Installation and Operation Manual

Solar Inverter
M70A_260 (Delta part number RPI703M260000)

Europe United Kingdom

This manual applies to the following inverter models:

- **M70A_260 (Delta part number RPI703M260000)**

with firmware versions:

DSP1: 1.12 / DSP2: 1.12 / RED: 1.12 / COMM: 1.12 / ARC: 1.11 / SCM: 1.12 or higher

The Delta part number can be found on the type plate of the inverter. The firmware versions can be read out using the Delta Service Software (DSS).

Delta manuals undergo continuous revision in order to provide you with complete information about installing and operating our inverters. Therefore, before starting installation work, **always** consult solarsolutions.delta-emea.com to check whether a newer version of the Quick Installation Guide or of the Installation and Operation Manual is available.

This manual is intended for use by electrical installers who are trained and approved for installation and commissioning of grid-connected solar inverters.

The information in this manual is to be treated as confidential and no part of this manual may be reproduced without prior written permission from Delta Electronics. The information in this manual may not be used for any purpose not directly connected to the use of the inverter.

All information and specifications can be modified without prior notice.

All translations of this manual that are not authorized by Delta Electronics (Netherlands) B.V. must be marked with the words "Translation of the original operating instructions."

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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 grid-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 chapter **1. About this manual**. The latter means that the contents are marked according to their meaning. Thus operations, names of buttons and error messages can always be recognized by their specific formatting.

The chapter **2. Basic safety instructions** identifies the safety risks associated with using the inverter. You **must** read this chapter 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 chapter **3. Intended purpose** . This chapter also describes purposes for which the use of the inverter is not permitted, even though in some cases they are similar to the purposes for which the inverter may be used.

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

The chapter **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.

There are multiple ways to commission the inverter after installation. The preparations required for each method are described in the chapter **6. Planning the Commissioning**.

The chapter **7. Installation** is a detailed step-by-step guide for all necessary and optional installation work. For example, this chapter describes how to install optional accessories, set up device communication and monitoring or connect cables. For smooth running, you must have made all necessary preparations beforehand according to the chapters **4. Product overview**, **5. Planning the installation** and **6. Planning the Commissioning**.

The various ways of commissioning the inverter are described in the chapter **8. Commissioning**. It is essential to read the chapter **6. Planning the Commissioning** before commissioning the system to ensure that it functions smoothly.

Error messages, their cause and measures for their rectification are listed in the chapter **9. Error events and troubleshooting**. Follow the instructions without fail. Never attempt to correct an error marked "Contact Delta Customer Service" yourself.

Maintenance and repair work that you can perform yourself is described in the chapter **10. Maintenance**. All other maintenance and repair work must only be carried out by Delta personnel or after consultation with Delta Customer Service.

A list of the most important technical data can be found in the chapter **11. Technical Data**. 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 to describe 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.

ATTENTION

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

A notice 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 work instructions 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 complete.

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

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 in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

You should therefore always carry out the following steps before working on the inverter:

1. Turn both DC isolating switches 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 restored accidentally.
3. Wait at least 60 seconds for the internal capacitors to discharge.

DANGER

Electric shock

Potentially fatal voltages are present at the DC connections of the inverter. 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 both DC isolating switches to the ***OFF*** position.
- ► Disconnect the connection to the grid so that the inverter cannot feed energy into the grid.
- ► Disconnect the inverter from all AC and DC voltage sources. Make sure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

The IP65 protection rating is no longer guaranteed when the door is open.

- ► Only open the door when absolutely necessary.
- ► Do not open the door if water or dirt might enter the inverter.
- ► After work is completed, ensure that the door is properly shut and tightened again. Check that the doors are properly sealed.

WARNING

Heavy weight

The inverter is heavy.

- ► The inverter must be lifted and carried by at least two people.

WARNING

Hot surfaces

The surface of the inverter can get very hot during operation.

- Always wear safety gloves when touching the inverter.

- To comply with 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 only be installed and commissioned by installers who have been trained and approved for the installation and operation of grid-connected solar inverters.
- All repair work on the inverter must be carried out by Delta Electronics. Otherwise the warranty will be void.
- Warning notices, warning symbols and other markings 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 commissioning.
- Do not disconnect any cables while the inverter is under load due to risk of an arc fault.
- To prevent damage due to lightning strikes, follow the applicable regulations in your country.
- Only equipment in accordance with SELV (EN 60950) may be connected to the RS485 interfaces.
- All external connections must be sufficiently sealed in order to ensure an IP65 protection rating. Seal any unused connections with the cover caps supplied.
- The covers inside the inverter do **not** have to be removed for the standard installation. All connections required for the standard installation are also accessible with the covers attached.
- Do not disconnect any cables while the inverter is under load due to risk of an arc fault.
- Only equipment in accordance with SELV (EN 60950) may be connected to the RS485 interfaces.

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 grid. 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 grid.
- 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 grid. The inverter has functions that prevent isolated operation.
- Use in mobile solar systems.

4. Product overview

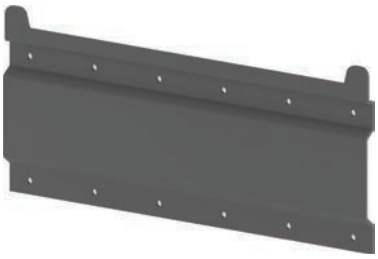
4.1 Scope of delivery

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

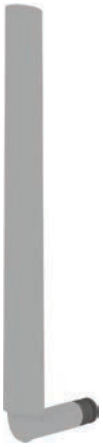
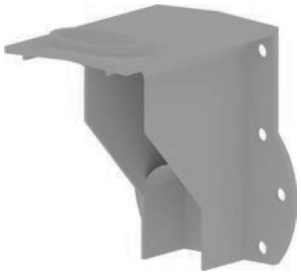
Do not use any damaged components.

Keep the packaging.

4.1.1 Inverter

Part		Description	Part		Description
Inverter	1		Mounting plate	1	For mounting the inverter 
Support bracket for DC cables	6	For supporting the weight of the DC cables 	Mounting tool for DC plug	2	For releasing the Amphenol H4 plugs from the DC connections of the inverter 
DC plug for DC+	18	Amphenol plug H4 for 4/6 mm² (H4C**F**C4D●MS) 	DC plug for DC–	18	Amphenol plug H4 for 4/6 mm² (H4C**M**C4D●MS) 
Quick Installation Guide	1		Allen key	1	For releasing the door screws and securing the open door from slamming shut. 

4.1.2 Sub-1G antenna

Sub-1G antenna	1		Bracket	1	For mounting the Sub-1G antenna to the inverter. 
Mounting screws	3	For screwing the bracket onto the inverter; screws with spring washer and washer 			

4.1.3 Accessories to be ordered separately

Accessories for floor mounting

Feet for floor mounting	2	For screwing the inverter onto the floor 	Mounting screws	2	For mounting the feet to the inverter; machine screw with spring washer and washer 

Wi-Fi module

Wi-Fi module	1		Mounting screws	2	Screws with spring washer and washer 

4.2 Overview of components and connections

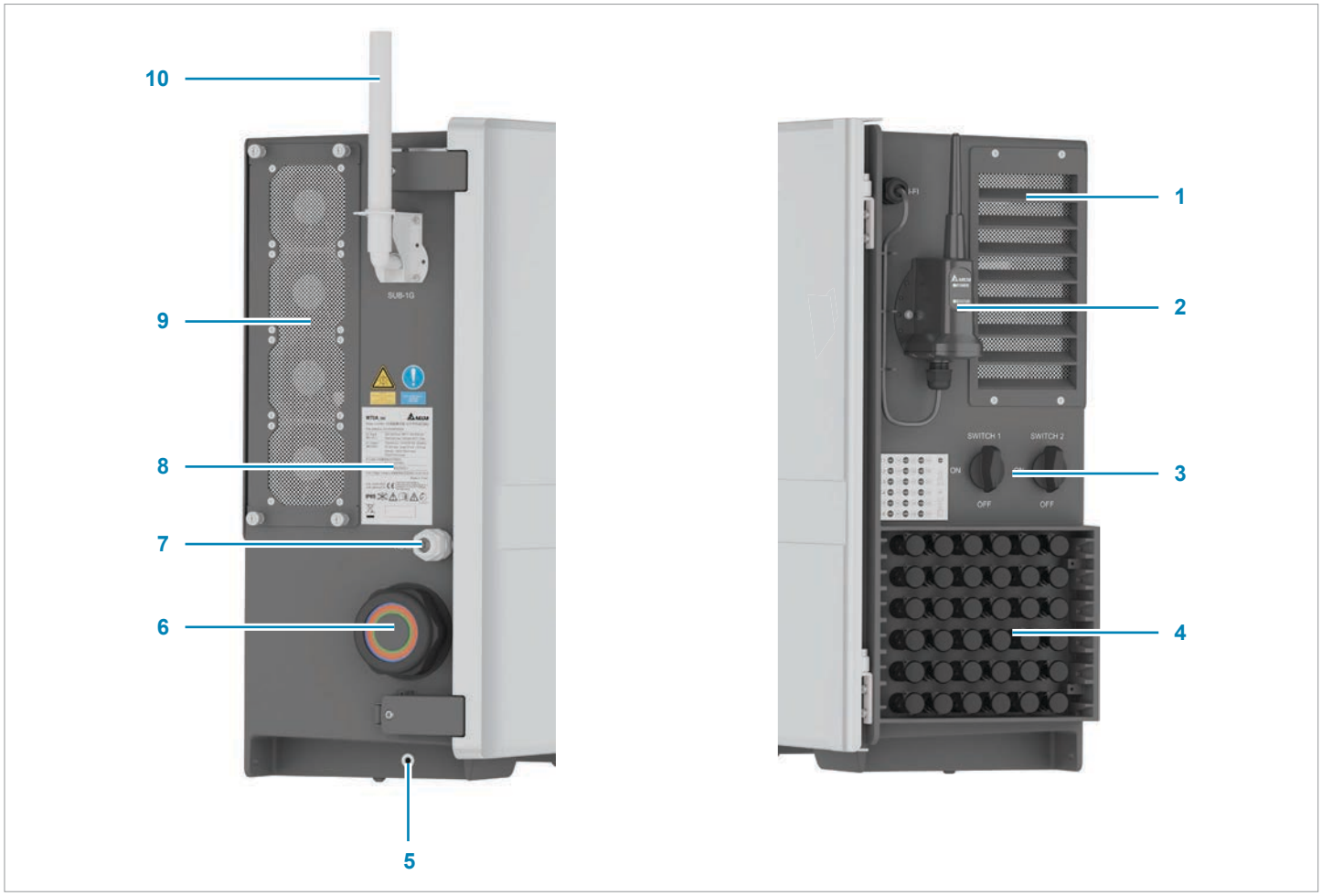


Fig. 4.1: Overview of external components and connections

1	Air outlet
2	Wi-Fi module (optional accessory)
3	DC isolating switch 1+2
4	DC connector panel
5	Grounding connection
6	AC cable gland
7	Cable gland for RS485, digital inputs, dry contacts, external power-off
8	Type plate
9	Air inlet with fan module
10	Sub-1G antenna

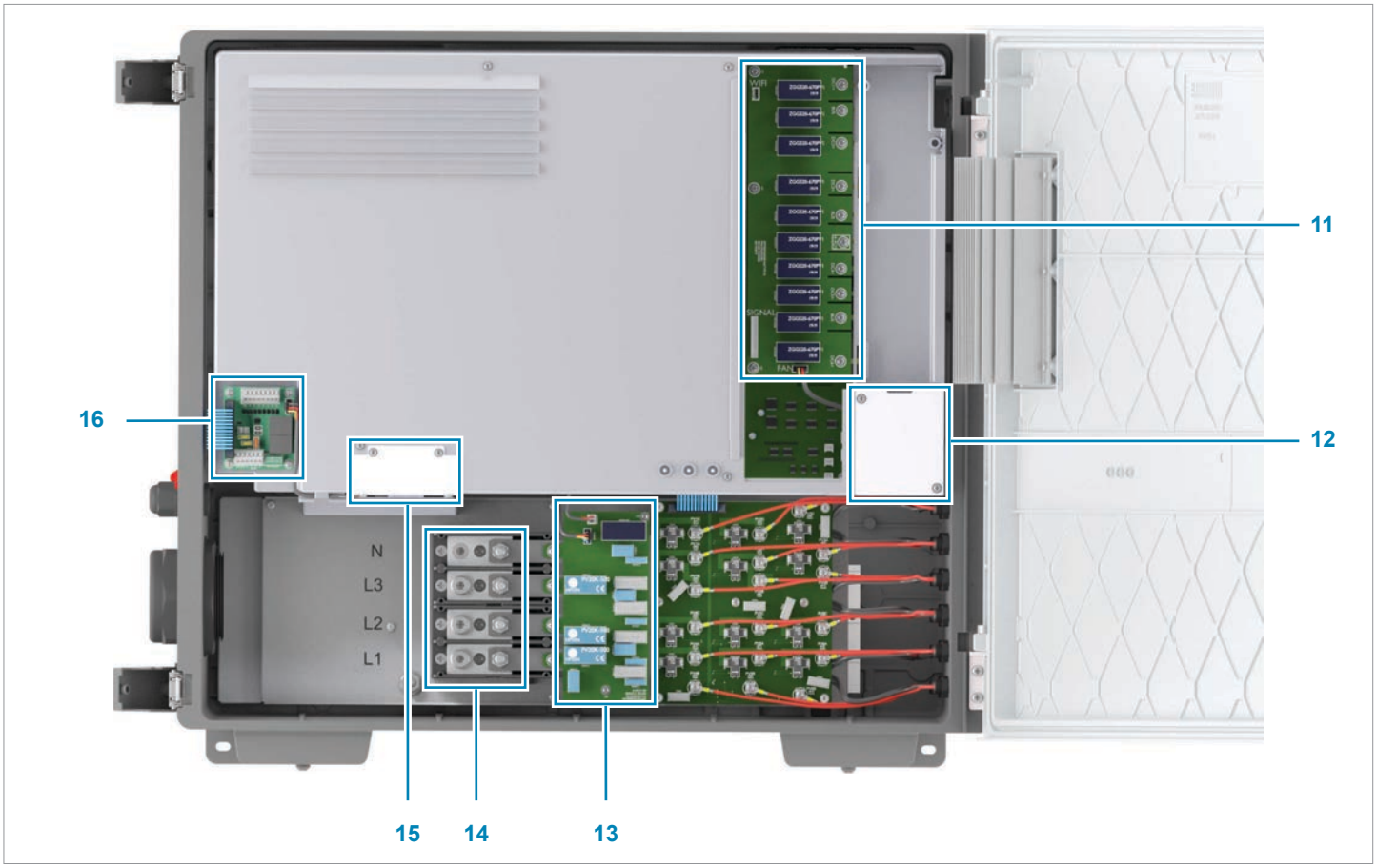
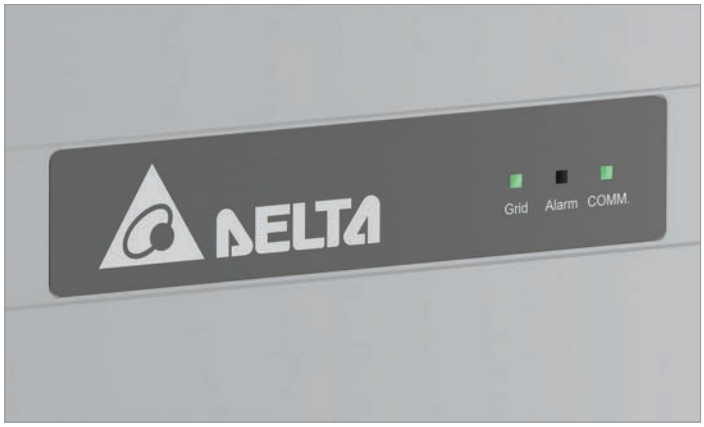


Fig. 4.2: Overview of components inside the inverter

11 Type 2 DC surge protection devices
12 Internal fan 2
13 Type 2 AC surge protection devices
14 AC connection terminals
15 Internal fan 1
16 Connection terminals for RS485, digital inputs, external power-off and dry contacts

4.3 LEDs



GRID	Grid	LED Green
ALARM	Alarm	LED Red/yellow
COMM.	Communication	LED Red/yellow/green

Table 4.1.: Use and color of the LEDs

○	LED is off.		
☀	LED flashes yellow.	☀	LED lights up yellow.
☀	LED flashes green.	☀	LED lights up green.
☀	LED flashes red.	☀	LED lights up red.

Table 4.2.: Meaning of the LED symbols used in this manual

GRID	ALARM	Explanation
		Countdown (inverter is starting up).
		The inverter is connected to the grid.
		Error. Power-off via external signal.
		Warning.
		Solar system failure.
		Solar system warning.
		No DC. Also appears when both DC isolating switches are open.
		Updating firmware.
		Standby mode.

Table 4.3.: Meaning of the LED displays on the inverter

4.4 AC-side components

4.4.1 AC cable gland

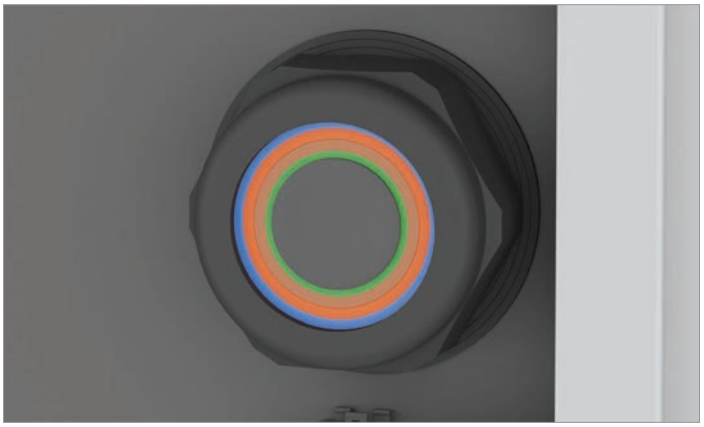


Fig. 4.3: Position of the AC cable gland

The AC cable gland consists of several sealing rings for different cable diameters.

Related topics

“5.4 Grid connection (AC)”, page 34
“7.10.3 AC cable gland”, page 85

4.4.2 AC connection terminal

Fig. 4.4: Position of the AC terminal

The inverter is suitable for 3-phase grids with/without neutral conductor.

The PE connection is realized as a separate bolt. The M10 nut, spring washer and washer are already mounted in the inverter.

Related topics

"5.4 Grid connection (AC)", page 34

"5.4.10 AC terminal block specifications", page 36

"5.4.11 Specification for copper cable", page 36

4.4.3 Type-2 AC surge protection devices

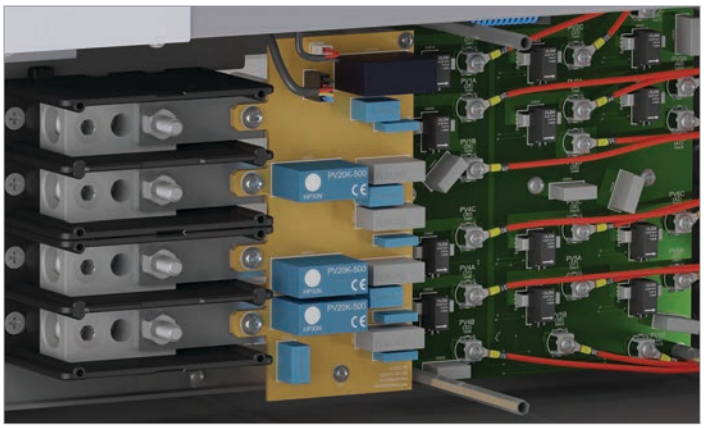


Fig. 4.5: View of type 2 AC surge protection devices with the cover removed

The inverter has replaceable type-2 AC surge protection devices which protect the inverter against excessive voltages. The type-2 AC surge protection devices are replaced as a block.

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}

Table 4.4.: Specification of the pre-installed type-2 AC surge protection devices

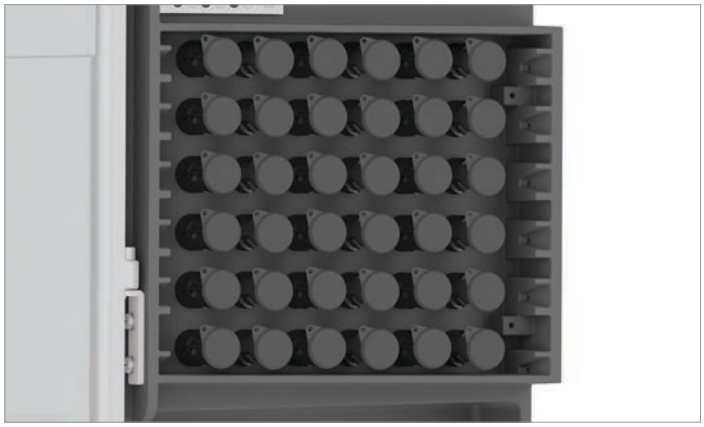
Type 1+2 combined AC surge protection devices can be ordered as accessories.

Related topics

"10.10 Replacing the AC surge protection devices", page 132

4.5 DC-side components

4.5.1 DC connector panel



The DC connector panel has 18 pairs of DC connectors (6 MPP trackers with 3 pairs of DC connectors each).

Plug type:

- DC+: Amphenol H4 for 4/6 mm² (Amphenol part number H4C**F**C4D●MS)
- DC–: Amphenol H4 for 4/6 mm² (Amphenol part number H4C**M**C4D●MS)

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

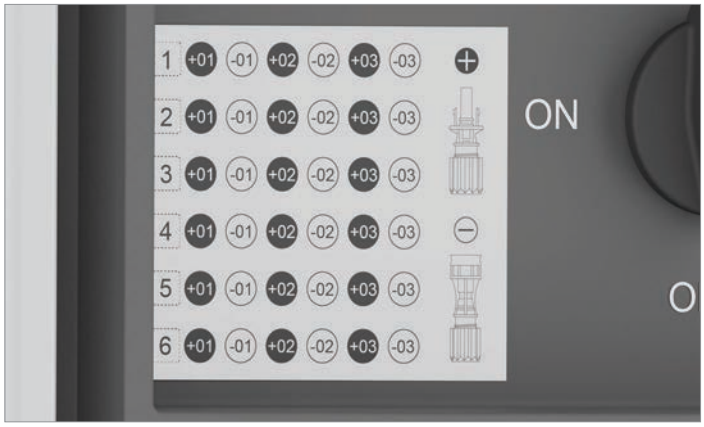


Fig. 4.7: Label showing the assignment of each DC connector

The assignment of the individual DC connectors to the strings is shown on a label.

Related topics

“5.5 Connecting the solar modules (DC)”, page 37
“7.11 Connecting the solar modules (DC)”, page 88

4.5.2 DC isolating switches

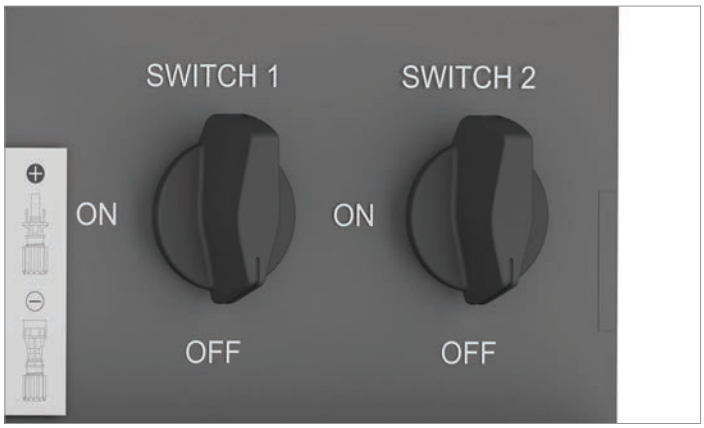


Fig. 4.8: Position of the two DC isolating switches

The DC isolating switches are marked on the inverter with "SWITCH 1" and "SWITCH 2".

DC isolating switch 1 separates the DC strings of MPP trackers 1 to 3.

DC isolating switch 2 separates the DC strings of MPP trackers 4 to 6.

Germany: The DC isolating switches meet the requirements of VDE 0100-712.

France: The DC isolating switches meet the requirements of UTE 15-712-1.

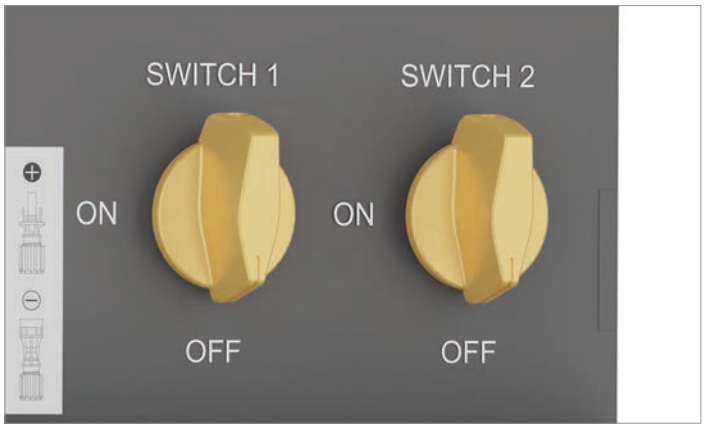


*Fig. 4.9: Both DC isolating switches in the **OFF** position = the connection to the solar modules is disconnected*

The connection between the inverter and the solar modules is**disconnected** when both DC isolating switches are in the ***OFF*** position.

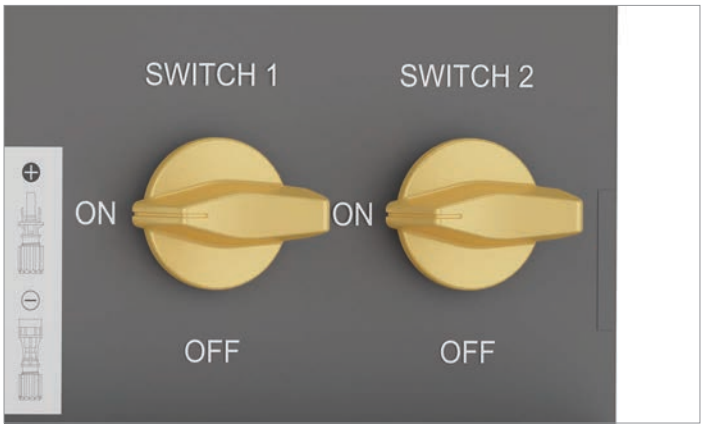


*Fig. 4.10: Both DC isolating switches in the **ON** position = the connection to the solar modules is closed*

The connection between the inverter and the solar modules is**closed** when both DC isolating switches are in the ***ON*** position.

4.5.3 Type 2 DC surge protection devices

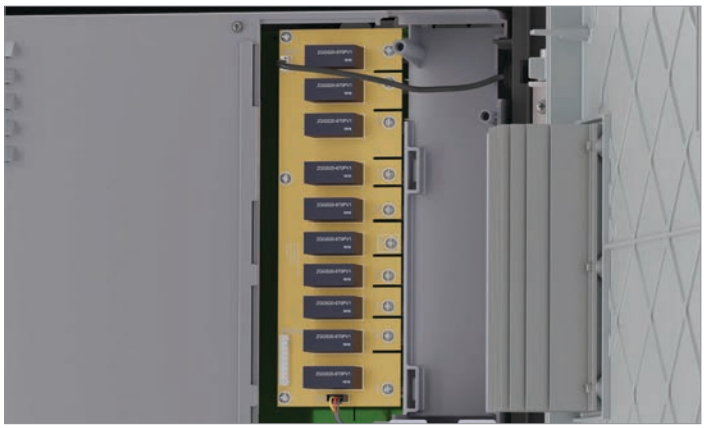


Fig. 4.11: Position of the type 2 DC surge protection devices with the cover removed

The inverter has replaceable type-2 DC surge protection devices which protect the inverter against excessive voltages. The type-2 DC surge protection devices are replaced as a block.

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

Table 4.5.: Specification of the pre-installed type-2 DC surge protection devices

Type 1+2 combined DC surge protection devices can be ordered as accessories.

Related topics

"7.6 Installing the type 1+2 combined DC surge protection devices before commissioning (optional)", page 60
"10.9 Replacing the DC surge protection devices", page 127

4.6 Communication connection

Fig. 4.12: Position of the cable gland for the communication cables

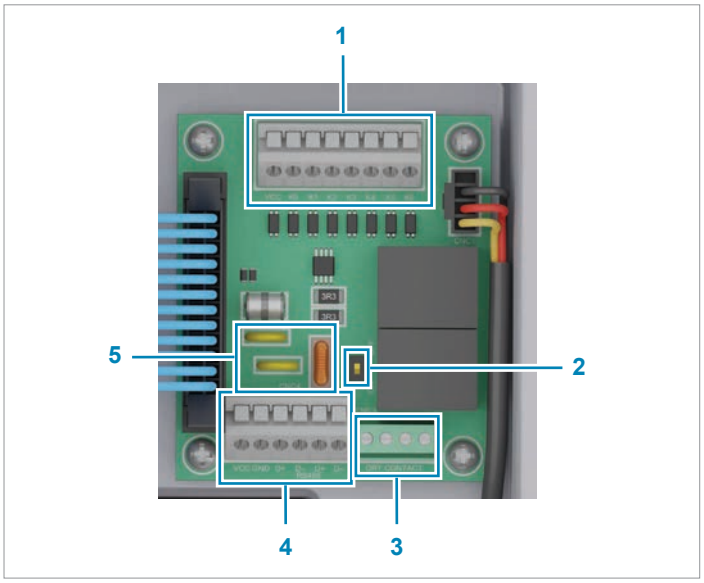


Fig. 4.13: Components of the communication card

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

Connection	Connector type
2 x RS485 (DATA+ and DATA–)	Terminal block
1 x VCC (12 V, 0.5 A)	Terminal block
6 x digital inputs	Terminal block
2 x dry contacts	Terminal block
1 x external power-off (EPO)	Terminal block

Table 4.6.: Connections on the communication card

Cable type	Shielded and twisted pair cable (CAT5 or CAT6)
Cable diameter	7.2 mm
Wire cross-section	0.25 to 1.5 mm^2

Table 4.7.: Specification of the communication cable

Related topics

"5.6 Mains and system protection", page 40
"7.7 Connecting the communication card", page 64

4.7 Grounding connection

4.7.1 External grounding connection

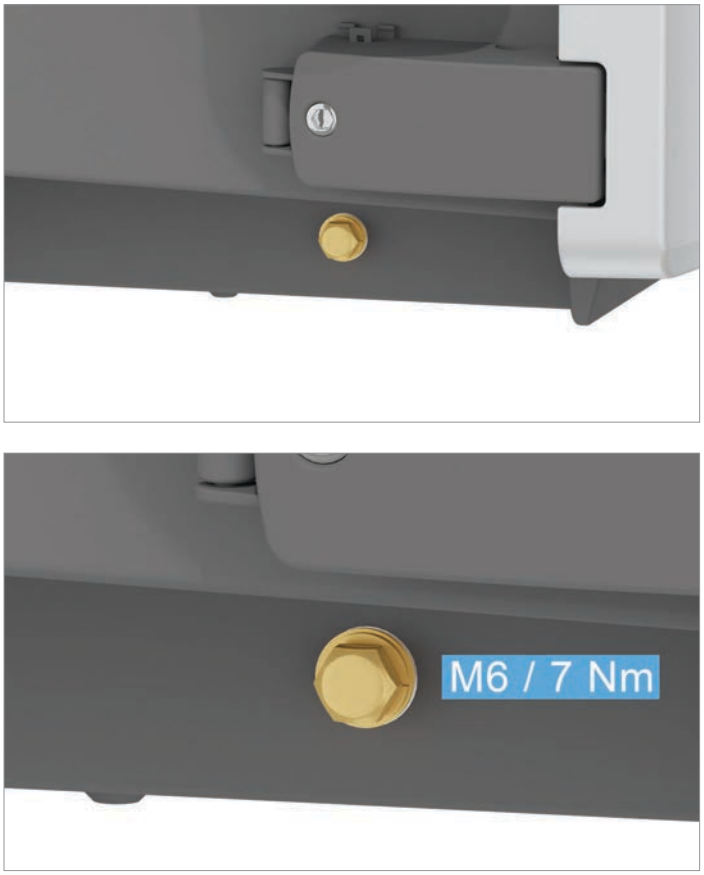


Fig. 4.14: Position of the external grounding connection on the left foot of the inverter

The M6 screw, spring washer and washer are included in the scope of delivery. A toothed washer is not required**.**

Related topics

"5.4.6 Grounding the inverter", page 35

4.7.2 Internal PE connection

Fig. 4.15: Position of the internal PE connection

The M10 nut, spring washer and washer are already mounted in the inverter. A toothed washer is not required.

Related topics

"5.4.6 Grounding the inverter", page 35

4.8 Cooling system

4.8.1 Air inlet, air outlet and fan module

Fig. 4.16: Position of the air inlet with fan module on the left side

Fig. 4.17: Position of the air outlet on the right side

The air for cooling is drawn in through the air inlet on the left side of the inverter. The heated air is released back to the environment through the air outlets on the right side of the inverter.

The fan module can be replaced.

Related topics

"10.7 Cleaning/replacing the fan module", page 121
"10.8 Cleaning the air outlets", page 125

4.8.2 Internal fans

The internal fans circulate the air inside the inverter to prevent heat buildup.

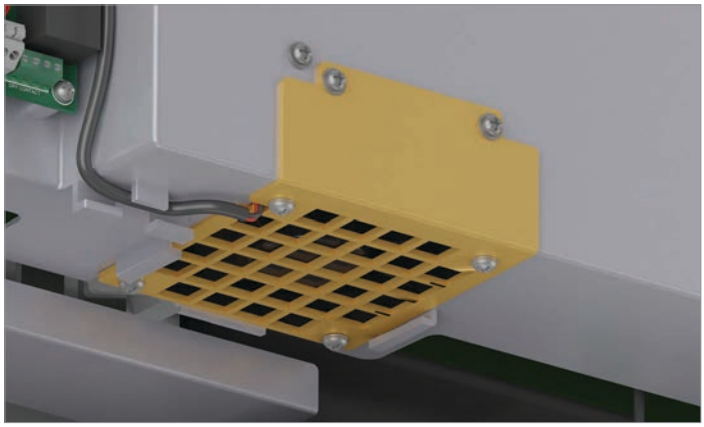


Fig. 4.18: Position of internal fan 1

Fig. 4.19: Position of internal fan 2

Related topics

“10.5 Clean/replace internal fan 1”, page 112

“10.6 Clean/replace internal fan 2”, page 116

4.8.3 Internal heat sinks

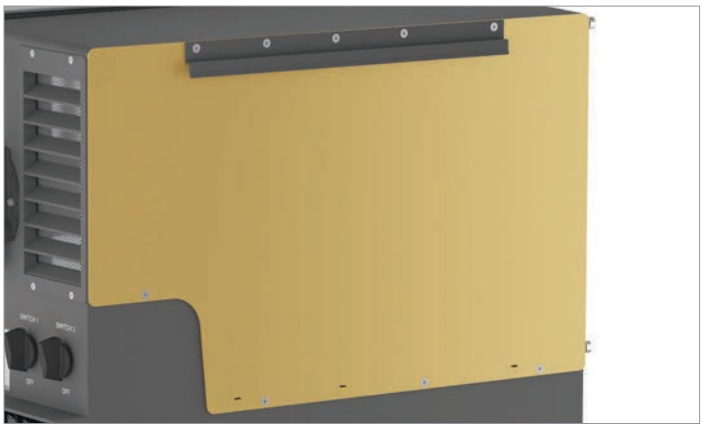


Fig. 4.20: Rear cover plate

The rear cover plate can be removed.

4.9 Sub-1G antenna

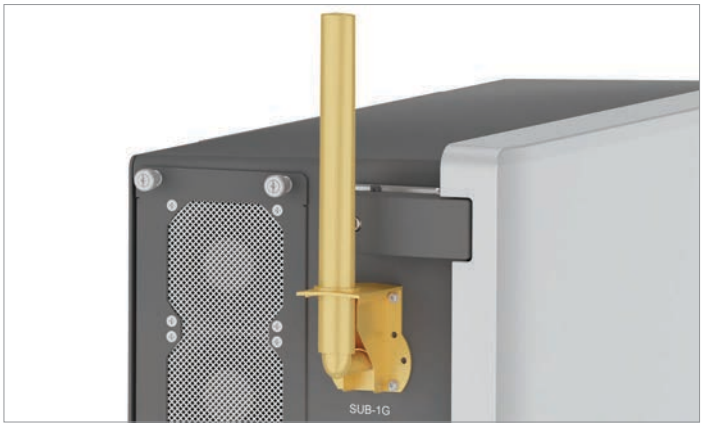


Fig. 4.21: Position of the Sub-1G antenna

Sub-1G antenna and mounting materials are included in the scope of delivery.

Related topics

“6. Planning the Commissioning”, page 48
“7.8 Installing the Sub-1G antenna (optional)”, page 77

4.10 Wi-Fi module

Fig. 4.22: Position of the Wi-Fi module

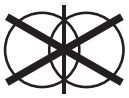
The Wi-Fi module is an accessory that must be ordered separately.

Related topics

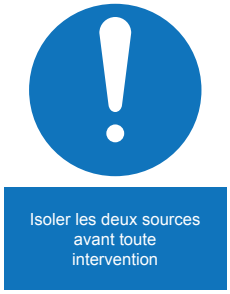
“6. Planning the Commissioning”, page 48
“7.9 Installing the Wi-Fi module before commissioning (optional)”, page 80

4.11 Type plate and other markings

Fig. 4.23: Position of the type plate and other markings

Information on the type plate	Description
 60 seconds	**Risk of death due to electric shock** Potentially fatal voltage is present inside the inverter during operation and this voltage remains present for up to 60 seconds after disconnection from the power supply.
	Before working on the inverter, read the supplied manual and follow the instructions provided.
	This inverter is not separated from the grid by a transformer.
	The inverter housing must be grounded if this is required by local regulations.
	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.

For France

Warning notice	Description
	**For France: Warning notice according to UTE 15712-1** Attention: Présence de deux sources de tension - Réseau de distribution - Panneaux photovoltaics
	**For France: Warning notice according to UTE 15712-1** Isoler les deux sources avant toute intervention

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.

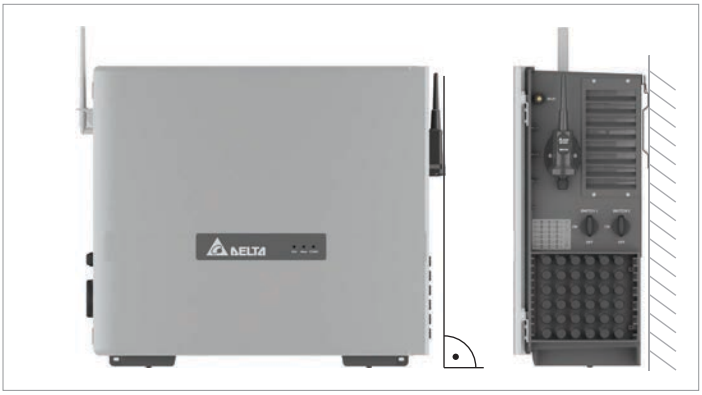
5.1 Installation location

5.1.1 Requirements for the wall or mounting system

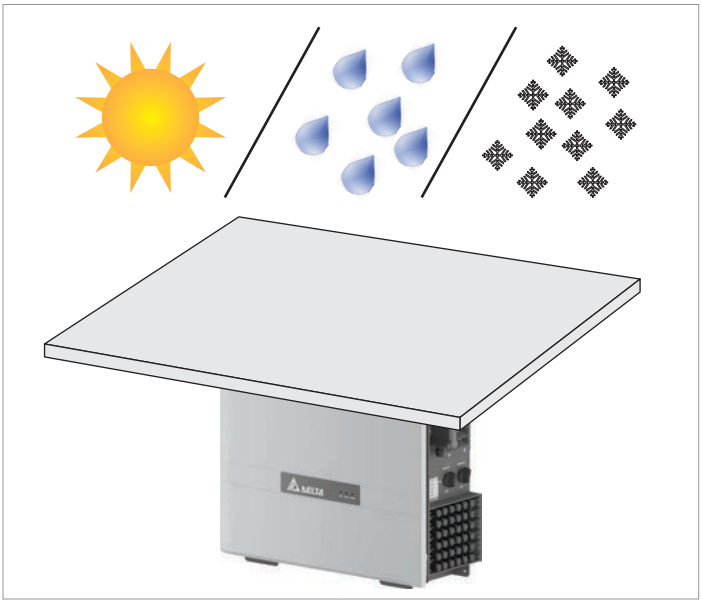
- ► The inverter can be suspended or mounted in a standing position. Mounting feet are available for floor mounting and must be ordered separately.
- ► The inverter is heavy. The wall, floor and mounting system must be able to bear the heavy weight of the inverter.
- ► Always use the mounting plate supplied with the inverter when mounted in a suspended position.
- ► 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, choose the installation location carefully.
- ► Mount the inverter on a fireproof wall.

5.1.2 Mounting alignment

- ► Mount the inverter vertically.



5.1.3 Outdoor installations



- ► 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.

5.1.4 Lifting and transporting the inverter

- ► The inverter must be lifted and carried by at least two people.

5.1.5 Installation clearances

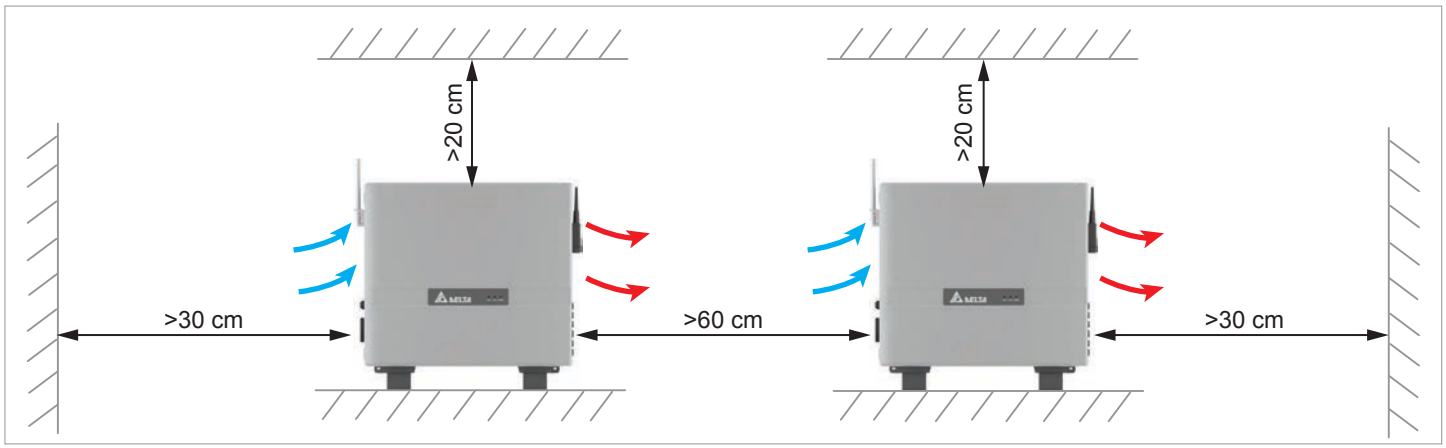


Fig. 5.24: Installation clearances and air circulation

- ► Observe the minimum bend radius of the cables used (especially the AC cable)!
- ► Ensure the accessibility of the side components (air filters, fan module, AC cable gland, DC connector panel, etc.) for maintenance and repair work.
- ► Allow space to the front to open the door.
- ► Ensure sufficient air circulation. There must not be heat buildup around the inverter.
- ► Position multiple inverters so that they do not heat each other up.
- ► Observe *Operating temperature range without derating* the *Total operating temperature range* (see “11. Technical Data”, page 144). When the *Operating temperature range without derating* is exceeded, the inverter reduces the AC power fed into the grid. When the *Total operating temperature range* is exceeded, the inverter stops feeding AC power into the grid. This is normal operating behavior for the inverter and is necessary to protect the internal electronics.
- ► In areas with many trees or fields, plant parts can clog the air filters and obstruct the air flow.

Special instructions for mounting in a standing position

In principle, the inverter can be mounted directly onto the floor or directly onto the roof in the case of roof systems.

However, if there is a risk of flooding (for example in heavy rain) or snow drifts, you should place the inverter in an elevated position.

For example, if there is a circumferential boundary wall on the roof, it can be used for installation.

Fig. 5.25, p. 28Shows example use of mounting brackets so that the inverter is positioned off the ground. The cable duct is located behind the inverter.

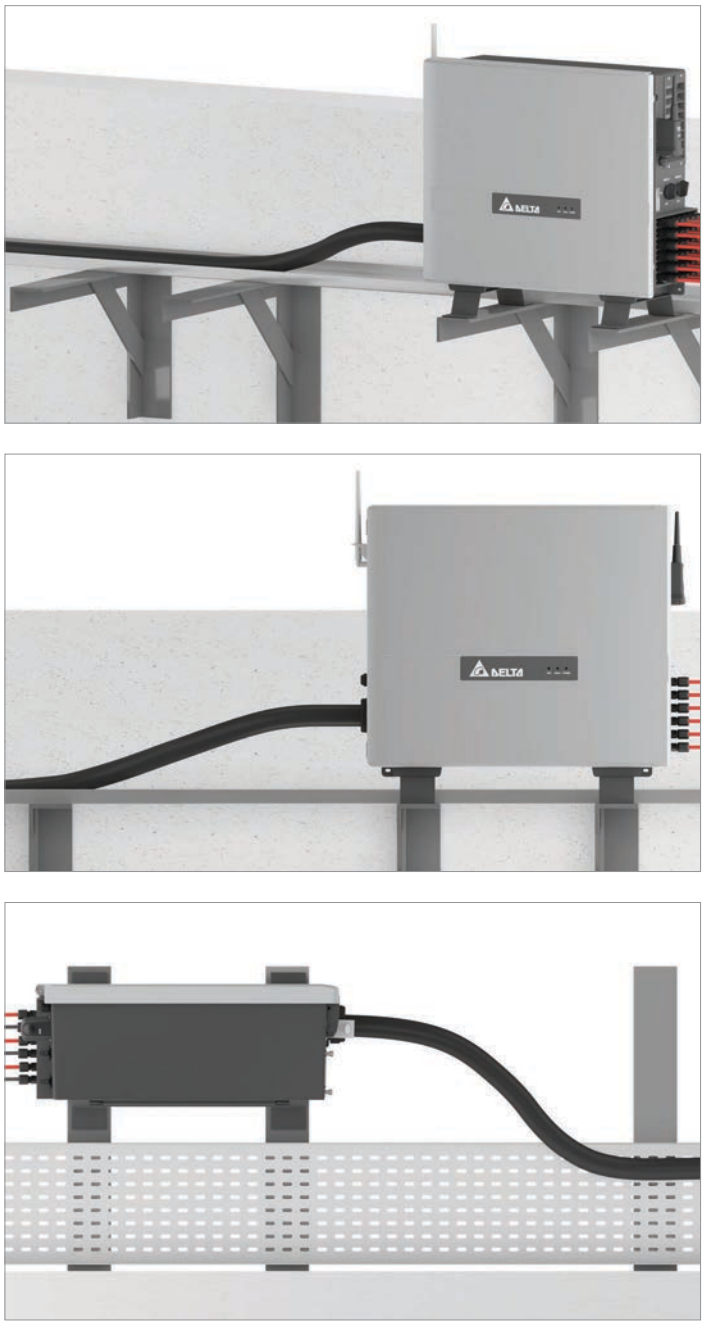


Fig. 5.25: Standing installation with clearance from the ground

5.2 Characteristic curves

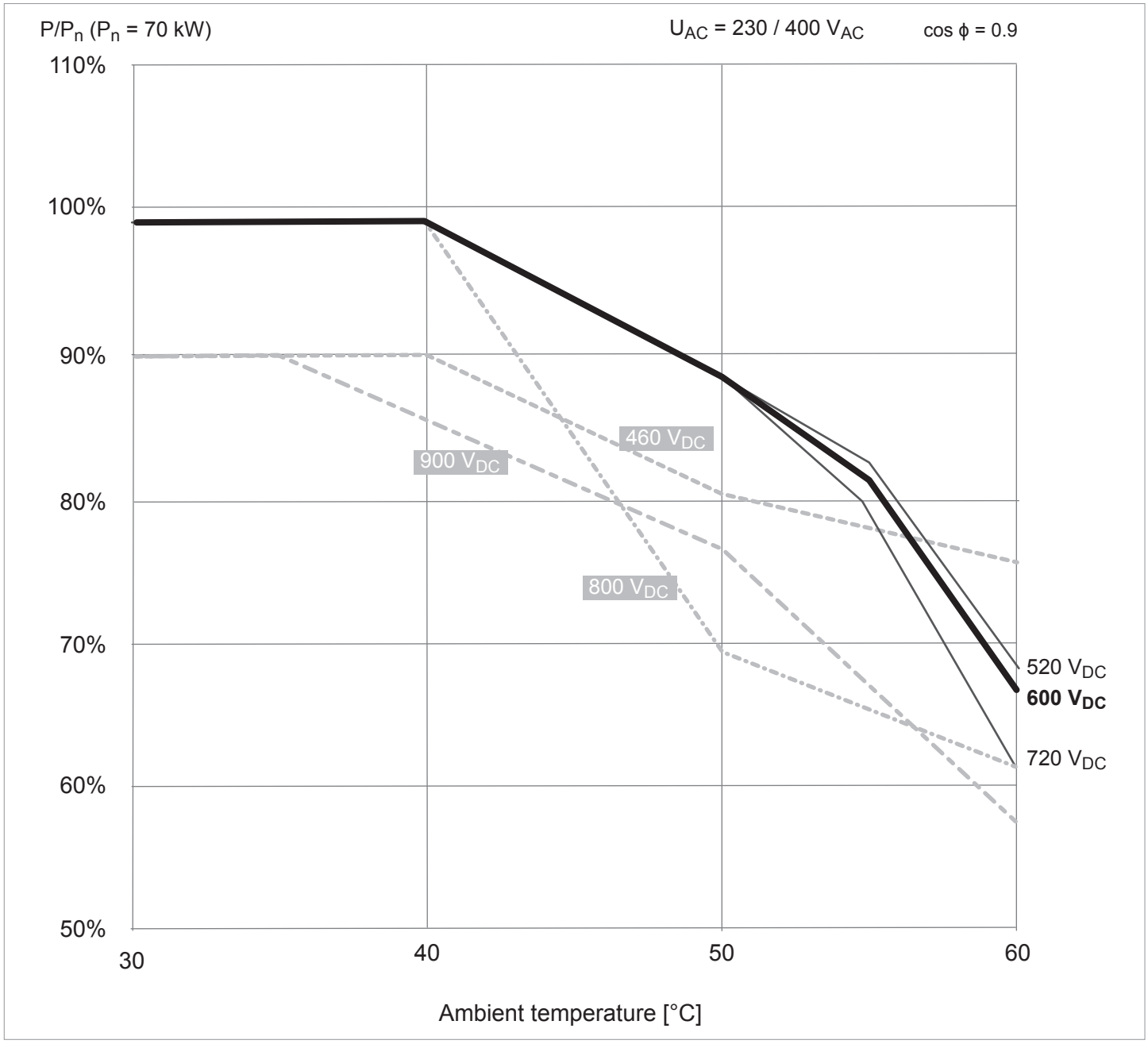


Fig. 5.26: Characteristic curve "Active power control depending on the ambient temperature, cos φ = 0.90, AC voltage 230/400 V"

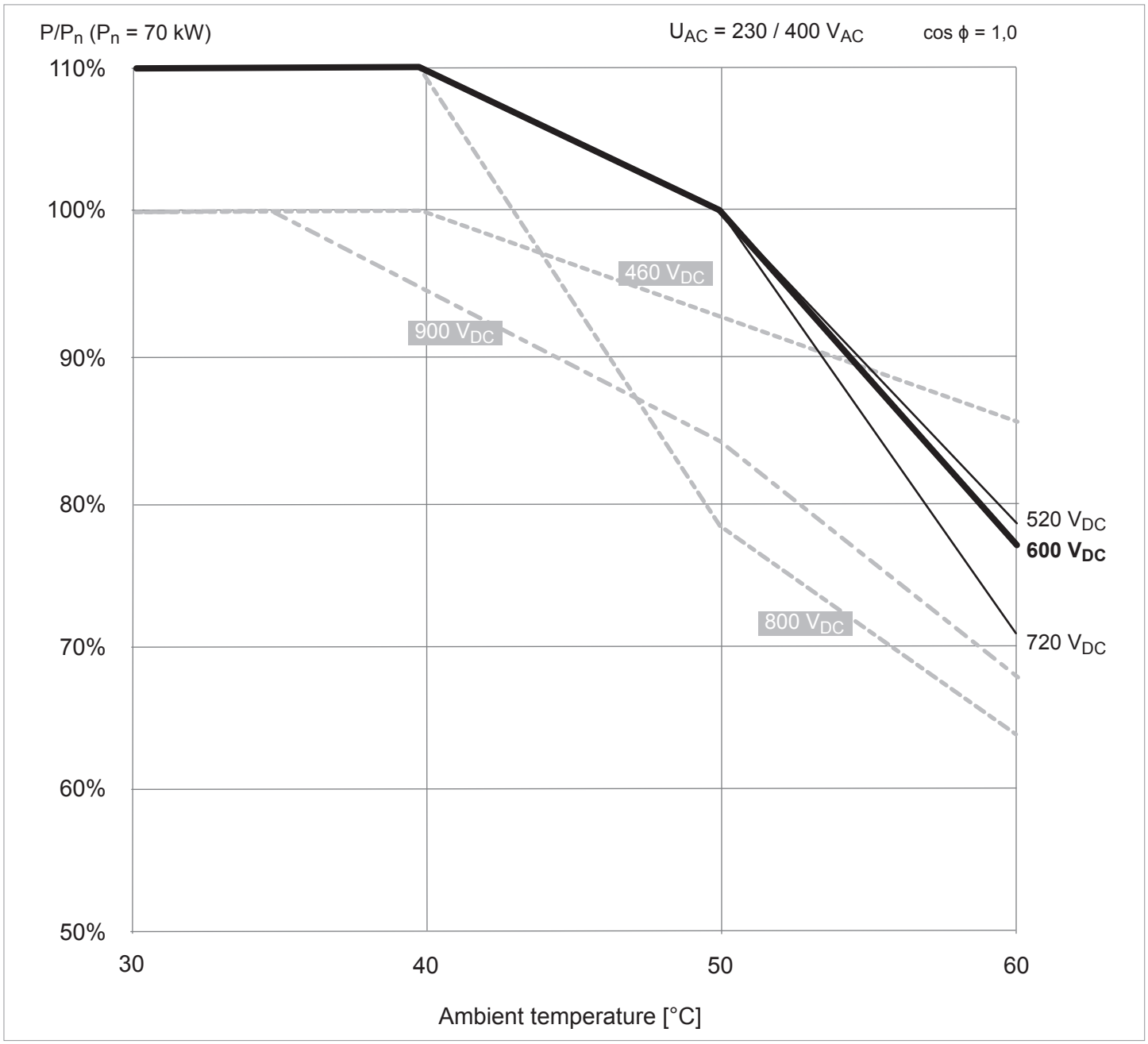


Fig. 5.27: Characteristic curve "Active power control depending on the ambient temperature, cos φ = 1.00, AC voltage 230/400 V"

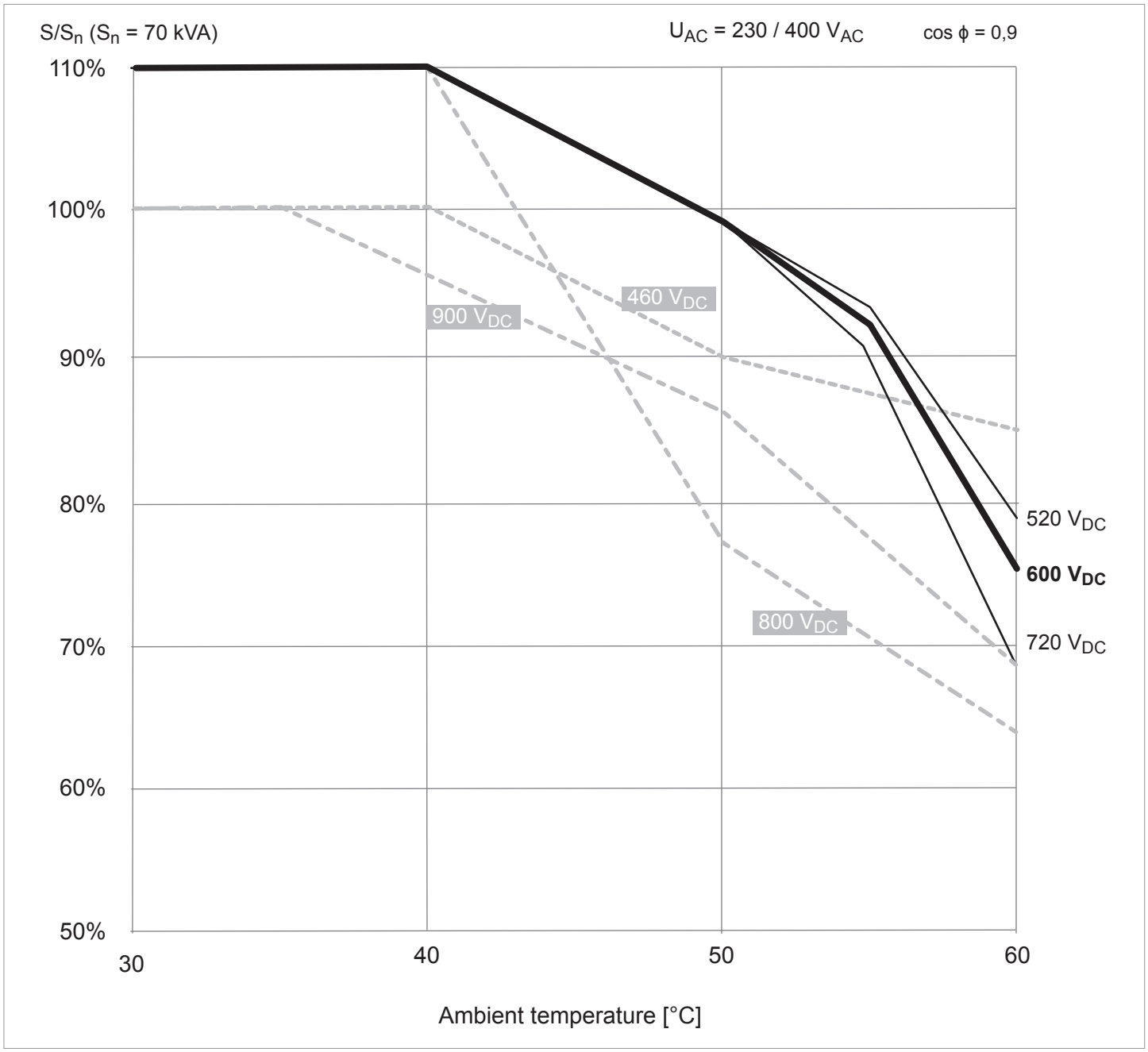


Fig. 5.28: Characteristic curve "Apparent power control depending on the ambient temperature, cos φ = 0.90, AC voltage 230/400 V"

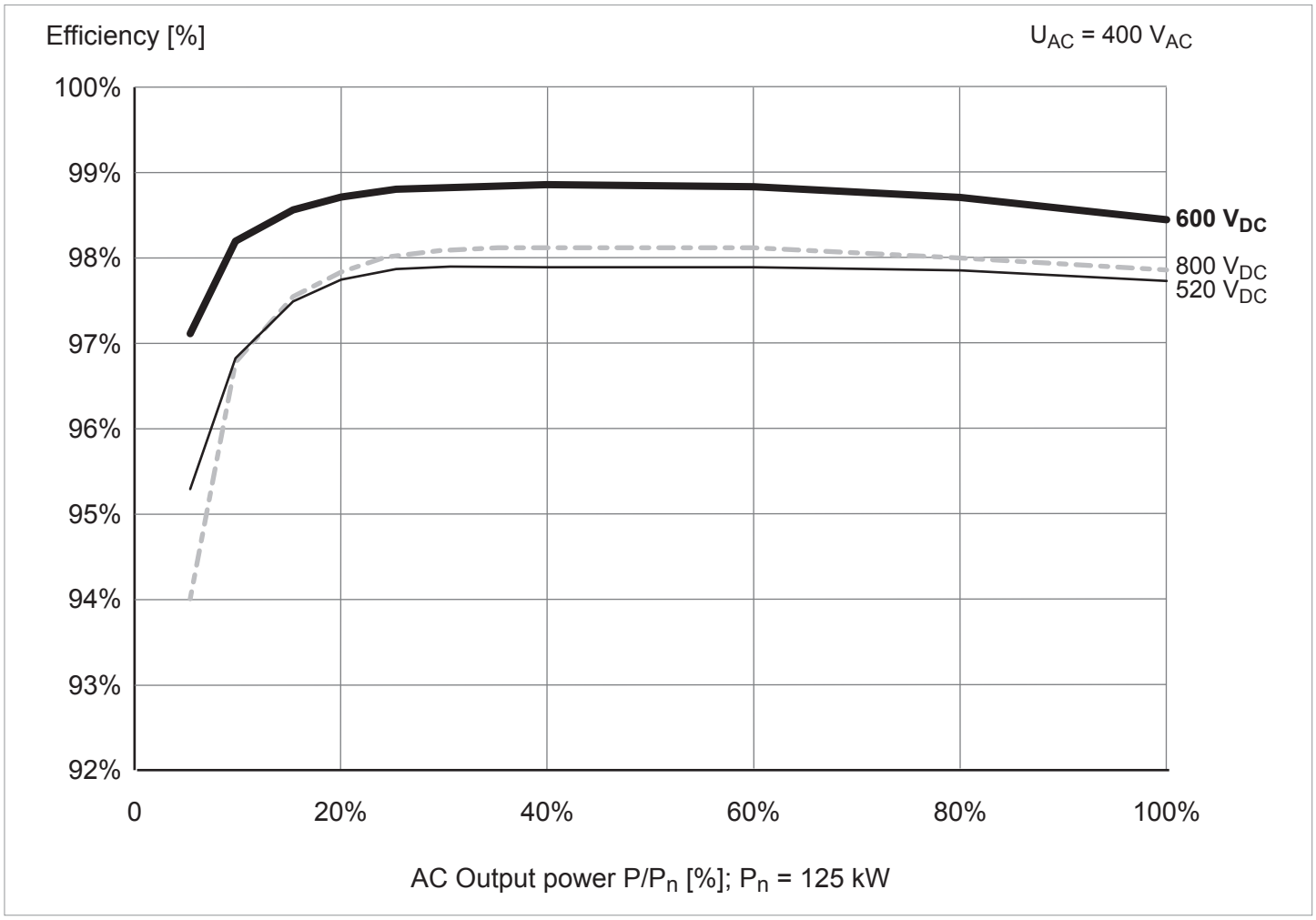


Fig. 5.29: Efficiency characteristic curve

5.3 Dimensions

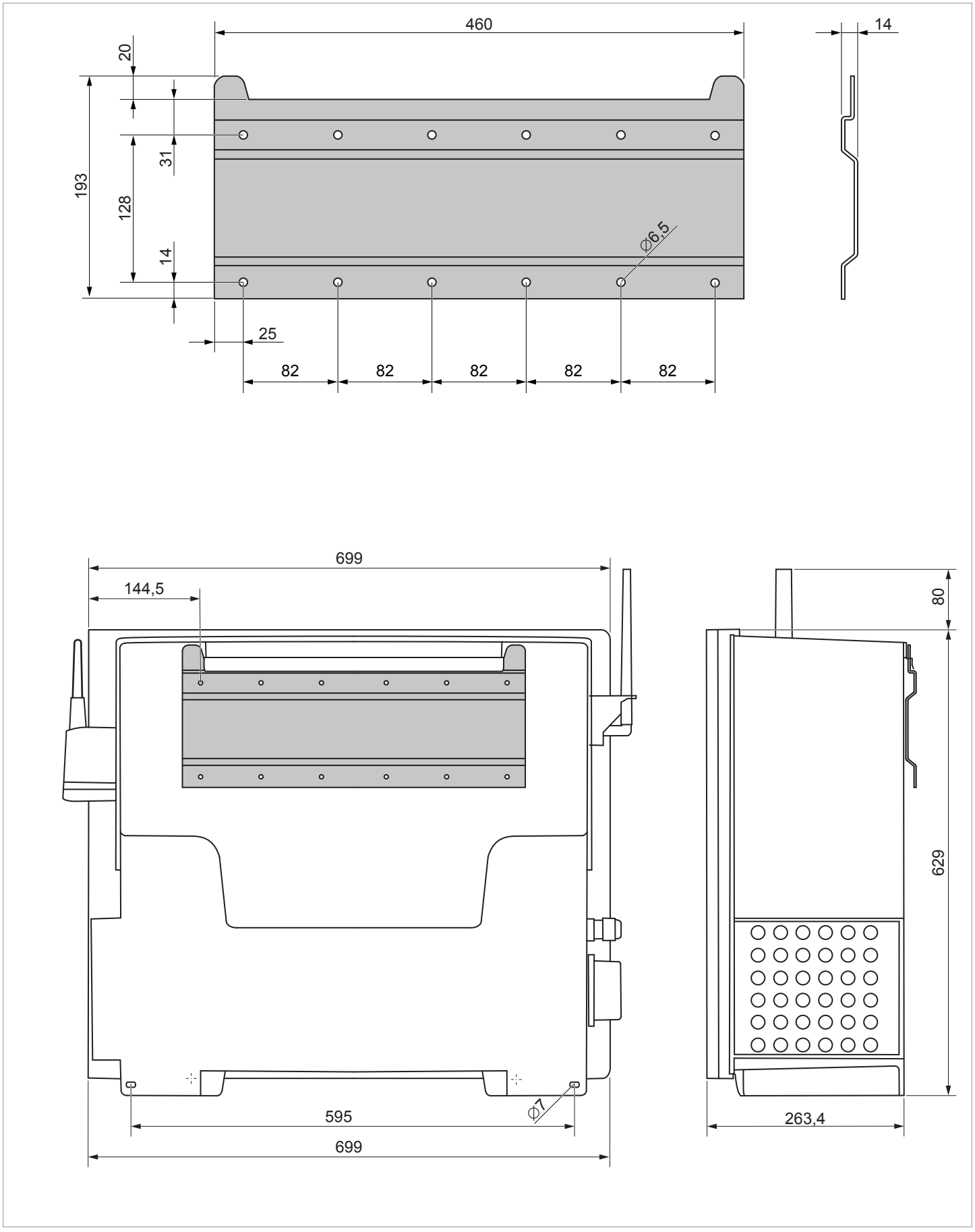


Fig. 5.30: Dimensions

5.4 Grid connection (AC)

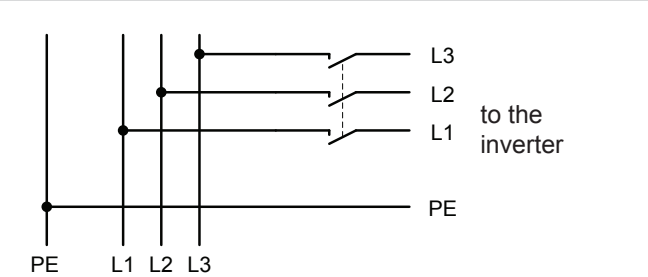
Further information

"7.10 Connecting to the grid (AC)", page 84

5.4.1 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	max. 150 A



- ► Selection of the protective devices for the grid cables to the transformer of the grid 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 IT networks.

5.4.2 Residual current circuit breaker

Due to its design, the inverter cannot supply the grid 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.

5.4.3 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, Section 6.6.2.

5.4.4 AC surge protection devices

The inverter is equipped with type-2 AC surge protection devices. Replacements can be ordered from Delta Electronics.

Alternativ können bei Delta Electronics kombinierte AC-Überspannungsableiter Typ 1 + 2 bestellt werden.

5.4.5 Permissible grounding systems

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

5.4.6 Grounding the inverter

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.
- ► The grounding cable cross-section must be at least 6 mm².

Fig. 5.31: Position of the internal PE connection

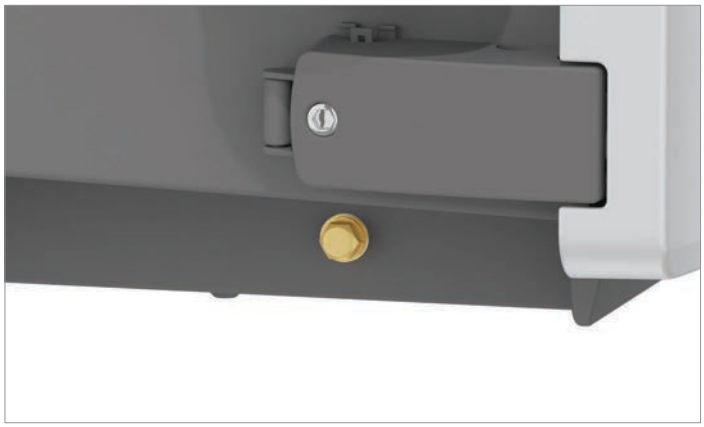


Fig. 5.32: Position of the external ground connection

5.4.7 Requirements for the grid voltage

3P3W	Voltage Range	3P4W	Voltage Range
L1-L2	400 V_{AC} -20%/+30%	L1-N	230 V_{AC} -20%/+30%
L1-L3	400 V_{AC} -20%/+30%	L2-N	230 V_{AC} -20%/+30%
L2-L3	400 V_{AC} -20%/+30%	L3-N	230 V_{AC} -20%/+30%

5.4.8 Special tools required

Use an insulated torque wrench.

5.4.9 Notes on calculating the cable cross-section

Consider the following factors when calculating the cable cross-section:

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

Always follow the IEC 60364-5-52 requirements and your country-specific installation instructions.

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

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

5.4.10 AC terminal block specifications

Connection type	Screws with hexagon socket head
Rated current I_N	96 A
Rated voltage U_N	1000 V
Attaching the conductor	
Type of attachment	• 8 mm hexagon socket (L1, L2, L3, N) • M8 nut (PE)
Tightening torque	• 31 Nm (L1, L2, L3, N) • 14, 7 Nm (PE)

5.4.11 Specification for copper cable

Min./max. Cable diameter	26.0 to 57.0 mm
Min./max. Wire cross-section	
Without wire end sleeve	
• Rigid cable	35–120 mm^2
• Multi-wire cable	35–120 mm^2
With wire end sleeve	
• Flexible cable	35–120 mm^2
Stripping length	20 mm

5.4.12 Specification for aluminum cable

Aluminum cables can only be used in conjunction with Al-Cu compression joints (see “5.4.14 Instructions regarding selection and utilization of Al-Cu compression joints”, page 37)

Min./max. Cable diameter	26.0 to 57.0 mm
Min./max. Wire cross-section	
Without wire end sleeve	
• Rigid cable	35–120 mm^2
• Multi-wire cable	35–120 mm^2

5.4.13 Handling aluminum conductors during installation work

The special properties of aluminum must be taken into 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.

ATTENTION

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

► Keep the installation location as free as possible from moisture or corrosive atmospheres.

► Connect the aluminum cables quickly.

► Clean the stripped end of the aluminum conductor mechanically (for example, using 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 Al-Cu compression joint.

5.4.14 Instructions regarding selection and utilization of Al-Cu compression joints

When using aluminum cables with Al-Cu compression joints (e.g. e.g. from Klauke, Elpress or Mecatraction) and heat-shrink tubing, observe the following instructions.

- ► Select compression joints suitable for the type of cable that is used.
- ► Comply with the installation instructions issued by the manufacturer of the compression joints.
- ► Secure the cables with an external strain relief element.

Additional Al-Cu crimped connectors and heat-shrink sleeving are required

5.5 Connecting the solar modules (DC)

Further information

"7.11 Connecting the solar modules (DC)", page 88

5.5.1 Safety precautions

DANGER

Electric shock

Potentially fatal voltages are present at the DC connections of the inverter. 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 both DC isolating switches to the ***OFF*** position.
- ► Disconnect the connection to the grid so that the inverter cannot feed energy into the grid.
- ► Disconnect the inverter from all AC and DC voltage sources. Make sure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

ATTENTION

Incorrectly dimensioned solar system.

If the solar system is dimensioned incorrectly, this may damage the inverter.

- ► When calculating the module string, always pay attention to technical specifications of the inverter (*input voltage range*, *maximum input current* and *maximum input power*), see "11. Technical Data", page 144).

ATTENTION

Overheating of the DC connections.

Exceeding the *maximum input current* can cause the DC connections to overheat and result in a fire.

- ► When dimensioning the module strings, always take into account the *maximum input current* of the DC connections.

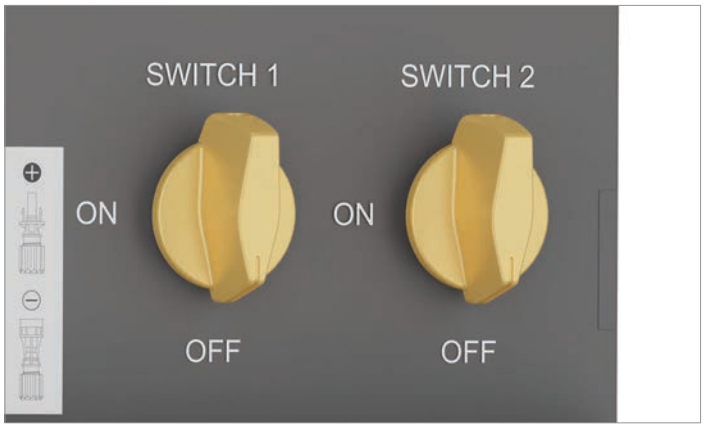
ATTENTION

Ingress of moisture.

Moisture can enter via open DC connections.

- ► To ensure protection degree IP65, close unused DC connections with the rubber plugs that are attached to the DC connections.

Before connecting the solar modules, turn both DC isolating switches to the ***OFF*** position.

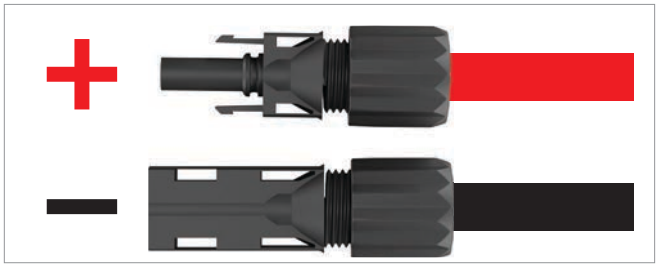


5.5.2 Special tools required

Mounting tool for disconnecting the DC plug and the protective caps from the DC connections. Included in scope of delivery. Amphenol part number: UTXTWA001.

5.5.3 Polarity of the DC voltage

► Check the polarity of the DC voltage of the DC strings before connecting the solar modules.

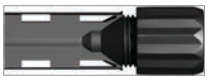


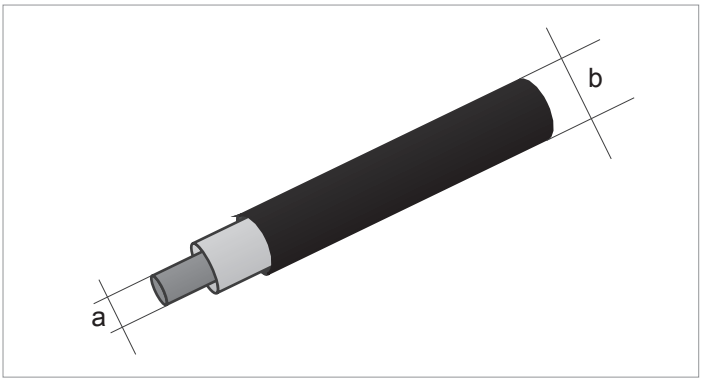
5.5.4 DC cable requirements

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

The plugs are only suitable for copper wire.

You can download the assembly instructions for the DC plugs from Amphenol at: www.amphenol-solar.com.

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



	a	b	Amphenol DC plug[1)]
	mm²	mm	
DC+	4/6	5.3–7.65	H4C**F**C4D●S
DC–	4/6	5.3–7.65	H4C**M**C4D●S

[1)] Included in scope of delivery

5.5.5 Connection of the module strings

The inverter has 6 MPP trackers. 2 or 3 module strings can be connected to each MPP tracker.

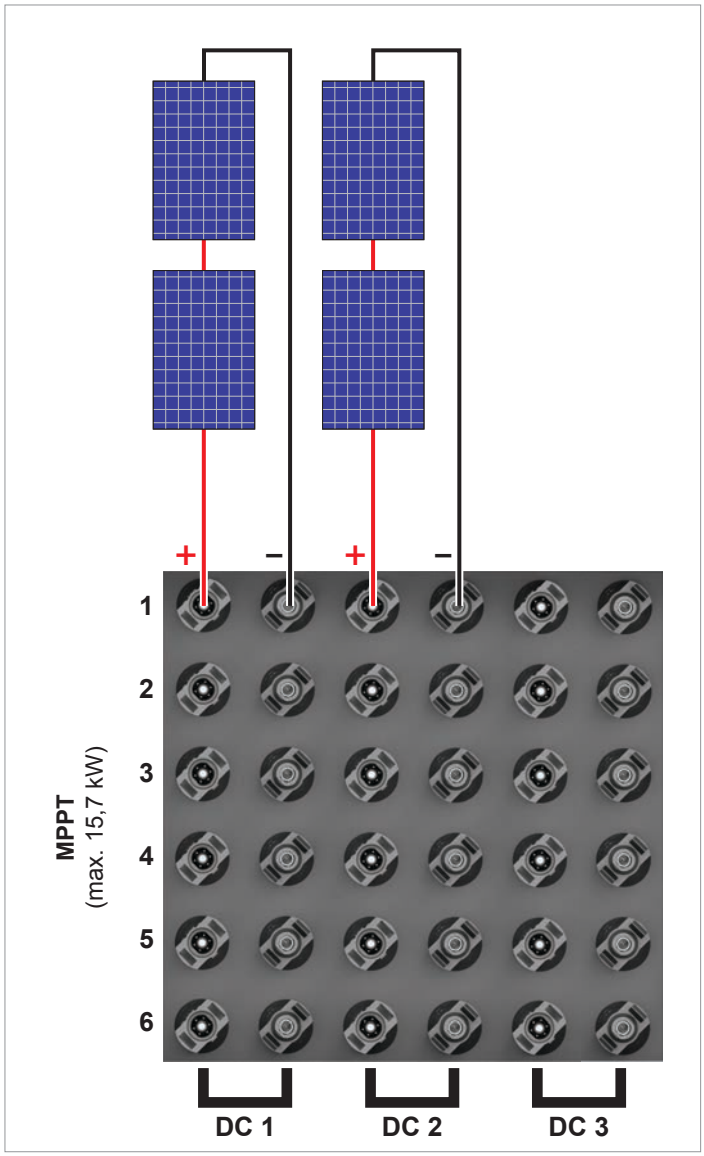


Fig. 5.33: Connection of 2 module strings to an MPP tracker

With 2 module strings per MPP tracker, no string fuses are required. It does not matter which DC inputs are used.

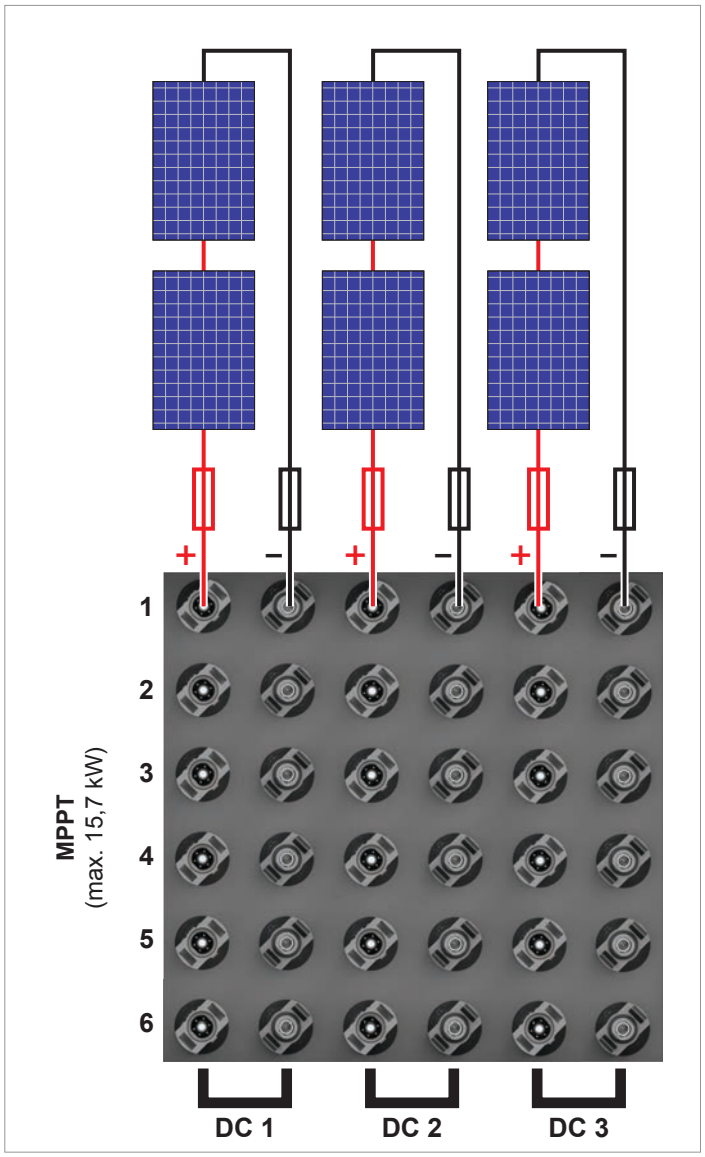


Fig. 5.34: Connection of 3 module strings to an MPP tracker

String fuses **must** be used for 3 module strings per MPP tracker.

5.6 Mains and system protection

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

This inverter meets the requirement in (2). External grid and system protection is not required.

5.7 Device communication and system monitoring

Related topics

"6. Planning the Commissioning", page 48
"7.7 Connecting the communication card", page 64
"7.8 Installing the Sub-1G antenna (optional)", page 77
"7.9 Installing the Wi-Fi module before commissioning (optional)", page 80

5.7.1 Introduction

The inverter offers the following options for communication with other devices (e.g. PC, smartphone, data logger):

- RS485 (communication card with RS485 connections, digital inputs, dry contacts, external power-off and 12 V_{DC} power supply)
- Sub-1G antenna (included in scope of delivery)
- Wi-Fi module (optional accessory)

5.7.2 Communication card

5.7.2.1 Components of the communication card

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.

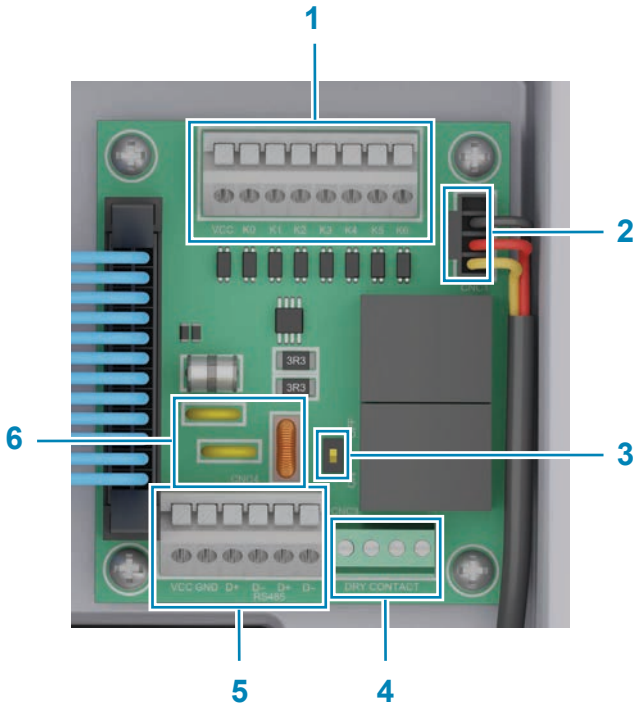


Fig. 5.35: Components of the communication card

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

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

Table 5.1.: Connections on the communication card

5.7.3 Communication cable requirements

Cable type	Shielded and twisted pair cable (CAT5 or CAT6)
Cable diameter	7.2 mm
Wire cross-section	0.25–1.5 mm^2

Table 5.2.: Specification of the communication cable

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

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

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

5.7.4 Cable gland for the communication connection

The inverter has 1 cable gland for 2 communication cables.

5.7.5 Connection of a data logger via RS485

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.

Connecting a single inverter to a data logger

► Switch on the RS485 termination resistor.

► Lay the communication 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

► If the data logger is located at one end of the RS485 chain, then switch on the RS485 termination resistor of the data logger and of the last inverter in the RS485 chain.

► If the data logger is **not** located at either end of the RS485 chain, switch on the RS485 termination resistor at the two inverters at the ends of the RS485 chain.

► Switch off the RS485 termination resistor at all other inverters (standard setting).

► 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 (standard: 19200).

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

5.7.6 Connection of a DC1 data collector from Delta

You can use the DC1 data collector for, among other things:

- Commissioning the inverter (see “6. Planning the Commissioning”, page 48 and “8. Commissioning”, page 92)
- Updating the firmware
- Connecting to the MyDeltaSolar Cloud or another monitoring system

Follow the instructions in the DC1 manual to connect the inverter to the DC1.

The inverter can be connected to the DC1 via RS485, Sub-1G or Wi-Fi.

Connection via RS485

Observe the general instructions in section “5.7.5 Connection of a data logger via RS485”, page 42.

The DC1 does not have an integrated RS485 termination resistor. For this reason, refer to the information in Fig. 5.36, p. 43.

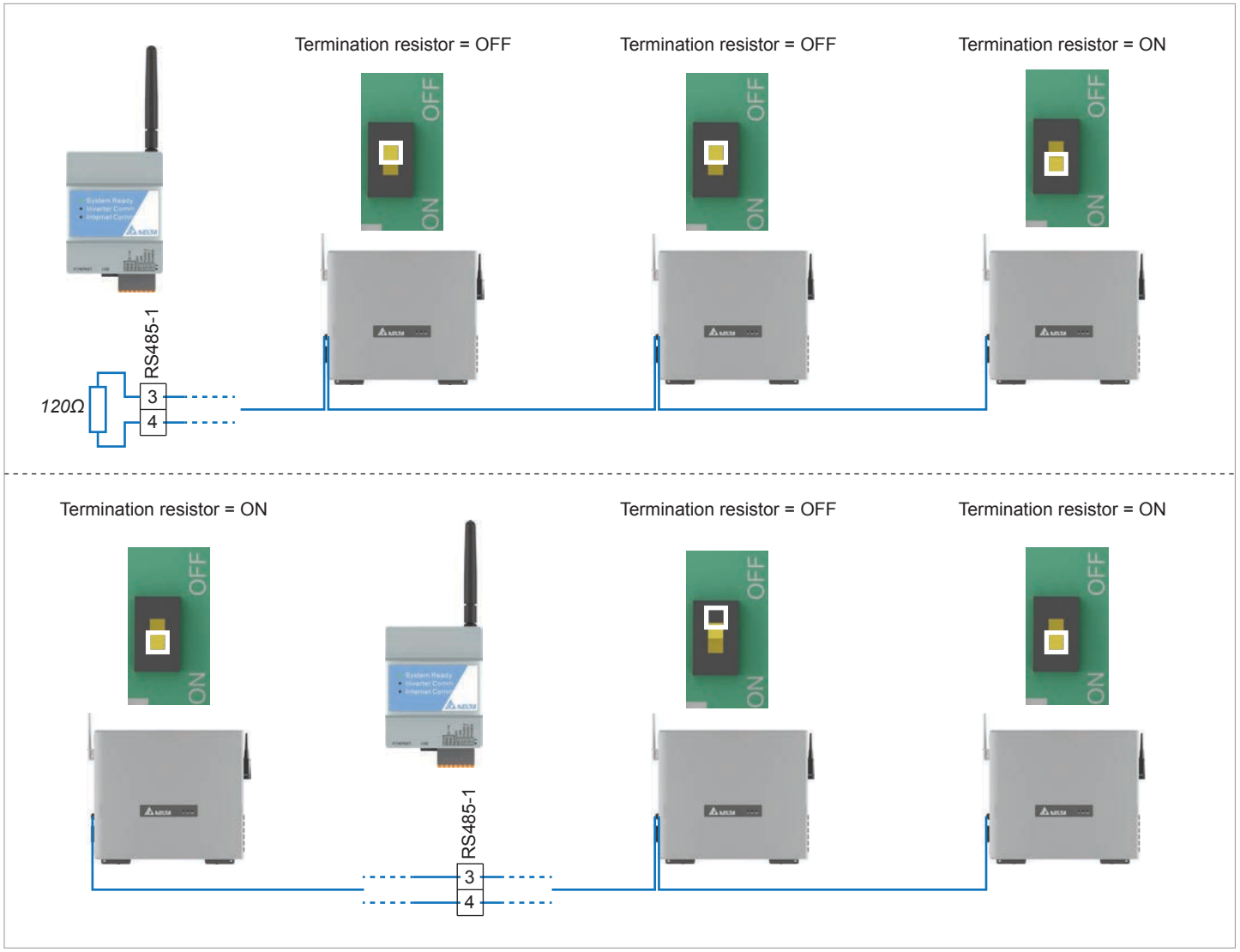


Fig. 5.36: RS485 connection diagram for a DC1 data collector with multiple inverters

Connection via Wi-Fi

To use the Wi-Fi feature, the Wi-Fi module must be installed on the inverter. The Wi-Fi module must be ordered separately from Delta.

Connection via Sub-1G

The inverter is supplied with a Sub-1G antenna. You can order a separate Sub-1G module for the DC1.

Required software

In order to access the DC1 and the inverter through it, you also need:

- A mobile device (smartphone, tablet) with the MyDeltaSolar app

or

- A Windows PC running the Delta Service Software (DSS)

or

- A Windows PC with the commissioning software for updating the firmware and commissioning the inverter

The MyDeltaSolar app is available for iOS and Android.

DSS and commissioning software can be downloaded at https://solarsolutions.delta-emea.com.

5.7.7 Connecting an external alarm unit

The inverter has two relays allowing connection of an acoustic or visual alarm unit to each (using dry contacts).

The dry contacts for connecting the external alarm units are located on the communication card. The communication card also has a 12 V_{DC} power supply.

Both relays are designed as NO contacts.

After commissioning, each relay can be assigned an event at which the multi-function relay switches. Only one event can be assigned to each relay, but these can be different. By default, the relays are disabled.

To set an event for the relays, you need:

- A mobile device (smartphone, tablet) with the MyDeltaSolar app

or

- A Windows PC running the Delta Service Software (DSS)

The MyDeltaSolar app is available for iOS and Android.

You can download the DSS at https://solarsolutions.delta-emea.com.

Event	Description
`Disabled`	The function is disabled.
`On Grid`	The inverter is connected to the grid.
`Fan defective`	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.

Table 5.3.: Events for which the external alarm device relay can trigger

The default setting for both relays is **`Disabled`**.

5.7.8 Connecting a ripple control receiver

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

The digital inputs are located on the communication card.

Pin	Naming	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

Table 5.4.: Pin assignment of the terminal block with digital inputs for connecting a ripple control receiver

5.7.9 External power-off

The inverter has a relay allowing an external shutdown of the inverter to be triggered. The relay is designed as a NO contact. The relay can also be set as an NC contact in the inverter settings.

The connections for the external shutdown are located on the communication card.

Pin	Naming	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

Table 5.5.: Pin assignment of the terminal block for the external power-off

5.7.10 Connecting a PC

A PC can be connected to the inverter via RS485.

You can use the PC to commission the inverter and change the settings. This requires the following accessories.

Accessories	Description
Standard USB/RS485 adapter	For connecting the PC to the inverter.
Delta Service Software (DSS)	For changing the inverter settings.
Commissioning Software	For commissioning the inverter. Limited functionality.

To select a suitable USB/RS485 adapter, please contact Delta Customer Service.

You can download the software from https://partnerportal.delta-emea.com.

Cable requirements

Bell wire. Both ends open.

5.7.11 Connecting to a mobile device

In order to connect your mobile device (e.g. smartphone or tablet) to the inverter, the Wi-Fi module must be installed on the inverter. The Wi-Fi module must be ordered separately from Delta.

In addition, you will need the MyDeltaSolar app on your mobile device. The app is available for iOS and Android.

Follow the instructions in the MyDeltaSolar app to connect your mobile device to the inverter (point-to-point connection).

Once connected, you can do a variety of tasks with the app, including:

- Installing new firmware
- Commissioning the inverter
- Changing the inverter settings

5.8 Use of combined type 1+2 DC surge protection devices

The inverter is supplied with pre-installed type 2 AC and DC surge protection devices. The DC surge protection devices can be replaced by separately available type 1+2 combined DC surge protection devices.

Ideally, install the combined DC surge protection devices before installing the inverter. The easiest way to do this is with the inverter horizontal. However, you can also perform the replacement on a suspended inverter.

Install the combined surge protection devices before connecting the inverter to the grid and solar modules.

If the inverter is already in operation, the replacement is considerably more complicated for safety reasons.

Related topics

“7.6 Installing the type 1+2 combined DC surge protection devices before commissioning (optional)”, page 60

6. Planning the Commissioning

6.1 Introduction

Once the inverter has been installed and all electrical connections (to the grid, to the solar modules, communication) have been set up, the inverter can be commissioned.

In order to allow you to plan commissioning on site, the various commissioning methods are briefly described in this chapter.

6.2 Commissioning options

6.2.1 Commissioning software

Available for Windows PC.

The PC is connected to the RS485 terminal block of the inverter.

You can commission inverters connected via RS485 simultaneously.

The setting options are limited:

- Set the country or grid type
- Synchronize the date and time
- Set the inverter ID

The firmware of the inverter cannot be updated with this method.

6.2.2 Delta Service Software (DSS)

Available for Windows PC.

The PC is connected to the RS485 terminal block of the inverter.

You must commission each inverter individually.

You can use the DSS to set all parameters of the inverter.

The firmware of the inverter cannot be updated with this method.

Download link: https://solarsolutions.delta-emea.com/en/Solar-Inverter-Support-171.htm

6.2.3 MyDeltaSolar App with direct connection to inverter

Available for iOS or Android mobile devices (smartphone, tablet).

The mobile device will connect directly to the inverter via Wi-Fi. This requires the Wi-Fi module to be installed on the inverter, which must be ordered separately.

Since this creates a point-to-point connection between the mobile device and the inverter, you must commission each inverter individually.

With the MyDeltaSolar app you can set all parameters of the inverter.

The firmware of the inverter can be updated with this method.

6.2.4 MyDeltaSolar app with DC1 Data Collector from Delta

The DC1 can connect to the inverter via RS485, Sub-1G or Wi-Fi. For details, refer to the manual of the DC1 data collector, in particular the number of inverters that can be connected to the DC1 via the respective connection variant.

When RS485 is used, the DC1 is connected to the RS485 terminal block of one of the inverters in the RS485 series.

The Sub-1G antenna is included in the scope of delivery.

The Wi-Fi module must be ordered separately.

You can perform the following tasks on all inverters connected to the DC1:

- Commission all inverters at the same time.
- Set all parameters of the inverters.
- Update the inverter firmware.

7. Installation

► Read chapter “5. Planning the installation”, page 26 and this chapter in full before you start installation.

7.1 Safety precautions

DANGER

Electric shock

Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

You should therefore always carry out the following steps before working on the inverter:

1. Turn both DC isolating switches 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 restored accidentally.
3. Wait at least 60 seconds for the internal capacitors to discharge.

DANGER

Electric shock

Potentially fatal voltages are present at the DC connections of the inverter. 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 both DC isolating switches to the ***OFF*** position.
- ► Disconnect the connection to the grid so that the inverter cannot feed energy into the grid.
- ► Disconnect the inverter from all AC and DC voltage sources. Make sure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

If the doors of the inverter are open, the IP65 degree of protection is no longer guaranteed.

- ► Only open the door when absolutely necessary.
- ► Do not open the door if water or dirt might enter the inverter.
- ► After work is completed, ensure that the door is properly shut and tightened again. Check that the doors are properly sealed.

WARNING

Heavy weight

The inverter is heavy.

- ► The inverter must be lifted and carried by at least two people.

ATTENTION

Water ingress.

- ► All sealing caps removed during installation should be stored for later use (e.g. transportation or storage).

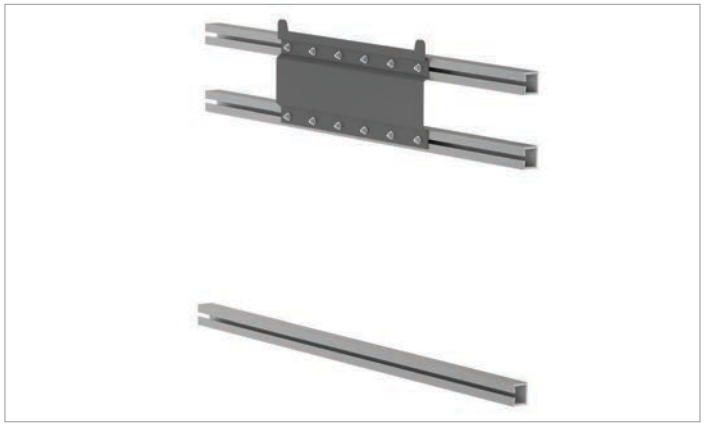
7.2 Sequence of installation and commissioning steps

Step	Notice	Description in chapter
Mounting the inverter		“7.3 Mounting the inverter”, page 51
Grounding the inverter housing		“7.4 Grounding the inverter housing”, page 54
Preparing electrical installation		“7.5 Preparing electrical installation”, page 56
Connecting the communication card	Optional	“7.7 Connecting the communication card”, page 64
Installing the Sub-1G antenna	Optional	“7.7 Connecting the communication card”, page 64
Installing the Wi-Fi module	Optional	“7.9 Installing the Wi-Fi module before commissioning (optional)”, page 80
Connecting the PC to the inverter	This step is only necessary if commissioning is carried out via PC.	“7.7.7 Connecting a PC via RS485 (optional)”, page 76
Connecting to the grid (AC)		“7.10 Connecting to the grid (AC)”, page 84
Connecting the solar modules (DC)		“7.11 Connecting the solar modules (DC)”, page 88
Completing electrical installation		“7.12 Completing electrical installation”, page 89
Commissioning the inverter		“8. Commissioning”, page 92

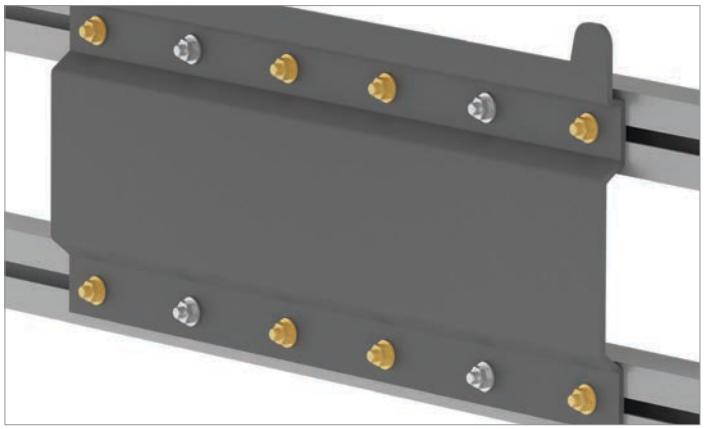
7.3 Mounting the inverter

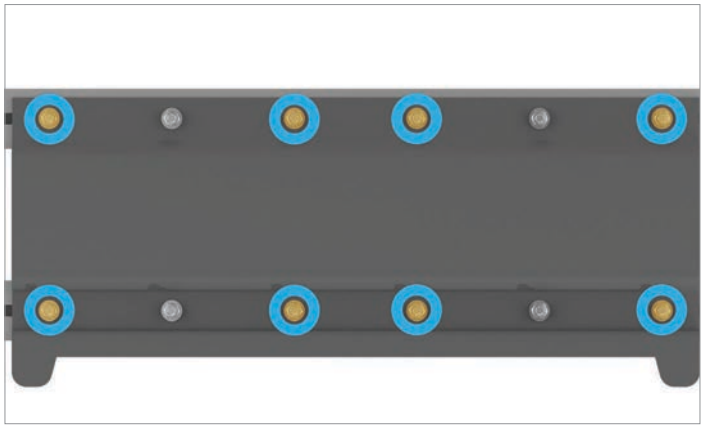
7.3.1 Wall mounting (suspended)

Special case: hanging the inverter without screwing into the base
In general, the inverter must **always** be screwed onto the feet during wall mounting. Deviations from this are only possible in exceptional cases approved by Delta Electronics. Always check with Delta Customer Service **first** if you want to deviate from the work instructions given in this section.

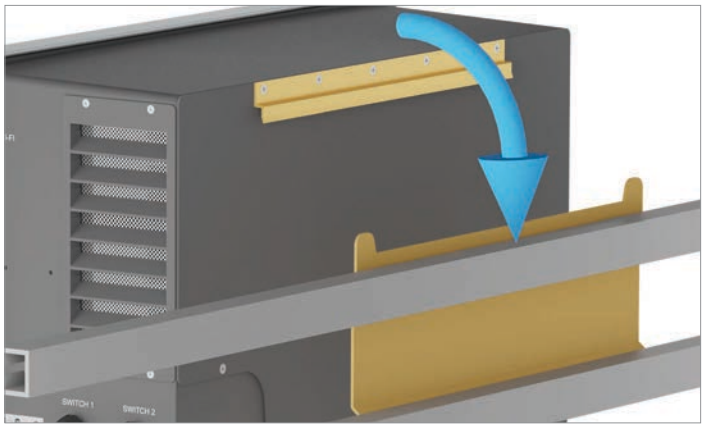


1. Attach the mounting plate to the wall/mounting system with at least 8 M6 screws.

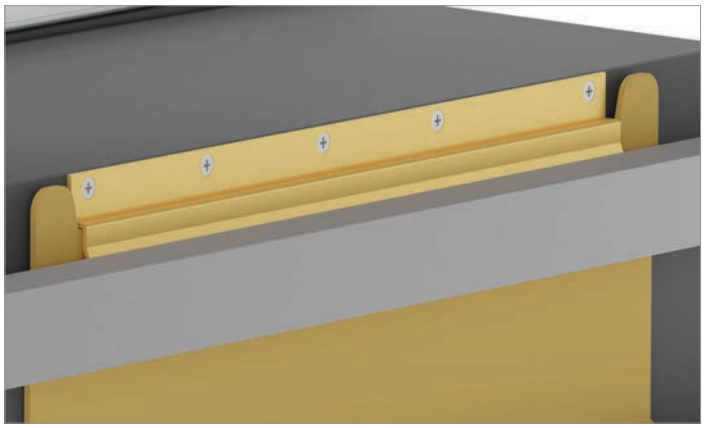




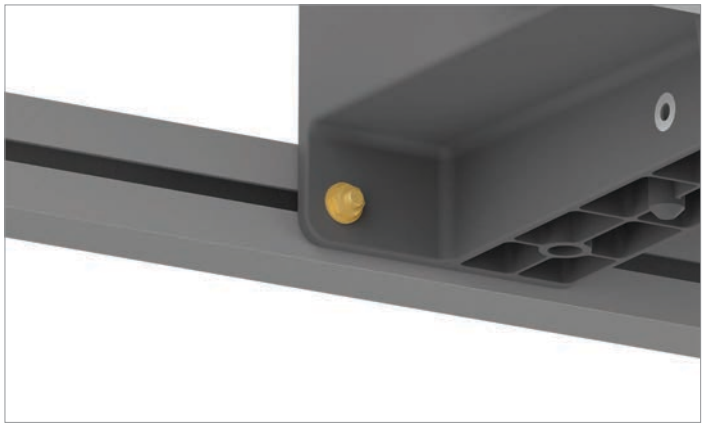
2. Tighten the 8 points highlighted in the image at a minimum.



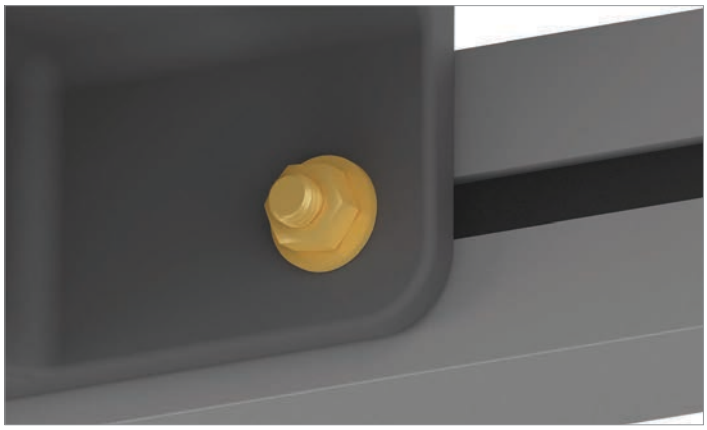
3. Mount the inverter on the mounting plate.



4. Check that the inverter hangs correctly on the mounting plate.



5. Screw the lower left side of the inverter onto the wall or mounting system using the M10 screw, spring washer and washer.



6. Screw the lower right side of the inverter onto the wall or mounting system using the M10 screw, spring washer and washer.

7.4 Grounding the inverter housing

WARNING

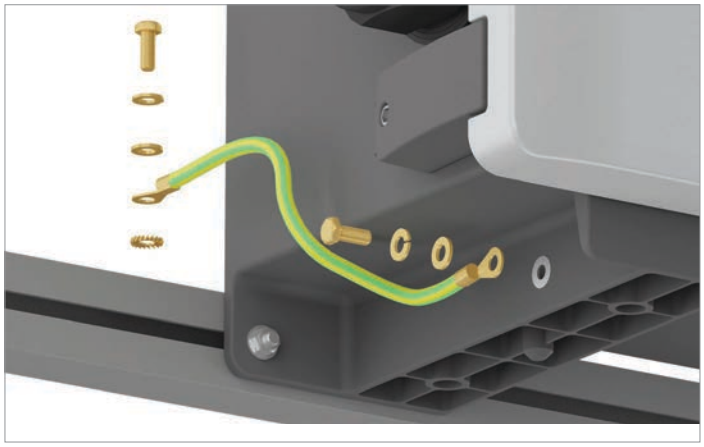
High current

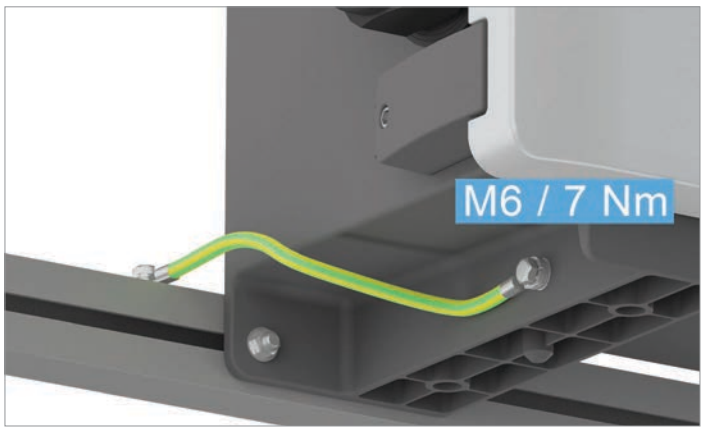
- ► Always observe the local regulations relating to grounding cable requirements.
- ► To increase the safety of the system, always ground the inverter housing even when this is not required by the local regulations.
- ► Always ground the inverter housing **before** connecting the inverter to the grid and solar modules.
- ► The grounding cable cross-section must be at least 6 mm².

The inverter housing can be grounded at 2 points:

- bottom left at the outer grounding screw
- inside, on the PE screw of the AC connection

7.4.1 Grounding via the outer grounding screw





1. Screw the grounding cable onto the left side of the inverter base. The screw, spring washer and washer are already mounted on the inverter.
   Grounding screw: 1 x M10

2. Perform a continuity check of the grounding connection.
   → If there is not a sufficiently conductive connection, clean the contact surface on the grounding screws or use a toothed washer if necessary.

7.4.2 Grounding via the PE screw of the AC connection

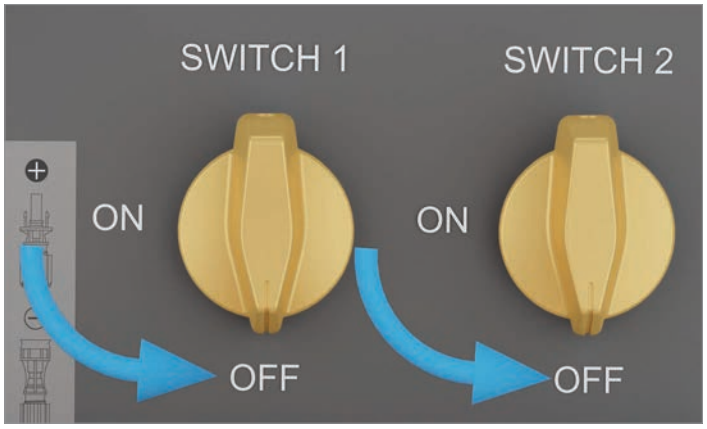
1. Screw the PE/PEN cable onto the PE screw (torque: 14.7 Nm). M8 nut, spring washer and washer are provided.

2. Perform a continuity check of the grounding connection.

7.5 Preparing electrical installation

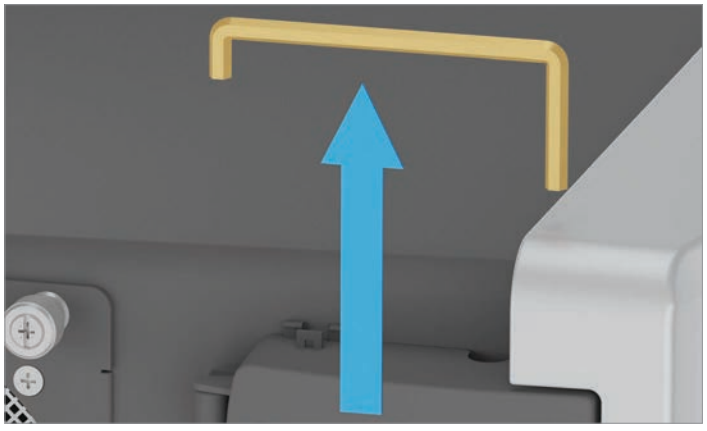
There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the grid and between the inverter and the solar modules. This isolates the inverter from all the AC and DC voltage sources and renders it de-energized.

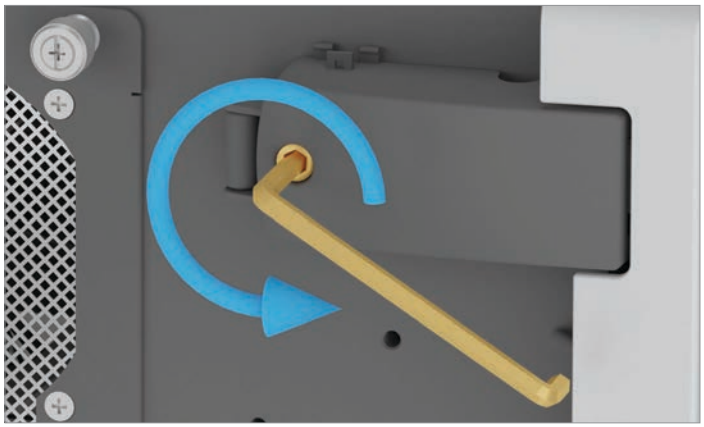
1. To ensure that no voltage can be applied to the inverter during installation work, open the isolating switches between the inverter and the grid connection point and between the inverter and the solar modules.
   Secure all the isolating switches to prevent them from being switched back on accidentally.



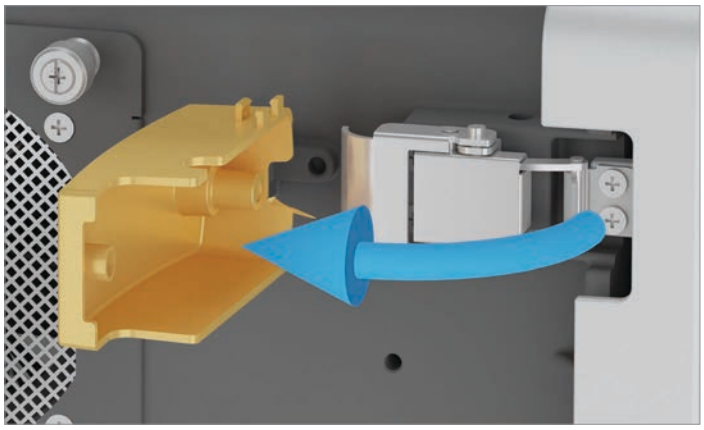
2. Turn both DC isolating switches to the ***OFF*** position.

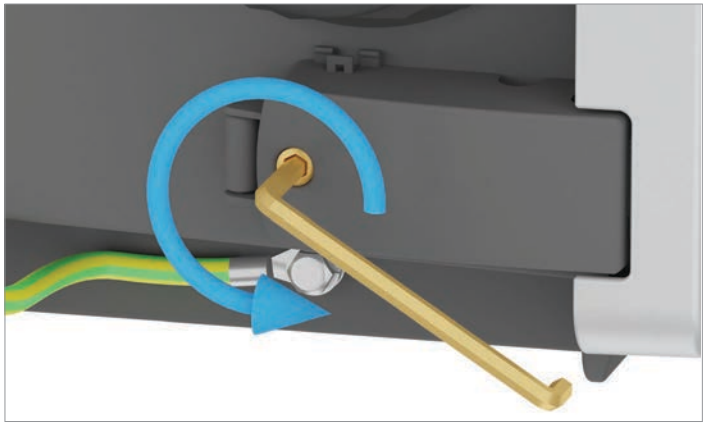
3. Remove the Allen key from the upper door lock.



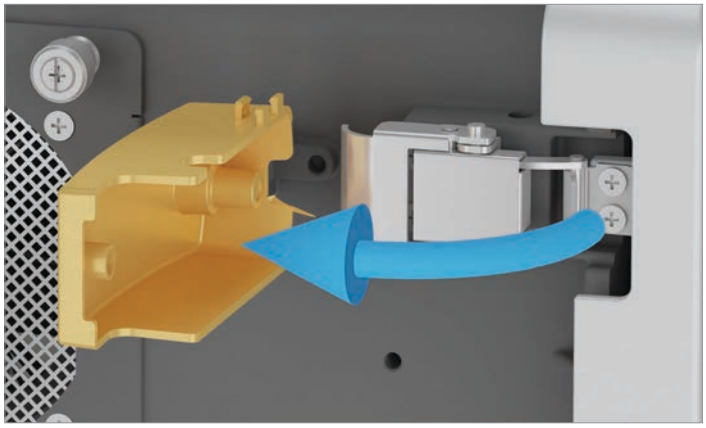


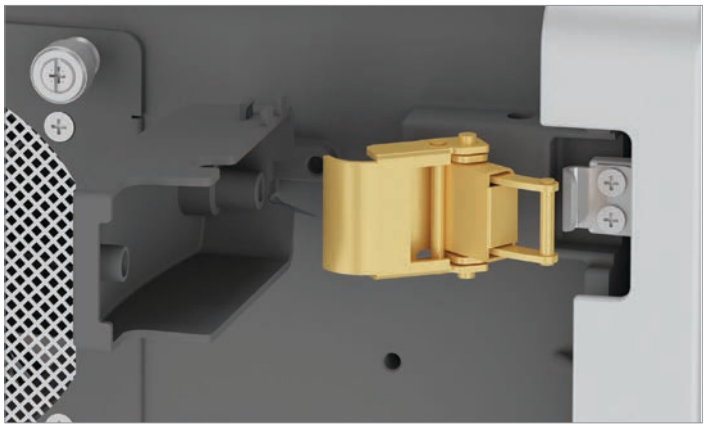
4. Unscrew and open the upper door lock cover.

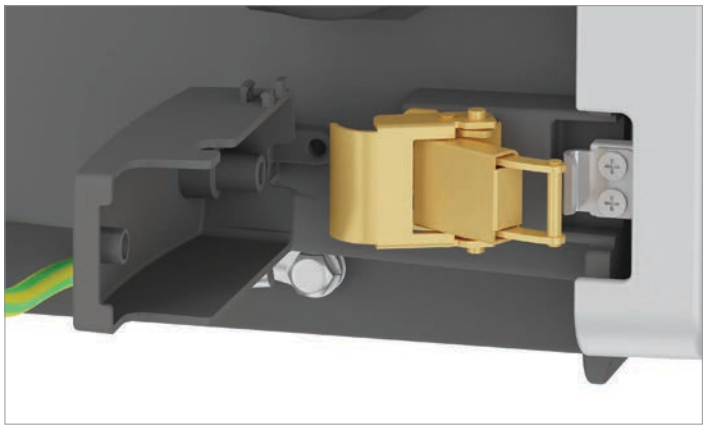




5. Unscrew and open the lower door lock cover.







6. Open the upper and lower door lock.

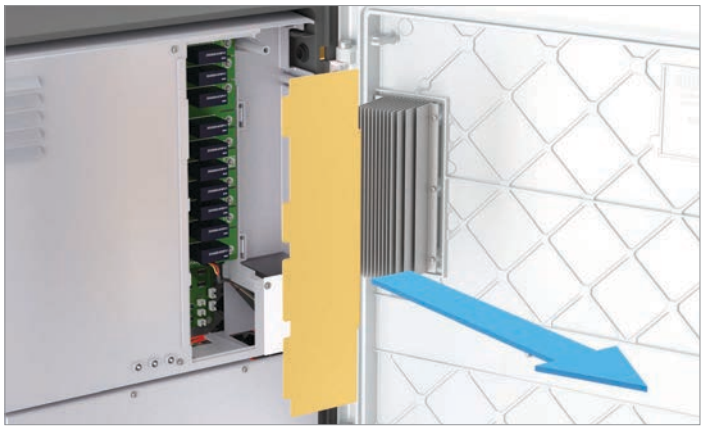
7. Open the door and secure it on top with the Allen key.

7.6 Installing the type 1+2 combined DC surge protection devices before commissioning (optional)

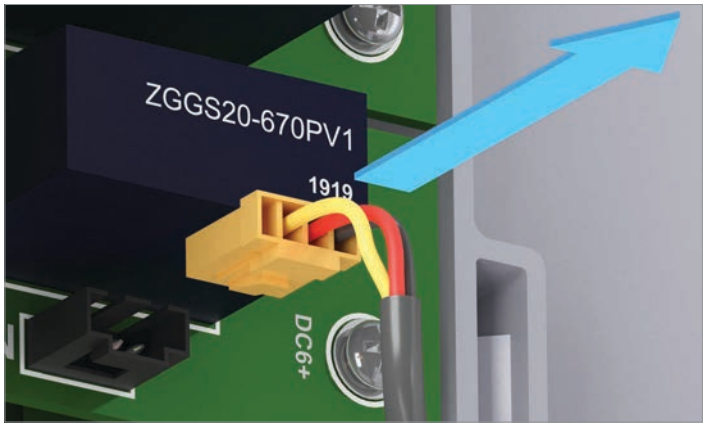
Type 2 DC surge protection devices are installed as standard. Type 1+2 combined DC surge protection devices can be ordered as accessories.

Use an insulated magnetic screwdriver to loosen the screws.

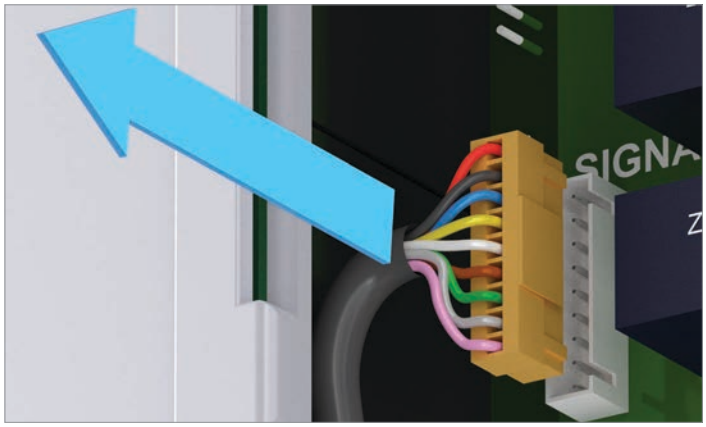
Make sure that no screws fall into the inverter.



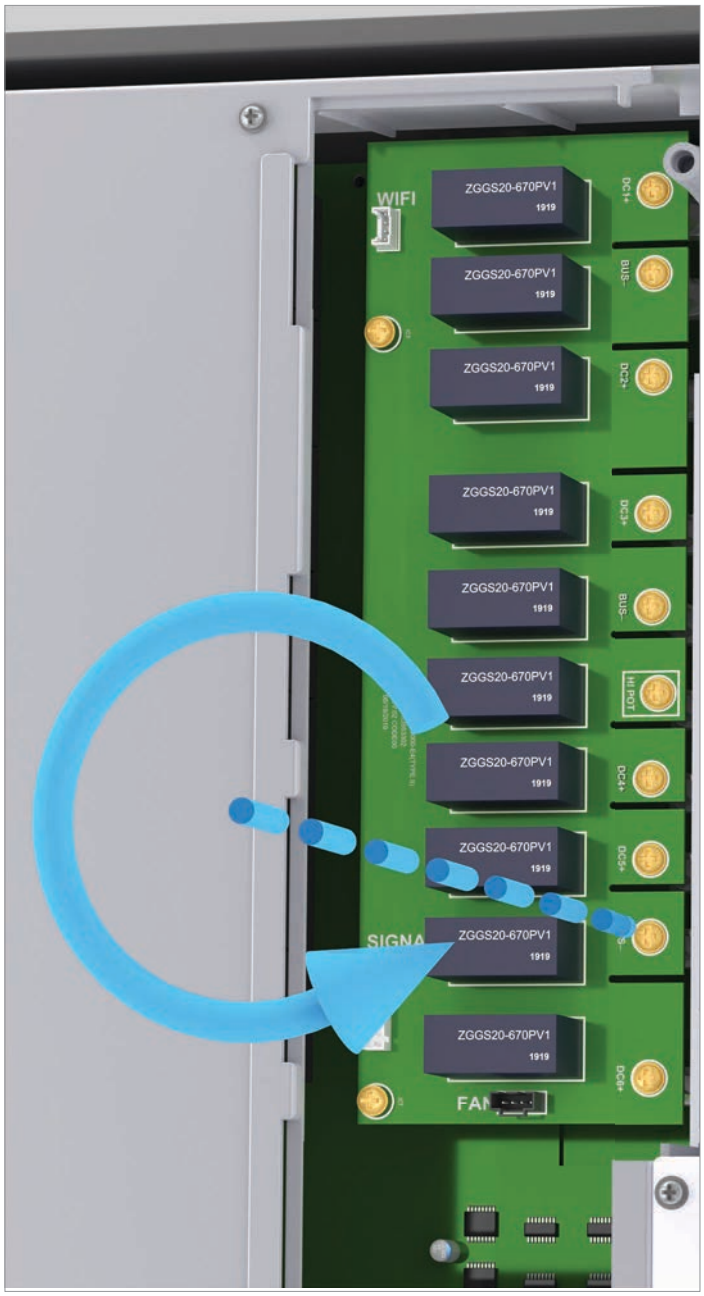
1. Remove the protective cover from the DC surge protection devices.

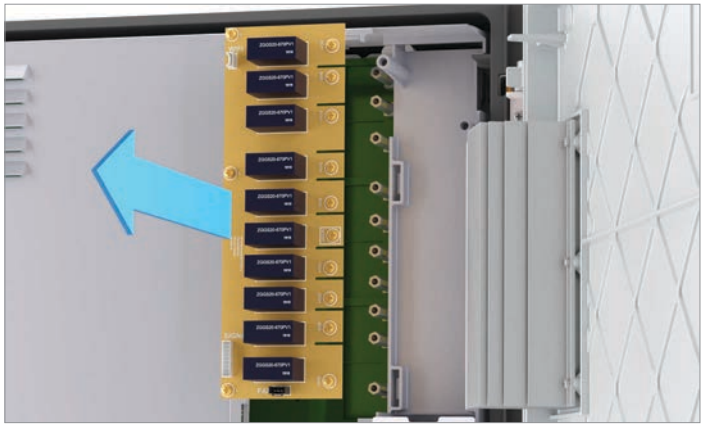


2. Pull out the power supply cable of internal fan 2.

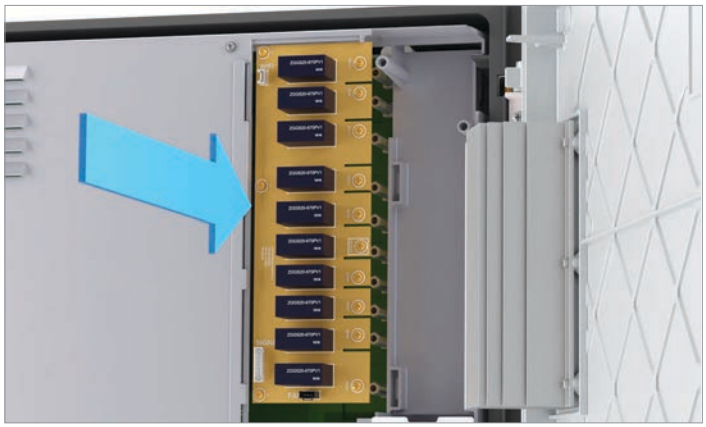


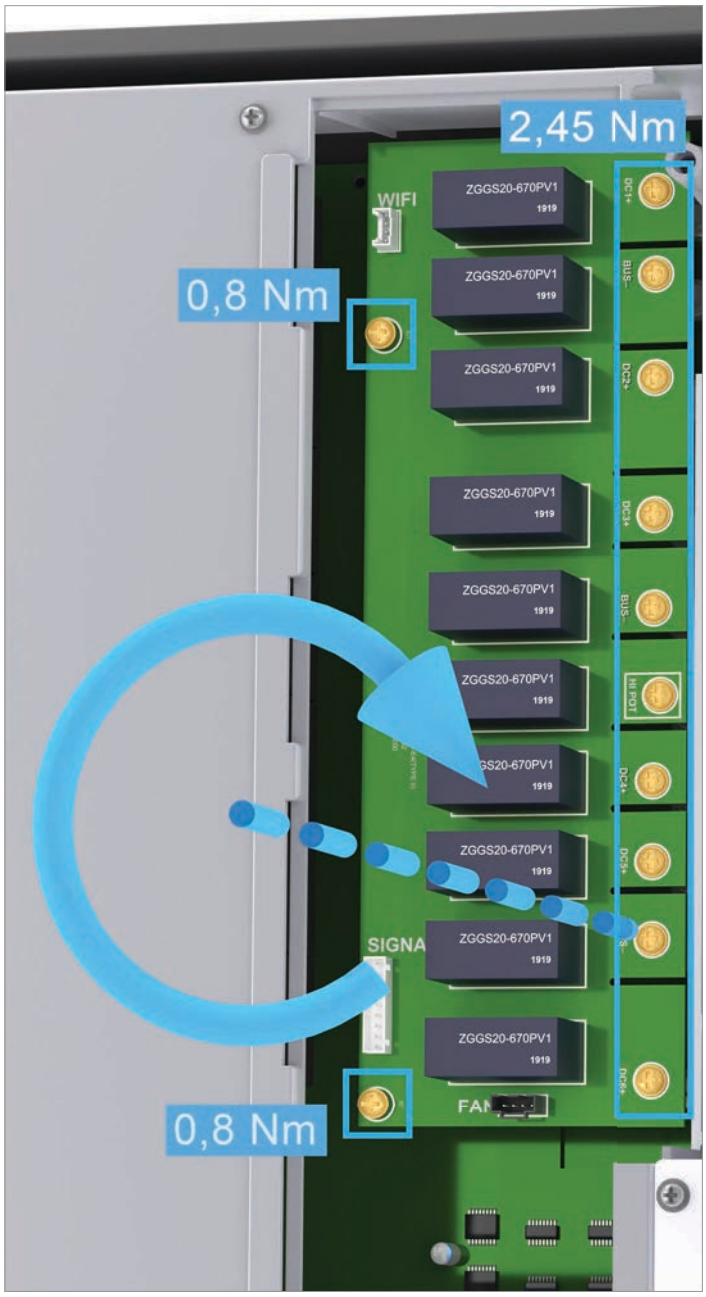
3. Pull out the signal cable.



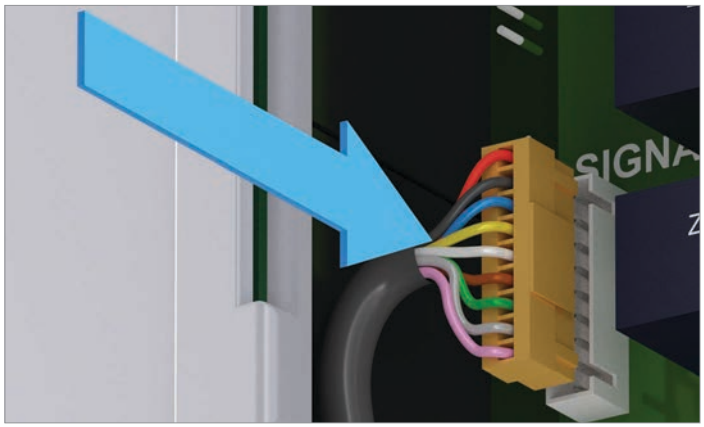


4. Loosen all screws on the printed circuit board with the DC surge protection devices and remove the printed circuit board.

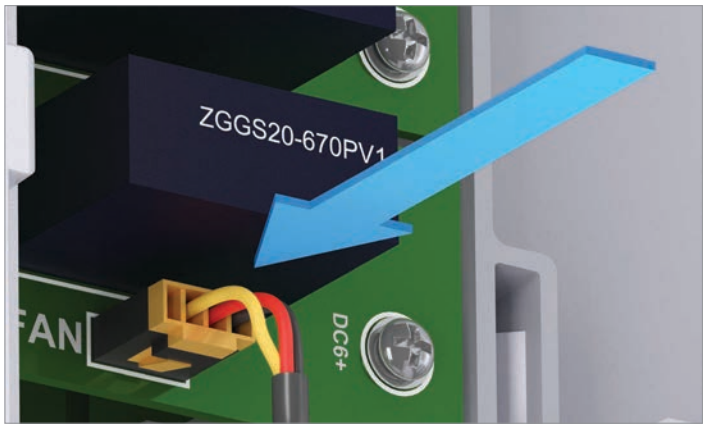




5. Install the new printed circuit board and tighten all screws on the printed circuit board.



6. Plug in the signal cable.



7. Plug in the power supply cable of internal fan 2.

8. Insert the cover for the DC surge protection devices.

☑ The installation of the combined DC surge protection devices is complete.

7.7 Connecting the communication card

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

NOTICE

Water ingress.
► All sealing caps removed during installation should be stored for later use (e.g. transportation or storage).

7.7.1 Connections on the communication card

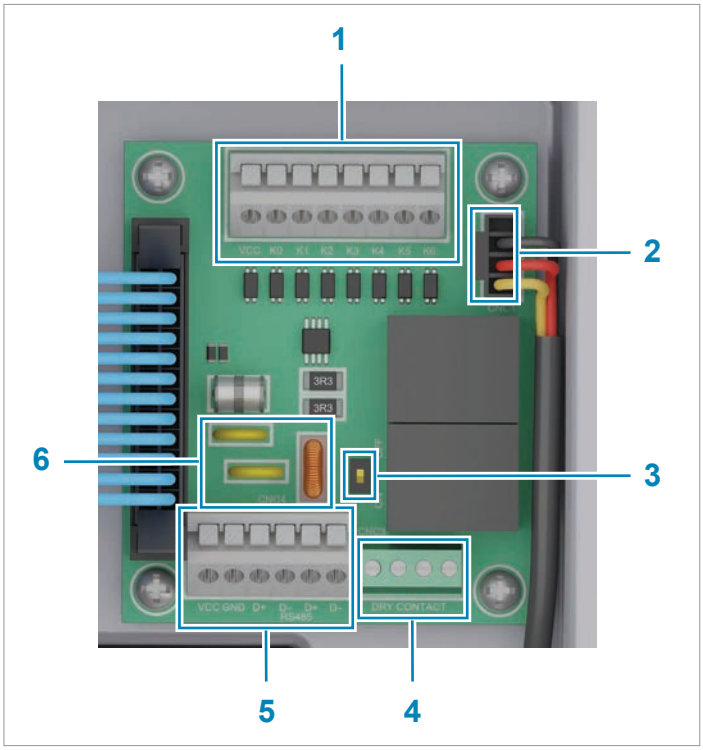


Fig. 7.37: Components of the communication card

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

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

Table 7.1.: Connections on the communication card

Cable type	Shielded and twisted pair cable (CAT5 or CAT6)
Cable diameter	2x 7.2 mm
Wire cross-section	0.25–1.5 mm²

Table 7.2.: Specification of the communication cable

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

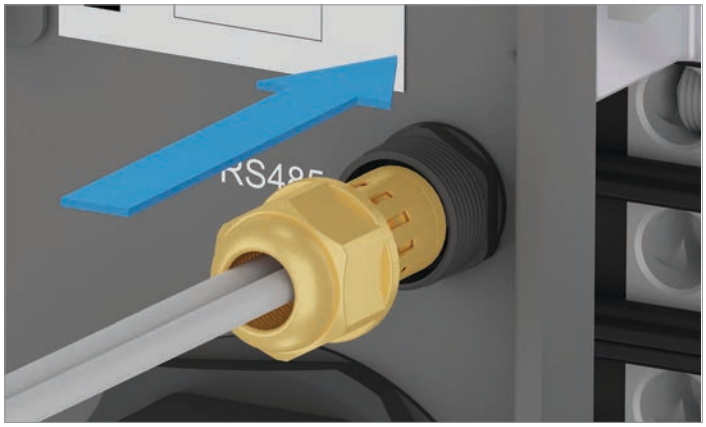
- Data logger
- External alarm unit
- Ripple control receiver
- External power-off

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

7.7.2 Threading the communication cable

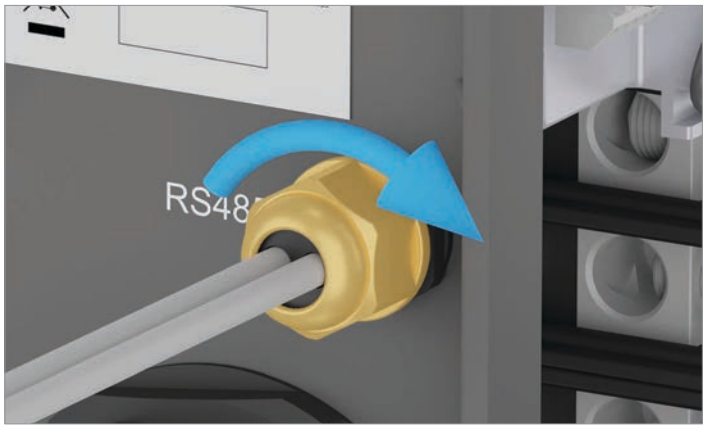
1. Unscrew the cable gland of the communication connection and remove the cable gland and seal.

2. Thread all communication cables through the cable gland and seal.



3. Insert the seal and cable gland of the communication connection and fasten the cable gland.

Connecting the communication card



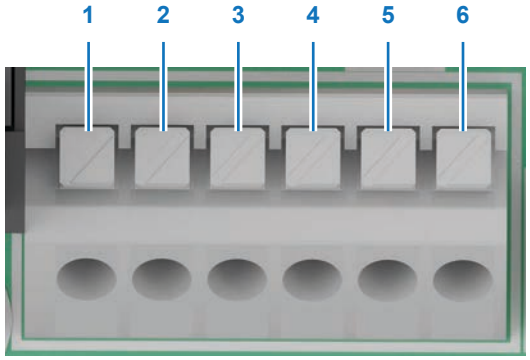
7.7.3 Connecting a data logger via RS485

7.7.3.1 Introduction

NOTICE

Unwanted currents.
In some installation variants, unwanted currents can flow when multiple inverters are connected via RS485.
► Do not use GND and VCC.

Terminal assignment of 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)

Fig. 7.38: Terminal assignment of the RS485 terminal block

Terminal pair 3/4 or 5/6 can be used to connect a data logger. The second terminal pair is only required when connecting several inverters via RS485. The second terminal pair can also be used to connect a PC.

Data format

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

DIP switch for the RS485 termination resistor

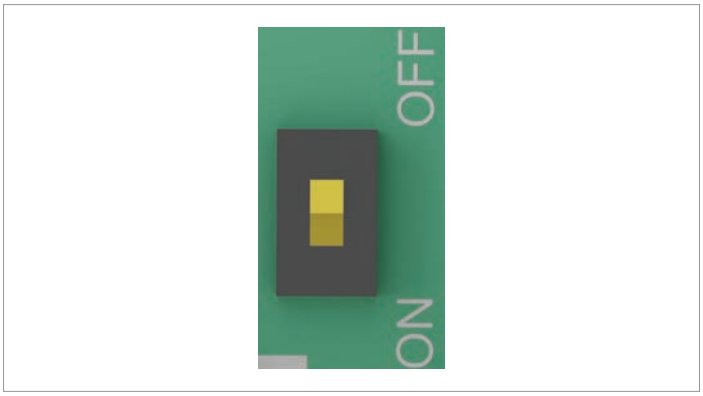


Fig. 7.1: DIP switch for the RS485 termination resistor

RS485 connection diagram for a single inverter

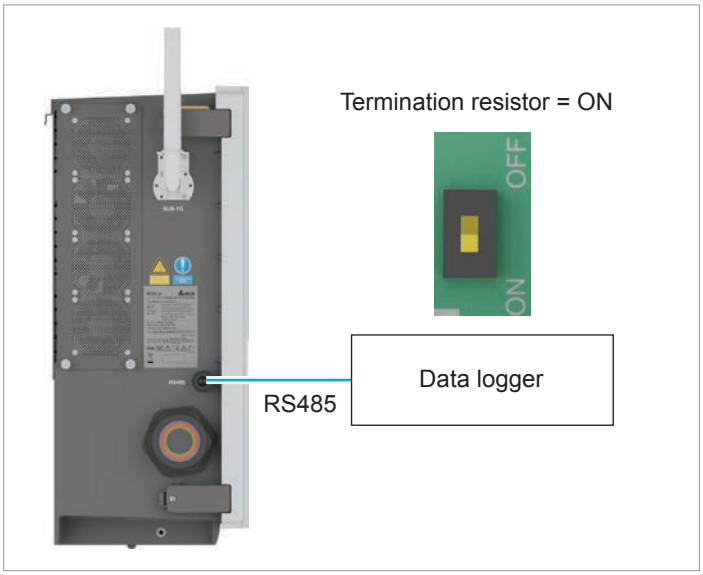


Fig. 7.2: RS485 connection diagram for a single inverter

RS485 connection diagram for multiple inverters

If you are using a DC1 data collector from Delta, also refer to the notes in the next section.

- ► On the last inverter in the RS485 series, set the DIP switch of the RS485 termination resistor to ***ON***.
- ► If the data logger is located at one end of the RS485 chain, then also switch on the RS485 termination resistor of the data logger. If the data logger does not have an integrated RS485 termination resistor, then also switch on the DIP switch of the first inverter in the RS485 series, i.e. the one that is directly connected to the data logger.
- ► Set a different inverter ID at each inverter during commissioning of the inverters.

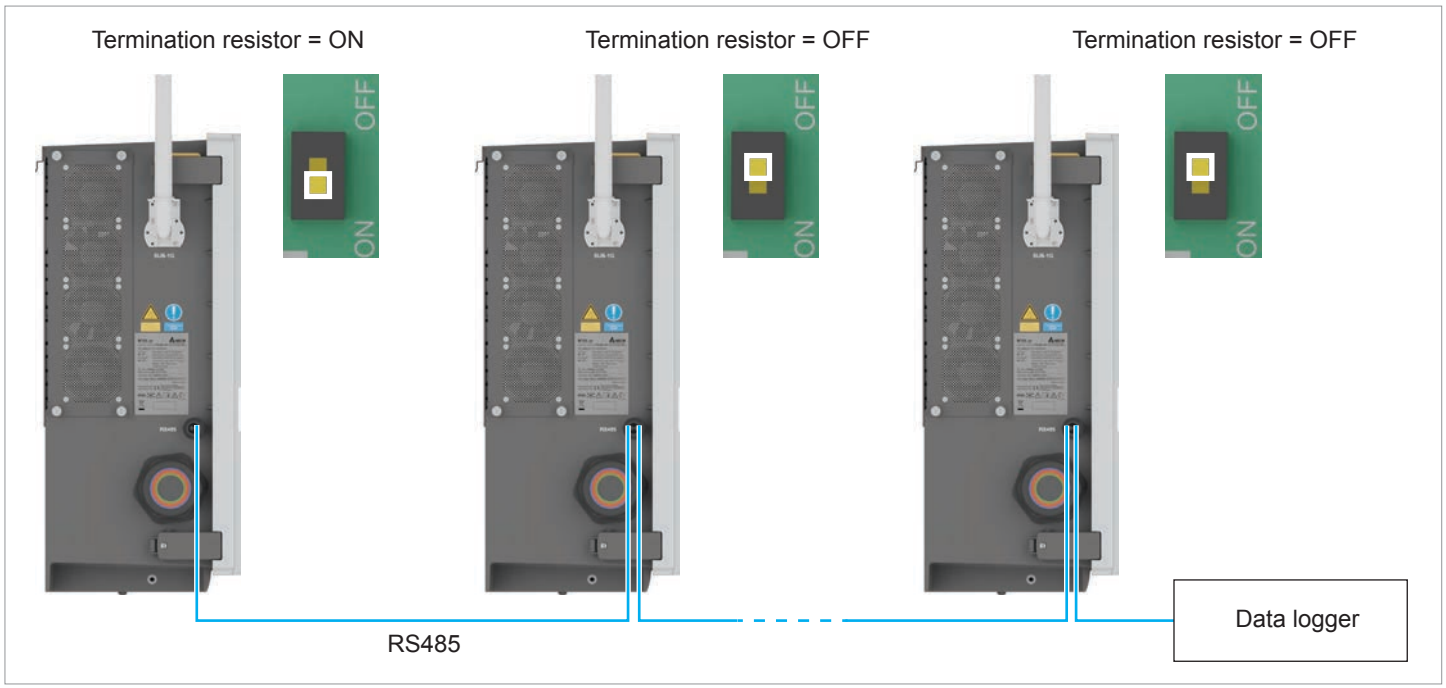


Fig. 7.3: RS485 connection diagram for several inverters

RS485 connection diagram for a DC1 data collector with multiple inverters

The DC1 data collector from Delta does not have an integrated RS485 termination resistor. Depending on where the DC1 is located in the RS485 series, an external RS485 termination resistor may need to be connected, see Fig. 7.4, p. 69.

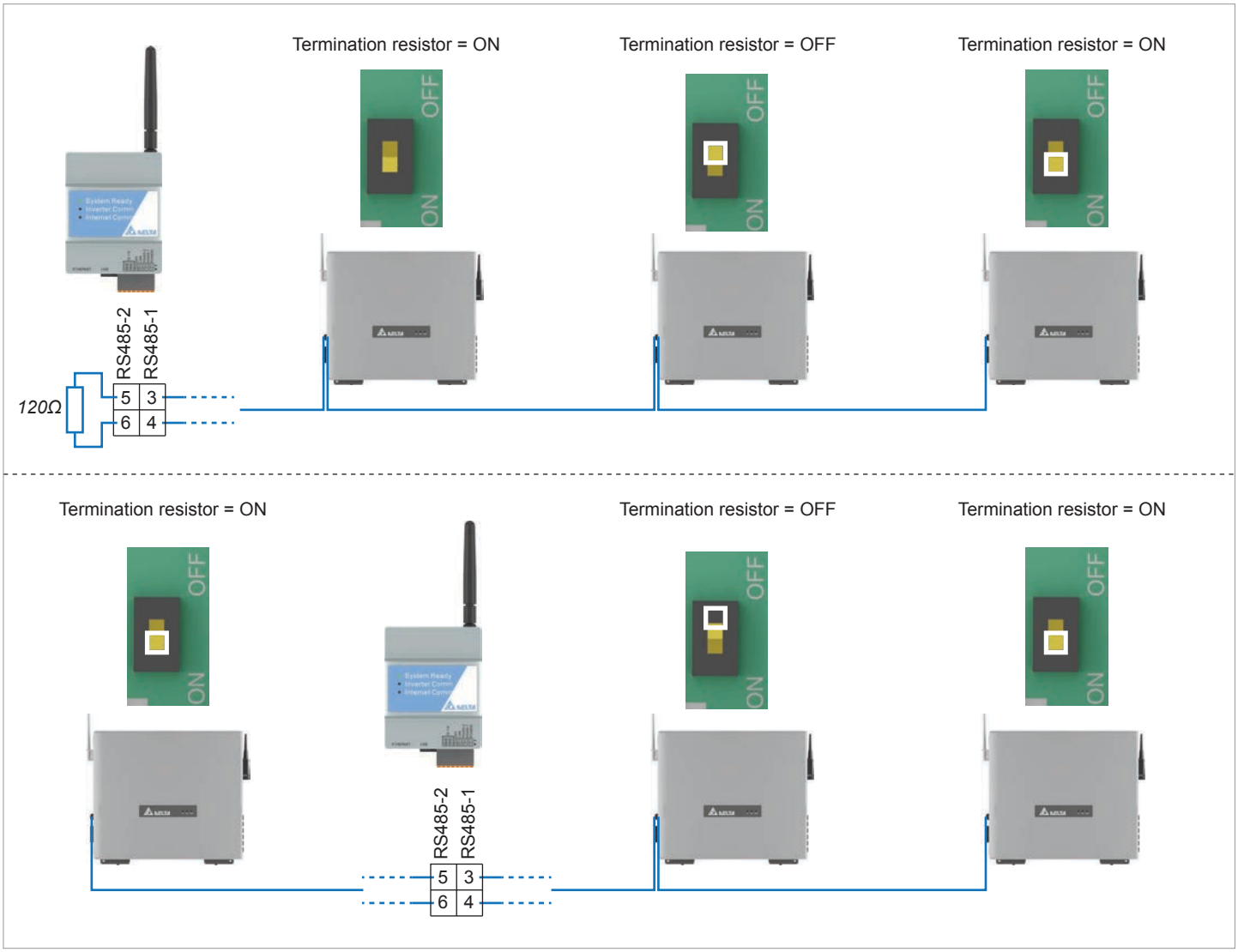
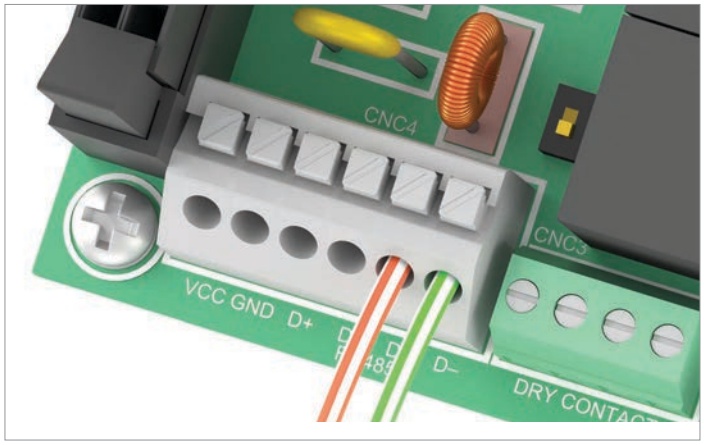
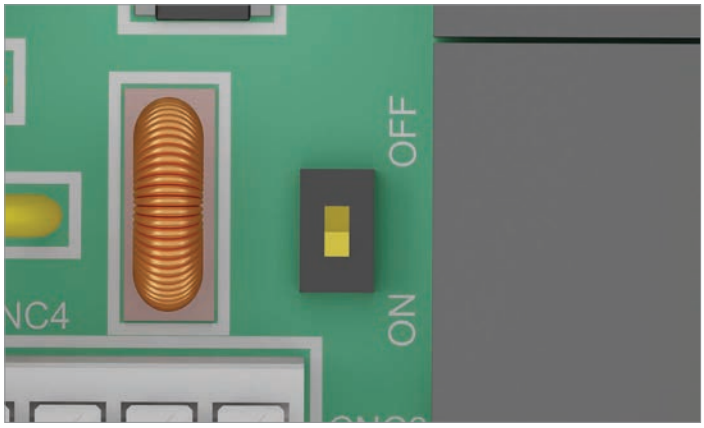


Fig. 7.4: RS485 connection diagram for a DC1 data collector with multiple inverters

1.1.1.1 Wiring for a single inverter

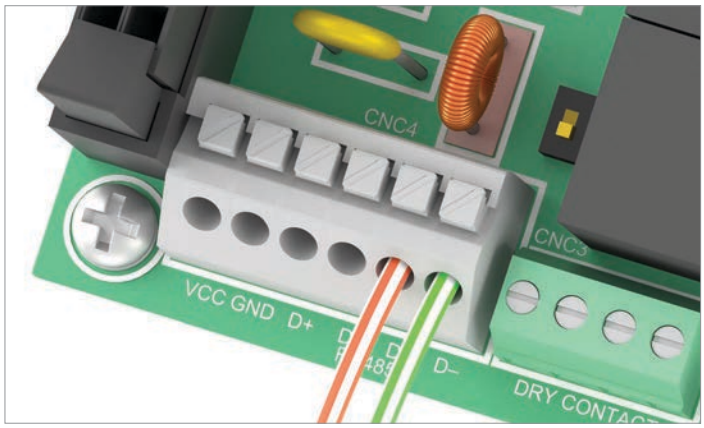


1. Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.

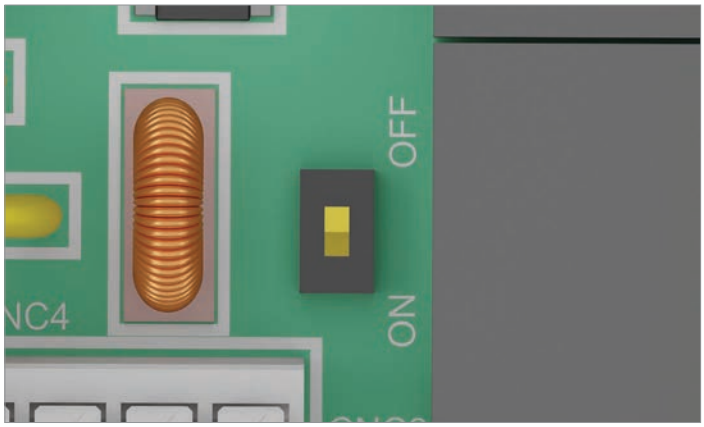


2. Set the DIP switch for the RS485 termination resistor (DIP 2) to the ***ON*** position.

7.7.3.2 Wiring for multiple inverters



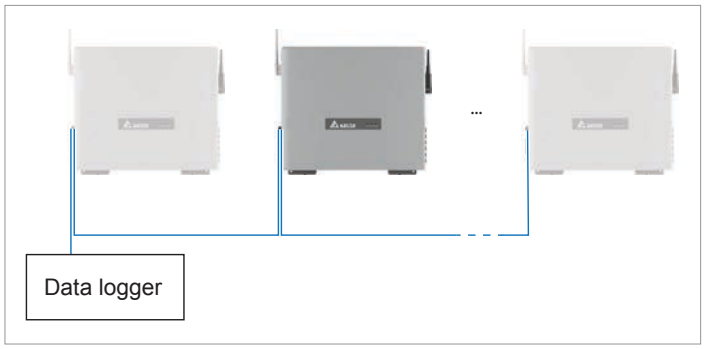
1. On the cable coming from the data logger: Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.
   On the cable going to the second inverter: Connect the DATA+ wire to terminal 3 and the DATA– wire to terminal 4.

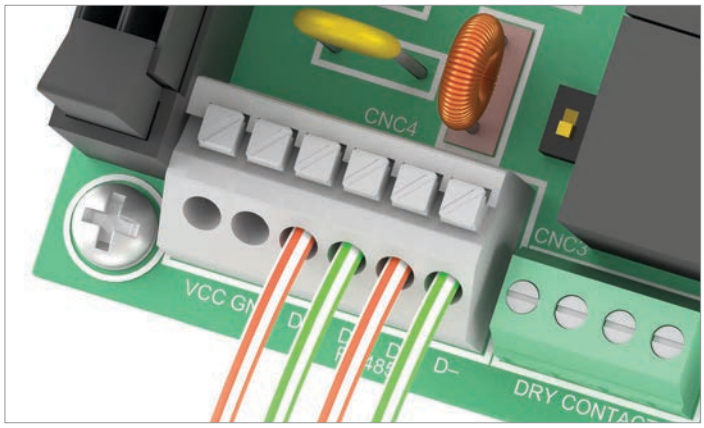


2. Depending on the RS485 connection diagram (see “RS485 connection diagram for multiple inverters”, page 68), switch the DIP switch for the RS485 termination resistor on or off.

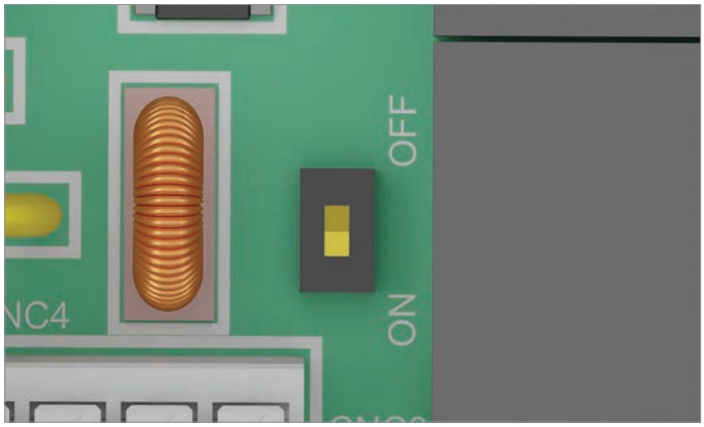
7 Installation

Connecting the communication card

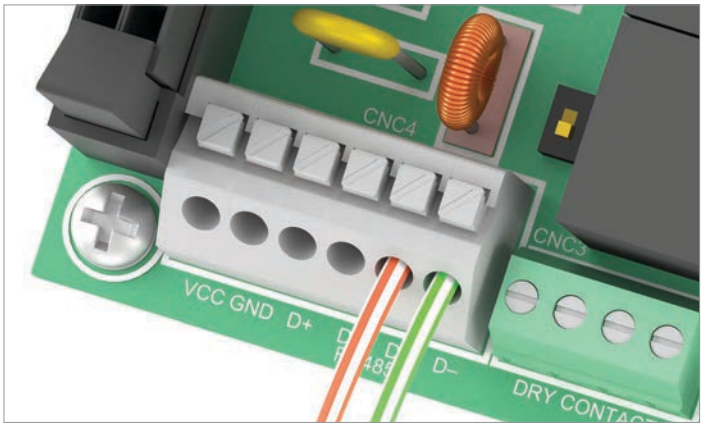




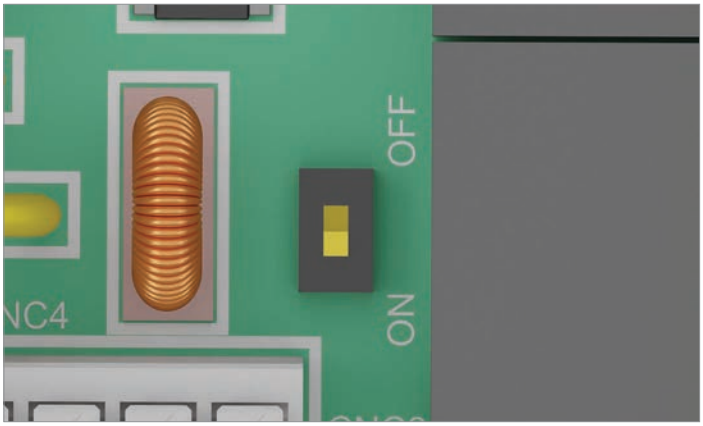
3. On the cable coming from the previous inverter: Connect the DATA+ wire to terminal 5 and the DATA– wire to terminal 6.
   On the cable going to the next inverter: Connect the DATA+ wire to terminal 3 and the DATA– wire to terminal 4.



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



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

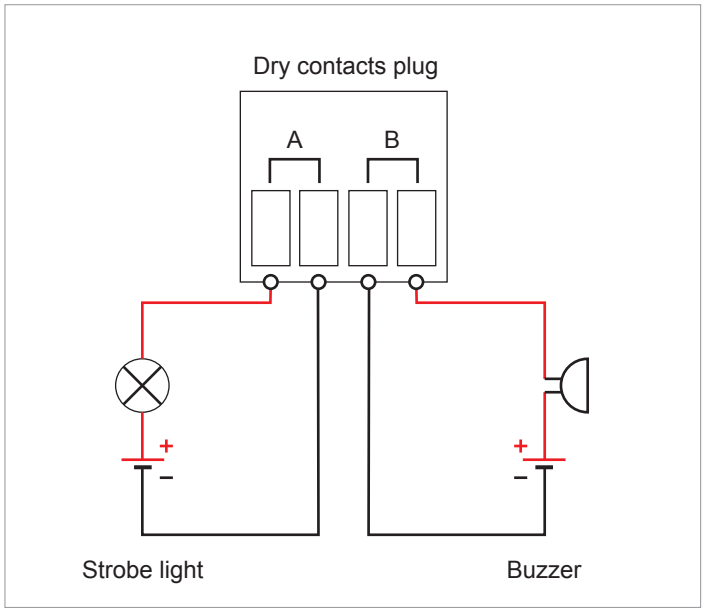


6. Set the DIP switch for the RS485 termination resistor to the ***ON*** position.

7.7.4 Connecting an external alarm unit

The external alarm unit is connected to the dry contacts.

7.7.4.1 Wiring for an external alarm unit with an external 12 VDC power supply



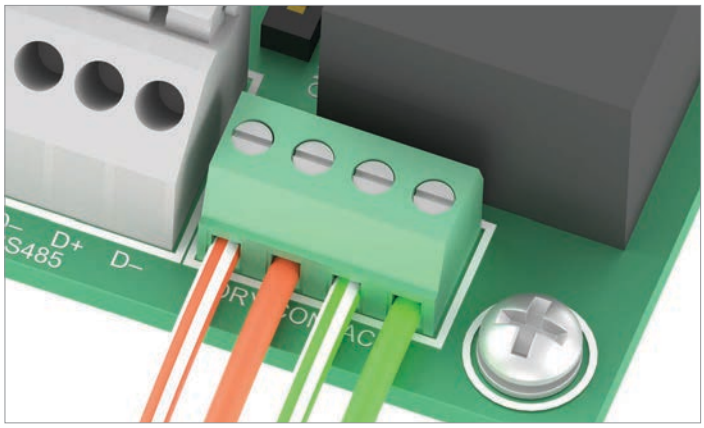
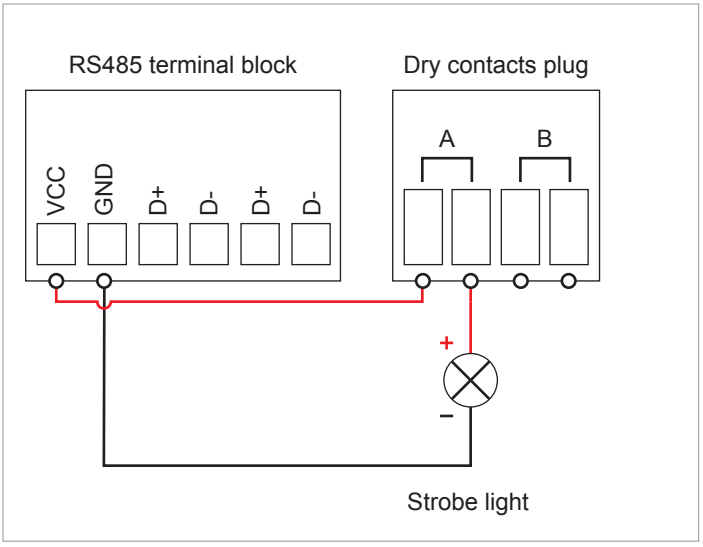


Fig. 7.5: Connection example: Connecting 2 external alarm units with external 12 V_{DC} power supply to the dry contacts

► An event can be assigned to the dry contacts with Delta Service Software or the MyDeltaSolar app after commissioning.

7.7.4.2 Wiring for a single alarm unit with an internal 12 VDC power supply



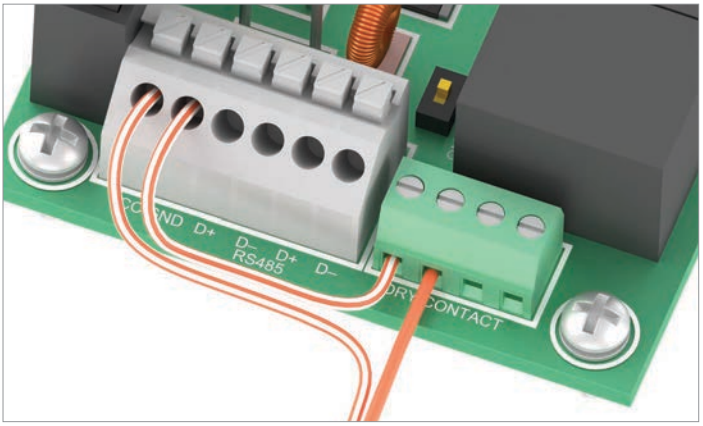


Fig. 7.6: Connection example: Connecting 1 external alarm unit with internal 12 V_{DC} power supply to the dry contacts

► An event can be assigned to the dry contacts with Delta Service Software or the MyDeltaSolar app after commissioning.

7.7.5 Connecting a ripple control receiver

Pin	Naming	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

Table 7.3.: Pin assignment of the terminal block with digital inputs for connecting a ripple control receiver

Connection schema

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

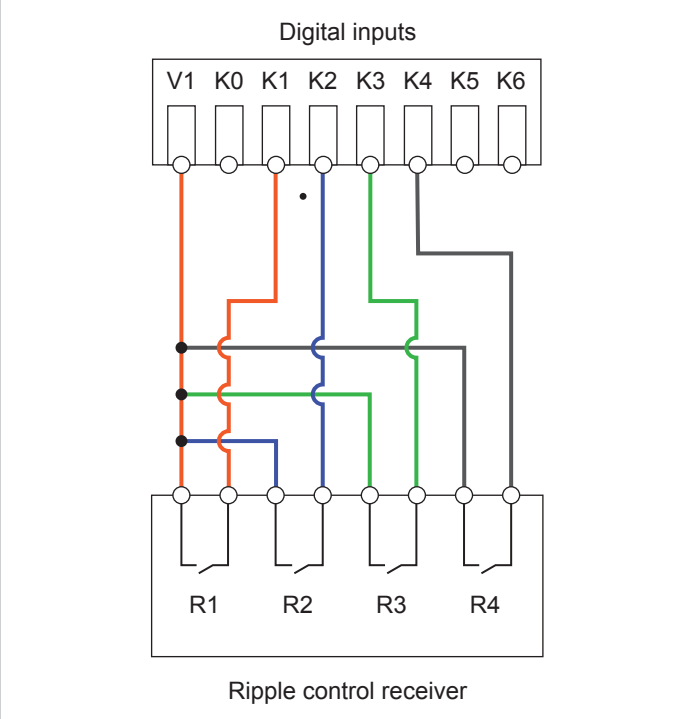


Fig. 7.7: Connection diagram for a ripple control receiver

7.7.6 Connecting the external power-off (EPO)

Pin assignments

Pin	Naming	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

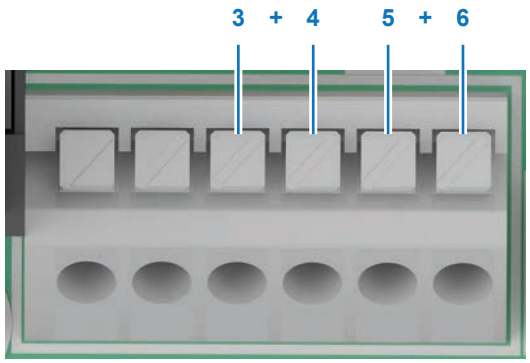
Table 7.4.: Pin assignment of the terminal block for the external power-off

1. Connect the wires to the terminals V1 and K0.
2. After commissioning, the relay for the external power-off can be defined with Delta Service Software as a normally closed or normally open contact.

7.7.7 Connecting a PC via RS485 (optional)

This section describes how to connect a PC if you want to use a Windows PC with the Delta Service Software (DSS) or Delta commissioning software for commissioning.

Note that you must disconnect the PC from the inverter again after commissioning!



You can use terminal pairs 3+4 or 5+6 to connect the PC.

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

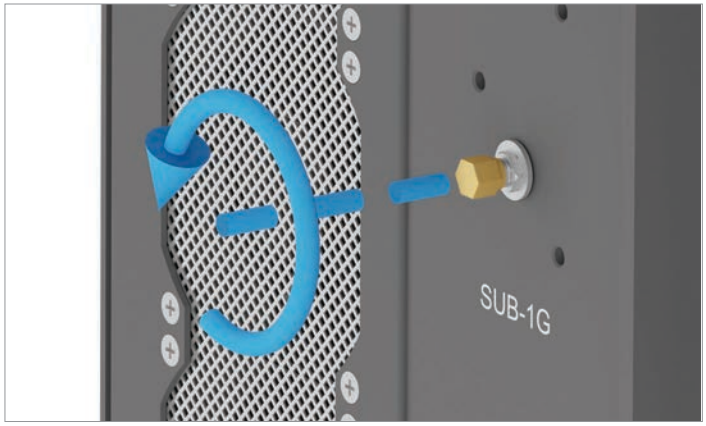
Cable requirements

Bell wire. Both ends open.

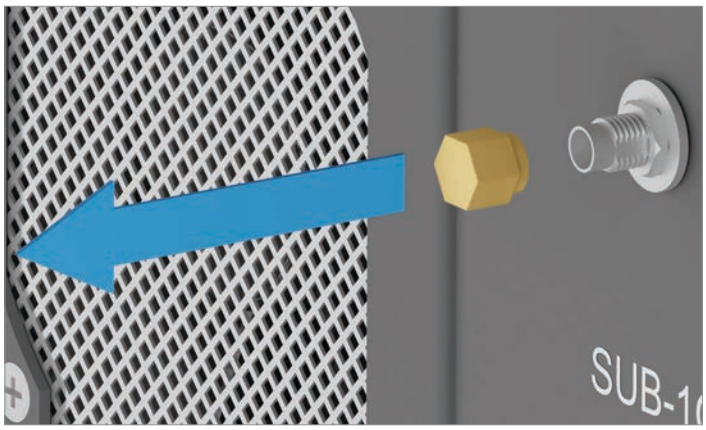
7.8 Installing the Sub-1G antenna (optional)

The Sub-1G antenna and mounting hardware are supplied in the scope of delivery.

Use an insulated magnetic screwdriver to prevent the screws from falling.

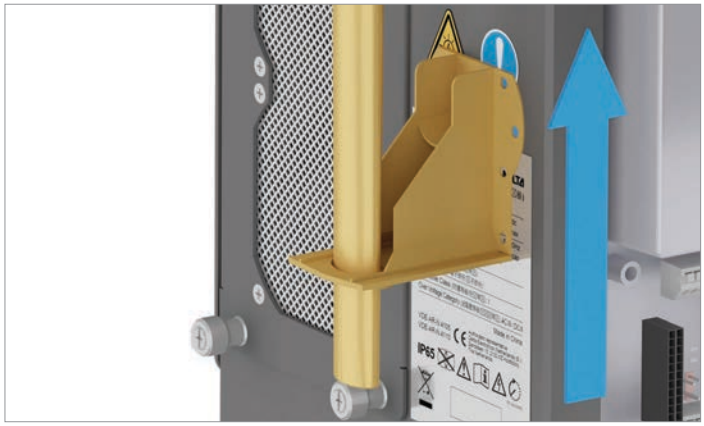


1. Unscrew and remove the cover cap of the Sub-1G connector.

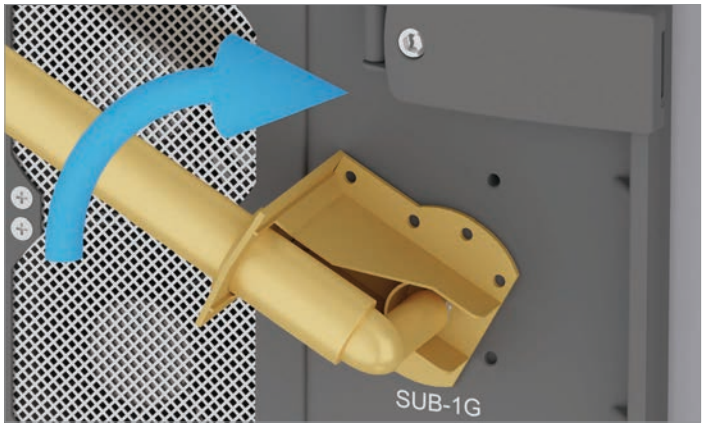


2. Mount the Sub-1G antenna and screw it on so that it can still be rotated.

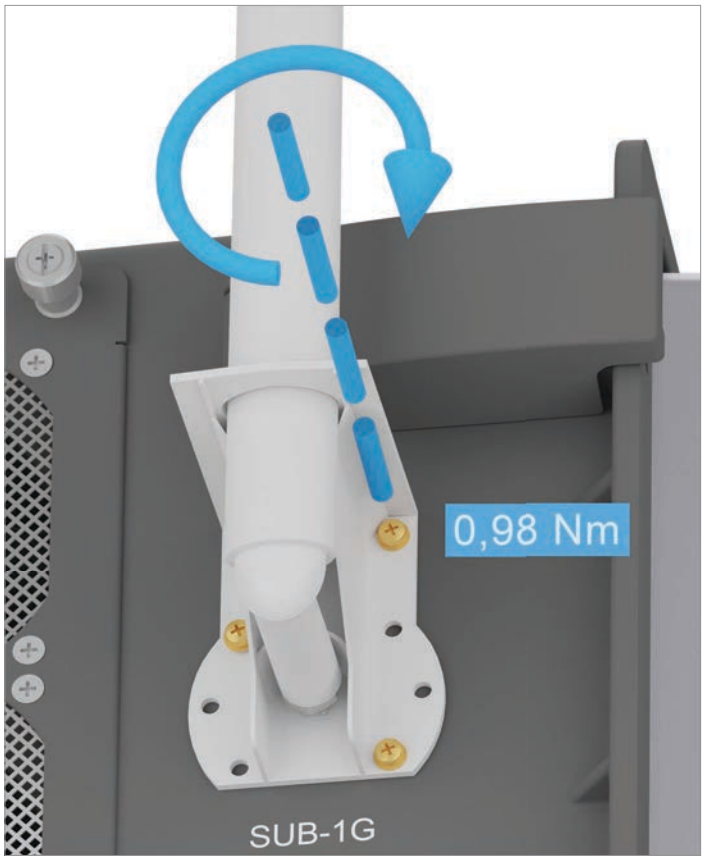
3. Rotate the Sub-1G antenna downward.



4. Slide the mounting frame over the Sub-1G antenna upside down from below.



5. Rotate the mounting frame with the Sub-1G antenna upward.



6. Screw on the mounting frame.

☑ The installation of the Sub-1G antenna is complete.

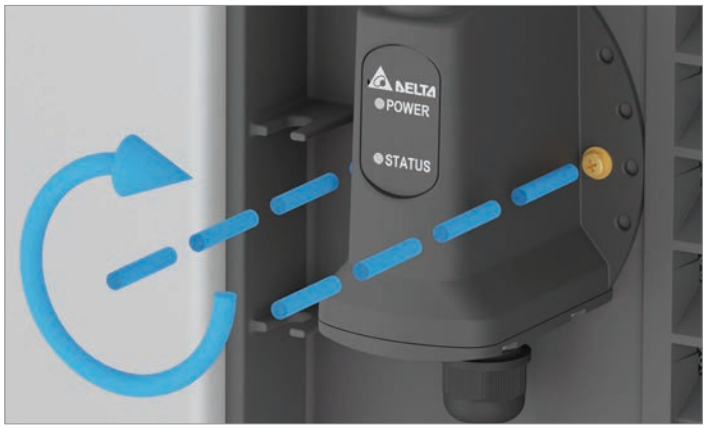
7.9 Installing the Wi-Fi module before commissioning (optional)

The Wi-Fi module is an accessory that must be ordered separately.

The Wi-Fi module, cable and mounting materials are included in the scope of delivery.

1. Unscrew the cable gland of the Wi-Fi connection and remove the cable gland and seal.

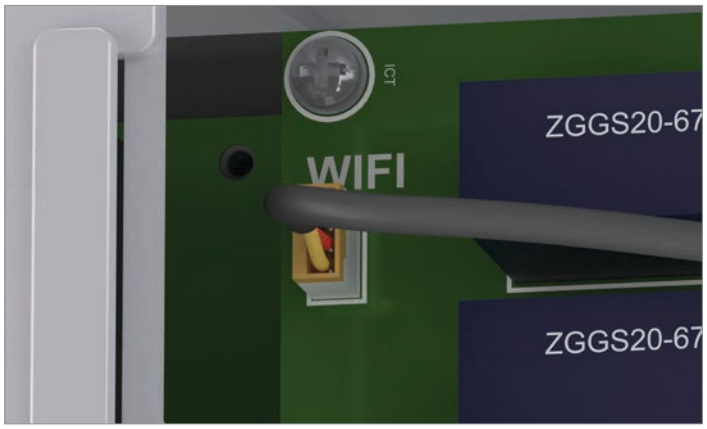
2. Mount and fasten the Wi-Fi module.



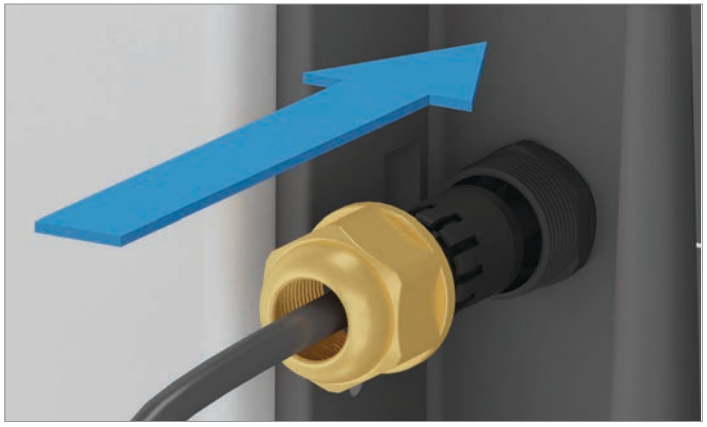
3. Thread the cable through the cable gland and seal.

4. Remove the protective cover from the DC surge protection devices.

5. Plug the cable into the power supply connection on the printed circuit board with the DC surge protection devices.



6. Mount the protective cover of the DC surge protection devices.



7. Insert the seal and cable gland of the Wi-Fi connection and screw the cable gland in place.

☑ The installation of the Wi-Fi module is complete.

7.10 Connecting to the grid (AC)

7.10.1 Specification for copper cable

Min./max. Cable diameter	26.0 to 57.0 mm
Min./max. Wire cross-section	
Without wire end sleeve	
● Rigid cable	35–120 mm^2
● Multi-wire cable	35–120 mm^2
With wire end sleeve	
● Flexible cable	35–120 mm^2
Stripping length	20 mm

7.10.2 Specification for aluminum cable

Aluminum cables can only be used in conjunction with Al-Cu compression joints (see “5.4.14 Instructions regarding selection and utilization of Al-Cu compression joints”, page 37)

Min./max. Cable diameter	26.0 to 57.0 mm
Min./max. Wire cross-section	
Without wire end sleeve	
● Rigid cable	35–120 mm^2
● Multi-wire cable	35–120 mm^2

7.10.3 AC cable gland

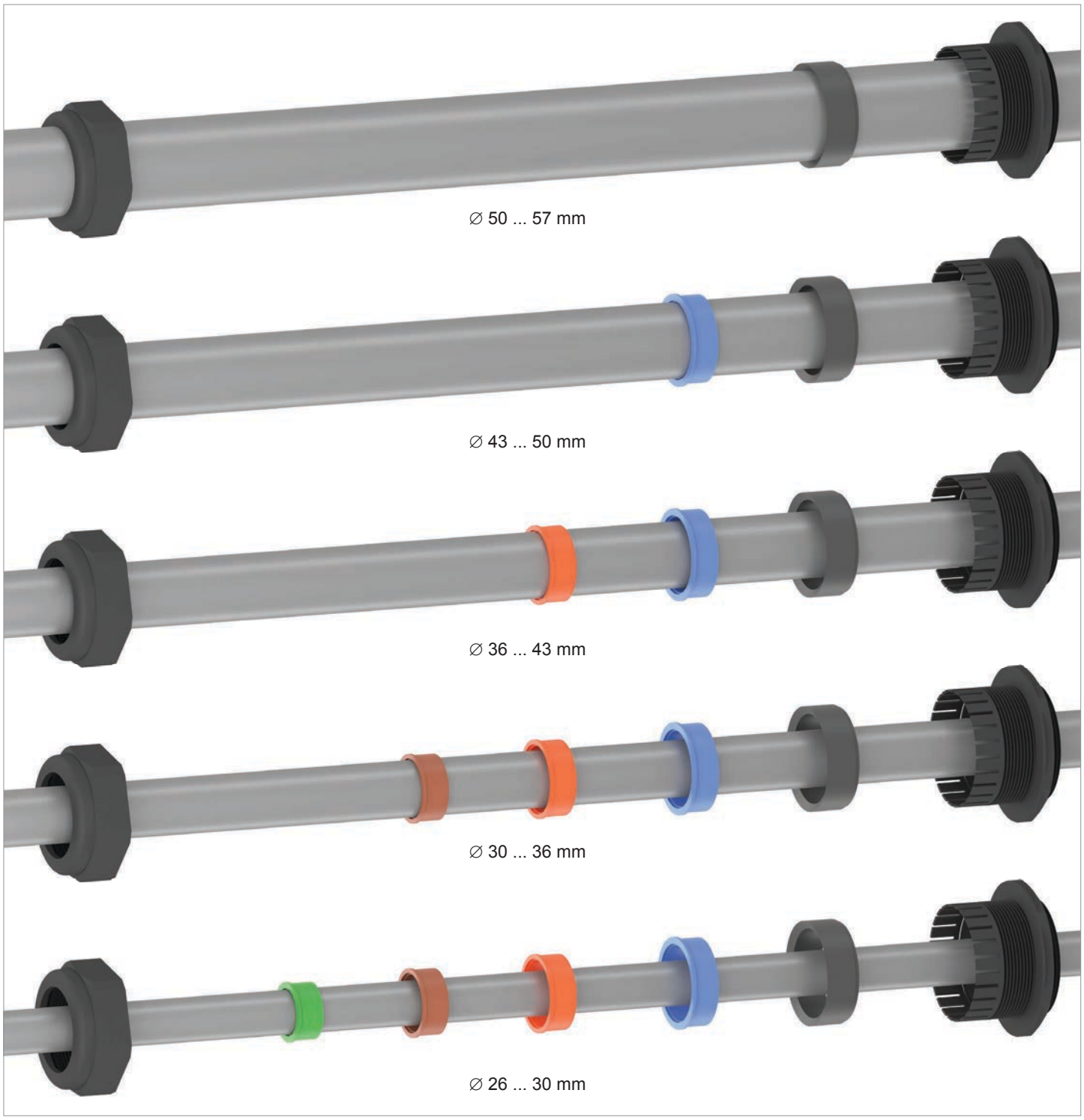
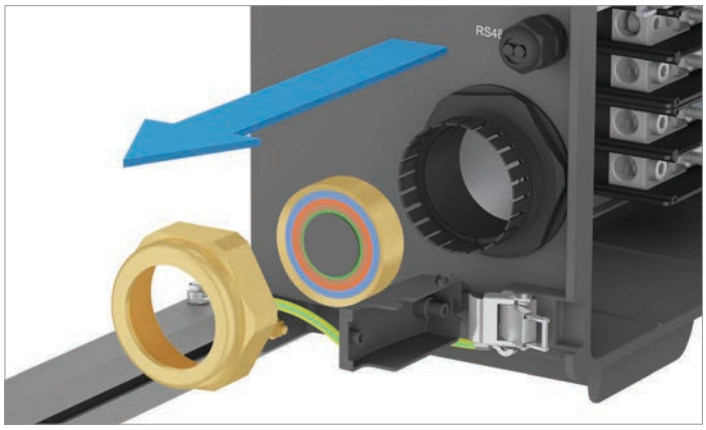


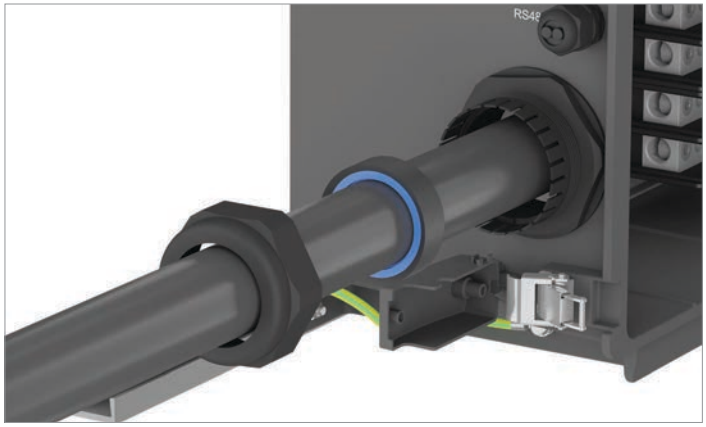
Fig. 7.8: Use of the parts of the AC cable glands depending on the cable diameter

7 Installation

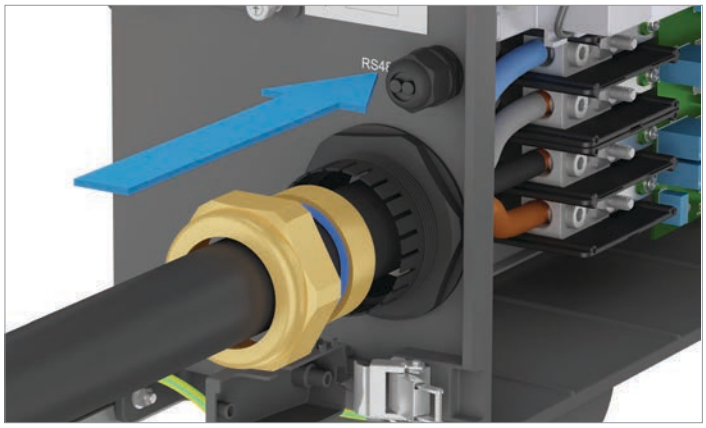
Connecting to the grid (AC)

1. Unscrew the cable gland for the AC connection, remove the cable gland and seal.





2. Thread the cable through the cable gland and seal.



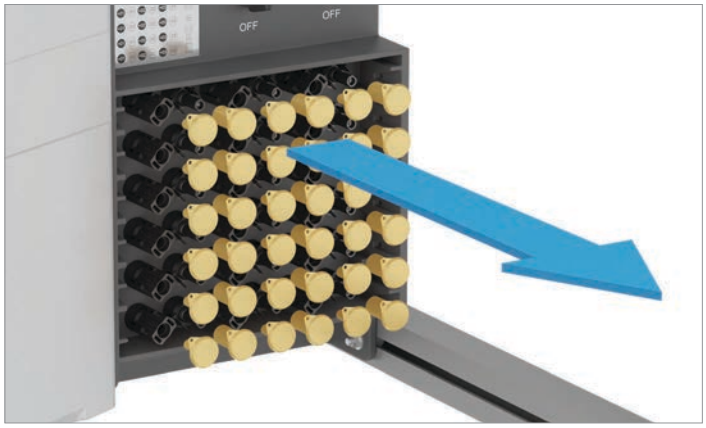
3. Insert the seal and cable gland for the AC connection and screw the cable gland in place.

7.10.4 Connection examples

Connection example: 3 phases + N + PE

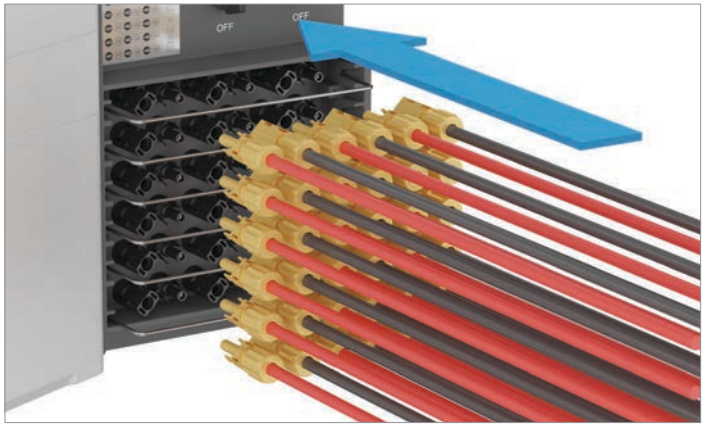
Connection example: 3 phases + PE

7.11 Connecting the solar modules (DC)



1. Pull out the cover caps of the DC connections.

2. Insert the metal brackets to support the DC cables.

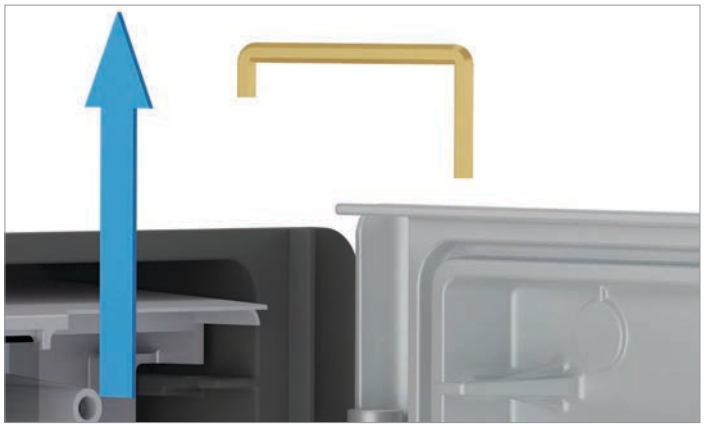


3. Plug in the DC cables.

4. The illustration on the left shows how the wiring should look when all DC connections are in use.

7.12 Completing electrical installation

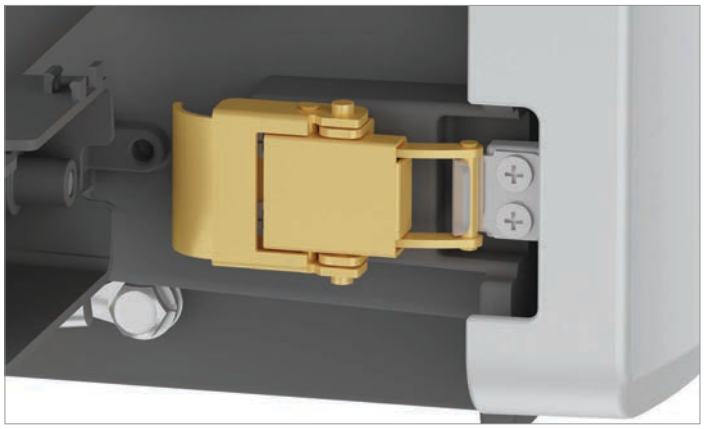
If you have connected a PC for commissioning (see “7.7.7 Connecting a PC via RS485 (optional)”, page 76), you must disconnect the PC from the inverter again after commissioning (see “8.4 Commissioning with the Delta Service Software (DSS)”, page 97)!

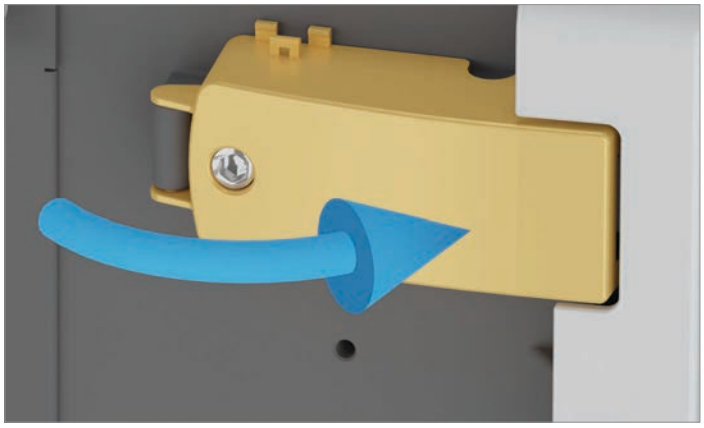


1. Remove the Allen key from the top of the door.

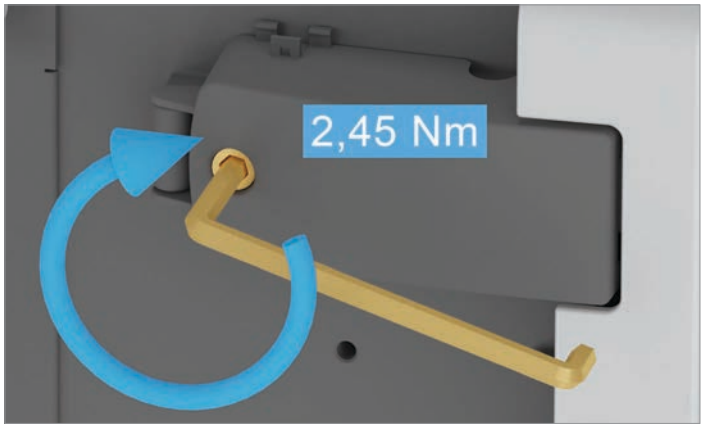
2. Close the door.

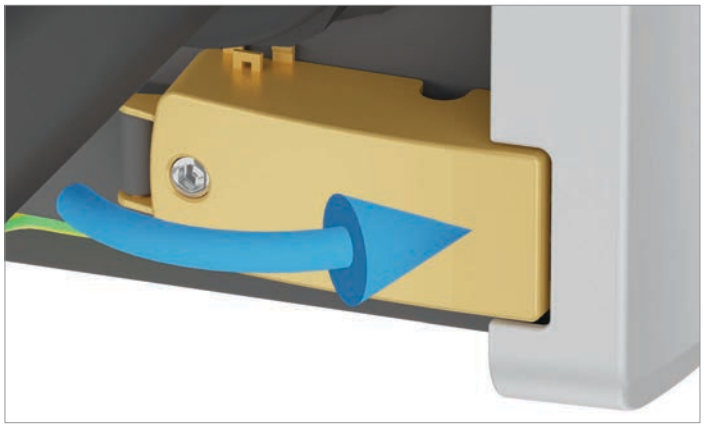
3. Close the upper and lower door locks.



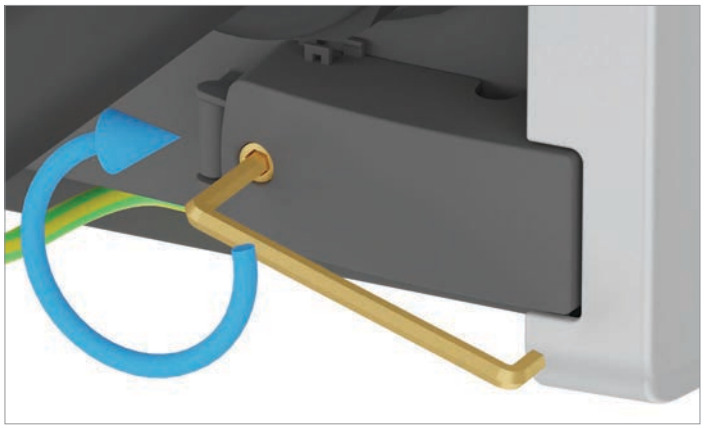


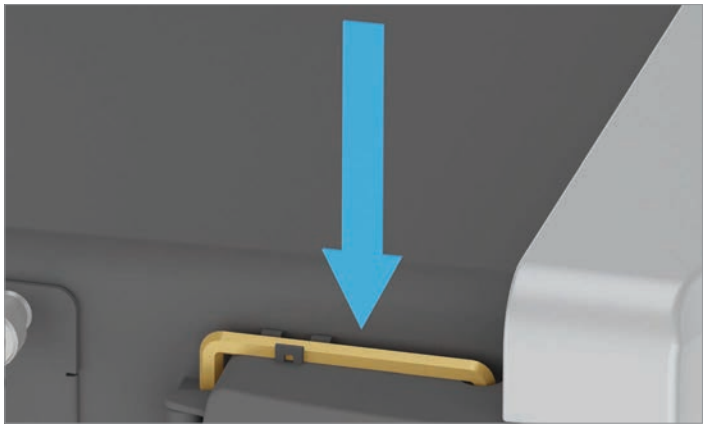
4. Close and tighten the cover of the upper door lock.





5. Close and tighten the cover of the lower door lock.





6. Insert the Allen key into the upper door lock.

7. Close the isolating switch between the inverter and the grid connection point or inverter and the solar modules.

8. Continue to chapter “8. Commissioning”, page 92.

8. Commissioning

8.1 Prerequisites for commissioning

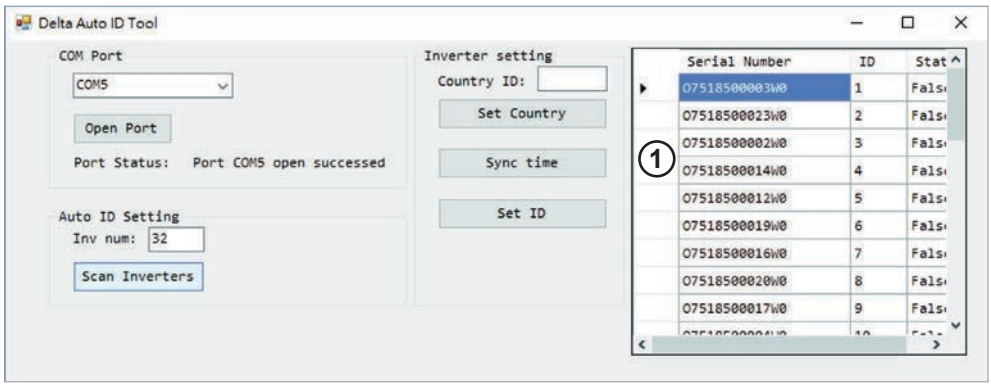
- All inverters in the system are connected with one another via RS485.
- All inverters are supplied with AC or DC voltage.
- The PC is connected to the RS485 network of the inverters via a USB/RS485 adapter.
- Commissioning the inverter requires a PC with the commissioning software and Delta Service Software (DSS) installed. You can download both at www.solar-inverter.com.

8.2 Commissioning with the commissioning software

1. Start the commissioning software.

2. Select a COM port **(1)**and click on the **Open Port** button **(2)**.

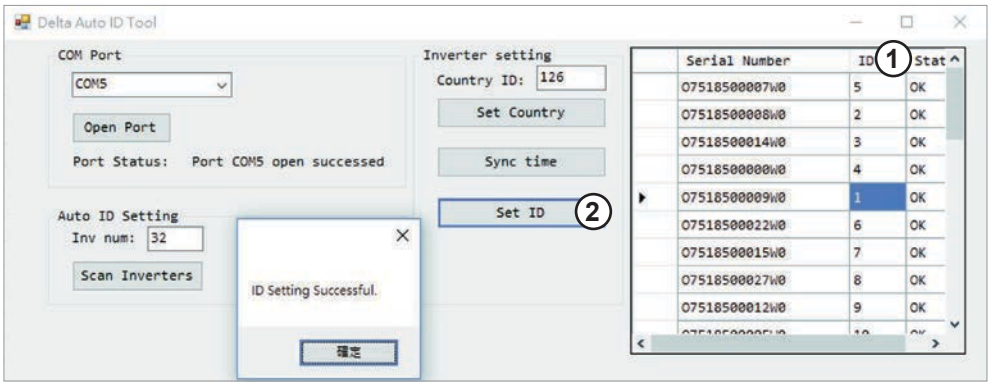
3. Enter the number of inverters connected via RS485 **(1)** and click on the **Scan Inverters** button **(2)**.



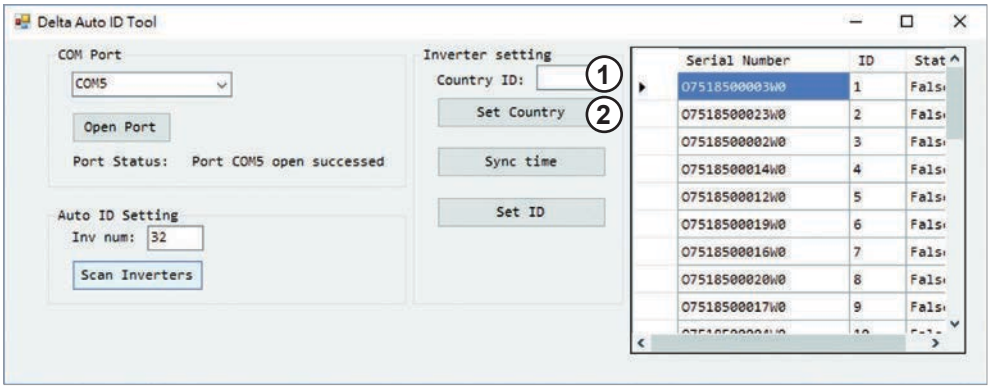
→ A list of the inverters found is displayed. Each inverter is automatically assigned an inverter ID **(1)**.

→ See “8.3 Commissioning troubleshooting”, page 95 if an error message appears.

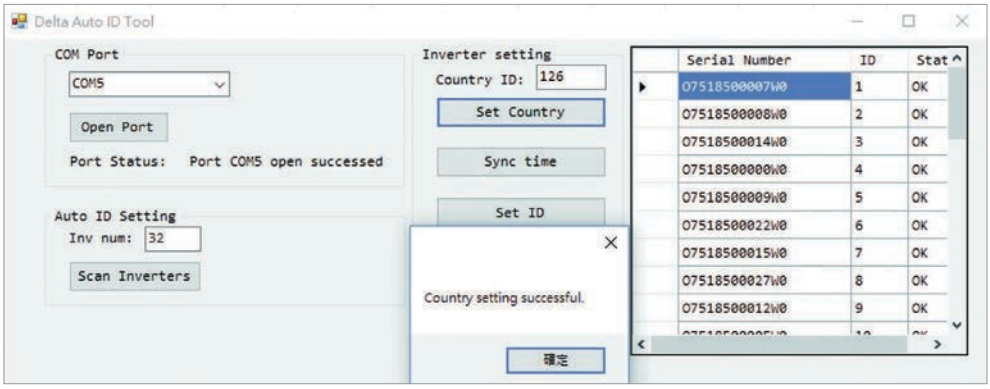
If multiple inverters are connected to the PV system, a different inverter ID must set for each inverter. The inverter ID is used, for example, by monitoring systems to uniquely identify each inverter.



4. To change an inverter ID, click in the corresponding **ID** text box **(1)** and enter the new inverter ID.
5. To save the new inverter IDs, click on the **Set ID** button **(2)**.
   → The message "ID Setting Successful" appears if the setting was successful.

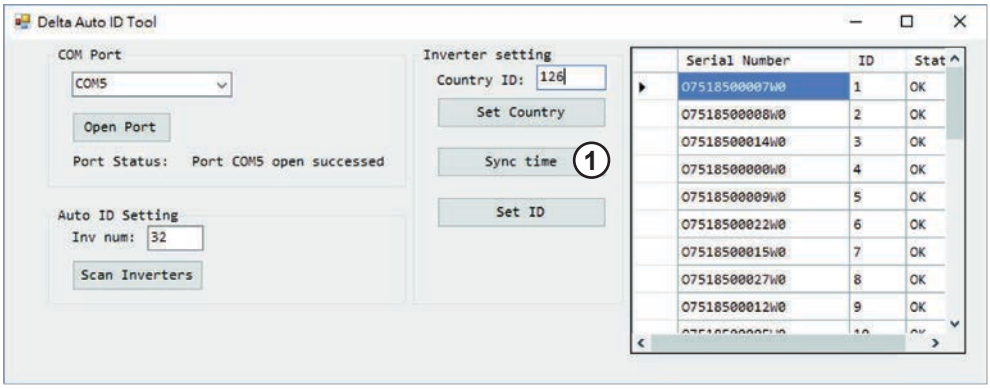


6. In the **Country ID (1)** text box, enter the number of your country and click on the **Set Country (2)** button.

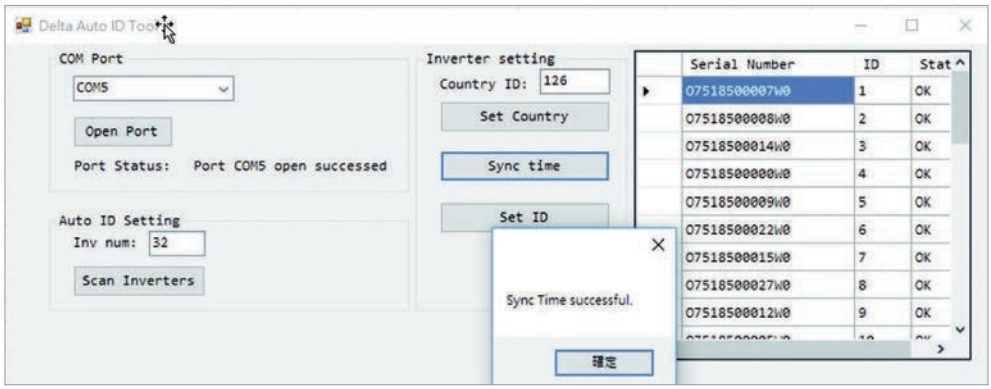


→ The message "Country Setting Successful" appears if the setting was successful.

→ See “8.3 Commissioning troubleshooting”, page 95 if an error message appears.



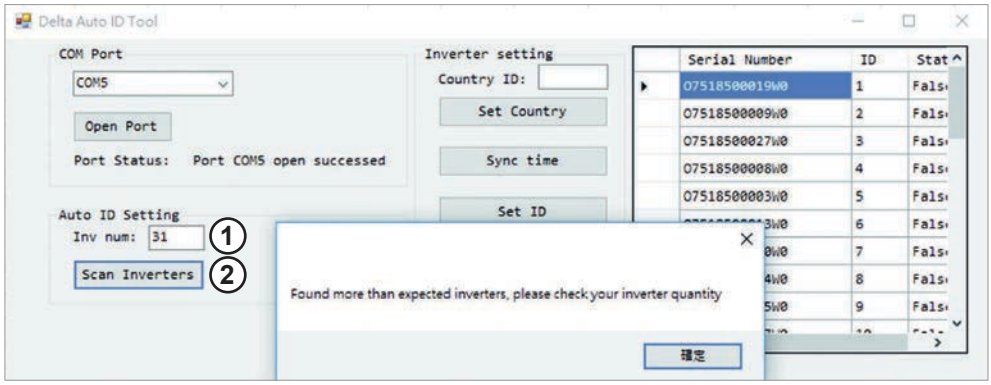
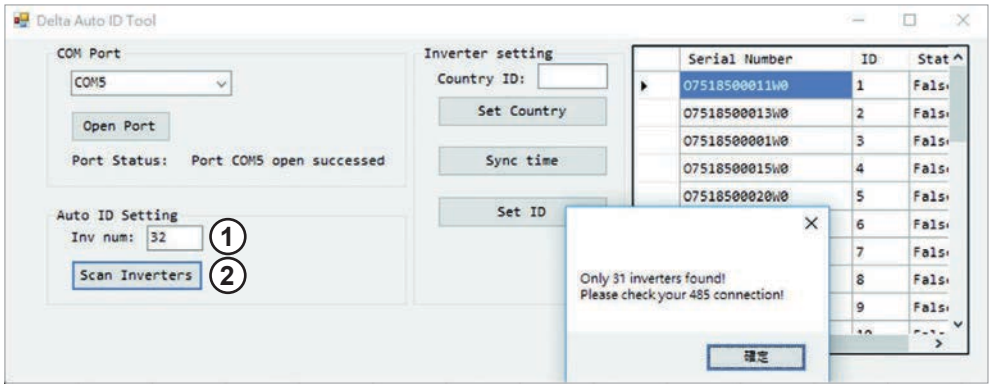
7. To set the date and time for all inverters, click on the **Sync time (1)** button.



→ The message "Sync Time successful" appears if the setting was successful.

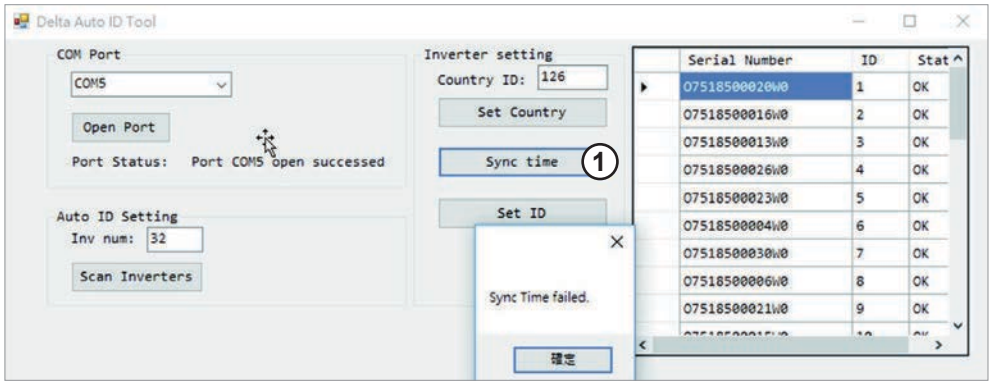
☑ Commissioning is now complete.

8.3 Commissioning troubleshooting

Error message and cause of error	Error correction
Error event "Found more than expected inverters, please check your inverter quantity." ("More inverters found than expected. Please check the number of inverters.") **Cause of error** More inverters were found when scanning the RS485 ring than specified in the **Inv num** text box.  	► Check whether the entry in the **Inv num** text box is correct. Change the value if necessary. ► Check whether all inverters are connected in the correct RS485 ring. ► To finish, click on the **Scan Inverters** button (2).
Error event "Only xx inverters found! Please check your 485 connection." ("Only xx inverters found. Please check the RS485 connection.") **Cause of error** Fewer inverters were found when scanning the RS485 ring than specified in the **Inv num** text box.  	► Check whether the entry in the **Inv num** text box is correct **(1)**. Change the value if necessary. ► Check whether all inverters are connected to the RS485 ring. ► To finish, click on the **Scan Inverters** button **(2)**.

Error message and cause of error	Error correction
Error event "Wrong country ID setting! Please check your country ID!" ("Invalid country ID. Please check the RS485 connection.") **Cause of error** Fewer inverters were found when scanning the RS485 ring than specified in the **Inv num** text box.	► Check whether the entry in the **Country-ID** text box is correct **(1)**. Change the value if necessary. ► To finish, click on the **Set Country** button **(2)**.

Error event "Time Sync failed." (German: "Synchronisierung der Uhrzeit fehlgeschlagen.") **Cause of error** Time synchronization failed.	► Check the time on the PC. ► To finish, click on the **Sync time** button **(1)**.



8.4 Commissioning with the Delta Service Software (DSS)

Prerequisites

During installation, a Windows PC on which the Delta Service Software is installed was connected to the inverter (see “7.7.7 Connecting a PC via RS485 (optional)”, page 76).

Download link https://solarsolutions.delta-emea.com/en/Solar-Inverter-Support-171.htm

Procedure

► Launch the Delta Service Software and follow the instructions.

8.5 Commissioning with the MyDeltaSolar app

8.5.1 Direct connection between mobile device and inverter

Prerequisites

During installation, the Wi-Fi module was installed on the inverter (see “7.9 Installing the Wi-Fi module before commissioning (optional)”, page 80).

The MyDeltaSolar app is installed on the mobile device (smartphone, tablet with iOS or Android).

Procedure

1. Launch the MyDeltaSolar app.
2. Follow the instructions in the app to connect your mobile device to the inverter.
3. Once the connection is established, follow the instructions in the commissioning procedure.

8.5.2 Mobile device connected to inverter via DC1 data collector

Prerequisites

The inverter is connected to the DC1 (see “6. Planning the Commissioning”, page 48)

The MyDeltaSolar app is installed on the mobile device (smartphone, tablet with iOS or Android).

1. Launch the MyDeltaSolar app.
2. Follow the instructions in the app to connect your mobile device to the DC1.
3. Once the connection is established, follow the instructions in the commissioning procedure.

9. Error events and troubleshooting

DANGER

Electric shock

Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

You should therefore always carry out the following steps before working on the inverter:

1. Turn both DC isolating switches 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 restored accidentally.
3. Wait at least 60 seconds for the internal capacitors to discharge.

DANGER

Electric shock

Potentially fatal voltages are present at the DC connections of the inverter. 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 both DC isolating switches to the ***OFF*** position.
- ► Disconnect the connection to the grid so that the inverter cannot feed energy into the grid.
- ► Disconnect the inverter from all AC and DC voltage sources. Make sure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock

The IP65 protection rating is no longer guaranteed when the door is open.

- ► Only open the door when absolutely necessary.
- ► Do not open the door if water or dirt might enter the inverter.
- ► After work is completed, ensure that the door is properly shut and tightened again. Check that the doors are properly sealed.

WARNING

Heavy weight

The inverter is heavy.

- ► The inverter must be lifted and carried by at least two people.

WARNING

Hot surfaces

The surface of the inverter can get very hot during operation.

- Always wear safety gloves when touching the inverter.

For information on maintenance and repair work that you are authorized to carry out yourself, refer to chapter “10. Maintenance”, page 104. For all other work, please contact Delta Customer Service.

To read error messages or change parameter settings, you need the Delta Service Software (DSS) or the MyDeltaSolar app.

9.1 Error

Error number	Message	Possible causes	Suggestions for resolution
E01	**AC Freq High**	Grid frequency lies above the ***OFR*** setting (overfrequency relay).	Check the grid frequency.
		Incorrect country or grid type setting.	Check the country and grid type settings.
E02	**AC Freq Low**	Grid frequency lies below the ***UFR*** setting (underfrequency relay).	Check the grid frequency.
		Incorrect country or grid type setting.	Check the country and grid type settings.
E07	**Grid Quality**	Non-linear load in the grid and in the vicinity of the inverter.	The grid connection of the inverter must be kept away from non-linear loads; if necessary, move it further away.
			If this error occurs repeatedly, contact Delta Customer Service.
E08	**HW Connect Fail**	AC cable is not connected correctly.	Check that the AC cable is connected correctly.
E09	**No Grid**	There is normally an external load isolating switch between the inverter and the grid (e.g. in an equipment terminal box). This is used to isolate the inverter from the grid and to shut off its AC voltage supply.	Check that the external load isolating switch is closed.
		AC cable is not connected correctly.	Check that the AC cable is connected correctly.
E10, E15, E20	**AC Volt Low**	Grid voltage lies below the ***UVR*** setting (undervoltage relay).	Check the grid voltage connection at the inverter terminals.
		Incorrect country or grid type setting.	Check the country and grid type settings.
		AC cable is not connected correctly.	Check that the AC cable is connected correctly.
E11, E13, E16, E18, E21, E23	**AC Volt High**	Grid frequency lies above the ***OVR*** setting (overvoltage relay).	Check the grid voltage.
		Supply voltage during operation is greater than the ***OVR long*** setting.	Check the grid voltage.
		Incorrect country or grid type setting.	Check the country and grid type settings.
E30	**Solar High**	The DC input voltage is too high.	Design the module strings so that the DC input voltage is below the maximum permissible DC input voltage.
E34	**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. Dry the PV modules if necessary.

9.2 Warnings

Warning number	Message	Possible causes	Suggestions for resolution
W01	**Solar Low**	DC input voltage is too low.	Check the DC input voltage on the inverter display. There may be insufficient solar radiation.
W07	**De-rating**	The inverter is not delivering the expected power. This can have several causes:	
		The temperature is too high.	Check the ambient conditions (e.g. air circulation).
		A power limit has been set.	Change the power limit settings.
		The "Active power control via grid frequency" function is active and has regulated the active power.	Check the grid frequency.
		The "Active power control via grid voltage" function is active and has regulated the active power.	Check the grid voltage.
		The grid voltage is too low.	Check the grid voltage.
		The solar voltage is too low or too high.	Check the solar voltage.
W08	**String fault**	The polarity of the DC string is reversed.	Connect the DC strings correctly.
		The string monitoring circuit is defective.	Contact Delta Customer Service.
W11	**Int Fan Fail** **Ext Fan Fail**	One or more fans are blocked.	Clean or replace the fans.
		One or more fans are defective. One or more fans are disconnected from the power supply.	Check the connections for all fans.
W17	**DC SPD fault**	A lightning bolt has struck in the vicinity of the inverter and the DC surge protection devices have tripped.	Check on the inverter whether the DC surge protection devices have tripped. If yes, replace the card with the DC surge protection devices.
		One or more DC surge protection devices are defective.	Replace the card with the DC surge protection devices.
		The card containing the DC surge protection devices is not inserted correctly, fastening screws are missing or the fastening screws are not tightened correctly.	Check that the card is seated correctly. Check that no screws are missing and tighten all screws.
		The signal cable is not inserted correctly.	Check that the signal cable is inserted correctly.
W18	**AC SPD fault**	A lightning bolt has struck in the vicinity of the inverter and the AC surge protection devices have tripped.	Check on the inverter whether the DC surge protection devices have tripped. If yes, replace the card with the DC surge protection devices.
		One or more AC surge protection devices are defective.	Replace the card with the DC surge protection devices.
		The card containing the AC surge protection devices is not inserted correctly, fastening screws are missing or the fastening screws are not tightened correctly.	Check that the card is seated correctly. Check that no fastening screws are missing and tighten all fastening screws.
		The two cables are not inserted correctly.	Check that the signal cable is inserted correctly.

9.3 Faults

Fault number	Message	Possible causes	Suggestions for resolution
F01, F02, F03	HW DC Injection	The grid waveform is abnormal.	Contact Delta Customer Service.
		Internal error.	Contact Delta Customer Service.
F05	Temperature High	The ambient temperature is > 60 °C.	Check the system environment.
F06, F08, F09, F10	HW NTC1 Fail, HW NTC2 Fail, HW NTC3 Fail, HW NTC4 Fail	Ambient temperature is > 90 °C or < -30 °C.	Check the system environment.
		Detection circuit malfunction.	Contact Delta Customer Service.
F07	Temperature Low	The ambient temperature is < -30 °C.	Check the system environment.
		Internal error.	Contact Delta Customer Service.
F13, F29	Relay Open	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 input voltage.	Check the DC input voltage on the inverter display. There may be insufficient solar radiation.
		Internal error.	Contact Delta Customer Service.
F18, F19	HW Red ADC1, HW Red ADC2	The DC input voltage is less than the minimum required DC input 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	Incorrect calibration.	Check the accuracy of the voltage and power.
		Internal error.	Contact Delta Customer Service.
F22	HW COMM2	Internal error.	Contact Delta Customer Service.
F23	HW COMM1	Internal error.	Contact Delta Customer Service.
F24	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 < 12 µF. Install an external transformer if necessary.
		Internal error.	Contact Delta Customer Service.
F26	HW Connect Fail	Internal error.	Contact Delta Customer Service.
F27	RCMU Fail	Internal error.	Contact Delta Customer Service.
F28	Relay Short	Internal error.	Contact Delta Customer Service.
		Fault in the relay driver circuit.	Contact Delta Customer Service.
F30	Bus Imbalance	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.
F31, F33, F35	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 is below the maximum permissible DC input voltage.
		Overvoltage during operation.	Contact Delta Customer Service.
		Internal error.	Contact Delta Customer Service.

9 Error events and troubleshooting

Faults

Fault number	Message	Possible causes	Suggestions for resolution
F36, F37, F38, F39, F40, F41	**AC Current High**	Overvoltage during operation.	Contact Delta Customer Service.
		Internal error.	Contact Delta Customer Service.
F42	**HW CT A Fail**	Internal error.	Contact Delta Customer Service.
F43	**HW CT B Fail**	Internal error.	Contact Delta Customer Service.
F44	**HW CT C Fail**	Internal error.	Contact Delta Customer Service.
F45	**HW AC OCR**	Large grid harmonics.	Check the grid waveform. The grid connection of the inverter must be kept away from non-linear loads; if necessary, move it further away.
		Internal error.	Contact Delta Customer Service.
F50	**HW ZC Fail**	Internal error.	Contact Delta Customer Service.
F60, F61, F70, F71	**DC Current High**	Internal error.	Contact Delta Customer Service.

10. Maintenance

10.1 Safety Instructions

DANGER

Electric shock
Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.
You should therefore always carry out the following steps before working on the inverter:

1. Turn both DC isolating switches 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 restored accidentally.
3. Wait at least 60 seconds for the internal capacitors to discharge.

DANGER

Electric shock
Potentially fatal voltages are present at the DC connections of the inverter. 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 both DC isolating switches to the ***OFF*** position.
- ► Disconnect the connection to the grid so that the inverter cannot feed energy into the grid.
- ► Disconnect the inverter from all AC and DC voltage sources. Make sure that none of the connections can be restored accidentally.
- ► Ensure that the DC cables cannot be touched accidentally.

WARNING

Electric shock
The IP65 protection rating is no longer guaranteed when the door is open.

- ► Only open the door when absolutely necessary.
- ► Do not open the door if water or dirt might enter the inverter.
- ► After work is completed, ensure that the door is properly shut and tightened again. Check that the doors are properly sealed.

WARNING

Heavy weight
The inverter is heavy.

- ► The inverter must be lifted and carried by at least two people.

WARNING

Hot surfaces
The surface of the inverter can get very hot during operation.

- Always wear safety gloves when touching the inverter.

Always start all maintenance and replacement work with “10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)”, page 106!

Always complete all maintenance and replacement work with “10.12 Finishing the maintenance work - connecting the inverter to the grid (AC) and solar modules (DC)”, page 139!

All work described in this section must only be carried out by electrical installers who are trained and approved for work on grid-connected solar inverters.

10.2 Periodic maintenance

Delta inverters are designed for use under difficult environmental conditions and are characterized by low maintenance requirements.

Excessive deposits on the fan module and air filters may affect energy yield, but will not limit operation.

In order to detect unusual power losses in time, Delta recommends the use of a monitoring system in combination with the Delta Modbus protocol.

It is the responsibility of the PV system service provider to draw up a maintenance plan for the inverters that takes into account the local external conditions.

10.3 Replacing components

The replacement of components must only be carried out by electrical installers who are trained and approved for work on grid-connected solar inverters.

The following components may be replaced:

- Fan module and air filters
- Internal fans
- AC surge protection devices
- DC surge protection devices
- Sub-1G antenna
- Wi-Fi module

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

The work instructions in this section apply to all maintenance work.

Always start maintenance work with this section.

DANGER

Electric shock

Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

You should therefore always carry out the following steps before working on the inverter:

1. Turn both DC isolating switches 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 restored accidentally.
3. Wait at least 60 seconds for the internal capacitors to discharge.

There is normally an isolating switch (for example in an equipment terminal box) between the inverter and the grid and between the inverter and the solar modules. This isolates the inverter from all the AC and DC voltage sources and renders it de-energized.

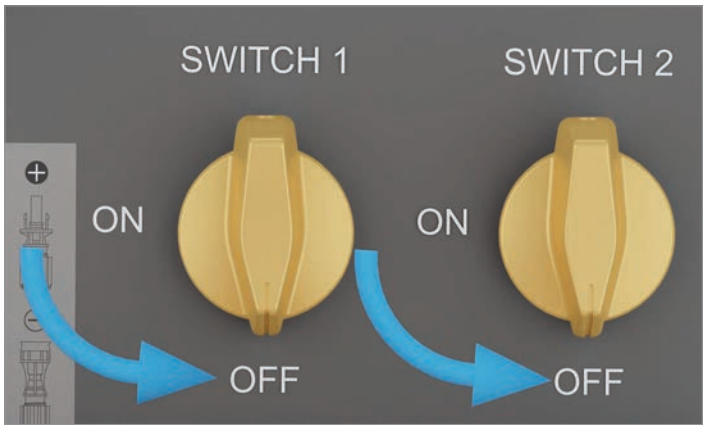
Tools required

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

- Voltmeter to check for the absence of voltage inside the inverter

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

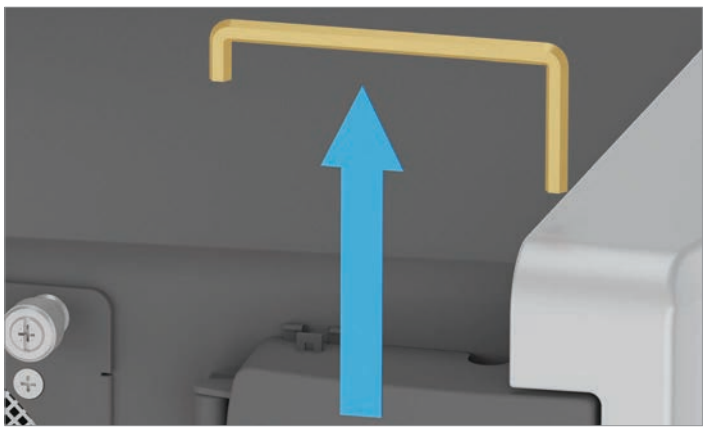
1. To shut off the inverter at the grid, open the load isolating switch between the inverter and the grid connection point.
   Secure the load isolating switch to prevent it from being switched back on accidentally.

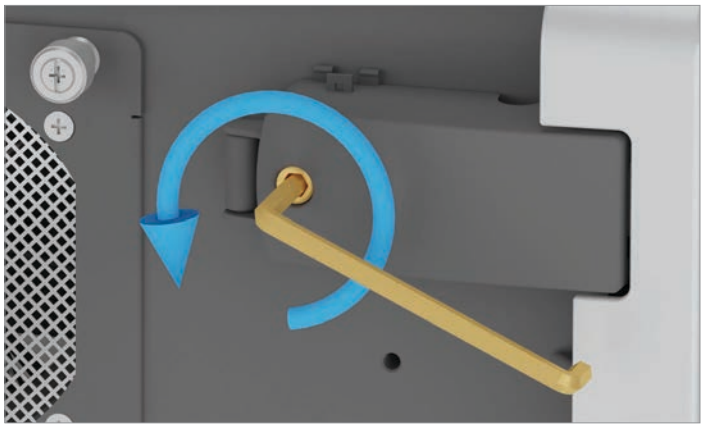


2. Turn both DC isolating switches to the ***OFF*** position.

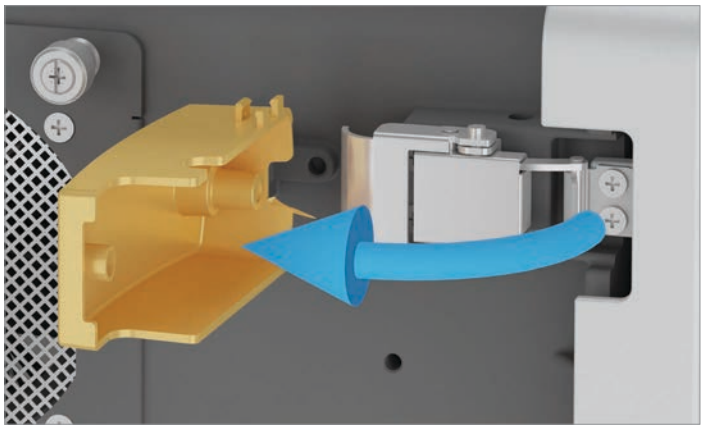
3. Wait at least 60 seconds until the internal capacitors have discharged.

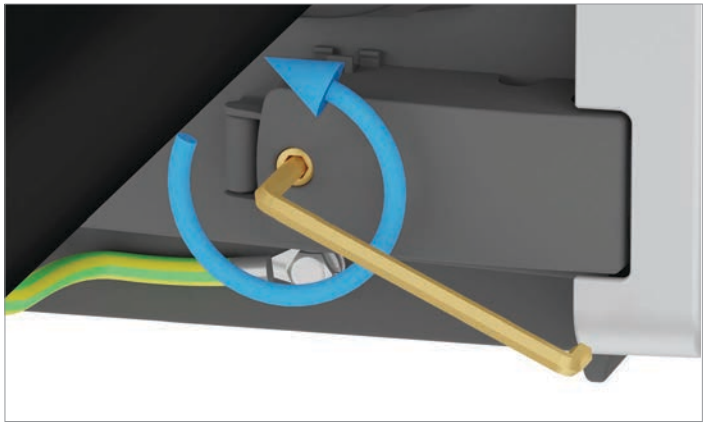
4. Remove the Allen key from the upper door lock.



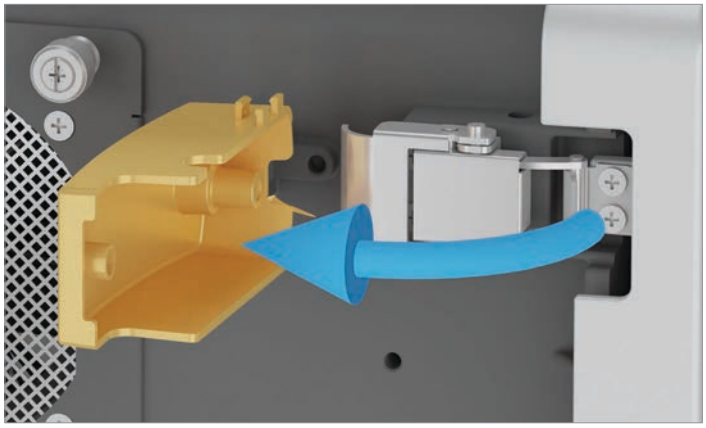


5. Unscrew and open the upper door lock cover.

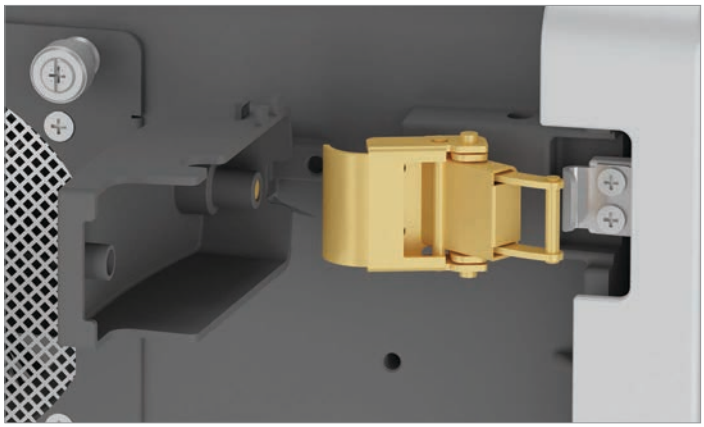




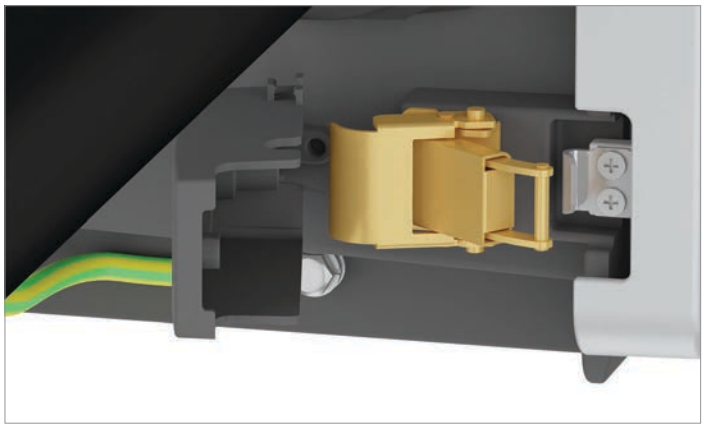
6. Unscrew and open the lower door lock cover.



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

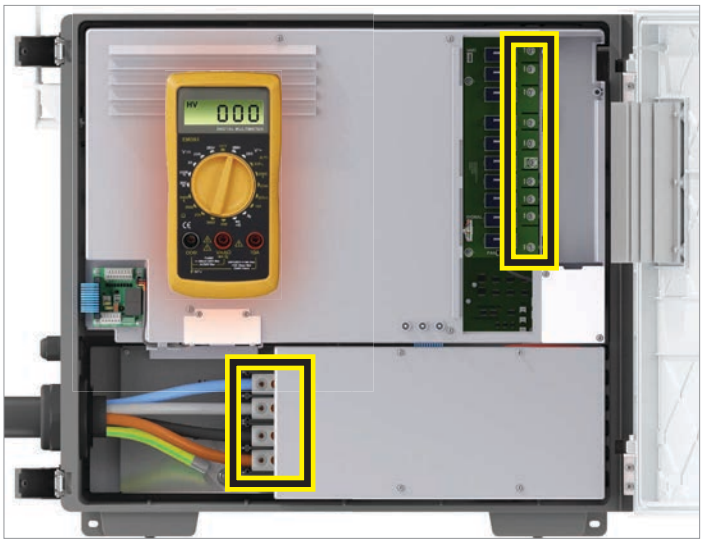


7. Open the upper door lock.



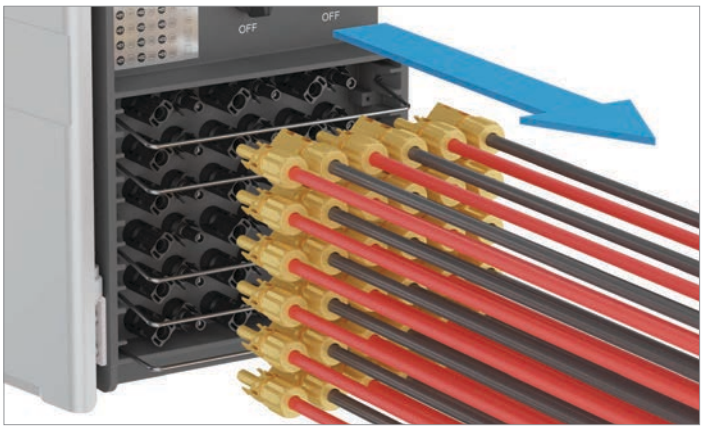
8. Open the lower door lock.

9. Open the door and secure it on top with the Allen key.

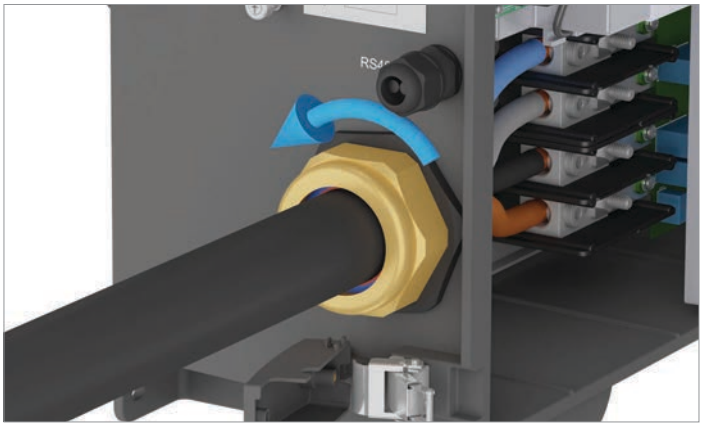


10. Use a voltmeter to check that there is no longer any voltage at the marked connections.
    → If voltage is present, open the external load isolating switch of the AC line and check that both DC isolating switches are in the ***OFF*** position.
    → If you detect no voltage, continue to the next step.

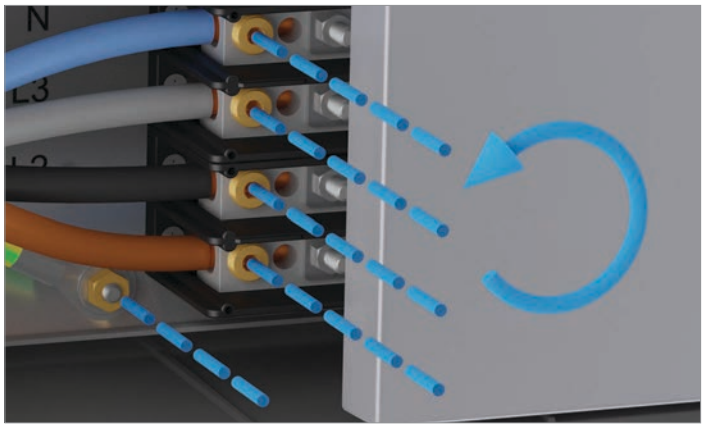
11. Use the mounting tool to release the DC cables and then pull them out.

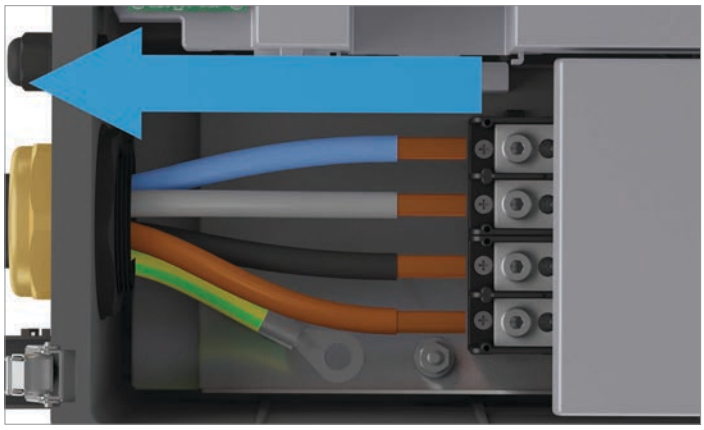


12. Unscrew the AC cable gland.



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





13. Unscrew the conductors of the AC cable and pull out the AC cable.

10.5 Clean/replace internal fan 1

DANGER

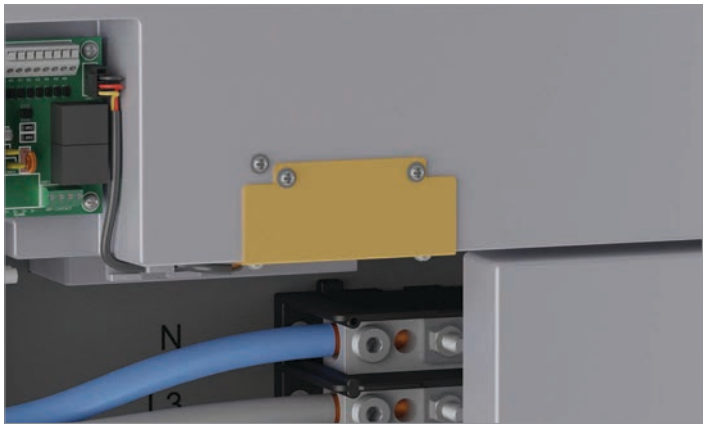
Electric shock

Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

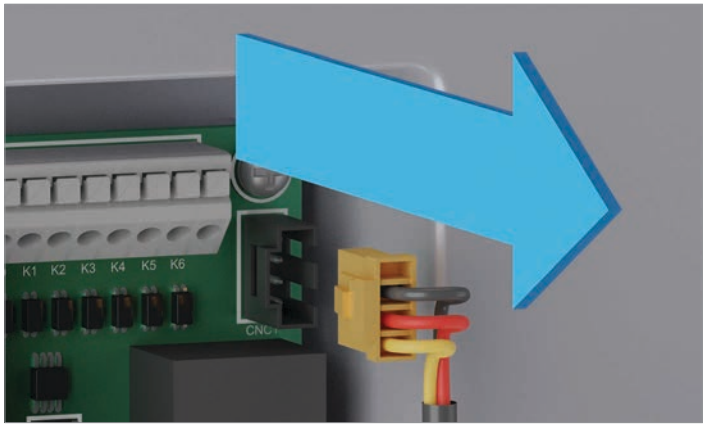
► Perform the instructions listed in “10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)”, page 106 **before** you start work on the inverter!

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

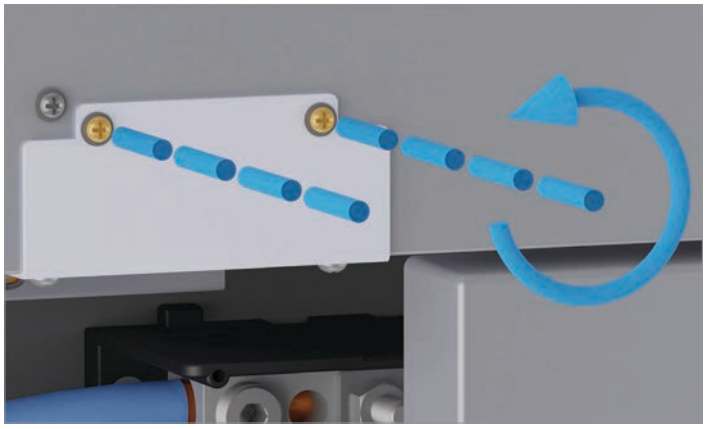
Do not use liquids for cleaning.



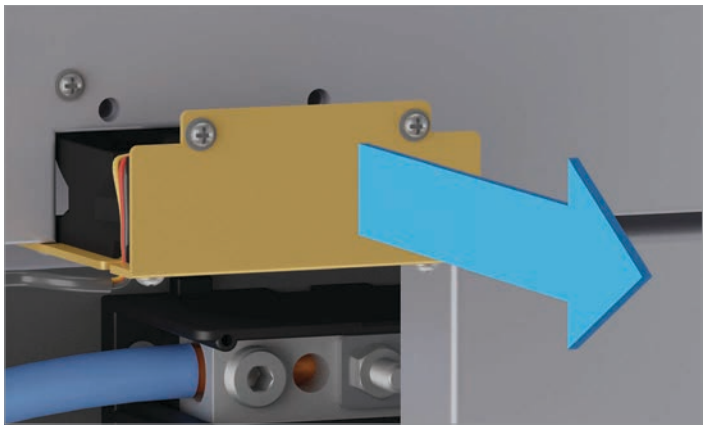
Position of internal fan 1

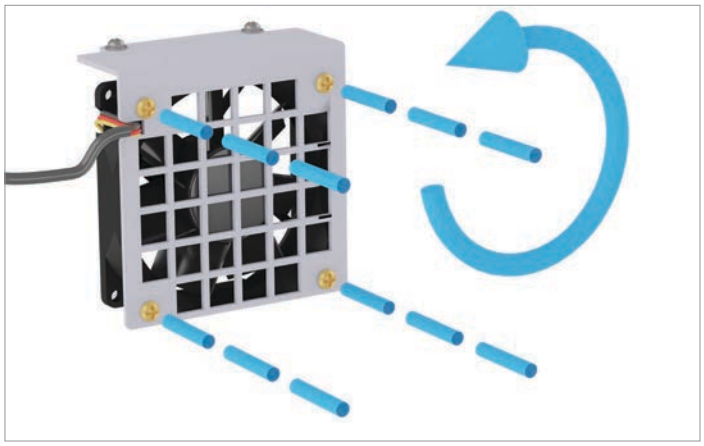


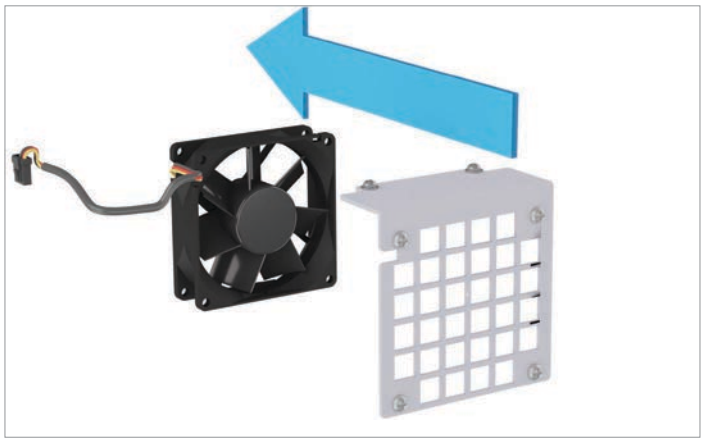
1. Pull out the power supply cable plug located on the top right of the communication card



2. Unscrew and pull out the cover. The fan is screwed onto the cover.

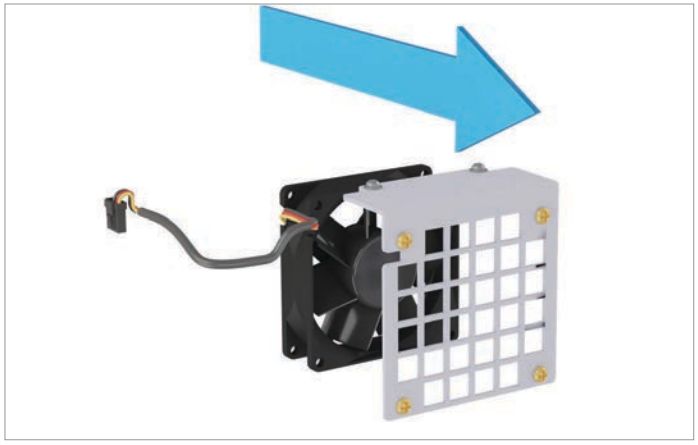


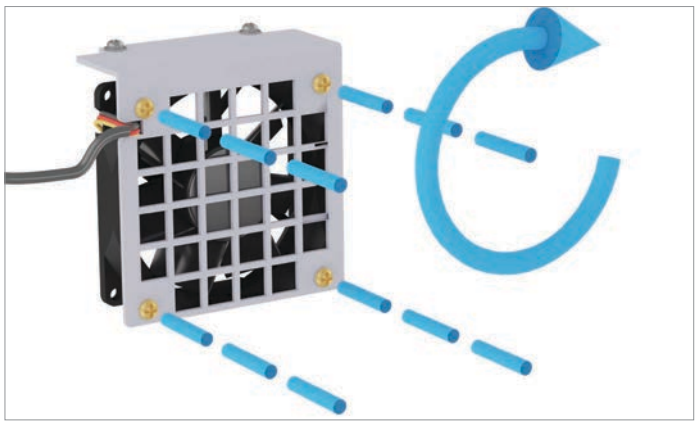




This work step must only be carried out if the fan is to be replaced. The work step is not necessary for cleaning the fan.

3. Unscrew the fan from the cover and pull it out.

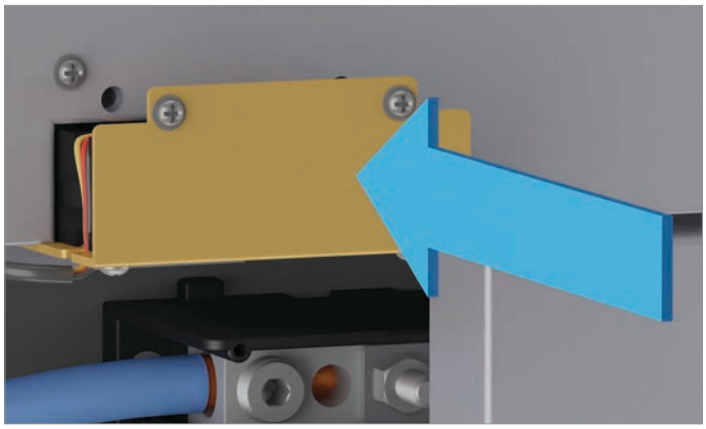


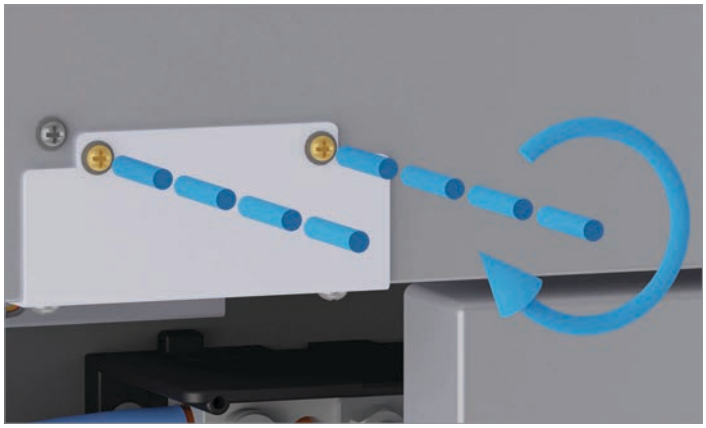


4. Clean the fan and metal housing with compressed air or a firm brush.

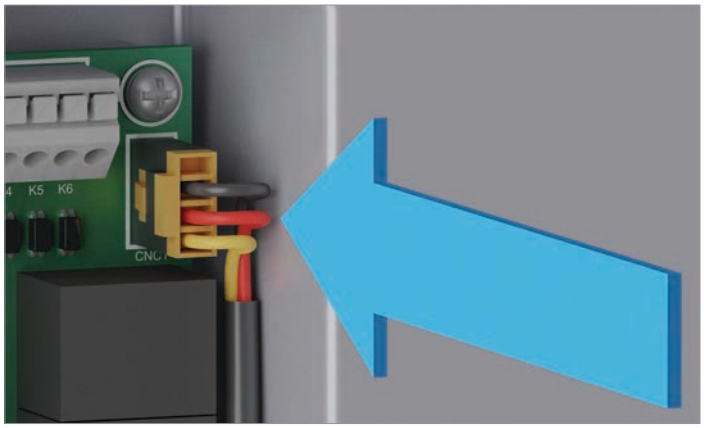
This work step must only be carried out if the fan is to be replaced. The work step is not necessary for cleaning the fan.

5. Insert and screw the fan into the cover.





6. Insert the cover with the fan attached and screw the cover in place.



7. Plug in the power supply cable plug.

10.6 Clean/replace internal fan 2

DANGER

Electric shock

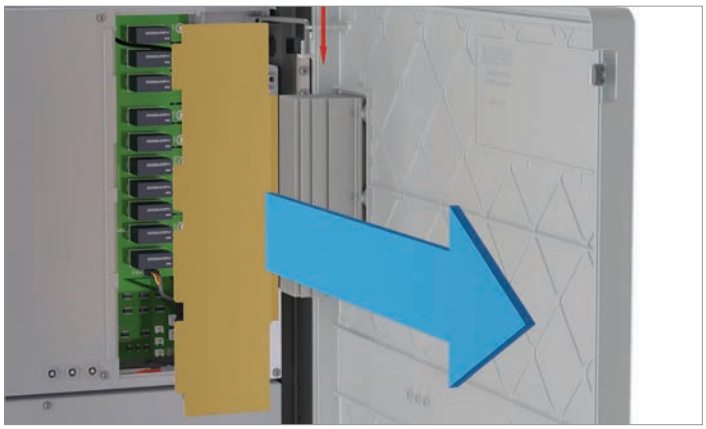
Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

► Perform the instructions listed in “10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)”, page 106 **before** you start work on the inverter!

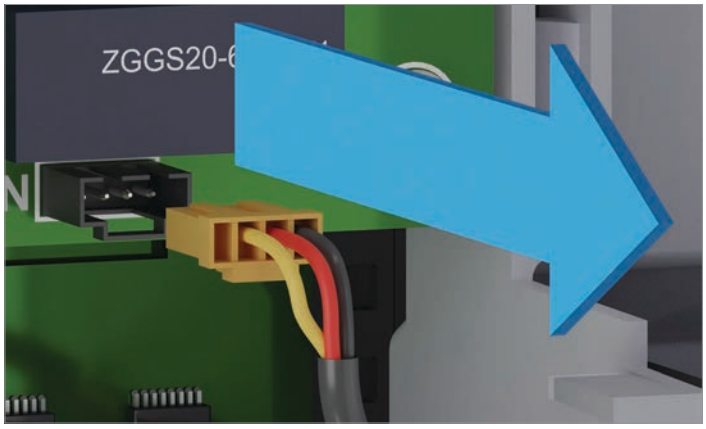
Do not use any sharp, pointed or hard objects for cleaning.

Do not use liquids for cleaning.

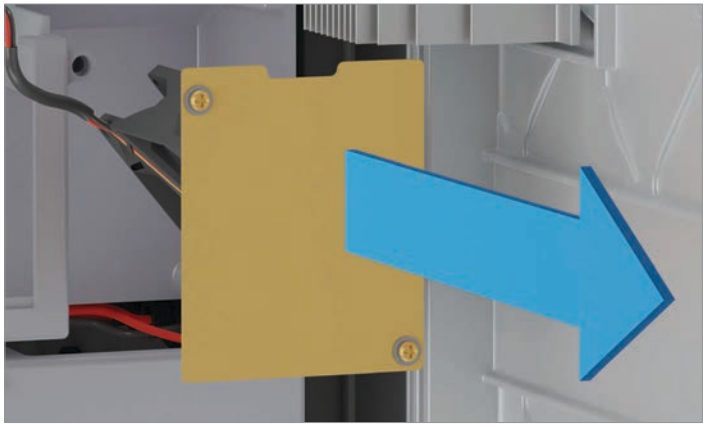
Position of internal fan 2



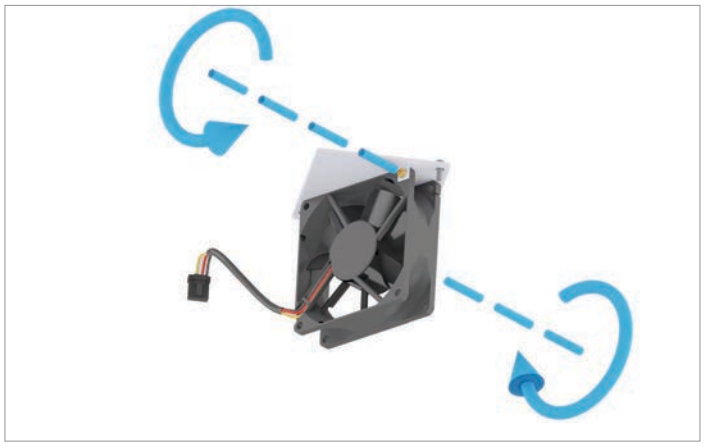
1. Remove the protective cover from the DC surge protection devices.

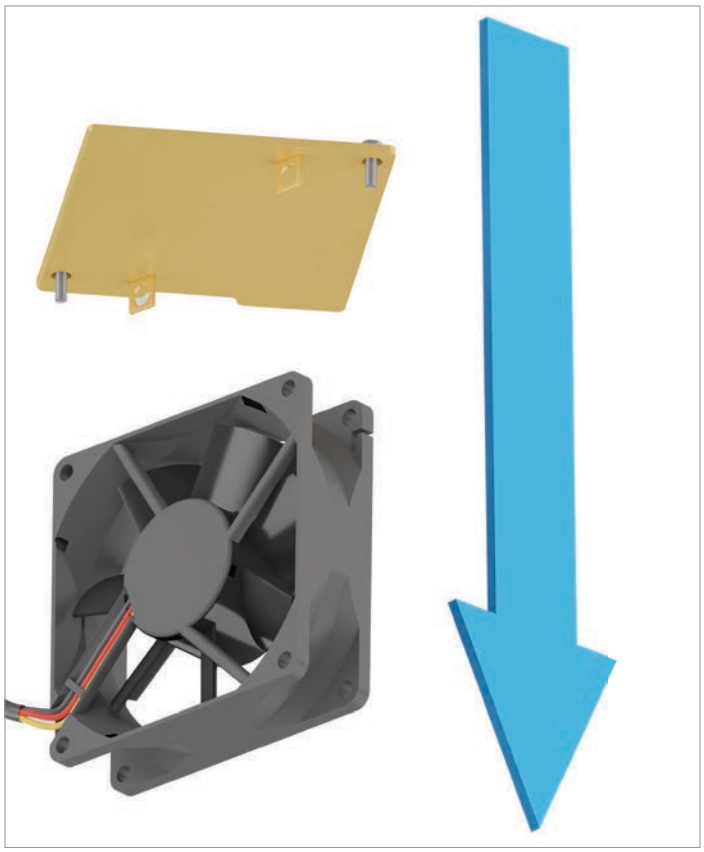


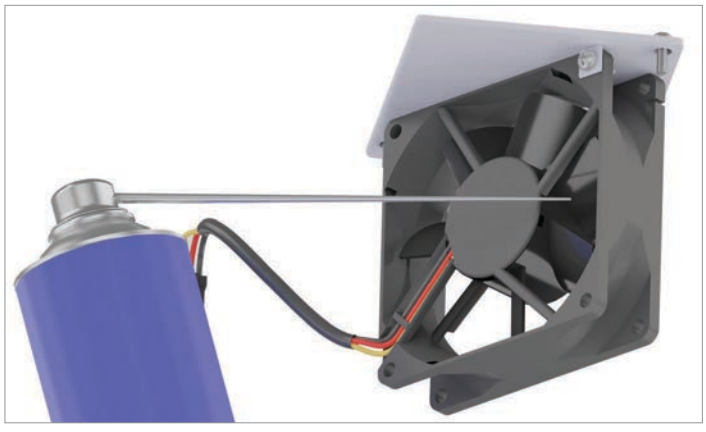
2. Pull out the power supply cable plug located on the bottom of the card with the DC surge protection devices.



3. Unscrew and pull out the cover. The fan is screwed onto the cover.



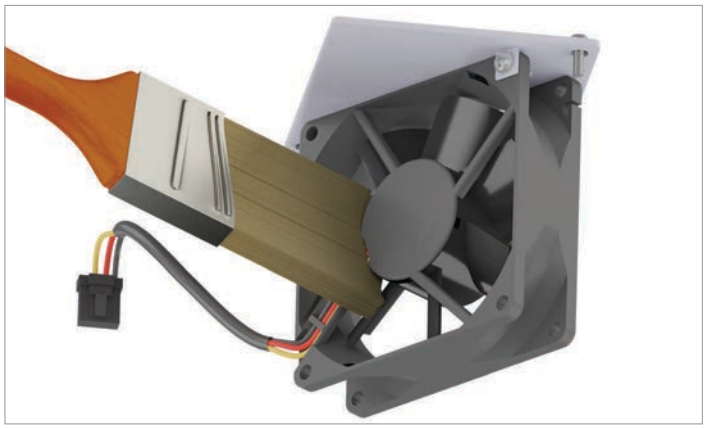


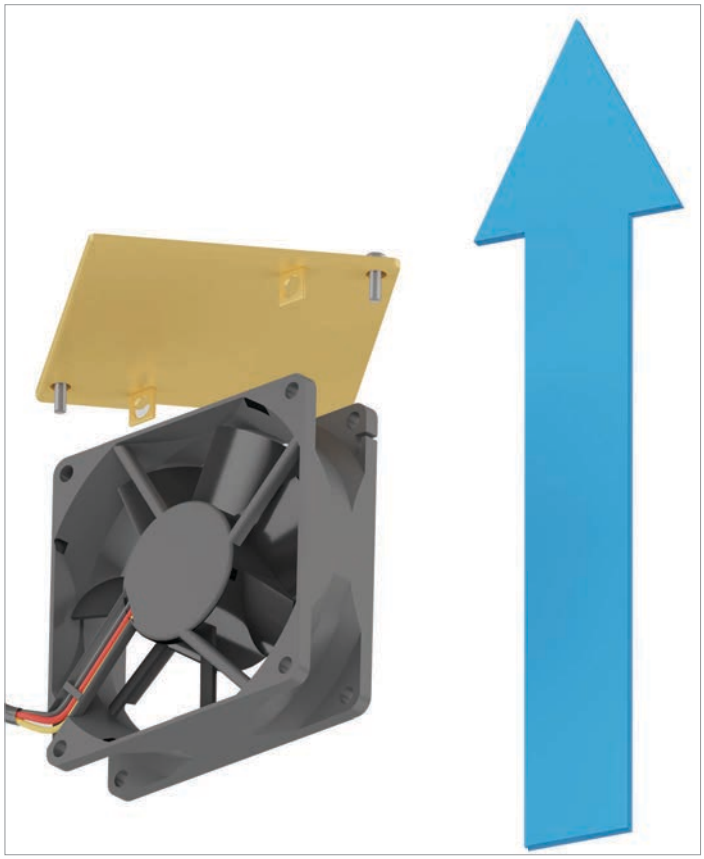


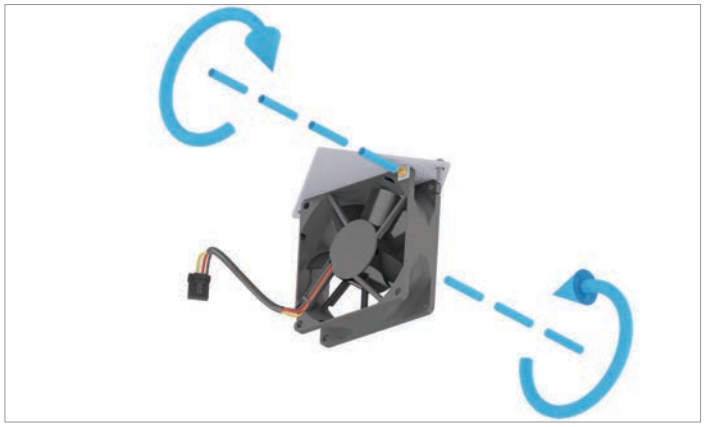
This work step must only be carried out if the fan is to be replaced. The work step is not necessary for cleaning the fan.

4. Unscrew the fan from the cover and pull it out.

5. Clean the fan and metal housing with compressed air or a firm brush.

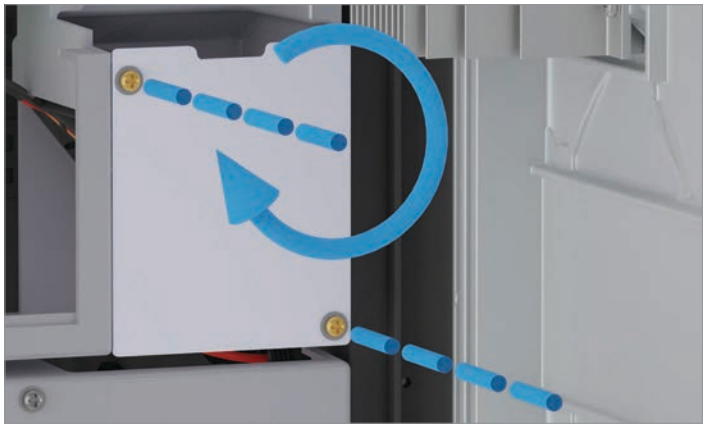




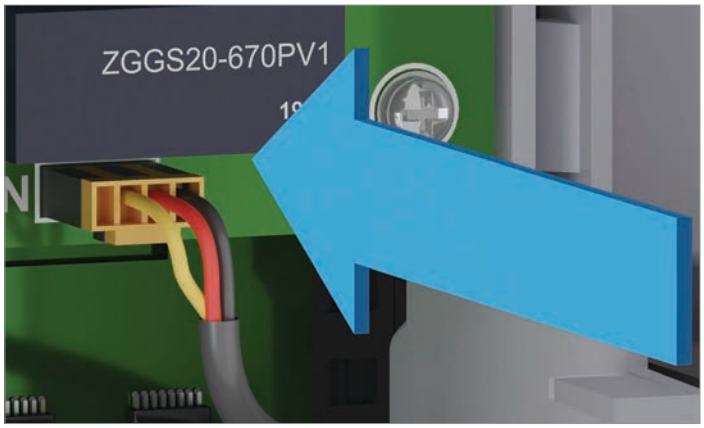


This work step must only be carried out if the fan is to be replaced. The work step is not necessary for cleaning the fan.

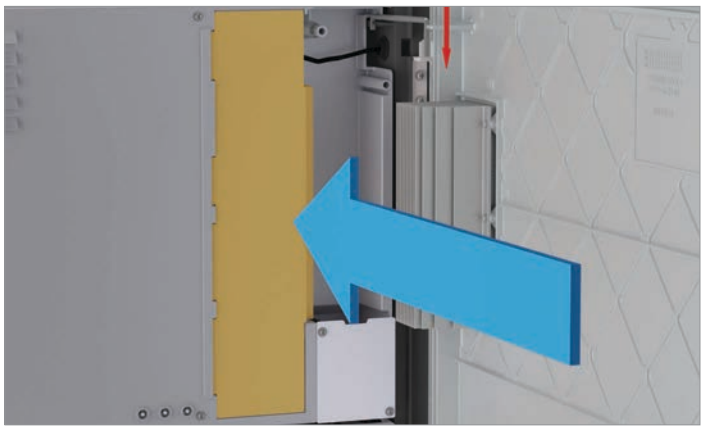
6. Insert and screw the fan into the cover.



7. Insert the cover with the fan attached and screw the cover in place.



8. Plug in the power supply cable plug.



9. Insert the cover for the DC surge protection devices.

10.7 Cleaning/replacing the fan module

DANGER

Electric shock
Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

► Perform the instructions listed in “10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)”, page 106 **before** you start work on the inverter!

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

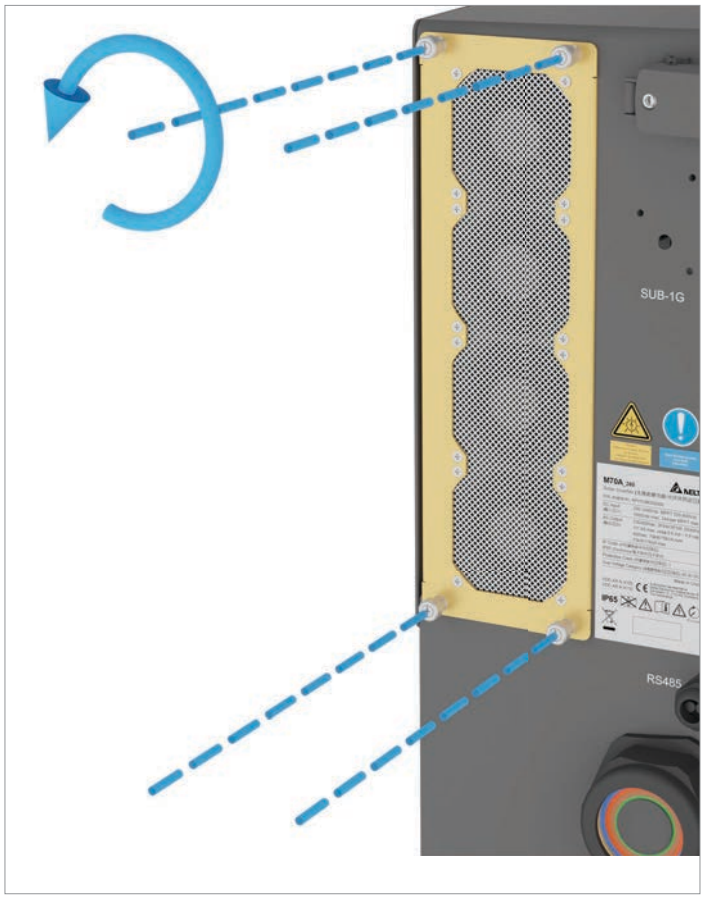
Do not use liquids for cleaning.

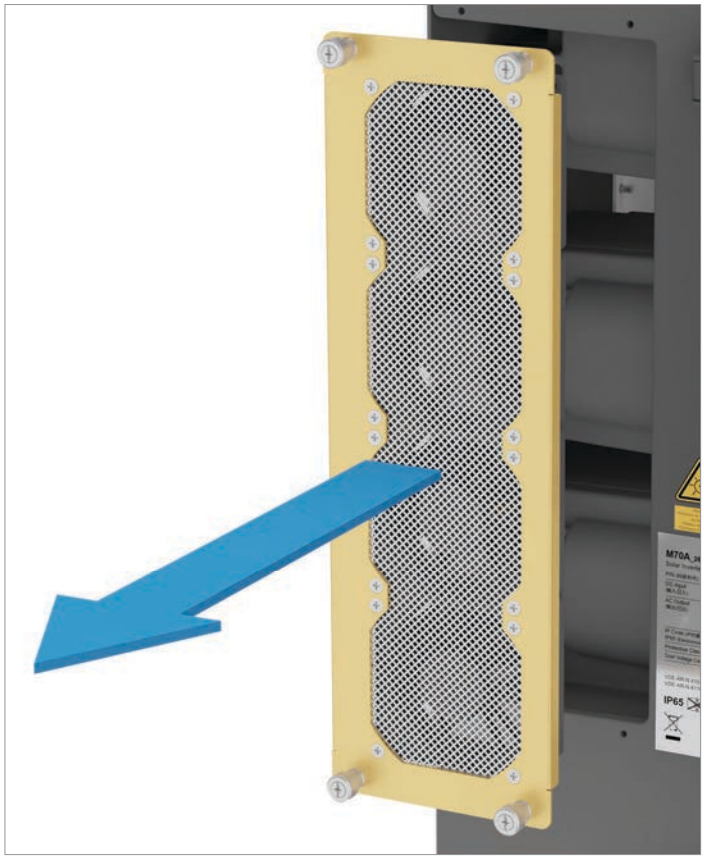
The screws on the air inlets and air outlets are very small and can easily be dropped. You should therefore use a magnetic screwdriver.

The fan module is located on the left side of the inverter.

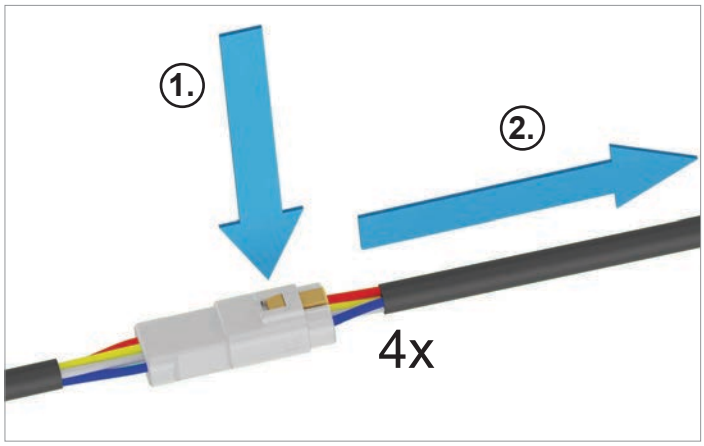
10 Maintenance

Cleaning/replacing the fan module

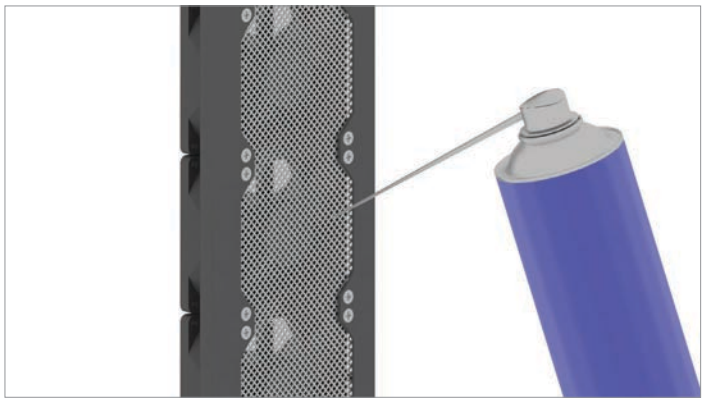




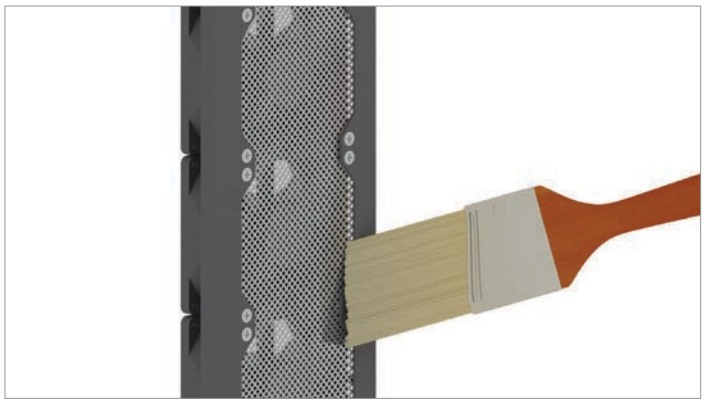
1. Unscrew and remove the fan module.

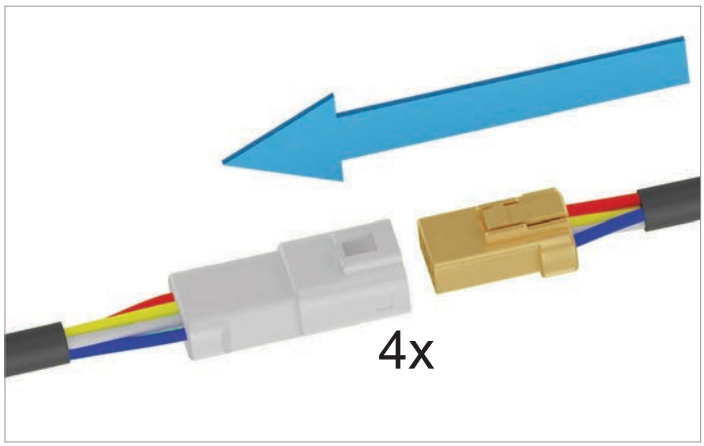


2. Pull out the 4 power supply cable plugs.

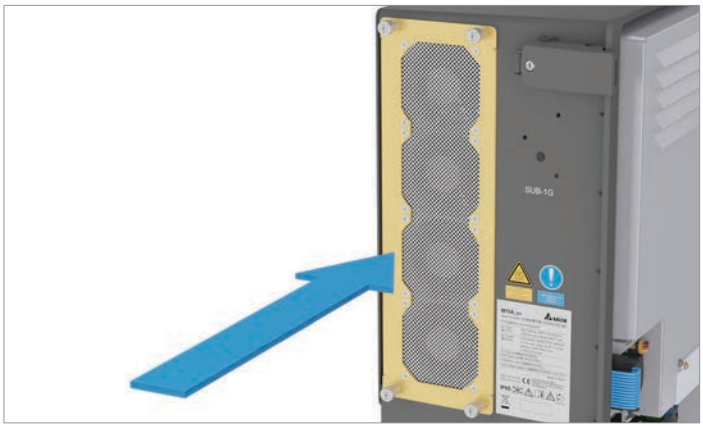


3. Clean the fan module with a compressed air cleaner or a firm brush.

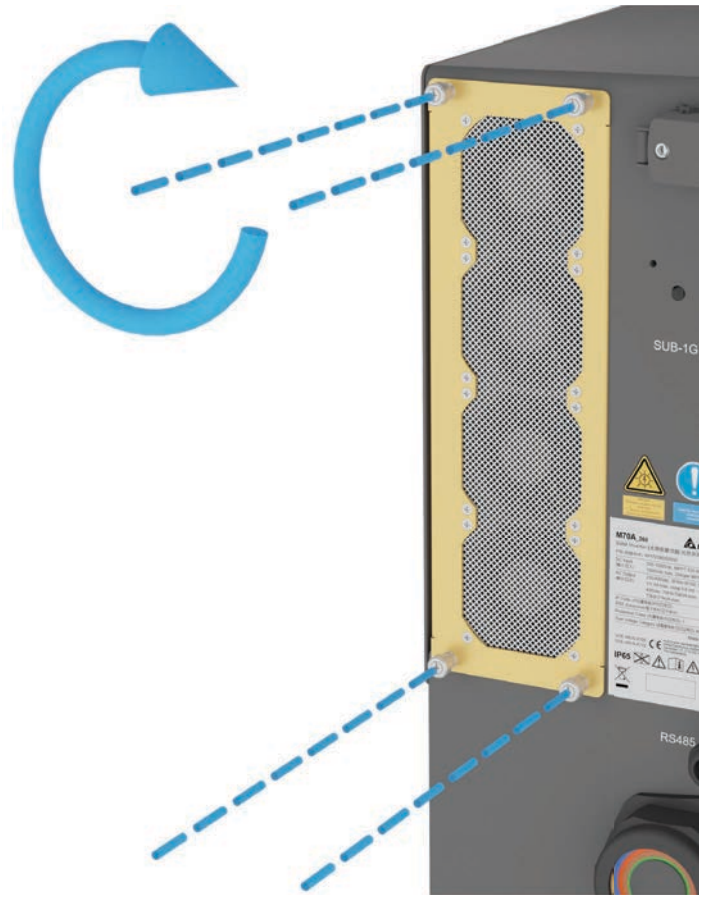




4. Plug in the 4 power supply cable plugs until they engage. It does not matter which power cable you use for which fan.



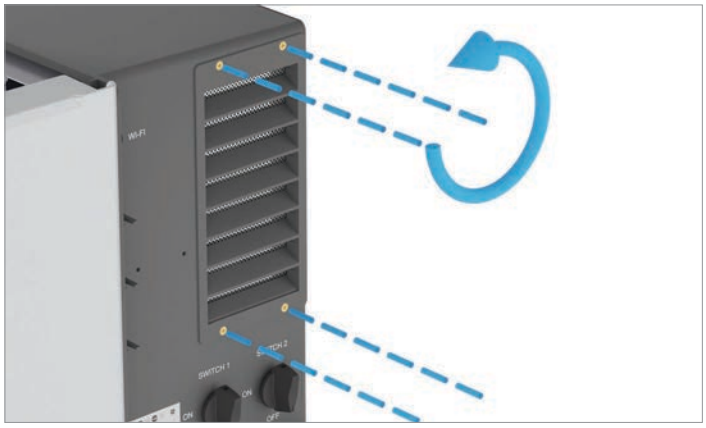
5. Insert the fan module so that the power cables are on the right side of the fan module.



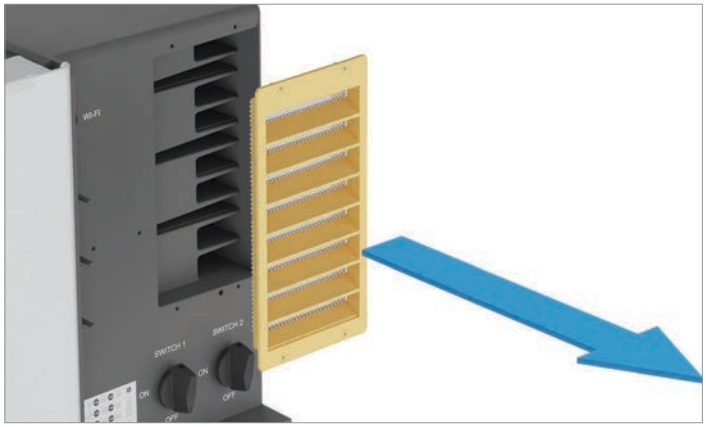
6. Screw on the fan module.

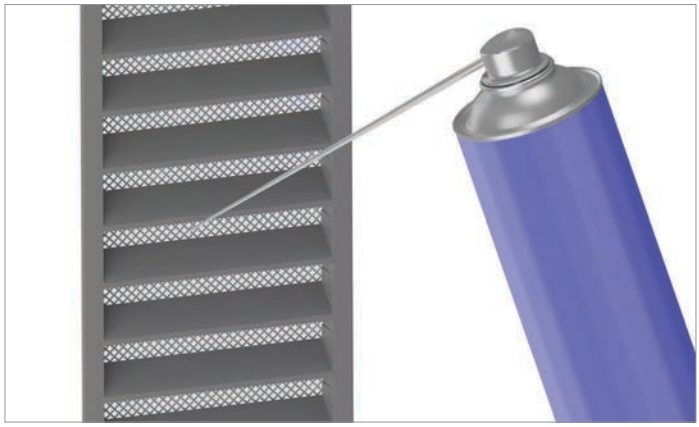
10.8 Cleaning the air outlets

This procedure is the same for both air outlets.

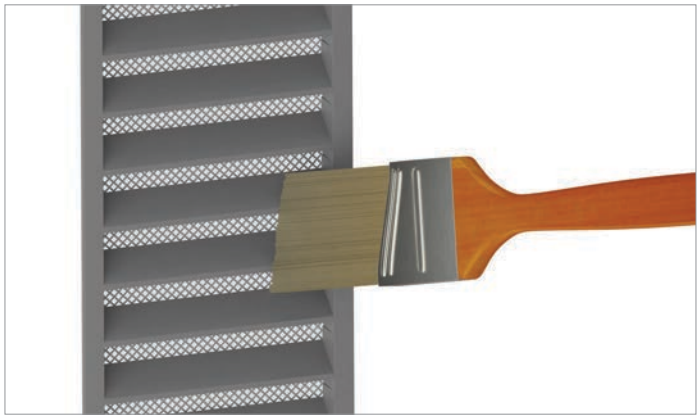


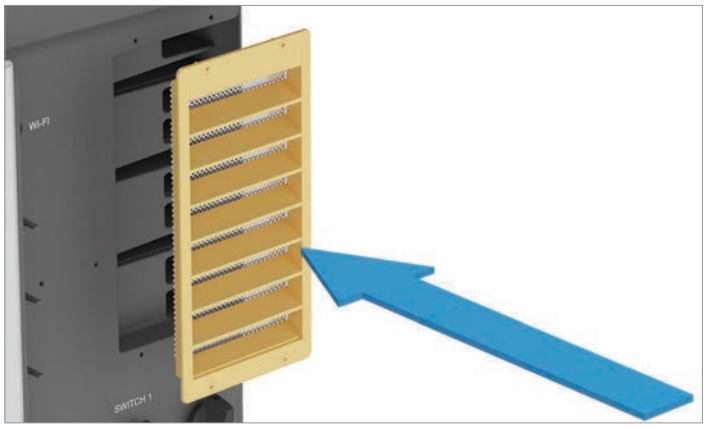
1. Unscrew and remove the air filter.

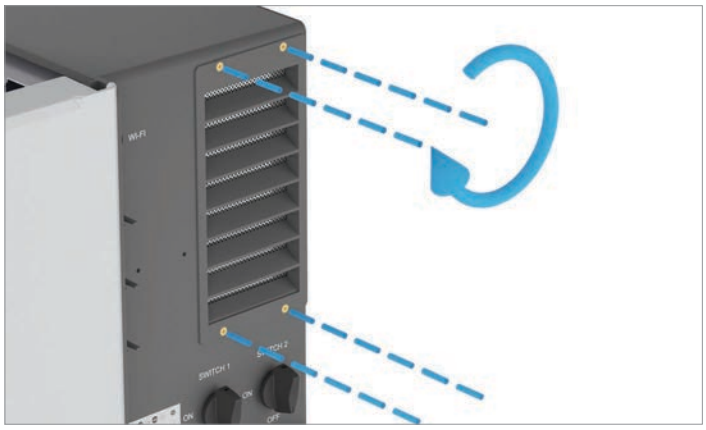




2. Clean the air filter with a compressed air cleaner or a firm brush.







3. Insert and screw on the air filter. The fins must be facing downward.

10.9 Replacing the DC surge protection devices

DANGER

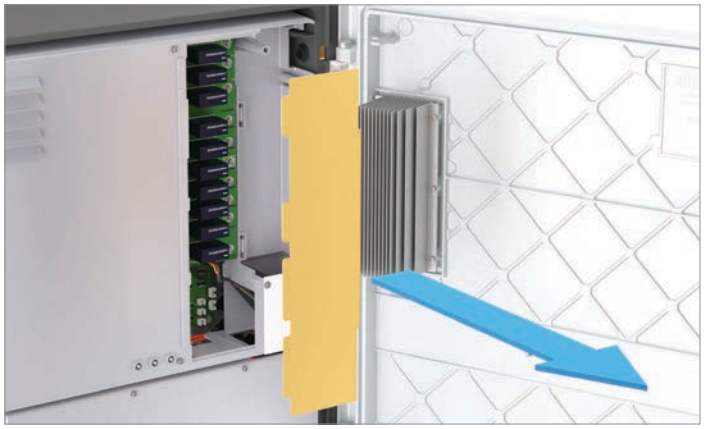
Electric shock

Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

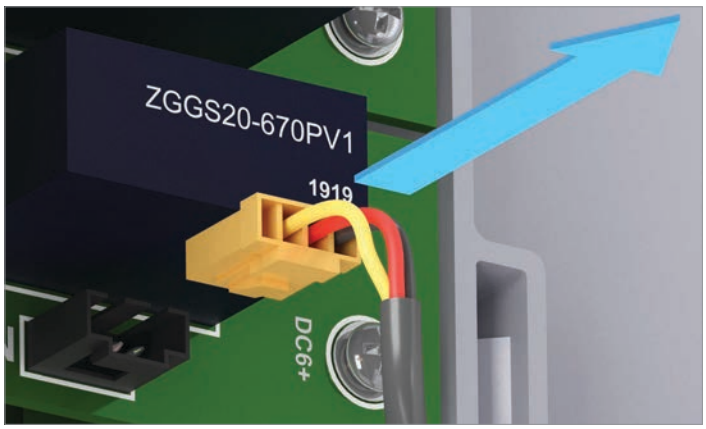
► Perform the instructions listed in "10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)", page 106 **before** you start work on the inverter!

Use an insulated magnetic screwdriver to loosen the screws.

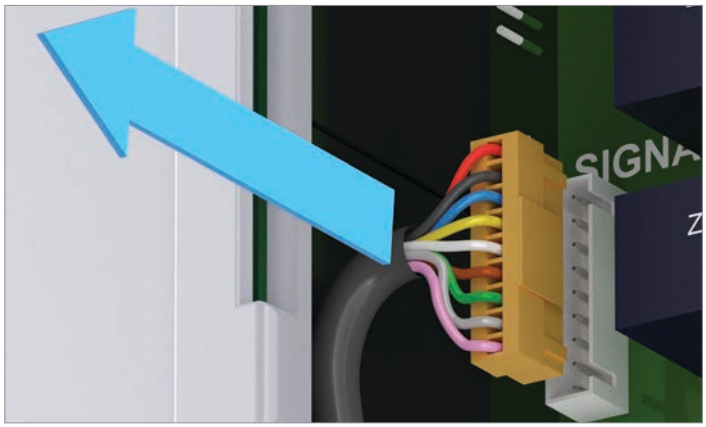
Make sure that no screws fall into the inverter.



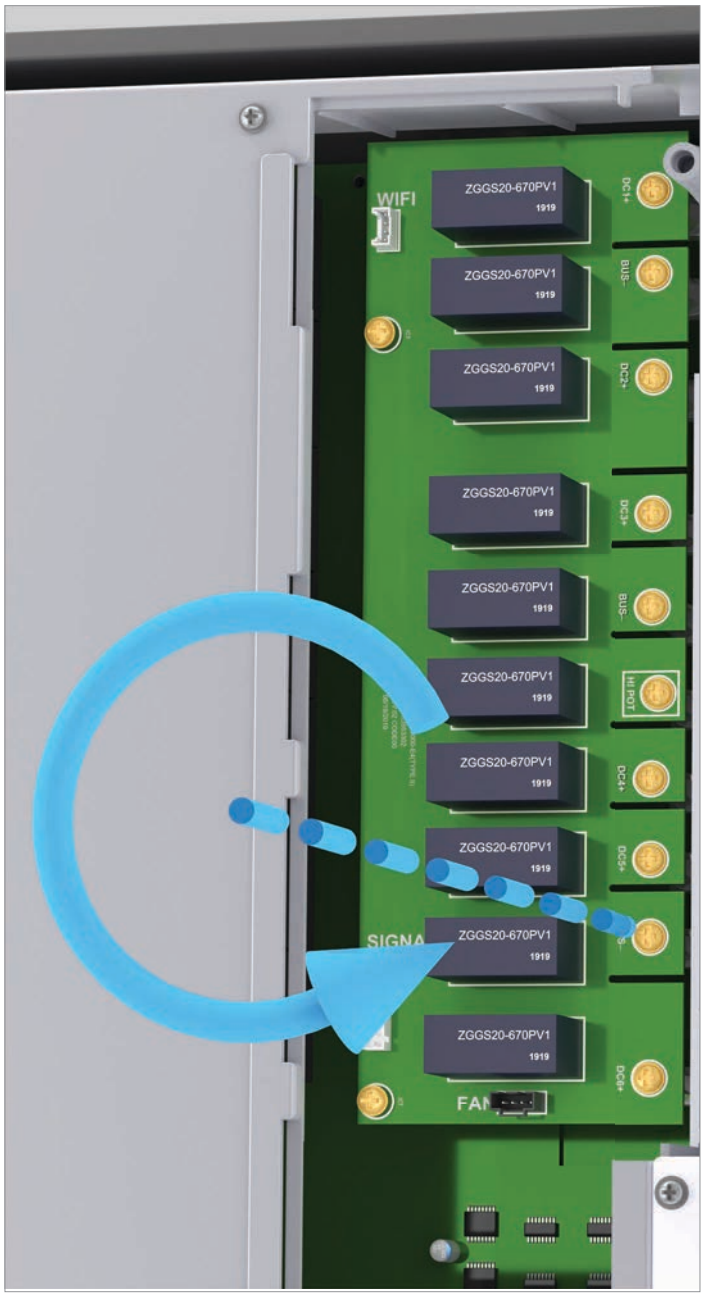
1. Remove the protective cover from the DC surge protection devices.



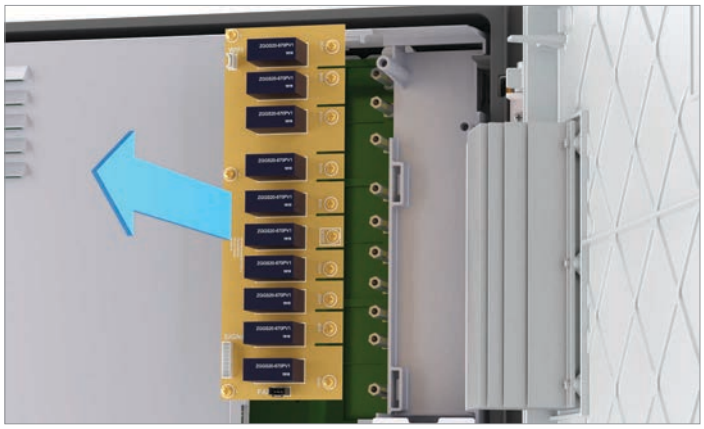
2. Pull out the power supply cable of internal fan 2.

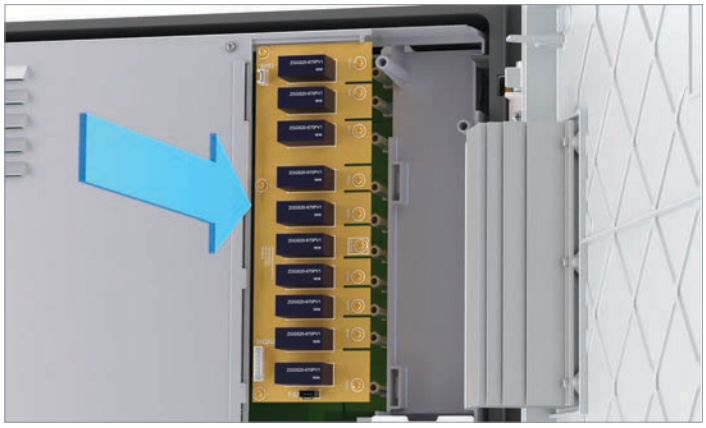


3. Pull out the signal cable.

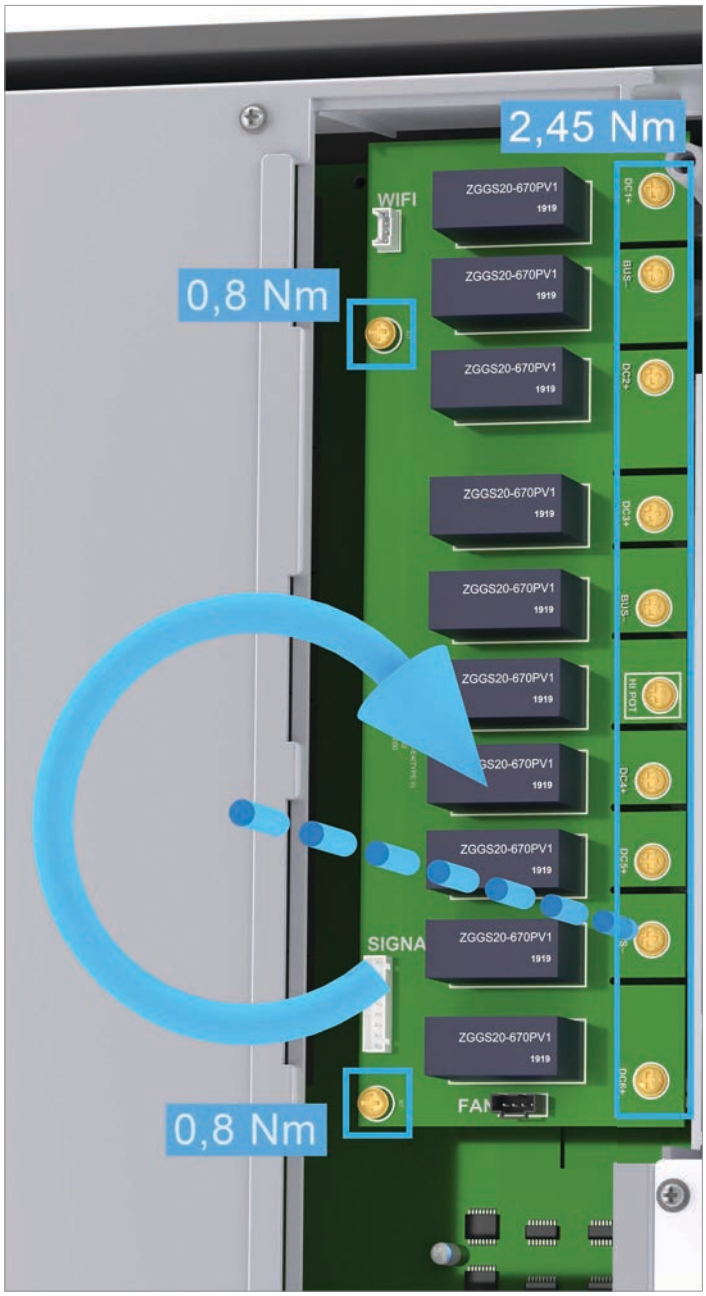


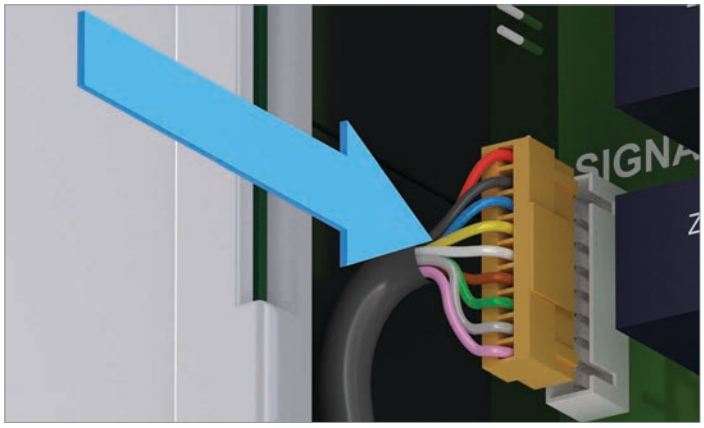
4. Loosen all screws on the printed circuit board with the DC surge protection devices and remove the printed circuit board.



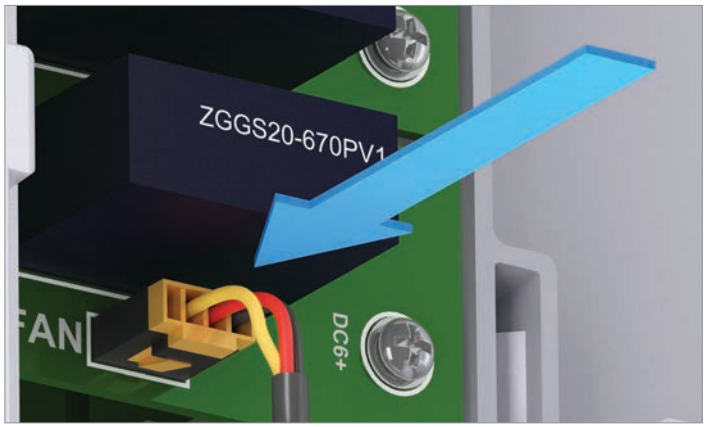


5. Install the new printed circuit board and tighten all screws on the printed circuit board.





6. Plug in the signal cable.



7. Plug in the power supply cable of internal fan 2.

8. Insert the cover for the DC surge protection devices.

9. To complete the maintenance work, follow the instructions in the following section: “10.12 Finishing the maintenance work - connecting the inverter to the grid (AC) and solar modules (DC)”, page 139

10.10 Replacing the AC surge protection devices

DANGER

Electric shock

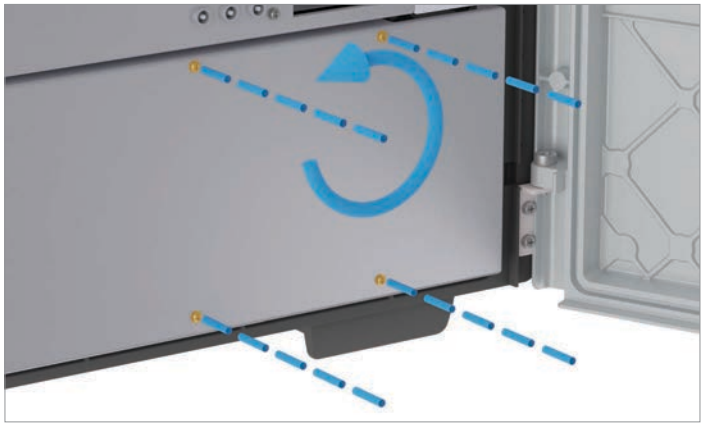
Potentially fatal voltages are present in the inverter during operation. When the inverter is disconnected from all power sources, this voltage remains in the inverter for up to 60 seconds.

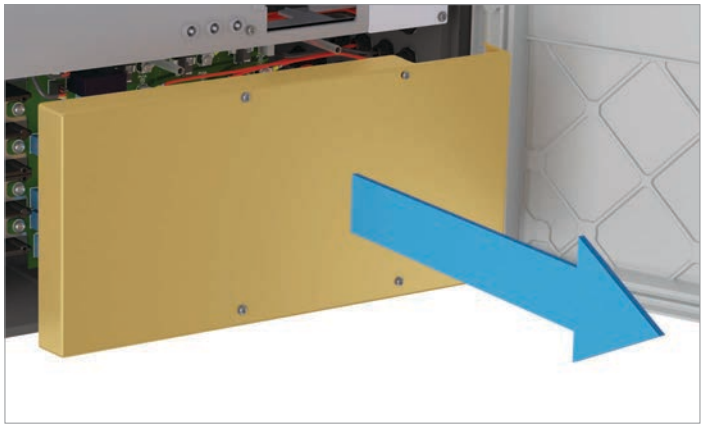
► Perform the instructions listed in "10.4 Making preparations for maintenance work - disconnecting the inverter from the grid (AC) and solar modules (DC)", page 106 **before** you start work on the inverter!

Type 2 AC surge protection devices are installed as standard. Type 1+2 combined AC surge protection devices can be ordered as accessories.

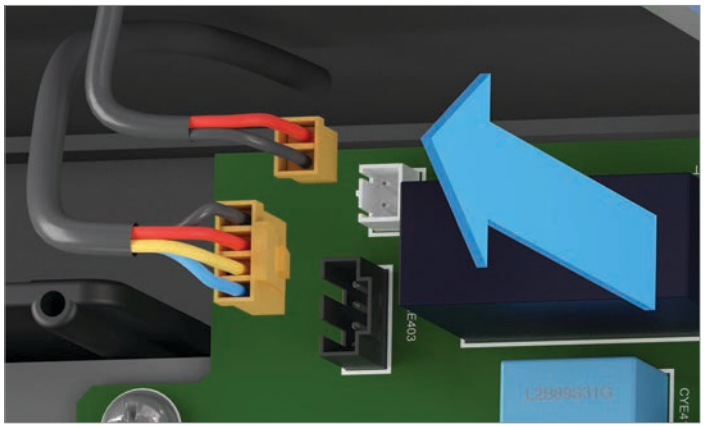
Use an insulated magnetic screwdriver to prevent the screws from falling.

Make sure that no screws fall into the inverter.

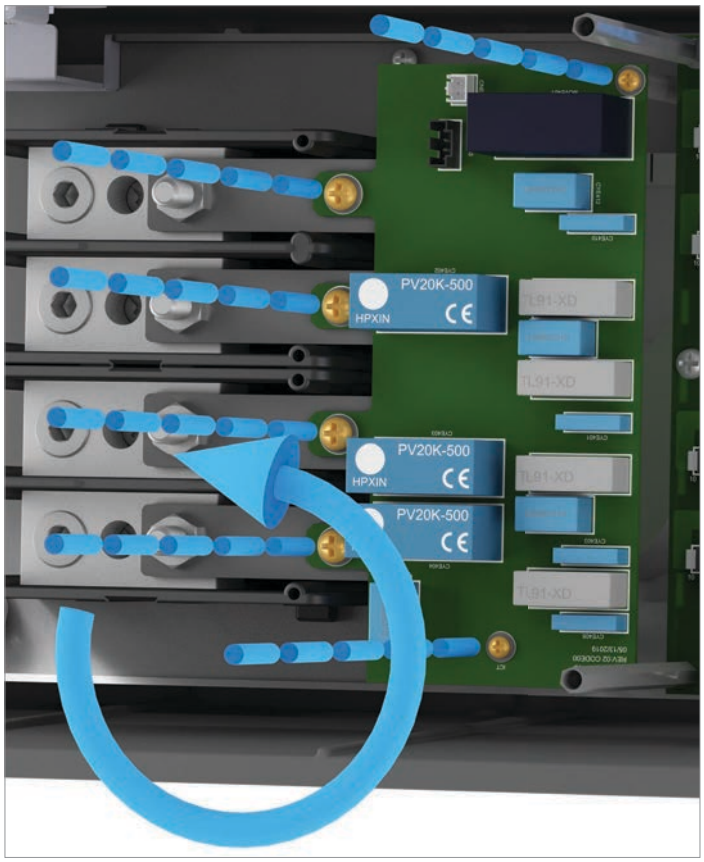




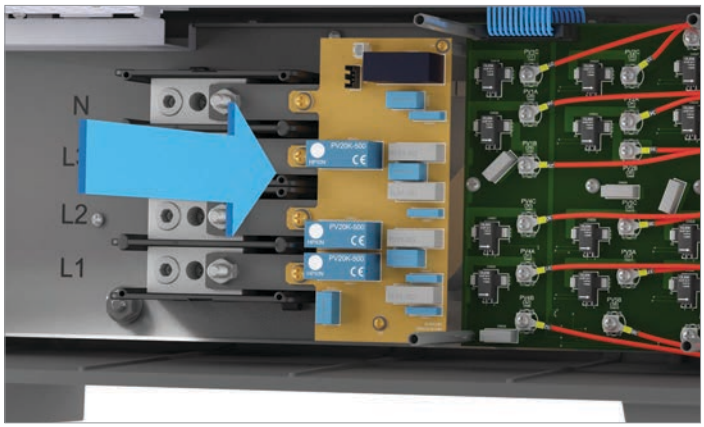
1. Unscrew and remove the cover of the type 2 AC surge protection devices.

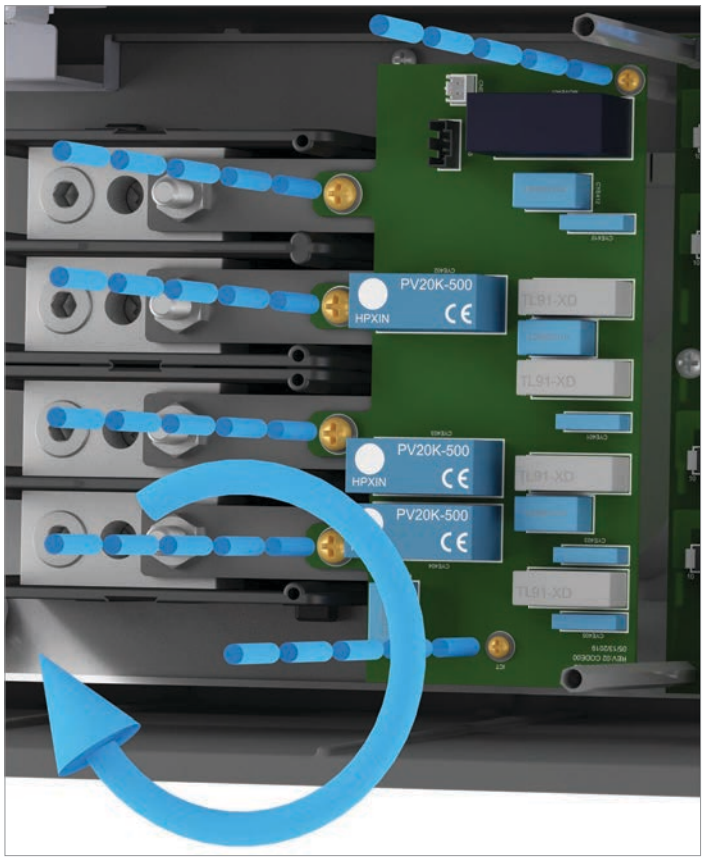


2. Pull out both cables from the top of the printed circuit board.

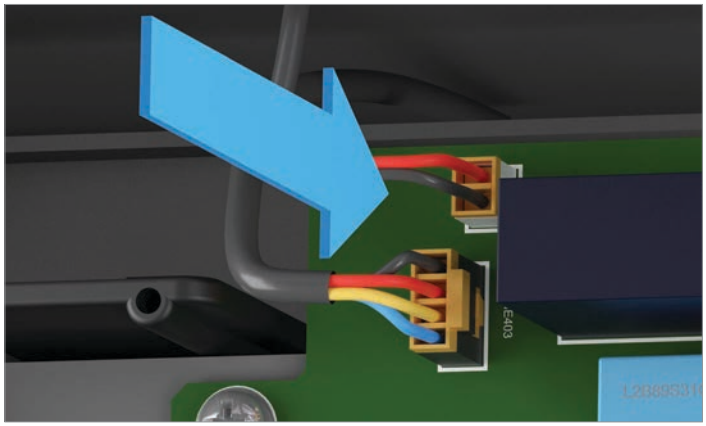


3. Loosen all screws on the printed circuit board with the AC surge protection devices and remove the printed circuit board.

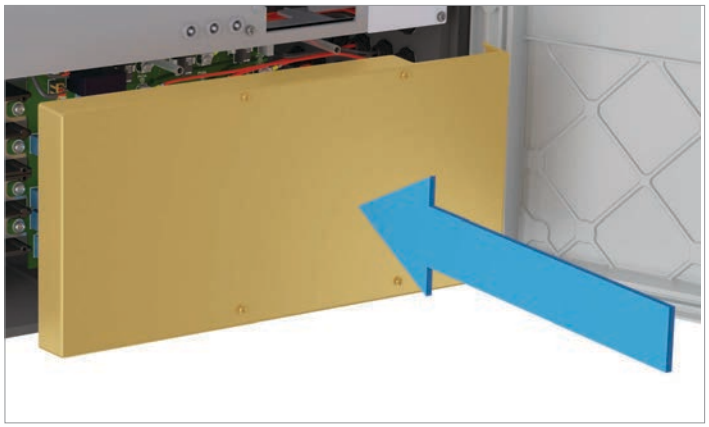




4. Install the new printed circuit board and tighten all screws on the printed circuit board.

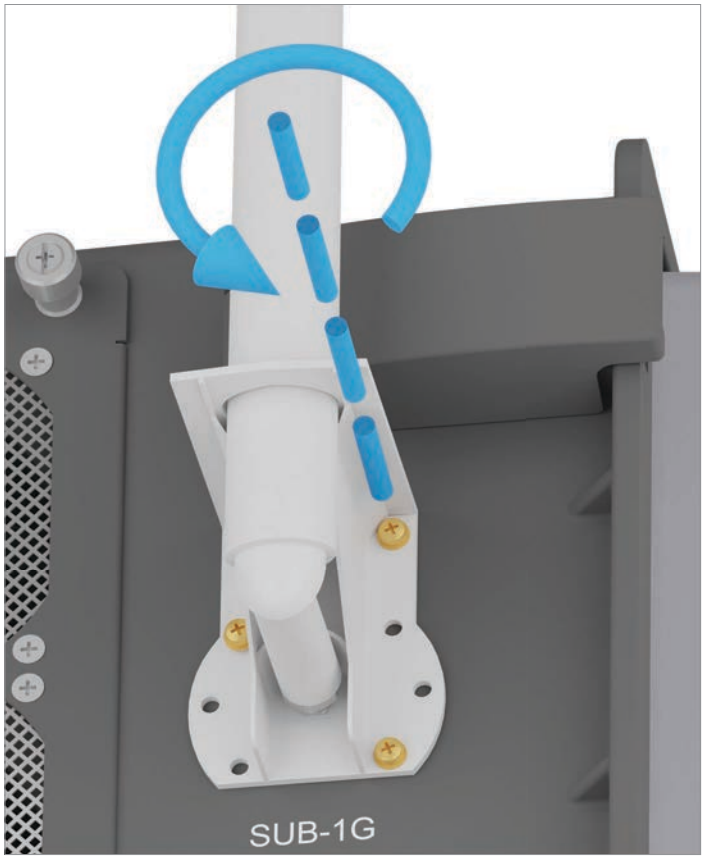


5. Plug the two cables into the top of the printed circuit board.

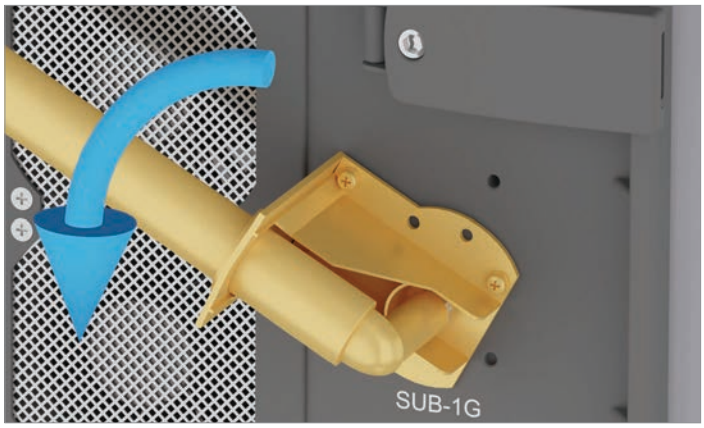


6. Mount and screw on the cover of the AC surge protection devices.

10.11 Replacing the Sub-1G antenna

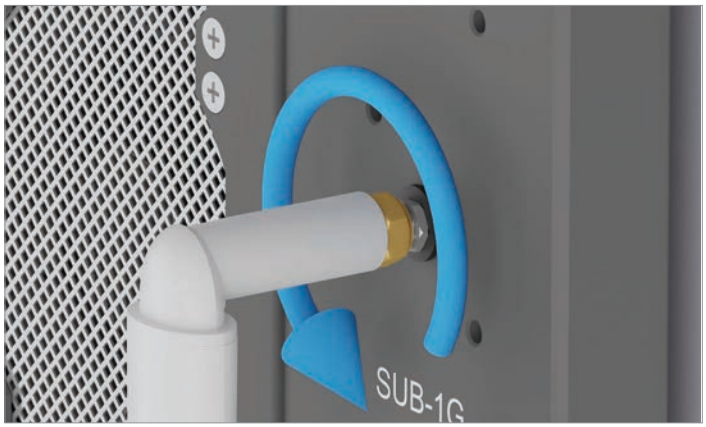


1. Unscrew the mounting frame.



2. Rotate the mounting frame with the Sub-1G antenna downward.

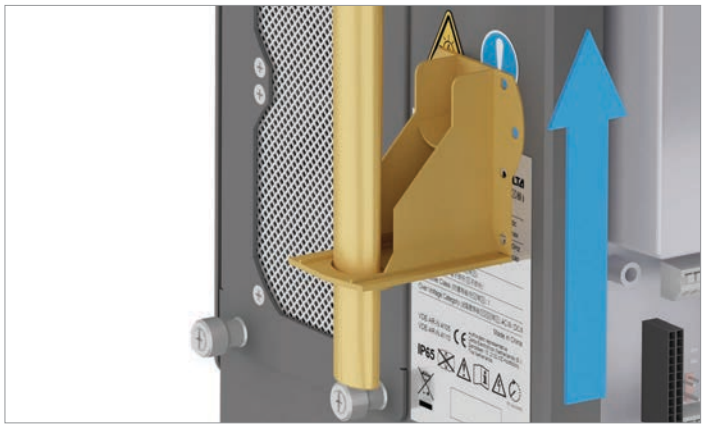
3. Pull the mounting frame downward.



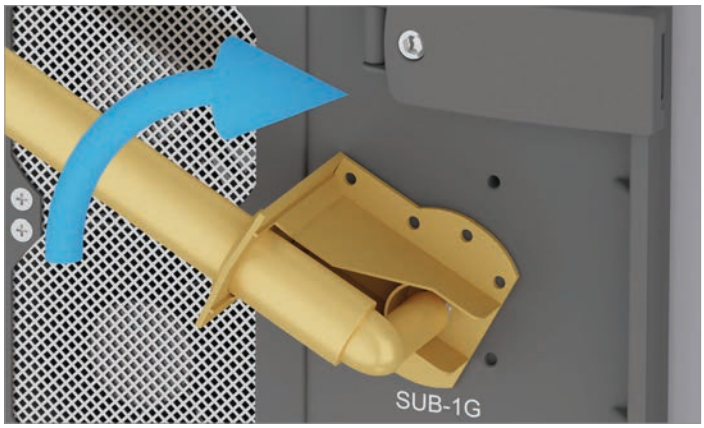
4. Unscrew the Sub-1G antenna.

5. Mount the new Sub-1G antenna and screw it on so that it can still be rotated.

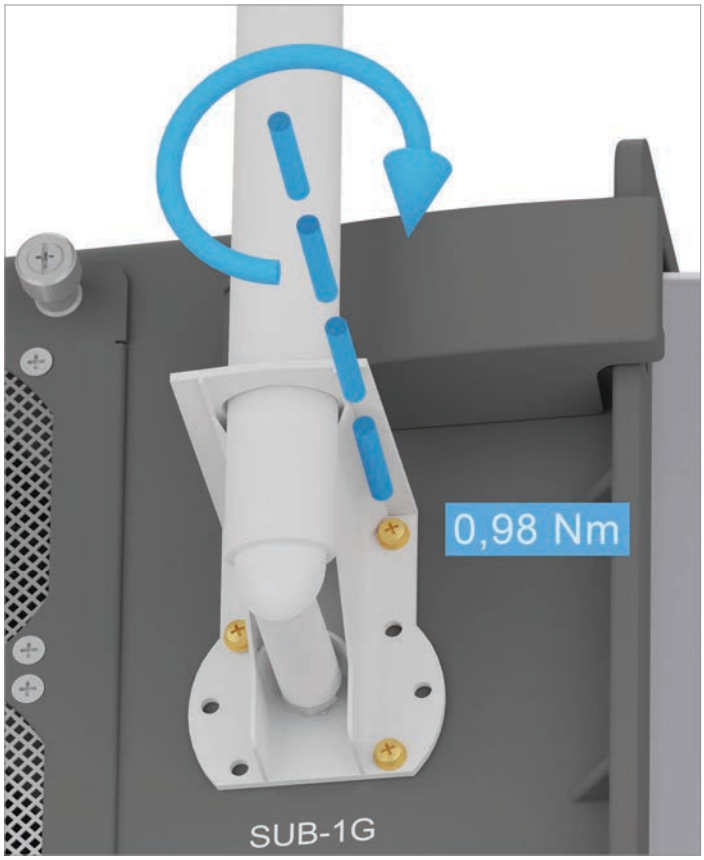
6. Rotate the Sub-1G antenna downward.



7. Slide the mounting frame over the Sub-1G antenna upside down from below.

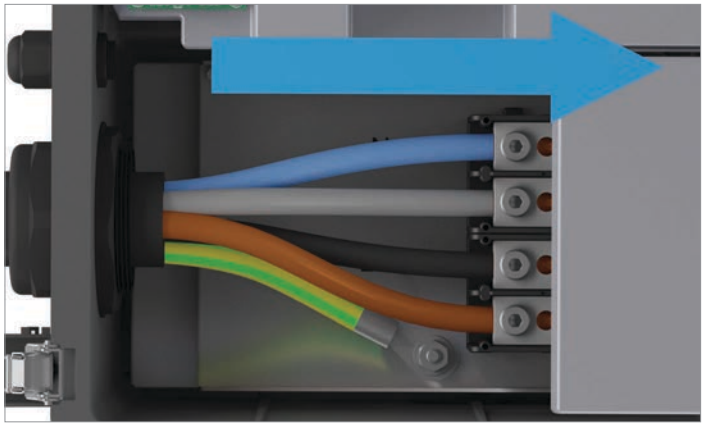


8. Rotate the mounting frame with the Sub-1G antenna upward.

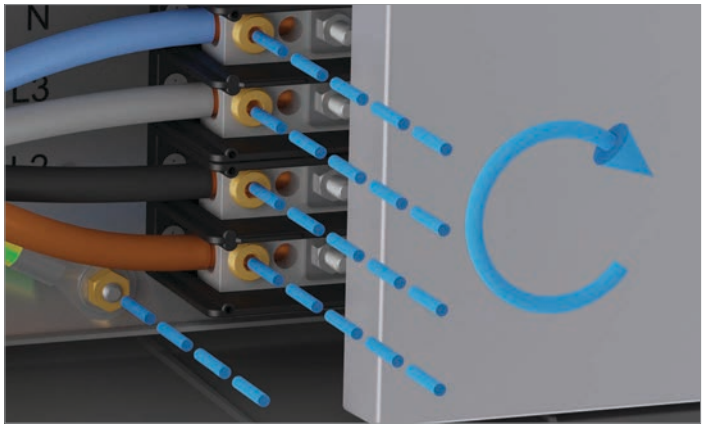


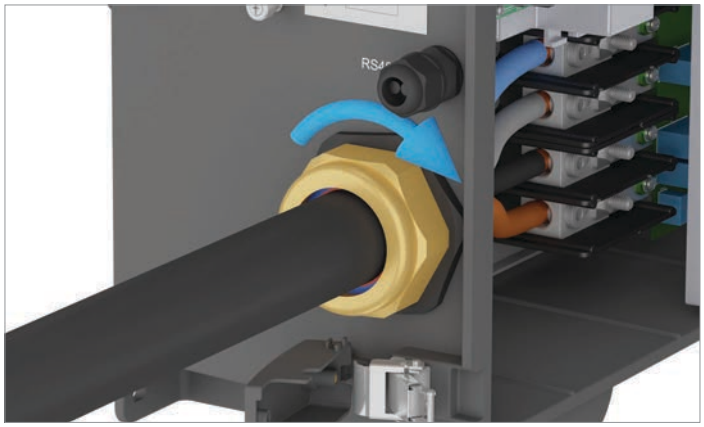
9. Screw on the mounting frame.

10.12 Finishing the maintenance work - connecting the inverter to the grid (AC) and solar modules (DC)

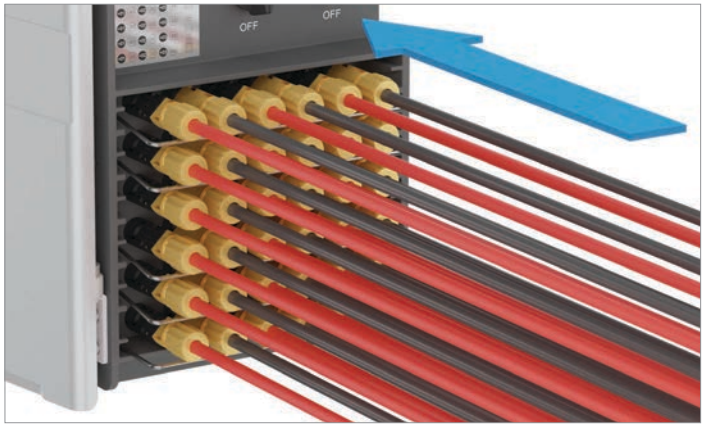


1. Plug in and tighten the conductors of the AC cable.



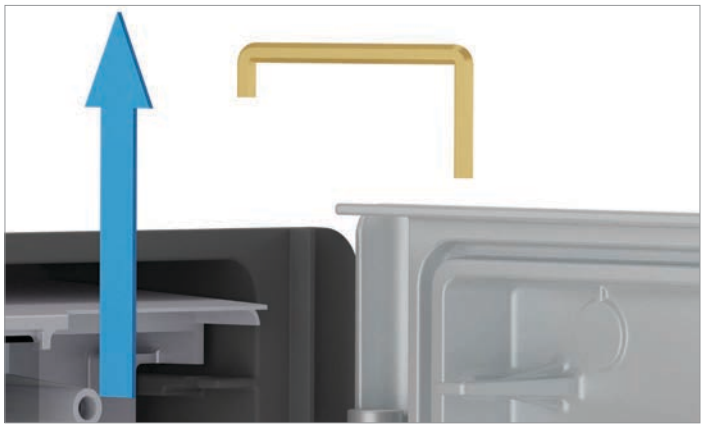


2. Tighten the AC cable gland.



3. Plug in the DC cables.

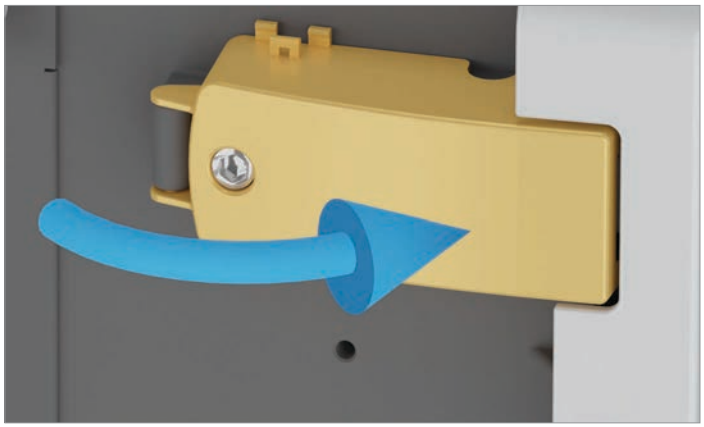
Finishing the maintenance work - connecting the inverter to the grid (AC) and solar modules (DC)



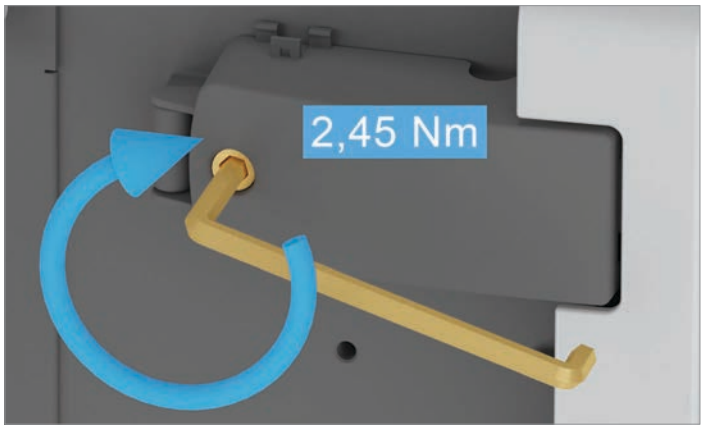
1. Remove the Allen key from the top of the door.

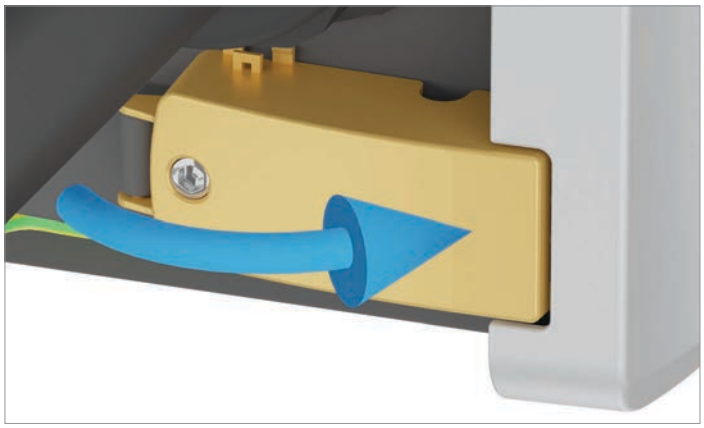
2. Close the door.

3. Close the upper and lower door locks.

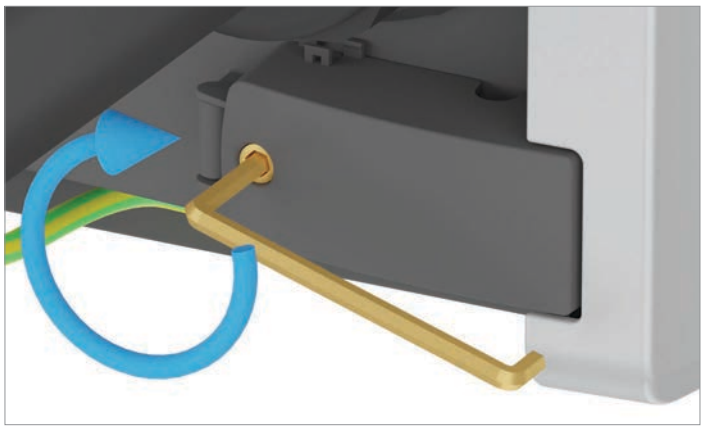


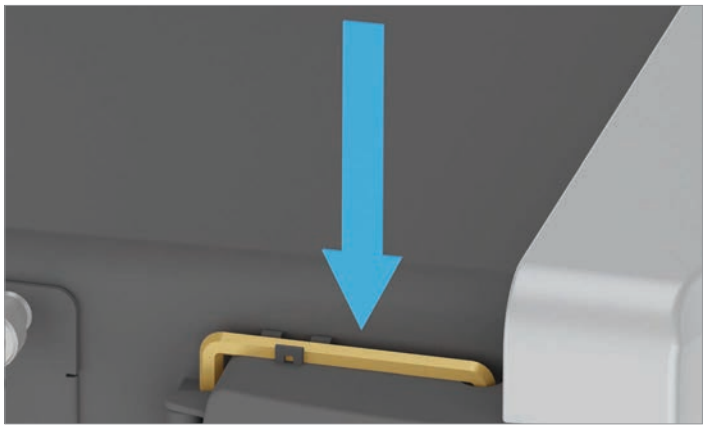
4. Close and tighten the cover of the upper door lock.





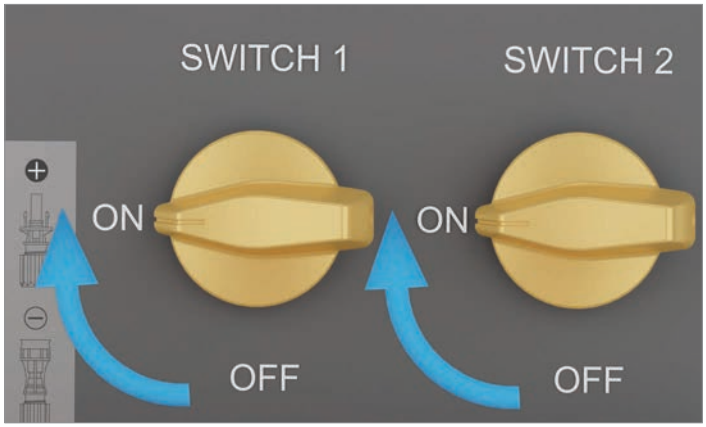
5. Close and tighten the cover of the lower door lock.





6. Insert the Allen key into the upper door lock.

7. Close the isolating switch between the inverter and the grid connection point or inverter and the solar modules.



8. Turn both DC isolating switches to the ***ON*** position.

11. Technical Data

Input (DC)	M70A
Recommended maximum PV power	125 kW_P
Maximum input power (per MPP Tracker/total)	15.7 kW/78.5 kW
Rated power	70 kW
Maximum input voltage	1100 V_{DC} Infeed stopped at > 1000 V_{DC}
Operating input voltage range	200 to 1000 V_{DC}
Rated voltage	600 V_{DC}
Switch-on voltage	250 V_{DC}
Switch-on power	150 W
MPP input voltage range	200 to 1000 V_{DC}
MPP input voltage range with full power	Ambient temperature <35 C: 460–900 V_{DC} Ambient temperature 35–40 °C: 460–800 V_{DC} Ambient temperature 40–50 °C: 520–720 V_{DC}
MPP input voltage range at rated power	400 to 900 V_{DC}
Asymmetrical design	15.7 kW/13 kW
Maximum input current (per MPP Tracker/total)	26 A/156 A
Maximum DC short-circuit current I_{SC}	50 A
Maximum interruption current	50 A per MPP tracker
Open-circuit voltage V_{OC}	1000 V_{DC}/1100 V_{DC} without damage
Number of MPP trackers	6 2 strings per MPPT: No external string fuses required 3 strings per MPPT: External string fuses required
Number of DC plugs	18 pairs
Galvanic isolation	No
Overvoltage category [2)]	II
Surge protection devices [3)]	Type 2, replaceable (combination type 1+2 upgradeable)
String Monitoring	Yes

Output (AC)	M70A
Max. Apparent power	77 kVA
Max. Active power	77 kW
Rated apparent power [4)]	70 kVA
Rated voltage[5)]	230/400 V -20%/+30%, 3 phases + N + PE, (△ or Y)
Rated current	102 A
Maximum current	112 A
Maximum current in case of fault	120 A
Switch-on current	120 A
Rated frequency	50/60 Hz
Frequency range [5)]	45 to 65 Hz
Adjustable power factor	0.8 cap. to 0.8 ind. (0.9 cap. to 0.9 ind. at max. active power)
Total harmonic distortion	<3% at rated apparent power
DC power supply	<0.5% at rated current
Power loss in night mode	2 W
Overvoltage category [2)]	III
Surge protection devices [3)]	Type 2, replaceable

Mechanical details	M70A
Dimensions (W x H x D)	699 × 629 × 263.4 mm
Weight	69 kg
Cooling	4 Fans
AC connection type	L1, L2, L3, N: Terminal with hexagon socket screw PE: M10 threaded bolt with nut
DC connection type	Amphenol H4
Communication interfaces	2x RS485, 2x dry contacts, 1x external power-off, 6x digital inputs, 1x Sub-1G antenna, 1x Wi-Fi module (optional accessory)

General specifications	M70A
Delta model name	M70A_260
Delta part number	RPI703M260000
Maximum efficiency	98.8%
EU efficiency	98.4%
Total operating temperature range	-25 to +60 °C
Operating temperature range without derating	-25 to +50 °C
Storage temperature range	-25 to +60 °C
Relative humidity	0 to 100%, non-condensing
Max. operating height	4000 m above sea level
Noise level (at a distance of 1 m)	<67.5 dB(A)

Standards and guidelines	M70A
IP rating	IP65
Protection class	I
Pollution degree	II
Overload behavior	Current limit, power limit
Safety	IEC 62109-1/-2, CE compliance
EMC	EN 61000-6-2/-6-3/-3-11/-3-12
Noise immunity	IEC 61000-4-2/-3/-4/-5/-6/-8
Distortion factor	EN 61000-3-2
Fluctuations and fibrillations	EN 61000-3-3
Grid connection guidelines	You will find the current list at solarsolutions.delta-emea.com

[1] IEC 60664-1, IEC 62109-1
[2] EN 50539-11
[3] EN 61463-11
[4] For cos phi = 1 (VA = W)
[5] AC voltage and frequency range are programmed using the corresponding country specifications.

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Belgium	support.belgium@solar-inverter.com	0800 711 35 (toll free)
Bulgaria	support.bulgaria@solar-inverter.com	+421 42 4661 333
Czech Republic	podpora.czechia@solar-inverter.com	800 143 047 (toll free)
Denmark	support.danmark@solar-inverter.com	8025 0986 (toll free)
France	support.france@solar-inverter.com	0800 919 816 (toll free)
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Slovakia	podpora.slovensko@solar-inverter.com	0800 005 193 (toll free)
Slovenia	podpora.slovenija@solar-inverter.com	+421 42 4661 333
Spain	soporto.espana@solar-inverter.com	900 958 300 (toll free)
Switzerland	support.switzerland@solar-inverter.com	0800 838 173 (toll free)
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