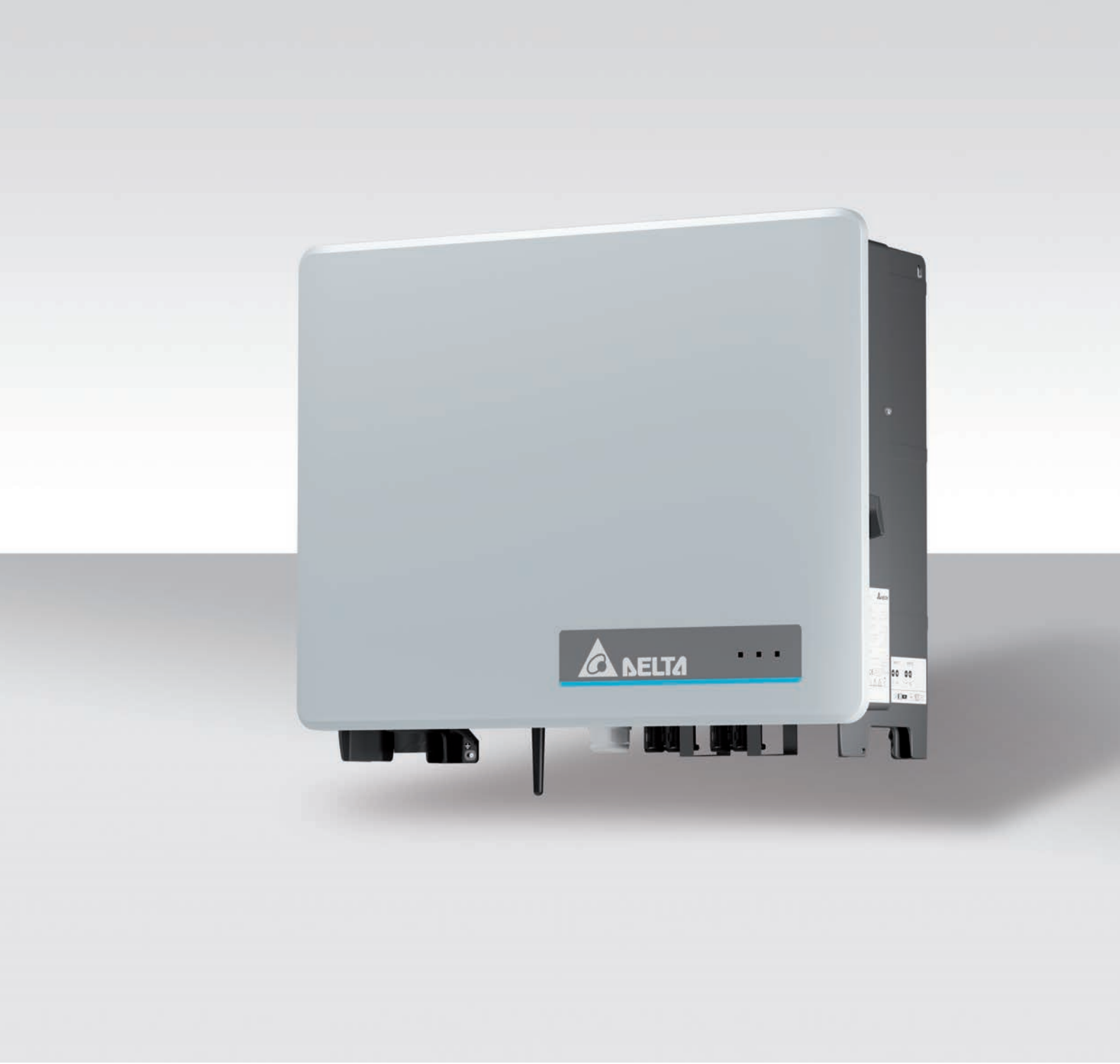


# Installation and Operation Manual

Solar inverter
M15A_220/M20A_220
Product version 0

Europe

This manual applies to the inverter models:

- M15A_220 (Delta part number RPI153M220100, product version 0)
- M20A_220 (Delta part number RPI203M220100, product version 0)

and DSS software version 6.0 or higher

The Delta part number and the product version can be found on the type plate of the inverter (see section “ Identification of the product and the product version”, page 2.

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 Therefore, before starting installation work, **always** consult solarsolutions.delta-emea.com to check whether a newer version of the Quick Installation Guide or the Installation and Operation Manual is available.

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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."

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

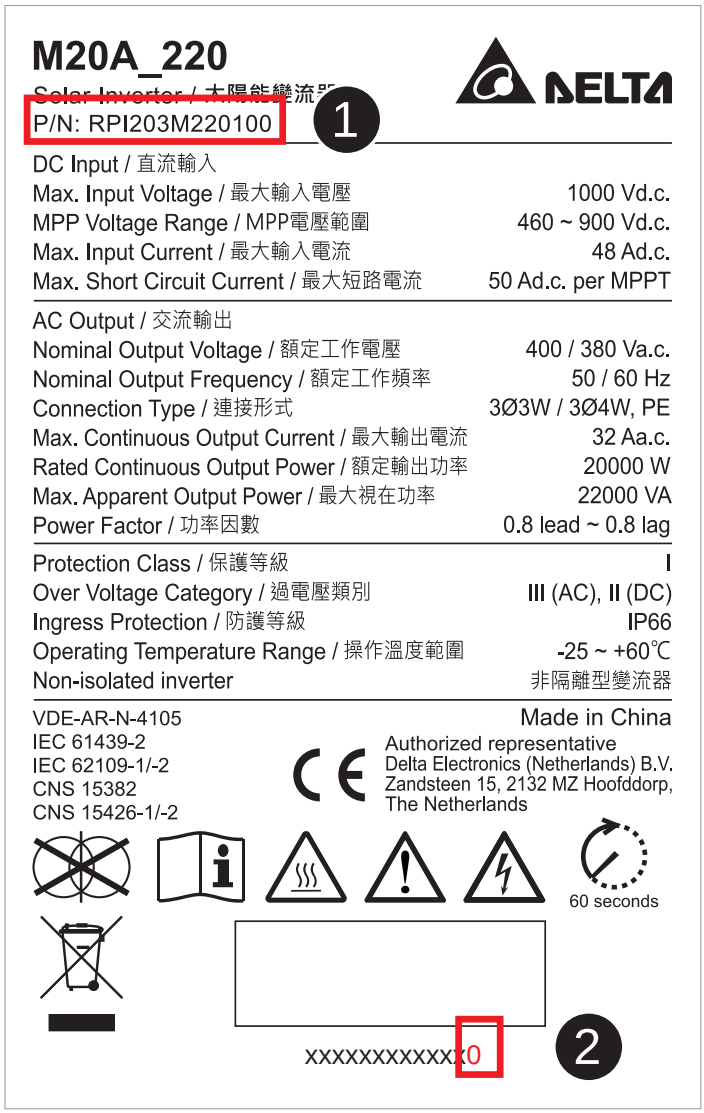
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**Information about the versions of this manual**

| Version | Date | Changes |
|---|---|---|
| 1.0 | 2021-11-05 | First edition for the product version 0 |

## Identification of the product and the product version




| Product version | Identification of the product and the product version |
|---|---|
| 0 | ❶ Delta part number<br>❷ The last letter of the serial number indicates the product version. |

# Table of Contents

**1. About this manual . . . 7**
1.1 Purpose of this manual . . . 7
1.2 Target audience of this manual . . . 7
1.3 Warning notices and warning symbols . . . 7
1.4 Writing and labeling conventions . . . 8

**2. Basic safety instructions . . . 9**

**3. Intended purpose . . . 11**

**4. Product overview . . . 12**
4.1 Scope of delivery . . . 12
4.1.1 Inverter . . . 12
4.2 Overview of components and connections . . . 14
4.3 LEDs . . . 15
4.4 Grid connection (AC) . . . 16
4.4.1 AC socket . . . 16
4.4.2 AC surge protection devices . . . 16
4.5 DC-side components . . . 17
4.5.1 DC connection panel . . . 17
4.5.2 DC disconnectors . . . 18
4.5.3 DC surge protection devices . . . 18
4.6 Communication connection . . . 19
4.7 Grounding the inverter housing . . . 20
4.7.1 Grounding the inverter housing . . . 20
4.8 Cooling system . . . 21
4.9 Installation options . . . 21
4.10 Type plate and markings . . . 22
4.10.1 M15A . . . 22
4.10.2 M20A . . . 24

**5. Planning the installation . . . 27**
5.1 Installation location . . . 27
5.1.1 Requirements for the wall, ground and mounting system . . . 27
5.1.2 Installation height . . . 27
5.1.3 Installation position . . . 27
5.1.4 Outdoor installations . . . 27
5.1.5 Lifting and transporting the inverter . . . 27
5.1.6 Installation clearances and air circulation . . . 28
5.2 Characteristic curves . . . 29
5.2.1 M15A characteristic curves . . . 29
5.2.2 M20A characteristic curves . . . 32
5.3 Dimensions . . . 35
5.4 Planning the grid connection (AC) . . . 36
5.4.1 Important safety instructions . . . 36
5.4.2 Residual current circuit breaker . . . 36
5.4.3 Integrated residual current monitoring unit . . . 36
5.4.4 AC surge protection devices . . . 36
5.4.5 Permissible grounding systems . . . 36
5.4.6 Planning grounding of the inverter . . . 37
5.4.7 Permissible grid voltages . . . 38
5.4.8 Selecting the AC cable . . . 38

5.5 Planning the connection of the solar modules (DC) . . . 40
5.5.1 Safety instructions . . . 40
5.5.2 Polarity of the DC voltage . . . 40
5.5.3 Arrangement of the DC inputs on the DC connection panel . . . 41
5.5.4 Functioning of integrated string monitoring . . . 41
5.5.5 Use of string fuses . . . 42
5.5.6 Specifications for the DC cables . . . 42
5.6 Planning the device communication and plant monitoring . . . 43
5.6.1 Introduction . . . 43
5.6.2 Components of the communication card . . . 43
5.6.3 Cable gland for the communication connection . . . 44
5.6.4 Connection of a data logger via RS485 . . . 44
5.6.5 Connection of a DC1 data collector from Delta . . . 45
5.6.6 Connecting an external alarm unit . . . 46
5.6.7 Connecting a ripple control receiver . . . 46
5.6.8 External power-off . . . 47
5.6.9 Connecting a PC . . . 48
5.7 Grid and system protection . . . 49

**6. Planning the Commissioning . . . 50**
6.1 Introduction . . . 50
6.2 Commissioning options . . . 50
6.2.1 Delta Service Software (DSS) . . . 50
6.2.2 DeltaSolar app with direct connection to the inverter via Wi-Fi . . . 50
6.2.3 DeltaSolar app with DC1 data collector from Delta . . . 50

**7. Installation . . . 51**
7.1 Safety instructions . . . 51
7.2 Sequence of installation and commissioning steps . . . 52
7.2.1 General information . . . 52
7.3 Mounting the inverter . . . 53
7.4 Grounding the inverter housing . . . 55
7.5 Connecting the communication card . . . 57
7.5.1 Connections on the communication card . . . 57
7.5.2 Threading the communication cable . . . 58
7.5.3 Connecting a data logger via RS485 . . . 59
7.5.4 Connection of a DC1 data collector via RS485 . . . 61
7.5.5 Connecting an external alarm unit . . . 62
7.5.6 Connecting a ripple control receiver . . . 63
7.5.7 Connecting the external power-off (EPO) . . . 64
7.5.8 Connecting a PC via RS485 (optional) . . . 64
7.5.9 Reinstalling the communication card . . . 65
7.6 Connecting the grid (AC) . . . 66
7.6.1 Handling aluminum conductors during installation work . . . 66
7.6.2 Wire the AC plug . . . 67
7.6.3 Connecting the AC cables . . . 68
7.7 Connecting the solar modules (DC) . . . 69

**8. Commissioning . . . 71**
8.1 General prerequisites for commissioning . . . 71
8.2 Commissioning with a Windows PC and the Delta Service Software (DSS) . . . 71
8.3 Commissioning with the DeltaSolar app . . . 71
8.3.1 Direct connection between smartphone and inverter . . . 71
8.3.2 Mobile device connected to inverter via DC1 data collector . . . 71
8.4 Completing the commissioning process . . . 71

# Table of Contents


**9. Error events and troubleshooting . . . 72**
9.1 LED status indicators . . . 73
9.2 Error . . . 74
9.3 Warnings . . . 75
9.4 Faults . . . 76

**10. Disconnecting the inverter from the power supply before working on it . . . 78**
10.1 Safety instructions . . . 78
10.2 Procedure . . . 79

**11. Replacing or cleaning components, installing accessories . . . 83**
11.1 General information . . . 84
11.2 Replacing DC surge protection devices . . . 85
11.3 Replacing the AC surge protection devices . . . 88

**12. Recommissioning the inverter after work . . . 91**
12.1 Safety instructions . . . 91
12.2 Procedure . . . 93

**13. Replacing the inverter . . . 96**
13.1 Safety instructions . . . 96
13.2 Special notes on replacement . . . 97
13.3 Sequence of work steps . . . 98
13.4 Tools required . . . 99
13.5 Disconnecting the inverter from the power supply . . . 100
13.6 Removing the communication card . . . 102
13.7 Removing and packing the inverter . . . 103

**14. Decommissioning . . . 105**
14.1 Safety instructions . . . 105
14.2 Tools required . . . 106
14.3 Disconnecting the inverter from the power supply . . . 107
14.4 Removing the communication card . . . 109
14.5 Removing the inverter . . . 110

**15. Disposal . . . 112**

**16. Technical Data . . . 113**

# 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 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 hazardous situation that, if not avoided, **will result** in death or serious injury.

**WARNING**

Indicates a hazardous situation that, if not avoided, **could result** in death or serious injury.

**CAUTION**

Indicates a hazardous situation that, if not avoided, **could result** in minor or moderate injury.

***NOTICE***

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

A note provides information on efficient use of the inverter.

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



High electrical voltages or currents



Hot surfaces



Heavy weight



General danger

In addition, there are symbols for the use of protective equipment.



Wear safety gloves

## 1.4 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.

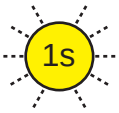
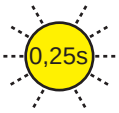
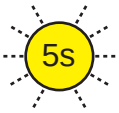
1. First step
   → Where necessary, the result of the work step is described here. This is used for checking that the work step has been completed correctly.
2. Second step
3. Third step

☑ Work step is now complete.

If the work instructions consist of just one 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 is off. |
|  | LED flashes at the standard rate (1 s ON, 1 s OFF). |
|  | LED flashes rapidly (0.25 sec ON, 0.25 sec OFF). |
|  | LED flashes slowly (5 s ON, 10 s OFF). |
|  | LED stays on. |

# 2. Basic safety instructions

For a description of how to structure warning notices and of the warning symbols used, refer to section “1.3 Warning notices and warning symbols”, page 7.

**DANGER**



**Electric shock**

Potentially fatal voltages are present in the inverter during operation.

- ► If the inverter is installed in a location to which children or other persons in need of protection have access, do not store the Allen key to open the front door on or near the inverter.

**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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**



**Electric shock**

The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**WARNING**



**Electric shock**

The IP66 protection degree 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 door is properly sealed.

**WARNING**



**Heavy weight**

The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

**WARNING**



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

- Always wear safety gloves when touching the inverter.

***NOTICE***



**Use of aluminum cables**
► Always observe the applicable regulations and rules for the use of aluminum cables. For detailed information, refer to the complete Installation and Operation Manual.

***NOTICE***



**Working in freezing conditions**
In frosty conditions, the rubber seal of the front door can freeze to the enclosure, tear when opened and thus become leaky.

► Before opening the front door, defrost the rubber seal with some warm air.
► Open the front door slowly.

- 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.
- To avoid the risk of arcing, do not disconnect cables when the inverter is under load.
- To prevent damage due to lightning strikes, follow the applicable regulations in your country.
- All external connections must be sufficiently sealed in order to ensure an IP65 protection degree. 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.
- 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.

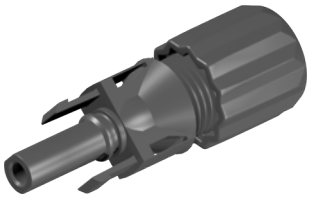
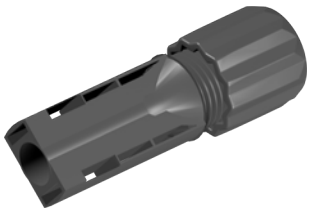
# 4. Product overview

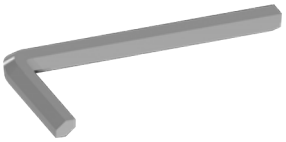
## 4.1 Scope of delivery

- ► Check the delivery for completeness and all components for damage before starting installation work.
- ► Do not use any damaged components.

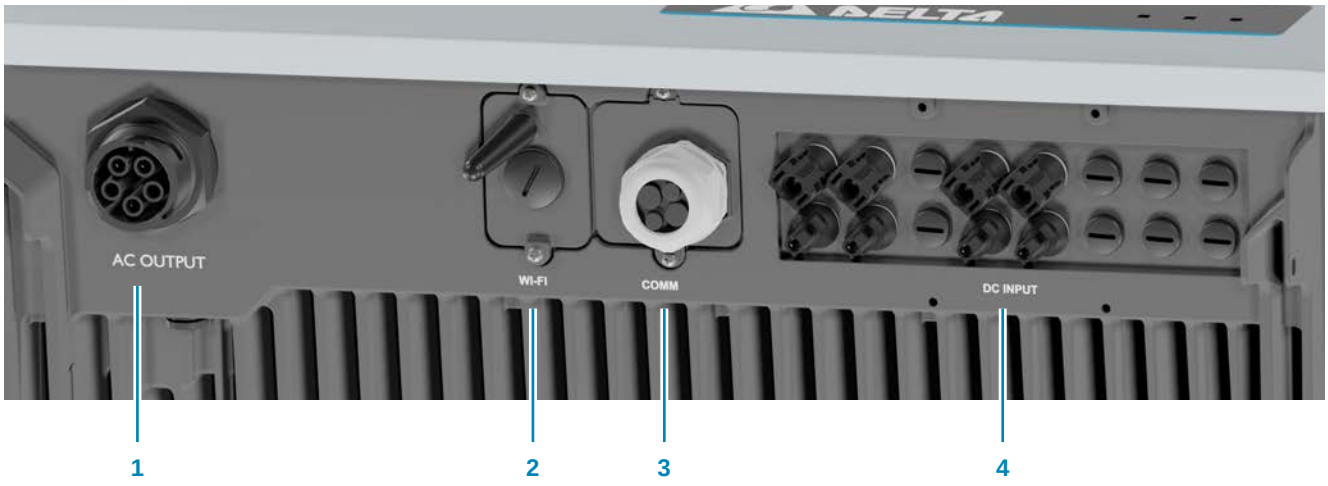
- ► Keep the packaging.

### 4.1.1 Inverter

| Part | Q'ty | Description |
|---|---|---|
| Inverter | 1 |  |
| Mounting plate | 1 | For mounting the inverter  |
| DC plug for DC+ | 4 | Amphenol H4 DC plug for 4/6 mm² (H4C**F** C4D●MS)  |
| DC plug for DC– | 4 | Amphenol H4 DC plug for 4/6 mm² (H4C**M** C4D●MS)  |
| Mounting tool for DC plug | 2 | For unscrewing the Amphenol H4 DC plugs from the DC connections of the inverter  |

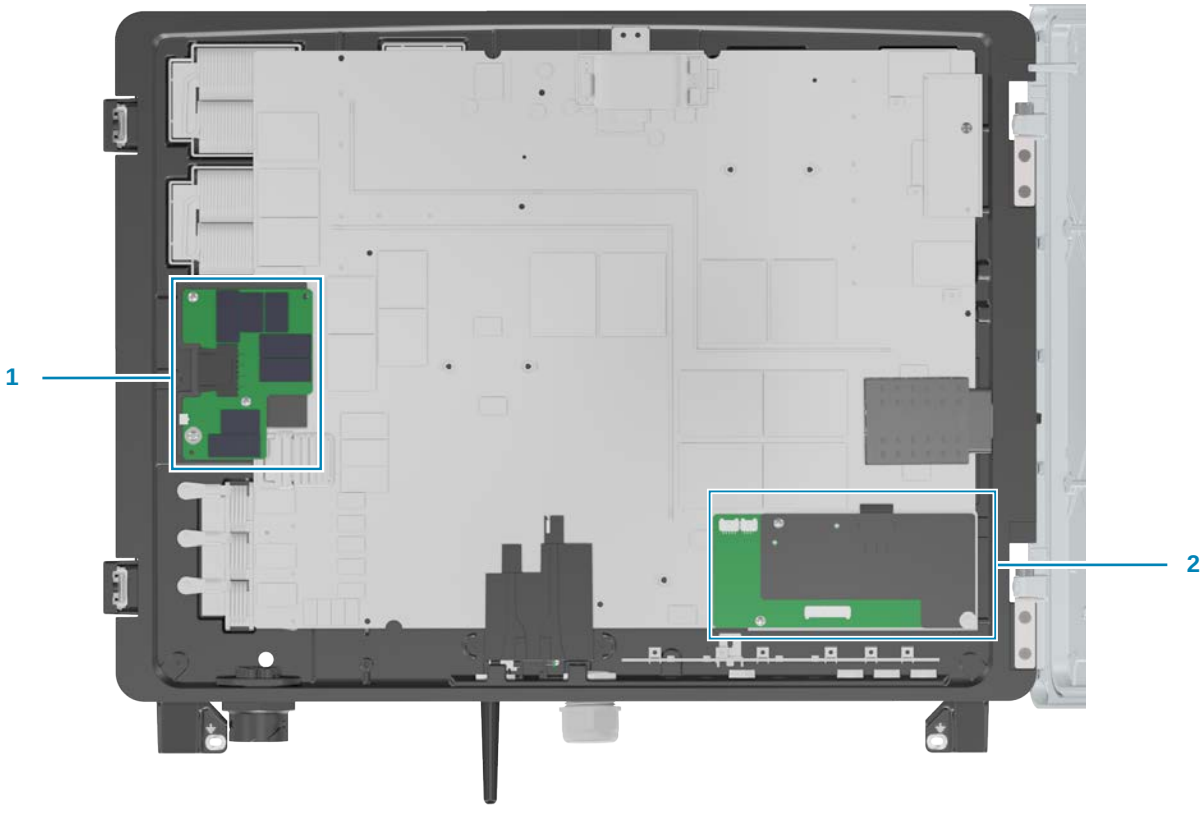
| Part | Q'ty | Description |
|---|---|---|
| AC plug | 1 | To connect the inverter to the grid  |
| Allen key for AC plug | | For tightening the conductors of the AC cable.  |
| Wi-Fi antenna | 1 | The inverter can be connected to a PC or smartphone via the Wi-Fi antenna.  |
| Allen key for the door | 1 | For releasing the door screws and securing the open door from slamming shut. The Allen key is attached to the upper door lock.  |
| Quick Installation Guide | 1 |   |

## 4.2 Overview of components and connections




**1** AC connection
**2** Wi-Fi module
**3** Communication connection
**4** DC connection panel

*Fig. 4.1: Overview of electrical connections*




**1** DC surge protection devices
**2** AC surge protection devices

*Fig. 4.2: Overview of internal components*

The inverter does not need to be opened for installation.

## 4.3 LEDs




| | | |
|---|---|---|
| **GRID** | Grid | LED: green |
| **ALARM** | Alarm | LED: red / yellow |
| **COMM.** | Communication | LED: red / yellow / green |

*Tab. 4.1.: Use and color of the LEDs*

| | |
|---|---|
| | LED is off. |
| 1s | LED flashes at the standard rate (1 s ON, 1 s OFF). |
| 0,25s | LED flashes rapidly (0.25 sec ON, 0.25 sec OFF). |
| 5s | LED flashes slowly (5 s ON, 10 s OFF). |
| | LED stays on. |

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

#### 4.3.1.1 Status display: operation

| GRID Green | ALARM Red | ALARM Yellow | Explanation |
|---|---|---|---|
| 1s | | | Countdown (inverter is starting up). |
| | | | The inverter is connected to the grid and is operating as expected. |
| | | | Error.<br>Power-off via external signal. |
| | 1s | | Warning. The inverter continues to supply electricity. |
| | 1s | | Warning. The inverter is no longer supplying electricity. |
| | | | Solar panel system failure. The inverter is no longer supplying electricity. |
| | | 1s | Solar system warning. The inverter continues to supply electricity. |
| | | 5s | No DC. Also appears when both DC disconnectors are open. |
| 1s | 1s | | Updating firmware. |
| 1s | | 1s | Standby mode. |
| 0,25s | | 0,25s | Check the PV power. |
| | 1s | 1s | System lock. |

*Tab. 4.3.: Meaning of the LED displays on the inverter*

## 4.4 Grid connection (AC)

**Related topics**

“5.4 Planning the grid connection (AC)”, page 36
“7.6 Connecting the grid (AC)”, page 66

### 4.4.1 AC socket

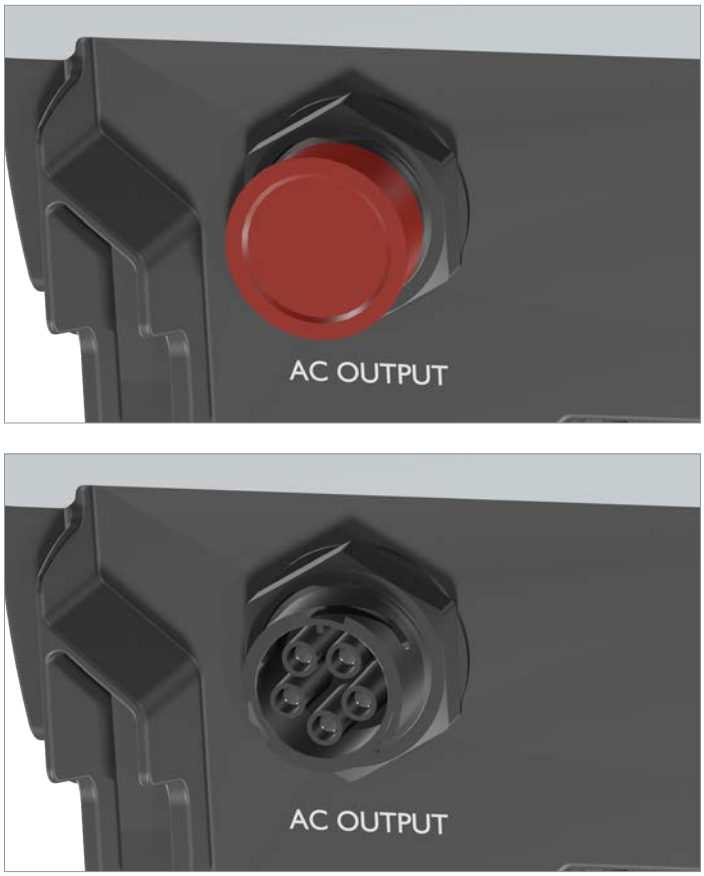



*Fig. 4.3: AC socket*

The AC connection is suitable for grids with and without a neutral conductor.

The AC plug is included in the scope of delivery.

### 4.4.2 AC surge protection devices

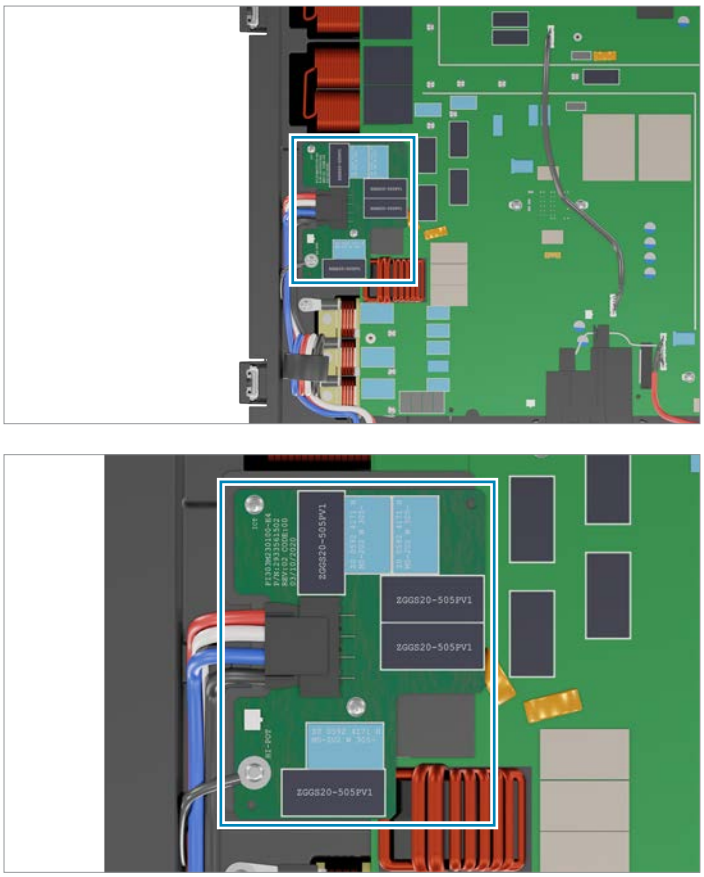



*Fig. 4.4: AC surge protection devices*

The inverter has replaceable type 2 AC surge protection devices (EN 61463-11). The type-2 AC surge protection devices are replaced as a block.

**Related topics**

“11.3 Replacing the AC surge protection devices”, page 88

## 4.5 DC-side components

**Related topics**

“5.5 Planning the connection of the solar modules (DC)”, page 40
“7.7 Connecting the solar modules (DC)”, page 69

### 4.5.1 DC connection panel

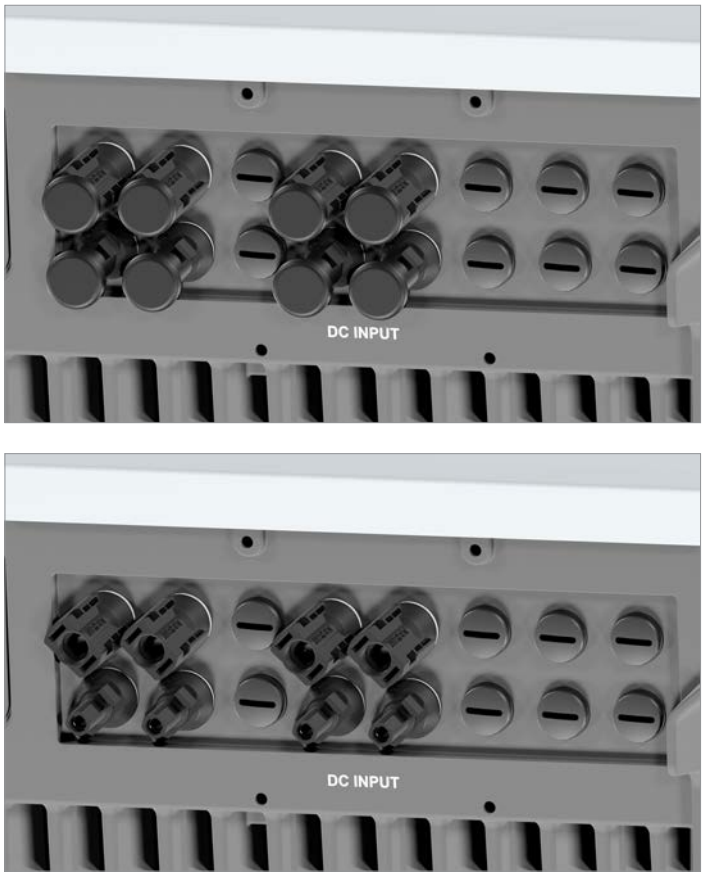



*Fig. 4.5: DC connection panel*

The DC connector panel has 2 pairs of DC connectors (2 MPP trackers with 2 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)

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

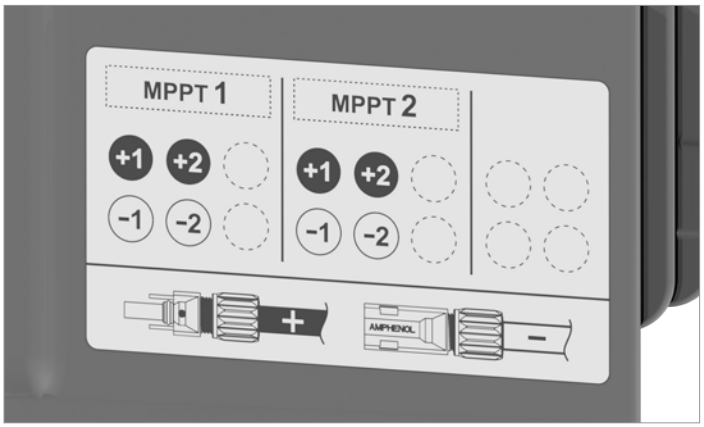



*Fig. 4.6: Assignment of the DC connectors to the MPP trackers*

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

### 4.5.2 DC disconnectors

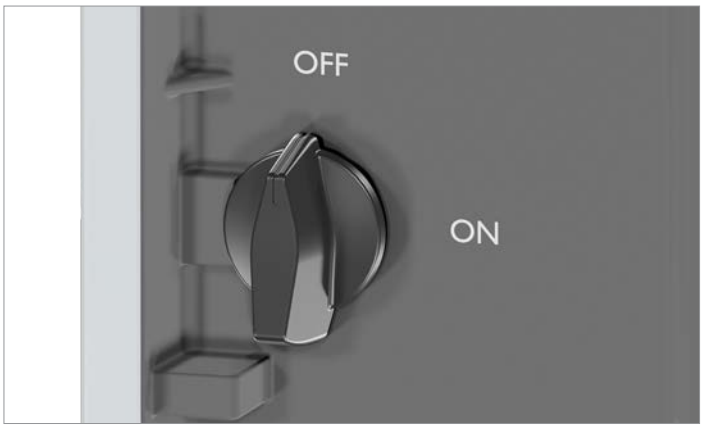



*Fig. 4.7: DC disconnectors*

The DC disconnector is a mechanical disconnector that disconnects all DC strings.

Germany: The DC disconnector meets the requirements of VDE 0100-712.

France: The DC disconnector meets the requirements of UTE 15-712-1.

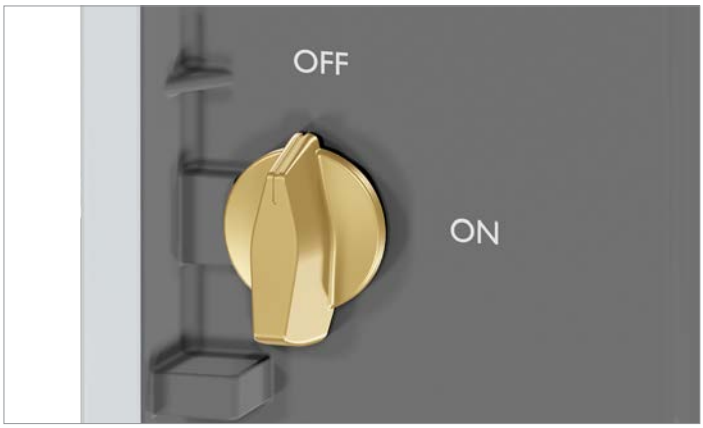



*Fig. 4.8: The DC disconnector in the **OFF** position = the connection to the solar modules is disconnected*

The connection between the inverter and the solar modules is **disconnected** when the DC disconnector is in the ***OFF*** position.

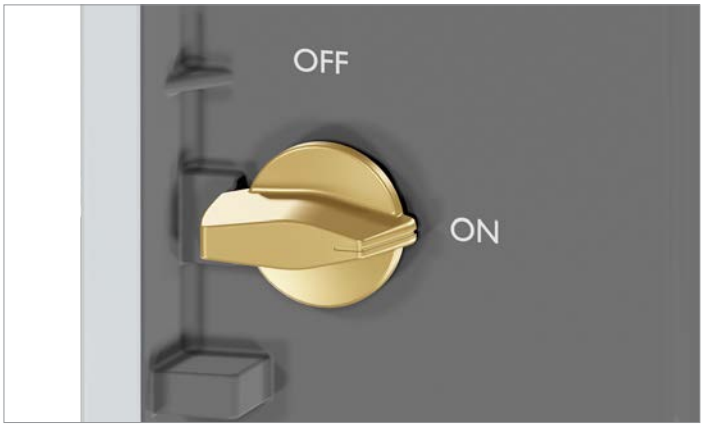



*Fig. 4.9: The DC disconnector in the **ON** position = the connection to the solar modules is closed*

The connection between the inverter and the solar modules is **closed** when the disconnector is in the ***ON*** position.

### 4.5.3 DC surge protection devices

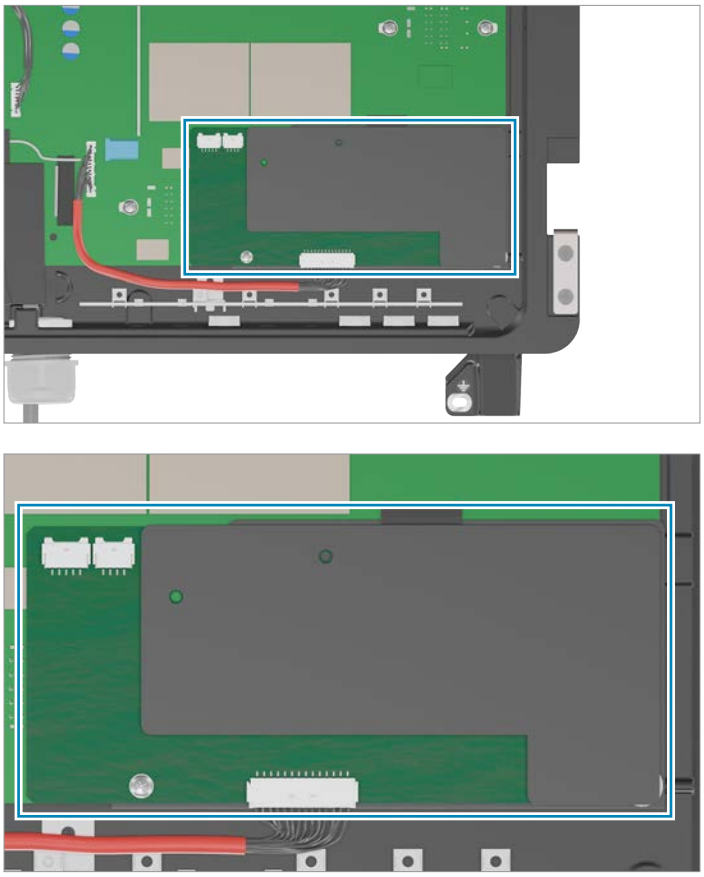


*Fig. 4.10: DC surge protection devices*

The inverter has replaceable type 2 DC surge protection devices (EN 50539-11). The DC surge protection devices are replaced as a block.

**Related topics**

“11.2 Replacing DC surge protection devices”, page 85

## 4.6 Communication connection

**Related topics**

"5.6 Planning the device communication and plant monitoring", page 43
"5.7 Grid and system protection", page 49
"6. Planning the Commissioning", page 50
"7.5 Connecting the communication card", page 57




*Fig. 4.11: Wi-Fi card and communication card*

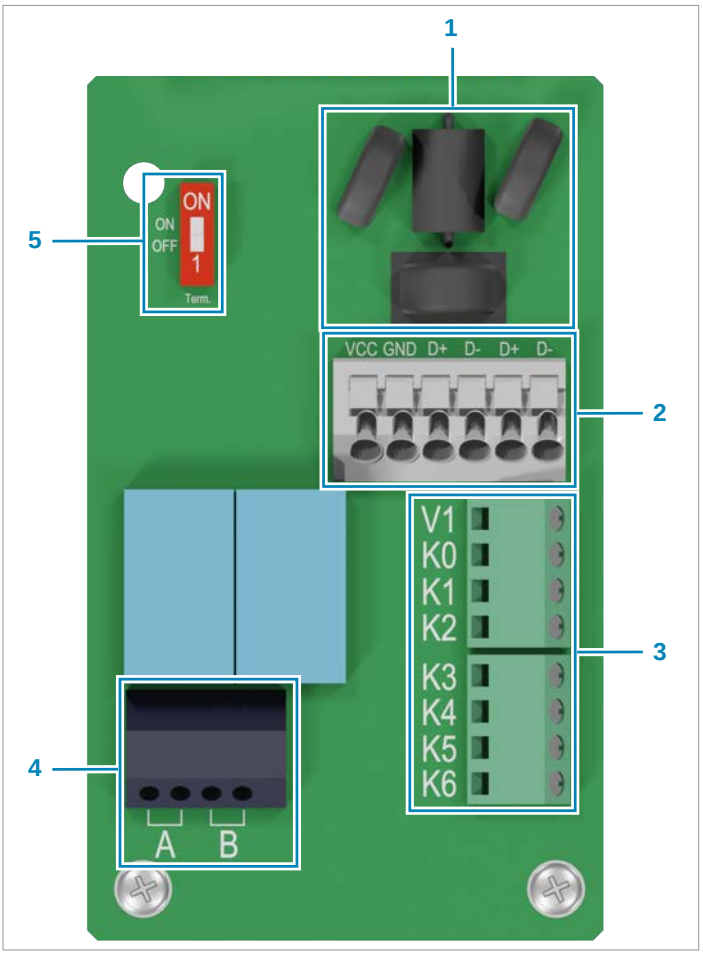



*Fig. 4.12: Components of the communication card*

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

| 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 |

*Tab. 4.4.: Connections on the communication card*

| | |
|---|---|
| Cable type | Shielded and twisted pair cable (CAT5 or CAT6) |
| Cable diameter | 7.2 to 10 mm |
| Wire cross section | 0.25 ... 1.5 $mm^2$ |

*Tab. 4.5.: Specification of the communication cable*

## 4.7 Grounding the inverter housing

**Related topics**

“5.4.6 Planning grounding of the inverter”, page 37
“7.4 Grounding the inverter housing”, page 55

### 4.7.1 Grounding the inverter housing

The inverter offers four possibilities for grounding the inverter housing.







*Fig. 4.13: Grounding connections at the left foot of the inverter*







*Fig. 4.14: Grounding connections on the right foot of the inverter*

Variant B: The M6 screw, spring washer and washer are mounted on the inverter. A toothed washer is not required.

## 4.8 Cooling system

**Related topics**

“5.1 Installation location”, page 27

The inverter is cooled by means of natural convection.



*Fig. 4.15: Cooling fins on the back of the inverter*

## 4.9 Installation options

The inverter can be mounted on a wall/ceiling. For this purpose, a mounting plate is supplied with the inverter.

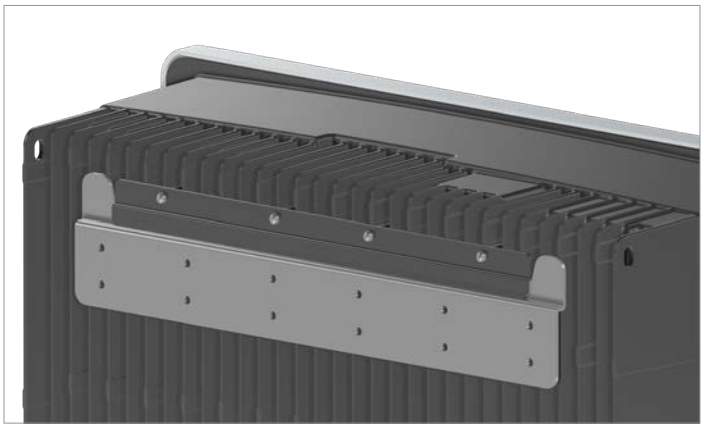


*Fig. 4.16: Mounting plate*

There is a mounting hole on the both left and right foot to attach the inverter to the wall or to the mounting system.




*Fig. 4.17: Mounting holes*

## 4.10 Type plate and markings

### 4.10.1 M15A




*Fig. 4.18: M15A type plate on the inverter*

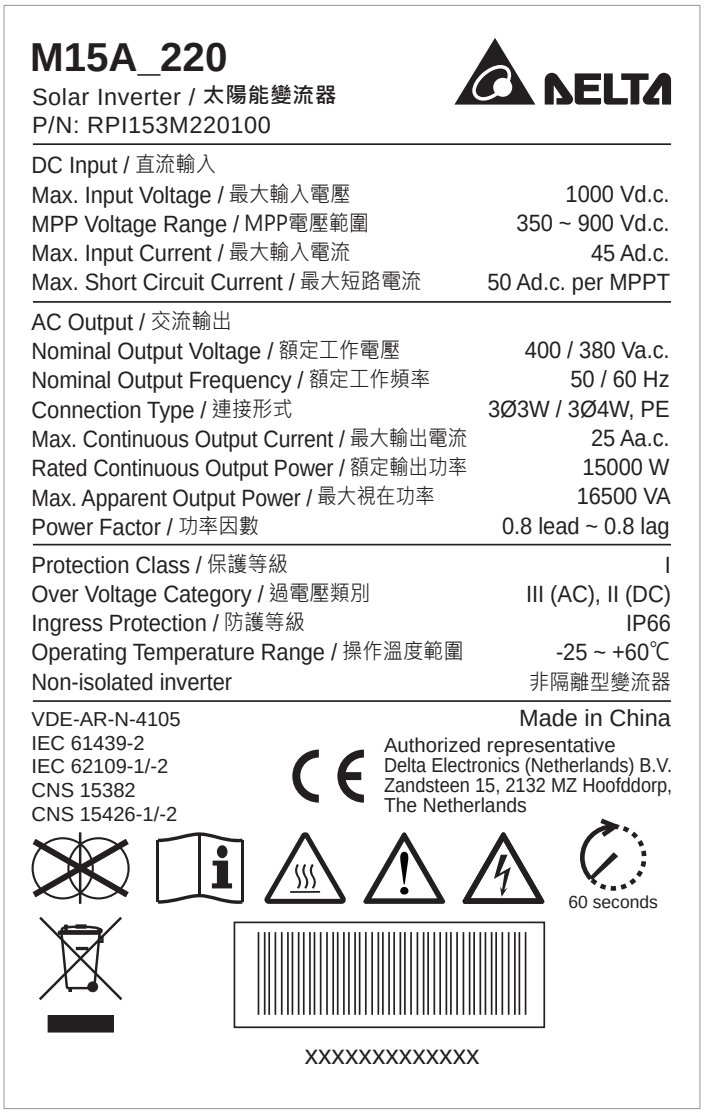



*Fig. 4.19: M15A type plate*

### Information on the type plate

| Information on the type plate | Meaning |
|---|---|
| M15A_220 | Delta model name |
| P/N: RPI153M220100 | Delta part number |
| **DC INPUT** | DC input |
| Max. Input voltage: 1000 V DC | Max. input voltage |
| MPP voltage range 350 ~ 900 V DC | MPP input voltage range |
| Max. Input current: 45 A DC | Total maximum DC input current |
| Max. Short circuit current: 50 A DC per MPPT | Maximum DC short-circuit current per MPP tracker |
| **AC OUTPUT** | AC output |
| Nominal output voltage: 400/380 V AC | Rated output voltage |
| Nominal output frequency: 50/60 Hz | Rated frequency |
| Connection type: 3Ø3W/3Ø4W, PE | The inverter can be connected to 3-phase grids without neutral conductors (3P3W, 3 phases + PE) and 3-phase grids with neutral conductors (3P4W, 3 phases + N + PE). |
| Max. Continuous output current: 25 A AC | Maximum output current |
| Rated continuous output power: 15,000 W | Rated output power |
| Max. Apparent output power: 16,500 VA | Maximum apparent power |
| Power factor: 0.8 lead ~ 0.8 lag | Setting range of the power factor cos φ |
| | |
| Protection class: I | Safety class as per EN 61140 |
| Overvoltage category: III (AC), II (DC) | Overvoltage category for AC and DC as per EN 50539-11 |
| Ingress protection: IP66 | Protection degree according to EN 60529 |
| Operating temperature range: -25 ~ +60°C. | Operating temperature range |
| Non-isolated inverter | The inverter has no galvanic isolation. |
| | |
| Made in China | The device was made in China. |
| VDE-AR-N 4105 | The inverter fulfills the requirements of VDE-AR-N 4105. |
| IEC 61439-2 | The inverter meets the requirements of IEC61439-2. |
| IEC 62109-1/-2 | The inverter meets the requirements of IEC 62109-1/-2. |
| CNS 15382 | The inverter meets the requirements of CNS 15382. |
| CNS 15426-1/-2 | The inverter meets the requirements of CNS 15426-1/-2. |
| CE | CE mark. By applying this mark, Delta declares that the inverter satisfies the provisions of the applicable EU directives. |

### 4.10.2 M20A




*Fig. 4.20: M20A type plate on the inverter*

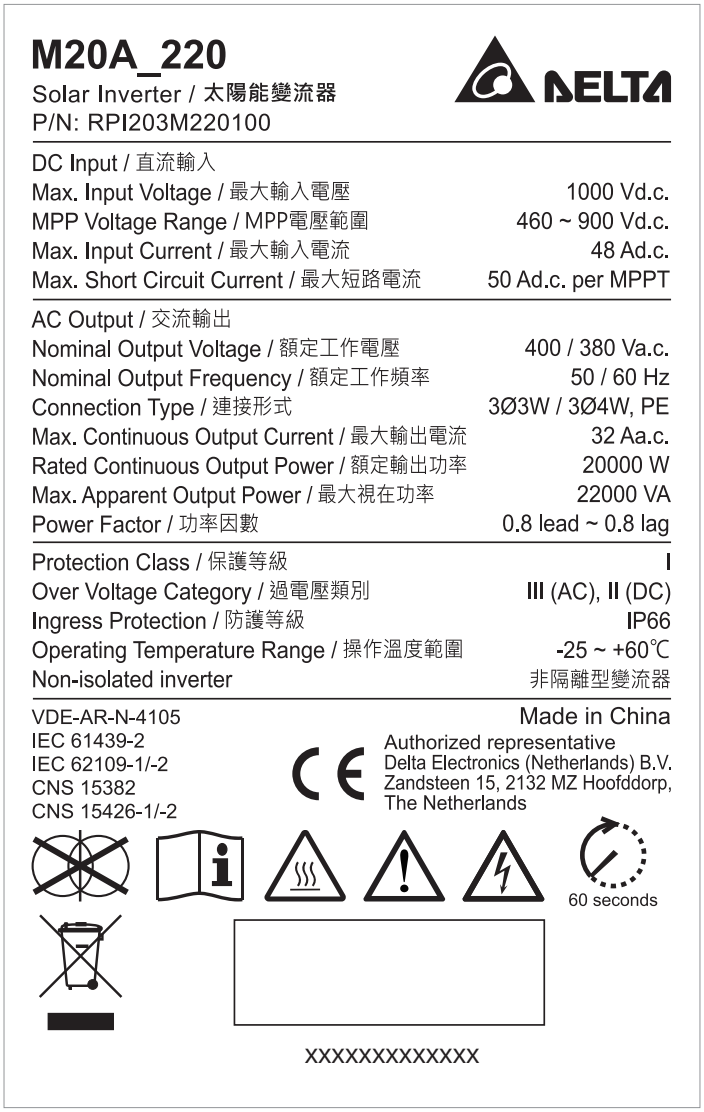


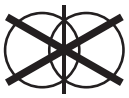

*Fig. 4.21: M20A type plate*

### Information on the type plate

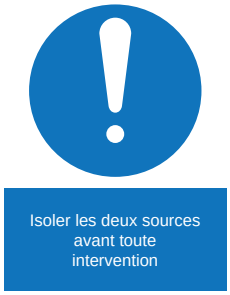
| Information on the type plate | Meaning |
|---|---|
| M20A_220 | Delta model name |
| P/N: RPI203M220100 | Delta part number |
| **DC INPUT** | DC input |
| Max. Input voltage: 1000 V DC | Max. input voltage |
| MPP voltage range 460 ~ 900 V DC | MPP input voltage range |
| Max. Input current: 50 A DC | Total maximum DC input current |
| Max. Short circuit current: 50 A DC per MPPT | Maximum DC short-circuit current per MPP tracker |
| **AC OUTPUT** | AC output |
| Nominal output voltage: 400/380 V AC | Rated output voltage |
| Nominal output frequency: 50/60 Hz | Rated frequency |
| Connection type: 3Ø3W/3Ø4W, PE | The inverter can be connected to 3-phase grids without neutral conductors (3P3W, 3 phases + PE) and 3-phase grids with neutral conductors (3P4W, 3 phases + N + PE). |
| Max. Continuous output current: 32 A AC | Maximum output current |
| Rated continuous output power: 20,000 W | Rated output power |
| Max. Apparent output power: 22,000 VA | Maximum apparent power |
| Power factor: 0.8 lead ~ 0.8 lag | Setting range of the power factor cos φ |
| | |
| Protection class: I | Safety class as per EN 61140 |
| Overvoltage category: III (AC), II (DC) | Overvoltage category for AC and DC as per EN 50539-11 |
| Ingress protection: IP66 | Protection degree according to EN 60529 |
| Operating temperature range: -25 ~ +60°C. | Operating temperature range |
| Non-isolated inverter | The inverter has no galvanic isolation. |
| | |
| Made in China | The device was made in China. |
| VDE-AR-N 4105 | The inverter fulfills the requirements of VDE-AR-N 4105. |
| IEC 61439-2 | The inverter meets the requirements of IEC61439-2. |
| IEC 62109-1/-2 | The inverter meets the requirements of IEC 62109-1/-2. |
| CNS 15382 | The inverter meets the requirements of CNS 15382. |
| CNS 15426-1/-2 | The inverter meets the requirements of CNS 15426-1/-2. |
| CE | CE mark. By applying this mark, Delta declares that the inverter satisfies the provisions of the applicable EU directives. |

# 4 Product overview

## Type plate and markings

| Icon | Meaning |
|---|---|
|  | This inverter is not separated from the grid by a transformer. |
|  | Before working on the inverter, read the supplied manual and follow the instructions provided. |
|  | The inverter housing can become very hot during operation. |
|  | The inverter housing must be grounded if this is required by local regulations. |
|  60 seconds | **Risk of death due to electric shock**<br>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. |
|  | WEEE mark<br>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**<br>Attention<br>Présence de deux sources de tension<br>- Réseau de distribution<br>- Panneaux photovoltaics |
|   | **For France: Warning notice according to UTE 15712-1**<br>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 “7. Installation”, page 51.

## 5.1 Installation location

**Related topics**

“7.3 Mounting the inverter”, page 53

### 5.1.1 Requirements for the wall, ground and 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, ground 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 Installation height

- ► Mount the inverter so that the LEDs are always visible.

### 5.1.3 Installation position

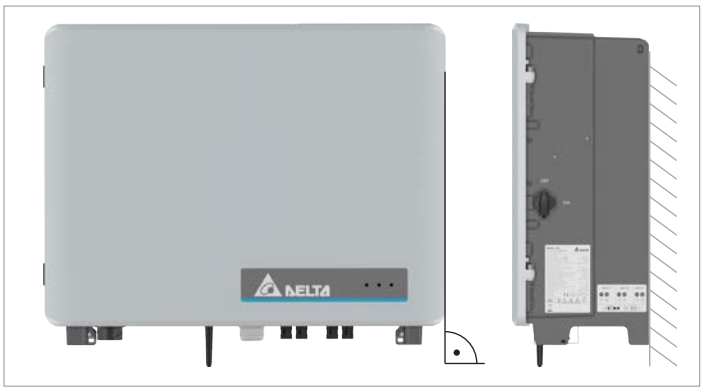


*Fig. 5.1: Installation position*

- ► Mount the inverter vertically.

### 5.1.4 Outdoor installations

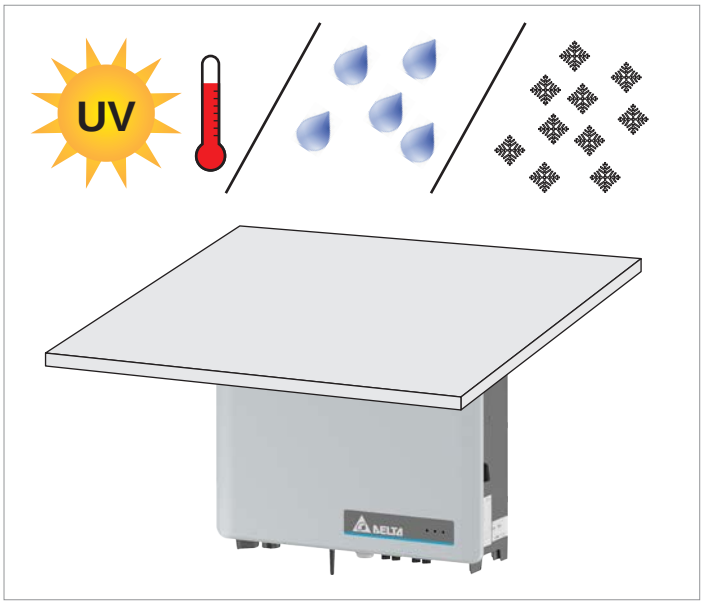



*Fig. 5.2: For outdoor installations, protect the inverter from direct sun, UV radiation, rain and snow*

The inverter has a protection degree of IP65 and can be installed indoors and outdoors. Despite this, the inverter should be protected by a roof against direct sun, UV radiation, 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.

### 5.1.5 Lifting and transporting the inverter

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

### 5.1.6 Installation clearances and air circulation

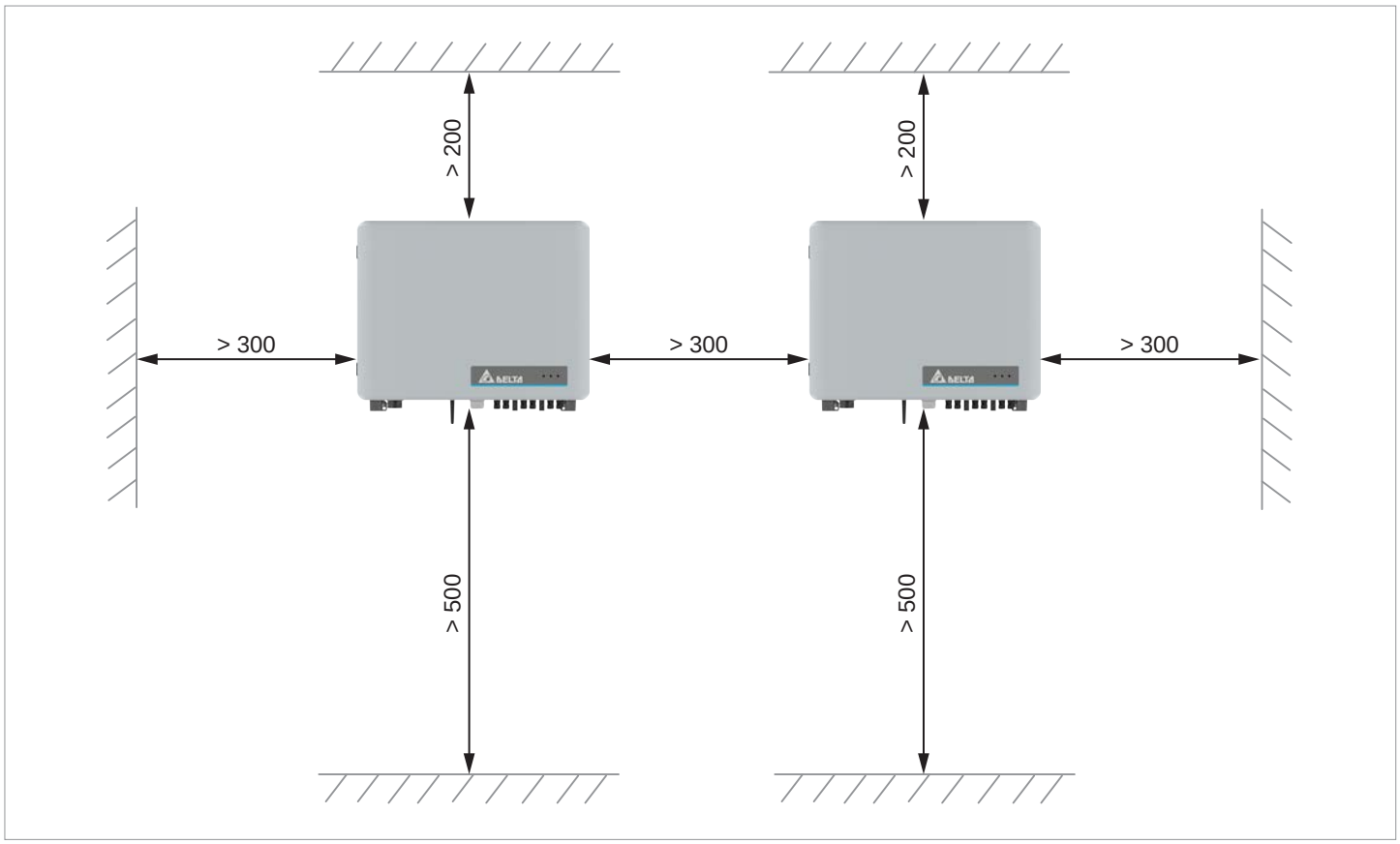



*Fig. 5.3: Mounting distances (in mm)*

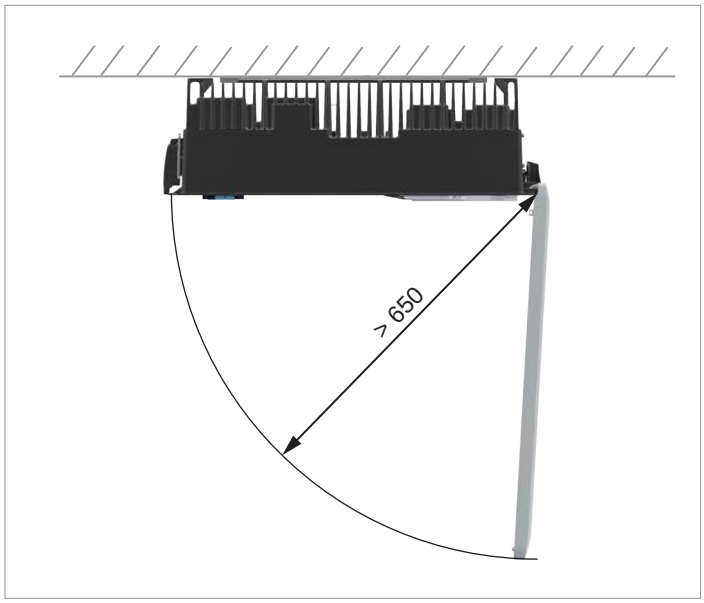



*Fig. 5.4: Mounting distances (in mm)*

- ► Ensure sufficient air circulation. There must not be heat buildup around the inverter.
- ► Observe *Operating temperature range without derating* the *Total operating temperature range* (see “16. Technical Data”, page 113).

  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.
- ► Position multiple inverters so that they do not heat each other up.
- ► Observe the minimum bend radius of the cables used (especially the AC cable)!
- ► Allow space to the front to open the door.
- ► In areas with many trees or fields, pollen and other parts of plants can clog the air inlets and air outlets, obstructing the air flow.

  If there is a loss of performance during operation, clogged air filters may be a cause (see chapter “11. Replacing or cleaning components, installing accessories”, page 83).

## 5.2 Characteristic curves

### 5.2.1 M15A characteristic curves

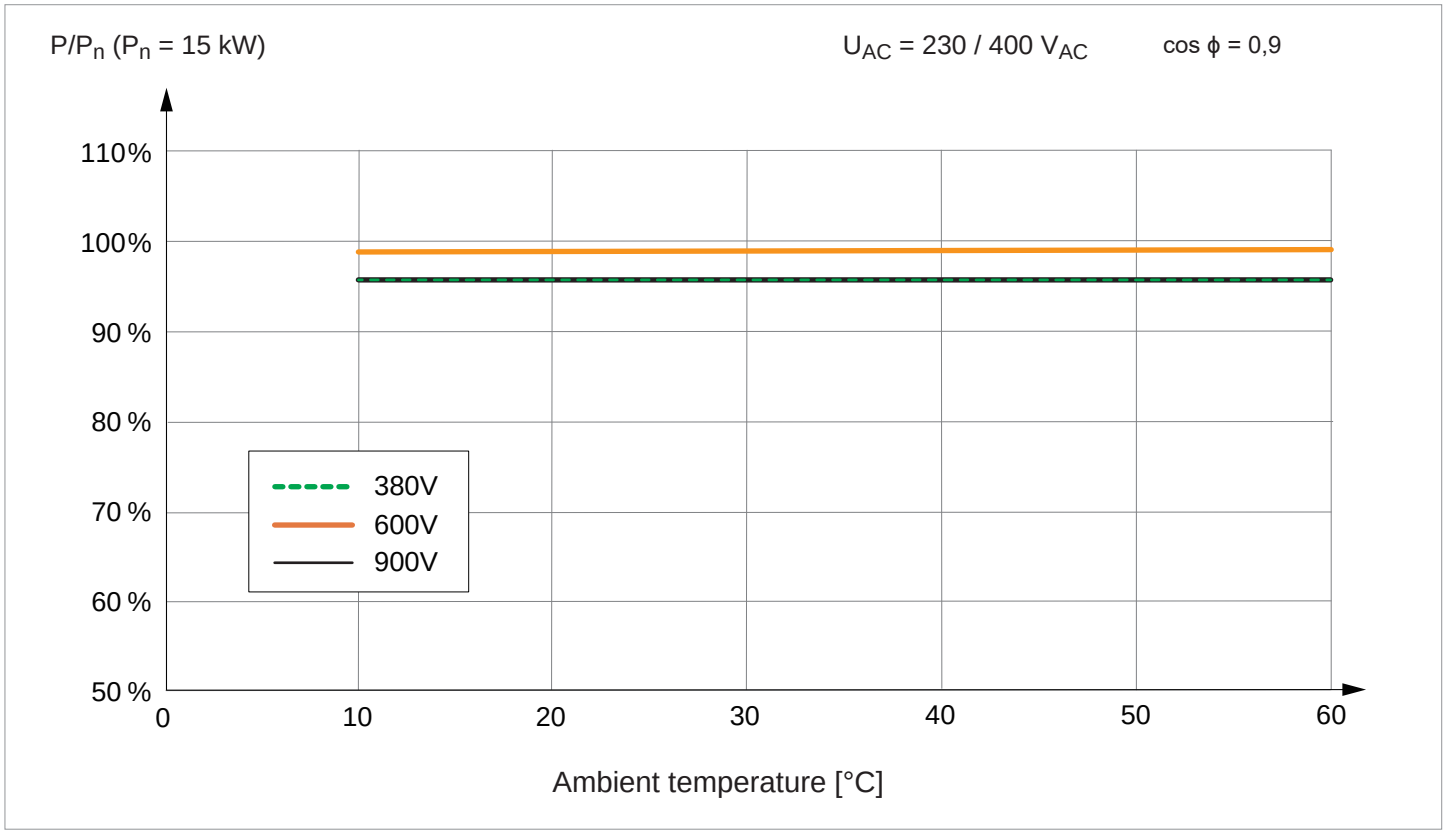



*Fig. 5.5: Characteristic curve “Active power control depending on the ambient temperature, cos φ = 0.90”*

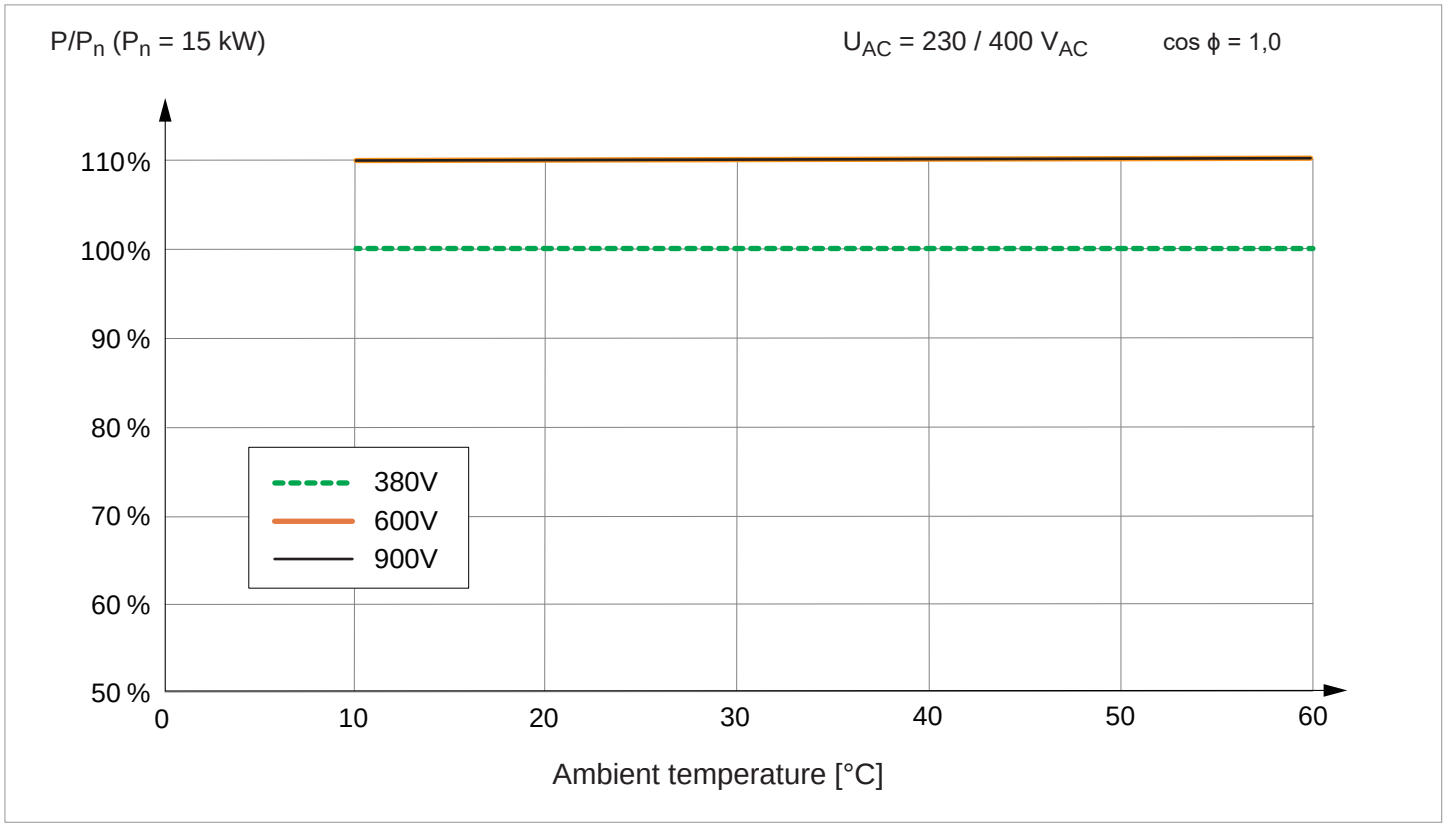



*Fig. 5.6: Characteristic curve “Active power control depending on the ambient temperature, cos φ = 1.0”*

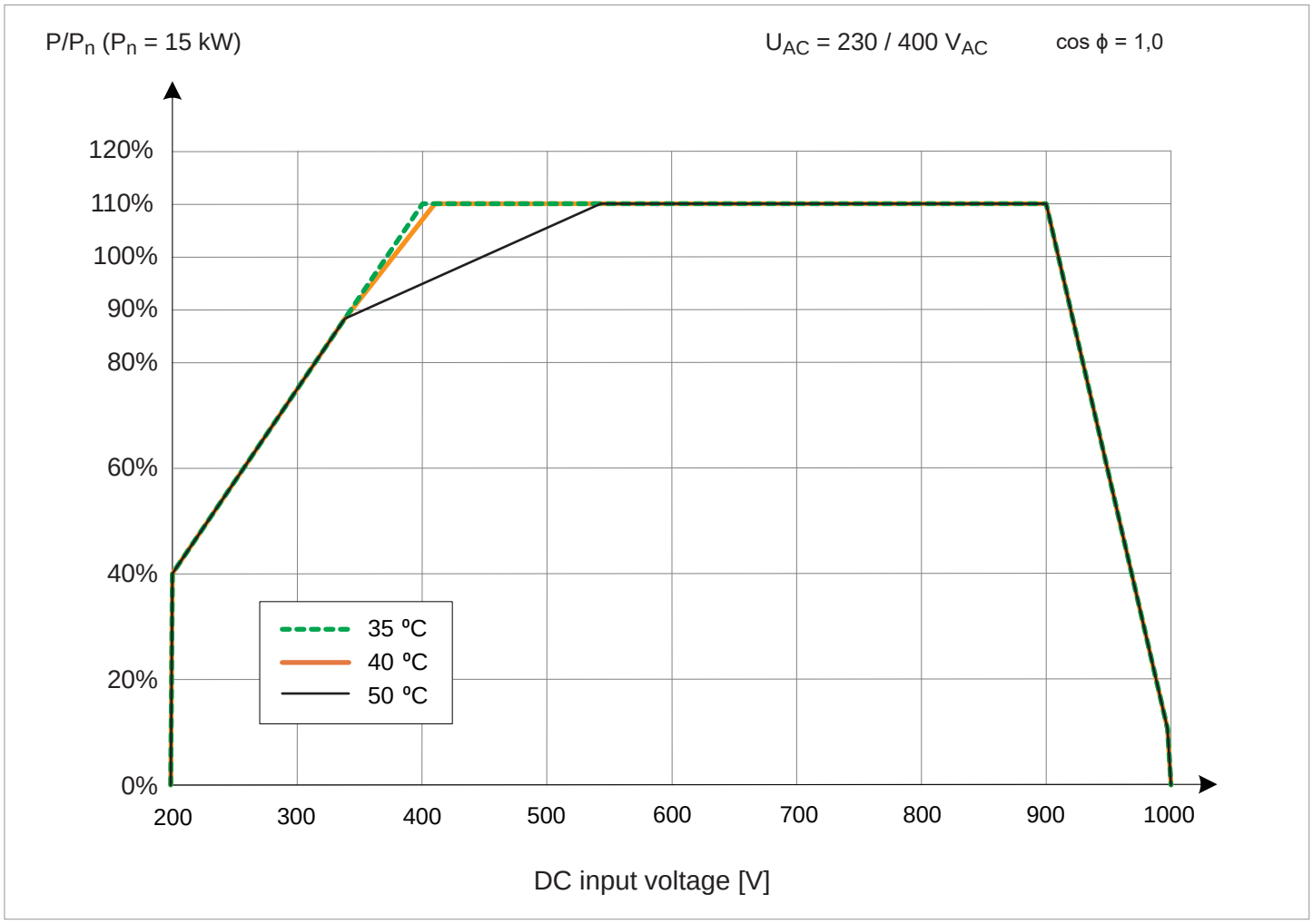



*Fig. 5.7: Characteristic curve “Active power control depending on the DC input voltage, cos φ = 1.0”*

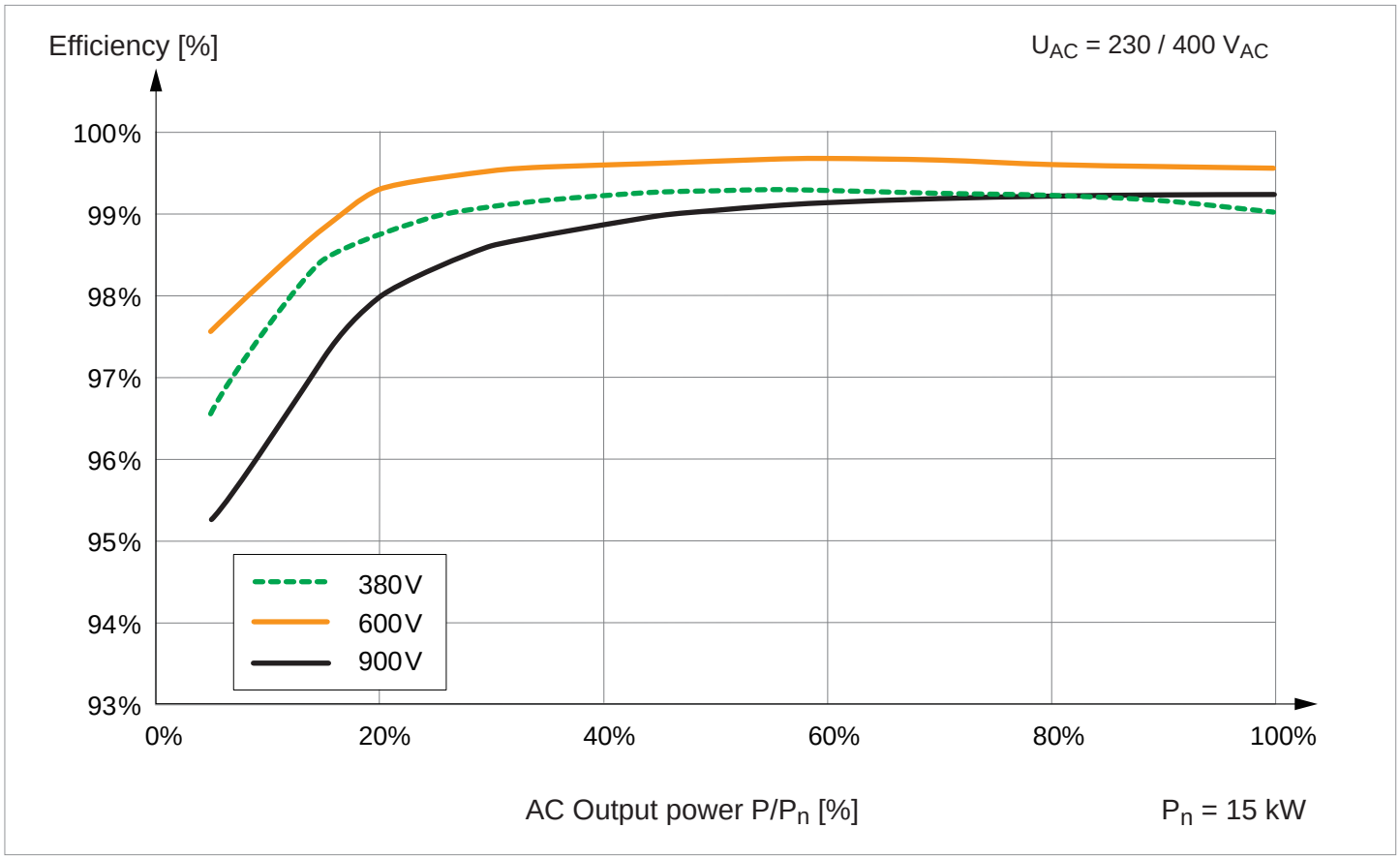



*Fig. 5.8: Efficiency characteristic curve*

## 5.2.2 M20A characteristic curves

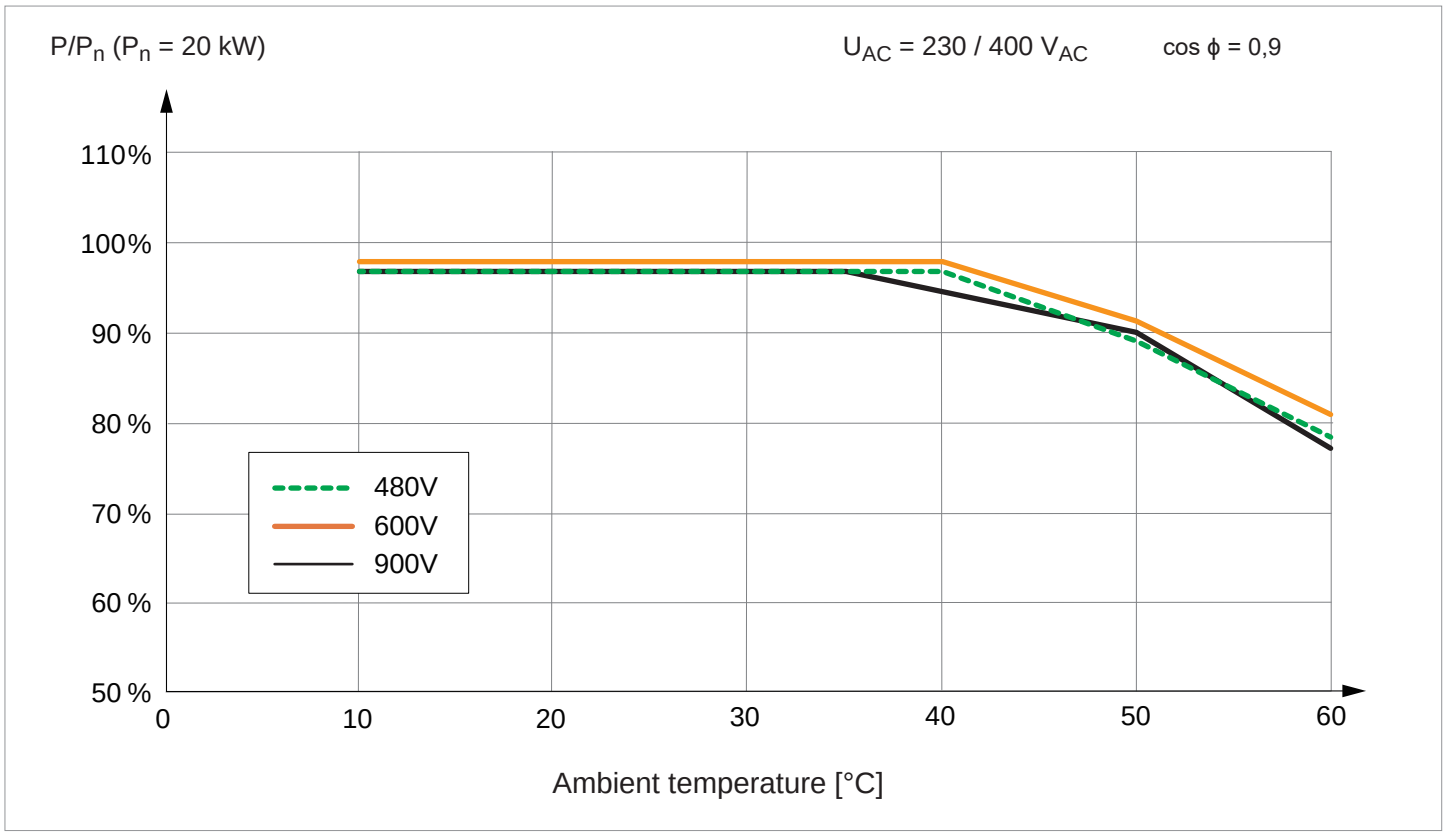



*Fig. 5.9: Characteristic curve “Active power control depending on the ambient temperature, cos φ = 0.90”*

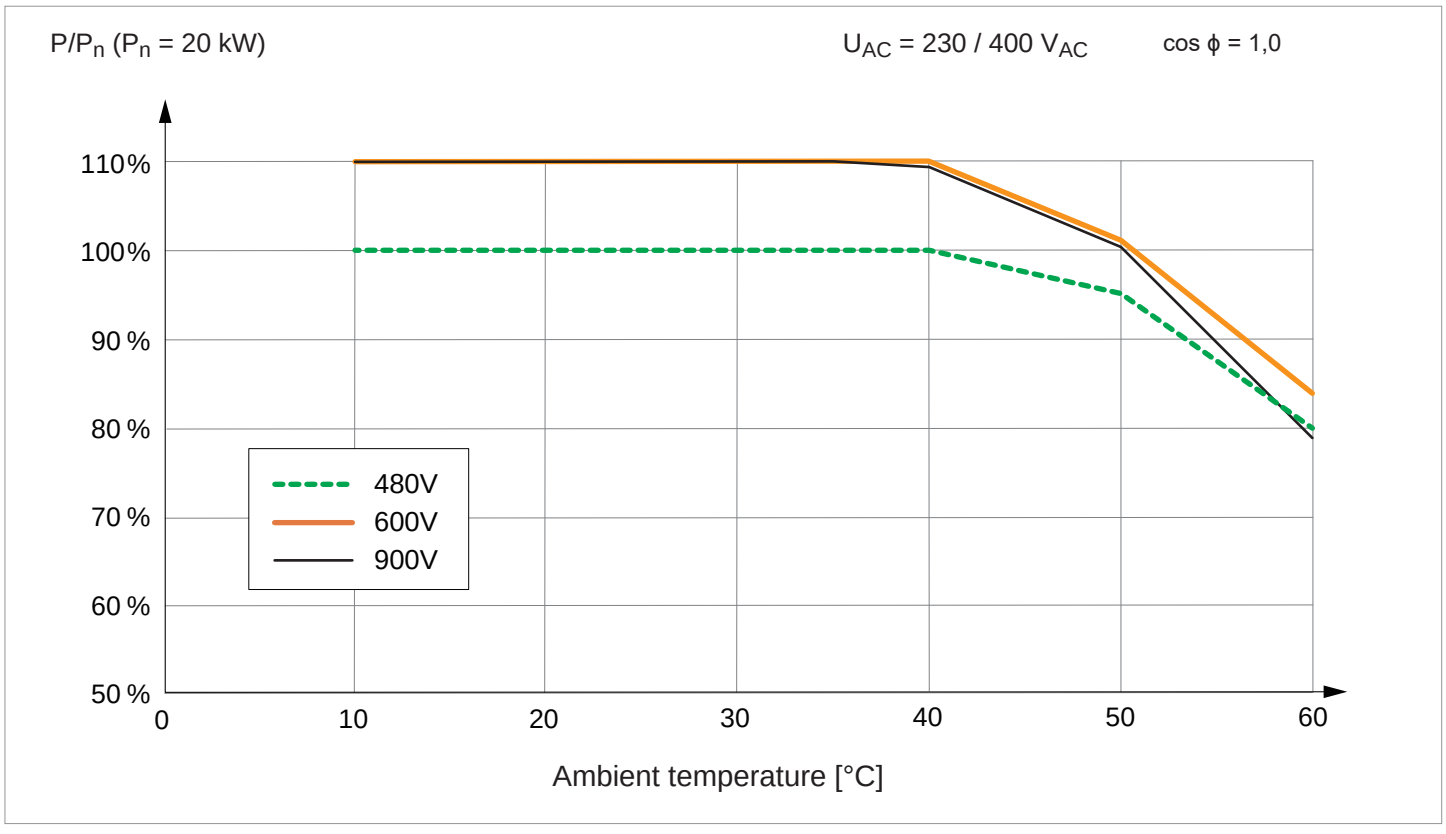



*Fig. 5.10: Characteristic curve “Active power control depending on the ambient temperature, cos φ = 1.0”*

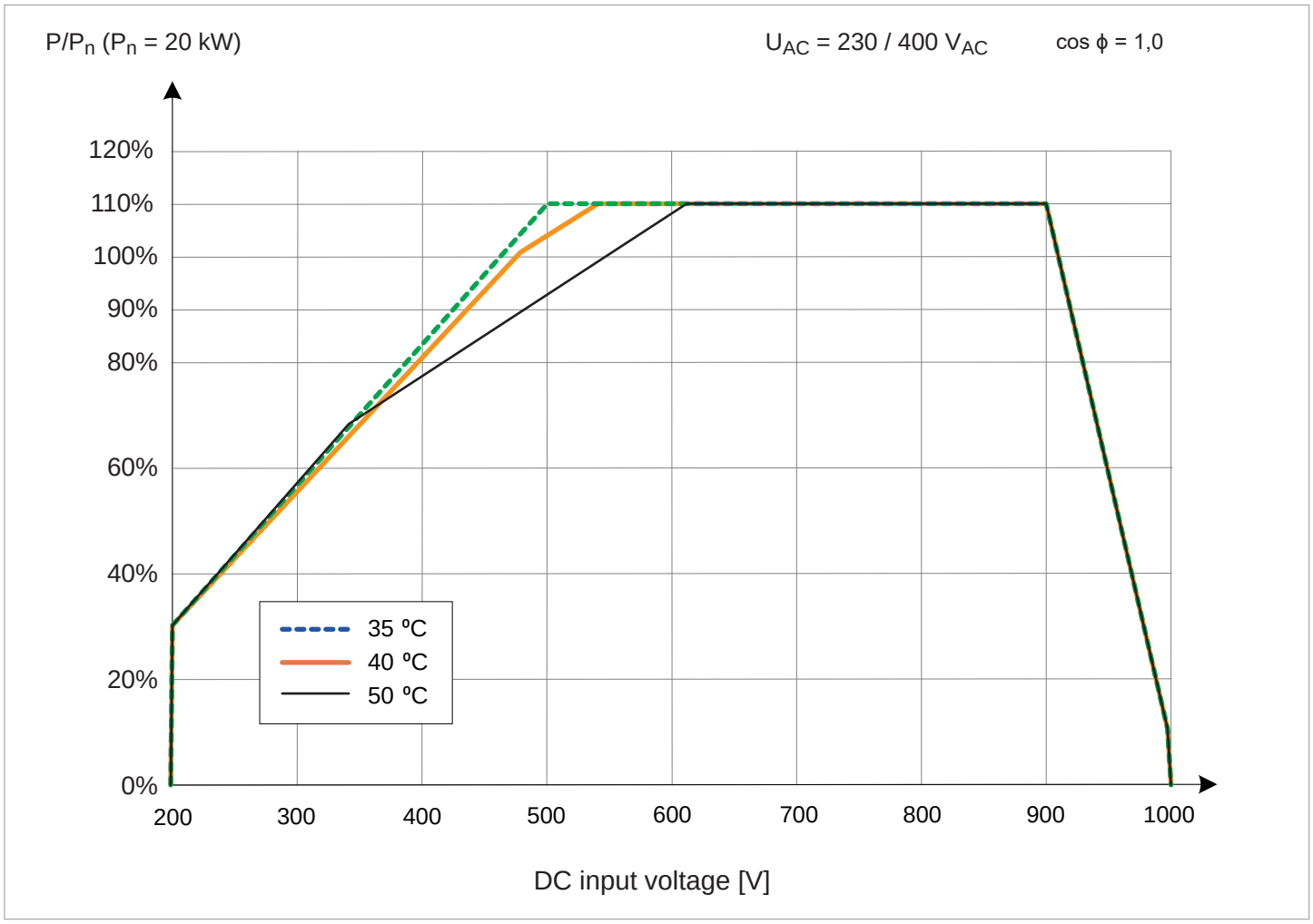



*Fig. 5.11: Characteristic curve “Active power control depending on the DC input voltage, cos φ = 1.0”*

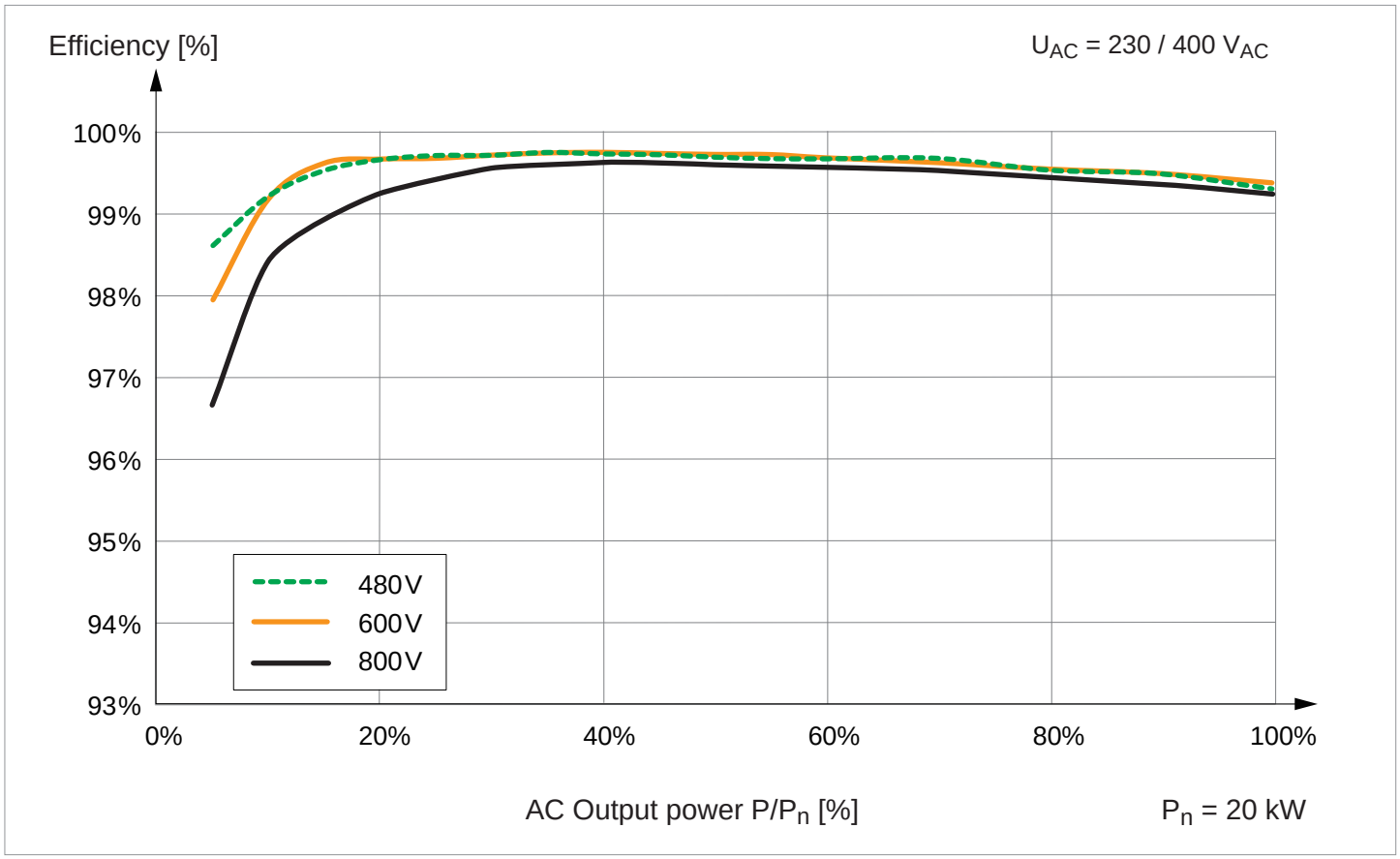



*Fig. 5.12: Efficiency characteristic curve*

## 5.3 Dimensions

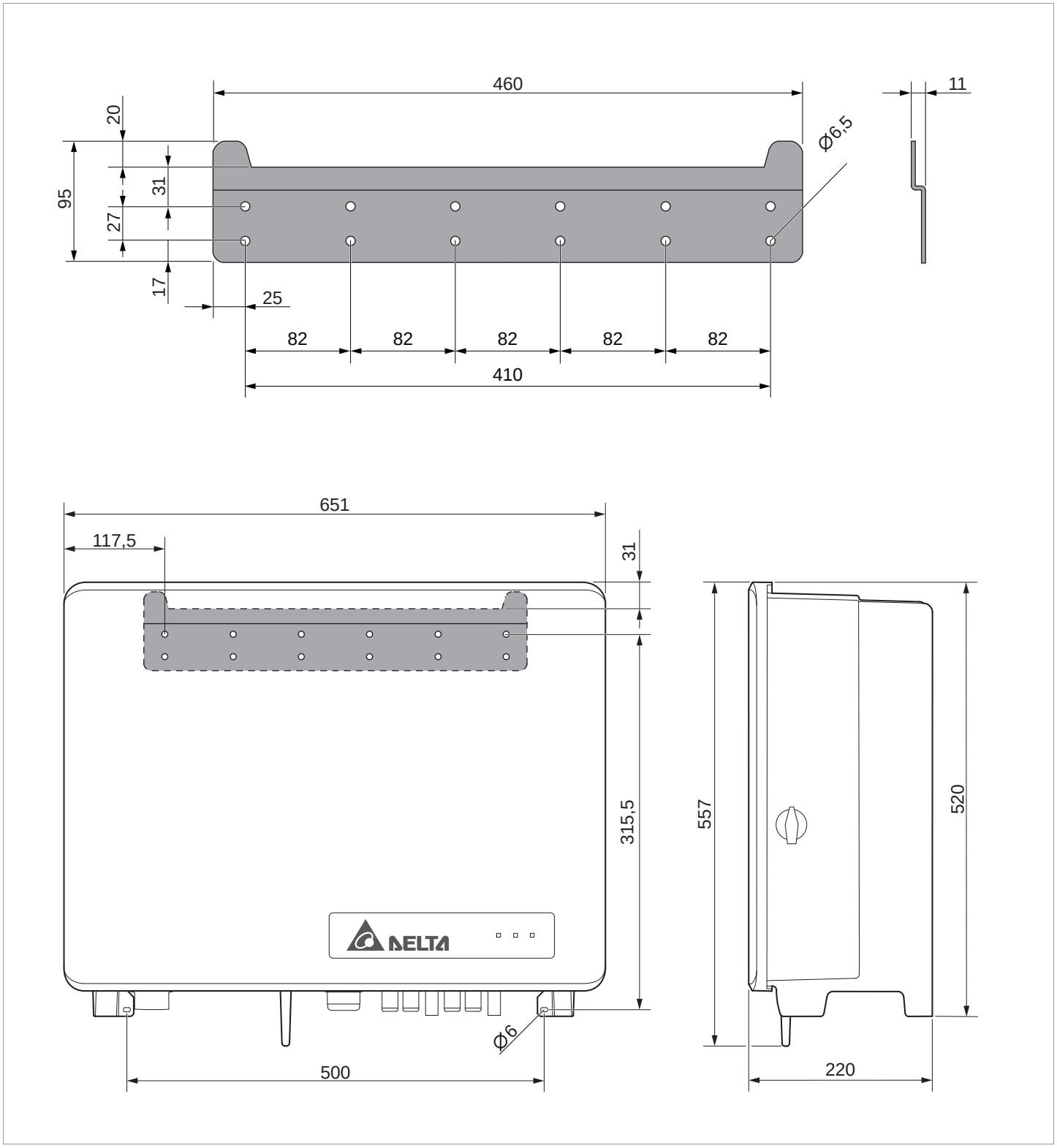



*Fig. 5.13: Inverter with mounting plate, dimensions without antennae (in mm)*

## 5.4 Planning the grid connection (AC)

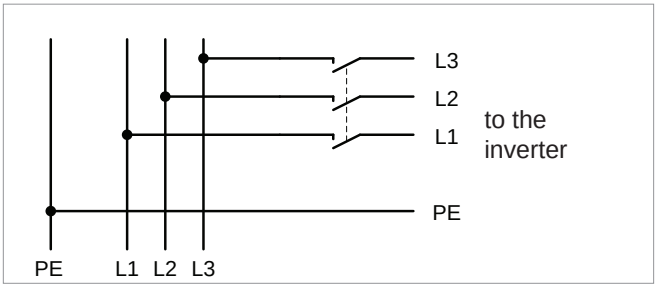
**Related topics**

“7.6 Connecting the grid (AC)”, page 66

### 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 | 63 A recommended |




- ► 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 (for example, 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 §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.

Alternatively, Delta Electronics can order combined type 1+2 AC surge protection devices.

### 5.4.5 Permissible grounding systems

**DANGER**

**Electric shock**

In IT grids, a twofold insulation fault can lead to high residual currents on the inverter housing.

- ► Ground the housing of the inverter via the grounding connection.
- ► Set up a permanent insulation monitoring system.
- ► The first time an insulation fault occurs, this insulation fault must be rectified **immediately**!

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

### 5.4.6 Planning grounding of the inverter

**WARNING**

**High current**

- ► Always observe the local regulations relating to grounding cable requirements.
- ► To increase the safety of the system, always use the grounding screw to 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.

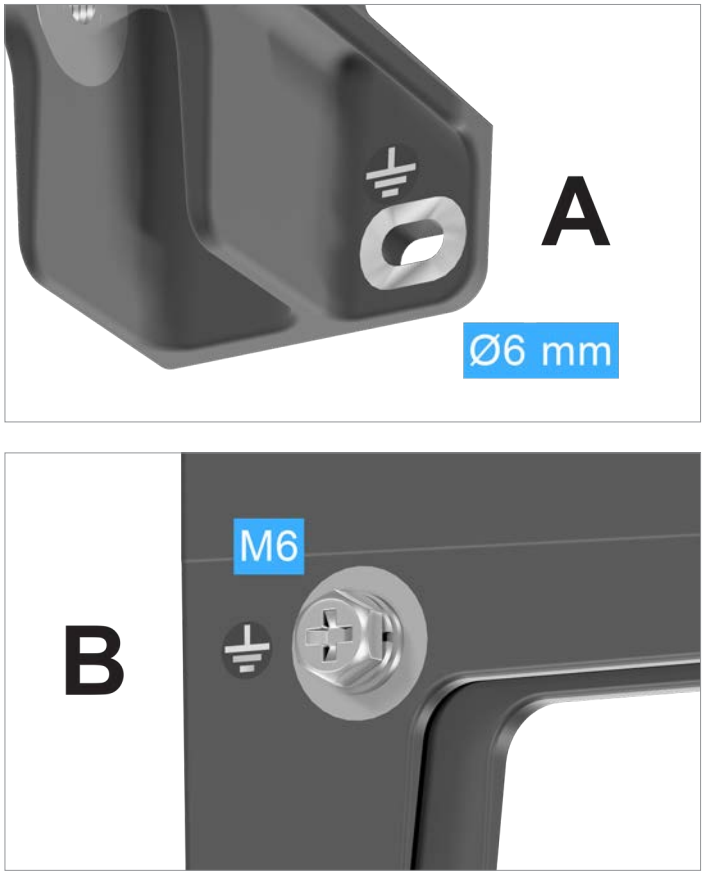



*Fig. 5.14: Grounding connections at the left foot of the inverter*

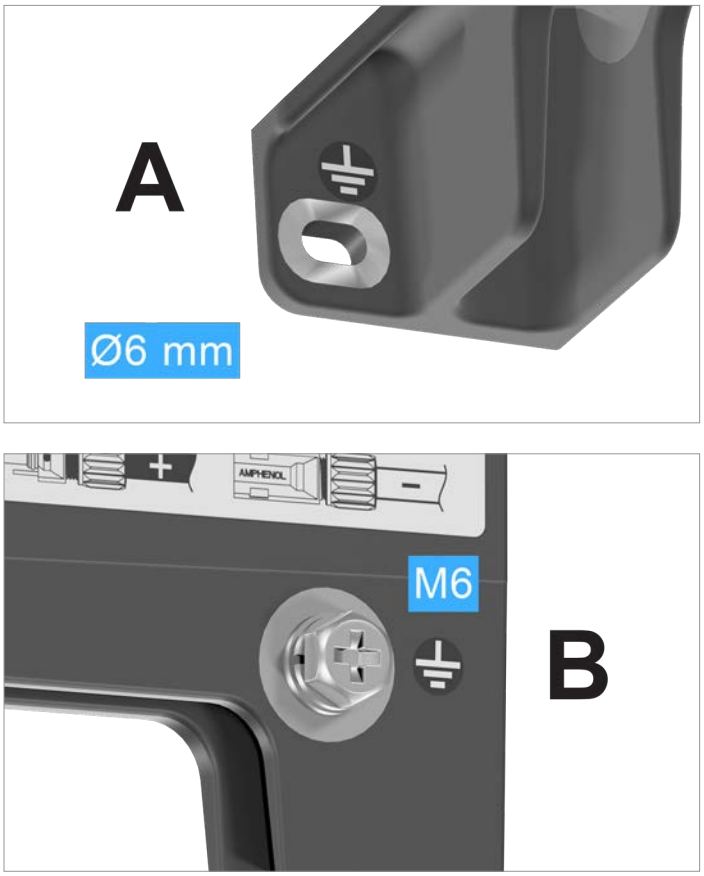



*Fig. 5.15: Grounding connections on the right foot of the inverter*

Variant B: The M6 screw, spring washer and washer are mounted on the inverter. A toothed washer is not required.

## 5.4.7 Permissible grid voltages

| 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 Selecting the AC cable

**NOTICE**



The AC plug is only approved for copper cables. Aluminum cables must not be used.

### 5.4.8.1 Technical properties of the AC connection

| | |
|---|---|
| Connection type | 5-pin plug |
| Rated voltage $U_N$ | 600 V |
| Operating temperature range | -40 to +85°C |

*Tab. 5.1.: Technical specification for the AC connection*

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

### 5.4.8.3 Specifications for copper AC cables

| | |
|---|---|
| Cable diameter | 20 to 26 mm |
| Min./max. Wire cross section | |
| Without wire end sleeve | |
| • Rigid cable | 2.5 to 16 $mm^2$ |
| • Multi-wire cable | 2.5 to 16 $mm^2$ |
| With wire end sleeve | |
| • Flexible cable | 2.5 to 16 $mm^2$ |

*Tab. 5.2.: Specifications for copper AC cables*

### 5.4.8.4 Stripping length

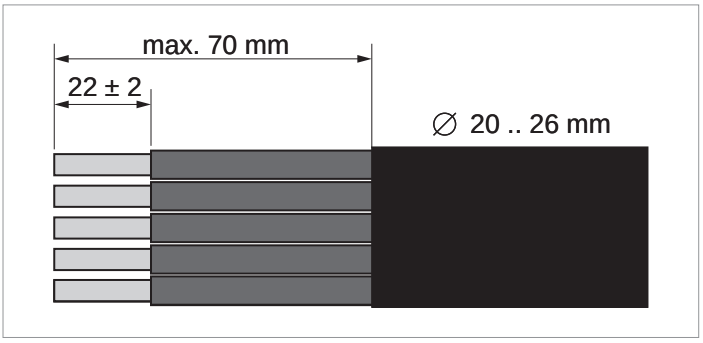
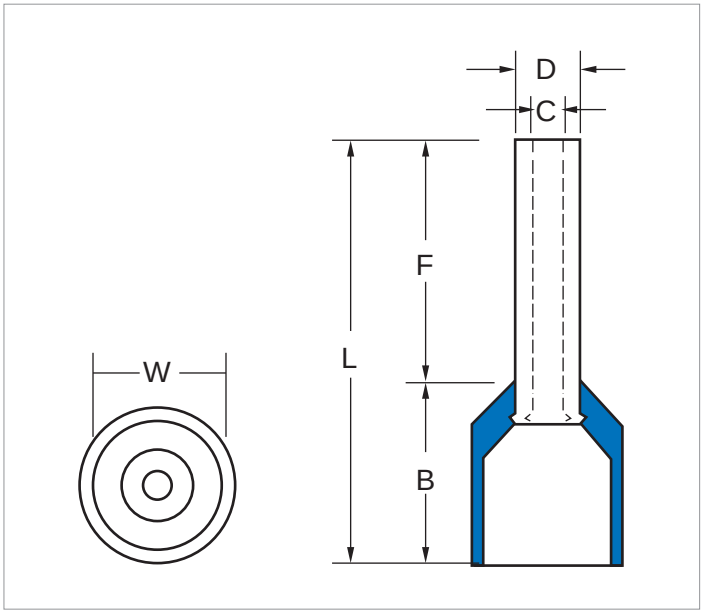



*Fig. 5.16: Stripping length for AC cables*

#### 5.4.8.5 Wire end-sleeves




| Wire cross section | 16 mm² |
|---|---|
| L | 28 mm |
| F | 18 mm |
| B | 10 mm |
| ØC | 5.8 mm |
| ØD | 6.2 mm |
| ØW | 8.7 mm |

## 5.5 Planning the connection of the solar modules (DC)

**Related topics**

“7.7 Connecting the solar modules (DC)”, page 69

### 5.5.1 Safety instructions

**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 the DC isolating switch 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.

**NOTICE**

**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 “16. Technical Data”, page 113).

**NOTICE**

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

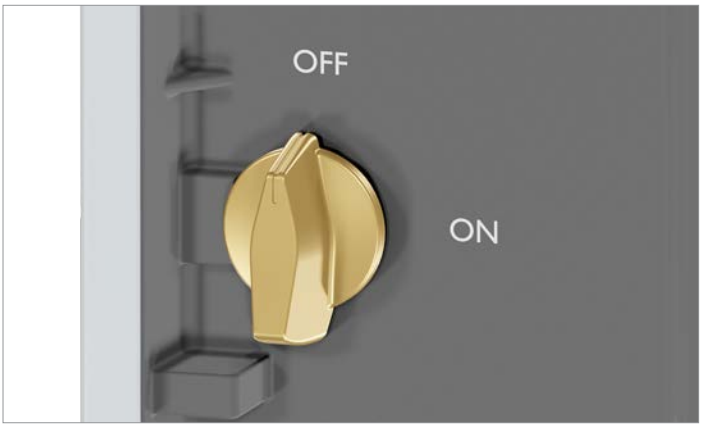
- ► When dimensioning the module strings, always take into account the *maximum input current* of the DC connections (see “16. Technical Data”, page 113).

**NOTICE**

**Ingress of moisture**
Moisture can enter via open DC connectors.

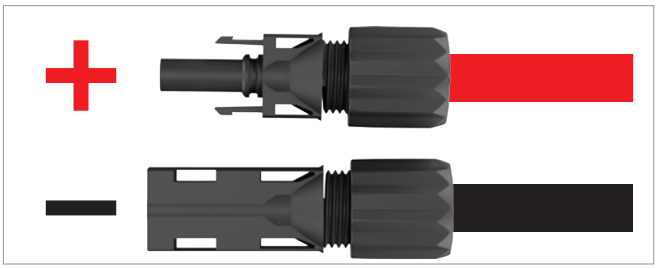
- ► To ensure protection degree IP65, close unused DC connectors with the rubber plugs that are attached to the DC connectors.

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




### 5.5.2 Polarity of the DC voltage

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



The inverter has an integrated function for detecting reverse polarity on the DC side. If such reverse polarity is detected, the inverter triggers an error message. This error message is indicated by the ***ALARM*** LED as soon as the inverter is switched on.

### 5.5.3 Arrangement of the DC inputs on the DC connection panel

The inverter has 3 MPP trackers (MPPT1 to MPPT3) with 2 DC connections each. Up to 6 module strings can be connected to the inverter.

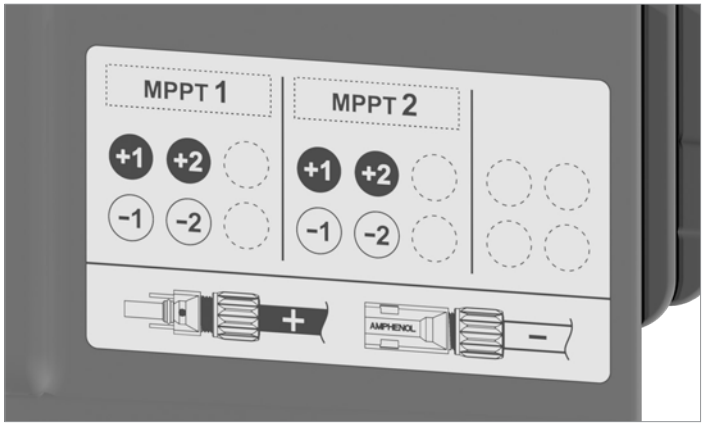



*Fig. 5.17: Assignment of the DC connectors to the MPP trackers*

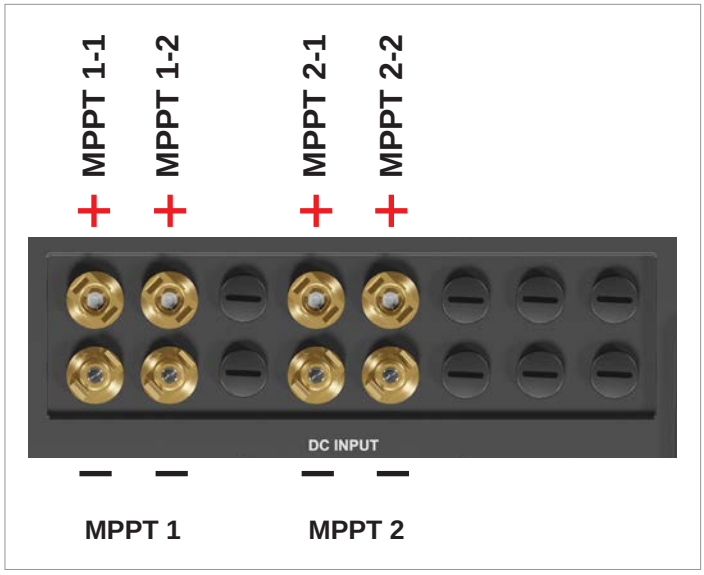



*Fig. 5.18: Arrangement of the DC inputs on the DC connection panel*

### 5.5.4 Functioning of integrated string monitoring

The string is monitored via current sensors. Fig. 5.19 shows the distribution of the current sensors to the module strings of a DC input.

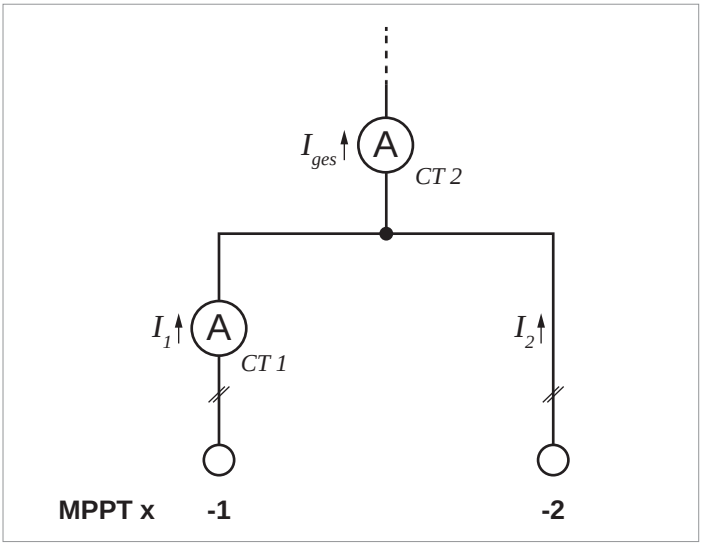



*Fig. 5.19: Arrangement of the current sensors of a DC input*

DC connections 1 and 3 each have a current sensor (*CT 1* and *CT 2*). Current sensor *CT 3* measures the total current of all three module strings. The current in module string 2 is calculated by the difference: $I_2 = I_{total} - (I_1 + I_3)$.

## 5.5.5 Use of string fuses

When connecting one or two module strings per DC input, no string fuses are required.

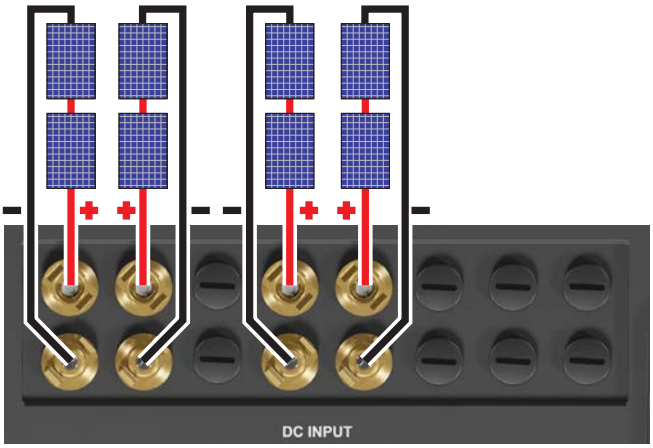



*Fig. 5.20: Connection of one or two module strings per DC input (= MPP tracker): no string fuses necessary*

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

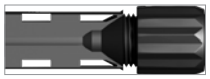
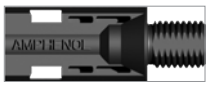
## 5.5.6 Specifications for the DC cables

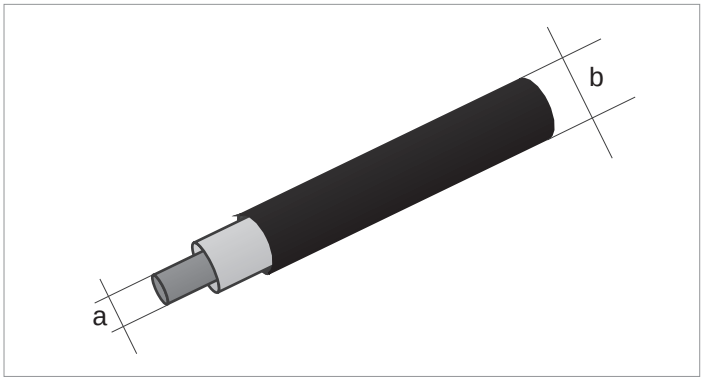
The DC plugs for all DC connectors are supplied with the inverter.

The DC plugs are only suitable for copper wire.

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

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

| | DC plugs for DC cables | DC connections on the inverter |
|---|---|---|
| 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

*Fig. 5.21: Specification for the DC cables*

## 5.6 Planning the device communication and plant monitoring

**Related topics**

"6. Planning the Commissioning", page 50
"7.5 Connecting the communication card", page 57

### 5.6.1 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)

### 5.6.2 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.

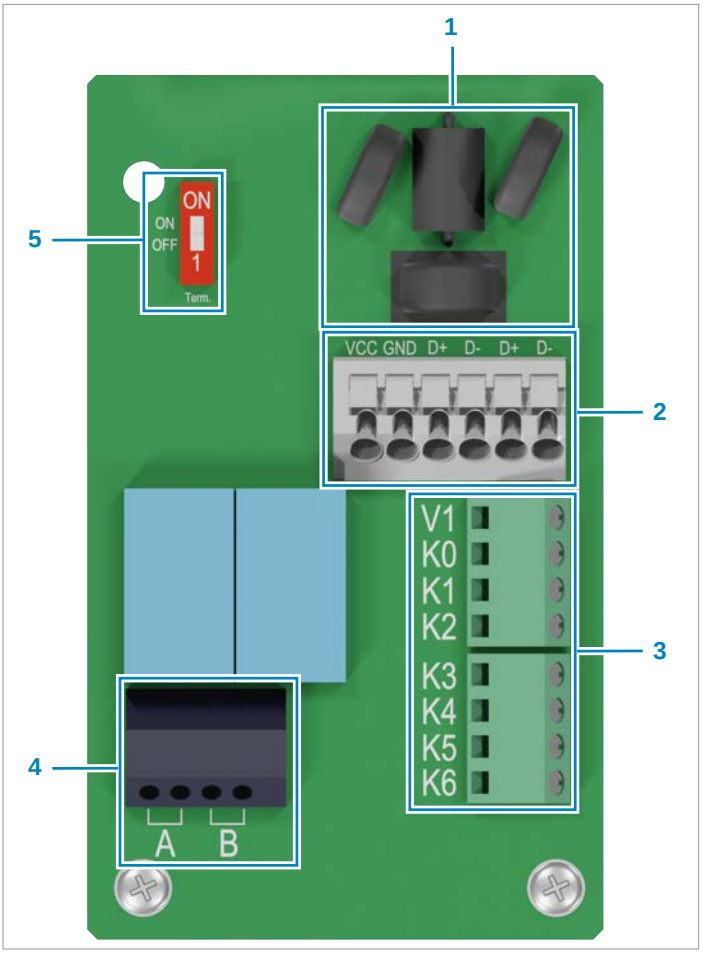



*Fig. 5.22: Components of the communication card*

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

| 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 |

*Tab. 5.3.: Connections on the communication card*

| | |
|---|---|
| Cable type | Shielded and twisted pair cable (CAT5 or CAT6) |
| Cable diameter | 7.2 to 10 mm |
| Wire cross section | 0.25 ... 1.5 $mm^2$ |

*Tab. 5.4.: Specification of the communication cable*

## 5.6.3 Cable gland for the communication connection



The inverter has one cable gland for up to four communication cables.

## 5.6.4 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.

Take into account the notes for ensuring 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

Consideration of the position of the data logger in the RS485 bus:

- ► The data logger is located at one of the two ends of the RS485 bus:
  - – Switch the RS485 termination resistor of the data logger *on*.
  - – Switch the RS485 termination resistor of the inverter at the other end of the RS485 bus *on*.
- ► The data logger is *not* at either end of the RS485 bus:
  - – Switch the RS485 termination resistor of the data logger *off*.
  - – Switch the RS485 termination resistor of the two inverters at the ends of the RS485 bus *on*.
- ► Switch the RS485 termination resistor on all other inverters *off* (default setting from the factory).

Further notes:

- ► Set a different inverter ID for each inverter. Otherwise the data logger cannot identify the individual inverters.
- ► Set the same RS485 baud rate at each inverter (factory setting: 19200).
- ► Lay the RS485 cable with a suitable clearance to the AC and DC cables to prevent interference in the data connection.

### 5.6.5 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 50 and “8. Commissioning”, page 71)
- Updating the firmware
- Connecting to the MyDeltaSolar Cloud or another monitoring system

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

#### Connection via RS485

Observe the general instructions in section “5.6.4 Connection of a data logger via RS485”, page 44.

The DC1 does not have an integrated RS485 termination resistor. For this reason, refer to the information in Fig. 5.23.

#### 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)

The MyDeltaSolar app is available for iOS and Android.

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

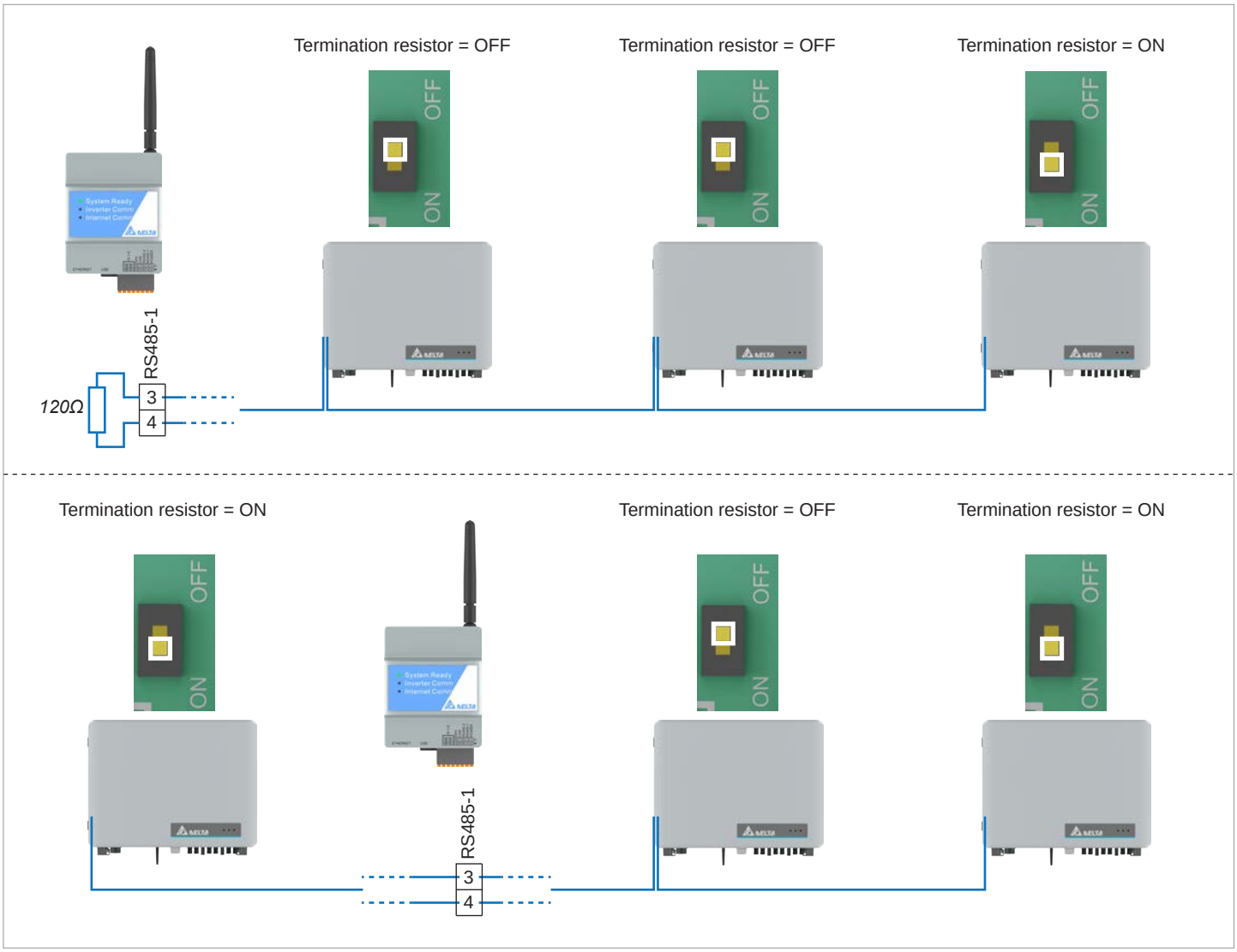



*Fig. 5.23: RS485 connection diagram for a DC1 data collector with multiple inverters*

## 5.6.6 Connecting an external alarm unit

The inverter has two relays for triggering external alarm devices. The communication card contains 2 pairs of dry contacts, each of which can be connected to an external acoustic or optical alarm device.

The communication card also has a 12 $V_{DC}$ power supply.

Both relays are designed as normally open contacts.

After commissioning, each relay can be assigned an event at which the relay switches. 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. |

*Tab. 5.5.: Events for which the relay can trigger*

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

## 5.6.7 Connecting a ripple control receiver

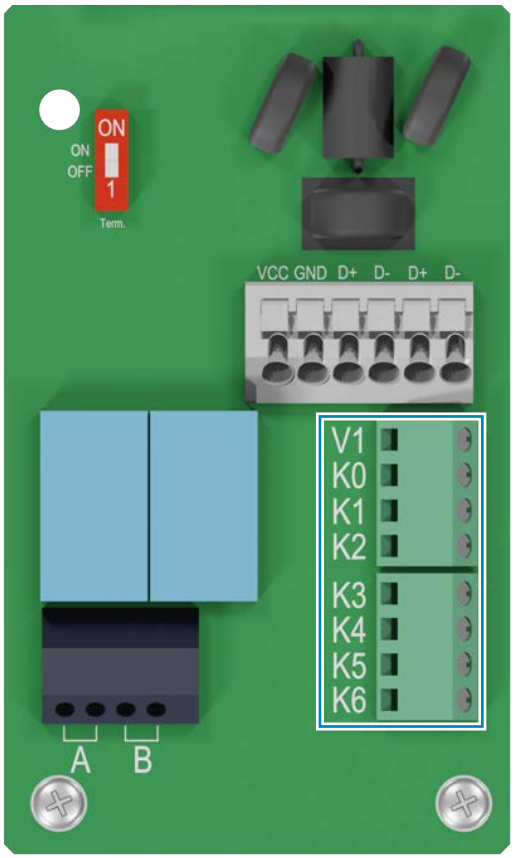



*Fig. 5.24: Terminal block with digital inputs*

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 |

*Tab. 5.6.: Pin assignment of the terminal block with digital inputs for connecting a ripple control receiver*

### 5.6.8 External power-off

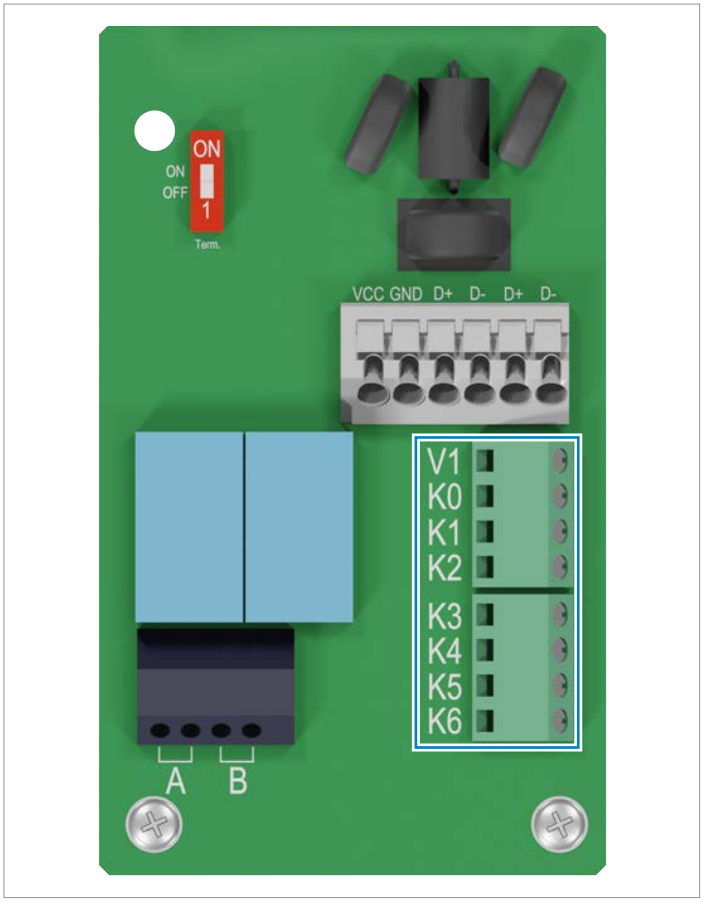



*Fig. 5.25: Terminal block with digital inputs*

To disconnect the inverter AC-side from the grid connection point, a switching signal can be sent via an external monitoring unit using the digital input K0.

The relay is designed at the factory as a normally open contact. The relay can also be set as an normally closed contact in the inverter settings.

The connection for external disconnection is located on the terminal block with the digital inputs of 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 |

*Tab. 5.7.: Pin assignment of the terminal block for the external power-off*

### 5.6.9 Connecting a PC

You can use the PC to commission the inverter and change all settings and parameters.

The Delta Service Software (DSS) is available for this purpose.

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

Options for connecting the PC to the inverter:

- Via the RS485 terminal block on the communication card of the inverter
- Via Wi-Fi

To connect the PC via RS485, you will need:

- A **USB/RS485-Adaptor**.
- **Bell wire**. Both ends open.

## 5.7 Grid 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.

# 6. Planning the Commissioning



Commissioning requires either a Windows PC with the Delta Service software or a smartphone with the DeltaSolar app.

## 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 Delta Service Software (DSS)

The Delta Service Software is available for Windows PCs.

Options for connecting a PC to the inverter:

- Via the RS485 terminal block on the communication card of the inverter
- Via Wi-Fi

You can set all inverters on the RS485 bus at the same time.

When using Wi-Fi, you will have to commission each inverter separately. Note the limited range and signal strength of the Wi-Fi signal.

The DSS enables you to:

- Commission the inverter
- Set all parameters.
- Update the firmware

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

### 6.2.2 DeltaSolar app with direct connection to the inverter via Wi-Fi

The DeltaSolar app is available for mobile devices (smartphone, tablet) with iOS or Android.

The mobile device is connected directly to the inverter via Wi-Fi (point-to-point connection).

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

Features of the app:

- Commission the inverter
- Set all parameters.
- Update the firmware

### 6.2.3 DeltaSolar app with DC1 data collector from Delta

The DC1 can connect to the solar system inverter via RS485, Wi-Fi or Sub-1G. These connection types can also be used in combination. For details, refer to the manual of the DC1, 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.

You can access the DC1 via the DeltaSolar app or DSS.

You can perform the following tasks on the 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 27 and this chapter in full before you start installation.

## 7.1 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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**

**Electric shock**
The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**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 door is properly sealed.
- ► The inverter does **not** need to be opened for standard installation.

**WARNING**

**Heavy weight**
The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

***NOTICE***

Water ingress.

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

***NOTICE***

**Working in freezing conditions**
In frosty conditions, the rubber seal of the front door can freeze to the enclosure, tear when opened and thus become leaky.

- ► Before opening the front door, defrost the rubber seal with some warm air.
- ► Open the front door slowly.

Use insulated tools.

## 7.2 Sequence of installation and commissioning steps

### 7.2.1 General information

Ideally, install optional internal accessories in a dry environment. If the inverter is installed outdoors, this is done on the



Install optional internal accessories such as type 1+2 AC and DC combined surge protection devices ideally before mounting the inverter.

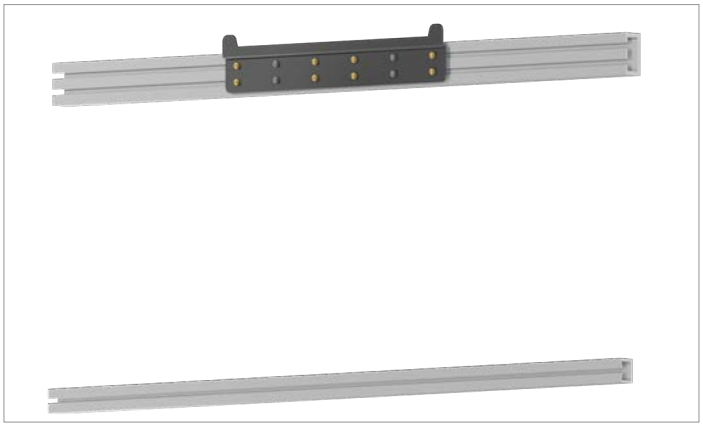
| Step | Notice | Description in chapter |
|---|---|---|
| Mounting the inverter | | “7.3 Mounting the inverter”, page 53 |
| Grounding the inverter housing | | “7.4 Grounding the inverter housing”, page 55 |
| Connecting the communication card | Optional | “7.5 Connecting the communication card”, page 57 |
| Connecting the PC to the inverter | This step is only necessary if commissioning is carried out via PC. | “7.5.8 Connecting a PC via RS485 (optional)”, page 64 |
| Connecting the grid (AC) | | “7.6 Connecting the grid (AC)”, page 66 |
| Connecting the solar modules (DC) | | “7.7 Connecting the solar modules (DC)”, page 69 |
| Commission the inverter | | “8. Commissioning”, page 71 |

## 7.3 Mounting the inverter

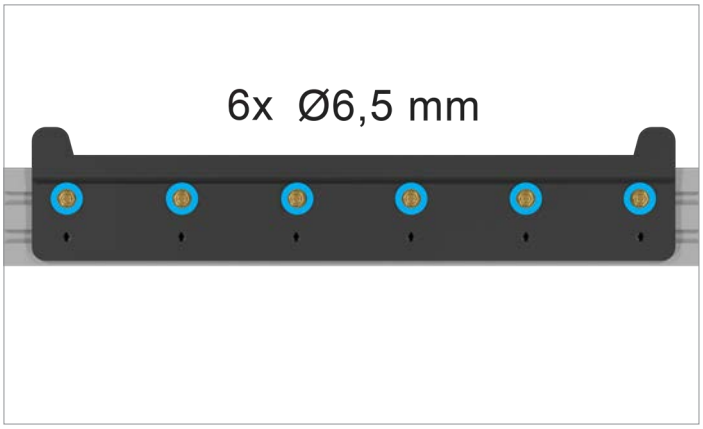
**WARNING**

**Heavy weight**
The inverter is heavy.
► Lift and carry the inverter with at least 2 people.

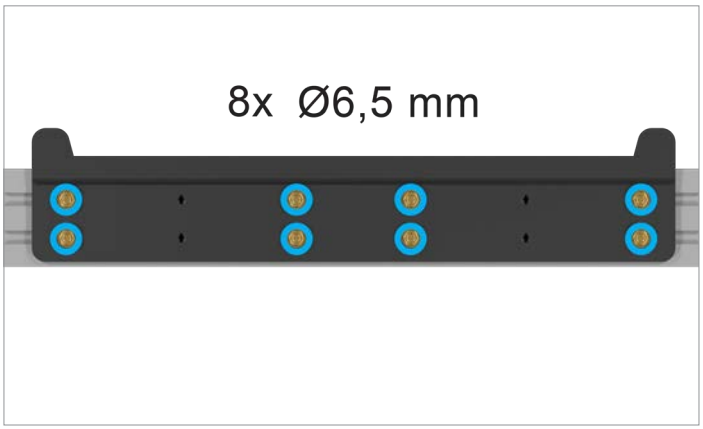
Always check with Delta Customer Service **first** if you want to deviate from the work instructions given in this section.



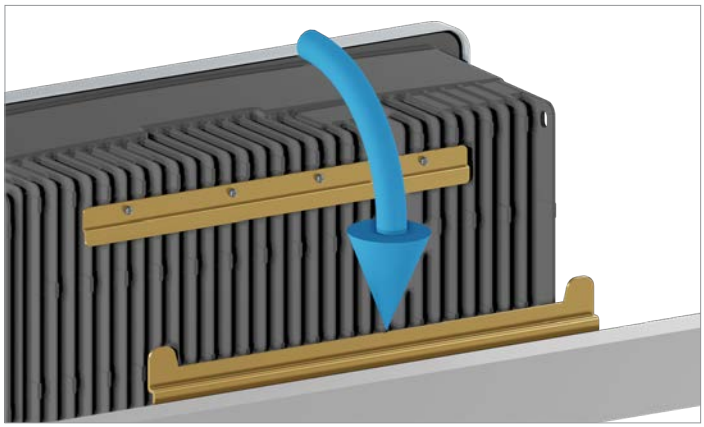
1. Attach the mounting plate to the wall/mounting system using one of the options shown below.



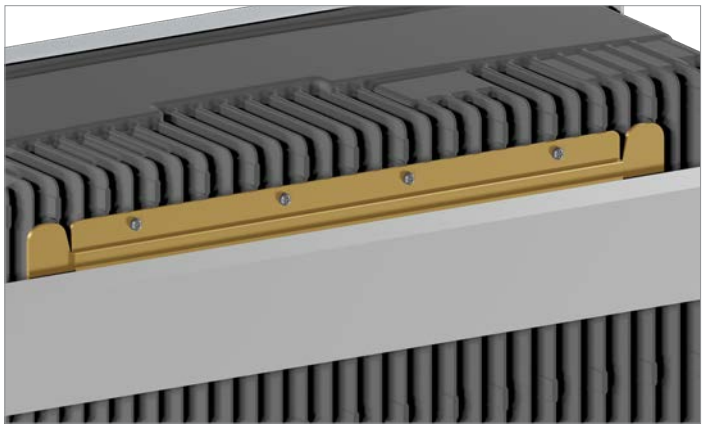

Option 1: Attach with at least **6** screws



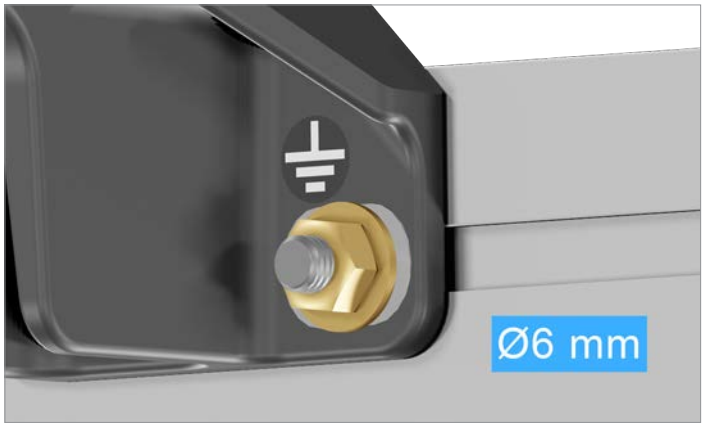

Option 2: Attach with at least **8** screws



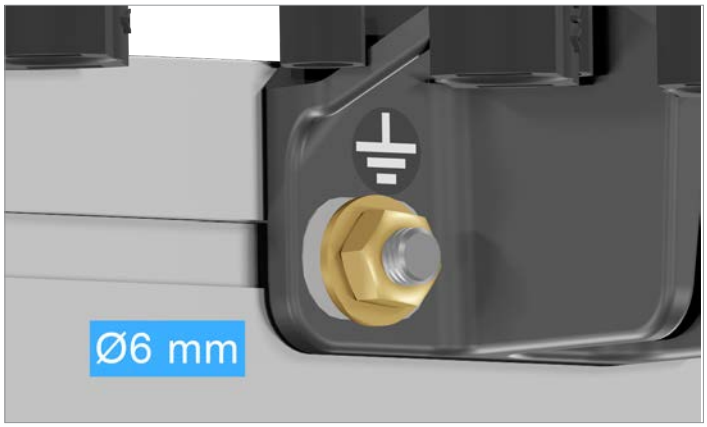
2. Mount the inverter on the mounting plate.



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




4. Screw the lower left and right sides of the inverter onto the wall or mounting system using one screw, spring washer and washer on each side.



## 7.4 Grounding the inverter housing

**WARNING**

**High current**

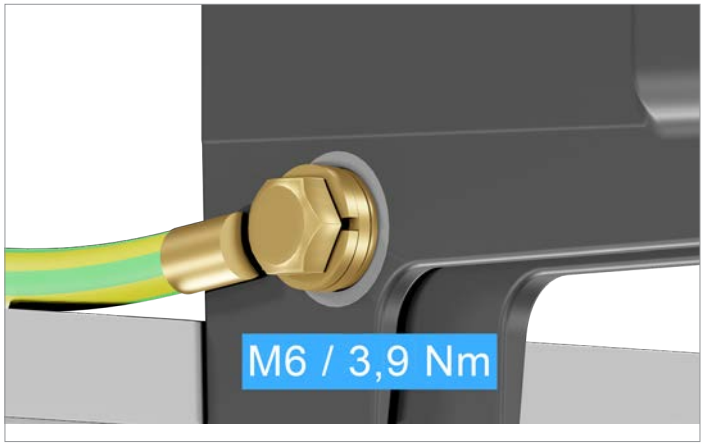
- ► Always observe the local regulations relating to grounding cable requirements.
- ► To increase the safety of the system, always ground the inverter housing even when this is not required by the local regulations.
- ► Always ground the inverter housing **before** connecting the inverter to the grid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

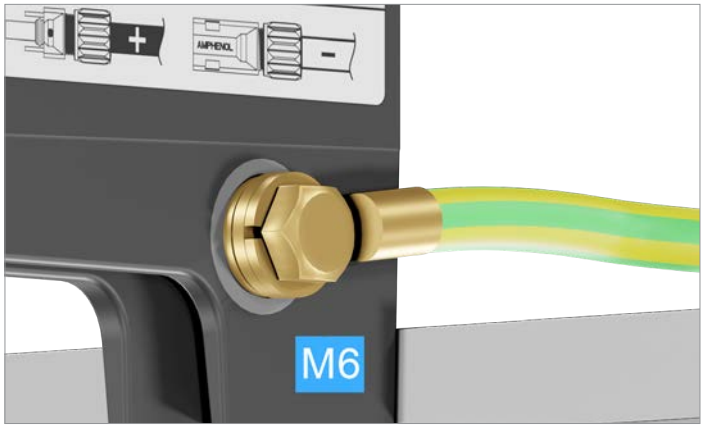
**DANGER**

**Electric shock**

In IT grids, a twofold insulation fault can lead to high residual currents on the inverter housing.

- ► Ground the housing of the inverter via the grounding connection.
- ► Set up a permanent insulation monitoring system.
- ► The first time an insulation fault occurs, this insulation fault must be rectified **immediately**!




1. Screw the ground cable to the lower left side or lower right side of the ground connection (torque: 3.9 Nm). The M6 screw, spring washer and washer are mounted on the inverter. A toothed washer is **not** required.

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

## 7.5 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 (for example, transportation or storage).

### 7.5.1 Connections on the communication card

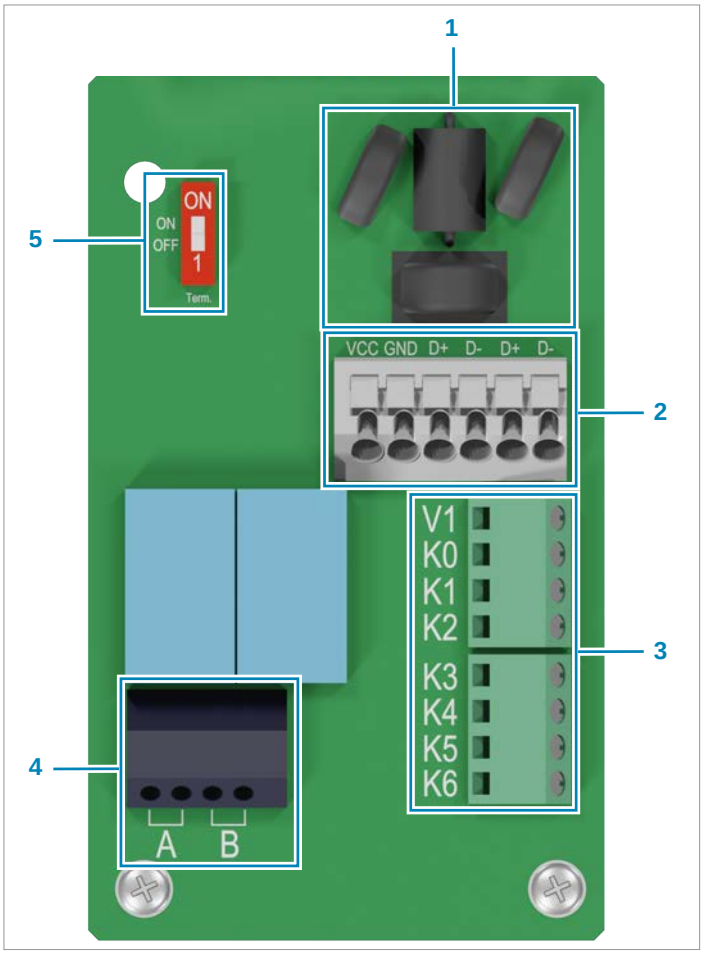



*Fig. 7.1: Components of the communication card*

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

| 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 7.1.: Connections on the communication card*

| | |
|---|---|
| Cable type | Shielded and twisted pair cable (CAT5 or CAT6) |
| Cable diameter | 7.2 to 10 mm |
| Wire cross section | 0.25 ... 1.5 mm² |

*Table 7.2.: Specification of the communication cable*

| | |
|---|---|
| Cable type | Shielded and twisted pair cable (CAT5 or CAT6) |
| Cable diameter | 2 x 7.2 / 8 / 10 mm |
| Wire cross section | 0.25 ... 1.5 mm² |

*Table 7.3.: 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.

## 7.5.2 Threading the communication cable




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

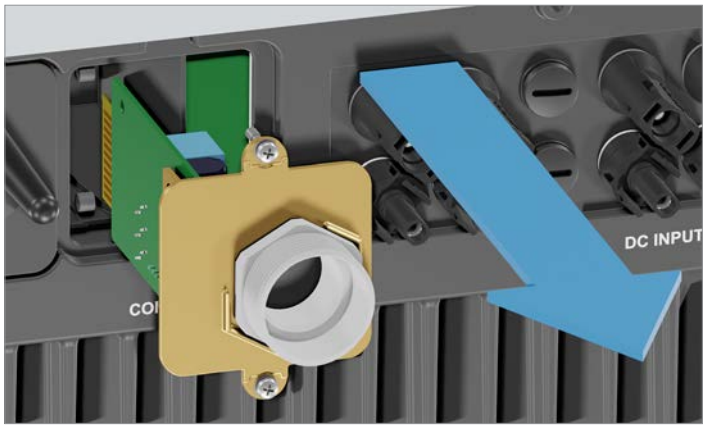






The communication card is screwed on to the cover!

2. Unscrew the communication card cover and carefully pull out the communication card.



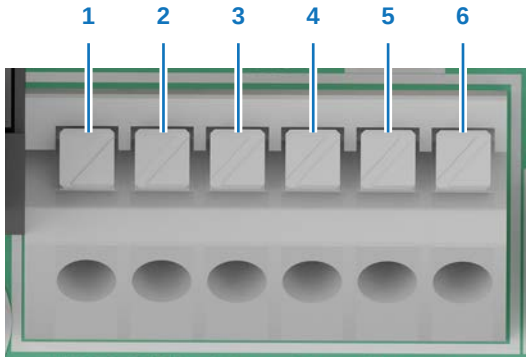
## 7.5.3 Connecting a data logger via RS485

### 7.5.3.1 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. 7.2: 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. 7.3: DIP switch for the RS485 termination resistor*

**RS485 connection diagram for a single inverter**

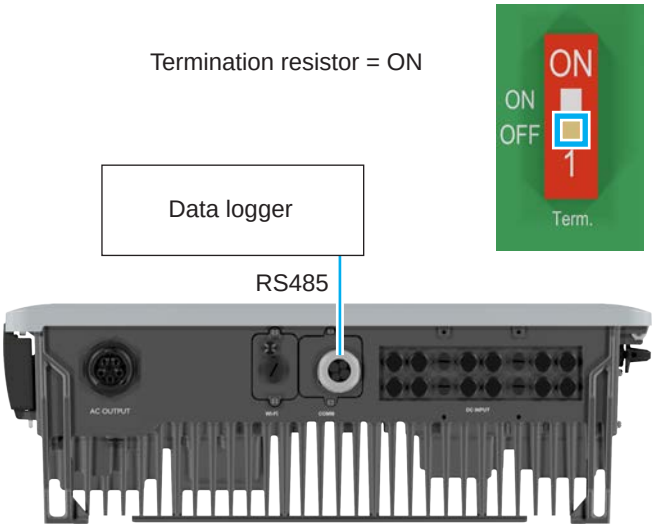



*Fig. 7.4: RS485 connection diagram for a single inverter*

### 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 bus, 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.

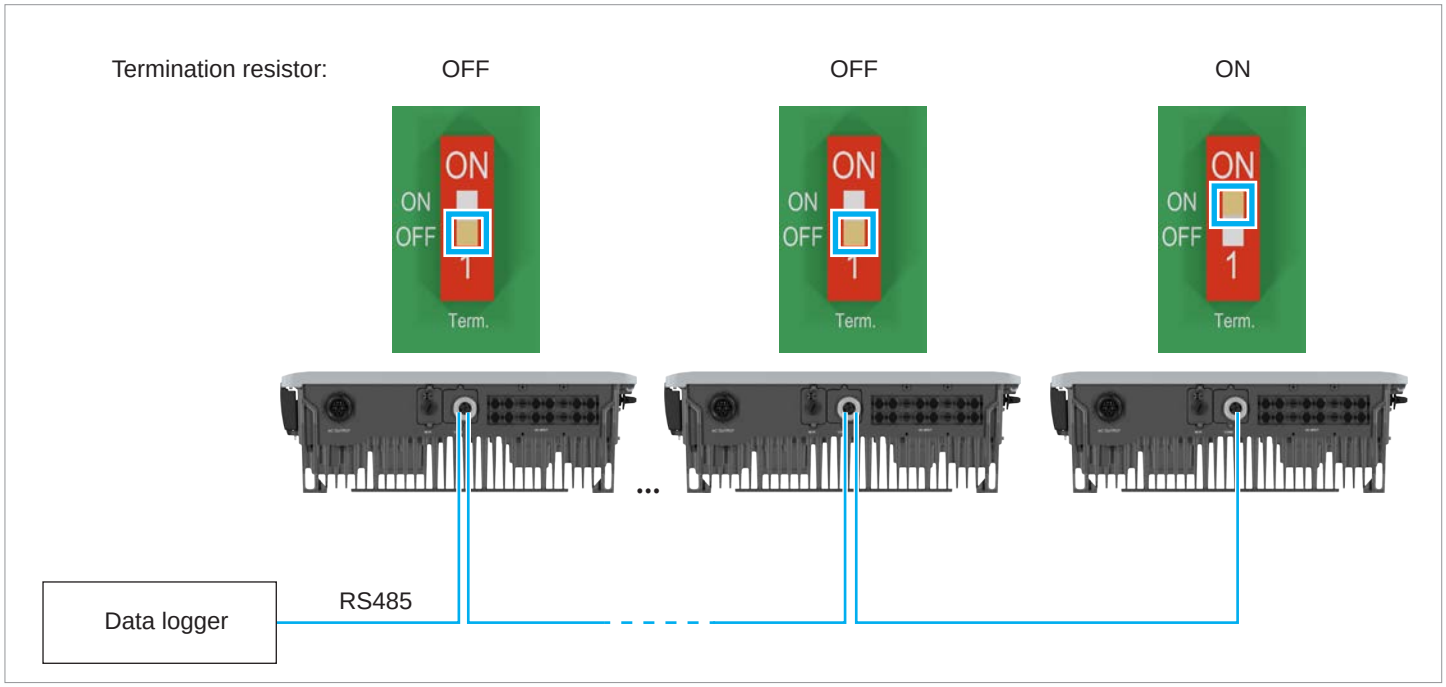



*Fig. 7.5: RS485 connection diagram for multiple inverters*

## 7.5.4 Connection of a DC1 data collector via RS485

### 7.5.4.1 Connecting 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 bus, an external RS485 termination resistor may need to be connected, see “Fig. 7.6”, page 61.

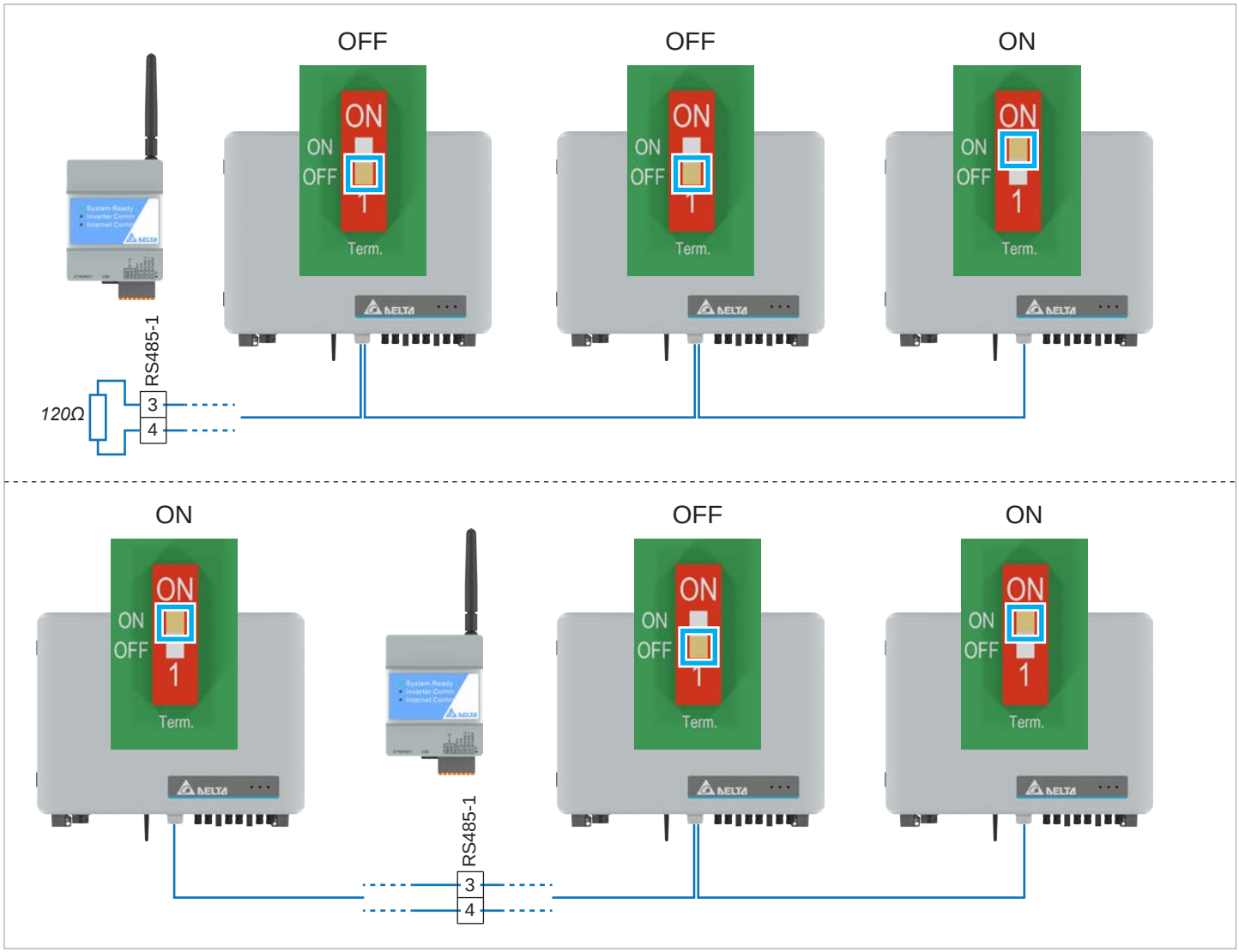
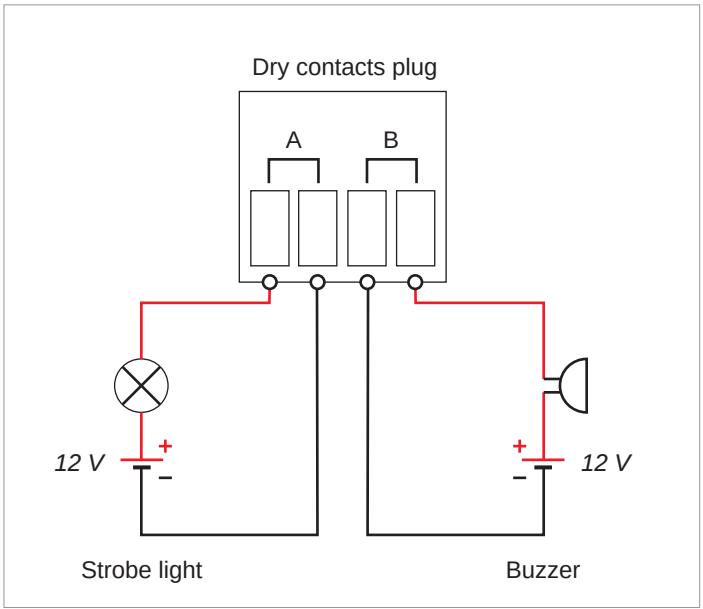



*Fig. 7.6: RS485 connection diagram for a DC1 data collector with multiple inverters*

## 7.5.5 Connecting an external alarm unit

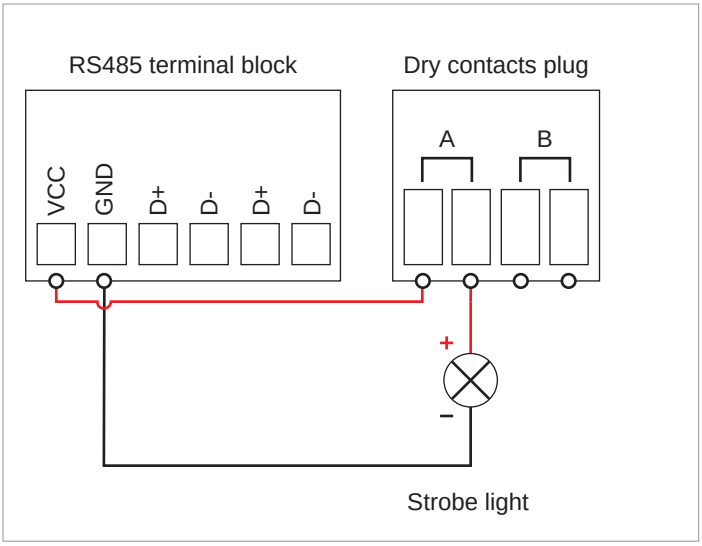
The external alarm unit is connected to the dry contacts.

### 7.5.5.1 Wiring for an external alarm unit with an external 12 $V_{DC}$ power supply




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

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




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

### 7.5.6 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 7.4.: Pin assignment of the terminal block with digital inputs for connecting a ripple control receiver*

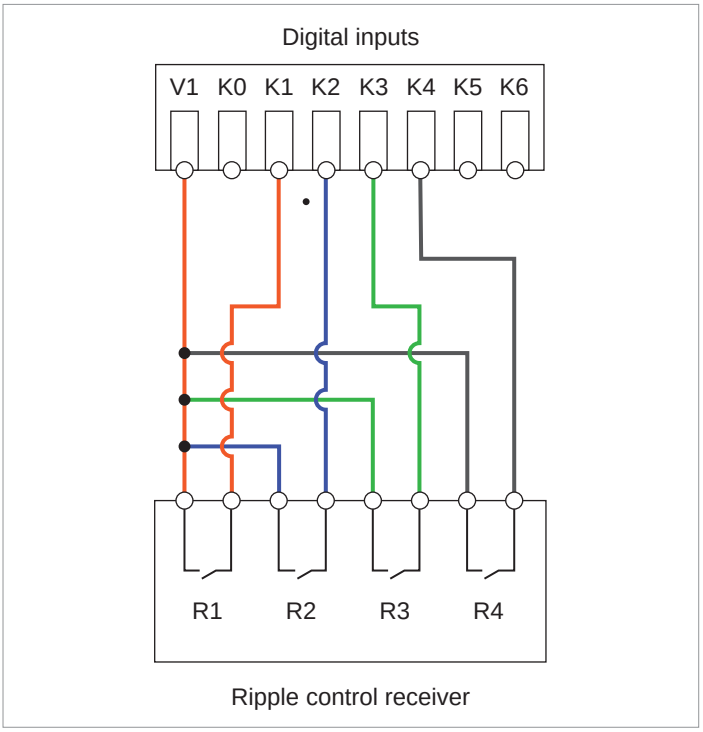



*Fig. 7.7: Connection diagram for a ripple control receiver*

**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 |

## 7.5.7 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 7.5.: 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.

## 7.5.8 Connecting a PC via RS485 (optional)

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

Alternatively, you can connect the PC to the inverter via Wi-Fi:

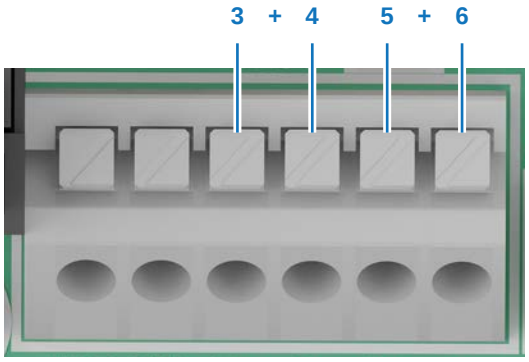

“6. Planning the Commissioning”, page 50

“8. Commissioning”, page 71


| Accessories | Description |
|---|---|
| Standard USB/RS485 adaptor | For connecting the PC to the inverter. |
| Delta Service Software (DSS) | For changing the inverter settings. |

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

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




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.

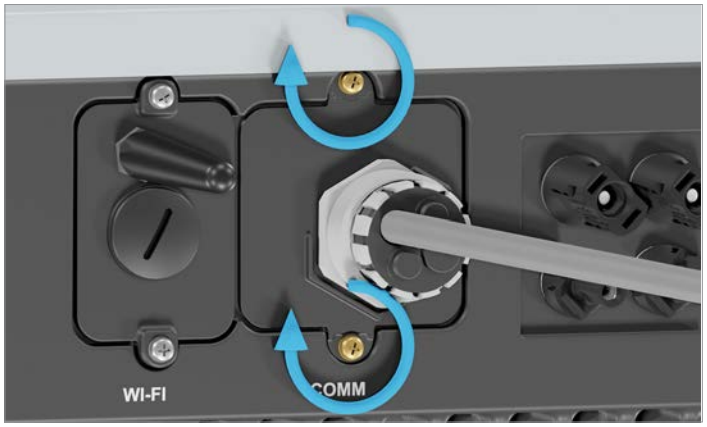
### 7.5.9 Reinstalling the communication card




1. Thread the communication cable through the cable gland and seal.




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




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




4. Tighten the cable gland.

## 7.6 Connecting the grid (AC)

► Always observe the information in section “5.4 Planning the grid connection (AC)”, page 36!




*Fig. 7.8: AC connection*

### 7.6.1 Handling aluminum conductors during installation work

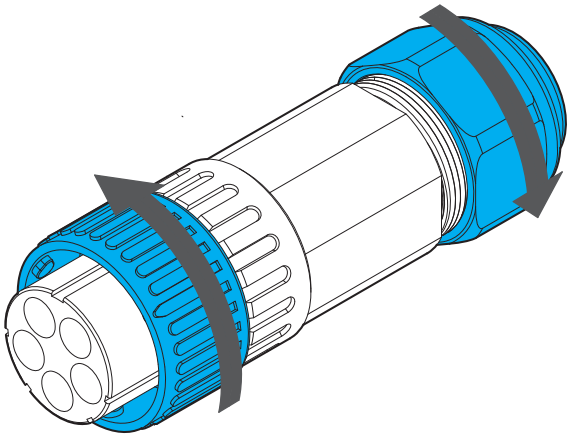
► The special properties of aluminum must be taken into consideration when using aluminum conductors:
  – Aluminum "flows," i.e. it gives way under pressure.
  – A thin non-conductive oxide layer forms within a few minutes on de-insulation, which increases the contact resistance between the conductor and clamping point.
  – The specific conductivity and hence the current carrying capacity is approximately one third less than that of copper.

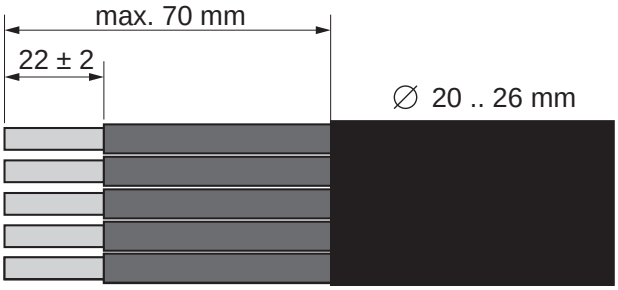
**NOTICE**

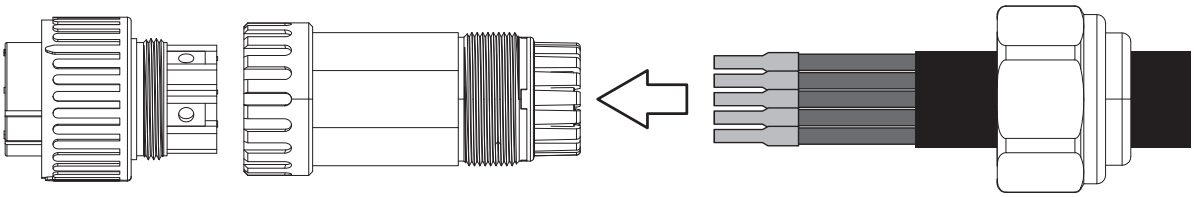
To ensure a safe and reliable contact with aluminum conductors, **always** perform the following work steps:

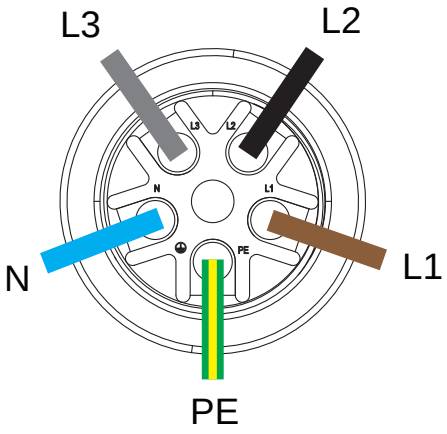
► Keep the installation location as free as possible from moisture or corrosive atmospheres.
► Connect the aluminum cables quickly.
► Clean the stripped end of the aluminum conductor mechanically (for example, using a knife blade to scrape off the oxide layer), then immediately dip the aluminum conductor into acid-fee and alkaline-free (= neutral) Vaseline and straight away insert it into the Al-Cu compression joint.

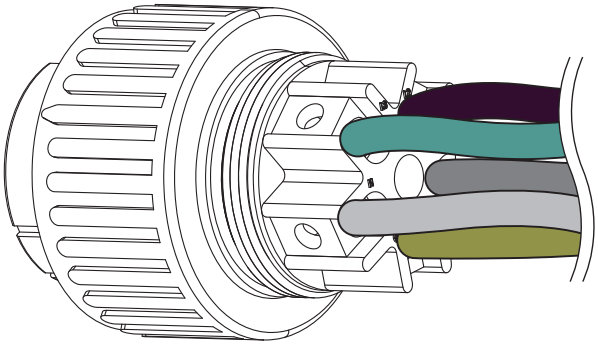
### 7.6.2 Wire the AC plug

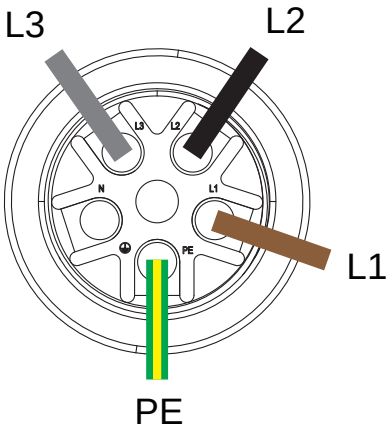


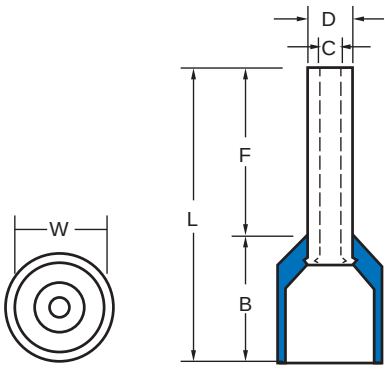






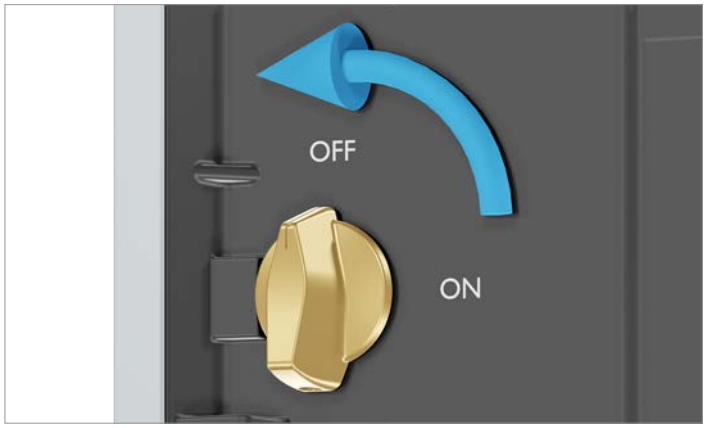

| | |
|---|---|
| Cu 16 mm² | |
| L | 28 mm |
| F | 18 mm |
| B | 10 mm |
| ØC | 5,8 mm |
| ØD | 6,2 mm |
| ØW | 8,7 mm |

## 7.6.3 Connecting the AC cables

There is normally an isolating switch (for example in an equipment wiring box) between the inverter and the grid connection box 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 the DC isolating switch to the ***OFF*** position.




3. Screw on the AC plug.

## 7.7 Connecting the solar modules (DC)

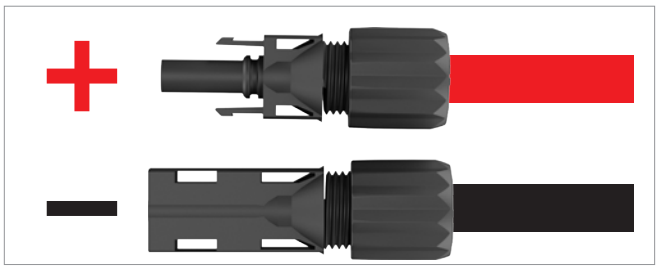
Always use the supplied mounting tools to open the DC connectors.

When disconnecting the DC cables, take care not to damage the connectors.

Do not use force.

Pull out at the DC connector, **not** at the DC cable.

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



The inverter has an integrated function for detecting reverse polarity on the DC side. If such reverse polarity is detected, the inverter triggers an error message. This error message is indicated by the ***ALARM*** LED as soon as the inverter is switched on.

### Special tools required

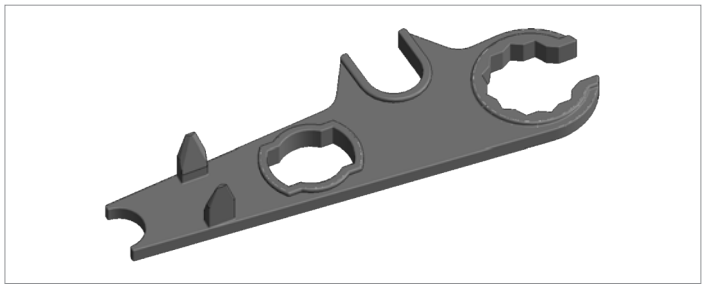
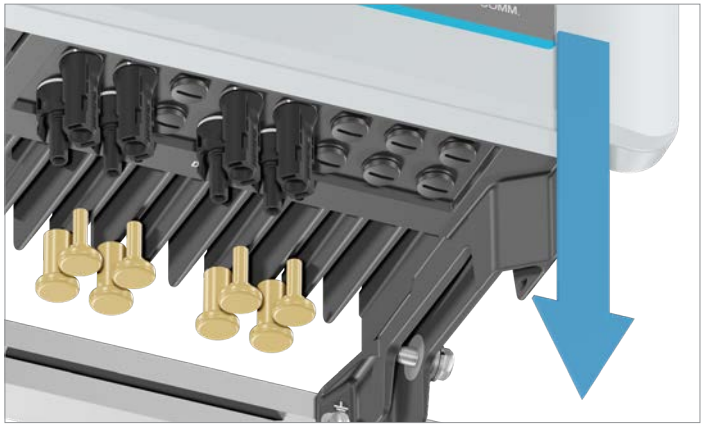
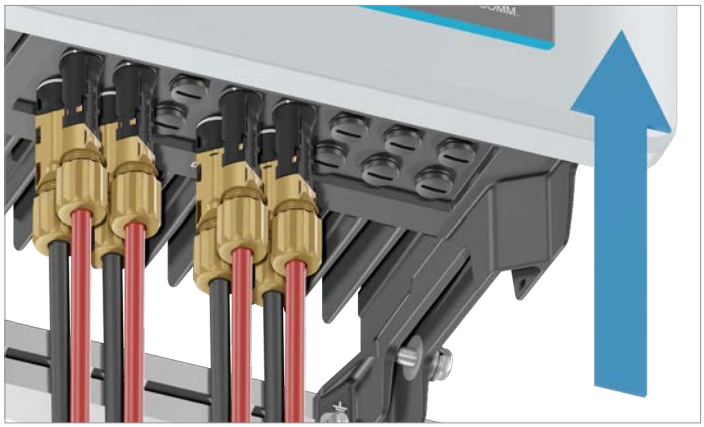


*Fig. 7.9: Mounting tools for DC connectors (included in delivery)*



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



2. Plug in the DC cables.

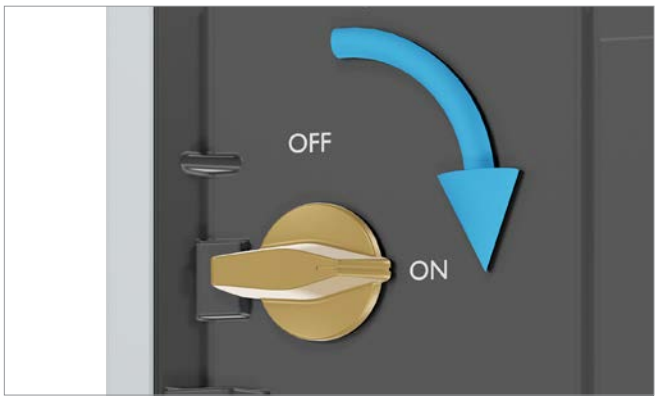
# 8. Commissioning

Commissioning requires either a Windows PC with the Delta Service software or a smartphone with the DeltaSolar app.

## 8.1 General prerequisites for commissioning

All inverters are supplied with AC or DC voltage.

► Turn the DC isolating switch to the ***ON*** position.




## 8.2 Commissioning with a Windows PC and the Delta Service Software (DSS)

**Prerequisites**

- The PC is connected to one of the inverters in the RS485 bus via a USB/RS485 adaptor (see “7.5.8 Connecting a PC via RS485 (optional)”, page 64).

  or:

- The PC is connected to a single inverter via Wi-Fi. If several inverters are installed in your system, you must commission each inverter individually.

  and

- The Delta Service Software (DSS) is installed on the PC. Download from: https://solarsolutions.delta-emea.com/en/Solar-Inverter-Support-171.htm

**Prerequisites**

► Start the DSS and follow the instructions.

## 8.3 Commissioning with the DeltaSolar app

### 8.3.1 Direct connection between smartphone and inverter

**Prerequisites**

The DeltaSolar app is installed on your smartphone.

**Procedure**

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

### 8.3.2 Mobile device connected to inverter via DC1 data collector

**Prerequisites**

All inverters are connected to the DC1 (see “6. Planning the Commissioning”, page 50)

The DeltaSolar app is installed on your smartphone.

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

## 8.4 Completing the commissioning process

**DANGER**

**Electric shock**

Potentially fatal voltages are present in the inverter during operation.

► If the inverter is installed in a location to which children or other persons in need of protection have access, do not store the Allen key to open the front door on or near the inverter.

# 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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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 door is properly sealed.

**WARNING**



**Heavy weight**

The inverter is heavy.

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

**WARNING**



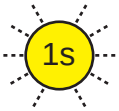
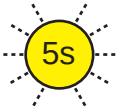
**Hot surfaces**

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



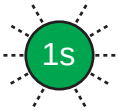
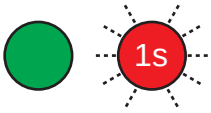
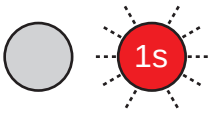
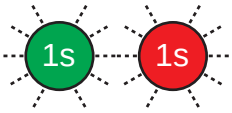
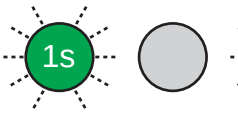
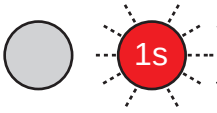
- Always wear safety gloves when touching the inverter.

## 9.1 LED status indicators

| | |
|---|---|
|  | LED is off. |
|   | LED flashes at the standard rate (1 s ON, 1 s OFF). |
|   | LED flashes rapidly (0.25 sec ON, 0.25 sec OFF). |
|   | LED flashes slowly (5 s ON, 10 s OFF). |
|  | LED stays on. |

*Tab. 9.1.: Meaning of the LED symbols used in this manual*

**Status display: operation**

| GRID | ALARM | | Explanation |
|---|---|---|---|
| Green | Red | Yellow | |
|   | | | Countdown (inverter is starting up). |
|  | | | The inverter is connected to the grid and is operating as expected. |
|  | | | Error.<br>Power-off via external signal. |
|   | | | Warning. The inverter continues to supply electricity. |
|   | | | Warning. The inverter is no longer supplying electricity. |
|  | | | Solar panel system failure. The inverter is no longer supplying electricity. |
|  | | | Solar system warning. The inverter continues to supply electricity. |
|  | | | No DC. Also appears when both DC disconnectors are open. |
|   | | | Updating firmware. |
|   | | | Standby mode. |
|   | | | Check the PV power. |
|   | | | System lock. |

*Tab. 9.2.: Meaning of the LED displays on the inverter*

## 9.2 Error

| Error number | Description | Suggestions for resolution |
|---|---|---|
| E01 | Mains frequency lies above the ***OFR*** setting (overfrequency detection). | Check the grid frequency. |
| | Incorrect country or grid type setting. | Check the country and grid type settings. |
| E02 | Mains frequency lies below the ***UFR*** setting (underfrequency detection). | Check the grid frequency. |
| | Incorrect country or grid type setting. | Check the country and grid type settings. |
| E07 | 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 | AC cable is not connected correctly. | Check the AC cable connection. |
| E09 | There is normally an external load isolating switch between the inverter and the mains (e.g. in an equipment terminal box). This is used to isolate the inverter from the mains and to shut off its AC voltage supply. | Check that the external load-break switch is closed. |
| | AC cable is not connected correctly. | Check the AC cable connection. |
| E10, E15, E20 | Grid voltage lies below the ***UVR*** setting (undervoltage detection). | 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 | Mains voltage lies above the ***OVR*** setting (overvoltage detection). | Check the grid voltage. |
| | Supply voltage during operation is greater than the ***OVR Langs.*** setting. | Check the grid voltage. |
| | Incorrect country or grid type setting. | Check the country and grid type settings. |
| E30 | 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 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 capacity. Dry the PV modules if necessary. |

## 9.3 Warnings

| Warning number | Description | Suggestions for resolution |
|---|---|---|
| W01 | DC input voltage is too low. | Check the DC input voltage on the inverter display.<br>There may be insufficient solar radiation. |
| W07 | The inverter is not delivering the expected power. This can have several causes: | |
| | The temperature is too high. | Check the ambient conditions (for example, 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 | The polarity of the DC string is reversed. | Connect the DC strings correctly. |
| | The string monitoring circuit is defective. | Contact Delta Customer Service. |
| W11 | One or more fans are blocked. | Clean or replace the fans if necessary. |
| | One or more fans are defective. | Replace the defective fans. |
| | One or more fans are disconnected from the power supply. | Check the power supply connections of the fans. |
| W17 | 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.<br>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.<br>Check that there are no missing screws.<br>Tighten all screws. |
| | The signal cable is not inserted correctly. | Check that the signal cable is inserted correctly. |
| W18 | 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.<br>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 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.<br>Check that there are no missing screws.<br>Tighten all screws. |
| | The signal cable is not inserted correctly. | Check that the signal cable is inserted correctly. |

## 9.4 Faults

| Fault number | Possible causes | Suggestions for resolution |
|---|---|---|
| F01, F02, F03 | The grid waveform is abnormal. | Contact Delta Customer Service. |
| | Internal error. | Contact Delta Customer Service. |
| F05 | The ambient temperature is > 60°C. | Check the system environment. |
| F06, F08, F09, F10 | The ambient temperature is > 90°C or < -30°C. | Check the system environment. |
| | Detection circuit malfunction. | Contact Delta Customer Service. |
| F07 | The ambient temperature is < -30°C. | Check the system environment. |
| | Internal error. | Contact Delta Customer Service. |
| F13, F29 | Internal error. | Contact Delta Customer Service. |
| F15, F16, F17 | The DC input voltage is less than the minimum required DC input voltage. | Check the DC input voltage on the inverter display.<br>There may be insufficient solar radiation. |
| | Internal error. | Contact Delta Customer Service. |
| F18, F19 | The DC input voltage is less than the minimum required DC input voltage. | Check the DC input voltage on the inverter display.<br>There may be insufficient solar radiation. |
| | Internal error. | Contact Delta Customer Service. |
| F20 | Incorrect calibration. | Check the accuracy of the voltage and power. |
| | Internal error. | Contact Delta Customer Service. |
| F22 | Internal error. | Contact Delta Customer Service. |
| F23 | Internal error. | Contact Delta Customer Service. |
| F24 | 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 | Internal error. | Contact Delta Customer Service. |
| F27 | Internal error. | Contact Delta Customer Service. |
| F28 | Internal error. | Contact Delta Customer Service. |
| | Fault in the relay driver circuit. | Contact Delta Customer Service. |
| F30 | 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 | 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. |

| Fault number | Possible causes | Suggestions for resolution |
|---|---|---|
| F36, F37, F38, F39, F40, F41 | Overvoltage during operation. | Contact Delta Customer Service. |
| | Internal error. | Contact Delta Customer Service. |
| F42 | Internal error. | Contact Delta Customer Service. |
| F43 | Internal error. | Contact Delta Customer Service. |
| F44 | Internal error. | Contact Delta Customer Service. |
| F45 | 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 | Internal error. | Contact Delta Customer Service. |
| F60, F61, F70, F71 | Internal error. | Contact Delta Customer Service. |

# 10. Disconnecting the inverter from the power supply before working on it

**Before carrying out any** work on the inverter, carry out the steps described in this chapter! Always follow the specified sequence!

**To complete all** work on the inverter, carry out the work steps described in the chapter “12. Recommissioning the inverter after work”, page 91.

## 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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**

**Electric shock**
The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**WARNING**

**Electric shock**
The IP66 protection degree 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 door is properly sealed.

**WARNING**

**Heavy weight**
The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

**WARNING**

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

- Always wear safety gloves when touching the inverter.

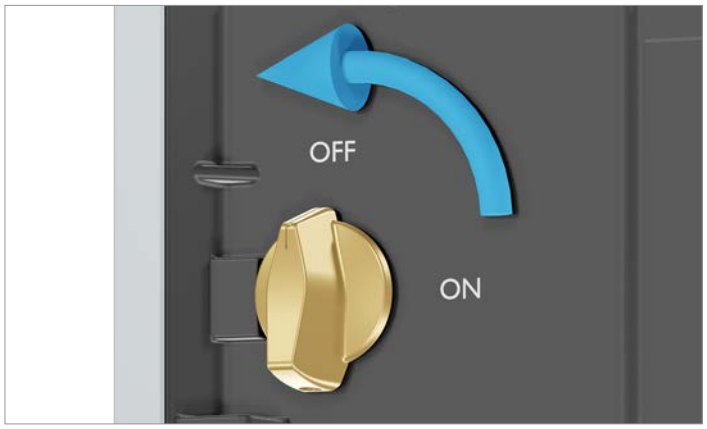
All work described in this section must only be carried out by electrical installers who are trained and approved for work on grid-connected solar inverters.

Use insulated tools.

## 10.2 Procedure

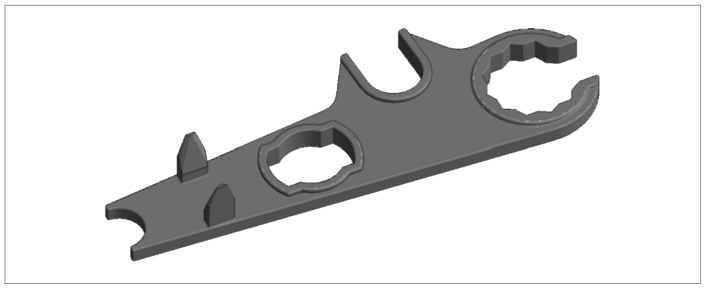
1. To shut off the inverter at the grid, open the load-break switch between the inverter and the grid connection point.

   Secure the load-break switch to prevent it from being switched back on.




2. Turn the DC isolating switch to the ***OFF*** position.

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

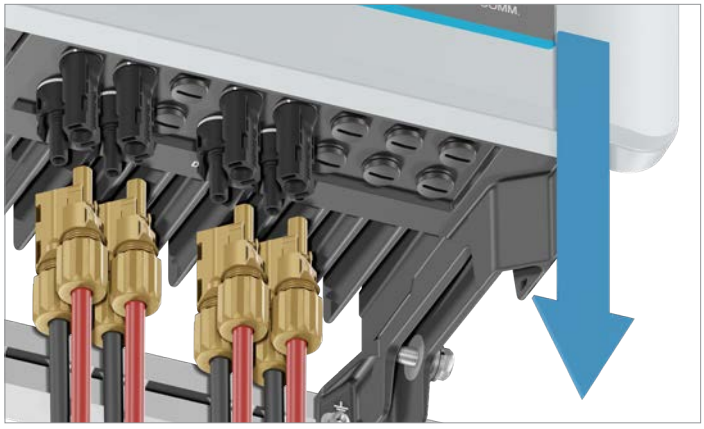


Always use the supplied mounting tools to open the DC connectors.

When disconnecting the DC cables, take care not to damage the connectors.

Do not use force.

Pull out at the DC connector, **not** at the DC cable.

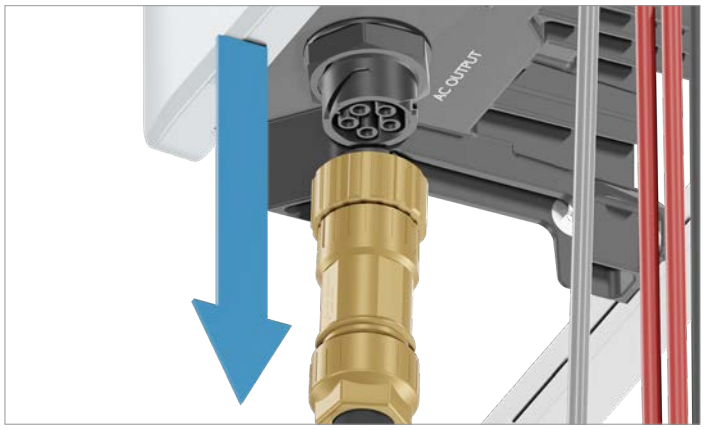


4. Use the mounting tool to release the DC cables and then pull them out.

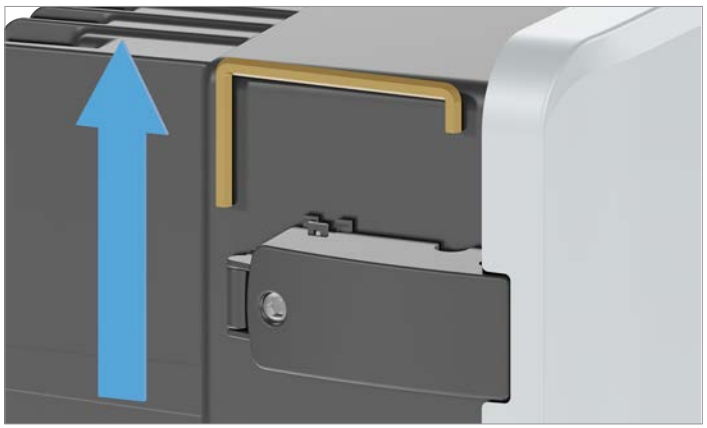
# 10 Disconnecting the inverter from the power supply before working on it

**Procedure**

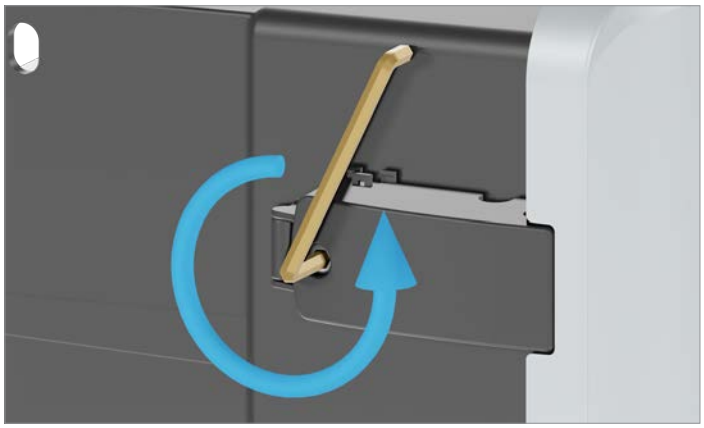


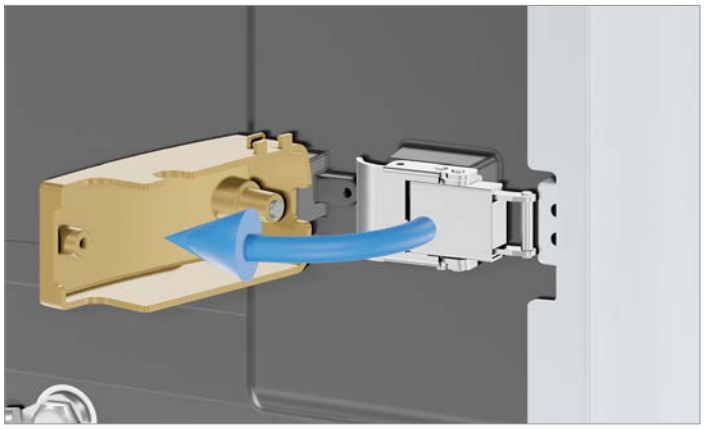

5. Unscrew and unplug the AC plug.



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

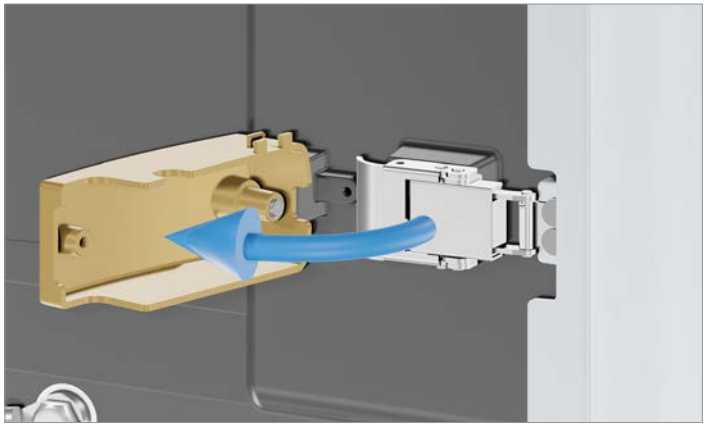


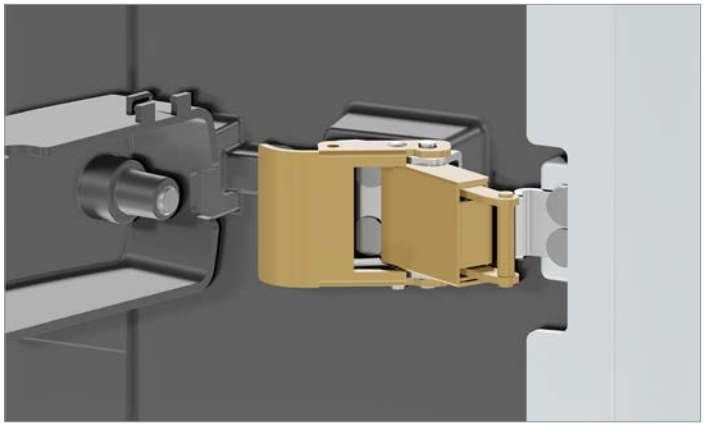
7. Unscrew and open the upper door lock cover.





8. Unscrew and open the lower door lock cover.

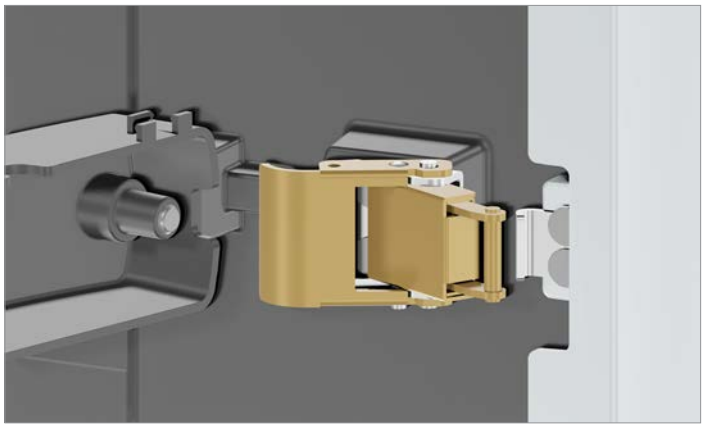




9. Open the upper and lower door lock.

# 10 Disconnecting the inverter from the power supply before working on it

**Procedure**





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

# 11. Replacing or cleaning components, installing accessories

**DANGER**



**Electric shock**

Potentially fatal voltages are present in the inverter during operation.

- ► **Before carrying out any** work on the inverter, carry out the work steps described in the chapter “10. Disconnecting the inverter from the power supply before working on it”, page 78!
- ► **To complete all** work on the inverter, carry out the work steps described in the chapter “12. Recommissioning the inverter after work”, page 91.

## Summary

**11.1 General information** . . . . . 84

**11.2 Replacing DC surge protection devices** . . . . . 85

**11.3 Replacing the AC surge protection devices** . . . . . 88

## 11.1 General information

For the following work, the inverter must be disconnected from the power supply.

- Replacing DC surge protection devices
- Replacing the AC surge protection devices

Perform the instructions listed in chapter “10. Disconnecting the inverter from the power supply before working on it”, page 78**before** you start work on the inverter!

The following work can be carried out on a running inverter.

- Replacing the Wi-Fi module
-

## 11.2 Replacing 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.

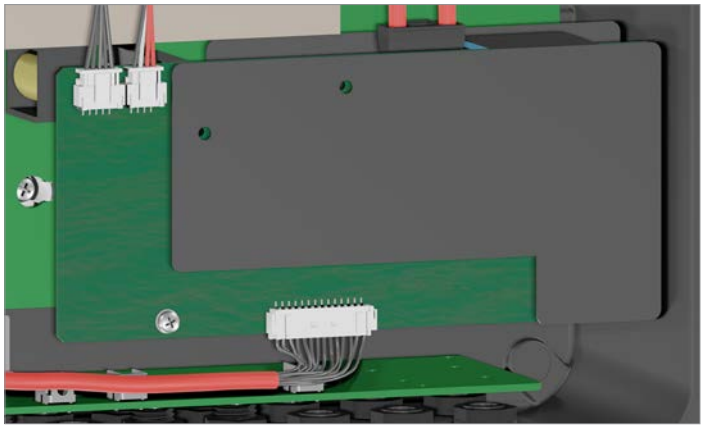
► Perform the instructions listed in chapter “10. Disconnecting the inverter from the power supply before working on it”, page 78 **before** you start work on the inverter!

**DC surge protection devices are supplied without screws.**

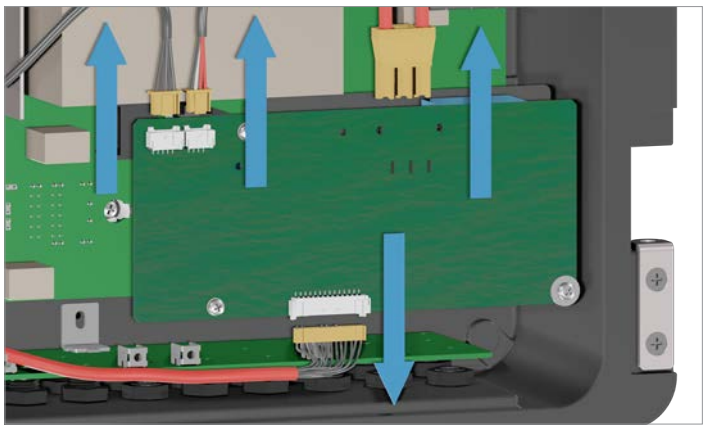
**All** screws including spring washers and washers of the old DC surge protection devices must be reused for the new DC surge protection devices.

Use an insulated, strongly magnetic screwdriver.

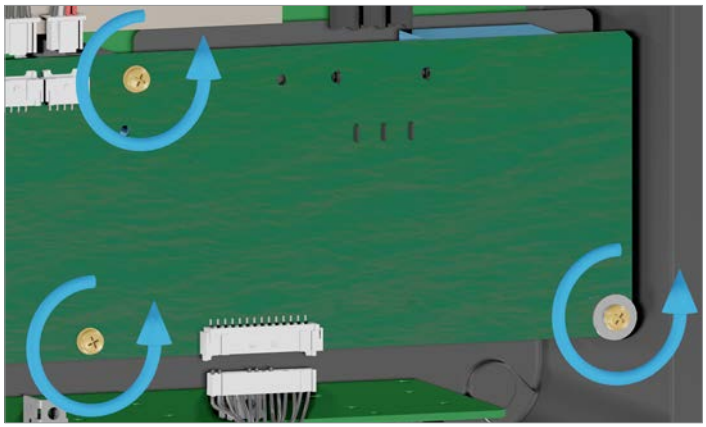
Make sure that no screws fall down in the process.



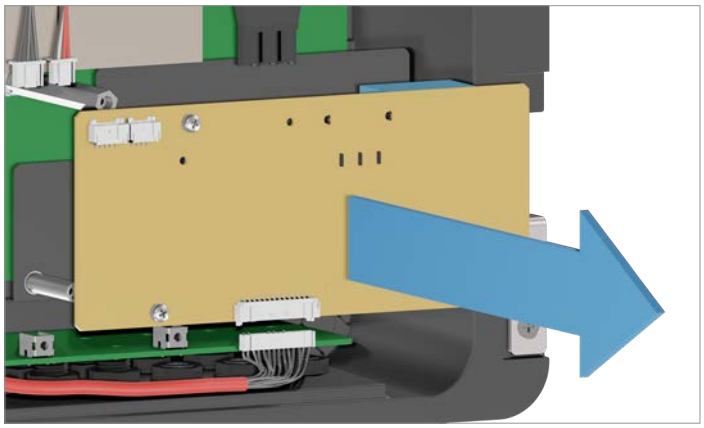
Position of the DC surge protection devices.



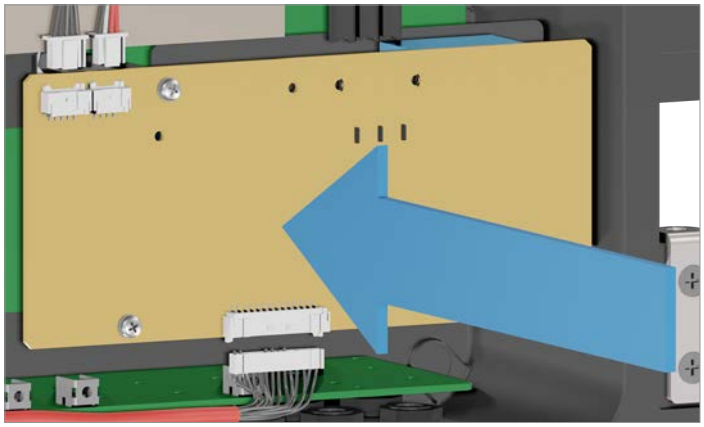
1. Pull out the 4 cables.



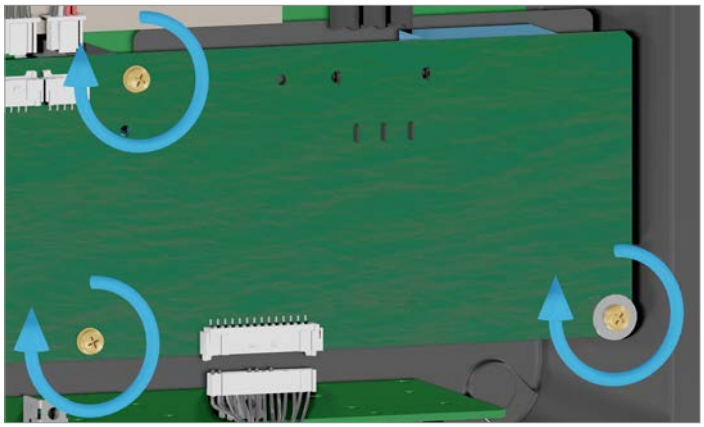
2. Loosen the card screws.



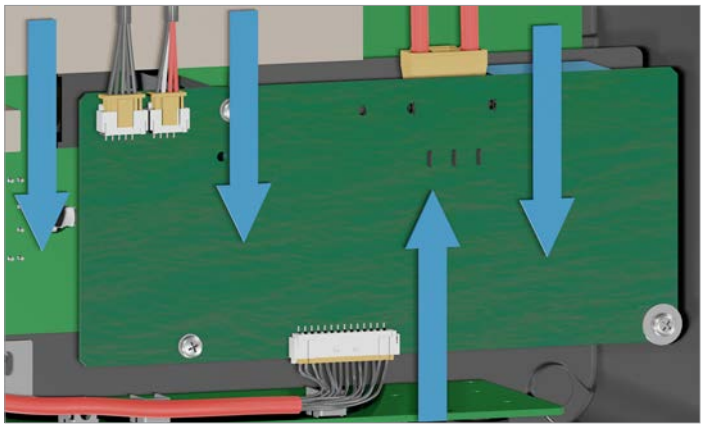
3. Pull out the card.



4. Install the new card.



5. Screw the card into place using the 3 mounting screws.



6. Plug in the 4 cables.

7. To complete the work, follow the instructions in the chapter “12. Recommissioning the inverter after work”, page 91.

## 11.3 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.

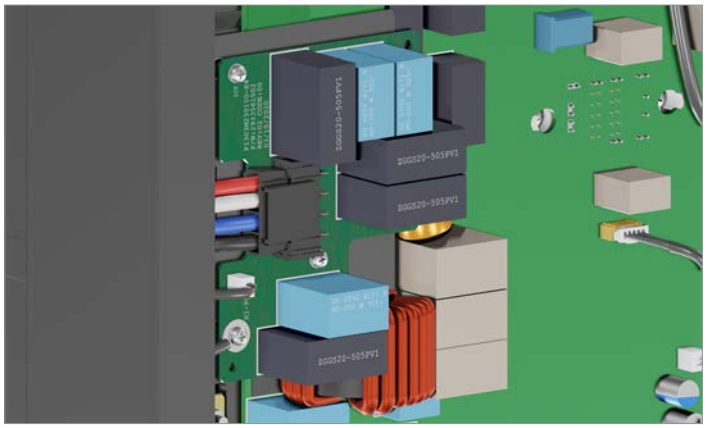
► Perform the instructions listed in chapter “10. Disconnecting the inverter from the power supply before working on it”, page 78 **before** you start work on the inverter!

**AC surge protection devices are supplied without screws.**

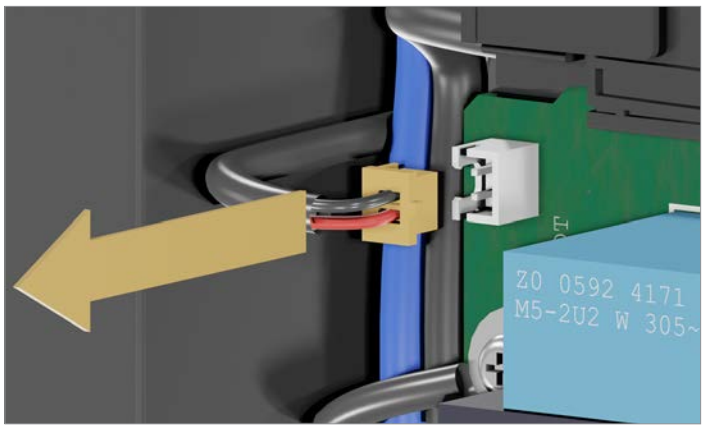
**All** screws including spring washers and washers of the old AC surge protection devices must be reused for the new AC surge protection devices.

Use an insulated, strongly magnetic screwdriver.

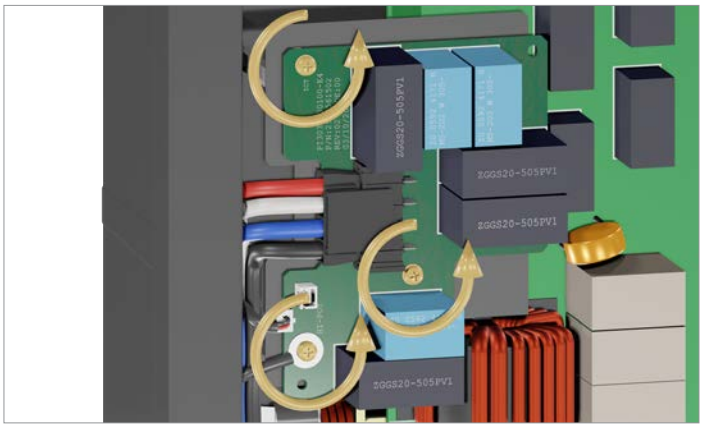
Make sure that no screws fall down in the process.



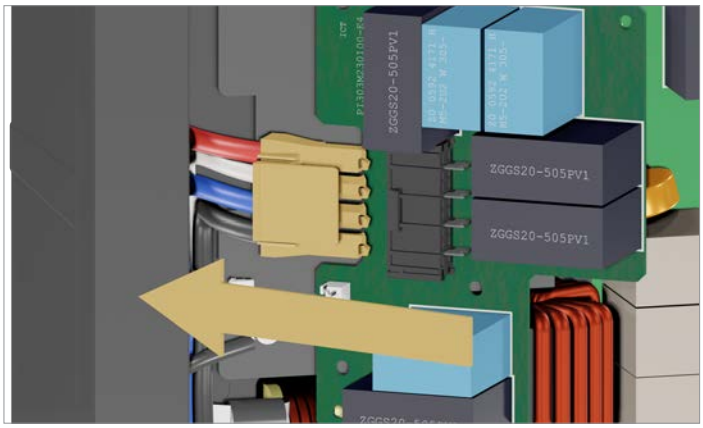
Position of the AC surge protection devices



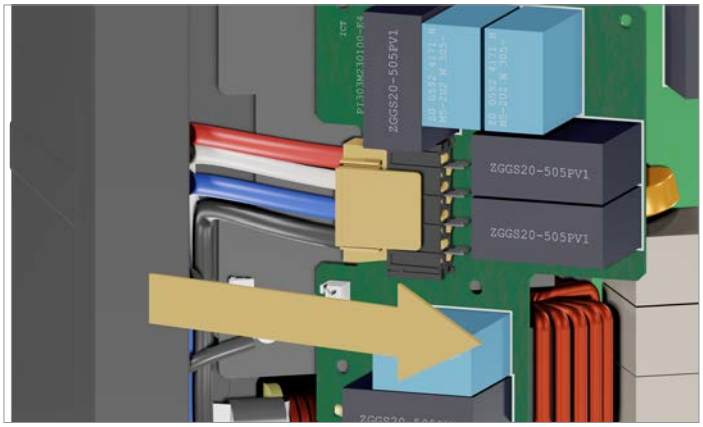

1. Pull out the signal cable.




2. Loosen the 3 mounting screws.

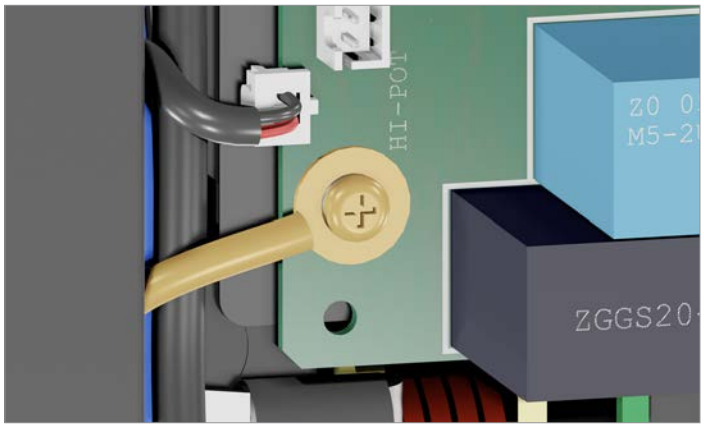



3. Pull out the AC cable and remove the card

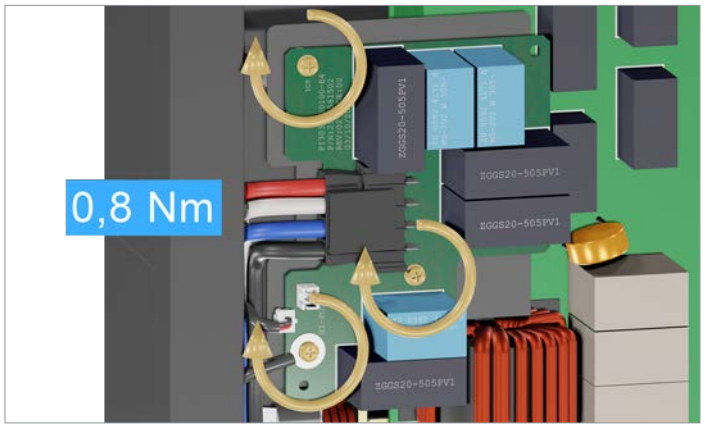


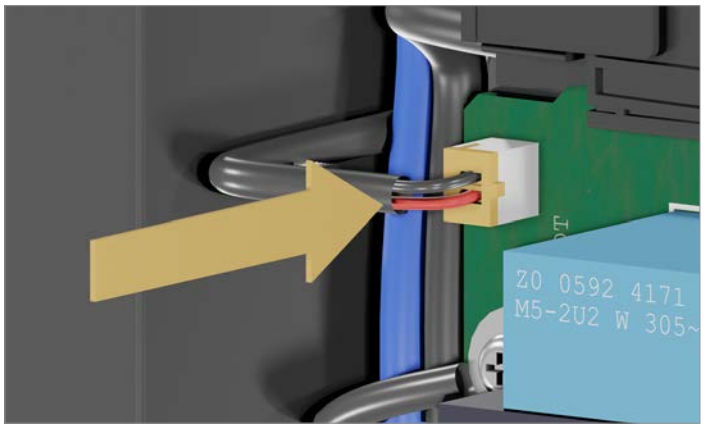

When installing, make sure that the cables are not pinched.

4. Insert the AC cable into the new card.




5. Connect the hipot cable to the lower mounting screw and screw the card into place using the 3 mounting screws.




6. Plug in the signal cable.

7. To complete the work, follow the instructions in the chapter “12. Recommissioning the inverter after work”, page 91.

# 12. Recommissioning the inverter after work

**Before carrying out any** work on the inverter, carry out the work steps described in the chapter “10. Disconnecting the inverter from the power supply before working on it”, page 78!

**To complete all** work on the inverter, carry out the work steps described in this chapter!

## 12.1 Safety instructions

**DANGER**

**Electric shock**

Potentially fatal voltages are present in the inverter during operation.

- ► If the inverter is installed in a location to which children or other persons in need of protection have access, do not store the Allen key to open the front door on or near the inverter.

**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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**

**Electric shock**

The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**WARNING**

**Electric shock**

The IP66 protection degree 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 door is properly sealed.

**WARNING**

**Heavy weight**

The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

**WARNING**



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



- Always wear safety gloves when touching the inverter.

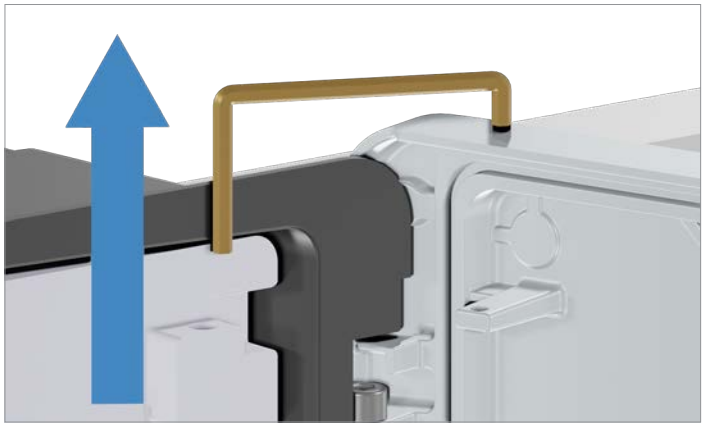


All work described in this section must only be carried out by electrical installers who are trained and approved for work on grid-connected solar inverters.

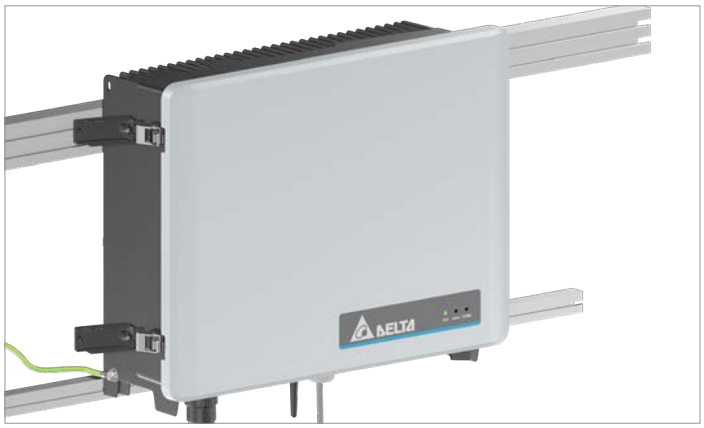


Use insulated tools.

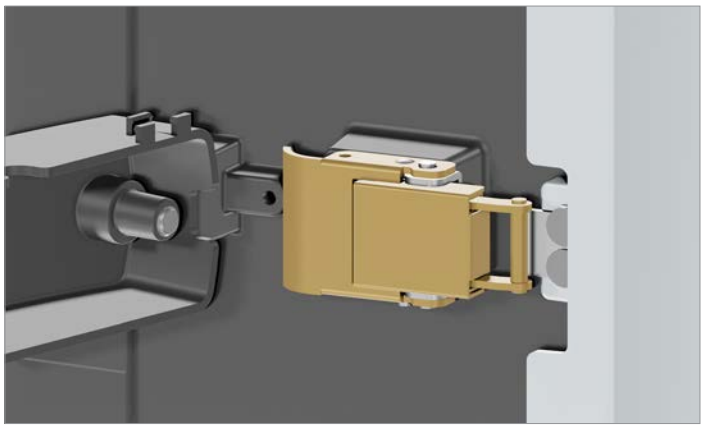
## 12.2 Procedure



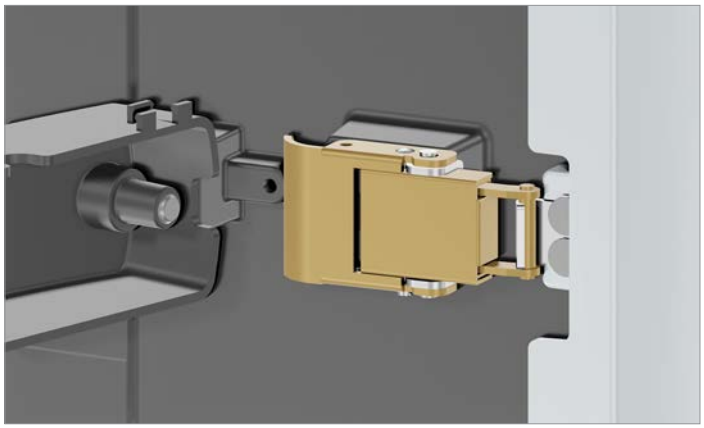
1. Remove the Allen key from the top of the door.

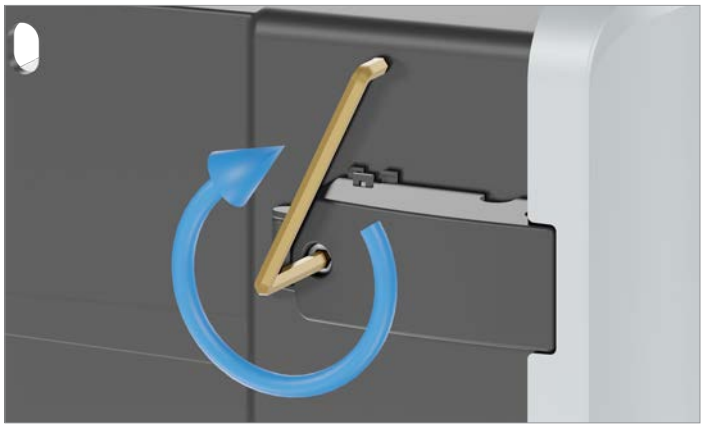


2. Close the door.

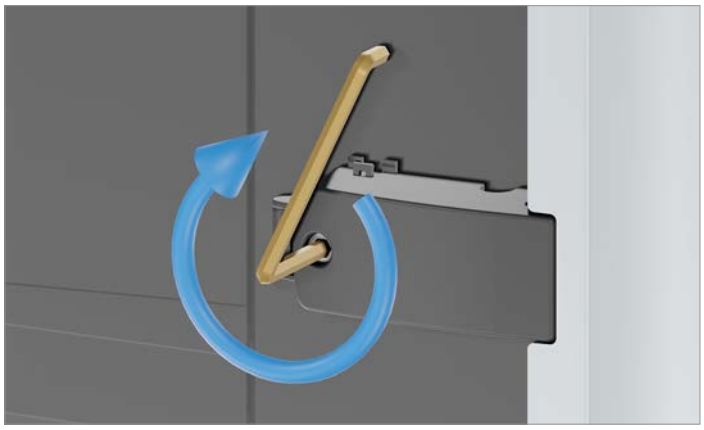


3. Close the upper and lower door locks.





4. Close and screw on the cover of the upper door lock.



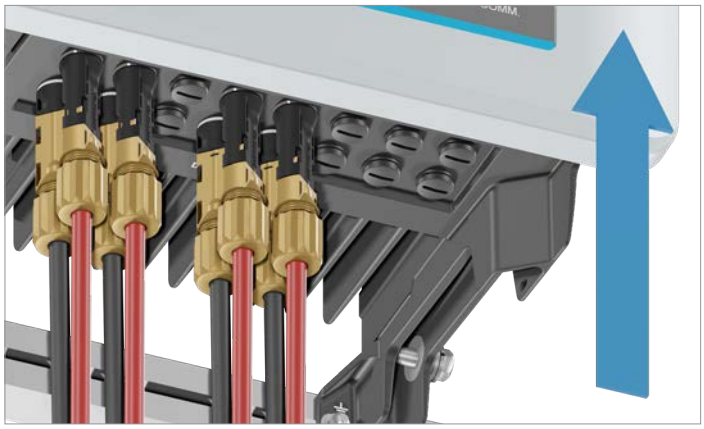
5. Close and screw on the cover of the lower door lock.



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

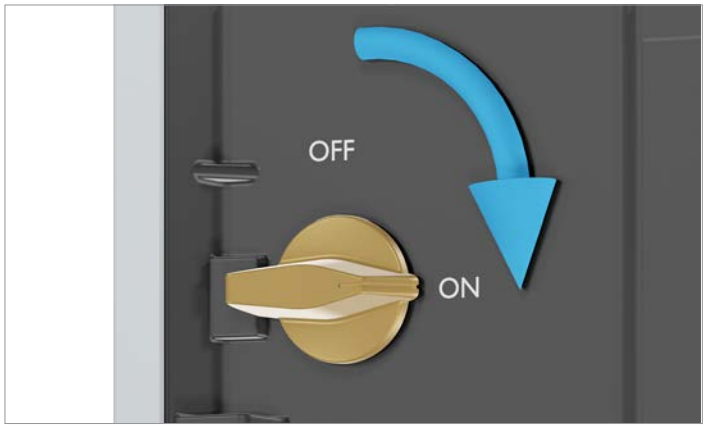



7. Tighten the AC plug.



8. Plug in the DC cables.

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




10. Turn the DC isolating switch to the ***ON*** position.

☑ Recommissioning is complete.

# 13. Replacing the inverter

## 13.1 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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**



**Electric shock**

The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**WARNING**



**Electric shock**

The IP66 protection degree 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 door is properly sealed.

**WARNING**



**Heavy weight**

The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

**WARNING**



**Hot surfaces**

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



- Always wear safety gloves when touching the inverter.



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.



It is best to wait before removing the old inverter until you have received the replacement device from Delta Electronics.



Use insulated tools.

## 13.2 Special notes on replacement

Delta Electronics will provide you with a fully equipped replacement device and detailed information about the replacement process.

If you are continuing to use the components of the old inverter, attach the appropriate parts of the replacement device to the old inverter before returning it to Delta Electronics. This is also necessary to ensure that all openings of the inverter are properly closed and that no moisture can enter during transportation.

Pack the old inverter into the box of the replacement device and return everything to Delta Customer Service.

All necessary work steps are described in this chapter.

## 13.3 Sequence of work steps

| Step | Description in chapter |
|---|---|
| Disconnect the inverter from AC and DC | “13.5 Disconnecting the inverter from the power supply”, page 100 |
| Remove the communication cable | “13.6 Removing the communication card”, page 102 |
| Removing the inverter | “13.7 Removing and packing the inverter”, page 103 |
| Pack the inverter | “13.7 Removing and packing the inverter”, page 103 |

## 13.4 Tools required

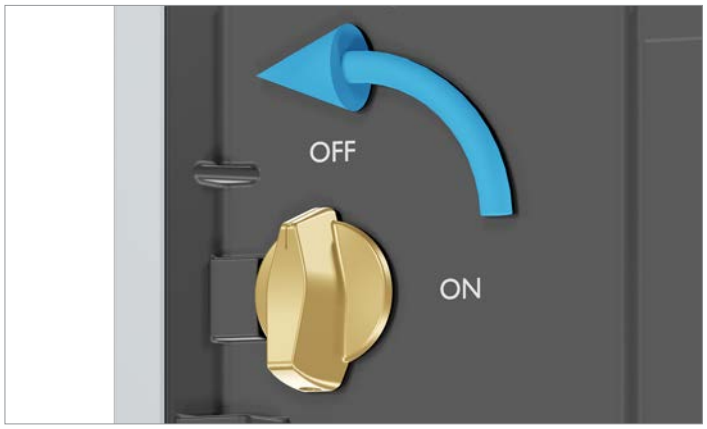
In addition to standard tools such as screwdrivers, open-ended wrenches, Allen keys and socket wrenches in various sizes, the following tools are required for working on the inverter:

- Mounting tool for disconnecting the Amphenol plug connectors from the DC cables (included in the scope of delivery)

## 13.5 Disconnecting the inverter from the power supply

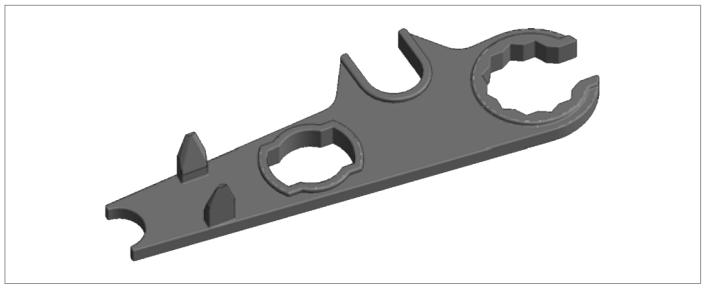
1. To shut off the inverter at the grid, open the load-break switch between the inverter and the grid connection point.

   Secure the load-break switch to prevent it from being switched back on.




2. Turn the DC isolating switch to the ***OFF*** position.

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

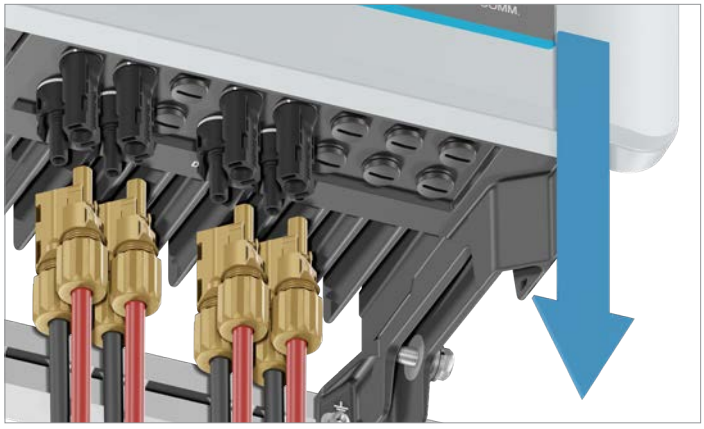


Always use the supplied mounting tools to open the DC connectors.

When disconnecting the DC cables, take care not to damage the connectors.

Do not use force.

Pull out at the DC connector, **not** at the DC cable.



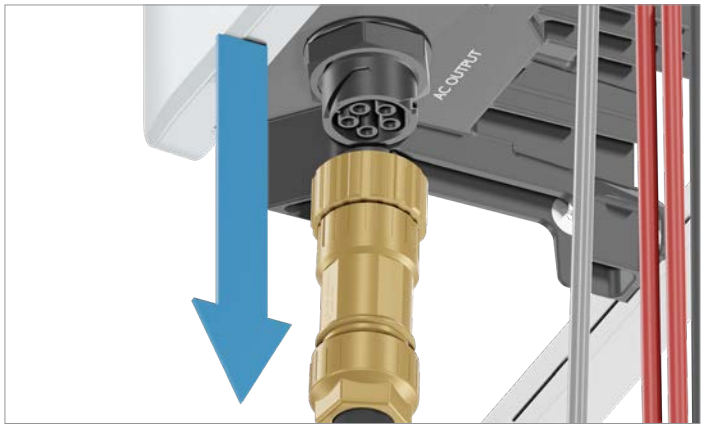
4. Use the mounting tool to release the DC cables and then pull them out.

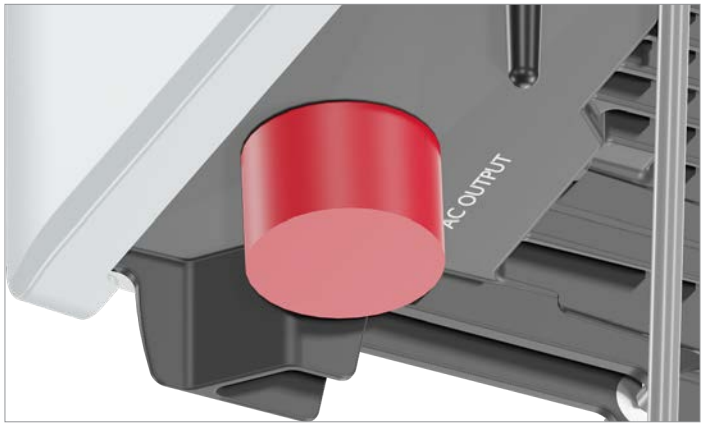



5. Place the cover caps on the DC connections.




6. Unscrew and unplug the AC plug.

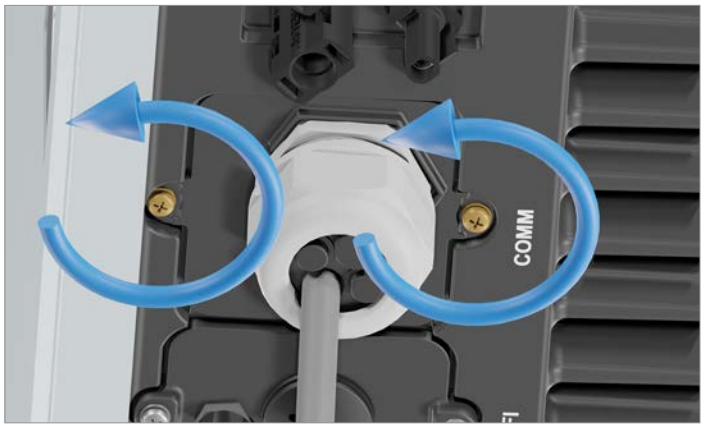


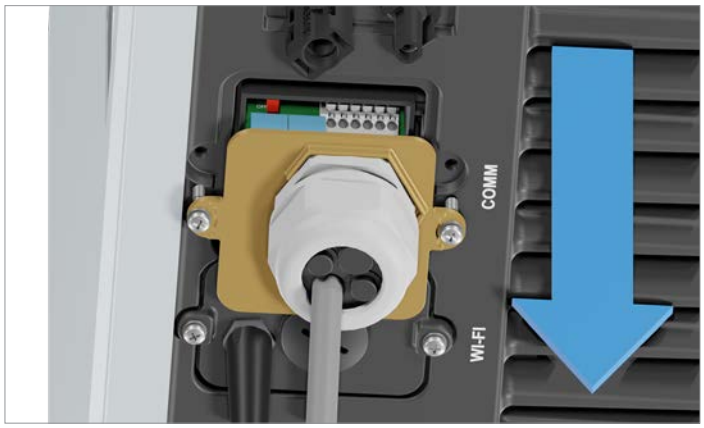




7. Fit the cover cap.

## 13.6 Removing the communication card

You can reuse the wired communication card for the replacement device.



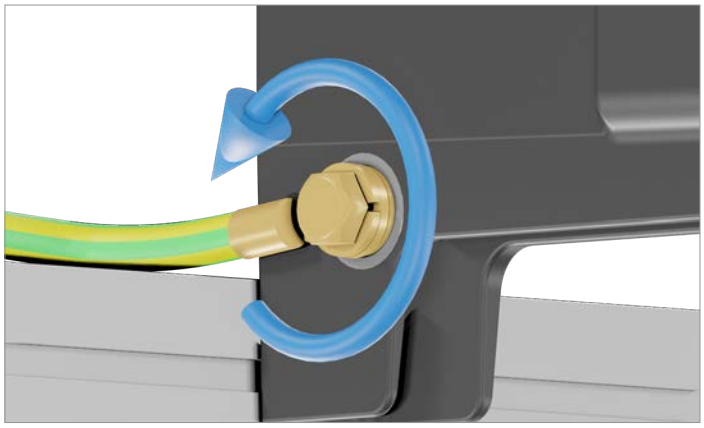

The communication card is screwed on to the cover!

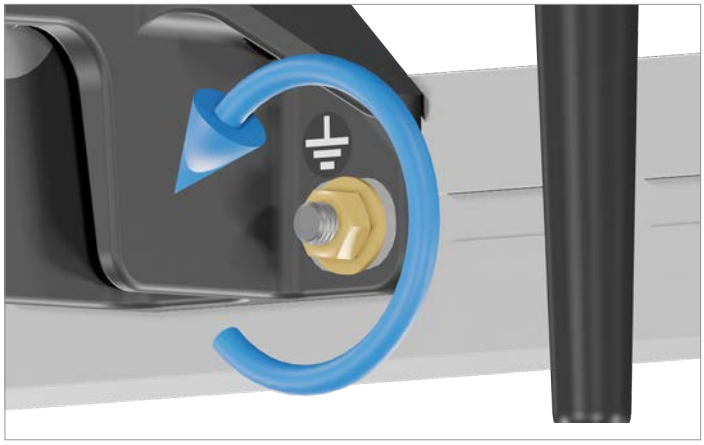
8. Unscrew the communication card cover and carefully pull out the communication card.

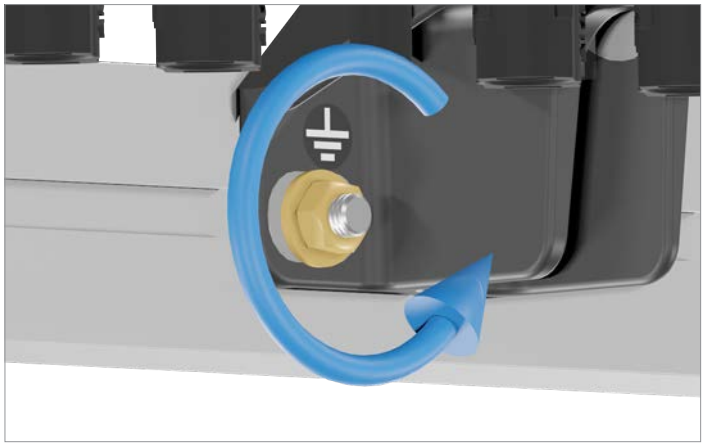
## 13.7 Removing and packing the inverter

**WARNING**

**Heavy weight**
The inverter is heavy.
► Lift and carry the inverter with at least 2 people.



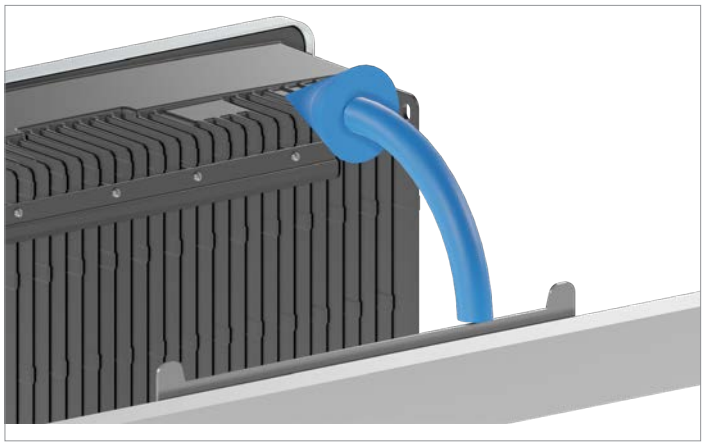




The grounding cable can be connected to the left or right foot.

1. Unscrew the grounding cable.

2. Unscrew the inverter from the bottom left and right of the wall or the mounting system.



3. Lift the inverter out of the mounting plate and place it in the box of the replacement device.

4. Place all components of the replacement device that will not be needed back into the box.

5. Package and ship the old inverter in accordance with the description received from Delta Customer Service.

6. Install and commission the new inverter in accordance with the installation instructions supplied.

# 14. Decommissioning

## 14.1 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 the DC isolating switch to the ***OFF*** position.
2. Disconnect the inverter from all AC and DC voltage sources and make sure that none of the connections can be 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 the DC isolating switch 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.

**DANGER**



**Electric shock**
The inverter has a high leakage current value.

- ► **Always** connect the ground cable first, then the AC and DC cables.

**WARNING**



**Electric shock**
The IP66 protection degree 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 door is properly sealed.

**WARNING**



**Heavy weight**
The inverter is heavy.

- ► Lift and carry the inverter with at least 2 people.

**WARNING**



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



- Always wear safety gloves when touching the inverter.



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.



Use insulated tools.

## 14.2 Tools required

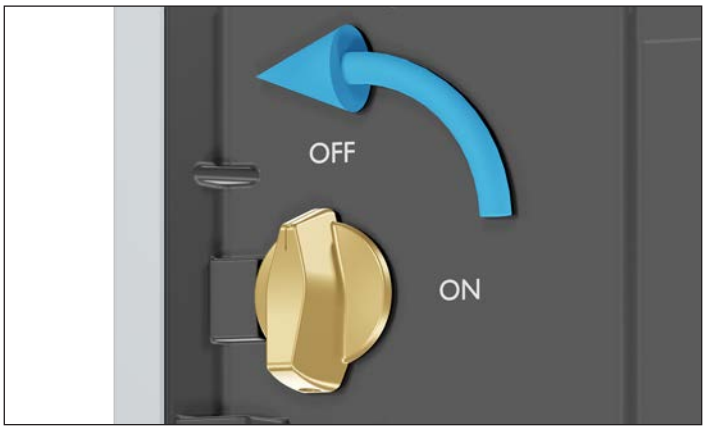
In addition to standard tools such as screwdrivers, open-ended wrenches, Allen keys and socket wrenches in various sizes, the following tools are required for working on the inverter:

- Mounting tool for disconnecting the Amphenol plug connectors from the DC cables (included in the scope of delivery)
- Use insulated tools.

## 14.3 Disconnecting the inverter from the power supply

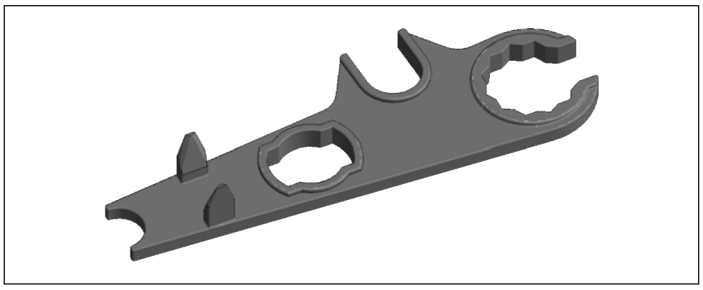
1. To shut off the inverter at the grid, open the load-break switch between the inverter and the grid connection point.

   Secure the load-break switch to prevent it from being switched back on.




2. Turn the DC isolating switch to the ***OFF*** position.

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

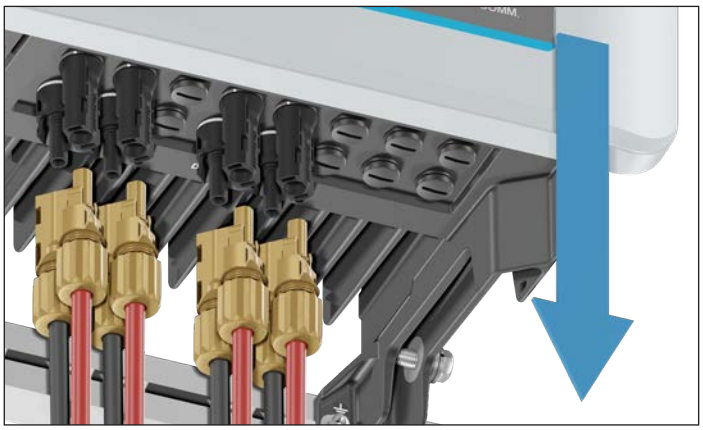


Always use the supplied mounting tools to open the DC connectors.

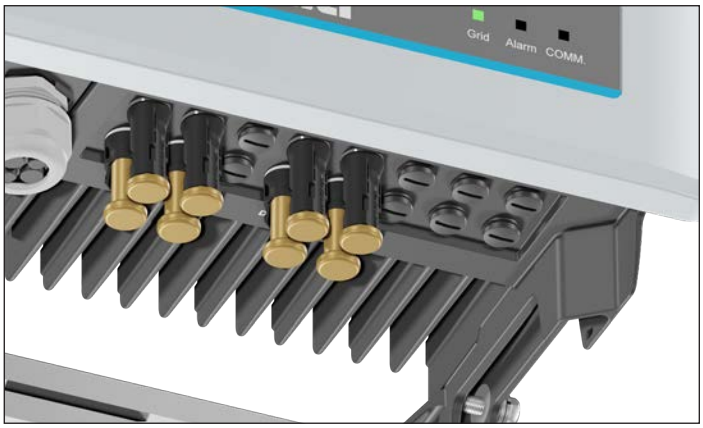
When disconnecting the DC cables, take care not to damage the connectors.

Do not use force.

Pull out at the DC connector, **not** at the DC cable.



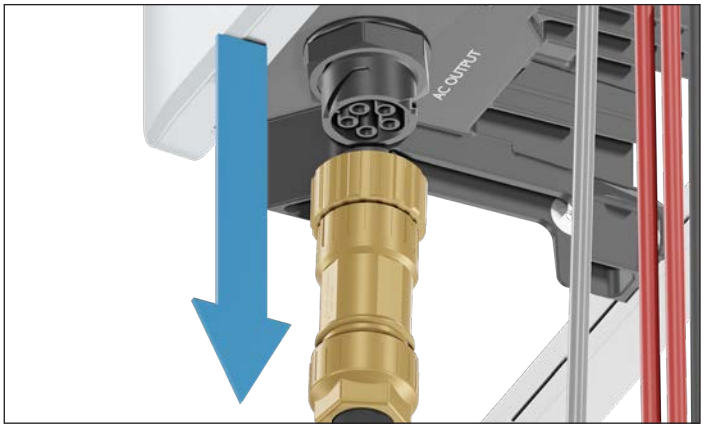
4. Use the mounting tool to release the DC cables and then pull them out.

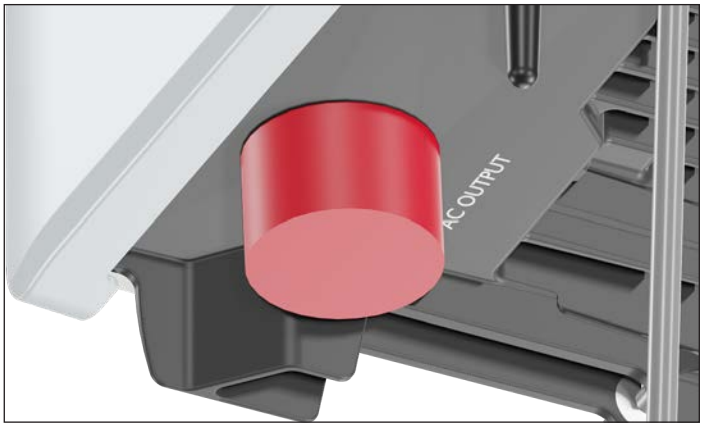



5. Place the cover caps on the DC connections.




6. Unscrew and unplug the AC plug.

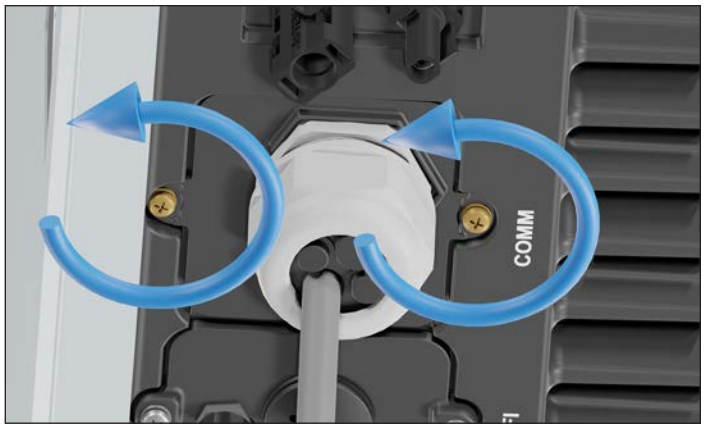


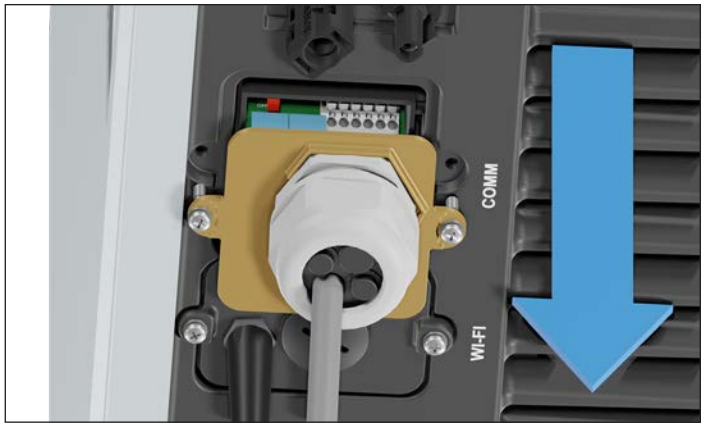



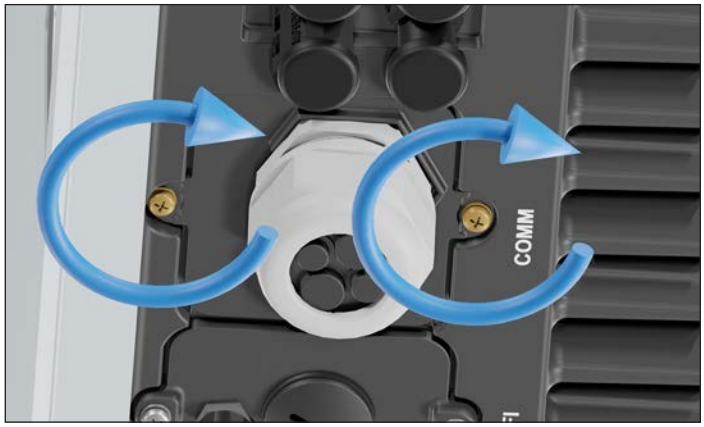

7. Fit the cover cap.

## 14.4 Removing the communication card

You can reuse the wired communication card for the replacement device.




The communication card is screwed on to the cover!

8. Unscrew the communication card cover and carefully pull out the communication card.

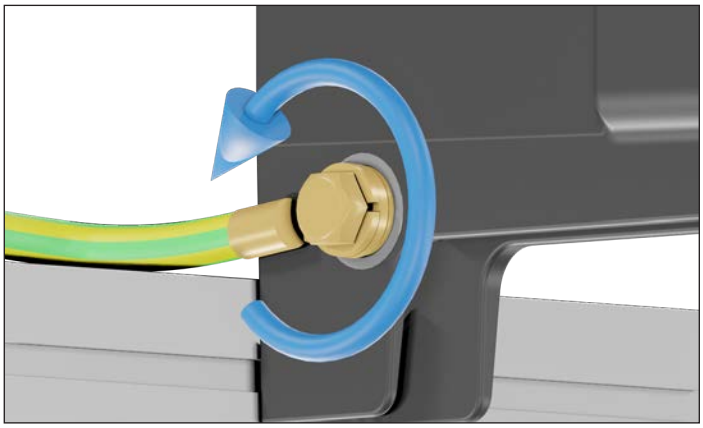
9. Remove all cables, insert the rubber seals and reinstall the communication card.

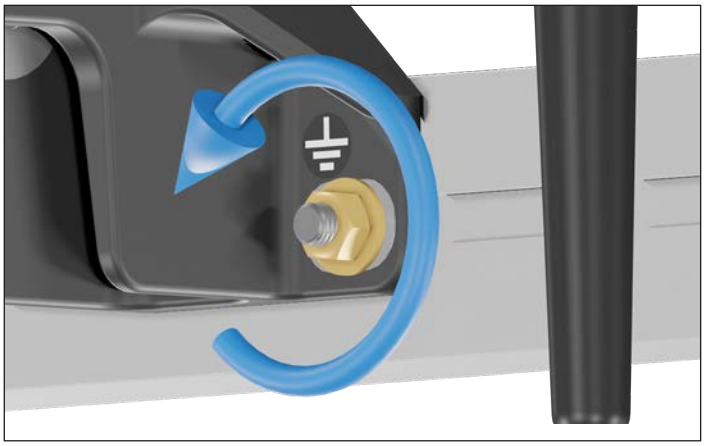
## 14.5 Removing the inverter

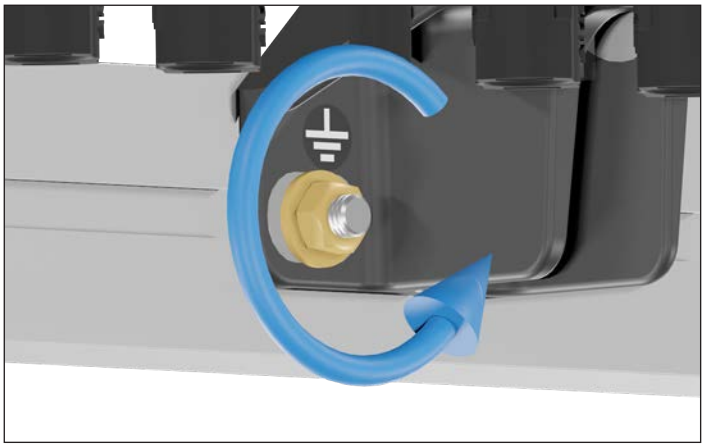
**WARNING**



**Heavy weight**
The inverter is heavy.
► Lift and carry the inverter with at least 2 people.



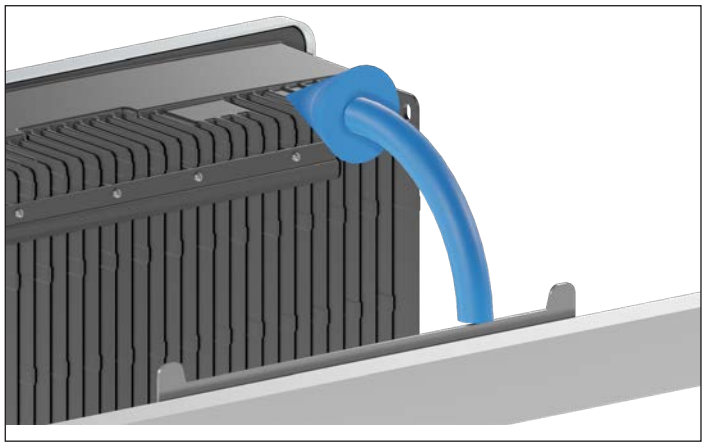




The grounding cable can be connected to the left or right foot.

1. Unscrew the grounding cable.

2. Unscrew the inverter from the bottom left and right of the wall or the mounting system.



3. Lift the inverter out of the mounting plate and place it in the box of the replacement device.

4. If you want to store the inverter, pack the inverter and all parts included in the scope of delivery into the original box.

## 15. Disposal

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.

# 16. Technical Data

| Input (DC) | M15A | M20A |
|---|---|---|
| Maximum input power (per MPP Tracker/total) | 9,85 kW / 16,5 kW | 13,5 kW / 22 kW |
| Rated power | 15 kW | 20 kW |
| Input voltage range for operation | 200 to 1000 $V_{DC}$ | |
| Max. input voltage | 1100 $V_{DC}$ [1] | |
| Rated voltage | 600 $V_{DC}$ | |
| Switch-on voltage | 250 V | |
| Switch-on power | ??? W | |
| Number of MPP trackers | Parallel inputs: 1; separate inputs: 2 | |
| Number of DC connections (per MPP tracker/total) | 2/4 | |
| MPP input voltage range total | 200 to 1000 $V_{DC}$ | |
| MPP input voltage range with full power | 325 to 900 $V_{DC}$ | 460 to 900 $V_{DC}$ |
| Maximum asymmetrical design | 90%/10%; 10%/90% | 67.5%/32.5%; 32.5%/67.5% |
| Maximum input current (per MPP Tracker/total) | 26 A/48 A | |
| Maximum DC short-circuit current $I_{SC}$ | 50 A per MPP tracker | |
| DC connection panel | | |
| Connector type | Amphenol H4 connector | |
| Number of DC connections | 4 pairs | |
| DC cable specifications | 4/6 $mm^2$ | |
| Use of external string fuses | 1 or 2 strings per MPPT: no external string fuses required | |
| Overvoltage category [2] | II | |
| Surge protection devices | Type 2 (EN 50539-11), replaceable | |
| Galvanic isolation | No | |

| Output (AC) | M15A | M20A |
|---|---|---|
| Maximum apparent power [3] | 15 kVA at 40°C; 16.5 kVA at 35°C | 20 kVA at 40°C; 22 kVA at 35°C |
| Maximum active power | 15 kW at 40°C; 16.5 kW at 35°C | 20 kW at 40°C; 22 kW at 35°C |
| Nominal active power | 15 kW | 20 kW |
| Nominal apparent power | 15kVA | 20KVA |
| Rated voltage [4] | 230/400 V -20%/+30%, 3 phases + PE, 3 phases + N + PE | |
| Maximum output current | 25 A | 32 A |
| Switch-on current | 110 A/50 µs | |
| Maximum current in case of fault | 40 $A_{rms}$ | |
| Maximum surge protection | 77 A | |
| Frequency range [4] | 50/60 Hz ± 5 Hz | |
| Power factor adjustment range | 0.8 cap to 0.8 ind | |
| Total harmonic distortion | <3% at rated apparent power | |
| Power consumption in night mode | <2 W [5] | |
| AC connection | | |
| Connector type | AC connector (included with delivery) | |
| Copper cable specifications | | |
| Cable diameter | 20 to 26 mm | |
| Conductor type | Single-wire; multi-wire; fine-wire with end sleeve | |
| Wire cross section | 2.5 to 16 $mm^2$ with end sleeve | |
| Aluminum cable specifications | not permitted | |
| Overvoltage category [2] | III | |
| Surge protection devices | Type 2 (EN 61463-11), replaceable | |

# 16 Technical Data

| Mechanical details | M15A | M20A |
|---|---|---|
| Dimensions (W x H x D) | 650 × 520 × 220 mm | |
| Weight | 40.5 kg | |
| Cooling | Natural convection | |
| Installation options | suspended (mounting plate included in the scope of delivery) | |
| Disconnectors | 1x mechanical DC disconnector | |

| Communication and data visualization | M15A | M20A |
|---|---|---|
| Communication interfaces | 2x RS485, 2x dry contacts, 1x EPO, 1x 12 $V_{DC}$ power supply, 6x digital inputs | |
| Communication | RS485, Wi-Fi, Sub-1G (optional) | |
| Communication protocols | Modbus RTU | |

| General specifications | M15A | M20A |
|---|---|---|
| Delta model name | M15A_220 | M20A_220 |
| Delta part number | RPI153M220100 | RPI203M220100 |
| Overall operating temperature range | -25 to +60°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 | ≤31.6 dB(A) | |

| Standards and guidelines | M15A | M20A |
|---|---|---|
| Protection class | IP66 | |
| Safety class | I | |
| Pollution degree | II | |
| Configurable trip parameters | Yes | |
| Insulation monitoring | Yes | |
| 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 | |
| Voltage fluctuations and flicker | EN 61000-3-3 | |
| Islanding protection/grid connection guidelines | You will find the current list at solarsolutions.delta-emea.com | |

1) The maximum withstand voltage is 1100 $V_{DC}$. The inverter starts to work if the input voltage falls below 1000 $V_{DC}$.
2) IEC 60664-1, IEC 62109-1
3) For cos phi = 1 (VA = W)
4) Rated voltage and frequency range will be programmed according to the specific country requirements.
5) Power consumption with standby communication

## Delta customer service

| | | |
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