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Grid-tie Transformerless Solar Inverter

M88H

Operation and Installation Manual

English 1

繁體中文 97

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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 μ 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 serious 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**.

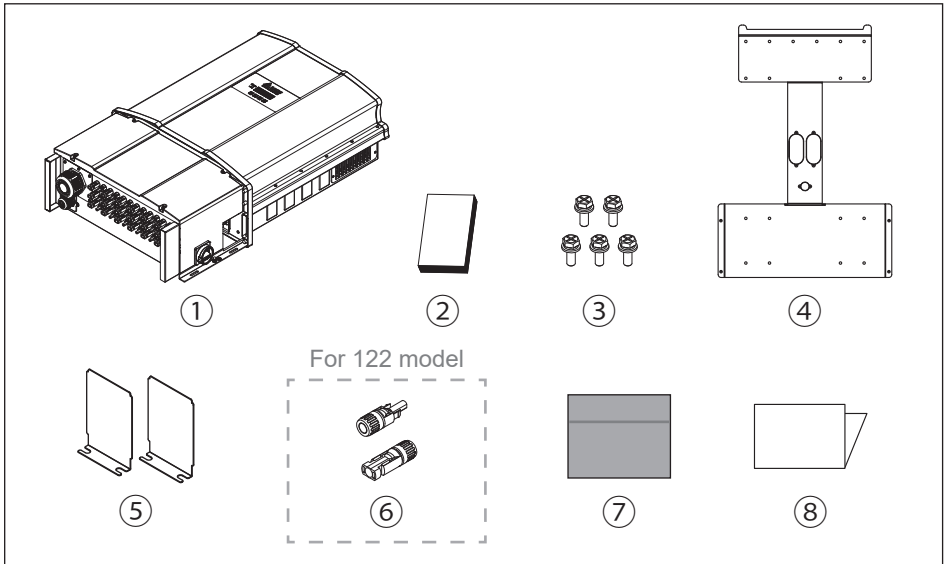


Figure 2-1 : Components of M88H

Table 2-1 : Packing list 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	To secure inverter to mounting bracket (Stainless/M6/12mm)
4	Mounting Bracket	1 pc	Wall mounting bracket (Material: Aluminum/Thickness: 3mm)
5	Shielding Plate	1 pair	Shielding plate for filter (use is optional)
6	MC4 Connector	18 pairs	String inputs (122 model only)
7	Nameplate Protection	1 pc	Nameplate protection for display
8	Nameplate Protection Manual	1 pc	Instructions for nameplate protection

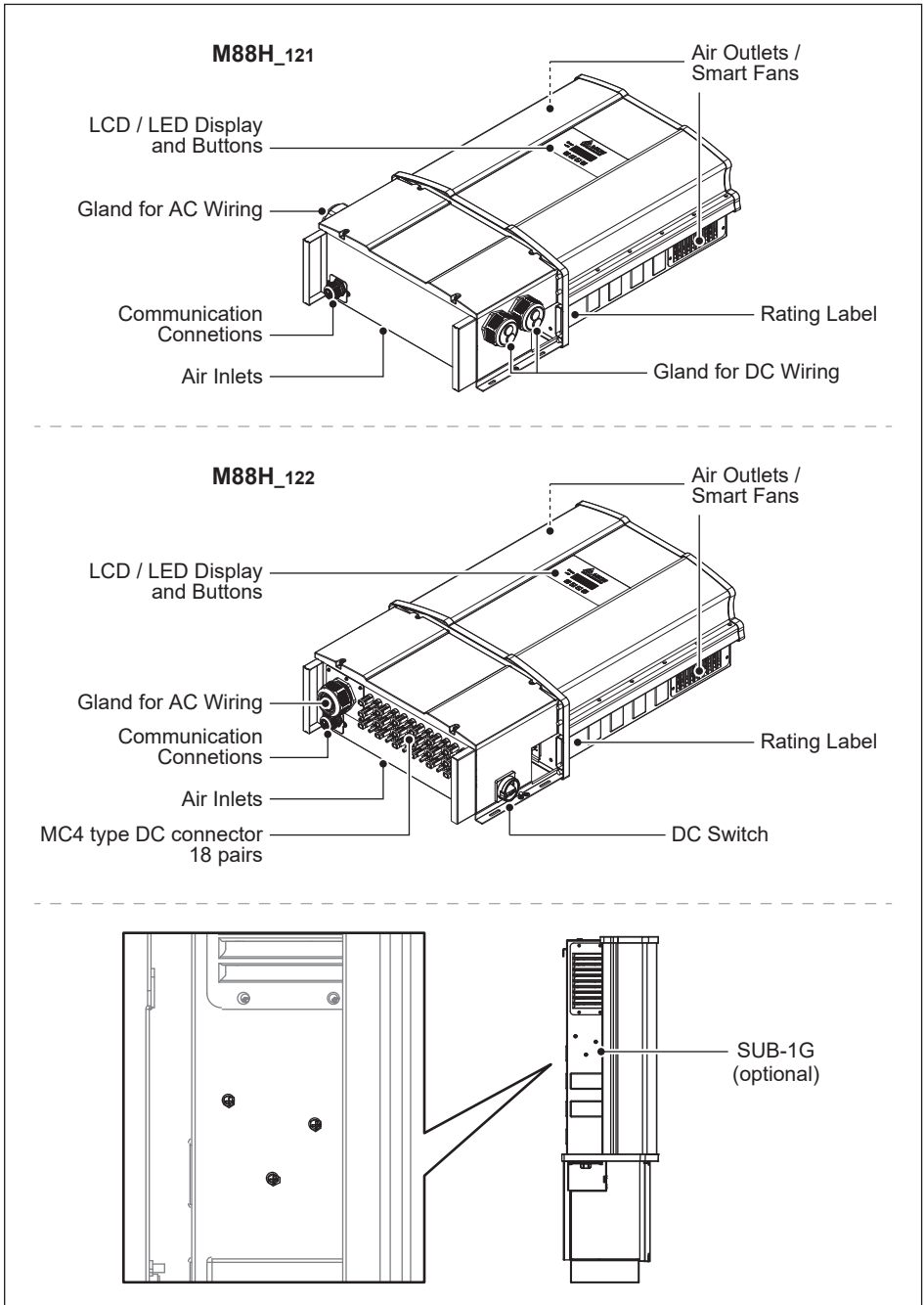


Figure 2-2 : Overview of M88 series

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.

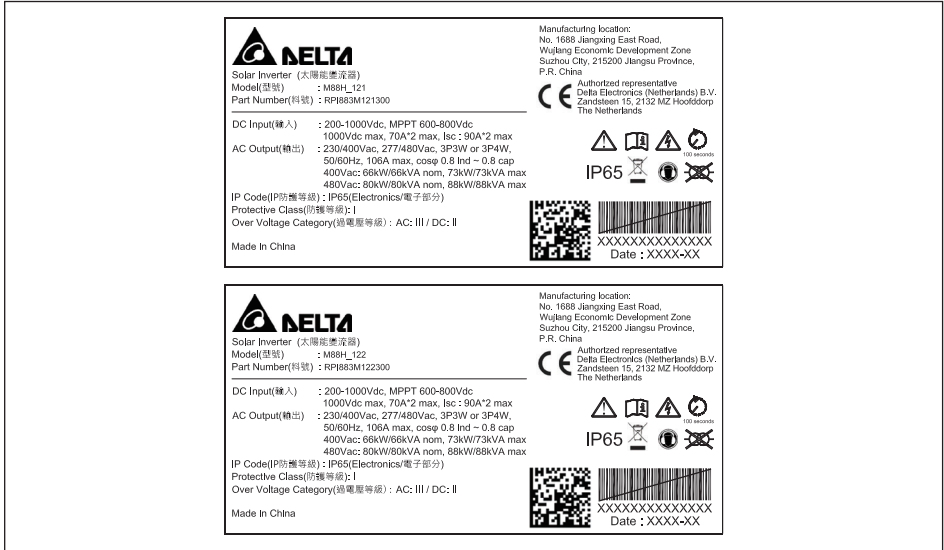








Figure 2-3 : Rating labels of M88H

Table 2-2 : Rating label explanation of M88H

Symbol	Definition
	Danger to life through electric shock 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 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.
	WEEE marking 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.

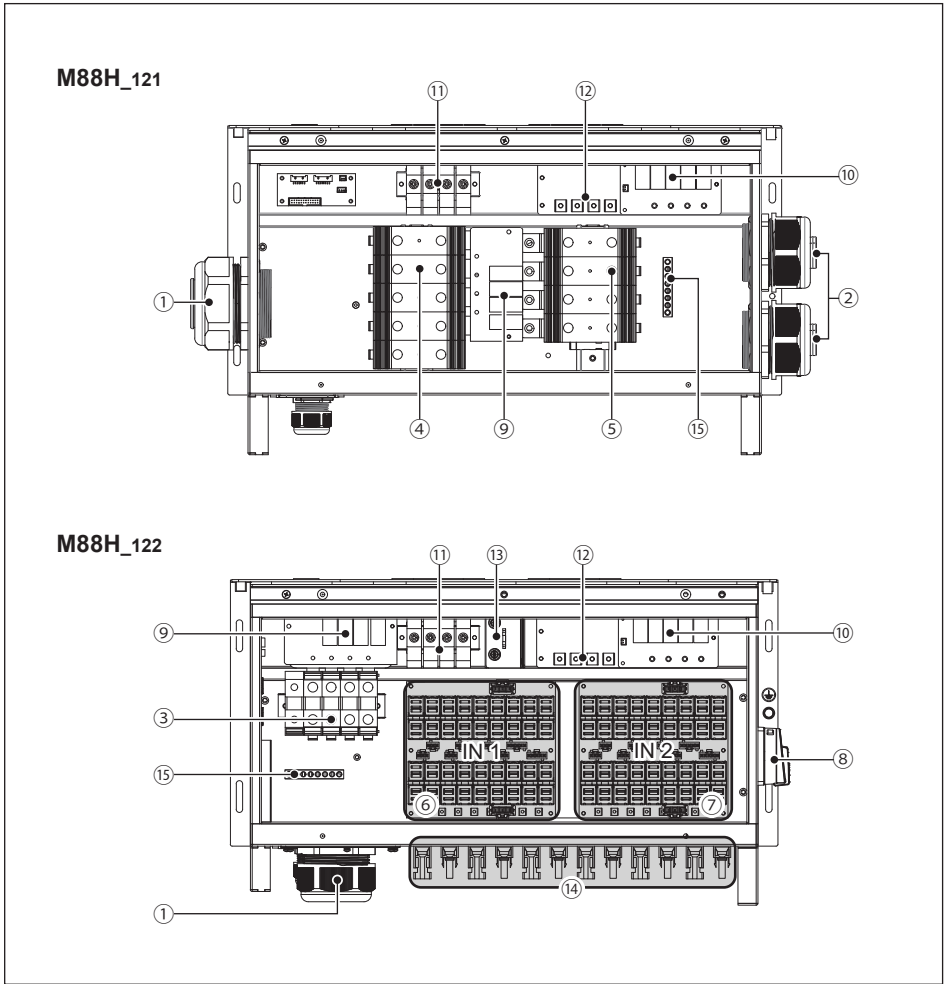


Figure 2-4 : Wiring box layout of M88H

Table 2-3 : Wiring box layout description of M88H

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

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 3-2** through **3-4**. First, fix the wall mounting bracket on a solid support surface. Second, please mount the inverter on the bracket securely. Note that **Figure 3-2** through **3-8** 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 3-2** and **3-3** for correct installation.
2. **Figure 3-1** shows the hoisting hook instruction.
3. There are two ways for fixing the wall mounting bracket as shown in **Figure 3-3**.
4. Hang the inverter on the wall mounting bracket.
5. **Figure 3-4** through **3-8** describes correct mounting installation.
6. **Figure 3-8** 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.

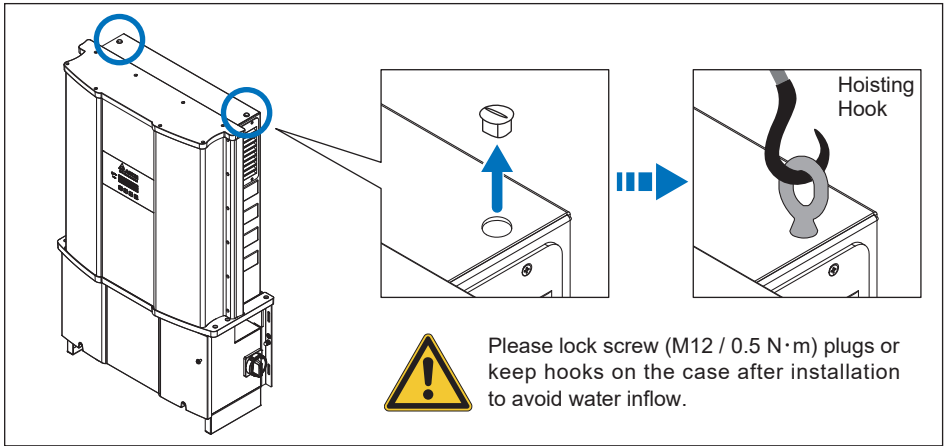


Figure 3-1 : Attaching the Hoisting hooks

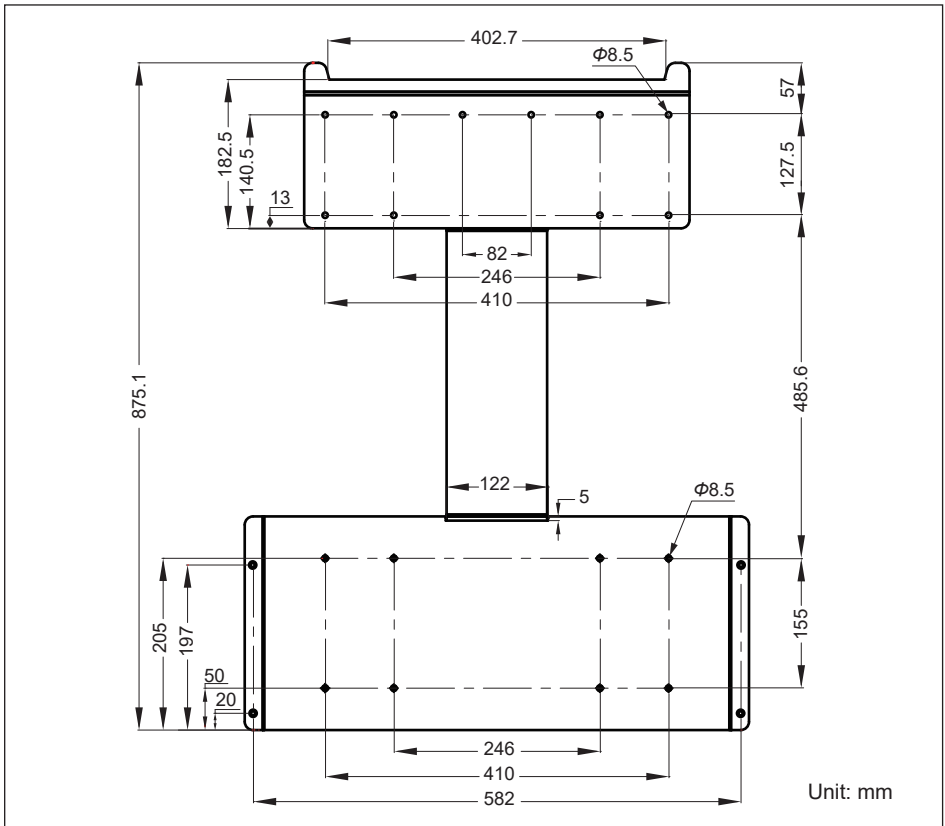


Figure 3-2 : Mounting bracket dimensions

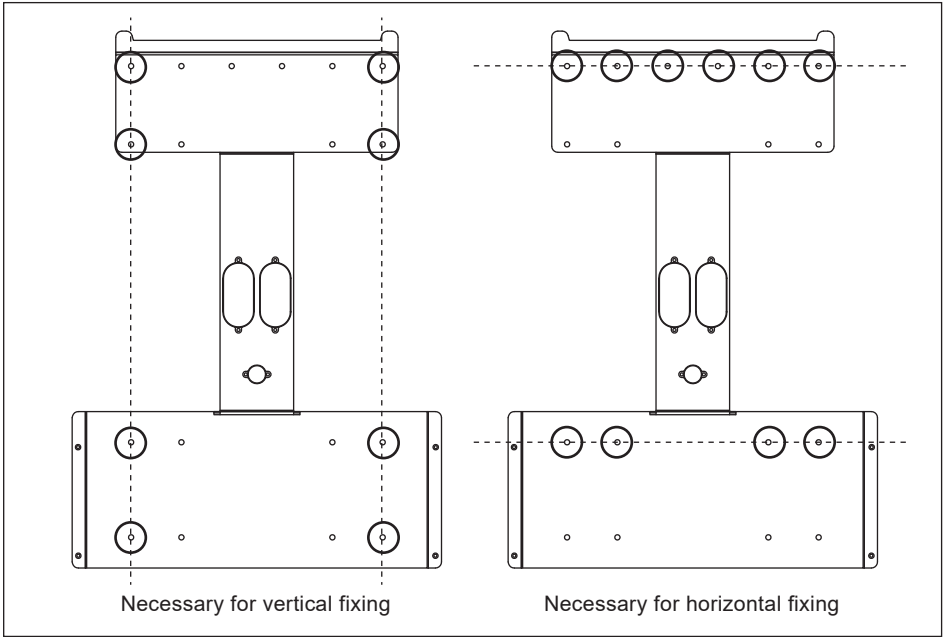


Figure 3-3 : Required position for at least 8 screws

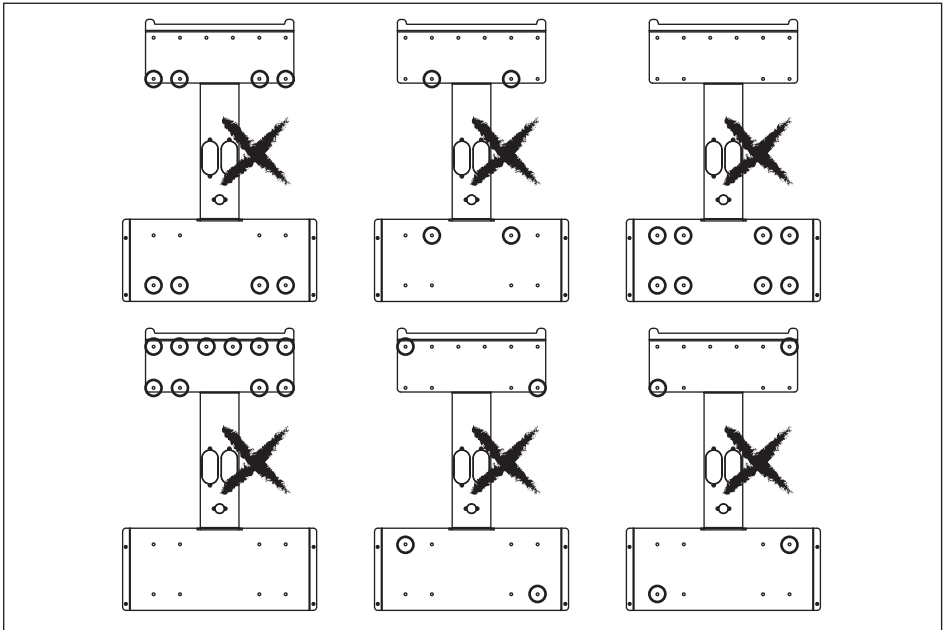


Figure 3-4 : Prohibited position for screws

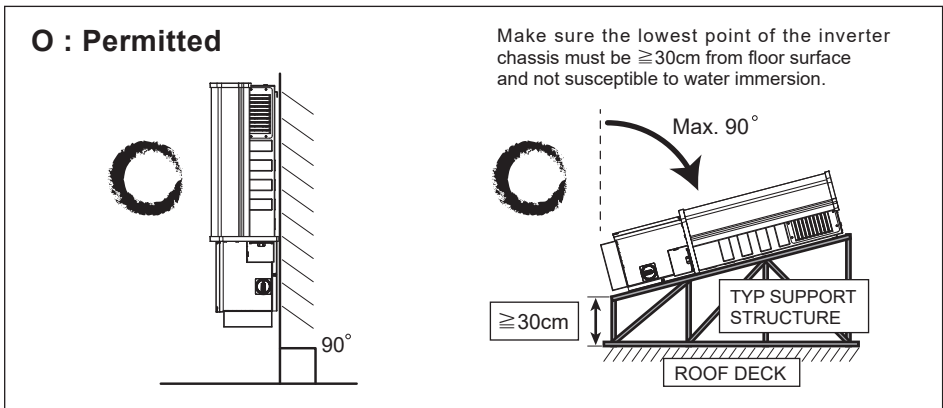


Figure 3-5 : Permitted mounting positions

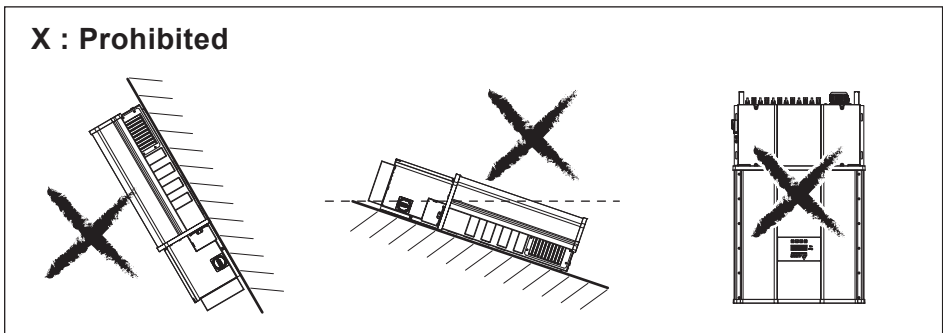
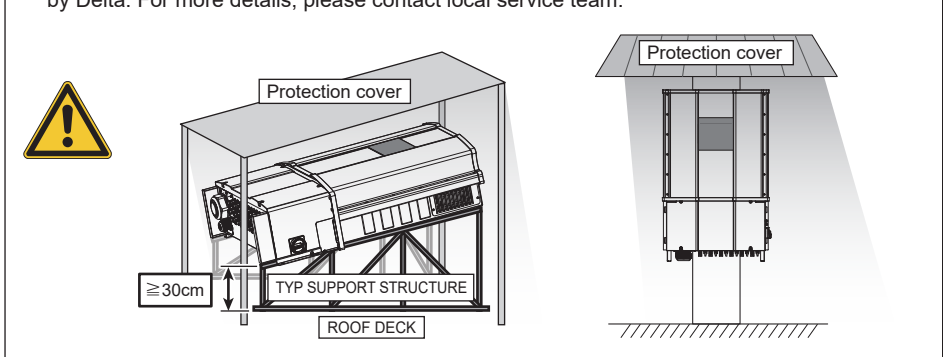


Figure 3-6 : Prohibited mounting positions

CAUTION !

- Name plate cover is required for all types of installation.
- To avoid malfunction of inverter caused by extreme weather (ex: snow, hail...etc) or non-proper installation/maintenance, an additional protection cover is strongly recommended to be installed by Delta. For more details, please contact local service team.



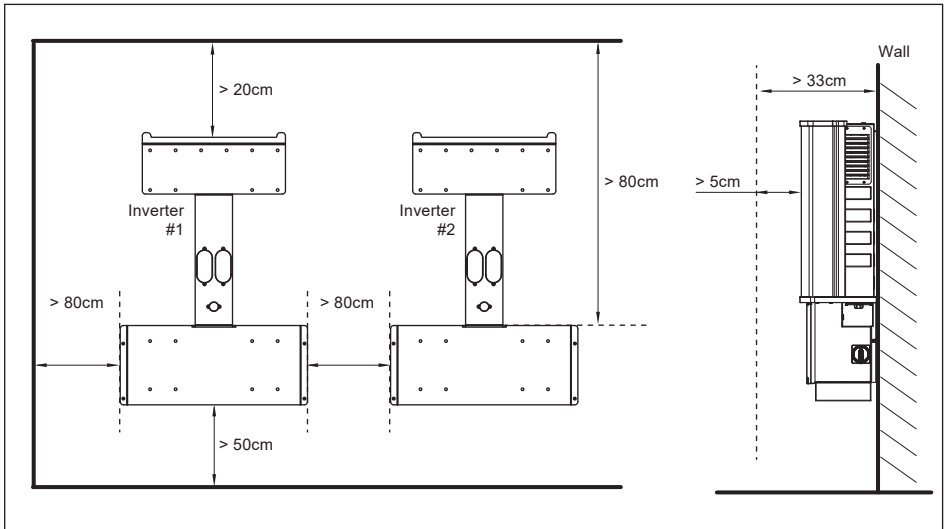


Figure 3-7 : Required mounting clearances

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

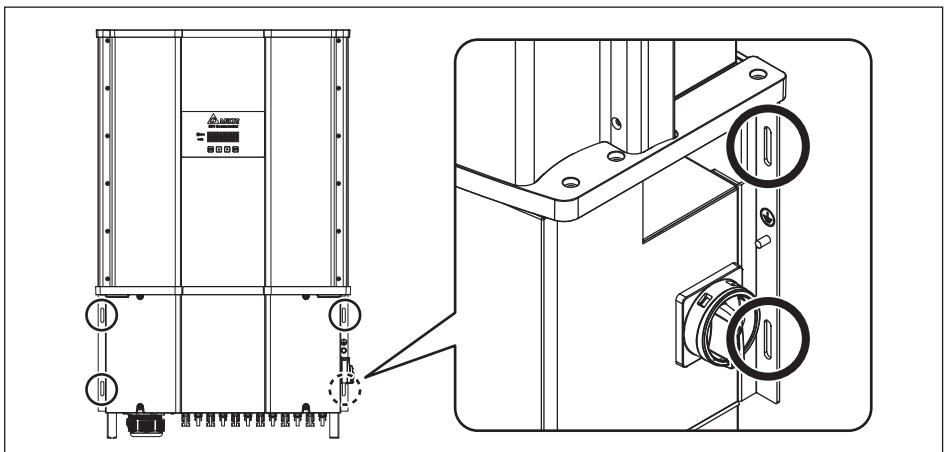


Figure 3-8 : Specification of fixing WB for wall-mounting installation

If customers need to use the shielding plate, please refer to the installation method in **Figure 3-9**.

The torque of the screw: 45 kgf.cm

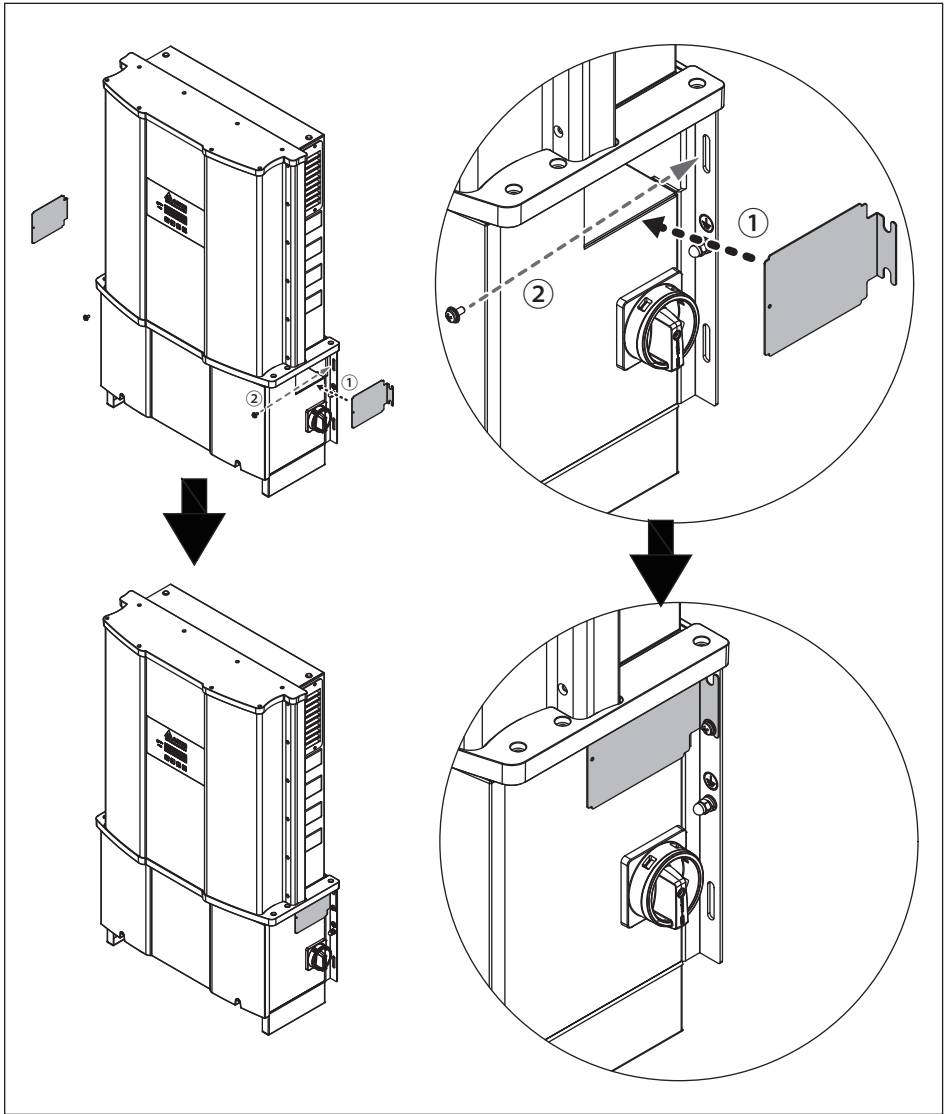


Figure 3-9 : Installation method of shielding plate

Nameplate Protection

CAUTION !



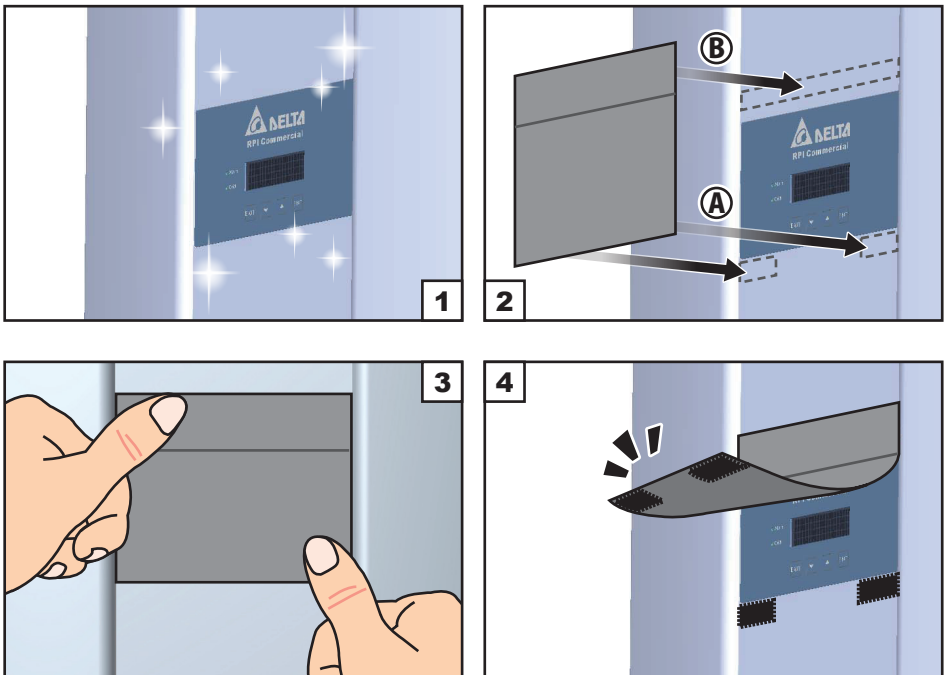
- Must wipe around nameplate before pasting.
- After pasting, press nameplate protector hard and check its flatness.
- Let nameplate protector sit at least for one hour to ensure sufficient stickiness of glue.

To protect nameplate/LCM from the damage by external factors (like animal, foreign object, UV irradiation etc.), this nameplate protector must be installed for tilted/horizontal or exposed in direct sunlight installation.

Installation procedures:

- A. Paste the sticker with two short velcros along with bottom edge of nameplate.
- B. Then paste the sticker with long velcro.

When installation is done, the bottom velcro can be torn to open nameplate protector.



3.2 Wiring box cover

For first time installing/re-installing WB cover, in order to guarantee proper long-term operation of the inverter, procedures in **Section 5.1** must be followed.

3.3 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 !



- Installation for AC terminal must meet the local electrical code.
 - Failed to follow the instructions may damage AC cable.

CAUTION: WRONG AC WIRING !



- In order not to damage the components in the inverter, ensure the correct conductor is connected to the appropriate AC terminal on the inverter.

ATTENTION



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

Allowable grounding systems

Grounding system	TN-S	TN-C	TN-C-S	TT	IT
Allowed	Yes	Yes	Yes	Yes	Yes



TT is not recommended. The voltage of N must be very close to the grounding voltage (difference <math>< 20 V_{rms}</math>)

3.3.1 Required Protective Devices and AC Cabling Installation for M88H₁₂₁

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

Model	Upstream circuit breaker
M88H	$\geq 150A$

Please follow the following steps for assembling the AC terminal (M88H₁₂₁) :

- 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 50 -120 mm².

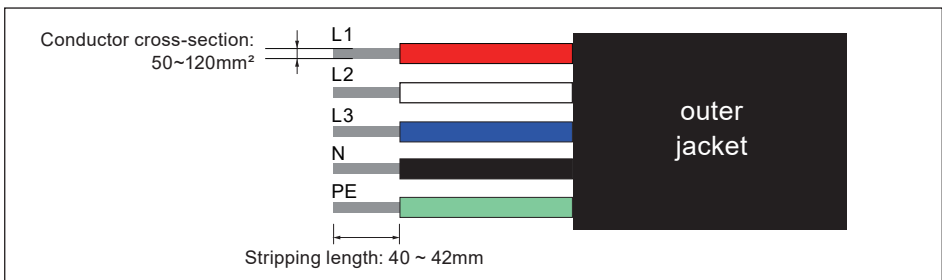


Figure 3-10 : Stripping cables for M88H₁₂₁ AC terminal

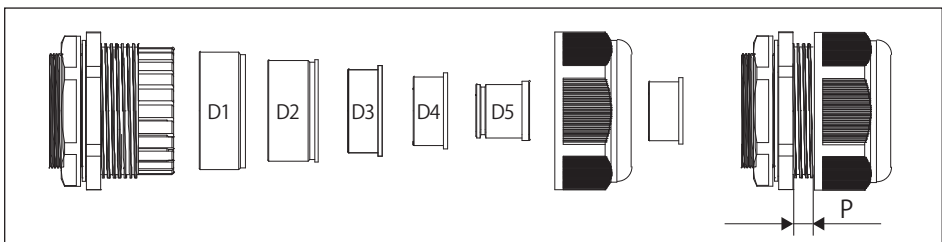


Figure 3-11: AC Gland with multiple inlet (M88H₁₂₁)

Table 3-1: Cable size comparison table (M88H₁₂₁)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	53.5~65.9	13.7~18.1	1~8.4
D2	43.8~53.5	23~24.5	1~7.8
D3	34.8~43.8	19.4~36.9	1~6.4
D4	27.2~34.8	34.3~36.4	1~6.4
D5	23.9~27.2	25.9~36.3	1~6.4

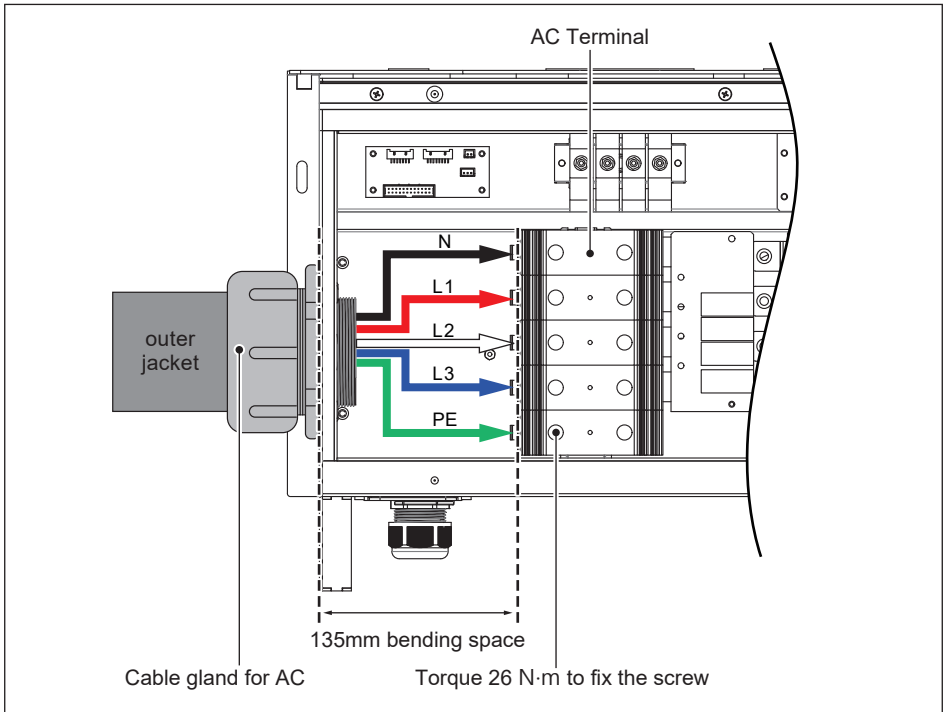


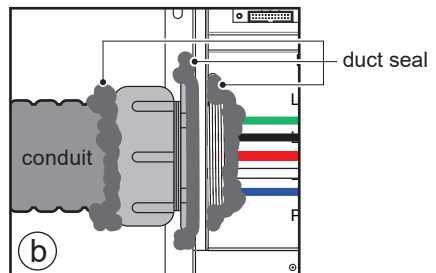
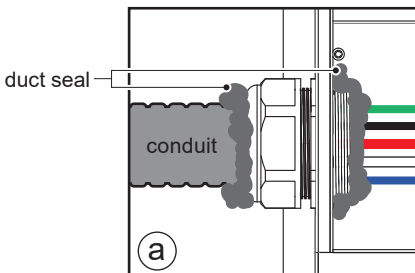
Figure 3-12 : Location for M88H_121 AC terminal

CAUTION !



The cable gland is suitable for multi-core cable, if wiring is using single-core cable with 2.5" flexible metal conduit, please follow below suggestions to avoid water intrusion:

- a. Insert the flexible metal conduit to cable gland and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.
- b. Replace the cable gland to 2.5" EMT connector and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.



3.3.2 Required Protective Devices and AC Cabling Installation for M88H₁₂₂

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

Model	Upstream circuit breaker
M88H	$\geq 150\text{A}$

Please follow the following steps for assembling the AC terminal (M88H₁₂₂) :

- 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 2~2/0 AWG.

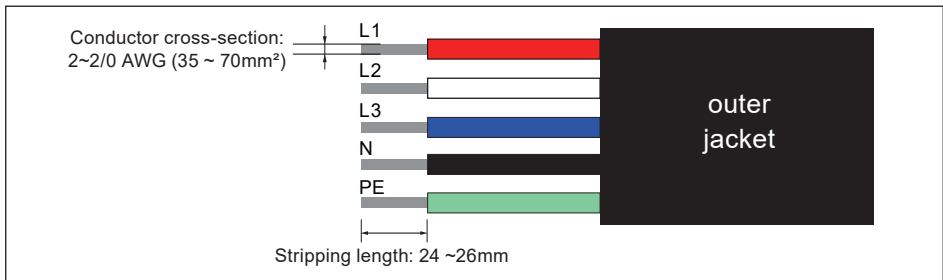


Figure 3-13 : Stripping cables for M88H₁₂₂ AC terminal

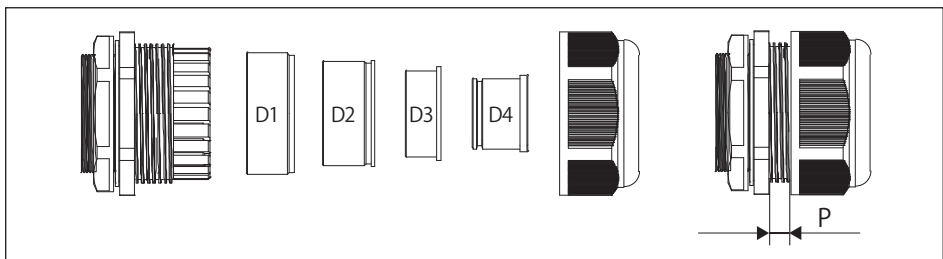


Figure 3-14: AC Gland with multiple inlet (M88H₁₂₂)

Table 3-2: Cable size comparison table (M88H₁₂₂)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	43.5~51.3	8.5~11	1~4
D2	34.8~43.5	8.5~11	1~5
D3	27.2~34.8	8.5~11	1~3.5
D4	23.9~27.2	8.5~11	1~3.5

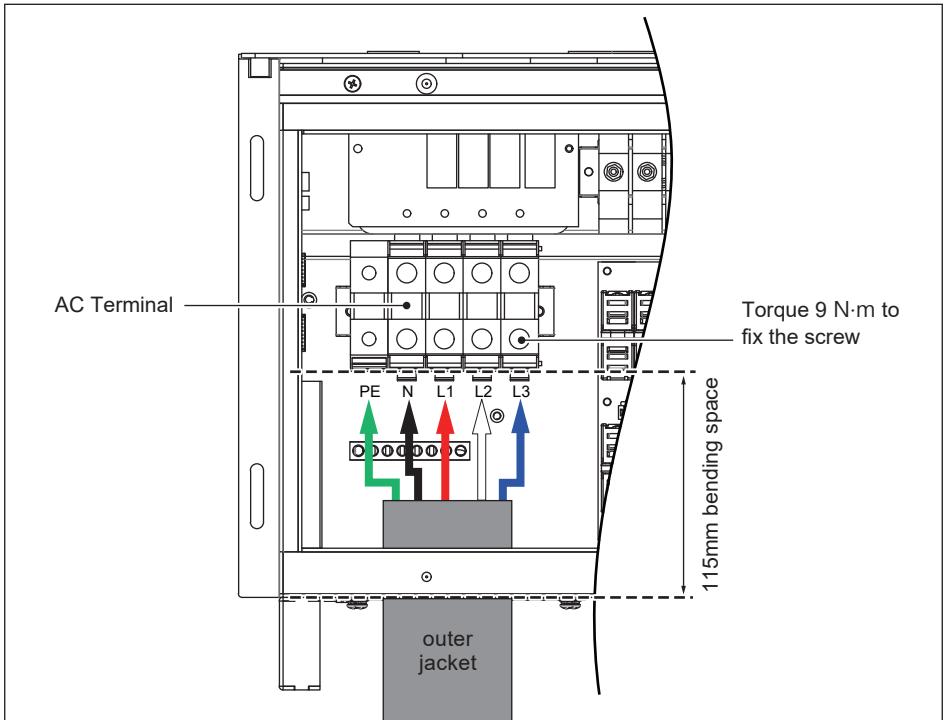


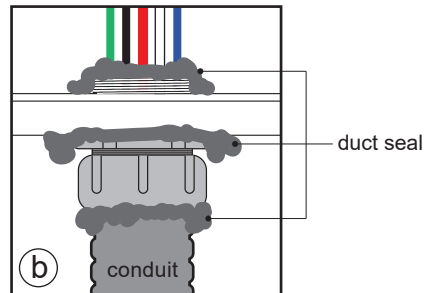
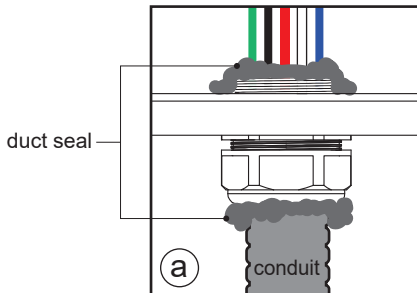
Figure 3-15 : Location for M88H_122 AC terminal

CAUTION !



The cable gland is suitable for multi-core cable, if wiring is using single-core cable with 2" flexible metal conduit, please follow below suggestions to avoid water intrusion:

- a. Insert the flexible metal conduit to cable gland and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.
- b. Replace the cable gland to 2" EMT connector and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.



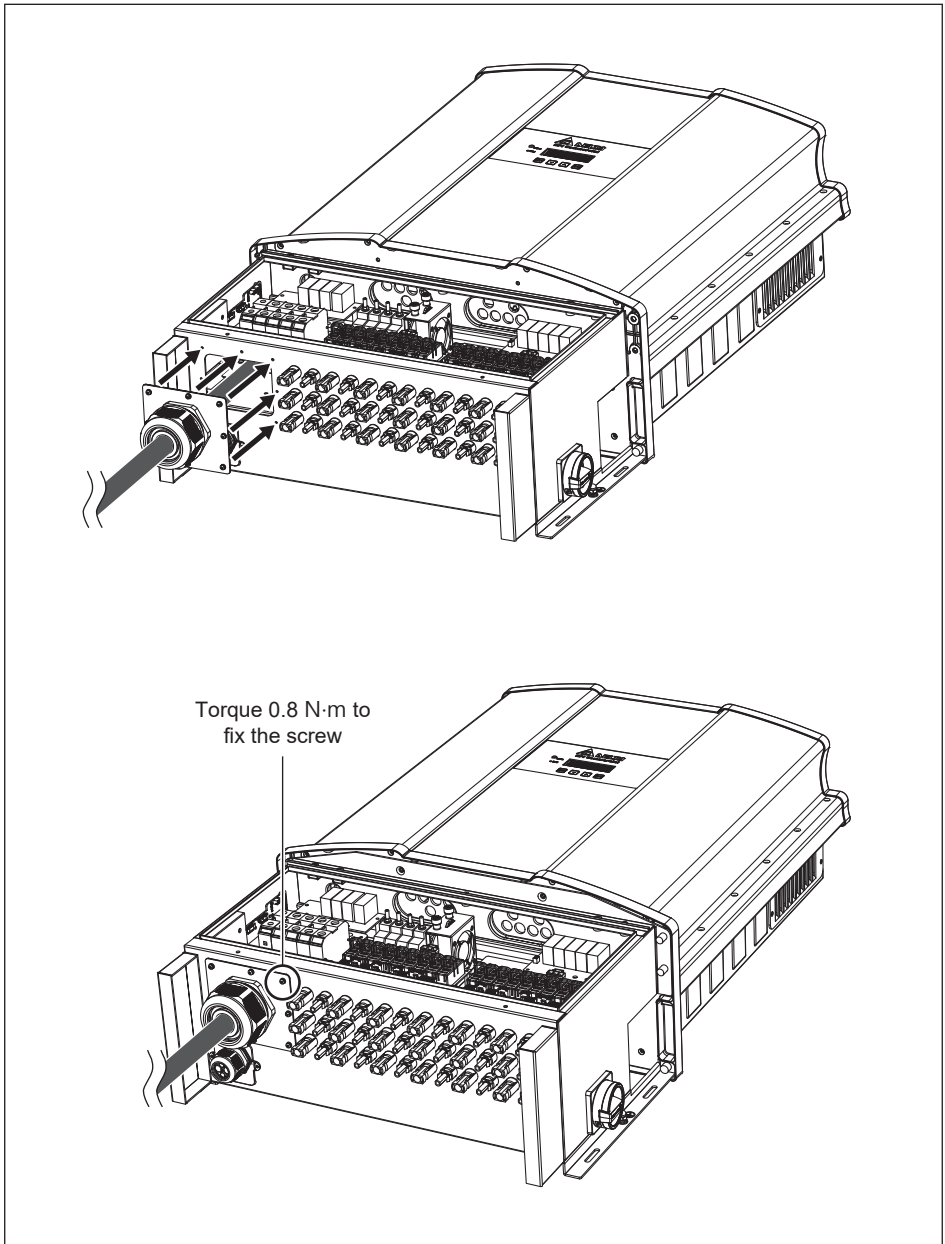


Figure 3-16 : AC gland assembling for M88H_122

M88H support direct 1/4 sector-shaped aluminum wire connection
(M88H_121: DC and AC side; M88H_122: AC side)

Please follow the following guideline for cabling when using 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

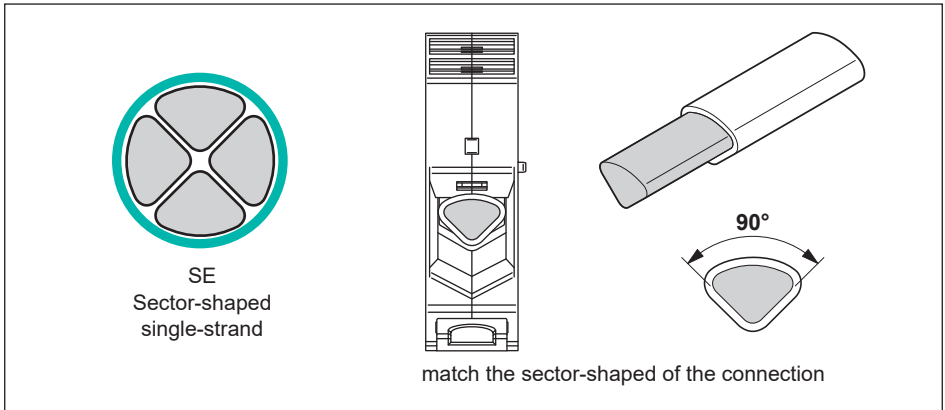


Figure 3-17 : Guideline for aluminum conductor

For other types of Al wires:

To make sure good conductivity, bi-metal adapter must be used in conjunction with aluminum wires. Please follow **Figure 3-18** for selecting proper size of bi-metal adapter.

NOTICE

Extreme temperature rise at the clamping point

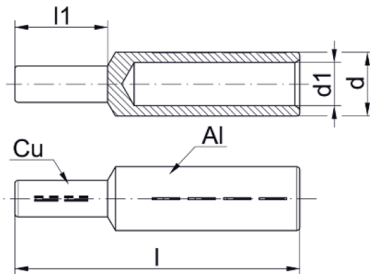
If the contact resistance between the aluminum conductor and clamping point is too high, the clamping point can become very hot and even catch fire in extreme cases.

To ensure a safe and reliable contact, **always** perform the following work steps:

- ▶ Use a conductor cross-section at least one number larger due to the lower current-carrying capacity.
- ▶ Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ▶ Connect the aluminum cables quickly.
- ▶ Mechanically clean the stripped end of the aluminum conductor (using for instance a knife blade to scrape off the oxide layer). Then immediately dip the aluminum conductor into acid-free and alkaline-free (=neutral) Vaseline and straight away insert it into the terminal block.
- ▶ Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.



Type: Compression joints
with Cu bolts, Al



For M88H_121, $d < 30.0\text{mm}$

For M88H_122, $d < 19.0\text{mm}$

Heat-Shrinkable tube must be applied
on Al part

Figure 3-18 : Guideline for bi-metal adapter

3.4 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.

CAUTION: DC SWITCH ON/OFF !



- In order not to damage the components in the inverter, don't repeat to change the status of DC Switch quickly, the correct operation is waiting for the LCD display show "No DC" or turn on the switch after 1 minute later.

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.

ATTENTION



- Do not remove the waterproof plug for unused DC strings. (M88H_122)

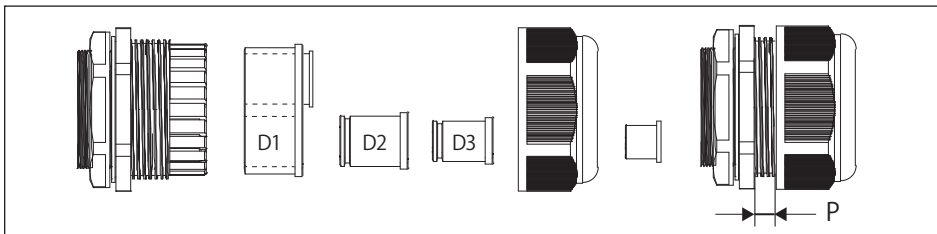


Figure 3-19: DC Gland with multiple inlet (M88H_121)

Table 3-3: Cable size comparison table (M88H_121)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	21.9 ~25.7	31.4 ~35.3	0~4
D2	15.8~21.9	45.1 ~52.0	0~5
D3	11.3~15.8	37.3 ~41.1	0~4

3.4.1 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 50 -120 mm².
- DC Terminals connection as seen in **Figure 3-21**.

ATTENTION



- The screw with torque 26 N·m is required for fixing.
- The required bending space is 135 mm as the requirement states.
- **For aluminum cable :**
Min./max. Conductor cross-section 120 / 150 mm²
Tightening torque 30 N·m

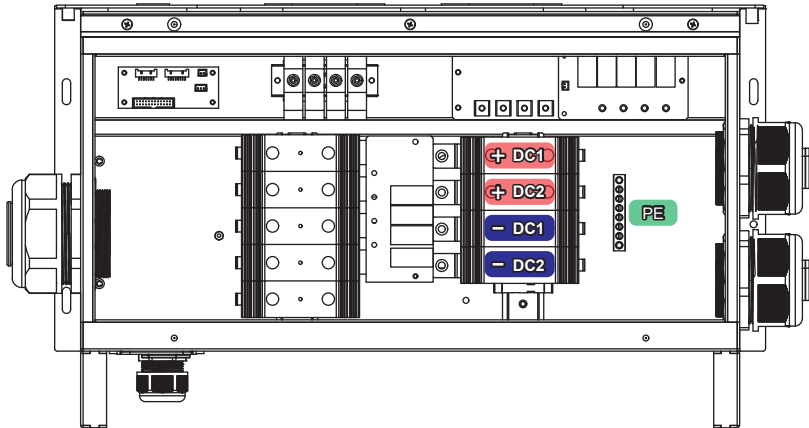
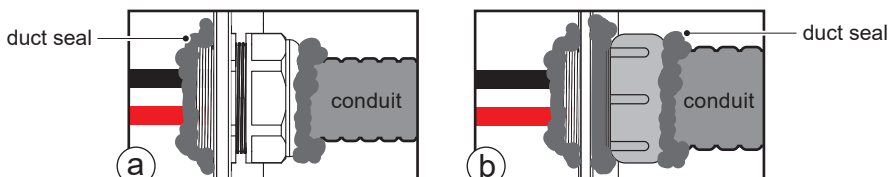


Figure 3-20 : Wiring Box layout for M88H_121

CAUTION !

The cable gland is suitable for multi-core cable, if wiring is using single-core cable with 2" flexible metal conduit, please follow below suggestions to avoid water intrusion:

- Insert the flexible metal conduit to cable gland and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.
- Replace the cable gland to 2" EMT connector and seal the conduit from both inside and outside the wiring box and the gap between gland and conduit by using duct seal to prevent living creature or moisture enter the wiring box.



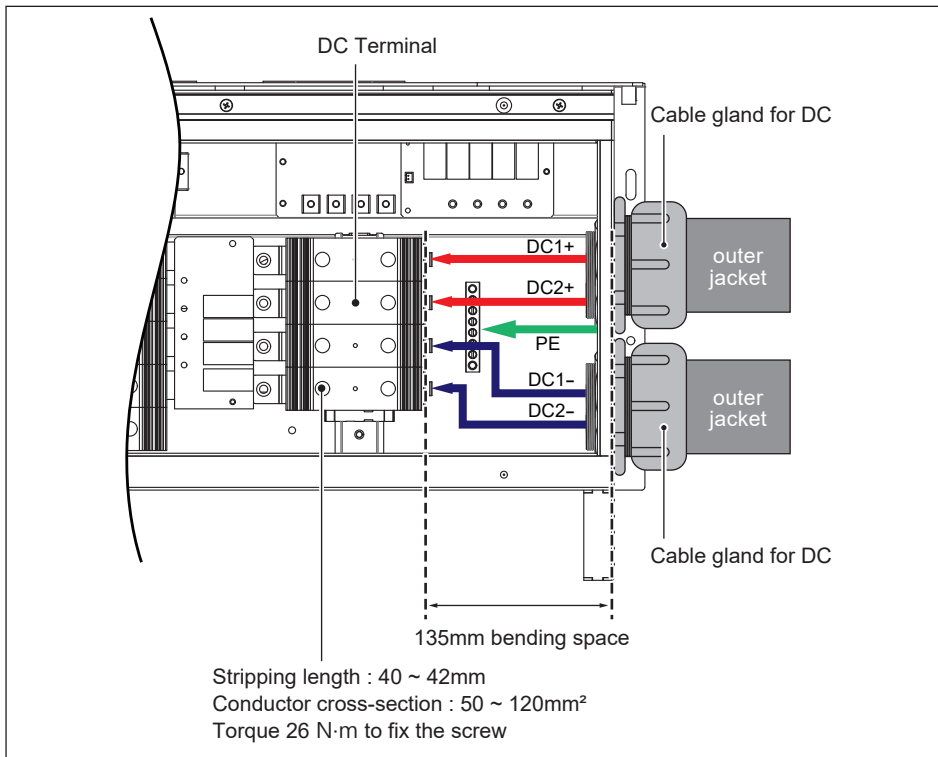
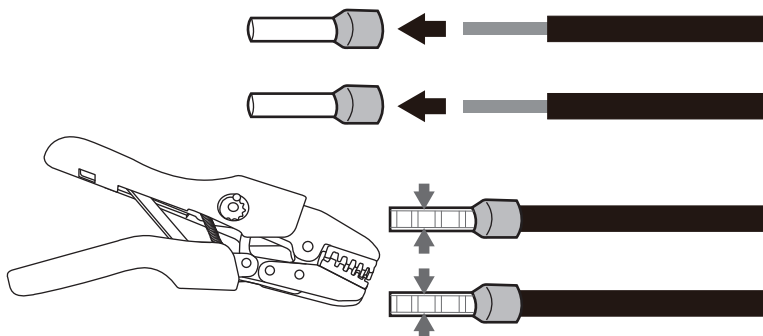


Figure 3-21: Location for DC terminals for M88H_121

CAUTION !



The terminal block can only support down to 35mm² Cu cable in some particular application, in this case the wiring terminal must be installed on the cable, to make sure the cable won't be loosened from terminal block, please follow below installation process.



- For 1MPPT Application please check the following procedure and notice:
- Insert the insertion bridge into DC terminal, see **Figure 3-22**.
 - Insert the DC cable, then tightened the DC terminal with 26 N·m torque

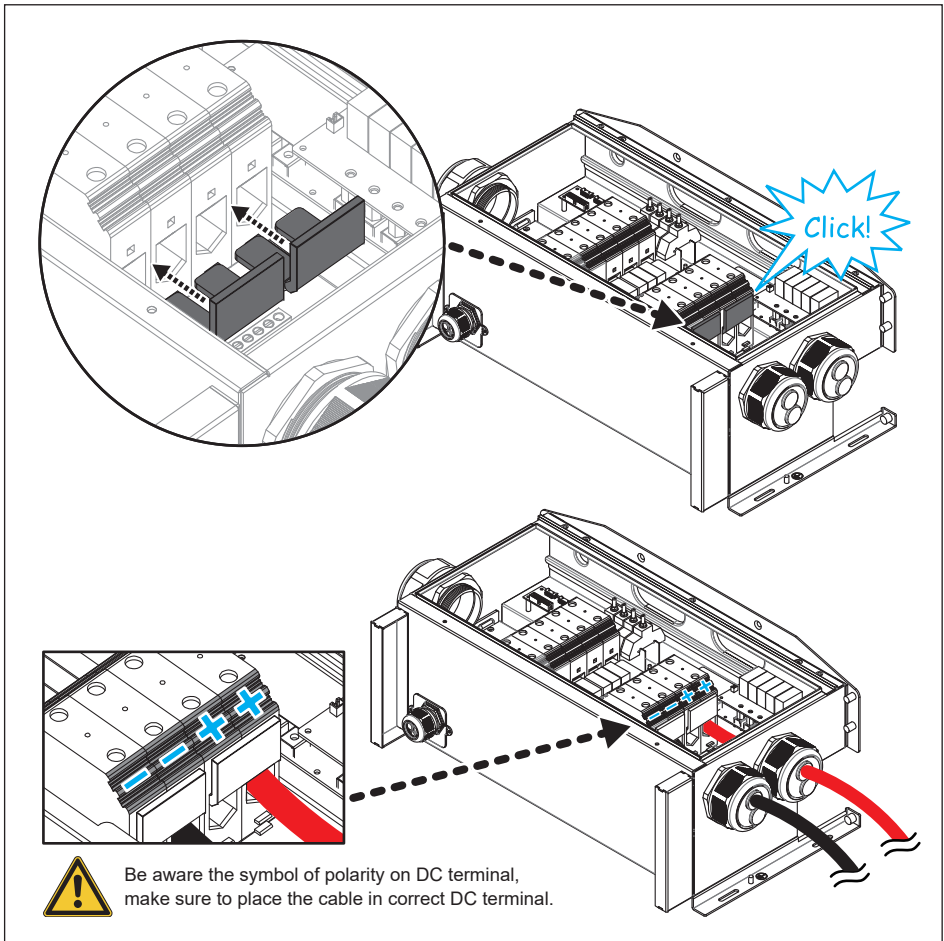
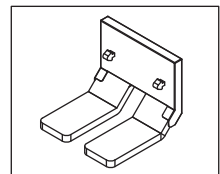


Figure 3-22 : One MPPT application for M88H_121

NOTICE



1. If there is a requirement for Insertion bridge, Please contact Delta service team.
2. Do not use insertion bridge that manufacturer Non-approved to bridge DC terminal which may cause damage to inverter.



M88H support direct 1/4 sector-shaped aluminum wire connection
(M88H_121: DC and AC side; M88H_122: AC side)

Please follow the following guideline for cabling when using 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

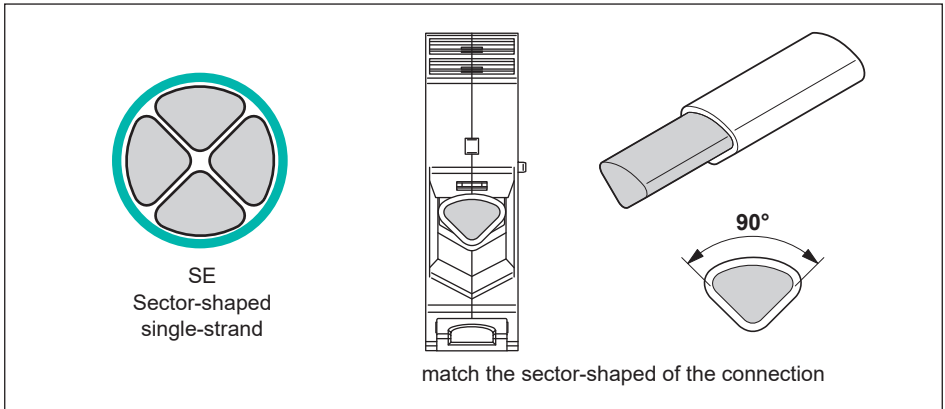


Figure 3-23 : Guideline for aluminum conductor

For other types of Al wires:

To make sure good conductivity, bi-metal adapter must be used in conjunction with aluminum wires. Please follow **Figure 3-24** for selecting proper size of bi-metal adapter.

NOTICE

Extreme temperature rise at the clamping point

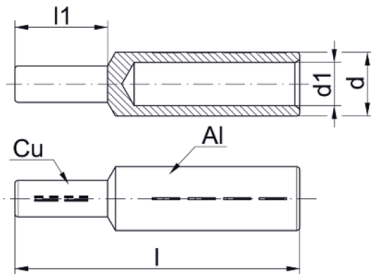
If the contact resistance between the aluminum conductor and clamping point is too high, the clamping point can become very hot and even catch fire in extreme cases. To ensure a safe and reliable contact, **always** perform the following work steps:



- ▶ Use a conductor cross-section at least one number larger due to the lower current-carrying capacity.
- ▶ Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ▶ Connect the aluminum cables quickly.
- ▶ Mechanically clean the stripped end of the aluminum conductor (using for instance a knife blade to scrape off the oxide layer). Then immediately dip the aluminum conductor into acid-free and alkaline-free (=neutral) Vaseline and straight away insert it into the terminal block.
- ▶ Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.



Type: Compression joints
with Cu bolts, Al



For M88H_121, $d < 30.0\text{mm}$
Heat-Shrinkable tube must be applied
on Al part

Figure 3-24 : Guideline for bi-metal adapter

3.4.2 DC Cabling Installation for M88H_122

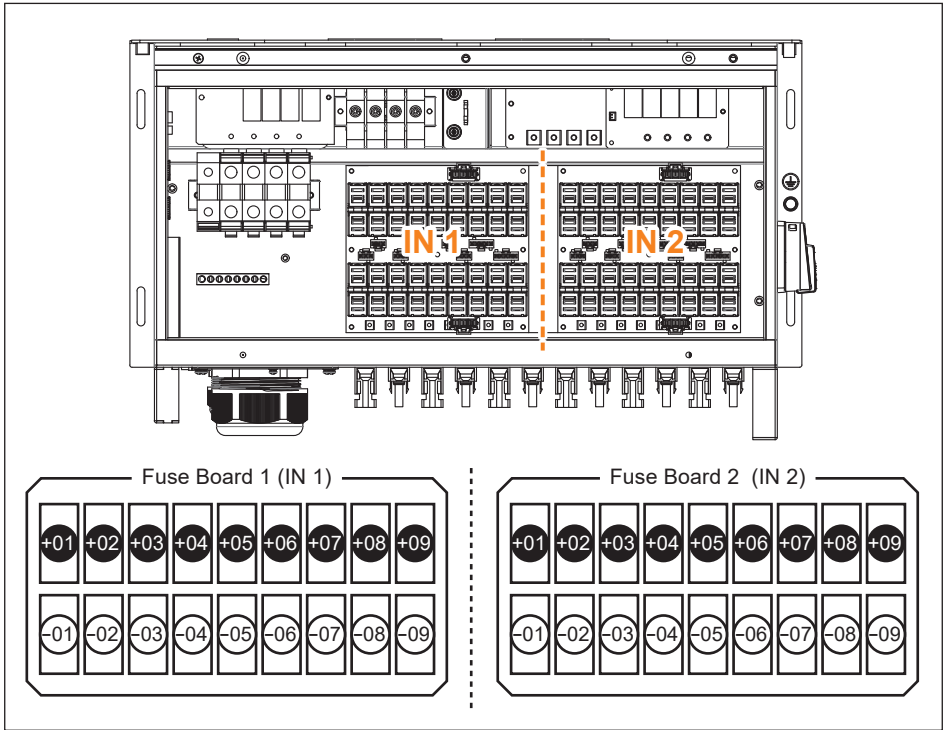


Figure 3-25 : Wiring Box layout for M88H_122

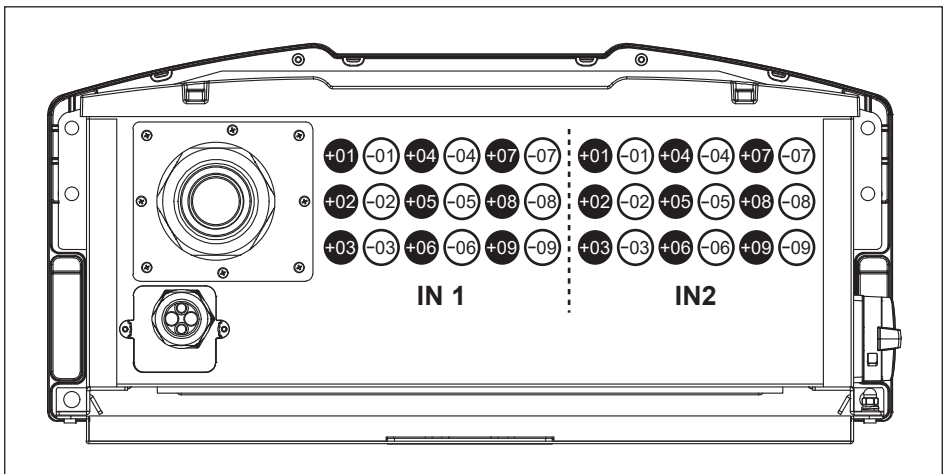


Figure 3-26 : Location for DC terminals for M88H_122

3.5 Communication Module Connections

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

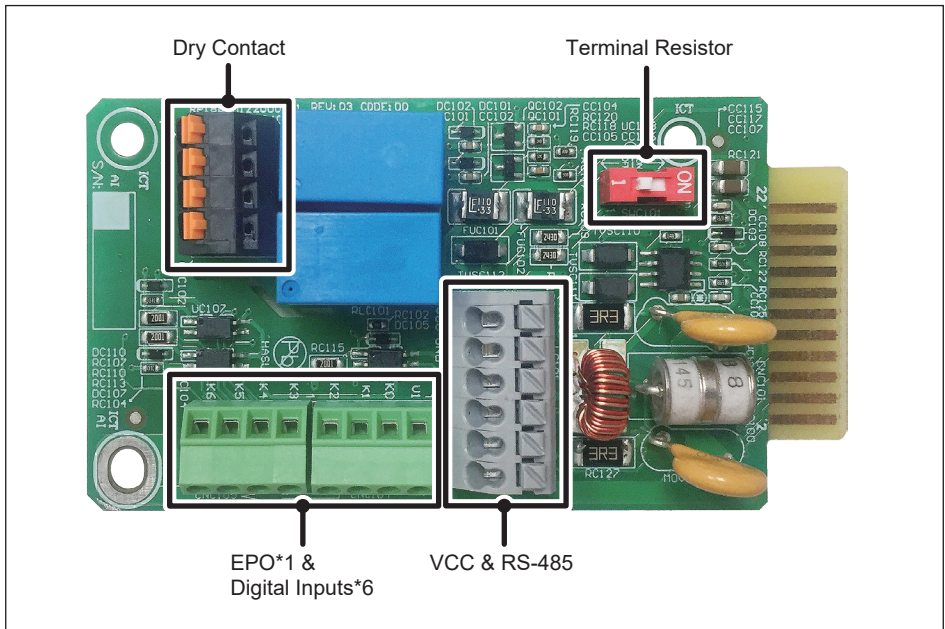


Figure 3-27 : Communication Module

3.5.1 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.

Table 3-4 : Definition of RS-485

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


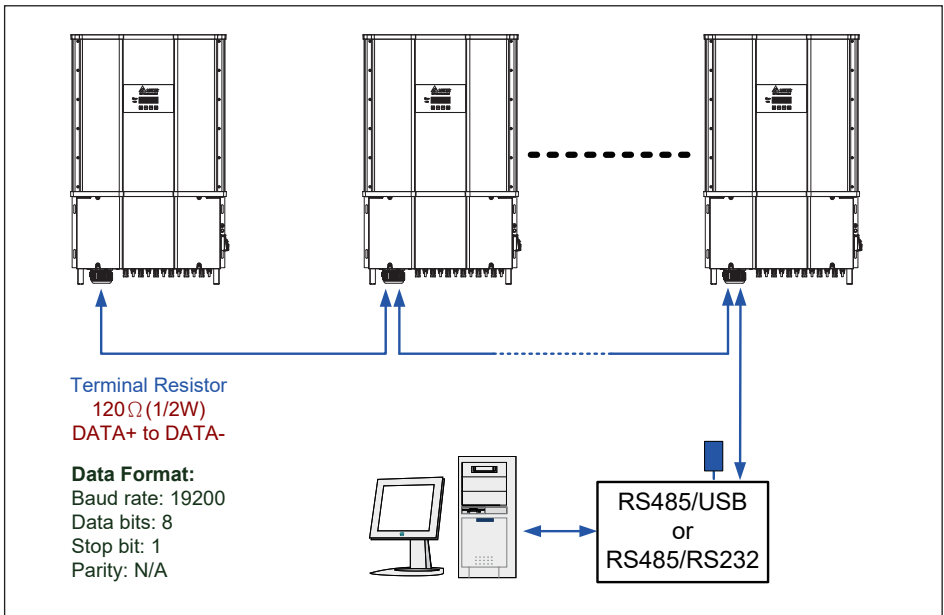



Figure 3-28 : Multiinverter connection illustration

Table 3-5 : Terminal resistor setting

	Switch 1
ON	Terminal Resistor ON
OFF	Terminal Resistor OFF

3.5.2 EPO Function & Digital Input

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

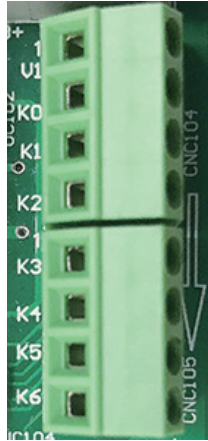


Figure 3-29 : EPO function

Table 3-6 : Definition of digital input & 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

3.5.3 Dry Contact connection

M88H provide 2 sets of Dry Contact. The function can be customized by users, please refer to section 4.8.5 Dry Contact.

The dry contact port can withstand with 250Vac/28Vdc/9A, and suitable electric wire is 20 AWG (0.5mm²).

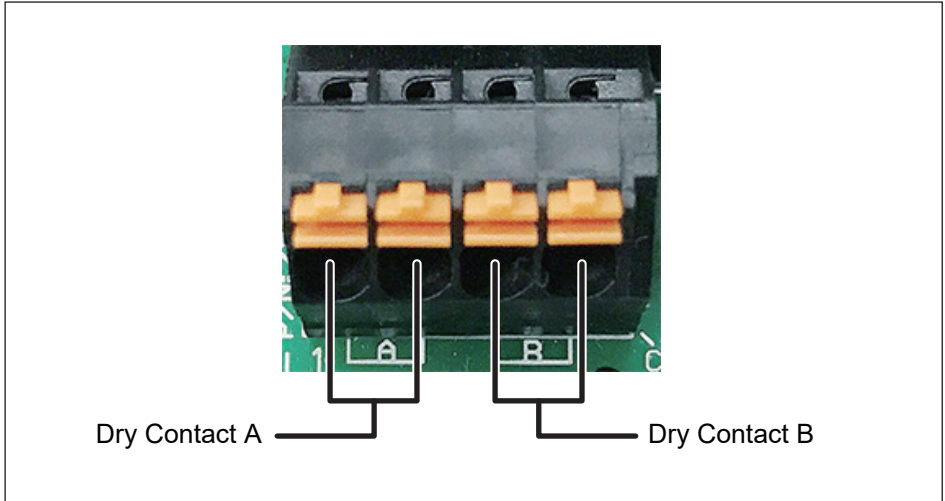


Figure 3-30 : Dry Contact connection

3.6 On-site insulation test

For customers who want to do on-site insulation test, please make sure:

1. The DC switches are in “OFF” position.
2. Apply one probe to the positions shown in **Figure 3-31**, the other to the ground. It might cause damages to the inverter if probes are applied to inappropriate positions.

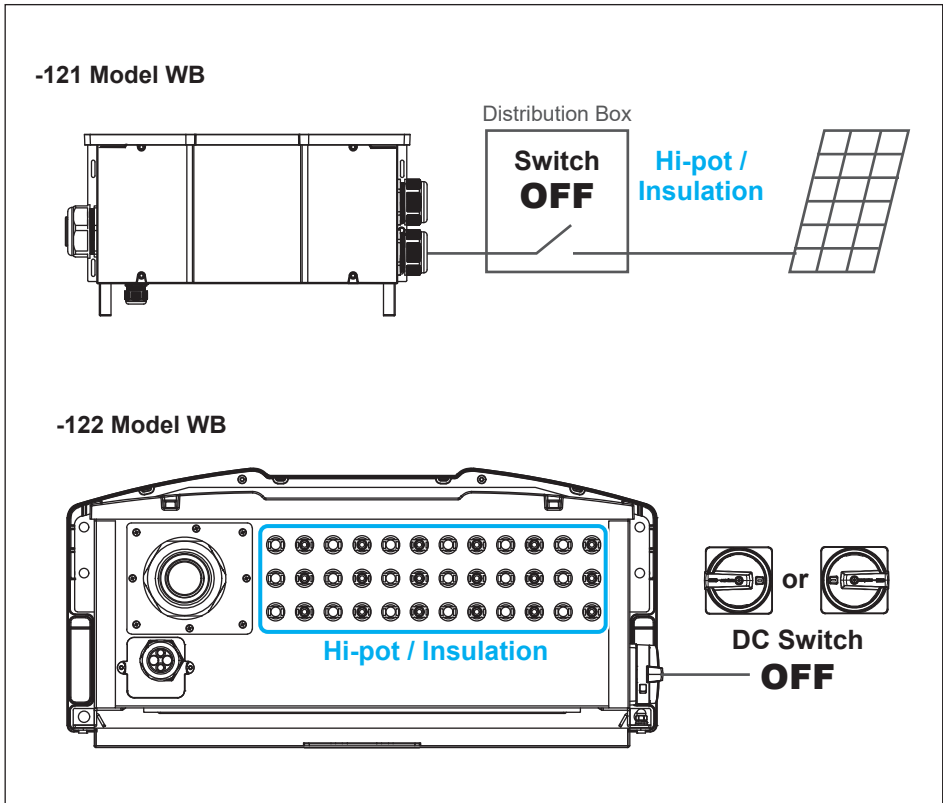


Figure 3-31 : Precautions for on-site insulation test

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	4.3
Energy Log	4.4
Event Log	4.5
Inverter Information	4.6
General Settings	4.7
Install Settings	4.8
Active/Reactive Power	4.9
FRT	4.10

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.

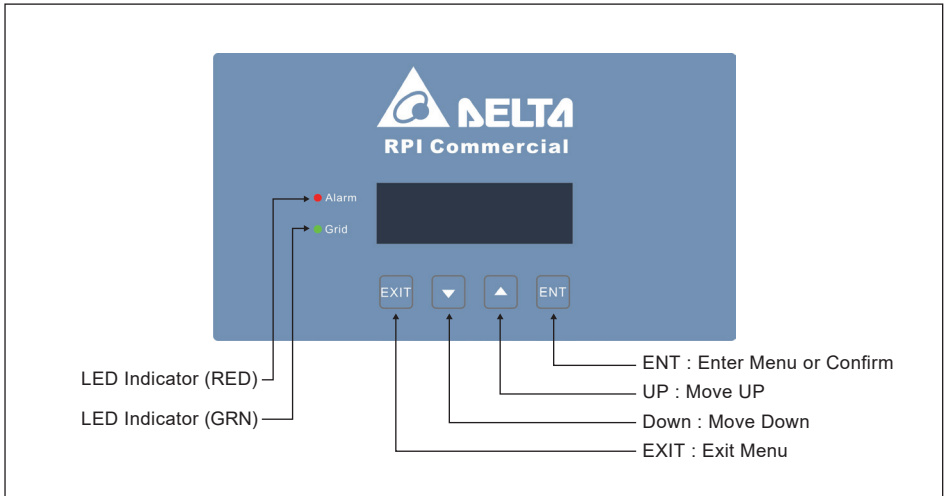


Figure 4-1 : Panel indicator

Table 4-1 : LED 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

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.

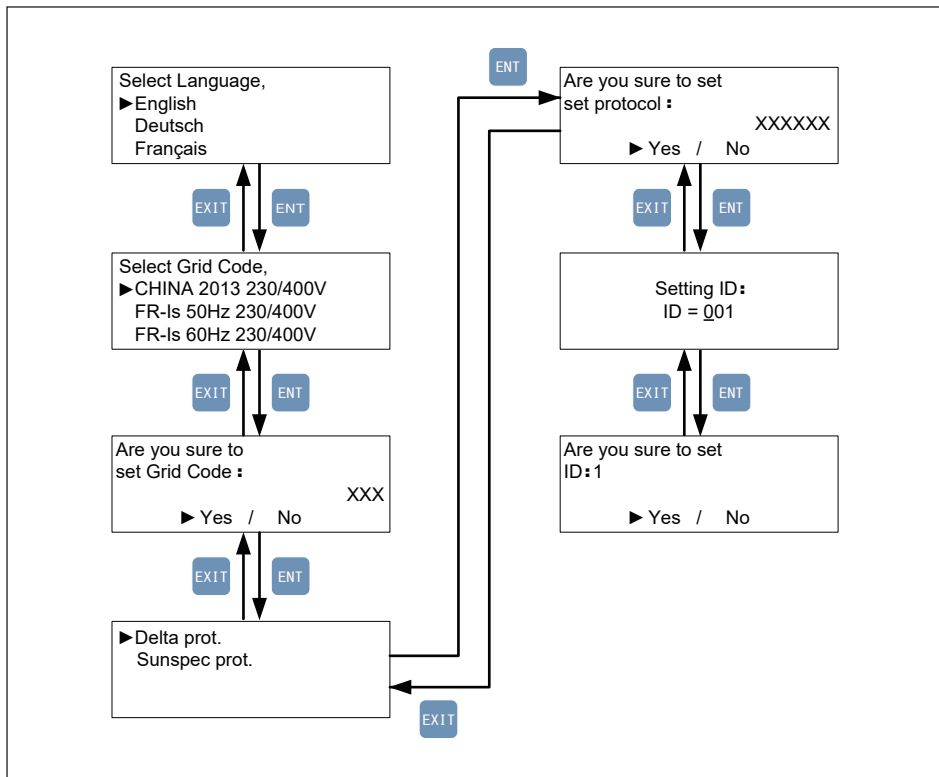


Figure 4-2 : Grid Code, language and ID settings for first startup

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.

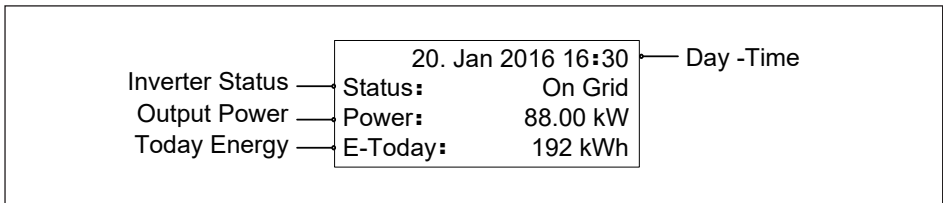


Figure 4-3 : Home page

4.3 Power meter / String monitoring

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

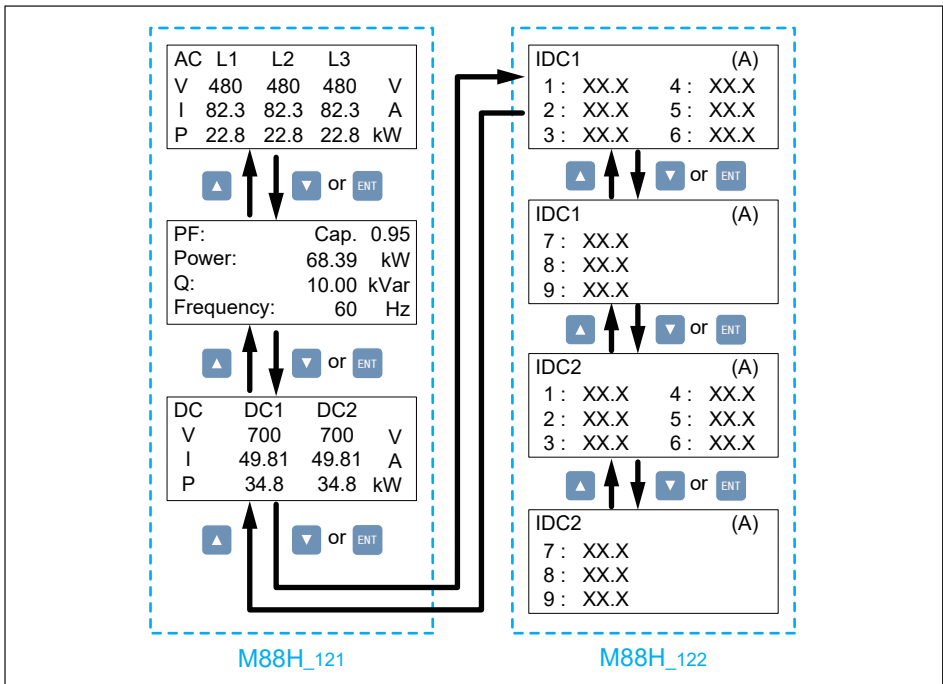


Figure 4-4 : Power meter page

4.4 Energy Log

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

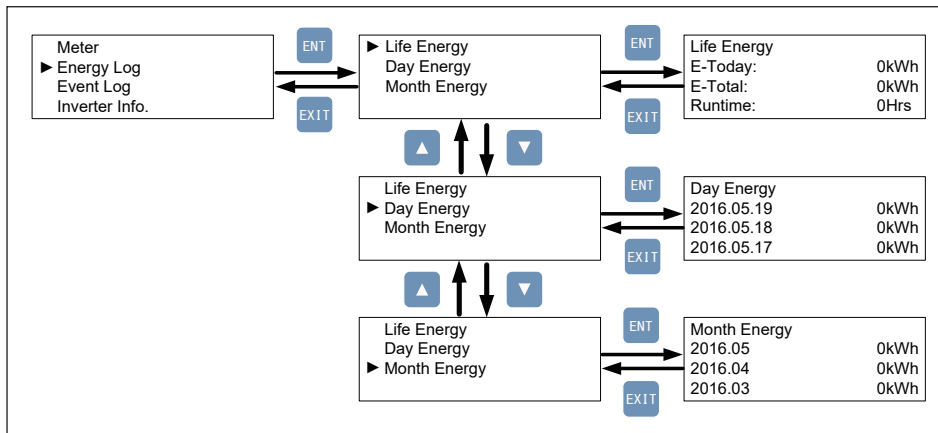


Figure 4-5 : Energy log Page

4.5 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.

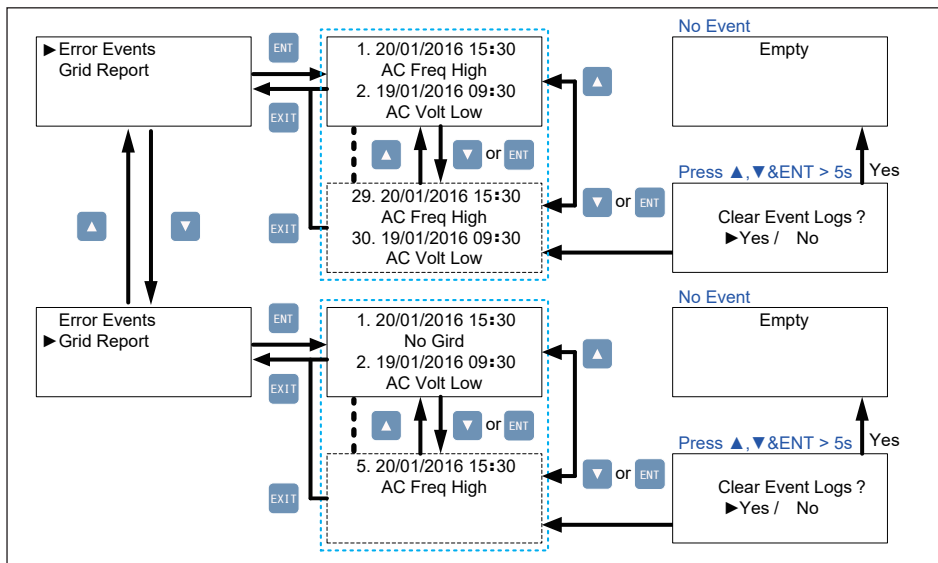


Figure 4-6 : Event log Page

4.6 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.

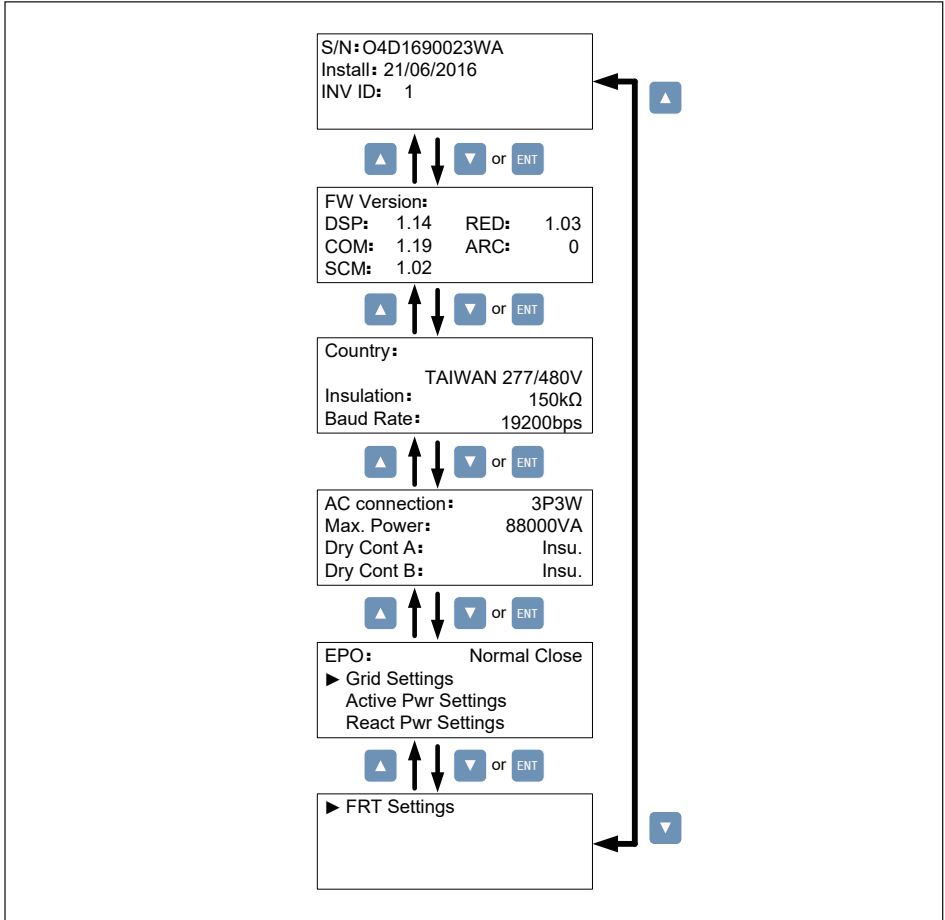


Figure 4-7 : Inverter information page

4.7 General Settings

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

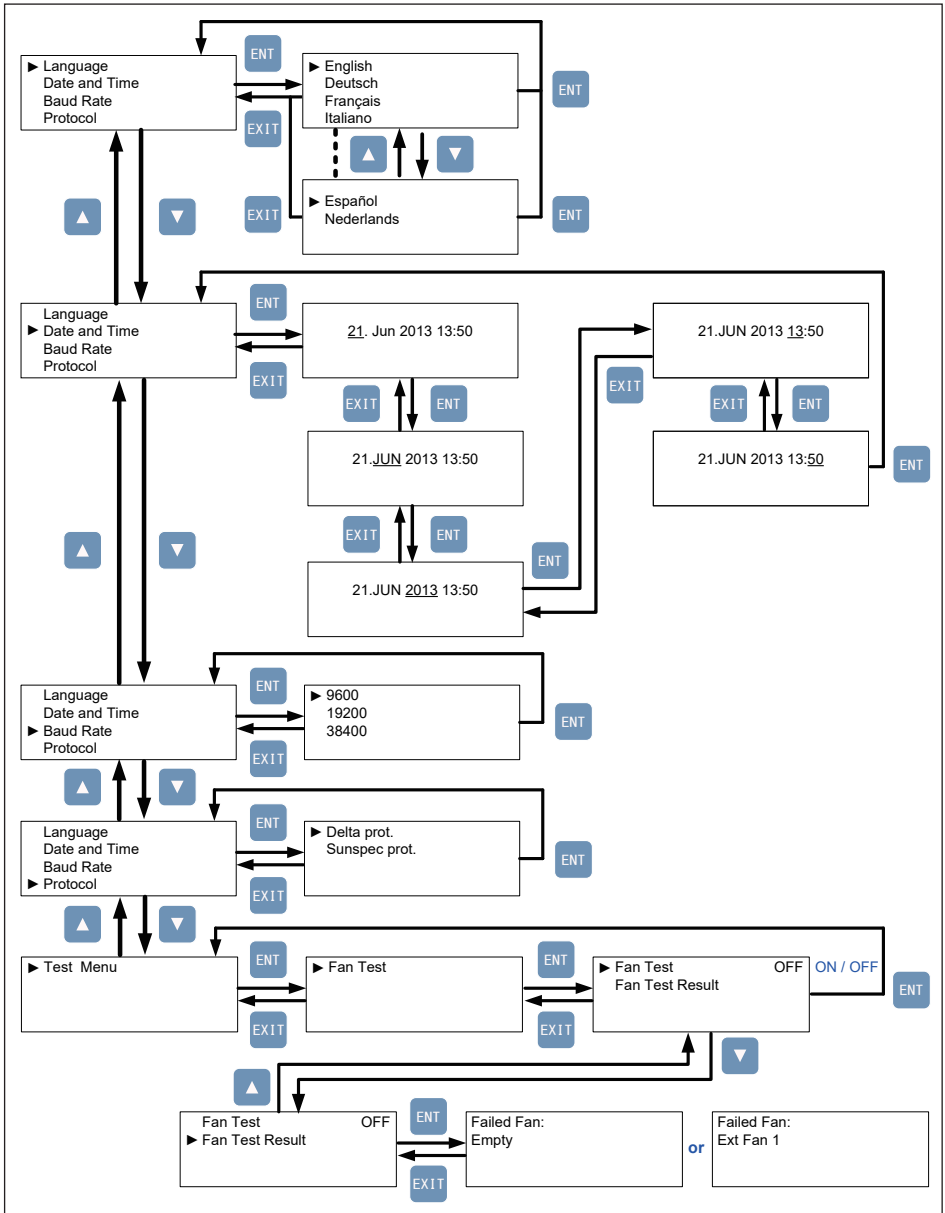


Figure 4-8 : General settings page

4.8 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.

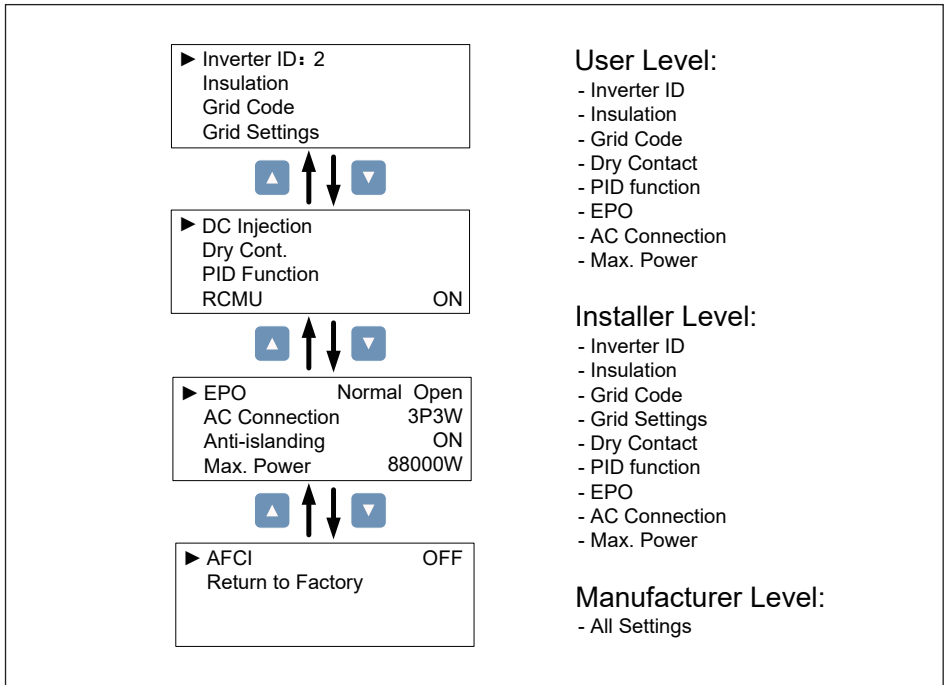


Figure 4-9 : Install settings page

4.8.1 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.

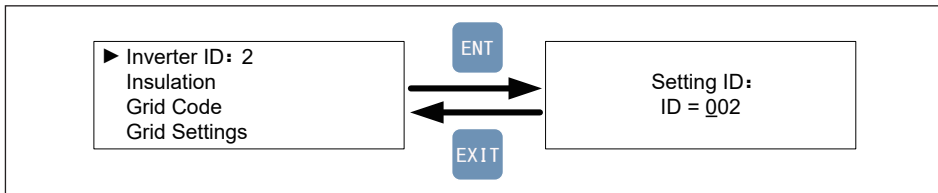


Figure 4-10 : Inverter ID page

4.8.2 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.

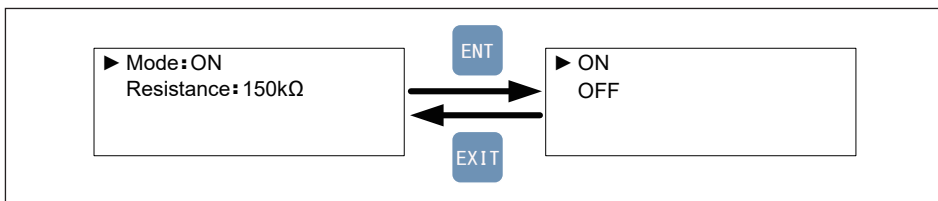


Figure 4-11 : Insulation page

4.8.3 Grid Code

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

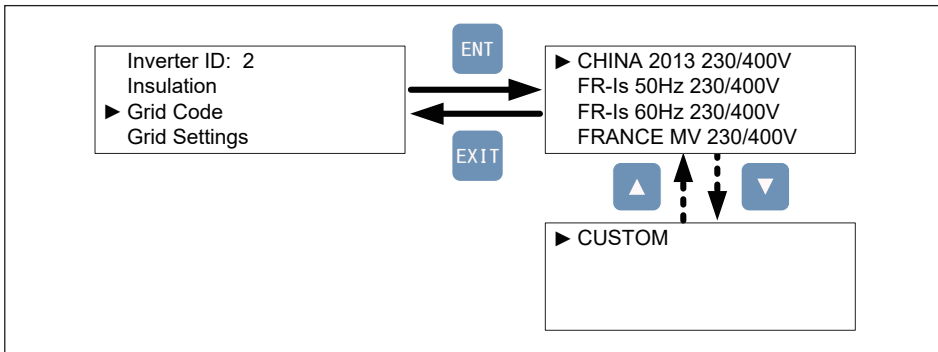


Figure 4-12 : Grid Code page

4.8.4 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.

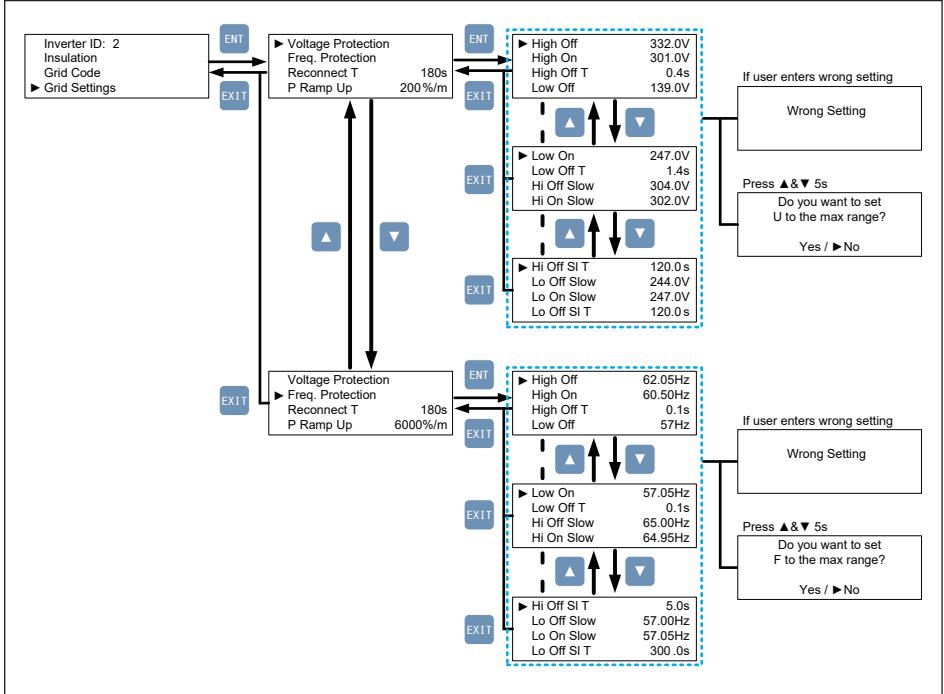


Figure 4-13 : Grid Settings page

4.8.5 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.

Table 4-2 : Dry Contact Trigger Setting

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.

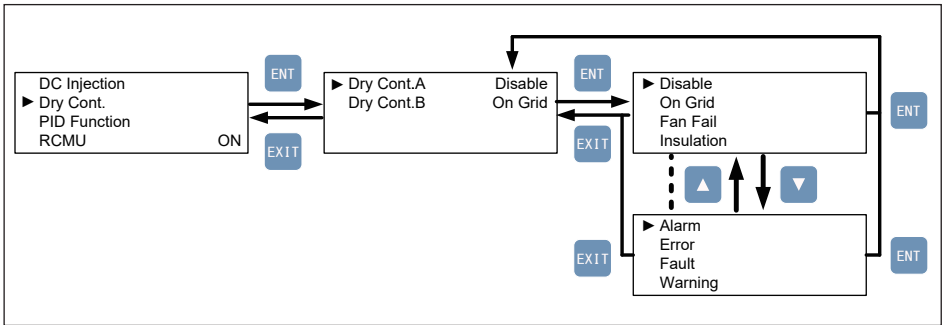


Figure 4-14 : Dry Contact page

4.8.6 Anti-PID function

The default action time is set with 0, user can set the time from 0-10 Hour or Auto. Anti-PID function will be started in 30 minutes after “No DC” shows up, Delta has our own patent for Anti-PID solution during night time.

* Do not run “Anti-PID function” and “Q setting $24\frac{1}{7}$ function” at the same time.

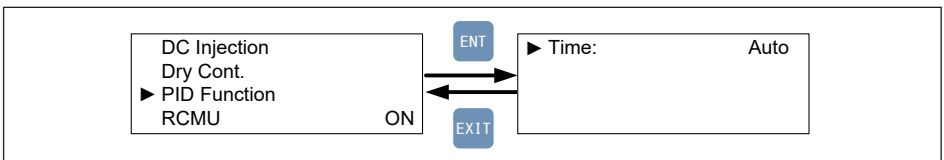


Figure 4-15 : PID function settings

4.8.7 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	3P3W
Anti-islanding	ON
Max. Power	88000W

Figure 4-16 : EPO page

4.8.8 AC connection

M88H models can support 3P3W and 3P4W system.

Please select the correct AC wiring type.

EPO	Normal Close
▶ AC Connection	3P3W
Anti-islanding	ON
Max. Power	88000W

Figure 4-17 : AC connection

4.8.9 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	3P3W
Anti-islanding	ON
▶ Max. Power	88000W

Figure 4-18 : Max. Power page

4.9 Active/Reactive Pwr

The inverter has three control modes Active Power/ Reactive Power/ Q setting $\frac{24}{7}$, users need to enter password for enter this page.

- All function's voltage settings used by phase voltage. -

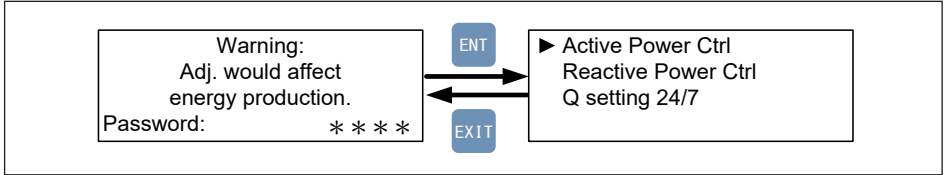


Figure 4-19 : Active / Reactive pwr page

4.9.1 Active Power Ctrl

In active power control, there are 3 function: Power Limit, Power vs. Frequency and P(V). Refer the following section to the information of each functions.

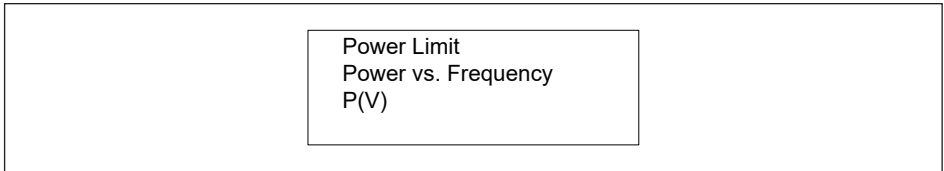


Figure 4-20 : Active Power Ctrl page

4.9.1.1 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.

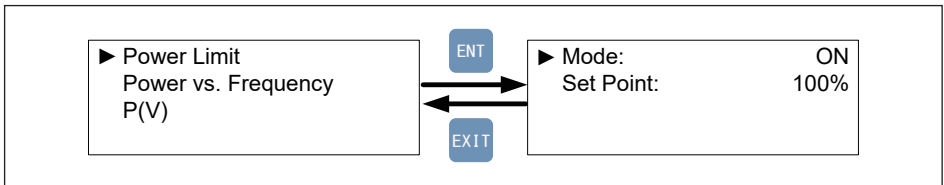


Figure 4-21 : Power Limit page

4.9.1.2 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.

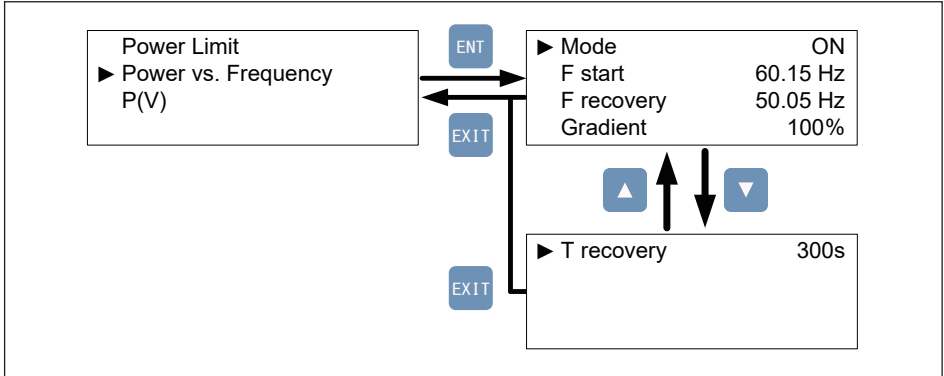


Figure 4-22 : Power vs Frequency page

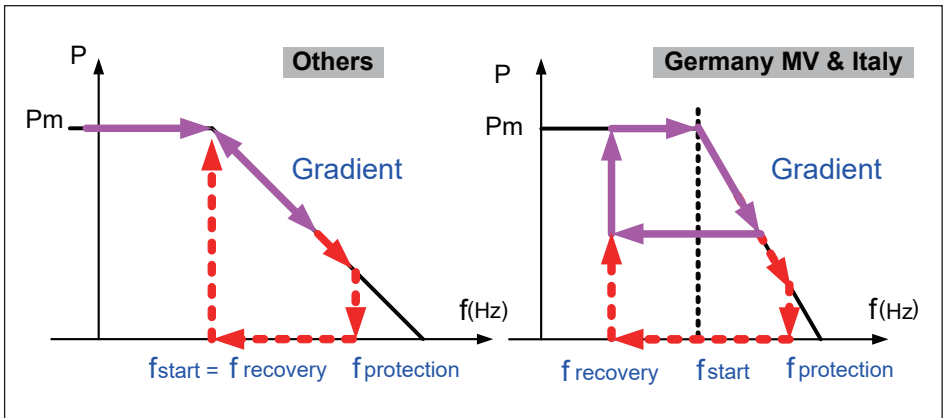


Figure 4-23 : Power vs Frequency parameters

4.9.1.3 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).

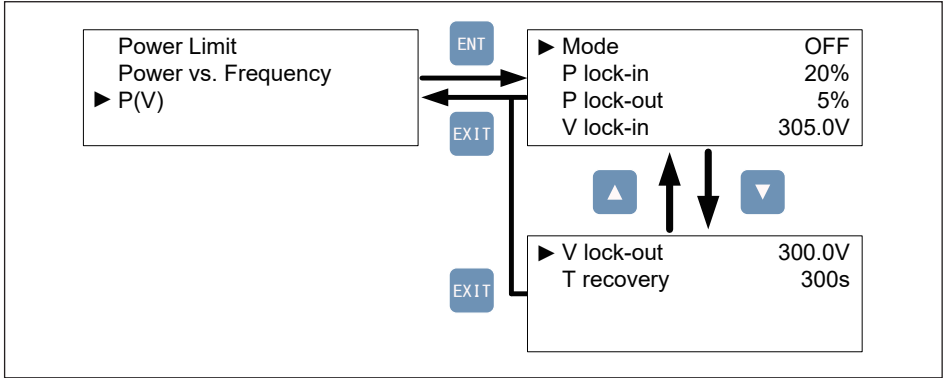


Figure 4-24 : P(V) page

4.9.2 Rective power Ctrl

In reactive power control, there are 4 modes: Constant cos-phi, cos-phi(P), Constant Q, and Q(V). Refer the following section to the information of each functions.

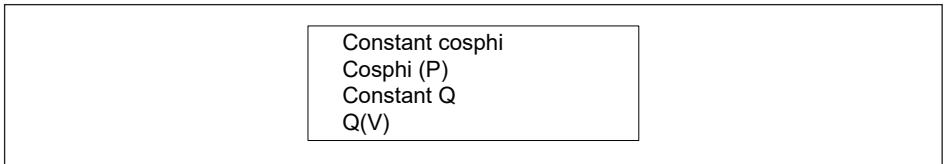


Figure 4-25 : Reactive Power Ctrl page

4.9.2.1 Constant cosphi

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

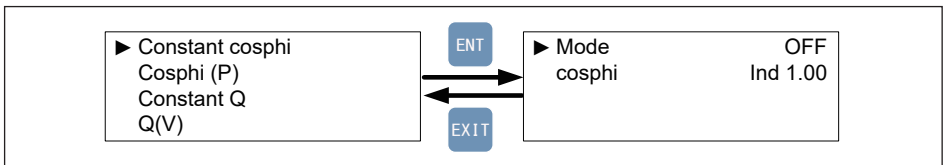


Figure 4-26 : Constant cosphi page

4.9.2.2 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).

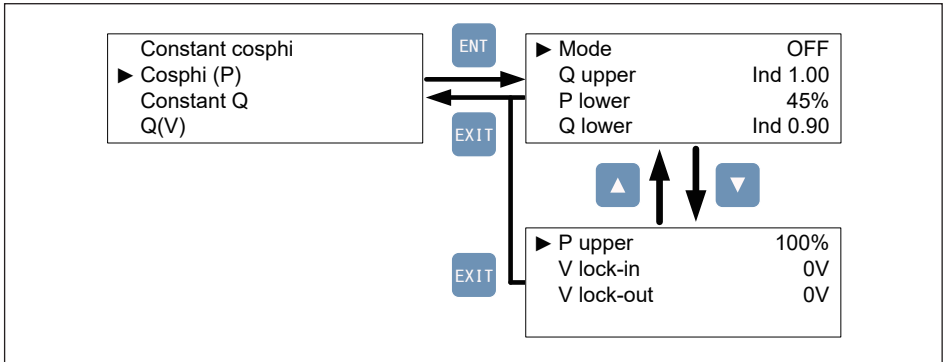


Figure 4-27 : Cosphi (P) page

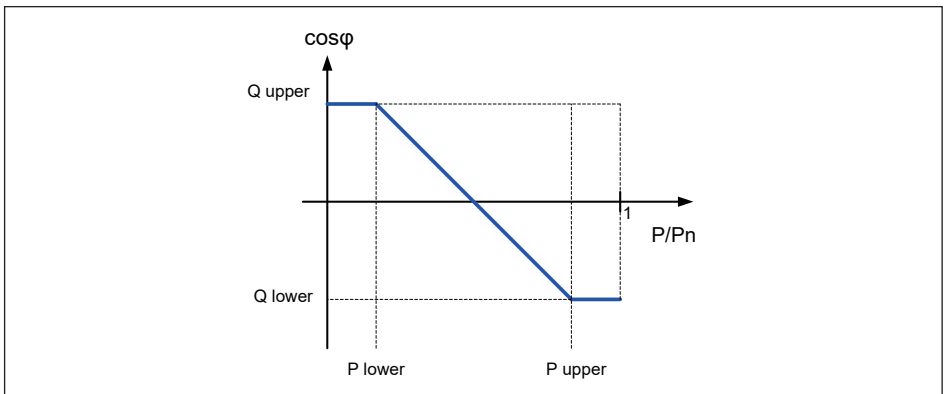


Figure 4-28 : Cosphi (P) curve

4.9.2.3 Constant Q

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

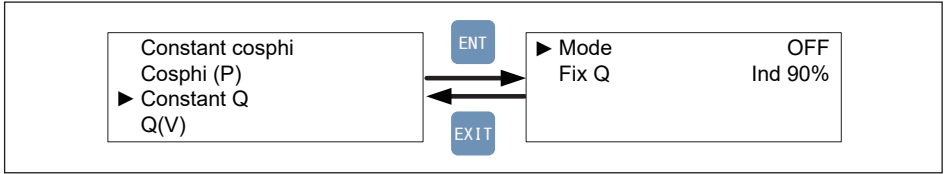


Figure 4-29 : Constant Q page

4.9.2.4 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.

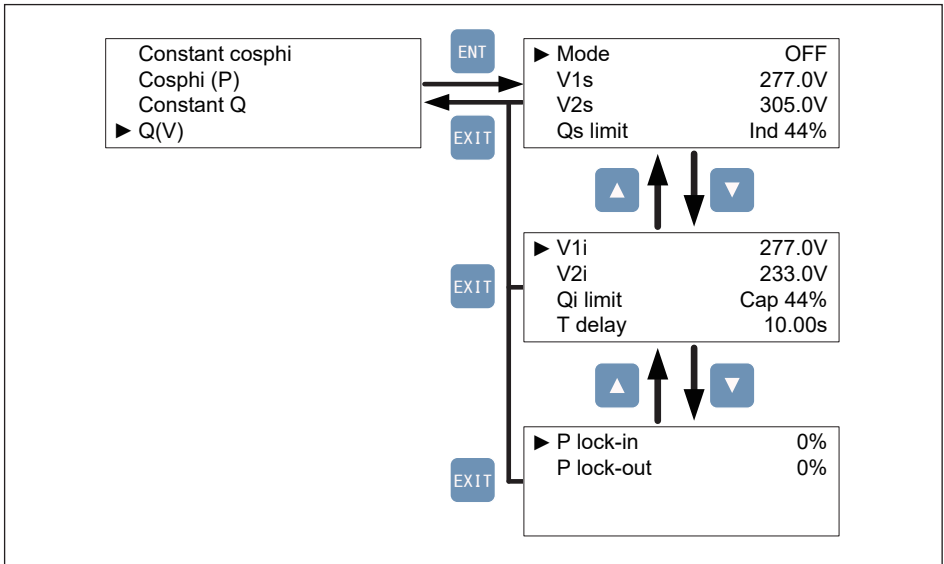


Figure 4-30 : Q(V) page

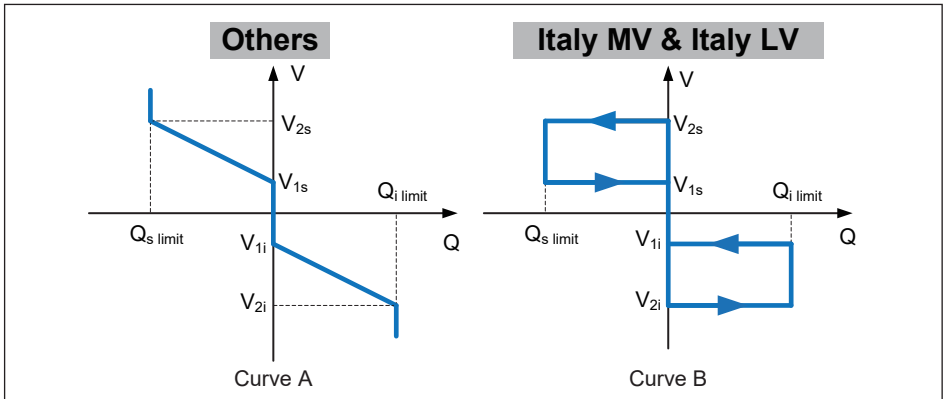


Figure 4-31 : Q(V) parameters

4.9.3 Q setting $24/7$ function

In “Q setting $24/7$ ”, there are 4 modes: Q setting point, Q(P), Q(V), Q(T), with the “Q setting $24/7$ ” control mode, the AC relay remains connected to the grid during night time and provide the reactive power. If the inverter disconnected from grid at night time, it can only restart when there is enough DC voltage from PV panel to the inverter.

* Do not run “Q setting $24/7$ function” and “PID function” at the same time.

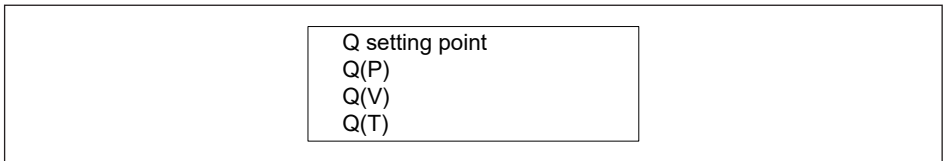


Figure 4-32 : Q setting 24/7 page

4.9.3.1 Q setting point

In Q setting point, user can assign a percentage of reactive power to the inverter.

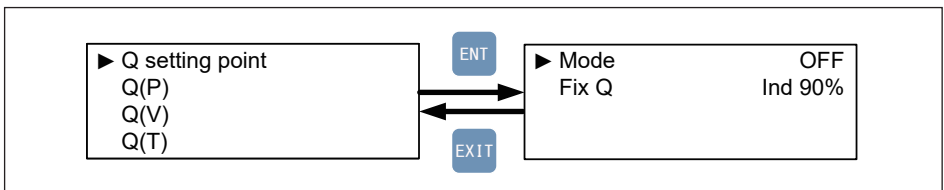


Figure 4-33 : Q setting point page

4.9.3.2 Q(P)

Q(P) is a function that inverter will feed in reactive power when the output power reach the setting value.

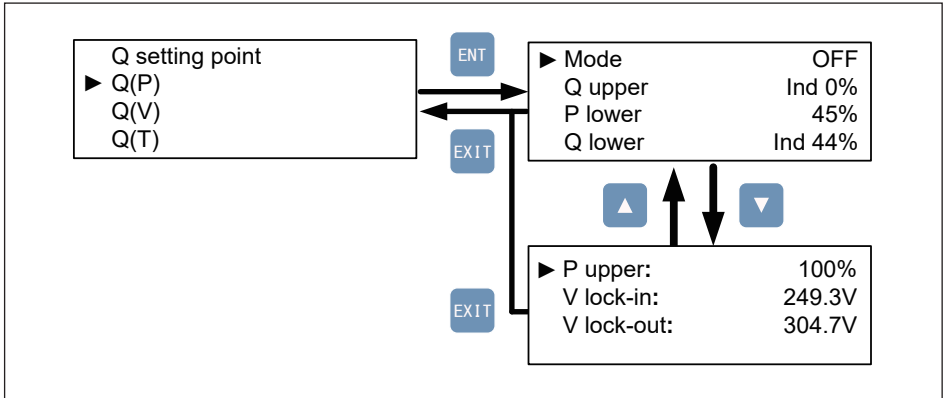


Figure 4-34 : Q(P) page

4.9.3.3 Q(V)

Q(V) is a function that inverter will provide reactive power according to grid voltage. The setting procedure is same as 4.9.2.4

4.9.3.4 Q(T)

In Q(T) function users can scheduled the feed in reactive power by external monitoring system.

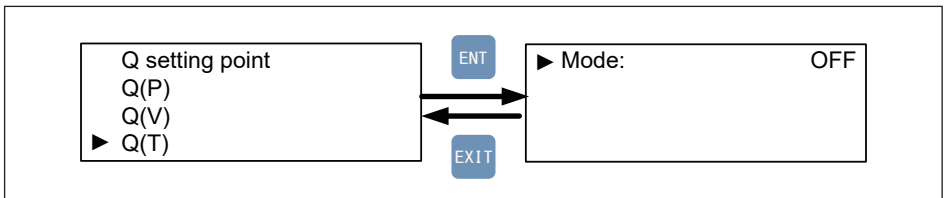


Figure 4-35 : Q(T) page

4.10 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.

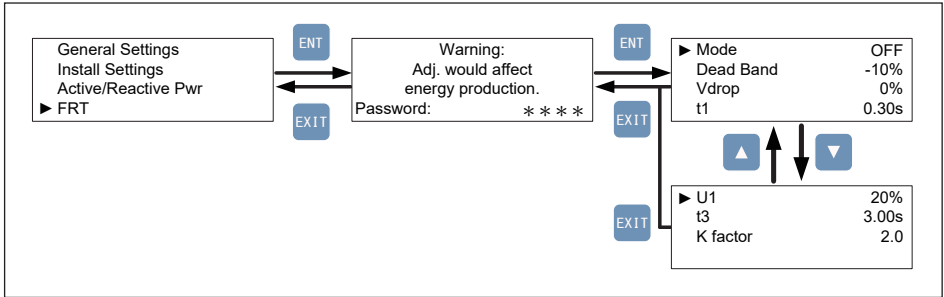


Figure 4-36 : FRT page

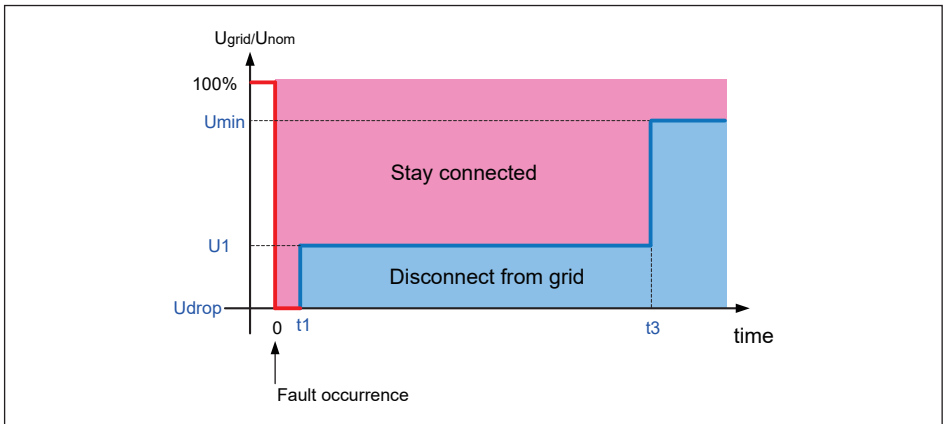


Figure 4-37 : FRT Parameters

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 fallen objects in the path of the heat outlet.

WARNING !



- Prior to beginning any maintenance procedures switch AC and DC power off to avoid risk of electrical shock!

5.1 Removing and re-installing the Wiring Box (WB) cover

In order to guarantee proper long-term operation of the inverter, the following procedures must be followed used to remove and re-install the WB cover, Refer to **Figure 5-1**.

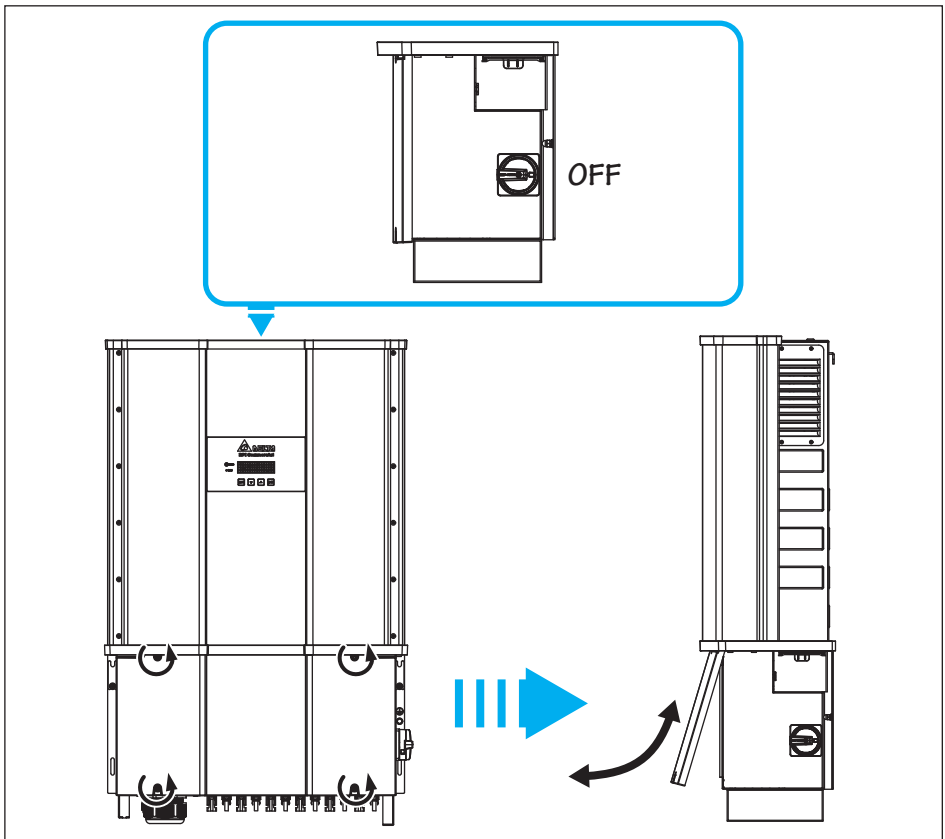


Figure 5-1 : Removing and reinstalling the WB cover

5.1.1 Removing the WB cover

- Never attempt to remove the WB cover in rainy damp weather without weather protection around the inverter.
- Switch AC and DC power off and wait until LCD display turns off.
- Ensure WB cover is clean before removing.
- Loosen the 4 screws on the WB front cover and remove cover.
- Use care not to contaminate the WB cover gasket and mating surfaces

After removing the WB cover, do not leave the WB uncovered for long periods of time.

5.1.2 Re-installing the WB cover

Before re-installing the wiring box (WB) cover:

1. Ensure mating surfaces and gasket are clean
2. The gasket is properly located and aligned in its mounting slot.

When re-installing the wiring box cover:

1. The screws of WB cover are aligned when holding WB cover by hand.
2. Hand tighten screws cross wise and equally.
3. Fully tighten the WB cover screws to 21 in-lb of torque (2.37N-m)

After re-installing the wiring box (WB) cover:

1. Use care to ensure the WB cover screws are started properly and not cross-threaded.
2. After tightening, check that screw heads are flush with cover

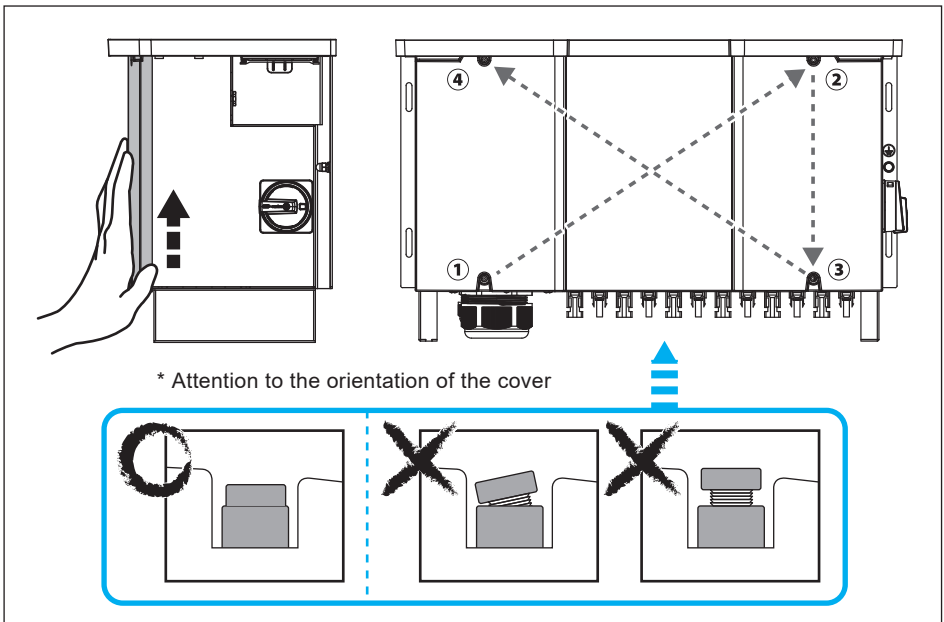


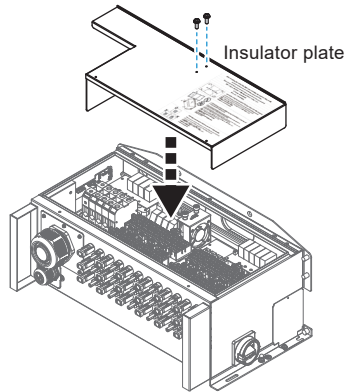
Figure 5-2 : Re-installing process for Wiring Box cover

ATTENTION



If it's necessary to remove the insulator plate of wiring box during Cabling or maintenance, the insulator plate must be put back in to the wiring box before re-install the cover, refer the figure right.

* Screw torque required for assembling:
8 kgf.cm (0.8 N·m)



5.2 Replace Surge Protection Device (SPD)

M88 series models have the surge protection device (SPD) at both AC and DC side as shown in **Figure 5-3**. **Table 5-1** summarizes the specifications of AC and DC SPD.

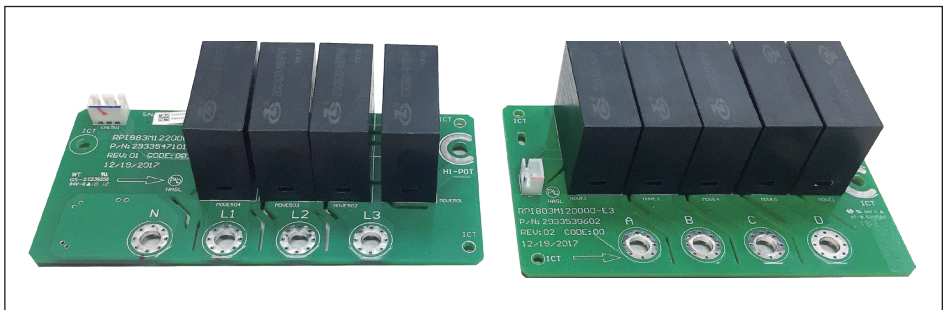


Figure 5-3 : AC and DC SPD

Table 5-1 : SPD Specifications

Specification of SPD

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

Work Amp In (8/20 μ s) : 10kA

Rate Amp I max (8/20 μ s) : 20kA

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

Manufacturers :

Sichuan Zhongguang Lightning Protection Technologies Co., Ltd

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 5-4**)
3. Find out which SPD unit was damaged.
For AC SPD, “AC Surge” with show on the corner of the LCD panel. (**Figure 5-5**)
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 5-6**)
5. Reassemble the inverter. Please be careful of the waterproof seal.

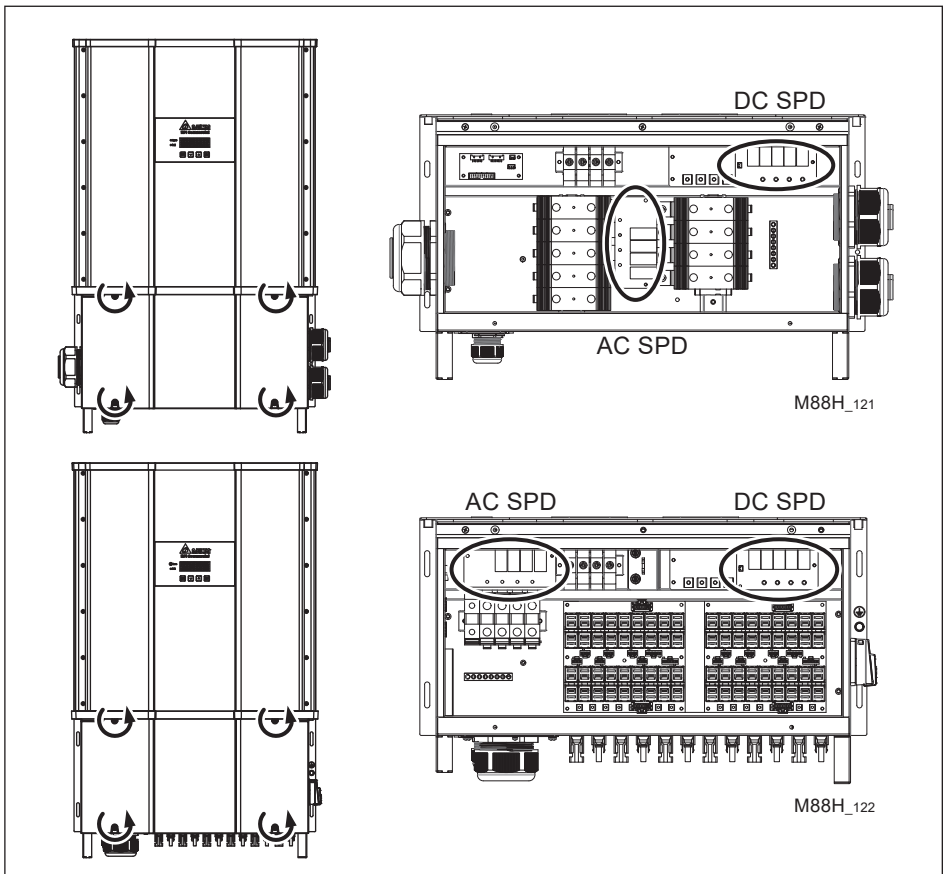


Figure 5-4 : Remove front cover of wiring box compartment

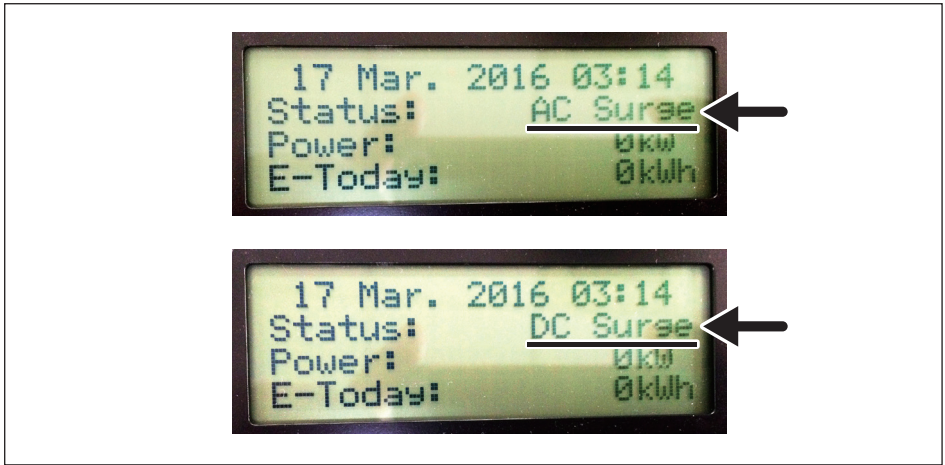


Figure 5-5 : The alarms indicate AC and DC SPD Fail

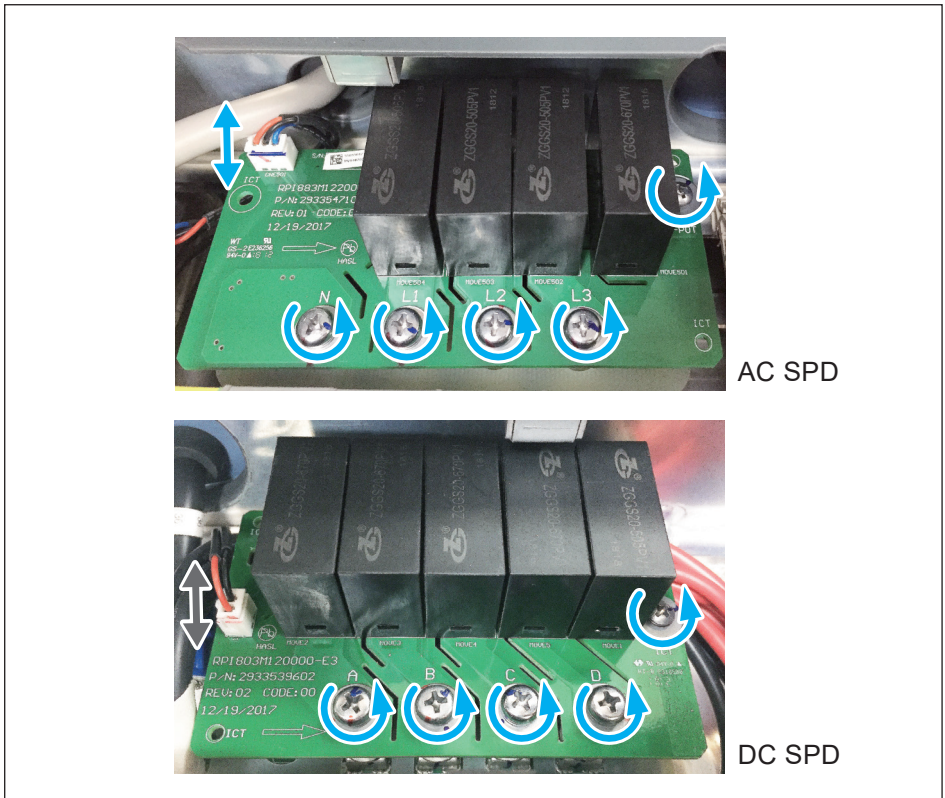


Figure 5-6 : Pull out the connectors and remove the screws as shown in arrows

The M88H_122 wiring box is equipped with 36 combiner fuses in “pull-out fuse holders, which support connection of up to 18 strings (9/MPPT). The fuse holders are mounted on two separate PWBs (one/MPPT). The pull-out fuse holders allow safe removal of fuses which are inserted into a carrier.

Figure 5-7 shows the location of the combiner fuse holders, and **Figure 5-8** provides details to remove a fuse from the -122 WB; refer to **Figure 2-4** for additional information.

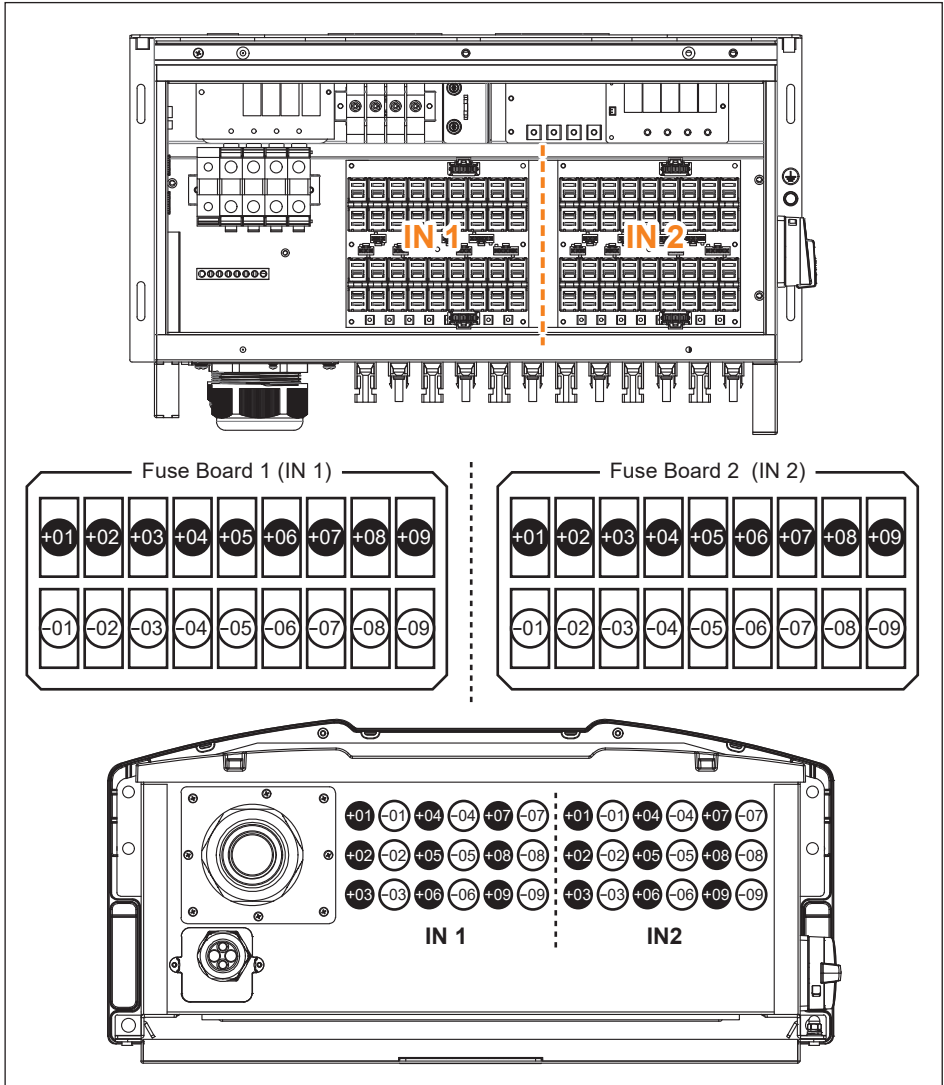


Figure 5-7 : Fuse holder locations for M88H_122

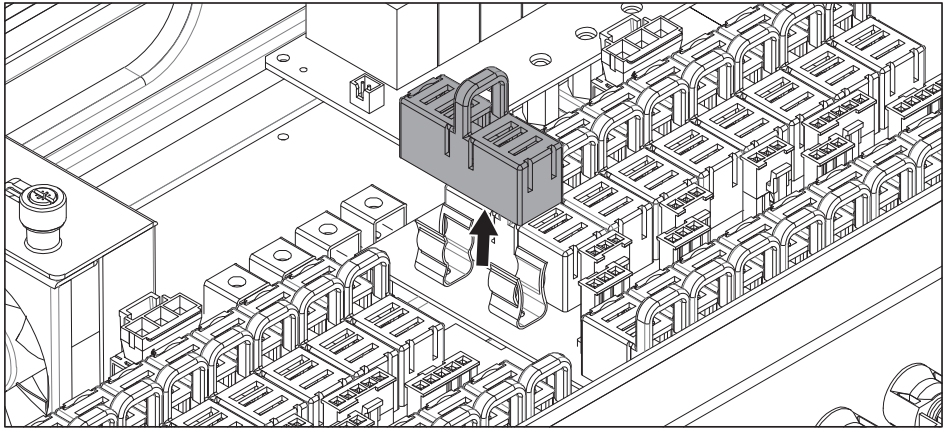


Figure 5-8 : Accessing the individual fuses for M88H_122

Check the combiner fuses if the power generation of inverter is abnormal using the following procedure:

1. Check “Power meter/string monitoring” page on the LCD display, to determine if any string current measurement is zero, which will most probably indicate a blown fuse. (**Figure 5-9**)
2. Switch AC and DC power off and wait until LCD display turns off.
3. **To access the wiring box, use procedure found in Section 5.1.1**
4. Based on step 1, check the corresponding fuse locations by pulling out the fuse holder (**Figure 5-8**) and checking continuity of the fuse.
5. Replace the fuse if necessary.
6. **Re-install the WB cover, using the procedure found in Section 5.1.2**

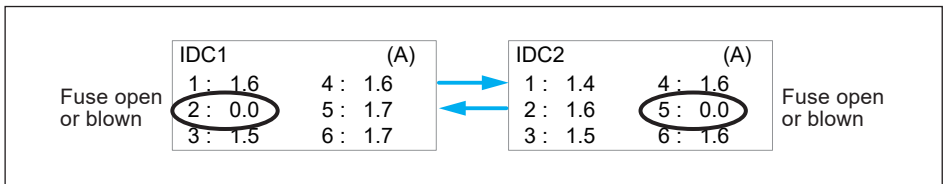


Figure 5-9 : String monitor

WARNING !



- Before removing the fuses, please turn off DC switch and make sure the inverter has stopped working, then remove the corresponding MC4 connector.

5.3 Smart Fans Replacement and Filters Cleaning

This section provides the instructions for smart fans replacement and filters cleaning for M88 series models. **Figure 5-10, 5-11, 5-12** 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 5-10**). The following procedure depicts the steps to clean the filters.

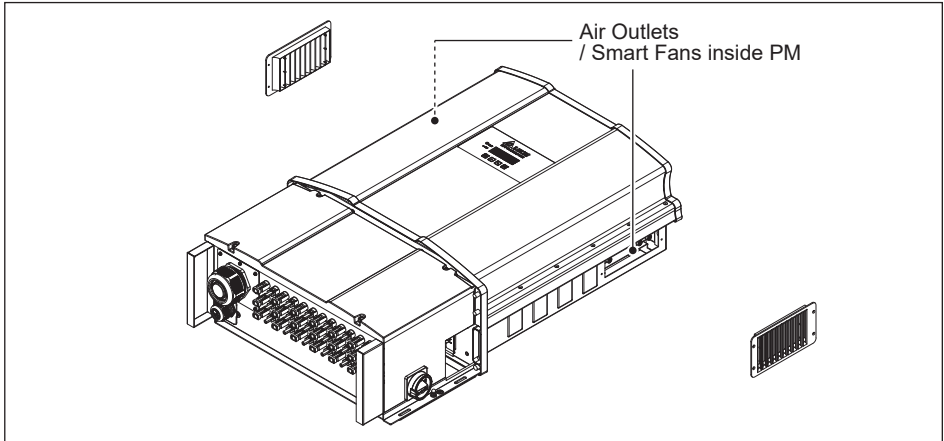


Figure 5-10 : Smart fans location on Power Module compartment

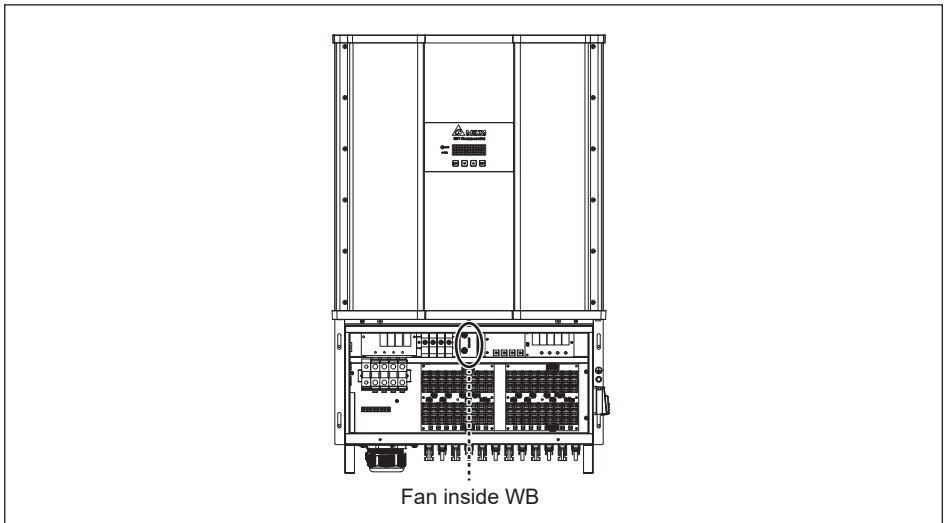


Figure 5-11 : Smart fan location on WB (M88H_122 only)

The M88 series feature 12cm 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.

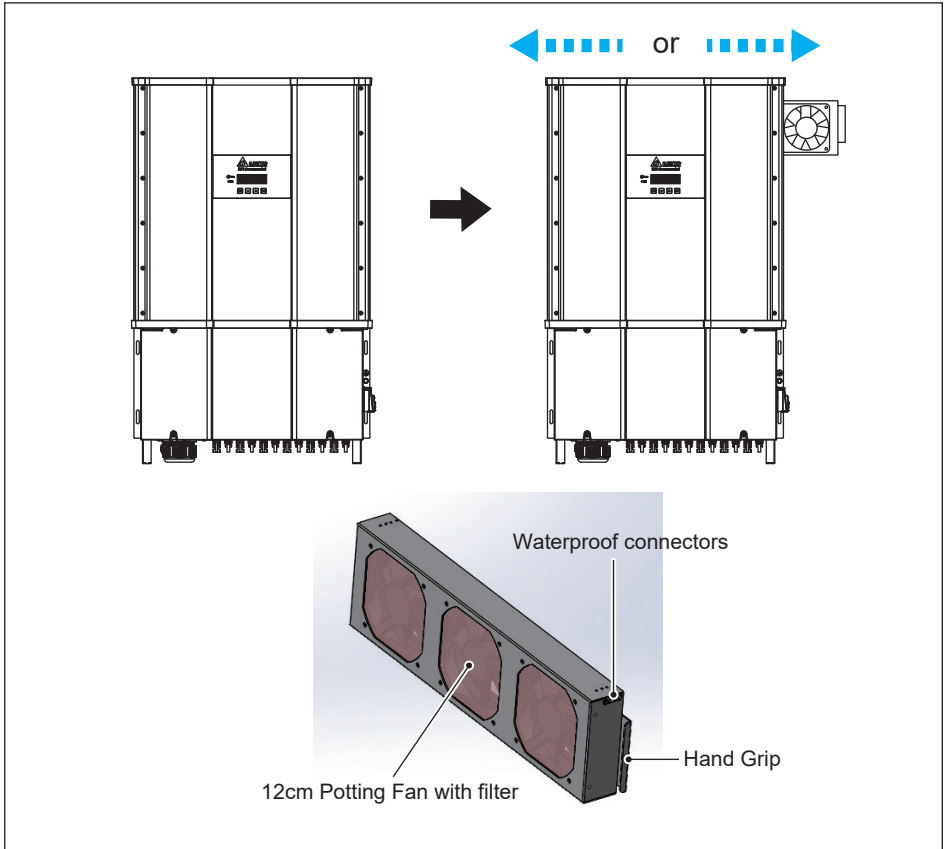


Figure 5-12 : 12cm Potting fan kit

ATTENTION



- Periodic fan and filter cleaning is required to insure long life and reliability.
- The time period between cleanings depends on the quality of the environment.
 - Under normal duty use, Delta recommends smart fans and filters be cleaned every 6 months
 - For very dusty locations, it may be necessary to clean the fans and filters quarterly or monthly.

1. Wiring Box compartment (WB): User should disassemble the top 2 pcs screws (2 Black ones as shown in **Figure 5-13**) outside the fan cabinet and disconnect the connector (white one as shown in **Figure 5-13**) right in front of the fan cover. Then replace new fan and reassemble the 2 pcs screws and plug in the connector.



Figure 5-13 : Disassembling fan inside the wiring box compartment (M88H_122 only)

2. Power Module compartment (PM):

Figure 5-14 shows one side (the right-hand side) of the PM compartment only due to the symmetry of the air outlets. Therefore, the following **Figure 5-14** 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.

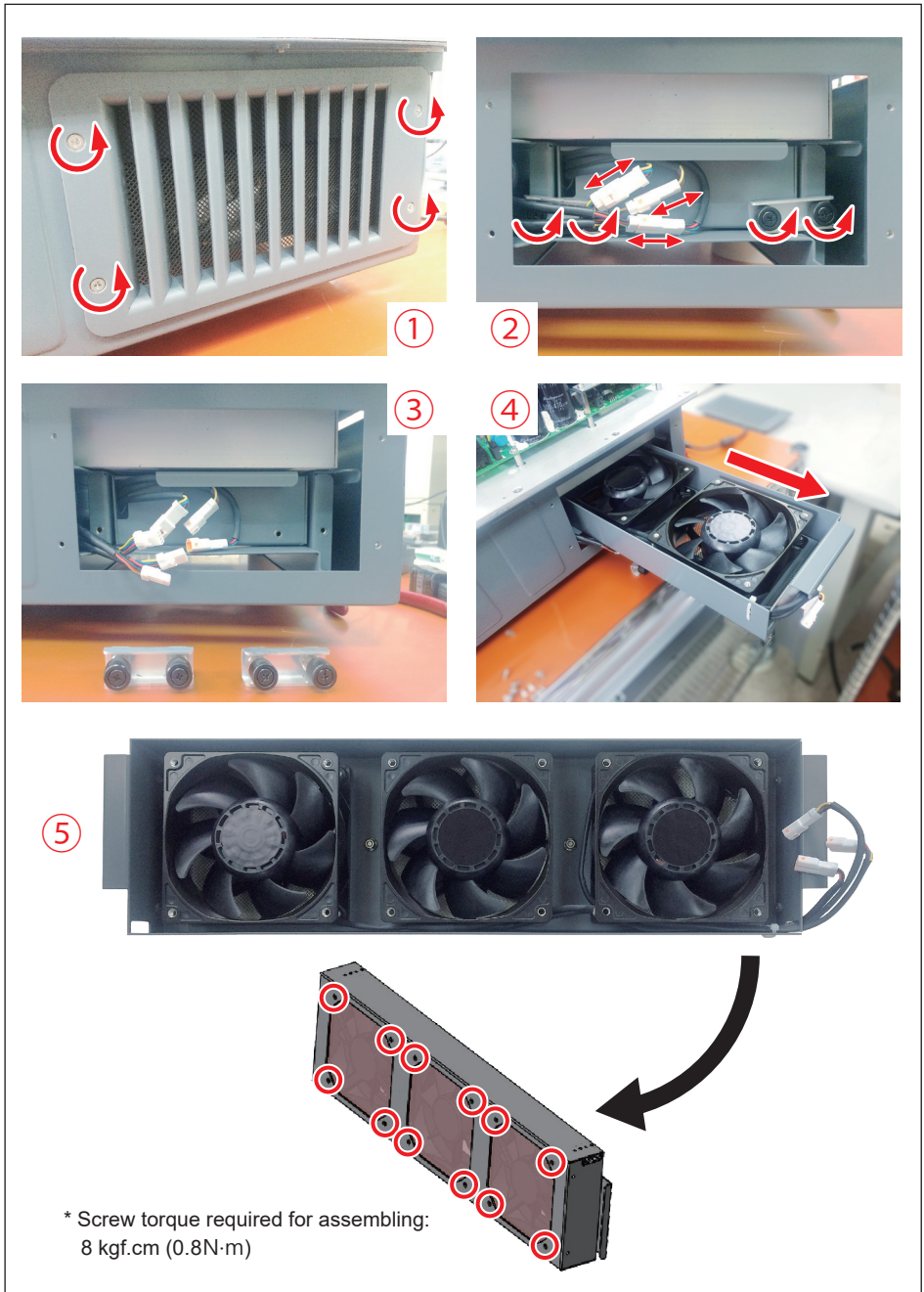


Figure 5-14 : Disassembling fans inside the power module compartment (showing one side only)

Figure 5-15 illustrates filters location of M88 series models.

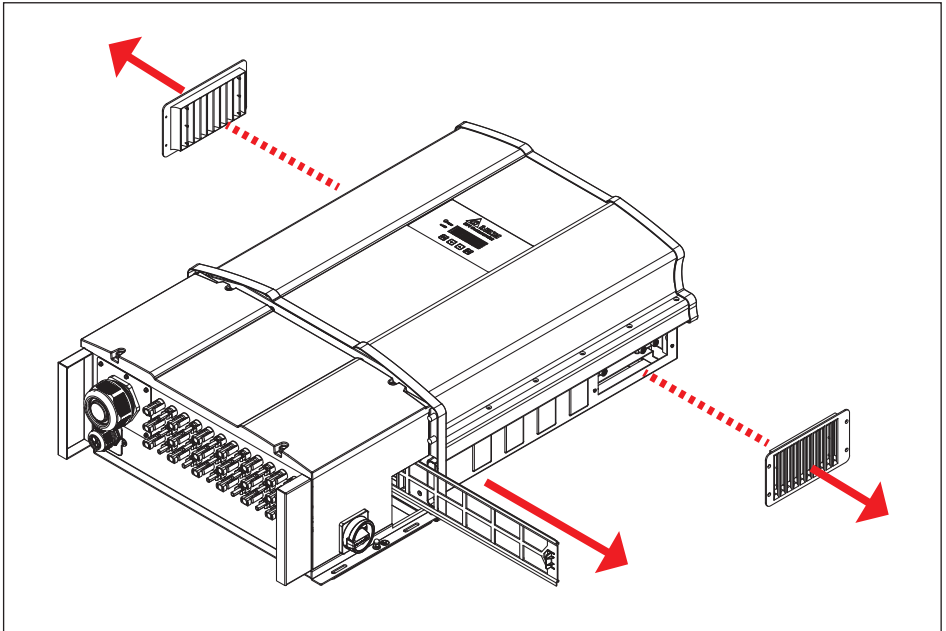


Figure 5-15 : Removal of filters

5.4 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.

5.4.1 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 5-16** shows the correct way to turn off the DC switches.

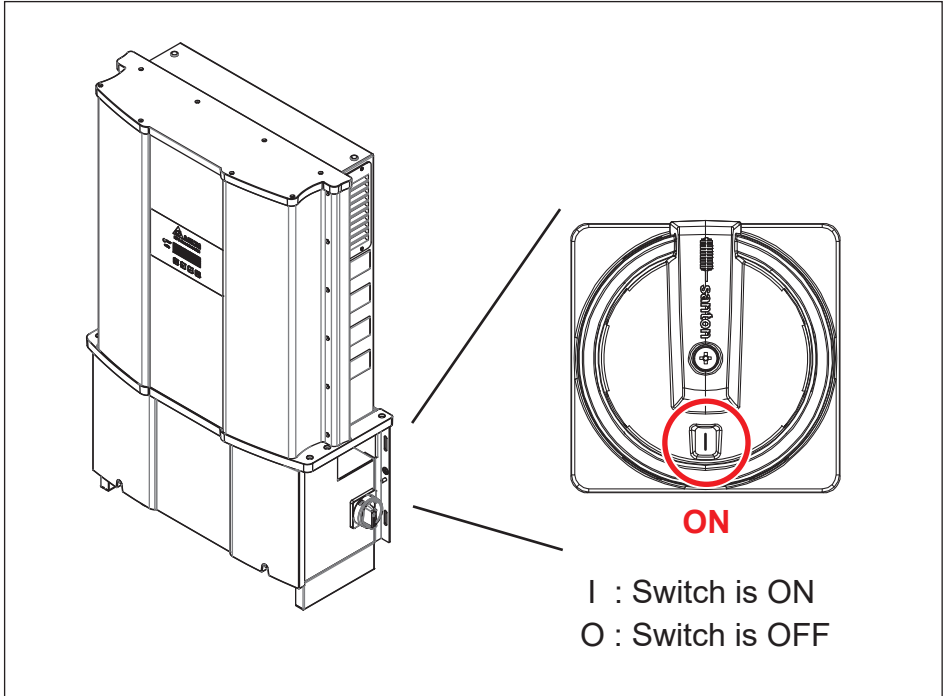


Figure 5-16 : The ON/OFF positions of DC Switches (M88H_122 only)

- 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 5-17**.

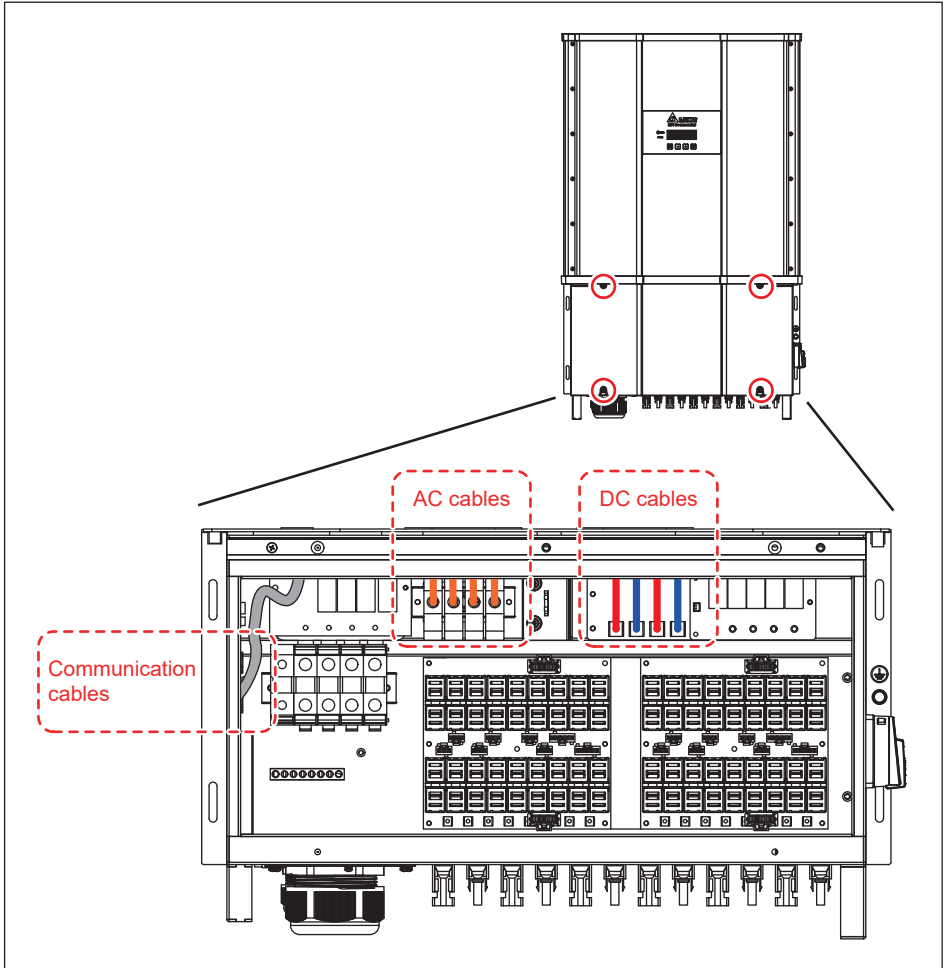


Figure 5-17 : Remove AC, DC, and communication cables and then unscrew 6 screws

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 5-18**.
8. Make sure the packing has been installed.

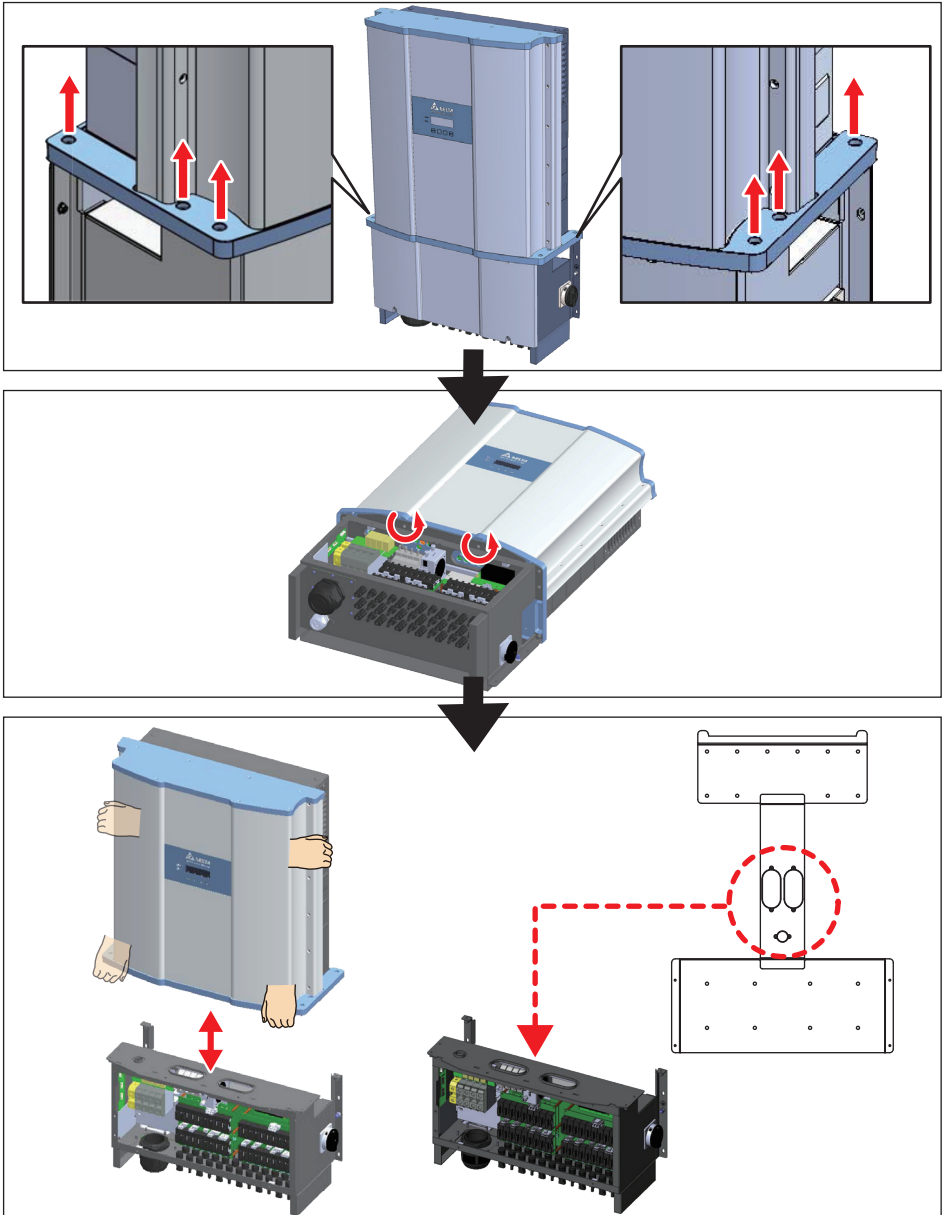


Figure 5-18 : Remove 8 screws and then separate WB from PM

6 Error message and Trouble Shooting

Table 6-1 : Error Message

ERROR		
Message	Possible cause	Action
AC Freq High (E01)	<ol style="list-style-type: none"> 1. Actual utility frequency is over the OFR setting 2. Incorrect Grid Code setting 3. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the utility frequency 2. Check Grid Code setting 3. Contact our customer service for technical support
AC Freq Low (E02)	<ol style="list-style-type: none"> 1. Actual utility frequency is under the UFR setting 2. Incorrect Grid Code or Grid setting 3. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the utility frequency 2. Check Grid Code & Grid setting 3. Contact our customer service for technical support
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
AC Con. Fail (E08)	<ol style="list-style-type: none"> 1. Wrong connection in AC terminal 2. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the AC connection in accordance with the user manual 2. Contact our customer service for technical support
No Grid (E09)	<ol style="list-style-type: none"> 1. AC breaker is OFF 2. Disconnect in AC terminal 	<ol style="list-style-type: none"> 1. Switch on AC breaker 2. Check the connection in AC terminal and make sure it connects to inverter
AC Volt Low (E10, E15, E20)	<ol style="list-style-type: none"> 1. Actual utility voltage is under the UVR setting 2. Incorrect Grid Code or Grid setting 3. Wrong connections in AC terminal 4. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the utility voltage within the suitable range 2. Check Grid Code & Grid setting 3. Check the connection in AC terminal 4. Contact our customer service for technical support
AC Volt High (E11, E13, E16, E18, E21, E23)	<ol style="list-style-type: none"> 1. Actual utility voltage is over the OVR setting 2. Utility voltage is over the Slow OVR setting during operation 3. Incorrect Grid Code or Grid setting 4. Detection circuit malfunction 5. Wrong connection in AC terminal 	<ol style="list-style-type: none"> 1. Check the utility voltage within the suitable range 2. Check Grid Code & Grid setting 3. Check the connection in AC terminal 4. Contact our customer service for technical support
Solar1 High (E30)	<ol style="list-style-type: none"> 1. Actual Solar1 voltage is over 1000Vdc 2. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Modify the solar array setting, and make the Voc less than 1000Vdc 2. Contact our customer service for technical support
Solar2 High (E31)	<ol style="list-style-type: none"> 1. Actual Solar2 voltage is over 1000Vdc 2. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Modify the solar array setting, and make the Voc less than 1000Vdc 2. Contact our customer service for technical support
Insulation (E34)	<ol style="list-style-type: none"> 1. PV array insulation fault 2. Large PV array capacitance between Plus to Ground or Minus to Ground or both. 3. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the insulation of Solar inputs 2. Check the capacitance, dry PV panel if necessary 3. Contact our customer service for technical support

Table 6-2 : Warning Message

Warning		
Message	Possible cause	Action
Solar1 Low (W01)	<ol style="list-style-type: none"> Actual Solar1 voltage is under the limit Some devices were damaged inside the inverter if the actual Solar1 voltage is close to "0" Detection circuit malfunction 	<ol style="list-style-type: none"> Check the Solar1 voltage connection to the inverter terminal Check all switching devices in boost1 Contact our customer service for technical support
Solar2 Low (W02)	<ol style="list-style-type: none"> Actual Solar2 voltage is under the limit Some devices were damaged inside the inverter if the actual Solar2 voltage is close to "0" Detection circuit malfunction 	<ol style="list-style-type: none"> Check the Solar2 voltage connection to the inverter terminal Check all switching devices in boost2 Contact our customer service for technical support
De-rating (W07)	<ol style="list-style-type: none"> Over temperature Fan fail Power Limit function Power vs. Frequency function P(V) function Grid Voltage low Solar Voltage low Solar Voltage High 	<ol style="list-style-type: none"> Check the installation ambient and environment Check the fan(s) Check Grid Code & Grid setting Check the utility frequency on the inverter terminal Check the utility voltage on the inverter terminal 6-1. Check the utility voltage on the inverter terminal 6-2. Check reactive power setting Check the Solar voltage on the inverter terminal Check the Solar voltage on the inverter terminal
String fault (W08)	<ol style="list-style-type: none"> Incorrect DC wiring causes overcurrent String current monitoring function is failure 	<ol style="list-style-type: none"> Check the DC wiring is proper Contact customer service for technical support
WB Fan Fail Int Fan Fail Ext Fan Fail (W11)	<ol style="list-style-type: none"> One or more fans are locked One or more fans are defective One or more fans are disconnected Detection circuit malfunction 	<p>Ext Fan Fail</p> <ol style="list-style-type: none"> Remove the object that stuck in the fan(s) Replace the defective fan(s) Check the connections of all fans Contact customer service for technical support <hr style="border-top: 1px dashed black;"/> <p>Int Fan Fail & WB Fan Fail Contact customer service for technical support</p>
DC SPD Fault (W17) AC SPD Fault (W18)	<ol style="list-style-type: none"> Inverter was struck by lightning. One or more SPD are defective One or more SPD are disconnected Detection circuit malfunction Wrong connection in AC terminal 	<ol style="list-style-type: none"> Check inverter's status Replace the defective SPD Check the connections of SPDs Check the connection in AC terminal Contact our customer service for technical support

Table 6-3 : Fault Message

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

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

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

FAULT		
Message	Possible cause	Action
HW CT B Fail (F43)	<ol style="list-style-type: none"> 1. Test current loop is broken 2. CTP4 is defective 3. Detection circuit malfunction 	Contact our customer service for technical support
HW CT C Fail (F44)	<ol style="list-style-type: none"> 1. Test current loop is broken 2. CTP5 is defective 3. Detection circuit malfunction 	Contact our customer service for technical support
HW AC OCR (F45)	<ol style="list-style-type: none"> 1. Large Grid harmonics 2. Switching device is defective 3. Detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary 2. Check all switching devices in inverter stage 3. Contact our customer service for technical support
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"> 1. AFCI is not installed. 2. AFCI self-test is fail. 	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"> 1. Switching device in boost is defective 2. Driver for boost is defective 3. Input current detection circuit malfunction 	<ol style="list-style-type: none"> 1. Check all switching device in boost 2. Check the driver circuit for boost inside the inverter 3. Check input current detection circuit
HW DC RLY (F76)	One or more DC relays are abnormal	Please contact our customer service for technical support

7 Technical Data

Table 7-1 : Specifications for M88H

Model	M88H_121	M88H_122
DC Input		
Occasionally Max. voltage	1100V *	
Operating voltage range	200-1000V	
Start voltage	>250V	
MPP voltage, rated power	Vac400V : 500 - 800V / Vac480V : 600 - 800V	
Rated voltage	Vac400V : 600V / Vac480V : 710V	
MPP tracker	2	
Max. input current / Each MPPT	140 / 70A	
Connection type	50~120mm ² terminal block for 2 MPPTs	18 pairs of MC4 connector
Type II SPD	●	●
15A string fuses (16A optional)	—	●
DC Switch	—	●
String monitoring	—	●
AC Output		
Max. output power	Vac400: 73kW / Vac480: 88kW	
Rated output power	Vac400: 66kW / Vac480: 80kW	
Q setting 24/7 range	0~27kVar (0%~30% S _{Max.}) @ 480Vac 0~22kVar (0%~30% S _{Max.}) @ 400Vac	
Max. output current	106A	
Rated output current	96A	
Rated voltage	3 Ph 400V & 480V Δ / Y	
Operating voltage range	Vac400V : ±30% / Vac480V : ±20%	
Operating frequency range	50/60Hz ±5Hz	
Power factor	1 at rated power, 0.8 ind ~ 0.8 cap adjustable	
Surge Protection	Type II SPD	
T.H.D	<3%	
Connection type	50 ~120 mm ²	35 ~95 mm ²
Night time consumption	<3W	

* The max withstand voltage is 1100Vdc. (the inverter stops to operate when the PV voltage is over 1000Vdc) ● : Available
— : Not Available

Model	M88H_121	M88H_122	
Efficiency			
Peak Efficiency	98.8 %		
Euro Efficiency	98.5 %		
Information			
Communication port	RS-485		
Display	20 x 4 LCD		
Regulation			
	VDE-AR-N 4105 VDE0126-1-1 BDEW EN 61000-6-1 EN 61000-6-4	NB/T 32004: 2013 GB/T 19964: LVRT IEC 62109-1/-2 EN 61000-6-2	UTE C15-712 UK G59/3 CE compliance EN 61000-6-3
General Data			
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 986 x 275		
Weight (kg)	86		
Noise	74.5 dBA @1m, Amb25°C		
Overvoltage category	AC output :III, DC Input :II		
Maximum backfeed current to the array	0		
Protective Class	I		
Pollution Degree	3		
Humidity range	0% ~ 100% non-condensing		

* At 400Vac system, Amb>50°C derating from nominal power @ 600Vdc.

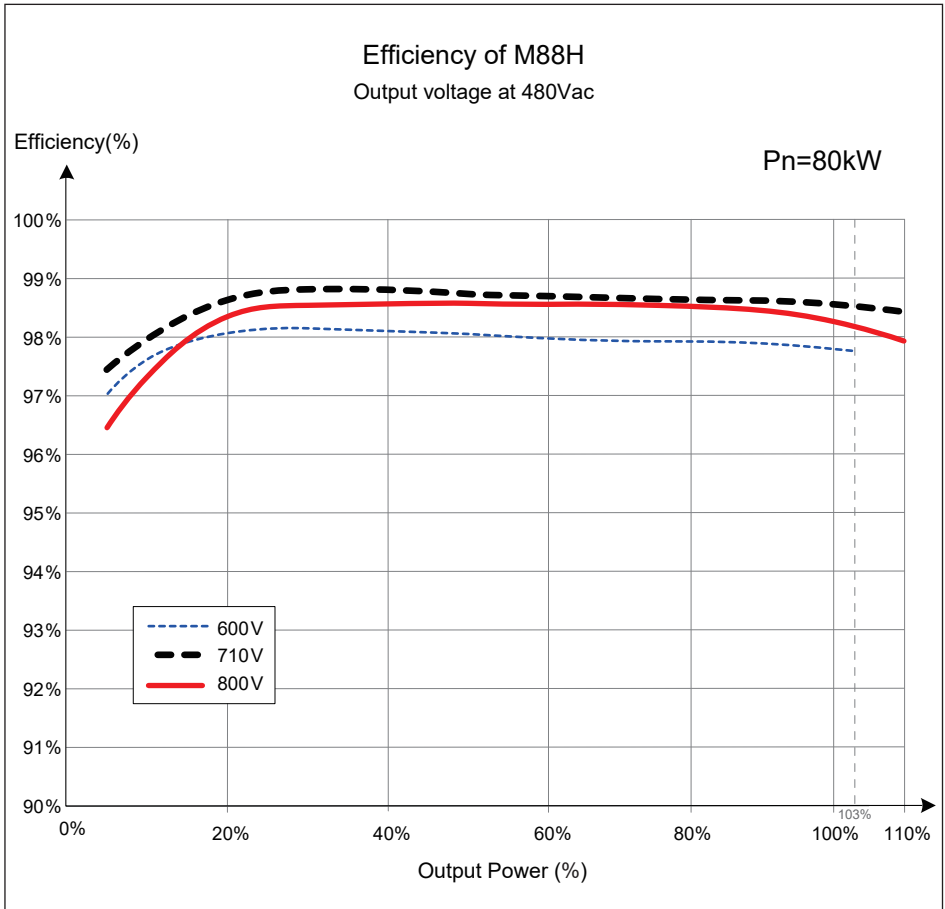


Figure 7-1 : Efficiency Curve (Output voltage at 480V)

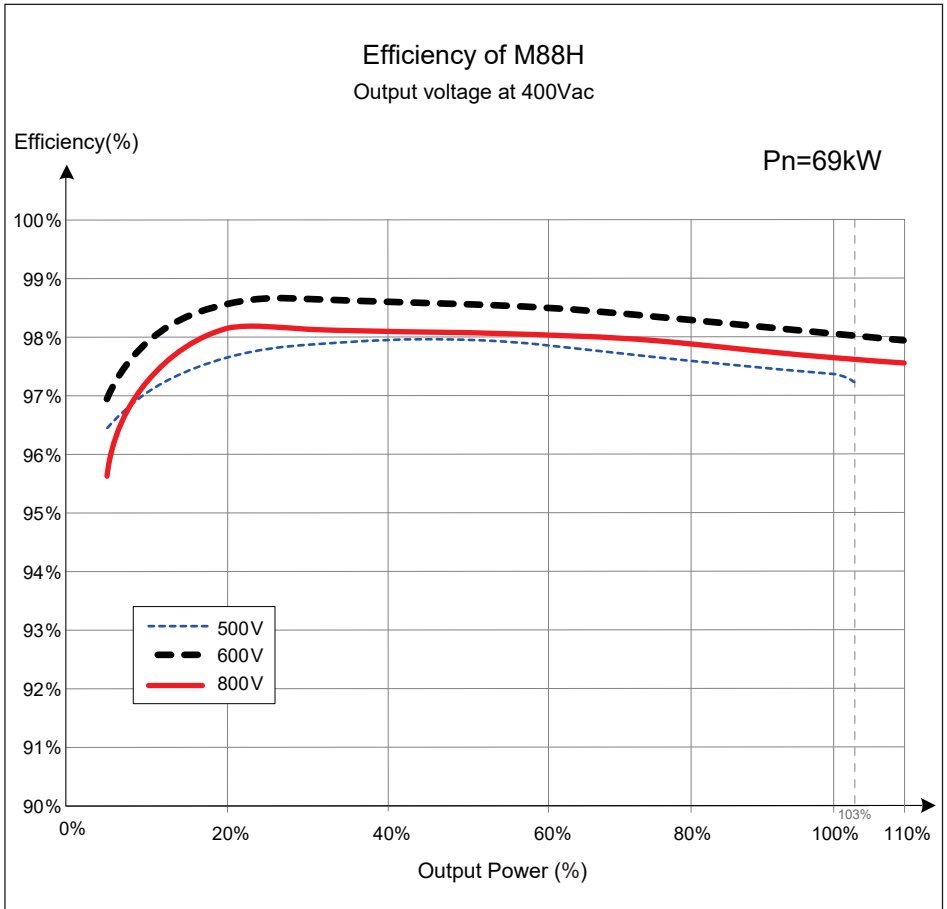


Figure 7-2 : Efficiency Curve (Output voltage at 400V)

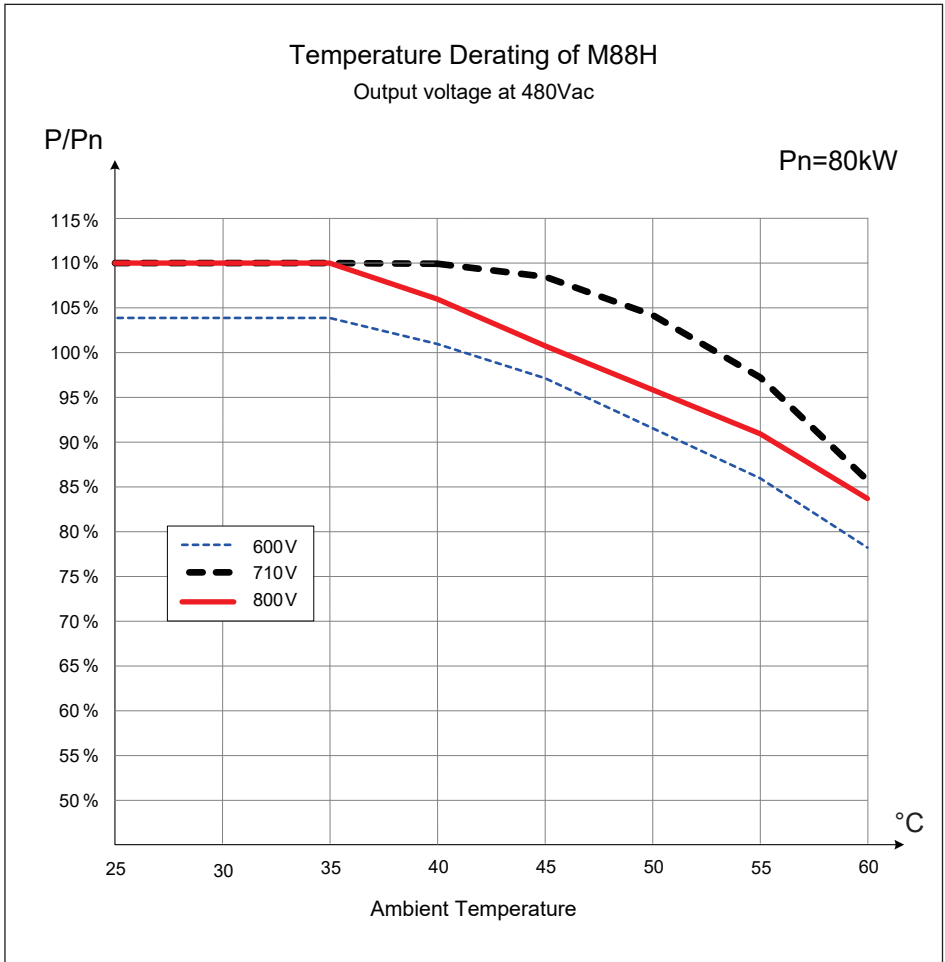


Figure 7-3 : Thermal Derating curve for 480Vac

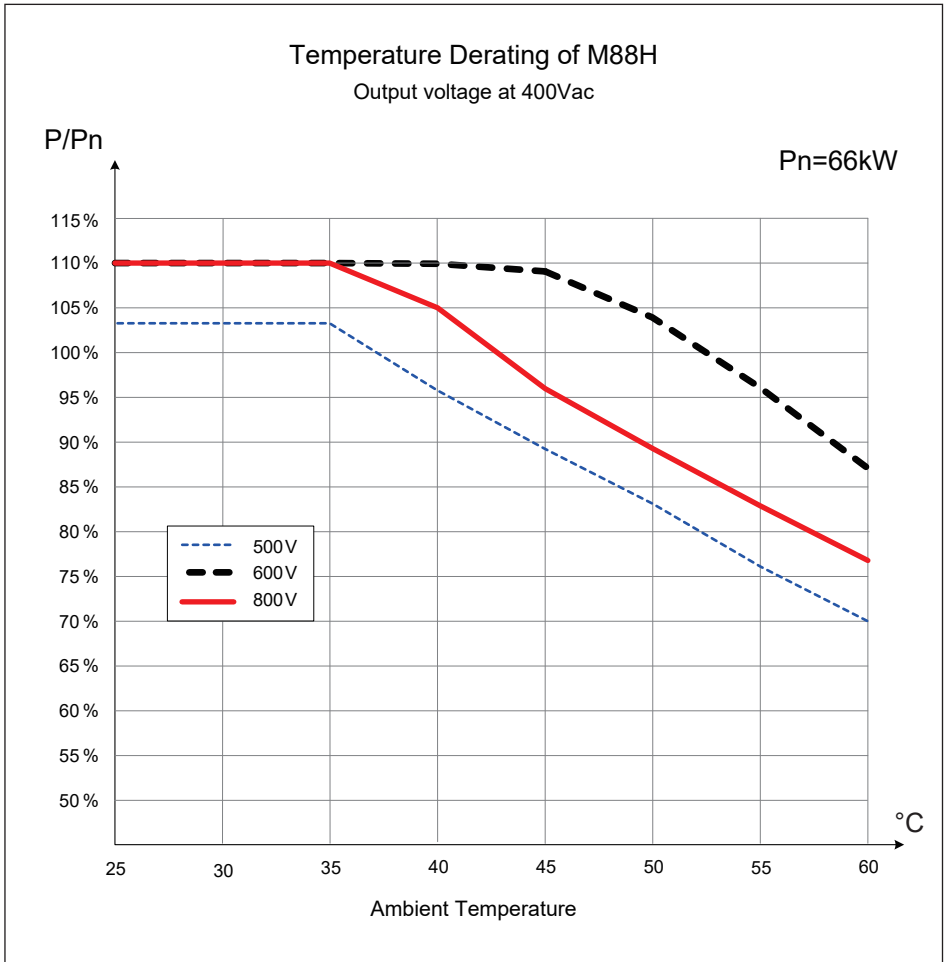


Figure 7-4 : Thermal Derating curve for 400Vac

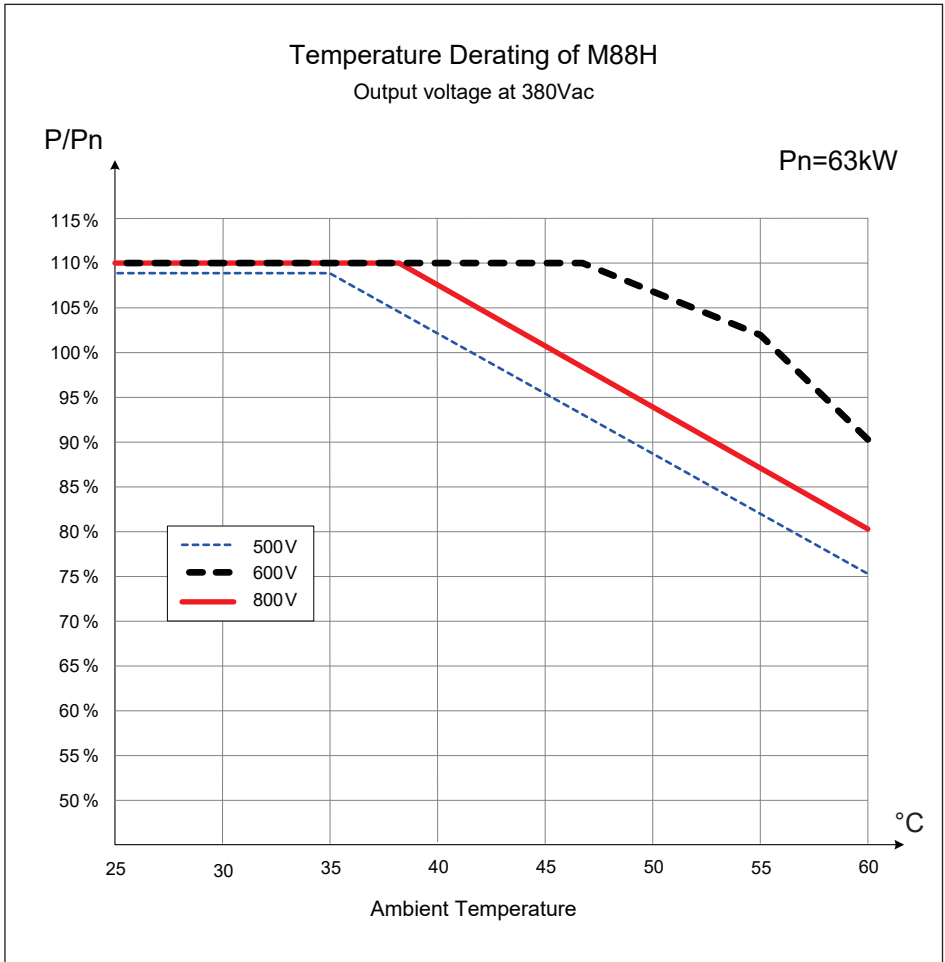
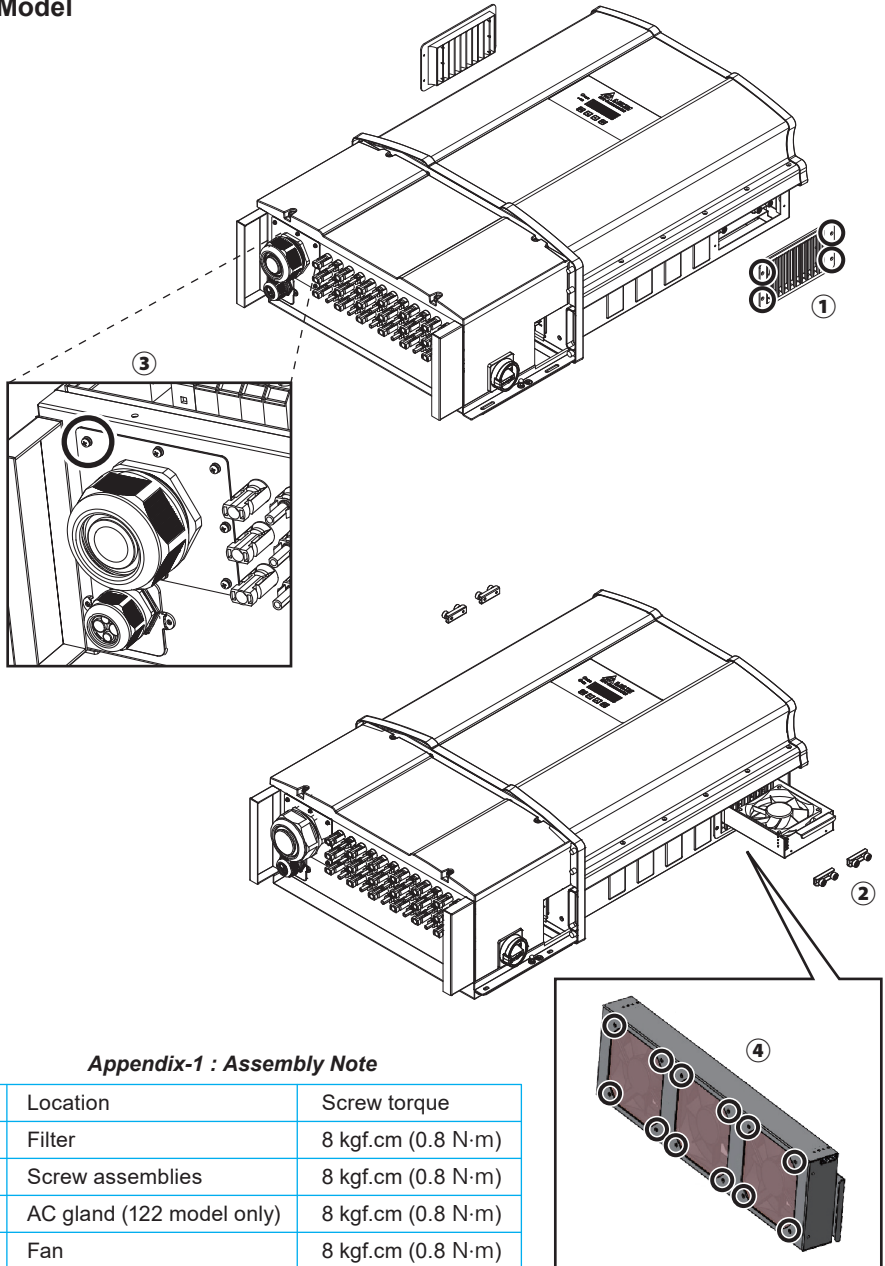


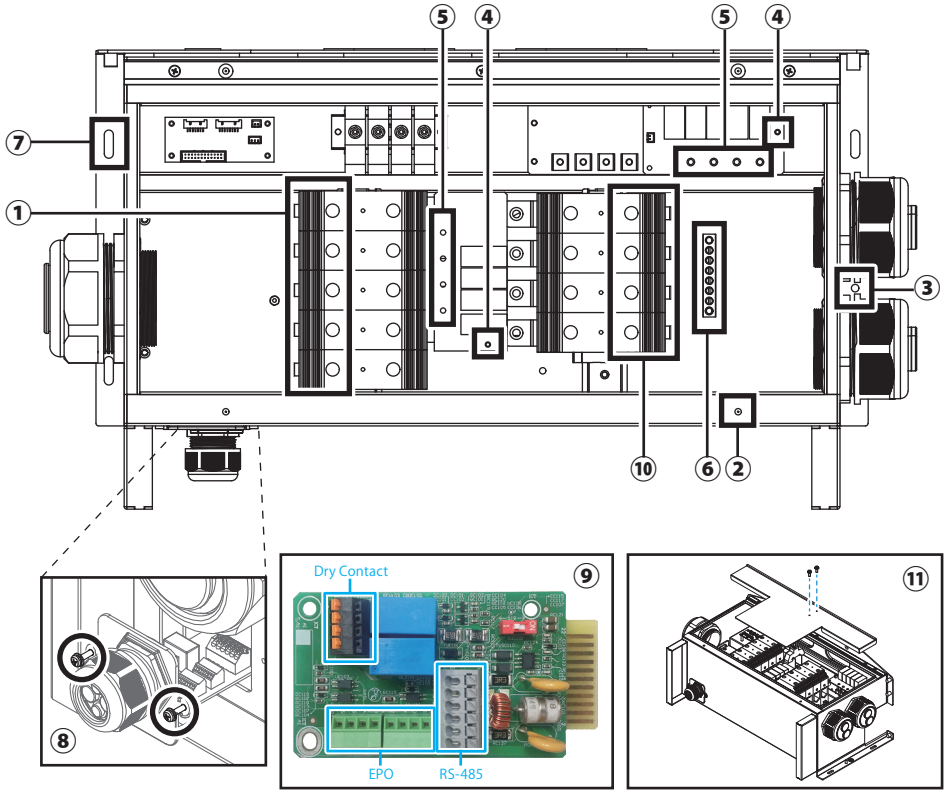
Figure 7-5 : Thermal Derating curve for 380Vac

Appendix: Assembly Note

-All Model

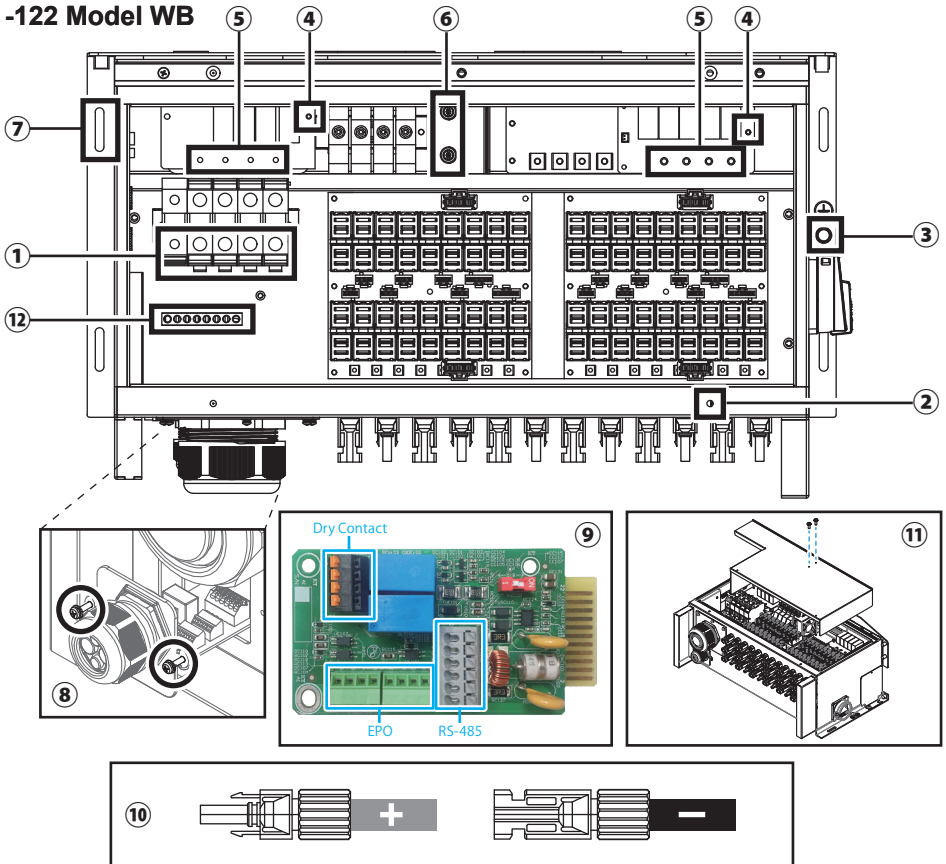


-121 Model WB



Appendix-2 : Assembly Note for 121 model

NO	Location	Screw torque	Conductor cross-section
1	AC terminal	265 kgf-cm (26 N·m)	1 AWG ~ 250 kcmil (50~120 mm ²)
2	Wiring box cover	24.2 kgf-cm (2.4 N·m)	-
3	Grounding point	79.9 kgf-cm (7.8 N·m)	-
4	Ground of SPD board	8 kgf-cm (0.8 N·m)	-
5	SPD board	17 kgf-cm (1.7 N·m)	-
6	Grounding bar	30.6 kgf-cm (3 N·m)	6~4 AWG (14~22 mm ²)
7	Mounting bracket	46.1 kgf-cm (4.5 N·m)	-
8	Communication cover	8 kgf-cm (0.8 N·m)	-
9	Communication port	-	20 AWG (0.5 mm ²)
10	DC terminal	265 kgf-cm (26 N·m)	1 AWG ~ 250 kcmil (50~120 mm ²)
11	Insulator cover	8 kgf-cm (0.8 N·m)	-



Appendix-3 : Assembly Note for 122 model

NO	Location	Screw torque	Conductor cross-section
1	AC terminal	91.7 kgf-cm (9 N·m)	2~2/0 AWG (35~70 mm ²)
2	Wiring box cover	24.2 kgf-cm (2.4 N·m)	-
3	Grounding point	79.9 kgf-cm (7.8 N·m)	-
4	Ground of SPD board	8 kgf-cm (0.8 N·m)	-
5	SPD board	17 kgf-cm (1.7 N·m)	-
6	Wiring box fan	8 kgf-cm (0.8 N·m)	-
7	Mounting bracket	46.1 kgf-cm (4.5 N·m)	-
8	Communication cover	8 kgf-cm (0.8 N·m)	-
9	Communication port	-	20 AWG (0.5 mm ²)
10	MC4 wire	-	12~10 AWG (4~6 mm ²)
11	Insulator cover	8 kgf-cm (0.8 N·m)	-
12	Grounding bar	30.6 kgf-cm (3 N·m)	6~4 AWG (14~22 mm ²)



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M88H

操作手冊

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1 安全規範

1.1 變流器資料

1.1.1 免責聲明

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本說明書及產品供終端使用者使用。技術資料及內圖文皆為機密資料且不經 DELTA ELECTRONICS, INC. 許可，禁止複製翻印。

維修工程師及終端使用者禁止洩漏內涵之訊息及除以正確使用本產品以外的目的使用本說明書。所有資訊若有變更，不另外通知。

DELTA ELECTRONICS, INC. 針對以下情形造成的損害將不負任何責任及義務：

- (a) 產品沒有恰當的安裝或維修
- (b) 產品未依照說明書正確使用
- (c) 產品於拆裝過程受損

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
- 了解太陽能變流器如何運行及操作
- 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變流器長期運轉，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變流器提供重要指示。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。
市電端與變流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、無變壓器太陽能變流器，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變流器匹配。

太陽能面板之對地電容不可超過 8 μ 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變流器長期運轉，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！



- 此警語表示當變流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。
- 市電端與變流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。

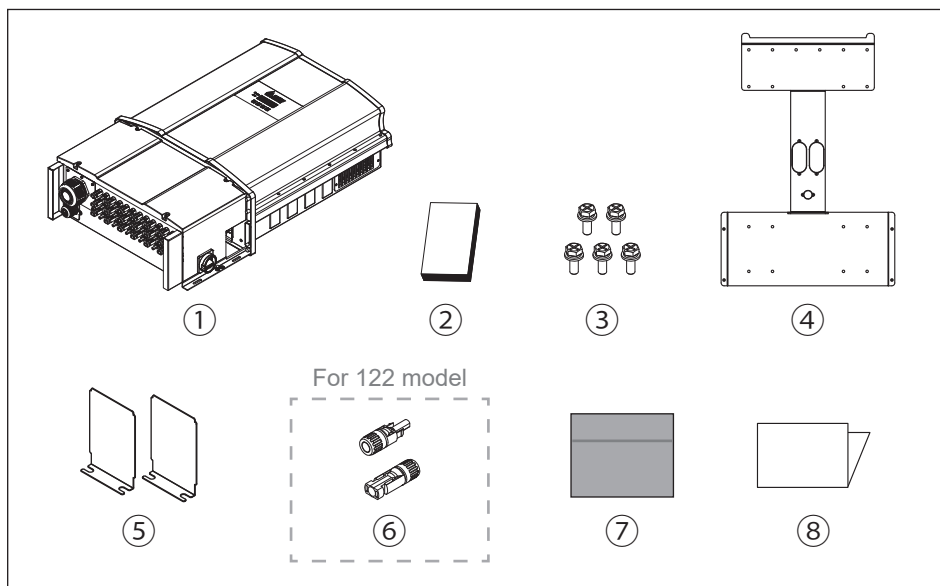


圖2-1：M88H內容物

表2-1：M88H內容清單

M88H			
	物件	數量	描述
1	DELTA太陽能變流器	1	太陽能變流器
2	說明書	1	安裝及維運過程中務必參考本說明書中的安全指示
3	螺絲	5	變流器與壁掛架鎖附螺絲 (不銹鋼/ M6 /12mm)
4	壁掛架	1	將變流器掛起之壁掛架 (材質：鋁/厚度：3mm)
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)
7	銘板保護	1	用於保護控制面板
8	銘板保護 說明書	1	銘板保護安裝說明

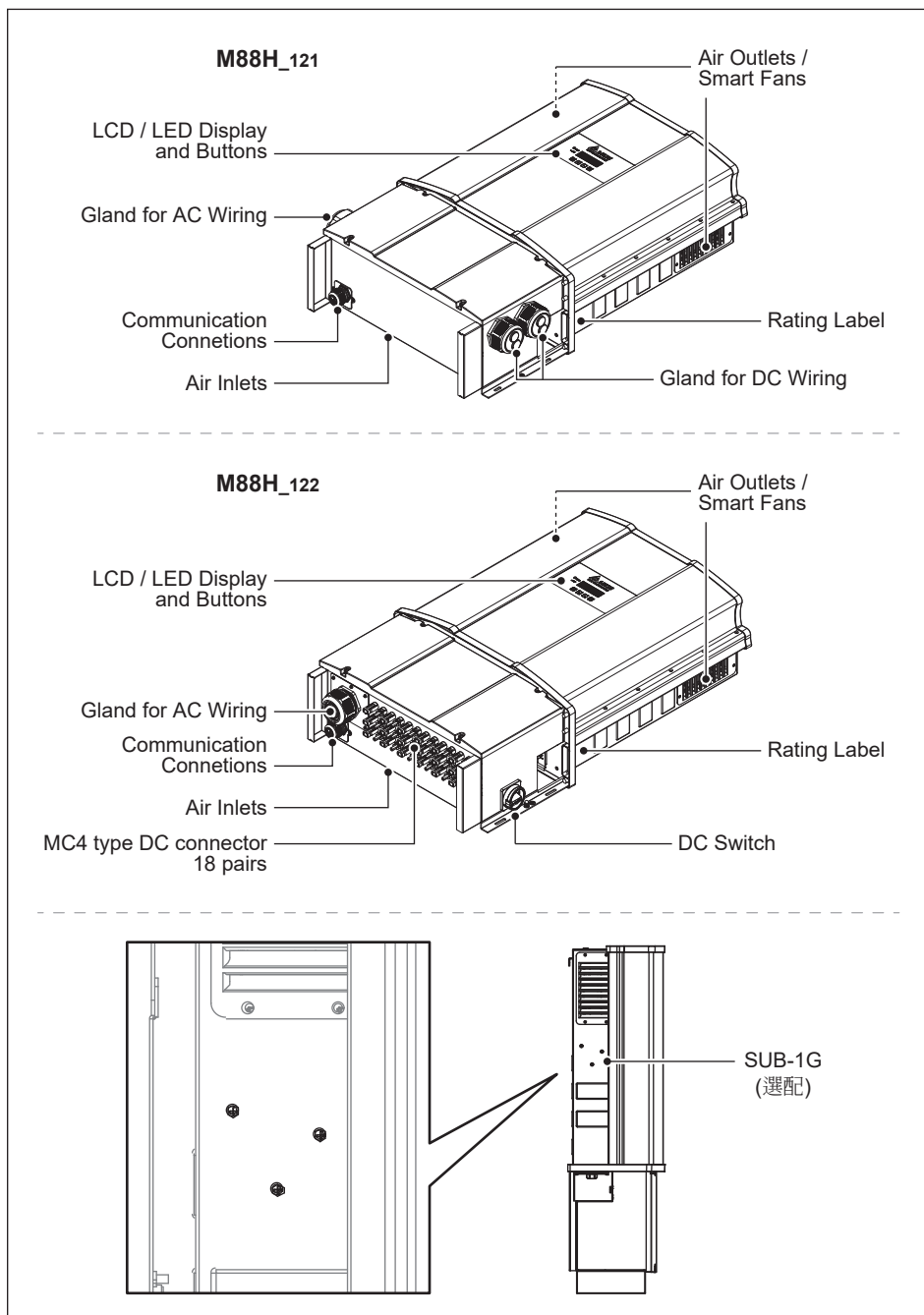








圖2-2 : M88H外觀介紹

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

表2-2 : M88H標籤內容描述

Symbol	Definition
	嚴重觸電危險 變流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，時間內請勿接觸變流器。 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。
	使用此變流器前，請詳閱說明書。
	此變流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。
	WEEE marking 本變流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。

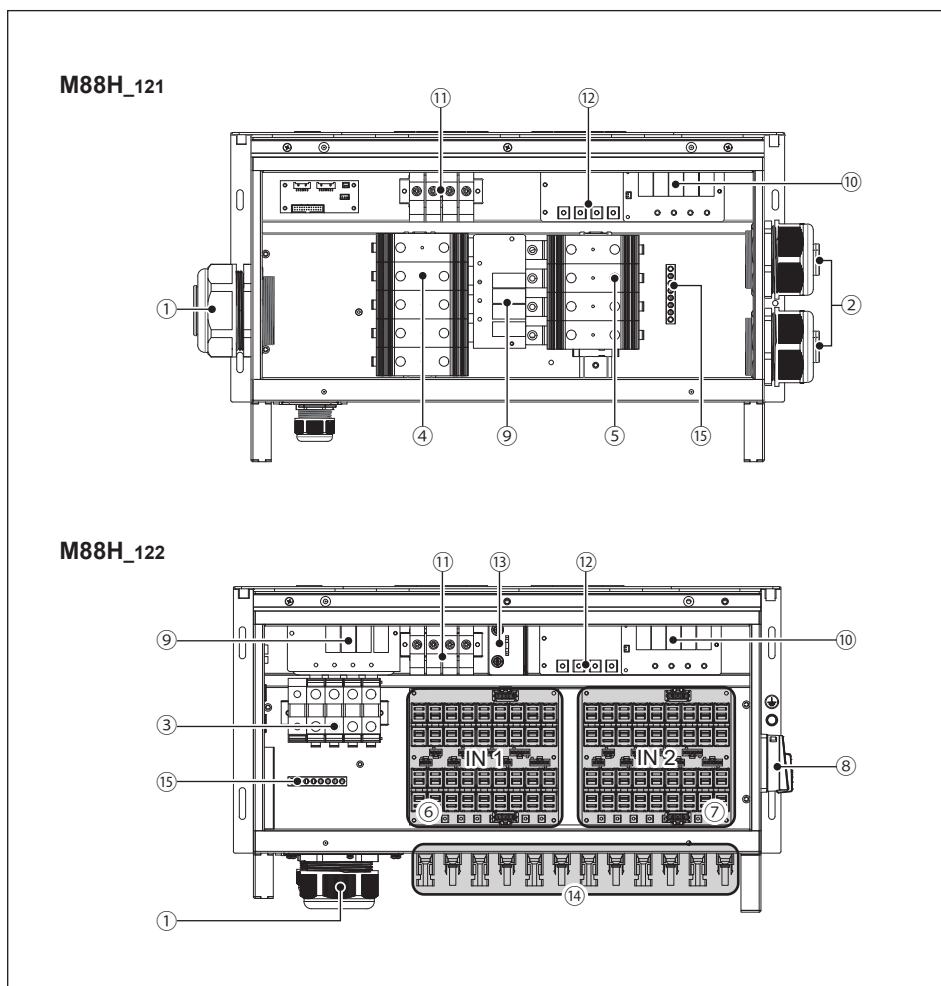


圖2-4 : M88H配線箱架構圖

表2-3 : M88H配線箱架構圖內容描述

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

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3-2至圖3-8的安裝指示，首先安裝壁掛架於堅固表面，並將變流器牢固地鎖附於壁掛架上。

請參考以下步驟鎖附變流器至牆上。

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3-2及3-3。
2. 圖3-1提供吊掛安裝方式。
3. 圖3-2及3-3提供建議的螺絲孔位置。
4. 將變流器掛至壁掛架上。
5. 圖3-4至3-8描述正確的安裝方式。
6. 圖3-8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。

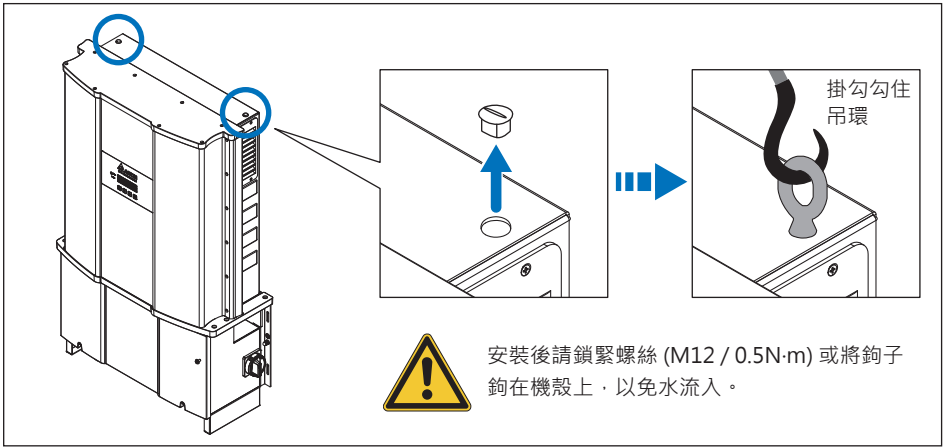


圖3-1：安裝吊掛鋼環

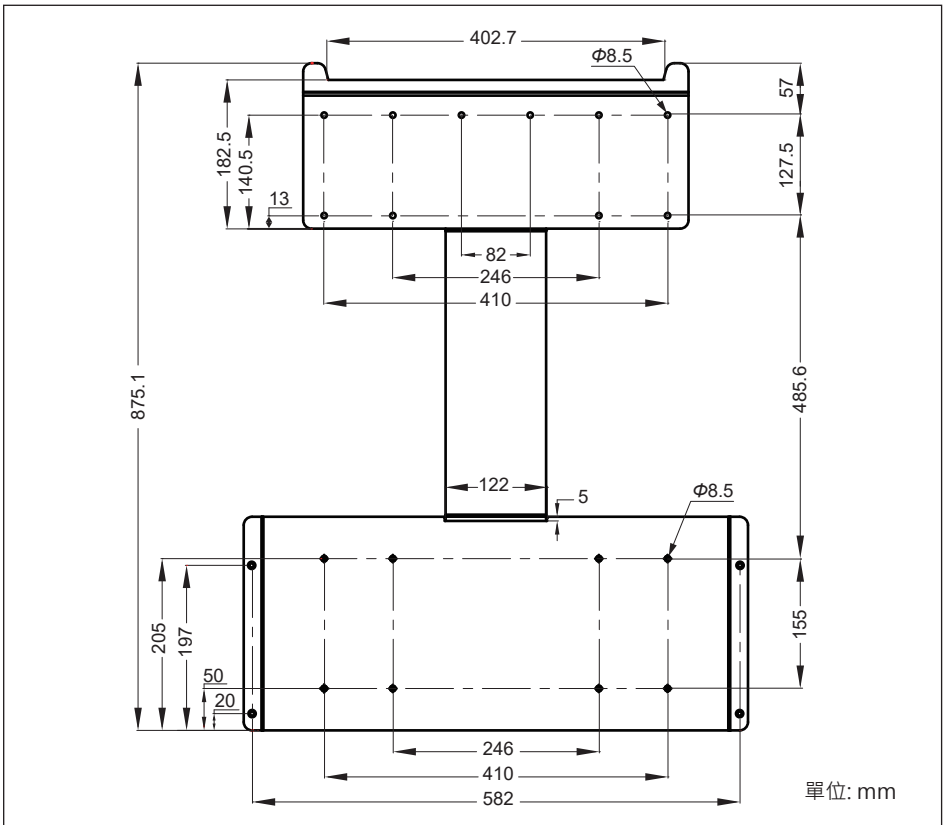


圖3-2：壁掛架詳細尺寸

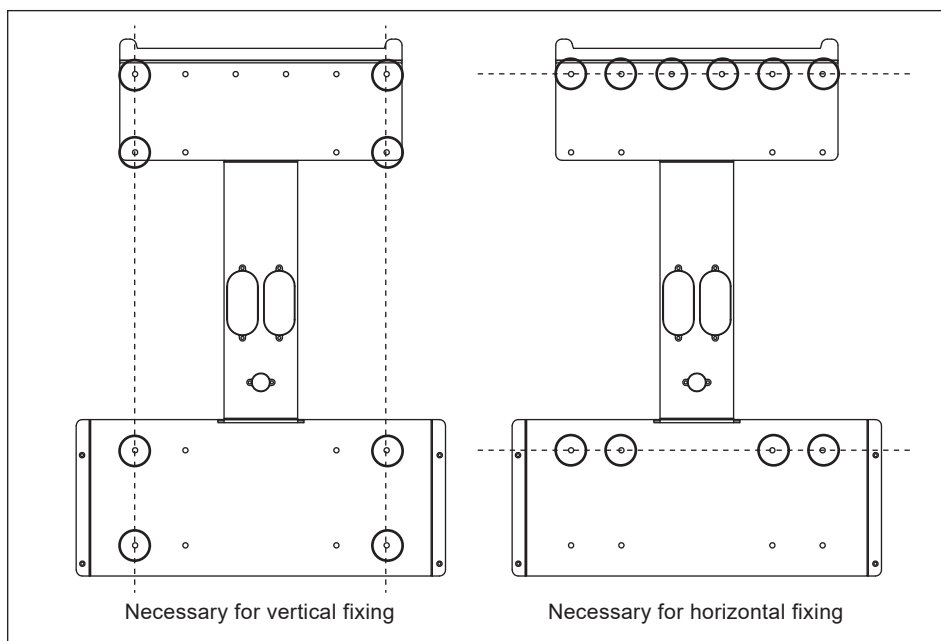


圖3-3：壁掛建議螺絲鎖附孔位置(至少8枚螺絲)

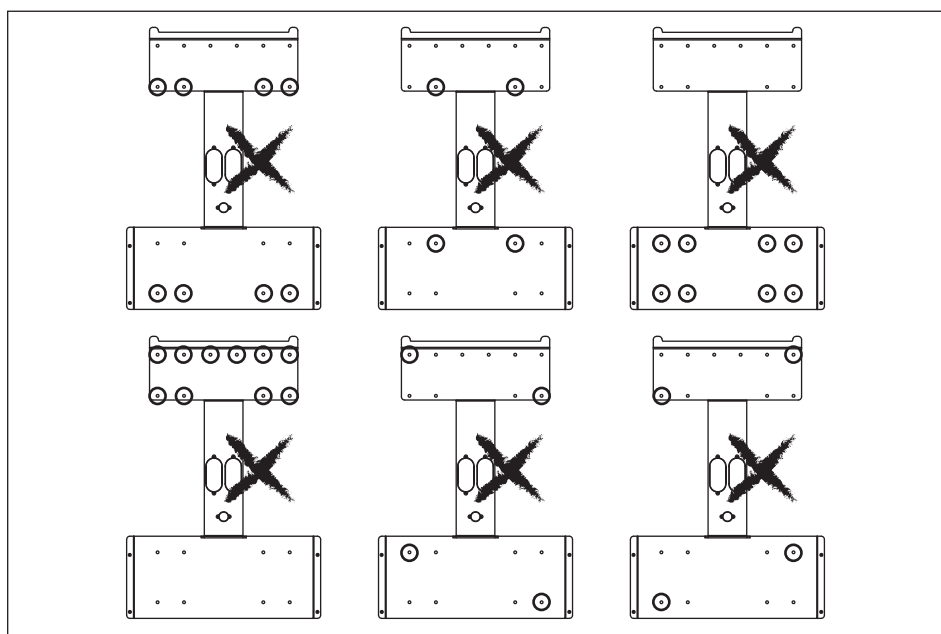


圖3-4：錯誤的螺絲鎖附位置

O : Permitted

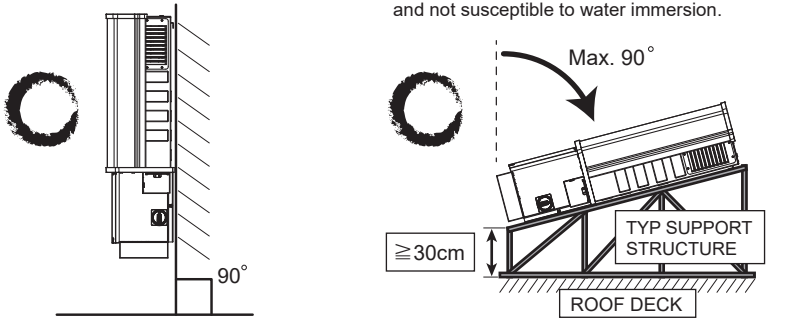


圖3-5 : 正確的安裝位置

X : Prohibited

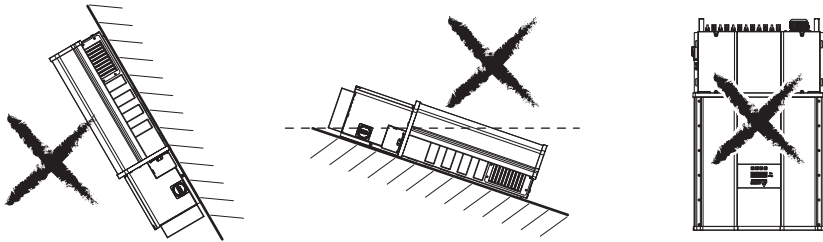
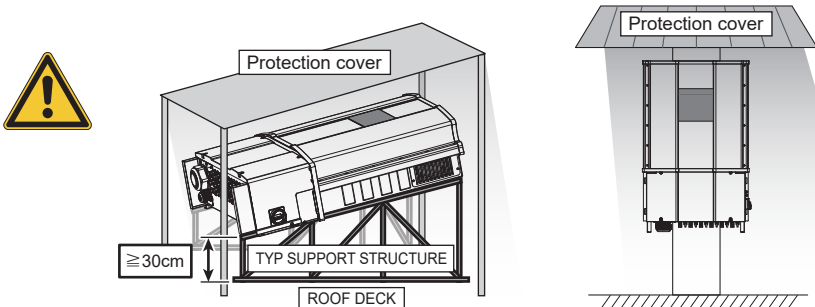


圖3-6 : 禁止的安裝方式

注意 !

- 銘板保護蓋於任何安裝形式下皆須安裝。
- 為避免由於極端氣候(大雪, 冰雹...等)或不恰當的安裝/維運所導致的變流器故障, 台達強烈建議安裝額外的保護蓋, 詳細細節請洽當地服務團隊。



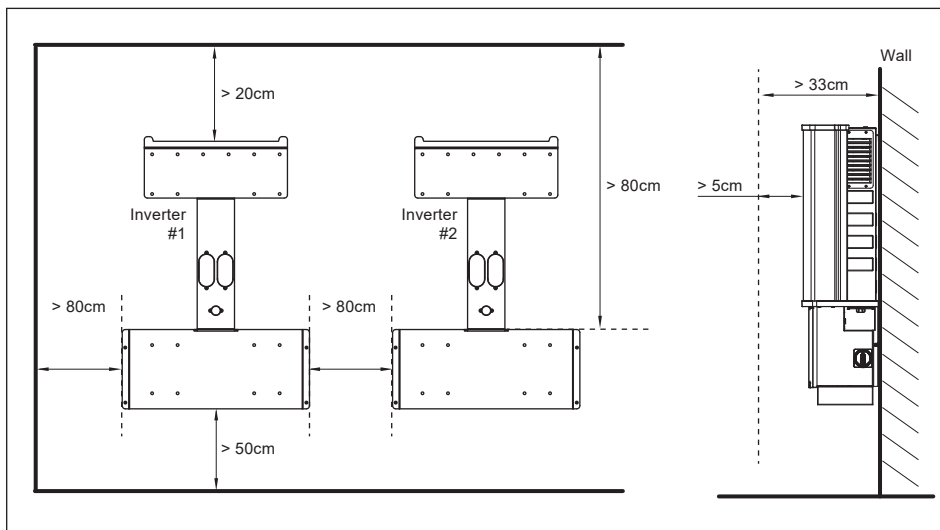


圖3-7：機台間最低要求距離

注意！



- 請遵照允許的安裝方式進行施工。

將變流器掛上後，請以鎖附扭力45 kgf.cm將四枚螺絲鎖上。

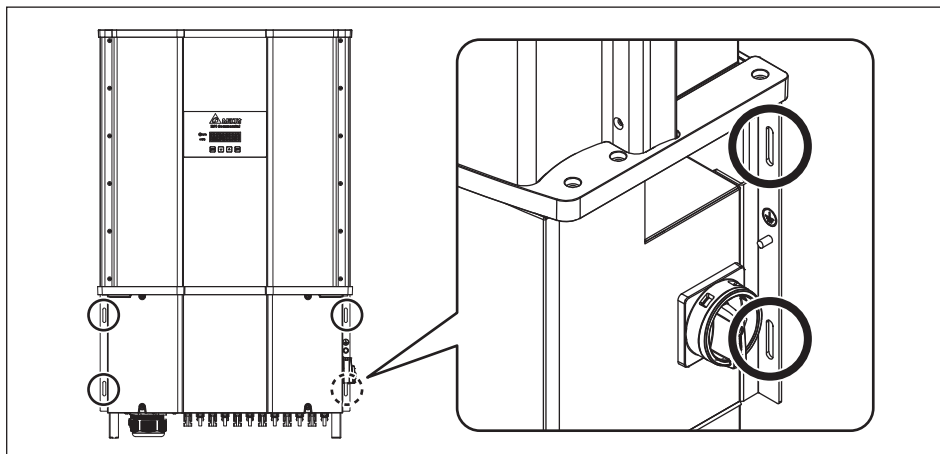


圖3-8：配線箱與壁掛架鎖附螺絲位置

要使用遮蔽板，請參考圖3-9的安裝方式。
 (鎖附扭力45 kgf.cm)

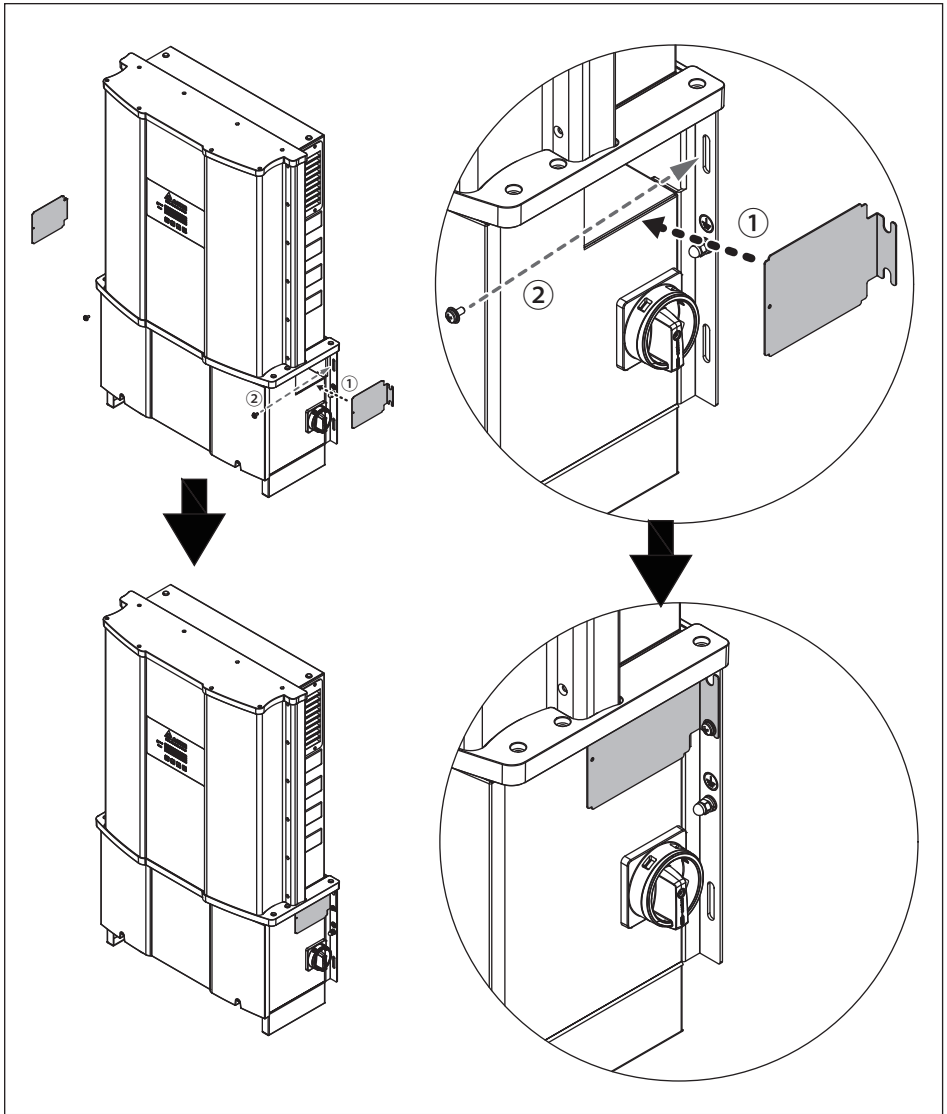


圖3-9：遮蔽板的安裝方法

銘板保護

注意！



- 黏貼前須將銘板周圍擦拭乾淨
- 完整黏貼完畢後需用力按壓並確認平整度
- 靜置1小時以上使其充分發揮膠貼的黏性

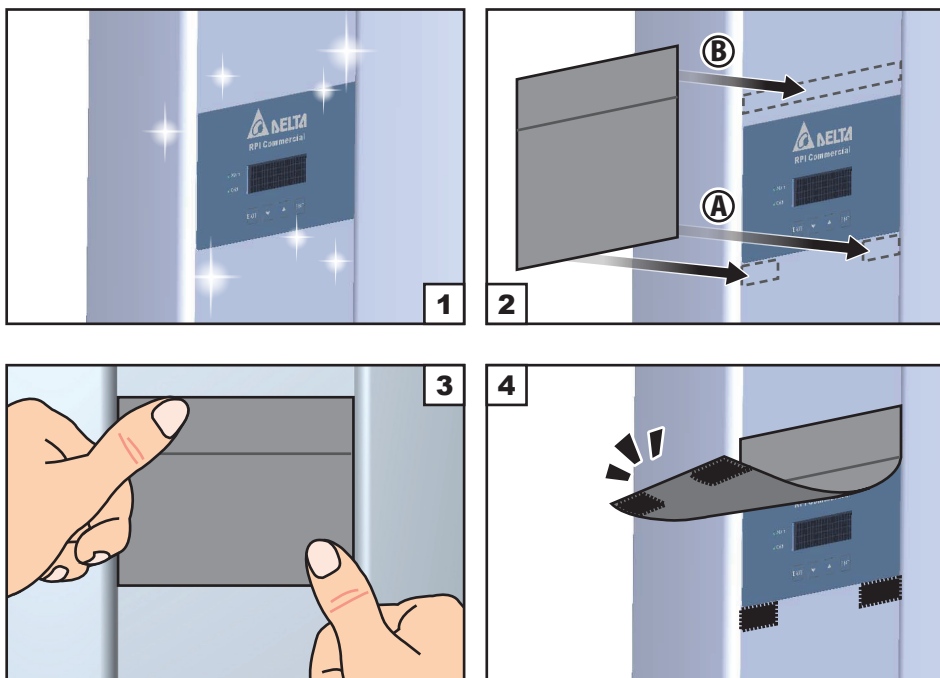
為了銘板/螢幕不受外在因素(像是動物、異物和紫外光照射等)造成毀損，使用斜躺/水平式或是朝陽安裝請務必安裝銘板保護貼。

安裝流程如下：

A. 將有兩片短的魔鬼氈那一側的貼紙沿著銘板下緣黏貼。

B. 黏貼完畢後，接著黏貼上方長條魔鬼氈的貼紙。

安裝完畢後，可撕開下方魔鬼氈且由下往上打開銘板保護貼。



3.2 接線盒上蓋

為了確保變流器可以良好的長期運轉，拆裝接線盒時，請務必參考5.1章節的步驟說明。

3.3 交流配線安裝

危險：觸電危險!!



- 配線時禁止供給變流器任何電源。

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：變流器及設備可能損毀！



- 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：錯誤的交流線材！



- 為了不損壞變流器中的組件，請確保將正確的線材連接到變流器上相應的交流端子。

注意



- 變流器可能因溼度或沙塵損壞，請勿打開變流器機殼。

允許的接地系統

接地系統	TN-S	TN-C	TN-C-S	TT	IT
允許	Yes	Yes	Yes	Yes	Yes



- 不建議使用TT。N的電壓必須非常接近接地電壓（差值<20 Vrms）

3.3.1 M88H₁₂₁必須保護裝置及交流配線安裝

建議於市電端與變流器間加入斷路器做為過電流保護。

型號	斷路器規格
M88H	≥ 150A

請遵循以下步驟組裝交流端子 (M88H₁₂₁) :

- 請選用適當線材尺寸
- 剝去線皮40 mm
- 線材表面積範圍為 50 -120 mm²

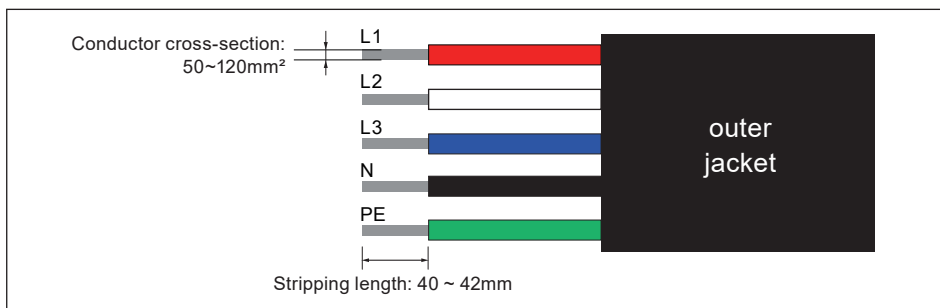


圖3-10：M88H₁₂₁交流線材剝線

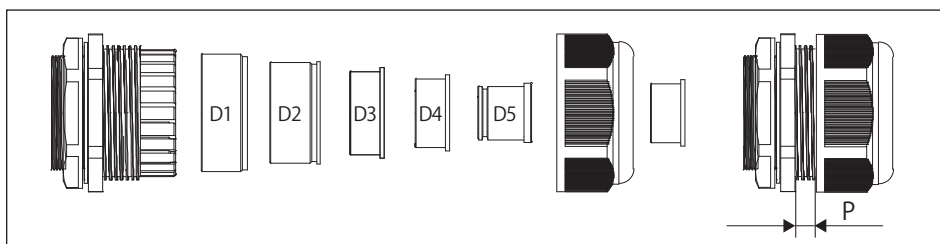


圖3-11: AC側多層式防水塞蓋 (M88H₁₂₁)

表3-1: AC側電纜線尺寸對照表 (M88H₁₂₁)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	53.5~65.9	13.7~18.1	1~8.4
D2	43.8~53.5	23~24.5	1~7.8
D3	34.8~43.8	19.4~36.9	1~6.4
D4	27.2~34.8	34.3~36.4	1~6.4
D5	23.9~27.2	25.9~36.3	1~6.4

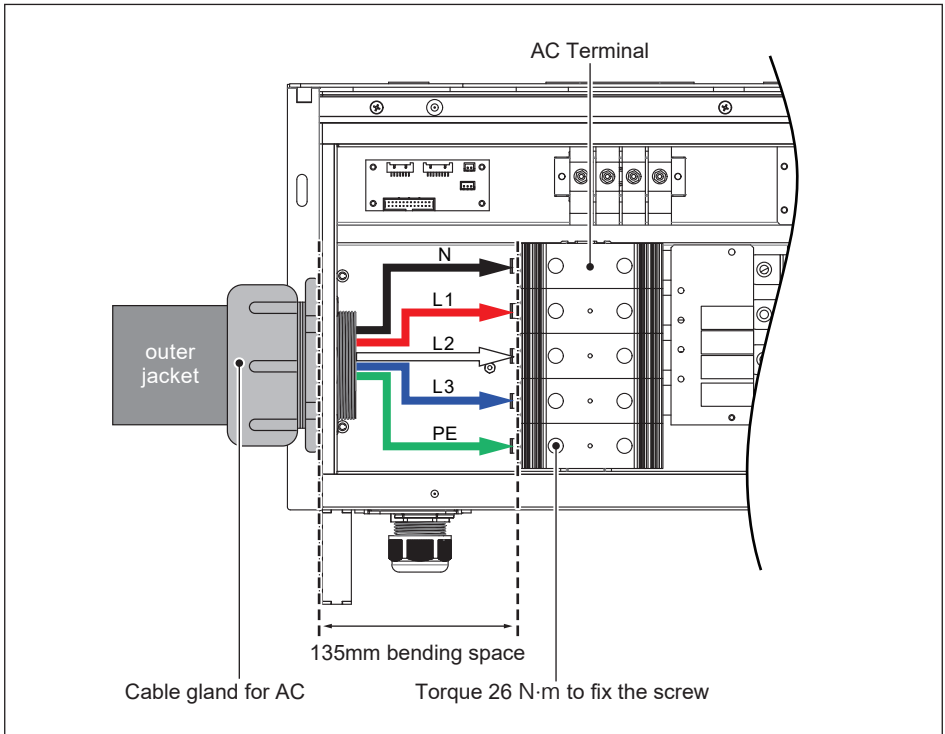


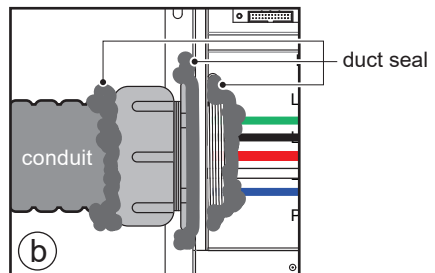
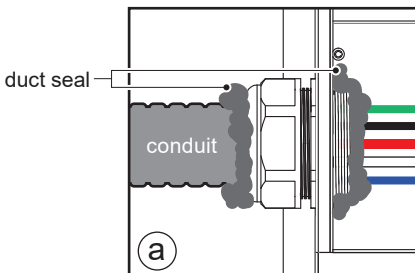
圖3-12 : M88H_121 交流端子位置

注意！

機器上的電纜接頭適用於多芯電纜。當使用單芯電纜搭配2.5" 金屬軟管配線時，請遵照下列建議預防水氣侵入：



- a. 將金屬軟管接入電纜接頭內，並使用防火泥填補軟管與接線盒內外部及電纜接頭與軟管間的縫隙
- b. 將電纜接頭更換為2.5" 金屬管接頭，並使用防火泥填補軟管與接線盒內外部及金屬管接頭與軟管間的縫隙



3.3.2 M88H₁₂₂必須保護裝置及交流配線安裝

建議於市電端與變流器間加入斷路器做為過電流保護。

型號	斷路器規格
M88H	≥ 150A

請遵循以下步驟組裝交流端子 (M88H₁₂₁) :

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

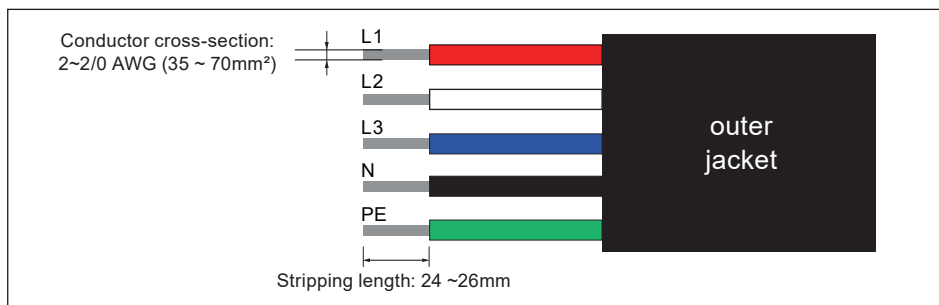


圖3-13 : M88H₁₂₂ 交流線材剝線

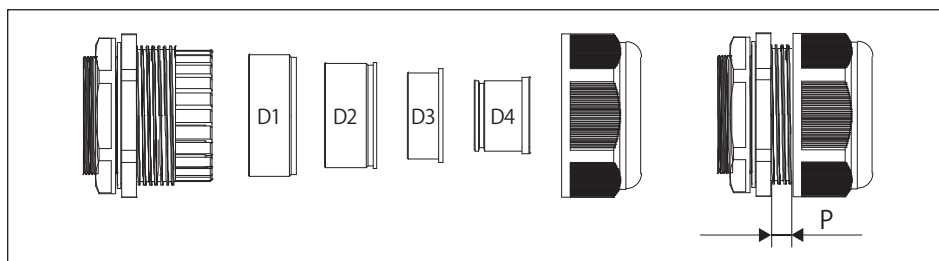


圖3-14: AC側多層式防水塞蓋 (M88H₁₂₂)

表3-2: AC側電纜線尺寸對照表 (M88H₁₂₂)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	43.5~51.3	8.5~11	1~4
D2	34.8~43.5	8.5~11	1~5
D3	27.2~34.8	8.5~11	1~3.5
D4	23.9~27.2	8.5~11	1~3.5

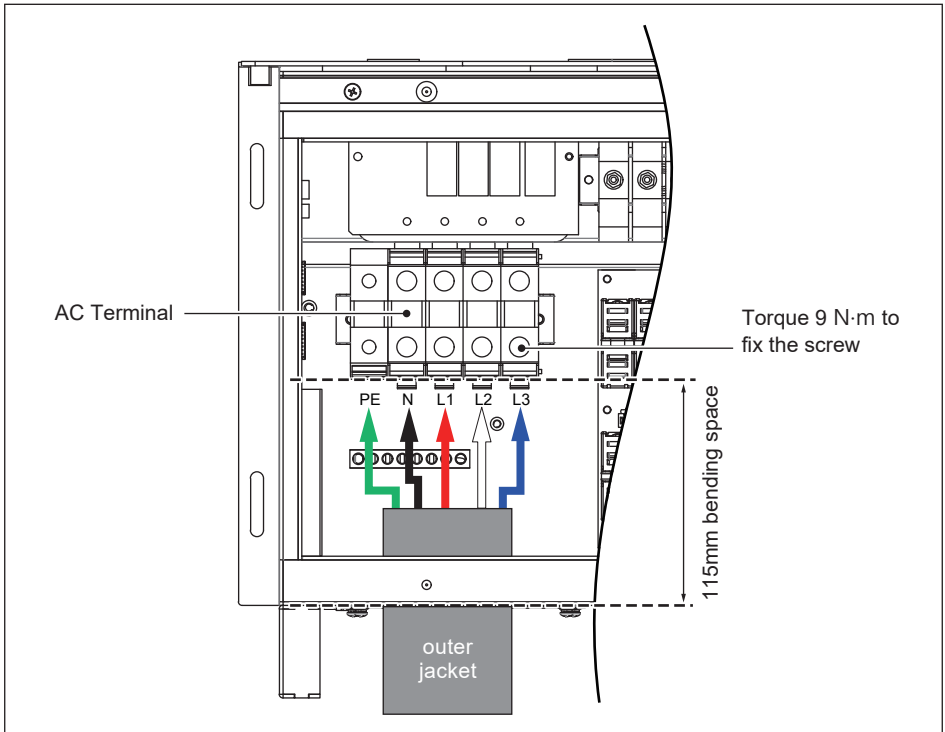


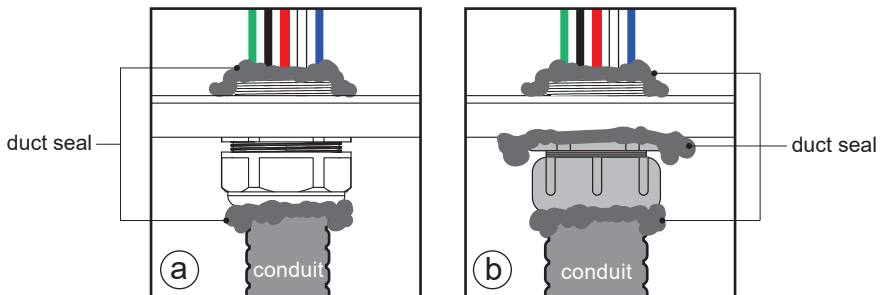
圖3-15 : M88H_122交流端子位置

注意 !

機器上的電纜接頭適用於多芯電纜，當使用單芯電纜搭配2" 金屬軟管配線時，請遵照下列建議預防水氣侵入：



- 將金屬軟管接入電纜接頭內，並使用防火泥填補軟管與接線盒內外部及電纜接頭與軟管間的縫隙
- 將電纜接頭更換為2" 金屬管接頭，並使用防火泥填補軟管與接線盒內外部及金屬管接頭與軟管間的縫隙



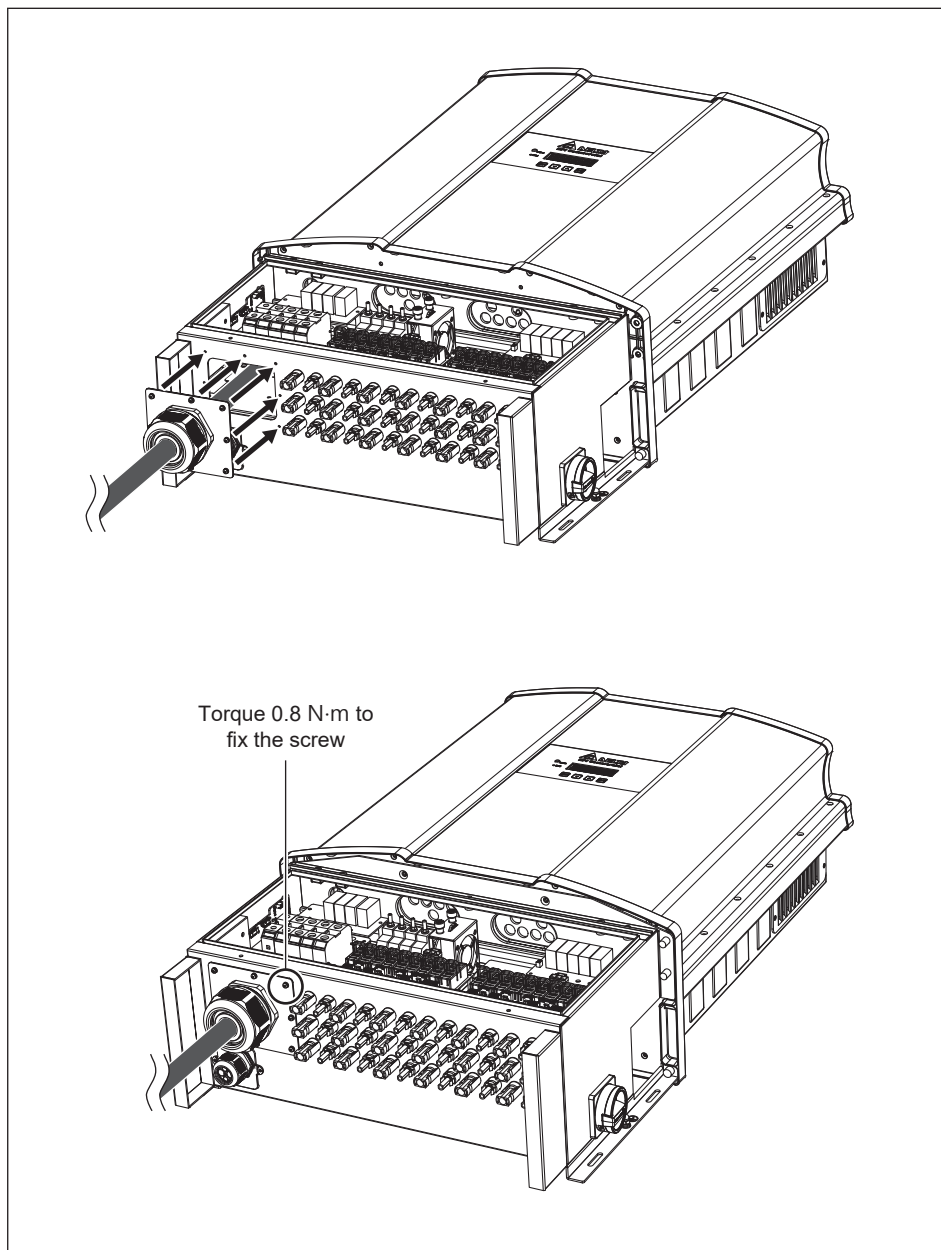


圖3-16：M88H_122交流固定頭的組裝方式

M88H支援1/4扇形鋁線直接配接 (M88H_121: 直流和交流側; M88H_122: 交流側)

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

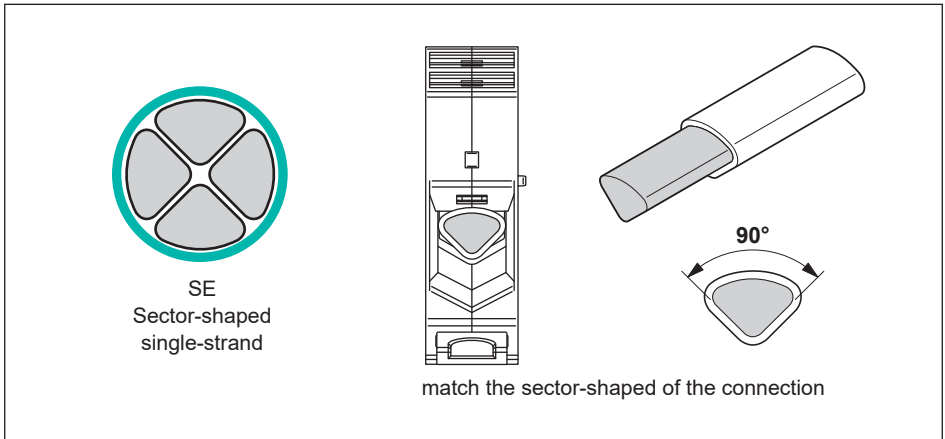


圖3-17：鋁線使用指示

對於其他類型的鋁線：

為確保良好的導電性，鋁線必須搭配銅鋁端子一起使用。

請按照圖3-18選擇合適尺寸的銅鋁端子。

注意：

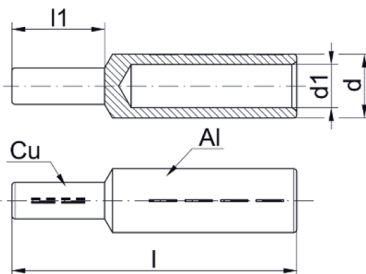
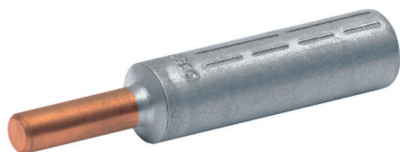
有可能產生高溫：

若壓接點的阻抗過高，該點則有可能產生高溫導致火災。



為確保安全性及可靠的接觸點，請確實遵守以下步驟

1. 鋁線的導電性較銅線差，鋁線線徑請至少選用比銅線線徑大一個等級。
2. 安裝鋁線時請盡量在低濕度且低腐蝕性的環境下進行。
3. 安裝過程需快速。
4. 確實使用硬體工具(如刀子)將剝線後的裸露表面氧化層刮除，並立即將裸露線材浸泡至凡士林內(須為中性、不含酸、鹼成分)，然後放入銅鋁端子內。
5. 使用最大允許的壓接扭力進行壓接。



Type: Compression joints
with Cu bolts, Al

For M88H_121, $d < 30.0\text{mm}$
For M88H_122, $d < 19.0\text{mm}$
在鋁的部分必須使用熱縮管

圖3-18：銅鋁端子選用指示

3.4 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：DC開關！



- 為了不損壞變流器內部元件，請勿頻繁且快速地接換直流開關，正確的操作方式為當直流開關切至OFF需等待LCD面板顯示“NO DC”或一分鐘後，再切為ON的狀態。

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變流器之間做為過電流保護裝置。
- 未使用的DC串列輸入端子，請勿移除防水塞。(M88H_122)

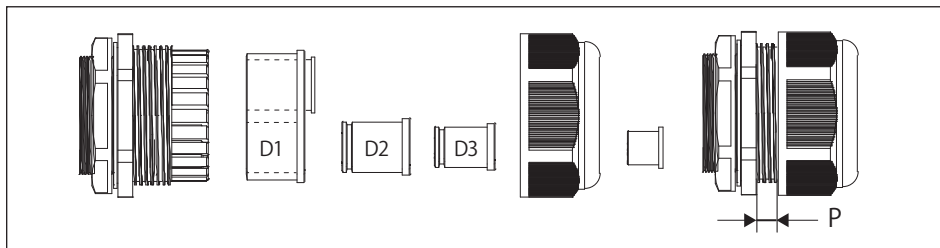


圖3-19: DC側多層式防水塞蓋 (M88H_121)

表3-3: DC側電纜線尺寸對照表 (M88H_121)

	Sizes of Cables (mm)	Torque (N·m)	Dimension of P (mm)
D1	21.9 ~ 25.7	31.4 ~ 35.3	0 ~ 4
D2	15.8 ~ 21.9	45.1 ~ 52.0	0 ~ 5
D3	11.3 ~ 15.8	37.3 ~ 41.1	0 ~ 4

3.4.1 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 50 -120 mm²
- 直流端子台配線如圖3-21所示

注意



- 直流端子鎖附扭力為 26 N·m
- 所需的配線空間為 135 mm
- 對於鋁電纜 :
最小/最大導線線徑 120 / 150 mm² (鎖附扭力 30 N·m)

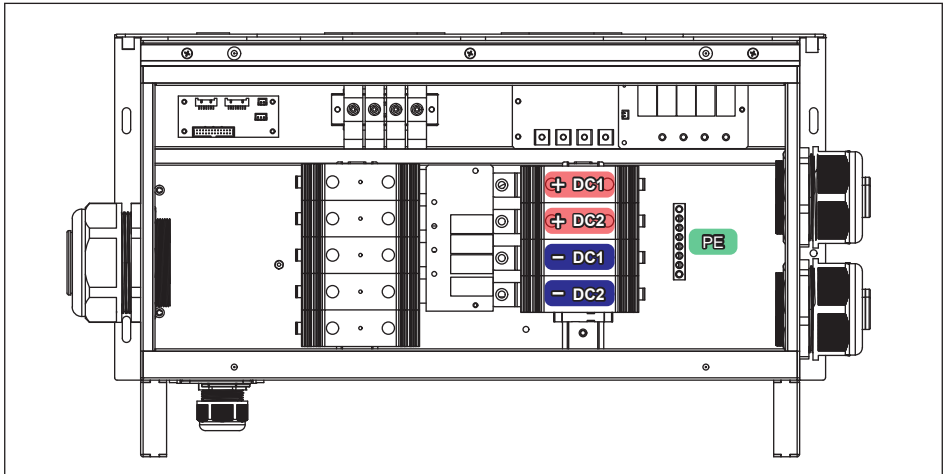


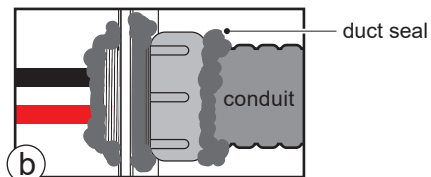
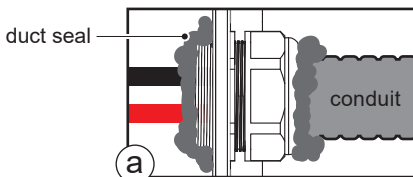
圖3-20: M88H_121配線箱架構圖

CAUTION !



機器上的電纜接頭適用於多芯電纜，當使用單芯電纜搭配 2" 金屬軟管配線時，請遵照下列建議預防水氣侵入：

- 將金屬軟管接入電纜接頭內，並使用防火泥填補軟管與接線盒內外部及電纜接頭與軟管間的縫隙
- 將電纜接頭更換為 2" 金屬管接頭，並使用防火泥填補軟管與接線盒內外部及金屬管接頭與軟管間的縫隙



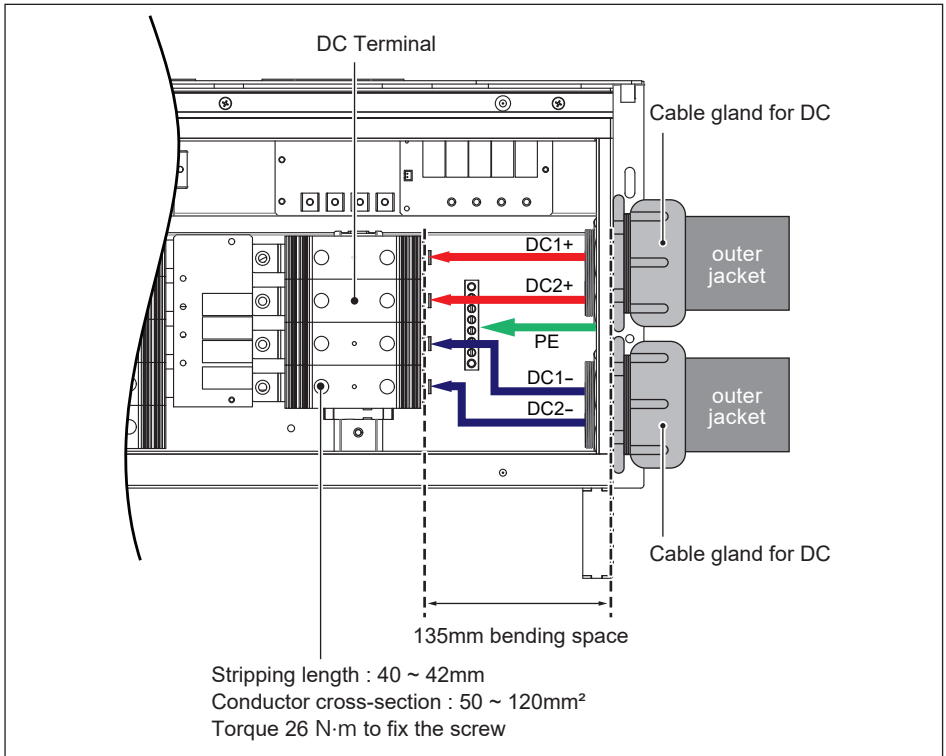
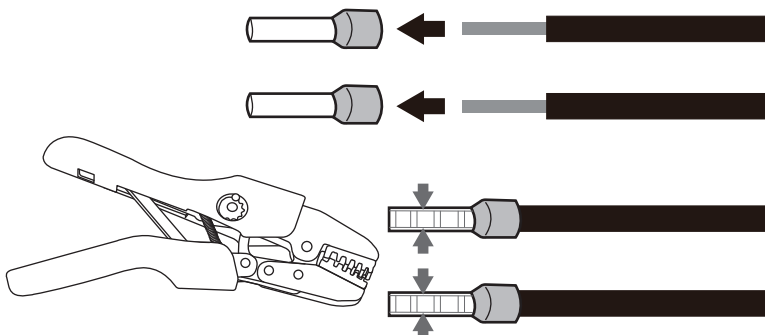


圖3-21：M88H_121直流端子台位置

注意！



M88H_121 的接線端子在一些特別應用下可以支援35mm²的銅線，此應用條件必須加裝接線端子頭後再對線材進行鎖附，確保線材不會鬆脫，下圖是安裝端子頭流程。



針對配接成單組MPPT應用，請參考以下流程與注意事項：
插入短路橋接片於直流端子，如圖3-22。
配入直流電纜線並且以2.6 N·m扭力確實鎖緊直流端子。

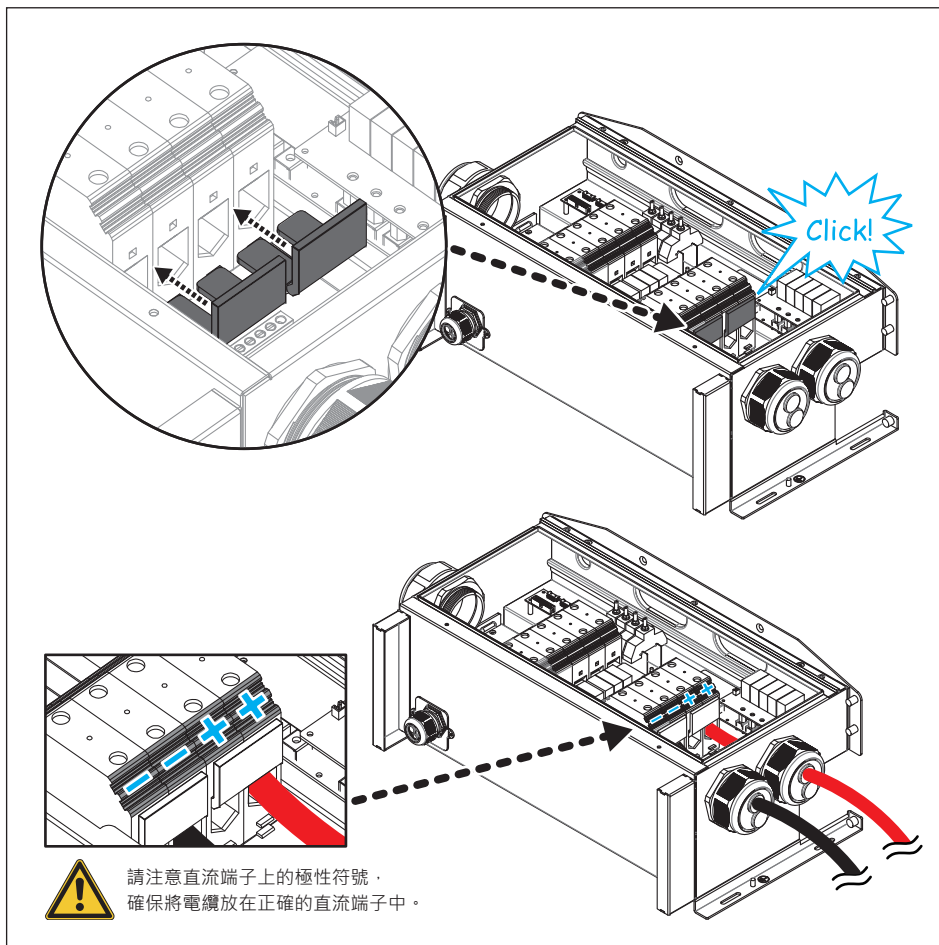
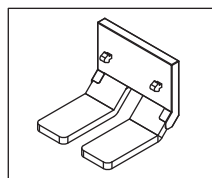


圖3-22 : M88H_121單組MPPT應用程序

注意



1. 若需要使用短路橋接片，請連繫當地台達客服
2. 請勿使用未經廠商認可的短路橋接片進行DC側橋接，否則會造成變流器的損壞。



M88H支援1/4扇形鋁線直接配接 (M88H_121: 直流和交流側; M88H_122: 交流側)

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

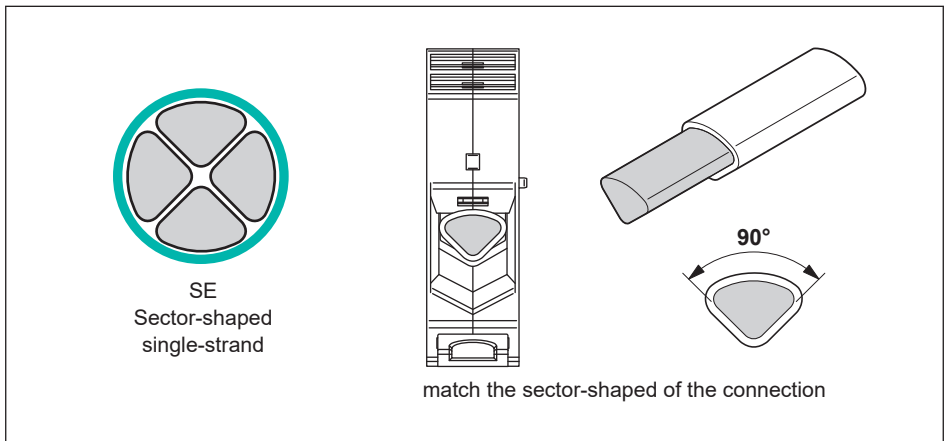


圖3-23：鋁線使用指示

對於其他類型的鋁線：

為確保良好的導電性，鋁線必須搭配銅鋁端子一起使用。

請按照圖3-24選擇合適尺寸的銅鋁端子。

注意：

有可能產生高溫：

若壓接點的阻抗過高，該點則有可能產生高溫導致火災。

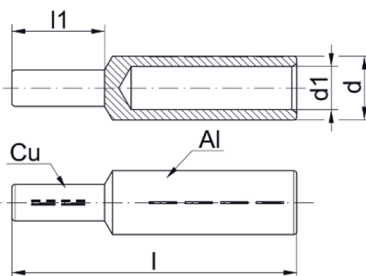
為確保安全性及可靠的接觸點，請確實遵守以下步驟



1. 鋁線的導電性較銅線差，鋁線線徑請至少選用比銅線線徑大一個等級。
2. 安裝鋁線時請盡量在低濕度且低腐蝕性的環境下進行。
3. 安裝過程需快速。
4. 確實使用硬體工具(如刀子)將剝線後的裸露表面氧化層刮除，並立即將裸露線材浸泡至凡士林內(須為中性、不含酸、鹼成分)，然後放入銅鋁端子內。
5. 使用最大允許的壓接扭力進行壓接。



Type: Compression joints
with Cu bolts, Al



For M88H_121, $d < 30.0\text{mm}$
在鋁的部分必須使用熱縮管

圖3-24：銅鋁端子選用指示

3.4.2 M88H₁₂₂直流配線安裝

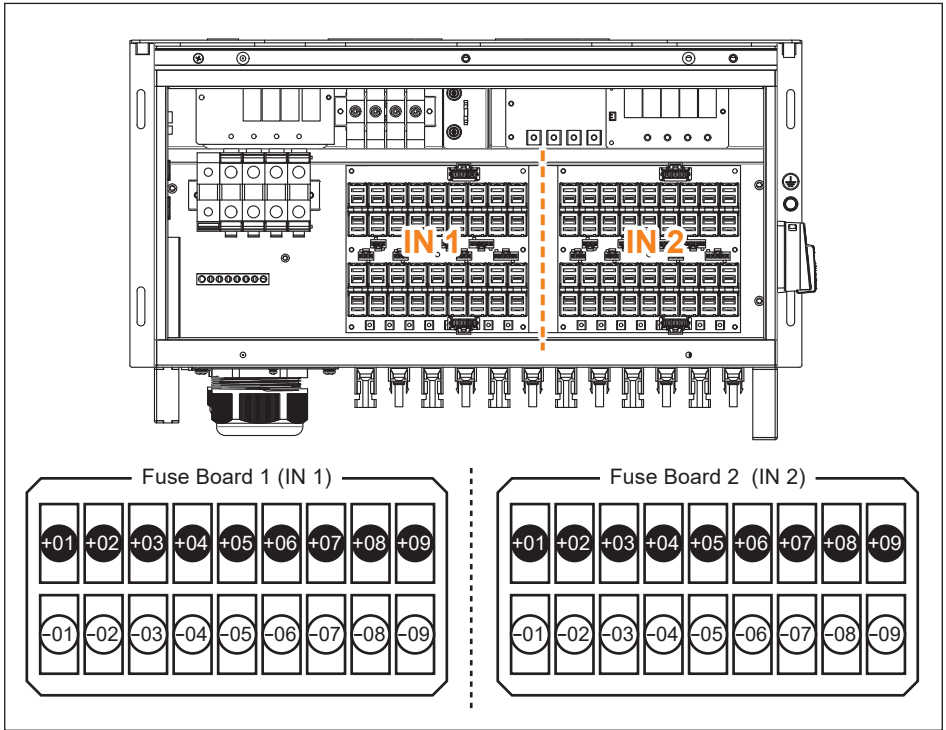


圖3-25：M88H₁₂₂配線箱架構圖

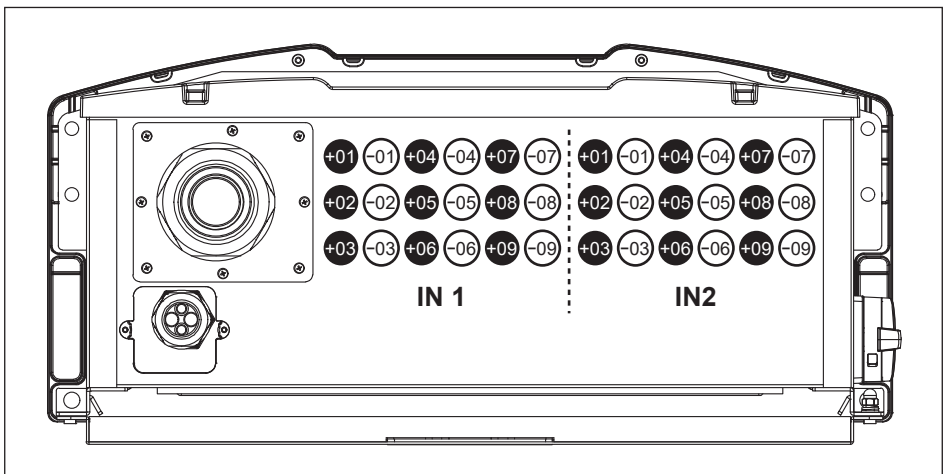


圖3-26：M88H₁₂₂直流端子位置

3.5 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。

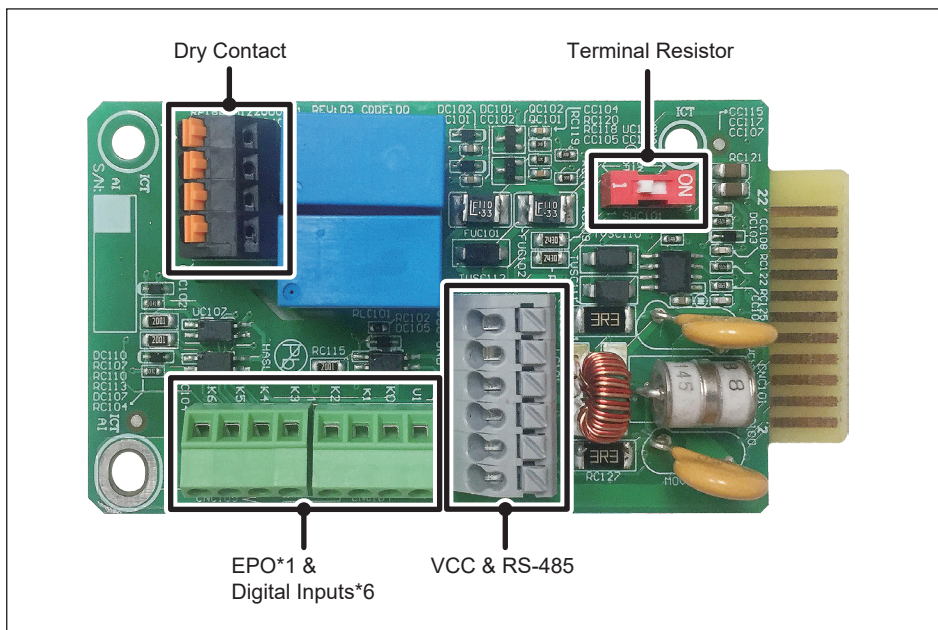


圖3-27：通訊模組

3.5.1 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。

- 只有一台變流器連接：開啟終端電阻
- 多台變流器連接：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。

表3-4：RS-485腳位定義

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


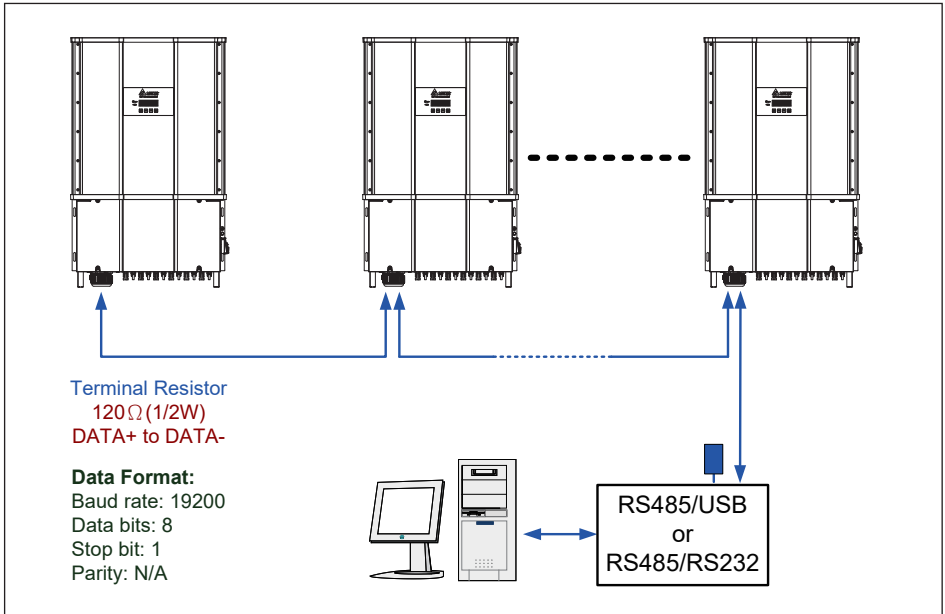



圖3-28：多台變流器連接示意圖

表3-5：終端電阻設定

	開關 1
開	終端電阻 開
關	終端電阻 關

3.5.2 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。

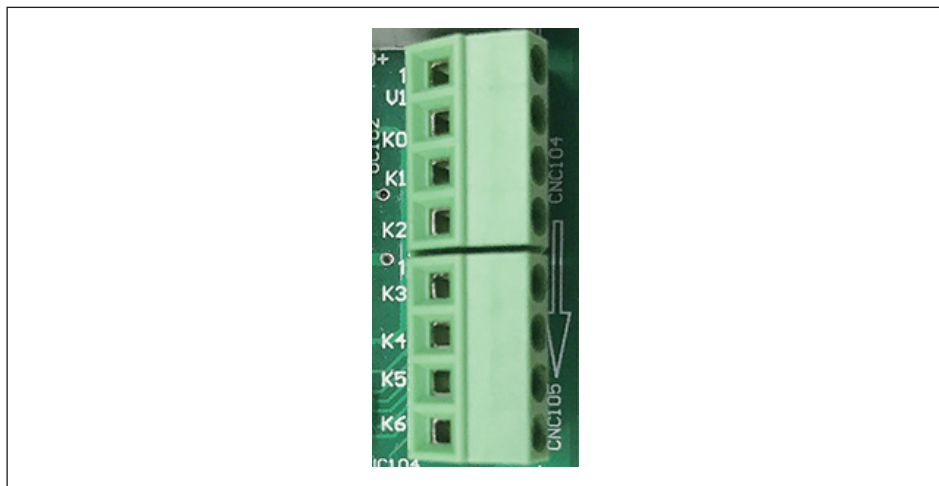


圖3-29 : EPO功能

表3-6 : EPO及數位輸入功能定義

短路	變流器動作
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

3.5.3 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4.8.5章節。
乾接點可以承受250Vac/28Vdc/9A 的電氣規格，適當線徑為20AWG (0.5mm²)。

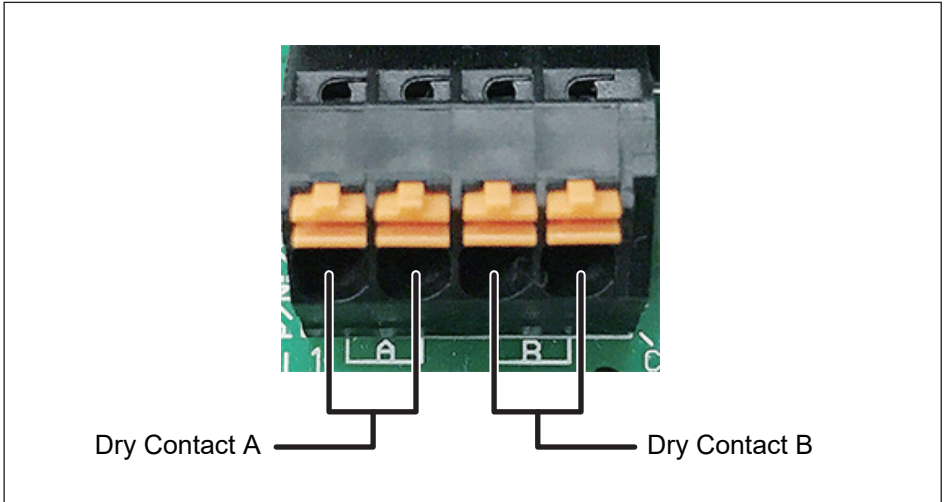


圖3-30：乾接點連接

3.6 案場絕緣測試

針對客戶想要於太陽能案場進行絕緣測試時，請依循下列步驟：

1. 確認直流開關於OFF的狀態
2. 請確認高阻計對變流器以及對地的接法正確如圖3-31，若是不正確的接線可能會導致變流器的損壞

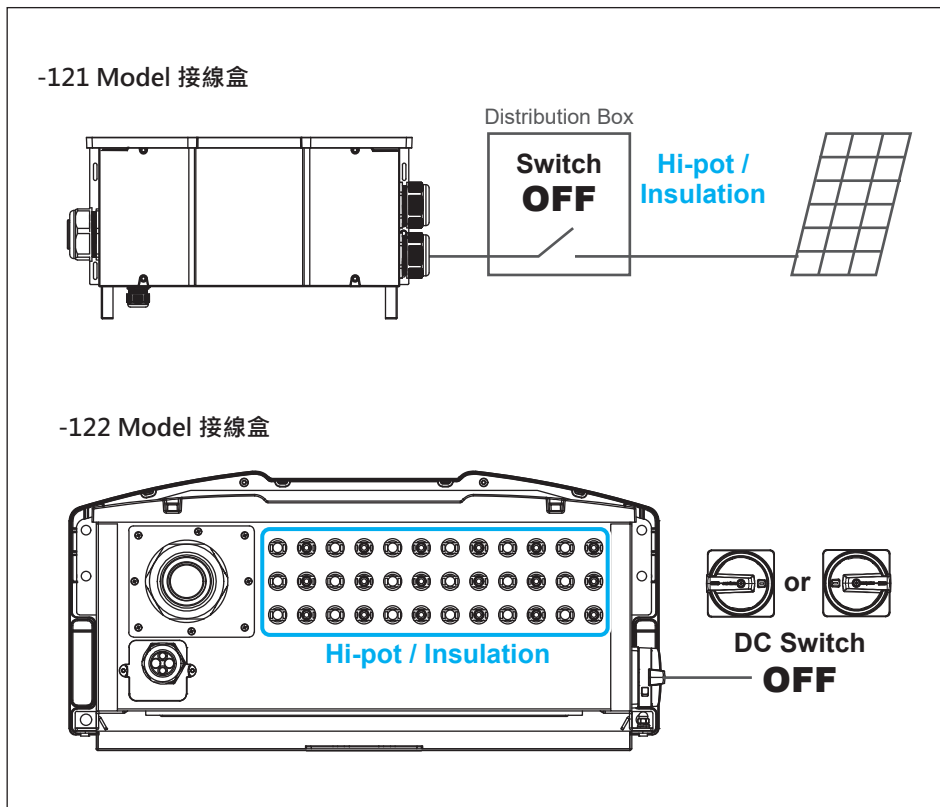


圖3-31：現場絕緣測試注意事項

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變流器。

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	4.3
Energy Log	4.4
Event Log	4.5
Inverter Information	4.6
General Settings	4.7
Install Settings	4.8
Active/Reactive Power	4.9
FRT	4.10

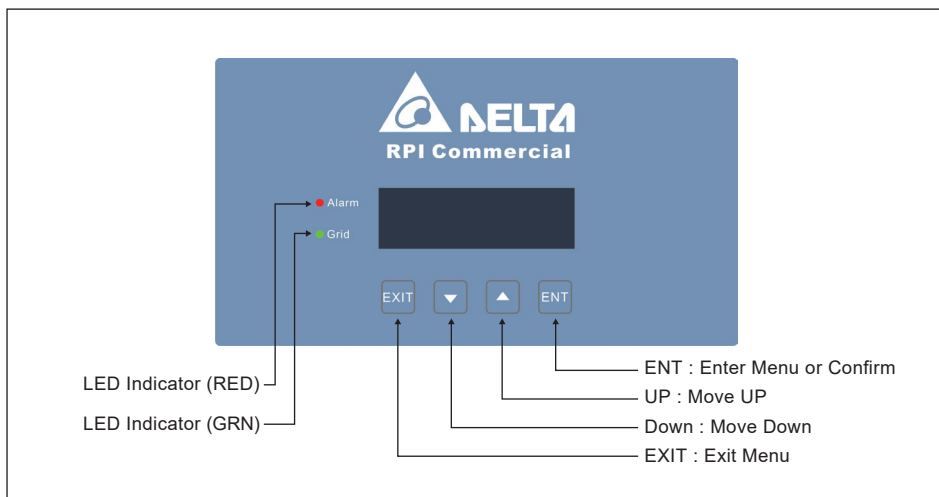


圖4-1 : 控制面板

表4-1 : LED指示燈

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

4.2 首次開機

初次運行時，請先將AC電源送入變流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，等待變流器初始自我測試約2分鐘後會進入併網倒數，倒數完畢變流器便會併網送電。

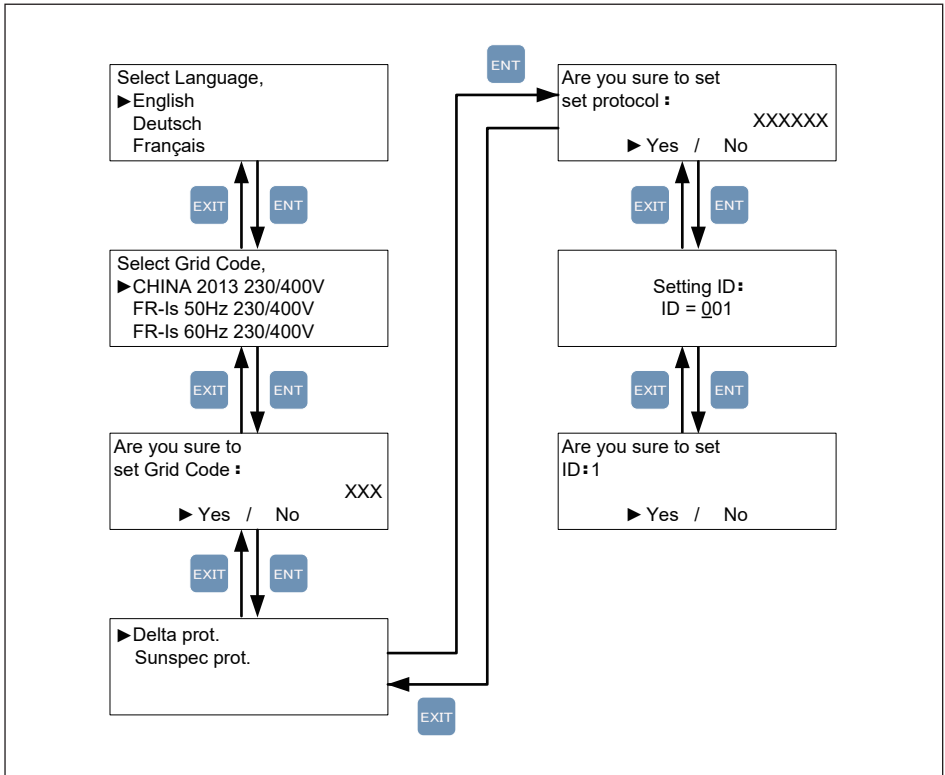


圖4-2：首次啟動之國別·語言及ID設定

4.2.1 主畫面

若變流器正常運作，即可在首頁看到輸出功率、變流器狀態、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主頁。

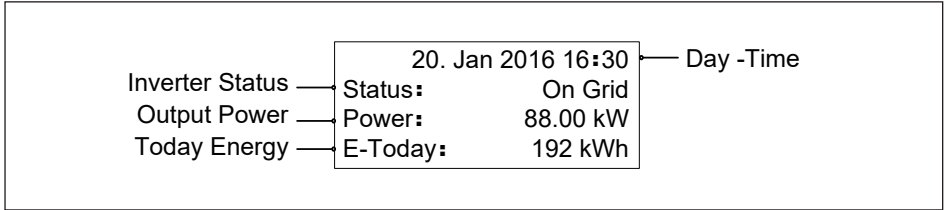


圖4-3：主畫面

4.3 Power meter / String monitoring

本頁面顯示交直流電壓，電流及功率

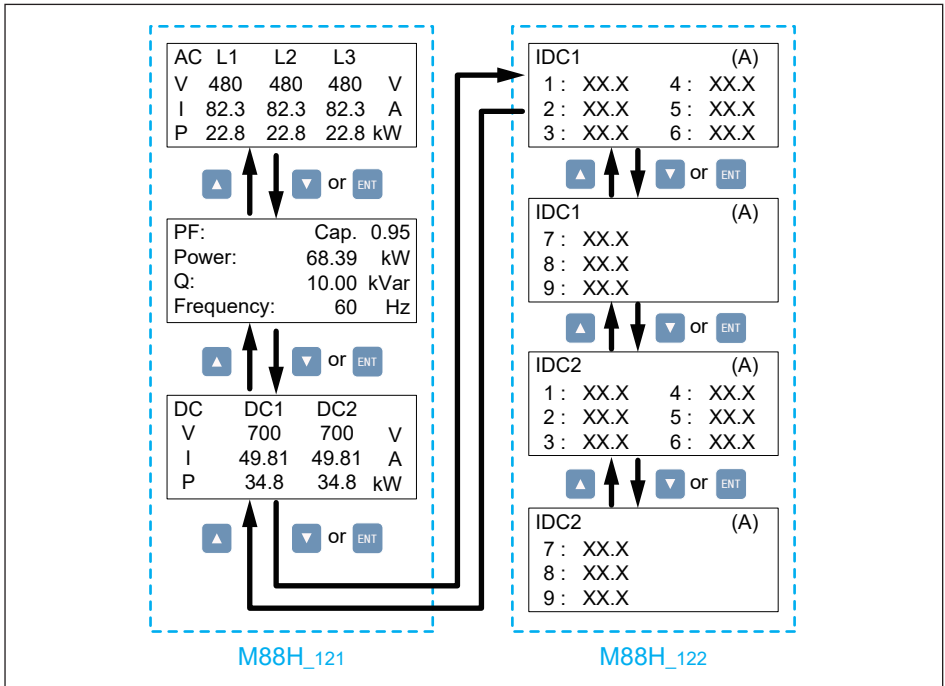


圖4-4：Power meter頁面

4.4 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。

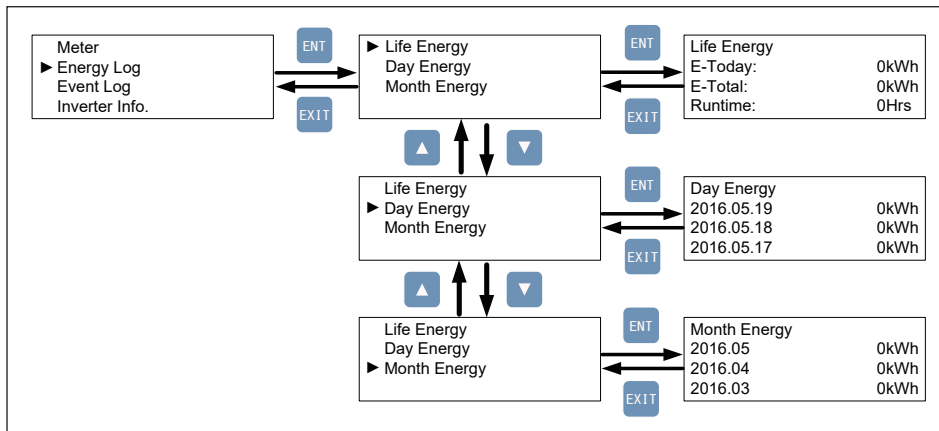


圖4-5 : Energy log頁面

4.5 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。

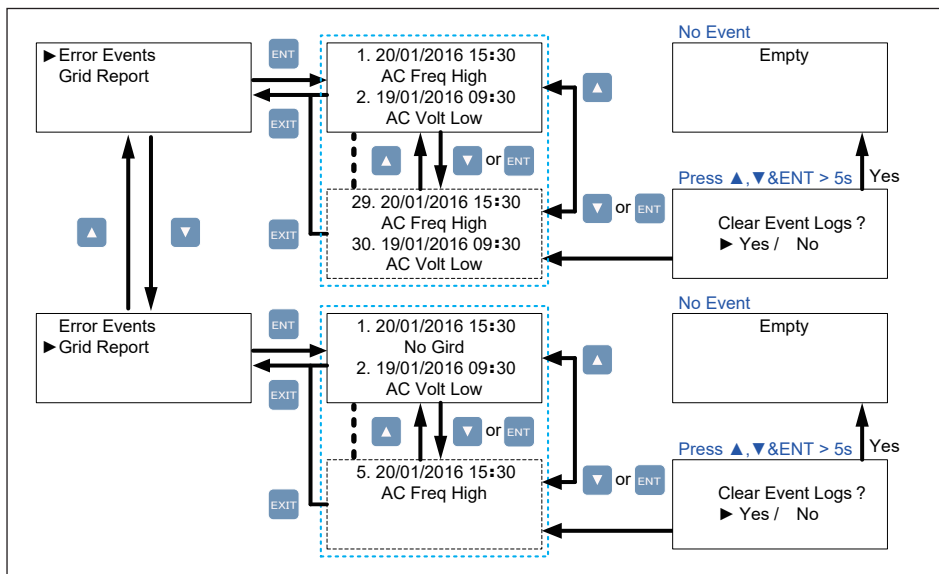


圖4-6 : Event log流程

4.6 Inverter Information

本頁面協助使用者確認變流器資訊，包含其序號、安裝日、ID、韌體版本。

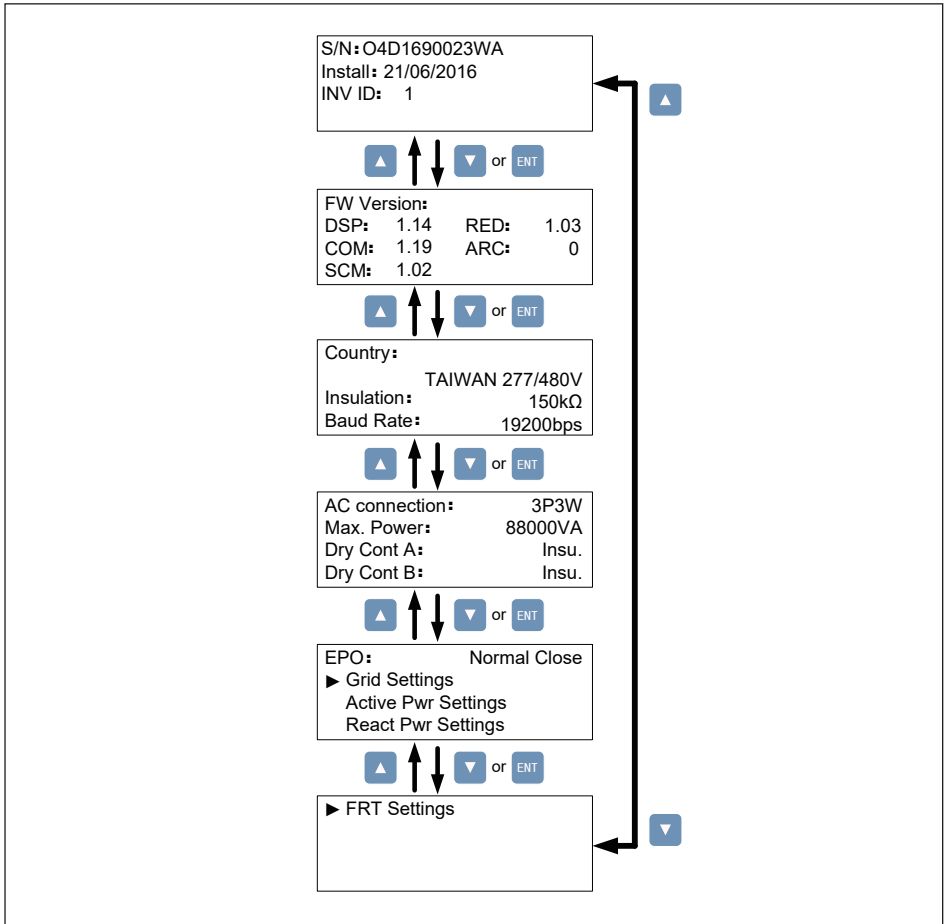


圖4-7 : Inverter information 頁面

4.7 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。

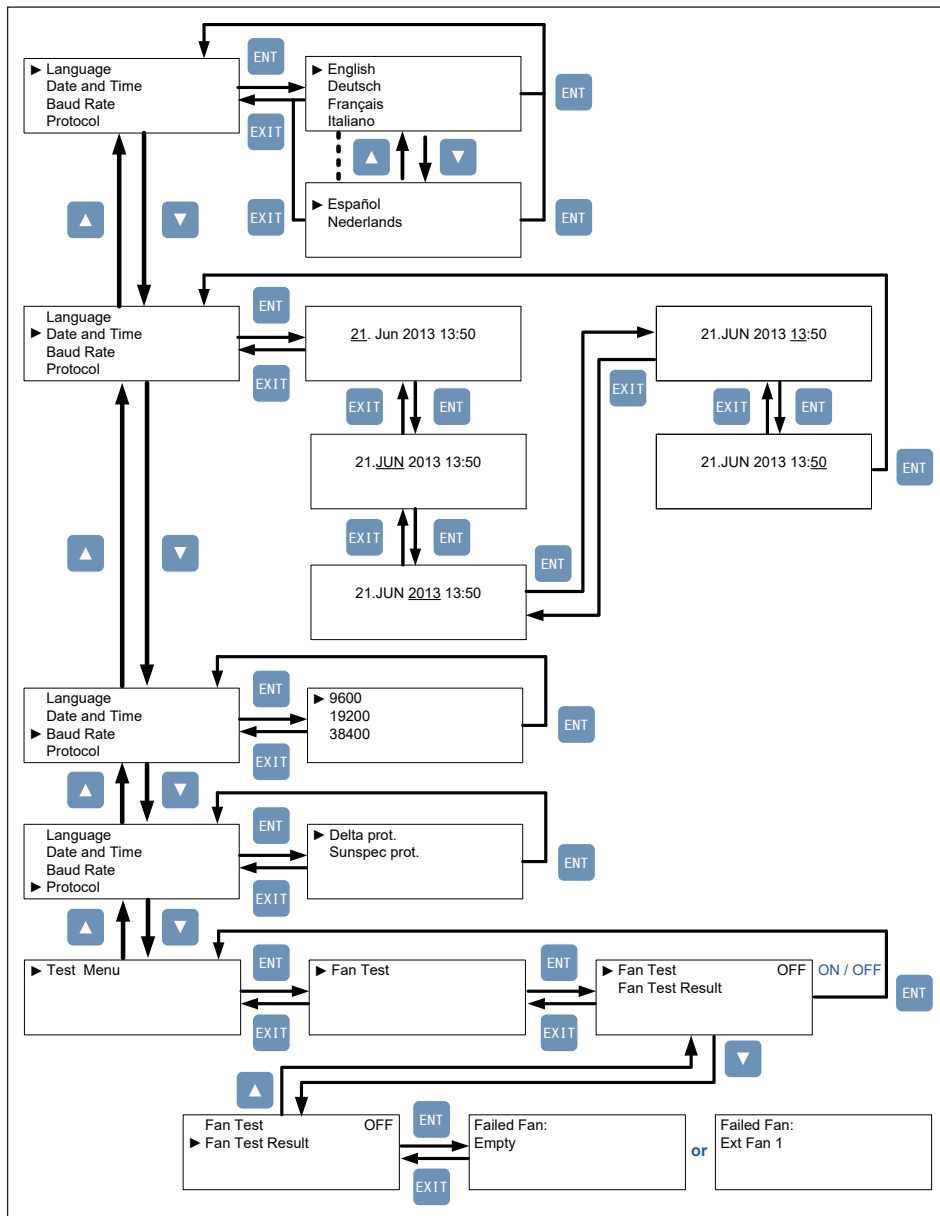


圖4-8 : General settings頁面

4.8 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。

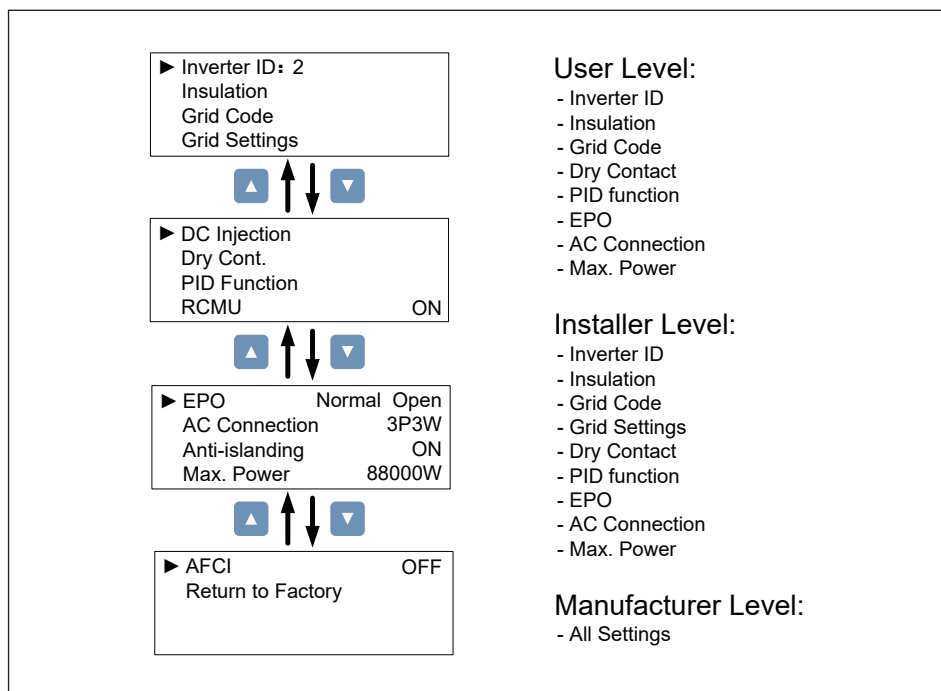


圖4-9：Install settings頁面

4.8.1 Inverter ID

變流器ID供RS-485通訊使用，在同一串列上的變流器需有不同的ID。

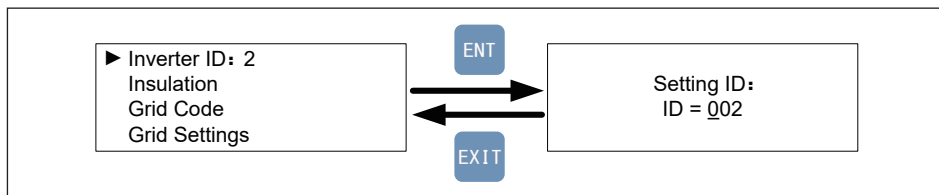


圖4-10：Inverter ID頁面

4.8.2 Insulation

併網前，變流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。

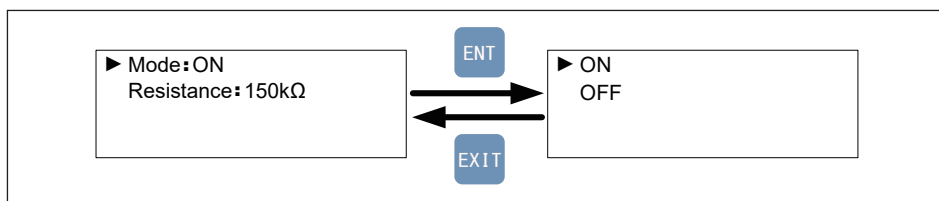


圖4-11：Insulation頁面

4.8.3 Grid Code

選單中的每一個國家選項即代表一種電力法規，安裝者於安裝變流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。

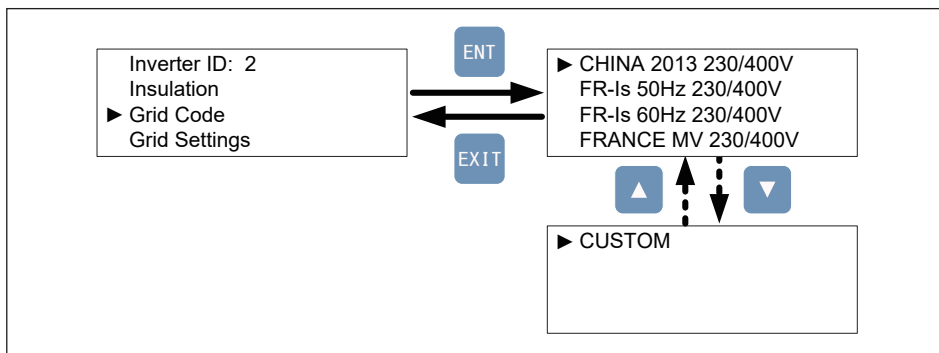


圖4-12：Grid Code頁面

4.8.4 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。

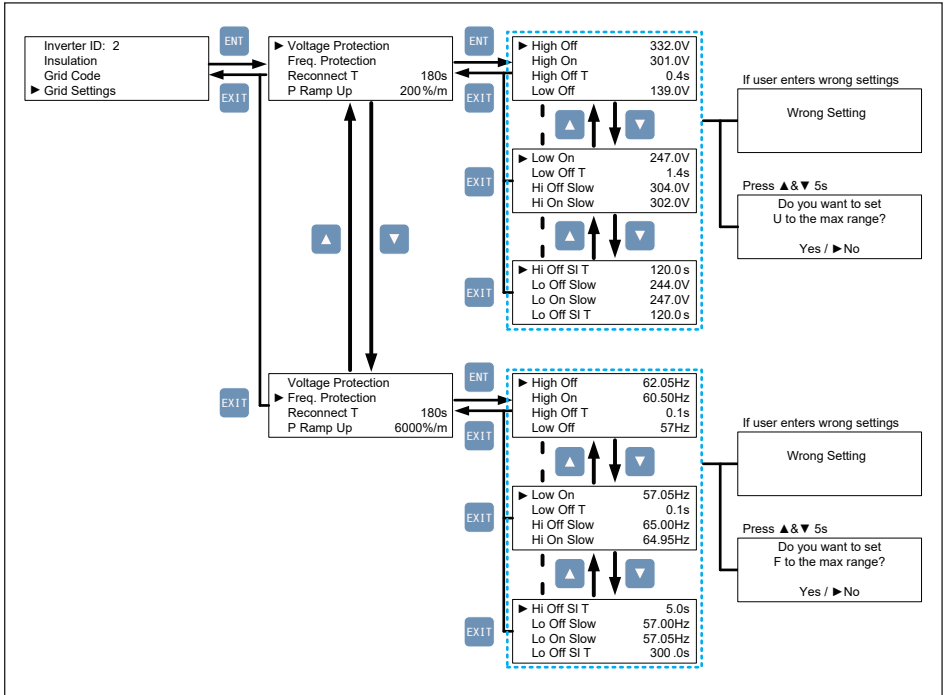


圖4-13 : Grid Settings 頁面

4.8.5 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。

表4-2：乾接點作動條件設定

設定	乾接點作動條件
Disable (無作用)	無反應
On Grid (併網)	變流器併網
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

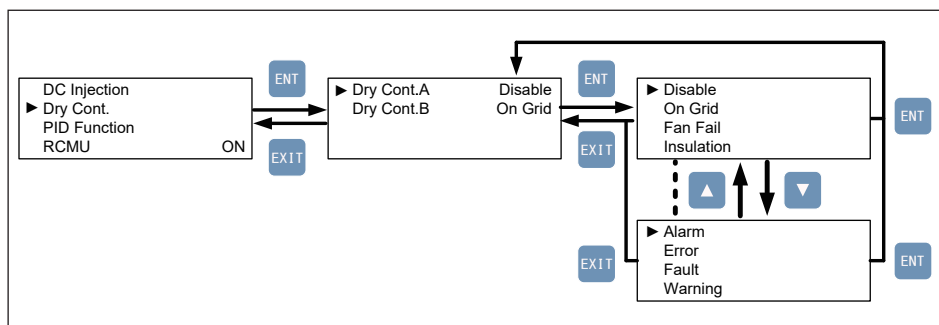


圖4-14：Dry Contact 頁面

4.8.6 Anti-PID function

預設作動時間為0，使用者可選擇0~10小時，或自動模式。

Anti-PID 功能會在No DC出現後30分鐘內啟動，台達擁有專屬的夜間Anti-PID 解決方案專利。

* 請不要同時運行 Anti-PID 跟 Q setting 24/7 功能。

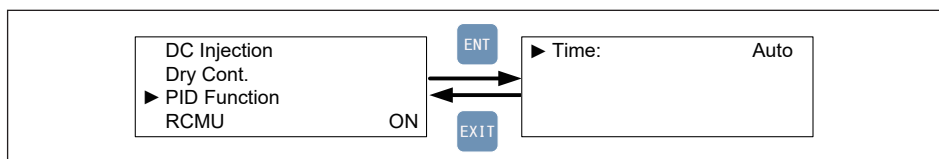


圖4-15：PID Function 頁面

4.8.7 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	3P3W
Anti-islanding	ON
Max. Power	88000W

圖4-16：EPO頁面

4.8.8 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	3P3W
Anti-islanding	ON
Max. Power	88000W

圖4-17：AC配線方式

4.8.9 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變流器的最大功率輸出額度。

EPO	Normal Close
AC Connection	3P3W
Anti-islanding	ON
▶ Max. Power	88000W

圖4-18：Max. Power頁面

4.9 Active/Reactive Pwr

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。

- 所有功能的電壓設置由相電壓去作設定的。 -

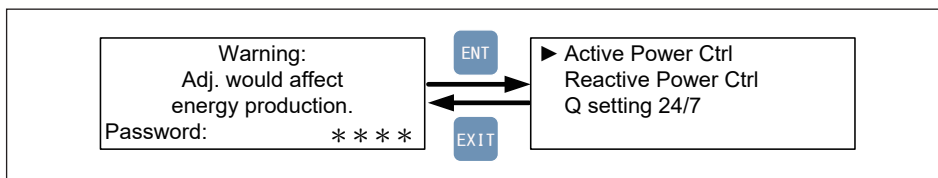


圖4-19 : Active / Reactive pwr 頁面

4.9.1 Active Power Ctrl

於實功控制頁面中有三個功能，分別為Power Limit、Power vs. Frequency及P(V)。各功能詳細的敘述請參考以下小節。

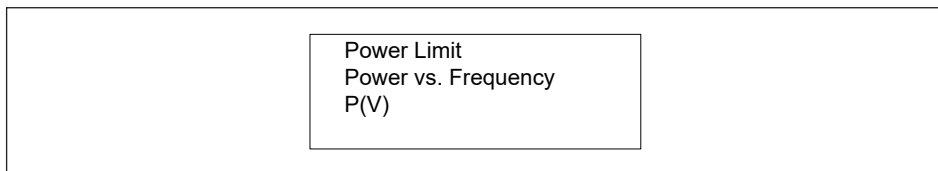


圖4-20 : Active Power Ctrl 頁面

4.9.1.1 Power limit

此控制模式可限制變流器之輸出功率。使用者可透過設定Set Point來指定變流器所能輸出的最大功率。

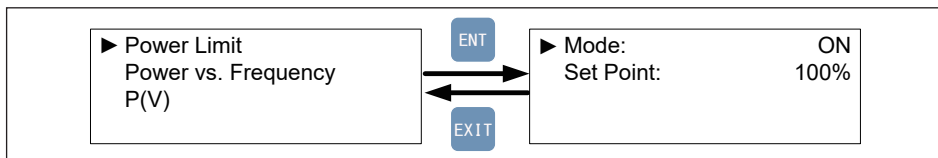


圖4-21 : Power Limit 頁面

4.9.1.2 Power vs frequency

此模式開啟後，變流器可隨著市電頻率升高而自動降低其輸出功率。

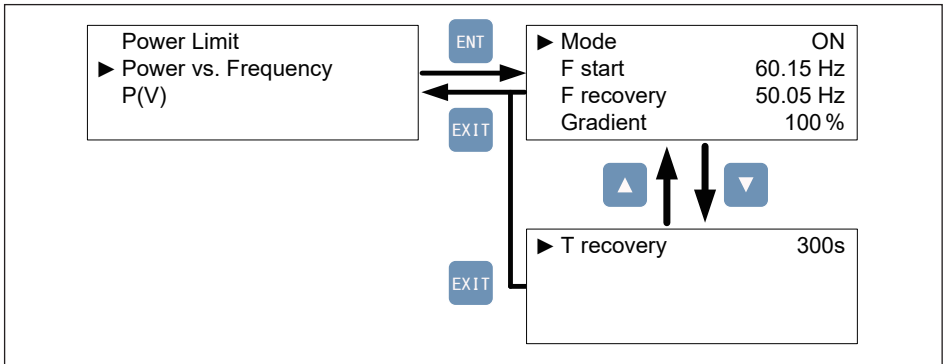


圖4-22 : Power vs Frequency 頁面

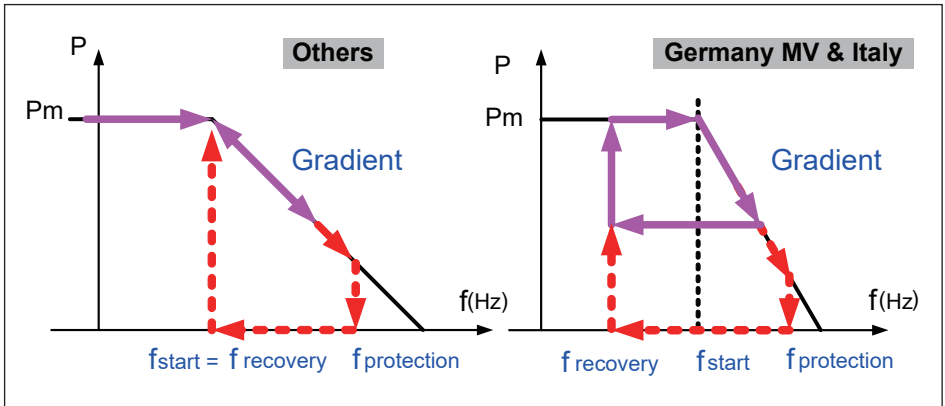


圖4-23 : Power vs Frequency參數對照

4.9.1.3 P(V)

此模式啟動後，當市電電壓大於V lock-in且此時變流器之輸出功率大於P lock-in時，變流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。

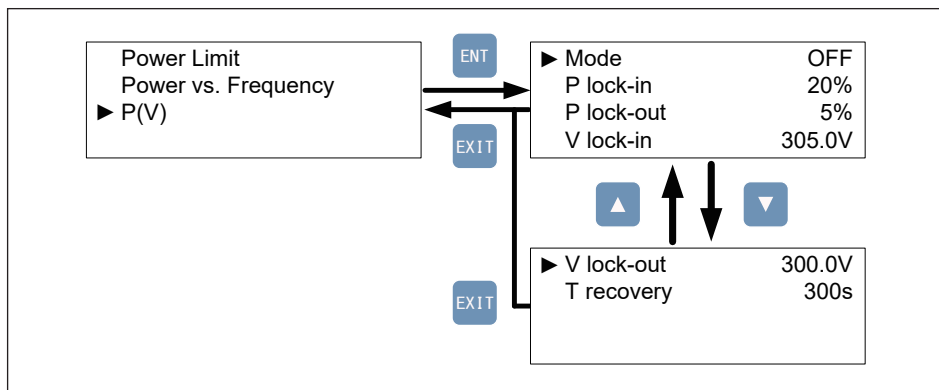


圖4-24 : P(V)頁面

4.9.2 Rective power Ctrl

於虛功控制頁面中有四個功能，分別為Constant cos-phi、cos-phi(P)、Constant Q及Q(V)。各功能詳細的敘述請參考以下小節。

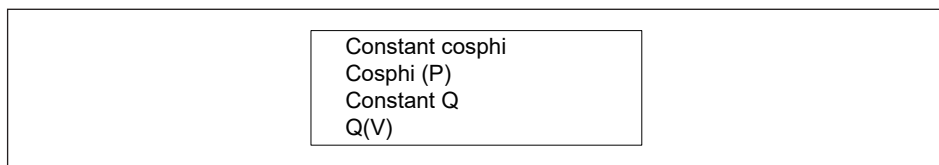


圖4-25 : Reactive Power Ctrl 頁面

4.9.2.1 Constant cosphi

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

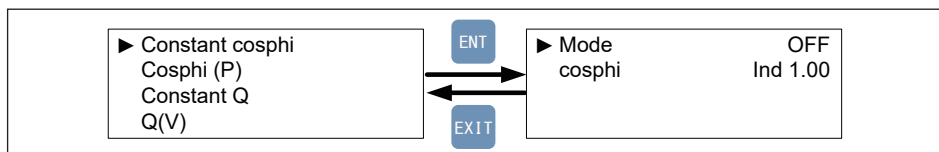


圖4-26 : Constant cosphi 頁面

4.9.2.2 Cosphi (P)

此功能啟動後，變流器可隨著輸出之實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。

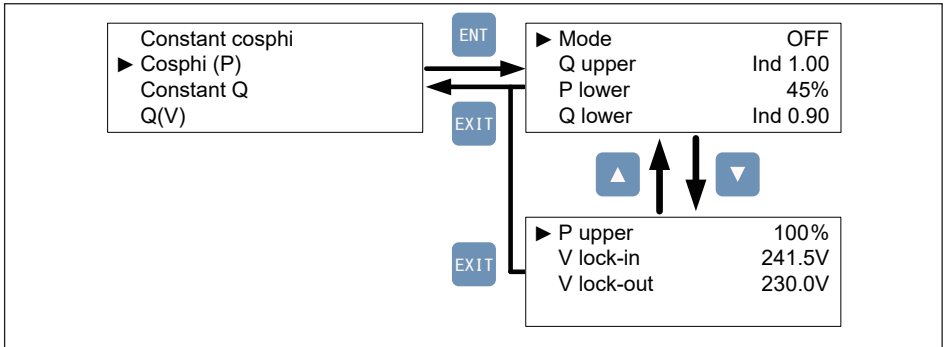


圖4-27 : Cosphi (P)頁面

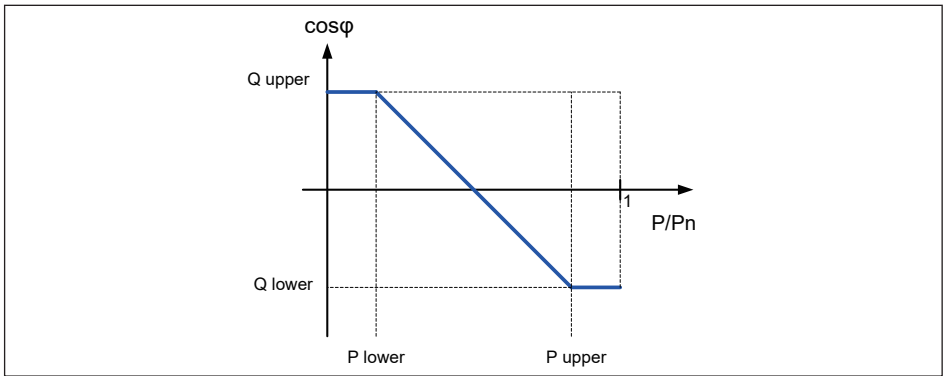


圖4-28 : Cosphi (P)參數對照

4.9.2.3 Constant Q

此模式啟動後，變流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。

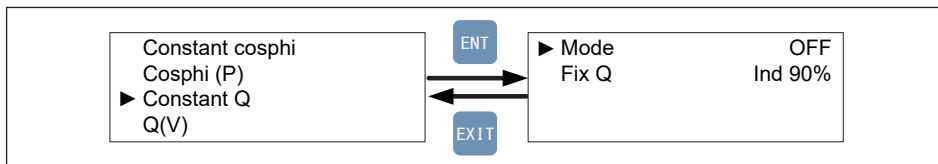


圖4-29 : Constant Q頁面

4.9.2.4 Q(V)

此模式啟動後，變流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。

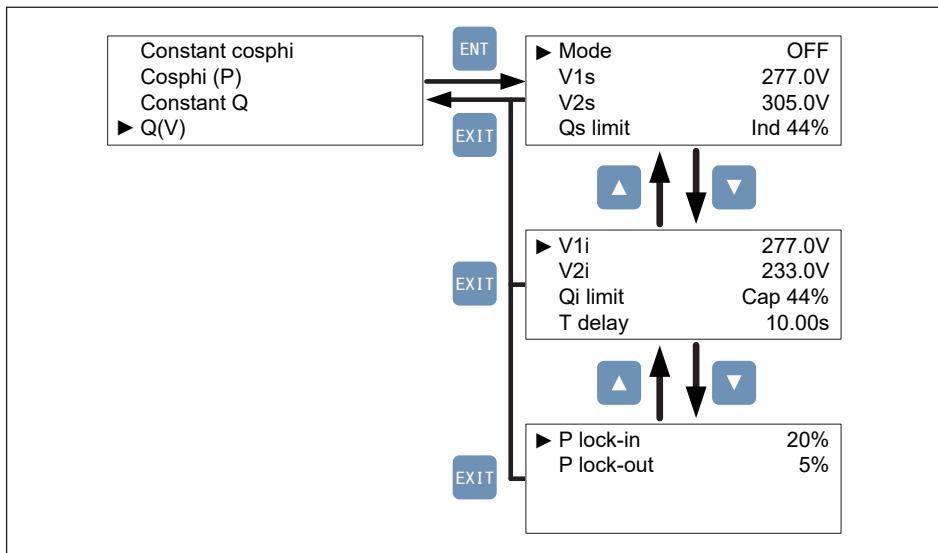


圖4-30 : Q(V)頁面

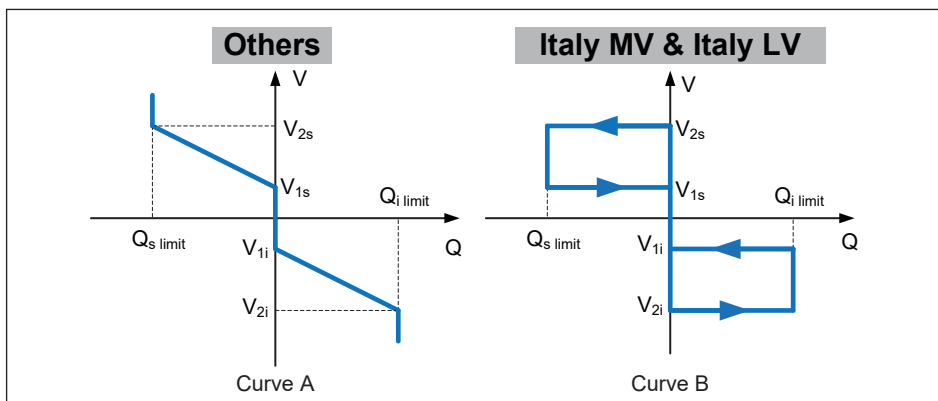


圖4-31 : Q(V)參數對照

4.9.3 Q setting 24/7 function

於Q setting 24/7頁面中有四個功能，分別為Q setting point, Q(P), Q(V), Q(T)。當使用此控制模式時，變流器於夜間時會保持併網，並饋入使用者設定的虛功量。假使變流器於夜間解除併網狀態，則必須等到直流端有足夠的電壓才會使變流器重新啟動。各功能詳細的敘述請參考以下小節。

* 請不要同時運行 Q setting 24/7 跟 Anti-PID 功能

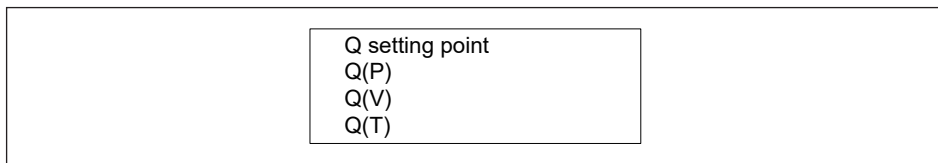


圖4-32 : Q setting 24/7 頁面

4.9.3.1 Q setting point

在Q setting point頁面中，使用者得以百分比的形式設定變流器饋入電網的虛功量。

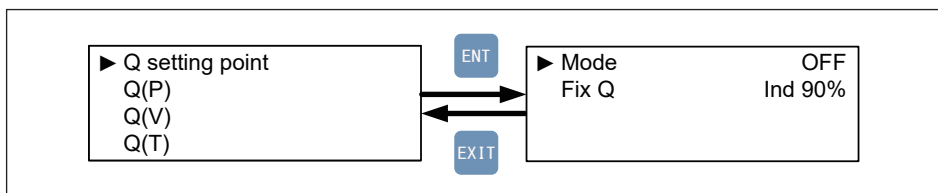


圖4-33 : Q setting point 頁面

4.9.3.2 Q(P)

Q(P)功能可以使變流器根據實功率高低而饋入一定比例的虛功。

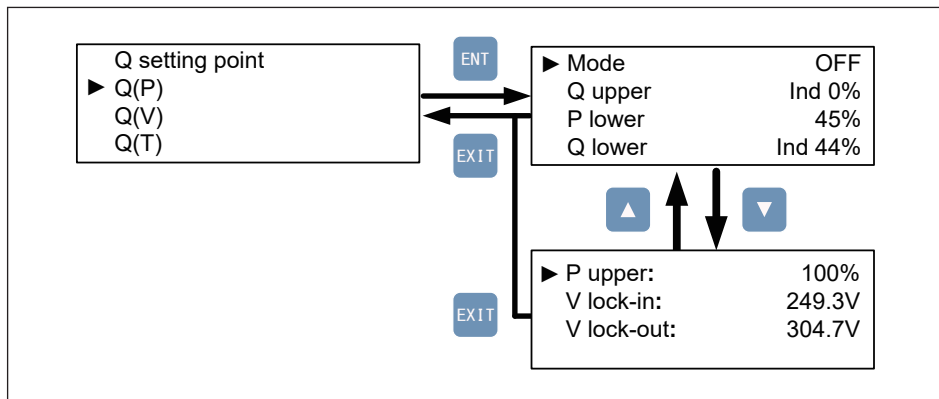


圖4-34 : Q(P) 頁面

4.9.3.3 Q(V)

此模式啟動後，變流器會根據市電電壓變化而饋入不同的虛功功率。此功能設定流程與4.9.2.4節相同。

4.9.3.4 Q(T)

此功能開啟後，可以供使用者利用外部監控系統進行排程，依據時間控制饋入電網的虛功。

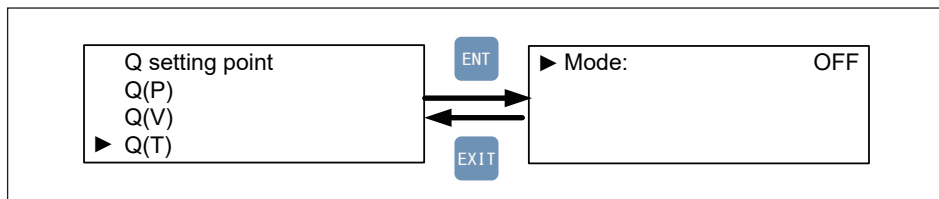


圖4-35 : Q(T) 頁面

4.10 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。

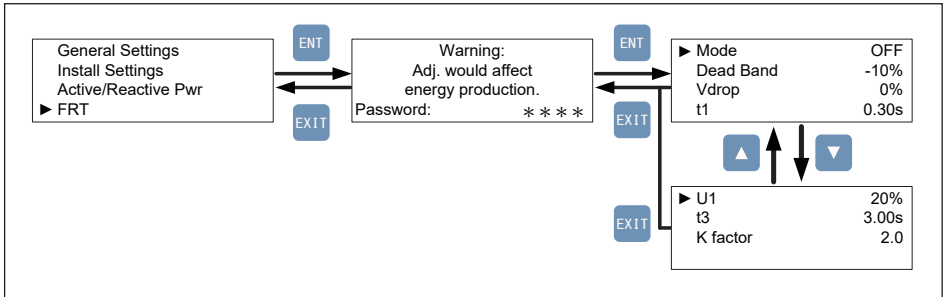


圖4-36 : FRT頁面

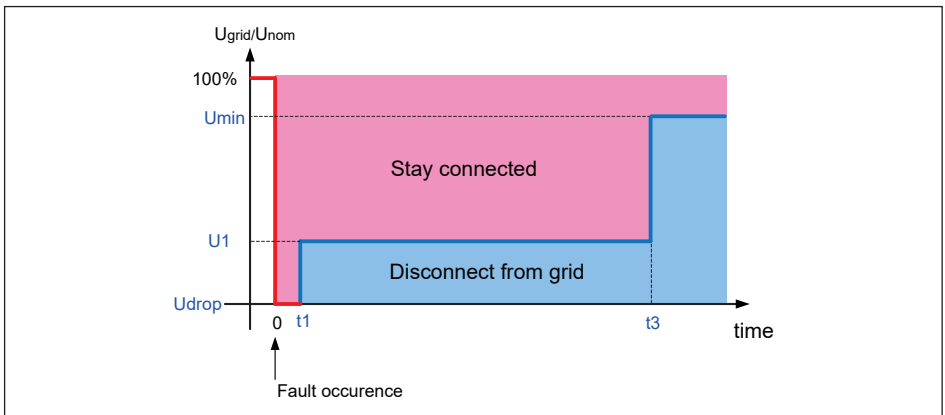


圖4-37 : FRT參數對照

5 維護

為確保PV Inverter正常運轉，請至少每半年確認一次變流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 卸下和重新安裝接線盒上蓋

為保證變流器長期正常運行，請遵循以下說明必須遵循程序來拆卸和重新安裝接線盒上蓋，請參閱到圖5-1。

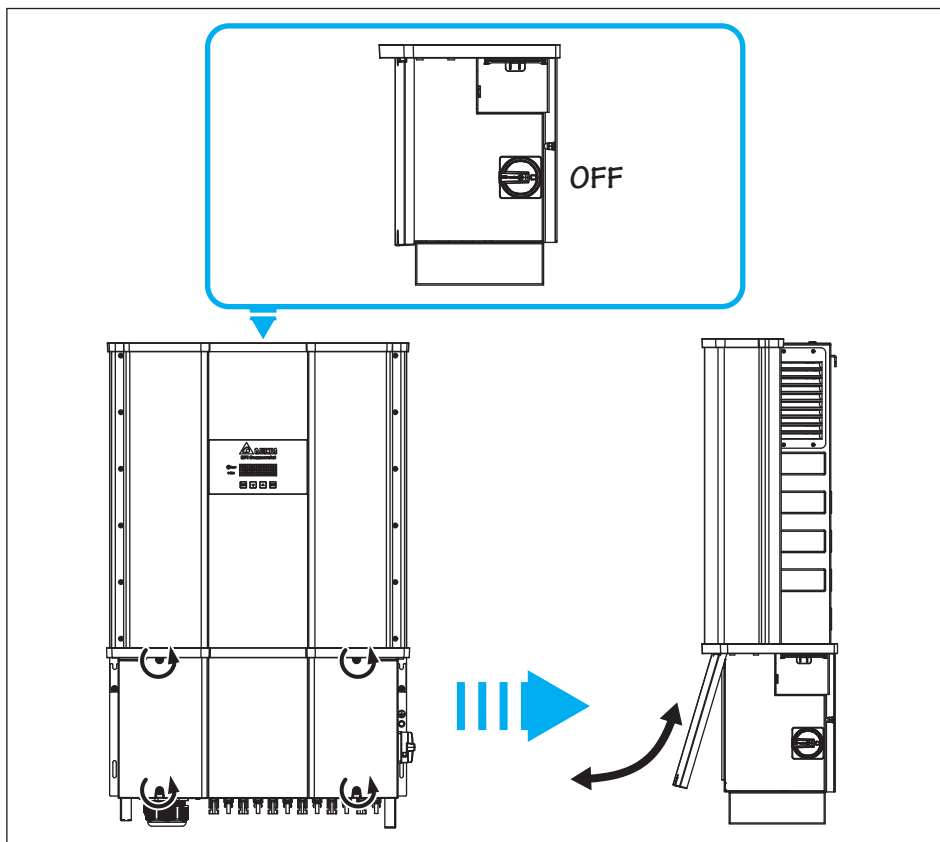


圖5-1：卸下並重新安裝接線盒上蓋

5.1.1 卸下接線盒上蓋

- 對於變流器沒有環境保護的狀態下，於潮濕的氣候或下雨天請勿開啟接線盒上蓋
- 切斷交流與直流開關，等待液晶顯示熄滅
- 卸下接線盒上蓋前確保上蓋清潔
- 鬆開接線盒上蓋的四顆螺絲，並取下上蓋
- 請保持上蓋表面與防水膠條的清潔

取下接線盒上蓋後，請不要長時間暴露接線盒

5.1.2 重新安裝接線盒上蓋

卸下接線盒上蓋後，勿長時間暴露接線盒內部

重新安裝接線盒上蓋前：

1. 確認上蓋與接線盒的接合面及膠條無髒污
2. 確認膠條無脫離上蓋溝槽

安裝接線盒上蓋時：

1. 用手扶住接線盒上蓋確保對準螺絲孔位
2. 以對角方式先預鎖四顆螺絲
3. 再以21 in-lb (2.37N·m) 的鎖附扭力完整鎖緊

安裝接線盒上蓋後：

1. 確認螺絲鎖附方向無歪斜
2. 確認螺絲無突出上蓋表面

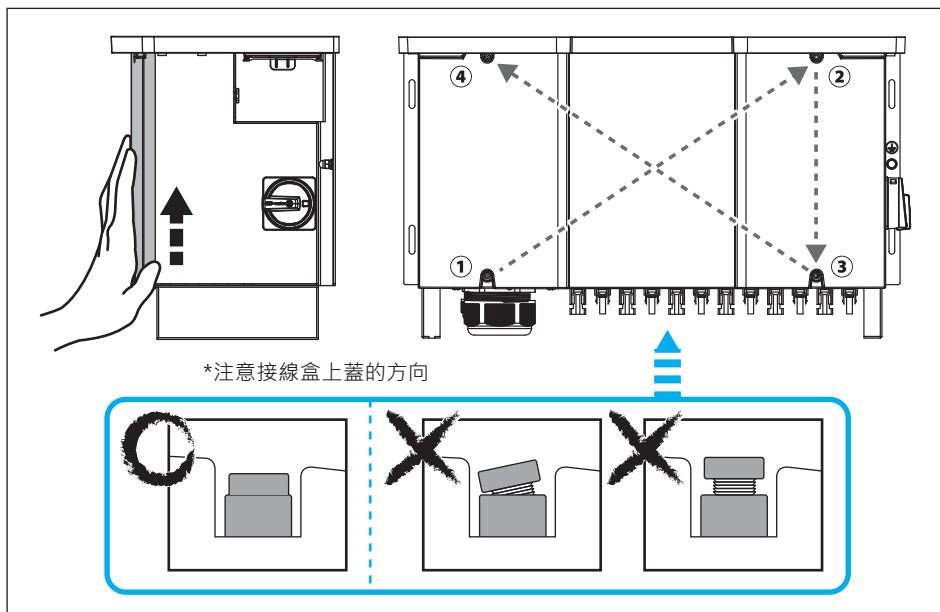


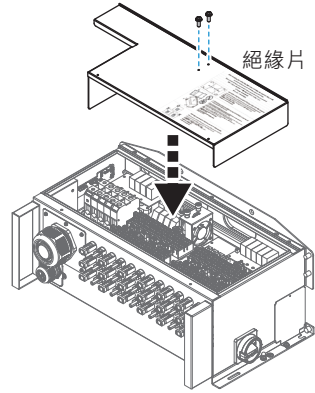
圖5-2：接線盒上蓋的重新安裝程序

注意



若在配線或維護期間有需要取下絕緣片，在安裝接線盒上蓋前請必須將絕緣片放回接線盒，請參考右圖。

*組裝所需的螺釘扭矩: 8 kgf.cm (0.8N·m)



5.2 更換SPD

M88H系列機種於交直流側皆含有突波吸收裝置如圖5-3所示，表5-1列出所使用的突波吸收裝置規格。

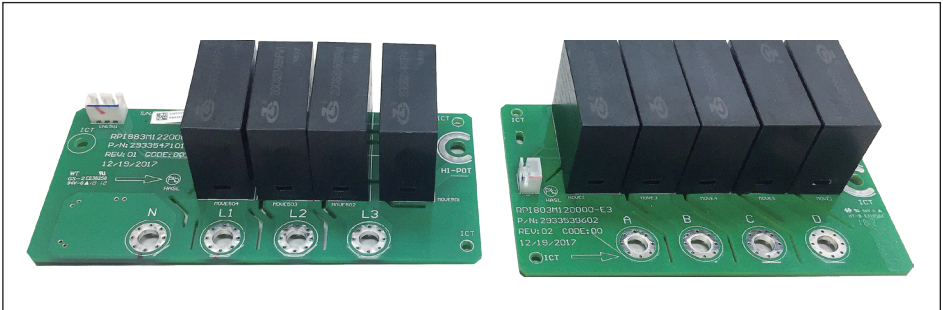


圖5-3：交直流突波吸收裝置

表5-1：交直流突波吸收裝置規格

Specification of SPD
Work voltage : 895V (AC RMS value) 1175V (DC)
Work Amp In (8/20 μ s) : 10kA
Rate Amp I max (8/20 μ s) : 20kA
Temperature : -40 $^{\circ}$ C~85 $^{\circ}$ C
Manufacturers :
Sichuan Zhongguang Lightning Protection Technologies Co., Ltd

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5-4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。

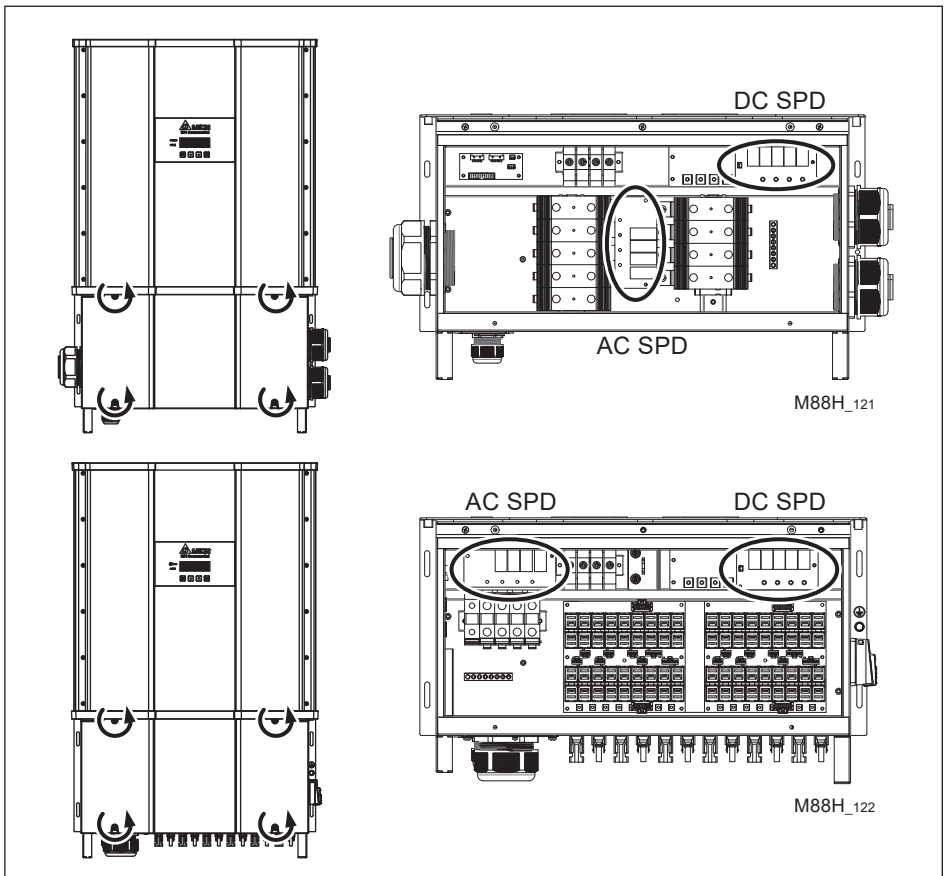


圖5-4：移除配線箱上蓋

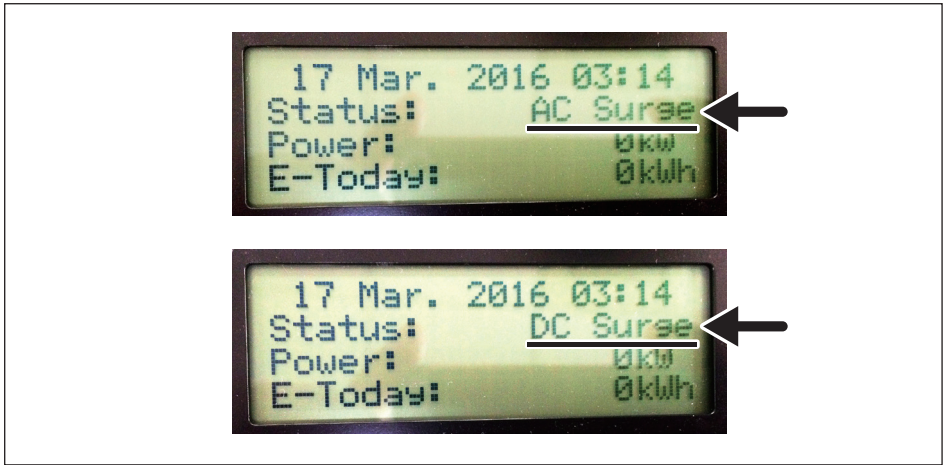


圖5-5：AC/DC SPD 損壞時的告警

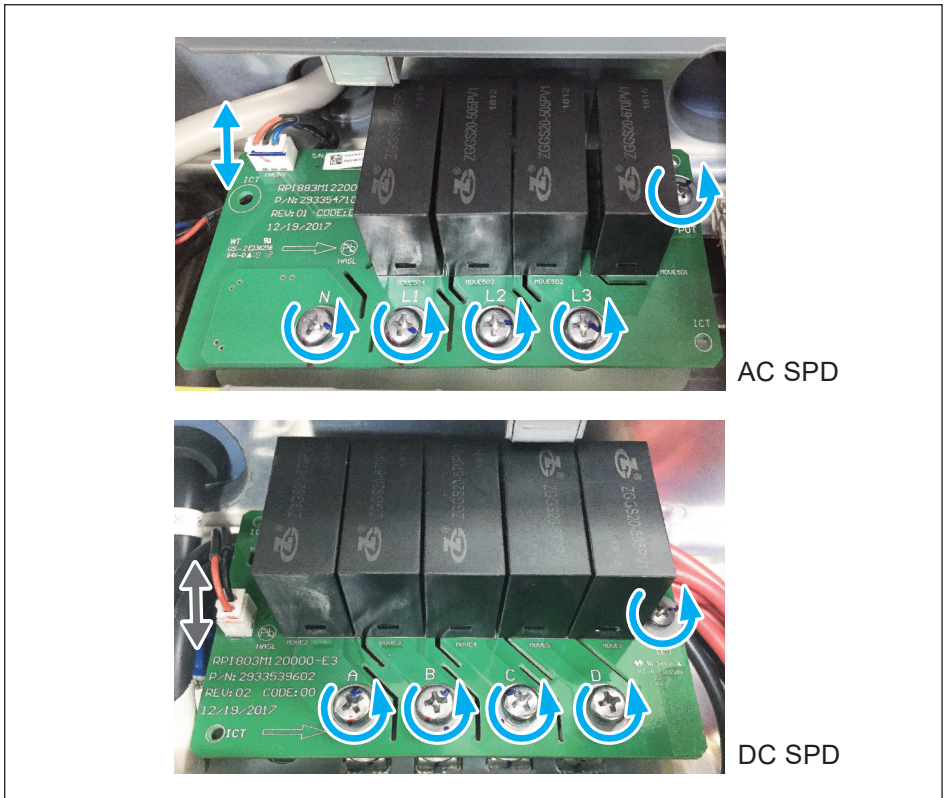


圖5-6：拔起連接線並移除螺絲

M88H₁₂₂ 接線盒內直流正負端總共配有36個拉拔式保險絲座，可支援18串的太陽能模組（9串/ MPPT），保險絲座分別在兩張電路板上（一張/ MPPT），拉拔式保險絲座可以取出保險絲座更安全方便。
 拉拔式保險絲的位置如圖5-7所示，拔除保險絲座的方法請參考圖5-8；接線盒更詳細的資訊請參考前述章節圖2-4。

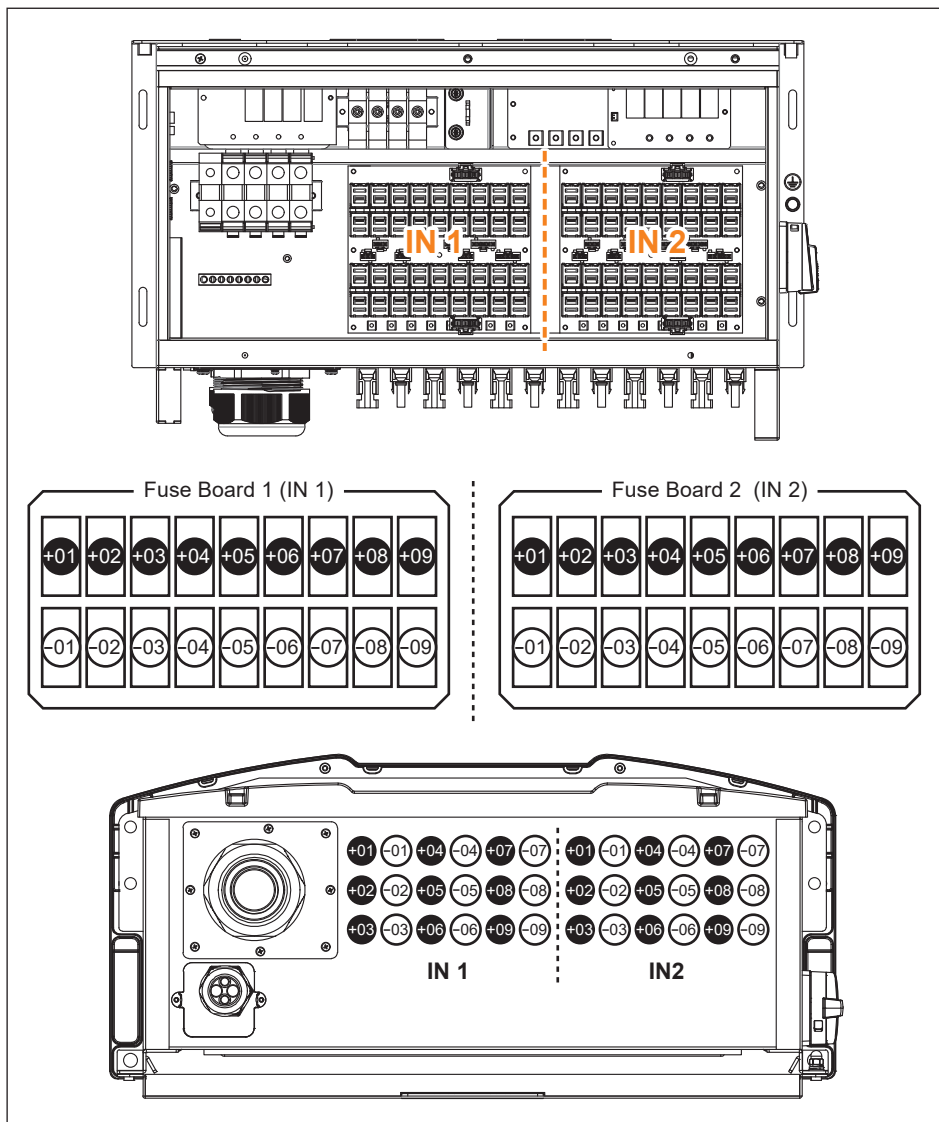


圖5-7：M88H₁₂₂ 拉拔式保險絲座

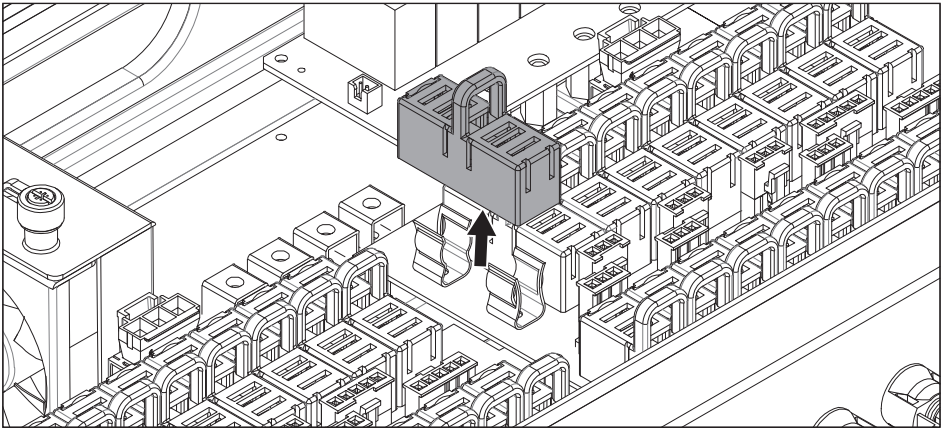


圖5-8：拔除保險絲座的方法

若變流器發生發電異常，請依照下列步驟檢查保險絲：

1. 檢查液晶顯示面板“Power meter / string monitoring”頁面，確認是否有組數顯示為零，若有則該組的保險絲有可能已經熔斷。
2. 切斷直流與交流電源並且等待液晶顯示面板熄滅。
3. 需要開啟接線盒，請參考**章節5.1.1**操作步驟。
4. 根據第一步驟，確認熔斷的保險絲位置並取下，取下後請確認用三用電錶確認是否已熔斷。
5. 若需要請更換新的保險絲。
6. 重新安裝接線盒上蓋時，請參考**章節5.1.2**。

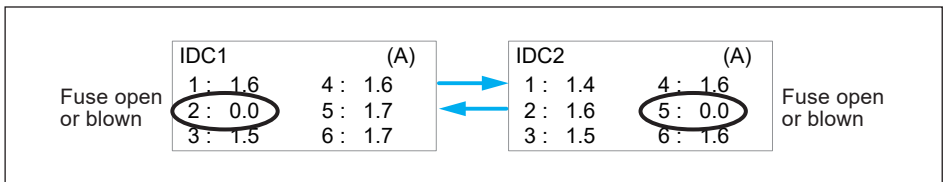


圖5-9：String monitor

警告！



- 拔除保險絲前，請確定變流器已停止運作，並拔除相對應的MC4接頭。

5.3 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5-10、5-11、5-12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5-10所示。下列的步驟為如何清洗濾網。

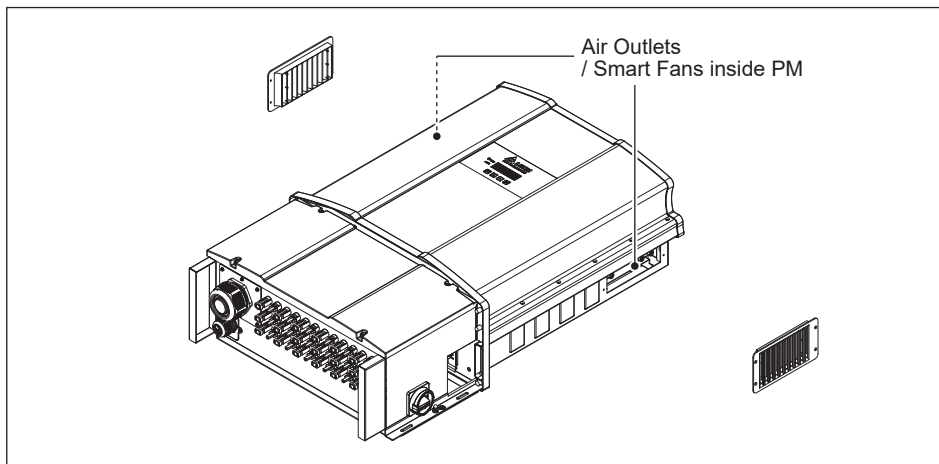


圖5-10：功率模組智慧風扇位置

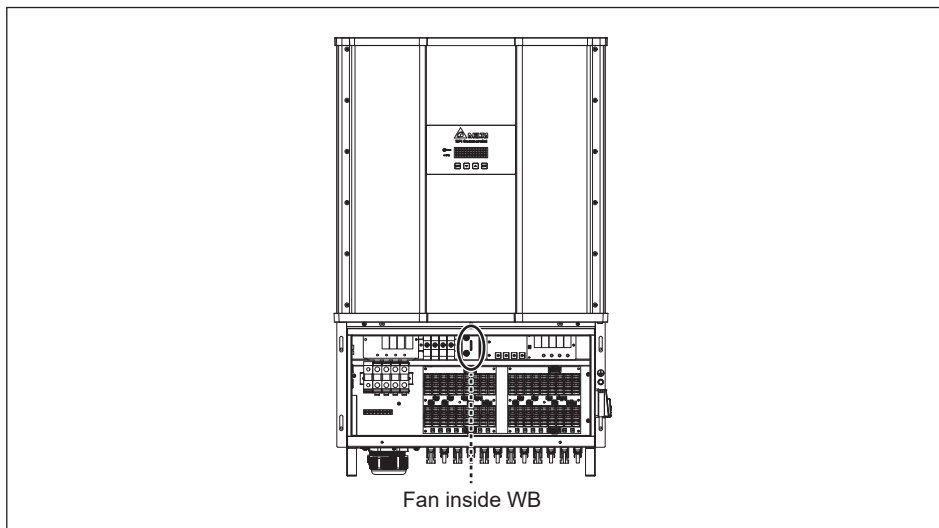


圖5-11：配線箱智慧風扇位置(僅M88H_122)

M88H系列內含12cm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。

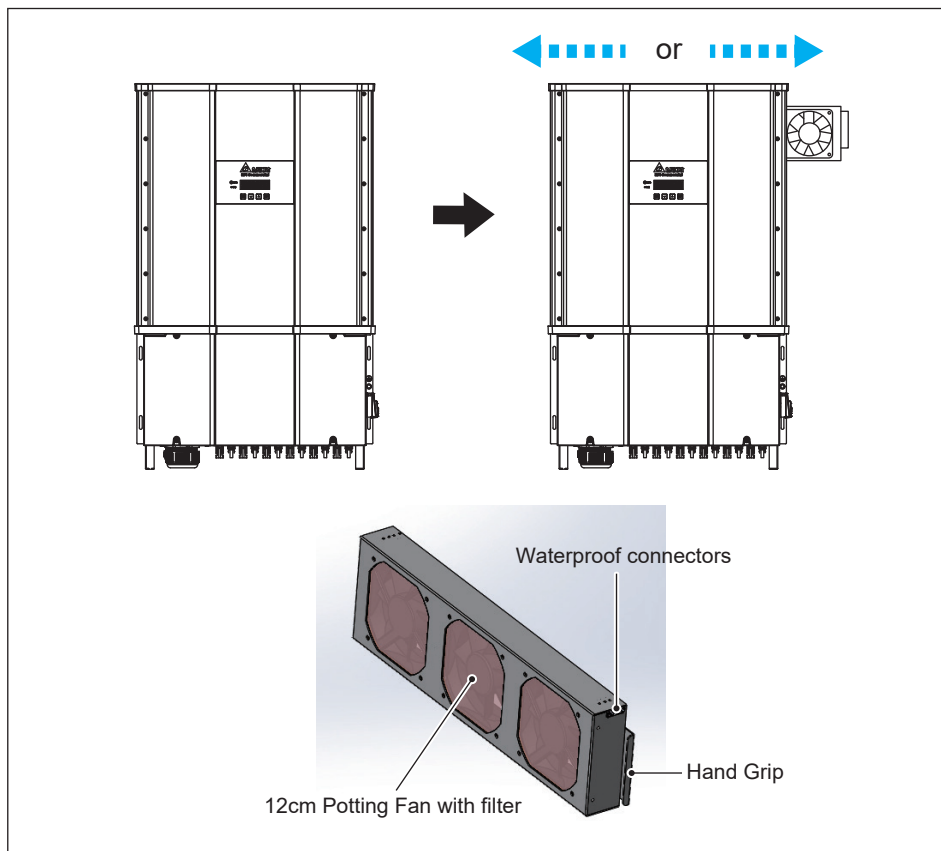


圖5-12：12cm風扇模組

注意



需要定期的風扇和過濾器清潔，以確保長壽命和可靠性。

- 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5-13)。最後將風扇模組替換後，將螺絲鎖上，連接線接上。



圖5-13：拆卸配線箱區塊之智慧風扇 (僅M88H_122)

功率模組區塊：

圖5-14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5-14組圖5為整個風扇槽的外觀

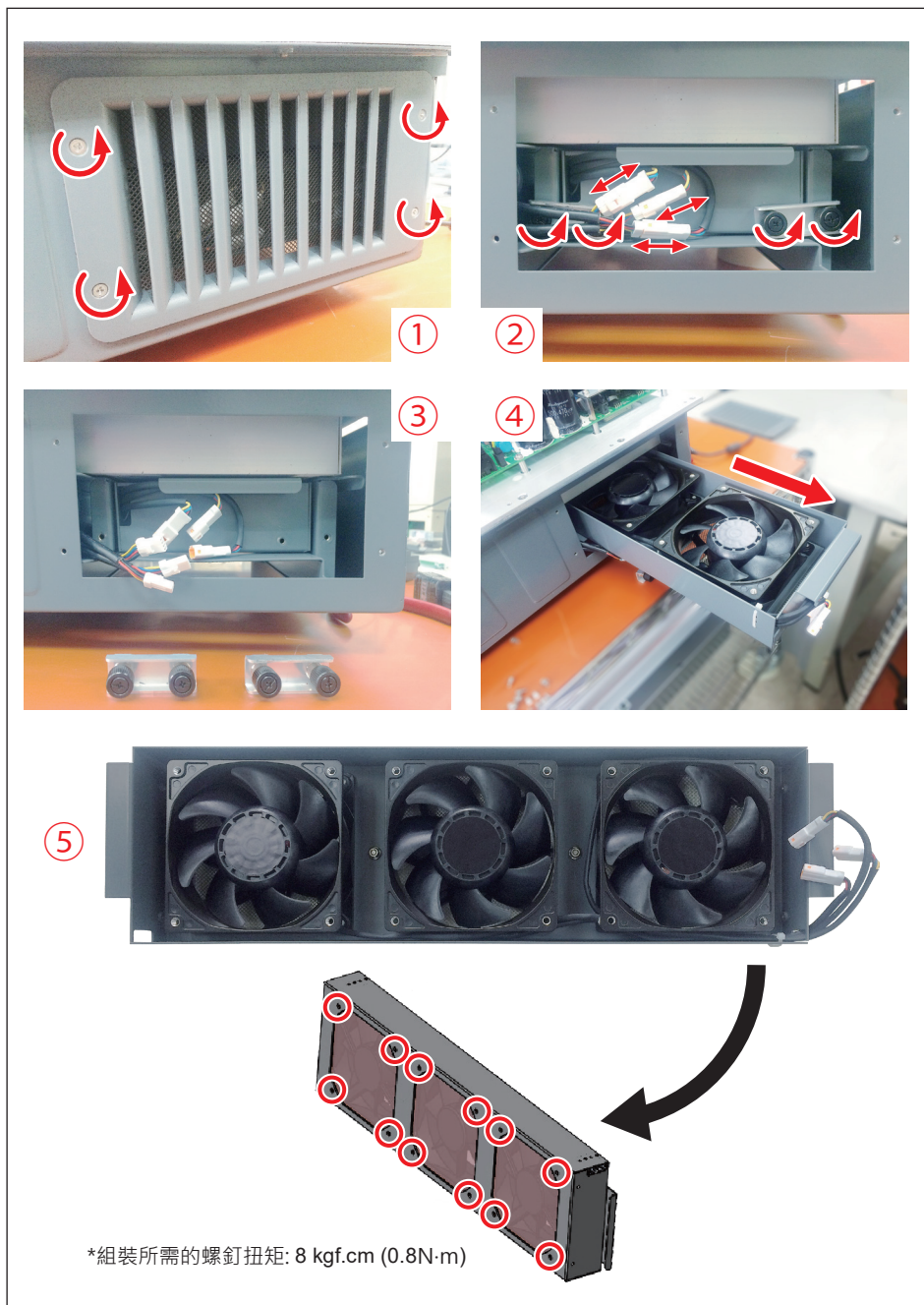


圖5-14: 拆卸功率模組風扇 (僅以單側為例)

圖5-15為濾網位置。

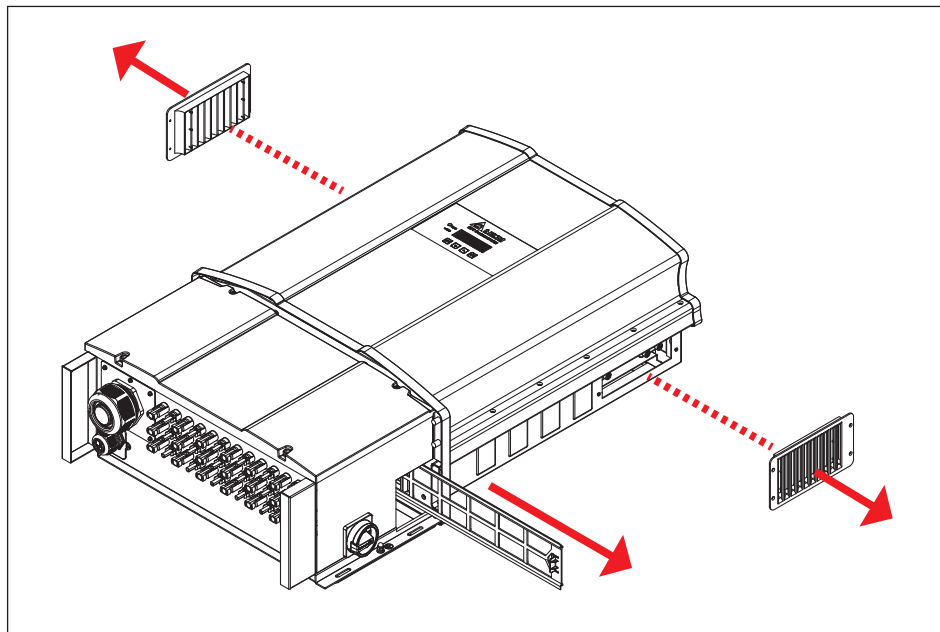


圖5-15：濾網拆卸方向

5.4 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：

- 關斷手動開關終止變流器運行
- 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！



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

注意: 可能造成傷害！



- 變流器重達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。

5.4.1 配線箱拆卸

請依以下指示將變流器終止運行，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. 再次確認變流器已終止運轉且無觸電風險。
3. 圖5-16為正確切斷直流開關的方式。

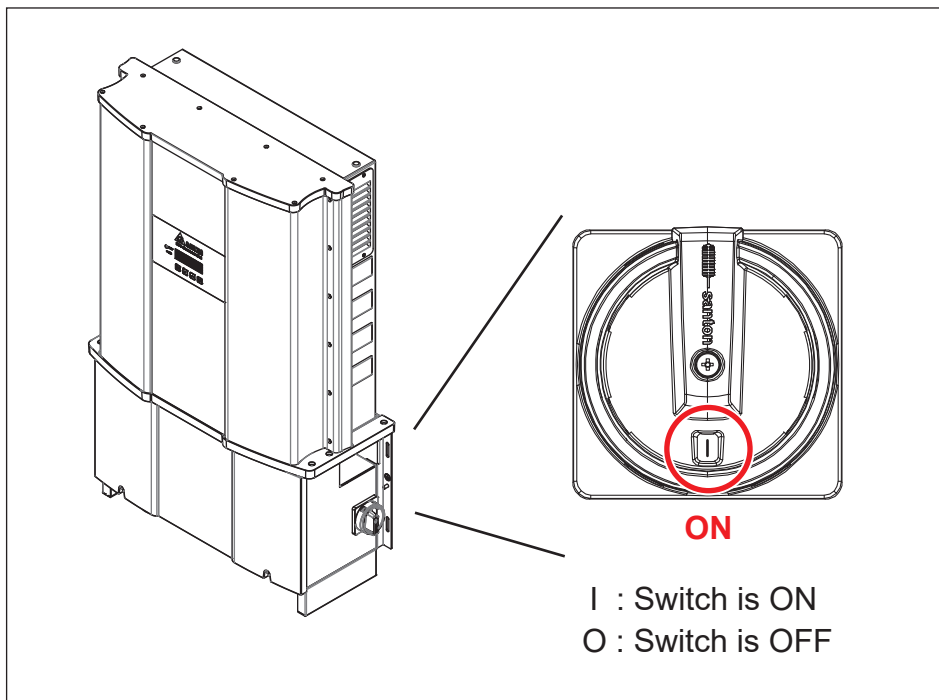


圖5-16：直流開關之開 / 關位置 (僅M88H₁₂₂)

- 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5-17所示之螺絲。

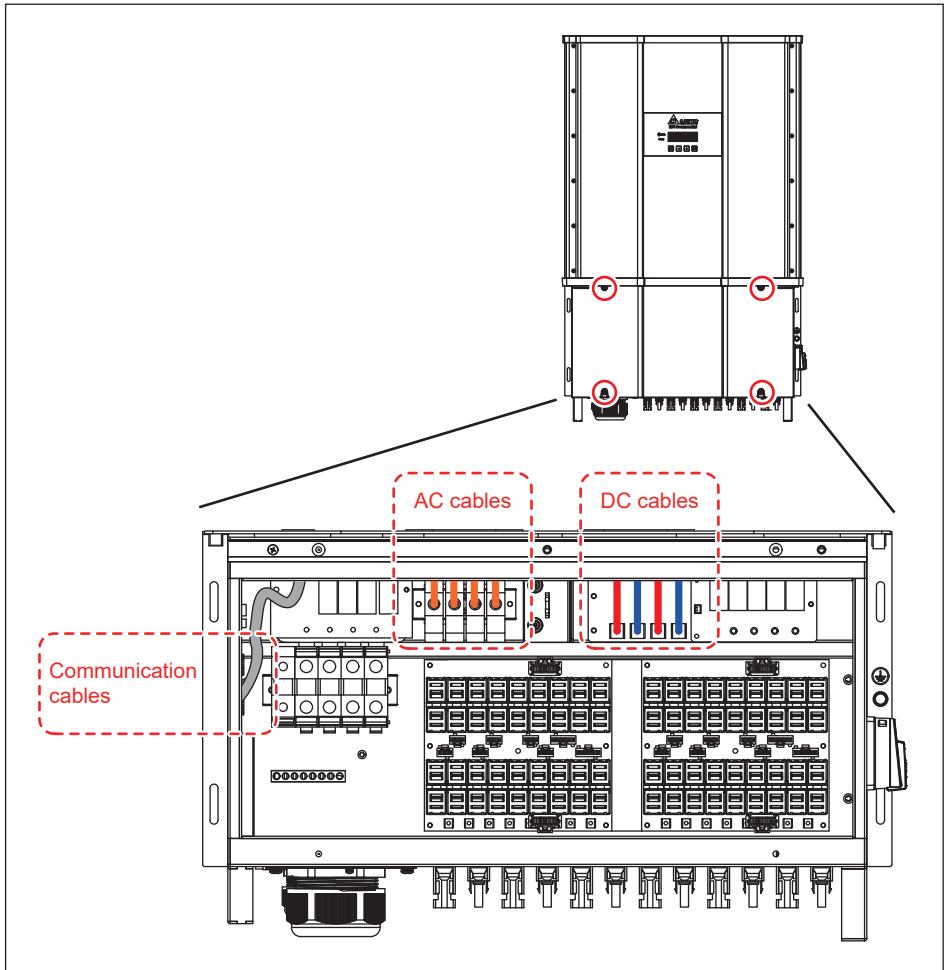


圖5-17：移除交直流線材及通訊線，並卸下6顆螺絲

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。

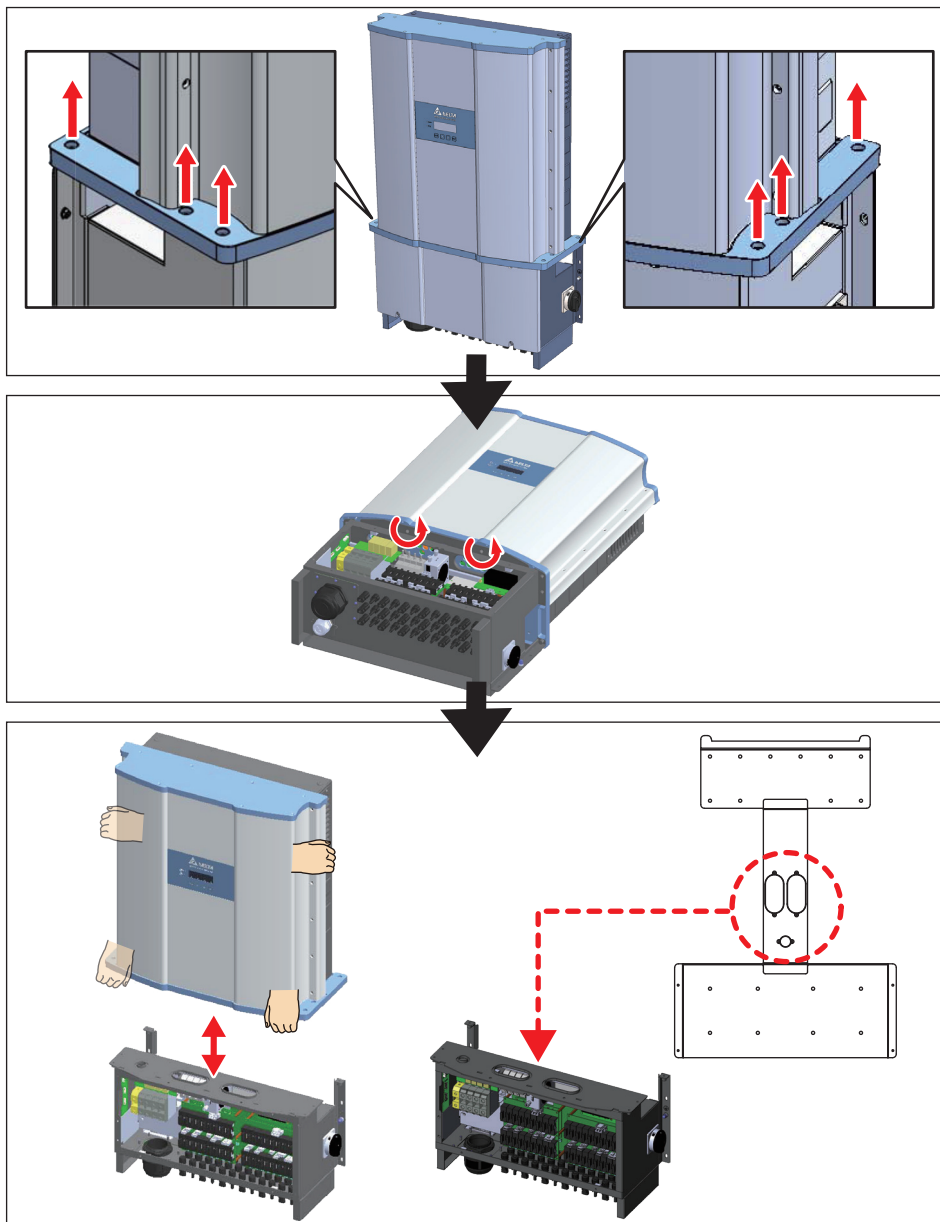


圖5-18：拆下8顆螺絲後，將配線箱與功率模組分離

6 錯誤告警及排除問題

表6-1：錯誤資訊

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"> 1. 實際的市電頻率高過過頻率保護設定 2. 國家設定不正確 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查變流器端的市電頻率 2. 檢查國家設定 3. 檢查變流器端的偵測電路
AC Freq Low (E02)	<ol style="list-style-type: none"> 1. 實際的市電頻率低於欠頻率保護設定 2. 國家或電網設定不正確 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查變流器端的市電頻率 2. 檢查國家與電網設定 3. 檢查變流器端的偵測電路
Grid Quality (E07)	在電網或靠近變流器附近非線性的負載	必要時變流器與電網連接處必須遠離非線性的負載
AC Con. Fail (E08)	<ol style="list-style-type: none"> 1. 在AC介面連接錯誤 2. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查AC連接，必須和使用手冊一致 2. 檢查變流器內部的偵測電路
No Grid (E09)	<ol style="list-style-type: none"> 1. AC 斷路器跳開 2. 中斷AC介面 	<ol style="list-style-type: none"> 1. 斷開AC 斷路器 2. 檢查連接AC介面並確認其連接至變流器
AC Volt Low (E10, E15, E20)	<ol style="list-style-type: none"> 1. 實際市電的電壓低於低電壓保護設定 2. 國家或電網設定不正確 3. AC介面連接錯誤 4. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查市電與變流器端的連接 2. 檢查國家或電網設定 3. 檢查AC介面連接 4. 檢查變流器內部的偵測電路
AC Volt High (E11, E13, E16, E18, E21, E23)	<ol style="list-style-type: none"> 1. 實際市電的電壓高於過電壓保護設定 2. 操作期間，市電的電壓高於慢速電壓保護設定 3. 國家或電網設定不正確 4. 偵測電路功能異常 5. AC介面連接錯誤 	<ol style="list-style-type: none"> 1. 檢查變流器端的市電電壓 2. 檢查變流器端的市電電壓 3. 檢查國家或電網設定 4. 檢查變流器內部的偵測電路 5. 檢查AC介面連接
Solar1 High (E30)	<ol style="list-style-type: none"> 1. 實際Solar1電壓超過1000Vdc 2. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 修正 solar array 設定並使得 Voc 小於 1000Vdc 2. 檢查變流器內部的偵測電路
Solar2 High (E31)	<ol style="list-style-type: none"> 1. 實際Solar2電壓超過1000Vdc 2. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 修正 solar array 設定並使得 Voc 小於 1000Vdc 2. 檢查變流器內部的偵測電路

錯誤資訊		
資訊顯示	可能原因	故障排除
Insulation (E34)	<ol style="list-style-type: none"> 1. 太陽能板絕緣測試未通過 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 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查輸入端絕緣 2. 檢查電容值，必要時擦乾太陽能板 3. 檢查變流器內部的偵測電路

表6-2：警告資訊

警告		
資訊顯示	可能原因	故障排除
Solar1 Low (W01)	<ol style="list-style-type: none"> 1. 實際Solar1電壓低於下限值 2. 若實際Solar1電壓接近0，變流器內部可能有裝置損壞 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查Solar1電壓至變流器端的連接 2. 檢查boost1的所有開關裝置 3. 檢查變流器內部的偵測電路
Solar2 Low (W02)	<ol style="list-style-type: none"> 1. 實際Solar2電壓低於下限值 2. 若實際Solar1電壓接近0，變流器內部可能有裝置損壞 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查Solar2 voltage至變流器端的連接 2. 檢查boost2的所有開關裝置 3. 檢查變流器內部的偵測電路
De-rating (W07)	<ol style="list-style-type: none"> 1. 本體及環境溫度過高 2. 風扇故障 3. 實功率限制功能作動 4. P-F功能作動 5. P(V) 功能作動 6. 市電電壓過低 7. 輸入電壓過低 8. 輸入電壓過高 	<ol style="list-style-type: none"> 1. 確認安裝機器本體及環境溫度 2. 確認風扇能否正常運轉 3. 確認國別及最大功率限制參數設定 4. 確認市電頻率是否異常 5. 確認市電電壓是否異常 6-1. 確認市電電壓是否異常 6-2. 確認虛功控制功能設定 7. 確認PV panel輸入電壓是否過低 8. 確認PV panel輸入電壓是否過高
String fault (W08)	<ol style="list-style-type: none"> 1. 不正確接線導致組串過電流 2. 組串電流偵測功能異常 	<ol style="list-style-type: none"> 1. 確認直連接線是否正確 2. 請聯繫客服人員，尋求技術支援
WB Fan Fail Int Fan Fail Ext Fan Fail (W11)	<ol style="list-style-type: none"> 1. 一個或多個風扇鎖死 2. 一個或多個風扇無效 3. 一個或多個風扇未連接 4. 偵測電路功能異常 	<p>外部風扇</p> <ol style="list-style-type: none"> 1. 移除卡在風扇內的對象 2. 替換無效的風扇 3. 檢查風扇的連接 4. 檢查變流器內部的偵測電路 <hr/> <p>內部風扇 & WB風扇 檢查變流器內部的偵測電路</p>
DC SPD Fault (W17) AC SPD Fault (W18)	<ol style="list-style-type: none"> 1. 變流器遭受到雷擊 2. 一個或多個SPD有缺陷 3. 一個或多個SPD未連接 4. 偵測電路功能異常 5. AC介面連接錯誤 	<ol style="list-style-type: none"> 1. 檢查變流器是否遭受雷擊 2. 更換有缺陷之SPD 3. 檢查SPD的連接 4. 檢查變流器內部之偵測線路 5. 檢查AC介面連接

表6-3：故障資訊

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

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

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

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"> 1. 測試電流回路損壞 2. CSC2無效 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查WC3至CNC16的連接 2. 替換新的CSC2 3. 檢查變流器內部的偵測電路
HW CT C Fail (F44)	<ol style="list-style-type: none"> 1. 測試電流回路損壞 2. CSC3無效 3. 偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查WC3至CNC16的連接 2. 替換新的CSC3 3. 檢查變流器內部的偵測電路
HW AC OCR (F45)	<ol style="list-style-type: none"> 1. 檢查WC3至CNC16的連接 2. 替換新的CSC3 3. 檢查變流器內部的偵測電路 	<ol style="list-style-type: none"> 1. 檢查市電波形. 必要時變流器與電網連接處必須遠離非線性的負載 2. 檢查inverter stage開關裝置 3. 檢查變流器內部的偵測電路
HW ZC Fail (F50)	同步訊號偵測電路功能異常	檢查變流器內部同步訊號的偵測電路
AFCI Circuit Fail (F58)	<ol style="list-style-type: none"> 1. 電弧偵測裝置沒有安裝 2. 電弧偵測裝置自我測試失效 	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)	變流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"> 1. Boost開關裝置無效 2. Boost驅動電路無效 3. 輸入電流偵測電路功能異常 	<ol style="list-style-type: none"> 1. 檢查boost全部開關裝置 2. 檢查變流器內部的boost驅動電路 3. 檢查輸入電流偵測電路
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

7 技術資料

表7-1 : M88H規格

Model	M88H_121	M88H_122
直流輸入		
最大輸入電壓	1100V *	
工作電壓範圍	200-1000V	
啟動電壓	>250V	
額定功率電壓範圍	Vac400V : 500 - 800V / Vac480V : 600 - 800V	
額定電壓	Vac400V : 600V / Vac480V : 710V	
MPPT追蹤	2	
最大輸入電流/每個MPPT	140 / 70A	
接頭種類	50~120mm ² terminal block for 2 MPPTs	18 pairs of MC4 connector
雷擊保護裝置(type II)	●	●
15安倍保險絲(可選配16安倍)	—	●
直流開關	—	●
組列電流監控	—	●
交流輸出		
最大輸出功率	Vac400: 73kW / Vac480: 88kW	
額定輸出功率	Vac400: 66kW / Vac480: 80kW	
Q setting 24/7 範圍	0~27kVar (0%~30% S _{Max.}) @ 480Vac 0~22kVar (0%~30% S _{Max.}) @ 400Vac	
最大輸出電流	106A	
額定輸出電流	96A	
額定電壓	3 Ph 400V & 480V Δ / Y	
工作電壓範圍	Vac400V : ±30% / Vac480V : ±20%	
工作頻率範圍	50/60Hz ±5Hz	
功率因數	1 at rated power, 0.8 ind ~ 0.8 cap adjustable	
保護	Type II SPD	
T.H.D	<3%	
接頭種類	50 ~120 mm ²	35 ~95 mm ²
夜間耗電	<3W	

* 最大可承受電壓為1100V。(當電壓超過1000V時變流器停止運轉)

● : 有
— : 沒有

Model	M88H_121	M88H_122	
效率			
最高效率	98.8 %		
歐洲效率	98.5 %		
資訊			
通訊介面	RS-485		
顯示螢幕	20 x 4 LCD		
規範認證			
	VDE-AR-N 4105 VDE0126-1-1 BDEW EN 61000-6-1 EN 61000-6-4	NB/T 32004: 2013 GB/T 19964: LVRT IEC 62109-1/-2 EN 61000-6-2	UTE C15-712 UK G59/3 CE compliance EN 61000-6-3
一般數據			
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 986 x 275		
重量 (kg)	86		
噪音	74.5 dBA @1m, Amb25°C		
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	0% – 100% non-condensing		

* 在400Vac系統下, 當直流電壓600Vdc時, 環境溫度大於50度才會開始降載

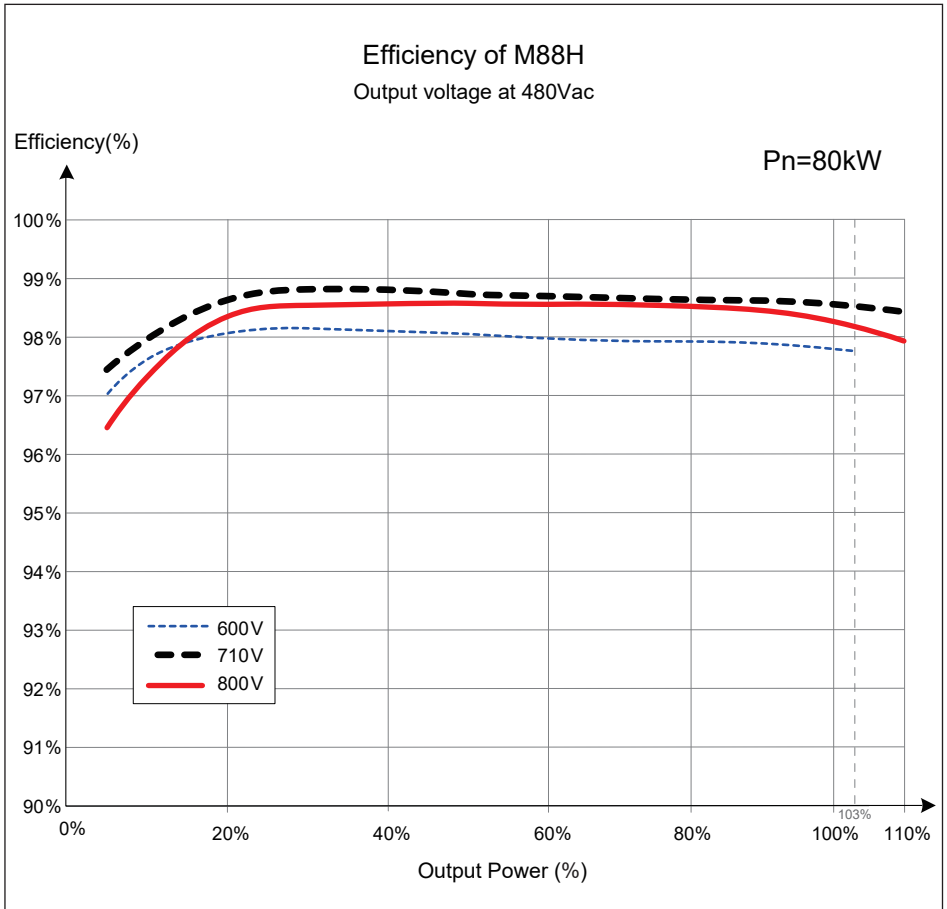


圖7-1 : M88H效率曲線 (Output voltage at 480V)

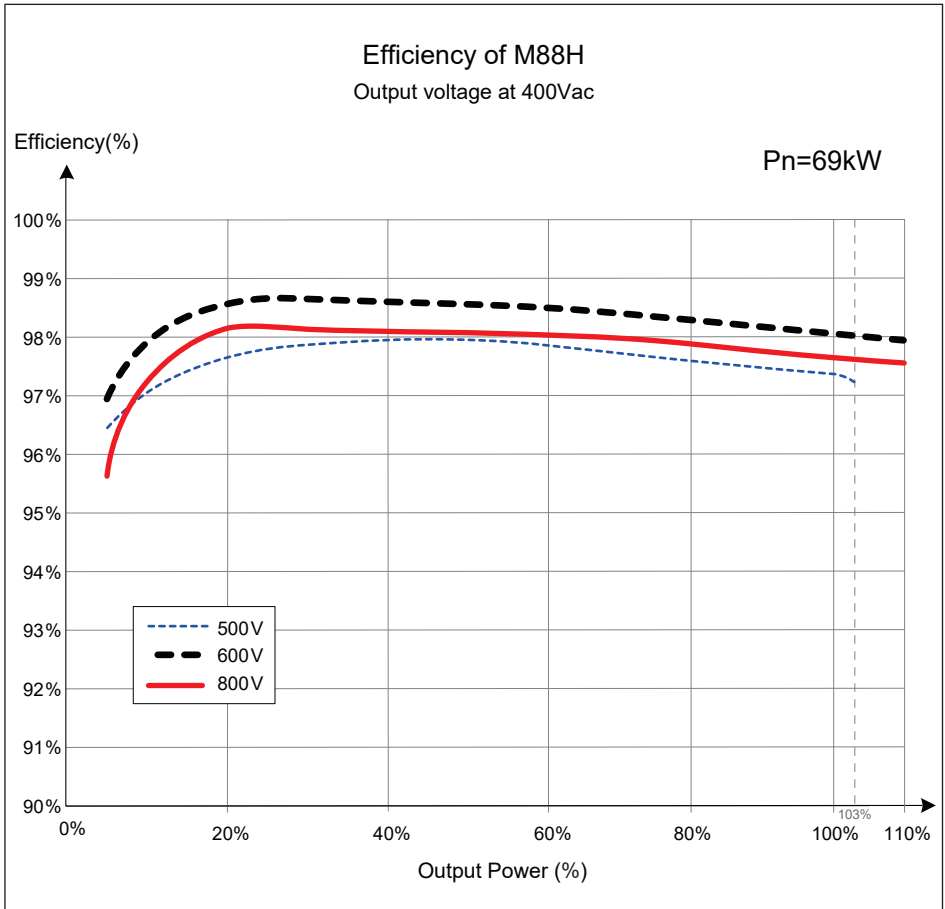


圖7-2 : M88H效率曲線 (Output voltage at 400V)

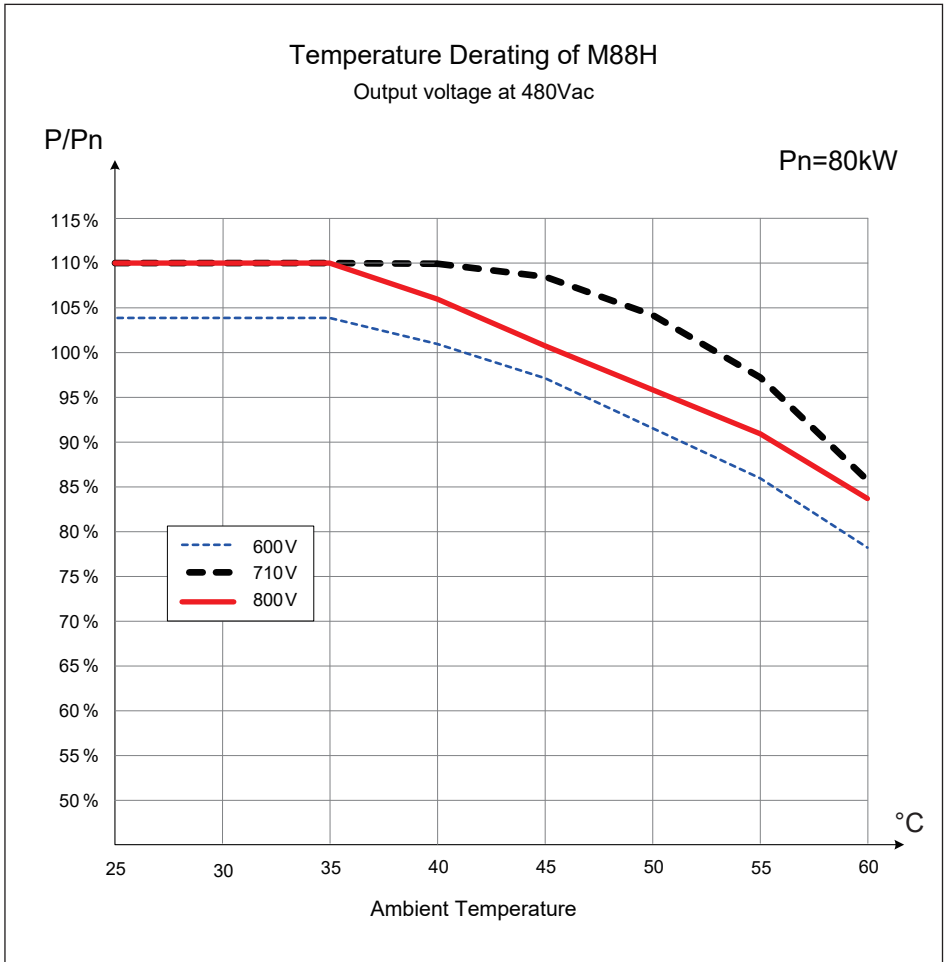


圖7-3 : M88H溫度降載曲線 (Output voltage at 480V)

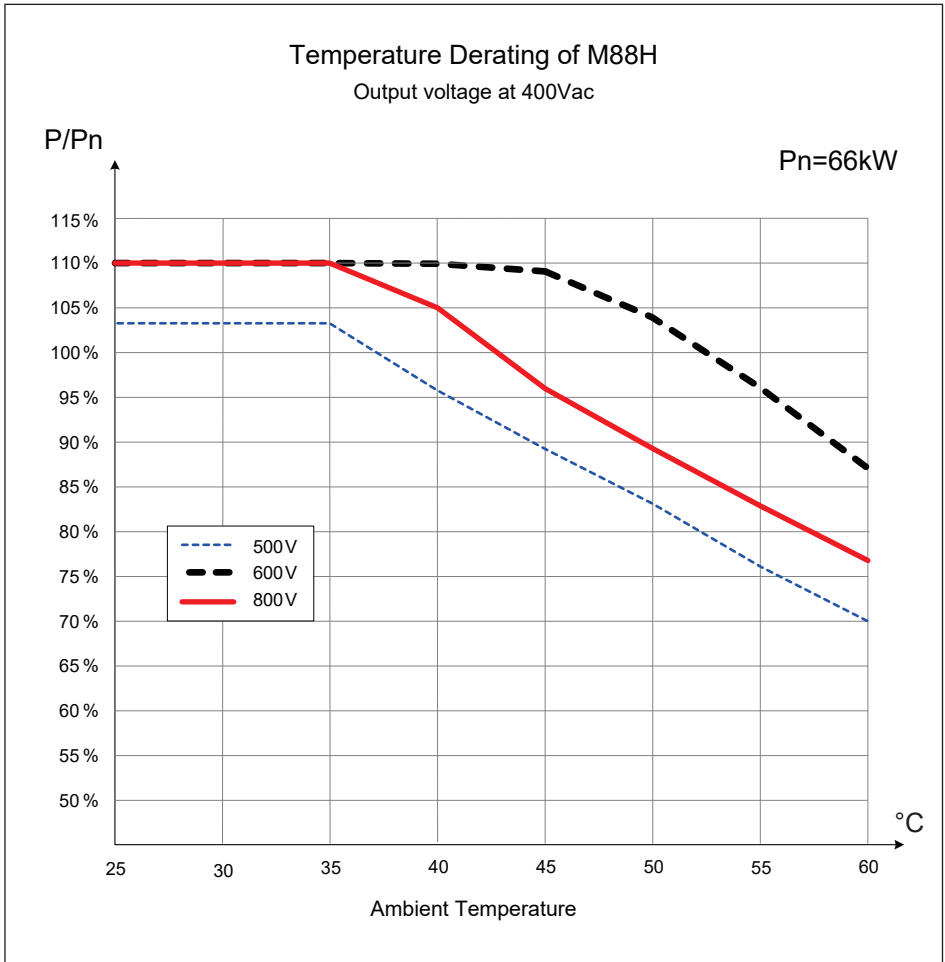


圖7-4 : M88H溫度降載曲線 (Output voltage at 400V)

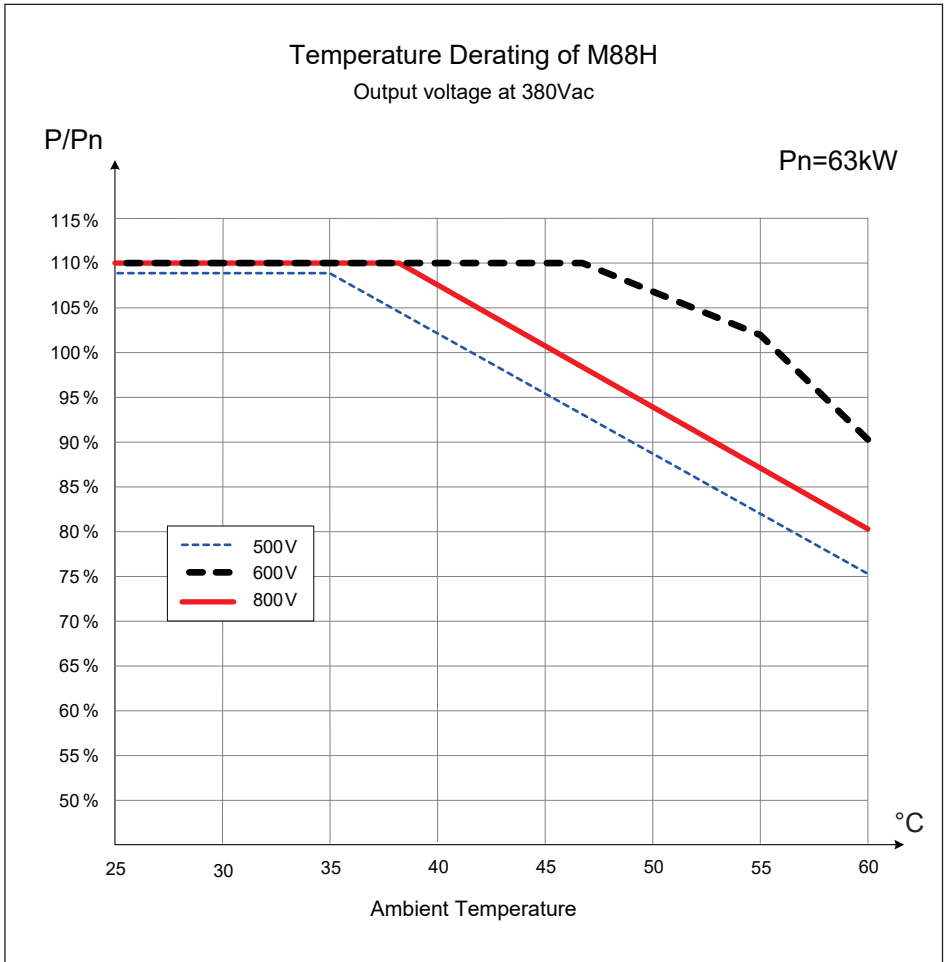
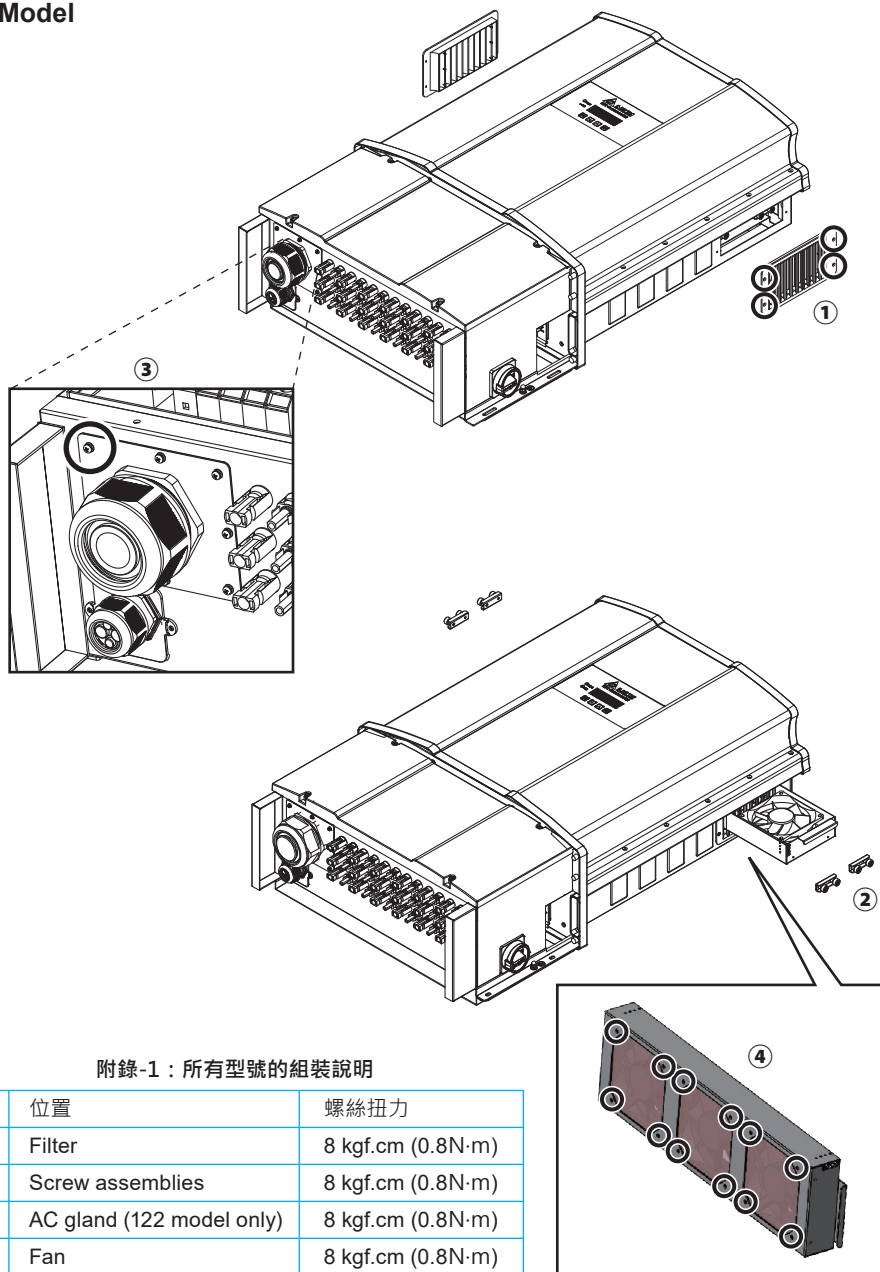


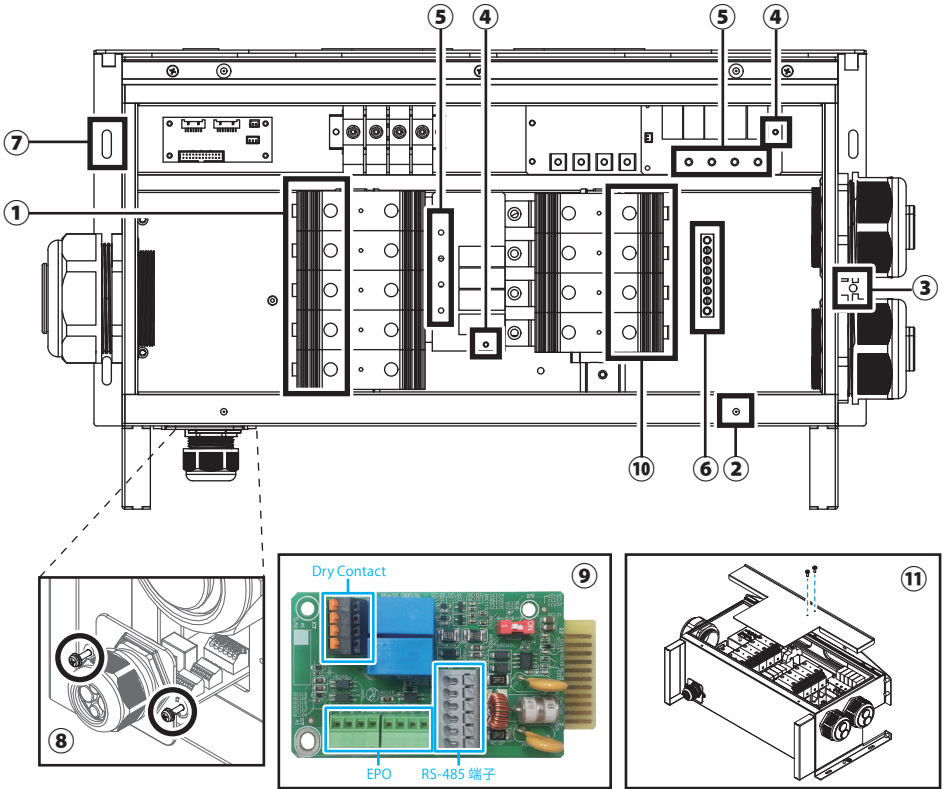
圖7-5 : M88H溫度降載曲線 (Output voltage at 380V)

附錄：組裝說明

-All Model

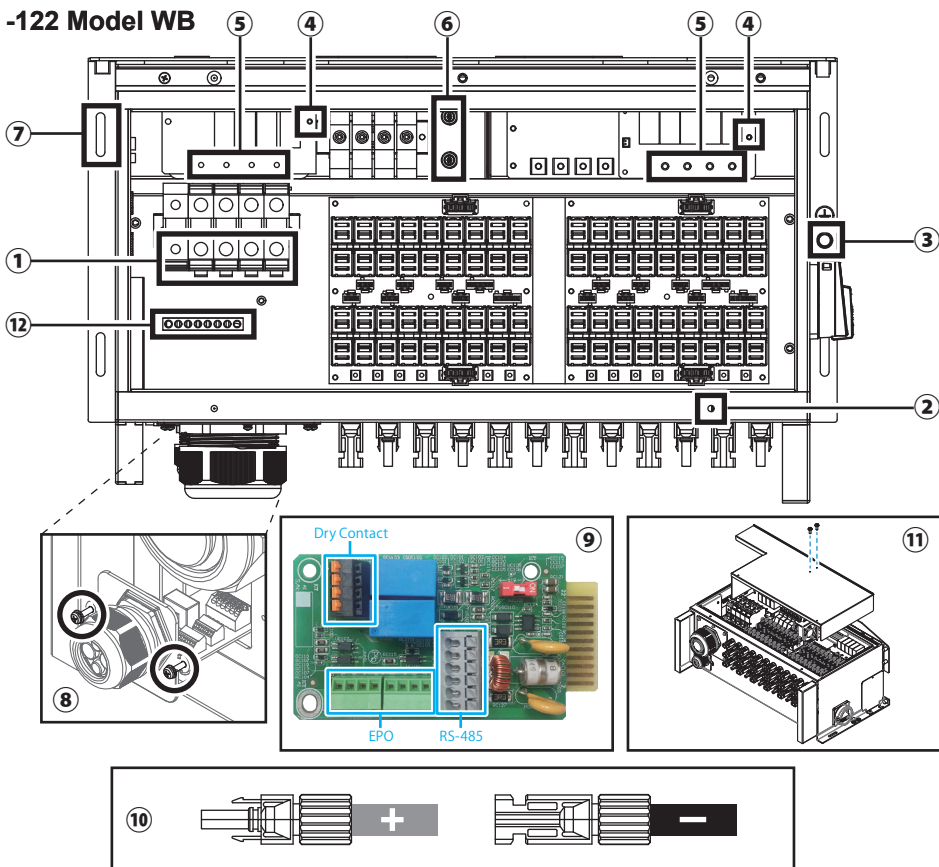


-121 Model WB



附錄-2：121型號的組裝說明

NO	位置	螺絲扭力	導體橫截面
1	AC terminal	265 kgf-cm (26 N·m)	1 AWG ~ 250 kcmil (50~120 mm ²)
2	Wiring box cover	24.2 kgf-cm (2.4 N·m)	-
3	Grounding point	79.9 kgf-cm (7.8 N·m)	-
4	Ground of SPD board	8 kgf-cm (0.8 N·m)	-
5	SPD board	17 kgf-cm (1.7 N·m)	-
6	Grounding bar	30.6 kgf-cm (3 N·m)	6~4 AWG (14~22 mm ²)
7	Mounting bracket	46.1 kgf-cm (4.5 N·m)	-
8	Communication cover	8 kgf-cm (0.8 N·m)	-
9	Communication port	-	20 AWG (0.5 mm ²)
10	DC terminal	265 kgf-cm (26 N·m)	1 AWG ~ 250 kcmil (50~120 mm ²)
11	Insulator cover	8 kgf-cm (0.8 N·m)	-



附錄-3：122型號的組裝說明

NO	位置	螺絲扭力	導體橫截面
1	AC terminal	91.7 kgf-cm (9 N·m)	2~2/0 AWG (35~70 mm ²)
2	Wiring box cover	24.2 kgf-cm (2.4 N·m)	-
3	Grounding point	79.9 kgf-cm (7.8 N·m)	-
4	Ground of SPD board	8 kgf-cm (0.8 N·m)	-
5	SPD board	17 kgf-cm (1.7 N·m)	-
6	Wiring box fan	8 kgf-cm (0.8 N·m)	-
7	Mounting bracket	46.1 kgf-cm (4.5 N·m)	-
8	Communication cover	8 kgf-cm (0.8 N·m)	-
9	Communication port	-	20 AWG (0.5 mm ²)
10	MC4 wire	-	12~10 AWG (4~6 mm ²)
11	Insulator cover	8 kgf-cm (0.8 N·m)	-
12	Grounding bar	30.6 kgf-cm (3 N·m)	6~4 AWG (14~22 mm ²)

