. Alternatively, VDE-AR-N 4105, Section 6.4.1, allows the use of an inverter with an internal coupling switch when this switch disconnects the inverter from the mains in less than 100 ms.

This inverter satisfies the requirements of (2) when the following firmware versions are installed: DSP ≥ 1.30 / RED ≥ 1.20 / COMM ≥ 1.10. External grid and system protection is not necessary for inverters with these firmware versions.

5.7.9 Connecting a PC

The inverter settings can be changed using a PC. This requires the following accessories.

Accessories	Description
Standard USB/RS485 adapter	For connecting a PC to the inverter
Delta Service Software	For changing the inverter settings

The Delta Service Software can be downloaded from www.solar-inverter.com.

Cable requirements

Bell wire. Both ends open.

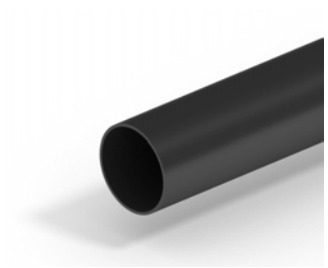
5.8 Tools and materials required

This sections lists the necessary tools and materials not included in the scope of delivery.

5.8.1 For mounting the inverter

Part	Quantity	Description
Attachment screws	6 to 12	The mounting plate must be attached using 6 to 12 M6 screws. Additional mounting materials may be required depending on the installation position of the inverter (e.g. brick wall, concrete wall, metal frame etc.): Dowels, washers, lock washers, nuts etc. Always take the conditions at the installation location into account when selecting the mounting materials. Galvanic corrosion can occur when using mounting materials made of different materials.

5.8.2 For connecting the inverter to the mains (AC)

Part	Quantity	Description
AC cable		For selection of the AC cables see “5.5.9 AC cable requirements”, p. 35.
Wire end-sleeves (optional)	4 - 5	For copper cables. The copper cable that is used govern whether wire end-sleeves must be used. For further information, see “Specification for copper cable”, p. 35. Attach the wire end-sleeves to the wires using a crimping tool. 
Al-Cu crimp connectors (optional)	4 - 5	For use with round or round crimped aluminum cables. For further information, see “5.5.9.2 Special instructions for the use of aluminum cables”, p. 36. 
Heat shrink sleeves (optional)	-	For use with Al-Cu crimp connectors. 

Part	Quantity	Description
Klauke crimp tool for Al-Cu crimp connectors	optional	For crimping Klauke Al-Cu crimp connectors. (e.g. manual crimping tool Klauke K 18, cordless hydraulic crimping tool Klauke EK 120/42)  

5.8.3 For connecting the inverter to the solar modules

Part	Quantity	Description
DC cables	-	See “5.7.7 External power-off”, p. 48 for notes on selecting the DC cable
DC protective caps	Up to 24	The protective caps lock the DC plug so that it can only be disconnected from the DC connections using the special DC mounting tool. Available from Multi-Contact. Observe the local regulations regarding the use of DC protective caps. France: The DC protective caps must be used. 
DC mounting tool	1	Mounting tool for disconnecting the DC plug and the DC protective caps from the DC connections. Available from Multi-Contact. 

5.8.4 For grounding the inverter housing

Part	Quantity	Description
Grounding cable with cable lug	-	Typically a yellow-green copper cable with a conductor cross-section of at least 6 mm^2. Observe the local regulations relating to grounding cable requirements.

5.8.5 For connection of a data logger

Part	Quantity	Description
Cable	-	For selection of the communications cable see “5.7.2 Communications cable requirements”, p. 46.

5.8.6 For connection of an external alarm unit

Part	Quantity	Description
Cable	-	For selection of the communications cable see “5.7.2 Communications cable requirements”, p. 46.

5.8.7 For connection of a ripple control receiver and an external power-off

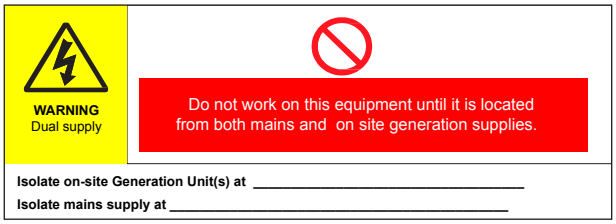
Part	Quantity	Description
Cable	-	For selection of the communications cable see “5.7.2 Communications cable requirements”, p. 46.

5.8.8 For connection of a PC

Part	Quantity	Description
USB-RS485 adapter	1	For connection of a PC to the inverter. 
2-core cable	1	Bell wire. Both ends open.
Delta Service Software	1	For changing the inverter settings. Available from Delta. Many settings can also be changed directly at the inverter display, see “8. Settings”, p. 92.

5.8.9 Other parts

Part	Quantity	Description
		Observe the local regulations regarding the application of warning labels.
Warning stickers	-	



Warning
Two voltage sources present
- Distribution network
- PV modules

Prior to any work, disconnect both sources

6. Installation

► Read chapter “5. Planning the installation”, p. 23 and this chapter in full before you start installation.

6.1 Safety instructions

DANGER

Electric shock
Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter

1. Turn the DC isolating switch to the ***0 (OFF)*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
3. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock
Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

► Never disconnect the inverter from the solar modules when it is under load.

► Turn the DC isolating switch to the ***0 (OFF)*** position.

► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.

► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.

► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock
When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

► Remove the cover only when absolutely necessary.

► Do not remove the cover if water might enter the inverter.

► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

WARNING

Heavy weight
The inverter is very heavy.

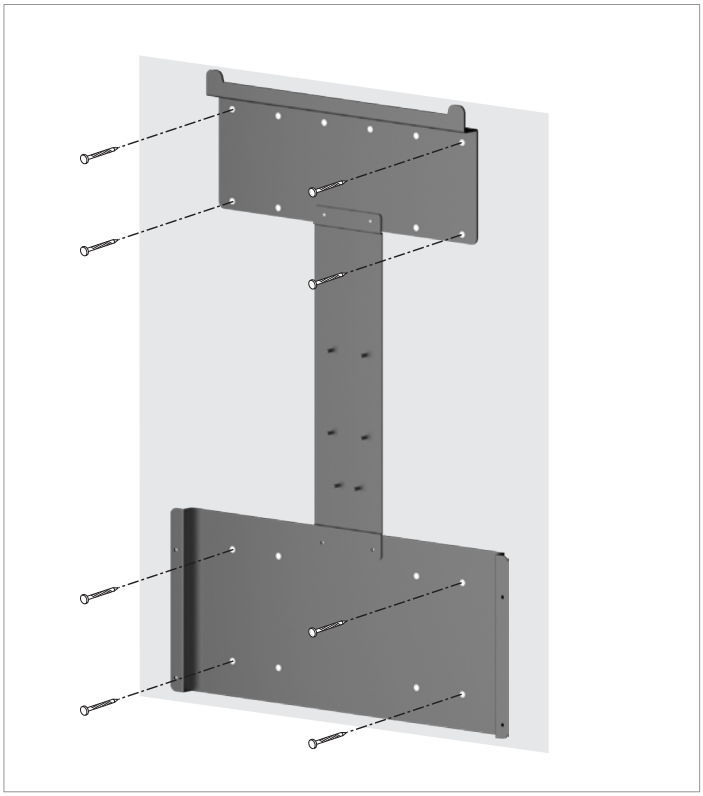
► The inverter must be lifted and carried by at least 3 people or using appropriate lifting gear (e.g. block and tackle or crane).

NOTICE

Water penetration.

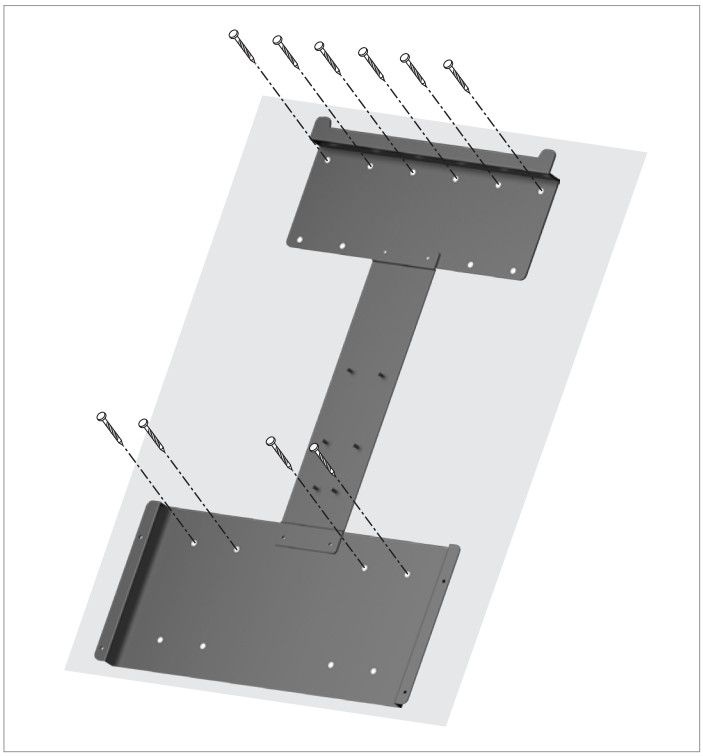
► All sealing caps removed during installation should be stored for later use (such as transport or storage).

6.2 Mounting the inverter



1. For **vertical** mounting of the inverter, attach the mounting plate to the wall/the mounting system using 8 M8 screws as shown in the illustration on the left.

   Be sure to use these 8 fixing points in any event when using more than 8 screws.

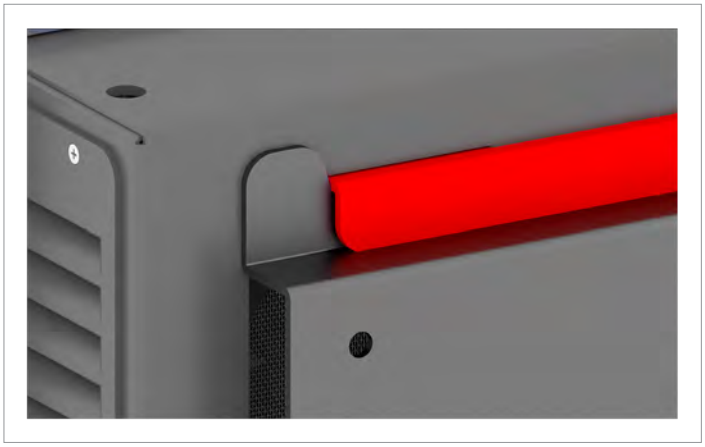


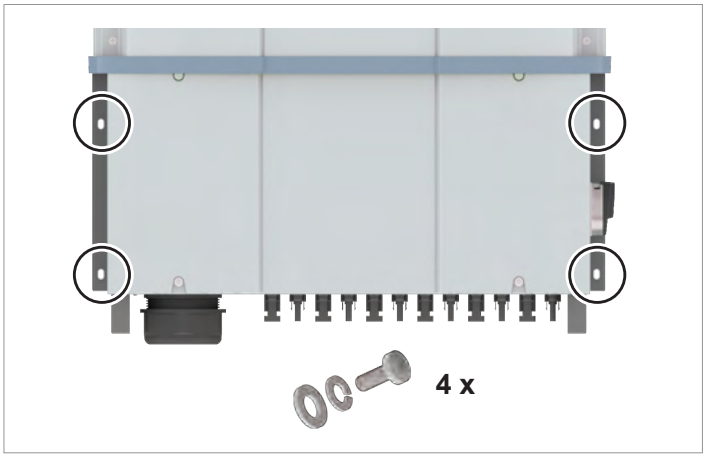
For **tilted** or **horizontal** mounting of the inverter, attach the mounting plate to the wall / the mounting system with 10 M8 screws in accordance with the illustration on the left.

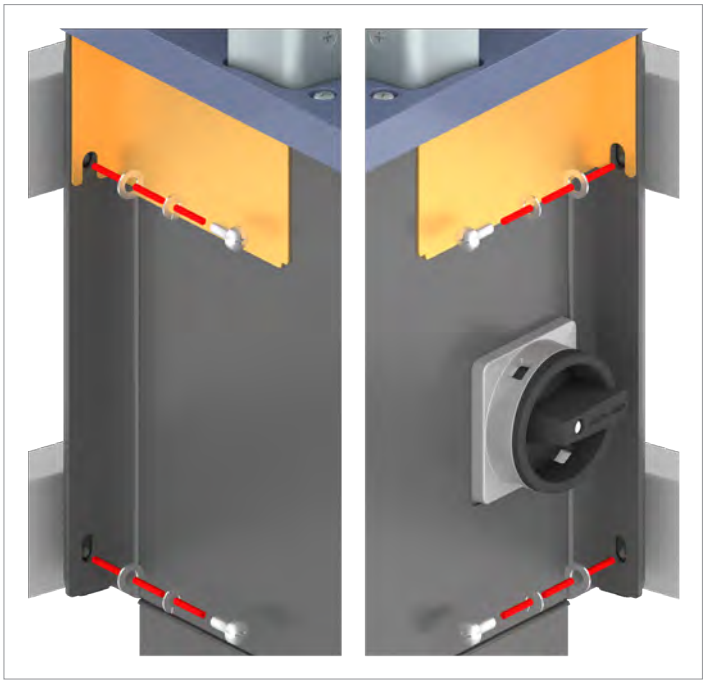
Be sure to use these 10 fixing points in any event when using more than 10 screws.

2. Mount the inverter on the mounting plate.

3. Check that the inverter is correctly mounted on the mounting plate.







4. Screw the inverter to the mounting plate with 4 M5 screws, spring washer and washer. The screws are supplied in the scope of delivery.

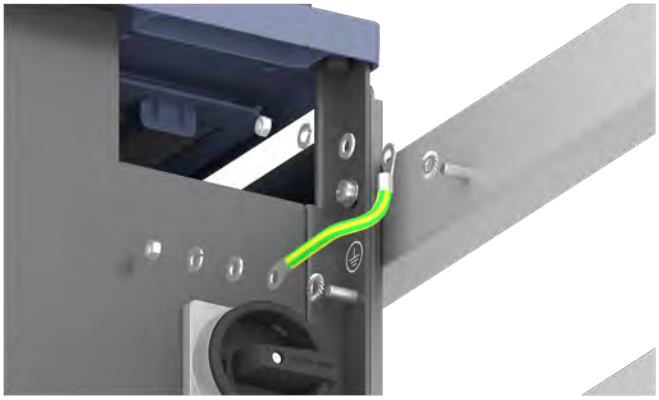
   If desired, also mount the cover panels for the side air inlets.

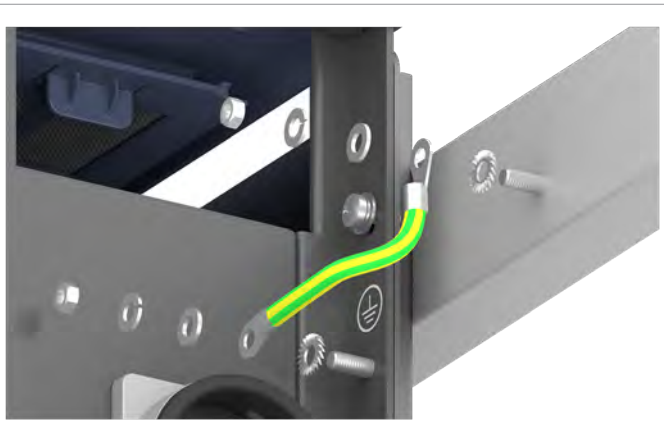
6.3 Grounding the inverter housing

WARNING

High current

- ► Always observe the local regulations relating to grounding cable requirements.
- ► To increase the safety of the system, always ground the inverter housing even when this is not required by the local regulations.
- ► Always ground the inverter housing **before** connecting the inverter to the grid and solar modules.





1. Bolt the grounding cable onto the inverter. Nut, spring washer, washer, and toothed lock washer are already mounted on the inverter.

2. Perform a continuity check of the grounding connection. If there is insufficient conductive connection, scratch away the paint from the inverter housing under the toothed lock washer to achieve a better electrical contact.

6.4 Connecting the communications card

The connections for RS485, the dry contacts, the digital inputs and the external shutdown (EPO) are all on the communications card. This means that the installation work can be combined.

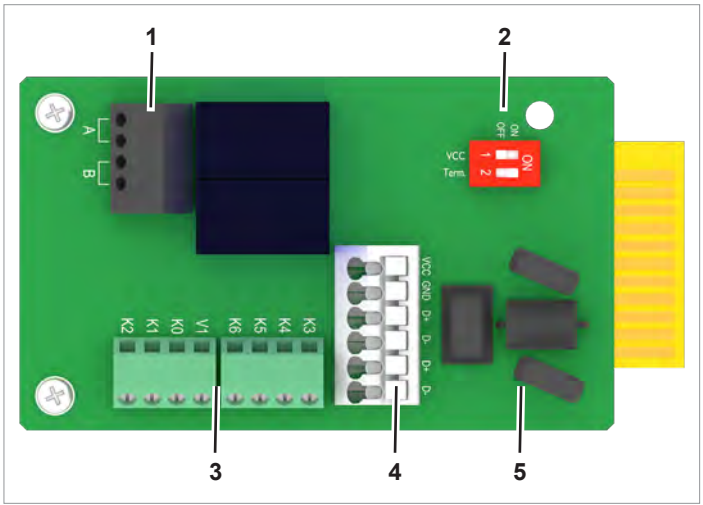
NOTICE

Water penetration.

► All sealing caps removed during installation should be stored for later use (such as transport or storage).

6.4.1 Introduction

6.4.1.1 Components of the communications card



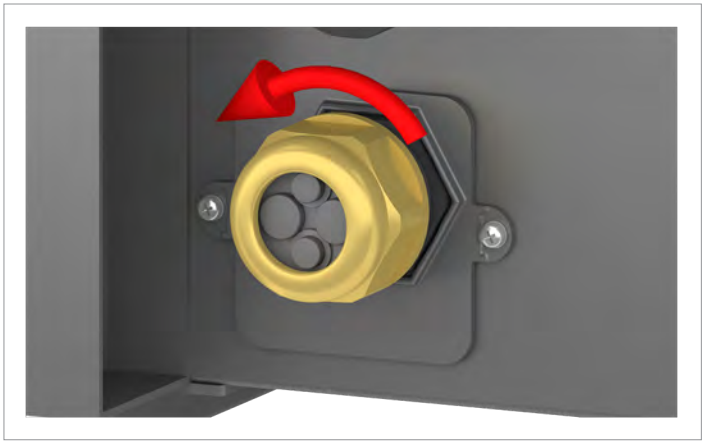
1 2 x dry contacts (terminal box)
2 DIP switch for RS485 termination resistor and VCC
3 Digital inputs and external power-off (terminal block)
4 RS485 (terminal block)
5 Protection against electromagnetic interference (EMI)

6.4.1.2 Communications cable requirements

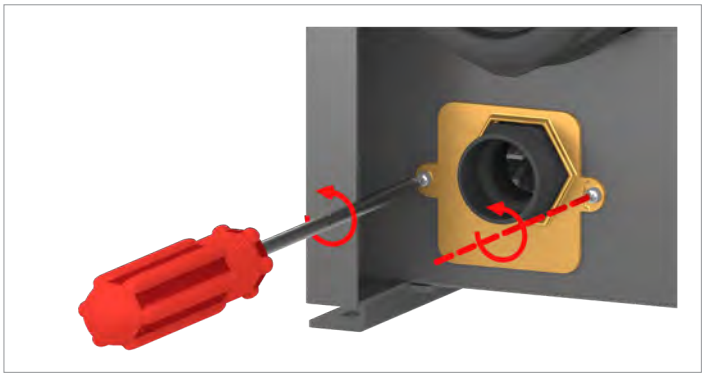
- Shielded twisted-pair cable (CAT5 or CAT6)
- Cable diameter: 7.2 / 8.7 / 10.0 mm
- Wire cross-section: 0.25 ... 1.5 mm²

Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

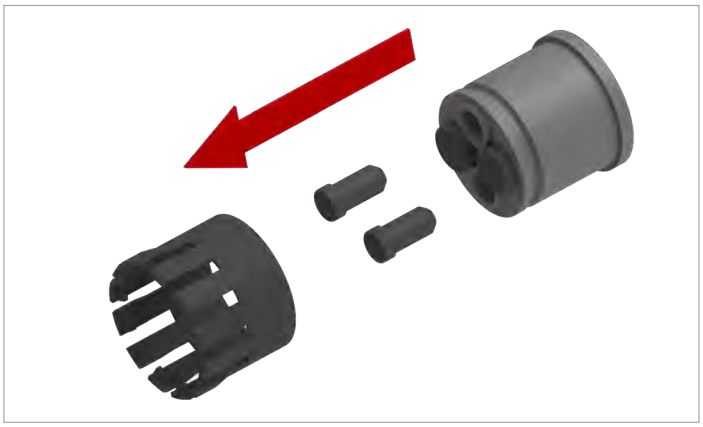
6.4.2 Initial steps



1. Unscrew the cable gland of the communication connection and remove the cable gland and seal.



2. Unscrew and carefully pull out the cover. The communications card is screwed to the cover.



3. Remove the same number of rubber plugs from the seal corresponding to the number of cables to be connected. Do not remove the rubber plugs from the unused seal feed-throughs.

4. Pull the cable through the cable gland and seal.

6.4.3 Connecting a data logger via RS485

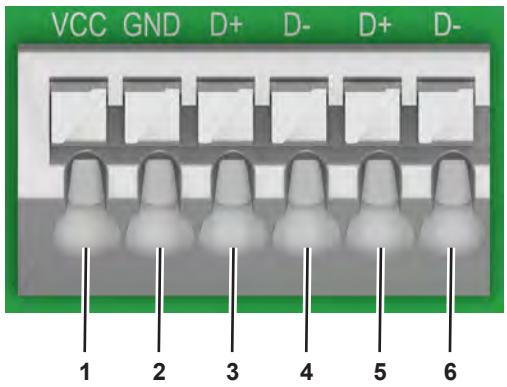
6.4.3.1 Introduction

NOTICE

Unwanted currents.
Unwanted currents can flow when multiple inverters are connected via RS485.

- ► Do not use GND and VCC.
- ► If the cable shield is used for providing lightning protection then the housing of only one inverter in the RS485 chain should be grounded.

Terminal assignments on the RS485 terminal block



1 VCC (+12 V; 0.5 A)
2 GND
3 DATA+ (RS485)
4 DATA– (RS485)
5 DATA+ (RS485)
6 DATA– (RS485)

Terminal pairs 3/4 or 5/6 can be used. The second terminal pair is only required when connecting several inverters via RS485.

Data format

Baud rate	9600, 19200, 38400; standard: 19200
Data bits	8
Stop bit	1
Parity	Not applicable

The Baud rate can be set on the inverter display after commissioning, see “8.2.3 Baud rate”, p. 98.

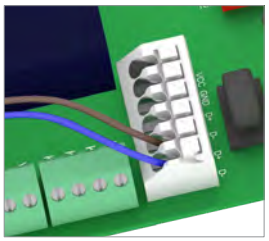
DIP switch for RS485 termination resistor and VCC

1 VCC (+12 V; 0.5 A)
2 RS485 termination resistor

Connecting the data logger

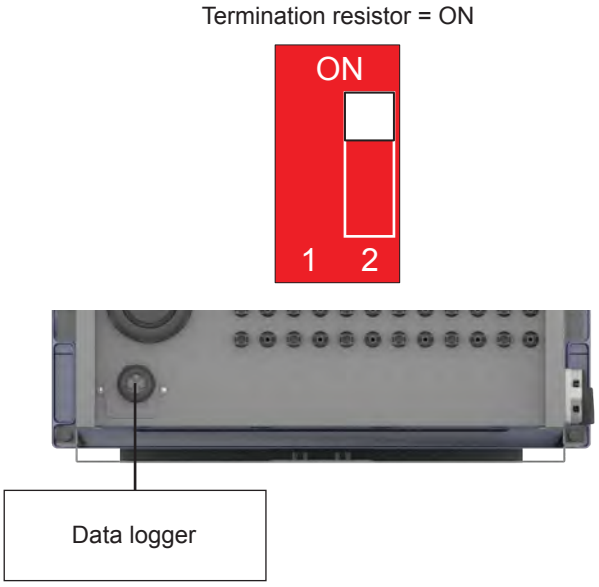
The data logger must support MODBUS RTU with SUNDSPEC protocol.

Individual wires are connected to the inverter.



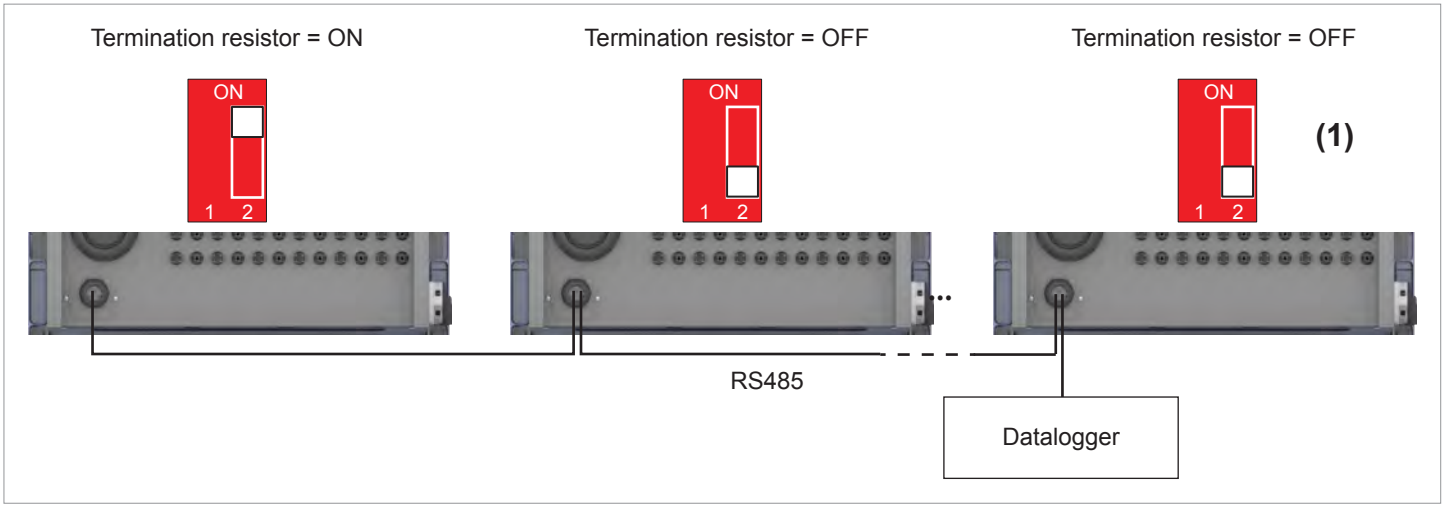
DATA+	Terminal 3 or 5
DATA–	Terminal 4 or 6

Wiring diagram for a single inverter

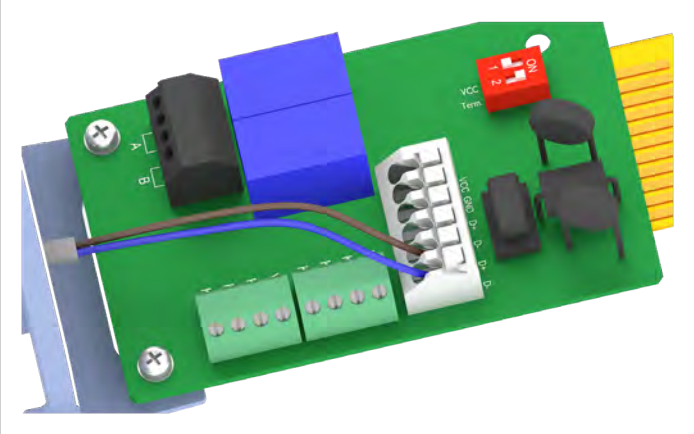


Wiring diagram for multiple inverters

- ► If the data logger does not have an integrated RS485 termination resistor, switch on the RS485 termination resistor on the first inverter.
- ► Set a different inverter ID at each inverter during commissioning of the inverters.



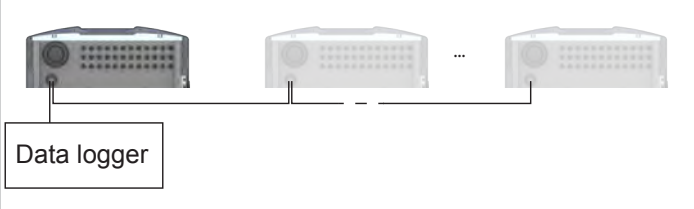
6.4.3.2 Wiring for a single inverter

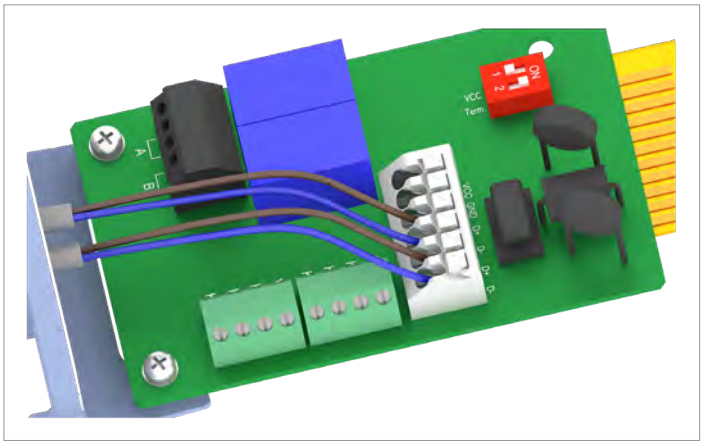


1. Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.

2. Set the DIP switch for the RS485 termination resistor (DIP 2) to the ***ON*** position.

6.4.3.3 Wiring for multiple inverters



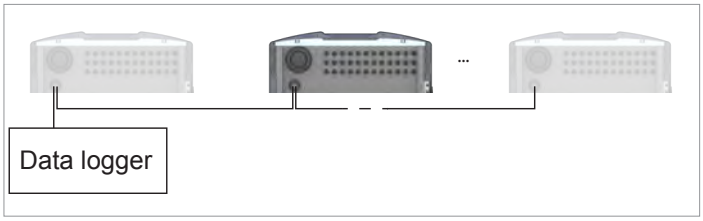


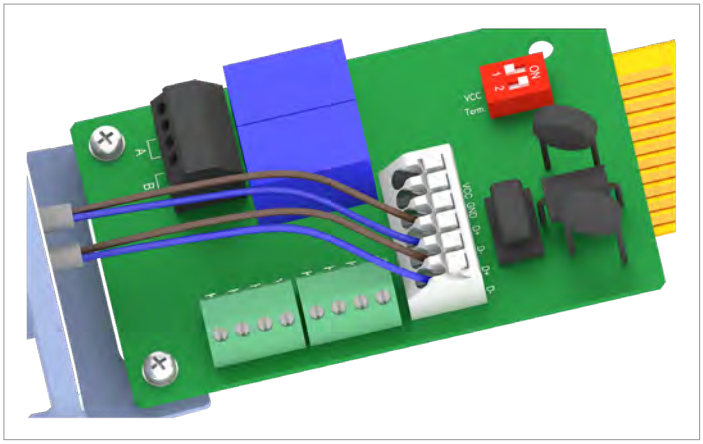
1. On the cable coming from the data logger: Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.
   On the cable going to the second inverter: Connect the DATA+ wire to terminal 3 and the DATA– wire to terminal 4.

2. Set the DIP switch for the RS485 termination resistor (DIP 2) to the ***OFF*** position.

6 Installation

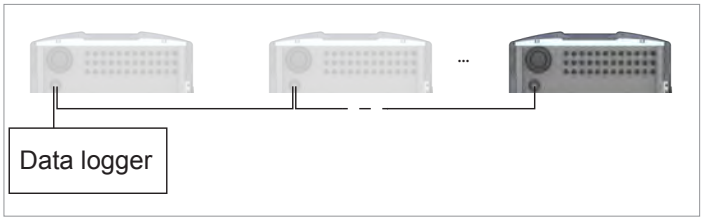
Connecting the communications card

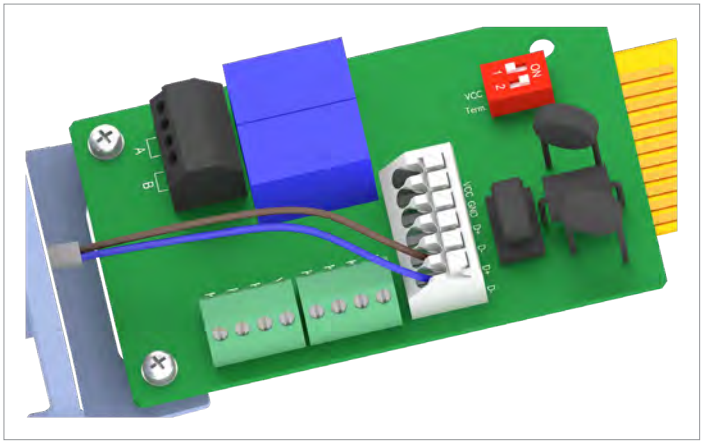




3. On the cable coming from the previous inverter: Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.
   On the cable going to the next inverter: Connect the DATA+ wire to terminal 3 and the DATA– wire to terminal 4.

4. Set the DIP switch for the RS485 termination resistor (DIP 2) to the ***OFF*** position.





5. Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6

6. Set the DIP switch for the RS485 termination resistor (DIP 2) to the ***ON*** position.

6.4.4 Connecting an external alarm unit

6.4.4.1 Wiring for an external alarm unit with an external 12 V_{DC} power supply

The external alarm unit must be connected to an external power supply if the internal 12-V_{DC} power supply is not used.

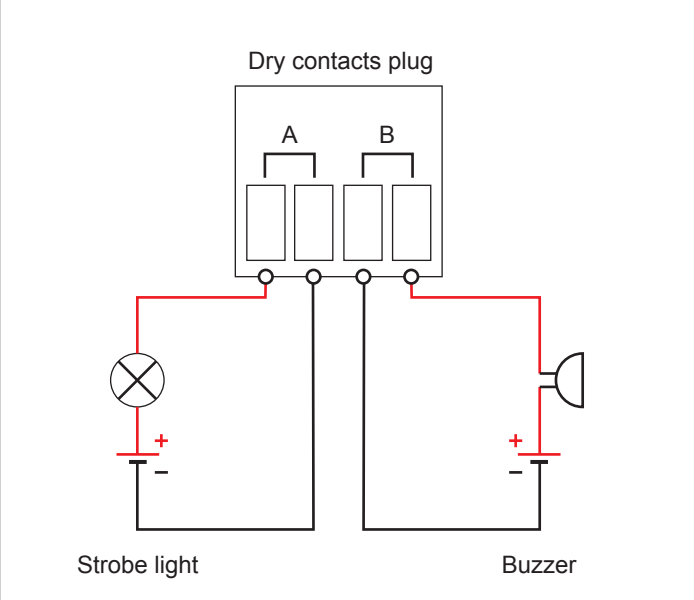
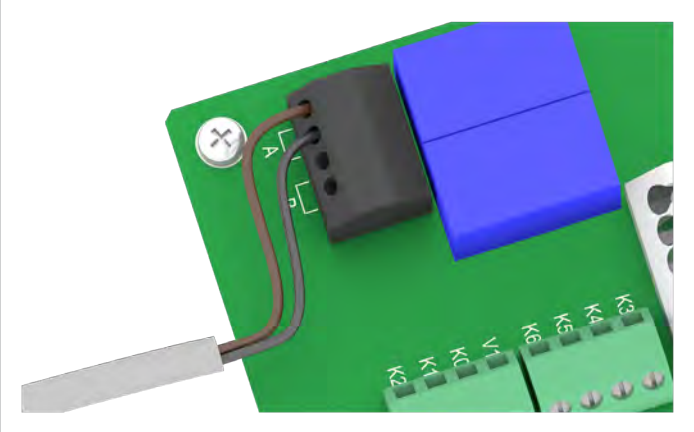


Fig. 6.40: Connection example: dry contacts with an external power supply

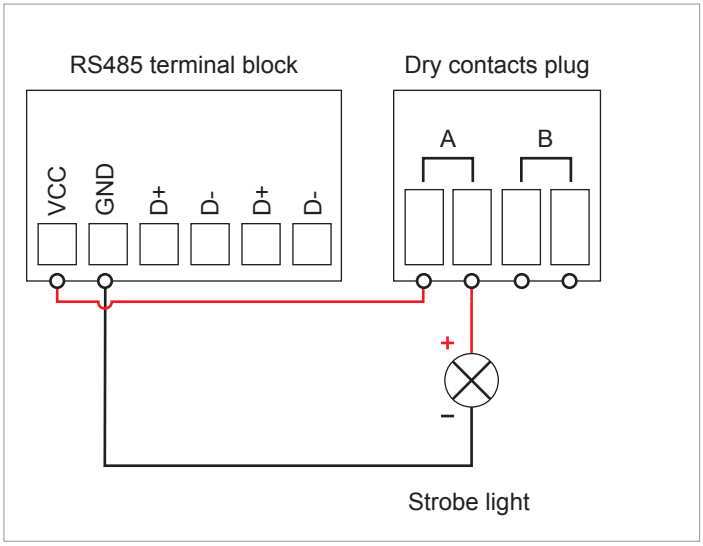


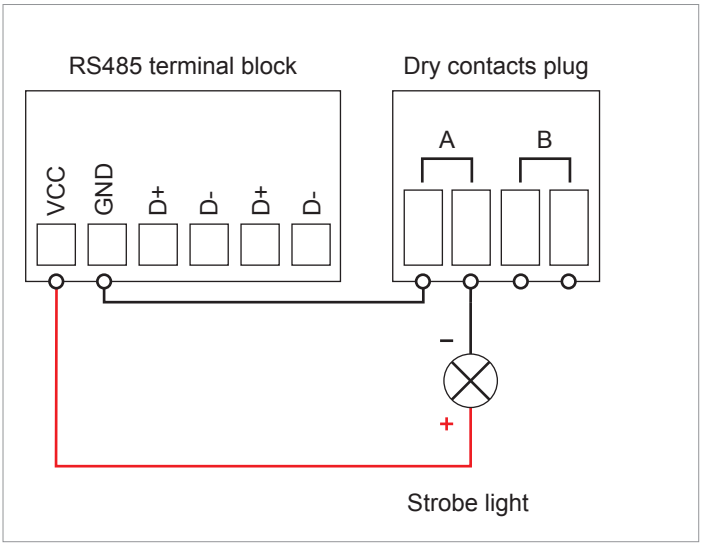
1. Connect two wires of the cable to one of the two dry contacts.

2. After commissioning, use the inverter display to assign an event for triggering the alarm unit (see “8.3.6 Dry contacts”, p. 117).

6.4.4.2 Wiring for a single alarm unit with an internal 12 V_{DC} power supply

Connection examples





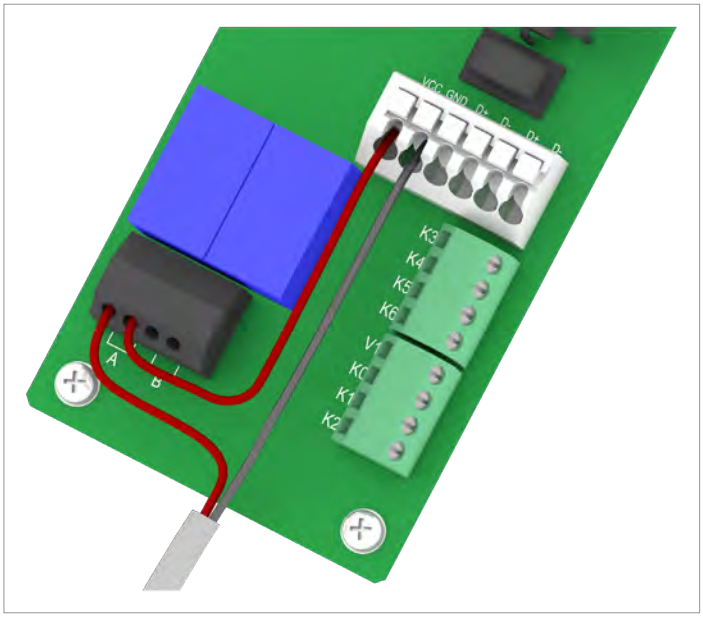


Fig. 6.41: Connection example 1: 1 dry contact with an internal 12 VDC power supply for an external alarm unit, variant 1

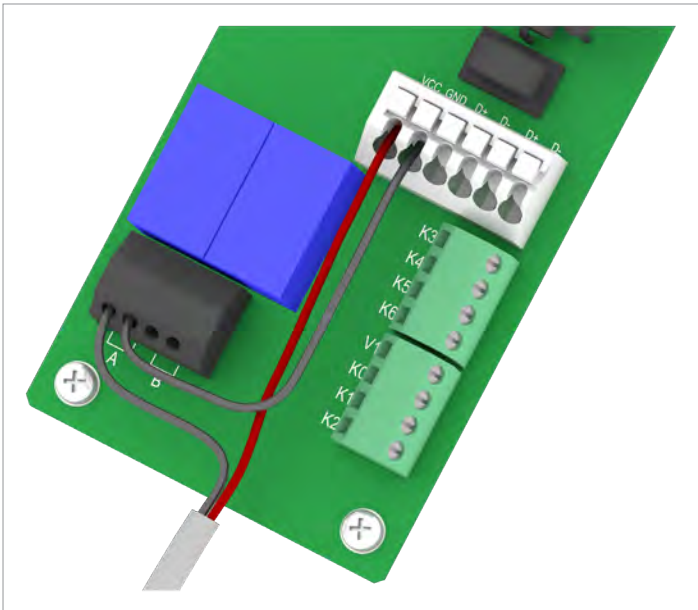
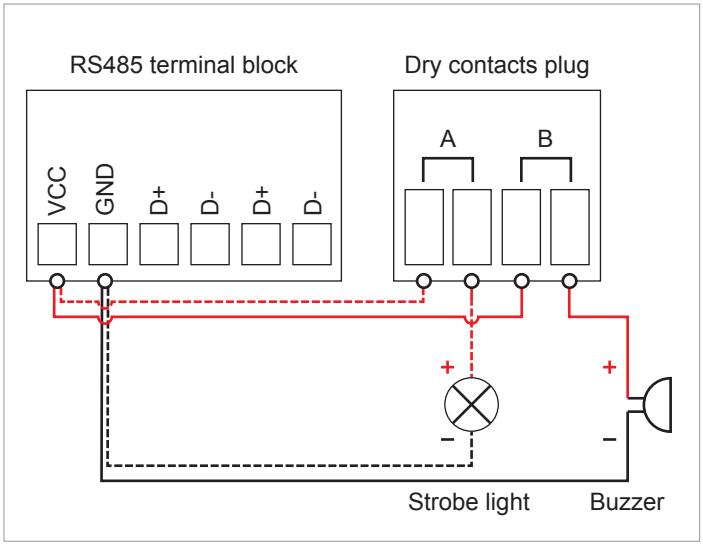


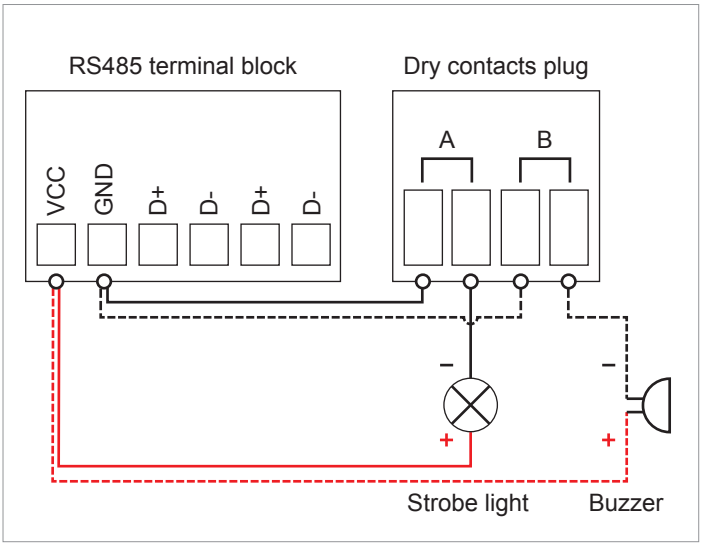
Fig. 6.42: Connection example 2: 1 dry contact with an internal 12 VDC power supply for an external alarm unit, variant 2

1. Connect the wires according to the desired connection diagram, see “Connection examples”, p. 69.
2. After commissioning, an event can be assigned to the dry contacts on the display, (see “8.3.6 Dry contacts”, p. 117).

6.4.4.3 Wiring for two alarm units with an internal 12 V_{DC} power supply

Connection examples





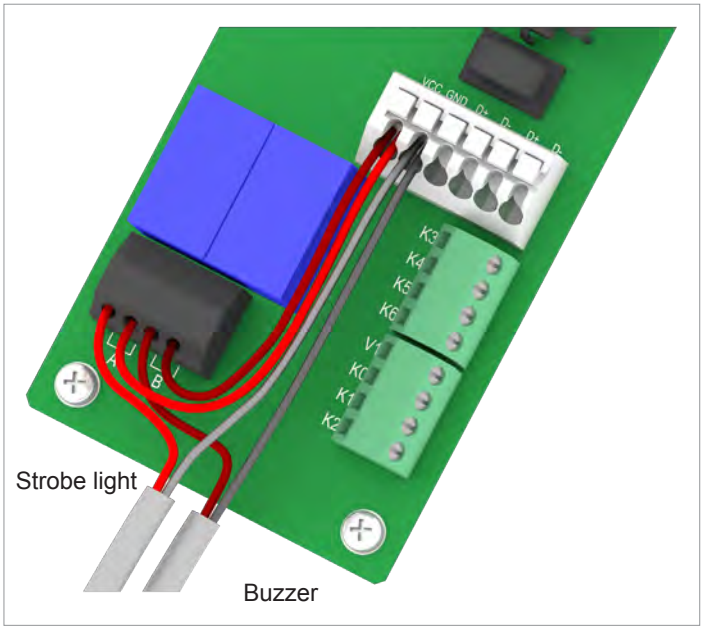


Fig. 6.43: Connection example 3: 2 dry contacts with an internal 12 VDC power supply for 2 external alarm units, variant 1

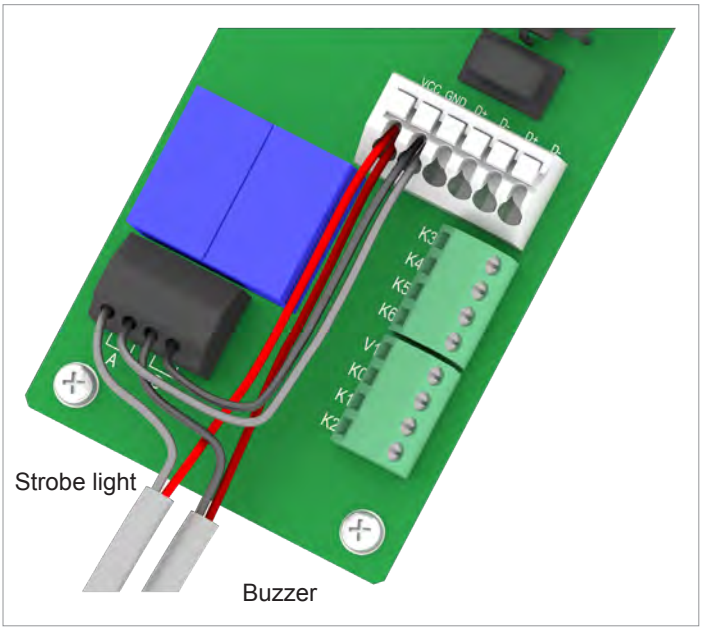


Fig. 6.44: Connection example 4: 2 dry contacts with an internal 12 VDC power supply for 2 external alarm units, variant 2

1. Connect the wires according to the desired connection diagram, see “Connection examples”, p. 69.
2. After commissioning, an event can be assigned to the dry contacts on the display, (see “8.3.6 Dry contacts”, p. 117).

6.4.5 Connecting a ripple control receiver

Cable and wiring requirements

- Shielded twisted-pair cable (CAT5 or CAT6)
- Cable diameter: 7.2 / 8.7 / 10.0 mm
- Wire cross-section: 0.25 ... 1, 5 mm²

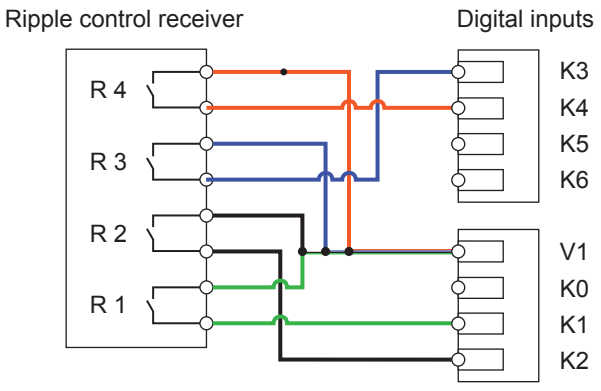
Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

Pin assignment

Pin	Designation	Short circuit	Assigned action
1	V1	–	–
2	K0	V1 + K0	External power-off (EPO)
3	K1	V1 + K1	Set maximum active power to 0%
4	K2	V1 + K2	Set maximum active power to 30%
5	K3	V1 + K3	Set maximum active power to 60%
6	K4	V1 + K4	Set maximum active power to 100%
7	K5	V1 + K5	Reserved
8	K6	V1 + K6	Reserved

Connecting a ripple control receiver

Power limiting to:	Short circuit
0%	Terminals V1 and K1
30%	Terminals V1 and K2
60%	Terminals V1 and K3
100%	Terminals V1 and K4



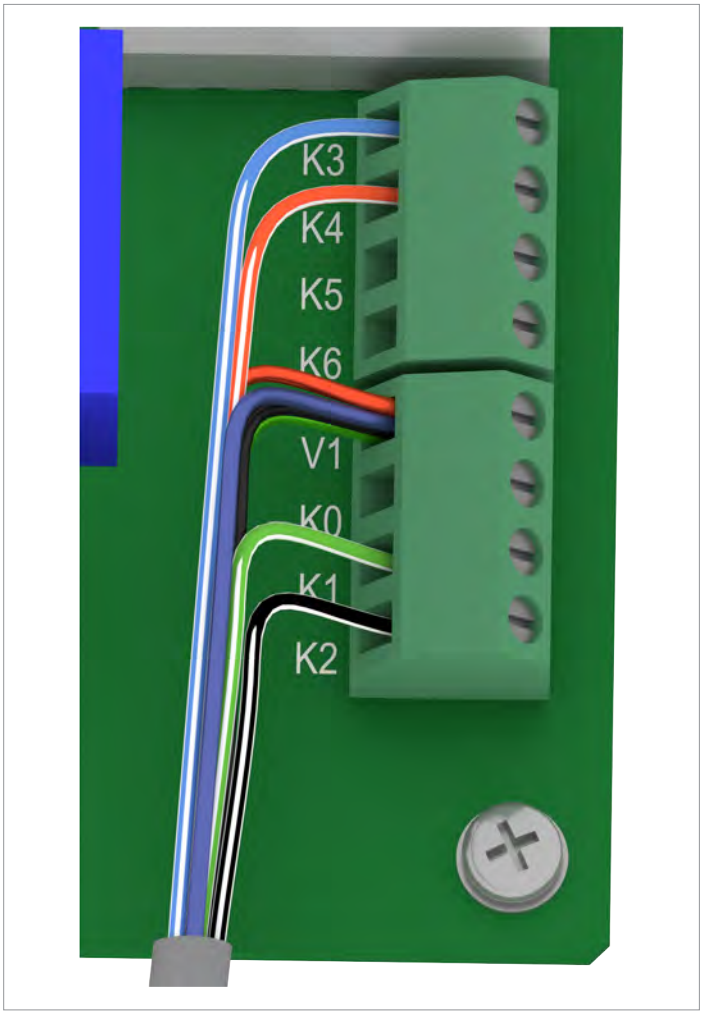


Fig. 6.45: Connection example 7: Connecting a ripple control receiver

The colors of the wires in the connection example correspond to a standard CAT5 cable and may differ in other cables. The wire colors have no effect on the function of the wiring.

1. Connect the wires according to the desired connection diagram.

6.4.6 Connecting the external power-off (EPO)

Cable and wiring requirements

- Shielded twisted-pair cable (CAT5 or CAT6)
- Cable diameter: 7.2 / 8.7 / 10.0 mm
- Wire cross-section: 0.25 ... 1, 5 mm^2

Lay the cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

Pin assignment

Pin	Designation	Short circuit	Assigned action
1	V1	–	–
2	K0	V1 + K0	External power-off (EPO)
3	K1	V1 + K1	Set maximum active power to 0%
4	K2	V1 + K2	Set maximum active power to 30%
5	K3	V1 + K3	Set maximum active power to 60%
6	K4	V1 + K4	Set maximum active power to 100%
7	K5	V1 + K5	Reserved
8	K6	V1 + K6	Reserved

Wiring examples

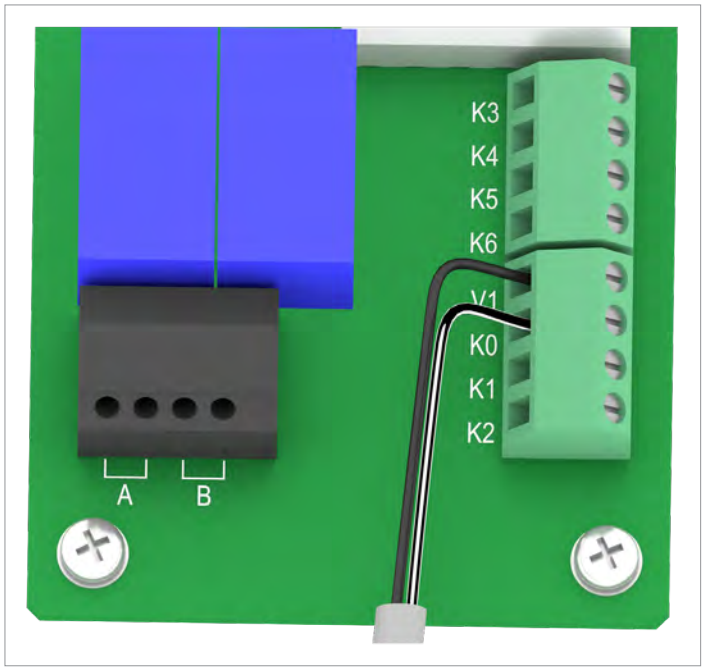
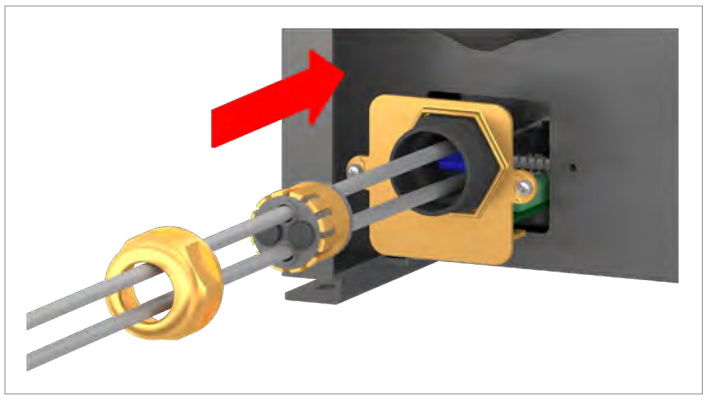


Fig. 6.46: Connection example 8: Connecting an external power-off

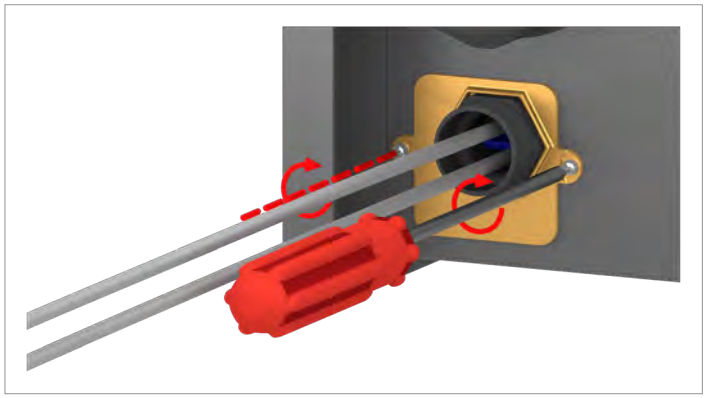
The colors of the wires in the connection example correspond to a standard CAT5 cable and may differ in other cables. The wire colors have no effect on the function of the wiring.

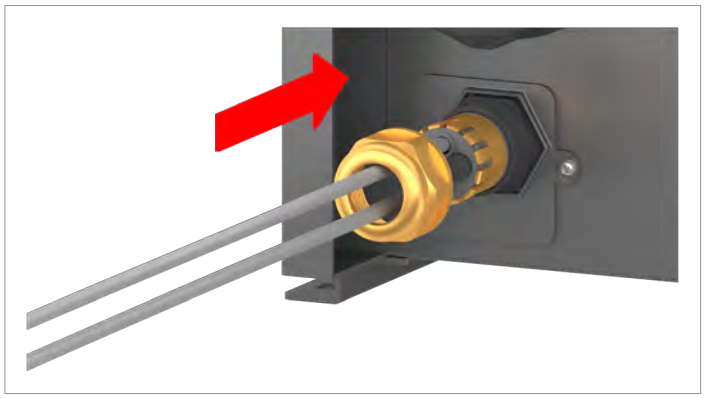
1. Connect the wires according to the desired connection diagram.
2. After commissioning, the relays can be defined as make-contact or break-contact for the external shutdown on the display (see “8.3.9 EPO Emergency power-off (external shutdown)”, p. 121).

6.4.7 Final work



1. Insert the communication card and screw it in place.



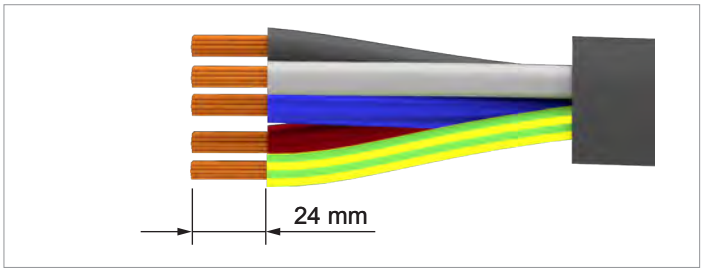


2. Fit the seal and the COMM cable gland, and screw the COMM cable gland tight.

6.5 Connecting the mains (AC)

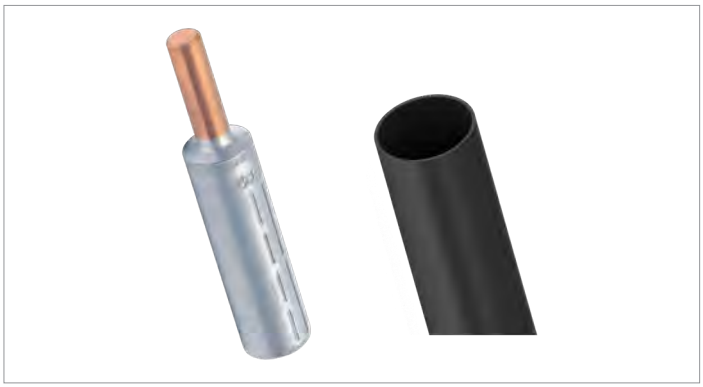
6.5.1 Preparing the AC cables

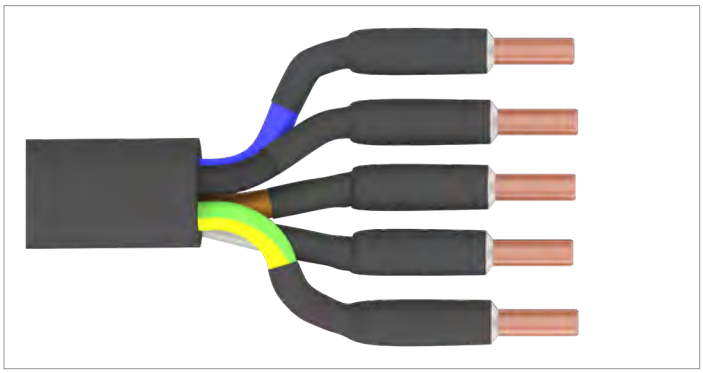
Copper cables



► Remove the insulation from the cables and the conductors. Do not twist stranded conductors, because this reduces the contact surface area with the wire end sleeves.

Aluminum cables





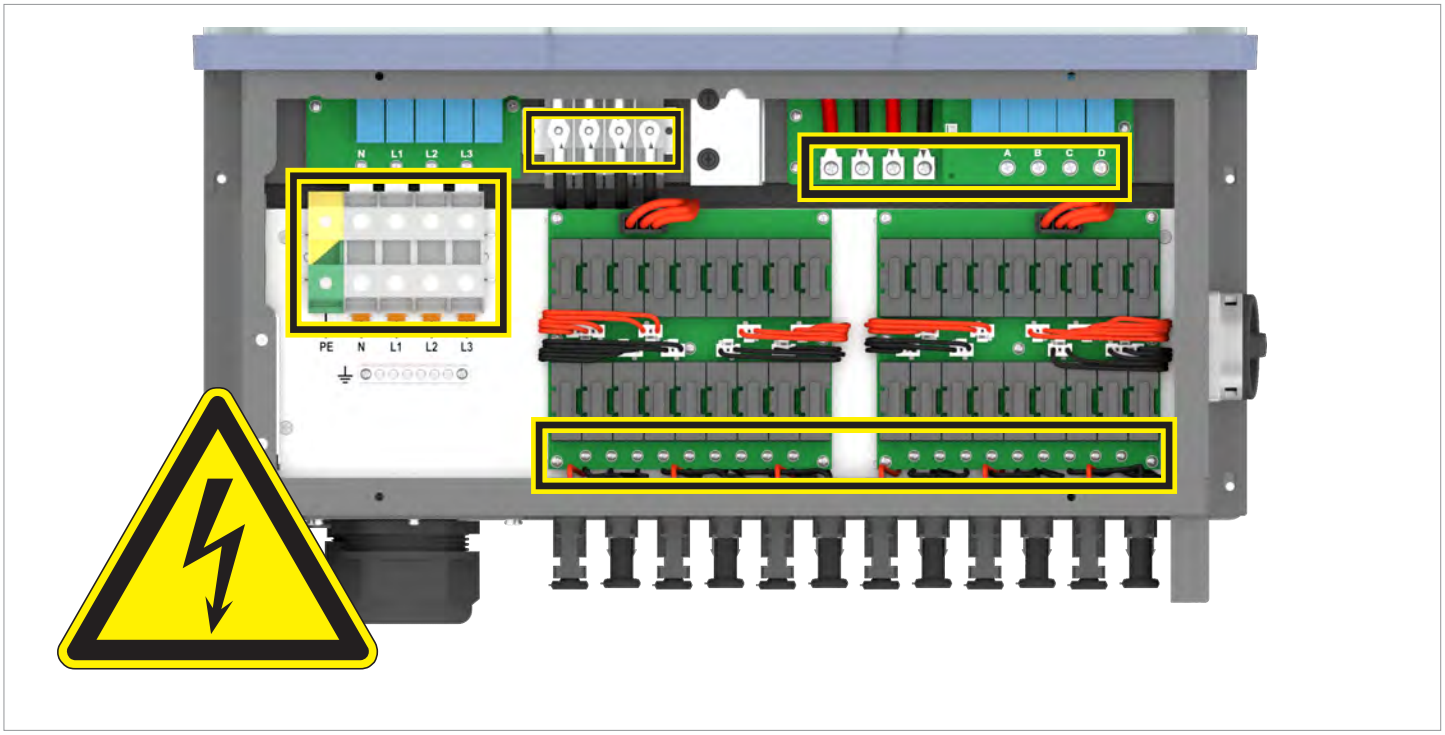
► Fit the crimp connectors according to the manufacturer's instructions, and secure them additionally with heat-shrink sleeving.

6.5.2 Connecting the AC cables

NOTICE

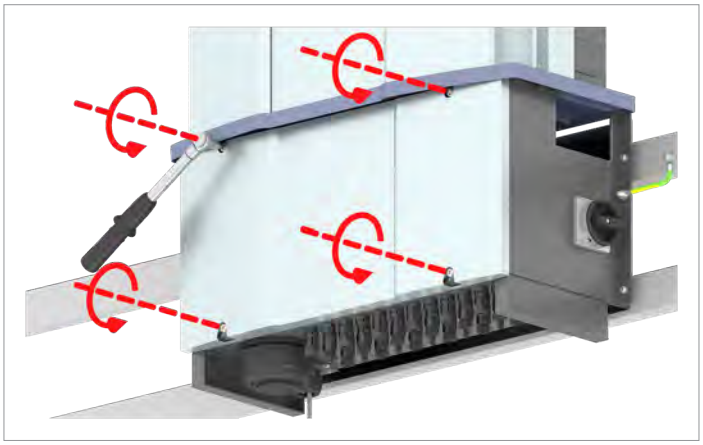
Danger of a cable fire.
Bending and twisting will cause damage to the inner structure of the conductor, leading to a punctiform increase in electrical resistance. This can result in an overheating of the conductor and destruction of the insulation.

► When bending and twisting cables or conductors, always comply with the manufacturer's instructions.



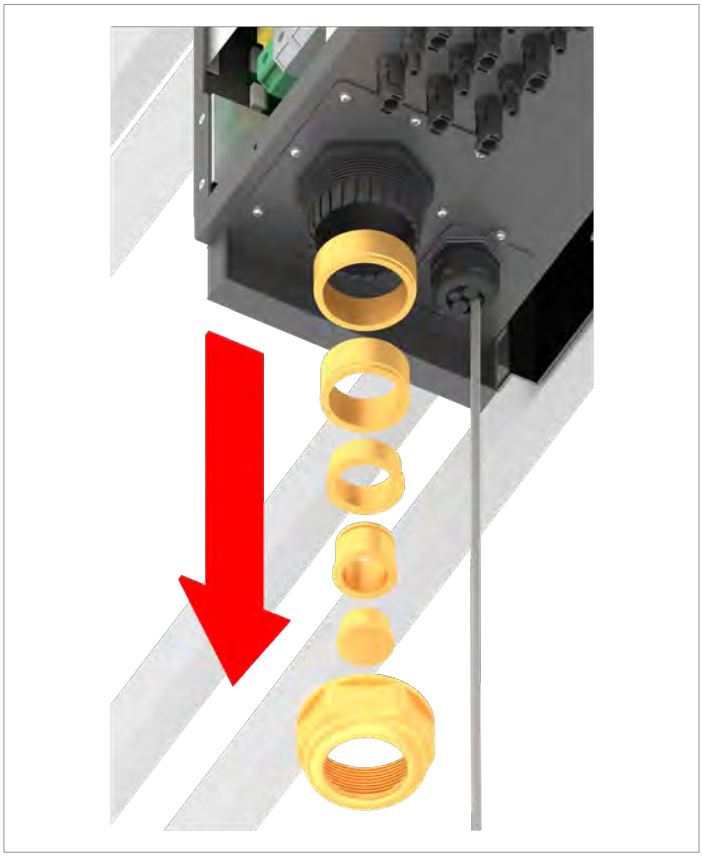
Hazard zones with potentially life-threatening currents and voltages

1. Turn the DC isolating switch to the ***0 (OFF)*** position.

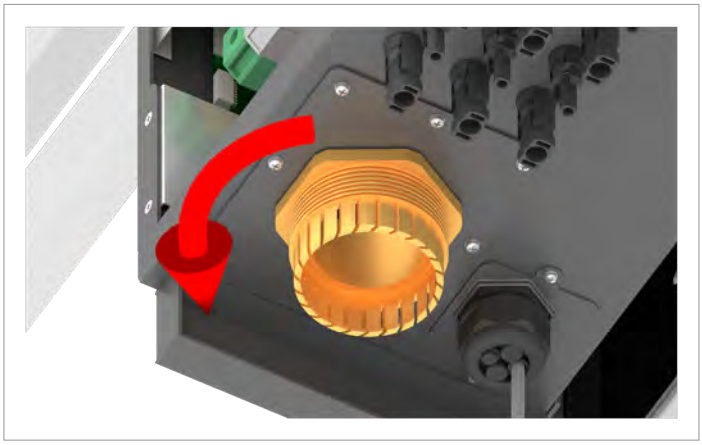


The protective cover inside the terminal box does not have to be removed for installation work.

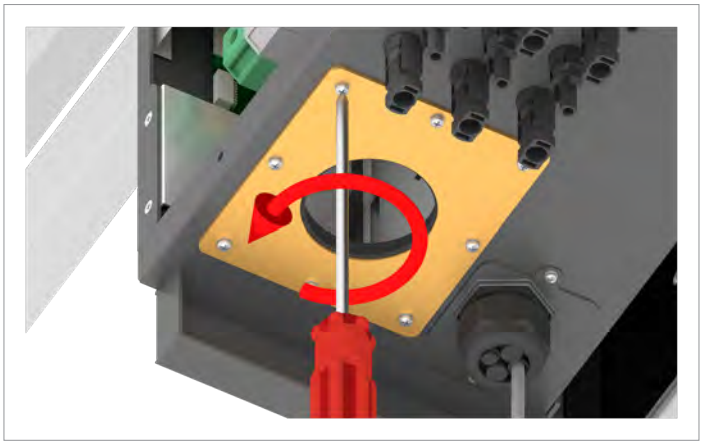
2. Unscrew and remove the junction box cover.



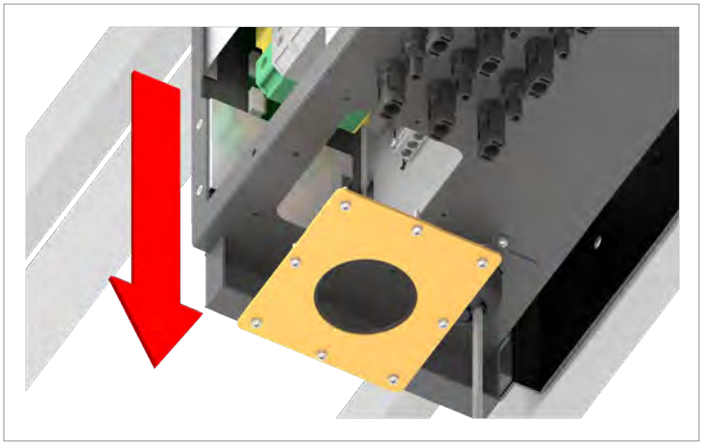
3. Unscrew the cable gland for the AC cable and remove the cable gland and seal.



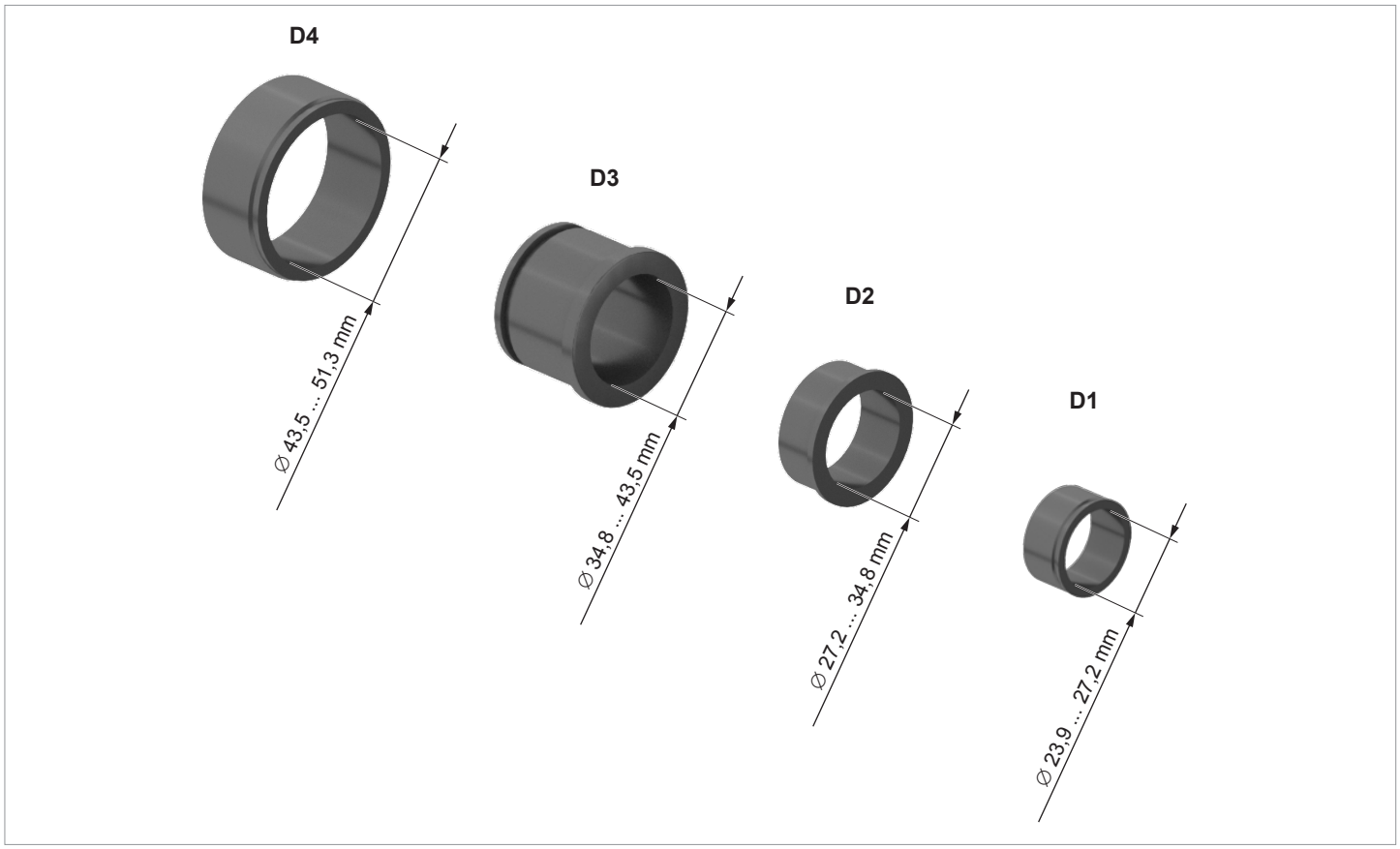
4. Unscrew the inner and outer ring of the cable gland.

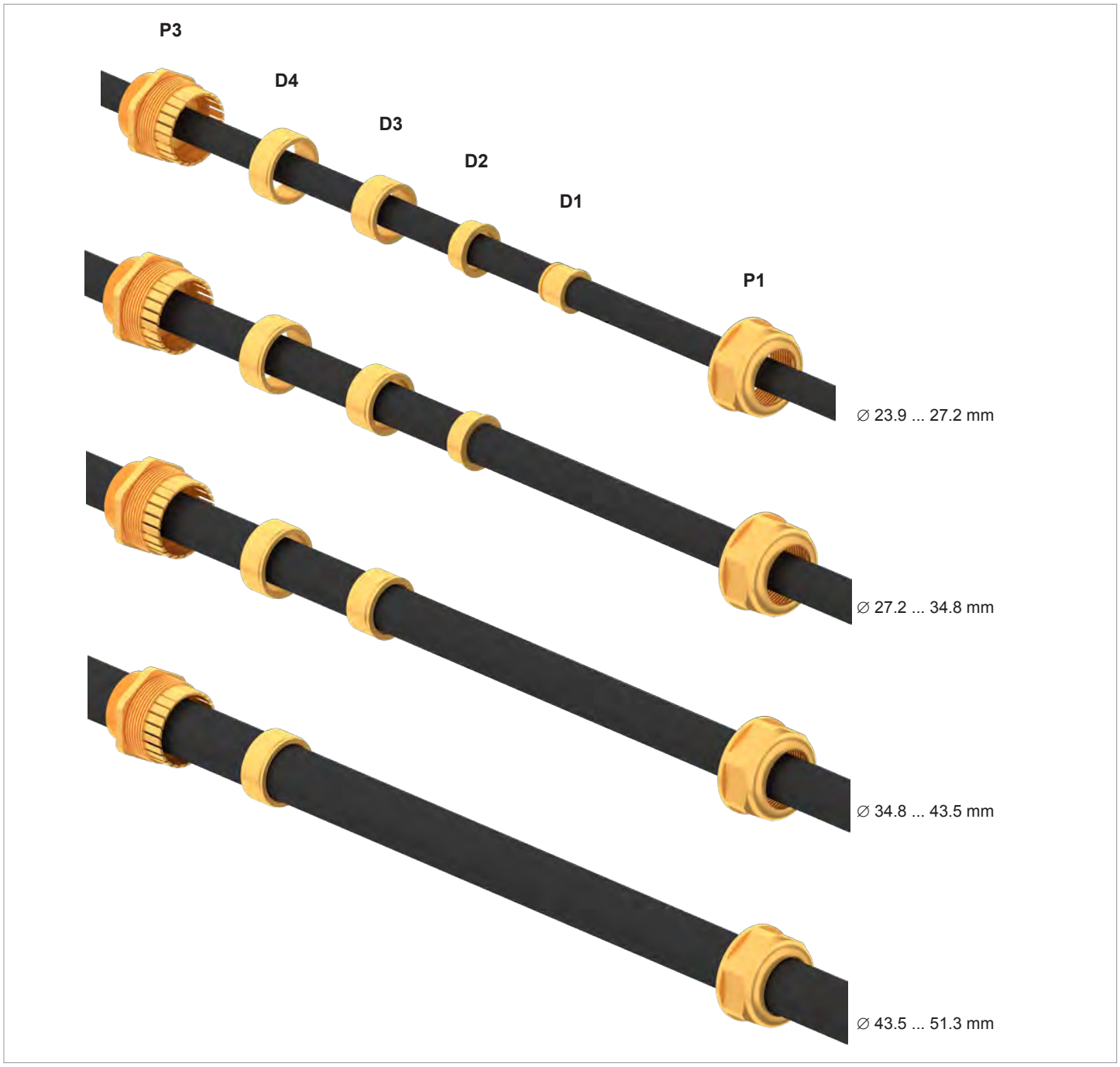


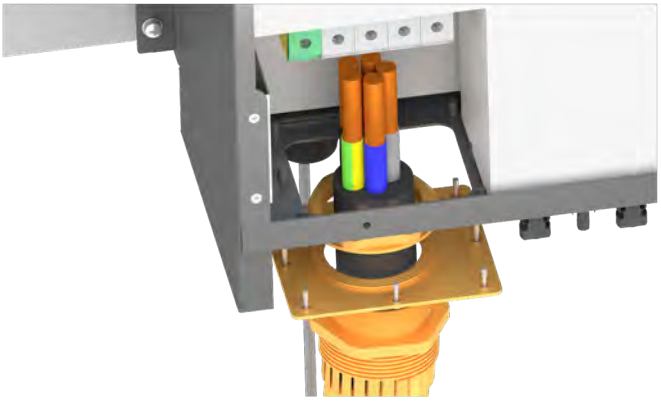
5. Unscrew the cover of the AC cable feed-through.

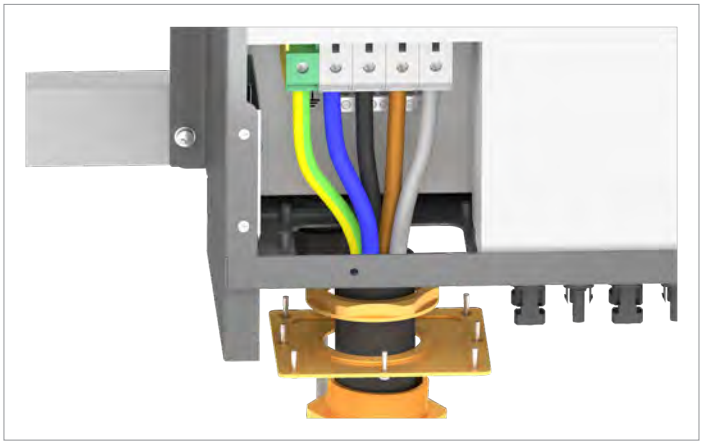


6. In accordance with the overviews below, select all the parts for the cable glands that are required for the respective cable diameters.


D4
Ø 43,5 ... 51,3 mm
D3
Ø 34,8 ... 43,5 mm
D2
Ø 27,2 ... 34,8 mm
D1
Ø 23,9 ... 27,2 mm


P3
D4
D3
D2
D1
P1
∅ 23.9 ... 27.2 mm
∅ 27.2 ... 34.8 mm
∅ 34.8 ... 43.5 mm
∅ 43.5 ... 51.3 mm

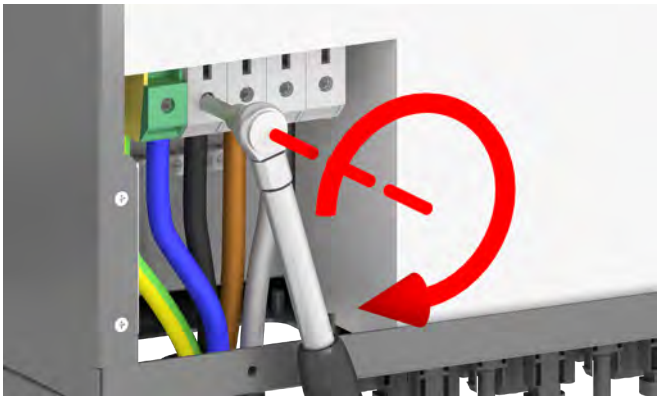


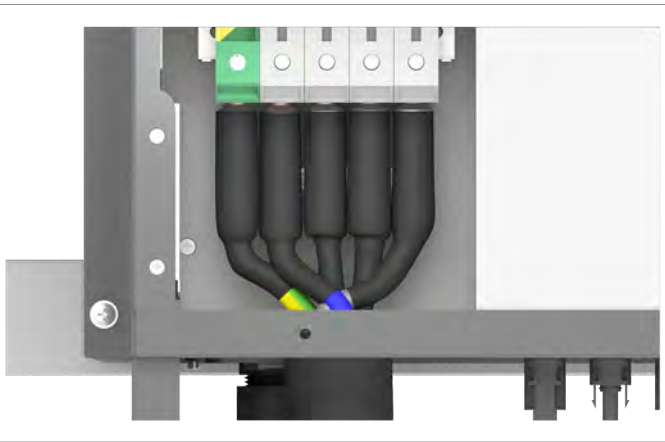


When bending and twisting cables or conductors, always comply with the manufacturer's instructions so as to avoid breakage of the conductors or the insulation.

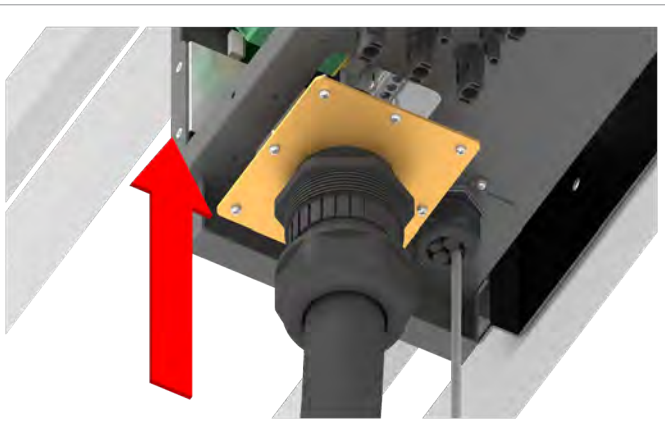
7. Pull the prepared AC cables through all the necessary parts of the cable glands and the AC cable feed-throughs.

► Insert the conductors of the AC cable into the terminals of the AC terminal block in accordance with the phase assignment, and tighten the terminals (torque 8 ... 10 Nm). The illustration on the left shows the wiring for a 5-conductor system with PE and N when using copper cables.

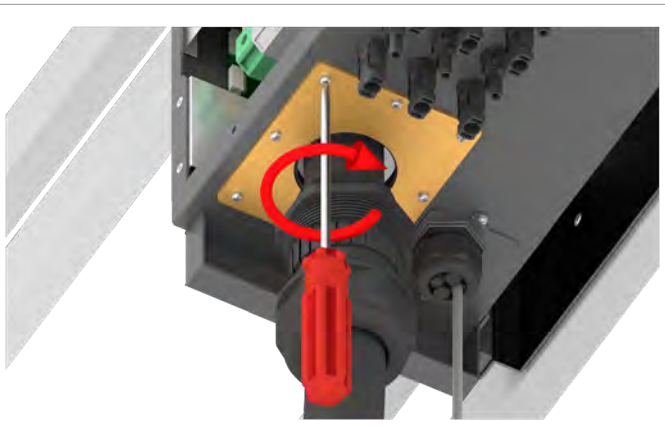


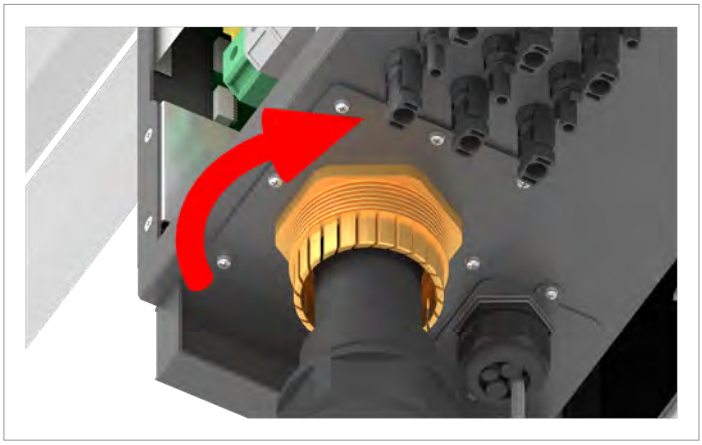


If aluminum cables with crimped connectors are being used, the installation should appear as shown in this illustration.

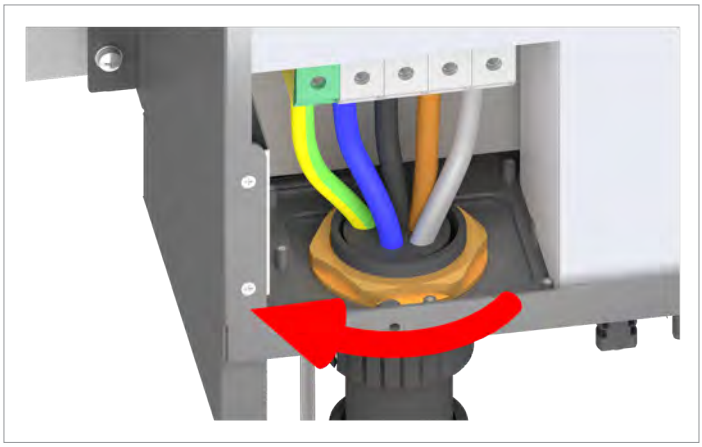


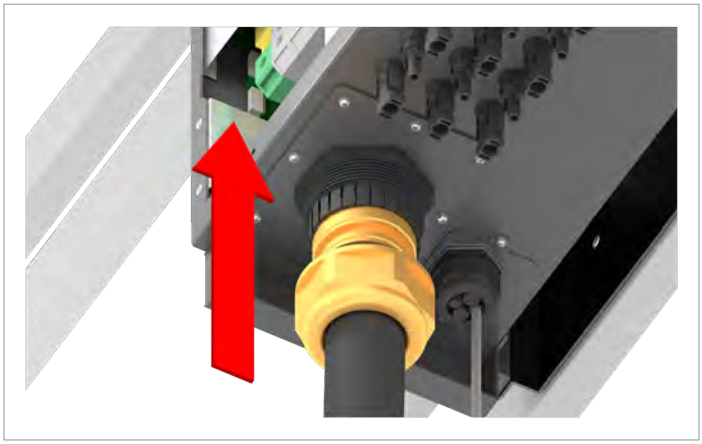
8. Screw on the cover of the AC cable feed-through.



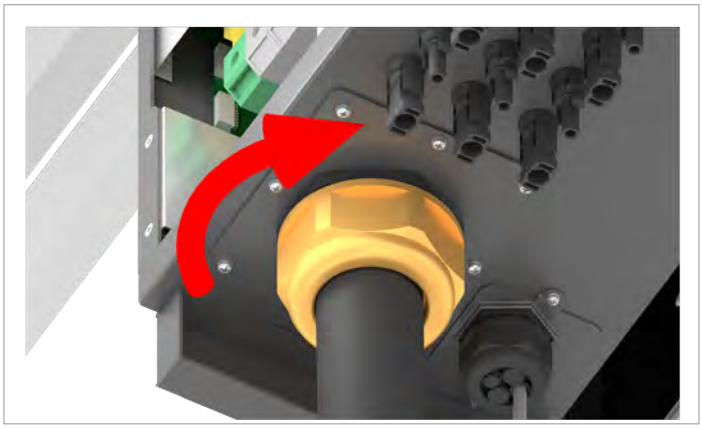


9. Tighten the inner and outer rings of the AC cable gland.



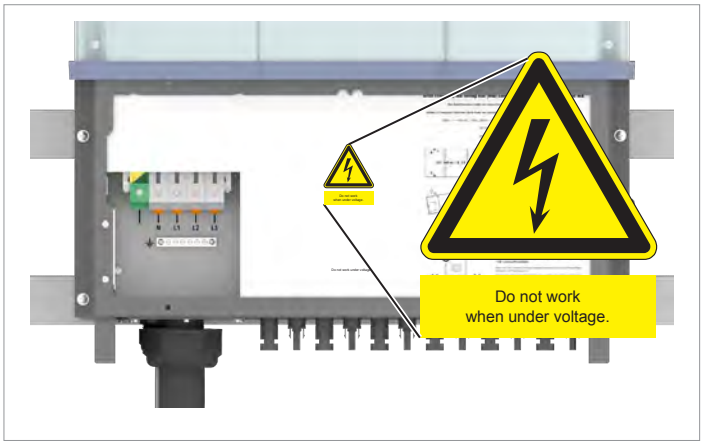


10. Fit the seal and AC cable gland, and screw the cable gland tight.



11. Secure the AC cable using a strain relief element.

12. Affix all the necessary warning labels inside the terminal box. Always follow the local regulations.



This work step is only required in France.

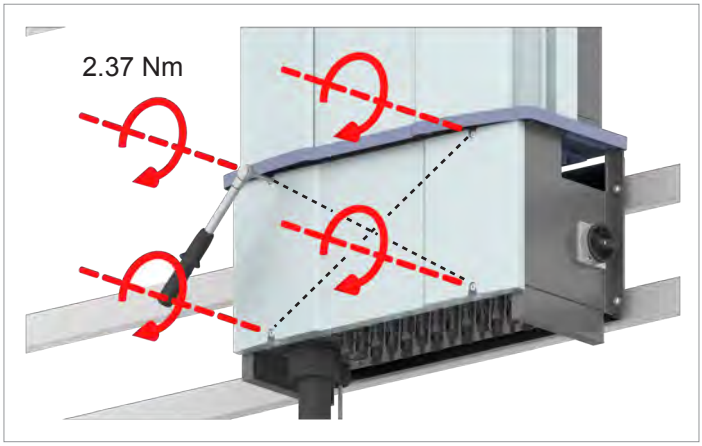
13. Affix the "Do not work when under voltage" warning label.

NOTICE

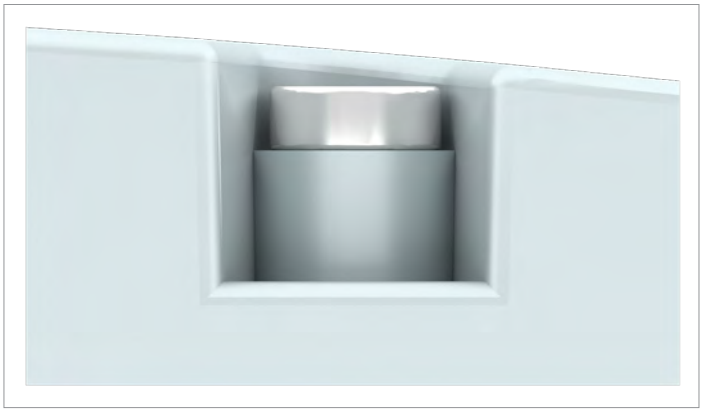
Impairment of operating response caused by moisture and dirt.
In order to restore the IP65 degree of protection once the installation work is complete, attach the cover of the terminal box in accordance with the following instructions.

14. Before screwing on the cover, check all the seals and surfaces are clean positioned correctly.

15. Attach the cover in such a way that it is evenly mounted and not skewed.



16. Tighten the screws by hand at first and then use a torque wrench to tighten them crosswise with a torque of 2.37 Nm.



17. Do not skew the screws. The screw heads must be flush with the surface.

☑ Work on the AC connection is now complete.

6.6 Connecting the solar modules (DC)

DANGER

Electric shock

Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

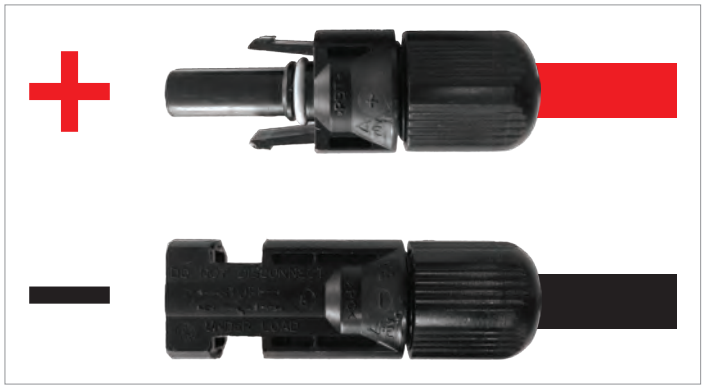
- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Turn the DC isolating switch to the ***0 (OFF)*** position.
- ► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

NOTICE

Danger of a cable fire.

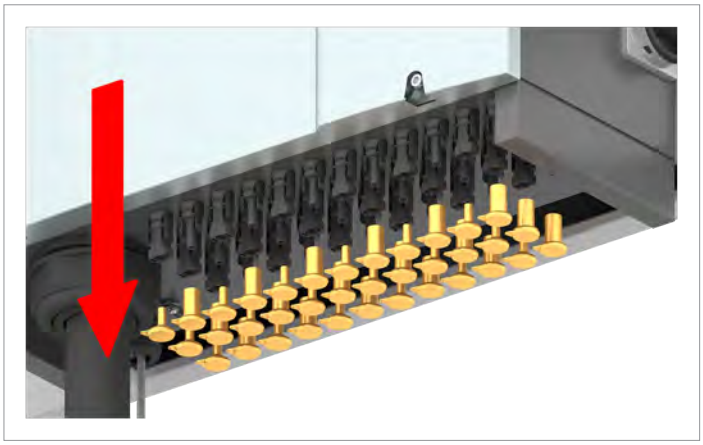
Bending and twisting causes damage to the inner structure of the conductor, which leads to punctiform increase in electrical resistance. This can result in an overheating of the conductor and destruction of the insulation.

- ► When bending and twisting cables or conductors, always comply with the manufacturer's instructions.



1. Use a red cable for DC+ and a black cable for DC–. Use a voltmeter to check the polarity.

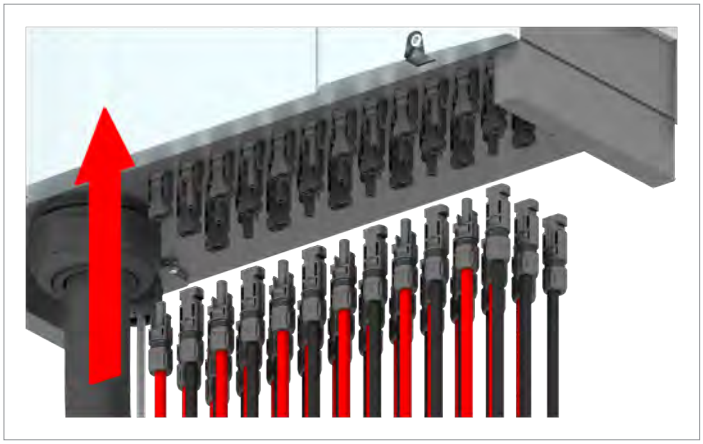
2. Turn the DC isolating switch to the ***0 (OFF)*** position.



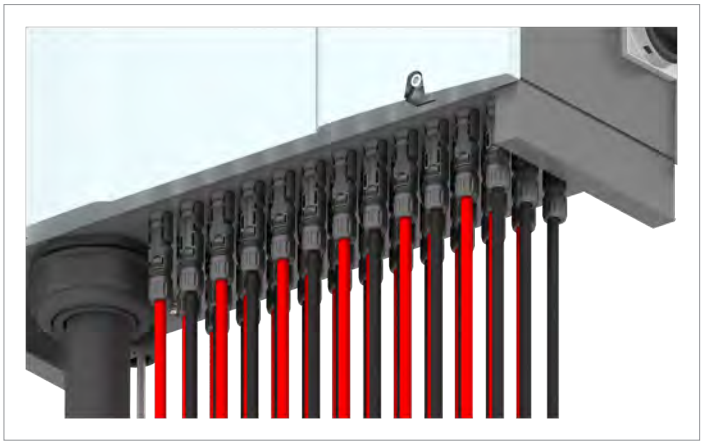
3. Remove the sealing caps from the DC connections and store in a safe place.

   Do not remove the sealing caps from the unused DC connections.

   Keep the sealing caps.



4. Plug the DC plugs with the DC cables into the DC connections on the inverter.



☑ Work on the DC connection is now complete.

6.7 Attaching warning labels to the inverter

All countries

► Attach all necessary warning labels to the inverter. Always follow the local regulations.

Some examples of warning labels are listed below.

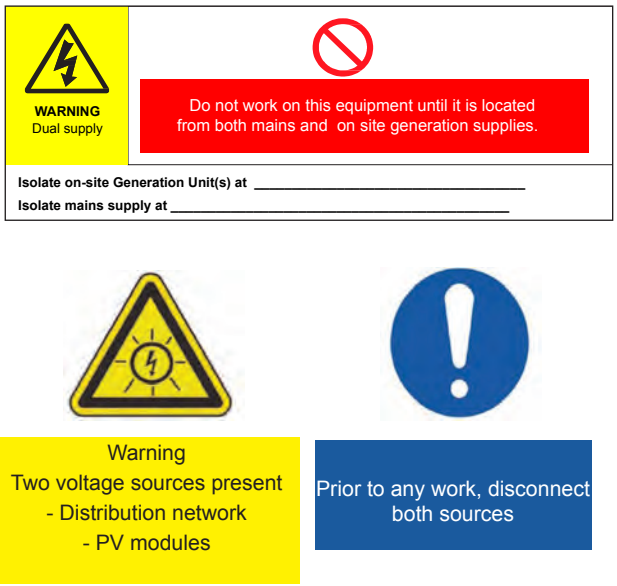


Fig. 6.47: Examples of warning labels

France

As required by UTE 15-712-1 the following warning labels must be attached:

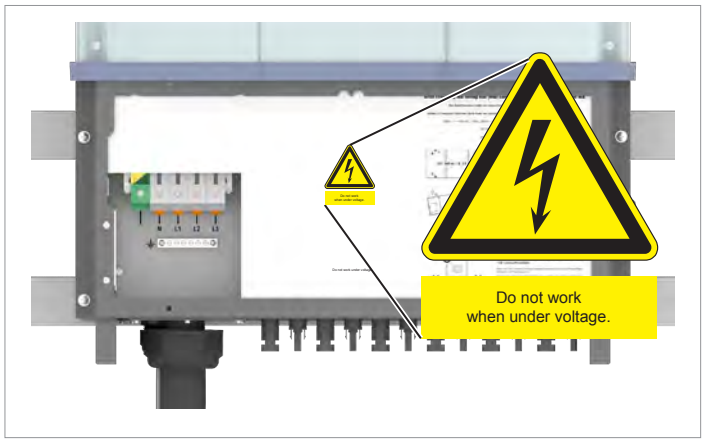


Fig. 6.48: Warning label on the inside of the terminal box cover

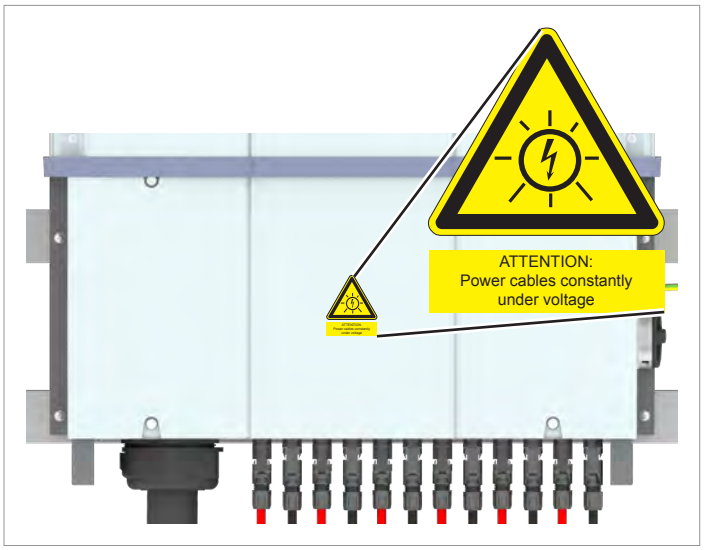
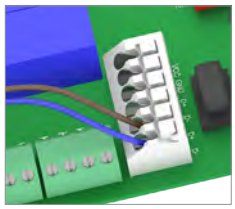


Fig. 6.49: Warning label on the terminal box cover

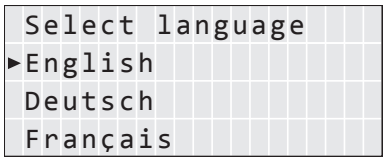
6.8 Connecting a PC via RS485

	Inverter	USB/RS485 adapter
		
DATA+	Terminal 3 or 5	D+
DATA–	Terminal 4 or 6	D–

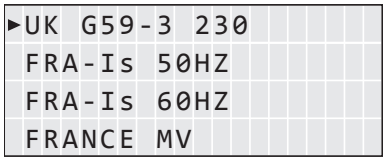
7. Commissioning

To make the settings as described in this chapter, the inverter must be powered with alternating current (mains grid).

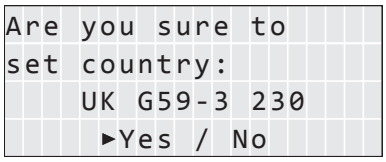
The inverter also needs a DC voltage in order to operate fully from the energy provider.



1. Use the ▼ and ▲ buttons to select the **English** language and then press the ENT button.



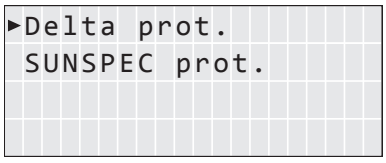
2. Use the ▼ and ▲ buttons to select your country or mains type and then press the ENT button.



3. Check that the correct country or mains type is selected.

   If the correct country is selected, use the ▼ and ▲ buttons to select the ***Yes*** entry and the press the ENT button.

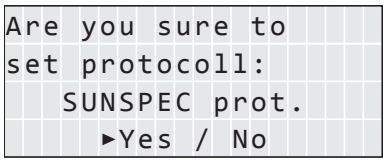
   To change the selection, press the EXIT button.



NOTICE

The Delta protocol is the Delta Modbus protocol and is intended for utilization with the Delta Service Software.

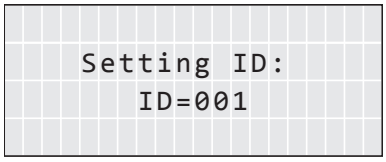
4. Use the ▼ and ▲ buttons to select SUNSPEC as RS485 protocol option and then press the ENT button.



5. Check that the correct protocol is selected.

   If the protocol is selected, use the ▼ and ▲ buttons to select the ***Yes*** entry and then press the ENT button.

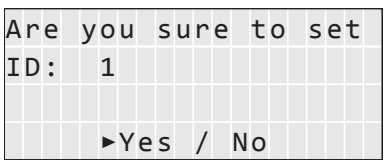
   Press the EXIT button to change the selection



NOTICE

If multiple inverters are connected to the PV system then a different inverter ID must set for each inverter. For example, the inverter ID is used by monitoring systems to uniquely identify each inverter.

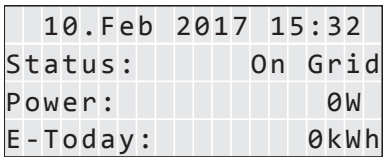
6. Use the ▼ and ▲ buttons to set the individual digits and then press the ENT button.



7. Check that the correct inverter ID is set.

   If the correct inverter ID is selected, use the ▼ and ▲ buttons to select the ***Yes*** entry and the press the ENT button.

   Press the EXIT button to change the selection



☑ The basic settings are now complete. The standard menu is displayed.

→ The inverter starts a self-test lasting approx. 2 minutes. The remaining time is shown on the display.

8. Settings

This section describes only the settings that can be changed directly on the inverter display. The Delta Service Software offers a wider range of setting facilities.

8.1 "Inverter info." menu area (current settings)

Overview

This function allows you to display the current inverter settings.

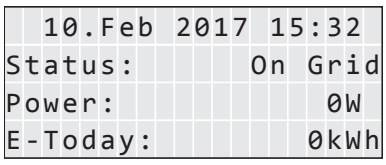
Setting options

None.

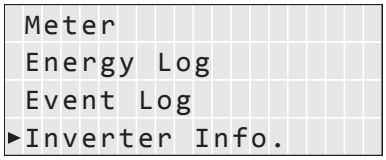
Menu item path

`Main menu > Inverter Info.`

Displaying the inverter information

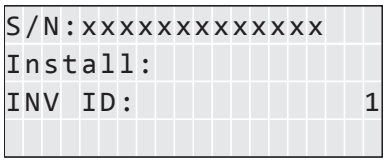
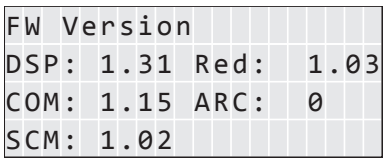


1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`Inverter Info.`** entry and then press the ENT button.
3. Use the ▼ and ▲ buttons to page through the list.
   Note: Some list items contain sub-items with additional information.
4. Press the EXIT button to exit the menu.

Overview of the information displayed at this menu item.

Displayed information	Description	How can I change this setting
Page 1		
	**`S/N: xxxxxxxxxxxxx`** The 13-character serial number of the inverter. The serial number is also located on the type plate of the inverter.	This setting cannot be changed.
	`Install:` The installation date of the inverter.	This setting cannot be changed.
	`ID: 1` The inverter ID. This is required in order to uniquely identify an inverter when several inverters are installed in a system.	See "8.3.1 Inverter ID", p. 101 for a detailed description and how to change the settings
Page 2		
	The version numbers of the installed firmware. This manual relates to the firmware versions listed here.	This setting cannot be changed.

Displayed information	Description	How can I change this setting
Page 3		
Country: UK G59-3 230 Insulation: 250kΩ Baudrate: 19200bps	**Country: GERMANY LV** The configured country or mains type.	See "8.3.3 Country", p. 104 for a detailed description and how to change the settings
	Insulation: 250 kΩ The insulation resistance.	See "8.3.2 Insulation", p. 102 for a detailed description and how to change the settings
	Baudrate: 19200 bps The RS485 Baud rate.	See "8.2.3 Baud rate", p. 98 for a detailed description and how to change the settings
Page 4		
AC connection: 3P4W Max. Power: 88000W Dry Cont. A: Disable Dry Cont. B: Disable	**AC connection: 3P4W** The mains type (with or without a neutral conductor).	See "8.3.10 AC connection", p. 122 for a detailed description and how to change the settings
	Max. power: 88000W The maximum injection power (active power) to which the inverter is limited.	See "8.3.12 Max. power (maximum active power)", p. 124 for a detailed description and how to change the settings
	Dry Cont. A: Disable **Dry Cont. B: Disable** The event at which the relays trigger the dry contacts.	See "8.3.6 Dry contacts", p. 117 for a detailed description and how to change the settings
Page 5		
EPO: Normal open ►Grid Settings Active Pwr Settings React Pwr Settings	**E-Power off: Normal Open** The setting for the external power off relay.	See "8.3.9 EPO Emergency power-off (external shutdown)", p. 121 for a detailed description and how to change the settings
	Grid Settings Sub-item with the settings for mains voltage, mains frequency and reconnection time after a mains fault and increase in the active power until reconnection.	See "8.3.4 Grid settings", p. 105 for a detailed description and how to change the settings
	Setting for active power Sub-item with the settings for the functions controlling active power.	See below for a description.
	Setting for reactive power Sub-item with the settings for the functions controlling reactive power.	See below for a description.
Sub-item "Setting for active power"		
►Power Limit Power vs. Frequency P(V)	**Power limit** Function for power limitation	See "8.4.1 Power limit (active power)", p. 127 for a detailed description and how to change the settings
	Power vs. Frequency Function for regulating the active power depending on the mains frequency.	See "8.4.2 Regulating the active power via the mains frequency", p. 129 for a detailed description and how to change the settings
	P(V) Function for regulating the active power depending on the mains voltage.	See "8.4.3 P (V) (regulating the active power via the mains voltage)", p. 132 for a detailed description and how to change the settings

Displayed information	Description	How can I change this setting
Sub-item "Setting for reactive power"		
▸Constant cos phi Cos phi (P) Constant Q Q(V)	**Constant cos phi** Function for setting a constant cos phi (power factor). **Cos phi (P)** Function for regulating the cos phi (power factor) depending on the active power. **Constant Q** Function for setting a constant reactive power. **Q(V)** Function for regulating the reactive power depending on the mains voltage.	See "8.4.3 P (V) (regulating the active power via the mains voltage)", p. 132 for a detailed description and how to change the settings See "8.4.5 Cos phi (P) (regulate cos phi via active power)", p. 136 for a detailed description and how to change the settings See "8.4.6 Constant Q (constatnt reactive power)", p. 138 for a detailed description and how to change the settings See "8.4.7 Q (V) – Regulating reactive power via voltage", p. 140 for a detailed description and how to change the settings
Page 6		
▸FRT Settings	**FRT Settings** Function for setting the operating behavior in the event of a mains voltage failure.	See "8.5 FRT (Fault Ride Through)", p. 143 for a detailed description and how to change the settings

8.2 "General settings" menu area

8.2.1 Language

Overview

This function allows you to set the display language.

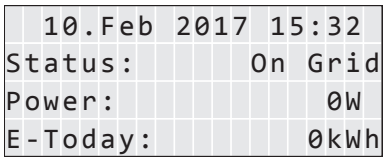
Setting options

Parameter	Description	Setting range
Language	The display language.	**German | English | Spanish | French | Italian | Dutch**

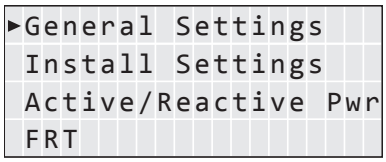
Menu item path

Main menu > General settings > Language

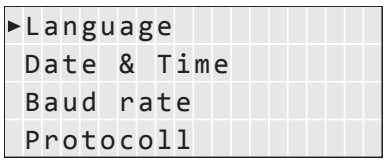
Set the display language



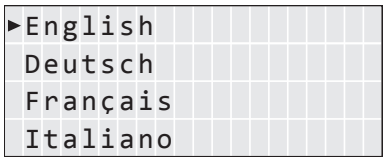
1. If the default information is displayed, press any button to open the main menu. Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **General Settings** entry and then press the ENT button.



3. Use the ▼ and ▲ buttons to select the **Language** entry and then press the ENT button.



4. Use the ▼ and ▲ buttons to select a language and then press the ENT button.

8.2.2 Date and Time

Overview

This function allows you to set the date and time.

The date and time must be set correctly for exact calculations of the statistics in the inverter or in a monitoring system.

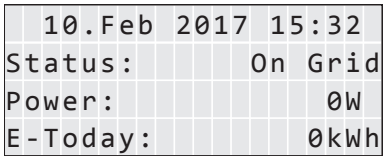
Setting options

Parameter	Description	Setting range
-	Date and Time	–

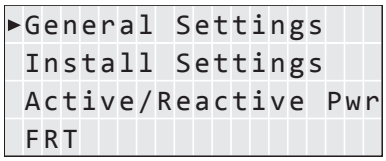
Menu item path

`Main menu > General settings > Date and time`

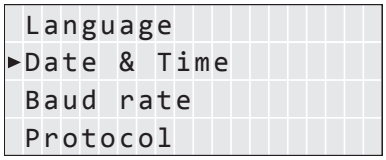
Setting the date and time



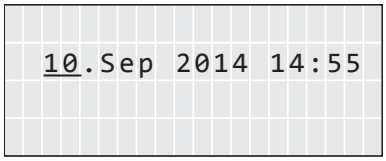
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`General Settings`** entry and then press the ENT button.



3. Press the ▼ and ▲ buttons to select the entry **`Date and time`** and press the ENT button.



4. Use the ▼ and ▲ buttons to change the selected (underlined) value and then press the ENT button.

   → The selection jumps to the next value.

8.2.3 Baud rate

Overview

This function allows you to set the RS485 Baud rate.

If multiple inverters are connected via RS485 then the same Baud rate must be set at every inverter.

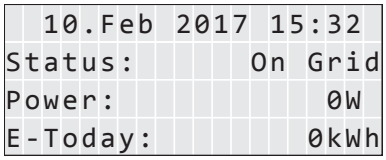
Setting options

Parameter	Description	Setting range
`Baud rate`	Baud rate for RS485	`9600` | `19200` | `38400`

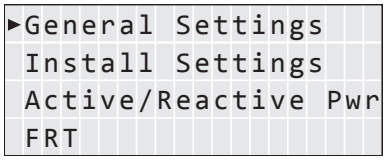
Menu item path

`Main menu > General settings > Baud rate`

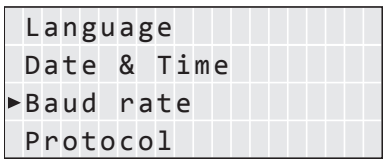
Setting the Baud rate for RS485



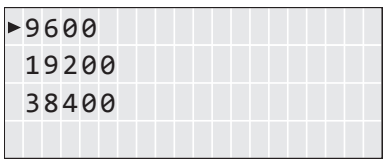
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`General Settings`** entry and then press the ENT button.



3. Use the buttons ▼ and ▲ to select the entry **`Baud Rate`** and press the ENT button.



4. Use the ▼ and ▲ buttons to select the value and then press the ENT button.

8.2.4 Protocol

Overview

This function allows you to select the RS485 protocol.

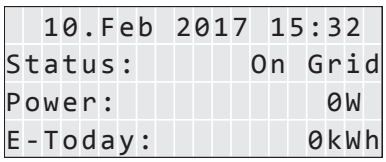
Setting options

Parameter	Description	Setting range
Prot. Delta	Delta Modbus protocol, for use with Delta Service Software only	-
Prot. SUNSPEC	Standard RS485 protocol	-

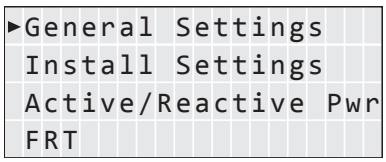
Menu item path

Main menu > General settings > Baud rate

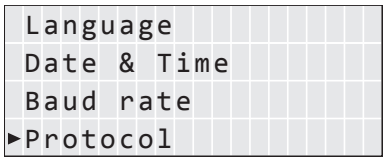
Setting the Baud rate for RS485



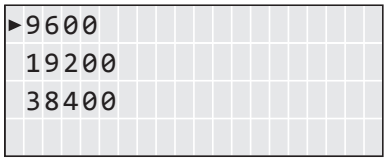
1. If the default information is displayed, press any button to open the main menu. Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **General Settings** entry and then press the ENT button.



3. Use the ▼ and ▲ buttons to select the **Protocol** entry and then press the ENT button.



4. Use the ▼ and ▲ buttons to select the entry and then press the ENT button.

8.2.5 Test menu

See “11.4 Checking the fans”, p. 156 for a description

8.3 "Installation settings" menu area

This menu area is password-protected because the settings in this menu area affect the energy production of the inverter.

► Exercise extra care with all settings in this menu area.

8.3.1 Inverter ID

Overview

This function allows you to set the inverter ID.

If multiple inverters are connected to the PV system then a different inverter ID must set for each inverter. For example, the inverter ID is used by monitoring systems to uniquely identify each inverter.

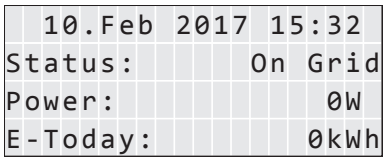
Setting options

Parameter	Description	Setting range
`Setting ID`	Inverter ID	`001 .. 254`

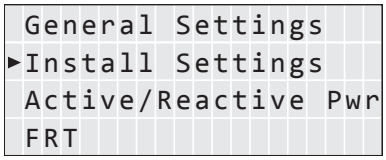
Menu item path

`Main Menu > Install Settings > Inverter ID`

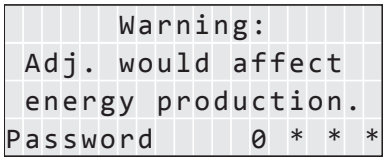
Setting the inverter ID



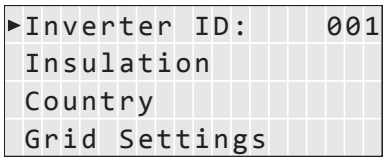
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



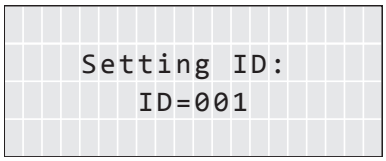
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the buttons ▼ and ▲ to select the entry **`Inverter ID`** and press the ENT button.
   The currently set value is displayed after the entry.



5. Use the ▼ and ▲ buttons to set the inverter ID and then press the ENT button.

8.3.2 Insulation

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to set the insulation mode and insulation resistance.

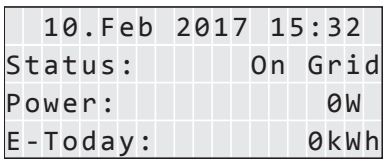
Setting options

Parameter	Description	Setting range
Mode	The insulation mode.	ON Plus grounding Minus grounding OFF
Resistance	Insulation resistance	150 kΩ | 250 kΩ | 1200 kΩ

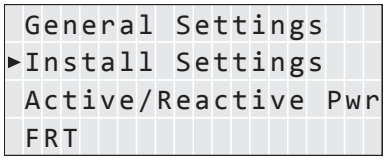
Menu item path

Main Menu > Install Settings > Insulation

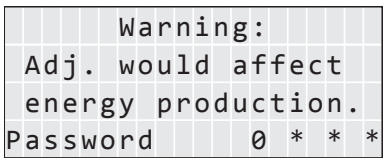
Calling up the menu



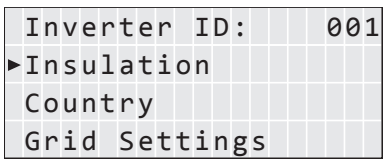
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



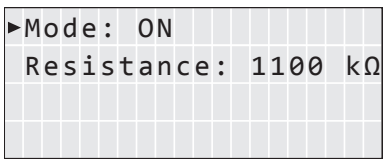
2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.



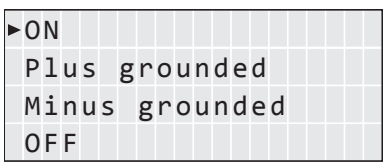
3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



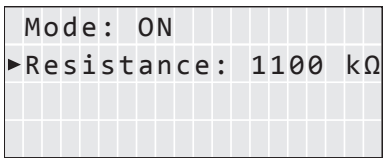
4. Use the ▼ and ▲ buttons to select the **Insulation** entry then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.
   The currently set value is displayed after the entry.

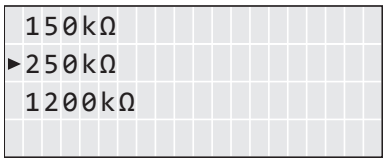


6. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.



7. Use the ▼ and ▲ buttons to select the **Resistance** entry and then press the ENT button.

The currently set value is displayed after the entry.



8. Use the ▼ and ▲ buttons to select a value and then press the ENT button.

8.3.3 Country

Change this setting only after consultation with Delta customer service.

Overview

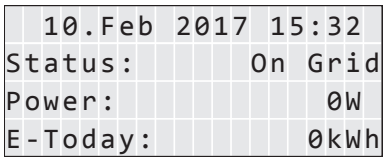
To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to set the country.

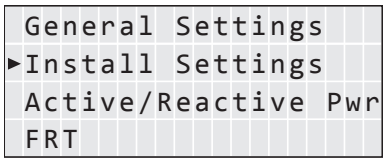
Menu item path

`Main Menu > Install Settings > Country`

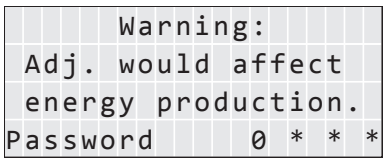
Loading the factory settings



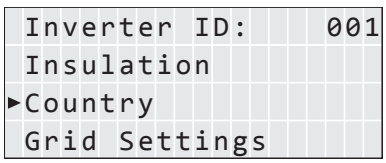
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



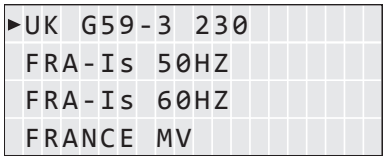
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Country`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select a country or mains type and then press the EXIT button.

8.3.4 Grid settings

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

8.3.4.1 Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This menu area is used to define the behavior of the inverter in the event of faults in the public mains.

The **`Grid Settings`** menu area has the following sub-areas:

Voltage protection	The behavior of the inverter in the event of mains overvoltage or undervoltage.
Frequency protection	The behavior of the inverter in the event of mains overfrequency or underfrequency.
Reconnection time	The time that the inverter will wait before reconnecting to the mains after a mains fault.
P Ramp Up	The increase in active power per minute when the inverter is reconnecting to the mains after a mains fault.

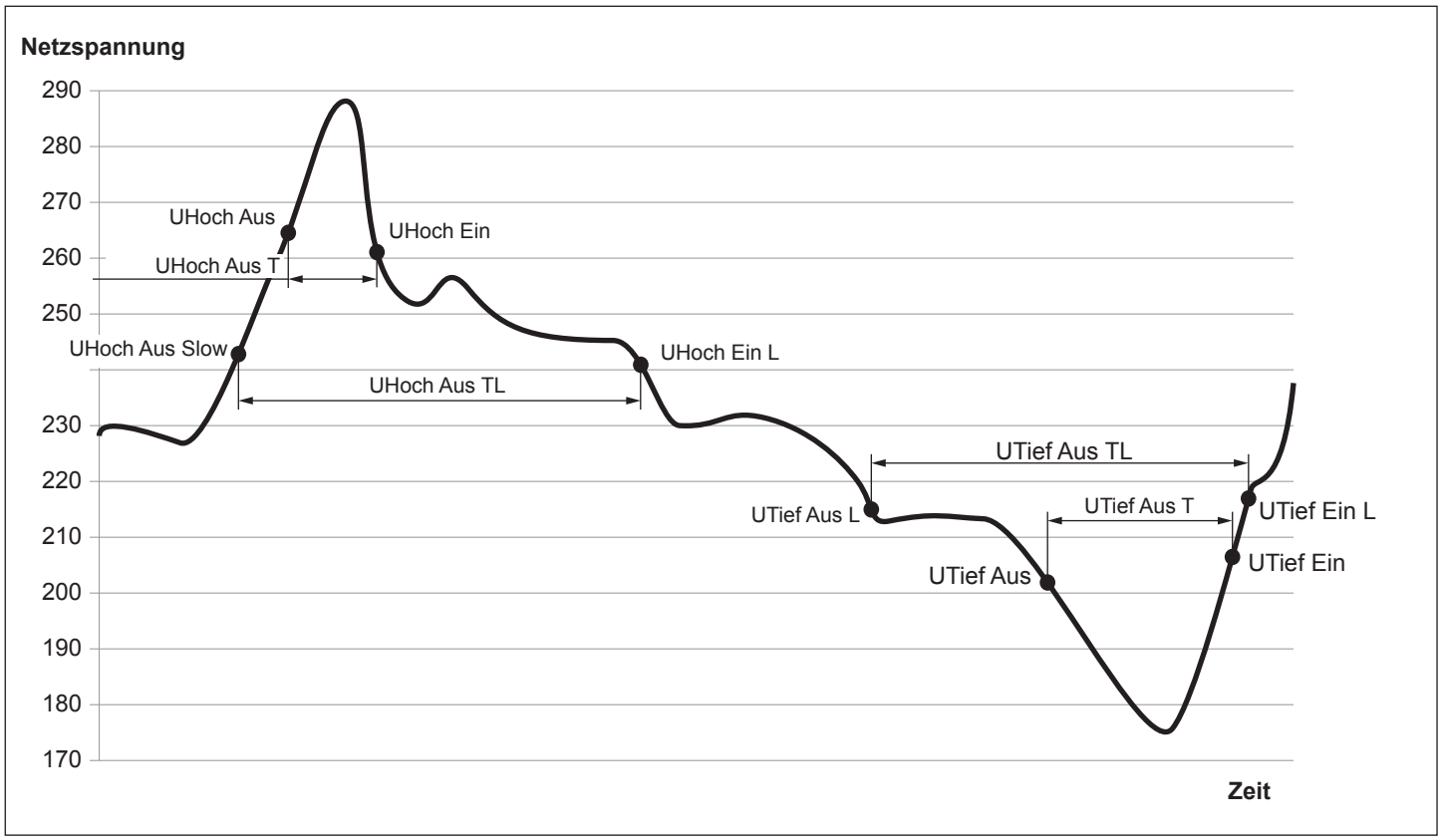
8.3.4.2 Voltage protection

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to defined the behavior of the inverter in the event of mains overvoltage or undervoltage.



Setting options

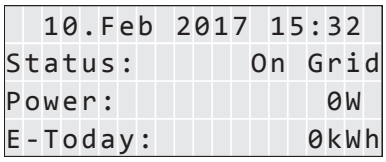
Parameter	Description	Setting range
`High Off`	Voltage high off	`104.0 .. 374.0 V`
`High On`	Voltage high on	`104.0 .. 374.0 V`
`High Off T`	Disconnection time for voltage high off	`0.0 .. 5.0 s`
`Low Off`	Voltage low off	`104.0 .. 374.0 V`
`Low On`	Voltage low on	`104.0 .. 374.0 V`
`Low Off T`	Disconnection time for voltage high off	`0.0 .. 5.0 s`
`Hi Off Slow`	Voltage high off slowly	`104.0 .. 374.0 V`
`Lo On Slow`	Voltage low on slowly	`104.0 .. 374.0 V`
`Hi Off Sl T`	Disconnection time for voltage high off slowly	`0.0 .. 600.0 s`
`Lo Off Slow`	Voltage low off slowly	`104.0 .. 374.0 V`
`Lo On Slow`	Voltage low on slowly	`104.0 .. 374.0 V`
`Lo Off Sl T`	Disconnection time for voltage low off slowly	`0.0 .. 600.0 s`

Menu item path

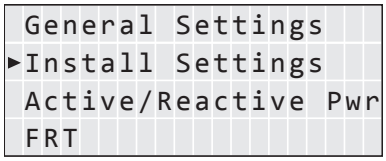
`Main Menu > Install Settings > Grid Settings > Voltage Protection`

Changing the settings

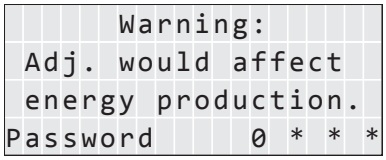
This procedure is the same for all parameters.



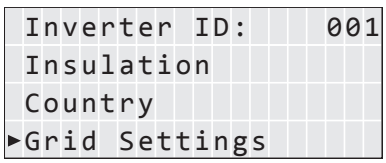
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



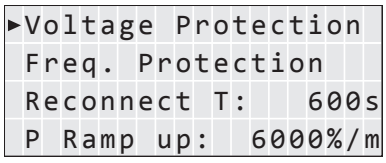
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



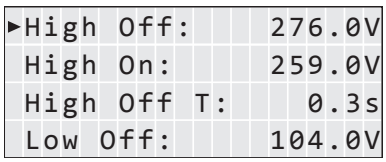
3. Enter the password provided by Delta customer service. Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Grid Settings`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Voltage Protection`** entry and then press the ENT button.



6. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the value can be changed.

The currently set value is displayed after the entry.

7. Use the ▼ and ▲ buttons to configure the value and then press the EXIT button.

8.3.4.3 Frequency protection

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to defined the behavior of the inverter in the event of mains overfrequency or underfrequency.

Setting options

Parameter	Description	Setting range
`High Off`	Frequency high off	`45.00 .. 65.00 Hz`
`High On`	Frequency high on	`45.00 .. 65.00 Hz`
`High Off T`	Disconnection time for frequency high off	`0.0 .. 5.0 s`
`Low Off`	Frequency low off	`45.00 .. 65.00 Hz`
`Low On`	Frequency low on	`45.00 .. 65.00 Hz`
`Low Off T`	Disconnection time for frequency high off	`0.0 .. 5.0 s`
`Hi Off Slow`	Frequency high off slowly	`45.00 .. 65.00 Hz`
`Lo On Slow`	Frequency low on slowly	`45.00 .. 65.00 Hz`
`Hi Off Sl T`	Disconnection time for frequency high off slowly	`0 .. 600 s`
`Lo Off Slow`	Frequency low off slowly	`45.00 .. 65.00 Hz`
`Lo On Slow`	Frequency low on slowly	`45.00 .. 65.00 Hz`
`Low Off Sl T`	Disconnection time for voltage low off slowly	`0.0 .. 600.0 s`

Menu item path

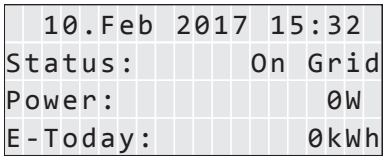
`Main Menu > Install Settings > Grid Settings > Freq. Protection`

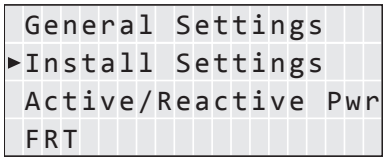
8 Settings

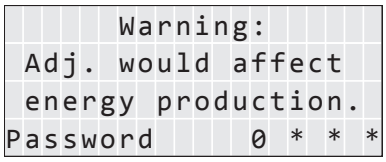
"Installation settings" menu area

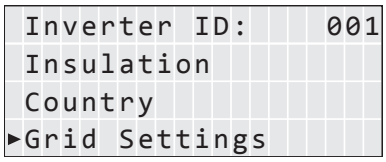
Changing the settings

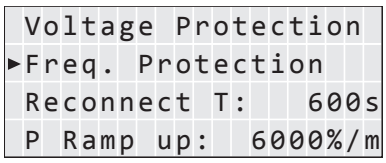
This procedure is the same for all parameters.

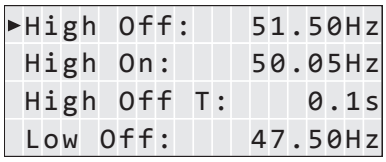












1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.
3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.
4. Use the ▼ and ▲ buttons to select the **`Grid Settings`** entry and then press the ENT button.
5. Use the ▼ and ▲ buttons to select the **`Freq. Protection`** entry and then press the ENT button.
6. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.
   → If the shape of the arrow changes →|, the value can be changed.
   The currently set value is displayed after the entry.
7. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.4.4 Reconnection time

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to specify a reconnection time for cases where the inverter disconnects from the mains due to a voltage failure or frequency fault.

Once the fault has disappeared, the inverter waits for the specified reconnection time before reconnecting to the mains.

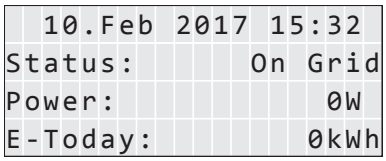
Setting options

Parameter	Description	Setting range
`Reconnection T`	Reconnection time	`0 .. 600 s`

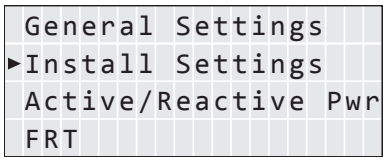
Menu item path

`Main Menu > Install Settings > Grid Settings > Reconnection T`

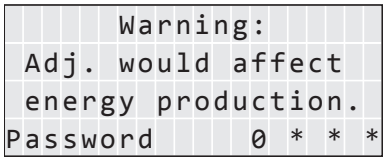
Setting the reconnection time



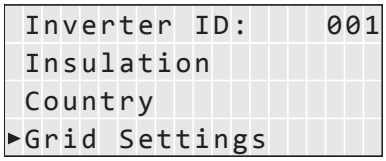
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



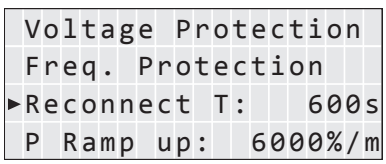
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Grid Settings`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Reconnection T`** entry and then press the ENT button.
   → If the shape of the arrow changes →|, the value can be changed.
   The currently set value is displayed after the entry.

6. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.4.5 P Ramp Up

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to specify the active power increase ramp for cases where the inverter disconnects from the mains due to a voltage failure or frequency fault.

Once the fault has disappeared, the inverter continuously increases the active power according to the specified ramp.

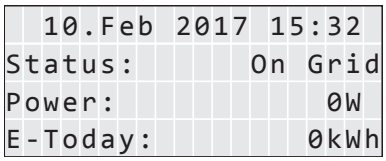
Setting options

Parameter	Description	Setting range
`P Ramp Up`	Increase of the fed active power in percent per minute.	`0 .. 6000 %/min`

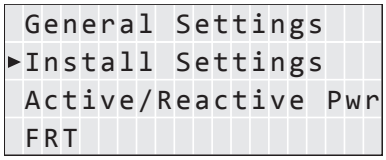
Menu item path

`Main Menu > Install Settings > Grid Settings > P Ramp Up`

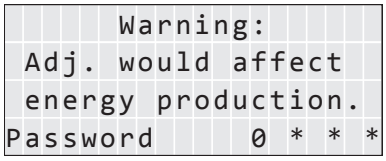
Setting the active power increase ramp



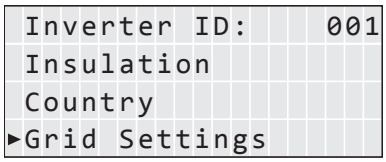
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



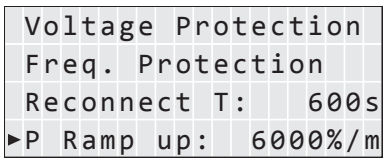
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



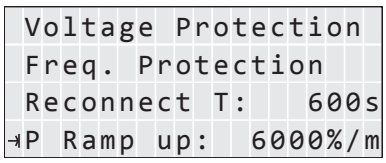
3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Grid Settings`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`P Ramp Up`** entry and then press the ENT button.
   → If the shape of the arrow changes →|, the value can be changed.
   The currently set value is displayed after the entry.



6. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.5 DC Injection

Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to specify the behavior of the inverter when a DC component occurs in the infeed to the mains.

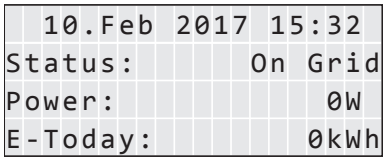
Setting options

Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`
`Trip Value`	The amount of DC current at which the inverter stops feeding into the mains.	`0.01 .. 1.00 A`
`Trip Time`	When the switch-off value is exceeded, the inverter waits for the specified time to see if the DC current drops below the switch-off value again. When this time has expired, the inverter switches off.	`0.0 .. 5.0 s`

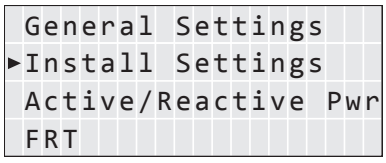
Menu item path

`Main Menu > Install Settings > DC Injection`

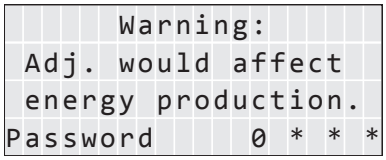
Calling up the menu item



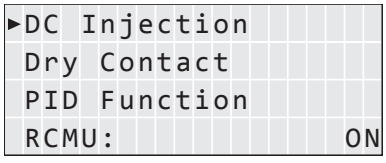
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.

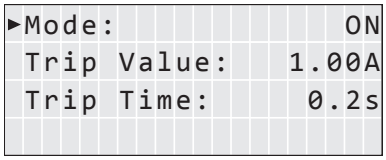


4. Use the ▼ and ▲ buttons to select the **`DC injection`** entry and then press the ENT button.

8 Settings

"Installation settings" menu area

Setting the mode



5. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

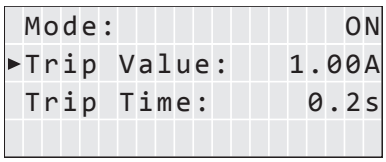
→ If the shape of the arrow changes →|, the mode can be changed.

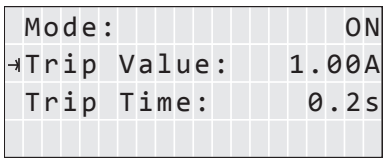
The currently set mode is displayed after the entry.

6. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings

This procedure is the same for all parameters.





7. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the mode can be changed.

The currently set value is displayed after the entry.

8. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.6 Dry contacts

Overview

If you have connected an external alarm unit to the dry contacts you can use this function to specify the events that trigger the external alarm unit.

You can specify a different event for each dry contact.

Setting options

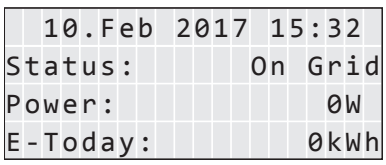
Parameter	Description	Setting range
Dry contact A	The event for dry contact A.	**Disable** | **On Grid** | **Fan def.** | **Insulation** | **Alarm** | **Error** | **Fault** | **Warning**
Dry contact B	The event for dry contact B.	

Event	Description
Disable	The function of the dry contacts is disabled.
On Grid	The inverter is connected to the mains.
Fan Fail	The fans are defective.
Insulation	The insulation test has failed.
Alarm	An error event message, fault message or warning has been sent.
Error	An error event message has been sent.
Fault	A fault message has been sent.
Warning	A warning message has been sent.

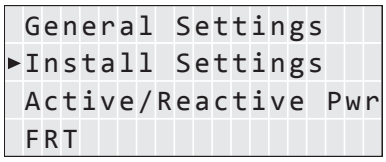
Menu item path

Main Menu > Install Settings > Dry Cont.

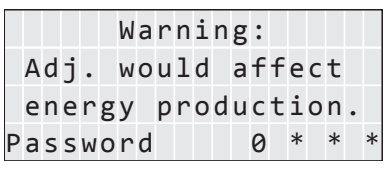
Assigning events to the dry contacts



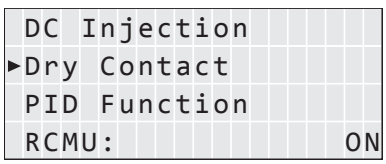
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



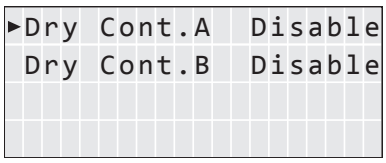
2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.



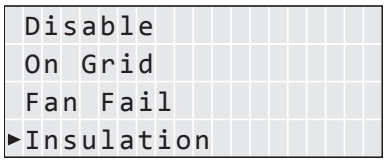
3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the buttons ▼ and ▲ to select the **Dry Cont** button press the ENT button.



5. Use the buttons ▼ and ▲ to select a dry contact press the ENT button.



6. Use the ▼ and ▲ buttons to select an event and then press the ENT button.

8.3.7 PID Function

Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

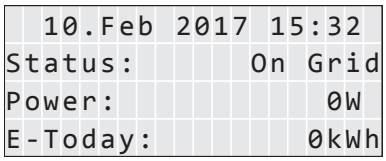
Setting options

Parameter	Description	Setting range
		`0 .. 10 hrs.` | `Auto`

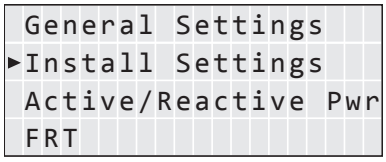
Menu item path

`Main Menu > Install Settings > PID Function`

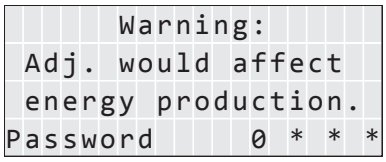
Setting the PID function



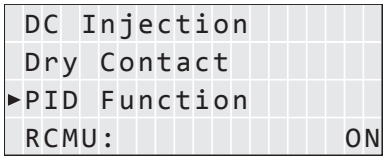
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



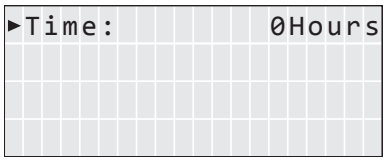
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`PID function`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.
   → If the shape of the arrow changes →|, the value can be changed.
   The currently set value is displayed after the entry.

6. Use the ▼ and ▲ buttons to configure a value and then press the ENT button.

8.3.8 RCMU - Integrated residual current monitoring unit

Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to switch the integrated residual current monitoring unit on and off.

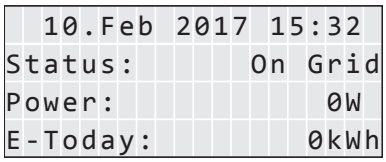
Setting options

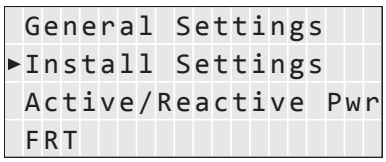
Parameter	Description	Setting range
RCMU	Switch the function on and off.	**ON** | **OFF**

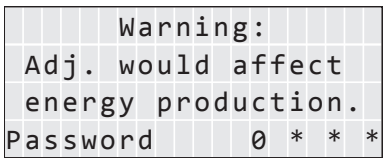
Menu item path

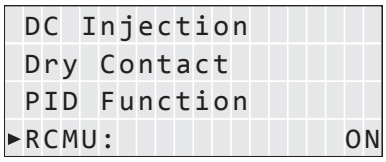
Main Menu > Install Settings > RCMU

Setting the integrated residual current monitoring unit









1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.
2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.
3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.
4. Use the ▼ and ▲ buttons to select the **RCMU** entry and then press the ENT button.
   → If the shape of the arrow changes →|, the mode can be changed.
5. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

8.3.9 EPO Emergency power-off (external shut-down)

Overview

This function allows you to define the external shutdown (EPO) relay contacts as being normally closed or normally open contacts.

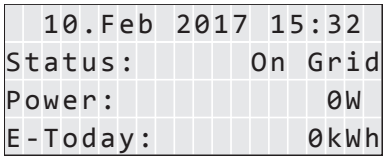
Setting options

Parameter	Description	Setting range
EPO	Defines how the relay functions for the external shutdown (EPO).	**Normally Open** | **Normally Closed**

Menu item path

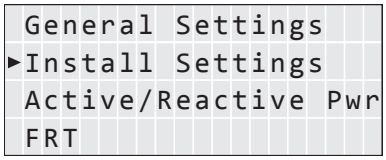
Main Menu > Install Settings > EPO

Set EPO

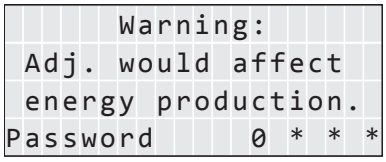


1. If the default information is displayed, press any button to open the main menu.

Otherwise, press the EXIT button repeatedly until the main menu is displayed.



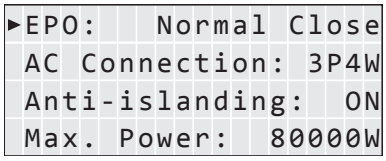
2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.



3. This function is protected with password 5555.

Use the ▼ and ▲ buttons to set the individual numerals.

Press the ENT button to confirm a numeral.



4. Use the buttons ▼ and ▲ to select the entry **EPO** and press the ENT button.

→ If the shape of the arrow changes →|, the value can be changed.

The currently set value is displayed after the entry.

5. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.10 AC connection

Overview

The inverter is configured by default for a mains connection with 3 phases and a neutral conductor (**3P4W**). If you wish to connect the inverter without a neutral conductor then you must set the AC connection type to **3P3W** after commissioning.

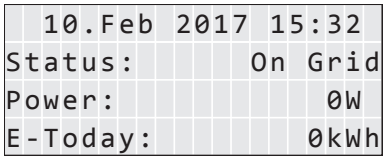
Setting options

Parameter	Description	Setting range
	Set the AC connection type.	
AC connection	**3P3W**: 3-phase system **without** a neutral conductor (L1, L2, L3, PE)	**3P3W** | **3P4W**
	3P4W: 3-phase system **with** a neutral conductor (L1, L2, L3, N, PE)	

Menu item path

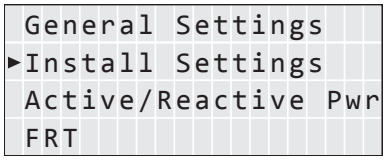
Main Menu > Install Settings > AC connection

Setting the AC connection type

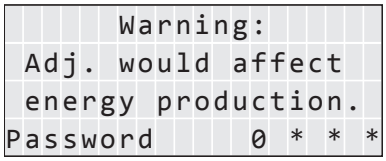


1. If the default information is displayed, press any button to open the main menu.

Otherwise, press the EXIT button repeatedly until the main menu is displayed.



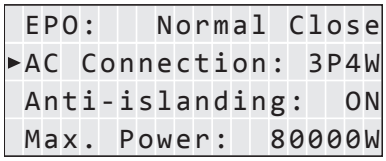
2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.



3. This function is protected with password 5555.

Use the ▼ and ▲ buttons to set the individual numerals.

Press the ENT button to confirm a numeral.



4. Use the buttons ▼ and ▲ to select the entry **AC connection** and press the ENT button.

→ If the shape of the arrow changes →|, the value can be changed.

The currently set value is displayed after the entry.

5. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.11 Anti-islanding

Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to switch the anti-islanding protection on and off.

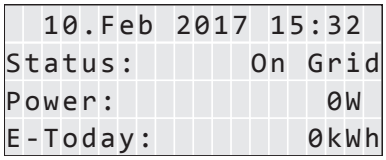
Setting options

Parameter	Description	Setting range
Anti-islanding	Switch the anti-islanding protection on and off.	**ON** | **OFF**

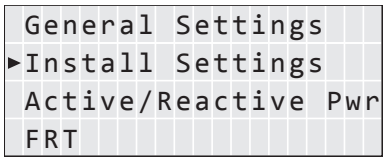
Menu item path

Main Menu > Install Settings > Anti-islanding

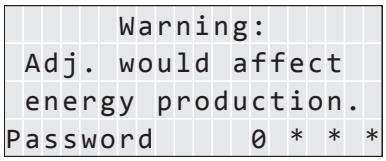
Set anti-islanding



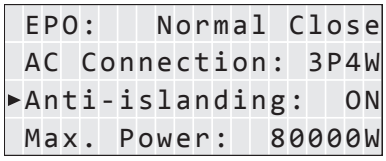
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **Install Settings** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **Anti-islanding** entry then press the ENT button.

5. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

8.3.12 Max. power (maximum active power)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to set the maximum active power fed into the mains.

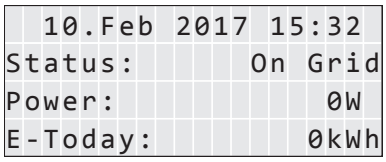
Setting options

Parameter	Description	Setting range
`Max. Power`	The maximum active power that can be fed into the mains.	**`0 .. 66000 W`** (for U_{AC} = 400 V_{AC}) **`0 .. 88000 W`** (for U_{AC} = 480 V_{AC})

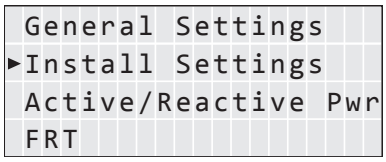
Menu item path

`Main Menu > Install Settings > Max. Power`

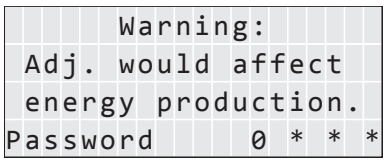
Setting the maximum active power



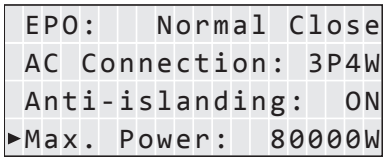
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Max. Power`** entry and then press the ENT button.
   → If the shape of the arrow changes →|, the value can be changed.
   The currently set value is displayed after the entry.
5. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.3.13 AFCI

Overview

This function is not available at present.

8.3.14 Loading the factory settings

Change this setting only after consultation with Delta customer service.

Overview

To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to reset the inverter to the factory settings.

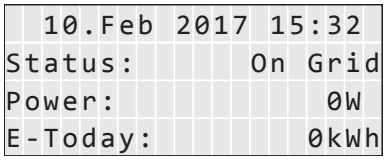
Setting options

Parameter	Description	Setting range
`Return to Factory`	Reset the inverter to the factory settings.	None

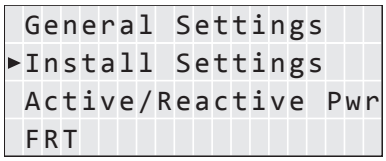
Menu item path

`Main Menu > Install Settings > Return to Factory`

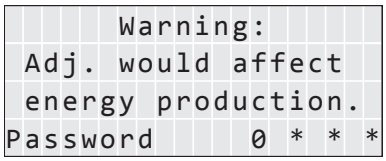
Loading the factory settings



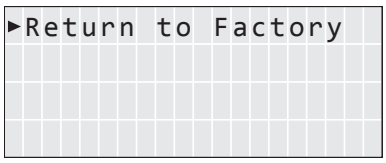
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



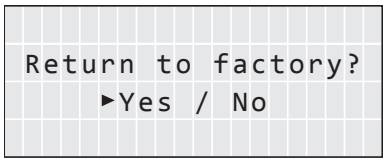
2. Use the ▼ and ▲ buttons to select the **`Install Settings`** entry and then press the ENT button.



3. Enter the password provided by Delta customer service.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.



4. Use the ▼ and ▲ buttons to select the **`Return to Factory`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Yes`** entry and then press the EXIT button.

8.4 "Active/reactive power" menu area

This menu area is password-protected because the settings in this menu area affect the energy production of the inverter.

► Exercise extra care with all settings in this menu area.

8.4.1 Power limit (active power)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to additionally limit the active power. The active power is specified as a percentage of the value set in the **Max. power** parameter (see "8.3.12 Max. power (maximum active power)", p. 124).

Example

Maximum power = 75000 W (from the parameter **Max. power**)

Power limit = 90%

Maximum active power = max. power x power limit

Maximum active power = 75000 W x 90% = 67500 W

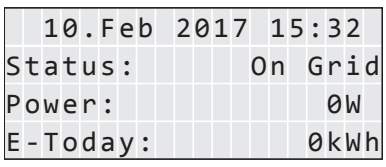
Setting options

Parameter	Description	Setting range
Mode	Switch the function on and off.	**ON** | **OFF**
Set Point	Additional active power limitation	**0 .. 100%**

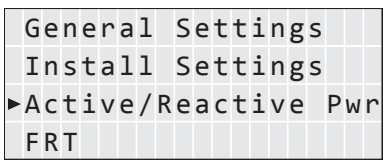
Menu item path

Main menu > **Active/Reactive Pwr** > **Active Power Ctrl** > **Power Limit**

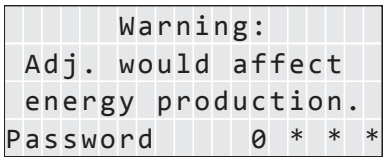
Calling up the menu item



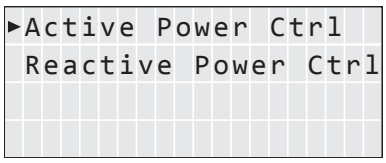
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



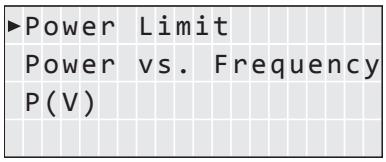
2. Use the ▼ and ▲ buttons to select the **Active/Reactive Pwr** entry and then press the button ENT.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.

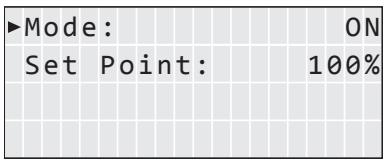


4. Use the ▼ and ▲ buttons to select the **`Active Power Ctrl`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Power Limit`** entry and then press the ENT button.

Setting the mode



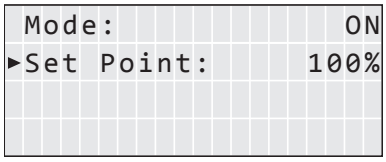
6. Use the ▼ and ▲ buttons to select the **`Mode`** entry and then press the ENT button.

→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

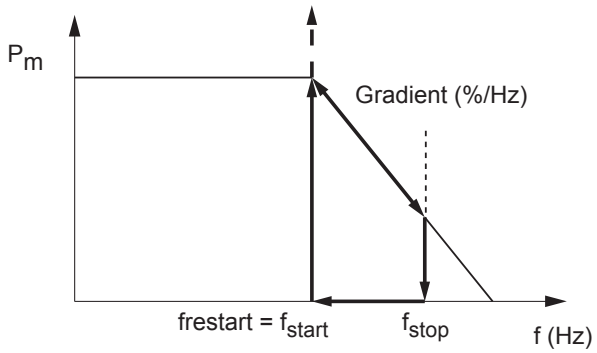
8.4.2 Regulating the active power via the mains frequency

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to regulate the active power fed into the mains via the mains frequency.

Standard behavior of low-voltage power grids in Germany (VDE-AR-N 4105)



When the mains frequency exceeds f_{start} the instantaneous value of the active power is stored and the fed active power is reduced according to the gradient.

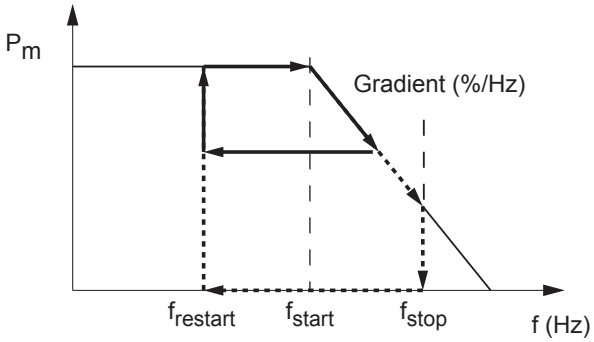
The active power is regulated according to the gradient as long as the mains frequency lies between f_{start} and f_{stop}.

The active power feed is stopped when the mains frequency exceeds f_{stop}.

Feeding remains stopped until the mains frequency falls below f_{start} again.

Feeding is resumed at the stored instantaneous value when the mains frequency falls below f_{start} again.

Standard behavior of medium-voltage power grids in Germany (BDEW)



When the mains frequency exceeds f_{start} the instantaneous value of the active power is stored and the fed active power is reduced according to the gradient.

The subsequent mains feed behavior depends on changes in the mains frequency.

a)

When the mains frequency falls again, the fed active power stored at this time is maintained before reaching f_{stop}.

Feeding is resumed at the stored instantaneous value when the mains frequency falls below $f_{restart}$.

b)

The active power feed is stopped when the mains frequency exceeds f_{stop}.

Feeding remains stopped until the mains frequency falls below $f_{restart}$.

Feeding is resumes at the stored instantaneous value when the mains frequency falls below $f_{restart}$ again.

f_{stop} is automatically calculated using the following formula:

$f_{stop} = f_{start} + (1 / \text{gradient})$

8 Settings

"Active/reactive power" menu area

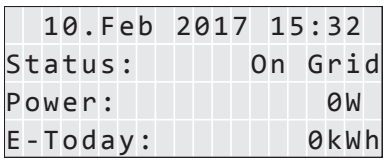
Setting options

Parameter	Description	Setting range
Mode	Switch the function on and off.	**ON** | **OFF**
F Start	The mains frequency above which the active power being fed is reduced.	**50.00 .. 55.00 Hz**
F recovery	The mains frequency below which the active power being fed is no longer reduced.	**50.00 .. 55.00 Hz**
Gradient	When the mains frequency exceeds **F Start** the active power being fed is continuously reduced by the value specified here.	**0 .. 100%**
T recovery	When the mains frequency falls below **F recovery** again, the inverter waits for the time specified here before removing the previously imposed reduction of fed active power.	**0 .. 600 s**

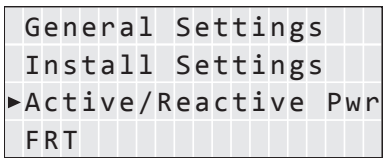
Menu item path

Main Menu > **Active/Reactive Pwr** > **Active Power Ctrl** > **Power vs. Frequency**

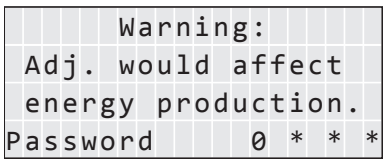
Calling up the menu item



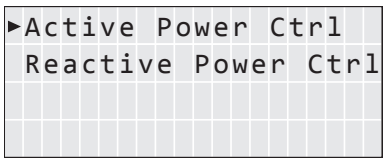
1. If the default information is displayed, press any button to open the main menu.
Otherwise, press the EXIT button repeatedly until the main menu is displayed.



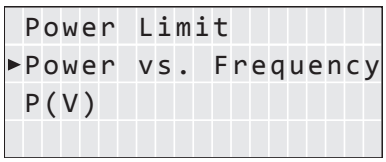
2. Use the ▼ and ▲ buttons to select the **Active/Reactive Pwr** entry and then press the button ENT.



3. This function is protected with password 5555.
Use the ▼ and ▲ buttons to set the individual numerals.
Press the ENT button to confirm a numeral.

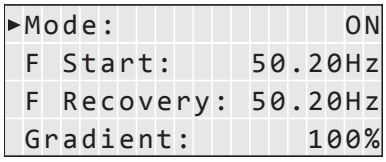


4. Use the ▼ and ▲ buttons to select the **Active Power Ctrl** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **Power vs. Frequency** entry and then press the ENT button.

Setting the mode



6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

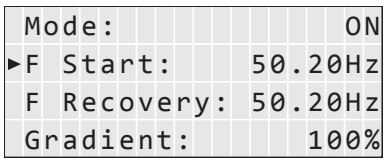
→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings

This procedure is the same for all parameters.



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.4.3 P (V) (regulating the active power via the mains voltage)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to regulate the active power fed into the mains via the mains voltage.

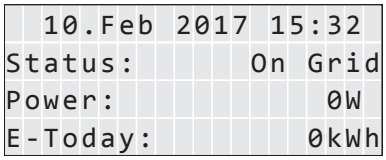
Setting options

Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`
`P lock-in`		`10 .. 100%`
`P lock-out`		`0 .. 50%`
`V lock-in`		`230.0 .. 276.1 V`
`V lock-out`		`207.0 .. 253.1 V`
`T recovery`		`10 .. 900 s`

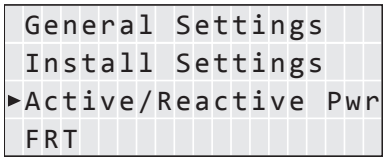
Menu item path

`Main menu` > `Active/Reactive Pwr` > `Active Power Ctrl` > `P(V)`

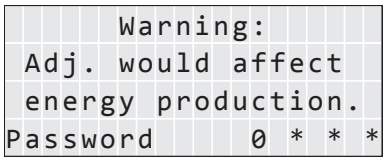
Calling up the menu item



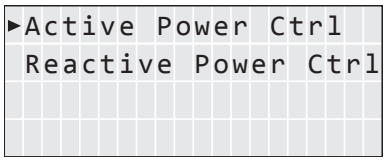
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



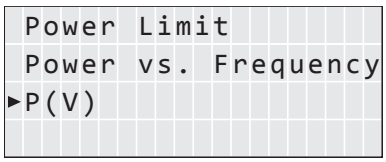
2. Use the ▼ and ▲ buttons to select the **`Active/Reactive Pwr`** entry and then press the button ENT.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.

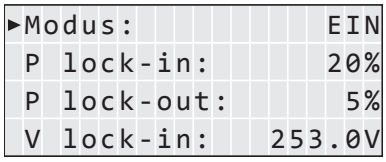


4. Use the ▼ and ▲ buttons to select the **`Active Power Ctrl`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`P(V)`** entry and then press the ENT button.

Setting the mode



6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

→ If the shape of the arrow changes →|, the mode can be changed.

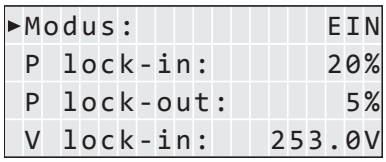
The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode.

Press the ENT button to confirm or the EXIT button to cancel.

Changing the settings

This procedure is the same for all parameters.



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.4.4 Constantt cos phi (cos φ)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to set a constant cos φ.

Setting options

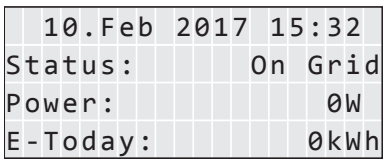
Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`

`Cos Phi`	`Constant cos phi (cos ϕ)`, capacitive or inductive	`0.800 .. 0.999 cap`
		`1`
		`0.800 .. 0.999 ind`

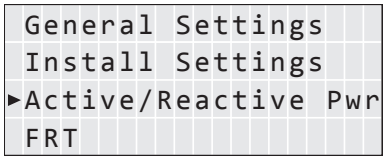
Menu item path

`Main Menu` > `Active/Reactive Pwr` > `Reactive Power Ctrl` > `Constant cos phi`

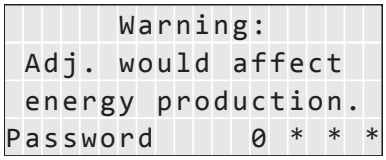
Calling up the menu item



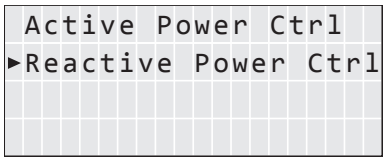
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



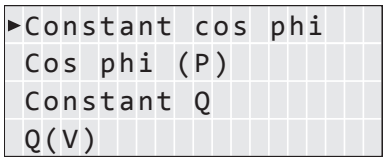
2. Use the ▼ and ▲ buttons to select the **`Active/Reactive Pwr`** entry and then press the button ENT.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.

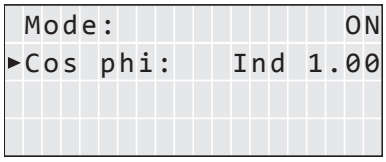


4. Use the ▼ and ▲ buttons to select the **`Reactive Power Ctrl`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Constant cos phi`** entry and then press the ENT button.

Setting the mode



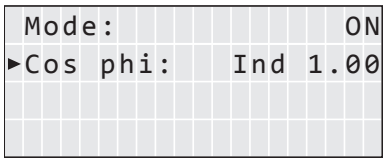
6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

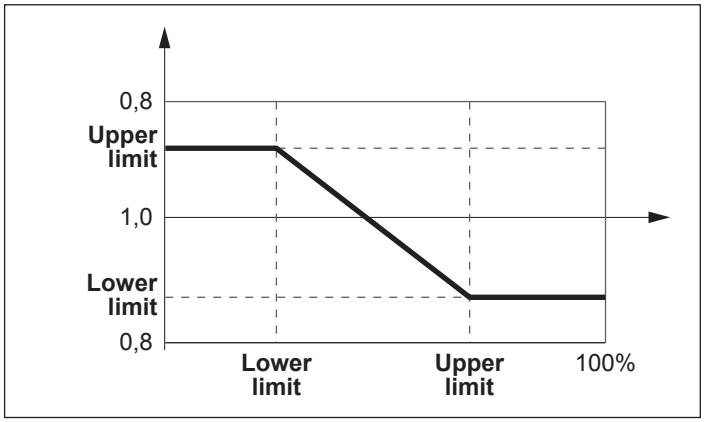
9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.4.5 Cos phi (P) (regulate cos phi via active power)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to regulate cos phi (cos φ) via the via active power.



Setting options

Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`

`Q upper`	The upper limit of cos phi (cos φ).	`0.800 .. 0.999 cap`
		`1`
		`0.800 .. 0.999 ind`

`P lower`	The lower limit of the active power.	`0 .. 100%`

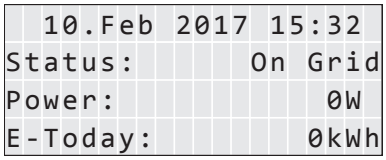
`Q lower`	The lower limit of cos phi (cos φ).	`0.800 .. 0.999 cap`
		`1`
		`0.800 .. 0.999 ind`

`P upper`	The upper limit of the active power.	`0 .. 100%`
`V lock-in`		`230.0 .. 253.1 V`
`V lock-out`		`207.0 .. 230.0 V`

Menu item path

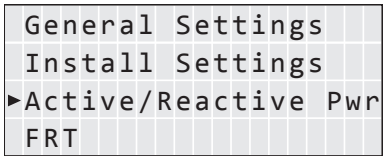
`Main Menu` > `Active/Reactive Pwr` > `Reactive Power Ctrl` > `Cos phi (P)`

Calling up the menu item

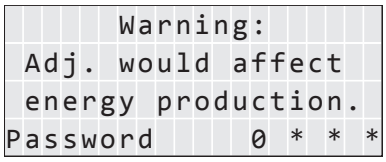


1. If the default information is displayed, press any button to open the main menu.

Otherwise, press the EXIT button repeatedly until the main menu is displayed.



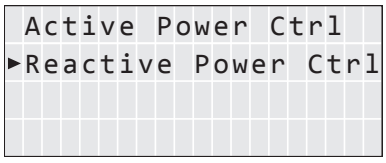
2. Use the ▼ and ▲ buttons to select the **Active/Reactive Pwr** entry and then press the button ENT.



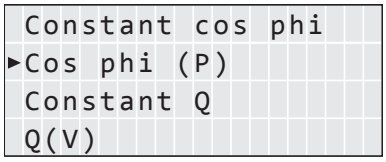
3. This function is protected with password 5555.

Use the ▼ and ▲ buttons to set the individual numerals.

Press the ENT button to confirm a numeral.

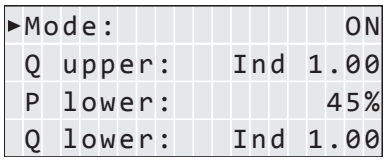


4. Use the ▼ and ▲ buttons to select the **Reactive Power Ctrl** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **Cos phi (P)** entry and then press the ENT button.

Setting the mode



6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

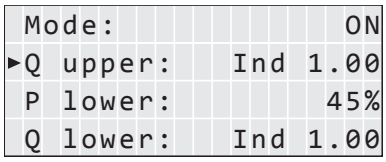
→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings

This procedure is the same for all parameters.



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.4.6 Constant Q (constatnt reactive power)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to set constant reactive power.

Setting options

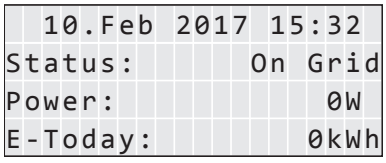
Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`

`Fixed Q`	The constant reactive power as a percentage of the nominal apparent power.	`1 .. 100% cap`
		`0%`
		`1 .. 100% ind`

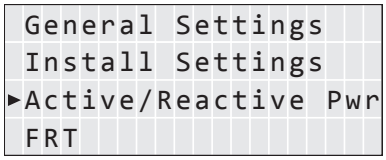
Menu item path

`Main Menu` > `Active/Reactive Pwr` > `Reactive Power Ctrl` > `Constant Q`

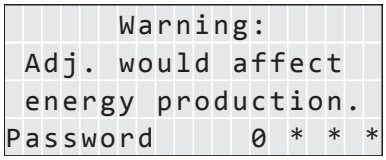
Calling up the menu item



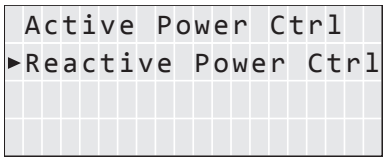
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



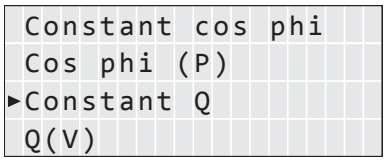
2. Use the ▼ and ▲ buttons to select the `Active/Reactive Pwr` entry and then press the button ENT.



3. This function is protected with password 5555.
   Use the ▼ and ▲ buttons to set the individual numerals.
   Press the ENT button to confirm a numeral.

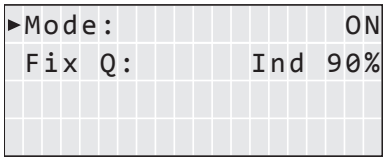


4. Use the ▼ and ▲ buttons to select the `Reactive Power Ctrl` entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the `Constant Q` entry and then press the ENT button.

Setting the mode



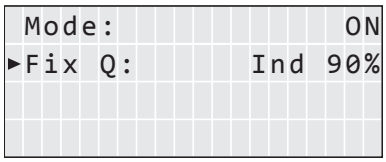
6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

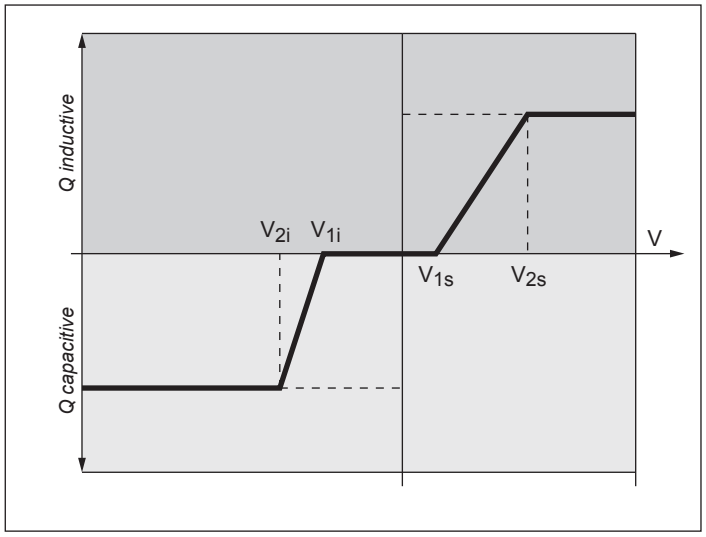
8.4.7 Q (V) – Regulating reactive power via voltage

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

This function allows you to regulate the reactive power via the voltage.

This function is only available for medium-voltage grids.



Case 1: Mains voltage > nominal voltage
When the mains voltage drops below the lower voltage limit **V1s** the inverter begins feeding inductive reactive power.

If the **Delay time** is greater than 0 (zero), the inverter waits for the time specified here to see if the mains voltage falls below **V1s** again, before feeding capacitive reactive power.

When the mains voltage increases again, the inductive reactive power is increased according to the ramp specified by the characteristic curve.

When the mains voltage exceeds the upper voltage limit **V2s** the inductive reactive power remains at the level specified in **Qs Limit**.

Case 2: Mains voltage < nominal voltage
When the mains voltage drops below the upper voltage limit **V1i** the inverter begins feeding capacitive reactive power.

If the **Delay time** is greater than 0 (zero), the inverter waits for the time specified here to see if the mains voltage rises above **V1i** again, before feeding capacitive reactive power.

When the mains voltage increases again, the capacitive reactive power is increased according to the ramp specified by the characteristic curve.

When the mains voltage drops below the lower voltage limit **V2i** the capacitive reactive power remains at the level specified in **Qi limit**.

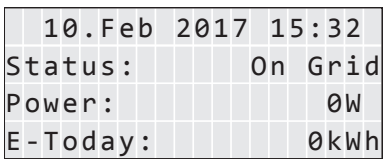
Setting options

Parameter	Description	Setting range
Mode	Switch the function on and off.	**Curve A | Curve B | OFF**
V1s	The lower voltage limit for feeding inductive reactive power.	**230.0 .. 264.6 V**
V2s	The upper voltage limit for feeding inductive reactive power.	**230.0 .. 264.6 V**
Qs limit	The limit value for inductive reactive power. The value is set as a percentage of the nominal apparent power S_n. This value is connected to the parameter **V2s**.	**ind 63% .. 1% | 0%**
V1i	The upper voltage limit for feeding capacitive reactive power.	**184.0 .. 230.0 V**
V2i	The lower voltage limit for feeding capacitive reactive power.	**184.0 .. 230.0 V**
Qi limit	The limit value for capacitive reactive power. The value is set as a percentage of the nominal apparent power S_n. This value is connected to the parameter **V2i**.	**cap 63% .. 1% | 0%**
T Delay	Delay time before feeding reactive power.	**0.00 .. 120.00 s**
Lock-in power	The upper limit of the active power range in which the function is active. The value is set as a percentage of the nominal active power.	Cannot be changed
Lock-out power	The lower limit of the active power range in which the function is active. The value is set as a percentage of the nominal active power.	Cannot be changed

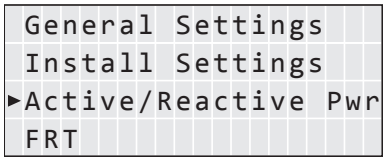
Menu item path

Main Menu > **Active/Reactive Pwr** > **Reactive Power Ctrl** > **Q(V)**

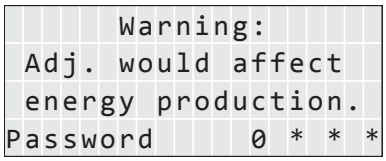
Calling up the menu item



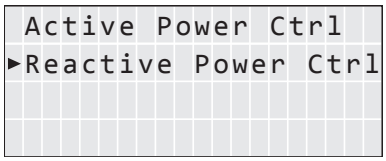
1. If the default information is displayed, press any button to open the main menu.
Otherwise, press the EXIT button repeatedly until the main menu is displayed.



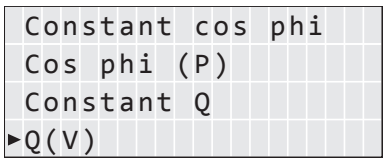
2. Use the ▼ and ▲ buttons to select the **Active/Reactive Pwr** entry and then press the button ENT.



3. This function is protected with password 5555.
Use the ▼ and ▲ buttons to set the individual numerals.
Press the ENT button to confirm a numeral.

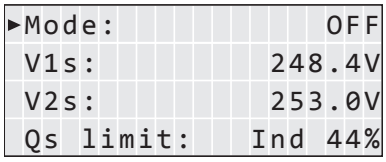


4. Use the ▼ and ▲ buttons to select the **Reactive Power Ctrl** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **Q(V)** entry and then press the ENT button.

Setting the mode



6. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

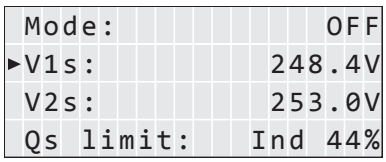
→ If the shape of the arrow changes →|, the mode can be changed.

The currently set mode is displayed after the entry.

7. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings

This procedure is the same for all parameters.



8. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes →|, the parameter can be changed.

The currently set value is displayed after the entry.

9. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

8.5 FRT (Fault Ride Through)

These parameters are set according to the requirements of the selected country. Changing these parameter settings can invalidate the type approval of the unit. Change this setting only after consultation with Delta customer service.

Overview

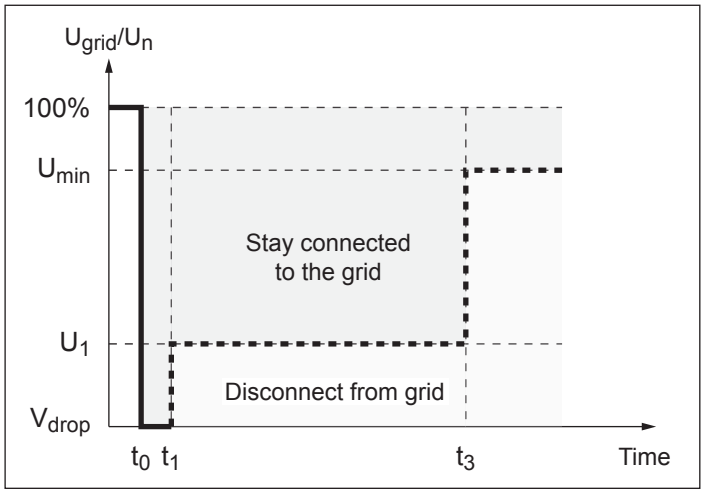
To change this setting, you need a special password provided by Delta customer service. You can find the contact information on the back of this document.

This function allows you to defined the behavior of the inverter in the event of short-term mains voltage dropouts.

Menu item path

`Main menu` > `Settings` > `FRT`

Setting options



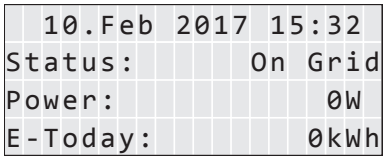
t_0 : The time at which a voltage collapse begins.

Parameter	Description	Setting range
`Mode`	Switch the function on and off.	`ON` | `OFF`
`Dead band`	The upper voltage limit of the voltage range in which this function **is not** active. The percentage value relates to the nominal voltage.	`-20 .. 0%`
`Vdrop`	Voltage drop	`0 .. 90%`
`t1`	Time t1	`0.00 .. 5.00 s`
`U1`	Voltage U1	`20 .. 90%`
`t3`	Time t3	`0.00 .. 5.00 s`
`K factor`	Switching current factor	`0.00 .. 10.00`

8 Settings

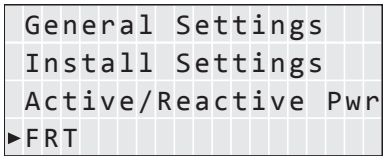
FRT (Fault Ride Through)

Calling up the menu item

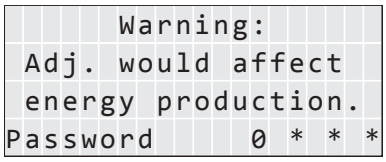


1. If the default information is displayed, press any button to open the main menu.

Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **Active/Reactive Pwr** entry and then press the button ENT.

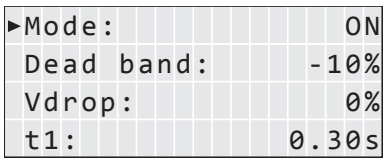


3. This function is protected with password 5555.

Use the ▼ and ▲ buttons to set the individual numerals.

Press the ENT button to confirm a numeral.

Setting the mode



4. Use the ▼ and ▲ buttons to select the **Mode** entry and then press the ENT button.

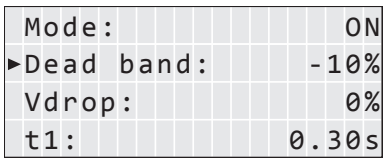
→ If the shape of the arrow changes ⇥, the mode can be changed.

The currently set mode is displayed after the entry.

5. Use the ▼ and ▲ buttons to select a mode and then press the ENT button.

Changing the settings

This procedure is the same for all parameters.



6. Use the ▼ and ▲ buttons to select a parameter and then press the ENT button.

→ If the shape of the arrow changes ⇥, the parameter can be changed.

The currently set value is displayed after the entry.

7. Use the ▼ and ▲ buttons to configure the value and then press the ENT button.

9. Measurements and statistics

The following information is available:

Type of information	Description
Measurements	Current data for various parameters
Energy log	Information on the energy generated over the entire usage period of the inverter
Event log	A list of major events, e.g. warning messages, faults, parameter changes etc., with date and time.
Inverter information	Information on general settings, mains settings, active power and reactive power monitoring, firmware versions etc. (see "8.1 "Inverter info." menu area (current settings)", p. 93)

9.1 Measurements

Overview

This menu displays the current data for various parameters in real time.

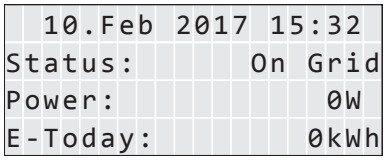
Setting options

The displayed information cannot be edited.

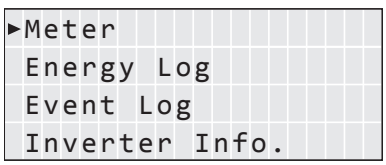
Menu item path

`Main menu > Meter`

Displaying measurements

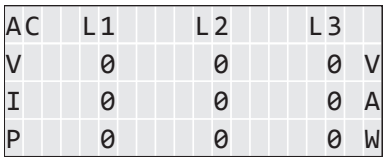


1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **Meter** entry and then press the ENT button.

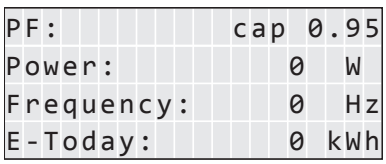
3. Use the ▼ and ▲ buttons to page through the menu.
   Press the EXIT button to cancel.



AC side

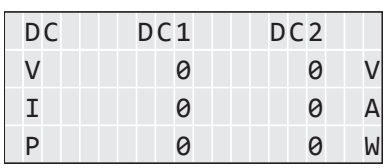
The instantaneous values for phases L1, L2 and L3 are shown.

V: AC voltage in V
I: AC current in A
P: AC active power in W



AC side

Cos phi: Active power factor cos phi
Power: Instantaneous active power being fed in kW
Frequency: Current mains frequency in Hz
E-Today: Amount of energy generated today up to now



DC side

The instantaneous values for DC inputs DC1 and DC2 are shown.

V: DC voltage in V
I: DC current in A
P: DC active power in W

9.2 Energy log

Overview

This menu shows the energy yields for various time periods.

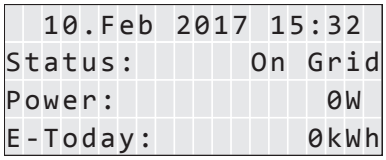
Setting options

The displayed information cannot be edited.

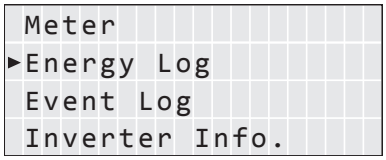
Menu item path

`Main menu > Energy Log`

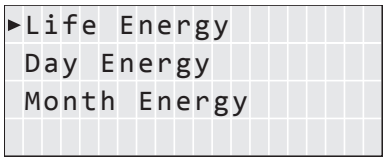
Displaying the energy log



1. If the default information is displayed, press any button to open the main menu.
Otherwise, press the EXIT button repeatedly until the main menu is displayed.

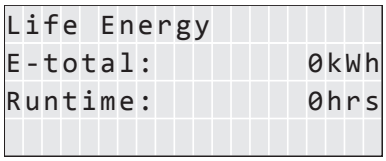


2. Use the ▼ and ▲ buttons to select the **`Energy Log`** entry and then press the ENT button.



3. Use the ▼ and ▲ buttons to page through the menu.
Press the ENT button to open a sub-menu.
Press the EXIT button to cancel.

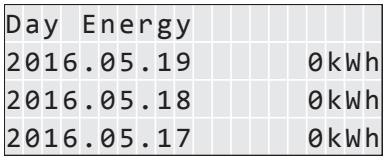
`Life Energy`



`Life Energy`: The energy generated over the runtime period.

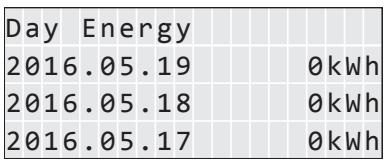
`Runtime`: Total running time of the inverter.

`Day Energy`



Amount of energy generated per day.

`Month Energy`



Amount of energy generated per month.

9.3 Event log

The event log contains error event messages and a mains report.

9.3.1 Error events

Overview

This menu shows a list with the last 30 error events.

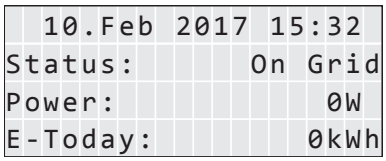
Setting options

The list can be deleted.

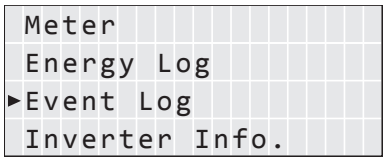
Menu item path

`Main Menu > Event Log > Error Events`

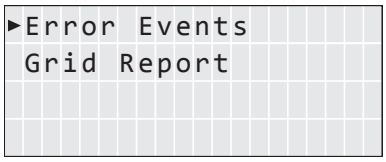
Displaying error events



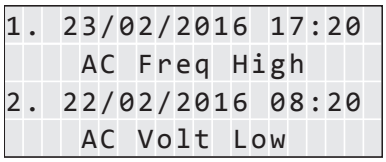
1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **`Event Log`** entry and then press the ENT button.



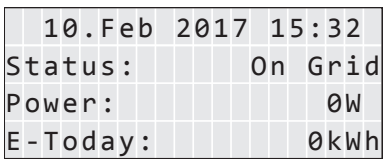
3. Use the ▼ and ▲ buttons to select the **`Error Events`** entry and then press the ENT button.



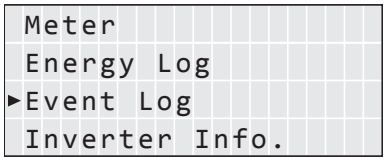
4. Use the ▼ and ▲ buttons to page through the menu.
   Press the EXIT button to cancel.

Deleting error events

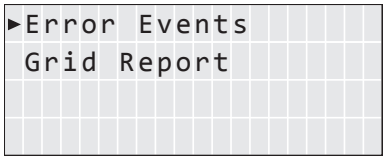
The mains report is also deleted together with the error events!



1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.

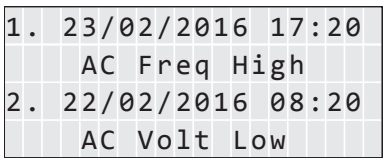


2. Use the ▼ and ▲ buttons to select the **`Event Log`** entry and then press the ENT button.



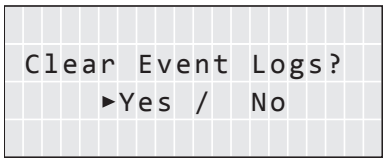
3. Use the ▼ and ▲ buttons to select the **`Error Events`** entry and then press the ENT button.

   → The list of error events is displayed.



4. Press and hold the ▼ , ▲ and ENT buttons simultaneously for at least 5 seconds.

→ A confirmation prompt is displayed.



5. Use the ▼ and ▲ buttons to select the **Yes** entry and then press the ENT button.

→ .

☑ The event log has now been deleted.

9.3.2 Mains report

Overview

This menu shows a list with the last 5 error events.

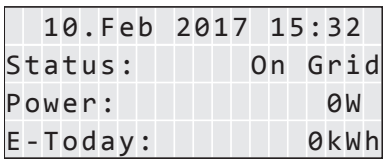
Setting options

The list can be deleted.

Menu item path

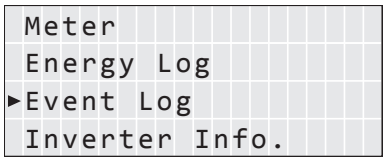
Main Menu > Event Log > Grid Report

Displaying the mains report

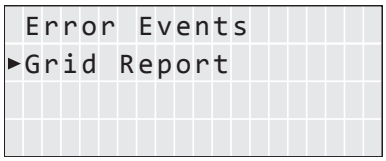


1. If the default information is displayed, press any button to open the main menu.

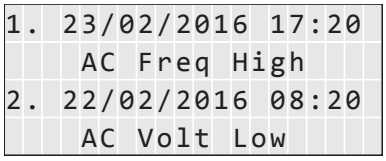
Otherwise, press the EXIT button repeatedly until the main menu is displayed.



2. Use the ▼ and ▲ buttons to select the **Event Log** entry and then press the ENT button.



3. Use the ▼ and ▲ buttons to select the **Grid Report** entry and then press the ENT button.

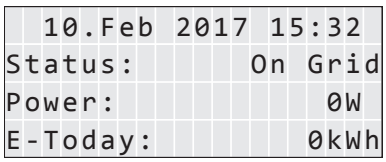


4. Use the ▼ and ▲ buttons to page through the menu.

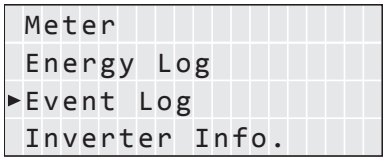
Press the EXIT button to cancel.

Deleting the mains report

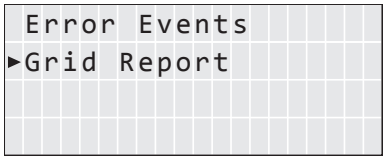
The error events are also deleted together with the mains report!



1. If the default information is displayed, press any button to open the main menu.
   Otherwise, press the EXIT button repeatedly until the main menu is displayed.

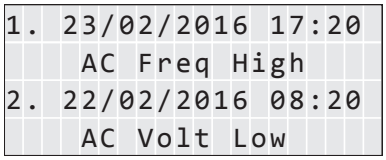


2. Use the ▼ and ▲ buttons to select the **Event Log** entry and then press the ENT button.



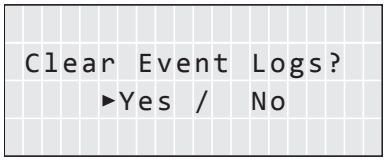
3. Use the ▼ and ▲ buttons to select the **Grid Report** entry and then press the ENT button.

   → The list of error events is displayed.



4. Press and hold the ▼ , ▲ and ENT buttons simultaneously for at least 5 seconds.

   → A confirmation prompt is displayed.



5. Use the ▼ and ▲ buttons to select the **Yes** entry and then press the ENT button.

   → .

☑ The event log has now been deleted.

10. Error events and troubleshooting

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter

1. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
2. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock

Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

- ► Remove the cover only when absolutely necessary.
- ► Do not remove the cover if water might enter the inverter.
- ► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

Only Delta Customer Service is permitted to perform repair work and replace inverter components.

Exceptions:

- ► Replacing the fans.
- ► Cleaning the air inlets/outlets.
- ► Replacing AC and DC surge protection devices.

Failure to adhere to this requirement will invalidate the warranty.

The Delta Customer Service contact information for your country is provided on the last page of this document.

10.1 Error

Number	Message	Possible causes	Correction suggestions
E01	**AC Freq High** (AC Freq. High)	Mains mains frequency lies above the ***OFR*** setting (overfrequency detection).	Check the mains frequency on the inverter display.
		Incorrect country setting.	Check the country setting on the inverter display.
E02	**AC Freq Low** (AC Freq Low)	Mains mains frequency lies below the ***UFR*** setting (underfrequency detection).	Check the mains frequency on the inverter display.
		Incorrect country or mains type setting.	Check the country and mains type settings.
E11, E13, E16, E18, E21, E23	**AC Volt High** (AC Volt High)	Mains mains voltage lies above the ***OVR*** setting (overvoltage detection).	Check the mains voltage on the inverter display.
		Supply voltage during operation is greater than the ***OVR Langs.*** setting.	Check the mains voltage on the inverter display.
		Incorrect country or mains type setting.	Check the country and mains type settings.
E10, E15, E20	**AC Volt Low** (AC Volt Low)	Mains mains voltage lies below the ***UVR*** setting (undervoltage detection).	Check the mains voltage connection at the inverter terminals.
		Incorrect country or mains type setting.	Check the country and mains type settings.
		Incorrectly wired AC plug.	Check the wiring of the AC plug.
E07	**Grid Quality** (Mains quality)	Non-linear load in the mains and in the vicinity of the inverter.	If necessary, the mains connection must be far away from a non-linear load.
E08	**HW Connect Fail** (HW connection failed)	Incorrectly wired AC plug.	Check the wiring of the AC plug.
E34	**Insulation** (Insulation)	Insulation fault in the PV system.	Check the insulation of the DC inputs.
		Large PV system capacitance between Plus and Ground or Minus and Ground or both.	Check the capacitance and dry the PV modules if necessary.
E09	**No Grid** (No Mains)	The AC/DC disconnector is in the **OFF** position.	Turn the AC/DC disconnector to the **ON** position.
		AC plug is not correctly connected.	Check the connection in the AC plug and its connection to the inverter.
		Incorrectly wired AC plug.	Check the wiring of the AC plug.
E30	**Solar1 High** (Solar1 High)	The DC input voltage at DC1 is greater than the maximum permissible DC input voltage.	Change the solar system setting so that the DC input voltage at DC1 lies below the maximum permissible DC input voltage.
E31	**Solar2 High** (Solar2 High)	The DC input voltage at DC2 is greater than the maximum permissible DC input voltage.	Change the solar system setting so that the DC input voltage at DC1 lies below the maximum permissible DC input voltage.

10.2 Warnings

Number	Message	Possible causes	Correction suggestions
W01	**Solar1 Low** (Solar1 Low)	The DC input voltage at DC1 is less than the minimum permissible DC input voltage.	Check the DC input voltage at DC1 on the inverter display. There may be insufficient solar radiation.
W02	**Solar2 Low** (Solar2 Low)	The DC input voltage at DC2 is less than the minimum permissible DC input voltage.	Check the DC input voltage at DC2 on the inverter display. There may be insufficient solar radiation.
W11	**HW Fan** (HW Fan)	One or more fans are blocked.	Remove all objects that might be blocking the fans.
		One or more fans are defective.	Replace the fans.
		One or more fans are disconnected.	Check the connections for all fans.
	SPD Fail (SPD failed)	The inverter has been hit by lightning.	Check the inverter status.
		One or more surge protection devices are defective.	Replace the defective surge protection devices.
		One or more surge protection devices are incorrectly fitted.	Check all surge protection devices.

10.3 Faults

Number	Message	Possible causes	Correction suggestions
F36, F37, F38, F39, F40, F41	**AC Current High** (AC Current High)	Overvoltage during operation.	Contact Delta Customer Service.
		Internal error.	Contact Delta Customer Service.
F30	**Bus Imbalance** (Bus not symmetrical)	Incomplete independent or parallel configuration between the inputs.	Check the input connections.
		Grounding of the PV system.	Check the insulation of the PV system.
		Internal error.	Contact Delta Customer Service.
F60, F61, F70, F71	**DC Current High** (DC Current High)	Internal error.	Contact Delta Customer Service.
F24	**Ground Current** (Ground Current)	Insulation fault in the PV system.	Check the insulation of the DC inputs.
		Large PV system capacitance between Plus and Ground or Minus and Ground.	Check the capacitance, it must be < 2.5 µF. Install an external transformer if necessary.
		Internal error.	Contact Delta Customer Service.
F45	**HW AC OCR** (HW AC OCR)	Large mains harmonics.	Check the mains waveform. The mains connection of the inverter must be kept away from non-linear loads; if necessary, move it further away..
		Internal error.	Contact Delta Customer Service.
F31, F33, F35	**HW Bus OVR** (HW Bus OVR)	The DC input voltage is greater than the maximum permissible DC input voltage.	Change the solar system setting so that the DC input voltage at DC1 lies below the maximum permissible DC input voltage.
		Overvoltage during operation.	Contact Delta Customer Service.
		Internal error.	Contact Delta Customer Service.
F23	**HW COMM1** (HW COMM1)	Internal error.	Contact Delta Customer Service.
F22	**HW COMM2** (HW COMM2)	Internal error.	Contact Delta Customer Service.

Number	Message	Possible causes	Correction suggestions
F26	**HW Connect Fail** (HW connection failed)	Internal error.	Contact Delta Customer Service.
F42	**HW CT A Fail** (HW CT A failed)	Internal error.	Contact Delta Customer Service.
F43	**HW CT B Fail** (HW CT B failed)	Internal error.	Contact Delta Customer Service.
F44	**HW CT C Fail** (HW CT C failed)	Internal error.	Contact Delta Customer Service.
F01, F02, F03	**HW DC Injection** (HW DC injection)	The mains waveform is abnormal.	Check the mains waveform. The mains connection of the inverter must be kept away from non-linear loads; if necessary, move it further away..
		Internal error.	Contact Delta Customer Service.
F15, F16, F17	**HW DSP ADC1**, **HW DSP ADC2**, **HW DSP ADC3**	The DC input voltage is less than the minimum required DC voltage.	Check the DC input voltage on the inverter display. There may be insufficient solar radiation.
		Internal error.	Contact Delta Customer Service.
F20	**HW Efficiency** (HW Efficiency)	Incorrect calibration.	Check the accuracy of the voltage and power.
		Internal error.	Contact Delta Customer Service.
F06, F08, F09, F10	**HW NTC1 Fail**, **HW NTC2 Fail**, **HW NTC3 Fail**, **HW NTC4 Fail** (HW NTCx failed)	Ambient temperature is > 90 °C or < -30 °C.	Check the system environment.
		Fault in the detection circuit.	Check the detection circuit in the ***Inverter***.
F18, F19	**HW Red ADC1**, **HW Red ADC2**	The DC input voltage is less than the minimum required DC voltage.	Check the DC input voltage on the inverter display. There may be insufficient solar radiation.
		Internal error.	Contact Delta Customer Service.
F50	**HW ZC Fail** (HW ZC failed)	Internal error.	Contact Delta Customer Service.
F27	**RCMU Fail** (RCMU failed)	Internal error.	Contact Delta Customer Service.
F13, F29	**Relay Open** (Relay Open)	Internal error.	Contact Delta Customer Service.
F28	**Relay Short** (Relay short circuit)	Internal error.	Contact Delta Customer Service.
		Fault in the relay driver circuit.	Check the driver circuit in the ***inverter***.
F05	**Temperature High** (Temperature High)	The ambient temperature is > 60 °C.	Check the system environment.
F07	**Temperature Low** (Temperature Low)	The ambient temperature is < -30 °C.	Check the system environment.
		Internal error.	Contact Delta Customer Service.

11. Maintenance

11.1 Safety instructions

DANGER

Electric shock
Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter

1. Turn the DC isolating switch to the ***0 (OFF)*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
3. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock
Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Turn the DC isolating switch to the ***0 (OFF)*** position.
- ► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock
When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

- ► Remove the cover only when absolutely necessary.
- ► Do not remove the cover if water might enter the inverter.
- ► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

WARNING

Heavy weight
The inverter is very heavy.

- ► The inverter must be lifted and carried by at least 3 people or using appropriate lifting gear.

Always begin all maintenance and replacement tasks with “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158!

The only exception to this rule is the replacement of string fuses. A different procedure applies to this situation (see “11.10 Replacing string fuses”, p. 178).

Always conclude all maintenance and replacement tasks with “11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)”, p. 182!

11.2 Periodic maintenance

Perform the following checks every 6 months.

- Check the string fuses. Measure the current using a current transformer.
- Check the fans for soiling and clean them if necessary.
- Checking the fans.
- Check the air inlets for soiling and clean them if necessary.

11.3 Replacing components

The following components may be replaced by the installation technician:

- String fuses
- Ventilation block
- Fan in the terminal box
- AC surge protection devices
- DC surge protection devices

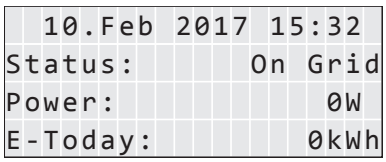
11.4 Checking the fans

In order to allow performance of the fan test, the inverter must be supplied with DC voltage.

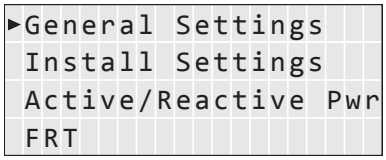
Menu item path

`Main menu > General settings > Test Menu`

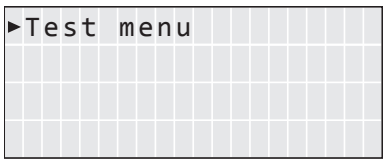
Performing the fan test



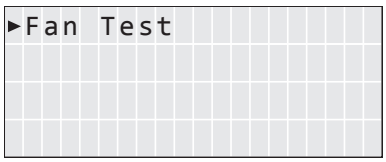
1. If the default information is displayed, press any button to open the main menu. Otherwise, press the EXIT button repeatedly until the main menu is displayed.



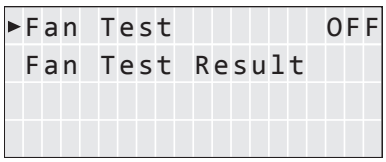
2. Use the ▼ and ▲ buttons to select the **`General Settings`** entry and then press the ENT button.



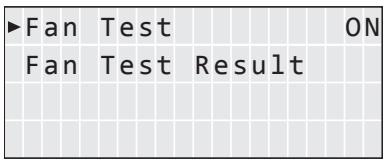
3. Use the ▼ and ▲ buttons to select the **`Test Menu`** entry and then press the ENT button.



4. Use the ▼ and ▲ buttons to select the **`Fan Test`** entry and then press the ENT button.



5. Use the ▼ and ▲ buttons to select the **`Fan Test`** entry again and then press the ENT button.



6. To start the fan test, use the ▼ and ▲ buttons to set the **`Fan Test`** entry to **`ON`** and then press the ENT button.

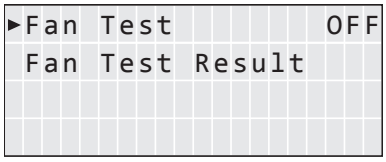
→ The fan test starts after approx. 5 seconds.

→ The fans audibly accelerate to maximum speed. The fans have reached maximum speed when the fan noise remains constant.

7. Allow the fans to run at a maximum speed for approximately 20 seconds.

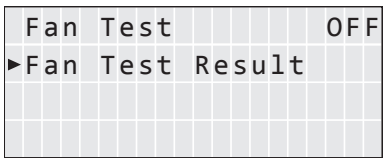
→ If one of the fans is not functioning correctly, the ***ALARM*** LED starts flashing after around 10 seconds.

→ If all fans are functioning correctly the ***ALARM*** LED remains off.



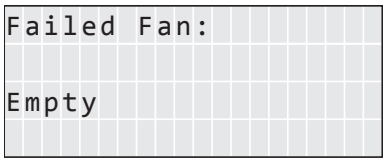
8. To end the fan test, use the ▼ and ▲ buttons to set the **`Fan Test`** entry to **`OFF`** and then press the ENT button.

→ The fan speed drops and the fans come to a standstill.

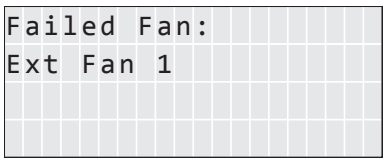


9. To see the results of the fan test, use the ▼ and ▲ buttons to select the **`Fan Test Result`** entry and then press the ENT button.

The list shows the fans that are defective.



Result if no fans are defective.

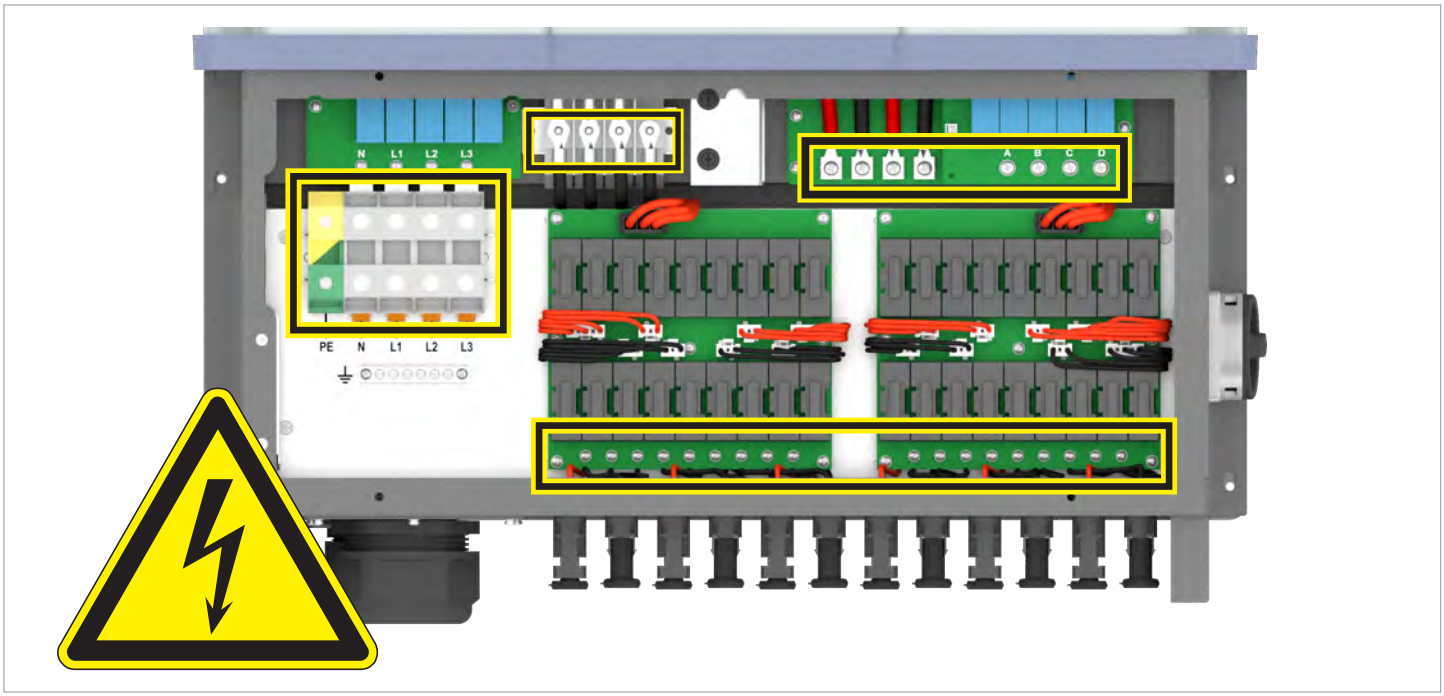


Result if one fan is defective.

11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)

The work instructions in this segment apply for all maintenance work that the installer is permitted to perform on the inverter.

The only exception to this rule is the replacement of string fuses. A different procedure applies to this situation (see “11.10 Replacing string fuses”, p. 178).



Hazard zones with potentially life-threatening currents and voltages

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter

1. Turn the DC isolating switch to the ***0 (OFF)*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
3. Wait at least 100 seconds until the internal capacitors have discharged.

Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)

There is normally an external load isolating switch between the inverter and the mains (e.g. in an equipment terminal box). This is used to isolate the inverter from the mains and to shut off its AC voltage supply.

Tools required

In addition to standard tools such as screwdrivers, open-ended wrenches and socket wrenches in various sizes, the following tools are required for working on the inverter:

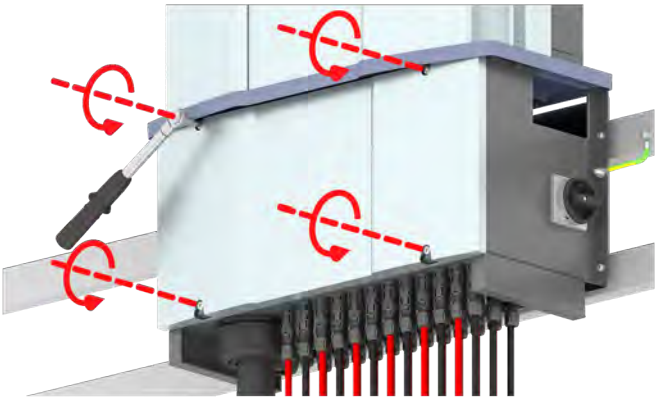
- Voltmeter to check that the junction box is de-energized.
- M6 Allen wrench (hexagon socket) for opening the cover of the junction box
- M10 Allen wrench (hexagon socket) for disconnecting the cables on the AC terminal block
- Mounting tool for disconnecting the MC4 plug connectors of the DC cables

1. To shut off the inverter's AC voltage, open the load isolating switch between the inverter and the mains connection point.

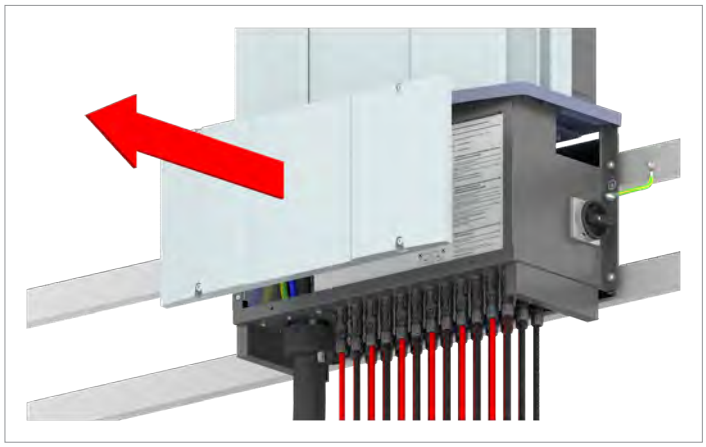
   Secure the load isolating switch to prevent it from accidentally being switched back on.

2. Turn the DC isolating switch to the ***0 (OFF)*** position.

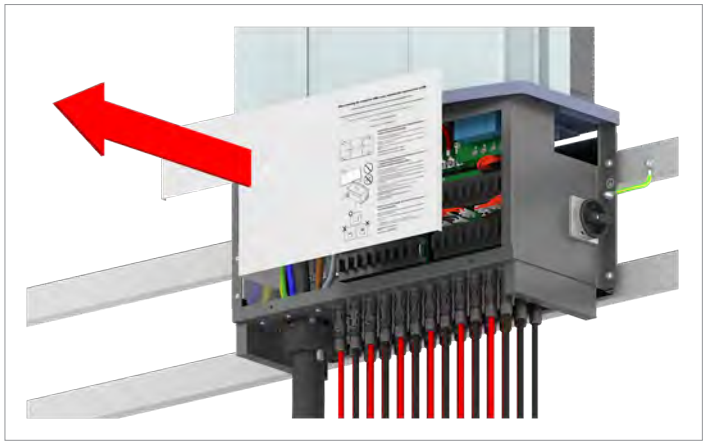
3. Wait at least 100 seconds until the internal capacitors have discharged.



4. Unscrew and remove the junction box cover.



5. Measure with a voltmeter to check that there is no more voltage in the AC terminal block.
   → If you detect voltage, open the external load isolating switch.
   → If you detect no voltage, proceed to the next step.

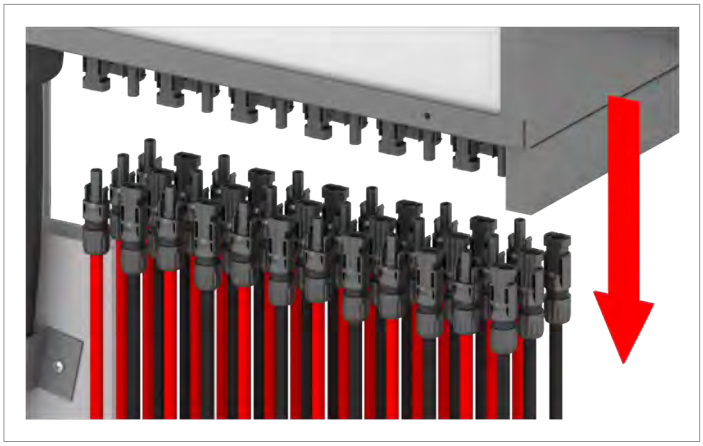


6. Remove the cover in the interior of the junction box.

7. If you have not done so already, label the DC cable so that you can re-connect it to the correct DC connection later on.

8. Use the mounting tool to release the DC cables and then pull them out.

Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)



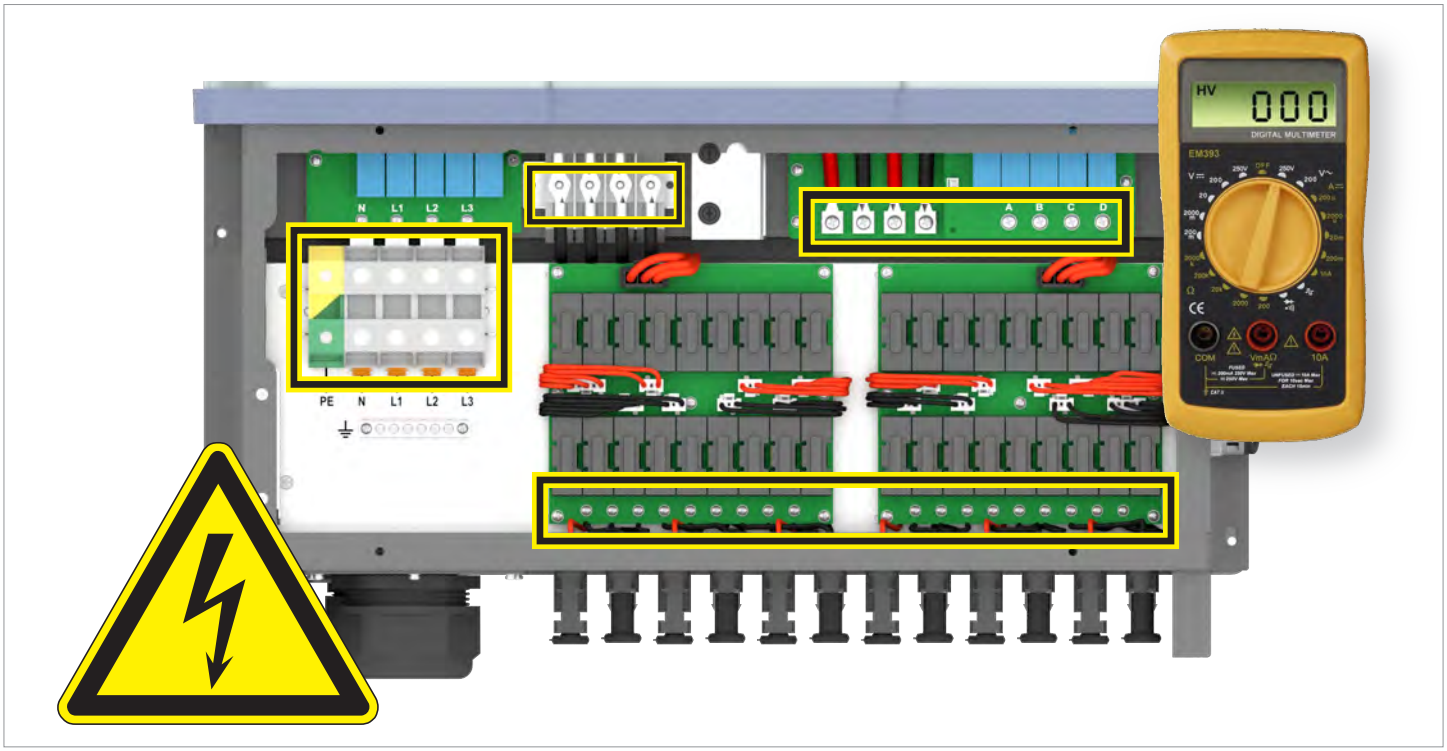
DANGER

Electric shock

Voltage-carrying parts can still be live!

► Do not touch potentially voltage-carrying parts until these have been proven to be de-energized using a voltmeter!

9. Use a voltmeter to check that there is no more voltage in the danger zones.



11.6 Cleaning the cooling system

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

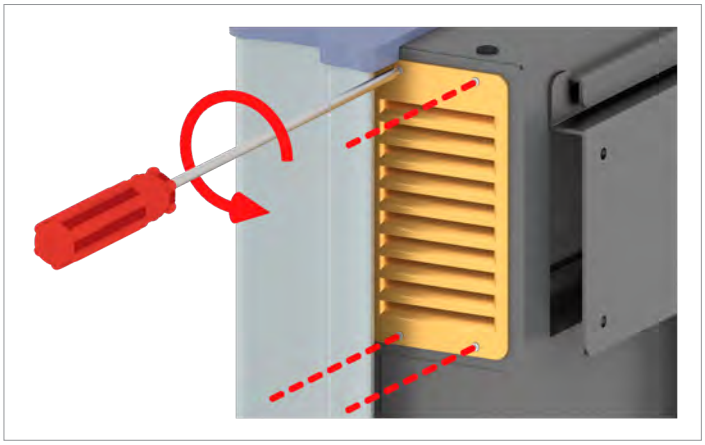
► Perform the instructions listed in “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158 **before** you start work on the inverter!

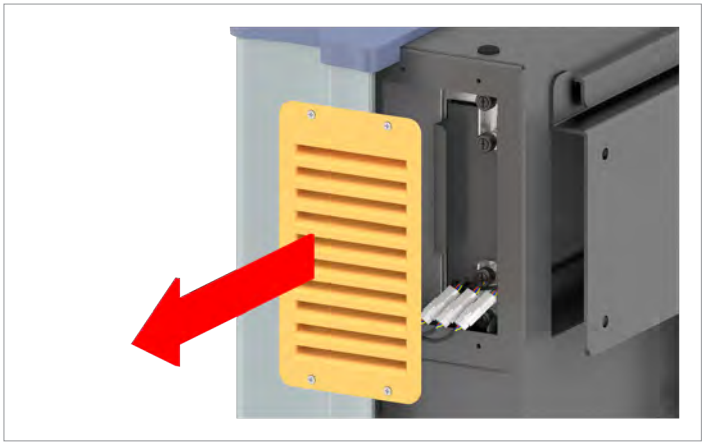
Do not use any sharp, pointed or hard objects for cleaning.

Do not use liquids for cleaning.

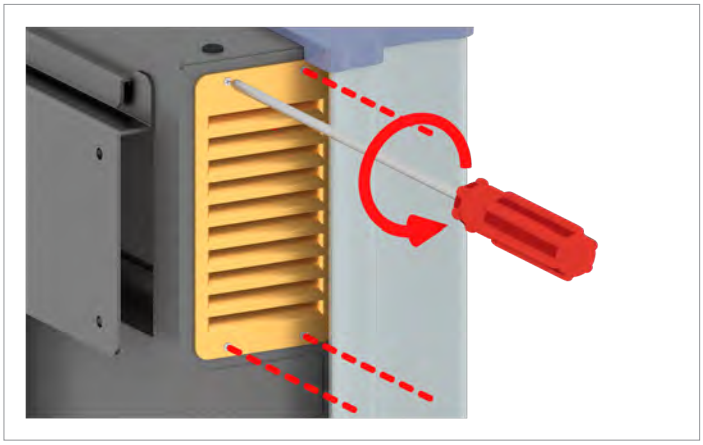
The screws on the air outlets are very small and can easily be dropped. You should therefore use a magnetic screwdriver.

11.6.1 Cleaning the air outlets and fans

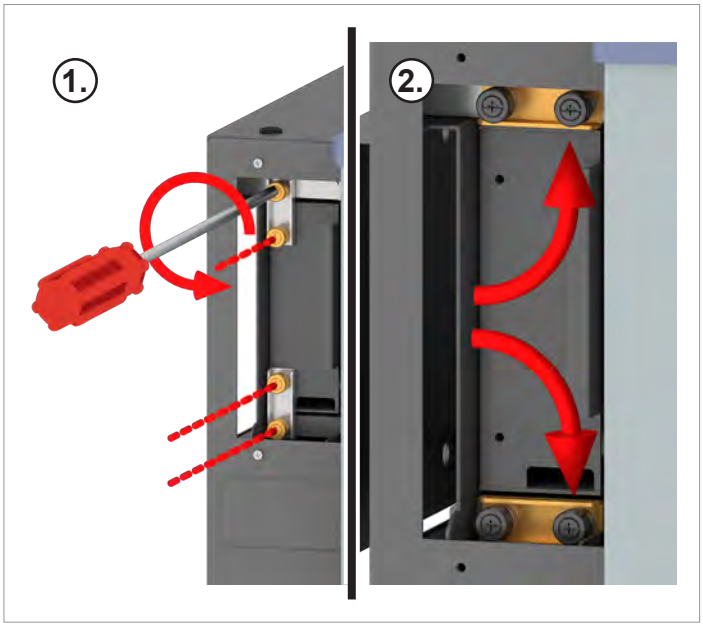




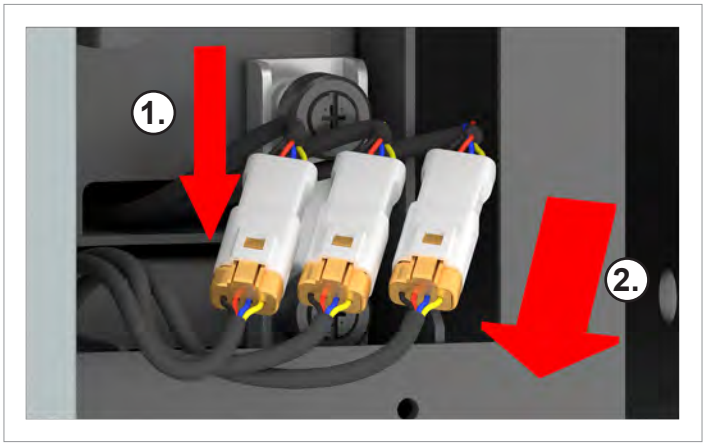
1. Unscrew and remove the cover on the right hand side of the air outlet.



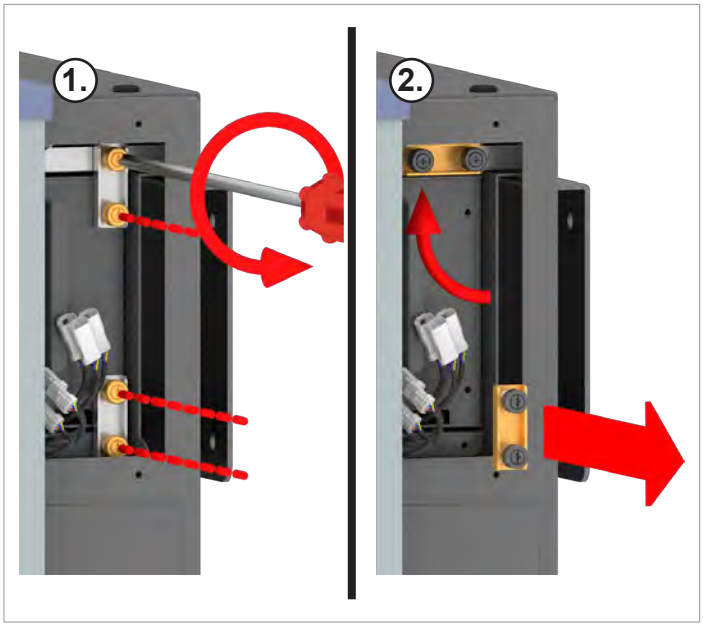
2. Unscrew and remove the cover on the left hand side of the air outlet.



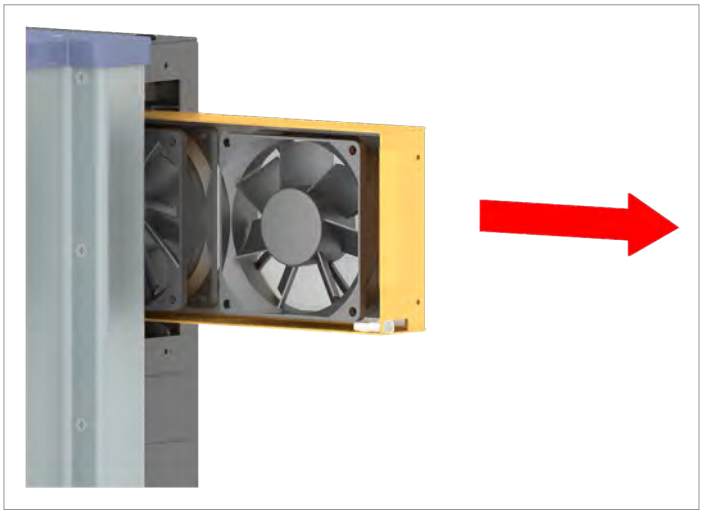
3. Undo the attachment screws on the left hand side of the fan module.



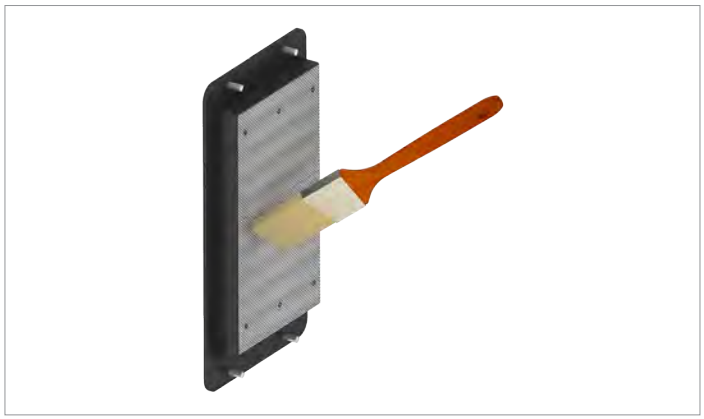
4. On the right hand side, disconnect the plug connectors for the 3 power supply cables to the fan module.



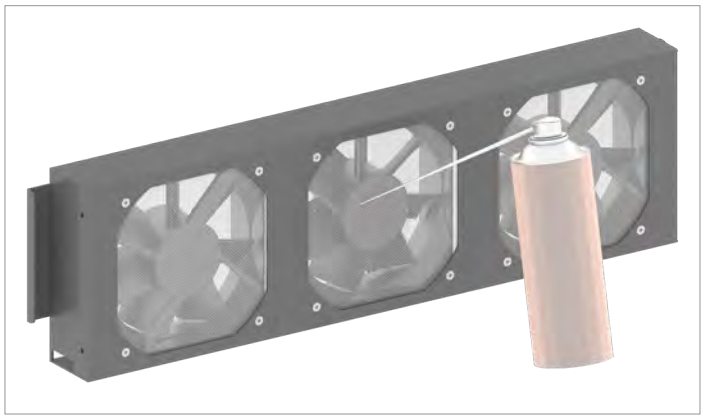
5. Undo the attachment screws on the right hand side of the fan module.
   Remove the lower attachment screws.

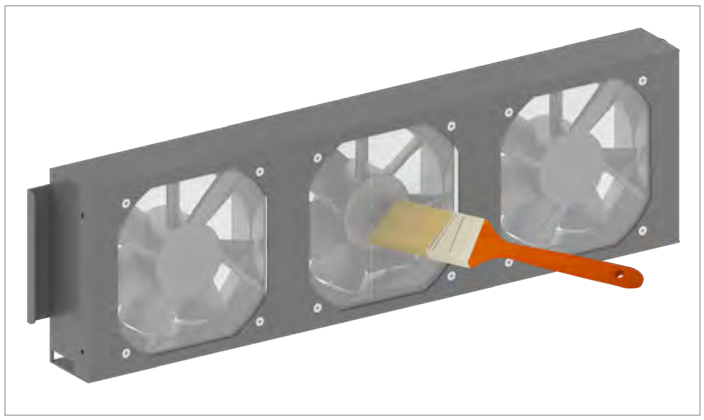


6. Pull out the fan module to the right.



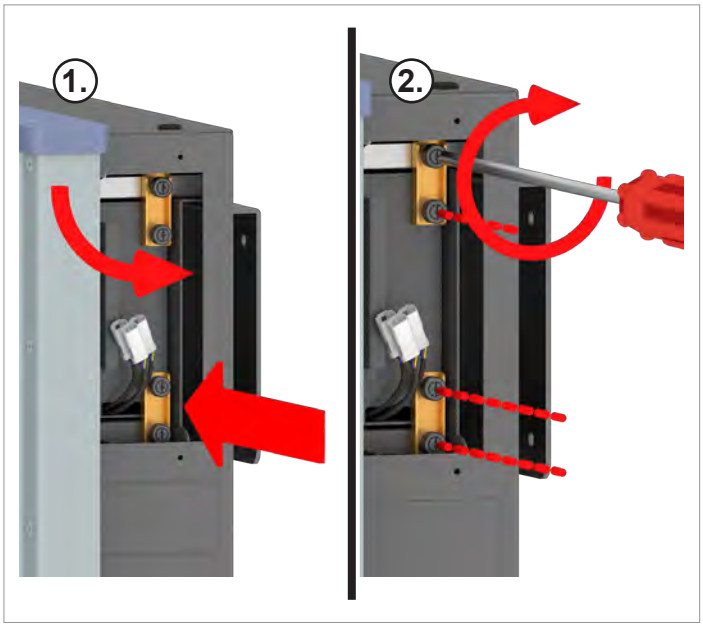
7. Clean the air outlets with a compressed air cleaner or a stiff paintbrush.



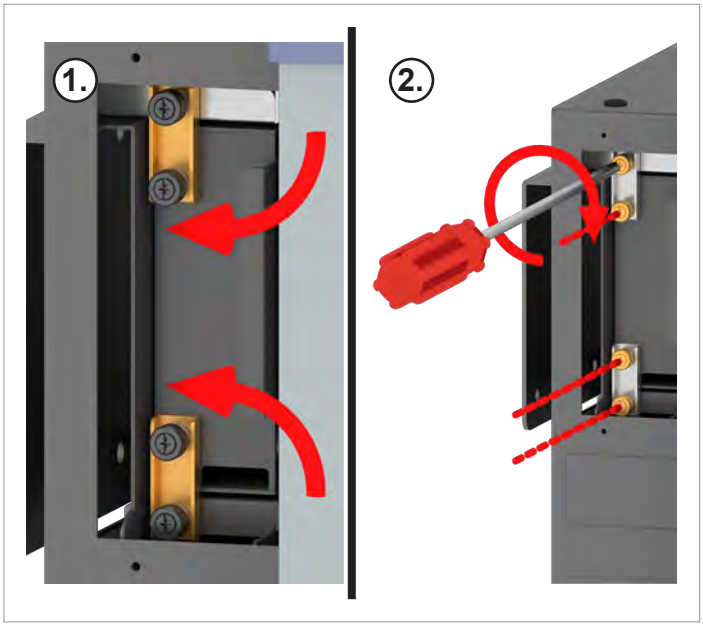


8. Clean the fan module with a compressed air cleaner or a stiff paintbrush.

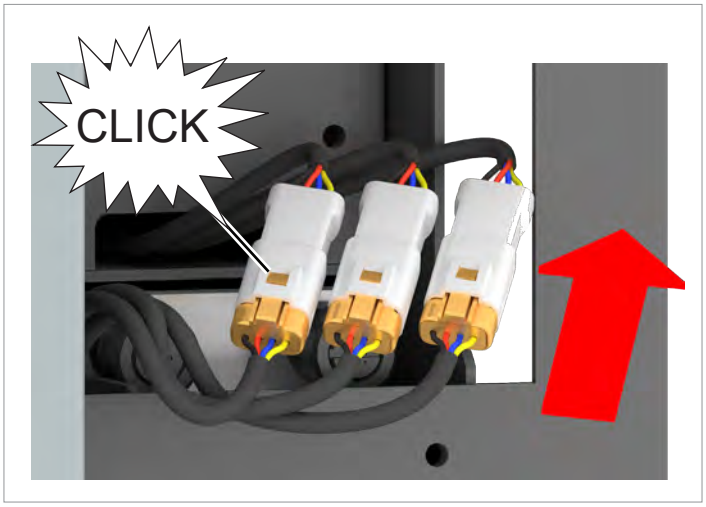
9. Slide the fan module into the inverter from the right hand side.



10. Screw in the attachment screws on the right hand side of the fan module.



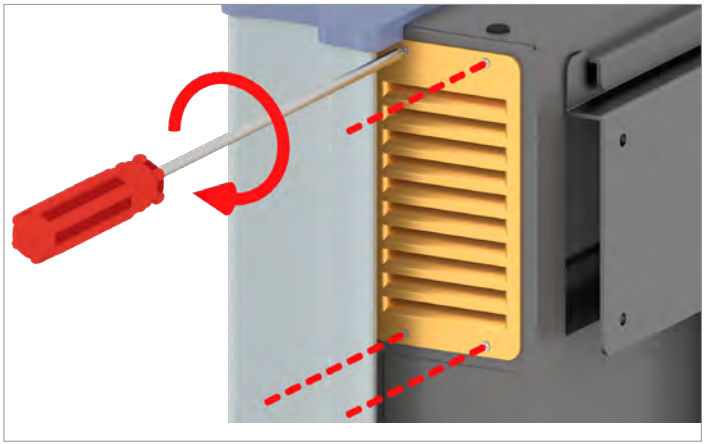
11. Screw in the attachment screws on the left hand side of the fan module.

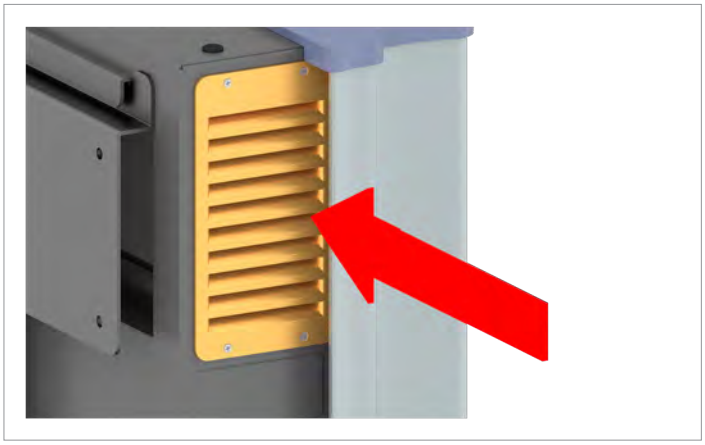


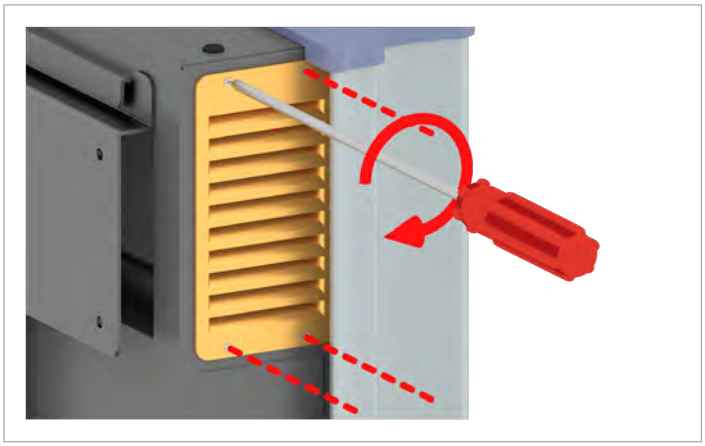
NOTE: The sequence of the plug connectors is unimportant.

12. On the right hand side, push together the plug connectors for the 3 power supply cables to the fan module, until they click home.

13. Insert and tighten the screws on the cover on the right hand side of the air outlet.

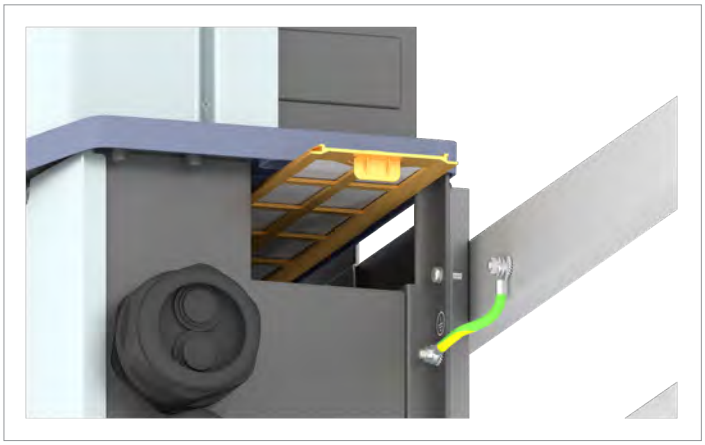


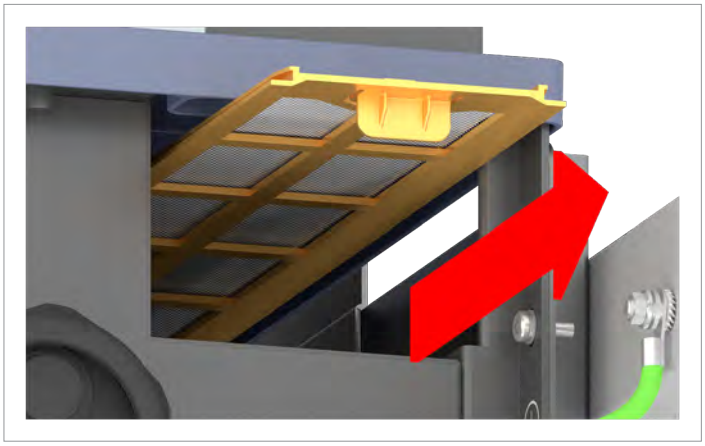




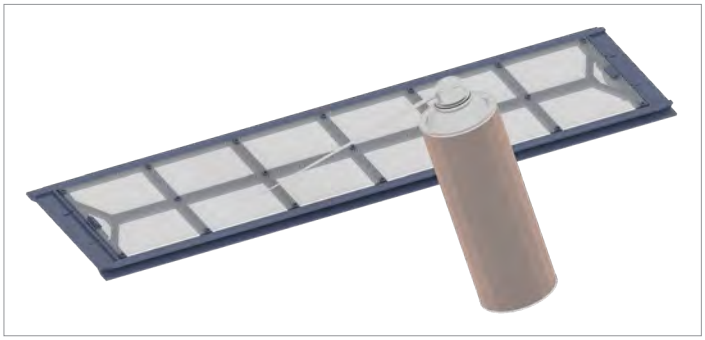
14. Insert and tighten the screws on the cover on the left hand side of the air outlet.

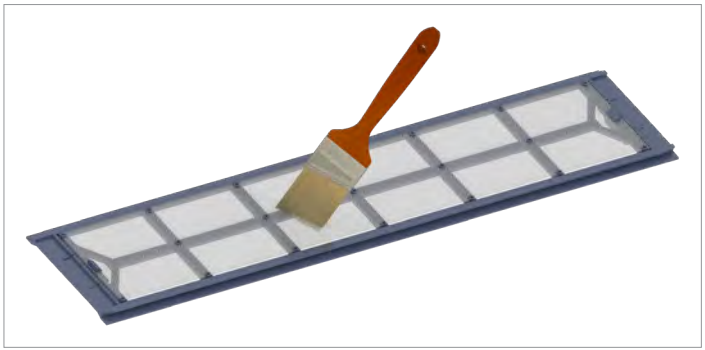
11.6.2 Cleaning the air inlet



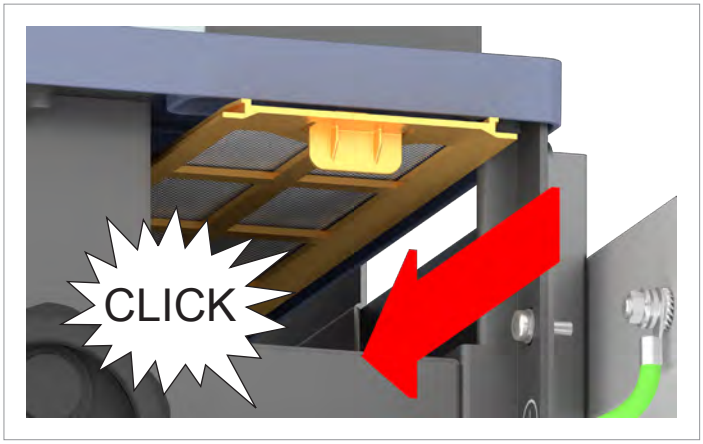


15. Pull out the air inlet filter to the left or the right.





16. Clean the air inlet filter with a compressed air cleaner or a stiff paintbrush.



17. Insert the air inlet filter into the guide rails from the left or right and push it in until it clicks home.

18. To complete the maintenance work, follow the instructions in the following section: “11.9 Replacing the fan inside the terminal box”, p. 176.

11.7 Replacing DC surge protection devices

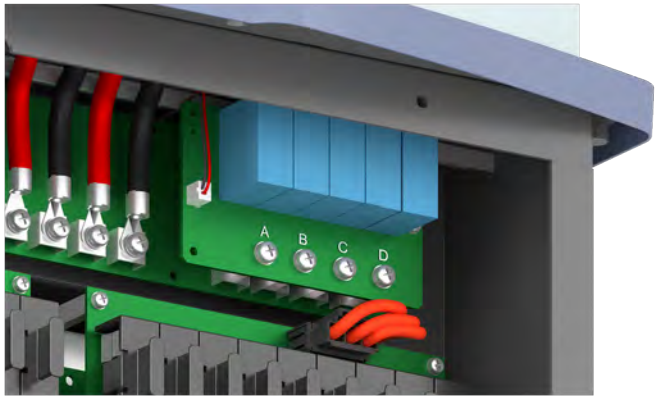
DANGER

Electric shock
Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

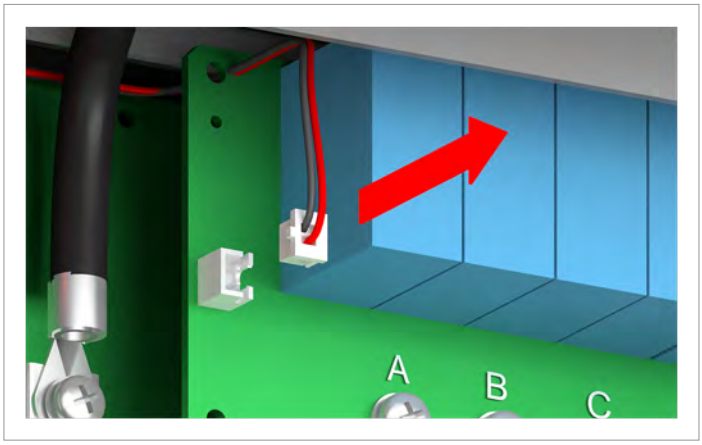
- ► Perform the instructions listed in “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158 **before** you start work on the inverter!
- ► Use an insulated screwdriver!

The surge protection devices are replaced as a block. You can obtain spare parts from Delta Customer Service. You can find the contact information on the back of this document.

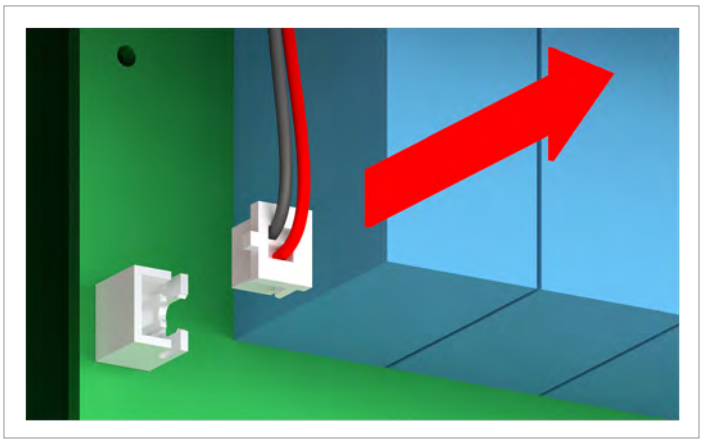
Some of the attachment screws for the surge protection devices are very small and can easily be dropped into the junction box. You should therefore use a magnetic screwdriver.

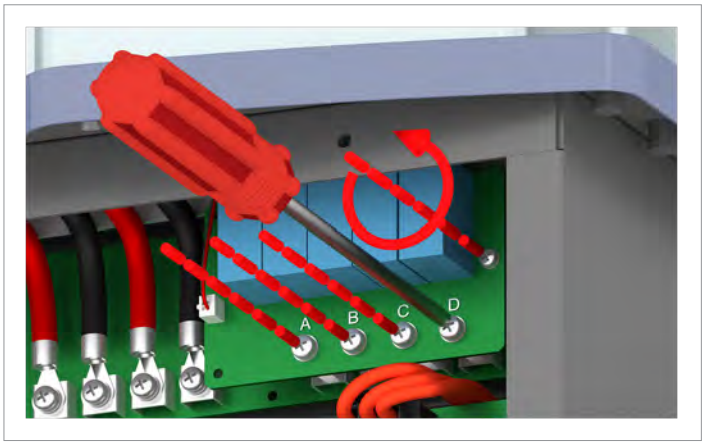


1. Perform the instructions listed in “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158 **before** you perform the following operations!

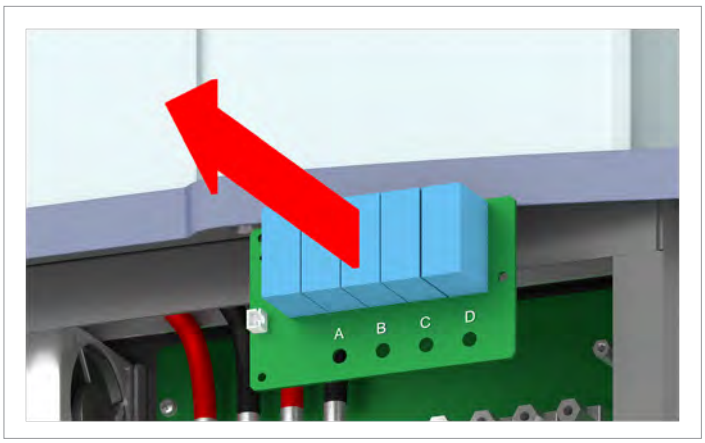


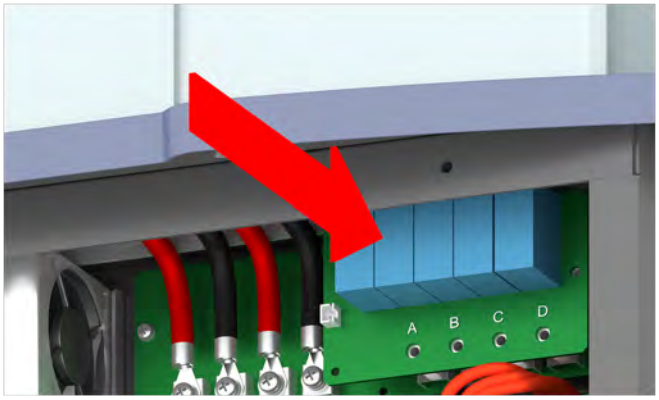
2. Pull out the communication cable plug.



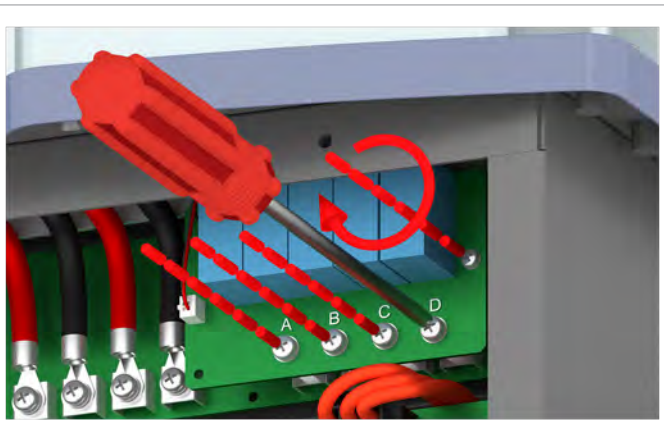


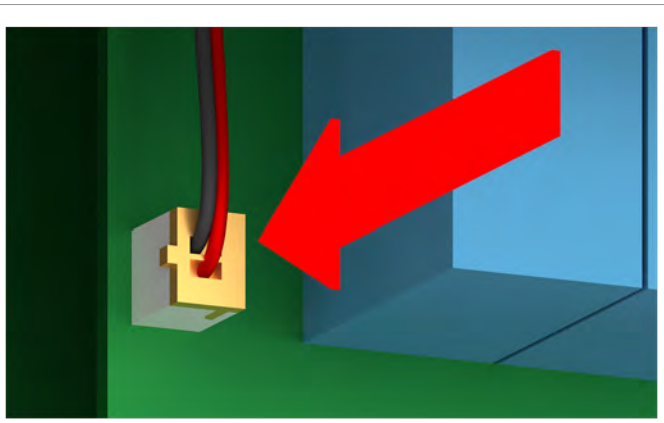
3. Unscrew the 5 screws and lift out the block with the defective surge protection devices.





4. Fit the new block with the surge protection devices and screw in place using the 5 screws.



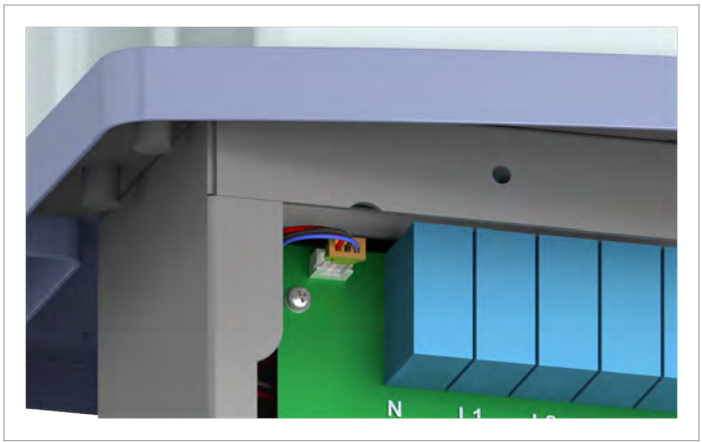


5. Plug in the communication cable plug.

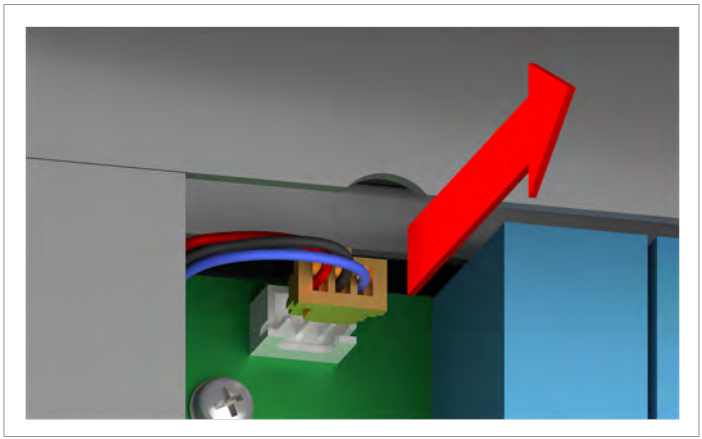
6. To complete the maintenance work, follow the instructions in the following section: “11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)”, p. 182.

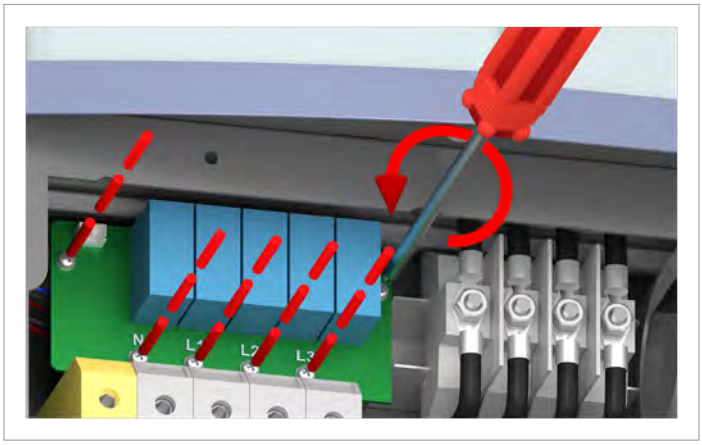
11.8 Replacing AC surge protection devices

1. Perform the instructions listed in “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158 **before** you perform the following operations!

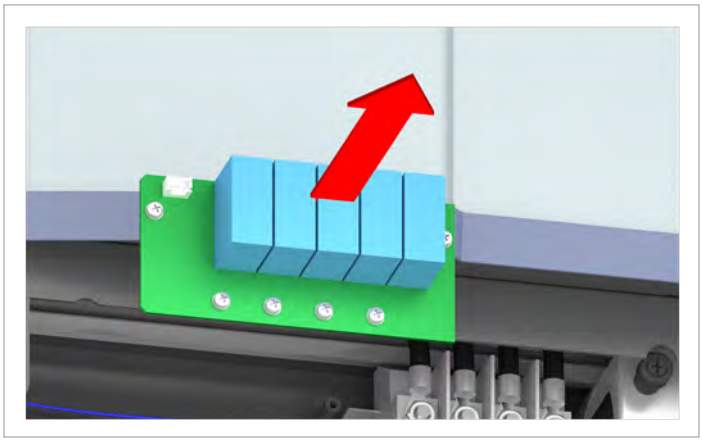


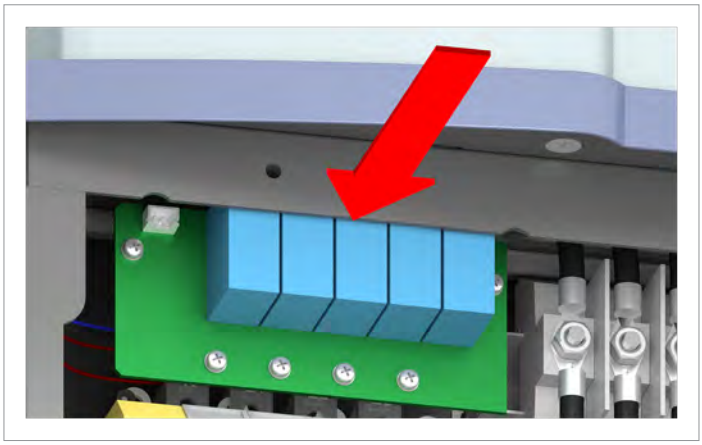
2. Pull out the communication cable plug.



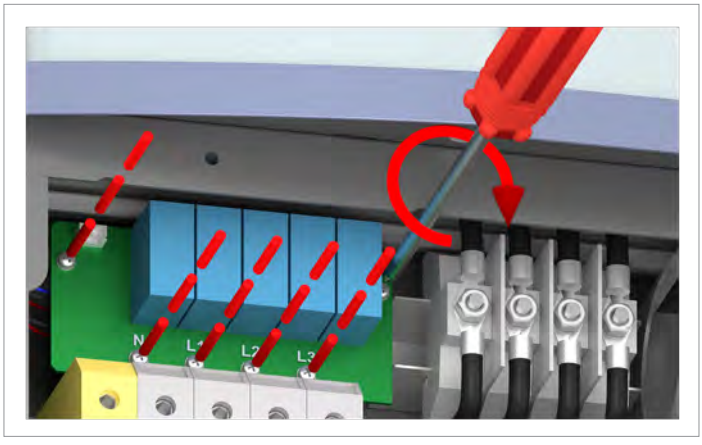


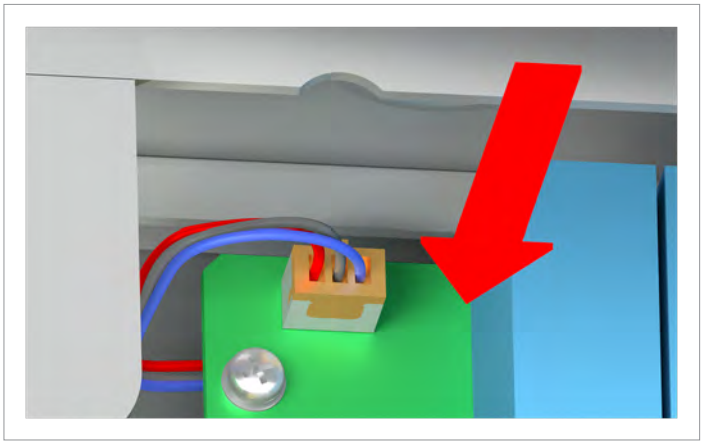
3. Unscrew the 6 screws and lift out the block with the defective surge protection devices.





4. Fit the new block with the surge protection devices and screw in place using the 6 screws.





5. Plug in the communication cable plug.

6. To complete the maintenance work, follow the instructions in the following section: “11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)”, p. 182.

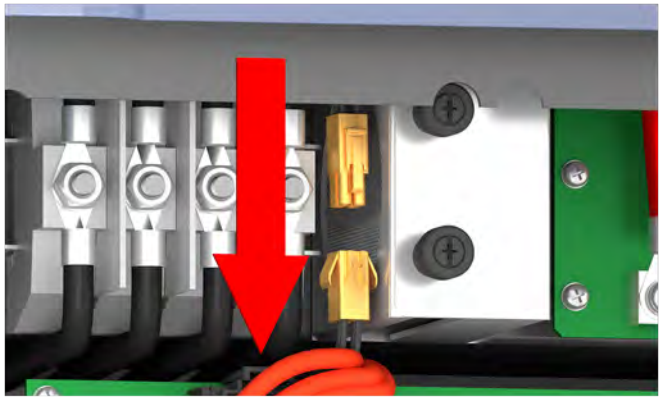
11.9 Replacing the fan inside the terminal box

DANGER

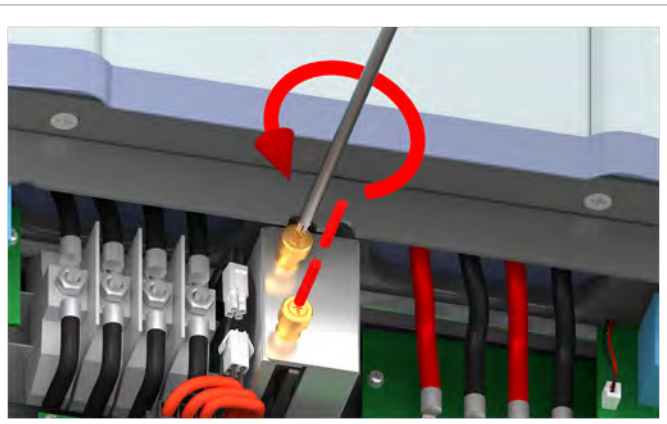
Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

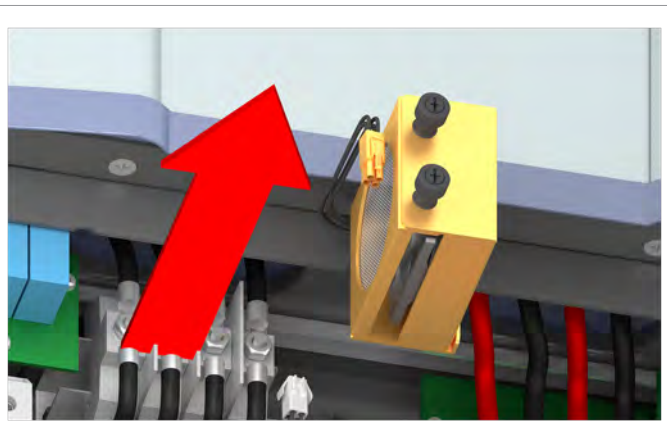
► Perform the instructions listed in “11.5 Making preparations for maintenance work - disconnecting the inverter from the mains (AC) and solar modules (DC)”, p. 158 **before** you start work on the inverter!

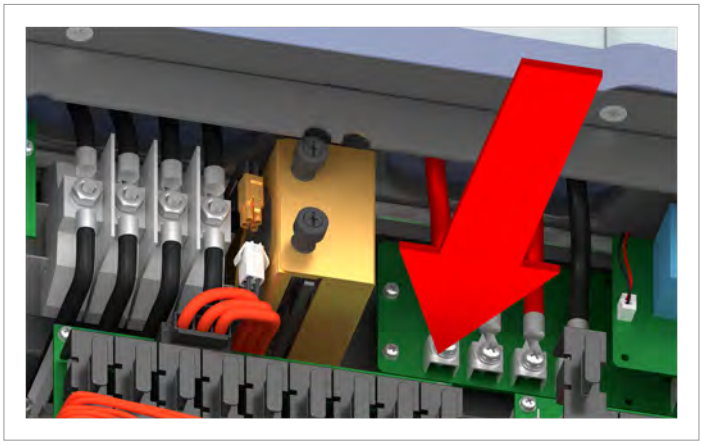


1. Disconnect the internal fan's power supply cable.

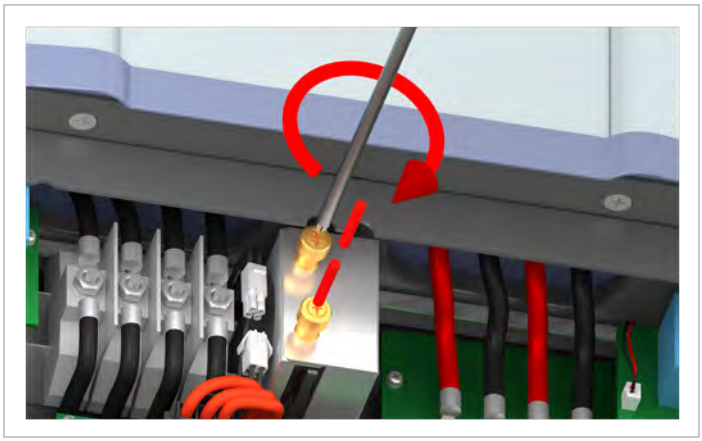


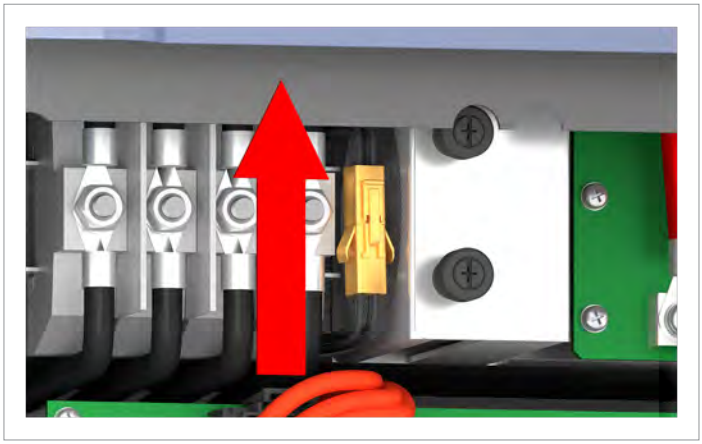
2. Unscrew and remove the internal fan.





3. Insert the new internal fan and screw it in place.





4. Plug in the internal fan's power supply cable.

5. To complete the maintenance work, follow the instructions in the following section: “11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)”, p. 182.

11.10 Replacing string fuses

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

► Carry out **all** the works steps listed in this section, and always in the correct order.

There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the mains and between the solar modules. This isolates the inverter from all the AC and DC voltage sources and renders it de-energized.

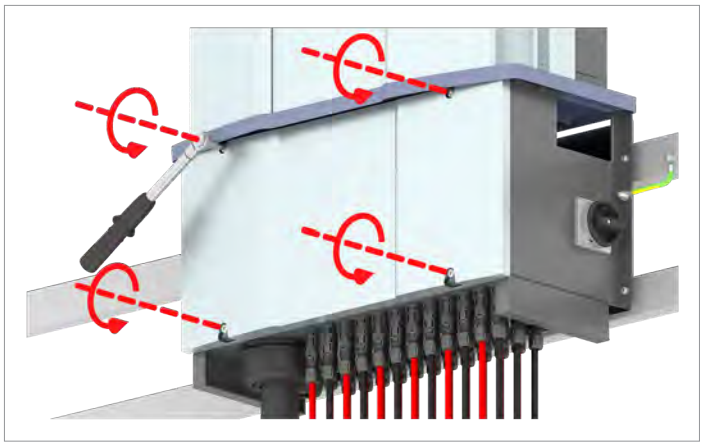
1. Using a clip-on ammeter on the inverter, locate the string with the defective string fuse and mark the corresponding cable.

2. Disconnect the inverter from the mains by opening the external AC load isolating switch.

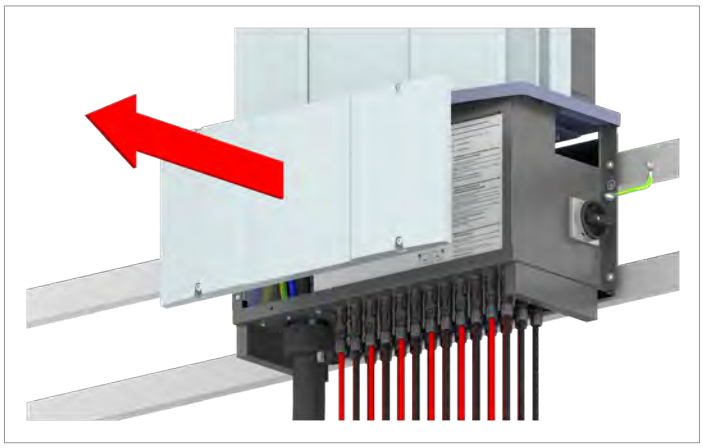
   Secure the external AC load isolating switch to prevent it from accidentally being switched back on.

3. Turn the inverter's DC isolating switch to the ***0 (OFF)*** position.

4. Wait at least 100 seconds until the internal capacitors have discharged.



5. Unscrew and remove the junction box cover.

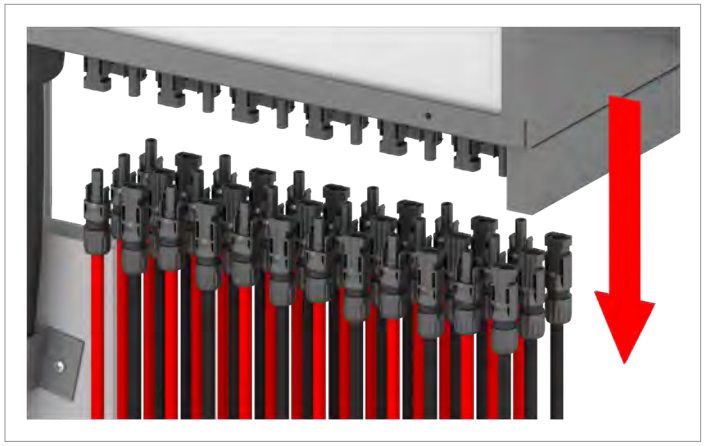


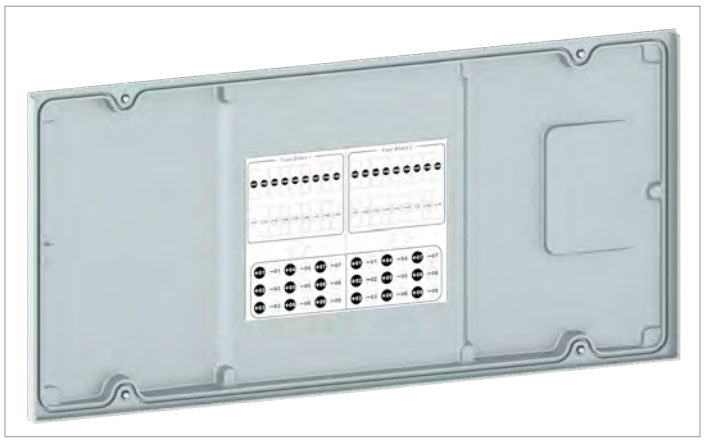
6. Measure with a voltmeter to check that there is no more voltage in the AC terminal block.
   → If you detect voltage, open the external load isolating switch.
   → If you detect no voltage, proceed to the next step.

7. Remove the cover in the interior of the junction box.

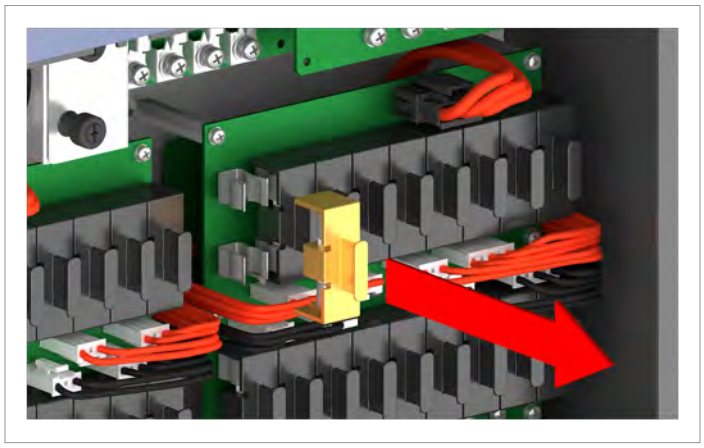
8. If you have not done so already, label the DC cable so that you can re-connect it to the correct DC connection later on.

9. Use the mounting tool to release the DC cables and then pull them out.

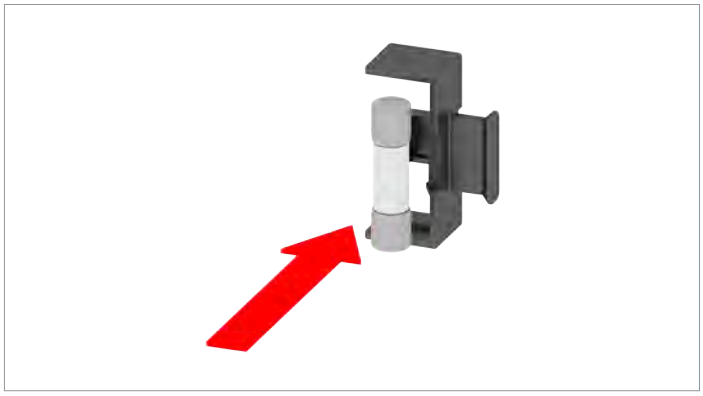




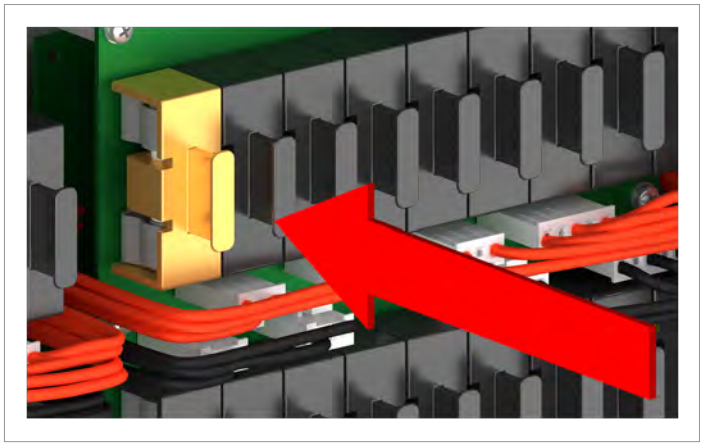
10. Use the overview diagram on the inside of the terminal box cover to determine which string fuse needs to be replaced.



11. Pull out the fuse holder of the defective string fuse by hand.



12. Replace the defective string fuse with a new string fuse.



13. Insert the fuse holder with the new string fuse.

14. To complete the maintenance work, follow the instructions in the following section: “11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)”, p. 182.

11.11 Finishing the maintenance work - connecting the inverter to the mains (AC) and solar modules (DC)

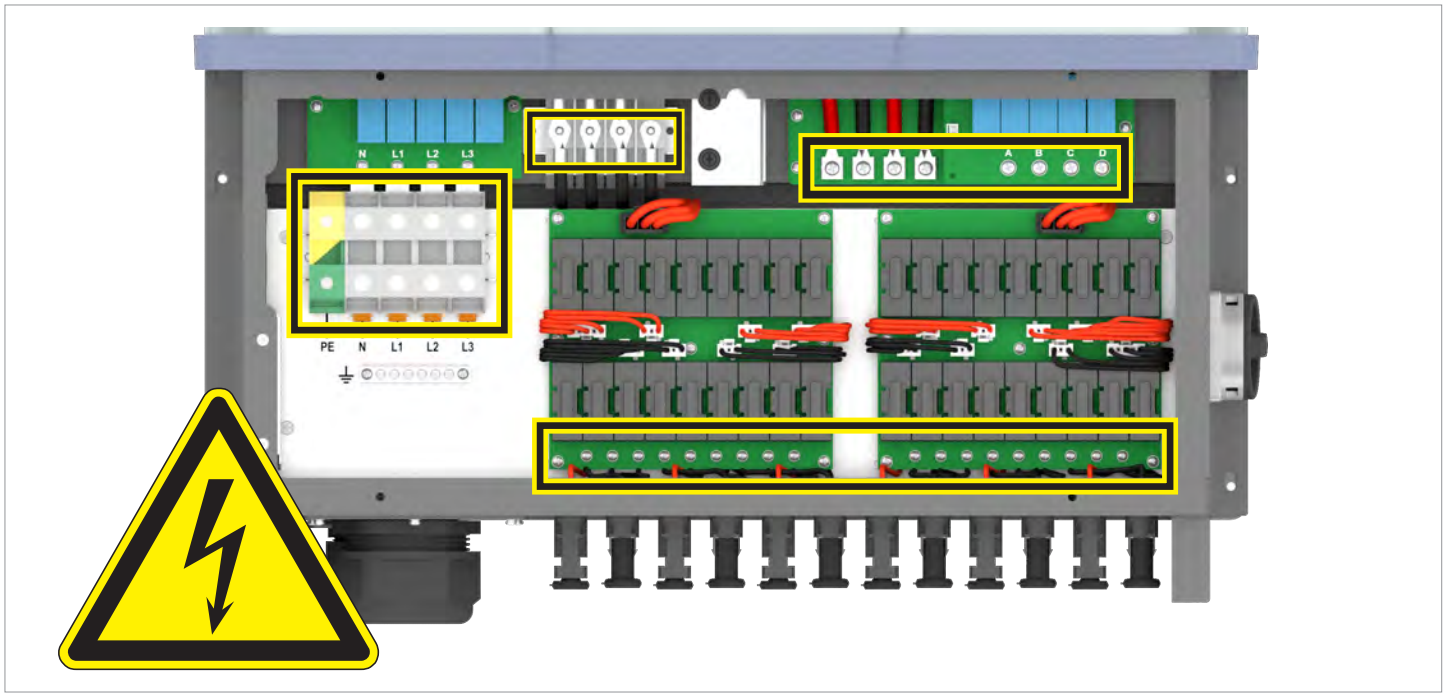
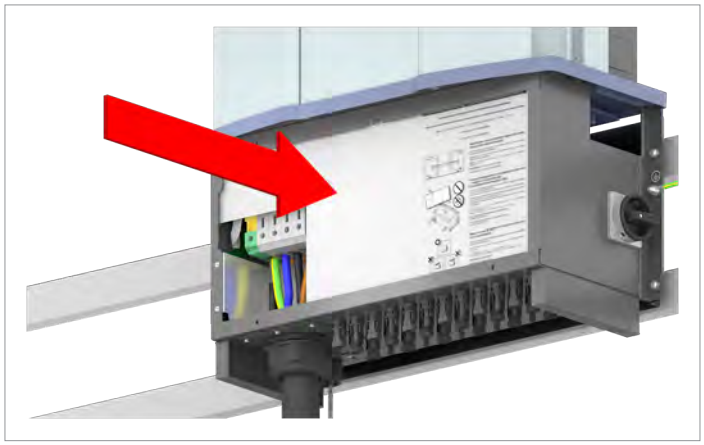
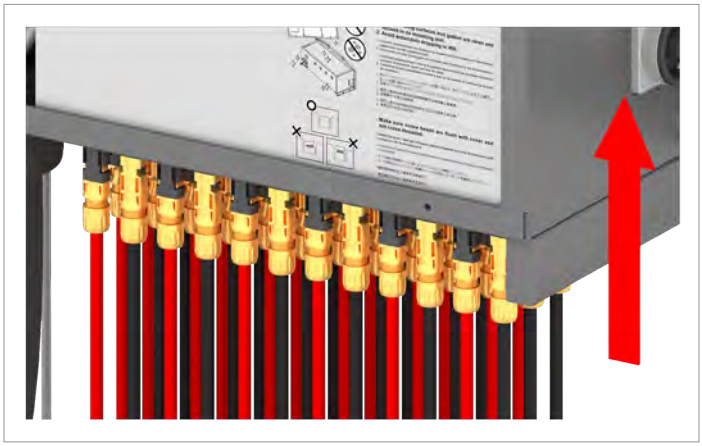


Fig. 11.1: Hazard zones with potentially life-threatening currents and voltages

There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the mains and between the solar modules, to isolate the inverter from all AC and DC voltage sources and to render it de-energized.



1. Insert the cover in the interior of the junction box.

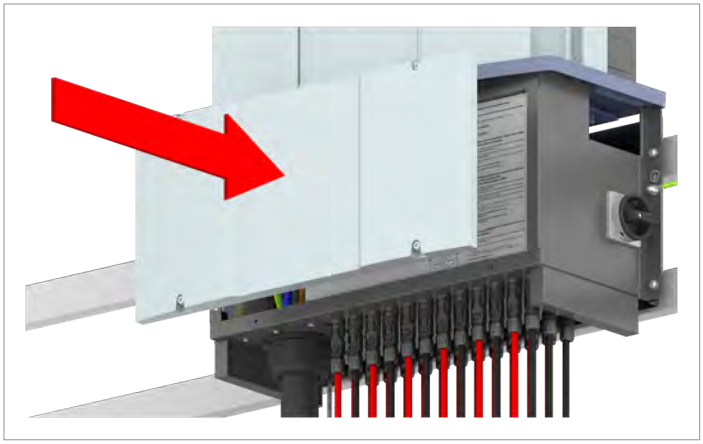


2. Plug in the DC cables.

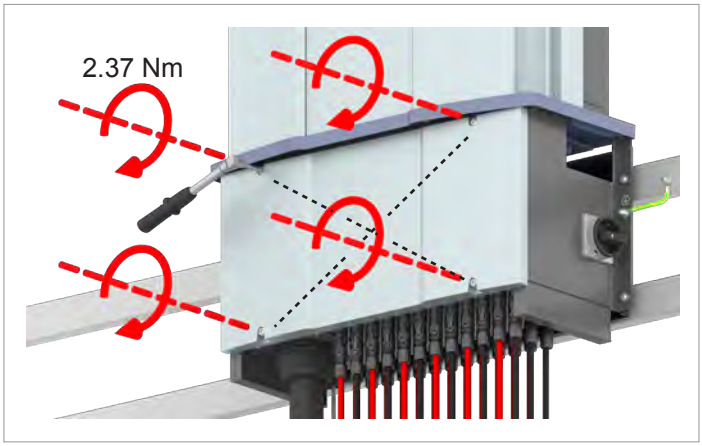
NOTICE

Impairment of operating response caused by moisture and dirt.
In order to restore the IP65 degree of protection once the installation work is complete, attach the cover of the terminal box in accordance with the following instructions.

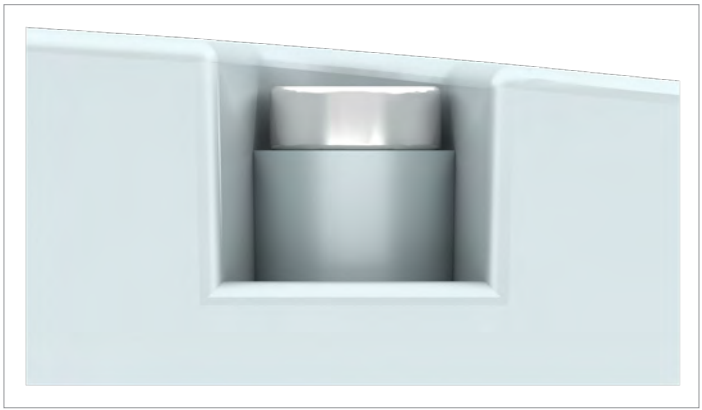
3. Before screwing on the cover, check all the seals and surfaces are clean positioned correctly.



4. Attach the cover in such a way that it is evenly mounted and not skewed.



5. Tighten the screws by hand at first and then use a torque wrench to tighten them crosswise with a torque of 2.37 Nm.



6. Do not skew the screws. The screw heads must be flush with the surface.

7. To connect the inverter to the mains, close the isolating switches between the inverter and the mains.

8. Turn the DC isolating switch to the ***1 (ON)*** position.
   → The inverter starts a self-test lasting approx. 2 minutes. The remaining time is shown on the display.

12. Replacing the inverter

12.1 Safety instructions

DANGER

Electric shock
Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.
Therefore, always carry out the following steps before working on the inverter

1. Turn the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
3. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock
Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Turn the DC isolating switch to the ***OFF*** position.
- ► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock
When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

- ► Remove the cover only when absolutely necessary.
- ► Do not remove the cover if water might enter the inverter.
- ► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the mains and between the solar modules. This isolates the inverter from all the AC and DC voltage sources and renders it de-energized.

If the entire inverter, the power module or the junction box need to be sent to Delta for repair, then you will receive a suitable substitute from Delta.

Always contact Delta Customer Service before commencing the removal of the inverter for replacement.

The inverter can be either replaced in its entirety or only the power module or the junction box separately.

The work steps respectively required for this are described in the following segments.

It is best to wait before performing the removal until you have received the replacement device. You must then use the delivery box in which the replacement device was delivered to send back the old part.

All of the attachments required, e.g. cable glands or communications card, are supplied with the replacement device. You need not send back the cable glands and communications card of the old inverter, i.e. you can reuse them.

WARNING

Heavy weight
The inverter is very heavy.

- ► The inverter must be lifted and carried by at least 3 people or using appropriate lifting gear (e.g. block and tackle or crane).

12.2 Replacing the entire inverter

12.2.1 Tools required

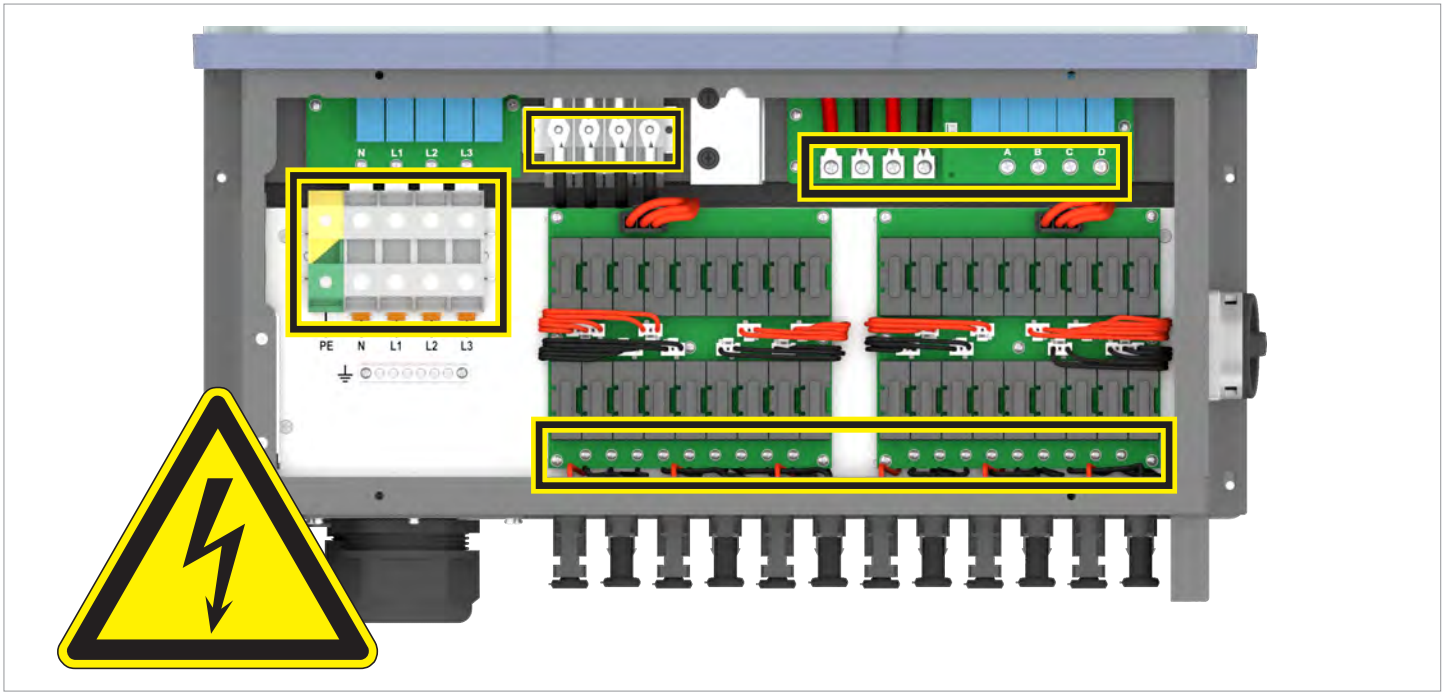
You do not need to send back the cable glands or communication card for the old inverter.

However, all of the necessary cable glands and a communication card are supplied with the new inverter.

In addition to standard tools such as screwdrivers, open-ended wrenches and socket wrenches in various sizes, the following tools are required for working on the inverter:

- Voltmeter to check that the junction box is de-energized
- M6 Allen wrench (hexagon socket) for opening the cover of the junction box
- M10 Allen wrench (hexagon socket) for disconnecting the cables on the AC terminal block
- M12 eyebolts for raising the inverter
- Block and tackle or small crane for lifting the inverter (take into account the weight of the inverter!) or, alternatively, 3 people
- Mounting tool for disconnecting the MC4 plug connectors from the DC cables

12.2.2 Disconnecting the inverter from external voltage sources



Hazard zones with potentially life-threatening currents and voltages

NOTICE

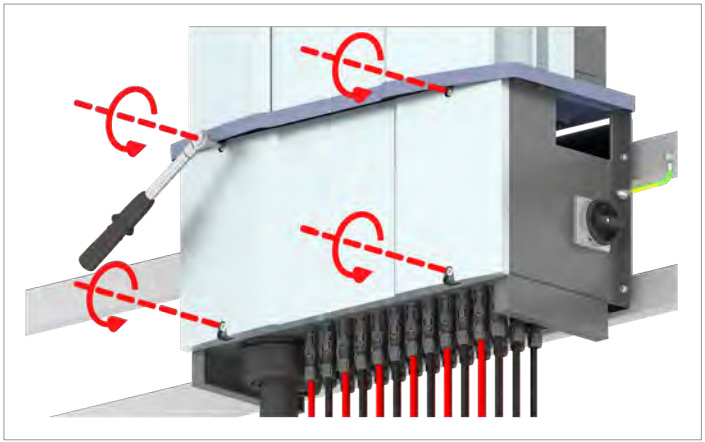
When pulling out the cables, take care to ensure that no parts are damaged in the junction box.

There is normally an external load isolating switch between the inverter and the mains (e.g. in an equipment terminal box). This is used to isolate the inverter from the mains and to shut off its AC voltage supply.

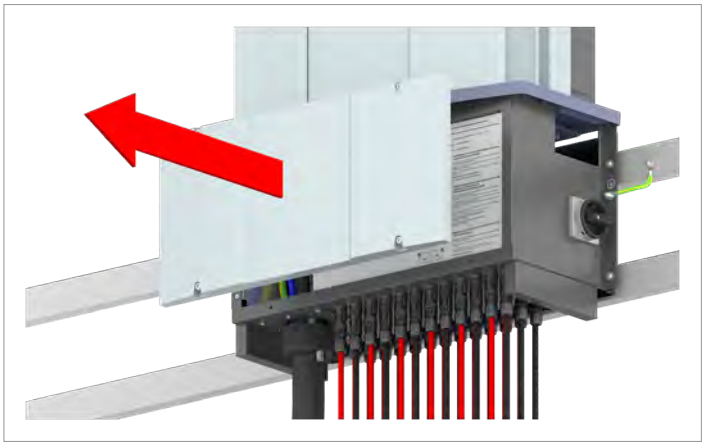
1. To shut off the inverter's AC voltage, open the load isolating switch between the inverter and the mains connection point.
   Secure all the isolating switches to prevent them from being accidentally switched back on.

2. Turn the DC isolating switch to the ***0 (OFF)*** position.

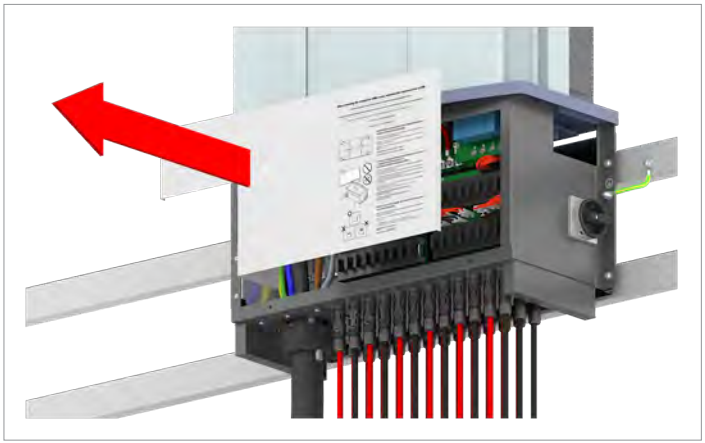
3. Wait at least 100 seconds until the internal capacitors have discharged.



4. Unscrew and remove the junction box cover.

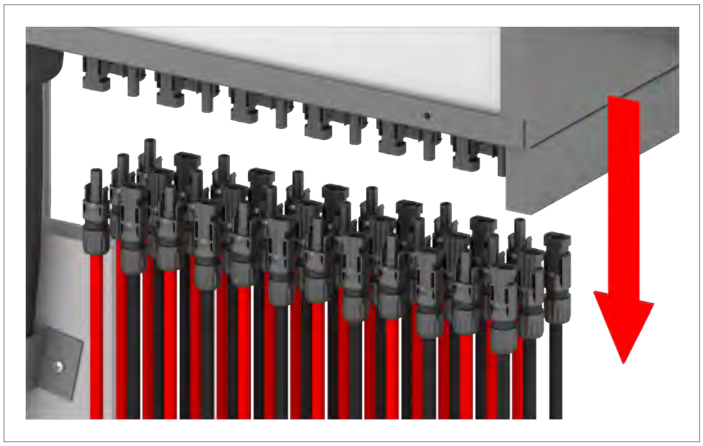


5. Measure with a voltmeter to check that there is no more voltage in the AC terminal block.
   → If you detect voltage, open the external load isolating switch.
   → If you detect no voltage, proceed to the next step.



6. Remove the cover in the interior of the junction box.

7. Use the mounting tool to release the DC cables and then pull them out.



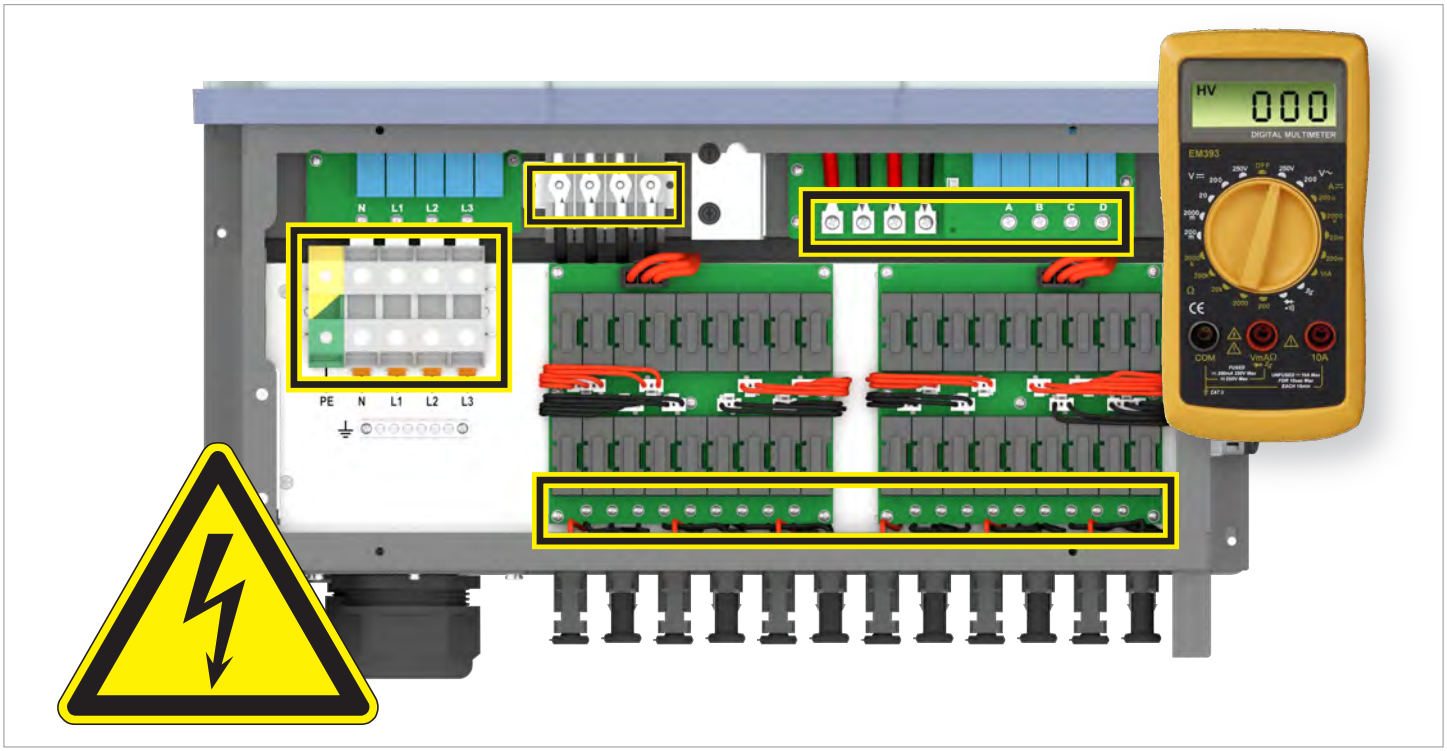
DANGER

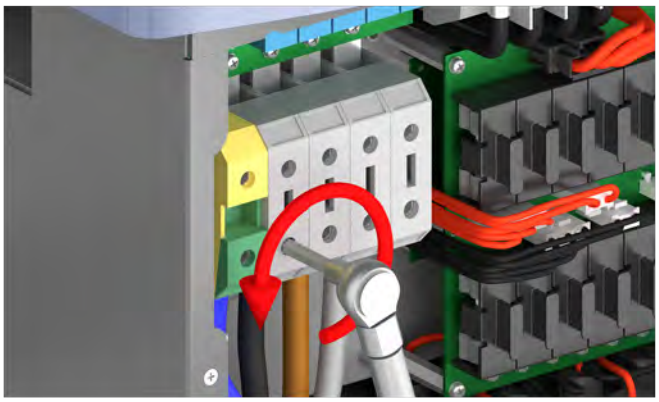
Electric shock

Voltage-carrying parts can still be live!

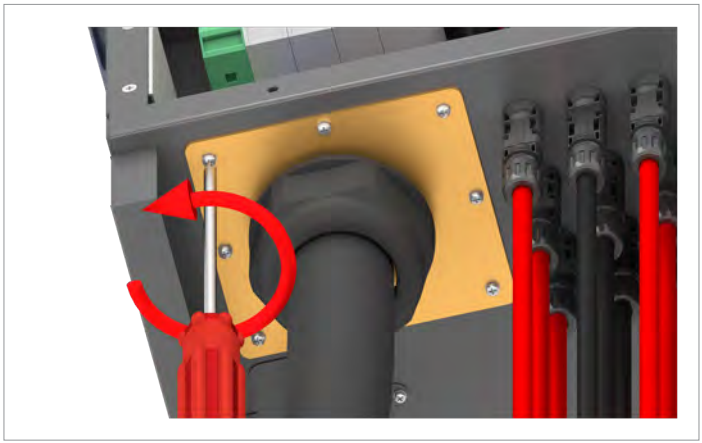
► Do not touch potentially voltage-carrying parts until these have been proven to be de-energized using a voltmeter!

8. Use a voltmeter to check that there is no more voltage in the danger zones.

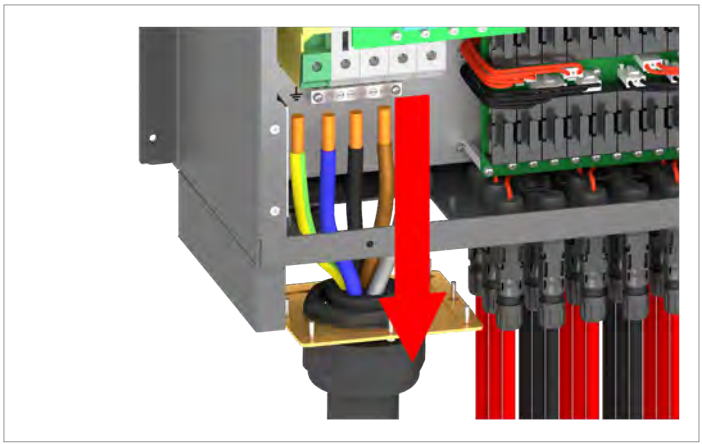


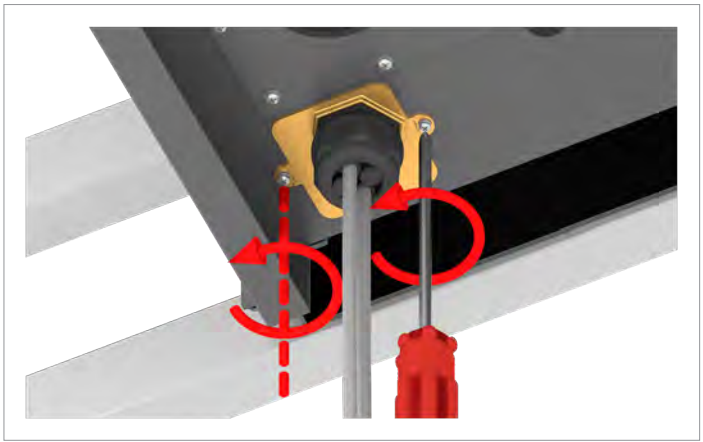


9. Unscrew the AC cable on the AC terminal block.

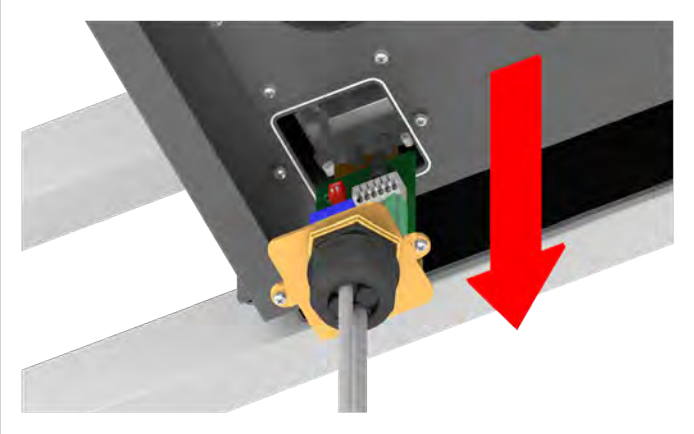


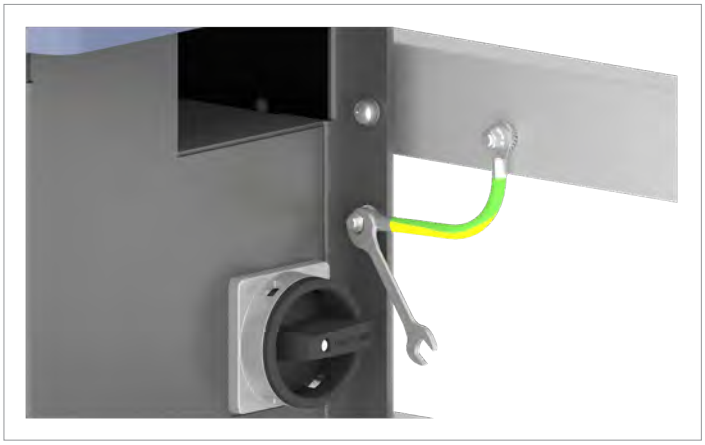
10. Unscrew and remove the AC connection cover.



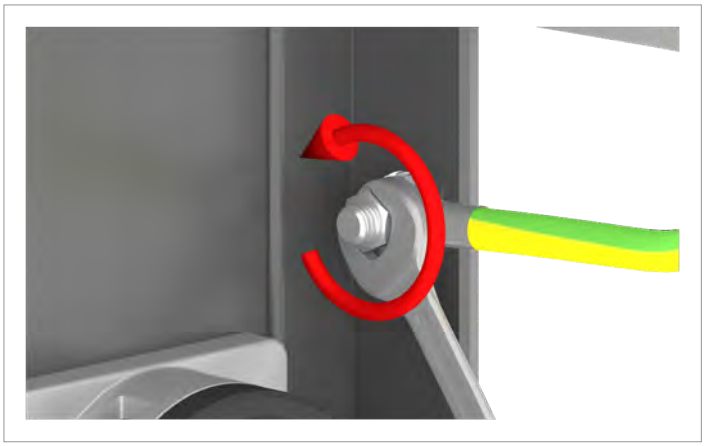


11. Unscrew the cover of the communication connection and pull it out carefully. The communications card is screwed onto the cover.

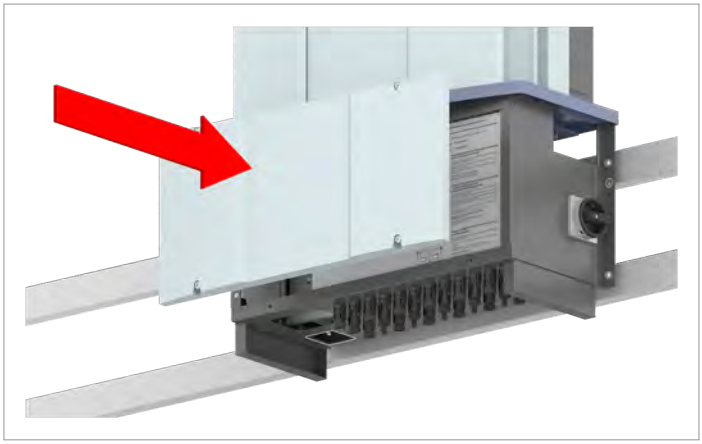




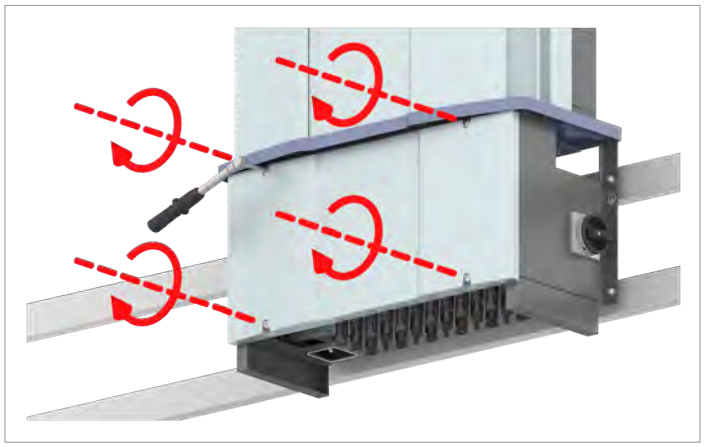
12. Unscrew the grounding cable.



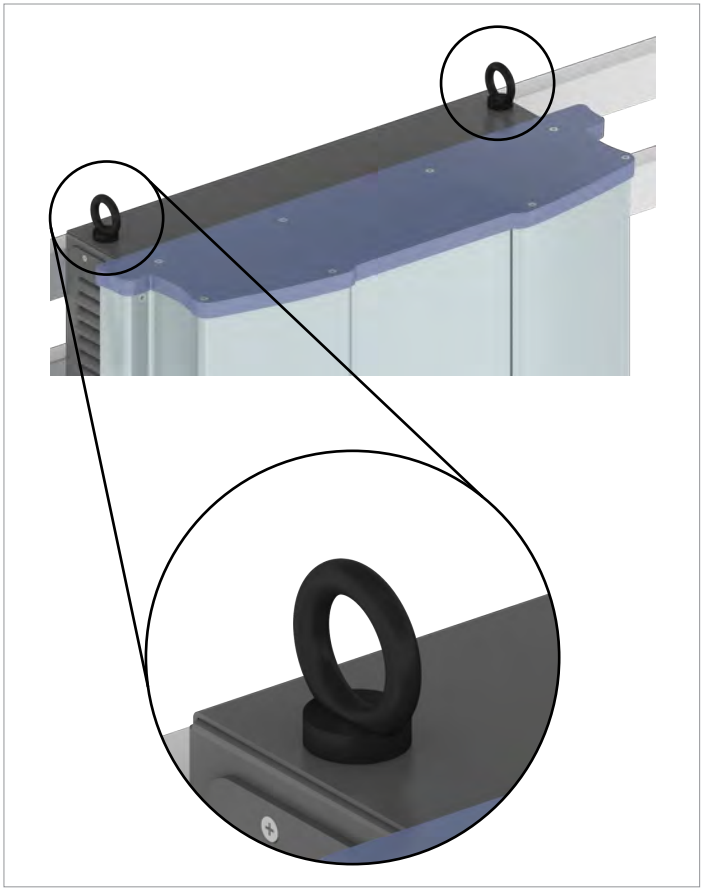
13. Insert the cover in the interior of the junction box.



14. Fit the terminal box cover and screw it into place.

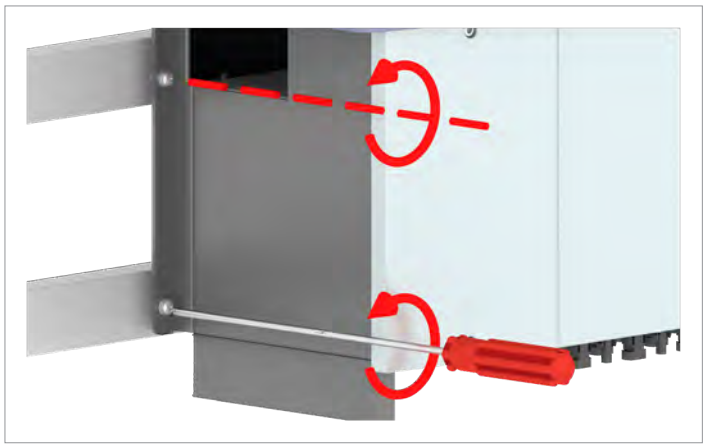


12.2.3 Removing the old inverter

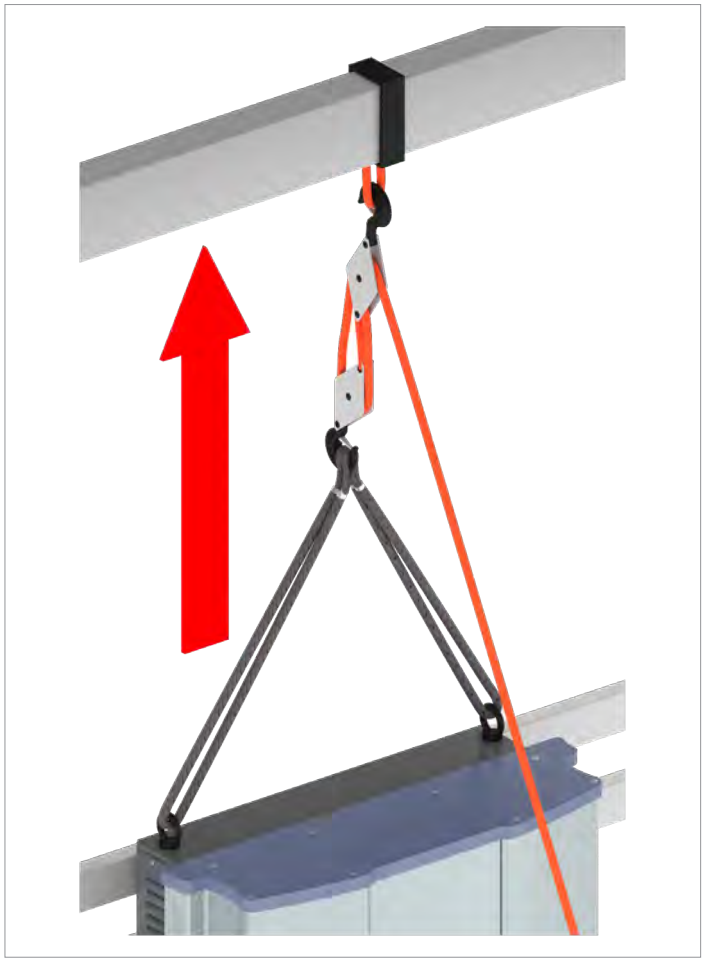


15. Attach M12 eyebolts to the top side of the inverter. The screw eyebolts are not included in the scope of delivery.

16. Secure the inverter using a block and tackle or crane.



17. Unscrew the junction box from the mounting plate.



18. Lift the inverter with a block and tackle or crane and place it in the box of the replacement device.

    If that is not possible, then place the inverter for the time being on a stable and dry surface that can support the great weight of the inverter.

12.2.4 Installing the new inverter

19. Install the new inverter in accordance with the instructions in the Quick Installation Guide that is supplied with the new inverter.

12.3 Replacing a power module

NOTICE

When the junction box is unscrewed from the power module, the power module will be suspended from the mounting plate without any additional securing mechanisms.

► Always secure the power module using a block and tackle or crane.

12.3.1 Overview of work steps

1. “12.3.3 Disconnecting the inverter from external voltage sources”, p. 198
1. “12.3.4 Disconnecting the internal cables”, p. 201
2. “12.3.5 Removing the old power module”, p. 203
3. “12.3.6 Mounting the new power module”, p. 206
4. “12.3.7 Connecting the new power module”, p. 210

12.3.2 Tools required

In addition to standard tools such as screwdrivers, open-ended wrenches and socket wrenches in various sizes, the following tools are required for working on the inverter:

- Voltmeter to check that the junction box is de-energized.
- M6 Allen wrench (hexagon socket) for opening the cover of the junction box
- M12 eyebolts for raising the inverter
- Block and tackle or small crane for lifting the inverter (take into account the weight of the inverter!)
- Mounting tool for disconnecting the MC4 plug connectors from the DC cables

12.3.3 Disconnecting the inverter from external voltage sources

NOTICE

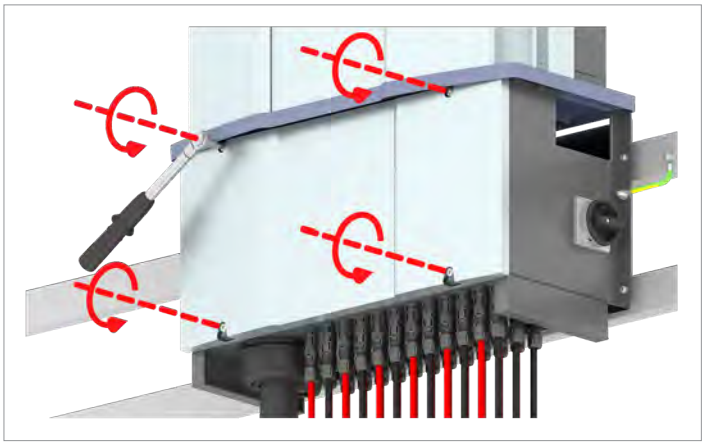
When pulling out the cables, take care to ensure that no parts are damaged in the junction box.

There is normally an external load isolating switch between the inverter and the mains (e.g. in an equipment terminal box). This is used to isolate the inverter from the mains and to shut off its AC voltage supply.

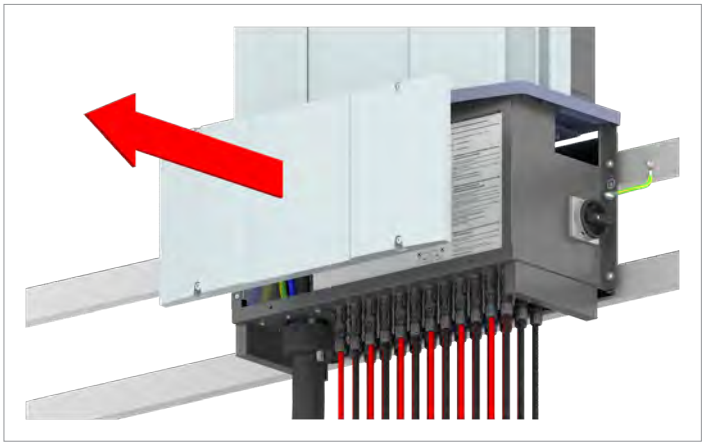
1. To shut off the inverter's AC voltage, open the load isolating switch between the inverter and the mains connection point.

   Secure all the isolating switches to prevent them from being accidentally switched back on.

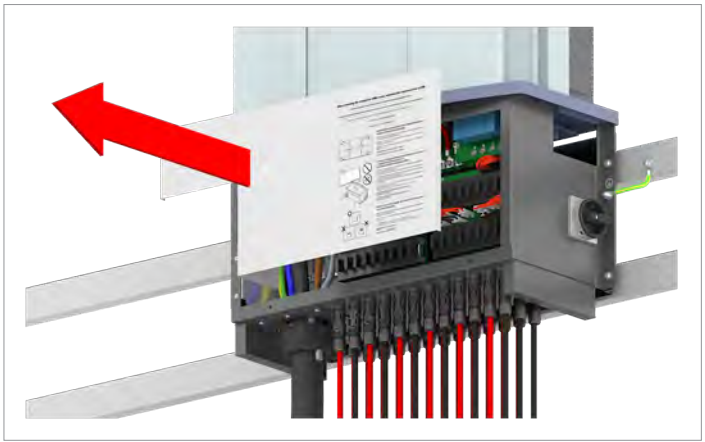
2. Turn the DC isolating switch to the ***0 (OFF)*** position.



3. Unscrew and remove the junction box cover.



4. Measure with a voltmeter to check that there is no more voltage in the AC terminal block.
   → If you detect voltage, open the external load isolating switch.
   → If you detect no voltage, proceed to the next step.

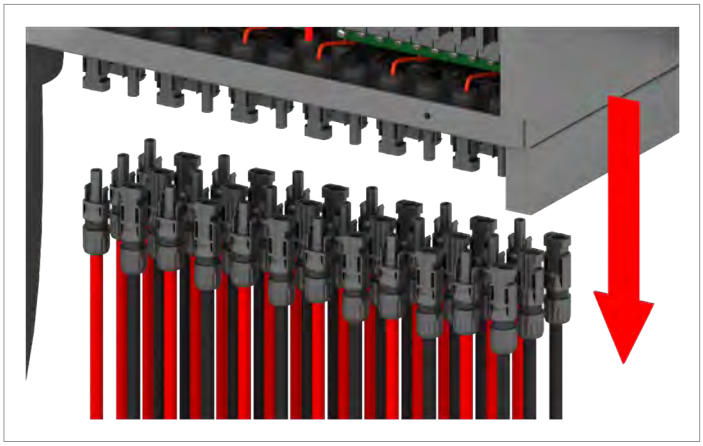


5. Remove the cover in the interior of the junction box.

6. Use the mounting tool to release the DC cables and then pull them out.

12 Replacing the inverter

Replacing a power module



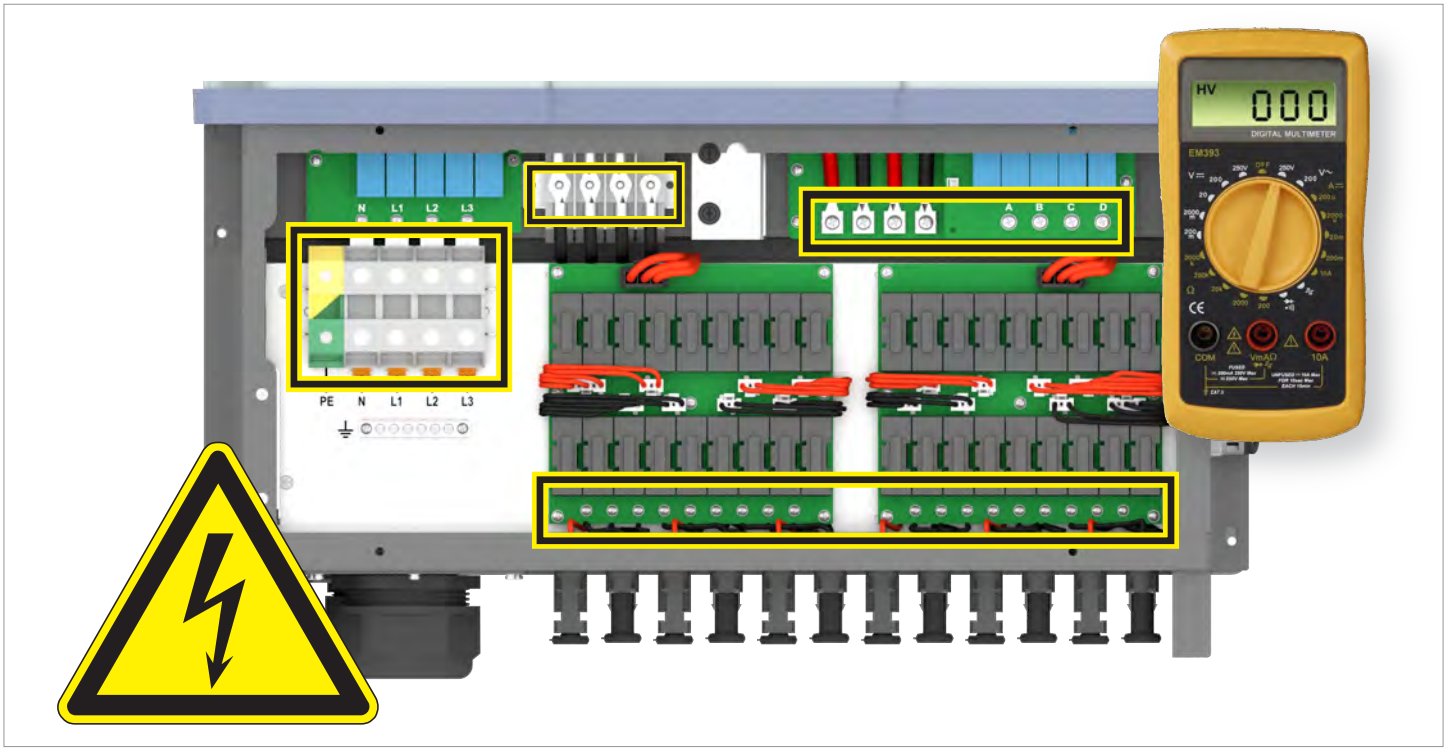
12.3.4 Disconnecting the internal cables

DANGER

Electric shock
Voltage-carrying parts can still be live!

► Do not touch potentially voltage-carrying parts until these have been proven to be de-energized using a voltmeter!

7. Use a voltmeter to check that there is no more voltage in the danger zones.

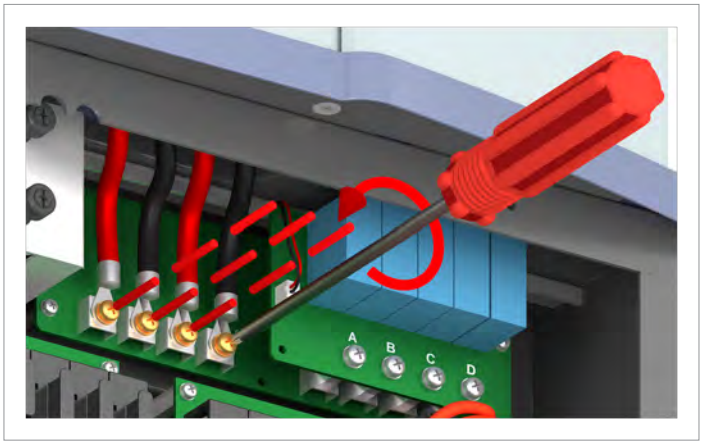


NOTICE

When pulling out the cables, take care to ensure that no parts are damaged in the junction box.

All the cables that lead from the junction box into the power module must be disconnected:

- Internal communications cable
- Internal AC cables
- Internal DC cables

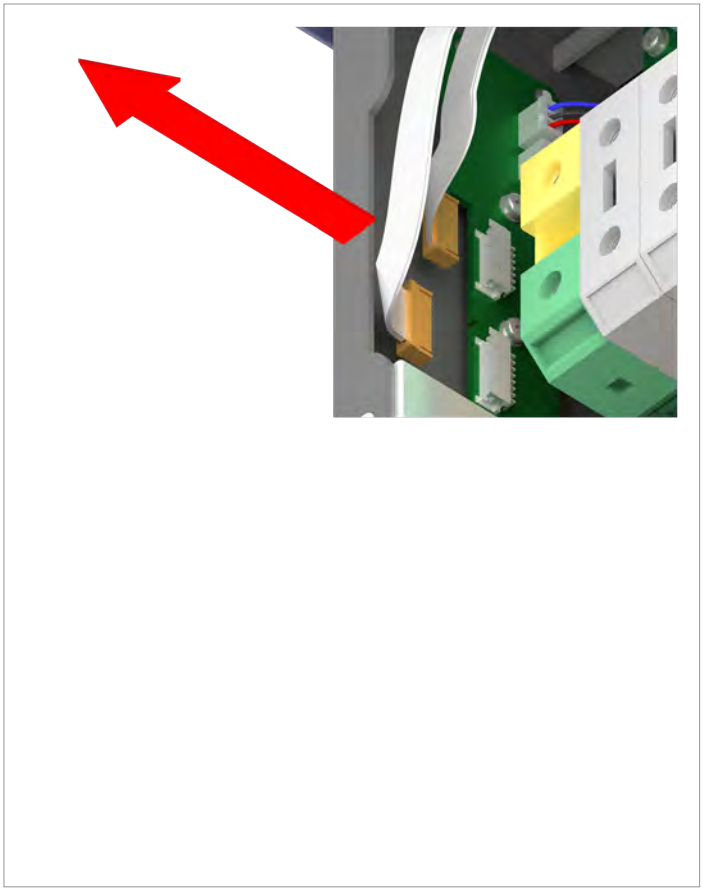


8. Disconnect the internal DC cables (4 cables).

9. Pull off the internal AC cables (4 cables) and the cables that come out of the power module.

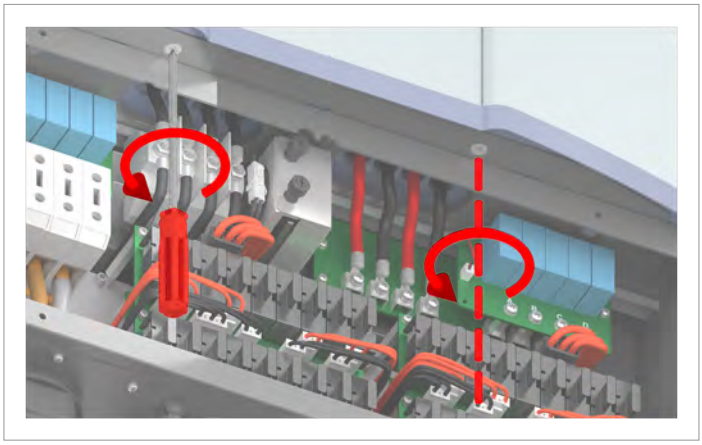
10. Disconnect the two internal communication cables in the top left-hand corner of the terminal box.

12.3.5 Removing the old power module



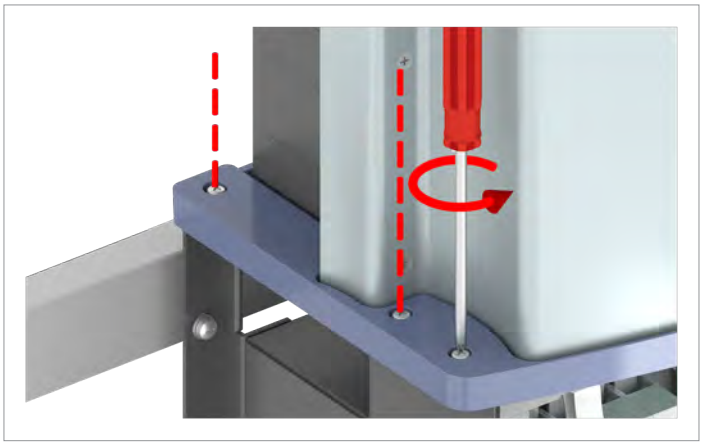
11. Attach M12 eyebolts to the top side of the power module. The screw eyebolts are not included in the scope of delivery.

12. Secure the inverter with a block and tackle or with crane so that the weight will be suspended from the block and tackle after the connection screws to the junction box have been loosened.



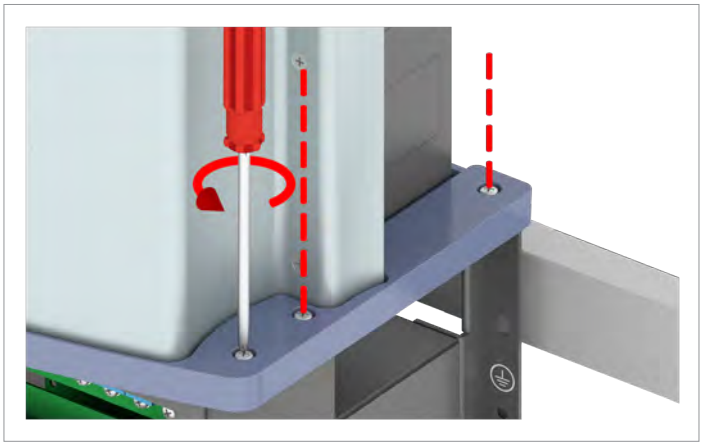
13. Unscrew the connection screws between power module and junction box in the interior of the junction box (2 screws).

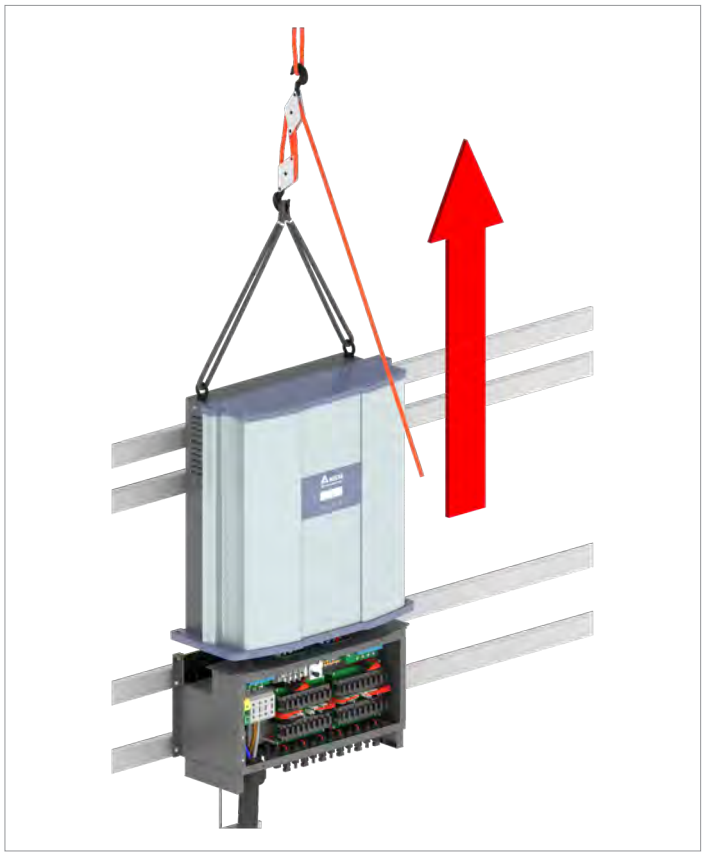
    Keep the two screws in a safe place.



14. Unscrew the connection screws between the power module and junction box on the left-hand and right-hand exterior sides (3 screws on each side).

    Keep the 6 screws in a safe place.





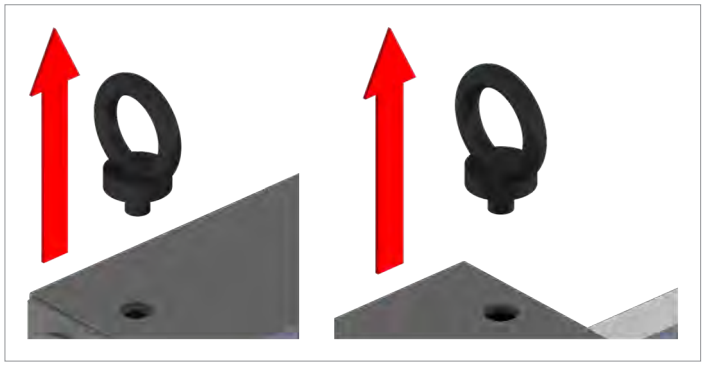
NOTICE

Damage to internal components of the power module

When lifting the power module, take care to ensure that the internal cables disconnected in the preceding work steps do not get caught on parts of the junction box.

15. Lift the power module using a block and tackle or crane and place it in the box of the replacement device.

    If that is not possible, place the power module on a stable and dry surface that can support the weight of the heavy power module for the time being.



16. Attach the eyebolts to the top side of the power module.

12.3.6 Mounting the new power module

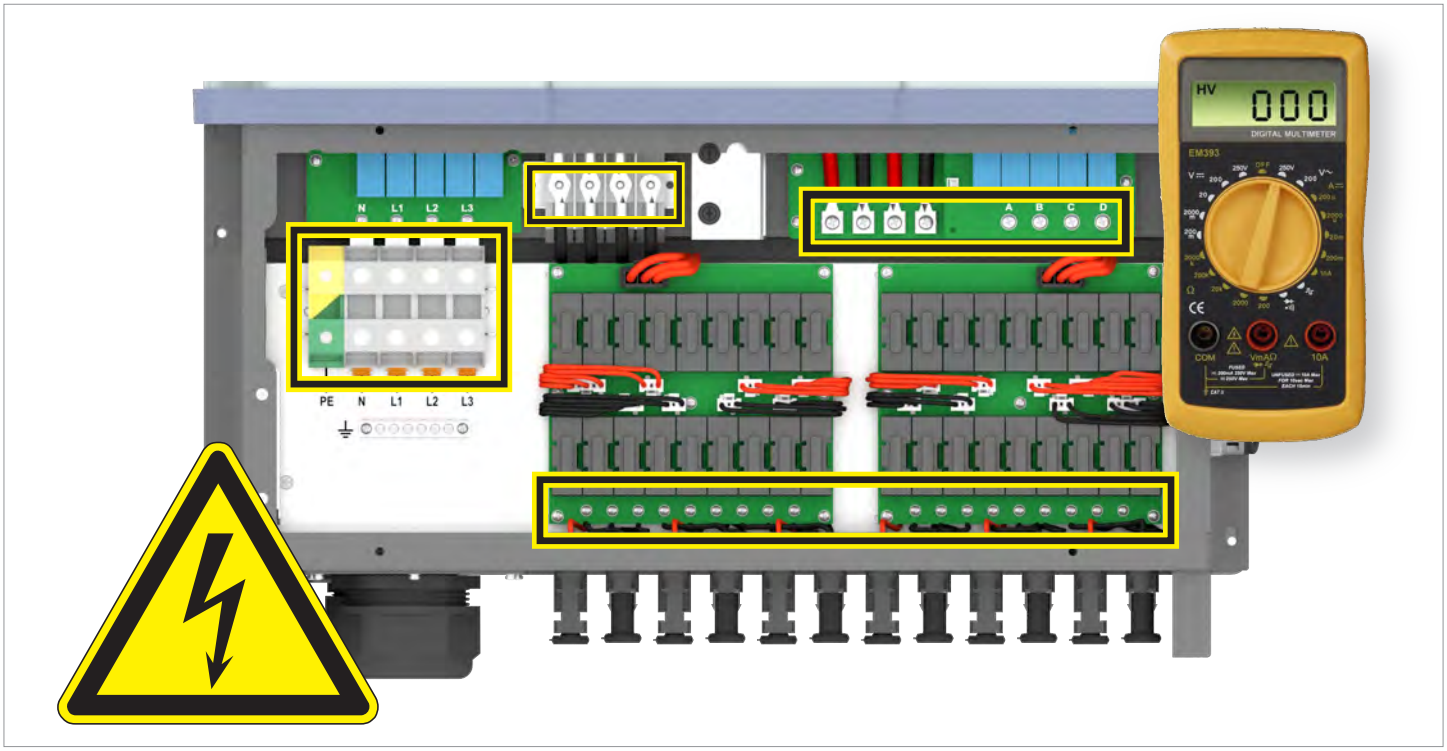
DANGER

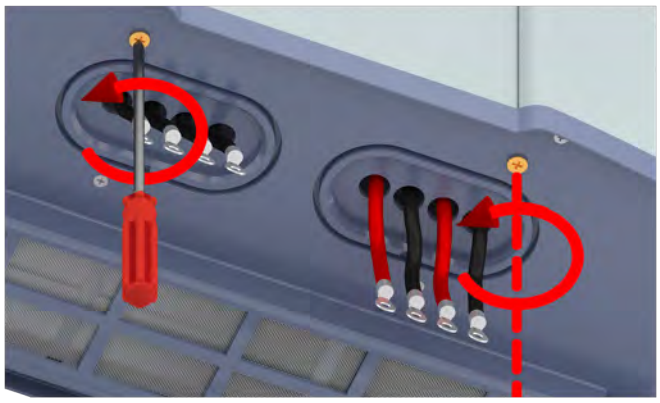
Electric shock

Voltage-carrying parts can still be live!

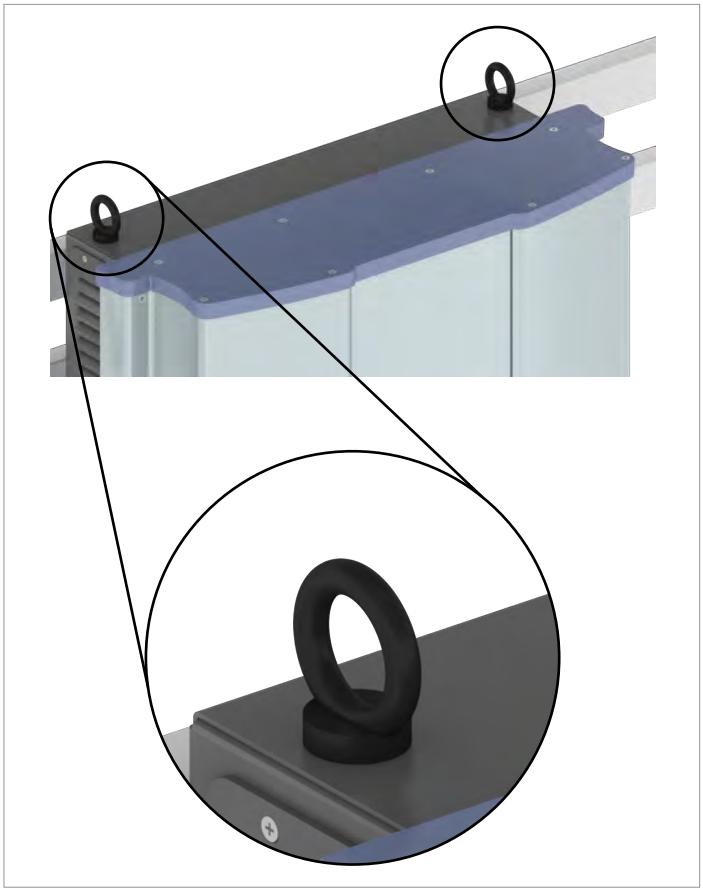
► Do not touch potentially voltage-carrying parts until these have been proven to be de-energized using a voltmeter!

17. Use a voltmeter to check that there is no more voltage in the danger zones.

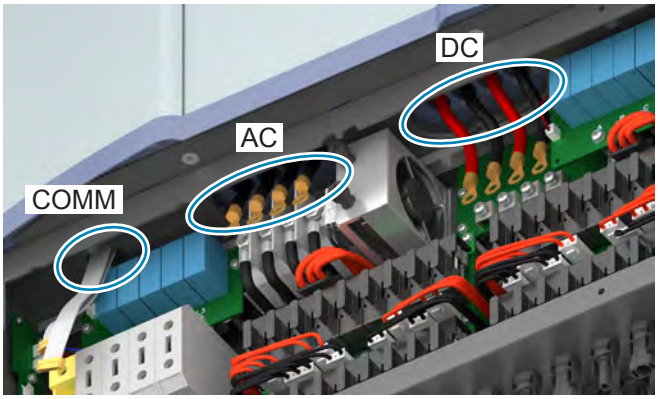


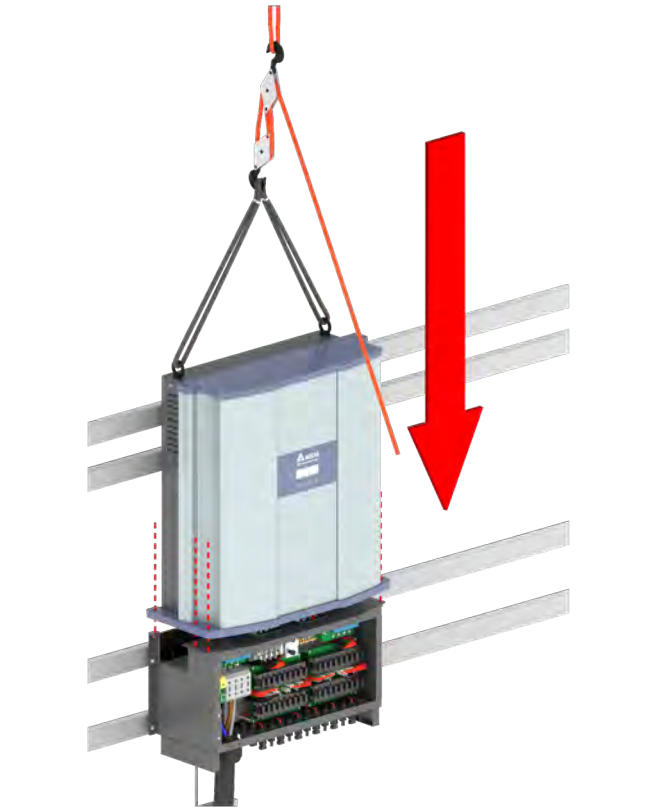


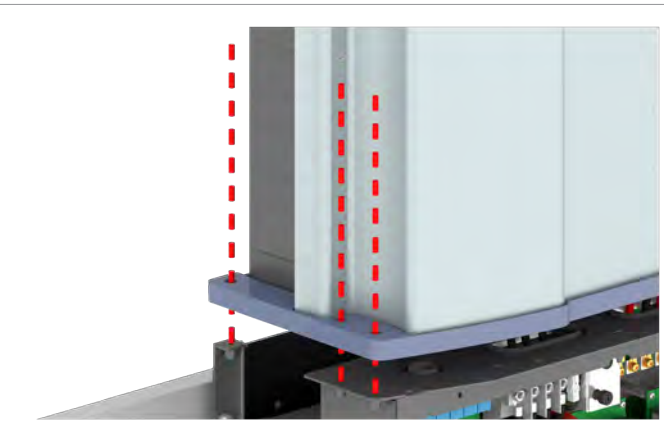
18. Attach the connection screws to the underside of the power module (2 screws).



19. Attach M12 eyebolts to the top side of the power module. The screw eyebolts are not included in the scope of delivery.







NOTICE

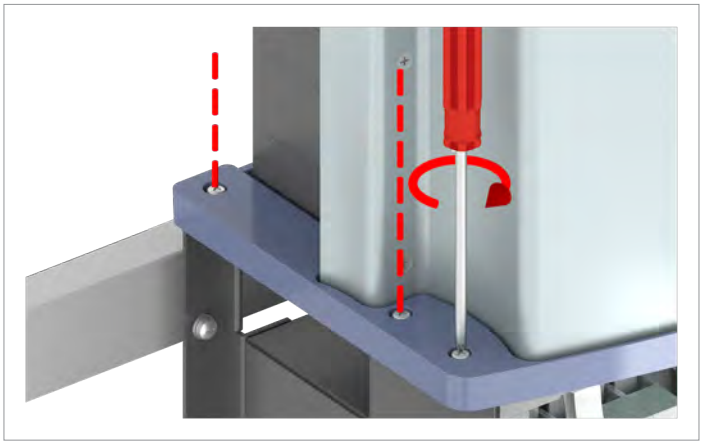
Damage to the cables or internal components

Cables are hanging out of the underside of the power module.

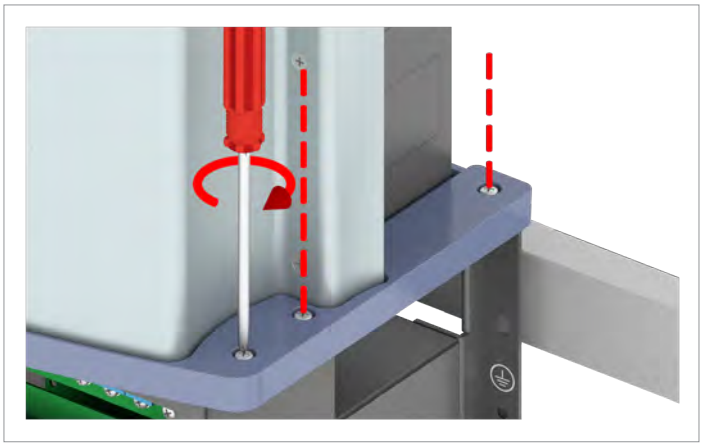
- ► When moving the power module, take care to ensure that the cables are not left hanging at other parts of the installation.
- ► When mounting the power module on the junction box, take care to ensure that the cables do not get jammed between the power module and the junction box.
- ► Guide the cables through the correct opening in the junction box.

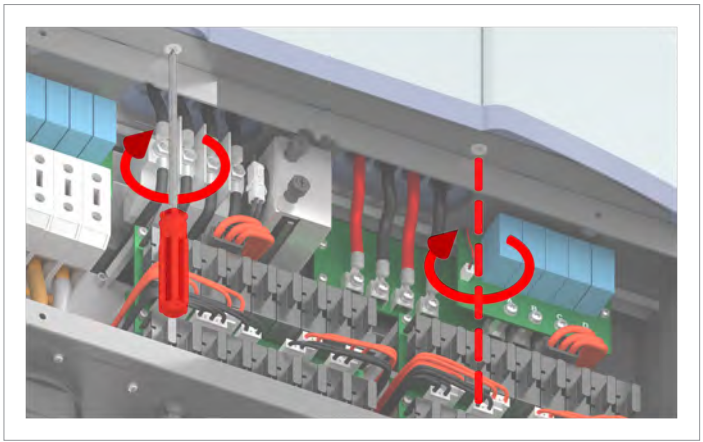
20. Lift the power module using a block and tackle or crane and suspend it in the mounting plate.

When mounting the junction box, make sure that the mounting holes on both sides of the power module and junction box are correctly aligned with one another.



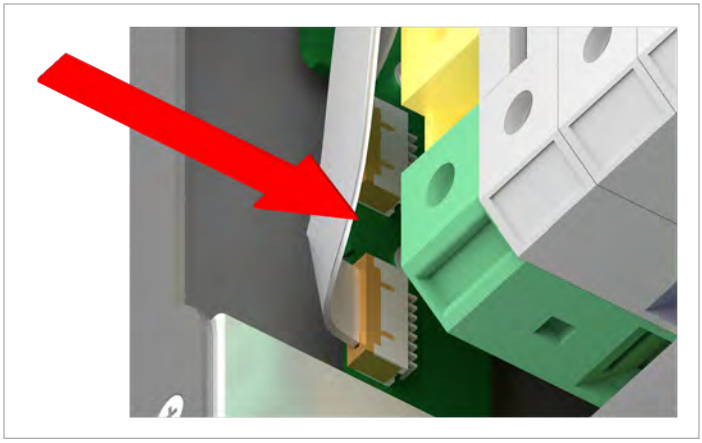
21. Screw in the connection screws between the power module and junction box on the right-hand and left-hand exterior sides (3 screws on each side).





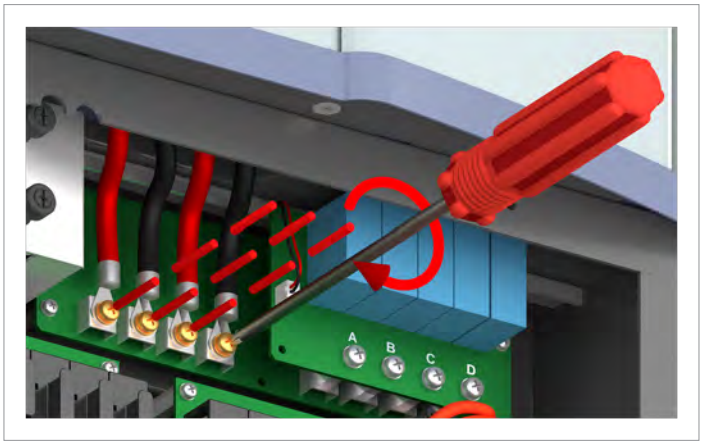
22. Screw the connection screws between power module and junction box on in the interior of the junction box (2 screws).

12.3.7 Connecting the new power module

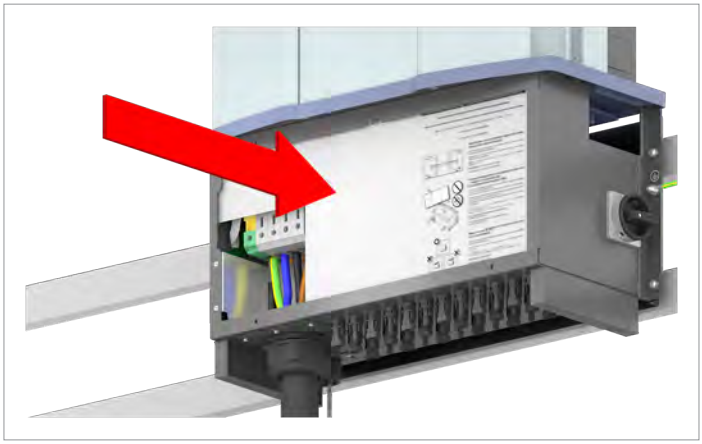


23. Plug in the two internal communication cables in the top left-hand corner of the terminal box.

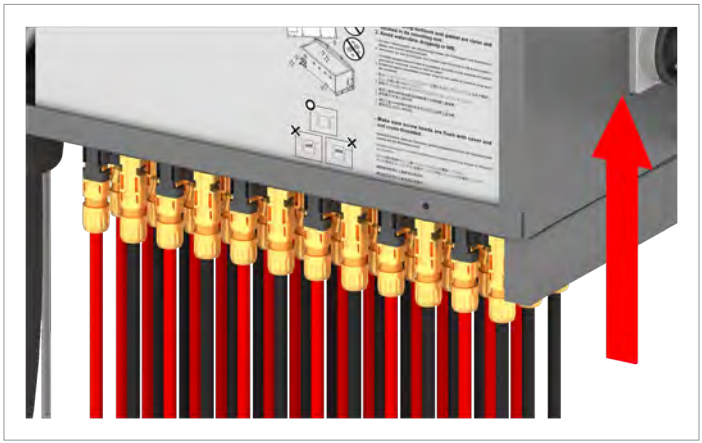
24. Screw on the internal AC cables (4 screws).



25. Screw on the internal DC cables (4 screws).



26. Insert the cover in the interior of the junction box.

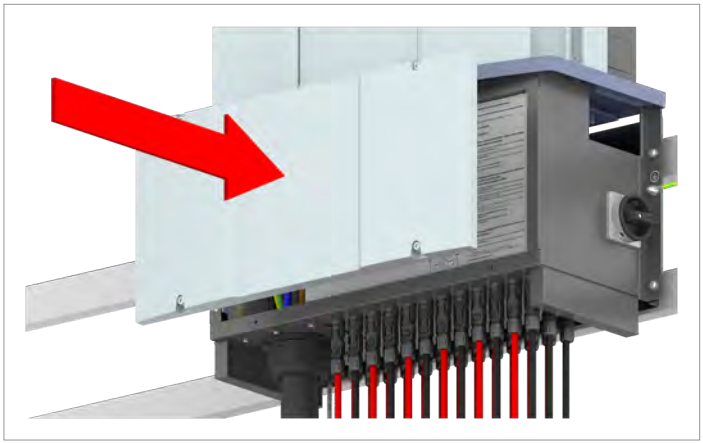


27. Plug in the external DC cables.

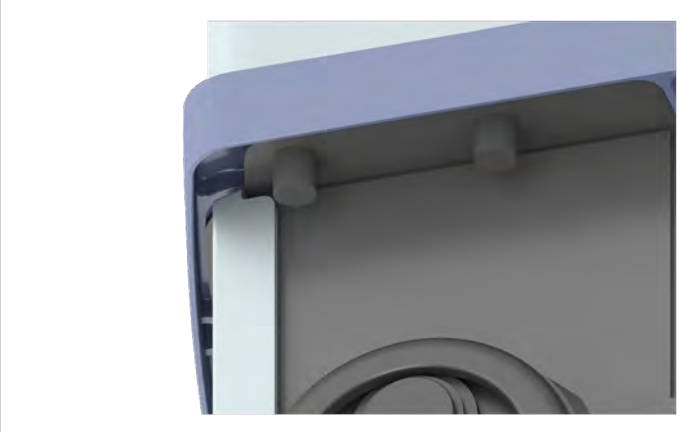
NOTICE

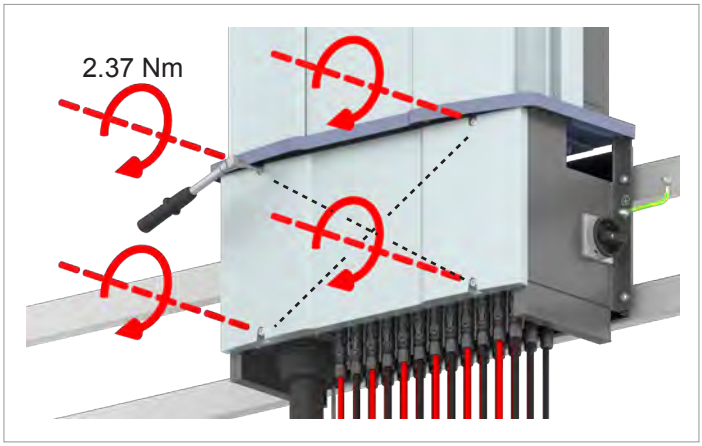
Impairment of operating response caused by moisture and dirt.
In order to restore the IP65 degree of protection once the installation work is complete, attach the cover of the terminal box in accordance with the following instructions.

28. Before screwing on the cover, check all the seals and surfaces are clean positioned correctly.

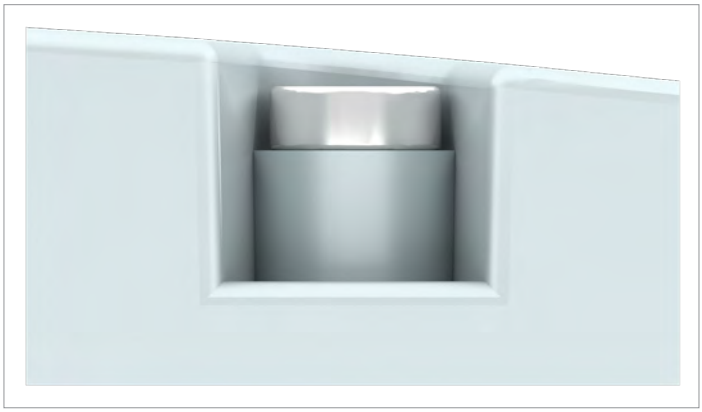


29. Attach the cover in such a way that it is evenly mounted and not skewed.





30. Tighten the screws by hand at first and then use a torque wrench to tighten them crosswise with a torque of 2.37 Nm.



31. Do not skew the screws. The screw heads must be flush with the surface.

32. To connect the inverter to the mains, close the isolating switches between the inverter and the mains.

33. Turn the DC isolating switch to the ***1 (ON)*** position.
    → The inverter starts a self-test lasting approx. 2 minutes. The remaining time is shown on the display.

13. Decommissioning

13.1 Safety instructions

DANGER

Electric shock

Potentially fatal voltages are present at the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 100 seconds.

Therefore, always carry out the following steps before working on the inverter:

1. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be accidentally restored.
2. Wait at least 100 seconds until the internal capacitors have discharged.

DANGER

Electric shock

Potentially fatal voltages are present at the inverter DC connections. When light falls on the solar modules, they immediately start to generate electricity. This also happens when light does not fall directly on the solar modules.

- ► Never disconnect the inverter from the solar modules when it is under load.
- ► Disconnect the connection to the mains so that the inverter cannot supply energy to the mains.
- ► Disconnect the inverter from all AC and DC voltage sources. Ensure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

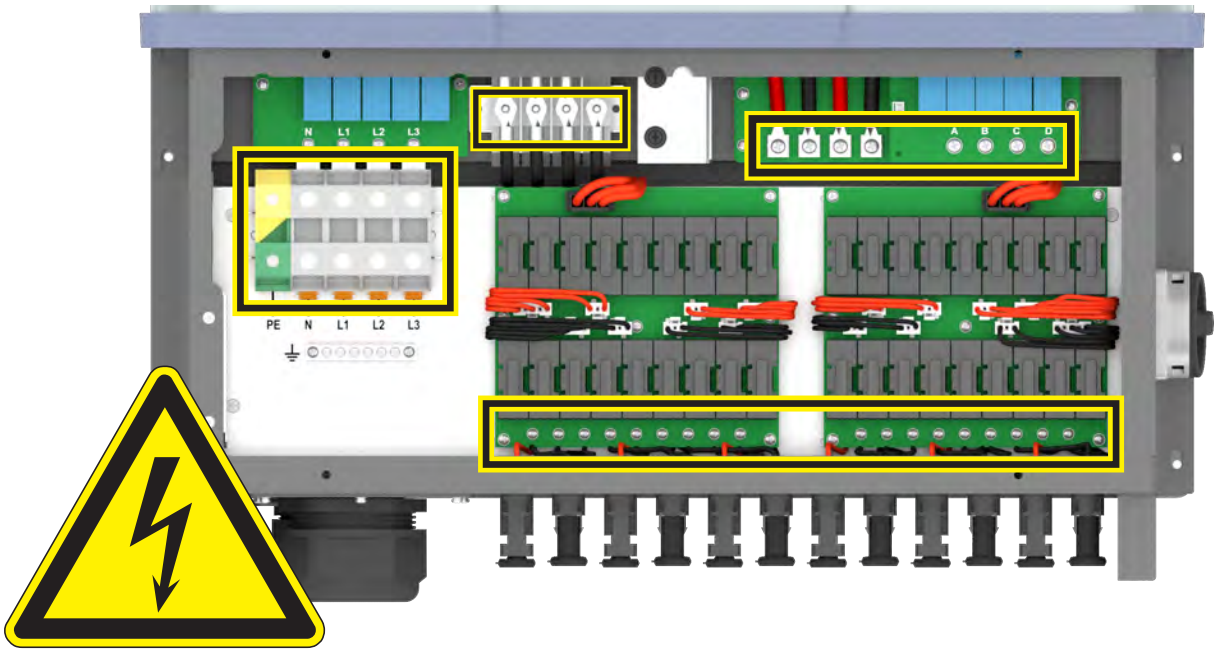
When the cover is removed from the wiring box, this exposes voltage-carrying parts and protection conforming to IP65 is no longer guaranteed.

- ► Remove the cover only when absolutely necessary.
- ► Do not remove the cover if water might enter the inverter.
- ► After work is completed, ensure that the cover is properly replaced and screwed in. Check that the cover is properly sealed.

13 Decommissioning

Safety instructions

There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the mains and between the solar modules, to isolate the inverter from all AC and DC voltage sources and to render it de-energized.



Hazard zones with potentially life-threatening currents and voltages

13.2 Disconnecting the inverter from external voltage sources

NOTICE

When pulling out the cables, take care to ensure that no parts are damaged in the junction box.

There is normally an external load isolating switch between the inverter and the mains (e.g. in an equipment terminal box). This is used to isolate the inverter from the mains and to shut off its AC voltage supply.

Tools required

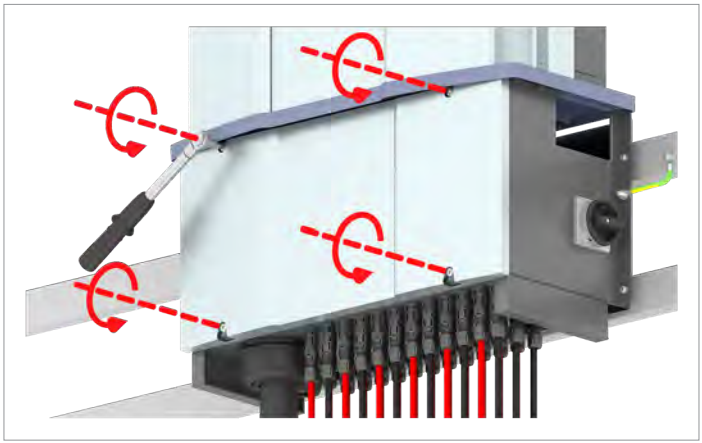
In addition to standard tools such as screwdrivers, open-ended wrenches and socket wrenches in various sizes, the following tools are required for working on the inverter:

- Voltmeter to check that the junction box is de-energized.
- M6 Allen wrench (hexagon socket) for opening the cover of the junction box
- M10 Allen wrench (hexagon socket) for disconnecting the cables on the AC terminal block
- M12 eyebolts for raising the inverter
- Block and tackle or small crane for lifting the inverter (take into account the weight of the inverter!) or, alternatively, 3 people
- Mounting tool for disconnecting the MC4 plug connectors from the DC cables

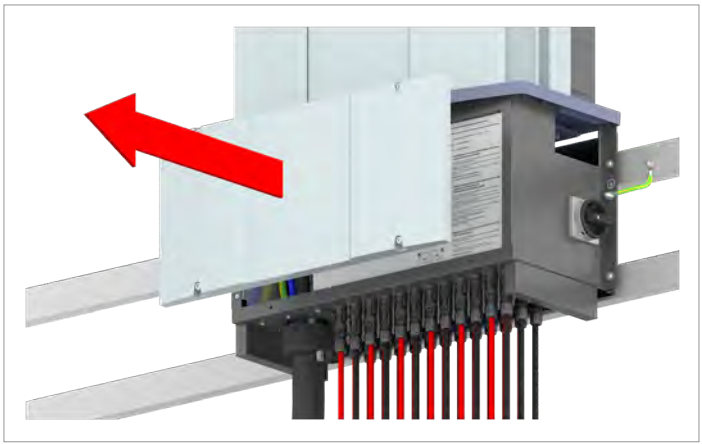
1. To shut off the inverter's AC voltage, open the load isolating switch between the inverter and the mains connection point.
   Secure all the isolating switches to prevent them from being accidentally switched back on.

2. Turn the DC isolating switch to the ***0 (OFF)*** position.

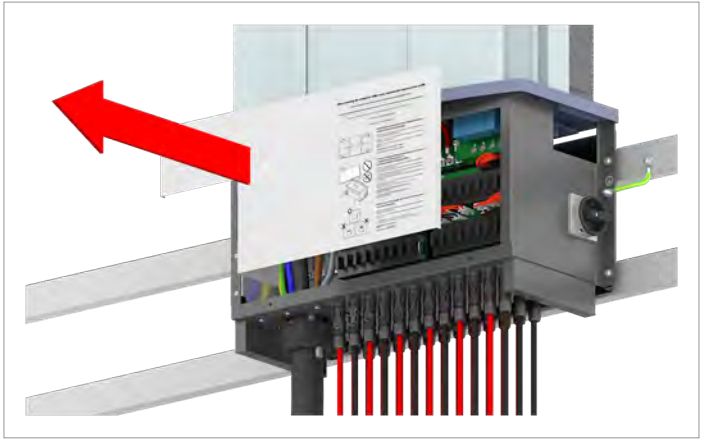
3. Wait at least 100 seconds until the internal capacitors have discharged.



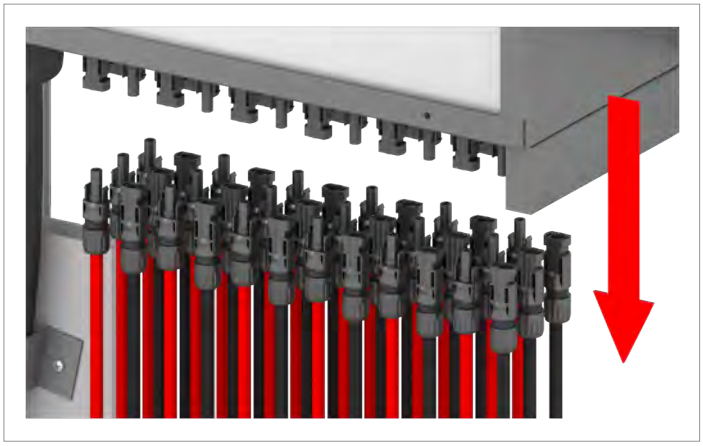
4. Unscrew and remove the junction box cover.



5. Measure with a voltmeter to check that there is no more voltage in the AC terminal block.
   → If you detect voltage, open the external load isolating switch.
   → If you detect no voltage, proceed to the next step.



6. Remove the cover in the interior of the junction box.



7. Use the mounting tool to release the DC cables and then pull them out.

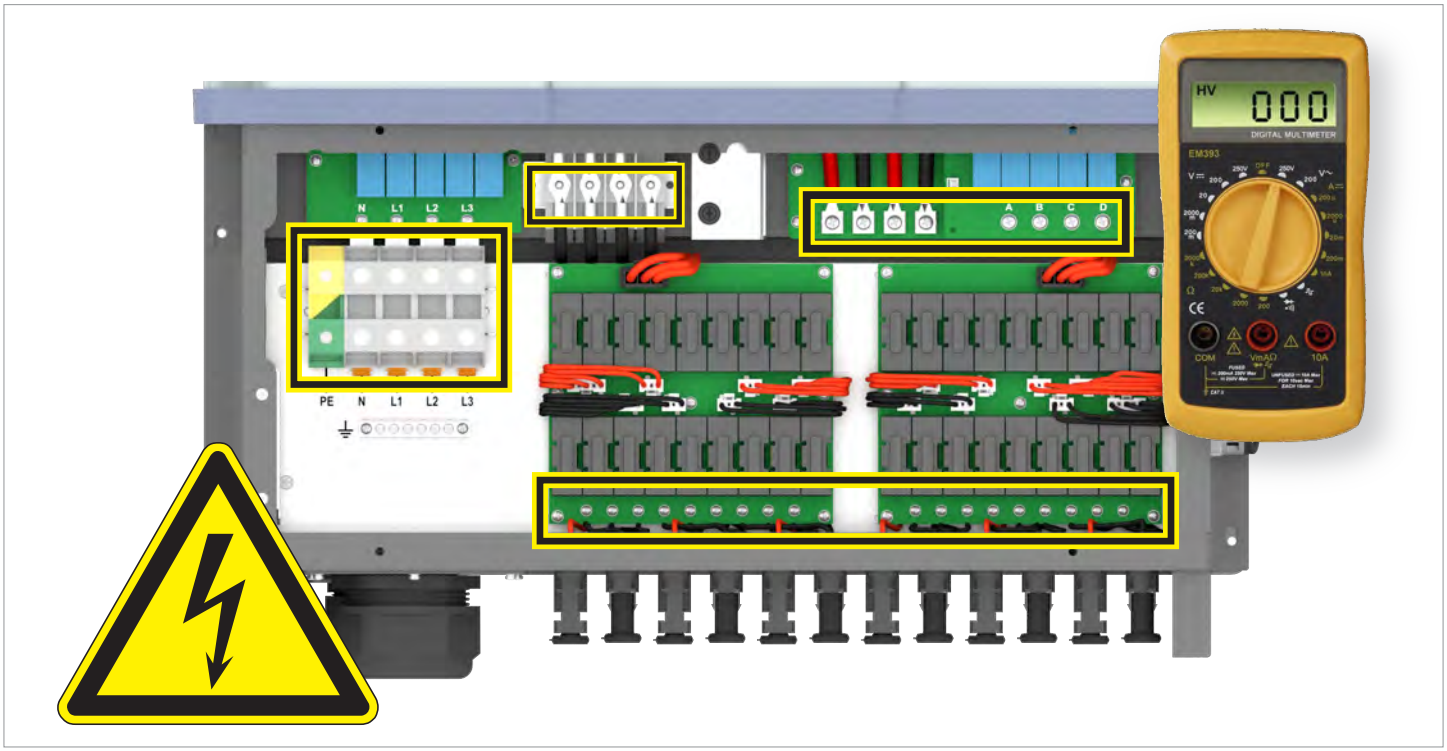
DANGER

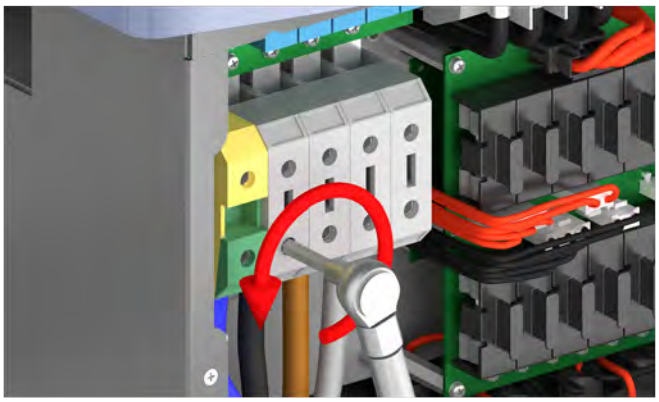
Electric shock

Voltage-carrying parts can still be live!

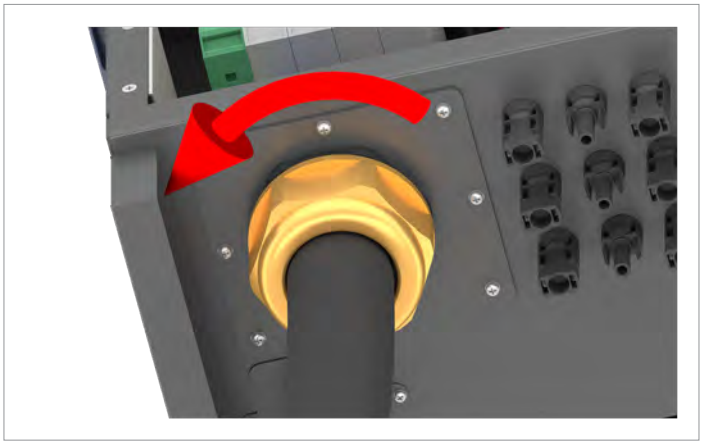
► Do not touch potentially voltage-carrying parts until these have been proven to be de-energized using a voltmeter!

8. Use a voltmeter to check that there is no more voltage in the danger zones.

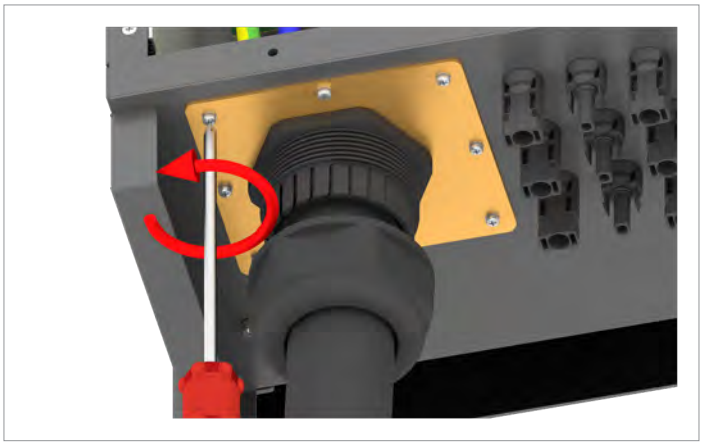




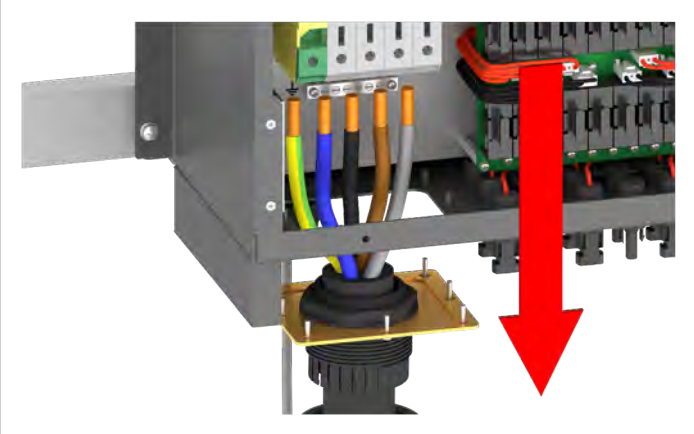
9. Unscrew the AC cable on the AC terminal block.



10. Unscrew the cable gland from the AC connection.

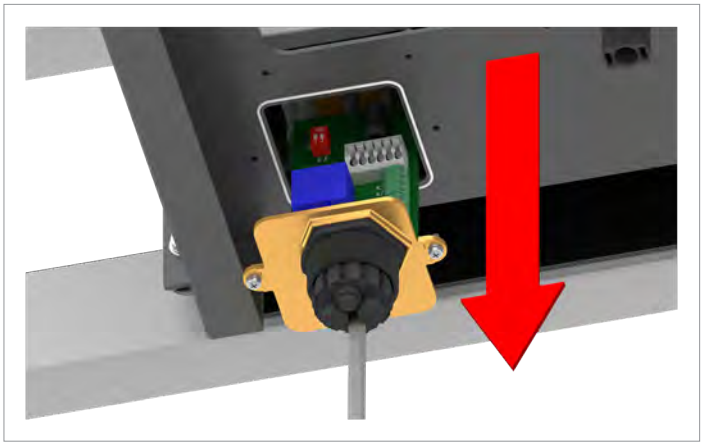


11. Unscrew the cover of the AC cable feed-through. and pull it out with the AC cable.

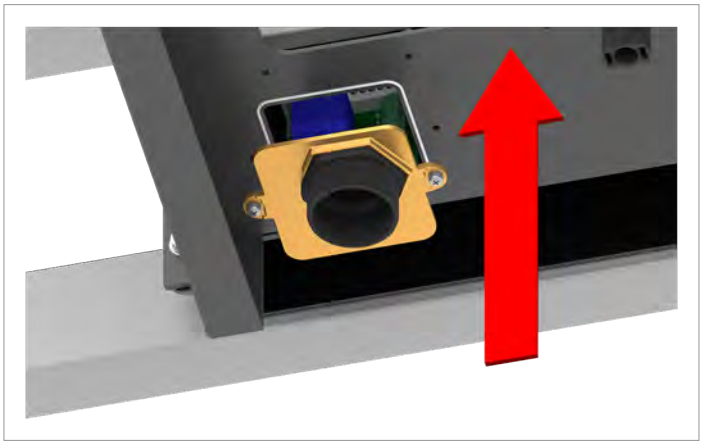


12. Unscrew the cable gland on the communication connection.

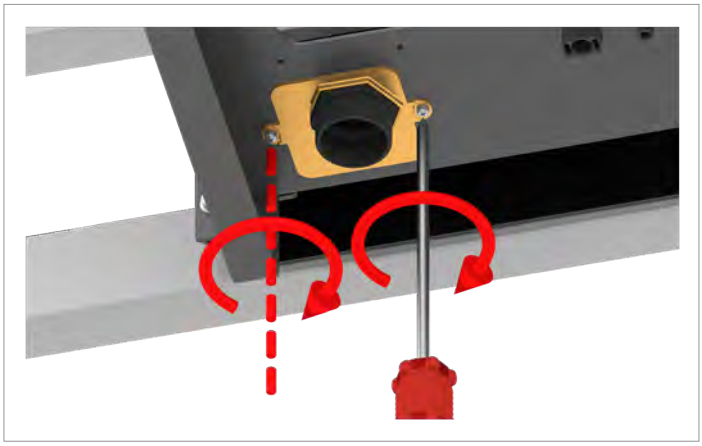
13. Unscrew the cover of the communication connection and pull it out carefully. The communications card is screwed onto the cover.



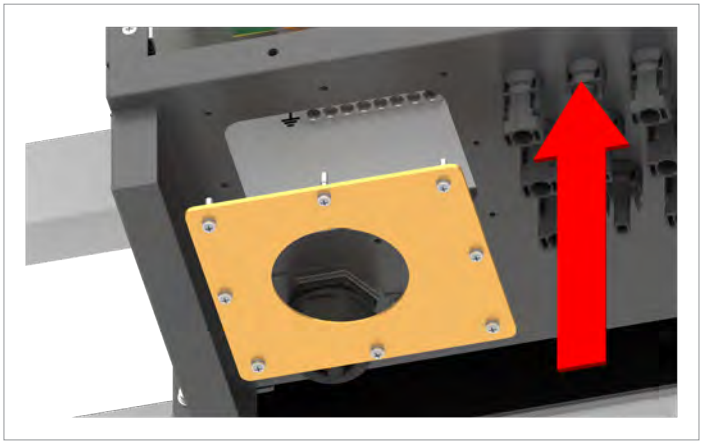
14. Remove all cables from the communications card and pull them out of the cable gland.



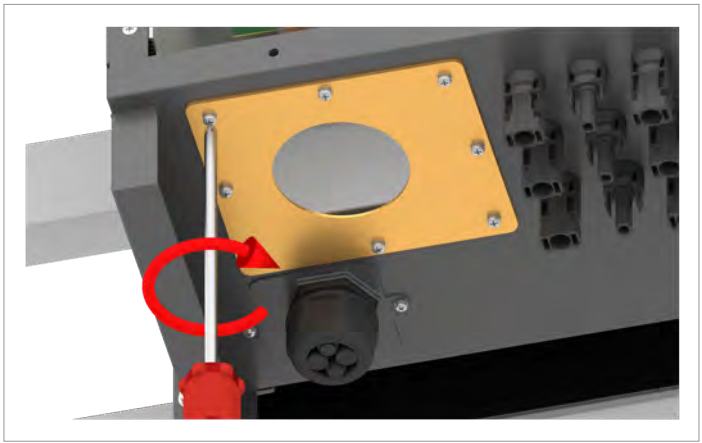
15. Insert the communications card cover and screw it in place.

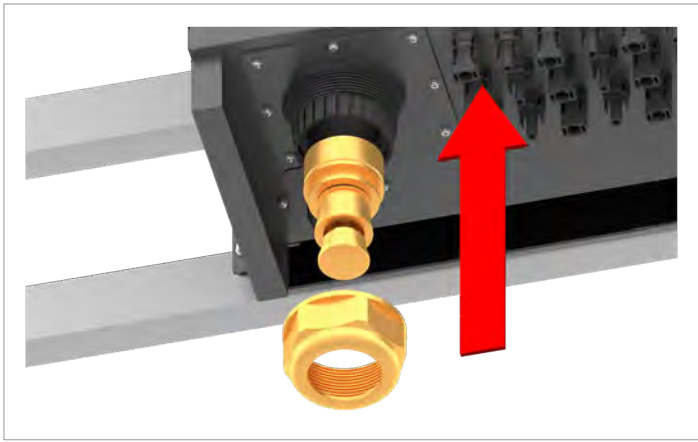


16. Insert the seals and cable gland of the communication connection and screw the cable gland in place.

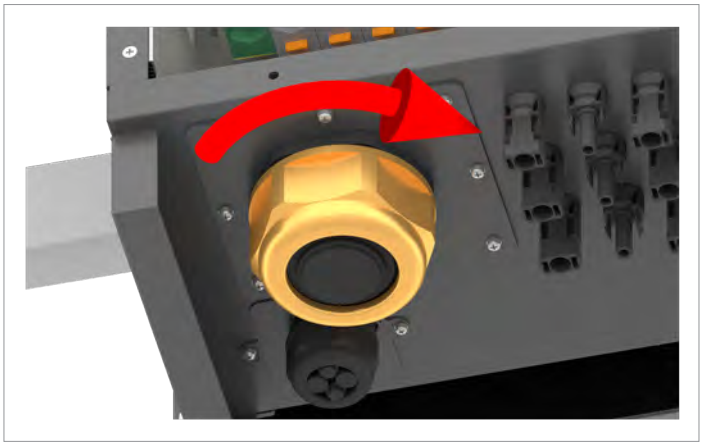


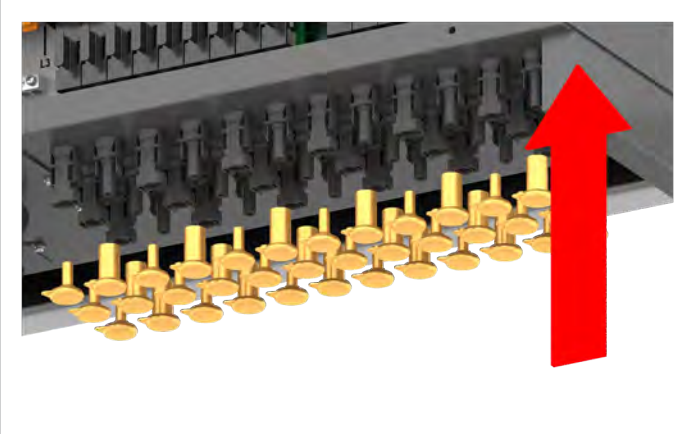
17. Fit the AC cable feed-through cover and screw it into place.





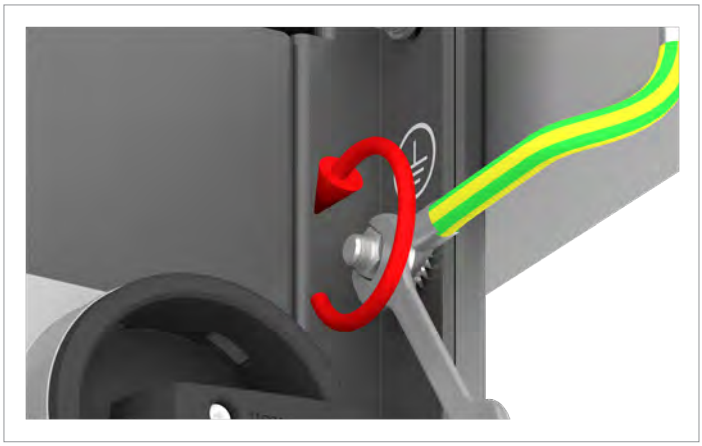
18. Insert the seals and cable gland of the AC cable feed-through and screw the cable gland in place.

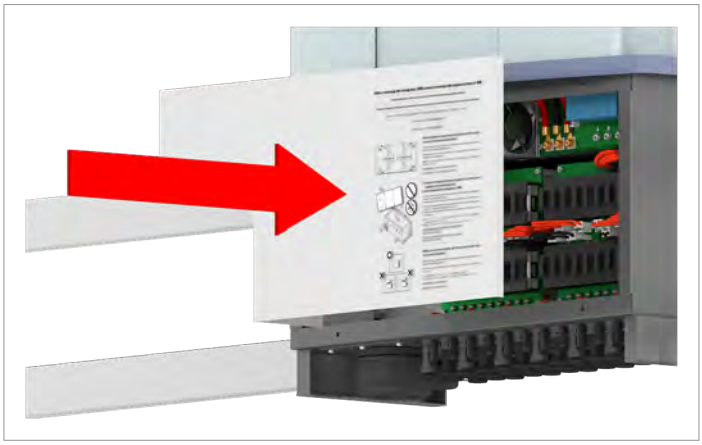




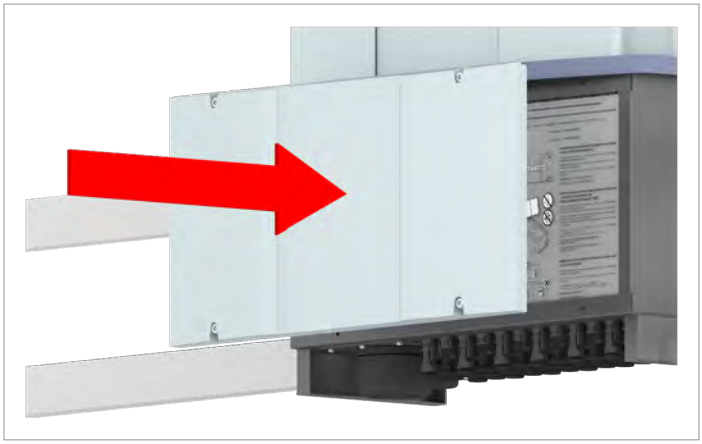
19. Insert the sealing caps for the DC connections.

20. Unscrew the grounding cable.





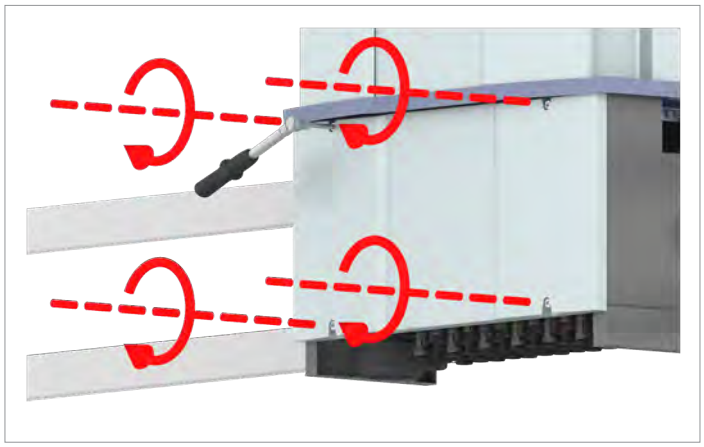
21. Insert the cover in the interior of the junction box.



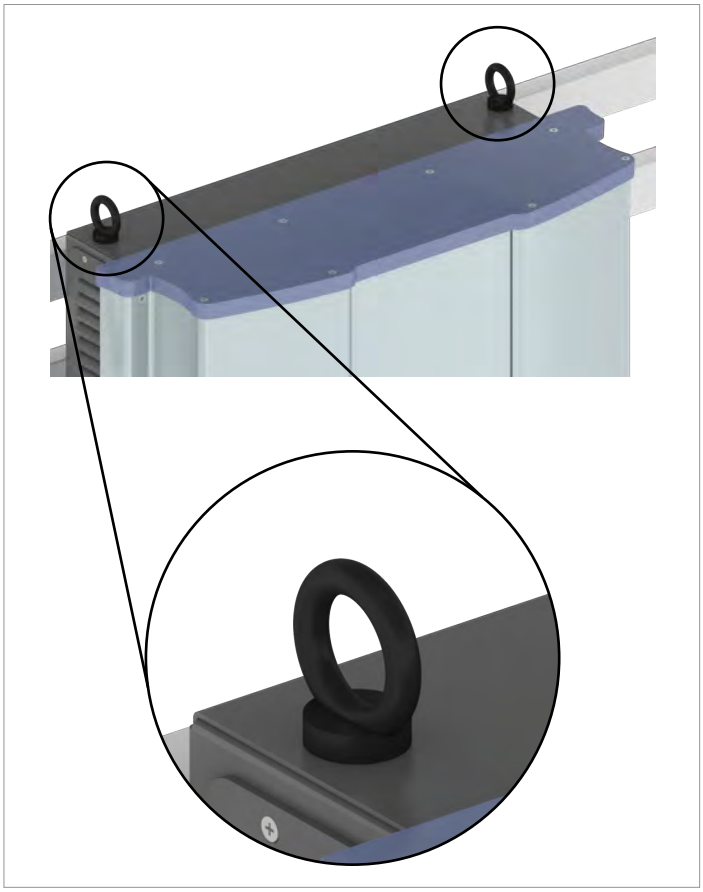
22. Fit the terminal box cover and screw it into place.

13 Decommissioning

Disconnecting the inverter from external voltage sources

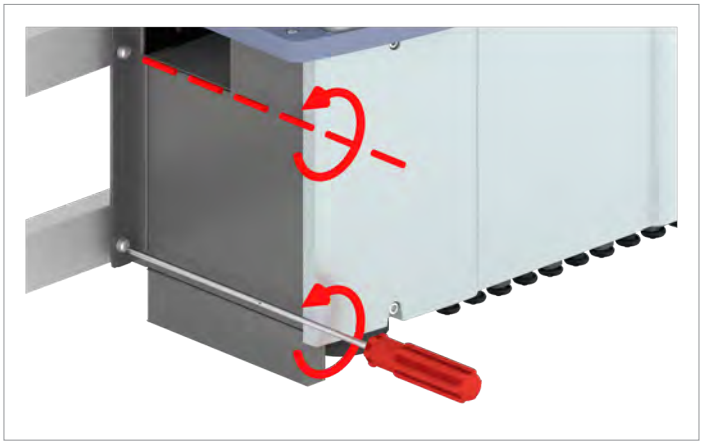


13.3 Removing the inverter

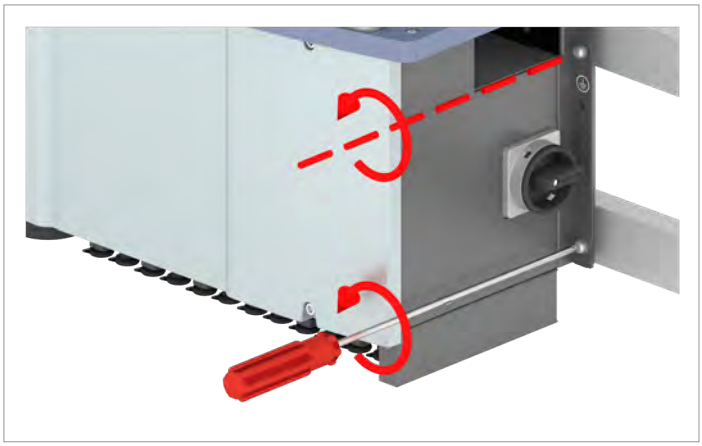


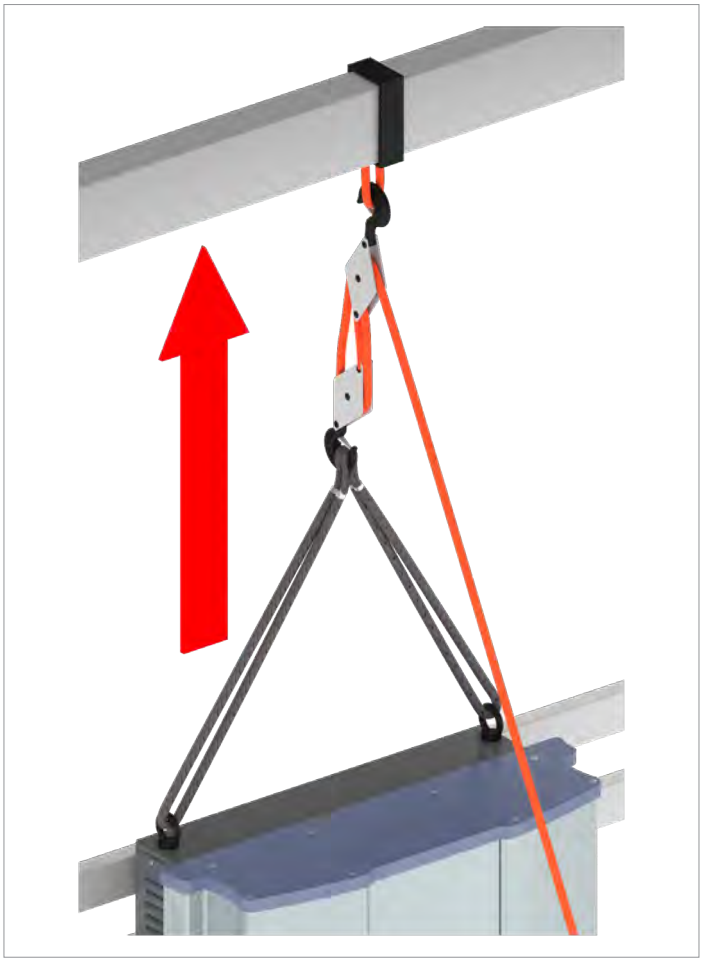
23. Screw the eyebolts onto the top side of the inverter. The screw eyebolts are not included in the scope of delivery.

24. Secure the inverter with a block and tackle or with crane so that the weight will be suspended from the block and tackle after the mounting screws are loosened.



25. Unscrew the junction box from the mounting plate.





26. Lift the inverter using a block and tackle or crane.

27. Place the inverter in the original box along with all of the accessory parts.

28. Store the inverter under the necessary environmental conditions (e.g. Storage temperature, see “14. Technical data”, p. 228).

14. Technical data

Input (DC)	M88H_122 (CF)	
for AC nominal voltage	**400 V_{AC}**	**480 V_{AC}**
Recommended maximum PV power	90 kW_P	110 kW_P
Maximum input power (total / per input)		
Symmetrical design	76 kW / 38 kW	91 kW / 45.5 kW
Asymmetrical design	45.6 kW / 30.4 kW	54.6 kW / 36.4 kW
Rated power	70 kW	84 kW
Maximum input voltage	1100 V_{DC}	
Operating input voltage range	200 ... 1000 V_{DC}	
Nominal voltage	595 V_{DC}	710 V_{DC}
Cut-in voltage	250 V_{DC}	
Cut-in power	150 W	
MPP input voltage range	200 ... 1000 V_{DC}	
MPP input voltage range with full power		
Symmetrical design	540 ... 800 V_{DC}	650 ... 800 V_{DC}
Asymmetrical design (60% / 40%)	650 / 440 V_{DC}	780 / 520 V_{DC}
MPP input voltage range at rated power		
Symmetrical design	500 ... 800 V_{DC}	600 ... 800 V_{DC}
Asymmetrical design (60% / 40%)	580 / 390 V_{DC}	710 / 475 V_{DC}
Asymmetrical design	60/40%; 40/60%	
Maximum total input current (DC1 / DC2)	140 A (70 A / 70 A)	
Maximum DC short-circuit current I_{SC}	180 A (90 A per DC input, 10 A per DC string)	
Maximum breaking current	120 A	
Open-circuit voltage VOC	1000 V	
Number of MPP trackers	Parallel inputs: 1 MPP tracker; Separate inputs: 2 MPP trackers	
Number of DC inputs, total (DC1/DC2)	18 (9 / 9)	
Electrical isolation	No	
Overvoltage category [1)]	II	
String fuses	15 A [2)]	
Surge protection devices [3)]	Type 2, replaceable	

Output (AC)	M88H_122 (CF)	
AC nominal voltage	**400 V_{AC}**	**480 V_{AC}**
Maximum apparent power [4)]	73 kVA [5)]	88 kVA [6)]
Rated apparent power [5)]	66 kVA	80 kVA
Nominal voltage [7)]	400 ± 30% Δ and Y / 480 V_{AC} ± 20% Δ and Y 3 phases + PE or 3 phases + N + PE	
Nominal current	96 A	
Maximum current	106 A	
Maximum current under fault conditions	115.4 A_{rms}	
Switch-on current	40 A / 100 µs	
Nominal frequency	50 / 60 Hz	
Frequency range [7)]	45 ... 65 Hz	
Configurable power factor	0.8 cap ... 0.8 ind	
Total harmonic distortion	<3% at rated apparent power	

Output (AC)	M88H_122 (CF)
DC injection	<0.5% at nominal current
Power loss in night mode	<3 W
Overvoltage category [1]	III
Surge protection devices [8]	Type 2, replaceable

Mechanical details	M88H_122 (CF)
Dimensions (W x H x D)	960 × 615 × 275 mm
Weight	84 kg (power module: 68 kg)
Cooling	3 fans
AC connection type	Phoenix Contact UKH 70
DC connection type	Multi-Contact MC4
Communication interfaces	2x RS485, 2x dry contacts, 1x external power-off, 6x digital inputs

General specifications	M88H_122 (CF)
Delta model name	RPI M88H_122
Delta part number	RPI883M122000
Maximum efficiency	98.8%
EU efficiency	98.5%
Operating temperature range	-25 ... +60 °C
Operating temperature range without derating	-25 ... +40 °C
Storage temperature range	-25 ... +60 °C
Relative humidity	0 ... 100%, non-condensing
Max. operating height	3000 m above sea level
Noise level (at a distance of 1 m)	75.8 dB(A)

Standards and guidelines	RPI M88H_12x
Protection degree	IP65
Safety class	I
Pollution degree	II
Overload behavior	Current limit, power limit
Safety	IEC 62109-1 / -2, CE-compliance
EMC	EN 61000-6-2, EN 61000-6-3
Fault-free operation	IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8
Harmonic distortion	EN 61000-3-2
Fluctuations and fibrillations	EN 61000-3-3
Mains connection guidelines	You will find the current list at www.solar-inverter.com.

[1] IEC 60664-1, IEC 62109-1
[2] The specified value applies for a temperature of 25 °C in the interior of the inverter. At higher temperatures, the value can drop down to 10 A.
[3] EN 50539-11
[4] For cos phi = 1 (VA = W)
[5] Can occur under the following conditions: DC input voltage > 540 V; symmetrical design; ambient temperature < 35 °C.
[6] Can occur under the following conditions: DC input voltage > 650 V; symmetrical design; ambient temperature < 35 °C.
[7] AC voltage and frequency range are programmed using the corresponding country specifications.
[8] EN 61463-11

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