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## Grid-tie Transformerless Solar Inverter

H2.5 / H3 / H3A / H4A / H5A

Operation and Installation Manual

English ..... 1

繁體中文 ..... 45

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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 its 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

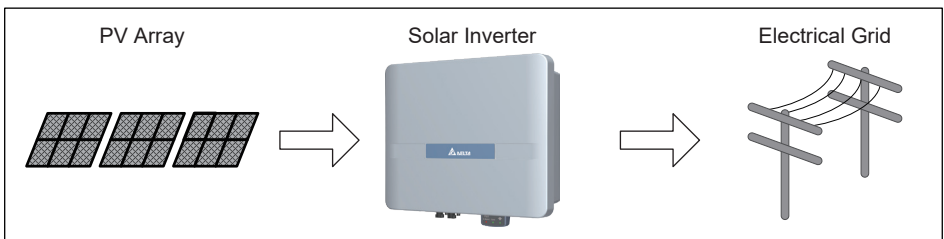
This device is a single-phase grid-tie solar inverter. It converts direct current (DC) electricity from the PV array into single phase alternating current (AC) to supply power to the load and feed the excess generated power back to the local grid. This inverter allows for a wide voltage input range and 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](http://www.deltaww.com)

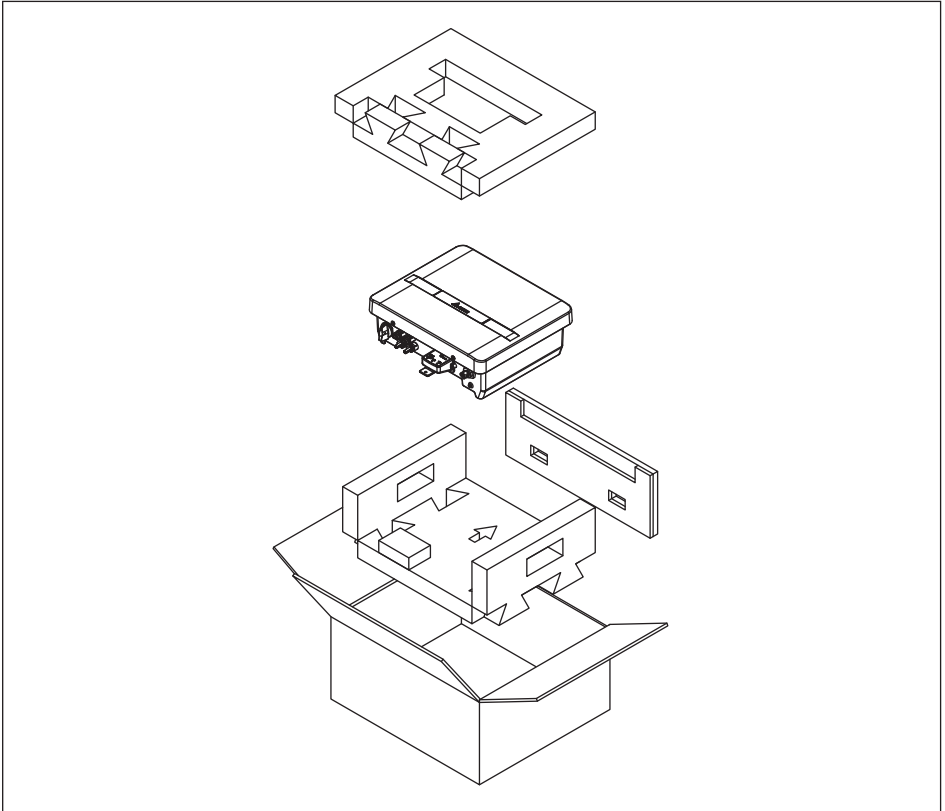
## 2 Installation and Wiring

### 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 its 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**:

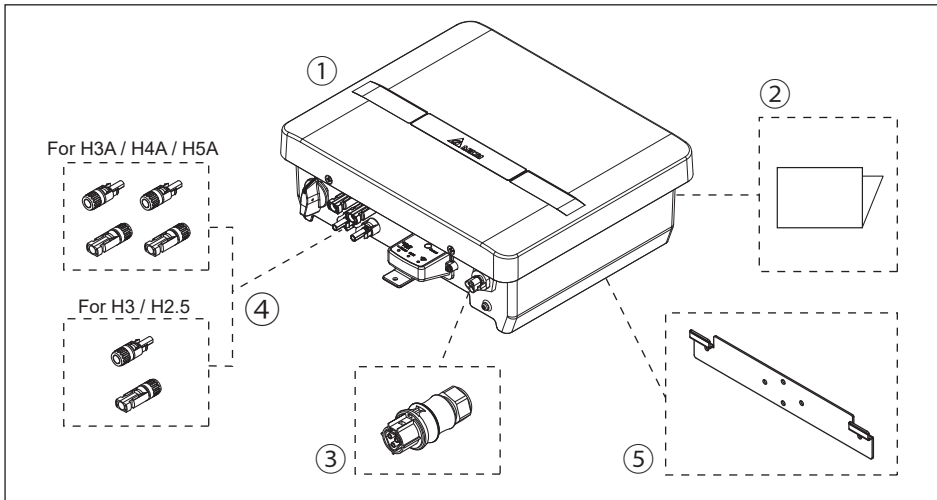


Figure 2-2 : Components of H2.5 / H3 / H3A / H4A / H5A\_220 / H5A\_221

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.



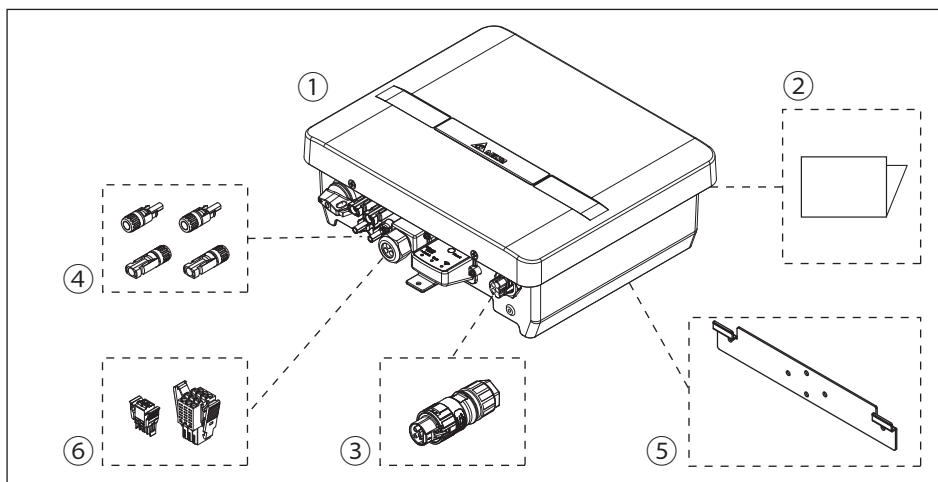


Figure 2-3 : Components of H5A\_222

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**.

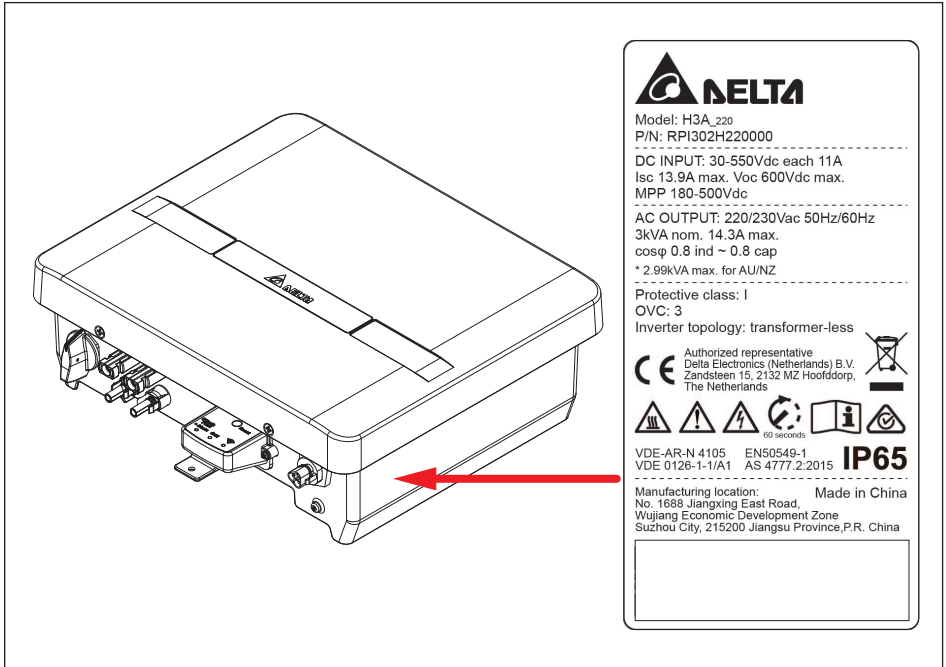
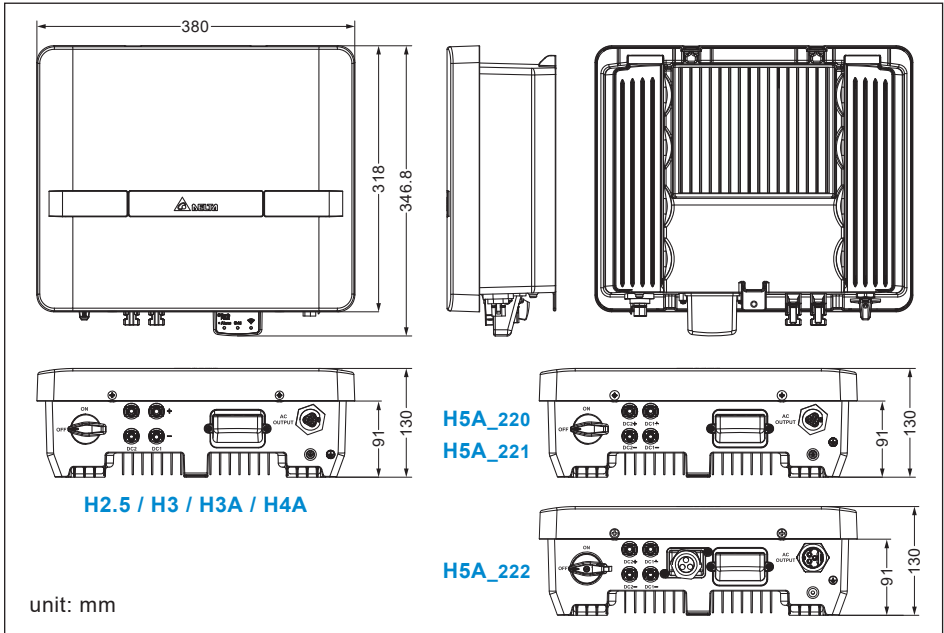


Figure 2-4 : The identification label

## 3 Product Overview

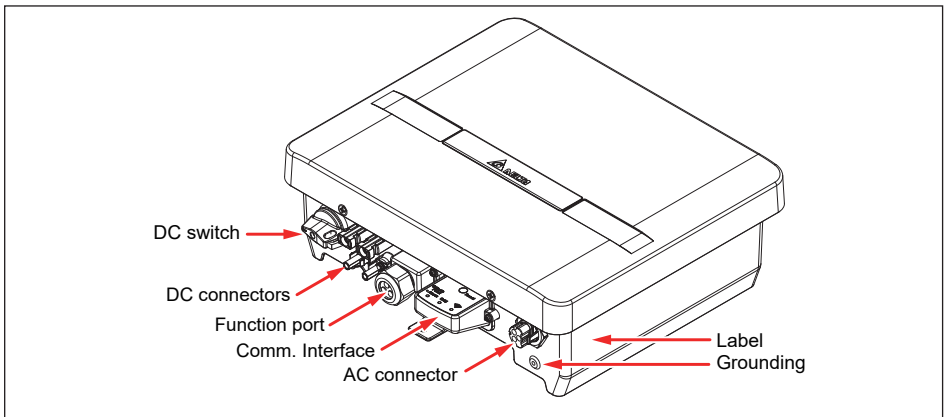
### 3.1 Dimensions



**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**

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

LED	Action	Status
Alarm	Flash:100ms On, 100ms Off	Insulation
	Steady on	Error or Fault. (see <i>Chapter 9.1</i> )
Grid	Flash:100ms On, 100ms Off	Default Country Setting
	Flash:1s On, 1s Off	Countdown
	Steady on	On grid
Wi-Fi	Flash:3s On, 3s Off	Connected to Wi-Fi router/DC1
	Flash:3s Flash(100ms), 3s Off	Connected to both WiFi router/DC1 and mobile device
	Off	Not connected
	Steady on	Connected to mobile device
	Flash:100ms On, 100ms Off	Connected to mobile device and transferring data
	Flash:500ms On, 500ms Off	Reboot Wi-Fi (Press Button 3~10s)
	Flash:1s On, 1s Off	Reset password & Wi-Fi settings (Press Button 20~30s)

Reset Button	Wi-Fi LED Status	Description
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

### 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.

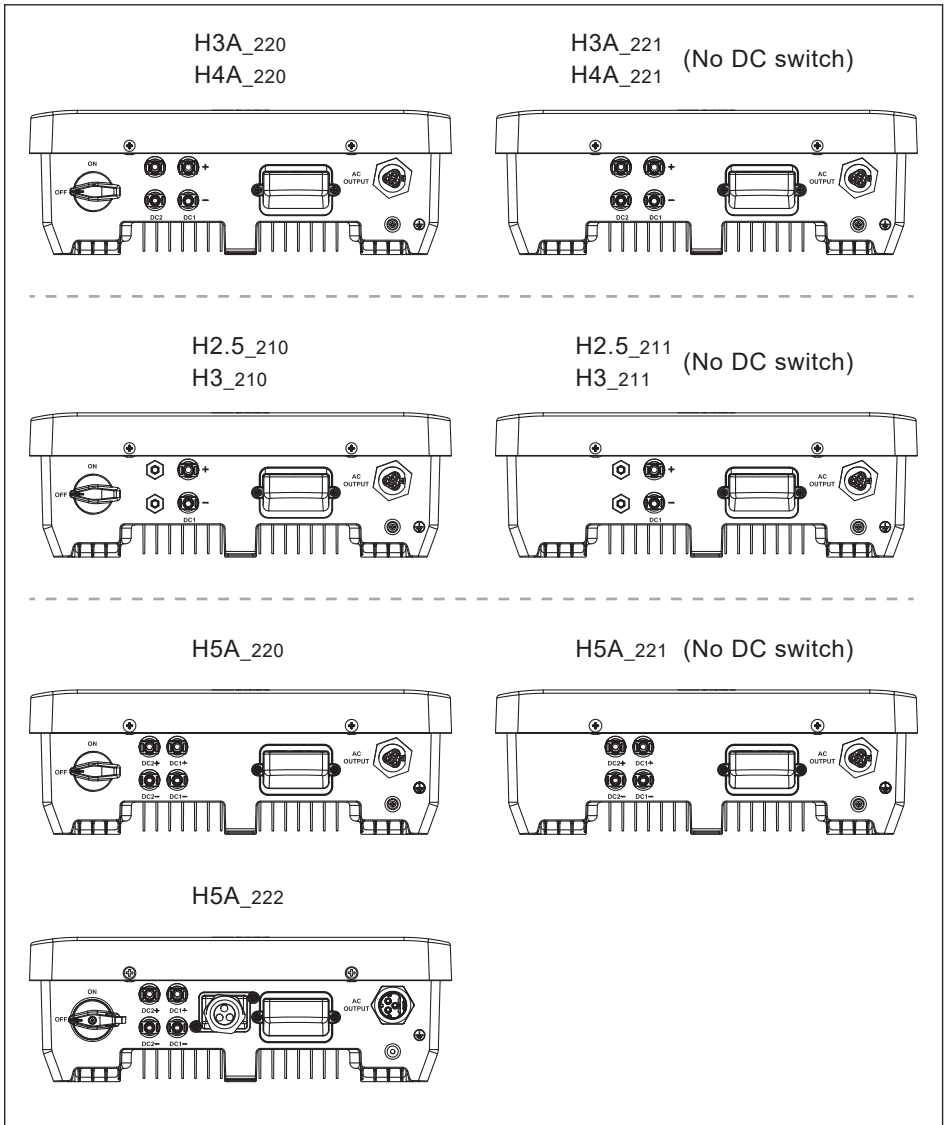


Figure 3-4 : Inverter comparison

## 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 \*  $\Phi$ 5.5mm Phillips head screws.
2. Attach the inverter to the mounting bracket.
3. Use Hex Wrench fixing the inverter with 1 \*  $\Phi$ 5.0mm Hexagon Socket screw.

Please refer to **Figure 4-1**.

#### 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 (refer to **Figure 4-3**).
- Please install solar inverter at eye level to allow easy observation for operation and parameter setting.
- Ambient temperature for operation:  $-25^{\circ}\text{C}\sim+60^{\circ}\text{C}$  (power derating above  $40^{\circ}\text{C}$ ).

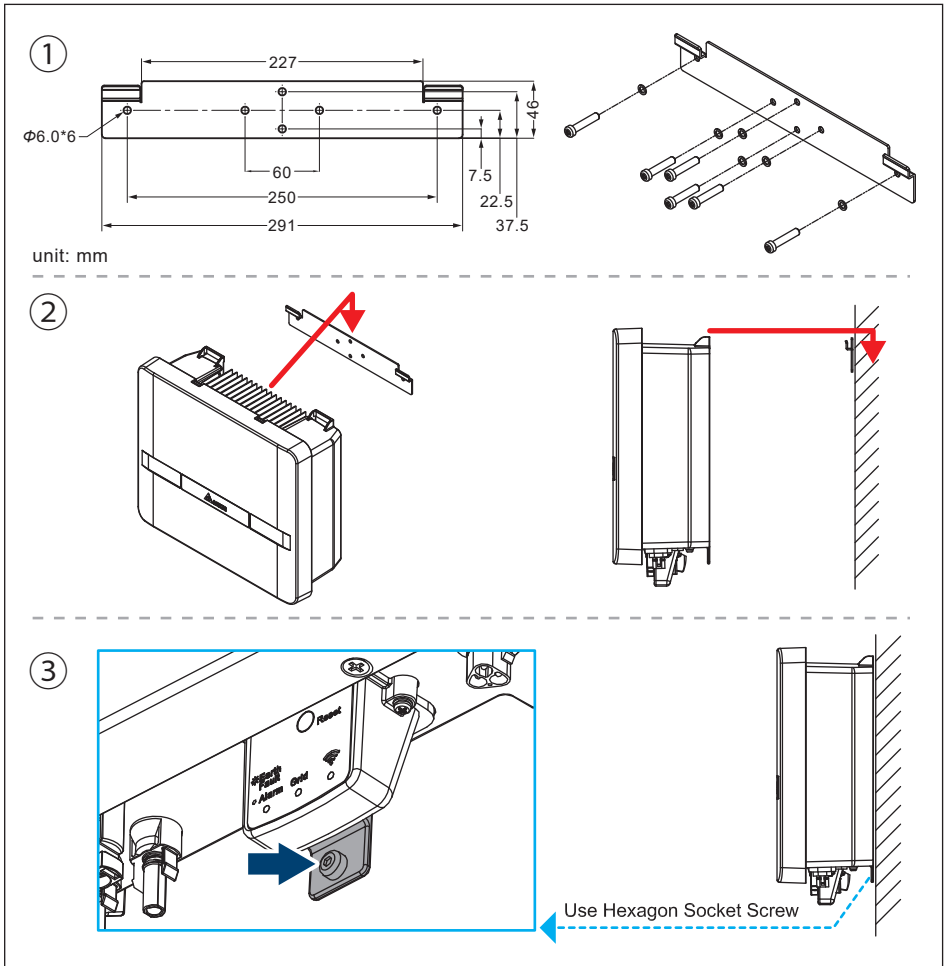


Figure 4-1 : Attaching the mounting bracket for H2.5 / H3 / H3A / H4A / H5A

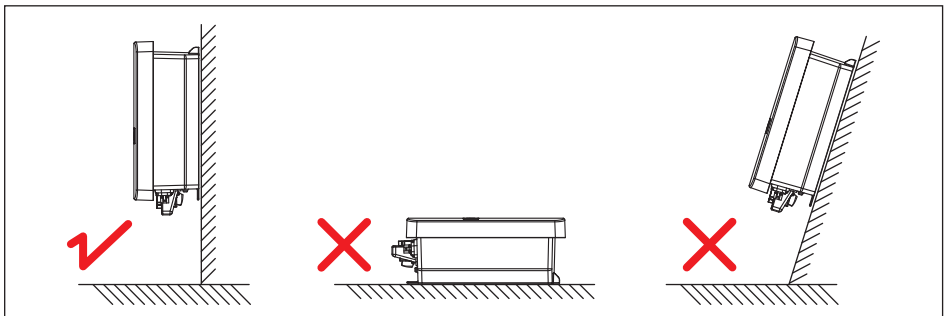
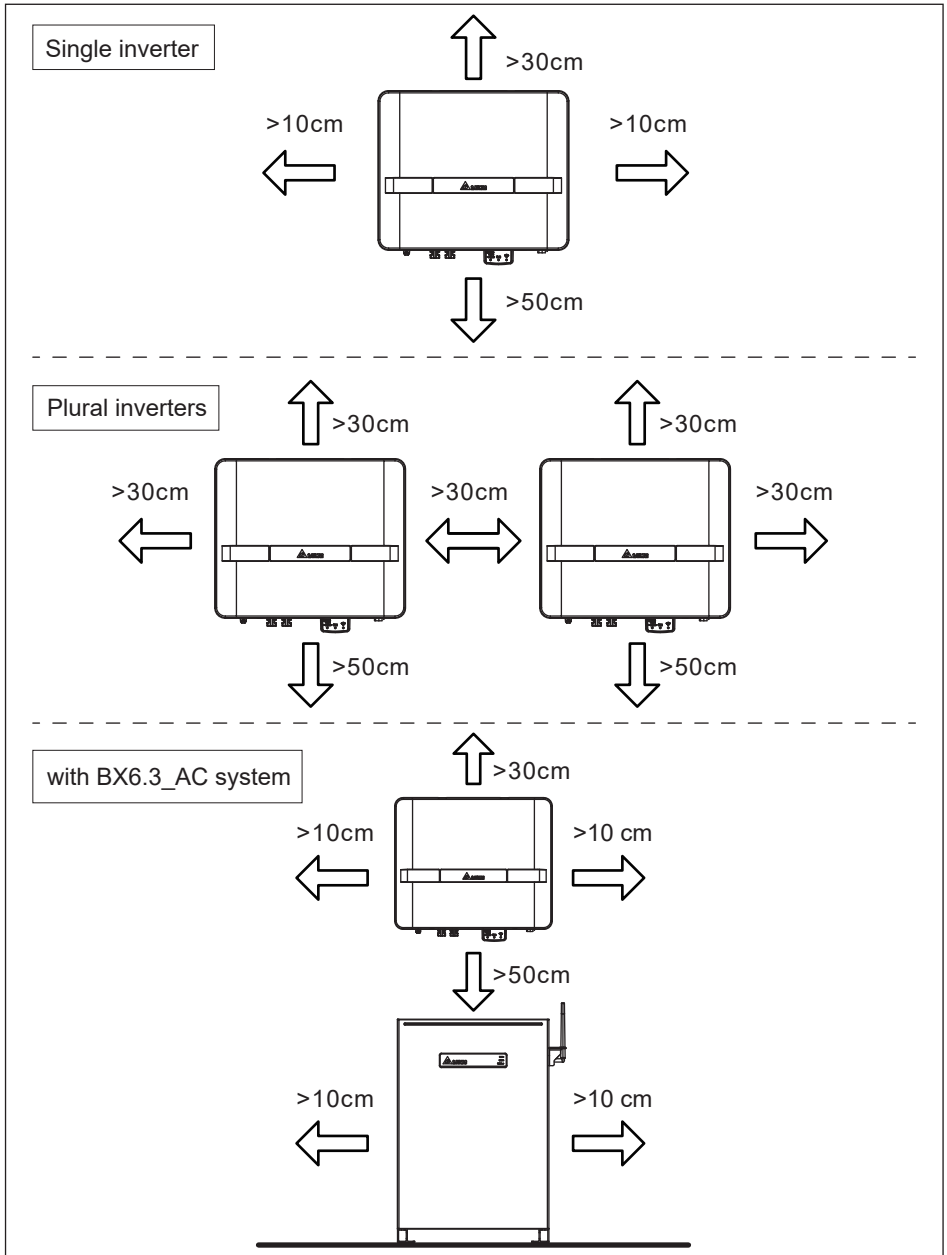


Figure 4-2 : Correct and incorrect installation illustration

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**.



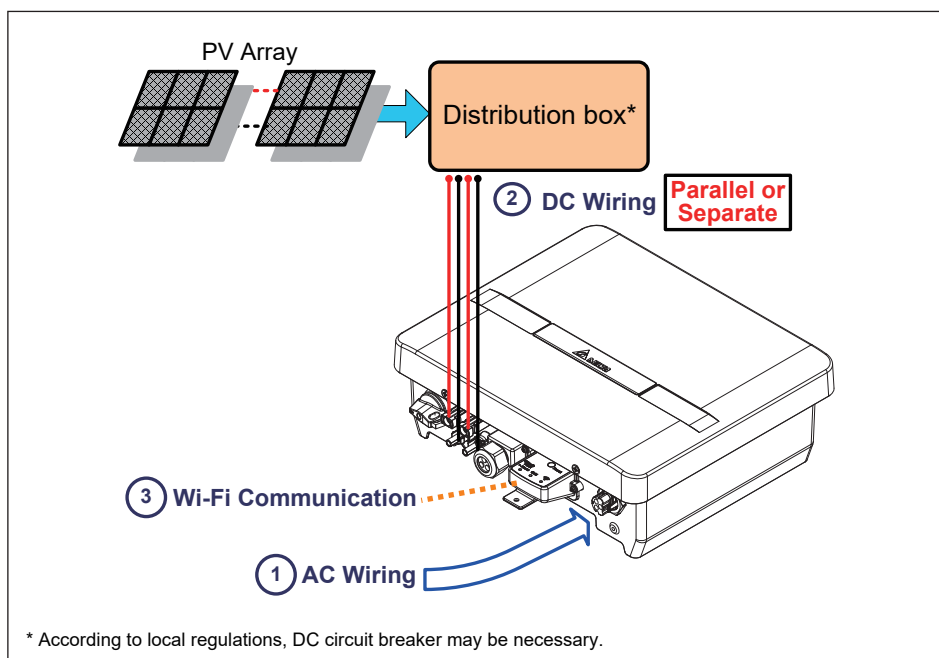
**Figure 4-3 : Adequate installation gap**



## 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.



**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	3.125 kVA	16A
H3 / H3A	3.75 kVA	20A
H4A / H5A	5 kVA	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 <sup>2</sup>
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!

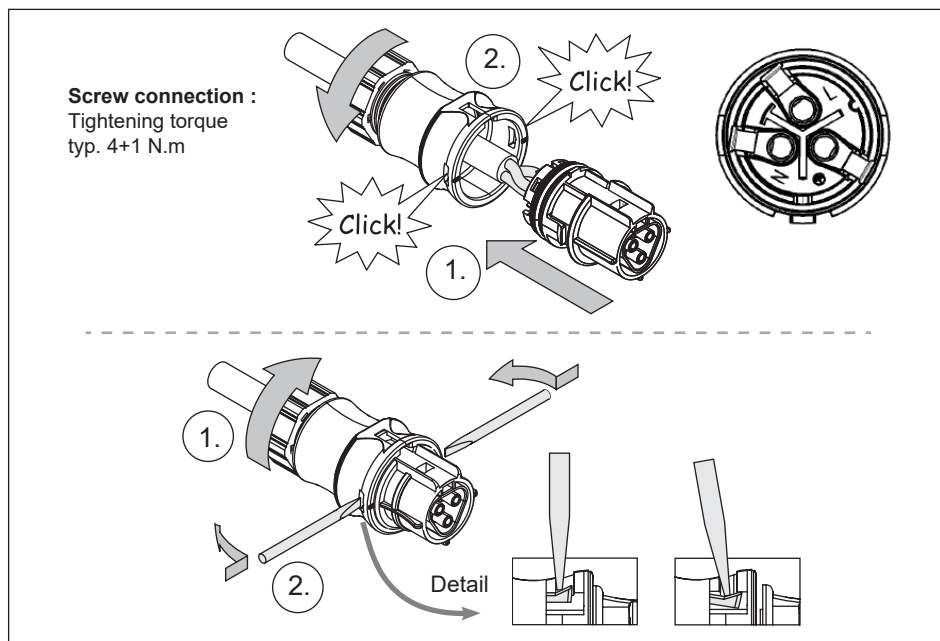


Figure 5-2 : AC plug illustration (96.031.4154.3 01K, Wieland Electric GmbH)

## 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	IP66** / IP68 (2 m, 24 h)** / IP69K***			
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:	35 A	32 A	21,4 A	
6 mm <sup>2</sup>	32 A	25 A	17,3 A	
4 mm <sup>2</sup>	24 A	20 A	14,1 A	
2.5 mm <sup>2</sup>	17,5 A	17,5 A	12,2 A	
2.5 mm <sup>2</sup> with 1.5 mm <sup>2</sup> field plug	IEC 61984	IEC 61535	2 PFG 1915	UL 2238
Nominal voltage	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!

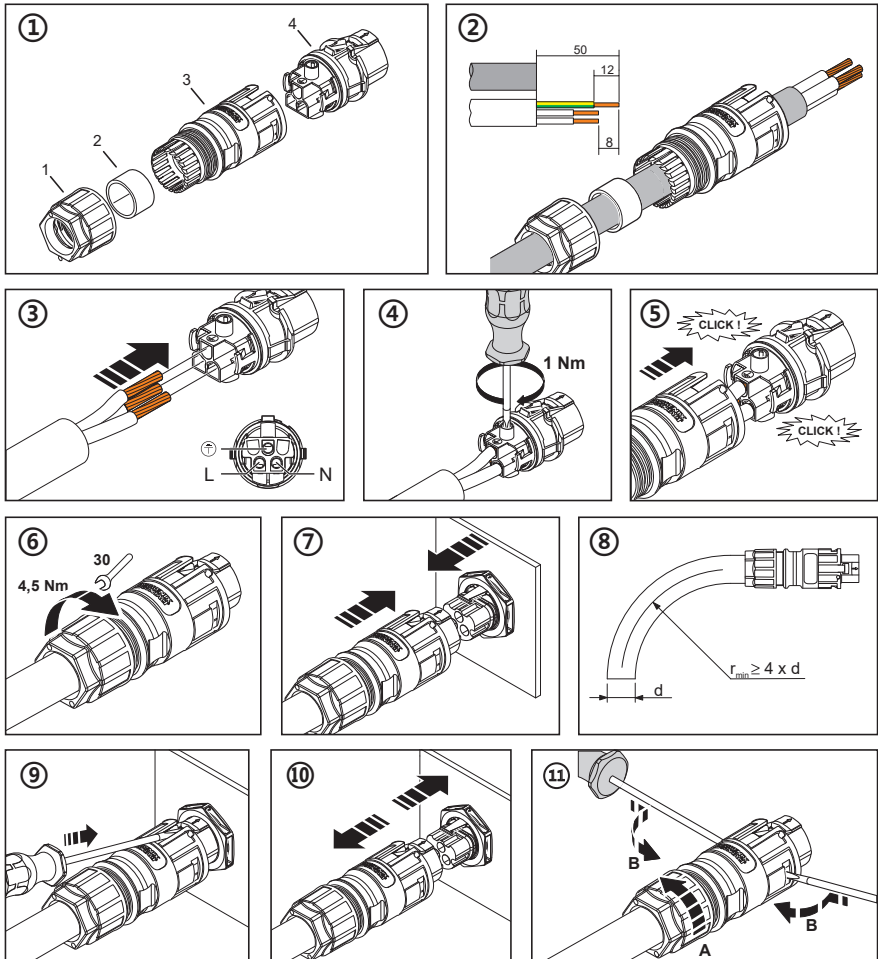


Figure 5-3 : AC plug illustration (PRC 3-FC-FS6)

## 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.

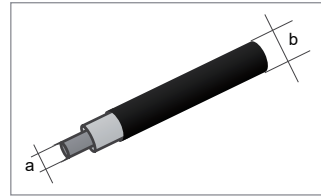
MPP range with Max. power	H3A	H4A	H5A
Symmetrical load	180~500V	240~500V	240~500V
Asymmetrical load	290~500V	380~500V	430~500V
Max. ratio for asymmetrical load	100/0% ; 0/100%	100/0% ; 0/100%	94/6% ; 6/94%

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 mm <sup>2</sup>	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.

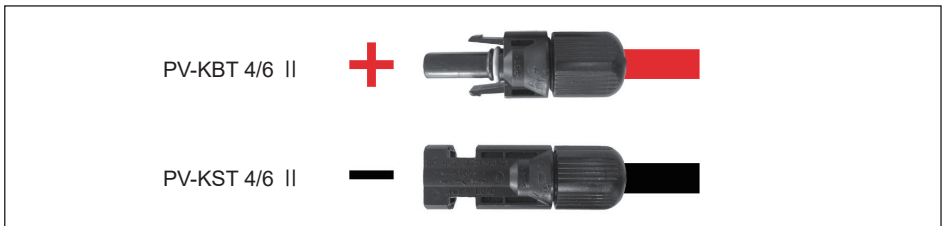


Figure 5-4 : DC Wiring illustration of H3A / H4A / H5A\_220 / H5A\_221

### 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.

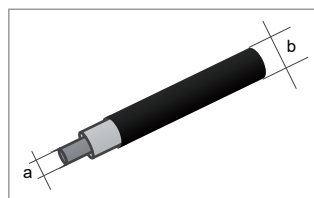
MPP range with Max. power	H5A_222
Symmetrical load	240~500V
Asymmetrical load	430~500V
Max. ratio for asymmetrical load	94/6% ; 6/94%

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.

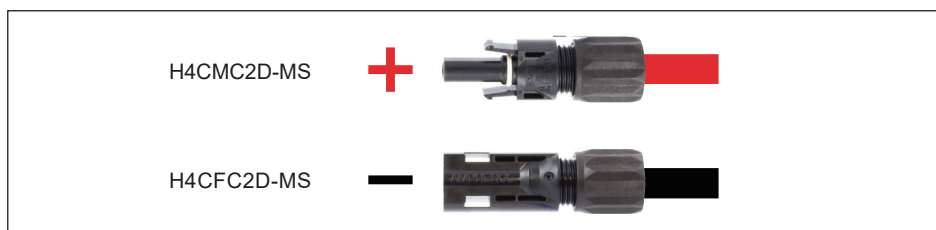
If you want to order more or need a different size, see the information in the following table.



Description	Specifications		
contact size	2.5mm <sup>2</sup> / 14AWG	4mm <sup>2</sup> / 12AWG	6mm <sup>2</sup> / 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):

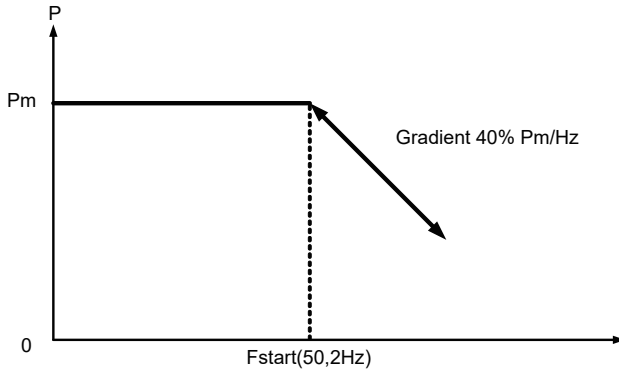
At frequencies between 50.2Hz and 51.5Hz, all adjustable power generation systems shall reduce (for frequency increase) or increase (for frequency decrease) the active power  $P_m$  generated instantaneously (at the time of exceeding the mains frequency 50.2Hz; freezing the value on the current level) with a gradient of 40% of  $P_m$  per Hertz).

According to CEI 0-21 (8.5.3.2):

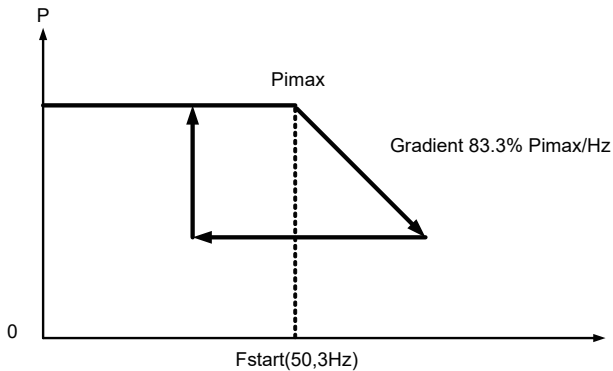
Within a frequency range from 50.3Hz to 51.5Hz, all adjustable production plants equipped with static converters have to be able to reduce the currently generated active power in case of an increase of the frequency with a variable drop of 2% to 5% with a default value of 2.4% (with corresponds to a 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  $\cos\phi$  (VDE-AR-N 4105 ,CEI 0-21)
- displacement factor/active power characteristic curve  $\cos\phi(p)$  (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 $\cos\phi$ (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 $\cos\phi(P)$ (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.

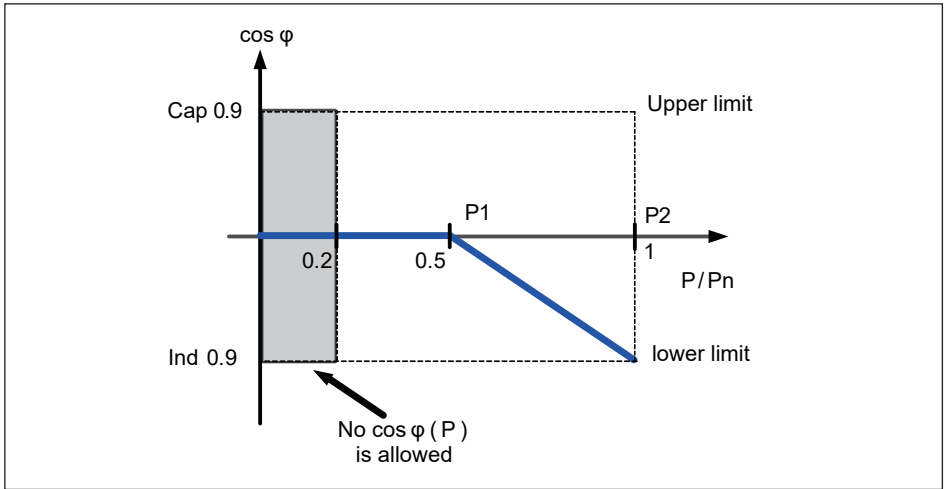


Figure 6-2 :  $\cos\phi(P)$  characteristic

### 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.

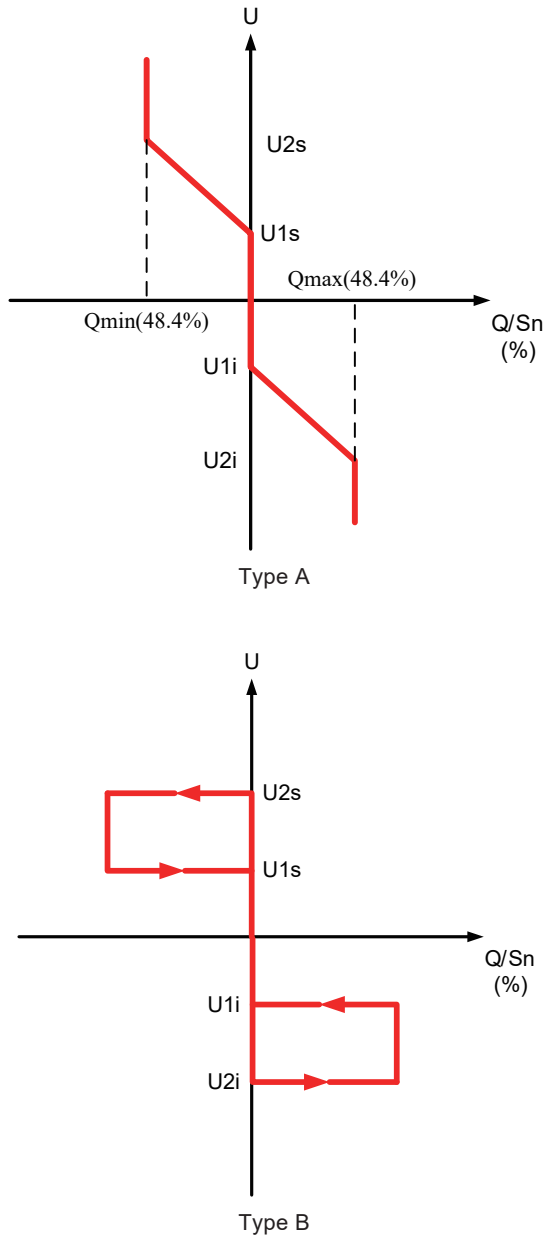
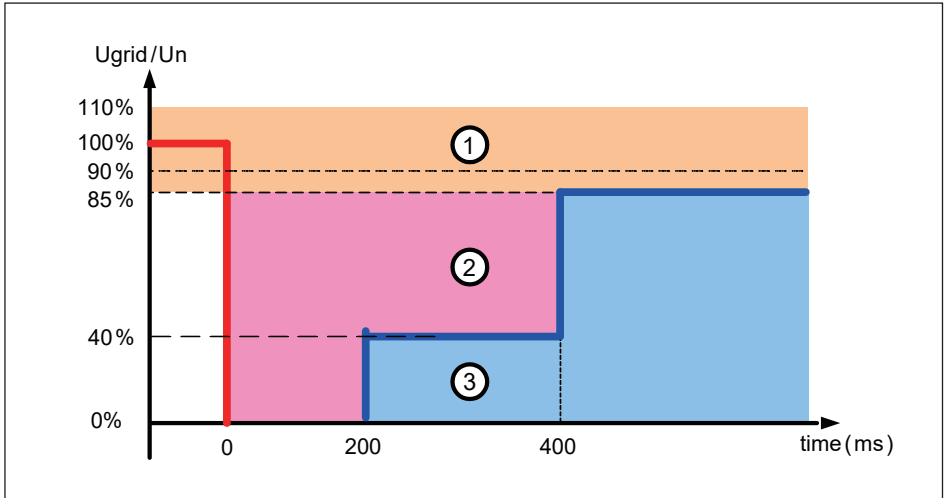


Figure 6-3 :  $Q(U)$  characteristic

### 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.

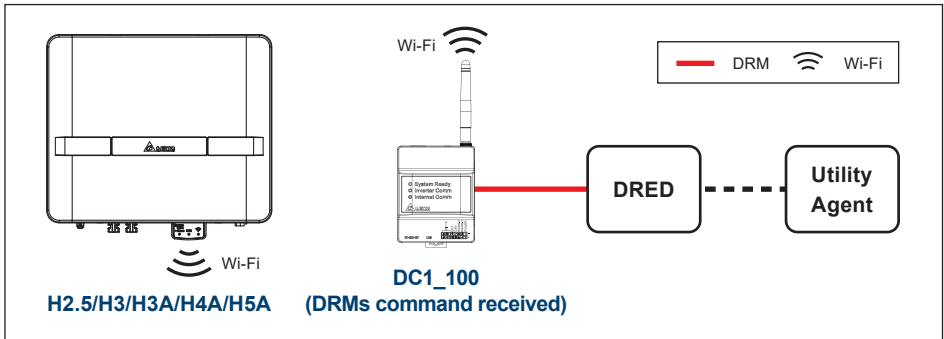


Figure 6-5 : Digital input via DC1\_100

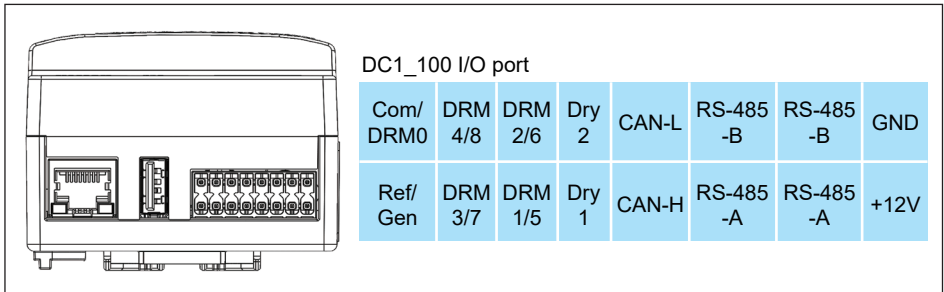
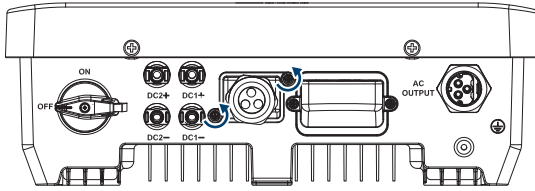
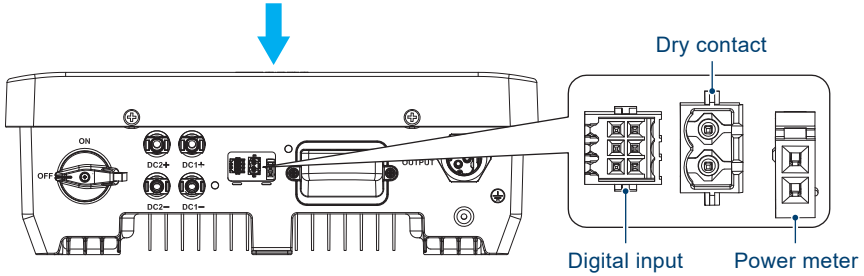


Figure 6-6 : Digital input on DC1\_100

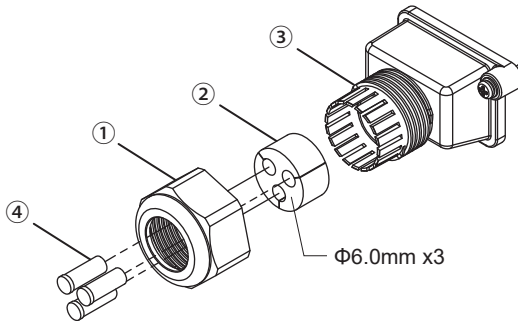
## 6.5 Function Port of H5A\_222



\* Screw torque required for assembling:  $8\pm 2$  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 mm<sup>2</sup> (AWG24) ~ 0.081 mm<sup>2</sup>. (AWG28)
- Outside diameter of cable: 3.8mm ~ 5.2mm
- Please refer to UL 2464 computer cable guideline

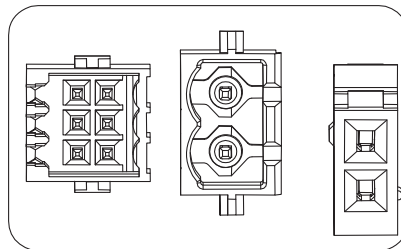


Figure 6-7 : Digital input, Dry contact & Power meter

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

### 6.5.3 Dry Contact connection

Provide single set of Dry Contact.

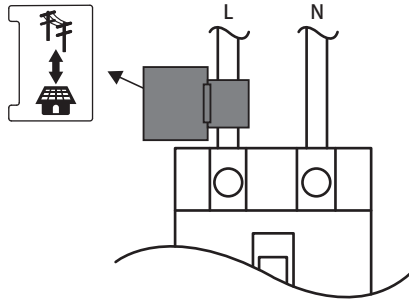
The function can be customized by users.

The dry contact port can withstand with 250Vac/28Vdc/9A, and suitable electric wire is 0.2-1.5 mm<sup>2</sup>.

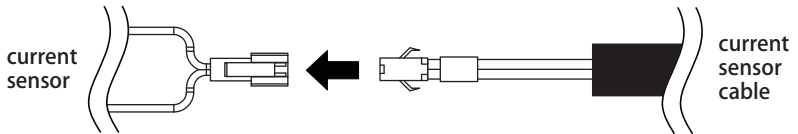
### 6.5.4 Power meter

Connecting the current sensor in the following steps

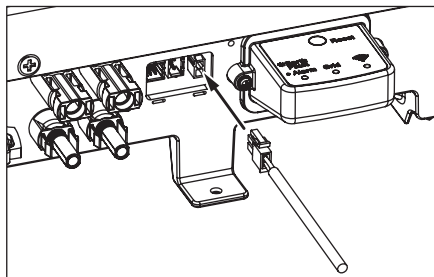
- (1) Attach a current sensor to the L cables of the main earth leakage circuit breaker.
- (2) Clamp current sensor on power line and make sure that the direction is correct



- (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

### ATTENTION



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.

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 (Wi-Fi or RS-485)  
The Communication Module supports the communication with the device with Wi-Fi function. (e.g., smart phone, tablet ect.)

#### Wi-Fi communication

Please refer to the following website or scan the QR-code for Wi-Fi connection and APP operation guide.

<https://mydeltasolar.deltaww.com/index.php?p=manual>



### ATTENTION



To establish a successful communication between Inverter Wi-Fi to MyDeltaSolar Cloud, in the Wi-Fi connection setup page, the signal strength must be above -70dBm between each Wi-Fi device (Wi-Fi router, inverter, DC1...etc.). In case the signal strength is below -70dbm, it may cause certain communication errors which may prevent a successful Wi-Fi communication. To avoid such issues, please adjust the Wi-Fi device position to improve the signal strength/quality.

#### RS-485 connection

Please contact the customer service center for the detail.

## 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

Table 9-1 : Error Message

Error		
Message	Possible cause	Action
E01: OFR	<ol style="list-style-type: none"> <li>1. Actual utility frequency is higher than the OFR setting</li> <li>2. Incorrect country setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency on the inverter terminal</li> <li>2. Check country setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E02: UFR	<ol style="list-style-type: none"> <li>1. Actual utility frequency is lower than the UFR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency on the inverter terminal</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E09: No Grid	<ol style="list-style-type: none"> <li>1. AC breaker is OFF</li> <li>2. AC plug disconnected</li> <li>3. Internal fuses are broken</li> </ol>	<ol style="list-style-type: none"> <li>1. Switch on AC breaker</li> <li>2. Check the connection in AC plug and make sure it connects to inverter</li> <li>3. Replace fuses and check all switching devices in boost &amp; inverter stages</li> </ol>
E10: UVR	<ol style="list-style-type: none"> <li>1. Actual utility voltage is higher the UVR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Measure the utility AC voltage to the inverter terminal.</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E11: OVR	<ol style="list-style-type: none"> <li>1. Actual utility voltage is higher than the OVR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Measure the utility AC voltage to the inverter terminal.</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E13: OVR-Slow	<ol style="list-style-type: none"> <li>1. Actual utility voltage is over than the OVR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility voltage on the inverter terminal</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E26: OFR-Slow	<ol style="list-style-type: none"> <li>1. Actual utility frequency is over the OFR setting</li> <li>2. Incorrect country or grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency on the inverter terminal</li> <li>2. Check country setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E27: UFR-Slow	<ol style="list-style-type: none"> <li>1. Actual utility frequency is under the UFR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency on the inverter terminal</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>

Error		
Message	Possible cause	Action
E28: UVR-Slow	<ol style="list-style-type: none"> <li>1. Actual utility voltage is under the UVR setting</li> <li>2. Incorrect country or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility voltage on the inverter terminal</li> <li>2. Check country &amp; Grid setting</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
E30: OVR(PV)	<ol style="list-style-type: none"> <li>1. Actual Solar voltage is over 510Vdc (H2.5) or 560Vdc (H3/ H3A/ H4A/ H5A)</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Modify the solar array configuration and make the Voc less than 500Vdc (H2.5) or 550Vdc (H3/ H3A/ H4A/ H5A)</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
E34: Insulation	<ol style="list-style-type: none"> <li>1. PV array insulation fault</li> <li>2. Large PV array capacitance between Plus to Ground or Minus to Ground or both.</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the insulation of Solar inputs</li> <li>2. Check the capacitance, dry PV panel if necessary</li> <li>3. Check the detection circuit inside the inverter</li> </ol>

Table 9-2 : Fault Message

Fault		
Message	Possible cause	Action
F01: DC Injection	<ol style="list-style-type: none"> <li>1. Utility waveform is abnormal</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F05: NTC OTP	<ol style="list-style-type: none"> <li>1. The ambient temp. is over 60°C</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the installation ambient temperature and environment</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F06: NTC0 Circuit Fail	<ol style="list-style-type: none"> <li>1. Ambient temp. &gt;100°C or &lt;-40°C</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the installation ambient temperature and environment</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F07: NTC LTP	<ol style="list-style-type: none"> <li>1. Ambient temp. &lt;-30°C</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the installation ambient temperature and environment</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F09: Ntc2 Circuit Fail	<ol style="list-style-type: none"> <li>1. Ambient temp. &gt;100°C or &lt;-40°C</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the installation ambient temperature and environment</li> <li>2. Check the detection circuit inside the inverter</li> </ol>

Fault		
Message	Possible cause	Action
F15: HW ADC1	<ol style="list-style-type: none"> <li>1. Auxiliary power circuitry malfunction</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the auxiliary circuitry inside the inverter</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F16: HW ADC2	<ol style="list-style-type: none"> <li>1. Auxiliary power circuitry malfunction</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the auxiliary circuitry inside the inverter</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F17: HW ADC3	<ol style="list-style-type: none"> <li>1. Auxiliary power circuitry malfunction</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the auxiliary circuitry inside the inverter</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F19: HW ADC5	<ol style="list-style-type: none"> <li>1. Auxiliary power circuitry malfunction</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the auxiliary circuitry inside the inverter</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F20: Efficiency Abnormal	<ol style="list-style-type: none"> <li>1. The calibration is incorrect</li> <li>2. Current feedback circuit is defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the accuracy of current and power</li> <li>2. Check the current feedback circuit inside the inverter</li> </ol>
F23: Comm. Fault (Dis.)	<ol style="list-style-type: none"> <li>1. DSP is idling</li> <li>2. The communication connection is disconnected</li> <li>3. The communication circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check reset and crystal in DSP</li> <li>2. Check the connection between DSP and COMM</li> <li>3. Check the communication circuit</li> </ol>
F24: RCMU Over Rating	<ol style="list-style-type: none"> <li>1. PV array insulation fault</li> <li>2. Large PV array capacitance between Plus to Ground or Minus to Ground</li> <li>3. Either side of boost driver or boost choke malfunction</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the insulation of Solar inputs</li> <li>2. Check the capacitance (+ &lt;-&gt; GND &amp; - &lt;-&gt; GND), must &lt; 2.5uF. Install an external transformer if necessary</li> <li>3. Check boost driver &amp; boost choke</li> <li>4. Check the detection circuit inside the inverter</li> </ol>
F27: RCMU Circuit Fail	<ol style="list-style-type: none"> <li>1. RCMU is disconnected</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the RCMU connection inside the inverter</li> <li>2. Check the detection circuit inside the inverter</li> </ol>
F28: Relay Test Short	<ol style="list-style-type: none"> <li>1. One or more relays are sticking</li> <li>2. The driver circuit for the relay malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the defective relay(s)</li> <li>2. Check the driver circuit inside the inverter</li> </ol>
F29: Relay Test Open	<ol style="list-style-type: none"> <li>1. One or more relays are abnormal</li> <li>2. The driver circuit for the relay malfunction</li> <li>3. The detection accuracy is not correct for Vgrid and Vout</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the defective relay(s)</li> <li>2. Check the driver circuit inside the inverter</li> <li>3. Check the Vgrid and Vout voltage detection accuracy</li> </ol>

Fault		
Message	Possible cause	Action
F35: HW Bus OVR	<ol style="list-style-type: none"> <li>1. Driver for boost is defective</li> <li>2. Voc of PV array is over 510Vdc (H2.5) or 560Vdc (H3/ H3A/ H4A/ H5A)</li> <li>3. Surge occurs during operation</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the driver circuit for boost inside the inverter</li> <li>2. Modify the solar array setting, and make the Voc less than 500Vdc (H2.5) or 550Vdc (H3/ H3A/ H4A/ H5A)</li> <li>3. N/A</li> <li>4. Check the detection circuit inside the inverter</li> </ol>
F37: OOCF	Detection circuit malfunction	Check the detection circuit inside the inverter
F42: CT sensor Fail (A)	<ol style="list-style-type: none"> <li>1. Inverter choke Fail</li> <li>2. Output Filter Fail</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check Inverter choke inductance.</li> <li>2. Check output filter capacitance.</li> <li>3. Check the detection circuit inside the inverter</li> </ol>
F56: HW incompat.	HW power rating incorrect	Check comm. HW power rating info.
F60: IOCP(PV1)	<ol style="list-style-type: none"> <li>1. Switching device in boost is defective</li> <li>2. Driver for boost is defective</li> <li>3. Input current detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all switching device in boost</li> <li>2. Check the driver circuit for boost inside the inverter</li> <li>3. Check input current detection circuit</li> </ol>
F61: IOCP(PV2)	<ol style="list-style-type: none"> <li>1. Switching device in boost is defective</li> <li>2. Driver for boost is defective</li> <li>3. Input current detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all switching device in boost</li> <li>2. Check the driver circuit for boost inside the inverter</li> <li>3. Check input current detection circuit</li> </ol>

## 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

**Table 11-1 : Specifications**

Model 1	H2.5_210 H2.5_211	H3_210 H3_211	H3A_220 H3A_221	H4A_220 H4A_221	H5A_220 H5A_221	H5A_222
<b>GENERAL</b>						
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	Non-isolated (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					
<b>DC INPUT (Solar side)</b>						
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 / 18Adc for total		11Adc for each / 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	H3_210	H3A_220	H4A_220	H5A_220	H5A_222
	H2.5_211	H3_211	H3A_221	H4A_221	H5A_221	
<b>DC Switch parameters (Solar side)</b>						
Insulation voltage (Ui)	850 V					1200 V
Rated impulse withstand voltage(Uimp)	8 kV					
Suitability for isolation	Isolating device					
Rated operational current	650 V / 30 A					600 V / 30 A
PV utilization category	DC-21B					DC-PV2
Rated thermal current uninterrupted duty (Iu)	45 A					50 A
Rated short-time withstand current (1s) (Icw)	700 A					
Rated short-circuit making capacity (Icm)	1.4 kA					1 kA
Rated conditional short-circuit current (Isc)	5 kA					
<b>AC OUTPUT (Grid side)</b>						
Nominal output power 2	2500 VA	3000 VA		4000 VA	5000 VA	
Maximum power	2500 VA	3000 VA		4000 VA	5000 VA	
Voltage	220/230 Vac -20%~+22%					
Nominal output current	10.9 A	13 A		17.4 A	22 A 3	
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 4	<3% @Rated power					
Power factor 4	>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					
Active anti-islanding method	AC Current frequency					
<b>MECHANISM</b>						
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	H3_210	H3A_220	H4A_220	H5A_220	H5A_222
	H2.5_211	H3_211	H3A_221	H4A_221	H5A_221	
<b>REGULATIONS &amp; DIRECTIVES</b>						
Safety	IEC 62109-1 / -2 CE compliance					
Grid interface	VDE AR-N 4105 / VDE 0126-1-1 / AS4777.2:2015 5-1 / G83-2 / G59-3 / EN50438 / VFR2014 / C10 / C11 / UTE C15-712-1 / IEC61683 / IEC61727 / IEC62116 / EN50549-1:2019 / ABNT NBR 16149 5-2 / ABNT NBR 16150 5-2					AS4777.2:2015 IEC61683 IEC62116 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				

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, New Zealand (AU / NZ)
- (b) H3 / H3A : 2.99kVA max. for Australia, New Zealand (AU / NZ)
- (c) H5A : 4.99kVA max. for Australia, New Zealand (AU / NZ)
- (d) H5A : 4.6kVA max. for Germany (DE)
- (e) H4A/ H5A : 3.68kVA max. for Denmark (DK1 / DK2)

3: 21.7A nom. for Australia, New Zealand (AU / NZ)

4: reactive power control disabled

5-1: not support AS4777.2:2015 Single-phase inverters used in three-phase combinations  
5-2: only H3\_210/ H4A\_220/ H5A\_220 support





## 單相並網型變流器

H2.5 / H3 / H3A / H4A / H5A  
操作手冊

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# 1 概要

## 1.1 手冊簡介

此手冊內提供太陽能變流器H2.5 / H3 / H3A / H4A / H5A的規格、安裝程式及相關功能設定，關於安裝人員對於太陽能發電系統需經過訓練及認證，並於安裝時遵照安規及安裝程式作業。

## 1.2 安規圖示說明

小心搬運您的產品可以使產品的使用壽命更長，可靠度更佳，使您的產品達到最大效益。產品有時可能會過重，需要兩個人一起搬運。

### 注意！



電子元件在變流器正常工作時存有危險電壓，不良的搬運方式可能導致機器和人身體的損毀。確切遵守本手冊之規定，任何安裝步驟只可以由合格安裝人員來進行。

### 警告！



電子元件的維修工作只可由製造商進行，機器內部並無提供任何可由使用者操作的元件。確切遵守本手冊之規定，機器進行任何操作之前務必將本變流器從市網以及太陽能板隔離。

### 危險！



為避免電擊，請勿打開變流器，機器內部並無提供任何可由使用者操作的元件。擅自打開機器會使保固失效。任何電源切斷一分鐘內仍存有危險電壓，建議五分鐘的放電時間。



60 seconds

本機器存有高漏電電流，任何操作前確認PE導線已經接受。

### 警告：高溫危險！



當機器運轉時溫度可能超過攝氏70度，高溫環境易造成危險發生，禁止觸摸！！

### 注意



本機器操作及安裝請參考使用說明書。



## 1.3 合法性

此使用手冊由台達電子公司之品牌提供以下機種的安裝程式、維修保養與安規資訊。

- H2.5
- H3
- H3A
- H4A
- H5A

## 1.4 產品概述

本機為單相市電並網太陽能變流器，此裝置將自太陽能板發出的直流電流(DC)轉換為單相AC交流電流輸出，並提供至市電網路。

本機設計時為方便使用者，提供了大範圍的輸入電壓和高轉換效率，並使用專用的DSP(Digital Signal Processor)來簡化電路設計及電子元件的數量。請特別注意此裝置並不支援獨立發電功能，以下為H2.5 / H3 / H3A / H4A / H5A特性介紹。

### 產品特性

- 額定功率：2.5kVA (H2.5), 3kVA (H3 / H3A), 4kVA (H4A), 5kVA (H5A)
- 單相 (L + N + PE) · 併網型非變壓器隔離型太陽能變流器
- 最大效率：>97.4 % (>98.3% @ H5A)
- 歐洲效率: 96.8% (98.0% @ H5A)
- 虛功容量 (Cap 0.8 – Ind 0.8)
- 滿載時總諧波失真率(THD < 3%)
- Wi-Fi通訊

## 1.5 變流器動作原理

太陽能變流器之操作如下圖1-1，此裝置將自太陽能板發出的DC電流轉換為單相AC電流輸出以達到節省能量與電力的功效。

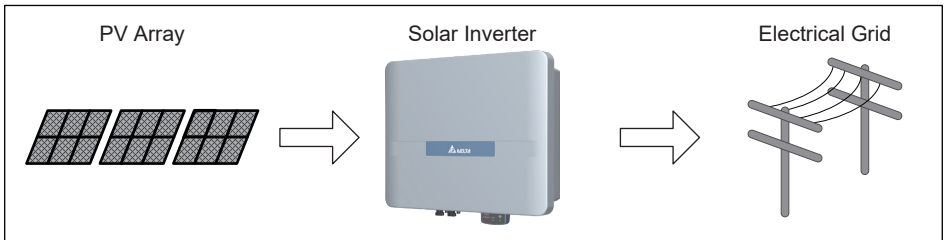


圖1-1：太陽能變流器系統操作圖解

## 1.6 其他相關資訊

若需要關於H2.5 / H3 / H3A / H4A / H5A其他細節資訊或其他產品資訊內容，可參考台達電子網站：[www.deltaww.com](http://www.deltaww.com)

## 2 安裝與配線

### 2.1 安裝前指南

因用戶端設備環境的多變，建議安裝前須完整閱讀操作手冊，且所有安裝流程和開機動作需由合格之專業人員來著手進行。

### 2.2 拆除包裝

拆裝流程如圖2-1。

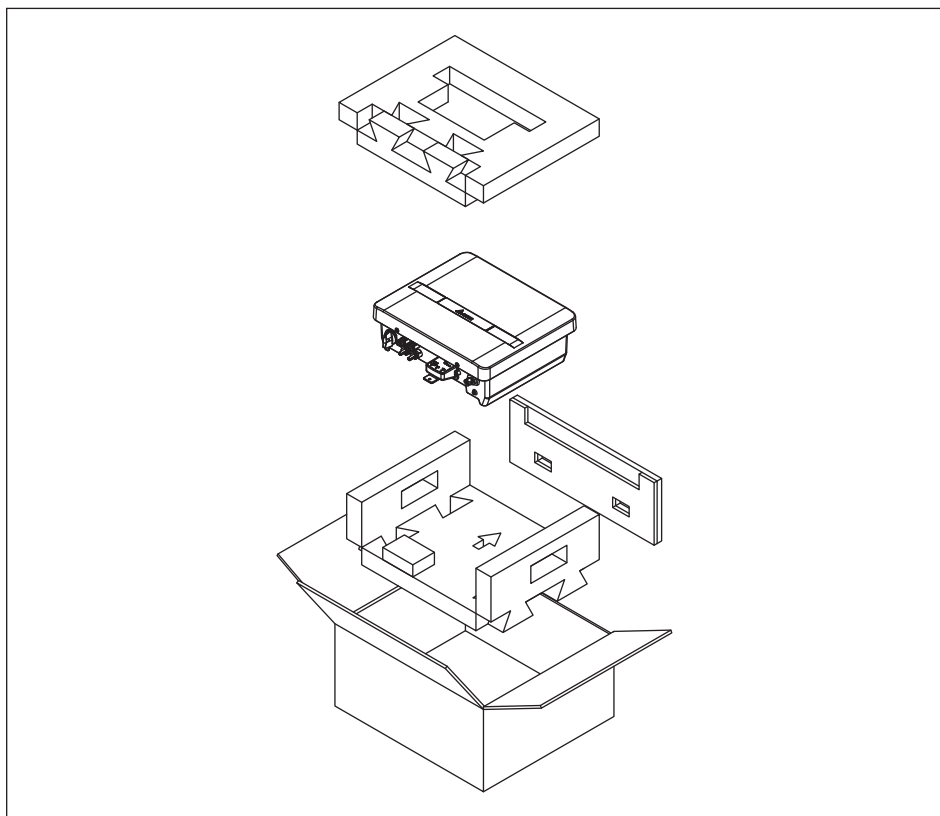


圖2-1：拆除包裝流程

當您收到全新的變流器時，會需要拆除其外包裝。這些包裝由不同材質所組成，在不同材質上有列印不同的回收方式。

為了共同營造一個更好的生活環境，請確實回收這些包裝材料。

## 2.3 包裝檢驗

由於在產品運輸過程中可能有無法預期之狀況產生，請先確認包裝外觀是否有任何毀損。

拆裝後，依以下流程逐步檢查產品之內外部：

檢查產品外殼右側之產品型號及產品規格是否符合購買型號，檢查是否有元件鬆脫，檢查下表內所有附件是否有缺少，標準配件詳見表2-1、H5A\_222標準配件詳見表2-2。

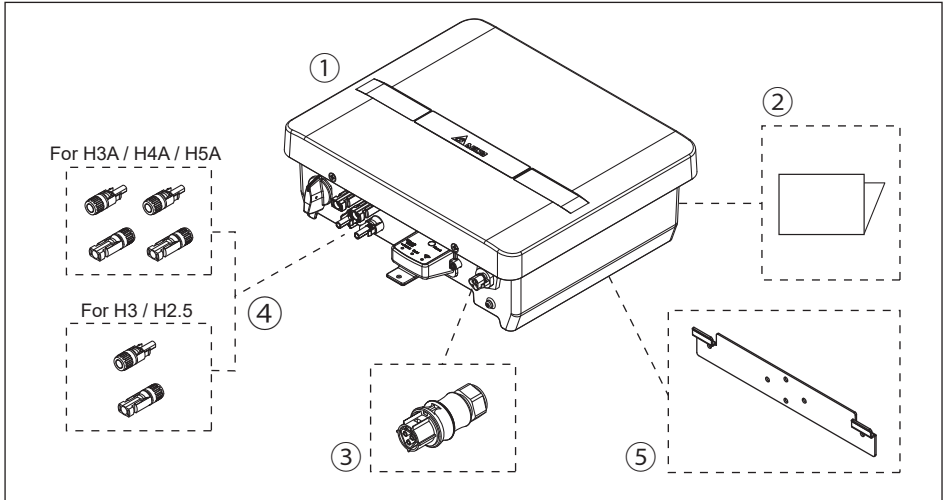


圖2-2：H2.5 / H3 / H3A / H4A / H5A\_220 / H5A\_221 內容物清單

H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221			
	品名	數量	描述
①	太陽能變流器	1	太陽能變流器本體
②	快速安裝手冊	1	提供安規、安裝、規格等相關資訊
③	AC 插頭	1	做AC端的連結
④	DC 插頭	2 組	用於H3A / H4A / H5A DC端的連結
		1 組	用於H3 / H2.5 DC端的連結
⑤	壁掛板	1	固定變流器於牆上用

表2-1：H2.5 / H3 / H3A / H4A / H5A\_220 / H5A\_221 內容物清單

### 注意！



當產品內部或外部及配件有任何不完整或毀損狀況發生時，請在安裝前與變流器之供應商聯繫。

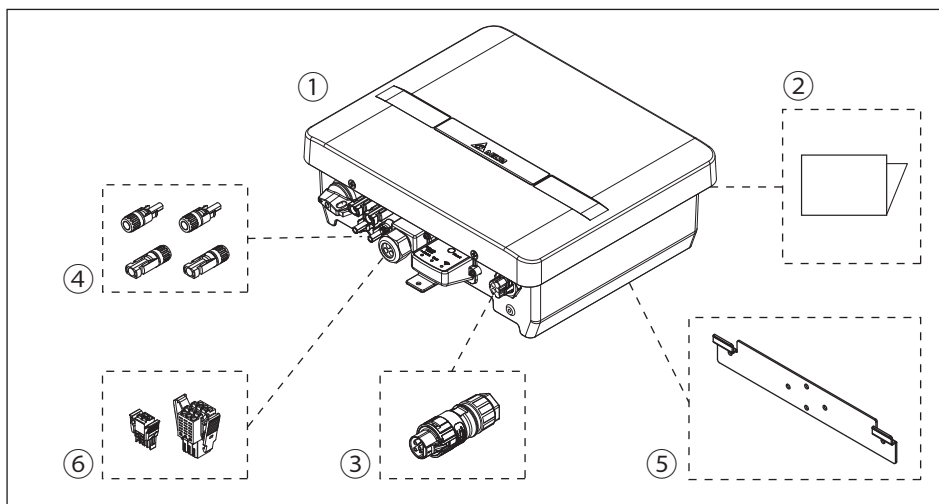


圖2-3 : H5A\_222 內容物清單

H5A_222			
	品名	數量	描述
①	太陽能變流器	1	太陽能變流器本體
②	快速安裝手冊	1	提供安規、安裝、規格等相關資訊
③	AC 插頭	1	做AC端的連結
④	DC 插頭	2 組	做DC端的連結
⑤	壁掛板	1	固定變流器於牆上用
⑥	數位輸入端子 乾接點端子	2	用於H5A_222功能配件端

表2-2 : H5A\_222 內容物清單

選配			
型號	品名	外觀	描述
PPM CT16_101	比流器		用於H5A_222內置電表功能
PPM W2_210	10m連接線		用於比流器的連接線
PPM W2_230	30m連接線		

表2-3 : H5A\_222 選配清單

**注意！**



當產品內部或外部及配件有任何不完整或毀損狀況發生時，請在安裝前與變流器之供應商聯繫。

## 2.4 規格標籤

識別變流器時，使用者可利用產品標籤上的資訊，標籤上列有產品序號及型號，標籤位置如下圖所示：

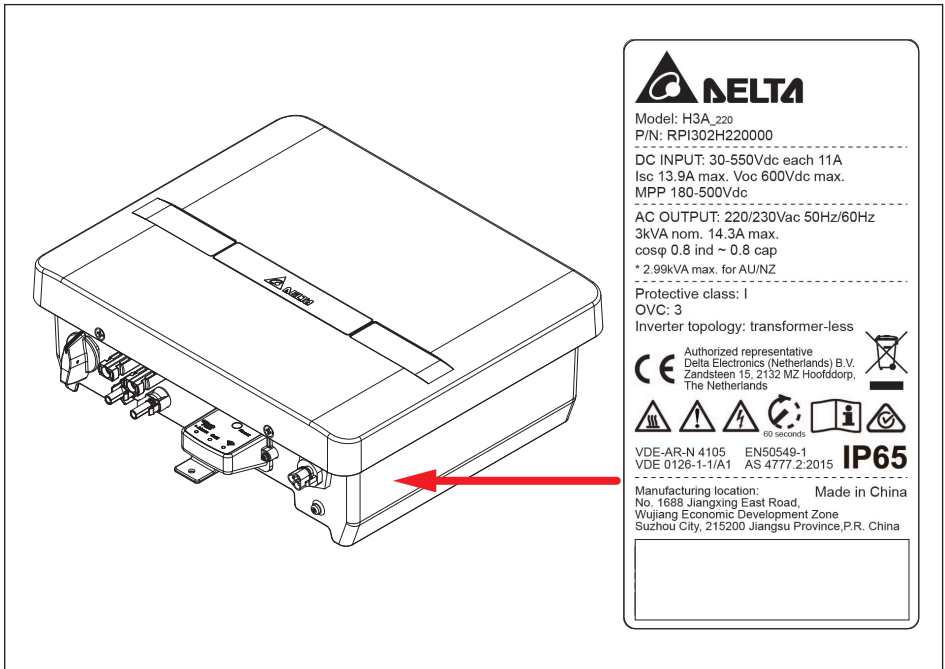


圖2-4：規格標籤

### 3 產品概觀

#### 3.1 尺寸規格

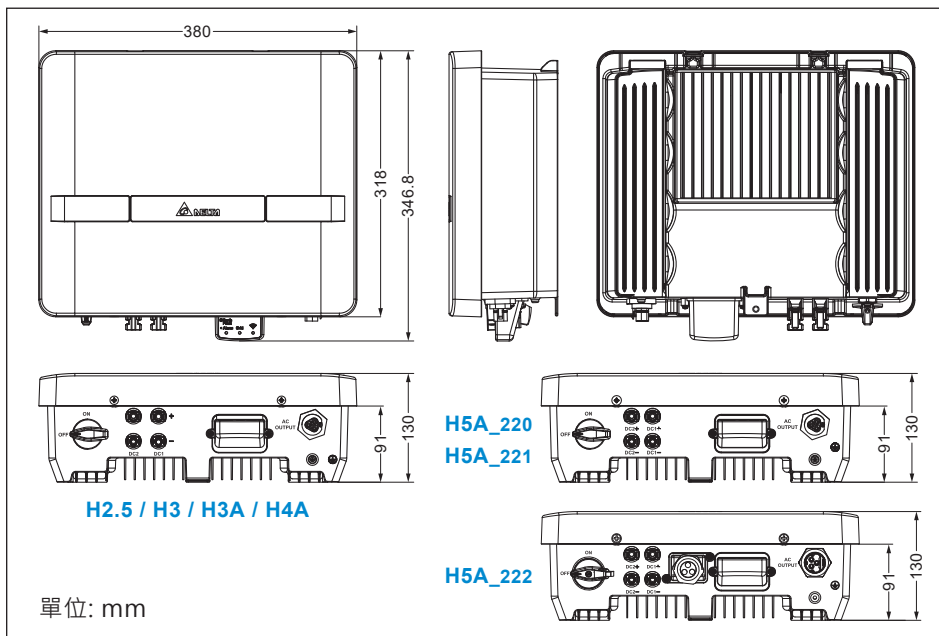


圖3-1：尺寸規格

#### 3.2 功能介紹

變流器外部物件如圖3-2所示，在3.2.1章節中有詳細功能介紹。

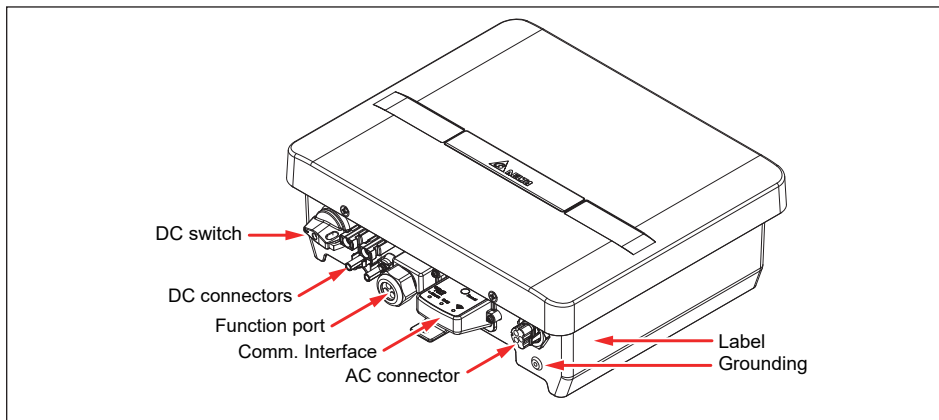


圖3-2：變流器外觀

## 3.2.1 LED指示燈與按鍵



圖3-3 : LED指示燈與按鍵

表3-1 : LED指示燈與Reset鍵功能

LED	LED 顯示	說明
Alarm	閃爍	發生Error "E34: Insulation"
	恆亮	發生Error 或是Fault (請參考9.1 錯誤訊息)
Grid	快閃(亮0.1秒 暗0.1秒)	變流器國別尚未設定 (國別: default)
	慢閃(亮1秒 暗1秒)	變流器於併網倒數流程中
	恆亮	併網中
Wi-Fi	長閃(亮3秒 暗3秒)	與WiFi路由器/DC1連線中
	間歇快閃(閃3秒 暗3秒)	同時與WiFi路由器/DC1及行動裝置連線中
	恆暗	尚無連線
	恆亮	與行動裝置連線中
	快閃(亮0.1秒 暗0.1秒)	與行動裝置連線且通訊中
	快閃(亮0.5秒 暗0.5秒)	重啟WiFi模組 (按壓Reset按鈕 3~10s)
	慢閃(亮1秒 暗1秒)	重置WiFi密碼及其設定 (按壓Reset按鈕 20~30s)

Reset 按鍵	Wi-Fi LED 顯示	說明
長按 3s到10s	快閃(亮0.5秒 暗0.5秒)	Wi-Fi 模組重新啟動
長按 10s到20s	不閃爍	Wi-Fi 模組不動作
長按 20s以上	慢閃(亮1秒 暗1秒)	Wi-Fi 模組重新啟動且密碼回復出廠預設"DELTASOL"

### 3.3 變流器對照

DC SWITCH只在210/220/222系列機種才有提供；211/221系列機種沒有提供。

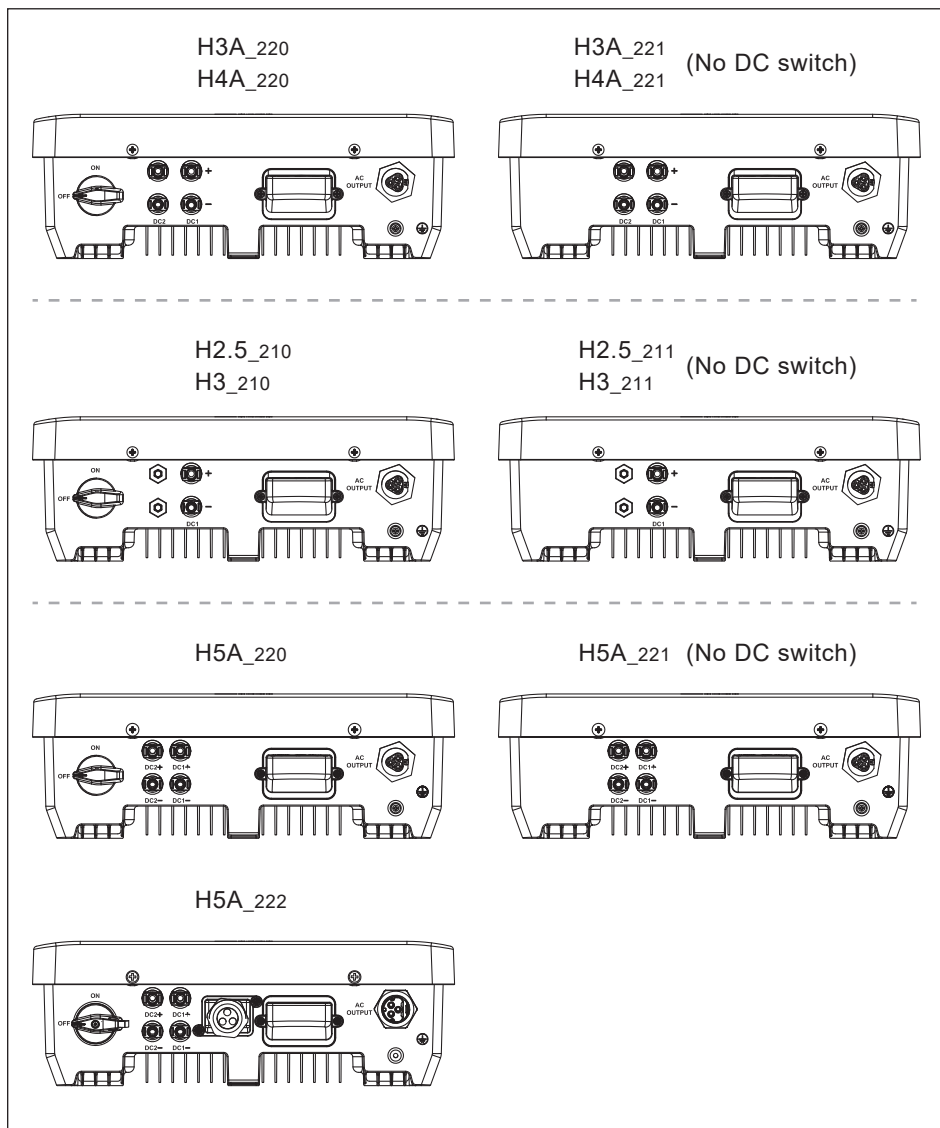


圖3-4：變流器對照



## 4 安裝

### 4.1 安裝地點

本機可安裝於室內外的環境。

#### 警告！



請勿安裝於可燃物附近。  
請將產品確實固定於堅固平坦的牆上。

#### 注意！



請勿將產品安裝於陽光可直接曝曬的地方。

### 4.2 壁掛作業

本機屬於壁掛式系統，安裝時請確保產品與地面保持垂直，AC插頭在產品之底部，勿將產品架設於傾斜之牆面。

壁掛板尺寸規格列於下圖所示：

1. 使用  $6 * \Phi 5.5 \text{ mm}$  十字頭螺絲將壁掛板鎖附於牆上。
2. 將變流器附掛於壁掛板上。
3. 用六角扳手用  $1 * \Phi 5.0 \text{ mm}$  內六角螺絲固定變流器。  
請參考圖4-1。

#### 警告！



- 壁掛板是專為變流器安裝而設計，變流器只可安裝在壁掛板上。
- 安裝地點以堅固平面為佳，以承受變流器之重量。
- 建議安裝於進出暢通而且安全的地點，以利後續服務與維護保養。
- 安裝多台變流器時產品之間請保持適當距離 (請參考圖4-3)。
- 請將產品安裝於視線容易觀察之地點以利操作與設定。
- 環境溫度介於  $-25^{\circ}\text{C}$  到  $60^{\circ}\text{C}$  之間。(  $40^{\circ}\text{C}$  以上會發生功率降額 )

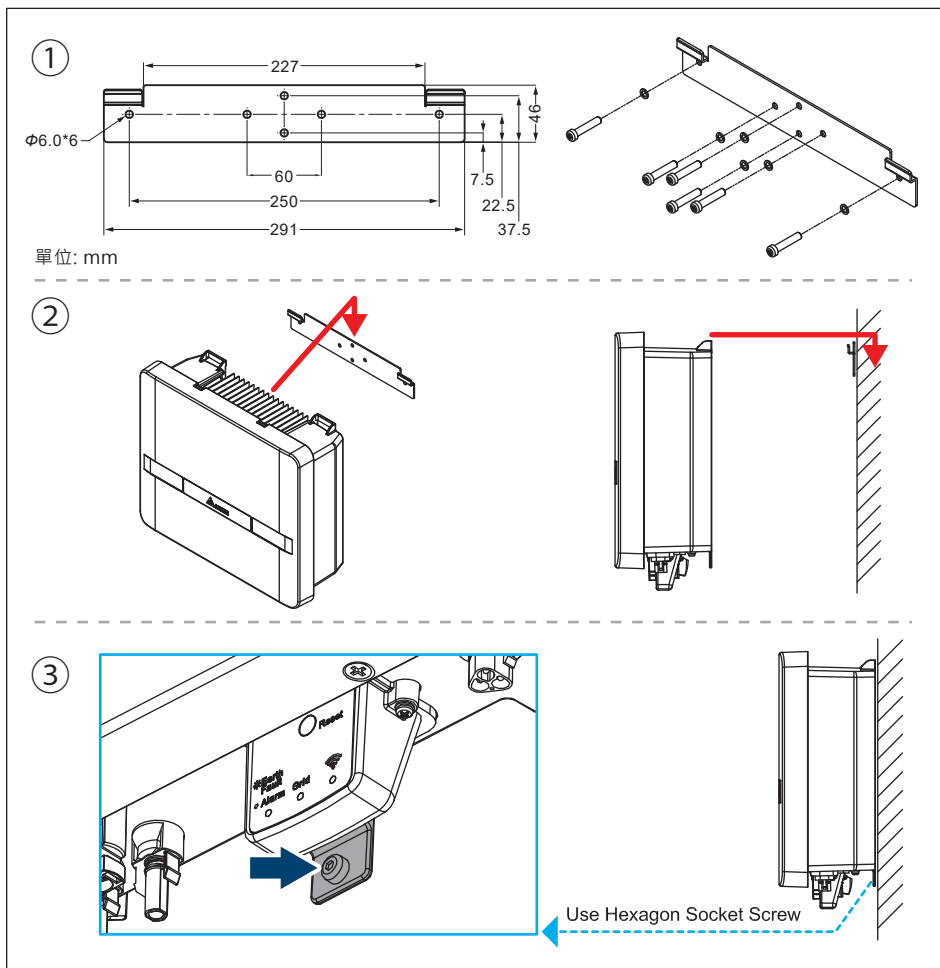


圖4-1: H2.5 / H3 / H3A / H4A / H5A壁掛板安裝方式

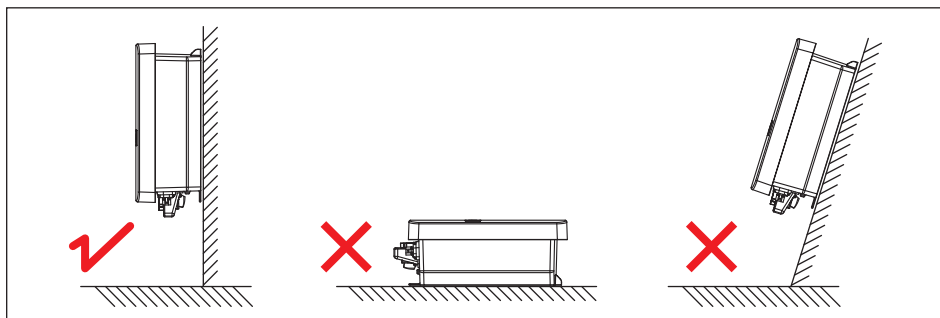


圖4-2: 正確與不正確之安裝圖解

產品架設之前要確認空間足夠以利散熱，建議安裝的空間尺寸請參考圖4-3，安裝人員若需要可自行加大間隙以利產品安裝。

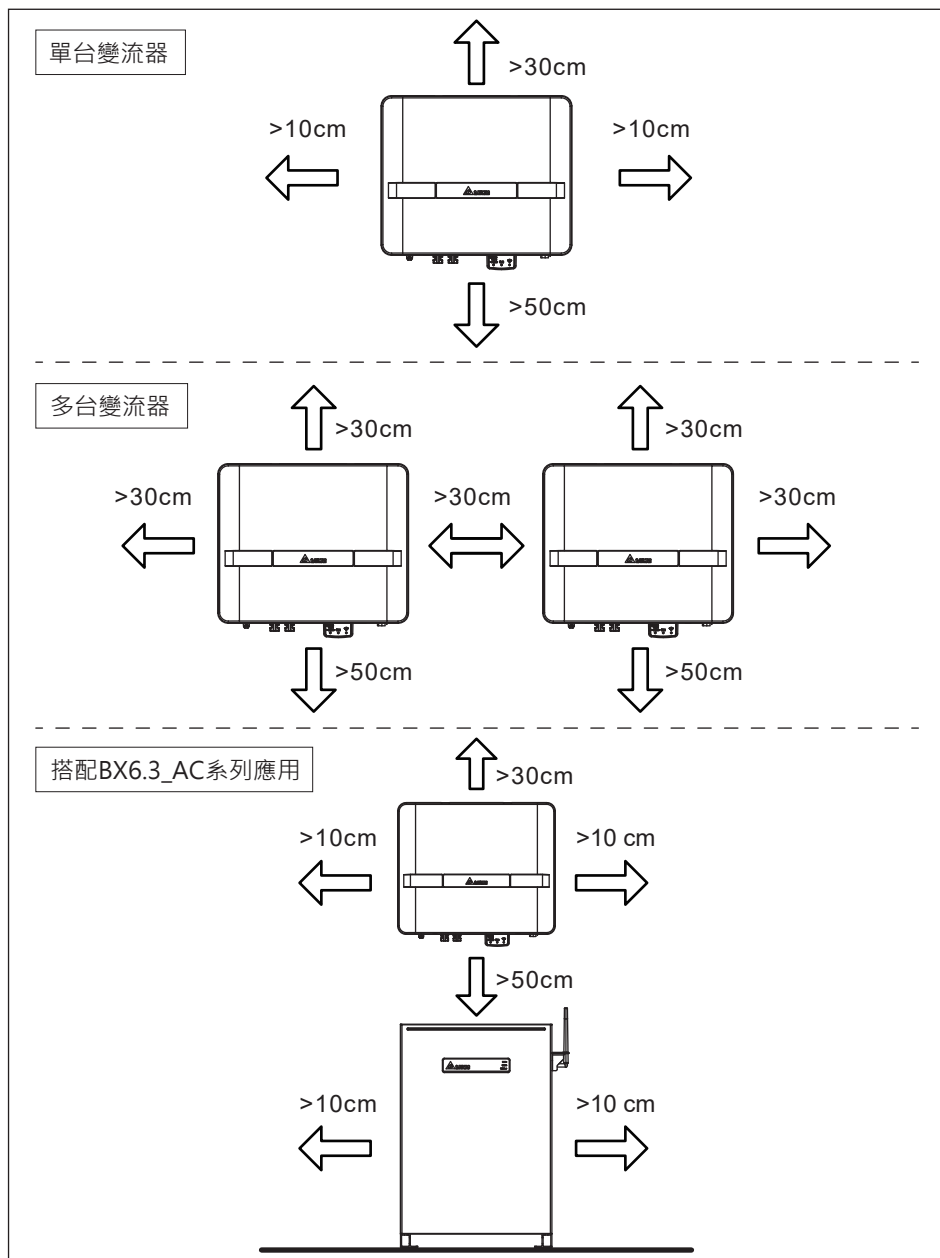


圖4-3：安裝之適當間隙

## 5 配線

### 5.1 配線前準備

1. 確認電壓值、電壓極性是否正確。
2. 由於本機器H2.5 / H3 / H3A / H4A / H5A在直流輸入和交流輸出之間並無做直流隔離，當太陽能板需要正端或副端接地時，產品須另接隔離變壓器。
3. 接地阻抗偵測線路為內部固定功能設定，不能被更改。
4. 如圖5-1所示，產品可接受DC並聯輸入。
5. 根據 IEC 62109-2，請使用符合IEC 61730 Class A的PV 模塊。

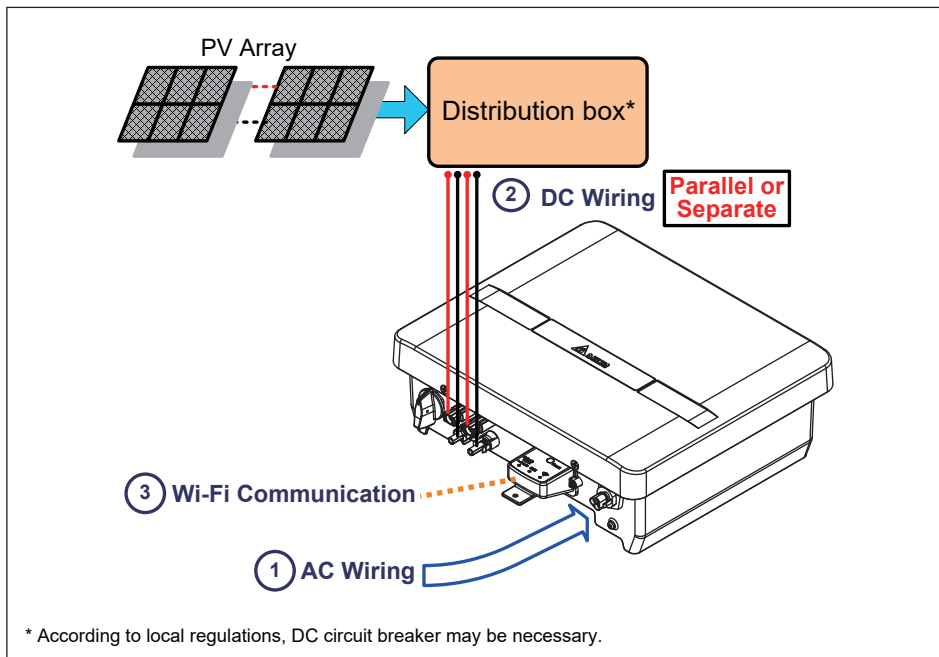


圖5-1：太陽能變流器配線圖(DC側不接地)

#### 警告：觸電危險！



當太陽能板暴露於陽光時，太陽能板會提供直流電至變流器，輸出電線與金屬端子會有觸電的危險，為了降低安裝時觸電之風險，在開始配線之前以絕緣物質覆蓋於太陽能板之上並確認斷路裝置設定在OFF。

## 5.2 AC連接: L + N + PE

**警告：可能導致人員傷亡！**



在AC配線之前，先確認AC斷路器已切換至OFF。

### 5.2.1 保護裝置及導線規格

#### 5.2.1.1 H2.5 / H3 / H3A / H4A / H5A<sub>220</sub> / H5A<sub>221</sub> AC插頭

	額定功率	前端電路斷路器
H2.5	3.125 kVA	16A
H3 / H3A	3.75 kVA	20A
H4A / H5A	5 kVA	25A

表5-1 : H2.5 / H3 / H3A / H4A / H5A<sub>220</sub> / H5A<sub>221</sub> 前端電路保護

變流器配備的交流插頭具有以下技術特點：

交流連接器	96.031.4154.3 01K, Wieland Electric GmbH
電流額定值	≤ 25 A
Min. / Max. 電纜直徑	10 ... 14 mm
Min. / Max. 導線線徑	1.25 ... 4 mm <sup>2</sup>
端子螺絲的建議扭矩	0.8~1 N.m

閱讀並遵循交流插頭提供的說明。

變流器附贈的交流電源插頭可與柔性或剛性銅纜一起使用。

計算電纜橫截面時，請考慮：

- 使用材料
- 溫度條件
- 電纜長度
- 安裝類型
- 交流電壓降
- 電纜損耗

務必遵循您所在國家定義的系統安裝要求！

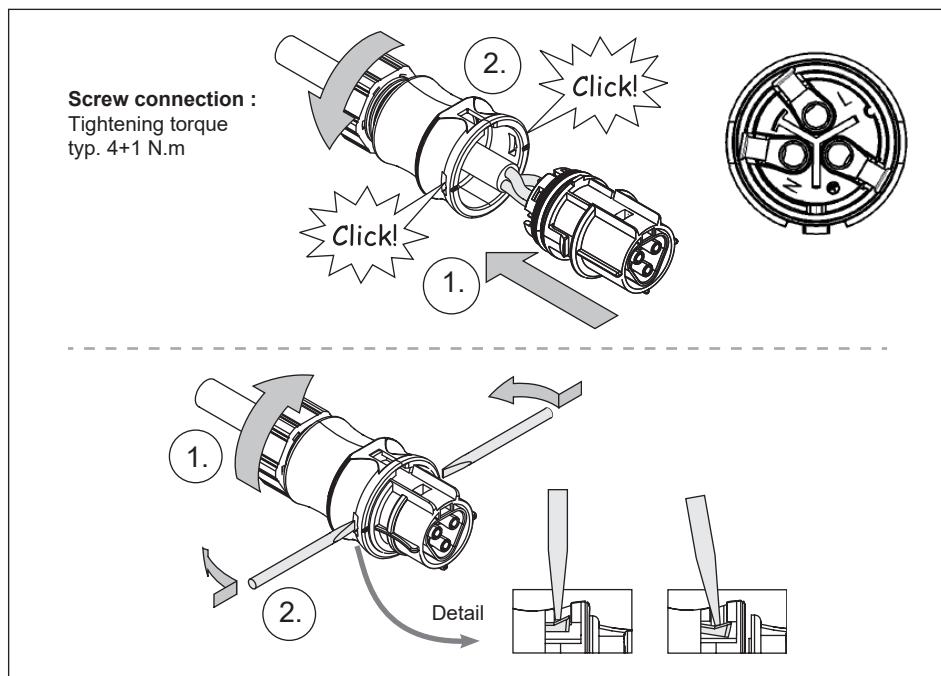


圖5-2：AC插頭圖解 (96.031.4154.3 01K, Wieland Electric GmbH)

## 5.2.1.2 H5A\_222 AC插頭

	Power rating	Upstream AC circuit breaker
H5A_222	5 kVA	25A

表5-2：H5A\_222 前端電路保護

變流器配備的交流插頭具有以下技術特點：

Technical data	IP66** / IP68 (2 m, 24 h)* / IP69K**			
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:	35 A	32 A	21,4 A	
	32 A	25 A	17,3 A	
	24 A	20 A	14,1 A	
2.5 mm <sup>2</sup> with 1.5 mm <sup>2</sup> 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

閱讀並遵循交流插頭提供的說明。

變流器附贈的交流電源插頭可與柔性或剛性銅纜一起使用。

計算電纜橫截面時，請考慮：

- 使用材料
- 溫度條件
- 電纜長度
- 安裝類型
- 交流電壓降
- 電纜損耗

務必遵循您所在國家定義的系統安裝要求！

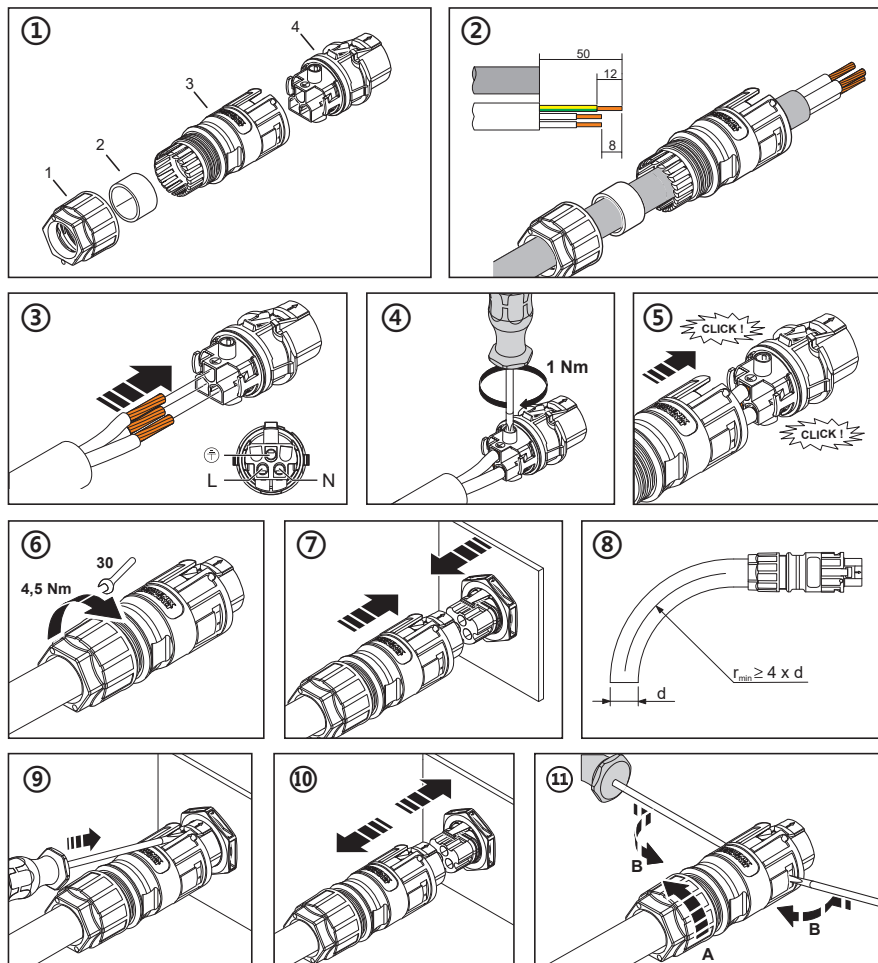


圖5-3：AC插頭圖解（3-FC-FS6）

## 5.3 DC連接 (從太陽能板)

### 警告！



在DC配線時請選擇適當佈線連結至正確極性。  
在DC配線時請確認太陽能板的開關已關閉。

### 注意！



太陽能板的最大開路電壓不能超過500Vdc(H2.5) / 600Vdc (H3 / H3A / H4A / H5A)。

### 資訊



安裝於太陽能板與變流器之間的無熔絲開關，電壓規格需大於該變流器的最大輸入電壓



## 5.3.1 非對稱加載

### 5.3.1.1 H3A / H4A / H5A\_220 / H5A\_221 DC插頭

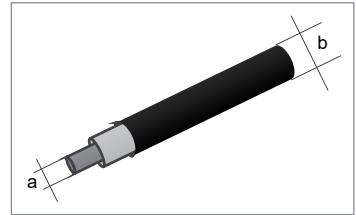
變流器H3A/ H4A/ H5A使用兩組獨立MPP追蹤來優化調整對稱與非對稱性系統之負載。以此來達成複合發電系統設計的要求。

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%

RPI系列光伏變流器使用正品Multi-Contact®MC4連接器。

#### 直流插頭和直流電纜

所有直流連接的直流插頭隨變流器一起提供。  
如果要訂購更多或需要不同的尺寸，請參閱  
以下表格中的信息：







DC connectors on the inverter	DC plugs for DC cable		
	a mm <sup>2</sup>	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

表5-3 : MC4 connectors

DC 接頭配線極性可區分為正極與負極如圖5-4。

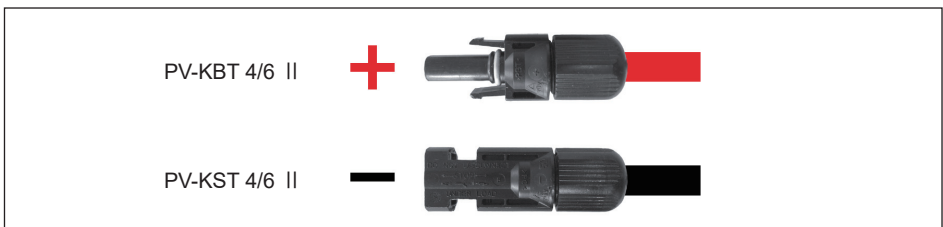


圖5-4 : H2.5 / H3 / H3A / H4A / H5A\_220 / H5A\_221 DC接頭配線圖

### 5.3.1.2 H5A\_222 DC插頭

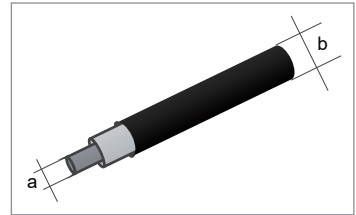
變流器H5A\_222使用兩組獨立MPP追蹤來優化調整對稱與非對稱性系統之負載。以此來達成複合發電系統設計的要求。

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

RPI系列光伏變流器使用正品Amphenol H4連接器。

#### 直流插頭和直流電纜

所有直流連接的直流插頭隨變流器一起提供。如果要訂購更多或需要不同的尺寸，請參閱以下表格中的信息：



Description	Specifications		
contact size	2.5mm <sup>2</sup> / 14AWG	4mm <sup>2</sup> / 12AWG	6mm <sup>2</sup> / 10AWG
rated current (TUV)	25A @85°C	35A @85°C	45A @85°C

表5-4 : H4 connectors

DC 接頭配線極性可區分為正極與負極如圖5-5。

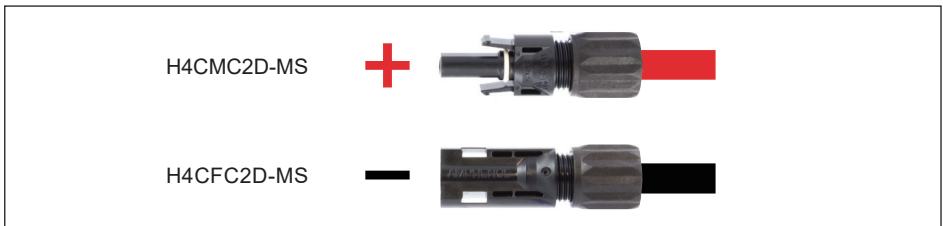


圖5-5 : H5A\_222 DC接頭配線圖

## 6 實功與虛功控制及低壓穿越(非必要選項)

依據VDE-AR-N 4105及CEI 0-21，使用者有2種實功控制設定及4種虛功控制設定。

### ATTENTION



參數設定是根據所選擇的國家併網規定，若是修改設定參數有可能會違反規定。參數修改前必須要與Delta客服聯繫。

### 6.1 實功控制

#### 6.1.1 功率限制

使用者可用百分比的方式降低變流器輸出功率。  
設定方式有兩種：

1. 以額定功率為100%。
2. 依當下輸出功率為100%。

#### 6.1.2 功率vs.頻率

根據VDE-AR-N 4105 (5.7.3.3)：

參考圖6-1。當頻率介於50.2Hz至51.5Hz之間，輸出功率會隨著頻率上升(下降)而下降(上升)。輸出功率上升(下降)的斜率為40%Pm/1Hz。Pm為50.2Hz時的輸出功率。

詳細的動作原理可參考VDE-AR-N 4105 (5.7.3.3)

根據CEI 0-21 (8.5.3.2)：

參考圖6-1。當頻率介於50.3Hz至51.5Hz之間，輸出功率會隨著頻率上升而下降。輸出功率下降的斜率為83.3%Pm/1Hz。Pm為50.3Hz時的輸出功率。

詳細的動作原理可參考CEI 0-21 (8.5.3.2)

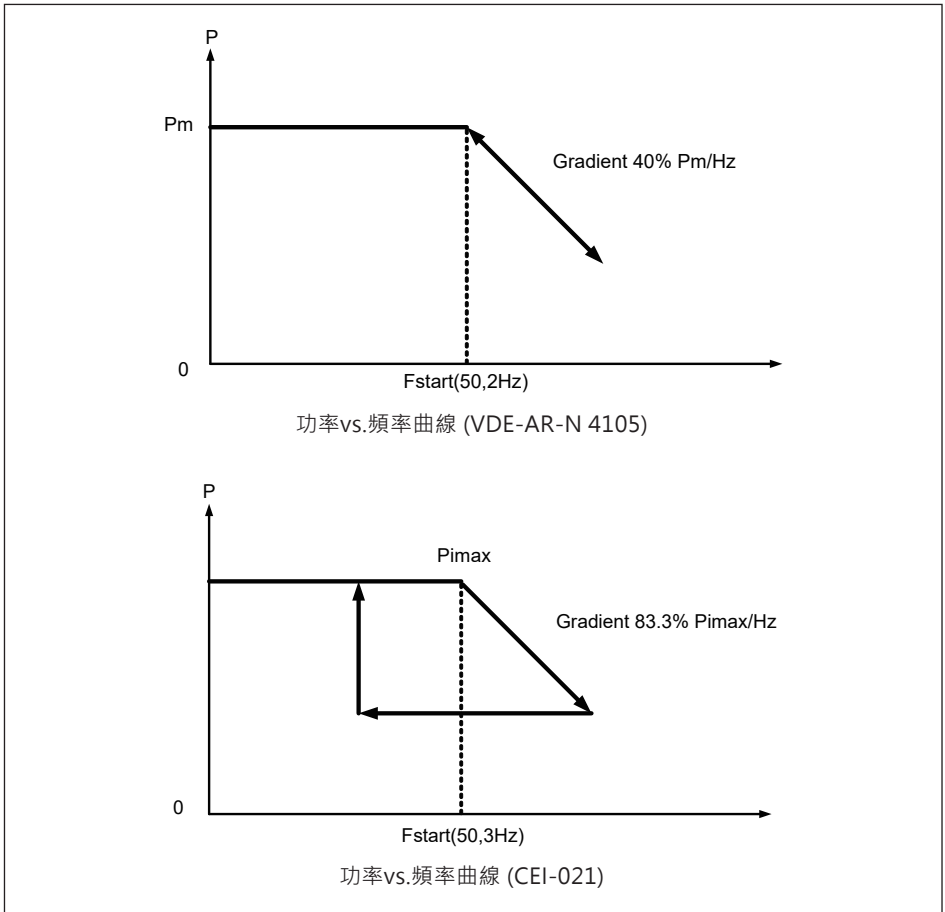


圖6-1 : 功率vs.頻率特性

## 6.2 虛功控制

使用者有以下四種虛功控制方式：

- 固定功率因數  $\cos\phi$  (VDE-AR-N 4105 ,CEI 0-21)
- displacement factor/active power characteristic curve  $\cos\phi(p)$  (VDE-AR-N 4105 ,CEI 0-21)
- 固定虛功量(Var)(CEI 0-21)
- 虛功 / 電壓特性Q(U). (CEI 0 -21)

## 6.2.1 Fixed Power Factor $\cos\phi$ (VDE-AR-N 4105,CEI 0-21)

使用者可設定輸出功率因數從Cap 0.8到Ind 0.8 (若輸出功率低於額定功率20% · 變流器將停止虛功控制)。

## 6.2.2 $\cos\phi(P)$ (VDE-AR-N 4105,CEI 0-21)

使用者可設定P1 · P2 · Cap 0.9 · Ind 0.9四個參數來決定輸出功率因數與輸出功率關係。如圖6-2。

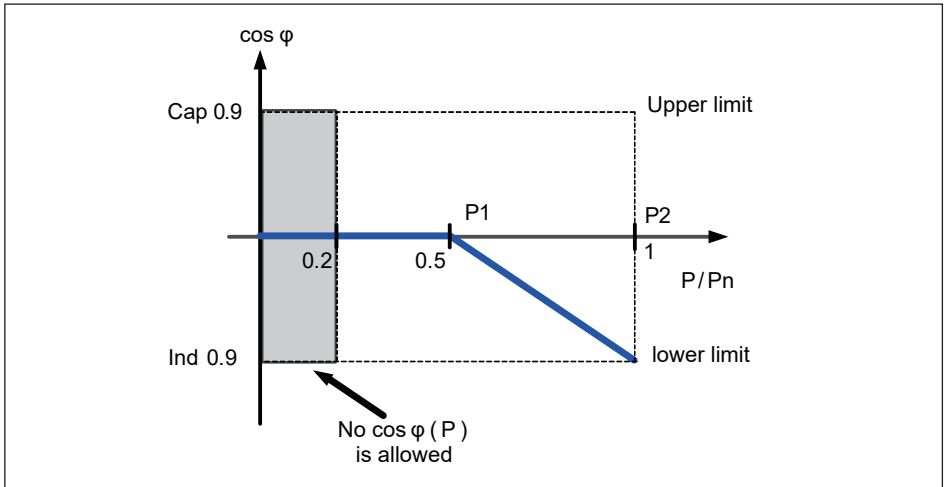


圖6-2： $\cos\phi(P)$ 特性

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

使用此種方式時，變流器將依照固定虛功設定值來輸出虛功。使用者可設定輸出範圍從Cap 53% 到 Ind 53%。

## 6.2.4 虛功 / 電壓特性 $Q(U)$ (CEI 0-21)

使用者可設定  $U_{1s}$  ·  $U_{1i}$  ·  $U_{2s}$  ·  $U_{2i}$  ·  $Q_{min}$  ·  $Q_{max}$  六個參數來決定輸出。Q與市電電壓關係，如圖6-3。

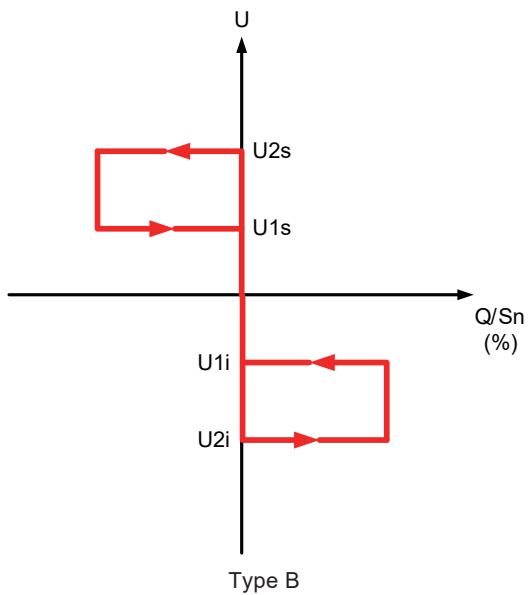
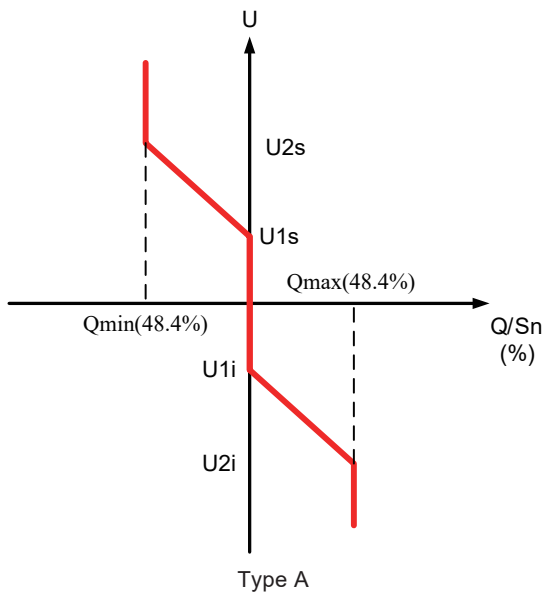


圖6-3 : Q(U)特性

## 6.3 低壓穿越 (LVRT)

根據CEI 0-21, 8.5.1

當電壓下降現象發生時，為了避免與網路不正常脫離，總功率超過6千瓦的發電系統必須符合一定的功能性需求，就是國際上一般通稱的低壓穿越LVRT (Low Voltage Ride Through)。

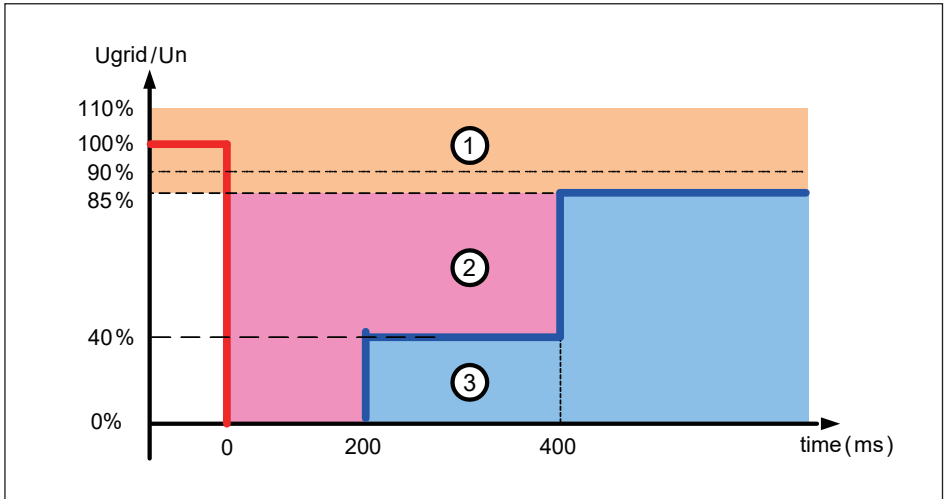


圖6-4：LVRT特性

區域 1：變流器正常運轉

區域 2：變流器在與市電解連前會暫時性的中斷輸出實功及虛功

區域 3：變流器與市電解連

## 6.4 數位輸入

要達成功率控制的目的，數位輸入介面會經由一個漣波控制接收器(ripple control receiver)或命令響應裝置(DRED)接收電廠發出的訊息。在不同國家有不同的控制內容。

H2.5/H3/H3A/H4A/H5A 可透過 DC1\_100 接收這些命令。

德國：實功控制分成四個階層 0%，30%，60% and 100%

義大利：太陽能板安裝的功率輸出最大6KW

- a. 遠程控制關機
- b. 窄頻率跳脫點在49.5 Hz到50.5Hz之間

澳洲與紐西蘭：

變流器支援需求響應模式(DRMs)。

DRM 0 - 斷開裝置

DRM 5 - 不發電

DRM 6 - 輸出功率小於總功率之50%

DRM 7 - 輸出功率小於總功率之75%。並允許虛功控制

DRM 8 - 不限制輸出功率。並允許虛功控制

客制化：使用者自行定義

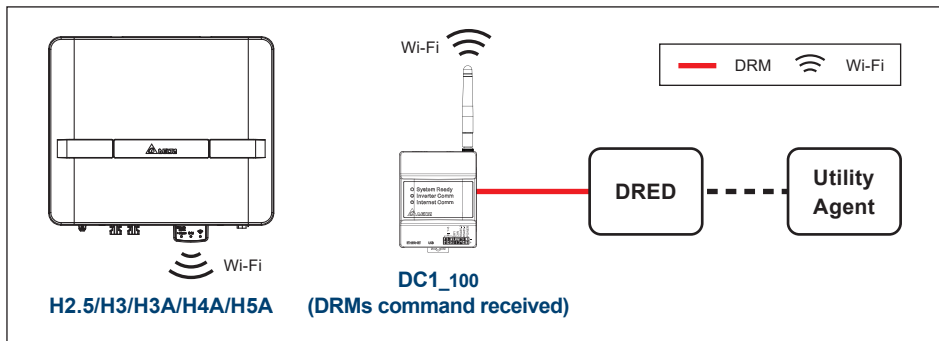


圖6-5：透過DC1\_100接受數位輸入

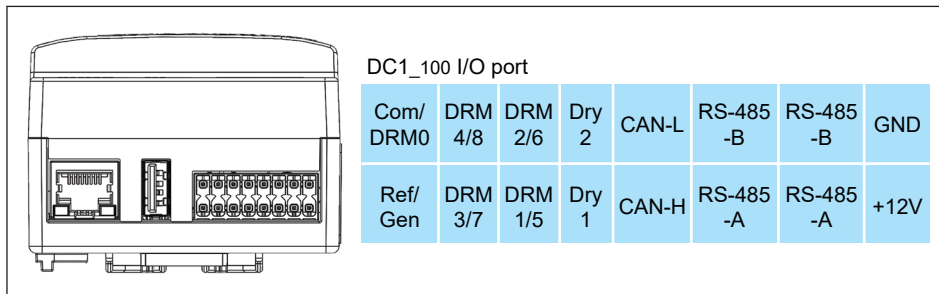
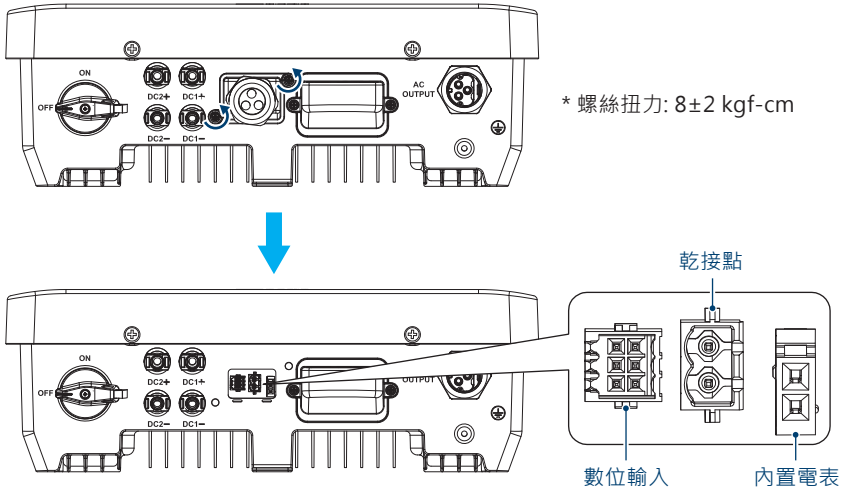


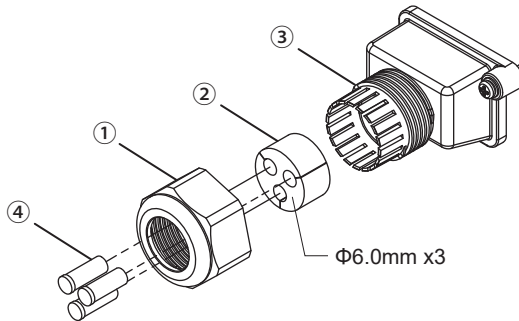
圖6-6：DC1\_100 的數位輸入接口



## 6.5 功能配件



### 6.5.1 防水墊圈安裝



- (1) 逆時針鬆開前蓋 ①。
- (2) 從緊固環③拆下防水墊圈②。
- (3) 移除防水塞 ④ 並從墊圈②切口裝入電纜。
- (4) 將電纜連接通訊端子。
- (5) 將防水墊圈② 裝回緊固環③。
- (6) 確實擰緊前蓋 ①。

\* 請確保電纜未扭曲以防接觸不良。

## 6.5.2 數位輸入

要達成功率控制的目的，數位輸入介面會經由一個漣波控制接收器(ripple control receiver)或命令響應裝置(DRED)接收電廠發出的訊息。

澳洲與紐西蘭:

變流器支援需求響應模式(DRMs).

DRM 0 - 斷開裝置

DRM 5 - 不發電

DRM 6 - 輸出功率小於總功率之50%

DRM 7 - 輸出功率小於總功率之75%。並允許虛功控制

DRM 8 - 不限制輸出功率。並允許虛功控制

客制化：使用者自行定義

Short pins	Inverter behavior (AU)
D6 & D1	DRM 0 - 斷開裝置
D6 & D2	DRM 8 - 不限制輸出功率
D6 & D3	DRM 7 - 輸出功率小於總功率之75%
D6 & D4	DRM 6 - 輸出功率小於總功率之50%
D6 & D5	DRM 5 - 不發電

電纜要求：

- 導體橫截面: 0.205 mm<sup>2</sup> (AWG24) ~ 0.081 mm<sup>2</sup> (AWG28)
- 電纜外徑: 3.8mm ~ 5.2mm
- 請參閱UL 2464電腦電纜線指南

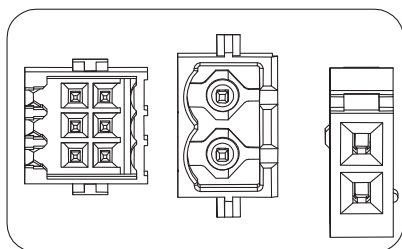


圖 6-7: 數位輸入、乾接點、內置電表

D6	D3	乾接點	內置電表
D5	D2		
D4	D1	乾接點	內置電表

## 6.5.3 乾接點連接方式

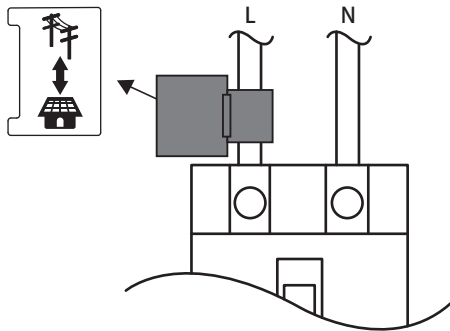
提供單組乾接點，該接點可依客戶需求設定。

乾接點可以承受250Vac/28Vdc/9A 的電氣規格，適當線徑為0.2-1.5mm<sup>2</sup>。

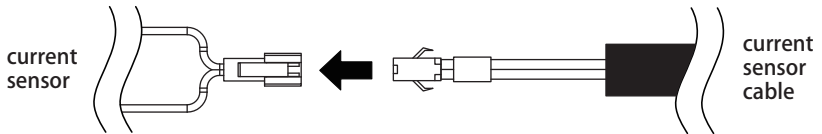
## 6.5.4 內置電表

依照以下步驟連接比流器

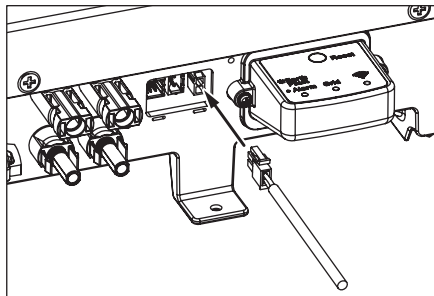
- (1) 將比流器安裝在主漏電斷路器的L電纜上。
- (2) 扣緊比流器於電纜線上，並確認方向的正確性。



- (3) 比流器與端子線對接。



- (4) 比流器連接至功能配件上的內置電表端子。



## 7 變流器的開啟與關閉

### 警告：高溫危險！



產品運作時外殼溫度可能超過70°C，導致表面產生高溫燙傷的危險，請勿觸摸！

安裝完成後，請確認AC、DC及通訊連結狀況是否正確，若日照充足，且自我測試(每日第一次啟動約2分鐘)未出現異常狀況，變流器將自動開始運作。

### 7.1 產品啟動程式

#### 7.1.1 檢查太陽能板的DC電壓

1. 將太陽能板直接曝曬於陽光之下，陽光必須大到可以產生足夠的輸出電壓。
2. 量測太陽能板正負兩端子間的開路直流電壓。

#### 7.1.2 檢查AC市電電壓

使用AC 伏特計量測L1 (L) 和L2 (N) 之間市電開路電壓，確保電壓落於大約正常值，變流器將工作在一個近似市電的弦波的一般電壓值，請參照 “11. 技術資料” 的輸出部分以瞭解本機器市電電壓操作範圍。

## 7.1.3 開啟變流器

### 注意



因用戶端設備環境的多變，請由合格之專業人員進行安裝。  
錯誤的設定，可能導致變流器無法正常工作。

1. 將DC和AC斷路器切換到ON的位置。
2. 首次設定，Grid燈號為快閃(亮0.1秒 暗0.1秒)，表示變流器國別尚未設定
3. 連接通訊，提供Wi-Fi或RS-485連線  
通訊模組提供本變流器與擁有Wi-Fi功能的連網設備(例如：智慧型手機、平板裝置...等)之間的通訊功能，使用本功能時需經由Wi-Fi連線。

#### Wi-Fi連線

關於Wi-Fi及APP操作流程指南請參閱QR-code或下方網址內容

<https://mydeltasolar.deltaww.com/index.php?p=manual>



### 注意



進行Wi-Fi連接設定時，Wi-Fi裝置(Wi-Fi路由器, 變流器, DC1...等)之間的通訊強度需大於-70dbm，若訊號強度<-70dbm會導致傳輸異常與資料遺失的風險，請嘗試調整相對位置來改善通訊品質。

#### RS-485連線

請聯繫系統商進行設定

## 8 保養維護

為了使本機器可以永久保持正常運作，請固定至少半年或是一年檢查一次，包含所有的金屬端子，螺帽，電纜線是否接受，如果有發現受損的元件，請聯絡合格的技工來維修或是置換新元件，還有散熱片部分必須請合格技工至少一年清理一次。

**警告：可能導致人員傷亡！**



保養之前請先將DC和AC斷路，避免電擊導致危險。

## 9 故障訊息和疑難排解

### 9.1 錯誤訊息和故障排解

表9-1：錯誤訊息

錯誤訊息		
資訊顯示	可能原因	排除方式
E01: OFR	<ol style="list-style-type: none"> <li>1. 實際市電頻率超過OFR設定值</li> <li>2. 國別設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器AC端子的市電頻率</li> <li>2. 檢查國別設定</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E02: UFR	<ol style="list-style-type: none"> <li>1. 實際市電頻率低於UFR設定值</li> <li>2. 國別設定或市電保護設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器AC端子的市電頻率</li> <li>2. 檢查國別設定或市電保護設定</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E09: No Grid	<ol style="list-style-type: none"> <li>1. AC斷路器已跳開</li> <li>2. AC接頭脫落</li> <li>3. 內部保險絲毀損</li> </ol>	<ol style="list-style-type: none"> <li>1. 開啟AC斷路器</li> <li>2. 檢查AC接頭確實連結至變流器</li> <li>3. 更換內部保險絲並檢測內部其他切換式裝置是否有異常</li> </ol>
E10: UVR	<ol style="list-style-type: none"> <li>1. 市電實際電壓低於UVR設定值</li> <li>2. 國別設定或市電保護設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器AC端子的市電電壓</li> <li>2. 檢查國別或市電保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E11: OVR	<ol style="list-style-type: none"> <li>1. 市電實際電壓高於OVR設定值</li> <li>2. 國別設定或市電保護設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器AC端子的市電電壓</li> <li>2. 檢查國別或市電保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E13: OVR-Slow	<ol style="list-style-type: none"> <li>1. 實際市電電壓高於OVR設定值</li> <li>2. 國別設定或市電保護設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查連接至變流器的市電實際電壓</li> <li>2. 檢查國別或市電設保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E26: OFR-Slow	<ol style="list-style-type: none"> <li>1. 市電實際頻率高於OFR設定值</li> <li>2. 國別或市電設定值錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器端子的實際市電頻率</li> <li>2. 檢查國別或市電保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E27: UFR-Slow	<ol style="list-style-type: none"> <li>1. 市電實際頻率低於UFR設定值</li> <li>2. 國別或市電設定值錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查變流器端子的實際市電頻率</li> <li>2. 檢查國別或市電保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E28: UVR-Slow	<ol style="list-style-type: none"> <li>1. 實際市電電壓低於UVR設定值</li> <li>2. 國別設定或市電保護設定錯誤</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查連接至變流器的市電實際電壓</li> <li>2. 檢查國別或市電設保護設定值</li> <li>3. 檢查變流器內部偵測線路</li> </ol>
E30: OVR(PV)	<ol style="list-style-type: none"> <li>1. 實際Solar電壓高於510Vdc (H2.5) 或560Vdc (H3/ H3A/ H4A)</li> <li>2. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 修改太陽能板設定，確保輸出開路電壓低於500Vdc (H2.5)或550Vdc (H3/ H3A/ H4A)</li> <li>2. 檢查變流器內部偵測線路</li> </ol>
E34: Insulation	<ol style="list-style-type: none"> <li>1. 太陽能板的絕緣狀況異常</li> <li>2. 太陽能板的正端對地或負端對地的電容過大</li> <li>3. 偵測線路異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查DC輸入的絕緣狀況</li> <li>2. 檢查太陽能板的正端對地或負端對地的電容</li> <li>3. 檢查變流器內部偵測線路</li> </ol>

表9-2：故障訊息

故障訊息		
資訊顯示	可能原因	排除方式
F01: DC Injection	1. 市電波形異常 2. 偵測線路異常	1. 檢測市電波形，非線性負載需遠離變流器市電端 2. 檢查變流器內部偵測線路
F05: NTC OTP	1. 環境溫度高於60°C 2. 偵測線路異常	1. 檢查安裝位置周遭環境溫度 2. 檢查變流器內部偵測線路
F06: NTC0 Circuit Fail	1. 環境溫度高於100°C 或低於-40°C 2. 偵測線路異常	1. 檢查安裝位置周遭環境溫度 2. 檢查變流器內部偵測線路
F07: NTC LTP	1. 環境溫度低於-30°C 2. 偵測線路異常	1. 檢查安裝位置周遭環境溫度 2. 檢查變流器內部偵測線路
F09: Ntc2 Circuit Fail	1. Inverter 電路散熱片溫度高於100°C 或低於-40°C 2. 偵測線路異常	1. 檢查安裝位置周遭環境溫度 2. 檢查變流器內部偵測線路
F15: HW ADC1	1. 輔助電源電路異常 2. 偵測線路異常	1. 檢測輔助電源電路 2. 檢查變流器內部偵測線路
F16: HW ADC2	1. 輔助電源電路異常 2. 偵測線路異常	1. 檢測輔助電源電路 2. 檢查變流器內部偵測線路
F17: HW ADC3	1. 輔助電源電路異常 2. 偵測線路異常	1. 檢測輔助電源電路 2. 檢查變流器內部偵測線路
F19: HW ADC5	1. 輔助電源電路異常 2. 偵測線路異常	1. 檢測輔助電源電路 2. 檢查變流器內部偵測線路
F20: Efficiency Abnormal	1. 指示電錶未校正 2. 電流回授電路損壞	1. 檢測電流及功率的正確性 2. 檢查變流器內部電流回授線路
F23: Comm. Fault (Dis.)	1. DSP 閒置 2. 通訊連結中斷 3. 通訊電路異常	1. 檢查DSP中的reset and crystal 2. 檢測DSP 和 COMM 之間的連結狀況 3. 檢測通訊電路
F24: RCMU Over Rating	1. 太陽能板的絕緣狀況異常 2. 太陽能板的正端對地或負端對地的電容過大 3. boost 電路的驅動電路或boost 電感異常 4. 偵測線路異常	1. 檢查DC 輸入的絕緣狀況 2. 檢查太陽能板的正端對地或負端對地的電容，需小於2.5uF. (必要時安裝外部變壓器) 3. 檢查boost 電路的驅動電路或boost 電感 4. 檢查變流器內部偵測線路



故障訊息		
資訊顯示	可能原因	排除方式
F27: RCMU Circuit Fail	1. 漏電流偵測線路未連接 2. 偵測線路異常	1. 檢查變流器內部RCMU 的聯機 2. 檢查變流器內部偵測線路
F28: Relay Test Short	1. 一個或一個以上繼電器異常 2. 繼電器的驅動電路異常	1. 更換繼電器 2. 檢測繼電器的驅動電路
F29: Relay Test Open	1. 一個或一個以上繼電器異常 2. 繼電器的驅動電路異常 3. Vgrid 和 Vout 偵測的精確度不正確	1. 更換繼電器 2. 檢測繼電器的驅動電路 3. 檢查Vgrid 和 Vout 電壓偵測的精確度
F35: HW Bus OVR	1. boost 電路的驅動電路異常 2. 太陽能板的開路電壓超過510Vdc (H2.5) 或560Vdc(H3/ H3A/ H4A) 3. 產品運作時有突波發生 4. 偵測線路異常	1. 檢測boost 電路的驅動電路 2. 修正太陽能板的設定值，使開路電壓低於500Vdc (H2.5)或550Vdc (H3/ H3A/ H4A) 3. N/A 4. 檢查變流器內部偵測線路
F37: OSCP	偵測線路異常	檢查變流器內部偵測線路
F42: CT sensor Fail (A)	1. Inverter 端電感失效 2. 輸出濾波器失效 3. 偵測線路異常	1. 檢測Inverter 端電感值 2. 檢測輸出濾波電容值 3. 檢查變流器內部偵測線路
F56: HW incompat.	硬體功率額定值不正確	檢查硬體功率額定值
F60: IOCP(PV1)	1. boost 電路的切換式裝置異常 2. boost 電路的驅動電路異常 3. 輸入電流偵測線路異常	1. 檢測boost 電路的切換式裝置 2. 檢測boost 電路的驅動電路 3. 檢測輸入電流偵測線路
F61: IOCP(PV2)	1. boost 電路的切換式裝置異常 2. boost 電路的驅動電路異常 3. 輸入電流偵測線路異常	1. 檢測boost 電路的切換式裝置 2. 檢測boost 電路的驅動電路 3. 檢測輸入電流偵測線路

## 10 拆機

### 拆卸程式

如有需要將本變流器停機拆卸，請務必遵守以下指令：

#### 警告！

為了避免人員受傷，請遵守以下步驟：

1. 將AC斷路器切換到OFF，解除和市電端的連接。
2. 將太陽能板斷路器開關切換到OFF，解除和太陽能板的連接。
3. 使用合適的電壓表量測，確認AC和DC都已經完全斷除。
4. 拔除和市電端連接的AC配線。
5. 拔除和太陽能板連接的DC配線。

待完成以上所有步驟之後，即可將本機卸下。



# 11 技術資料

## 11.1 規格

表11-1：規格

Model 1	H2.5_210 H2.5_211	H3_210 H3_211	H3A_220 H3A_221	H4A_220 H4A_221	H5A_220 H5A_221	H5A_222
<b>GENERAL</b>						
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	Non-isolated (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	$Z = 0.4 + j 0.25 \Omega$ (total impedance)					
Three-phase combinations	No					
<b>DC INPUT (Solar side)</b>						
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 / 18Adc for total		11Adc for each / 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	H3_210	H3A_220	H4A_220	H5A_220	H5A_222
	H2.5_211	H3_211	H3A_221	H4A_221	H5A_221	
<b>DC Switch parameters (Solar side)</b>						
Insulation voltage (Ui)	850 V					1200 V
Rated impulse withstand voltage(Uimp)	8 kV					
Suitability for isolation	Isolating device					
Rated operational current	650 V / 30 A					600 V / 30 A
PV utilization category	DC-21B					DC-PV2
Rated thermal current uninterrupted duty (Iu)	45 A					50 A
Rated short-time withstand current (1s) (Icw)	700 A					
Rated short-circuit making capacity (Icm)	1.4 kA					1 kA
Rated conditional short-circuit current (Isc)	5 kA					
<b>AC OUTPUT (Grid side)</b>						
Nominal output power <sup>2</sup>	2500 VA	3000 VA		4000 VA	5000 VA	
Maximum power	2500 VA	3000 VA		4000 VA	5000 VA	
Voltage	220/230 Vac -20%~+22%					
Nominal output current	10.9 A	13 A		17.4 A	22 A <sup>3</sup>	
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 <sup>4</sup>	<3% @Rated power					
Power factor <sup>4</sup>	>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					
Active anti-islanding method	AC Current frequency					
<b>MECHANISM</b>						
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	H3_210	H3A_220	H4A_220	H5A_220	H5A_222
	H2.5_211	H3_211	H3A_221	H4A_221	H5A_221	
<b>REGULATIONS &amp; DIRECTIVES</b>						
Safety	IEC 62109-1 / -2 CE compliance					
Grid interface	VDE AR-N 4105 / VDE 0126-1-1 / AS4777.2:2015 <sup>5-1</sup> / G83-2 / G59-3 / EN50438 / VFR2014 / C10 / C11 / UTE C15-712-1 / IEC61683 / IEC61727 / IEC62116 / EN50549-1:2019 / ABNT NBR 16149 <sup>5-2</sup> / ABNT NBR 16150 <sup>5-2</sup>					AS4777.2:2015 IEC61683 IEC62116 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				

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, New Zealand (AU / NZ)  
(b) H3 / H3A : 2.99kVA max. for Australia, New Zealand (AU / NZ)  
(c) H5A : 4.99kVA max. for Australia, New Zealand (AU / NZ)  
(d) H5A : 4.6kVA max. for Germany (DE)  
(e) H4A/ H5A : 3.68kVA max. for Denmark (DK1 / DK2)

3: 21.7A nom. for Australia, New Zealand (AU / NZ)

4: reactive power control disabled

5-1: not support AS4777.2:2015 Single-phase inverters used in three-phase combinations

5-2: only H3\_210/ H4A\_220/ H5A\_220 support

