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# PhotoVoltaic Inverter

## C1000

## Operation and Installation Manual

English ····· 1

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# Conventions

## General Conventions

The following conventions are used in this manual:

**Example**



- Indicates information used to demonstrate or explain an associated concept.

**NOTE**



- Indicates additional information that is relevant to the current process or procedure.

**WARNING !**



- Warning information appears before the text it references to emphasize that the content may prevent damage to the device or equipment.

**CAUTION!**



- CAUTION APPEARS BEFORE THE TEXT IT REFERENCES TO EMPHASIZE THAT THE CONTENT CONTAINS VITAL HEALTH AND SAFETY WARNING.

## Typographical Conventions

The following typographical conventions are used in this document:

*Italics*
Indicates denotes references to other titles, directories, files, paths, and/or pro- grams.

Screen Display width
Indicates computer output shown on a computer screen, including menus, prompts, responses to input, and error messages.

**Bold type**
Indicates keyboard keys that are pressed by the user.

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# 1 Introduction

## 1.1 About This Manual

This manual provides the detail information of specification, installation procedures and all related function setting about the C1000 PV Inverter. Installation technicians must be well-trained and qualified for installing solar system and must follow all the safety instruction and installation procedures.

## 1.2 Valid Models

This user manual describes the installation procedures, maintenance, technical data and safety instruction of the following solar inverter models under Delta brand.

• C1000 PV Inverter

## 1.3 Target Group

The guidelines in this manual provide instructions for a person who is well training and skillful for the installation of the central inverter.

## 1.4 System Usage

See the system usage in the following diagram:

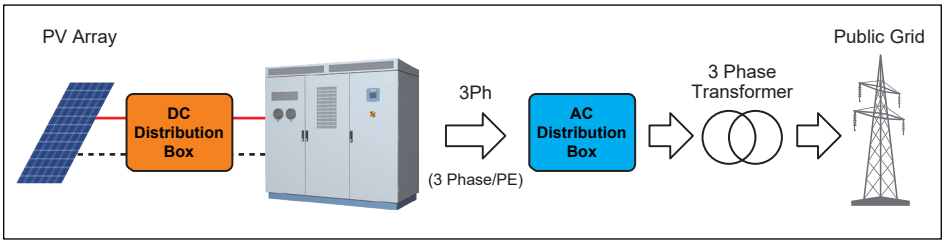



***Figure 1-1 : System Usage***

**External output transformer requirements**

The external output transformer is used with separate primary and secondary windings rated 1000kVA minimum, and limited to a maximum impedance variance of less than or equal to 6%. This external transformer is required to be located between the output of the central inverter and the utility power connection.
For the application of MV transformer .Please refer to the Appendix C “ Delta MV transformer application note”.

## 1.5 Disconnecting

Isolation of the device must always occur under load-free conditions.

**CAUTION! RISK OF LETHAL ELECTRIC SHOCK.**



It is admitted to work on the PV Inverter only after switching the relative power sources.
The VDE regulations must be followed:
- Disconnect
- Ensure that the device cannot be reconnected
- Ensure that no voltage is present
- Ground and short-circuit the unit if necessary (not on the DC side)
- If necessary, cover or shield any adjacent live components

The following power sources must be isolated:
- Grid voltage for grid feeding
- Grid voltage for internal power supply (optional)
- DC voltage from the photovoltaic generator

Simply switching off the main AC and DC switches is not sufficient to ensure proper isolation of the device. The main switches only separate the power circuit from the grid and the photovoltaic generator.

**CAUTION! RISK OF LETHAL ELECTRIC SHOCK.**



Dangerous accidental-contact voltages can be present in the PV Inverter even when the main AC and DC switches are switched off!
- Wait at least 6 minutes after switching off the PV Inverter.

The DC voltage is isolated by using internal circuit breaker or external circuit breaker if present. Isolation by turning internal curcuit breaker off must occur under load-free conditions.
The device contains capacitors on DC and AC side that must discharge once the device has been switched off. After switching off, dangerous accidental-contact voltage remians within the device for several minutes.
If there is a fault in the device, the voltage may also be existed for a longer time. Please wait at least 6 minutes after switching the device off before opening the device.

**CAUTION! RISK OF LETHAL ELECTRIC SHOCK.**



Dangerous accidental-contact voltages can be present in the PV Inverter even when the main AC and DC switches are switched off!
- Wait at least 6 minutes after switching off the PV Inverter.

# 2 Product Overview

## 2.1 Product Description

The Delta RPI inverter models include the C1000. It is manufactured to meet high standards of quality and to maximize the yield of every solar plant (up to 98.84% efficiency).
The RPI series include a IP65 protection level enclosure and corrosion resistant features to ensure the protection of the inverter within an indoor or outdoor environment.

## 2.2 Product View

| C1000 |
| --- |
| 14 Runs (DC Breaker) |

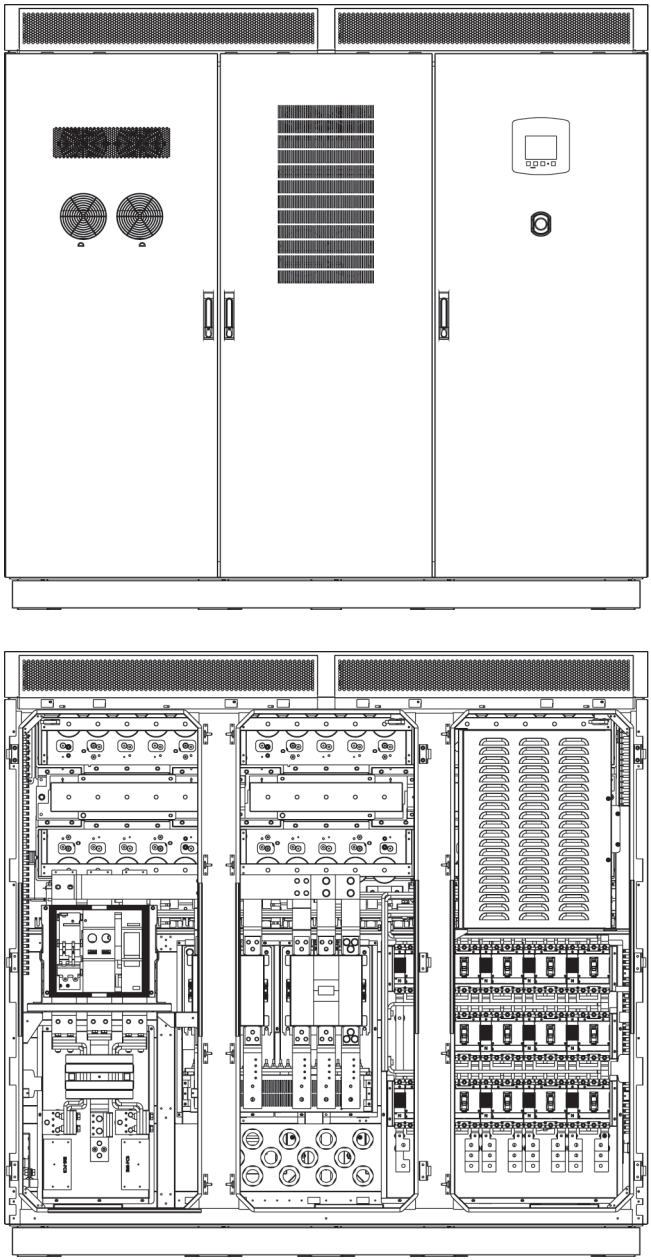


*Figure 2-1 : C1000 - 14 Runs (DC Breaker)*

## 2.2.1 Exterior Front View

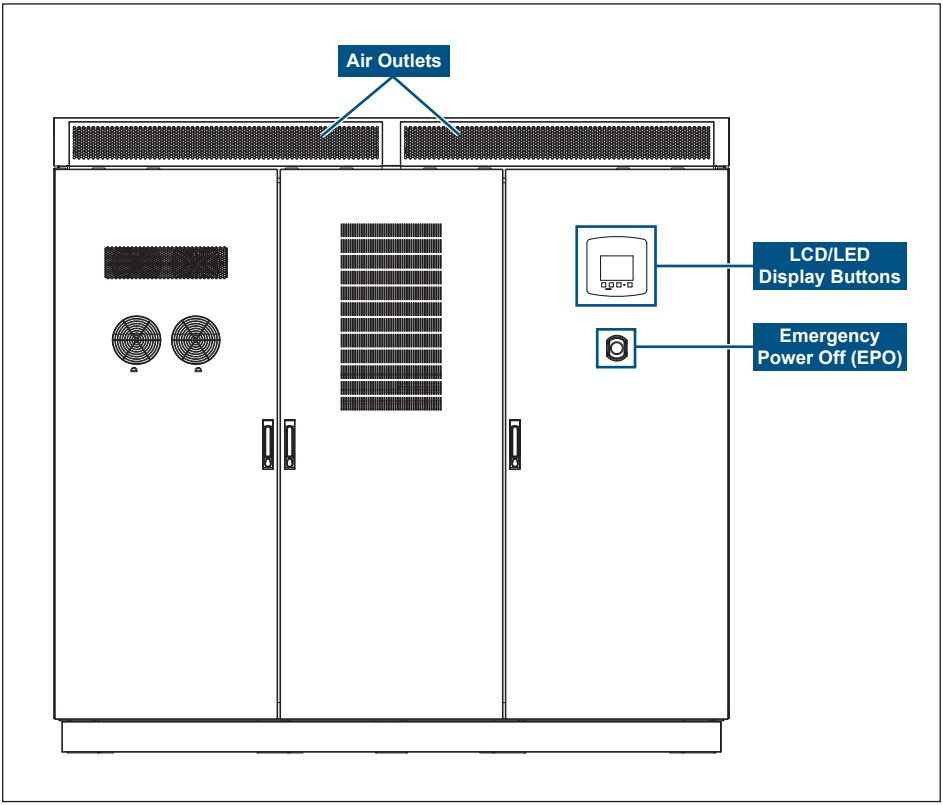



*Figure 2-2 : Exterior Front View*

## 2.2.2 Exterior Back View

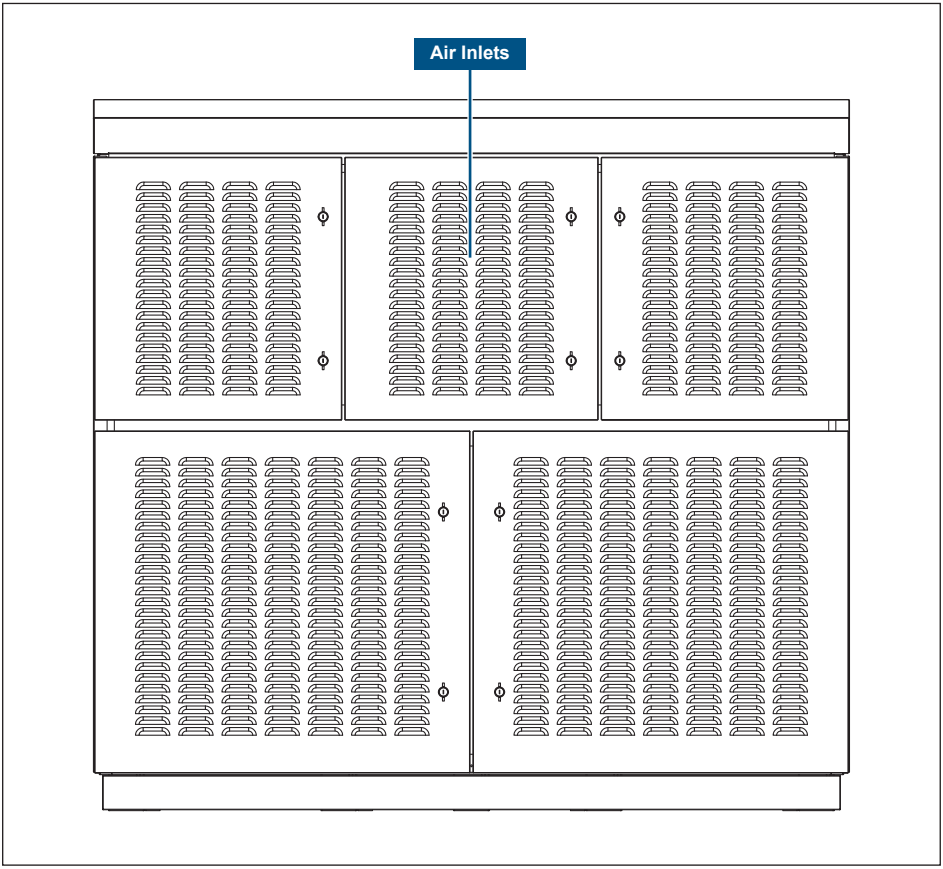



*Figure 2-3 : Exterior Back View*

## 2.3 Features

The following are important features of the product(s) described in this manual:

- High efficiency, peak 98.84%, EUR 98.4%
- 3 Phase (3 Lines + PE) 1000kVA solar inverter
- Wide input range (520-1000Vdc)
- Wide MPPT range (550-850Vdc)
- 1 MPP Trackers
- 5” Graphic LCD display (Adjustable contrast & brightness)
- IP-65 protective level (electrics)

## 2.4 Identify the Inverter

Please refer to the following image for identifying the inverter.

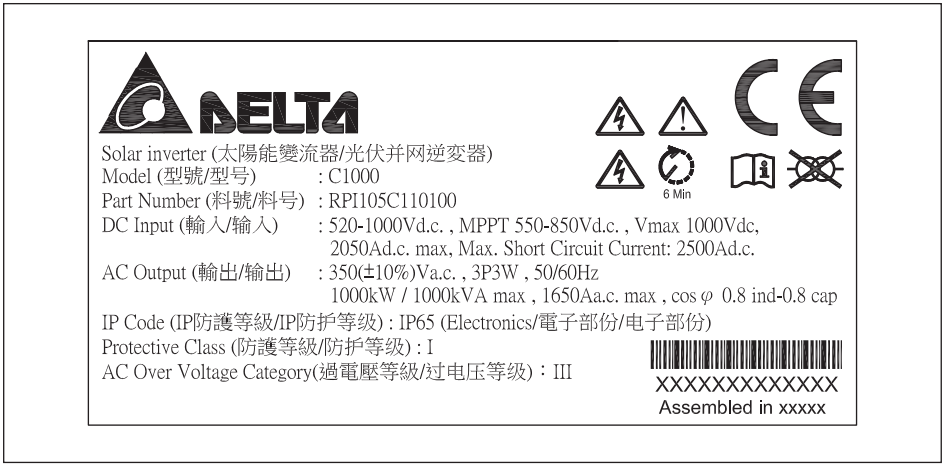



***Figure 2-4 : Inverter Identification***

# 3 Transportation & Installation Preparation

## 3.1 Installation Site Requirements

### 3.1.1 Site Space

Make sure the room for system loading and the destination installation site meet the space requirements described in this section.

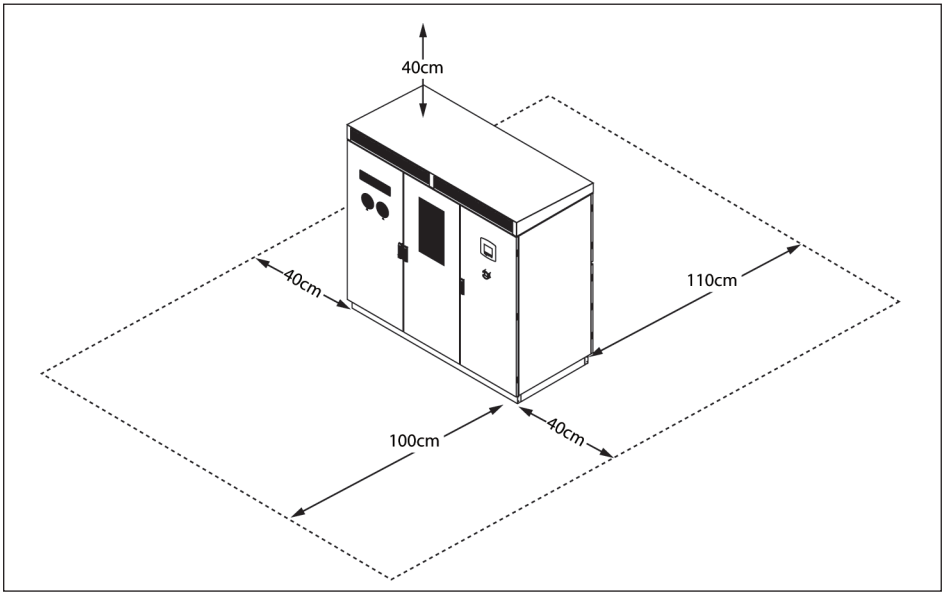



***Figure 3-1 : Inverter Space Requirements***

The loading site should provide enough space to unpack the entire system and release the container. See the following dimensions:

- Height of the package: 2210 mm (87 inches)
- Width of the package: 2280 mm (89.8 inches)
- Depth of the package: 1200 mm (47.2 inches)
- Height of the system: 1980 mm (78 inches)
- Width of the system: 2100 mm (82.7 inches)
- Depth of the system: 950 mm (37.4 inches)

**NOTE**

- The ambient temperature range of installation site must be less than 60°C.
- Direct solar irradiation may reduce the output power of the central inverter.

## 3.2 Preparing the Installation Site

Prior to unpacking the system, make sure that you read and understand all environmental and space requirements.

### 3.2.1 Dimensions of trench

Prepare a trench for laying cables from DC and AC distribution box safely. The suggested width of trench is 250mm (shaded area in ***Figure 3-2***) and the suggested depth is depended on user.

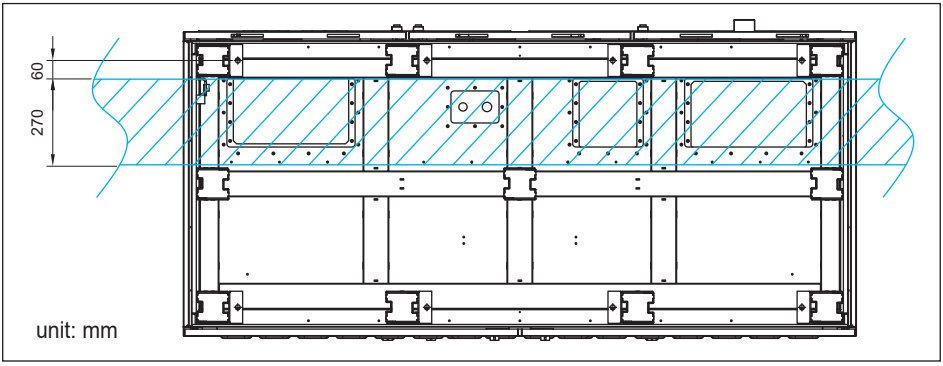



***Figure 3-2 : Trench Dimensions***

### 3.2.2 Dimensions & Characteristics of the base

Build an installation base using the dimensions from the following illustration. The width and depth of the metal base should not be smaller than the inverter, and make sure the base can hold at least the weight of the inverter.

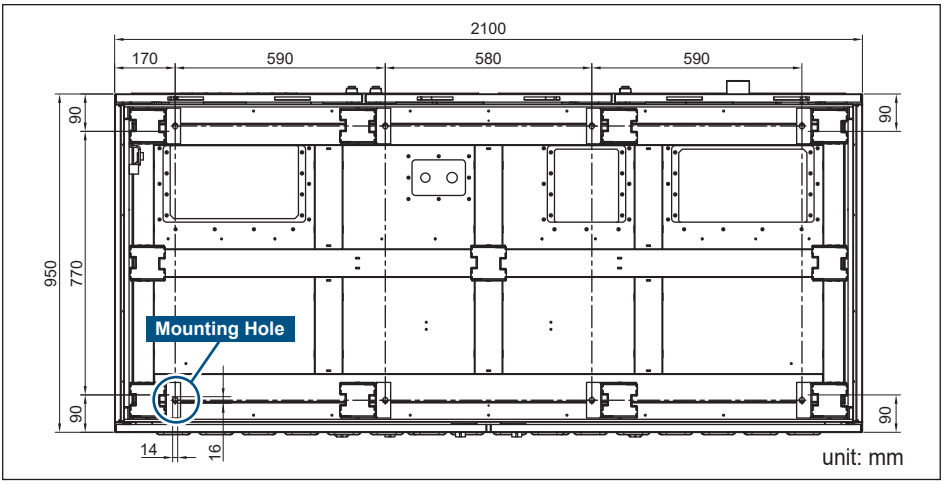



***Figure 3-3 : Installation Base Dimensions***

## 3.2.3 Fixed Methods

The inverter can be installed by following methods:

1. Install on the ground directly.
2. Install on the base mounted on the ground.
3. The recommended distance between bottom of solar inverter and AC/DC cables should be at least 1-meter high.

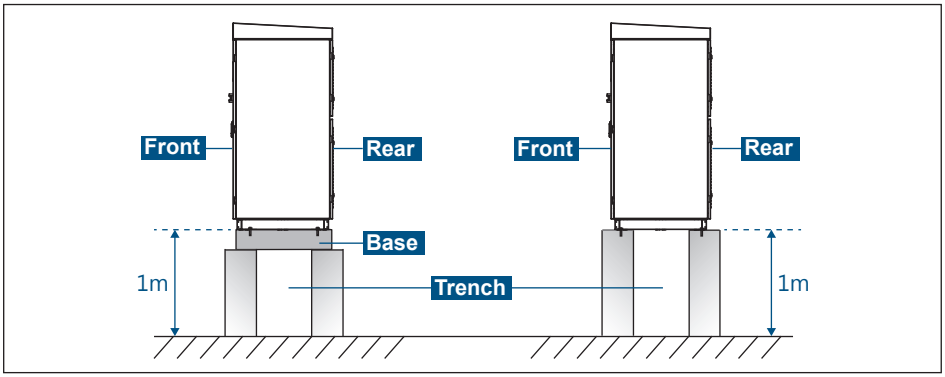



*Figure 3-4 : Fixed Methods*

## 3.2.4 Dimensions of central inverter for indoor installation

For indoor installation, the hot air generated from inverter should be conducted to outside by ventilation duct that is fixed on the top of the inverter.

The interal air outlet information of inverter can be referred to ***Figure 3-5*** & ***Figure 3-6***.

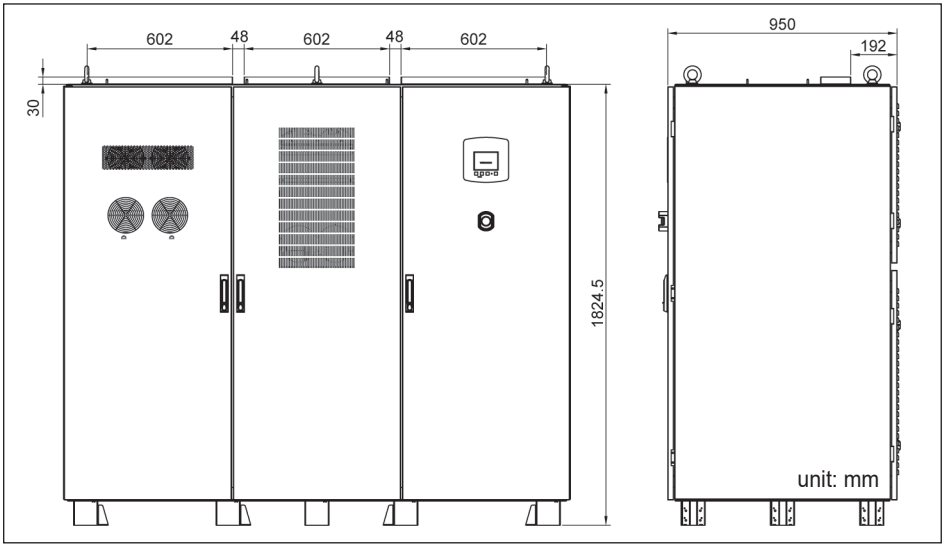



*Figure 3-5 : Dimensions without top cover*

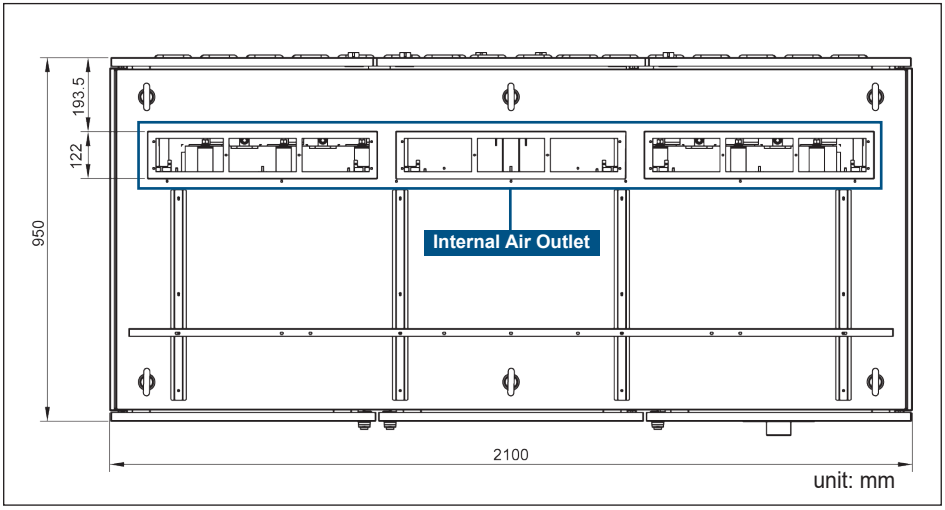



*Figure 3-6 : Internal air outlet dimensions (top view)*

## 3.3 Delivery Options and Recommended Vehicle

Any equipment used for the transport of the central inverter must be suitable for the weight of the central inverter. The following equipment can be used for the transport of the central inverter:

- Forklift or pallet trunk (Recommended)
- Crane
- Hoisting steel cables
- Hoisting hooks
- Steel rings

## 3.3.1 Using a Forklift or pallet trunk

The method of moving the central inverter by using a forklift or pallet trunk is the same whether the unit is packed in a shipping crate or not. Follow these steps:

1. Place the forks of the forklift or pallet trunk under the unit and pay attention to the center of gravity of the unit.

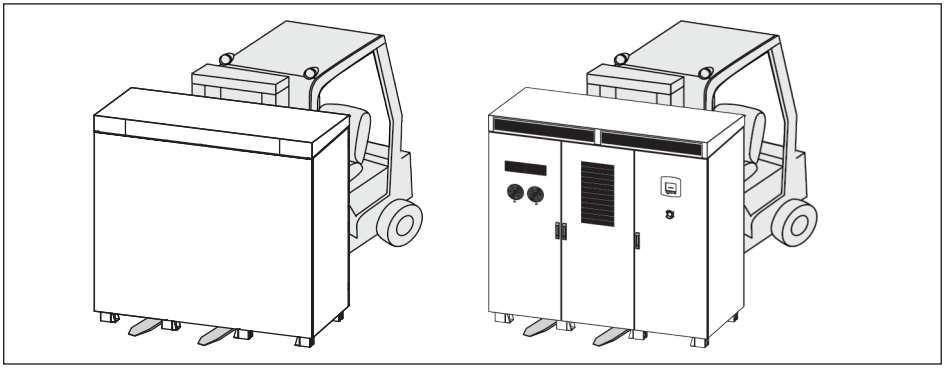


*Figure 3-7 : Moving the Central Inverter*

2. Lift the unit and move to the installation site directly.

## 3.3.2 Using a Crane

The method of moving the central inverter by using a crane is different if the unit is packed or unpacked in a shipping crate. Follow these steps respectively:

If the unit is packed in a shipping crate:

1. Use wire rope to secure the inverter, and make sure that it is evenly weighted.
2. Lift up the inverter and transfer to the installation site steadily.
3. Unraveled the wire rope.

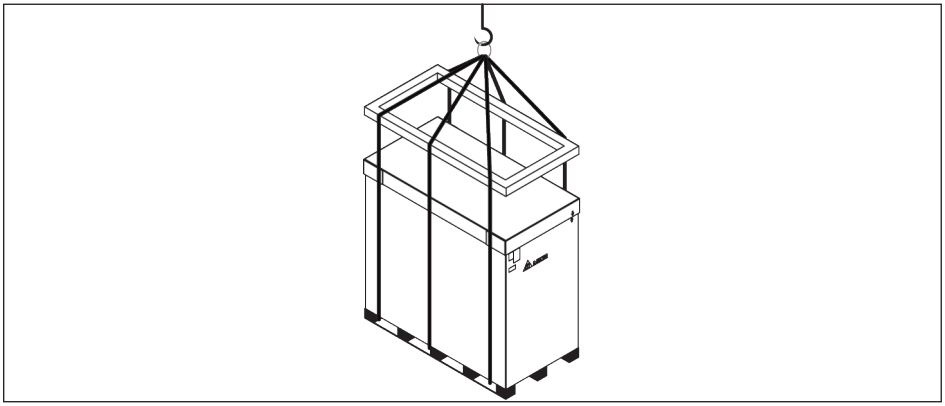


*Figure 3-8 : Using the Wire Rope*

If the unit is unpacked in a shipping crate:

1. Open the front and back door of the central inverter.
2. Loosen the screws on the top cover. (Torque: 25 Kgf-cm)

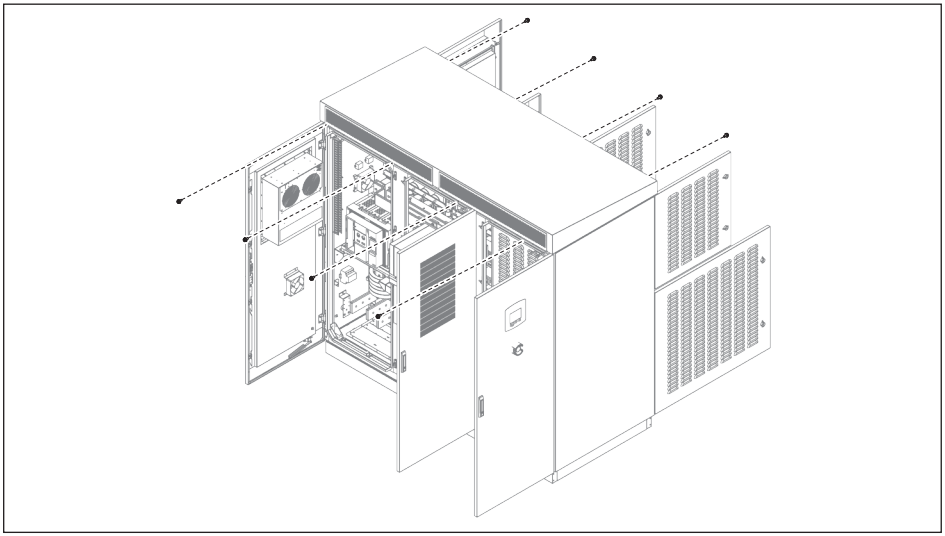


***Figure 3-9 : Loosen the Screws on the Top Cover***

3. Remove the top cover of the inverter.

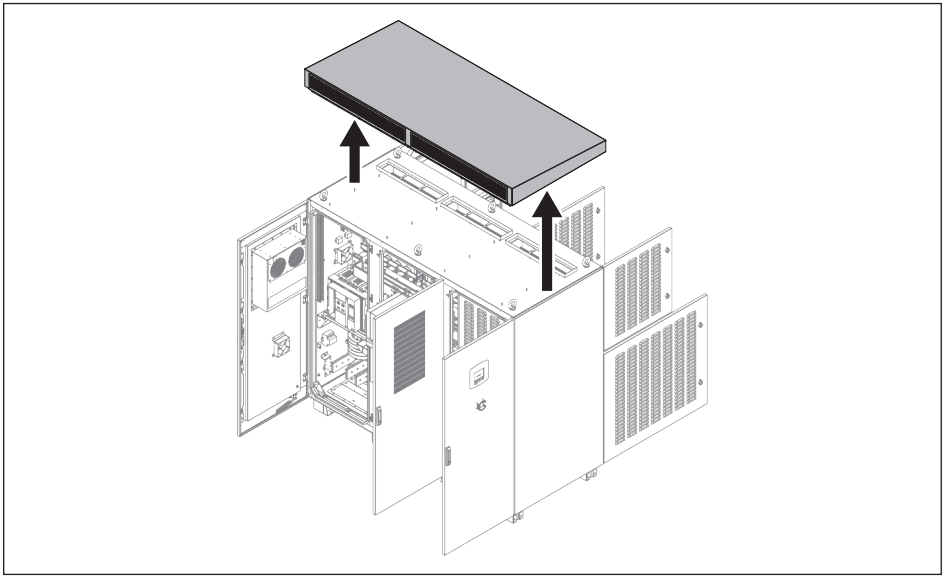


***Figure 3-10 : Removing the Inverter's Top Cover***

4. Attach the hoisting hooks and cables to the steel rings on the inverter.

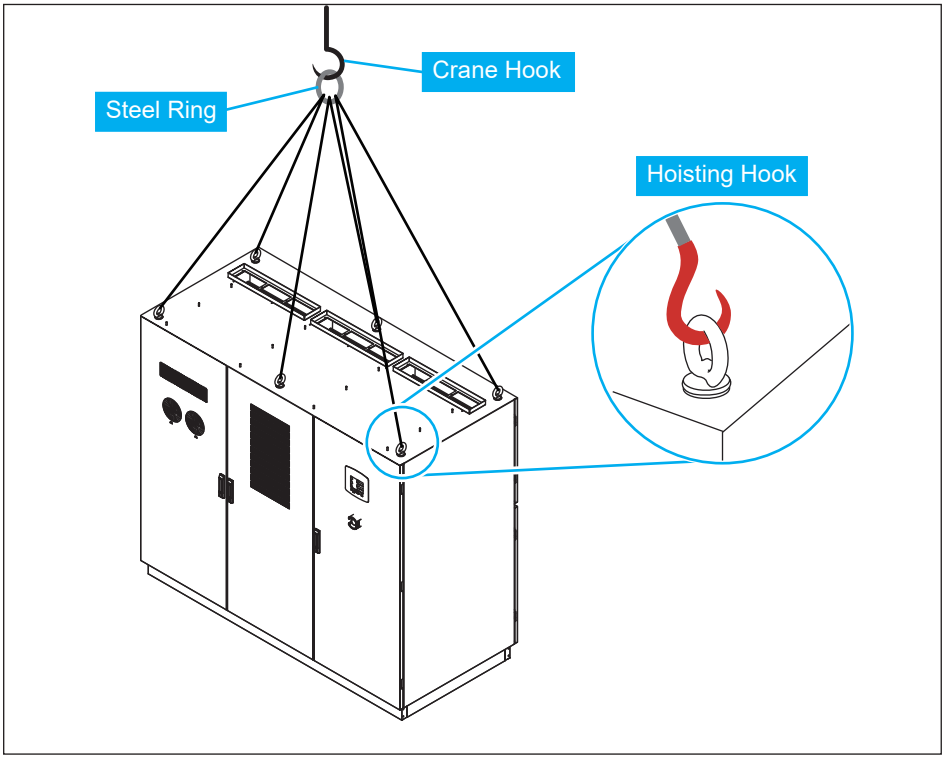



***Figure 3-11 : Attaching the Hoisting Cables***

5. Attach the crane hook to the steel ring on the hoisting cables.
6. Lift up the inverter and transfer to the installation site steadily.
7. Remove the hoisting cables.

## 3.4 Unpacking

To unpack the central inverter from shipping crate, follow these steps:

1. Remove top cover of paper case and then remove the paper box in clockwise direction.

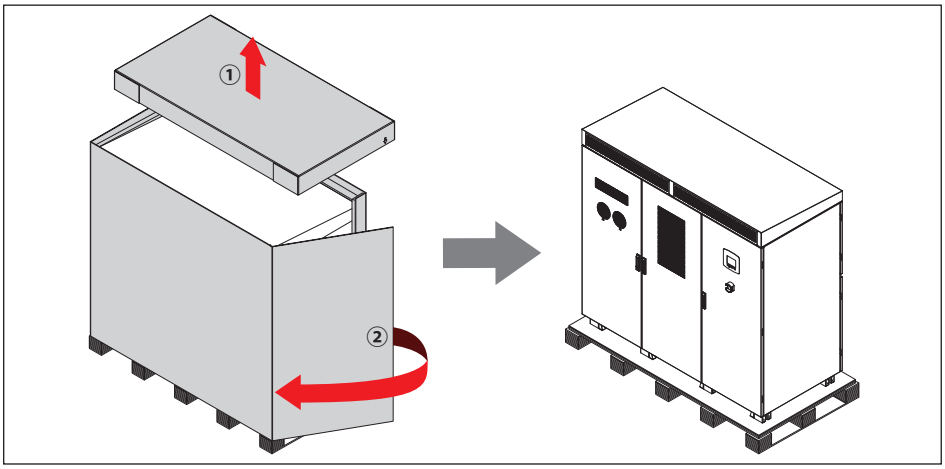



*Figure 3-12 : Removing the paper case*

2. Loosen the screws & nuts that attach it to the shipping pallet and the bottom of central inverter.

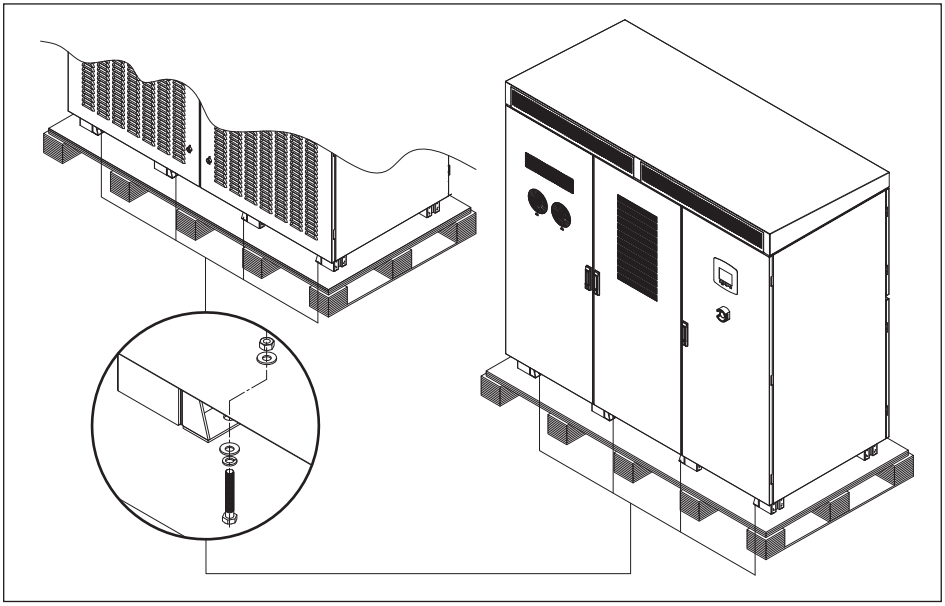


*Figure 3-13 : Loosening the screws & nuts*

3. Remove the central inverter from the pallet.

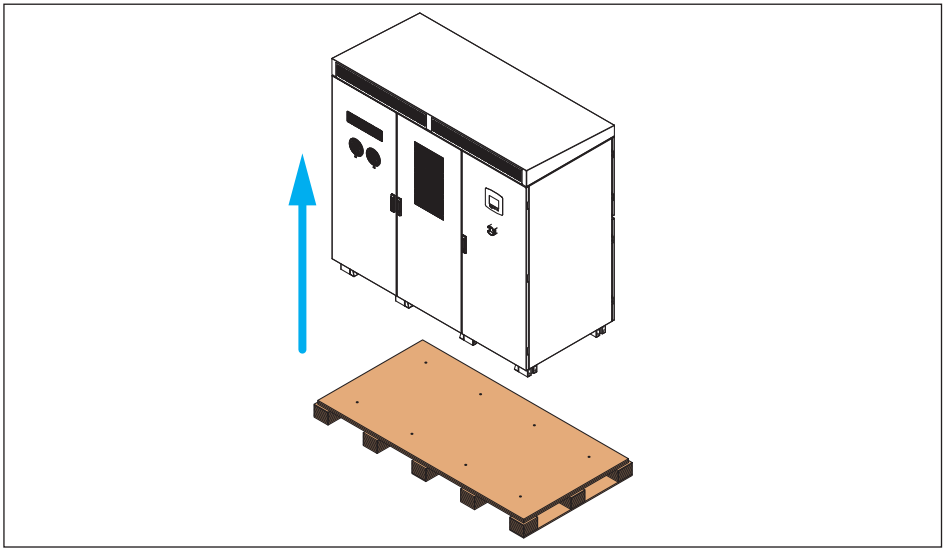


*Figure 3-14 : Removing the Central Inverter from the Pallet*

## 3.5 Package Contents

| Object | Qty | Description |
|---|---|---|
| Central Inverter | 1 | C1000 Inverter |
| Key | 4 | Open/Close the door of the inverter<br>(Front door*2 /Back door*2) |
| Installation Manual | 1 | The instruction to provide the information of safety, installation, specification, etc. |
| M10 Screw Set | 4 | Include of screw and nut<br>Reserve for DC connection |
| M12 Screw Set | 2 | Include of 50mm screw and nut and reserve for AC connection |
| Wire | 1 | Positive/negative grounding setting for PV array |
| M5 Screw | 1 | Attach positive/negative grounding setting for PV array (12 mm long) |
| Card License | 1 | Inverter qualification certificate |
| Test Report | 1 | Inverter relative test data content |
| U-type insulator | 1 | Insulate different phase terminals and prevent them from touching |
| L-type insulator | 1 | Prevent touching with AC busbar after installation |
| M4 Screw | 2 | Attach transparent Insulator |
| Movable Bushing | 15 | Prevent cable from being broken by the edge of the bottom plate |

*Table 3-1 : Package Contents*

# 4 Installation

## 4.1 Recommended Tools

Only use tools that have been recommended to install the unit.

- Power meter (power analyzer)
- Voltmeter
- Current meter
- Adjustable / Torque / Socket Wrench
- Screwdriver

## 4.2 DC Connection

1. Thread the DC power cables through the bottom plate of DC side that is shown in ***Figure 4-1***.

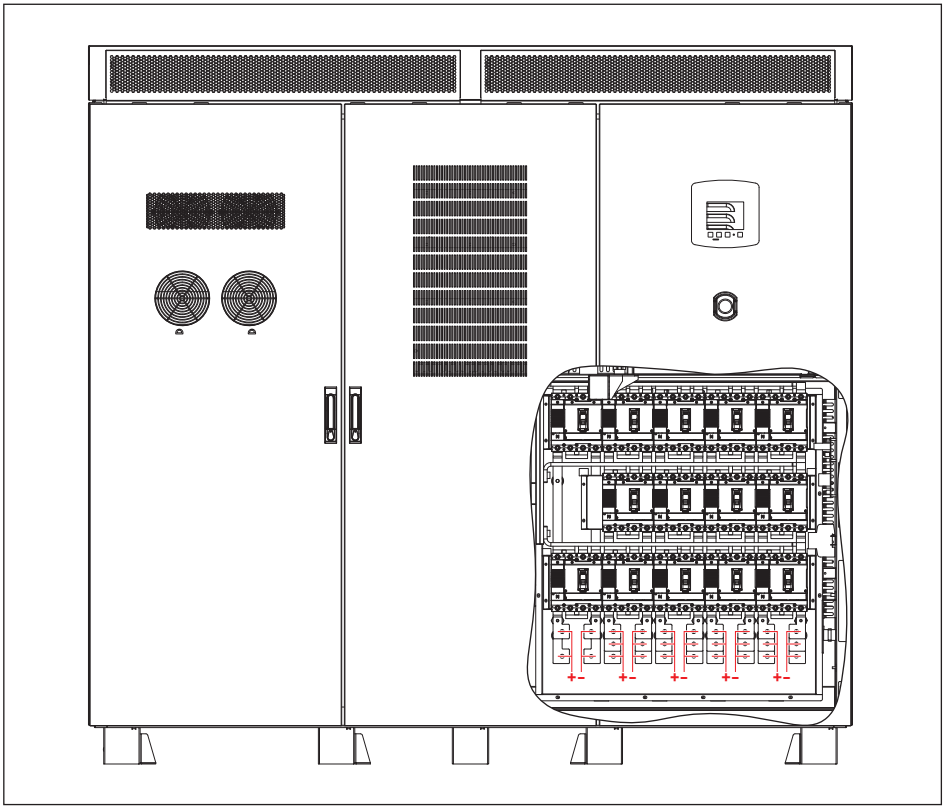


***Figure 4-1 : DC Power Cable Wiring***

2. Connect the power cables from the DC distribution box to the PV Inverter.

**C1000**

| DC Terminal | No. of conductor (+/-) | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 12 ~ 14 | M10 | 25 |

| DC Cable (Cu) | Minimum cable size requirement for DC+/DC- |
|---|---|
| | 70 $mm^2$ (14 Runs) / 95 $mm^2$ (≧12 Runs) |

| DC Cable (Al) | Minimum cable size requirement for DC+/DC- |
|---|---|
| | 95 $mm^2$ (14 Runs) / 120 $mm^2$ (≧12 Runs) |

* Maximum cable size allowed for DC+/DC- → 240 $mm^2$

**NOTE**

The detailed dimension of DC bottom plate can refer to Appendix B.

**CAUTION!**

- The working temperature of power cable should be at least 105°C.

**NOTE**

Need to use moving bushing and silicon rubber for waterproof and dust.
The recommended material of movable bushing and silicon rubber is shown as below:

| Component | Part number | Vendor |
|---|---|---|
| Movable bushing | KG-020 | KANG YANG HARDWARE |
| Silicon rubber | RTV162 | GE Bayer Silicones |

**For cables and terminals:**

Delta recommends the cables used should be flexible unarmored multi-strand and with suitable ampacity.

Delta would highly recommend that the material surface of copper wire / aluminum wire lug should be tin or nickel electroplated.

**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:

- ► Please select the Al wire size according to rules due to lower conductivity of Al.
- ► Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ► Connect the aluminum cables quickly.
- ► Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.

## 4.2.1 Dimension of DC Busbar

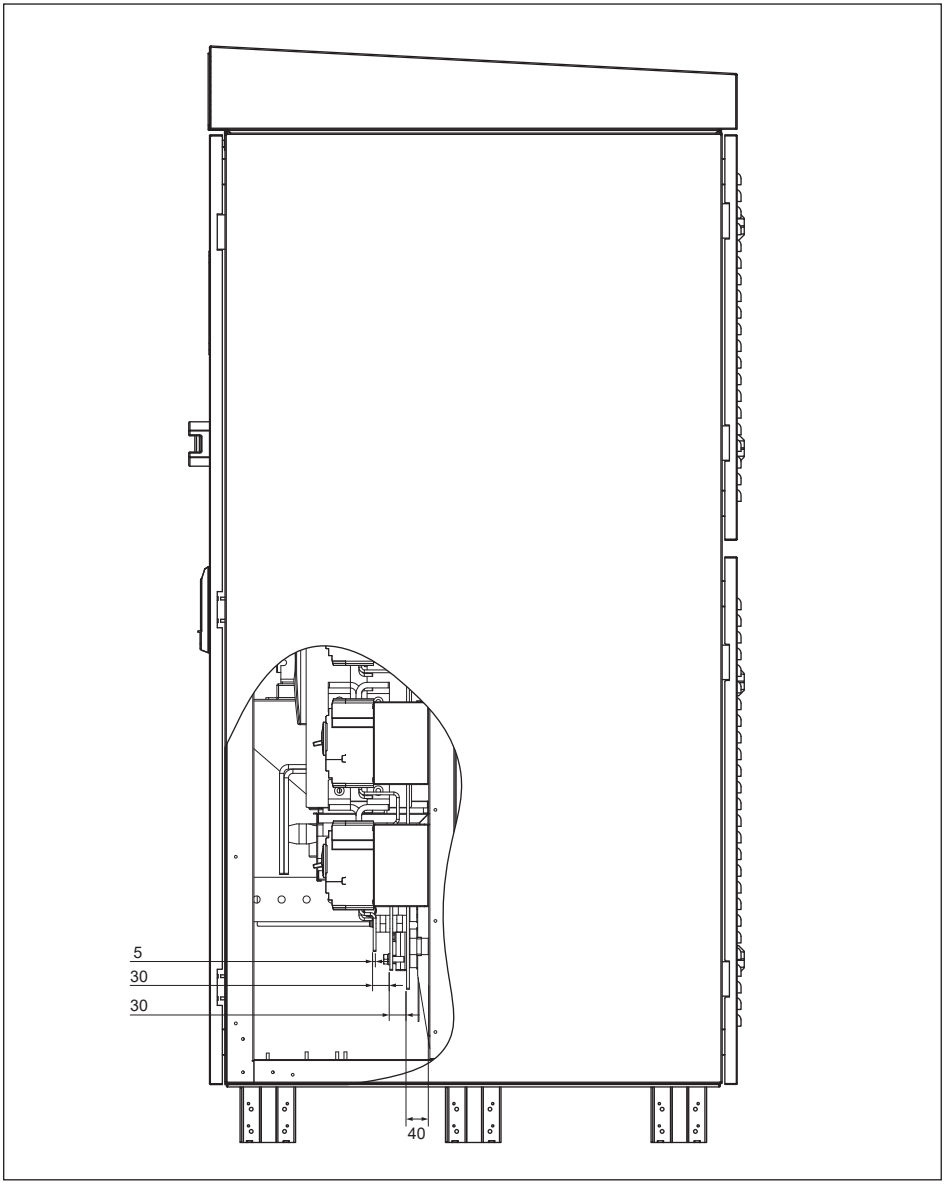



*Figure 4-2 : DC Busbar dimensions (side view)*

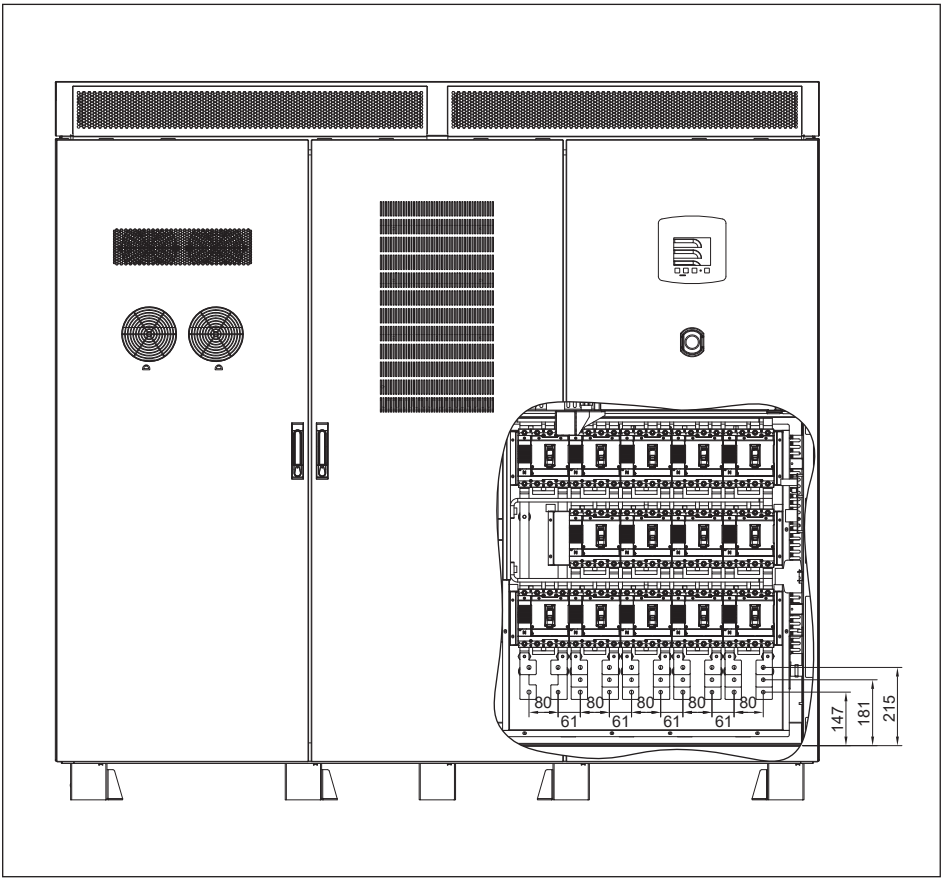



***Figure 4-3 : Dimensions of the DC connection lugs***

## 4.2.2 Positive/Negative Grounding

The PV array can be grounded using positive grounding or negative grounding.
To ground the PV array follow these steps: (***Figure 4-4***)

1. Connect the grounding cable to the fuse holder.
2. Secure the grounding cable to the DC+ or DC- busbar with one screw.
   (Fuse holder: 30 Kgf-cm (3N-m) / busbar+/-: 25 Kgf-cm (2.5N-m))

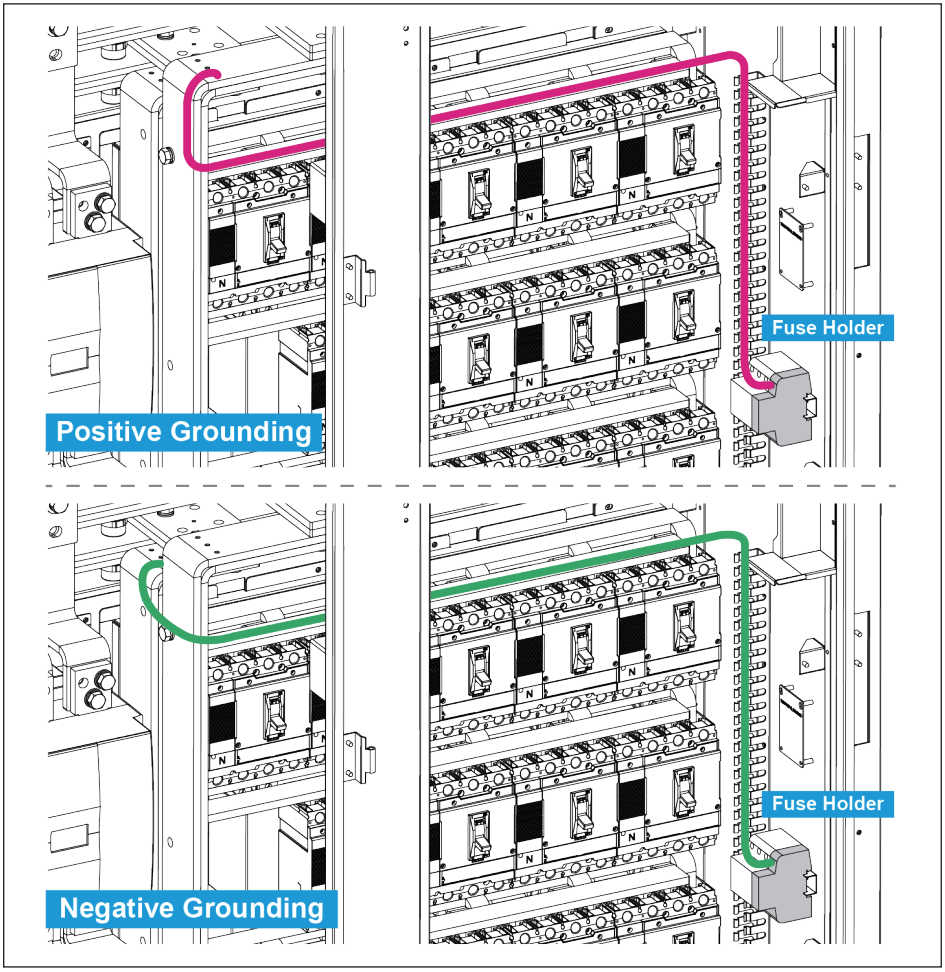



***Figure 4-4 : Configure to Positive (DC+) / Negative (DC-) Grounding***

**NOTE**

Positive and negative grounding can be set via display.
Please refer to ***5.3.7.3 Install Settings***

## 4.3 AC Connection

1. Thread the AC power cables through the bottom plate of AC side that is shown in ***Figure 4-5.***

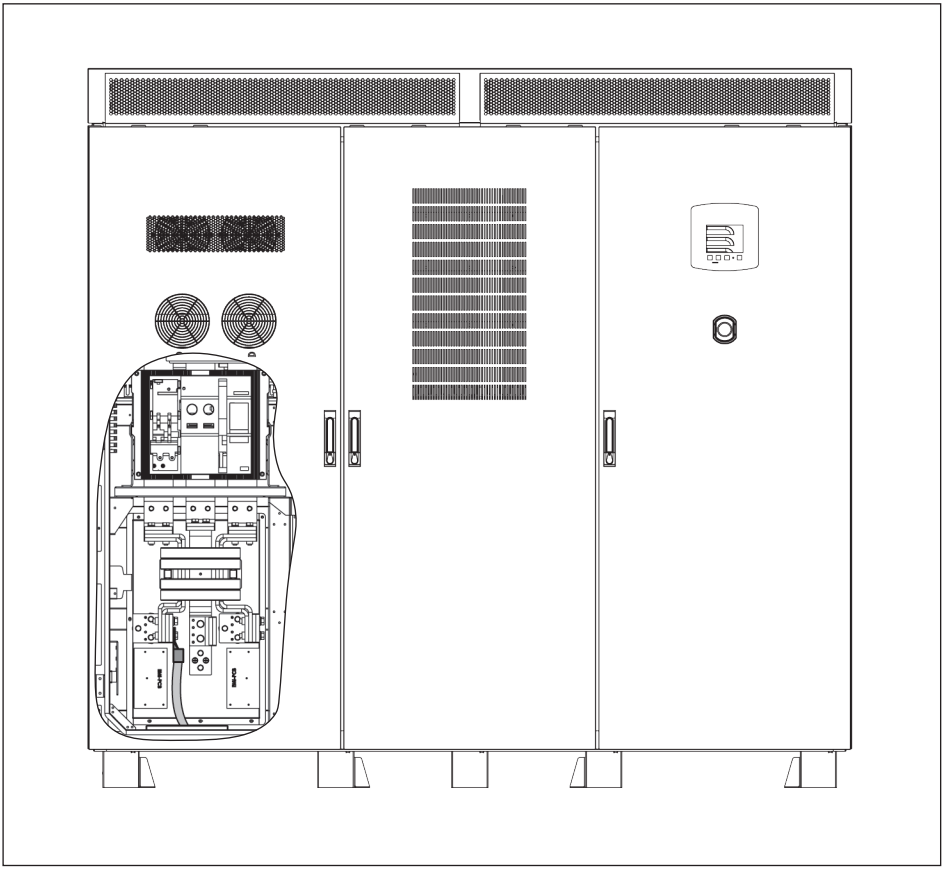


***Figure 4-5 : AC Power Cable Wiring***

2. Connect the power cables from the AC distribution box to the PV Inverter.

## C1000

| AC Terminal | Maximum No. of conductor for each phase | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 8 (<300 $mm^2$) | M12 | 45 |

| AC Cable (Cu) | Minimum total cable size requirement for each phase |
|---|---|
| | 1110 $mm^2$ |
| | The minimum requirement of individual cable size and numbers for each phase AC cable. |
| | 150 $mm^2$ x 8 |

| AC Cable (Al) | Minimum total cable size requirement for each phase |
|---|---|
| | 1480 $mm^2$ |
| | The minimum requirement of individual cable size and numbers for each phase AC cable. |
| | 185 $mm^2$ x 8 |

**NOTE**

The detailed dimension of AC bottom plate can refer to Appendix B.

**CAUTION!**

- The working temperature of power cable should be at least 105°C.

**NOTE**

Need to use moving bushing and silicon rubber for waterproof and dust.
The recommended material of movable bushing and silicon rubber is shown as below:

| Component | Part number | Vendor |
|---|---|---|
| Movable bushing | KG-020 | KANG YANG HARDWARE |
| Silicon rubber | RTV162 | GE Bayer Silicones |

**For cables and terminals:**

Delta recommends the cables used should be flexible unarmored multi-strand and with suitable ampacity.

Delta would highly recommend that the material surface of copper wire / aluminum wire lug should be tin or nickel electroplated.

**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:

- ► Please select the Al wire size according to rules due to lower conductivity of Al.
- ► Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ► Connect the aluminum cables quickly.
- ► Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.

When the first time, the AC breaker is being used, keep swinging the charge handle up and down to charge until the Charged/Discharged Indicator shows “CHARGED” status. Then press the green ”ON button”, and AC breaker will be conducted and also the ON/OFF indicator will show “ON” status for operation appearance.
If press the red ”OFF button” , AC breaker will trip out. When you need to turn on the breaker again, please recharge then press the green “ON button”.




1 Charge handle  2 ON button  3 OFF button
4 Charged/Discharged indicator  5 ON/OFF indicator

***Figure 4-6 : AC breaker***

## 4.3.1 Dimension of AC Busbar

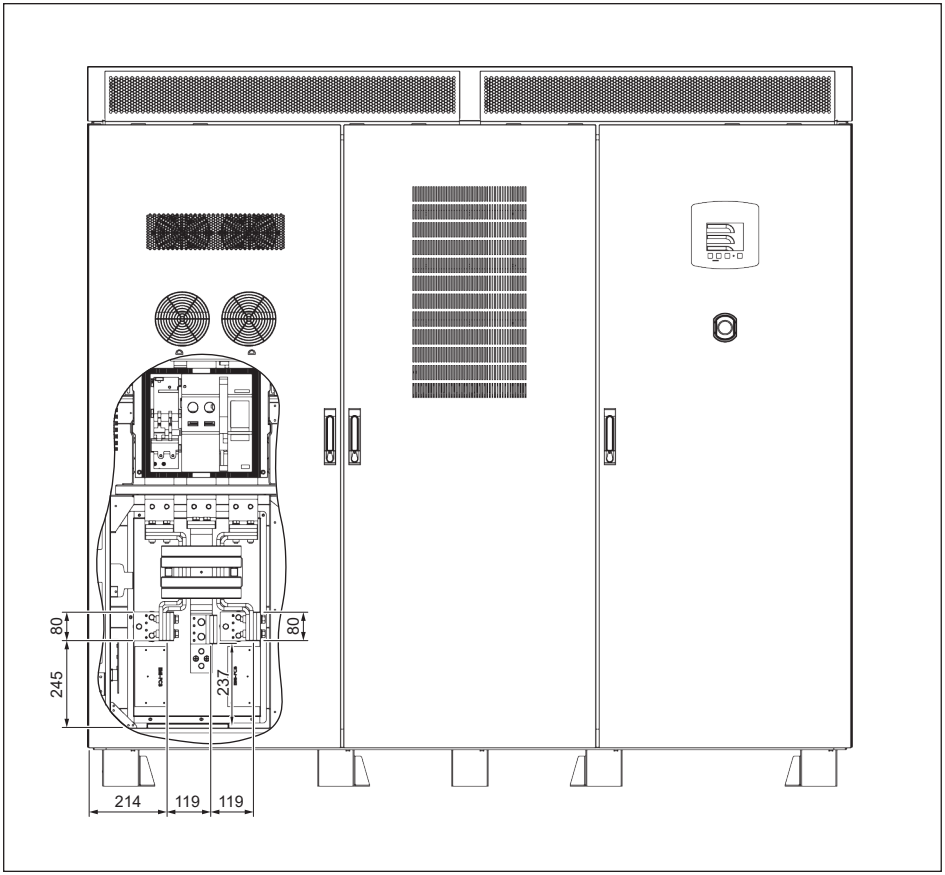



*Figure 4-7 : AC Busbar dimensions (Bottom view)*

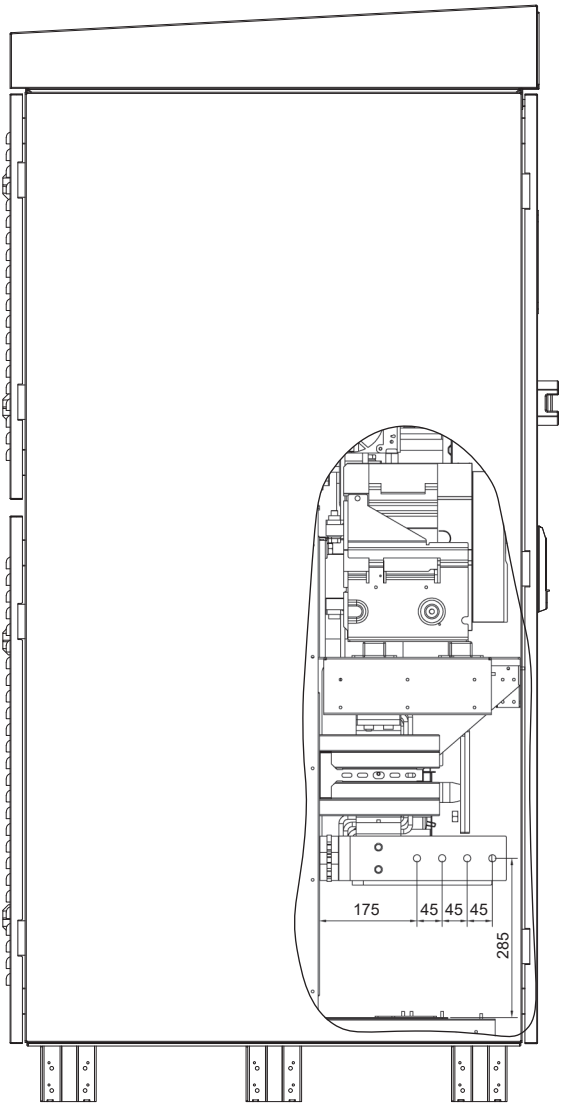



***Figure 4-8 : Dimensions of the AC connection lugs***

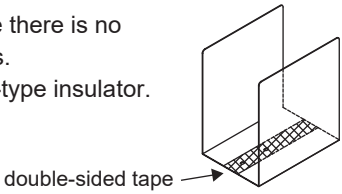
## 4.4 AC Side Insulator Installation

**CAUTION!**

- TO AVOID ELECTRICAL HAZARD, PLEASE TURN OFF ALL DC AND AC POWER BEFORE INSTALLATION AND REMOVAL.

After wiring at AC side, if the gap between different two-phase terminals is within 10 mm, please install the U-type insulator to prevent terminals from touching.

1. Turn off all DC and AC Power, and make sure there is no remaining electricity on both DC and AC sides.
2. Tear the double-sided tape on back side of U-type insulator.
3. Stick the insulator on AC busbar.



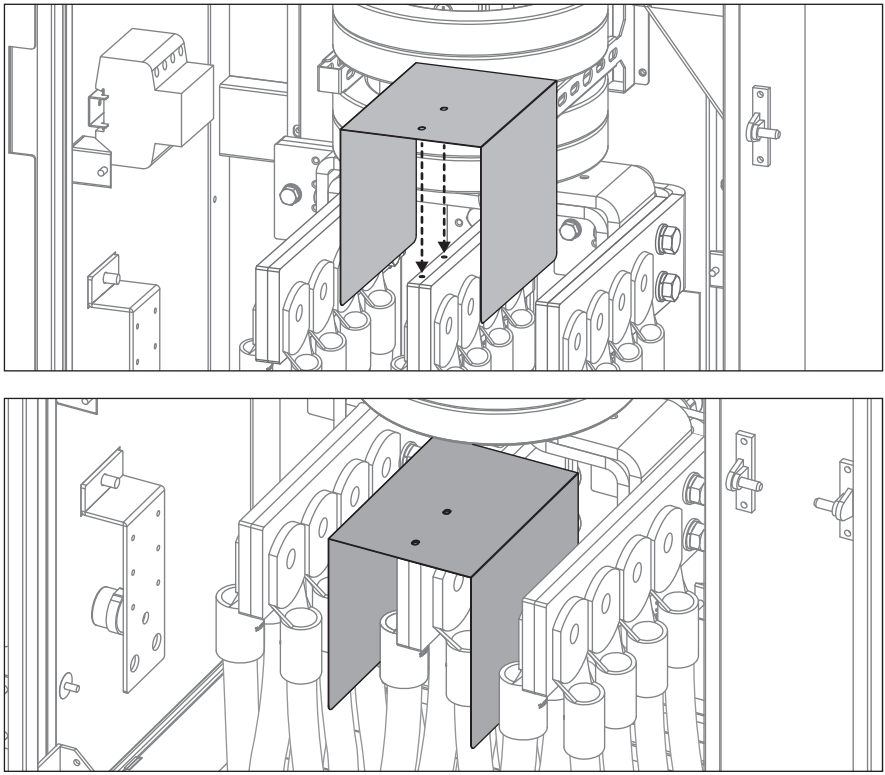
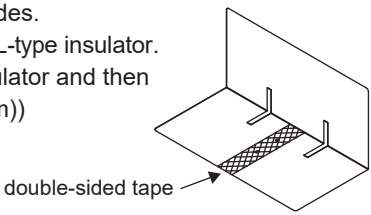



*Figure 4-9 : AC Side U-type Insulator Installation*

Install the L-type insulator on the U as the same steps to prevent touching with the AC busbar.

1. Turn off all DC and AC Power, and make sure there is no remaining electricity on both DC and AC sides.
2. Tear the double-sided tape on back side of L-type insulator.
3. Stick the L-type insulator on the U-type insulator and then attach M4 Screws. (Torque: 8kgf-cm(0.8Nm))



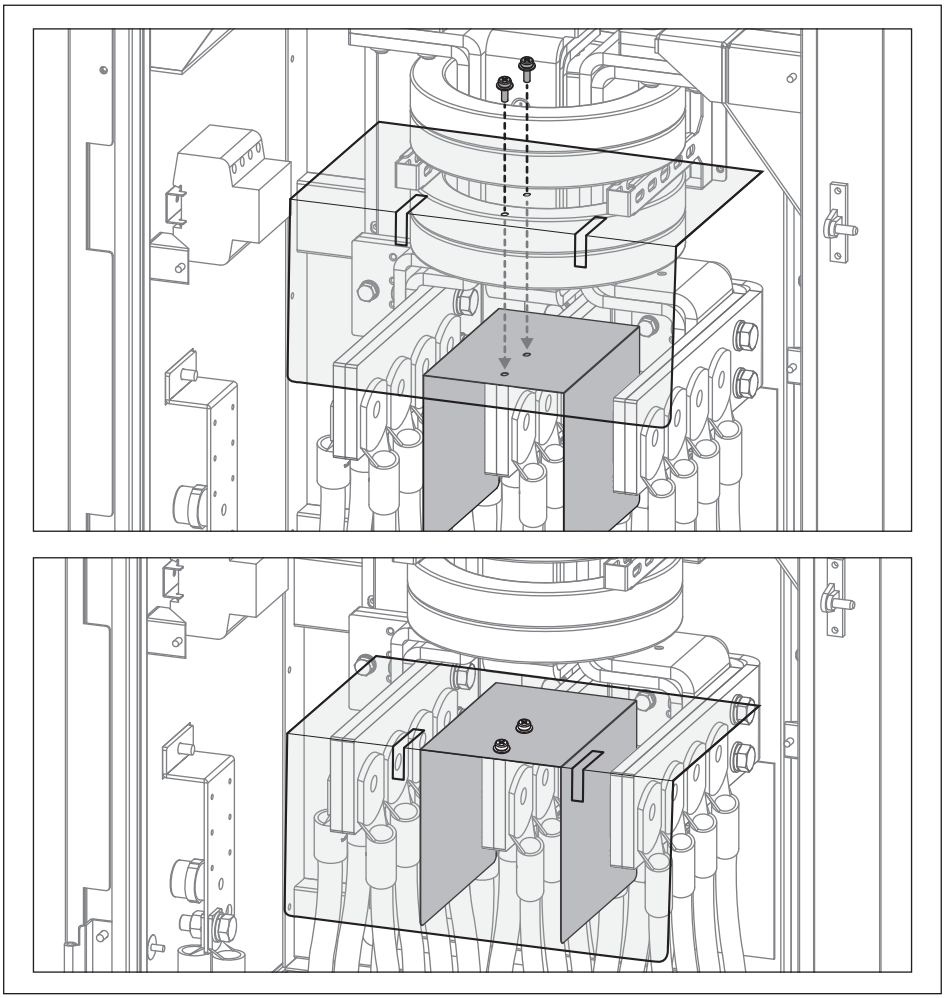



***Figure 4-10 : AC Side L-type Insulator Installation***

## 4.5 PE Connection

There are two positions that can be connected to PE.

1. Inverter inside. Connect PE to the busbar in AC or DC side.
2. Inverter outside. Connect PE to the inverter holder.

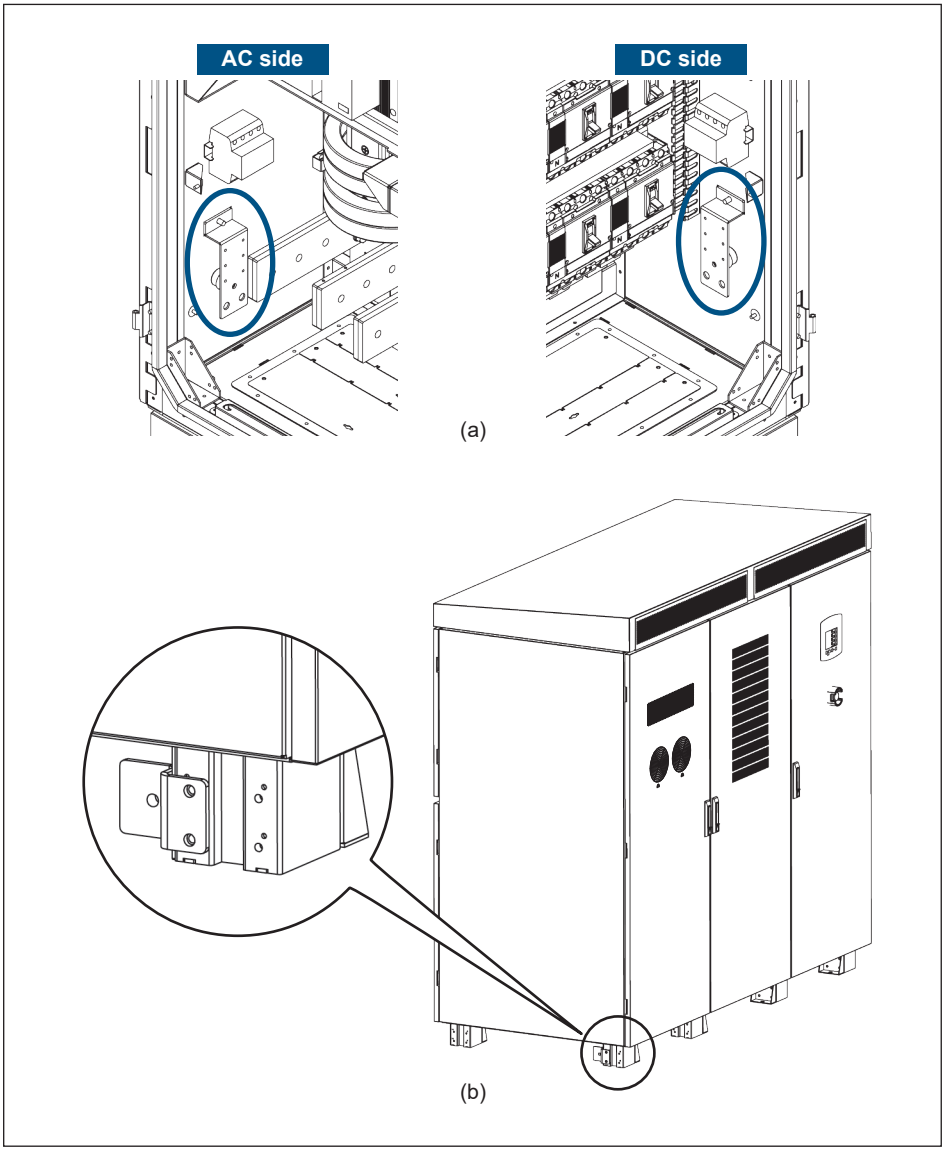



*Figure 4-11 : PE Connection (a) inverter inside; (b) inverter outside*

## 4.5.1 Dimension of PE Busbar

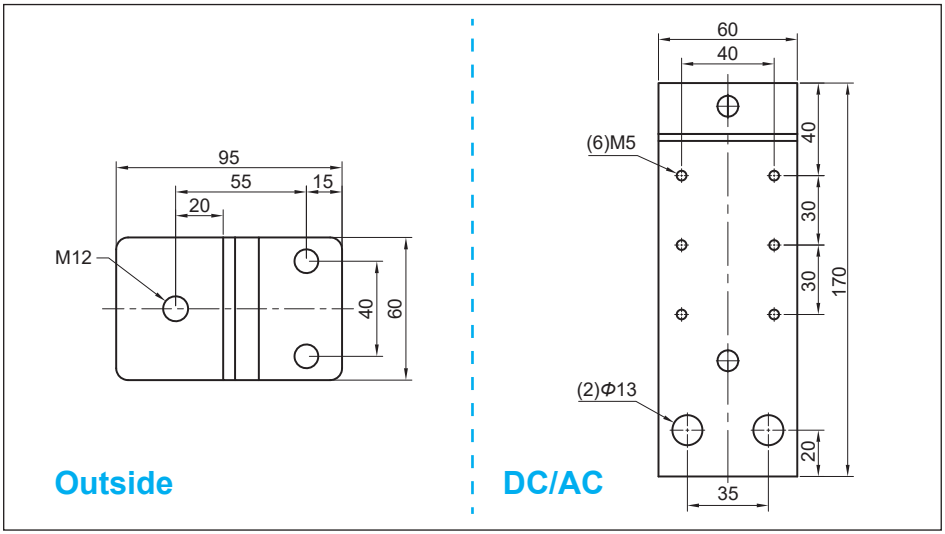



*Figure 4-12 : Dimensions of the PE connection lugs*

**C1000**

| PE Terminal | Maximum No. of conductor (DC/AC/Outside) | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 4/4/1 | M12 | 45 |

| PE Cable (Cu) | Minimum total cable size requirement |
|---|---|
| | 555 $mm^2$ |

| PE Cable (Al) | Minimum total cable size requirement |
|---|---|
| | 740 $mm^2$ |

**CAUTION!**

- The working temperature of power cable should be at least 105°C.

**NOTE**

Please follow these steps when using other cable combinations.

1. Check the terminal lug of the cable whether to match the connection with the terminal of busbar, including the hole size of screw and the width of screw hole on busbar. The relative information of the dimension is shown as ***Figure 4-11.***
2. If the cable size and number is not suitable for the above mentioned due to insufficient space. You can replace cable gland by snap bushing and silicon rubber. The recommended material of movable bushing and silicon rubber is shown as below:

| Component | Part number | Vendor |
|---|---|---|
| Movable bushing | KG-020 | KANG YANG HARDWARE |
| Silicon rubber | RTV162 | GE Bayer Silicones |

**For cables and terminals:**

Delta recommends the cables used should be flexible unarmored multi-strand and with suitable ampacity.

Delta would highly recommend that the material surface of copper wire / aluminum wire lug should be tin or nickel electroplated.

**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:

- ► Please select the Al wire size according to rules due to lower conductivity of Al.
- ► Keep the installation location as free as possible from moisture or corrosive atmospheres.
- ► Connect the aluminum cables quickly.
- ► Tighten the clamping screw in the clamping body with the maximum permissible tightening torque.

## 4.6 Attach/Remove the Plates

To attach the plates, follow these steps:

1. Attach the plates to the front and back of the bottom of the central inverter.
2. Tighten the screws on the both side of the plates.

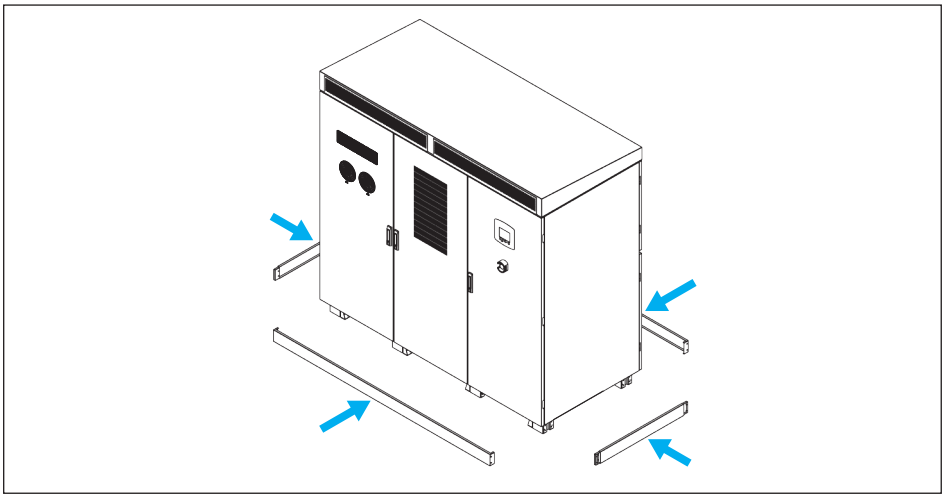


*Figure 4-13 : Attaching the plates*

To remove the plates, follow these steps:

1. Loosen the screws on the both side of the plates
2. Remove the plates of the central inverter.

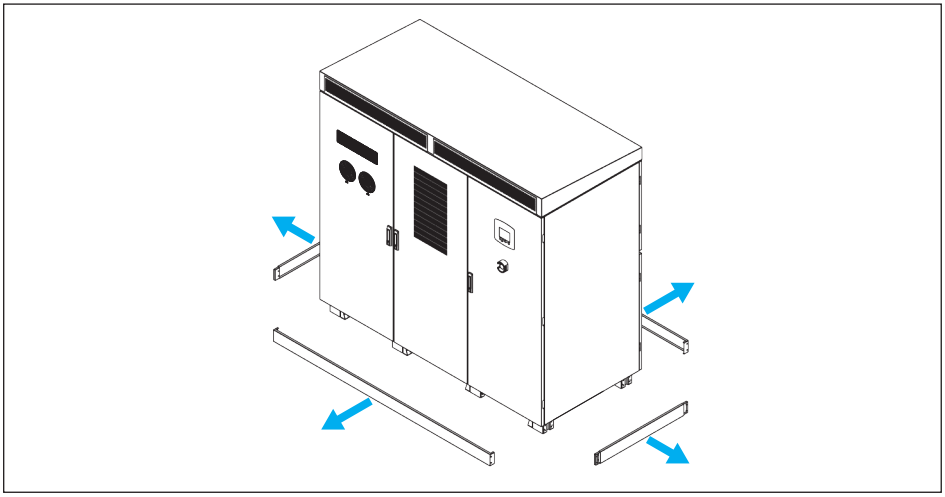


*Figure 4-14 : Removing the plates*

## 4.7 Connection of Communication Modules

The Communication Module provide the function of communication with 2-port RS-485 and 2-port dry contacts.

### 4.7.1 RS-485 Connection

The pin definition of RS-485 is shown as in ***Table 4-1.*** Installer should switch **ON** the terminal resistor when single inverter is installed. The cable wire position and wiring of multi-inverter connection is shown as ***Figure 4-14*** & ***Figure 4-15.*** Installer must switch **ON** terminal resister at the first and last devices on the RS-485 chain as ***Figure 4-15***. The other terminal resisters must be switch **OFF**. Please refer to ***Table 4-3*** for the terminal resister setting.

**ATTENTION**

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

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




***Table 4-1 : Definition of RS-485 PIN***

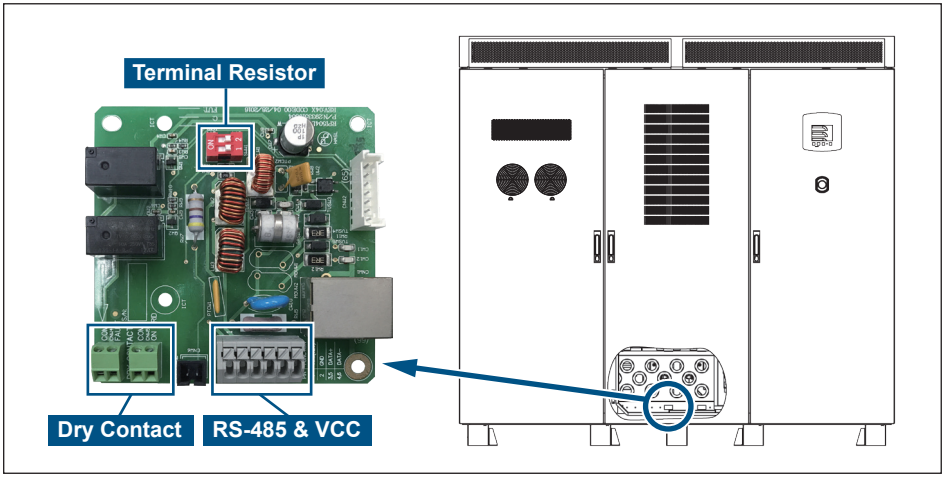



***Figure 4-15 : Cable Wire Position for Multi-inverter Connection***

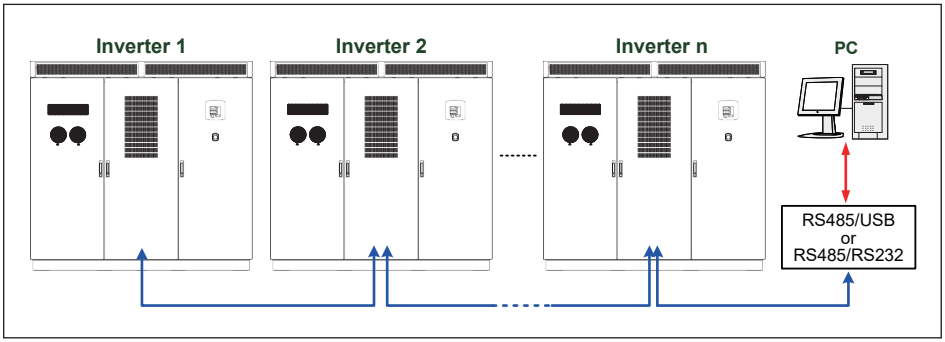
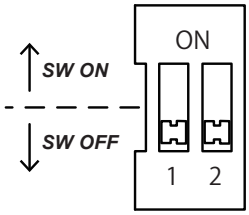



*Figure 4-16 : Multi-inverter Connection Illustration*

| | |
|---|---|
| Baud rate | 9600/19200(default)/38400 |
| Data bit | 8 |
| Stop bit | 1 |
| Parity | N/A |

*Table 4-2 : RS-485 Data Format*




| SW / Terminal Resistor | 1 | 2 |
|---|---|---|
| OFF | OFF | OFF |
| ON | ON | OFF |
| | OFF | ON |
| | ON | ON |

*Table 4-3 : Terminal Resister Setting*

## 4.7.2 Dry Contact Connection

Provide 2 set of Dry Contact function for gird and fault respectively. When inverter is on grid, COM & NO2 will be shorted. When the Hardware Fail is detected, COM & NO1 will be shorted. This might be programmable according to the request of customer.

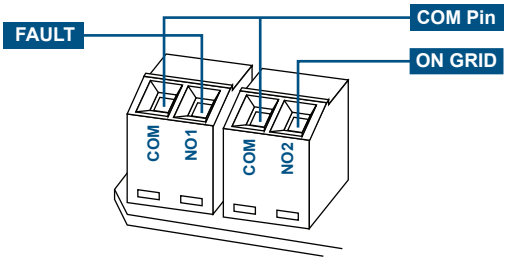



*Figure 4-17 : Dry Contact Port & Assignments*

# 5 Turn on PV Inverter

## 5.1 Before Powering Up

1. Check the PV array.

**NOTE**



The PV array open circuit DC voltage must be greater than 650Vdc and less than 1000Vdc.

a. Measure the PV array open circuit DC voltage across the DC positive (+) and negative (-) terminals in DC distribution.

2. Check the AC utility voltage.

Use an AC voltmeter to measure the AC utility voltage. The voltage level should be at the nominal value of 350Vac Line to Line.

## 5.2 Powering Up the Inverter and Self-test

1. Configure the PV inverter settings.

To provide power to the inverter, switch on the DC switch. The LCD display would be worked normally after 40seconds.

a. For the first time start-up, the Select Country screen is displayed. Highlight a country in the list by pressing the up ▲ or down ▼ buttons and press **ENT** to select or **EXIT** to cancel.
b. Verify the language you selected is correct by pressing **ENT** for Yes or **EXIT** for No. Select No to return to the previous screen.
c. The Select Language screen is displayed. Highlight a language by press- ing the up ▲ or down ▼ buttons and press **ENT** to select or **EXIT** to cancel and return to the first screen.
d. The Main Menu screen is displayed. Highlight E-Today by pressing the up ▲ or down ▼ buttons and press **ENT** to select or **EXIT** to cancel.
e. The E-Today screen is displayed while the inverter performs a self-test. If the self-test passes. the System Boot Countdown screen is displayed. If the self-test fails, the test is performed again.
f. The System Boot Countdown screen is displayed and the countdown begins. Press **EXIT** to return to the Main Menu screen.
g. The Main Menu screen is displayed. Highlight Power Meter by pressing the up ▲ or down ▼ buttons and press **ENT** to select.
h. The Power Meter screen is displayed. Confirm input and output information and press **EXIT** to return to the main menu screen.
i. The Main Menu screen is displayed and the setup is complete.

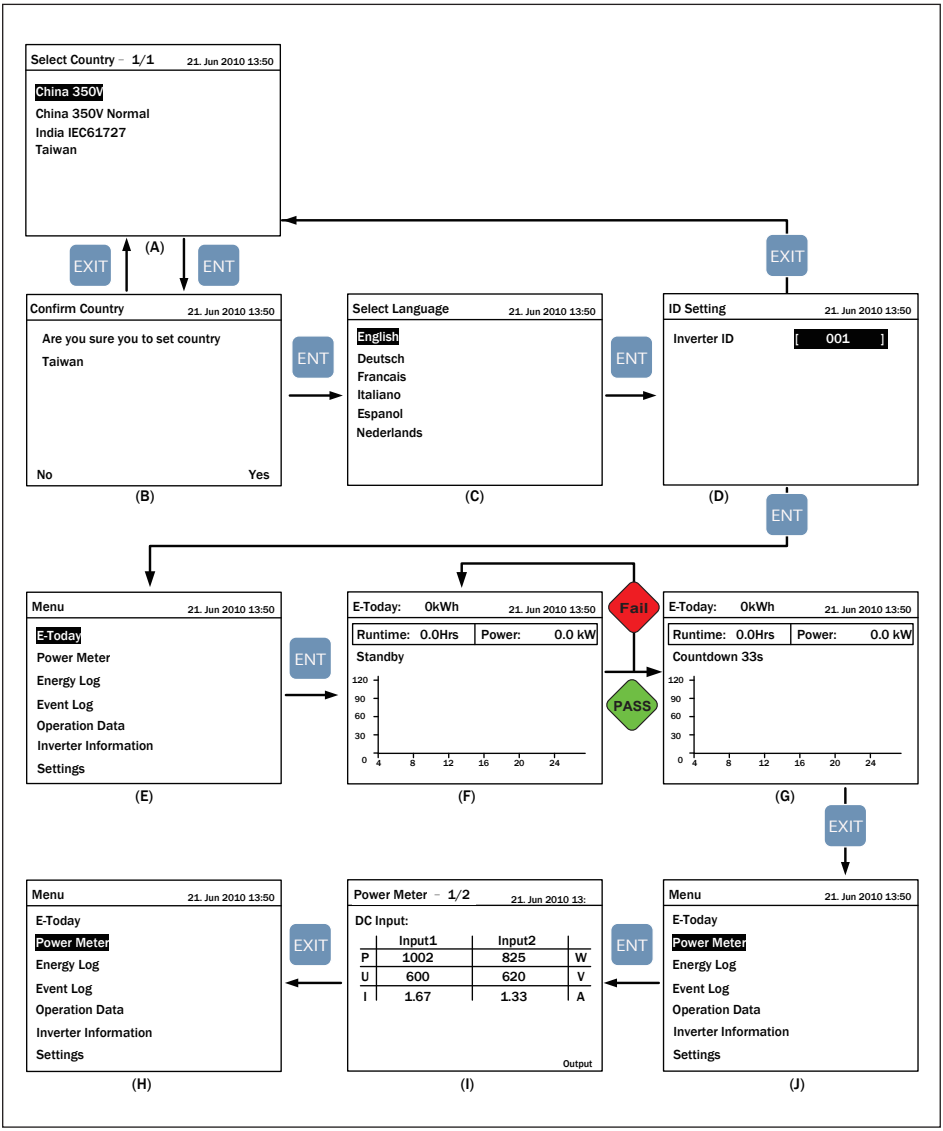



*Figure 5-1 : Configuration Screens*

## 5.3 LCD Flowchart

C1000 model has a 320x240 pixel LCD display and two LED lights to indicate inverter's status. Please refer to ***Table 5-1*** for more information about inverter's statuses and LED indicator.

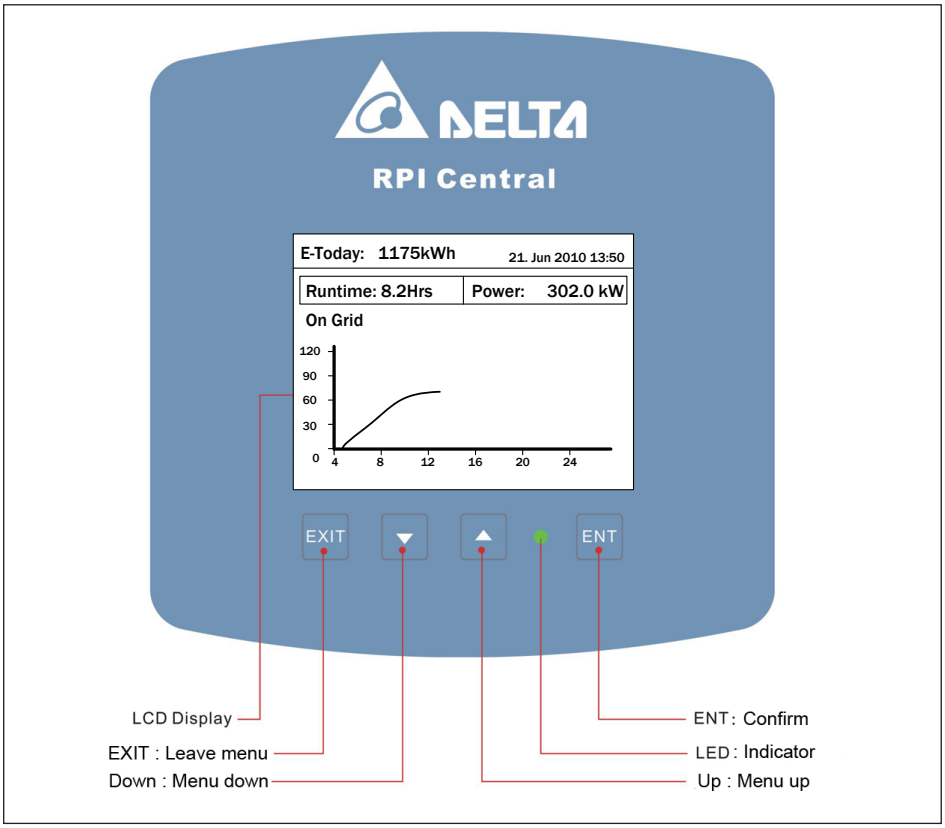



***Figure 5-2 : Panel indicator***

| Condition | Green LED | Red LED |
|---|---|---|
| Countdown | FLASH * | OFF |
| Power ON | ON | OFF |
| Error or Fault | OFF | ON |
| Standby or Night time | OFF | OFF |
| Bootloader mode | FLASH * | |

* ON 1s / OFF 1s

***Table 5-1 : LED indicator***

## 5.3.1 Home Page

When inverter is operating normally, LCD will show home page as ***Figure 5-3***, user can get the information about output power, inverter status, E-today, date and time.

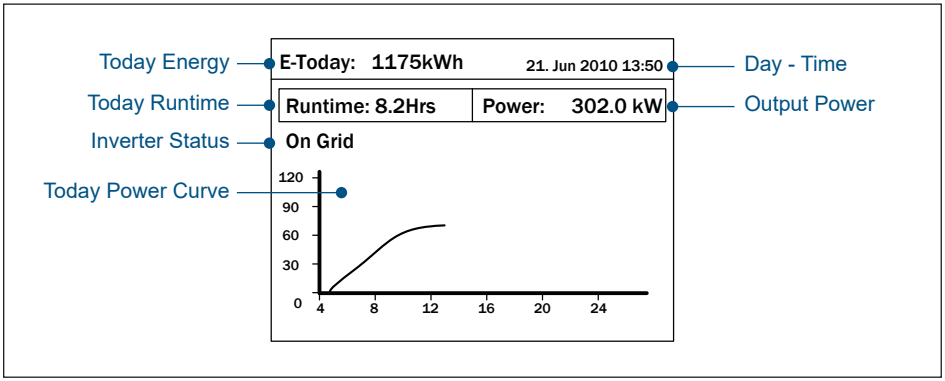



***Figure 5-3 : Home Page***

## 5.3.2 Power Meter

This page shows the information about input and output power.

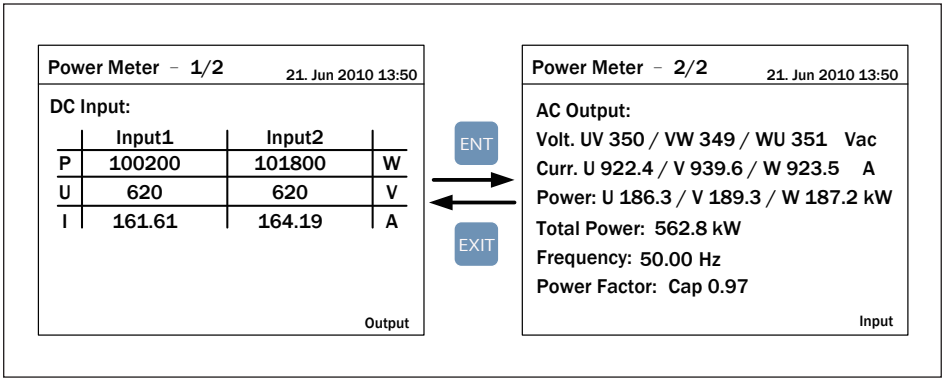



***Figure 5-4 : Power Meter Page***

## 5.3.3 Energy Log

After pressing ***ENT*** in this page, user can view the historical data about power generating yearly, monthly, and daily.

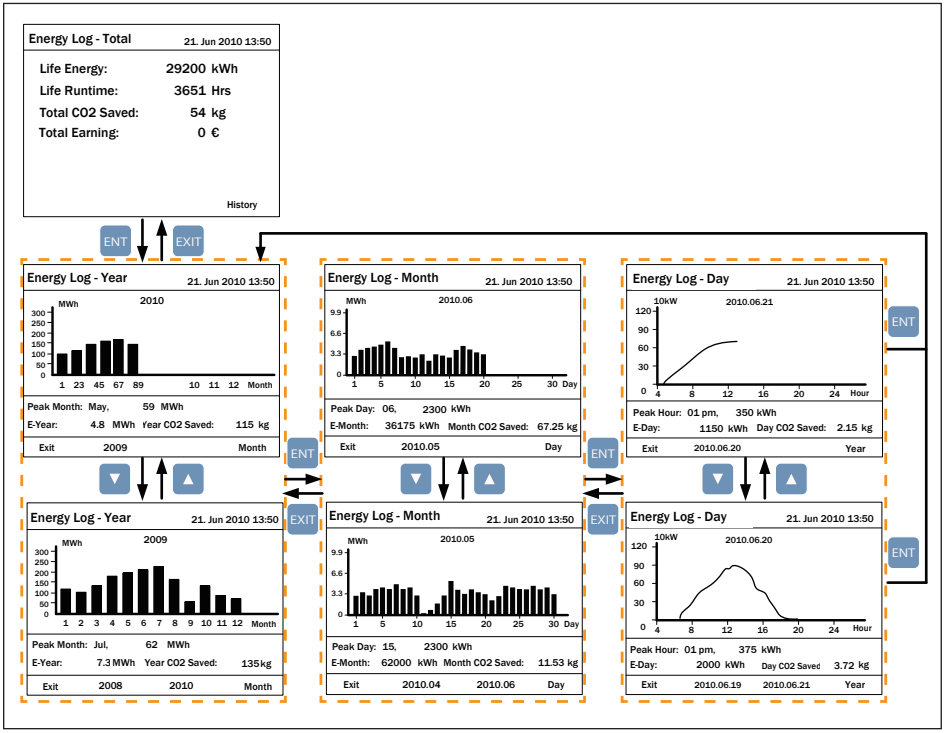



***Figure 5-5 : Energy Log Flow Chart***

## 5.3.4 Event Log

When entering this page, the display will show all the events (error or fault) and it can show 30 records at most with the latest one on the top. When pressing ***ENT***, user can view all the statistical data.

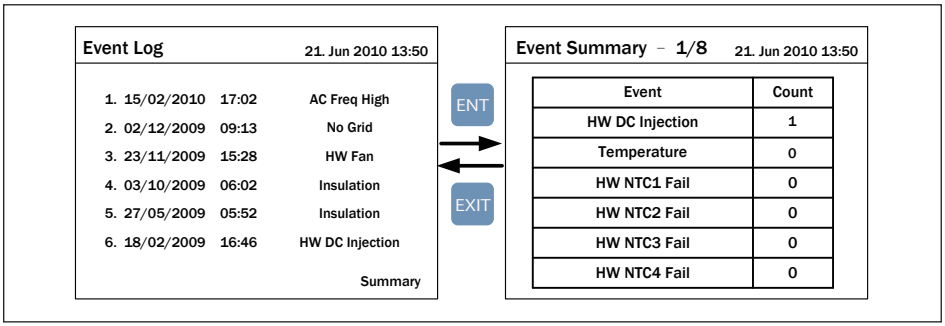



*Figure 5-6 : Event Log Flow Chart*

## 5.3.5 Operation Data

Have 4 pages; record the maximum and/or minimum values of history, including voltage, current, power and temperature.

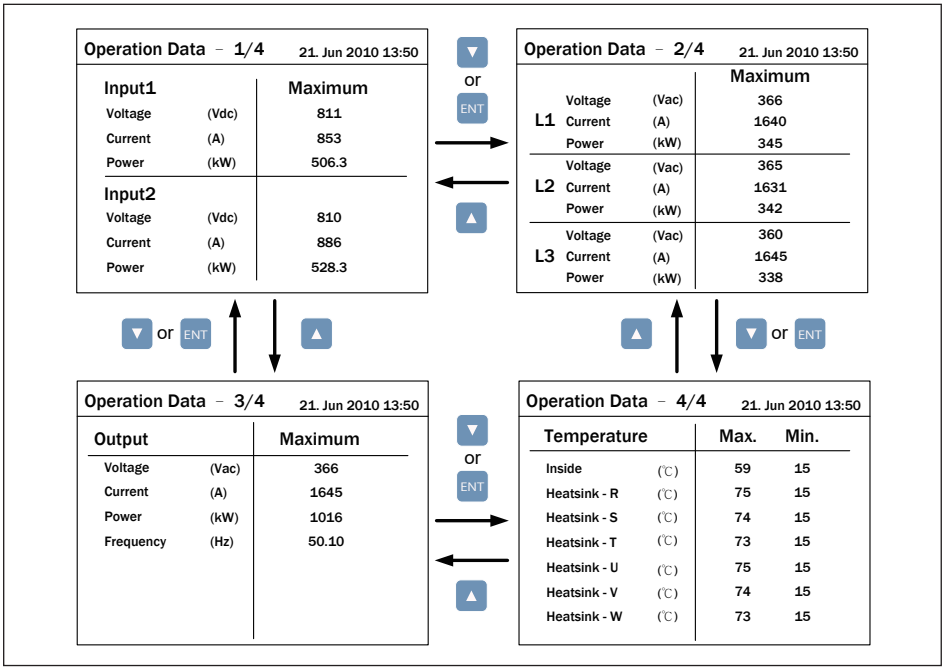



*Figure 5-7 : Operation Data Flow Chart*

## 5.3.6 Inverter Information

This page has the following information: serial number, firmware version, installation date and inverter ID. If user wants to change inverter ID, please refer to Settings.

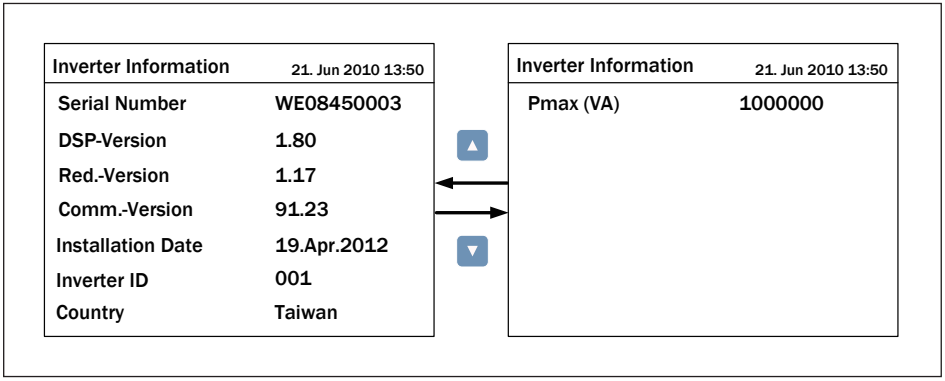



*Figure 5-8 : Inverter Information Page*

## 5.3.7 Settings

The settings menu included of Personal Settings, Coefficients Settings, Install Settings, Active/Reactive Power Control and FRT.

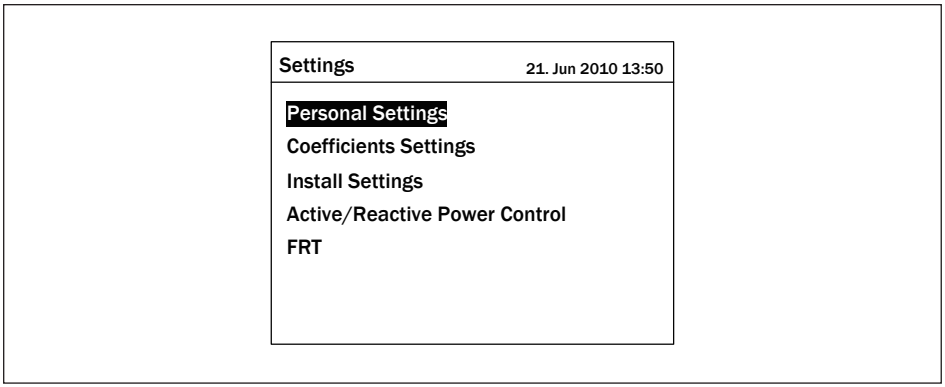



*Figure 5-9 : Setting Page*

## 5.3.7.1 Personal Settings

User can set Language, Date, Time, Screen Saver, LCD brightness and contrast in Personal Settings. Screen Saver can adjust from 5min-60min. When over the setting time limitation without using button functions, the LCD backlight will turn off automatically. Brightness and Contrast can adjust the level 1-5 (low- high).

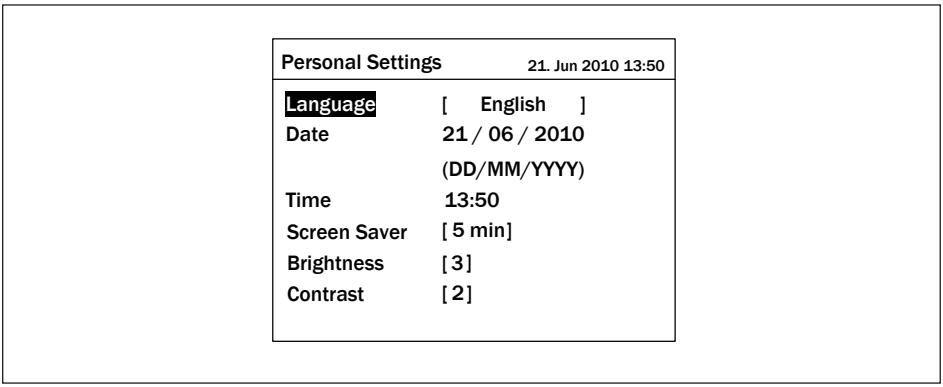



*Figure 5-10 : Personal Settings Page*

## 5.3.7.2 Coefficient Settings

Users can set the following parameters according their needs.

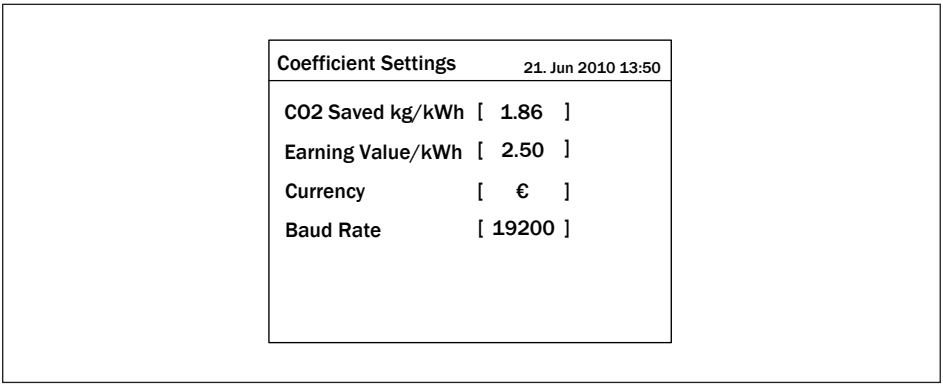



*Figure 5-11 : Coefficient Settings Page*

## 5.3.7.3 Install Settings

**CAUTION!**

ONLY PROFESSIONAL INSTALLER CAN DO THE FOLLOWING CHANGES AND SETTINGS. SETTINGS CHANGED MAY CAUSE DAMAGE TO THE CONVERTER.

Correct passwords are requested when entering Install Settings. Install Settings for user and installation technician are different. The password cannot be revised. After confirmation as the general user password, user can set Inverter ID, and Insulation.

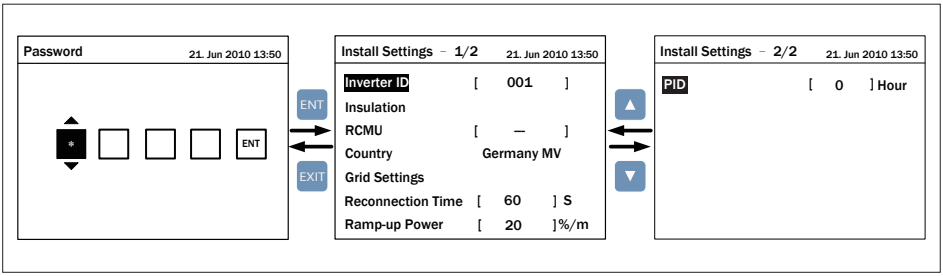



*Figure 5-12 : Install Setting Page -User Mode*

After confirmation as the installation technician passwords, system will add setting options of DC-Injection, Return to Factory, Country and Grid Setting. In Grid Setting selection, technician can adjust the parameter for protection (OVR, UVR, OFR, UFR, etc.) to Utility. Before setting of the protection to Utility in Grid Settings page, please set country as “Custom”. Return to Factory will turn inverter to default setting and delete all the records of event and energy.

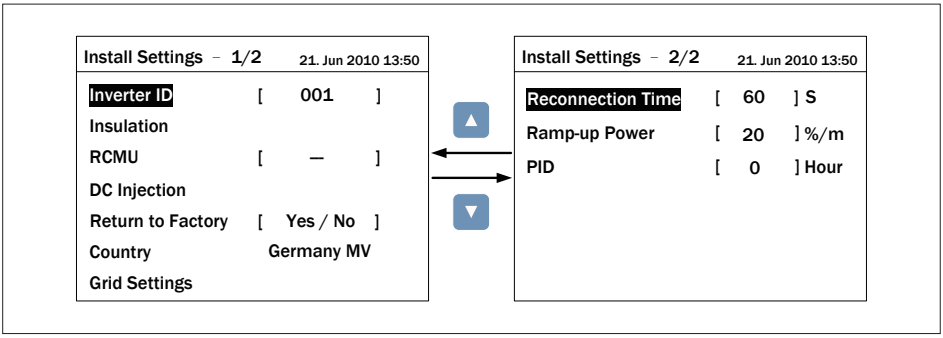



*Figure 5-13 : Install Setting Page -Installer Mode*

## 5.3.7.3.1 Insulation

Inverter will measure the impedance between Array and PE before connect to grid. If the impedance between Array and PE is lower than the value that set in Insulation Settings, inverter will stop connecting to grid. There are 4 modes users can select in Insulation settings: ON, Positive Ground, Negative Ground, or Disable. Installer can also select different impedance according to the actual situation.

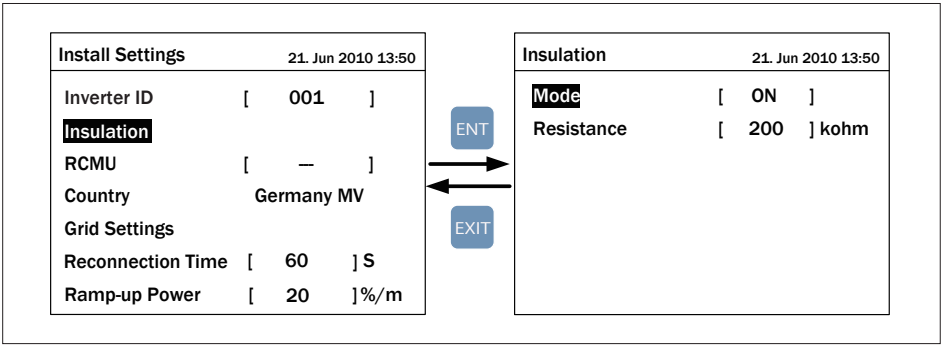



*Figure 5-14 : Insulation Setting*

## 5.3.7.3.2 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 5-15 : Grid Setting Page*

There are 19 parameters in Grid Settings page. User can refer to ***Table 5-2***. for the function of each parameter.

| Parameter | Description |
|---|---|
| Vac High Off | Inverter will be disconnected from grid if the phase voltage of AC rises to this value. |
| Vac High On | Inverter will be reconnected to grid if the phase voltage of AC drops to this value. |
| Vac High Off T | If AC voltage reaches to the value of Vac High Off, inverter will be disconnected in this time. |
| Vac Low Off | Inverter will be disconnected from grid if the phase voltage of AC drops to this value. |
| Vac Low On | Inverter will be reconnected to grid if the phase voltage of AC rises to this value. |
| Vac Low Off T | If AC voltage reaches to the value of Vac Low Off, inverter will be disconnected in this time. |
| Vac High Off Slow | The function is same as Vac High Off, but the value must be lower than former. |
| Vac High On Slow | The function is same as Vac High On, but the value must be lower than former. |
| Vac High Off Slow T | The function is same as Vac High Off T, but the time must be longer than former. |
| Vac Low Off Slow | The function is same as Vac Low Off, but the value must be higher than former. |
| Vac Low On Slow | The function is same as Vac Low On, but the value must be higher than former. |
| Vac Low Off Slow T | The function is same as Vac High Off T, but the time must be longer than former. |
| Fac High Off | Inverter will be disconnected from grid if AC frequency rises to this value. |
| Fac High On | Inverter will be reconnected to grid if AC frequency drops to this value. |
| Fac High Off T | If AC frequency reaches to the value of Fac High Off, inverter will be disconnected in this time. |
| Fac Low Off | Inverter will be disconnected from if AC frequency drops to this value. |
| Fac Low On | Inverter will be reconnected to grid if AC frequency rises to this value. |
| Fac Low Off T | If AC frequency reaches to the value of Fac Low Off, inverter will be disconnected in this time. |
| Fac High Off Slow | The function is same as Fac High Off, but the value must be lower than former. |
| Fac High On Slow | The function is same as Fac High On, but the value must be lower than former. |
| Fac High Off Slow T | The function is same as Fac High Off T, but the time must be longer than former. |

***Table 5-2 : Grid Setting Parameters***

| Parameter | Description |
|---|---|
| Fac Low Off Slow | The function is same as Fac Low Off, but the value must be higher than former. |
| Fac Low On Slow | The function is same as Fac Low On, but the value must be higher than former. |
| Fac Low Off Slow T | The function is same as Fac High Off T, but the time must be longer than former. |
| Reconnection Time | The countdown time before inverter connected to grid. |

***Table 5-2 : Grid Setting Parameters (Continued)***

**NOTE**

Once you change any item listed above, the country will be turn to “Custom”. You can go back the original country via re-selecting the country in the page “Install settings” - “Country”.

## 5.3.7.3.3 PID

The PID function default action time is set with 0, user can set the time from 0-10 or Auto. It will be started the function at 1 minutes after No DC, and will be stop the function when DC voltage is input.

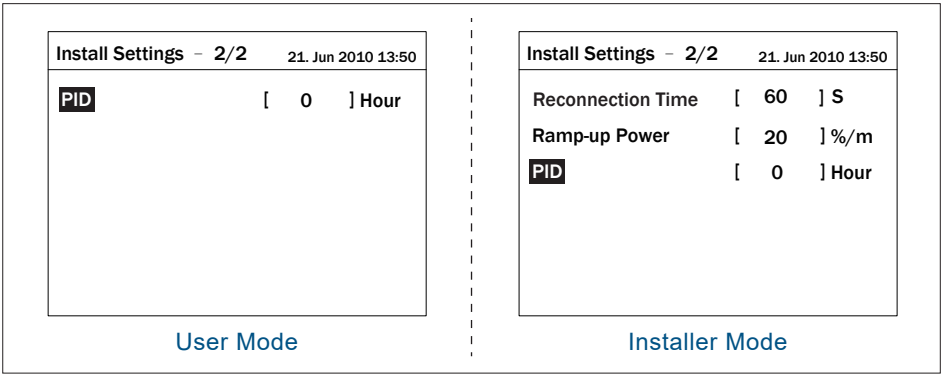



***Figure 5-16 : PID function settings***

## 5.3.7.4 Active/Reactive Power Control

Only when country sets as Germany MV, China, or India user can enter this page. User has to enter user's password before enter this page.

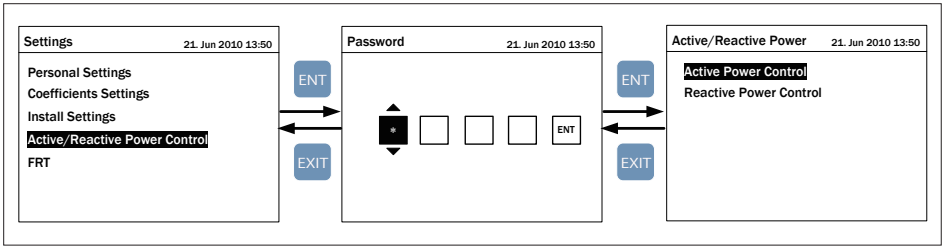



*Figure 5-17 : Active/Reactive power setting page*

## 5.3.7.4.1 Power Limit

User can set percentage of actual or rated power to limit inverter's output power. Inverter will start the action once user set Mode as "ON". On the contrary, inverter will stop power reduction and back to MPP Tracking once user set Mode as "OFF".

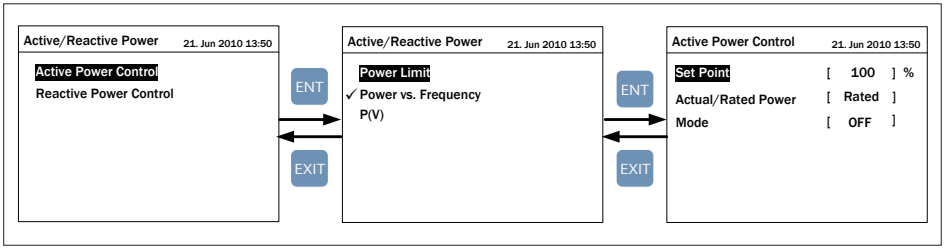



*Figure 5-18 : Power limit setting page*

## 5.3.7.4.2 Power vs. Frequency

Gradient means the slope of power reduction, ie. –xx%/Hz

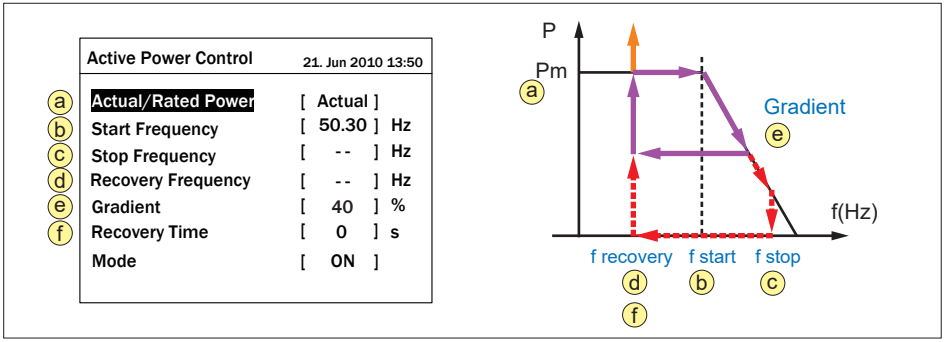



*Figure 5-19 : Power vs. frequency setting page*

## 5.3.7.4.3 Constant cosφ

When this Mode is turned on, inverter will maintain power factor as a constant value. Users can set power factor from Cap 0.80 to Ind 0.80.

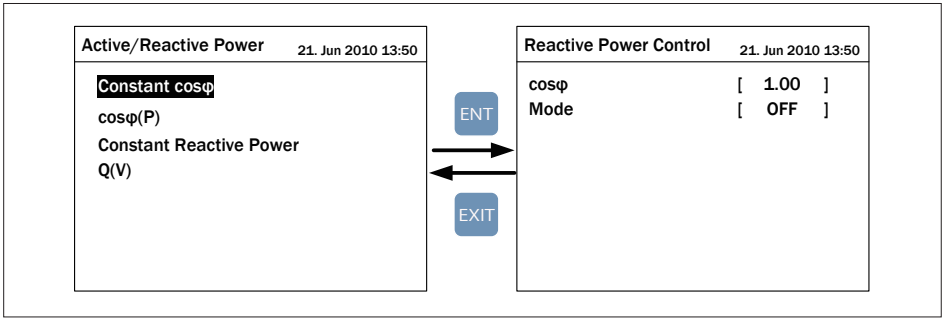



*Figure 5-20 : Constant cosφ setting page*

## 5.3.7.4.4 cosφ(P)

The inverter controls the output cosφ as a function of the power it injects into the utility mains and cosφ (P) control will not concern Grid voltage.

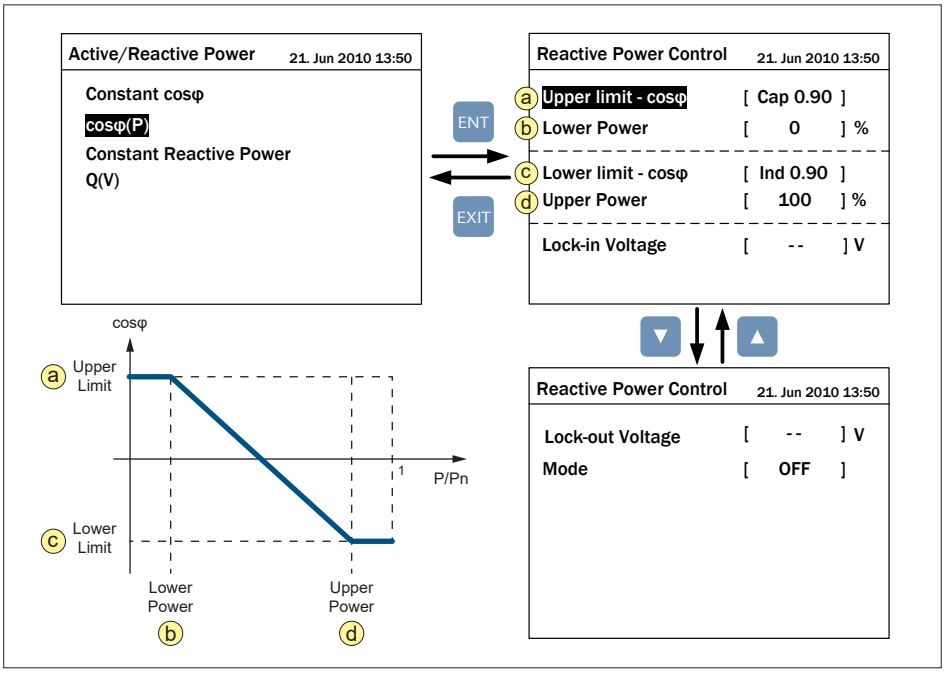



*Figure 5-21 : cosφ(P) setting page*

## 5.3.7.4.5 Constant Reactive Power

When this Mode is turned on, inverter will maintain reactive power as a constant value.

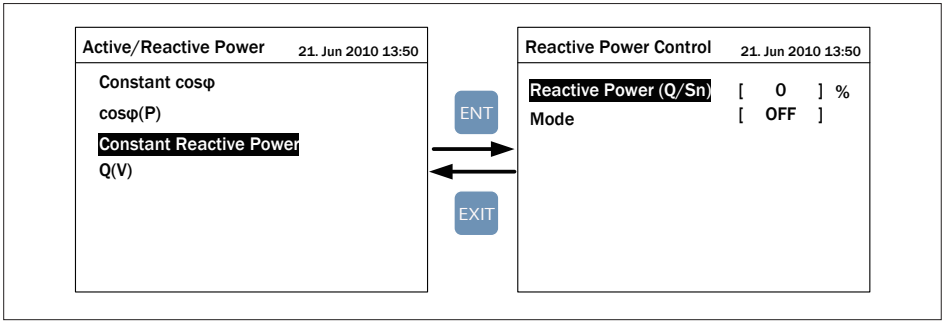



*Figure 5-22 : Constant Reactive Power setting page*

## 5.3.7.4.6 Q(U)

Users can fine-tune the parameters according to their actual need.

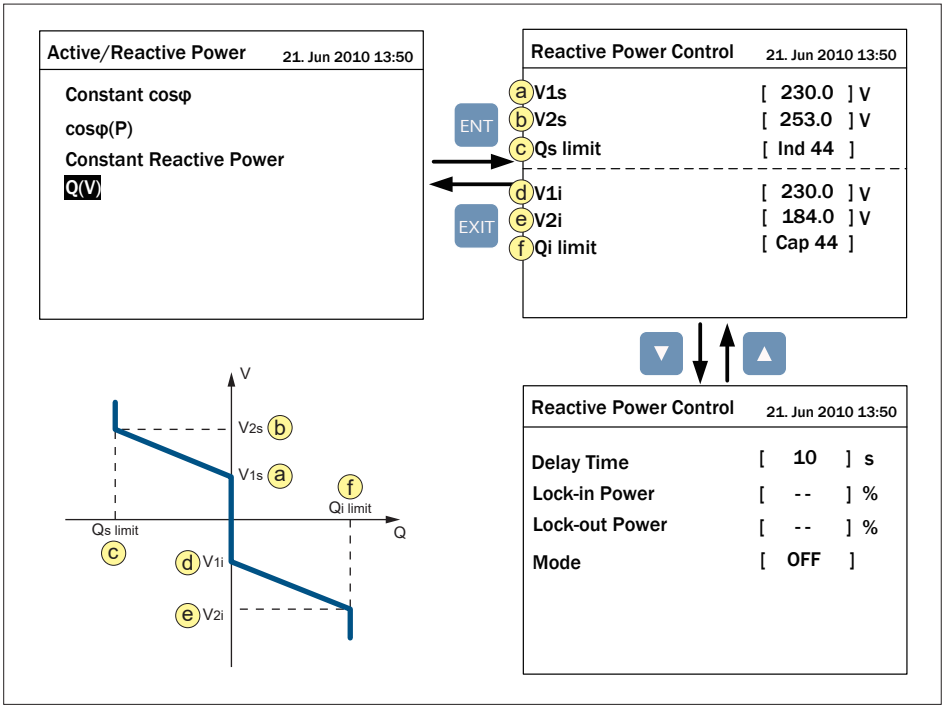



*Figure 5-23 : Q(U) setting page*

## 5.3.7.5 Q 24/7

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 inverter 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 PV power at DC input of the inverter.

Refer the following section to the information of each control modes.

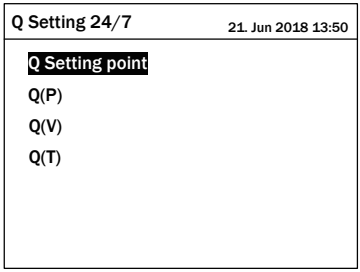



*Figure 5-24 : Q setting 24/7 page*

## 5.3.7.5.1 Q Setting Point

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

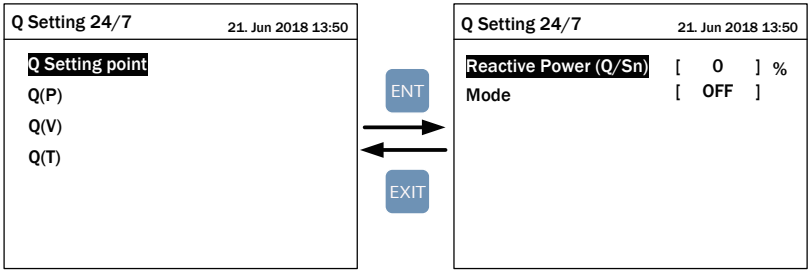



*Figure 5-25 : Q setting point page*

## 5.3.7.5.2 Q(P)

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

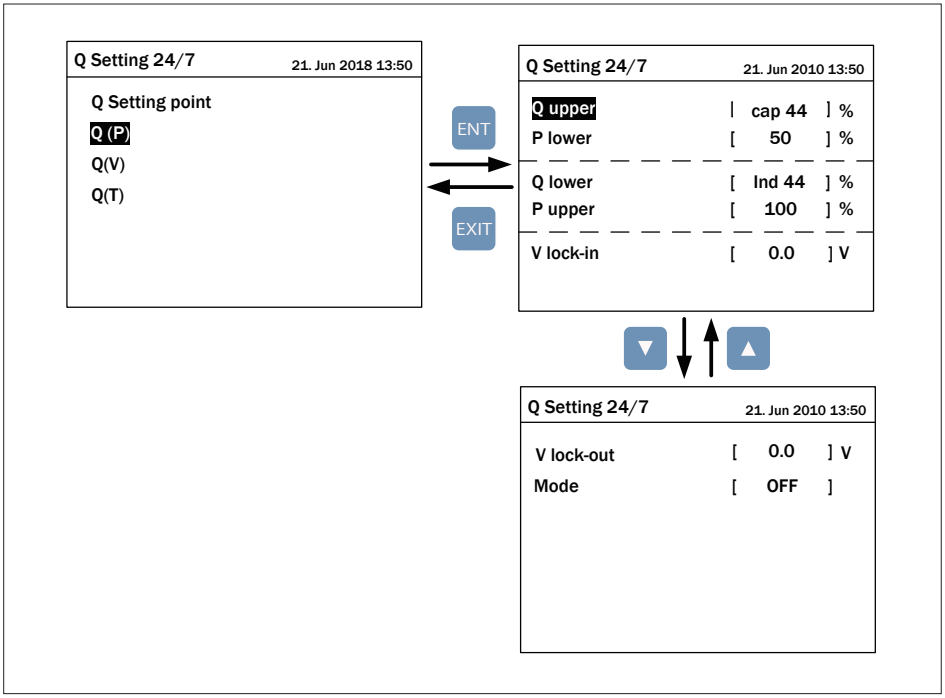



*Figure 5-26 : Q(P) page*

## 5.3.7.5.3 Q(V)

Q(V) is a function that inverter will provide reactive power according to grid voltage. The setting procedure is same as 5.3.7.4.6.

## 5.3.7.5.4 Q(T)

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

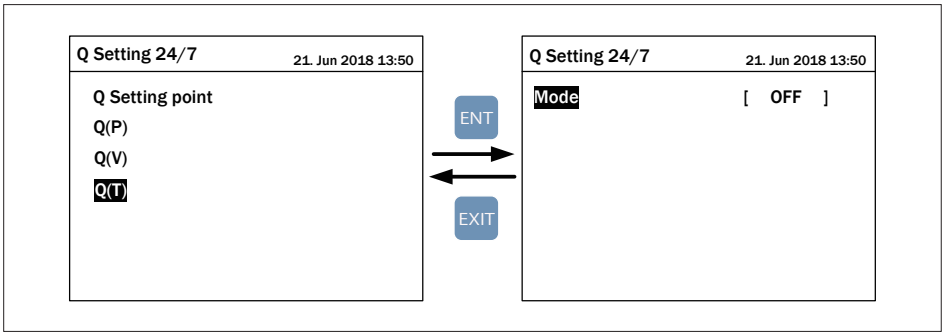



*Figure 5-27 : Q(T) page*

## 5.3.7.6 FRT (Fault ride through)

Users can refer to the figure below and fine tune the parameters in FRT setting page.

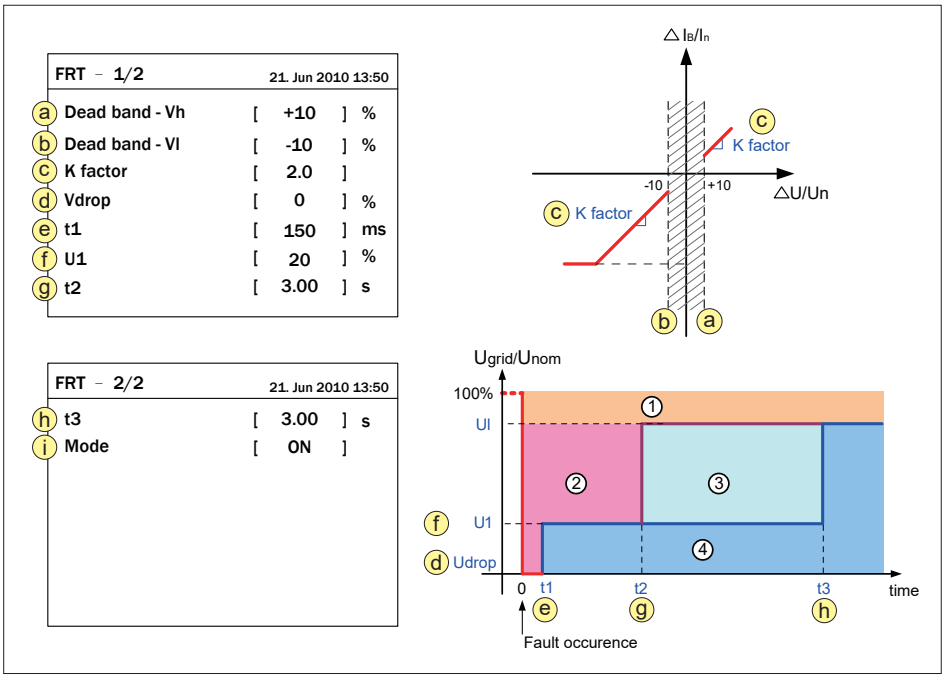



*Figure 5-28 : FRT setting page*

# 6 Troubleshooting

Ones can check the Error Message on LCD then make simple and quick trouble shooting according to the following table.

| Message | Possible cause | Action |
|---|---|---|
| AC Frequency High | 1. Actual utility frequency is over the OFR setting<br>2. Incorrect country setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| AC Frequency Low | 1. Actual utility frequency is under the UFR setting<br>2. Incorrect country setting<br>3. Detection circuit malfunction | 1. Check the utility frequency on the inverter terminal<br>2. Check country setting<br>3. Check the detection circuit inside the inverter |
| Grid Quality | Non-linear load in Grid and near to inverter | Grid connection of inverter need to be far away from non-linear load if necessary |
| HW Connect Fail | 1. Wrong AC connection<br>2. Detection circuit malfunction | 1. Check the AC connection based on the manual<br>2. Check the detection circuit inside the inverter |
| No Grid | 1. AC breaker is OFF<br>2. No voltage on AC side | 1. Switch on AC breaker<br>2. Provide AC voltage to output node of the inverter |
| AC Volt Low | 1. Actual utility voltage is under the UVR setting<br>2. Incorrect country or Grid setting<br>3. Wrong AC connections<br>4. Detection circuit malfunction | 1. Check the utility voltage connection to the inverter terminal<br>2. Check country & Grid setting<br>3. Check the connection in AC<br>4. Check the detection circuit inside the inverter |
| AC Volt High | 1. Actual utility voltage is over the OVR setting<br>2. Utility voltage is over the Slow OVR setting during operation<br>3. Incorrect country or Grid setting<br>4. Detection circuit malfunction | 1. Check the utility voltage on the inverter terminal<br>2. Check country & Grid setting<br>3. Check the detection circuit inside the inverter |

***Table 6-1 : Error Messages***

| Message | Possible cause | Action |
|---|---|---|
| Solar1 High | 1. Actual PV array voltage is over 1000Vdc<br>2. Detection circuit malfunction | 1. Modify the PV array setting, and make the Voc less than 1000Vdc<br>2. Check the detection circuit inside the inverter |
| Insulation | 1. PV array insulation resistance setting is different from display setting<br>2. Large PV array capacitance due to moist PV array, it will affect accuracy of measurement.<br>3. Detection circuit malfunction | 1. Check display setting<br>2. Dry PV panel if necessary<br>3. Check the detection circuit inside the inverter |

***Table 6-1 : Error Messages (Continued)***

| Message | Possible cause | Action |
|---|---|---|
| Solar1 Low | 1. Actual<br>2. Detection circuit of input voltage malfunction | 1. N/A<br>2. Check the detection circuit inside the inverter |
| PID Relay Fail | PID Relay detection circuit malfunction | Check the detection circuit inside inverter |
| PID OCR | The impedance between negative DC bus terminal (DC-) to Protective Earth terminal（PE） is too low | Check the circuit between negative DC Bus terminal（DC-）to Protective Earth terminal（PE） |
| HW FAN | 1. One or more fans are locked<br>2. One or more fans are defective<br>3. One or more fans are disconnected<br>4. Detection circuit malfunction | 1. Remove the object that stuck in the fan(s)<br>2. Replace the defective fan(s)<br>3. Check the connections of all fans<br>4. Check the detection circuit inside the inverter |
| EPO | EPO button is activated | 1. Release the EPO (Release with N.C )<br>2. Check the connection of EPO |
| DC Surge | SPD on DC Side damaged | 1. Contact the signal wire connection of DC SPD<br>2. Check the DC SPD if damaged |
| AC Surge | SPD on AC Side damaged | 1. Contact the signal wire connection of AC SPD<br>2. Check the AC SPD if damaged |
| DC Aux - Power Fail | 1. DC Aux-Power offer incorrect output voltage<br>2. Detection circuit of DC Auxpower malfunction | 1. Check the connection between Inverter and DC side<br>2. Check the detection circuit |

***Table 6-2 : Warning Message***

| Message | Possible cause | Action |
|---|---|---|
| Temperature | 1. The ambient is over 60°C (The installation is abnormal)<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter |
| HW NTC1 Fail | 1. Ambient temperature >105°C or <-40°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter (RTM1) |
| Temperature | 1. Ambient temperature is <-30°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter |
| HW NTC2 Fail | 1. Ambient temperature >125°C or <-30°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter (NTC_R & NTC_U) |
| HW NTC3 Fail | 1. Ambient temperature >125°C or <-30°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter (NTC_S & NTC_V) |
| HW NTC4 Fail | 1. Ambient temperature >125°C or <-30°C<br>2. Detection circuit malfunction | 1. Check the installation ambient and environment<br>2. Check the detection circuit inside the inverter (NTC_T & NTC_W) |
| Choke OTP | 1. Filters of air inlet are blocked<br>2. Detection circuit malfunction | 1. Replace filters of air inlet<br>2. Check the detection circuit inside inverter |
| HW DSP ADC1 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| HW DSP ADC2 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| HW DSP ADC3 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |
| HW Red ADC1 | 1. Auxiliary power circuitry malfunction<br>2. Detection circuit malfunction | 1. Check the auxiliary circuitry inside the inverter<br>2. Check the detection circuit inside the inverter |

***Table 6-3 : Fault Message***

| Message | Possible cause | Action |
|---|---|---|
| HW COMM2 | 1. Red. CPU is idling<br>2. The communication connection is disconnected | 1. Check the function of reset pin and crystal in Red. CPU<br>2. Check the connection between Red. CPU and DSP |
| HW COMM1 | 1. DSP is idling<br>2. The communication connection is disconnected<br>3. The communication circuit mal- function | 1. Check the function of reset pin and crystal in DSP<br>2. Check the connection between DSP and COMM<br>3. Check the communication circuit |
| HW Connect Fail | 1. Power cables fall off inside the inverter<br>2. Current feedback circuit is defective<br>3. Driver circuit of inverter malfunction | 1. Check the power cables inside the inverter<br>2. Check the current feedback circuit inside the inverter<br>3. Check driver circuit of the inverter |
| Relay Test Short | 1. The driver circuit for the contactor malfunction<br>2. The contacts of contactor are stuck | 1. Check the driver circuit inside the inverter<br>2. Replace a new contactor |
| Relay Test Open | 1. Driver circuit for Contactor is defective<br>2. Contactor coil is defective<br>3. The detection accuracy is not correct for Vgrid and Vout | 1. Check the driver circuit for contactor<br>2. Replace contactor coil<br>3. Check the Vgrid and Vout voltage detection accuracy |
| HW Bus OVR | 1. Power BackFeed Occurred (DC Power < AC Power)<br>2. Something wrong with AC Frequency PLL | 1. Check the connection between Solar Panel and Inverter<br>2. Check the Vgrid and Vout voltage detection accuracy |
| AC Current High | 1. Surge occurs during operation<br>2. Driver for inverter stage is defective<br>3. Switching device is defective<br>4. Detection circuit malfunction | 1. N/A<br>2. Check the driver circuit in inverter stage<br>3. Check all switching devices in inverter stage<br>4. Check the detect circuit inside the inverter |
| HW CT A Fail | 1. Test current loop is broken<br>2. Detection circuit malfunction | 1. Check CT Sensor Wire<br>2. Check the detection circuit inside the inverter |
| HW CT B Fail | 1. Test current loop is broken<br>2. Detection circuit malfunction | 1. Check CT Sensor Wire<br>2. Check the detection circuit inside the inverter |
| HW CT C Fail | 1. Test current loop is broken<br>2. Detection circuit malfunction | 1. Check CT Sensor Wire<br>2. Check the detection circuit inside the inverter |

***Table 6-3 : Fault Message (Continued)***

| Message | Possible cause | Action |
|---|---|---|
| HW AC OCR | 1. Large Grid harmonics<br>2. Switching device is defective<br>3. Detection circuit malfunction | 1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary<br>2. Check all switching devices in inverter stage<br>3. Check the detection circuit inside the inverter |
| AC Aux Fail | 1. AC AuxPower offer incorrect output voltage<br>2. Detection circuit of AC Auxpower malfunction | 1. Check the connection between Inverter and AC side<br>2. Check detection circuit |
| DC Current High | Input current detection circuit malfunction | Check input current detection circuit |

***Table 6-3 : Fault Message (Continued)***

| Message | Possible cause | Action |
|---|---|---|
| Door Opened | 1. Door switches are defective<br>2. Door switches are disconnected<br>3. Detection circuit malfunction | 1. Replace the defective door switch(es)<br>2. Check the connections of all switches<br>3. Check the detection circuit inside the inverter |

***Table 6-4 : Other Message***

* F / W will be updated periodically.

# 7 Maintenance

## 7.1 Replacing a Fan Module

1. Rotate the handle and then open the rear panel door.

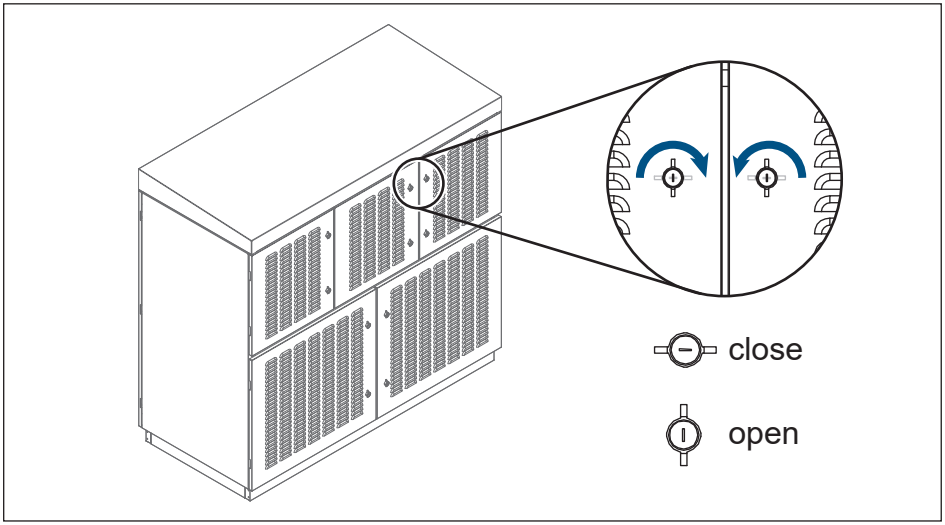



*Figure 7-1 : Rotate the handle*

2. Disconnect the connectors of the fan modules.

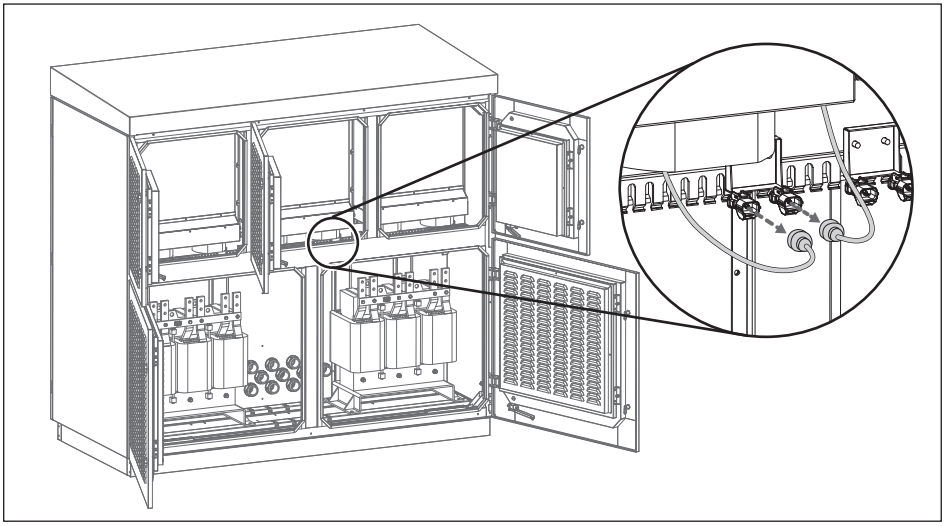


*Figure 7-2 : Disconnecting the Connectors*

3. Loosen the screws and nuts securing the bottom fan module to the chassis and remove the module. (Torque: 25 Kgf-cm)

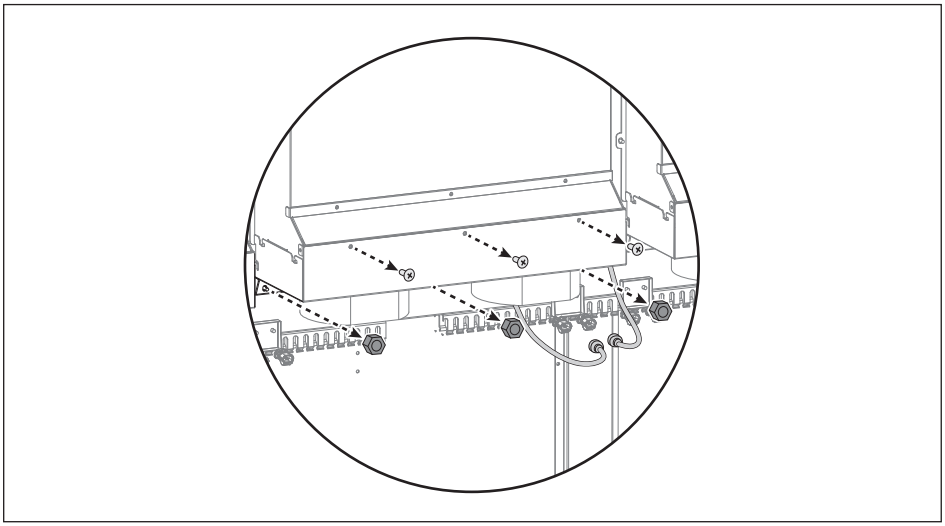


***Figure 7-3 : Loosening Bottom Fan Module Screws***

4. Remove the module.

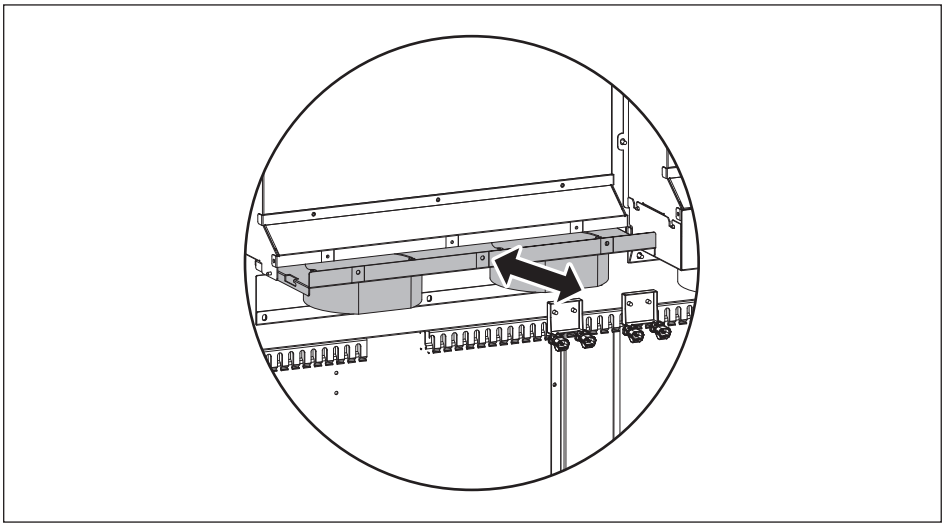


***Figure 7-4 : Remove the module***

## 7.2 Replacing an Air Filter

1. Rotate the handle and then open the rear panel door.

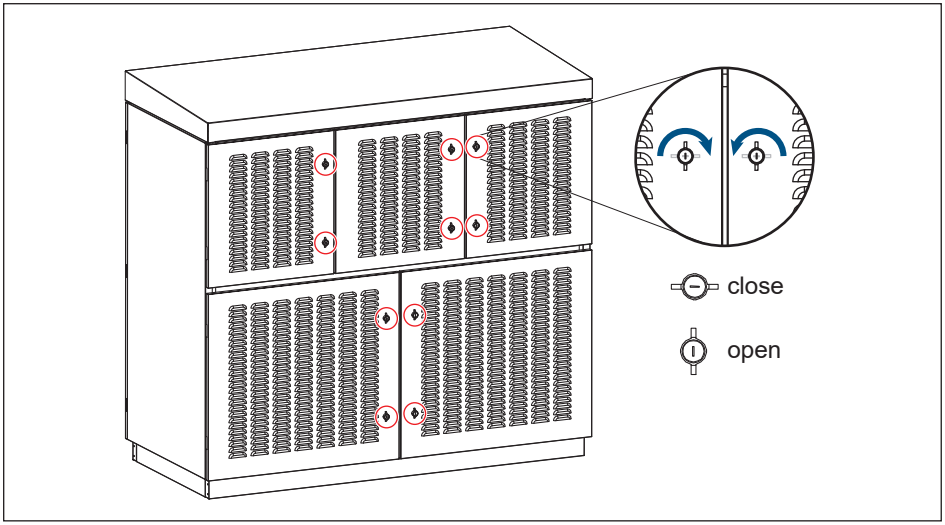



*Figure 7-5 : Rotate the handle*

2. Loosen the screws securing the air filter cover to the rear panel door and then open the cover. (Torque: 25 Kgf-cm)

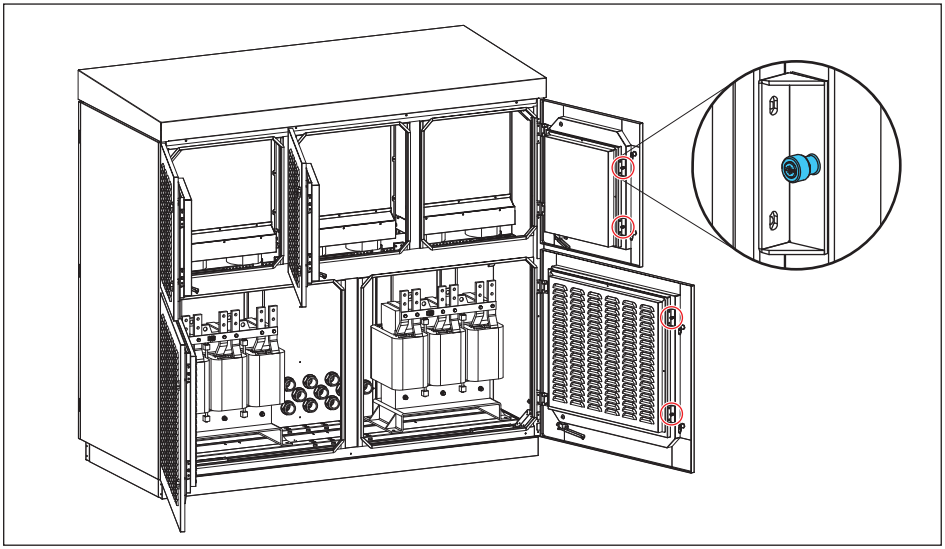


*Figure 7-6 : Loosening Air Filter Cover Screws*

3. Loosen the filter.

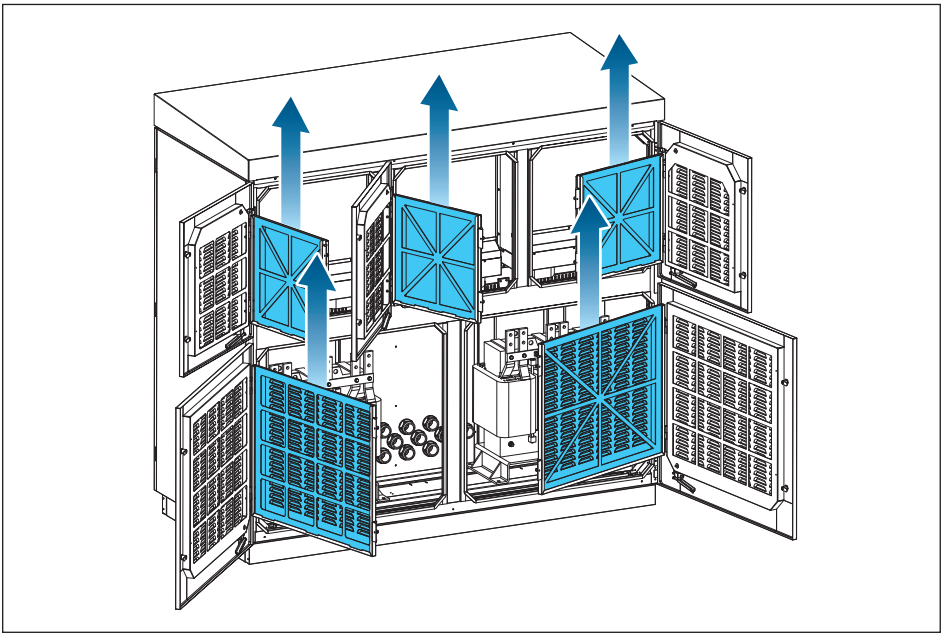


*Figure 7-7 : Loosening the Air Filter*

**NOTE**

1. At least 3 months for replacement of the new vent filters is recommended.
2. We recommend inspecting the vent filters each month, clean or replacement if necessary.
3. If the vent filters haven't been replaced for a long time, poor heat dissipation may result in the damage of cooling fans.

## 7.3 Clean Air Outlets

1. Open the front door of the central inverter.
2. Loosen the nuts on the plates of air outlets.

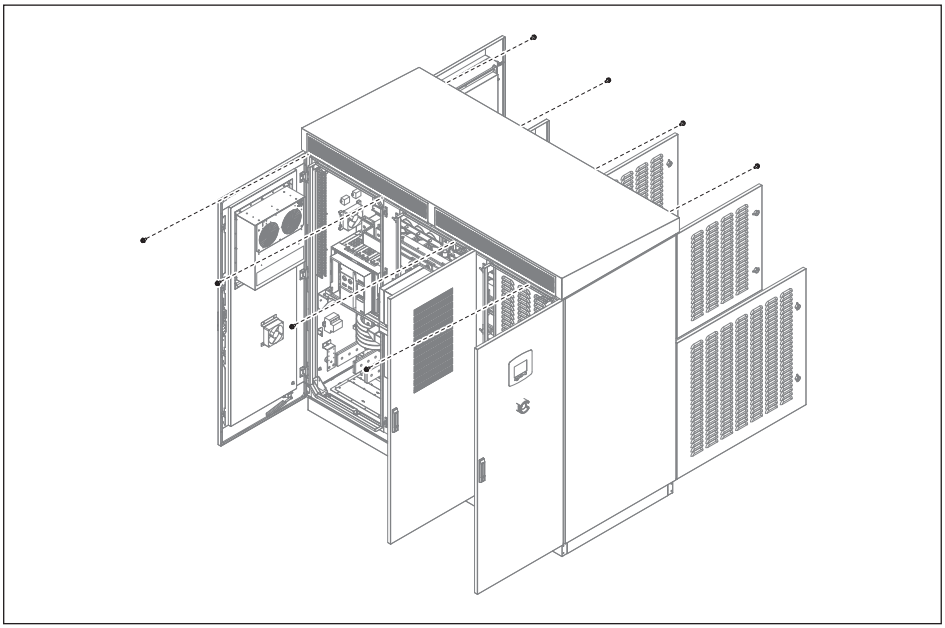


*Figure 7-8 : Loosening the nuts of air outlets*

3. Move the plates of air outlets to the right.

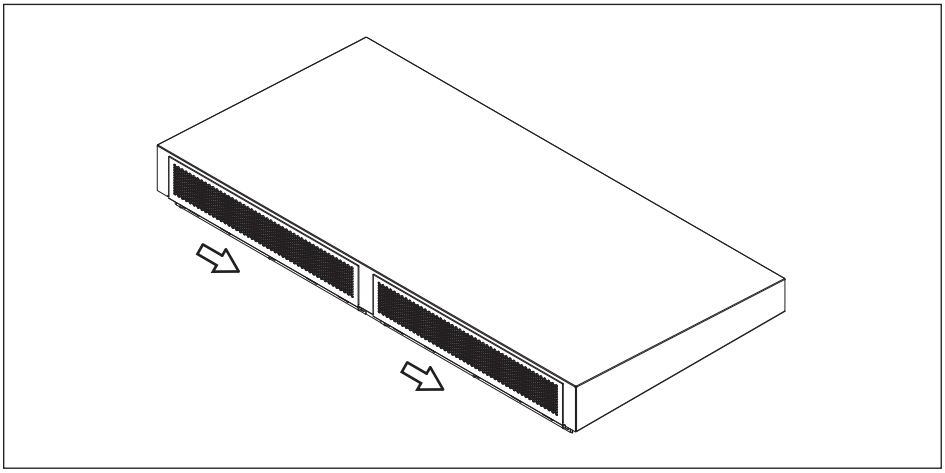


*Figure 7-9 : Move the plates to the right*

4. Remove the plates and air outlets directly.

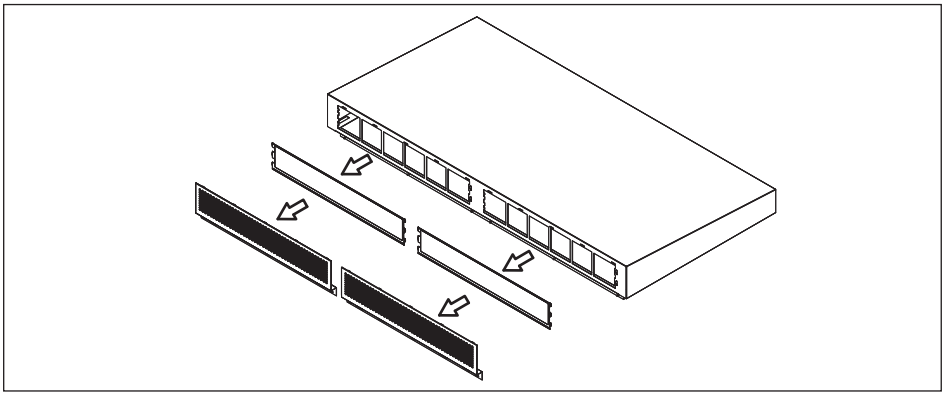


*Figure 7-10 : Remove the air outlets*

**NOTE**

1. Inspect periodically whether the vent filters are stuck with dust or foreign object. Clean if the vent filters are stuck.
2. Once vent filters get stuck, poor heat dissipation of the solar inverter may cause damage to the cooling fans.

## 7.4 Replacing Surge Protection Device (SPD)

Once the inverter encounters voltage spikes (e.g. struck by lightning), SPD will protect the inverter and got damaged. If you find a warning message “DC Surge” or “AC Surge” shown on display panel, please follow the steps below to replace the SPD.

1. Switch AC and DC power off and check no residue voltage exists on DC/AC side.
2. Rotate the handle and open the front door.

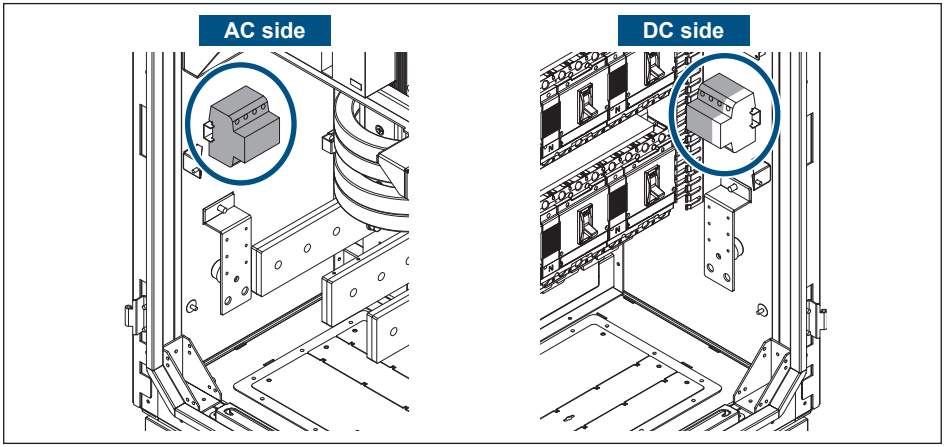



*Figure 7-11 : SPD Position*

3. Recognize which SPD unit was damaged.
   • For DC and AC SPD, find the one that green light was changed to red.

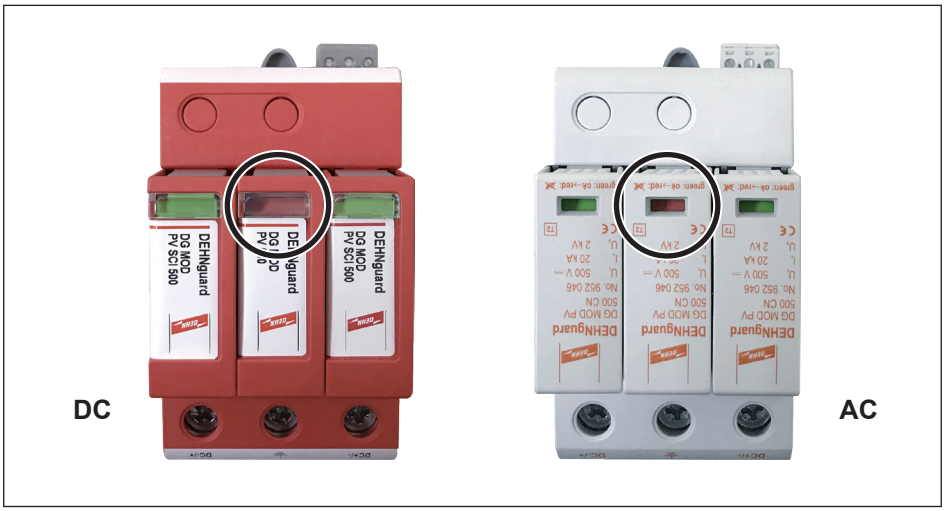



*Figure 7-12 : Recognize the damaged SPD unit*

4. Pull out the damaged unit and replace a new one.

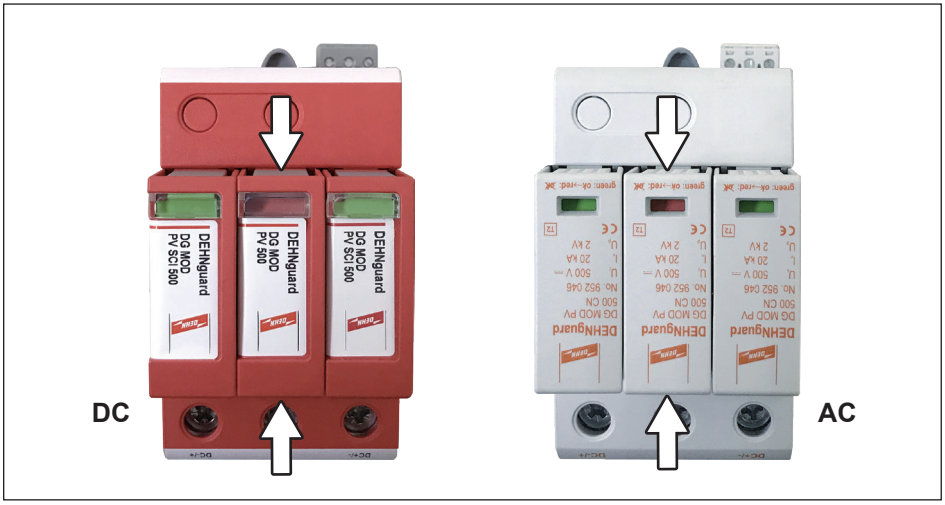



*Figure 7-13 : Pull out the SPD unit*

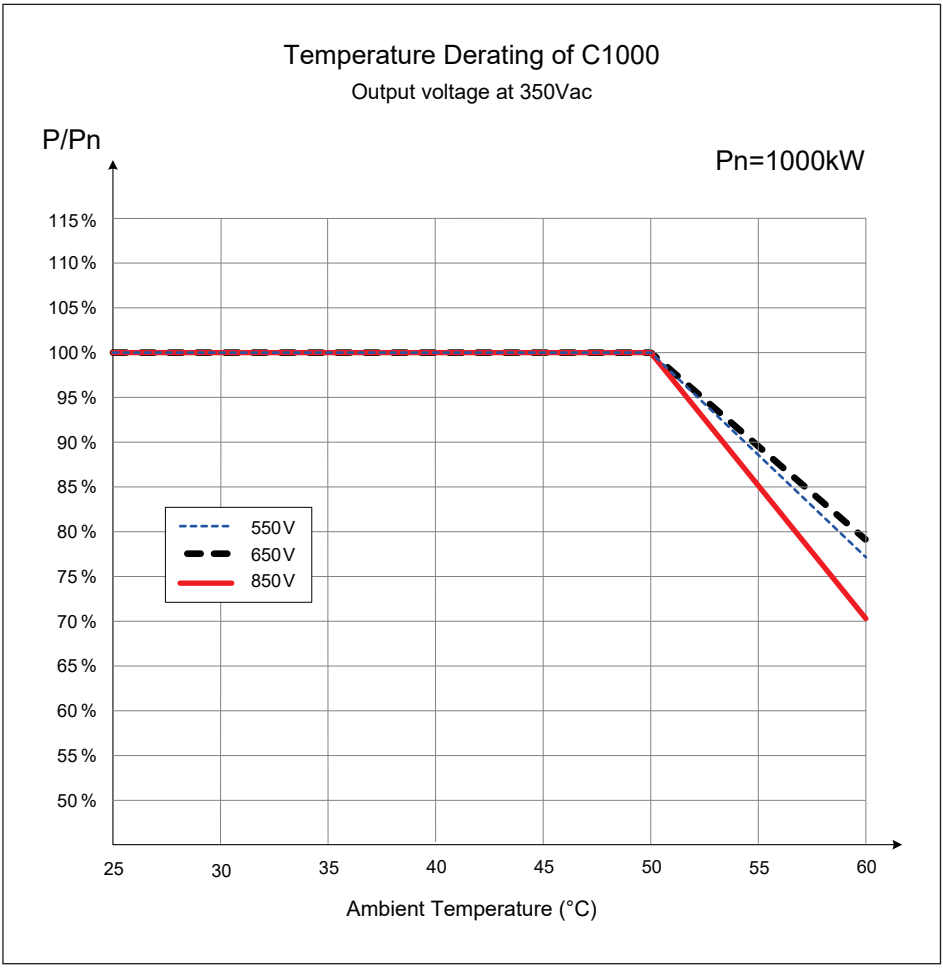
# Appendix

## Appendix A: Type of Equipment

| Type of Equipment | |
|---|---|
| Model | C1000 |
| Input | |
| Absolute maximum PV input voltage | 1100Vdc<br>> 1000Vdc, INV Stop |
| Operation voltage range | 520Vdc – 1000Vdc |
| Maximum power MPPT range | 550Vdc – 850Vdc |
| MPPT accuracy | > 99.9% at rated power |
| Inverter wake up voltage | > 200Vdc (Aux-power on) |
| Startup voltage | 570Vdc |
| MPP tracker | 1 |
| Input current limitation | 2050A |
| Maximum input short circuit current | 2500A |
| Input detection tolerance | Input voltage deviation < 2% |
| DC breaker | 250A×14 Runs |
| Input protection | DC over voltage_electronic shutdown<br>DC current limitation_current control<br>Surge arrestor_1000V/40kA Type 2 |
| Output | |
| Output capacity | 1000kW / 1000kVA |
| Grid | Three phase (3P3W-IT) |
| Utility voltage range | 350VΔ ±10% |
| Utility frequency | 50/60Hz |
| Utility frequency range | Domestic regulation (Max 50/60Hz ± 5Hz) |
| Maximum output current | 1650A |
| Anti-islanding | Domestic regulation |
| Output reconnect | Connect to utility after utility recover and countdown finished |
| Reconnect time | Domestic regulation |

| Model | C1000 |
|---|---|
| Output | |
| DC current (Offset) | < 0.5% at rated current |
| Output current harmonic distortion | < 3% at rated power |
| Reactive power control | 0.8 leading to 0.8 lagging |
| Active power control | 1% each step |
| Nighttime power consumption | < 55 watts (without optional transformer) |
| Detection tolerance | Utility voltage deviation < 2%<br>Utility frequency deviation < 0.03 Hz<br>Countdown timer deviation < 1.0 sec<br>Output power deviation < 3% at full power |
| Power limitation | Temperature sensors depend on heatsink & internal air temperature. |
| AC Circuitry Breaker | 690V/2000A |
| Protection | AC Circuitry Breaker & Thermal protection<br>Surge arrestor_600V/30kA Type 2 |
| Efficiency | |
| CQC | CQC 98.20% (internal AC AUX) |
| | CQC 98.34% (external AC AUX) |
| EUR Efficiency | 98.4% |
| Peak Efficiency | 98.84% |
| Information | |
| Communication Port | RS-485 Delta Protocol |
| LED | Operation: Green<br>(Flashing during countdown)<br>Alarm: Red |
| LCD display | 5” Graphic, 320*240 pixels |
| Display buttons | 4 operational buttons |
| Energy log | Day/Month/Year |
| Event Log | 30 events recently<br>Event times for each event |
| EPO (Emergency power off) | 1 set |
| Dry Contact | 2 set |

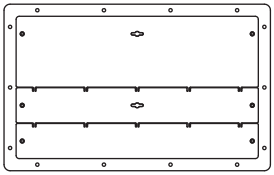
| Model | | C1000 |
|---|---|---|
| Regulatory | | |
| Electrical Safety Standard | | CNS15426-1<br>CNS15426-2<br>IEC61683<br>IEC61727<br>IEC62116<br>IEC62109-1<br>IEC62109-2<br>IEC60068<br>CE |
| Grid Interface Standard | | IEC62910<br>CNS15382<br>GB/T 19964: LVRT<br>NB/T 32004-2013<br>CNCA/CTS 0002-2014<br>CNCA/CTS 0048-2014 |
| EMC, Emission | | IEC 61000-6-4 |
| EMC, Immunity | | CNS14674-2<br>CNS14674-4<br>IEC 61000-6-2<br>IEC 61000-4-2<br>IEC 61000-4-3<br>IEC 61000-4-4<br>IEC 61000-4-5<br>IEC 61000-4-6<br>IEC 61000-4-8 |
| Operation | | |
| Operating temperature | | -25°C~60°C<br>(Full power -25°C~50°C) |
| Storage temperature | | -30°C~60°C |
| Relative humidity | | 5%~95% |
| Audible noise | | < 80dB |
| Operating elevation | | 0 to 3000m |
| Environment | | |
| Vibration | | GB/T 2423.10 & GB/T 2423.56 |
| Mechanical | | |
| Dimension (mm) | Width | 2100 |
| | Depth | 950 |
| | High | 1980 |
| Weight (kg) | | 1740 |
| Cooling | | Air cooling with Fans with inlet filter |
| Enclosure rating | | IP-65 (Electric parts) |

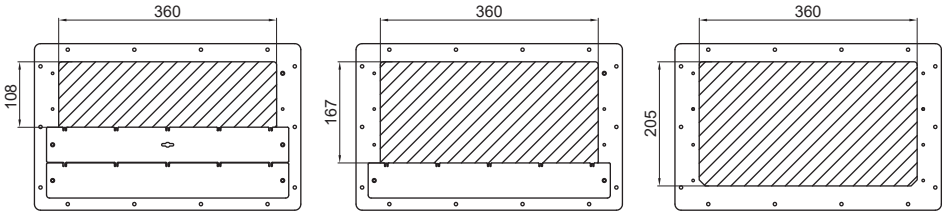



***Appendix A-1 : C1000 Thermal Derating curve for 350Vac***

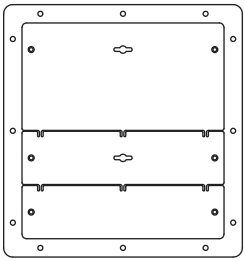
# Appendix B:
# Hole Size of plate & Installation Of Movable Bushing

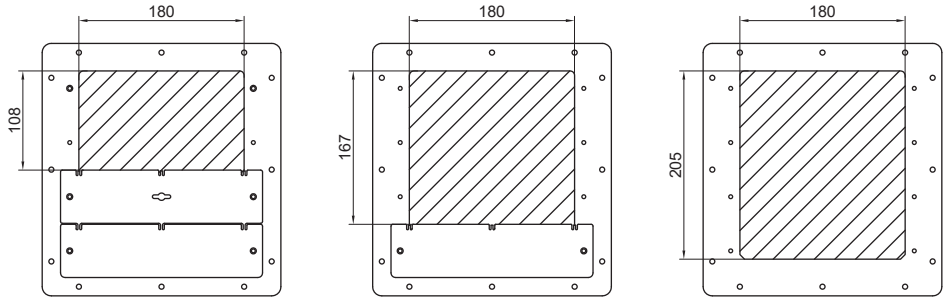
- DC & AC Side bottom plate






- DC Side bottom plate





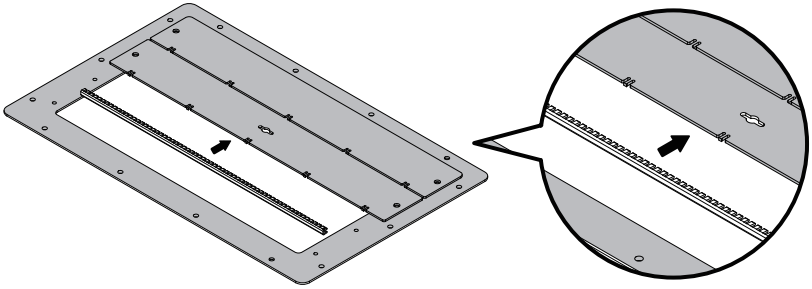

**NOTE**

1. Shaded area is a wiring area and can adjust wiring area via moving small plate.
2. After power cables wiring, the gaps should be fully covered with high temperature resistant and waterproof materials. (fire retardant cable sealant or silicon)

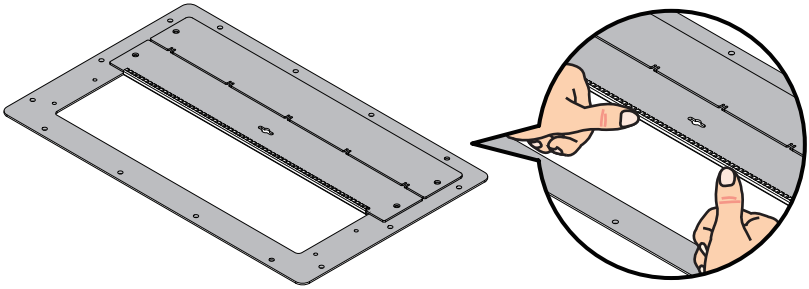
## ● Installation for Movable Bushing

After confirming the hole size of plate, please take the movable bushing from the package, and then install it on the plate according to the steps below.

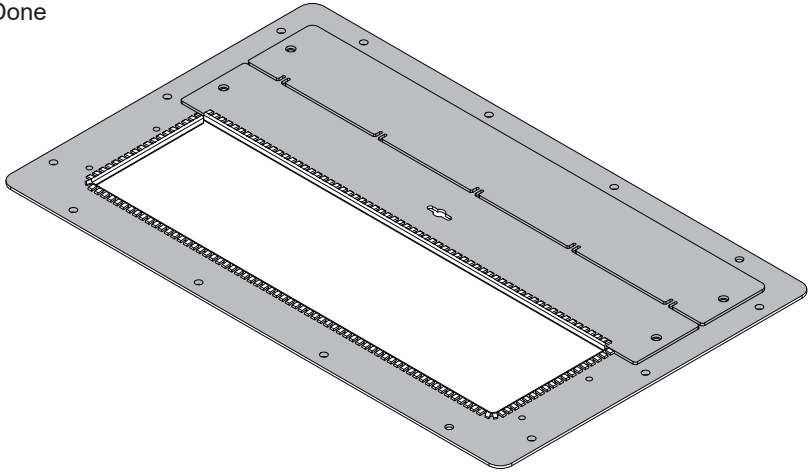
1. Put the movable bushing on the edge of the bottom plate.



2. Fit the movable bushing on the edge of the bottom plate.



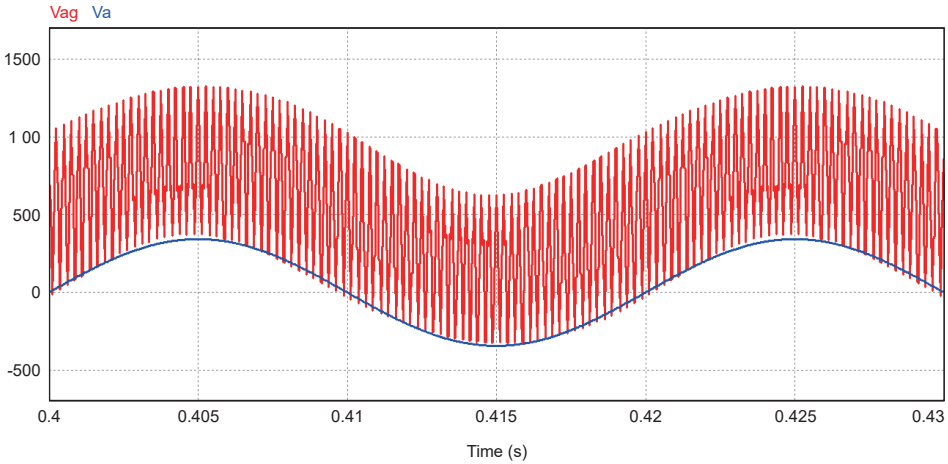
3. Done



# Appendix C:
# Delta MV Transformer and Auxiliary Power transformer Application Note

## A. Technical requirement of MV transformer

A.1 The required insulation voltage of low voltage winding in MV transformer should be,
- To endure the pulse mode voltage of inverter with a maximum 1400V to earth.
- To endure the maximum RMS voltage to earth is 700V
- To capable of voltage gradient dv/dt up to 500V/μS.

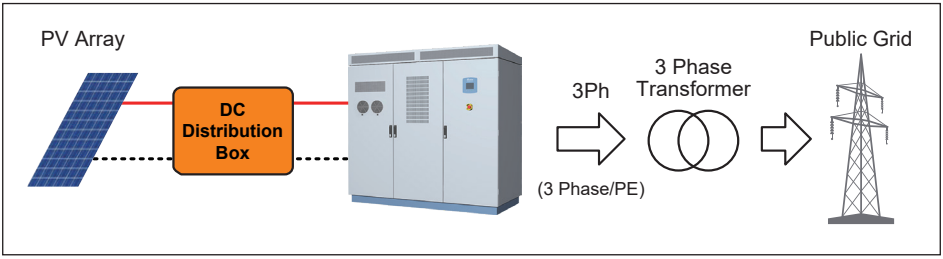



- The earthed shielding plant should be added between windings of high voltage and of low voltage to serve as filter for dv/dt.

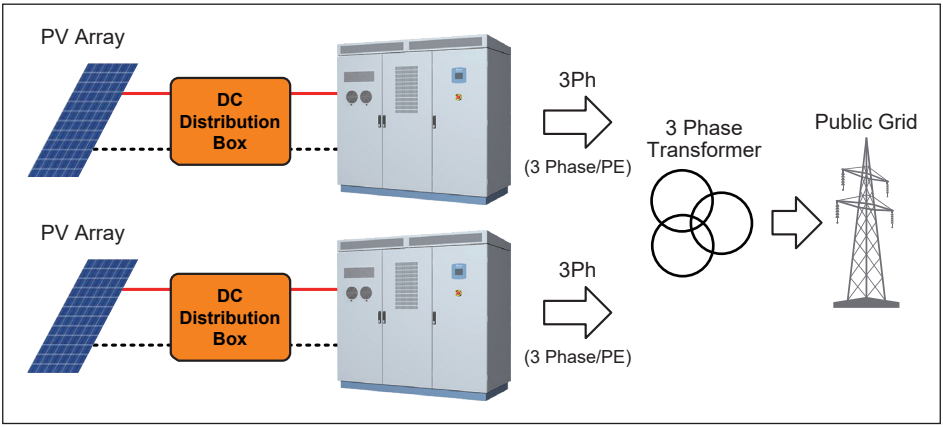
A.2 Each inverter require a separate isolated voltage winding. It is forbid to use several inverters in parallel with one low voltage winding.
A.3 The MV transformer can be oil-type or dry-type.
A.4 It is suggested to have tap changer on the high voltage side to align the voltage level to medium voltage.
A.5 Higher thermal stress of MV transformer should be taken country settings into consideration, including the voltage and frequency.
A.6 The transformer is capable of withstanding of max 5% total harmonic current at nominal power.
A.7 The transformer should be design according to the following inverter rating.

| Model No | Nominal Voltage Range (Line-Line) (V) | Nominal Output Current Range @ 50°C (A) | Maximum Output Current (A) |
|---|---|---|---|
| C1000 | 350±10% | 1650 | 1710 |

## B. The inverter can be connected to MV transformer as following diagram.




Double winding transformer for one inverter

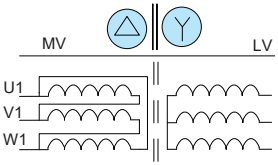



Three winding transformer for two inverters

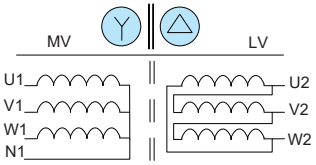
B.1 Technical requirement of two-winding transformer

- The voltage impedance should line between 4.0-6.6%
- The vector grouping of two-winding transformer can be Dy11, YNd11 or Dd0

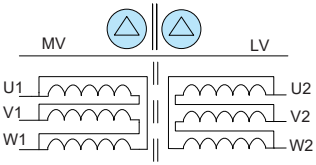
* Please use DC+ to earth ground or DC- to earth ground if YNd11 is applied.




Dy11




YNd11

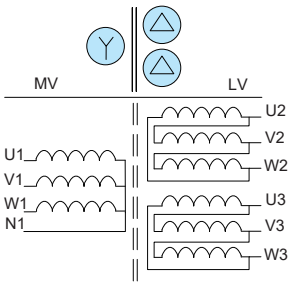



Dd0

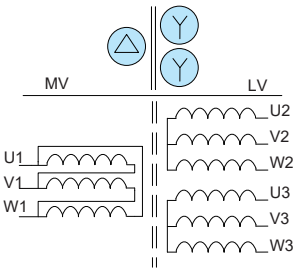
B.2 Technical requirement of three-winding transformer

- The impedance voltage between each low voltage winding and high voltage should lie between 4.0-6.6%.
- The impedance voltage between two low voltage winding should lie between 9~11%.
- The vector grouping of three-winding transformer can be YNd11d11, Dy11y11 or Dd0d0.
- If Dyn11yn11 does apply, to left both the Neutral point of low voltage winding unconnected.

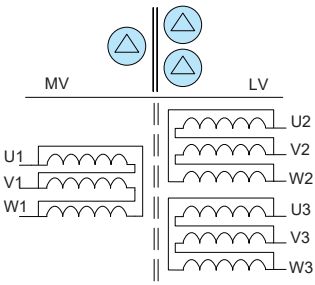
* Please use DC+ to earth ground or DC- to earth ground if YNd11d11 is applied.




YNd11d11



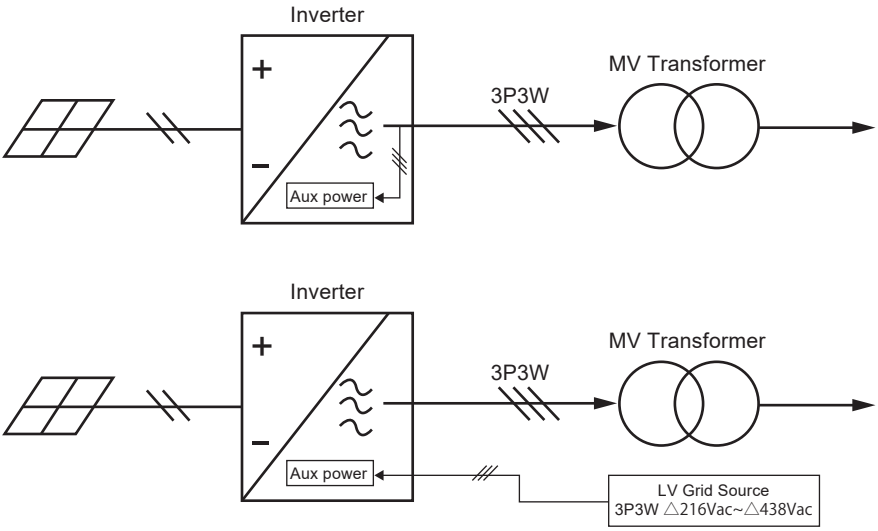

Dy11y11



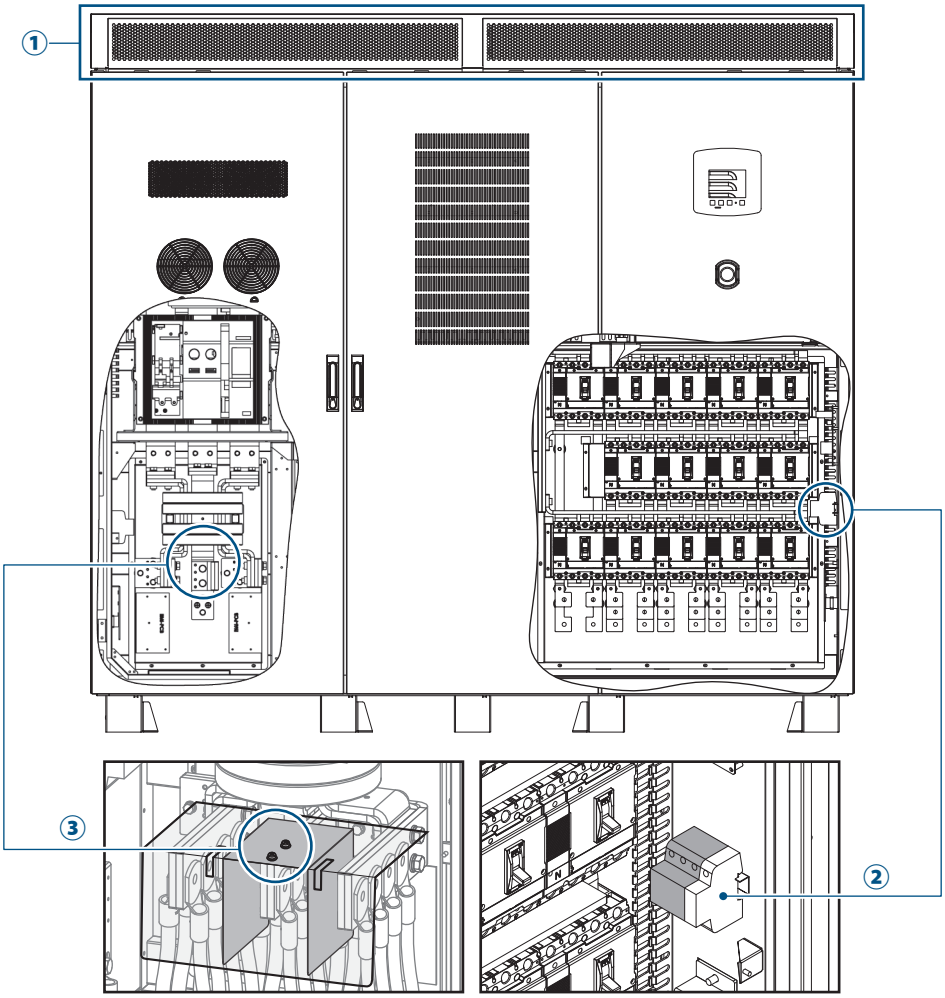

Dd0d0

## C. The Auxiliary Power powered by external source with a transformer.

The auxiliary power is powered by the output of inverter with 3P3W in default to saving the requirement of extra power source on the field.
If ones do require powering the auxiliary power by the farm-side grid, the three phase transformer should be applied with output line to line voltage within 216V ~ 438V and power rating should be larger than 2.8kVA.
The output of transformer can be either Star or Delta connection for the auxiliary power. If the Neutral point of Star connection is brought out, to leave it unconnected.

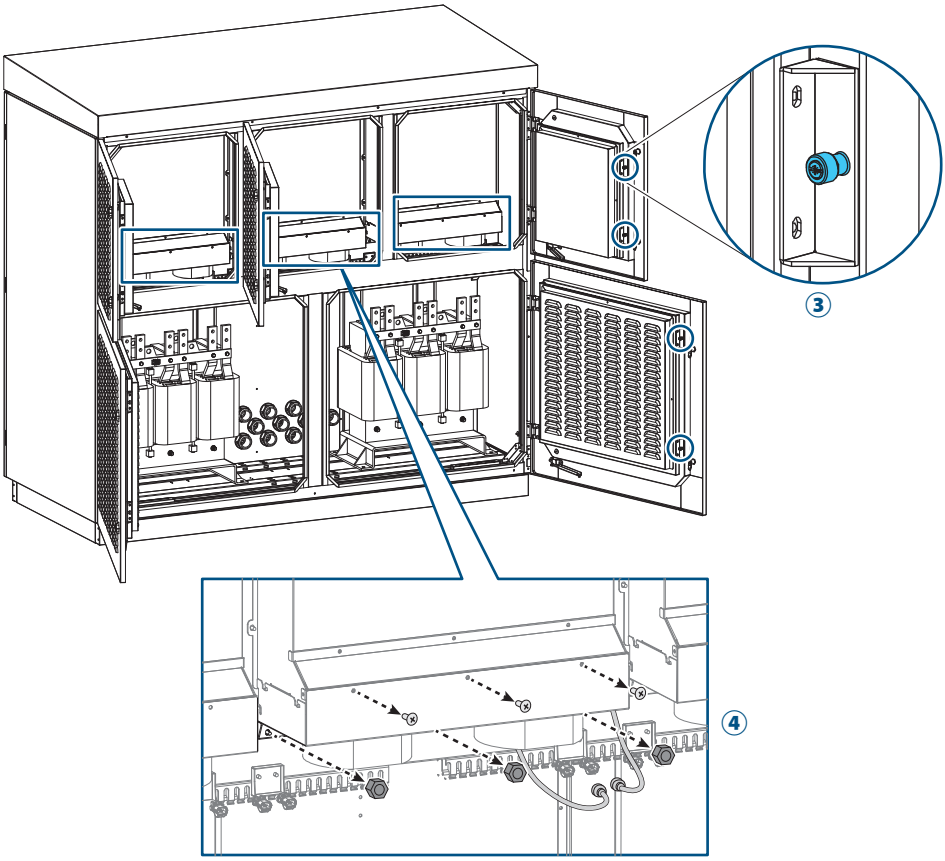


# Appendix D: Assembly Note




| NO | Location | | Screw torque |
|---|---|---|---|
| 1 | Top cover | | 25 Kgf-cm (2.5N-m) |
| 2 | DC Grounding (10 AWG) | Fuse holder | 30 Kgf-cm (3.0N-m) |
| | | busbar +/- | 25 Kgf-cm (2.5N-m) |
| 3 | Insulator | | 8.0 Kgf-cm (0.8N-m) |

***Appendix D-1 : Assembly Note - 1***




| NO | Location | Screw torque |
|---|---|---|
| 3 | Air Filter Cover | 25 Kgf-cm (2.5N-m) |
| 4 | Fan Module | 25 Kgf.cm (2.5N-m) |

***Appendix D-2 : Assembly Note - 2***

## DC

| DC Terminal | No. of conductor (+/-) | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 12 ~ 14 | M10 | 25 |

| DC Cable (Cu) | Minimum cable size requirement for DC+/DC- |
|---|---|
| | 70 $mm^2$ (14 Runs) / 95 $mm^2$ (≧12 Runs) |

| DC Cable (Al) | Minimum cable size requirement for DC+/DC- |
|---|---|
| | 95 $mm^2$ (14 Runs) / 120 $mm^2$ (≧12 Runs) |

* Maximum cable size allowed for DC+/DC- → 240 $mm^2$

## AC

| AC Terminal | Maximum No. of conductor for each phase | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 8 (<300 $mm^2$) | M12 | 45 |

| AC Cable (Cu) | Minimum total cable size requirement for each phase |
|---|---|
| | 1110 $mm^2$ |
| | The minimum requirement of individual cable size and numbers for each phase AC cable. |
| | 150 $mm^2$ x 8 |

| AC Cable (Al) | Minimum total cable size requirement for each phase |
|---|---|
| | 1480 $mm^2$ |
| | The minimum requirement of individual cable size and numbers for each phase AC cable. |
| | 185 $mm^2$ x 8 |

## PE

| PE Terminal | Maximum No. of conductor (DC/AC/Outside) | Screw/Nut size | Torque requirement (Nm) |
|---|---|---|---|
| | 4/4/1 | M12 | 45 |

| PE Cable (Cu) | Minimum total cable size requirement |
|---|---|
| | 555 $mm^2$ |

| PE Cable (Al) | Minimum total cable size requirement |
|---|---|
| | 740 $mm^2$ |

***Appendix D-3 : Assembly Note - 3***



The power behind competitiveness

# 三相併網型變流器

## C1000

操作手冊

English ····· 1

繁體中文 ····· 89

www.deltaww.com

Smarter. Greener. Together.

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# 圖示與字體

## 一般標示

以下所提到的標誌常見於本手冊中:

**範例**



- 此圖樣出現的目的是要解說相關的概念。

**說明**



- 此圖樣出現的目的是要說明相關的程式或參考步驟。

**警告!**



- 此圖示出現在某一段文字之前是要強調該段文字陳述的操作內容可能導致機器設備的損毀。

**注意!**



- 此圖示出現在某一段文字之前是要強調該段文字陳述的操作內容可能導致人身的安全發生危害。

## 印刷字體規範

以下所提到的字體規範常見於本手冊中。

斜體字
常見於標題，目錄，檔案，路徑和程式中。

螢幕顯示
螢幕顯示為計算器輸出內容，包含操作功能表，開頭提示字，回應輸入內容以及錯誤資訊。

**粗體字**
出現粗體字時表示使用者要在鍵盤上按下這個字。

# 著作權

本安裝手冊的擁有權和智慧財產權，涵蓋的範圍包含文字敘述，資料和圖樣皆屬於台達電子股份有限公司(以下稱”台達電子”)擁有。本手冊的目的僅在說明本機器的操作使用方式，沒有台達電子的書面同意，對於本手冊任何行式的給予或轉讓、複製、散撥、再制、修改、翻譯、摘錄或其它使用行為一律禁止。為了本產品的持續研發或改良，台達電子將在未通知顧客的情況下，不定期修改或更新手冊內容。台達電子將盡其所能更新手冊並維持其正確性。台達電子謹此聲明，不負責任何與本手冊有關之明示或默示擔保責任。同時，台達電子不會就本手冊及其有關文件之準確性、可靠性或作出任何保證及擔保。

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# 1 前言

## 1.1 關於此手冊

本手冊記載了本機C1000太陽能變流器的詳細規格、操作步驟和相關的功能設定。安裝技師必須經過合格的太陽能變流器安裝訓練，在安裝時也必須嚴格遵守安全指示和操作步驟。

## 1.2 適用機型

本手冊在本公司的授權下記載了以下太陽能變流器的操作程式、維修方式、技術資料和安全規範。

- C1000 太陽能變流器

## 1.3 適用對象

本手冊所陳列之操作步驟皆需經由良好訓練的合格太陽能變流器安裝技師來操作。

## 1.4 太陽能變流器系統組態

太陽能變流器系統組態如圖 2-1。

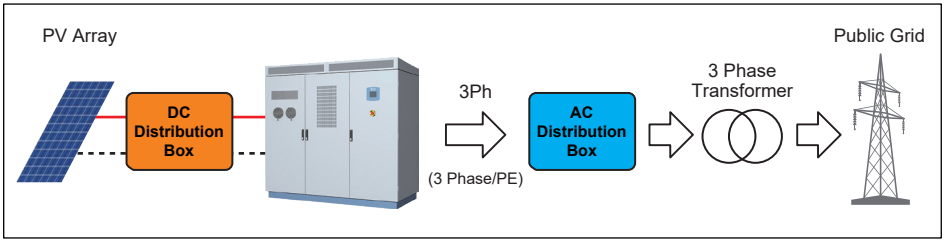



**圖1-1 : 太陽能變流器系統配置**

**外部輸出變壓器需求**

此外接變壓器規格必須使用一次側和二次側之間的繞線可以承受至少1000kVA，其阻抗變化最多不能超過6%。此變壓器必須要置於本機和市電之間。
有關於中壓系統變壓器的應用可以參考附錄C “Delta中壓變壓器與輔助電源變壓器應用說明” 。

## 1.5 安全規範

任何執行隔離本機的動作必須要在無負載狀態下。

**注意! 本動作可能觸電導致人員傷亡！**



斷開相關電源之後，方可操作太陽能變流器的動作，而且要遵守下列相關的VDE規範：
- 拆除所有電源連接線
- 確保所有設備不會重新接上
- 確保沒有任何電壓存在
- 有需要的話將設備短路到地（非DC端）
- 有需要的話將鄰近的零元件覆蓋起來或是使其絕緣

下列電源端應該要確實隔離：
- 由電網送入的電網電壓
- 電網電壓供給內部電源供應器（非必要項目）
- 來自太陽能板的DC電源

將DC和AC開關切至OFF並不足以將本機和電源隔離，這些開關只會將機器從太陽能板和市電隔離。

**注意! 本動作可能觸電導致人員傷亡！**



即便將DC和AC開關切至OFF，仍然會有誤觸電壓的危險。
- 要碰觸本機請至少在關機六分鐘之後進行。

本機隔離DC電壓的方式是靠內部斷路器, 或是使用外部的斷路器。若要關掉內部斷路器必須要在無負載的狀態下進行。
變流器在DC端和AC端都有放置電容器，關機時，這些電容器會開始放電，所以在幾分鐘之內，碰觸機器仍有觸電的危險，尤其是當機器出現故障，這些危險電壓停留在機器裡的時間會更久，所以要開啟機器前請至少在關機六分鐘後進行。

**注意! 本動作可能觸電導致人員傷亡！**



即便將DC和AC開關切至OFF，仍然會有誤觸電壓的危險。
- 要碰觸本機請至少在關機六分鐘之後進行。

# 2 產品外觀

## 2.1 產品說明

台達RPI系列變流器機種包含有C1000。本機的製造符合最高規格的轉換效率(最高可達98.84%)。
RPI系列機種的防水防塵等級是 IP65再加上抗腐蝕的特性，使得本機器不論在室內或是室外，都可以達到最完善的保護。

## 2.2 產品檢視

| C1000 |
| --- |
| 14 Runs (DC Breaker) |

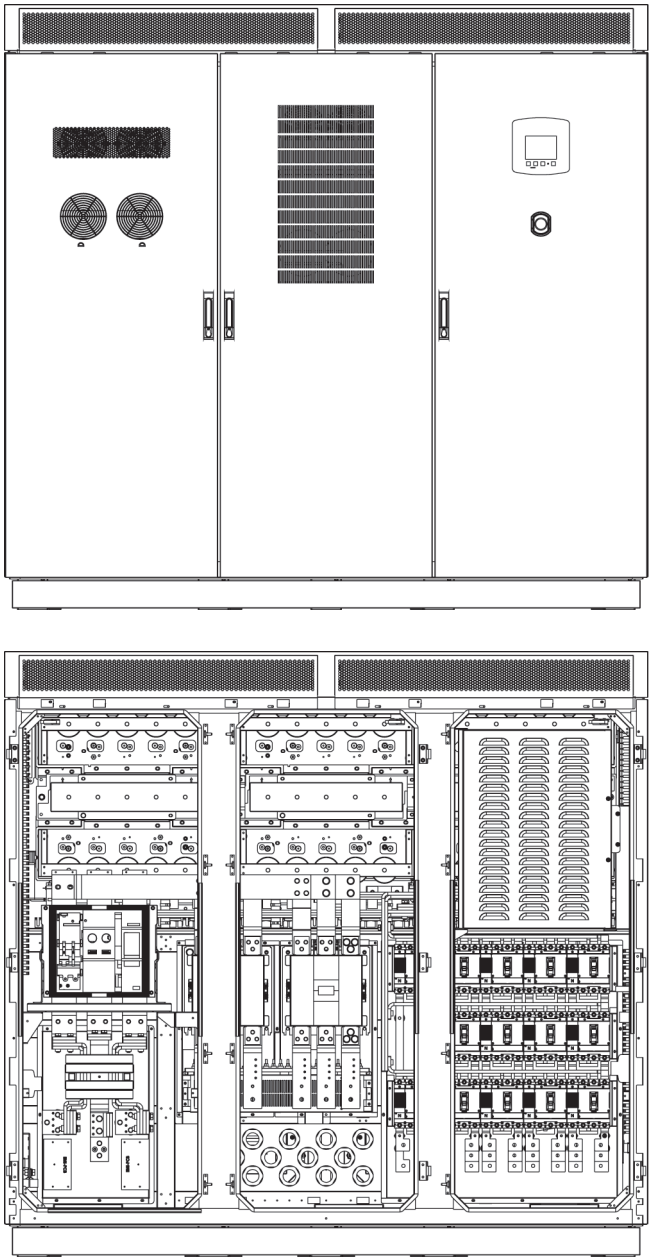


圖2-1 : C1000 - 14路（直流斷路器）

## 2.2.1 外部前視圖

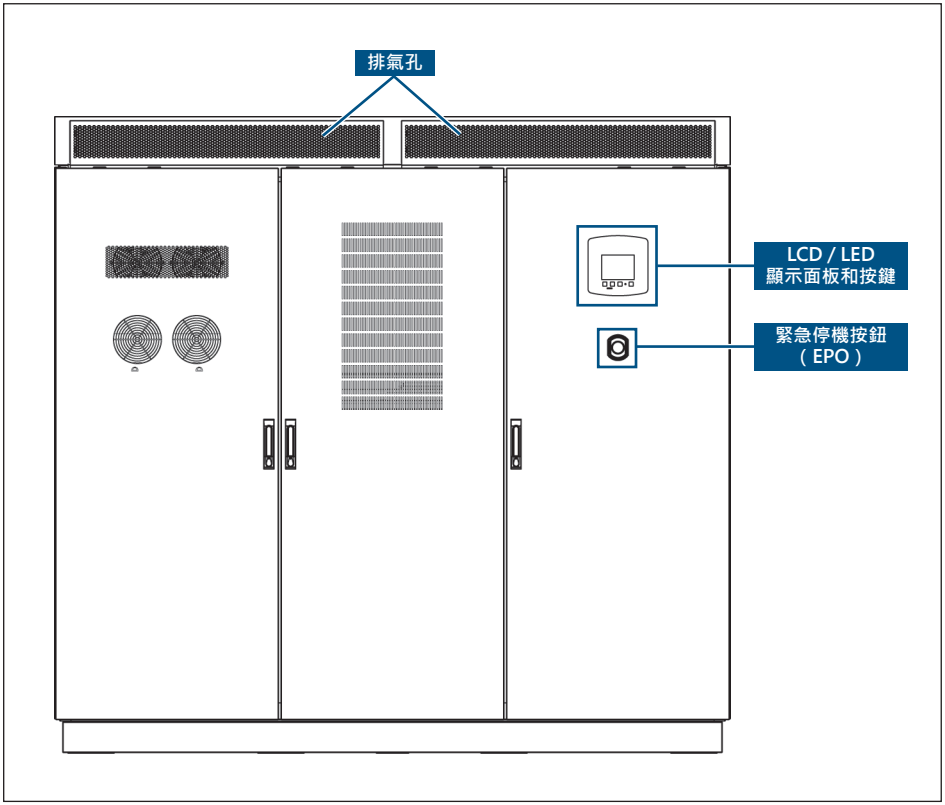



圖2-2 : 外部前視圖

## 2.2.2 外部後視圖

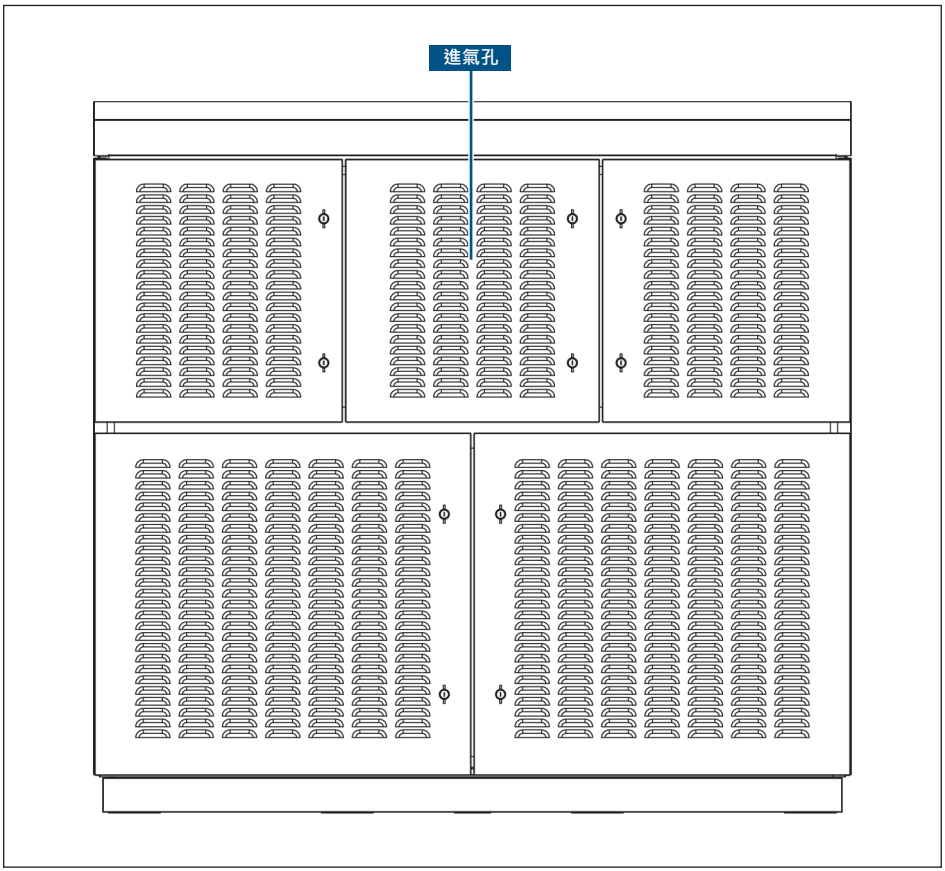



圖2-3 : 外部後視圖

## 2.3 特色

以下項目為本變流器重要特色：

- 最高轉換效率98.84%，歐洲轉換效率98.4%
- 三相三線 (3 Lines + PE) 1000kVA太陽能變流器
- 寬的輸入電壓範圍 (520-1000Vdc)
- 寬的最大功率追蹤範圍 (550-850Vdc)
- 1組最大功率追蹤器
- 5吋圖型化液晶顯示器 (可調亮度和對比)
- IP-65 防水防塵等級 (電子設備)

## 2.4 變流器標籤

機器型號的規格請參照下圖：

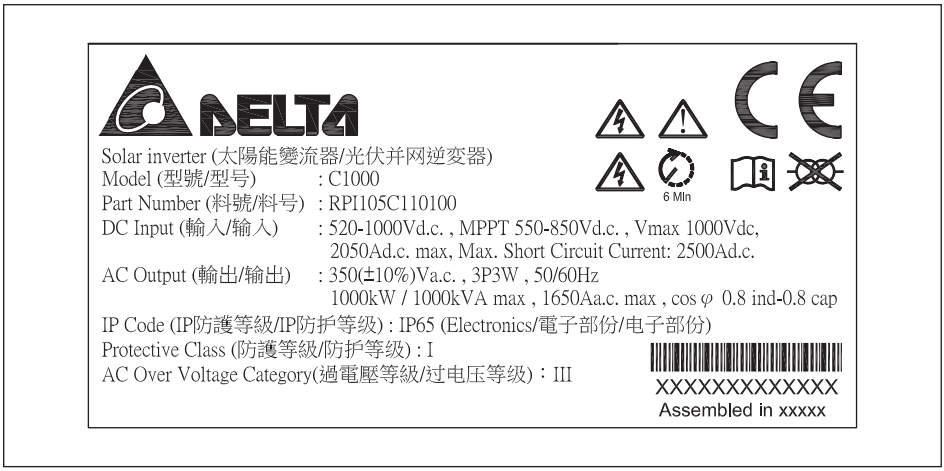



**圖2-4 : 變流器標籤**

# 3 運輸和安裝準備

## 3.1 安裝地點需求

### 3.1.1 地點空間

請確認保留足夠的空間來移動或組裝本變流器，相關敘述請參照本章節。

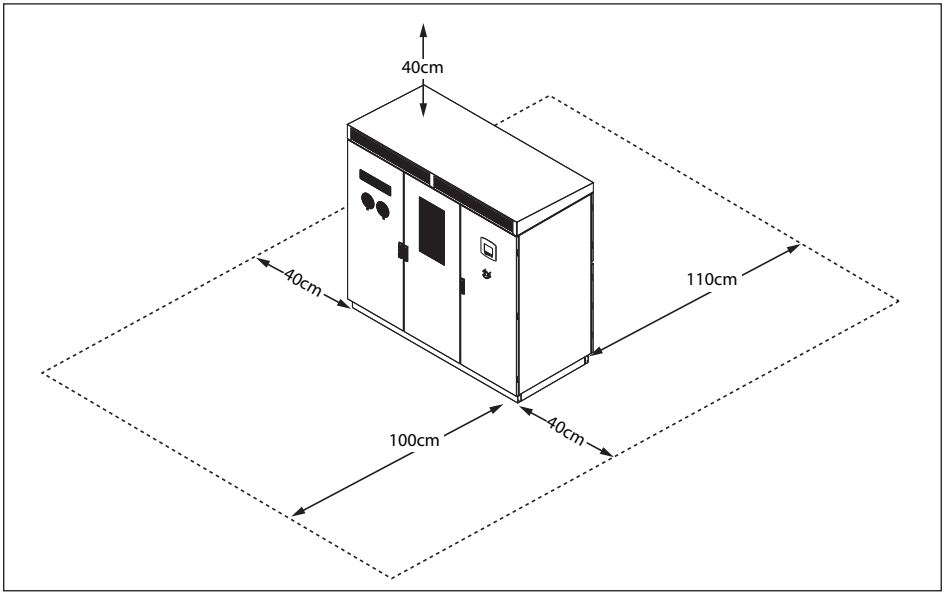



**圖3-1 : 變流器空間需求**

裝貨地點的空間必需足夠容下本機器的拆卸和釋放貨櫃，詳見下列空間資料：

- 變流器外包裝高度：2210 mm (87 inches)
- 變流器外包裝寬度：2280 mm (89.8 inches)
- 變流器外包裝深度：1200 mm (47.2 inches)
- 變流器高度：1980 mm (78 inches)
- 變流器寬度：2100 mm (82.7 inches)
- 變流器深度：950 mm (37.4 inches)

**說明**

- 安裝地點的環境溫度範圍必定要小於60°C。
- 太陽光直接照射的話將有可能使得變流器的輸出功率降低。

## 3.2 安裝地點的準備

拆卸包裝之前，請確定本手冊所有對空間和環境的需求都已閱讀並確實瞭解。

### 3.2.1 溝渠尺寸

準備溝渠是為了能夠安全地擺放從直流和交流配線箱配接過來的纜線。建議的溝渠寬度為270公釐（如圖3-2斜線區域所示），建議的溝渠深度則是依照使用者環境決定。

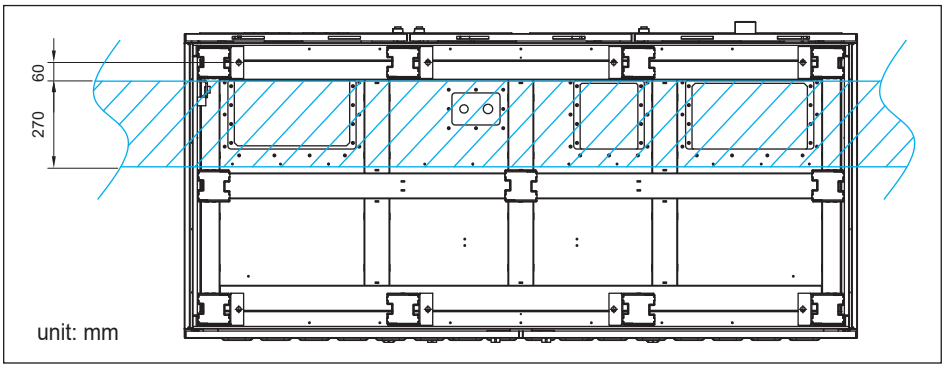



圖3-2 : 溝渠尺寸

### 3.2.2 安裝基座的尺寸和特性

建造安裝基座的尺寸請參照下列說明。

安裝基座的長度和寬度不應該小於變流器本體的基座，並且確認基座可以乘載變流器的重量。

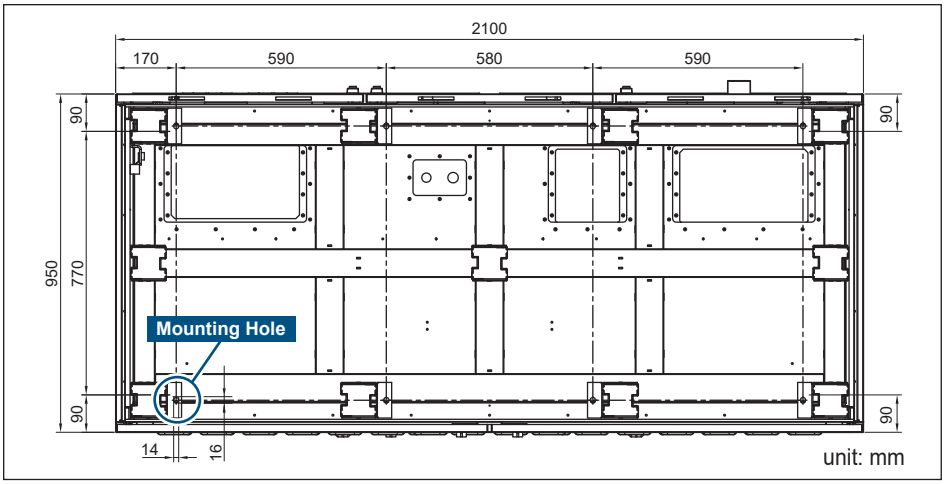



圖3-3 : 安裝基座尺寸

## 3.2.3 固定方式

安裝與固定變流器有以下方法：

1. 直接安裝固定在地面上。
2. 先將基座固定在地面上，再將變流器安裝在基座上。
3. 建議AC/DC端配接之纜線，距離變流器底座至少大於1m高度。

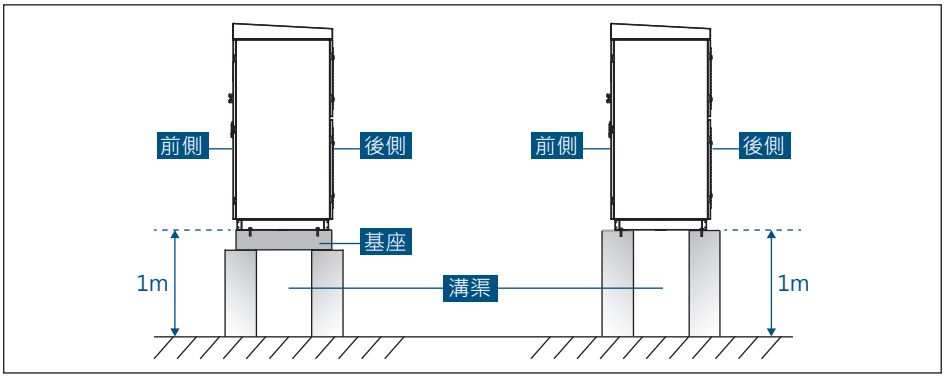



**圖3-4 : 固定方式**

## 3.2.4 針對室內安裝的變流器尺寸

如果變流器安裝於室內空間，需要配置適當的通風管，一端直接固定於變流器的頂部，使得能將機台冷卻後的熱風排到戶外去。

需要做相關配置可參考圖3-5與圖3-6。

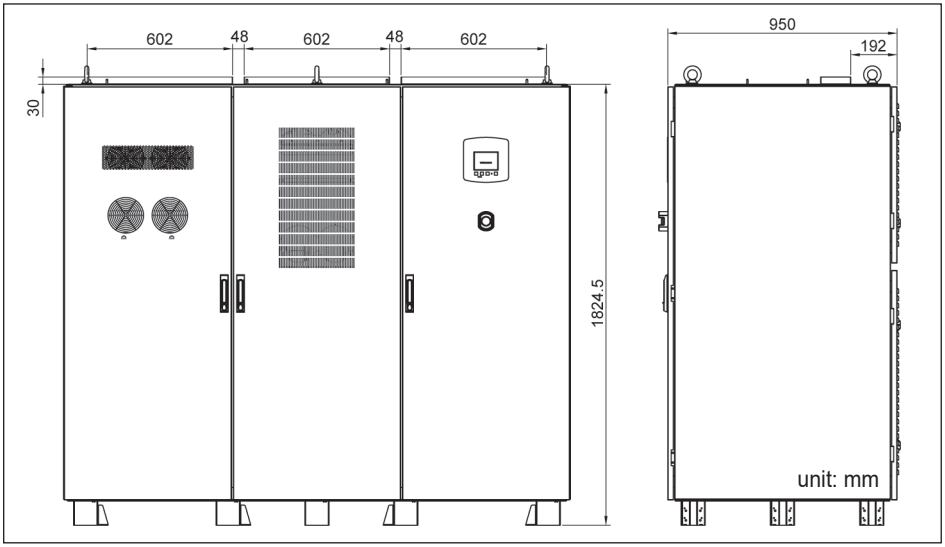



**圖3-5 : 不含屋頂的尺寸**

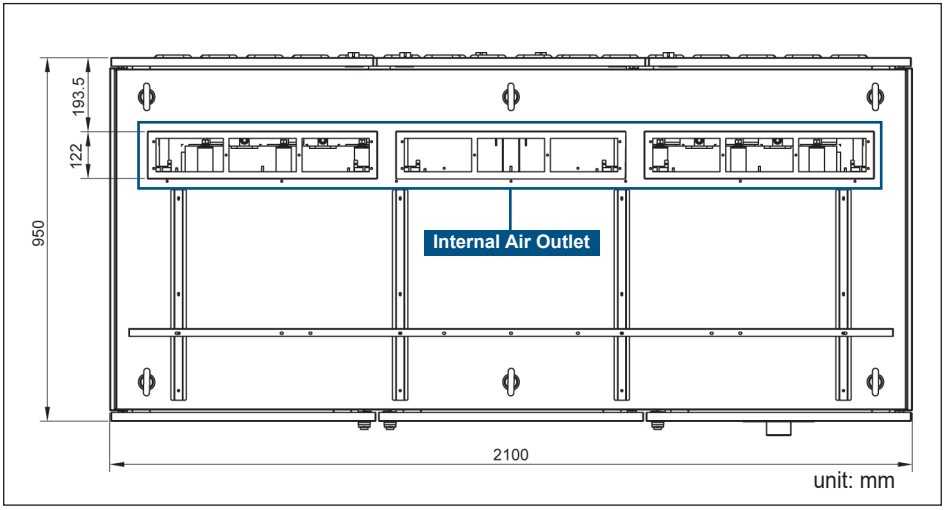



圖3-6 : 內部出風口尺寸

## 3.3 運送方式和建議工具

任何機具用來搬運變流器必須要考慮到該機具要可以承載變流器的重量，下列介紹的幾種設備可以用來搬運變流器：

- 堆高機或拖板車(建議做法)
- 起重機
- 鋼索
- 掛勾
- 鋼環

## 3.3.1 使用堆高機或拖板車

不管是使用堆高機或是拖板車來搬運其實方法是一樣的，你可以把包裝拆除直接搬運變流器或者是連同包裝紙箱（含棧板）一起搬運都可以，搬移時請遵守以下步驟：

1. 堆高機或是拖板車的叉子插入變流器下方，請注意叉子位置必須置於搬運物體的重心位置。

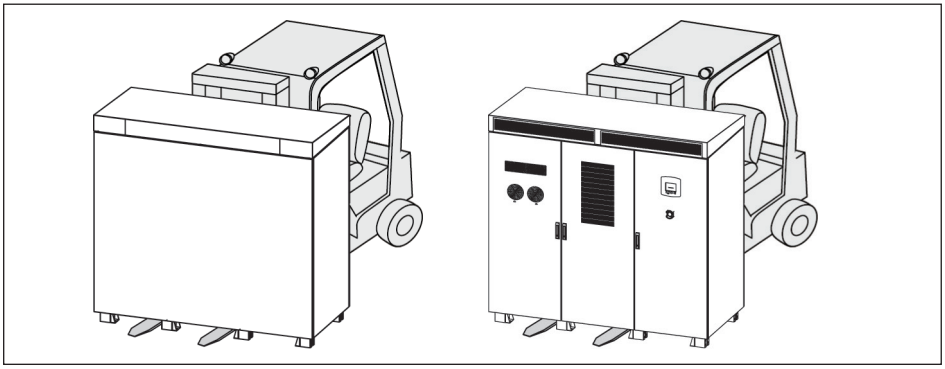


**圖3-7 : 搬運變流器**

2. 抬起變流器之後就直接運送到安裝地點。

## 3.3.2 使用起重機

當變流器有含包裝紙箱和棧板或是沒包含包裝紙箱和棧板在使用起重機搬運時的方法是不同的，因此請分別遵守以下步驟：

搬運時含包裝紙箱和棧板：

1. 使用繩索固定變流器，確定每條繩索受力平均。
2. 吊起變流器並穩定的移送到安裝地點。
3. 解開繩索。

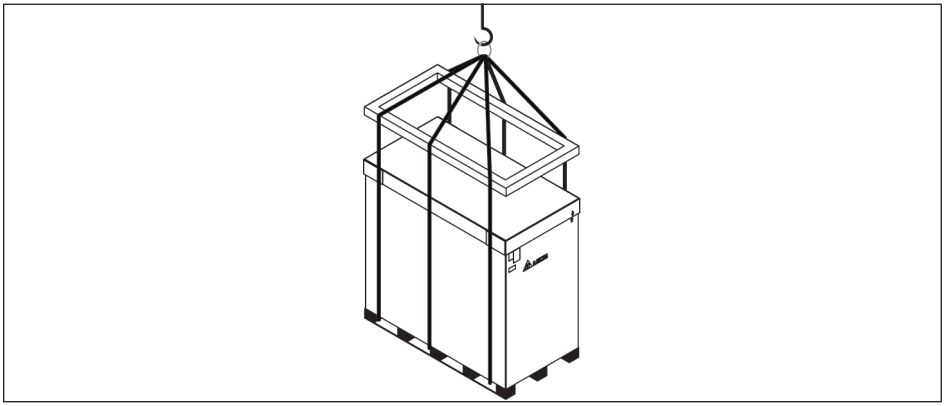


**圖3-8 : 使用繩索運送**

搬運時不含包裝紙箱和棧板：

1. 將變流器前門和後門打開。
2. 鬆開上蓋的螺絲。 (鎖附扭力: 25 Kgf-cm)

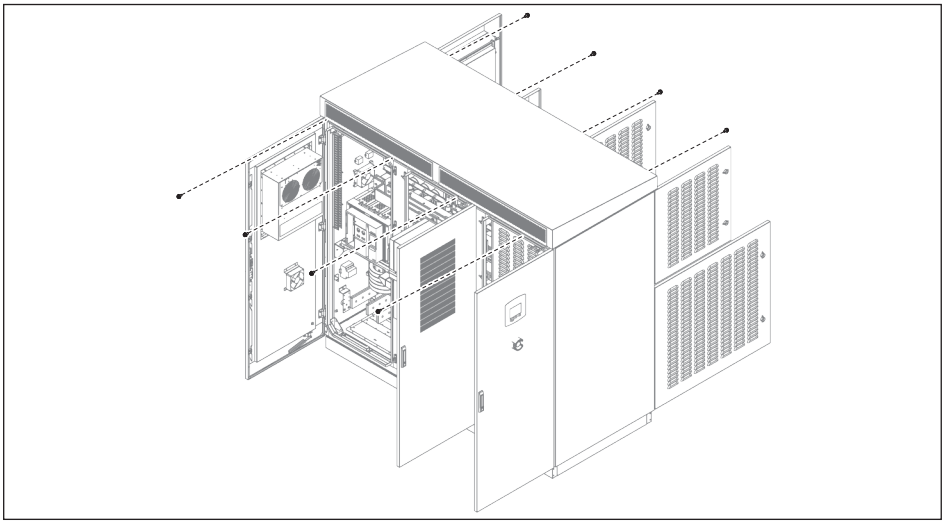


**圖3-9 : 鬆開上蓋的螺絲**

3. 拆掉變流器的上蓋。

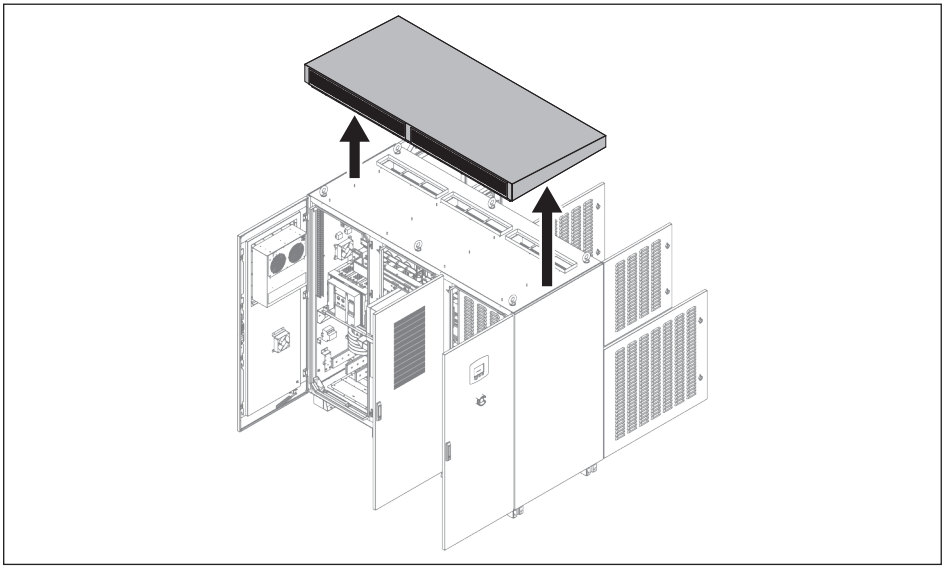


**圖3-10 : 拆掉變流器上蓋**

4. 將鋼索上的掛勾確實勾在變流器上方四個角落的吊環上。

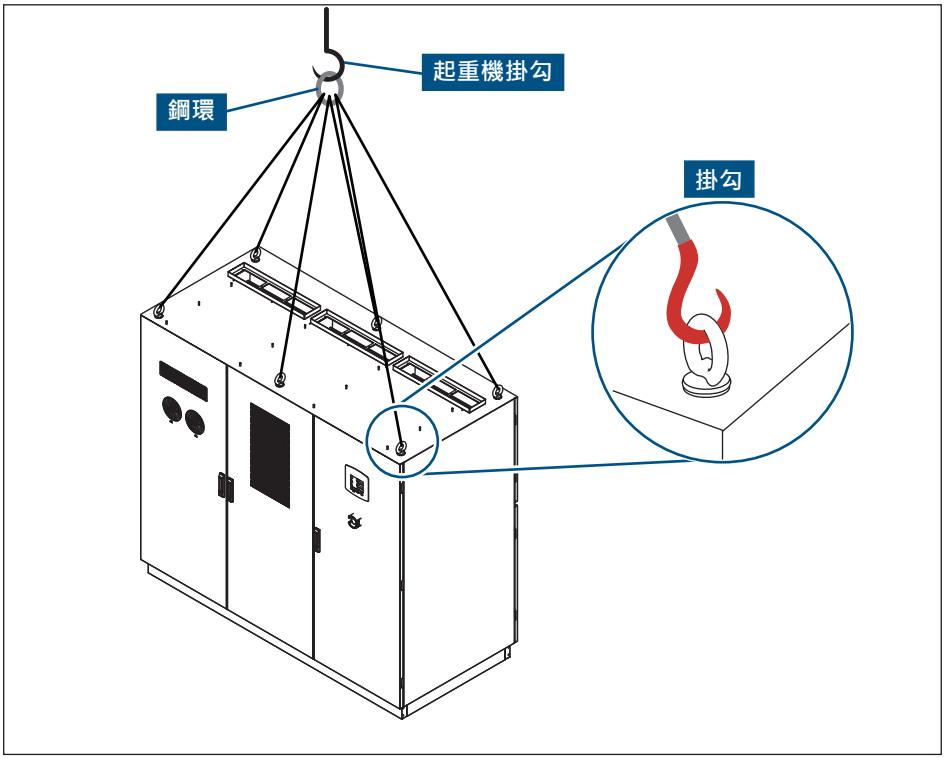



**圖3-11 : 鋼索勾在變流器上**

5. 將連接鋼索的鋼環掛在起重機的吊鉤上。
6. 吊起變流器並穩定的移送到安裝地點。
7. 解開鋼索。

## 3.4 包裝拆解

要拆開外包裝的紙箱請遵循以下步驟：

1. 先拆開紙箱頂蓋，然後順時針方向將紙箱外殼拆除。

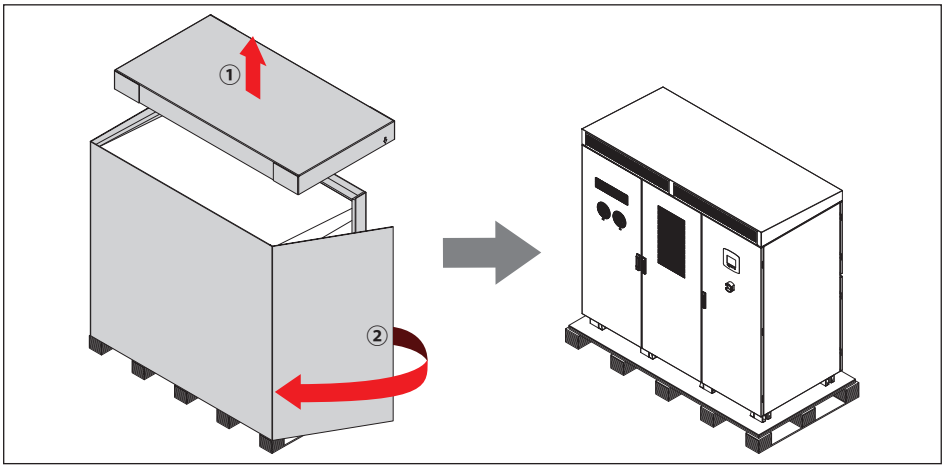



**圖3-12 : 拆除包裝紙箱**

2. 鬆開鎖附在棧板上和變流器底部之間的螺絲與螺帽

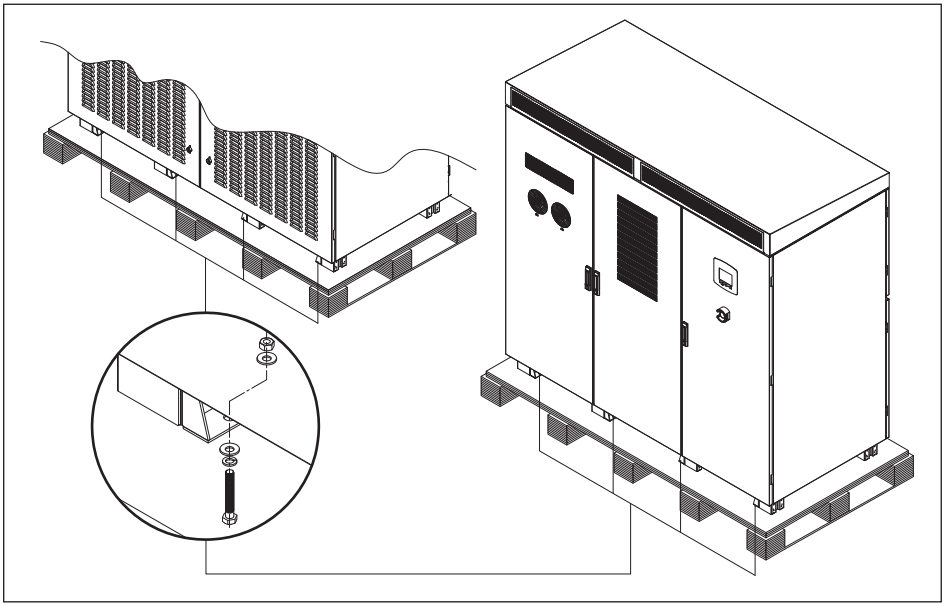


**圖3-13 : 鬆開螺絲與螺帽**

3. 將變流器從棧板上移開

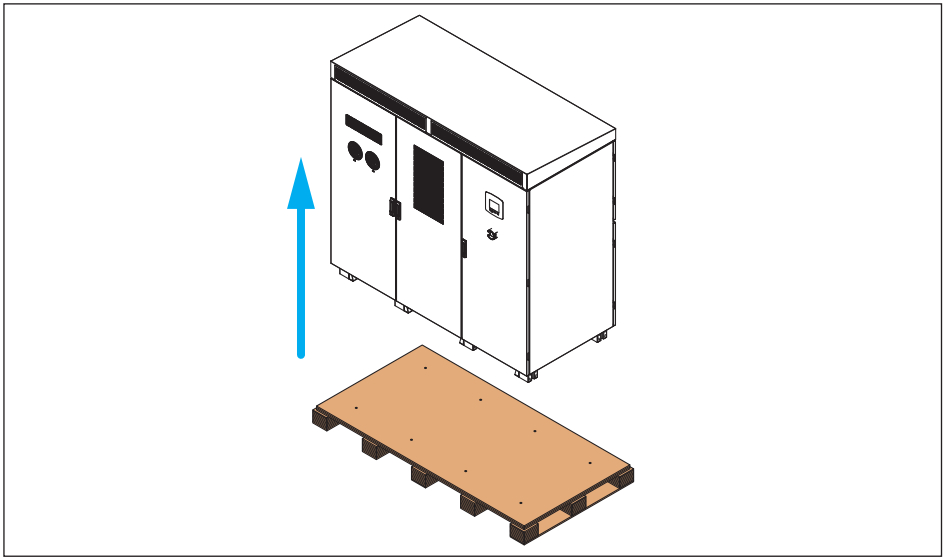


圖3-14 : 將變流器從棧板上移開

## 3.5 物品清單

| 物品 | 數量 | 說明 |
|---|---|---|
| 太陽能變流器 | 1 | C1000太陽能變流器。 |
| 鑰匙 | 4 | 用來開啟或關上變流器的門。 (前門*2 / 後門*2) |
| 安裝手冊 | 1 | 手冊內含安全規範、安裝說明、產品規格等。 |
| M10 螺絲組 | 4 | 包含螺絲和螺帽。預留給直流配線用。 |
| M12 螺絲組 | 2 | 包含50mm長的螺絲和螺帽。預留給交流配線用。 |
| 線材 | 1 | 用來設定太陽能板正接地/負接地。 |
| M5 螺絲 | 1 | 用來鎖附太陽能板正接地/負接地之線材。(12mm長) |
| 合格證 | 1 | 變流器出廠合格證明。 |
| 測試報告 | 1 | 變流器出廠驗證相關資料。 |
| U型絕緣片 | 1 | 用來隔絕不同相位的電力線端子，避免碰觸。 |
| L型絕緣片 | 1 | 用來防止裝機完後直接碰觸到帶電體(匯流排)。 |
| M4 螺絲 | 2 | 用來鎖附絕緣片。 |
| 護線套 | 15 | 用來保護纜線線皮，避免被底板孔邊緣磨損。 |

表3-1 : 物品清單

# 4 安裝說明

## 4.1 建議工具

安裝變流器時請使用下列建議的工具：

- 功率表 (功率分析儀)
- 電壓表
- 電流錶
- 扭力板手/ 套筒板手/ 開口板手
- 螺絲起子

## 4.2 DC端連接

1. 如圖4-1所示將連接到DC端的電纜穿過底板。

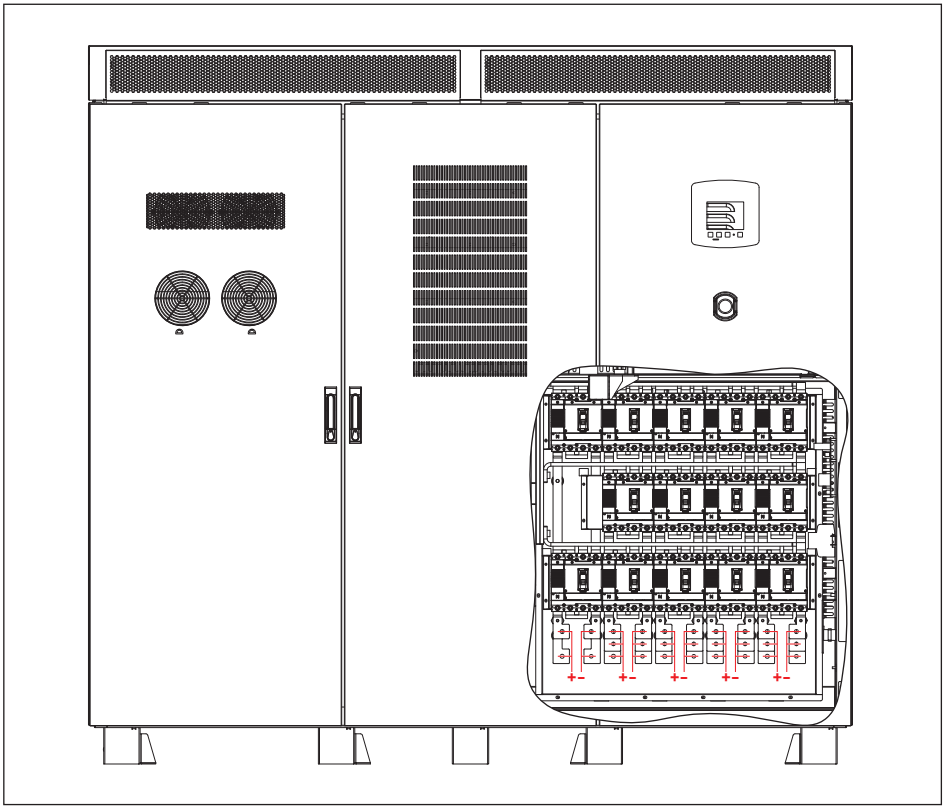


**圖4-1 : DC端配線**

2. 將從DC配線盒來的電纜連線到變流器。

**C1000**

| DC端 | 導線數目 (+/-) | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 12 ~ 14 | M10 | 25 |

| DC端纜線 (銅) | DC+/DC-端最小需要的纜線截面積 |
|---|---|
| | 70 $mm^2$ (14 路) / 95 $mm^2$ (≧12 路) |

| DC端纜線 (鋁) | DC+/DC-端最小需要的纜線截面積 |
|---|---|
| | 95 $mm^2$ (14 路) / 120 $mm^2$ (≧12 路) |

* 最大可鎖附纜線截面積 → 240 $mm^2$

**說明**

DC側底板相關資訊請參閱附錄B。

**注意!**

- 選用的纜線操作溫度要有到105°C。

**說明**

需使用護線環搭配矽氧樹脂來做到防水防塵功能。以下為活用護線環與矽氧樹脂建議的廠商與型號。

| 零件名稱 | 型號 | 廠商 |
|---|---|---|
| 活用護線環 (Movable bushing) | KG-020 | KANG YANG HARDWARE |
| 矽氧樹脂 (Silicon rubber) | RTV162 | GE Bayer Silicones |

**對於線材與接線端子:**

台達建議線材使用適當耐流能力之多股軟芯線。

台達建議銅線端子/鋁線端子材料表面需電鍍：錫(Sn) or 鎳(Ni)。

**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，鋁線線徑請確實遵照規範。
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. 使用最大允許的壓接扭力進行壓接。

## 4.2.1 DC端配接尺寸

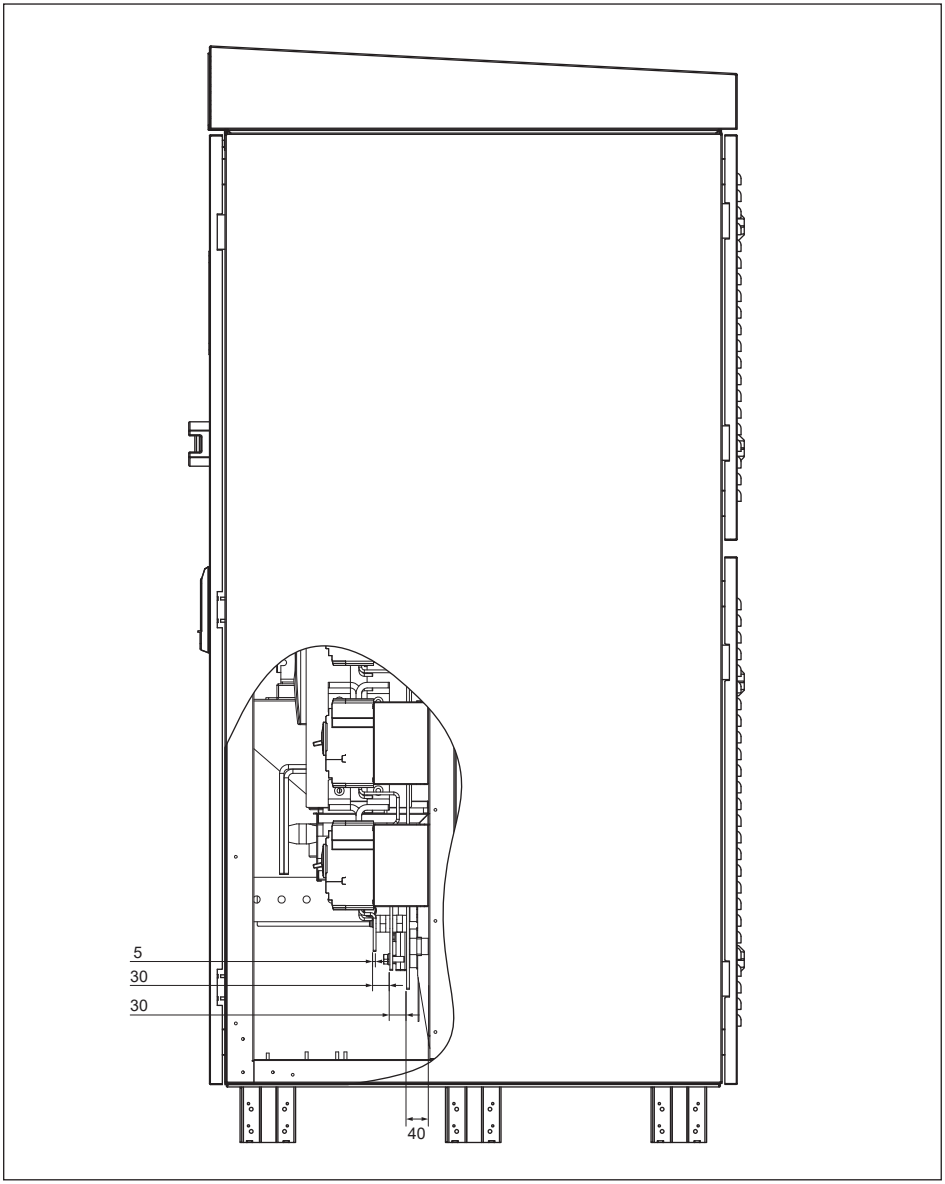



圖4-2 : DC端配接側視圖

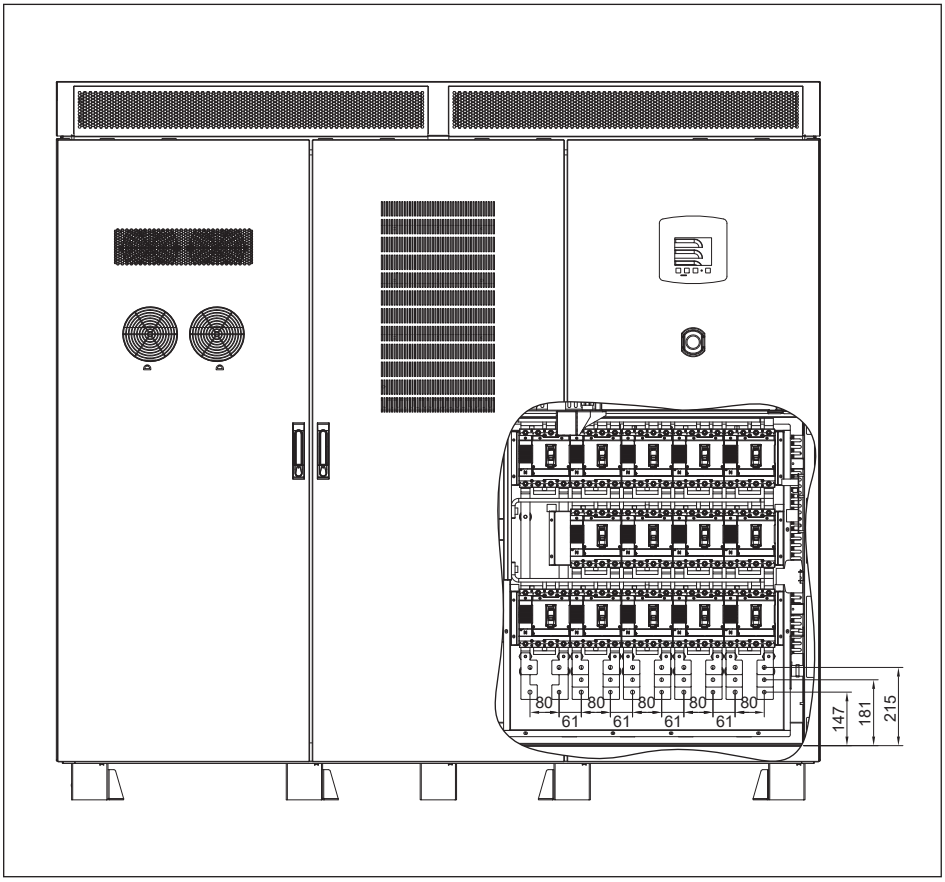



**圖4-3 : DC端連接端尺寸圖**

## 4.2.2 正接地與負接地

太陽能板有兩種接地方式：一種是正接地，另一種是負接地，要將太陽能板接地請依照下列步驟，如圖 4-4所示：

1. 將接地電纜連線至保險絲插座。
2. 將接地電纜用一根螺絲鎖附在正端（ DC+ ）或是負端（ DC- ）的匯流排上。(保險絲座: 30Kgf-cm (3N-m) / 匯流排+/-: 25 Kgf-cm (2.5N-m))

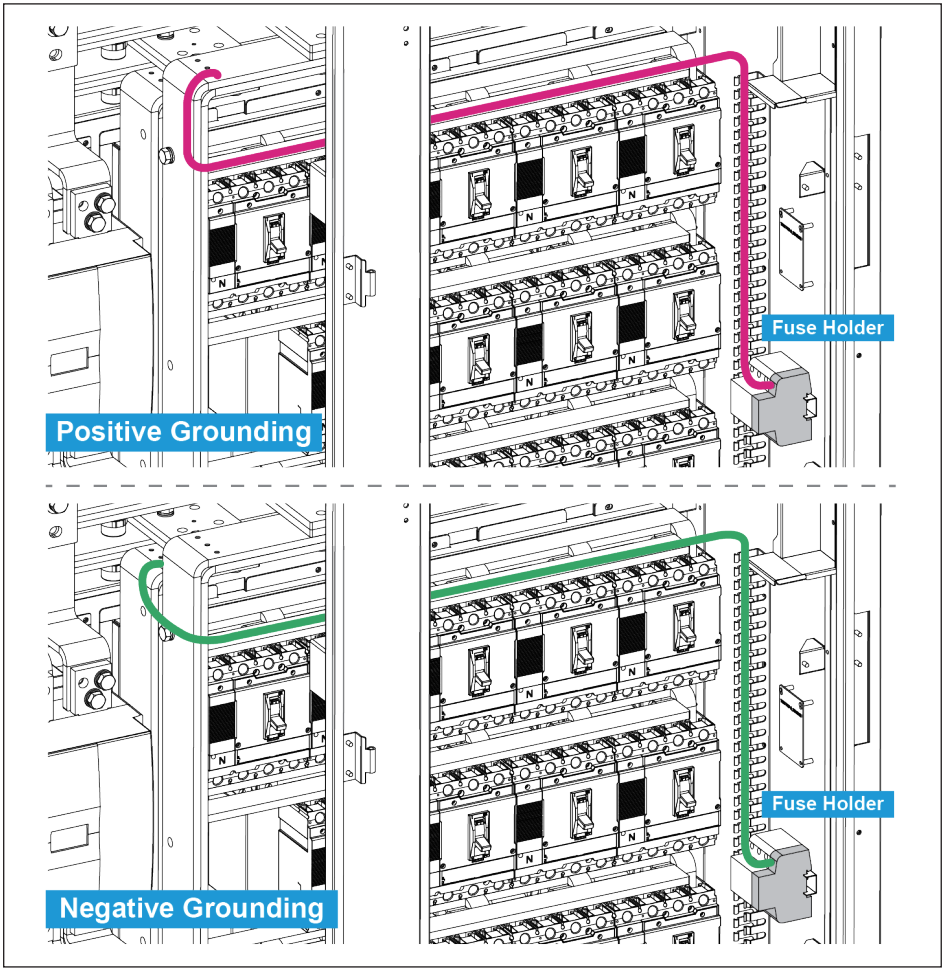



圖4-4 : 正接地或負接地示意圖

**說明**

正接地與負接地必須透過面板來進行設定，相關介紹請參考5.3.7.3 Install Settings。

## 4.3 AC端連接

1. 如圖 4-5所示將連接到AC端的電纜穿過底板。

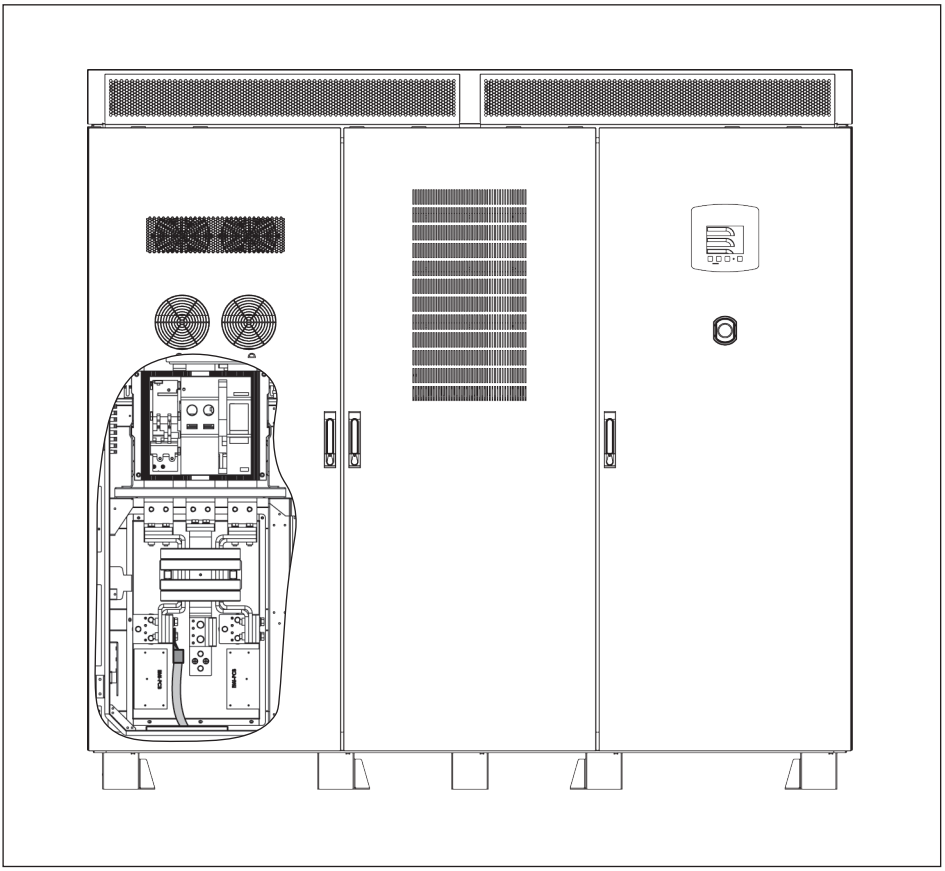


**圖4-5 : AC端配線**

2. 將從AC配線盒來的電纜連線到變流器。

**C1000**

| AC端 | 各相最大纜線數目 | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 8 (<300 $mm^2$) | M12 | 45 |

| AC端纜線 (銅) | AC端最小需要的單相纜線總截面積 |
|---|---|
| | 1110 $mm^2$ |
| | AC端最小需要的單相纜線單條截面積 x 數量 |
| | 150 $mm^2$ x 8 |

| AC端纜線 (鋁) | AC端最小需要的單相纜線總截面積 |
|---|---|
| | 1480 $mm^2$ |
| | AC端最小需要的單相纜線單條截面積 x 數量 |
| | 185 $mm^2$ x 8 |

**說明**

AC側底板相關資訊請參閱附錄B。

**注意!**

- 選用的纜線操作溫度要有到105°C。

**說明**

需使用護線環搭配矽氧樹脂來做到防水防塵功能。以下為活用護線環與矽氧樹脂建議的廠商與型號。

| 零件名稱 | 型號 | 廠商 |
|---|---|---|
| 活用護線環 (Movable bushing) | KG-020 | KANG YANG HARDWARE |
| 矽氧樹脂 (Silicon rubber) | RTV162 | GE Bayer Silicones |

**對於線材與接線端子:**

台達建議線材使用適當耐流能力之多股軟芯線。

台達建議銅線端子/鋁線端子材料表面需電鍍：錫(Sn) or 鎳(Ni)。

**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，鋁線線徑請確實遵照規範。
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. 使用最大允許的壓接扭力進行壓接。

交流斷路器(AC Breaker)於首次使用時，需使用充電手把(Charge handle)上下搖曳進行充電直到”Charged/Discharged Indicator”顯示Charged後，按壓綠色”ON button”使交流斷路器(AC Breaker) 導通，此時”ON/OFF Indicator”會顯示”ON”。若按壓紅色”OFF Button”會使交流斷路器(AC Breaker)斷開，如需再次導通交流斷路器(AC Breaker)，則重新充電後按壓綠色”ON button”。




1 Charge handle　2 ON button　3 OFF button
4 Charged/Discharged indicator　5 ON/OFF indicator

**圖4-6 : 交流斷路器**

# 4.3.1 AC端配接尺寸

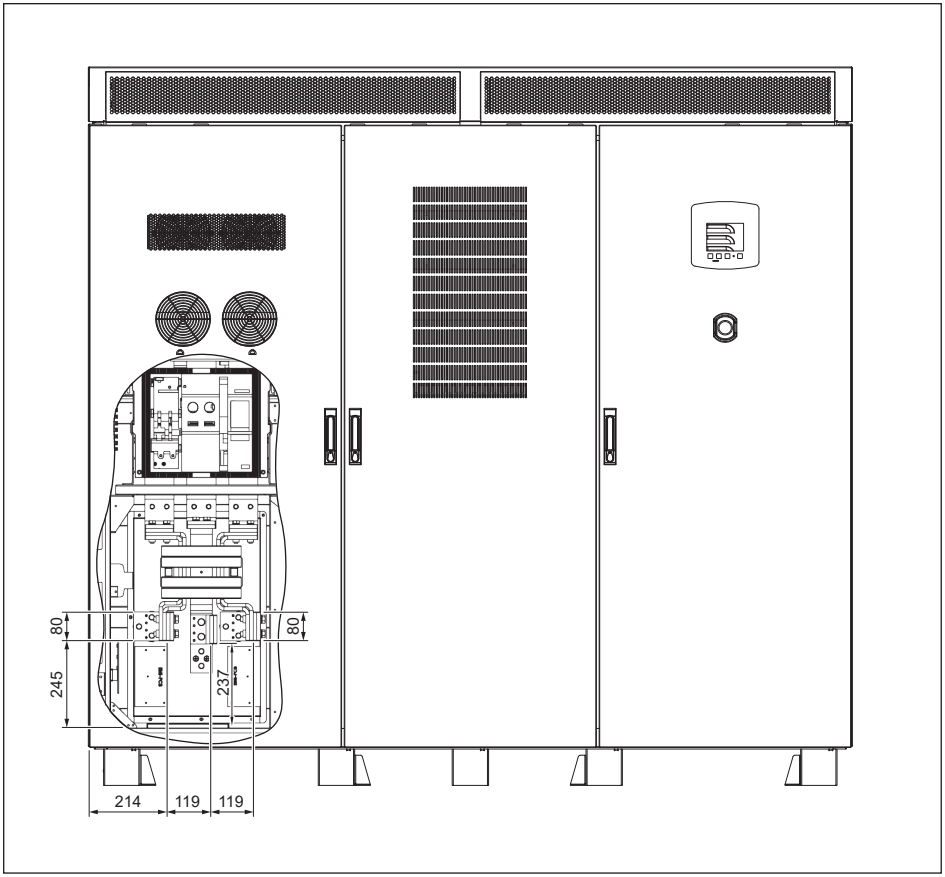



圖4-7 : AC端配接底視圖

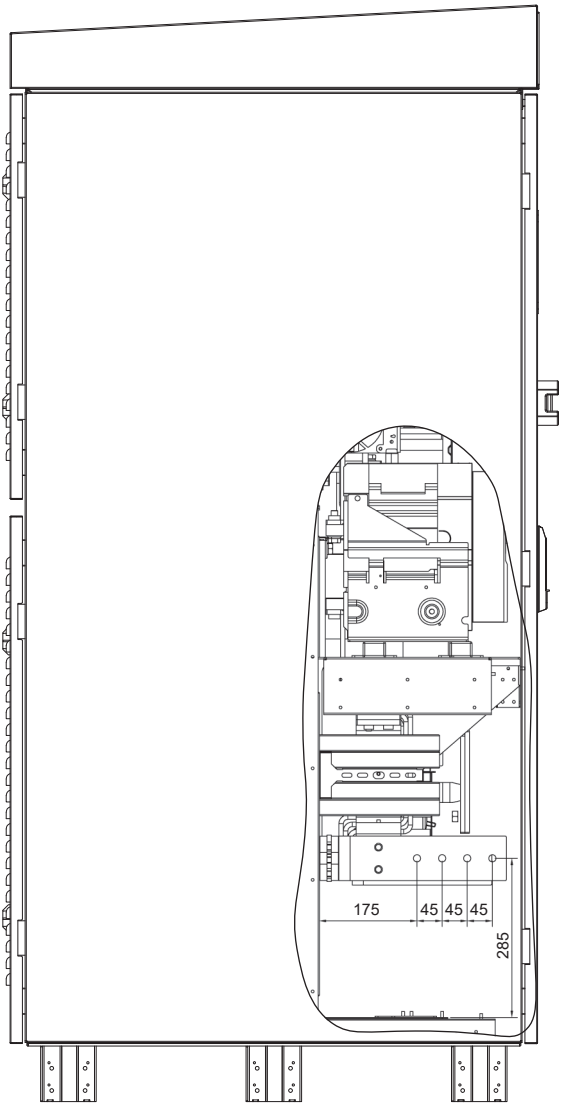



**圖4-8 : AC端連接端尺寸圖**

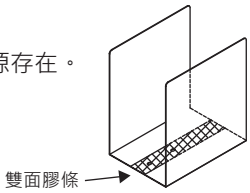
# 4.4 AC端絕緣片安裝

**CAUTION!**

- 安裝與拆下時都必須關閉所有直流和交流電源以避免觸電危險！

AC端配線後，如果不同的2相的端子與端子間的間距可能在10mm以內的情況下，我們會建議安裝U型絕緣片防止端子間的碰觸。

1. 關閉所有DC和AC電源，並確認DC與AC端沒有剩餘電源存在。
2. 將U型絕緣片背面雙面膠撕開。
3. 對準螺絲孔後黏貼於匯流排上。



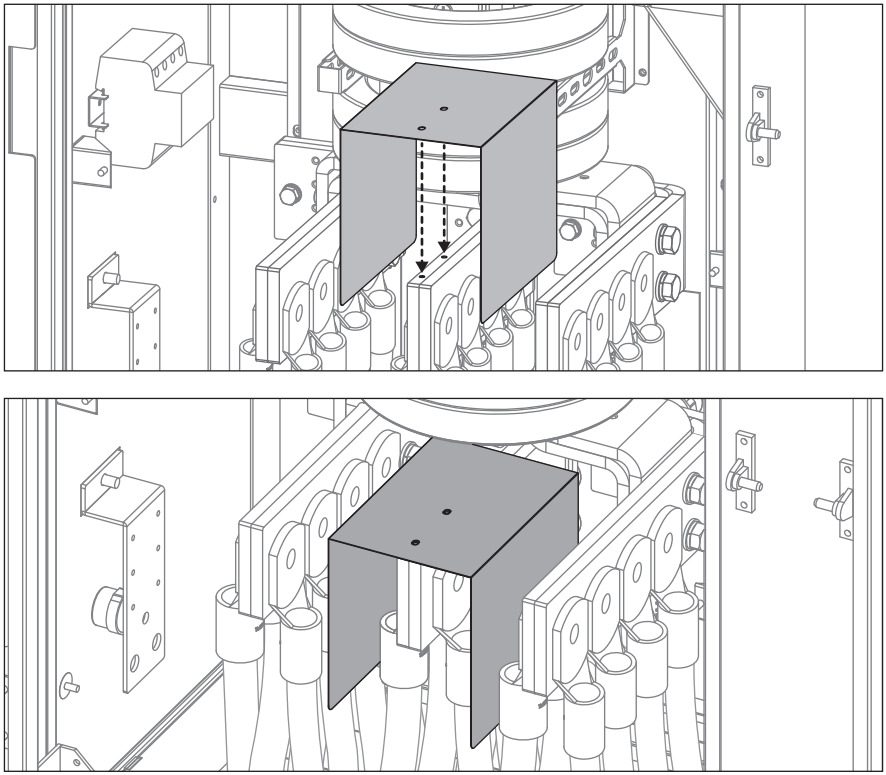
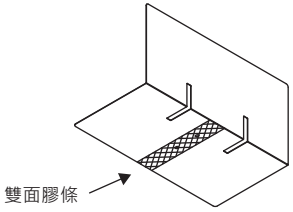



**圖4-9 : AC端U型絕緣片安裝**

黏貼上U型絕緣片後，安裝L型絕緣片，防止裝機完後直接碰觸到帶電體(匯流排)。

1. 關閉所有DC和AC電源，並確認DC與AC端沒有剩餘電源存在。
2. 將L型絕緣片背面雙面膠撕開。
3. 黏貼於U型絕緣片上後鎖上M4螺絲(扭力:8Kgf-cm(0.8Nm))。



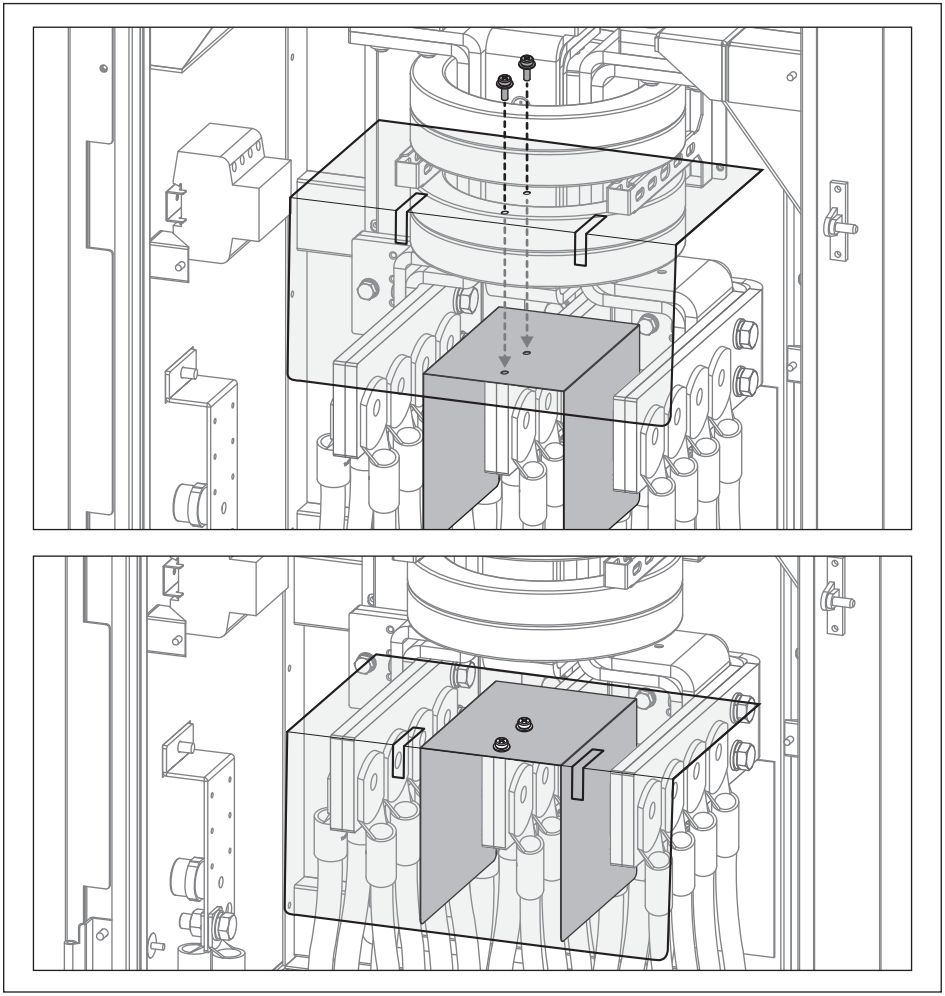



**图4-10 : AC端L型绝缘片安装**

## 4.5 PE端連接

PE端連接有以下兩個地方可以使用。

1. 變流器內部。可將PE連接到內部的DC側或是AC側的匯流排上。
2. 變流器外部。可將PE連接到外部的變流器支撐腳上。

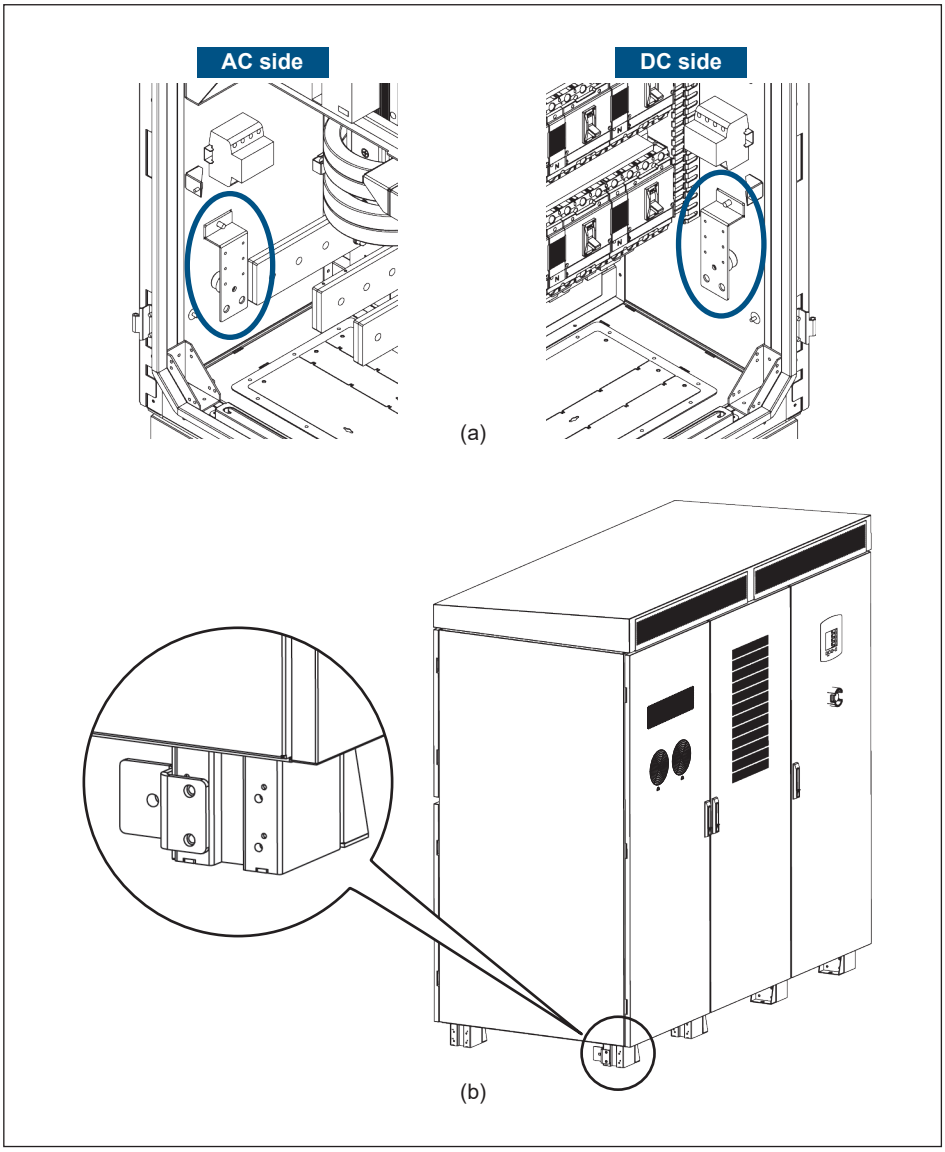



**圖4-11 : PE端連接。(a)變流器內部；(b)變流器外部**

# 4.5.1 PE端配接尺寸

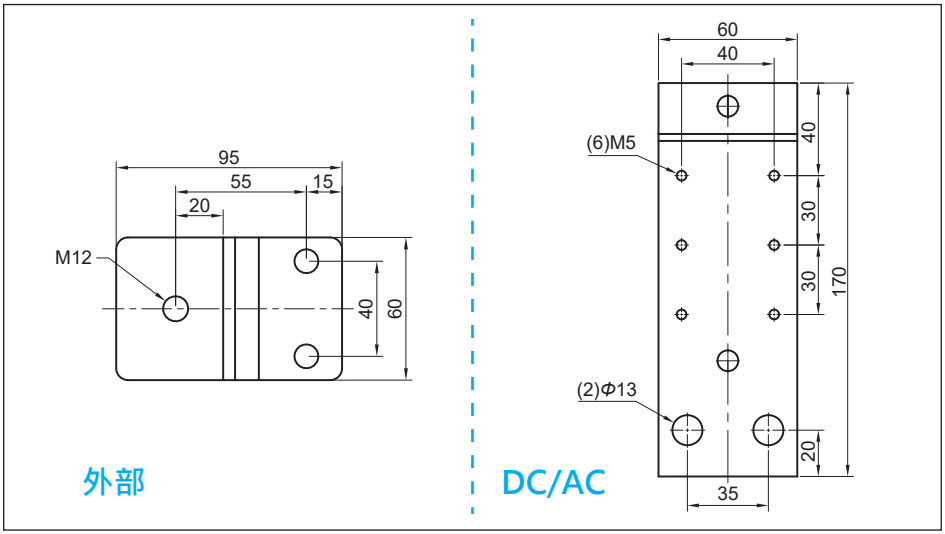



**圖4-12 : PE端連接端尺寸圖**

## C1000

| PE端 | 最大纜線數目 (DC/AC/外部) | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 4/4/1 | M12 | 45 |

| PE端纜線 (銅) | 最小需要的總纜線尺寸 |
|---|---|
| | 555 $mm^2$ |

| PE端纜線 (鋁) | 最小需要的總纜線尺寸 |
|---|---|
| | 740 $mm^2$ |

**注意!**

- 選用的纜線操作溫度要有到105°C。

**說明**

若使用其他配置組合，可以透過下列步驟來進行操作：

1. 先確認使用的纜線端子頭是否能夠與匯流排連接，包含螺絲孔洞大小和匯流排上螺絲寬度。這部分相關尺寸訊息可參考圖4-11。
2. 若因未安裝環境空間不足而無法使用上述建議的纜線尺寸與數目，可以使用護線環搭配矽氧樹脂來取代電纜接頭。以下為活用護線環與矽氧樹脂建議的廠商與型號。

| 零件名稱 | 型號 | 廠商 |
|---|---|---|
| 活用護線環 (Movable bushing) | KG-020 | KANG YANG HARDWARE |
| 矽氧樹脂 (Silicon rubber) | RTV162 | GE Bayer Silicones |

**對於線材與接線端子:**

台達建議線材使用適當耐流能力之多股軟芯線。

台達建議銅線端子/鋁線端子材料表面需電鍍：錫(Sn) or 鎳(Ni)。

**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，鋁線線徑請確實遵照規範。
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. 使用最大允許的壓接扭力進行壓接。

## 4.6 擋鼠板安裝和拆除

要安裝擋鼠板時麻煩請遵循以下步驟：

1. 將擋鼠板安裝於變流器底部的前側與後側。
2. 把螺絲鎖緊在擋鼠板的兩側。

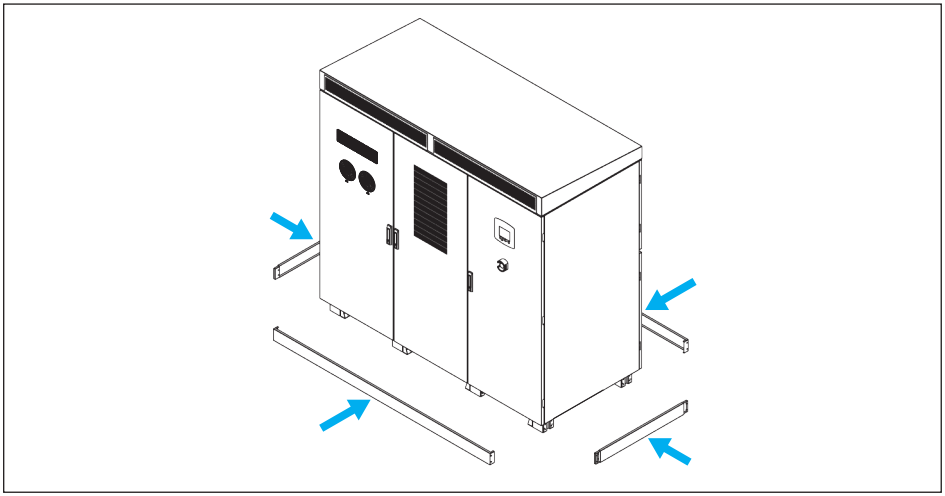


**圖4-13 : 安裝擋鼠板**

要拆除擋鼠板時麻煩請遵循以下步驟：

1. 鬆開位於擋鼠板兩側的螺絲。
2. 拆除變流器擋鼠板。

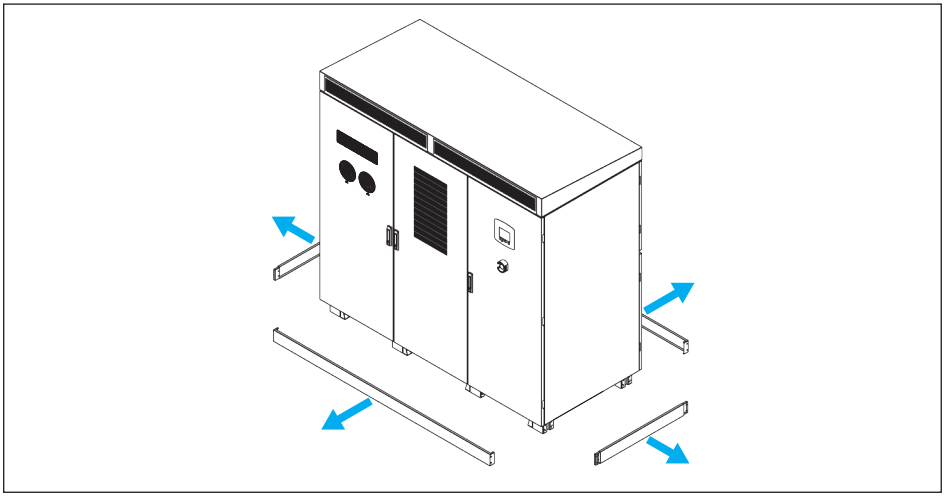


**圖4-14 : 拆除擋鼠板**

## 4.7 通訊介面連接

本機提供2組RS-485介面, 可以串接多台變流器並同時監控, 並提供兩組乾接點(Dry Contact)。

### 4.7.1 RS-485連接

RS-485的PIN腳定義如表4-1。只安裝單台變流器時, 安裝者須將終端電阻設置為ON。多台變流器串接時如圖 4-14和圖 4-15所示，安裝者必須將首台與末台變流器之RS-485終端電阻設置為ON，其餘機子則設定為OFF。終端電阻設定方式請參考表 4-3。

**注意**

為了良好的傳輸品質，推薦使用雙絞線作為通訊電纜。

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

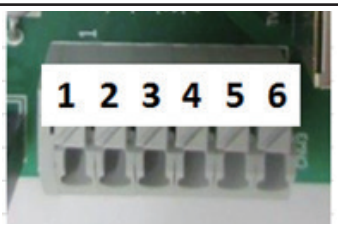



表4-1 : RS-485 PIN腳定義

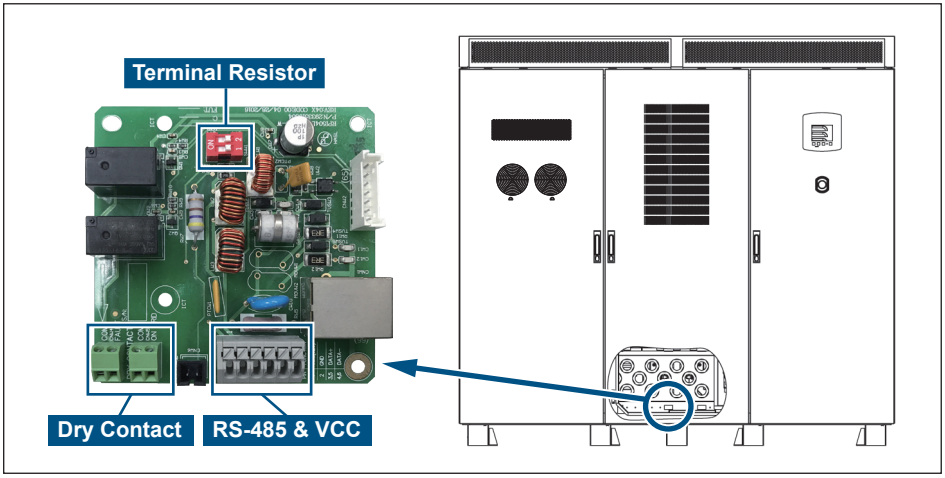



圖4-15 : 多組變流器組裝時的配線盤位置

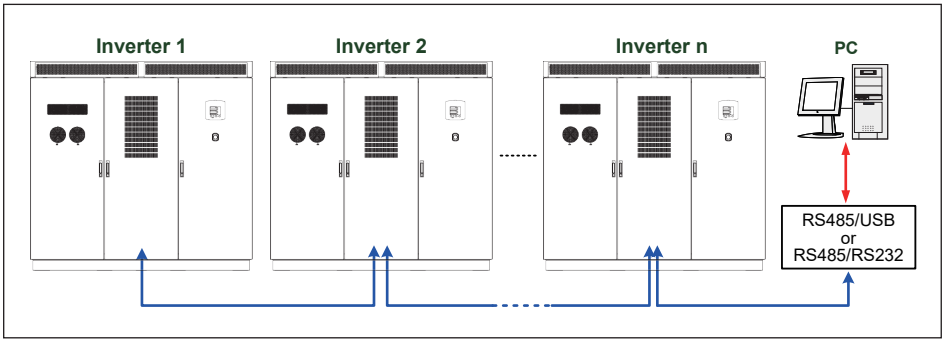
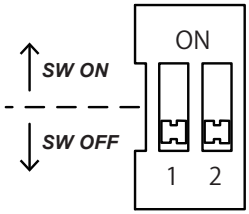



圖4-16 : 多組變流器的配線說明

| | |
|---|---|
| Baud rate | 9600/19200(default)/38400 |
| Data bit | 8 |
| Stop bit | 1 |
| Parity | N/A |

表4-2 : RS-485資料格式




| SW / Terminal Resistor | 1 | 2 |
|---|---|---|
| OFF | OFF | OFF |
| ON | ON | OFF |
| | OFF | ON |
| | ON | ON |

表4-3 : 終端電阻設定

## 4.7.2 乾接點連接

本變流器提供兩組乾接點以連接外部裝置，功能分別是ON GRID（併網狀態）和FAULT（故障）。當變流器處於併網狀態, COM和NO2會短路；當機器偵測到硬體故障時則COM和NO1會短路，這些功能可以由顧客的需求來做設定。

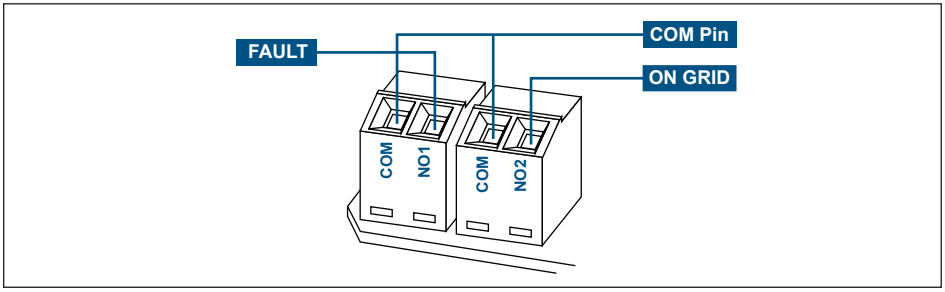



圖4-17 : 乾接點和接腳的定義

# 5 變流器開機

## 5.1 開機前的準備

1. 檢查太陽能板。

**說明**

太陽能板的DC開路電壓必須大於650Vdc且小於1000Vdc。

a. 在DC配電箱中量測太陽能板DC開路電壓的正端(+)和負端(-)。

2. 檢查AC市電電壓。
使用AC電壓表去量測AC市電電壓，正常電壓值應為線電壓350Vac。

## 5.2 開機和自我測試

1. 配置太陽能變流器的設定
要送電給變流器請將DC開關切換到ON，液晶顯示面板將在40秒之後開始正常顯示。
   a. 第一次開機時，顯示面板會出現Select Country和國家名稱，此時按壓▲上或▼下將會依序在不同國家名稱之間反白。按壓**ENT**表示該國家選項確認；按壓**EXIT**表示該國家選項取消。
   b. 確認語言選項正確與否，按壓**ENT**表示選擇Yes；或是按壓**EXIT**表示選擇No。選擇No顯示畫面將會回到上一個畫面。
   c. 畫面顯示Select Language時，按壓▲上或▼下將會依序在不同語言之間反白。按壓**ENT**表示該語言選項確認；按壓**EXIT**表示該語言選項取消，接著顯示面板會回到第一個畫面。
   d. 畫面顯示Menu時，按壓▲上或▼下將會依序在不同功能之間反白。按壓**ENT**表示該選項確認；按壓**EXIT**表示該選項取消。
   e. 當變流器執行自我測試時，畫面顯示E-Today。自我測試通過時，畫面顯示System Boot Countdown。自我測試失敗時，自我測試會再執行一次。
   f. 畫面出現System Boot Countdown時，系統開始倒數，此時按壓**EXIT**畫面會回到Menu。
   g. 畫面顯示Menu時，按壓▲上或▼下將Power Meter反白，接著按下**ENT**選擇該功能。
   h. 畫面顯示Power Meter時，確認輸入和輸出資訊之後，按壓**EXIT**畫面會回到Menu。
   i. 此時畫面出現Menu，整個設定步驟完成。

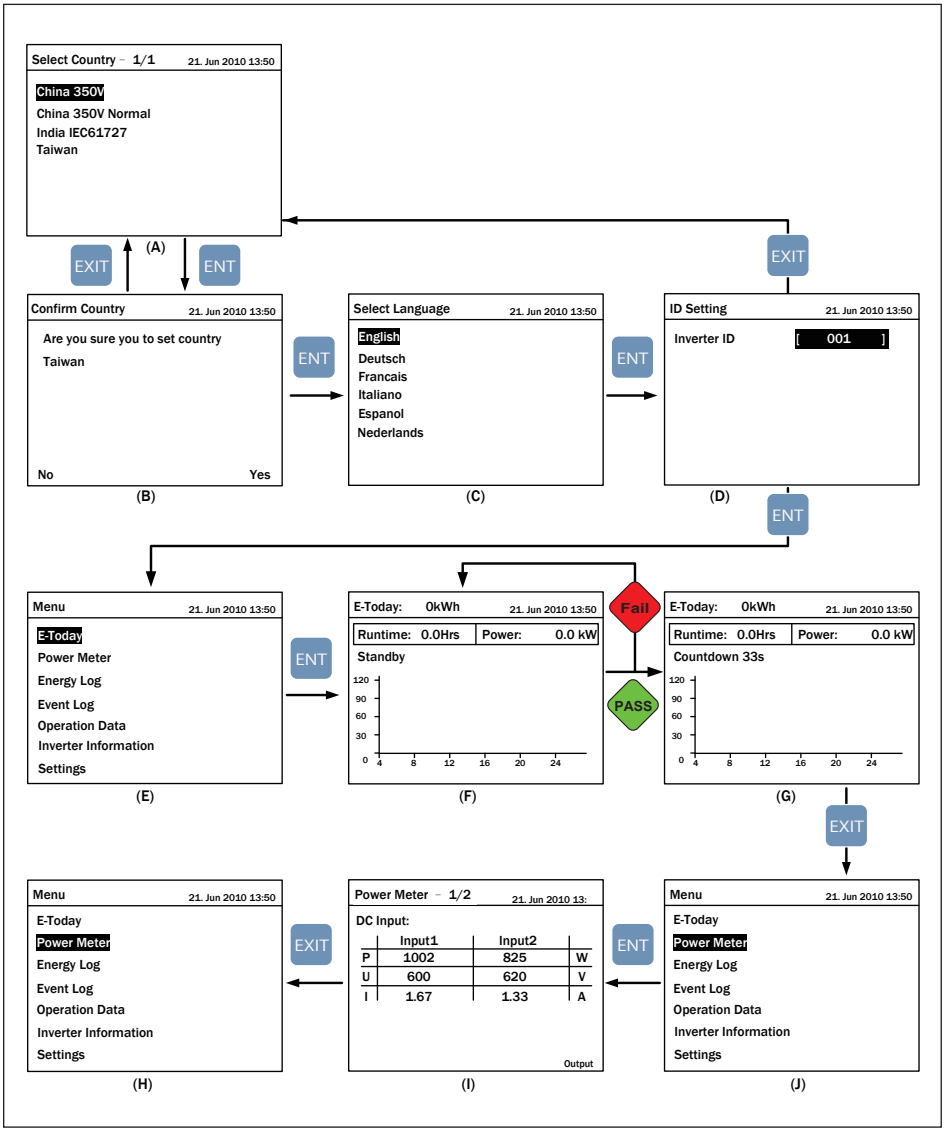



圖5-1：所有組態設定頁面

## 5.3 LCD顯示畫面及操作

C1000機種的控制台含有一個320x240圖元之顯示器與兩顆LED指示燈。
不同的指示燈號代表變流器不同的工作狀態，各種燈號的說明請參考表 5-1。

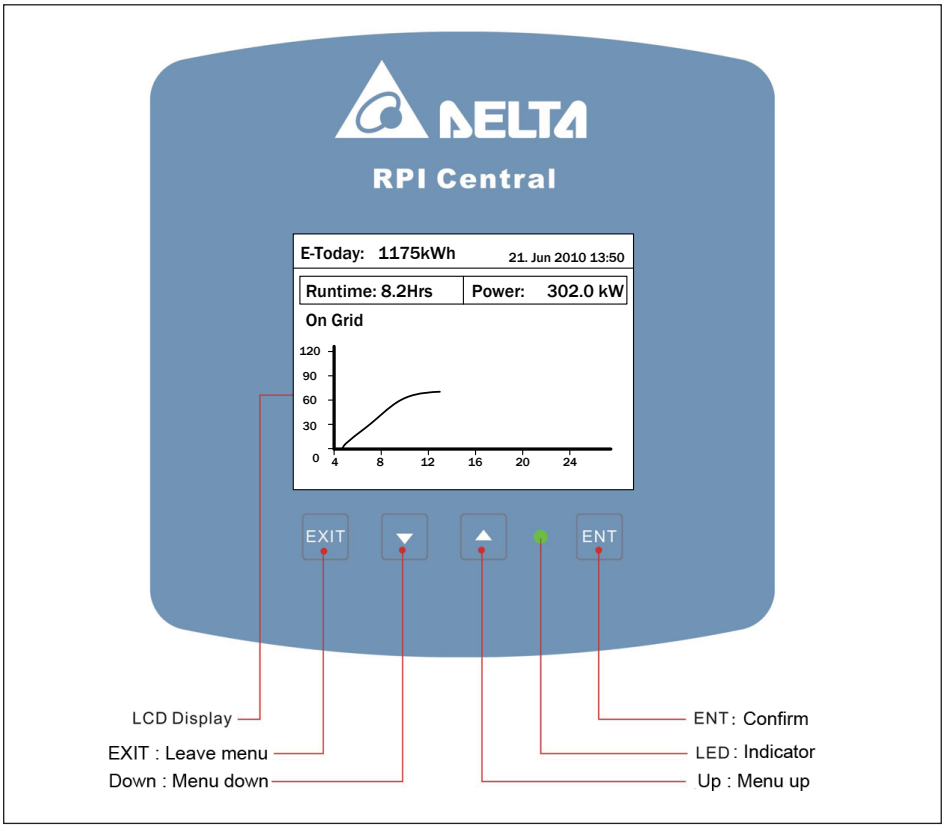



圖5-2 : 控制面板

| 狀態 | 綠色LED | 紅色LED |
|---|---|---|
| 併網前倒數 | 閃爍 * | OFF |
| 成功併網 | ON | OFF |
| 發生Error或Fault | OFF | ON |
| 待機、夜間模式 | OFF | OFF |
| 燒錄模式 | 閃爍 * | |

* ON 1s / OFF 1s

表5-1 : LED指示燈狀態

## 5.3.1 Home Page

變流器正常動作時，LCD顯示畫面如圖 5-3，可以得知Output Power（目前發電功率）、Inverter Status（變流器狀態）、Today Energy（今日總發電量）、Today Runtime（今日發電時數）、Today Power Curve（今日發電曲線）、Date-Time（日期-時間）。

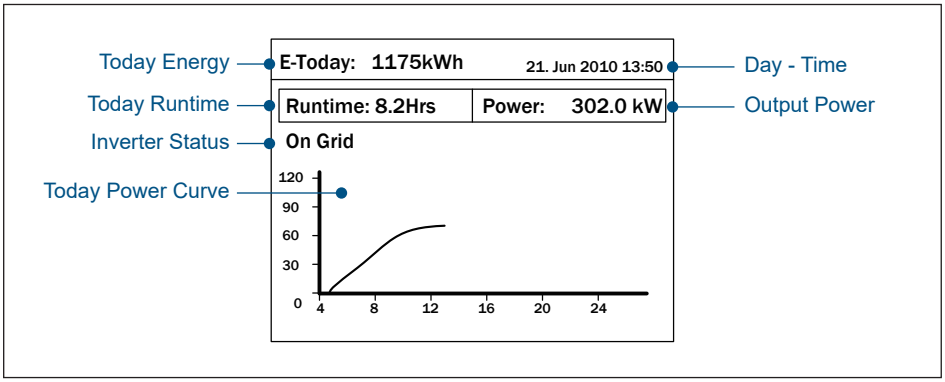



圖5-3 : 主頁面

## 5.3.2 Power Meter

此頁面會顯示輸入端與輸出端的電壓、電流、功率...等資訊。

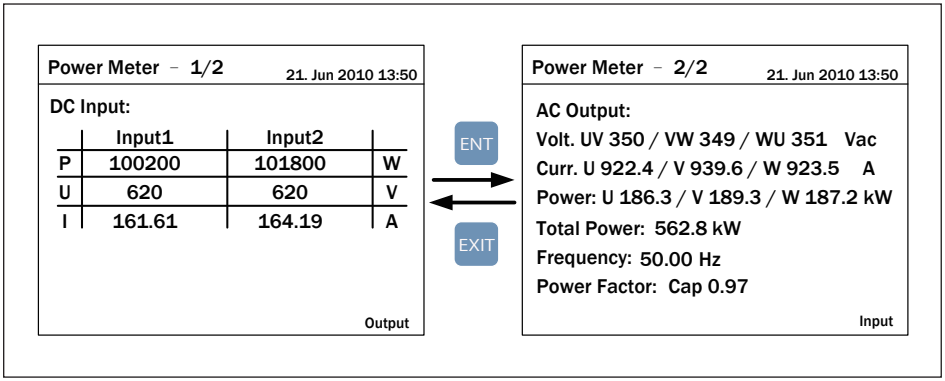



圖5-4 : Power Meter頁面

## 5.3.3 Energy Log

在此頁面按**ENT**鍵可觀看歷史資料，有年、月、日的發電量，年與月以長條圖表示，日則以曲線表示。

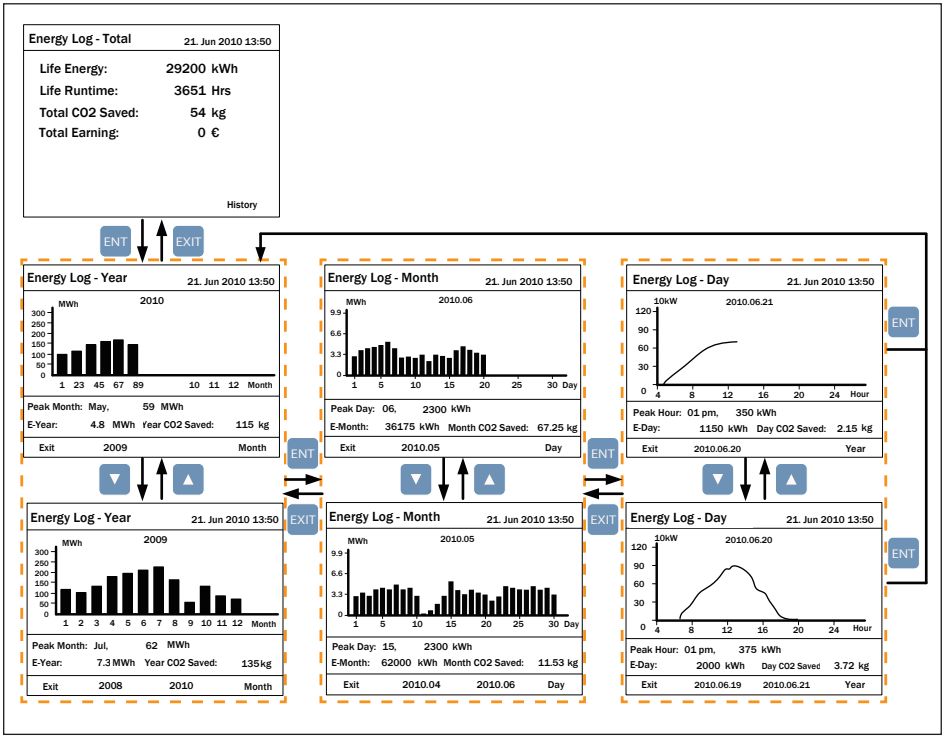



圖5-5 : Energy Log頁面

## 5.3.4 Event Log

進入此頁面會顯示發生過的事件(Error or fault), 最多可顯示最新的30筆事件, 新的事件置於頂部, 按**ENT**鍵可檢視所有事件的統計資料。

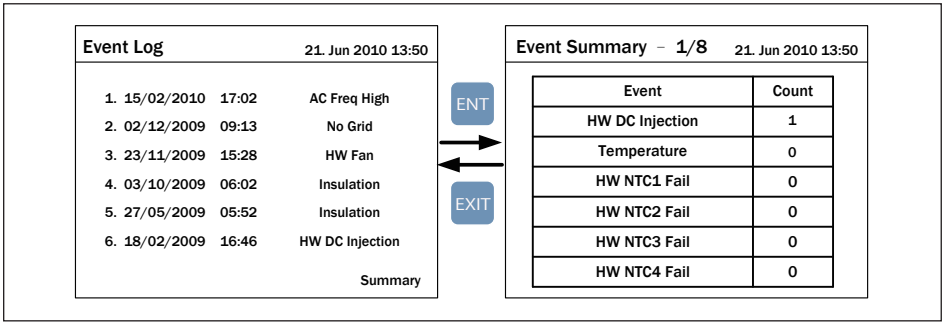



圖5-6 : Event Log頁面

## 5.3.5 Operation Data

共四頁, 記錄變流器工作的歷史最大資料, 包括輸入/出的最大電壓、電流與功率；散熱片與變流器內部最高溫度。

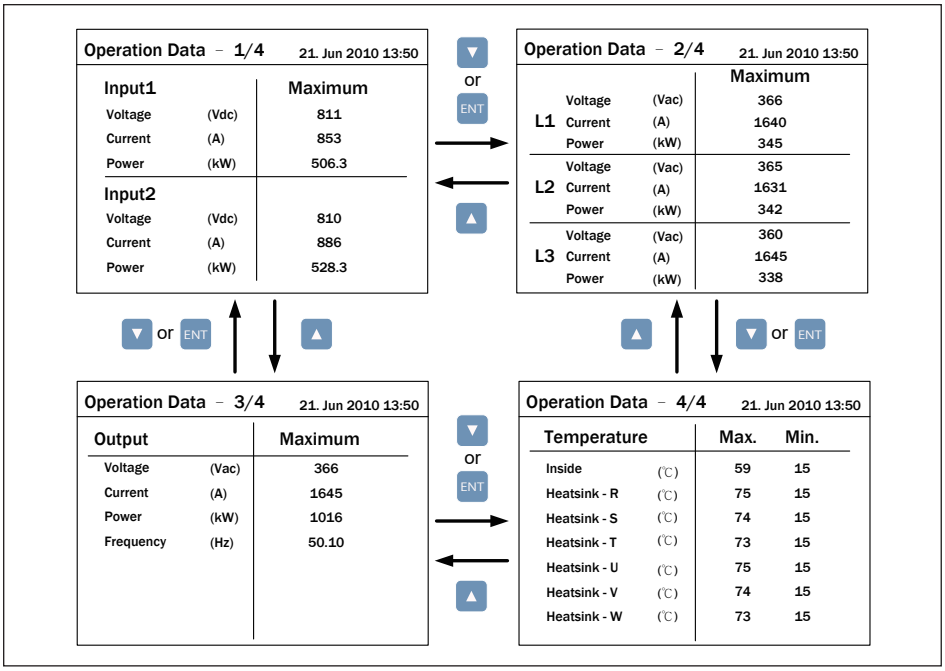



圖5-7 : Operation Data頁面

## 5.3.6 Inverter Information

此頁面顯示以下資訊：serial number（產品序號）、firmware version（韌體版本）、installation date（安裝日期）和inverter ID（變流器ID）。使用者要更改inverter ID，更改方式請參照下一節 Settings。

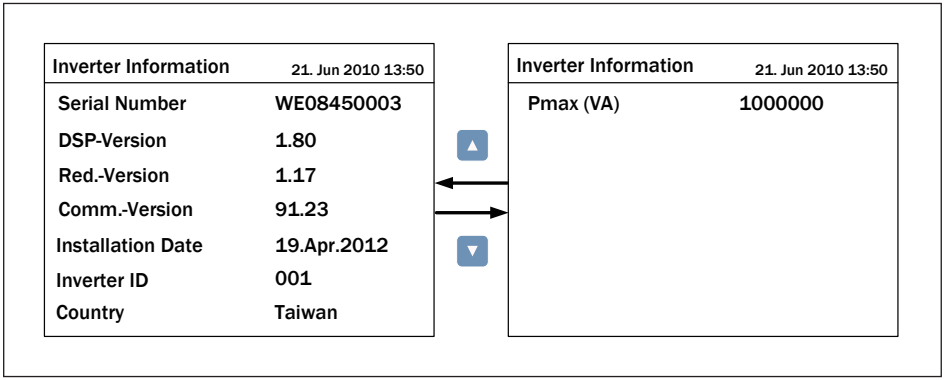



圖5-8 : Inverter Information頁面

## 5.3.7 Settings

此頁可供設定的項目有：Personal Settings（個人設定）、Coefficients settings（參數設定）、Install Settings（安裝設定）、Active/Reactive Power Control（實功/虛功控制）和FRT（故障穿越）。

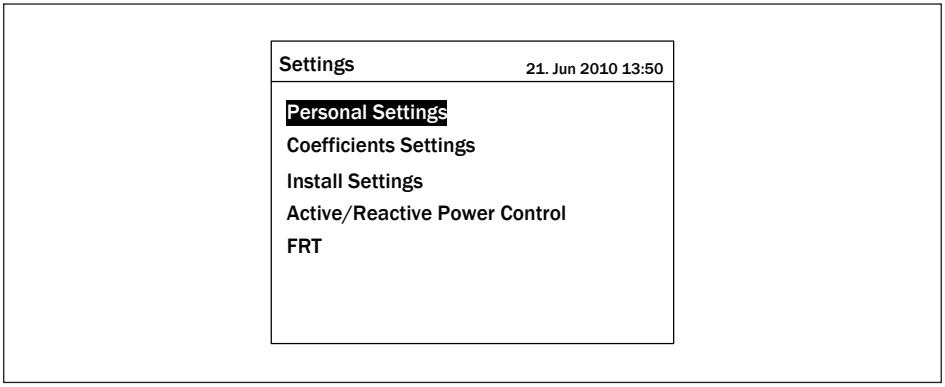



圖5-9 : Settings頁面

## 5.3.7.1 Personal Settings

在此可以設定的項目：Language（語言）、Date（日期）、Time（時間）、Screen Saver（螢幕保護裝置程式）、Brightness（螢幕亮度）和Contrast（螢幕對比度）。螢幕保護裝置程式可設定5分鐘到60分鐘，一旦使用者超過設定時間沒有使用按鍵功能，面板會自動關閉LCD背光並回到首頁。螢幕亮度和對比共可設定等級1-5（從弱到強）。

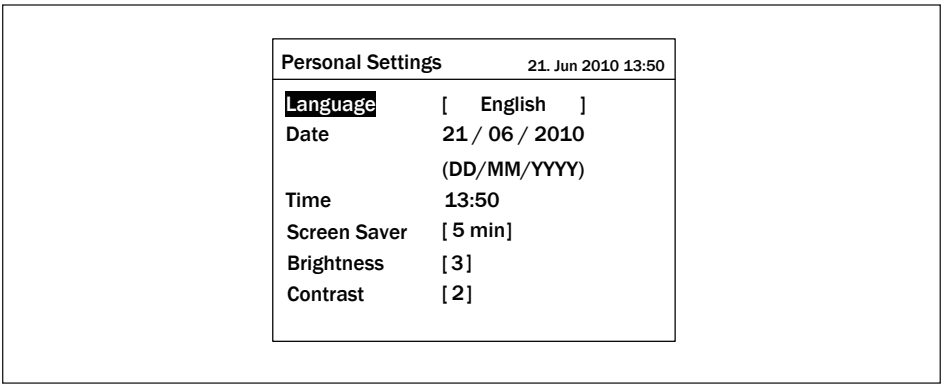



圖5-10 : Personal Settings頁面

## 5.3.7.2 Coefficient Settings

使用者可以針對使用者所在地區的需求做下列設定參數。

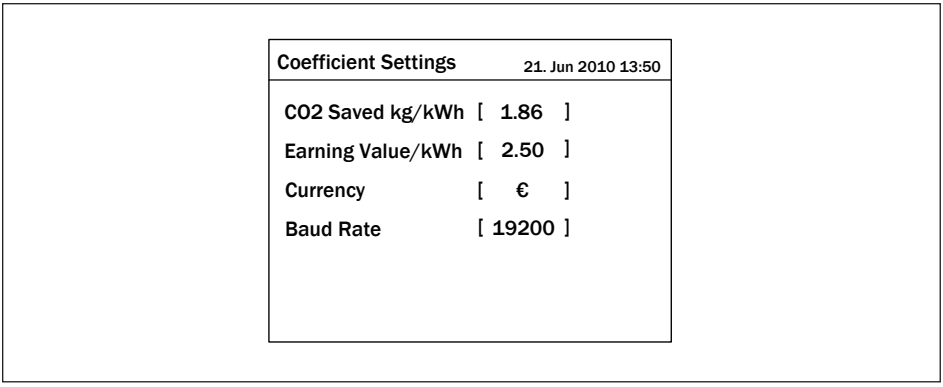



圖5-11 : Coefficient Settings頁面

# 5.3.7.3 Install Settings

**注意!**

下面操作僅允許專業安裝人員更改設定, 更改這些設定有可能會造成變流器損壞。

進入Install Settings之前必須要輸入正確的密碼，密碼分為一般使用者與安裝人員兩種等級, 兩種密碼皆不能修改，系統確認為一般使用者密碼後可設定Inverter ID和Insulation。

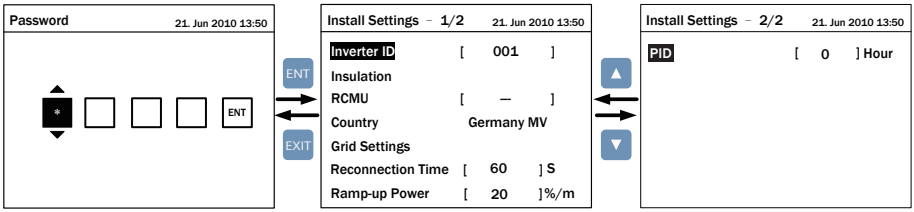



圖5-12 : 一般使用者設定頁面

輸入安裝技師的密碼會比輸入一般使用者密碼多出以下選項：DC-Injection（直流注入）、Return to Factory（出廠模式）、Country（國家）和Grid Setting（市電設定）。在市電設定選項裡，技師可調整變流器對市電的跳脫保護點（例如OVR, UVR, OFR, UFR）。進入市電設定調整市電保護參數之前，請先將國家設定為“Custom”。

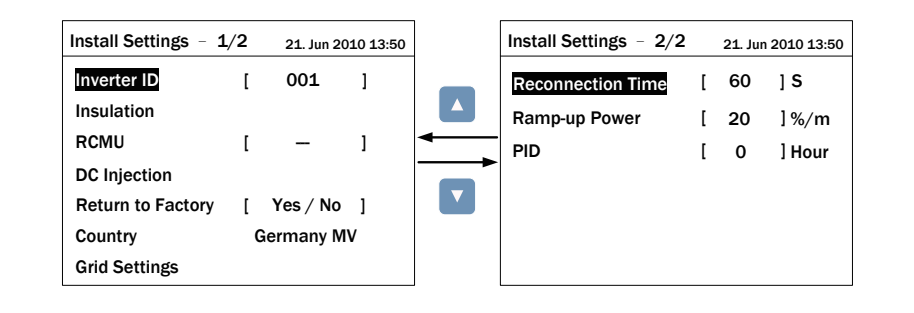



圖5-13 : 安裝技師設定頁面

## 5.3.7.3.1 Insulation

變流器於開機前會檢查機器會偵測太陽能板到地之間的阻抗，如果這個阻抗值低於Insulation Settings（隔離設定）裡面的設定值，變流器將會停止運轉，隔離設定共提供了四種模式：ON（開啟）、Positive Ground（正接地）、Negative Ground（負接地）和Disable（失能）。安裝人員也可以針對實際狀況設定不同的阻抗。

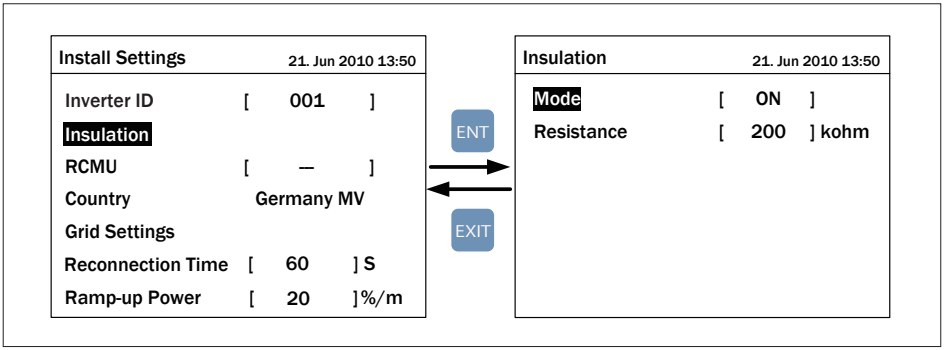



圖5-14 : 隔離設定

## 5.3.7.3.2 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5-15 : Grid Settings頁面

市電設定頁面總共19個參數，各個參數詳細的介紹請參考表 5-2。

| 參數 | 功能描述 |
|---|---|
| Vac High Off | 當AC三相電壓任何一相的電壓值高於此參數值時，變流器會斷開與AC的連結，隨即進入待機模式。 |
| Vac High On | 承上，斷開AC後，若AC電壓回復到此參數值時，變流器會重新連結市電。 |
| Vac High Off T | 當AC電壓觸動Vac High Off時，控制系統會在此參數所設定的時間內斷開AC，以保護變流器。 |
| Vac Low Off | 當AC三相電壓任何一相的電壓值低於此參數值時，變流器會斷開與AC的連結，隨即進入待機模式。 |
| Vac Low On | 承上，斷開AC後，若AC電壓回復到此參數值時，變流器會重新連結市電。 |
| Vac Low Off T | 當AC電壓觸動Vac Low Off時，控制系統會在此參數值所設定的時間內斷開AC，以保護變流器。 |
| Vac High Off Slow | 功能同於Vac High Off參數，可作為第二重保護，但參數值不能高於Vac High Off的設定值。 |
| Vac High On Slow | 功能同於Vac High On參數，可作為第二重保護，但參數值不能高於Vac High On的設定值。 |
| Vac High Off Slow T | 功能同於Vac High Off T參數，但時間不能短於Vac High Off T所設定的時間。 |
| Vac Low Off Slow | 功能同於Vac Low Off參數，可作為第二重保護，但參數值不能低於Vac Low Off的設定值。 |
| Vac Low On Slow | 功能同於Vac Low On參數，可作為第二重保護，但參數值不能低於Vac Low On的設定值。 |
| Vac Low Off Slow T | 功能同於Vac Low Off T參數，但時間不能短於Vac Low Off T所設定的時間。 |
| Fac High Off | 當AC頻率高於此參數值時，變流器會斷開與AC的連結，隨即進入待機模式。 |
| Fac High On | 承上，斷開AC後，若AC頻率回復到此參數值時，變流器會重新連結市電。 |
| Fac High Off T | 當AC頻率觸動Fac High Off時，控制系統會在此參數所設定的時間內斷開AC，以保護變流器。 |
| Fac Low Off | 當AC頻率低於此參數值時，變流器會斷開與AC的連結，隨即進入待機模式。 |
| Fac Low On | 承上，斷開AC後，若AC頻率回復到此參數值時，變流器會重新連結市電。 |
| Fac Low Off T | 當AC頻率觸動Fac Low Off時，控制系統會在此參數所設定的時間內斷開AC，以保護變流器。 |
| Fac High Off Slow | 功能同於Fac High Off參數，可作為第二重保護，但參數值不能高於Fac High Off的設定值。 |
| Fac High On Slow | 功能同於Fac High On參數，可作為第二重保護，但參數值不能高於Fac High On的設定值。 |
| Fac High Off Slow T | 功能同於Fac High Off T參數，但時間不能短於Fac High Off T所設定的時間。 |

**表5-2 : 市電設定參數**

| 參數 | 功能描述 |
|---|---|
| Fac Low Off Slow | 功能同於Fac Low Off參數，可作為第二重保護，但參數值不能低於Fac Low Off的設定值。 |
| Fac Low On Slow | 功能同於Fac Low On參數，可作為第二重保護，但參數值不能低於Fac Low On的設定值。 |
| Fac Low Off Slow T | 功能同於Fac Low Off T參數，但時間不能短於Fac Low Off T所設定的時間。 |
| Reconnection Time | 變流器重新連結至AC時的倒數時間。 |

**表5-2 : 市電設定參數 (接上頁)**

**說明**

上方所列的參數一旦被更動，國家將會被自動改成“Custom”，如果您想要改回原先您設定的國家，請到“Install settings”選單裡的“Country”去做更改。

## 5.3.7.3.3 PID

PID功能預設時間為0小時，使用者可自行設定時間，時間區間0-10小時或是Auto。
PID功能在沒有直流電壓後1分鐘啟動，當直流電壓輸入時則停止該功能。

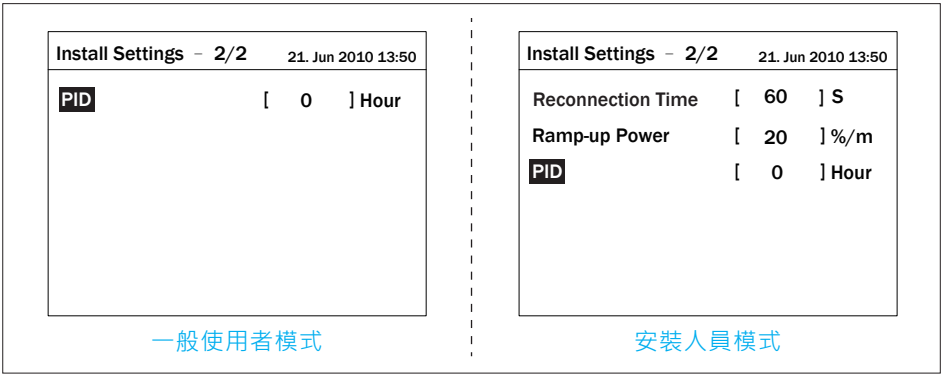



**圖5-16 : PID功能設定**

# 5.3.7.4 Active/Reactive Power Control

當國家設定成Germany MV、India、China才可進入這個頁面。進入前必須輸入一般使用者密碼，安裝人員密碼無法進入。

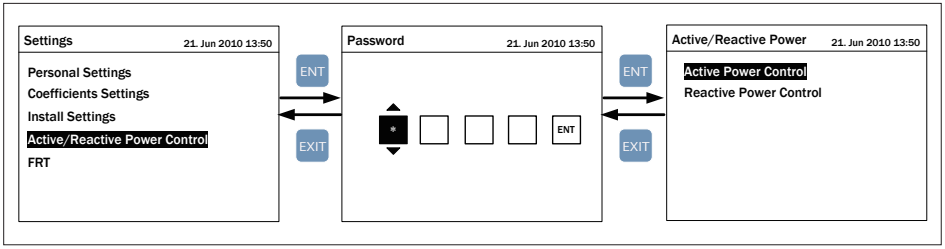



圖5-17 : Active/Reactive power setting頁面

# 5.3.7.4.1 Power Limit

使用者可設定百分比來限制變流器的輸出功率。當Mode設定為ON時啟動此功能，設定為Off時則回到MPP Tracking模式。

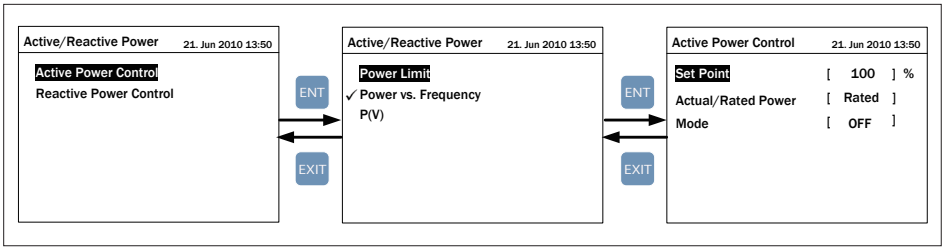



圖5-18 : Power limit setting頁面

# 5.3.7.4.2 Power vs. Frequency

Gradient表示單位頻率限制功率的幅度。ie. –xx%/Hz.

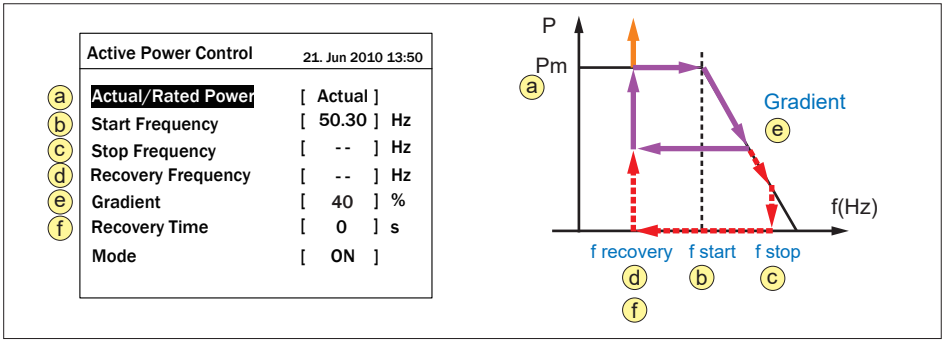



圖5-19 : Power vs. Frequency setting頁面

## 5.3.7.4.3 Constant cosφ

當此模式開啟時，變流器會將功率因數控制在用戶所設定的值。用戶可設定的功率因數範圍為Cap 0.80 到 Ind 0.80。

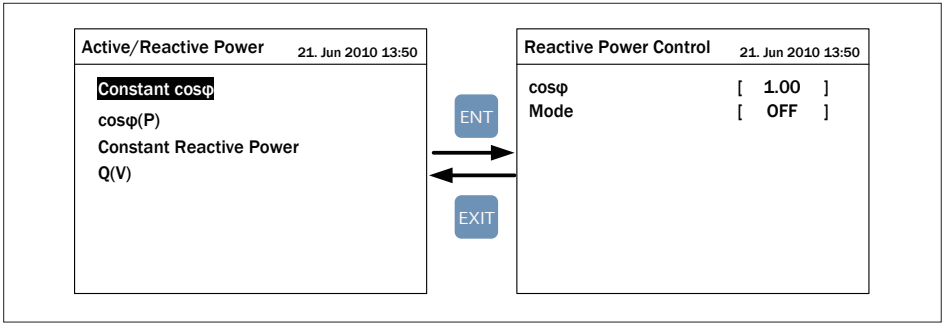



圖5-20 : Constant cosφ setting頁面

## 5.3.7.4.4 cosφ(P)

cosφ (P)時不考慮市電電壓(即無需調整Lock-in/Lock-out voltage)。

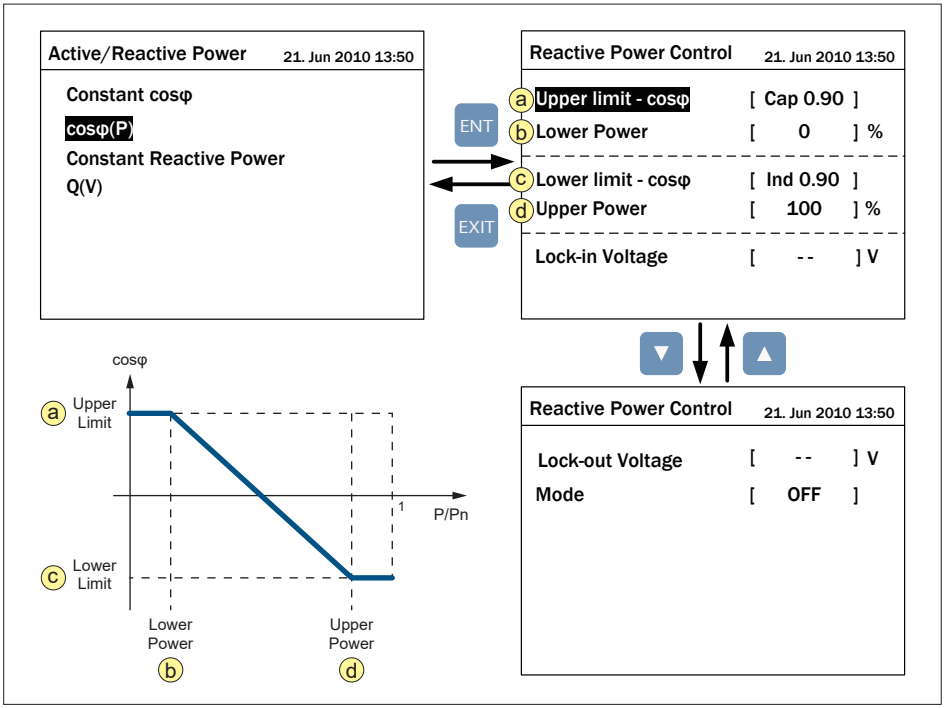



圖5-21 : cosφ(P) setting頁面

## 5.3.7.4.5 Constant Reactive Power

啟動此功能時，變流器將會將虛功控制在一定值。

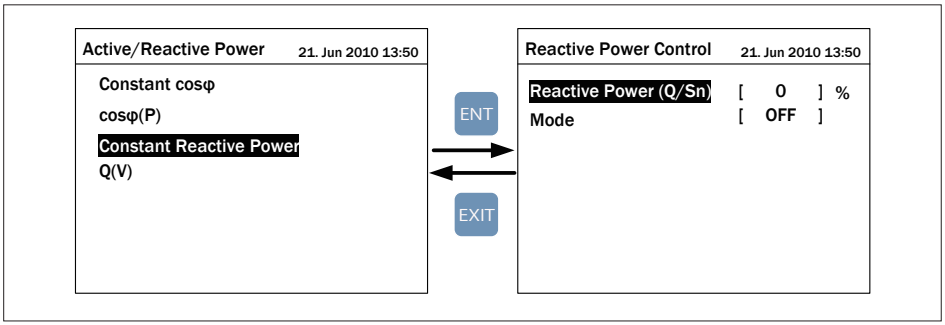



圖5-22 : Constant Reactive Power setting頁面

## 5.3.7.4.6 Q(U)

使用者也可按照實際需求微調參數。

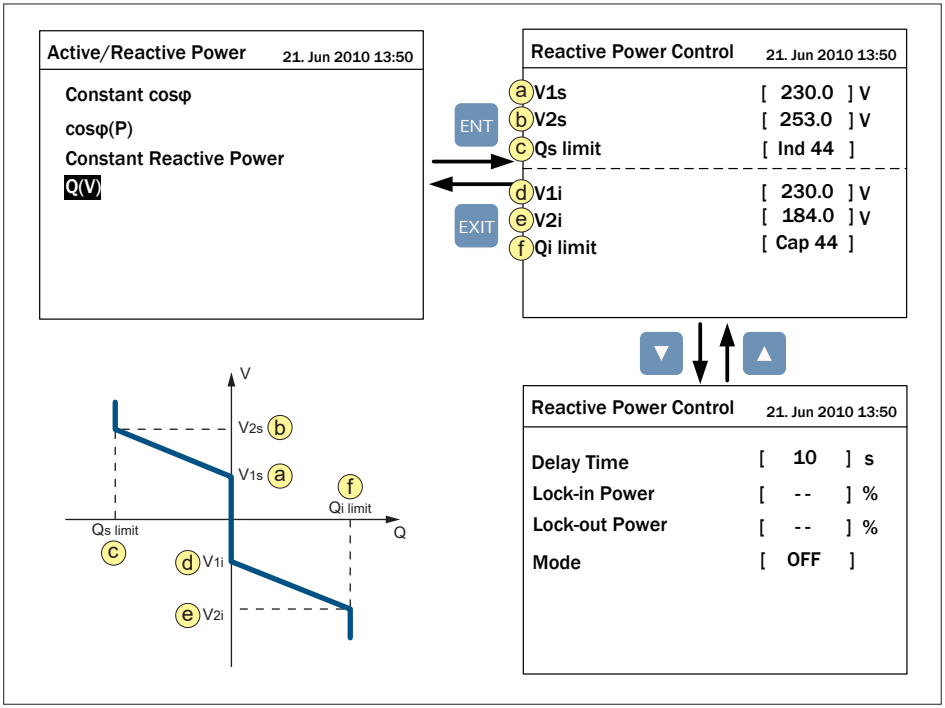



圖5-23 : Q(U) setting頁面

## 5.3.7.5 Q 24/7

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能量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。

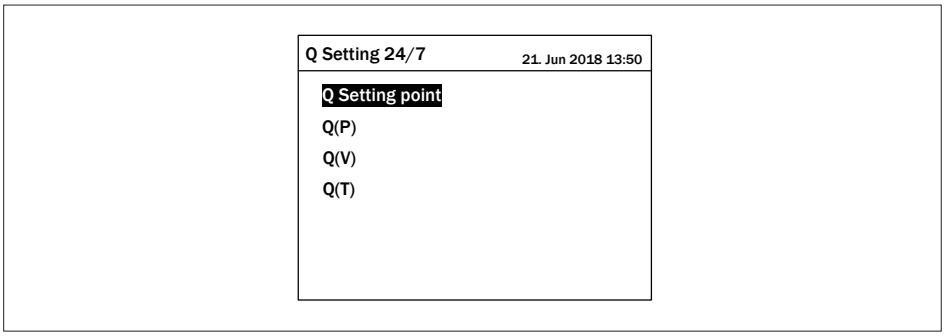



圖5-24 : Q setting 24/7 頁面

### 5.3.7.5.1 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。

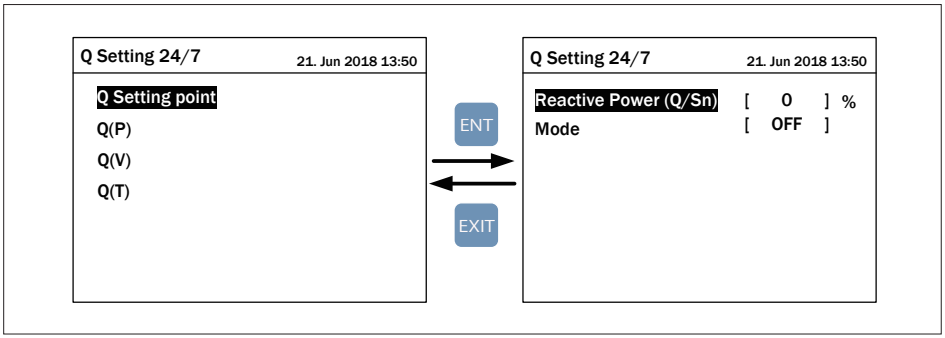



圖5-25 : Q setting point 頁面

## 5.3.7.5.2 Q(P)

Q(P)功能可以使變流器根據實功功率高低而饋入一定比例的虛功。

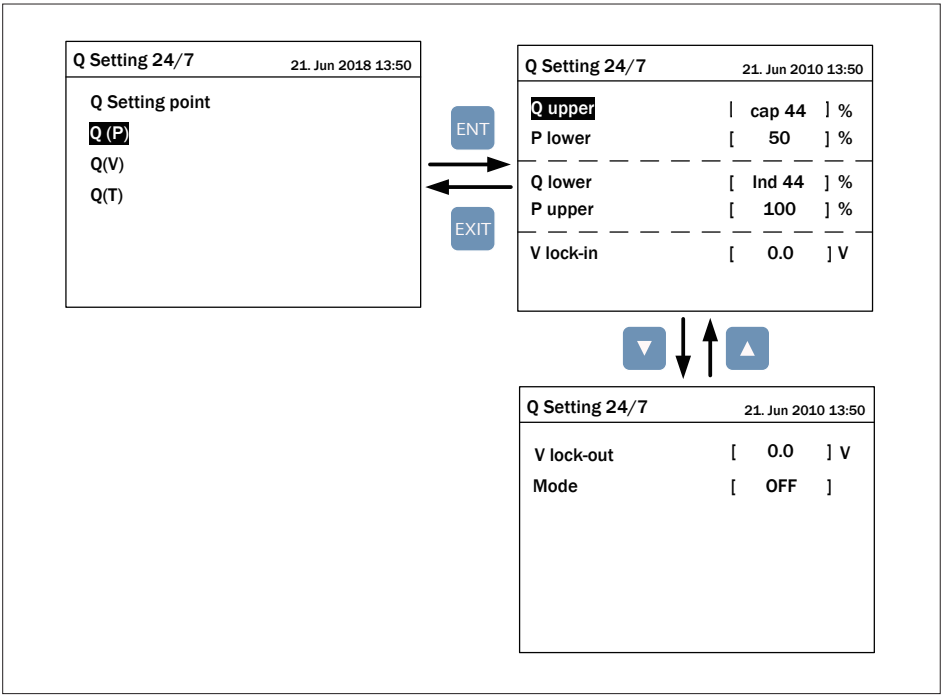



圖5-26 : Q(P) 頁面

## 5.3.7.5.3 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5.3.7.4.6節相同。

## 5.3.7.5.4 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。

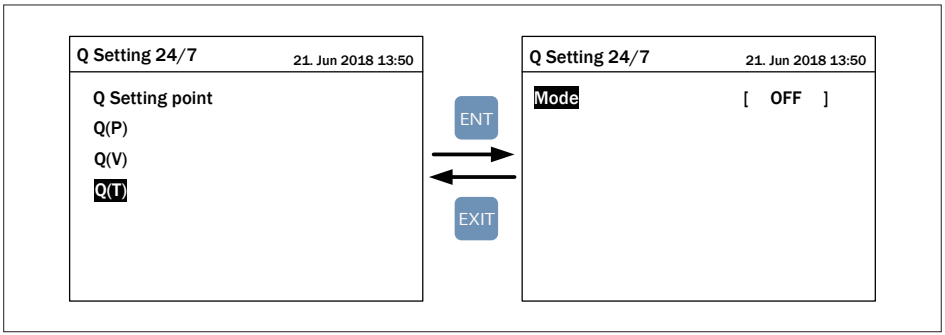



圖5-27 : Q(T) 頁面

## 5.3.7.6 FRT (Fault ride through)

使用者可參考下圖微調參數。

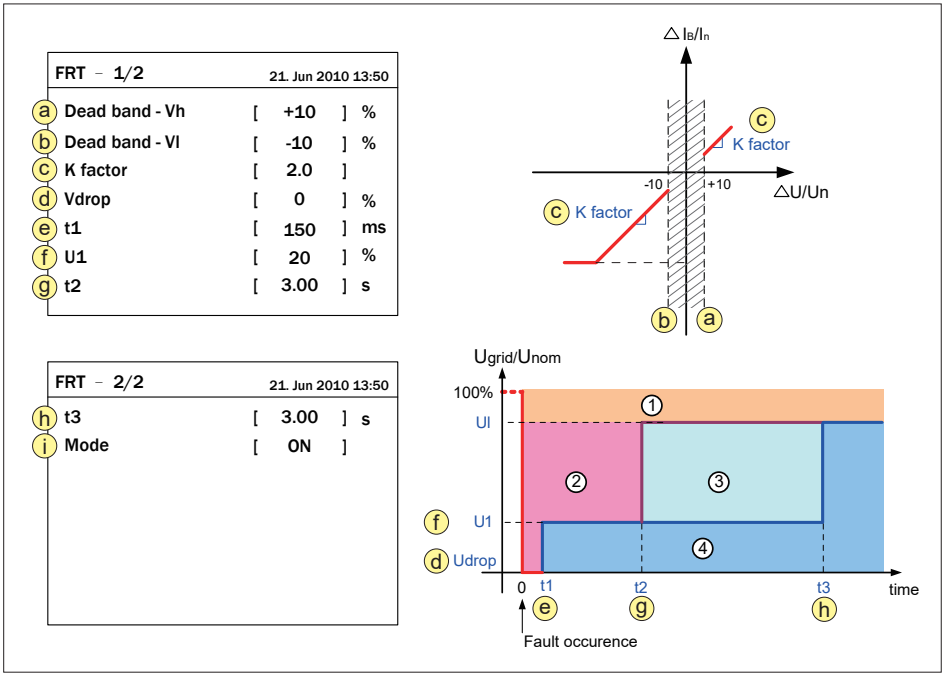



圖5-28 : 故障穿越頁面

# 6 錯誤訊息和故障排除

根據下表使用者能夠確認LCD上的錯誤訊息然後可以做簡易且快速的故障排除。

| 訊息顯示 | 可能原因 | 排除方式 |
|---|---|---|
| AC Frequency High | 1. 實際的市電頻率高過過頻率保護設定<br>2. 國家設定不正確<br>3. 偵測電路功能異常 | 1. 檢查變流器端的市電頻率<br>2. 檢查國家設定<br>3. 檢查變流器端的偵測電路 |
| AC Frequency Low | 1. 實際的市電頻率低於欠頻率保護設定<br>2. 國家或電網設定不正確<br>3. 偵測電路功能異常 | 1. 檢查變流器端的市電頻率<br>2. 檢查國家與電網設定<br>3. 檢查變流器端的偵測電路 |
| Grid Quality | 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 |
| HW Connect Fail | 1. AC端配線錯誤<br>2. 偵測電路功能異常 | 1. 檢查AC連接，必須和使用手冊一致<br>2. 檢查變流器內部的偵測電路 |
| No Grid | 1. AC 斷路器跳開<br>2. AC端沒有電壓 | 1. 重啟AC 斷路器<br>2. 提供AC電壓至變流器輸出端 |
| AC Volt Low | 1. 實際市電的電壓低於低電壓保護設定<br>2. 國家或電網設定不正確<br>3. AC介面連接錯誤<br>4. 偵測電路功能異常 | 1. 檢查市電與變流器端的連接<br>2. 檢查國家或電網設定<br>3. 檢查AC介面連接<br>4. 檢查變流器內部的偵測電路 |
| AC Volt High | 1. 實際市電的電壓高於過電壓保護設定<br>2. 操作期間，市電的電壓高於慢速電壓保護設定<br>3. 國家或電網設定不正確<br>4. 偵測電路功能異常 | 1. 检查逆变器端的市电电压<br>2. 检查逆变器端的市电电压<br>3. 检查国家或电网设定<br>4. 检查逆变器内部的侦测电路 |

**表6-1 : 錯誤訊息與簡易故障排除**

| 訊息顯示 | 可能原因 | 排除方式 |
|---|---|---|
| Solar1 High | 1. 實際太陽能板電壓設定超過1000Vdc<br>2. 偵測電路功能異常 | 1. 修正太陽能板設定並使得Voc小於1000Vdc<br>2. 檢查變流器內部的偵測電路 |
| Insulation | 1. 太陽能板對大地阻抗不符合面板設定<br>2. 太陽能板受潮後，對地的寄生電容隨之增大影響到偵測電路判讀的正確性<br>3. 偵測電路功能異常 | 1. 檢查面板設定是否正確<br>2. 必要時擦乾太陽能板<br>3. 檢查變流器內部的偵測電路 |

**表6-1 : 錯誤訊息與簡易故障排除(接上頁)**

| 訊息顯示 | 可能原因 | 排除方式 |
|---|---|---|
| Solar1 Low | 1. 因太陽能板照度不足使得輸入電壓低於可操作電壓範圍<br>2. 輸入電壓偵測電路異常 | 1. N/A<br>2. 檢查變流器內部的偵測電路 |
| PID Relay Fail | PID Relay偵測線路異常 | 檢查變流器內部的偵測電路 |
| PID OCR | 負端 （DC-）對 PE 端 的阻抗過低 | 檢查負端 （DC-）對 PE 端 的線路 |
| HW FAN | 1. 一個或多個風扇鎖死<br>2. 一個或多個風扇無效<br>3. 一個或多個風扇未連接<br>4. 偵測電路功能異常 | 1. 移除卡在風扇內的對象<br>2. 替換無效的風扇<br>3. 檢查風扇的連接<br>4. 檢查變流器內部的偵測電路 |
| EPO | EPO按鈕被啟動 | 1. 解除EPO<br>2. 檢查EPO的連接狀況 |
| DC Surge | 在DC側的SPD損壞 | 1. 檢查DC SPD的遙控訊號線連接狀況<br>2. 檢查DC SPD是否損壞 |
| AC Surge | 在AC側的SPD損壞 | 1. 檢查AC SPD的遙控訊號線連接狀況<br>2. 檢查AC SPD是否損壞 |
| DC Aux - Power Fail | 1. DC Aux-Power提供不正確的輸出電壓<br>2. DC AuxPower偵測電路異常 | 1. 檢查變流器與DC側的連接狀況<br>2. 檢查偵測電路是否異常 |

**表6-2 : 警告訊息與簡易故障排除**

| 訊息顯示 | 可能原因 | 排除方式 |
|---|---|---|
| Temperature | 1. 環境溫度超過60℃ (裝置異常)<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路 |
| HW NTC1 Fail | 1. 環境溫度>105℃或<-40℃<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路(RTM1) |
| Temperature | 1. 環境溫度<-30℃<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路 |
| HW NTC2 Fail | 1. 環境溫度>125℃或<-30℃<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路<br>(NTC_R & NTC_U) |
| HW NTC3 Fail | 1. 環境溫度>125℃或<-30℃<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路<br>(NTC_S & NTC_V) |
| HW NTC4 Fail | 1. 環境溫度>125℃或<-30℃<br>2. 偵測電路功能異常 | 1. 檢查設備的周遭和環境<br>2. 檢查變流器內部的偵測電路<br>(NTC_T & NTC_W) |
| Choke OTP | 1. 進氣口濾網阻塞<br>2. 偵測電路功能異常 | 1. 更換進氣口濾網<br>2. 檢查變流器內部的偵測電路 |
| HW DSP ADC1 | 1. 輔助電源電路功能異常<br>2. 偵測電路功能異常 | 1. 檢查變流器內部的輔助電源電路<br>2. 檢查變流器內部的偵測電路 |
| HW DSP ADC2 | 1. 輔助電源電路功能異常<br>2. 偵測電路功能異常 | 1. 檢查變流器內部的輔助電源電路<br>2. 檢查變流器內部的偵測電路 |
| HW DSP ADC3 | 1. 輔助電源電路功能異常<br>2. 偵測電路功能異常 | 1. 檢查變流器內部的輔助電源電路<br>2. 檢查變流器內部的偵測電路 |
| HW Red ADC1 | 1. 輔助電源電路功能異常<br>2. 偵測電路功能異常 | 1. 檢查變流器內部的輔助電源電路<br>2. 檢查變流器內部的偵測電路 |
| HW COMM2 | 1. Red. CPU閒置中<br>2. 通訊連接中斷 | 1. 檢查Red. CPU的reset pin和晶振功能是否正常<br>2. 檢查Red. CPU和DSP通訊連接 |
| HW COMM1 | 1. DSP 閒置中<br>2. 通訊連接中斷<br>3. 通訊電路功能異常 | 1. 檢查DSP中的reset pin和晶振功能是否正常<br>2. 檢查DSP和COMM通訊連接<br>3. 檢查通訊電路 |

**表6-3 : 故障訊息與簡易故障排除**

| 訊息顯示 | 可能原因 | 排除方式 |
|---|---|---|
| HW Connect Fail | 1. 變流器內部的電纜線脫落<br>2. 電流回授電路無效<br>3. 變流器驅動電路異常 | 1. 檢查變流器內部電纜線連接是否妥當<br>2. 檢查變流器內部電流回授電路<br>3. 檢查變流器驅動電路 |
| Relay Test Short | 1. 接觸器驅動電路功能異常<br>2. 接觸器接點黏著 | 1. 檢查變流器內部驅動電路<br>2. 更換接觸器 |
| Relay Test Open | 1. 接觸器驅動電路無效<br>2. 接觸器線圈無效<br>3. Vgrid和Vout偵測精確度不正確 | 1. 檢查接觸器驅動電路<br>2. 替換接觸器線圈<br>3. 檢查Vgrid和Vout電壓偵測精確度 |
| HW Bus OVR | 1. 逆灌發生 (DC功率 < AC功率)<br>2. AC頻率鎖相回路異常 | 1. 檢查太陽能板和變流器之間的連接<br>2. 檢查Vgrid和Vout電壓偵測精確度 |
| AC Current High | 1. 操作期間突波發生<br>2. Inverter stage Driver無效<br>3. 開關裝置無效<br>4. 偵測電路功能異常 | 1. N/A<br>2. 檢查inverter stage驅動電路<br>3. 檢查inverter stage全部開關裝置<br>4. 檢查變流器內部的偵測電路 |
| HW CT A Fail | 1. 測試電流回路損壞<br>2. 偵測到電路功能異常 | 1. 檢查CT感測器的的連接線<br>2. 檢查變流器內部的偵測電路 |
| HW CT B Fail | 1. 測試電流回路損壞<br>2. 偵測電路功能異常 | 1. 檢查CT感測器的的連接線<br>2. 檢查變流器內部的偵測電路 |
| HW CT C Fail | 1. 測試電流回路損壞<br>2. 偵測電路功能異常 | 1. 檢查CT感測器的的連接線<br>2. 檢查變流器內部的偵測電路 |
| HW AC OCR | 1. 市電諧波成分大<br>2. 開關裝置無效<br>3. 偵測電路功能異常 | 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<br>2. 檢查inverter stage開關裝置<br>3. 檢查變流器內部的偵測電路 |

**表6-3 : 故障訊息與簡易故障排除(接上頁)**

| 訊息顯示 | 可能原因 | 排除方式 |
| --- | --- | --- |
| AC Aux Fail | 1. AC AuxPower提供不正確的輸出電壓<br>2. AC AuxPower偵測電路功能異常 | 1. 檢查變流器與AC側的連接狀況<br>2. 檢查偵測電路是否異常 |
| DC Current High | 輸入電流偵測電路功能異常 | 檢查輸入電流偵測電路 |

**表6-3： 故障訊息與簡易故障排除(接上頁)**

| 訊息顯示 | 可能原因 | 排除方式 |
| --- | --- | --- |
| Door Opened | 1. 門上開關無效<br>2. 門上開關未連接<br>3. 偵測電路功能異常 | 1. 替換無效的門上開關<br>2. 檢查門上開關的連接<br>3. 檢查變流器內部的偵測電路 |

**表6-4 : 其它訊息與簡易故障排除**

* F/W會定期更新。

# 7 維修保養

## 7.1 更換風扇模組

1. 扭轉把手，之後打開後門。

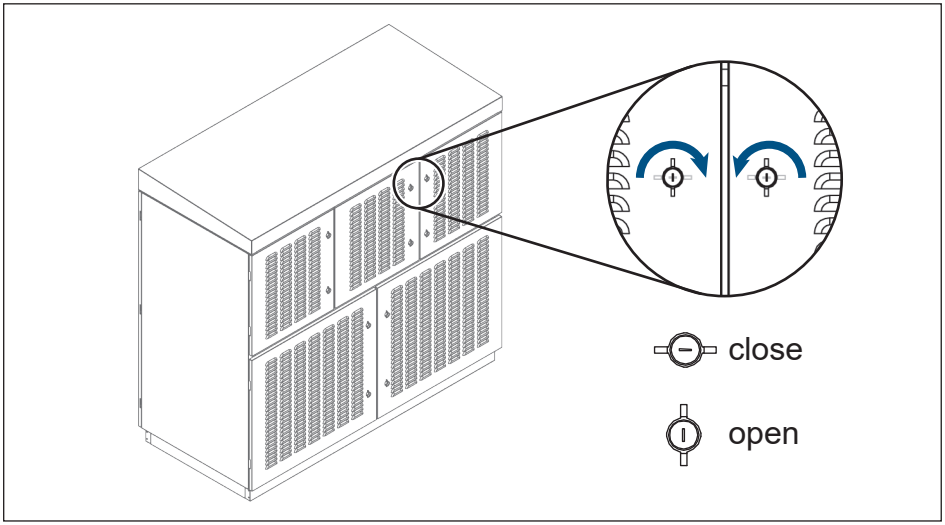



**圖7-1 : 扭轉把手**

2. 將需置換的風扇模組上的電源接頭拔除。

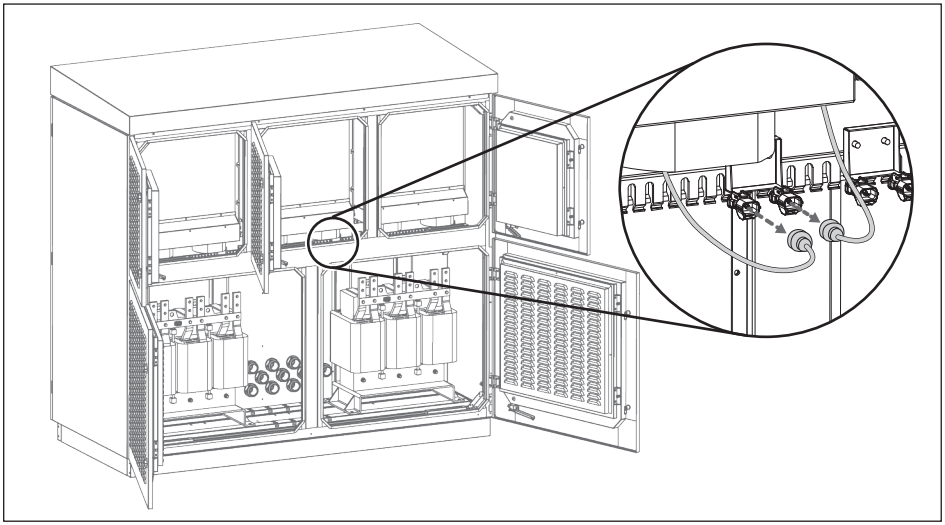


**圖7-2 : 拔除電源接頭**

3. 鬆開鎖附在下風扇與機殼上的螺絲和螺帽 (扭力: 25 Kgf-cm)，然後將下風扇移除。

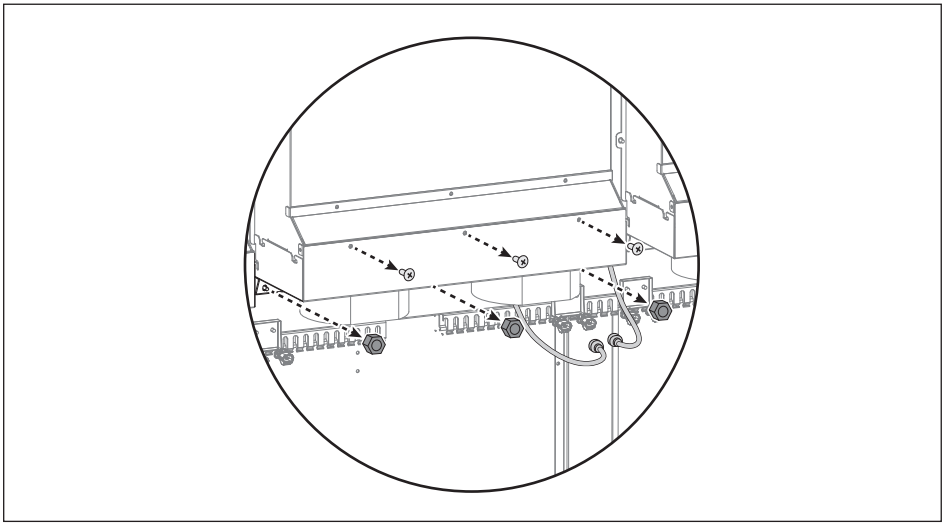


**圖7-3 : 鬆開下風扇的螺絲和螺帽**

4. 將上風扇移除。

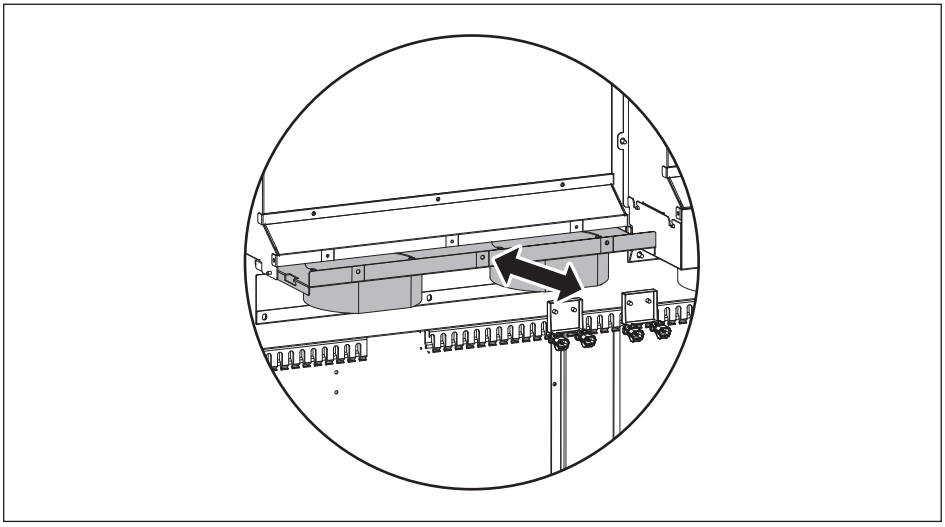


**圖7-4 : 上風扇移除**

## 7.2 更換進氣口濾網

1. 扭轉把手，之後打開後門。

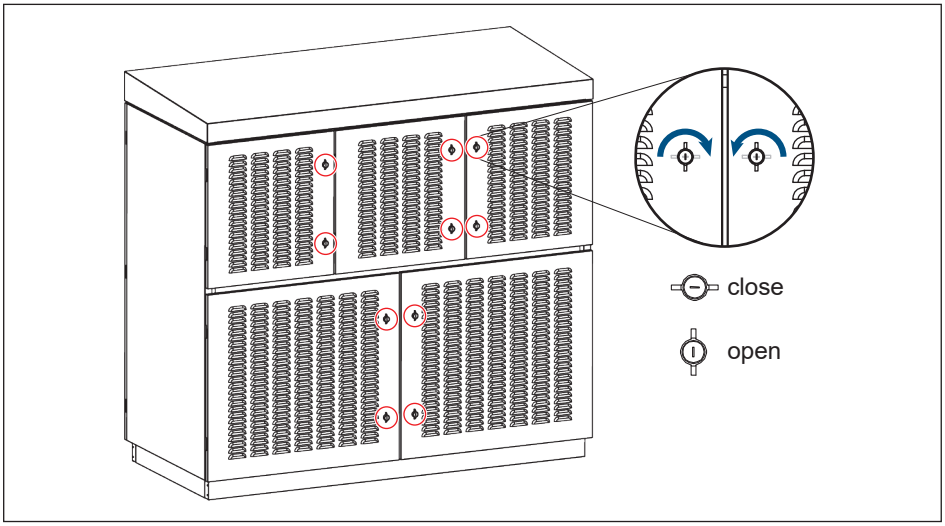



**圖7-5 : 扭轉把手**

2. 鬆開鎖附在濾網蓋與後門上的螺絲 (扭力: 25 Kgf-cm)，之後打開濾網蓋。

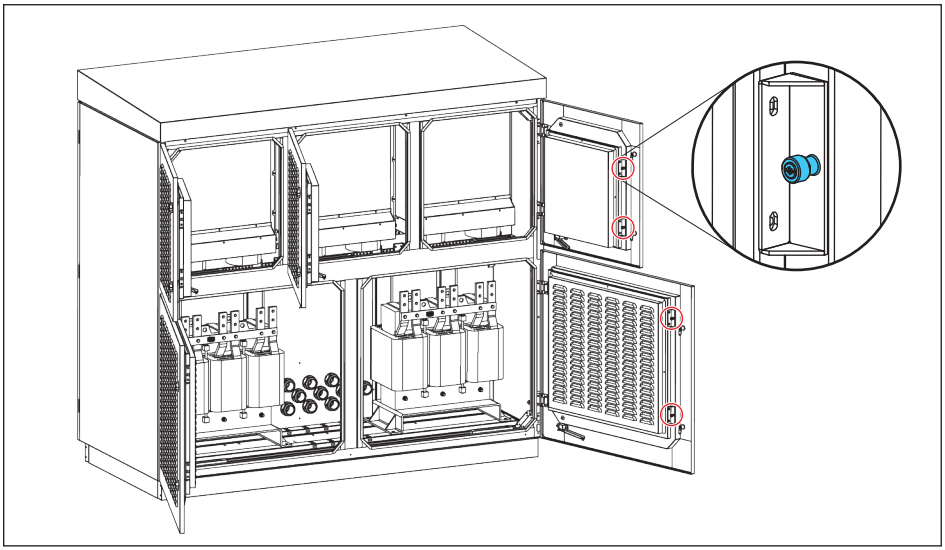


**圖7-6 : 鬆開濾網蓋上的螺絲**

3. 取出濾網。

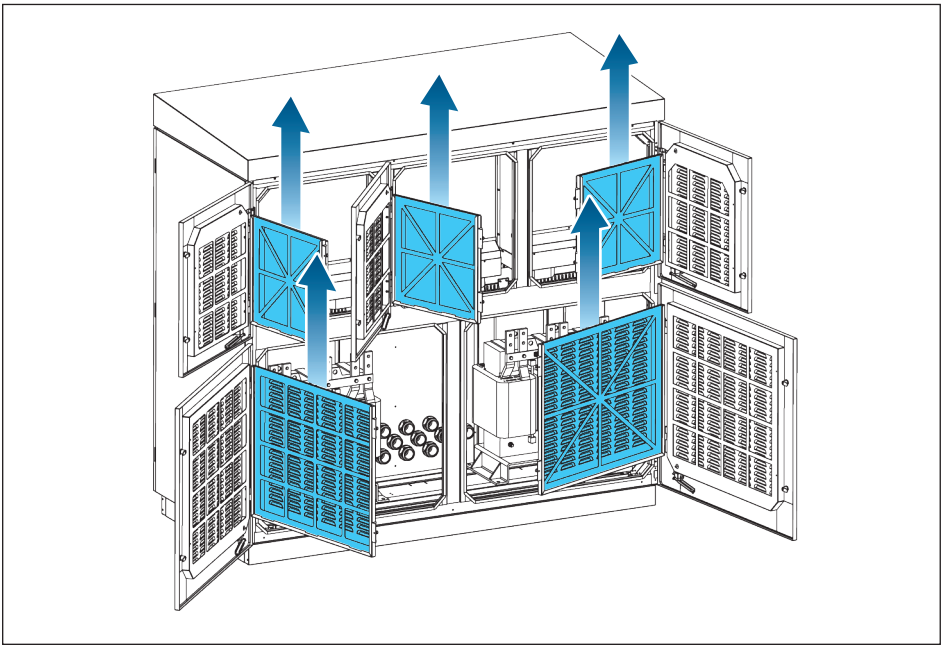


**圖7-7 : 取出濾網**

**說明**

1. 建議最少每三個月，需更換一次新濾網。
2. 建議每月定期檢查濾網阻塞程度，進行清潔濾網或更換新濾網。
3. 長時間未更換濾網，會導致變流器散熱不良與損壞散熱風扇。

## 7.3 清理排氣孔濾網

1. 將變流器前門打開。
2. 鬆開排氣孔濾網擋板上的螺帽。

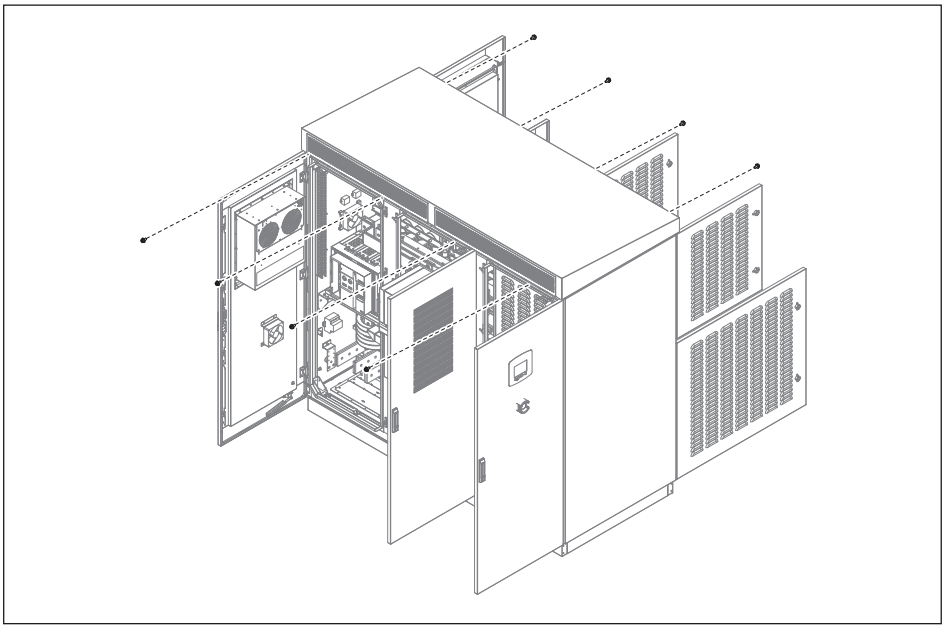


**圖7-8 : 鬆開排氣孔濾網的螺帽**

3. 把排氣孔濾網擋板向右移動

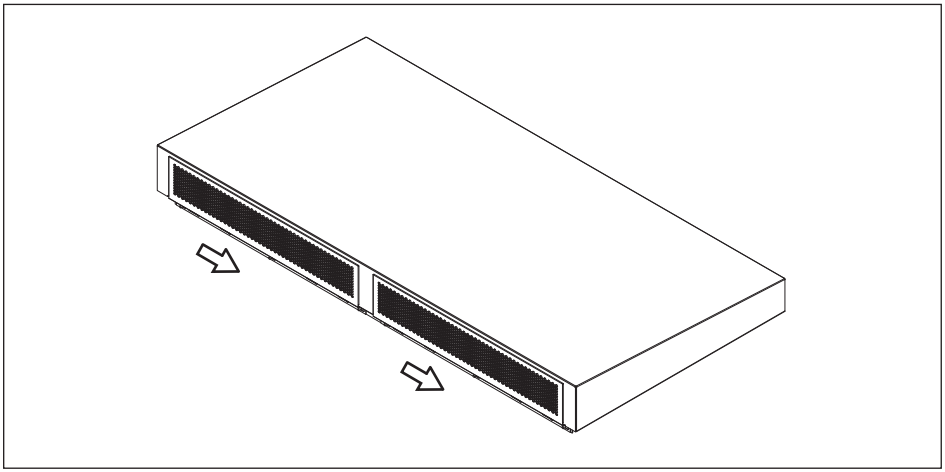


**圖7-9 : 將擋板向右移動**

4. 直接取出擋板和排氣孔濾網

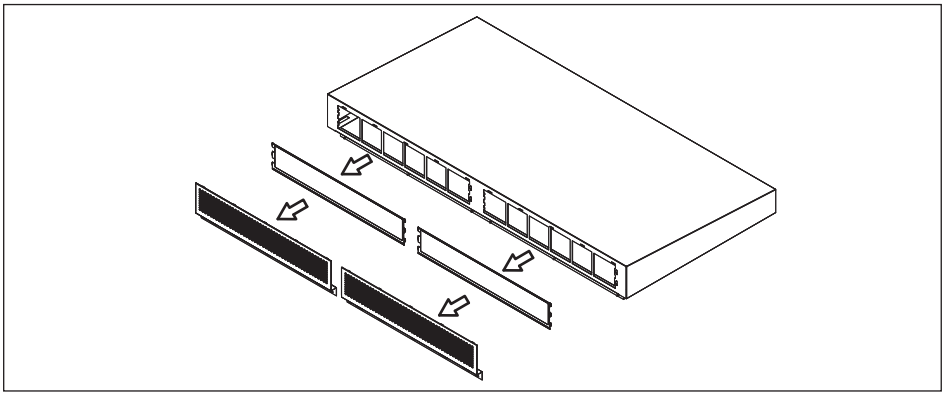


圖7-10 : 取出排氣孔濾網

**說明**

1. 需定期檢視排氣孔濾網是否有砂塵、異物阻塞、清潔濾網。
2. 排氣孔濾網阻塞，會導致變流器散熱不良與損壞散熱風扇。

## 7.4 更換Surge Protection Device (SPD)

一旦變流器遭遇到電壓突波（如：雷擊等），SPD將會保護變流器而SPD則會損壞。如果在變流器螢幕上看到像”DC Surge”或是”AC Surge”的警告訊息，請遵循以下步驟來更換SPD。

1. 關閉所有DC和AC電源，並確認DC與AC端沒有剩餘電源存在。
2. 按拉且扭轉把手，之後打開前門。

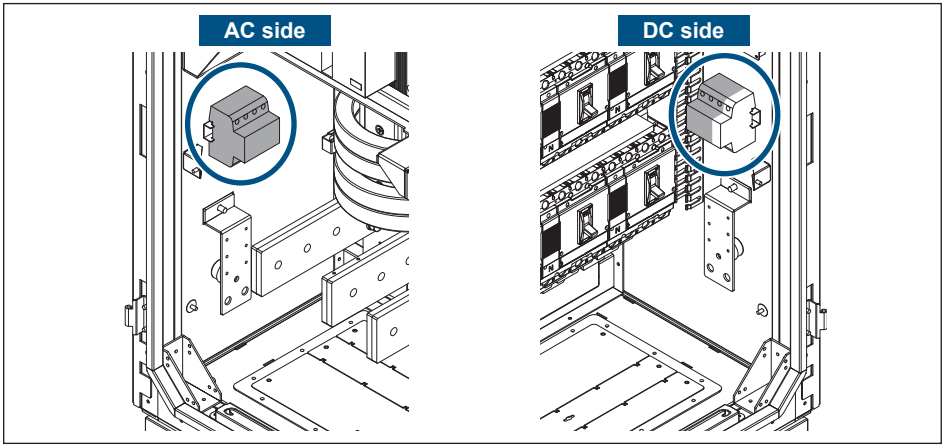



圖7-11 : SPD位置

3. 確認哪一個SPD損壞。
   • 針對DC與AC SPD來說，看哪一個SPD上的綠燈變成紅燈。




**圖7-12 : 確認損壞的SPD**

4. 退出已損壞的SPD並更換新的。

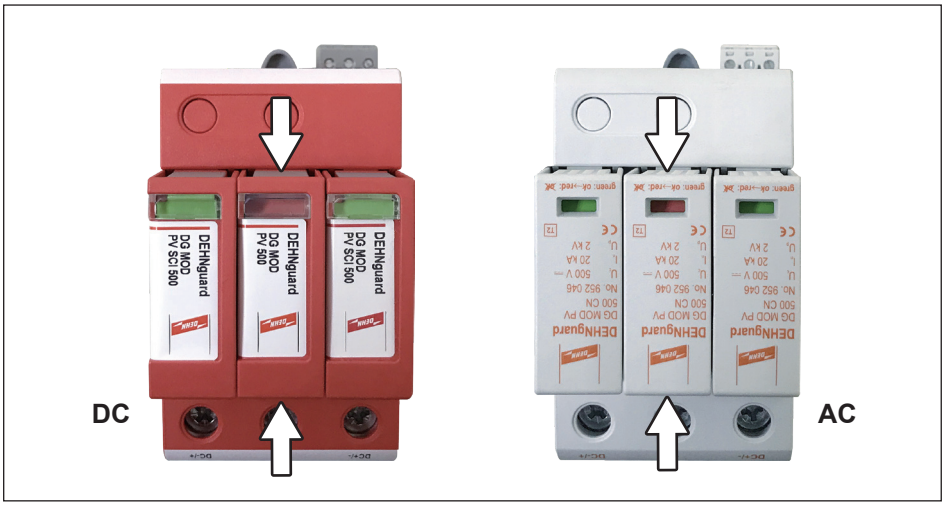



**圖7-13 : 退出已損壞的SPD**

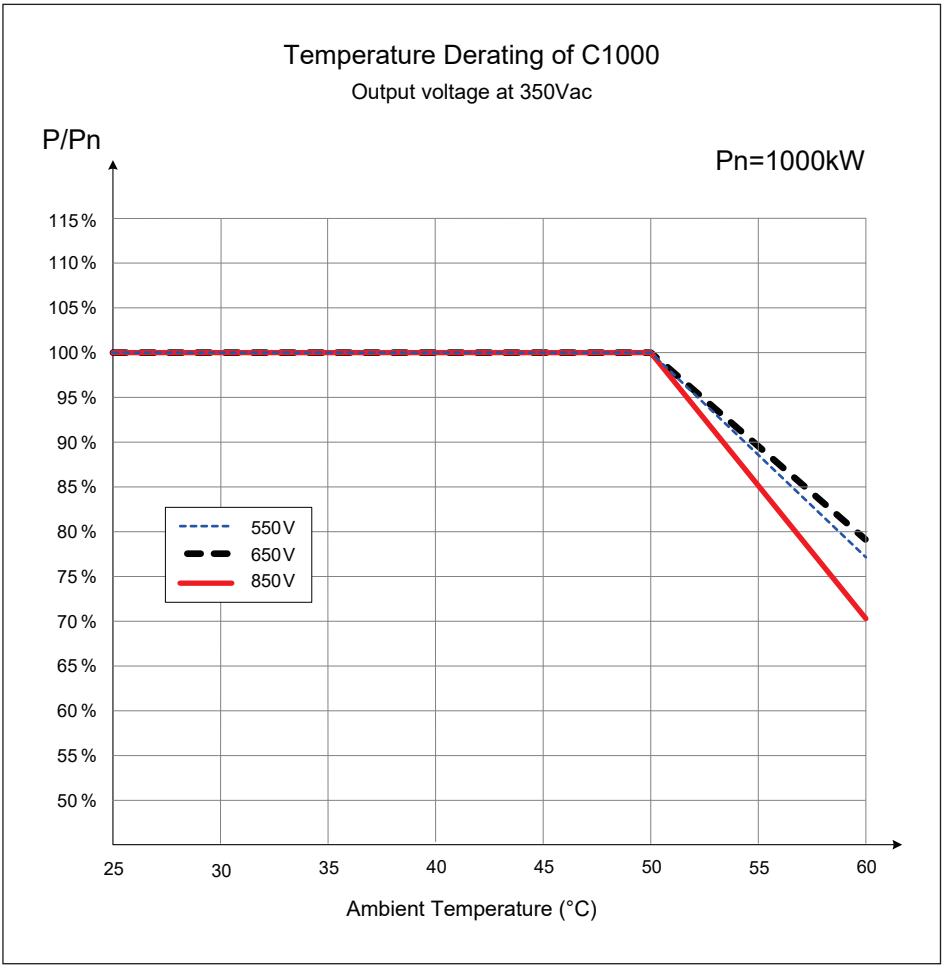
# 附錄

## 附錄 A: 技術資料

| | |
|---|---|
| **設備型式** | |
| 戶外併網型變流器 | C1000 |
| **輸入規格** | |
| 太陽能板絕對最大輸入電壓 | 1100Vdc<br>> 1000Vdc, INV Stop |
| 操作電壓範圍 | 520Vdc – 1000Vdc |
| 最大功率追蹤電壓範圍 | 550Vdc – 850Vdc |
| 功率追蹤正確率 | > 99.9% at rated power |
| 可喚醒變流器電壓 | > 200Vdc (輔助電源啟動) |
| 啟動電壓 | 570Vdc |
| 最大功率追蹤 | 1 |
| 輸入電流限制 | 2050A |
| 最大輸入短路電流 | 2500A |
| 輸入電壓誤差率 | Input voltage deviation < 2% |
| DC斷路器 | 250A×14 Runs |
| 輸入保護 | DC over voltage_electronic shutdown<br>DC current limitation_current control<br>Surge arrestor_1000V/40kA Type 2 |
| **輸出規格** | |
| 輸出容量 | 1000kW / 1000kVA |
| 電網 | Three phase (3P3W-IT) |
| 市電電壓範圍 | 350VΔ ±10% |
| 市電頻率 | 50/60Hz |
| 市電頻率範圍 | Domestic regulation (Max 50/60Hz ± 5Hz) |
| 最大輸出電流 | 1650A |
| 防孤島 | Domestic regulation |
| 輸出端重新連接 | Connect to utility after utility recover and countdown finished |
| 重新連線時間 | Domestic regulation |

| 戶外併網型變流器 | C1000 |
|---|---|
| **輸出規格** | |
| 輸出電流直流成分 | < 0.5% at rated current |
| 輸出電流諧波失真 | < 3% at rated power |
| 虛功控制 | 0.8 leading to 0.8 lagging |
| 實功控制 | 1% each step |
| 夜間消耗功率 | < 55 watts (without optional transformer) |
| 偵測誤差率 | Utility voltage deviation < 2%<br>Utility frequency deviation < 0.03 Hz<br>Countdown timer deviation < 1.0 sec<br>Output power deviation < 3% at full power |
| 功率限制 | Temperature sensors depend on heatsink & internal air temperature. |
| AC斷路器規格 | 690V/2000A |
| 保護裝置 | AC Circuitry Breaker & Thermal protection<br>Surge arrestor_600V/30kA Type 2 |
| **一般資訊** | |
| CQC | CQC 98.20% (internal AC AUX) |
| | CQC 98.34% (external AC AUX) |
| EUR Efficiency | 98.4% |
| Peak Efficiency | 98.84% |
| **一般資訊** | |
| 通訊介面 | RS-485 Delta Protocol |
| LED | Operation: Green<br>(Flashing during countdown)<br>Alarm: Red |
| LCD 螢幕 | 5” Graphic, 320*240 pixels |
| 螢幕按鍵 | 4 operational buttons |
| 能量記錄方式 | Day/Month/Year |
| 故障記錄方式 | 30 events recently<br>Event times for each event |
| 緊急開關 | 1 set |
| 乾接點 | 2 set |

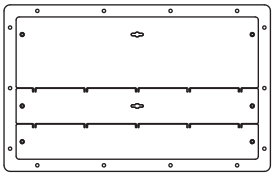
| 戶外併網型變流器 | | C1000 |
|---|---|---|
| **認證** | | |
| Electrical Safety Standard | | CNS15426-1<br>CNS15426-2<br>IEC61683<br>IEC61727<br>IEC62116<br>IEC62109-1<br>IEC62109-2<br>IEC60068<br>CE |
| Grid Interface Standard | | IEC62910<br>CNS15382<br>GB/T 19964: LVRT<br>NB/T 32004-2013<br>CNCA/CTS 0002-2014<br>CNCA/CTS 0048-2014 |
| EMC, Emission | | IEC 61000-6-4 |
| EMC, Immunity | | CNS14674-2<br>CNS14674-4<br>IEC 61000-6-2<br>IEC 61000-4-2<br>IEC 61000-4-3<br>IEC 61000-4-4<br>IEC 61000-4-5<br>IEC 61000-4-6<br>IEC 61000-4-8 |
| **操作** | | |
| 操作溫度 | | -25°C~60°C<br>(Full power -25°C~50°C) |
| 儲存溫度 | | -30°C~60°C |
| 相對濕度 | | 5%~95% |
| 噪音值 | | < 80dB |
| 機器使用高度 | | 0 to 3000m |
| **環境** | | |
| Vibration | | GB/T 2423.10 & GB/T 2423.56 |
| **機構** | | |
| Dimension (mm) | Width | 2100 |
| | Depth | 950 |
| | High | 1980 |
| Weight (kg) | | 1740 |
| Cooling | | Air cooling with Fans with inlet filter |
| Enclosure rating | | IP-65 (Electric parts) |

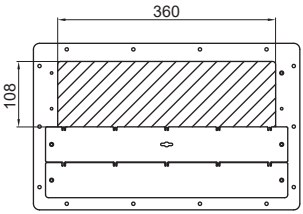


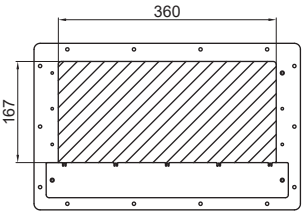

**附錄 A-1 : C1000溫度降載曲線 (Output voltage at 350V)**

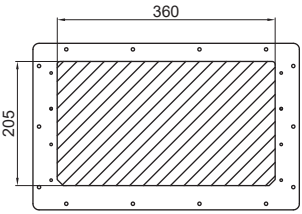
# 附錄 B: 底板開孔尺寸與護線套安裝

## • DC & AC側底板

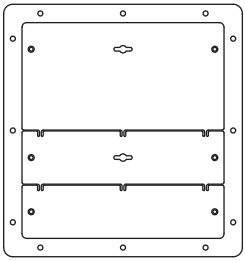


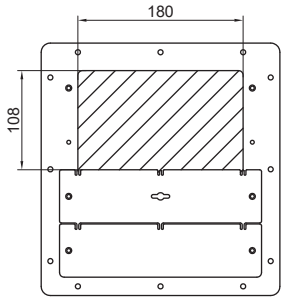


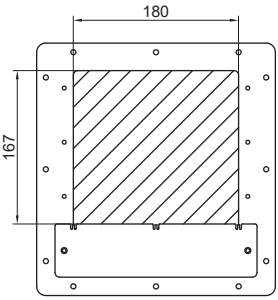



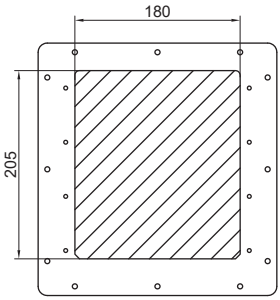




## • DC側底板





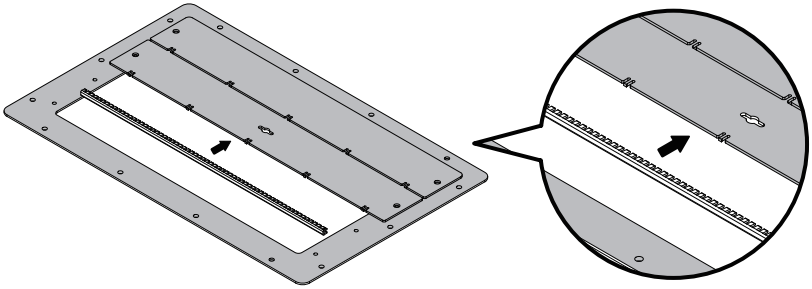

**說明**

1. 斜線區域為可穿纜線區域，而且可透過小底板調整可穿纜線區域大小。
2. 完成配線後，需以耐高溫防水材料(防火泥或硅膠)完全覆蓋孔隙。

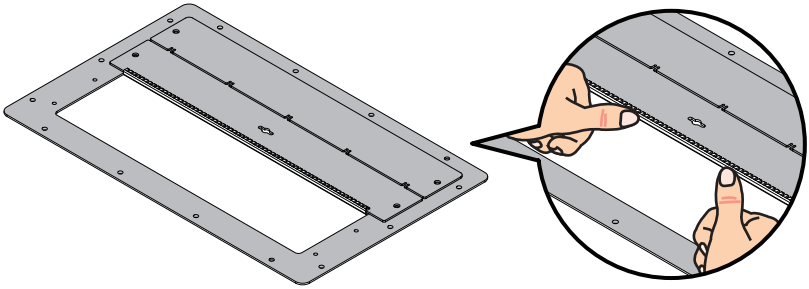
## • 護線套安裝

在確定底板開孔尺寸後，請將配件包中的護線套取出，並依照下述步驟將護線套安裝於底板上。

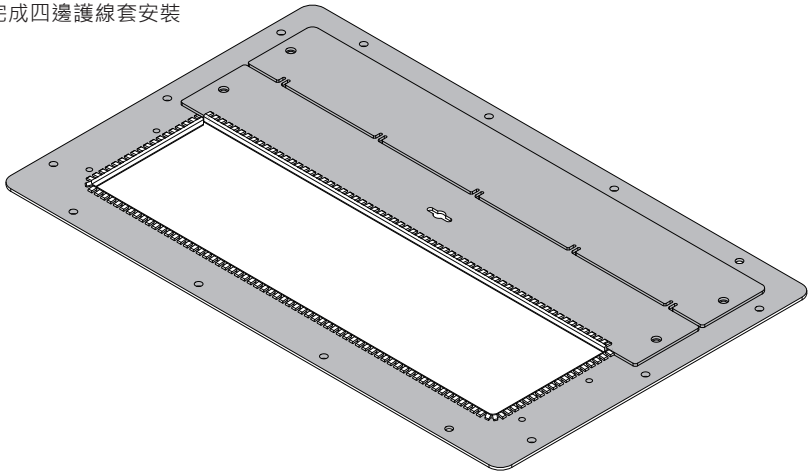
1. 於底板邊緣套上護線套



2. 壓緊護線套使之貼合於底板邊緣



3. 完成四邊護線套安裝

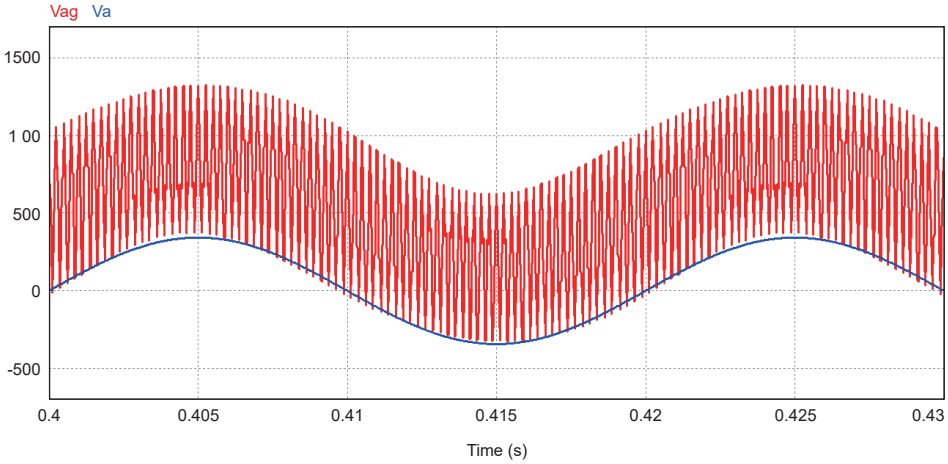


# 附錄 C: Delta中壓變壓器與輔助電源變壓器應用說明

## A. 中壓變壓器的技術需求

A.1 在中壓變壓器中，低壓側繞組所需的絕緣電壓要能符合以下條件：

- 要能夠承受最大1400V對大地變流器的脈衝形式電壓
- 要能夠承受最大有效值電壓700V對大地
- 要能夠承受電壓變化dv/dt高達500V/μS

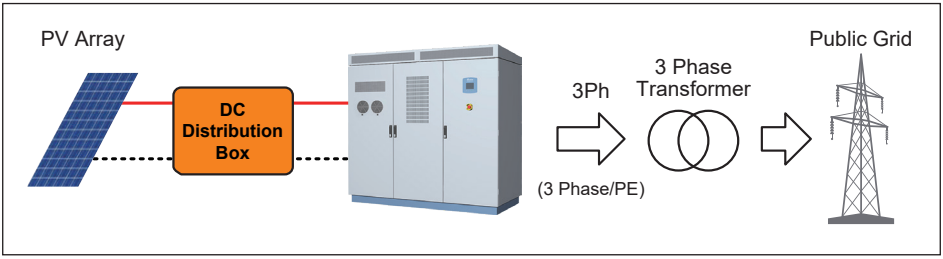



- 接地用設備應被增加架設在高壓繞組與低壓繞組之間，此接地用設備是針對dv/dt(單位時間電壓變化)作為濾波器使用的。

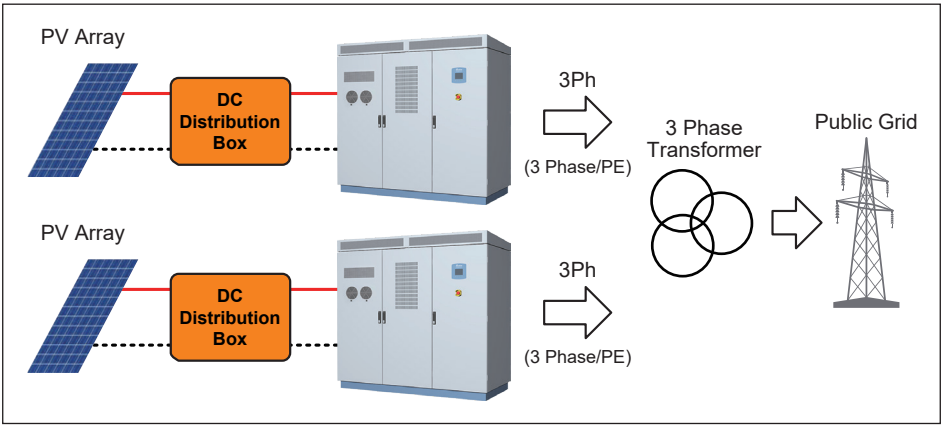
A.2 每一台變流器都需要有各自分離的隔離電壓繞組。 使用多台變壓器並聯在同一個低壓繞組上是不允許的。
A.3 中壓變壓器類型可以為油式或是乾式。
A.4 建議在高壓端持有抽頭切換開關以便於校正電壓准位元至中壓。
A.5 中壓變壓器較高的熱應力應該要考慮到國別設定，包括電壓與頻率。
A.6 中壓變壓器在額定功率下要有能夠抵擋最大5%的總諧波電流的能力。
A.7 中壓變壓器需要根據以下變流器的額定規格來進行設計。

| 產品名稱 | 額定電壓範圍 (線-線) (V) | 額定輸出電流範圍 @ 50℃ (A) | 最大輸出電流 (A) |
|---|---|---|---|
| C1000 | 350±10% | 1650 | 1710 |

## B. 變流器可以透過以下圖示來與中壓變壓器進行連接




對於 1 台變流器使用雙繞組變壓器

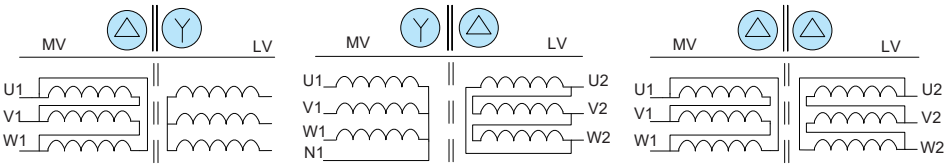



對於 2 台變流器使用三繞組變壓器

B.1 雙繞組變壓器的技術需求

- 阻抗電壓應在4.0-6.6%之間。
- 雙繞組變壓器的向量組合可為Dy11、YNd11 or Dd0。

* 如果使用YNd11需配合 DC+或DC-下地使用。

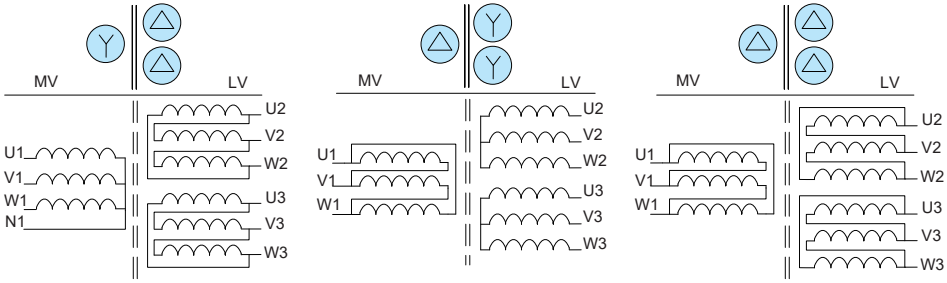



Dy11　　YNd11　　Dd0

B.2 三繞組變壓器的技術需求

- 在每一個低壓繞組與高壓繞組之間的阻抗電壓應在4.0-6.6%之間。
- 在兩個低壓繞組之間的阻抗電壓應在9.0-11.0%之間。
- 三繞組變壓器的向量組合可為Dy11y11、YNd11d11 or Dd0d0。
- 假若Dyn11yn11真的實施了,讓兩個低壓繞組的中性點不作任何連接。

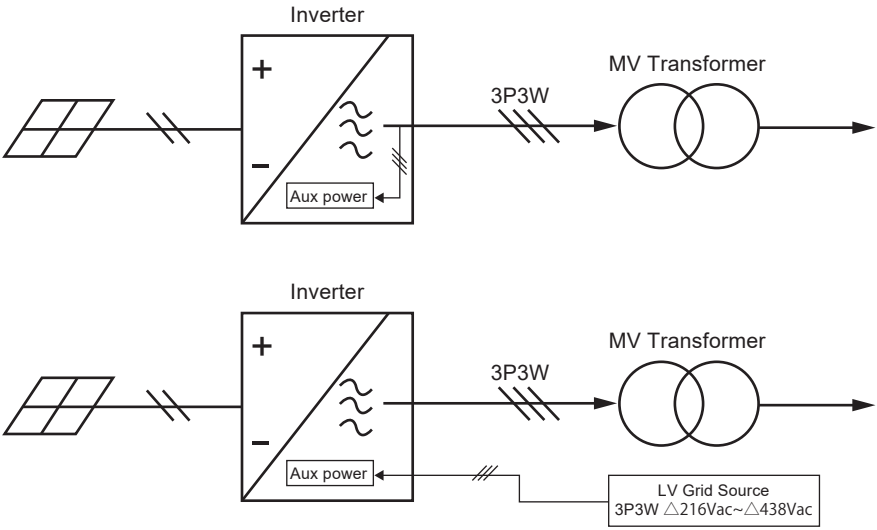
* 如果使用YNd11d11需配合 DC+或DC-下地使用。



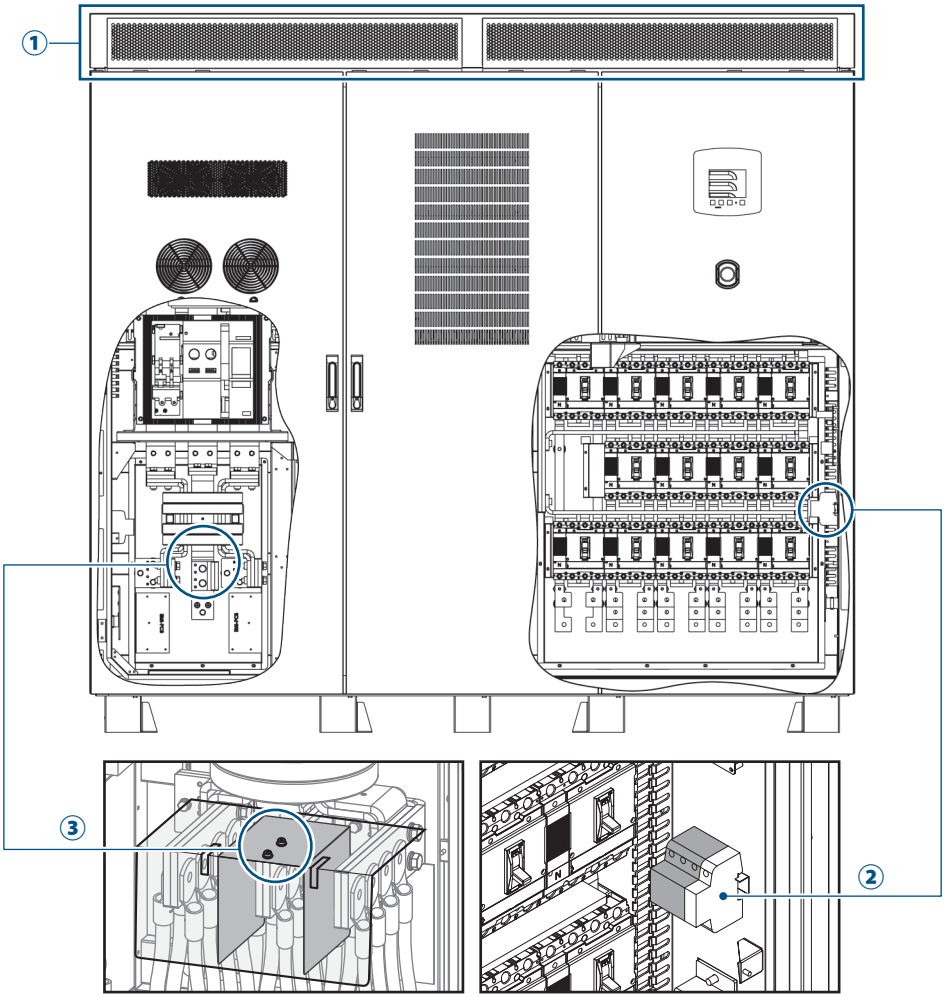

YNd11d11　　Dy11y11　　Dd0d0

## C. 利用變壓器作為外部來源供電給輔助電源

透過變流器輸出（預設配置是3P3W）供電給輔助電源，如此一來就可以省下在案場上額外電源的安裝需求。
假設真的需要透過農場邊的市電作為輔助電源的供電來源，那這個三相變壓器須被設計為輸出線對線電壓在216V ~ 438V且額定功率要大於2.8KVA。
對於輔助電源來說，變壓器的輸出不是為星形接法就是三角形接法。如果星形接法的中性點有顯露出來，就讓此中性點不作任何連接。

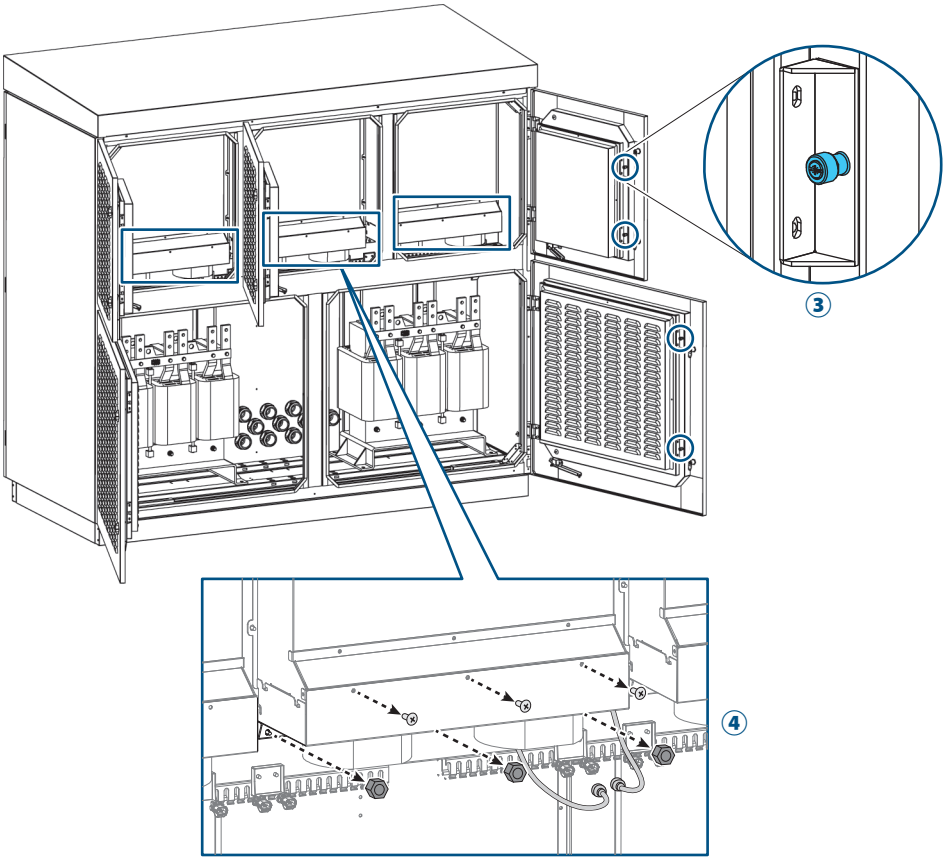


# 附錄 D: 組裝說明




| NO | 位置 | | 螺絲扭力 |
|---|---|---|---|
| 1 | 變流器上蓋 | | 25 Kgf-cm (2.5N-m) |
| 2 | DC接地 | 保險絲座 | 30 Kgf-cm (3.0N-m) |
| | | 匯流排+/- | 25 Kgf-cm (2.5N-m) |
| 3 | 絕緣片 | | 8.0 Kgf-cm (0.8N-m) |

**附錄 D-1 : 組裝說明 - 1**




| NO | 位置 | 螺絲扭力 |
|---|---|---|
| 3 | 濾網蓋 | 25 Kgf-cm (2.5N-m) |
| 4 | 風扇模組 | 25 Kgf.cm (2.5N-m) |

**附錄 D-2 : 組裝說明 - 2**

## DC

| DC端 | 導線數目 (+/-) | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 12 ~ 14 | M10 | 25 |

| DC端纜線 (銅) | DC+/DC-端最小需要的纜線截面積 |
|---|---|
| | 70 $mm^2$ (14 路) / 95 $mm^2$ (≧12 路) |

| DC端纜線 (鋁) | DC+/DC-端最小需要的纜線截面積 |
|---|---|
| | 95 $mm^2$ (14 路) / 120 $mm^2$ (≧12 路) |

* 最大可鎖附纜線截面積 → 240 $mm^2$

## AC

| AC端 | 各相最大纜線數目 | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 8 (<300 $mm^2$) | M12 | 45 |

| AC端纜線 (銅) | AC端最小需要的單相纜線總截面積 |
|---|---|
| | 1110 $mm^2$ |
| | AC端最小需要的單相纜線單條截面積 x 數量 |
| | 150 $mm^2$ x 8 |

| AC端纜線 (鋁) | AC端最小需要的單相纜線總截面積 |
|---|---|
| | 1480 $mm^2$ |
| | AC端最小需要的單相纜線單條截面積 x 數量 |
| | 185 $mm^2$ x 8 |

## PE

| PE端 | 最大纜線數目 (DC/AC/外部) | 螺絲/螺帽尺寸 | 扭力需求 (Nm) |
|---|---|---|---|
| | 4/4/1 | M12 | 45 |

| PE端纜線 (銅) | 最小需要的總纜線尺寸 |
|---|---|
| | 555 $mm^2$ |

| PE端纜線 (鋁) | 最小需要的總纜線尺寸 |
|---|---|
| | 740 $mm^2$ |

**附錄 D-3 : 組裝說明 - 3**




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Version 08190725