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# Grid-tie Transformerless Solar Inverter

M88H

Operation and Installation Manual

English ..... 1

简体中文 ..... 75

繁體中文 ..... 149

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# 1 Safety

## 1.1 Information of the Inverter

### 1.1.1 Disclaimer

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This manual accompanies our product for use by the end users. The technical instructions and illustrations contained in this manual are to be treated as confidential and no part may be reproduced without the prior written permission of DELTA ELECTRONICS, INC. Service engineers and end users may not divulge the information contained herein or use this manual for purpose other than those strictly connected with correct use of the product. All information and specifications are subject to change without notice.

DELTA ELECTRONICS, INC. shall have no obligation to both personal injury and property damage hereinafter with respect to any actions -- (a) the product has been installed and repaired improperly; (b) the product has been misuse without following the instructions on this user manual; (c) the product has failed due to incorrect unpacking.

### 1.1.2 Target Group

This user manual of the solar inverter is prepared for a person who is well-trained for installing, commissioning, using, and doing maintenance. The well-trained person must have the following basic and advanced skills:

- The fundamentals of electricity, wiring, electrical components and electrical schematic symbols.
- Knowledge of how a solar inverter works and is operated.
- Training in the installation and commissioning of electrical devices and installations.
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and installations.
- Compliance with this manual and all safety information.

Please read the user manual before working on the product.

## 1.2 General Safety

### IMPORTANT SAFETY INSTRUCTIONS : SAVE THESE INSTRUCTIONS !



- Please read these instructions carefully and save them for later use.

To prevent any personal injury and any property damage, also ensure long-term operation of the solar inverter, you must read this section carefully and review all the safety instructions at all times before using this inverter.

This user manual provides important instructions for Delta grid-tie transformerless solar inverter. The product is designed, tested, verified, and certified according to international safety requirements, regulations, and standards but precautions must be observed when installing and operating the product.

### ATTENTION : NO GALVANIC ISOLATION



- There is no accessory such as a transformer along with our product and therefore the product has no galvanic isolation. External transformer should be installed between AC output of inverter and Grid. Please do not connect grounded Photovoltaic modules to the product. If you connect grounded Photovoltaic modules to the product, the error message **INSULATION (E34)** shows up.
- It is prohibited to connect the L1, L2, L3, and N to the ground.

### 1.2.1 Condition of Use

The M88H is a transformerless solar inverter with two MPP trackers which converts the variable direct current of the solar array into a utility frequency grid-compliant three-phase current and feeds it into the utility grid.

The Photovoltaic modules used must be compatible with the inverter.

Photovoltaic modules with a high parasitic capacitance to ground may only be applied if the capacitive coupling does not exceed 8 $\mu$ F.

The inverter must only be operated in countries for which it is approved by Delta and the grid operator.

## 1.2.2 Symbols

This section describes the definition of the symbols in this manual. In order to prevent both personal injury and property damage, and to ensure long-term operation of the product, please read this section carefully and follow all the safety instructions while you use the product.

### DANGER!



- This warning indicates an immediate hazard which will lead to death or serious injury may occur.

### WARNING !



- This warning indicates a possible hazard which may lead to death or serious injury may occur.

### CAUTION !



- This warning indicates a possible hazard which may lead to minor injury may happen.

### ATTENTION



- This warning indicates a possible damage to property and the environment might happen.

**INFORMATION**

- Additional information is indicated by an exclamation mark enclosed by double circle. This means the following section contains important information and user should follow the instruction to prevent any hazards.

**DANGER : ELECTRICAL HARZARD!!**

- This warning indicates an immediate electrical hazard which will lead to death or s erious injury may occur.

**CAUTION : HOT SURFACES, DO NOT TOUCH!**

- This warning indicates be careful of hot surfaces when operating the product.
- Do not perform any task until the product cool down sufficiently.



- Wait for a prescribed amount of time before engaging in the indicated action.
- Patientez le délai requis avant d'entreprendre l'action indiquée



- Equipment grounding conductor (PE)
- (PE) Équipement conducteur de terre

## 2 Introduction

The M88H is designed to enable the highest levels of efficiency and provide longest operating life of photovoltaic inverter by state-of-the-art high-frequency and low EMI technology. It is suitable for outdoor use.

### ATTENTION : NO GALVANIC ISOLATION



- There is no accessory such as a transformer along with our product and therefore the product has no galvanic isolation.  
External transformer should be installed between AC output of inverter and Grid.  
Please do not connect grounded Photovoltaic modules to the product.  
If you connect grounded Photovoltaic modules to the product, the error message **INSULATION (E34)** shows up.
- It is prohibited to connect the L1, L2, L3, and N to the ground.

### 2.1 Valid Model

The user manual is valid for the following device types :

- M88H\_121
- M88H\_122

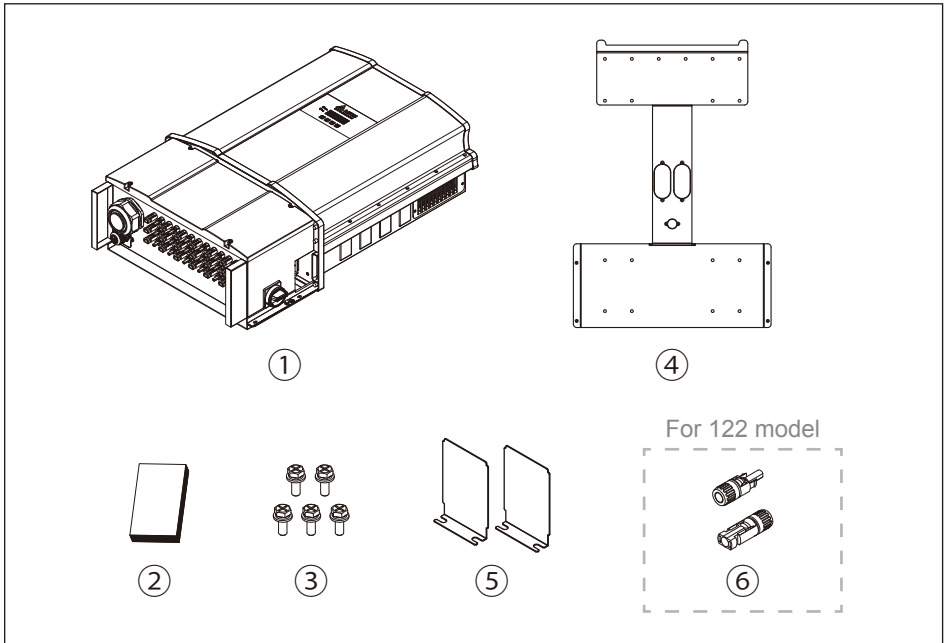
This user manual must be followed during installation, operation, and maintenance.

The M88 Series have 2 models as shown in **Figure 2-2**. Delta reserves the right to make modifications to the content and technical data in this user manual without prior notice.



## 2.2 Product Overview

The components of M88H is shown as **Figure 2-1**.



**Figure 2-1 : Components of M88H**

M88H			
	Object	Qty	Description
1	Delta Solar Inverter	1 pc	Solar inverter
2	User Manual	1 pc	Important instructions for solar inverter Safety instructions should be followed during installation and maintenance
3	Screw	5 pcs	Inverter with wall mount screws
4	Mounting Bracket	1 pc	Wall mounting bracket (include packing for wiring box)
5	Shielding plate	1 pair	Shielding plate for filter (not necessary)
6	MC4 connector	18 pairs	String inputs (122 model only)

**Table 2-1 : Packing list of M88H**

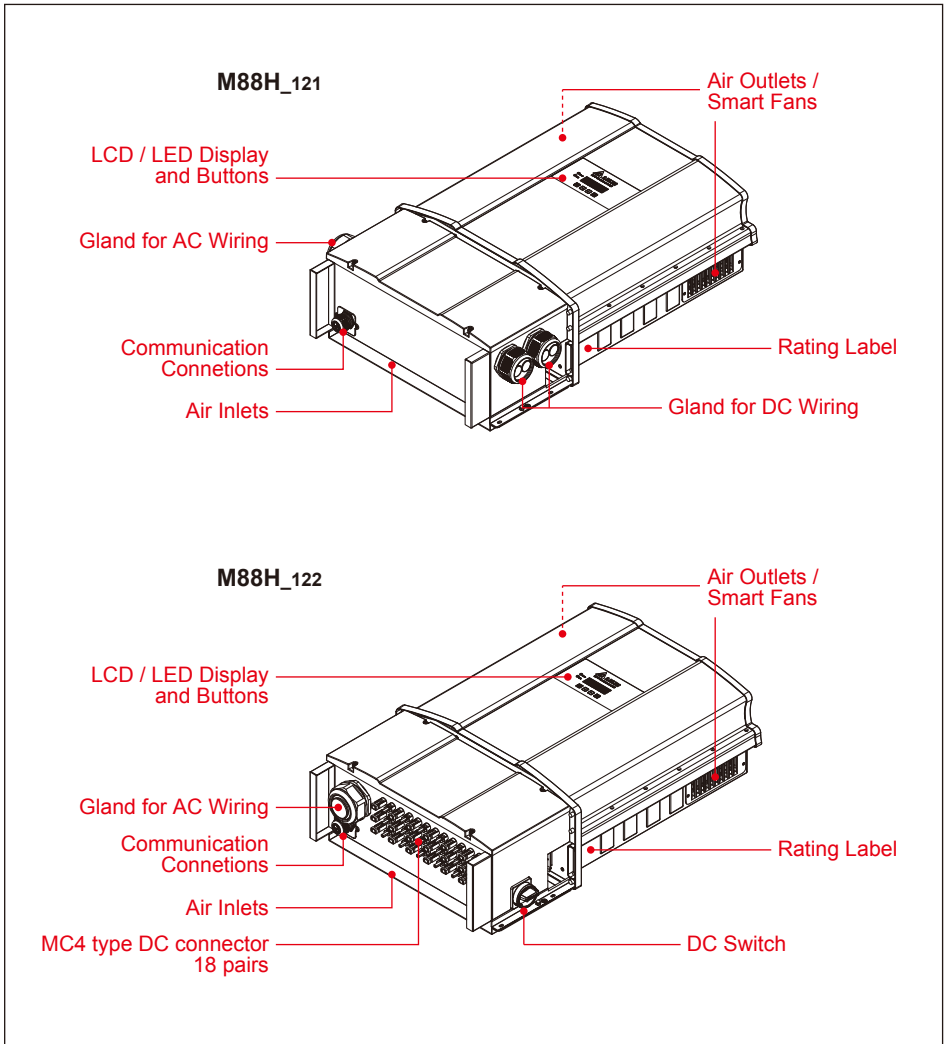


Figure 2-2 : Overview of M88 series







The following **Figure 2-3** shows the rating labels of M88H along with these labels explains the definition of the specific mark.

**Figure 2-4** illustrates the layout of wiring box of M88H and the table (**Table 2-3**) along with this layout describes the detail of each area.

This compartment includes inverter inputs (DC), outputs (AC), surge protection device (SPD), fuse holder, DC switch and the communication connection such as RS-485.



**Figure 2-3 : Rating labels of M88H**

Symbol	Definition
	<b>Danger to life through electric shock</b> Potentially fatal voltage is applied to the inverter during operation. This voltage persists even 100 seconds after disconnection of the power supply. Never open the inverter. The inverter contains no components that must be maintained or repaired by the operator or installer. Opening the housing will void the warranty.
	Before working with the inverter, you must read the supplied manual and follow the instructions contained therein.
	This inverter is not separated from the grid with a transformer.
	The housing of the inverter must be grounded if this is required by local regulations.
	Please be aware of noise protection.
	<b>WEEE marking</b> The inverter must not be disposed of as standard household waste, but in accordance with the applicable electronic waste disposal regulations of your country or region.

**Table 2-2 : Rating label explanation of M88H**

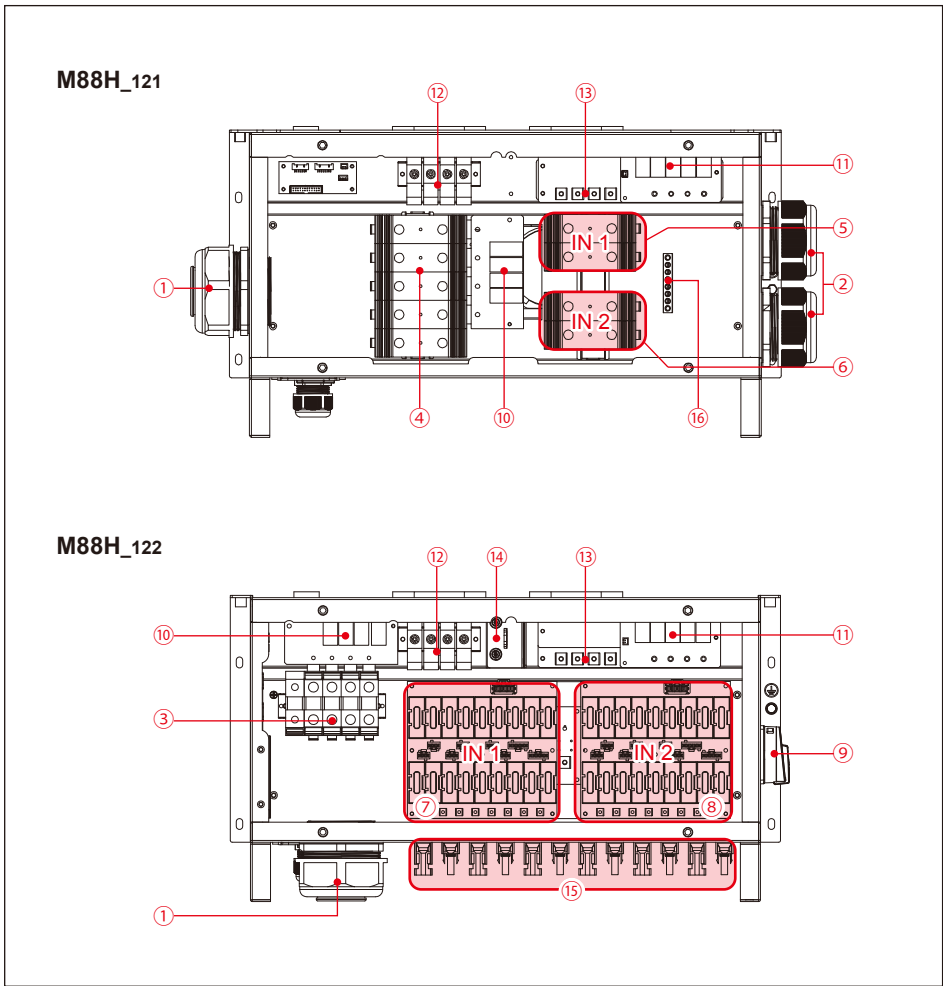


Figure 2-4 : Wiring box layout of M88H

NO.	Component	NO.	Component	NO.	Component
1	Cable gland for AC	7	Fuse holder type DC IN1	13	Internal DC terminal
2	Cable gland for DC	8	Fuse holder type DC IN2	14	Wiring box fan
3	95mm <sup>2</sup> AC terminal	9	DC switch	15	MC4 connector
4	120mm <sup>2</sup> AC terminal	10	Type II AC SPD	16	Grounding bar
5	120mm <sup>2</sup> DC terminal for IN 1	11	Type II DC SPD		
6	120mm <sup>2</sup> DC terminal for IN 2	12	Internal AC terminal		

Table 2-3 : Wiring box layout description of M88H

## 3 Installation

### CAUTION !



- The unit should not be installed in direct sunlight.

### WARNING !



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

The chapter contains instructions for (1) Mechanical installation; (2) Electrical Installation; (3) Communication setup.

### 3.1 Mechanical Installation

This unit is designed to be wall-mounted. Please ensure that the installation is perpendicular to the floor and the AC and DC terminal are at the bottom position. Please follow the instruction as shown from **Figure 3-1** through **3-3**. First, fix the wall mounting bracket on a solid support surface. Second, please mount the inverter on the bracket securely. Note that **Figure 3-1** through **3-7** should be followed.

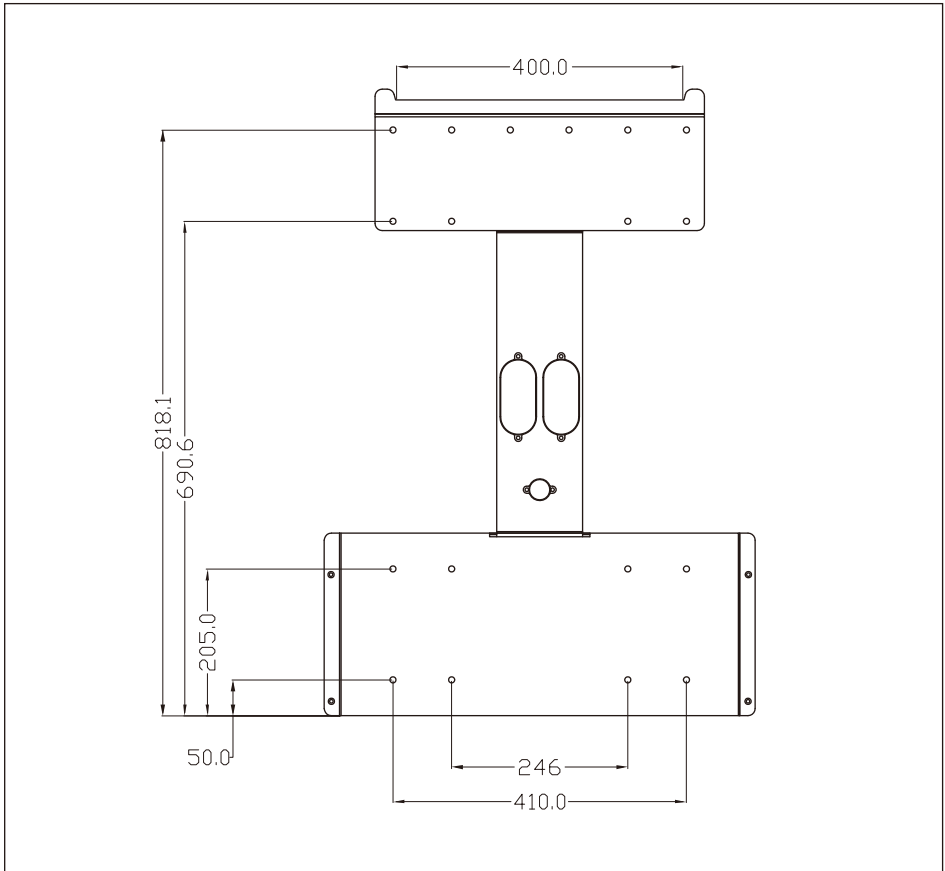
To mount the inverter on the wall, please follow the procedure :

1. Screw the wall mounting bracket on the wall with at least 8 M8 Phillips head screws. Please refer to **Figure 3-1** and **3-2** for correct installation.
2. Hang the inverter on the wall mounting bracket.
3. There are two ways for fixing the wall mounting bracket as shown in **Figure 3-2**.
4. **Figure 3-3** through **3-7** describes correct mounting installation.
5. **Figure 3-7** shows the installation detail for fixing the wiring box.

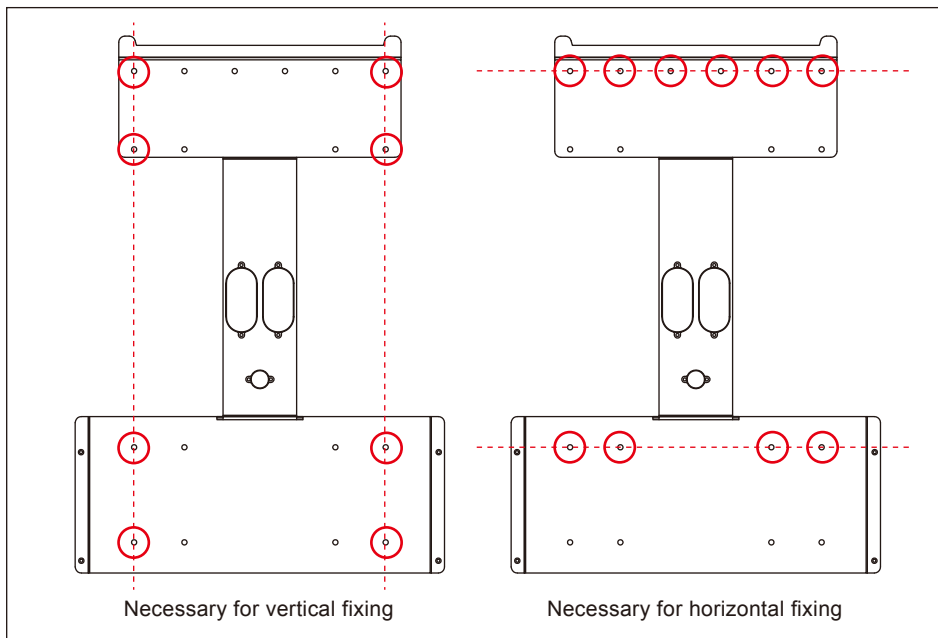
### CAUTION !



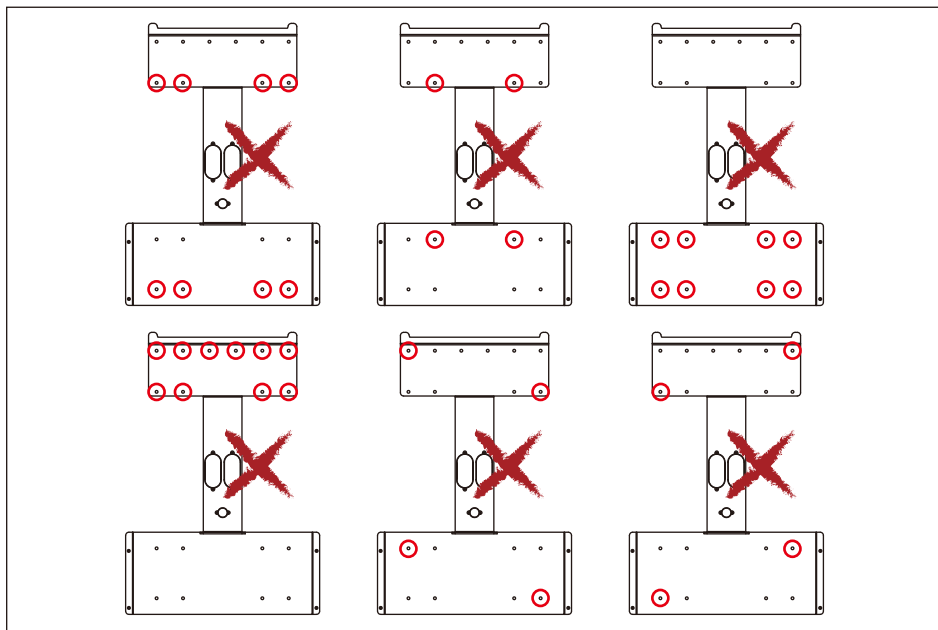
- Please fix at least 8 M8 Phillips head screws for the wall mounting bracket.
- The bracket shipped with the unit is specially designed and should be the only mounting device for the mechanical installation.



**Figure 3-1 : Mounting bracket dimensions**



**Figure 3-2 : Required position for at least 8 screws**



**Figure 3-3 : Prohibited position for screws**

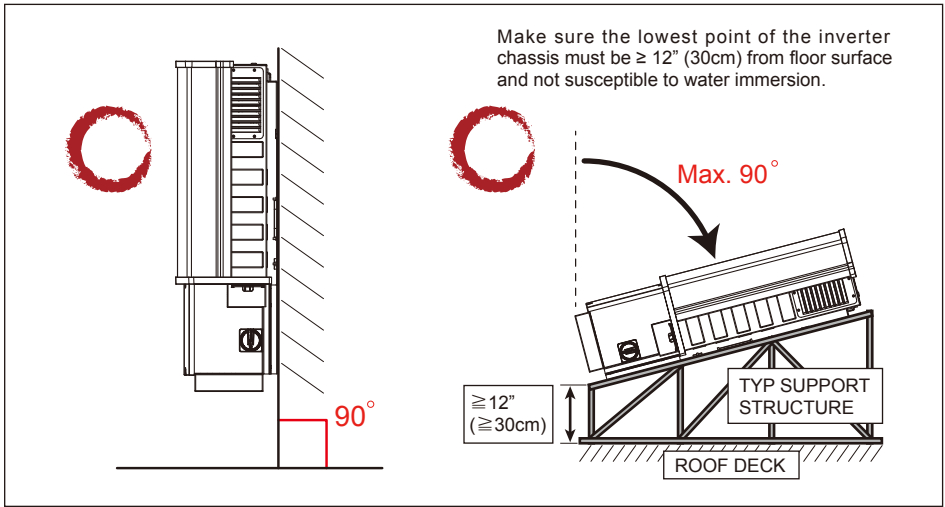


Figure 3-4 : Permitted mounting positions

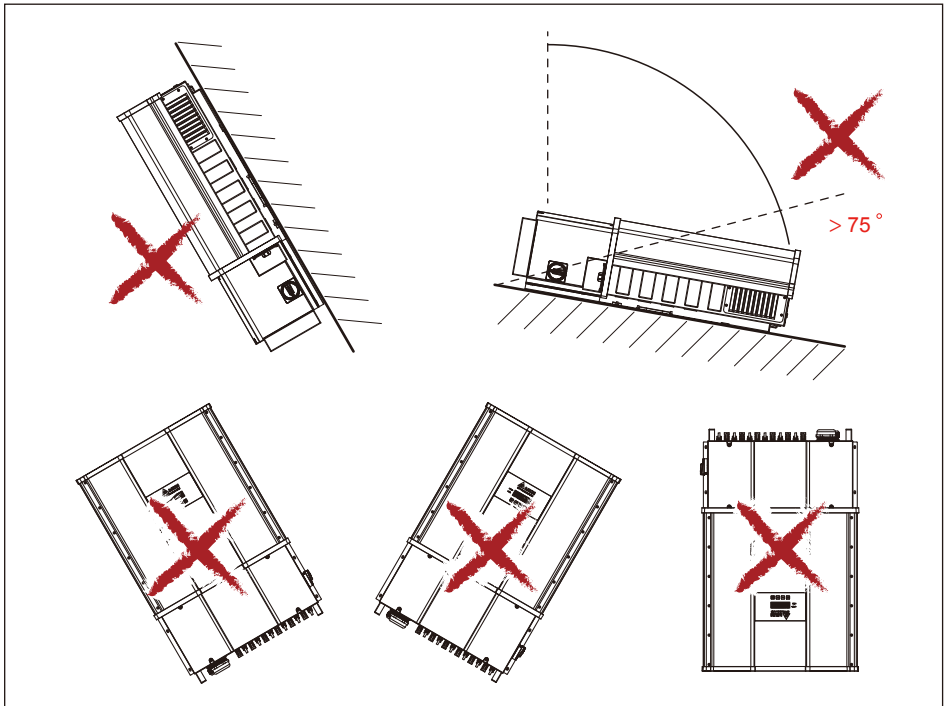
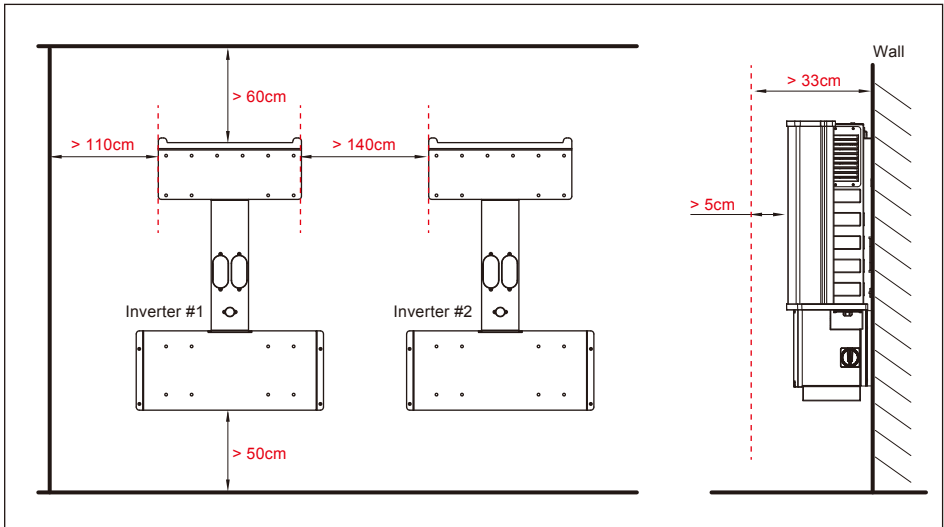


Figure 3-5 : Prohibited mounting positions

O : Permitted / X : Prohibited





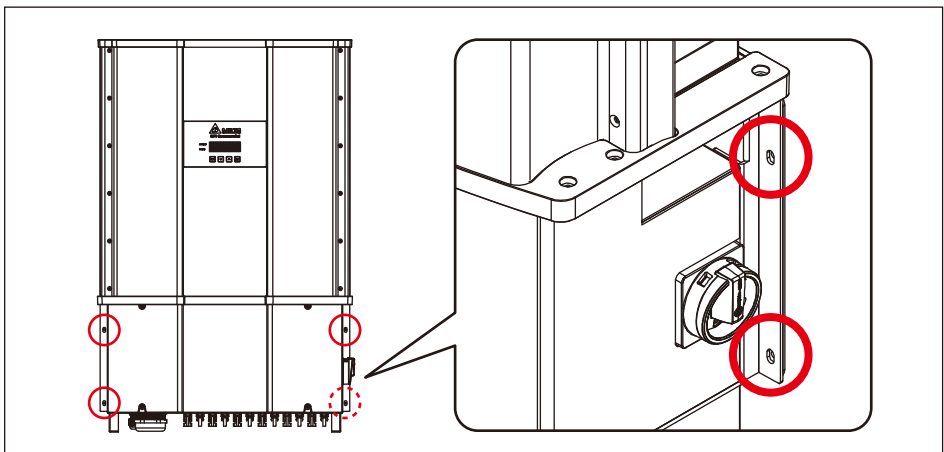
**Figure 3-6 : Required mounting clearances**

### CAUTION !



- Please follow the instructions above such as permitted positions and permitted mounting clearances for the correct installation.

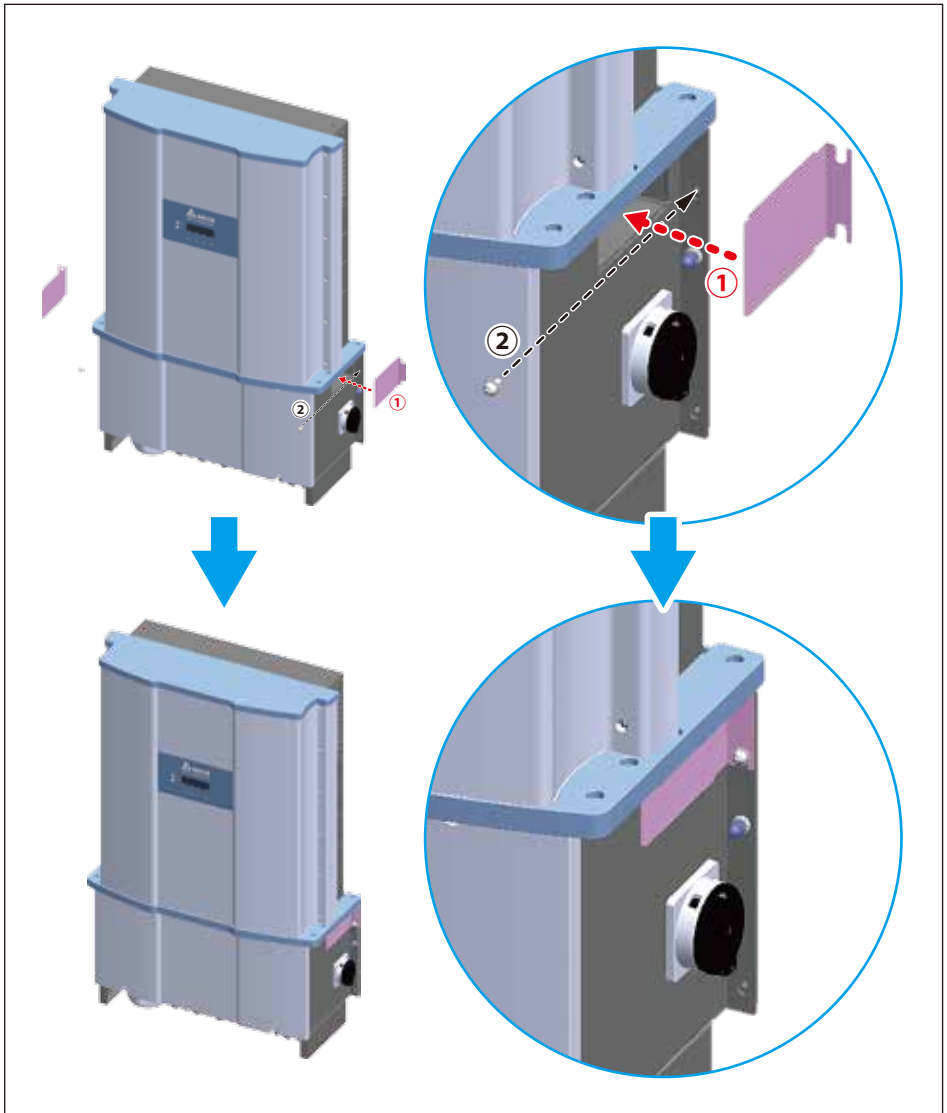
After installing the unit, fix the wiring box with 4 screws.  
The torque of the screw: 45 kgf.cm



**Figure 3-7 : Specification of fixing WB for wall-mounting installation**

If customers need to use the shielding plate, please refer to the installation method in **Figure 3-8**.

The torque of the screw: 45 kgf.cm



**Figure 3-8 : Installation method of shielding plate**

## 3.2 Electrical Installation for AC Cabling

### DANGER : ELECTRICAL HARZARD!!



- Any AC electric power connected to the inverter during cabling is prohibited.

### WARNING !



- Code compliance is the installer's responsibility.
- Inverter warranty void if the DC input voltage exceeds 1000 Vdc.

### CAUTION : INVERTER AND EQUIPMENT DAMAGE MAY OCCUR !



- Please make sure to choose the proper size for AC cable.
- Installation for AC terminal must meet the local electrical code.
- Failed to follow the instructions may damage AC cable.

### ATTENTION



- This inverter may be damaged due to moisture or dust intrusion.  
Please do not open the lid of the inverter.

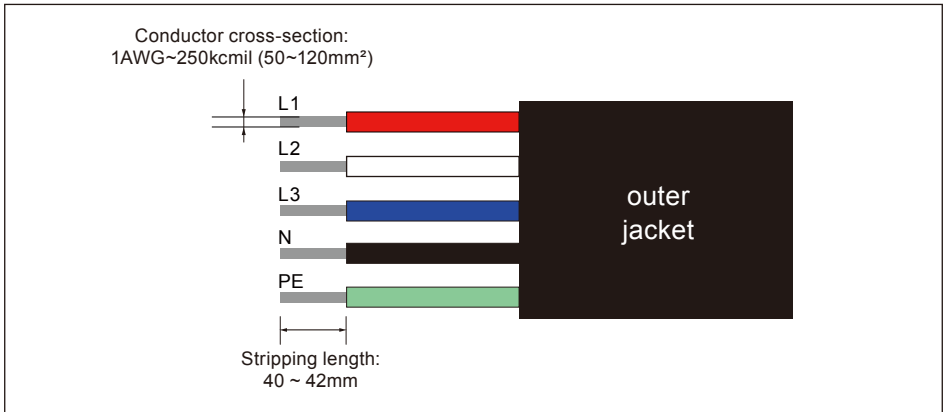
### 3.2.1 Required Protective Devices and AC Cabling Installation for M88H<sub>121</sub>

It is recommended to install an upstream circuit breaker between AC side and inverter side for over current protection.

Model	Upstream circuit breaker
M88H	$\geq 125A$

Please follow the following steps for assembling the AC terminal (M88H<sub>121</sub>) :

- It is important to choose the proper size for AC cable.
- Strip off all wires for 40 mm.
- The cross-sectional area for each internal cable is 1AWG ~ 250kcmil.



**Figure 3-9 : Stripping cables for M88H<sub>121</sub> AC terminal**

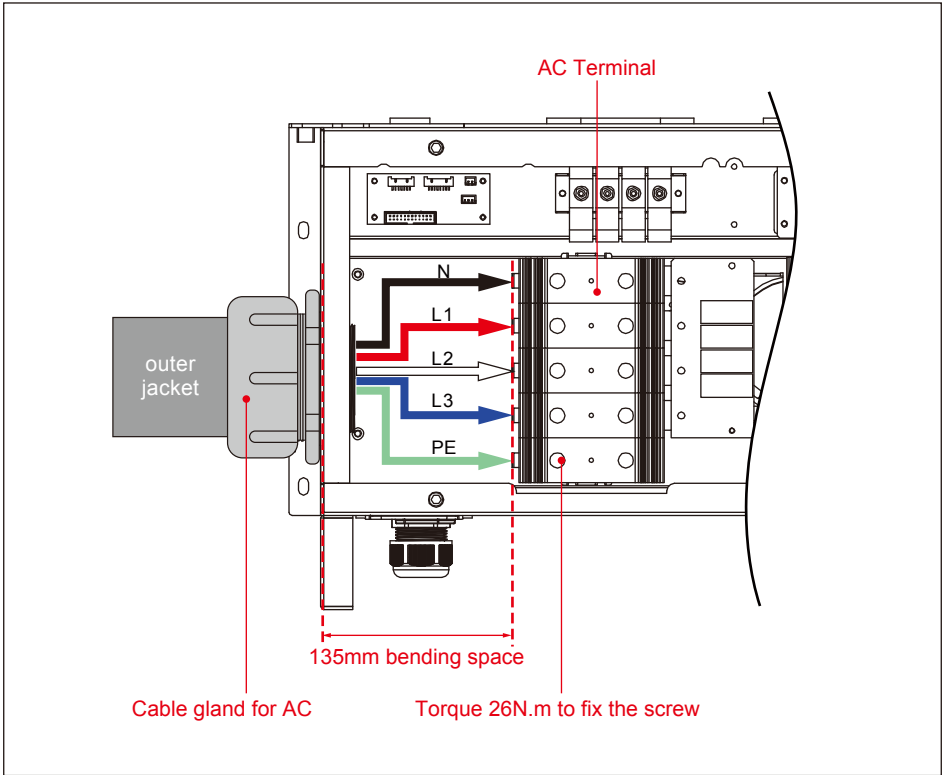


Figure 3-10 : Location for M88H\_121 AC terminal

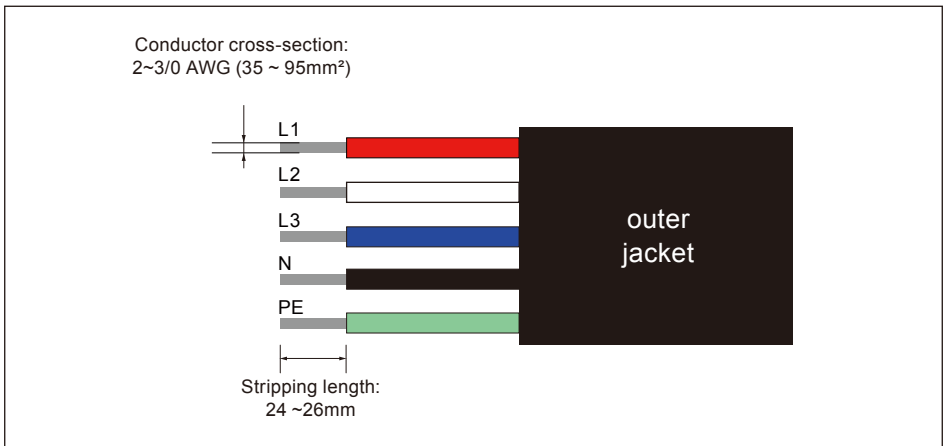
### 3.2.2 Required Protective Devices and AC Cabling Installation for M88H<sub>122</sub>

It is recommended to install an upstream circuit breaker between AC side and inverter side for over current protection.

Model	Upstream circuit breaker
M88H	$\geq 125A$

Please follow the following steps for assembling the AC terminal (M88H<sub>122</sub>) :

- It is important to choose the proper size for AC cable.
- Strip off all wires for 24 mm.
- The cross-sectional area for each internal cable is 2~3/0 AWG.



**Figure 3-11 : Stripping cables for M88H<sub>122</sub> AC terminal**

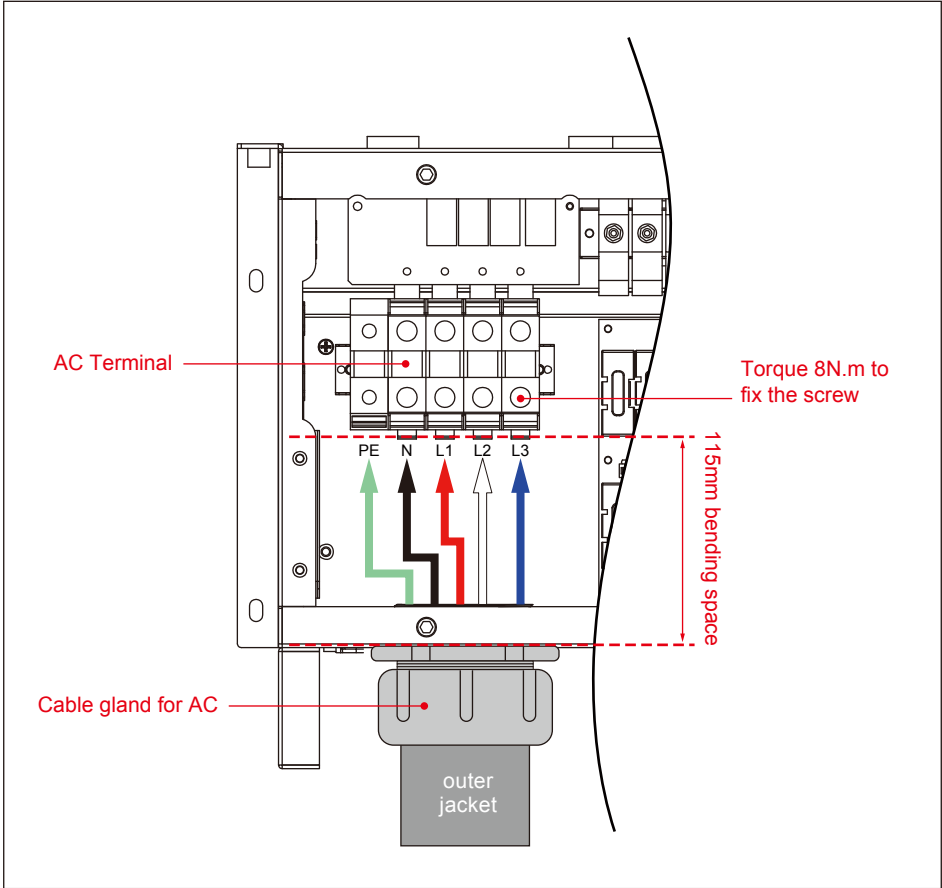
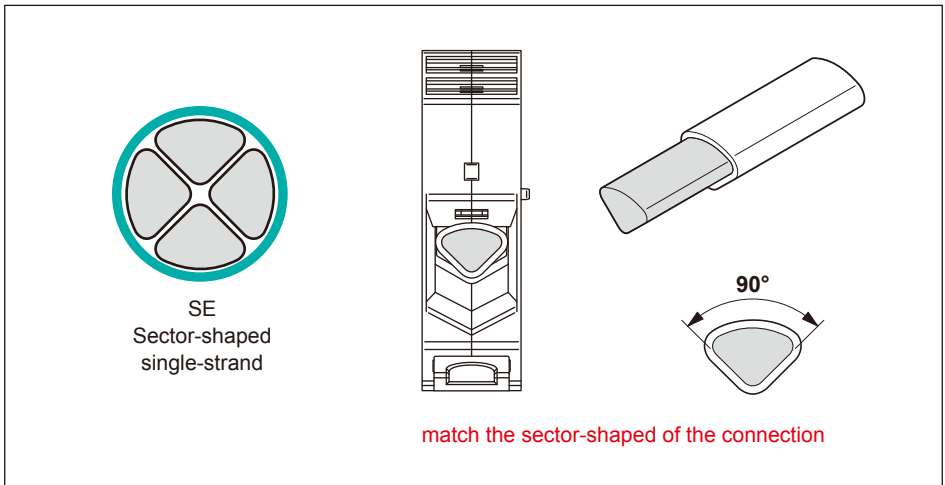


Figure 3-12 : Location for M88H\_122 AC terminal

Please follow the following guideline for cabling if you use aluminum cables.

Guideline for aluminum conductor :

- The oxide layer must be removed from the surface of the stripped aluminum conductor.
- The stripped aluminum conductor is greased with Vaseline or contact grease with comparable properties after oxide layer removed.
- Tightened with the maximum tightening torque for the modular terminal block.
- The installation location must be kept free from humidity or aggressive atmospheres.
- It is recommend to apply to sector-shaped single-strand conductor ;  
The conductor shape must match the sector-shaped connection



**Figure 3-13 : Guideline for aluminum conductor**



### 3.3 Electrical Installation for DC Cabling

#### DANGER : ELECTRICAL HARZARD!!



- PV array converts sunlight into electric power with high DC voltage and high DC current which can cause dangerous electrical shock hazard. Please use an opaque material to cover the PV array before wiring or cabling.
- Please ensure the correct polarities are connected when DC cabling is applied.

#### WARNING !



- The risk of electric shock and fire. Only PV modules that are listed with system voltage under 1100V are permitted for use.
- Please ensures that the DC Switch Turns "OFF" as well as the PV array is disconnected when DC cabling is applied.

#### ATTENTION



- The PV Array positive or negative leads must not be connected to ground.
- According to UTE certification, it is recommended to install an circuit breaker between PV array and inverter for over current protection.

### 3.3.1 DC Cabling Installation for M88H\_121

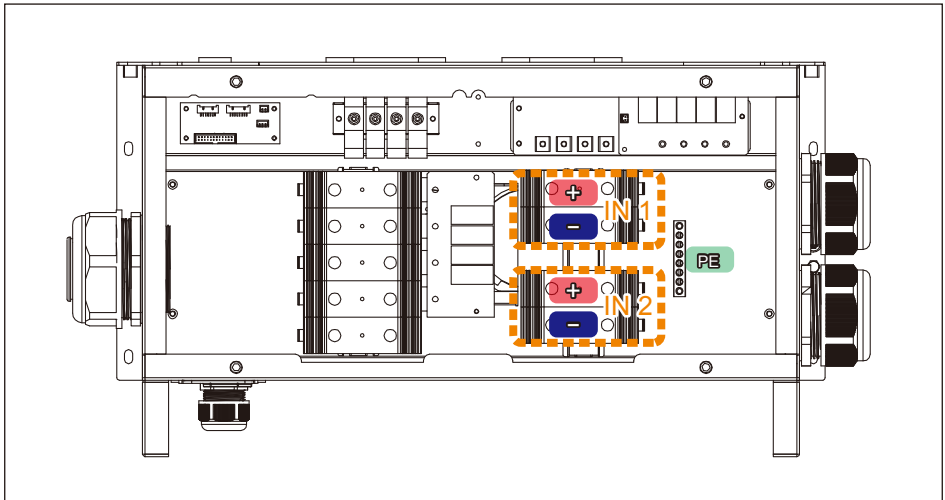
Please read the following instructions for attaching DC terminals (M88H\_121) :

- It is important to choose the proper size for DC cable.
- The cross-sectional area for each internal cable is 1AWG~250kcmil.
- DC Terminals connection as seen in **Figure 3-15**.

#### ATTENTION



- The screw with torque 26N.m is required for fixing.
- The required bending space is 135 mm as the requirement states.



**Figure 3-14 : Wiring Box layout for M88H\_121**

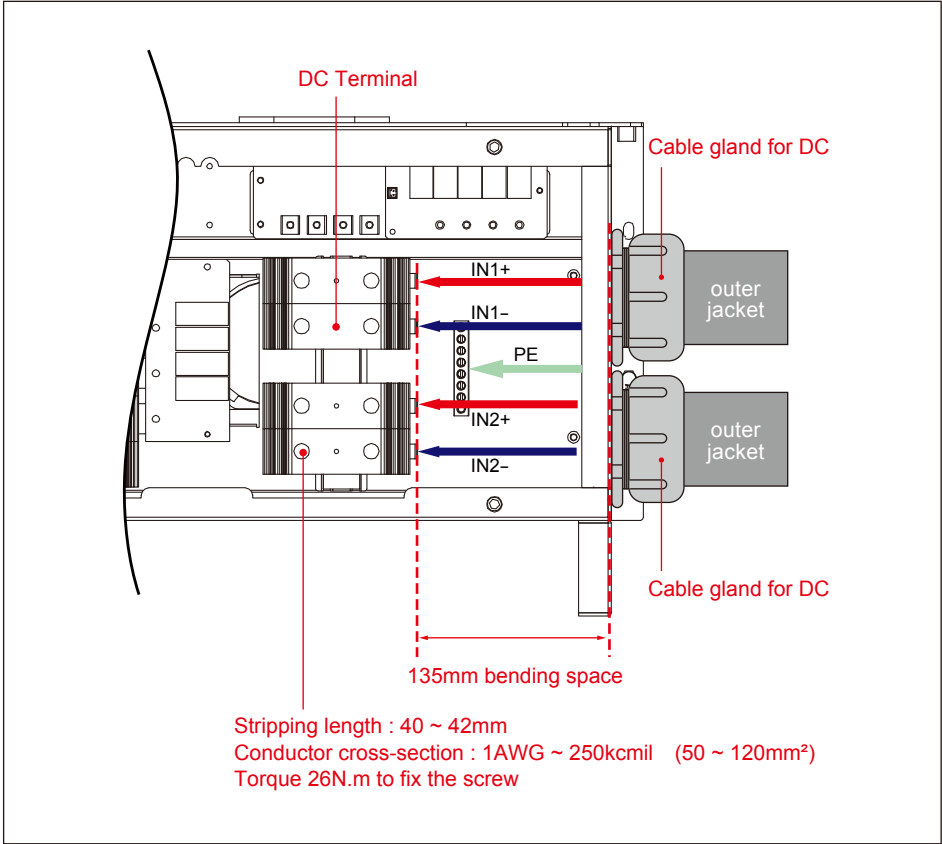


Figure 3-15 : Location for DC terminals for M88H\_121

### 3.3.2 DC Cabling Installation for M88H\_122

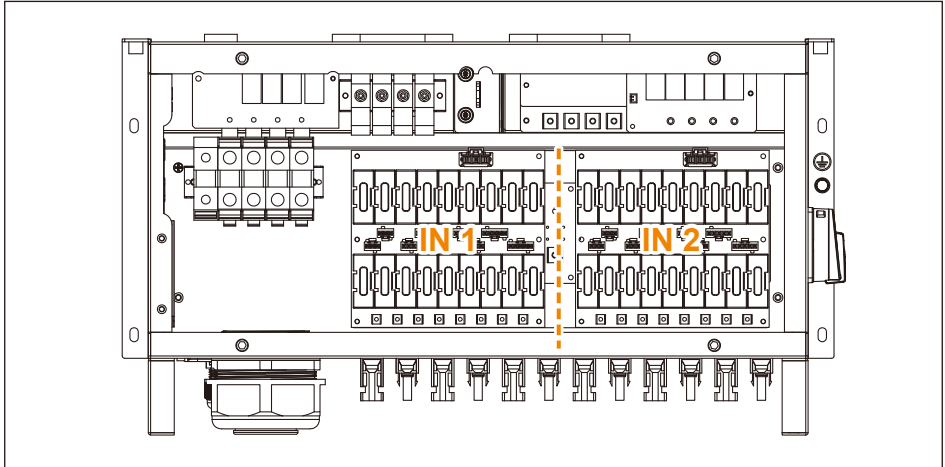


Figure 3-16 : Wiring Box layout for M88H\_122

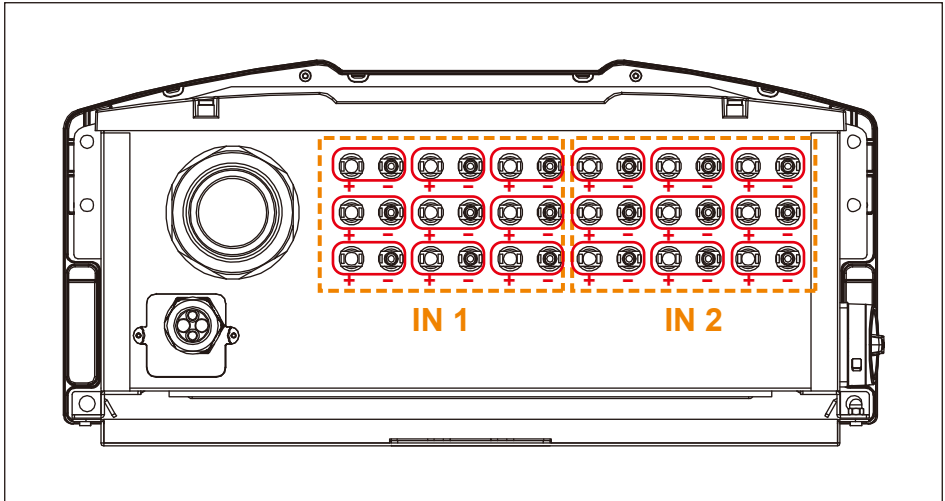
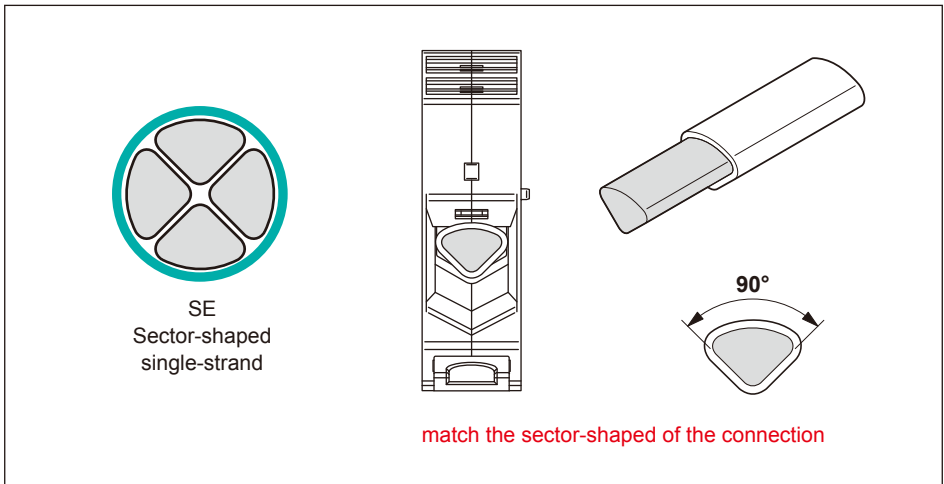


Figure 3-17 : Location for DC terminals for M88H\_122

Please follow the following guideline for cabling if you use aluminum cables.

Guideline for aluminum conductor :

- The oxide layer must be removed from the surface of the stripped aluminum conductor.
- The stripped aluminum conductor is greased with Vaseline or contact grease with comparable properties after oxide layer removed.
- Tightened with the maximum tightening torque for the modular terminal block.
- The installation location must be kept free from humidity or aggressive atmospheres.
- It is recommend to apply to sector-shaped single-strand conductor ;  
The conductor shape must match the sector-shaped connection



**Figure 3-18 : Guideline for aluminum conductor**

### 3.4 Communication Module Connections

The communication module of M88H provides VCC, RS-485, dry contact, EPO, and Digital Input terminals for different use.

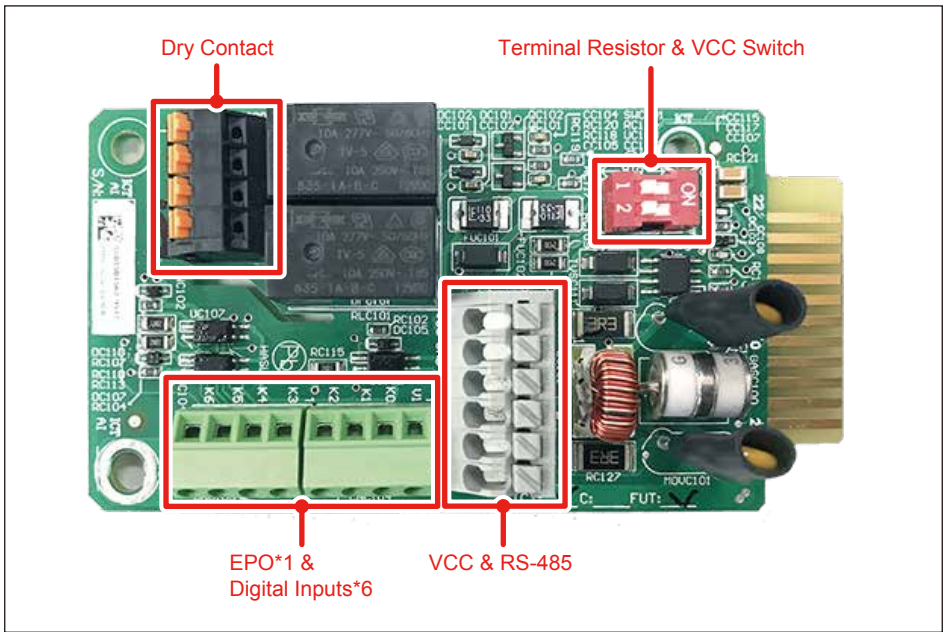


Figure 3-19 : Communication Module

#### 3.4.1 RS-485 Connection

The pin definition of RS-485 is shown in the following table. Different RS-485 connection requires different set up for the terminal resistor.

- When single inverter is installed, the terminal resistor on its communication module should be switched ON.
- When several inverters are cascaded, only the first and the last inverter’s terminal resistors MUST be switched ON.

#### ATTENTION



In order to have good transfer quality, twisted-pair wire is recommended to be used as communication cable.

Pin	Function
1	VCC (+12V)
2	GND
3	DATA+
4	DATA-
5	DATA+
6	DATA-




Table 3-1 : Definition of RS-485

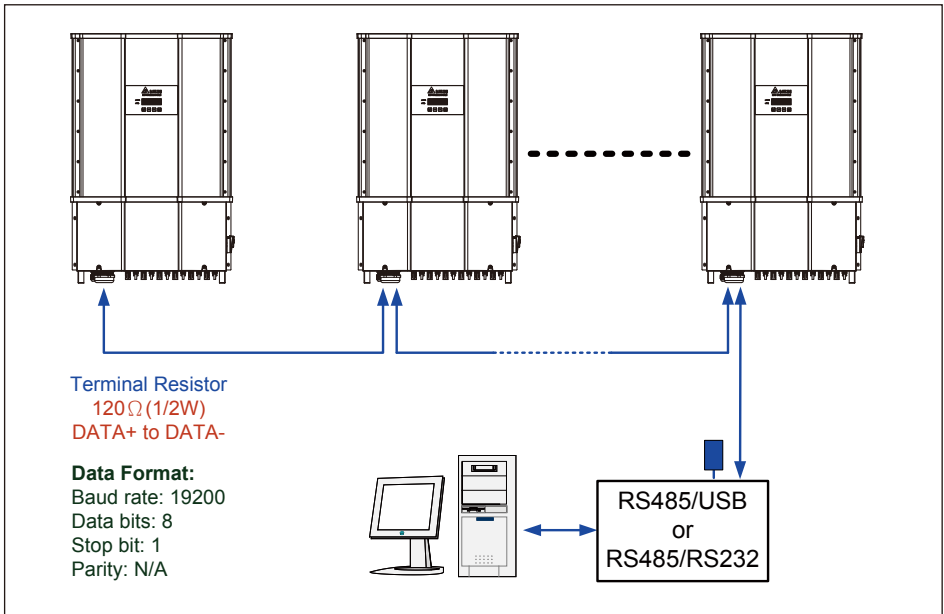


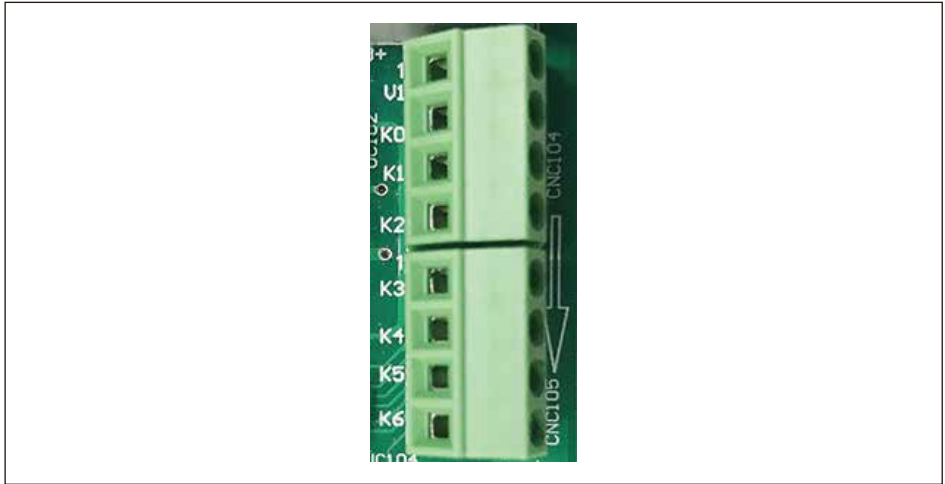
Figure 3-20 : Multiinverter connection illustration

	Switch 1	Switch 2
ON	VCC ON	Terminal Resistor ON
OFF	VCC OFF	Terminal Resistor OFF

Table 3-2 : Terminal resister setting

### 3.4.2 EPO Function & Digital Input

Communication Module has 1 set of emergency power off function (EPO). Users can customize EPO function in Install Settings page.



**Figure 3-21 : EPO function**

Short	Inverter's action
V1 & K0	Emergency power off (EPO)
V1 & K1	0% active power
V1 & K2	Maximum 30% rated power
V1 & K3	Maximum 60% rated power
V1 & K4	Maximum 100% rated power
V1 & K5	Reserved
V1 & K6	Reserved

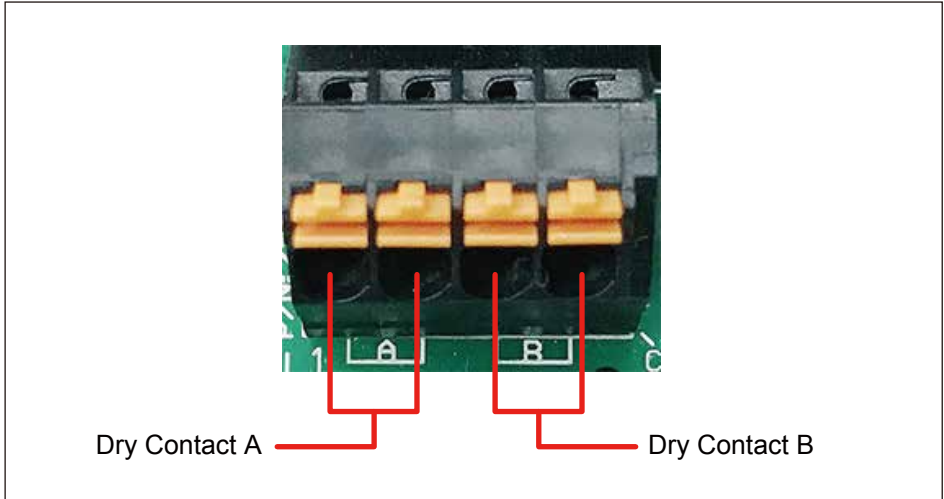
**Table 3-3 : Definition of digital input & EPO function**



### 3.4.3 Dry Contact connection

M88H provide 2 sets of Dry Contact. The function can be customized by users, please refer to section 4.2.10 Dry Contact.

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



*Figure 3-22 : Dry Contact connection*

## 4 Commissioning

### CAUTION : HOT SURFACES, DO NOT TOUCH!



- This warning indicates be careful of hot surfaces when operating the product.
- Do not perform any task until the product cool down sufficiently.

### 4.1 Display Introduction

M88 series include a 4x20 character type LCD display and 2 LED lights ( located on the left-hand side of the LCD ) to indicate inverter's status as shown in **Figure 4-1**. Please refer to **Table 4-1** for more information about inverter's statuses and LED indicator.

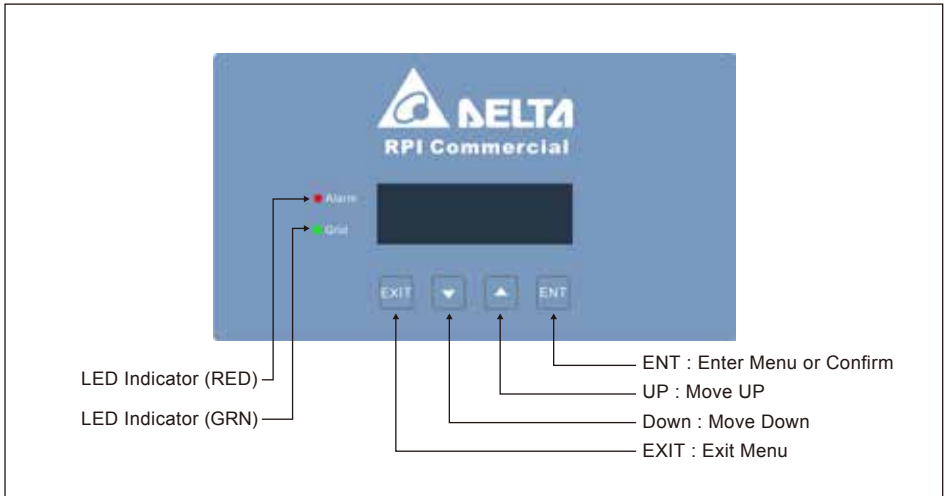
The following section will introduce the functions that can be adjusted by users through the LCD panel. When you are adjusting settings, LCD panel will change the display cursor from "▶" to "➔".

Power meter / String monitoring	4.2.2
Energy Log	4.2.3
Event Log	4.2.4
Inverter Information	4.2.5
General Settings	4.2.6
Install Settings	4.2.7
Active/Reactive Power	4.2.8
FRT	4.2.9

### ATTENTION



According to ERDF certification in France, any production installation with Pmax power greater than or equal to 5MW shall remain P(F) control and FRT function in operation.



**Figure 4-1 : Panel indicator**

Condition	Green LED	Red LED
Countdown	FLASH *	OFF
Power ON	ON	OFF
Error or Fault	OFF	ON
Standby or Night time (No DC)	OFF	OFF
Bootloader mode	FLASH *	

\* ON 1s / OFF 1s

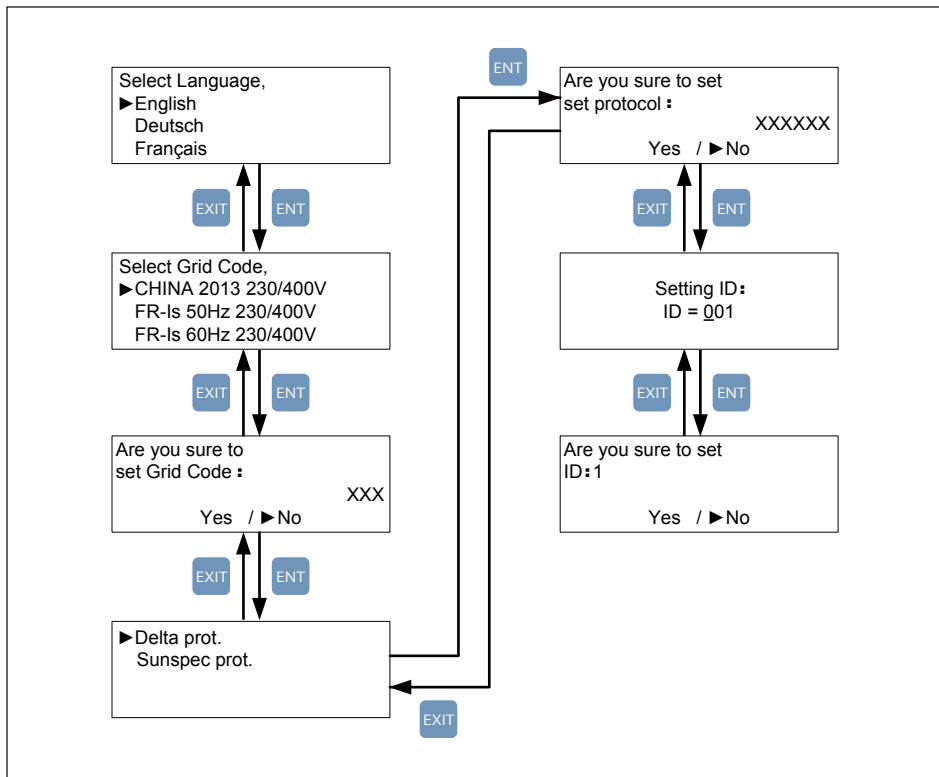
**Table 4-1 : LED indicator**

## 4.2 First startup

At first startup, user has to feed in AC power and switch on the manual switch and DC Power Switch. Inverter will start up and LCD display panel will turn on when powered on through AC. Please set language and the correct country (Grid Code) according to your region.

Please make sure that there is no any error, fault or warning showing on home page. Now you can feed in DC power and wait for inverter initially self-test about 2 minutes. If there is enough power generated from PV array, inverter will start feeding in power to grid.

The following **Figure 4-2** illustrates the display flow charts of the inverter startup.

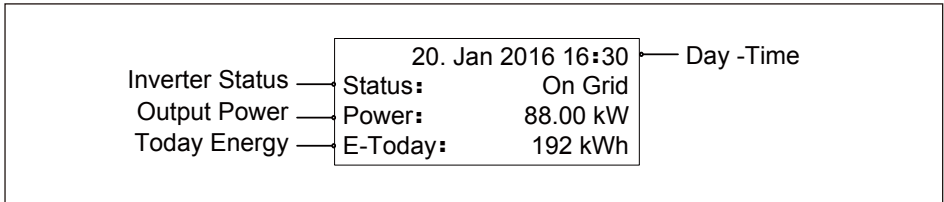


**Figure 4-2 : Grid Code, language and ID settings for first startup**

## 4.2.1 Home Page

When inverter is being operated normally, the LCD will display the homepage as shown in **Figure 4-3**, user can get the information about output power, inverter status, E-today, date and time.

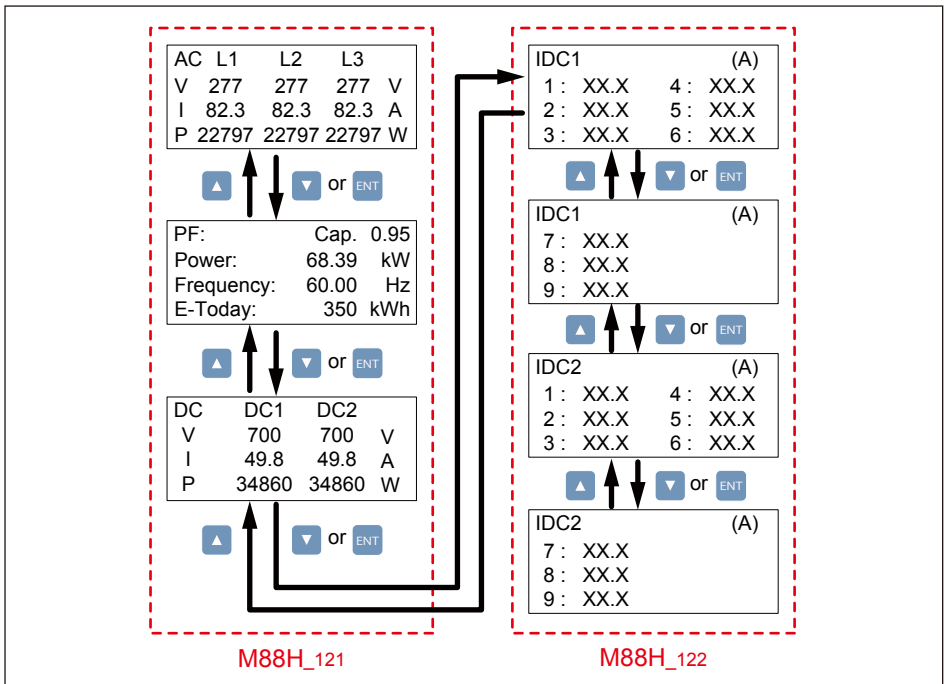
Press "any" key in home page will be directed to the main menu. Press EXIT at main menu or wait 5 minutes without any operation, the display will return to homepage.



**Figure 4-3 : Home page**

## 4.2.2 Power meter / String monitoring

This page displays voltage, current and power from both AC and DC side.



**Figure 4-4 : Power meter page**

### 4.2.3 Energy Log

User can view the inverter's life energy and life runtime via Energy Log page.

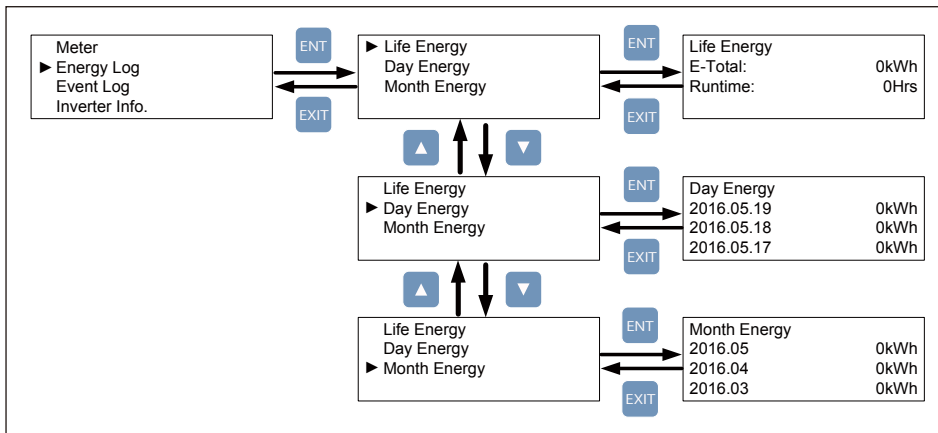


Figure 4-5 : Energy log Page

### 4.2.4 Event Log

Event Log has two subpages : Error Events page and Grid Report page. Error Events page displays all the events (Error and Fault) and it can show 30 records at a time. Grid Report page only displays the error that occurred at grid side, and it can show 5 records at a time.

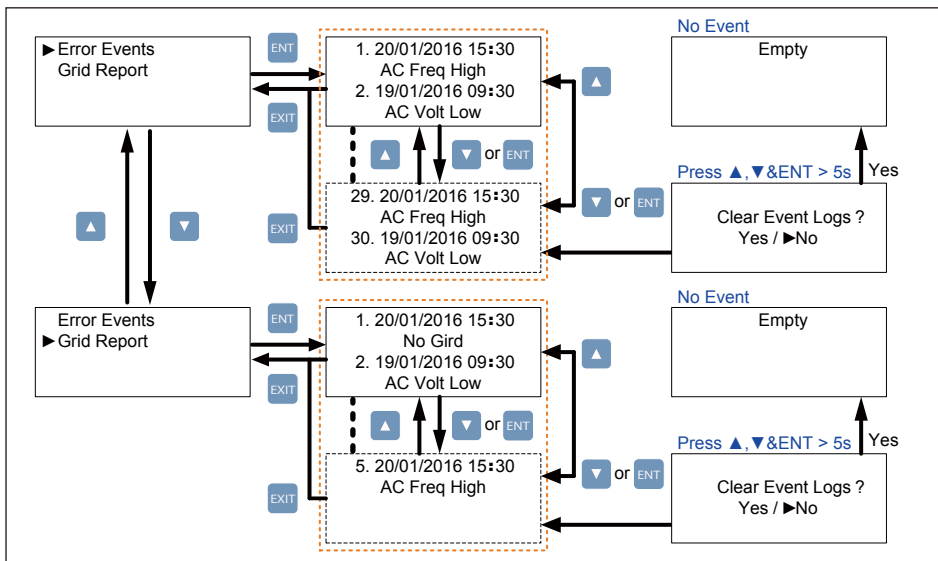


Figure 4-6 : Event log Page

## 4.2.5 Inverter Information

This page can help user to recognize the inverter. First section displays serial number, installation date, ID, and firmware version. The settings of inverter functions are described in the following sections.

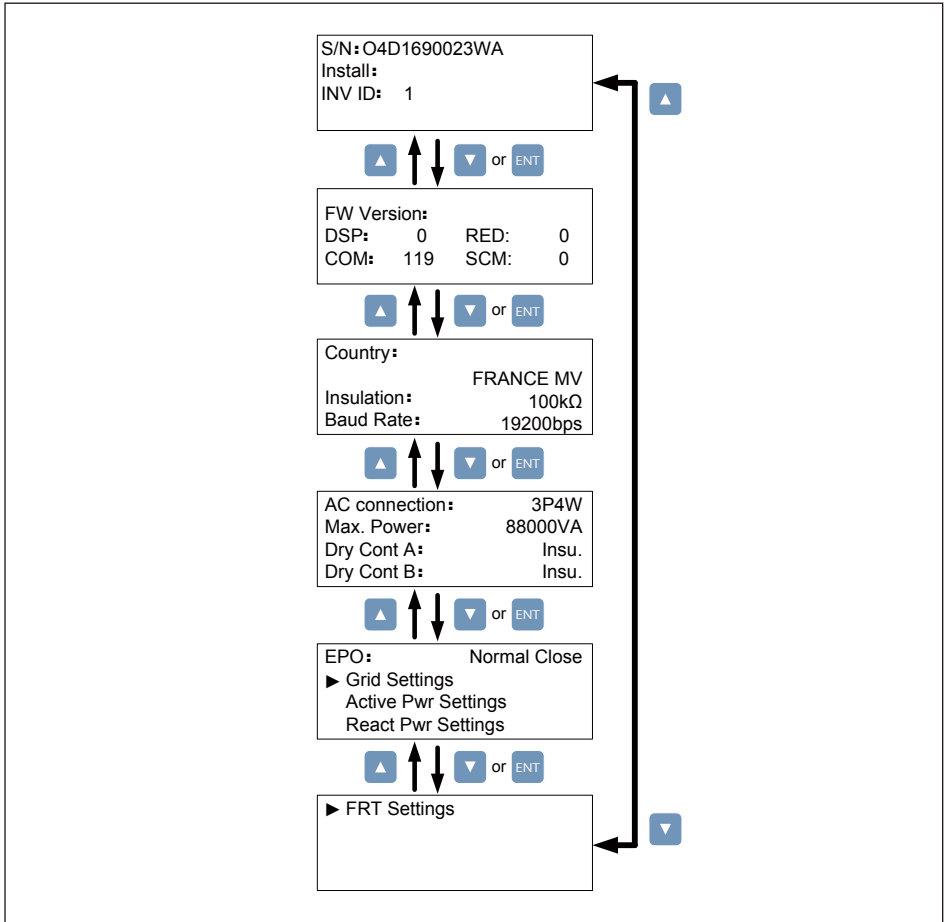


Figure 4-7 : Inverter information page

## 4.2.6 General Settings

Users can set Language, Date and Time, RS-485 communication baud rate, Protocol and Fan Test in this page.

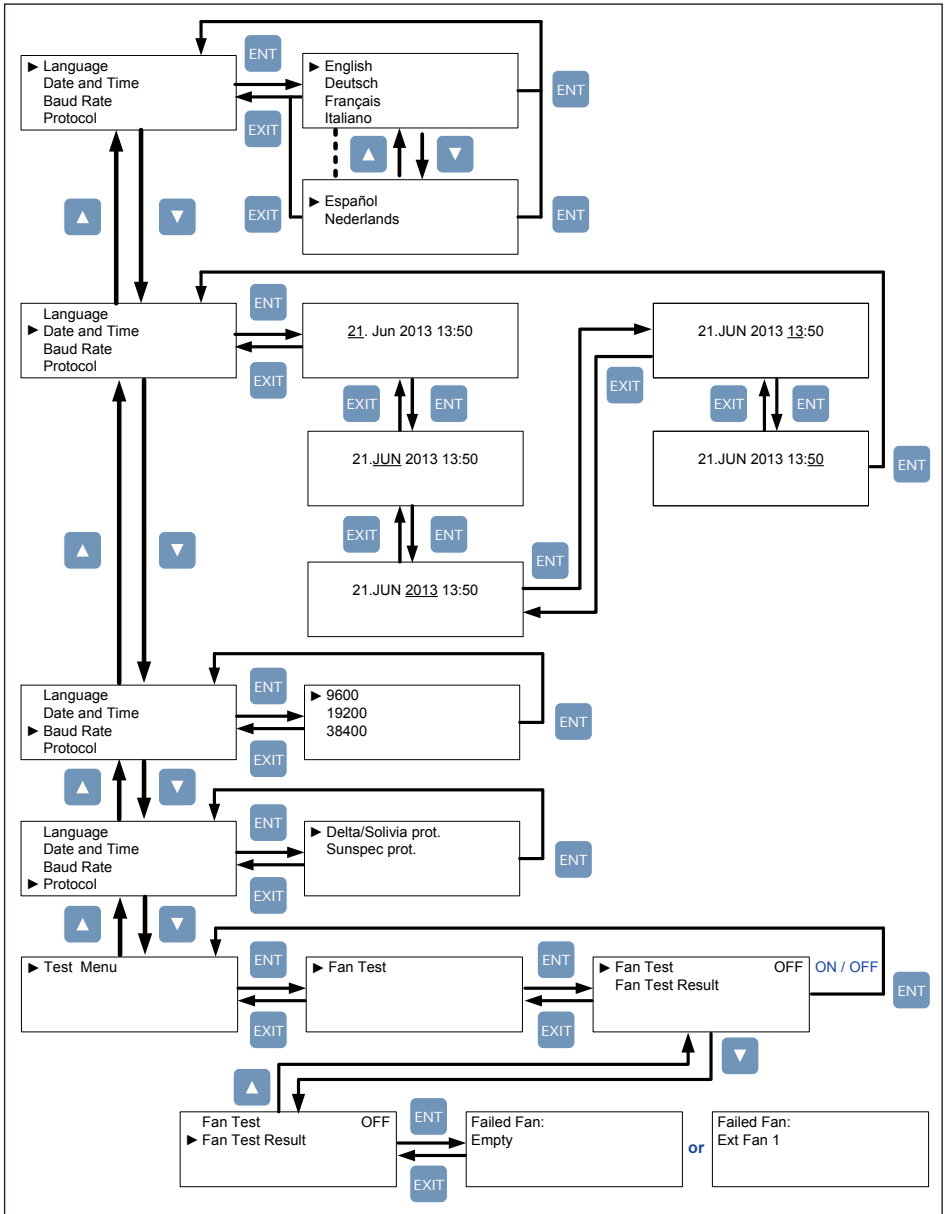


Figure 4-8 : General settings page



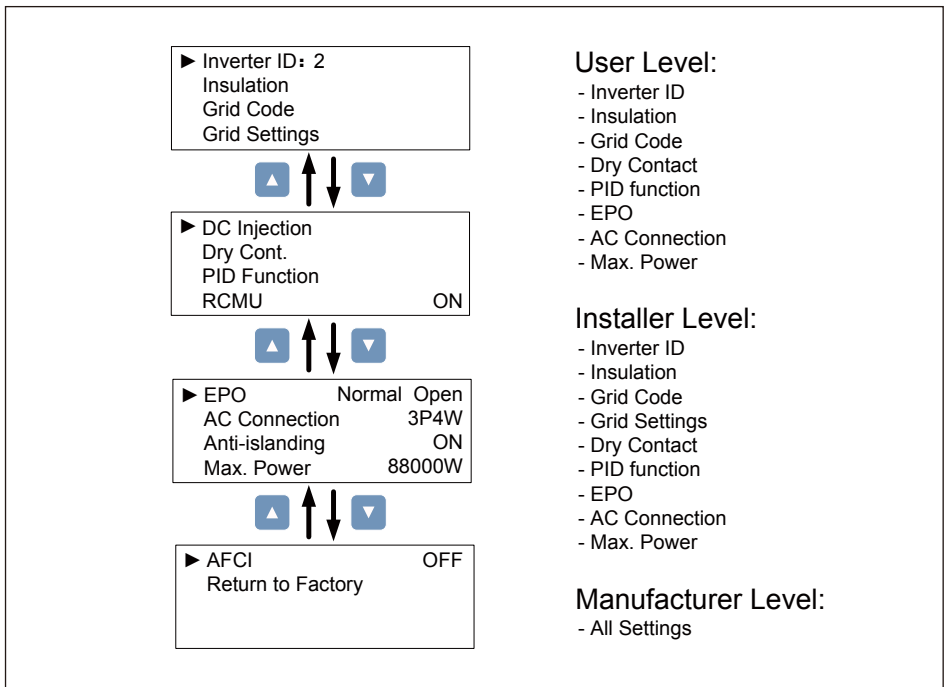
## 4.2.7 Install Settings

### CAUTION !



- The settings in Install Settings page can only be adjusted by qualified installers or engineers. Changing these settings may result in damage to the inverter and other equipment.

To enter Install Settings page, users have to enter correct password. There are 3 sets of password with different permissions: user level, installer level, and manufacturer level. The following sub-sections will introduce the setting items in Install Settings page of user level and installer level.



**Figure 4-9 : Install settings page**

### 4.2.7.1 Inverter ID

Inverter ID is used in RS-485 communication, for PC recognizing the inverter. If users connect several inverters together via RS-485, each inverter must have different ID.

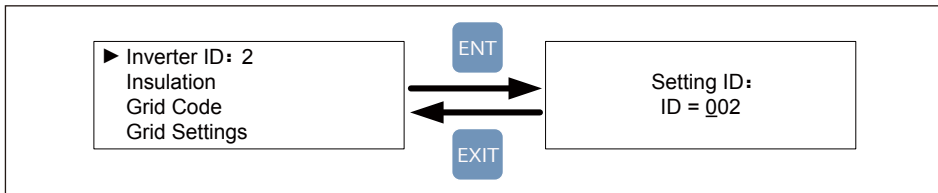


Figure 4-10 : Inverter ID page

### 4.2.7.2 Insulation

Before connecting to grid, inverter will measure the impedance between the PV array and PE first. M88H models provide 2 types of impedance measurement methods (ON and OFF) and 2 impedance limits. Installer must select the appropriate method based on PV array's wiring.

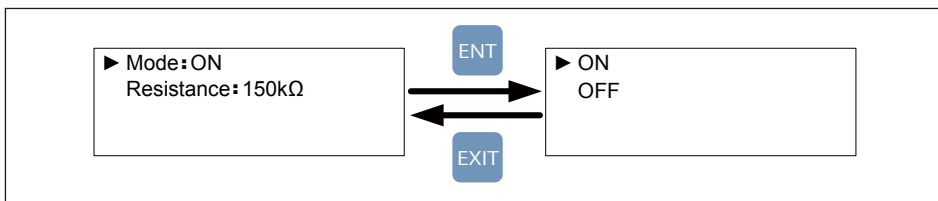


Figure 4-11 : Insulation page

### 4.2.7.3 Grid Code

Each Grid Code has its own electricity regulations. Installer must select the Grid Code correctly.

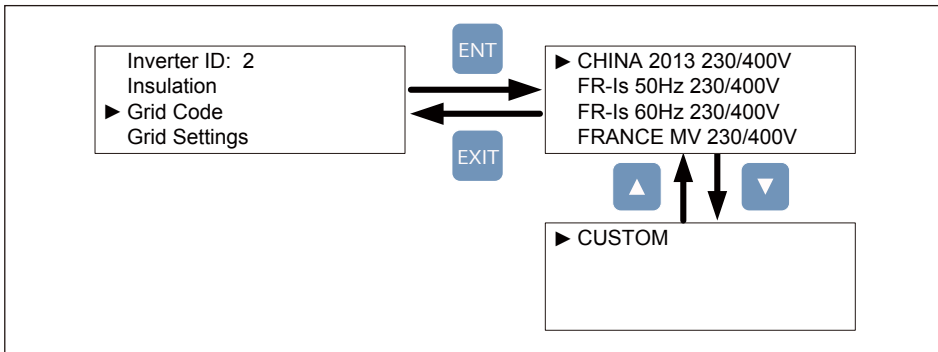


Figure 4-12 : Grid Code page

## 4.2.7.4 Grid Settings

Grid settings page includes the voltage and frequency protection points. These protection points are linked to electricity regulations.

If there is no any special requirement, please do not change any grid settings.

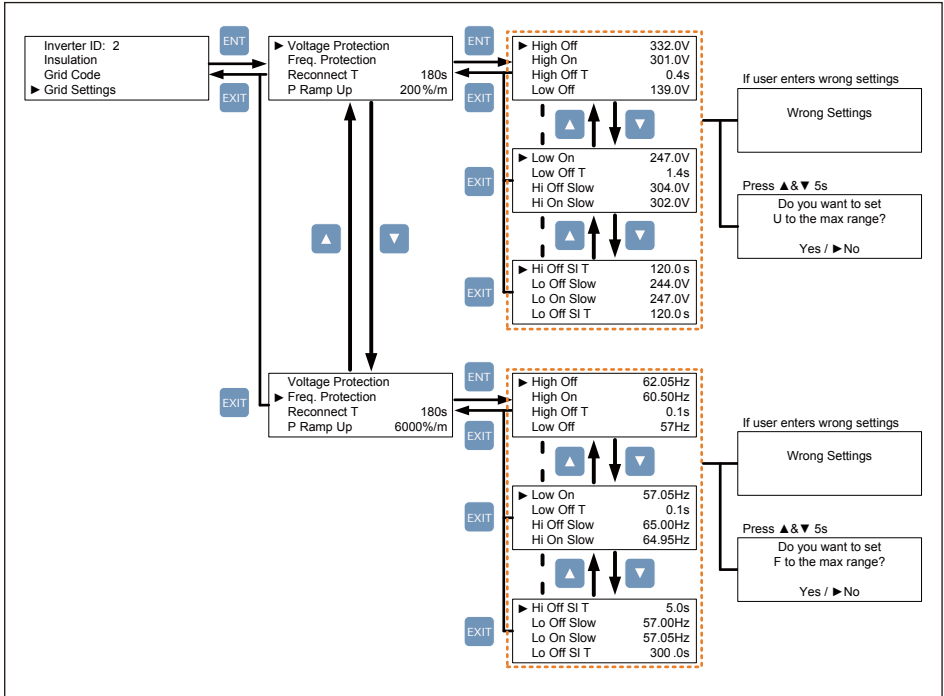


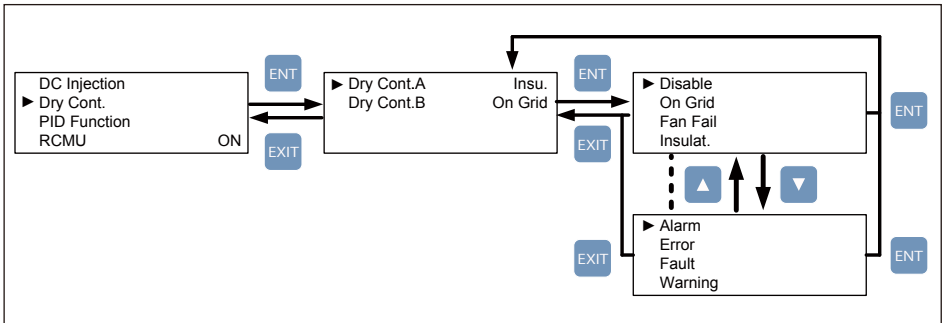
Figure 4-13 : Grid Settings page

### 4.2.7.5 Dry Contact

Users can choose the trigger condition of dry contact. There are 8 options in the setting page: Disable, On Grid, Fan Fail, Insulation, Alarm, Error, Fault, and Warning. Please refer to **Table 4-2** for more details about these options.

Setting	Dry Contact Trigger Timing
Disable	No action.
On Grid	Inverter is connecting to grid.
Fan Fail	Fan Fail occurs.
Insulation	Insulation test fail.
Alarm	Any error, fault, or warning occurs.
Error	Any Error occurs.
Fault	Any Fault occurs.
Warning	Any Warning occurs.

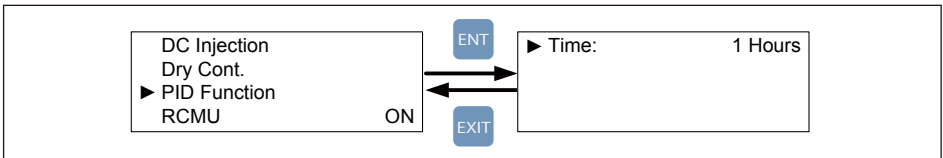
**Table 4-2 : Dry Contact Trigger Setting**



**Figure 4-14 : Dry Contact page**

### 4.2.7.6 PID

The default action time is set with 0, user can set the time from 0-10 or Auto. When PID function is enabled it will be started at 30 minutes after No DC.



**Figure 4-15 : PID function settings**

### 4.2.7.7 EPO

EPO function has 2 detection methods: Normal Open and Normal Close.

Normal Open means EPO pins are usually open-circuited. When these two pins are short-circuited, inverter will shut down immediately.

Normal Close is contrary to Normal Open. Please choose an appropriate detection method according to your needs.

▶ EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

*Figure 4-16 : EPO page*

### 4.2.7.8 AC connection

M88H models can support 3P3W and 3P4W system.

Please select the correct AC wiring type.

EPO	Normal Close
▶ AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

*Figure 4-17 : AC connection*

### 4.2.7.9 Max. Power

Electricity regulation in some area requests that inverter must have power limit function. In these areas, users can adjust Max. Power to limit the maximum output power of the inverter.

EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
▶ Max. Power	88000W

*Figure 4-18 : Max. Power page*

## 4.2.8 Active / Reactive power

A password is required to enter Active / Reactive Power page.

This page includes two kinds of function: active power control and reactive power control. In active power control function, there are 3 control modes: Power Limit, Power vs. Frequency, and P(V). In reactive power control function, there are 4 control modes: Constant cosphi, cosphi(P), Constant Q, and Q(V). These modes will be introduced in next section.

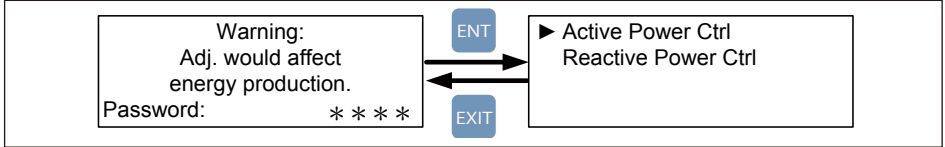


Figure 4-19 : Active / Reactive power page

### 4.2.8.1 Power Limit

This control mode can reduce the output power to a percentage of inverter's rated power. Users can limit the output power by set the Set Point in Power Limit page.

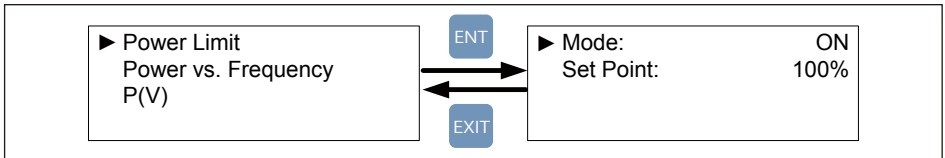


Figure 4-20 : Power Limit page

### 4.2.8.2 Power vs. Frequency

Inverter will reduce output power when grid frequency rises up if this mode enabled. Users can tune the parameters in Power vs. Frequency page to change the inverter's behavior.

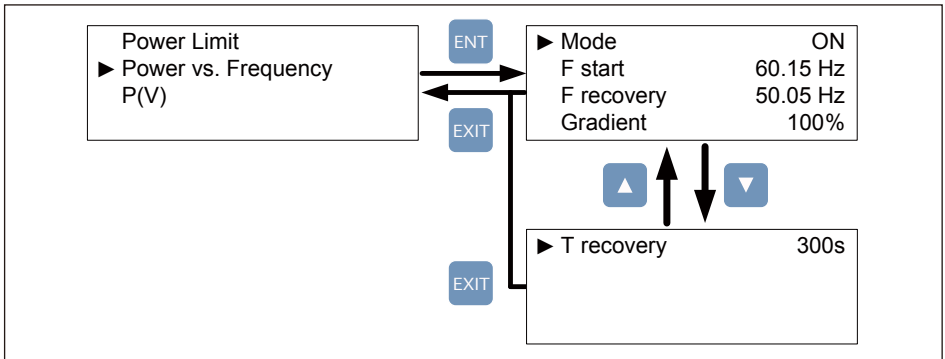


Figure 4-21 : Power vs Frequency page

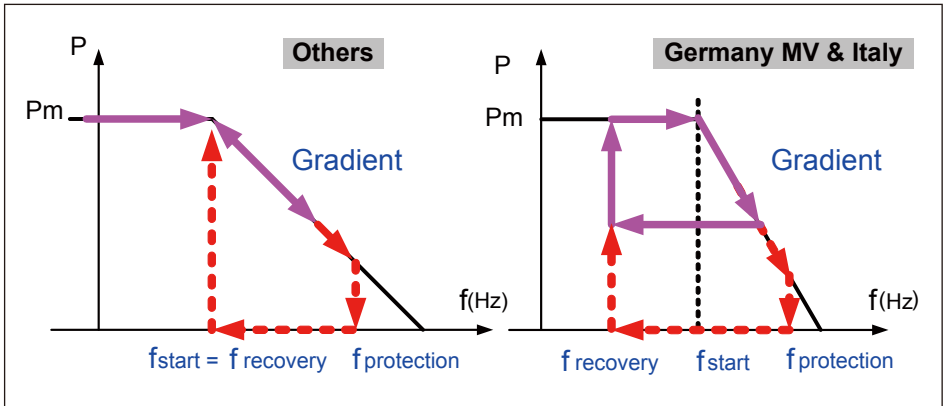


Figure 4-22 : Power vs Frequency parameters

### 4.2.8.3 P(V)

When grid voltage rises up to a lock-in voltage(V lock-in) and inverter's present output power is greater than lock-in power(P lock-in), inverter will reduce the output power and keep it at a certain value(P lock-out) until grid voltage drop back to lock-out voltage(V lock-out) and passing a certain time(T recovery).

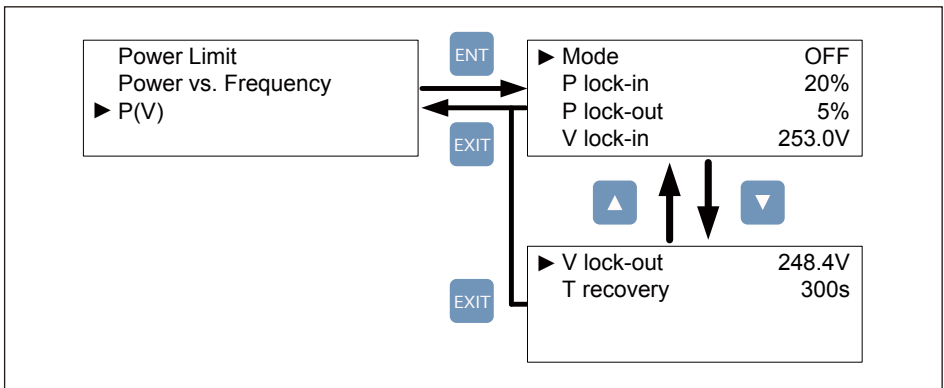


Figure 4-23 : P(V) page

### 4.2.8.4 Constant cosphi

Inverter can feed in a fixed reactive power to grid. Users can set the power factor(cosphi) in Constant cosphi page.

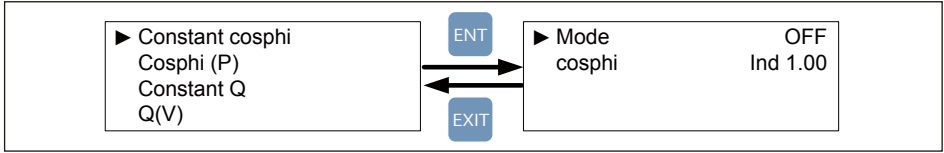


Figure 4-24 : Constant cosphi page

### 4.2.8.5 Cosphi (P)

Cosphi (P) is a function that inverter will feed in reactive power when its output active power reach the setting values. For country Italy MV and Italy LV, users can set lock-in voltage and lock-out voltage to assign the operation interval. When grid voltage reach the lock-in voltage(V lock-in), inverter will enable cosphi (P) function automatically and disabled it when grid voltage reach lock-out voltage(V lock-out).

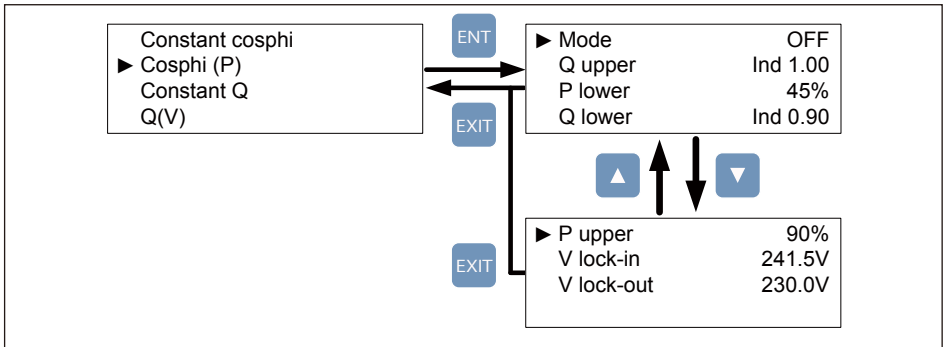


Figure 4-25 : Cosphi (P) page

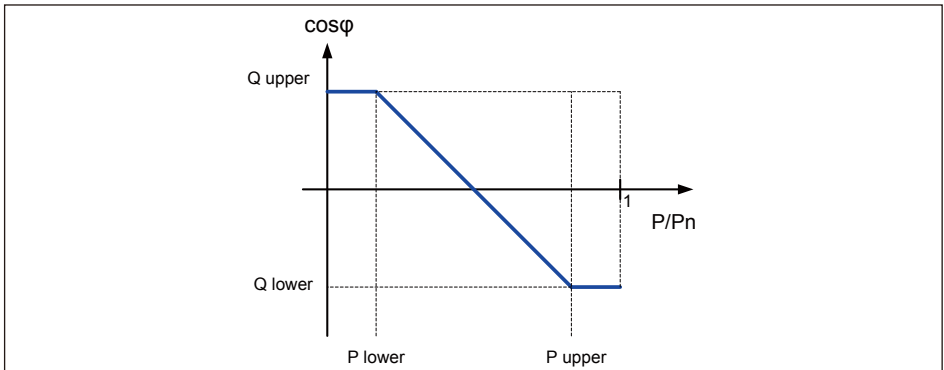


Figure 4-26 : Cosphi (P) curve



### 4.2.8.6 Constant Q

Like Constant cosphi function, users can assign a percentage of reactive power in Constant Q page.

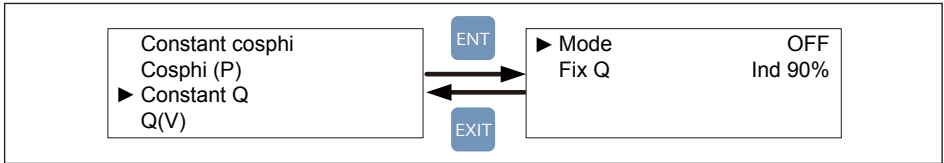


Figure 4-27 : Constant Q parameters

### 4.2.8.7 Q(V)

Q(V) is a control mode that inverter will provide reactive power according to grid voltage. For country Italy MV and Italy LV, users can set lock-in power and lock-out power to assign Q(V) function operation interval.

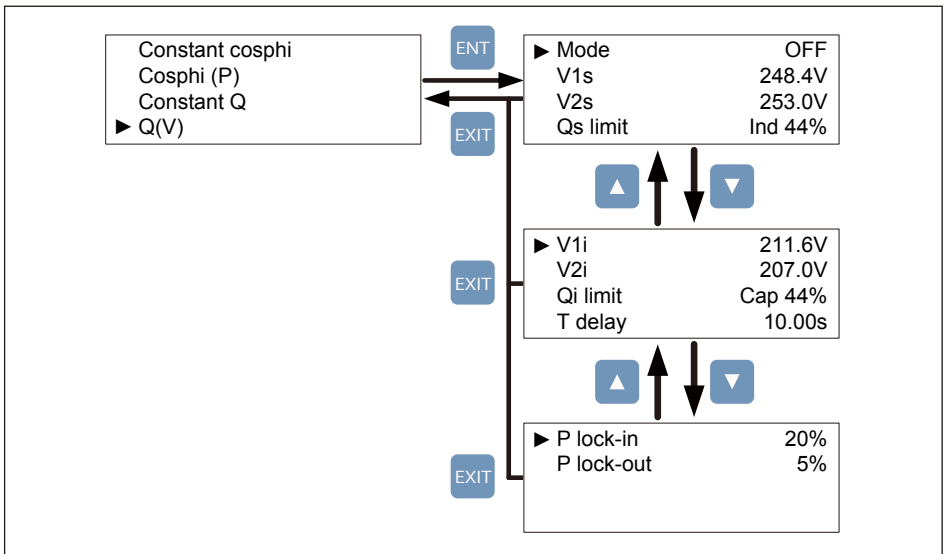


Figure 4-28 : Q(V) page

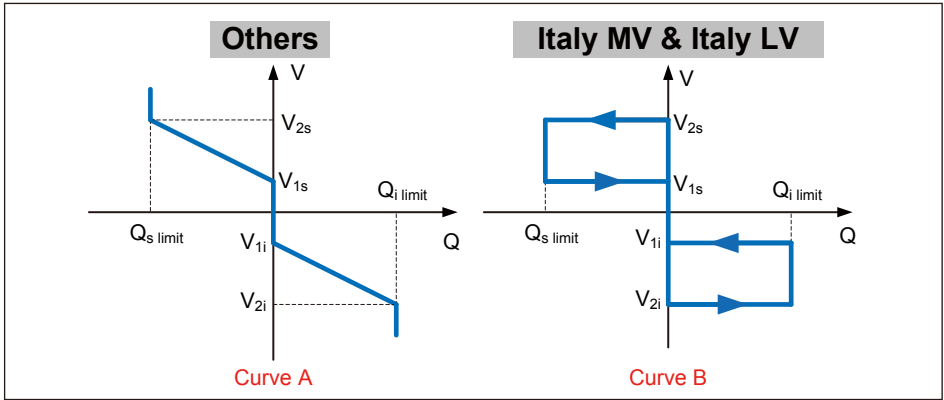


Figure 4-29 : Q(V) parameters

### 4.2.9 FRT (Fault ride through)

Some area requests that inverter should keep connected to grid when grid voltage drops suddenly in few seconds. In these areas, users can enable FRT function and adjust the parameters to meet the requirement.

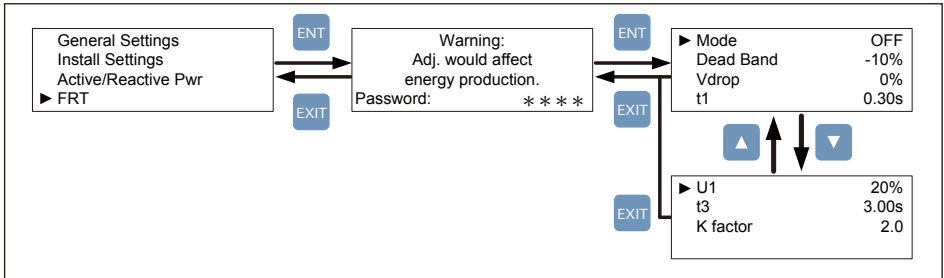


Figure 4-30 : FRT page

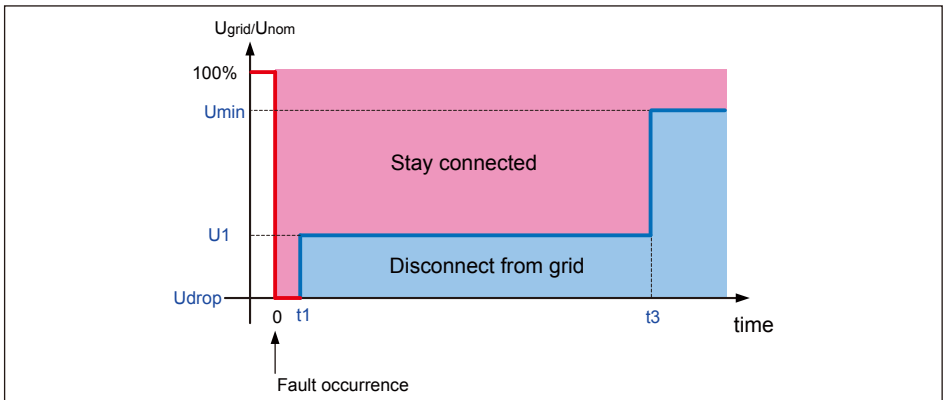


Figure 4-31 : FRT Parameters

## 5 Maintenance

Please check the unit regularly. If there are any impaired or loose parts, please contact your solar installer. Ensure that there are no foreign objects in the path of the heat outlet.

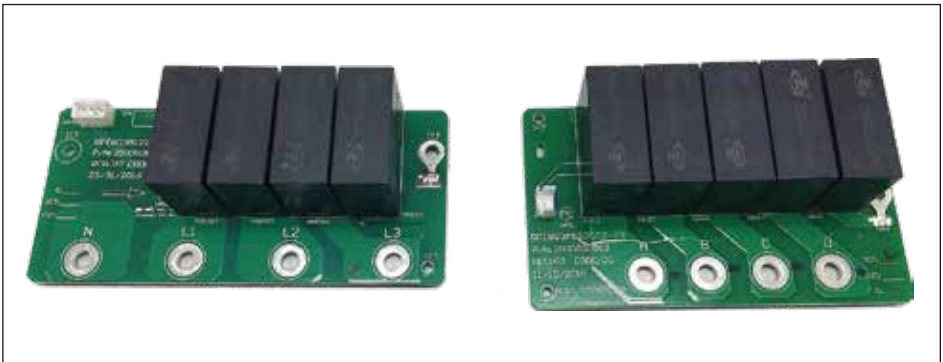
### WARNING !



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

### 5.1 Replace Surge Protection Device (SPD)

M88 series models have the surge protection device (SPD) at both AC and DC side as shown in **Figure 5-1**. **Table 5-1** summarizes the specifications of AC and DC SPD.



**Figure 5-1 : AC and DC SPD**

#### Specification of SPD

Work voltage : 895V (AC RMS value)

1175V (DC)

Work Amp In (8/20 $\mu$ s) : 10kA

Rate Amp I max (8/20 $\mu$ s) : 20kA

Temperature : -40 $^{\circ}$ C~85 $^{\circ}$ C

Manufacturers :

Sichuan Zhongguang Lightning Protection Technologies Co., Ltd

**Table 5-1 : SPD Specifications**

The surge protection devices (SPD), located on both AC and DC input terminals, are designed to protect sensitive circuit elements of the inverter from damage caused by lightning and electrical transient surges. If you find a warning message “AC Surge” or “DC Surge” shown on display panel, please follow the steps below to replace the SPD.

1. Switch AC and DC power off and wait until LCD display turn off.
2. Loosen the 4 screws on the front cover of wiring box compartment.  
You will see AC and DC SPD as indicated in the figure. (**Figure 5-2**)
3. Find out which SPD unit was damaged.  
For AC SPD, “AC Surge” with show on the corner of the LCD panel. (**Figure 5-3**)  
For DC SPD, “DC Surge” with show on the corner of the LCD panel.
4. Pull out the connector (white; 3 pins at AC side; 2 pins at DC side) and replace a whole new SPD PCB. (**Figure 5-4**)
5. Reassemble the inverter. Please be careful of the waterproof seal.

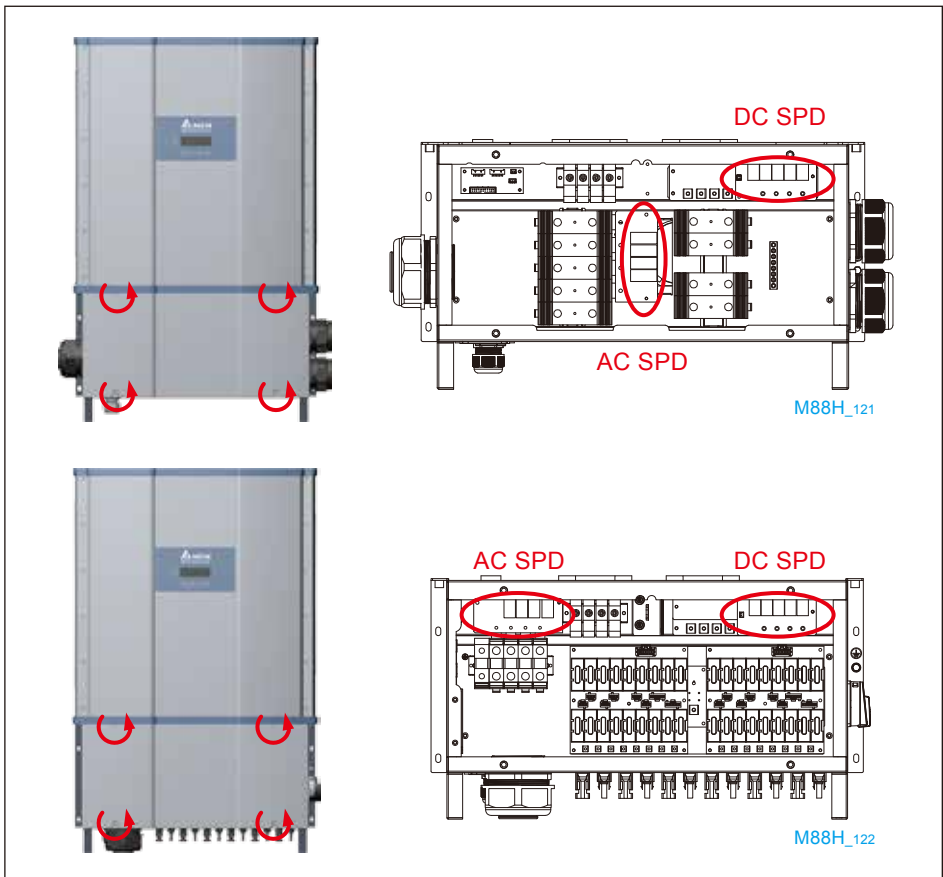
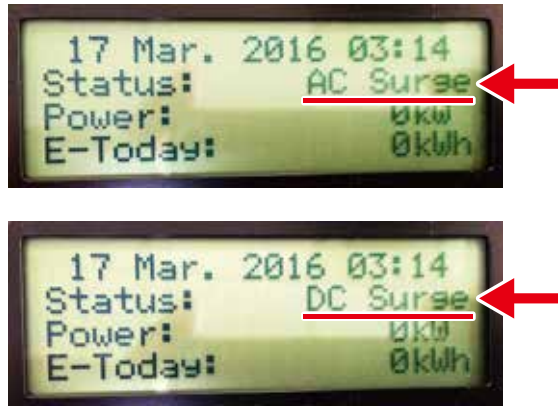


Figure 5-2 : Remove front cover of wiring box compartment



*Figure 5-3 : The alarms indicate AC and DC SPD Fail*

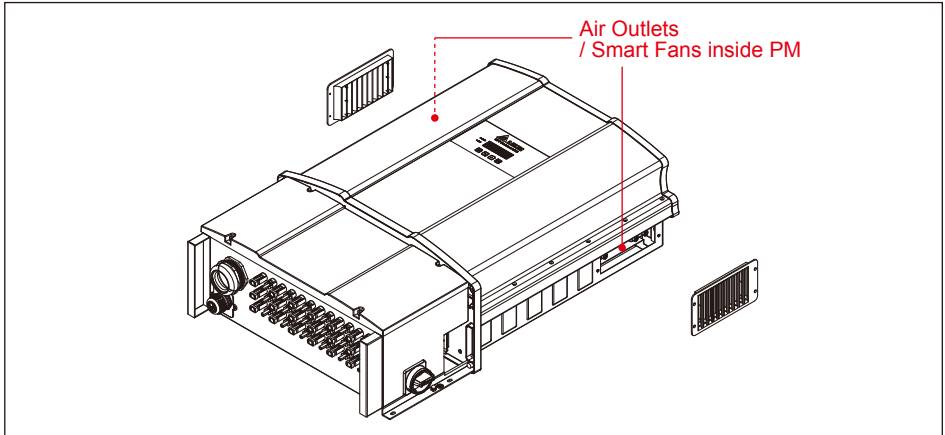


*Figure 5-4 : Pull out the connectors and remove the screws as shown in arrows*

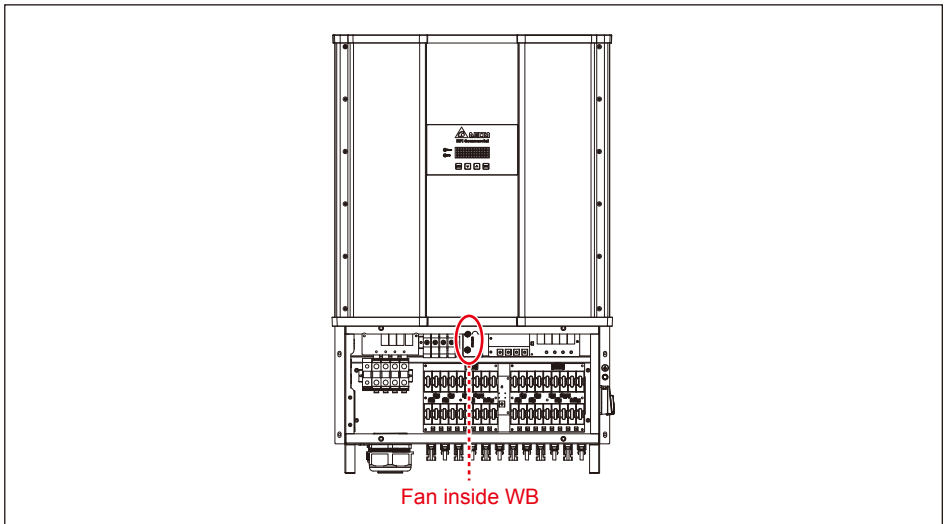
## 5.2 Smart Fans Replacement and Filters Cleaning

This section provides the instructions for smart fans replacement and filters cleaning for M88 series models. **Figure 5-5, 5-6, 5-7** illustrates the locations of smart fans.

M88 series models have smart fans that can be categorized into two parts: Wiring Box compartment (WB) and Power Module compartment (PM) as shown in the overview picture (**Figure 5-5**). The following procedure depicts the steps to clean the filters.

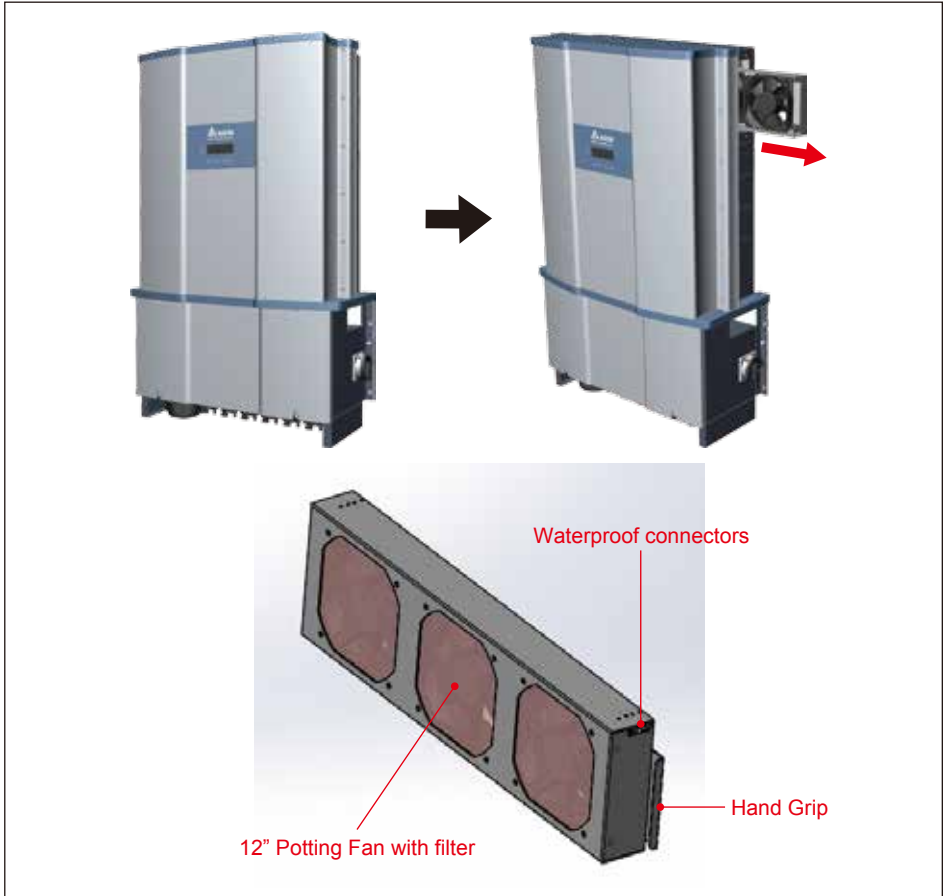


**Figure 5-5 : Smart fans location on Power Module compartment**



**Figure 5-6 : Smart fan location on WB (M88H\_122 only)**

The M88 series feature 12" potting fans with filter inside the power module compartment. The potting fans are designed long service life that provides high reliability. They feature detection of "FAN-FAIL" alarm as well as power de-rating behavior for safety operation. The Cooling Fan kit is easy to be removed and cleaned. As a result, the replacement of fans is also smart.



*Figure 5-7 : 12" Potting fan kit*

## ATTENTION



- The smart fans and filter cleaning depends on the quality of the environment.
- The smart fans and filter need to be cleaned every 6 months for their normal use, however,
- The smart fans and filter cleaning is required every 1 month or every quarter of the year, if necessary.

1. Wiring Box compartment (WB): User should disassemble the top 2 pcs screws (2 Black ones as shown in **Figure 5-8**) outside the fan cabinet and disconnect the connector (white one as shown in **Figure 5-8**) right in front of the fan cover. Then replace new fan and reassemble the 2 pcs screws and plug in the connector.



**Figure 5-8 : Disassembling fan inside the wiring box compartment (M88H\_122 only)**

2. Power Module compartment (PM):

**Figure 5-9** shows one side (the right-hand side) of the PM compartment only due to the symmetry of the air outlets. Therefore, the following **Figure 5-9** shows one side only.

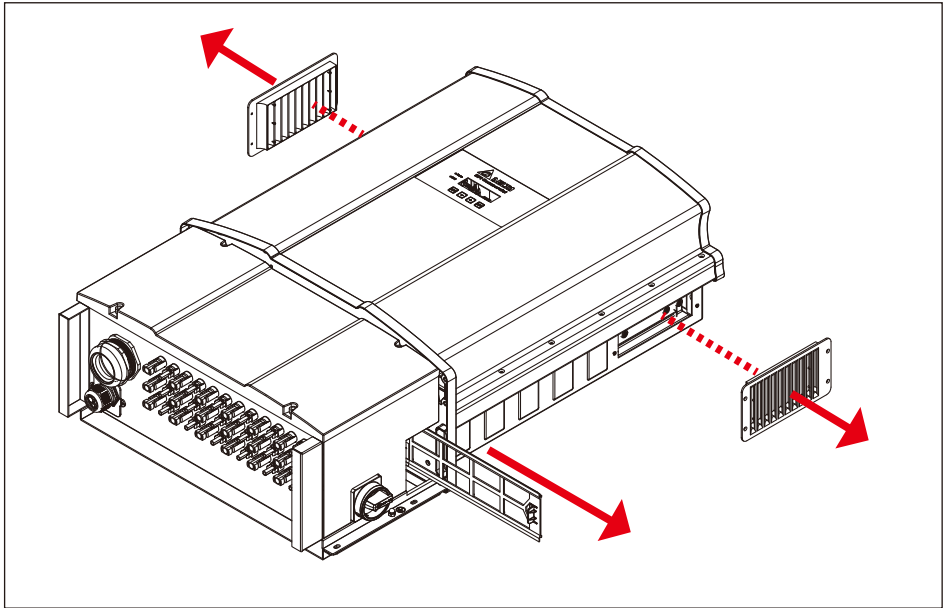
- (1) User should disassemble the 4 pcs screws on the air outlet filter panel.
- (2) Disconnect the connector (white as shown at the top left corner of second sub-picture) and unscrew the 4 pcs on this side and 4 pcs on the other side (total 8 screws) at the same time.
- (3) Make sure both the left 2 and right 2 screws are removed.
- (4) Pull out the drawer of the fans.
- (5) This sub-picture shows the overview of the smart fans.





**Figure 5-9 : Disassembling fans inside the power module compartment (showing one side only)**

**Figure 5-10** illustrates filters location of M88 series models.



**Figure 5-10 : Removal of filters**

## 5.3 De-Commissioning

If it is necessary to put the device out of operation for maintenance and / or storage, please follow the instructions below.

### **DANGER : ELECTRICAL HARZARD!!**



To avoid any serious injuries, please follow the procedures:

- Switch off Manual Switch to shut down the inverter.
- Switch off AC circuit breaker to disconnect with electricity grid.
- Switch off the PV array switch to disconnect from the PV array.
- Use proper voltmeter to confirm that the AC and DC power are disconnected from the unit.
- Remove the AC terminal immediately to completely disconnect from electricity grid.
- Remove the DC terminals to disconnect from PV Array.
- Remove the communication module RS-485 connection from the computer.

### **CAUTION : HOT SURFACES, DO NOT TOUCH !**



- Please be careful of hot surfaces if the inverter is just shutting down.
- Do not perform any task until the product cool down sufficiently.

### **CAUTION : POSSIBLE INJURY !**



- The inverter weighs more than 80 kg (177 lb). The risk of injury may happen when the inverter is carried incorrectly or dropped during transported or when attaching or removing it from the wall mounting bracket.

### **ATTENTION**

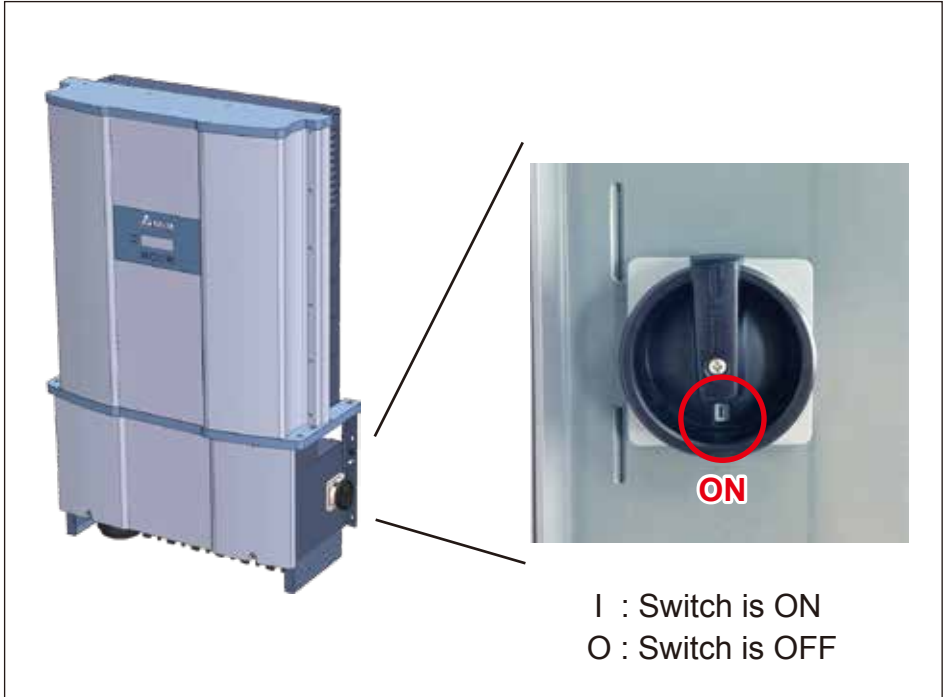


- Please be careful of the screws and nuts after removing them. Do not leave them at any corner inside the wiring box compartment.

### 5.3.1 Disassemble the Wiring box compartment

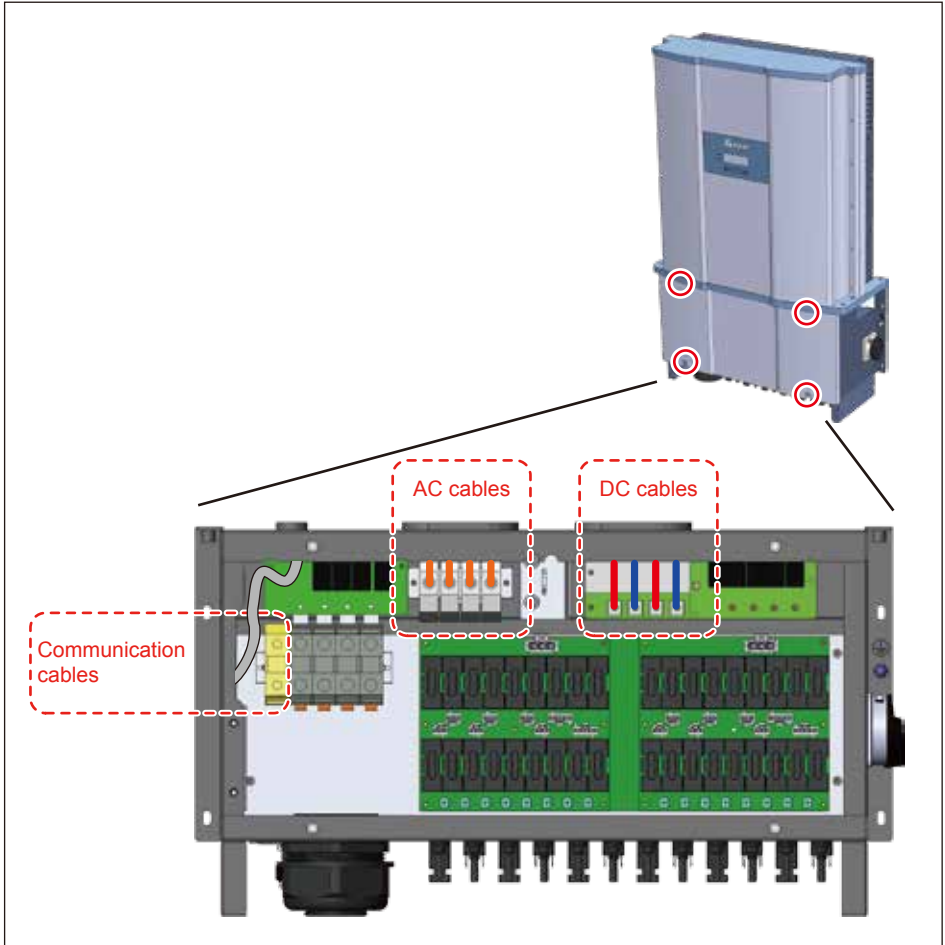
In order to disassemble the wiring box compartment (WB) if necessary, please follow the following instructions.

1. Please make sure turning off the external AC breaker and DC switches
2. Double-check the inverter is shutted down and there is no electrical hazard.
3. **Figure 5-11** shows the correct way to turn off the DC switches.



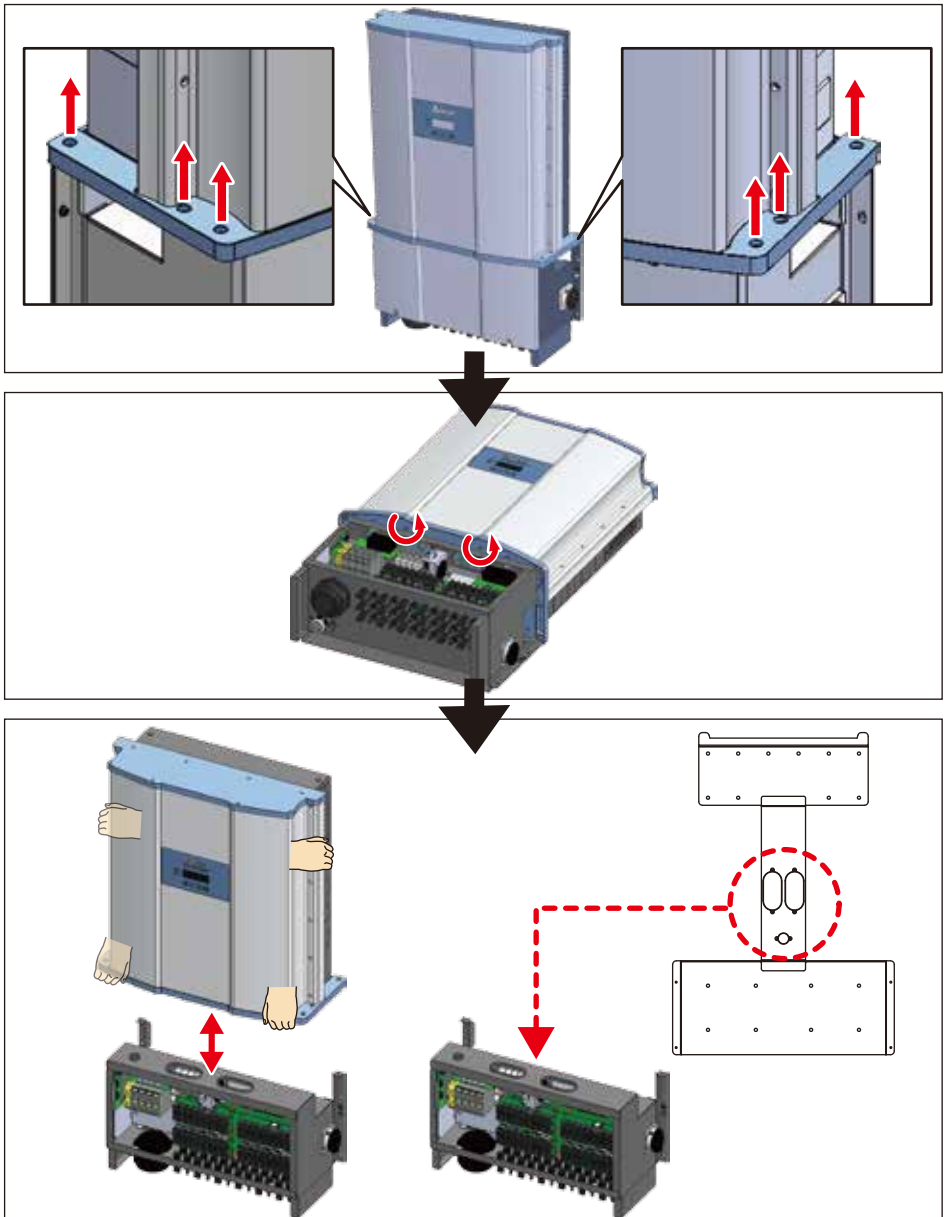
**Figure 5-11 : The ON/OFF positions of DC Switches (M88H\_122 only)**

- Please confirm both the AC and DC power is turned off.
4. Open the wiring box compartment lid.
  5. Then remove AC, DC, communication cables.
  6. Unscrew those screws shown in **Figure 5-12**.



**Figure 5-12 : Remove AC, DC, and communication cables and then unscrew 6 screws**

7. Unscrew 8 screws and use hands to grip tightly to separate the wiring box compartment from the power module compartment as shown in **Figure 5-13**.
8. Make sure the packing has been installed.



**Figure 5-13 : Remove 8 screws and then separate WB from PM**

## 6 Error message and Trouble Shooting

ERROR		
Message	Possible cause	Action
AC Freq High (E01)	<ol style="list-style-type: none"> <li>1. Actual utility frequency is over the OFR setting</li> <li>2. Incorrect Grid Code setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency</li> <li>2. Check Grid Code setting</li> <li>3. Contact our customer service for technical support</li> </ol>
AC Freq Low (E02)	<ol style="list-style-type: none"> <li>1. Actual utility frequency is under the UFR setting</li> <li>2. Incorrect Grid Code or Grid setting</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility frequency</li> <li>2. Check Grid Code &amp; Grid setting</li> <li>3. Contact our customer service for technical support</li> </ol>
Grid Quality (E07)	Non-linear load in Grid and near to inverter	Grid connection of inverter need to be far away from non-linear load if necessary
HW Con. Fail (E08)	<ol style="list-style-type: none"> <li>1. Wrong connection in AC terminal</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the AC connection in accordance with the user manual</li> <li>2. Contact our customer service for technical support</li> </ol>
No Grid (E09)	<ol style="list-style-type: none"> <li>1. AC breaker is OFF</li> <li>2. Disconnect in AC terminal</li> </ol>	<ol style="list-style-type: none"> <li>1. Switch on AC breaker</li> <li>2. Check the connection in AC terminal and make sure it connects to inverter</li> </ol>
AC Volt Low (E10, E15, E20)	<ol style="list-style-type: none"> <li>1. Actual utility voltage is under the UVR setting</li> <li>2. Incorrect Grid Code or Grid setting</li> <li>3. Wrong connections in AC terminal</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility voltage within the suitable range</li> <li>2. Check Grid Code &amp; Grid setting</li> <li>3. Check the connection in AC terminal</li> </ol>
AC Volt High (E11, E13, E16, E18, E21, E23)	<ol style="list-style-type: none"> <li>1. Actual utility voltage is over the OVR setting</li> <li>2. Utility voltage is over the Slow OVR setting during operation</li> <li>3. Incorrect Grid Code or Grid setting</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility voltage within the suitable range</li> <li>2. Check Grid Code &amp; Grid setting</li> <li>3. Contact our customer service for technical support</li> </ol>
Solar1 High (E30)	<ol style="list-style-type: none"> <li>1. Actual Solar1 voltage is over 1000Vdc</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Modify the solar array setting, and make the Voc less than 1000Vdc</li> <li>2. Contact our customer service for technical support</li> </ol>
Solar2 High (E31)	<ol style="list-style-type: none"> <li>1. Actual Solar2 voltage is over 1000Vdc</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Modify the solar array setting, and make the Voc less than 1000Vdc</li> <li>2. Contact our customer service for technical support</li> </ol>
Insulation (E34)	<ol style="list-style-type: none"> <li>1. PV array insulation fault</li> <li>2. Large PV array capacitance between Plus to Ground or Minus to Ground or both.</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the insulation of Solar inputs</li> <li>2. Check the capacitance, dry PV panel if necessary</li> <li>3. Contact our customer service for technical support</li> </ol>

Table 6-1 : Error Message

Warning		
Message	Possible cause	Action
Solar1 Low (W01)	<ol style="list-style-type: none"> <li>1. Actual Solar1 voltage is under the limit</li> <li>2. Some devices were damaged inside the inverter if the actual Solar1 voltage is close to "0"</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the Solar1 voltage connection to the inverter terminal</li> <li>2. Check all switching devices in boost1</li> <li>3. Contact our customer service for technical support</li> </ol>
Solar2 Low (W02)	<ol style="list-style-type: none"> <li>1. Actual Solar2 voltage is under the limit</li> <li>2. Some devices were damaged inside the inverter if the actual Solar2 voltage is close to "0"</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the Solar2 voltage connection to the inverter terminal</li> <li>2. Check all switching devices in boost2</li> <li>3. Contact our customer service for technical support</li> </ol>
De-rating (W07)	<ol style="list-style-type: none"> <li>1. Over temperature</li> <li>2. Fan fail</li> <li>3. Power Limit function</li> <li>4. Power vs. Frequency function</li> <li>5. P(V) function</li> <li>6. Grid Voltage low</li> <li>7. Solar Voltage low</li> <li>8. Solar Voltage High</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the installation ambient and environment</li> <li>2. Check the fan(s)</li> <li>3. Check Grid Code &amp; Grid setting</li> <li>4. Check the utility frequency on the inverter terminal</li> <li>5. Check the utility voltage on the inverter terminal</li> <li>6-1. Check the utility voltage on the inverter terminal</li> <li>6-2. Check reactive power setting</li> <li>7. Check the Solar voltage on the inverter terminal</li> <li>8. Check the Solar voltage on the inverter terminal</li> </ol>
HW FAN (W11)	<ol style="list-style-type: none"> <li>1. One or more fans are locked</li> <li>2. One or more fans are defective</li> <li>3. One ore more fans are disconnected</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove the object that stuck in the fan(s)</li> <li>2. Replace the defective fan(s)</li> <li>3. Check the connections of all fans</li> <li>4. Contact our customer service for technical support</li> </ol>
AC Surge DC Surge	<ol style="list-style-type: none"> <li>1. Inverter was struck by lightning.</li> <li>2. One or more SPD are defective</li> <li>3. One or more SPD are disconnected</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check inverter's status</li> <li>2. Replace the defective SPD</li> <li>3. Check the connections of SPDs</li> <li>4. Contact our customer service for technical support</li> </ol>

Table 6-2 : Warning Message



FAULT		
Message	Possible cause	Action
DC Injection (F01, F02, F03)	<ol style="list-style-type: none"> <li>Utility waveform is abnormal</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary</li> <li>Contact our customer service for technical support</li> </ol>
Temperature (F05)	<ol style="list-style-type: none"> <li>The ambient is over 60°C (The installation is abnormal)</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Contact our customer service for technical support</li> </ol>
Temperature (F07)	<ol style="list-style-type: none"> <li>Ambient temperature is &lt;-30 °C</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Contact our customer service for technical support</li> </ol>
HW NTC1 Fail (F06)	<ol style="list-style-type: none"> <li>Ambient temperature &gt;90 °C or &lt;-30 °C</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Contact our customer service for technical support</li> </ol>
HW NTC2 Fail (F08)	<ol style="list-style-type: none"> <li>Ambient temperature &gt;90 °C or &lt;-30 °C</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Please contact our customer service</li> </ol>
HW NTC3 Fail (F09)	<ol style="list-style-type: none"> <li>Ambient temperature &gt;90 °C or &lt;-30 °C</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Contact our customer service for technical support</li> </ol>
HW NTC4 Fail (F10)	<ol style="list-style-type: none"> <li>Ambient temperature &gt;90 °C or &lt;-30 °C</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the installation ambient and environment</li> <li>Contact our customer service for technical support</li> </ol>
HW RLY (F13)	<ol style="list-style-type: none"> <li>Driver circuit for relay is defective</li> <li>Relay(s) is defective</li> <li>Detection circuit malfunction (Inverter voltage)</li> </ol>	<ol style="list-style-type: none"> <li>Check the input voltage, must &gt;150Vdc</li> <li>Replace the defective relay</li> <li>Contact our customer service for technical support</li> </ol>
HW DSP ADC1 (F15)	<ol style="list-style-type: none"> <li>Insufficient input power</li> <li>Auxiliary power circuitry malfunction</li> <li>Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>Check the input voltage, must &gt;150Vdc</li> <li>Check the auxiliary circuitry inside the inverter</li> <li>Contact our customer service for technical support</li> </ol>

FAULT		
Message	Possible cause	Action
HW DSP ADC2 (F16)	<ol style="list-style-type: none"> <li>1. Insufficient input power</li> <li>2. Auxiliary power circuitry malfunction</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the input voltage, must &gt;150Vdc</li> <li>2. Check the auxiliary circuitry inside the inverter</li> <li>3. Contact our customer service for technical support</li> </ol>
HW DSP ADC3 (F17)	<ol style="list-style-type: none"> <li>1. Insufficient input power</li> <li>2. Auxiliary power circuitry malfunction</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the input voltage, must &gt;150Vdc</li> <li>2. Check the auxiliary circuitry inside the inverter</li> <li>3. Contact our customer service for technical support</li> </ol>
HW Red ADC1 (F18)	<ol style="list-style-type: none"> <li>1. Insufficient input power</li> <li>2. Auxiliary power circuitry malfunction</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the input voltage, must &gt;150Vdc</li> <li>2. Check the auxiliary circuitry inside the inverter</li> <li>3. Contact our customer service for technical support</li> </ol>
HW Red ADC2 (F19)	<ol style="list-style-type: none"> <li>1. Insufficient input power</li> <li>2. Auxiliary power circuitry malfunction</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the input voltage, must &gt;150Vdc</li> <li>2. Check the auxiliary circuitry inside the inverter</li> <li>3. Contact our customer service for technical support</li> </ol>
HW Eff. (F20)	<ol style="list-style-type: none"> <li>1. The calibration is incorrect</li> <li>2. Current feedback circuit is defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the accuracy of current and power</li> <li>2. Check the current feedback circuit inside the inverter</li> </ol>
HW COMM1 (F23)	<ol style="list-style-type: none"> <li>1. DSP is idling</li> <li>2. The communication connection is disconnected</li> <li>3. The communication circuit is malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact our customer service for technical support</li> <li>2. Check the connection interface RS-485</li> <li>3. Check the communication card</li> </ol>
HW COMM2 (F22)	<ol style="list-style-type: none"> <li>1. Red. CPU is idling</li> <li>2. The internal communication connection is disconnected</li> </ol>	Contact our customer service for technical support
Ground Cur. (F24)	<ol style="list-style-type: none"> <li>1. PV array insulation fault</li> <li>2. Large PV array capacitance between Plus to Ground or Minus to Ground</li> <li>3. Either side of boost driver or boost choke malfunction</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the insulation of Solar inputs</li> <li>2. Check the capacitance (+ &lt;-&gt; GND &amp; - &lt;-&gt; GND), must &lt; 2.5uF. Install a external transformer if necessary</li> <li>3. Contact our customer service for technical support</li> </ol>

FAULT		
Message	Possible cause	Action
HW Con. Fail (F26)	<ol style="list-style-type: none"> <li>1. Power line is disconnected inside the inverter</li> <li>2. Current feedback circuit is defective</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the power lines inside the inverter</li> <li>2. Contact our customer service for technical support</li> </ol>
RCMU Fail (F27)	<ol style="list-style-type: none"> <li>1. RCMU is disconnected</li> <li>2. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the RCMU connection inside the inverter</li> <li>2. Contact our customer service for technical support</li> </ol>
RLY Short (F28)	<ol style="list-style-type: none"> <li>1. One or more relays are sticking</li> <li>2. The driver circuit for the relay malfunction</li> </ol>	Contact our customer service for technical support
RLY Open (F29)	<ol style="list-style-type: none"> <li>1. One or more relays are abnormal</li> <li>2. The driver circuit for the relay malfunction</li> <li>3. The detection accuracy is not correct for Vgrid and Vout</li> </ol>	Contact our customer service for technical support
Bus Unbal. (F30)	<ol style="list-style-type: none"> <li>1. Not totally independent or parallel between inputs</li> <li>2. PV Array short to Ground</li> <li>3. Driver for boost is defective or disconnected</li> <li>4. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the inputs connections</li> <li>2. Check the PV Array insulation</li> <li>3. Contact our customer service for technical support</li> </ol>
HW Bus OVR (F31, F33, F35)	<ol style="list-style-type: none"> <li>1. Driver for boost is defective</li> <li>2. Voc of PV array is over 1000Vdc</li> <li>3. Surge occurs during operation</li> <li>4. Detection circuit malfunction</li> </ol>	Contact our customer service for technical support
AC Cur. High (F36, F37, F38, F39, F40, F41)	<ol style="list-style-type: none"> <li>1. Surge occurs during operation</li> <li>2. Driver for inverter stage is defective</li> <li>3. Switching device is defective</li> <li>4. Detection circuit malfunction</li> </ol>	Contact our customer service for technical support
HW CT A Fail (F42)	<ol style="list-style-type: none"> <li>1. Test current loop is broken</li> <li>2. CTP3 is defective</li> <li>3. Detection circuit malfunction</li> </ol>	Contact our customer service for technical support

FAULT		
Message	Possible cause	Action
HW CT B Fail (F43)	<ol style="list-style-type: none"> <li>1. Test current loop is broken</li> <li>2. CTP4 is defective</li> <li>3. Detection circuit malfunction</li> </ol>	Contact our customer service for technical support
HW CT C Fail (F44)	<ol style="list-style-type: none"> <li>1. Test current loop is broken</li> <li>2. CTP5 is defective</li> <li>3. Detection circuit malfunction</li> </ol>	Contact our customer service for technical support
HW AC OCR (F45)	<ol style="list-style-type: none"> <li>1. Large Grid harmonics</li> <li>2. Switching device is defective</li> <li>3. Detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary</li> <li>2. Check all switching devices in inverter stage</li> <li>3. Contact our customer service for technical support</li> </ol>
HW ZC Fail (F50)	The detection circuit for synchronal signal malfunction	Check the detection circuit for synchronal signal inside the inverter
AFCI Circuit Fail (F58)	<ol style="list-style-type: none"> <li>1. AFCI is not installed.</li> <li>2. AFCI self-test is fail.</li> </ol>	Check the AFCI detection circuit board for making sure it is conneted correctly
AFCI Fault (F59)	The inverter detects Arcing occurs.	Check cables for replacement
DC Cur. High (F60, F61, F70, F71)	<ol style="list-style-type: none"> <li>1. Switching device in boost is defective</li> <li>2. Driver for boost is defective</li> <li>3. Input current detection circuit malfunction</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all switching device in boost</li> <li>2. Check the driver circuit for boost inside the inverter</li> <li>3. Check input current detection circuit</li> </ol>
HW DC RLY (F76)	One or more DC relays are abnormal	Please contact our customer service for technical support

Table 6-3 : Fault Message

## 7 Technical Data

Model	M88H_121	M88H_122
DC Input		
Max. input power	Vac230/400V : 76kW Vac277/480V : 91kW	
Recommended PV power	Vac230/400V : 90kW Vac277/480V : 110kW	
Occasionally maximum voltage	1100 V *	
Operating voltage range	200 - 1000 V	
Start voltage	> 250 V	
MPP voltage, rated power	Vac230/400V : 500-800V Vac277/480V : 600-800V	
Rated voltage	Vac230/400V : 600V Vac277/480V : 710V	
MPP tracker	2	
Max. input current / Each MPPT	140 / 70A	
Max. Isc / Each MPPT	180 / 90A	
Connection type	Terminal block for 2 MPPTs	18 pairs of MC4 connector
Type II SPD	●	●
15A string fuses	—	●
DC switch	—	●
AC Output		
Max. output power	Vac230/400V : 73kW Vac277/480V : 88kW	
Max. output current	106A	
Inrush current	40A / 100μs	
Maximum output fault current (rms)	115.4A (rms)	
Maximum output over current protection	125A	
Rated voltage	3Ph, 230/400 & 277/480Vac	
Operating voltage range	Vac230/400V : ±30% Vac277/480V : ±20%	
Operating frequency range	50/60Hz ± 5Hz	
Power factor	1 at rated power, 0.8 ind ~ 0.8 cap adjustable	
Protection	Type II SPD	
THD	< 3%	
Connection type	50 ~120 mm <sup>2</sup>	35 ~95 mm <sup>2</sup>
Night time consumption	< 3 W	

\* The max withstand voltage is 1100Vdc. (the inverter stops to operate when the PV voltage is over 1000Vdc)  
 About 1000Vdc above application, please refer to appendix.

● : Available  
 — : Not Available

Model	M88H_121	M88H_122
<b>Efficiency</b>		
Peak Efficiency	98.8 %	
Euro Efficiency	98.5 %	
<b>Information</b>		
Communication port	RS-485	
Display	20 x 4 LCD	
<b>Regulation</b>		
	IEC 62109-1/-2 VDE-AR-N 4105 EN 61000-6-1 EN 61000-6-2 EN 61000-6-3 EN 61000-6-4 CE compliance	
<b>General Data</b>		
Operating temp. range	-25~60°C (Max power: -25~35°C)	
Protection Level	IP65	
Operating elevation	< 3000 m	
Cooling	Forced air cooling plus Smart Fans control	
Dimension (W x H x D) (mm)	615 x 962 x 275	
Weight (kg)	84	
Noise (1m)	75.8 dB	
Overvoltage category	AC output :III, DC Input :II	
Maximum backfeed current to the array	0	
Protective Class	I	
Pollution Degree	3	
Humidity range	4-100%	

Table 7-1 : Specifications for M88H



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## 三相并网型逆变器

M88H  
操作手冊

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# 1 安全规范

## 1.1 逆变器资料

### 1.1.1 免责声明

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- ( a ) 产品没有恰当的安装或维修
- ( b ) 产品未依照说明书正确使用
- ( c ) 产品于拆装过程受损

### 1.1.2 适用对象

本说明书适用于针对安装、试运行、实际操作、后续维护受过良好训练的人以下基础及进阶技巧为必需的。

- 了解基础电力、配线、电子元件及电子电路符号
- 了解太阳能逆变器如何运行及操作
- 针对电子产品的安装及试运行受过训练
- 针对安装及使用电子产品的过程中会遇到的危险及风险受过训练
- 遵守本说明书及所有安全规范

开始接触此产品前，请详阅本说明书。

## 1.2 安全概述

### 重要安全指示：保存所有指示！



- 请详阅所有指示及保存供后续使用。

为了避免人员受伤或其他损失及确保逆变器长期运转，在使用此产品前请务必详阅所有安全指示。

本说明书针对Delta并网型无变压器太阳能逆变器提供重要指示。本产品进行设计、测试、验证且经国际安全规范认证，但安装及使用本产品前仍须做好防范措施。

### 注意：无电气隔离



- 本产品无附加变压器，为非电气隔离型。
- 市电端与逆变器间需加入外部变压器。
- 请勿使用需接地(正极或负极)之太阳能板。
- 若使用了，则本产品会以INSULATION (E34) 告警。
- L1, L2, L3, 及 N 禁止连接至地。

### 1.2.1 使用条件

M88H为双MPP追踪、无变压器太阳能逆变器，能将太阳能串列的变动电流转换成与市电频率相同之三相交流能量并馈入市电。

所使用之太阳能模组需与逆变器匹配。

太阳能面板之对地电容不可超过 8 $\mu$ F。

本产品仅可在经Delta及市电业者许可之国家运行。

## 1.2.2 标志

本节说明本说明书会出现的标志定义，为了避免人员受伤或其他损失及确保逆变器长期运转，在使用此产品前请务必详阅所有安全指示并遵守。

### 危险！



- 此警语表示可能发生致死或严重伤亡的情形。

### 警告！



- 此警语表示可能发生致死或严重伤亡的情形。

### 注意！



- 此警语表示可能发生较轻微伤害的情形。

### 注意



- 此警语表示可能对资产或环境造成伤害。



## 资讯



- 进一步的资讯会经由双圈惊叹号指示。  
这代表接续的内容将含有使用者该遵守的重要资讯以免造成任何伤害。

## 危险：触电！！



- 此警语表示可能会有造成严重伤亡的触电可能。

## 注意：表面高温，请勿触碰！



- 此警语表示当逆变器运行时机体表面高温，  
待表面温度下降後在進行需接觸的工作。



- 等待图示中所显示的时间后再进行工作



- 设备接地导体

## 2 产品介绍

M88H以最先进之高频切换及低EMI技术设计而成，同时具有高效率及高寿命的特点，亦适用于户外。

### 注意：无电气隔离



- 本产品无附加变压器，为非电气隔离型。
- 市电端与逆变器间需加入外部变压器。
- 请勿使用需接地(正极或负极)之太阳能板。
- 若使用了，则本产品会以INSULATION (E34) 告警。
- L1、L2、L3 及 N 禁止连接至地。

### 2.1 适用机种

本说明书适用以下机种：

- M88H\_121
- M88H\_122

安装、运行及维护过程皆必须遵守本说明书。

M88H系列包含两机种如图2-2所示。Delta保留在不另行告知的前提下修改内容及技术资料的权力。

## 2.2 产品概述

M88H内容物如图2-1所示。

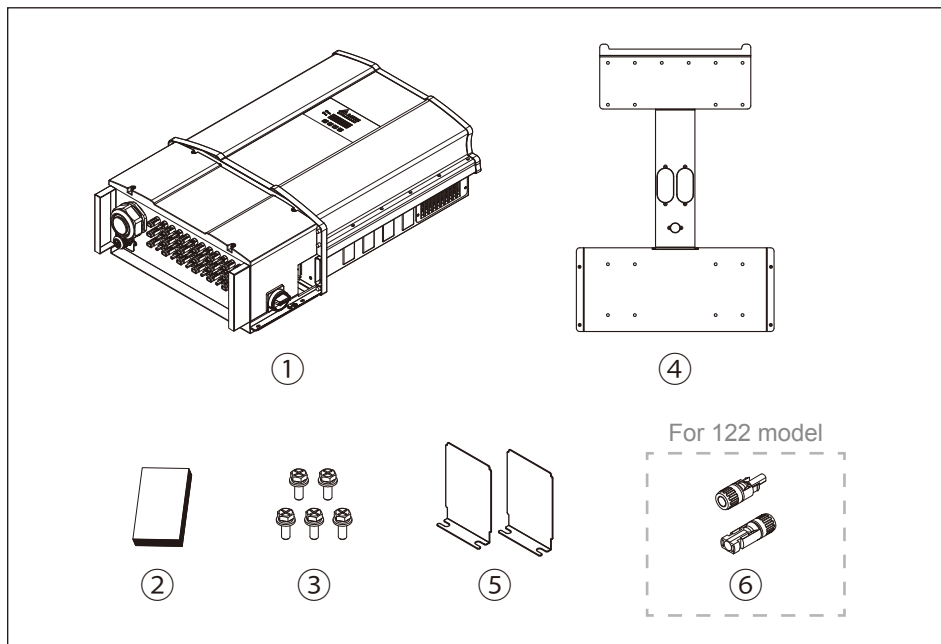


图2-1 : M88H内容物

M88H			
	物件	数量	描述
1	DELTA太阳能逆变器	1	太阳能逆变器
2	说明书	1	安装及维运过程中务必参考本说明书中的安全指示
3	螺丝	5	逆变器与壁挂架锁附螺丝
4	壁挂架	1	将逆变器挂起之壁挂架
5	遮蔽板	1对	滤网的遮蔽板 (非必要)
6	MC4端子	18对	组串输入接头 (仅122机种)

表2-1 : M88H内容清单

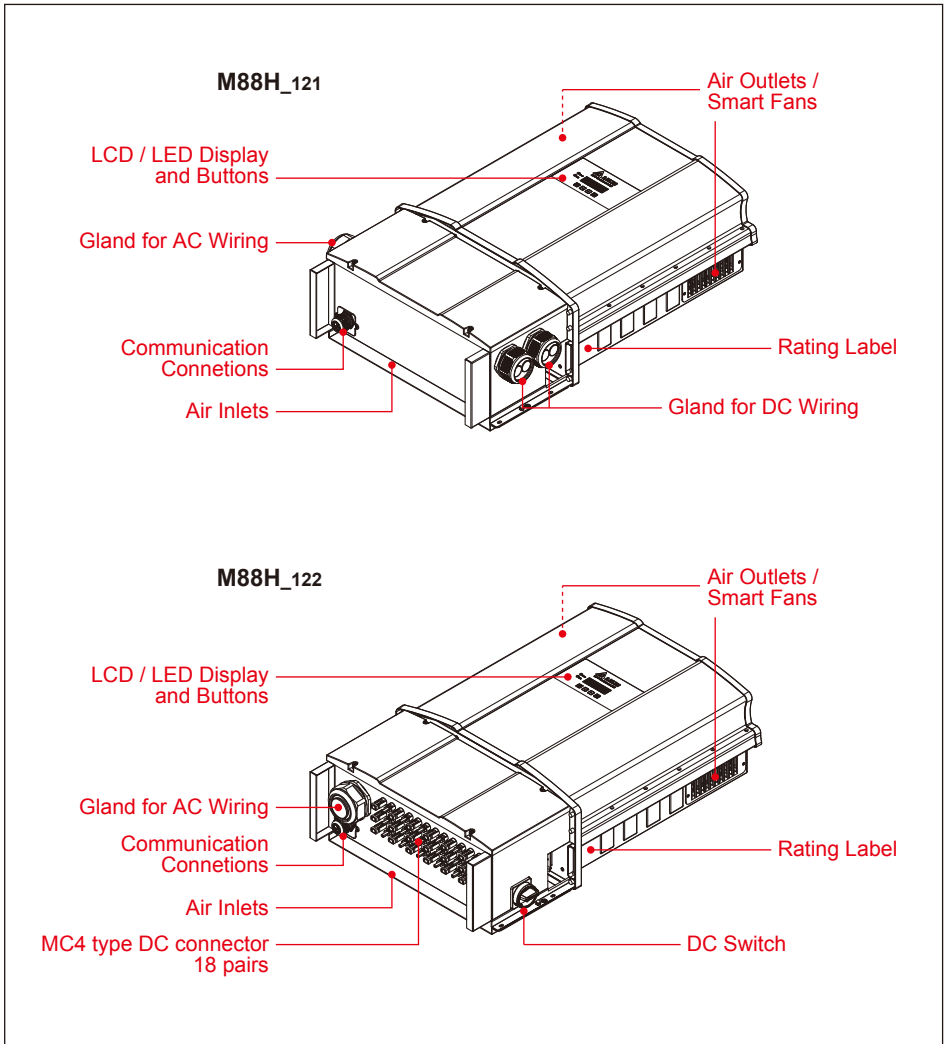


图2-2 : M88H外观介绍

图2-3为M88H产品标签并配合表2-2针对特殊符号做解释。图2-4为M88H配线箱的架构图详细描述可参照表2-3，其中包含输入输出端的突波吸收元件(SPD)、保险丝座、及通讯连接(RS-485)。



图2-3 : M88H标签

Symbol	Definition
	<b>严重触电危险</b> 逆变器运行时会有致命高压存在，切断后危险电压存在约100秒，时间内请勿接触逆变器。 本产品不含任何需要开启机壳之元件。擅自开启机壳会使保固失效。
	使用此逆变器前，请详阅说明书。
	此逆变器本身没有经由变压器与市电端分离。
	若当地规范要求，机体外壳请务必下地。
	请注意噪音防范。
	<b>WEEE marking</b> 本逆变器须以标准家用废弃物报废，并同时遵守当地针对电器报废的相关规范。

表2-2 : M88H标签内容描述

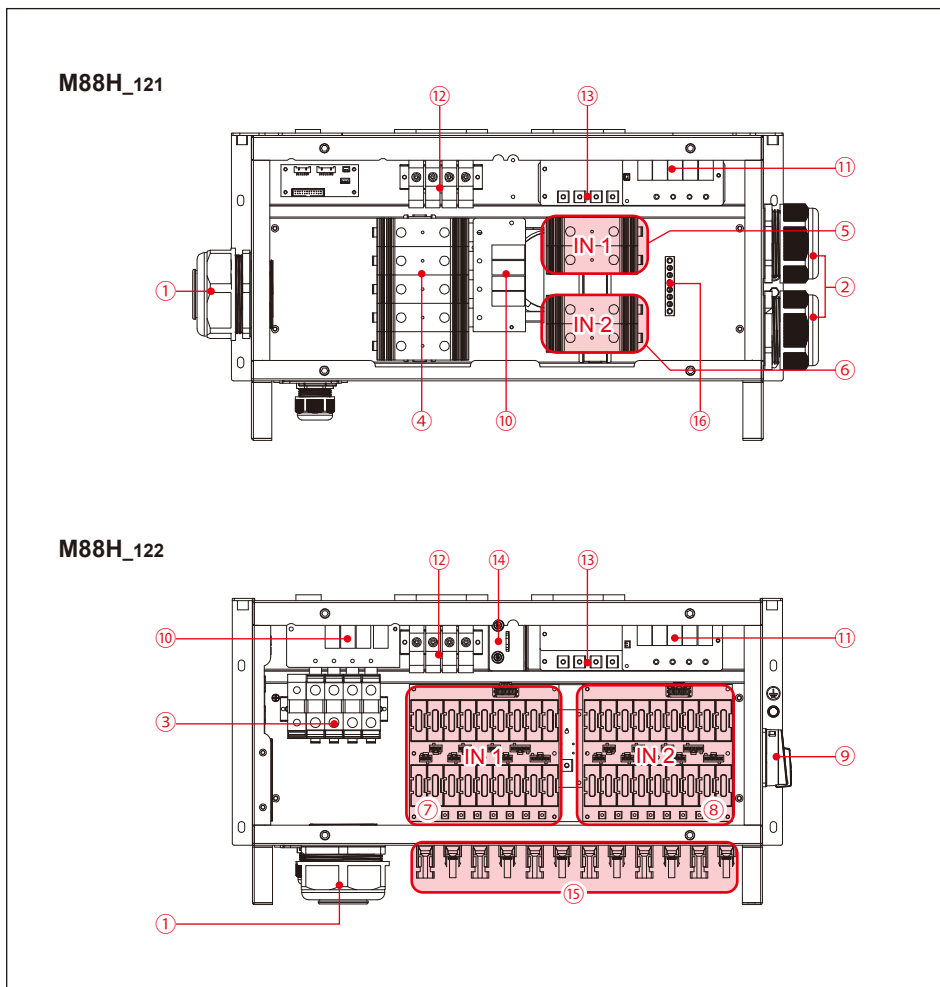


图2-4 : M88H配线箱架构图

NO.	Component	NO.	Component	NO.	Component
1	Cable gland for AC	7	Fuse holder type DC IN1	13	Internal DC terminal
2	Cable gland for DC	8	Fuse holder type DC IN2	14	Wiring box fan
3	95mm <sup>2</sup> AC terminal	9	DC switch	15	MC4 connector
4	120mm <sup>2</sup> AC terminal	10	Type II AC SPD	16	Grounding bar
5	120mm <sup>2</sup> DC terminal for IN 1	11	Type II DC SPD		
6	120mm <sup>2</sup> DC terminal for IN 2	12	Internal AC terminal		

表2-3 : M88H配线箱架构图内容描述

## 3 安装

### 注意！



- 本产品不建议安装在直接日照曝晒处。

### 警告！



- 请勿将本产品安装在易燃表面附近。
- 请将本产品安装于坚固且平顺之表面。

本章节包含以下指示

- 1.机构安装
- 2.电气安装
- 3.通讯安装

### 3.1 机构安装

本产品设计为壁挂型。请确保安装时，本产品与地面垂直且交直流配线处为接近地面端，请务必遵循图3-1至图3-7的安装指示，首先安装壁挂架于坚固表面，并将逆变器牢固地锁附于壁挂架上。

请参考以下步骤锁附逆变器至墙上。

- 1.至少使用8枚M8十字螺丝将壁挂架固定墙上，螺丝孔位置请遵从图3-1及3-2。
- 2.将逆变器挂至壁挂架上。
- 3.图3-1及3-2提供建议的螺丝孔位置。
- 4.图3-3至3-7描述正确的安装方式。
- 5.图3-7为正确锁附配线箱的方法。

### 注意！



- 至少使用8枚M8十字螺丝将壁挂架固定墙上。
- 该壁挂架为本产品专用，请勿使用其他壁挂架来搭配本产品使用。

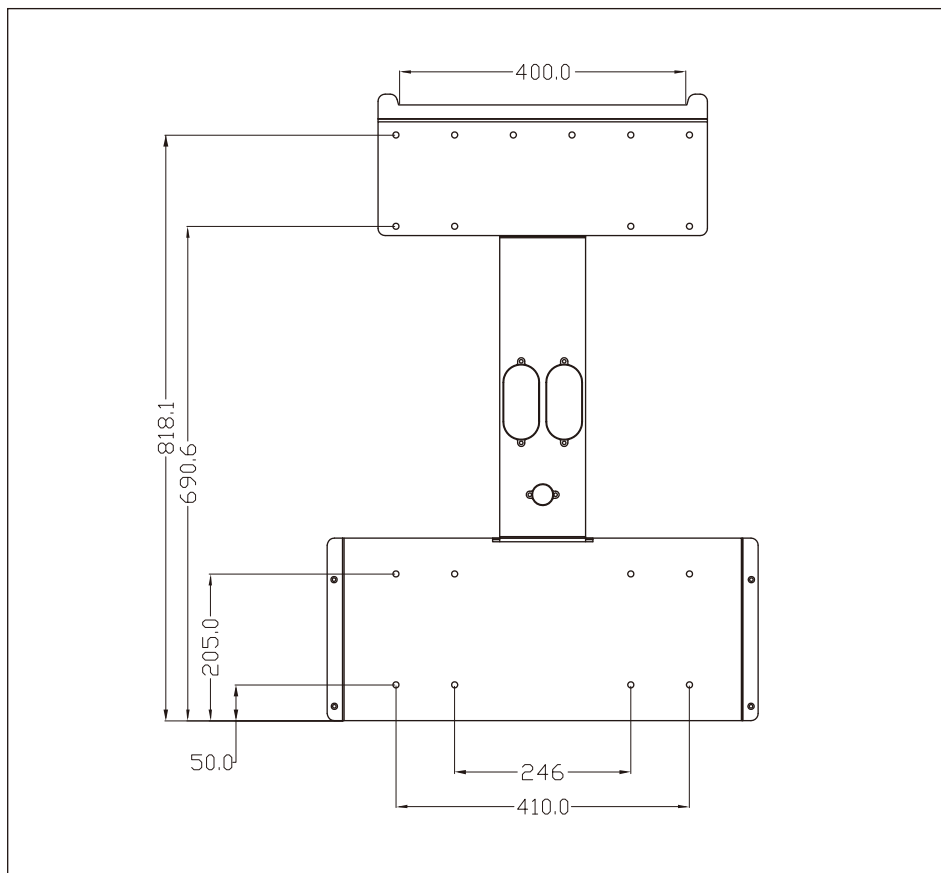


图3-1：壁挂架详细尺寸



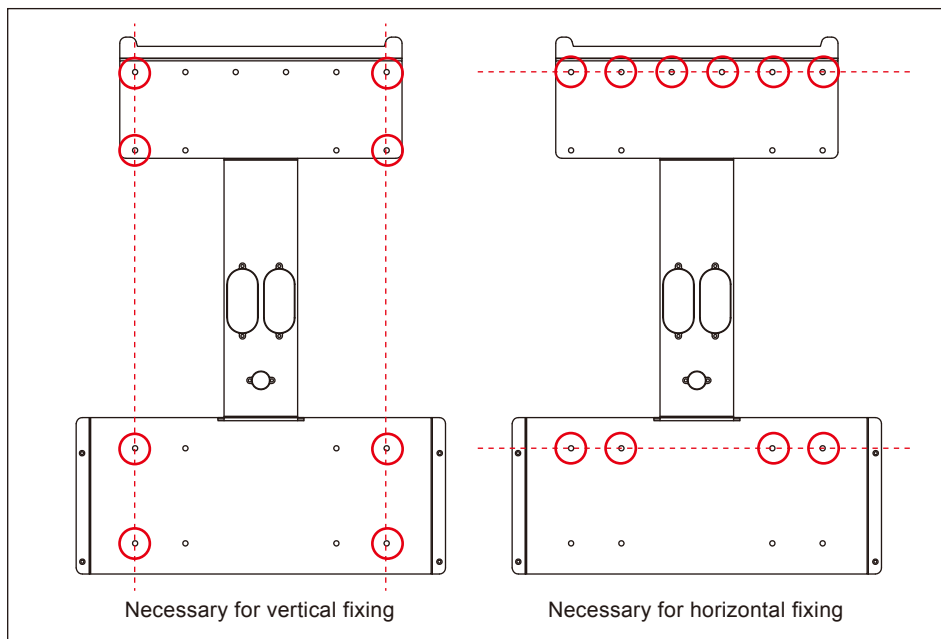


图3-2：壁挂建议螺丝锁附位置(至少8枚螺丝)

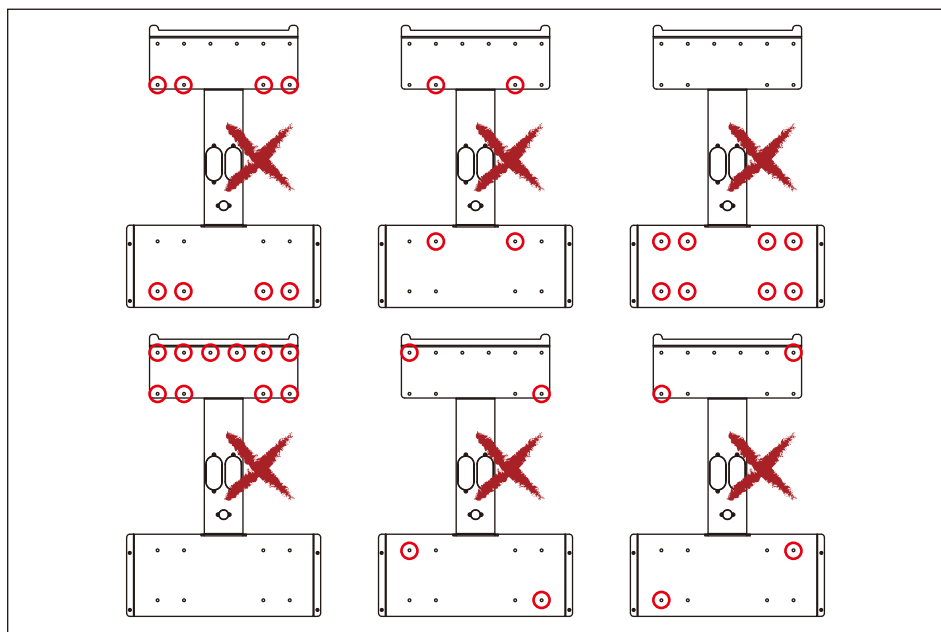


图3-3：错误的螺丝锁附位置

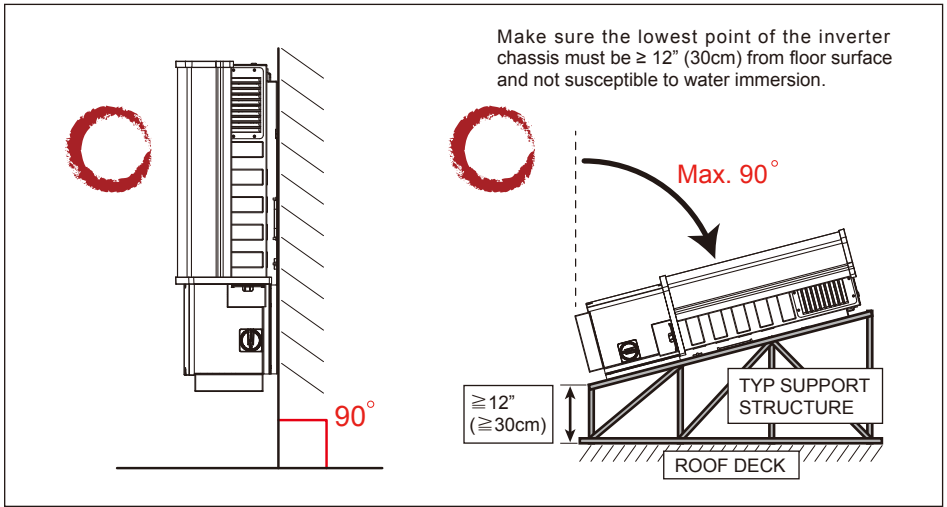


图3-4：正确的安装位置

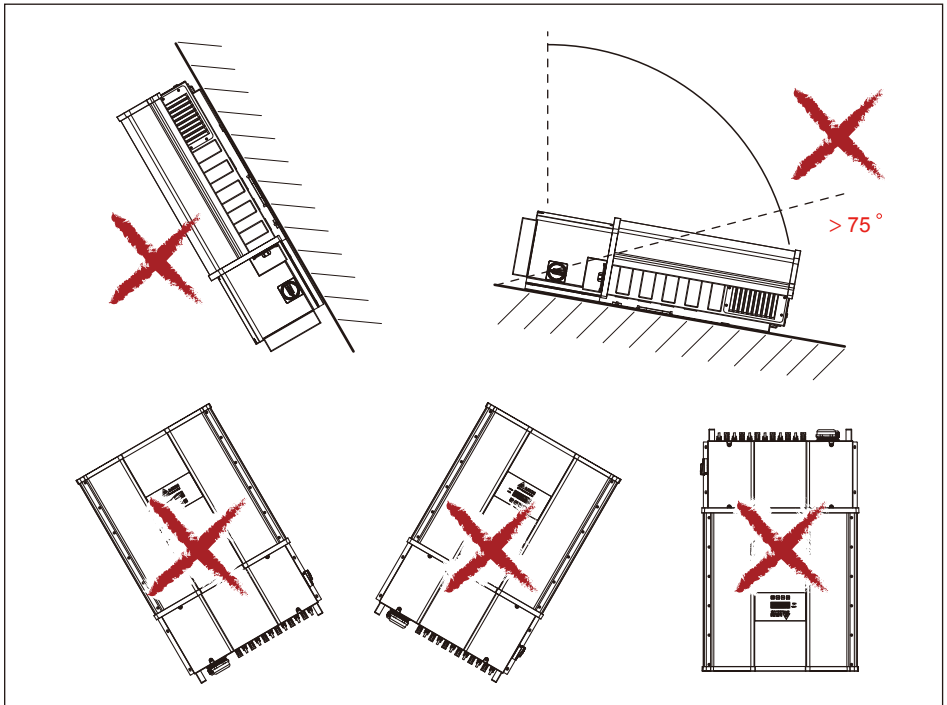


图3-5：禁止的安装方式

O : Permitted / X : Prohibited

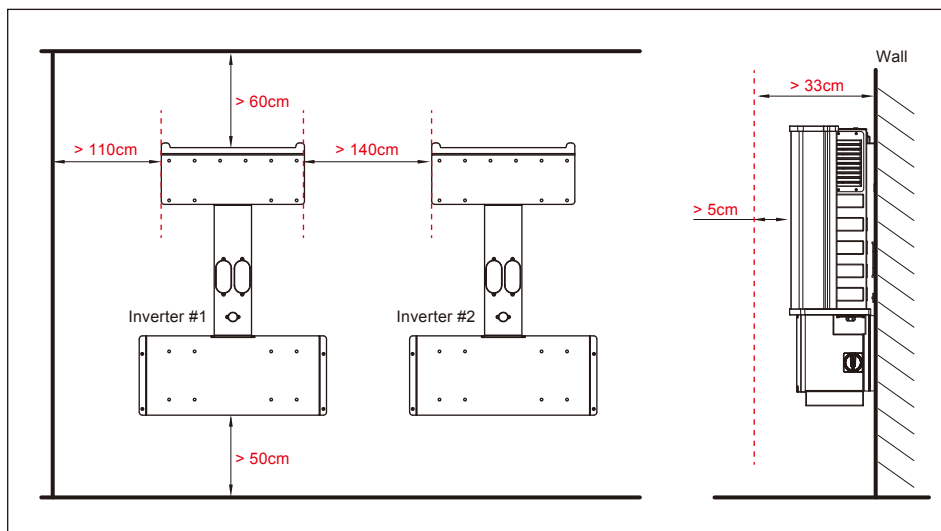


图3-6：机台间最低要求距离

**注意！**



- 请遵照允许的安装方式进行施工。

将逆变器挂上后，请以锁附扭力45 kgf.cm将四枚螺丝锁上。

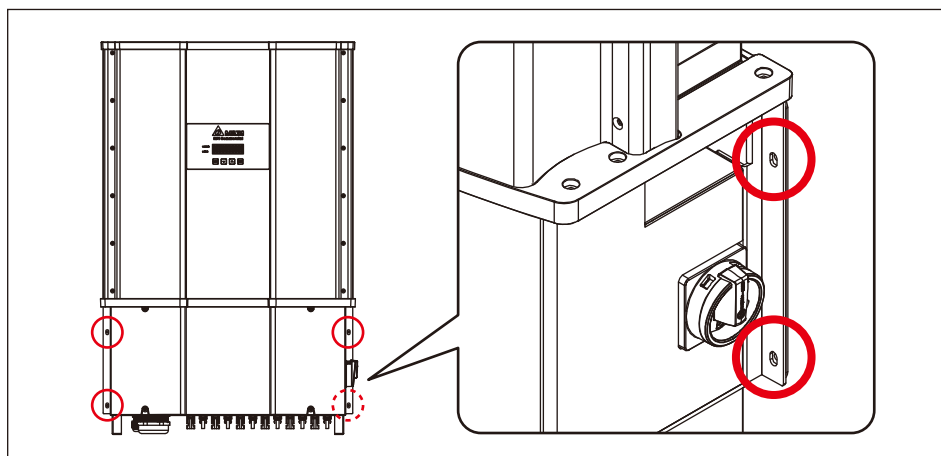


图3-7：配线箱与壁挂架锁附螺丝位置

要使用遮蔽板，请参考图3-8的安装方式。  
(锁附扭力45 kgf.cm)

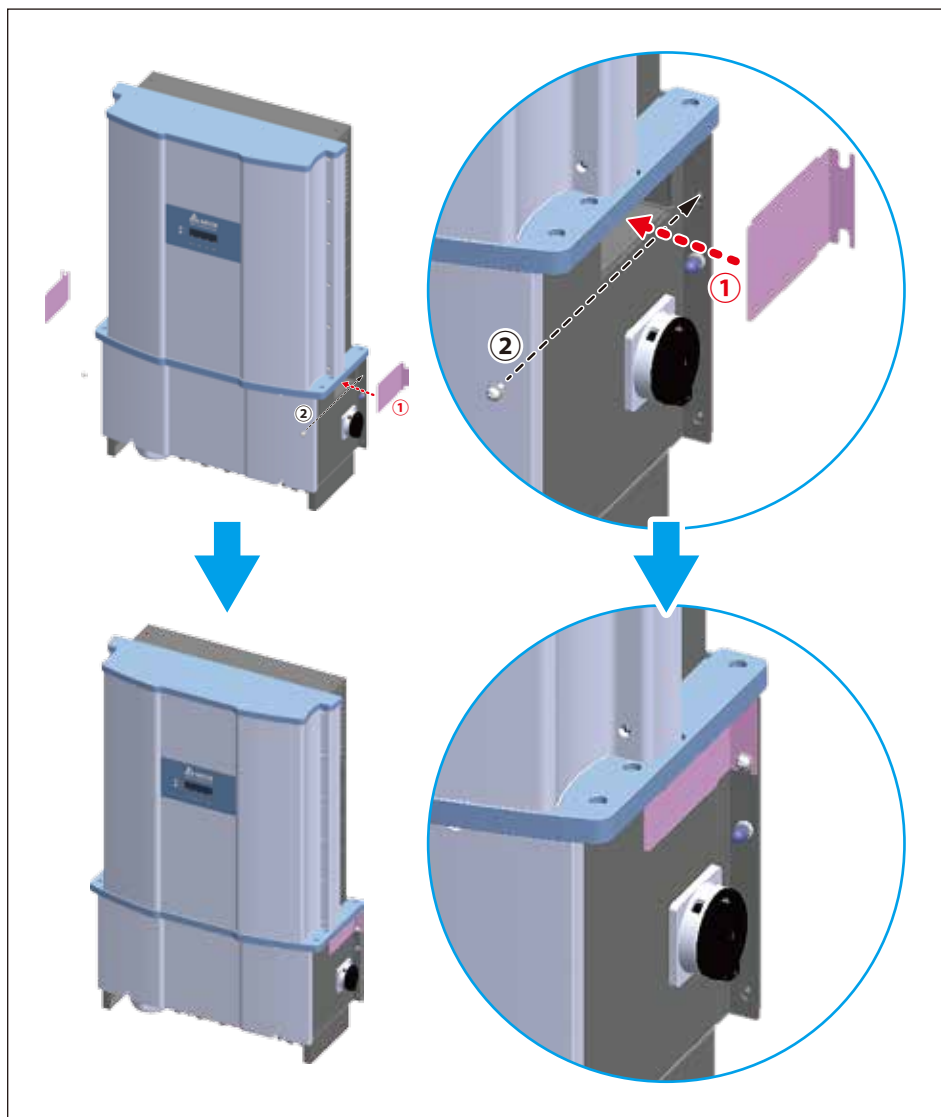


图3-8：遮蔽板的安装方法

## 3.2 交流配线安装

### 危险：触电危险!!



- 配线时禁止供给逆变器任何电源。

### 警告！



- 遵守条文为安装者的责任。
- 直流电压超过1000V则保固失效。

### 注意：逆变器及设备可能损毁！



- 请选用正确尺寸之交流线材。
- AC端子安装须遵守当地电气法规。
- 不遵守指示可能会损坏交流线材。

### 注意



- 逆变器可能因湿度或沙尘损坏，请勿打开逆变器机壳。

### 3.2.1 M88H<sub>121</sub>必须保护装置及交流配线安装

建议于市电端与逆变器间加入断路器做为过电流保护。

型号	断路器规格
M88H	≥ 125A

请遵循以下步骤组装交流端子 (M88H<sub>121</sub>) :

- 请选用适当线材尺寸
- 剥去线皮40mm
- 线材表面积范围为 1AWG ~ 250kcmil

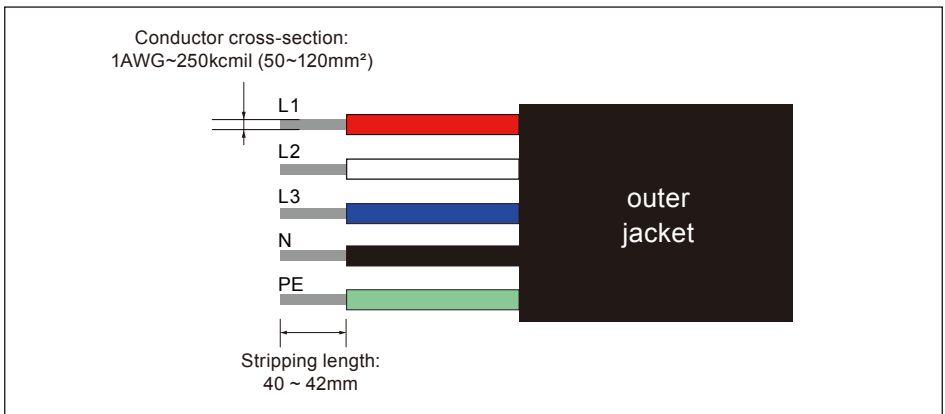


图3-9 : M88H<sub>121</sub>交流线材剥线

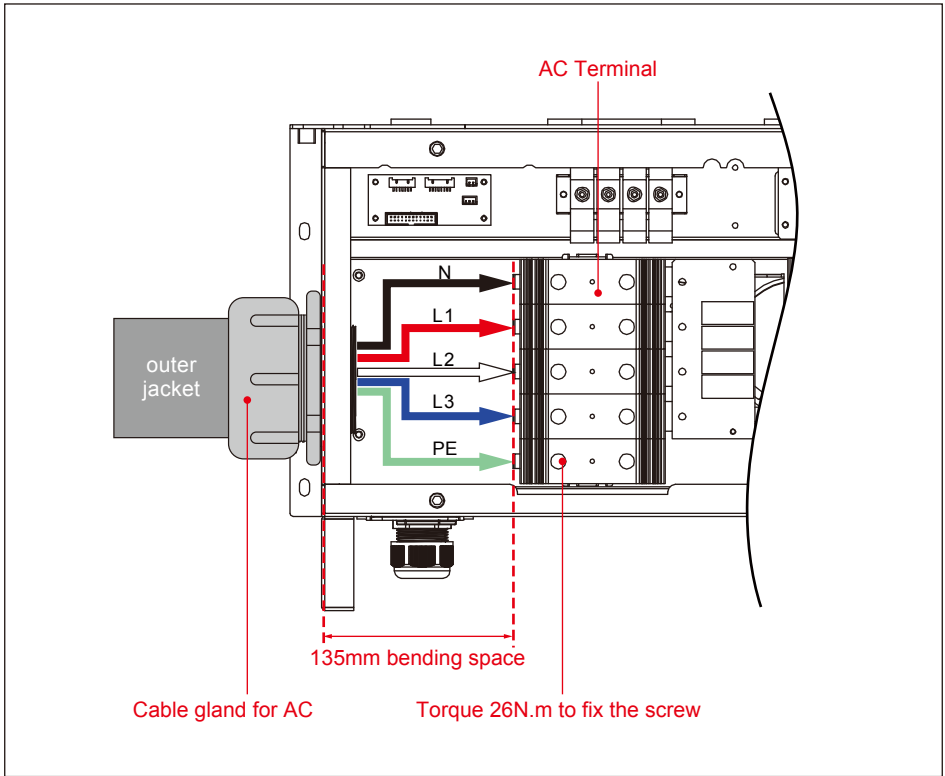


图3-10 : M88H\_121交流端子位置

### 3.2.2 M88H<sub>122</sub>必须保护装置及交流配线安装

建议于市电端与逆变器间加入断路器做为过电流保护。

型号	断路器规格
M88H	≥ 125A

请遵循以下步骤组装交流端子 (M88H<sub>121</sub>) :

- 请选用适当线材尺寸
- 剥去线皮24mm
- 线材表面积范围为2~3/0 AWG

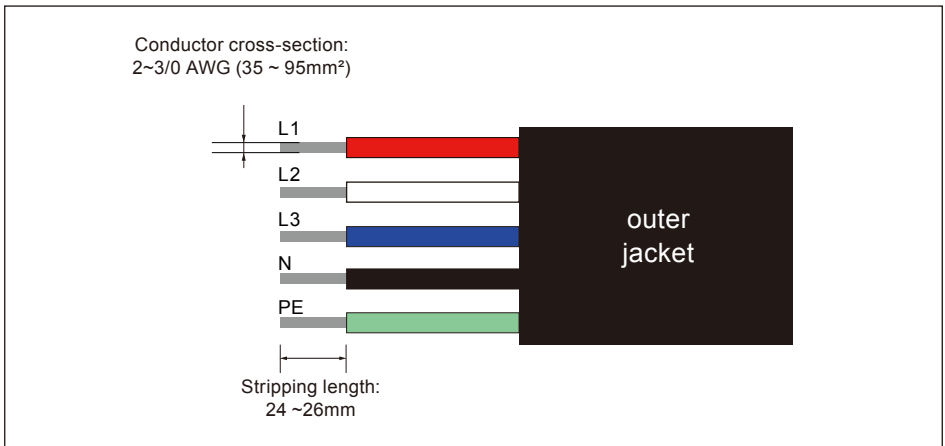


图3-11 : M88H<sub>122</sub>交流线材剥线



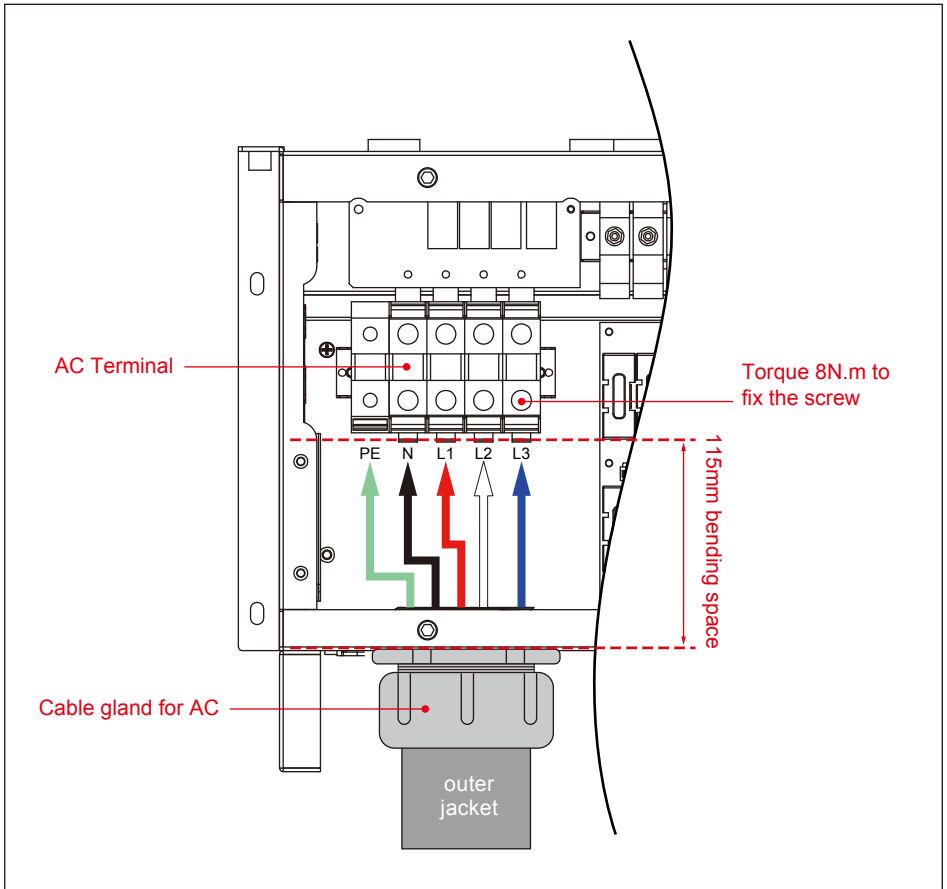


图3-12 : M88H\_122交流端子位置

若使用铝线，请遵循以下指示

铝线使用指示：

- 剥线后氧化层请去除
- 氧化层去除后请涂上凡士林或类似性质之接面油
- 请以该端子台之最大锁附扭力锁附线材
- 安装处请远离潮湿环境或极端气候
- 强烈建议使用区块成形及单芯线

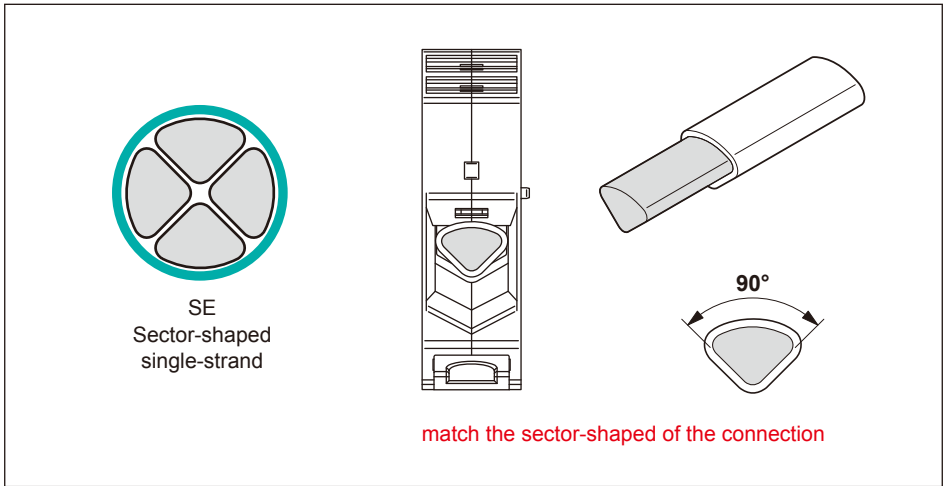


图3-13：铝线使用指示

### 3.3 直流配线安装

#### 危险:触电危险!!



- 太阳能串列将太阳能转换成高压直流形式，此高压有可能造成触电危险。配线前请使用非透明物质将太阳能串列遮盖起来。
- 配线时请确认电压极性

#### 警告!



- 触电及火灾危险。仅允许使用有标示低于1100V的太阳能串列。
- 配线时请确认直流开关在“关”的模式，且太阳能阵列没有连接。

#### 注意



- 太阳能阵列的正或负端皆禁止接到地。
- 根据UTE法规，建议配置断路器于太阳能阵列与逆变器之间做为过电流保护装置。

### 3.3.1 M88H\_121直流配线安装

请遵循以下步骤组装交流端子 (M88H\_121) :

- 请选用适当线材尺寸
- 线材表面积范围为1AWG~250kcmil
- 直流端子台配线如图3-15所示

#### 注意



- 直流端子锁附扭力为26N.m
- 所需的配线空间为135mm

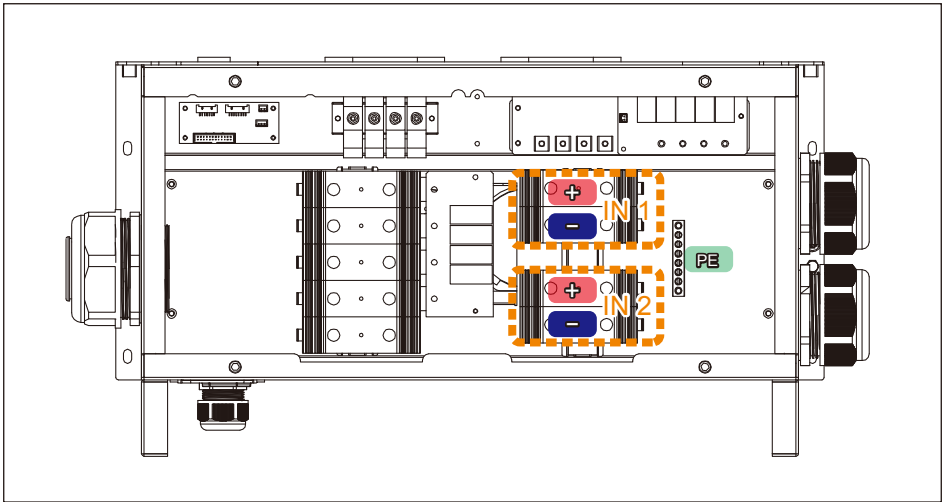


图3-14 : M88H\_121配线箱架构图

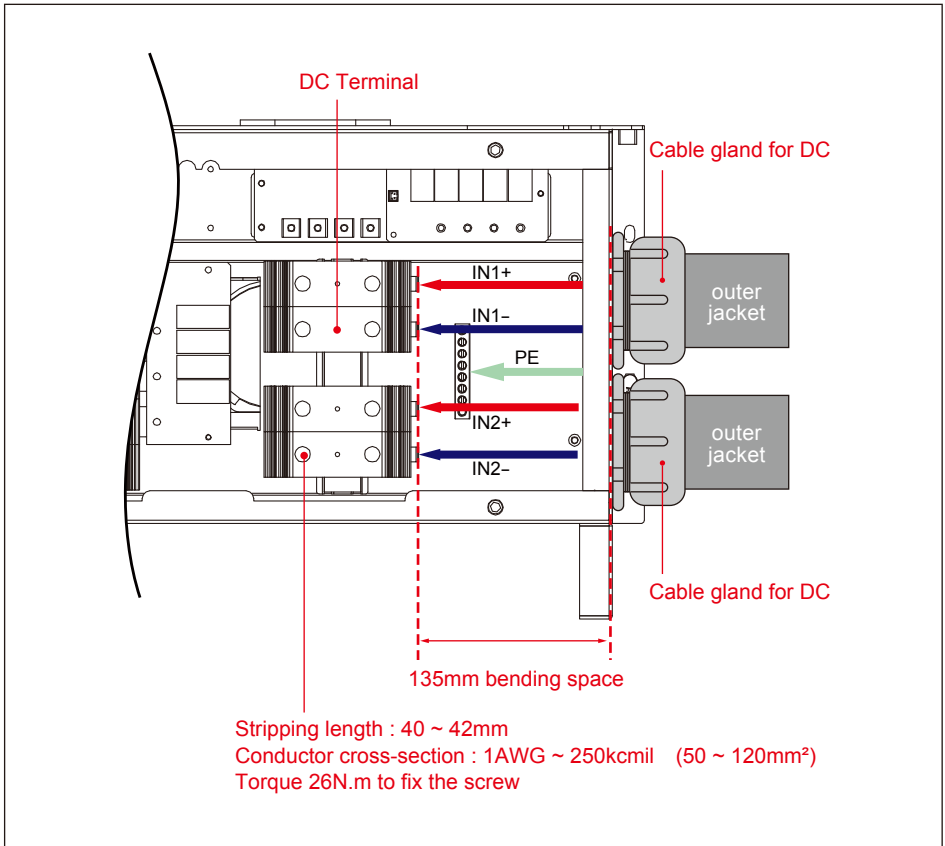


图3-15 : M88H\_121直流端子台位置

### 3.3.2 M88H\_122直流配线安装

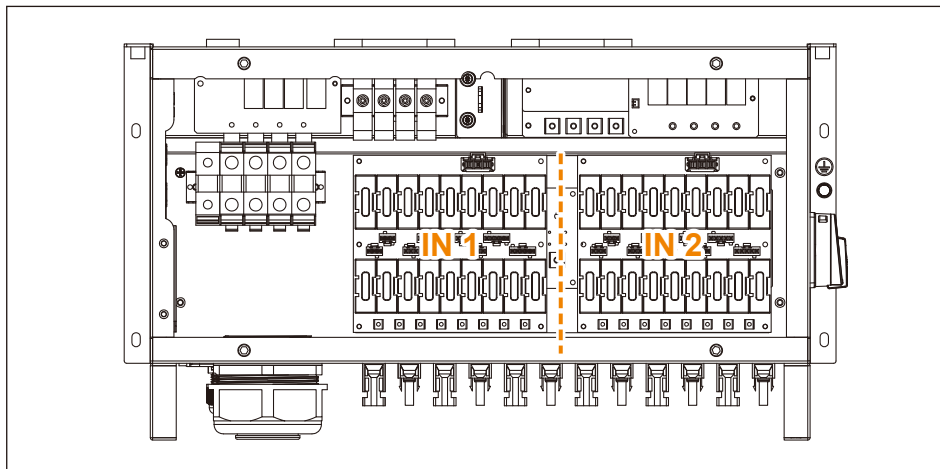


图3-16：M88H\_122配线箱架构图

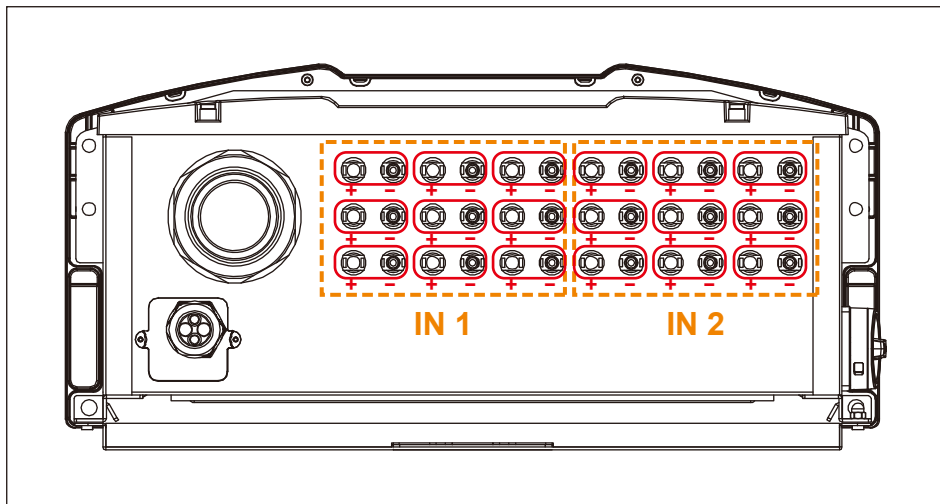


图3-17：M88H\_122直流端子位置

若使用铝线, 请遵循以下指示

铝线使用指示 :

- 剥线后氧化层请去除
- 氧化层去除后请涂上凡士林或类似性质之接面油
- 请以该端子台之最大锁附扭力锁附线材
- 安装处请远离潮湿环境或极端气候
- 强烈建议使用区块成形及单芯线

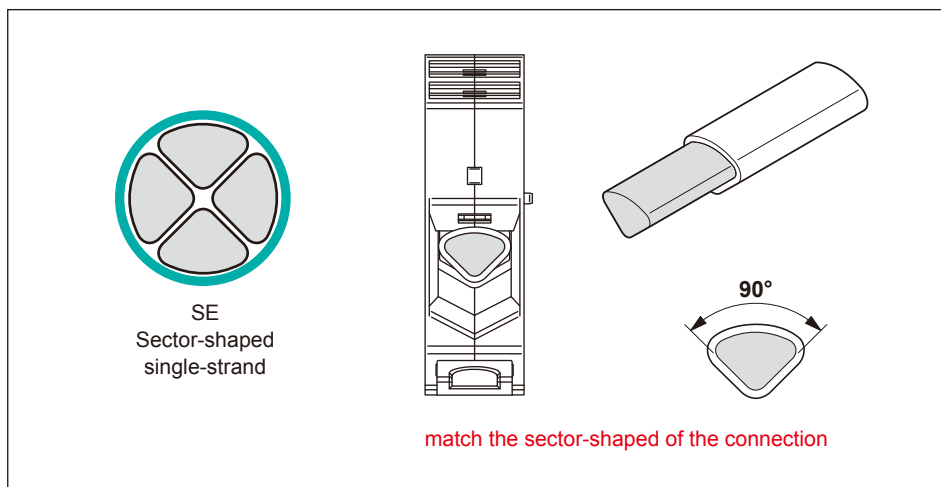


图3-18 : 铝线使用指示

## 3.4 通讯模组连接方式

M88H通讯模组提供VCC、RS-485、干接点、EPO、及各种不同功能之数位输入端子台。

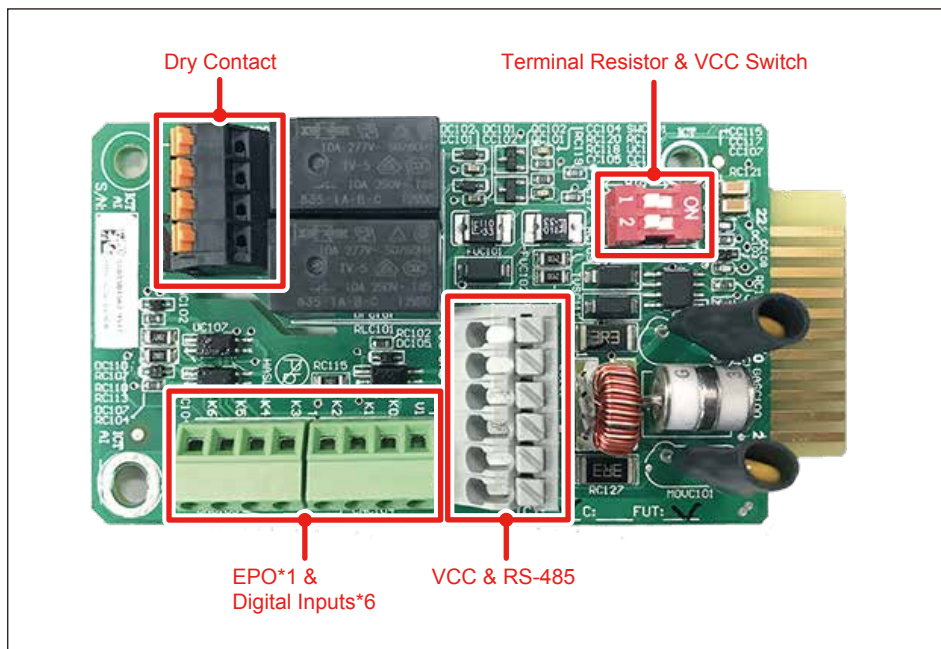


图3-19：通讯模组

### 3.4.1 RS-485连接方式

下表将描述RS-485各脚位定义，不同的RS-485连接方式将有不同的终端电阻设定方式。

- 只有一台逆变器连接：开启终端电阻
- 多台逆变器连接：第一台和最后一台终端电阻需开启

#### 注意



为了良好的传输品质，推荐使用双绞线作为通讯电缆。



Pin	Function
1	VCC (+12V)
2	GND
3	DATA+
4	DATA-
5	DATA+
6	DATA-




表3-1 : RS-485脚位定义

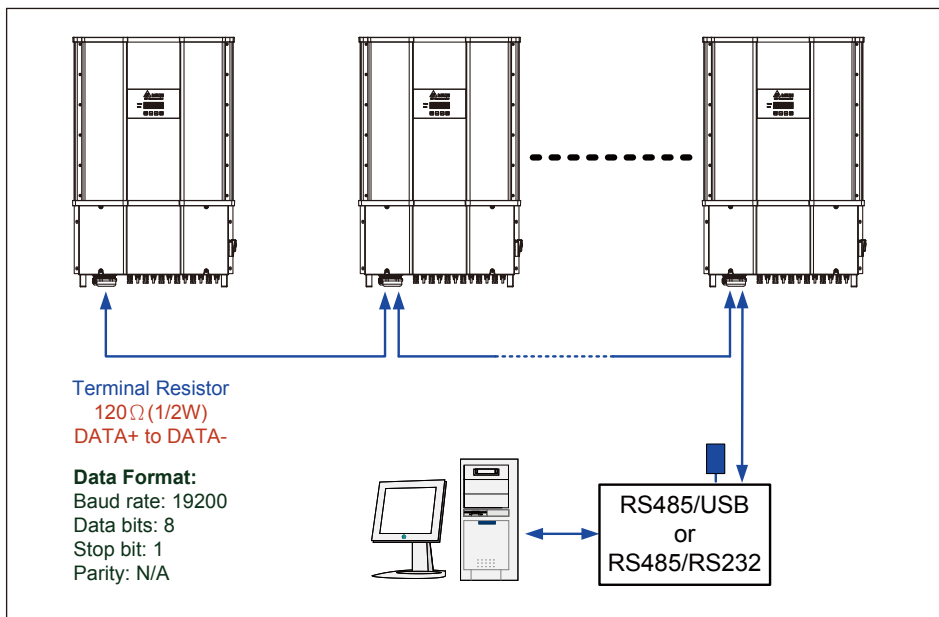


图3-20 : 多台逆变器连接示意图

	开关 1	开关 2
开	VCC 开	终端电阻 开
关	VCC 关	终端电阻 关

表3-2 : 终端电阻设定

### 3.4.2 紧急失断(EPO)及数位输入

通讯模组提供一组紧急失断功能(EPO)，可依使用者需求于设定页面进行设定。

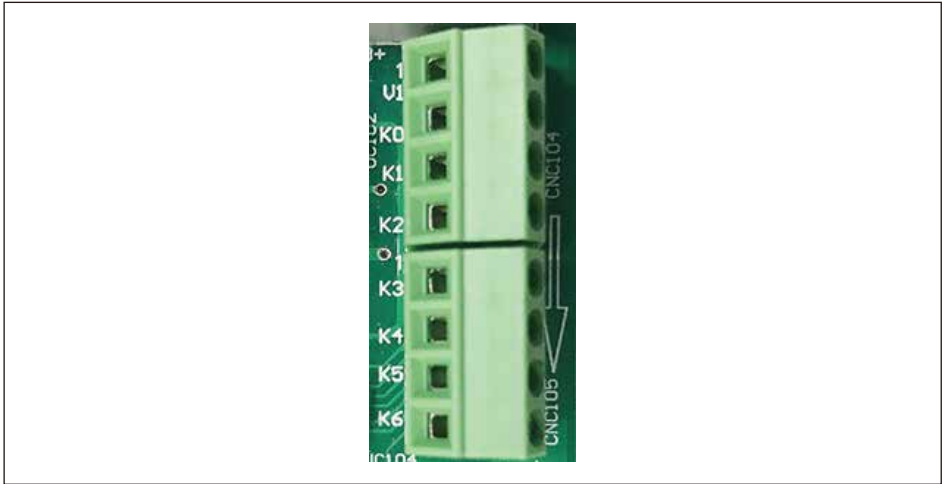


图3-21：EPO功能

短路	逆变器动作
V1 & K0	紧急失断
V1 & K1	0%实功输出
V1 & K2	最大30%额定输出
V1 & K3	最大60%额定输出
V1 & K4	最大100%额定输出
V1 & K5	保留
V1 & K6	保留

表3-3：EPO及数位输入功能定义

### 3.4.3 干接点连接方式

M88H提供两组干接点，该接点可依客户需求设定，请参照4.2.10章节。  
干接点可以承受250Vac/28Vdc/9A 的电气规格，适当线径为0.2-1.5mm<sup>2</sup>。

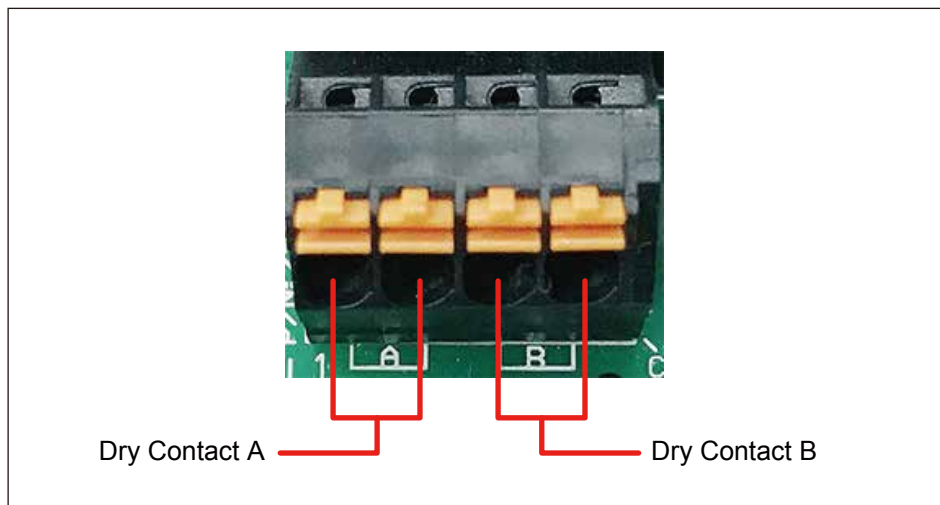


图3-22：干接点连接

## 4 试运行

注意：表面高温，请勿触碰！



- 当开盖时请小心表面高温。
- 表面冷却前请勿接触逆变器。

### 4.1 控制面板介绍

M88H系列内含 4x20 字母之LCD显示萤幕及2 LED状态指示灯如图4-1，表4-1说明各灯号的意义。

下面的章节将介绍使用者可经由显示萤幕进行设定的部分，当按压按钮进行设定时，指标会从"▶"变为"➔"。

Power meter / String monitoring	4.2.2
Energy Log	4.2.3
Event Log	4.2.4
Inverter Information	4.2.5
General Settings	4.2.6
Install Settings	4.2.7
Active/Reactive Power	4.2.8
FRT	4.2.9

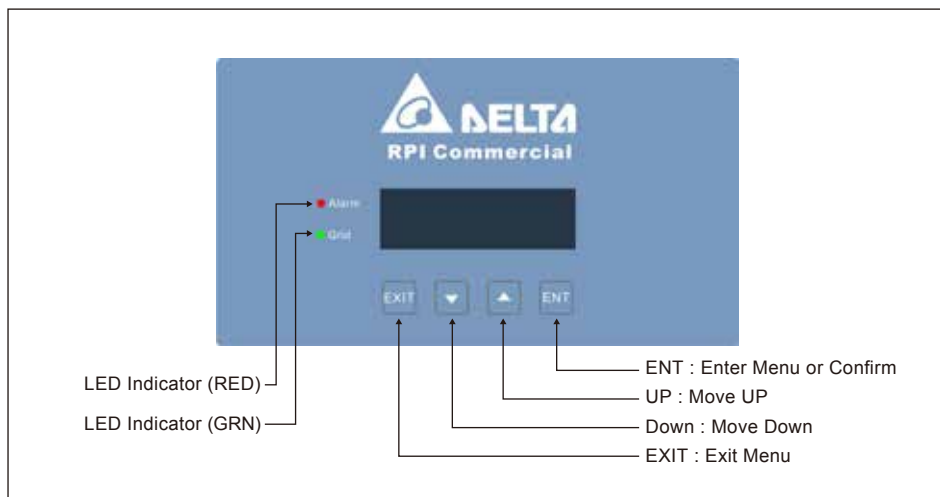


图4-1 : 控制面板

状况	绿LED	红LED
并网前倒数	闪烁 *	关
成功并网	开	关
发生Error或Fault	关	开
待机、夜间模式 (无DC时)	关	关
刻录模式	闪烁 *	

\* 开一秒 / 关一秒

表4-1 : LED指示灯

## 4.2 首次开机

初次运行时，请先将AC电源送入逆变器并打开手动开关及直流开关，此时显示面板会被点亮并开始进行初始设定如图4-2所示。请依据当地选用适当语言及国别并确认主画面中的Status是否有显示任何错误讯息，等待逆变器初始自我测试约2分钟后会进入并网倒数，倒数完毕逆变器便会并网送电。

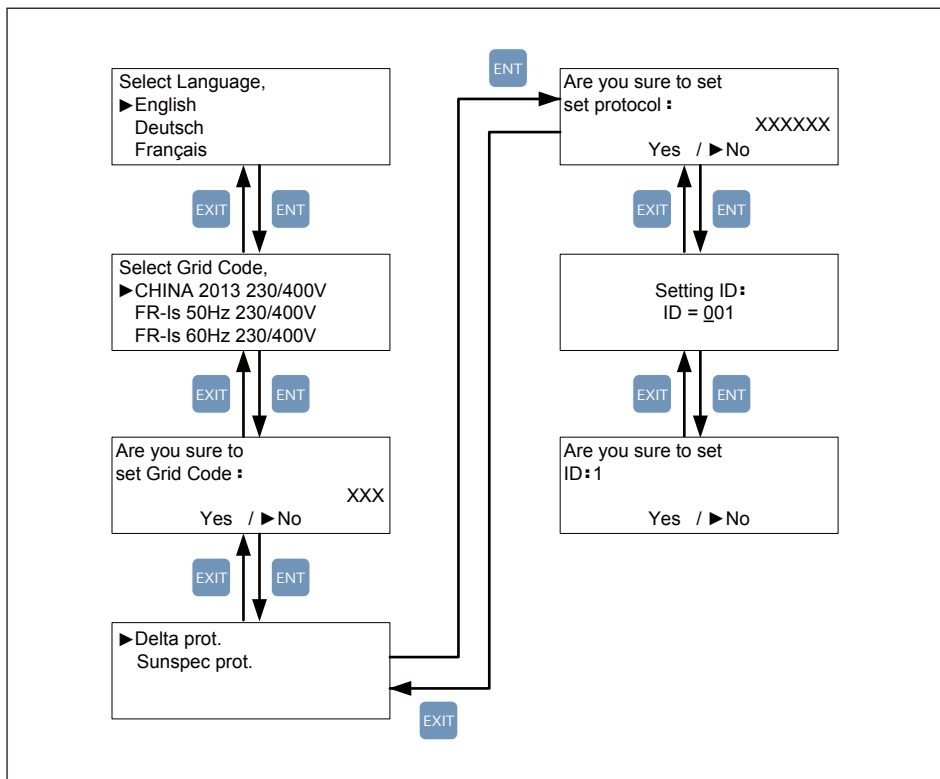


图4-2：首次启动之国别·语言及ID设定

## 4.2.1 主画面

若逆变器正常运行，即可在首页看到输出功率、逆变器状态、今日发电量时间、日期等相关资讯，按压任意按键将会导回主目录，于主目录按压EXIT或静置数秒后即回到主页。

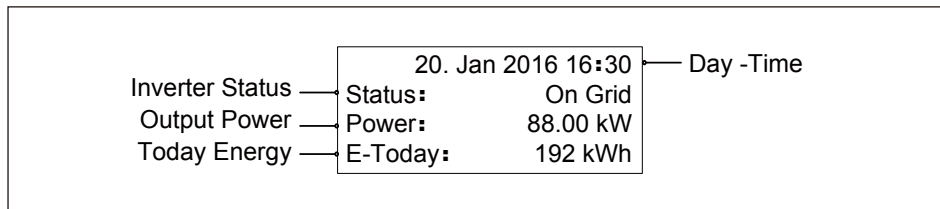


图4-3：主画面

## 4.2.2 Power meter / String monitoring

本页面显示交直流电压, 电流及功率

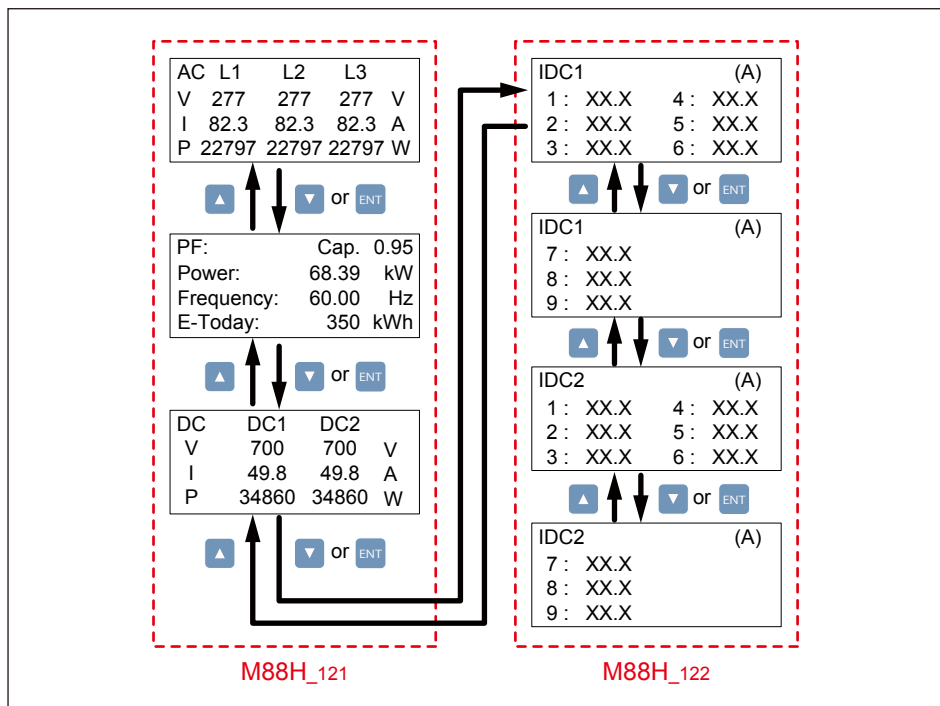


图4-4：Power meter页面

### 4.2.3 Energy Log

使用者可经由本页面查询历史发电量，当日发电量以及当月发电量。

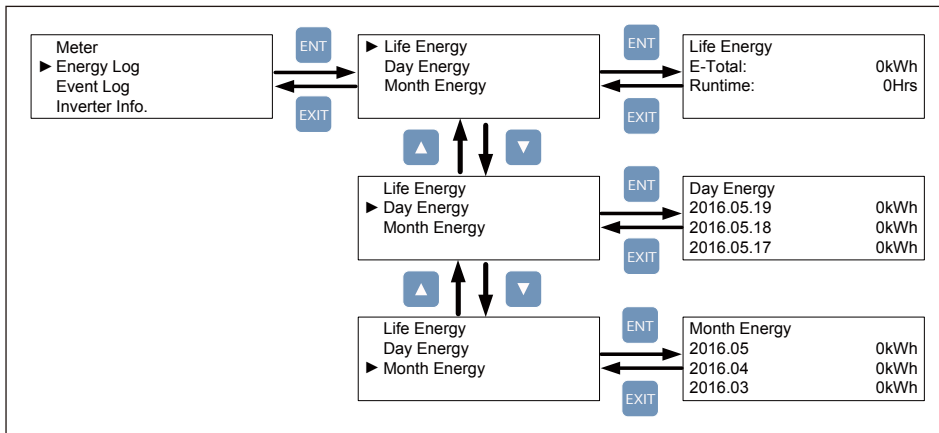


图4-5 : Energy log页面

### 4.2.4 Event Log

Event Log可分为Error Events与Grid Report两个分页。Error Events页面显示最近30笔错误讯息，Grid Report页面则纪录最近5笔市电相关问题。

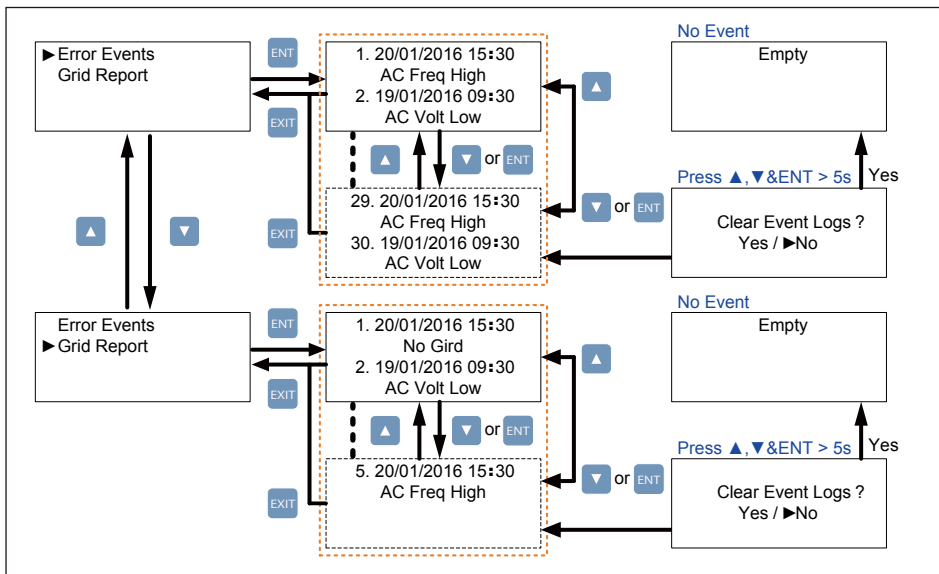


图4-6 : Event log流程



## 4.2.5 Inverter Information

本页面协助使用者确认逆变器资讯，包含其序号、安装日、ID、韧体版本。

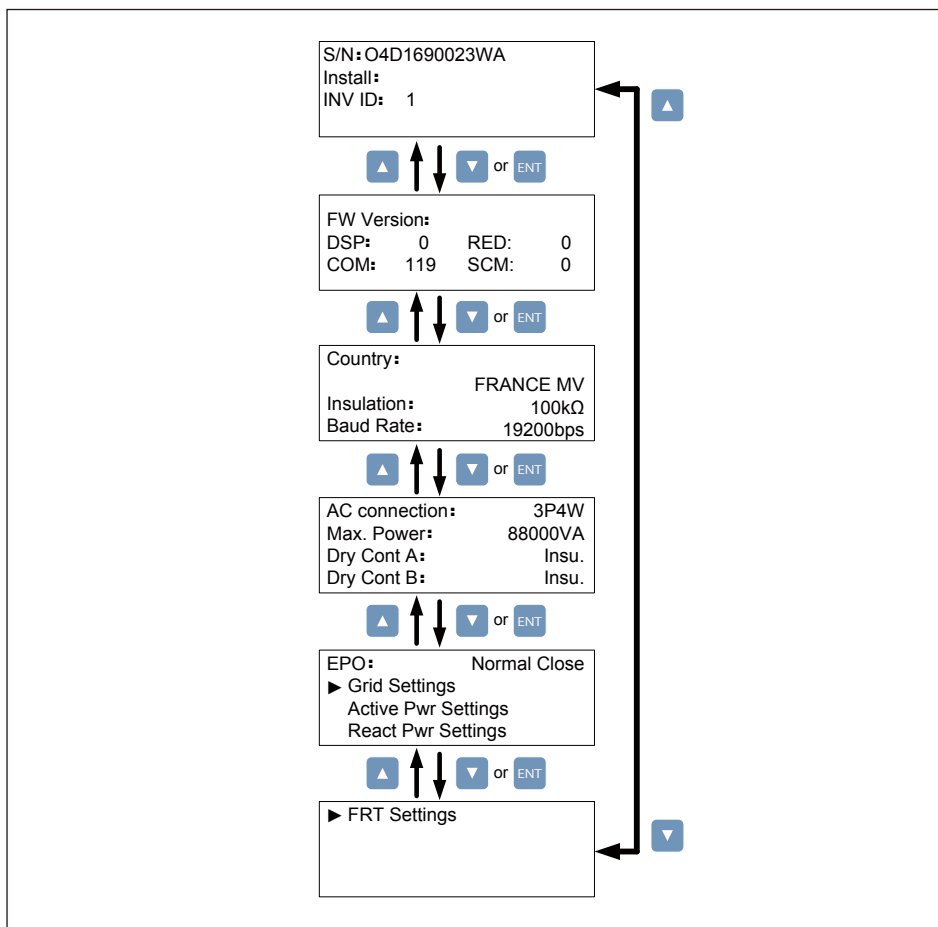


图4-7 : Inverter information页面

## 4.2.6 General Settings

使用者可在此页面设定语言、日期时间、通讯封包速度、通讯协定及风扇测试。

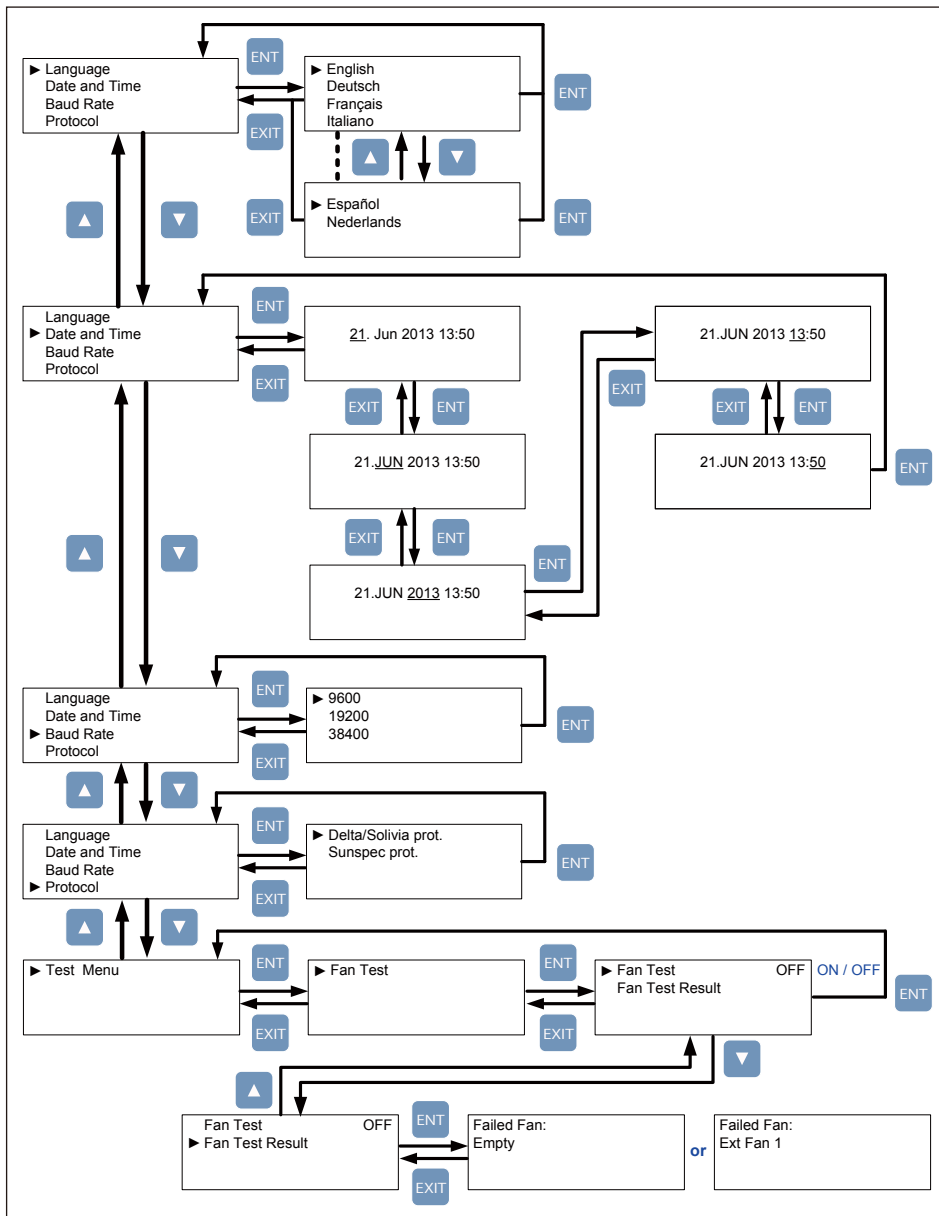


图4-8 : General settings页面

## 4.2.7 Install Settings

### 注意！



- 本安装设定页面仅供符合资格的安装业者或工程师使用，任意变更此页面设定可能会导致机体或其他设备损伤。

进入Install Settings页面前需要输入密码，密码分为三种权限：使用者权限、安装者权限以及制造商权限。以下章节仅会介绍使用者权限与安装者权限所需之各项设定值。

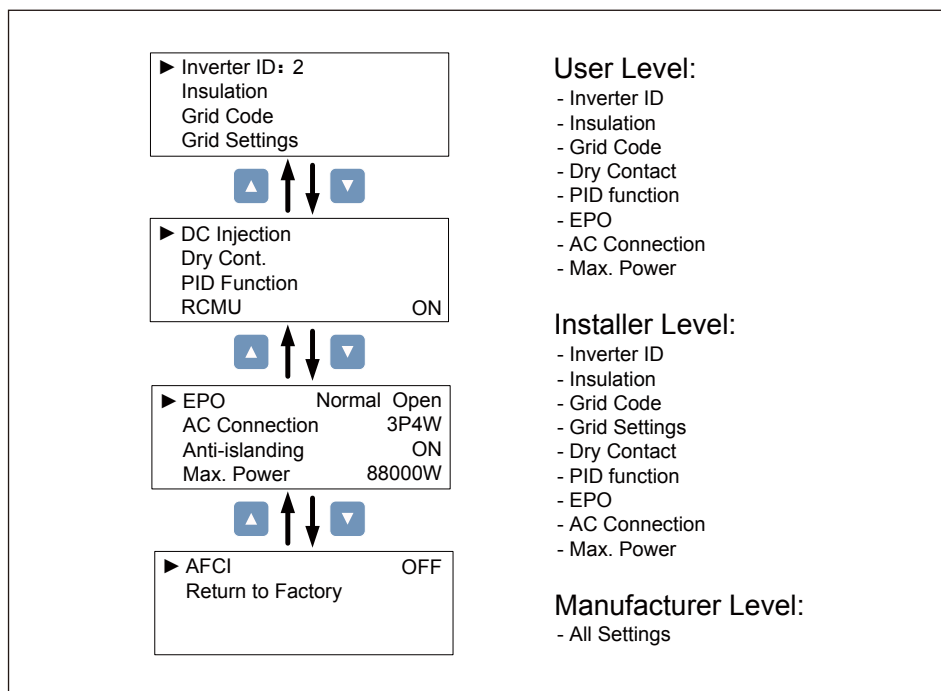


图4-9：Install settings页面

### 4.2.7.1 Inverter ID

逆变器ID供RS-485通讯使用，在同一串列上的逆变器需有不同的ID。

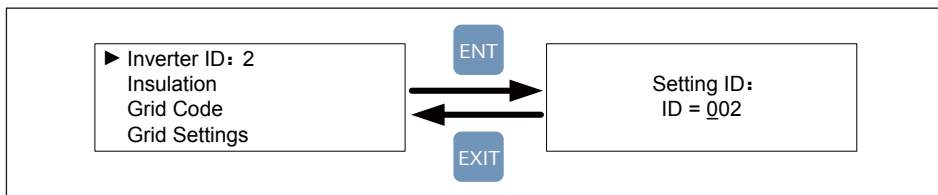


图4-10 : Inverter ID页面

### 4.2.7.2 Insulation

并网前，逆变器会计算太阳能模组对地的阻抗，M88H可以选择是否侦测且同时有两种阻抗值供选择，安装者应依照实际太阳能模组安装情形选用适当的数值。

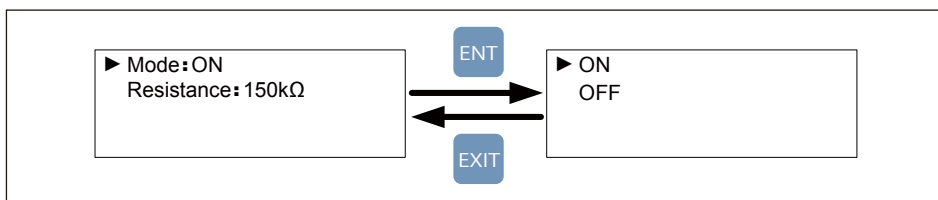


图4-11 : Insulation页面

### 4.2.7.3 Grid Code

选单中的每一个国家选项即代表一种电力法规，安装者于安装逆变器后必须选择正确的国家选项，以符合当地电力法规的要求。

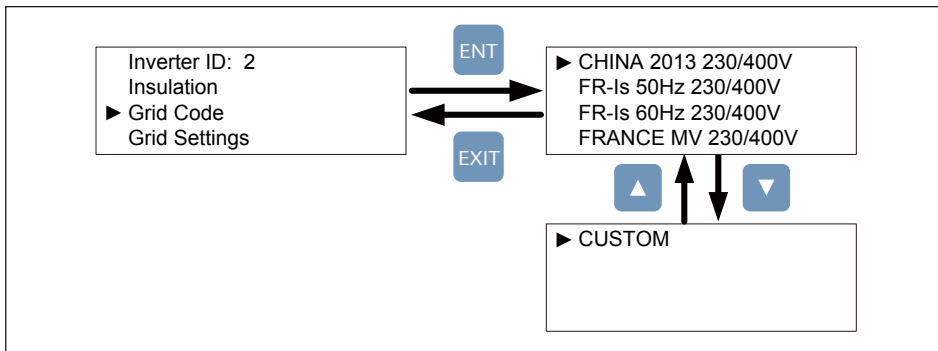


图4-12 : Grid Code页面

## 4.2.7.4 Grid Settings

Grid Settings页面包含各种电压与频率保护值，这些保护值乃依据各电力法规所建立，若无特殊需求请勿修改任何保护值。

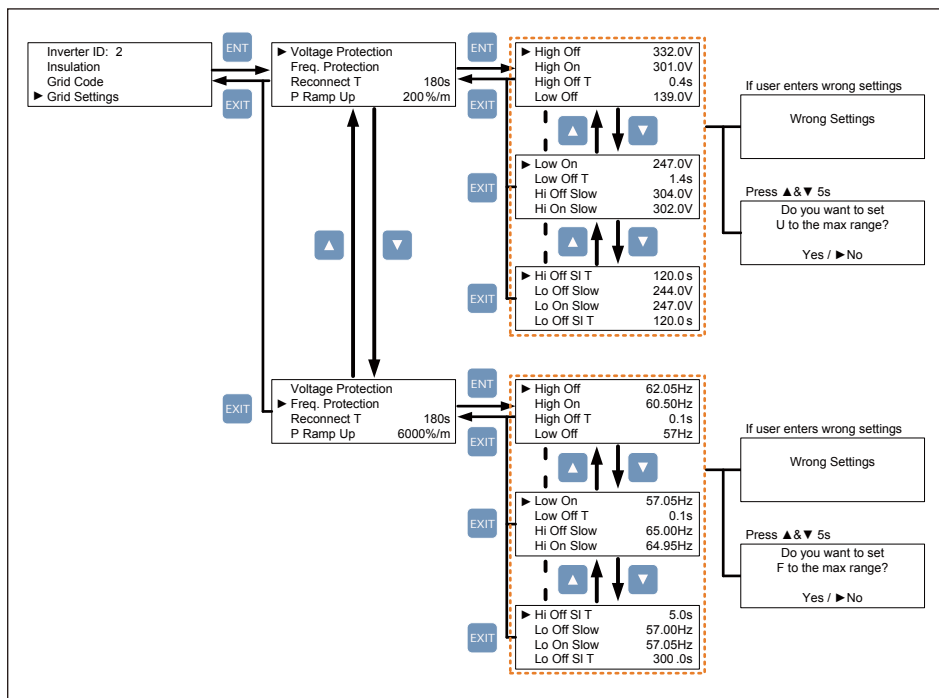


图4-13 : Grid Settings 页面

### 4.2.7.5 Dry Contact

使用者可选择干接点触发的条件，在设定页面共有8种选项。

其中包含：无作用、并网、风扇故障、绝缘阻抗、警示、错误、故障、警告。

设定	干接点动作条件
Disable (无作用)	无反应
On Grid (并网)	逆变器并网
Fan Fail (风扇故障)	风扇产生故障
Insulation (绝缘阻抗)	绝缘阻抗测试失败
Alarm (警示)	任何错误, 故障, 警告 发生
Error (错误)	任何错误发生
Fault (故障)	任何故障发生
Warning (警告)	任何警告发生

表4-2：干接点动作条件设定

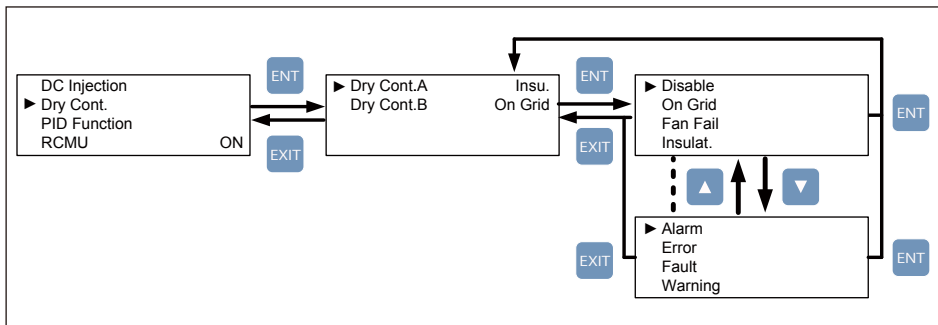


图4-14：Dry Contact 页面

### 4.2.7.6 PID

预设动作时间为0，使用者可选择0~10小时，或自动模式。

PID功能在NO DC后半小时会启动。

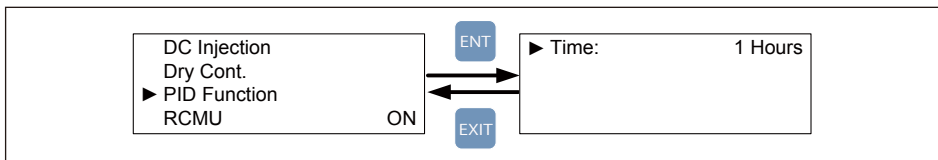


图4-15：PID Function页面

### 4.2.7.7 EPO

EPO有两种侦测模式：Normal Open与Normal Close。Normal Open代表EPO常态为开路，短路时则触发紧急关机功能。Normal Close则代表常态为短路，开路时则触发紧急关机功能。请依据您的需求选择适合的侦测模式。

▶ EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

图4-16：EPO页面

### 4.2.7.8 AC connection

M88H支持3P3W与3P4W配线方式，请依照实际配线方式选择对应的设定，确保机器能正常运行。

EPO	Normal Close
▶ AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

图4-17：AC配线方式

### 4.2.7.9 Max. Power

某些电力法规有调整最大功率输出之要求，参照此类电力法规之用户可透过此功能更改逆变器的最大功率输出额度。

EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
▶ Max. Power	88000W

图4-18：Max. Power页面

## 4.2.8 Active / Reactive power

进入实功/虚功控制页面前必须输入密码。此页面包含实功功率控制与虚功功率控制两个主要功能。

实功功率控制有三种模式：

Power Limit, Power vs. Frequency, and P(V)；

虚功功率控制有四种模式：

Constant cosphi, cosphi(P), Constant Q, and Q(V)。

这些模式将会在下方的章节中详细的介绍。

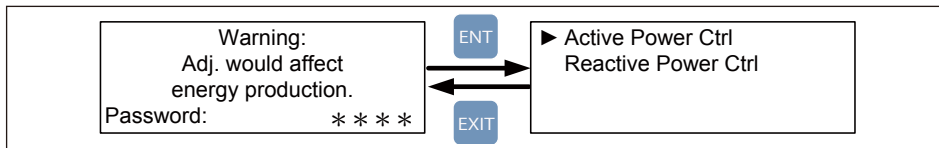


图4-19 : Active/Reactive power页面

### 4.2.8.1 Power Limit

此控制模式可限制逆变器之输出功率。使用者可透过设定Set Point来指定逆变器所能输出的最大功率。

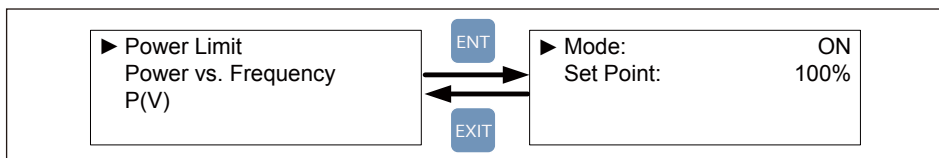


图4-20 : Power Limit page页面

### 4.2.8.2 Power vs. Frequency

此模式开启后，逆变器可随着市电频率升高而自动降低其输出功率。

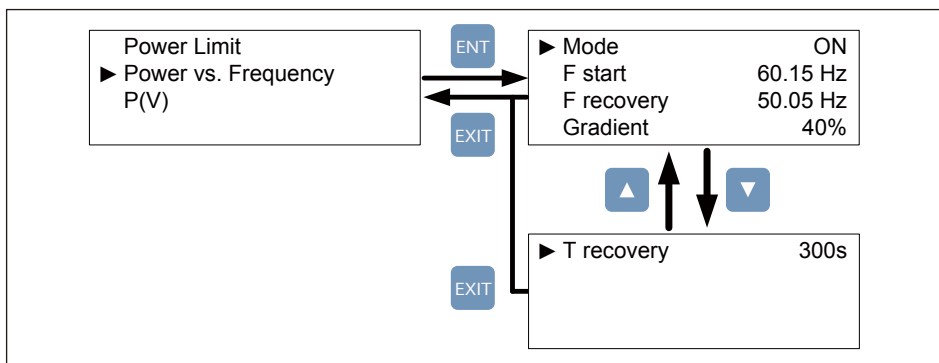


图4-21 : Power vs Frequency页面



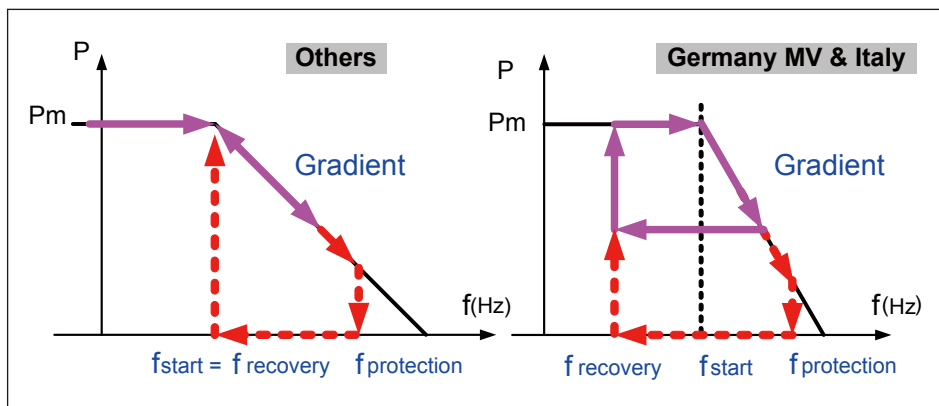


图4-22 : Power vs Frequency参数对照

### 4.2.8.3 P(V)

此模式启动后，当市电电压大于V lock-in且此时逆变器之输出功率大于P lock-in时，逆变器将会自动将输出功率降低至P lock-out，直到市电电压低于V lock-out且经过T recovery秒后方恢复正常功率输出。

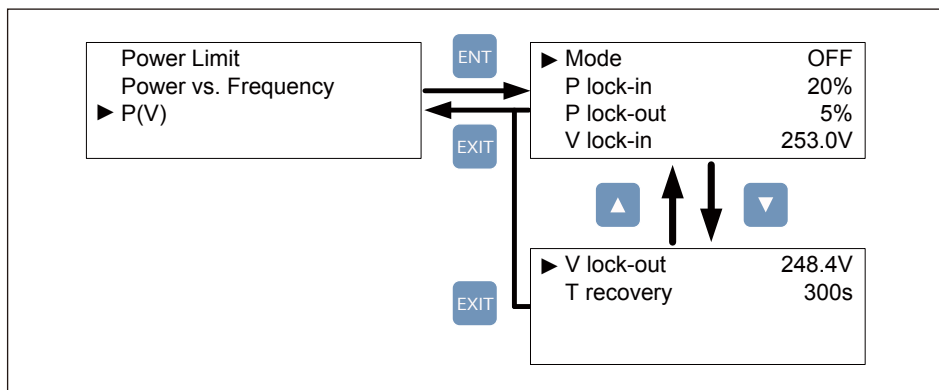


图4-23 : P(V)页面

### 4.2.8.4 Constant cosphi

此模式启动后，逆变器可馈入固定功率因子(cosphi)之虚功率至市电，使用者可透过设定页面指定欲馈入之功率因子。

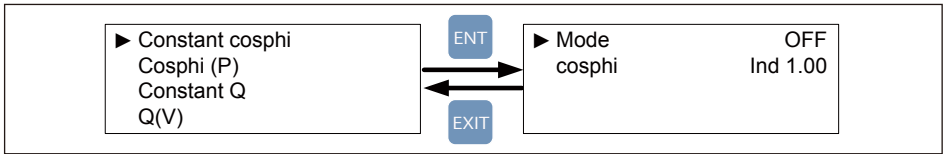


图4-24 : Constant cosphi页面

### 4.2.8.5 Cosphi (P)

此功能启动后，逆变器可随着输出之实功率高低而馈入一定比例之虚功率。当国家设定为Italy LV或Italy MV时，使用者可进一步指定当市电电压高于V lock-in时方馈入虚功，电压低于V lock-out后，无论此时输出实功率为何，皆不馈入虚功。

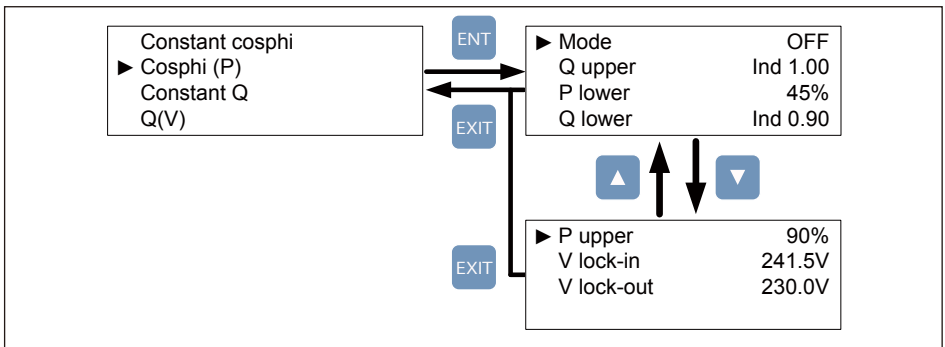


图4-25 : Cosphi (P)页面

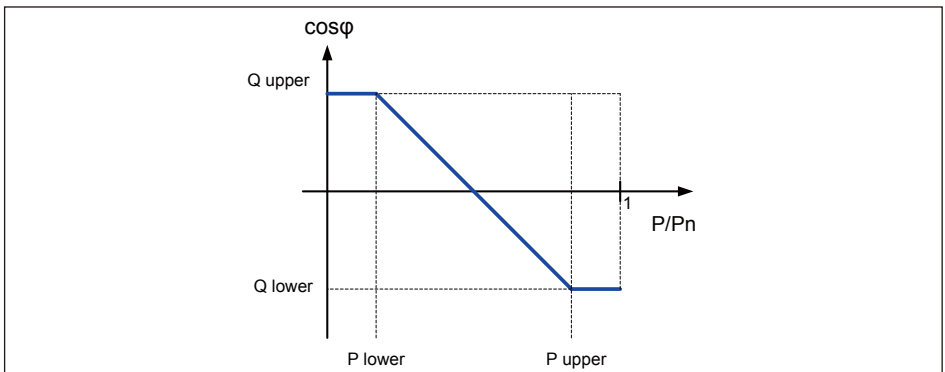


图4-26 : Cosphi (P)参数对照

### 4.2.8.6 Constant Q

此模式启动后，逆变器可馈入固定比例之虚功率至市电，使用者可透过设定页面指定欲馈入之虚功率量。

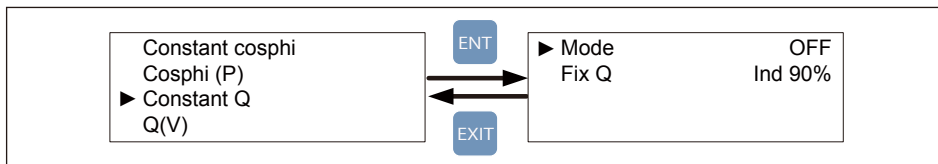


图4-27 : Constant Q页面

### 4.2.8.7 Q(V)

此模式启动后，逆变器会随着市电电压变化而馈入不同性质的虚功率。当国家设定为Italy LV或Italy MV时，使用者可进一步指定输出功率达到P lock-in时方馈入虚功，输入功率小于P lock-out时则无论市电电压为何，皆不馈入任何虚功。

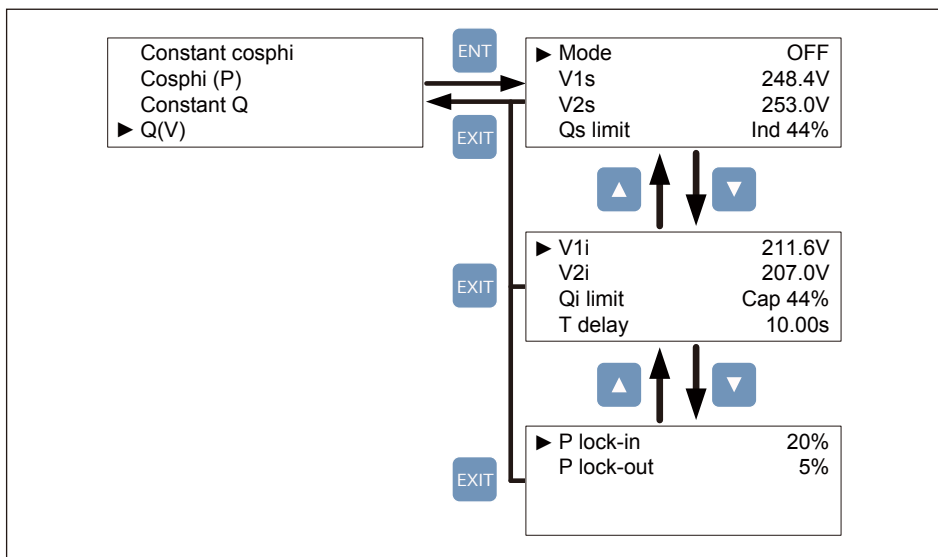


图4-28 : Q(V)页面

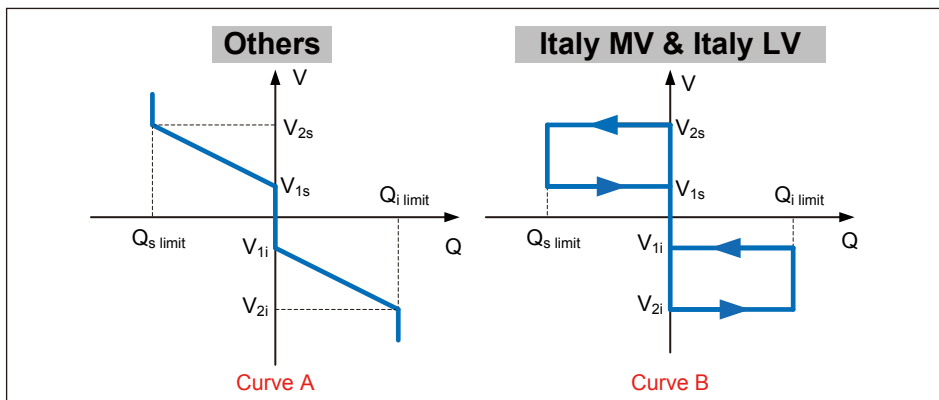


图4-29 : Q(V)参数对照

### 4.2.9 FRT (Fault ride through)

根据某些特定地区之电力法规规范，当市电电压发生骤降时，在一定的时间内逆变器必须维持并网状态。使用者可透过启动FRT功能并设定所需的参数来达到这项要求。

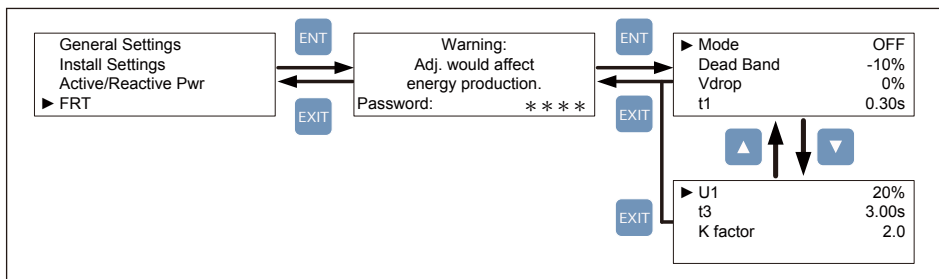


图4-30 : FRT页面

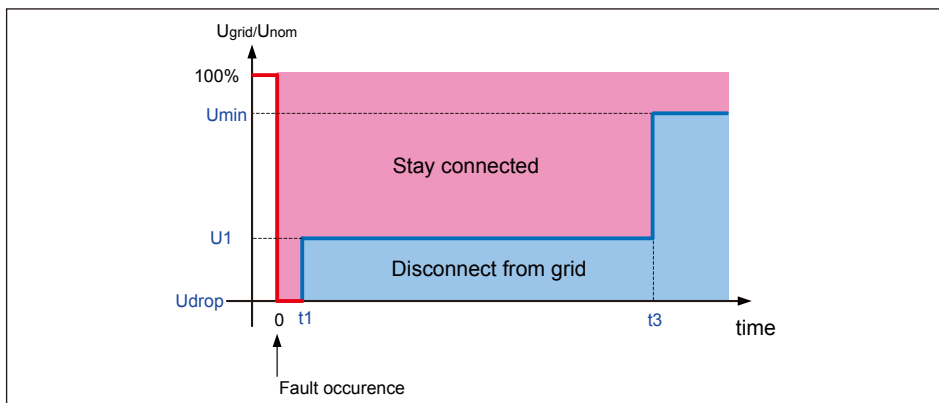


图4-31 : FRT参数对照

## 5 维护

为确保PV Inverter正常运转，请至少每半年确认一次逆变器所有端子与螺丝是否松脱、电缆线是否损坏、散热出风口有无异物阻塞。如有上述情形，请联络合格之技术人员进行维修、清理或更换。

### 警告！



- 进行任何维修动作前，请确定交直流电源皆已切断以避免触电危险。

### 5.1 更换SPD

M88H系列机种于交直流侧皆含有突波吸收装置如图5-1所示，表5-1列出所使用的突波吸收装置规格。

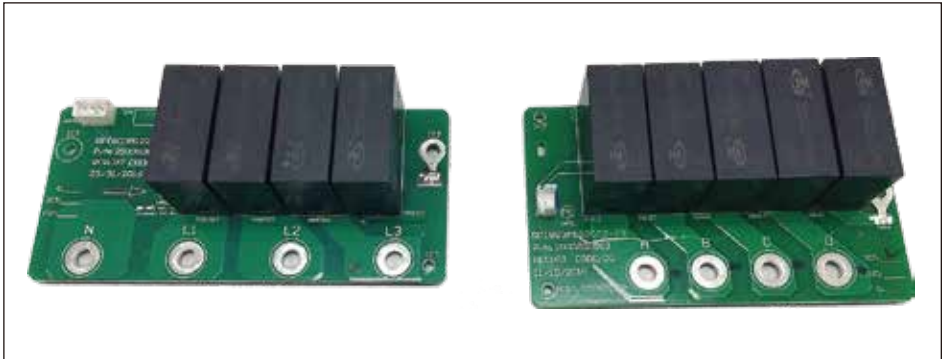


图5-1：交直流突波吸收装置

#### Specification of SPD

Work voltage : 895V (AC RMS value)  
1175V (DC)

Work Amp In (8/20 $\mu$ s) : 10kA

Rate Amp I max (8/20 $\mu$ s) : 20kA

Temperature : -40 $^{\circ}$ C~85 $^{\circ}$ C

Manufacturers :

Sichuan Zhongguang Lightning Protection Technologies Co., Ltd

表5-1：交直流突波吸收装置规格

位于交直流端子附近的突波吸收装置是为了保护较敏感的电路元件受到电击或急遽电压变化而损坏。若于显示面板发现警告讯息“AC Surge”或“DC Surge”，请依以下步骤替换：

1. 中断交直流电源，且等到显示萤幕没电。
2. 将配线箱上盖的四枚螺丝松脱，便可看到如图5-2所示的SPD位置。
3. 找出损坏的SPD：
  - “AC Surge”表示AC SPD
  - “DC Surge”表示DC SPD损毁
4. 拔起连接线 (白色，AC：三脚，DC：两脚) 并替换全新的SPD PCB板。
5. 重新组装上盖，并确认防水封条。

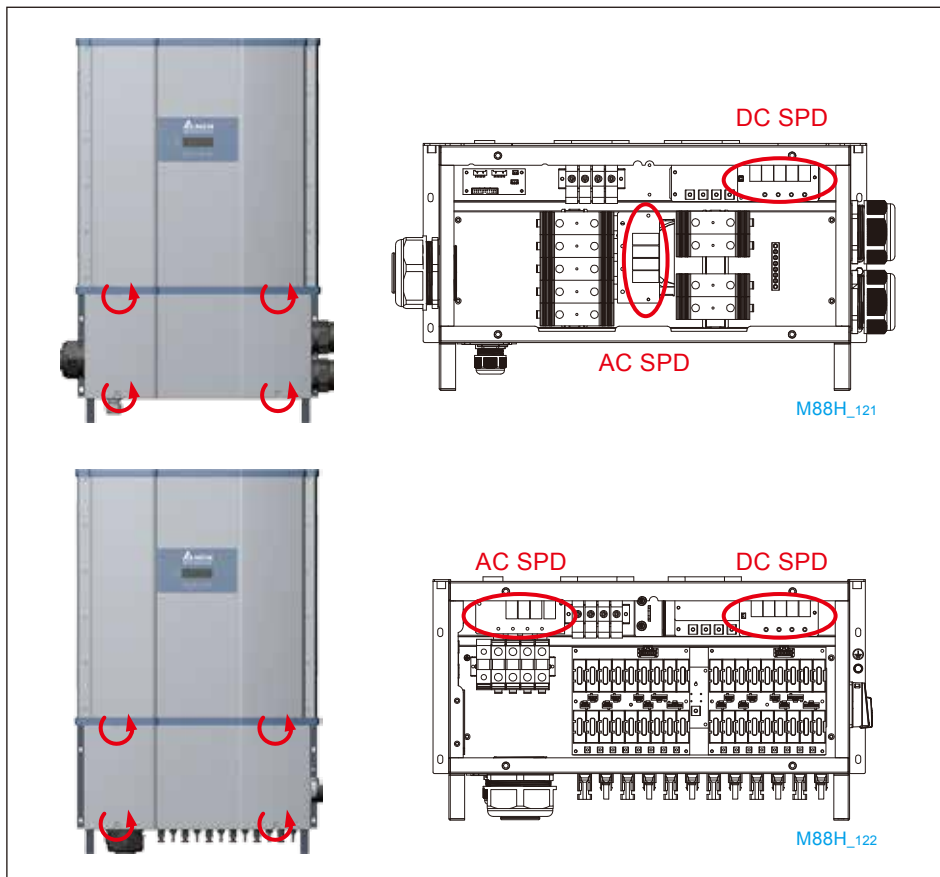


图5-2：移除配线箱上盖



图5-3 : AC/DC SPD 损坏时的告警



图5-4 : 拔起连接线并移除螺丝

## 5.2 风扇替换及清洁

本章节提供M88H系列如何替换智慧风扇及滤网的方式。图5-5、5-6、5-7标示出智慧风扇的位置。

M88H系列的智慧风扇可区分为两大类，配线箱风扇及功率模组风扇如图5-5所示。下列的步骤为如何清洗滤网。

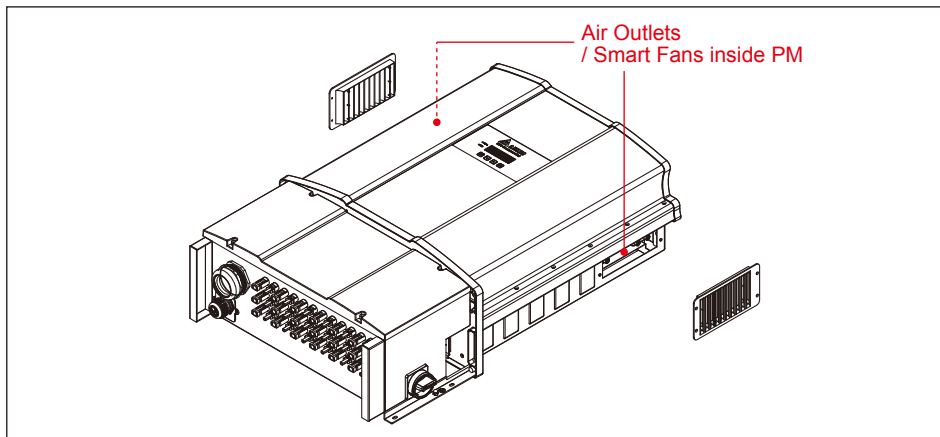


图5-5：功率模组智慧风扇位置

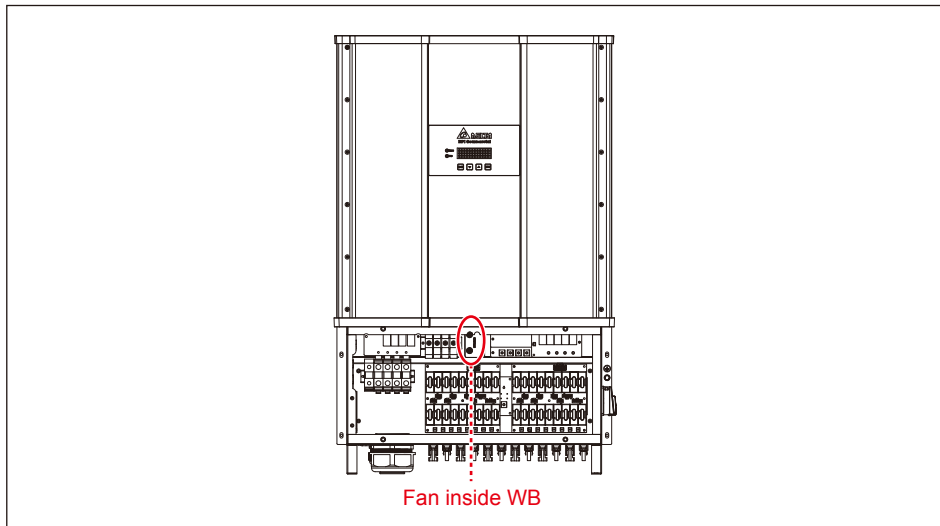


图5-6：配线箱智慧风扇位置(仅M88H\_122)



M88H系列内含12吋风扇，同时于功率模组内含有滤网。该风扇具有高寿命及高可靠性，同时拥有"FAN-FAIL"告警及限制输出功能以确保安全。同时该风扇模组也具有容易替换的设计，使维护更加方便。



图5-7：12吋风扇模组

### 注意



- 风扇及滤网清洁频率由当地环境决定。
- 正常环境条件使用下，每半年需清洁风扇及滤网一次。
- 若安装于严苛环境，建议每个月或每一季需清洁风扇及滤网一次。

配线箱区块：使用者须将2枚螺丝松脱并拔除连接线 (如图5-8)。最后将风扇模组替换后，将螺丝锁上，连接线接上。



图5-8：拆卸配线箱区块之智慧风扇 (仅M88H\_122)

功率模组区块：

图5-9为其中一侧的出风口，另一侧和此侧对称，故在此以其中一侧为例。

1. 将出风口上的四枚螺丝卸下
2. 拔除连接线并卸下四枚螺丝
3. 确认所有螺丝皆已卸下
4. 拉出风扇槽
5. 图5-9组图5为整个风扇槽的外观



图5-9：拆卸功率模组风扇 (仅以单侧为例)

图5-10为滤网位置。

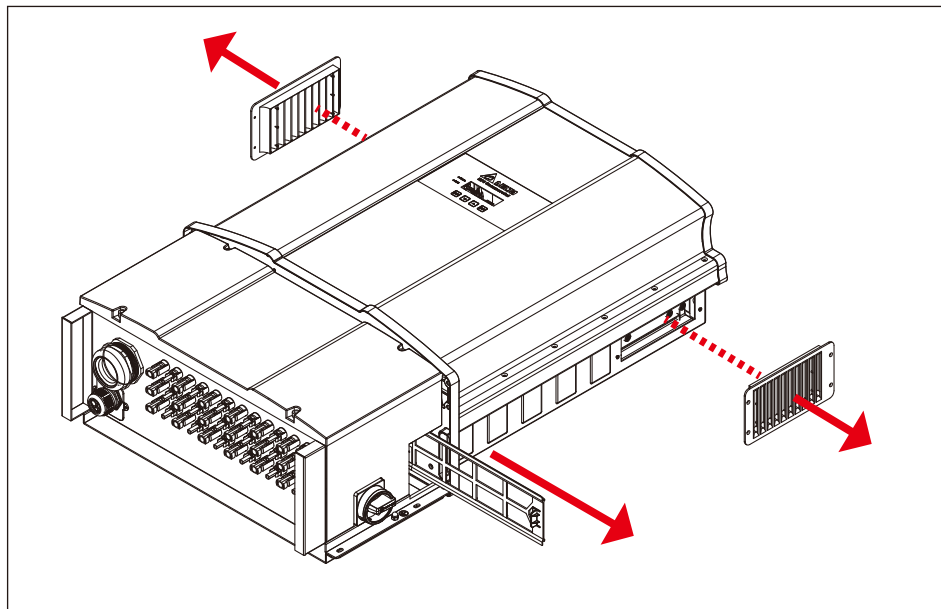


图5-10：滤网拆卸方向

## 5.3 终止运转

若需要终止运转以利维护，或保存，请依照下列指示进行。

### 危险: 触电危险!!



为避免严重伤亡，请依下列步骤进行：

- 关闭手动开关终止逆变器运行
- 关闭交流断路器确认与市电解离
- 关闭直流断路器确认与太阳能模组解离
- 使用电表量测确认交直流皆不带电
- 移除交流端子确认与市电解离
- 移除直流端子确认与太阳能模组解离
- 移除通讯模组与电脑解离

### 注意 表面高温 请勿触碰！



- 逆变器刚中断时，请注意表面高温。
- 直到表面降至适当温度前，请勿碰触逆变器。

### 注意: 可能造成伤害！



- 逆变器重达80公斤以上，若在搬运或从壁挂架拆卸过程中意外掉落可能造成伤害。

### 注意



- 螺丝螺帽移除后请留意，切勿将他们遗漏于配线箱内。

## 5.3.1 配线箱拆卸

请依以下指示将逆变器终止运行，若有需要将配线箱与功率模组分离，请参照以下步骤：

1. 请确认交流断路器与直流开关皆已切断。
2. 再次确认逆变器已终止运转且无触电风险。
3. 图5-11为正确切断直流开关的方式。

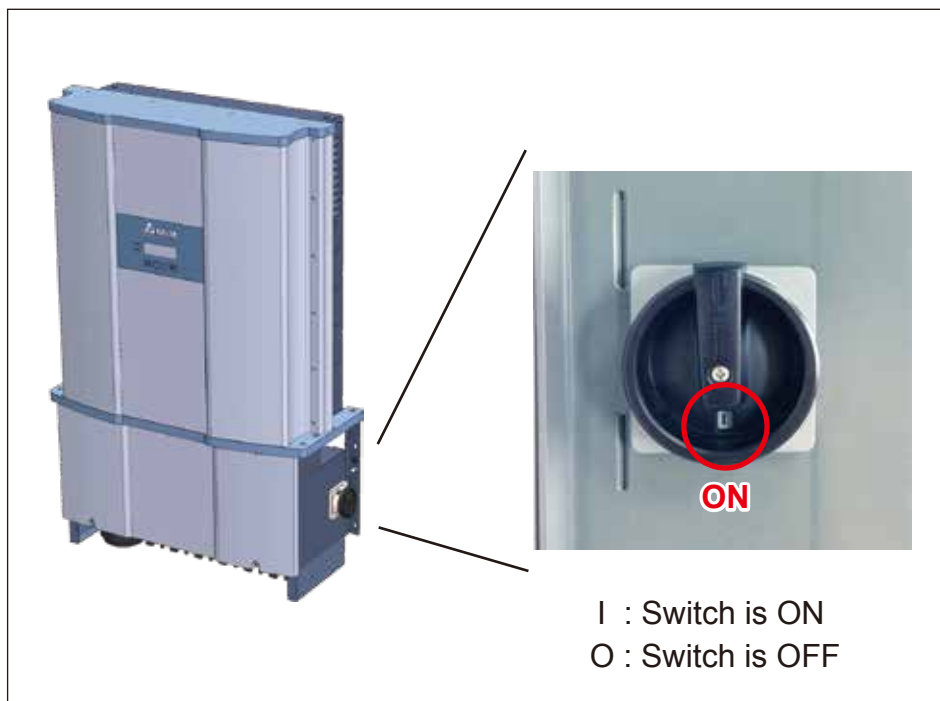


图5-11：直流开关之开 / 关位置 (仅M88H\_122)

- 请确认交直流电源皆已关断。
4. 打开配线箱上盖。
  5. 移除交直流线材及通讯线。
  6. 移除如图5-12所示之螺丝。

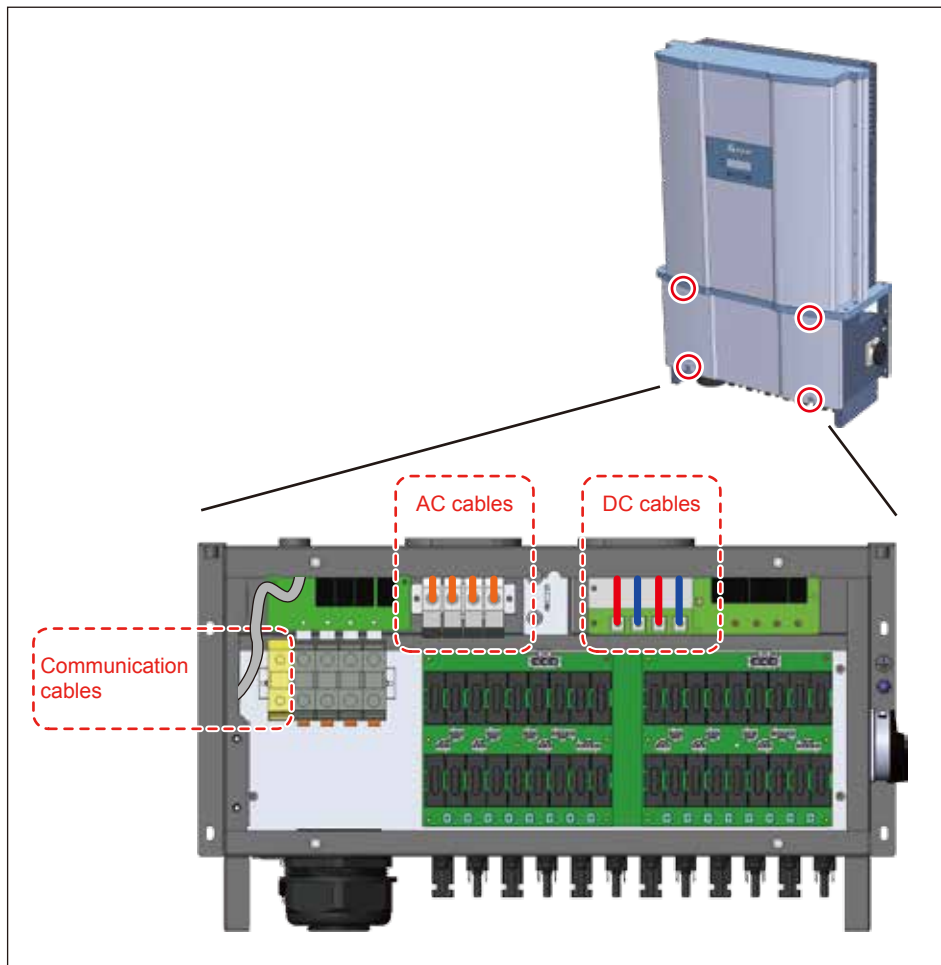


图5-12：移除交直流线材及通讯线，并卸下6颗螺丝

7. 卸下8颗螺丝并用手抓住功率模组使其与配线箱分开。
8. 确定密封盖有盖上。

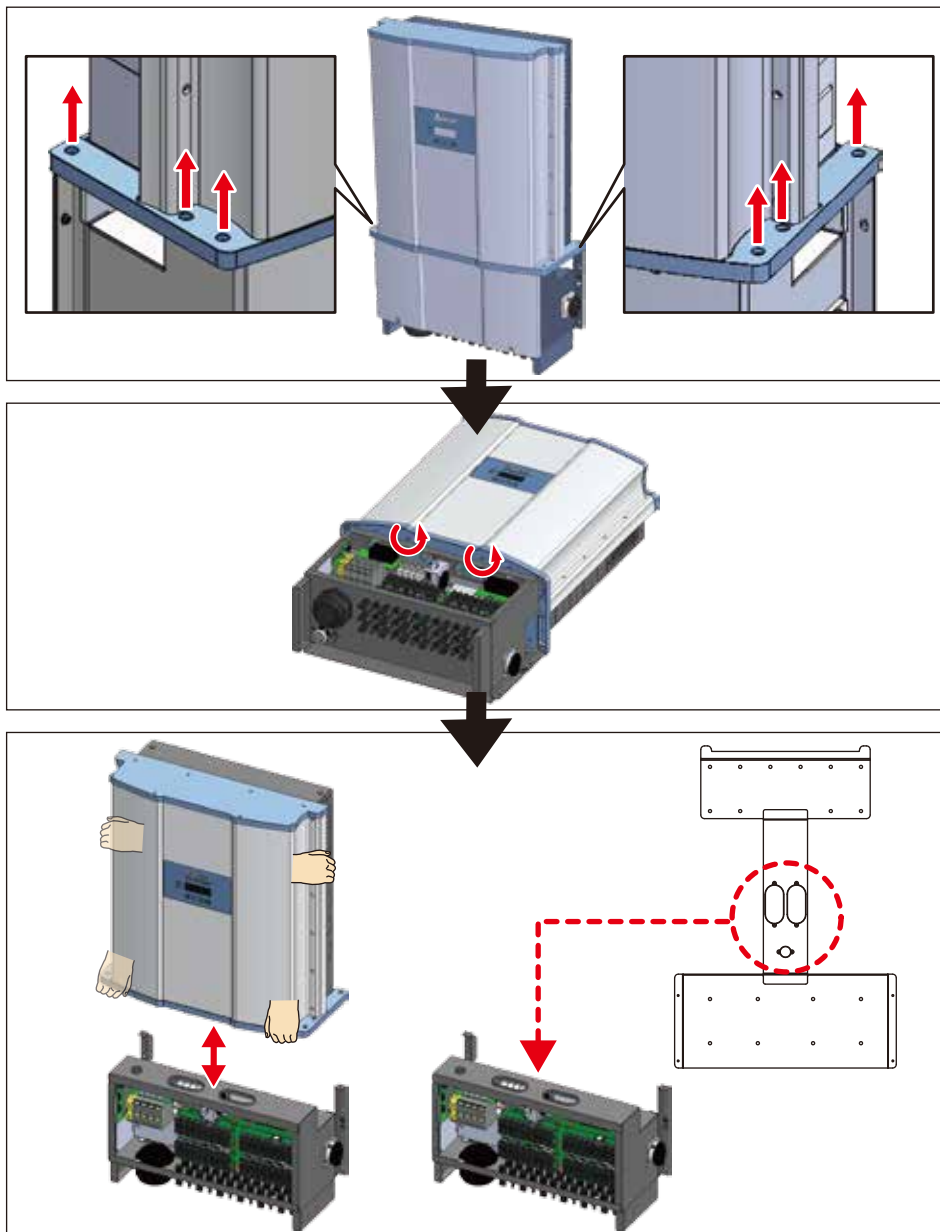


图5-13：拆下8颗螺丝后，将配线箱与功率模组分离



## 6 错误告警及排除问题

错误信息		
信息显示	可能原因	故障排除
AC Freq High (E01)	<ol style="list-style-type: none"> <li>实际的市电频率高过过频率保护设定</li> <li>国家设定不正确</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查逆变器端的市电频率</li> <li>检查国家设定</li> <li>检查逆变器端的侦测电路</li> </ol>
AC Freq Low (E02)	<ol style="list-style-type: none"> <li>实际的市电频率低于欠频率保护设定</li> <li>国家或电网设定不正确</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查逆变器端的市电频率</li> <li>检查国家与电网设定</li> <li>检查逆变器端的侦测电路</li> </ol>
Grid Quality (E07)	在电网或靠近逆变器附近非线性的负载	必要时逆变器与电网连接处必须远离非线性的负载
HW Con. Fail (E08)	<ol style="list-style-type: none"> <li>在AC接口连接错误</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查AC连接，必须和使用手册一致</li> <li>检查逆变器内部的侦测电路</li> </ol>
No Grid (E09)	<ol style="list-style-type: none"> <li>AC 断路器跳开</li> <li>中断AC界面</li> </ol>	<ol style="list-style-type: none"> <li>断开AC 断路器</li> <li>检查连接AC接口并确认其连接至逆变器</li> </ol>
AC Volt Low (E10, E15, E20)	<ol style="list-style-type: none"> <li>实际市电的电压低于低电压保护设定</li> <li>国家或电网设定不正确</li> <li>AC接口连接错误</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查市电与逆变器端的连接</li> <li>检查国家或电网设定</li> <li>检查AC接口连接</li> <li>检查逆变器内部的侦测电路</li> </ol>
AC Volt High (E11, E13, E16, E18, E21, E23)	<ol style="list-style-type: none"> <li>实际市电的电压高于过电压保护设定</li> <li>操作期间，市电的电压高于慢速电压保护设定</li> <li>国家或电网设定不正确</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查逆变器端的市电电压</li> <li>检查逆变器端的市电电压</li> <li>检查国家或电网设定</li> <li>检查逆变器内部的侦测电路</li> </ol>
Solar1 High (E30)	<ol style="list-style-type: none"> <li>实际Solar1电压超过1000Vdc</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>修正 solar array 设定并使得 Voc 小于 1000Vdc</li> <li>检查逆变器内部的侦测电路</li> </ol>
Solar2 High (E31)	<ol style="list-style-type: none"> <li>实际Solar2电压超过1000Vdc</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>修正 solar array 设定并使得 Voc 小于 1000Vdc</li> <li>检查逆变器内部的侦测电路</li> </ol>

错误信息		
信息显示	可能原因	故障排除
Insulation (E34)	<ol style="list-style-type: none"> <li>1. 太阳能板绝缘测试未通过</li> <li>2. 太阳能板电容值介于正到接地端或负到接地端太大或者两者皆有之</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入端绝缘</li> <li>2. 检查电容值, 必要时擦干太阳能板</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>

表6-1 : 错误信息

警告		
信息显示	可能原因	故障排除
Solar1 Low (W01)	<ol style="list-style-type: none"> <li>1. 实际Solar1电压低于下限值</li> <li>2. 若实际Solar1电压接近0, 逆变器内部可能有装置损坏</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查Solar1电压至逆变器端的连接</li> <li>2. 检查boost1的所有开关装置</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
Solar2 Low (W02)	<ol style="list-style-type: none"> <li>1. 实际Solar2电压低于下限值</li> <li>2. 若实际Solar1电压接近0, 逆变器内部可能有装置损坏</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查Solar2 voltage至逆变器端的连接</li> <li>2. 检查boost2的所有开关装置</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
De-rating (W07)	<ol style="list-style-type: none"> <li>1. 本体及环境温度过高</li> <li>2. 风扇故障</li> <li>3. 实功率限制功能作动</li> <li>4. P-F功能作动</li> <li>5. P(V) 功能作动</li> <li>6. 市电电压过低</li> <li>7. 输入电压过低</li> <li>8. 输入电压过高</li> </ol>	<ol style="list-style-type: none"> <li>1. 确认安装机器本体及环境温度</li> <li>2. 确认风扇能否正常运转</li> <li>3. 确认国别及最大功率限制参数设定</li> <li>4. 确认市电频率是否异常</li> <li>5. 确认市电电压是否异常</li> <li>6-1. 确认市电电压是否异常</li> <li>6-2. 确认虚功控制功能设定</li> <li>7. 确认PV panel输入电压是否过低</li> <li>8. 确认PV panel输入电压是否过高</li> </ol>
HW FAN (W11)	<ol style="list-style-type: none"> <li>1. 一个或多个风扇死锁</li> <li>2. 一个或多个风扇无效</li> <li>3. 一个或多个风扇未连接</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 移除卡在风扇内的对象</li> <li>2. 替换无效的风扇</li> <li>3. 检查风扇的连接</li> <li>4. 检查逆变器内部的侦测电路</li> </ol>
SPD Fail	<ol style="list-style-type: none"> <li>1. 逆变器遭受到雷击</li> <li>2. 一个或多个SPD有缺陷</li> <li>3. 一个或多个SPD未连接</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查逆变器是否遭受雷击</li> <li>2. 更换有缺陷之SPD</li> <li>3. 检查SPD的连接</li> <li>4. 检查逆变器内部之侦测线路</li> </ol>

表6-2 : 警告信息

故障		
信息显示	可能原因	故障排除
DC Injection (F01, F02, F03)	<ol style="list-style-type: none"> <li>市电波形异常</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查市电波形. 必要时逆变器与电网连接处必须远离非线性的负载</li> <li>检查逆变器内部的侦测电路</li> </ol>
Temperature (F05)	<ol style="list-style-type: none"> <li>环境温度超过60°C (装置异常)</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路</li> </ol>
Temperature (F07)	<ol style="list-style-type: none"> <li>环境温度 &lt; -30°C</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路 (RTM1, RTB1, RTG1 and RTH1)</li> </ol>
HW NTC1 Fail (F06)	<ol style="list-style-type: none"> <li>环境温度 &gt; 90°C 或 &lt; -30°C</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路(RTM1)</li> </ol>
HW NTC2 Fail (F08)	<ol style="list-style-type: none"> <li>环境温度 &gt; 90°C 或 &lt; -30°C</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路(RTB1)</li> </ol>
HW NTC3 Fail (F09)	<ol style="list-style-type: none"> <li>环境温度 &gt; 90°C 或 &lt; -30°C</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路(RTG1)</li> </ol>
HW NTC4 Fail (F10)	<ol style="list-style-type: none"> <li>环境温度 &gt; 90°C 或 &lt; -30°C</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查设备的周遭和环境</li> <li>检查逆变器内部的侦测电路(RTH1)</li> </ol>
HW RLY (F13)	<ol style="list-style-type: none"> <li>继电器的驱动电路故障</li> <li>一个或多个继电器本体故障</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查输入电压需大于150Vdc</li> <li>更换故障之继电器</li> <li>检查逆变器内部之侦测电路</li> </ol>
HW DSP ADC1 (F15)	<ol style="list-style-type: none"> <li>输入功率不足</li> <li>辅助电源电路功能异常</li> <li>侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>检查输入电压必须 &gt; 150Vdc</li> <li>检查逆变器内部的辅助电源电路</li> <li>检查逆变器内部的侦测电路</li> </ol>

故障		
信息显示	可能原因	故障排除
HW DSP ADC2 (F16)	<ol style="list-style-type: none"> <li>1. 输入功率不足</li> <li>2. 辅助电源电路功能异常</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入电压必须 &gt; 150Vdc</li> <li>2. 检查逆变器内部的辅助电源电路</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW DSP ADC3 (F17)	<ol style="list-style-type: none"> <li>1. 输入功率不足</li> <li>2. 辅助电源电路功能异常</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入电压必须 &gt; 150Vdc</li> <li>2. 检查逆变器内部的辅助电源电路</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW Red ADC1 (F18)	<ol style="list-style-type: none"> <li>1. 输入功率不足</li> <li>2. 辅助电源电路功能异常</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入电压必须 &gt; 150Vdc</li> <li>2. 检查逆变器内部的辅助电源电路</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW Red ADC2 (F19)	<ol style="list-style-type: none"> <li>1. 输入功率不足</li> <li>2. 辅助电源电路功能异常</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入电压必须 &gt; 150Vdc</li> <li>2. 检查逆变器内部的辅助电源电路</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW Eff. (F20)	<ol style="list-style-type: none"> <li>1. 校正不正确</li> <li>2. 电流回授电路无效</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查电流和功率的精度</li> <li>2. 检查逆变器内部电流回授电路</li> </ol>
HW COMM1 (F23)	<ol style="list-style-type: none"> <li>1. DSP 闲置中</li> <li>2. 通讯连接中断</li> <li>3. 通讯电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查DSP中reset和crystal</li> <li>2. 检查DSP和COMM通讯连接</li> <li>3. 检查通讯电路</li> </ol>
HW COMM2 (F22)	<ol style="list-style-type: none"> <li>1. Red. CPU闲置中</li> <li>2. 通讯连接中断</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查Red. CPU中reset和crystal</li> <li>2. 检查Red. CPU和DSP通讯连接</li> </ol>
Ground Cur. (F24)	<ol style="list-style-type: none"> <li>1. 太阳能板绝缘测试未通过</li> <li>2. 太阳能板电容值介于正到接地端或负到接地端太大</li> <li>3. Boost 驱动电路或Boost电感其中之一功能异常</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入端的绝缘</li> <li>2. 检查电容值 (+ &lt;-&gt; GND &amp; - &lt;-&gt; GND) , 必须 &lt; 2.5uF. 必要时安装外部的变压器</li> <li>3. 检查boost驱动电路和boost电感</li> <li>4. 检查逆变器内部的侦测电路</li> </ol>

故障		
信息显示	可能原因	故障排除
HW Con. Fail (F26)	<ol style="list-style-type: none"> <li>1. 逆变器内部的电源线未连接</li> <li>2. 电流回授电路无效</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查逆变器内部电源线</li> <li>2. 检查逆变器内部电流回授电路</li> </ol>
RCMU Fail (F27)	<ol style="list-style-type: none"> <li>1. RCMU连接中断</li> <li>2. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查逆变器内部RCMU连接</li> <li>2. 检查逆变器内部的侦测电路</li> </ol>
RLY Short (F28)	<ol style="list-style-type: none"> <li>1. 一个或多个继电器是闭合的</li> <li>2. 继电器driver电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 替换无效的继电器</li> <li>2. 检查逆变器内部的驱动电路</li> </ol>
RLY Open (F29)	<ol style="list-style-type: none"> <li>1. 一个或多个继电器异常</li> <li>2. 继电器驱动电路功能异常</li> <li>3. Vgrid与Vout侦测精度不正确</li> </ol>	<ol style="list-style-type: none"> <li>1. 替换无效的继电器</li> <li>2. 检查逆变器内部的驱动电路</li> <li>3. 检查Vgrid与Vout电压侦测精度</li> </ol>
Bus Unbal. (F30)	<ol style="list-style-type: none"> <li>1. 输入端并未完全独立或并联</li> <li>2. 太阳能板短路到地</li> <li>3. Boost驱动电路无效或连接中断</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查输入连接</li> <li>2. 检查太阳能板绝缘设定</li> <li>3. 检查逆变器内部boost的驱动电路</li> <li>4. 检查逆变器内部的侦测电路</li> </ol>
HW Bus OVR (F31, F33, F35)	<ol style="list-style-type: none"> <li>1. Boost驱动电路无效或连接中断</li> <li>2. 太阳能板Voc超过1000Vdc</li> <li>3. 操作期间突波发生</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查逆变器内部boost的驱动电路</li> <li>2. 修正太阳能板设定, 并使得Voc 小于 1000Vdc</li> <li>3. N/A</li> <li>4. 检查逆变器内部的侦测电路</li> </ol>
AC Cur. High (F36, F37, F38, F39, F40, F41)	<ol style="list-style-type: none"> <li>1. 操作期间突波发生</li> <li>2. Inverter stage驱动电路无效</li> <li>3. 开关装置无效</li> <li>4. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. N/A</li> <li>2. 检查inverter stage驱动电路</li> <li>3. 检查inverter stage全部开关装置</li> <li>4. 检查逆变器内部的侦测电路</li> </ol>
HW CT A Fail (F42)	<ol style="list-style-type: none"> <li>1. 测试电流回路损坏</li> <li>2. CSC1无效</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查WC3至CNC16的连接</li> <li>2. 替换新的CSC1</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>

故障		
信息显示	可能原因	故障排除
HW CT B Fail (F43)	<ol style="list-style-type: none"> <li>1. 测试电流回路损坏</li> <li>2. CSC2无效</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查WC3至CNC16的连接</li> <li>2. 替换新的CSC2</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW CT C Fail (F44)	<ol style="list-style-type: none"> <li>1. 测试电流回路损坏</li> <li>2. CSC3无效</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查WC3至CNC16的连接</li> <li>2. 替换新的CSC3</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW AC OCR (F45)	<ol style="list-style-type: none"> <li>1. 市电谐波成分大</li> <li>2. 开关装置无效</li> <li>3. 侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查市电波形, 必要时逆变器与电网连接处必须远离非线性的负载</li> <li>2. 检查inverter stage开关装置</li> <li>3. 检查逆变器内部的侦测电路</li> </ol>
HW ZC Fail (F50)	同步讯号侦测电路功能异常	检查逆变器内部同步讯号的侦测电路
AFCI Circuit Fail (F58)	<ol style="list-style-type: none"> <li>1. 电弧侦测装置没有安装</li> <li>2. 电弧侦测装置自我测试失效</li> </ol>	检查电弧侦测装置电路板, 确认连接线是否正确连接
AFCI Fault (F59)	逆变器侦测到有电弧存在	检查DC端配线是否有问题
DC Cur. High (F60, F61, F70, F71)	<ol style="list-style-type: none"> <li>1. Boost开关装置无效</li> <li>2. Boost驱动电路无效</li> <li>3. 输入电流侦测电路功能异常</li> </ol>	<ol style="list-style-type: none"> <li>1. 检查boost全部开关装置</li> <li>2. 检查逆变器内部的boost驱动电路</li> <li>3. 检查输入电流侦测电路</li> </ol>
HW DC RLY (F76)	一个或多个直流电驿异常	请联系客服人员, 寻求技术支持

表6-3: 故障信息

## 7 技术资料

Model	M88H_121	M88H_122
<b>直流输入</b>		
最大输入功率	Vac230/400V : 76kW Vac277/480V : 91kW	
建议PV配置功率	Vac230/400V : 90kW Vac277/480V : 110kW	
机体可承受最大直流电压	1100 V *	
工作电压范围	200 - 1000 V	
启动电压	> 250 V	
最大功率追踪范围(额定功率)	Vac230/400V : 500-800V Vac277/480V : 600-800V	
额定电压	Vac230/400V : 600V Vac277/480V : 710V	
MPP追踪器数量	2	
最大输入电流/每一MPP追踪器	140 / 70A	
最大输入短路电流/每一MPP追踪器	180 / 90A	
接线型式	Terminal block for 2 MPPTs	18 pairs of MC4 connector
型式2 SPD	●	●
15A 串列保险丝	—	●
直流开关	—	●
<b>交流输出</b>		
最大输出功率	Vac230/400V : 73kW Vac277/480V : 88kW	
最大输出电流	106A	
涌浪电流	40A / 100μs	
最大输出故障电流	115.4A (rms)	
最大输出过电流保护	125A	
额定电压	3Ph, 230/400 & 277/480Vac	
工作电压范围	Vac230/400V : ±30% Vac277/480V : ±20%	
操作频率范围	50/60Hz ± 5Hz	
功率因素	1 at rated power, 0.8 ind ~ 0.8 cap adjustable	
突波保护	Type II SPD	
谐波成分	< 3%	
接线型式	50 ~120 mm <sup>2</sup>	35 ~95 mm <sup>2</sup>
夜间功耗	< 3 W	

\* 最大可承受电压为1100V。(当电压超过1000V时逆变器停止运转)

● : 有

— : 没有

Model	M88H_121	M88H_122
<b>效率</b>		
最高效率	98.8 %	
欧洲效率	98.5 %	
<b>资讯</b>		
通讯介面	RS-485	
显示萤幕	20 x 4 LCD	
<b>规范认证</b>		
	IEC 62109-1/-2 VDE-AR-N 4105 EN 61000-6-1 EN 61000-6-2 EN 61000-6-3 EN 61000-6-4 CE compliance	
<b>一般数据</b>		
操作温度范围	-25~60°C (Max power: -25~35°C)	
防水防尘等级	IP65	
操作海拔范围	< 3000 m	
冷却模式	Forced air cooling plus Smart Fans control	
尺寸 (W x H x D) (mm)	615 x 962 x 275	
重量 (kg)	84	
噪音 (距离1公尺)	75.8 dB	
过电压类别	AC output :III, DC Input :II	
最大反馈电流至太阳能模组端	0	
保护等级	I	
污染程度	3	
湿气范围	4-100%	

表7-1 : M88H规格





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## 三相併網型逆變器

M88H  
操作手冊

English ..... 1

简体中文 ..... 75

繁體中文 ..... 149

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# 1 安全規範

## 1.1 逆變器資料

### 1.1.1 免責聲明

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### 1.1.2 適用對象

本說明書適用於針對安裝、試運行、實際操作、後續維護受過良好訓練的人以下基礎及進階技巧為必需的。

- 了解基礎電力、配線、電子元件及電子電路符號
- 了解太陽能逆變器如何運行及操作
- 針對電子產品的安裝及試運行受過訓練
- 針對安裝及使用電子產品的過程中會遇到的危險及風險受過訓練
- 遵守本說明書及所有安全規範

開始接觸此產品前，請詳閱本說明書。



## 1.2 安全概述

### 重要安全指示：保存所有指示！



- 請詳閱所有指示及保存供後續使用。

為了避免人員受傷或其他損失及確保逆變器長期運轉，在使用此產品前請務必詳閱所有安全指示。

本說明書針對Delta併網型無變壓器太陽能逆變器提供重要指示。本產品進行設計、測試、驗證且經國際安全規範認證，但安裝及使用本產品前仍須做好防範措施。

### 注意：無電氣隔離



- 本產品無附加變壓器，為非電氣隔離型。  
市電端與逆變器間需加入外部變壓器。  
請勿使用需接地(正極或負極)之太陽能板。  
若使用了，則本產品會以INSULATION (E34) 告警。
- L1, L2, L3, 及 N 禁止連接至地。

### 1.2.1 使用條件

M88H為雙MPP追蹤、無變壓器太陽能逆變器，能將太陽能串列的變動電流轉換成與市電頻率相同之三相交流能量並饋入市電。

所使用之太陽能模組需與逆變器匹配。

太陽能面板之對地電容不可超過 8 $\mu$ F。

本產品僅可在經Delta及市電業者許可之國家運行。

## 1.2.2 標誌

本節說明本說明書會出現的標誌定義，為了避免人員受傷或其他損失及確保逆變器長期運轉，在使用此產品前請務必詳閱所有安全指示並遵守。

### 危險！



- 此警語表示可能發生致死或嚴重傷亡的情形。

### 警告！



- 此警語表示可能發生致死或嚴重傷亡的情形。

### 注意！



- 此警語表示可能發生較輕微傷害的情形。

### 注意



- 此警語表示可能對資產或環境造成傷害。

### 資訊



- 進一步的資訊會經由雙圈驚嘆號指示。  
這代表接續的內容將含有使用者該遵守的重要資訊以免造成任何傷害。

### 危險：觸電!!



- 此警語表示可能會有造成嚴重傷亡的觸電可能。

### 注意：表面高溫，請勿觸碰！



- 此警語表示當逆變器運行時機體表面高溫，  
待表面溫度下降後在進行需接觸的工作。



- 等待圖示中所顯示的時間後再進行工作



- 設備接地導體

## 2 產品介紹

M88H以最先進之高頻切換及低EMI技術設計而成，同時具有高效率及高壽命的特點，亦適用於戶外。

### 注意：無電氣隔離



- 本產品無附加變壓器，為非電氣隔離型。
- 市電端與逆變器間需加入外部變壓器。
- 請勿使用需接地(正極或負極)之太陽能板。
- 若使用了，則本產品會以INSULATION (E34) 告警。
- L1、L2、L3 及 N 禁止連接至地。

### 2.1 適用機種

本說明書適用以下機種:

- M88H\_121
- M88H\_122

安裝、運行及維護過程皆必須遵守本說明書。

M88H系列包含兩機種如圖2-2所示。Delta保留在不另行告知的前提下修改內容及技術資料的權力。

## 2.2 產品概述

M88H內容物如圖2-1所示。

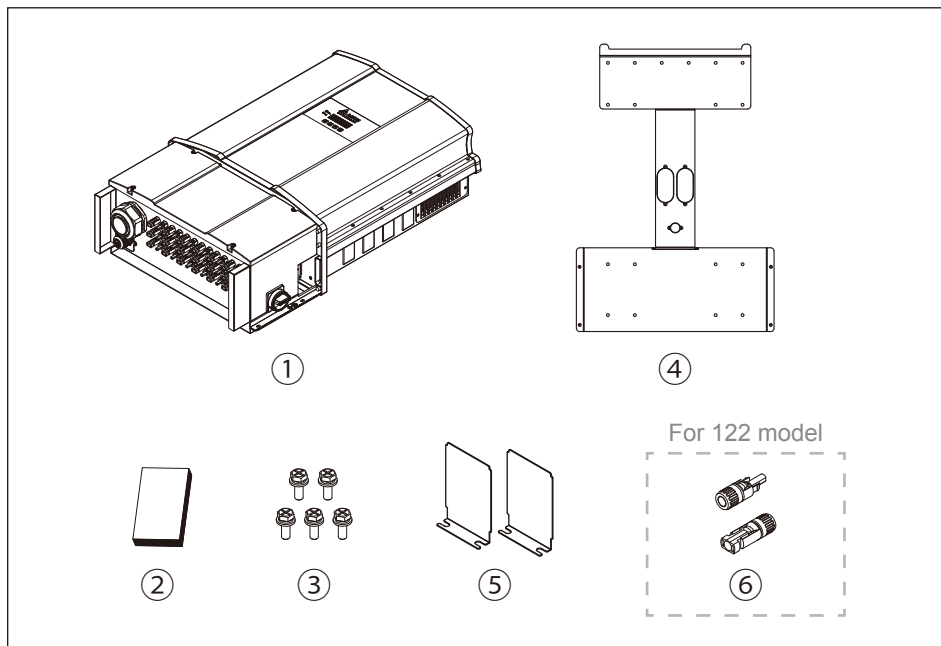


圖2-1：M88H內容物

M88H			
	物件	數量	描述
1	DELTA太陽能逆變器	1	太陽能逆變器
2	說明書	1	安裝及維護過程中務必參考本說明書中的安全指示
3	螺絲	5	逆變器與壁掛架鎖附螺絲
4	壁掛架	1	將逆變器掛起之壁掛架
5	遮蔽板	1對	濾網的遮蔽板 (非必要)
6	MC4端子	18對	組串輸入接頭 (僅122機種)

表2-1：M88H內容清單

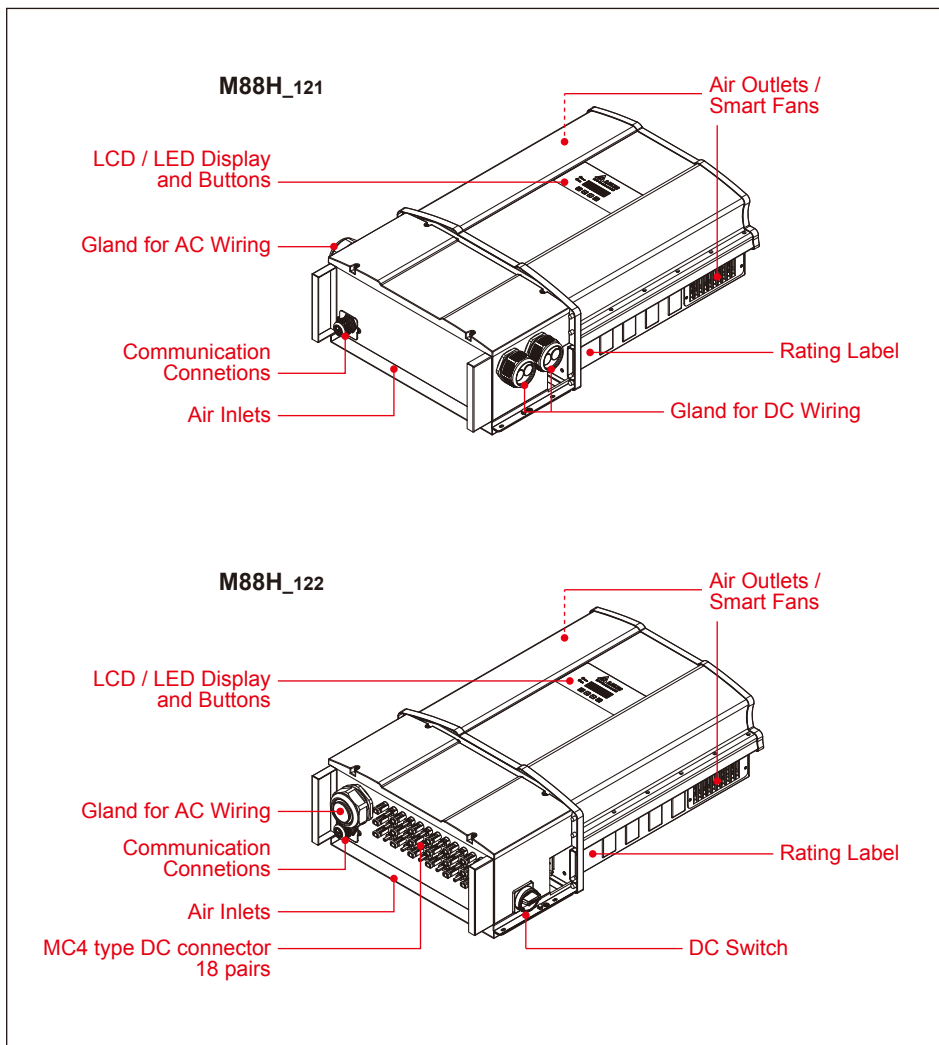


圖2-2 : M88H外觀介紹

圖2-3為M88H產品標籤並配合表2-2針對特殊符號做解釋。圖2-4為M88H配線箱的架構圖詳細描述可參照表2-3，其中包含輸入輸出端的突波吸收元件(SPD)、保險絲座、及通訊連接(RS-485)。



圖2-3：M88H標籤







Symbol	Definition
	<b>嚴重觸電危險</b> 逆變器運行時會有致命高電壓存在，切斷後危險電壓存在約100秒，時間內請勿接觸逆變器。 本產品不含任何需要開啟機殼之元件。擅自開啟機殼會使保固失效。
	使用此逆變器前，請詳閱說明書。
	此逆變器本身沒有經由變壓器與市電端分離。
	若當地規範要求，機體外殼請務必下地。
	請注意噪音防範。
	<b>WEEE marking</b> 本逆變器須以標準家用廢棄物報廢，並同時遵守當地針對電器報廢的相關規範。

表2-2：M88H標籤內容描述

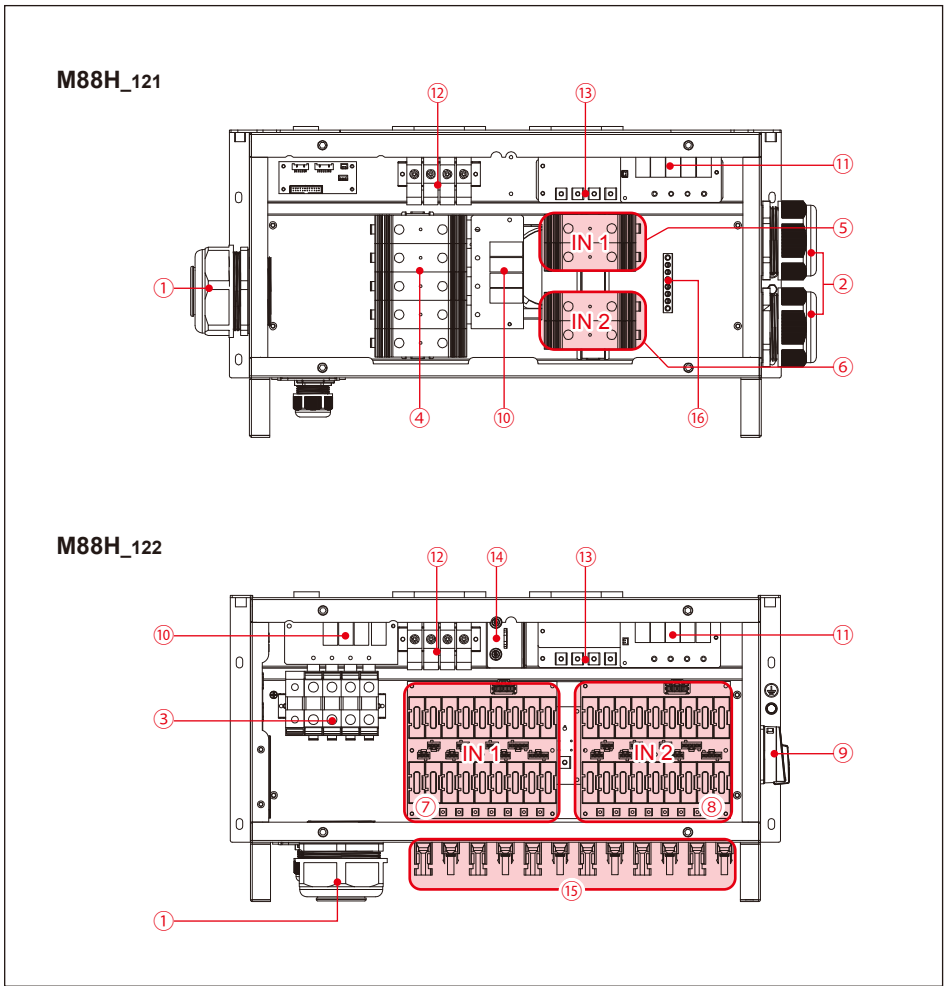


圖2-4：M88H配線箱架構圖

NO.	Component	NO.	Component	NO.	Component
1	Cable gland for AC	7	Fuse holder type DC IN1	13	Internal DC terminal
2	Cable gland for DC	8	Fuse holder type DC IN2	14	Wiring box fan
3	95mm <sup>2</sup> AC terminal	9	DC switch	15	MC4 connector
4	120mm <sup>2</sup> AC terminal	10	Type II AC SPD	16	Grounding bar
5	120mm <sup>2</sup> DC terminal for IN 1	11	Type II DC SPD		
6	120mm <sup>2</sup> DC terminal for IN 2	12	Internal AC terminal		

表2-3：M88H配線箱架構圖內容描述



## 3 安裝

### 注意！



- 本產品不建議安裝在直接日照曝曬處。

### 警告！



- 請勿將本產品安裝在易燃表面附近。
- 請將本產品安裝於堅固且平順之表面。

本章節包含以下指示

1. 機構安裝
2. 電氣安裝
3. 通訊安裝

### 3.1 機構安裝

本產品設計為壁掛型。請確保安裝時，本產品與地面垂直且交直流配線處為接近地面端，請務必遵循圖3-1至圖3-7的安裝指示，首先安裝壁掛架於堅固表面，並將逆變器牢固地鎖附於壁掛架上。

請參考以下步驟鎖附逆變器至牆上。

1. 至少使用8枚M8十字螺絲將壁掛架固定牆上，螺絲孔位置請遵從圖3-1及3-2。
2. 將逆變器掛至壁掛架上。
3. 圖3-1及3-2提供建議的螺絲孔位置。
4. 圖3-3至3-7描述正確的安裝方式。
5. 圖3-7為正確鎖附配線箱的方法。

### 注意！



- 至少使用8枚M8十字螺絲將壁掛架固定牆上。
- 該壁掛架為本產品專用，請勿使用其他壁掛架來搭配本產品使用。

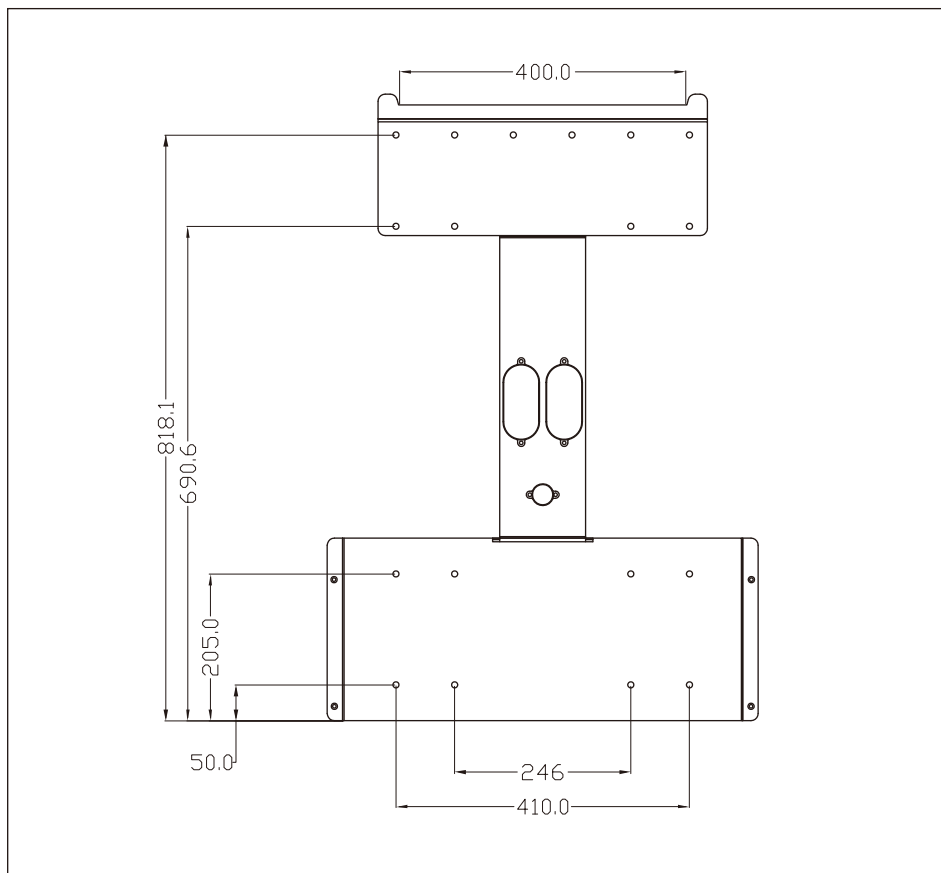


圖3-1：壁掛架詳細尺寸

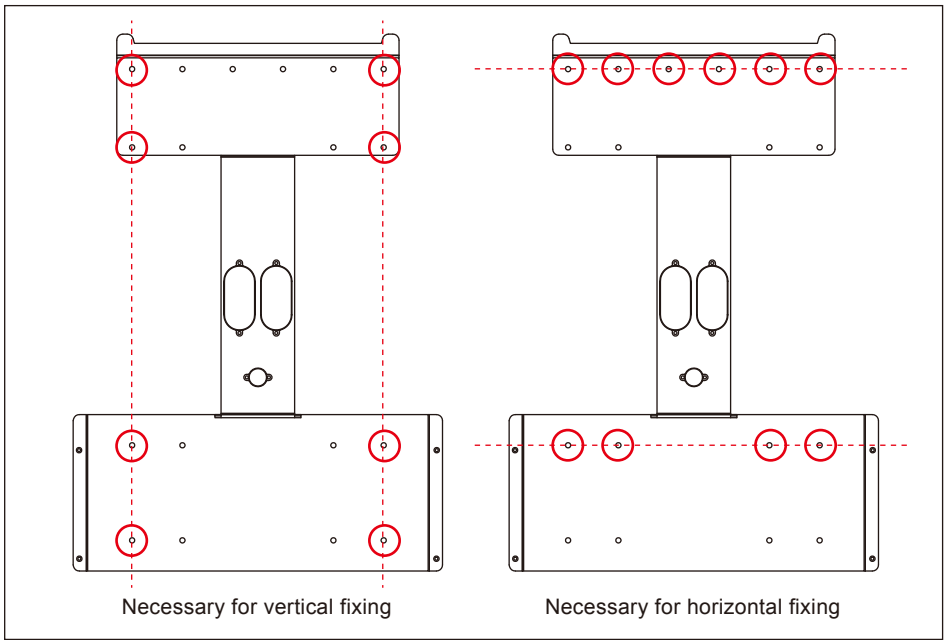


圖3-2：壁掛建議螺絲鎖附孔位置(至少8枚螺絲)

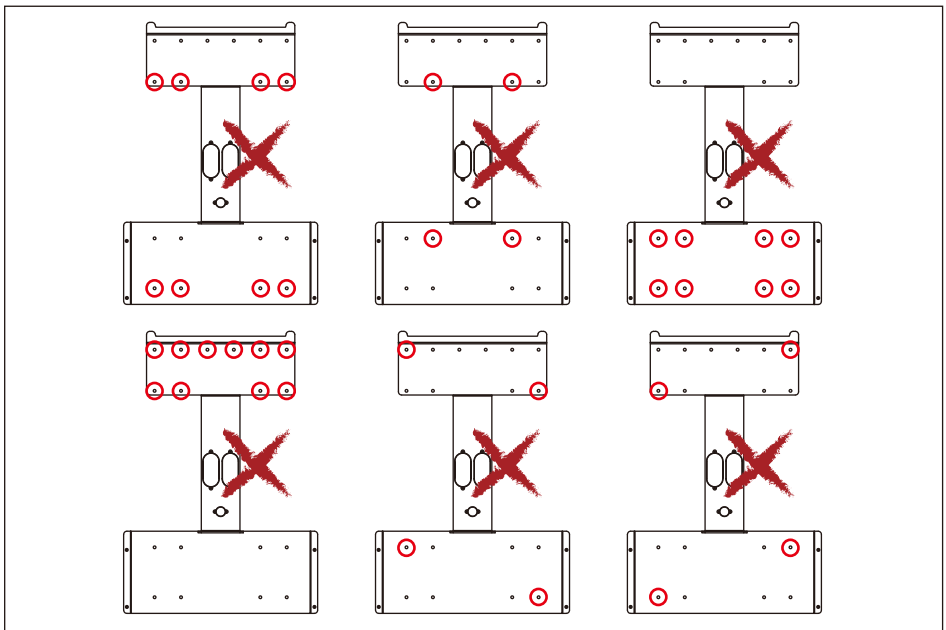


圖3-3：錯誤的螺絲鎖附位置

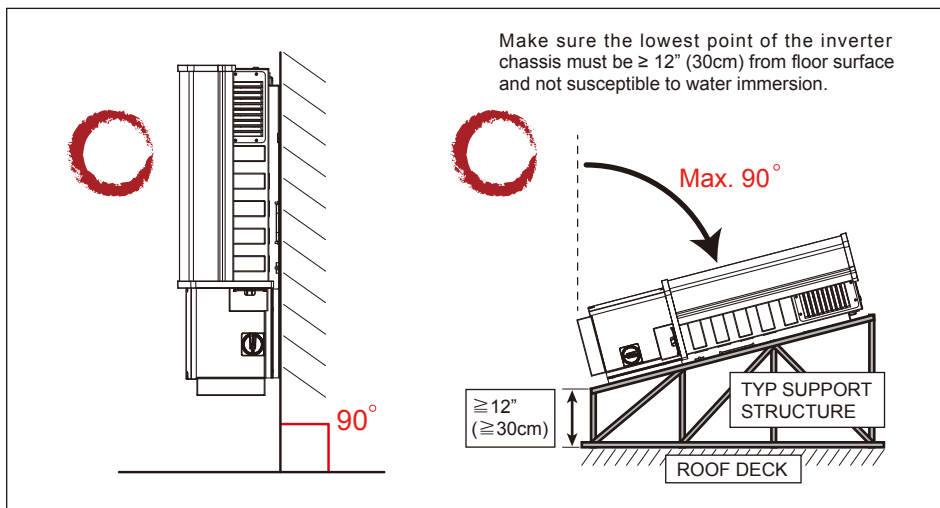


圖3-4：正確的安裝位置

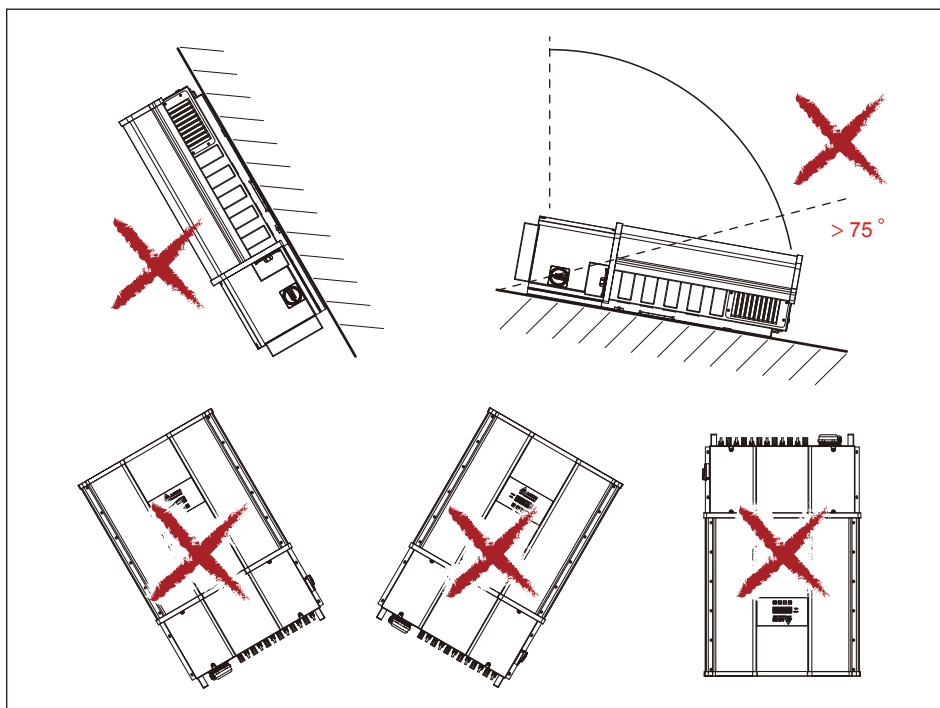


圖3-5：禁止的安裝方式

O : Permitted / X : Prohibited

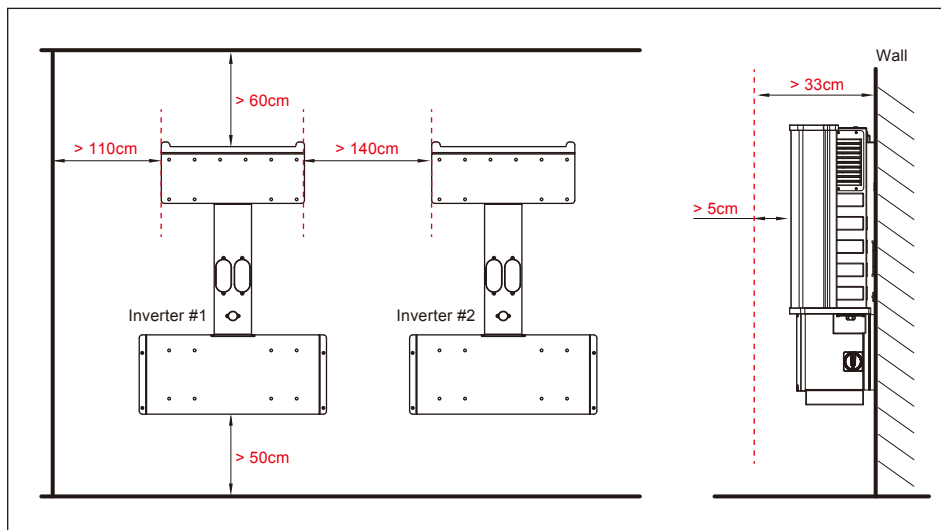


圖3-6：機台間最低要求距離

**注意！**



- 請遵照允許的安裝方式進行施工。

將逆變器掛上後，請以鎖附扭力45 kgf.cm將四枚螺絲鎖上。

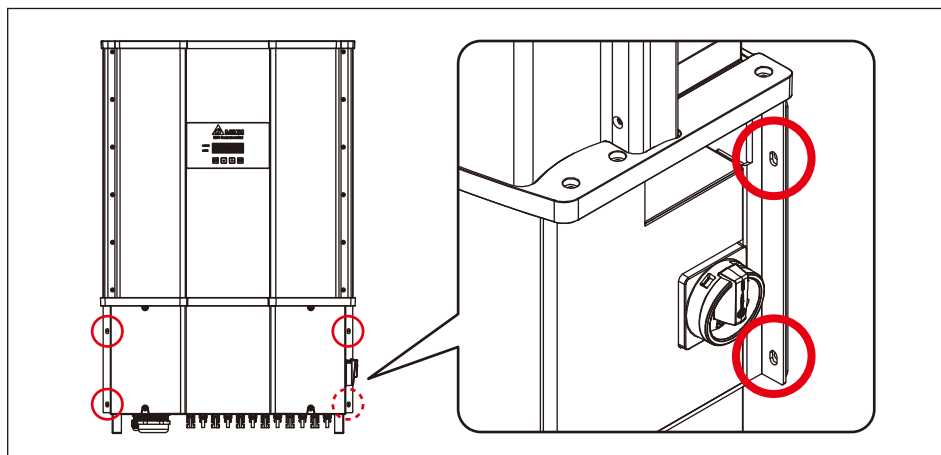


圖3-7：配線箱與壁掛架鎖附螺絲位置

要使用遮蔽板，請參考圖3-8的安裝方式。  
(鎖附扭力45 kgf.cm)

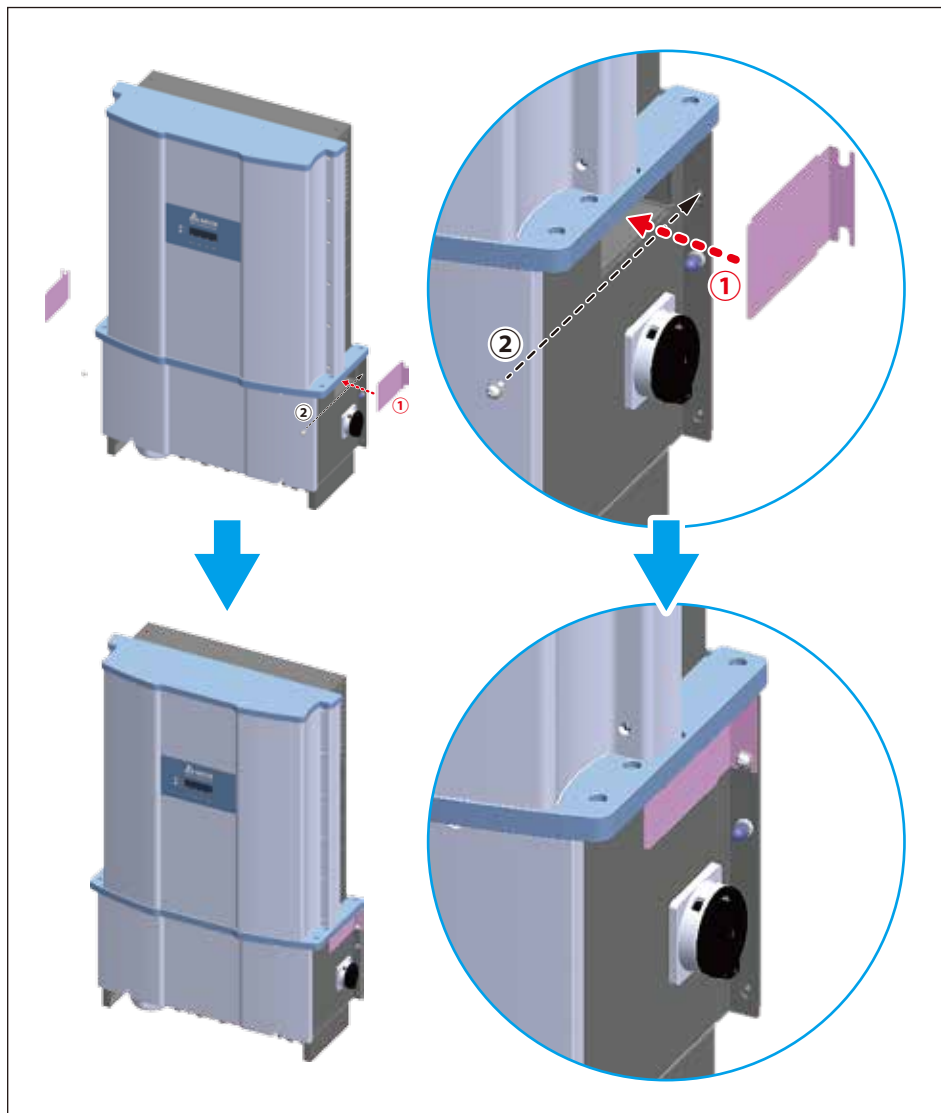


圖3-8：遮蔽板的安裝方法

## 3.2 交流配線安裝

### 危險：觸電危險!!



- 配線時禁止供給逆變器任何電源。

### 警告！



- 遵守條文為安裝者的責任。
- 直流電壓超過1000V則保固失效。

### 注意：逆變器及設備可能損毀！



- 請選用正確尺寸之交流線材。
- AC端子安裝須遵守當地電氣法規。
- 不遵守指示可能會損壞交流線材。

### 注意



- 逆變器可能因溼度或沙塵損壞，請勿打開逆變器機殼。

### 3.2.1 M88H<sub>121</sub>必須保護裝置及交流配線安裝

建議於市電端與逆變器間加入斷路器做為過電流保護。

型號	斷路器規格
M88H	≥ 125A

請遵循以下步驟組裝交流端子 (M88H<sub>121</sub>) :

- 請選用適當線材尺寸
- 剝去線皮40mm
- 線材表面積範圍為 1AWG ~ 250kcmil

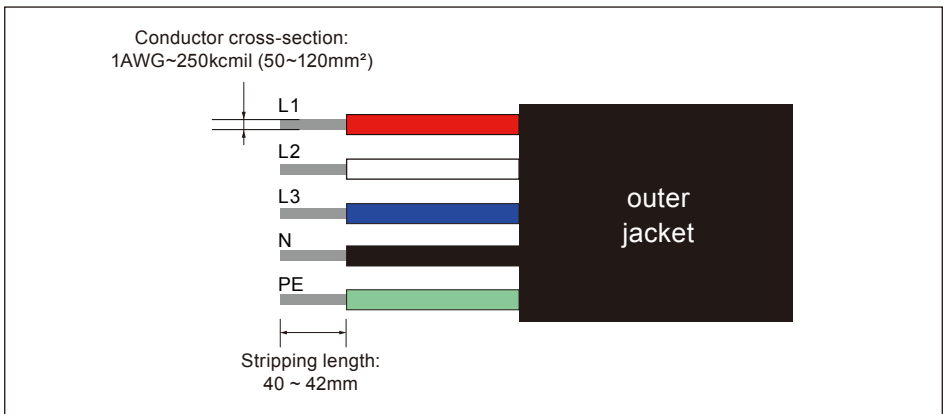


圖3-9：M88H<sub>121</sub>交流線材剝線



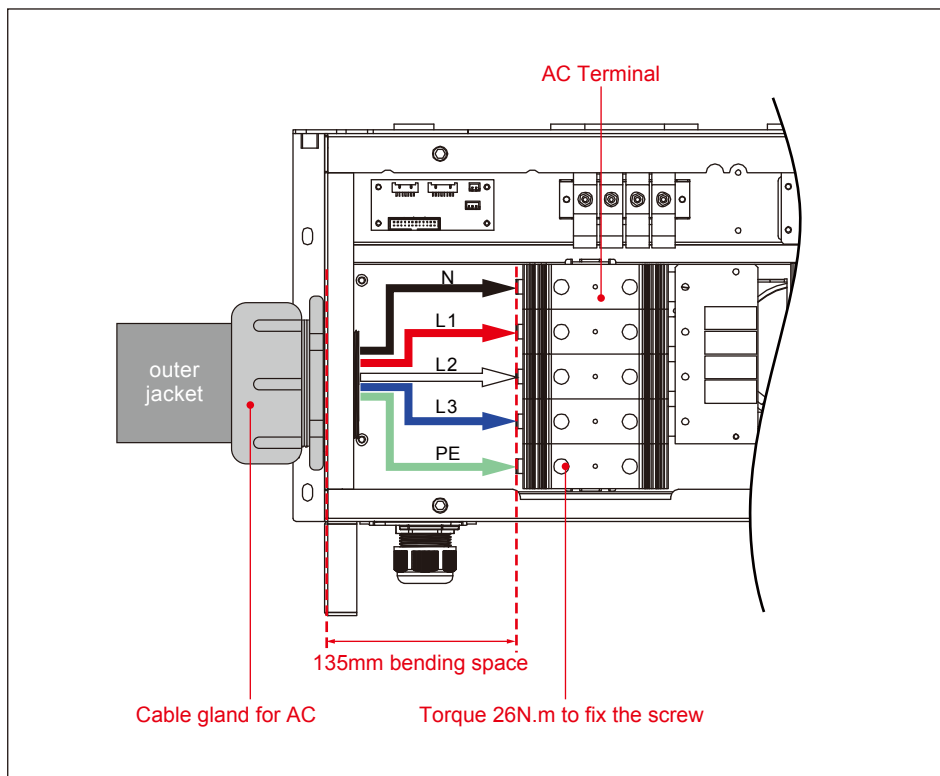


圖3-10 : M88H\_121交流端子位置

### 3.2.2 M88H<sub>122</sub>必須保護裝置及交流配線安裝

建議於市電端與逆變器間加入斷路器做為過電流保護。

型號	斷路器規格
M88H	≥ 125A

請遵循以下步驟組裝交流端子 (M88H<sub>121</sub>) :

- 請選用適當線材尺寸
- 剝去線皮24mm
- 線材表面積範圍為2~3/0 AWG

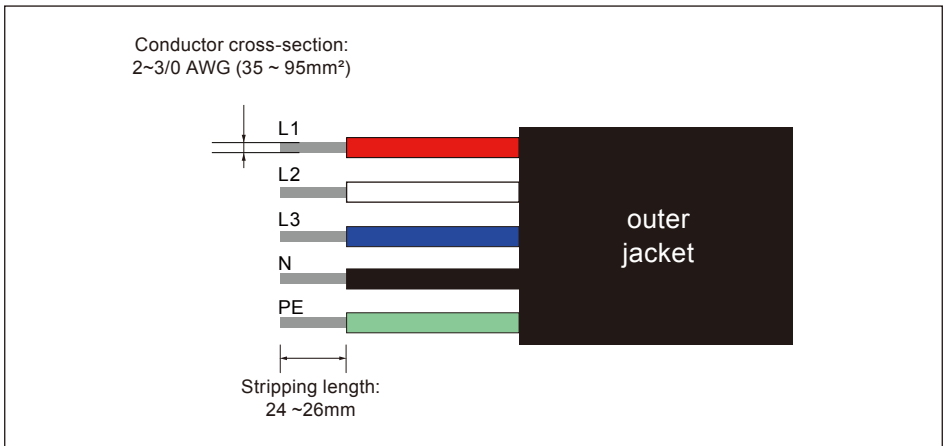


圖3-11 : M88H<sub>122</sub>交流線材剝線

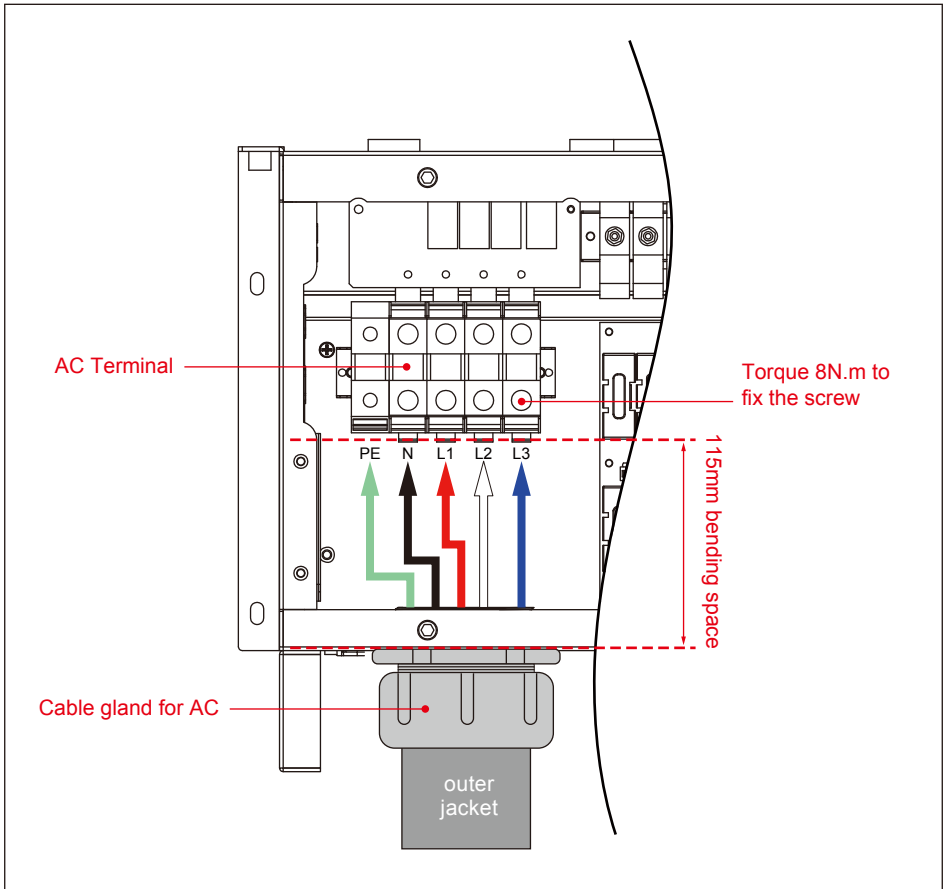


圖3-12 : M88H\_122交流端子位置

若使用鋁線，請遵循以下指示

鋁線使用指示：

- 剝線後氧化層請去除
- 氧化層去除後請塗上凡士林或類似性質之接面油
- 請以該端子台之最大鎖附扭力鎖附線材
- 安裝處請遠離潮濕環境或極端氣候
- 強烈建議使用區塊成形及單芯線

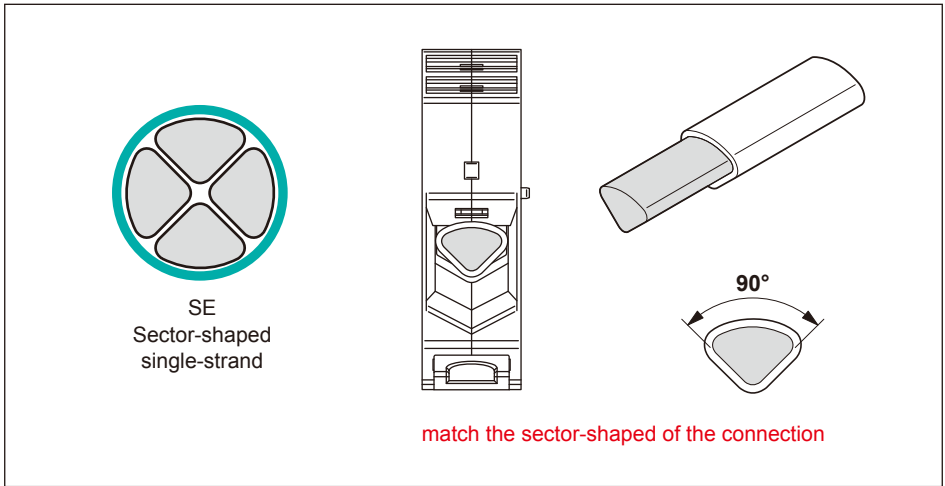


圖3-13：鋁線使用指示

### 3.3 直流配線安裝

#### 危險:觸電危險!!



- 太陽能串列將太陽能轉換成高壓直流形式，此高壓有可能造成觸電危險。
- 配線前請使用非透明物質將太陽能串列遮蓋起來。
- 配線時請確認電壓極性

#### 警告!



- 觸電及火災危險。僅允許使用有標示低於1100V的太陽能串列。
- 配線時請確認直流開關在"關"的模式，且太陽能陣列沒有連接。

#### 注意



- 太陽能陣列的正或負端皆禁止接到地。
- 根據UTE法規，建議配置斷路器於太陽能陣列與逆變器之間做為過電流保護裝置。

### 3.3.1 M88H\_121直流配線安裝

請遵循以下步驟組裝交流端子 (M88H\_121) :

- 請選用適當線材尺寸
- 線材表面積範圍為1AWG~250kcmil
- 直流端子台配線如圖3-15所示

#### 注意



- 直流端子鎖附扭力為26N.m
- 所需的配線空間為135 mm

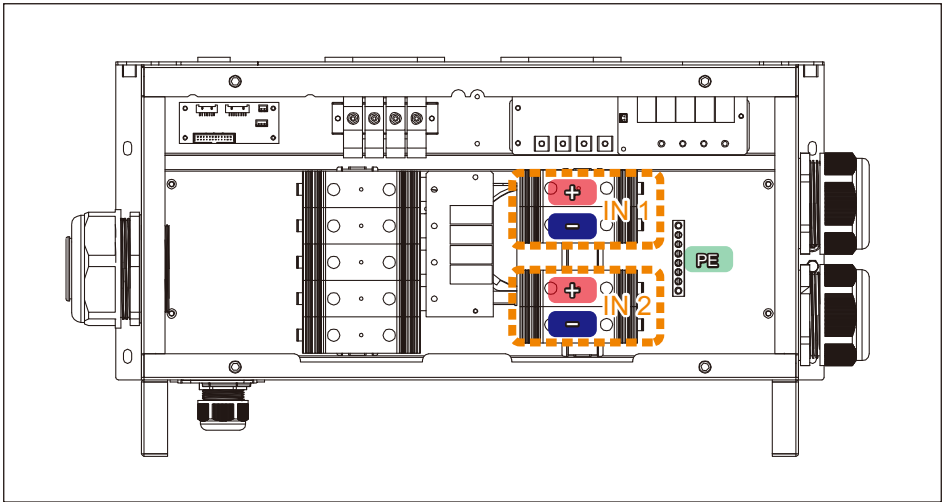


圖3-14 : M88H\_121配線箱架構圖

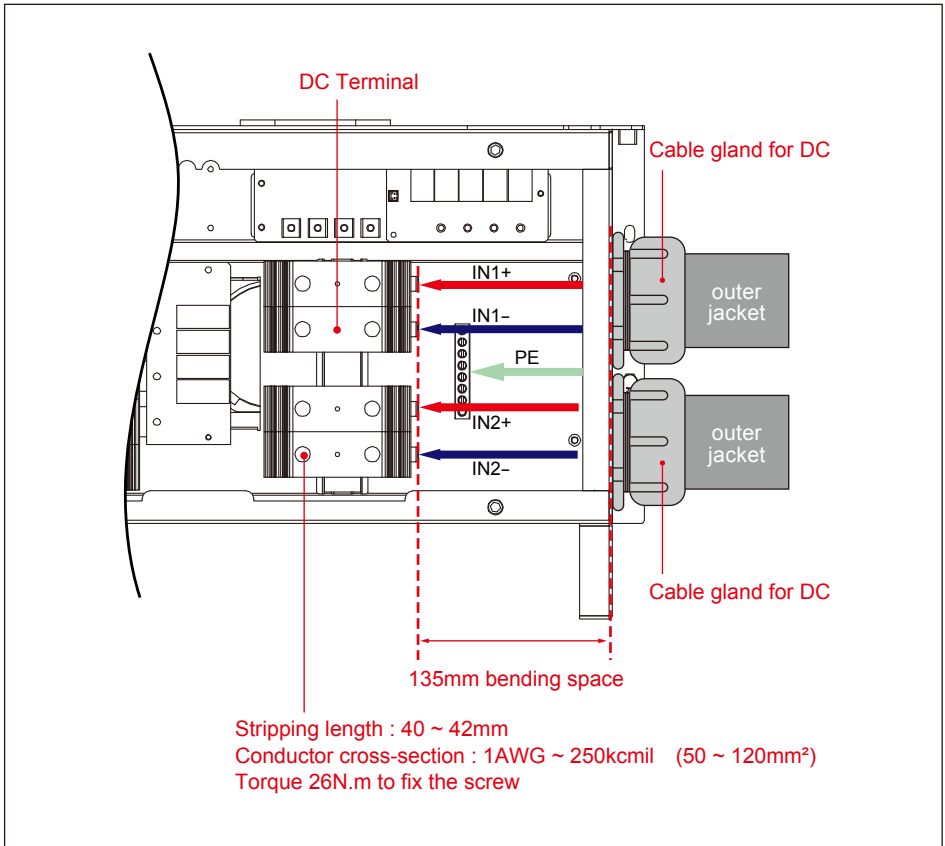


圖3-15：M88H\_121直流端子台位置

### 3.3.2 M88H\_122直流配線安裝

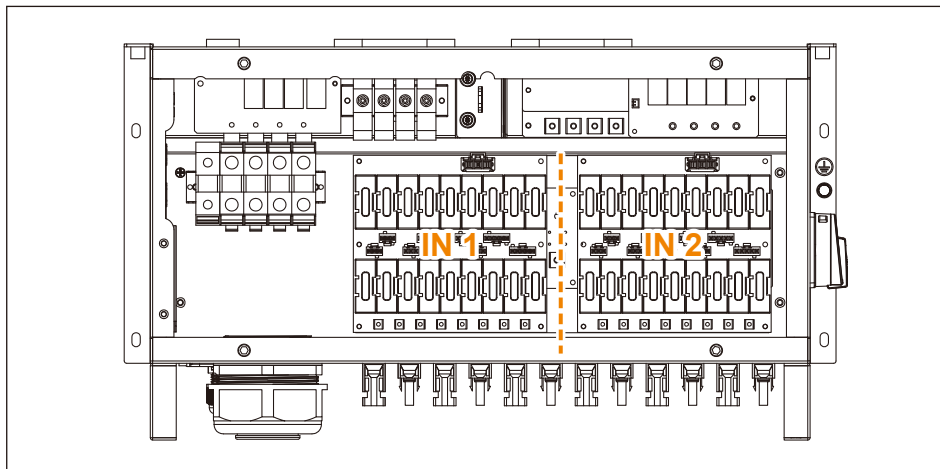


圖3-16：M88H\_122配線箱架構圖

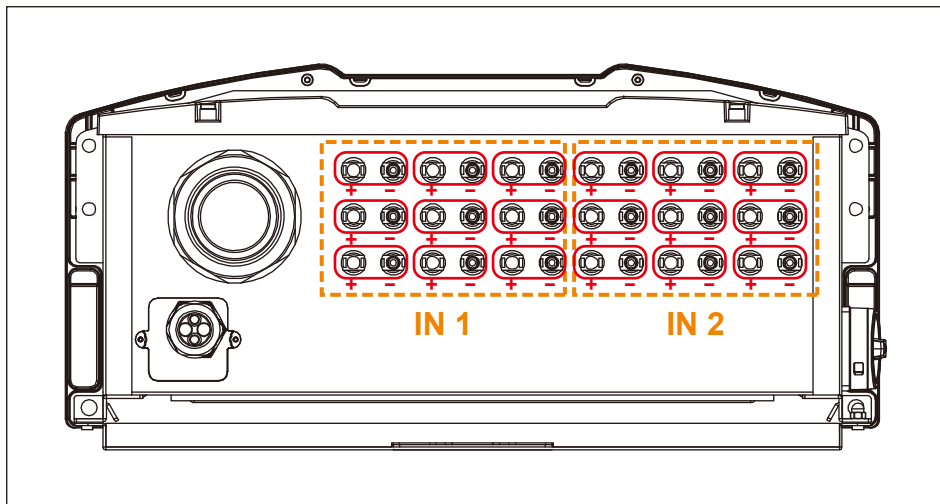


圖3-17：M88H\_122直流端子位置



若使用鋁線, 請遵循以下指示

鋁線使用指示 :

- 剝線後氧化層請去除
- 氧化層去除後請塗上凡士林或類似性質之接面油
- 請以該端子台之最大鎖附扭力鎖附線材
- 安裝處請遠離潮濕環境或極端氣候
- 強烈建議使用區塊成形及單芯線

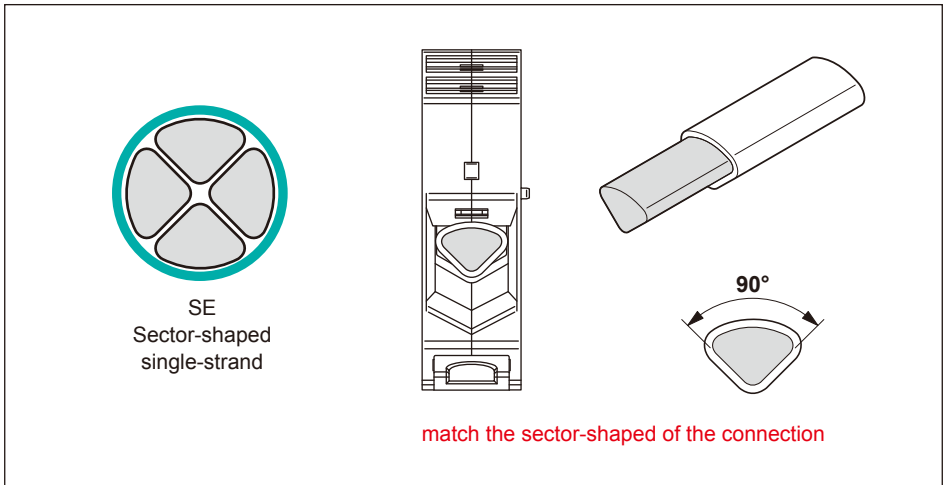


圖3-18 : 鋁線使用指示

## 3.4 通訊模組連接方式

M88H通訊模組提供VCC、RS-485、乾接點、EPO、及各種不同功能之數位輸入端子台。

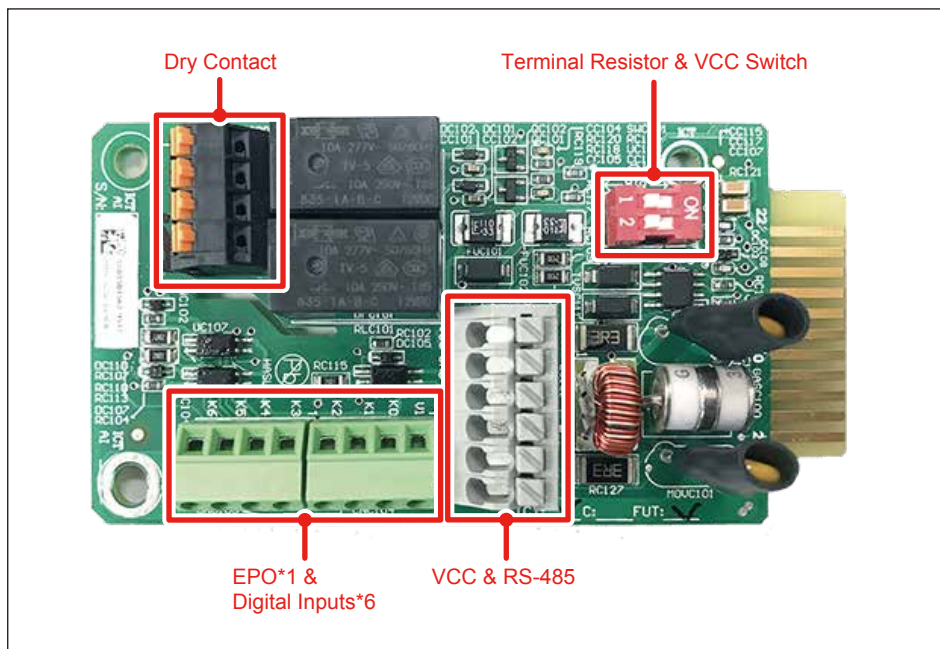


圖3-19：通訊模組

### 3.4.1 RS-485連接方式

下表將描述RS-485各腳位定義，不同的RS-485連接方式將有不同的終端電阻設定方式。

- 只有一台逆變器連接：開啟終端電阻
- 多台逆變器連接：第一台和最後一台終端電阻需開啟

#### 注意



為了良好的傳輸品質，推薦使用雙絞線作為通訊電纜。

Pin	Function
1	VCC (+12V)
2	GND
3	DATA+
4	DATA-
5	DATA+
6	DATA-




表3-1 : RS-485腳位定義

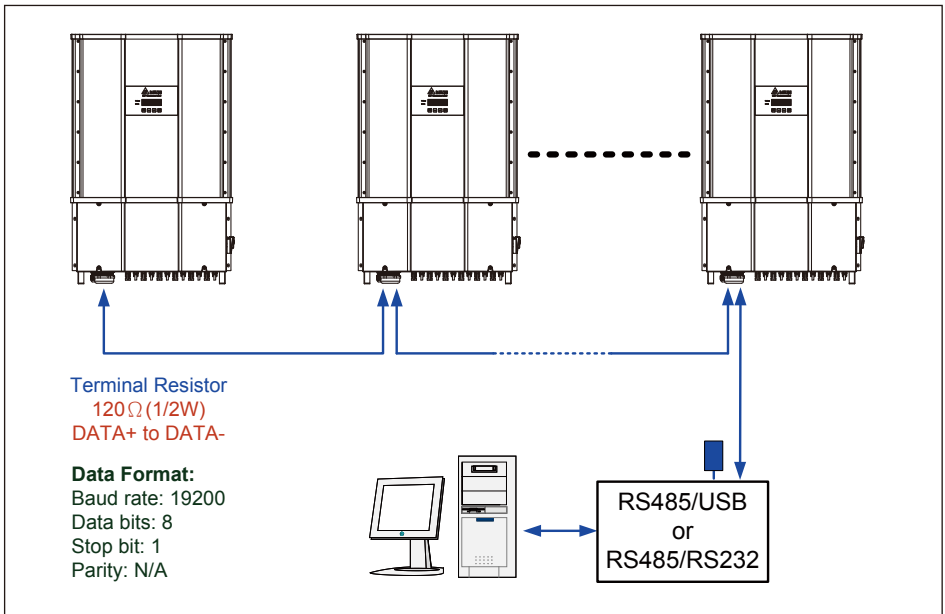


圖3-20 : 多台逆變器連接示意圖

	開關 1	開關 2
開	VCC 開	終端電阻 開
關	VCC 關	終端電阻 關

表3-2 : 終端電阻設定

### 3.4.2 緊急關斷(EPO)及數位輸入

通訊模組提供一組緊急關斷功能(EPO)·可依使用者需求於設定頁面進行設定。

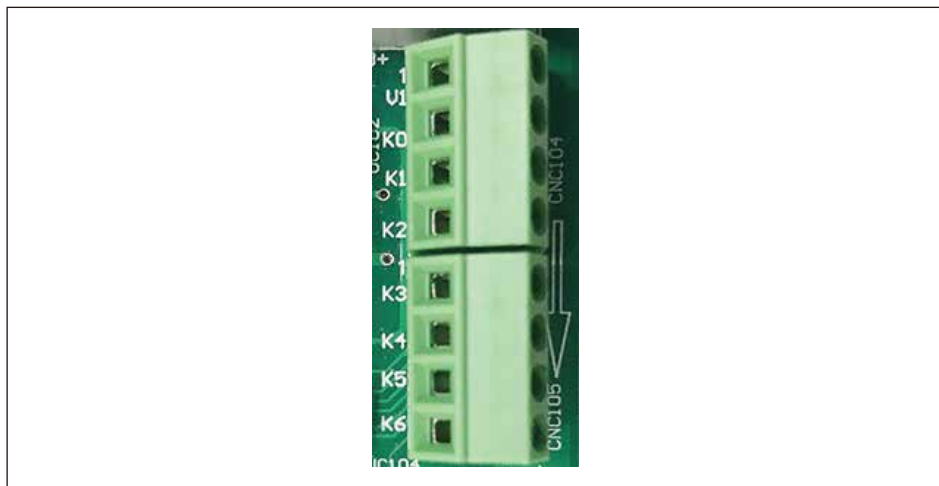


圖3-21 : EPO功能

短路	逆變器動作
V1 & K0	緊急關斷
V1 & K1	0%實功輸出
V1 & K2	最大30%額定輸出
V1 & K3	最大60%額定輸出
V1 & K4	最大100%額定輸出
V1 & K5	保留
V1 & K6	保留

表3-3 : EPO及數位輸入功能定義

### 3.4.3 乾接點連接方式

M88H提供兩組乾接點，該接點可依客戶需求設定，請參照4.2.10章節。  
乾接點可以承受250Vac/28Vdc/9A 的電氣規格，適當線徑為0.2-1.5mm<sup>2</sup>。

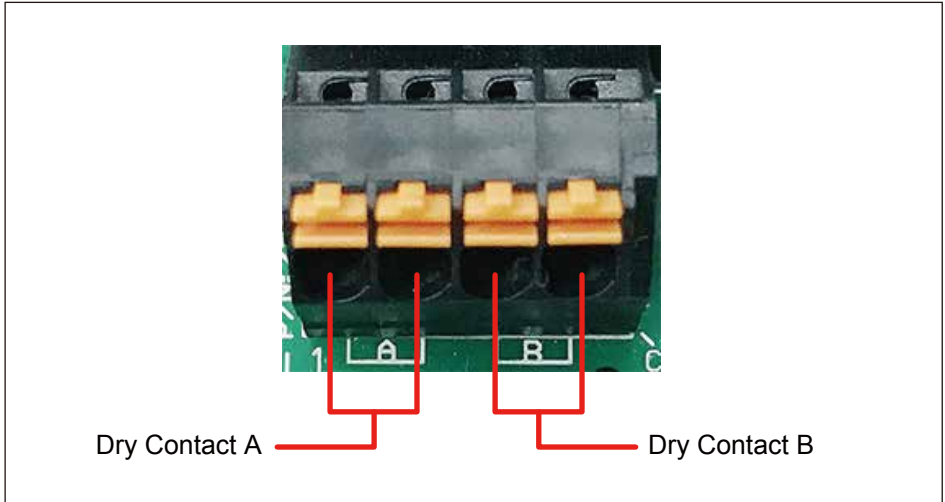


圖3-22：乾接點連接

## 4 試運行

注意：表面高溫，請勿觸碰！



- 當開蓋時請小心表面高溫。
- 表面冷卻前請勿接觸逆變器。

### 4.1 控制面板介紹

M88H系列內含 4x20 字母之LCD顯示螢幕及2 LED狀態指示燈如圖4-1，表4-1說明各燈號的意義。

下面的章節將介紹使用者可經由顯示螢幕進行設定的部分，當按壓按鈕進行設定時，指標會從"▶" 變為"➔"。

Power meter / String monitoring	4.2.2
Energy Log	4.2.3
Event Log	4.2.4
Inverter Information	4.2.5
General Settings	4.2.6
Install Settings	4.2.7
Active/Reactive Power	4.2.8
FRT	4.2.9

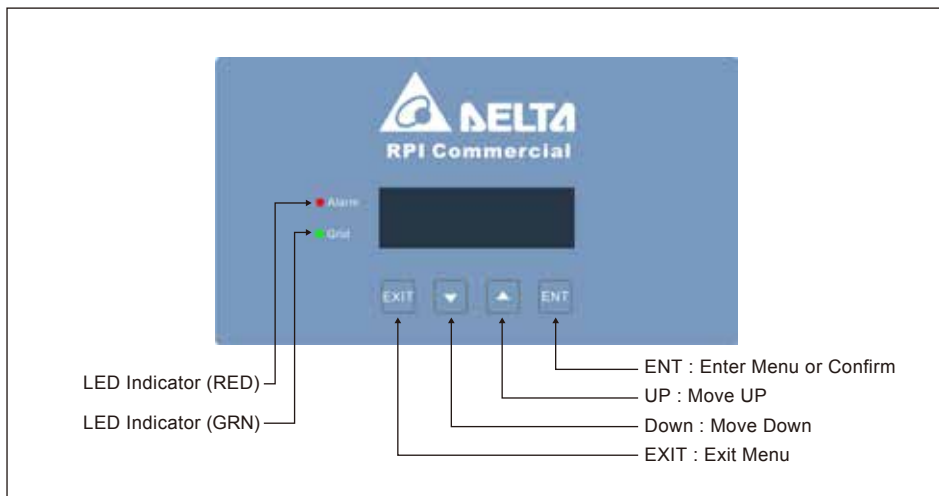


圖4-1：控制面板

狀況	綠LED	紅LED
併網前倒數	閃爍 *	關
成功併網	開	關
發生Error或Fault	關	開
待機、夜間模式(無DC時)	關	關
燒錄模式	閃爍 *	

\* 開一秒 / 關一秒

表4-1：LED指示燈

## 4.2 首次開機

初次運行時，請先將AC電源送入逆變器並打開手動開關及直流開關，此時顯示面板會被點亮並開始進行初始設定如圖4-2所示。請依據當地選用適當語言及國別並確認主畫面中的Status是否有顯示任何錯誤訊息，等待逆變器初始自我測試約2分鐘後會進入併網倒數，倒數完畢逆變器便會併網送電。

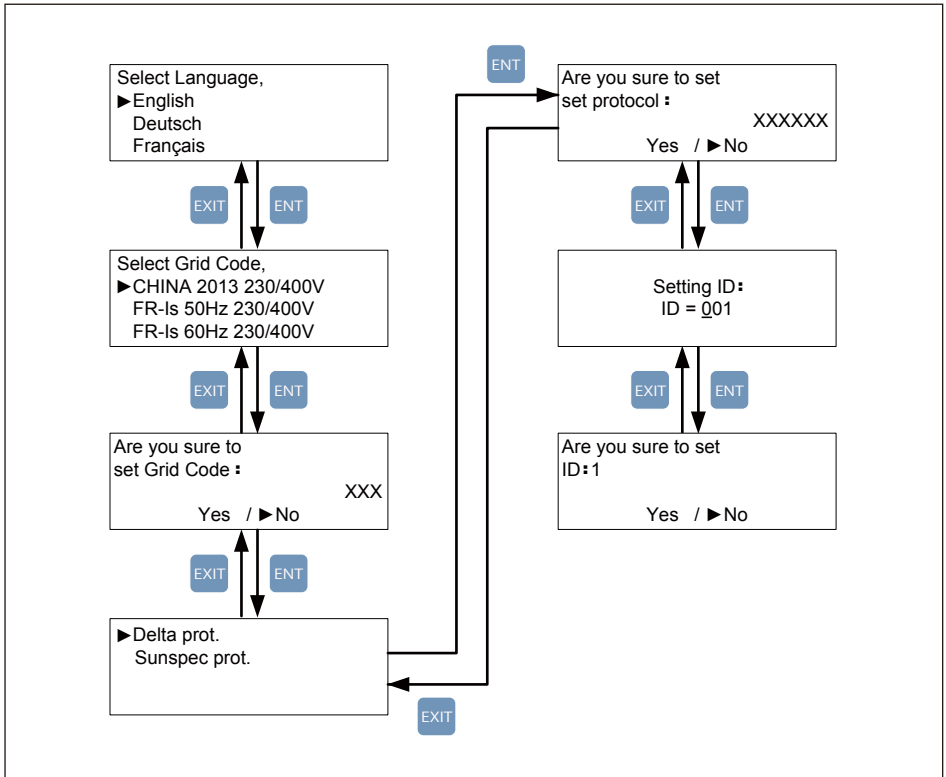


圖4-2：首次啟動之國別·語言及ID設定



## 4.2.1 主畫面

若逆變器正常運作，即可在首頁看到輸出功率、逆變器狀態、今日發電量時間、日期等相關資訊，按壓任意按鍵將會導回主目錄，於主目錄按壓EXIT或靜置數秒後即回到首頁。

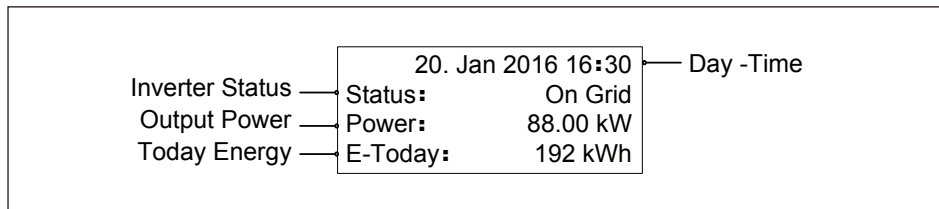


圖4-3：主畫面

## 4.2.2 Power meter / String monitoring

本頁面顯示交直流電壓，電流及功率

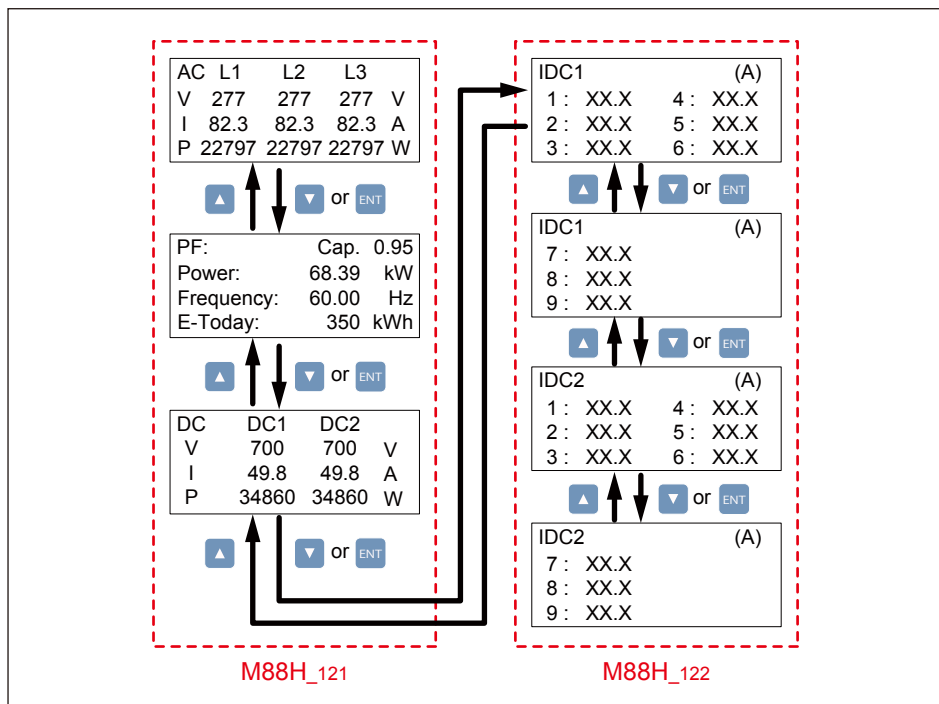


圖4-4：Power meter頁面

### 4.2.3 Energy Log

使用者可經由本頁面查詢歷史發電量，當日發電量以及當月發電量。

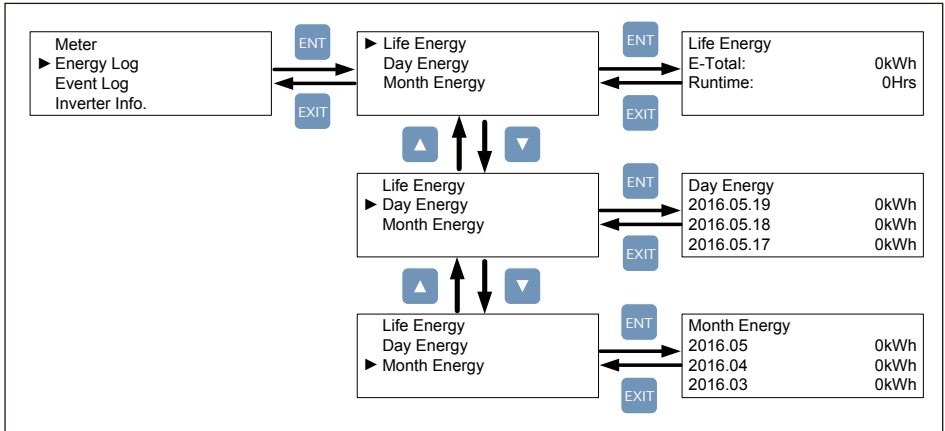


圖4-5 : Energy log頁面

### 4.2.4 Event Log

Event Log可分為Error Events與Grid Report兩個分頁。Error Events頁面顯示最近30筆錯誤訊息，Grid Report頁面則紀錄最近5筆市電相關問題。

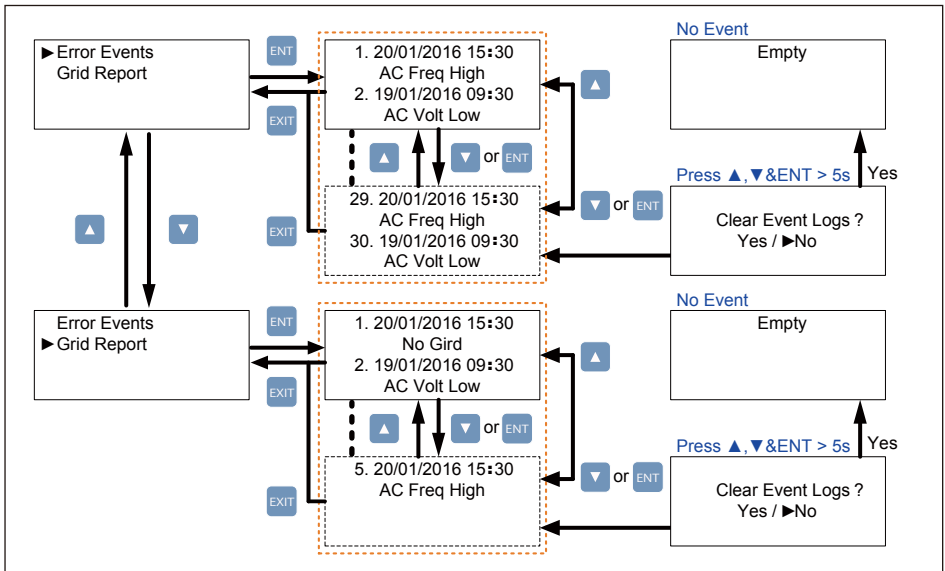


圖4-6 : Event log流程

## 4.2.5 Inverter Information

本頁面協助使用者確認逆變器資訊，包含其序號、安裝日、ID、韌體版本。

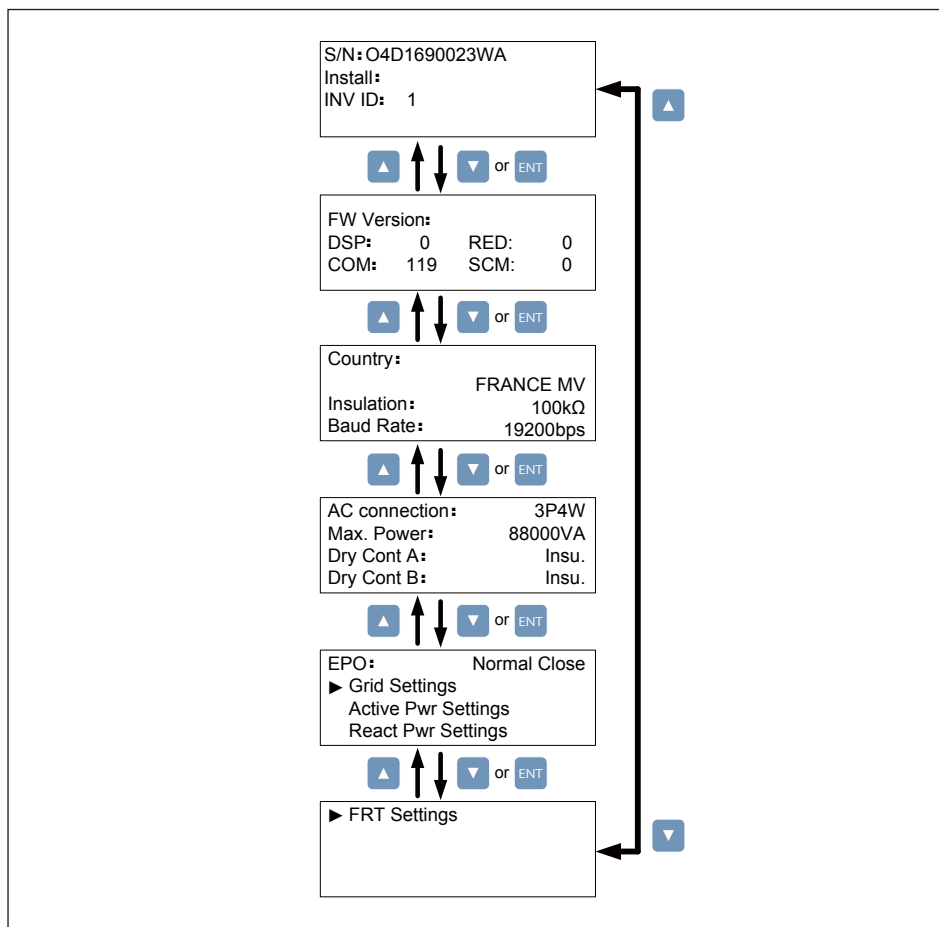


圖4-7 : Inverter information 頁面

## 4.2.6 General Settings

使用者可在此頁面設定語言、日期時間、通訊封包速度、通訊協定及風扇測試。

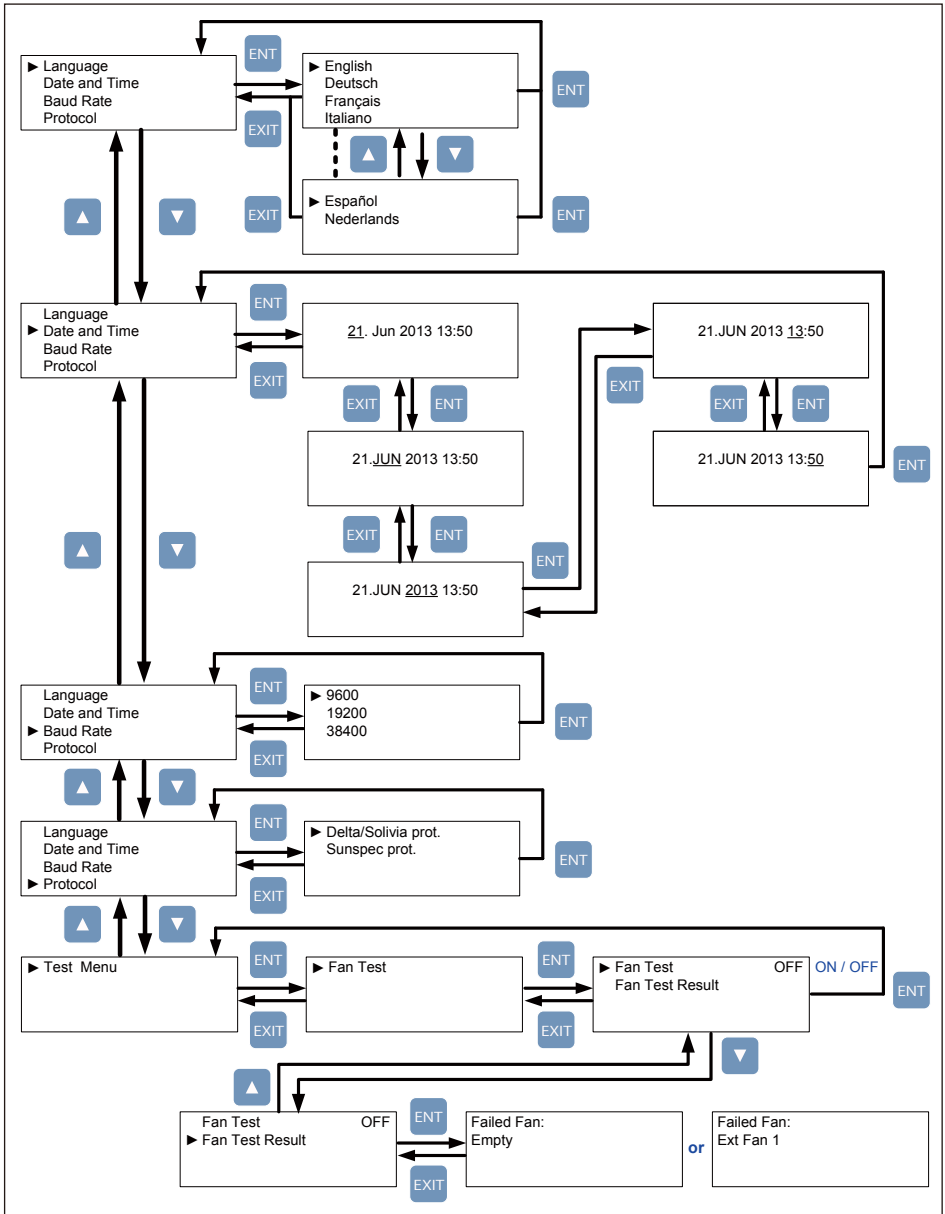


圖4-8 : General settings頁面

## 4.2.7 Install Settings

### 注意！



- 本安裝設定頁面僅供符合資格的安裝業者或工程師使用，任意變更此頁面設定可能會導致機體或其他設備損傷。

進入Install Settings頁面前需要輸入密碼，密碼分為三種權限：使用者權限、安裝者權限以及製造商權限。以下章節僅會介紹使用者權限與安裝者權限所需之各項設定值。

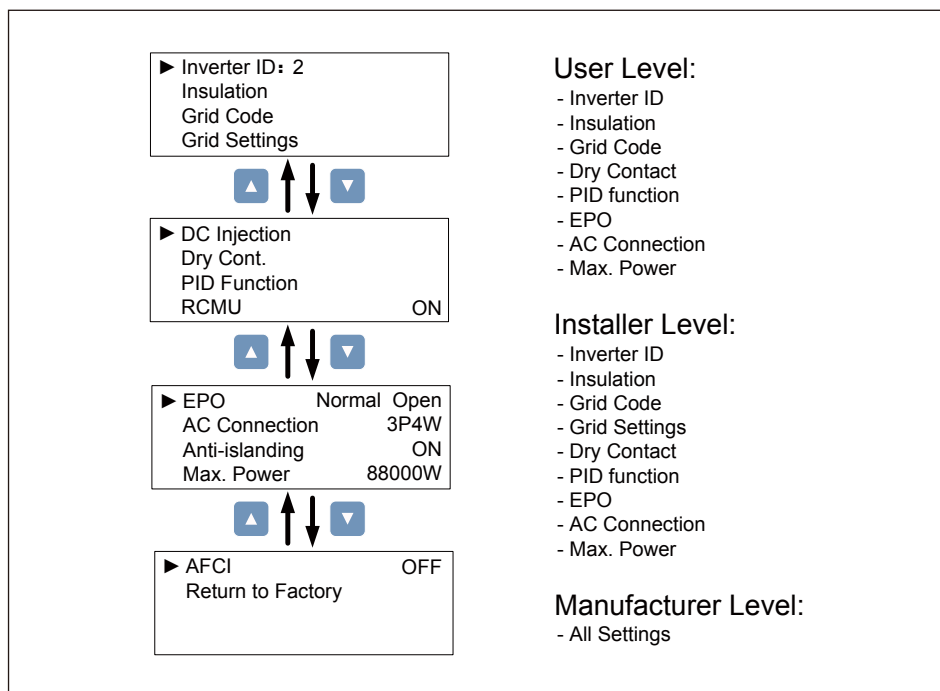


圖4-9：Install settings頁面

### 4.2.7.1 Inverter ID

逆變器ID供RS-485通訊使用，在同一串列上的逆變器需有不同的ID。

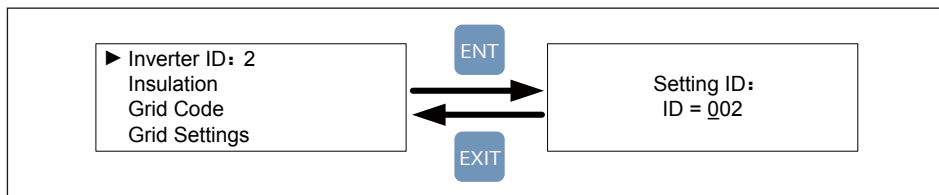


圖4-10 : Inverter ID頁面

### 4.2.7.2 Insulation

併網前，逆變器會計算太陽能模組對地的阻抗，M88H可以選擇是否偵測且同時有兩種阻抗值供選擇，安裝者應依照實際太陽能模組安裝情形選用適當的數值。

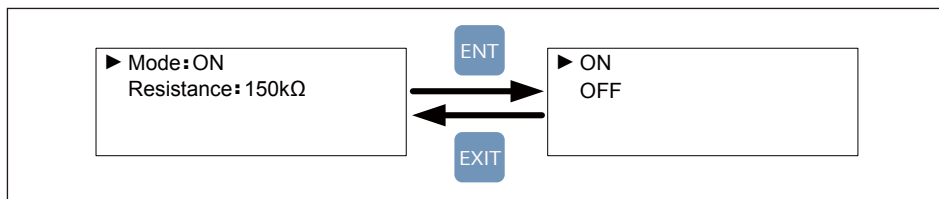


圖4-11 : Insulation頁面

### 4.2.7.3 Grid Code

選單中的每一個國家選項即代表一種電力法規，安裝者於安裝逆變器後必須選擇正確的國家選項，以符合當地電力法規的要求。

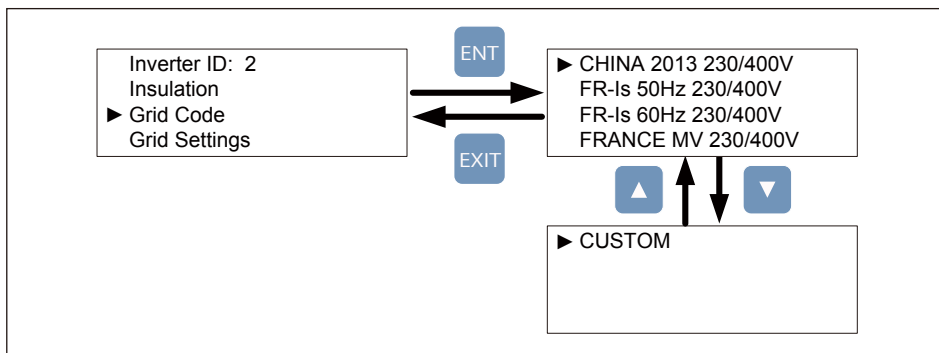


圖4-12 : Grid Code頁面

## 4.2.7.4 Grid Settings

Grid Settings頁面包含各種電壓與頻率保護值，這些保護值乃依據各電力法規所建立，若無特殊需求請勿修改任何保護值。

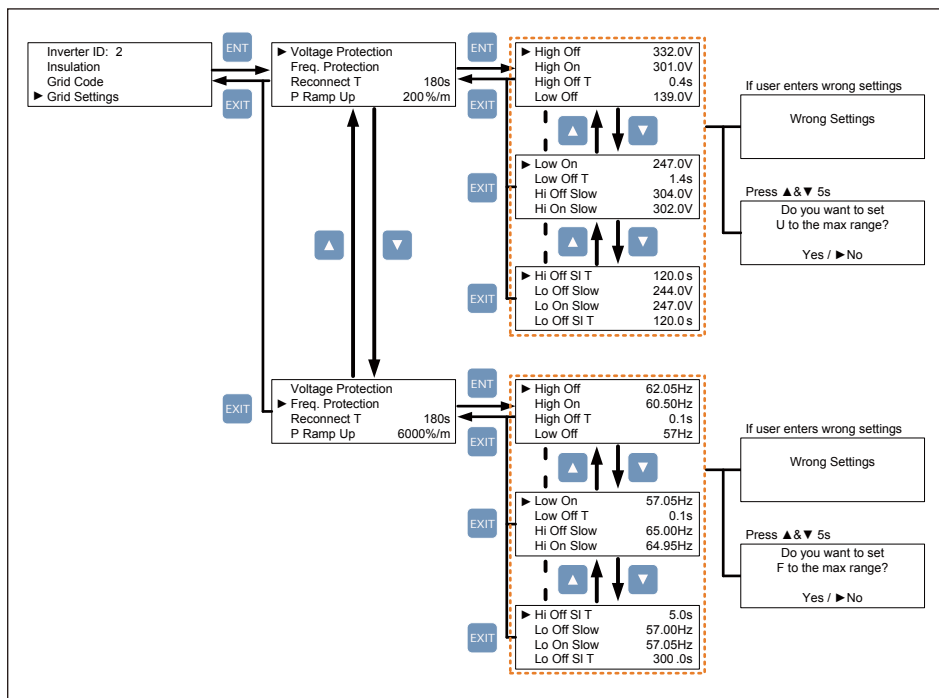


圖4-13 : Grid Settings 頁面

## 4.2.7.5 Dry Contact

使用者可選擇乾接點觸發的條件，在設定頁面共有8種選項。

其中包含：無作用、併網、風扇故障、絕緣阻抗、警示、錯誤、故障、警告。

設定	乾接點作動條件
Disable (無作用)	無反應
On Grid (併網)	逆變器併網
Fan Fail (風扇故障)	風扇產生故障
Insulation (絕緣阻抗)	絕緣阻抗測試失敗
Alarm (警示)	任何錯誤, 故障, 警告 發生
Error (錯誤)	任何錯誤發生
Fault (故障)	任何故障發生
Warning (警告)	任何警告發生

表4-2：乾接點作動條件設定

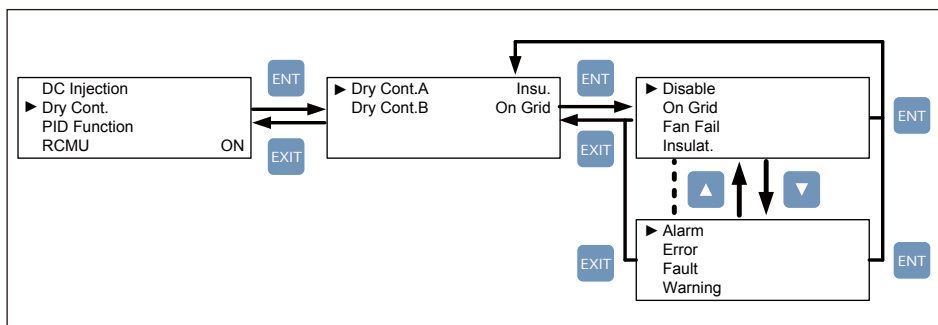


圖4-14：Dry Contact 頁面

## 4.2.7.6 PID

預設作動時間為0，使用者可選擇0~10小時，或自動模式。

PID功能在NO DC後半小時會啟動。

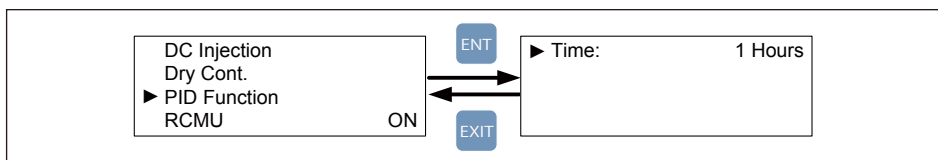


圖4-15：PID Function頁面



## 4.2.7.7 EPO

EPO有兩種偵測模式：Normal Open與Normal Close。Normal Open代表EPO常態為開路，短路時則觸發緊急關機功能。Normal Close則代表常態為短路，開路時則觸發緊急關機功能。請依據您的需求選擇適合的偵測模式。

▶ EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

圖4-16：EPO頁面

## 4.2.7.8 AC connection

M88H支援3P3W與3P4W配線方式，請依照實際配線方式選擇對應的設定，確保機子能正常運作。

EPO	Normal Close
▶ AC Connection	3P4W
Anti-islanding	ON
Max. Power	88000W

圖4-17：AC配線方式

## 4.2.7.9 Max. Power

某些電力法規有調整最大功率輸出之要求，參照此類電力法規之使用者可透過此功能更改逆變器的最大功率輸出額度。

EPO	Normal Close
AC Connection	3P4W
Anti-islanding	ON
▶ Max. Power	88000W

圖4-18：Max. Power頁面

## 4.2.8 Active / Reactive power

進入實功/虛功控制頁面前必須輸入密碼。此頁面包含實功功率控制與虛功功率控制兩個主要功能。

實功功率控制有三種模式：

Power Limit, Power vs. Frequency, and P(V)；

虛功功率控制有四種模式：

Constant cosphi, cosphi(P), Constant Q, and Q(V)。

這些模式將會在下面的章節中詳細的介紹。

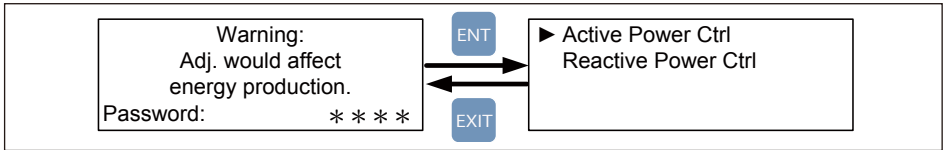


圖4-19 : Active/Reactive power頁面

### 4.2.8.1 Power Limit

此控制模式可限制逆變器之輸出功率。使用者可透過設定Set Point來指定逆變器所能輸出的最大功率。

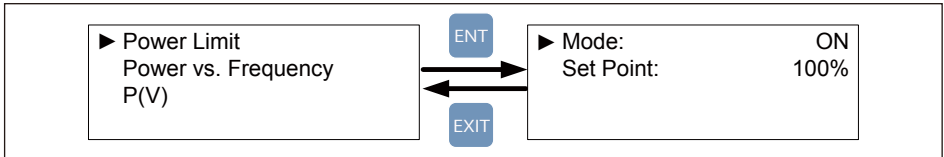


圖4-20 : Power Limit page頁面

### 4.2.8.2 Power vs. Frequency

此模式開啟後，逆變器可隨著市電頻率升高而自動降低其輸出功率。

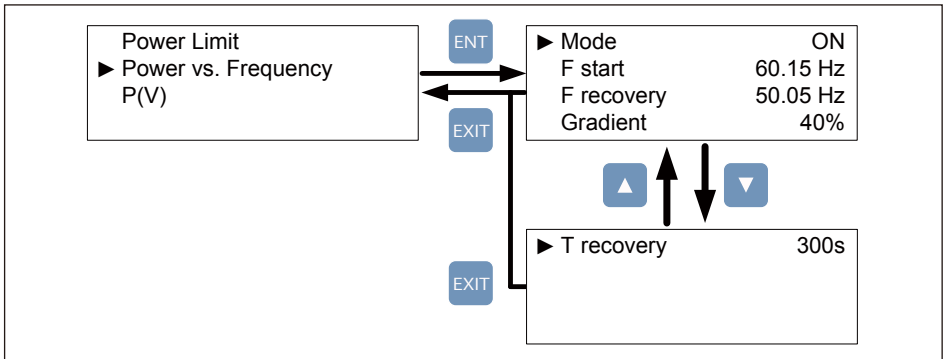


圖4-21 : Power vs Frequency頁面

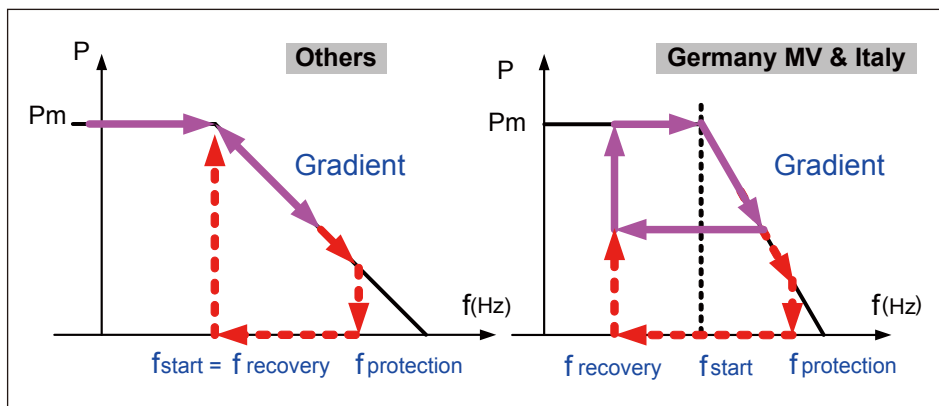


圖4-22 : Power vs Frequency參數對照

### 4.2.8.3 P(V)

此模式啟動後，當市電電壓大於V lock-in且此時逆變器之輸出功率大於P lock-in時，逆變器將會自動將輸出功率降低至P lock-out，直到市電電壓低於V lock-out且經過T recovery秒後方回復正常功率輸出。

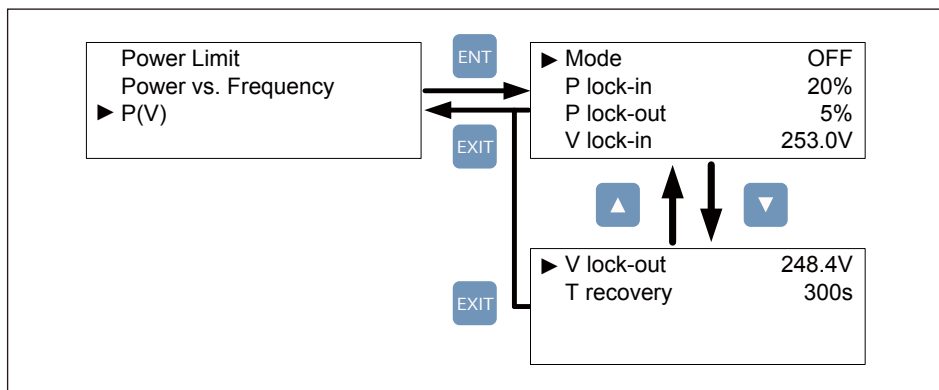


圖4-23 : P(V)頁面

### 4.2.8.4 Constant cosphi

此模式啟動後，逆變器可饋入固定功率因子(cosphi)之虛功率至市電，使用者可透過設定頁面指定欲饋入之功率因子。

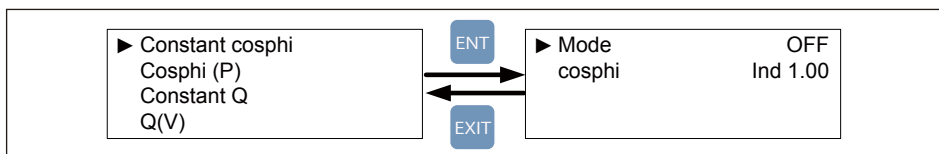


圖4-24 : Constant cosphi頁面

### 4.2.8.5 Cosphi (P)

此功能啟動後，逆變器可隨著輸出之實功功率高低而饋入一定比例之虛功率。當國家設定為Italy LV或Italy MV時，使用者可進一步指定當市電電壓高於V lock-in時方饋入虛功，電壓低於V lock-out後，無論此時輸出實功率為何，皆不饋入虛功。

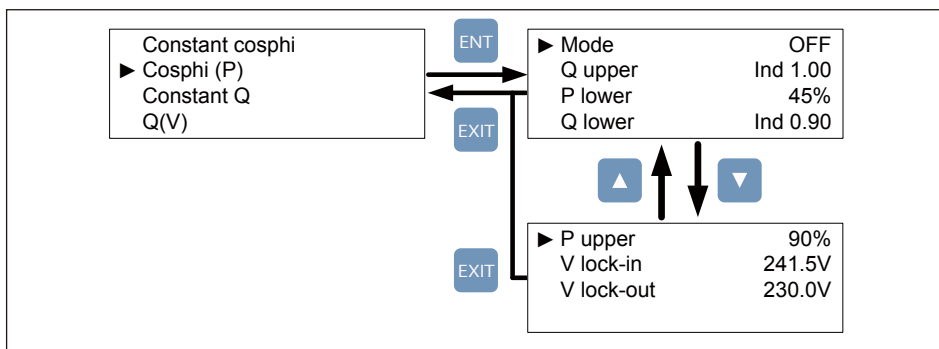


圖4-25 : Cosphi (P)頁面

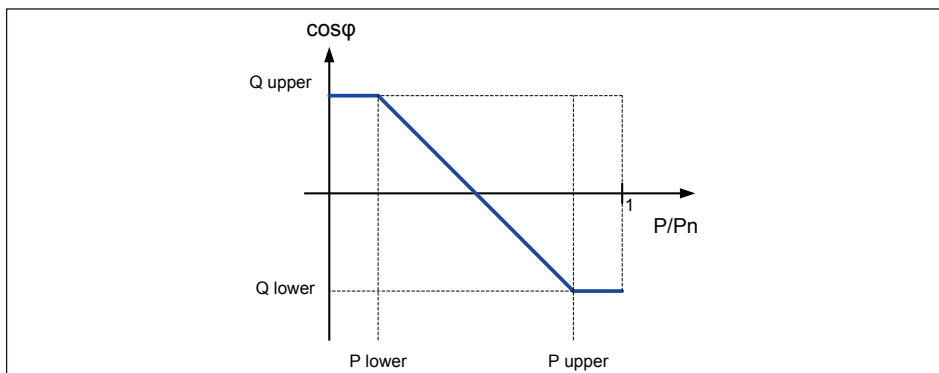


圖4-26 : Cosphi (P)參數對照

### 4.2.8.6 Constant Q

此模式啟動後，逆變器可饋入固定比例之虛功率至市電，使用者可透過設定頁面指定欲饋入之虛功率量。

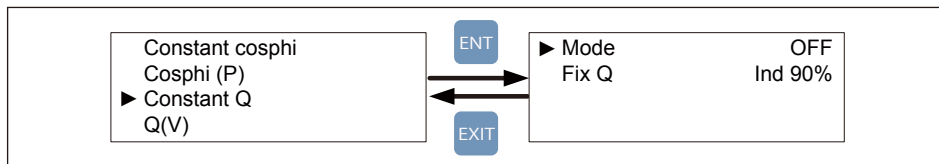


圖4-27 : Constant Q頁面

### 4.2.8.7 Q(V)

此模式啟動後，逆變器會隨著市電電壓變化而饋入不同性質的虛功率。當國家設定為Italy LV或Italy MV時，使用者可進一步指定輸出功率達到P lock-in時方饋入虛功，輸入功率小於P lock-out時則無論市電電壓為何，皆不饋入任何虛功。

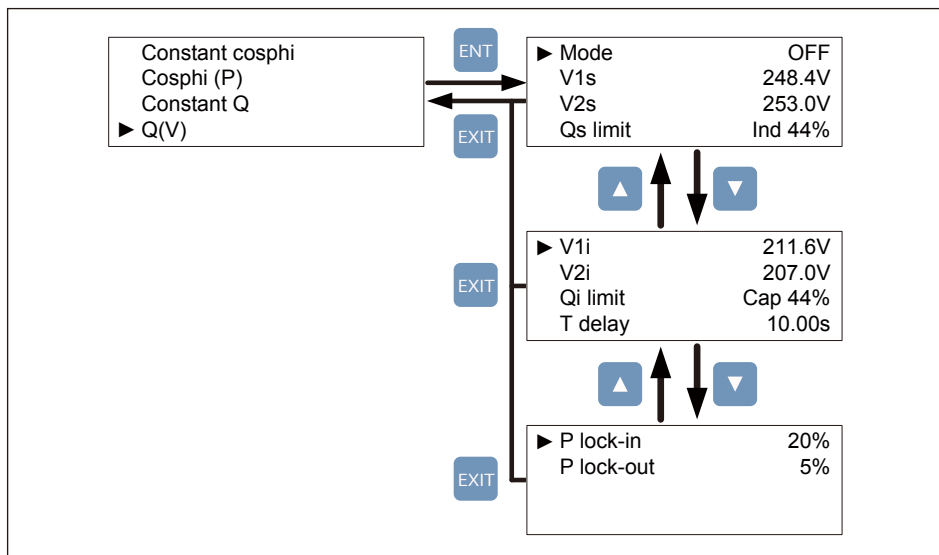


圖4-28 : Q(V)頁面

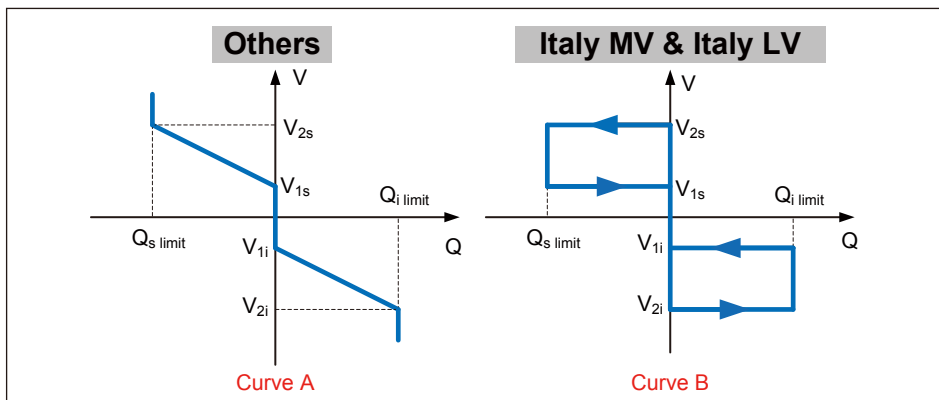


圖4-29 : Q(V)參數對照

### 4.2.9 FRT (Fault ride through)

根據某些特定地區之電力法規規範，當市電電壓發生驟降時，在一定的時間內逆變器必須維持併網狀態。使用者可透過啟動FRT功能並設定所需的參數來達到這項要求。

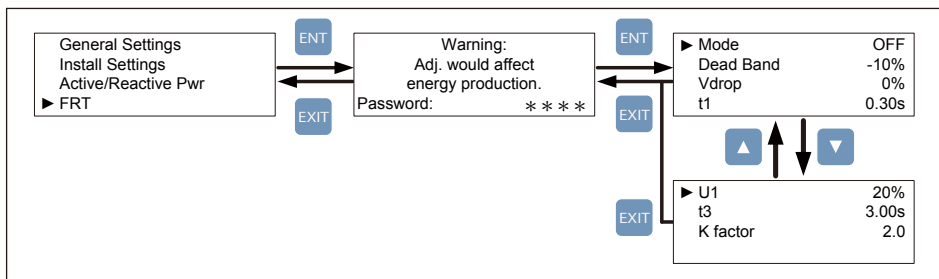


圖4-30 : FRT頁面

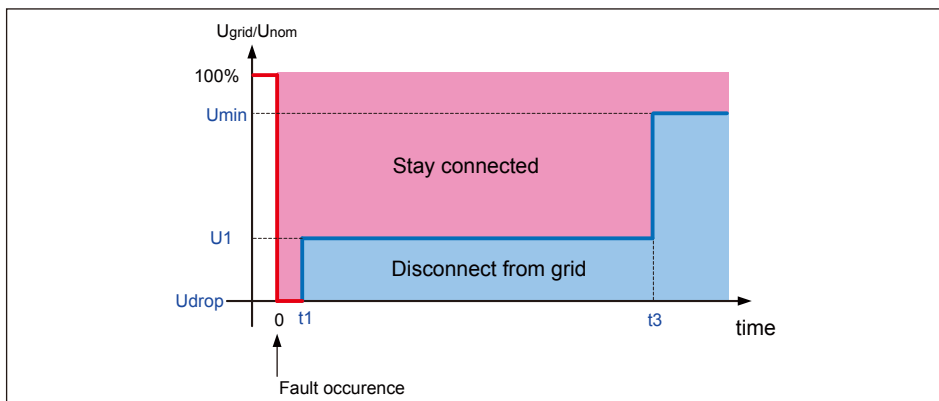


圖4-31 : FRT參數對照

## 5 維護

為確保PV Inverter正常運轉，請至少每半年確認一次逆變器所有端子與螺絲是否鬆脫、電纜線是否毀損、散熱出風口有無異物阻塞。如有上述情形，請聯絡合格之技術人員進行維修、清理或更換。

### 警告！



- 進行任何維修動作前，請確定交直流電源皆已切斷以避免觸電危險。

### 5.1 更換SPD

M88H系列機種於交直流側皆含有突波吸收裝置如圖5-1所示，表5-1列出所使用的突波吸收裝置規格。

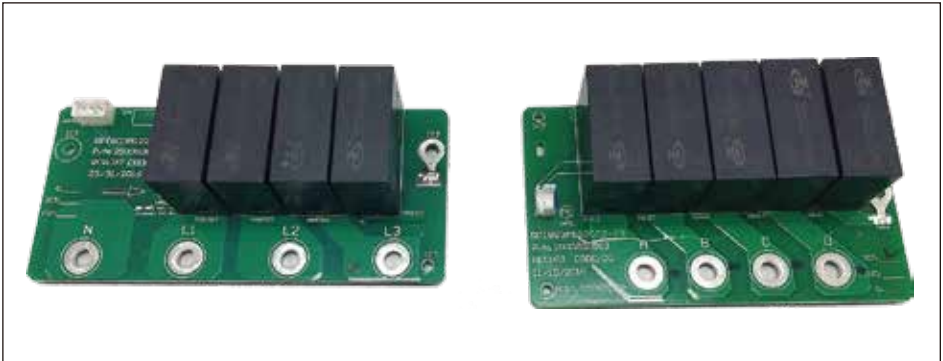


圖5-1：交直流突波吸收裝置

#### Specification of SPD

Work voltage : 895V (AC RMS value)  
1175V (DC)

Work Amp In (8/20 $\mu$ s) : 10kA

Rate Amp I max (8/20 $\mu$ s) : 20kA

Temperature : -40 $^{\circ}$ C~85 $^{\circ}$ C

Manufacturers :

Sichuan Zhongguang Lightning Protection Technologies Co., Ltd

表5-1：交直流突波吸收裝置規格

位於交直流端子附近的突波吸收裝置是為了保護較敏感的電路元件受到電擊或急遽電壓變化而損壞。若於顯示面板發現警告訊息“AC Surge”或“DC Surge”，請依以下步驟替換：

1. 中斷交直流電源，且等到顯示螢幕沒電。
2. 將配線箱上蓋的四枚螺絲鬆脫，便可看到如圖5-2所示的SPD位置。
3. 找出損壞的SPD：
  - “AC Surge” 表示AC SPD
  - “DC Surge” 表示DC SPD損毀
4. 拔起連接線 (白色，AC：三腳，DC：兩腳) 並替換全新的SPD PCB板。
5. 重新組裝上蓋，並確認防水封條。

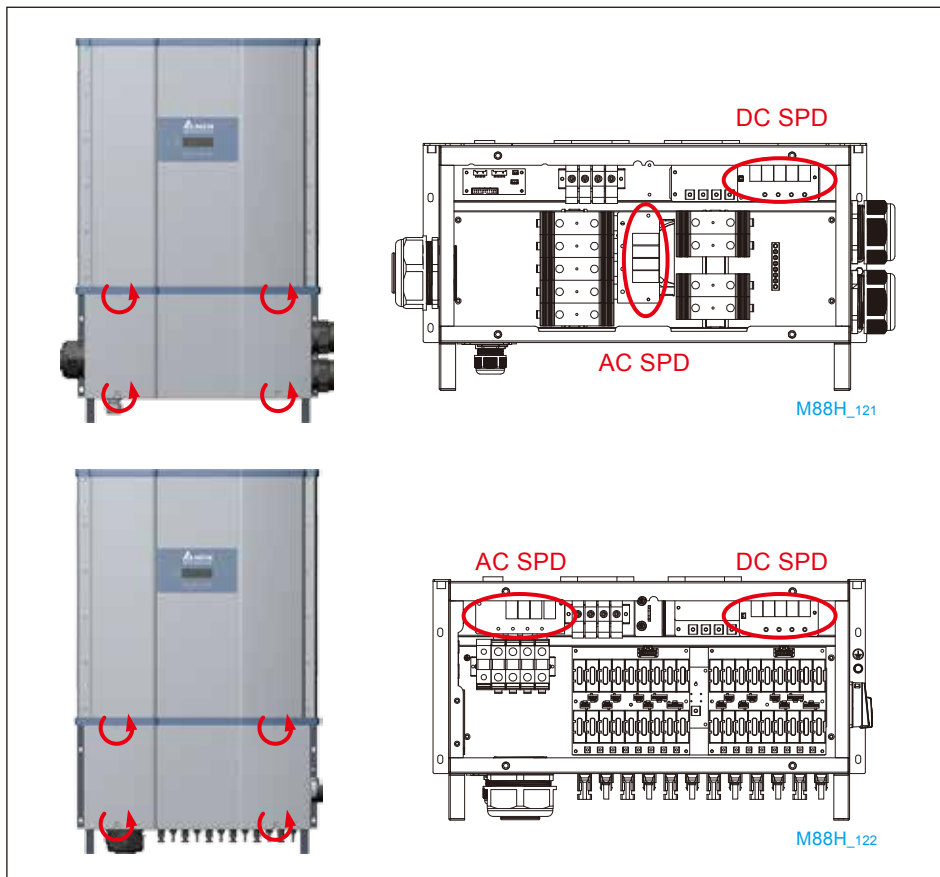


圖5-2：移除配線箱上蓋



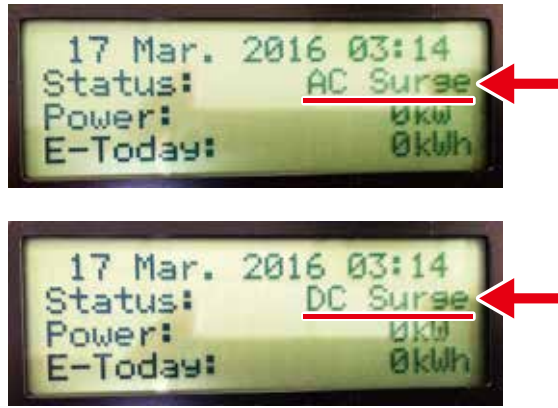


圖5-3 : AC/DC SPD 損壞時的告警



圖5-4 : 拔起連接線並移除螺絲

## 5.2 風扇替換及清潔

本章節提供M88H系列如何替換智慧風扇及濾網的方式。圖5-5、5-6、5-7標示出智慧風扇的位置。

M88H系列的智慧風扇可區分為兩大類，配線箱風扇及功率模組風扇如圖5-5所示。下列的步驟為如何清洗濾網。

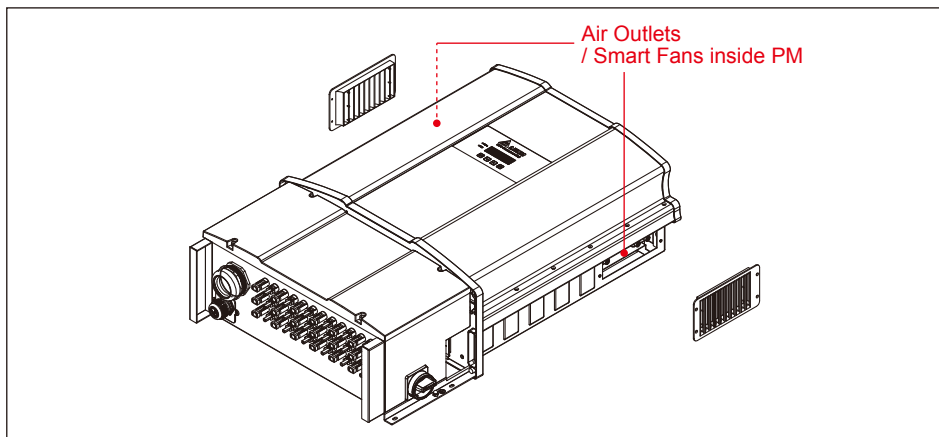


圖5-5：功率模組智慧風扇位置

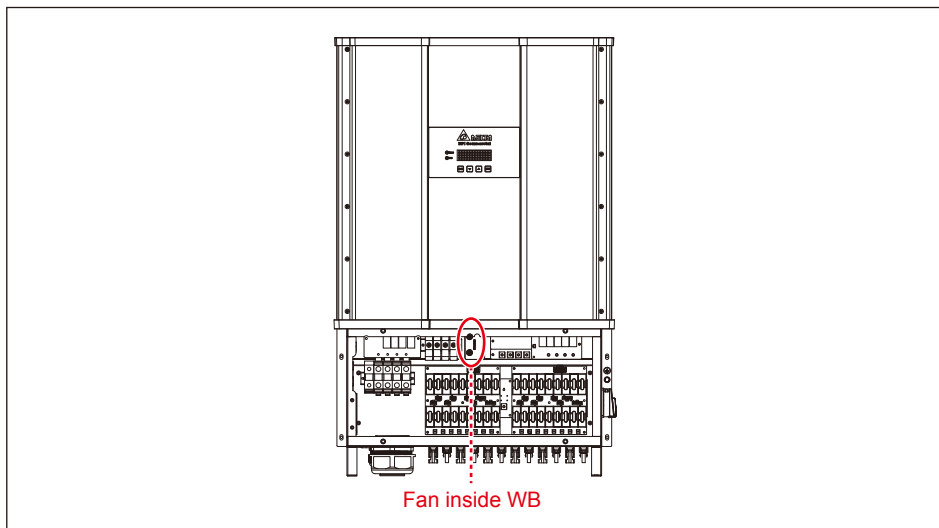


圖5-6：配線箱智慧風扇位置(僅M88H\_122)

M88H系列內含12吋風扇，同時於功率模組內含有濾網。該風扇具有高壽命及高可靠性，同時擁有"FAN-FAIL"告警及限制輸出功能以確保安全。同時該風扇模組也具有容易替換的設計，使維護更加方便。



圖5-7：12吋風扇模組

### 注意



- 風扇及濾網清潔頻率由當地環境決定。
- 正常環境條件使用下，每半年需清潔風扇及濾網一次。
- 若安裝於嚴苛環境，建議每個月或每一季需清潔風扇及濾網一次。

配線箱區塊：使用者須將2枚螺絲鬆脫並拔除連接線 (如圖5-8)。最後將風扇模組替換後，將螺絲鎖上，連接線接上。



圖5-8：拆卸配線箱區塊之智慧風扇 (僅M88H\_122)

功率模組區塊：

圖5-9為其中一側的出風口，另一側和此側對稱，故在此以其中一側為例。

1. 將出風口上的四枚螺絲卸下
2. 拔除連接線並卸下四枚螺絲
3. 確認所有螺絲皆已卸下
4. 拉出風扇槽
5. 圖5-9組圖5為整個風扇槽的外觀



圖5-9：拆卸功率模組風扇（僅以單側為例）

圖5-10為濾網位置。

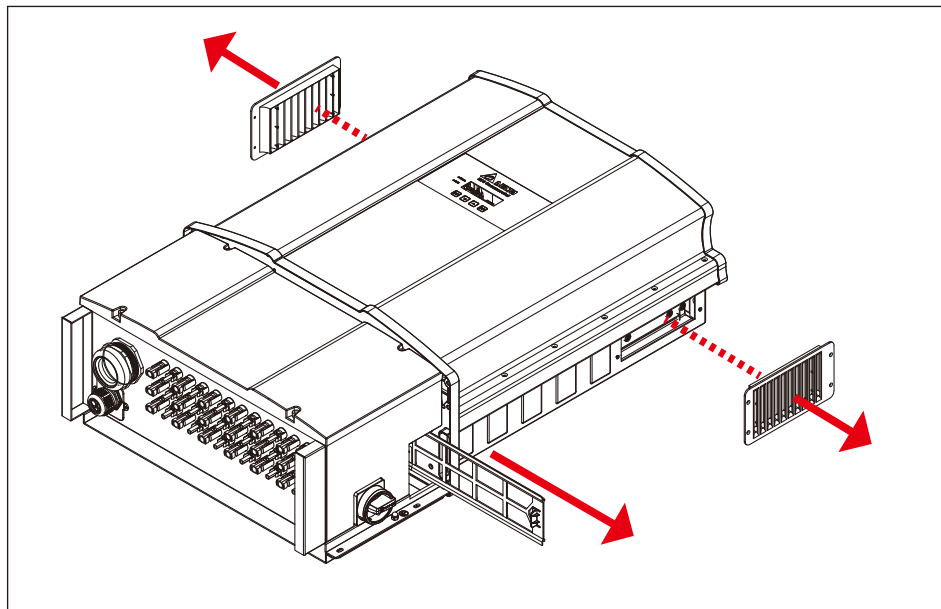


圖5-10：濾網拆卸方向

## 5.3 終止運轉

若需要終止運轉以利維護，或保存，請依照下列指示進行。

### 危險: 觸電危險!!



為避免嚴重傷亡，請依下列步驟進行：

- 關斷手動開關終止逆變器運行
- 關斷交流斷路器確認與市電解離
- 關斷直流斷路器確認與太陽能模組解離
- 使用電表量測確認交直流皆不帶電
- 移除交流端子確認與市電解離
- 移除直流端子確認與太陽能模組解離
- 移除通訊模組與電腦解離

### 注意 表面高溫 請勿觸碰！



- 逆變器剛中斷時，請注意表面高溫。
- 直到表面降至適當溫度前，請勿碰觸逆變器。

### 注意: 可能造成傷害！



- 逆變器重達80公斤以上，若在搬運或從壁掛架拆卸過程中意外掉落可能造成傷害。

### 注意



- 螺絲螺帽移除後請留意，切勿將他們遺漏於配線箱內。

### 5.3.1 配線箱拆卸

請依以下指示將逆變器終止運行，若有需要將配線箱與功率模組分離，請參照以下步驟：

1. 請確認交流斷路器與直流開關皆已切斷。
2. 再次確認逆變器已終止運轉且無觸電風險。
3. 圖5-11為正確切斷直流開關的方式。

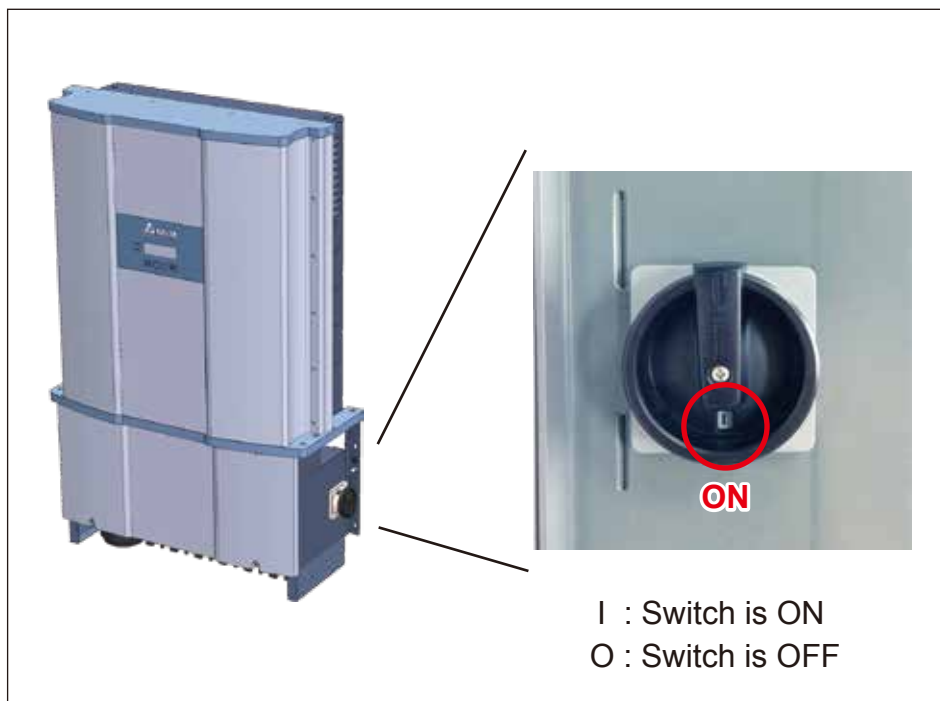


圖5-11：直流開關之開 / 關位置 (僅M88H\_122)



- 請確認交直流電源皆已關斷。
4. 打開配線箱上蓋。
  5. 移除交直流線材及通訊線。
  6. 移除如圖5-12所示之螺絲。

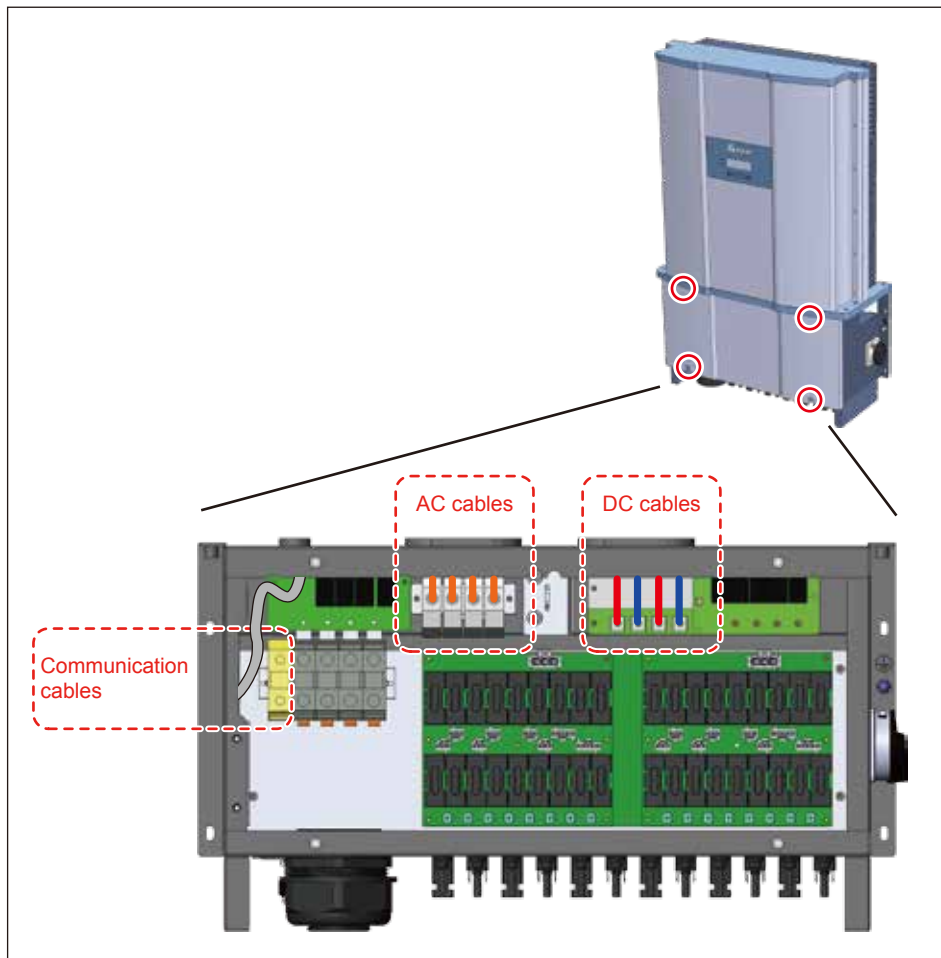


圖5-12：移除交直流線材及通訊線，並卸下6顆螺絲

7. 卸下8顆螺絲並用手抓住功率模組使其與配線箱分開。
8. 確定密封蓋有蓋上。

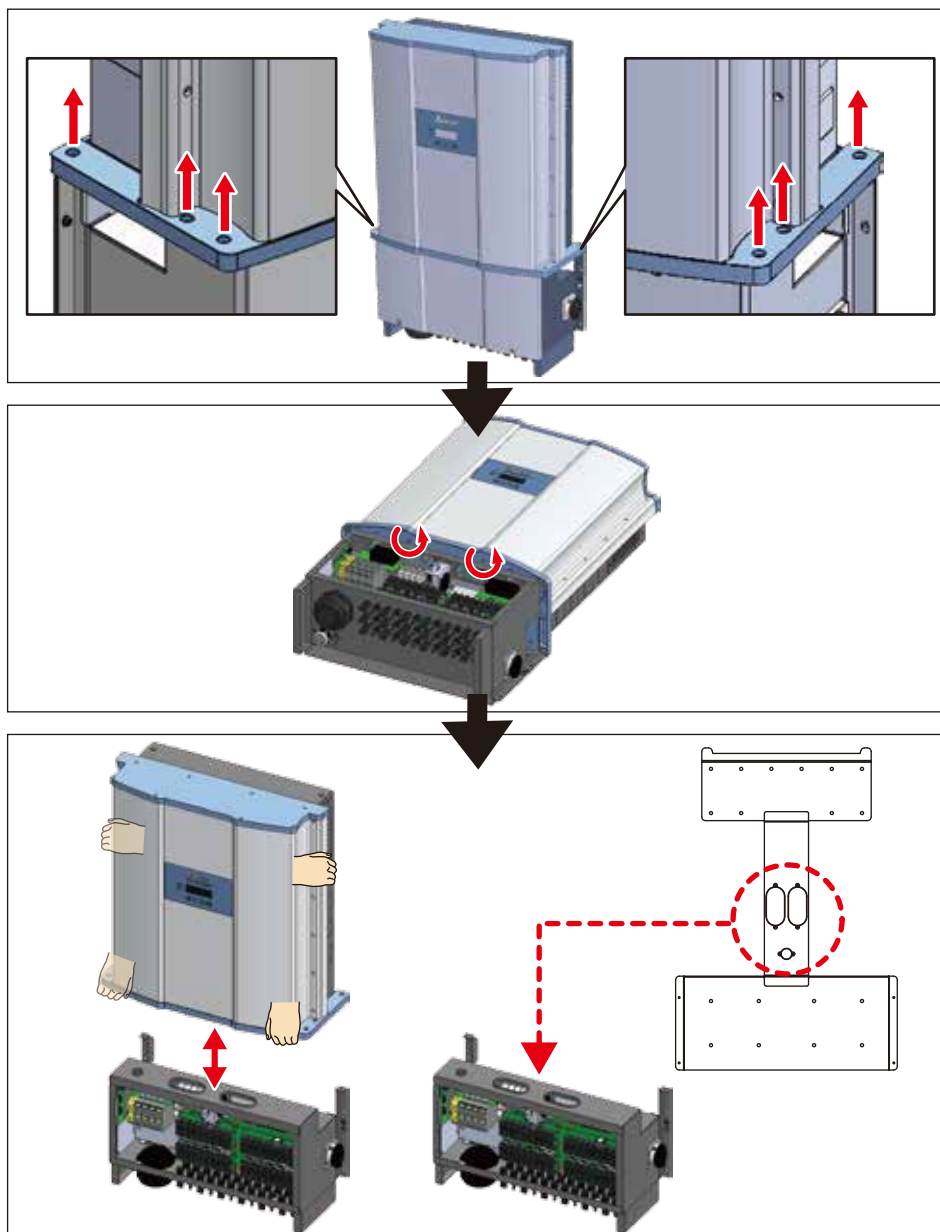


圖5-13：拆下8顆螺絲後，將配線箱與功率模組分離

## 6 錯誤告警及排除問題

錯誤資訊		
資訊顯示	可能原因	故障排除
AC Freq High (E01)	<ol style="list-style-type: none"> <li>1. 實際的市電頻率高過過頻率保護設定</li> <li>2. 國家設定不正確</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器端的市電頻率</li> <li>2. 檢查國家設定</li> <li>3. 檢查逆變器端的偵測電路</li> </ol>
AC Freq Low (E02)	<ol style="list-style-type: none"> <li>1. 實際的市電頻率低於欠頻率保護設定</li> <li>2. 國家或電網設定不正確</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器端的市電頻率</li> <li>2. 檢查國家與電網設定</li> <li>3. 檢查逆變器端的偵測電路</li> </ol>
Grid Quality (E07)	在電網或靠近逆變器附近非線性的負載	必要時逆變器與電網連接處必須遠離非線性的負載
HW Con. Fail (E08)	<ol style="list-style-type: none"> <li>1. 在AC介面連接錯誤</li> <li>2. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查AC連接，必須和使用手冊一致</li> <li>2. 檢查逆變器內部的偵測電路</li> </ol>
No Grid (E09)	<ol style="list-style-type: none"> <li>1. AC 斷路器跳開</li> <li>2. 中斷AC介面</li> </ol>	<ol style="list-style-type: none"> <li>1. 斷開AC 斷路器</li> <li>2. 檢查連接AC介面並確認其連接至逆變器</li> </ol>
AC Volt Low (E10, E15, E20)	<ol style="list-style-type: none"> <li>1. 實際市電的電壓低於低電壓保護設定</li> <li>2. 國家或電網設定不正確</li> <li>3. AC介面連接錯誤</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查市電與逆變器端的連接</li> <li>2. 檢查國家或電網設定</li> <li>3. 檢查AC介面連接</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
AC Volt High (E11, E13, E16, E18, E21, E23)	<ol style="list-style-type: none"> <li>1. 實際市電的電壓高於過電壓保護設定</li> <li>2. 操作期間，市電的電壓高於慢速電壓保護設定</li> <li>3. 國家或電網設定不正確</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器端的市電電壓</li> <li>2. 檢查逆變器端的市電電壓</li> <li>3. 檢查國家或電網設定</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
Solar1 High (E30)	<ol style="list-style-type: none"> <li>1. 實際Solar1電壓超過1000Vdc</li> <li>2. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 修正 solar array 設定並使得 Voc 小於 1000Vdc</li> <li>2. 檢查逆變器內部的偵測電路</li> </ol>
Solar2 High (E31)	<ol style="list-style-type: none"> <li>1. 實際Solar2電壓超過1000Vdc</li> <li>2. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 修正 solar array 設定並使得 Voc 小於 1000Vdc</li> <li>2. 檢查逆變器內部的偵測電路</li> </ol>

錯誤資訊		
資訊顯示	可能原因	故障排除
Insulation (E34)	<ol style="list-style-type: none"> <li>1. 太陽能板絕緣測試未通過</li> <li>2. 太陽能板電容值介於正到接地端或負到接地端太大或者兩者皆有之</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入端絕緣</li> <li>2. 檢查電容值，必要時擦乾太陽能板</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>

表6-1：錯誤資訊

警告		
資訊顯示	可能原因	故障排除
Solar1 Low (W01)	<ol style="list-style-type: none"> <li>1. 實際Solar1電壓低於下限值</li> <li>2. 若實際Solar1電壓接近0，逆變器內部可能有裝置損壞</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查Solar1電壓至逆變器端的連接</li> <li>2. 檢查boost1的所有開關裝置</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
Solar2 Low (W02)	<ol style="list-style-type: none"> <li>1. 實際Solar2電壓低於下限值</li> <li>2. 若實際Solar1電壓接近0，逆變器內部可能有裝置損壞</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查Solar2 voltage至逆變器端的連接</li> <li>2. 檢查boost2的所有開關裝置</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
De-rating (W07)	<ol style="list-style-type: none"> <li>1. 本體及環境溫度過高</li> <li>2. 風扇故障</li> <li>3. 實功率限制功能作動</li> <li>4. P-F功能作動</li> <li>5. P(V) 功能作動</li> <li>6. 市電電壓過低</li> <li>7. 輸入電壓過低</li> <li>8. 輸入電壓過高</li> </ol>	<ol style="list-style-type: none"> <li>1. 確認安裝機器本體及環境溫度</li> <li>2. 確認風扇能否正常運轉</li> <li>3. 確認國別及最大功率限制參數設定</li> <li>4. 確認市電頻率是否異常</li> <li>5. 確認市電電壓是否異常</li> <li>6-1. 確認市電電壓是否異常</li> <li>6-2. 確認虛功控制功能設定</li> <li>7. 確認PV panel輸入電壓是否過低</li> <li>8. 確認PV panel輸入電壓是否過高</li> </ol>
HW FAN (W11)	<ol style="list-style-type: none"> <li>1. 一個或多個風扇鎖死</li> <li>2. 一個或多個風扇無效</li> <li>3. 一個或多個風扇未連接</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 移除卡在風扇內的對象</li> <li>2. 替換無效的風扇</li> <li>3. 檢查風扇的連接</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
SPD Fail	<ol style="list-style-type: none"> <li>1. 逆變器遭受到雷擊</li> <li>2. 一個或多個SPD有缺陷</li> <li>3. 一個或多個SPD未連接</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器是否遭受雷擊</li> <li>2. 更換有缺陷之SPD</li> <li>3. 檢查SPD的連接</li> <li>4. 檢查逆變器內部之偵測線路</li> </ol>

表6-2：警告資訊

故障		
資訊顯示	可能原因	故障排除
DC Injection (F01, F02, F03)	<ol style="list-style-type: none"> <li>市電波形異常</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查市電波形. 必要時逆變器與電網連接處必須遠離非線性的負載</li> <li>檢查逆變器內部的偵測電路</li> </ol>
Temperature (F05)	<ol style="list-style-type: none"> <li>環境溫度超過60°C (裝置異常)</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路</li> </ol>
Temperature (F07)	<ol style="list-style-type: none"> <li>環境溫度 &lt; -30°C</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路 (RTM1, RTB1, RTG1 and RTH1)</li> </ol>
HW NTC1 Fail (F06)	<ol style="list-style-type: none"> <li>環境溫度 &gt; 90°C 或 &lt; -30°C</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路 (RTM1)</li> </ol>
HW NTC2 Fail (F08)	<ol style="list-style-type: none"> <li>環境溫度 &gt; 90°C 或 &lt; -30°C</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路 (RTB1)</li> </ol>
HW NTC3 Fail (F09)	<ol style="list-style-type: none"> <li>環境溫度 &gt; 90°C 或 &lt; -30°C</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路 (RTG1)</li> </ol>
HW NTC4 Fail (F10)	<ol style="list-style-type: none"> <li>環境溫度 &gt; 90°C 或 &lt; -30°C</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查設備的周遭和環境</li> <li>檢查逆變器內部的偵測電路 (RTH1)</li> </ol>
HW RLY (F13)	<ol style="list-style-type: none"> <li>繼電器的驅動電路故障</li> <li>一個或多個繼電器本體故障</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查輸入電壓需大於150Vdc</li> <li>更換故障之繼電器</li> <li>檢查逆變器內部之偵測電路</li> </ol>
HW DSP ADC1 (F15)	<ol style="list-style-type: none"> <li>輸入功率不足</li> <li>輔助電源電路功能異常</li> <li>偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>檢查輸入電壓必須 &gt; 150Vdc</li> <li>檢查逆變器內部的輔助電源電路</li> <li>檢查逆變器內部的偵測電路</li> </ol>

故障		
資訊顯示	可能原因	故障排除
HW DSP ADC2 (F16)	<ol style="list-style-type: none"> <li>1. 輸入功率不足</li> <li>2. 輔助電源電路功能異常</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入電壓必須 &gt; 150Vdc</li> <li>2. 檢查逆變器內部的輔助電源電路</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW DSP ADC3 (F17)	<ol style="list-style-type: none"> <li>1. 輸入功率不足</li> <li>2. 輔助電源電路功能異常</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入電壓必須 &gt; 150Vdc</li> <li>2. 檢查逆變器內部的輔助電源電路</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW Red ADC1 (F18)	<ol style="list-style-type: none"> <li>1. 輸入功率不足</li> <li>2. 輔助電源電路功能異常</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入電壓必須 &gt; 150Vdc</li> <li>2. 檢查逆變器內部的輔助電源電路</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW Red ADC2 (F19)	<ol style="list-style-type: none"> <li>1. 輸入功率不足</li> <li>2. 輔助電源電路功能異常</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入電壓必須 &gt; 150Vdc</li> <li>2. 檢查逆變器內部的輔助電源電路</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW Eff. (F20)	<ol style="list-style-type: none"> <li>1. 校正不正確</li> <li>2. 電流回授電路無效</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查電流和功率的精度</li> <li>2. 檢查逆變器內部電流回授電路</li> </ol>
HW COMM1 (F23)	<ol style="list-style-type: none"> <li>1. DSP 閒置中</li> <li>2. 通訊連接中斷</li> <li>3. 通訊電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查DSP中reset和crystal</li> <li>2. 檢查DSP和COMM通訊連接</li> <li>3. 檢查通訊電路</li> </ol>
HW COMM2 (F22)	<ol style="list-style-type: none"> <li>1. Red. CPU閒置中</li> <li>2. 通訊連接中斷</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查Red. CPU中reset和crystal</li> <li>2. 檢查Red. CPU和DSP通訊連接</li> </ol>
Ground Cur. (F24)	<ol style="list-style-type: none"> <li>1. 太陽能板絕緣測試未通過</li> <li>2. 太陽能板電容值介於正到接地端或負到接地端太大</li> <li>3. Boost 驅動電路或Boost電感其中之一功能異常</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入端的絕緣</li> <li>2. 檢查電容值 (+ &lt;-&gt; GND &amp; - &lt;-&gt; GND) , 必須 &lt; 2.5uF. 必要時安裝外部的變壓器</li> <li>3. 檢查boost驅動電路和boost電感</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>

故障		
資訊顯示	可能原因	故障排除
HW Con. Fail (F26)	<ol style="list-style-type: none"> <li>1. 逆變器內部的電源線未連接</li> <li>2. 電流回授電路無效</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器內部電源線</li> <li>2. 檢查逆變器內部電流回授電路</li> </ol>
RCMU Fail (F27)	<ol style="list-style-type: none"> <li>1. RCMU連接中斷</li> <li>2. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器內部RCMU連接</li> <li>2. 檢查逆變器內部的偵測電路</li> </ol>
RLY Short (F28)	<ol style="list-style-type: none"> <li>1. 一個或多個繼電器是閉合的</li> <li>2. 繼電器driver電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 替換無效的繼電器</li> <li>2. 檢查逆變器內部的驅動電路</li> </ol>
RLY Open (F29)	<ol style="list-style-type: none"> <li>1. 一個或多個繼電器異常</li> <li>2. 繼電器驅動電路功能異常</li> <li>3. Vgrid與Vout偵測精度不正確</li> </ol>	<ol style="list-style-type: none"> <li>1. 替換無效的繼電器</li> <li>2. 檢查逆變器內部的驅動電路</li> <li>3. 檢查Vgrid與 Vout電壓偵測精度</li> </ol>
Bus Unbal. (F30)	<ol style="list-style-type: none"> <li>1. 輸入端並未完全獨立或並聯</li> <li>2. 太陽能板短路到地</li> <li>3. Boost驅動電路無效或連接中斷</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查輸入連接</li> <li>2. 檢查太陽能板絕緣設定</li> <li>3. 檢查逆變器內部boost的驅動電路</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
HW Bus OVR (F31, F33, F35)	<ol style="list-style-type: none"> <li>1. Boost驅動電路無效或連接中斷</li> <li>2. 太陽能板Voc超過1000Vdc</li> <li>3. 操作期間突波發生</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查逆變器內部boost的驅動電路</li> <li>2. 修正太陽能板設定, 並使得Voc 小於 1000Vdc</li> <li>3. N/A</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
AC Cur. High (F36, F37, F38, F39, F40, F41)	<ol style="list-style-type: none"> <li>1. 操作期間突波發生</li> <li>2. Inverter stage驅動電路無效</li> <li>3. 開關裝置無效</li> <li>4. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. N/A</li> <li>2. 檢查inverter stage驅動電路</li> <li>3. 檢查inverter stage全部開關裝置</li> <li>4. 檢查逆變器內部的偵測電路</li> </ol>
HW CT A Fail (F42)	<ol style="list-style-type: none"> <li>1. 測試電流回路損壞</li> <li>2. CSC1無效</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查WC3至CNC16的連接</li> <li>2. 替換新的CSC1</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>

故障		
資訊顯示	可能原因	故障排除
HW CT B Fail (F43)	<ol style="list-style-type: none"> <li>1. 測試電流回路損壞</li> <li>2. CSC2無效</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查WC3至CNC16的連接</li> <li>2. 替換新的CSC2</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW CT C Fail (F44)	<ol style="list-style-type: none"> <li>1. 測試電流回路損壞</li> <li>2. CSC3無效</li> <li>3. 偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查WC3至CNC16的連接</li> <li>2. 替換新的CSC3</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW AC OCR (F45)	<ol style="list-style-type: none"> <li>1. 檢查WC3至CNC16的連接</li> <li>2. 替換新的CSC3</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查市電波形, 必要時逆變器與電網連接處必須遠離非線性的負載</li> <li>2. 檢查inverter stage開關裝置</li> <li>3. 檢查逆變器內部的偵測電路</li> </ol>
HW ZC Fail (F50)	同步訊號偵測電路功能異常	檢查逆變器內部同步訊號的偵測電路
AFCI Circuit Fail (F58)	<ol style="list-style-type: none"> <li>1. 電弧偵測裝置沒有安裝</li> <li>2. 電弧偵測裝置自我測試失效</li> </ol>	檢查電弧偵測裝置電路板, 確認連接線是否正確連接
AFCI Fault (F59)	逆變器偵測到有電弧存在	檢查DC端配線是否有問題
DC Cur. High (F60, F61, F70, F71)	<ol style="list-style-type: none"> <li>1. Boost開關裝置無效</li> <li>2. Boost驅動電路無效</li> <li>3. 輸入電流偵測電路功能異常</li> </ol>	<ol style="list-style-type: none"> <li>1. 檢查boost全部開關裝置</li> <li>2. 檢查逆變器內部的boost驅動電路</li> <li>3. 檢查輸入電流偵測電路</li> </ol>
HW DC RLY (F76)	一個或多個直流電驛異常	請聯繫客服人員, 尋求技術支援

表6-3: 故障資訊



## 7 技術資料

Model	M88H_121	M88H_122
<b>直流輸入</b>		
最大輸入功率	Vac230/400V : 76kW Vac277/480V : 91kW	
建議PV配置功率	Vac230/400V : 90kW Vac277/480V : 110kW	
機體可承受最大直流電壓	1100 V *	
工作電壓範圍	200 - 1000 V	
啟動電壓	> 250 V	
最大功率追蹤範圍(額定功率)	Vac230/400V : 500-800V Vac277/480V : 600-800V	
額定電壓	Vac230/400V : 600V Vac277/480V : 710V	
MPP追蹤器數量	2	
最大輸入電流/每一MPP追蹤器	140 / 70A	
最大輸入短路電流/每一MPP追蹤器	180 / 90A	
接線型式	Terminal block for 2 MPPTs	18 pairs of MC4 connector
型式2 SPD	●	●
15A 串列保險絲	—	●
直流開關	—	●
<b>交流輸出</b>		
最大輸出功率	Vac230/400V : 73kW Vac277/480V : 88kW	
最大輸出電流	106A	
湧浪電流	40A / 100μs	
最大輸出故障電流	115.4A (rms)	
最大輸出過電流保護	125A	
額定電壓	3Ph, 230/400 & 277/480Vac	
工作電壓範圍	Vac230/400V : ±30% Vac277/480V : ±20%	
操作頻率範圍	50/60Hz ± 5Hz	
功率因素	1 at rated power, 0.8 ind ~ 0.8 cap adjustable	
突波保護	Type II SPD	
諧波成分	< 3%	
接線型式	50 ~120 mm <sup>2</sup>	35 ~95 mm <sup>2</sup>
夜間功耗	< 3 W	

\* 最大可承受電壓為1100V。(當電壓超過1000V時逆變器停止運轉)

● : 有  
— : 沒有

Model	M88H_121	M88H_122
<b>效率</b>		
最高效率	98.8 %	
歐洲效率	98.5 %	
<b>資訊</b>		
通訊介面	RS-485	
顯示螢幕	20 x 4 LCD	
<b>規範認證</b>		
	IEC 62109-1/-2 VDE-AR-N 4105 EN 61000-6-1 EN 61000-6-2 EN 61000-6-3 EN 61000-6-4 CE compliance	
<b>一般數據</b>		
操作溫度範圍	-25~60°C (Max power: -25~35°C)	
防水防塵等級	IP65	
操作海拔範圍	< 3000 m	
冷卻模式	Forced air cooling plus Smart Fans control	
尺寸 (W x H x D) (mm)	615 x 962 x 275	
重量 (kg)	84	
噪音 (距離1公尺)	75.8 dB	
過電壓類別	AC output :III, DC Input :II	
最大反饋電流至太陽能模組端	0	
保護等級	I	
汙染程度	3	
濕氣範圍	4-100%	

表7-1 : M88H規格





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