The power behind competitiveness

# Grid-tie Transformerless Solar Inverter

## H2.5 / H3 / H3A / H4A / H5A

## Operation and Installation Manual

www.deltaww.com

Smarter. Greener. Together.

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# 1 General Information

## 1.1 Scope of delivery

Congratulations on the purchase of your Delta H2.5 / H3 / H3A / H4A / H5A grid-tied solar inverter. This manual will assist you in becoming familiar with this product. Please observe all safety regulations and take into account the connection requirements by your local grid utility.

## 1.2 General Warnings / Notes on Safety

Careful handling of the product will contribute to it's service life durability and reliability. Both are essential to ensure maximum yield from your product. As some of the solar inverter models are heavy, two people may be required for lifting purposes.

**CAUTION !**

During operation of electrical devices, certain parts are under dangerous voltage. Inappropriate handling can lead to physical injury and material damage. Always adhere to the installation regulations. Installation may only be conducted by certified electricians.

**WARNING !**

Repair work on the device should ONLY be carried out by the manufacturer. The inverter contains no user serviceable parts inside. Please observe all points in the operation and installation manual. Isolate the device from the grid and the PV modules before undertaking work on the device.

**DANGER!**

60 seconds

To avoid risk of electrical shock, do not open the solar inverter. The inverter contains no user-serviceable parts. Opening the inverter will void the warranty. Dangerous voltage is present for 1 minute after disconnecting all sources of power, recommend 5 minutes for discharging. Remember that the unit has a high leakage current. The PE conductor MUST be connected prior to commencing operation.

**WARNING !**

The internal temperature may exceed over 70°C while operating. To avoid injury, do not touch the surface of the inverter whilst the unit is in operation.

**ATTENTION**

For operation and installation of inverter refer to the user manual. Failure to comply with the instructions in this manual may void the warranty.

## 1.3 Validity

This user manual describes the installation process, maintenance, technical data and safety instructions of the following solar inverter models under the DELTA brand.

• H2.5 • H3 • H3A • H4A • H5A

## 1.4 Product Description

This device is a single-phase grid-tie solar inverter. It converts direct current (DC) electricity from the PV array into single phase alternating current (AC) to supply power to the load and feed the excess generated power back to the local grid. This inverter allows for a wide voltage input range and has a high performance efficiency and user friendly operation. In addition, the special DSP (Digital Signal Processor) design reduces the complexity of the circuit and electronic components. Please note that this device does not support off-grid function. The features for H2.5 / H3 / H3A / H4A / H5A are shown below.

**Features**

- Power Rating: 2.5kVA (H2.5), 3kVA (H3/ H3A), 4kVA (H4A), 5kVA (H5A)
- Single–phase (L + N + PE), Grid-tie, transformerless solar inverter
- Maximum efficiency : >97.4% (>98.3% @ H5A)
- Europe efficiency : 96.8% (98.0% @ H5A)
- Reactive power capability (Cap 0.8 – Ind 0.8)
- Total harmonic distortion (THD < 3%) @ full load

## 1.5 How it Works

The operation of a solar inverter is shown in ***Figure 1-1.***
In order to save energy and electricity, the solar inverter converts the DC input power supplied from the PV Array into single-phase AC output power to Grid.

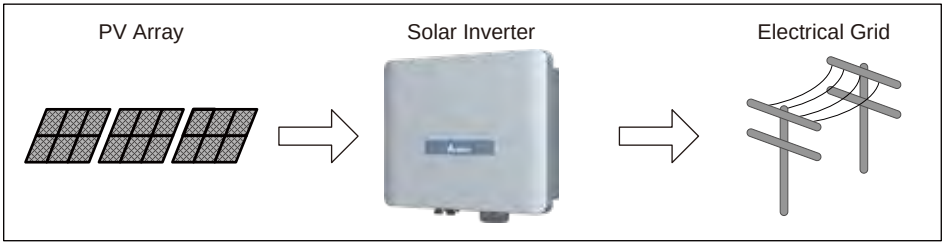



***Figure 1-1 : Solar system operation illustration***

## 1.6 Additional Information

For more detailed information for H2.5 / H3 / H3A / H4A / H5A or other related product information, please visit : www.deltaww.com

# 2 Installation and Wiring

## 2.1 Instruction before Installation

Due to the variety of users and installation environments, you must read this manual thoroughly before installation. Installation of the unit and start-up procedures must be carried out by an accredited technician.

## 2.2 Unpacking

Unpacking process is shown as ***Figure 2-1.***

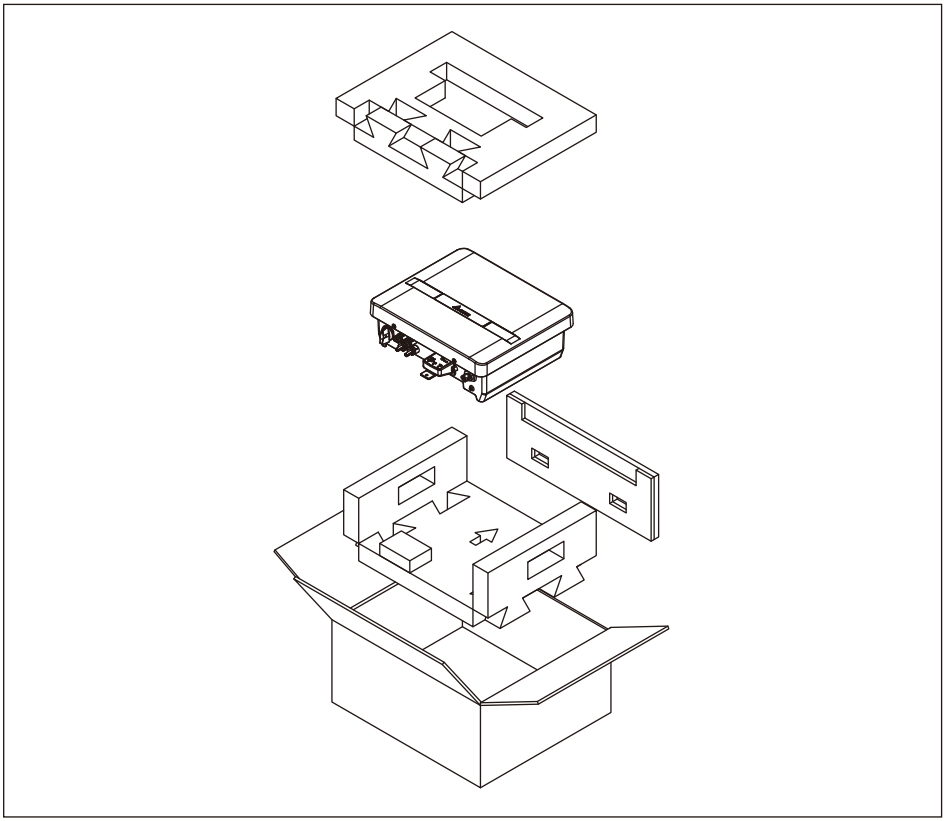


***Figure 2-1 : Unpacking process***

Upon receiving your brand new RPI inverter, you will be required to remove it's protective packaging. This packaging consists of various materials that will need to be disposed of according to the specific recycling marking printed on them.

## 2.3 Package Inspection

Unforeseeable events causing damage or movement may occur during shipment. Please check for damage on the packaging upon receiving your inverter.
Please check the model number and the serial number on the packaging is identical with the model number and serial number on the unit itself.
Check if all the accessories are in the package, the standard accessories are listed as ***Table 2-1***, and H5A_222 standard accessories are listed as ***Table 2-3***:

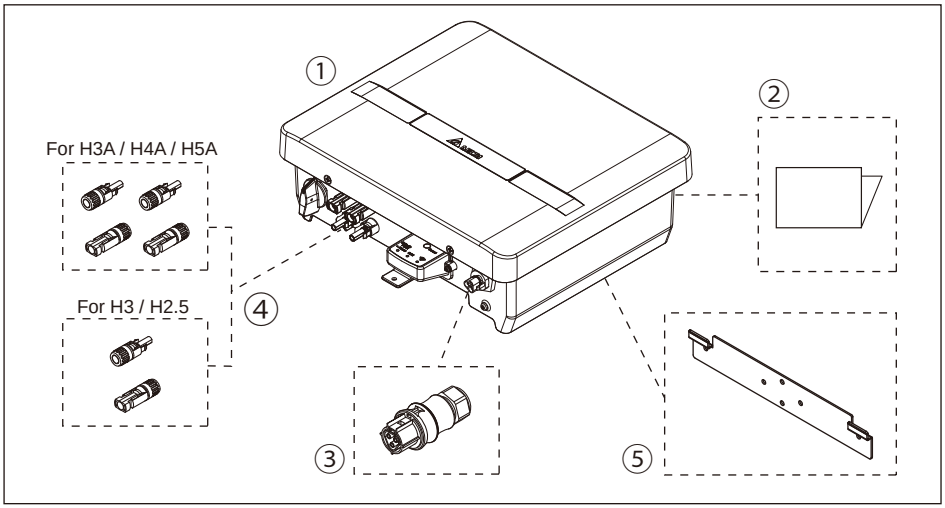



***Figure 2-2 : Components of H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221***

| H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221 | | | |
|---|---|---|---|
| | **Object** | **Qty** | **Description** |
| ① | PV Inverter | 1 | Solar inverter |
| ② | Quick installation guide | 1 | Important safety instructions and technical specifications should be followed during installation. |
| ③ | AC Plug | 1 | Connector for AC connection |
| ④ | DC Plug | 2 pairs | MC4 connector for DC connection for H3A / H4A / H5A models |
| | | 1 pairs | MC4 connector for DC connection for H3 / H2.5 models |
| ⑤ | Wall-Mount Bracket | 1 | To mount the solar inverter securely on the wall. |

***Table 2-1 : Packing list of H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221***

**CAUTION !**

If there is any visible damage to the inverter/accesories or any damage to the packaging, please contact your inverter supplier before installation.

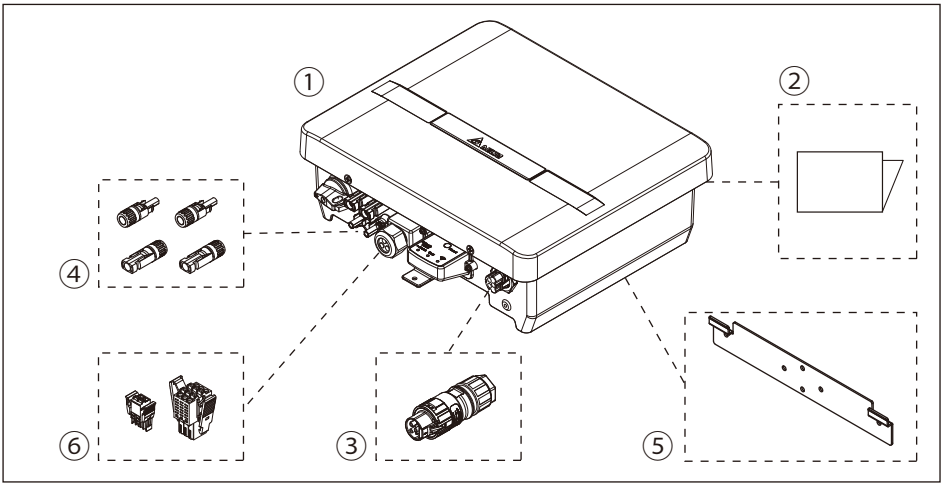



*Figure 2-3 : Components of H5A_222*

| H5A_222 | | | |
|---|---|---|---|
| | **Object** | **Qty** | **Description** |
| ① | PV Inverter | 1 | Solar inverter |
| ② | Quick installation guide | 1 | Important safety instructions and technical specifications should be followed during installation. |
| ③ | AC Plug | 1 | Connector for AC connection |
| ④ | DC Plug | 2 pairs | H4 connector for DC connection |
| ⑤ | Wall-Mount Bracket | 1 | To mount the solar inverter securely on the wall. |
| ⑥ | Digital input connector Dry contact connector | 2 | Digital input connector and dry contact connector for function port. |

*Table 2-2 : Packing list of H5A_222*

| Option part | | | |
|---|---|---|---|
| **Model** | **Object** | **Exterior** | **Description** |
| PPM CT16_101 | Current sensor |  | Current sensor for power meter function. |
| PPM W2_210 | 10m current sensor cable |  | Current sensor cable for current sensor |
| PPM W2_230 | 30m current sensor cable | | |

*Table 2-3 : Option part of H5A_222*

**CAUTION !**

If there is any visible damage to the inverter/accesories or any damage to the packaging, please contact your inverter supplier before installation.

## 2.4 Identification Label

Users can identify the model name by the information on the product label. The model name, serial number and other specifications can be located on the product label. For label location, please refer to ***Figure 2-3.***

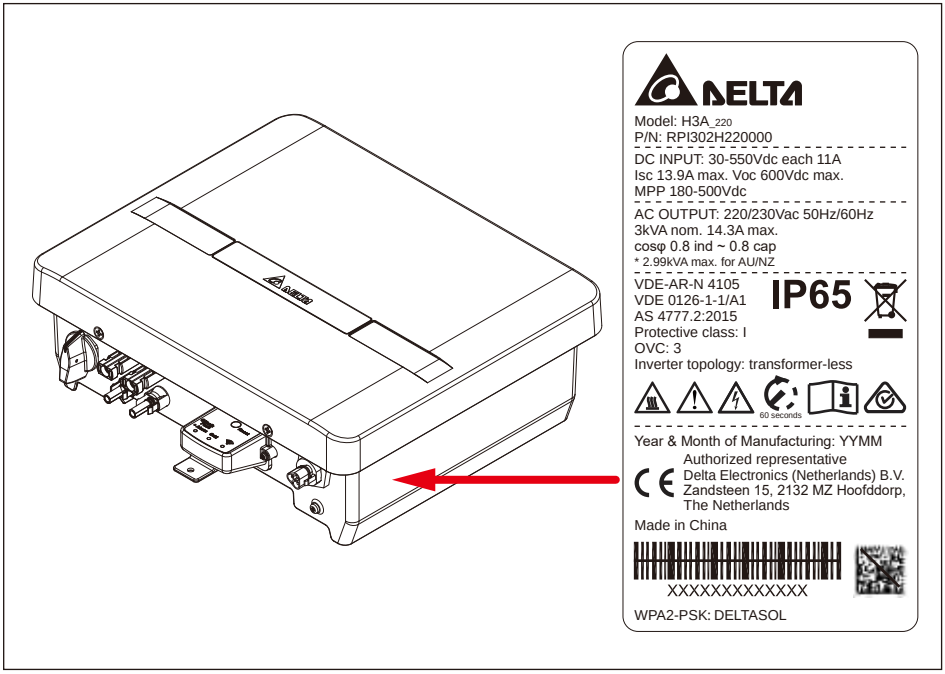



***Figure 2-4 : The identification label***

# 3 Product Overview

## 3.1 Dimensions

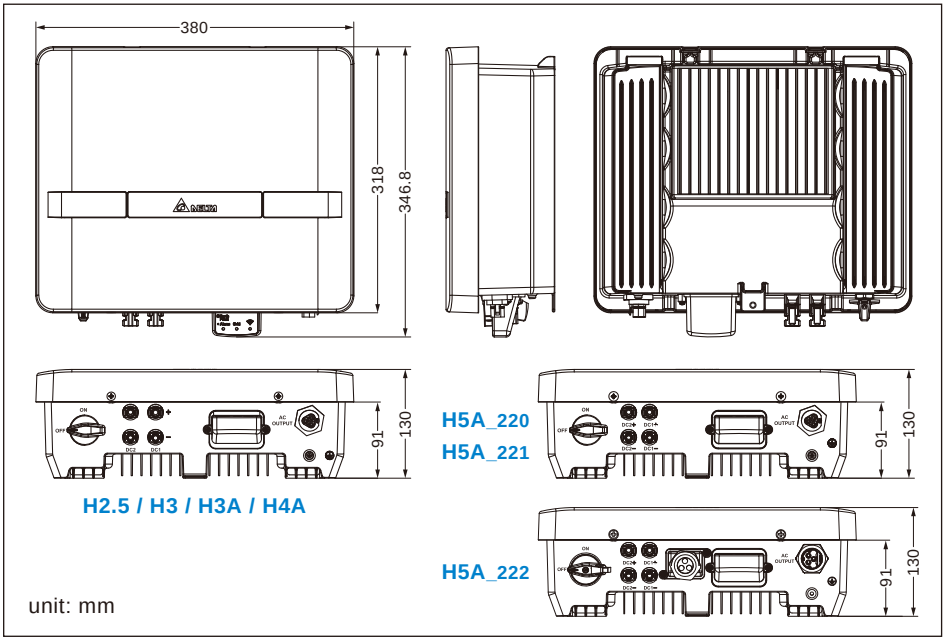



*Figure 3-1 : Dimensions of H2.5 / H3 / H3A / H4A / H5A*

## 3.2 Function Introduction

The Inverter's exterior is shown in ***Figure 3-2***. The description for individual objects can be found in sections 3.2.1.

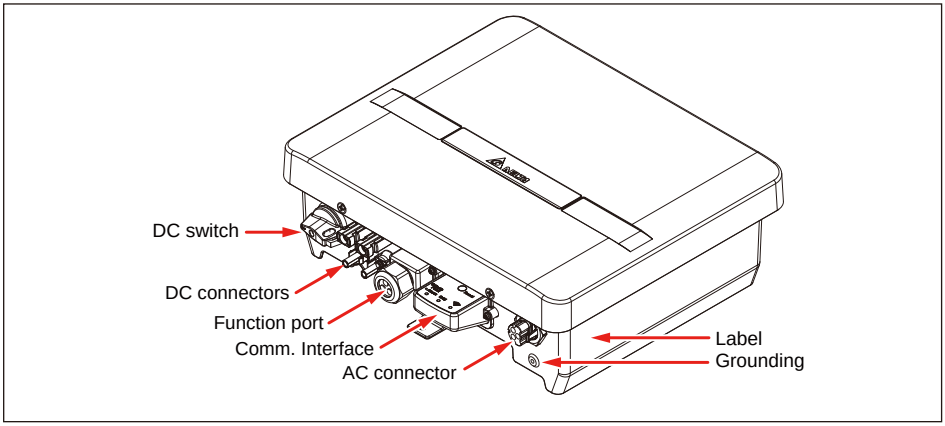



*Figure 3-2 : Inverter exterior objects*

## 3.2.1 LED and Button


*Figure 3-3 : LED and Button*

The LEDs indicate the operating state of the inverter.

| LED | Status | Explanation |
|---|---|---|
| Earth Fault Alarm | Flashing | The red LED flashing indicates error "E34：Insulation" |
| | Steady on | The red LED glowing indicates error or fault.<br>( see 9.1 Error Message ) |
| Grid | 0.1s on/off flashing | The inverter has not been setup yet. (country: default) |
| | 1s on/off flashing | The inverter is on countdown status, before connecting grid. |
| | Steady on | The inverter is connected to the grid. |
| Wi-Fi | Steady on | The Wi-Fi module is on data transmission. |

The reset button function

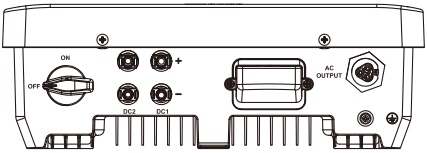
| Operation | Wi-Fi LED Status | Explanation |
|---|---|---|
| Push 3s~10s | Wi-Fi LED flashing once every half a second | Reset Wi-Fi module |
| Push 10s~20s | No flash | No function |
| Push 20s~ | Wi-Fi LED flashing once every one seconds | Reset Wi-Fi module, and Wi-Fi password returns to the default: DELTASOL |

*Table 3-1 : LED and Reset button function*

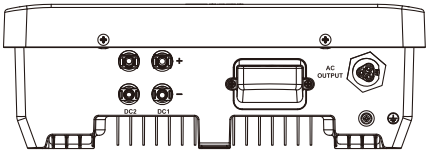
## 3.3 Inverter Comparison

The DC switch is only presented in the 210/220/222 models.
Model series 211/221 does not have the DC switch.

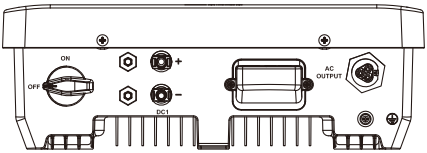
H3A_220
H4A_220



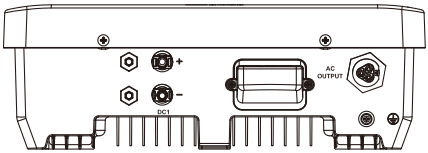

H3A_221
H4A_221 (No DC switch)



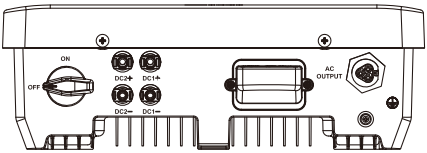

H2.5_210
H3_210



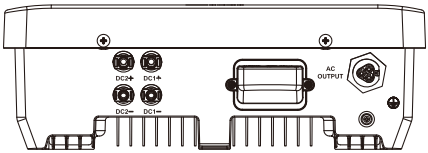

H2.5_211
H3_211 (No DC switch)




H5A_220




H5A_221 (No DC switch)




H5A_222

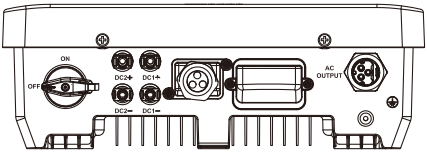



***Figure 3-4 : Inverter comparison***

# 4 Installation

## 4.1 Installation Location

The inverter can be installed in indoors / outdoors.

**WARNING !**

Do not install the unit near or on flammable surfaces.
Mount the unit tightly on a solid/smooth surface.

**CAUTION !**

The unit should not be installed in direct sunlight.

## 4.2 Mounting

This unit is designed to be wall-mounted. Please ensure the installation is perpendicular to the floor and the AC plug located at the base of the unit. Do not install the device on a slanting wall. The dimensions of the mounting bracket are shown in the figure below.

To mount the inverter on the wall, please follow the procedure below:

1.Screw the mounting bracket on the wall with 6 * Φ5.5mm Phillips head screws.

2.Attach the inverter to the mounting bracket.

3.Use Hex Wrench fixing the inverter with 1 * Φ5.0mm Hexagon Socket screw. Please refer to ***Figure 4-1.***

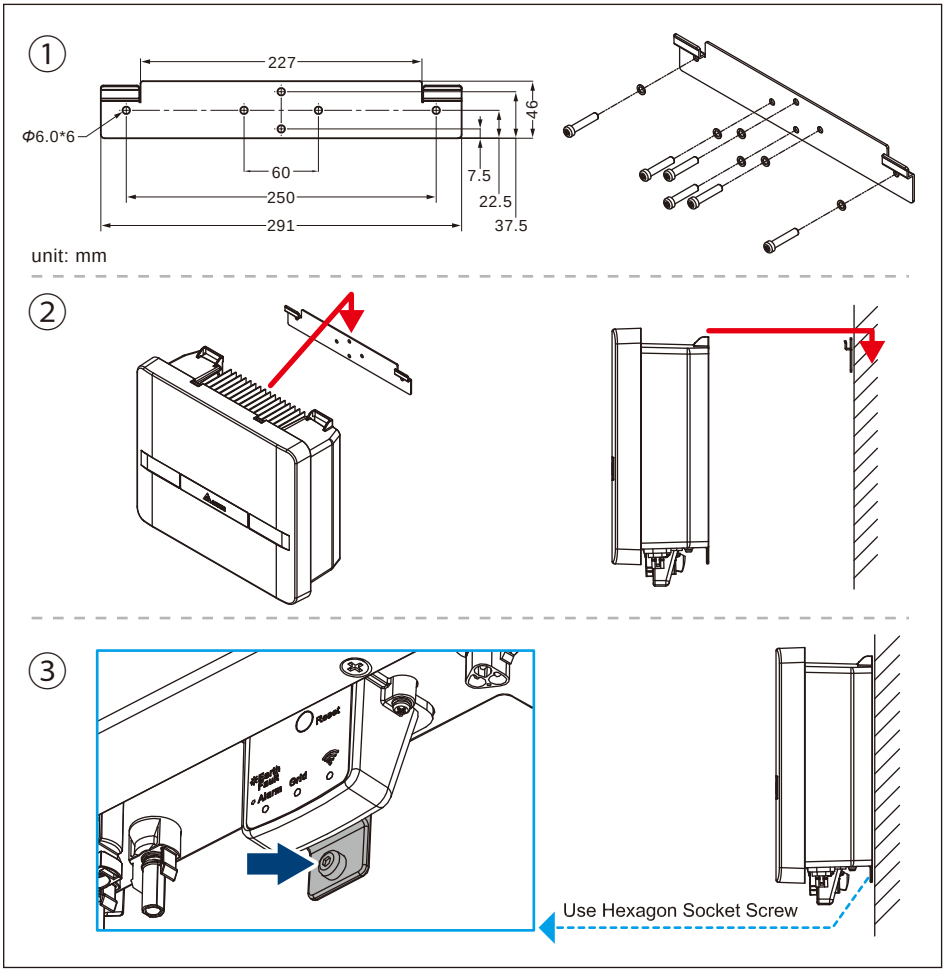



*Figure 4-1 : Attaching the mounting bracket for H2.5 / H3 / H3A / H4A / H5A*

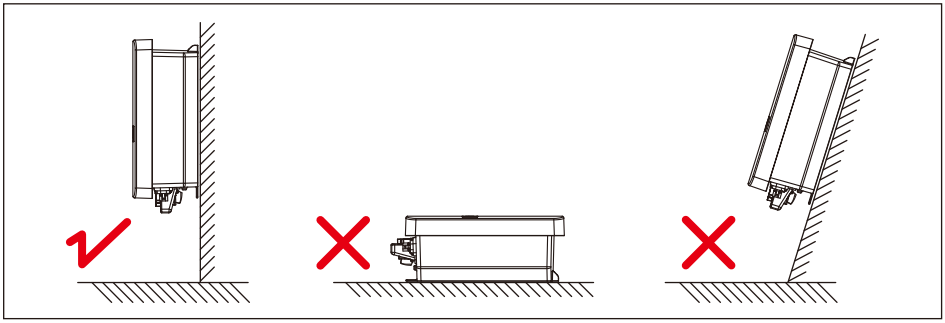


*Figure 4-2 : Correct and incorrect installation illustration*

**CAUTION !**

- The bracket supplied with the unit is specially designed and should be the only mounting device used for the unit.
- It is recommended to install the inverter in a suitable location which offers easy and safe access for service and maintenance.
- Please leave an appropriate gap in between units when installing multiple solar inverter systems.
- Please install solar inverter at eye level to allow easy observation for operation and parameter setting.
- Ambient temperature for operation: -25°C~+60°C (power derating above 40°C).

Please ensure the spacing requirement to allow for sufficient convective cooling. It is essential to ensure sufficient space for product operation as shown in ***Figure 4-3.***

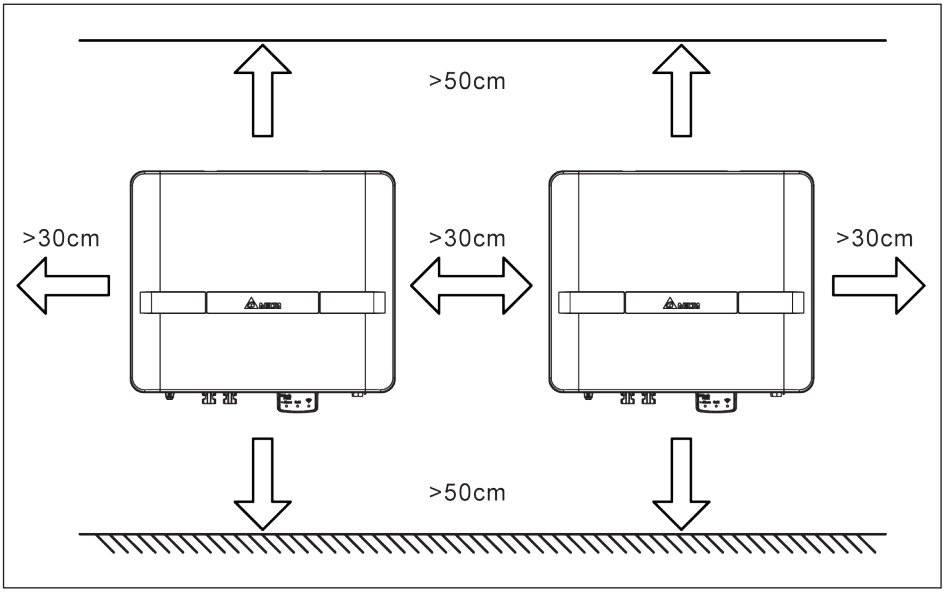
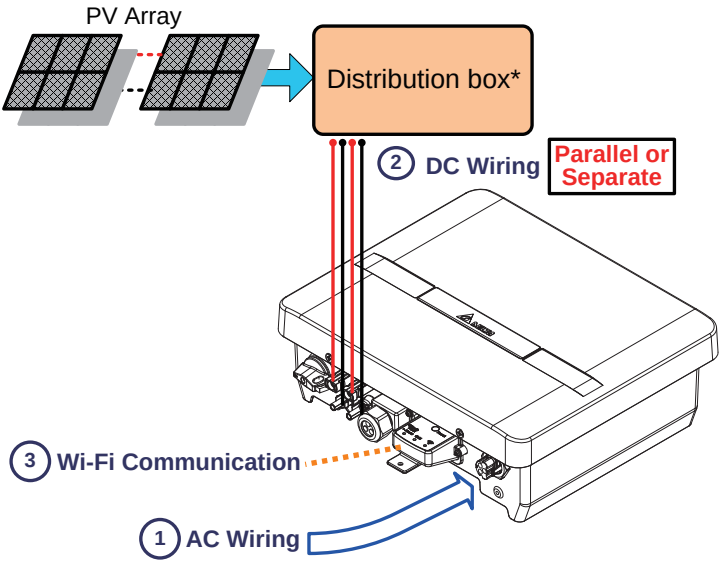



***Figure 4-3 : Adequate installation gap***

# 5 Wiring

## 5.1 Preparation before Wiring

1. Ensure voltage values and polarities are correct.
2. When grounding the solar array positive or negative terminal, an isolation transformer is required due to the H2.5 / H3 / H3A / H4A / H5A not having galvanic isolation between the DC-input and AC-output.
3. The ground fault detection is a fixed internal setting. It cannot be modified.
4. Please refer to ***Figure 5-1*** for connections. Inverter can accept DC inputs in parallel.
5. According to IEC 62109-2, the PV modules need to have an IEC 61730 Class A rating.




* According to local regulations, DC circuit breaker may be necessary.

***Figure 5-1 : Connection of a system for floating solar array***

**WARNING! SHOCK HAZARD**

When the photovoltaic array is exposed to light, it supplies a DC voltage to the Inverter, a shock hazard may exist due to output wires or exposed terminals. To reduce the risk of shock during installation, cover the array with an opaque (dark) material and ensure that the Disconnect Device in the inverter is set to OFF before commencing any wiring.

## 5.2 AC Grid Connection : L + N + PE

**WARNING !**

Before commencing AC wiring, please ensure all AC circuit breakers are switched off.

### 5.2.1 Required protective devices and cable cross-sections

#### 5.2.1.1 AC plug of H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221

| | Power rating | Upstream AC circuit breaker |
|---|---|---|
| H2.5<br>H3 / H3A<br>H4A / H5A | 3.125 kVA<br>3.75 kVA<br>5 kVA | 16A<br>20A<br>25A |

***Table 5-1: Recommended upstream protection***

The AC plug provided with the inverter has the following technical characteristics:

| | |
|---|---|
| AC connector | 96.031.4154.3 01K, Wieland Electric GmbH |
| Current rating | ≤ 25 A |
| Min. / Max. cable diameter | 10 ... 14 mm |
| Min. / Max. wire diameter | 1.25 ... 4 $mm^2$ |
| Recommended torque for terminal screws | 0.8~1 N.m |

Read and follow the instructions delivered with the AC plug.
The AC plug delivered with the inverter can be used with flexible or rigid copper cable.

When calculating the cross section of the cable, consider:
- material used
- thermal conditions
- cable length
- type of installation
- AC voltage drop
- power losses in cable

Always follow the system installation requirements defined for your country!

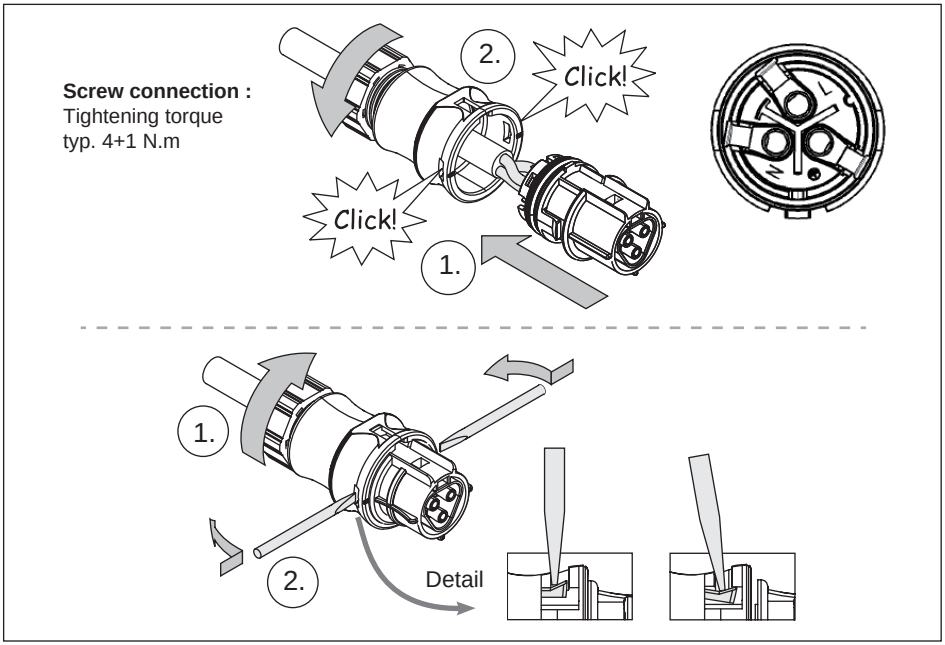



*Figure 5-2 : AC plug illustration (96.031.4154.3 01K, Wieland Electric GmbH)*

## 5.2.1.2 AC plug of H5A_222

| | Power rating | Upstream AC circuit breaker |
|---|---|---|
| H5A_222 | 5 kVA | 25A |

***Table 5-2: Recommended upstream protection***

The AC plug provided with the inverter has the following technical characteristics:

| Technical data | | | | | |
|---|---|---|---|---|---|
| Degree of protection | | IP66** / IP68 (2 m, 24 h)** / IP69K*** | | | |
| Nominal current (observe derating*) | | IEC 61984 | IEC 61535 | 2 PfG 1915 @ 85 °C | |
| - conductor cross section: | 6 mm² | 35 A | 32 A | 21,4 A | |
| | 4 mm² | 32 A | 25 A | 17.3 A | |
| | 2.5 mm² | 24 A | 20 A | 14,1 A | |
| 2.5 mm² with 1.5 mm² field plug | | 17,5 A | 17,5 A | 12,2 A | |
| Nominal voltage | | IEC 61984 | IEC 61535 | 2 PfG 1915 | UL 2238 |
| | | 690 V | 500 V | 500 V | 600 V |
| Rated surge voltage | | 6 kV | | | |
| Pollution degree | | 3 | | | |
| Operating temperature | | -40 °C ... +110 °C | -40 °C ... +110 °C | -40 °C ... +110 °C | -40 °C ... +105 °C |
| Material | | PPE | | | |

* Operating current [A] depending on ambient temperature [°C], according to conductor cross-section.

** TÜV Rheinland approved / *** Phoenix Contact approved

Read and follow the instructions delivered with the AC plug.
The AC plug delivered with the inverter can be used with flexible or rigid copper cable.

When calculating the cross section of the cable, consider:

- material used
- thermal conditions
- cable length
- type of installation
- AC voltage drop
- power losses in cable

Always follow the system installation requirements defined for your country!

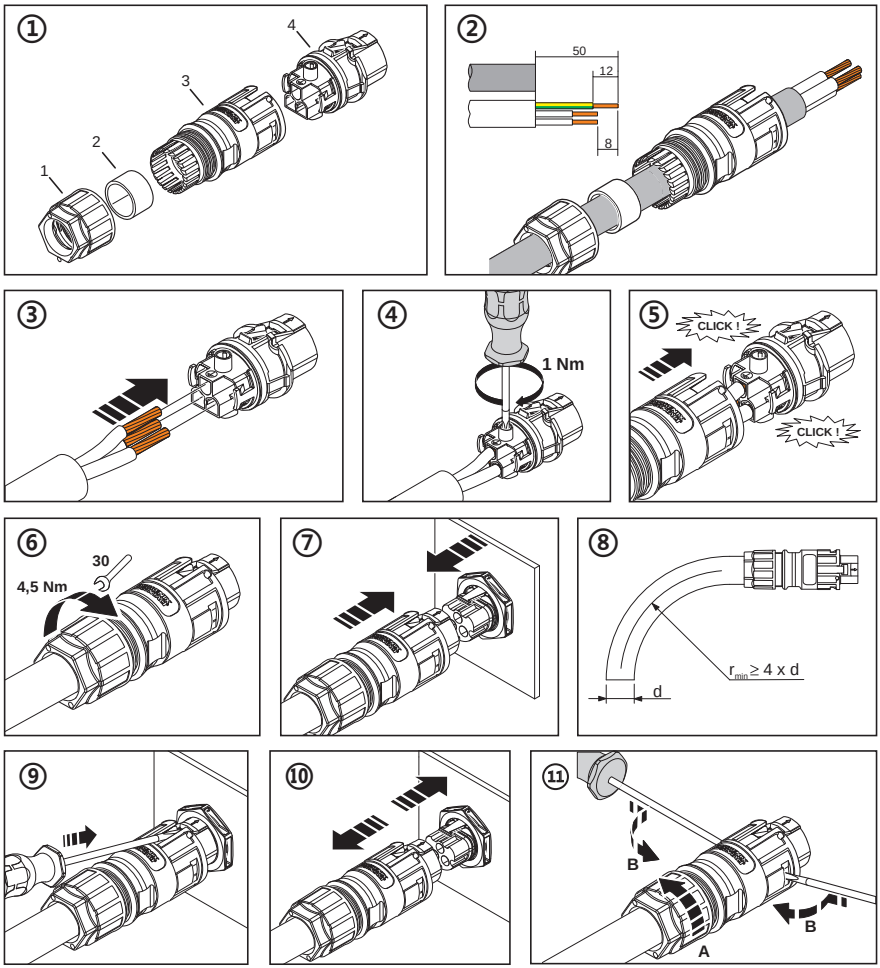



***Figure 5-3 : AC plug illustration (PRC 3-FC-FS6)***

## 5.3 DC Connection (from PV Array)

**WARNING !**

- When undertaking DC wiring, please ensure the correct polarities are connected.
- When undertaking DC wiring, please ensure that the DC isolator switch on the PV array is OFF.

**CAUTION !**

The maximum open circuit voltage of the PV Array must not exceed 500Vdc(H2.5) / 600Vdc (H3 / H3A / H4A / H5A).

**NOTE**

The isolator installed between the PV Array and inverter must meet the rating of voltage higher than this device's maximum input voltage.

# 5.3.1 Asymmetrical Loading

## 5.3.1.1 DC connector of H3A / H4A / H5A_220 / H5A_221

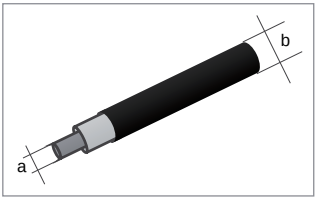
The inverters (H3A / H4A / H5A) operate using two separate MPP trackers that can handle both symmetrical and asymmetrical loads to allow for optimum adjustment. This allows for the requirements of complex PV system designs to be fulfilled.

| MPP range with Max. power | H3A | H4A | H5A |
|---|---|---|---|
| Symmetrical load | 180~500V | 240~500V | 240~500V |
| Asymmetrical load | 290~500V | 380~500V | 430~500V |
| Max. ratio for asymmetrical load | 100/0% ; 0/100% | 100/0% ; 0/100% | 94/6% ; 6/94% |

The RPI range of PV inverters uses genuine Multi-Contact® MC4 connectors.

### DC plugs and DC cables

The DC plugs for all DC connections are provided along with the inverter.
If you want to order more or need a different size, see the information in the following table.




| DC connectors on the inverter | | DC plugs for DC cable | | | |
|---|---|---|---|---|---|
| | | a mm² | b mm | Multi-Contact | |
| DC– |  |  | 1,5/2,5 | 3–6 | 32.0010P0001-UR |
| | | | | 5,5–9 | 32.0012P0001-UR |
| | | | 4/6 | 3–6 | 32.0014P0001-UR |
| | | | | 5,5–9 | 32.0016P0001-UR |
| DC+ |  |  | 1,5/2,5 | 3–6 | 32.0011P0001-UR |
| | | | | 5,5–9 | 32.0013P0001-UR |
| | | | 4/6 | 3–6 | 32.0015P0001-UR |
| | | | | 5,5–9 | 32.0017P0001-UR |

***Table 5-3 : MC4 connectors***

DC wiring polarities have two components, Plus and Minus, which are shown in ***Figure 5-3.*** The connection shall conform to the indication marked on inverter.

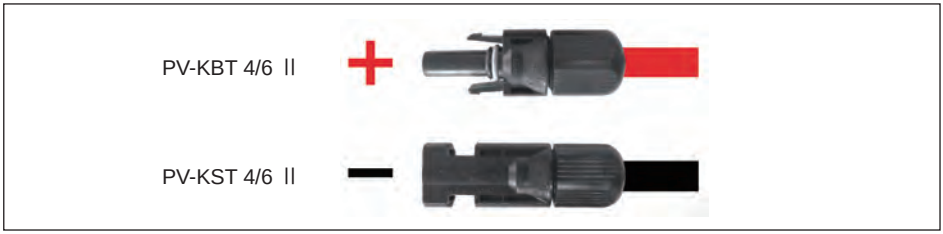



***Figure 5-4 : DC Wiring illustration of H3A / H4A / H5A_220 / H5A_221***

## 5.3.1.2 DC connector of H5A_222

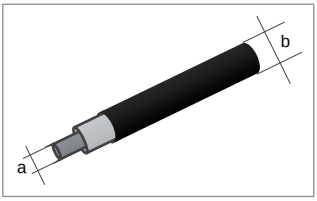
The inverter (H5A_222) operate using two separate MPP trackers that can handle both symmetrical and asymmetrical loads to allow for optimum adjustment. This allows for the requirements of complex PV system designs to be fulfilled.

| MPP range with Max. power | H5A_222 |
|---|---|
| Symmetrical load | 240~500V |
| Asymmetrical load | 430~500V |
| Max. ratio for asymmetrical load | 94/6% ; 6/94% |

The RPI range of PV inverters uses genuine Amphenol H4 connectors.

### DC plugs and DC cables

The DC plugs for all DC connections are provided along with the inverter.
If you want to order more or need a different size, see the information in the following table.




| Description | Specifications | | |
|---|---|---|---|
| contact size | 2.5mm² / 14AWG | 4mm² / 12AWG | 6mm² / 10AWG |
| rated current (TUV) | 25A @85˚C | 35A @85˚C | 45A @85˚C |

***Table 5-4 : H4 connectors***

DC wiring polarities have two components, Plus and Minus, which are shown in ***Figure 5-5.*** The connection shall conform to the indication marked on inverter.

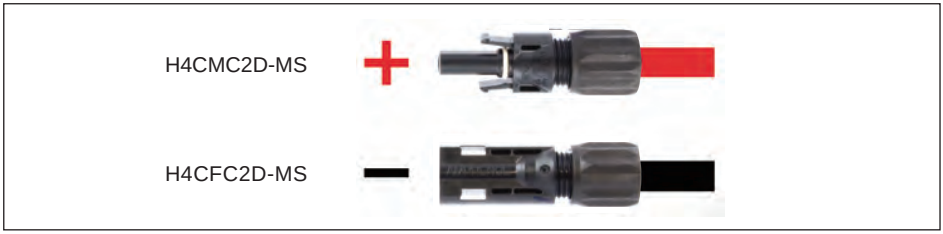



***Figure 5-5 : DC Wiring illustration of H5A_222***

# 6 Active/Reactive Power Control and LVRT (Optional)

There are 2 settings for active power and 4 settings for reactive power control that can be configured based on the requirement of the local network operator.

**ATTENTION**

The parameters are set according to the requirements of the selected country.
A change to the parameter settings may result in the approval being lost.

## 6.1 Active Power Control

### 6.1.1 Power Limit

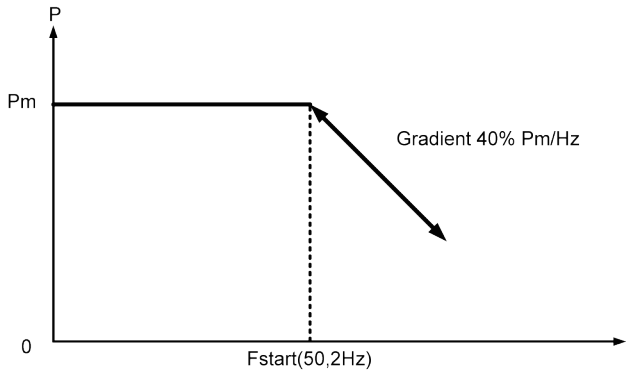
Users can reduce inverter output power by a set percentage of actual or rated power.

### 6.1.2 Power vs. Frequency

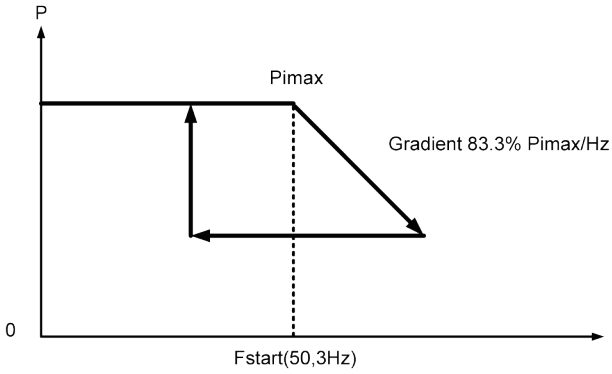
According to VDE-AR-N 4105 (5.7.3.3):
At frequencies between 50.2Hz and 51.5Hz, all adjustable power generation systems shall reduce (for frequency increase) or increase (for frequency decrease) the active power Pm generated instantaneously (at the time of exceeding the mains frequency 50.2Hz; freezing the value on the current level) with a gradient of 40% of Pm per Hertz).

According to CEI 0-21 (8.5.3.2):
Within a frequency range from 50.3Hz to 51.5Hz, all adjustable production plants equipped with static converters have to be able to reduce the currently generated active power in case of an increase of the frequency with a variable drop of 2% to 5% with a default value of 2.4% (with corresponds to a power gradient of 83.3%/Hz).

User can set all necessary settings to meet the requirements from the network operator. Please refer to actual Power vs. Frequency shown in ***Figure 6-1*** for the settings procedure.




Power vs. frequency curve for VDE-AR-N 4105




Power vs. frequency curve for CEI-021

***Figure 6-1 : Power vs. frequency characteristic***

## 6.2 Reactive Power Control

The setting value is either：

- fixed power factor cosφ (VDE-AR-N 4105 ,CEI 0-21)
- displacement factor/active power characteristic curve cosφ(p) (VDE-AR-N 4105 ,CEI 0-21)
- fixed reactive power in Var.(CEI 0-21)
- reactive power/voltage characteristic Q(U). (CEI 0-21)

## 6.2.1 Fixed Power Factor cosφ (VDE-AR-N 4105,CEI 0-21)

Users can set the power factor from Cap 0.8 to Ind 0.8 (inverter would stop reactive power control if output power is below 20% rated power).

## 6.2.2 cosφ(P) (VDE-AR-N 4105,CEI 0-21)

Once user enables this method, the inverter will deliver reactive power according to output active power at that moment. ***Figure 6-2*** is an example.

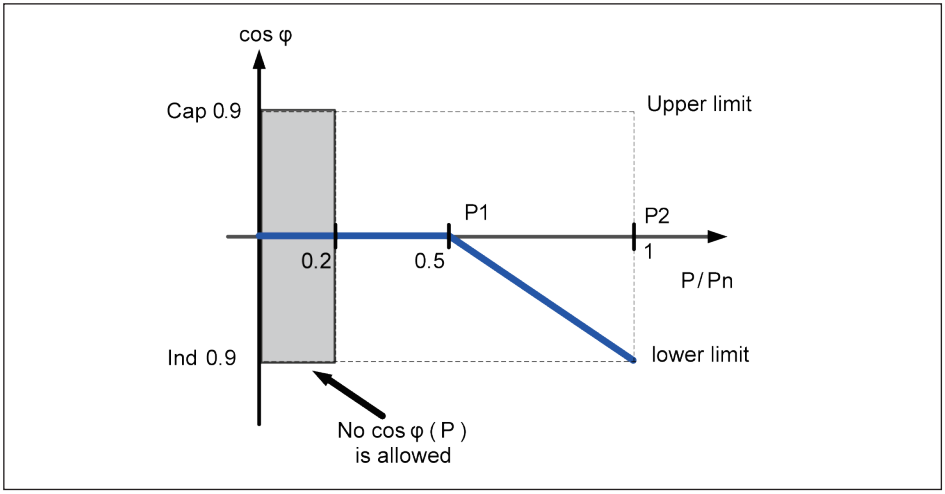



***Figure 6-2 : cosφ(P) characteristic***

## 6.2.3 Fixed Reactive Power InVAR(CEI 0-21)

Once user enables this method, the inverter will deliver reactive power (i.e. Q) consistent with that of the fixed reactive power setting.
The setting range is from Cap 53% to Ind 53%.

## 6.2.4 Reactive Power/ Voltage Characteristic Q(U)(CEI 0-21)

Once the user enables this method, the user can set Q vs. Grid voltage operation curve as in ***Figure 6-3*** below.

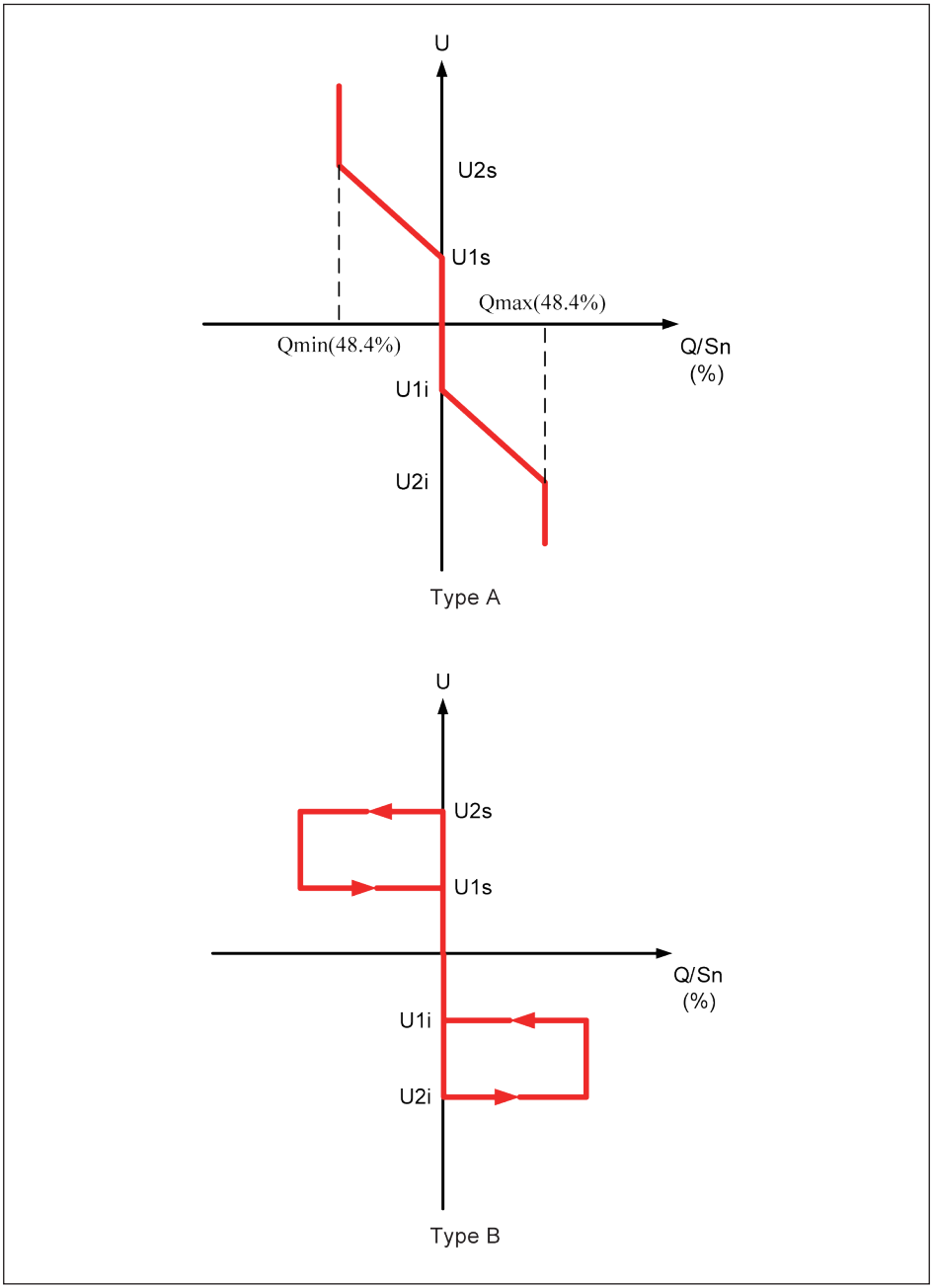



***Figure 6-3 : Q(U) characteristic***

## 6.3 Low Voltage Ride Through (LVRT)

According to CEI 0-21, 8.5.1

To avoid undue separation from the network if voltage dips occur, a generation system with over 6 kW total power must be able to comply with certain functional requirements, which are known as LVRT (Low Voltage Ride Through) in international literature.

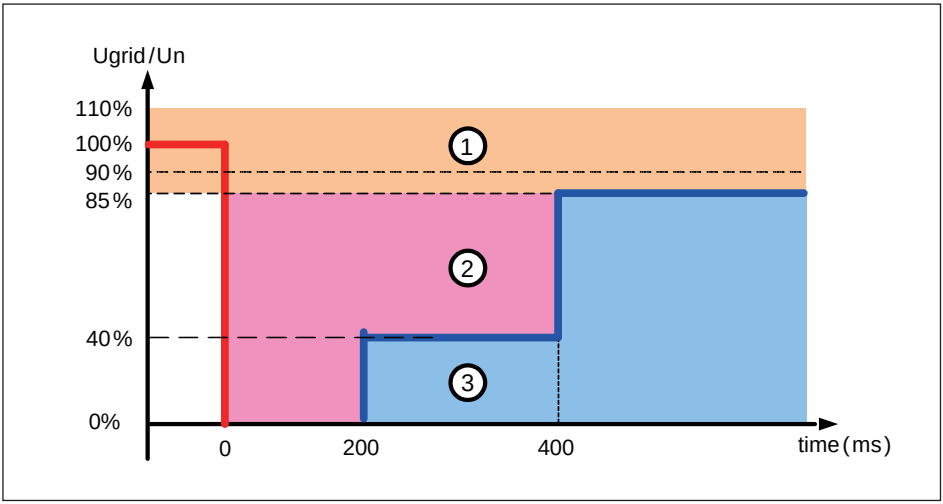



***Figure 6-4 : LVRT characteristic***

Zone 1 : The Inverter doesn't disconnect from the grid.
Zone 2 : The Inverter may temporarily interrupt the supply of active and reactive power supplied before the breakdown.
Zone 3 : The inverter disconnect from the grid.

## 6.4 Digital Input

To implementation of power management, the digital input interface receives the specifications of the network operator via a ripple control receiver or a DRED. H2.5/H3/H3A/H4A/H5A can access these command via DC1_100.

- **Germany** : The active power limitation in the stages 0%, 30%, 60% and 100%
- **Italy** : Power output of Max 6KW for PV plant installation.
  Remote shutdown
  Narrow Frequency limits between 49.5 Hz to 50.5Hz.
- **Australia and New Zealand:**
  The inverter support the demand response mode (DRMs).
  DRM 0 - Operate the disconnection device.
  DRM 5 - Do not generate power.
  DRM 6 - Do not generate at more than 50% of rated power.
  DRM 7 - Do not generate at more than 75% of rated power.
  And sink reactive power.
  DRM 8 - Increase power generation.
  (subject to constraints from other active DRMs)
- **Customer :** User defined.

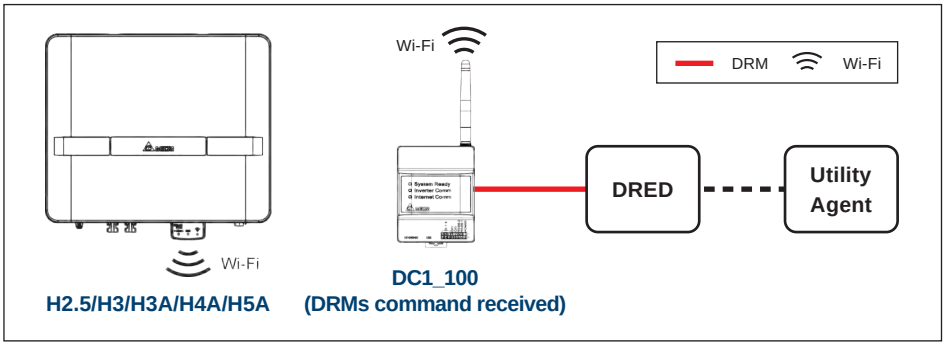
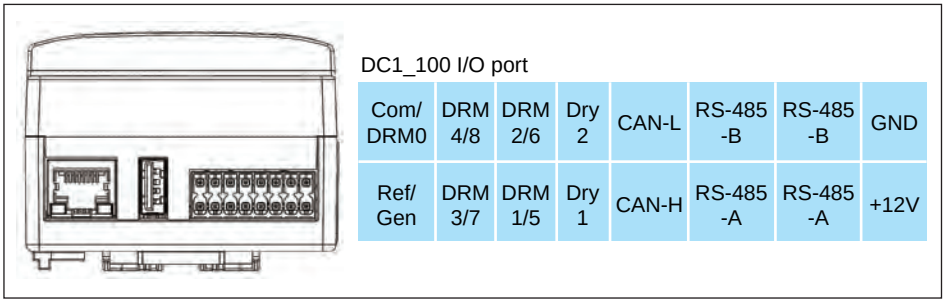



*Figure 6-5 : Digital input via DC1_100*

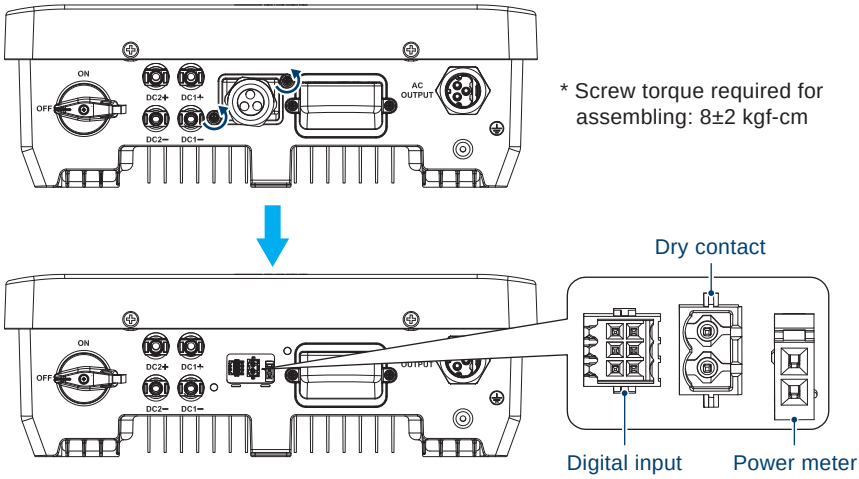


DC1_100 I/O port

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Com/ DRM0 | DRM 4/8 | DRM 2/6 | Dry 2 | CAN-L | RS-485 -B | RS-485 -B | GND |
| Ref/ Gen | DRM 3/7 | DRM 1/5 | Dry 1 | CAN-H | RS-485 -A | RS-485 -A | +12V |

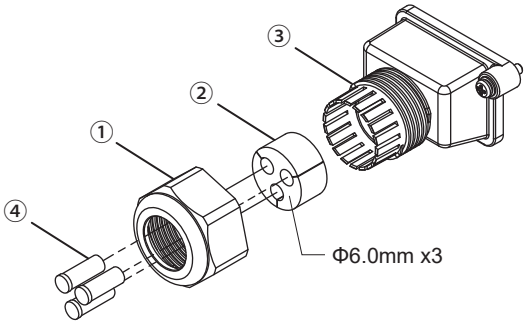
*Figure 6-6 : Digital input on DC1_100*

## 6.5 Function Port of H5A_222




* Screw torque required for assembling: 8±2 kgf-cm

## 6.5.1 Installation of the Rubber Washer




(1) Loosen the front cover ① counterclockwise.
(2) Remove the rubber washer ② from the fastening ring ③.
(3) Remove the washer plugs ④ and insert the cable from the cut out of rubber washer ②.
(4) Connect the cable with the terminal.
(5) Install the rubber washer ② to the fastening ring ③.
(6) Surely tighten the front cover ①.

* To ensure contactment, please make sure cables are not twisted.

## 6.5.2 Digital Input

To implementation of power management, the digital input interface receives the specifications of the network operator via a ripple control receiver.

- **Australia and New Zealand:**
  The inverter support the demand response mode (DRMs).
  DRM 0 - Operate the disconnection device.
  DRM 5 - Do not generate power.
  DRM 6 - Do not generate at more than 50% of rated power.
  DRM 7 - Do not generate at more than 75% of rated power.
  And sink reactive power.
  DRM 8 - Increase power generation.
  (subject to constraints from other active DRMs)
- **Customer :** User defined.

The inverter can detect the state of the relay of the ripple control receiver.
The information which relay shall be controlled parameter by the network operator.

| Short pins | Inverter behavior (AU) |
|---|---|
| D6 & D1 | DRM 0 - Disconnect from grid |
| D6 & D2 | DRM 8 - Power de-rating to 100% |
| D6 & D3 | DRM 7 - Power de-rating to 75% |
| D6 & D4 | DRM 6 - Power de-rating to 50% |
| D6 & D5 | DRM 5 - Power de-rating to 0% |

- Conductor cross-section: 0.205 mm² (AWG24) ~ 0.081 mm². (AWG28)
- Outside diameter of cable: 3.8mm ~ 5.2mm
- Please refer to UL 2464 computer cable guideline

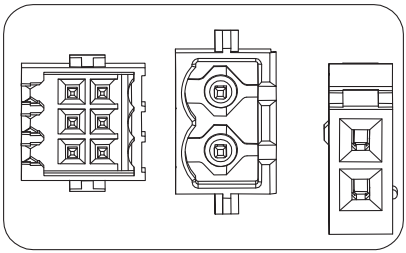


*Figure 6-7 : Digital input, Dry contact & Power meter*

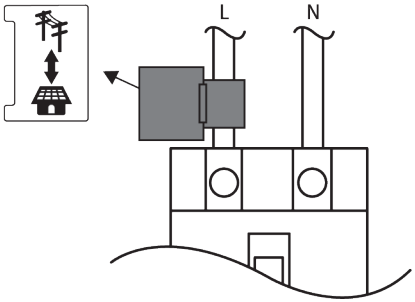
| | | | |
|---|---|---|---|
| D6 | D3 | | |
| D5 | D2 | Dry contact | Power meter |
| D4 | D1 | Dry contact | Power meter |

## 6.5.3 Dry Contact connection

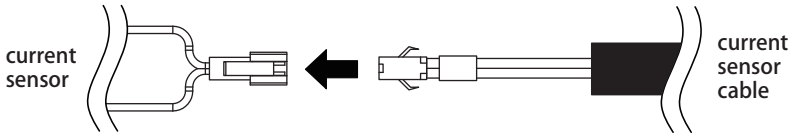
Provide single set of Dry Contact.
The function can be customized by users.
The dry contact port can withstand with 250Vac/28Vdc/9A, and suitable electric wire is 0.2-1.5 mm².

## 6.5.4 Power meter

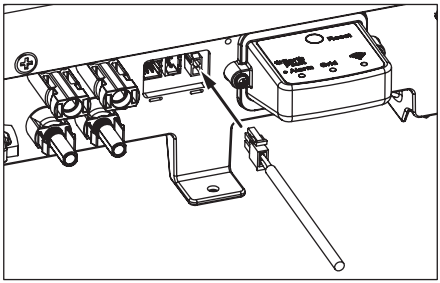
Connecting the current sensor in the following steps
(1) Attach a current sensor to the L cables of the main earth leakage circuit breaker.
(2) Clamp current sensor on power line and make sure that the direction is correct




(3) Connect the current sensor cable to the current sensor connection terminal of the measurement unit.




(4) Connect the current sensor cable to the CT sensor connection terminal on the function port.



# 7 Turning the PV inverter on/off

**WARNING !**

The internal temperature may exceed over 70°C while operating.
To avoid injury, do not touch the surface of the inverter whilst the unit is in operation.

After installation, please ensure the AC, the DC and communication connection are correct. When enough power is generated from the PV array, the device will operate automatically and will initial ‘self-test’. This self-test takes approximately 2 minutes and will occur at first start-up of the day.

## 7.1 Start-up Procedures

### 7.1.1 PV Array DC Voltage Checking

Firstly, uncover the PV arrays and expose them to full sunlight. Please note, the sunlight must be intense enough to produce the required output voltage for the inverter to start up.
Measure the PV array open circuit DC voltage across the DC positive (+) and negative (-) terminals.

### 7.1.2 AC Utility Voltage Checking

Using an AC voltmeter, measure the AC open circuit utility voltage between L1 (L) and L2 (N) Ensure the voltage is at approximately the nominal value. The inverter operates with a line-to-line voltage range around the nominal value.
Refer to page 33 "11. Technical data” output section for the utility voltage operating range for your inverter model.

## 7.1.3 Starting up the Inverter

1.Switch on the PV Array switch and DC switch (with DC switch model) to connect PV Array.

2.Switch on AC circuit breaker to connect electricity grid.

3.Communication Module

The Communication Module supports the communication with the device with Wi-Fi function.(e.g., smart phone, tablet ect.)

**Wi-Fi communication**

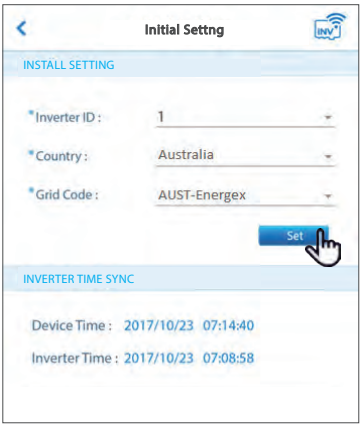
1. Turn on the device's Wi-Fi function.
2. Select the inverters' Wi-Fi SSID: Delta-[serial number]
   (e.g. Delta-O4L16A00001W0 ; See Inverter " The identification label")
3. Enter the Wi-Fi password: DELTASOL
   (The Default password is also printed on the identification label)
4. Use the "MyDeltaSolar" APP (You can download the APP via google play or App Store)

Please note：

(1) The product only support one device communicating at the same time.

(2) If the Wi-Fi password is forgotten, press and hold the Reset Button more than 20s to return the Default password to ("DELTASOL").

4.Upon first start-up of the inverter, country selection is required, please contact your system installer to process the setting.
More information please refer to "Get Started Register" guide.




**CAUTION !**

Due to the variety of installation environments, installation of the unit and start-up procedures must be carried out by an accredited technician.
Incorrect settings may cause the inverter to malfunction.

# 8 Maintenance

In order to ensure normal operation of the inverter, please check the unit regularly. Check that all terminals, screws and cables are connected and appear as they did upon installation. If there are any impaired or loose parts, please contact your solar installer immediately. Ensure that there are no foreign objects in the path of the heat outlet and keep the unit and it's surroundings clean and tidy at all times.

**WARNING !**

Before any maintenance, please switch AC and DC power off to avoid risk of electronic shock.

# 9 Error Message and Trouble Shooting

## 9.1 Error Message & Trouble Shooting

| Error | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| E01: OFR | 1. Actual utility frequency is higher than the OFR setting<br>2. Incorrect country setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| E02: UFR | 1. Actual utility frequency is lower than the UFR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E09: No Grid | 1. AC breaker is OFF<br>2. AC plug disconnected<br>3. Internal fuses are broken | 1. Switch on AC breaker<br>2. Check the connection in AC plug and make sure it connects to inverter<br>3. Replace fuses and check all switching devices in boost & inverter stages |
| E10: UVR | 1. Actual utility voltage is higher the UVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Measure the utility AC voltage to the inverter terminal.<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E11: OVR | 1. Actual utility voltage is higher than the OVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Measure the utility AC voltage to the inverter terminal.<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E13: OVR-Slow | 1. Actual utility voltage is over than the OVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility voltage on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E26: OFR-Slow | 1. Actual utility frequency is over the OFR setting<br>2. Incorrect country or grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| E27: UFR-Slow | 1. Actual utility frequency is under the UFR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |

| Error | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| E28: UVR-Slow | 1. Actual utility voltage is under the UVR setting<br>2. Incorrect country or Grid setting<br>3. Detection circuit malfunction | 1. Check the utility voltage on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |
| E30: OVR(PV) | 1. Actual Solar voltage is over 510Vdc (H2.5) or 560Vdc (H3/ H3A/ H4A/ H5A)<br>2. Detection circuit malfunction | 1. Modify the solar array configuration and make the Voc less than 500Vdc (H2.5) or 550Vdc (H3/ H3A/ H4A/ H5A)<br>2. Check the detection circuit inside the inverter |
| E34: Insulation | 1. PV array insulation fault<br>2. Large PV array capacitance between Plus to Ground or Minus to Ground or both.<br>3. Detection circuit malfunction | 1. Check the insulation of Solar inputs<br>2. Check the capacitance, dry PV panel if necessary<br>3. Check the detection circuit inside the inverter |

**Table 9-1 : Error Message**

| Fault | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| F01: DC Injection | 1. Utility waveform is abnormal<br>2. Detection circuit malfunction | 1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary<br>2. Check the detection circuit inside the inverter |
| F05: NTC OTP | 1. The ambient temp. is over 60℃<br>2. Detection circuit malfunction | 1. Check the installation ambient temperature and environment<br>2. Check the detection circuit inside the inverter |
| F06:<br>NTC0 Circuit Fail | 1. Ambient temp. >100℃ or <-40℃<br>2. Detection circuit malfunction | 1. Check the installation ambient temperature and environment<br>2. Check the detection circuit inside the inverter |
| F07: NTC LTP | 1. Ambient temp. <-30℃<br>2. Detection circuit malfunction | 1. Check the installation ambient temperature and environment<br>2. Check the detection circuit inside the inverter |
| F09:<br>Ntc2 Circuit Fail | 1. Ambient temp. >100℃ or <-40℃<br>2. Detection circuit malfunction | 1. Check the installation ambient temperature and environment<br>2. Check the detection circuit inside the inverter |

| Fault | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| F15: HW ADC1 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| F16: HW ADC2 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| F17: HW ADC3 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| F19: HW ADC5 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| F20: Efficiency Abnormal | 1. The calibration is incorrect<br>2. Current feedback circuit is defective | 1. Check the accuracy of current and power<br>2. Check the current feedback circuit inside the inverter |
| F23: Comm. Fault (Dis.) | 1. DSP is idling<br>2. The communication connection is disconnected<br>3. The communication circuit malfunction | 1. Check reset and crystal in DSP<br>2. Check the connection between DSP and COMM<br>3. Check the communication circuit |
| F24: RCMU Over Rating | 1. PV array insulation fault<br>2. Large PV array capacitance between Plus to Ground or Minus to Ground<br>3. Either side of boost driver or boost choke malfunction<br>4. Detection circuit malfunction | 1. Check the insulation of Solar inputs<br>2. Check the capacitance (+ <-> GND & - <-> GND), must < 2.5uF. Install an external transformer if necessary<br>3. Check boost driver & boost choke<br>4. Check the detection circuit inside the inverter |
| F27: RCMU Circuit Fail | 1. RCMU is disconnected<br>2. Detection circuit malfunction | 1. Check the RCMU connection inside the inverter<br>2. Check the detection circuit inside the inverter |
| F28: Relay Test Short | 1. One or more relays are sticking<br>2. The driver circuit for the relay malfunction | 1. Replace the defective relay(s)<br>2. Check the driver circuit inside the inverter |
| F29: Relay Test Open | 1. One or more relays are abnormal<br>2. The driver circuit for the relay malfunction<br>3. The detection accuracy is not correct for Vgrid and Vout | 1. Replace the defective relay(s)<br>2. Check the driver circuit inside the inverter<br>3. Check the Vgrid and Vout voltage detection accuracy |

| Fault | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| F35:<br>HW Bus OVR | 1. Driver for boost is defective<br>2. Voc of PV array is over<br>510Vdc (H2.5) or<br>560Vdc (H3/ H3A/ H4A/ H5A)<br>3. Surge occurs during operation<br>4. Detection circuit malfunction | 1. Check the driver circuit for boost inside the inverter<br>2. Modify the solar array setting, and make the Voc less than<br>500Vdc (H2.5) or<br>550Vdc (H3/ H3A/ H4A/ H5A)<br>3. N/A<br>4. Check the detection circuit inside the inverter |
| F37: OOCP | Detection circuit malfunction | Check the detection circuit inside the inverter |
| F42:<br>CT sensor Fail (A) | 1. Inverter choke Fail<br>2. Output Filter Fail<br>3. Detection circuit malfunction | 1. Check Inverter choke inductance.<br>2. Check output filter capacitance.<br>3. Check the detection circuit inside the inverter |
| F56:<br>HW incompat. | HW power rating incorrect | Check comm. HW power rating info. |
| F60: IOCP(PV1) | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| F61: IOCP(PV2) | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |

**Table 9-2 : Fault Message**

# 10 De-Commissioning

De-Commissioning Procedure:
If necessary to put the device out of operation for maintenance and/or storage, please follow the instructions below.

**WARNING !**

To avoid injuries, please follow this procedures

1. Switch off AC circuit breaker to disconnect from electricity grid.
2. Switch off the PV Array switch to disconnect from PV Array.
3. Use proper voltage meter to confirm that the AC and DC power are disconnected from the unit.
4. Remove the AC wiring immediately to completely disconnect from electricity grid.
5. Remove the DC wiring to disconnect from PV Array.
6. After completing all of the above steps, the inverter can be removed.

# 11 Technical Data

## 11.1 Specifications

| Model [1] | H2.5_210<br>H2.5_211 | H3_210<br>H3_211 | H3A_220<br>H3A_221 | H4A_220<br>H4A_221 | H5A_220<br>H5A_221 | H5A_222 |
|---|---|---|---|---|---|---|
| **GENERAL** | | | | | | |
| Enclosure | Powder-coated aluminium | | | | | |
| Operating temperature | -25~60°C, full power up to 40°C | | | | | |
| Operating Altitude | 2000m | | | | | |
| Relative humidity | 0% – 95% non-condensing. | | | | | |
| Environmental category | Outdoor, wet locations | | | | | |
| Galvanic isolation | No (TL Topology) | | | | | |
| Safety class | Class I metal enclosure with protective earth | | | | | |
| Pollution degree | Internal: II, External: III | | | | | |
| Overvoltage category | AC output: III, DC input: II | | | | | |
| Flicker impedance | Z = 0.4 + j 0.25 Ω (total impedance) | | | | | |
| Three-phase combinations | No | | | | | |
| **DC INPUT (Solar side)** | | | | | | |
| Max. input voltage | 500 Vdc | 600 Vdc | | | | |
| Operating voltage range | 30-500 Vdc | 30-550Vdc | | | | |
| MPP range (rated power) | 240-470 Vdc | 290-500Vdc | 180-500Vdc | 240-500Vdc | | |
| Normal voltage | 350 Vdc | | | | | |
| MPP tracker | 1 | | 2 | | | |
| Maximum input current | 11 A | | 11Adc for each /<br>18Adc for total | | 11Adc for each /<br>22Adc for total | |
| Max. short circuit current per MPPT | 15 A | | | | | |
| Max. inverter backfeed current to the array | 0A | | | | | |
| Startup voltage | 35 Vdc | | | | | |
| Input connection | MC4, 1 pairs | | MC4, 2 pairs | | | H4, 2 pairs |

| Model [1] | H2.5_210<br>H2.5_211 | H3_210<br>H3_211 | H3A_220<br>H3A_221 | H4A_220<br>H4A_221 | H5A_220<br>H5A_221 | H5A_222 |
|---|---|---|---|---|---|---|
| **AC OUTPUT (Grid side)** | | | | | | |
| Nominal output power [2] | 2500VA | 3000VA | | 4000VA | 5000VA | |
| Maximum power | 2500VA | 3000VA | | 4000VA | 5000VA | |
| Voltage | 230Vac -20%~+22% | | | | | |
| Nominal output current | 10.9 A | 13 A | | 17.4 A | 22 A | |
| Max. output current | 13.9 A | 14.3 A | | 18.6 A | 24 A | 23 A |
| Maximum output fault current | 16 A | | | 20 A | 25 A | |
| Maximum output over current protection | 16 A | | | 20 A | 25 A | |
| Current (inrush) (A, peak and duration) | 30A peak, 1ms | | | | | |
| Frequency | 50/60 Hz | | | | | |
| Total harmonic distortion [3] | <3% @Rated power | | | | | |
| Power factor [3] | >0.99 @Rated power | | | | | |
| Peak efficiency | 97.5% | | | | 98.3% | 97.5% |
| EU efficiency | 96.8% | | | | 98.0% | 96.8% |
| Output connection | IP 67 single-phase | | | | | |
| | **MECHANISM** | | | | | |
| Housing | Die casting | | | | | |
| Cooling | Convection cooling | | | | | |
| IP rating | IP65 | | | | | |
| External communication | Wi-Fi | | | | | |
| Weight | 10 kg | | | 11 kg | 12 kg | |
| Dimensions | 380 × 318 × 130 mm | | | | | |

| Model [1] | | H2.5_210<br>H2.5_211 | H3_210<br>H3_211 | H3A_220<br>H3A_221 | H4A_220<br>H4A_221 | H5A_220<br>H5A_221 | H5A_222 |
|---|---|---|---|---|---|---|---|
| **REGULATIONS & DIRECTIVES** | | | | | | | |
| Safety | | IEC 62109-1 / -2<br>CE compliance | | | | | |
| Grid interface | | VDE AR-N 4105 / VDE 0126-1-1 / AS4777.2:2015 [4-1] / G83-2 / G59-3 / EN50438 / VFR2014 / C10 / C11 / UTE C15-712-1 / IEC61683 / IEC61727 / IEC62116 / EN50549-1:2019 / ABNT NBR 16149 [4-2] / ABNT NBR 16150 [4-2] | | | | | AS4777.2:2015<br>IEC61683<br>IEC62116<br>IEC61727 |
| Emission | | IEC 61000-6-4, IEC 61000-6-3 | | | | | |
| Harmonics | | EN 61000-3-12 | | | | | |
| Variations and flicker | | EN 61000-3-11 | | | | | |
| Immunity | | EN 61000-6-2 | | | | | |
| Immunity | ESD | IEC 61000-4-2 | | | | | |
| | RS | IEC 61000-4-3 | | | | | |
| | EFT | IEC 61000-4-4 | | | | | |
| | Surge | IEC 61000-4-5 | | | | | |
| | CS | IEC 61000-4-6 | | | | | |
| | PFMF | IEC 61000-4-8 | | | | | |

**Table 11-1 : Specifications**

1: H2.5_210/ H3_210/ H3A_220/ H4A_220/ H5A_220/ H5A_222 : The product is with DC switch
H2.5_211/ H3_211/ H3A_221/ H4A_221/ H5A_221 : The product is without DC switch

2: (a) H2.5 : 2.49kVA max. for Australia (AU / NZ)
(b) H3 / H3A : 2.99kVA max. for Australia (AU / NZ)
(c) H5A : 4.99kVA max. for Australia (AU / NZ)
(d) H5A : 4.6kVA max. for Germany (DE)
(e) H4A/ H5A : 3.68kVA max. for Denmark (DK1 / DK2)

3: reactive power control disabled

4-1: not support AS4777.2:2015 Single-phase inverters used in three-phase combinations
4-2: only H3_210/ H4A_220/ H5A_220 support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