

# Grid-tie Transformerless Hybrid Inverter

## H5E_220

Operation and Installation Manual

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# 1 General Information

## 1.1 Scope of delivery

Congratulations on the purchase of your Delta H5E_220 grid-tied hybrid 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.

**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, the PV modules and the battery product before undertaking work on the device.

**DANGER!**





80 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 80 seconds 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 H5E_220 under the DELTA brand.

## 1.4 Product Description

This device is a single-phase grid-tie hybrid inverter. It converts DC electricity from the PV array with the stored energy into single phase 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. The features of H5E_220 and the extended hybrid system are shown below.

**Features**

- Power Rating: 5.5kVA (AU: 5kVA)
- Single–phase (L + N + PE), Grid-tie, transformerless solar inverter
- Maximum efficiency : >97.4%
- Europe efficiency : 96.8%
- Reactive power capability (Cap 0.8 – Ind 0.8)
- Total harmonic distortion (THD < 3%) @ full load
- Battery-ready PV Inverter
- Built-in Consumption meter
- Synchronize  standalone power function

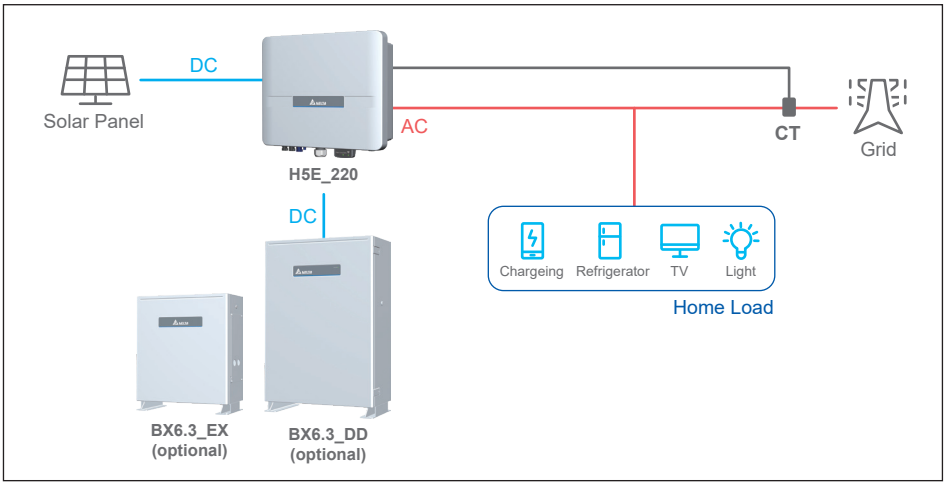



*Figure 1-1 : System diagram*

# 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.***

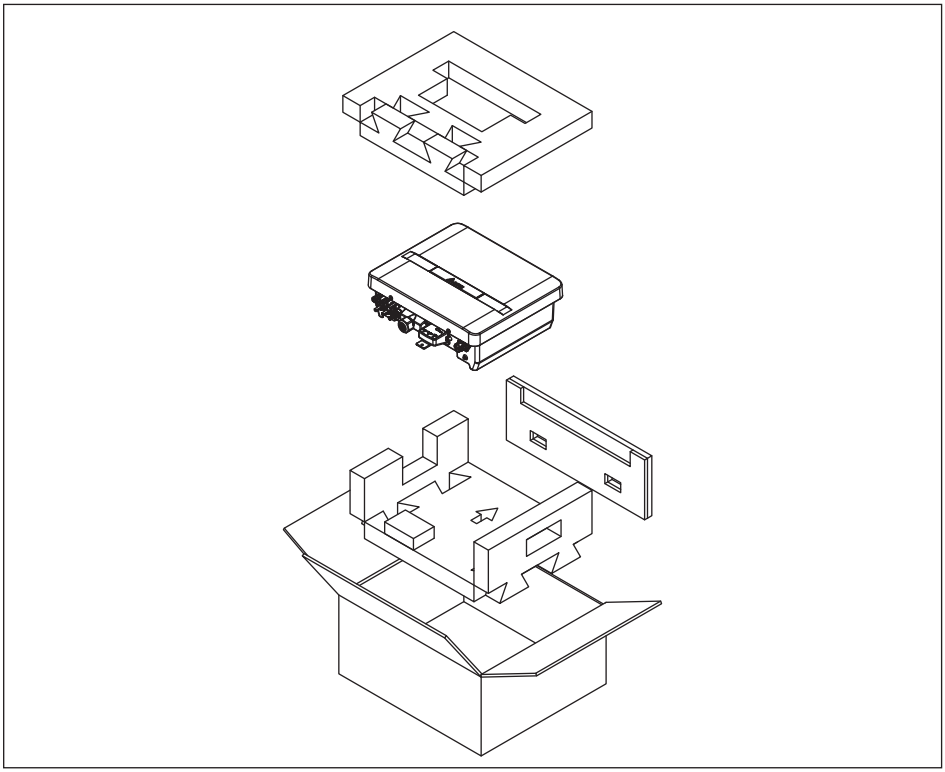


***Figure 2-1 : Unpacking process***

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.

**CAUTION !**



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

## 2.3 Package Inspection

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 as ***Table 2-1***.

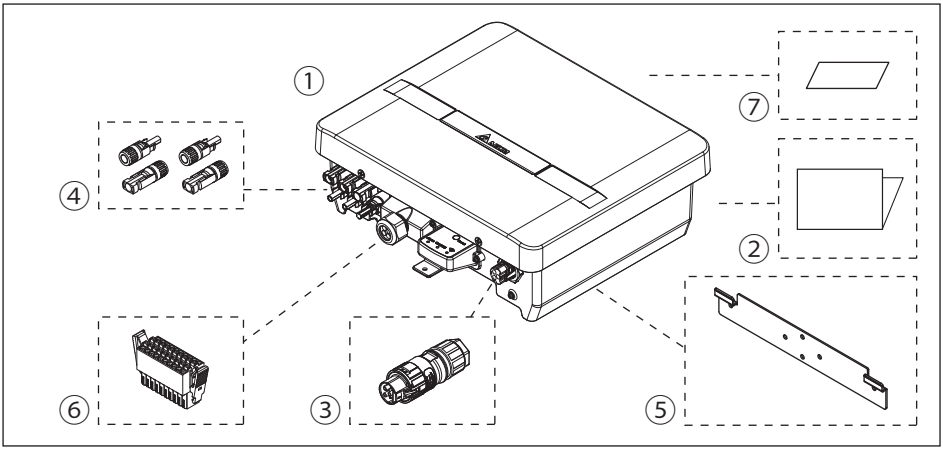



***Figure 2-2 : Components***

***Table 2-1 : Packing list***

| H5E_220 | | | |
|---|---|---|---|
| | **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 | Multi function connector | 1 | Connector for DRM, RS485, VSG and battery communication function. |
| ⑦ | Security Seal | 4 | Tamper stickers for Taiwan use only. |

***Table 2-2 : Optional part***

| Optional 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 | | |

## 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.***

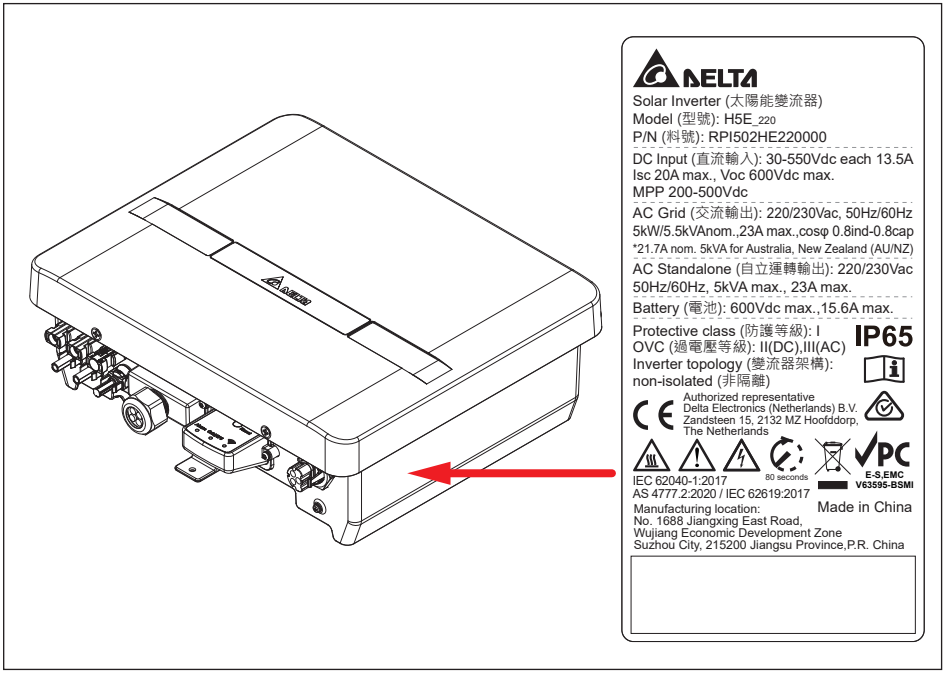



***Figure 2-3 : The identification label***

# 3 Product Overview

## 3.1 Dimensions

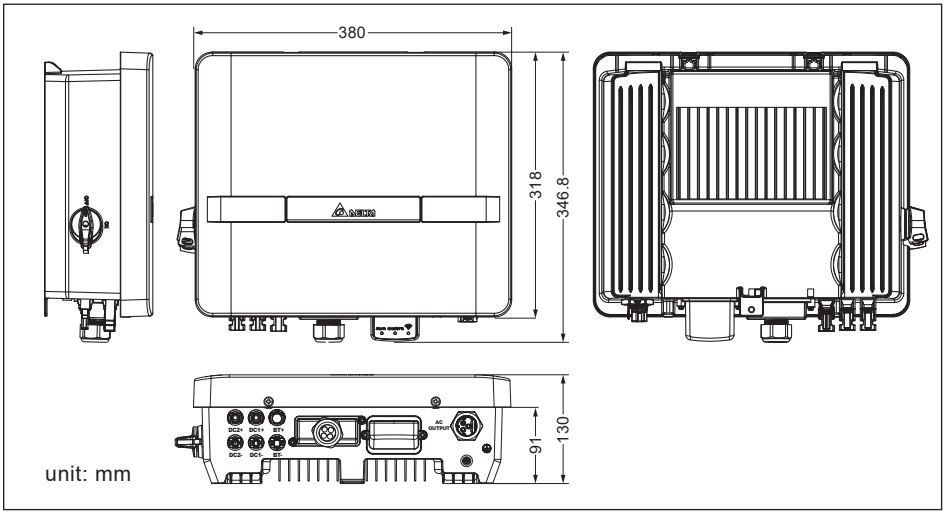



*Figure 3-1 : Dimensions*

## 3.2 Function Introduction

The Inverter's exterior is shown in ***Figure 3-2***.

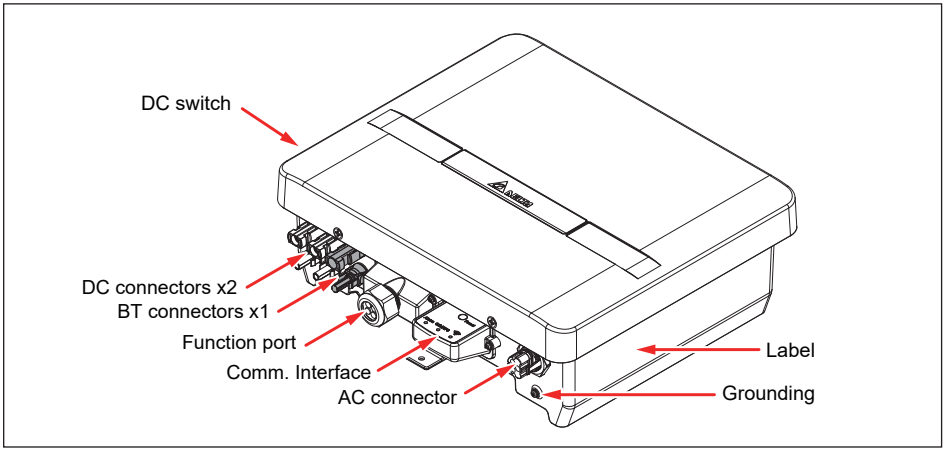



*Figure 3-2 : Inverter exterior objects*

## 3.2.1 LED and Button




***Figure 3-3 : LED and Button***

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

| **LED** | Action | Status |
|---|---|---|
| Alarm | 100ms On, 100ms Off | Insulation |
| | Steady on | Error or Fault. (see *Chapter 9*) |
| Grid/ SPS | 100ms On, 100ms Off | Default Country Setting |
| | 1s On, 1s Off | Countdown |
| | 2s flash(100ms), 2s on | The inverter is operating in standalone mode |
| | Steady on | On grid |
| Wi-Fi | 3s On, 3s Off | Connected to Wi-Fi router/DC1 |
| | 3s Flash(100ms), 3s Off | Connected to both WiFi router/DC1 and mobile device |
| | Off | Not connected |
| | Steady on | Connected to mobile device |
| | 100ms On, 100ms Off | Connected to mobile device and transferring data |
| | 500ms On, 500ms Off | Reboot Wi-Fi (Press Button 3~10s) |
| | 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 |

# 4 Installation and Wiring

## 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.
The unit should not be installed in direct sunlight.

**CAUTION !**



**The product supports wireless communication.**

- Install the product as far away as possible from devices that emit strong radio waves, such as civil band radio equipment.
- Do not install the product in metal box and make sure there is no metal barrier between the product and connecting devices to prevent the communication signal attenuation.
- When using Wi-Fi to connect the inverter, the connection signal strength is recommended to be at least -70dBm to ensure good communication quality.

## 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).

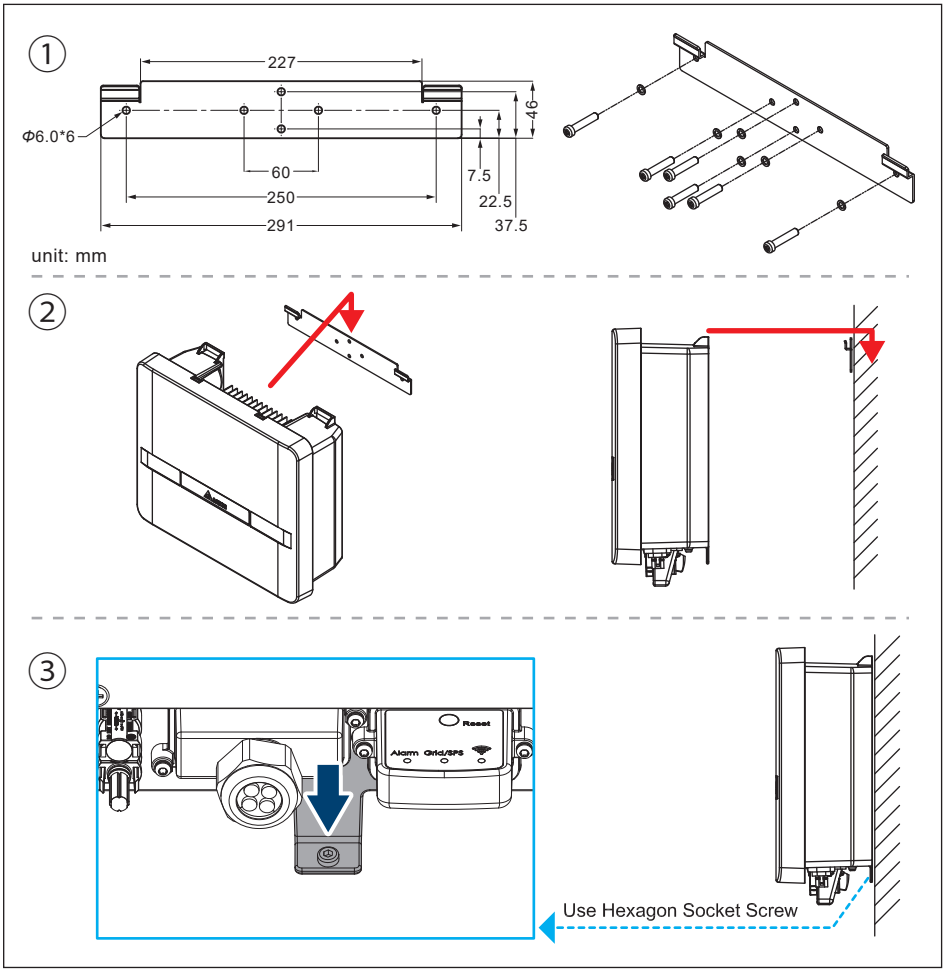



*Figure 4-1 : Attaching the mounting bracket*

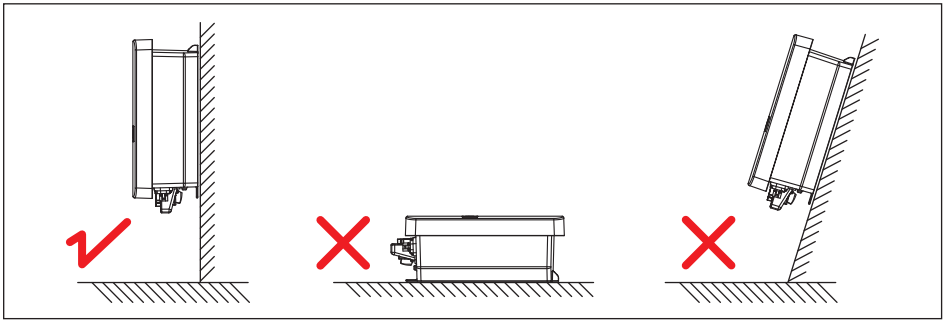


*Figure 4-2 : Correct and incorrect installation illustration*

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.***

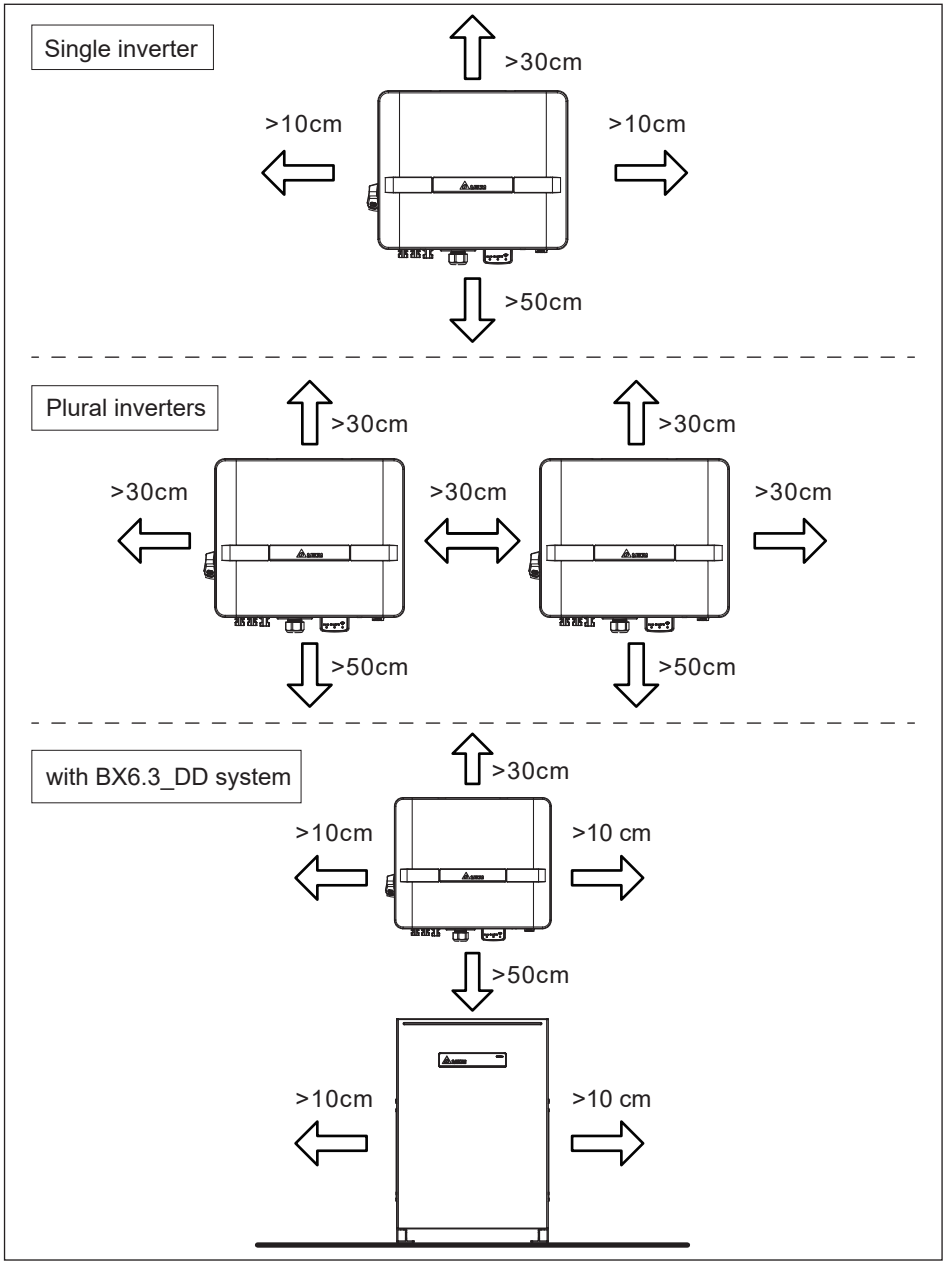



***Figure 4-3 : Adequate installation gap***

## 4.3 Preparation before Wiring

1. Ensure voltage values and polarities are correct.
2. Ensure PV Switch is set to OFF, and BX6.3_DD system is shutdown.
3. When grounding the solar array positive or negative terminal, an isolation transformer is required due to the inverter has no galvanic isolation between the DC-input and AC-output.
4. Please refer to ***Figure 4-4*** 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.

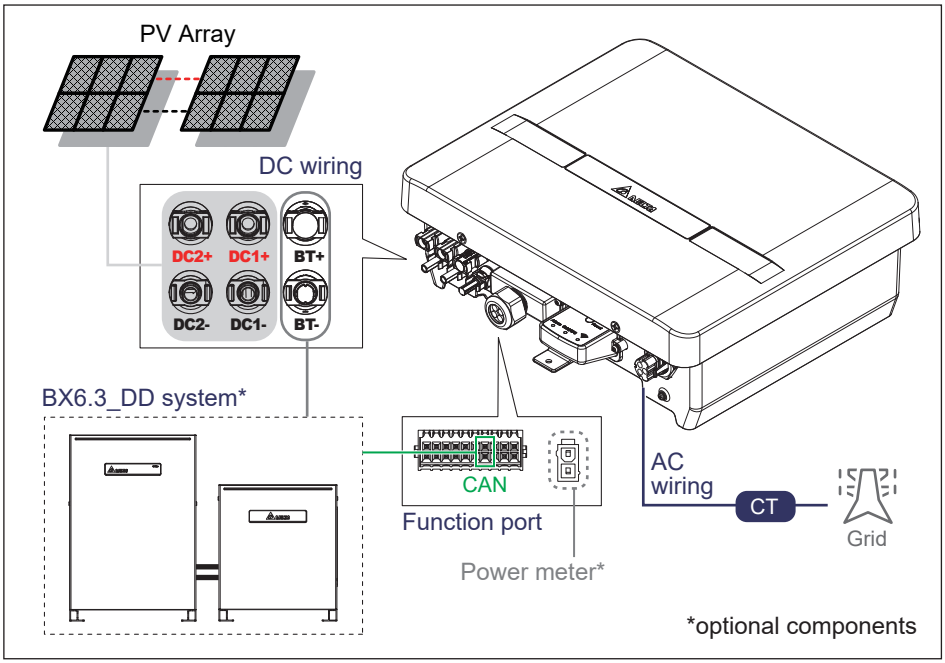



***Figure 4-4 : Cable connections***

**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.

# 4.4 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.

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

***Table 4-1: 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!

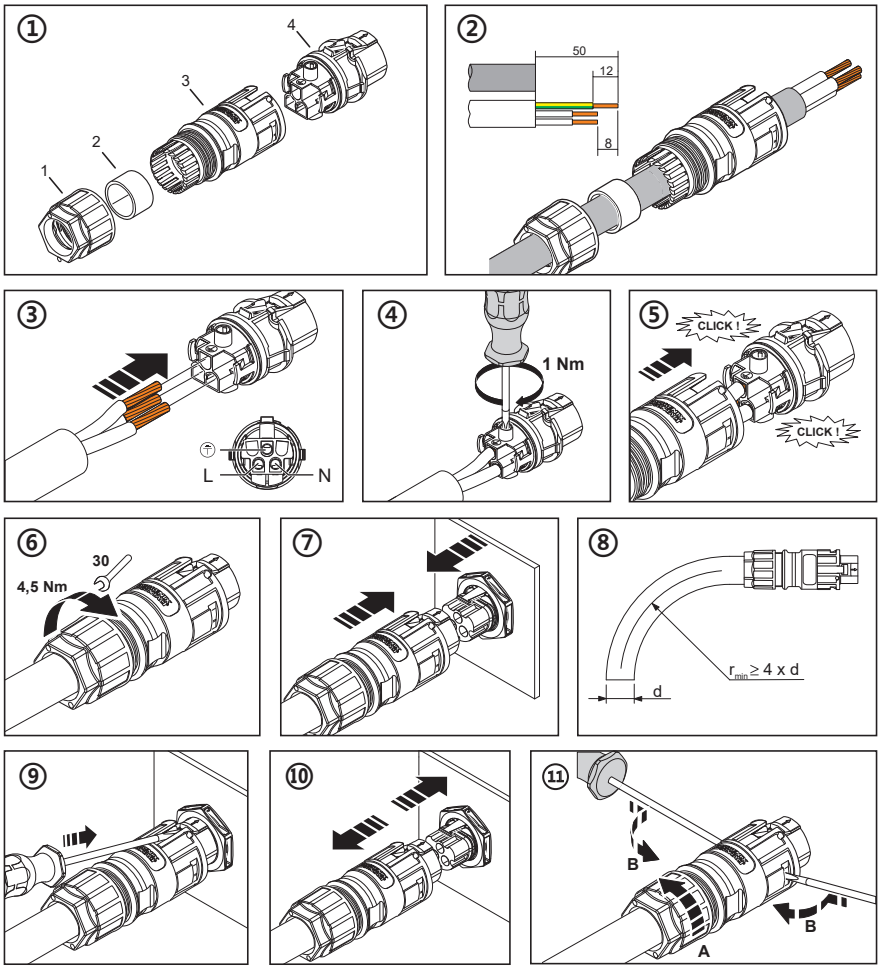



***Figure 4-5 : AC plug illustration (PRC 3-FC-FS6)***

## 4.5 DC Connection

**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.
- When undertaking BAT wiring, please ensure that the BX6.3_DD system is shutdown.

**CAUTION !**

The maximum open circuit voltage of the PV Array must not exceed 600Vdc.

**NOTE**

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

### 4.5.1 PV connector

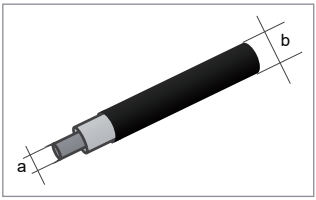
The inverter operate using two separate MPP trackers that can handle both symmetrical and asymmetrical loads to allow for optimum adjustment.
This allows for the requirements of complex PV system designs to be fulfilled.

| MPP range with Max. power | H5E_220 |
|---|---|
| Symmetrical load | 220~500V |
| Asymmetrical load | 440~500V |
| Max. ratio for asymmetrical load | 100/0% ; 0/100% |

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 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 4-2 : H4 connectors***

DC wiring polarities have two components, Plus and Minus, which are shown in ***Figure 4-6.*** The connection shall conform to the indication marked on inverter.

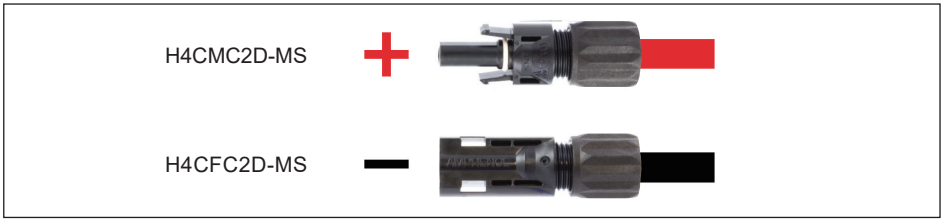


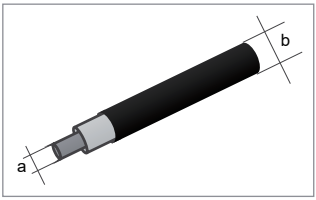

***Figure 4-6 : DC Wiring illustration***

## 4.5.2 Battery connector

H5E_220 is currently compatible with the BX6.3_DD / BX12.6_DD battery system as backup power.

### BAT plugs and BAT cables

The battery plugs are provided along with the package of battery system.
If you want to order more or need a different size, see 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 4-3 : H4 connectors***

BAT wiring polarities have two components, Plus and Minus, which are shown in ***Figure 4-7.*** The connection shall conform to the indication marked on inverter.

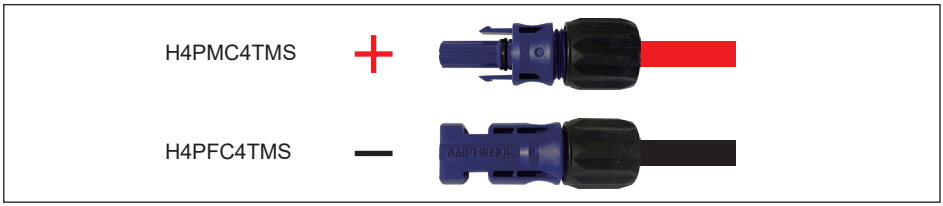



***Figure 4-7 : BAT Wiring illustration***

## 4.6 PE Connection

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

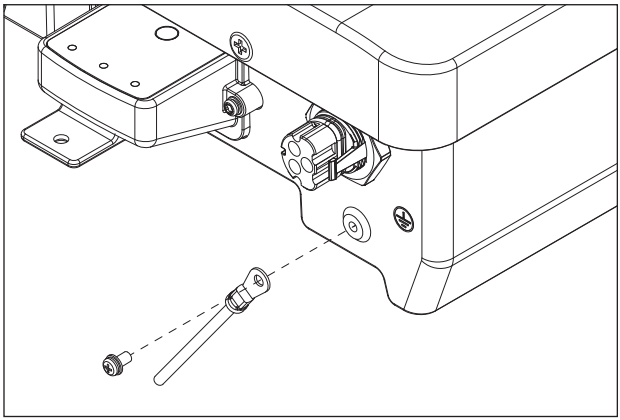


***Figure 4-8 : PE Wiring***

## 4.7 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. H5E_220 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 50.5 Hz.
- **Australia and New Zealand:**
  The inverter support the demand response mode (DRMs).
  DRM 0 - Operate the disconnection device.
  DRM 1 - Do not consume power
  DRM 2 - Do not consume at more than 50% of rated power
  DRM 3 - Do not consume at more than 75% of rated power and source reactive power
  DRM 4 - Increase power consumption (subject to constraints from other active DRMs)
  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.

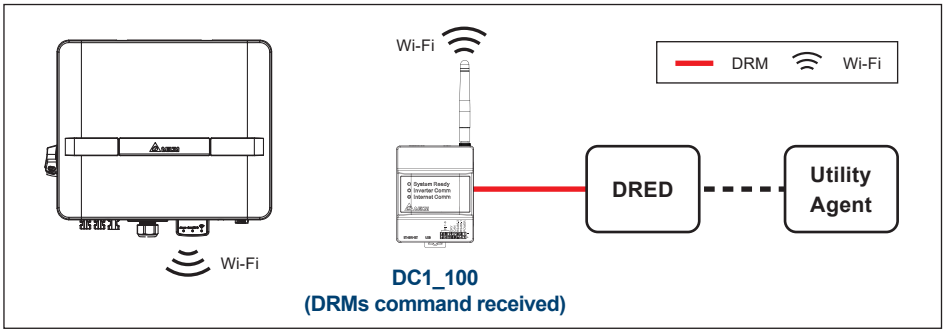
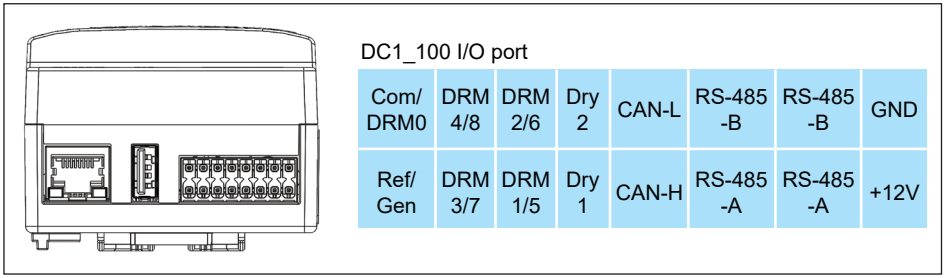



*Figure 4-9 : Digital input via DC1_100*



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 4-10 : Digital input on DC1_100*

## 4.8 Function Port

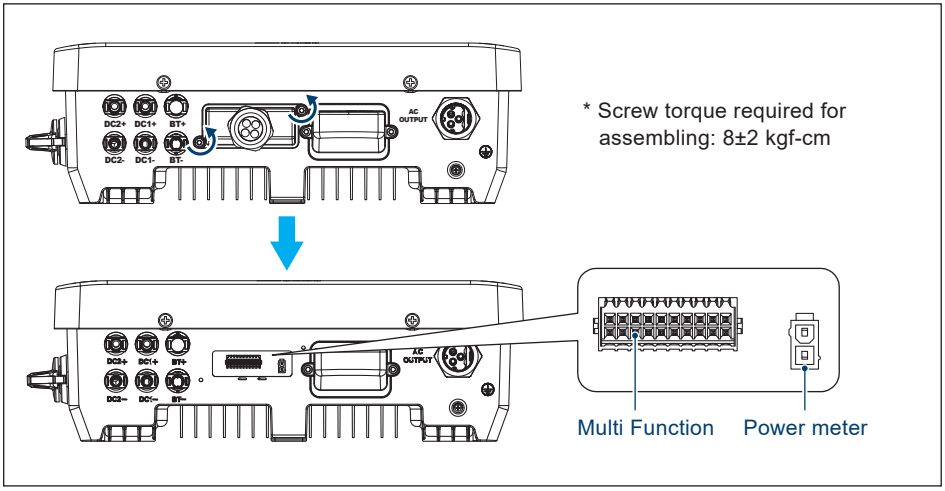
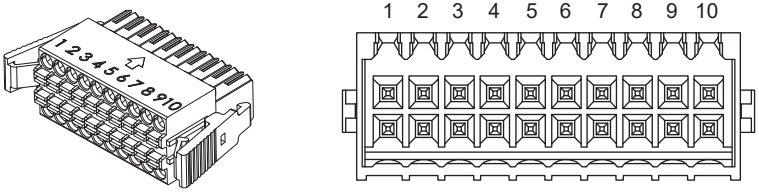


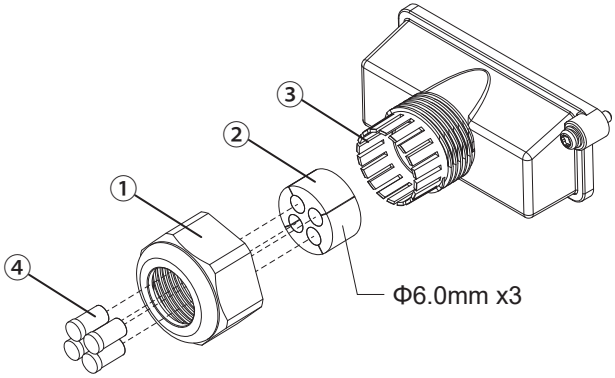

*Figure 4-11 : Function port*




| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| CAN-H (VSG) | GPIO-IN (VSG) | RS485+ | RS485+ | 16V3 | RS485 TERM. | CAN-H (DD) | DRM1/5 | DRM3/7 | REF GEN/0 |
| CAN-L (VSG) | GPIO-OUT (VSG) | RS485- | RS485- | GND | RS485 TERM. | CAN-L (DD) | DRM2/6 | DRM4/8 | COM LOAD/0 |

- Conductor cross-section: 0.205 mm² (AWG24) ~ 0.081 mm² (AWG28)
- Conductor cross-section: 0.326 mm² (AWG22) ~ 0.205 mm² (AWG24) for 16V3 & GND
- Outside diameter of cable: 3.8mm ~ 5.2mm
- Stripping Length: 7mm ~ 8mm
- Please refer to UL 2464 computer cable guideline

## 4.8.1 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.

## 4.8.2 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 1 - Do not consume power
DRM 2 - Do not consume at more than 50% of rated power
DRM 3 - Do not consume at more than 75% of rated power and source reactive power
DRM 4 - Increase power consumption (subject to constraints from other active DRMs)
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.

| Asserted by shorting pins | | Inverter behavior (AU) | |
|---|---|---|---|
| REF GEN/0 | COM LOAD/0 | DRM 0 - Disconnect from grid | Charge/Discharge mode |
| DRM1/5 | COM LOAD/0 | DRM 1 - Do not consume power | Charge mode |
| DRM2/6 | COM LOAD/0 | DRM 2 - Do not consume at more than 50% of rated power | |
| DRM3/7 | COM LOAD/0 | DRM 3 - Do not consume at more than 75% of rated power | |
| DRM4/8 | COM LOAD/0 | DRM 4 - Increase power consumption | |
| DRM1/5 | REF GEN/0 | DRM 5 - Do not generate power | Discharge mode |
| DRM2/6 | REF GEN/0 | DRM 6 - Do not generate at more than 50% of rated power | |
| DRM3/7 | REF GEN/0 | DRM 7 - Do not generate at more than 75% of rated power | |
| DRM4/8 | REF GEN/0 | DRM 8 - Increase power generation | |

- 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

## 4.8.3 Communication Connections

### 4.8.3.1 RS-485 Connection

The pin data format of RS-485 is shown below:

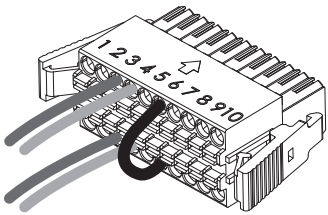
| Baud rate | Data bits | Stop bit | Parity |
|---|---|---|---|
| 19200 | 8 | 1 | N/A |

### 4.8.3.2 RS-485 Terminal Resistor

Add the termination resistor (short the RS485 TERM.) if this is the last device in the RS485 chain

**Multi Function**

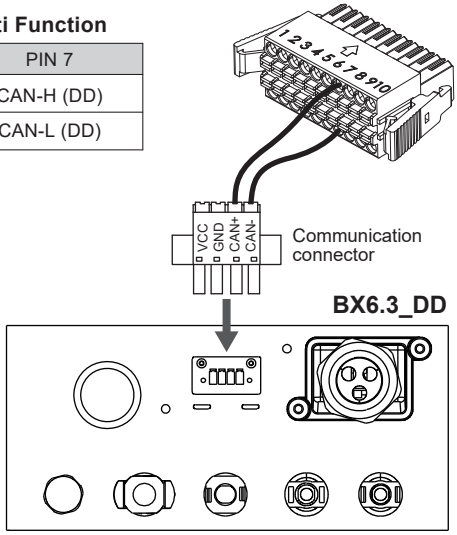
| PIN 3 | PIN 4 | PIN 6 |
|---|---|---|
| RS485+ | RS485+ | RS485 term. |
| RS485- | RS485- | RS485 term. |




## 4.8.4 CAN(DD) Connection (optional)

**Multi Function**

| PIN 7 |
|---|
| CAN-H (DD) |
| CAN-L (DD) |

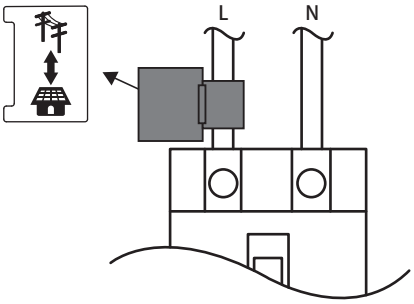


## 4.8.5 Power meter (optional)

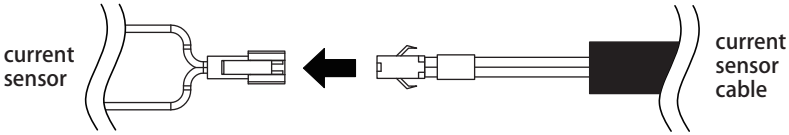
Connecting the current sensor in the following steps

(1) Attach a current sensor to the L cables of the main earth leakage circuit breaker.

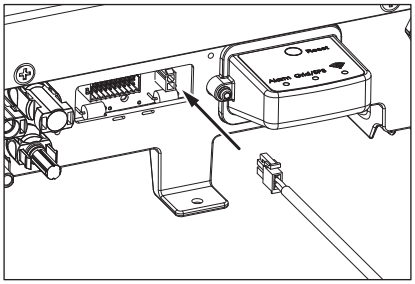
(2) Clamp current sensor on power line and make sure that the direction is correct




(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.



# 5 Main Parameters and Operation Modes

## 5.1 Local Monitoring Mode

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

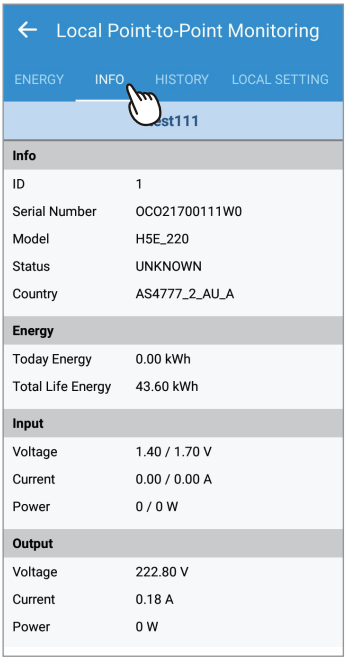
For more details about the App, please refer to the QR code or the following link for installation and operation manual.

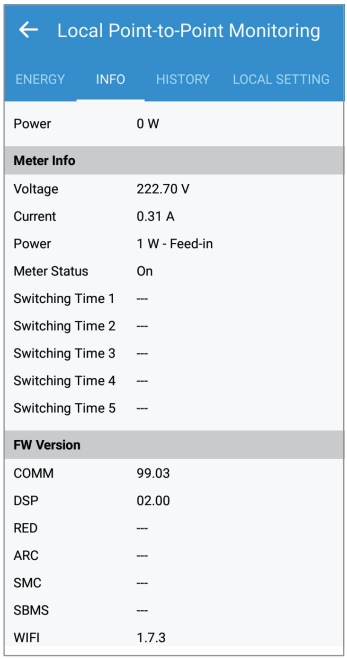
DeltaSolar
DELTA ELECTRONICS, INC.

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

## 5.2 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.



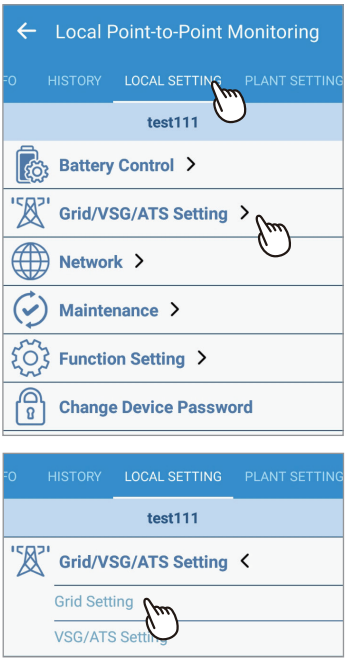



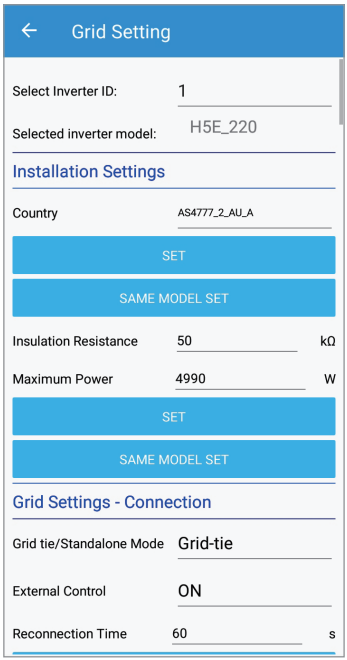
## 5.3 Country Setting and Grid Protection Setting

**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.

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.



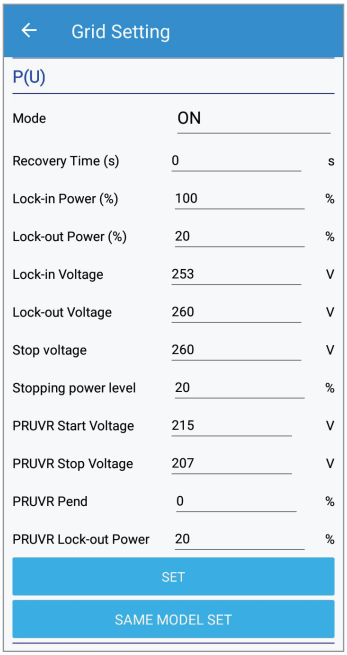
## 5.4 Active/Reactive Power Control

**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.

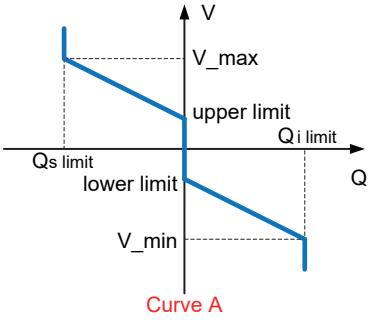
### 5.4.1 P(U) Control

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.

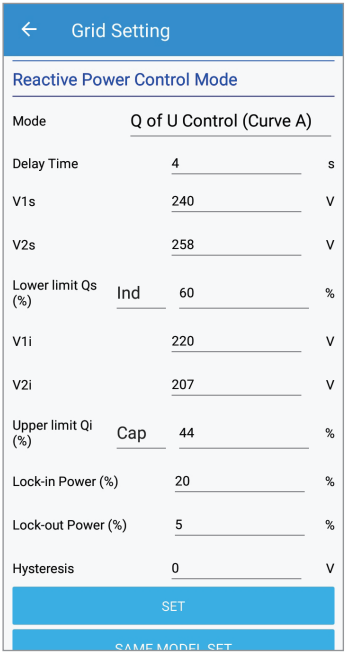


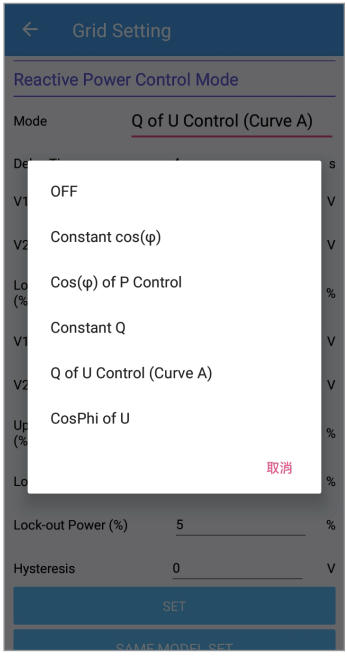
## 5.4.2 Q(U) Control

Q(U) is a control mode that inverter will provide reactive power according to grid voltage.



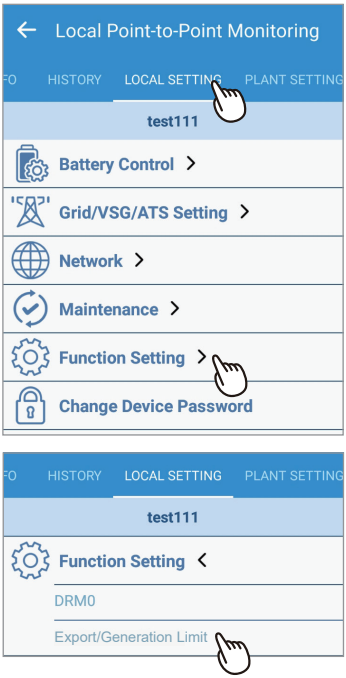

The setting of this function can be found in the “Grid Setting” page, please refer to previous sub-chapter for the .instruction to access to this page.

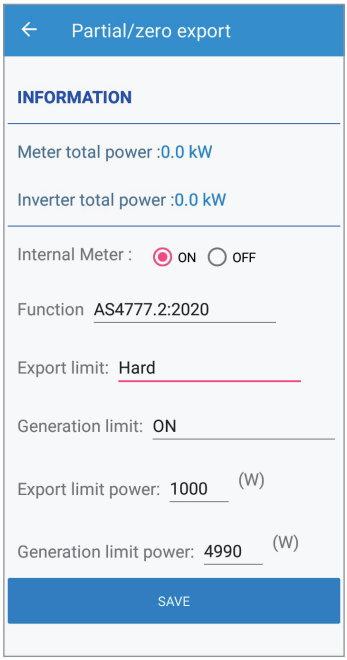


## 5.5 Export Limit and Generation Limit

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”.



## 5.6 Operation Mode

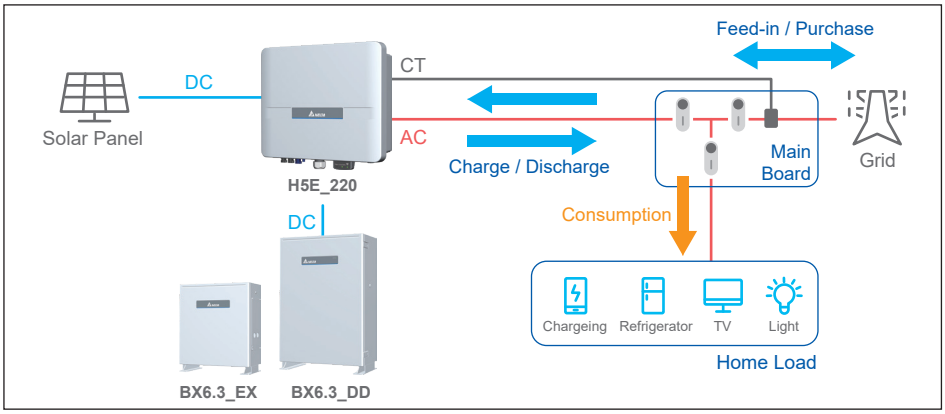
The H5E hybrid system has 6 operation modes for users to choose and 2 passive operation modes. Each mode has different behavior between battery, grid, and home load. In some area, the detail behavior of each operation mode may be different due to the local electricity regulations.

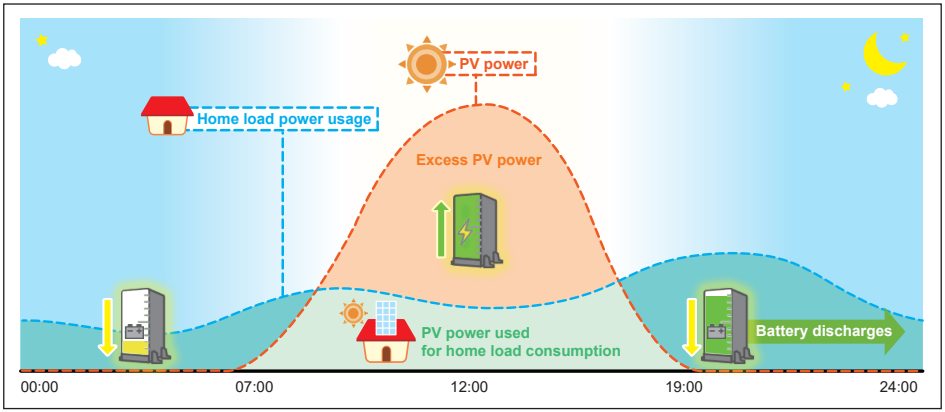
### 5.6.1 Self-consumption mode

In this mode, the system is operated in following priority :

1. Charge the battery with the excess PV energy which feed-in to the grid until the battery is fully charged.
2. Discharge the battery when the PV energy is insufficient to provide the home load consumption until the battery is fully discharged.

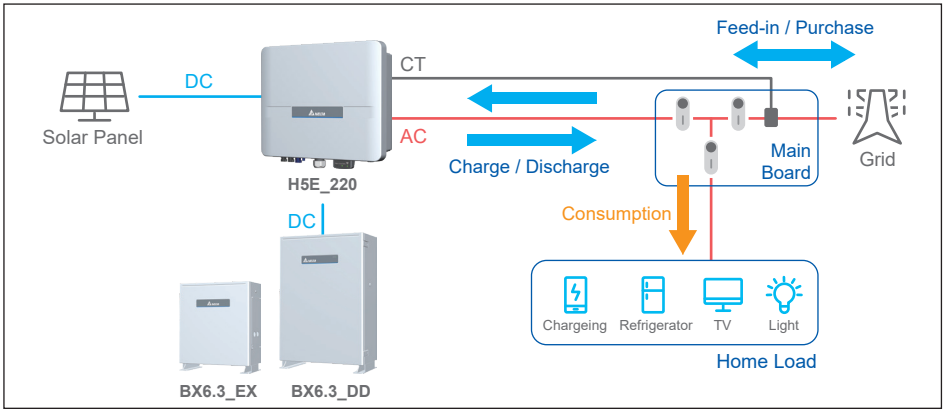
When there is no PV power, battery starts to discharge and supply home load until it's empty. If the time setting function is enabled, the behavior of the system will according to the time setting in priority. The detail operation of battery control setting is described in ***Chapter 5.7***.

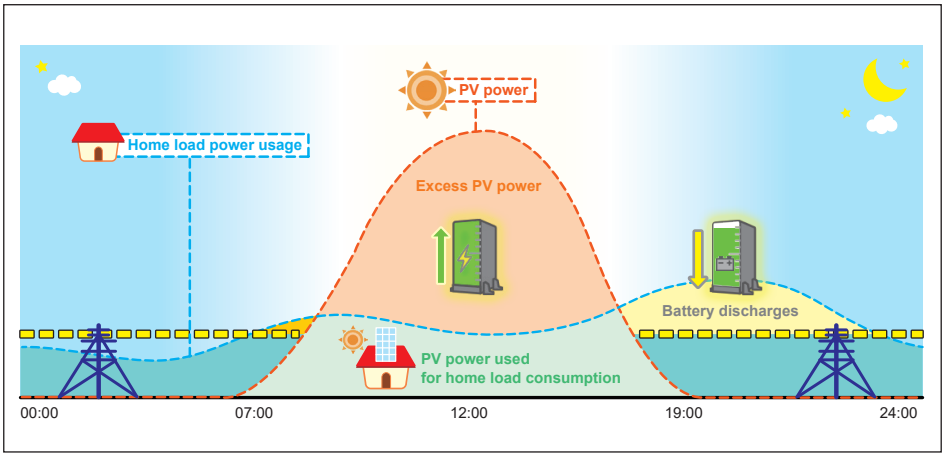


## 5.6.2 Peak cut mode

In this mode, the home load will consume the power from the PV inverter in priority. When the home load consume more power than the power generated by the inverter, it will consume the power from the grid. Then, battery will only discharged to the supply the extra load after the power consume from the grid exceeds the “peak cut power” setting value. “Peak cut power” can be assigned in the Battery Control page.



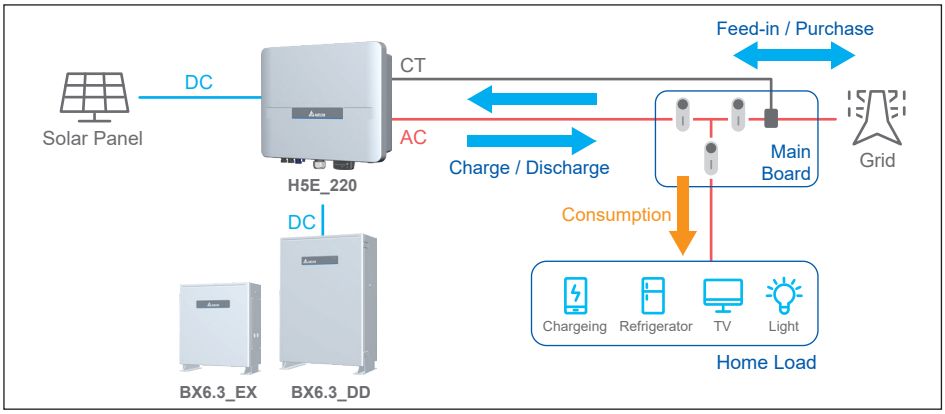



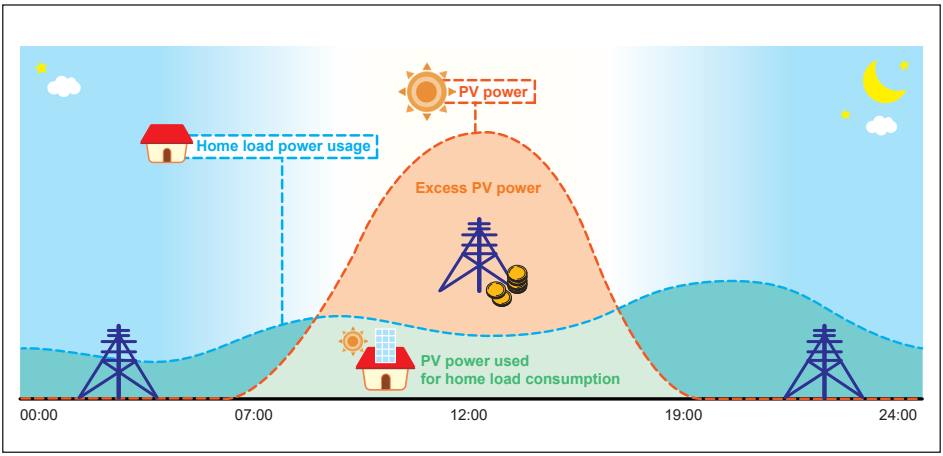
## 5.6.3 Selling first mode

Selling first mode is a standard mode combining with 6 time settings. In this mode, the system is operated in following priority:

1. If users have set the time settings, inverter will change behavior in these time intervals
2. Discharge the battery when purchased power from grid is detected until battery empty.

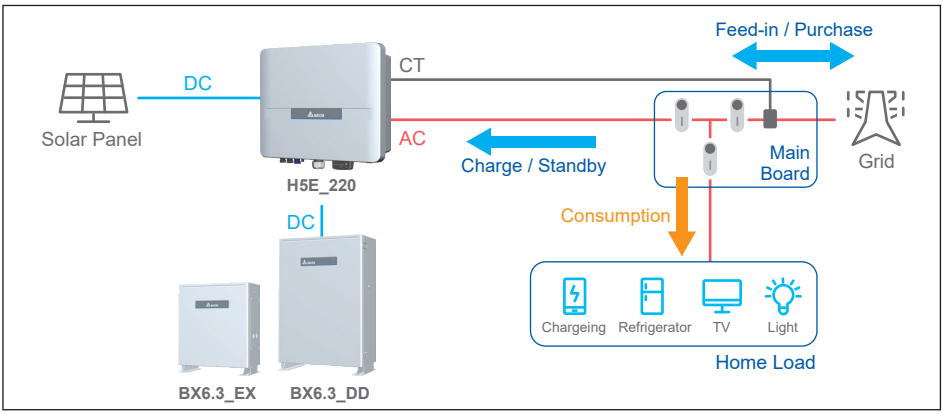
Please refer to ***Chapter 5.7*** for more detail about time settings.

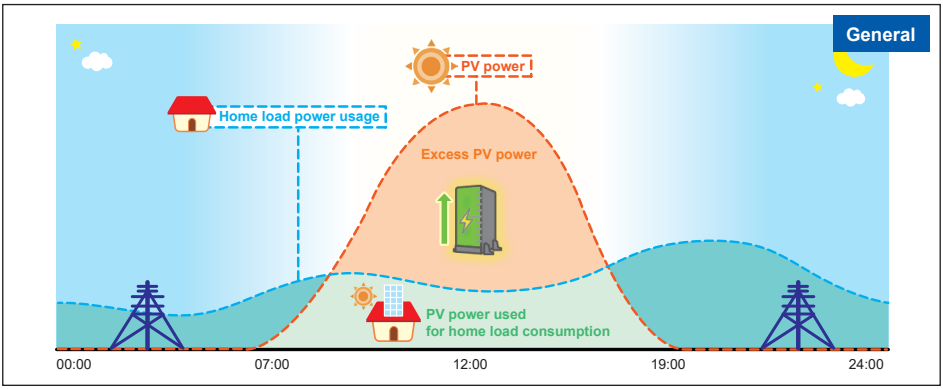


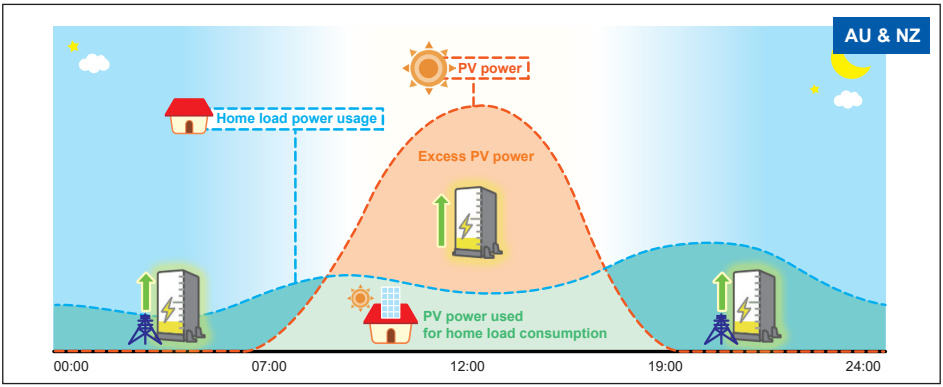



## 5.6.4 Charge first mode

In this mode, battery will be charged by PV or grid in priority, after battery is fully charged, the remaining PV power then feed-in to home load and grid. Battery will not be discharged in this mode even there is demand in the home load.

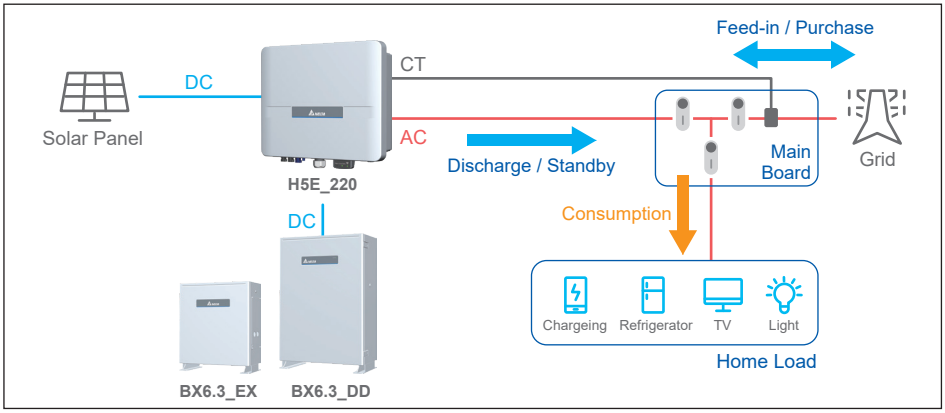


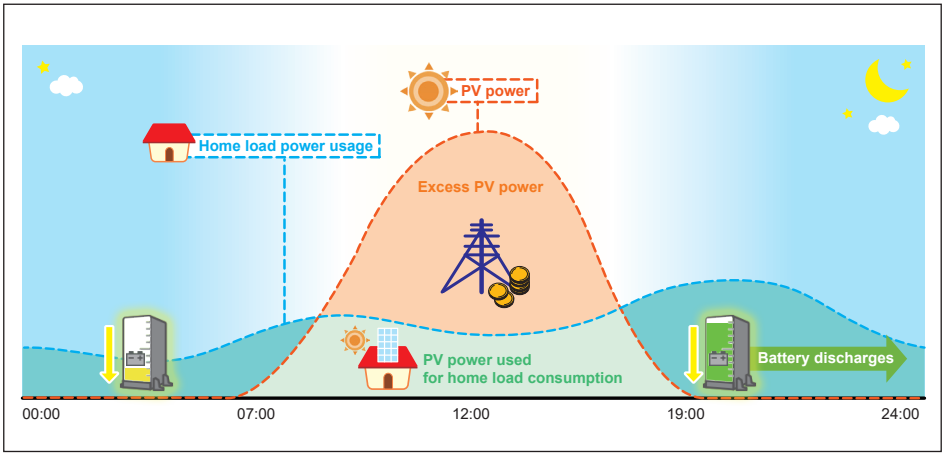



## 5.6.5 Discharge first mode

In this mode, the battery will only be discharged depends on the load consumption. It will not be charged even there is excess PV power. All the PV power is feed-in to home load and grid. Battery will keep discharging when there is demand in the home load until it fully discharged.



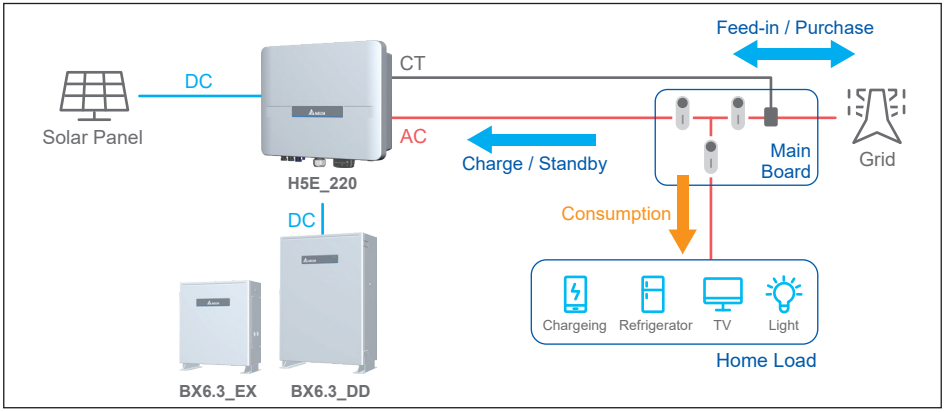



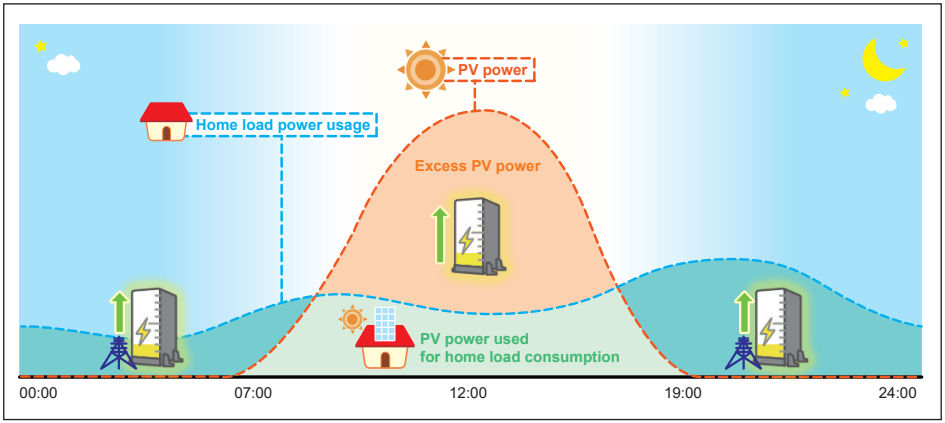
## 5.6.6 Standalone mode

Operation mode select 'Hybrid with backup charge - phase 2', the system changes to standalone mode automatically during a power outage occur. At this time, grid side is disconnected and hybrid inverter operate in micro-grid to provide simulated grid for home load and PV inverter. The detail configure application is described in ***Chapter 6***.

## 5.6.7 Forced charge mode

Forced charge mode is passive mode. Although battery stops any action when SOC (State Of Charge) reach 0%, the self-discharge phenomenon may still causing SOC lower than 0%.
At this time, hybrid inverter will force battery charging from PV power and grid power until the battery SOC reaching SOC limit setting (default is 30%).



## 5.6.8 Balance mode

This operation is passive mode and only applied to H5E_220+BX6.3_DD+BX6.3_EX system. During the installation, the battery voltage of BX6.3 series might be different. Due to the specifications of the battery module, the system will be switched to this mode automatically to balance the voltage of BX6.3 series.
When the system is operating under this mode, the system will either discharge the battery with 3 kW power to the load and the grid or charge the battery with 2.5 kW power from the grid.
Once the battery voltage of BX6.3 series are balance, this balance mode will stop and the system will automatically be switched to the operational mode selected by the user.

## 5.7 Battery Control Setting

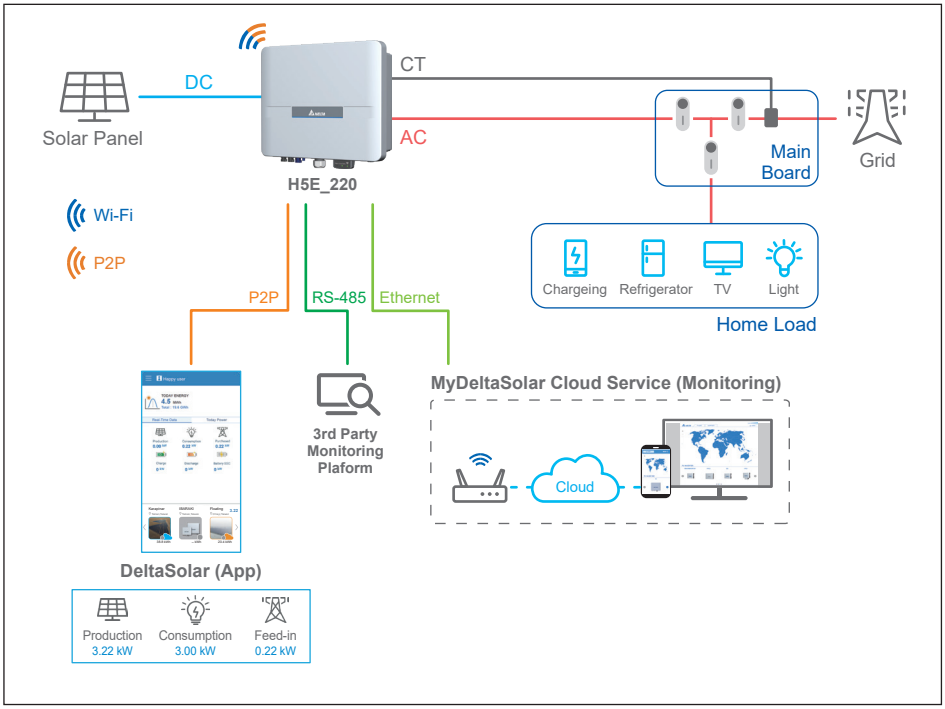
In battery control setting page, you can assign SOC limit, peak cut power, and BT charge / discharge time interval.

- **SOC Limit**
  You can assign the lower limit of battery SOC. Battery will stop discharging when its SOC reach this limit.
- **Peak Cut Power**
  Peak cut power is used in peak cut mode. You can assign the peak power of home load usage from grid. When the home load consumption exceeds this value, battery will discharge to supply remaining power.
- **Charge / Discharge Schedule**
  This settings can be separated into BT charge time and BT discharge time.
  Each setting has 3 time setting intervals. The time setting of all the intervals cannot overlap with each other.
  The function is only available under self-consumption mode and selling first mode. Under either mode, Hybrid inverter will automatically switched to charge first / discharge first mode according to the charge/discharge schedule and switched back to the original mode when the time is out of the setting interval.
- **Main Supply Breaker Capacity**
  Please set the current rating of the main supply breaker of the household. The system will refer to this setting to adjust its maximum charging power drawn from the grid during peak hours to avoid the unnecessary tripping of the breaker.
- **Time Schedule for SOH-cycle**
  Once a year the battery must do a FULL un-interrupted discharge and re-charge cycle. This will be completed and undertaken at a scheduled day and time as set by the user. Should the temperature of the battery be below 20 degrees Celsius the battery will postpone the process for 3 months.

# 6 System application

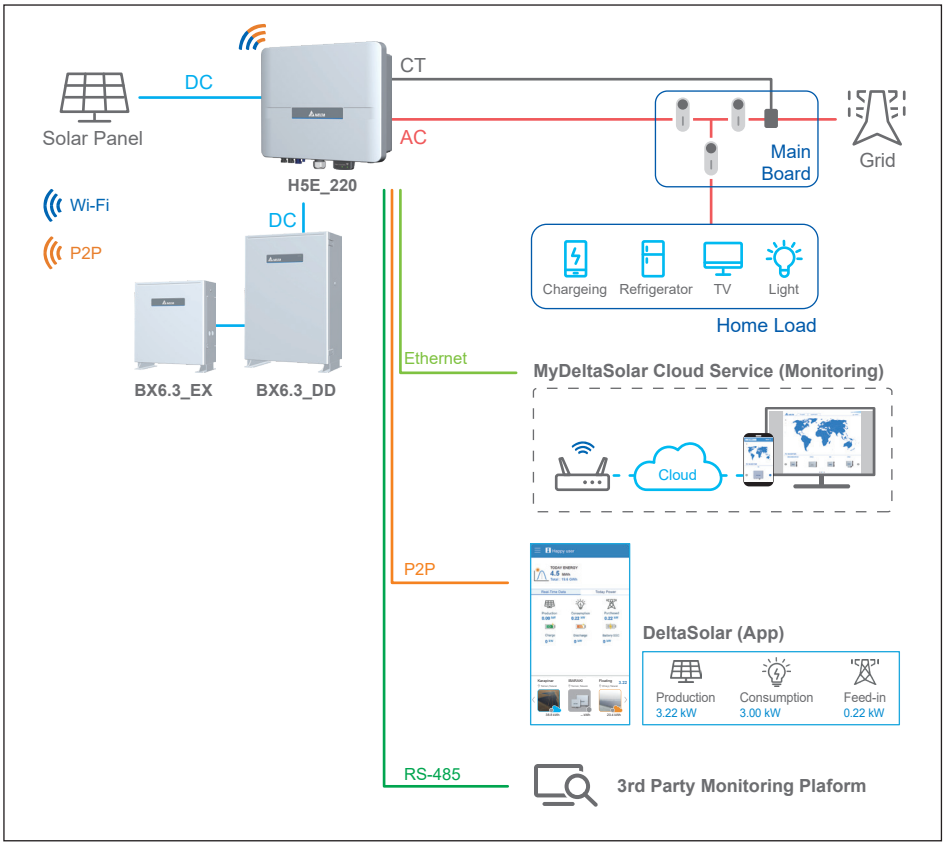
**1. PV only**

The Delta hybrid inverter can be used purely as an inverter without a battery connected to it.



### 2. Hybrid

To optimise self-consumption in your PV system, you can use a battery as a storage system. In this system, the inverter can store the excess PV energy and provide energy to the load when the PV power is insufficient.




**DANGER!**

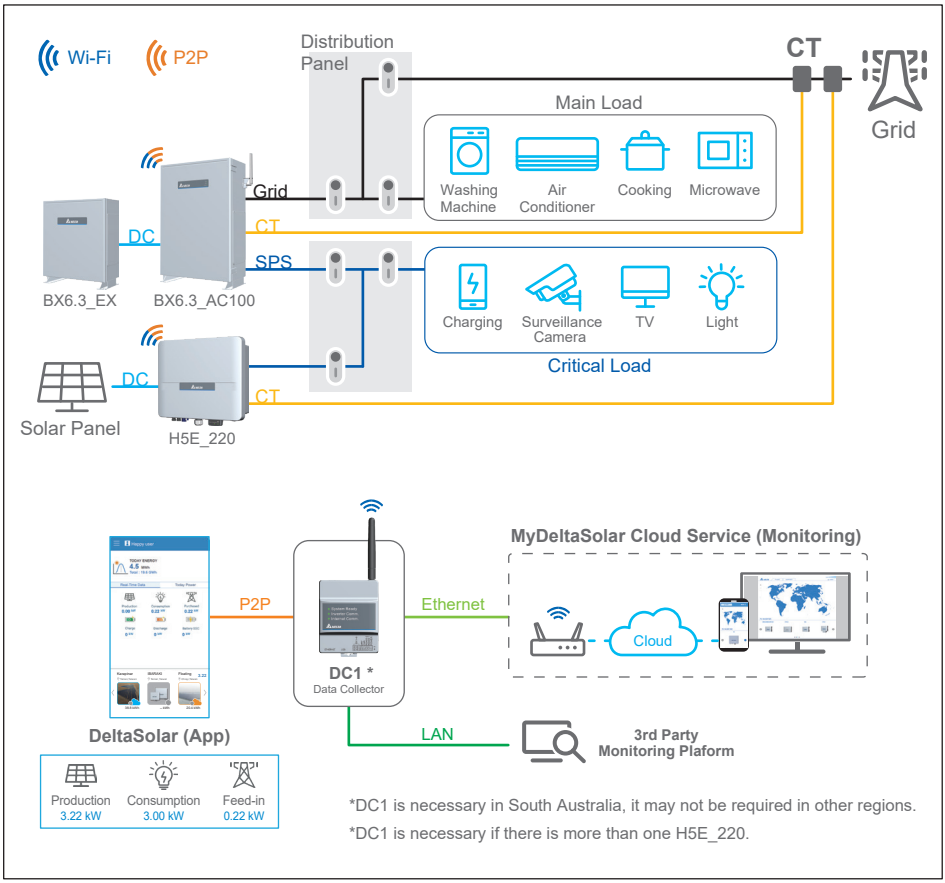
In general, you mustn't use the described system in backup power mode for life-support-systems or any other medical devices and systems. Backup power mode doesn't comply to the requirements for emergency power and isn't an uninterruptible power supply.

**ATTENTION**

Short circuit at the critical load may cause damage to the inverter in Hybrid with backup charge – phase 1

### 3. Hybrid with backup charge - phase 1

The key feature of this system is that it can support off-grid application and the PV inverter can continue generating power during power failure. In this application, the auto contactor is not necessary as it applies the internal contactor of BX6.3_AC100. Due to hardware limitation, this system can only provide maximum power of 5 kVA to the main load and the critical load must be operate below 5 kVA.



# 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.

**DANGER!**



When undertaking Battery wiring, please ensure that the BX6.3_DD system is shutdown.

## 7.1 Start-up Procedures

### 7.1.1 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 ***Chapter 11*** output section for the utility voltage operating range for the 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.

**RS-485 connection**
Please contact the customer service center for the detail.

## 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.
3. Push EPO button and check the BX6.3_DD system is shutdown.

**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

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

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

**Table 9-1 : Error Message**

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

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

| Fault | | |
|---|---|---|
| **Message** | **Possible cause** | **Action** |
| F35:<br>HW Bus OVR | 1. Driver for boost is defective<br>2. Voc of PV array is over 560Vdc<br>3. Surge occurs during operation<br>4. Detection circuit malfunction | 1. Check the driver circuit for boost inside the inverter<br>2. Modify the solar array setting, and make the Voc less than 550Vdc<br>3. N/A<br>4. Check the detection circuit inside the inverter |
| F37: OOCP | Detection circuit malfunction | Check the detection circuit inside the inverter |
| F42:<br>CT sensor Fail (A) | 1. Inverter choke Fail<br>2. Output Filter Fail<br>3. Detection circuit malfunction | 1. Check Inverter choke inductance.<br>2. Check output filter capacitance.<br>3. Check the detection circuit inside the inverter |
| F56:<br>HW incompat. | HW power rating incorrect | Check comm. HW power rating info. |
| F60: IOCP(PV1) | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| F61: IOCP(PV2) | 1. Switching device in boost is defective<br>2. Driver for boost is defective<br>3. Input current detection circuit malfunction | 1. Check all switching device in boost<br>2. Check the driver circuit for boost inside the inverter<br>3. Check input current detection circuit |
| F77:<br>External CT Fail | 1. Enable the CT function, but not optional the current sensor.<br>2. Wrong connection at current sensor | 1. Disable the CT function and log in to the DeltaSolar APP. Choose Local Setting > Function Setting > Export / Generation Limit > Internal meter turn OFF<br>2. Make sure the configuration (see Chapter 4.8.5) |

**Table 9-2 : Fault Message**

# 10 De-Commissioning

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

**WARNING !**



To avoid injuries, please follow this procedures

1. Switch off AC circuit breaker to disconnect from electricity grid.
2. Switch off the PV Array switch to disconnect from PV Array.
3. Push EPO button and check the Bx6.3DD_system is shutdown.
4. Use proper voltage meter to confirm that the AC and DC power are disconnected from the unit.
5. Remove the AC wiring immediately to completely disconnect from electricity grid.
6. Remove the DC wiring to disconnect from PV Array.
7. After completing all of the above steps, the inverter can be removed.

# 11 Technical Data

**Table 11-1 : Specifications**

| Model | H5E_220 |
|---|---|
| **GENERAL** | |
| Enclosure | Powder-coated aluminium |
| Operating temperature | -25~60°C, full power up to 40°C |
| Operating Altitude | < 2000m |
| Relative humidity | 0% – 95% non-condensing. |
| Environmental category | Outdoor, wet locations |
| Inverter topology | 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 [1] |
| **DC INPUT (Solar side)** | |
| Max. input voltage | 600 Vdc |
| Operating voltage range | 30-550Vdc |
| MPP range (rated power) | 200-500Vdc |
| Normal voltage | 350 Vdc |
| MPP tracker | 2 |
| Maximum input current | 13.5 Adc for each / 27 Adc for total |
| Maximum input power | 6200 W |
| Max. short circuit current | 20 A per MPPT |
| Max. inverter backfeed current to the array | 0A |
| Startup voltage | 35 Vdc |
| Input connection | H4, 2 pairs |

1) Testing to multiple inverter combinations as per AS/NZS 4777.2:2020 Section 5 has not been conducted

| DC Switch parameters (Solar side) | |
|---|---|
| Insulation voltage (Ui) | 1200 V |
| Rated impulse withstand voltage(Uimp) | 8 kV |
| Suitability for isolation | Isolating device |
| Rated operational current | 600V/30A |
| PV utilization category | DC-PV2 |
| Rated thermal current uninterrupted duty (Iu) | 50 A |
| Rated short-time withstand current (1s) (Icw) | 700 A |
| Rated short-circuit making capacity (Icm) | 1 kA |
| Rated conditional short-circuit current (Isc) | 5 kA |
| **DC INPUT (BAT side)** | |
| Max. voltage | 600 Vdc |
| Compatible brand | DELTA |
| Compatible battery box | BX6.3_DD |
| **Stand-alone mode [2]** | |
| Maximum power [3] | 5000 VA |
| Max. output current | 23 A |
| **AC INPUT/OUTPUT (Grid side)** | |
| Nominal output power [4] | 5500 VA |
| Maximum power | 5500 VA |
| Voltage | 220/230 Vac -20%~+22% |
| Nominal output current | 22 A [5] |
| Max. output current | 23 A |
| Maximum output fault current | 25 A |
| Maximum output over current protection | 25 A |
| Current (inrush) (A, peak and duration) | 30A peak, 1ms |
| Frequency | 50/60 Hz |
| Total harmonic distortion [6] | <3% @Rated power |
| Power factor [6] | >0.99 @Rated power |
| Peak efficiency | 97.5% |
| EU efficiency | 96.8% |
| Output connection | IP 67 single-phase |

| AC OUTPUT (Grid side) | | |
|---|---|---|
| Active anti-islanding method | | AC Current frequency |
| **INFORMATION** | | |
| Power meter | | Built-in |
| Communication | | RS-485 / Wi-Fi |
| Indicator | | LED |
| Display / Cloud | | DeltaSolar APP ( iOS / Android ) / MyDeltaSolar Cloud |
| Alarm | | Mail Notification [7] |
| **MECHANISM** | | |
| Housing | | Die casting |
| Cooling | | Convection cooling |
| IP rating | | IP65 |
| Weight | | 12 kg |
| Dimensions | | 380 × 318 × 130 mm |
| Country of manufacturer | | China |
| **REGULATIONS & DIRECTIVES** | | |
| Safety | | IEC 62109-1 / -2 IEC 62619:2017 IEC 62040-1:2017 CE compliance |
| Grid interface | | CNS 15382 IEC 62116 AS4777.2:2020 |
| 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 |

2) H5E_220 with ATS BOX can support stand-alone mode function.
3) 200-500Vdc can support the full power.
4) 5kVA max. for Australia (AU / NZ)
5) 21.7A nom. for Australia (AU / NZ)
6) reactive power control disabled
7) In the event of an earth fault alarm, mail notification will be sent via the monitoring portal.




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