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.

Contents

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Table

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!
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.

60 seconds

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.

PV Array   Solar Inverter   Electrical Grid
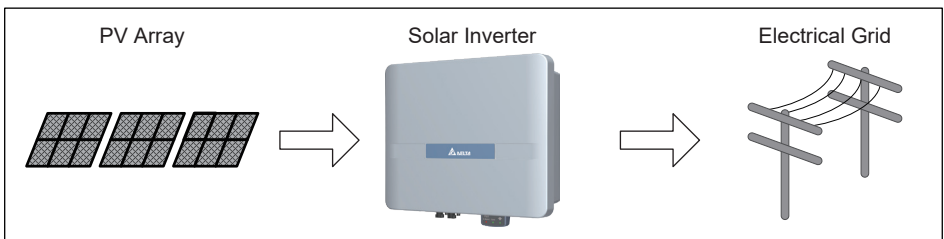
Figure 1-1 : Solar system operation illustration

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.*
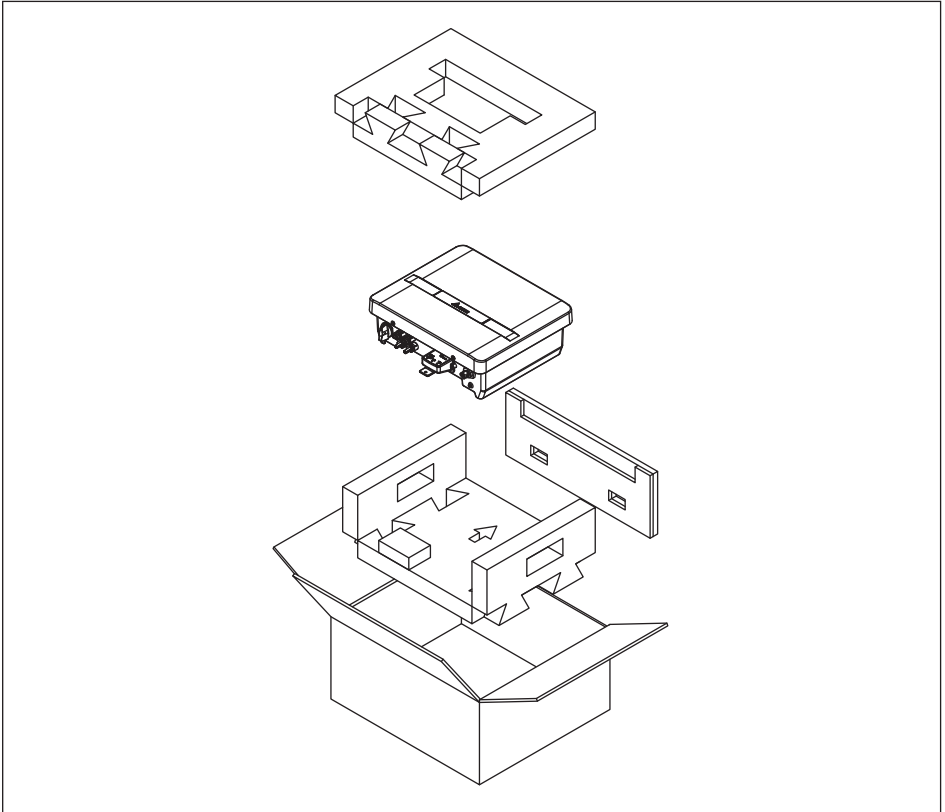
Figure 2-1 : Unpacking process

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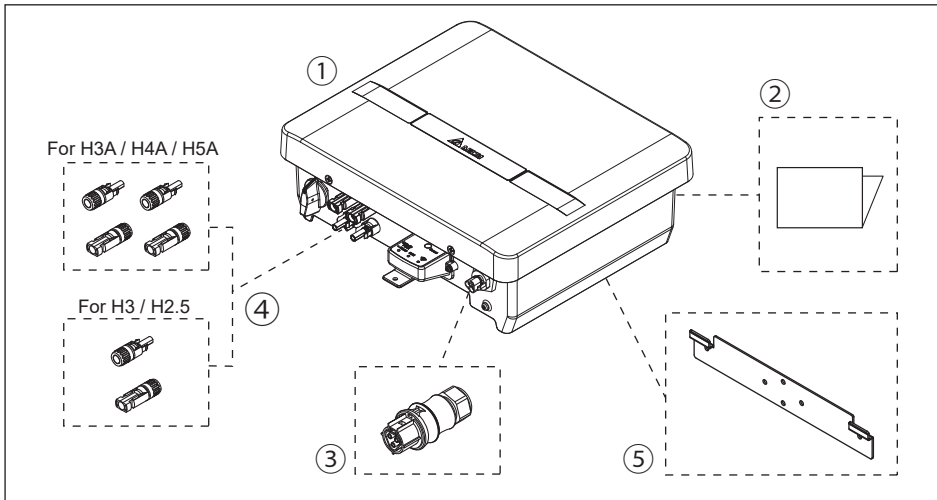
Figure 2-2 : Components of H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221

	Object	Qty	Description
H2.5 / H3 / H3A / H4A / H5A_220 / H5A_221			
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.
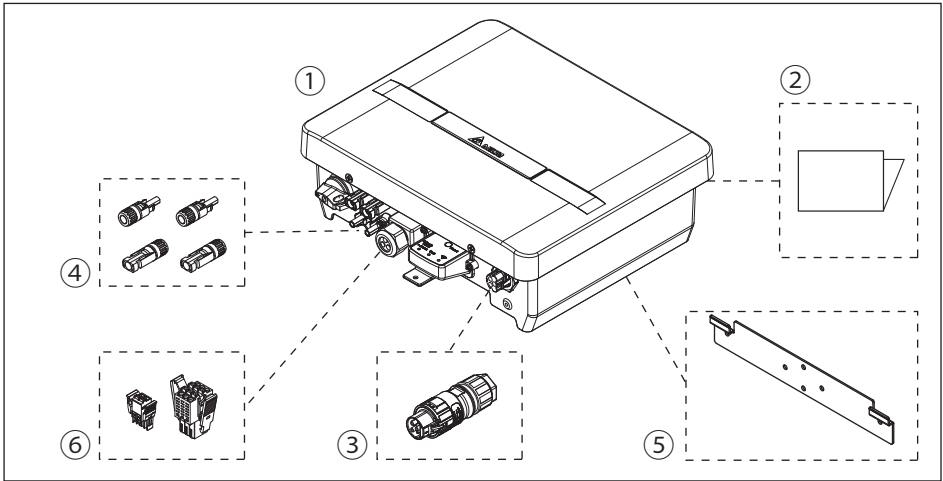
Figure 2-3 : Components of H5A_222

	Object	Qty	Description
	H5A_222		
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

Optional part			
Model	**Object**	**Exterior**	**Description**
PPM CT16_101	Current sensor		Current sensor (E-25150B) 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 : Optional 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.*
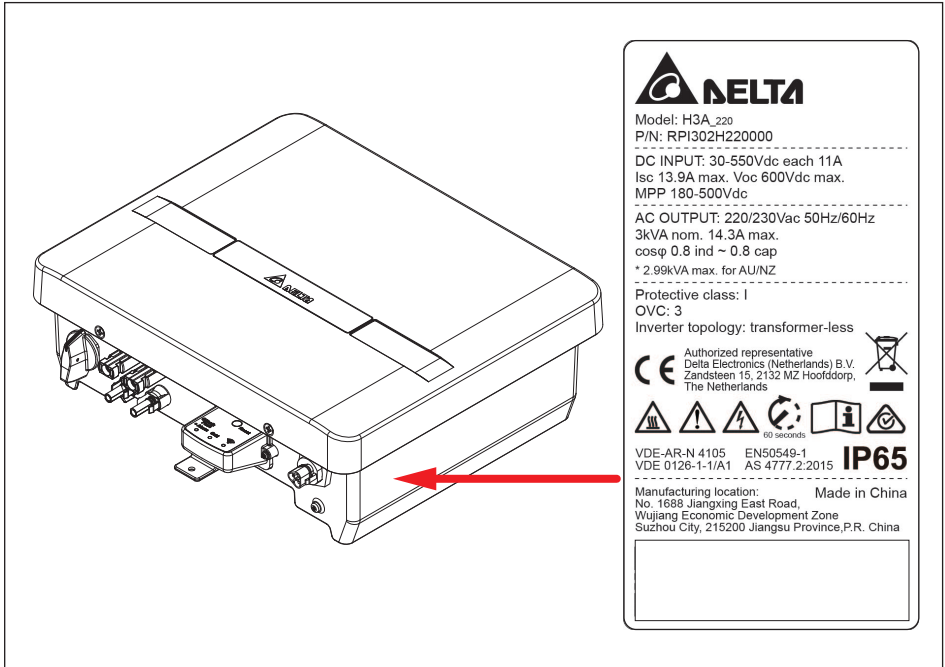
Figure 2-4 : The identification label

3 Product Overview

3.1 Dimensions

H5A_220
H5A_221

H2.5 / H3 / H3A / H4A

H5A_222

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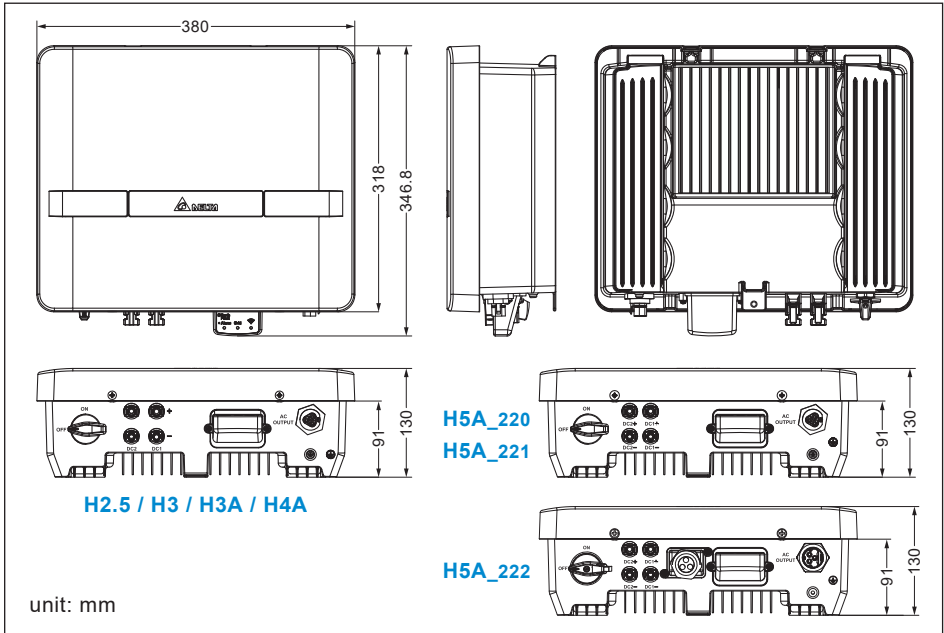
Figure 3-1 : Dimensions of H2.5 / H3 / H3A / H4A / H5A

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.

DC switch
DC connectors
Function port
Comm. Interface
AC connector
Label
Grounding
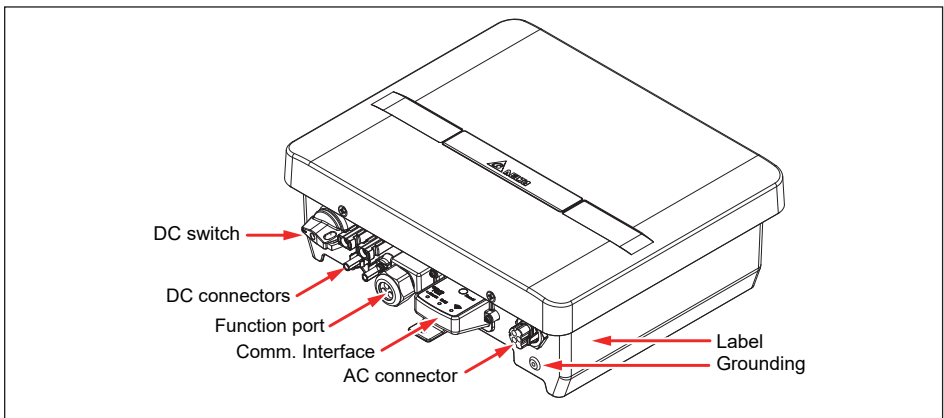
Figure 3-2 : Inverter exterior objects

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 *Chapter 9.1*)
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.
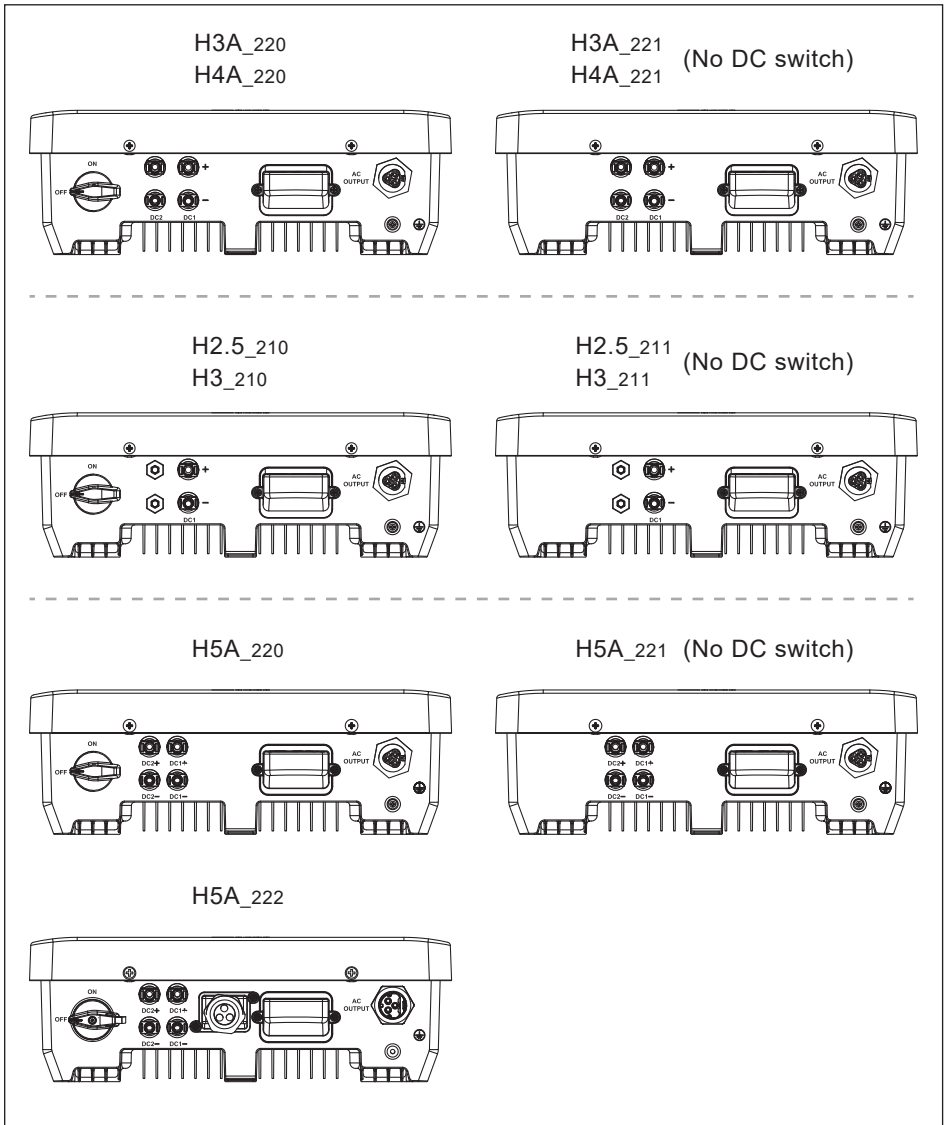
Figure 3-4 : Inverter comparison

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 * 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.*

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°C~+60°C (power derating above 40°C).
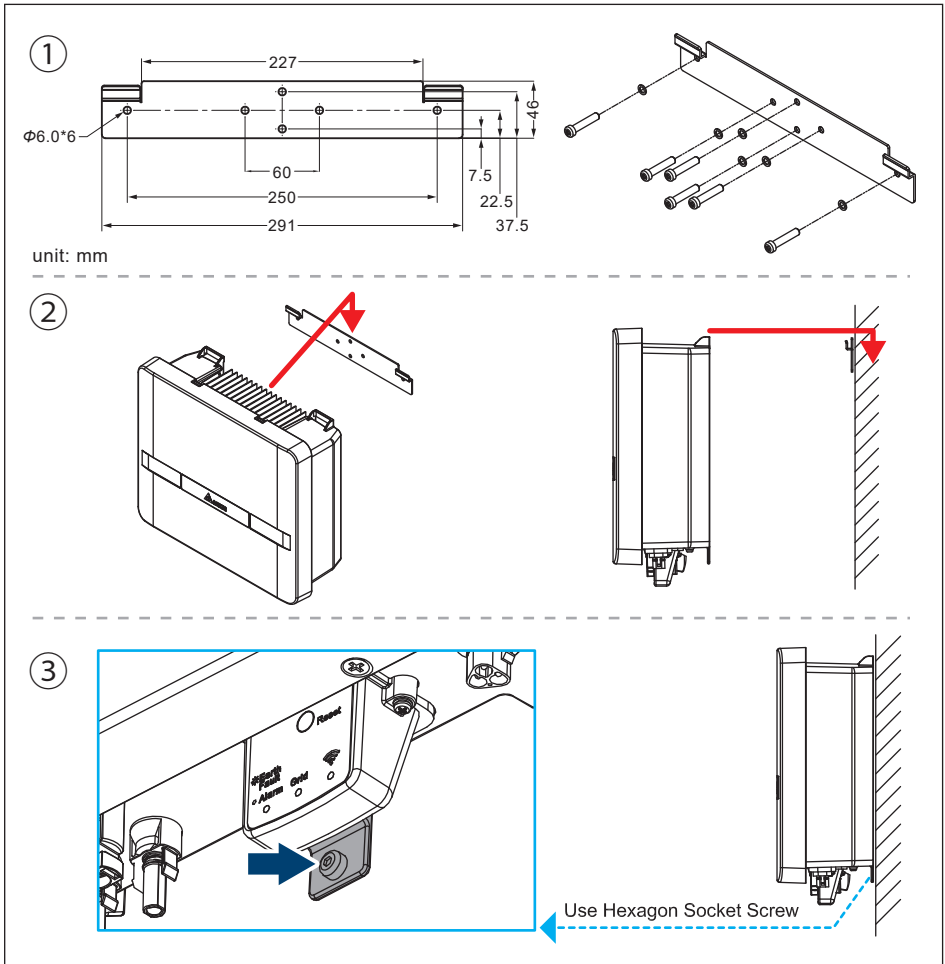
Figure 4-1 : Attaching the mounting bracket for H2.5 / H3 / H3A / H4A / H5A
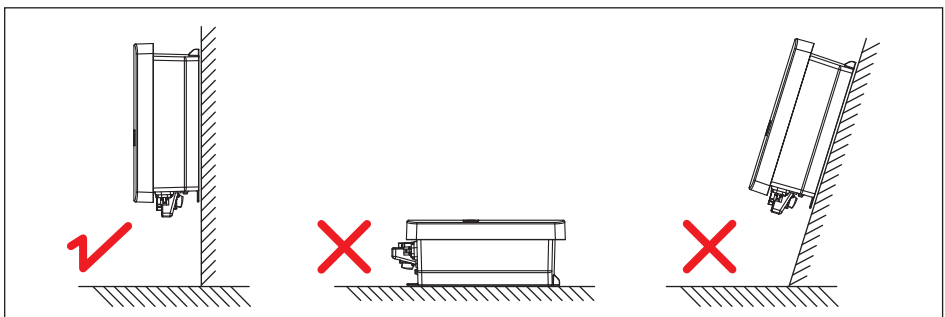
Figure 4-2 : Correct and incorrect installation illustration

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.*

Single inverter

>30cm

>10cm

>10cm

>50cm

Plural inverters

>30cm

>30cm

>30cm

>30cm

>30cm

>50cm

>50cm

with BX6.3_AC system

>30cm

>10cm

>10 cm

>50cm

>10cm

>10 cm
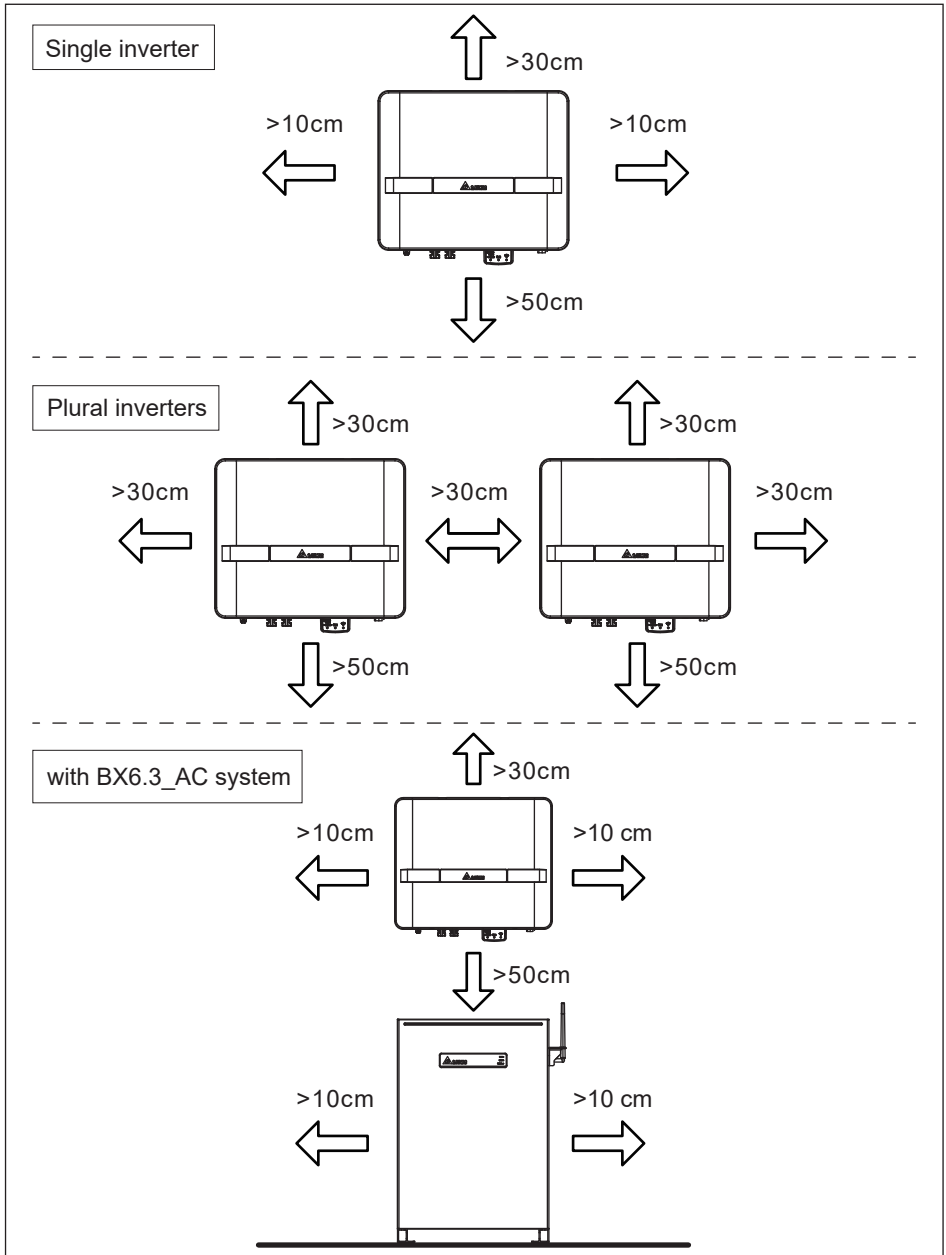
Figure 4-3 : Adequate installation gap

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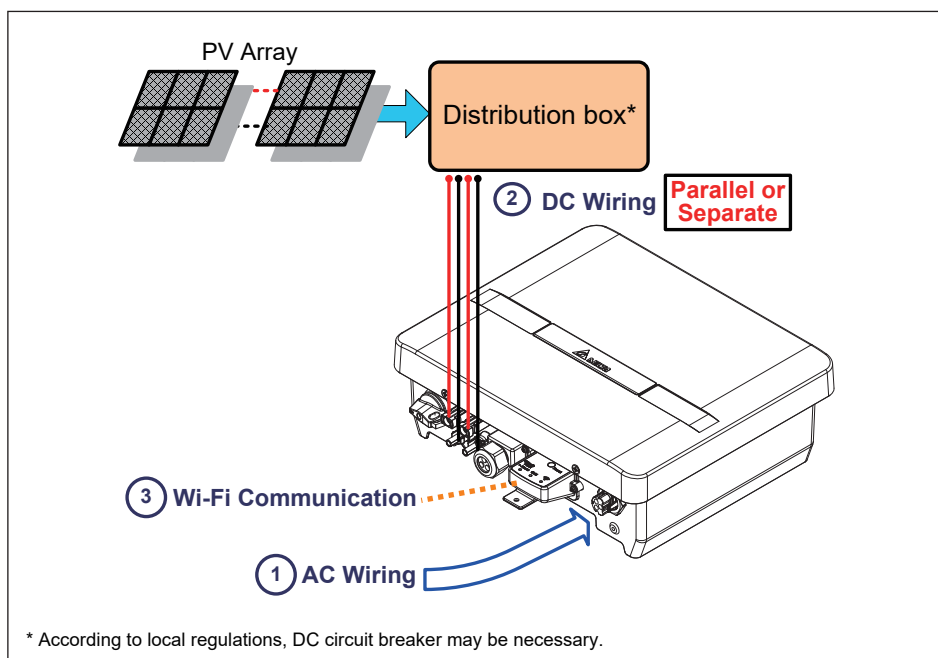
Figure 5-1 : Connection of a system for floating solar array

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.

Residual Current Monitoring Device

The inverter integrates Residual Current Monitoring Unit (RCMU) for the detection of residual current will disconnect immediately from the mains power once a fault current with a value exceeding the limit is detected.

However, if an external residual current device (RCD) (type A is recommended) is mandatory, the switch with rating 30 mA (recommended) should be used. RCD of other specifications can also be used according to local standard.

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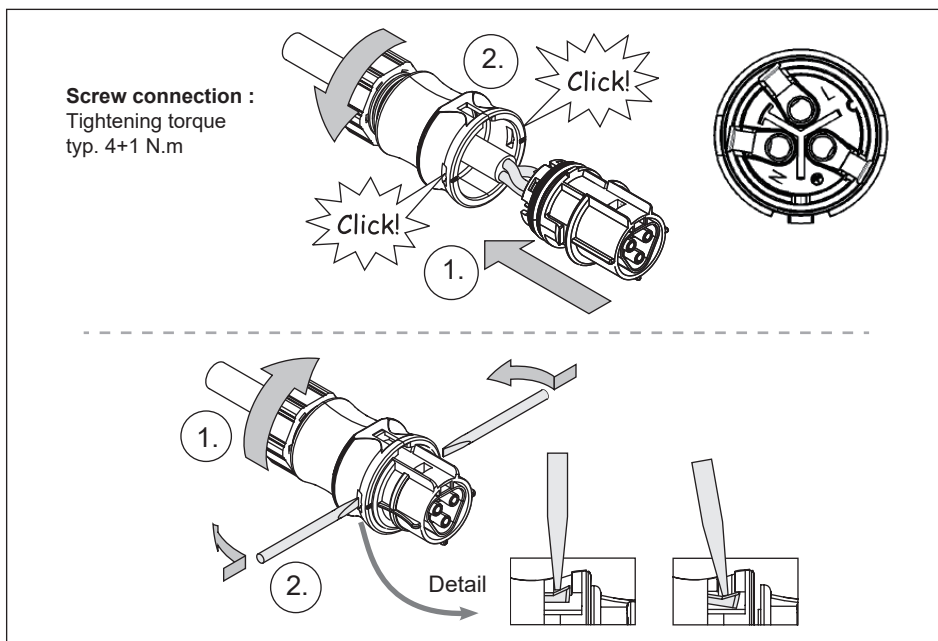
Figure 5-2 : AC plug illustration (96.031.4154.3 01K, Wieland Electric GmbH)

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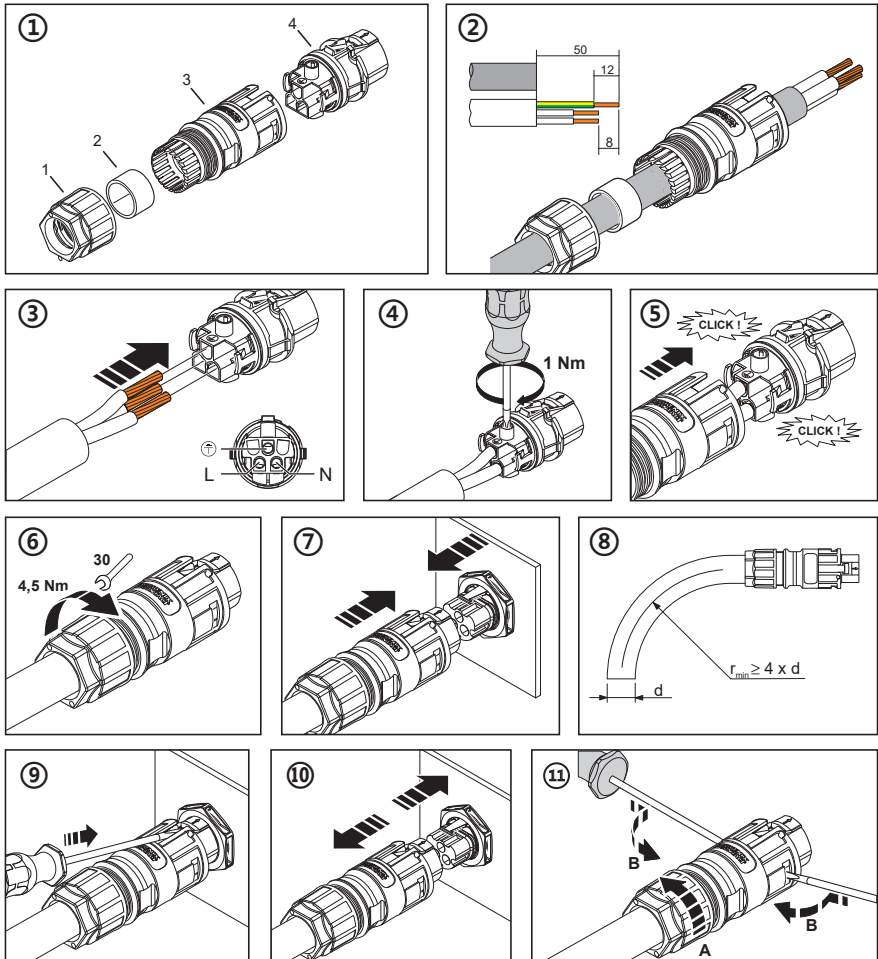
Figure 5-3 : AC plug illustration (PRC 3-FC-FS6)

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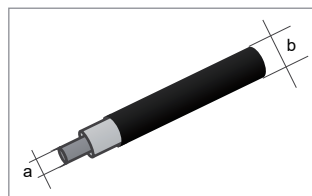
DC connectors on the inverter	DC plugs for DC cable		
	a	b	
	mm²	mm	Multi-Contact
DC–		3–6	32.0010P0001-UR
	1,5/2,5	5,5–9	32.0012P0001-UR
		3–6	32.0014P0001-UR
	4/6	5,5–9	32.0016P0001-UR
DC+		3–6	32.0011P0001-UR
	1,5/2,5	5,5–9	32.0013P0001-UR
		3–6	32.0015P0001-UR
	4/6	5,5–9	32.0017P0001-UR

Table 5-3 : MC4 connectors

DC wiring polarities have two components, Plus and Minus, which are shown in *Figure 5-4.* The connection shall conform to the indication marked on inverter.

PV-KBT 4/6 Ⅱ

PV-KST 4/6 Ⅱ
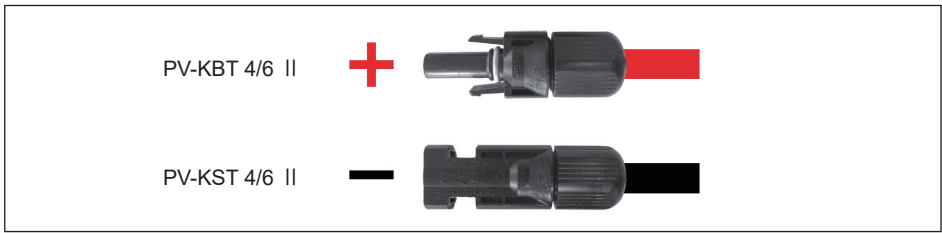
Figure 5-4 : DC Wiring illustration of H3A / H4A / H5A_220 / H5A_221

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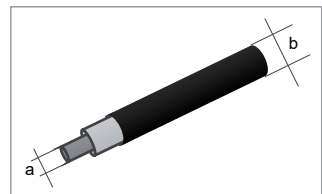
Description	Specifications		
contact size	2.5mm² / 14AWG	4mm² / 12AWG	6mm² / 10AWG
rated current (TUV)	25A @85˚C	35A @85˚C	45A @85˚C

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.

H4CMC2D-MS

H4CFC2D-MS
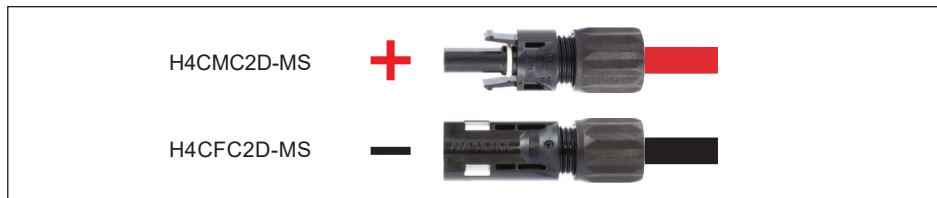
Figure 5-5 : DC Wiring illustration of H5A_222

5.4 PE Connection

To ground the inverter, please ensure the PE conductor to the grounding point. Recommended specifications：4mm² - 6mm²
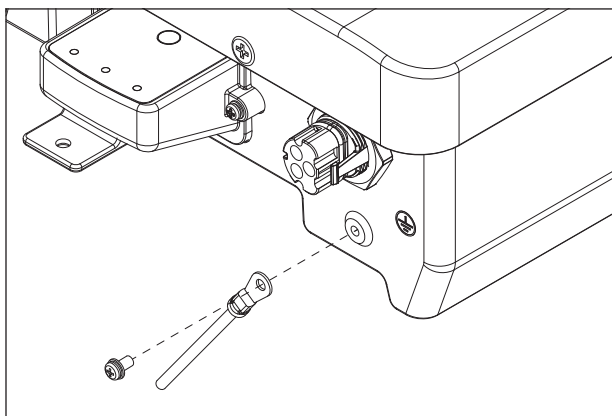
Figure 5-6 : PE Wiring

6 Active/Reactive Power Control and LVRT (Optional)

| 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 Local Monitoring Mode

To monitor and change the parameters setting of the inverter, please access to the "DeltaSolar" App and select "Local Monitoring."

For more details about the App, please refer to the QR code or the following link for installation and operation manual.

DeltaSolar
DELTA ELECTRONICS, INC.

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

To against unauthorized change, a password is required when changing the setting of the power quality response modes, grid protection settings, and export & generation limit function of the inverter. Meanwhile, the inverters setting can be viewed in a read-only mode for verification purpose.

Please contact Delta local service for the password if request.
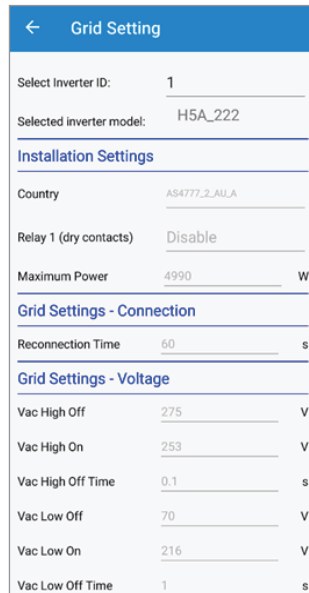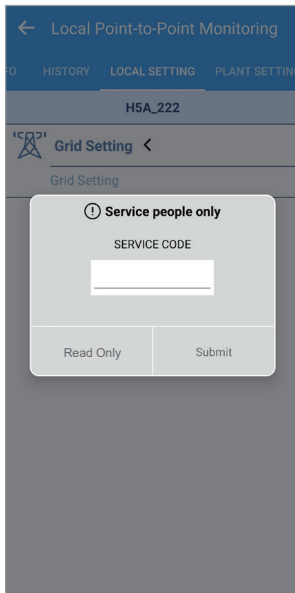
6.2 Main Information

After select "Local Monitoring" and connect to the inverter, please select "INFO" sheet on the top row. The information including Serial Number, Model Name, FW version and etc. can be found in this page.

← Local Point-to-Point Monitoring	
ENERGY **INFO** HISTORY LOCAL SETTING	
est111	
Info	
ID	1
Serial Number	OCO21700111W0
Model	H5E_220
Status	UNKNOWN
Country	AS4777_2_AU_A
Energy	
Today Energy	0.00 kWh
Total Life Energy	43.60 kWh
Input	
Voltage	1.40 / 1.70 V
Current	0.00 / 0.00 A
Power	0 / 0 W
Output	
Voltage	222.80 V
Current	0.18 A
Power	0 W

← Local Point-to-Point Monitoring	
ENERGY **INFO** HISTORY LOCAL SETTING	
Power	0 W
Meter Info	
Voltage	222.70 V
Current	0.31 A
Power	1 W - Feed-in
Meter Status	On
Switching Time 1	---
Switching Time 2	---
Switching Time 3	---
Switching Time 4	---
Switching Time 5	---
FW Version	
COMM	99.03
DSP	02.00
RED	---
ARC	---
SMC	---
SBMS	---
WIFI	1.7.3

6.3 Country Setting and Grid Protection Setting

To check the country setting and grid protection setting, please access to "Local Setting" on the top row, select "Grid/VSG/ATS Setting" and "Grid Setting". Please contact Delta local service for the access code to change the parameters in this page.

6.4 Active Power Control

6.4.1 Grid protection settings

The setting of this function can be found in the "Grid Setting" page, please refer to previous sub-chapter for the instruction to access to this page.
Installers can adjust settings to meet the requirements from the grid operator.
Passive anti-islanding voltage limit values.

Protective function	Protective function limit	Trip delay time	Maximum disconnection time
Undervoltage 2 (Vac Low Off)	70 V	1s	2s
Undervoltage 1 (Vac Low Off Slow)	180 V	10s	11s
Overvoltage 1 (Vac High Off Slow2)	265 V	1s	2s
Overvoltage 2 (Vac High Off)	275 V	-	0.2s

Passive anti-islanding grequency limit values

	Region	Australia A	Australia B	Australia C	New Zealand
Under frequency 1	Protective function limit value	47Hz	47Hz	45Hz	45Hz
	Trip delay time	1s	1s	5s	1s
	Maximum disconnection time	2s	2s	6s	2s
Over frequency 1	Protective function limit value	52Hz	52Hz	55Hz	55Hz
	Trip delay time	-	-	-	-
	Maximum disconnection time	0.2s	0.2s	0.2s	0.2s

6.4.2 P(U) Control

According to AS/NZS 4777.2:2020:
The volt–watt response mode varies the output power of the inverter in response to the voltage at its terminal. The inverter should have the volt–watt response mode. This mode is enabled by default.
The setting of this function can be found in the "Grid Setting" page, please refer to previous sub-chapter for the instruction to access to this page.
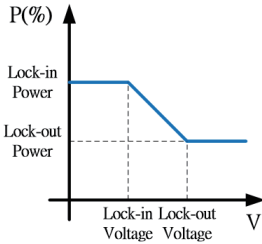
←	Grid Setting	
P(U)		
Mode	ON	
Recovery Time (s)	0	s
Lock-in Power (%)	100	%
Lock-out Power (%)	20	%
Lock-in Voltage	253	V
Lock-out Voltage	260	V
Stop voltage	260	V
Stopping power level	20	%
PRUVR Start Voltage	215	V
PRUVR Stop Voltage	207	V
PRUVR Pend	0	%
PRUVR Lock-out Power	20	%
SET		
SAME MODEL SET		

Table P(U) response default set-point values

Region	Default value	Lock-in Voltage	Lock-out Voltage
Australia A	Voltage	253 V	260 V
	Inverter maximum active power output level(P)% of S rated	100%	20%
Australia B	Voltage	250 V	260 V
	Inverter maximum active power output level(P)% of S rated	100%	20%
Australia C	Voltage	253 V	260 V
	Inverter maximum active power output level(P)% of S rated	100%	20%
New Zealand	Voltage	242 V	250 V
	Inverter maximum active power output level(P)% of S rated	100%	20%
Allowed range	Voltage	233 - 255 V	240 - 265 V
	Inverter maximum active power output level(P)% of S rated	100%	0 - 20%

6.4.3 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
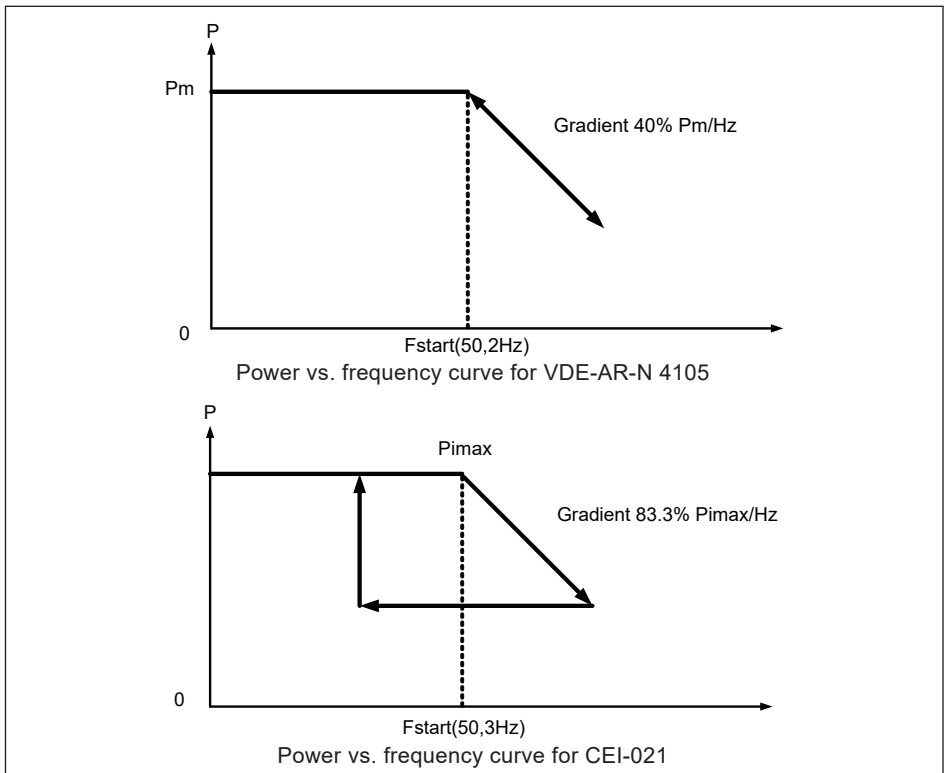
Figure 6-1 : Power vs. frequency characteristic

Frequency variation withstand limits

Inverter response	Decrease in frequency response Lower limit Hz	Lower limit of continuous operation range (fLLCO) Hz	Upper limit of continuous operation range (fULCO) Hz	Increase in frequency response Upper limit
Allowed range	-	49.5 - 49.9	50.1 - 50.5	-
Australia A	47	49.75	50.25	52
Australia B	47	49.85	50.15	52
Australia C	45	49.5	50.5	55
New Zealand	45	49.8	50.2	55

Frequency response limits

Inverter response	Decrease in frequency response limit	Increase in frequency response limit
	Frequency where power output level is maximum(fPmax) Hz	Frequency where power output level is minimum(fPmin) Hz
Allowed range	47 - 49	51 - 53
Australia A	48	52
Australia B	48	52
Australia C	47	53
New Zealand	48	52
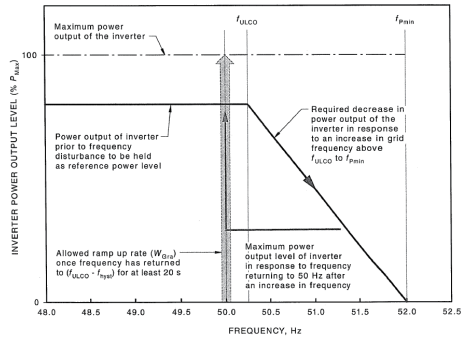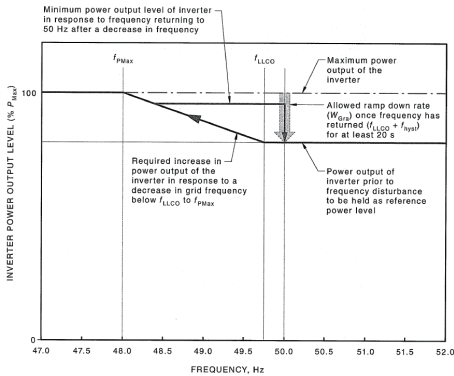
6.5 Reactive Power Control

The setting of this function can be found in the "Grid Setting" page, please refer to previous sub-chapter for the instruction to access to this page.
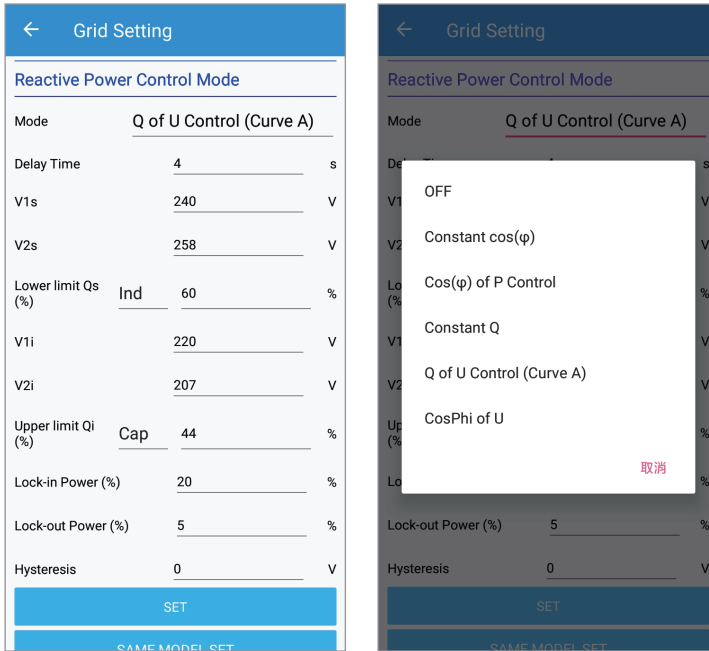
6.5.1 Fixed Power Factor cosφ (VDE-AR-N 4105,CEI 0-21)

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).

6.5.2 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.
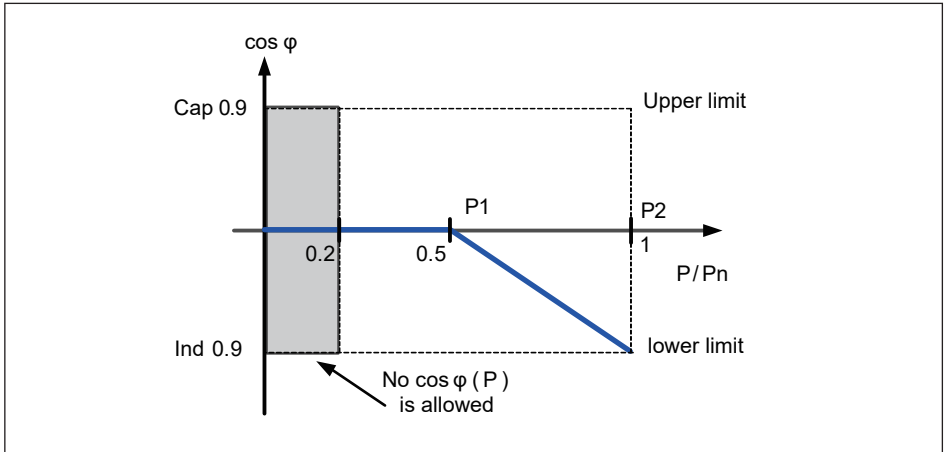
Figure 6-2 : cosφ(P) characteristic

6.5.3 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%.

6.5.4 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*.

Table Q(U) response default set-point values

Region	Default value	V2i	V1i	V1s	V2s
Australia A	Voltage	207 V	220 V	240 V	258 V
	Inverter reactive power level(Q)% of S rated	44% supplying	0%	0%	60% absorbing
Australia B	Voltage	205 V	220 V	235 V	255 V
	Inverter reactive power level(Q)% of S rated	30% supplying	0%	0%	40% absorbing
Australia C	Voltage	215 V	230 V	240 V	255 V
	Inverter reactive power level(Q)% of S rated	44% supplying	0%	0%	60% absorbing
New Zealand	Voltage	207 V	220 V	235 V	244 V
	Inverter reactive power level(Q)% of S rated	60% supplying	0%	0%	60% absorbing
Allowed range	Voltage	180 - 230 V	180 - 230 V	230 - 265 V	230 - 265 V
	Inverter reactive power level(Q)% of S rated	30 - 60% supplying	0%	0%	30 - 60% absorbing
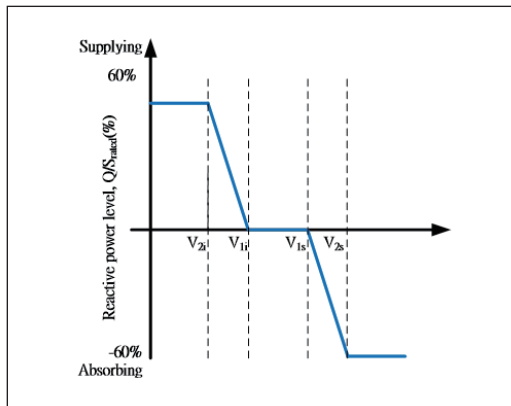
Figure 6-3 : Q(U) characteristic

6.6 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.
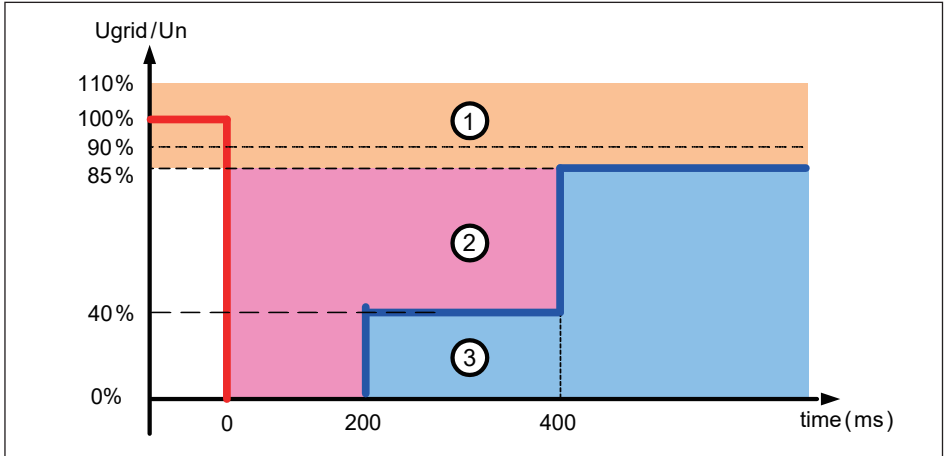
Figure 6-4 : LVRT characteristic

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.

6.7 Export Limit and Generation Limit

This function has to be used with optional external current sensor **(Table 2-3)**.
For the Installation of the external current sensor, please refer to **Chapter 6.9.4**.

As per AS4777.2:2020, there are two generation control functions required, including generation limit control and export limit control.
To change the setting of both control, please access to the "local setting" page, select "function setting" and select "Export / Generation Limit".
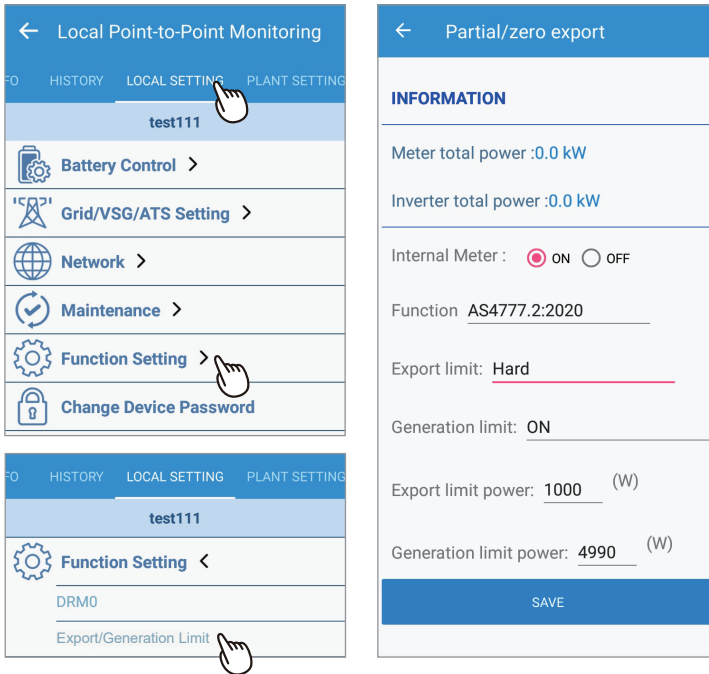
6.8 Digital Input

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.
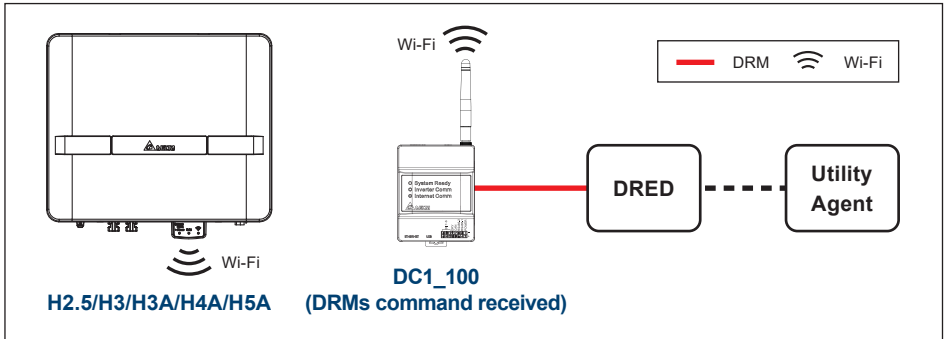
Figure 6-5 : Digital input via DC1_100

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
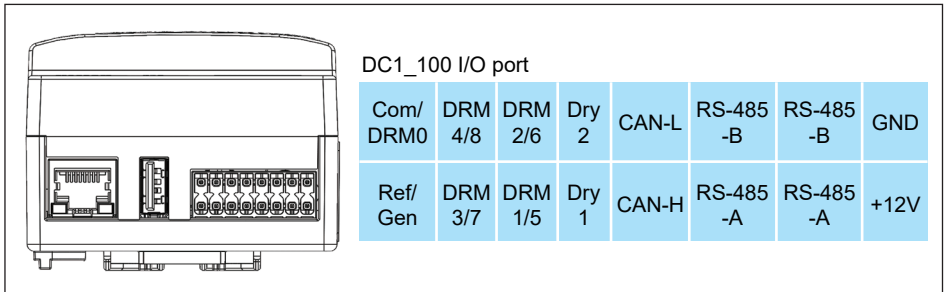
Figure 6-6 : Digital input on DC1_100

6.9 Function Port of H5A_222

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

Dry contact

Digital input   Power meter
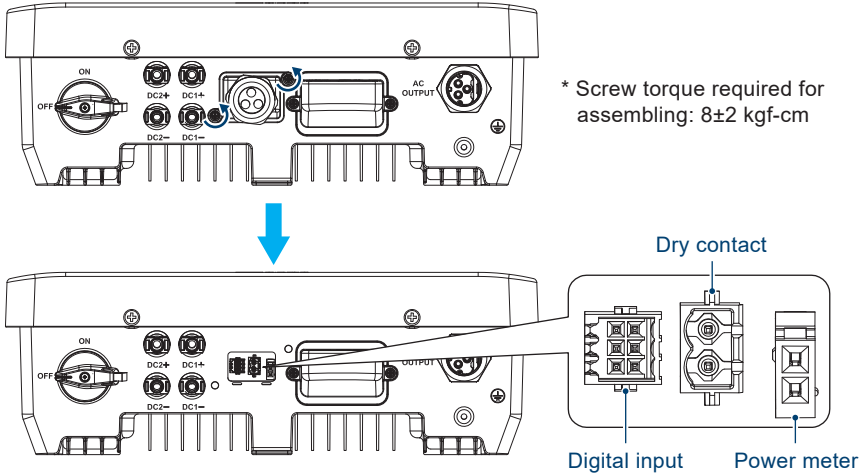
6.9.1 Installation of the Rubber Washer

Φ6.0mm x3
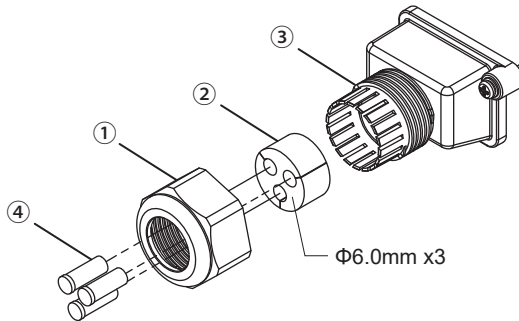
(1) Loosen the front cover ① counterclockwise.
(2) Remove the rubber washer ② from the fastening ring ③.
(3) Remove the washer plugs ④ and insert the cable from the cut out of rubber
      washer ②.
(4) Connect the cable with the terminal.
(5) Install the rubber washer ② to the fastening ring ③.
(6) Surely tighten the front cover ①.

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

6.9.2 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
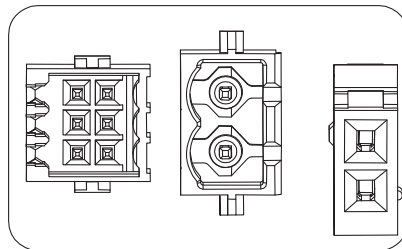
Figure 6-7 : Digital input, Dry contact & Power meter

D6	D3
D5	D2
D4	D1

Dry contact	Power meter
Dry contact	Power meter

6.9.3 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.

6.9.4 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
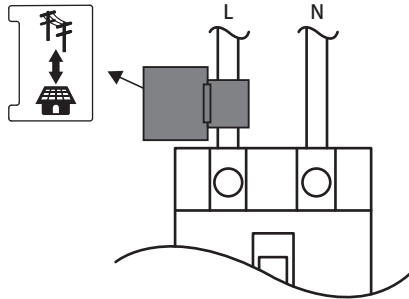
(3) Connect the current sensor cable to the current sensor connection terminal of the measurement unit.
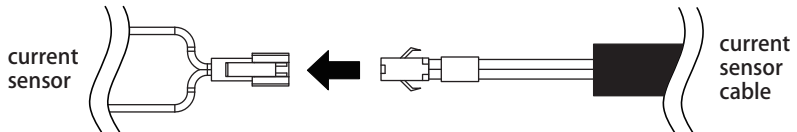
(4) Connect the current sensor cable to the CT sensor connection terminal on the function port.
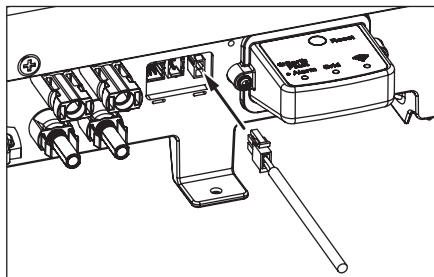
7 Turning the PV inverter on/off

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. Commission the inverter with the "DeltaSolar" App, please refer to the operation guide for more information.
   For compliance to AS/NZS 4777.2:2020, please select the country grid code from Australia Region A, B, C or New Zealand. Please contact your local grid operator for which region to select."

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.

7.2 Shutdown Procedures

1. Turn off the "Main Switch (Inverter Supply)" or AC isolator.
2. Turn off "PV Array DC isolator" located at the inverter.

WARNING !
⚠ Do not open plug and socket connectors under load. PV array DC isolators do not de-energize the PV array and array cabling.

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

Table 9-1 : Error Message

Error		
Message	**Possible cause**	**Action**
E01: OFR	1. Actual utility frequency is higher than the OFR setting 2. Incorrect country setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
E02: UFR	1. Actual utility frequency is lower than the UFR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E09: No Grid	1. AC breaker is OFF 2. AC plug disconnected 3. Internal fuses are broken	1. Switch on AC breaker 2. Check the connection in AC plug and make sure it connects to inverter 3. Replace fuses and check all switching devices in boost & inverter stages
E10: UVR	1. Actual utility voltage is higher the UVR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Measure the utility AC voltage to the inverter terminal. 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E11: OVR	1. Actual utility voltage is higher than the OVR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Measure the utility AC voltage to the inverter terminal. 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E13: OVR-Slow	1. Actual utility voltage is over than the OVR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility voltage on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E26: OFR-Slow	1. Actual utility frequency is over the OFR setting 2. Incorrect country or grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
E27: UFR-Slow	1. Actual utility frequency is under the UFR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country & Grid setting 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 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility voltage on the inverter terminal 2. Check country & Grid setting 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) 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) 2. Check the detection circuit inside the inverter
E34: Insulation	1. PV array insulation fault 2. Large PV array capacitance between Plus to Ground or Minus to Ground or both. 3. Detection circuit malfunction	1. Check the insulation of Solar inputs 2. Check the capacitance, dry PV panel if necessary 3. Check the detection circuit inside the inverter

Table 9-2 : Fault Message

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

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

Fault		
Message	**Possible cause**	**Action**

F35:
HW Bus OVR
	1. Driver for boost is defective
	2. Voc of PV array is over
	   510Vdc (H2.5) or
	   560Vdc (H3/ H3A/ H4A/ H5A)
	3. Surge occurs during operation
	4. Detection circuit malfunction
		1. Check the driver circuit for boost
		   inside the inverter
		2. Modify the solar array setting,
		   and make the Voc less than
		   500Vdc (H2.5) or
		   550Vdc (H3/ H3A/ H4A/ H5A)
		3. N/A
		4. Check the detection circuit inside
		   the inverter

F37: OOCP	Detection circuit malfunction	Check the detection circuit inside the inverter
F42: CT sensor Fail (A)	1. Inverter choke Fail 2. Output Filter Fail 3. Detection circuit malfunction	1. Check Inverter choke inductance. 2. Check output filter capacitance. 3. Check the detection circuit inside the inverter
F56: HW incompat.	HW power rating incorrect	Check comm. HW power rating info.

F60: IOCP(PV1)	1. Switching device in boost is defective
	2. Driver for boost is defective
	3. Input current detection circuit
	   malfunction
		1. Check all switching device in boost
		2. Check the driver circuit for boost
		   inside the inverter
		3. Check input current detection circuit

F61: IOCP(PV2)	1. Switching device in boost is defective
	2. Driver for boost is defective
	3. Input current detection circuit
	   malfunction
		1. Check all switching device in boost
		2. Check the driver circuit for boost
		   inside the inverter
		3. Check input current detection circuit

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
GENERAL						
Enclosure	Powder-coated aluminium					
Operating temperature	-25~60°C, full power up to 40°C [2]					
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					
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 / 18Adc for total		11Adc for each / 22Adc for total	
Max. short circuit current	13.9 A /MPPT					15 A /MPPT
Max. inverter backfeed current to the array	0A					
Startup voltage	35 Vdc					
Input connection	MC4, 1 pairs		MC4, 2 pairs			H4, 2 pairs

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: The operating conditions of the product:
   (a) 60°C for indoor conditioned
   (b) 60°C for indoor unconditioned
   (c) 60°C for outdoor unconditioned without solar effects
   (d) 60°C for outdoor unconditioned with solar effects

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
DC Switch parameters (Solar side)						
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					
AC OUTPUT (Grid side)						
Nominal output power [3]	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 [4]	
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 [5]	<3% @Rated power					
Power factor [5]	>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					
MECHANISM						
Housing	Die casting					
Cooling	Convection cooling					
IP rating	IP65					
Weight	10 kg				11 kg	12 kg
Dimensions	380 × 318 × 130 mm					
Country of manufacturer	China					

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
INFORMATION						
Power Meter	N/A					Built-in
Communication	Wi-Fi					
Indicator	LED					
Display / Cloud	DeltaSolar APP / MyDeltaSolar Cloud					
Alarm	Mail Notification [6]					
REGULATIONS & DIRECTIVES						
Safety	IEC 62109-1 / -2 CE compliance					
Grid interface	VDE AR-N 4105 / VDE 0126-1-1 / AS4777.2:2015 [7-1] / G83-2 / G59-3 / EN50438 / VFR2014 / C10 / C11 / UTE C15-712-1 / IEC61683 / IEC61727 / IEC62116 / EN50549-1:2019 / ABNT NBR 16149 [7-2] / ABNT NBR 16150 [7-2]					AS4777.2:2020 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				

3: (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 : 4.6kVA max. for Germany (DE)
   (d) H4A/ H5A : 3.68kVA max. for Denmark (DK1 / DK2)
4: 21.7A nom. for Australia, New Zealand (AU / NZ)
5: reactive power control disabled
6: Earth Fault Alarm - The inverter complies with IEC 62109. When the earth fault occurs, the Red
   LED Alarm indicator will light up and a notification email will be sent to the customer.
7-1: not support AS4777.2 Single-phase inverters used in three-phase combinations
7-2: only H3_210/ H4A_220/ H5A_220 support