PhotoVoltaic Inverter

RPI-C500 PV Inverter



TABLE OF CONTENTS

1. Introduction 1
1.1. About This Manual 1
1.2. Valid Models 1
1.3. Target Group 1
2. Safety 2
2.1. System Usage 2
2.2. Disconnecting 2
3. Product Overview 4
3.1. Product Description 4
3.2. Product View 4
3.2.1. Exterior Front View 4
3.2.2. Exterior Triangle View 5
3.3. Features 6
3.4. Identify the Inverter 6
4. Transportation & Installation Preparation 8
4.1. Installation Site Requirements 8
4.1.1. Site Space 8
4.2. Preparing the Installation Site 9
4.2.1. Dimensions of trench 9
4.2.2. Dimensions & Characteristics of the base 9
4.2.3. Fixed Methods 10
4.2.4. Dimensions of central inverter for indoor installation 10
4.3. Delivery Options and Recommended Vehicle 11
4.3.1. Using a Forklift or pallet trunk 12
4.3.2. Using a Crane 12
4.4. Unpacking 15

4.5. Package Contents 16

5. Installation 17

5.1. Recommended Tools 17

5.2. DC Connection 17

5.2.1. Dimension of DC Busbar 19

5.2.2. Choose Input DC Fuse and Cable Size 21

5.2.3. Positive/Negative Grounding 21

5.3. AC Connection 22

5.3.1. Dimension of AC Busbar 24

5.4. PE Connection 26

5.4.1. Dimension of PE Busbar 27

5.5. DC Fuse Installation 28

5.6. Attach/Remove the Plates 29

5.7. Connection of Communication Modules 30

5.7.1. RS-485 Connection 30

5.7.2. Dry Contact Connection 31

5.8. Auxiliary Power from External Source 32

5.9. First Time Powering Up 34

5.9.1. Before Powering Up 34

5.9.2. Powering Up the Inverter and Self-test 34

5.10. Active/Reactive Power Control and Fault Ride Through 36

5.10.1. Active Power Control 36

5.10.1.1. Power Limit 36

5.10.1.2. Power vs. Frequency 36

5.10.2. Reactive Power Control 37

5.10.2.1. Fixed Active Factor cosφ 37

5.10.2.2. Active Factor cosφ(P) 37

5.10.2.3. Fixed Reactive Power 38

5.10.2.4. Reactive Power/Voltage Characteristic Q(U) 38

5.10.3. Fault Ride Through (FRT) 38
5.11. LCD Flowchart 40
5.11.1. Home Page 40
5.11.2. Power Meter 41
5.11.3. Energy Log 41
5.11.4. Event Log 42
5.11.5. Operation Data 43
5.11.6. Inverter Information 44
5.11.7. Settings 44
5.11.7.1. Personal Settings 45
5.11.7.2. Coefficient Settings 45
5.11.7.3. Install Settings 46
5.11.7.4. Active/Reactive Power Control 49
5.11.7.4.1. Power Limit 49
5.11.7.4.2. Power vs. Frequency 50
5.11.7.4.3. Constant cosφ 50
5.11.7.4.4. cosφ(P) 50
5.11.7.4.5. Constant Reactive Power 51
5.11.7.4.6. Q(U) 51
5.11.7.5. FRT (Fault ride through) 52
6. Troubleshooting 53
6.1. Measurement Index 53
6.2. Error Message and Trouble-shooting 57
7. Maintenance 62
7.1. Replacing a Fan Module 62
7.2. Replacing an Air Filter 65
7.3. Clean Air Outlets 67
7.4. Replacing DC Fuses 69

7.5. Replacing Surge Protection Device (SPD) 70

Appendix A. Technical Data 72

Appendix B. Cable Combination Table & Hole Size of plate 76

Appendix C. Delta MV Transformer and Auxiliary Power transformer Application Note 77

Appendix D. Contact Information 81

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!

CAUTIONS APPEAR BEFORE THE TEXT IT REFERENCES. CAUTIONS APPEAR IN CAPITAL LETTERS TO EMPHASIZE THAT THE MESSAGE CONTAINS VITAL HEALTH AND SAFETY INFORMATION.

Typographical Conventions

The following typographical conventions are used in this document:

Italics

Indicates denotes references to other titles, directories, files, paths, and/or programs.

`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 RPI-C500 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.

- RPI-C500 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.

2. Safety

2.1. System Usage

See the system usage in the following diagram:

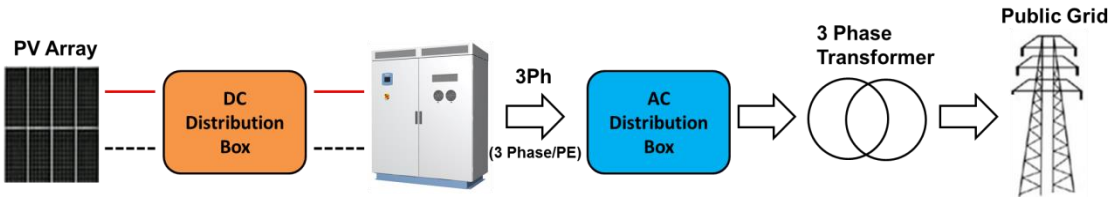


Figure 2-1. System Usage

External output transformer requirements

The external output transformer is used with separate primary and secondary windings rated 500kVA 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".

2.2. 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 5 minutes after switching off the PV Inverter.

The DC voltage is isolated using the internal or external DC input fuses, or using an external circuit breaker if present. Isolation by removing the DC input fuses must occur under load-free conditions.

The device contains capacitors on the AC and DC sides that must discharge once the device has been switched off. After switching off, dangerous accidental-contact voltages remain within the device for several minutes. If there is a fault in the device, these voltages may also be present for a longer period of time. Wait at least 5 minutes after switching off the device 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 5 minutes after switching off the PV Inverter.

3. Product Overview

3.1. Product Description

The Delta RPI inverter models include the RPI-C500. It is manufactured to meet high standards of quality and to maximize the yield of every solar plant (up to 98.7% efficiency).

The RPI series include a IP-65 protection level enclosure and corrosion resistant features to ensure the protection of the inverter within an indoor or outdoor environment.

3.2. Product View

3.2.1. Exterior Front View

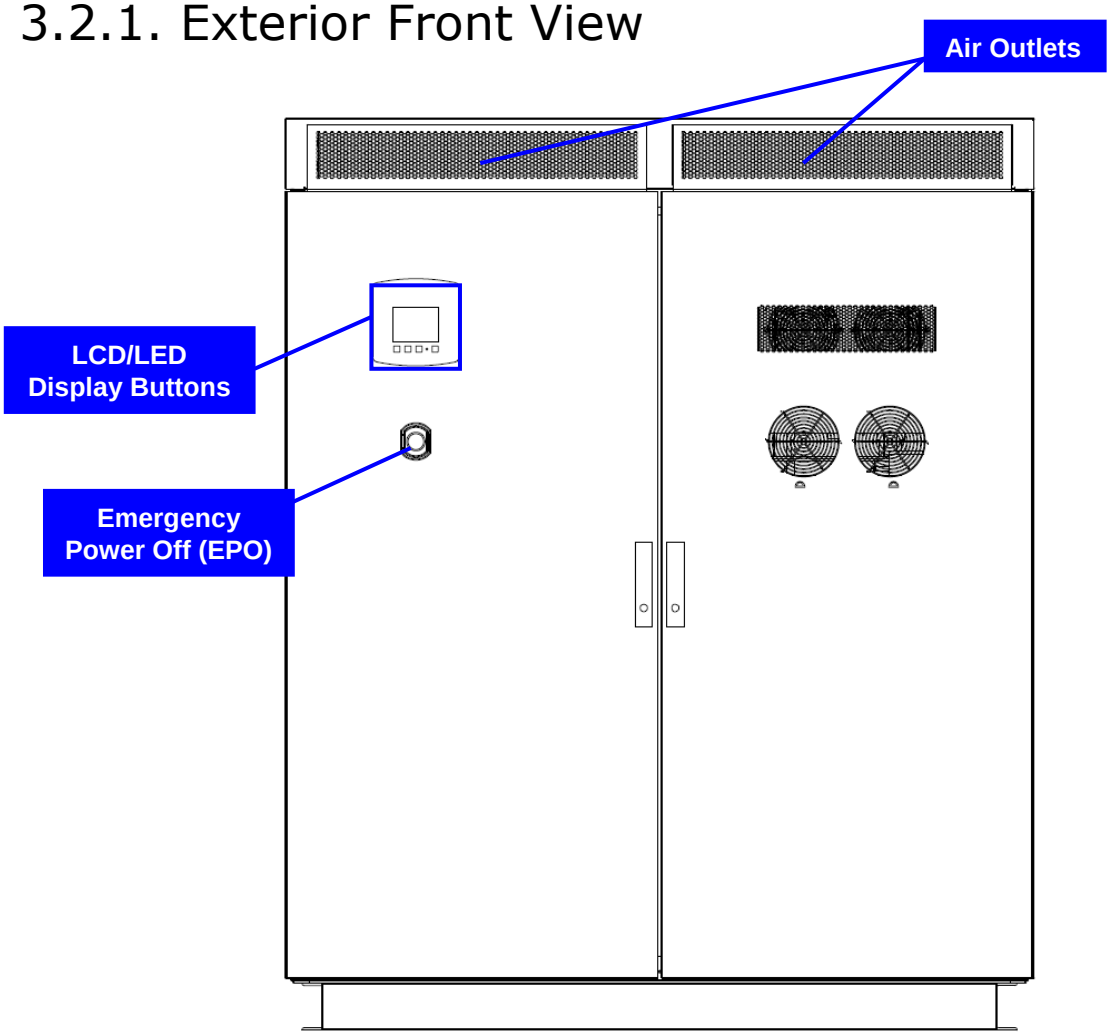


Figure 3-1. Exterior Front View

3.2.2. Exterior Triangle View

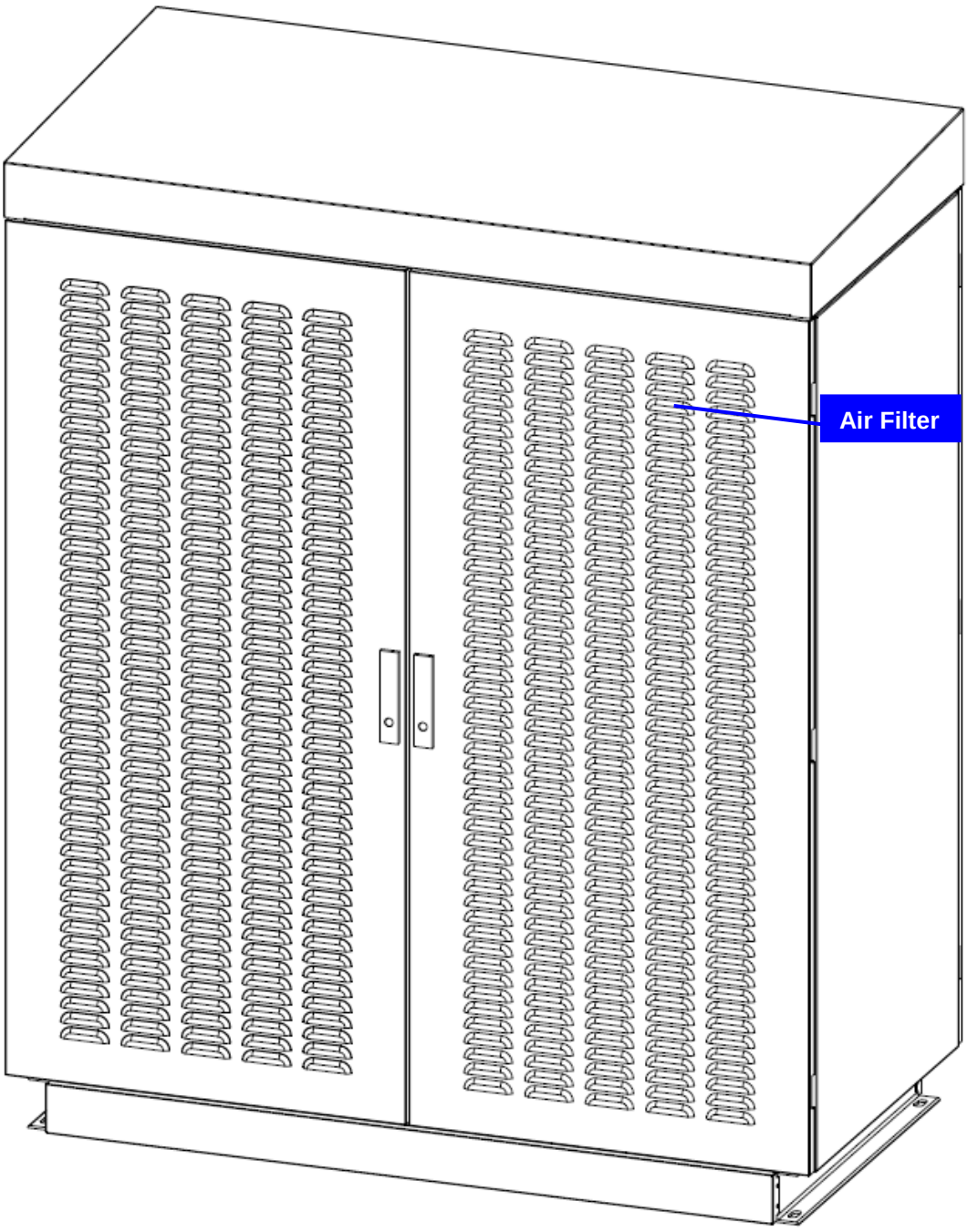


Figure 3-2. Exterior Rear View

3.3. Features

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

- High efficiency, peak 98.7%, EUR 98.4%
- 3 Phase (3 Lines + PE) 500kVA solar inverter
- Wide input range (420-1000Vdc)
- Wide MPPT range (450-820Vdc)
- 1 MPP Trackers
- 5” Graphic LCD display (Adjustable contrast & brightness)
- IP-65 protective level (electrics)

3.4. Identify the Inverter

Please refer to the following image for identifying the inverter.

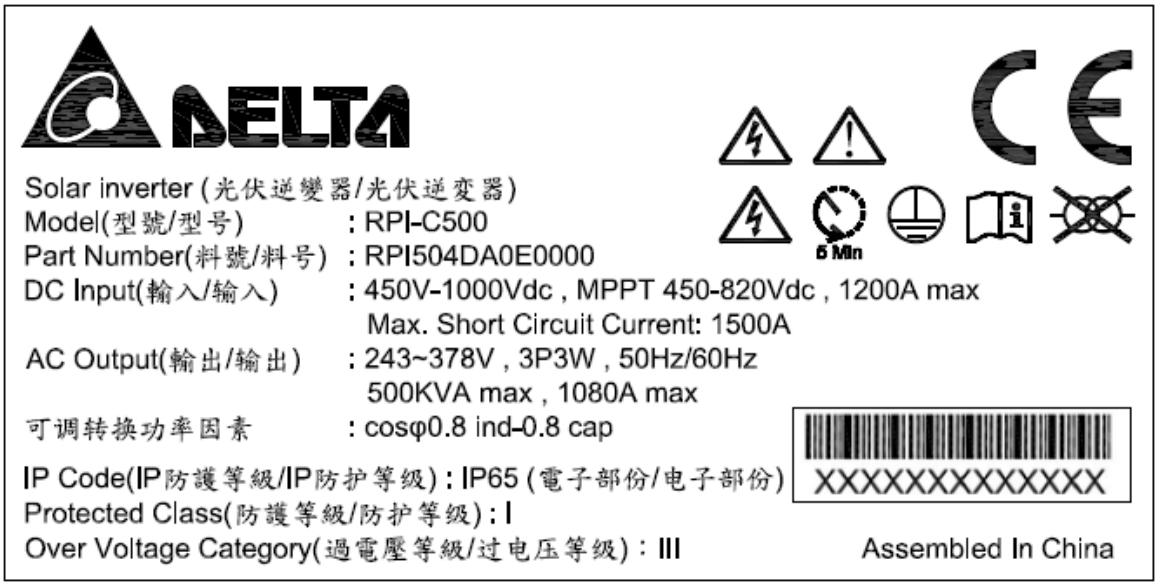


Figure 3-3. Inverter Identification

4. Transportation& Installation Preparation

4.1. Installation Site Requirements

4.1.1. Site Space

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

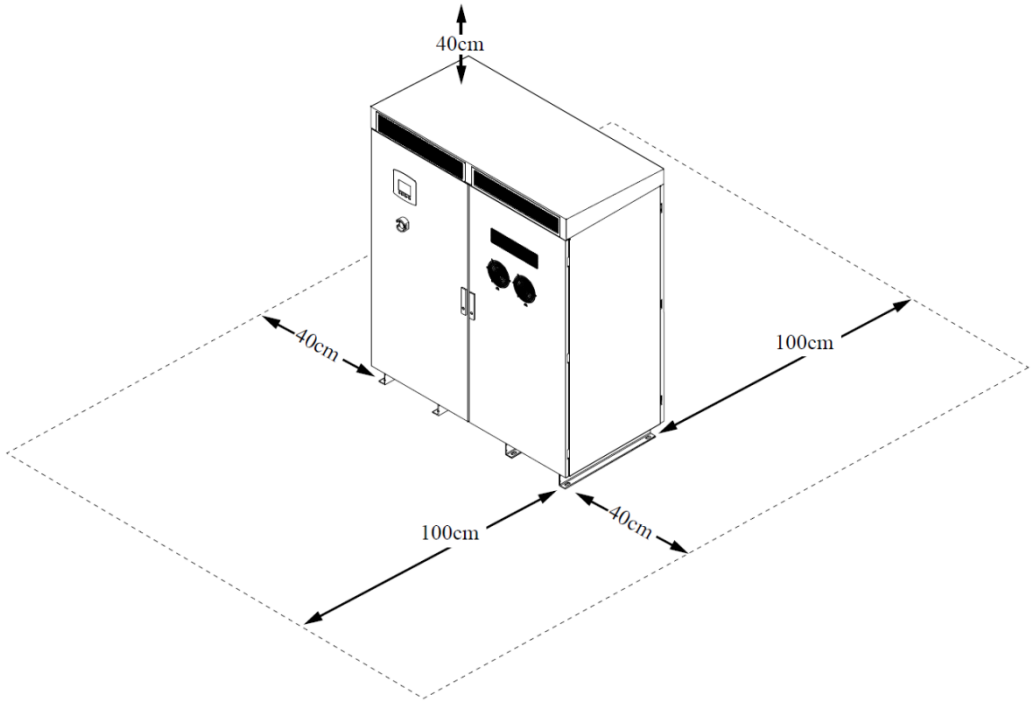


Figure 4-1. Inverter Space Requirements

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

- Full height of the system package on shipping pallet: 2210 mm (87 inches)
- Width of the system package, front: 1820 mm (72 inches)
- Length of the shipping pallet: 1090 mm (43 inches)
- Width of the system: 1600 mm (63 inches)
- Height of the system: 1950 mm (77 inches)
- Depth of the system: 800 mm (31 inches)

Note:

1. The ambient temperature range of installation site must be less than 60°C.
2. Direct solar irradiation reduces the output power of the central inverter.

4.2. Preparing the Installation Site

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

4.2.1. 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 4-2) and the suggested depth is depended on user.

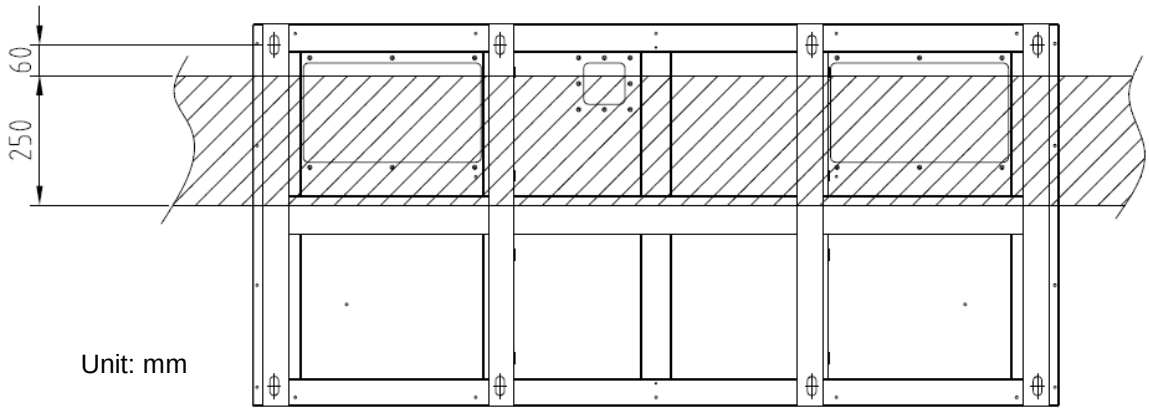


Figure 4-2. Trench Dimensions

4.2.2. Dimensions & Characteristics of the base

Build an installation base using the dimensions from the following illustration.

The width and depth of the mental base should not be smaller than the inverter, and make sure the base can hold at least the weight of the inverter.

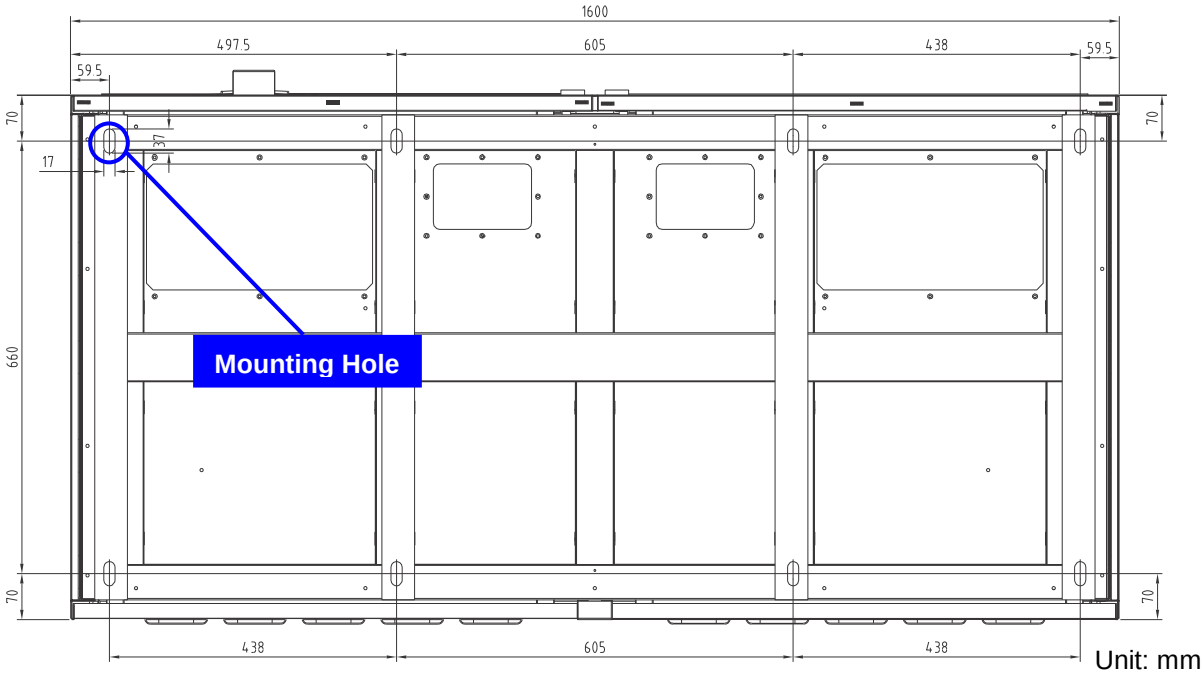


Figure 4-3. Installation Base Dimensions

4.2.3. Fixed Methods

You can install the inverter:

1. Install on the ground directly.
2. Install on the base mounted on the ground.

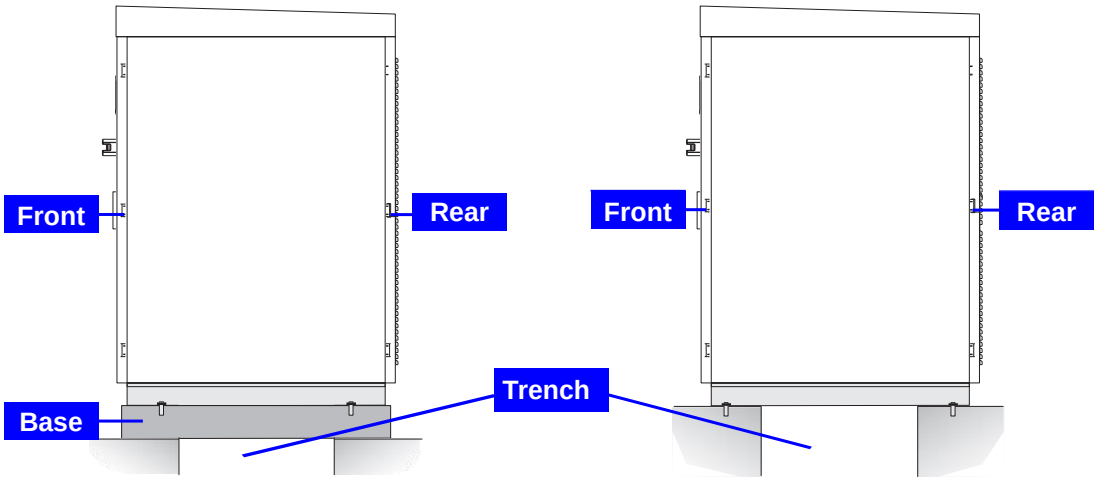


Figure 4-4. Fixed Methods

4.2.4. Dimensions of central inverter for indoor installation

If the inverter installed indoor, the hot air after cooling the inverter can be conducted to outdoor by ventilation duct with one end directly fixed on the top of inverter.

The following dimension (Figure 4-5 & Figure 4-6) you may require under such construction.

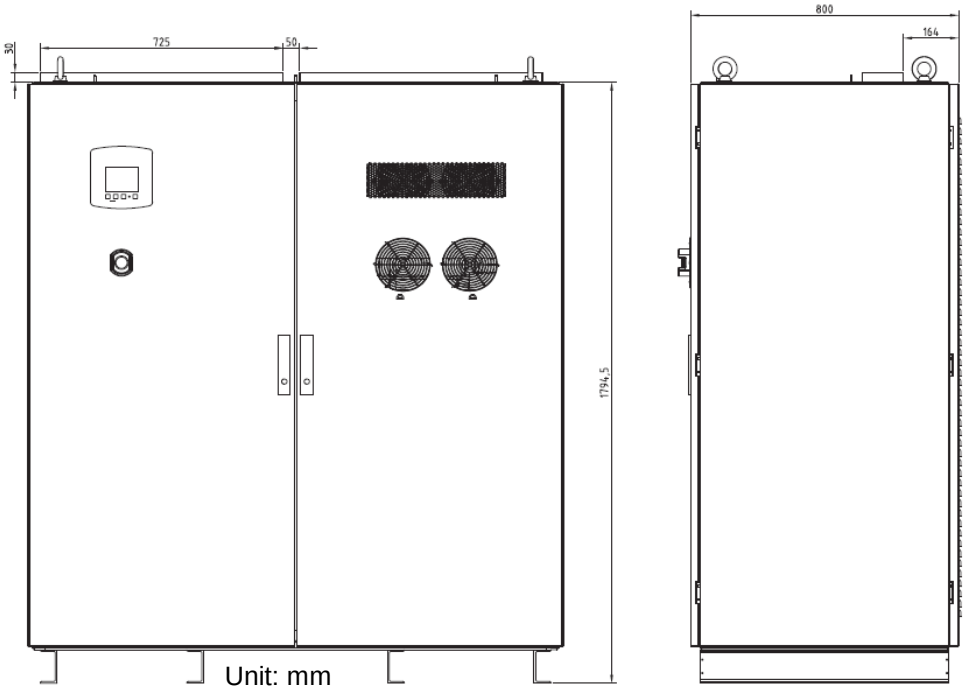


Figure 4-5. Dimensions without top cover

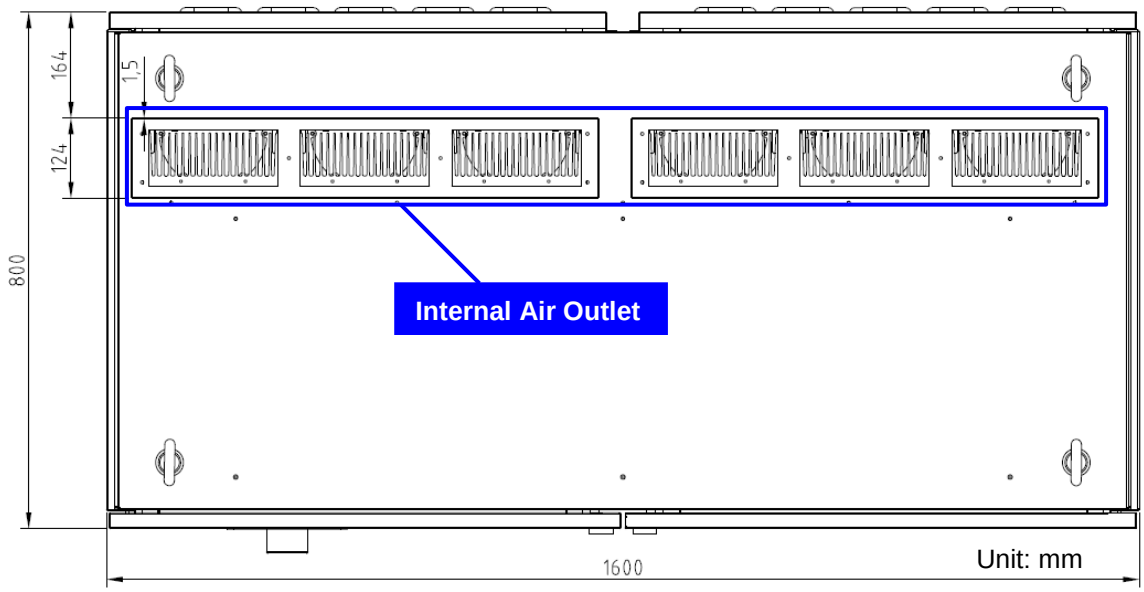


Figure 4-6. Internal air outlet dimensions (top view)

4.3. 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

4.3.1. 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.

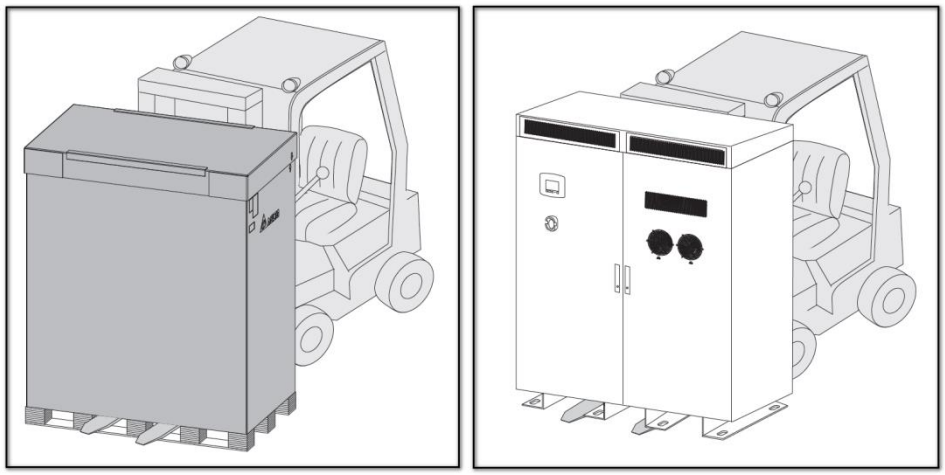


Figure 4-7. Moving the Central Inverter

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

4.3.2. 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.

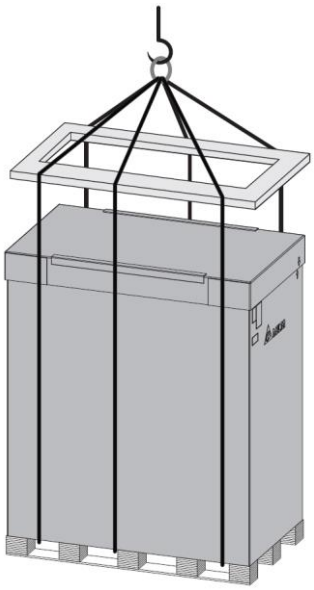


Figure 4-8. Using the Wire Rope

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.

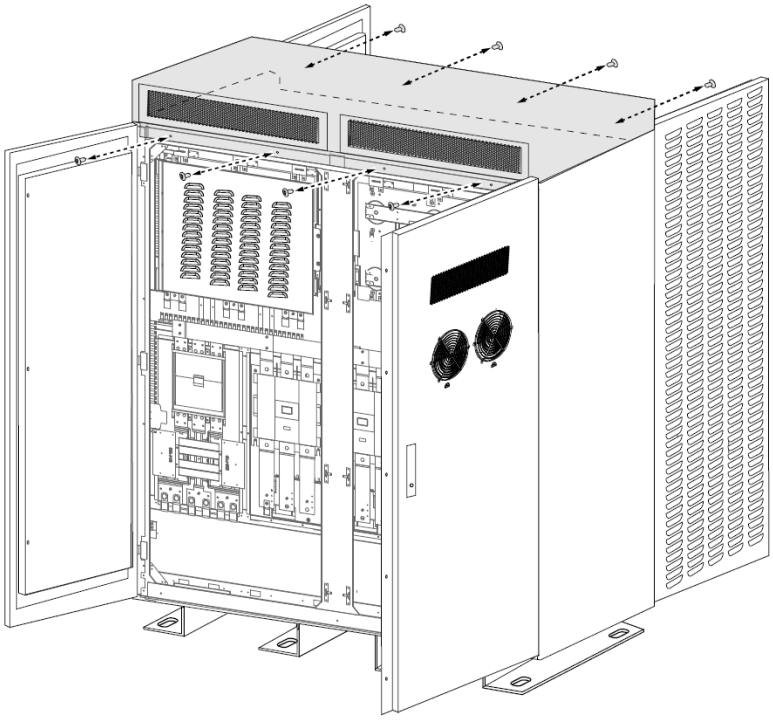


Figure 4-9. Loosen the Screws on the Top Cover

3. Remove the top cover of the inverter.

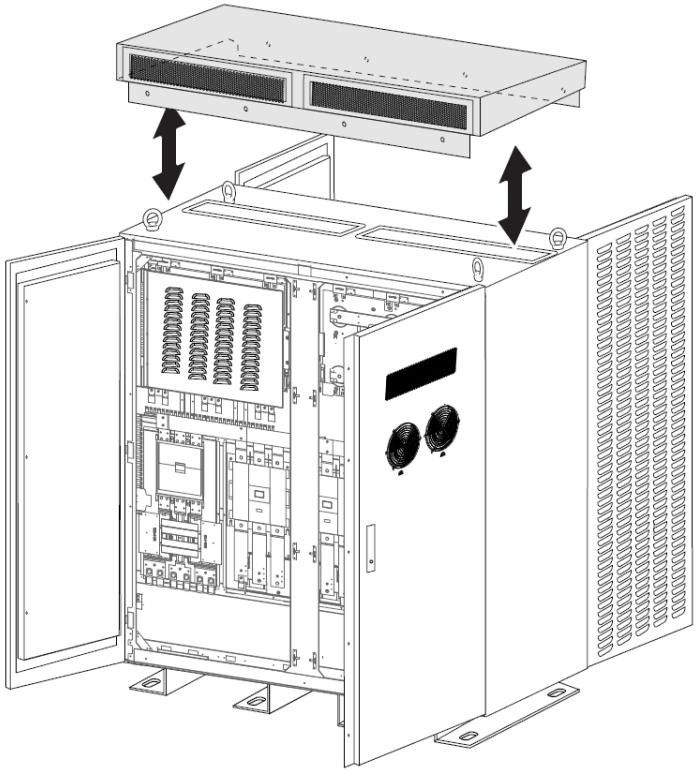


Figure 4-10. Removing the Inverter's Top Cover

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

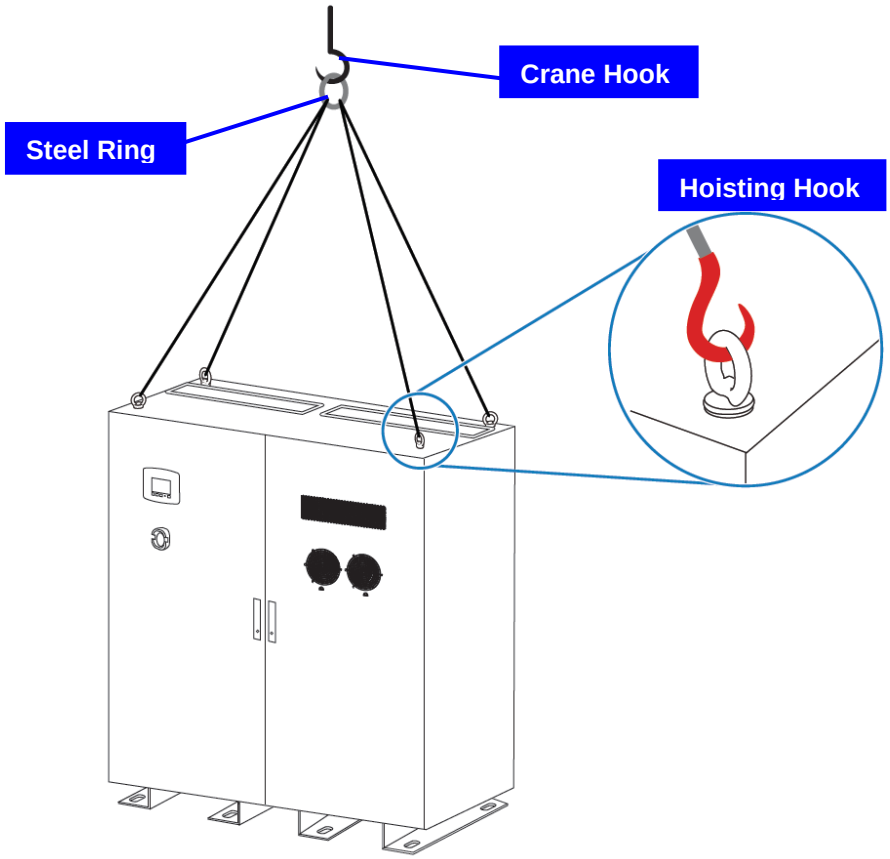


Figure 4-11. Attaching the Hoisting Cables

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.

4.4. 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.

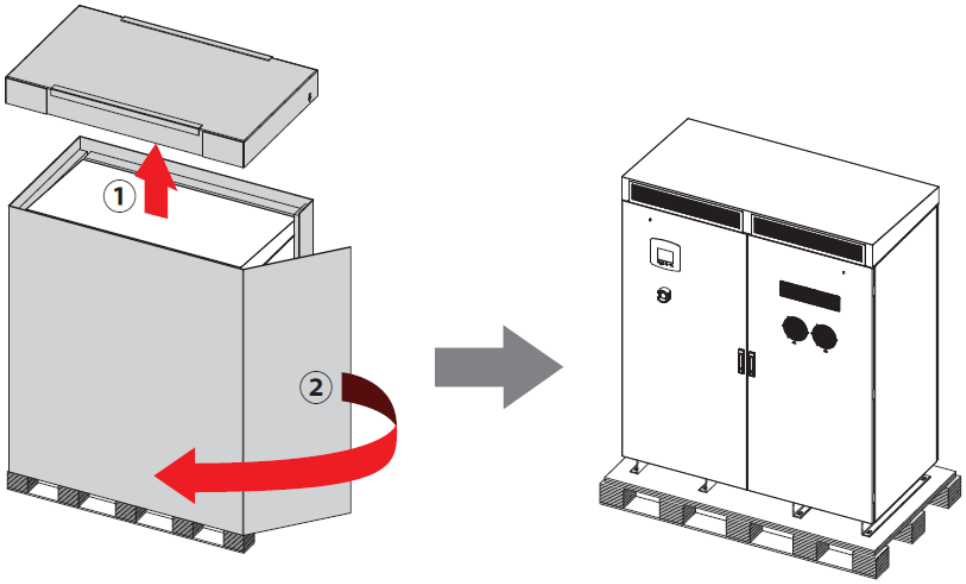


Figure 4-12. Removing the paper case

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

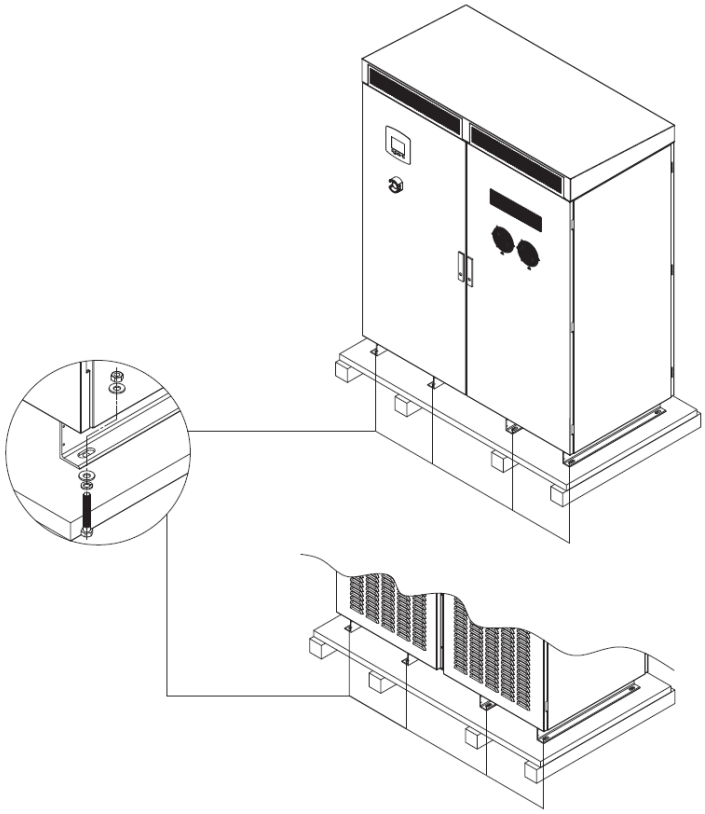


Figure 4-13. Loosening the screws & nuts

3. Remove the central inverter from the pallet.

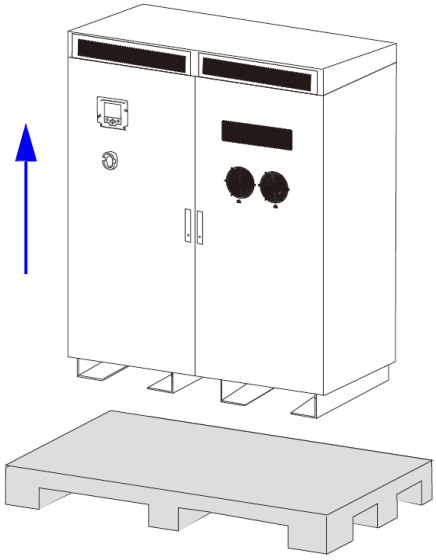


Figure 4-14. Removing the Central Inverter from the Pallet

4.5. Package Contents

Table 4-1: Package Contents

Object	Qty	Description
Central Inverter	1	RPI-C500 Inverter
Key	2	Open/Close the door of the inverter
Installation Manual	1	The instruction to provide the information of safety, installation, specification, etc.
Screw (M5)	8	Use to lock the plates
M10 Screw Set	2	Include of screw, washer spring, washer plain and nut Reserve for DC connection
M12 Screw Set	1	Include of 50mm screw and nut and reserve for AC connection
	1	Include of 45mm screw and nut and reserve for AC connection
	1	Include of 40mm screw and nut and reserve for AC connection
Wire	1	Positive/negative grounding setting for PV array
Card License	1	Inverter qualification certificate
Test Report	1	Inverter relative test data content

5. Installation

5.1. 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

5.2. DC Connection

1. Thread the DC power cables through the cable gland located shown in Figure 5-1.

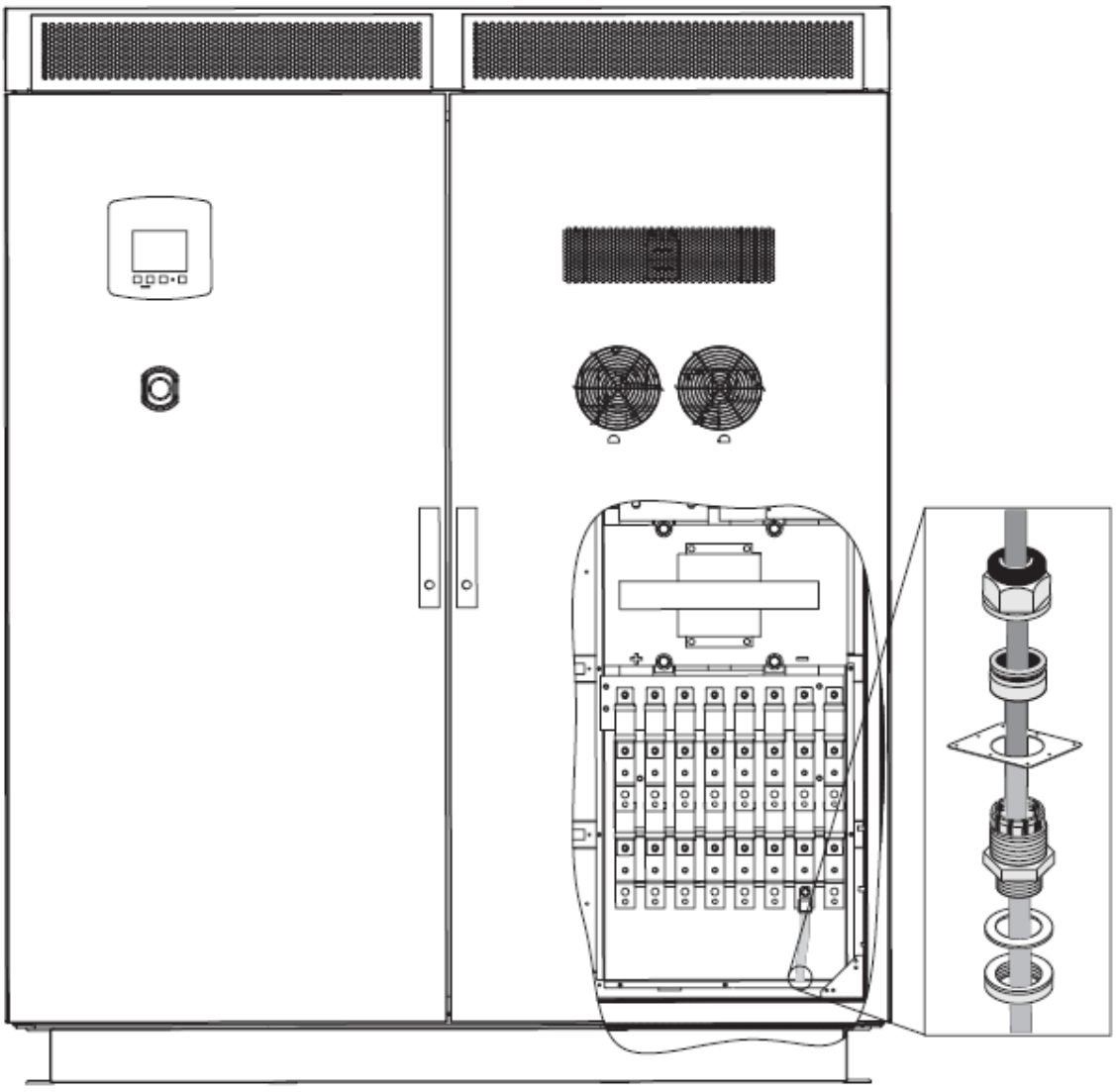


Figure 5-1. DC Power Cable Wiring

2. Connect the power cables from the DC distribution box to the PV Inverter shown in Figure 5-2.

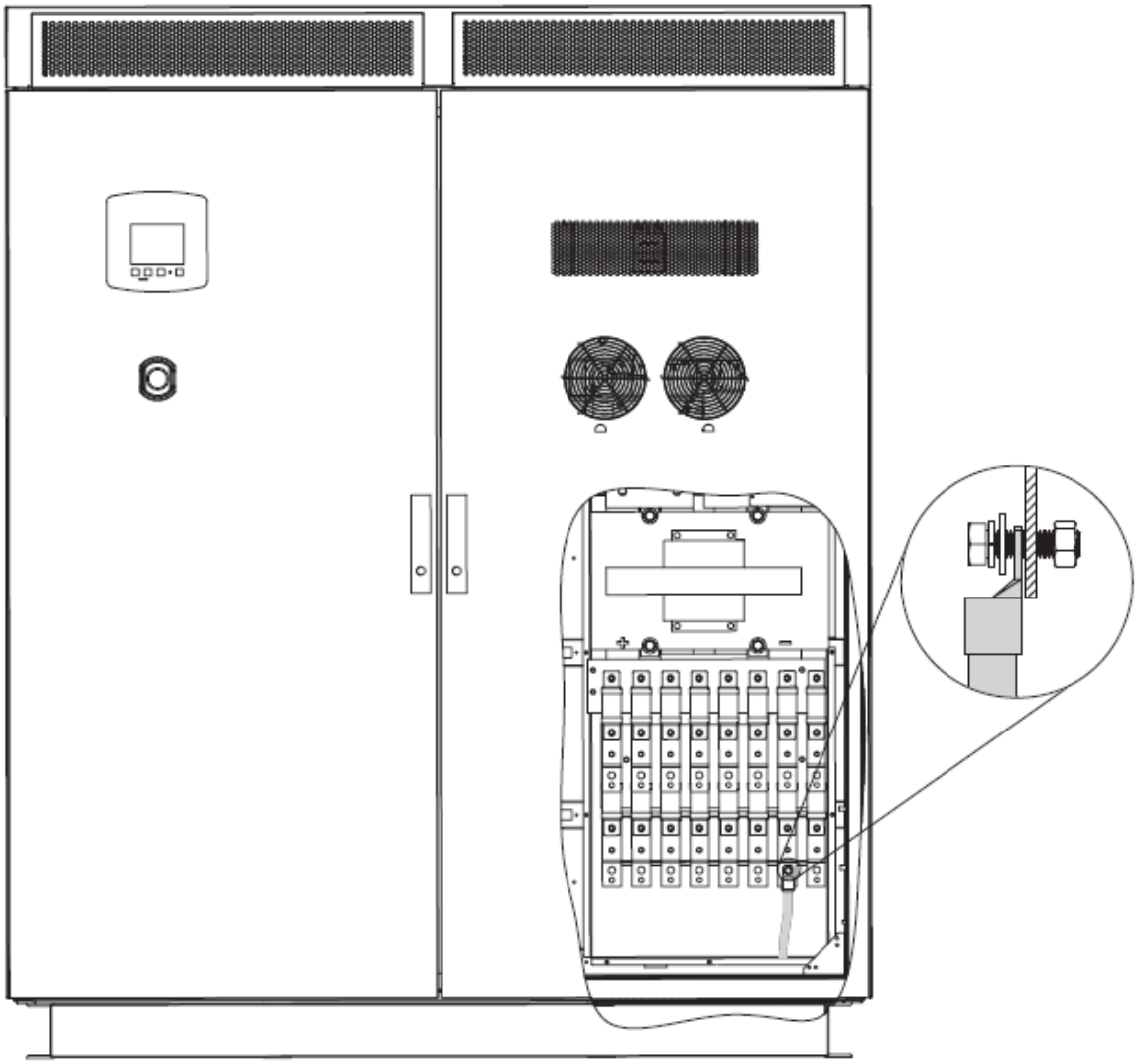


Figure 5-2. DC Connection

DC Terminal	Maximum No. of conductor (+/-)	Screw/Nut size	Torque requirement (Nm)
	8/8	M10	25

DC Cable	Minimum total cable size requirement for DC+/DC-
	600mm^2

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

CAUTION!
The working temperature of cable should be 105°C.

Note:

For cable size and number other than the default setting. You must consult with manufacturer (Delta Electronics) in advanced for other cable combinations.

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 5-3 & Figure 5-4.
2. Please refer to Appendix B to check the overall diameter of cable and the width of the terminal lug whether to match the range of cable gland. If the width of terminal is indeed larger than the limitation, you must thread the cable through the gland first and then press the terminal on the cable during the connection.
3. 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

5.2.1. Dimension of DC Busbar

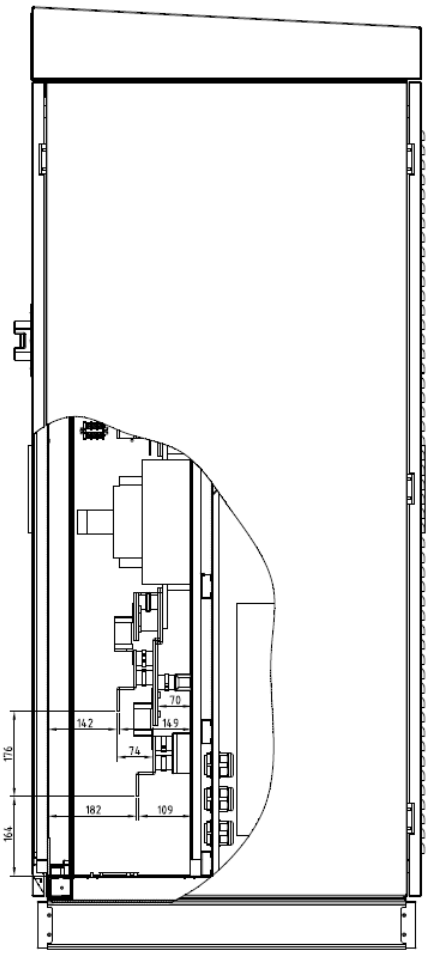


Figure 5-3. DC Busbar dimensions (side view)

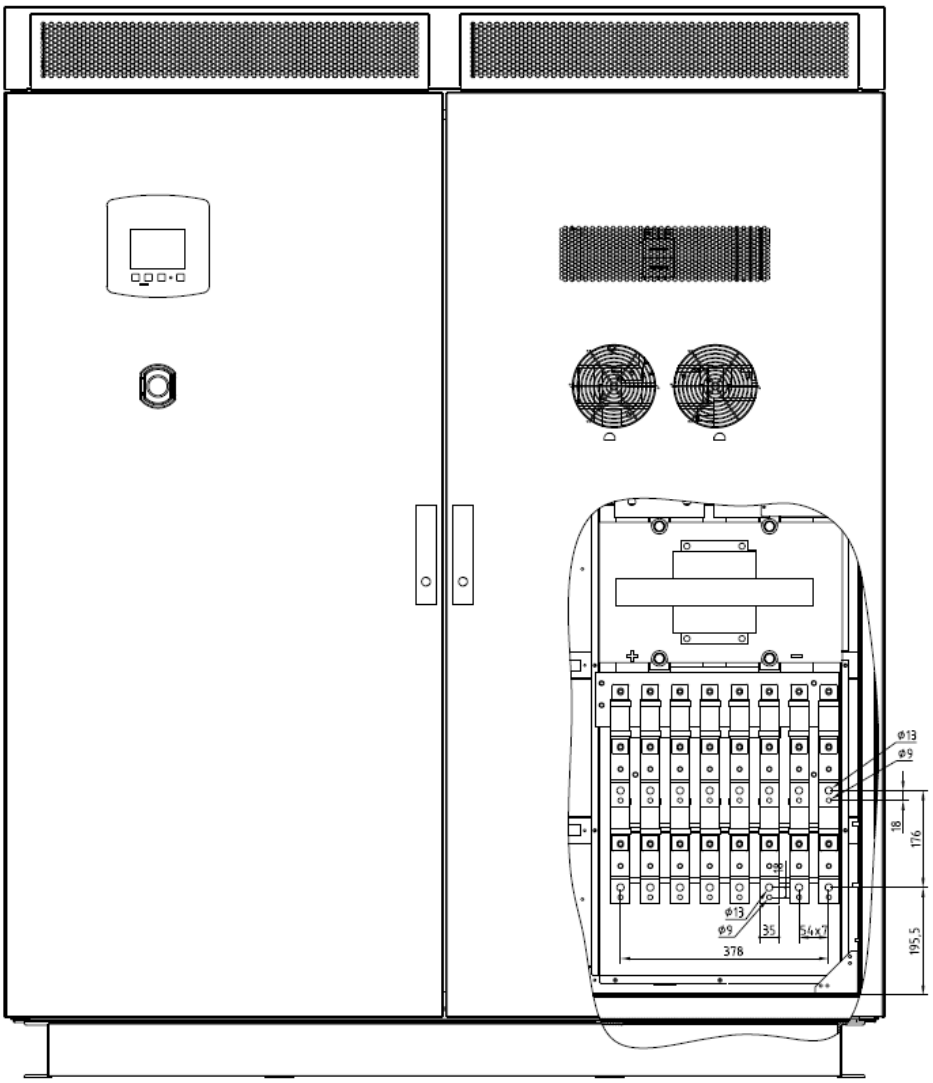


Figure 5-4. Dimensions of the DC connection lugs

5.2.2. Choose Input DC Fuse and Cable Size

The central inverter can be delivered with input DC fuses by customer requirement due to the difference of the installation site. In this case, install appropriate DC fuses to protect the inverter DC circuit and the DC input cables in a short-circuit situation. Protect the positive and negative poles of an input with separate fuses.

The table below shows the rated DC current for selecting the input DC fuses as per the number of the DC input connections to the solar generator.

No. of DC input connections	Rated current for the input DC fuses (A)	Part number	Vender
4	315A	1000GH-315UL	Hinode
5	315A	1000GH-315UL	
6	315A	1000GH-315UL	
7	250A	1000GH-250UL	
8	250A	1000GH-250UL	

Note:

1. The default setting of fuse is 250A*8 runs.

2. Must consult with Delta in advanced if using other rating type of fuse.

5.2.3. Positive/Negative Grounding

The PV array can be grounded using positive grounding or negative grounding. To ground the PV array follow these steps: (Figure 5-5)

1. Connect the grounding cable to the fuse holder.
2. Secure the grounding cable to the DC+ or DC- bus bar with one screw.

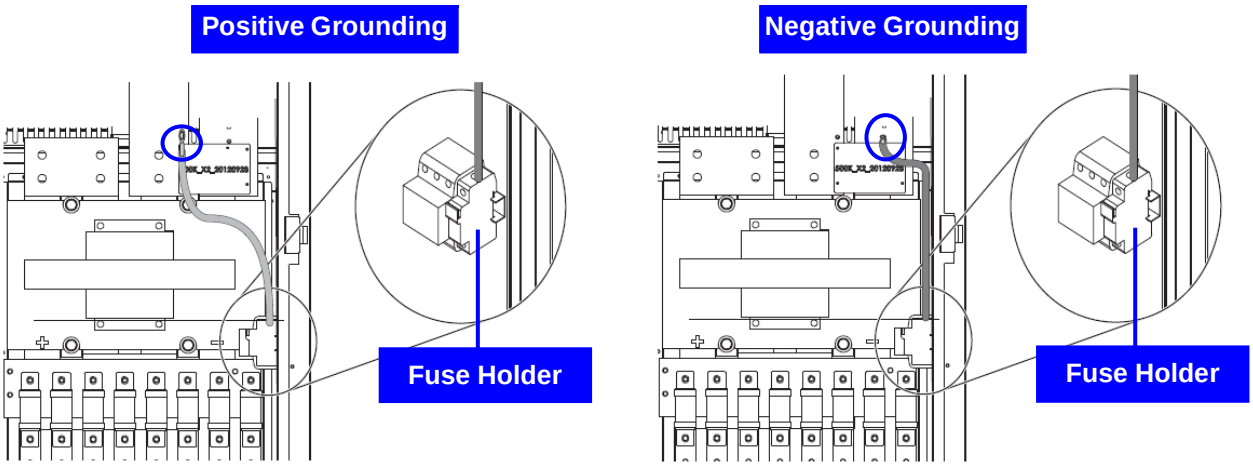


Figure 5-5. Configure to Positive (DC+) / Negative (DC-) Grounding

Note:

Positive and negative grounding can be set via display. Please refer to 5.10.7.3 *Install Settings.*

5.3. AC Connection

1. Thread the AC power cables through the bottom plate located shown in Figure 5-6.

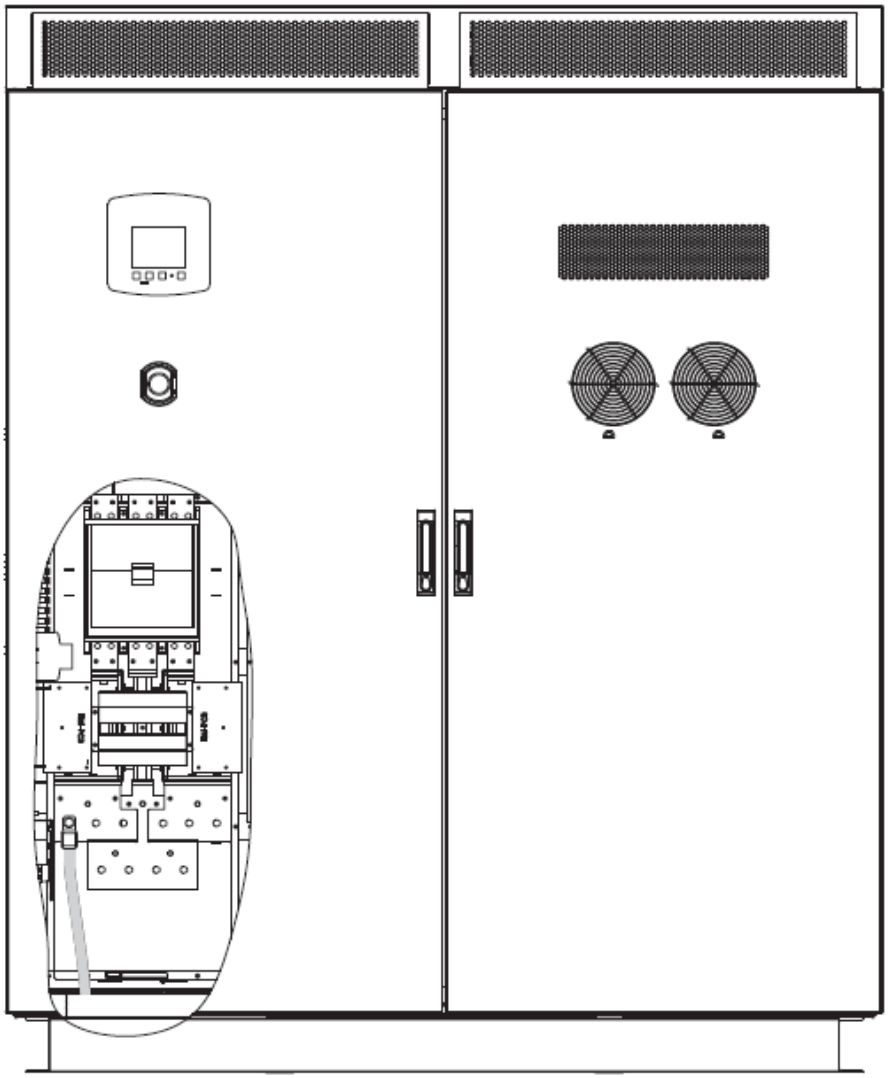


Figure 5-6. AC Power Cable Wiring

2. Connect the power cables from the AC distribution box to the PV Inverter shown in Figure 5-7.

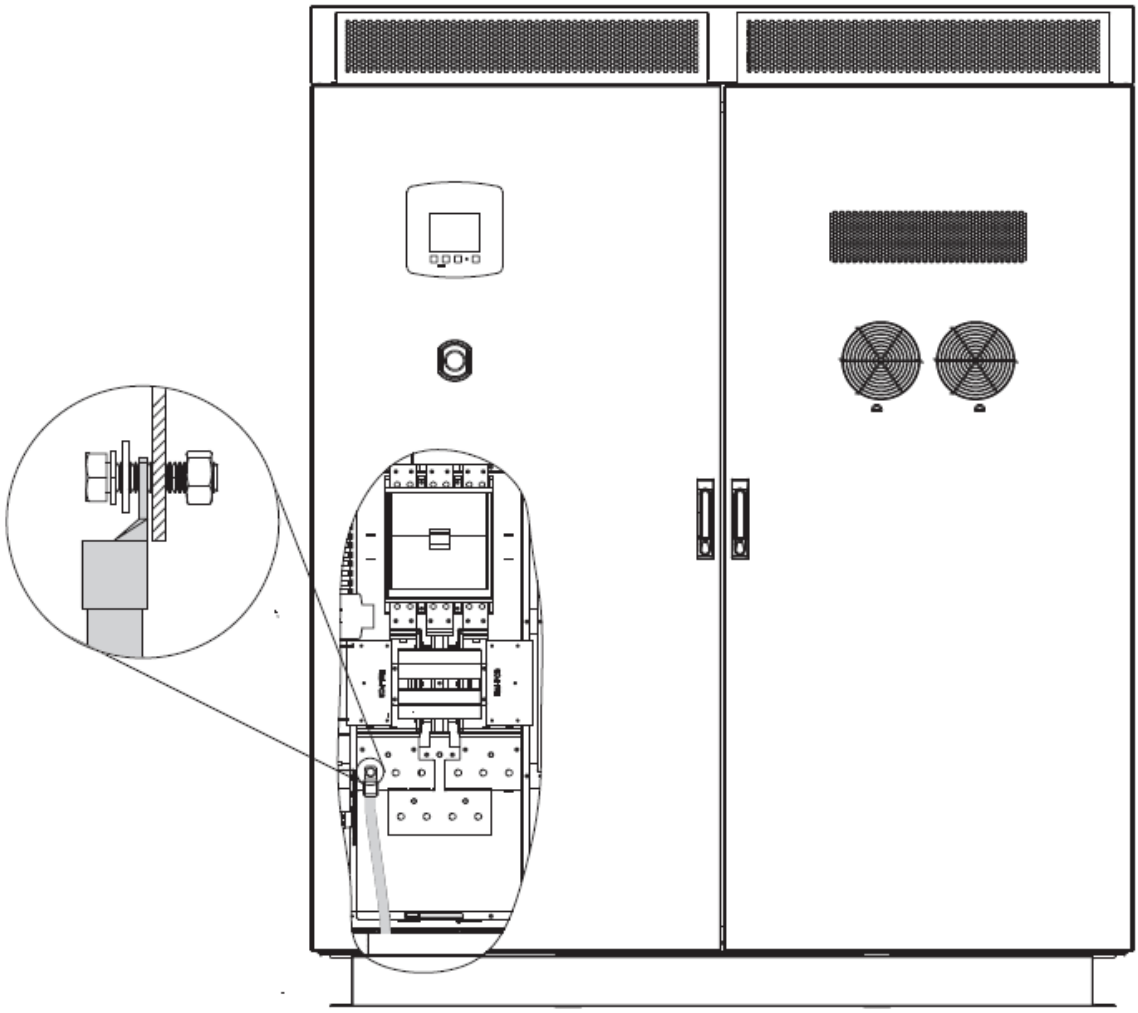


Figure 5-7. AC Connection

AC Terminal	Maximum No. of conductor for each phase	Screw/Nut size	Torque requirement (Nm)
	4	M12	45

AC Cable	Minimum total cable size requirement for each phase
	550mm^2

Note:

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

CAUTION!

The working temperature of cable should be 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

5.3.1. Dimension of AC Busbar



Figure 5-8. AC Busbar dimensions (Bottom view)

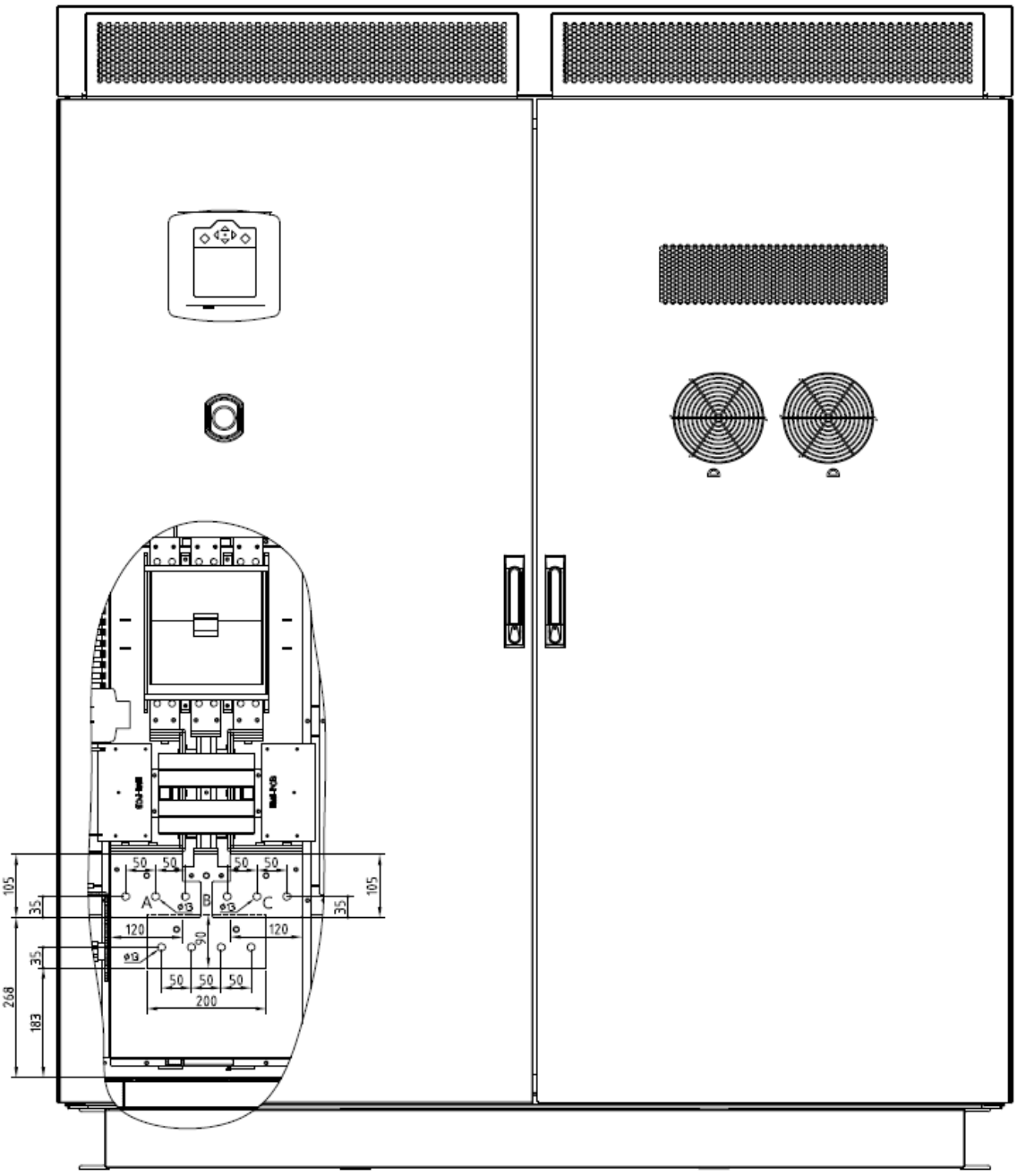
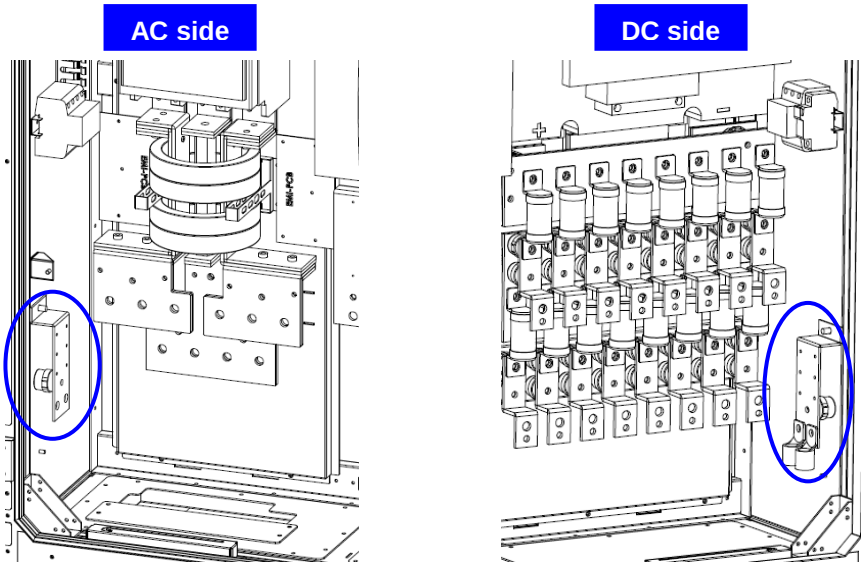


Figure 5-9. Dimensions of the AC connection lugs

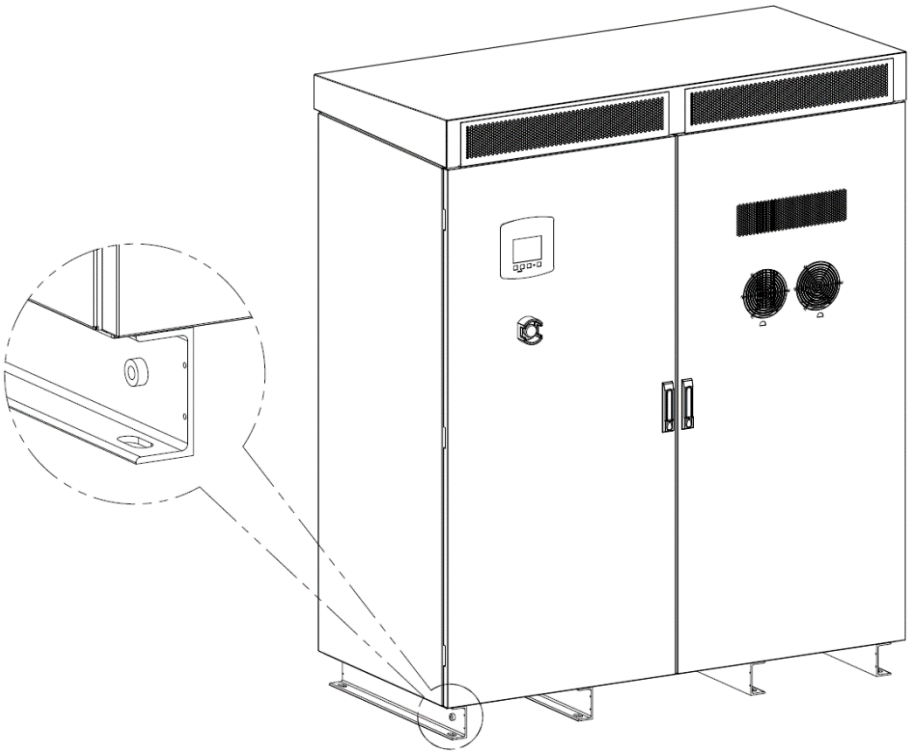
5.4. PE Connection

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.



(a)



(b)

Figure 5-10. PE Connection (a) inverter inside; (b) inverter outside

5.4.1. Dimension of PE Busbar

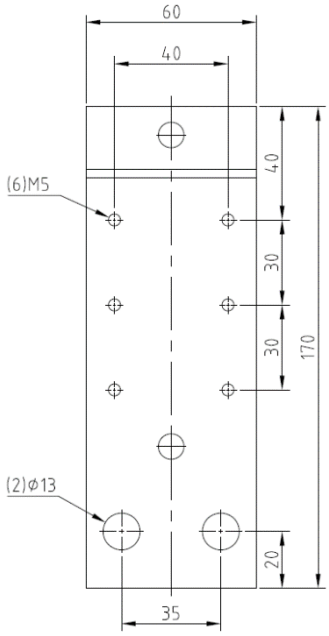


Figure 5-11. Dimensions of the PE connection lugs

PE Terminal	Maximum No. of conductor (DC/AC)	Screw/Nut size	Torque requirement (Nm)
	2/2	M10	25

PE Cable	Minimum total cable size requirement
	250mm^2

CAUTION!

The working temperature of cable should be 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 5-11.
2. Please refer to Appendix B to check the overall diameter of cable and the width of the terminal lug whether to match the range of cable gland. If the width of terminal is indeed larger than the limitation, you must thread the cable through the gland first and then press the terminal on the cable during the connection.
3. 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

5.5. DC Fuse Installation

1. Loosen the screws on the busbars, and then take the busbars off.

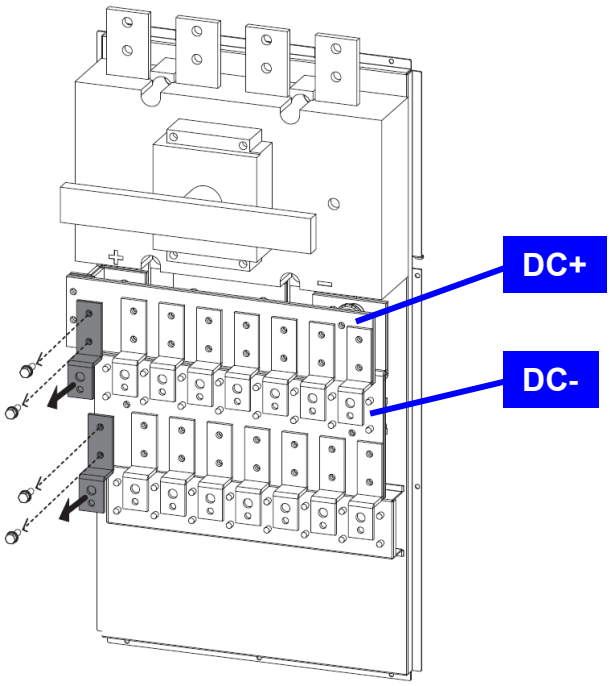


Figure 5-12. Remove screws and busbars

2. The steps of DC+ and DC- are the same, so install busbars and fuses, follow these steps:

- Put the busbar and screw on the barrier and tighten the screw
- Put the fuse and screws on the barrier DC+/DC- busbar and tighten the screws.

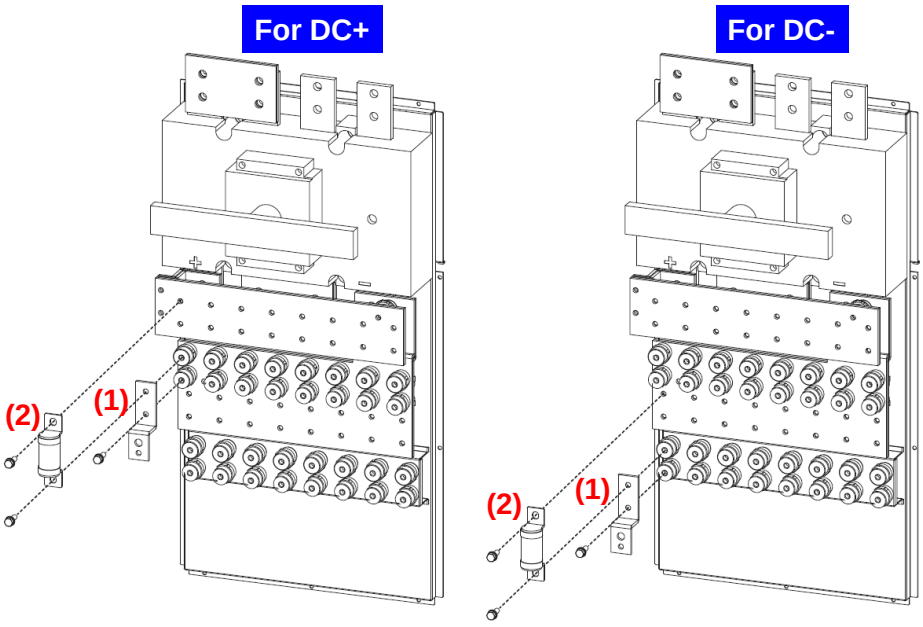


Figure 5-13. Install fuses and busbars

5.6. 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.

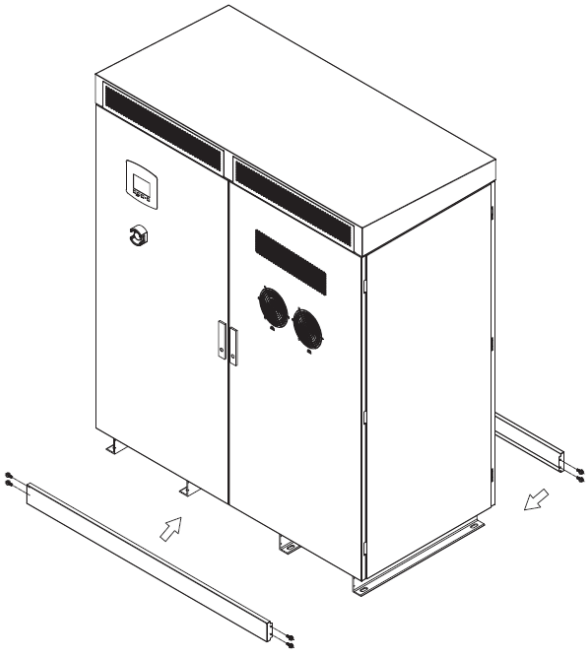


Figure 5-14. Attaching the plates

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.

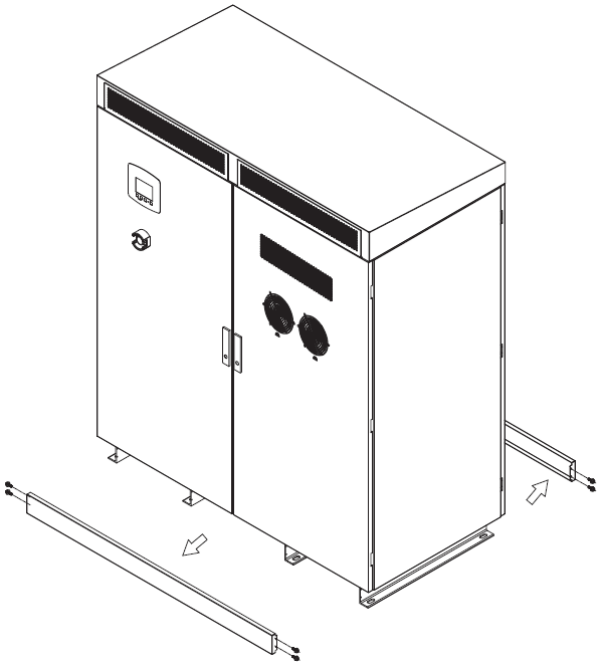


Figure 5-15. Removing the plates

5.7. Connection of Communication Modules

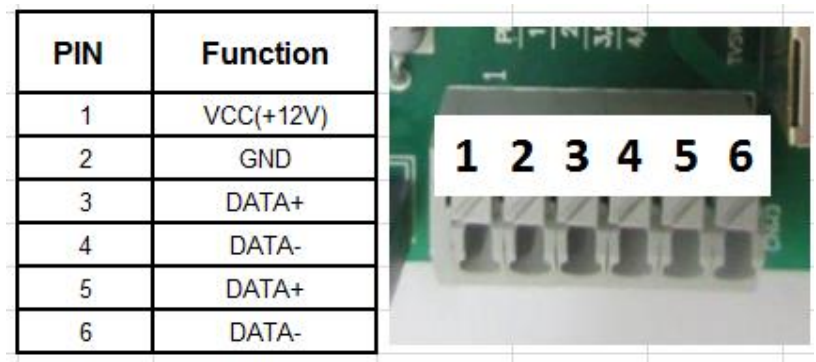
The Communication Module provide the function of communication with 2-port RS-485 and 2-port dry contacts.

5.7.1. RS-485 Connection

The pin definition of RS-485 is shown as in Table 5-1. 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 5-16 & Figure 5-17. Installer must switch **ON** terminal resister at the first and last devices on the RS-485 chain as Figure 5-17. The other terminal resisters must be switch **OFF**. Please refer to Table 5-3 for the terminal resister setting.

Table 5-1: Definition of RS-485 PIN

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



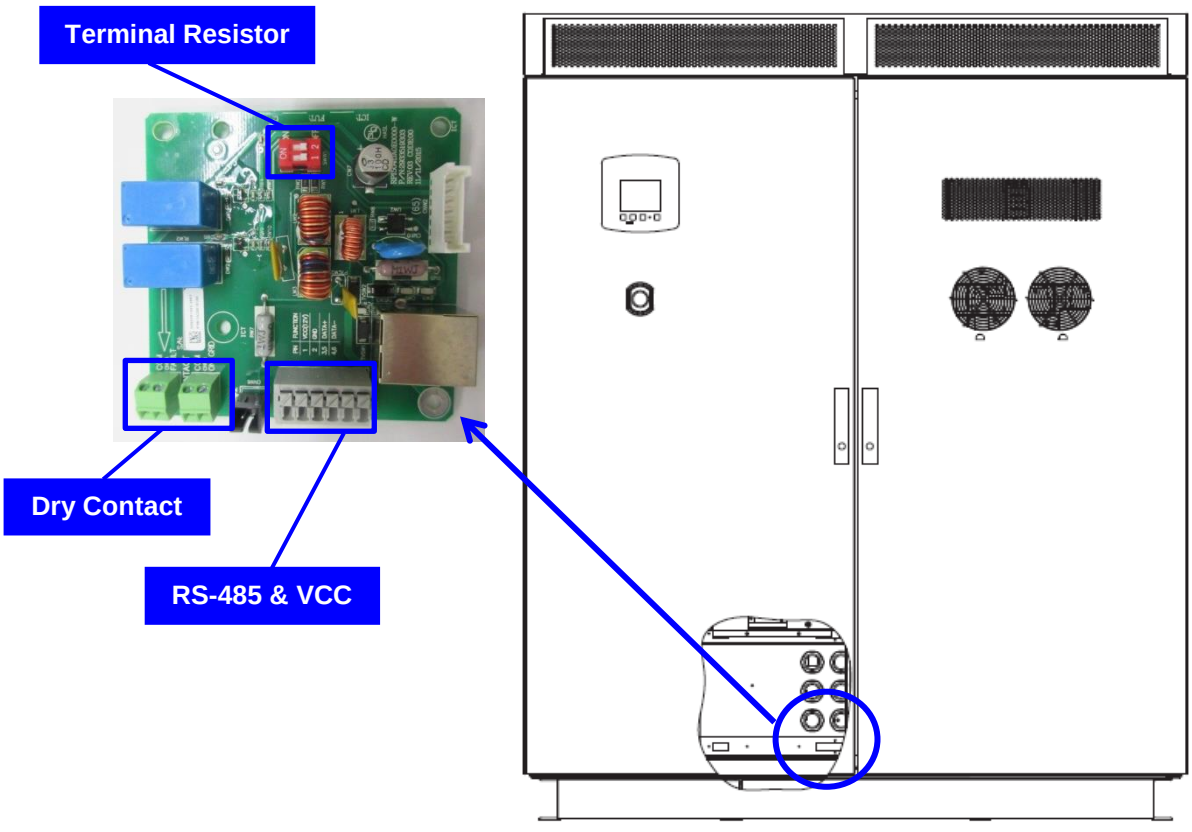


Figure 5-16. Cable Wire Position for Multi-inverter Connection

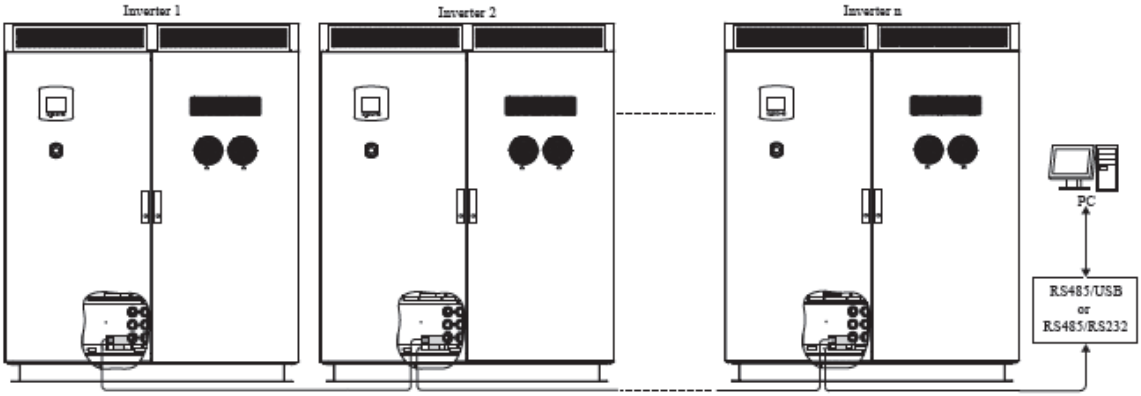
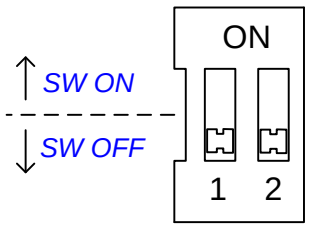


Figure 5-17. Multi-inverter Connection Illustration

Table 5-2: RS-485 Data Format

Baud rate	9600
Data bit	8
Stop bit	1
Parity	N/A

Table 5-3: Terminal Resister Setting



Terminal Resistor \ SW	1	2
OFF	OFF	OFF
ON	ON	OFF
	OFF	ON
	ON	ON

5.7.2. 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.

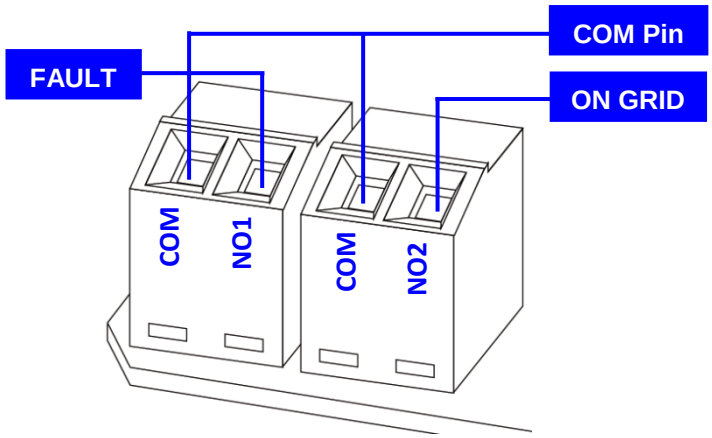


Figure 5-18. Dry Contact Port & Assignments

5.8. Auxiliary Power from External Source

If the power source of AC auxiliary power is changed from internal to external source, follow these steps:

1. Disconnect the terminal cables from the AC breaker.

Note:

The external power source should be able to provide with voltage 3P3W - 270Vac/315Vac/380Vac/400Vac ±15%, 50/60Hz, and power rating – 3kVA.

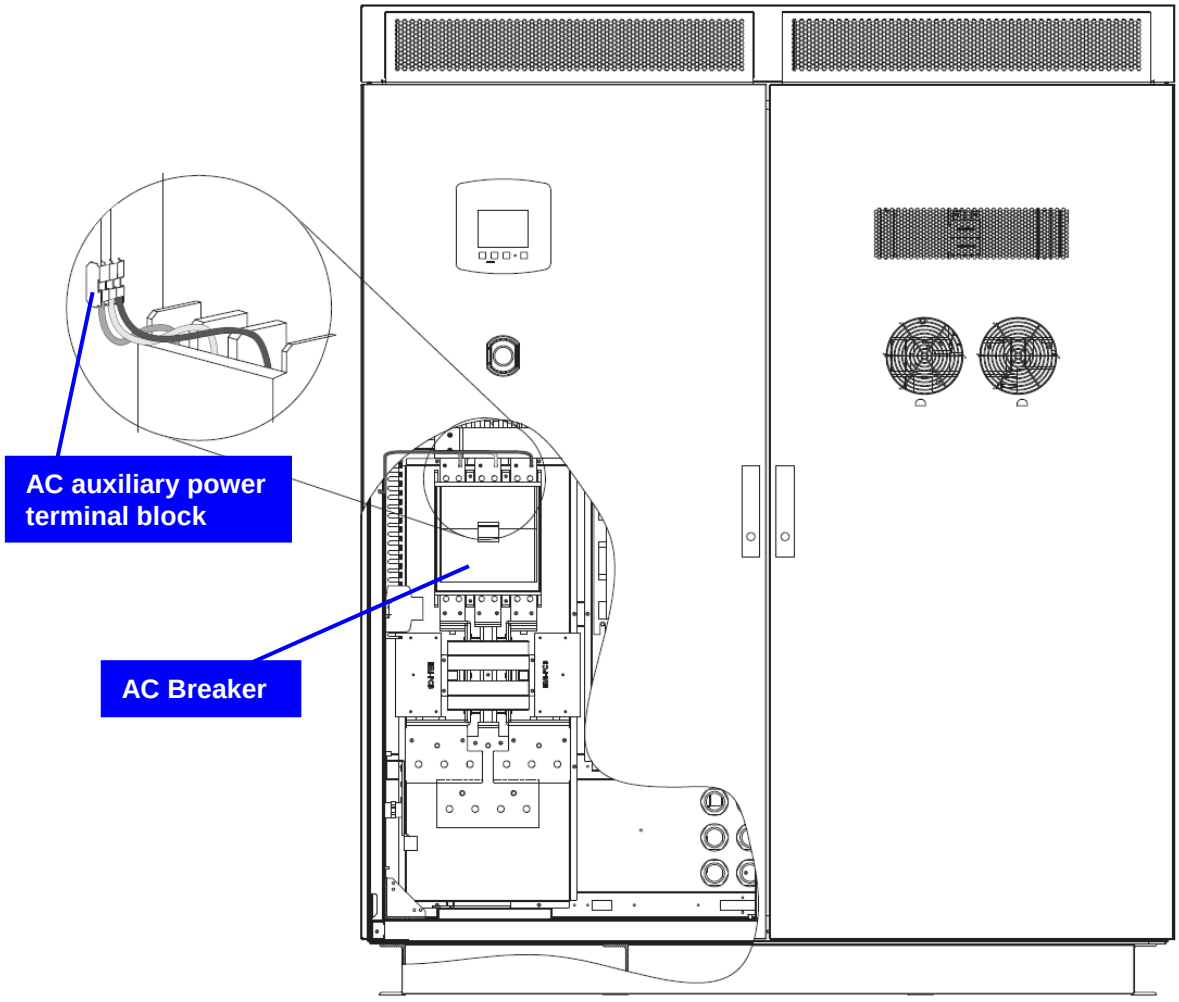


Figure 5-19. AC auxiliary Power Terminal Block Position

2. Disconnect the terminal cables from the AC auxiliary terminal block.

3. Remove the cables from the AC auxiliary power terminal block and AC breaker.

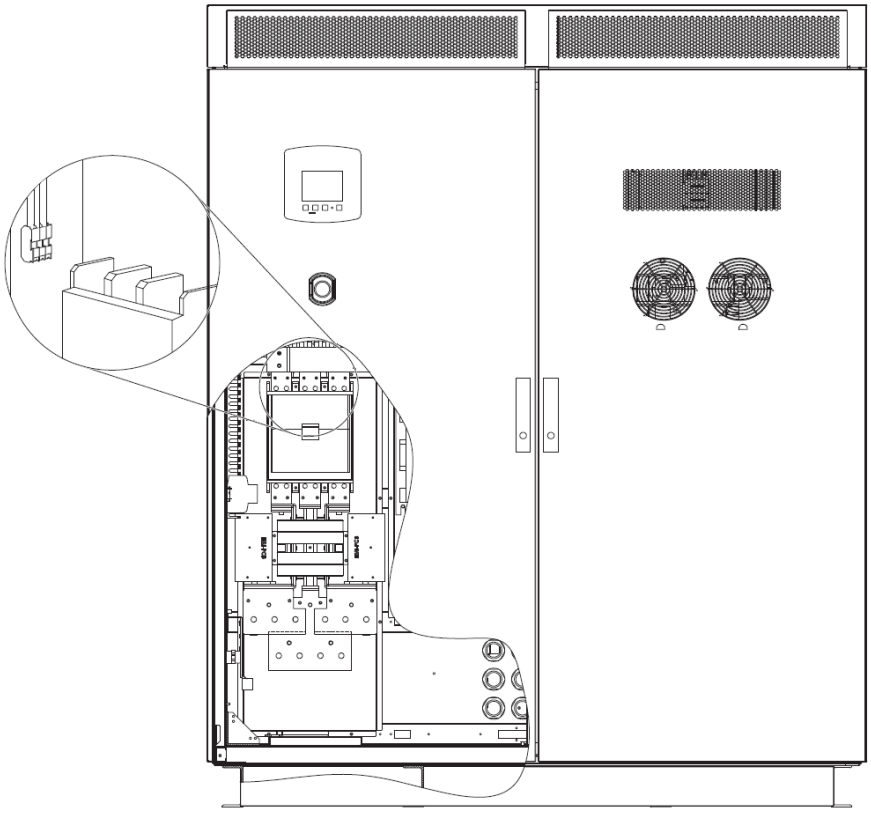


Figure 5-20. Removing the Cables

4. Thread the external power cables through the cable gland from external source.

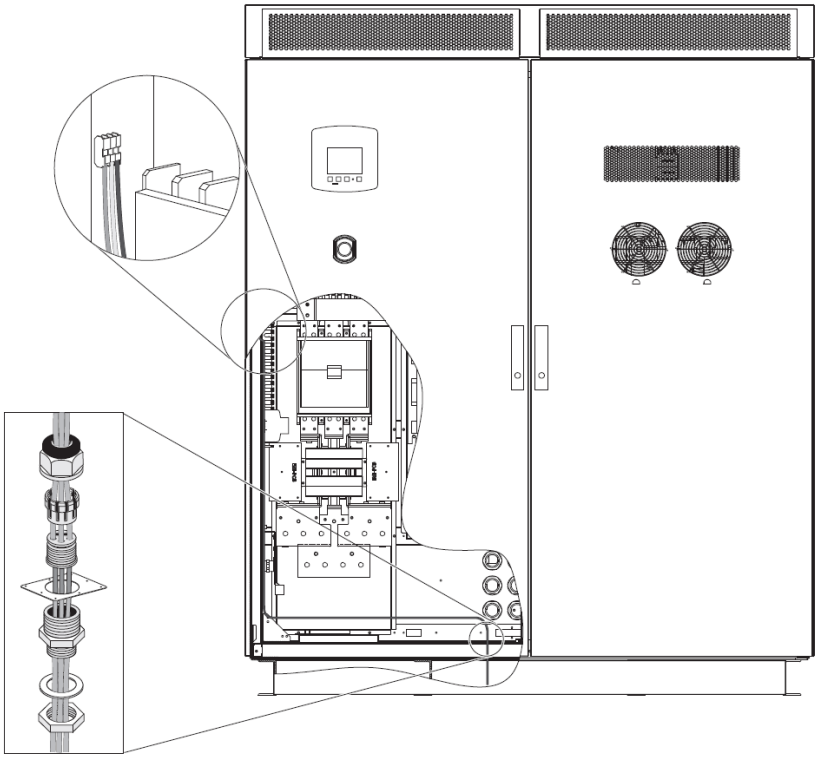


Figure 5-21. Auxiliary Power from External Source

5. Connect the terminal cables from external source to AC auxiliary terminal block.

5.9. First Time Powering Up

5.9.1. Before Powering Up

1. Check the PV array.

Note:

The PV array open circuit DC voltage must be greater than 500Vdc 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 270Vac or 315Vac Line to Line.

5.9.2. 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 pressing 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.

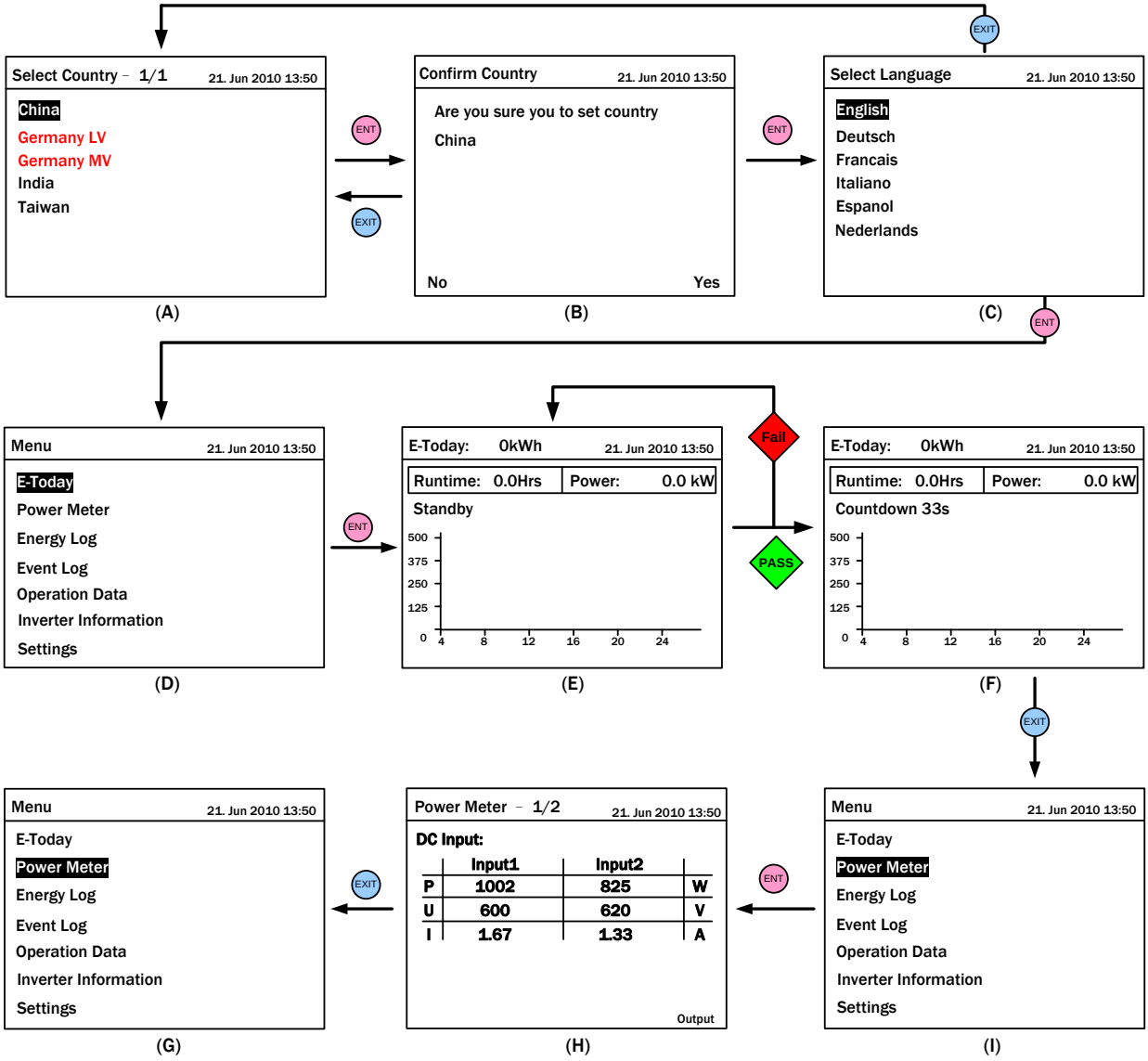


Figure 5-22. Configuration Screens

Note:

If Auxiliary Power is powered externally, the LCD display should be turn on before inverter working. Please refer to 5.8 *Auxiliary Power from External Source.*

5.10. Active/Reactive Power Control and Fault Ride Through

User can only set Active/Reactive power control in Grid System = Germany MV, India, or China (User has to key in password to change these settings). Fault ride through (FRT) can only be set in Grid System = Germany MV, India, or China.

There are 2 settings for active power control and 4 settings for reactive power control based on the requirement from network operator. User can select either or both active power control methods and/or one of the reactive power control methods.

5.10.1. Active Power Control

5.10.1.1. Power Limit

According to BDEW technical guideline in page 25 of June 2008 version as below:

It must be possible to operate the generating facility at reduced power output. In the cases listed below, the network operator is entitled to require a temporary limitation of the power feed-in or disconnect the facility:

- *potential danger to secure system operation,*
- *congestion or risk of overload on the network operator's network,*
- *risk of islanding,*
- *risk to the steady-state or dynamic network stability,*
- *rise in frequency endangering the system stability,*
- *repairs or implementation of construction measures,*
- *within the scope of generation management/ feed-in management/ network security management (see „Grundzüge zum Erzeugungsmanagement")*

User can reduce inverter output power by set percentage of actual or rated power. Please refer to **5.11.7.4.1 Power Limit** for the settings procedure.

5.10.1.2. Power vs. Frequency

User can set all necessary settings to meet the requirements from network operator. Please refer to **5.11.7.4.2 Power vs. Frequency** for the settings procedure.

Where:

P_m	is the power generated at the time of exceeding f_{start}
P	is the feeding power
f	is the mains frequency
fstart	is the freuqncy which starting power reduction
fstop	is the frequency which has zero power
Gradient	is the slop of power reduction

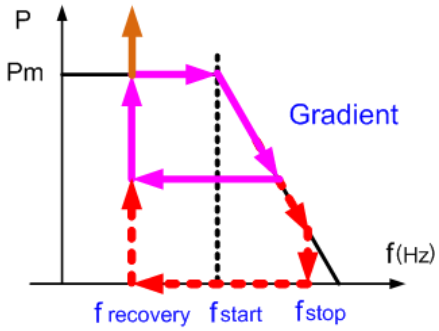


Figure 5-23. Power vs. frequency characteristic

5.10.2. Reactive Power Control

According to BDEW:

With active power output, it must be possible to operate the generating plant in any operating point with at least a reactive power output corresponding to a active factor at the network connection point of

cos φ = 0.95 underexcited to 0.95 overexcited

Values deviating from the above must be agreed upon by contract. In the consumer reference arrow system, that means operation in quadrant II (under-excited) or III (overexcited).With active power output, either a fixed target value for reactive power provision or a target value variably adjustable by remote control (or other control technologies) will be specified by the network operator in the transfer station. The setting value is either

a) a fixed active factor cosφ or
b) a active factor cosφ(P) or
c) a fixed reactive power in MVar or
d) a reactive power/voltage characteristic Q(U).

5.10.2.1. Fixed Active Factor cosφ

User can set reactive current from Cap 0.80 to Ind 0.80 (inverter would stop reactive power control if output power is below 10% rated power).

5.10.2.2. Active Factor cosφ(P)

Once user enables this method, inverter will deliver reactive current according to output active power at that moment. The below figure is an example. Please refer to **5.11.7.4.4 cosφ(P)** for the settings procedure.

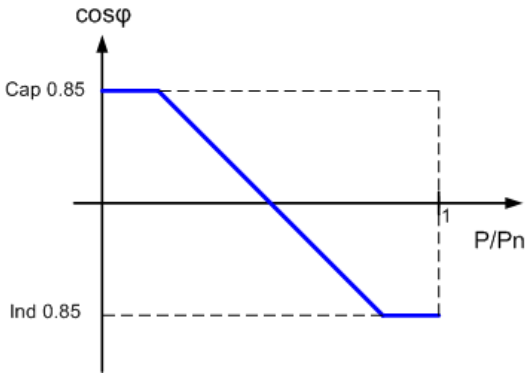


Figure 5-24. cosφ(P) characteristic

5.10.2.3. Fixed Reactive Power

Once user enables this method, inverter will deliver reactive power (ie. Q) according to the fixed reactive power setting. The setting range is from Cap 60% to Ind 60%.

5.10.2.4. Reactive Power/Voltage Characteristic Q(U)

After selecting “Q(U) control”, User can set Q vs. Grid voltage operation curves as below.

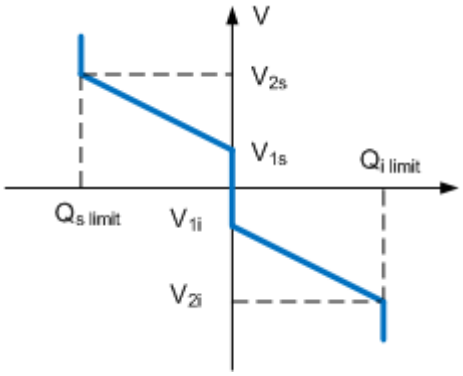


Figure 5-25. Q(U) characteristic

5.10.3. Fault Ride Through (FRT)

According to BDEW:

2.5.1.2 Dynamic network support

Dynamic network support means voltage control in the event of voltage drops within the high and extra-high voltage network with a view to avoiding unintentional disconnections of large feed-in power, and thus network collapse. In the light of the strong increase in the number of generating plants to be connected to the medium-voltage network, the integration of these plants into the dynamic network support scheme is becoming ever more important. Consequently, these generating plants must generally participate in dynamic network support even if this is not required by the network operator at the time of the plant's connection to the network. That means that generating plants must be able in technical terms

- *not to disconnect from the network in the event of network faults,*
- *to support the network voltage during a network fault by feeding a reactive current into the network,*
- *not to extract from the medium-voltage network after fault clearance more inductive reactive power than prior to the occurrence of the fault.*

These requirements apply to all types of short circuits (i.e. to single-phase, two-phase and three-phase short circuits).

Just like in the Transmission Code 2007 7, a distinction is made in these guidelines between type-1 and type-2 generating plants with regard to their behaviour in the event of network disturbances. A type-1 generating unit exists if a synchronous generator is directly (only through the generator transformer) connected to the network. All other plants are type-2 generating units.

The following conditions shall apply to type-2 generating plants, taking the Transmission Code 2007, Section 3.3.13.5, into account:

- *Generating units must not disconnect from the network in the event of voltage drops to 0 % Uc of a duration of ≤ 150 ms.*

- *Below the blue line shown in Figure 2.5.1.2-2, there are no requirements saying that generating plants have to remain connected to the network.*

Voltage drops with values above the borderline 1 must not lead to instability or to the disconnection of the generating plant from the network (TC2007; 3.3.13.5, section 13; extended to asymmetrical voltage drops).

If the voltage drops at values above the borderline 2 and below the borderline 1, generating units shall pass through the fault without disconnecting from the network. Feed-in of a short-circuit current during that time is to be agreed with the network operator. In consultation with the network operator, it is permissible to shift the borderline 2 if the generating plant's connection concept requires to do so. Also in consultation with the network operator, a short-time disconnection from the network is permissible if the generating plant can be resynchronized 2 seconds, at the latest, after the beginning of the short-time disconnection. After resynchronization, the active power must be increased with a gradient of at least 10% of the nominal capacity per second (TC2007; 3.3.13.5, section 14).

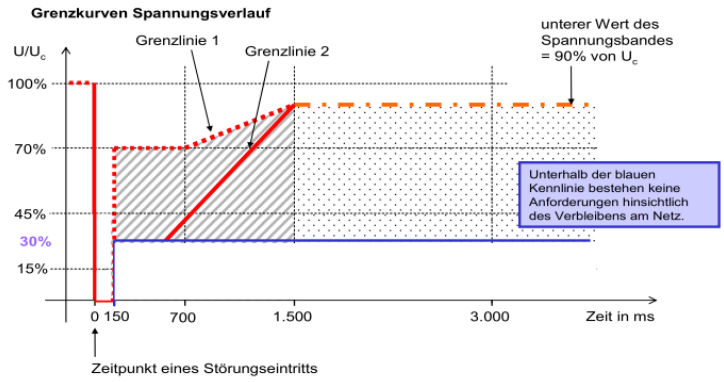


Figure 5-26. Borderlines of the voltage profile of a type-2 generating plant at the network connection point

RPI-C500 implements the FRT behavior as the figure below, in area

1. Keep normally operate
2. Feed-in reactive current according to ΔU/Un and K factor
3. Short time disconnect
4. Long time disconnect

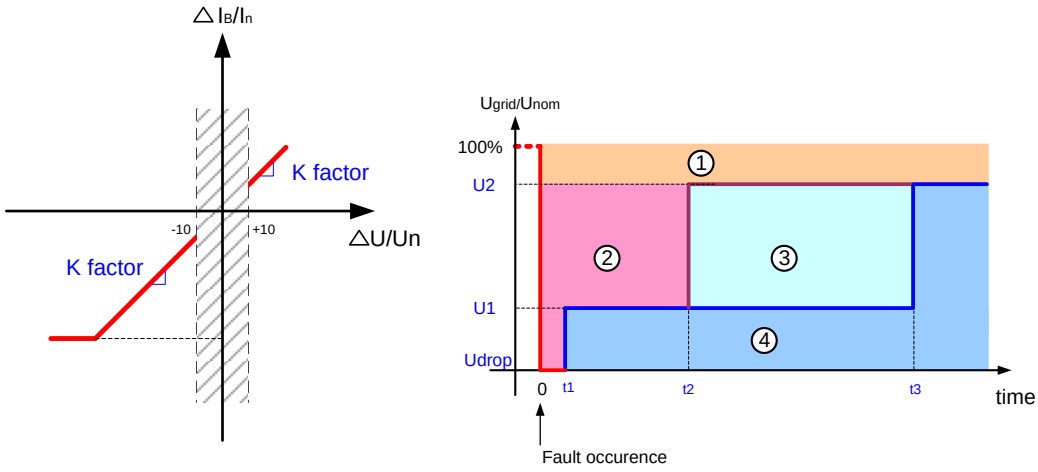


Figure 5-27. FRT characteristic

5.11. LCD Flowchart

Press ***EXIT*** button will enter menu page (Figure 5-28), E-today is the home page for the following items in this section.

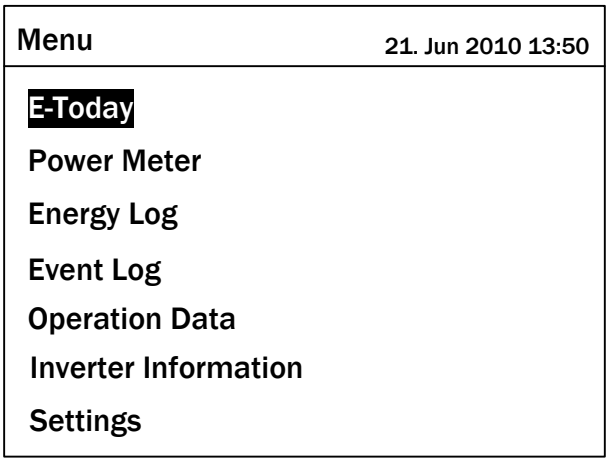


Figure 5-28. Menu Page

5.11.1. Home Page

When inverter is operating normally, LCD will show home page as Figure 5-29, user can get the information of output power, inverter status, E-today, date and time.

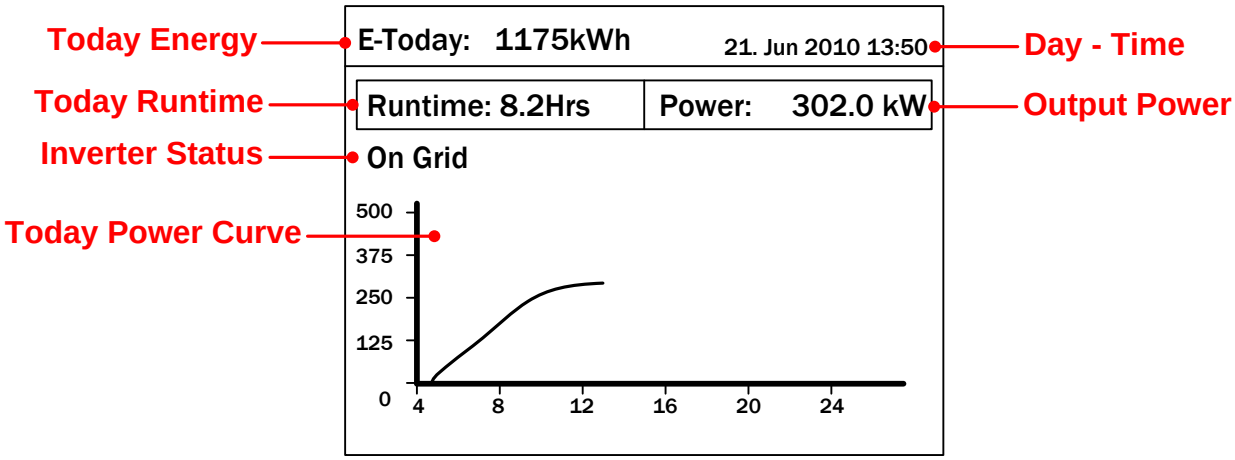


Figure 5-29. Home Page

5.11.2. Power Meter

This page shows the information about input and output power.

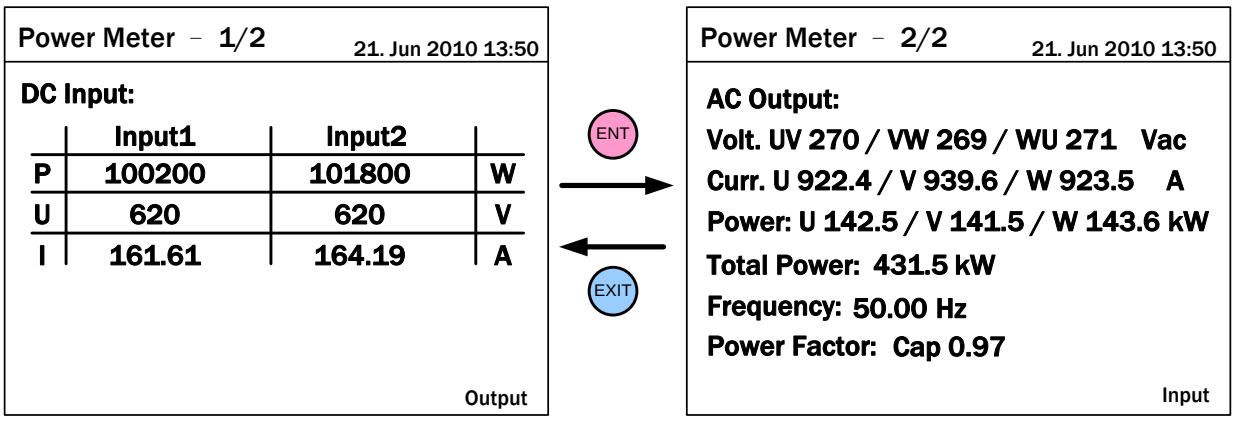


Figure 5-30. Power Meter Page

5.11.3. Energy Log

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

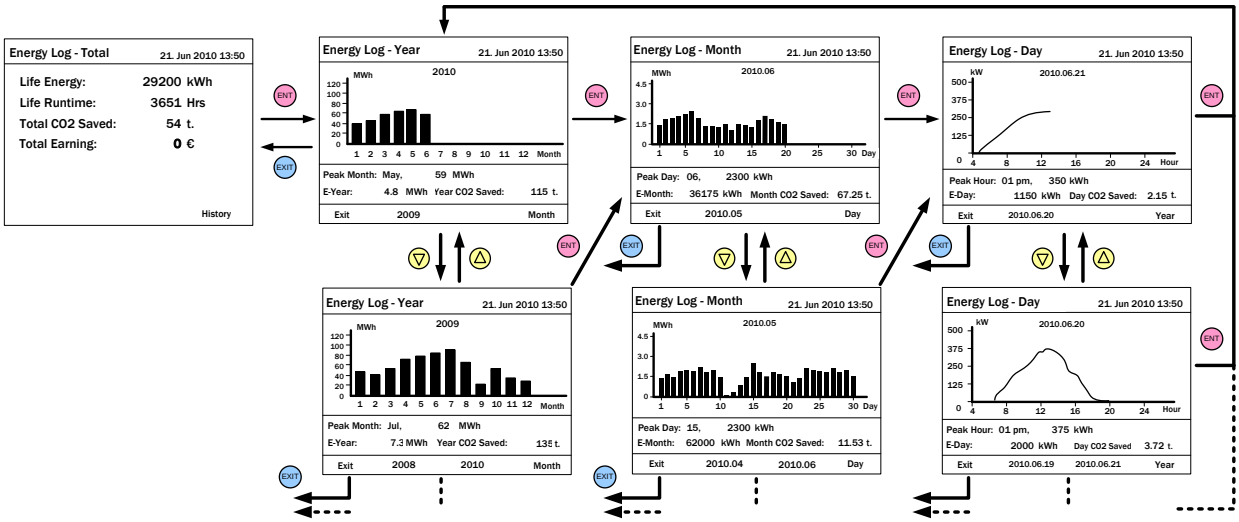


Figure 5-31. Energy Log Flow Chart

5.11.4. 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 statistic data.

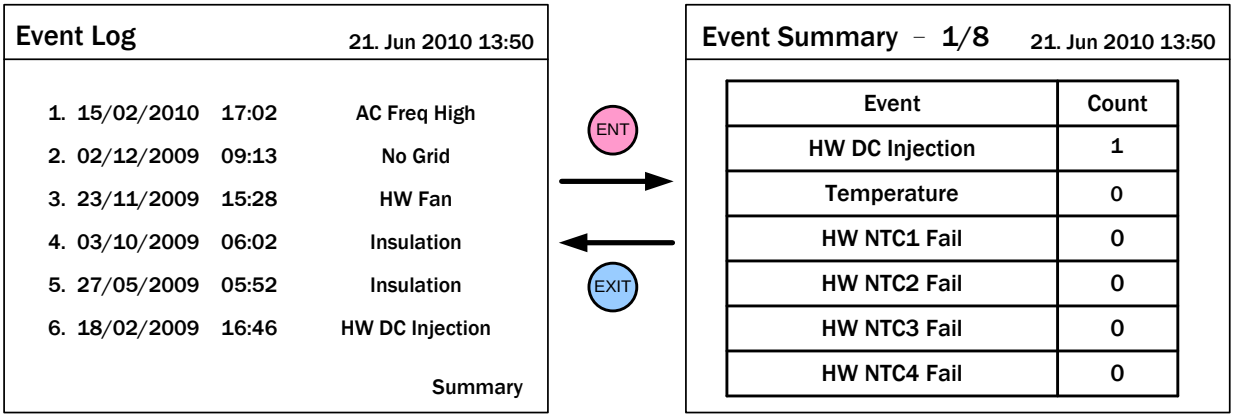


Figure 5-32. Event Log Flow Chart

5.11.5. Operation Data

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

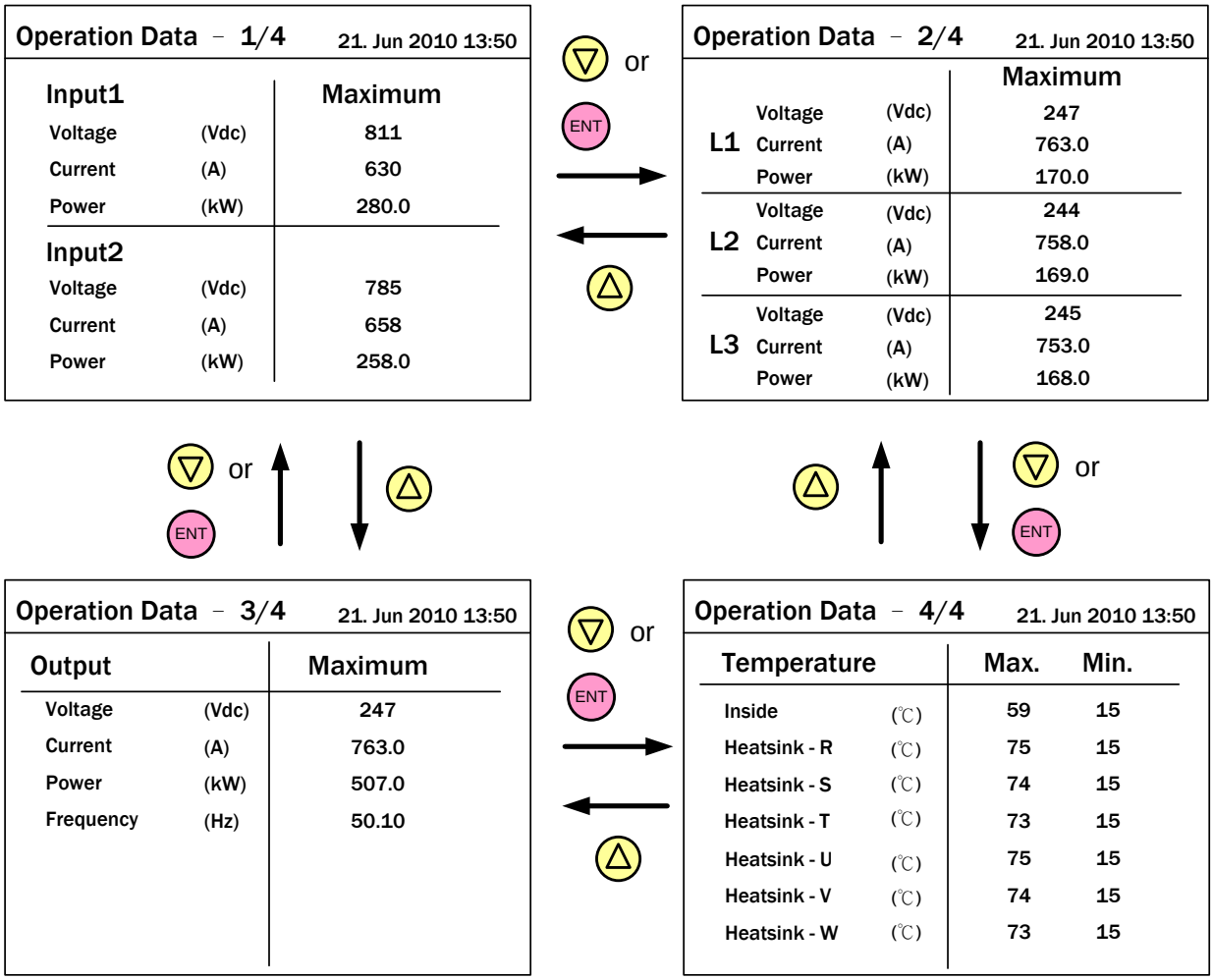


Figure 5-33. Operation Data Flow Chart

5.11.6. 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*.

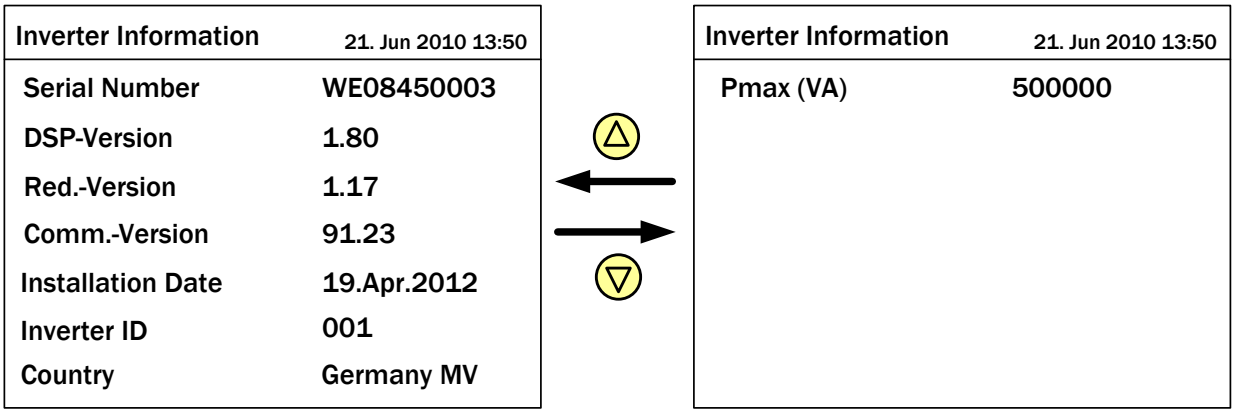


Figure 5-34. Inverter Information Page

5.11.7. Settings

The Settings menu includes Personal Setting, Coefficients setting, Install Setting, Active/Reactive Power Control, and FRT.

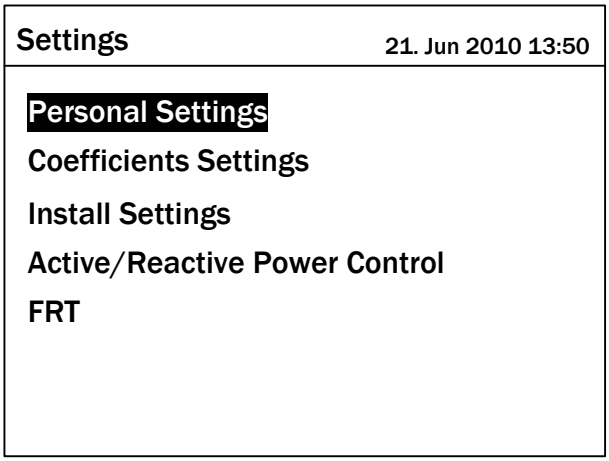


Figure 5-35. Setting Page

5.11.7.1. 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 LDC backlight will turn off automatically. Brightness and Contrast can adjust the level 1-5 (low- high).

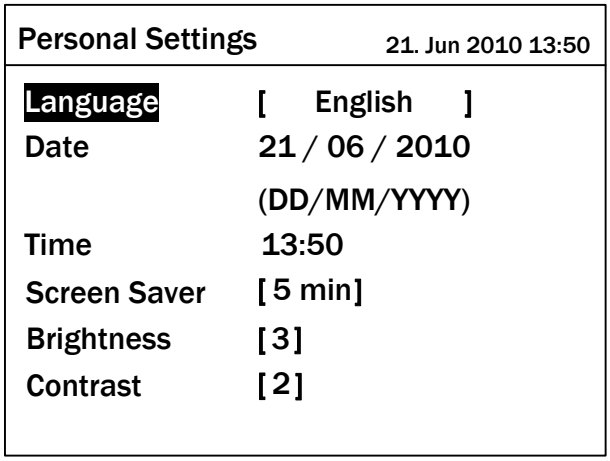


Figure 5-36. Personal Settings Page

5.11.7.2. Coefficient Settings

Users can set the following parameters according their needs.

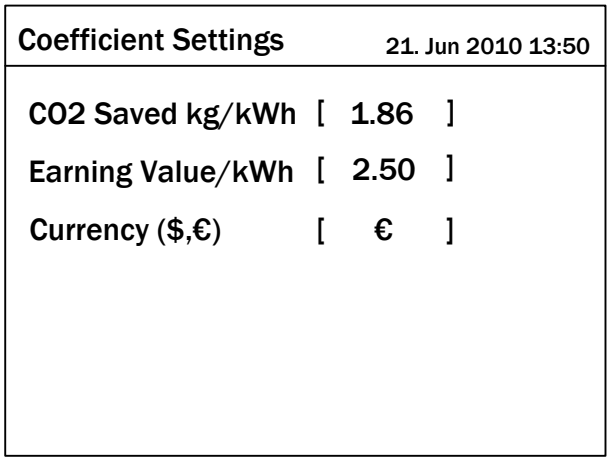


Figure 5-37. Coefficient Settings Page

5.11.7.3. Install Settings

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.

CAUTION!

CAUTIONS APPEAR BEFORE THE TEXT IT REFERENCES. CAUTIONS APPEAR IN CAPITAL LETTERS TO EMPHASIZE THAT THE MESSAGE CONTAINS VITAL HEALTH AND SAFETY INFORMATION.

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.

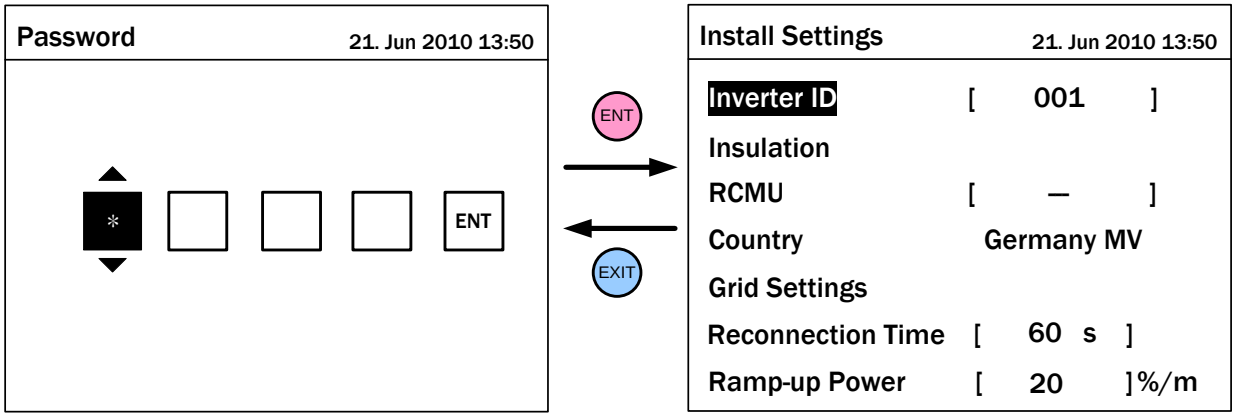


Figure 5-38. Install Setting Page -User Mode

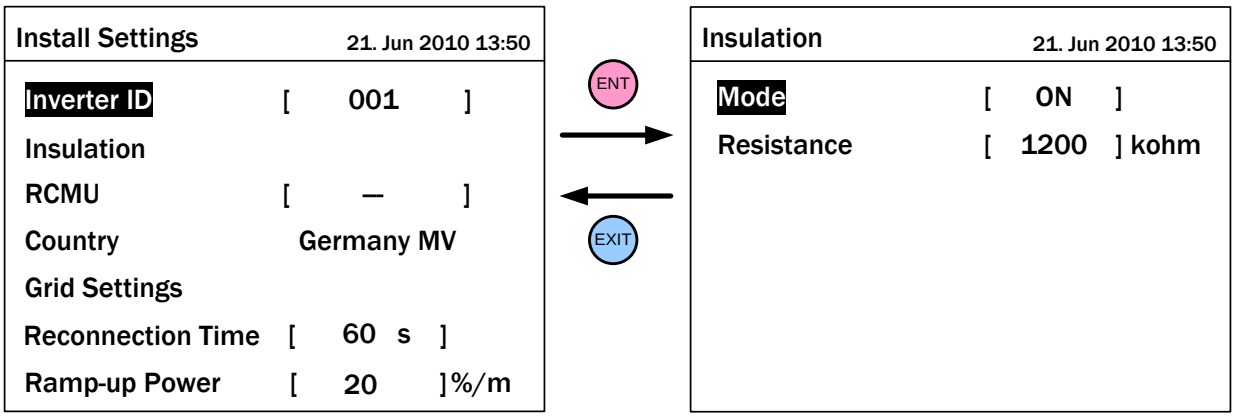


Figure 5-39. Insulation Setting

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.

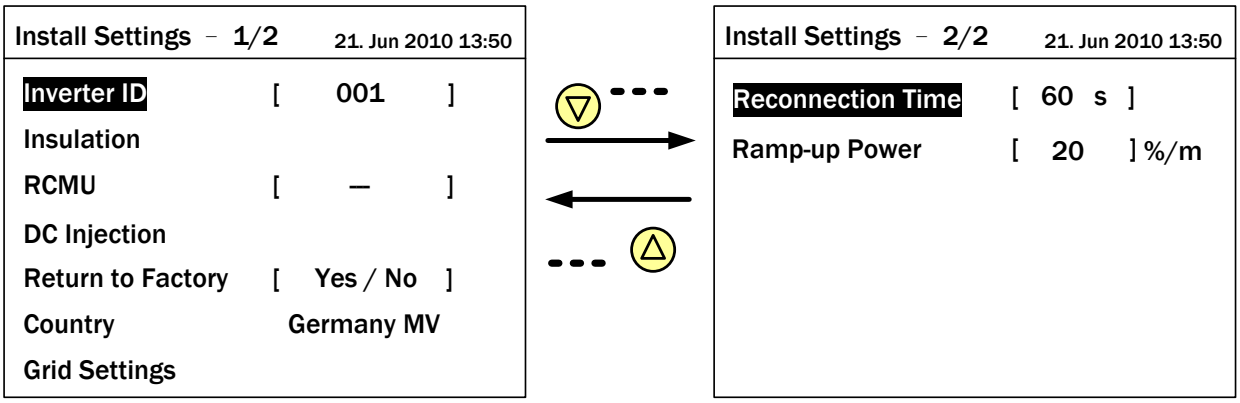


Figure 5-40. Install Setting Page -Installer Mode

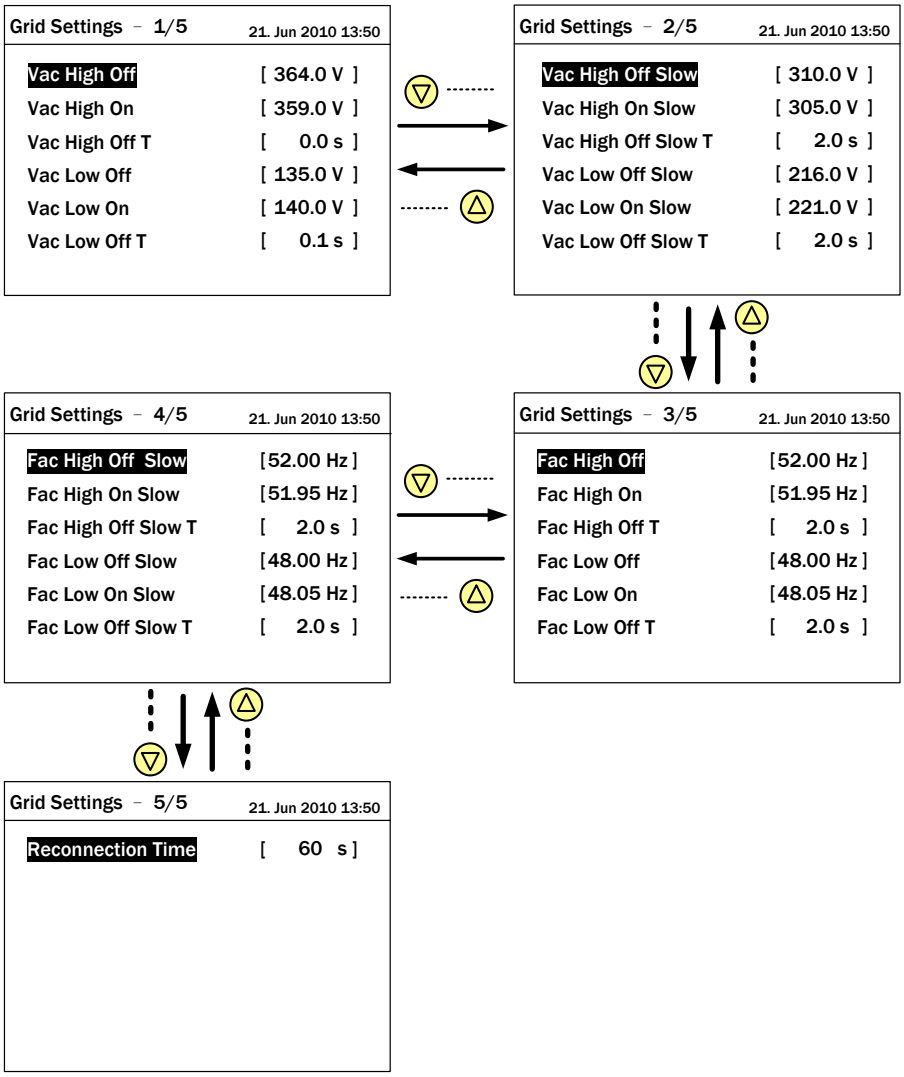


Figure 5-41. Grid Setting Page

There are 19 parameters in Grid Settings page. User can refer to Table 5-4. for the function of each parameter.

Table 5-4: Grid Setting Parameters

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 5-4: Grid Setting Parameters (Continued)

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.

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”.

5.11.7.4. Active/Reactive Power Control

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

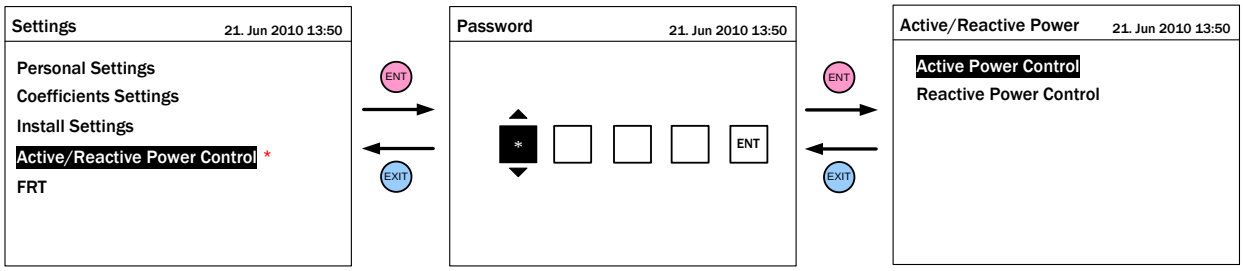


Figure 5-42. Active/Reactive power setting page

5.11.7.4.1. 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”.

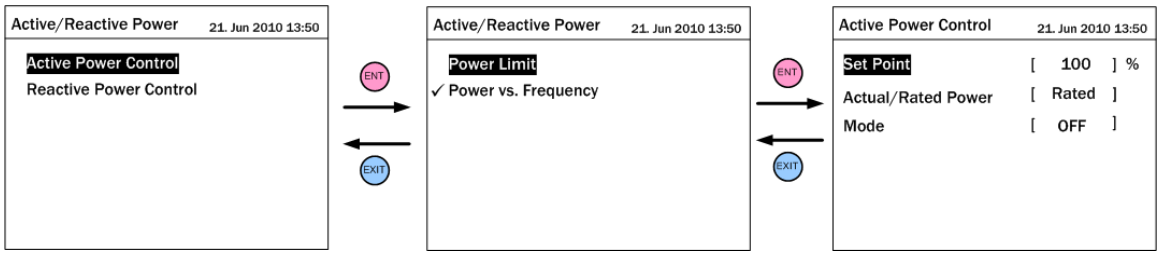


Figure 5-43. Power limit setting page

5.11.7.4.2. Power vs. Frequency

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

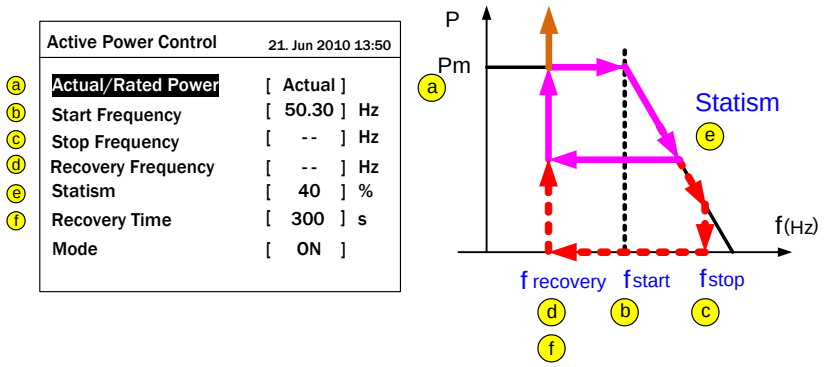


Figure 5-44. Power vs. frequency setting page

5.11.7.4.3. 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.

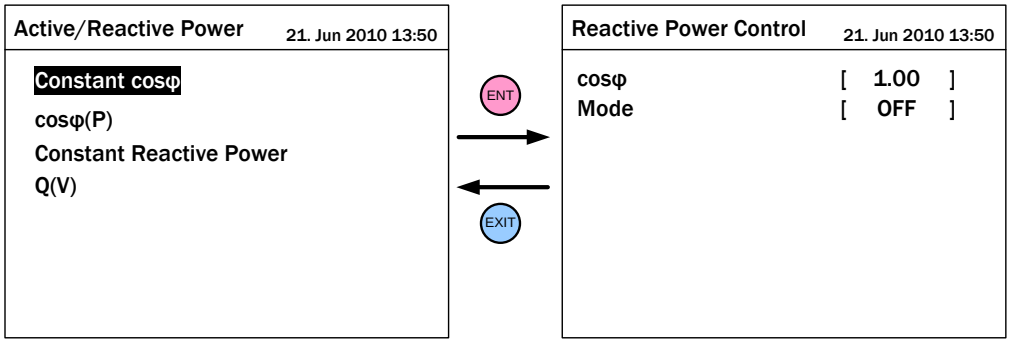


Figure 5-45. Constant cosφ setting page

5.11.7.4.4. 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.

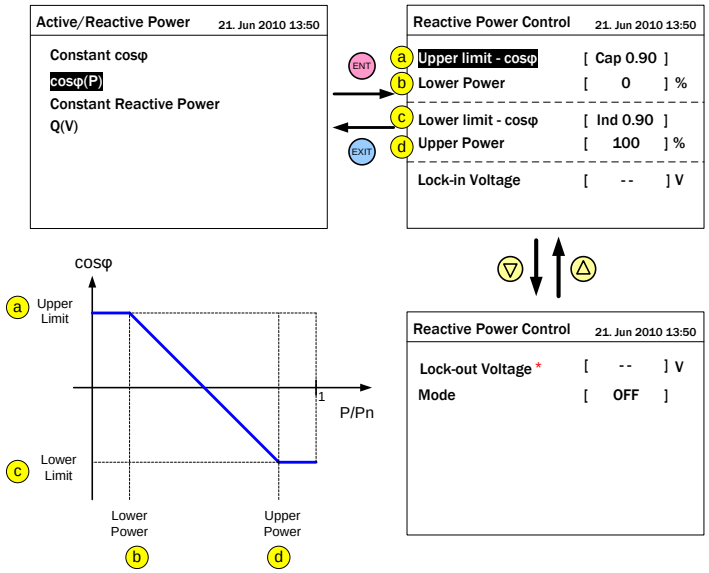


Figure 5-46. cosφ(P) setting page

5.11.7.4.5. Constant Reactive Power

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

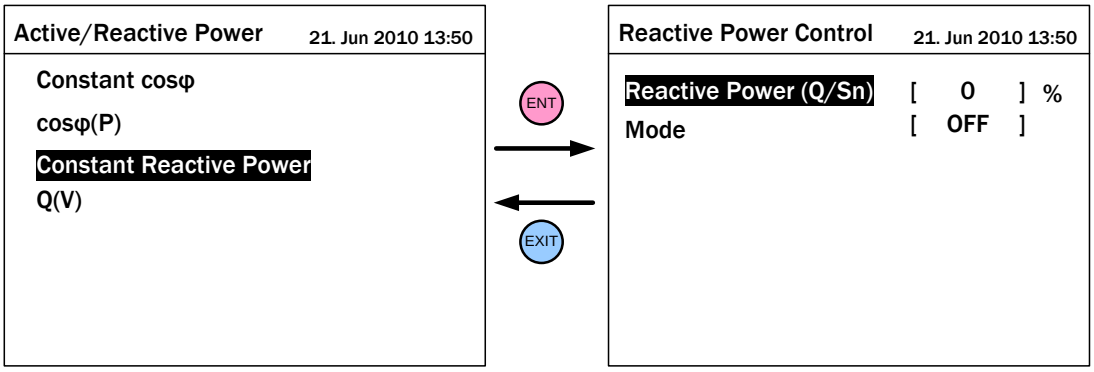


Figure 5-47. Constant Reactive Power setting page

5.11.7.4.6. Q(U)

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

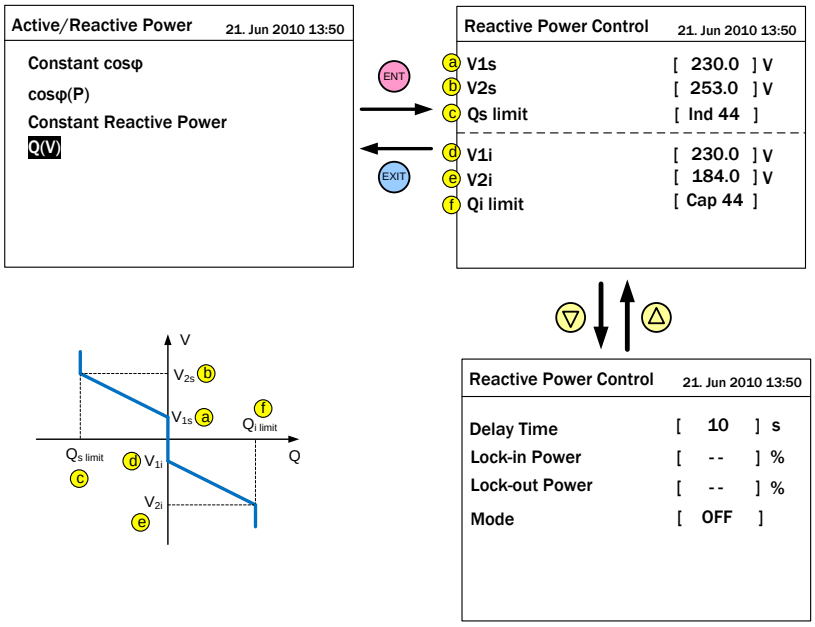


Figure 5-48. Q(U) setting page

5.11.7.5. FRT (Fault ride through)

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

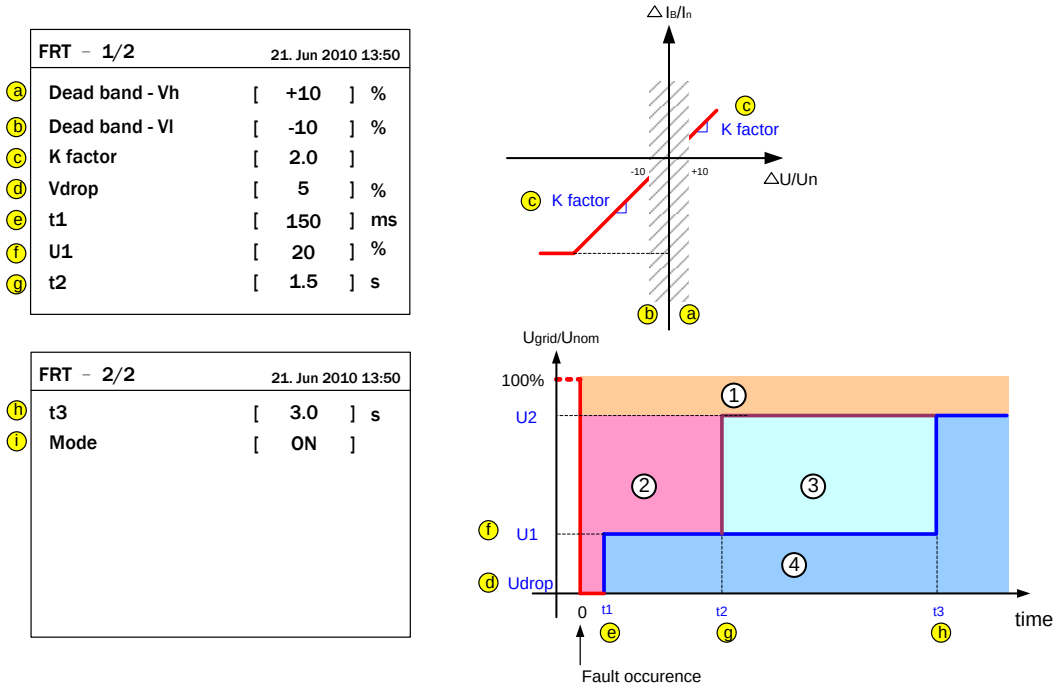


Figure 5-49. FRT setting page

6. Troubleshooting

6.1. Measurement Index

Please refer to the following tables for definition of Measurement Index.

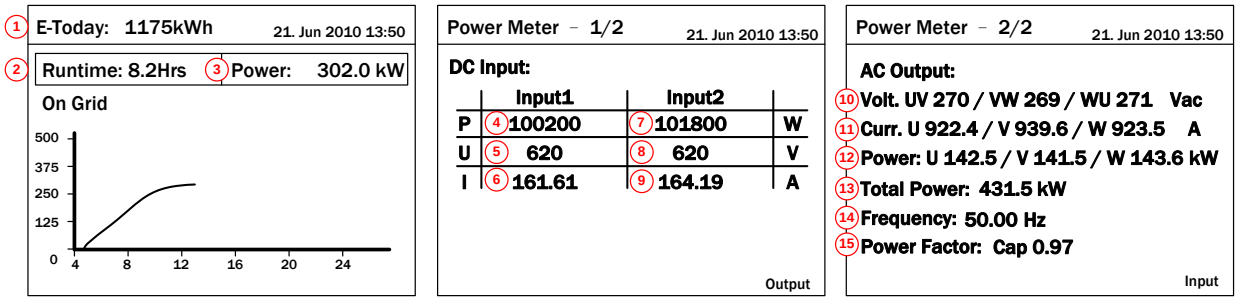


Figure 6-1. Measurement Index (1 of 3)

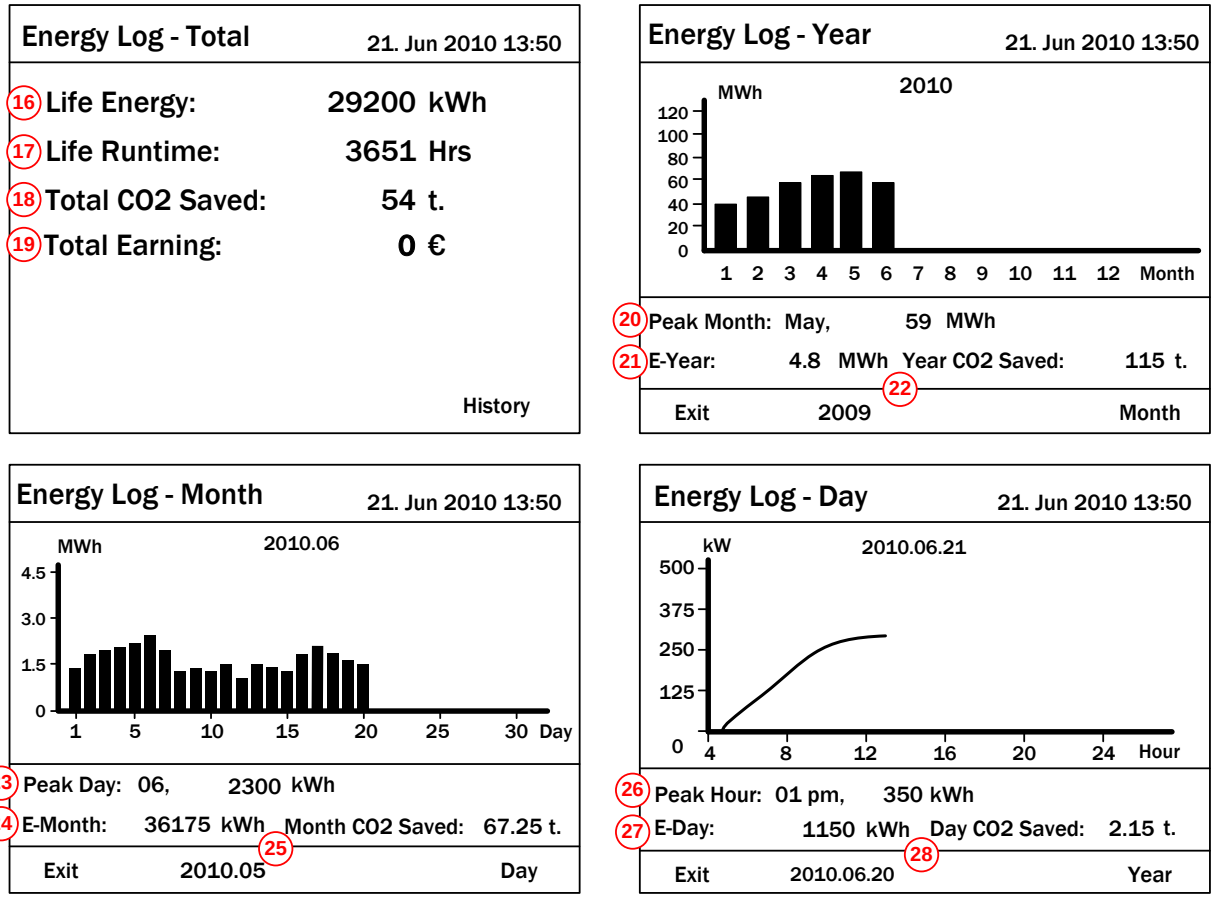


Figure 6-2. Measurement Index (2 of 3)

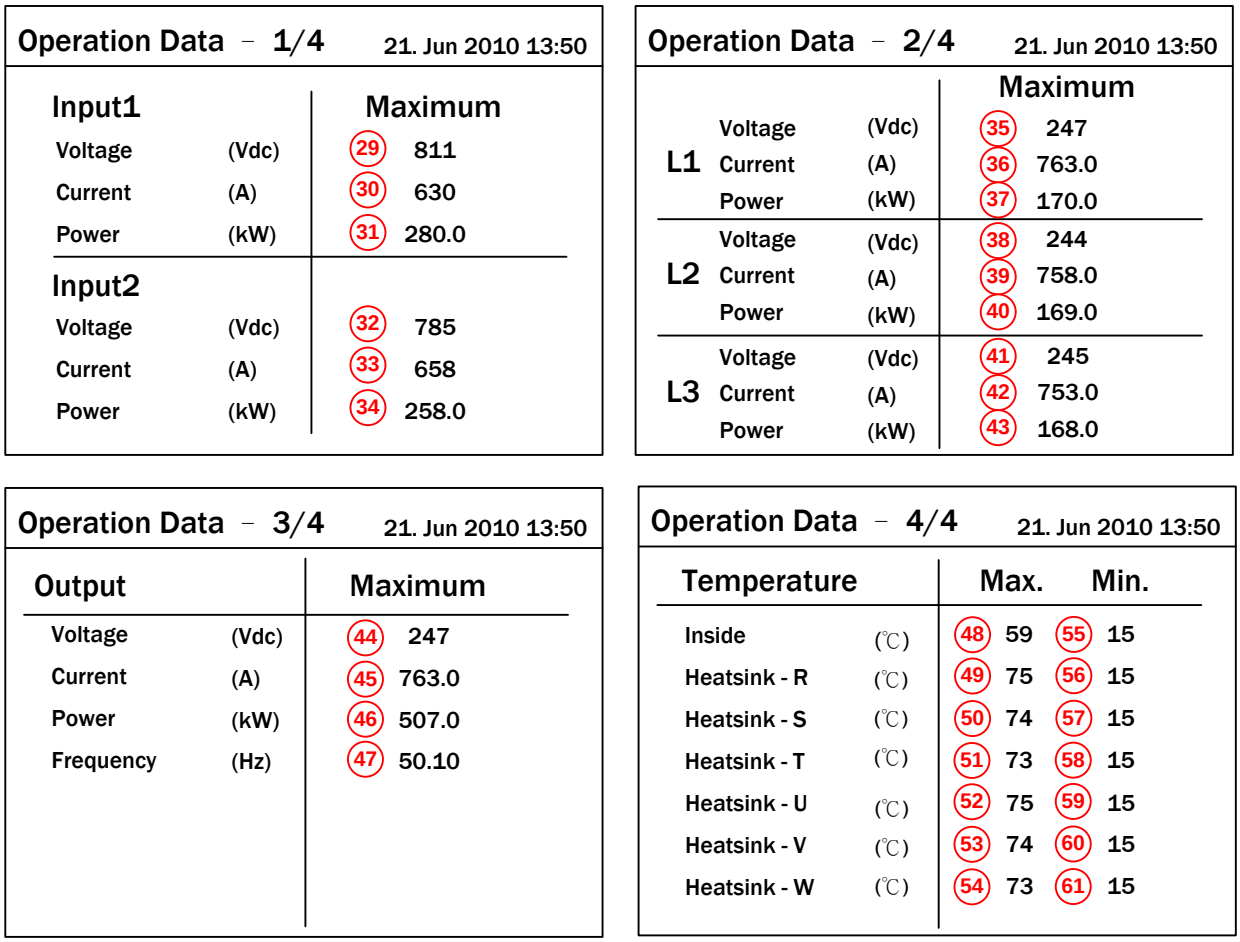


Figure 6-3. Measurement Index (3 of 3)

Table 6-1: Measurement Index

No.	Measurement	Meaning
1	E-Today	Total energy generated today
2	Runtime	Operation time today
3	Power	Actual power is generating
4	DC Input1 - P	Power of DC Input1
5	DC Input1 - U	Voltage of DC Input1
6	DC Input1 - I	Current of DC Input1
7	DC Input2 - P	Power of DC Input2
8	DC Input2 - U	Voltage of DC Input2
9	DC Input2 - I	Current of DC Input2
10	AC Output - Voltage	Voltage of AC Output for each phase
11	AC Output - Current	Current of AC Output for each phase
12	AC Output - Power	Power of AC Output for each phase
13	AC Output - Total Power	Total power of AC Output
14	AC Output - Frequency	Frequency of AC Output

Table 6-1: Measurement Index (Continued)

No.	Measurement	Meaning
15	AC Output - Power Factor	Power factor of AC Output
16	Life Energy	Total energy generated to present time
17	Life Runtime	Accumulated operation time to present time
18	Total CO_2 saved	Accumulated CO_2 emission retrenched to present time
19	Total Earning	Accumulated the total amount of money earned
20	Peak Month	The maximum energy generated of one month in that year.
21	E-Year	Total energy generated in that year
22	Year CO_2 saved	Accumulated CO_2 emission retrenched in that year
23	Peak Day	The maximum energy generated of one day in that month
24	E-Month	Total energy generated in that month
25	Month CO_2 saved	Accumulated CO_2 emission retrenched in that month
26	Peak Hour	The maximum energy generated of one hour in that day
27	E-Day	Total energy generated in that day
28	Day CO_2 saved	Accumulated CO_2 emission retrenched in that day
29	Input1 Voltage Maximum	The maximum DC Input1 voltage from history
30	Input1 Current Maximum	The maximum DC Input1 current from history
31	Input1 Power Maximum	The maximum DC Input1 power from history
32	Input2 Voltage Maximum	The maximum DC Input2 voltage from history
33	Input2 Current Maximum	The maximum DC Input2 current from history
34	Input2 Power Maximum	The maximum DC Input2 power from history
35	L1 Voltage Maximum	The maximum L1 phase voltage from history
36	L1 Current Maximum	The maximum L1 phase current from history
37	L1 Power Maximum	The maximum L1 phase power from history
38	L2 Voltage Maximum	The maximum L2 phase voltage from history
39	L2 Current Maximum	The maximum L2 phase current from history
40	L2 Power Maximum	The maximum L2 phase power from history
41	L3 Voltage Maximum	The maximum L3 phase voltage from history
42	L3 Current Maximum	The maximum L3 phase current from history
43	L3 Power Maximum	The maximum L3 phase power from history
44	Output Voltage Maximum	The maximum Grid voltage from history
45	Output Current Maximum	The maximum output current from history
46	Output Power Maximum	The maximum output power from history

Table 6-1: Measurement Index (Continued)

No.	Measurement	Meaning
47	Output Frequency Maximum	The maximum Grid frequency from history
48	Inside Max.	The maximum inverter inner temperature value
49	Heatsink-R Max.	The maximum Heatsink-R temperature value
50	Heatsink-S Max.	The maximum Heatsink-S temperature value
51	Heatsink-T Max.	The maximum Heatsink-T temperature value
52	Heatsink-U Max.	The maximum Heatsink-U temperature value
53	Heatsink-V Max.	The maximum Heatsink-V temperature value
54	Heatsink-W Max.	The maximum Heatsink-W temperature value
55	Inside Min.	The minimum inverter inner temperature value
56	Heatsink-R Min.	The minimum Heatsink-R temperature value
57	Heatsink-S Min.	The minimum Heatsink-S temperature value
58	Heatsink-T Min.	The minimum Heatsink-T temperature value
59	Heatsink-U Min.	The minimum Heatsink-U temperature value
60	Heatsink-V Min.	The minimum Heatsink-V temperature value
61	Heatsink-W Min.	The minimum Heatsink-W temperature value

6.2. Error Message and Trouble-shooting

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

Table 6-2: Error Messages

Message	Possible cause	Action
AC Freq High	1. Actual utility frequency is over the OFR setting 2. Incorrect country setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
AC Freq Low	1. Actual utility frequency is under the UFR setting 2. Incorrect country setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
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 2. Detection circuit malfunction	1. Check the AC connection based on the manual 2. Check the detection circuit inside the inverter
No Grid	1. AC breaker is OFF 2. No voltage on AC side	1. Switch on AC breaker 2. Provide AC voltage to output node of the inverter
AC Volt Low	1. Actual utility voltage is under the UVR setting 2. Incorrect country or Grid setting 3. Wrong AC connections 4. Detection circuit malfunction	1. Check the utility voltage connection to the inverter terminal 2. Check country & Grid setting 3. Check the connection in AC 4. Check the detection circuit inside the inverter
AC Volt High	1. Actual utility voltage is over the OVR setting 2. Utility voltage is over the Slow OVR setting during operation 3. Incorrect country or Grid setting 4. Detection circuit malfunction	1. Check the utility voltage on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter

Table 6-2: Error Messages (Continued)

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

Table 6-3: Warning Message

Message	Possible cause	Action
Solar1 Low	1. Actual 2. Detection circuit of input voltage malfunction	1. N/A 2. Check the detection circuit inside the inverter
HW FAN	1. One or more fans are locked 2. One or more fans are defective 3. One or more fans are disconnected 4. Detection circuit malfunction	1. Remove the object that stuck in the fan(s) 2. Replace the defective fan(s) 3. Check the connections of all fans 4. Check the detection circuit inside the inverter
EPO	EPO button is activated	1. Release the EPO (Release with N.C) 2. Check the connection of EPO
DC Surge	SPD on DC Side damaged	1. Contact the signal wire connection of DC SPD 2. Check the DC SPD if damaged
AC Surge	SPD on AC Side damaged	1. Contact the signal wire connection of AC SPD 2. Check the AC SPD if damaged
DC AuxPower Fail	1. DC AuxPower offer incorrect output voltage 2. Detection circuit of DC Auxpower malfunction	1. Check the connection between Inverter and DC side 2. Check the detection circuit

Table 6-4: Fault Message

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

Table 6-4: Fault Message (Continued)

Message	Possible cause	Action
HW Red ADC2	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
HW COMM2	1. Red. CPU is idling 2. The communication connection is disconnected	1. Check the function of reset pin and crystal in Red. CPU 2. Check the connection between Red. CPU and DSP
HW COMM1	1. DSP is idling 2. The communication connection is disconnected 3. The communication circuit mal-function	1. Check the function of reset pin and crystal in DSP 2. Check the connection between DSP and COMM 3. Check the communication circuit
HW Connect Fail	1. Power cables fall off inside the inverter 2. Current feedback circuit is defective 3. Driver circuit of inverter malfunction	1. Check the power cables inside the inverter 2. Check the current feedback circuit inside the inverter 3. Check driver circuit of the inverter
Relay Test Short	1. The driver circuit for the contactor malfunction 2. The contacts of contactor are stuck	1. Check the driver circuit inside the inverter 2. Replace a new contactor
Relay Test Open	1. Driver circuit for Contactor is defective 2. Contactor coil is defective 3. The detection accuracy is not correct for Vgrid and Vout	1. Check the driver circuit for contactor 2. Replace contactor coil 3. Check the Vgrid and Vout voltage detection accuracy
HW Bus OVR	1. Power BackFeed Occurred (DC Power < AC Power) 2. Something wrong with AC Frequency PLL	1. Check the connection between Solar Panel and Inverter 2. Check the Vgrid and Vout voltage detection accuracy

Table 6-4: Fault Message (Continued)

Message	Possible cause	Action
AC Current High	1. Surge occurs during operation 2. Driver for inverter stage is defective 3. Switching device is defective 4. Detection circuit malfunction	1. N/A 2. Check the driver circuit in inverter stage 3. Check all switching devices in inverter stage 4. Check the detect circuit inside the inverter
HW CT A Fail	1. Test current loop is broken 2. Detection circuit malfunction	1. Check CT Sensor Wire 2. Check the detection circuit inside the inverter
HW CT B Fail	1. Test current loop is broken 2. Detection circuit malfunction	1. Check CT Sensor Wire 2. Check the detection circuit inside the inverter
HW CT C Fail	1. Test current loop is broken 2. Detection circuit malfunction	1. Check CT Sensor Wire 2. Check the detection circuit inside the inverter
HW AC OCR	1. Large Grid harmonics 2. Switching device is defective 3. Detection circuit malfunction	1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary 2. Check all switching devices in inverter stage 3. Check the detection circuit inside the inverter
HW ZC Fail	The detection circuit for synchronal signal malfunction	Check the detection circuit for synchronal signal inside the inverter
AC Aux Fail	1. AC AuxPower offer incorrect output voltage 2. Detection circuit of AC Auxpower malfunction	1. Check the connection between Inverter and AC side 2. Check detection circuit
DC Current High	Input current detection circuit malfunction	Check input current detection circuit

Table 6-5: Other Message

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

7. Maintenance

7.1. Replacing a Fan Module

1. Pull and rotate the handle and then open the rear panel door

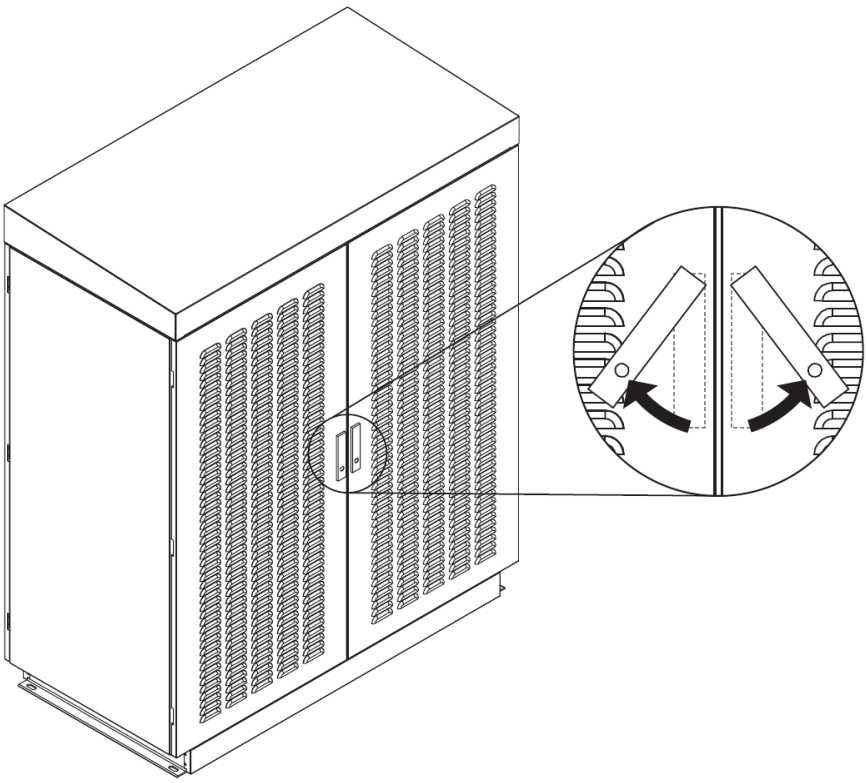


Figure 7-1. Pull and rotate the handle

2. Disconnect the connectors of the fan modules.

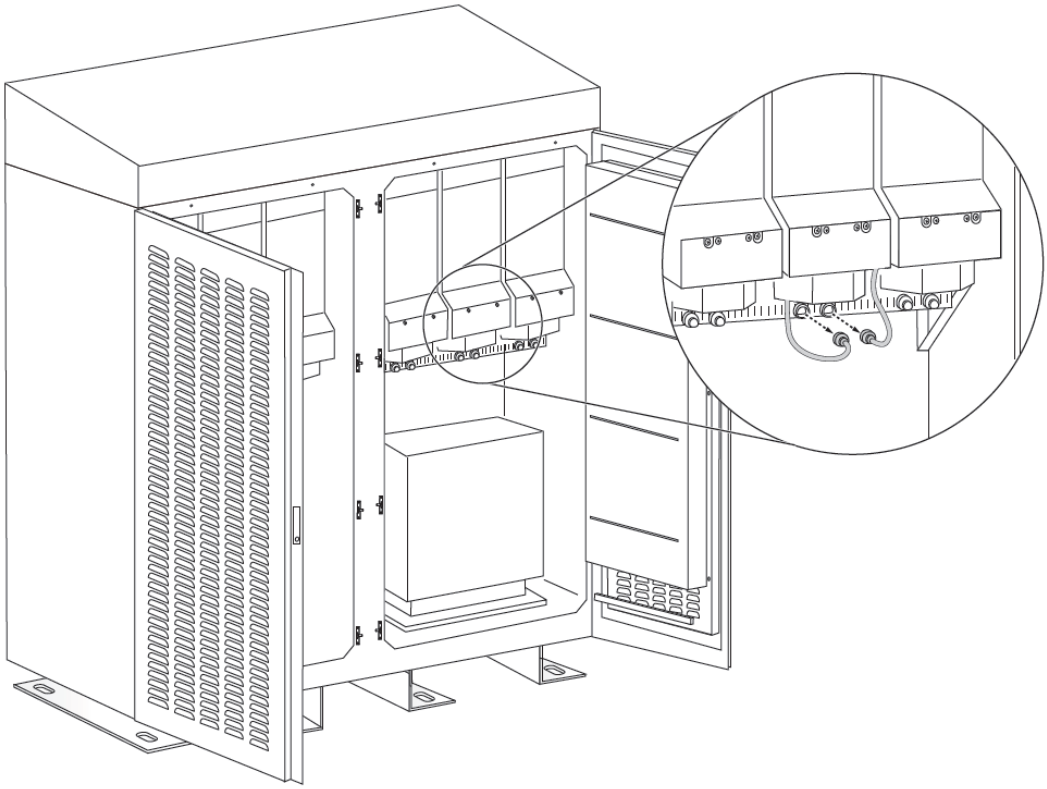


Figure 7-2. Disconnecting the Connectors

3. Loosen the screws and nuts securing the bottom fan module to the chassis and remove the module.

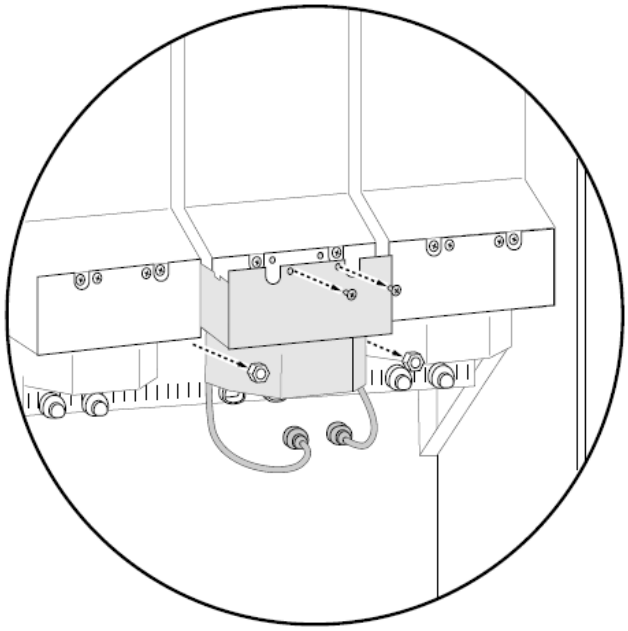


Figure 7-3. Loosening Bottom Fan Module Screws

4. Loosen the screws securing the top fan module to the chassis and remove the module.

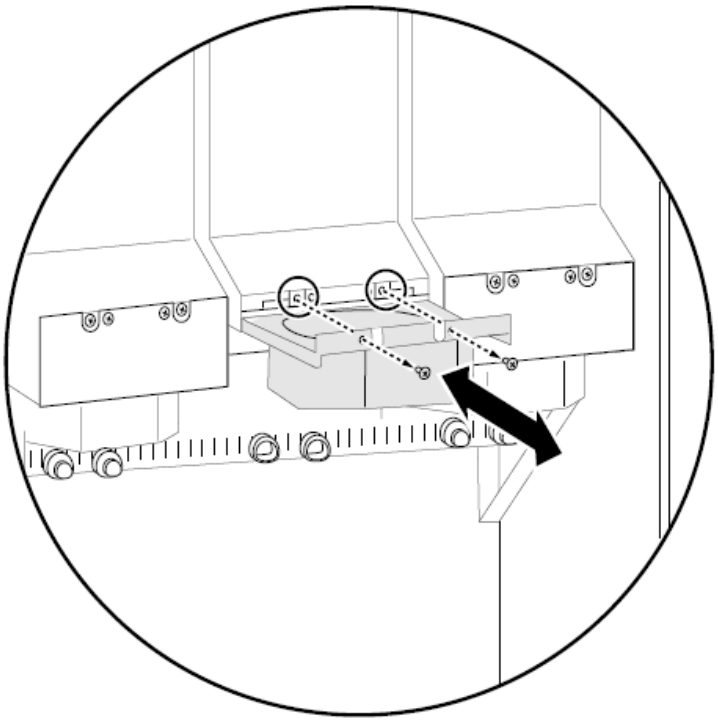


Figure 7-4. Loosening Top Fan Module Screws

7.2. Replacing an Air Filter

1. Pull and rotate the handle and then open the rear panel door

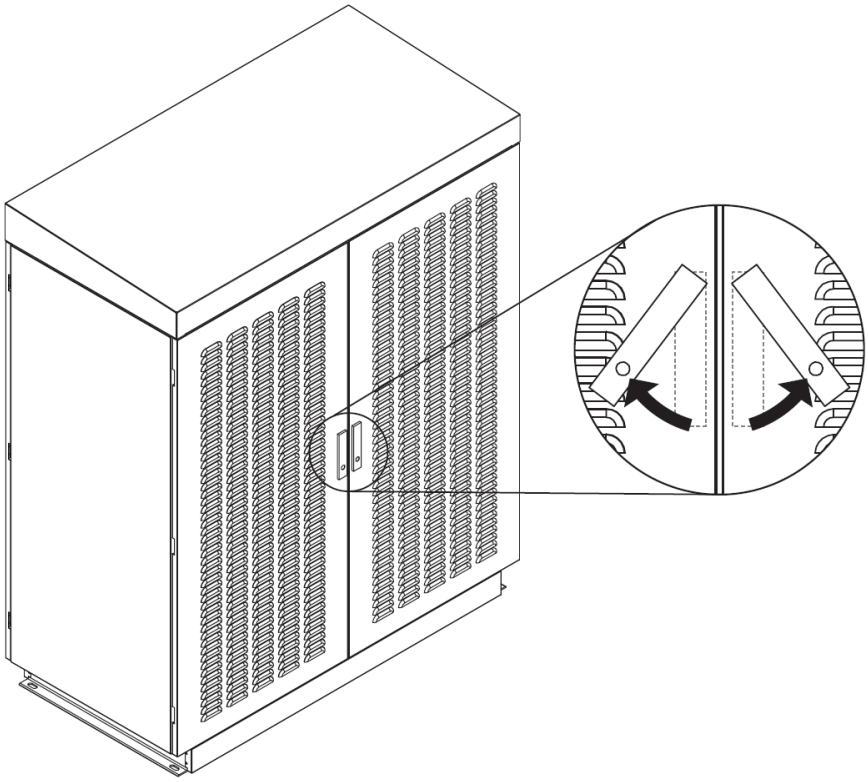


Figure 7-5. Pull and rotate the handle

2. Loosen the screws securing the air filter cover to the rear panel door and then open the cover.

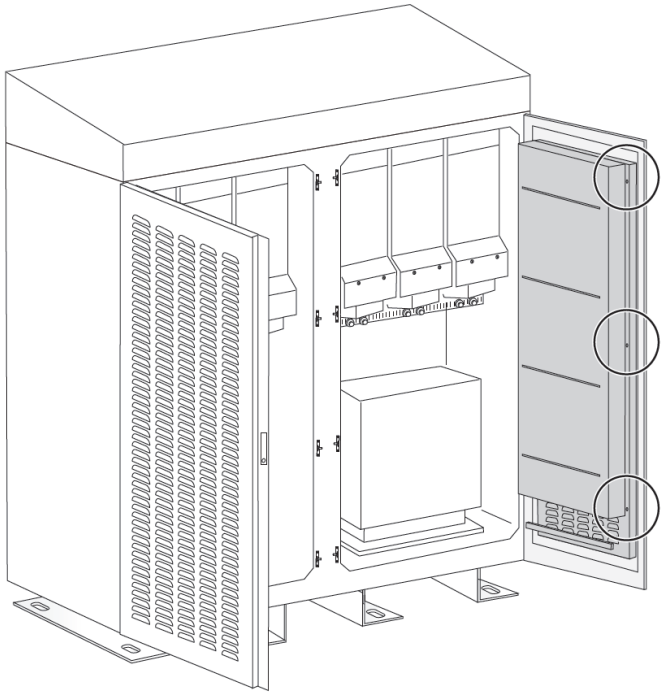


Figure 7-6. Loosening Air Filter Cover Screws

3. Loosen the screws securing the air filter to the rear panel door.

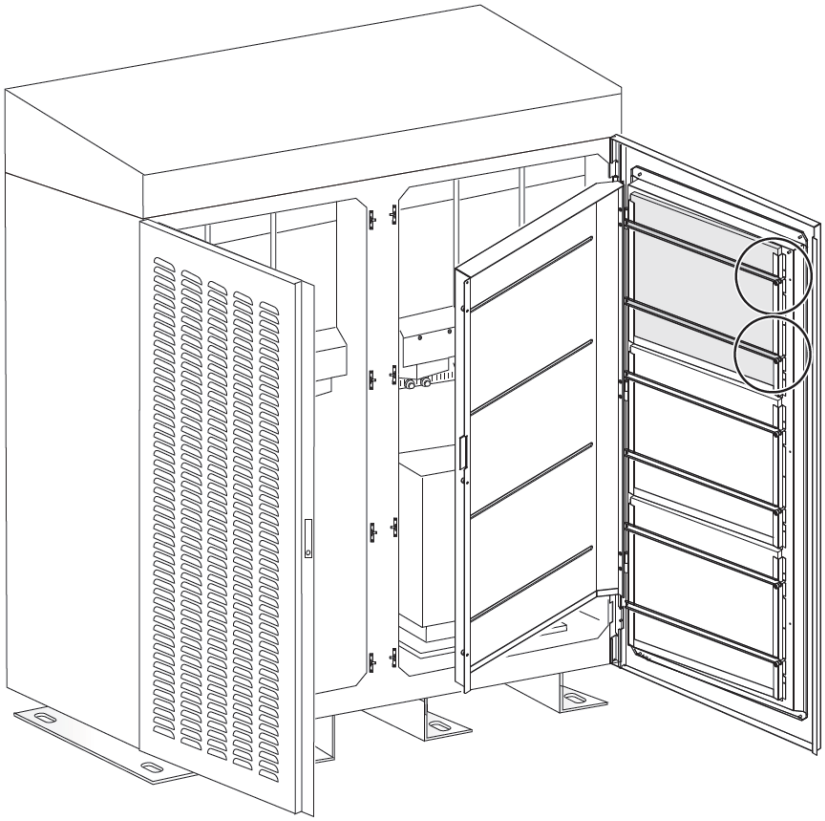


Figure 7-7. Loosening Air Filter Screws

4. Loosen the filter.

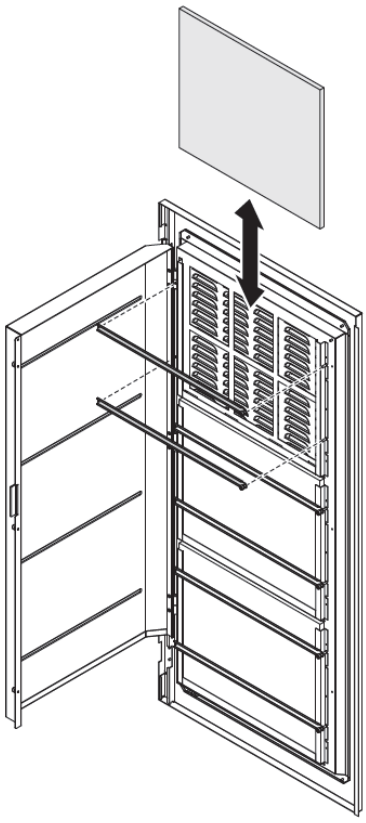


Figure 7-8. Loosening the Air Filter

7.3. Clean Air Outlets

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

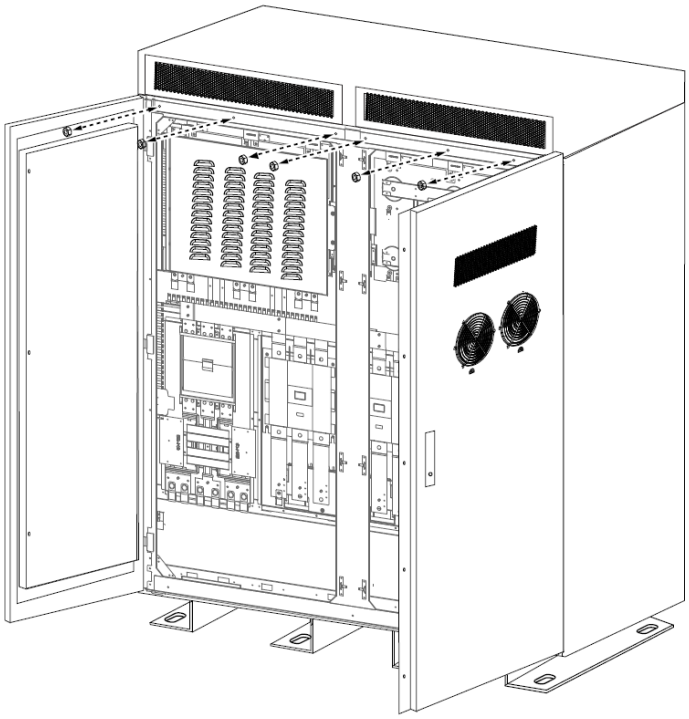


Figure 7-9. Loosening the nuts of air outlets

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

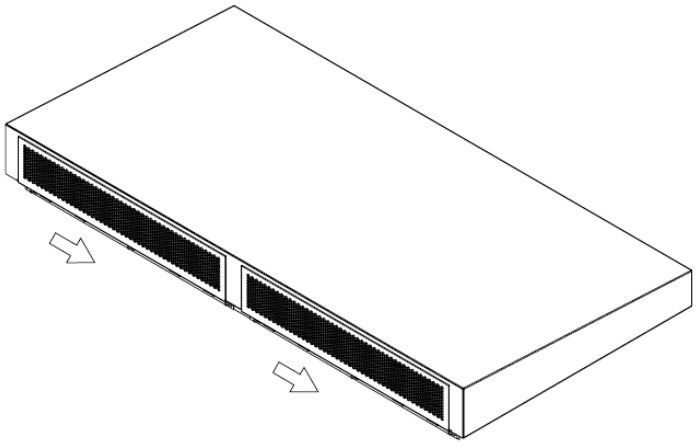


Figure 7-10. Move the plates to the right

4. Remove the plates and air outlets directly.

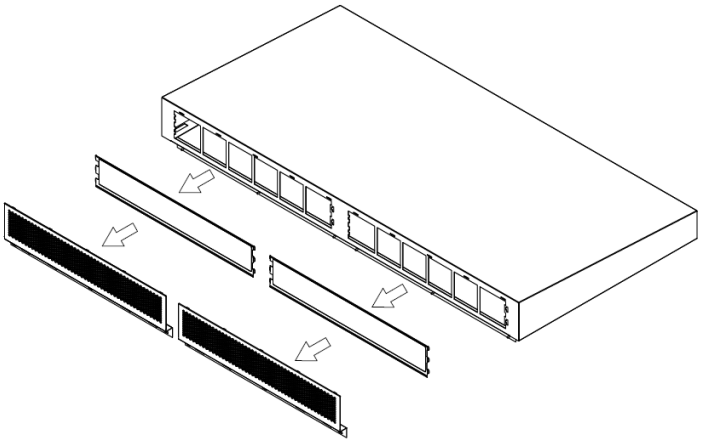


Figure 7-11. Remove the air outlets

7.4. Replacing DC Fuses

1. Switch AC and DC power off and check no residue voltage exists on DC/AC side.
2. Loosen the screws on the fuses, and then take the old fuses off.
3. Put the new fuses and screws on the busbar, and then tighten the screws.

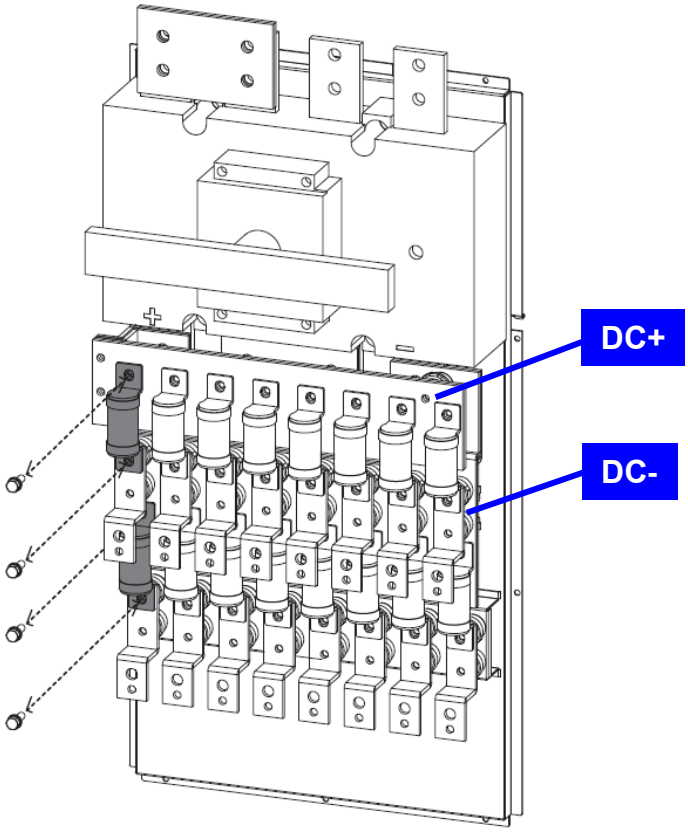


Figure 7-12. Remove the fuses

7.5. 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.

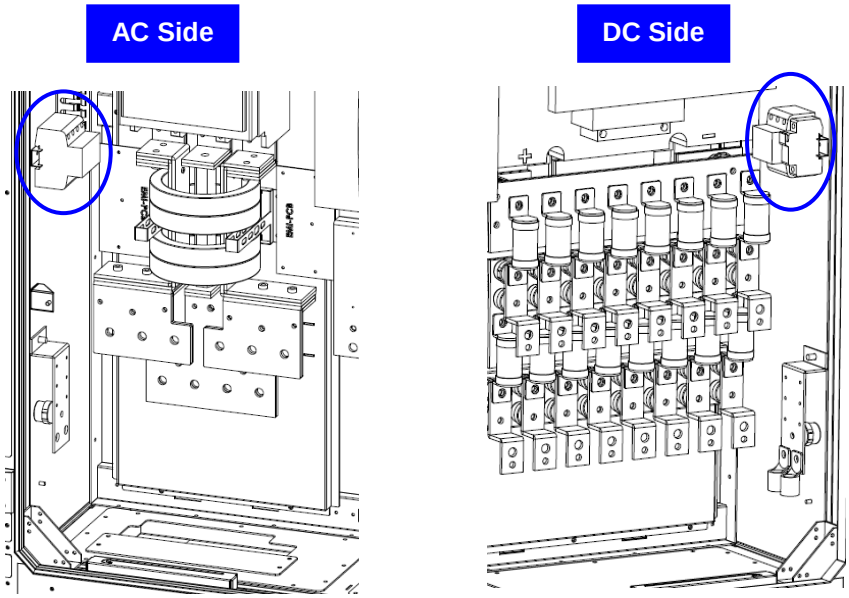


Figure 7-13. SPD Position

3. Recognize which SPD unit was damaged.

- For DC and AC SPD, find the one that green light was changed to red



Figure 7-14. Recognize the damaged SPD unit

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

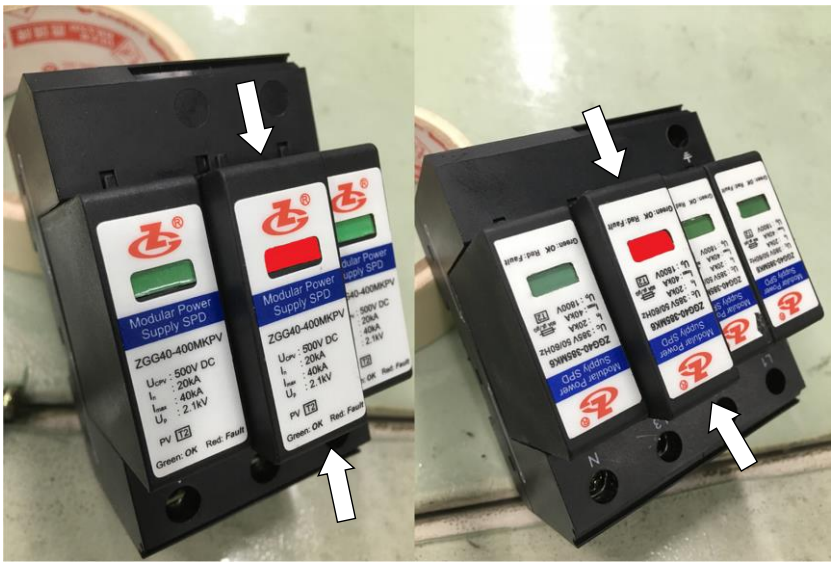


Figure 7-15. Pull out the SPD unit

Appendix A. Technical Data

Type of Equipment

Outdoor enclosure Grid tied PV inverter

Input

Absolute maximum PV input voltage	1000Vdc
Operation voltage range	420/485*Vdc – 1000Vdc
Maximum power MPPT range	450/500*Vdc – 820Vdc
MPPT accuracy	> 99.9% at rated power
Inverter wake up voltage	< 200Vdc (Aux-power on)
Startup voltage	470/500*Vdc
MPP tracker	1
Input current limitation	1200A
Maximum input short circuit current	1500A
Input detection tolerance	Input voltage deviation < 2%
DC Switch	1000V/1250A *1
Input protection	• DC over voltage_electronic shutdown • DC current limitation_current control • Surge arrestor_1000V/40kA Type 2

Output

Output capacity	500kVA
Grid	Three phase (3P3W-IT)
Utility voltage range	243~378VΔ
Utility frequency	50/60Hz
Utility frequency range	Domestic regulation (Max 50/60Hz ± 5Hz)
Maximum output current	1080A
Anti-islanding	Domestic regulation
Output reconnect	Connect to utility after utility recover and countdown finished
Reconnect time	Domestic regulation
Output current DC component	< 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	< 50 watts (without optional transformer)
Detection tolerance	• Utility voltage deviation < 2% • Utility frequency deviation < 0.03 Hz • Countdown timer deviation < 1.0 sec • Output power deviation < 3% at full power
Power limitation	Temperature sensors depend on heatsink & internal air temperature.
AC Circuitry Breaker	690V/1250A
Protection	• AC Circuitry Breaker & Thermal protection • Surge arrestor_600V/30kA Type 2

Information

Communication Port	RS-485 Delta Protocol
LED	• Operation: Green (Flashing during countdown) • Alarm: Red
LCD display	5” Graphic, 320*240 pixels
Display buttons	4 operational buttons
Energy log	Day/Month/Year
Event Log	• 30 events recently • Event times for each event
EPO (Emergency power off)	1 set
Dry Contact	2 set

Regulatory

Electrical safety	• IEC 62109-1 & IEC 62109-2 • CE
Grid interface	• BDEW Compatiable • CGC/GF 004 • GB/T 19964:LVRT
Emission	EN61000-6-4
Immunity	EN61000-6-2
Harmonic	BDEW

Operation

Operating temperature	-25°C~60°C (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	ISTA 1E
Drop	ISTA 1B

Mechanical

Dimension	
Width	1600mm
Depth	800mm
High	1950mm
Weight	1300kg
Cooling	Air cooling with Fans with inlet filter
Enclosure rating	IP-65 (Electric parts)

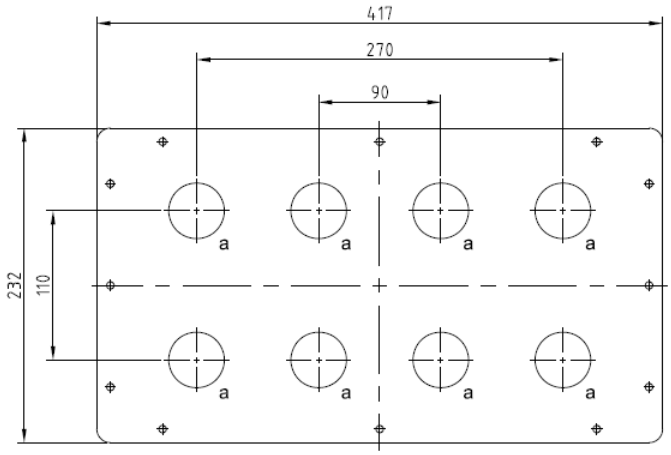
Note:

” * ” When AC output voltage is 315Vac.

Appendix B. Cable Combination Table & Hole Size of plate

- **DC Side bottom plate**

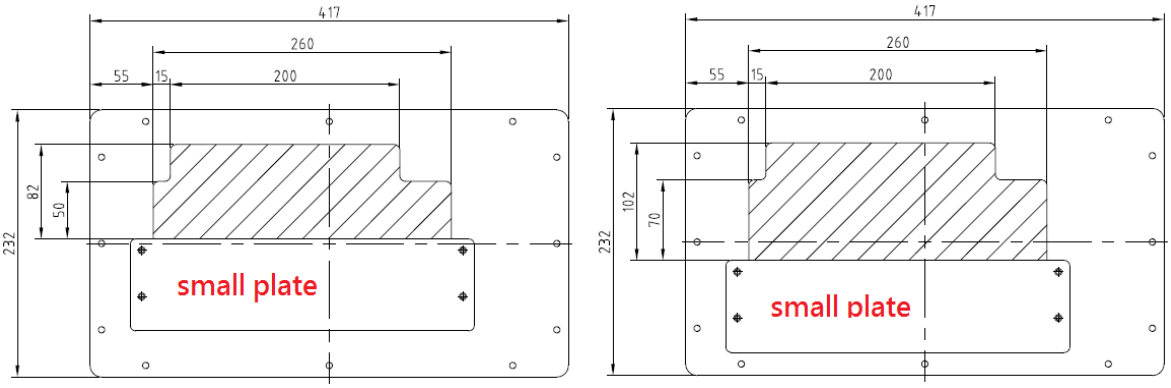
Cable Gland Model No.	Allowable Overall diameter of Cable (mm)	Maximum hole No. of DC bottom plate
AVC-MGB40-25-SD	Ø26.7 ~ 21.3	8



Note:

"a" in the figure represents the hole size of plate. a = Ø41

- **AC Side bottom plate**



Note:

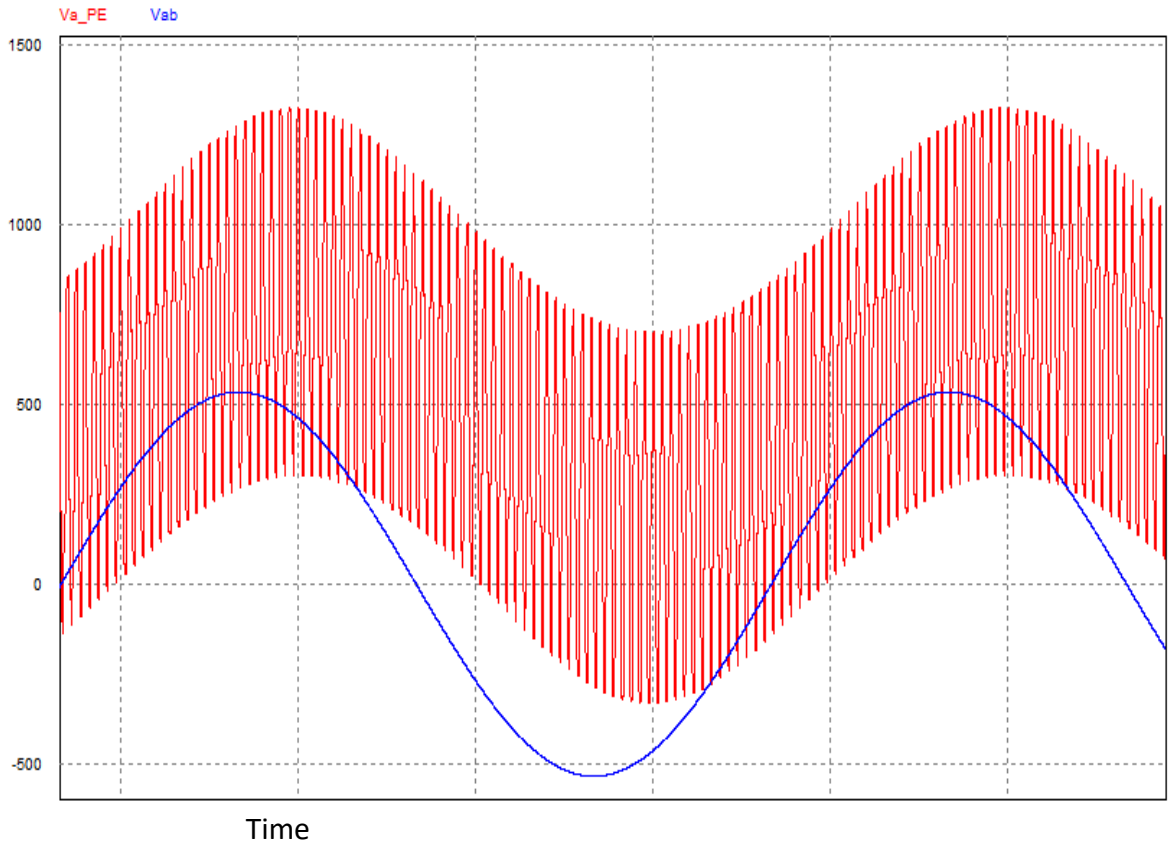
Shaded area is a wiring area and can adjust wiring area via moving small plate.

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 **1310V** to earth.
- To endure the maximum RMS voltage to earth is **650V**
- 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.

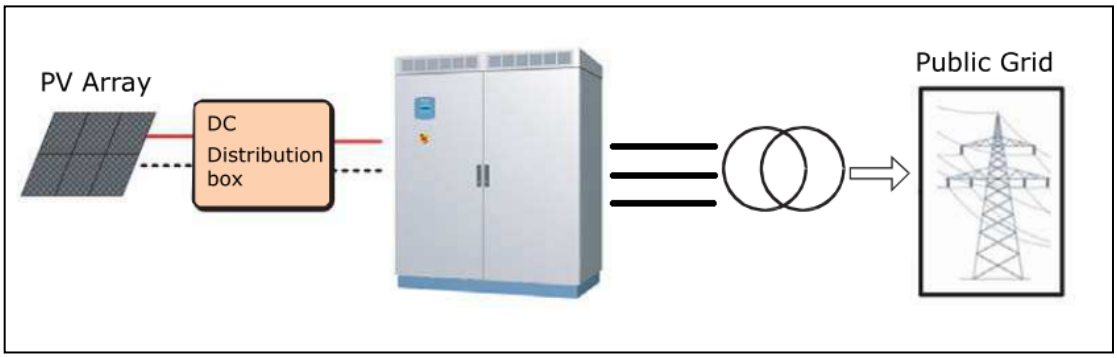
A.5 Higher thermal stress of MV transformer should be taken **country settings** into consideration, including the voltage and frequency.

A.6 The transformer is capable of withstanding of max **5%** total harmonic current at nominal power.

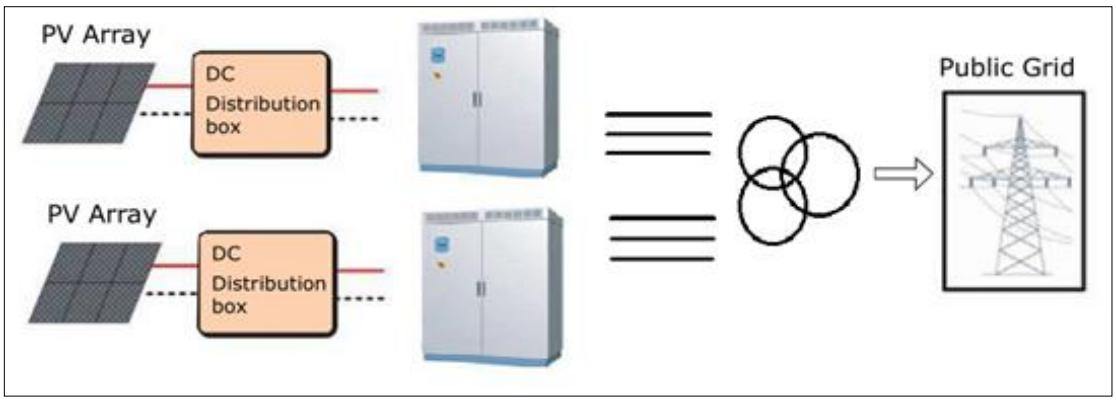
A.7 The transformer should be design according to the following inverter rating.

Model No	Nominal Voltage Range (Line-Line) (V)	Nominal Output Current Range @ 50 ℃ (A)	Maximum Output Current (A)
RPI-C500	243~378	770~1180	1250

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



Double winding transformer for one inverter

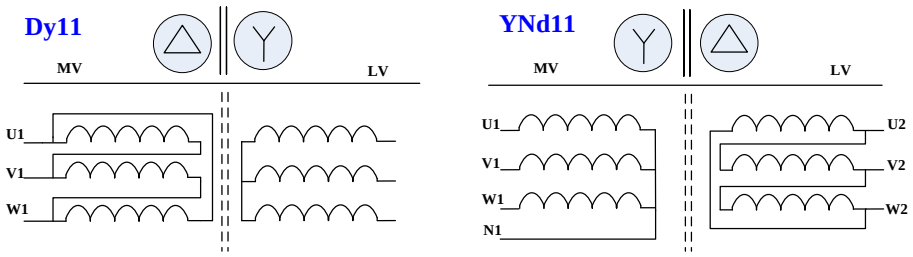


Three winding transformer for two inverters

B.1 Technical requirement of two-winding transformer

- The voltage impedance should line between 4.0-6.0%
- The vector grouping of two-winding transformer can be Dy11 or YNd11

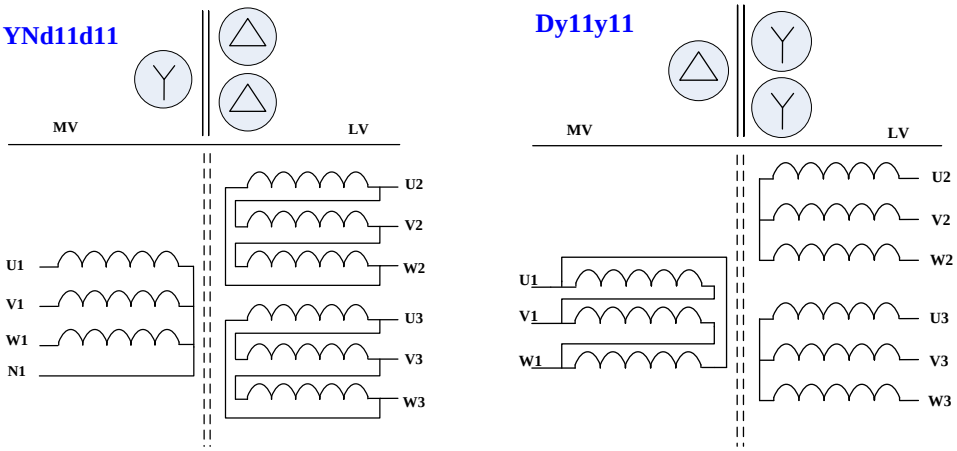
* Please use DC+ to earth ground or DC- to earth ground if YNd11 is applied.



B.2 Technical requirement of three-winding transformer

- The impedance voltage between each low voltage winding and high voltage should lie between **4.0-6.0%.**
- The impedance voltage between two low voltage winding should lie between **9~11%.**
- The vector grouping of three-winding transformer can be **Dy11y11 or YNd11d11**
- 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.

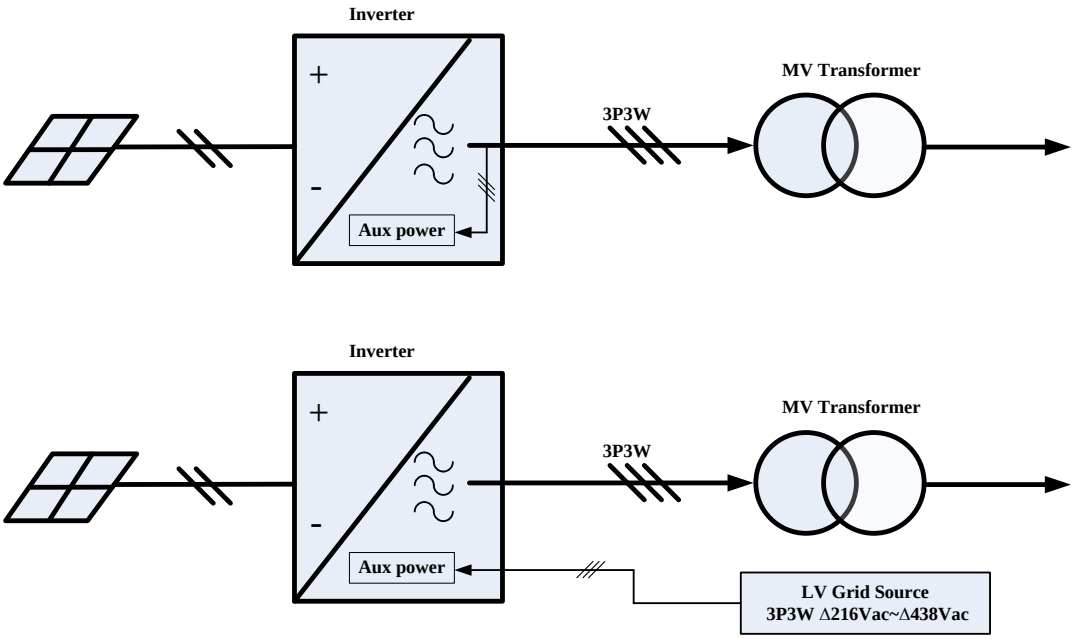


C. The Auxiliary Power powered by external source with a transformer.

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. Contact Information

Delta Power Solutions India Pvt Ltd

Ozone Manay Tech Park, "A" Block, 3rd Floor, Hosur Road, Hongasandra Village, Bangalore-560068.

Tel: +91 80 6716 4777, Fax: +91 80 6716 4784.

Website: www.deltaelectronicsindia.com / www.solar-inverter.com

Sales Contact (All India) :

Email: invertersales@delta.co.in

Landline: +91 80 6716 4777 (Ask for Inverter Sales contact)

Inverter Service Support Center (All India):

Customer to register faults by calling +91-80-6716 4716 (Monday to Friday from 9:30 to 18:00 HRS)

or

Service Mobile Number: +91 76762 54716 (After Office Hours & other days)

Email: invertersupport@delta.co.in

光伏逆变器

RPI-C500 光伏逆变器



目录

1. 前言 1
1.1. 关于此手册 1
1.2. 适用机型 1
1.3. 适用对象 1
2. 安全规范 2
2.1. 光伏逆变器系统配置 2
2.2. 断电 2
3. 产品外观 4
3.1. 产品说明 4
3.2. 产品检视 4
3.2.1. 外部前三角视图 4
3.2.2. 外部三角视图 5
3.3. 特色 6
3.4. 逆变器标签 6
4. 运输和安装准备 8
4.1. 安装地点需求 8
4.1.1. 地点空间 8
4.2. 安装地点的准备 9
4.2.1. 沟渠尺寸 9
4.2.1. 安装基座的尺寸和特性 9
4.2.3. 固定方式 10
4.2.4. 针对室内安装的逆变器尺寸 10
4.3. 运送方式和建议工具 11
4.3.1. 使用堆高机或拖板车 12
4.3.2. 使用起重机 12

4.4. 包装拆解 15
4.5. 物品清单 16
5. 安装说明 17
5.1. 建议工具 17
5.2. DC 端连接 17
5.2.1. DC 端铜排尺寸 19
5.2.2. 如何选择 DC 端保险丝与缆线尺寸 21
5.2.3. 正接地与负接地 21
5.3. AC 端连接 22
5.3.1. AC 端铜排尺寸 24
5.4. PE 端连接 26
5.4.1. PE 端铜排尺寸 27
5.5. 安装 DC 保险丝 28
5.6. 挡鼠板安装和拆除 29
5.7. 通讯接口连接 30
5.7.1. RS-485 连接 30
5.7.2. 干接点连接 31
5.8. 外接辅助电源 32
5.9. 第一次开机 34
5.9.1. 开机前的准备 34
5.9.2. 开机和自我测试 34
5.10. 有功/无功功率控制与故障穿越 36
5.10.1. 有功功率控制 36
5.10.1.1. 有功限制 36
5.10.1.2. 功率对应频率 36
5.10.2. 无功功率控制 37
5.10.2.1. 固定有功因素 cosφ 37
5.10.2.2. 有功因素 cosφ(P) 37

5.10.2.3. 固定无功因素 38
5.10.2.4. 无功功率/电压特性 Q(U) 38
5.10.3. 故障穿越（FRT） 38
5.11. LCD 显示画面及操作 40
5.11.1. Home Page 40
5.11.2. Power Meter 41
5.11.3. Energy Log 41
5.11.4. Event Log 42
5.11.5. Operation Data 43
5.11.6. Inverter Information 44
5.11.7. Settings 44
5.11.7.1. Personal Settings 45
5.11.7.2. Coefficient Settings 45
5.11.7.3. Install Settings 46
5.11.7.4. Active/Reactive Power Control 49
5.11.7.4.1. Power Limit 49
5.11.7.4.2. Power vs. Frequency 50
5.11.7.4.3. Constant cosφ 50
5.11.7.4.4. cosφ(P) 50
5.11.7.4.5. Constant Reactive Power 51
5.11.7.4.6. Q(U) 51
5.11.7.5. FRT (Fault ride through) 52
6. 故障排除 53
6.1. 量测项目 53
6.2. 错误讯息和故障排除 57
7. 维修保养 62
7.1. 更换风扇模块 62
7.2. 更换进气口滤网 65

7.3. 清理排气孔滤网 67
7.4. 更换 DC 保险丝 69
7.5. 更换 Surge Protection Device (SPD) 70
附录 A. 技术数据 72
附录 B. 缆线组合列表与底板开孔尺寸 76
附录 C. Delta 中压变压器与辅助电源变压器应用说明 77
附录 D. 连络我们 81

图标与字体

一般标示

以下所提到的标志常见于本手册中:



范例:

此图样出现的目的是要解说相关的概念。



说明:

此图样出现的目的是要说明相关的程序或参考步骤。



警告!

此图标出现在某一段文字之前是要强调该段文字陈述的操作内容可能导致机器设备的损毁。



注意!

此图标出现在某一段文字之前是要强调该段文字陈述的操作内容可能导致人身的安全发生危害。

印刷字体规范

以下所提到的字体规范常见于本手册中。

斜体字

常见于标题，目录，档案，路径和程序中。

屏幕显示

屏幕显示为计算器输出内容，包含操作菜单，开头提示字，响应输入内容以及错误信息。

粗体字

出现粗体字时表示使用者要在键盘上按下这个字。

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1. 前言

1.1. 关于此手册

本手册记载了本机 RPI-C500 光伏逆变器的详细规格、操作步骤和相关的功能设定。安装技师必须经过合格的光伏逆变器安装训练，在安装时也必须严格遵守安全指示和操作步骤。

1.2. 适用机型

本手册在本公司的授权下记载了以下光伏逆变器的操作程序、维修方式、技术数据和安全规范。

- RPI-C500 光伏逆变器

1.3. 适用对象

本手册所陈列之操作步骤皆需经由良好训练的合格光伏逆变器安装技师来操作。

2. 安全规范

2.1. 光伏逆变器系统配置

光伏逆变器系统配置如图 2-1。

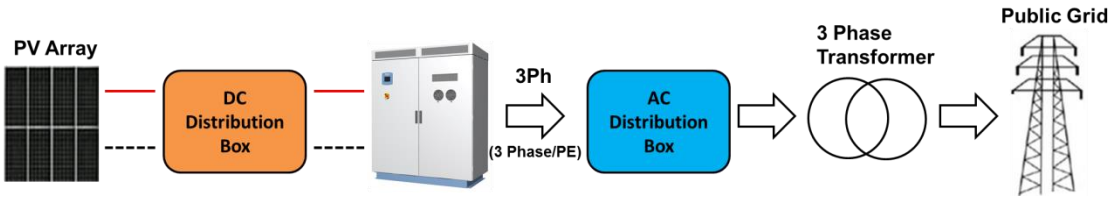


图 2-1. 光伏逆变器系统配置

外部输出变压器需求

此外接变压器规格必须使用一次侧和二次侧之间的绕线可以承受至少 500kVA，其阻抗变化最多不能超过 6%。此变压器必须要置于本机和市电之间。

有关于中压系统变压器的应用可以参考附录 C “Delta 中压变压器与辅助电源变压器应用说明”。

2.2. 断电

任何执行隔离本机的动作必须要在无负载状态下。

注意!

本动作可能触电导致人员伤亡!

断开相关电源之后，方可操作光伏逆变器的动作，而且要遵守下列相关的 VDE 规范：

- 拆除所有电源连接线
- 确保所有设备不会重新接上
- 确保没有任何电压存在
- 有需要的话将设备短路到地（非DC端）
- 有需要的话将邻近的零组件覆盖起来或是使其绝缘

下列电源端应该要确实隔离：

- 由电网送入的电网电压
- 电网电压供给内部电源供应器（非必要项目）
- 来自太阳能板的DC电源

将 DC 和 AC 开关切至 OFF 并不足以将本机和电源隔离，这些开关只会将机器从太阳能板和市电隔离。



注意!

本动作可能触电导致人员伤亡！

即便将 DC 和 AC 开关切至 OFF，仍然会有误触电压的危险。

- 要碰触本机请至少在关机五分钟之后进行。

本机隔离 DC 电压的方式是靠外部或内部的 DC 输入保险丝，或是使用外部的断路器 。要移除 DC 输入保险丝必须要在无负载的状态下进行。

逆变器在 DC 端和 AC 端都有放置电容器，关机时，这些电容器会开始放电，所以在几分钟之内，碰触机器仍然有触电的危险，尤其当机器出现故障，这些危险电压停留的时间会更久，所以要开启本机请至少在关机五分钟之后进行。



注意!

本动作可能触电导致人员伤亡！

即便将 DC 和 AC 开关切至 OFF，仍然会有误触电压的危险。

- 要碰触本机请至少在关机五分钟之后进行。

3. 产品外观

3.1. 产品说明

台达 RPI 系列逆变器机种包含有 RPI-C500。本机的制造符合最高规格的转换效率(最高可达 98.7%)。

RPI 系列机种的防水防尘等级是 IP-65 再加上抗腐蚀的特性，使得本机器不论在室内或是室外，都可以达到最完善的保护。

3.2. 产品检视

3.2.1. 外部前三角视图

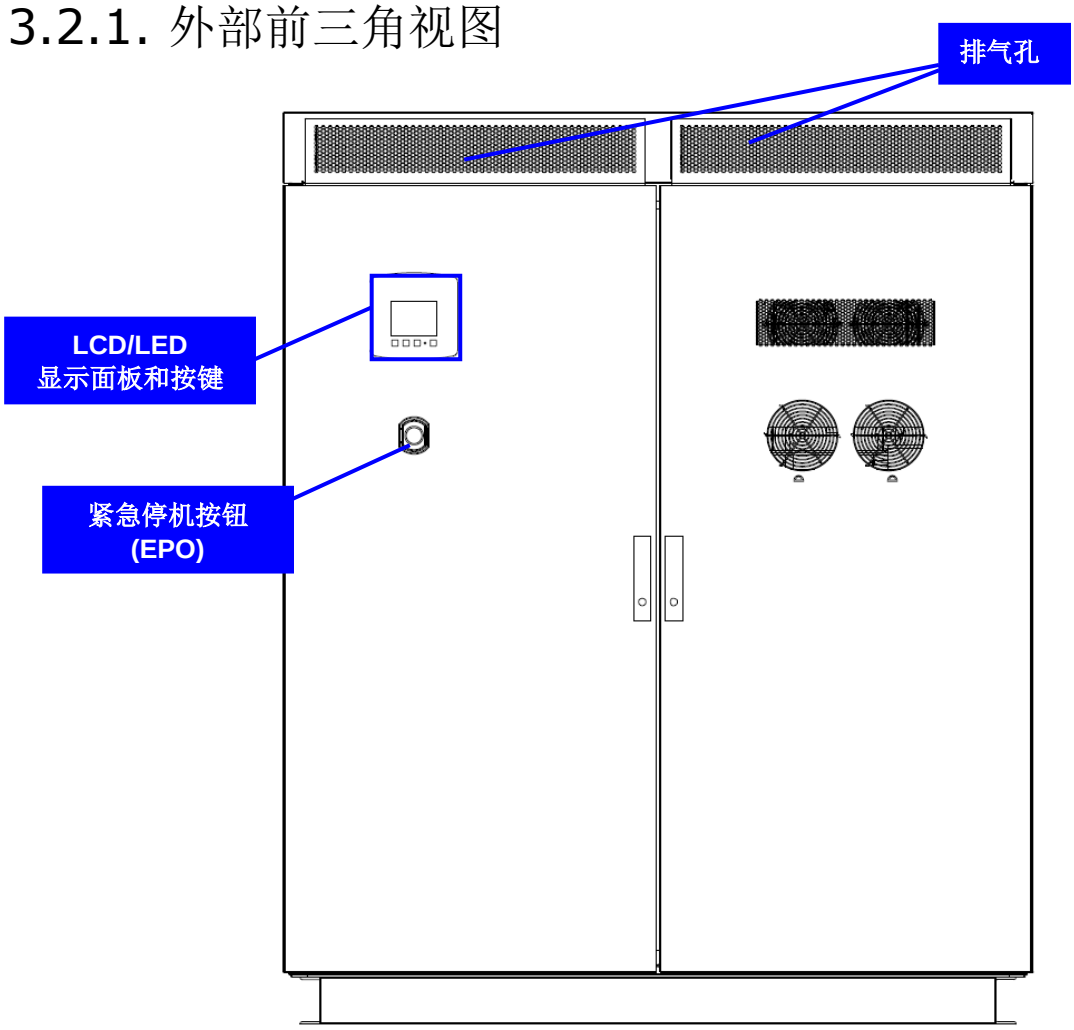


图 3-1. 外部前三角视图

3.2.2. 外部三角视图

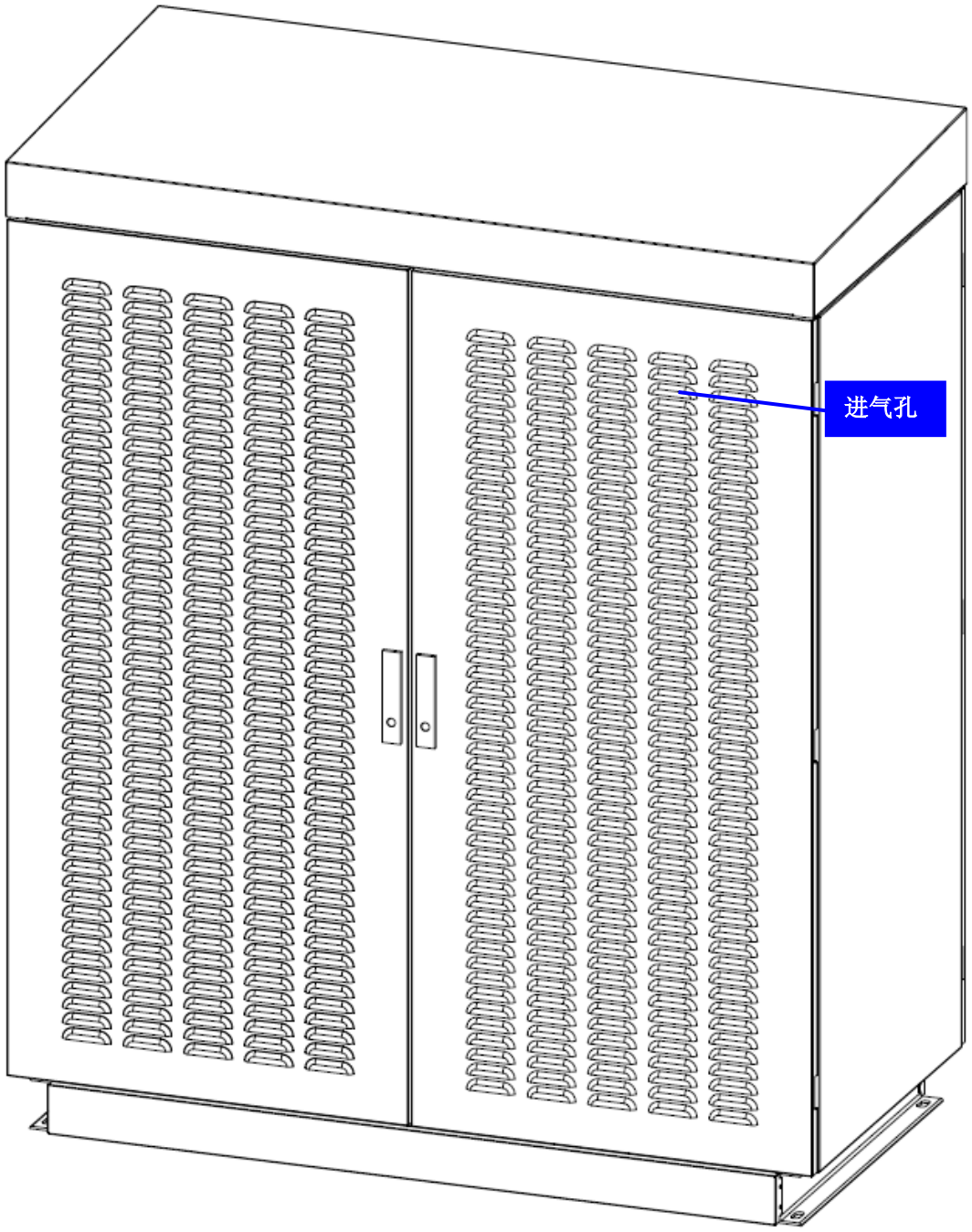


图 3-2. 外部后视图

3.3. 特色

以下项目为本逆变器重要特色：

- 最高转换效率 98.7%，欧洲转换效率 98.4%
- 三相三线(3 Lines + PE) 500kVA 光伏逆变器
- 宽的输入电压范围(420-1000Vdc)
- 宽的最大功率追踪范围(450-820Vdc)
- 1 组最大功率追踪器
- 5 吋图型化液晶显示器 (可调亮度和对比)
- IP-65 防水防尘等级(电子设备)

3.4. 逆变器标签

机器型号的规格请参照下图：

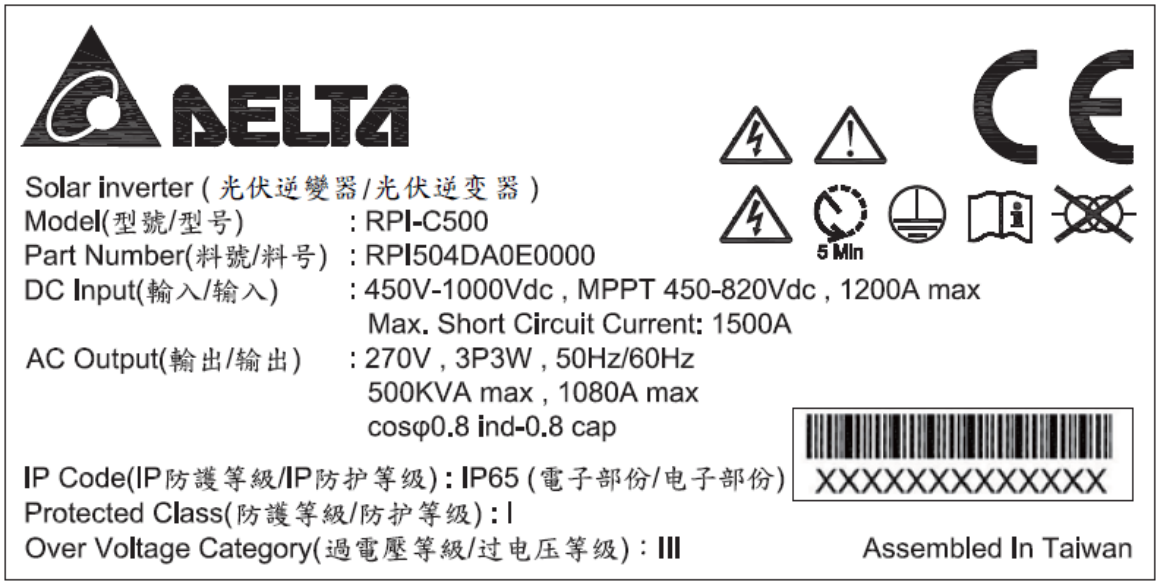


图 3-3. 逆变器标签

4. 运输和安装准备

4.1. 安装地点需求

4.1.1. 地点空间

请确认保留足够的空间来移动或组装本逆变器，相关叙述请参照本章节。

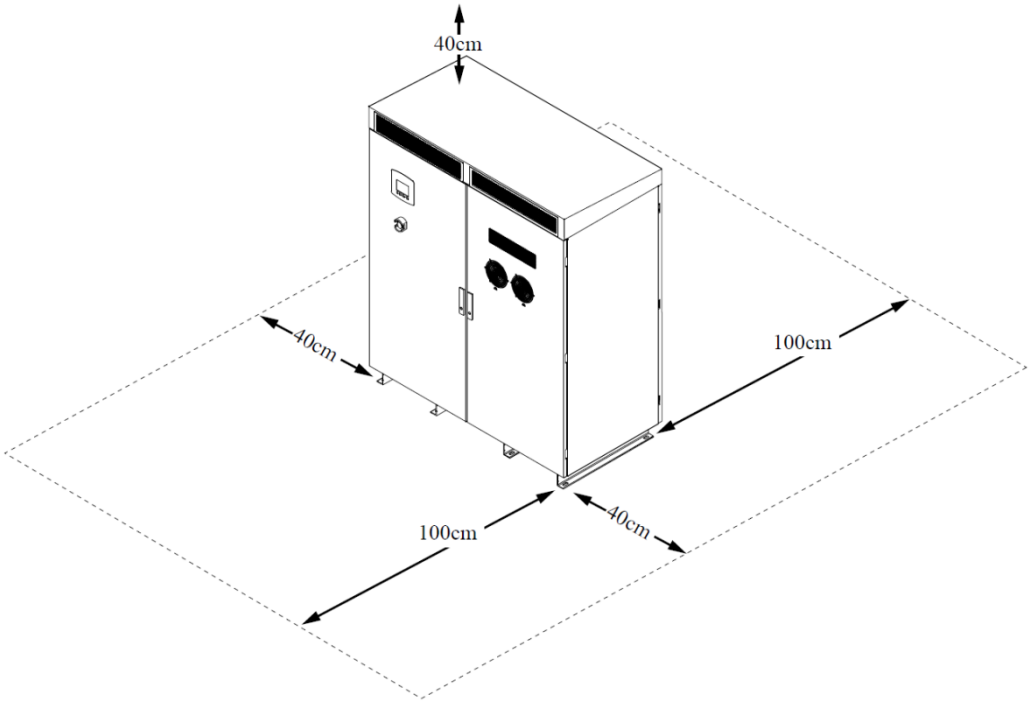


图 4-1. 逆变器空间需求

装货地点的空间必需足够容下本机器的拆卸和释放货柜，详见下列空间数据：

- 逆变器置放于栈板后的总高度：2210 mm (87 inches)
- 逆变器包装后前端长度：1820 mm (72 inches)
- 栈板长度：1090 mm (43 inches)
- 逆变器长度：1600 mm (63 inches)
- 逆变器高度：1950 mm (77 inches)
- 逆变器宽度：800 mm (31 inches)

说明:

1. 安装地点的环境温度范围必定要小于 60°C。
2. 太阳光直接照射的话将会降低逆变器的输出功率。

4.2. 安装地点的准备

拆卸包装之前，请确定本手册所有对空间和环境的需求都已阅读并确实了解。

4.2.1. 沟渠尺寸

准备沟渠是为了能够安全地摆放从直流和交流配线箱配接过来的缆线。建议的沟渠宽度为 250 公厘（如图 4-2 斜线区域所示），建议的沟渠深度则是依照使用者环境决定。

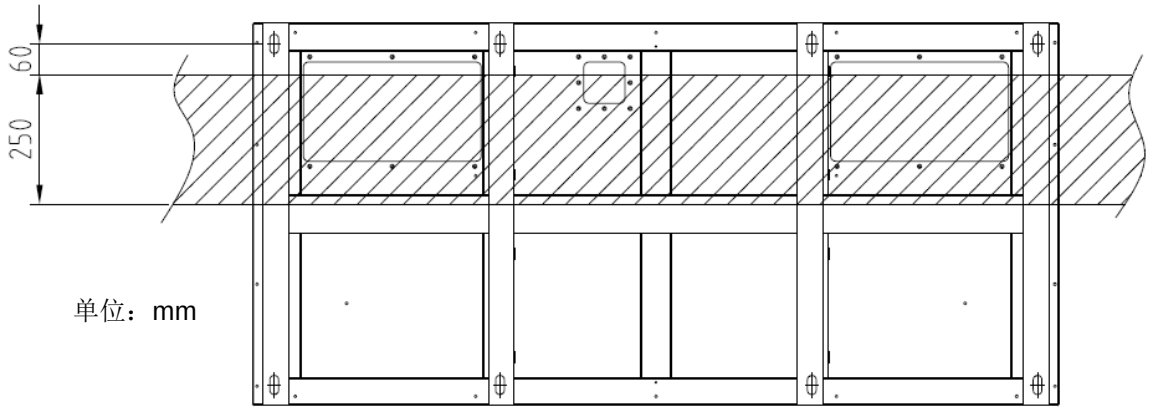


图 4-2. 沟渠尺寸

4.2.1. 安装基座的尺寸和特性

建造安装基座的尺寸请参照下列说明。

安装基座的长度和宽度不应该小于逆变器本体的基座，并且确认基座可以乘载逆变器的重量。

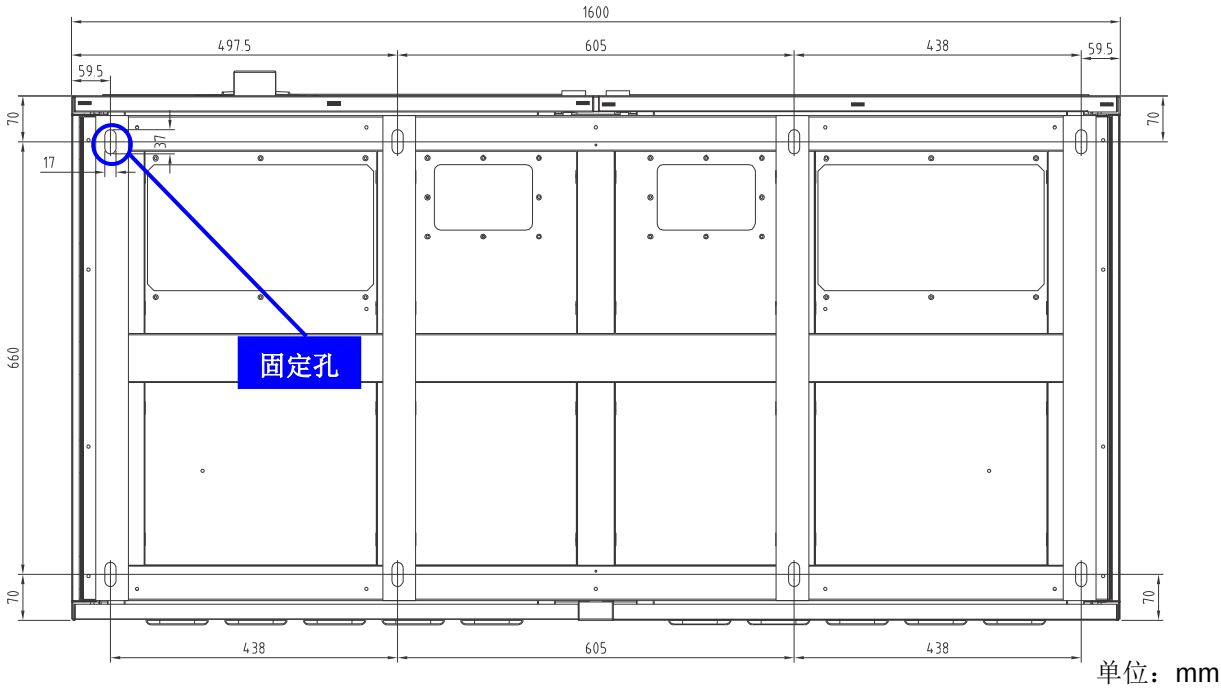


图 4-3. 安装基座尺寸

4.2.3. 固定方式

安装与固定逆变器有以下方法：

1. 直接安装固定在地面上。
2. 先将基座固定在地面上，再将逆变器安装在基座上。

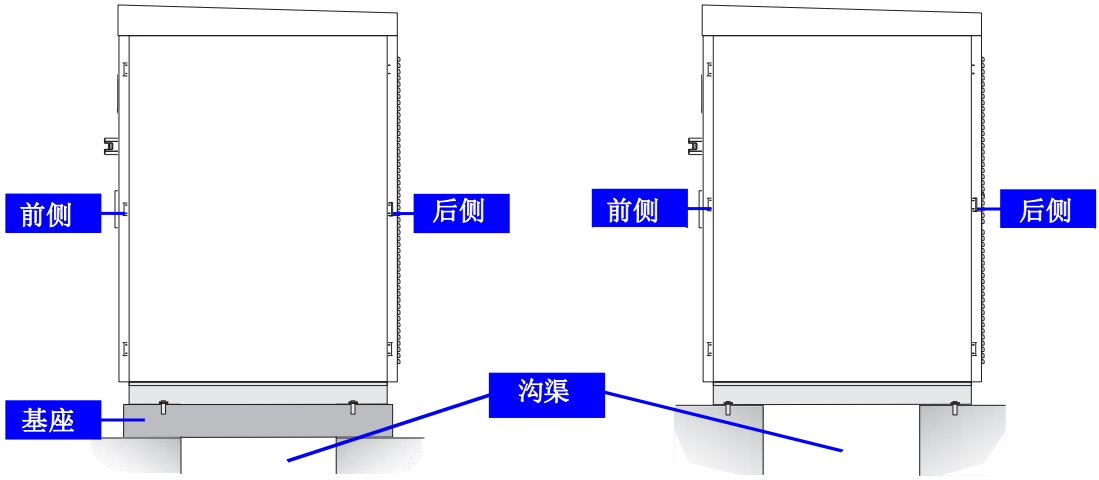


图 4-4. 固定方式

4.2.4. 针对室内安装的逆变器尺寸

如果逆变器安装于室内空间，需要配置适当的通风管，一端直接固定于逆变器的顶部，使得能将机台冷却后的热风排到户外去。

需要做相关配置可参考图 4-5 与图 4-6。

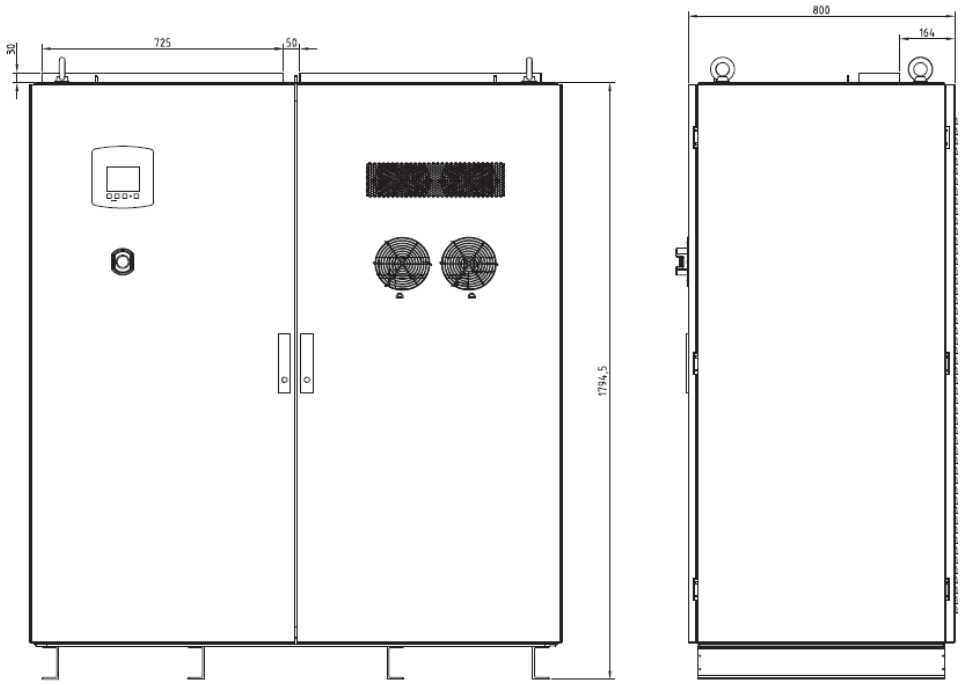


图 4-5. 不含屋顶的尺寸

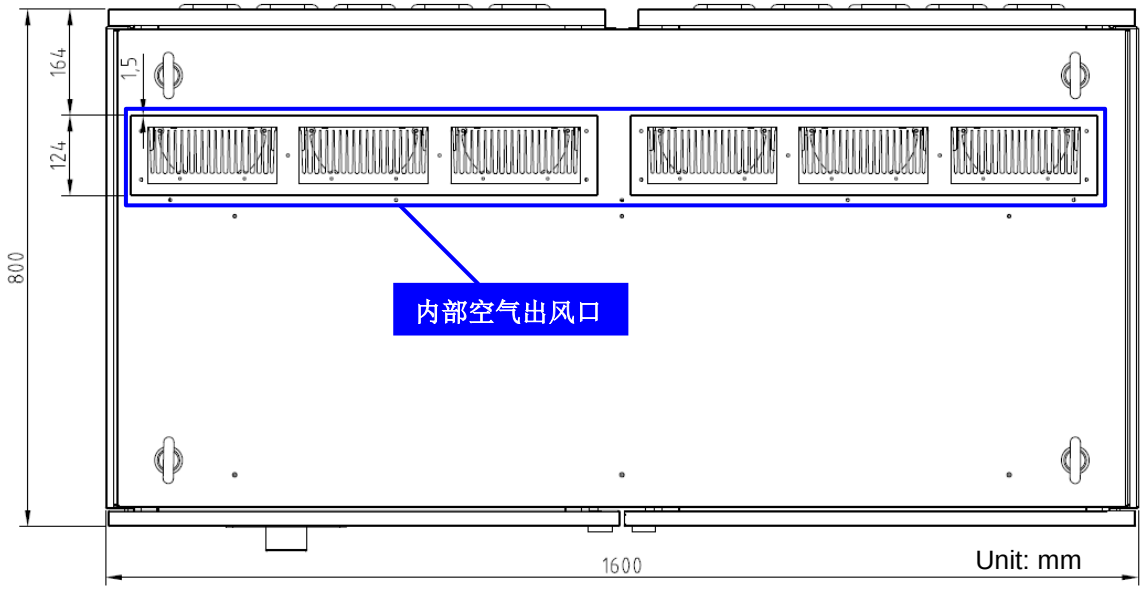


图 4-6. 内部出风口尺寸

4.3. 运送方式和建议工具

任何机具用来搬运逆变器必须要考虑到该机具要可以承载逆变器的重量，下列介绍的几种设备可以用来搬运逆变器：

- 堆高机或拖板车(建议做法)
- 起重机
- 钢索
- 挂勾
- 钢环

4.3.1. 使用堆高机或拖板车

不管是使用堆高机或是拖板车来搬运其实方法是一样的，你可以把包装拆除直接搬运逆变器或者是连同包装纸箱（含栈板）一起搬运都可以，搬移时请遵守以下步骤：

1. 堆高机或是拖板车的叉子插入逆变器下方，请注意叉子位置必须置于搬运物体的重心位置。

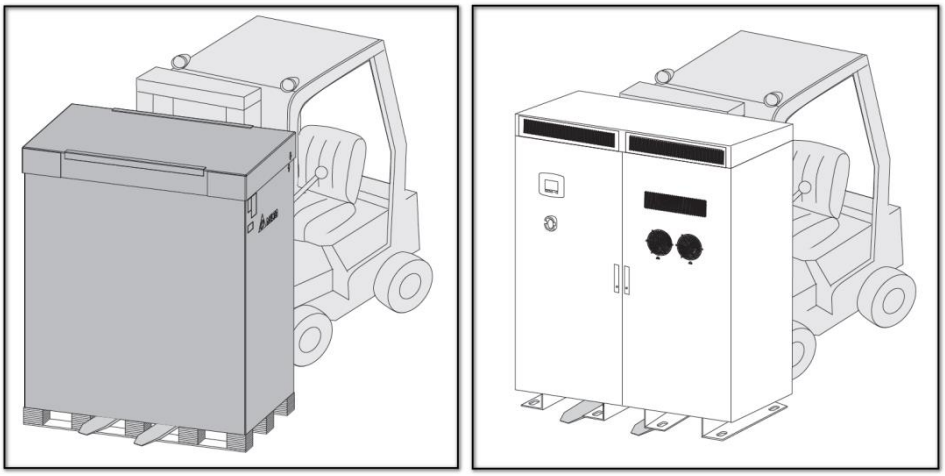


图 4-7. 搬运逆变器

2. 抬起逆变器之后就直接运送到安装地点。

4.3.2. 使用起重机

当逆变器有含包装纸箱和栈板或是没包含包装纸箱和栈板在使用起重机搬运时的方法是不同的，因此请分别遵守以下步骤：

搬运时含包装纸箱和栈板：

1. 使用绳索固定逆变器，确定每条绳索受力平均。
2. 吊起逆变器并稳定的移送到安装地点。
3. 解开绳索。

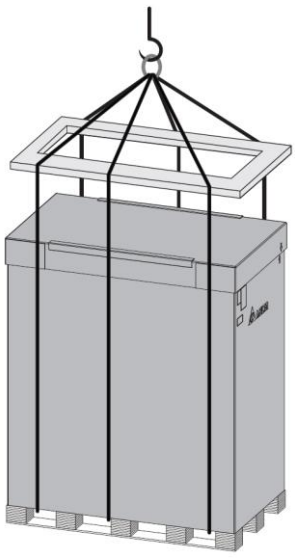


图 4-8. 使用绳索运送

搬运时不含包装纸箱和栈板：

1. 将逆变器前门和后门打开。
2. 松开上盖的螺丝。

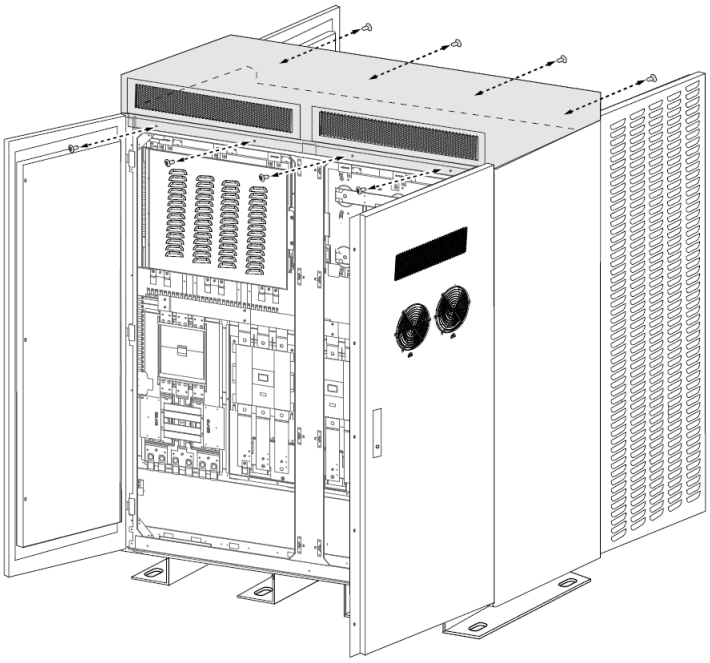


图 4-9. 松开上盖的螺丝

3. 拆掉逆变器的上盖。

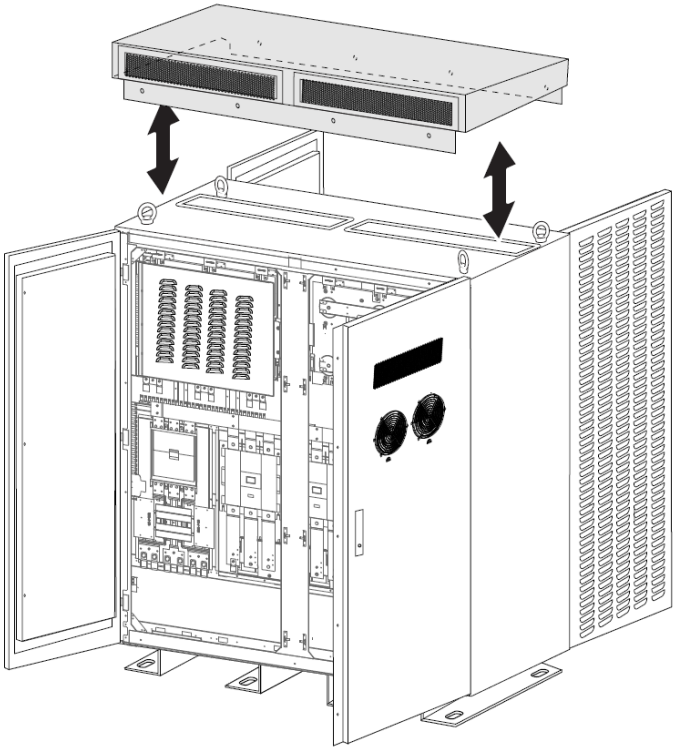


图 4-10. 拆掉逆变器上盖

4. 将钢索上的挂勾确实勾在逆变器上方四个角落的吊环上。

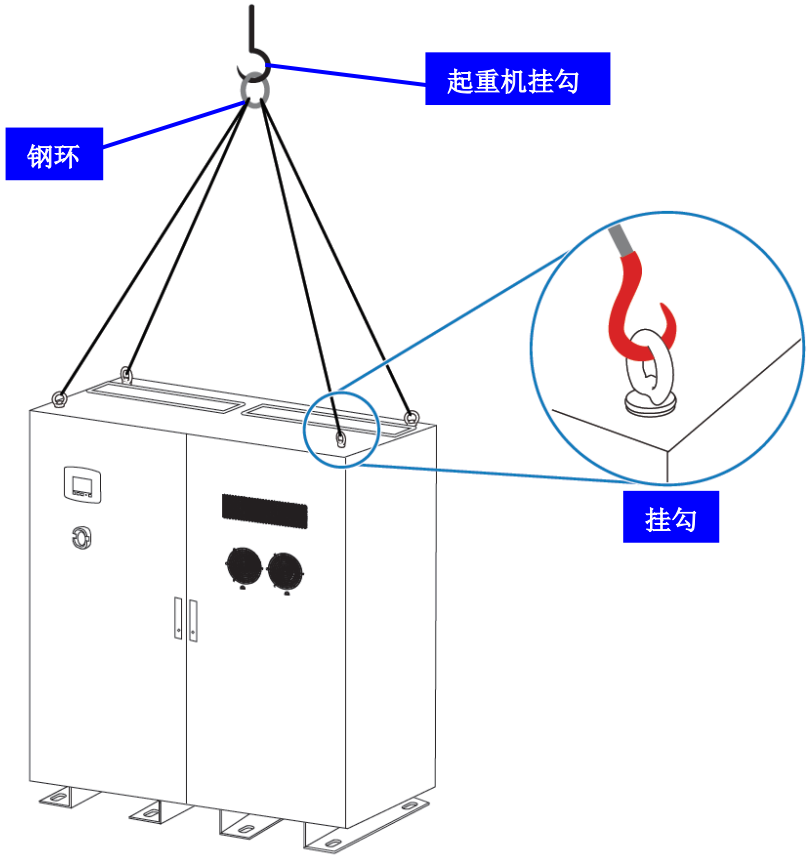


图 4-11. 钢索勾在逆变器上

5. 将连接钢索的钢环挂在起重机的吊钩上。
6. 吊起逆变器并稳定的移送到安装地点。
7. 解开钢索。

4.4. 包装拆解

要拆开外包装的纸箱请遵循以下步骤：

1. 先拆开纸箱顶盖，然后顺时针方向将纸箱外壳拆除。

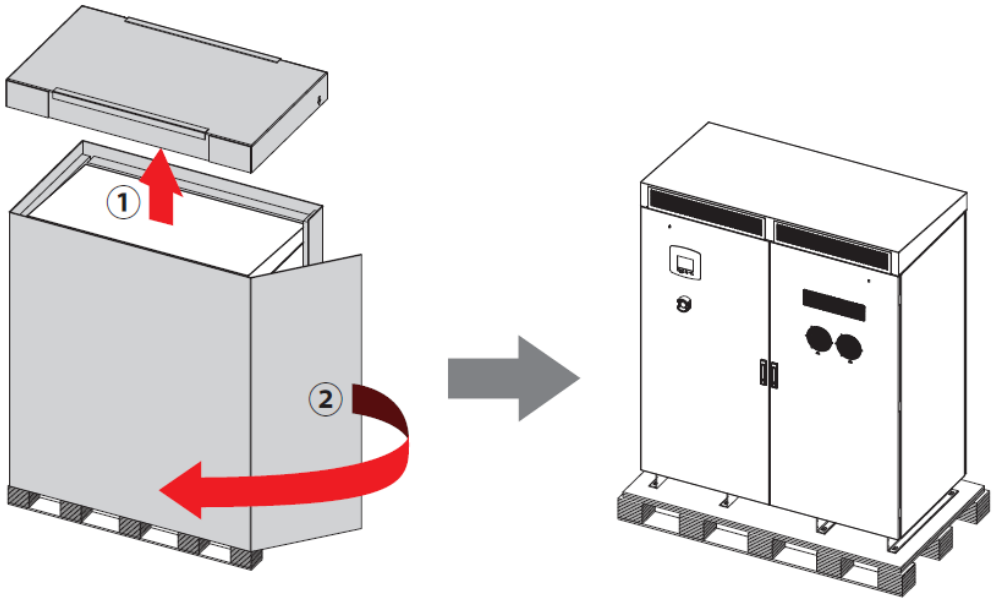


图 4-12. 拆除包装纸箱

2. 松开锁附在栈板上和逆变器底部之间的螺丝与螺帽

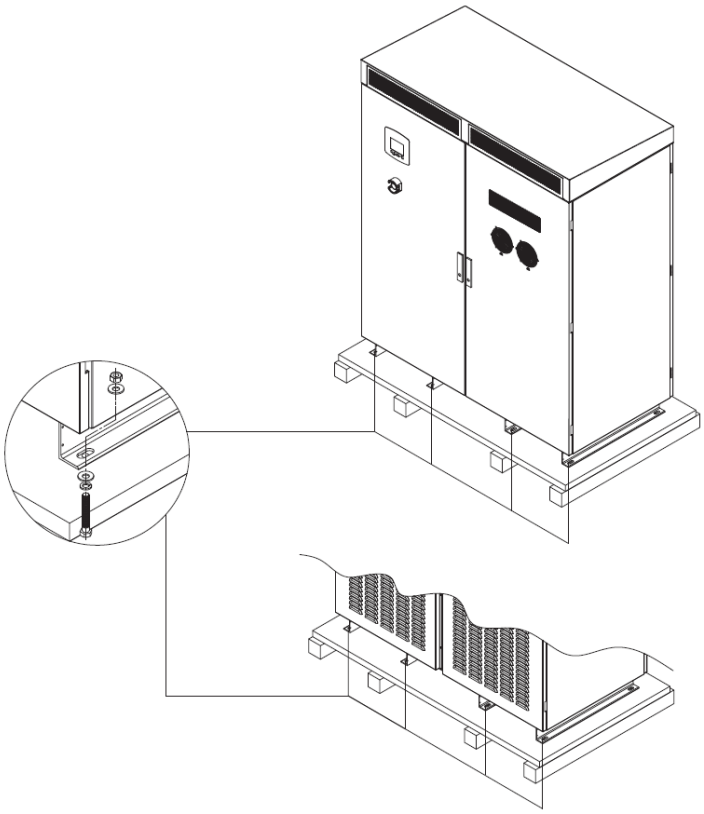


图 4-13. 松开螺丝与螺帽

3. 将逆变器从栈板上移开

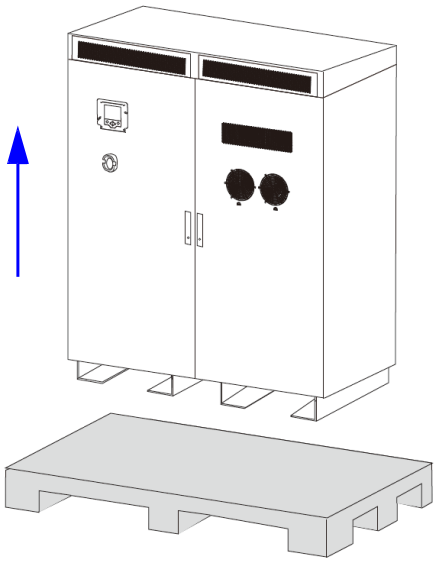


图 4-14. 将逆变器从栈板上移开

4.5. 物品清单

Table 4-1: 物品清单

物品	数量	说明
光伏逆变器	1	RPI-C500 光伏逆变器。
钥匙	2	用来开启或关上逆变器的门。
安装手册	1	手册内含安全规范、安装说明、产品规格等。
螺丝 (M5)	8	锁附挡鼠板用。
M10 螺丝组	2	包含螺丝、开口华司、平滑司和螺帽。预留给直流配线用。
M12 螺丝组	1	包含 50mm 长的螺丝和螺帽。预留给交流配线用。
	1	包含 45mm 长的螺丝和螺帽。预留给交流配线用。
	1	包含 40mm 长的螺丝和螺帽。预留给交流配线用。
线材	1	用来设定太阳能板正接地/负接地。
合格证	1	逆变器出厂合格证明。
测试报告	1	逆变器出厂验证相关资料。

5. 安装说明

5.1. 建议工具

安装逆变器时请使用下列建议的工具：

- 功率表 (功率分析仪)
- 电压表
- 电流表
- 扭力板手/ 套筒板手/ 开口板手
- 螺丝起子

5.2. DC 端连接

1. 如图 5-1 所示将连接到 DC 端的电缆穿过电缆接头。

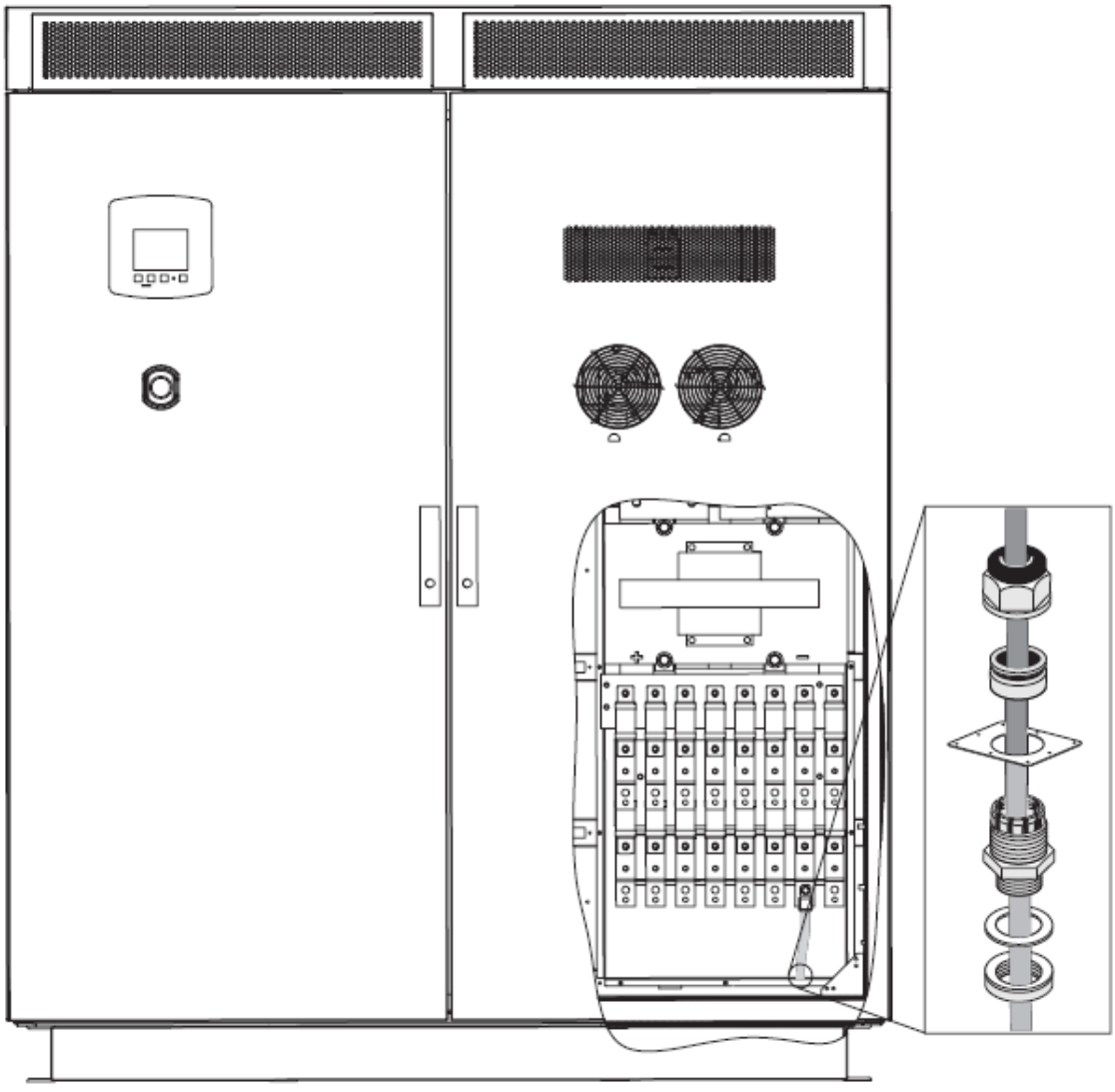


图 5-1. DC 端配线

2. 如图 5-2 所示将从 DC 配线盒来的电缆连接到逆变器。

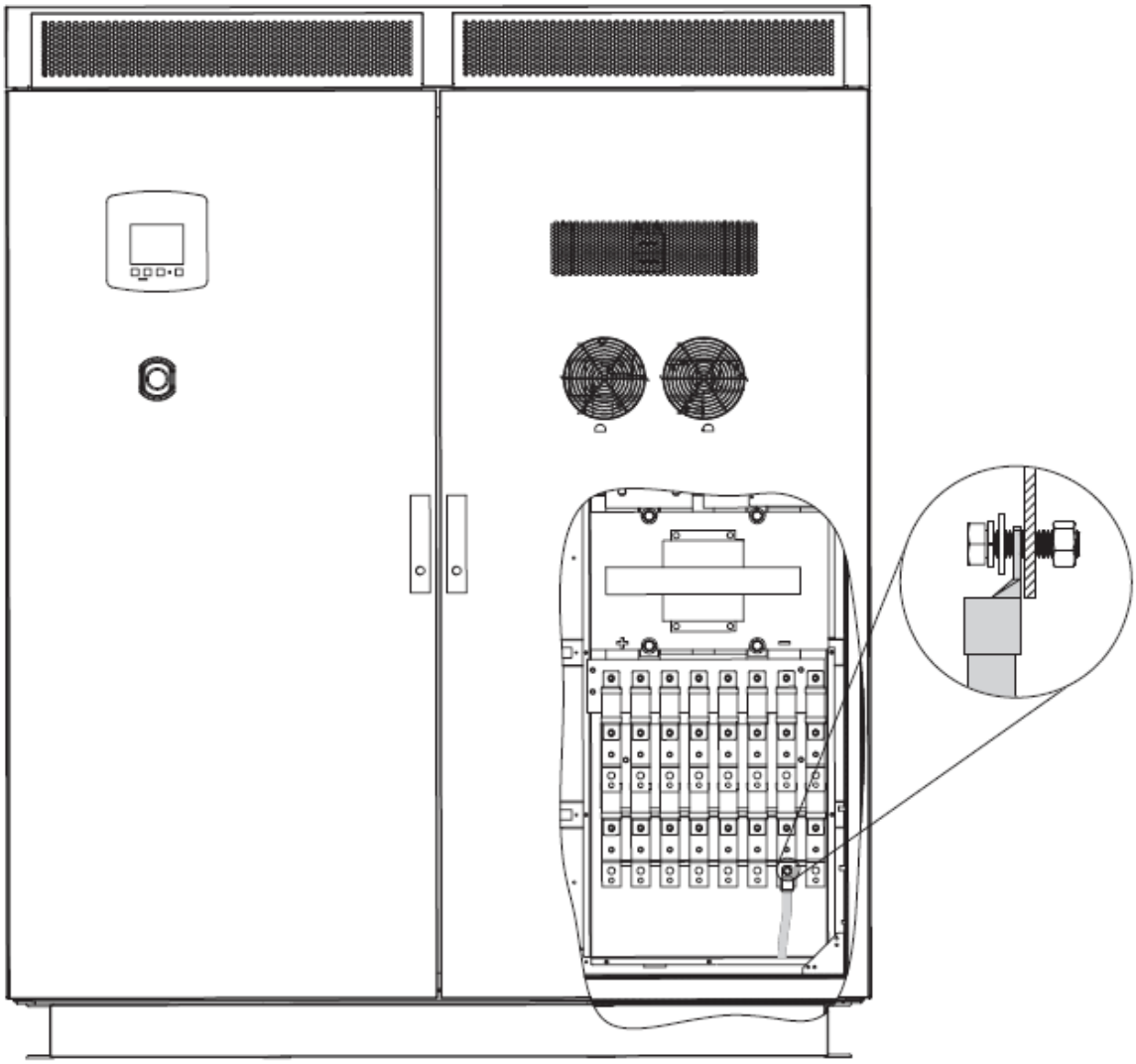


图 5-2. DC 端连接

DC 端	最大导线数目 (+/-)	螺丝/螺帽尺寸	扭力需求 (Nm)
	8/8	M10	25

DC 端缆线	DC+/DC-端最小需要的缆线总截面积
	600mm^2

说明:

DC 侧底板相关信息请参阅附录 B。

注意!

选用的缆线操作温度要有到 105°C。

说明:

针对出厂默认配置外的缆线尺寸与数目，关于其他配置组合内容需事先咨询制造商（台达电子）。

若使用其他配置组合，可以透过下列步骤来进行操作：

1. 先确认使用的缆线端子头是否能够与铜排连接，包含螺丝孔洞大小和铜排上螺丝宽度。这部分相关尺寸讯息可参考图 5-3 和图 5-4。
2. 请先参阅附录 B 中来确认缆线外径与其对应的端子头是否能够符合对应的电缆接头使用范围。如果端子头宽度确实超过建议限制，首先必须先将缆线穿过电缆接头，然后再将端子头压接于缆在线，避免配线中缆线无法穿过电缆接头。
3. 若因未安装环境空间不足而无法使用上述建议的缆线尺寸与数目，可以使用护线环搭配硅氧树脂来取代电缆接头。以下为活用护线环与硅氧树脂建议的厂商与型号。

零件名称	型号	厂商
活用护线环 (Movable bushing)	KG-020	KANG YANG HARDWARE
硅氧树脂 (Silicon rubber)	RTV162	GE Bayer Silicones

5.2.1. DC 端铜排尺寸

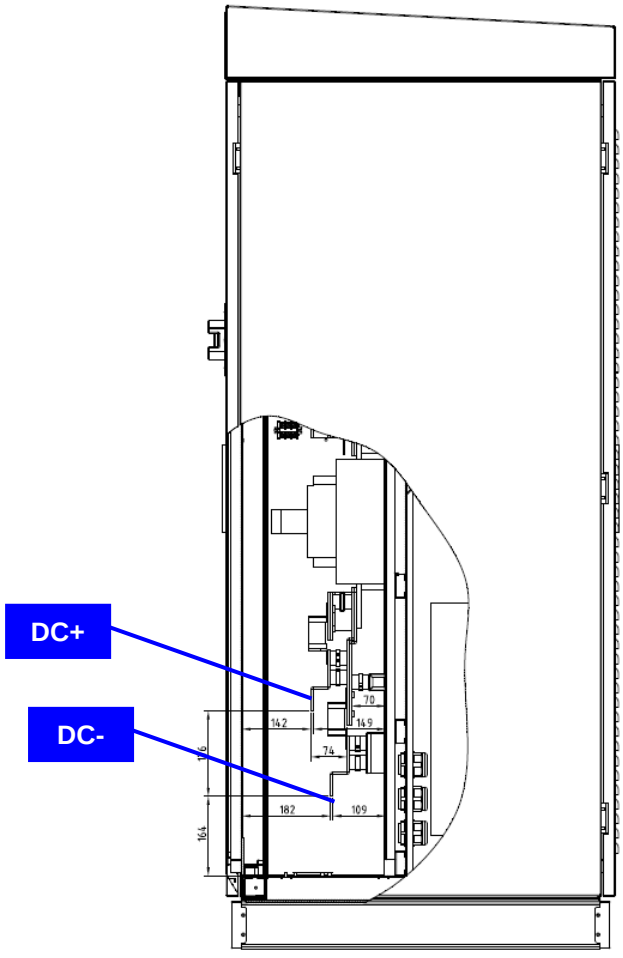


图 5-3. DC 端铜排侧视图

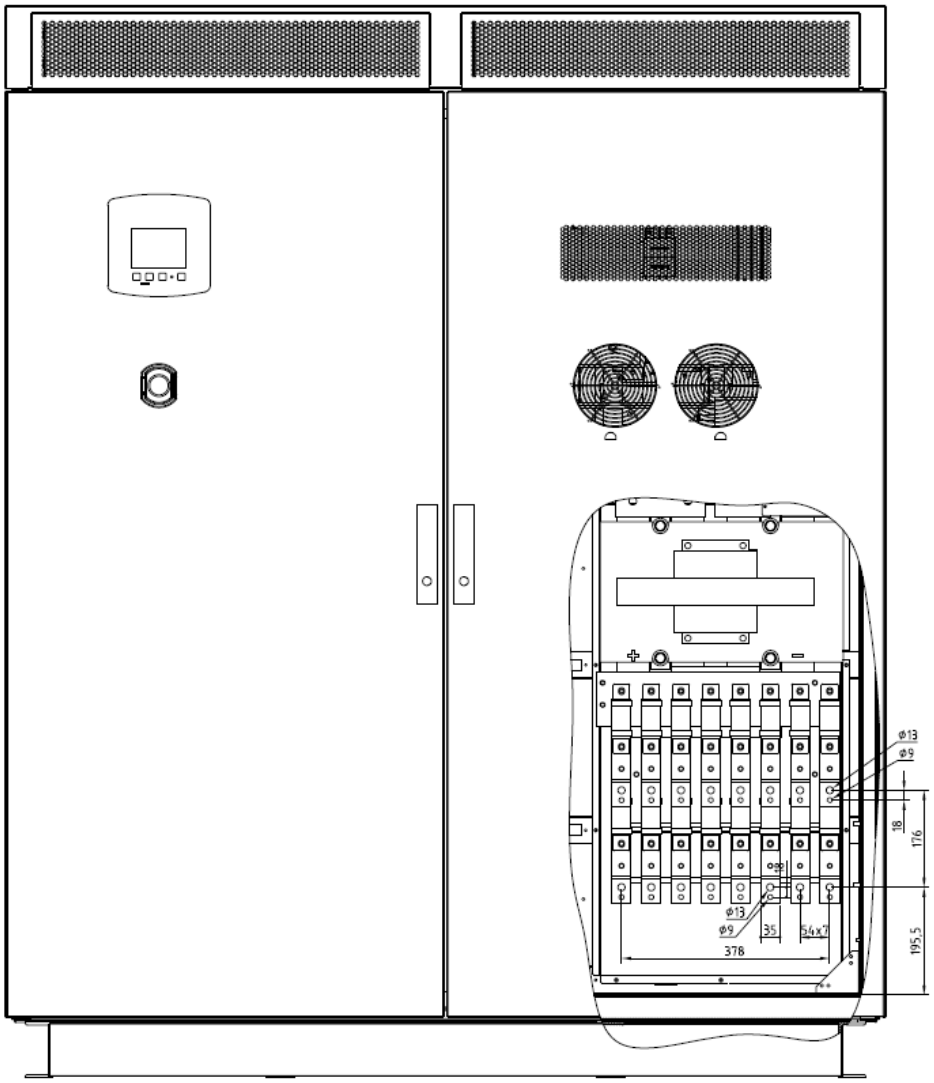


图 5-4. DC 端连接端尺寸图

5.2.2. 如何选择 DC 端保险丝与缆线尺寸

由于设置场地环境情况不同，逆变器将会依客户需求配接 DC 端保险丝，既然如此，必须安装适当的 DC 端保险丝来保护逆变器 DC 端的线路以及在短路情况发生时用来保护 DC 端缆线。而且用来保护输入的正端与负端是各自分开的保险丝。

下表提供输入保险丝额定电流对应到逆变器在 DC 端的连接数目。

DC 端连接数目	输入保险丝额定电流	型号	厂商
4	315A	1000GH-315UL	HINODE
5	315A	1000GH-315UL	
6	315A	1000GH-315UL	
7	250A	1000GH-250UL	
8	250A	1000GH-250UL	

说明:

1. 输入保险丝出厂默认配置是 250A*8 路。

2. 如果需要其他规格保险丝，须事先咨询制造商（台达电子）。

5.2.3. 正接地与负接地

太阳能板有两种接地方式：一种是正接地，另一种是负接地，要将太阳能板接地请依照下列步骤，如图 5-5 所示：

1. 将接地电缆连接至保险丝插座。
2. 将接地电缆用一根螺丝锁附在正端（ DC+）或是负端（DC-）的铜排上。

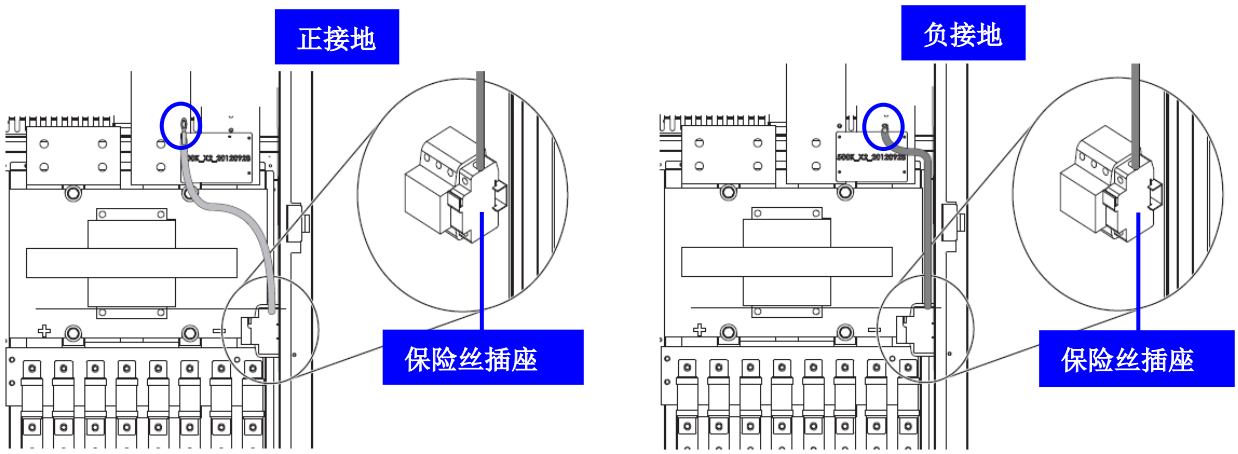


图 5-5. 正接地或负接地示意图

说明:

正接地与负接地必须透过面板来进行设定，相关介绍请参考 5.10.7.3 安装设定里的*隔离*。

5.3. AC 端连接

1. 如图 5-6 所示将连接到 AC 端的电缆穿过底板。

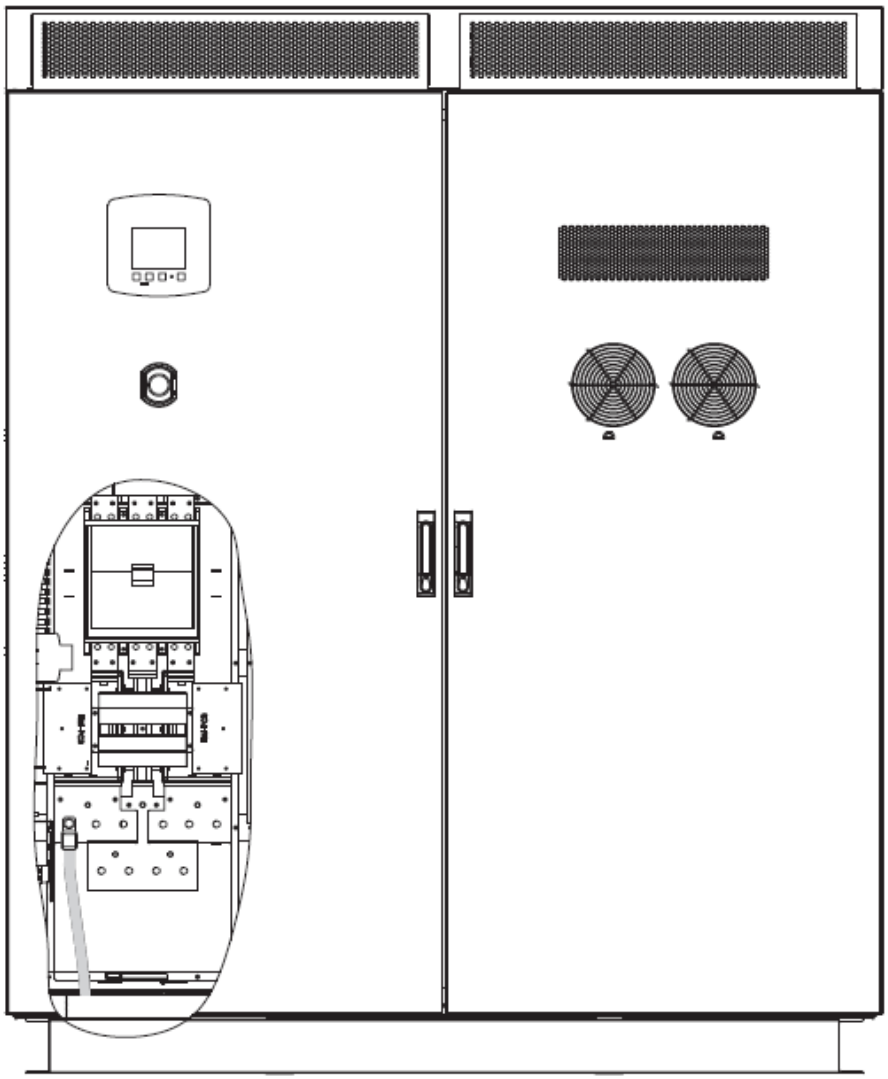


图 5-6. AC 端配线

2. 如图 5-7 所示将从 AC 配线盒来的电缆连接到逆变器。

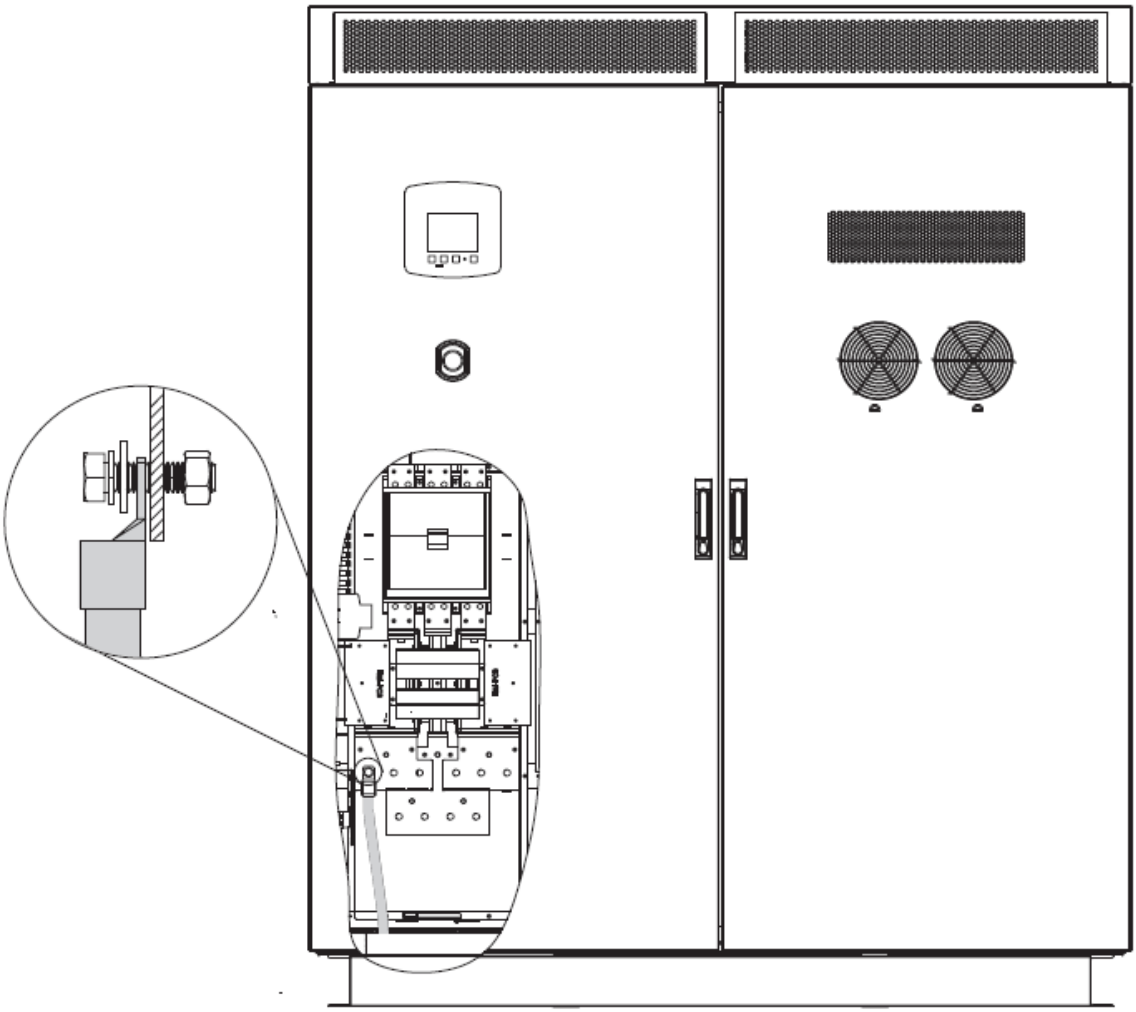


图 5-7. AC 端连接

AC 端	各相最大缆线数目	螺丝/螺帽尺寸	扭力需求 (Nm)
	4	M12	45

AC 端缆线	AC 端最小需要的缆线总截面积
	550mm^2

说明:

AC 侧底板相关信息请参阅附录 B。

注意!

选用的缆线操作温度要有到 105°C。

说明:

需使用护线环搭配硅氧树脂来做到防水防尘功能。以下为活用护线环与硅氧树脂建议的厂商与型号。

零件名称	型号	厂商
活用护线环 (Movable bushing)	KG-020	KANG YANG HARDWARE
硅氧树脂 (Silicon rubber)	RTV162	GE Bayer Silicones

5.3.1. AC 端铜排尺寸



图 5-8. AC 端铜排底视图

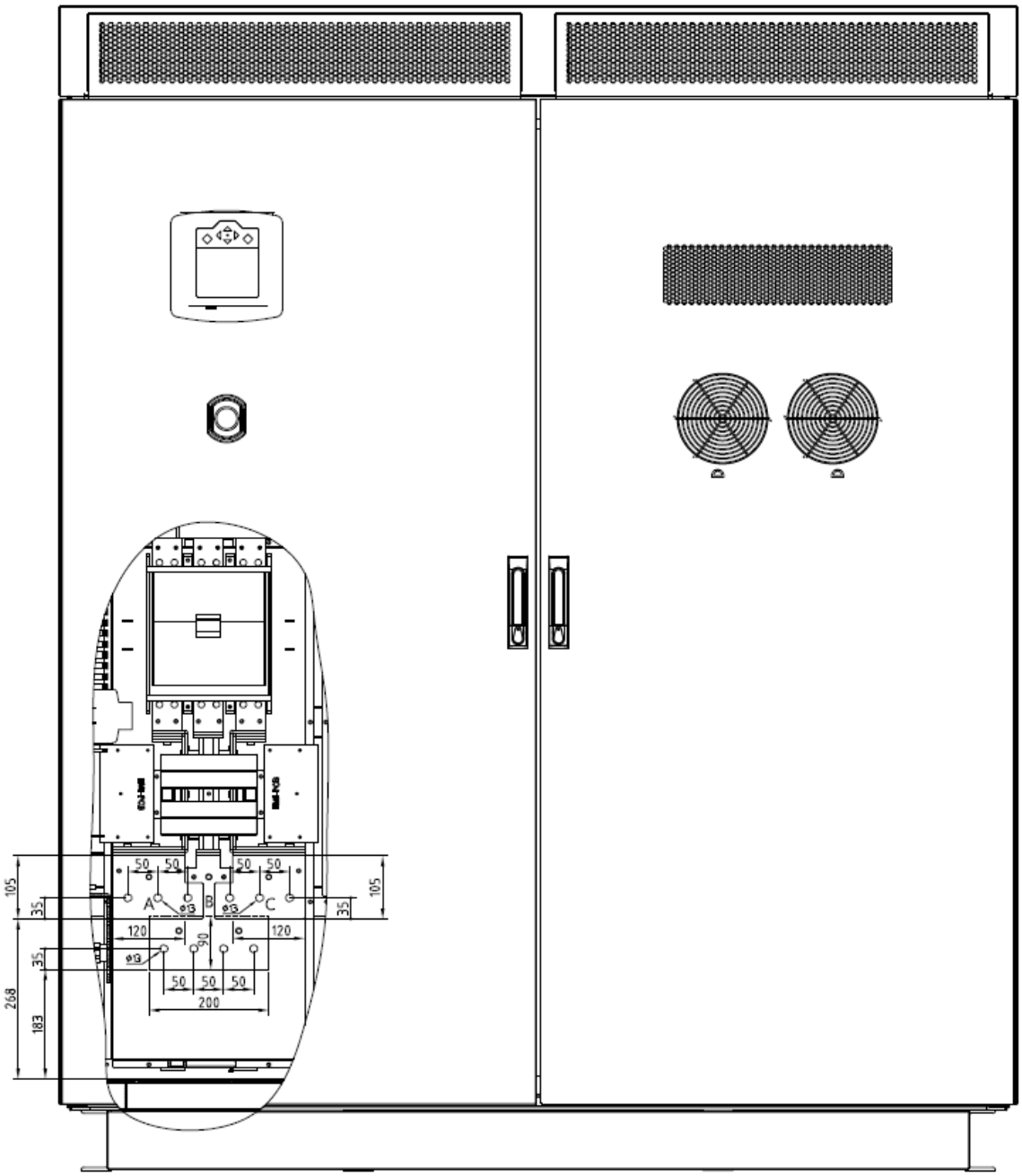


图 5-9. AC 端连接端尺寸图

5.4. PE 端连接

PE 端连接有以下两个地方可以使用。

1. 逆变器内部。可将 PE 连接到内部的 DC 侧或是 AC 侧的铜排上。
2. 逆变器外部。可将 PE 连接到外部的逆变器支撑脚上。

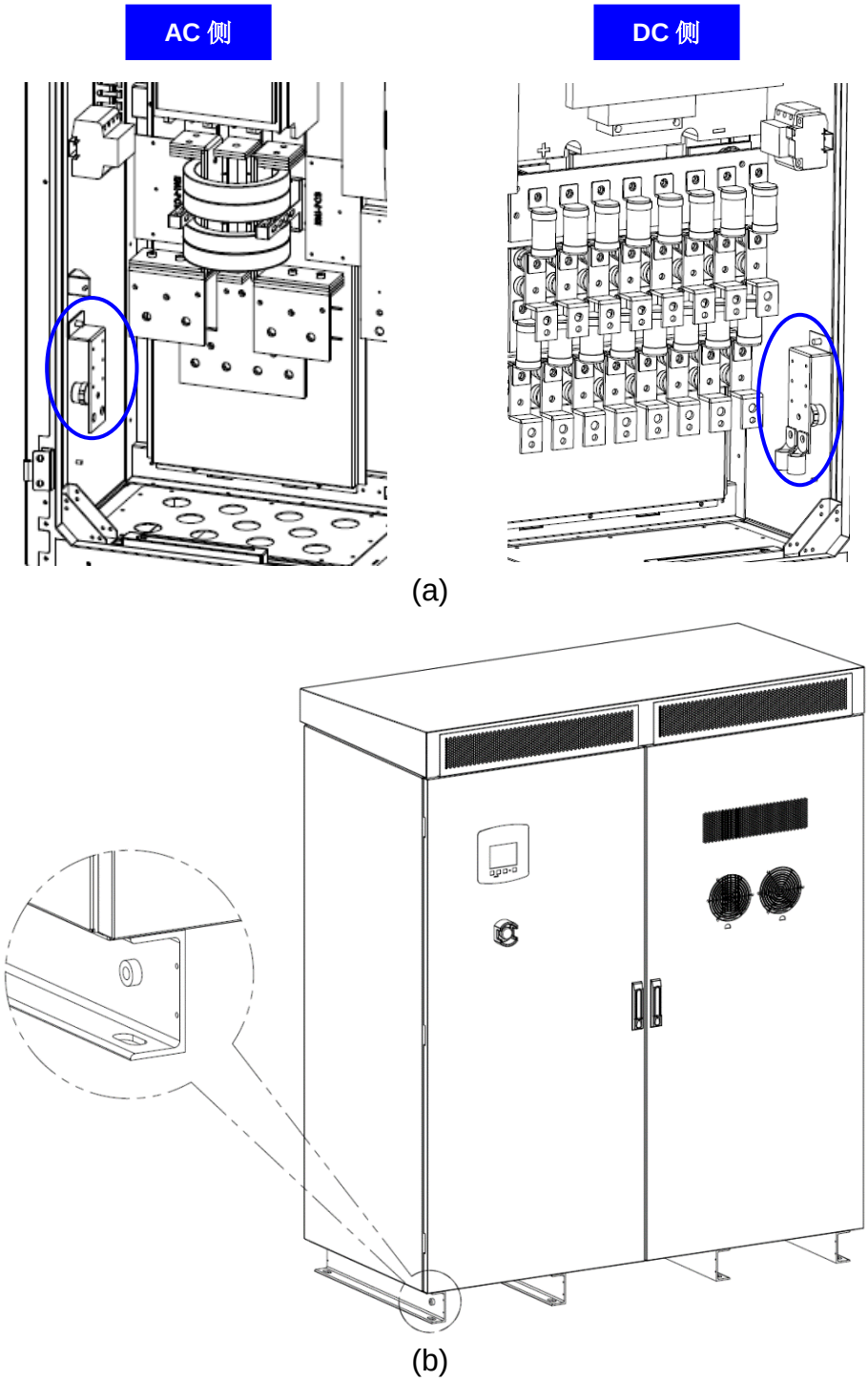


图 5-10. PE 端连接。(a)逆变器内部；(b)逆变器外部

5.4.1. PE 端铜排尺寸

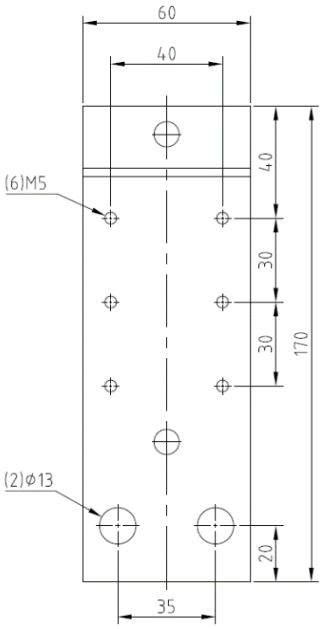


图 5-11. PE 端连接端尺寸图

PE 端	最大缆线数目 (DC/AC)	螺丝/螺帽尺寸	扭力需求 (Nm)
	2/2	M10	25

PE 端缆线	建议铜缆线尺寸
	250mm^2

注意!

选用的缆线操作温度要有到 105°C。

说明:

若使用其他配置组合，可以透过下列步骤来进行操作：

1. 先确认使用的缆线端子头是否能够与铜排连接，包含螺丝孔洞大小和铜排上螺丝宽度。这部分相关尺寸讯息可参考图 5-11。
2. 请先参阅附录 B 中来确认缆线外径与其对应的端子头是否能够符合对应的电缆接头使用范围。如果端子头宽度确实超过建议限制，首先必须先将缆线穿过电缆接头，然后再将端子头压接于缆在线，避免配线中缆线无法穿过电缆接头。
3. 若因未安装环境空间不足而无法使用上述建议的缆线尺寸与数目，可以使用护线环搭配硅氧树脂来取代电缆接头。以下为活用护线环与硅氧树脂建议的厂商与型号。

零件名称	型号	厂商
活用护线环 (Movable bushing)	KG-020	KANG YANG HARDWARE
硅氧树脂 (Silicon rubber)	RTV162	GE Bayer Silicones

5.5. 安装 DC 保险丝

1. 松开铜排上的螺丝，并将铜排取出。

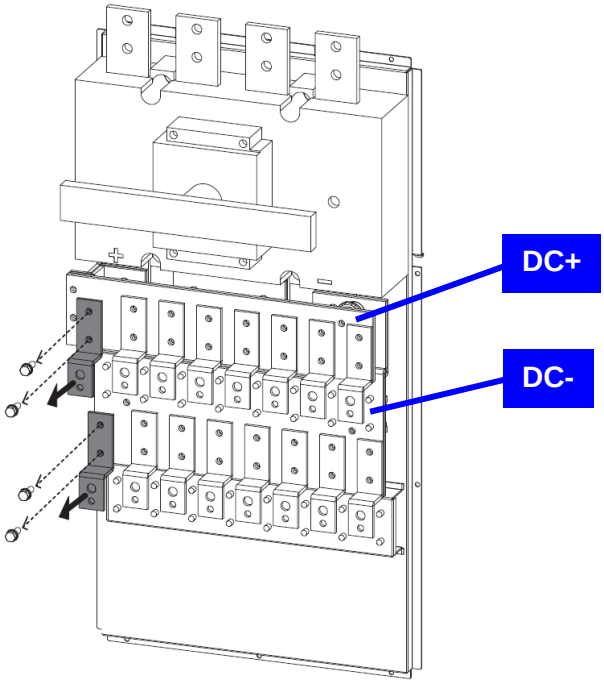


图 5-12. 取出铜排和螺丝

2. 安装 DC+和 DC-保险丝的步骤是相同的，所以请遵循以下步骤：

- 将铜排与螺丝放置于碍子上，并将螺丝锁紧。
- 接着将保险丝的两端与螺丝放置于碍子和 DC+/DC-铜排上，并将螺丝锁紧。

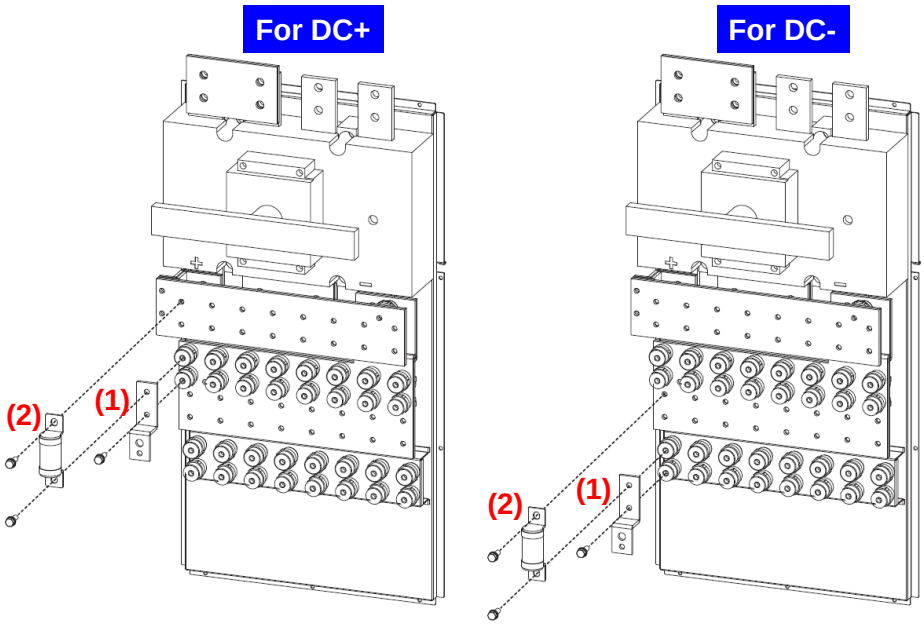


图 5-13. 安装保险丝与铜排

5.6. 挡鼠板安装和拆除

要安装挡鼠板时麻烦请遵循以下步骤：

1. 将挡鼠板安装于逆变器底部的前侧与后侧。
2. 把螺丝锁紧在挡鼠板的两侧。

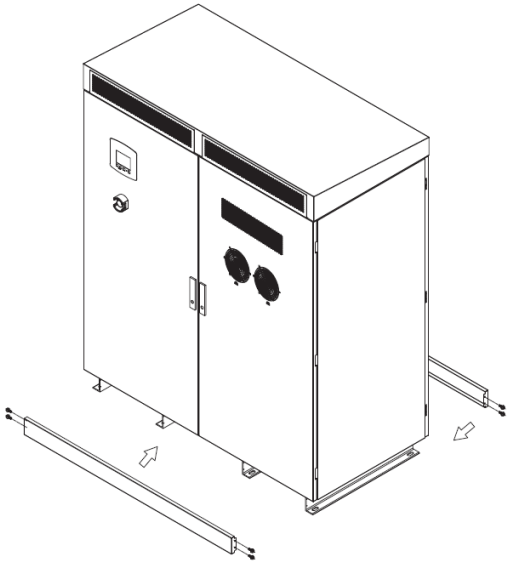


图 5-14. 安装挡鼠板

要拆除挡鼠板时麻烦请遵循以下步骤：

1. 松开位于挡鼠板两侧的螺丝。
2. 拆除逆变器挡鼠板。

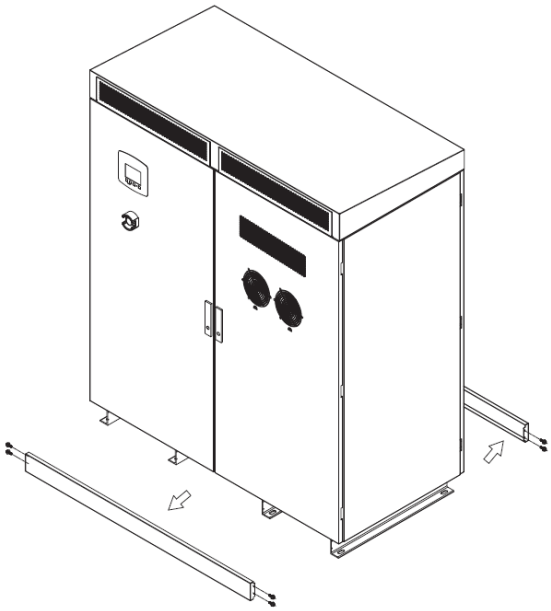


图 5-15. 拆除挡鼠板

5.7. 通讯接口连接

本机提供 2 组 RS-485 接口, 可以串接多台逆变器并同时监控, 并提供两组干接点(Dry Contact)。

5.7.1. RS-485 连接

RS-485 的 PIN 脚定义如表 5-1。只安装单台逆变器时, 安装者须将终端电阻设置为 **ON**。多台逆变器串接时如图 5-16 和图 5-17 所示，安装者必须将首台与末台逆变器之 RS-485 终端电阻设置为 **ON**，其余机子则设定为 **OFF**。终端电阻设定方式请参考表 5-3。

表 5-1: RS-485 PIN 脚定义

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



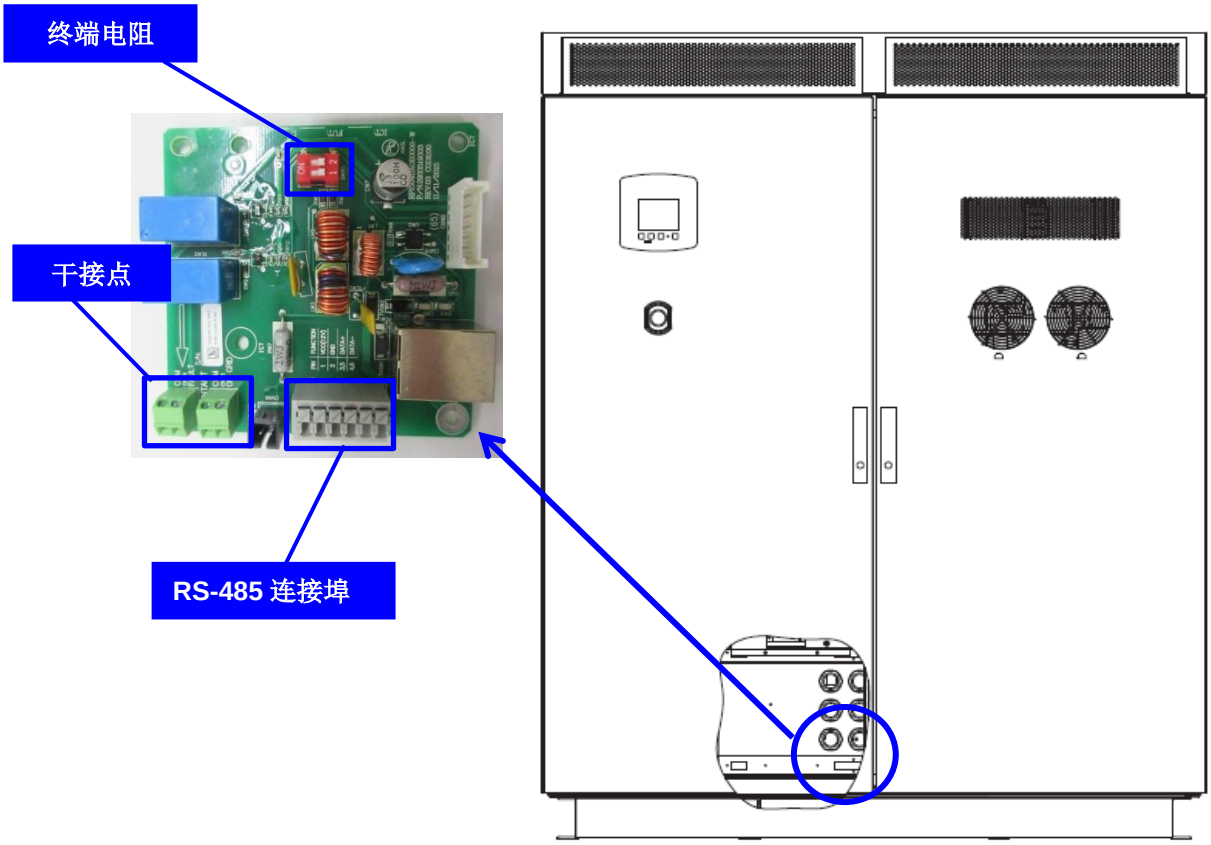


图 5-16. 多组逆变器组装时的配线盘位置

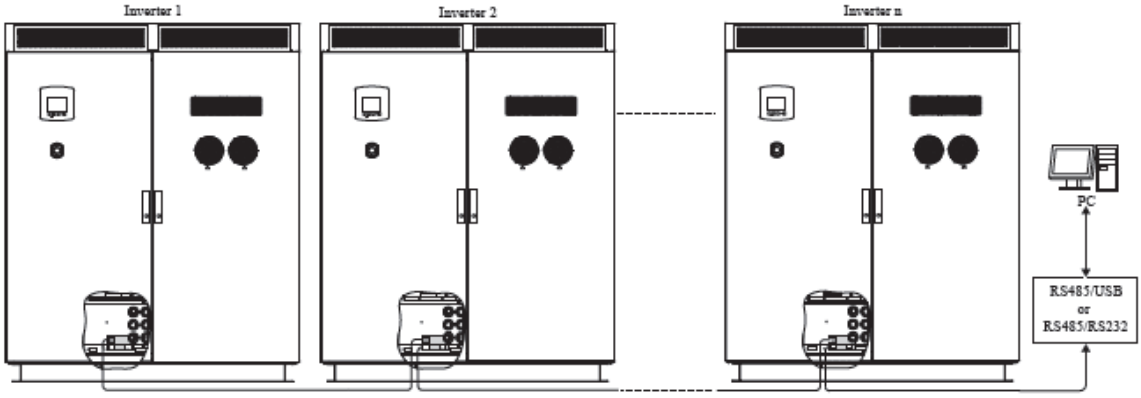
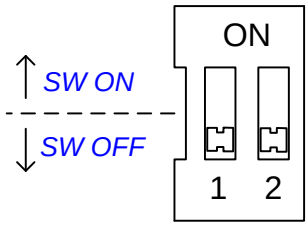


图 5-17. 多组逆变器的配线说明

表 5-2: RS-485 数据格式

Baud rate	9600
Data bit	8
Stop bit	1
Parity	N/A

表 5-3: 终端电阻设定



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

5.7.2. 干接点连接

本逆变器提供两组干接点以连接外部装置，功能分别是 ON GRID（并网状态）和 FAULT（故障）。当逆变器处于并网状态, COM 和 NO2 会短路；当机器侦测到硬件故障时则 COM 和 NO1 会短路，这些功能可以由顾客的需求来做设定。

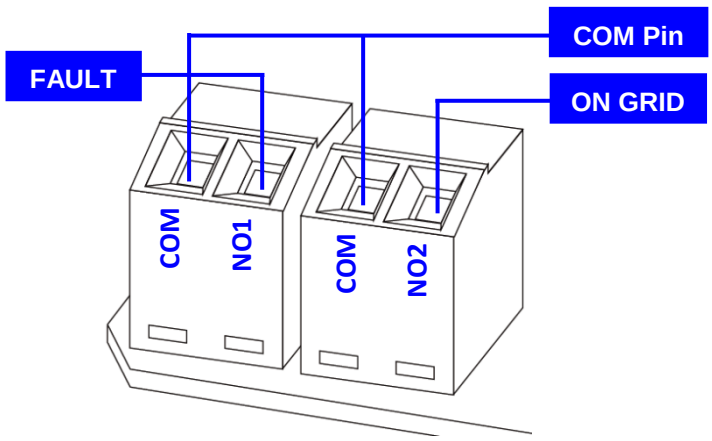


图 5-18. 干接点和接脚的定义

5.8. 外接辅助电源

如果 AC 辅助电源想要由内部供应改成外部供应，请依照以下步骤来操作：

1. 将电缆从 AC 断路器拆下。

说明:

外部供应辅助电源应能提供电压规格是：3P3W - 270Vac/315Vac/380Vac/400Vac ±15%，50/60Hz 且输出容量至少 3kA。

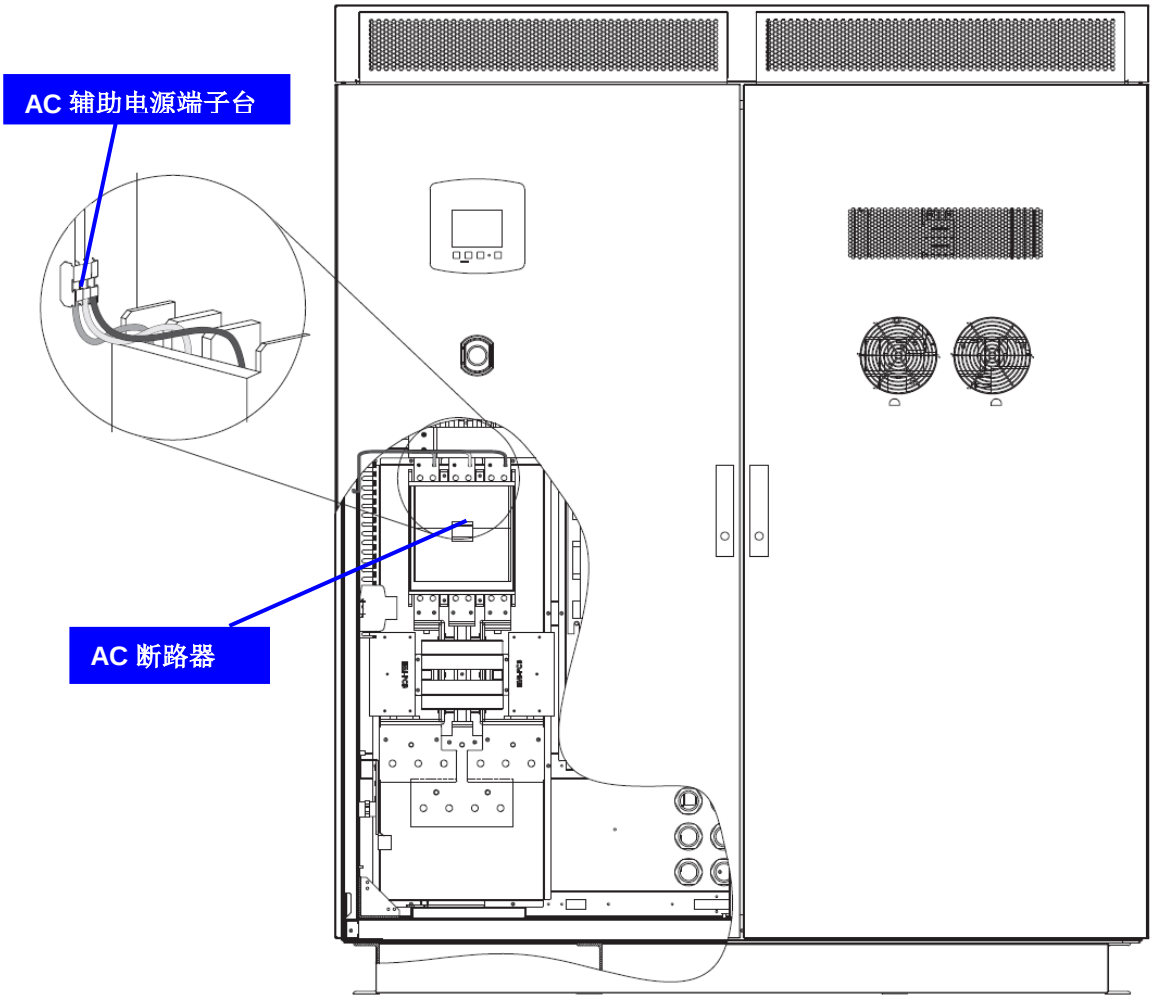


图 5-19. AC 辅助电源端子台位置

2. 将电缆从 AC 辅助电源端子台拆下。

3. 移除 AC 辅助电源端子台和 AC 断路器之间的电缆。

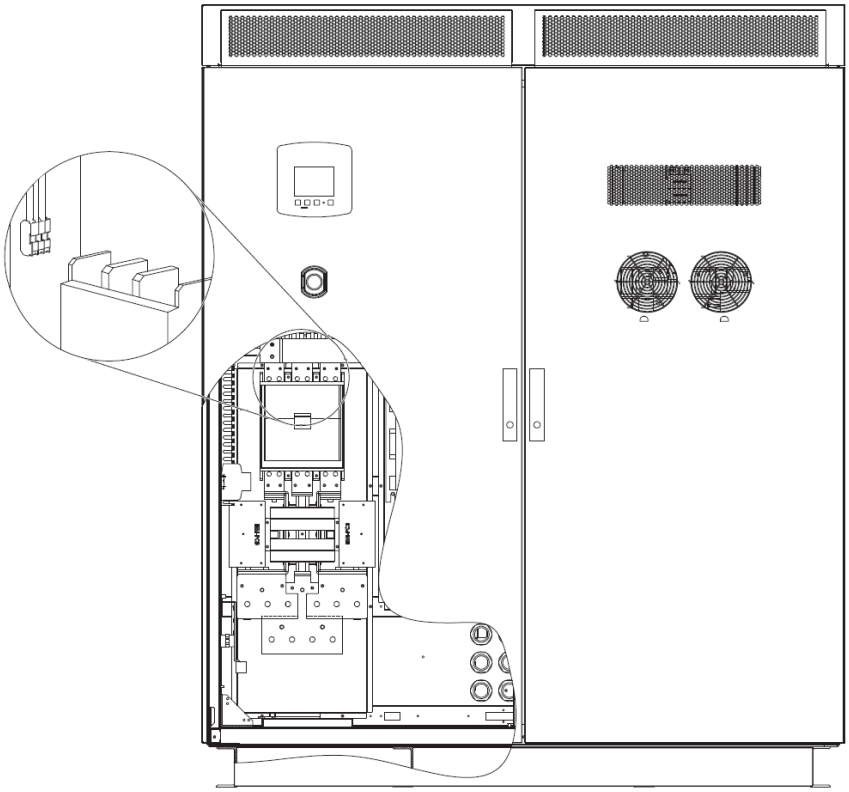


图 5-20. 移除缆线

4. 从外部电源来的电缆先穿过电缆接头。

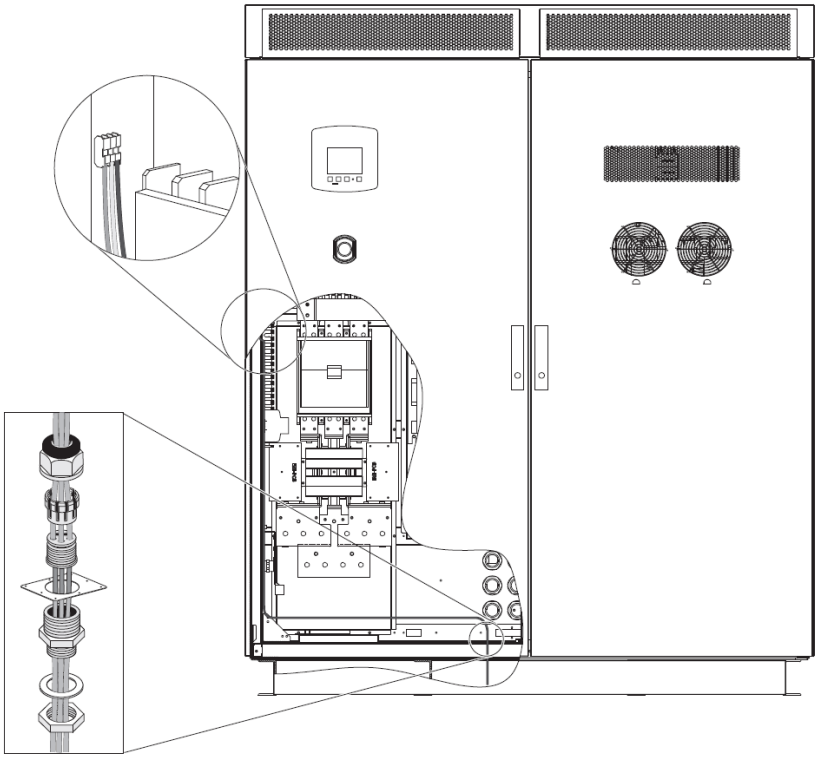


图 5-21. 外接电源缆线配置

5. 接着将从外部电源来的电缆接到 AC 辅助电源端子台上。

5.9. 第一次开机

5.9.1. 开机前的准备

1. 检查太阳能板。

说明:

太阳能板的 DC 开路电压必须大于 500Vdc 且小于 1000Vdc。

a. 在 DC 配电箱中量测太阳能板 DC 开路电压的正端(+)和负端(-)。

2. 检查 AC 市电电压。

使用 AC 电压表去量测 AC 市电电压，正常电压值应为线电压 270Vac。

5.9.2. 开机和自我测试

1. 配置光伏逆变器的设定

要送电给逆变器请将 DC 开关切换到 ON，液晶显示面板将在 40 秒之后开始正常显示。

a. 第一次开机时，显示面板会出现 Select Country 和国家名称，此时按压▲上或▼下将会依序在不同国家名称之间反白。按压 ***ENT*** 表示该国家选项确认；按压 ***EXIT*** 表示该国家选项取消。

b. 确认语言选项正确与否，按压 ***ENT*** 表示选择 Yes；或是按压 ***EXIT*** 表示选择 No。选择 No 显示画面将会回到上一个画面。

c. 画面显示 Select Language 时，按压▲上或▼下将会依序在不同语言之间反白。按压 ***ENT*** 表示该语言选项确认；按压 ***EXIT*** 表示该语言选项取消，接着显示面板会回到第一个画面。

d. 画面显示 Menu 时，按压▲上或▼下将会依序在不同功能之间反白。按压 ***ENT*** 表示该选项确认；按压 ***EXIT*** 表示该选项取消。

e. 当逆变器执行自我测试时，画面显示 E-Today。自我测试通过时，画面显示 System Boot Countdown。自我测试失败时，自我测试会再执行一次。

f. 画面出现 System Boot Countdown 时，系统开始倒数，此时按压 ***EXIT*** 画面会回到 Menu。

g. 画面显示 Menu 时，按压▲上或▼下将 Power Meter 反白，接着按下 ***ENT*** 选择该功能。

h. 画面显示 Power Meter 时，确认输入和输出信息之后，按压 ***EXIT*** 画面会回到 Menu。

i. 此时画面出现 Menu，整个设定步骤完成。

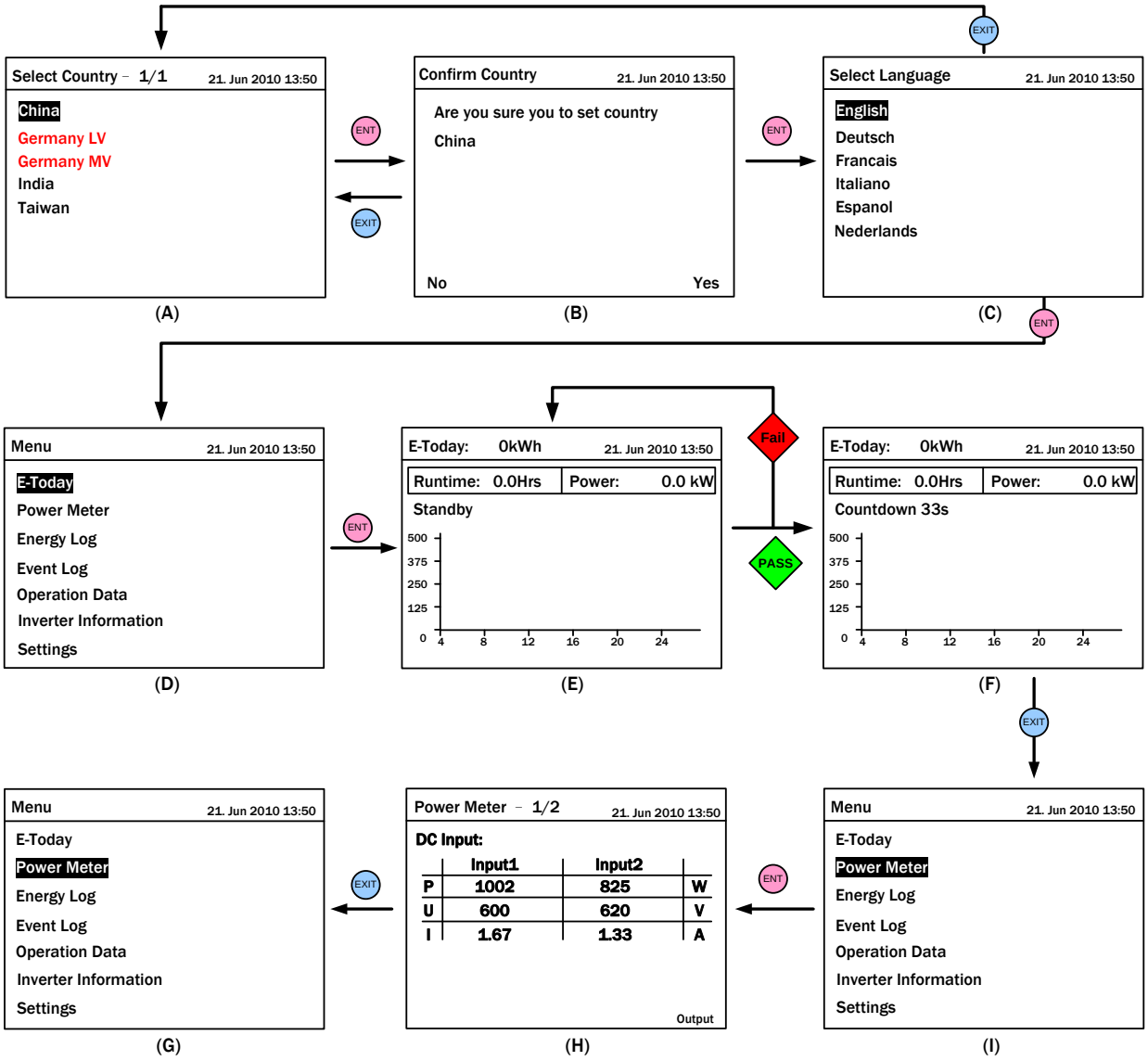


图 5-22. 所有组态设定页面

说明:

如果辅助电源是外接的话，逆变器动作前，先将辅助电源打开，详细说明请参考 5.8 *外接辅助电源* 。

5.10. 有功/无功功率控制与故障穿越

使用者只能在电网系统为 Germany MV、India 以及 China 时才能做有功/无功功率控制（使用者必须输入密码去更改这些设定）。故障穿越（FRT）只能在电网系统为 Germany MV、India、以及 China 时，才能去做设定。根据电网营运商的要求，有功功率控制有两个设定项而无功功率控制有四个设定项。使用者可选择要同时开启有功功率与无功功率控制，或是只开启其中一种，抑或是只开启无功功率控制中的其中一个设定项。

5.10.1. 有功功率控制

5.10.1.1. 有功限制

根据 2008 年六月版 BDEW 技术指导第 25 页如下：

发电设备必须要能够在降低输出功率的情况下运作。如下列举的情况，电网营运商被授权要求有暂时的馈入功率或中断设备的限制：

- *对安全运作的潜在危险*
- *电网营运商的电网过载的拥挤或危险*
- *孤岛效应的危险*
- *对电网稳态或动态稳定度的危险*
- *危害系统稳定度的频率上升*
- *结构量测的修复或实现*
- *在发电管理/馈入管理/电网安全的范围*
- *管理 (参见 „Grundzüge zum Erzeugungsmanagement“)*

使用者能够透过设定额定功率的百分比来减低输出功率。请见 **5.11.7.4.1 Power Limit** 的设定步骤。

5.10.1.2. 功率对应频率

使用者可依需求自行调整参数。请见 **5.11.7.4.2 Power vs. Frequency** 设定步骤。

简号说明:

P_m	:电网频率为 f_{start} 时逆变器的输出功率.
P	:逆变器输出功率.
f	:电网频率.
fstart	:开始限制输出功率的设定频率.
fstop	:无输出功率的设定频率.
Gradient	:输出功率下降的曲线斜率.

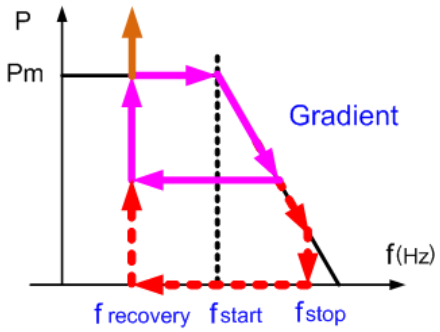


图 5-23. 功率对应频率特性

5.10.2. 无功功率控制

根据 BDEW:

至少在无功功率输出对应到有功因素在的电网连接点的值为 cos φ = 0.95 欠激至 0.95 过激，发电厂运作之有功功率输出必须能够操作在任何操作点。上述数值若有偏差必须依照合同的协议。在消耗参考系统（consumer reference arrow system），这代表操作在第二象限 (欠激) 或第三象限 (过激)。有功功率输出，不论是无功功率法规的固定目标值还是透过远端控制的可调整目标值（或其他控制技术）将会在转换站由电网营运商明确规定。

这些设定值有

a) a fixed active factor cosφ or
b) a active factor cosφ(P) or
c) a fixed reactive power in MVar or
d) a reactive power/voltage characteristic Q(U).

5.10.2.1. 固定有功因素 cosφ

使用者能够设定虚功电流自 Cap 0.80 至 Ind 0.80(若输出功率低於额定功率的 10%，逆变器将终止无功功率控制)。

5.10.2.2. 有功因素 cosφ(P)

一旦使用者开启这个功能，逆变器将会根据该瞬间的有功功率输出提供虚功电流。下图为一范例。请见 **5.11.7.4.4 cosφ(P)** 的设定步骤。

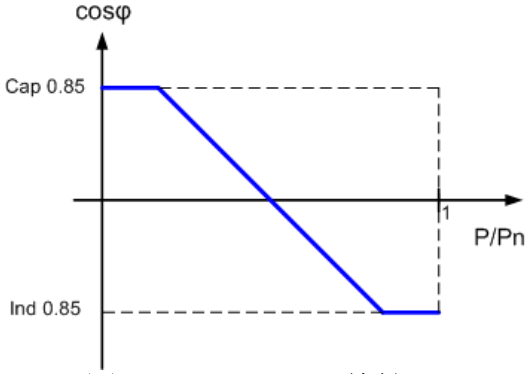


图 5-24. cos ϕ (P)特性

5.10.2.3. 固定无功因素

一旦使用者开启这个功能，逆变器将会根据固定无功功率的设定提供虚功 (ie. Q)。设定范围自 Cap 60%至 Ind 60%。

5.10.2.4. 无功功率/电压特性 Q(U)

选择“Q(U) control”之后，使用者能设定下图无功(Q) vs. 市电电压(Grid voltage)操作曲线。

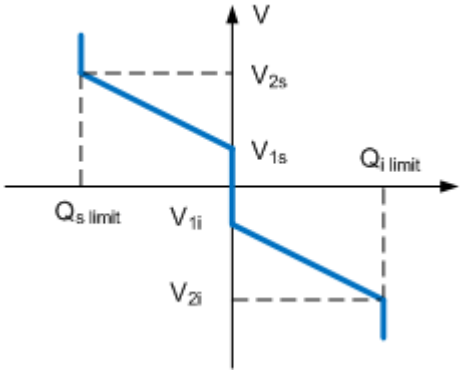


图 5-25. Q(U)特性

5.10.3. 故障穿越（FRT）

根据 BDEW:

2.5.1.2 动态电网支援

动态电网支援意指在电压骤降事件中的电压控制在高电压和极高电压电网目的是为了避免在偶然馈入过大的电流造成的市电中断并因此造成电网毁坏。按照连接到中压电网的发电厂数量不断地增加，这些电厂的结合在动态电网支援的方案中变得越来越重要。因此，即使在连接到电网时，没有被电网营运商要求，这些电厂通常必须加入动态电网支援考量。意即，电厂必须能够满足专门术语：

- *在电网故障事件发生时，不得自电网跳开*
- *在电网故障期间，提供虚功电流进入电网，以稳住电网电压*
- *在故障清除後，不要从中压电网取出比起在故障发生之前还多的电感性虚功*

这些要求应用在所有型态的短路电流 (亦即应用在单相，两相和三相短路电流)。

好比 Transmission Code 2007, 关於电网混乱的事件中，指导方针将他们的行为区分为 type-1 和 type-2 电厂。若一个同步机直接连接到市电(只经过发电机的变压器)，则其为 type-1 发电装置。而其他电厂是 type-2 的发电装置。

以下的情况必须应用於 type-2 电厂，把 Transmission Code 2007, Section 3.3.13.5 列入考虑：

- *在电压骤降事件中，在小於等於 150 ms 期间，电压降为 0 %的 Uc，发电装置不得自电网中断*

- *如图2.5.1.2-2 所示蓝线下方，并无要求说明电厂必须维持与电网连接。电压骤降的值落在边界 1 的上方，不得造成不稳定或者导致电厂自电网中断(TC2007; 3.3.13.5, section 13; extended to asymmetrical voltage drops).*

若电压骤降的值落在边界 2 之上且在边界 1 之下，发电装置必须能够穿越故障，不从电网中断。在这段时间馈入的短路电流，必须要与电网营运商达成协议。在与电网营运商谘询过後，若电厂连接的方式不同，则视需要而定，允许能平移边界 2 。再者，在与电网营运商谘询过後，假若发电厂能在最迟发生中断後 2 秒内再连接，则短时中断是被允许的。在再连接之後，有功功率必须以每秒至少额定功率的 10%的斜率增加(TC2007; 3.3.13.5, section 14).

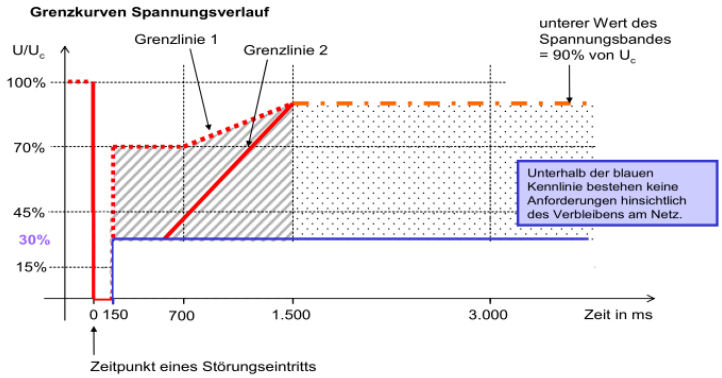


图 5-26. 连接至电网连接点的 type-2 电厂电压边界的图表

RPI-C500 实现 FRT 的行为如下图：

区域 1 维持正常运作

区域 2 根据 ΔU/Un 与 K factor 馈入虚功电流

区域 3 短时中断

区域 4 长时间的中断

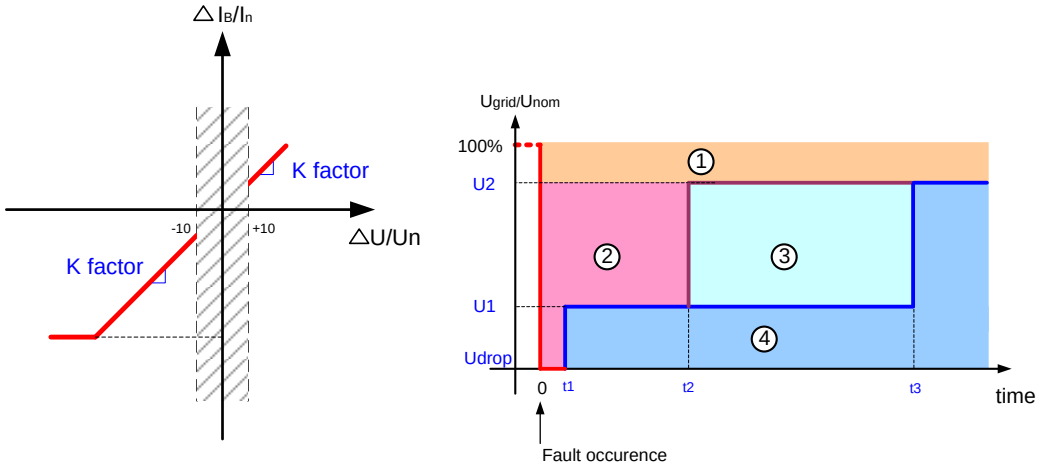


图 5-27. FRT 特性

5.11. LCD 显示画面及操作

于首页按 ***EXIT*** 键即进入选单（图 5-28）。E-Today 即首页, 其余每一选项的内容及操作详述于此章节

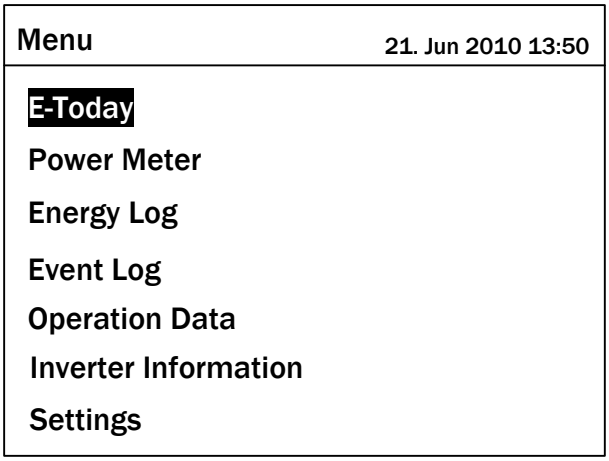


图 5-28. Menu 页面

5.11.1. Home Page

逆变器正常动作时，LCD 显示画面如图 5-29，可以得知 Output Power（目前发电功率）、Inverter Status（逆变器状态）、Today Energy（今日总发电量）、Today Runtime（今日发电时数）、Today Power Curve（今日发电曲线）、Date-Time（日期-时间）。

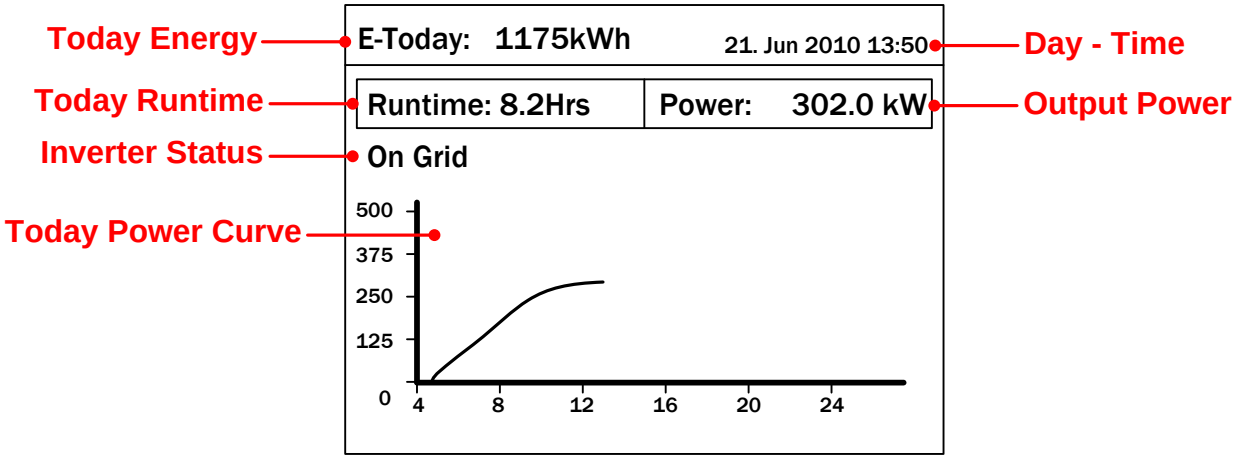


图 5-29. 主页面

5.11.2. Power Meter

此页面会显示输入端与输出端的电压、电流、功率…等资讯。

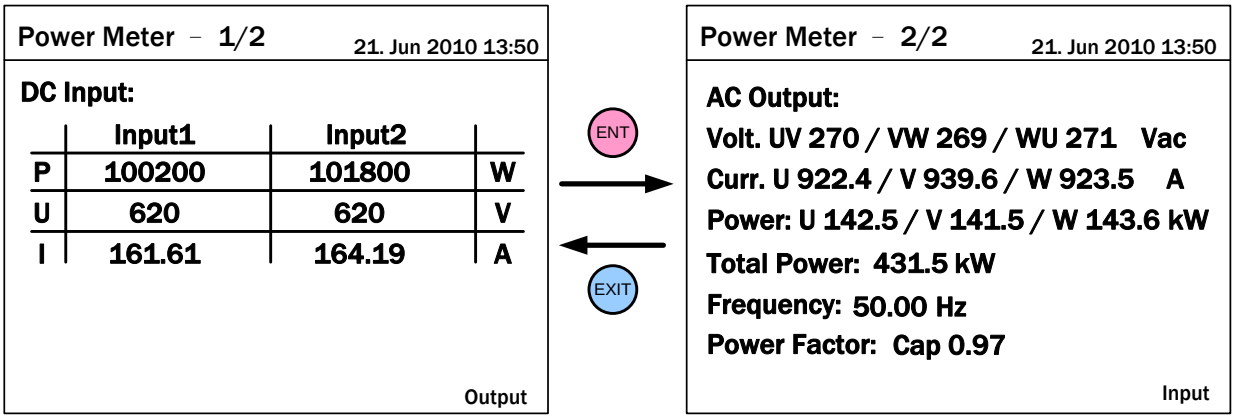


图 5-30. Power Meter 页面

5.11.3. Energy Log

在此页面按 ***ENT*** 键可观看历史资料，有年、月、日的发电量，年与月以长条图表示，日则以曲线表示。

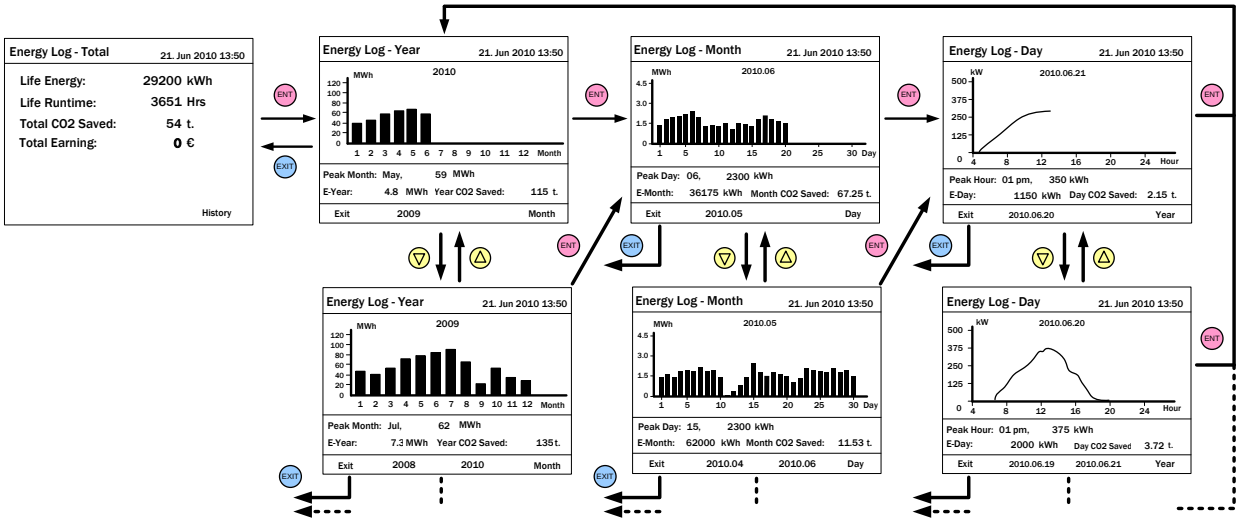


图 5-31. Energy Log 页面

5.11.4. Event Log

进入此页面会显示发生过的事件(Error or fault), 最多可显示最新的 30 笔事件, 新的事件置于顶部, 按 ***ENT*** 键可检视所有事件的统计资料。

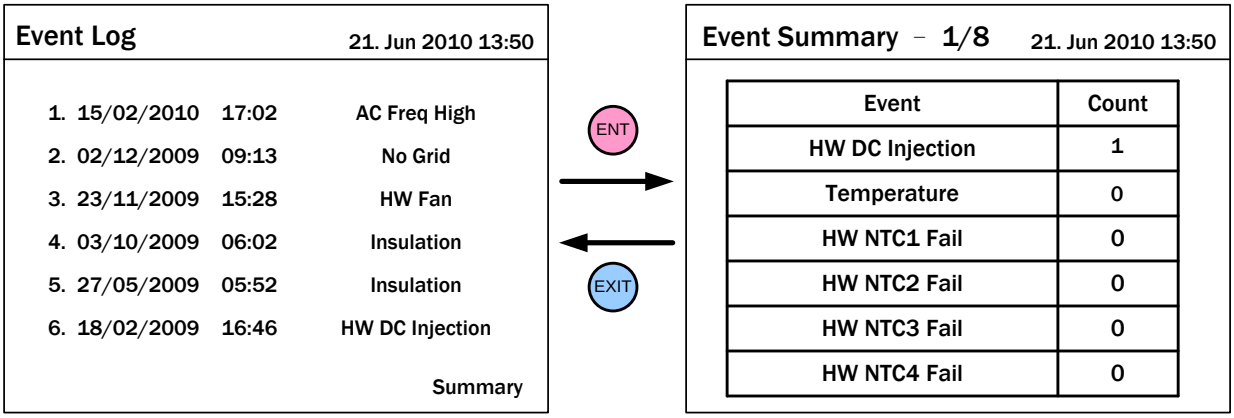


图 5-32. Event Log 页面

5.11.5. Operation Data

共四页, 记录逆变器工作的历史最大数据, 包括输入/出的最大电压、电流与功率；散热片与逆变器内部最高温度。

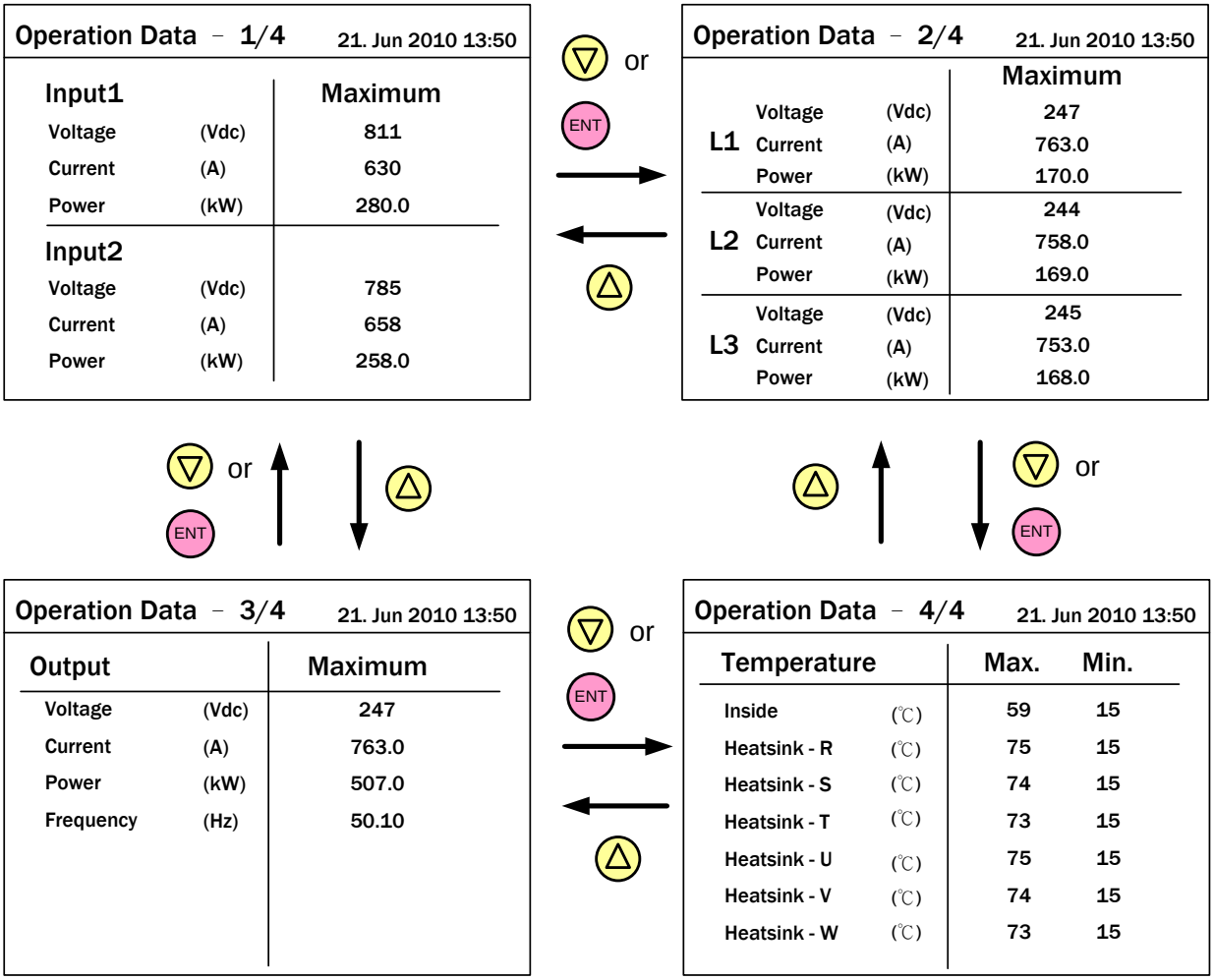


图 5-33. Operation Data 页面

5.11.6. Inverter Information

此页面显示以下信息：serial number（产品序号）、firmware version（韧体版本）、installation date（安装日期）和 inverter ID（逆变器 ID）。使用者要更改 inverter ID，更改方式请参照下一节 *Settings*。

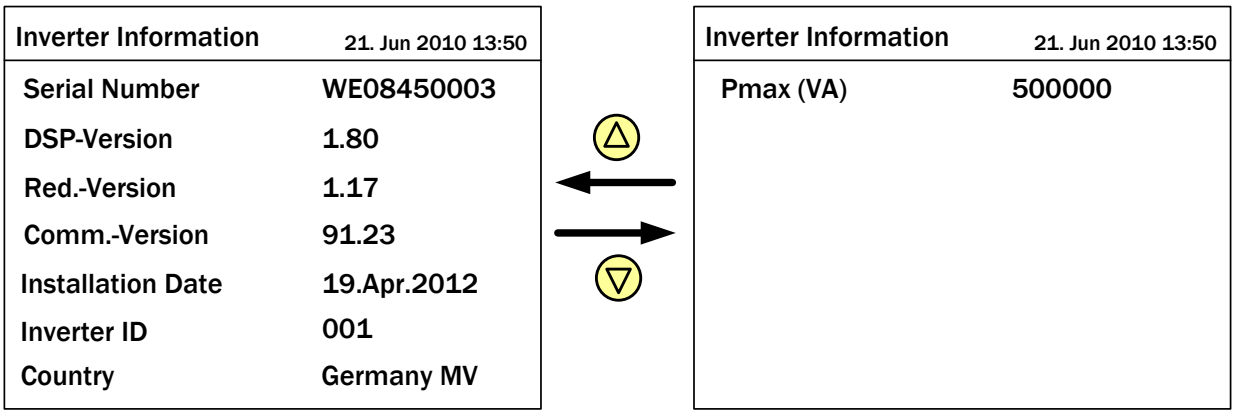


图 5-34. Inverter Information 页面

5.11.7. Settings

此页可供设定的项目有：Personal Settings（个人设定）、Coefficients settings（参数设定）、Install Settings（安装设定）、Active/Reactive Power Control（实功/虚功控制）和 FRT（故障穿越）。

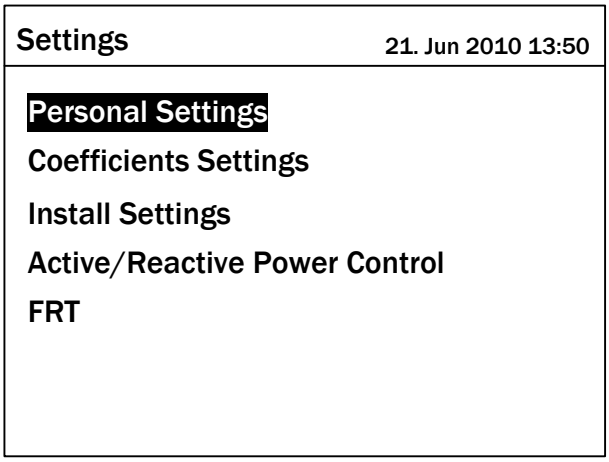


图 5-35. Settings 页面

5.11.7.1. Personal Settings

在此可以设定的项目：Language（语言）、Date（日期）、Time（时间）、Screen Saver（屏幕保护程序）、Brightness（屏幕亮度）和 Contrast（屏幕对比度）。屏幕保护程序可设定 5 分钟到 60 分钟，一旦使用者超过设定时间没有使用按键功能，面板会自动关闭 LCD 背光并回到首页。屏幕亮度和对比共可设定等级 1-5（从弱到强）。

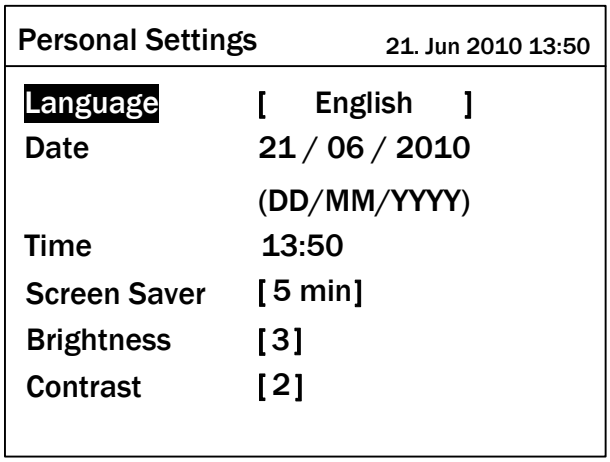


图 5-36. Personal Settings 页面

5.11.7.2. Coefficient Settings

使用者可以针对使用者所在地区的需求做下列设定参数。

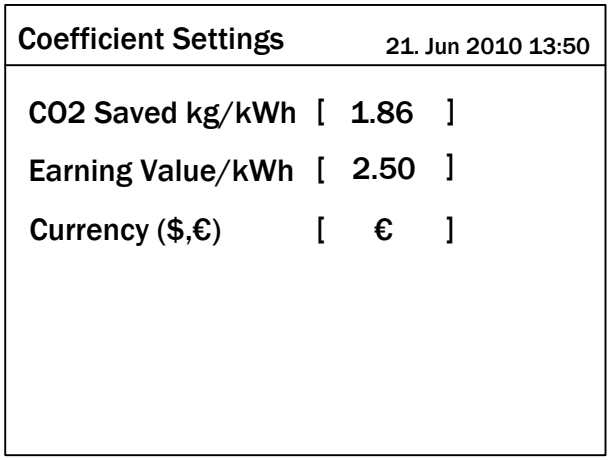


图 5-37. Coefficient Settings 页面

5.11.7.3. Install Settings

进入 Install Setting 之前必须要输入正确的密码，密码分为一般使用者与安装人员两种等级, 两种密码皆不能修改，系统确认为一般使用者密码后可设定 Inverter ID 和 Insulation。

注意!
下面操作仅允许专业安装人员更改设定, 更改这些设定有可能会造成逆变器损坏。

Insulation

逆变器于开机前会检查机器会侦测太阳能板到地之间的阻抗，如果这个阻抗值低于 Insulation Settings（隔离设定）里面的设定值，逆变器将会停止运转，隔离设定共提供了四种模式：ON（开启）、Positive Ground（正接地）、Negative Ground（负接地）和 Disable（失能）。安装人员也可以针对实际状况设定不同的阻抗。

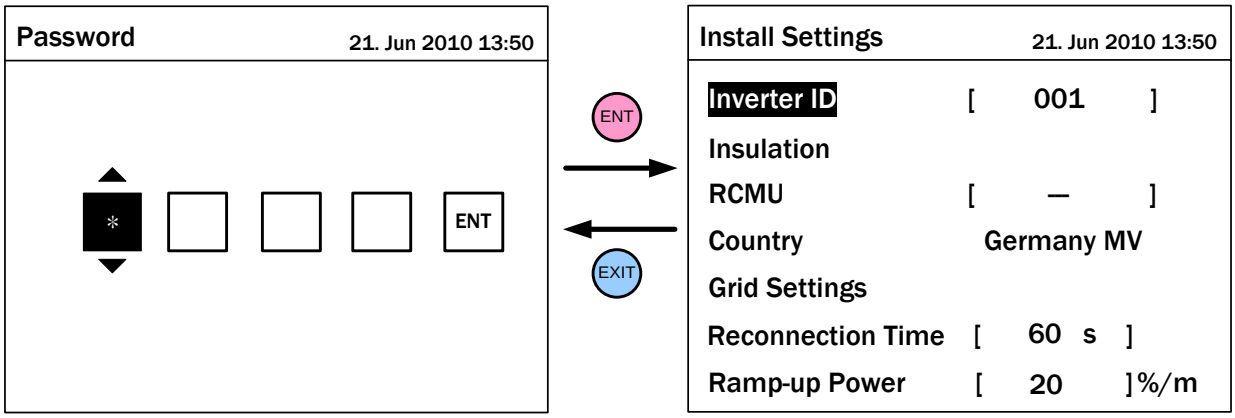


图 5-38. 一般使用者设定页面

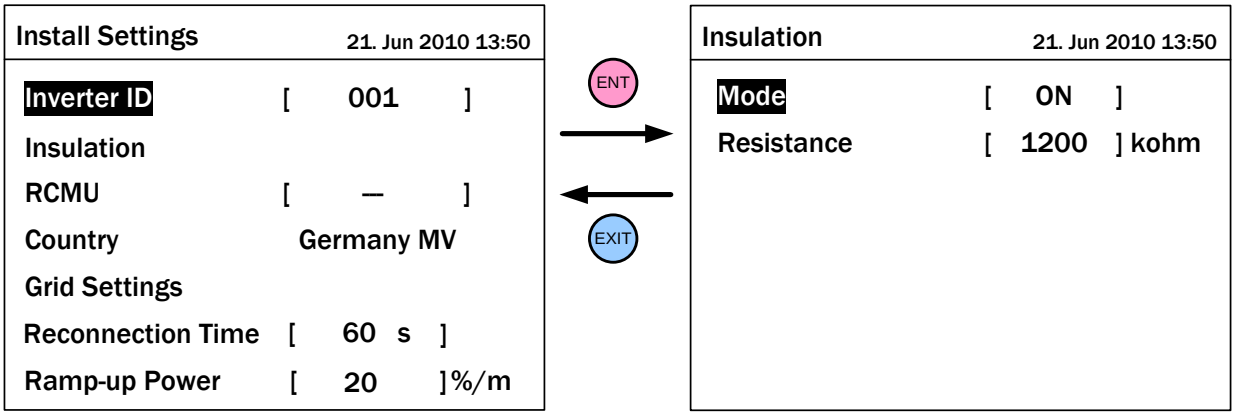


图 5-39. 隔离设定

输入安装技师的密码会比输入一般使用者密码多出以下选项：DC-Injection（直流注入）、Return to Factory（出厂模式）、Country（国家）和 Grid Setting（市电设定）。在市电设定选项里，技师可可调整逆变器对市电的跳脱保护点（例如 OVR, UVR, OFR, UFR）。 进入市电设定调整市电保护参数之前，请先将国家设定为“Custom”。

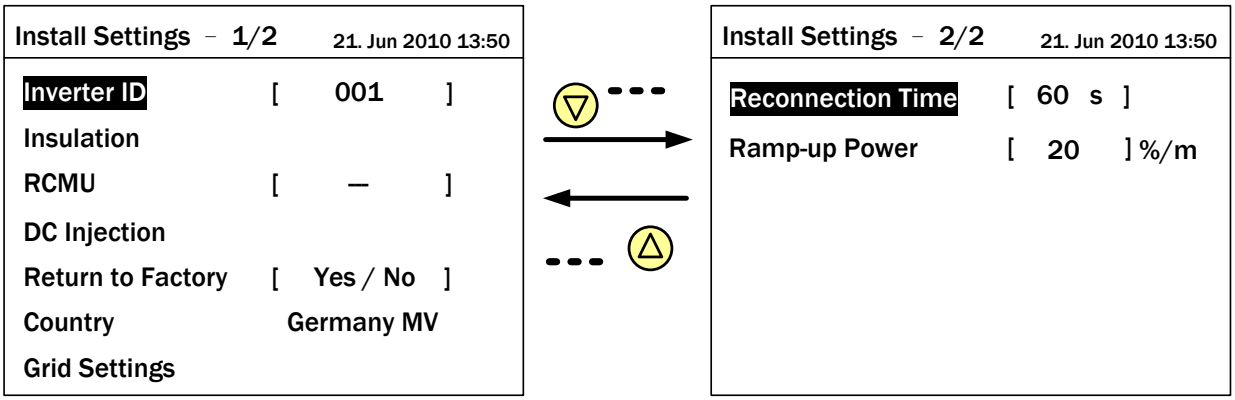


图 5-40. 安装技师设定页面

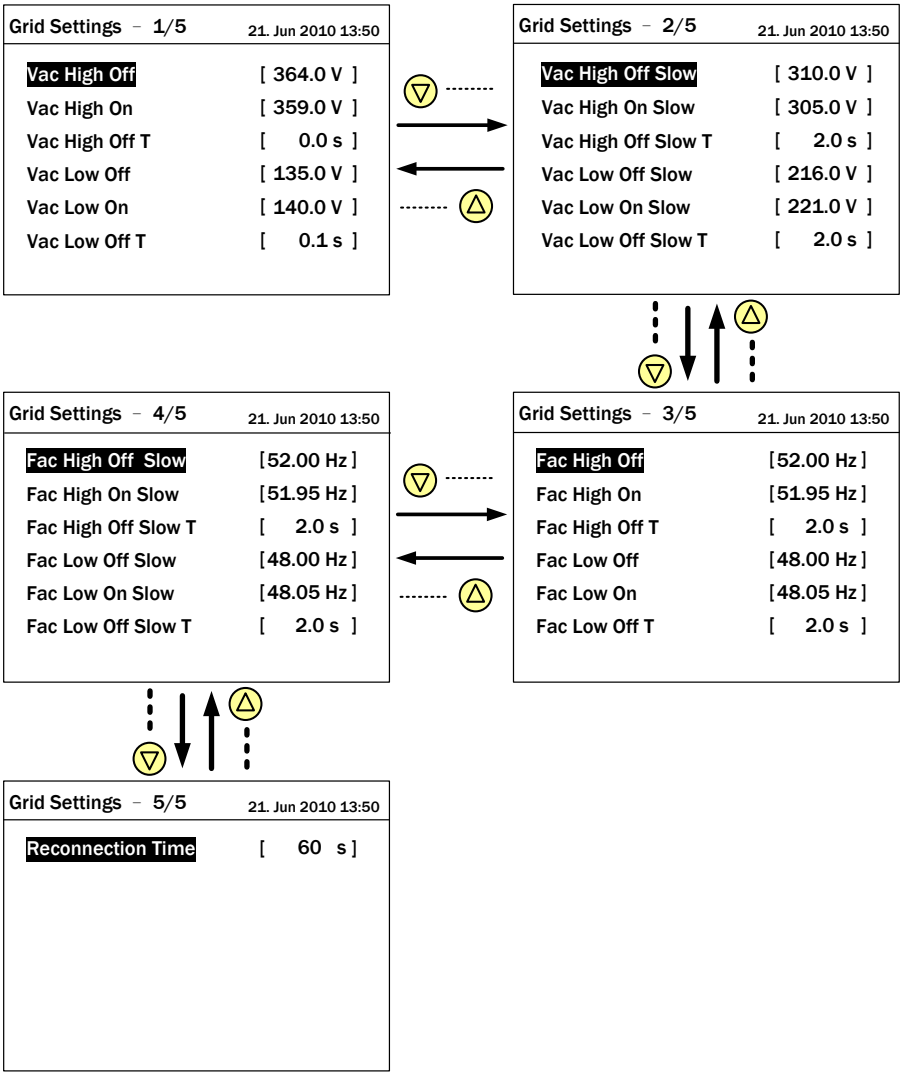


图 5-41. Grid Settings 页面

市电设定页面总共 19 个参数，各个参数详细的介绍请参考表 5-4

表 5-4: 市电设定参数

参数	功能描述
Vac High Off	当 AC 三相电压任何一相的电压值高于此参数值时，逆变器会断开与 AC 的连结，随即进入待机模式。
Vac High On	承上，断开 AC 后，若 AC 电压回复到此参数值时，逆变器会重新连结市电。
Vac High Off T	当 AC 电压触动 Vac High Off 时，控制系统会在此参数所设定的时间内断开 AC，以保护逆变器。
Vac Low Off	当 AC 三相电压任何一相的电压值低于此参数值时，逆变器会断开与 AC 的连结，随即进入待机模式。
Vac Low On	承上，断开 AC 后，若 AC 电压回复到此参数值时，逆变器会重新连结市电。
Vac Low Off T	当 AC 电压触动 Vac Low Off 时，控制系统会在此参数值所设定的时间内断开 AC，以保护逆变器。
Vac High Off Slow	功能同于 Vac High Off 参数，可作为第二重保护，但参数值不能高于 Vac High Off 的设定值。
Vac High On Slow	功能同于 Vac High On 参数，可作为第二重保护，但参数值不能高于 Vac High On 的设定值。
Vac High Off Slow T	功能同于 Vac High Off T 参数，但时间不能短于 Vac High Off T 所设定的时间。
Vac Low Off Slow	功能同于 Vac Low Off 参数，可作为第二重保护，但参数值不能低于 Vac Low Off 的设定值。
Vac Low On Slow	功能同于 Vac Low On 参数，可作为第二重保护，但参数值不能低于 Vac Low On 的设定值。
Vac Low Off Slow T	功能同于 Vac Low Off T 参数，但时间不能短于 Vac Low Off T 所设定的时间。
Fac High Off	当 AC 频率高于此参数值时，逆变器会断开与 AC 的连结，随即进入待机模式。
Fac High On	承上，断开 AC 后，若 AC 频率回复到此参数值时，逆变器会重新连结市电。
Fac High Off T	当 AC 频率触动 Fac High Off 时，控制系统会在此参数所设定的时间内断开 AC，以保护逆变器。
Fac Low Off	当 AC 频率低于此参数值时，逆变器会断开与 AC 的连结，随即进入待机模式。
Fac Low On	承上，断开 AC 后，若 AC 频率回复到此参数值时，逆变器会重新连结市电。
Fac Low Off T	当 AC 频率触动 Fac Low Off 时，控制系统会在此参数所设定的时间内断开 AC，以保护逆变器。
Fac High Off Slow	功能同于 Fac High Off 参数，可作为第二重保护，但参数值不能高于 Fac High Off 的设定值。
Fac High On Slow	功能同于 Fac High On 参数，可作为第二重保护，但参数值不能高于 Fac High On 的设定值。
Fac High Off Slow T	功能同于 Fac High Off T 参数，但时间不能短于 Fac High Off T 所设定的时间。

Fac Low Off Slow	功能同于 Fac Low Off 参数，可作为第二重保护，但参数值不能低于 Fac Low Off 的设定值。
Fac Low On Slow	功能同于 Fac Low On 参数，可作为第二重保护，但参数值不能低于 Fac Low On 的设定值。
Fac Low Off Slow T	功能同于 Fac Low Off T 参数，但时间不能短于 Fac Low Off T 所设定的时间。
Reconnection Time	逆变器重新连结至 AC 时的倒数时间。

说明:

上方所列的参数一旦被更动，国家将会被自动改成“Custom”，如果您想要改回原先您设定的国家，请到“Install settings”选单里的“Country”去做更改。

5.11.7.4. Active/Reactive Power Control

当国家设定成 Germany MV、India、China 才可进入这个页面。进入前必须输入一般用户密码，安装人员密码无法进入。

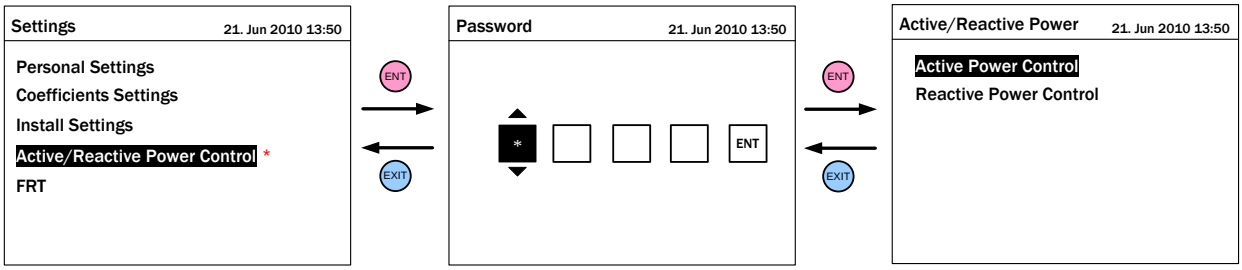


图 5-42. Active/Reactive power setting 页面

5.11.7.4.1. Power Limit

使用者可设定百分比来限制逆变器的输出功率。当 Mode 设定为 ON 时启动此功能，设定为 Off 时则回到 MPP Tracking 模式。

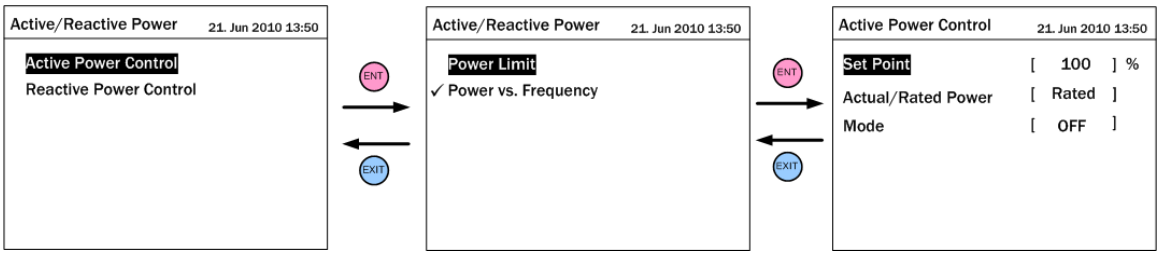


图 5-43. Power limit setting 页面

5.11.7.4.2. Power vs. Frequency

Gradient 表示单位频率限制功率的幅度。ie. –xx%/Hz.

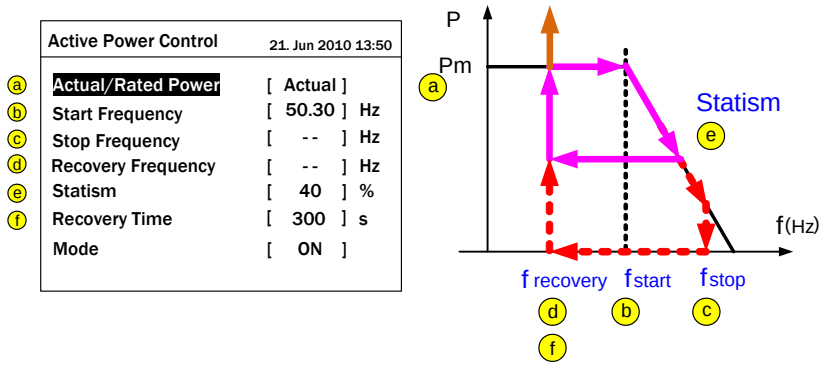


图 5-44. Power vs. Frequency setting 页面

5.11.7.4.3. Constant cosφ

当此模式开启时，逆变器会将功率因数控制在用户所设定的值。用户可设定的功率因数范围为 Cap 0.80 到 Ind 0.80。

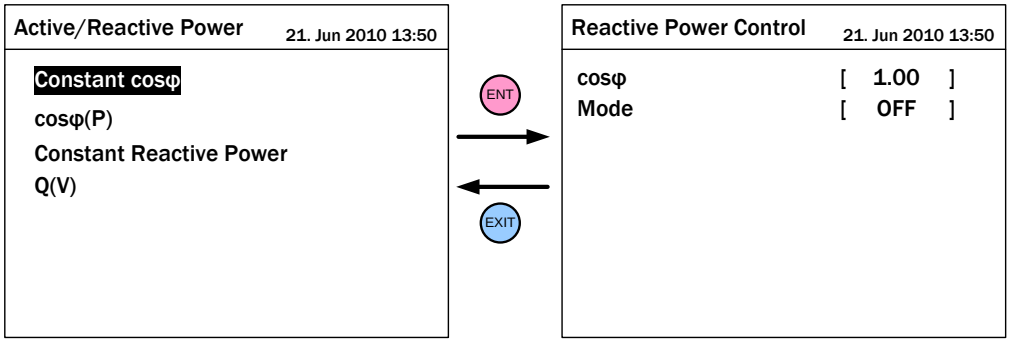


图 5-45. Constant cosφ setting 页面

5.11.7.4.4. cosφ(P)

cosφ (P)时不考虑市电电压(即无需调整 Lock-in/Lock-out voltage)。

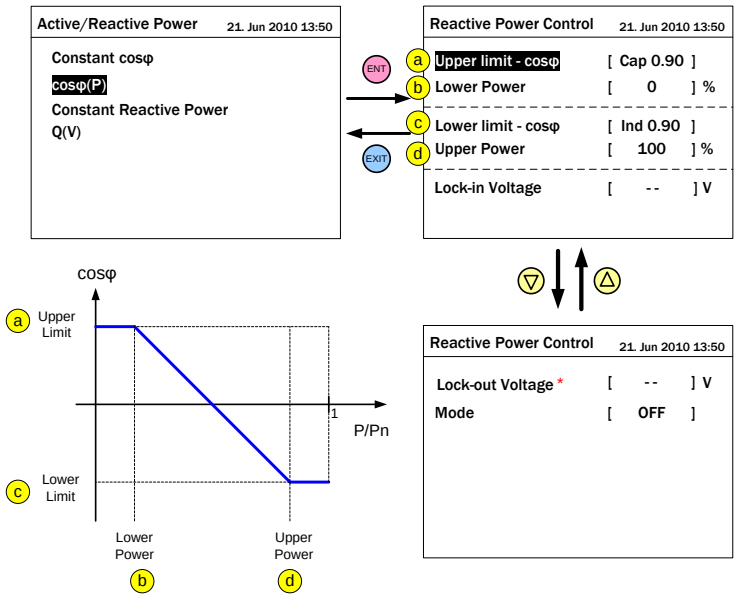


图 5-46. cosφ(P) setting 页面

5.11.7.4.5. Constant Reactive Power

启动此功能时，逆变器将会将虚功控制在一定值。

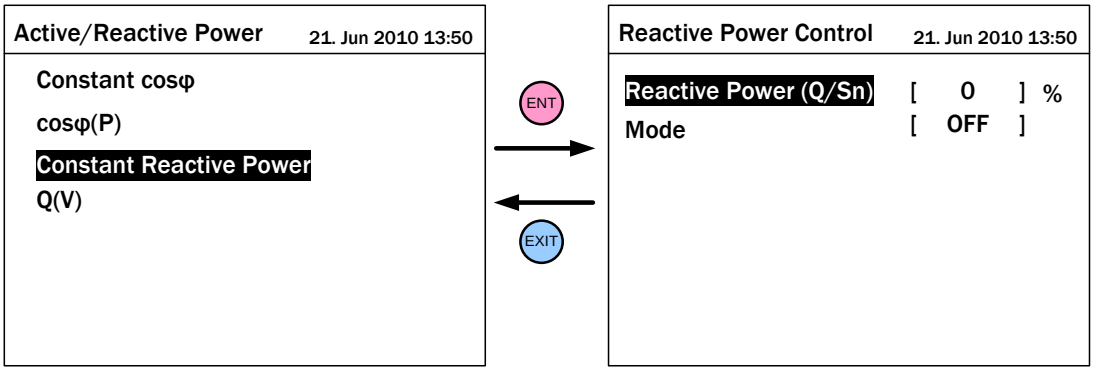


图 5-47. Constant Reactive Power setting 页面

5.11.7.4.6. Q(U)

使用者也可按照实际需求微调参数。

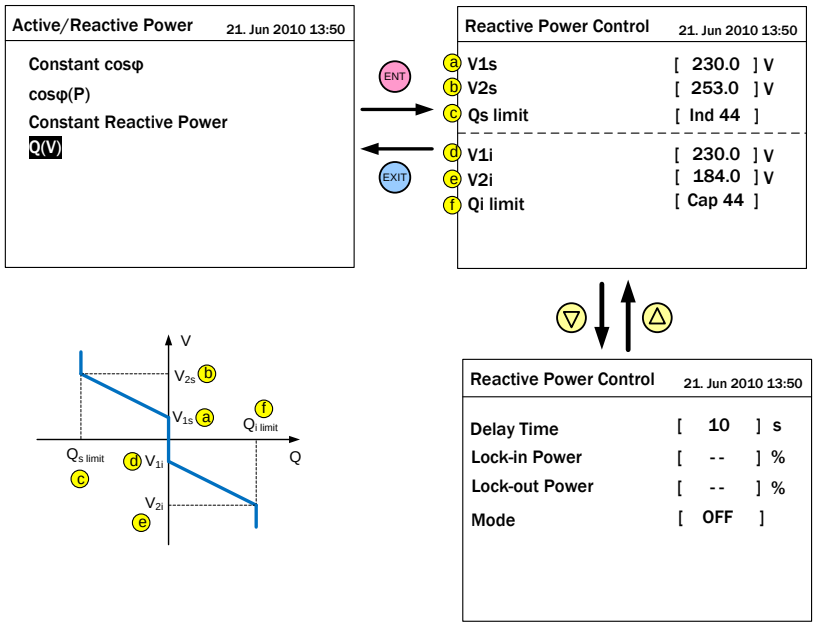


图 5-48. Q(U) setting 页面

5.11.7.5. FRT (Fault ride through)

使用者可参考下图微调个参数。

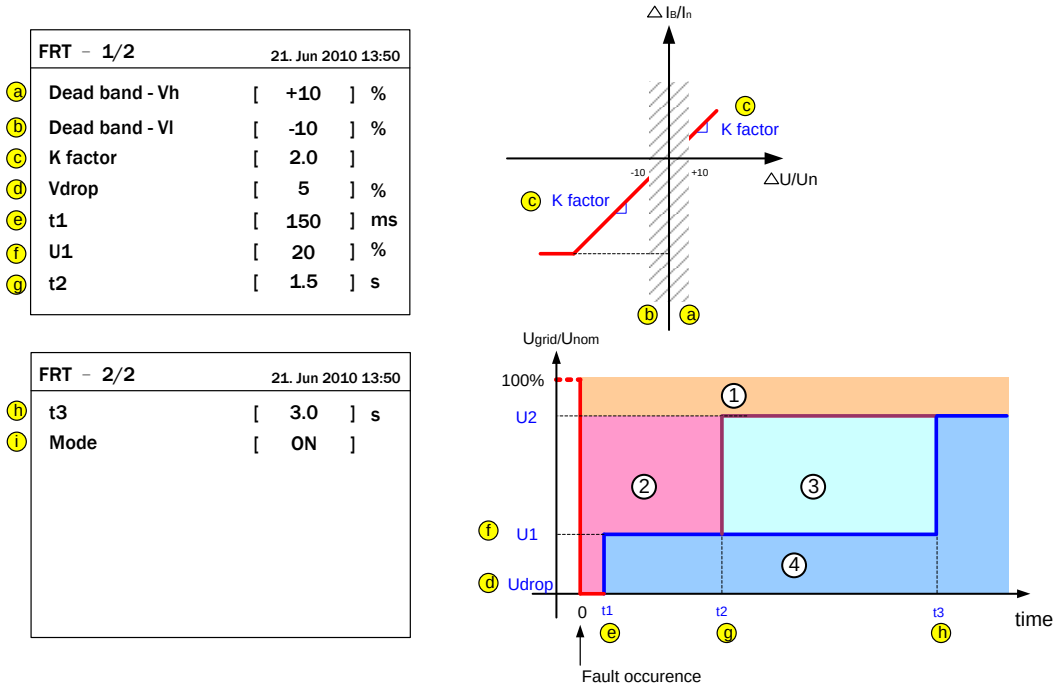


图 5-49. 故障穿越页面

6. 故障排除

6.1. 量测项目

量测项目的定义请参考下图

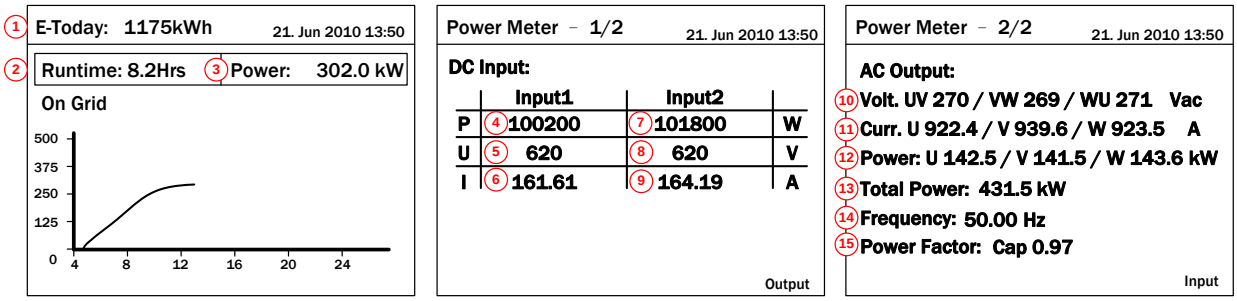


图 6-1. 量测项目 (1 of 3)

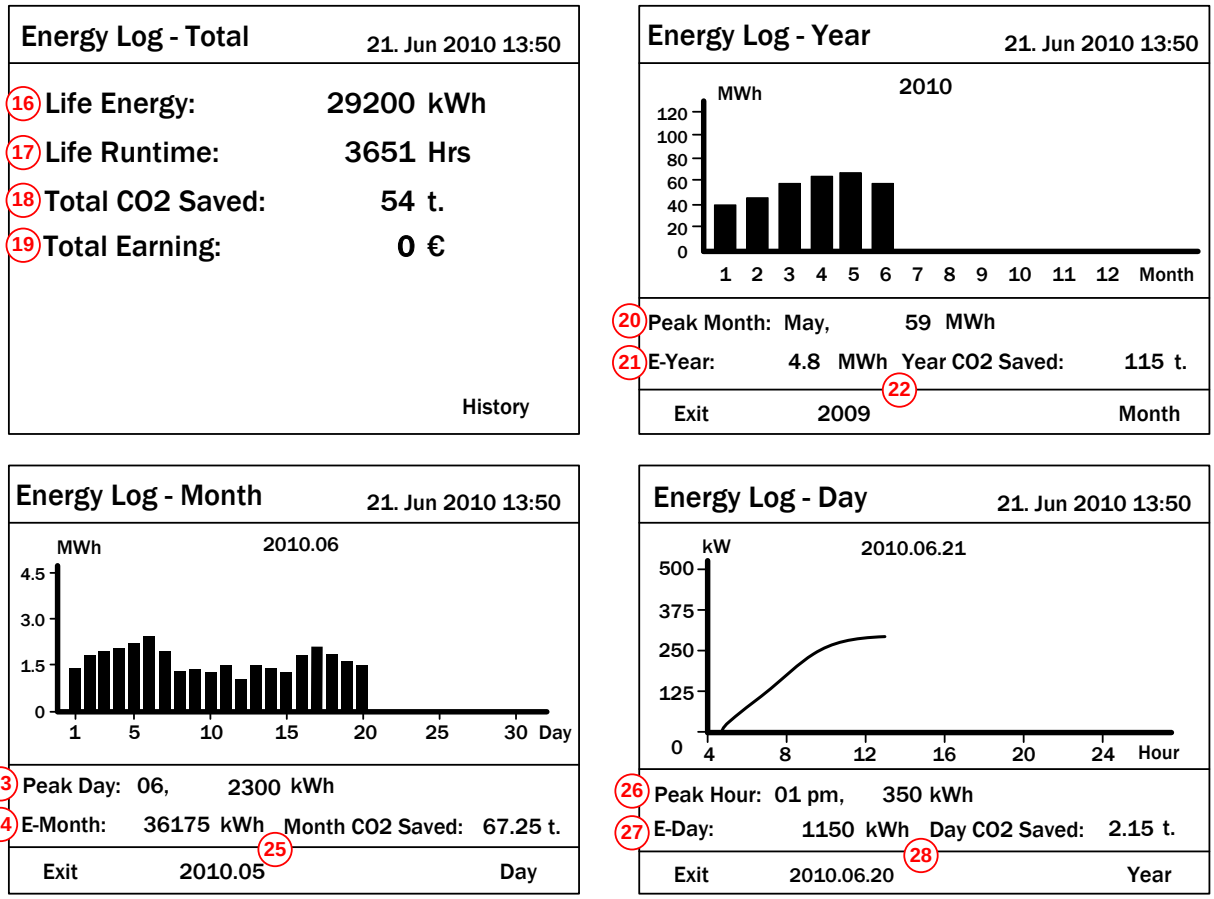
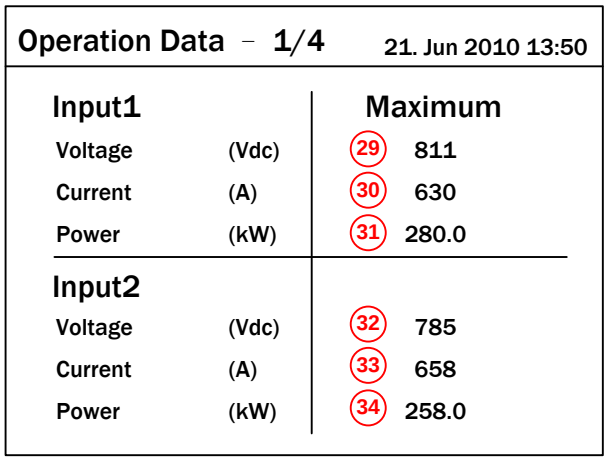
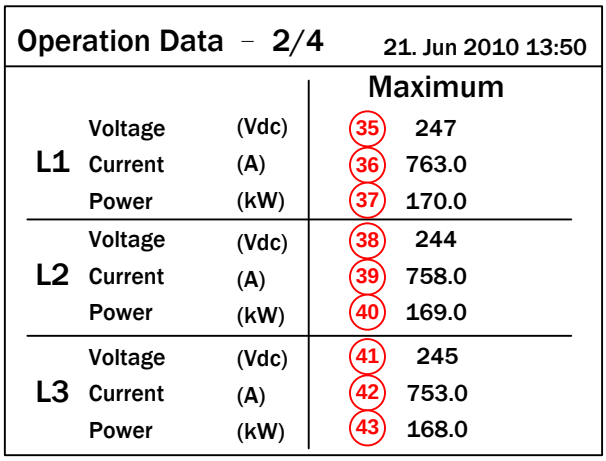
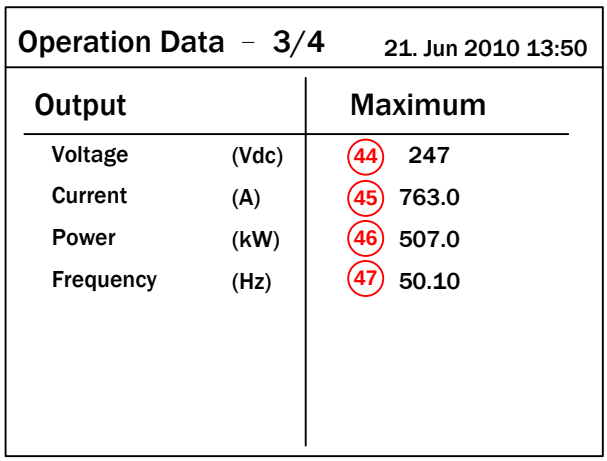


图 6-2. 量测项目 (2 of 3)







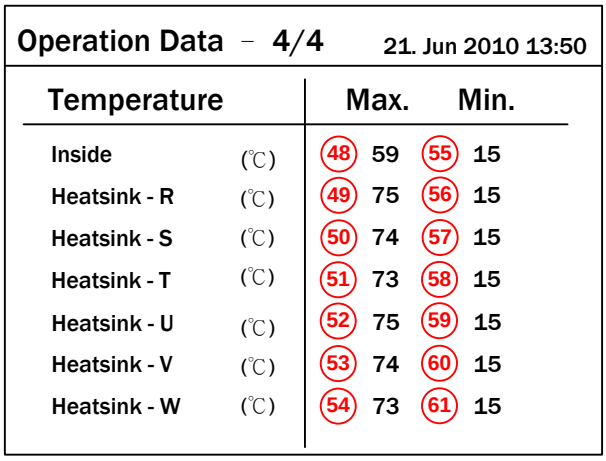


图 6-3. 量测项目 (3 of 3)

表 6-1: 量测项目

No.	项目	说明
1	E-Today	今天所发出的能量总和
2	Runtime	今日总发电时间
3	Power	实际发出的功率
4	DC Input1 - P	DC Input 1 的功率
5	DC Input1 - U	DC Input 1 的电压
6	DC Input1 - I	DC Input 1 的电流
7	DC Input2 - P	DC Input 2 的功率
8	DC Input2 - U	DC Input 2 的电压
9	DC Input2 - I	DC Input 2 的电流
10	AC Output - Voltage	AC Output 每相的电压
11	AC Output - Current	AC Output 每相的电流
12	AC Output - Power	AC Output 每相的功率
13	AC Output - Total Power	AC Output 的总功率
14	AC Output - Frequency	AC Output 的频率

表 6-1: 量测项目 (接上页)

No.	项目	说明
15	AC Output - Power Factor	AC Output 的功率因子
16	Life Energy	累积发电量总和
17	Life Runtime	累积运转时间总和
18	Total CO_2 saved	开机至今累积 CO_2 排放节省量总和
19	Total Earning	开机至今赚取金额的总和
20	Peak Month	一年中发电量最多那个月的发电量
21	E-Year	一年累积发电量总和
22	Year CO_2 saved	一年累积 CO_2 排放节省量总和
23	Peak Day	一个月中发电量最多那一天的发电量
24	E-Month	一个月累积发电量总和
25	Month CO_2 saved	一个月累积 CO_2 排放节省量总和
26	Peak Hour	一天中发电量最多那一小时的发电量
27	E-Day	一天累积发电量总和
28	Day CO_2 saved	一天累积 CO_2 排放节省量总和
29	Input1 Voltage Maximum	DC Input 1 的最大电压
30	Input1 Current Maximum	DC Input 1 的最大电流
31	Input1 Power Maximum	DC Input 1 的最大功率
32	Input2 Voltage Maximum	DC Input 2 的最大电压
33	Input2 Current Maximum	DC Input 2 的最大电流
34	Input2 Power Maximum	DC Input 2 的最大功率
35	L1 Voltage Maximum	AC L1 相的最大电压
36	L1 Current Maximum	AC L1 相的最大电流
37	L1 Power Maximum	AC L1 相的最大功率
38	L2 Voltage Maximum	AC L2 相的最大电压
39	L2 Current Maximum	AC L2 相的最大电流
40	L2 Power Maximum	AC L2 相的最大功率
41	L3 Voltage Maximum	AC L3 相的最大电压
42	L3 Current Maximum	AC L3 相的最大电流
43	L3 Power Maximum	AC L3 相的最大功率
44	Output Voltage Maximum	AC 3 相的最大电压
45	Output Current Maximum	AC 3 相的最大电流
46	Output Power Maximum	AC 3 相的最大功率

表 6-1: 量测项目 (接上页)

No.	项目	说明
47	Output Frequency Maximum	AC 3 相最大的频率
48	Inside Max.	逆变器内部温度最大值
49	Heatsink-R Max.	R 散热片温度最大值
50	Heatsink-S Max.	S 散热片温度最大值
51	Heatsink-T Max.	T 散热片温度最大值
52	Heatsink-U Max.	U 散热片温度最大值
53	Heatsink-V Max.	V 散热片温度最大值
54	Heatsink-W Max.	W 散热片温度最大值
55	Inside Min.	逆变器内部温度最小值
56	Heatsink-R Min.	R 散热片温度最小值
57	Heatsink-S Min.	S 散热片温度最小值
58	Heatsink-T Min.	T 散热片温度最小值
59	Heatsink-U Min.	U 散热片温度最小值
60	Heatsink-V Min.	V 散热片温度最小值
61	Heatsink-W Min.	W 散热片温度最小值

6.2. 错误讯息和故障排除

根据下表使用者能够确认 LCD 上的错误讯息然后可以做简易且快速的故障排除。

表 6-2: 错误讯息与简易故障排除

讯息显示	可能原因	排除方式
AC Freq High	1. 实际的市电频率高过过频率保护设定 2. 国家设定不正确 3. 侦测电路功能异常	1. 检查逆变器端的市电频率 2. 检查国家设定 3. 检查逆变器端的侦测电路
AC Freq Low	1. 实际的市电频率低于欠频率保护设定 2. 国家或电网设定不正确 3. 侦测电路功能异常	1. 检查逆变器端的市电频率 2. 检查国家与电网设定 3. 检查逆变器端的侦测电路
Grid Quality	在电网或靠近逆变器附近非线性的负载	必要时逆变器与电网连接处必须远离非线性的负载
HW Connect Fail	1. AC 端配线错误 2. 侦测电路功能异常	1. 检查 AC 连接，必须和使用手册一致 2. 检查逆变器内部的侦测电路
No Grid	1. AC 断路器跳开 2. AC 端没有电压	1. 重启 AC 断路器 2. 提供 AC 电压至逆变器输出端
AC Volt Low	1. 实际市电的电压低于低电压保护设定 2. 国家或电网设定不正确 3. AC 接口连接错误 4. 侦测电路功能异常	1. 检查市电与逆变器端的连接 2. 检查国家或电网设定 3. 检查 AC 接口连接 4. 检查逆变器内部的侦测电路
AC Volt High	1. 实际市电的电压高于过电压保护设定 2. 操作期间，市电的电压高于慢速电压保护设定 3. 国家或电网设定不正确 4. 侦测电路功能异常	1. 检查逆变器端的市电电压 2. 检查逆变器端的市电电压 3. 检查国家或电网设定 4. 检查逆变器内部的侦测电路

表 6-2: 错误讯息与简易故障排除(接上页)

讯息显示	可能原因	排除方式
Solar1 High	1. 实际太阳能板电压设定超过 1000Vdc 2. 侦测电路功能异常	1. 修正太阳能板设定并使得 Voc 小于 1000Vdc 2. 检查逆变器内部的侦测电路
Insulation	1. 太阳能板对大地阻抗不符合面板设定 2. 太阳能板受潮后，对地的寄生电容随之增大影响到侦测电路判读的正确性 3. 侦测电路功能异常	1. 检查面板设定是否正确 2. 必要时擦干太阳能板 3. 检查逆变器内部的侦测电路

表 6-3: 警告讯息与简易故障排除

讯息显示	可能原因	排除方式
Solar1 Low	1. 因太阳能板照度不足使得输入电压低于可操作电压范围 2. 输入电压侦测电路异常	1. N/A 2. 检查逆变器内部的侦测电路
HW FAN	1. 一个或多个风扇锁死 2. 一个或多个风扇无效 3. 一个或多个风扇未连接 4. 侦测电路功能异常	1. 移除卡在风扇内的对象 2. 替换无效的风扇 3. 检查风扇的连接 4. 检查逆变器内部的侦测电路
EPO	EPO 按钮被启动	1. 解除 EPO 2. 检查 EPO 的连接状况
DC Surge	在 DC 侧的 SPD 损坏	1. 检查 DC SPD 的遥控讯号线连接状况 2. 检查 DC SPD 是否损坏
AC Surge	在 AC 侧的 SPD 损坏	1. 检查 AC SPD 的遥控讯号线连接状况 2. 检查 AC SPD 是否损坏
DC AuxPower Fail	1. DC AuxPower 提供不正确的输出电压 2. DC AuxPower 侦测电路异常	1. 检查逆变器与 DC 侧的连接状况 2. 检查侦测电路是否异常

表 6-4: 故障讯息与简易故障排除

讯息显示	可能原因	排除方式
Temperature	1. 环境温度超过 60℃ (装置异常) 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路
HW NTC1 Fail	1. 环境温度>105℃或<-40℃ 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路(RTM1)
Temperature	1. 环境温度<-30℃ 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路
HW NTC2 Fail	1. 环境温度>125℃或<-30℃ 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路 (NTC_R & NTC_U)
HW NTC3 Fail	1. 环境温度>125℃或<-30℃ 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路 (NTC_S & NTC_V)
HW NTC4 Fail	1. 环境温度>125℃或<-30℃ 2. 侦测电路功能异常	1. 检查设备的周遭和环境 2. 检查逆变器内部的侦测电路 (NTC_T & NTC_W)
HW DSP ADC1	1. 辅助电源电路功能异常 2. 侦测电路功能异常	1. 检查逆变器内部的辅助电源电路 2. 检查逆变器内部的侦测电路
HW DSP ADC3	1. 辅助电源电路功能异常 2. 侦测电路功能异常	1. 检查逆变器内部的辅助电源电路 2. 检查逆变器内部的侦测电路
HW Red ADC1	1. 辅助电源电路功能异常 2. 侦测电路功能异常	1. 检查逆变器内部的辅助电源电路 2. 检查逆变器内部的侦测电路

表 6-4: 故障讯息与简易故障排除(接上页)

讯息显示	可能原因	排除方式
HW Red ADC2	1. 辅助电源电路功能异常 2. 侦测电路功能异常	1. 检查逆变器内部的辅助电源电路 2. 检查逆变器内部的侦测电路
HW COMM2	1. Red. CPU 闲置中 2. 通讯连接中断	1. 检查 Red. CPU 的 reset pin 和晶振功能是否正常 2. 检查 Red. CPU 和 DSP 通讯连接
HW COMM1	1. DSP 闲置中 2. 通讯连接中断 3. 通讯电路功能异常	1. 检查 DSP 中的 reset pin 和晶振功能是否正常 2. 检查 DSP 和 COMM 通讯连接 3. 检查通讯电路
HW Connect Fail	1. 逆变器内部的电缆线脱落 2. 电流回授电路无效 3. 逆变器驱动电路异常	1. 检查逆变器内部电缆线连接是否妥当 2. 检查逆变器内部电流回授电路 3. 检查逆变器驱动电路
Relay Test Short	1. 接触器驱动电路功能异常 2. 接触器接点黏着	1. 检查逆变器内部驱动电路 2. 更换接触器
Relay Test Open	1. 接触器驱动电路无效 2. 接触器线圈无效 3. Vgrid 和 Vout 侦测精确度不正确	1. 检查接触器驱动电路 2. 替换接触器线圈 3. 检查 Vgrid 和 Vout 电压侦测精确度
HW Bus OVR	1. 逆灌发生 (DC 功率 < AC 功率) 2. AC 频率锁相回路异常	1. 检查太阳能板和逆变器之间的连接 2. 检查 Vgrid 和 Vout 电压侦测精确度

表 6-4: 故障讯息与简易故障排除(接上页)

讯息显示	可能原因	排除方式
AC Current High	1. 操作期间突波发生 2. Inverter stage Driver 无效 3. 开关装置无效 4. 侦测电路功能异常	1. N/A 2. 检查 inverter stage 驱动电路 3. 检查 inverter stage 全部开关装置 4. 检查逆变器内部的侦测电路
HW CT A Fail	1. 测试电流回路损坏 2. 侦测到电路功能异常	1. 检查 CT 传感器的的连接线 2. 检查逆变器内部的侦测电路
HW CT B Fail	1. 测试电流回路损坏 2. 侦测电路功能异常	1. 检查 CT 传感器的的连接线 2. 检查逆变器内部的侦测电路
HW CT C Fail	1. 测试电流回路损坏 2. 侦测电路功能异常	1. 检查 CT 传感器的的连接线 2. 检查逆变器内部的侦测电路
HW AC OCR	1. 市电谐波成分大 2. 开关装置无效 3. 侦测电路功能异常	1. 检查市电波形. 必要时逆变器与电网连接处必须远离非线性的负载 2. 检查 inverter stage 开关装置 3. 检查逆变器内部的侦测电路
HW ZC Fail	synchronal signal 侦测电路功能异常	检查逆变器内部同步讯号的侦测电路
AC Aux Fail	1. AC AuxPower 提供不正确的输出电压 2. AC AuxPower 侦测电路功能异常	1. 检查逆变器与 AC 侧的连接状况 2. 检查侦测电路是否异常
DC Current High	输入电流侦测电路功能异常	检查输入电流侦测电路

表 6-5: 其它讯息与简易故障排除

讯息显示	可能原因	排除方式
Door Opened	1. 门上开关无效 2. 门上开关未连接 3. 侦测电路功能异常	1. 替换无效的门上开关 2. 检查门上开关的连接 3. 检查逆变器内部的侦测电路

7. 维修保养

7.1. 更换风扇模块

1. 按拉且扭转把手，之后打开后门。

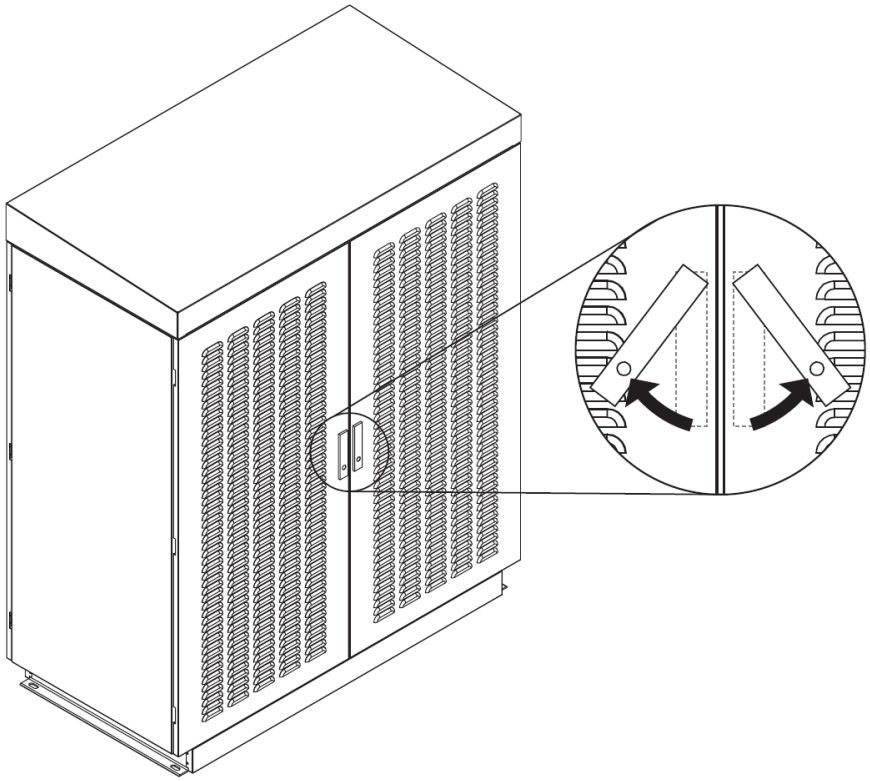


图 7-1. 按拉扭转把手

2. 将需置换的风扇模块上的电源接头拔除。

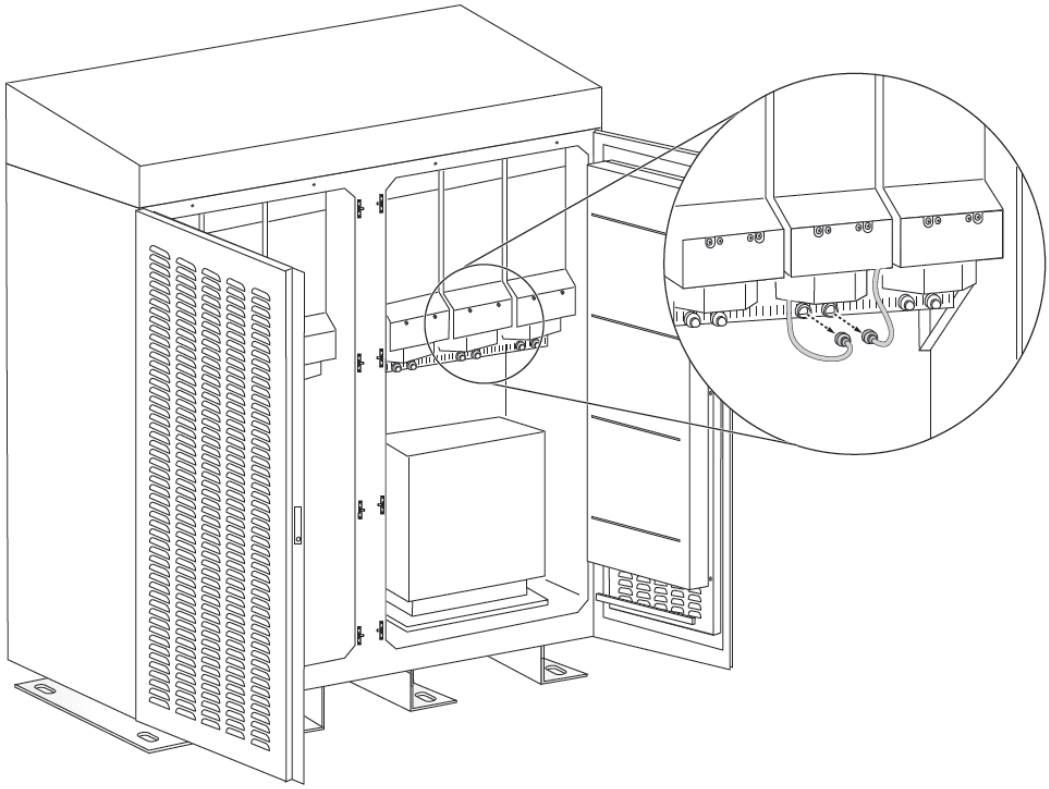


图 7-2. 拔除电源接头

3. 松开锁附在下风扇与机壳上的螺丝和螺帽，然后将下风扇移除。

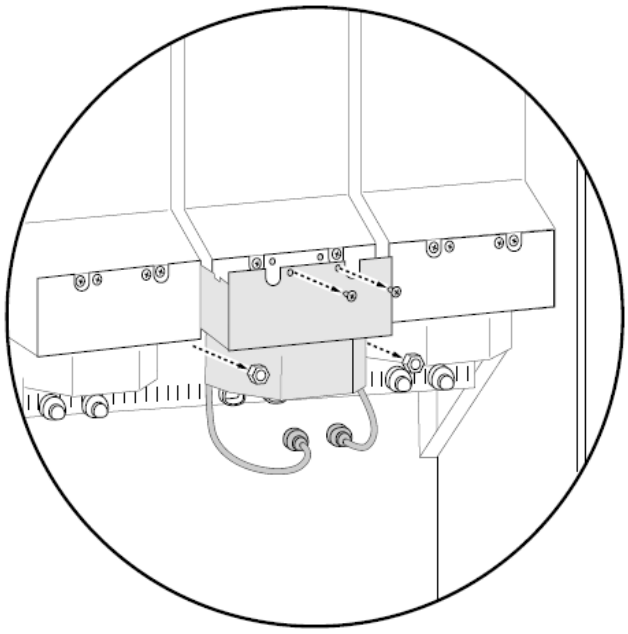


图 7-3. 松开下风扇的螺丝和螺帽

4. 松开锁附在上风扇与机壳上的螺丝，然后将上风扇移除。

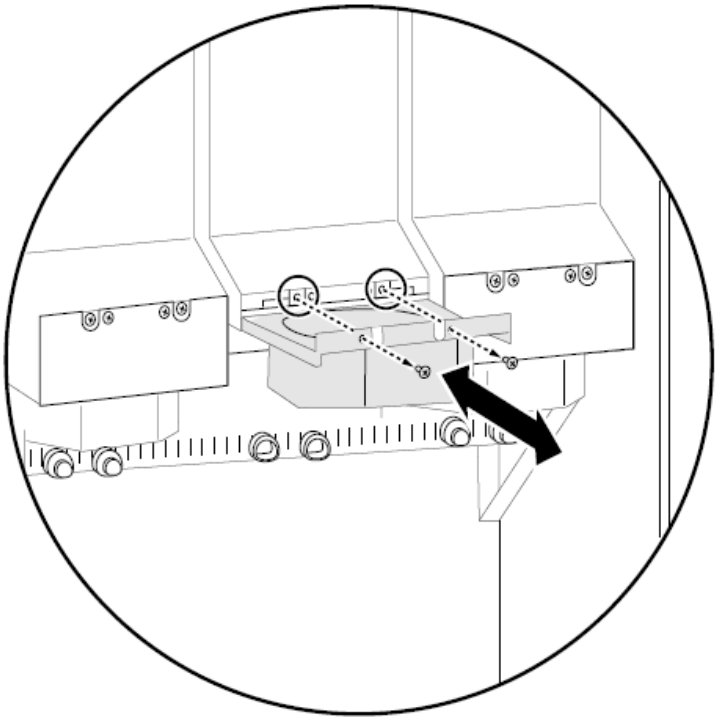


图 7-4. 松开上风扇的螺丝

7.2. 更换进气口滤网

1. 按拉且扭转把手，之后打开后门。

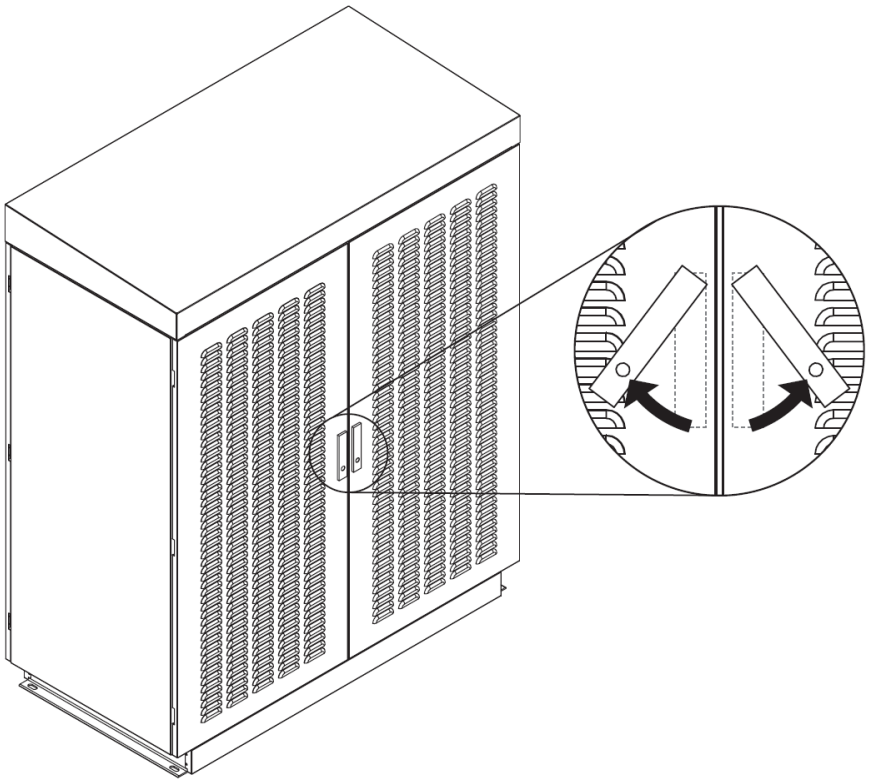


图 7-5. 按拉扭转把手

2. 松开锁附在滤网盖与后门上的螺丝，之后打开滤网盖。

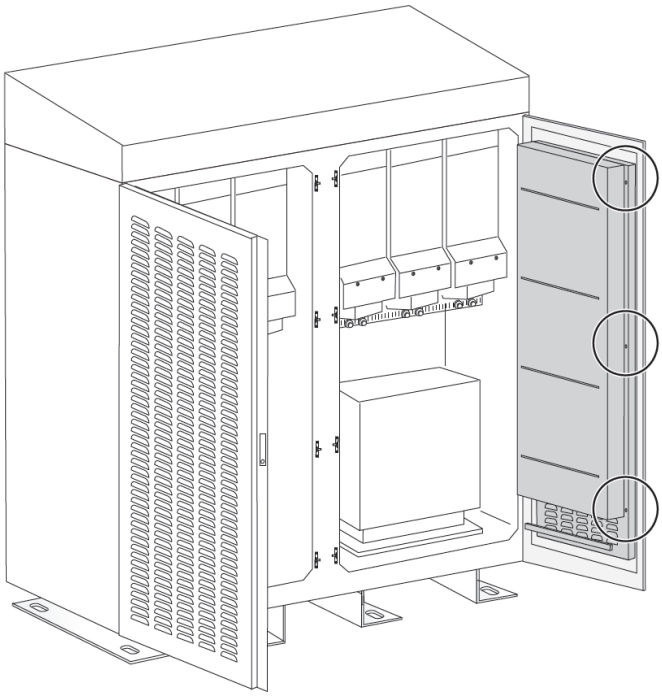


图 7-6. 松开滤网盖上的螺丝

3. 松开锁附在滤网上的螺丝。

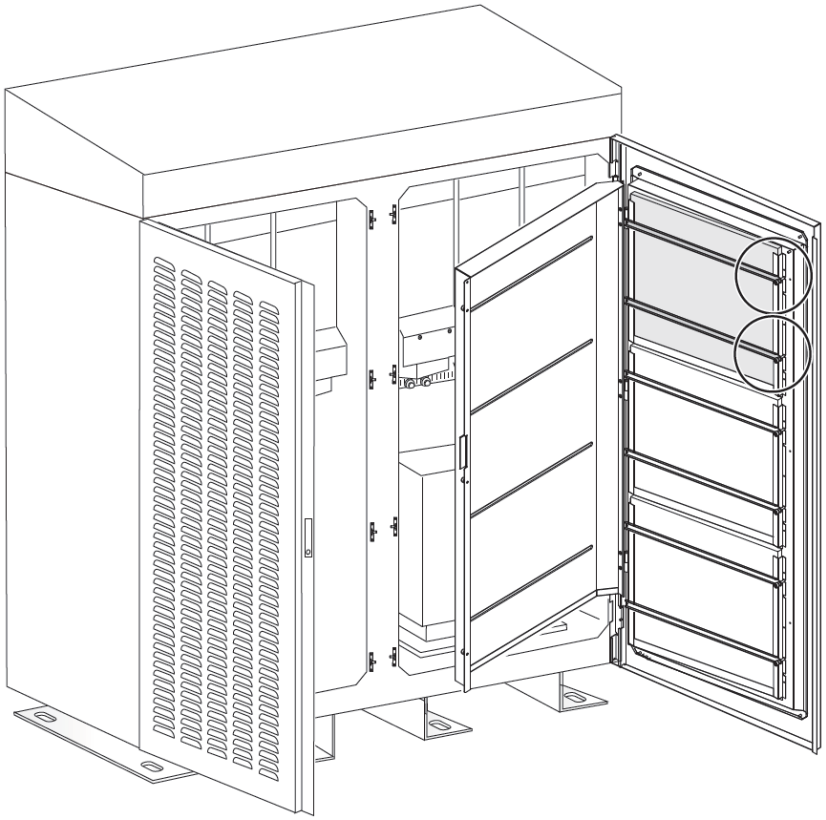


图 7-7. 松开滤网的螺丝

4. 取出滤网。

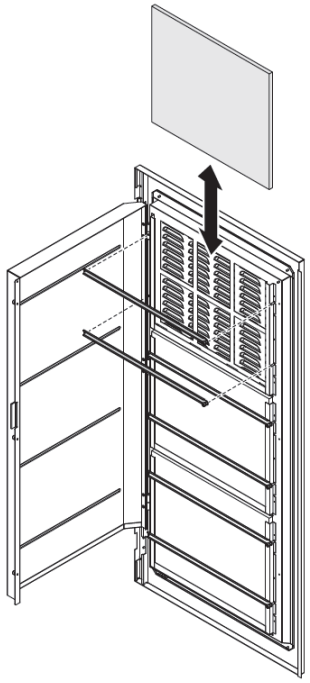


图 7-8. 取出滤网

7.3. 清理排气孔滤网

1. 将逆变器前门打开。
2. 松开排气孔滤网挡板上的螺帽。

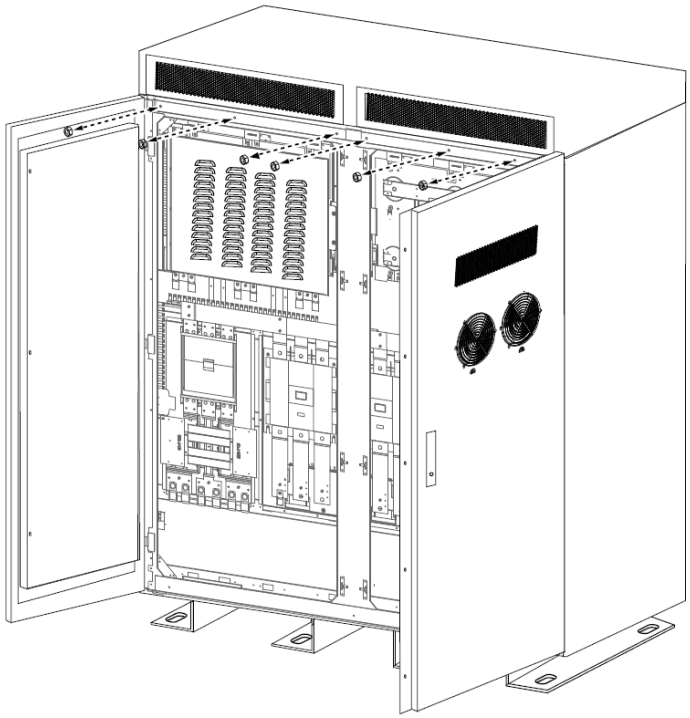


图 7-9. 松开排气孔滤网的螺帽

3. 把排气孔滤网挡板向右移动

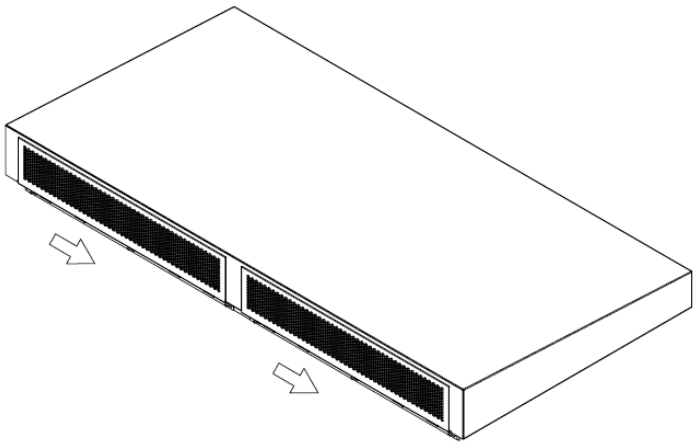


图 7-10. 将挡板向右移动

4. 直接取出挡板和排气孔滤网

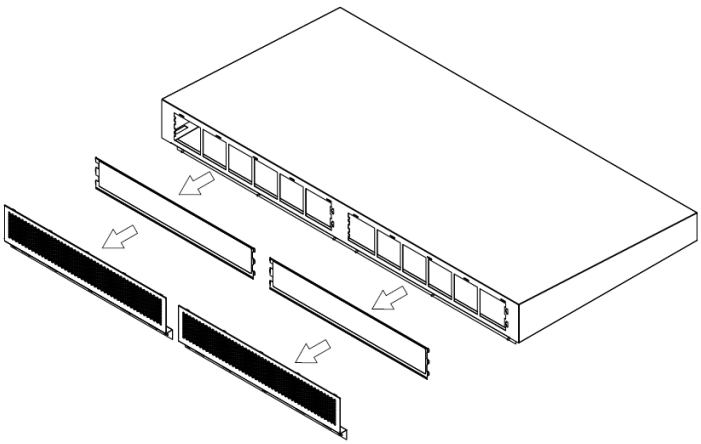


图 7-11. 取出排气孔滤网

7.4. 更换 DC 保险丝

1. 关闭所有 DC 和 AC 电源，并确认 DC 与 AC 端没有剩余电源存在。

2.松开保险丝上的螺丝，并将旧的保险丝取出。

3. 放上新的保险丝和螺丝，并将螺丝锁紧。

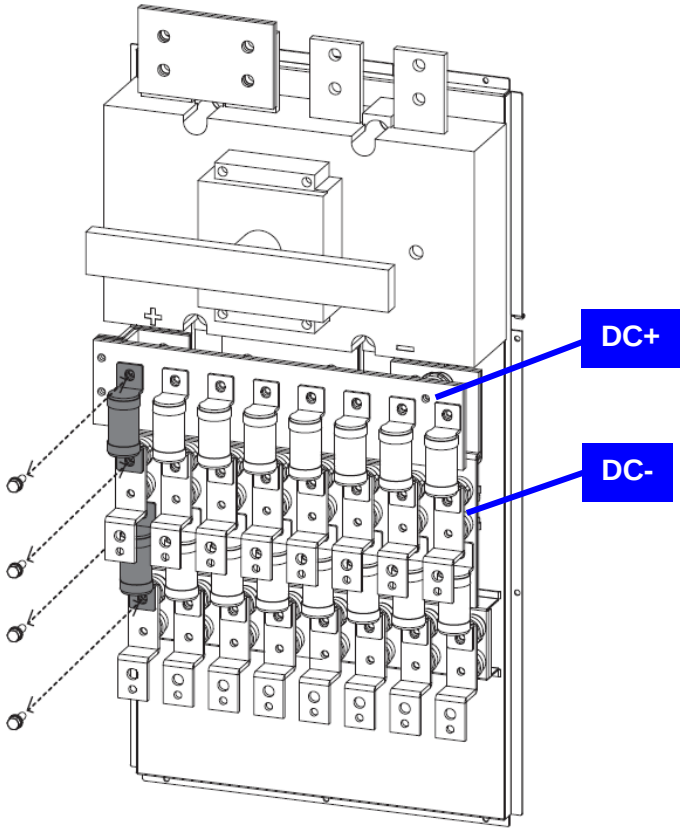


图 7-12. 取出保险丝

7.5. 更换 Surge Protection Device (SPD)

一旦逆变器遭遇到电压突波（如：雷击等），SPD 将会保护逆变器而 SPD 则会损坏。如果在逆变器屏幕上看到像”DC Surge”或是”AC Surge”的警告讯息，请遵循以下步骤来更换 SPD。

1. 关闭所有 DC 和 AC 电源，并确认 DC 与 AC 端没有剩余电源存在。
2. 按拉且扭转把手，之后打开前门。

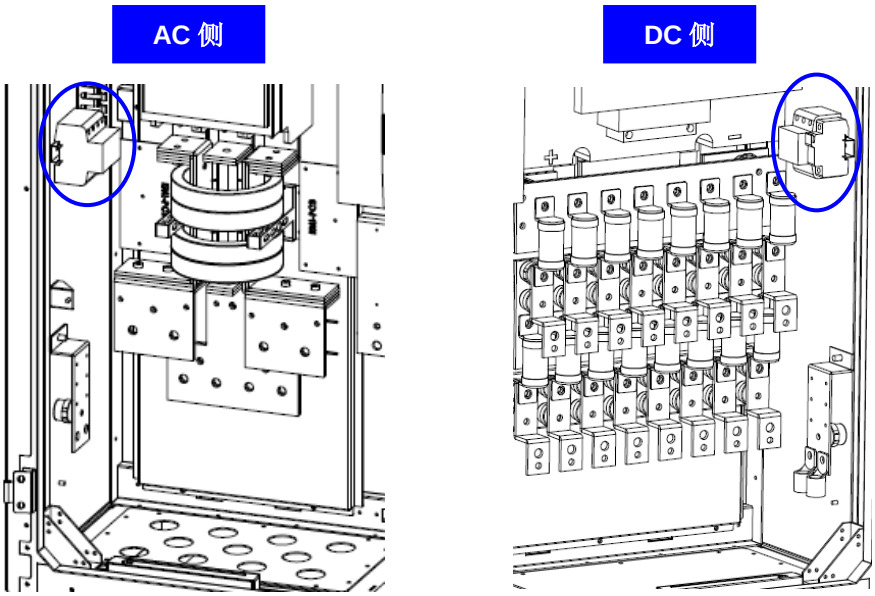


图 7-13. SPD 位置

3. 确认哪一个 SPD 损坏。

- 针对 DC 与 AC SPD 来说，看哪一个 SPD 上的绿灯变成红灯。



Figure 7-14. 确认损坏的 SPD

4. 退出已损坏的 SPD 并更换新的。

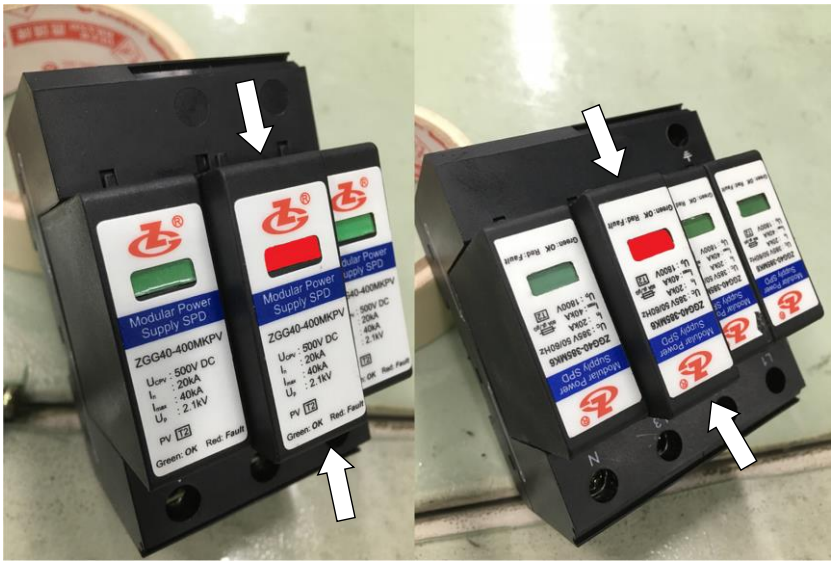


Figure 7-15. 退出已损坏的 SPD

附录 A. 技术数据

设备型式

户外并网型逆变器

输入规格

太阳能板绝对最大输入电压	1000Vdc
操作电压范围	420/485*Vdc – 1000Vdc
最大功率追踪电压范围	450/500*Vdc – 820Vdc
功率追踪正确率	> 99.9% at rated power
可唤醒逆变器电压	< 200Vdc (辅助电源启动)
启动电压	470/500*Vdc
最大功率追踪	1
输入电流限制	1200A
最大输入短路电流	1500A
输入电压误差率	Input voltage deviation < 2%
DC 开关	1000V/1250A *1
输入保护	• DC over voltage_electronic shutdown • DC current limitation_current control • Surge arrestor_1000V/40kA Type 2

输出规格

输出容量	500kVA
电网	Three phase (3P3W-IT)
市电电压范围	243~378VΔ
市电频率	50/60Hz
市电频率范围	Domestic regulation (Max 50/60Hz ± 5Hz)
最大输出电流	1080A
防孤岛	Domestic regulation
输出端重新连接	Connect to utility after utility recover and countdown finished
重新连接时间	Domestic regulation
输出电流直流成分	< 0.5% at rated current
输出电流谐波失真	< 3% at rated power
虚功控制	0.8 leading to 0.8 lagging
实功控制	1% each step
夜间消耗功率	< 50 watts (without optional transformer)
侦测误差率	• Utility voltage deviation < 2% • Utility frequency deviation < 0.03 Hz • Countdown timer deviation < 1.0 sec • Output power deviation < 3% at full power
功率限制	Temperature sensors depend on heatsink & internal air temperature.
AC 断路器规格	690V/1250A
保护装置	• AC Circuitry Breaker & Thermal protection • Surge arrestor_600V/30kA Type 2

一般信息

通讯接口	RS-485 Delta Protocol
LED	• Operation: Green (Flashing during countdown) • Alarm: Red
LCD 屏幕	5” Graphic, 320*240 pixels
屏幕按键	4 operational buttons
能量记录方式	Day/Month/Year
故障记录方式	• 30 events recently • Event times for each event
紧急开关	1 set
干接点	2 set

认证

Electrical safety	• IEC 62109-1 & IEC 62109-2 • CE
Grid interface	• BDEW Compatible • CGC/GF 004 • GB/T 19964:LVRT
Emission	EN61000-6-4
Immunity	EN61000-6-2
Harmonic	BDEW

操作

操作温度	-25°C~60°C (Full power -25°C~50°C)
储存温度	-30°C~60°C
相对湿度	5%~95%
噪音值	< 80dB
机器使用高度	0 to 3000m

环境

Vibration	ISTA 1E
Drop	ISTA 1B

机构

Dimension	
Width	1600mm
Depth	800mm
High	1950mm
Weight	1300kg
Cooling	Air cooling with Fans with inlet filter
Enclosure rating	IP-65 (Electric parts)

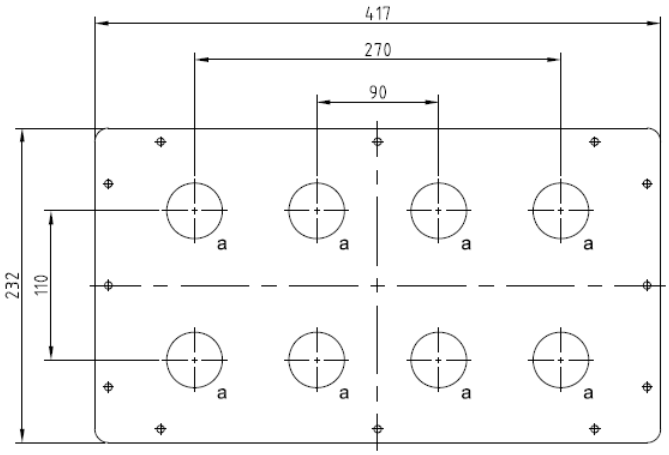
说明:

规格中有标注” * ”的内容是适用于输出电压为 315Vac。

附录 B. 缆线组合列表与底板开孔尺寸

- **DC 侧底板**

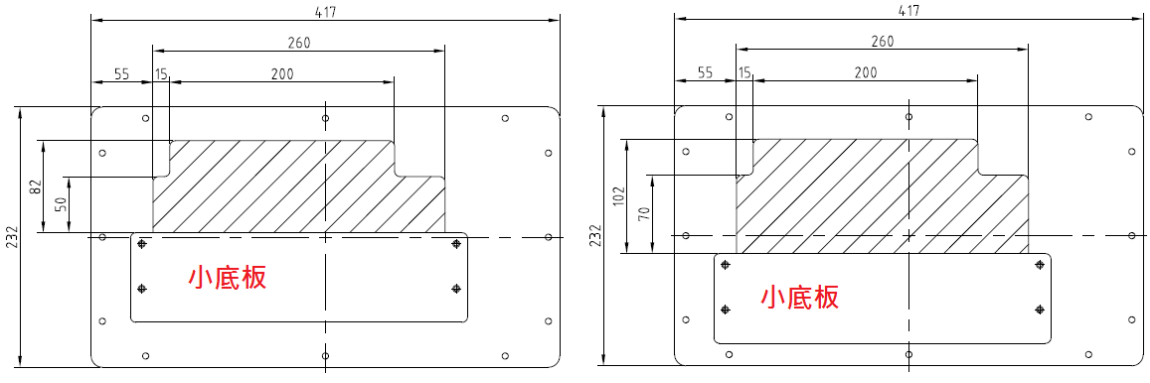
电缆接头型号	允许使用缆线外径 (mm)	DC 端底板最多开孔数目
AVC-MGB4025B-SD	Ø26.7 ~ 21.3	8



说明:

图中的"a"表示为底板开孔的尺寸。a = Ø41

- **AC 侧底板**



说明:

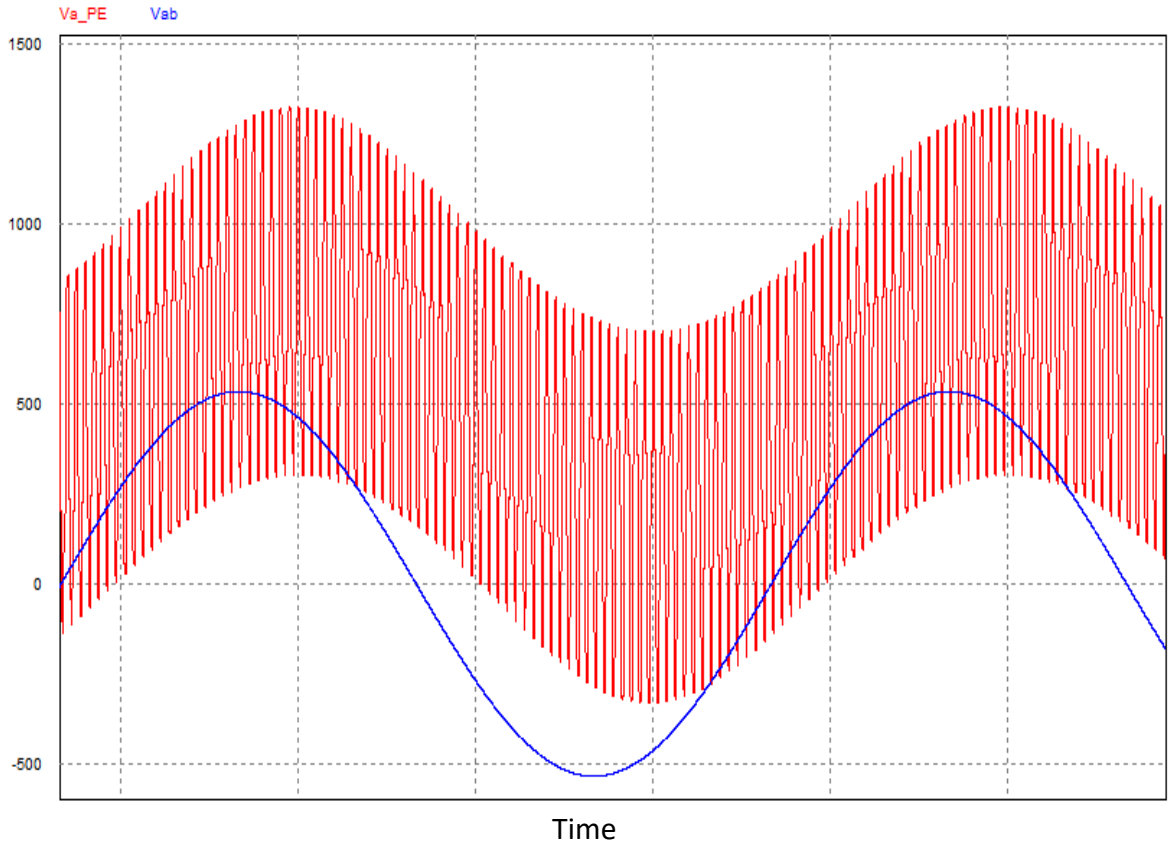
斜线区域为可穿缆线区域，而且可透过小底板调整可穿缆线区域大小。

附录 C. Delta 中压变压器与辅助电源变压器应用说明

A. 中压变压器的技术需求

A.1 在中压变压器中，低压侧绕组所需的绝缘电压要能符合以下条件：

- 要能够承受最大 **1310V** 对大地逆变器的脉冲形式电压
- 要能够承受最大有效值电压 **650V** 对大地
- 要能够承受电压变化 **dv/dt 高达 500V/μS**



- 接地用设备应被增加架设在高压绕组与低压绕组之间，此接地用设备是针对 dv/dt（单位时间电压变化）作为滤波器使用的。

A.2 **每一台逆变器都需要有各自分离的隔离电压绕组。** 使用多台变压器并联在同一个低压绕组上是不允许的。

A.3 中压变压器类型可以为**油式**或是**干式**。

A.4 建议在高压端持有**抽头切换开关**以便于校正电压准位至中压。

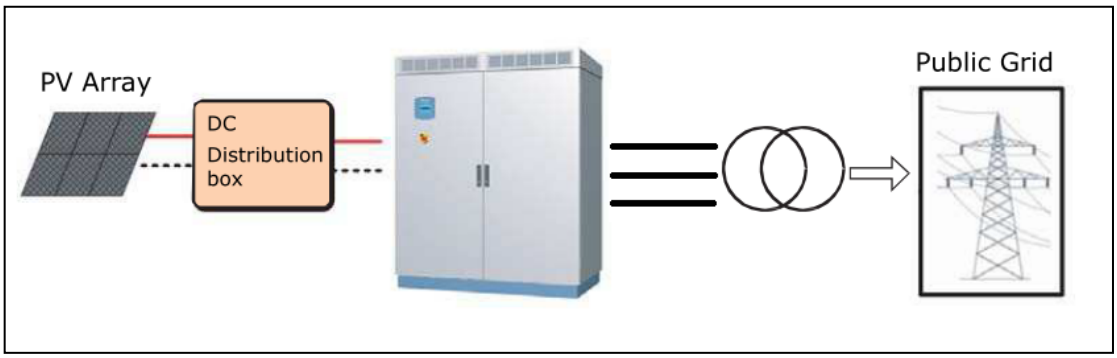
A.5 中压变压器较高的热应力应该要考虑到**国别设定**，包括电压与频率。

A.6 中压变压器在额定功率下要有能够抵挡最大 **5%**的总谐波电流的能力。

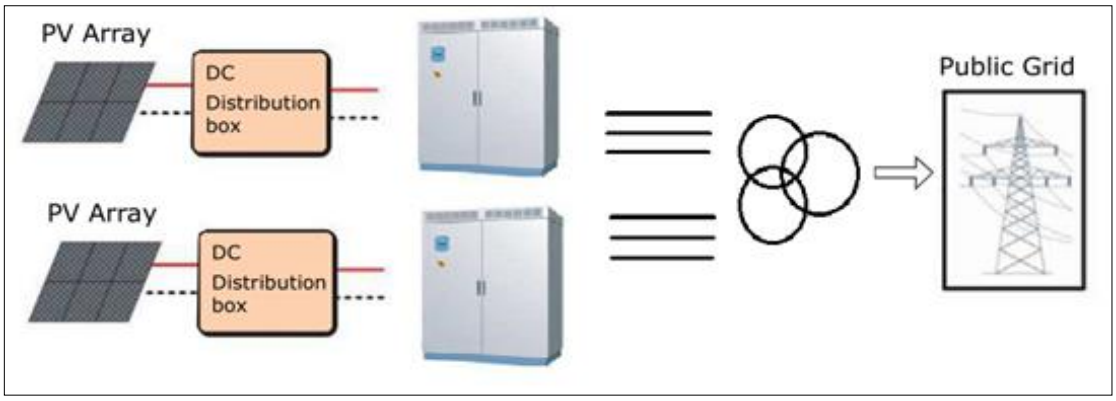
A.7 中压变压器需要根据以下逆变器的额定规格来进行设计。

产品名称	额定电压范围 (线-线) (V)	额定输出电流范围 @ 50℃ (A)	最大输出电流 (A)
RPI-C500	243~378	770~1180	1250

B. 逆变器可以透过以下图示来与中压变压器进行连接



对于 1 台逆变器使用双绕组变压器

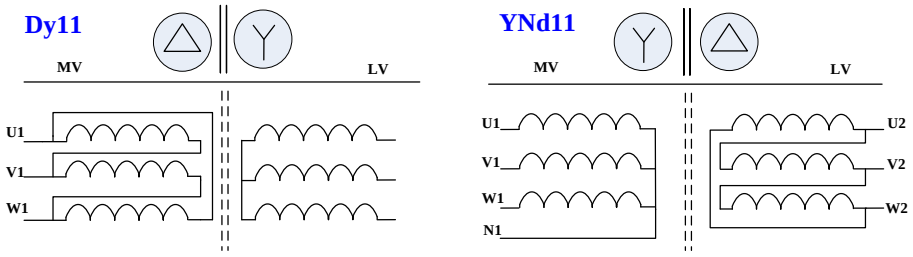


对于 2 台逆变器使用三绕组变压器

B.1 双绕组变压器的技术需求

- 阻抗电压应在 4.0-6.0%之间。
- 双绕组变压器的向量组合可为 Dy11 or YNd11。

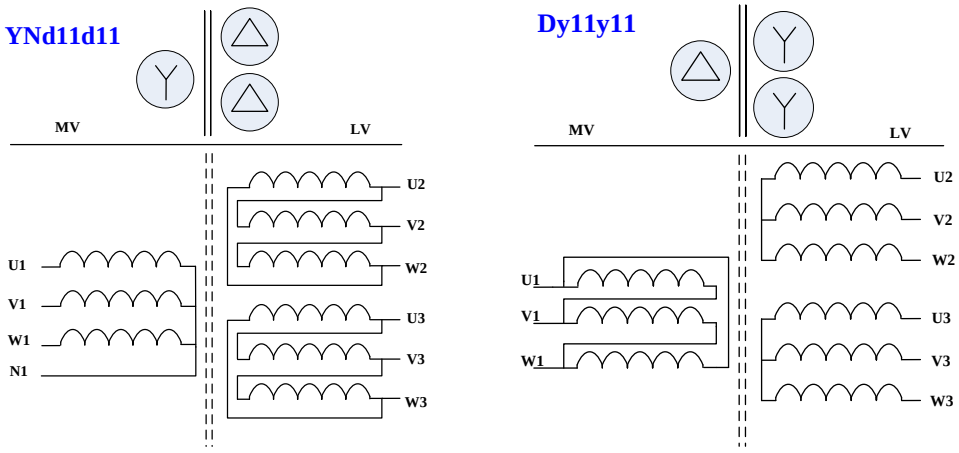
* 如果使用 YNd11 需配合 DC+或 DC-下地使用。



B.2 三绕组变压器的技术需求

- 在每一个低压绕组与高压绕组之间的阻抗电压应在 **4.0-6.0%**之间。
- 在两个低压绕组之间的阻抗电压应在 **9.0-11.0%**之间。
- 三绕组变压器的向量组合可为 **Dy11y11 or YNd11d11**。
- 假若 Dyn11yn11 真的实施了,让两个低压绕组的中性点不作任何连接。

* 如果使用 YNd11d11 需配合 DC+或 DC-下地使用。

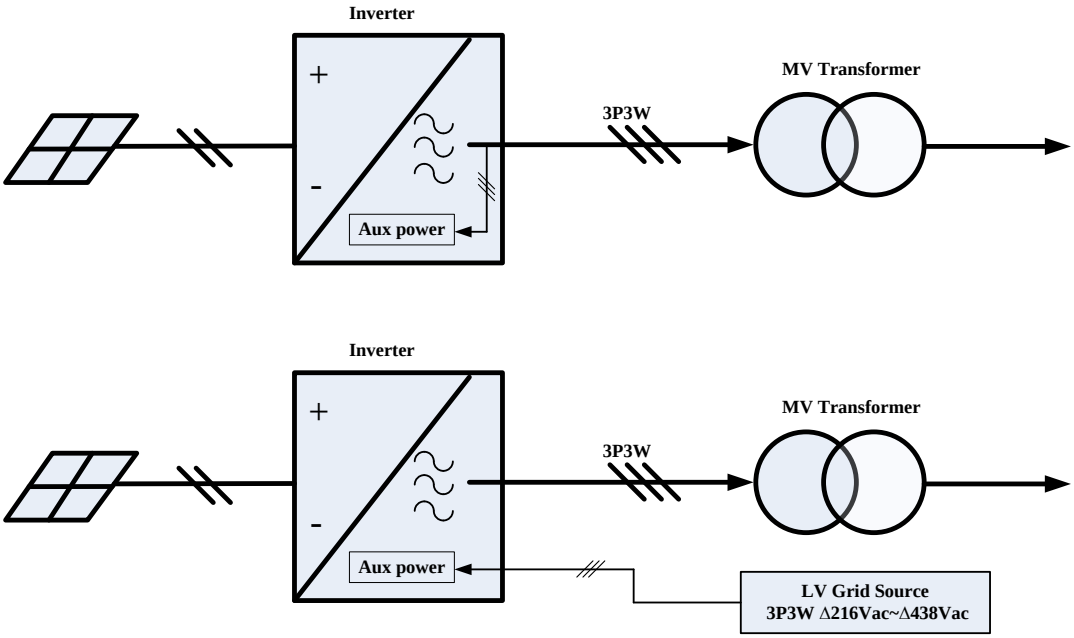


C. 利用变压器作为外部来源供电给辅助电源

透过逆变器输出（默认配置是 3P3W）供电给辅助电源，如此一来就可以省下在案场上额外电源的安装需求。

假设真的需要透过农场边的市电作为辅助电源的供电来源，那这个三相变压器须被设计为输出线对线电压在 **216V ~ 438V** 且额定功率要大于 **2.8KVA**。

对于辅助电源来说，变压器的输出不是为星形接法就是三角形接法。如果星形接法的中性点有显露出来，就让此中性点不作任何连接



附录 D. 连络我们

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Customer to register faults by calling +91-80-6716 4716 (Monday to Friday from 9:30 to 18:00 HRS)

or

Service Mobile Number: +91 76762 54716 (After Office Hours & other days)

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