



## Quick Installation Guide

Solar power inverter

M88H\_121 (ST, product version J)

M88H\_122 (CF, product version D)



Europe



United Kingdom



This quick installation guide applies for the following inverter models:

- **M88H\_121 (with DC terminal block, Delta part number RPI883M121200, Product Version J)**
- **M88H\_122 (with DC connections of Multi-Contact and String fuses, Delta part number RPI883M122000, Product Version D)**

with firmware versions:

**DSP: 1.38 / RED: 1.03 / COM: 1.18 or higher**

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

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starting installation work, **always** consult [www.solar-inverter.com](http://www.solar-inverter.com) to check whether a newer version of the Quick Installation Guide or of the comprehensive Installation and Operation Manual is available.

© Copyright – Delta Electronics (Netherlands) B.V. – All rights reserved.

This manual is intended for installers.

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

All information and specifications can be modified without prior notice.

All translations of this manual not authorized by Delta Electronics (Netherlands) B.V. must include the annotation: "Translation of the original operation manual".

Delta Electronics (Netherlands) B.V.

Tscheulinstraße 21

79331 Teningen

Germany

Authorized representative for this product in the EU:

Delta Electronics (Netherlands) B.V.

Zandsteen 15

2132 MZ Hoofddorp

Netherlands

# Table of Contents

<b>Basic safety instructions</b>	<b>4</b>
<b>Scope of delivery – M88H_121 (ST)</b>	<b>6</b>
<b>Scope of delivery – M88H_122 (CF)</b>	<b>7</b>
<b>Components of the M88H_121 (ST) inverter</b>	<b>8</b>
<b>Components of the M88H_122 (CF) inverter</b>	<b>10</b>
<b>Display, buttons, and LEDs</b>	<b>12</b>
<b>Information on the type plate</b>	<b>12</b>
<b>Hazard zones in the wiring box</b>	<b>13</b>
<b>Planning the installation</b>	<b>14</b>
<b>Dimensions</b>	<b>16</b>
<b>AC and DC cable requirements – M88H_121 (ST)</b>	<b>18</b>
AC and DC terminal blocks - general information	18
AC cable	19
DC cables	19
<b>AC and DC cable requirements – M88H_122 (CF)</b>	<b>20</b>
AC cable	20
DC cables	21
<b>Special instructions for the use of aluminum cables</b>	<b>22</b>
<b>Communications cable requirements</b>	<b>24</b>
<b>Routing the cables</b>	<b>25</b>
<b>Mounting the inverter</b>	<b>26</b>
<b>Grounding the inverter housing</b>	<b>29</b>
<b>Connecting the mains (AC) – general notes</b>	<b>30</b>
<b>Connecting the mains (AC) – Cable gland M88H_121 (ST)</b>	<b>32</b>
<b>Connecting the mains (AC) – Cable gland M88H_122 (CF)</b>	<b>34</b>
<b>Connecting the mains (AC) – Tips for M88H_121 (ST)</b>	<b>36</b>
<b>Connecting the mains (AC) – Tips for M88H_122 (CF)</b>	<b>37</b>
<b>Connecting solar modules (DC) – cable gland M88H_121 (ST)</b>	<b>38</b>
<b>Connecting solar modules (DC) – 1-/2-MPPT operation M88H_121 (ST)</b>	<b>39</b>
<b>Connecting solar modules (DC) – M88H_122 (CF)</b>	<b>41</b>
<b>Closing the wiring box</b>	<b>44</b>
<b>Overview of communications card</b>	<b>45</b>
<b>Connecting a data logger via RS485</b>	<b>46</b>
<b>Connecting the digital inputs, dry contacts and external power-off (optional)</b>	<b>47</b>
<b>Attaching warning labels to the inverter</b>	<b>48</b>
<b>Commissioning – basic settings</b>	<b>49</b>
Date and time	50
Inverter ID	50
Baud rate for RS485	51
AC connection type	51
External power-off (EPO)	52
Active power limitation	52
Dry contacts (relays)	53
<b>Technical Data – M88H_121 (ST)</b>	<b>54</b>
<b>Technical data – M88H_122 (CF)</b>	<b>56</b>
<b>Customer Service - Europe</b>	<b>60</b>

# Basic safety instructions

## Safety instructions for all M88H

### WARNING



#### Electric shock

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

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

### NOTICE



#### Incorrectly dimensioned solar system.

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

- ▶ When calculating the module string, always pay attention to technical data of the inverter (input voltage range, maximum current and maximum input power), see chapter "Technical Data".

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

## Safety instructions for the M88H\_121 (ST)

### DANGER



#### Electric shock

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

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

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

### DANGER



#### Electric shock

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

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

## Safety instructions for the M88H\_122 (CF)

### DANGER



#### Electric shock

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

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

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

### DANGER













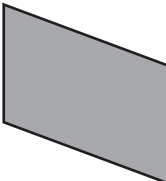


#### Electric shock

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

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













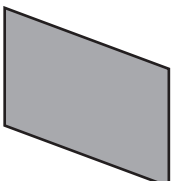
## Scope of delivery – M88H\_121 (ST)

Part	Description	Part	Description
M88H_121 inverter with wiring box	1 	Mounting plate	1 
Cover caps	2 		1 
Cable gland for AC feed-through	1  For feeding the AC cable into the junction box.	M6 grounding screw	1  For grounding the inverter housing; with spring washer, washer and toothed lock washer; mounted on the inverter.
Cable gland for DC feed-through	2  For feeding the DC cable into the junction box.	Screening plate for the air inlet	2  For covering the air inlets and preventing the entry of small animals.
Cable gland for the communication connection	1  For fastening the communication cables to the junction box.	Quick installation guide and basic safety instructions	1  <small>Quick Installation Guide</small> <small>See these models M88H_121 (ST) and M88H_120 (ST) Product Manual 12</small> <small>EN DE FR</small> 
M6 mounting screw	4  For fastening the wiring box to the mounting plate; with spring washer and washer.	Display cover	1  To protect the display against damage



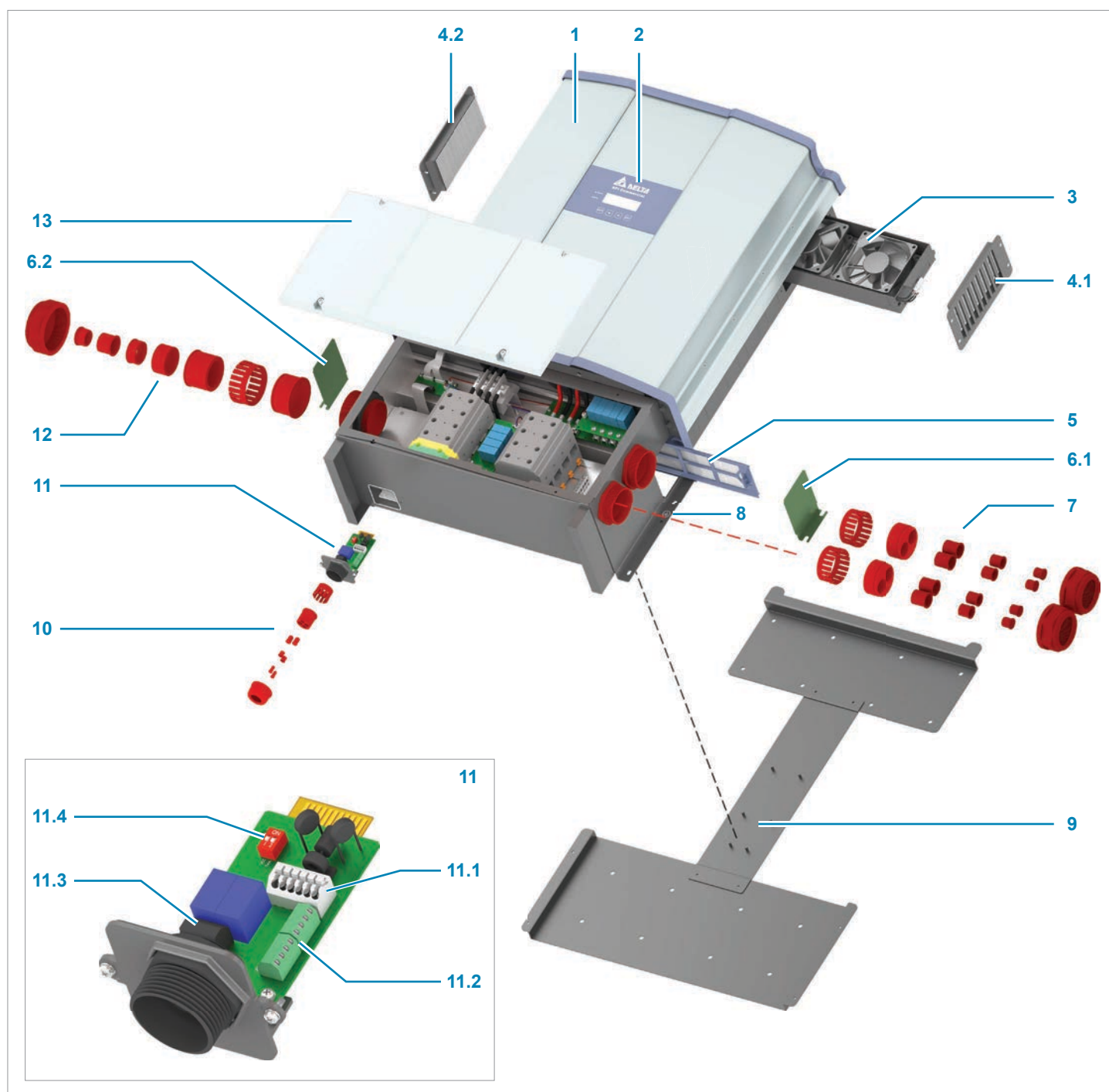
Check the delivery for completeness and all components for damage before starting installation work.  
Do not use any damaged components.  
Keep the packaging.

## Scope of delivery – M88H\_122 (CF)

Part	Description	Part	Description
M88H_122 inverter with wiring box	1 	Mounting plate	1 
For closing the upper cable feed-throughs on the wiring box when the inverter part is disconnected. The cover caps are fitted to the mounting plate.			
Cover caps	2 		1 
Multi-Contact MC4-plug for DC + (32.0017P0001-UR for 4/6 mm <sup>2</sup> )			
DC plug	18 	M6 grounding screw	1 
Multi-Contact MC4-plug for DC– (32.0016P0001-UR for 4/6 mm <sup>2</sup> )			
	18 	M6 mounting screw	4 
For feeding the AC cable into the junction box			
Cable gland for the AC connection	1 	Cable gland for the communication connection	1 
For covering the air inlets and preventing the entry of small animals.			
Quick installation guide and basic safety instructions	1 	Screening plate for the air inlet	2 
To protect the display against damage			
		Display cover	1 



# Components of the M88H\_121 (ST) inverter



- |      |   |    |  |
|------|---|----|--|
| 1    | Power module                                      | 8  | Grounding connection                         |
| 2    | Display, buttons, and LED                         | 9  | Mounting plate                               |
| 3    | Fan module  | 10 | Cable gland for the communication connection |
| 4    | Filter for air outlet (2x)                        | 11 | Communication card                           |
| 5    | Filter for air inlet                              | 12 | AC cable gland                               |
| 6    | Cover panel for the air inlet (2x)                | 13 | Cover panel for the wiring box               |
| 7    | DC cable gland (2x)                               |    |  |
| 11.1 | RS485 connection                                  |    |  |
| 11.2 | Digital inputs                                    |    |  |
| 11.3 | Dry contacts                                      |    |  |
| 11.4 | DIP switch for VCC and RS485 termination resistor |    |  |



# Components of the M88H\_121 (ST) inverter

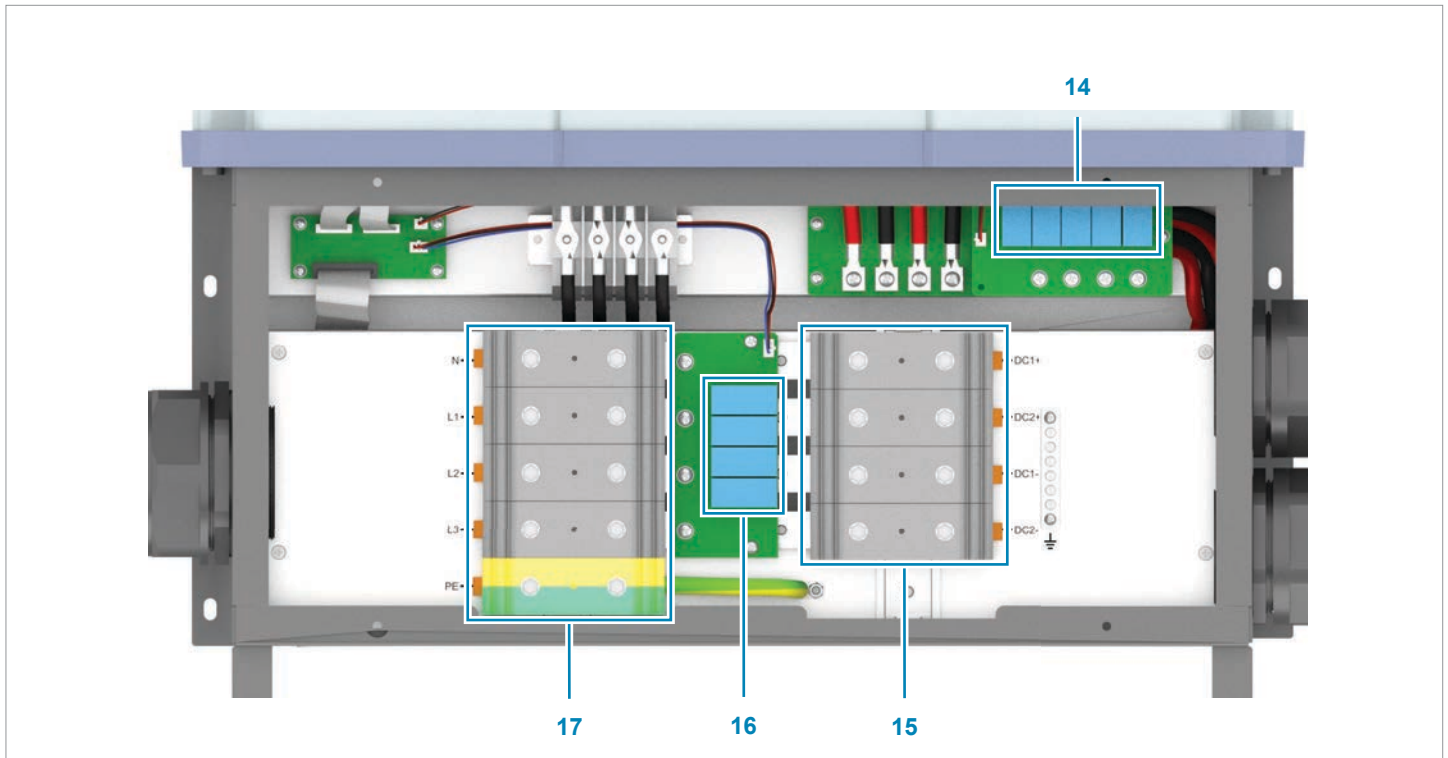
## DANGER



### Modified design of the DC connections

The design of the DC connections on the DC terminal block has changed in comparison with previous versions of the M88H\_121 (ST)!

- You must comply with the correct use of plus (+) and minus (-) when connecting the DC cables.



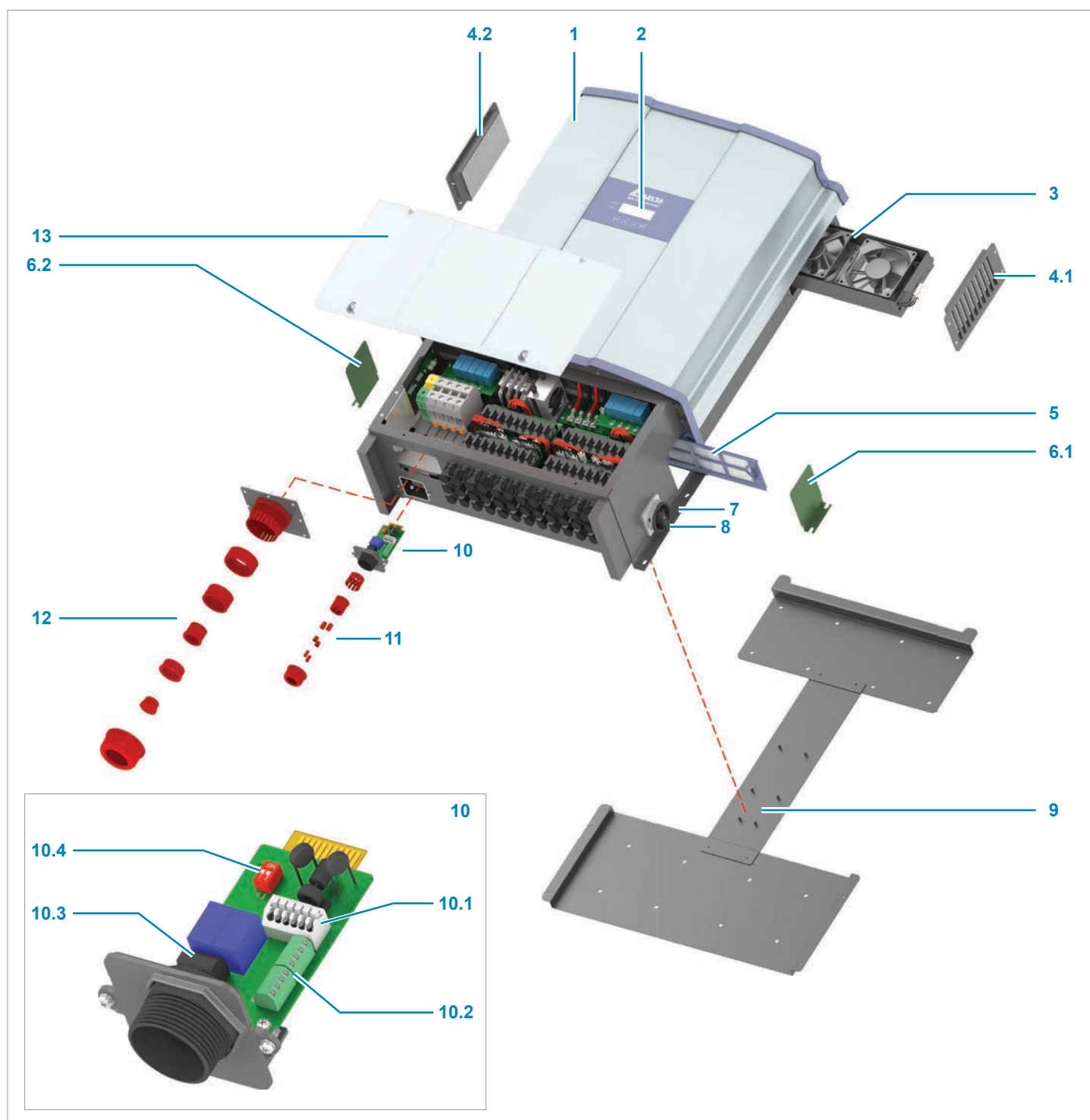
**14** DC surge protection devices

**15** DC terminal block

**16** AC surge protection devices

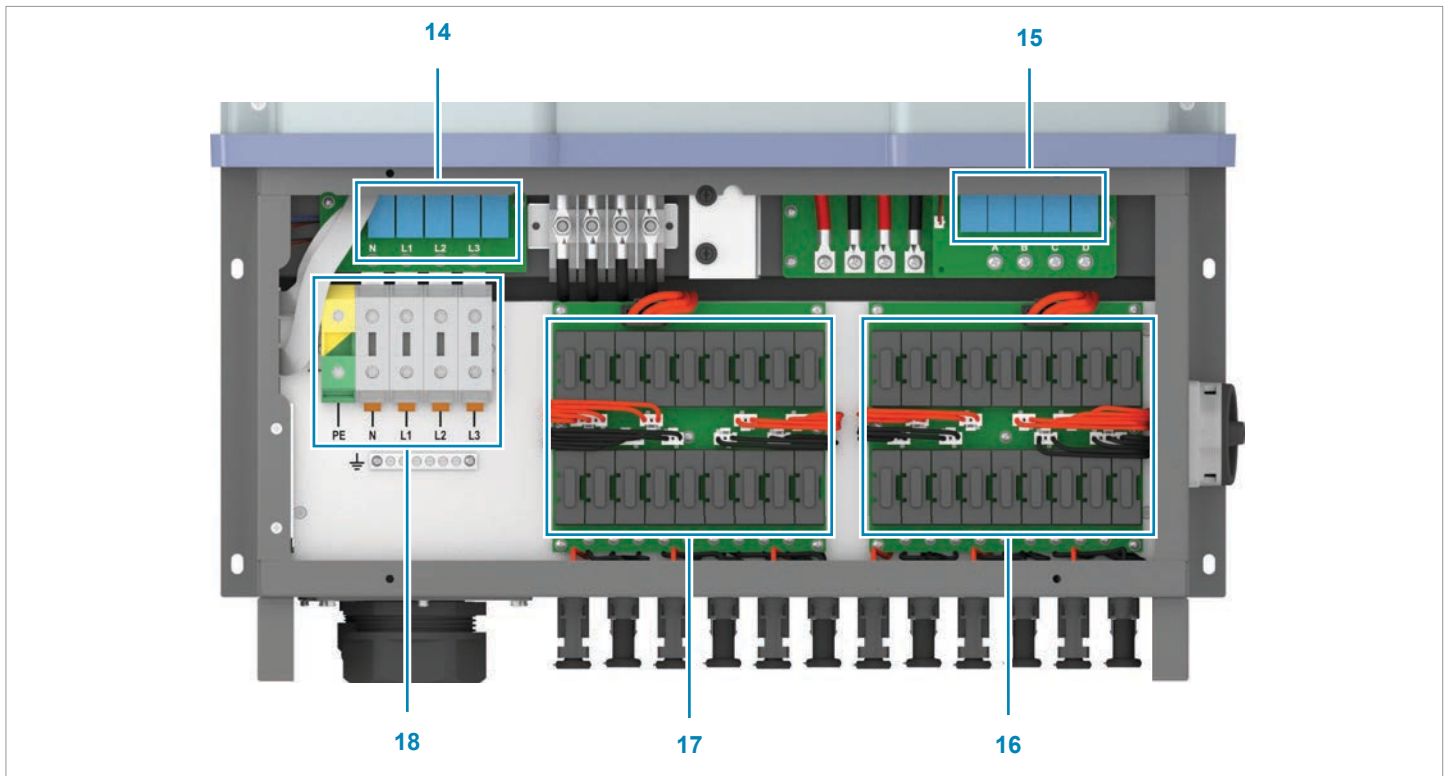
**17** AC terminal block

## Components of the M88H\_122 (CF) inverter



- |      |   |    |  |
|------|---|----|--|
| 1    | Power module                                      | 8  | DC isolating switch                          |
| 2    | Display, buttons, and LED                         | 9  | Mounting plate                               |
| 3    | Fan module  | 10 | Communication card                           |
| 4    | Filter for air outlet (2x)                        | 11 | Cable gland for the communication connection |
| 5    | Filter for air inlet                              | 12 | AC cable gland                               |
| 6    | Cover panel for the side air inlet (2x)           | 13 | Cover panel for the wiring box               |
| 7    | Grounding connection                              |    |  |
| 10.1 | RS485 connection                                  |    |  |
| 10.2 | Digital inputs                                    |    |  |
| 10.3 | Dry contacts                                      |    |  |
| 10.4 | DIP switch for VCC and RS485 termination resistor |    |  |

## Components of the M88H\_122 (CF) inverters



**14** AC surge protection devices  
**15** DC surge protection devices

**16** DC1 string fuses  
**17** DC2 string fuses

**18** AC terminal block

# Display, buttons, and LEDs



<b>GRID</b>	Grid	Green LED. Lights up when the inverter is supplying electricity to the mains grid.
<b>ALARM</b>	Alarm	Red LED. Indicates an error, a failure or a warning.

	EXIT	Exit the current menu. Cancel the setting for a parameter. Changes are not adopted.
	Down	Move downwards in the menu. Reduce the value of a configurable parameter.
	Up	Move upwards in the menu. Increase the value of a configurable parameter.
	ENTER	Select menu item. Open a configurable parameter for editing. Cancel the setting for a parameter. Changes are adopted.

## Information on the type plate

	<b>Danger to life through electric shock</b> Potentially fatal voltage is present inside the inverter during operation and this voltage remains present for up to 100 seconds after disconnection from the power supply. Only the wiring box may be opened. All other device parts may not be opened.
	Before working on the inverter, read the supplied manual and follow the instructions contained therein.
	This inverter is not separated from the grid by a transformer.
	The housing of the inverter must be grounded if this is required by local regulations.
	WEEE mark The inverter must not be disposed of as standard household waste, but in accordance with the applicable electronic waste disposal regulations of your country or region.
	This regulatory symbol does not apply to the EU because the noise level lies below the EU guidelines.

## Hazard zones in the wiring box

### DANGER



#### Electric shock

The cover in the interior of the terminal box does **not** need to be removed for cabling work. All connections are accessible, even when the internal cover is installed.

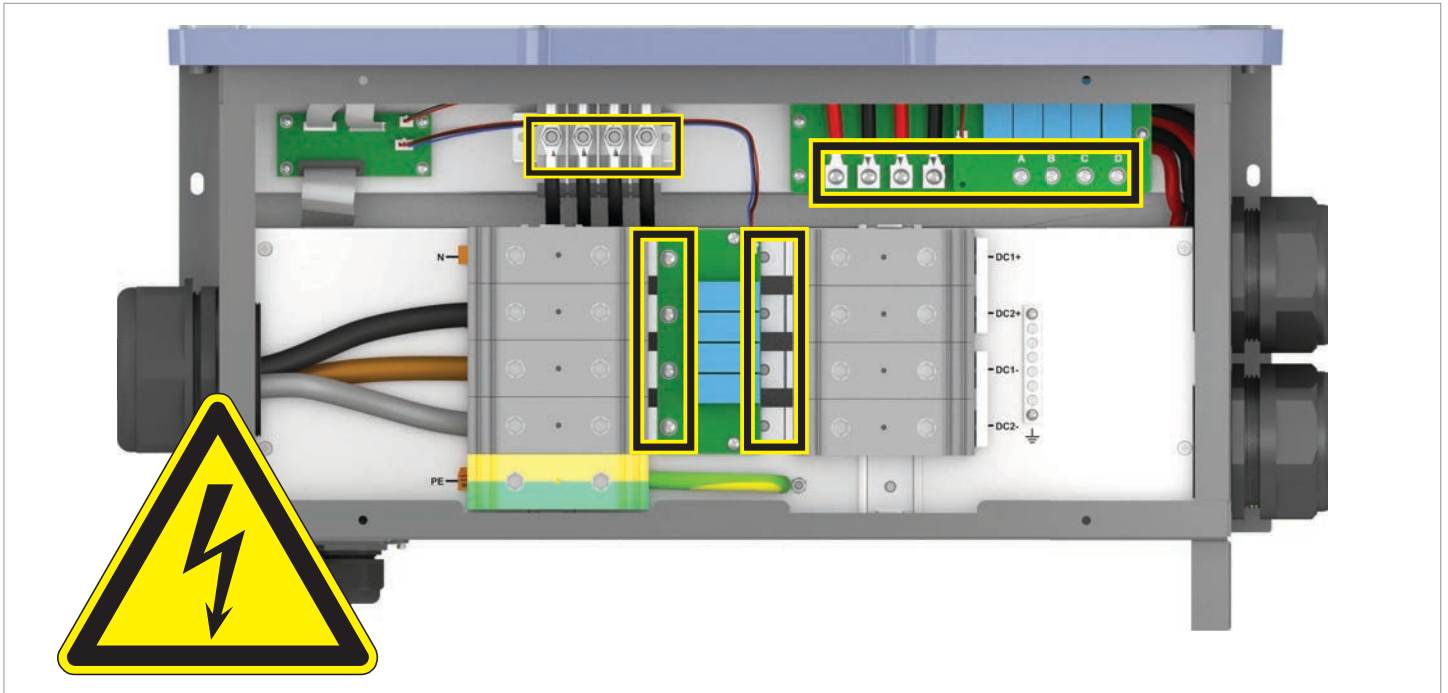
### DANGER



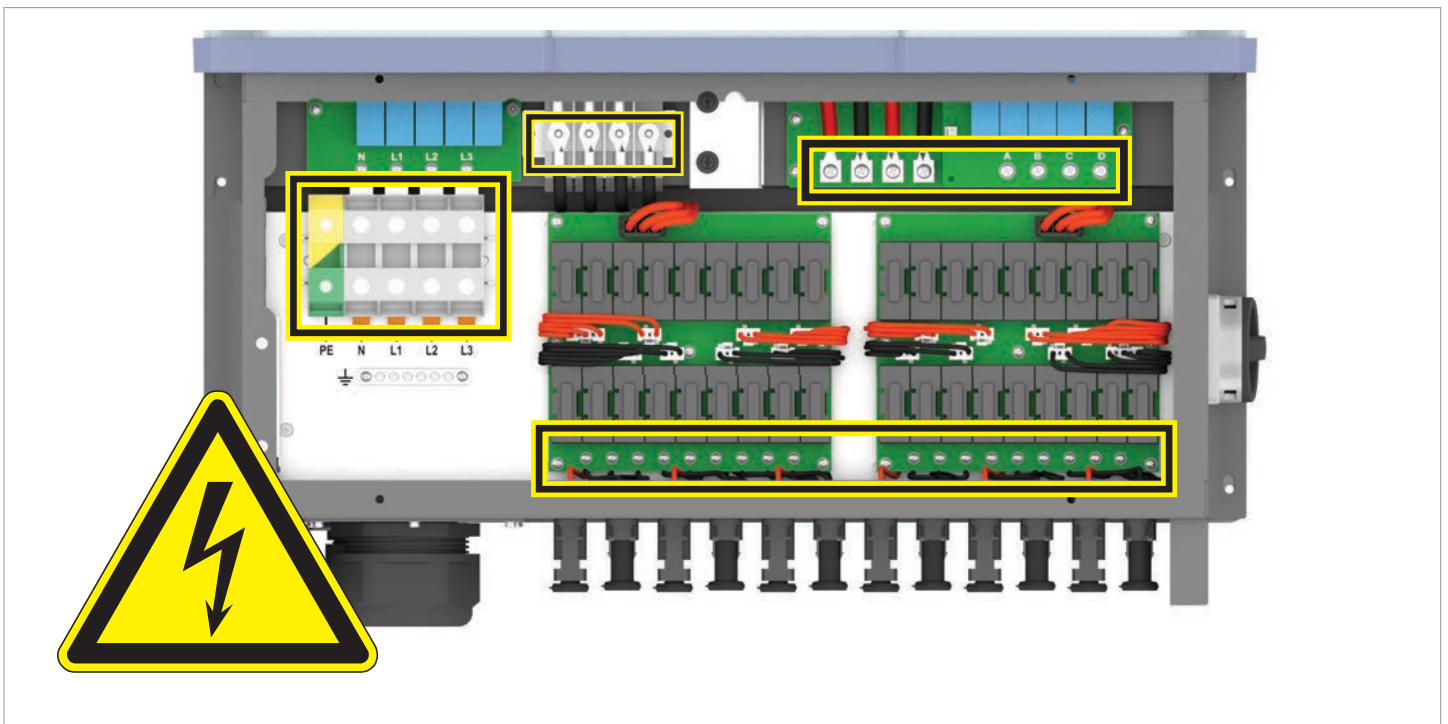
#### Modified design of the DC inputs

The design of the DC inputs on the DC terminal block has changed in comparison with previous versions of the M88H\_121 (ST)!

- You must comply with the correct use of plus (+) and minus (-) when connecting the DC cables.



Hazard zones with potentially life-threatening currents and voltages – M88H\_121 (ST)

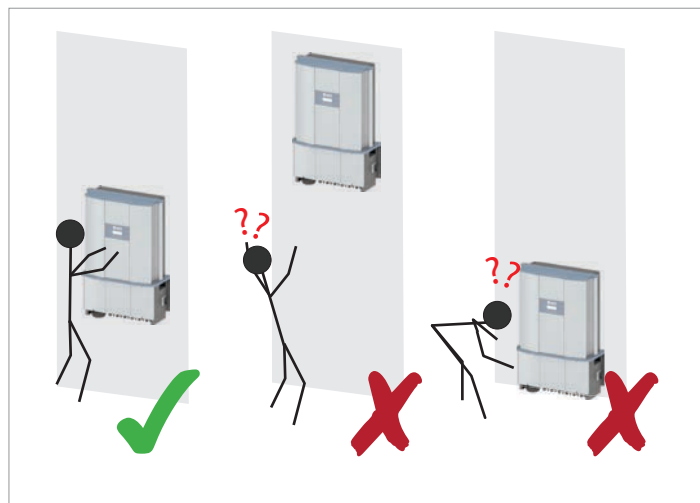


Hazard zones with potentially life-threatening currents and voltages – M88H\_122 (CF)

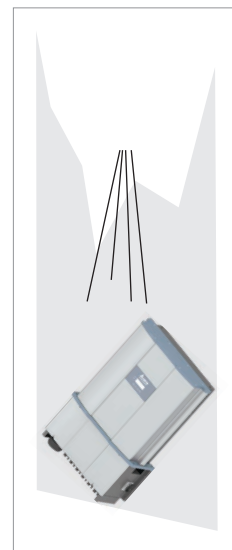
# Planning the installation

## Installation location of the inverter

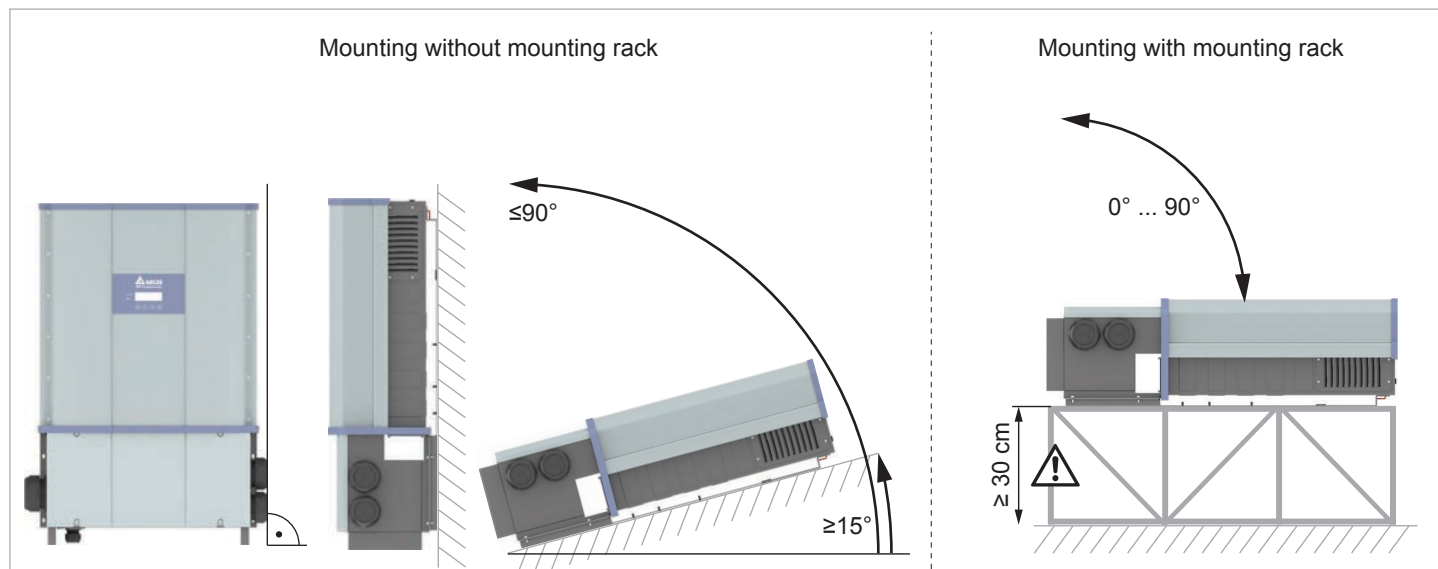
- Attach the inverter so that the information on the display can be read and the buttons can be operated without any problems.



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

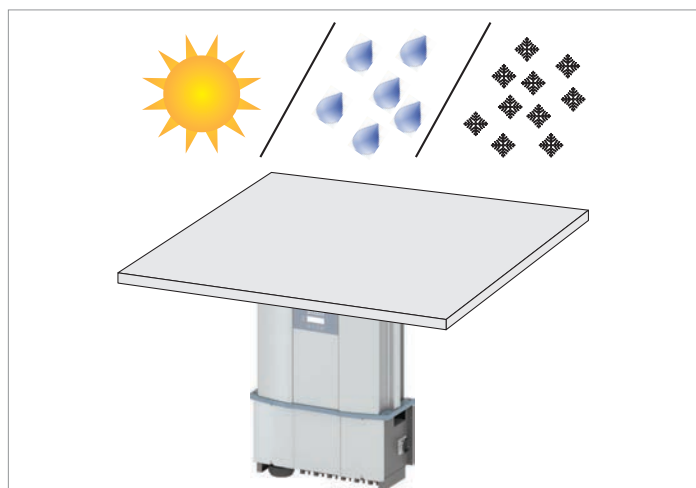


## Mounting alignment



## Outdoor installations

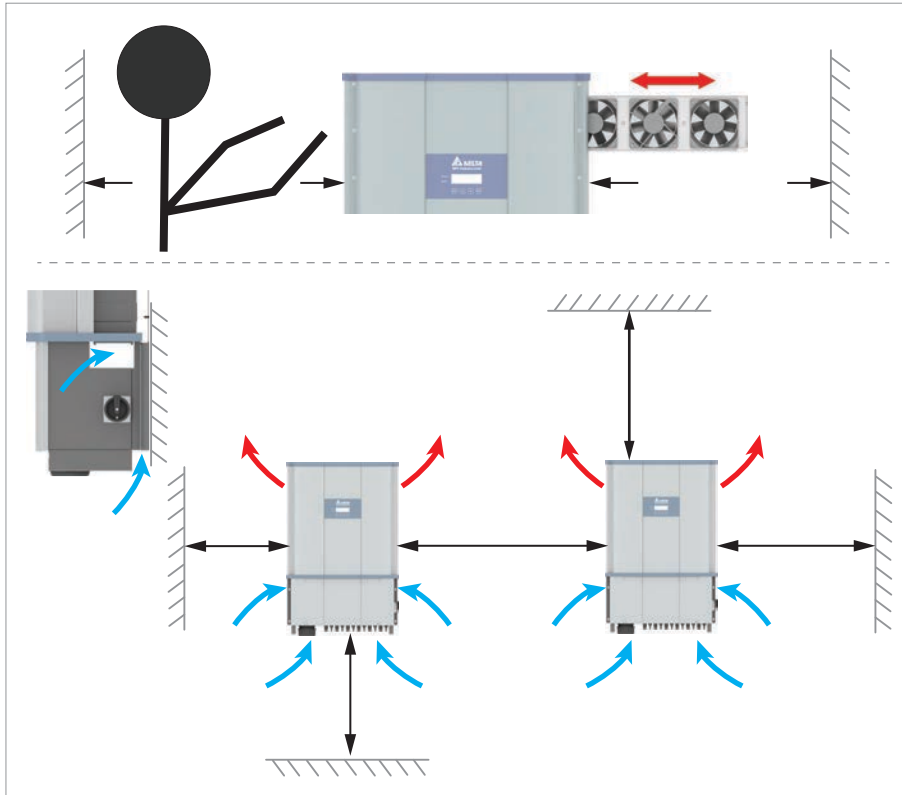
- The inverter has a protection degree of IP65 and can be installed indoors and outdoors. Despite this, the inverter should be protected by a roof against direct solar irradiation, rain and snow. For example, the power of the inverter will be reduced if it is too heavily heated by solar radiation. This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





# Planning the installation

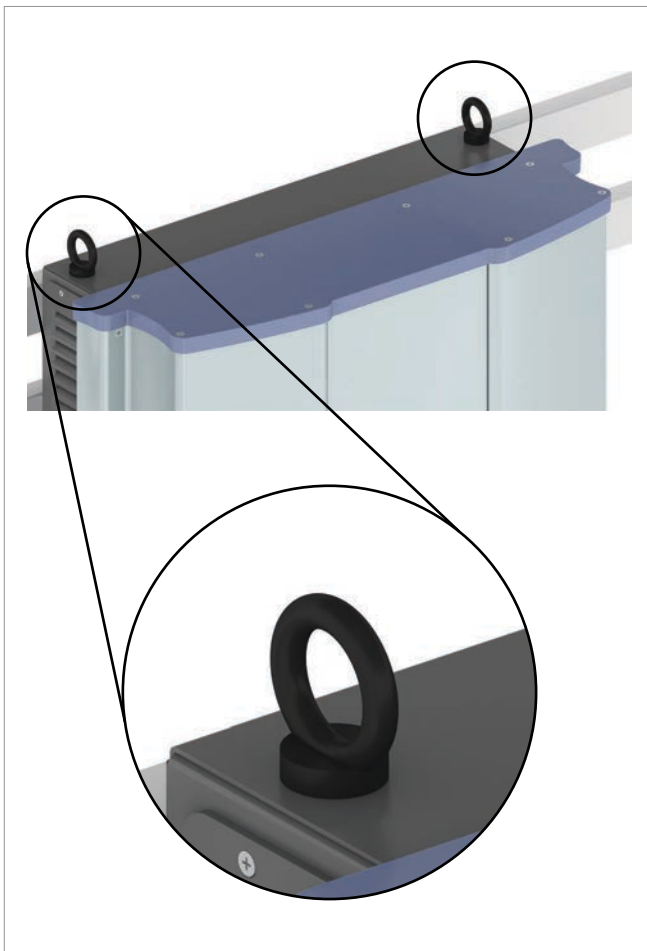
## Installation clearances and air circulation



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

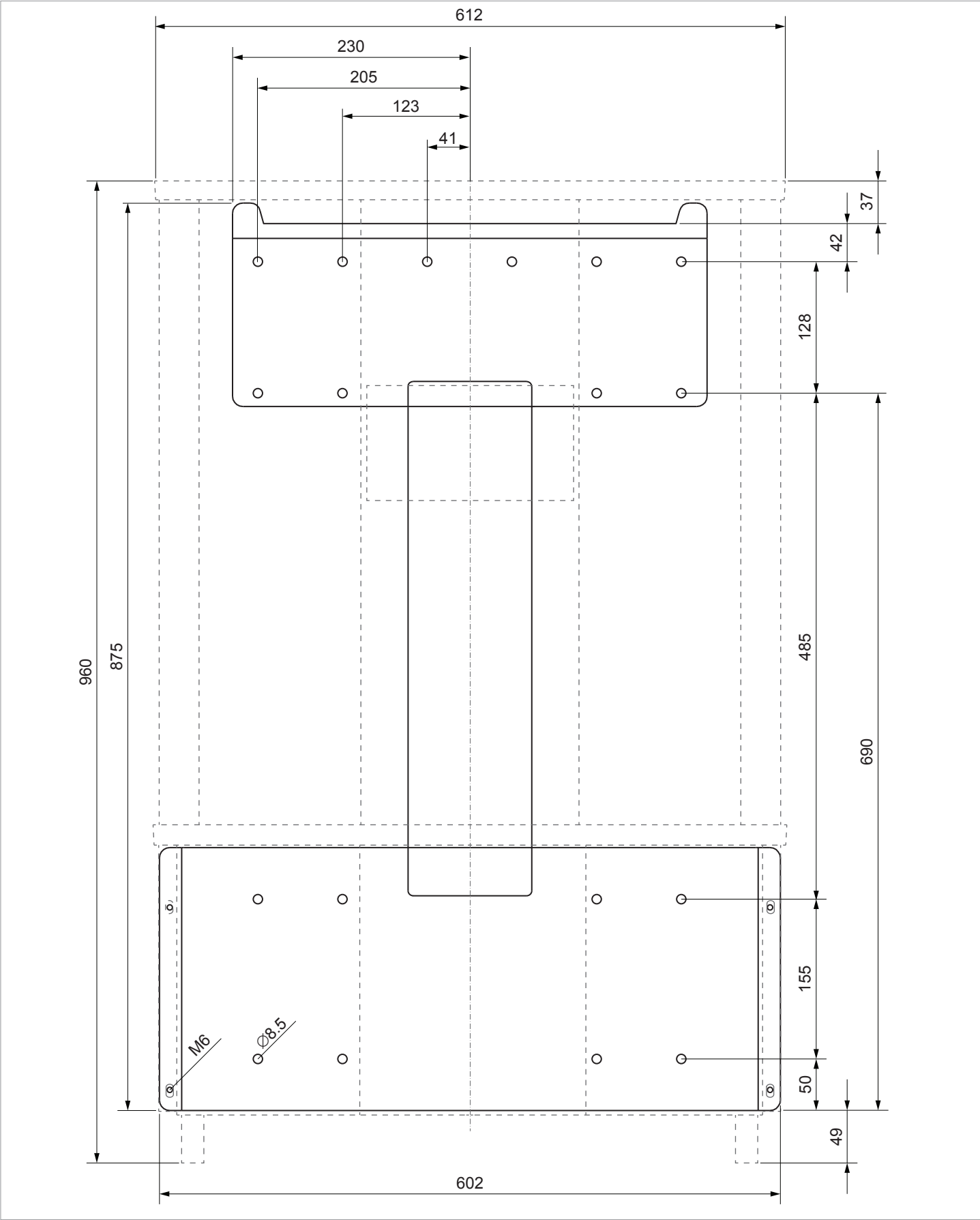
## Lifting and transporting the inverter

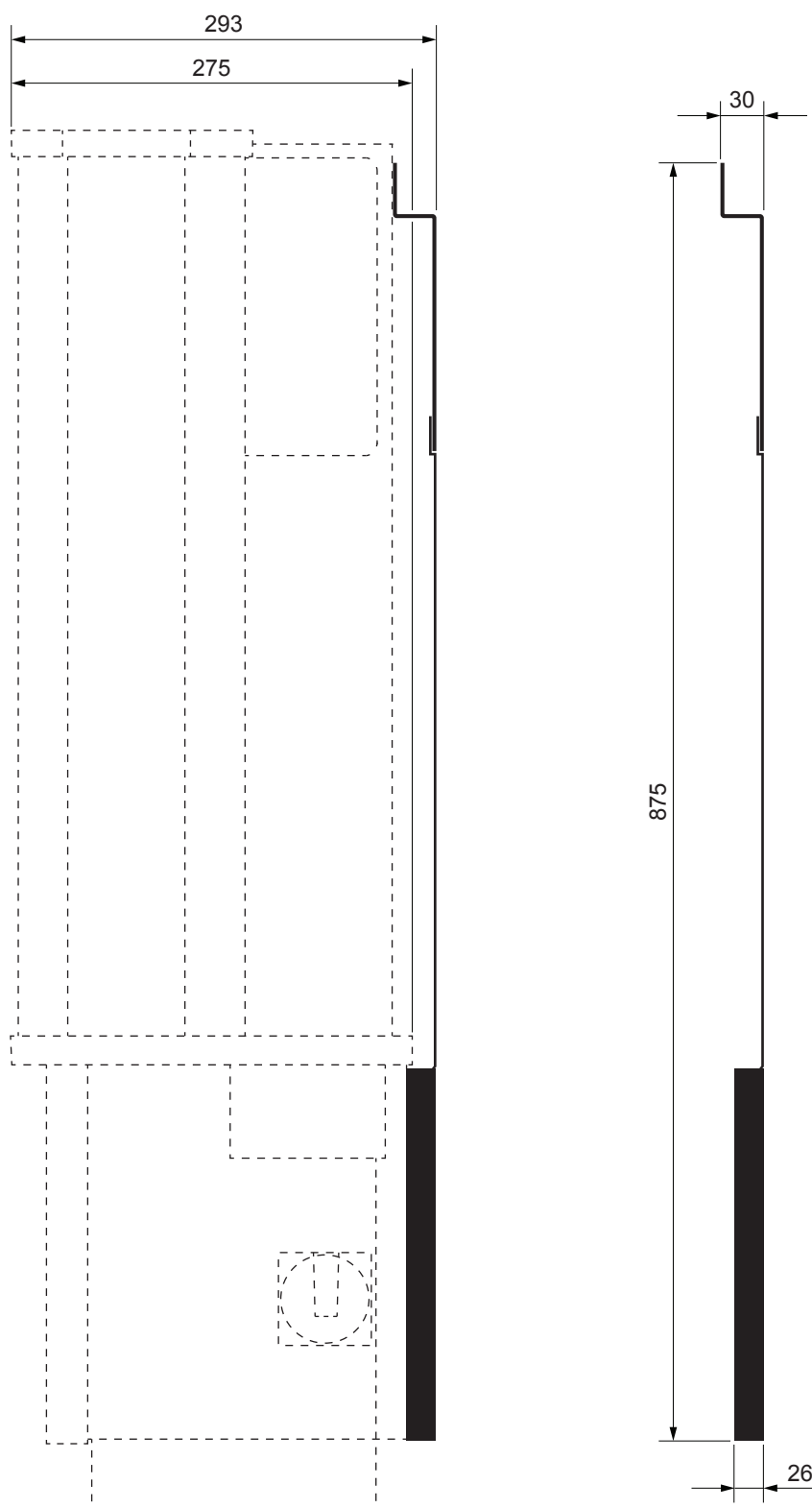
- Screw eyebolts onto the upper side of the inverter. The screw eyebolts are not included in the scope of delivery.
- Lift the inverter with a block and tackle or crane.





Dimensions





# AC and DC cable requirements – M88H\_121 (ST)

## AC and DC terminal blocks - general information

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

AC and DC terminal blocks are of the same type.



The specifications in this section have been defined by Phoenix Contact. Check if the technical specifications have change before starting installation work, see [www.phoenixcontact.com](http://www.phoenixcontact.com).

### NOTICE



#### Danger of a cable fire.

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

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

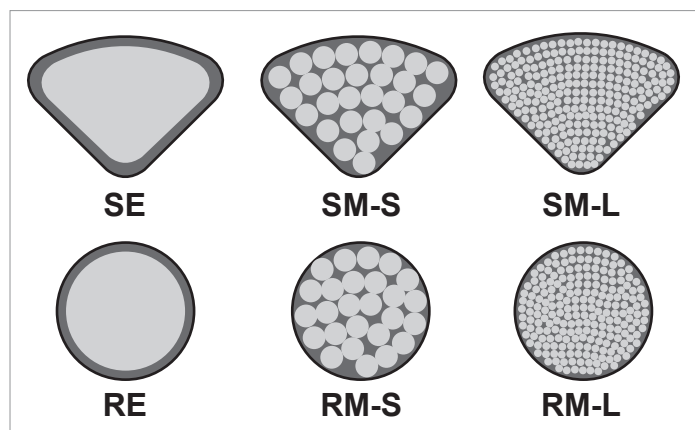
### AC and DC terminal block specifications

Designation	Phoenix Contact UKH 150
Connection type	Screws with hexagon socket head
Screw thread	M10
Rated current $I_N$	309 A
Rated voltage $U_N$	1000 V
Attaching the conductor	
Type of attachment	M10 screws with hexagon socket head
Tightening torque	25 ... 30 Nm

### Specification for copper cable

Min./max. Wire cross-section	
Without wire end sleeve	
• rigid cable	35 ... 150 mm <sup>2</sup>
• flexible cable	50 ... 150 mm <sup>2</sup>
with wire end sleeve	
• Flexible cable (wire end sleeve without plastic sleeve)	50 ... 150 mm <sup>2</sup>
• flexible cable (wire end sleeve with plastic sleeve)	50 ... 150 mm <sup>2</sup>
Stripping length	40 mm

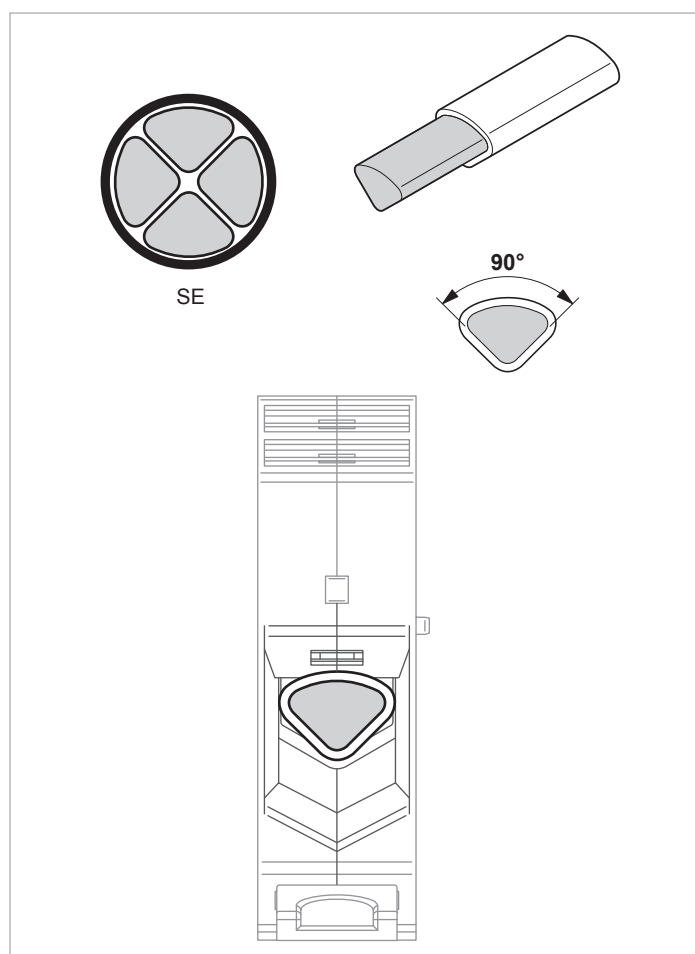
### Specification for aluminum cable



SE	sector-shaped, <b>solid</b> conductor
SM-S	sector-shaped, <b>multi-conductor</b> , rigid wires
SM-L	sector-shaped, <b>multi-conductor</b> , (stranded wires)
RE	round, <b>solid</b> conductor
RM-S	round, <b>multi-conductor</b> , rigid wires
RM-L	round, <b>multi-conductor</b> , (stranded wires)

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

Min./max. Conductor cross-section	120 / 150 mm <sup>2</sup>
Stripping length	40 mm



If other types of aluminum cables are used, Al-Cu crimped connectors (such as those from Klauke, Elpress or Mecatracton) must be used, see [“Special instructions for the use of aluminum cables”](#), page 22.

# AC and DC cable requirements – M88H\_121 (ST)

## AC cable

### AC cable gland



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

Min./max. Cable diameter 23.9 ... 65.9 mm

### Notes on calculating the cable cross-section

Consider the following factors when calculating the cable diameter:

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

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

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

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

## DC cables

### DC cable gland



The inverter has 2 DC cable glands with 2 cable feed-throughs each.

Min./max. Cable diameter 12.4 ... 25.7 mm

### Instructions for the use of aluminum cables

See [“Special instructions for the use of aluminum cables”, page 22.](#)

# AC and DC cable requirements – M88H\_122 (CF)

## AC cable

### General information on AC terminal block

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



The specifications in this section have been defined by Phoenix Contact. Check if the technical specifications have change before starting installation work, see [www.phoenixcontact.com](http://www.phoenixcontact.com).

### ATTENTION



#### Danger of a cable fire.

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

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

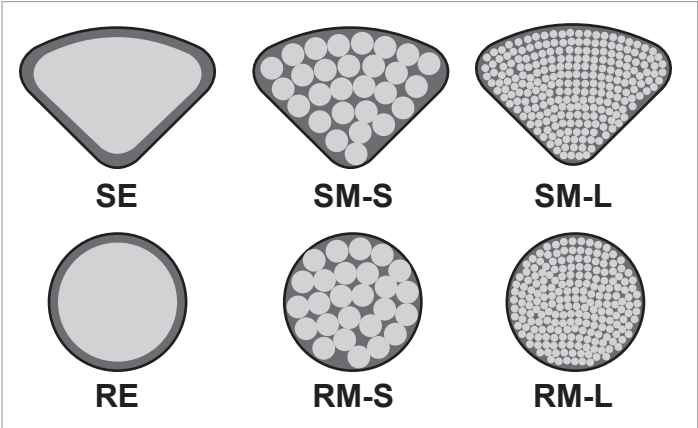
### AC terminal block specifications

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

### Specification for copper cable

Min./max. Wire cross-section	
Without wire end sleeve	
• rigid cable	16 ... 95 mm <sup>2</sup>
• flexible cable	25 ... 70 mm <sup>2</sup>
with wire end sleeve	
• Flexible cable (wire end sleeve without plastic sleeve)	16 ... 70 mm <sup>2</sup>
• flexible cable (wire end sleeve with plastic sleeve)	16 ... 70 mm <sup>2</sup>
Stripping length	24 mm

### Specification for aluminum cable

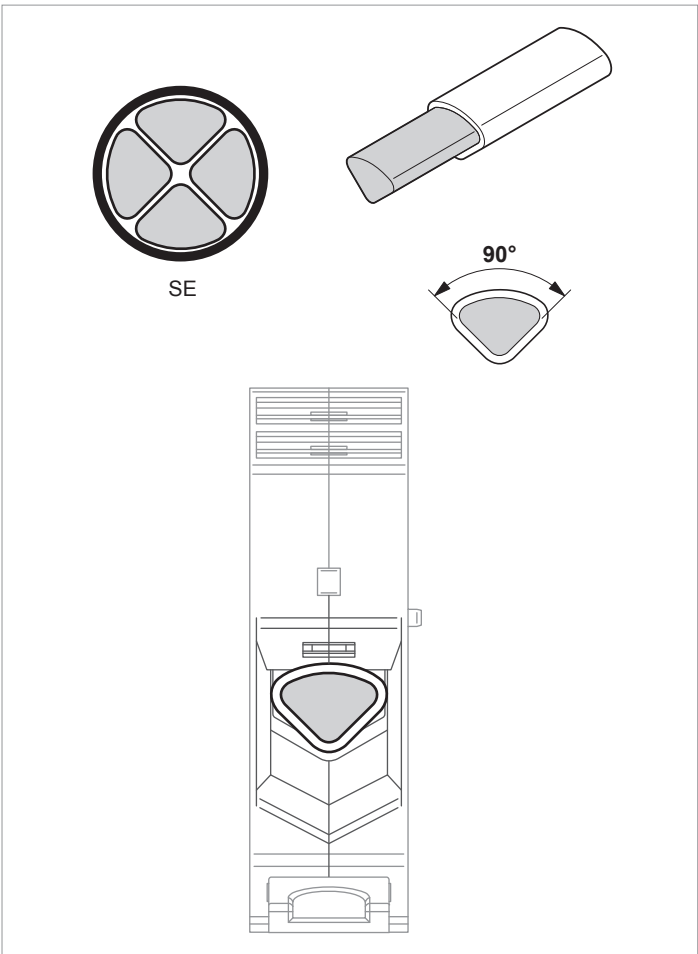


#### The most important cable types for aluminum cable

SE	sector-shaped, <b>solid</b> conductor
SM-S	sector-shaped, <b>multi-conductor</b> , rigid wires
SM-L	sector-shaped, <b>multi-conductor</b> , (stranded wires)
RE	round, <b>solid</b> conductor
RM-S	round, <b>multi-conductor</b> , rigid wires
RM-L	round, <b>multi-conductor</b> , (stranded wires)

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

Min./max. Conductor cross-section	50 / 70 mm <sup>2</sup>
Stripping length	24 mm



# AC and DC cable requirements – M88H\_122 (CF)



Check whether it is permissible in your country to utilize sector-shaped, solid aluminum cables.

Al-Cu crimped connectors (such as those from Klauke, Elpress or Mecatraction) must be used for all other types of aluminum conductors, see [“Special instructions for the use of aluminum cables”](#), page 22.

## AC cable gland



The inverter has 1 AC cable gland with 1 cable feed-through.  
Min./max. Cable diameter 23.9 ... 51.3 mm

### Notes on calculating the cable cross-section

Consider the following factors when calculating the cable diameter:

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

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

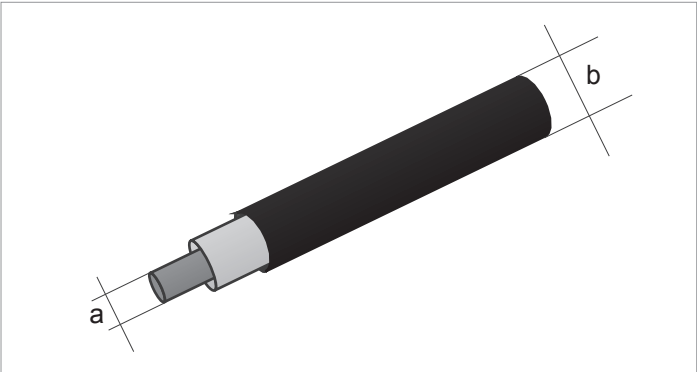
France: Follow the installation instructions of UTE 15-712-1. This standard contains the requirements for minimum cable diameters and for avoiding overheating due to high currents.

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

## DC cables

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

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



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

a	b	Multi-contact
mm <sup>2</sup>	mm	
4/6	3-6	32.0014P0001-UR
	5.5-9	32.0016P0001-UR <sup>1)</sup>
10	5.5-9	32.0034P0001-UR
4/6	3-6	32.0015P0001-UR
	5.5-9	32.0017P0001-UR <sup>1)</sup>
10	5.5-9	32.0035P0001-UR
4/6	3-6	32.0015P0001-UR
	5.5-9	32.0017P0001-UR

<sup>1)</sup> Included in delivery

# Special instructions for the use of aluminum cables



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

## Handling aluminum conductors during installation work

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

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

## ATTENTION



### Extreme temperature rise at the clamping point

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

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

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

## Instructions regarding selection and utilization of Al-Cu crimped connectors

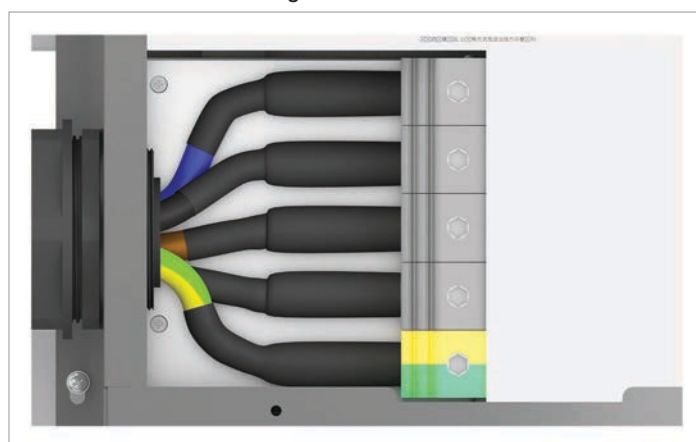
Observe the following instructions when using aluminum cables with Al-Cu crimped connectors (such as those from Klauke, Elpress or Mecatracton) and heat-shrink sleeving.

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



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

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

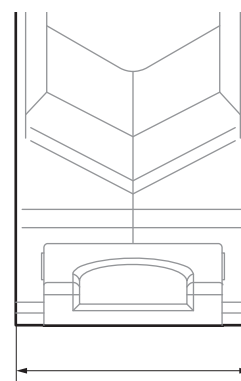
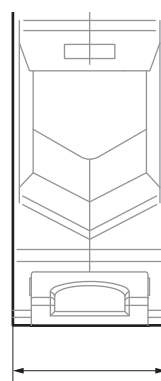


*AC cabling using aluminum cables, crimp connectors and heat-shrink sleeving*

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

UKH 70 (M88H\_122 CF)

UKH 150 (M88H\_121 ST)

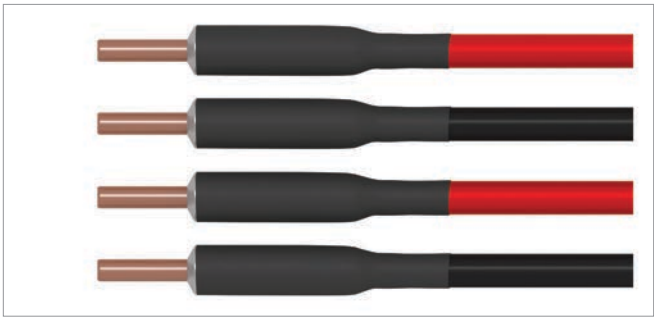


*Width of a clamping point on the terminal block*

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

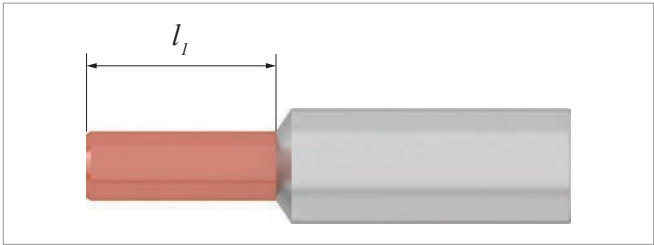


# Special instructions for the use of aluminum cables



*Pull the heat-shrink sleeving over the complete aluminum part*

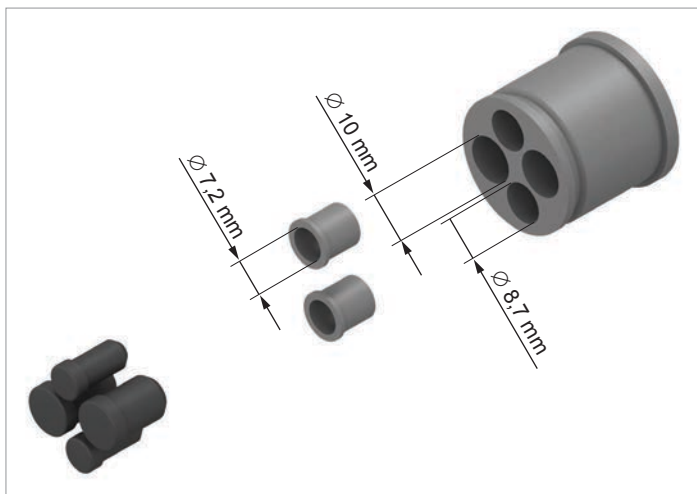
- The length of the copper bolt on the Al-Cu crimped connector must be approximately equal to the stripping length specified for copper cable by the manufacturer of the terminal block (see “AC and DC terminal block specifications”, page 18 for the M88H\_121 or “AC terminal block specifications”, page 20 for the M88H\_122):



Type	Stripping length	$l_1$ Copper bolts
UKH 70	24 mm	$\approx 24$ mm
UKH 150	40 mm	$\approx 40$ mm

# Communications cable requirements

## Cable gland



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

### Cable requirements

- Shielded twisted-pair cable (CAT5 or CAT6)
- Cable diameter: 7.2 / 8.7 / 10.0 mm
- Wire cross-section: 0.25 ... 1.5 mm<sup>2</sup>

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

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

## Routing the cables

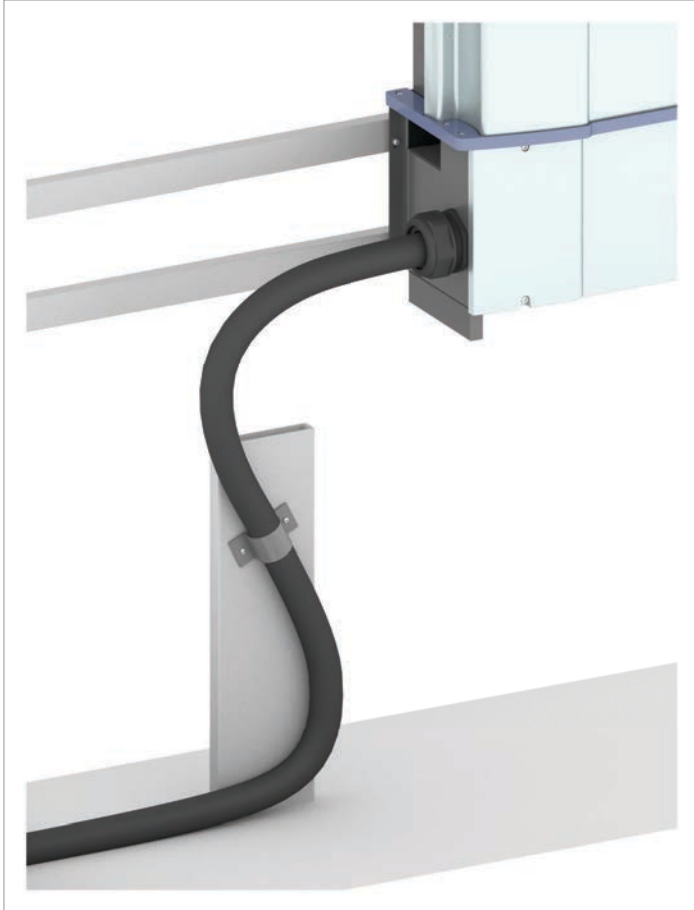
This section describes the optimum routing for the cables in the region of the inverter.



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

### AC cable

Fasten the cable with a strain relief element.



*Recommended feeding of the AC cable for the M88H\_121 (ST)*



*Recommended feeding of the AC cable for the M88H\_122 (CF)*

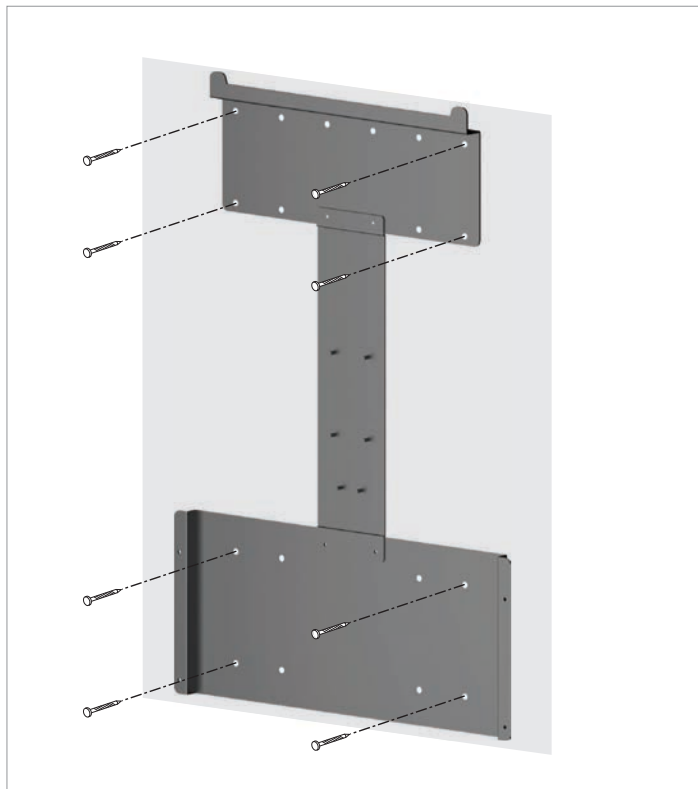
### Communications cables

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

# Mounting the inverter

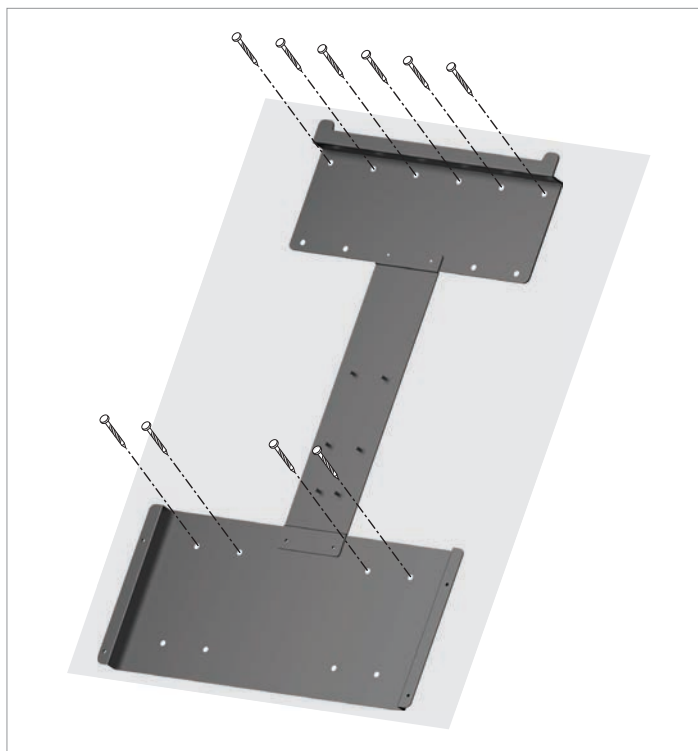


The illustrations in this section show the M88H\_121 (ST). The procedure for the M88H\_122 (CF) is identical.



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

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



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

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

## Mounting the inverter



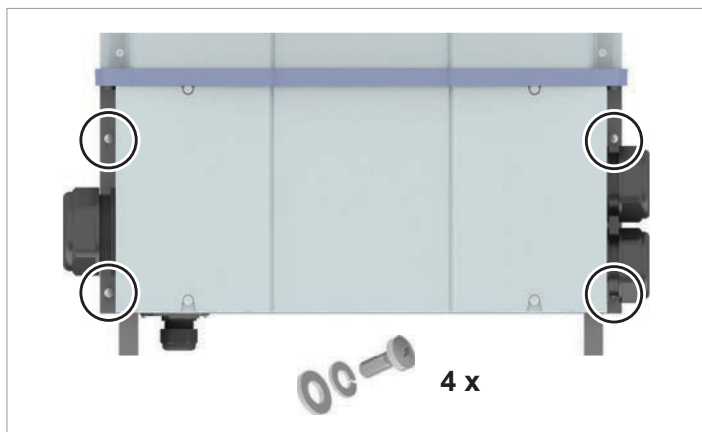
2. Mount the inverter on the mounting plate.



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



## Mounting the inverter



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

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



## Grounding the inverter housing



The illustrations in this section show the M88H\_121 (ST). The procedure for the M88H\_122 (CF) is identical.

### 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 mains and solar modules.
- ▶ The grounding cable cross-section must be at least 6 mm<sup>2</sup>.

### 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. Bolt the grounding cable onto the inverter. M6 screw, spring washer, washer, and toothed lock washer are already mounted on the inverter.

2. Perform a continuity check of the grounding connection. If there is no sufficient conductive connection, scratch away the paint from the inverter housing under the toothed lock washer to achieve a better electrical contact.



# Connecting the mains (AC) – general notes

## ATTENTION



### Ingress of moisture

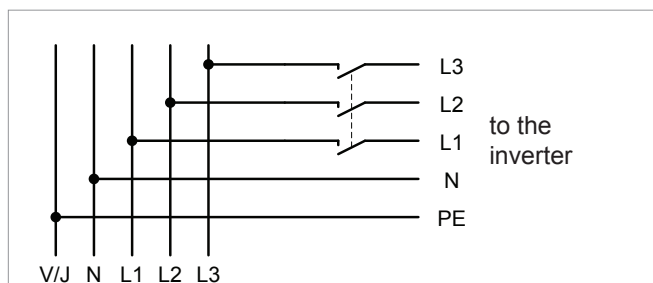
If the wiring box cover is removed, the degree of protection is no longer IP65.

- ▶ Only remove the cover when the inverter is in a dry environment.

## Important safety instructions

- ▶ Always follow the specific regulations of your country or region.
- ▶ Always follow the specific regulations of your energy provider.
- ▶ Install all stipulated safety and protective devices (such as automatic circuit breakers and/or surge arresters).
- ▶ Protect the inverter with a suitable upstream circuit breaker:

Upstream line protection 125 A



- ▶ Selection of the protective devices for the network cable to the transformer of the mains feed-in point: Always take into account the impedance between the PE of the inverter and the system and/or operational ground of the distribution network. This applies in particular for TT and IT networks.

## 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  $\geq 300$  mA



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

## 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.

## Integrated string fuses and surge protection devices

- ▶ Replace damaged string fuses with devices of the same type and from the same manufacturer.
- ▶ Surge protection devices are available from Delta.

## Grounding the inverter

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

## 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

## Requirements for the mains voltage

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

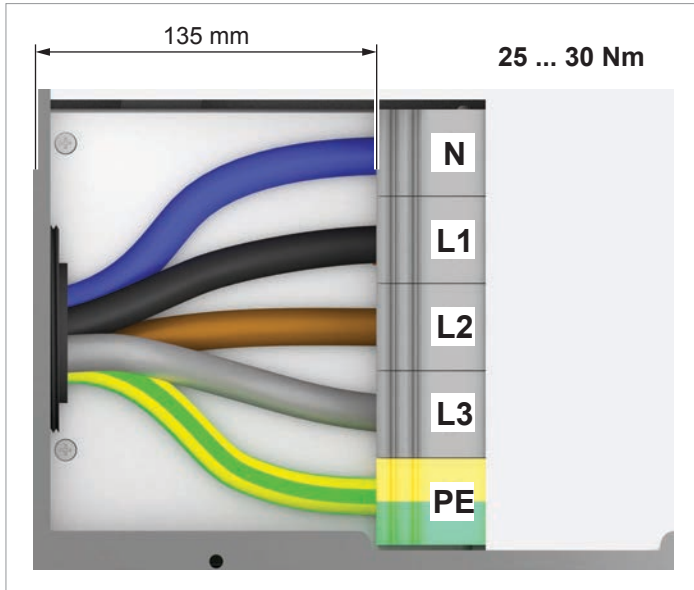
## Tools

Use an insulated torque wrench with an Allen key bit for the contact screws.

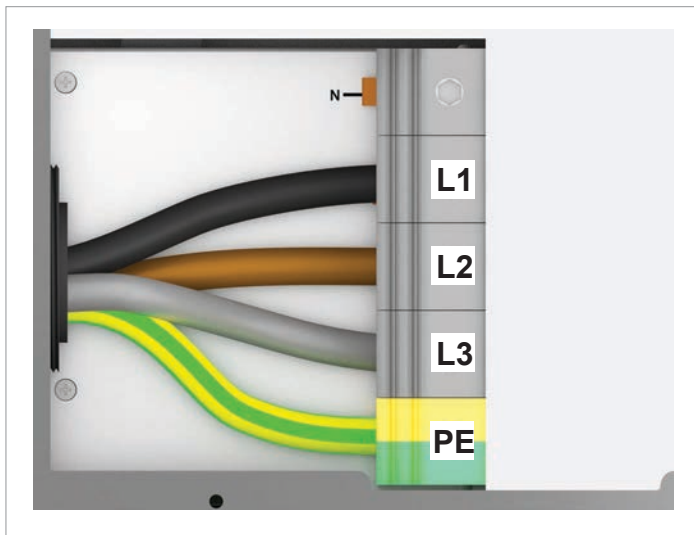


# Connecting the mains (AC) – general notes

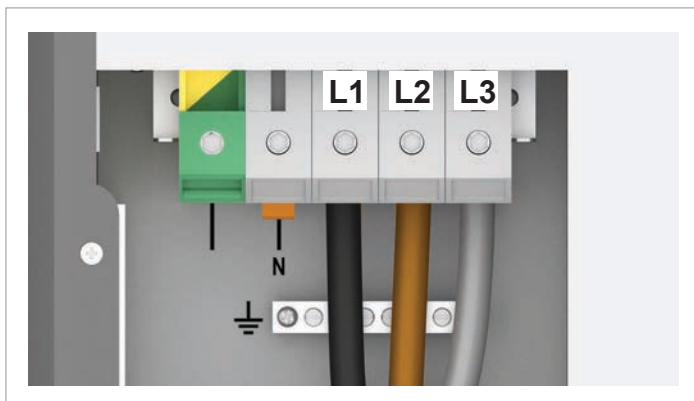
## Wiring examples for the M88H\_121 (ST)



Wiring example 1: With PE conductor, with neutral conductor

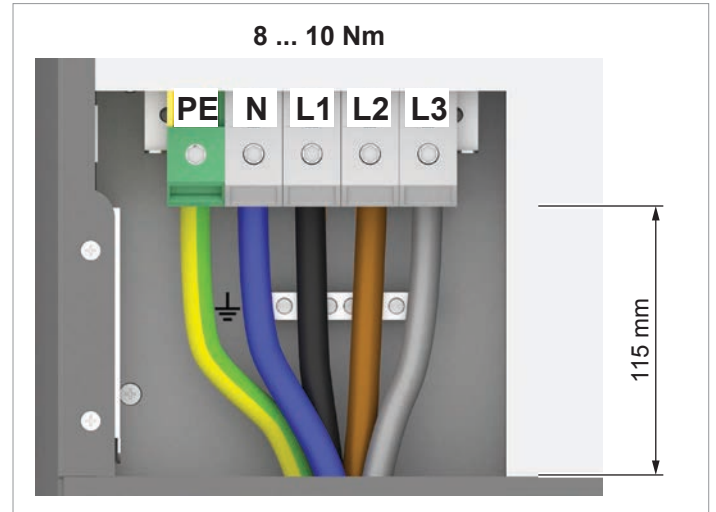


Wiring example 2: With PE conductor, without neutral conductor

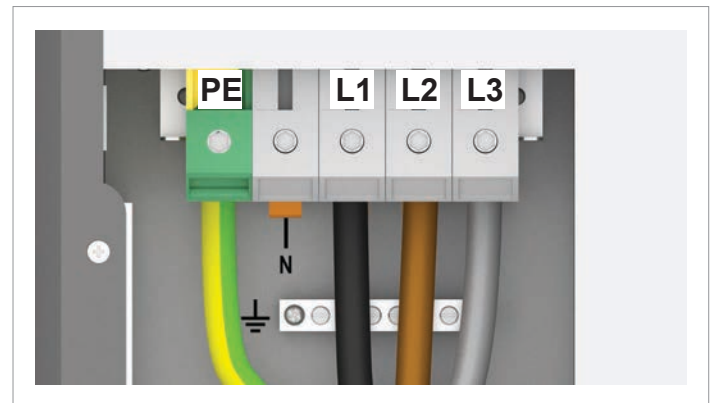


Wiring example 3: Without PE conductor, without neutral conductor

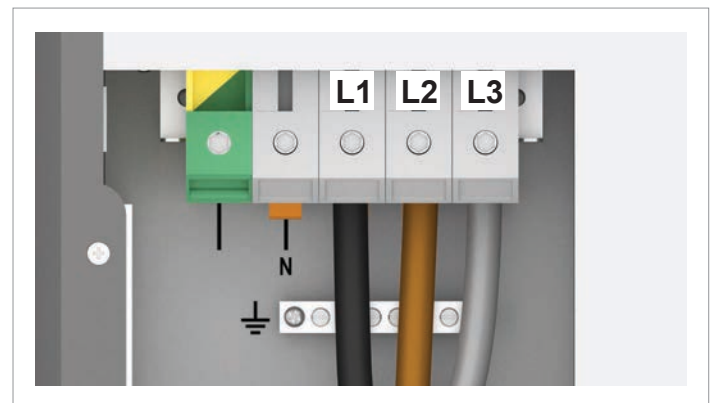
## Wiring examples for the M88H\_122 (CF)



Wiring example 1: With PE conductor, with neutral conductor

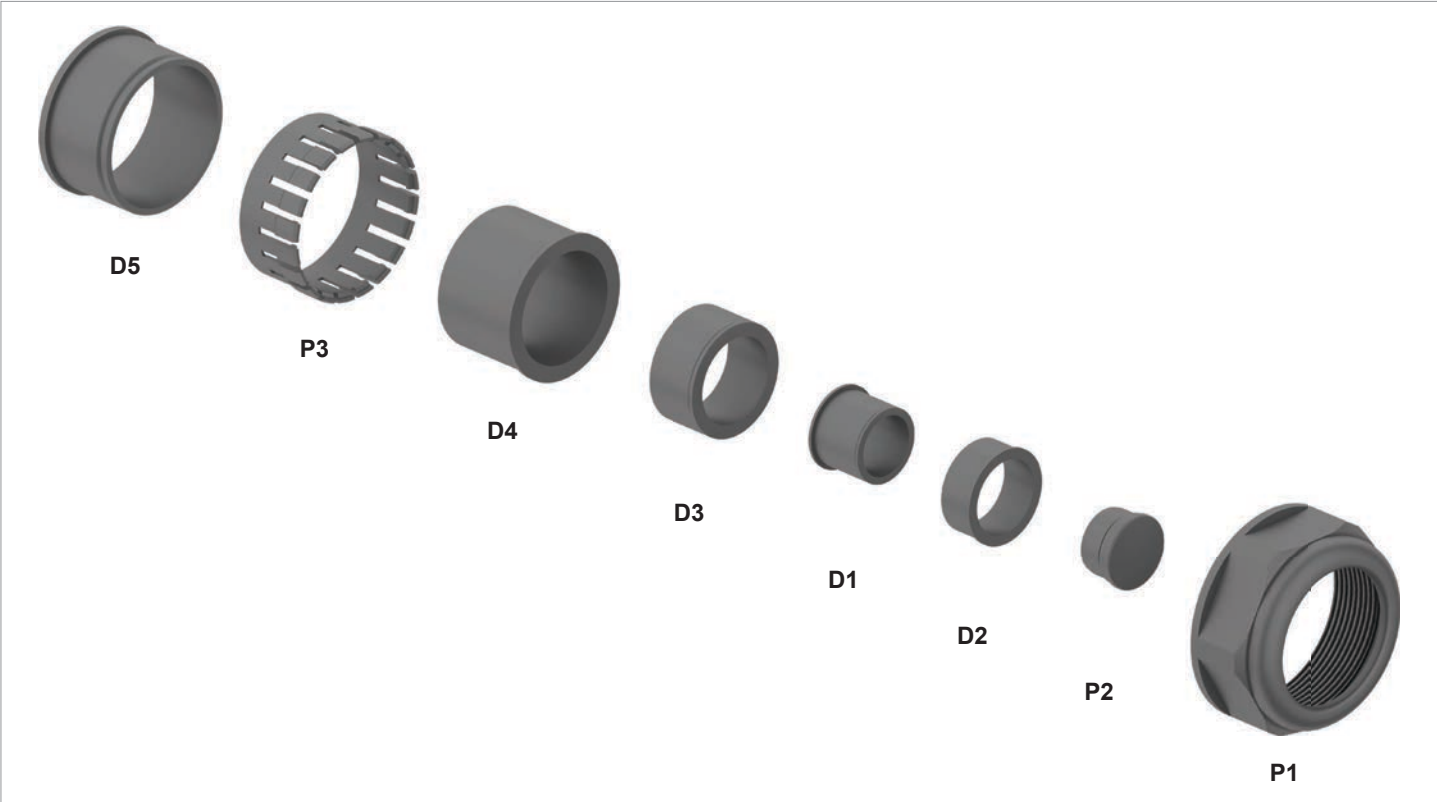


Wiring example 2: With PE conductor, without neutral conductor

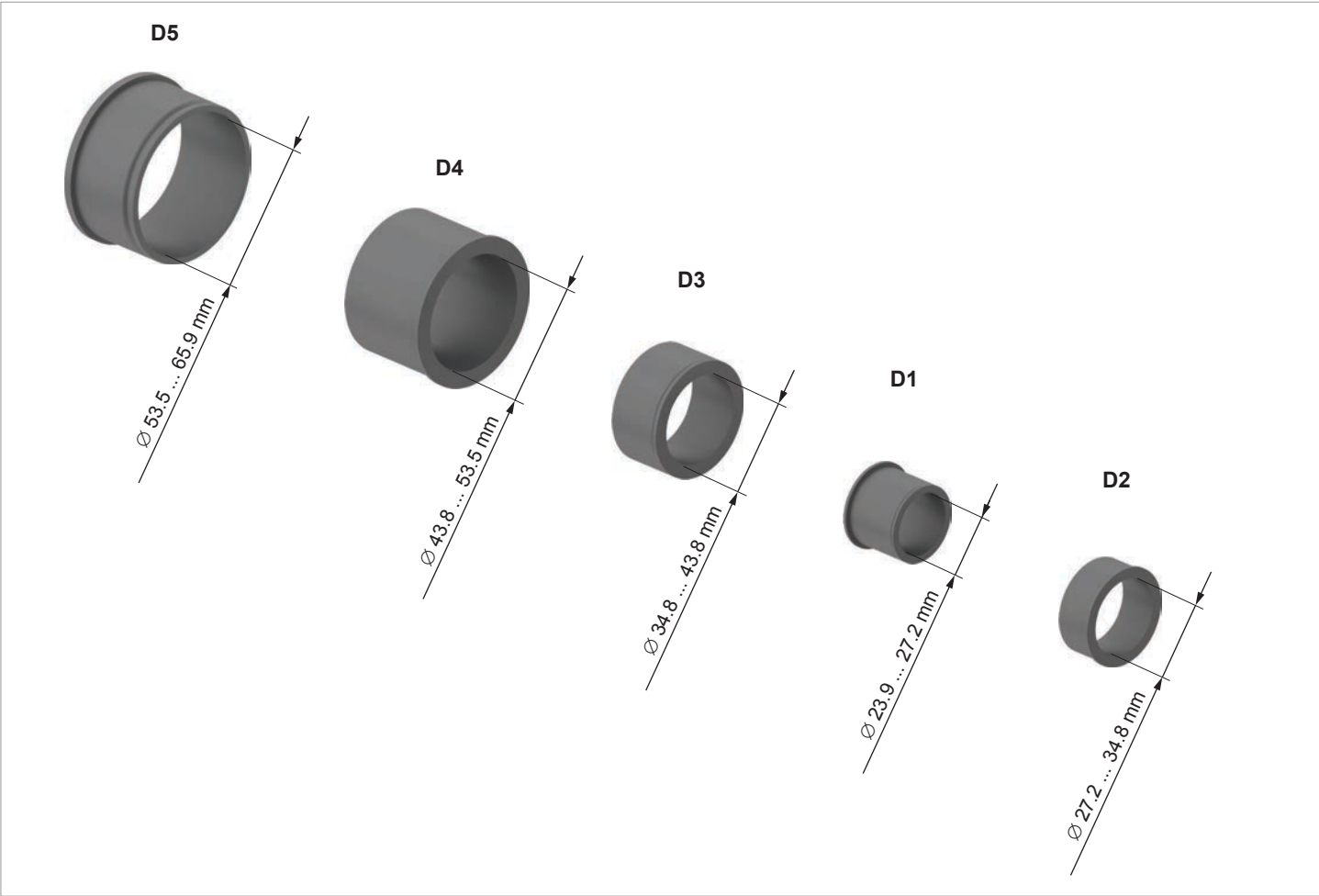


Wiring example 3: Without PE conductor, without neutral conductor

# Connecting the mains (AC) – Cable gland M88H\_121 (ST)

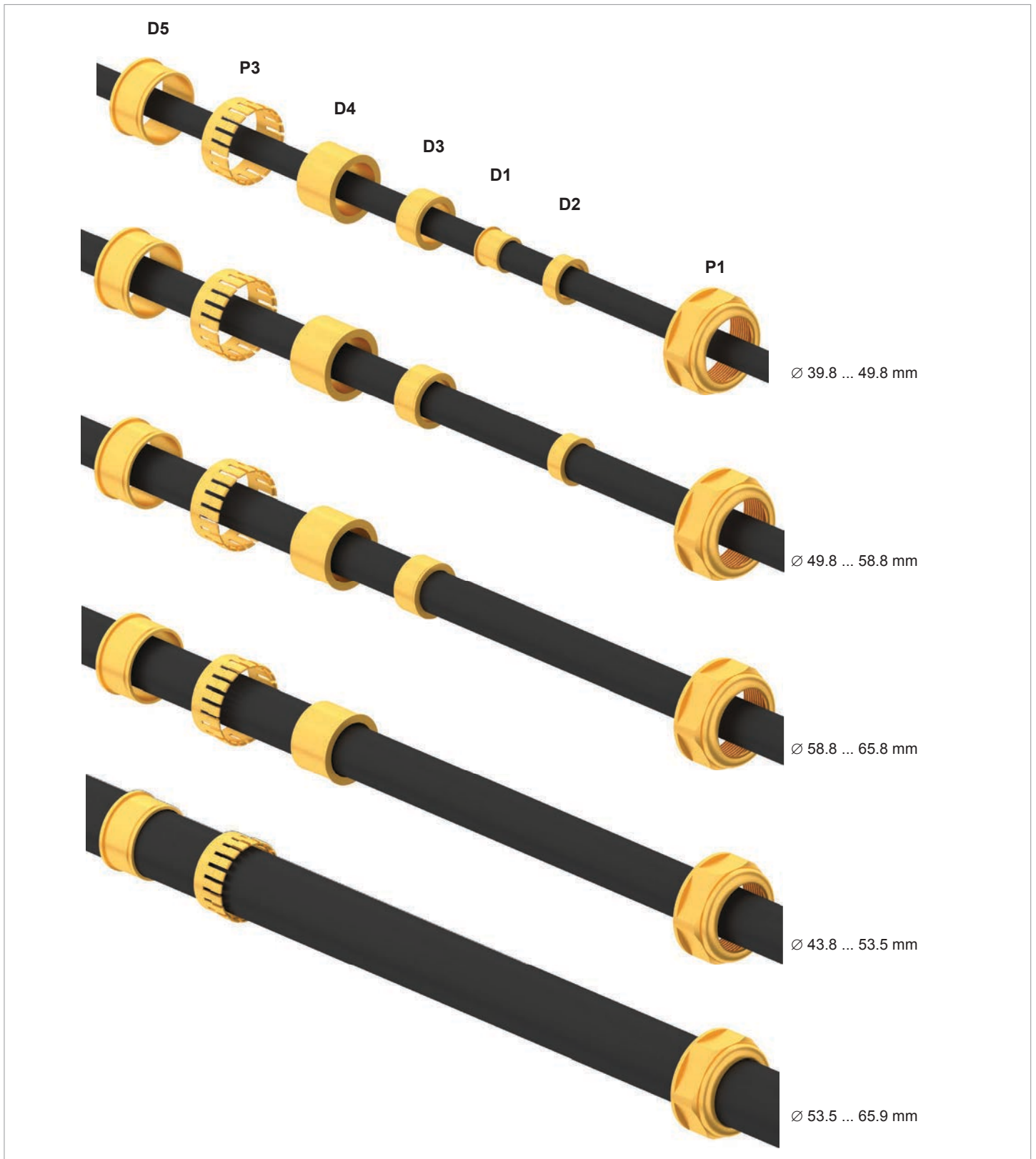


Overview of the parts of the AC cable glands



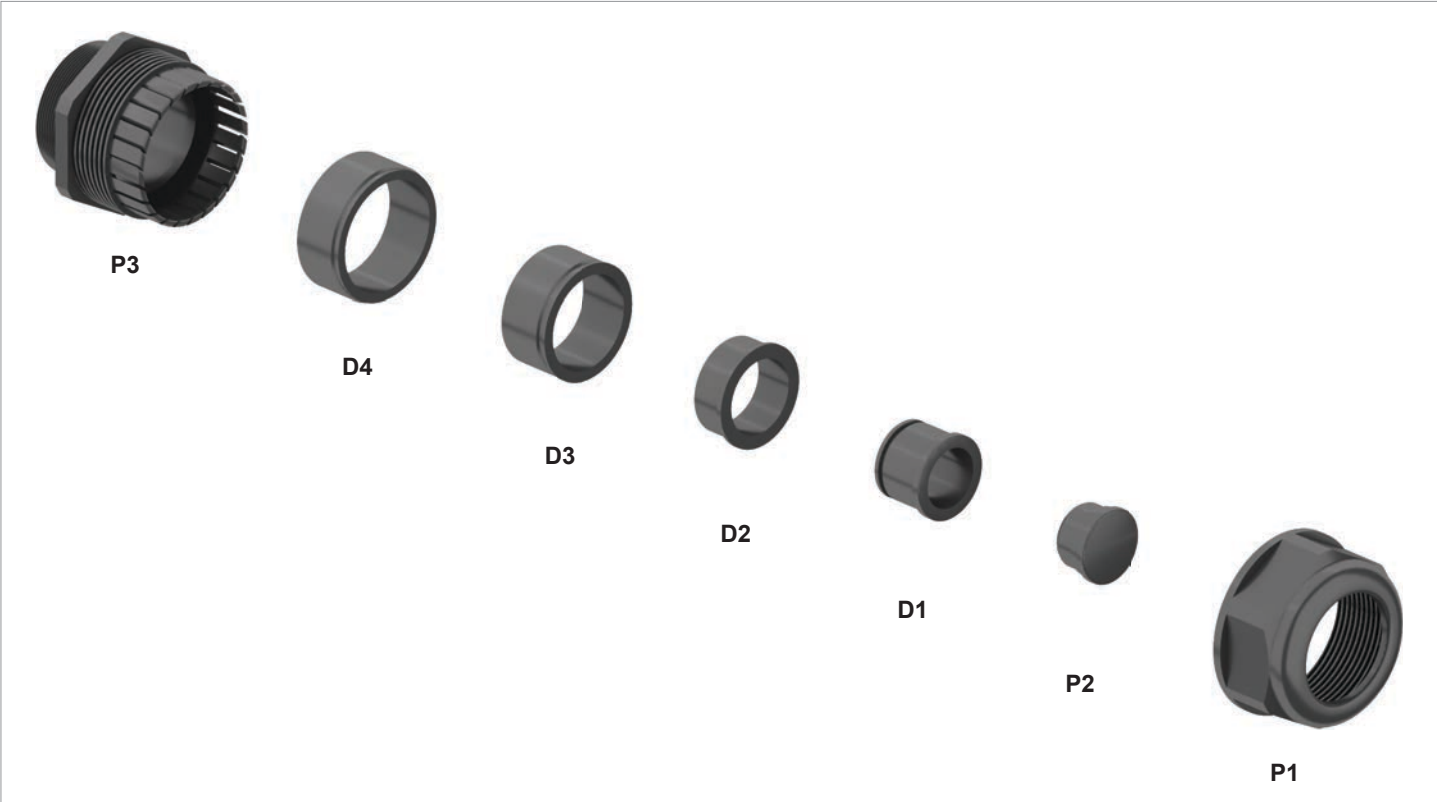
Dimensions of the sealing rings

## Connecting the mains (AC) – Cable gland M88H\_121 (ST)

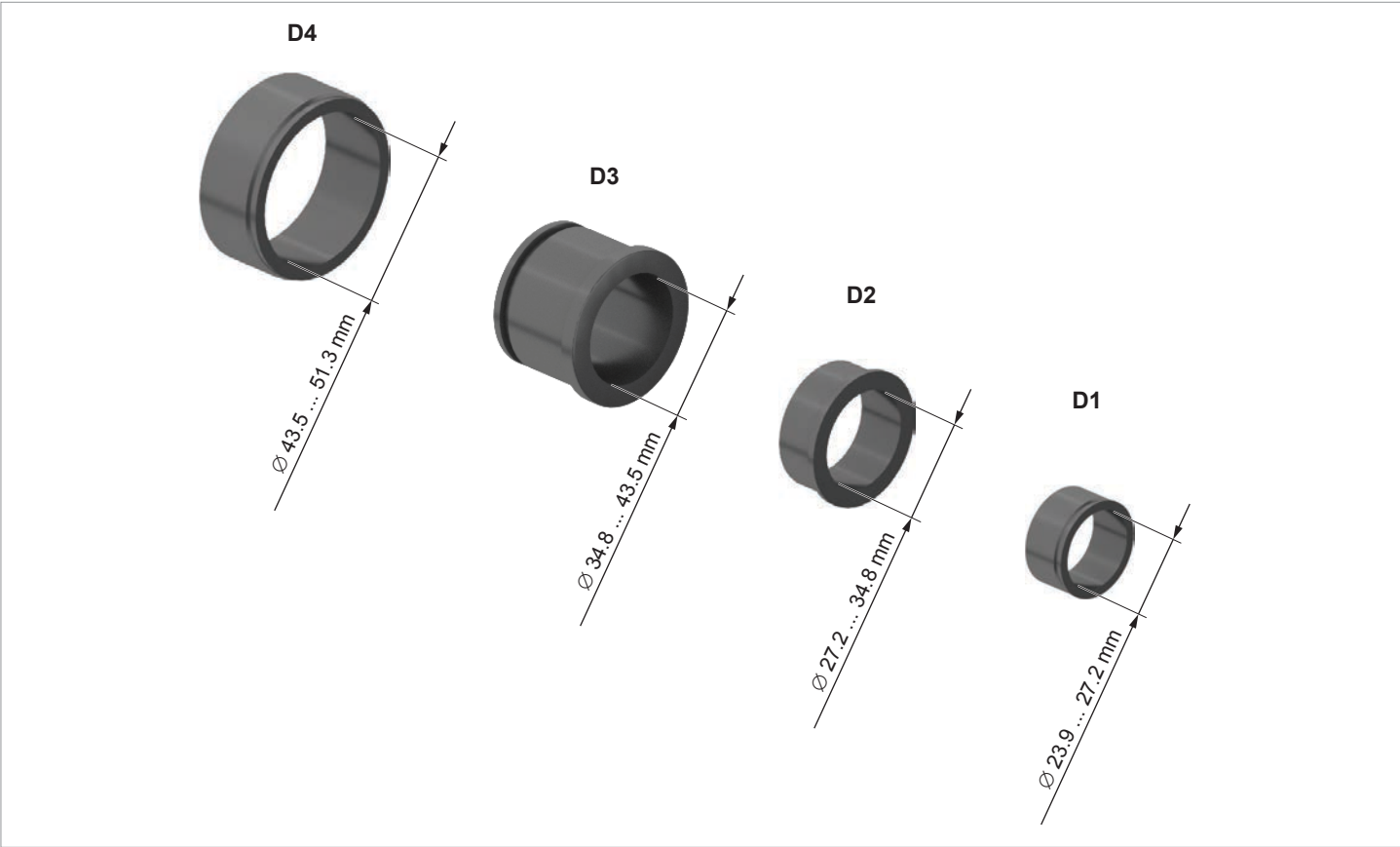


*Assignment of the sealing rings to the cable diameters*

# Connecting the mains (AC) – Cable gland M88H\_122 (CF)



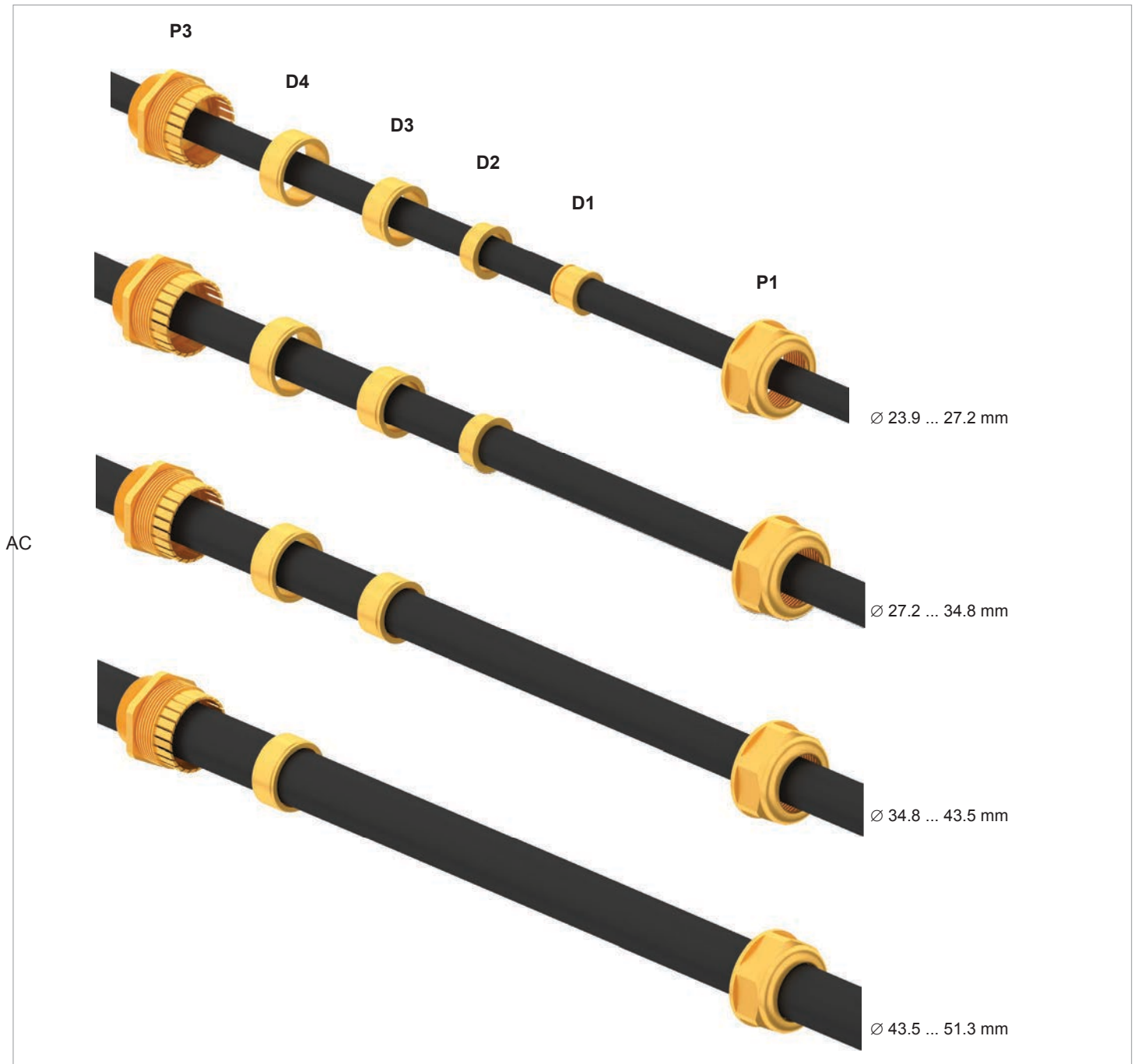
Overview of the parts of the AC cable glands



Dimensions of the sealing rings



## Connecting the mains (AC) – Cable gland M88H\_122 (CF)

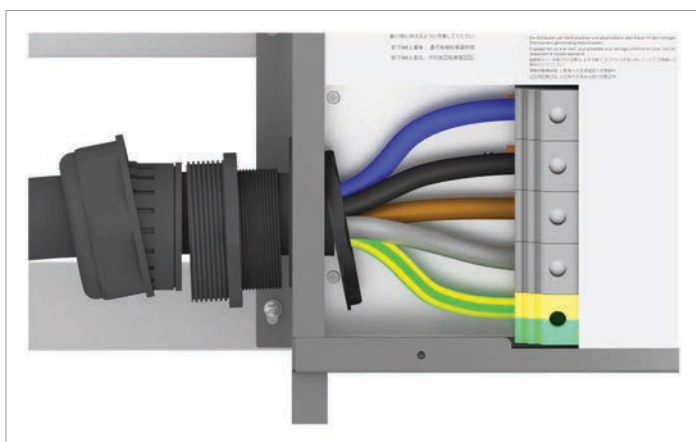
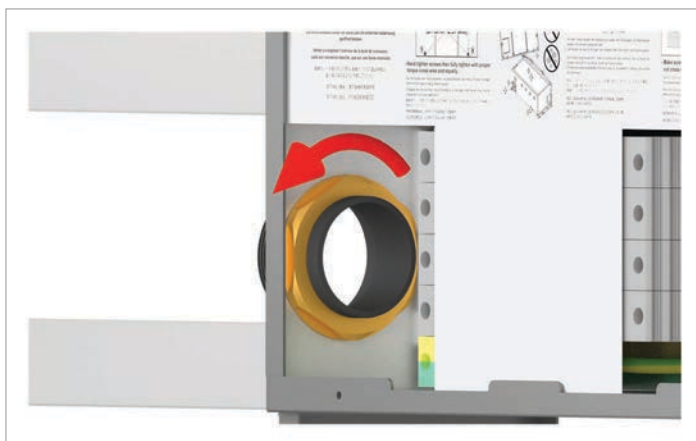


*Assignment of the sealing rings to the cable diameters*

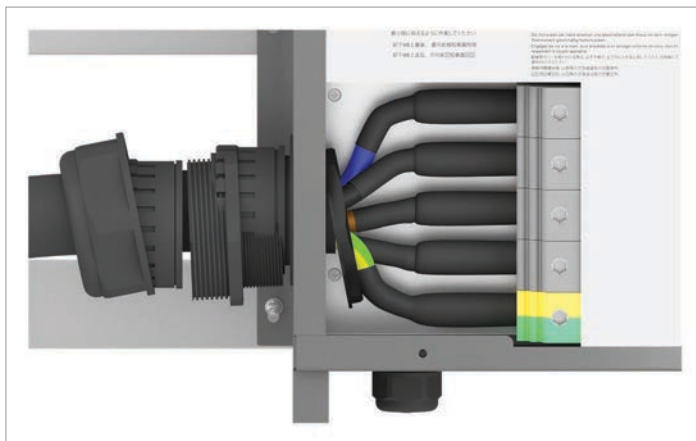
## Connecting the mains (AC) – Tips for M88H\_121 (ST)



- Screw off the outer and inner ring of the cable gland as well to make it easier to pull the AC cable into the junction box.



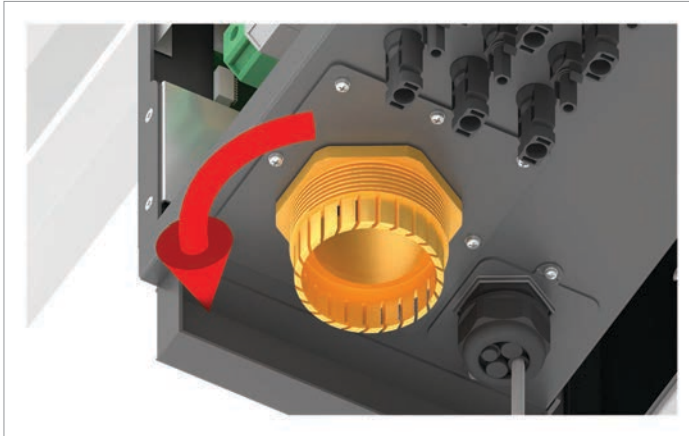
- Insert the conductors of the AC cable into the terminals of the AC terminal block in accordance with the phase assignment, and tighten the terminals (torque 25 ... 30 Nm). The illustration on the left shows the wiring for a 5-conductor system with PE and N.



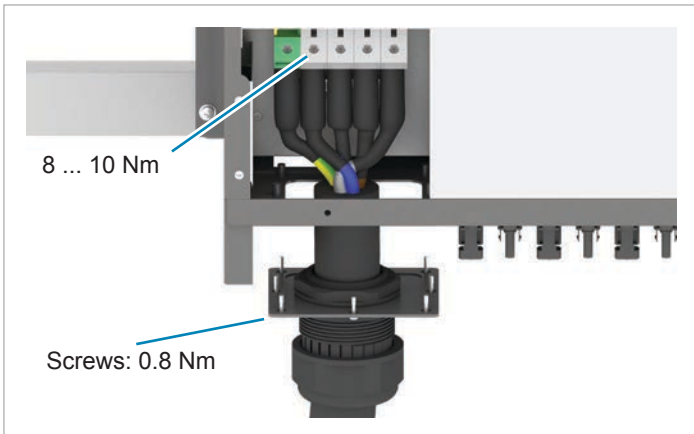
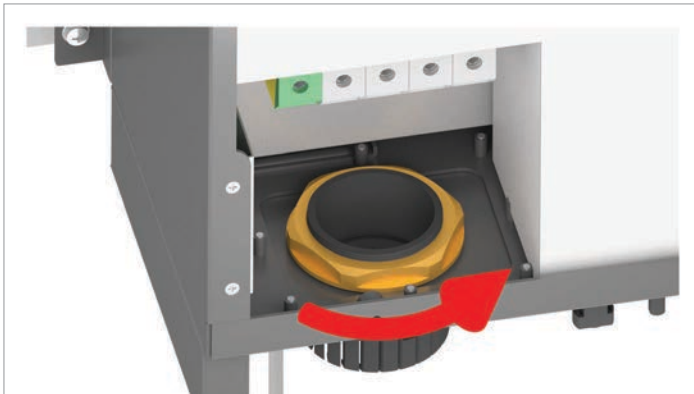
The illustration on the left shows the wiring for a 5-conductor system with PE and N when aluminum cables with crimp connectors are used.



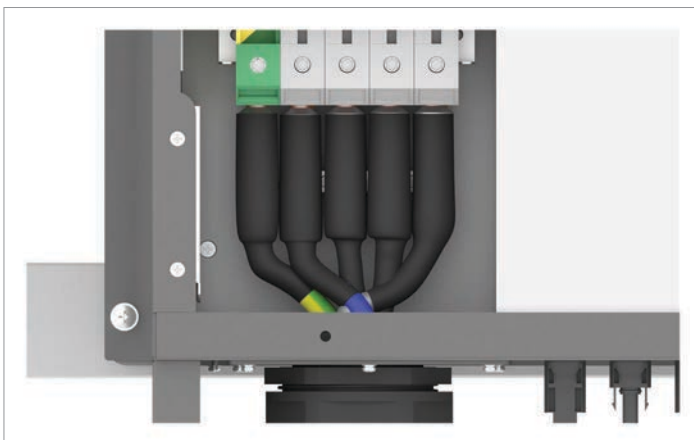
## Connecting the mains (AC) – Tips for M88H\_122 (CF)



- Screw off the outer and inner ring of the AC cable gland as well to make it easier to pull the AC cable through the cover.

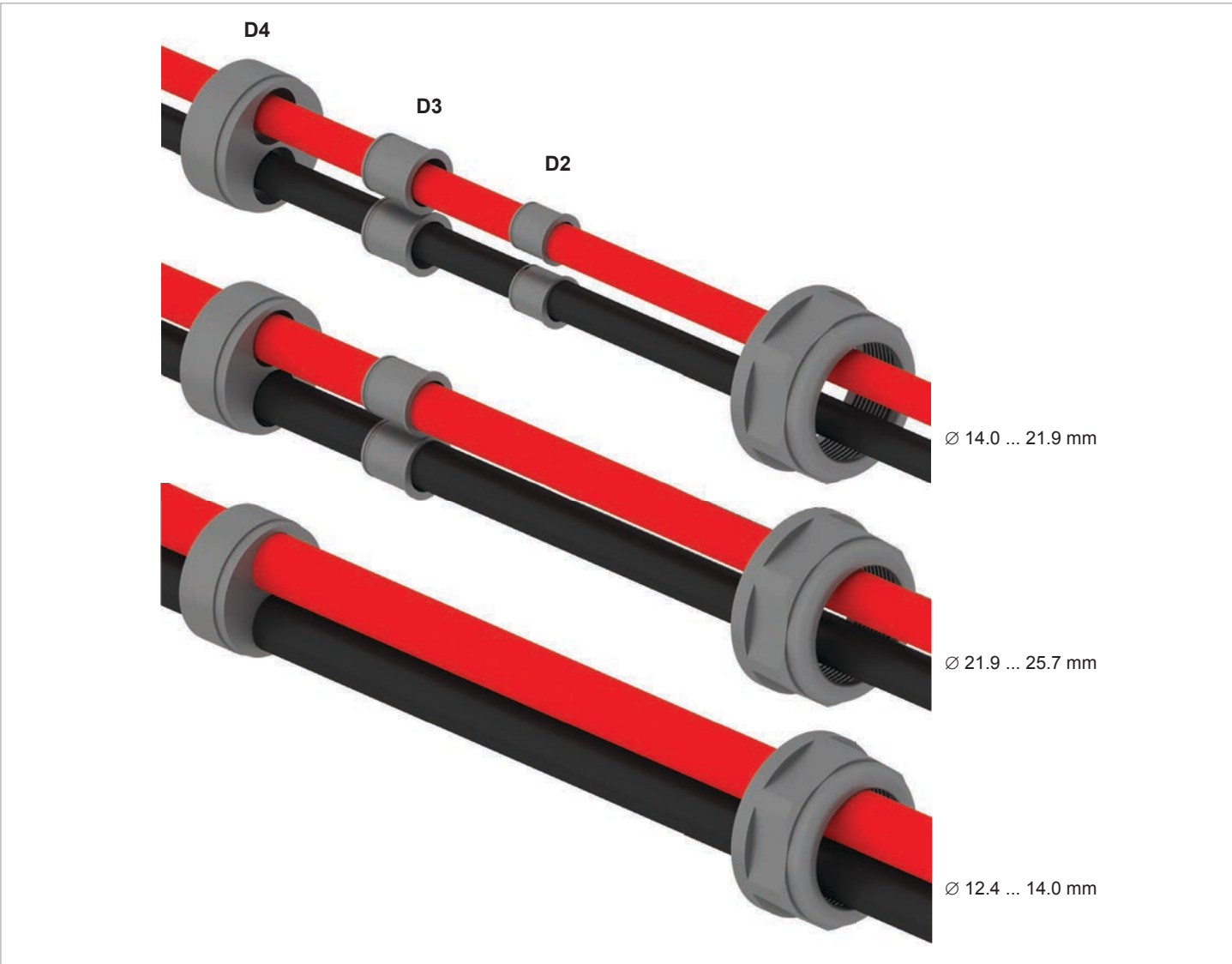
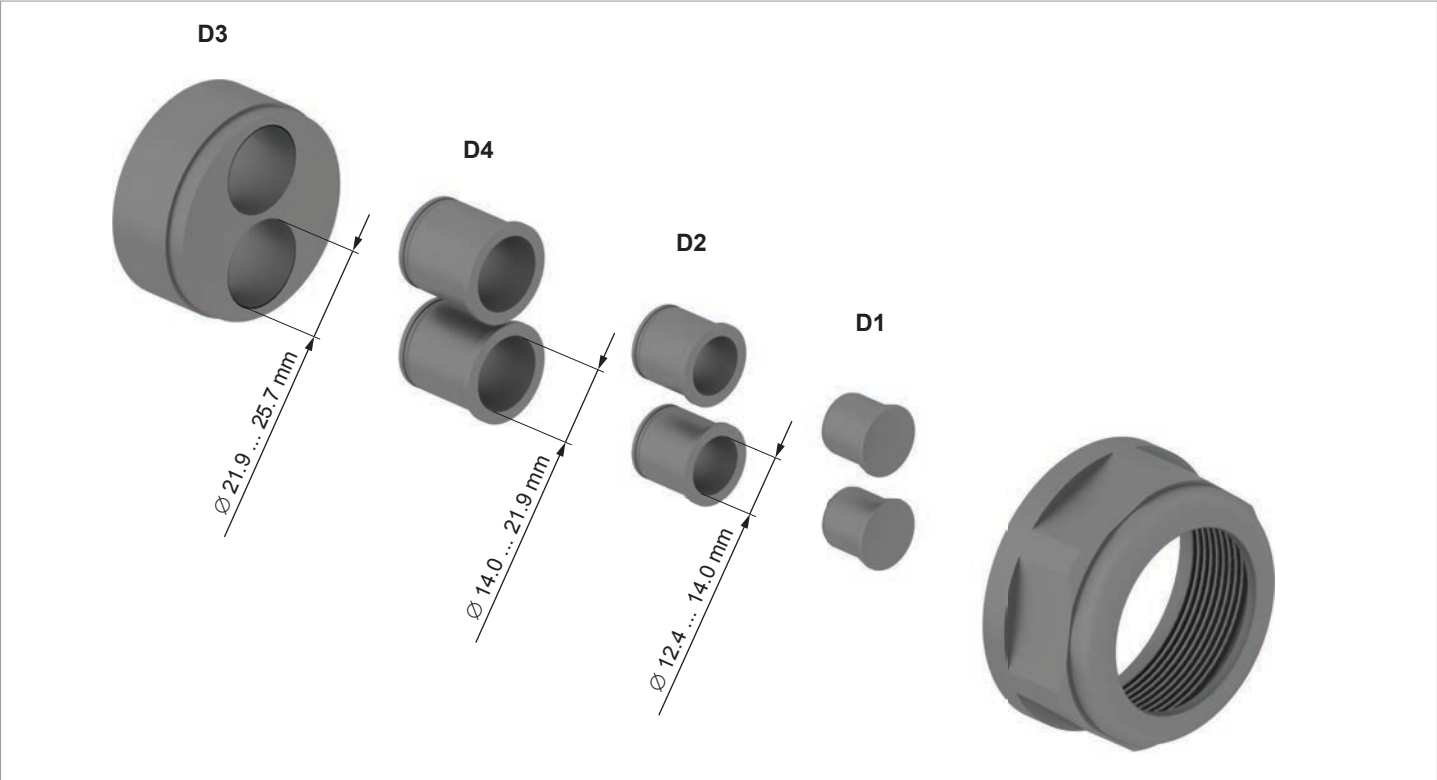


- Insert the conductors of the AC cable into the terminals of the AC terminal block in accordance with the phase assignment, and tighten the terminals (torque 8 ... 10 Nm). The illustration on the left shows the wiring for a 5-conductor system with PE and N.



The illustration on the left shows the wiring for a 5-conductor system with PE and N when aluminum cables with crimp connectors are used.

Connecting solar modules (DC) – cable gland M88H\_121 (ST)



## Connecting solar modules (DC) – 1-/2-MPPT operation M88H\_121 (ST)

### DANGER



#### Modified design of the DC inputs

The design of the DC inputs on the DC terminal block has changed in comparison with previous versions of the M88H\_121 (ST)!

- You must comply with the correct use of plus (+) and minus (-) when connecting the DC cables.

The M88H\_121 (ST) is designed by default for operation with 2 MPPT trackers (MPPT). To accomplish this, the operating point for the two DC inputs is adjusted separately. In cases of 2-MPPT operation, two cables are connected per DC input (DC1 and DC2), one each for DC+ and DC-.



*DC cabling for 2 MPPT operation when using aluminum cables with Al-Cu crimped connectors*

As an alternative, the M88H\_121 (ST) can be operated with only 1 MPPT tracker. If this is the case, then the DC connection proceeds with only 2 cables (1 cable each for DC+ and DC-).



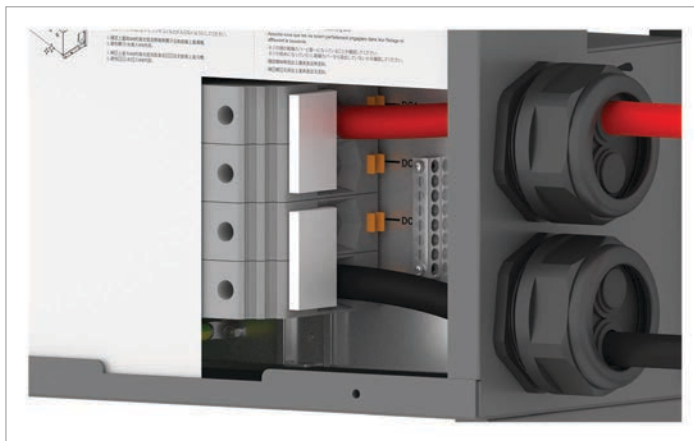
*Phoenix Contact jumper for operation with 1 MPPT tracker*

In addition, **2 jumpers** from Phoenix-Contact are required (Phoenix order number EB 2-31/UKH - 0201388 for UKH 150). The jumpers are **not** included in the scope of delivery and must be ordered separately from commercial outlets

## Connecting solar modules (DC) – 1-MPPT operation M88H\_121 (ST)



1. Insert one jumper each in DC1 and DC2 until they engage in the DC terminal block.



2. Connect the red cable (DC+) to terminal DC1+ and the black cable (DC-) to terminal DC2-.

The left-hand image shows the cabling when copper cables are used.



The image on the left shows the cabling when aluminum cables with Al-Cu crimped connectors are used.

# Connecting solar modules (DC) – M88H\_122 (CF)

## DANGER



### Electric shock

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

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

## Polarity of the DC voltage

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



## DC isolating switch

France: The DC isolating switch meets the regulations of the UTE 15-712-1 (VDE 0100 712).

## NOTICE



### Maximum power at the DC connections.

Exceeding the maximum current can cause overheating of the DC connections.

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

## NOTICE



### Ingress of moisture.

Moisture can enter via open DC connections.

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

## Safety notice

- ▶ Turn the DC disconnecter to the **0 (OFF)** position before connecting the solar modules.



## Integrated string fuses and DC surge protection devices

- ▶ Replace damaged string fuses with devices of the same type and from the same manufacturer.
- ▶ Surge protection devices are available from Delta.

## Tools



The protective caps lock the DC plug so that it can only be disconnected from DC connections using the mounting tool.

- ▶ Observe the local regulations with regards to the protective caps.
- France: The protective caps must be used.

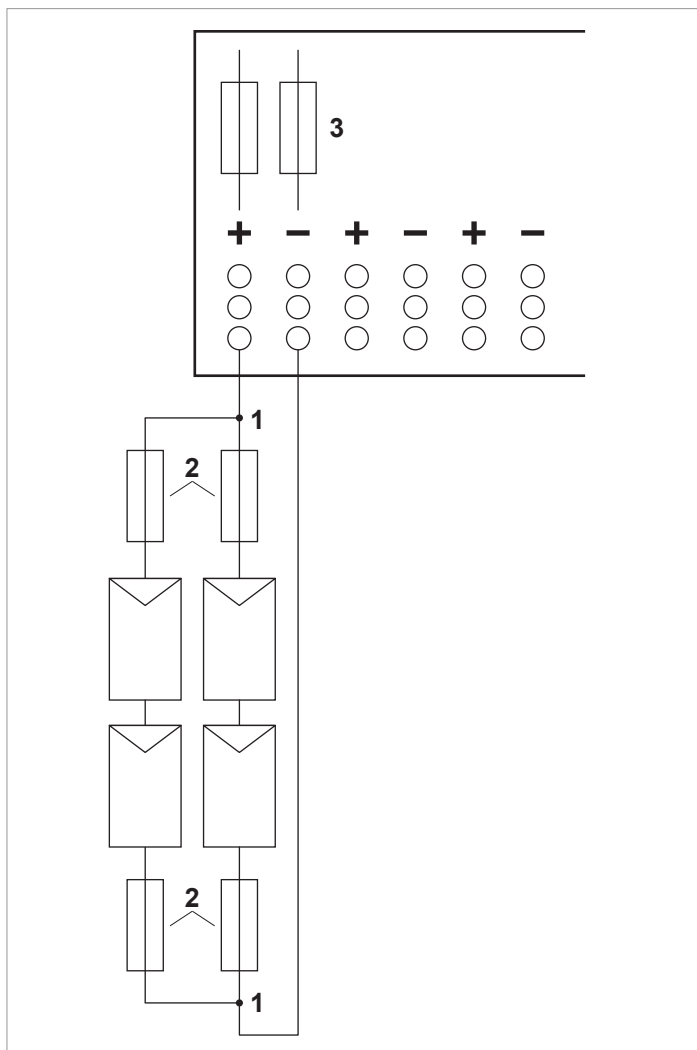


Mounting tool for disconnecting the DC plug and the protective caps from the DC connections. Available from Multi-Contact.

# Connecting solar modules (DC) – M88H\_122 (CF)

## Utilization of thin film modules

Thin film modules can be connected to a **maximum** of 2 DC connections per DC input in accordance with the following connection diagram.



- 1 Use MC4 branch socket PV-AZB4 (Stäubli order number 32.0018) or MC4 branch socket PV-AZS4 (Stäubli order number 32.0019).
- 2 Use MC4 fuses of the Stäubli "In-Line-Fuse PV-K/ILF" series.
- 3 The M88H\_122 (CF) is factory-equipped with 15A string fuses in the wiring box. These can be replaced by string fuses with a **maximum of 20A**.

When doing so, use 20A string fuses manufactured by Littelfuse (Littelfuse part number: 0SPF020.T).



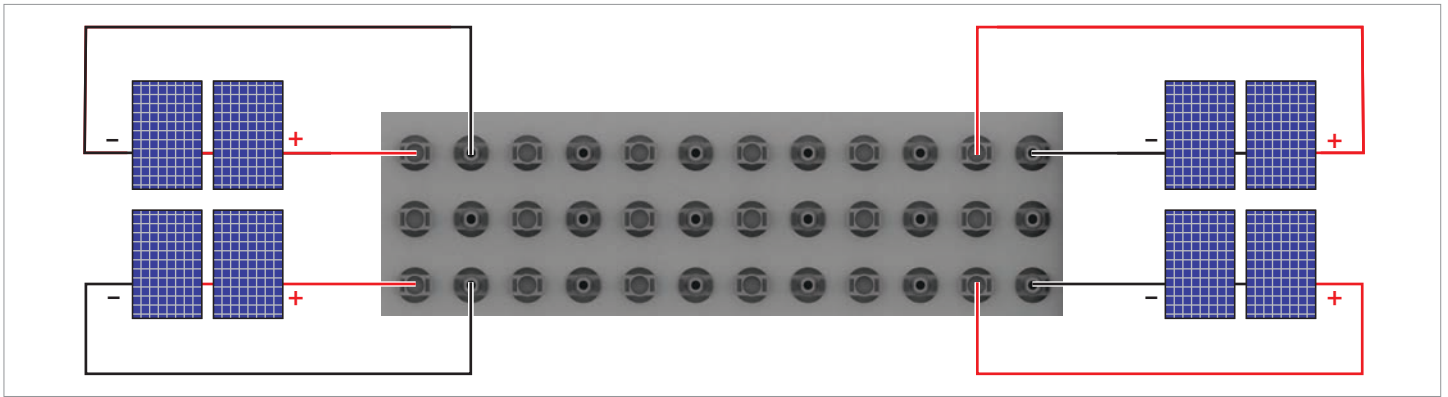
- Use only the original parts specified above from Stäubli (formerly Multi-Contact) or Littelfuse!

## Protective devices

When selecting the necessary protective devices (e.g. fuses) take into account the **Maximum reverse current** of the solar modules.

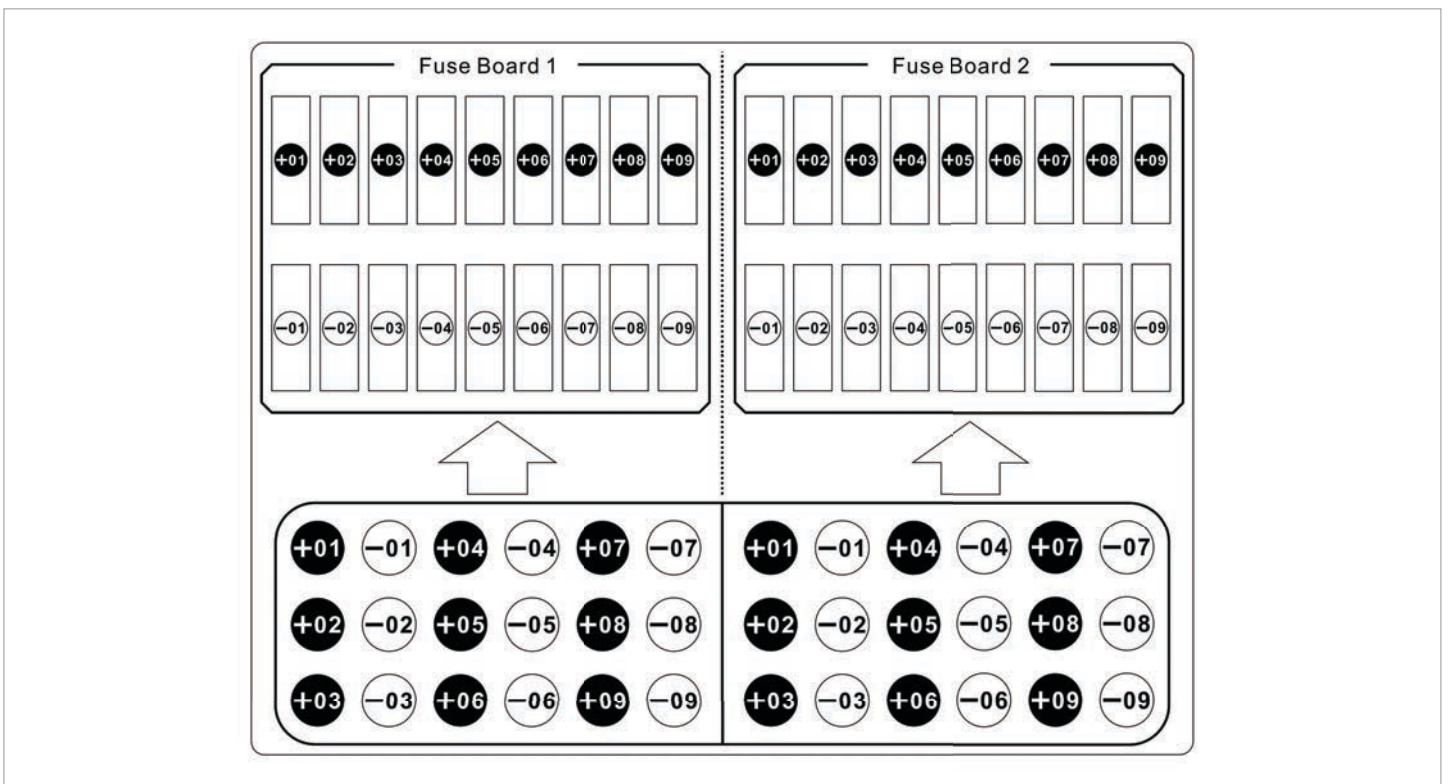


## Connecting solar modules (DC) – M88H\_122 (CF)

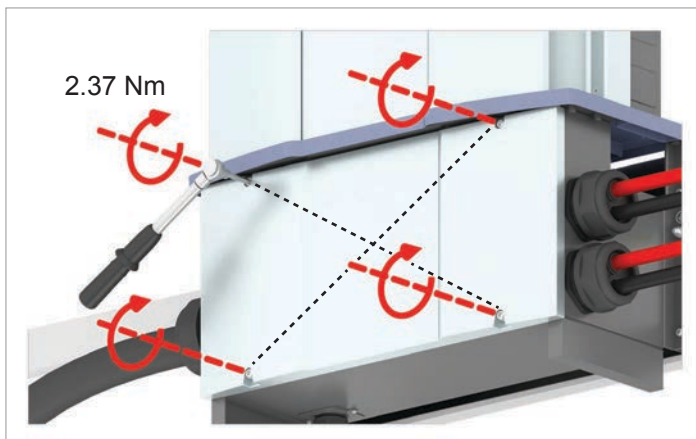
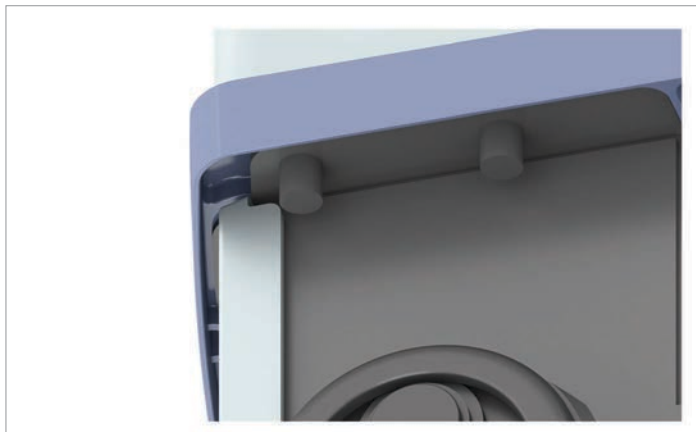


### Assignment of the DC string fuses to the DC connections

The following illustration is also attached to the inner side of the cover of the wiring box.



## Closing the wiring box



### NOTICE



#### **Impairment of operating response caused by moisture and dirt.**

In order to restore degree of protection IP65 after the completion of installation work, attach the cover of the wiring box in accordance with the following instructions.

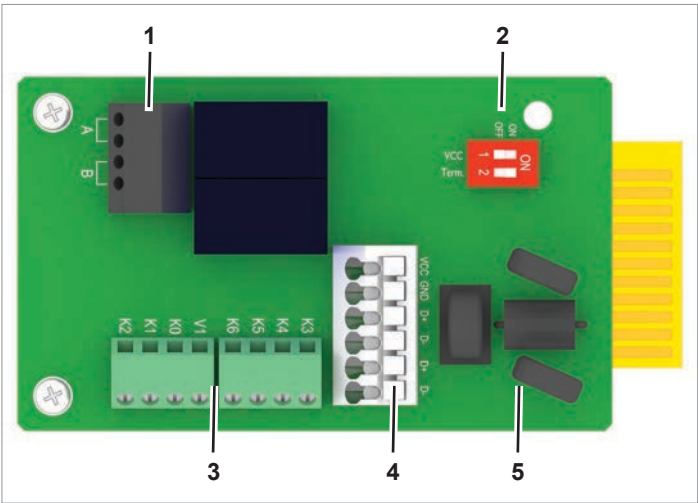
1. Before screwing on the cover, check all seals and surfaces for correct positioning and cleanliness.
2. Attach the cover in such a way that it is evenly mounted and not skewed.
3. Tighten the screws by hand at first and then use a torque wrench to tighten them crosswise with a torque of 2.37 Nm.
4. Do not skew the screws. The screw heads must be flush with the surface.



# Overview of communications 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.



## Connecting a PC via RS485

If you wish to use a PC with the Delta Service Software for setting up the inverter you will need a USB/RS485 adapter in order to connect the PC to the inverter.

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

### NOTICE

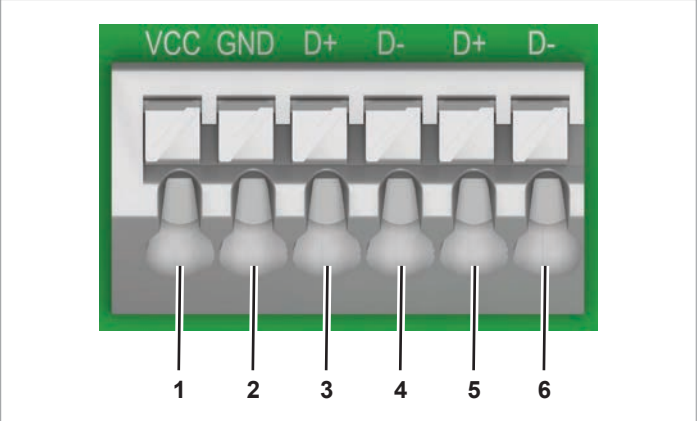


**Unwanted currents.**  
Unwanted currents can flow when multiple inverters are connected via RS485.

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

# Connecting a data logger via RS485

## RS485 terminal block



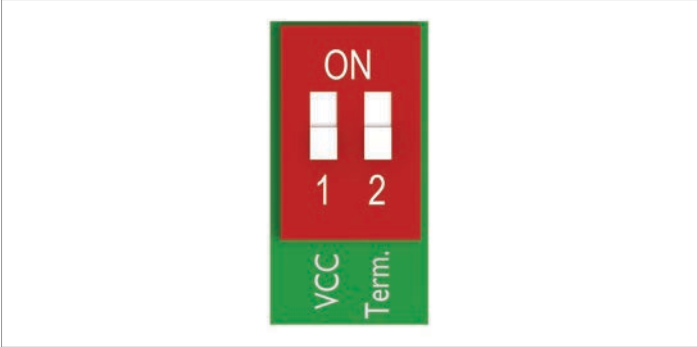
- 1 VCC (+12 V; 0.5 A)
- 2 GND
- 3 DATA+ (RS485)
- 4 DATA- (RS485)
- 5 DATA+ (RS485)
- 6 DATA- (RS485)

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

### Data format

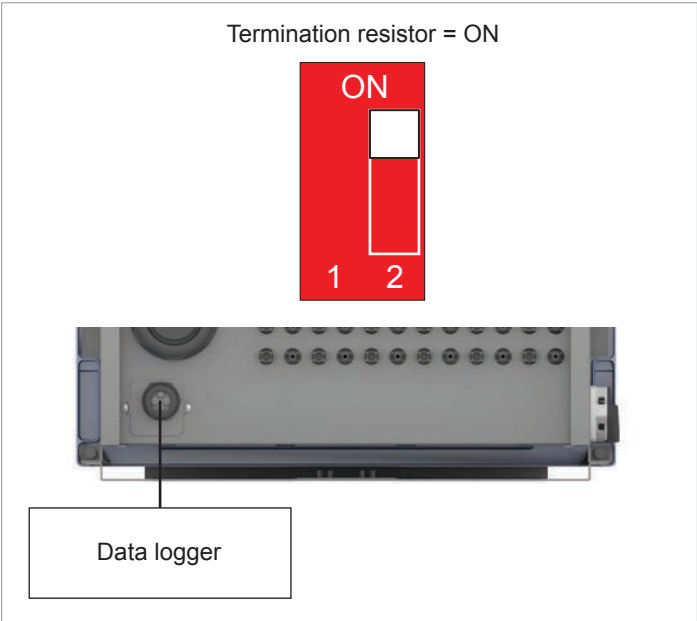
Baud rate 9600, 19200, 38400; standard: 19200  
Data bits 8  
Stop bit 1  
Parity Not applicable  
The baud rate can be set on the inverter display after commissioning, see “Baud rate for RS485”, page 51.

## DIP switch for RS485 termination resistor and VCC



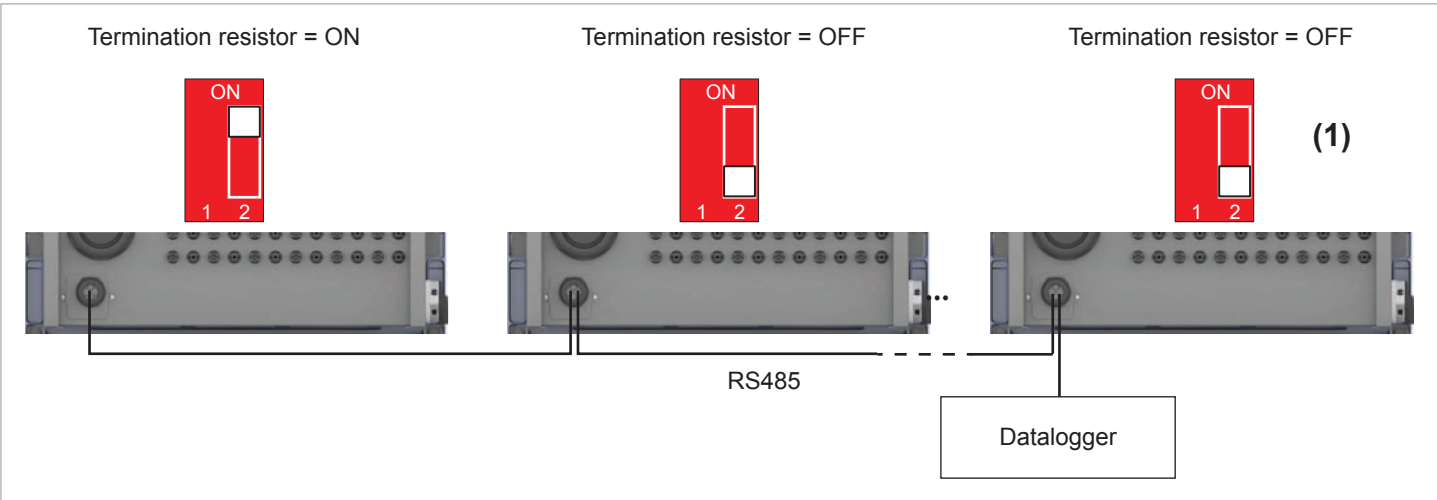
- 1 VCC (+12 V; 0.5 A)
- 2 RS485 termination resistor

## Connecting a single inverter to a data logger



## Connecting multiple inverters to a data logger

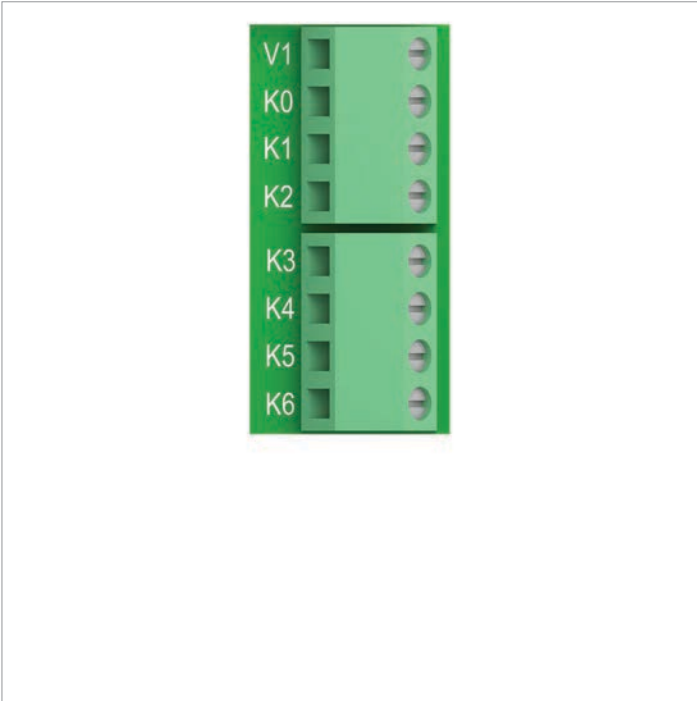
- If the data logger does not have an integrated RS485 termination resistor, switch the RS485 termination resistor on the first inverter to **ON (1)**.
- Set a different inverter ID at each inverter during commissioning, see “Commissioning – basic settings”, page 49.



# Connecting the digital inputs, dry contacts and external power-off (optional)

## Digital inputs and external power-off (EPO)

To control the active power, an external ripple control receiver can be connected to the digital inputs.

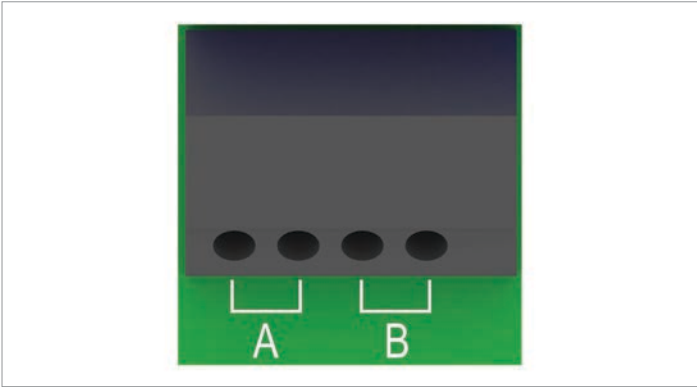


Pin	Short circuit	Assigned action
V1	-	-
K0	V1 + K0	External power-off (EPO)
K1	V1 + K1	Max. active power 0%
K2	V1 + K2	Max. active power 30 %
K3	V1 + K3	Max. active power 60 %
K4	V1 + K4	Max. active power 100 %
K5	V1 + K5	Reserved
K6	V1 + K6	Reserved

After commissioning, the relays for the external power-off can be defined on the display as normally closed or normally open relays.

## Dry contacts

The inverter has two dry contacts. The contacts are closed when the relays energize.



Event	Description
Disabled	The functions for the dry contacts are switched off.
On Grid	Inverter is connected to the mains grid.
Fan failure	The fans are defective.
Insulation	Insulation test failed.
Alarm	An error, failure or warning message is present.
Error	An error message is present.
Fault	A failure message is present.
Warning	A warning message is present.

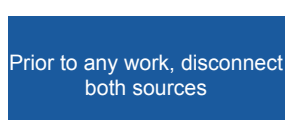
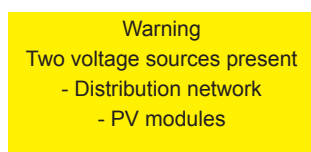
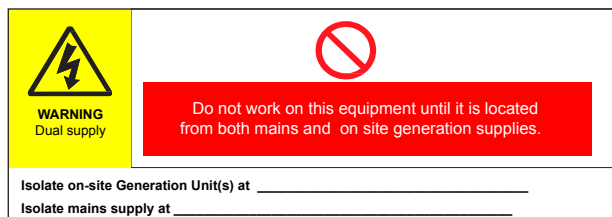
An event can be assigned to the dry contacts can be set on the inverter display after commissioning. The default setting for both contacts is "Disabled".

# Attaching warning labels to the inverter

## All countries

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

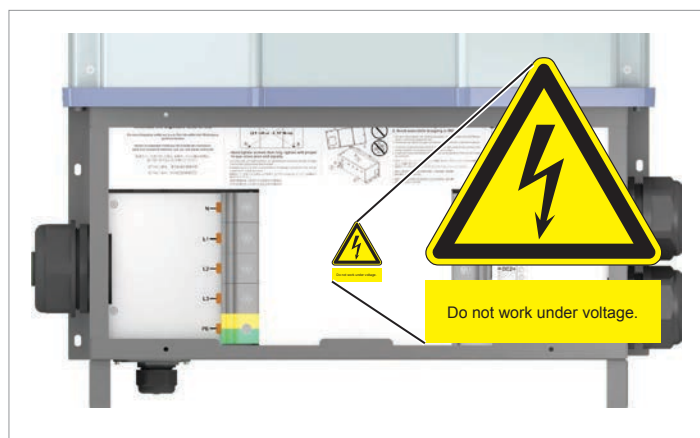
Some examples of warning labels are listed below.



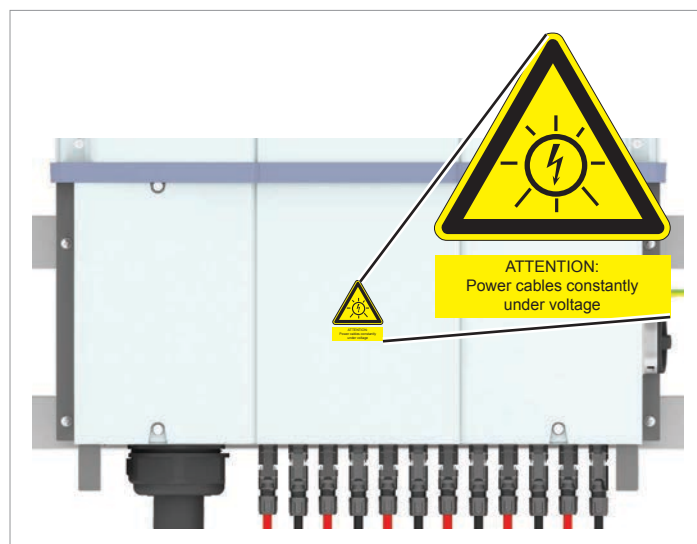
Examples of warning labels

## France

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



Warning label on the inside of the terminal box cover



Warning label on the terminal box cover

## Commissioning – basic settings



To make the settings as described in this chapter, the inverter must be powered with alternating current (mains grid). The inverter also needs a DC voltage in order to operate fully from the energy provider.

```
Select language
►English
Deutsch
Français
```

```
►UK G59-3 230
FRA-Is 50HZ
FRA-Is 60HZ
FRANCE MV
```

```
Are you sure to
set country:
    UK G59-3 230
    ►Yes / No
```

```
►Delta/SOLIVIA prot.
SUNSPEC prot.
```

```
Are you sure to
set protocol:
    SUNSPEC prot.
    ►Yes / No
```

```
Setting ID:
    ID=001
```

```
Are you sure to set
ID: 1
    ►Yes / No
```

```
10.Sep 2018 14:55
Status:      On Grid
Power:       0W
E-Today:     0kWh
```

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

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

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

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

To change the selection, press the EXIT button.

### NOTICE

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

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

5. Check that the correct protocol is selected.

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

Press the EXIT button to change the selection

### NOTICE

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

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

7. Check that the correct inverter ID is set.

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

Press the EXIT button to change the selection

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

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

## Commissioning – further settings (optional)

### Date and time

```
10.Sep 2018 14:55
Status:      On Grid
Power:       0W
E-Today:     0kWh
```

```
►General Settings
Install Settings
Active/Reactive Pwr
FRT
```

```
Language
►Date & Time
Baud rate
Protocol
```

```
10.Sep 2018 14:55
```

1. If the default information is displayed, press the **EXIT** button to open the main menu.  
Otherwise, press the **EXIT** button repeatedly until the main menu is displayed.
2. Use the **▼** and **▲** buttons to select the **General Settings** entry and then press the **ENT** button.
3. Press the **▼** and **▲** buttons to select the entry **Date and Time** and press the **ENT** button.
4. Use the **▼** and **▲** buttons to configure the value and then press the **ENT** button.  
Repeat the procedure for the other settings.

### Inverter ID



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

```
10.Sep 2018 14:55
Status:      On Grid
Power:       0W
E-Today:     0kWh
```

```
General Settings
►Install Settings
Active/Reactive Pwr
FRT
```

```
Warning:
Adj. would affect
energy production.
Password 0 * * *
```

```
►Inverter ID: 001
Insulation
Country
Grid Settings
```

```
Setting ID:
ID=001
```

1. If the default information is displayed, press the **EXIT** button to open the main menu.  
Otherwise, press the **EXIT** button repeatedly until the main menu is displayed.
2. Use the **▼** and **▲** buttons to select the **Install Settings** entry and then press the **ENT** button.
3. This function is protected with password 5555.  
Use the **▼** and **▲** buttons to set the individual numerals.  
Press the **ENT** button to confirm a numeral.
4. Use the **▼** and **▲** buttons to select the **inverter ID** entry and then press the **ENT** button.
5. Use the **▼** and **▲** buttons to configure the value and then press the **ENT** button.

## Commissioning – further settings (optional)

### Baud rate for RS485

10.Sep 2018 14:55
Status: On Grid
Power: 0W
E-Today: 0kWh

►General Settings
Install Settings
Active/Reactive Pwr
FRT

Language
Date & Time
►Baud rate
Protocol

9600
►19200
38400

1. If the default information is displayed, press the **EXIT** button to open the main menu.  
Otherwise, press the **EXIT** button repeatedly until the main menu is displayed.
2. Use the **▼** and **▲** buttons to select the **General Settings** entry and then press the **ENT** button.
3. Use the buttons **▼** and **▲** to select the entry **Baud Rate** and press the **ENT** button.
4. Use the **▼** and **▲** buttons to configure a value and then press the **ENT** button.  
Repeat the procedure for the other settings.

### AC connection type



By default, the AC connection type is set to 3P4W (3 phases + N + PE). You only need to change this setting if you are using an AC system with 3 phases + PE (3P3W).

10.Sep 2018 14:55
Status: On Grid
Power: 0W
E-Today: 0kWh

General Settings
►Install Settings
Active/Reactive Pwr
FRT

Warning:
Adj. would affect
energy production.
Password 0 * * *

EPO: Normal Close
►AC Connection: 3P4W
Anti-islanding: ON
Max. Power: 80000W

►AC Connection: 3P4W
Anti-islanding: ON
Max. Power: 80000W
Return to Factory

1. If the default information is displayed, press the **EXIT** button to open the main menu.  
Otherwise, press the **EXIT** button repeatedly until the main menu is displayed.
2. Use the **▼** and **▲** buttons to select the **Install Settings** entry and then press the **ENT** button.
3. This function is protected with password 5555.  
Use the **▼** and **▲** buttons to set the individual numerals.  
Press the **ENT** button to confirm a numeral.
4. Use the buttons **▼** and **▲** to select the entry **AC connection** and press the **ENT** button.
5. Use the **▼** and **▲** buttons to select the **3P3W** entry and then press the **ENT** button.

## Commissioning – further settings (optional)

### External power-off (EPO)

10.Sep 2018 14:55
Status: On Grid
Power: 0W
E-Today: 0kWh

General Settings
►Install Settings
Active/Reactive Pwr
FRT

Warning:
Adj. would affect
energy production.
Password 0 * * *

►EPO: Normal Close
AC Connection: 3P4W
Anti-islanding: ON
Max. Power: 80000W

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

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

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

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

5. Use the **▼** and **▲** buttons to select an option and then press the **ENT** button.

#### Available options

**Normally open:** The relay operates as a normally open device.

**Normally closed:** The relay operates as a normally closed device.

### Active power limitation



Change this setting only after consultation with Delta customer service.



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

10.Sep 2018 14:55
Status: On Grid
Power: 0W
E-Today: 0kWh

General Settings
►Install Settings
Active/Reactive Pwr
FRT

Warning:
Adj. would affect
energy production.
Password 0 * * *

EPO: Normal Close
AC Connection: 3P4W
Anti-islanding: ON
►Max. Power: 80000W

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

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

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

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

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



## Commissioning – further settings (optional)

### Dry contacts (relays)

10.Sep 2018 14:55
Status: On Grid
Power: 0W
E-Today: 0kWh

General Settings
►Install Settings
Active/Reactive Pwr
FRT

Warning:
Adj. would affect
energy production.
Password 0 * * *

DC Injection
Dry Contact
►PID Function: ON
RCMU: ON

►Dry Cont.A Disable
Dry Cont.B Disable

►Disable
On Grid
Fan Fail
Insulation

1. If the default information is displayed, press the **EXIT** button to open the main menu.  
Otherwise, press the **EXIT** button repeatedly until the main menu is displayed.
2. Use the **▼** and **▲** buttons to select the **Install Settings** entry and then press the **ENT** button.
3. This function is protected with password 5555.  
Use the **▼** and **▲** buttons to set the individual numerals.  
Press the **ENT** button to confirm a numeral.
4. Use the buttons **▼** and **▲** to select the **Dry Cont.** entry and press the **ENT** button.
5. Use the buttons **▼** and **▲** to select a dry contact and press the **ENT** button. The current setting is shown after the name of the dry contact.
6. Use the **▼** and **▲** buttons to select an option and then press the **ENT** button.  
See "Connecting the digital inputs, dry contacts and external power-off (optional)", page 47 for the available options.

## Technical Data – M88H\_121 (ST)

Input (DC)	M88H_121 (ST)	
<b>for AC nominal voltage</b>	<b>400 V<sub>AC</sub></b>	<b>480 V<sub>AC</sub></b>
Maximum recommended PV power	90 kW <sub>P</sub>	110 kW <sub>P</sub>
Maximum input power (total / per input)		
Symmetrical design	76 kW / 38 kW	91 kW / 45.5 kW
Asymmetrical design	45.6 kW / 30.4 kW	54.6 kW / 36.4 kW
Rated power	70 kW	84 kW
Maximum input voltage	1100 V <sub>DC</sub>	
Operating input voltage range	200 ... 1000 V <sub>DC</sub>	
Nominal voltage	600 V <sub>DC</sub>	710 V <sub>DC</sub>
Cut-in voltage	250 V <sub>DC</sub>	
Cut-in power	150 W	
MPP input voltage range	200 ... 1000 V <sub>DC</sub>	
MPP input voltage range with full power		
Symmetrical design	540 ... 800 V <sub>DC</sub>	650 ... 800 V <sub>DC</sub>
Asymmetrical design (60% / 40%)	650 / 440 V <sub>DC</sub>	780 / 520 V <sub>DC</sub>
MPP input voltage range at rated power		
Symmetrical design	500 ... 800 V <sub>DC</sub>	600 ... 800 V <sub>DC</sub>
Asymmetrical design (60% / 40%)	580 / 390 V <sub>DC</sub>	710 / 475 V <sub>DC</sub>
Asymmetrical design	60/40%; 40/60%	
Maximum total input current (DC1 / DC2)	140 A (70 A / 70 A)	
Maximum DC short-circuit current I <sub>SC</sub>	180 A (90 A per DC input)	
Maximum breaking current	120 A	
Open-circuit voltage VOC	1000 V	
Number of MPP trackers	Parallel inputs: 1 MPP tracker; separate inputs: 2 MPP tracker	
Number of DC inputs, total (DC1/DC2)	2 (1 / 1)	
Electrical isolation	No	
Overvoltage category <sup>1)</sup>	II	
Surge protection devices <sup>3)</sup>	Type 2, replaceable	
Output (AC)	M88H_121 (ST)	
<b>AC nominal voltage</b>	<b>400 V<sub>AC</sub></b>	<b>480 V<sub>AC</sub></b>
Maximum apparent power <sup>4)</sup>	73 kVA <sup>5)</sup>	88 kVA <sup>6)</sup>
Rated apparent power <sup>5)</sup>	66 kVA	80 kVA
Nominal voltage <sup>7)</sup>	400 ± 30% Δ and Y / 480 V <sub>AC</sub> ± 20% Δ and Y 3 phases + PE or 3 phases + N + PE	
Nominal current	96 A	
Maximum current	106 A	
Maximum current under fault conditions	115.4 A <sub>rms</sub>	
Switch-on current	40 A / 100 μs	
Nominal frequency	50 / 60 Hz	
Frequency range <sup>7)</sup>	45 ... 65 Hz	
Configurable power factor	0.8 cap ... 0.8 ind	
Total harmonic distortion	< 3% at rated apparent power	
DC injection	<0.5% at nominal current	
Power loss in night mode	<3 W	
Overvoltage category <sup>1)</sup>	III	
Surge protection devices <sup>8)</sup>	Type 2, replaceable	

## Technical Data – M88H\_121 (ST)

Mechanical details	M88H_121 (ST)
Dimensions (W x H x D)	960 × 615 × 275 mm
Weight	84 kg (power module: 68 kg)
Cooling	3 fans
AC connection type	Phoenix Contact UKH 150
DC connection type	Phoenix Contact UKH 150
Communication interfaces	2x RS485, 2x dry contacts, 1x external power-off, 6x digital inputs

General specifications	M88H_121 (ST)
Delta model name	RPI M88H_121
Delta part number	RPI883M121200
Maximum efficiency	98.8%
EU efficiency	98.5%
Operating temperature range	-25 ... +60 °C
Operating temperature range without derating	-25 ... +40 °C
Storage temperature range	-25 ... +60 °C
Relative humidity	0 ... 100%, non-condensing
Max. operating height	3000 m above sea level
Noise level (at a distance of 1 m)	75.8 dB(A)

Standards and guidelines	M88H_121 (ST)
Protection degree	IP65
Safety class	I
Pollution degree	II
Overload behavior	Current limit, power limit
Safety	IEC 62109-1 / -2, CE-compliance
EMC	EN 61000-6-2, EN 61000-6-3
Fault-free operation	IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8
Harmonic distortion	EN 61000-3-2
Fluctuations and fibrillations	EN 61000-3-3
Mains connection guidelines	You will find the current list at <a href="http://www.solar-inverter.com">www.solar-inverter.com</a> .

<sup>1)</sup> IEC 60664-1, IEC 62109-1

<sup>2)</sup> The specified value applies for a temperature of 25 °C in the interior of the inverter. At higher temperatures, the value can drop down to 10 A.

<sup>3)</sup> EN 50539-11

<sup>4)</sup> For cos phi = 1 (VA = W)

<sup>5)</sup> Can occur under the following conditions: DC input voltage > 540 V; symmetrical design; ambient temperature < 35 °C.

<sup>6)</sup> Can occur under the following conditions: DC input voltage > 650 V; symmetrical design; ambient temperature < 35 °C.

<sup>7)</sup> AC voltage and frequency range are programmed using the corresponding country specifications.

<sup>8)</sup> EN 61463-11

## Technical data – M88H\_122 (CF)

Input (DC)	M88H_122 (CF)	
<b>for AC nominal voltage</b>	<b>400 V<sub>AC</sub></b>	<b>480 V<sub>AC</sub></b>
Maximum recommended PV power	90 kW <sub>P</sub>	110 kW <sub>P</sub>
Maximum input power (total / per input)		
Symmetrical design	76 kW / 38 kW	91 kW / 45.5 kW
Asymmetrical design	45.6 kW / 30.4 kW	54.6 kW / 36.4 kW
Rated power	70 kW	84 kW
Maximum input voltage	1100 V <sub>DC</sub>	
Operating input voltage range	200 ... 1000 V <sub>DC</sub>	
Nominal voltage	600 V <sub>DC</sub>	710 V <sub>DC</sub>
Cut-in voltage	250 V <sub>DC</sub>	
Cut-in power	150 W	
MPP input voltage range	200 ... 1000 V <sub>DC</sub>	
MPP input voltage range with full power		
Symmetrical design	540 ... 800 V <sub>DC</sub>	650 ... 800 V <sub>DC</sub>
Asymmetrical design (60% / 40%)	650 / 440 V <sub>DC</sub>	780 / 520 V <sub>DC</sub>
MPP input voltage range at rated power		
Symmetrical design	500 ... 800 V <sub>DC</sub>	600 ... 800 V <sub>DC</sub>
Asymmetrical design (60% / 40%)	580 / 390 V <sub>DC</sub>	710 / 475 V <sub>DC</sub>
Asymmetrical design	60/40%; 40/60%	
Maximum total input current (DC1 / DC2)	140 A (70 A / 70 A)	
Maximum DC short-circuit current I <sub>SC</sub>	180 A (90 A per DC input, 10 A per DC string)	
Maximum breaking current	120 A	
Open-circuit voltage VOC	1000 V	
Number of MPP trackers	Parallel inputs: 1 MPP tracker; separate inputs: 2 MPP tracker	
Number of DC inputs, total (DC1/DC2)	18 (9 / 9)	
Electrical isolation	No	
Overvoltage category <sup>1)</sup>	II	
String fuses	15 A <sup>2)</sup>	
Surge protection devices <sup>3)</sup>	Type 2, replaceable	
Output (AC)	M88H_122 (CF)	
<b>AC nominal voltage</b>	<b>400 V<sub>AC</sub></b>	<b>480 V<sub>AC</sub></b>
Maximum apparent power <sup>4)</sup>	73 kVA <sup>5)</sup>	88 kVA <sup>6)</sup>
Rated apparent power <sup>5)</sup>	66 kVA	80 kVA
Nominal voltage <sup>7)</sup>	400 ± 30% Δ and Y / 480 V <sub>AC</sub> ± 20% Δ and Y 3 phases + PE or 3 phases + N + PE	
Nominal current	96 A	
Maximum current	106 A	
Maximum current under fault conditions	115.4 A <sub>rms</sub>	
Switch-on current	40 A / 100 μs	
Nominal frequency	50 / 60 Hz	
Frequency range <sup>7)</sup>	45 ... 65 Hz	
Configurable power factor	0.8 cap ... 0.8 ind	
Total harmonic distortion	< 3% at rated apparent power	
DC injection	<0.5% at nominal current	
Power loss in night mode	<3 W	
Overvoltage category <sup>1)</sup>	III	
Surge protection devices <sup>8)</sup>	Type 2, replaceable	

## Technical data – M88H\_122 (CF)

Mechanical details	M88H_122 (CF)
Dimensions (W x H x D)	960 × 615 × 275 mm
Weight	84 kg (power module: 68 kg)
Cooling	3 fans
AC connection type	Phoenix Contact UKH 70
DC connection type	Multi-Contact MC4
Communication interfaces	2x RS485, 2x dry contacts, 1x external power-off, 6x digital inputs

General specifications	M88H_122 (CF)
Delta model name	RPI M88H_122
Delta part number	RPI883M122000
Maximum efficiency	98.8%
EU efficiency	98.5%
Operating temperature range	-25 ... +60 °C
Operating temperature range without derating	-25 ... +40 °C
Storage temperature range	-25 ... +60 °C
Relative humidity	0 ... 100%, non-condensing
Max. operating height	3000 m above sea level
Noise level (at a distance of 1 m)	75.8 dB(A)

Standards and guidelines	RPI M88H_12x
Protection degree	IP65
Safety class	I
Pollution degree	II
Overload behavior	Current limit, power limit
Safety	IEC 62109-1 / -2, CE-compliance
EMC	EN 61000-6-2, EN 61000-6-3
Fault-free operation	IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8
Harmonic distortion	EN 61000-3-2
Fluctuations and fibrillations	EN 61000-3-3
Mains connection guidelines	You will find the current list at <a href="http://www.solar-inverter.com">www.solar-inverter.com</a> .

<sup>1)</sup> IEC 60664-1, IEC 62109-1

<sup>2)</sup> The specified value applies for a temperature of 25 °C in the interior of the inverter. At higher temperatures, the value can drop down to 10 A.

<sup>3)</sup> EN 50539-11

<sup>4)</sup> For cos phi = 1 (VA = W)

<sup>5)</sup> Can occur under the following conditions: DC input voltage > 540 V; symmetrical design; ambient temperature < 35 °C.

<sup>6)</sup> Can occur under the following conditions: DC input voltage > 650 V; symmetrical design; ambient temperature < 35 °C.

<sup>7)</sup> AC voltage and frequency range are programmed using the corresponding country specifications.

<sup>8)</sup> EN 61463-11

**Space for notes**





## Customer Service - Europe

Austria	service.oesterreich@solar-inverter.com	0800 291 512 (toll free)
Belgium	support.belgium@solar-inverter.com	0800 711 35 (toll free)
Bulgaria	support.bulgaria@solar-inverter.com	+421 42 4661 333
Czech Republic	podpora.czechia@solar-inverter.com	800 143 047 (toll free)
Denmark	support.danmark@solar-inverter.com	8025 0986 (toll free)
France	support.france@solar-inverter.com	0800 919 816 (toll free)
Germany	service.deutschland@solar-inverter.com	0800 800 9323 (toll free)
Great Britain	support.uk@solar-inverter.com	0800 051 4281 (toll free)
Greece	support.greece@solar-inverter.com	+49 7641 455 549
Israel	supporto.israel@solar-inverter.com	800 787 920 (toll free)
Italy	supporto.italia@solar-inverter.com	800 787 920 (toll free)
Netherlands	ondersteuning.nederland@solar-inverter.com	0800 022 1104 (toll free)
Poland	serwis.polska@solar-inverter.com	+48 22 335 26 00
Portugal	suporte.portugal@solar-inverter.com	+49 7641 455 549
Slovakia	podpora.slovensko@solar-inverter.com	0800 005 193 (toll free)
Slovenia	podpora.slovenija@solar-inverter.com	+421 42 4661 333
Spain	soporto.espana@solar-inverter.com	900 958 300 (toll free)
Switzerland	support.switzerland@solar-inverter.com	0800 838 173 (toll free)
Turkey	support.turkey@solar-inverter.com	+421 42 4661 333
Other European countries	support.europe@solar-inverter.com	+49 7641 455 549



5013240202 02

